



Diagnostic Manual

SR-2/SR-3 Microprocessor Based Control System Trailer Multi-Temperature Units

SR-2 Base Controller with Software Revision C052 and earlier

SR-2 HMI Control Panel with Software Revision 6518 and earlier

Used on: Spectrum SB Units, Spectrum SLX Units, Spectrum DE

SR-3 Base Controller with Software Revision F031 and earlier

SR-3 HMI Control Panel with Software Revision 75C2 and earlier

Used on: Spectrum SB Units, Spectrum SLX/SLXe Units, Spectrum DE

SR-3 Base Controller with Software Revision FA00

SR-3 HMI Control Panel with Software Revision 7B00

Used on: Spectrum SLX/SLXe/SLXi Units

Revision A

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Introduction

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Recover Refrigerant

Note: In the USA, EPA Section 608 Certification is required to work on refrigeration systems. In the EU, local F-gas Regulations must be observed when working on refrigeration systems.

At Thermo King®, we recognize the need to preserve the environment and limit the potential harm to the ozone layer that can result from allowing refrigerant to escape into the atmosphere.

We strictly adhere to a policy that promotes the recovery and limits the loss of refrigerant into the atmosphere.

When working on transport temperature control systems, a recovery process that prevents or minimizes refrigerant loss to the atmosphere is required by law. In addition, service personnel must be aware of the appropriate European Union, National, Federal, State, and/or Local regulations governing the use of refrigerants and certification of technicians. For additional information on regulations and technician programs, contact your local THERMO KING dealer.

Service Tools - Use the proper service tools. Gauge manifold sets should include appropriate shutoff valves or disconnects near the end of each service line.

Recovery Equipment - Recovery equipment must be used. Proper recovering, storing and recycling of refrigerants is an important part of all service work.

Service Procedures - Recommended procedures must be used to minimize refrigerant loss.

Components may be isolated by closing service valves and performing system pump-downs.

Components unable to be isolated for service must be repaired only after refrigerant is properly recovered.

Revision History

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| Revision A | (2/17) New manual format, update software revision information, add SLXi information, and general updates throughout manual. Section 2: add TK BlueBox information. Section 3: add Software Separation information; add Telematics Statics and other new features. Section 4: add Telematics Status, Refrigerant Type, and Unit Serial Number information. Section 5: add Alarm Codes 89, 137, 150, 151, 159. Section 6: update G03A with new style ETV information and add G04A. Section 9: new section for Specifications. Section 10: add diagrams for SLXi. |
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How To Use This Manual

Because not everyone is familiar with microprocessor based control systems, please take a few minutes to read this page. It explains the content and structure of this manual. This will make it easier for you to find the information you need.

Section 1 - Safety Information

This section contains the safety information for the SR-3 control system. Read this material carefully before working on the unit.

Section 2 - Hardware Description

This section describes the SR-3 control system hardware. It identifies and locates controllers, relays, LEDs, fuses, and other components and provides connector maps for all connectors.

Section 3 - Software Description

This section discusses the operation of the SR-3 control system software and programmable features. Each menu and feature is discussed individually to illustrate how they are used.

Section 4 - Operation

This section explains how to operate the SR-3 control system . This information is referenced by material in Section 5 Diagnostics.

Section 5 - Diagnostics

This section explains how to diagnose units equipped with the SR-3 control system. It includes both Alarm Code Diagnostics and Other Symptom Diagnostics. This section will reference material in Section 4 Operation and Section 6 Service Procedures.

Section 6 - Service Procedures

This section includes Service Procedures to assist the technician when servicing units equipped with the SR-3 control system. These procedures are referenced by the diagnostic routines in Section 5 Diagnostics.

Section 7 - Service Information

This section offers service information on the basic component parts of the SR-3 control system. It includes hardware and software history as well as interchangeability information.

Section 8 - Refrigeration Operation and Service Procedures

This section includes refrigeration Operation and Service Procedures to assist the technician when servicing units equipped with the SR-3 control system.

Section 9 - Specifications

This section includes the specifications for engine, belt tension, refrigeration system, electrical control system and components, electrical standby, and the optional electric fuel heater.

Section 10 - Diagrams

This section includes the electrical schematics and unit wiring diagrams.

Control System Notes

The following procedures must be followed when working on units equipped with microprocessor based control systems.

- Never use testers consisting of a battery and a light bulb to test circuits on any microprocessor based equipment.
- The unit must be turned off before connecting or disconnecting the battery.
- Any time a graded sensor is replaced, it must be calibrated in accordance with Service Procedure A15A Temperature Sensor Grade Calibration.
- Any time the Base Controller is replaced, the following Service Procedures must be used:
 - A02A Recording Existing Programmable Feature Settings
 - A03A Replacement of the Base Controller
 - A04A Programmable Feature Setup
- Any time welding is to be done on the unit or vehicle, Service Procedure A26A Welding on Units Equipped with Microprocessors must be followed.

Hardware and Software Features

This manual covers the following hardware versions:

- SR-2/SR-3 Base Controller/Interface Board
- SR-2/SR-3 HMI Control Panel

This manual covers the following software revisions:

- SR-2 Base Controller Software Revision through C052
- SR-3 Base Controller Software Revision through F031 (SL/SLX/SLXe)
- SR-3 Base Controller Software Revision FA00 (SL/SLX/SLXe/SLXi)
- SR-2 HMI Control Panel Software Revision through 6518
- SR-3 HMI Control Panel Software Revision through 75C2 (SL/SLX/SLXe/SLXi)
- SR-3 HMI Control Panel Software Revision 7B00 (SL/SLX/SLXe/SLXi)

SR-2 and SR-3 Base Controllers

- The SR-2 Base Controller and separate Interface Board were used for production Thermo King Spectrum multi-temperature units until 1st quarter 2013. The separate Interface Board is connected to the Base Controller via two 64 pin connectors. SR-2 Base Controllers and Interface Boards utilized C0xx software.
- The SR-3 integrated Base Controller/Interface Board is used for production Thermo King Spectrum multi-temperature units beginning 1st quarter 2013. SR-3 Base Controllers utilize F0xx/FAxx software.

Availability:

The Base Controller and HMI Control Panel Software revisions are available on the iService website. Go to: <http://www.thermoking.com/tk/index.asp>

When Base Controller and/or HMI Control Panel flash load files are downloaded from the Thermo King iService website, the flash load files are downloaded as a *.ZIP file. When flash load files for these SR-3 applications are unzipped, there will now be three flash load files instead of the usual two.

- The traditional *.mXX and *.cXX files will be unzipped. These two files are for use when flash loading an SR-3 unit in the traditional manner by using a data cable to connect the SR-3 unit to a computer loaded with WinTrac™ software.

Note: Both the *.mXX and *.cXX files must be present in order to perform a flash load using a data cable, even though only one of them is shown by WinTrac.

- A *.FLA file will also be unzipped. This file is for use when flash loading a unit using a WinTrac configured USB Flash Drive.

The Flashload Directory on the configured USB Flash Drive contains sub-directories for HMI and SR3 MULTI TEMP flash load *.FLA files. The *.FLA files must be placed in the correct directory on the flash drive using either the WinTrac Upload > Manage Flashload Files feature or Windows Explorer.

Installation:

- F031 Software - Choose iService Login.
 - For NAD: After logging in, choose TSA Info Central and select Home > Software and Downloads > Truck and Trailer > Microprocessors > Trailer Microprocessor Updates. The file name for the *.ZIP file containing both the traditional .mXX and .cXX files and the *.FLA file is "Micro Code F031 Update for the SR-3 Multi Temp Base Controller".
 - For ESA/EMEA: After logging in, choose EMEA Info Central and select Home > Software Updates > Microprocessors > SR3 > Multi-Temp. The file name for the *.ZIP file containing both the traditional .mXX and .cXX files and the *.FLA file is "F031".
- FA00 Software - Choose iService Login.
 - After logging in, choose EMEA Info Central and select Home > Software Updates > Microprocessors > SR3 > Multi-Temp. The file name for the *.ZIP file containing both the traditional .mXX and .cXX files and the *.FLA file is "FA00".
- 75C2 Software - Choose iService Login.
 - For NAD: After logging in, choose TSA Info Central and select Home > Software and Downloads > Truck and Trailer > Microprocessors > Trailer Microprocessor Updates. The file name for the *.ZIP file containing both the traditional .mXX and .cXX files and the *.FLA file is "Micro Code 75C2 Update for the SR-3 HMI Control Panel".
 - For ESA/EMEA: After logging in, choose EMEA Info Central and select Home > Software Updates > Microprocessors > HMI > 8Mb. The file name for the *.ZIP file containing both the traditional .mXX and .cXX files and the *.FLA file is "75C2".
- 7B00 Software - Choose iService Login.
 - After logging in, choose EMEA Info Central and select Home > Software Updates > Microprocessors > HMI > (8Mb > 7Bxx/7Cxx/7Dxx) or (4Mb > 7Exx). The file name for the *.ZIP file containing both the traditional .mXX and .cXX files and the *.FLA file is "7B00".

Flash Loading:

For additional information on flash loading software using a computer, WinTrac, and a data cable, refer to Service Procedure A46A and A46B.

SR-3 trailer units can also flash load HMI Control Panel and Base Controller software using a WinTrac configured USB Flash Drive. Refer to USB Flash Drive in Section 4 for details.

Customer Satisfaction Survey

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Scan the Quick Response (QR) code or click or type the web address http://irco.az1.qualtrics.com/SE/?SID=SV_2octfSHoUJxsk6x to complete the survey.





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Section 1 - Safety Information

Danger, Warning, Caution, and Notice

Thermo King® recommends that all service be performed by a Thermo King dealer and to be aware of several general safety practices.

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this unit depend upon the strict observance of these precautions.

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury and unsafe practices.

NOTICE

Indicates a situation that could result in equipment or property-damage only accidents.

General Practices

⚠ DANGER**Hazard of Explosion!**

Never apply heat to a sealed refrigeration system or container. Heat increases internal pressure, which might cause an explosion resulting in death or serious injury.

⚠ DANGER**Hazardous Gases!**

Refrigerant in the presence of an open flame, spark, or electrical short produces toxic gases that are severe respiratory irritants which can cause serious injury or possible death.

⚠ DANGER**Risk of Injury!**

Keep your hands, clothing, and tools clear of fans and/or belts when working on a unit that is running or when opening or closing compressor service valves. Loose clothing might entangle moving pulleys or belts, causing serious injury or possible death.

⚠ DANGER**Refrigerant Vapor Hazard!**

Do not inhale refrigerant. Use caution when working with refrigerant or a refrigeration system in any confined area with a limited air supply. Refrigerant displaces air and can cause oxygen depletion, resulting in suffocation and possible death.

⚠ DANGER**Confined Space Hazards!**

Avoid engine operation in confined spaces and areas or circumstances where fumes from the engine could become trapped and cause serious injury or death.

⚠ WARNING**Hazard of Explosion!**

Never close the compressor discharge service valve when the unit is operating. Never operate the unit with the discharge valve closed (front seated). This condition increases internal pressure, which can cause an explosion.

⚠ WARNING**Proper Equipment Condition!**

Gauge manifold hoses must be in good condition before using them. Never let them come in contact with moving belts, fans, pulleys or hot surfaces. Defective gauge equipment can damage components or cause serious injury.

⚠ WARNING**Personal Protective Equipment (PPE) Required!**

Always wear goggles or safety glasses when working on a unit. Refrigerant liquid, oil, and battery acid can permanently damage your eyes. See "First Aid".

⚠ WARNING**Equipment Damage and Risk of Injury!**

Never drill holes into the unit unless instructed by Thermo King. Holes drilled into high voltage cables could cause an electrical fire, severe personal injury, or even death.

⚠ WARNING**Risk of Injury!**

When using ladders to install or service refrigeration systems, always observe the ladder manufacturer's safety labels and warnings. A work platform or scaffolding is the recommended method for installations and servicing.

⚠ CAUTION**Sharp Edges!**

Exposed coil fins can cause lacerations. Service work on the evaporator or condenser coils is best left to a certified Thermo King technician.

NOTICE**Equipment Damage!**

All mounting bolts must be tight and are the correct length for their applications. Improper torque and incorrect bolt lengths can damage equipment.

Auto Start/Stop

⚠ CAUTION**Risk of Injury!**

The unit can start and run automatically any time the unit is turned on. Units start automatically in both Cycle Sentry mode and Continuous mode. Be sure to turn the unit Microprocessor On/Off switch Off before opening doors, doing inspections, or working on any part of the unit.

⚠ CAUTION**Risk of Injury!**

Thermo King units may have options that allow for remote starting from a fully off state. Be sure to turn the unit Microprocessor On/Off Switch Off before opening doors, doing inspections, or working on any part of the unit.

⚠ CAUTION**Risk of Injury!**

Some electronic components are connected directly to un-switched battery power. All connections and circuits labeled with a "2" prefix are directly connected to battery power. Always disconnect the unit starting battery before servicing the unit.

Electrical Hazards

High Voltage

Important: Do not move the vehicle if the power cable or the electric standby icon is illuminated.

⚠ DANGER**Hazardous Voltage!**

Lethal amounts of voltage are present in some electrical circuits. Use extreme care when working on an operating refrigeration unit.

⚠ DANGER**Hazardous Voltage!**

Dangerous three phase AC electric power is present whenever the unit is operating in either Diesel Mode or Electric Mode and whenever the unit is connected to a source of external standby power. Voltages of this magnitude can be lethal. Exercise extreme caution when working on the unit.

⚠ WARNING**Hazardous Voltage!**

Units featuring optional Electric Standby utilize 460, 400, or 230 volt 3 phase AC electrical power any time the unit is operating in Electric Mode. This voltage potential is also present any time the unit is connected to a source of external standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

⚠ WARNING**Hazardous Voltage!**

Treat all wires and connections as if they were high voltage until a meter and wiring diagram indicate otherwise. Use tools with well insulated handles. Never hold uninsulated metal tools near exposed, energized conductors.

⚠ WARNING**Hazardous Voltage!**

Never work alone on high voltage circuits in the refrigeration unit. Another person should be nearby to shut off the unit and provide aid in the event of an accident.

⚠ WARNING**Personal Protective Equipment (PPE) Required!**

Safety glasses, rubber-insulated gloves, and cable cutters should be near your work area in the event of an electrical accident.

⚠ WARNING**Risk of Injury!**

Do not make rapid moves when working on high voltage circuits in refrigeration units. Do not grab for falling tools because you might accidentally touch a high voltage source.

⚠ WARNING**Hazardous Voltage w/Capacitors!**

Be careful when working with electrical circuits that contain capacitors. Some capacitors hold a significant electrical charge that might cause burns or shocks if accidentally discharged. Capacitors must be discharged before working on electrical circuits.

Low Voltage

***Important:** Some components are connected directly to un-switched battery power. All connections and circuits labeled with a "2" prefix are connected directly to battery power. Always disconnect the battery before servicing the unit.*

⚠ WARNING**Live Electrical Components!**

Control circuits used in refrigeration units are low voltage (12 to 24 volts dc). However, the large amount of amperage available can cause severe burns if accidentally shorted to ground with metal objects, such as tools. Do not wear jewelry, watches, or rings because they increase the risk of shorting out electrical circuits and damaging equipment or causing severe burns.

Other Electrical Considerations

Base Controller Service

Precautions must be taken to prevent electrostatic discharge when servicing the Base Controller and related components. A potential difference less than that required to create a small spark between a finger and a doorknob can cause severe damage to solid state components.

NOTICE**Equipment Damage!**

When working with electrical circuits that contain microprocessors, always wear an ESD wrist strap and connect the opposite end to the chassis ground or CH terminal. This precaution will prevent electrostatic discharge from damaging circuits.

Welding

Precautions must be taken before welding on the unit. Refer to Service Procedure A26A Welding on Units Equipped with Microprocessors in Section 6 for additional information.

Batteries

When removing a battery from the unit, ALWAYS disconnect the negative battery terminal (-) first. Then remove the positive terminal (+). DO NOT LET A DISCONNECTED TERMINAL WITHOUT ISOLATION. WHEN RECONNECTING THE BATTERY TERMINALS, CONNECT THE POSITIVE TERMINAL (+) FIRST, AND CONNECT THE NEGATIVE (-) TERMINAL LAST.

Units Equipped With Telematics

⚠ WARNING

Risk of Injury!

Thermo King units equipped with optional 2 way communications can be turned on and off from remote locations at any time via satellite or cellular phone. Once turned on, the units can start and run automatically at any time.

⚠ CAUTION

Risk of Injury!

Thermo King units may have options that allow for remote starting from a fully off state. Be sure to turn the unit Microprocessor On/Off Switch Off before opening doors, doing inspections, or working on any part of the unit.

Some Thermo King units may be equipped with Telematics options. These options may feature 2 way communications that include the ability to start and stop the unit from a remote location via satellite or cellular phone.

Remote Control Warning Nameplate

Units equipped with 2 way communications will feature a Warning Nameplate located next to the unit's lower door release.

Figure 1. Warning Nameplate on Units Equipped with 2 Way Communications



Refrigerant Hazards

⚠ DANGER

Hazardous Pressures!

Always store refrigerant in proper containers, out of direct sunlight and away from intense heat. Heat increases pressure inside storage containers, which can cause them to burst and could result in severe personal injury.

⚠ DANGER

Combustible Hazard!

Do not use oxygen (O_2) or compressed air for leak testing. Oxygen mixed with refrigerant is combustible.

⚠ WARNING

Hazardous Gases!

Do not use a Halide torch. When a flame comes in contact with refrigerant, toxic gases are produced. These gases can cause suffocation, even death.

⚠ WARNING**Personal Protective Equipment (PPE) Required!**

Refrigerant in a liquid state evaporates rapidly when exposed to the atmosphere, freezing anything it contacts. Wear butyl lined gloves and other clothing and eye wear when handling refrigerant to help prevent frostbite.

NOTICE**Equipment Damage!**

When being transferred, refrigerant must be in liquid state to avoid possible equipment damage.

Refrigerant Oil Hazards

⚠ WARNING**Personal Protective Equipment (PPE) Required!**

Protect your eyes from contact with refrigerant oil. The oil can cause serious eye injuries. Protect skin and clothing from prolonged or repeated contact with refrigerant oil. To prevent irritation, wash your hands and clothing thoroughly after handling the oil. Rubber gloves are recommended.

NOTICE**Equipment Damage!**

Use the correct oil in Thermo King systems to avoid damaging equipment and nullifying its warranty.

NOTICE**Equipment Damage!**

Do not mix refrigerant oils because that can cause refrigeration system damage.

NOTICE**Equipment Damage!**

Use dedicated refrigeration equipment to prevent contaminating refrigeration systems with the wrong type of oil.

NOTICE**System Contamination!**

Do not expose the refrigerant oil to the air any longer than necessary. Store refrigerant oil in an approved sealed container to avoid moisture contamination. The oil will absorb moisture, which results in much longer evacuation times and possible system contamination.

NOTICE**Material Damage!**

Wipe up spills immediately. Refrigerant oil can damage paints and rubber materials.

First Aid

REFRIGERANT

- **Eyes:** For contact with liquid, immediately flush eyes with large amounts of water and get prompt medical attention.
- **Skin:** Flush area with large amounts of warm water. Do not apply heat. Remove contaminated clothing and shoes. Wrap burns with dry, sterile, bulky dressing to protect from infection. Get prompt medical attention. Wash contaminated clothing before reuse.
- **Inhalation:** Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.
- **Frost Bite:** In the event of frost bite, the objectives of First Aid are to protect the frozen area from further injury, warm the affected area rapidly, and to maintain respiration.

REFRIGERANT OIL

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention.
- **Skin:** Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.
- **Inhalation:** Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.
- **Ingestion:** Do not induce vomiting. Immediately contact local poison control center or physician.

ENGINE COOLANT

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention.
- **Skin:** Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.
- **Ingestion:** Do not induce vomiting. Immediately contact local poison control center or physician.

BATTERY ACID

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention. Wash skin with soap and water.

ELECTRICAL SHOCK

Take IMMEDIATE action after a person has received an electrical shock. Get quick medical assistance, if possible.

The source of the shock must be quickly stopped, by either shutting off the power or removing the victim. If the power cannot be shut off, the wire should be cut with a non-conductive tool, such as a wood-handle axe or thickly insulated cable cutters. Rescuers should wear insulated gloves and safety glasses, and avoid looking at wires being cut. The ensuing flash can cause burns and blindness.

If the victim must be removed from a live circuit, pull the victim away with a non-conductive material. Use wood, rope, a belt or coat to pull or push the victim away from the current. DO NOT TOUCH the victim. You will receive a shock from current flowing through the victim's body. After separating the victim from power source, immediately check for signs of a pulse and respiration. If no pulse is present, start Cardio Pulmonary Resuscitation (CPR). If a pulse is present, respiration might be restored by using mouth-to-mouth resuscitation. Call for emergency medical assistance.

ASPHYXIATION

Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.

Section 2 - Hardware Description

General Description

⚠ DANGER

Hazardous Voltage!

Dangerous three phase AC electric power is present whenever the unit is operating in either Diesel Mode or Electric Mode and whenever the unit is connected to a source of external standby power. Voltages of this magnitude can be lethal. Exercise extreme caution when working on the unit.

The SR-2/SR-3 SPECTRUM Trailer Multi-Temperature controller is a self-contained temperature control unit designed for trailer applications. Model 30 units are powered by a diesel engine and Model 50 units are powered by either the diesel engine or an external electric standby power source powering an electric motor. The host unit mounts on the nose of the trailer. Heat and defrost are by means of hot gas. Optional Zone 1 electric heat is available on Model 50 units (does not include DE units).

The host unit is the main refrigeration unit. It also provides the evaporator coil, control solenoids, and evaporator blower to serve Zone 1. The host unit includes the engine, compressor, condenser coil, control box, condenser blower, and host unit sensors and solenoid valves. It also includes the Zone 1 evaporator coil, Zone 1 evaporator blower, Zone 1 temperature sensors, and Zone 1 defrost damper.

If the unit is a DE, the host unit also includes the Zone 2 evaporator coil, Zone 2 evaporator blower, Zone 2 temperature sensors, and Zone 2 defrost damper.

If the unit is not a DE, Zone 2 (and Zone 3, if present) is served by remote evaporators. The remote evaporator assembly includes 12 Vdc electric fans, (two fans on S-2 models and three fans on S-3 models), the evaporator coil, three solenoid valves, three temperature sensors, drain tube heaters, and a mounting enclosure. Two evaporators can be connected in parallel in a remote zone.

SR-2/SR-3 Control System

The SR-2/SR-3 Base Controller Control System consists of the following main components:

- Base Controller On/Off Switch
- SR-2/SR-3 Base Controller/Interface Board
- Unit Sensors and Transducers
- Refrigeration Control Components
- Engine Control Components
- Communication Ports
- Multi-Temperature Expansion Module
- Optional Electric Standby

SR-2 Control System Overview

Figure 2. Control System Overview

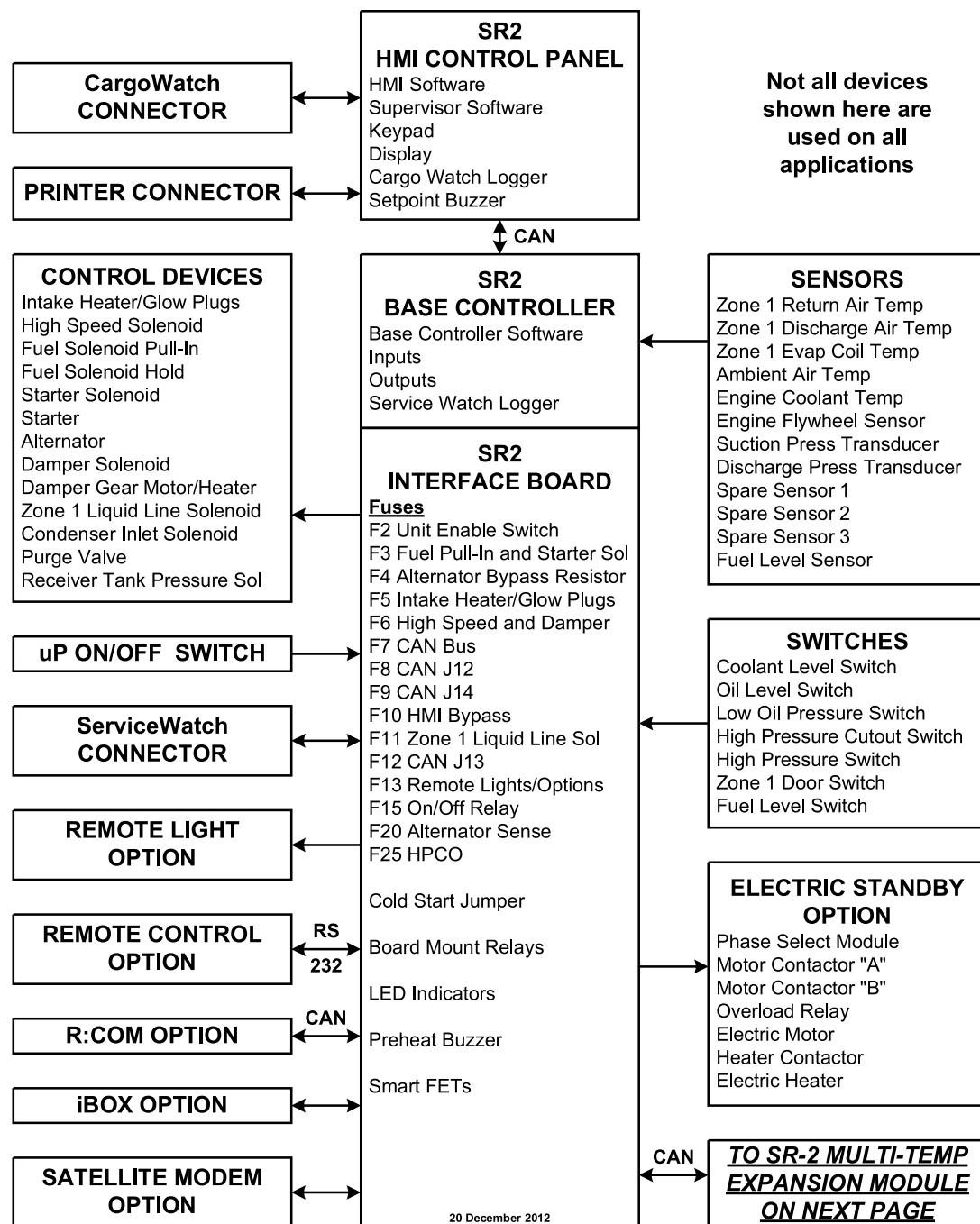
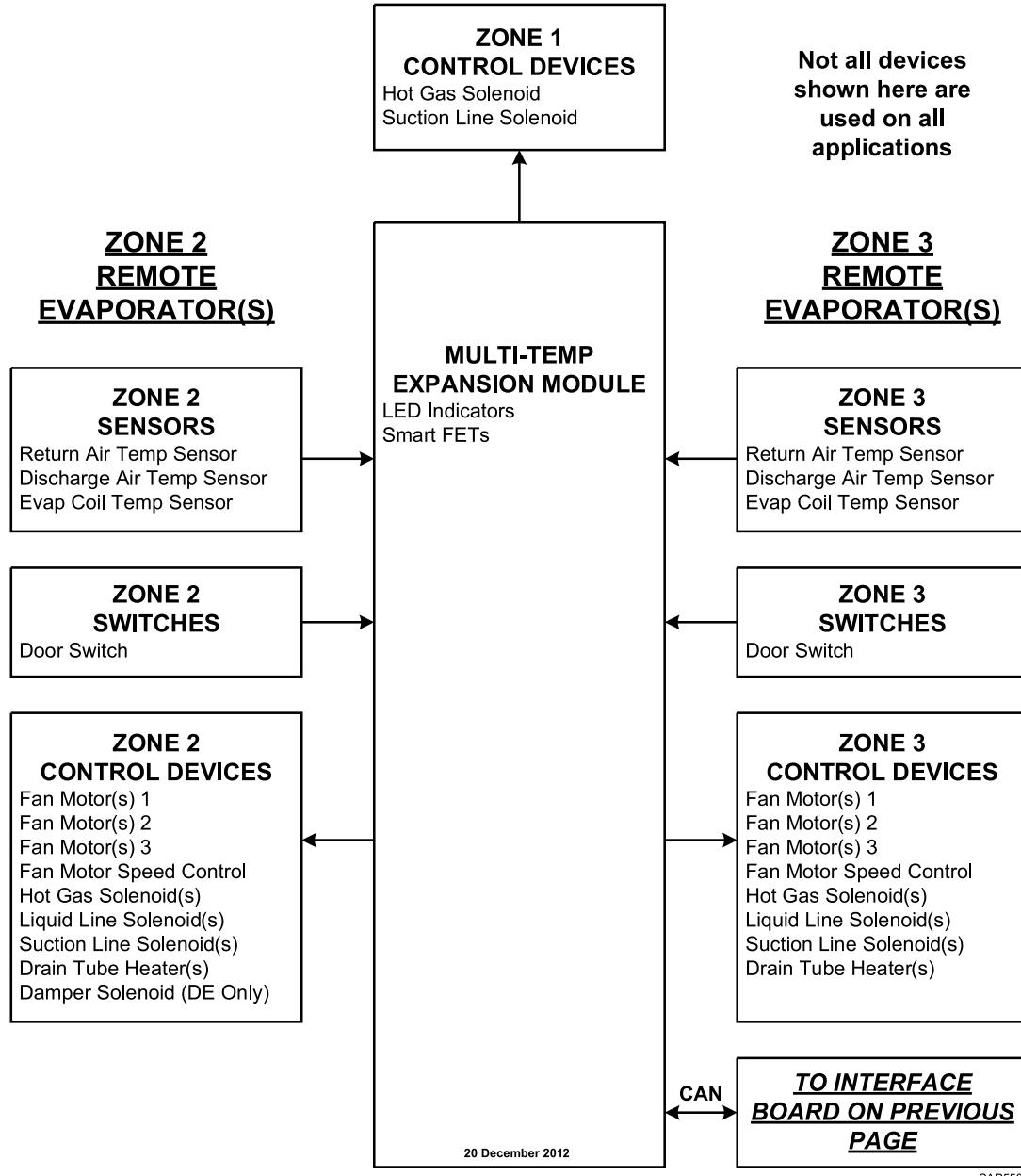
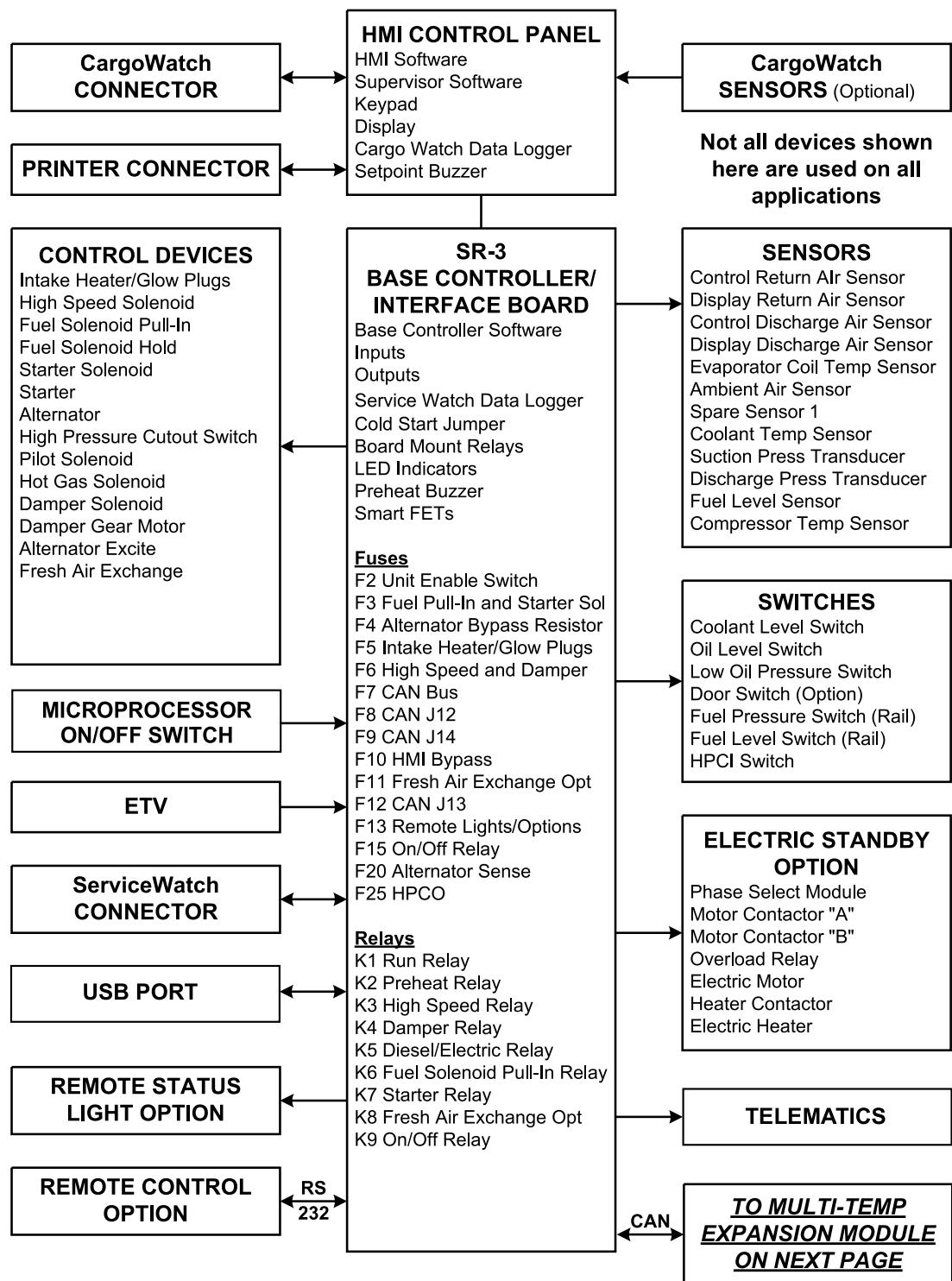


Figure 3. Control System Overview



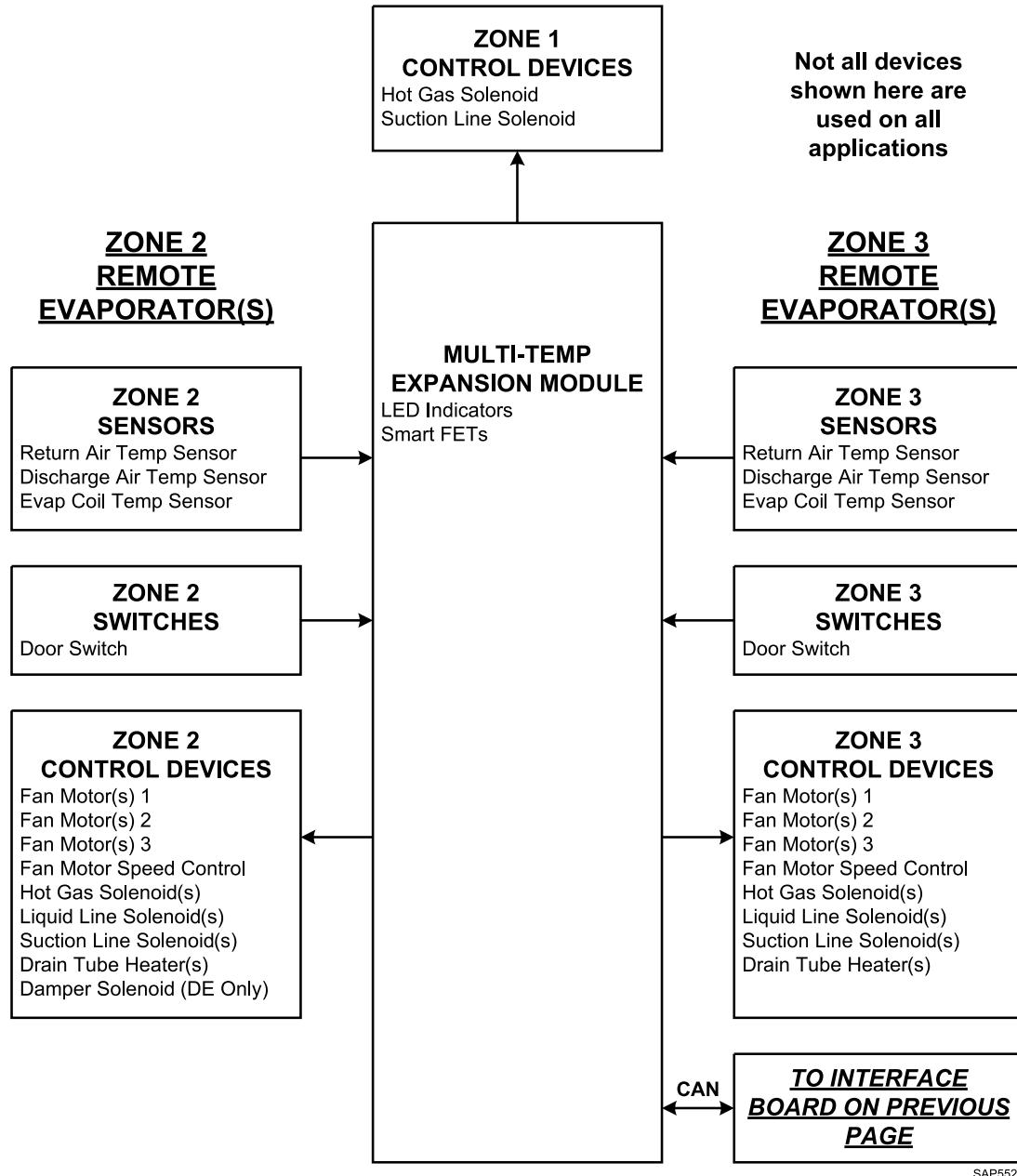
SR-3 Control System Overview

Figure 4. Control System Overview



SAP551

Figure 5. Control System Overview



SAP552

Control Components

The heart of the control system is the micro-processor based Base Controller and Interface Board. The Base Controller and Interface Board control most host unit functions.

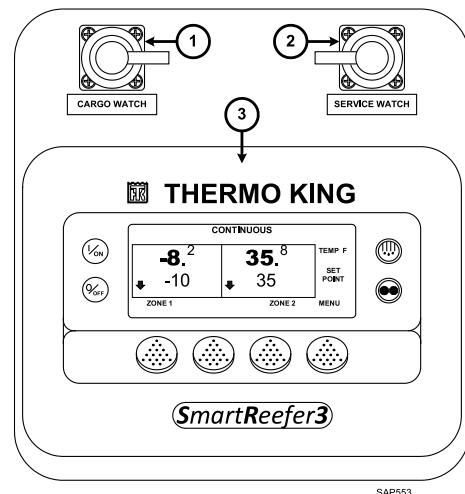
For SR-2 Base Controllers, the Interface Board is mounted on the Base Controller and is connected to it by means of connectors J1 and J2. When connected, the Base Controller and Interface Board form a one-piece Base Controller/Interface Board assembly.

For SR-3 Base Controllers, the Base Controller and Interface Board are an integrated one-piece Base Controller/Interface Board assembly.

For multi-temperature applications, an Expansion Module (EM) is connected to the SR-2/SR-3 Base Controller/Interface Board via a controller area network (CAN) communication connection. The Expansion Module provides the inputs and outputs necessary to support the remote zone evaporators. The Expansion Module supports inputs and outputs and contains its own microprocessor and software. The Expansion Module will only execute system control instructions from the SR-2/SR-3 Base Controller. It is not capable of stand-alone operation. Expansion Module software is updated each time communications are established between the Base Controller and the Expansion Module.

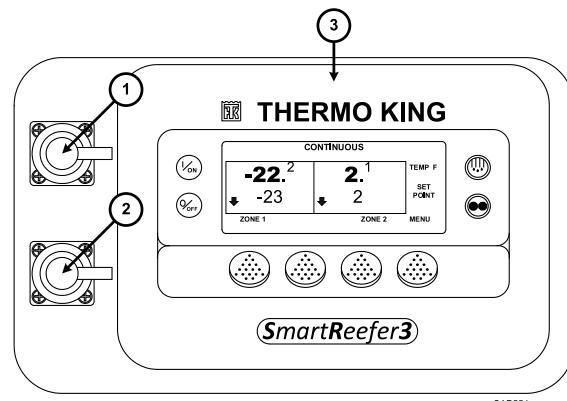
System conditions are displayed and operator instructions are sent using the HMI Control Panel.

Figure 6. SB Series Control Panel



- | | |
|----|----------------------------|
| 1. | CargoWatch Download Port |
| 2. | ServiceWatch Download Port |
| 3. | HMI Control Panel |

Figure 7. SLX Series Control Panel



| | |
|----|---|
| 1. | CargoWatch Download Port |
| 2. | CargoWatch Printer Port (SLX/SLXe) or USB Port (SLXi) |
| 3. | HMI Control Panel |

Microprocessor On/Off Switch

⚠ WARNING

Risk of Injury!

The unit can start at any time without warning. Press the OFF key on the HMI control panel and place the microprocessor On/Off switch in the Off position before inspecting or servicing any part of the unit.

The Microprocessor On/Off Switch applies 12 volts DC control power to the Base Controller (SR-3)/Interface Board (SR-2) at connector J4. Main power to the controls is supplied by 15 amp fuse F2.

Important: Always turn the Microprocessor On/Off switch off before inspecting or working on any part of the unit.

Note: The Microprocessor On/Off switch disconnects power to the controller and most controller outputs. It does not disconnect the HMI Control Panel supply power. The HMI Control Panel is directly connected to the unit starting battery.

SB Series Units

On SB units, the Microprocessor On/Off switch is located on the side of the control box. It can be reached by opening the engine compartment doors.

SLX Series Units

On SLX units, the Microprocessor On/Off Switch is located on a bracket just below the electric motor on Model 50 units or just below the jackshaft assembly on Model 30 units. It is accessible by opening the unit doors.

Figure 8. Microprocessor On/Off Switch



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Over-Current Protection

Over-current protection is provided by a fusible link located in the positive battery cable. A 15 amp main power fuse F2 is located in the "2A/2AB" circuit.

Outputs are protected by either a fuse or Smart FET (Field Effect Transistor). All fuses are located on the Base Controller (SR-3) or on the Interface Board (SR-2). Smart FETs halt current flow if an over-current condition exists and generate an alarm. The Smart FET will resume normal operation when the alarm is cleared and current flow is within limits. Smart FETs are not field repairable.

A polyswitch provides over-current protection for the On/Off relay. It is located just above Relay K8 (SR-3). The polyswitch will reset automatically and is not field repairable.

HMI Control Panel

⚠ WARNING

Risk of Injury!

The unit can start at any time without warning. Press the OFF key on the HMI control panel and place the microprocessor On/Off switch in the Off position before inspecting or servicing any part of the unit.

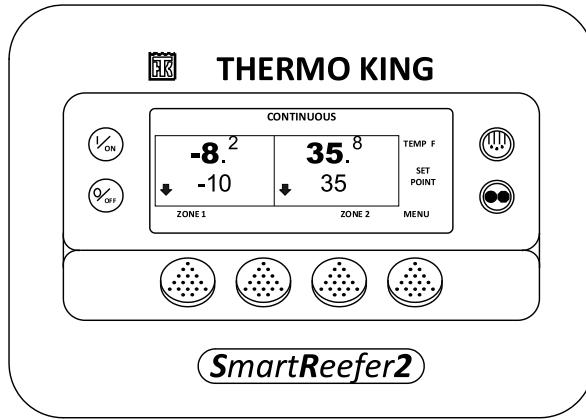
The Human Machine Interface (HMI) Control Panel consists of an LCD graphics display screen and eight touch sensitive keys.

- The four keys on the sides of the display screen are used to turn the unit on and off, initiate a manual defrost cycle, and select the desired operating mode. These keys are designated "Hard" keys as their function is always the same.
- The function of the four keys located below the display screen change as required by the current menu. The current function of the key is controlled by software and is displayed directly above the key. These keys are known as software controlled keys or "Soft" keys.
- The same HMI Control Panel is used for single temperature and multi-temperature applications.

SR-2 HMI Control Panel

Only HMI-2 Control Panels can be used for Multi-Temperature applications. The SR-2 HMI Control Panel features 4 MB of memory. The serial number will end in 0T2 and the label is located on the back of the HMI Control Panel. Refer to Section 7 for additional details.

- SPECTRUM SB applications require software version 6510 or later.
- SPECTRUM SLX applications require software version 6512 or later.

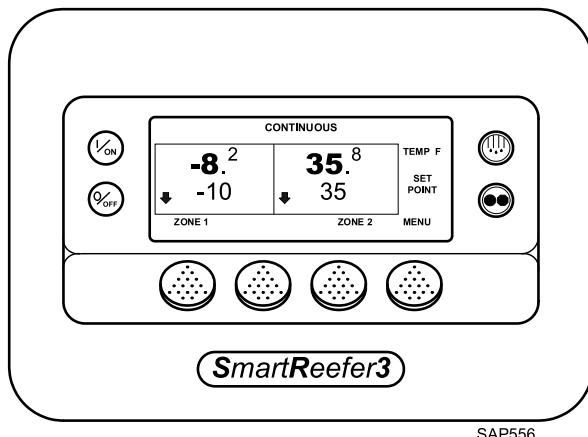


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SR-3 HMI Control Panel

The SR-3 Control System uses essentially the same HMI Control Panel as the SR-2 Control System. However, SR-3 HMI Control Panels feature 8 MB of memory to support future options and are marked Smart Reefer 3 on the lower front as shown. Refer to Section 7 for additional details.

- SPECTRUM SB and SLX applications require software version 6514 or later.



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HMI Control Panel Operation

The HMI contains a microprocessor and dedicated software. The HMI is a message center and does not directly control the unit operation. It communicates with the Base Controller via a controller area network (CAN) connection. The HMI displays system operating data and sends operating requests to the controller.

The display screen is used by the Base Controller to provide visual prompts and information to the operator, such as operating mode, setpoint temperatures, gauges, hourmeter readings, and operating conditions of the diesel engine or electric motor. The HMI also contains the CargoWatch™ Data Logger. The HMI and Base Controller communicate via a Controller Area Network (CAN) connection.

Information can be displayed in 24 possible languages. A single HMI Control Panel software revision can display a maximum of 11 languages. For this reason, there are a total of 4 HMI software revisions. Other than languages supported, these software revisions are identical. The table below shows the 4 HMI Software Revisions and the languages supported by each.

If the HMI Control Panel is disconnected from the unit while the unit is running, the unit will shut down. When the HMI Control Panel is reconnected the unit will not restart until the On key is pressed.

Note: If necessary, the HMI Control Panel can be bypassed using fuse F10. Refer to Section 2 Fuse F10.

Real Time Clock

The real time clock is located in the HMI Control Panel. The time is supplied to the Base Controller each time the unit is turned on.

- Clock Power

The HMI Control Panel features a capacitor to provide backup power to the real time clock. This capacitor is capable of maintaining the clock for approximately two weeks with no power connected to the unit. The capacitor is recharged any time the HMI Control Panel is installed in the unit and a properly functioning starting battery is connected.

If the unit starting battery is disconnected for an extended period the clock setting should be checked when the unit is returned to service. If the HMI Control Panel is changed the clock setting should also be verified.

CargoWatch™ Data Logger

The HMI Control Panel contains the CargoWatch Data Logger. The CargoWatch Data Logger is a fully independent temperature logger. Up to six temperature sensors and 3 digital inputs can be connected to the CargoWatch Data Logger. The optional CargoWatch temperature sensors are separate sensors installed as required by each user. The CargoWatch Data Logger records CargoWatch temperature sensors, unit setpoint, unit operating condition, and alarm codes.

The Countdown and Conservative features allow the CargoWatch Data Logger to continue to log after the unit is turned off. Refer to CargoWatch Sensor Configuration in Section 3 for details of operation.

Notes:

1. *For SB Units: CargoWatch Data Logger sensors are not included with the unit.*
2. *For SLX Units: Two CargoWatch Data Logger sensors are included with the unit. One CargoWatch Sensor is factory mounted in the return air inlet. The other sensor is shipped loose and is intended to be installed in the discharge air outlet or discharge air chute.*

Programmable Features

The settings of all programmable features are held in non-volatile memory in the Base Controller. The settings are supplied to the HMI Control Panel each time the unit is turned on. If the HMI Control Panel is changed, the current programmable feature settings will be supplied to the HMI Control Panel when the unit is turned on.

Display Heater

The HMI Control Panel is equipped with a display heater. This heater is necessary to make the display quickly visible in cold ambient temperatures.

The HMI has its own internal temperature sensor for the display heater. The display heater is energized when the unit is turned on and the temperature sensed by the internal sensor is below 29°F (-2°C). The display heater turns off when the temperature sensed by the internal sensor rises above 37°F (3°C). The display heater draws from 1.4 to 1.7 amps when energized.

The colder the ambient temperature the longer it will take for the heater to make the display visible on a cold startup. It may take 10-15 seconds for the display to appear with very cold ambient temperatures.

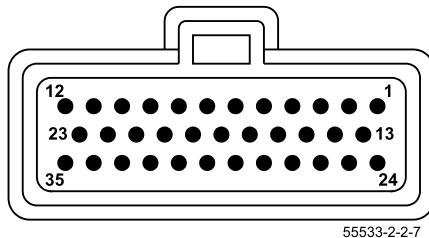


Section 2 - Hardware Description

SR-2/SR-3 HMI Control Panel Connector Map

| HMI Control Panel Connector (arranged by pin location) | | | HMI Control Panel Connector (arranged by use) | | |
|--|-----------|---|---|-----------|---|
| Pin # | Wire # | Description | Pin # | Wire # | Description |
| 1 | S6P | CargoWatch Sensor 6 positive | 22 | CANH-RED1 | HMI Control Panel CAN Bus |
| 2 | S5P | CargoWatch Sensor 5 positive | 10 | CANL-BLK | HMI Control Panel CAN Bus |
| 3 | S3P | CargoWatch Sensor 3 positive | 6 | 8XP-BLK3 | 8XP Power |
| 4 | S1P | CargoWatch Sensor 1 positive | 12 | BLK2-02 | 2P power |
| 6 | 8XP-BLK3 | 8XP Power | 34 | ON-RED2 | HMI Control Panel On |
| 7 | DPD3 | CargoWatch Data Pak Detect Input | 33 | OFF | HMI Control Panel Off |
| 9 | DPD1 | CargoWatch Data Pak Detect Input | 35 | CH-RED3 | HMI Control Panel chassis ground |
| 10 | CANL-BLK | HMI Control Panel CAN Bus | 23 | DRAIN-WHT | HMI Control Panel drain |
| 12 | BLK2-02 | 2P power | 21 | RXD1 | CargoWatch RS-232 comm port #1 receive |
| 13 | S5N | CargoWatch Sensor 5 negative | 32 | TXD1 | CargoWatch RS-232 comm port #1 transmit |
| 14 | S3N | CargoWatch Sensor 3 negative | 19 | COM1 | CargoWatch common |
| 15 | S2N | CargoWatch Sensor 2 negative | 9 | DPD1 | CargoWatch Data Pak Detect Input |
| 16 | S1N | CargoWatch Sensor 1 negative | 7 | DPD3 | CargoWatch Data Pak Detect Input |
| 18 | RXD3 | CargoWatch RS-232 comm port #3 receive | 20 | RXD2 | CargoWatch Printer RS-232 comm port #2 receive |
| 19 | COM1 | CargoWatch common | 31 | TXD2 | CargoWatch Printer RS-232 comm port #2 transmit |
| 20 | RXD2 | CargoWatch Printer RS-232 comm port #2 receive | 29 | D14 | Printer port print initiate digital input |
| 21 | RXD1 | CargoWatch RS-232 comm port #1 receive | 30 | TXD3 | CargoWatch RS-232 comm port #3 transmit |
| 22 | CANH-RED1 | HMI Control Panel CAN Bus | 18 | RXD3 | CargoWatch RS-232 comm port #3 receive |
| 23 | DRAIN-WHT | HMI Control Panel drain | 4 | S1P | CargoWatch sensor 1 positive |
| 24 | S6N | CargoWatch Sensor 6 negative | 16 | S1N | CargoWatch sensor 1 negative |
| 25 | S4N | CargoWatch Sensor 4 negative | 27 | S2P | CargoWatch sensor 2 positive |
| 26 | S4P | CargoWatch Sensor 4 positive | 15 | S2N | CargoWatch sensor 2 negative |
| 27 | S2P | CargoWatch Sensor 2 positive | 3 | S3P | CargoWatch sensor 3 positive |
| 29 | D14 | Printer port print initiate digital input | 14 | S3N | CargoWatch sensor 3 negative |
| 30 | TXD3 | CargoWatch RS-232 comm port #3 transmit | 26 | S4P | CargoWatch sensor 4 positive |
| 31 | TXD2 | CargoWatch Printer RS-232 comm port #2 transmit | 25 | S4N | CargoWatch sensor 4 negative |
| 32 | TXD1 | CargoWatch RS-232 comm port #1 transmit | 2 | S5P | CargoWatch sensor 5 positive |
| 33 | OFF | HMI Control Panel Off | 13 | S5N | CargoWatch sensor 5 negative |
| 34 | ON-RED2 | HMI Control Panel On | 1 | S6P | CargoWatch sensor 6 positive |
| 35 | CH-RED3 | HMI Control Panel chassis ground | 24 | S6N | CargoWatch sensor 6 negative |

Figure 9. HMI Control Panel Connector (shown from pin side)



SR-2 Base Controller

The SR-2 Base Controller is located on the rear panel of the control enclosure. Two multi-pin Interface Board connectors (J1 and J2) are located on the front of the Base Controller. The J1 and J2 connectors mate the Base Controller and Interface Board into a single Base Controller/Interface Board assembly and pass information and signals from the Base Controller to the Interface Board. A 35 pin sensor connector (J3) is located at the lower left of the Base Controller. The J3 connector is used for sensor inputs. The J3 connector mates to the refrigeration unit's electrical harness.

Only SR-2/C (0T3) and SR-2/D (0T4) Base Controllers can be used for SR-2 Trailer Multi-Temperature applications. The Base Controller serial number will end with 0T3 or 0T4. The serial number labels are located on the front surface of the J3 sensor connector or the front of the Base Controller between the J1 and J2 connectors.

Base Controller Hardware Versions

For complete details of Base Controller hardware versions and software requirements, refer to Section 7.

Base Controller Software Revisions

For complete details of Base Controller software revisions and hardware requirements, refer to Section 7.

Real Time Clock

The real time clock is located in the HMI Control Panel. The system time is supplied to the Base Controller each time the unit is turned on. If the Base Controller is changed, the clock setting will be automatically supplied to the Base Controller when the unit is turned on. If the HMI Control Panel is changed, the clock setting must be verified.

ServiceWatch Data Logger

The Base Controller contains the ServiceWatch Data Logger. The ServiceWatch Data Logger is a diagnostic data logger. This data logger records unit temperature sensors, unit setpoint, unit operating conditions, alarms and conditions that exist when an alarm is set.

When diagnosing alarm codes always download the ServiceWatch data logger using the WinTrac™ Service Tool. Review the data to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

Programmable Features

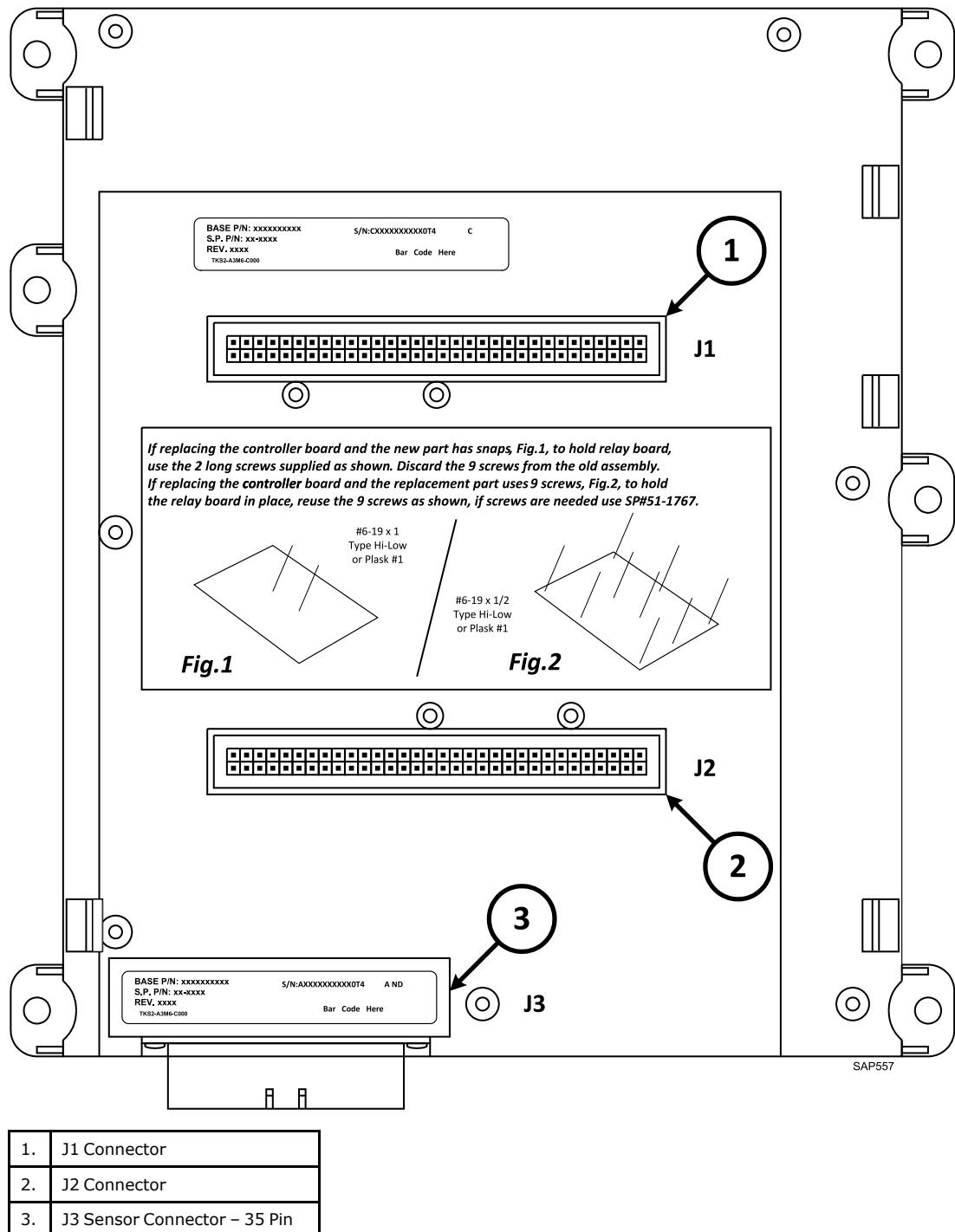
The settings of all programmable features are held in non-volatile memory in the Base Controller. The settings are supplied to the HMI Control Panel each time the unit is turned on. If the Base Controller is changed, all programmable features must be reprogrammed. If the HMI Control Panel is changed, the current programmable feature settings will be supplied to the new HMI Control Panel when the unit is turned on. Refer to Section 3 of this manual for programmable feature details.

Base Controller Operation

The Base Controller is the heart of the control system. It consists of a Base Controller, software, memory, inputs and outputs. The software provides the required operating and control functions and supports the ServiceWatch Data Logger.

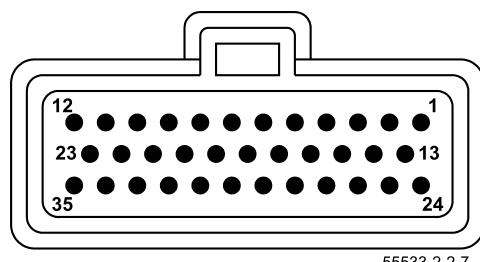
Inputs are used to supply power and system information to the Base Controller. The Base Controller uses the outputs to control the operation of the unit components. The Base Controller has no user serviceable components.

Figure 10. SR-2/D Base Controller



SR-2 Base Controller Connector Map
J3 - Base Controller Sensor Harness Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|--|
| 1 | RTP | Zone 1 return air temperature sensor positive (blue sensor wire) |
| 2 | RTN | Zone 1 return air temperature sensor negative (brown sensor wire) |
| 3 | ATP | Ambient temperature sensor positive (blue sensor wire) |
| 4 | ATN | Ambient temperature sensor negative (brown sensor wire) |
| 9 | DPI | Signal from discharge pressure transducer (white wire) (DPT) |
| 10 | SPI | Signal from suction pressure transducer (white wire) (SPT) |
| 12 | 2PL | Power for optional fuel level sensor |
| 13 | DTN | Zone 1 discharge air temperature sensor negative (brown sensor wire) |
| 14 | CTN | Zone 1 coil temperature sensor negative (brown sensor wire) |
| 15 | WTN | Water temperature sensor negative (brown sensor wire) |
| 16 | ST1N | Spare 1 temperature sensor negative (brown sensor wire) |
| 21 | ST2P | Spare 2 air temperature sensor positive (blue sensor wire) |
| 22 | ST3P | Spare 3 air temperature sensor positive (blue sensor wire) |
| 23 | FLL | Optional fuel level sensor |
| 24 | DTP | Zone 1 discharge air temperature sensor positive (blue sensor wire) |
| 25 | CTP | Zone 1 coil temperature sensor positive (blue sensor wire) |
| 26 | WTP | Water temperature sensor positive (blue sensor wire) |
| 27 | ST1P | Spare 1 temperature sensor positive (blue sensor wire) |
| 32 | ST2N | Spare 2 air temperature sensor negative (brown sensor wire) |
| 33 | ST3N | Spare 3 air temperature sensor negative (brown sensor wire) |
| 35 | FUELN | Optional fuel level sensor |

Figure 11. 35 Pin Sensor Harness Connector (shown from pin side)


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THERMO KING

Section 2 - Hardware Description

SR-2 Interface Board

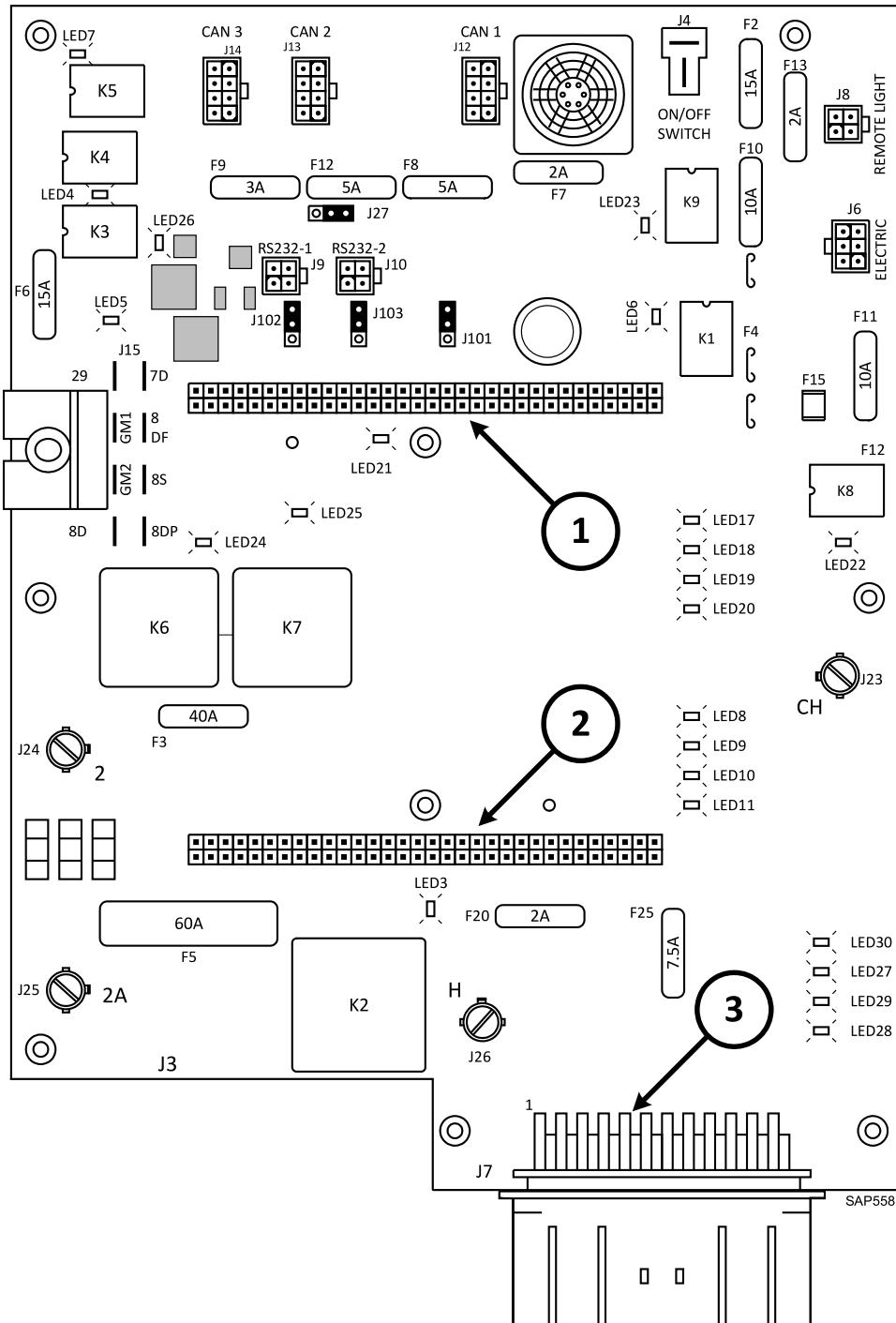
Only SR-2/C (0T3) and SR-2/D (0T4) Interface Boards with serial numbers that end in "0T3" or "0T4" can be used for multi-temperature applications. The label is located on the bottom of the Interface Board below the current shunts. It is necessary to remove the Interface Board from the Base Controller to read this label. Refer to Section 7 for additional details.

The Interface Board provides the interface between the Base Controller and the host unit components such as solenoids, valves, and motor contactors. It also provides over-current and short circuit protection for the controls and components.

The Base Controller controls the operation of the unit through the control relays and Smart FETs on the Interface Board and Expansion Module. The relays control power to the high current loads. The Smart FETs control power to the lower current loads. Each relay is individually fuse protected. The Smart FETs are self-protecting. An LED next to each relay or Smart FET is illuminated when the relay or FET is energized by the Base Controller. With relays, the LED illuminates only when the relay coil is energized and the relay contacts have transferred to the energized position.

The Interface Board is mounted directly onto the Base Controller and is secured with mounting hardware. Some units equipped with SR-2/C Base Controllers and all units equipped with SR-2/D Base Controllers use a combination of Base Controller mounted snaps and screws to secure the Interface Board. The Base Controller to Interface Board electrical connections are made through the J1 and J2 connectors. The main components on the Interface Board are the control relays, fuses, status LEDs to indicate relay or output states, preheat buzzer, jumpers, current shunt, Smart FETs, and the wiring harness connectors. The only user serviceable components on the Interface Board are the fuses and jumpers.

On all SR-2 applications, the engine functions, defrost damper, and refrigeration functions are controlled directly from the SR-2 Interface Board. On SR-2 multi-temperature applications, the Receiver Tank Pressure Solenoid (RTPS), Purge Valve (PV), Condenser Inlet Solenoid (CIS), and Liquid Line Solenoid for Zone 1 (LLS1) are also controlled directly from the SR-2 Interface Board. All other Zone 1 functions, as well as the remote evaporators are controlled by the Expansion Module.

Figure 12. SR-2 Interface Board


| | |
|----|--------------------------------------|
| 1. | J1 Connector (to Base Controller J1) |
| 2. | J2 Connector (to Base Controller J2) |
| 3. | J7 36 Pin Harness Connector |



Section 2 - Hardware Description

Interface Board Fuse Size & Function

| Fuse | Size | Function |
|------|------------|--|
| F2 | 15A | Power to On/Off Switch |
| F3 | 40A | Power to Fuel Sol Pull-In/Starter Solenoid |
| F4 | None or 2A | No fuse - all Bosch and TK alternators (Note 1) 2A fuse - all Prestolite alternators (Note 1) |
| F5 | 60A | Power to Air Intake Heater/Glow Plugs (Note 2) |
| F6 | 15A | Power to High Speed and Damper Solenoids |
| F7 | 2A | Switch On Power to CAN Bus |
| F8 | 5A | Battery power to CAN Connector J12 |
| F9 | 5A | Battery power to CAN Connector J14 |
| F10 | 10A | Power to Relay (upper pos)/Bypasses HMI control of power (lower pos) |
| F11 | 10A | Power to Liquid Line Solenoid Zone 1 |
| F12 | 5A | Battery power to CAN Connector J13 |
| F13 | 2A | Power to Remote Lights/Options |
| F15 | P/S | Power to On/Off Relay (Note 3) |
| F20 | 2A | Power to Alternator Sense |
| F25 | 7.5A | Power to HPCO/Run Circuit |

Notes:

1. *Fuse F4 must be in place for Prestolite alternators to charge. Fuse F4 must be removed for Bosch and Thermo King alternators. Service Parts Base Controllers are shipped without the F4 fuse.*
2. *The F5 preheat fuse is a "slow blow" type fuse. It is designed for use with the engine air pre-heater. Always replace the fuse with the TK specified fuse. Service Parts Base Controllers are shipped without the F5 fuse.*
3. *The device identified as F15 is a polyswitch. This polyswitch provides over-current protection for the On/Off relay. The polyswitch will reset automatically and is not field repairable.*

Fuse F10

There are three in-line fuse clips that allow for two configurations of the F10 fuse. The upper position is the normal position. This position has a white bar next to it on the circuit board. When fuse F10 is installed in the upper position, control power is routed to the K9 On/Off Relay contacts. The On/Off Keys on the HMI control panel energize and de-energize the K9 On/Off Relay. When the K9 On/Off Relay is energized, power is supplied through the normally open K9 contacts to turn the Base Controller on.

When fuse F10 is installed in the lower position, power bypasses the K9 On/Off relay contacts and the unit will start and run without the HMI control panel. Do not operate the unit with the F10 fuse installed in the lower position unless absolutely necessary.

Important: *If fuse F10 is installed in the lower position, the unit will start and run. The HMI Control Panel On and Off Keys will function. The Off Key will turn the unit off if Fuse F10 is in the lower position, but the Base Controller will remain powered up. The Base Controller will be powered up and in Standby when the HMI Control Panel is used to turn the unit off.*

Fuse F15

The device identified as F15 is a poly switch. This over-current device resets automatically and is not replaceable.

Relay Functions

Important: Do not attempt to remove the relays from the Base Controller. They are soldered in place.

| Relay | Function |
|-------|-----------------------------------|
| K1 | Run Relay |
| K2 | Pre-Heat Relay |
| K3 | High Speed Relay |
| K4 | Damper Relay |
| K5 | Diesel/Electric Relay |
| K6 | Fuel Solenoid Pull-In Relay |
| K7 | Starter Solenoid Relay |
| K8 | Liquid Line Solenoid Zone 1 Relay |
| K9 | On/Off Relay |

LED Functions

The LED is illuminated when the associated circuit output is energized. Not all output LEDs shown are used on multi-temperature trailer applications.

| LED # | Function | LED # | Function |
|--------|--|--------|-----------------------------------|
| LED 3 | K2 Preheat | LED 19 | Liquid Injection Valve (Not Used) |
| LED 4 | K4 Damper Solenoid | LED 20 | Water Valve (Not Used) |
| LED 5 | K3 High Speed Solenoid | LED 21 | Heartbeat (Note 1) |
| LED 6 | K1 Run Relay | LED 22 | K8 Zone 1 Liquid Line Solenoid |
| LED 7 | K5 Diesel/Electric Relay | LED 23 | K9 On/Off Relay |
| LED 8 | Condenser Inlet Solenoid | LED 24 | K6 Fuel Solenoid Pull-In |
| LED 9 | Receiver Tank Pressure Solenoid | LED 25 | K7 Starter Relay |
| LED 10 | Hot Gas Bypass/Loader Valve 2 (Not Used) | LED 27 | ETV-D (Note 2) |
| LED 11 | Purge Valve | LED 28 | ETV-B (Note 2) |
| LED 17 | Loader Valve 1 (Not Used) | LED 29 | ETV-A (Note 2) |
| LED 18 | Alternator Excite | LED 30 | ETV-C (Note 2) |

Notes:

1. The Status LED flashes once per second when the Base Controller is powered and operating normally. The Status LED flashes several times per second during a flash load. The Status LED is on without flashing during reboot and when the Base Controller is under test. The Status LED flashes twice within one second followed by one second off if a CAN communication error is present.
2. ETV LEDs are illuminated when the respective ETV output is energized. On applications without ETV, the LEDs may be illuminated.

Smart FET Outputs

A Smart FET is a self protecting output device used for the functions shown in the table. Smart FETs halt current flow if an over-current condition exists and generate an alarm. The Smart FET will resume normal operation when the alarm is cleared and current flow is within limits. Smart FETs are not field repairable. A fuse is not required.

| Output | Function |
|--------------------|-------------------------------|
| EVA, EVB, EVC, EVD | ETV Outputs |
| HG/LV2 | Hot Gas Sol or Loader Valve 2 |
| ALPC | Alarm Light |
| ALM | Alarm Light |
| LV1 | Loader Valve 1 |
| EXC | Alternator Excitation |
| WV | Water Valve |
| LQI | Liquid Injection Valve |
| LLS | Liquid Line Solenoid |
| GM1, GM2 | Damper Gear Motor (See Note) |
| CIS | Condenser Inlet Solenoid |
| RTPS | Receiver Tank Press Sol |
| PV | Purge Valve |

Note: Gear motor circuitry not present on all relay boards.

Board Jumpers

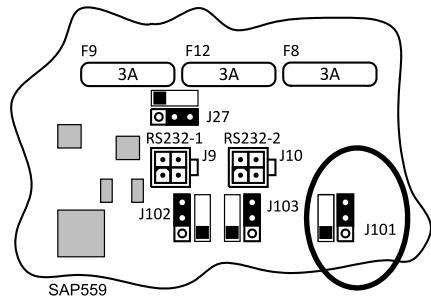
Four sets of jumper pins are located on the Interface Board. Each set consists of a jumper and three pins. A white bar next to each set of pins on the circuit board shows the usual jumper placement. For normal operation, the jumper must be installed as shown.

The J27 jumper is the CAN Bus Terminator. It should be left in the position shown. The J102 and J103 jumpers are not used.

The J101 jumper is the Cold Start Jumper and performs a Base Controller cold start to reset the Base Controller to default settings. To perform a cold start, turn the unit off and place the Base Controller Power Switch in the off position. This switch is located on the side of the control box (SB units), or on the front control panel (SLX units). Move the J101 pin jumper from the center and top pins to the cold start position on the center and bottom pins. Place the Base Controller Power Switch in the on position and turn the unit on by pressing the HMI Control Panel On Key. A cold start has been performed and all sensor grades and unit programmable settings have been returned to the default setting. Alarm Code 74 will be set to indicate that the Base Controller has been reset.

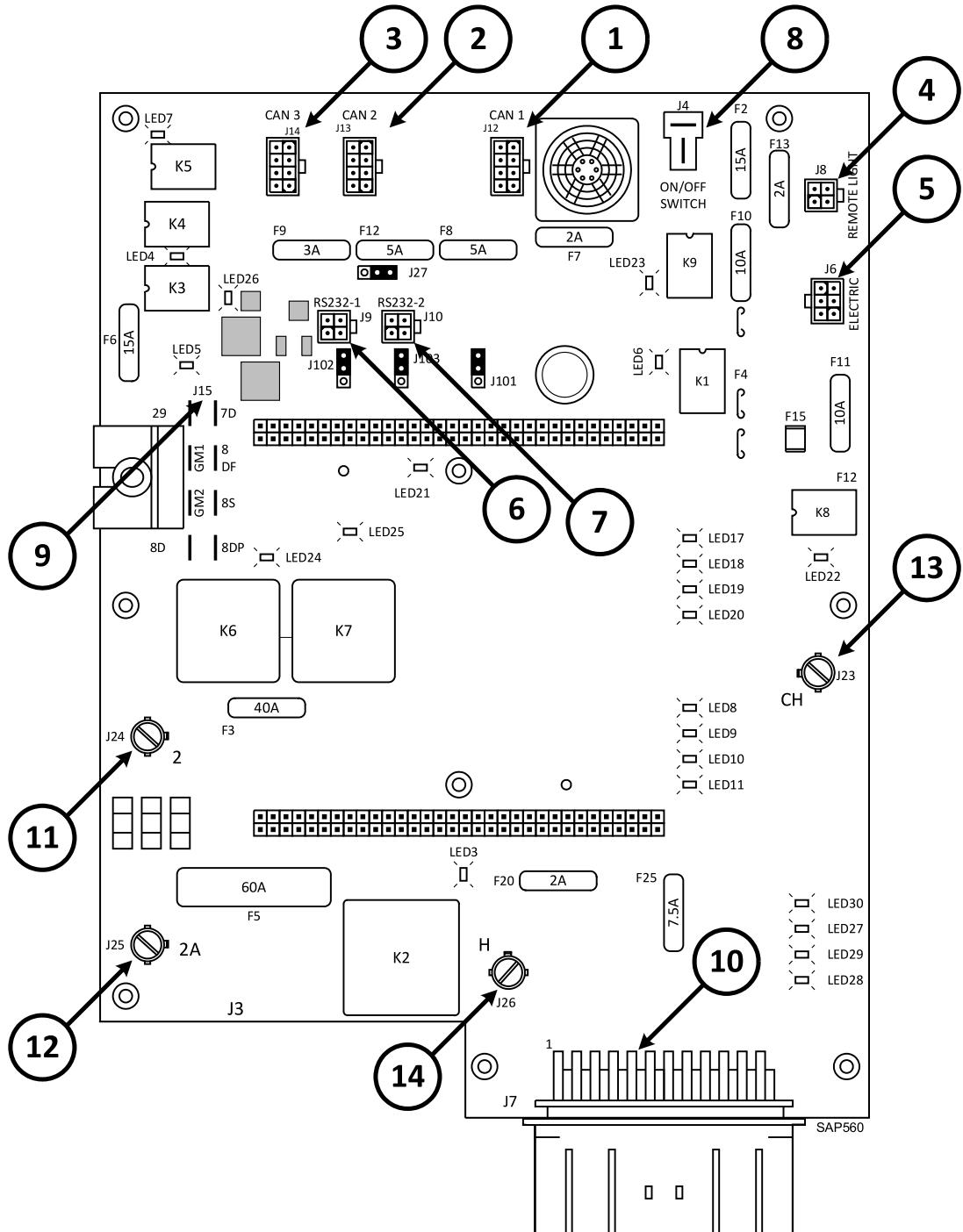
After the cold start has been performed, reverse the process and place the J101 jumper back in the normal position on the center and top pins. Failure to do so will result in a cold start every time the unit is turned on. Refer to Service Procedure A07A for additional details.

Figure 13. J101 Cold Start Jumper (Shown in the normal position)



Connector Locations

Note: The components shown in grey to the left of item number 6 in the illustration below are only present on Interface Boards equipped for use with damper gear motors.



Note: See Connector Usage for item number information.



Section 2 - Hardware Description

Connector Usage

| Number | Connector | Circuit |
|-----------|-----------|---|
| 1 | J12 | CAN1 connection |
| 2 | J13 | CAN2 connection |
| 3 | J14 | CAN3 connection |
| 4 | J15 | Connections to unit engine and damper (and defrost gear motor – if so equipped) |
| 5 | J24 | "2" circuit to fuse link |
| 6 | J4 | Connections to Base Controller On/Off Switch |
| 7 | J25 | "2A" circuit to alternator |
| 8 | J26 | "H" circuit to air intake heater |
| 9 | J3 | Connections to unit Sensor Harness |
| 10 | J7 | Connections to unit Main Harness |
| 11 | J23 | "CH" chassis ground to unit ground plate |
| 12 | J31 | USB Connector to USB Connector on Front Panel |
| 13 | J6 | Connections to optional Electric Standby |
| 14 | J8 | Connections to optional Remote Status Light |
| 15 | J10 | RS-232 Serial Port 2 connection to optional Remote Control Panel |
| 16 | J9 | RS-232 Serial Port 1 connection to ServiceWatch connector |
| 17 | J98 | CAN connector for REB Connection |

Note: Refer to the following pages for individual connector maps.

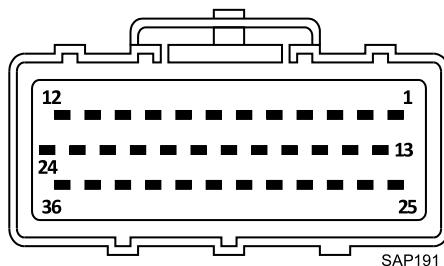
SR-2 Interface Board Connector Maps

J7 - Interface Board to Main Harness Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|-------|--------|--|
| 1 | LLS | Power to energize Liquid Line Solenoid (LLS) |
| 2 | 2 | Power to the alternator sense circuit |
| 3 | CIS | Power to energize Condenser Inlet Solenoid (CIS) |
| 4 | RTPS | Power to energize Receiver Tank Pressure Solenoid (RTPS) |
| 6 | PV | Power to energize Purge Valve (PV) |
| 13 | SPP | Power to suction pressure transducer (red wire) (SPT) |
| 14 | DPP | Power to discharge pressure transducer (red wire) (DPT) |
| 15 | CLP | Power to coolant level sensor (red wire) (CLS) |
| 16 | CLS | Signal from coolant level sensor (white wire) (CLS) |
| 17 | PHCP | To high pressure cutout switch (HPCO) |
| 18 | HPCO | To high pressure cutout switch (HPCO) |
| 19 | HPCS | To high pressure cut-in switch (HPCS) |
| 20 | DSP | Power to the optional door switch (red wire) (DS) |
| 21 | DS | Signal from the optional door switch (white wire) (DS) |

| Pin # | Wire # | Description |
|--------------|---------------|--|
| 25 | SPN | Ground to suction pressure transducer (black wire) (SPT) |
| 26 | DPN | Ground to discharge pressure transducer (black wire) (DPT) |
| 28 | 20B | To engine low oil pressure switch (LOPS) |
| 29 | OLS | To engine low oil level switch (OLS) |
| 33 | EXC | Power to the alternator excite circuit |
| 34 | W | To the alternator "W" circuit |
| 35 | FS1 | To flywheel sensor (FW) |
| 36 | FS2 | To flywheel sensor (FW) |

Figure 14. J7 - Interface Board Harness Connector (shown from pin side)



J6 - Electric Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|---|
| 1 | 7E | To 7EA terminal on phase select module (PSM) |
| 2 | EOL | To normally closed contact pin 95 on overload relay (OLR) |
| 3 | 8 | To 8 terminal on phase select module (PSM) |
| 4 | CHHV | To chassis ground |
| 5 | ER | To ER terminal on phase select module (PSM) |
| 6 | 26E | Power to heater contactor (HC) |

J8 - Remote Light Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|--------------------------------------|
| 1 | ALM | To white wire on remote light option |
| 2 | 8FC | To red wire on remote light option |
| 3 | ALPC | To black wire on remote light option |
| 4 | 8FC | Option Power |

J9 - ServiceWatch RS-232 Serial Download Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|--|
| 1 | RXD-RED1 | To J52 controller download connector pin A |
| 2 | TXD-BLK2 | To J52 controller download connector pin B |



Section 2 - Hardware Description

| Pin # | Wire # | Description |
|-------|----------|--|
| 3 | COM-BLK1 | To J52 controller download connector pin C |
| 4 | DPD-RED2 | To J52 controller download connector pin E |

J10 - Remote Controller Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|-------|------------|----------------------------------|
| 1 | RXD-BLK | To Remote Controller Panel Pin 7 |
| 2 | TXD-RED | To Remote Controller Panel Pin 8 |
| 3 | None | Not Used |
| 4 | REM-ON-BRN | To Remote Controller Panel Pin 6 |

J12 - Expansion Module CAN Bus and Power Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|-------|----------|---|
| 1 | CANL-BLU | To Expansion Module J2 pin 1 |
| 2 | CANH-GRE | To Expansion Module J2 pin 2 |
| 3 | SHLD | To Expansion Module J2 pin 3 |
| 4 | ON - RED | To Expansion Module J2 pin 4 |
| 5 | 2A - BLK | To Expansion Module J2 pin 5 |
| 6 | 8XP-YEL | To Expansion Module J2 pin 6 |
| 7 | | Not Used |
| 8 | CH - ORA | Chassis ground to Expansion Module J2 pin 8 |

J13 - Remote Controller Power Control Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|-------|--------------|---|
| 1 | CANL | Not Used |
| 2 | CANH | Not Used |
| 3 | SHLD | Not Used |
| 4 | ON-ORN | To Remote Controller Panel Pin 4 |
| 5 | 2-BLU | To Remote Controller Panel Pin 1 |
| 6 | 8XP | Not Used |
| 7 | None | Not Used |
| 8 | DRAIN/CH/GRN | Chassis ground to Remote Controller Panel Pin 2 |

J14 - HMI CAN Bus Communication and Power Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|-------|-----------|-----------------------------|
| 1 | CANL-BLK1 | To HMI Control Panel Pin 1 |
| 2 | CANH-RED1 | To HMI Control Panel Pin 22 |
| 3 | DRAIN-WHT | To HMI Control Panel Pin 23 |
| 4 | ON-RED2 | To HMI Control Panel Pin 34 |

| Pin # | Wire # | Description |
|--------------|---------------|--|
| 5 | 2A-BLK2 | To HMI Control Panel Pin 12 |
| 6 | 8XP-BLK3 | To HMI Control Panel Pin 6 |
| 7 | OFF | Not Used |
| 8 | CH-RED3 | Chassis ground to HMI Control Panel Pin 25 |

J4 - Power Switch Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|--------------------|
| 1 | 2AB | 2AB Power |
| 2 | 8 | 8 Power |

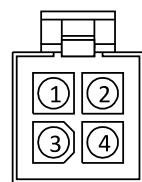
J15 - Engine Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|---|
| 1 | 8DP | Power to energize fuel solenoid pull-in coil (white wire) (FSP) |
| 2 | 8S | Power to energize starter solenoid (SS) |
| 3 | 8DF | Not Used |
| 4 | 7D | Power to energize high speed solenoid (HS) |
| 5 | 8D | Power to energize fuel solenoid hold coil (red wire) (FSH) |
| 6 | GM2 | Power to Damper Gear Motor (SLX Only) |
| 7 | GM1 | Power to Damper Gear Motor (SLX Only) |
| 8 | 29 | Power to energize damper solenoid (DS) |

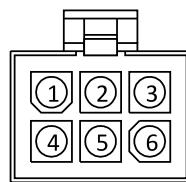
Screw Terminal Power Connections

| Terminal # | Wire # | Description |
|-------------------|---------------|--|
| 2 | RED | "2" circuit to fuse link |
| 2A | 2A | "2A" circuit to alternator |
| H | H | "CH" chassis ground to unit ground plate |
| CH | CH | "H" circuit to air intake heater |

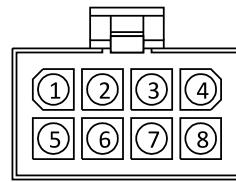
Figure 15. Mini Mate-N-Lok Harness Connectors (shown from pin side of harness connector)



4 Pin Connectors



6 Pin Connectors



8 Pin Connectors

55533-2-2-14

SR-3 Base Controller

⚠ WARNING

Risk of Injury!

The unit can start at any time without warning. Press the OFF key on the HMI control panel and place the microprocessor On/Off switch in the Off position before inspecting or servicing any part of the unit.

The heart of the integrated SR-3 control system is the Base Controller. The SR-3 Base Controller is mounted on a molded plastic mounting base that is secured to the back of the control box. The mounting hole pattern is exactly the same as the SR-2 Base Controller. It is located on the rear panel of the control box.

Base Controller Hardware Versions

For complete details of Base Controller hardware versions and software requirements, refer to Section 7.

Base Controller Software Revisions

For complete details of Base Controller software revisions and hardware requirements, refer to Section 7.

Real Time Clock

The real time clock is located in the HMI Control Panel. The system time is supplied to the Base Controller each time the unit is turned on. If the Base Controller is changed, the clock setting will be automatically supplied to the Base Controller when the unit is turned on. If the HMI Control Panel is changed, the clock setting must be verified.

ServiceWatch Data Logger

The Base Controller contains the ServiceWatch Data Logger. The ServiceWatch Data Logger is a diagnostic data logger. This data logger records unit temperature sensors, unit setpoint, unit operating conditions, alarms and conditions that exist when an alarm is set.

When diagnosing alarm codes always download the ServiceWatch data logger using the WinTrac™ Service Tool. Review the data to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

Programmable Features

The settings of all programmable features are held in non-volatile memory in the Base Controller. The settings are supplied to the HMI Control Panel each time the unit is turned on. If the Base Controller is changed, all programmable features must be reprogrammed. If the HMI Control Panel is changed, the current programmable feature settings will be supplied to the new HMI Control Panel when the unit is turned on. Refer to Section 3 of this manual for programmable feature details.

Base Controller Operation

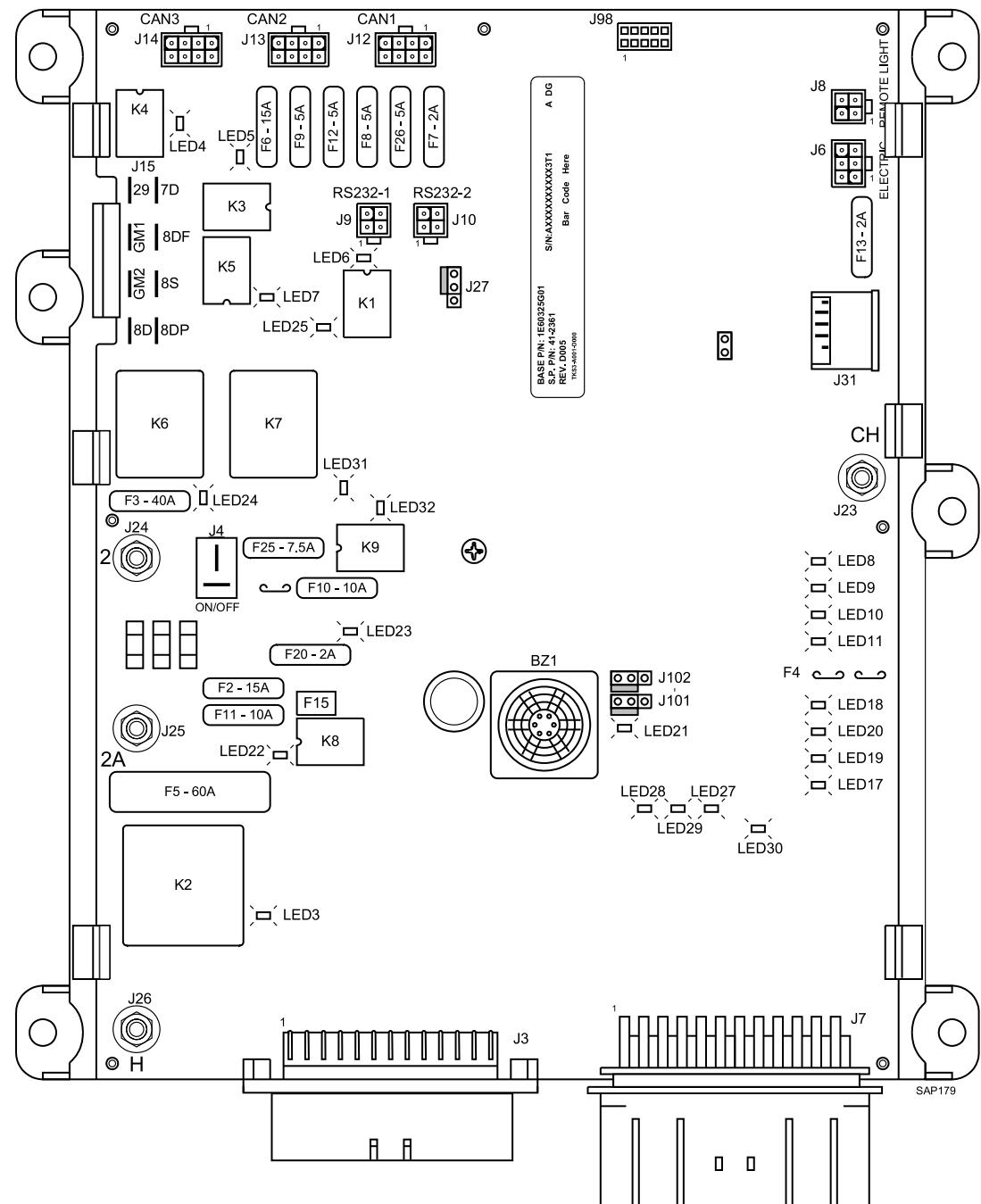
The Base Controller consists of an integrated microprocessor and interface board, software, memory, inputs, and outputs. The Base Controller also provides the interface between the controller inputs and outputs and the unit control components. The inputs are used to supply power and system information to the Base Controller. The Base Controller and software examine the status of the inputs and turn the outputs to the solenoids, valves and motor contactors on and off as required to control the operation of the unit. The Base Controller also provides over-current and short circuit protection for the control circuits.

The only user serviceable components on the Base Controller are the fuses and the Cold Start jumper.

The Base Controller controls the operation of the unit using control relays or Smart FETs. The relays control power to the high amperage loads . The Smart FETs control power to the lower

amperage loads such as solenoids and valves. Each relay is individually fuse protected. The Smart FETs are self-protecting. An LED next to each relay or Smart FET is illuminated when the relay or FET is energized by the Base Controller. With relays, the LED illuminates only when the relay coil is energized and the relay contacts have transferred to the energized position.

Figure 16. SR-3 Base Controller





Section 2 - Hardware Description

Relay Functions

Important: Do not attempt to remove the relays from the Base Controller. They are soldered in place.

| Relay | Function |
|-------|-------------------------------------|
| K1 | Run Relay |
| K2 | Pre-Heat Relay |
| K3 | High Speed Relay |
| K4 | Damper Relay |
| K5 | Diesel/Electric Relay |
| K6 | Fuel Solenoid Pull-In Relay |
| K7 | Starter Solenoid Relay |
| K8 | Fresh Air Exchange Relay (Optional) |
| K9 | On/Off Relay |

Base Controller Fuse Size & Function

| Fuse | Size | Function |
|------|------------|--|
| F2 | 15A | Power to On/Off Switch |
| F3 | 40A | Power to Fuel Sol Pull-In/Starter Solenoid |
| F4 | None or 2A | No fuse - all Bosch and TK alternators (Note 1) 2A fuse - all Prestolite alternators (Note 1) |
| F5 | 60A | Preheat Circuit (Note 2) |
| F6 | 15A | Power to Damper and High Speed Solenoids |
| F7 | 2A | Switch On Power to CAN Bus |
| F8 | 5A | 2A power to CAN Connector J12 |
| F9 | 5A | 2A power to CAN Connector J14 |
| F10 | 10A | Power to On Relay (Right Position) Bypass HMI Control of Power (Left Position) |
| F11 | 10A | Power to Auto Fresh Air Solenoid |
| F12 | 5A | 2A power to CAN Connector J13 |
| F13 | 2A | Power to Remote Lights |
| F15 | P/S | On/Off Relay (Note 3) |
| F20 | 2A | Power to Alternator Sense |
| F25 | 7.5A | Power to HPCO |
| F26 | 5A | Power to REB Board |

Notes:

1. Fuse F4 must be in place for Prestolite alternators to charge. Fuse F4 must be removed for Bosch and Thermo King alternators. Service Parts Base Controllers are shipped without the F4 fuse.
2. The F5 preheat fuse is a "slow blow" type fuse. It is designed for use with the engine air pre-heater. Always replace the fuse with the TK specified fuse. Service Parts Base Controllers are shipped without the F5 fuse.
3. The device identified as F15 is a polyswitch. This polyswitch provides over-current protection for the On/Off relay. The polyswitch will reset automatically and is not field repairable.

Fuse F10

There are three in-line fuse clips that allow for two configurations of the F10 fuse. The right position is the normal position. This position has a white bar below it on the circuit board. When fuse F10 is installed in the right position, control power is routed to the K9 On/Off Relay contacts. The On/Off keys on the HMI Control Panel energize and de-energize the K9 On/Off Relay. When the K9 On/Off Relay is energized, power is supplied through the normally open K9 contacts to turn the unit on.

When fuse F10 is installed in the left position, power bypasses the K9 On/Off relay contacts and the unit will start and run without the HMI Control Panel connected. **This fuse position is for emergency bypass operation only.** Do not operate the unit with the F10 fuse installed in the left position unless absolutely necessary.

Important: If fuse F10 is installed in the left position, the unit may start and run. If the HMI Control Panel is connected and functional, the On and Off keys will still work. The Off key will turn the unit off if fuse F10 is in the left position, but the Base Controller will remain powered up.

Important: If fuse F10 is installed in the left position and the unit is turned off using the Off key, the unit will shut down but the Base Controller will remain powered up. Leaving the unit turned off in this manner for an extended period may result in a dead battery.

Fuse F15

The device identified as F15 is a poly switch. This over-current device resets automatically and is not replaceable.

Smart FET Outputs

A Smart FET is a self protecting output device used for the functions shown in the table. Smart FETs halt current flow if an over-current condition exists and generate an alarm. The Smart FET will resume normal operation when the alarm is cleared and current flow is within limits. Smart FETs are not field repairable. A fuse is not required.

| Output | Function |
|--|---------------------------------|
| EVA, EVB, EVC, EVD | ETV Outputs |
| HGB | Hot Gas Bypass |
| EXC | Alternator Excitation |
| LLS | Liquid Line Solenoid |
| GM1, GM2 | Damper Gear Motor (See Note) |
| CIS | Condenser Inlet Solenoid |
| RTPS | Receiver Tank Pressure Solenoid |
| PV | Purge Valve |
| Note: Gear motor circuitry not present on all Base Controllers. | |

LED Functions

The LED is illuminated when the associated circuit output is energized. Not all output LEDs shown are used on multi-temperature trailer applications.

| LED # | Function | LED # | Function |
|-------|------------------------|--------|--------------------------------|
| LED 3 | K2 Preheat | LED 20 | Loader Valve 3 (Not Used) |
| LED 4 | K4 Damper Solenoid | LED 21 | Heartbeat (Note 1) |
| LED 5 | K3 High Speed Solenoid | LED 22 | K8 Zone 1 Liquid Line Solenoid |



Section 2 - Hardware Description

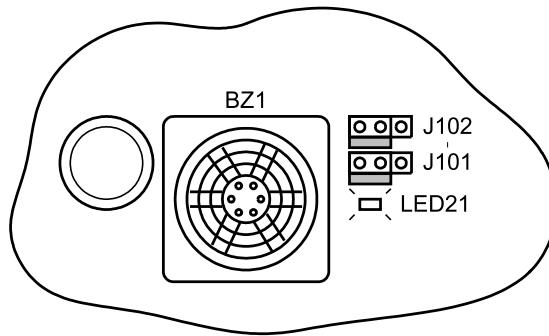
| LED # | Function | LED # | Function |
|--------|--|--------|--------------------------|
| LED 6 | K1 Run Relay | LED 23 | K9 On/Off Relay |
| LED 7 | K5 Diesel/Electric Relay | LED 24 | K6 Fuel Solenoid Pull-In |
| LED 8 | Condenser Inlet Solenoid | LED 25 | K7 Starter Relay |
| LED 9 | Receiver Tank Pressure Solenoid | LED 27 | ETV-D (Note 2) |
| LED 10 | Hot Gas Bypass/Loader Valve 2 (Not Used) | LED 28 | ETV-B (Note 2) |
| LED 11 | Purge Valve | LED 29 | ETV-A (Note 2) |
| LED 17 | Loader Valve 1 (Not Used) | LED 30 | ETV-C (Note 2) |
| LED 18 | Alternator Excite | LED 31 | Damper Gear Motor Close |
| LED 19 | Liquid Injection Valve (Not Used) | LED 32 | Damper Gear Motor Open |

Notes:

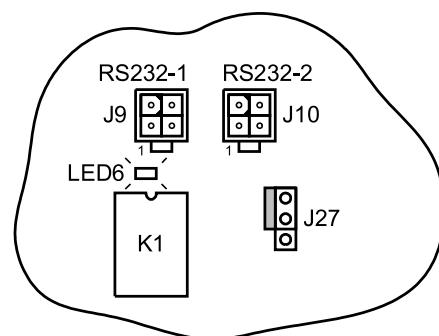
1. The Status LED flashes once per second when the Base Controller is powered and operating normally. The Status LED flashes several times per second during a flash load. The Status LED is on without flashing during reboot and when the Base Controller is under test. The Status LED flashes twice within one second followed by one second off if a CAN communication error is present.
2. ETV LEDs are illuminated when the respective ETV output is energized. On applications without ETV, the LEDs may be illuminated.

Board Jumpers

Three sets of jumper pins are located on the Base Controller. Each set consists of a jumper and three pins. A white bar next to each set of pins on the circuit board shows the usual jumper placement. For normal operation, the jumpers must be installed as shown.



J101 Cold Start Jumper and J102 Jumper

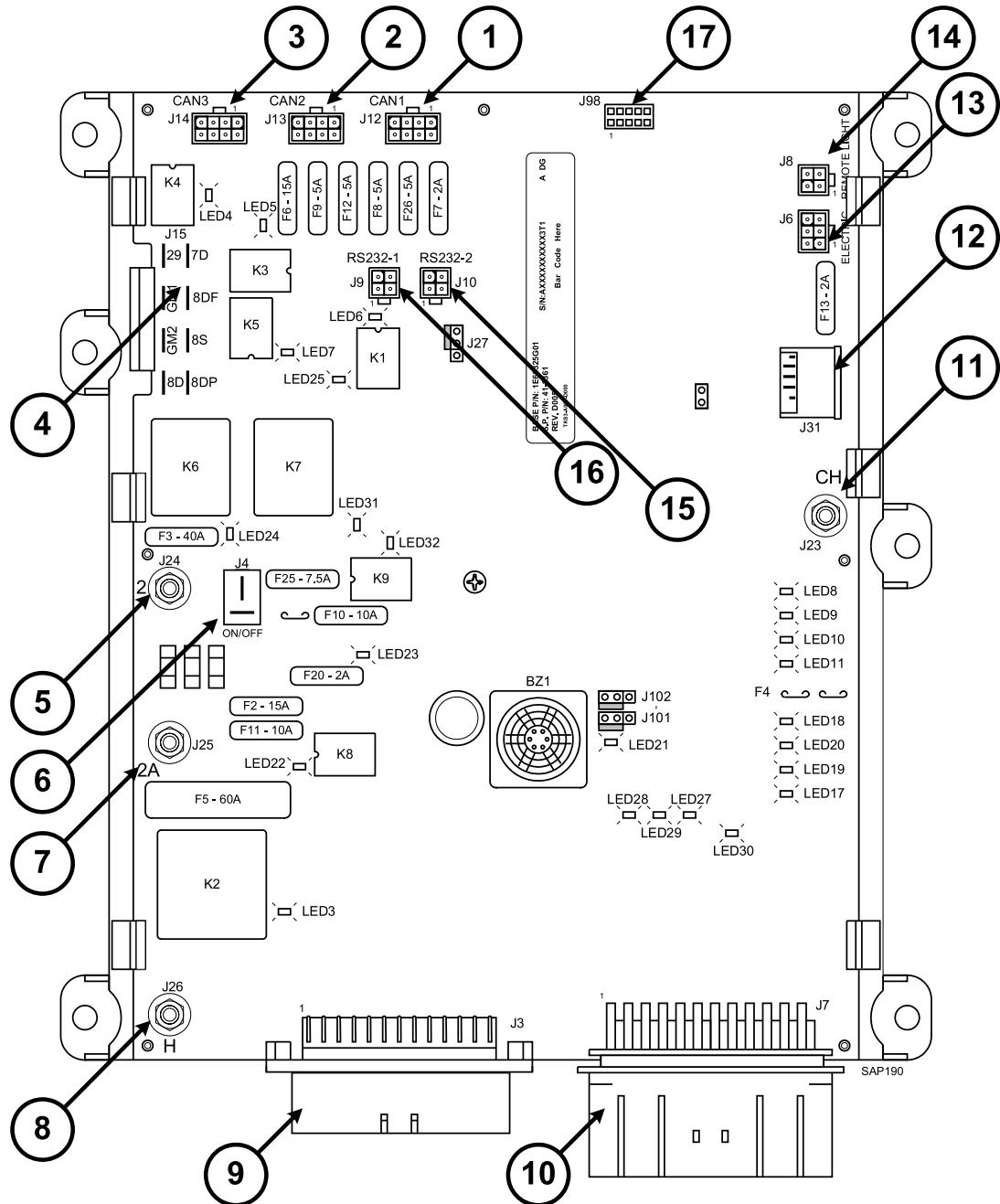


J27 CAN Bus Terminator Jumper

The J101 jumper is used to perform a Base Controller Cold Start. For details, refer to Service Procedure A07A Performing a Base Controller Cold Start. The J27 and J102 jumpers should not be moved.

Table 1. Jumper Functions

| | |
|------|----------------------------------|
| J27 | CAN Bus Terminator – Do Not Move |
| J101 | Cold Start Jumper |
| J102 | Not Used – Do Not Move |

Connector Locations


Note: See Connector Usage for item number information.



Section 2 - Hardware Description

Connector Usage

| Number | Connector | Circuit |
|-----------|-----------|---|
| 1 | J12 | CAN1 connection |
| 2 | J13 | CAN2 connection |
| 3 | J14 | CAN3 connection |
| 4 | J15 | Connections to unit engine and damper (and defrost gear motor – if so equipped) |
| 5 | J24 | "2" circuit to fuse link |
| 6 | J4 | Connections to Base Controller On/Off Switch |
| 7 | J25 | "2A" circuit to alternator |
| 8 | J26 | "H" circuit to air intake heater |
| 9 | J3 | Connections to unit Sensor Harness |
| 10 | J7 | Connections to unit Main Harness |
| 11 | J23 | "CH" chassis ground to unit ground plate |
| 12 | J31 | USB Connector to USB Connector on Front Panel |
| 13 | J6 | Connections to optional Electric Standby |
| 14 | J8 | Connections to optional Remote Status Light |
| 15 | J10 | RS-232 Serial Port 2 connection to optional Remote Control Panel |
| 16 | J9 | RS-232 Serial Port 1 connection to ServiceWatch connector |
| 17 | J98 | CAN connector for REB Connection |

Note: Refer to the following pages for individual connector maps.

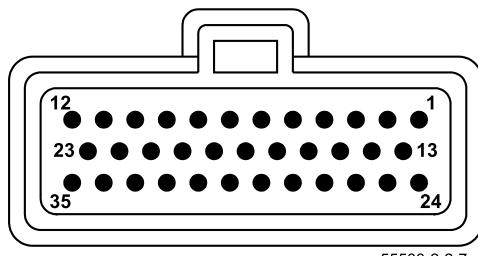
SR-3 Base Controller Connector Maps

J3 - Base Controller Sensor Harness Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|-------|--------|--|
| 1 | RTP | Zone 1 return air temperature sensor positive (blue sensor wire) |
| 2 | RTN | Zone 1 return air temperature sensor negative (brown sensor wire) |
| 3 | ATP | Ambient temperature sensor positive (blue sensor wire) |
| 4 | ATN | Ambient temperature sensor negative (brown sensor wire) |
| 9 | DPI | Signal from discharge pressure transducer (white wire) (DPT) |
| 10 | SPI | Signal from suction pressure transducer (white wire) (SPT) |
| 12 | 2PL | Power for Optional Fuel Level Sensor |
| 13 | DTN | Zone 1 discharge air temperature sensor negative (brown sensor wire) |
| 14 | CTN | Zone 1 coil temperature sensor negative (brown sensor wire) |
| 15 | WTN | Water temperature sensor negative (brown sensor wire) |
| 16 | ST1N | Spare 1 temperature sensor negative (brown sensor wire) |
| 21 | ST2P | Spare 2 air temperature sensor positive (blue sensor wire) |
| 22 | ST3P | Spare 3 air temperature sensor positive (blue sensor wire) |
| 23 | FLL | Optional fuel level sensor |

| Pin # | Wire # | Description |
|--------------|---------------|---|
| 24 | DTP | Zone 1 discharge air temperature sensor positive (blue sensor wire) |
| 25 | CTP | Zone 1 coil temperature sensor positive (blue sensor wire) |
| 26 | WTP | Water temperature sensor positive (blue sensor wire) |
| 27 | ST1P | Spare 1 temperature sensor positive (blue sensor wire) |
| 32 | ST2N | Spare 2 air temperature sensor negative (brown sensor wire) |
| 33 | ST3N | Spare 3 air temperature sensor negative (brown sensor wire) |
| 35 | FUELN | Optional fuel level sensor |

Figure 17. 35 Pin Sensor Harness Connector (shown from pin side)



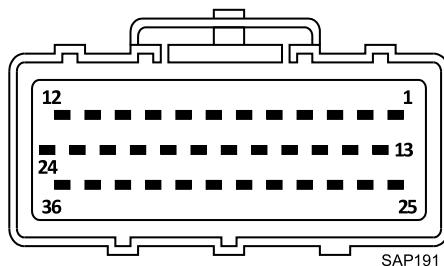
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J7 - Base Controller to Main Harness Connector

| Pin # | Wire # | Description |
|--------------|---------------|--|
| 1 | LLS | Power to energize Liquid Line Solenoid (LLS) |
| 2 | 2 | Power to the alternator sense circuit |
| 3 | CIS | Power to energize Condenser Inlet Solenoid (CIS) |
| 4 | RTPS | Power to energize Receiver Tank Pressure Solenoid (RTPS) |
| 6 | PV | Power to energize Purge Valve (PV) |
| 13 | SPP | Power to suction pressure transducer (red wire) (SPT) |
| 14 | DPP | Power to discharge pressure transducer (red wire) (DPT) |
| 15 | CLP | Power to coolant level sensor (red wire) (CLS) |
| 16 | CLS | Signal from coolant level sensor (white wire) (CLS) |
| 17 | PHPCO | To high pressure cutout switch (HPCO) |
| 18 | HPCO | To high pressure cutout switch (HPCO) |
| 19 | HPCS | To high pressure cut-in switch (HPCS) |
| 20 | DSP | Power to the optional door switch (red wire) (DS) |
| 21 | DS | Signal from the optional door switch (white wire) (DS) |
| 25 | SPN | Ground to suction pressure transducer (black wire) (SPT) |
| 26 | DPN | Ground to discharge pressure transducer (black wire) (DPT) |
| 28 | 20B | To engine low oil pressure switch (LOPS) |
| 29 | OLS | To engine low oil level switch (OLS) |
| 33 | EXC | Power to the alternator excite circuit |
| 34 | W | To the alternator "W" circuit |

| Pin # | Wire # | Description |
|--------------|---------------|-------------------------|
| 35 | FS1 | To flywheel sensor (FW) |
| 36 | FS2 | To flywheel sensor (FW) |

Figure 18. J7 Base Controller Harness Connector (shown from pin side)



J6 - Electric Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|---|
| 1 | 7E | To 7EA terminal on phase select module (PSM) |
| 2 | EOL | To normally closed contact pin 95 on overload relay (OLR) |
| 3 | 8 | To 8 terminal on phase select module (PSM) |
| 4 | CHHV | To chassis ground |
| 5 | ER | To ER terminal on phase select module (PSM) |
| 6 | 26E | Power to heater contactor (HC) |

J8 - Remote Light Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|--------------------------------------|
| 1 | ALM | To white wire on remote light option |
| 2 | 8FC | To red wire on remote light option |
| 3 | ALPC | To black wire on remote light option |
| 4 | 8FC | Option Power |

J9 - ServiceWatch RS-232 Serial Download Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|--|
| 1 | RXD-RED1 | To controller download connector pin A |
| 2 | TXD-BLK2 | To controller download connector pin B |
| 3 | GND-BLK1 | To controller download connector pin C |
| 4 | DPT-RED2 | To controller download connector pin E |

J10 - Remote Controller Serial Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|----------------------------------|
| 1 | RXD-BLK | To Remote Controller Panel Pin 1 |
| 2 | TXD-RED | To Remote Controller Panel Pin 2 |
| 3 | None | Not Used |
| 4 | REM-ON-BRN | To Remote Controller Panel Pin 8 |

J12 - Expansion Module CAN Bus and Power Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|---|
| 1 | CANL-BLU | To Expansion Module J2 Pin 1 |
| 2 | CANH-GRN | To Expansion Module J2 Pin 2 |
| 3 | SHLD | To Expansion Module J2 Pin 3 |
| 4 | ON/OFF-RED | To Expansion Module J2 Pin 4 |
| 5 | 2A-BLK | To Expansion Module J2 Pin 5 |
| 6 | 8XP-YEL | To Expansion Module J2 Pin 6 |
| 7 | OFF | Not Used |
| 8 | CH-ORA | Chassis ground to Expansion Module J2 Pin 8 |

J13 - Remote Controller Power Control Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|---|
| 1 | CANL | Not Used |
| 2 | CANH | Not Used |
| 3 | SHLD | Not Used |
| 4 | ON-ORN | To Remote Controller Panel Pin 4 |
| 5 | 2-BLU | To Remote Controller Panel Pin 1 |
| 6 | 8FP | Not Used |
| 7 | OFF | Not Used |
| 8 | CHP/GRN | Chassis ground to Remote Controller Panel Pin 2 |

J14 - HMI CAN Bus Communication and Power Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|--|
| 1 | CANL-BLK1 | To HMI Control Panel Pin 10 |
| 2 | CANH-RED1 | To HMI Control Panel Pin 22 |
| 3 | SHLD | To HMI Control Panel Pin 23 |
| 4 | ON-RED2 | To HMI Control Panel Pin 34 |
| 5 | 2P-BLK2 | To HMI Control Panel Pin 12 |
| 6 | 8XP-BLK3 | To HMI Control Panel Pin 6 |
| 7 | OFF | Not Used |
| 8 | CH-RED3 | Chassis ground to HMI Control Panel Pin 35 |

J4 - Power Switch Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|--------------------|
| 2 | 2AB | 2AB Power |
| 3 | 8 | 8 Power |

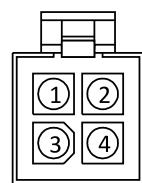
J15 - Engine Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|---|
| 1 | 8DP | Power to energize fuel solenoid pull-in coil (white wire) (FSP) |
| 2 | 8S | Power to energize starter solenoid (SS) |
| 3 | 8DF | Not Used |
| 4 | 7D | Power to energize high speed solenoid (HS) |
| 5 | 8D | Power to energize fuel solenoid hold coil (red wire) (FSH) |
| 6 | GM2 | Power to Damper Gear Motor (SLX) |
| 7 | GM1 | Power to Damper Gear Motor (SLX) |
| 8 | 29 | Power to energize damper solenoid (DS) |

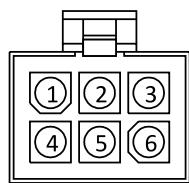
Screw Terminal Power Connections

| Terminal # | Wire # | Description |
|-------------------|---------------|------------------------------------|
| J24 (2) | RED | From fusible link (battery power) |
| J25 (2A) | 2A | From alternator |
| J26 (H) | H | To air intake heater or glow plugs |
| J23 (CH) | CH | Chassis Ground |

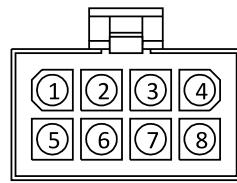
Figure 19. Mini Mate-N-Lok Harness Connectors (shown from pin side of harness connector)



4 Pin Connectors



6 Pin Connectors



8 Pin Connectors

55533-2-2-14

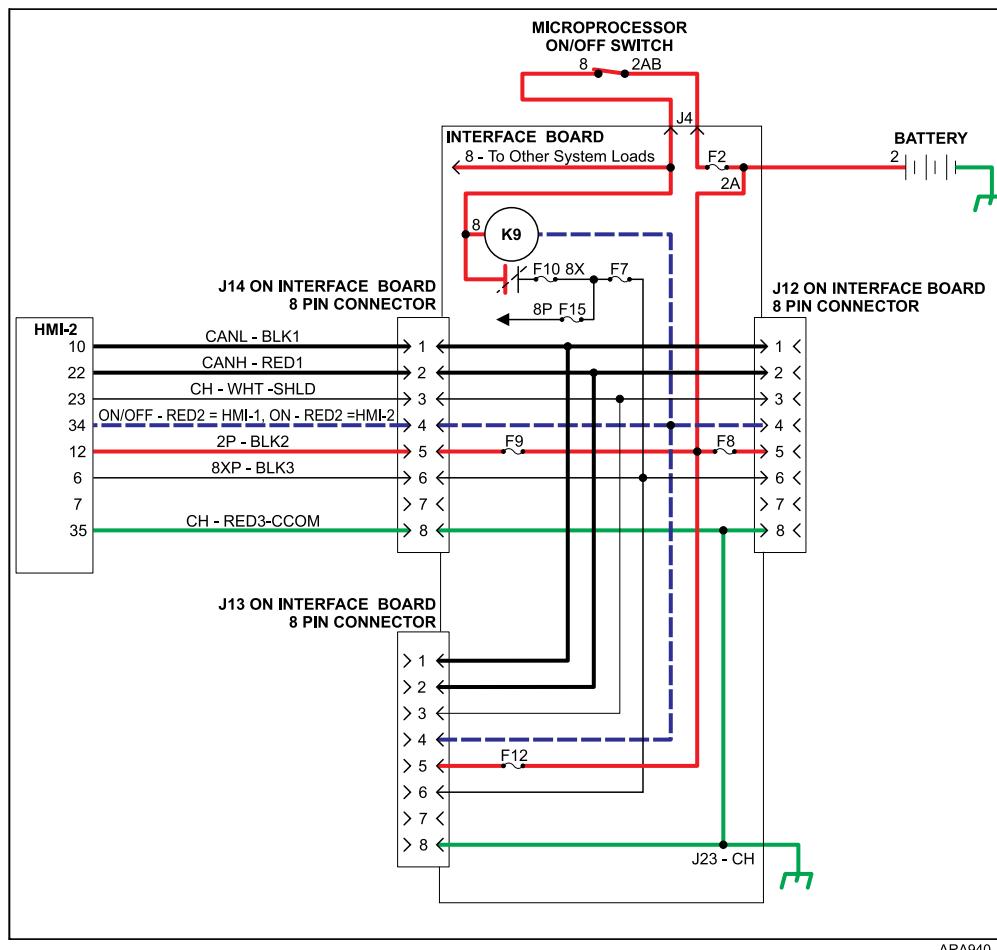
SR-2/SR-3 CAN Bus Connector Circuits - J12 (CAN1), J13 (CAN2), J14 (CAN3)

The following diagram (Figure 20, p. 63) shows the circuits to the J12, J13, and J14 connectors on the Interface Board. These connectors are also marked CAN1, CAN2, and CAN3 (respectively) on the Interface Board. The HMI Control Panel is typically connected to J14. A remote controller is typically connected to J13. An RCOM, i-Box, or Expansion Module is typically connected to J12.

The CANL, CANH, and 8X/8XP wires from J12, J13, and J14 have a common connection on the Interface Board. If any of these wires in the harness from J12, J13, or J14 should short to ground, they will effectively ground (short) all of the wires for that circuit. Example: A shorted CANH wire in the remote controller harness from J13 will cause the CANH for J12, J13, and J14 to be shorted to ground. This effectively shuts the CAN communication down. Refer to (“[Remote Controller Harness](#),” p. 388) for additional information.

The 2P circuits are individually fused by the F8, F9, and F12 fuses.

Figure 20. J12, J13, J14 CAN Bus Connector Circuits



ARA940-1

Expansion Module

The Expansion Module (EM) is a hardware module that allows for operation of up to three temperature controlled zones. The EM provides the interface between the Base Controller and the Zone 1, Zone 2, and Zone 3 multi-temperature components such as sensors, solenoids, valves, and fan motors. It also provides over-current and short circuit protection for the associated circuits. The EM features 100% solid state outputs. All outputs are Smart FET controlled.

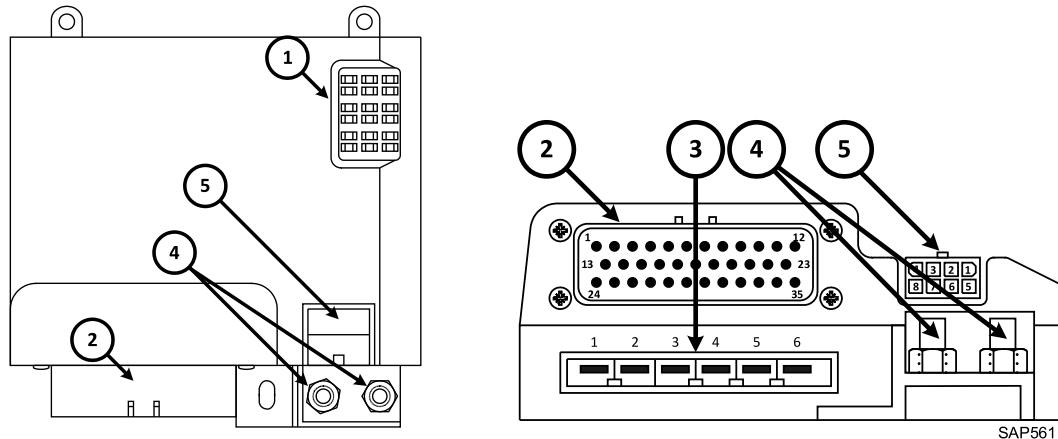
Section 2 - Hardware Description

All engine functions and some of the host unit valves are controlled by the Base Controller. This includes the Receiver Tank Pressure Solenoid (RTPS), Purge Valve (PV), and Condenser Inlet Solenoid (CIS). In addition, the Liquid Line Solenoid (LLS1) for Zone 1 is controlled directly from the Base Controller, and the Zone 1 return air temperature sensor, Zone 1 discharge air temperature sensor, and Zone 1 evaporator coil temperature sensor are input directly to the Base Controller. All other Zone 1 devices and all remote evaporators are controlled by the Expansion Module.

Load power is supplied to the Expansion Module by the alternator via the two 2A terminal studs. EM controller power is supplied via the 8 pin J2 CAN connector at pin 6 (8XP yellow). The EM also communicates with the Base Controller via the CAN bus connection. All remote zone input and solenoid output functions (except the Zone 1 LLSV) are connected via the Expansion Module J1 35 pin connector harness. The EM J13 fan connector has six remote evaporator fan motor outputs for powering up to 12 remote fan motors. Each output is capable of operating two fans. The EM has two outputs for controlling evaporator fan speed in up to two zones. Each output will control the fan speed for all motors in a zone. Refer to the connector maps on the following pages for additional details.

There are no user replaceable components on the Expansion Module. To check Expansion Module operation, refer to Service Procedure A01D.

Figure 21. Top and End Views



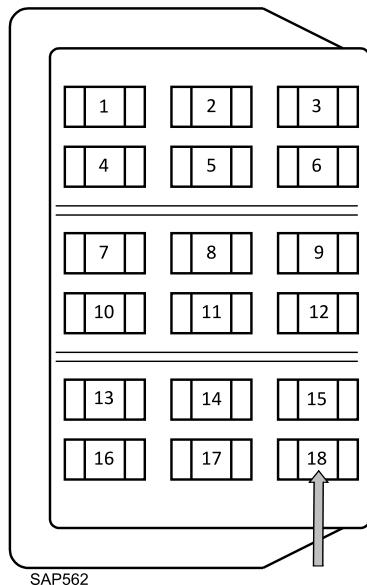
SAP561

| | |
|----|--|
| 1. | Expansion Module Status LEDs |
| 2. | J1 35 Pin Expansion Module Connector |
| 3. | J13 6 Pin Evaporator Fan Connector |
| 4. | 2A Power Connection Studs (2 ea) |
| 5. | J2 8 Pin CAN Connection to the Base Controller J12 CAN connector |

LED Functions

Output LEDs are provided to indicate outputs that are energized. These LED indicators are located in the corner of the Expansion Module body. The LED is illuminated when the associated circuit output is energized.

Figure 22. Green Status LED (all other LEDs are red)



| LED # | Function | LED # | Function |
|--------------|-------------------------------------|--------------|---|
| LED 1 | Fan Output #5 | LED 10 | Zone 2 Hot Gas Solenoid Output |
| LED 2 | Fan Output #6 | LED 11 | Zone 2 Suction Line Solenoid Output |
| LED 3 | Zone 3 Drain Tube Heater Output | LED 12 | Zone 2 Liquid Line Solenoid Output |
| LED 4 | Zone 3 Hot Gas Output | LED 13 | Fan Output #1 |
| LED 5 | Zone 3 Suction Line Solenoid Output | LED 14 | Fan Output #2 |
| LED 6 | Zone 3 Liquid Line Solenoid Output | LED 15 | Zone 1 Drain Tube Heater Output |
| LED 7 | Fan Output #3 | LED 16 | Zone 1 Hot Gas Solenoid Output |
| LED 8 | Fan Output #4 | LED 17 | Zone 1 Suction Line Solenoid Output |
| LED 9 | Zone 2 Drain Tube Heater Output | LED 18 | Status – <u>Flashes once per second</u> when the Base Controller is powered and operating normally. <u>Flashes several times per second</u> when flash loading. On without flashing during reboot and when under test. <u>Flashes twice within one second followed by one second off</u> if a CAN communication error is present. |

Connector Maps

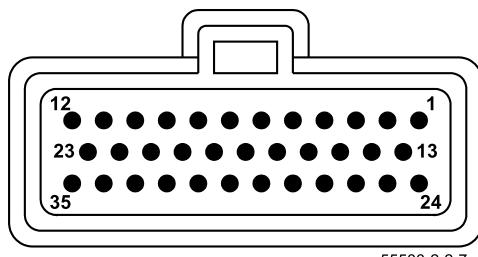
J1 - Expansion Module Harness Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|------------------------------------|
| 1 | DH3 | Zone 3 Drain Tube Heater Output |
| 2 | CH | Chassis Ground |
| 3 | DH1 | Zone 1 Drain Tube Heater Output |
| 4 | | Not Used |
| 5 | LLS2 | Zone 2 Liquid Line Solenoid Output |
| 6 | LLS3 | Zone 3 Liquid Line Solenoid Output |

THERMO KING
Section 2 - Hardware Description

| Pin # | Wire # | Description |
|-------|--------|---|
| 7 | HGS1 | Zone 1 Hot Gas Solenoid Output |
| 8 | HGS2 | Zone 2 Hot Gas Solenoid Output |
| 9 | HGS3 | Zone 3 Hot Gas Solenoid Output |
| 10 | SLS1 | Zone 1 Suction Line Solenoid Output |
| 11 | SLS2 | Zone 2 Suction Line Solenoid Output |
| 12 | SLS3 | Zone 3 Suction Line Solenoid Output |
| 13 | 2AF1 | 2A Circuit Output #1 Polyswitch Fused |
| 14 | 2AF2 | 2A Circuit Output #2 Polyswitch Fused |
| 15 | DTN2 | Zone 2 Discharge Air Temperature Sensor (-) Input |
| 16 | RTN2 | Zone 2 Return Air Temperature Sensor (-) Input |
| 17 | CTN2 | Zone 2 Evaporator Coil Temperature Sensor (-) Input |
| 18 | DTN3 | Zone 3 Discharge Air Temperature Sensor (-) Input |
| 19 | RTN3 | Zone 3 Return Air Temperature Sensor (-) Input |
| 20 | CTN3 | Zone 3 Evaporator Coil Temperature Sensor (-) Input |
| 21 | SC1 | Not Used |
| 22 | SC2 | Zone 2 Fan Speed Control Output |
| 23 | SC3 | Zone 3 Fan Speed Control Output |
| 24 | DH2 | Zone 2 Drain Tube Heater Output |
| 25 | | Not Used |
| 26 | DTP2 | Zone 2 Discharge Air Temperature Sensor (+) Input |
| 27 | RTP2 | Zone 2 Return Air Temperature Sensor (+) Input |
| 28 | CTP2 | Zone 2 Evaporator Coil Temperature Sensor (+) Input |
| 29 | DTP3 | Zone 3 Discharge Air Temperature Sensor (+) Input |
| 30 | RTP3 | Zone 3 Return Air Temperature Sensor (+) Input |
| 31 | CTP3 | Zone 3 Evaporator Coil Temperature Sensor (+) Input |
| 32 | DSP2 | Zone 2 Door Switch Power Output |
| 33 | DS2 | Zone 2 Door Switch Input |
| 34 | DSP3 | Zone 3 Door Switch Power Output |
| 35 | DS3 | Zone 3 Door Switch Input |

Figure 23. 35 Pin Module Harness Connector (shown from pin side)

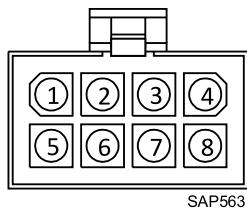


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J2 - Expansion Module CAN Harness Connector - Arranged by Pin Number

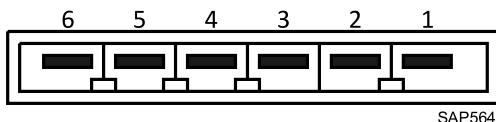
| Pin # | Wire # | Description |
|--------------|---------------|--------------------------------------|
| 1 | CANL-BLU | To Interface Board CAN Connector J12 |
| 2 | CANH-GRE | To Interface Board CAN Connector J12 |
| 3 | SHLD | To Interface Board CAN Connector J12 |
| 4 | ON-RED | To Interface Board CAN Connector J12 |
| 5 | 2A-BLK | To Interface Board CAN Connector J12 |
| 6 | 8FP-YEL | To Interface Board CAN Connector J12 |
| 7 | | Not Used |
| 8 | CH-ORA | To Interface Board CAN Connector J12 |

Figure 24. Mini Mate-N-Lok Harness Connector (shown from pin side of harness connector)

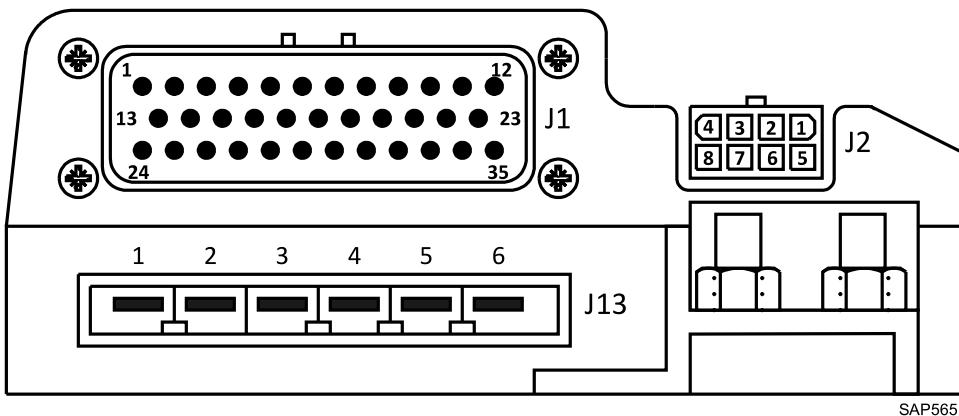

J13 - Remote Controller Power Control Connector - Arranged by Pin Number

| Pin # | Wire # | Description |
|--------------|---------------|---|
| 1 | FM21 | Zone 2 Fan Motor Output #1 (Zone 2 damper solenoid on DE units) |
| 2 | FM22 | Zone 2 Fan Motor Output #2 |
| 3 | FM23 | Zone 2 Fan Motor Output #3 |
| 4 | FM31 | Zone 3 Fan Motor Output #1 |
| 5 | FM32 | Zone 3 Fan Motor Output #2 |
| 6 | FM33 | Zone 3 Fan Motor Output #3 |

Figure 25. Expansion Module Fan Harness Connectors (shown from pin side of harness connector)



Connections



SAP565

Unit Sensors

The unit sensors monitor air temperatures at various points in the system, as well as the engine oil pressure, engine oil level, engine coolant level, engine coolant temperature, engine speed, alternator frequency, and fuel level. Host unit sensors are connected to the Base Controller via the J3 Sensor Connector. Remote evaporator temperature sensors are connected to the Expansion Module J1 connector.

Air Temperature Sensors

Graded and Un-graded Air Temperature Sensors

Single return and discharge air temperature sensors are used in all zones including the host zone. The return air and discharge air sensors are graded sensors. Sensor grading allows maximum accuracy without the need for ice water calibration. The sensor grade (from 1L through 9H) is printed on the sensor and must be entered into the Base Controller when a sensor is changed in order to properly calibrate the sensor for accurate temperature readings. If the grade is not changed from the factory setting of 5H, Alarm Code 92 will occur. Always update the sensor grade nameplate when graded sensors are changed. The nameplate is mounted on the side of the control box.

Un-graded sensors are used to measure the evaporator coil temperature and ambient temperature, since these temperatures are not as critical as the return and discharge air temperatures.

The host unit and each remote zone use return air, discharge air, and evaporator coil temperature sensors. Do not replace a graded sensor with an un-graded sensor.

Figure 26. New Style Graded Sensor



SAP349

Figure 27. New Style Un-graded Sensor with Yellow Shrink Tube Marker



SAP350

Return Air Sensors

These sensors monitor the temperature of the air returning to the evaporator coil of the host unit or remote evaporator. These sensors are located in the return air flow. The host unit sensor is connected directly to the Base Controller connector J3. The remote evaporator sensors are connected via the Expansion Module connector J1. These sensors are graded sensors and must be replaced with a graded sensor. The Base Controller must be calibrated to the respective grades of the installed sensors in order to operate properly.

Discharge Air Sensors

These sensors monitor the temperature of the air leaving the evaporator coil of the host unit or remote evaporator. These sensors are located in the evaporator discharge air path. The host unit sensor is connected directly to the Base Controller via connector J3. The remote evaporator sensors are connected via the Expansion Module connector J1. These sensors are graded sensors and must be replaced with a graded sensor. The Base Controller must be calibrated to the respective grades of the installed sensors in order to operate properly.

Evaporator Coil Temperature Sensor

This sensor monitors the temperature of the evaporator coil and is an un-graded sensor. The sensor is located on the evaporator coil header plate. The host unit sensor is connected directly to the Base Controller via connector J3. The remote evaporator sensors are connected to the Expansion Module connector J1. It is connected via the CTP and CTN wires.

Ambient Temperature Sensor

This sensor monitors the ambient air temperature and is an un-graded sensor. The sensor is located in the host unit adjacent to the roadside condenser coil and is connected directly to the Base Controller via connector J3. It is connected to the Base Controller via the ATP and ATN wires.

Spare Temperature Sensors

These three optional sensors monitor temperatures as selected by the customer. These graded sensors are installed as requested by the customer. They are connected to the Base Controller at J3 via the STxP and STxN wires, where 'x' is the sensor number.

CargoWatch™ Sensors

The CargoWatch Data Logger is internal to the HMI Control Panel. This Data Logger conforms to European standard EN12830. The Data Logger supports up to six temperature sensors and three digital inputs.

The sensors used for the CargoWatch Data Logger are thermistor-type sensors that differ from the sensors used for unit control. The CargoWatch sensors are connected directly to the HMI Control Panel.

Important: *The CargoWatch sensors ARE NOT interchangeable with the unit temperature sensors.*

Figure 28. CargoWatch Sensor - No Shrink Tubing



CargoWatch thermistor type sensors change resistance as the temperature changes. Resistance values can be measured using a high quality ohmmeter and are shown in the table below.

Note: *These resistance values only apply to CargoWatch sensors.*

Table 2. CargoWatch Sensor Resistance vs Temperature

| °F | °C | Ohms | °F | °C | Ohms |
|-------|-------|---------|------|------|--------|
| -20°F | -29°C | 166,356 | 40°F | 4°C | 26,688 |
| -10°F | -23°C | 115,757 | 50°F | 10°C | 19,904 |
| 0°F | -18°C | 86,501 | 60°F | 16°C | 15,002 |
| 10°F | -12°C | 61,737 | 70°F | 21°C | 11,944 |
| 20°F | -7°C | 47,070 | 80°F | 27°C | 9,166 |



Section 2 - Hardware Description

Table 2. CargoWatch Sensor Resistance vs Temperature (continued)

| °F | °C | Ohms | °F | °C | Ohms |
|------|------|--------|-------|------|-------|
| 30°F | -1°C | 34,374 | 90°F | 32°C | 7,402 |
| 32°F | 0°C | 32,650 | 100°F | 38°C | 5,775 |

Diagnostic Procedure

1. Disconnect the sensor to be tested from the sensor harness at the 12 pin Deutsch connector in the evaporator compartment.
2. Using a high quality meter, check the sensor resistance.
 - a. The sensor resistance is dependant on the sensor temperature as shown in the table (**Table 2, p. 69**). The measured sensor resistance should approximate the value shown for the current sensor temperature.
 - b. If the sensor resistance does not match, the sensor must be replaced.
3. If the resistance measured in the previous step is correct, proceed to Step 4. If the resistance measured is not correct, replace the sensor.
4. Using a high quality meter, check the voltage at the sensor harness wires at the 12 pin Deutsch connector in the evaporator compartment.
 - a. The voltage from the HMI Control Panel should be 2.5 Vdc with the sensor disconnected.
5. If the voltage measured in the previous step is correct, proceed to Step 7. If the voltage measured is not correct, proceed to Step 6.
6. If the voltage measured in Step 4 is incorrect, unplug the 35 pin connector at the HMI Control Panel and check the harness for shorts and open wires.
 - a. Perform a wiring harness continuity test and repair as required.
7. If the harness passes inspection, check the HMI Control Panel.
 - a. If the HMI Control Panel fails the test, it must be replaced.

Unit Refrigeration Control Components

The following components are used by the Base Controller to sense conditions or control operation of the refrigeration system. The Base Controller determines the necessary requirements by considering the setpoint, the software, the programmable feature, and the information supplied by the sensors.

Condenser Inlet Solenoid (CIS)

This valve controls the flow of refrigerant to the condenser and is located in the condenser section of the host unit. This solenoid is typically energized (closed) when any compartment is operating in heat or defrost mode. The condenser inlet solenoid is a normally open valve and is controlled by an output on the Base Controller and Interface Board.

Receiver Tank Pressure Solenoid (RTPS)

This valve pressurizes the receiver tank to verify adequate refrigerant flow into the heating circuits during heat and defrost mode operation. It is located in the condenser section of the host unit and is a normally closed valve. The receiver tank pressure solenoid is controlled by an output on the Base Controller and Interface Board.

Purge Valve (PV)

The purge valve is energized (open) during heat and defrost mode. It is located in the condenser section of the host unit and is a normally closed valve. The purge valve is controlled by an output on the Base Controller and Interface Board.

High Pressure Cutout (HPCO)

The high pressure cutout is located in the host unit on the discharge manifold of the four cylinder compressors. This switch monitors the discharge pressure at the compressor. The switch is closed with normal pressures, and opens with excessive pressures. The switch will open and close at pressures determined by the refrigerant used in the unit. It opens on high discharge pressure to shut the unit down to prevent damage.

High Pressure Control Switch (HPCS)

The High Pressure Control Switch is a pressure switch that opens at 312 psig and re-closes at 200 psig and is located in the host unit. This switch is used to control the purge valve and receiver tank pressure switch if the discharge pressure transducer fails.

Discharge Pressure Transducer (DPT)

This transducer supplies the discharge pressure at the compressor to the Base Controller and is located in the host unit. This information is used by the Base Controller and software to determine the unit operating conditions. If the discharge pressure sensor is disconnected, the HMI Control Panel display will indicate 26.9 psig.

Suction Pressure Transducer (SPT)

This transducer supplies the suction pressure at the compressor to the Base Controller and is located in the host unit. This information is used by the Base Controller and software to determine the unit operating conditions. The suction pressure transducer is located upstream of the compressor throttling valve. As a result, the suction pressure displayed is suction line pressure. This pressure may be higher than the compressor suction pressure. If the suction pressure sensor is disconnected, the HMI Control Panel display will indicate -10.8 psig.

Damper Solenoid (DS)

The damper solenoid is controlled by an output on the Base Controller and Interface Board and is located in the host unit. Two methods are used to open and close the host unit defrost damper doors. Damper solenoids are used on SB units. Damper gear motor actuators are used on SLX units. The DE model units have damper solenoids in both Zone 1 and Zone 2. The Interface Board for units with damper solenoids is different than the one used with defrost gear motor actuators. Refer to Section 7 for more information.

The Zone 1 damper solenoid is energized and Interface Board LED 4 is illuminated when the Base Controller energizes the K4 Damper Relay. The K4 Damper Relay normally open contacts supply power via the 29 wire to the damper solenoid. The circuit is protected by the 15 amp fuse F6.

On DE units, the Zone 2 damper solenoid is powered by the Expansion Module FM21 fan output. The Expansion Module LED 01 will illuminate when this output is turned on.

Damper Motor (DM)

SLX units use hermetically sealed defrost damper gear motors to open and close the defrost damper door. The Base Controller for units with damper solenoids is different than the one used with defrost damper motors. Refer to Section 7 for more information.

A damper motor heater is utilized with SL unit damper motor applications. The damper solenoid output is used to control the damper motor heater. The heater is part of the damper motor assembly.

Zone Refrigeration Control Components

The following solenoid valves are required for each zone. The Zone 1 valves (and Zone 2 valves if a DE unit) are located in the host unit. The Zone 2 valves (and Zone 3 valves if present) are located in the remote evaporator(s) for each zone.



Section 2 - Hardware Description

Liquid Line Solenoid (LLS)

This valve is energized (open) any time cooling, heating, or defrosting is required in its zone. The valve is de-energized when the zone is in null to stop refrigerant flow in that zone and is a normally closed valve.

The Zone 1 liquid line solenoid is controlled by an output on the Base Controller and Interface Board. The Zone 2 and Zone 3 liquid line solenoid outputs are located in the Expansion Module.

Hot Gas Solenoid (HGS)

This valve is energized (open) any time heating or defrosting is required in the zone and is a normally closed valve. All hot gas solenoid valve outputs are located in the Expansion Module.

Hot Gas Bypass Valve (HGBV)

The hot gas bypass valve is used in conjunction with the modulation valve or electronic throttling valve to reduce the capacity of the unit during modulation and also aid suction pressure control. This normally closed solenoid valve is located in the refrigeration line that connects the discharge line to the hot gas line. The controller energizes (opens) the hot gas bypass valve when the unit reaches full modulation. The controller de-energizes (closes) the hot gas bypass valve when the modulation cycle ends. For SLXi units, the hot gas bypass solenoid will pulse when the unit is running Host only. This is to help reduce fuel consumption.

Suction Line Solenoid (SLS)

All zones are capable of reverse cycle heating operation. Reverse cycle heating means that the evaporator coil in the zone in heat mode is used as the condenser coil during heat operation as long as at least one other zone is operating in cool mode.

The suction line solenoid is energized (closed) when its compartment is operating in heat mode as long as at least one other zone is operating in cool mode. This is a normally open valve. All suction line solenoid valve outputs are located in the Expansion Module.

Engine Control Components

The following components are used by the Base Controller to sense conditions and control operation of the diesel engine (or electric motor, if present).

Coolant Temperature Sensor

This sensor monitors the temperature of the coolant in the diesel engine. It is located on the diesel engine thermostat housing and is connected to the Base Controller via the J3 connector WTP and WTN wires.

Coolant Level Sensor (CLS)

This sensor monitors the engine coolant level. It is located on the radiator expansion tank. The magnetic reed switch consists of a press-in miniature reed switch and a captive magnetic float inside the radiator expansion tank. If the coolant level is low for a specified period of time, a low coolant condition is assumed to exist. The switch is connected to the Base Controller connector J3 via the CLS and CLP wire. The switch is closed with adequate coolant level and open with low coolant level.

Oil Pressure Switch (LOPS)

The normally closed low oil pressure switch monitors the oil pressure of the diesel engine. It is located on the engine side of the unit frame. It is connected to the Base Controller via J3 connector 20B and CH wires. The switch is open when the oil pressure is adequate.

Oil Level Switch (OLS)

The normally open oil level switch monitors the oil level in the diesel engine. It is located above the oil pan on the door side of the engine. It supplies information on the oil level to the Base Controller via the J3 connector OLS wire. The switch is closed when the oil level is low.

Flywheel Sensor (FW)

This sensor monitors the RPM of the diesel engine. The flywheel sensor is located on the door side of the engine just under the starter. It supplies engine speed information to the Base Controller connector J3 via the FS1 and FS2 wires.

Intake Air Heater

The intake air heater is located at the inlet to the intake manifold of the diesel engine. The intake air heater is energized and LED 3 is illuminated when the Base Controller energizes the K2 Preheat Relay. The K2 Preheat Relay normally open contacts supply power via the H wire to the intake air heater to preheat the engine before starting. The circuit is protected by the 60 amp fuse F5.

Note: *The preheat relay contacts are connected directly to the unit starting battery via the "2" circuit.*

Starter Motor (SM)

The starter motor is located on the door side of the engine. The starter motor is energized and LED 25 is illuminated when the Base Controller energizes the K7 Starter Relay. The K7 Starter Relay normally open contacts supply power via the 8S wire to the starter solenoid to crank the engine. The circuit is protected by the 40 amp fuse F3.

Note: *The starter relay contacts are connected directly to the unit starting battery via the "2" circuit.*

Fuel Solenoid (FSH, FSP)

The fuel solenoid is located at the rear of the injector pump and is used to start and stop the flow of fuel to the diesel engine during diesel mode operation. The fuel solenoid features two coils, a pull-in coil and a hold coil. The pull-in coil transfers the fuel solenoid to the open position. The hold coil maintains the fuel solenoid in the open position.

- The hold coil is energized in Diesel Mode when the Base Controller energizes the K1 Run Relay. LED 6 is illuminated when the Run Relay is energized and the contacts have transferred. The K1 Run Relay normally open contacts supply power from the 8 wire thru the normally closed Diesel/Electric relay to the 8D wire to energize the fuel solenoid hold coil. The circuit is protected by the 7.5 amp fuse F25.
- The pull-in coil is momentarily energized and LED 24 is momentarily illuminated in Diesel Mode when the Base Controller energizes the K6 Fuel Solenoid Pull-in Relay for two seconds. The K6 Fuel Solenoid Pull-in Relay normally open contacts supply power via the 8DP wire to the fuel solenoid pull-in coil to positively open the fuel solenoid. The circuit is protected by the 40 amp fuse F3.

Note: *The fuel solenoid pull in relay contacts are connected directly to the unit starting battery via the "2" circuit.*

High Speed Solenoid (HS)

The high speed (throttle) solenoid is located behind the fuel injection pump. The high speed solenoid is energized and LED 5 is illuminated when the Base Controller energizes the K3 High Speed Relay. The K3 High Speed Relay contacts supply power to the 7D wire to the high speed solenoid to enable high speed operation. The circuit is protected by the 15 amp fuse F6.

Alternator Frequency

Alternator frequency is monitored by the microprocessor via the "W" wire. When a unit equipped with optional Electric Standby is running in Diesel Mode, the ratio between the engine RPM and alternator frequency is monitored. If these values are not in the proper ratio, it is an indication that drive belt slippage is occurring. If this occurs, Alarm Code 48 is set as a Shutdown Alarm.



Section 2 - Hardware Description

Communication Ports

The SR-2/SR-3 features three externally accessible communication ports.

CargoWatch Port

The CargoWatch port is used to download the CargoWatch data logger and to flash load software to the HMI Control Panel. The CargoWatch port connector is located on the control panel. This is a serial RS-232 communication port.

ServiceWatch Port

The ServiceWatch port is used to download the ServiceWatch data logger and to flash load software to the Base Controller. On SB units, the ServiceWatch port connector is located on the control panel. On SLX units, the ServiceWatch port connector is located inside the control box. This is a serial RS-232 communication port.

CargoWatch Printer Port

This CargoWatch Printer port is used to print trip records from the CargoWatch data logger. On SB units, the CargoWatch Printer port connector is located inside the control box. On SLX/SLXe units, the CargoWatch Printer port connector is located on the control panel. This is a serial RS-232 communication port.

USB Port

On SLXi units, the Universal Serial Bus (USB) port is located on the control panel. If a USB Flash Drive is connected to the USB port, this menu item allows the operator to select the desired Flash Drive function.

Note: *The Flash Drive must be properly configured and the desired features must be enabled using the Wintrac Service Tool.*

Using a properly configured and enabled flash drive, the following functions may be available:

- Download the ServiceWatch Data Logger
- Download the CargoWatch Data Logger
- Flash load Base Controller Software
- Flash load HMI Control Panel Software
- Send OptiSet Plus Files
- Retrieve OptiSet Plus Files

Optional Electric Standby

Note: *Model 50 units only.*

The Electric Standby option allows the unit to be operated on either the diesel engine or external electric power. The units are supplied to operate on 230 or 460 Vac three phase power. Units to be operated on 460 Vac are equipped with a step-down transformer to reduce the voltage from 460 Vac to 230 Vac. The 230 Vac is used to run the blowers while in electric mode.

Model 50 Features

⚠ DANGER

Hazardous Voltage!

Dangerous three phase AC electric power is present whenever the unit is operating in either Diesel Mode or Electric Mode and whenever the unit is connected to a source of external standby power. Voltages of this magnitude can be lethal. Exercise extreme caution when working on the unit.

The following features are standard equipment on units equipped with Electric Standby:

- **Automatic Diesel/Electric Selection** - The unit can be programmed to automatically switch to electric operation when a power cord is connected and the standby power is switched on.

The unit can also be programmed to automatically switch back to diesel power if the standby power is switched off or fails. The HMI Control Panel will prompt for electric or diesel switchover if the respective auto-switch feature is not enabled.

Note: *Auto-switch from electric to diesel is not recommended when the unit is running in electric mode indoors or when below deck on a ferry.*

Note: *The unit will automatically switch to Cycle Sentry when the unit is manually switched or auto-switched to electric mode.*

- **Automatic Overload Reset** - The overload relay resets automatically after the motor cools. When the overload trips, it interrupts power to the motor contactor coil.
- **Electric Heat** - Both hot gas and electric heat is utilized on model 50 units. The electric heaters are also used during defrost. Electric heat and defrost are only used in Zone 1 (host evaporator). Electric heat is optional on SLX units.
- **Automatic Phase Correction** - The control system features two motor contactors. One of the contactors is energized by the phase detection module to verify correct motor rotation, regardless of phase rotation of the incoming power. The motor contactors are also mechanically interlocked.
- **Low Voltage Detection** - The phase detection modulation will not allow the unit to run if the supply voltage is too low.
- **Single Phase Protection** - The phase detection modulation will not allow the unit to run if it detects a single phase condition.

High Voltage Components

The high voltage enclosure or tray contains the motor contactors, overload relay, heater contactor, and phase select module used to operate the drive motor on units equipped with Electric Standby. The contactors are controlled by +12 volt dc control signals from the Base Controller. SB units have a separate control box located on the compressor side of the unit. SLX units utilize a high voltage tray located inside the unit control box.

Optional Remote Mount Power Receptacle

An optional Remote Power Receptacle is available. This Remote Power Receptacle is located and installed as specified by the customer. If an Optional Remote Power Receptacle is installed, a Standby Power Disconnect Switch is required in the high voltage enclosure for safety reasons.

Standby Power Disconnect Switch

A Standby Power Disconnect Switch is installed on all Electric Standby equipped units featuring the Remote Mount Power Receptacle. The Standby Power Disconnect Switch is located in the high voltage enclosure.

Diesel/Electric Relay K5

The Diesel/Electric Relay K5 is present on all units. If the Electric Standby option is not present or if the unit is running in Diesel Mode, control power is routed through the Diesel/Electric Relay normally closed contacts.

The Diesel/Electric Relay is energized and LED 7 is illuminated when the Base Controller requests Electric Mode operation. The K5 Diesel/Electric Relay normally open contacts supply power to the 7E circuit to enable Electric Mode operation.

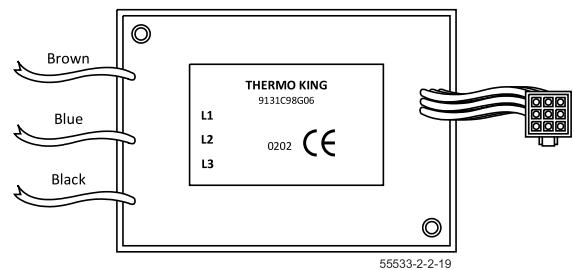
Heater Contactor HC

The heater contactor is used to supply standby power to the electric heaters during heat and defrost mode electric operation. The heater contactor is energized and LED 5 is illuminated when the Base Controller energizes the K3 High Speed Relay during electric mode operation. The K3 High Speed Relay Smart FET supplies chassis ground via the 26E wire to the heater contactor. The circuit is protected by the Smart FET.

Phase Detect Module

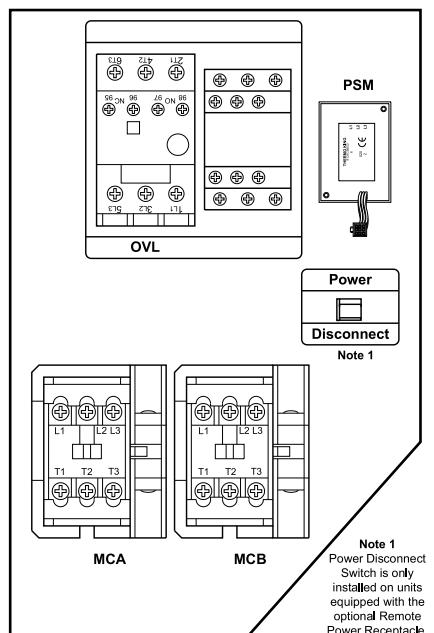
The phase detect module is designed to monitor three phase voltages from 160 volts AC to 510 volts AC. The phase detect module detects missing phases, automatically corrects phase rotation, and provides low voltage protection. Refer to Service Procedure A48A in Section 6 for operation and diagnostics.

Figure 29. Phase Detect Module



SB Unit Electric Standby Components

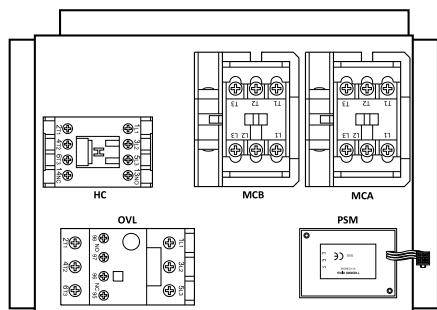
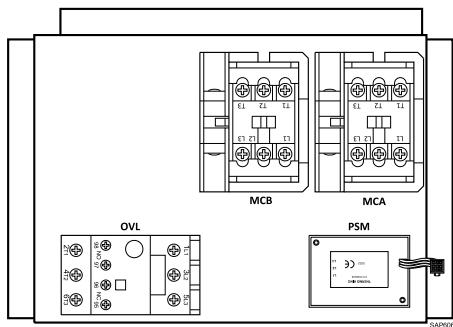
These components are located in a separate control box on the compressor side of the unit.



Note 1
Power Disconnect
Switch is only
installed on units
equipped with the
optional Remote
Power Receptacle.

SLX Unit Electric Standby Components

These components are located near the top of the unit control box.

Figure 30. SR-2

Figure 31. SR-3


TK BlueBox

Beginning in 2017, the TK BlueBox communication device is fitted as standard on new SLXi units and is also available as an option on certain other units. The TK BlueBox offers real-time information and two-way communication.

A Maintenance Menu feature called Telematics Status is available that allows the user to check for possible telematics status alerts. Telematics status alerts differ from standard unit alarms; they do not appear as alerts on the HMI main screen if there is an issue with the TK BlueBox. The user is required to access the Maintenance Menu and select Telematics Status to determine if there are alerts activated.

The alerts are listed below. Refer to the TK BlueBox Diagnostic Manual (TK 56391-12-OD) for complete information and diagnostic procedures.

| | | | |
|----|-------------------------|------|----------------------------|
| T1 | SIM Not Inserted | T8 | Data Delayed to TrackKing™ |
| T2 | Check SIM PIN | T9 | CAN Communication Issue |
| T3 | Check APN Configuration | T10 | Check iBox™ Third Party |
| T4 | Check GSM Antenna | T11 | iBox System Issue |
| T5 | No GSM Coverage | T12 | Check Backup Battery |
| T6 | Check GPS Antenna | TT99 | Telematics System Issue |
| T7 | No GPS Fix | | |

Section 3 - Software Description

Software Operation

The software is a very complex set of instructions used by the Base Controller, HMI Control Panel, and the Expansion Module to control the refrigeration system and interface with the operator. The Base Controller, HMI Control Panel, and Expansion Module microprocessors examine the conditions of all the inputs and compare them to the instructions contained in the software. The outputs are then energized as specified by the software instructions.

There is no way to determine from the schematic or wiring diagrams what conditions will cause the unit to operate in a particular mode. This decision is made by the software after examining all the input conditions and setpoint. However, operating mode can generally be deduced from the existing conditions. As an example, if a 35°F (2°C) setpoint is selected and the box temperature, as indicated by the return air sensor is 60°F (16°C), the affected zone should operate in cool mode when turned on.

Note: For the most accurate software information, refer to the applicable software related Service Bulletin.

The SR-2/SR-3 system utilizes the following software:

- Base Controller software C0xx (SR-2) and F0xx/FAx (SR-3).
- HMI Control Panel software 65/75/7Bxx, 66/76/7Cxx, 67/77/7Dxx, 68/7Exx.

The Expansion Module software is used for control of the zone evaporator's operational functions. The Expansion Module software is part of the Base Controller software and is not shown as a separate software revision.

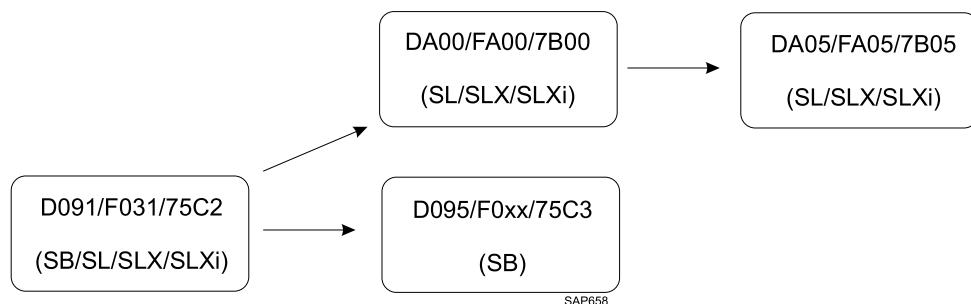
Base Controller and HMI Control Panel software updates are flash loaded using the Wintrac™ Service Tool (refer to Service Procedures A46A and A46B for details). To check the Base Controller or HMI Control Panel software revisions, refer to Section 4. For software revision details, refer to Section 7.

Software Separation

Due to the difficulty in managing the increasing number of unit configurations and diverging platforms, Thermo King has decided to separate the software between SB and SL/SLX/SLXi trailer platforms. This will help to reduce the development timelines and software scopes for future trailer units.

FA00 and 7B00 are the first software revisions with this separation. They are based on F031 and 75C2 software revisions but with additional changes/features.

Figure 32. Software Split (Example)



HMI Menu Structure

The basic HMI Control Panel menu structure consists of the Standard Display, TemperatureWatch™ Display, Main Menu, Maintenance Menu, and Guarded Access Menu. See the following for a general description of each menu and feature. Refer to Section 4 for complete operating instructions.

Standard Display

The Standard Display shows the zone return air temperature and setpoint. The Standard Display or the TemperatureWatch Display is shown when the unit is operating normally. All other menus are accessed from the Standard Display.

- The box temperature is usually return air temperature, but can be discharge air temperature if some features are enabled.
- The setpoint for each zone can be changed and Zone 2 and Zone 3 can be turned on and off using the soft key located below each zone display.
- If a zone is turned off, the display for that zone will show OFF instead of the setpoint for that zone.
- The readings of the unit gauges and temperature sensors can be shown from the Standard Display using the GAUGES and SENSORS soft keys unless these keys have been assigned different functions from the Guarded Access > Main Menu.
- If a USB Flash Drive or a computer is connected to the unit via a USB Port, a USB Icon will appear in the display (SLXi units only).

TemperatureWatch™ Display

The TemperatureWatch Display shows the return air temperature and setpoint using large numbers that allow unit conditions to be checked from a distance. If there are no alarms other than Log Alarms present, the TemperatureWatch Display will appear 2½ minutes after the last key is pressed. Press any soft key to return to the Standard Display.

Main Menu

The Main Menu consists of informational and operational functions intended for the unit operator. The Main Menu is directly accessible from the Standard Display using the MENU Soft Key. The Menu Soft Key is at the bottom right of the Standard Display.

Maintenance Menu

The Maintenance Menu consists of informational, operational, control, and diagnostic functions used to help the service technician maintain and diagnose the unit. The Maintenance Menu is indirectly accessible from the Main Menu.

Guarded Access Menu

The Guarded Access Menu consists of programmable features that configure the unit, set sensor grades, enable options, and allow the customer to tailor unit operation to their particular requirements. The CargoWatch data logger is configured from this menu. The Guarded Access Menu is indirectly accessible from the Maintenance Menu.

Operator Features

The Precedent SR-4 control system features many special operator functions. These functions are available from the Standard Display. A brief explanation of each menu is included here. For complete operating details, refer to Section 4.

Standard Display

The Standard Display is the default display that appears if no other display function is selected. The Standard Display shows the zone return air temperature and setpoint for up to three zones. The Standard Display soft keys provide direct operator access to turn Zone 2 and Zone 3 on and off, to change the setpoint for each zone, and to select the Main Menu. If a USB Flash Drive or a computer is connected to the unit via a USB Port, a USB Icon will appear in the display (SLXi units only).

Turning Zones On and Off

Zone 2 and Zone 3 can be turned on and off from the Standard Display using the soft key under each zone display. Zone 1 is always turned on when the HMI ON hard key is pressed. All zones are turned off when the HMI OFF hard key is pressed.

The On/Off state of Zone 2 and Zone 3 (if present) is saved when the unit is turned off. If Zone 2 or Zone 3 were turned on when the unit was turned off, then they will still be on when the unit is turned back on.

Setpoint Change

The setpoint menu for each zone can be directly accessed from the Standard Display using the soft key under each zone display.

Limited Setpoints

The Limited Setpoint feature limits the number of setpoints available from one to four. Up to four desired setpoints are programmed from the Guarded Access Menu. As an example, if only three setpoints are programmed, such as -10°F (-23°C), 35°F (1.6°C), and 50°F (10°C), pressing the Up or Down keys when selecting a setpoint will scroll between these three setpoints only. The setpoints available are the same for all zones.

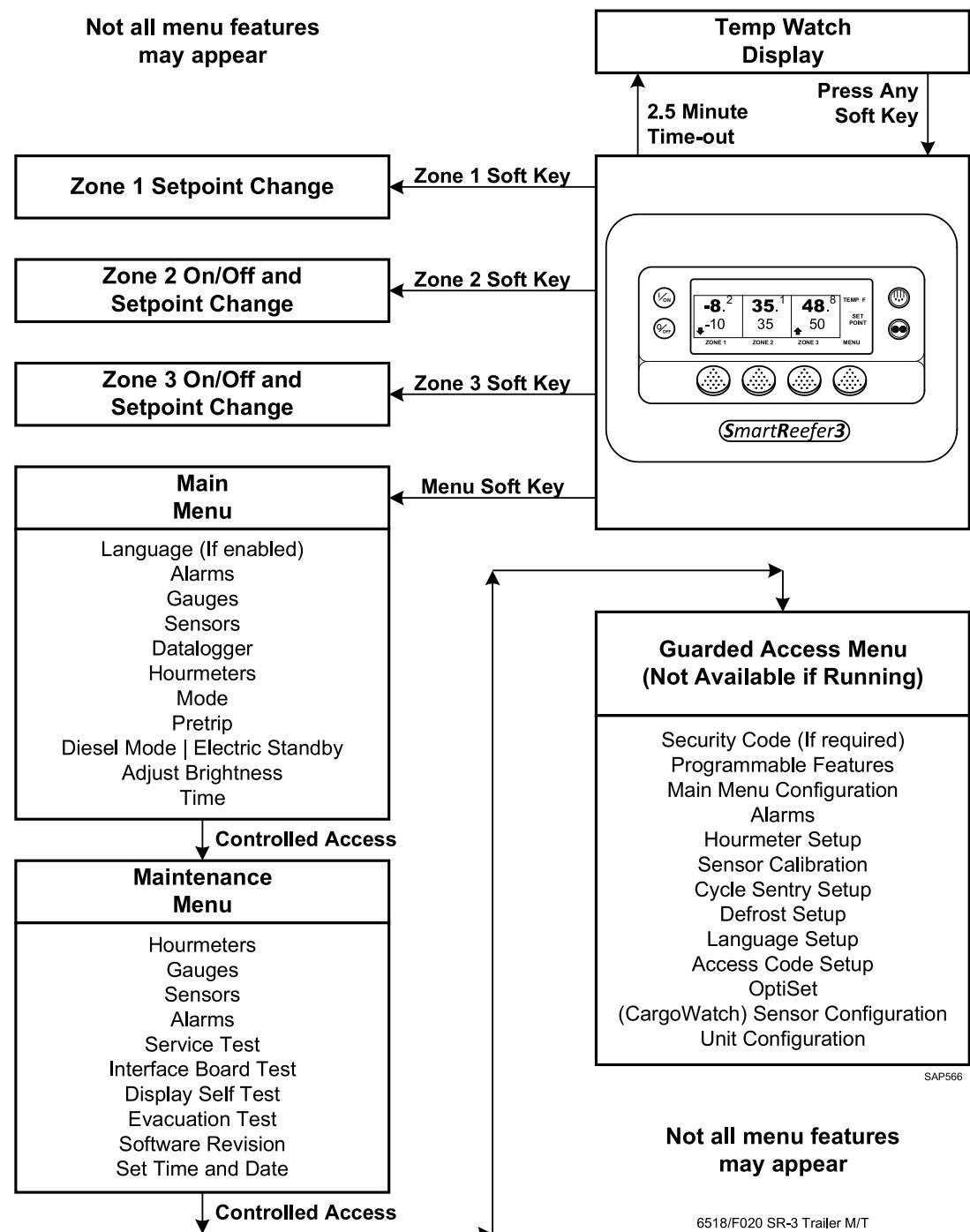
TemperatureWatch™ Display

The TemperatureWatch display will not appear if any Check, Prevent, or Shutdown Alarms are present or if the CargoWatch -15°C Alarm is active. If the TemperatureWatch display is active and any of these alarm conditions occur, the display will return to the Standard Display. If a Shutdown Alarm is present, the display will flash. This provides a quick method to check for units that may have an alarm set.

If a USB Flash Drive or a computer is connected to the unit via a USB Port, a USB Icon will appear in the display (SLXi units only).

Main Menu

Figure 33. Main Menu Overview (F020/6518)





Section 3 - Software Description

Figure 34. Main Menu Features (F020/6518)

| Main Menu 1 of 3 | Main Menu 2 of 3 |
|--|--|
| LANGUAGE Select from enabled languages ALARMS Display all alarms Clear most alarms GAUGES Coolant Temperature Coolant Level Amps Battery Voltage Engine RPM Fuel Level Sensor (if configured) Discharge Pressure Suction Pressure ETV Position (if configured) I/O (Input Output State) High Speed Relay Run Relay Defrost Damper Oil Pressure Oil Level Run Relay Feedback Fuel Pressure Alternator Frequency Diesel/Electric Relay Electric Ready Input Electric Overload Hot Gas Bypass Condenser Inlet Solenoid Receiver Tank Inlet Pressure Solenoid Purge Valve Liquid Line Solenoid Z1 Liquid Line Solenoid Z2 Liquid Line Solenoid Z3 Hot Gas Solenoid Z1 Hot Gas Solenoid Z2 Hot Gas Solenoid Z3 Suction Line Solenoid Z1 Suction Line Solenoid Z2 Suction Line Solenoid Z3 | SENSORS Datalogger Sensor 1 Temperature Datalogger Sensor 2 Temperature Datalogger Sensor 3 Temperature Datalogger Sensor 4 Temperature Datalogger Sensor 5 Temperature Datalogger Sensor 6 Temperature Zone 1 Return Air Temperature Zone 1 Discharge Air Temperature Zone 1 Temperature Differential Zone 1 Evaporator Coil Temperature Zone 2 Return Air Temperature Zone 2 Discharge Air Temperature Zone 2 Temperature Differential Zone 2 Evaporator Coil Temperature Zone 3 Return Air Temperature Zone 3 Discharge Air Temperature Zone 3 Temperature Differential Zone 3 Evaporator Coil Temperature Ambient Air Temperature Spare 1 Temperature Spare 2 Temperature Spare 3 Temperature Board Temperature Sensor DATALOGGER (CargoWatch) Start Trip Print Delivery Ticket Trip Ticket HOURMETERS (View Enabled Hourmeters Only) Total Hours Total Run Time Hours Engine Hours Electric Run Hours Zone 1 Run Time Hours Zone 2 Run Time Hours Zone 3 Run Time Hours Total Run Time Reminder #1 Hours Total Run Time Reminder #2 Hours Controller Power On Hours Pretrip Reminder Hours Engine Run Time Reminder #1 Hours Engine Run Time Reminder #2 Hours Electric Run Time Reminder #1 Hours Electric Run Time Reminder #2 Hours |

**Not all menu features
may appear**

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Figure 35. Main Menu Features (F020/6518)

| Main Menu | |
|--|---|
| 3 of 3 | |
| MODE | Turn On Off Cycle Sentry Fahrenheit Celsius Single Zone Control Keypad Lockout Start Sleep Mode Program a Wakeup Time Enter Day to Wake Up Enter Hour to Wake Up Enter Minutes to Wake Up Run Pretrip on Wake Up |
| PRETRIP | Full Pretrip if Not Running Running Pretrip if Running |
| DIESEL MODE ELECTRIC STBY (Model 50 Only) | |
| ADJUST BRIGHTNESS | Off - Low - Medium - High |
| TIME (View Only) | Hour/Minute/Day/Date/Month/Year |

Not all menu features
may appear

Figure 36. Main Menu Overview (FA00/7B00)

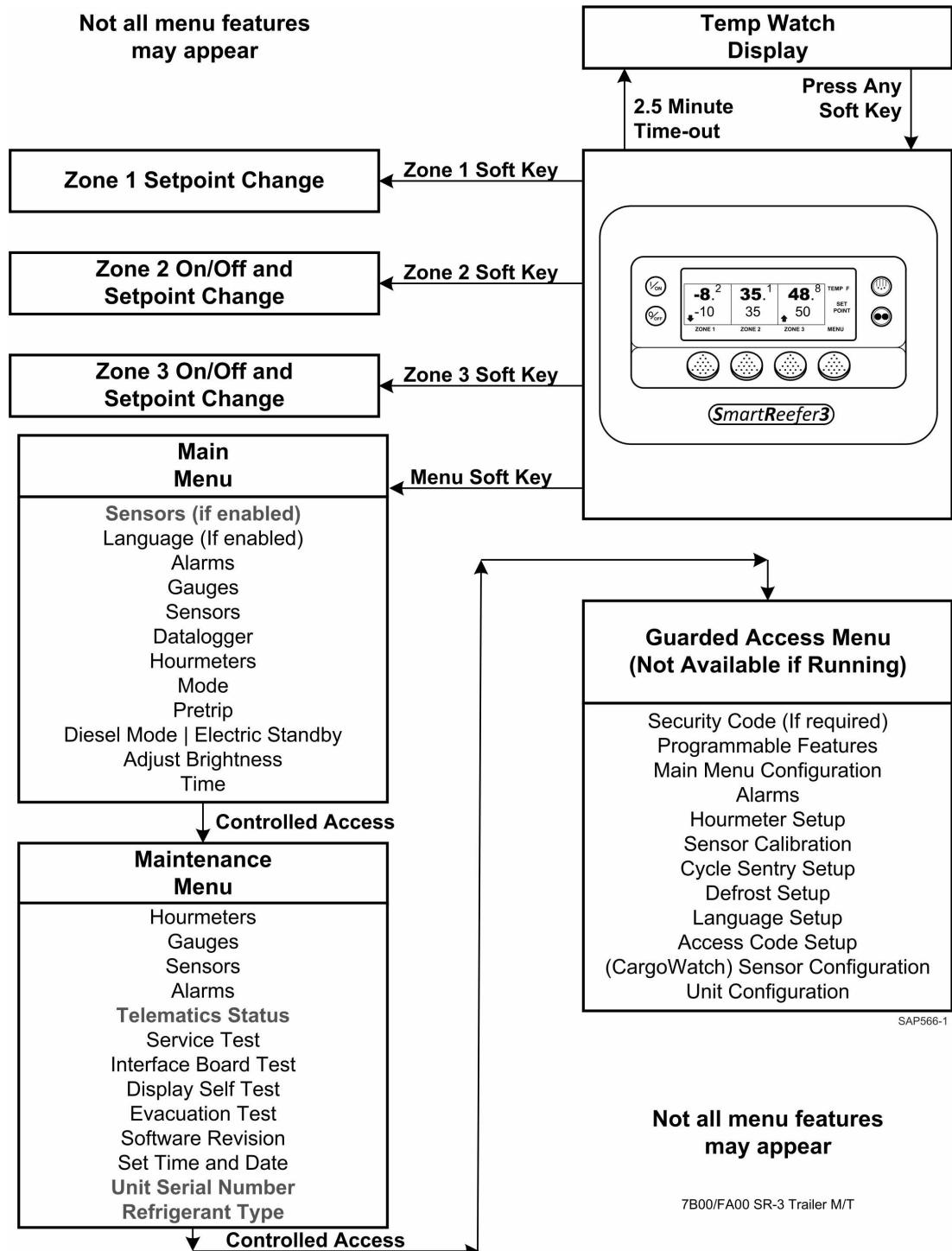


Figure 37. Main Menu Features (FA00/7B00)

| Main Menu 1 of 3 | Main Menu 2 of 3 |
|--|---|
| SENSORS (if enabled) LANGUAGE Select from enabled languages ALARMS Display all alarms Clear most alarms GAUGES Coolant Temperature Coolant Level Oil Pressure Oil Level Amps Battery Voltage Engine RPM Fuel Level Sensor (if configured) Discharge Pressure Suction Pressure ETV Position (if configured) I/O (Input Output State) High Speed Relay Run Relay Run Relay Feedback Alternator Excite Output Defrost Damper Alternator Frequency Diesel/Electric Relay Electric Ready Input Electric Overload Hot Gas Bypass Condenser Inlet Solenoid Receiver Tank Inlet Pressure Solenoid Purge Valve Liquid Line Solenoid Z1 Hot Gas Solenoid Z1 Suction Line Solenoid Z1 Liquid Line Solenoid Z2 Hot Gas Solenoid Z2 Suction Line Solenoid Z2 Drain Hose Heater Z2 Fan Output Z2 Liquid Line Solenoid Z3 Hot Gas Solenoid Z3 Suction Line Solenoid Z3 Drain Hose Heater Z3 Fan Output Z3 | SENSORS (if Easy Cargo enabled) Datalogger Sensor 1 Temperature Datalogger Sensor 2 Temperature Datalogger Sensor 3 Temperature Datalogger Sensor 4 Temperature Datalogger Sensor 5 Temperature Datalogger Sensor 6 Temperature Zone 1 Return Air Temperature Zone 1 Discharge Air Temperature Zone 1 Temperature Differential Zone 1 Evaporator Coil Temperature Zone 2 Return Air Temperature Zone 2 Discharge Air Temperature Zone 2 Temperature Differential Zone 2 Evaporator Coil Temperature Zone 3 Return Air Temperature Zone 3 Discharge Air Temperature Zone 3 Temperature Differential Zone 3 Evaporator Coil Temperature Ambient Air Temperature Spare 1 Temperature Spare 2 Temperature Spare 3 Temperature (if Easy Cargo disabled) Datalogger Sensor 1 Temperature Datalogger Sensor 2 Temperature Datalogger Sensor 3 Temperature Datalogger Sensor 4 Temperature Datalogger Sensor 5 Temperature Datalogger Sensor 6 Temperature Board Temperature Sensor DATALOGGER (CargoWatch) Start Trip Print/View Delivery Ticket Trip Ticket |

**Not all menu features
may appear**

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Section 3 - Software Description

Figure 38. Main Menu Features (FA00/7B00)

| Main Menu 3 of 3 | |
|--|--|
| HOURMETERS (View Enabled Hourmeters Only) | |
| Total Hours | |
| Total Run Time Hours | |
| Engine Hours | |
| Electric Run Hours | |
| Zone 1 Run Time Hours | |
| Zone 2 Run Time Hours | |
| Zone 3 Run Time Hours | |
| Total Run Time Reminder #1 Hours | |
| Total Run Time Reminder #2 Hours | |
| Controller Power On Hours | |
| Pretrip Reminder Hours | |
| Engine Run Time Reminder #1 Hours | |
| Engine Run Time Reminder #2 Hours | |
| Electric Run Time Reminder #1 Hours | |
| Electric Run Time Reminder #2 Hours | |
| MODE | |
| Turn On Off Cycle Sentry | |
| Fahrenheit Celsius (if enabled) | |
| Single Zone Control (if enabled) | |
| Keypad Lockout (if enabled) | |
| Start Sleep Mode (if enabled) | |
| Program a Wakeup Time | |
| Enter Day to Wake Up | |
| Enter Hour to Wake Up | |
| Enter Minutes to Wake Up | |
| Run Pretrip on Wake Up | |
| Precision Temperature Control Zone (if enabled) | |
| PRETRIP | |
| Full Pretrip if Not Running | |
| Running Pretrip if Running | |
| DIESEL MODE ELECTRIC STBY (Model 50 Only) | |
| ADJUST BRIGHTNESS | |
| Off - Low - Medium - High | |
| TIME (View Only) | |
| Hour/Minute/Day/Date/Month/Year | |
| Not all menu features may appear | |

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Main Menu Features

The Main menu allows the operator to check other unit conditions, change operating modes, and perform other operator functions. The Main Menu is accessed from the Standard Display by means of the Menu soft key. The sub-menus shown below may be available. For additional details, refer to Section 4.

Flash Drive

If a USB Flash Drive is connected to the Control Panel USB Flash Drive Port (if present), this menu item allows the operator to select the desired Flash Drive function.

Important: *The Flash Drive must be properly configured and the desired features must be enabled using the WinTrac™ Service Tool.*

Using a properly configured and enabled Flash Drive, the following functions may be available:

- Download the ServiceWatch Data Logger
- Download the CargoWatch Data Logger
- Flash load Base Controller Software
- Flash load HMI Control Panel Software
- Send OptiSet Plus Files
- Retrieve OptiSet Plus Files

Note: *For Flash Drive details, refer to the WinTrac Service Tool Help Menu.*

Language

If more than one language is enabled, this menu item allows the operator to select a language from a list of up to 11 languages at one time. All subsequent displays are shown in the selected language. Four different language packages with a total of 24 languages are available. English is the default language and is provided in each of the packages. For additional details, refer to Section 4.

Alarms

The Alarms display allows the operator to display any existing alarms. The operator can also clear most alarms from this menu.

A list of Alarm Codes including diagnostic procedures for each code is presented in Section 5.

Note: *Some alarms are clearable in Guarded Access only. Alarms with this feature will not provide a soft key "Clear" function. Refer to Section 4 for additional details.*

Gauges

The Gauges Menu allows the operator to display operating information such as coolant level and temperature, engine RPM, battery amps, battery volts, and suction and discharge pressure. The I/O selection under Gauges indicates the named outputs as either On or Off. Gauges can also be viewed from the Service Test Mode and Interface Board Test Mode displays. For additional details, refer to Section 4.

Note: *This menu contains the same information as the Standard Display Gauge Soft Key Menu.*

Sensors

The Sensors Menu allows the operator to display the reading of all unit temperature sensors as well as the calculated temperature differential. CargoWatch Data Logger sensors can also be displayed. For additional details, refer to Section 4.

Note: *This menu contains the same information as the Standard Display Sensors Soft Key Menu.*

Data Logger

This menu allows the operator to send a Start of Trip marker to the ServiceWatch and CargoWatch Data Loggers. It can also be used to print the contents of the CargoWatch Data Logger.

The unit can also be programmed such that every time the setpoint is changed a Start of Trip Marker is sent to the ServiceWatch and CargoWatch Data Loggers.

ServiceWatch and CargoWatch information can be downloaded and viewed by connecting a computer loaded with the WinTrac Service Tool software.

ServiceWatch and CargoWatch information can also be downloaded by connecting a properly configured and enabled Universal Flash Drive to the USB Flash Drive Port (if present) on the unit Control Panel. The Flash Drive is connected to a computer loaded with the WinTrac Service Tool software to save and view the information. For Flash Drive details, refer to the WinTrac Service Tool Help Menu.

Hourmeters

The Hourmeters menu allows the operator to view the unit hourmeters that have the view feature enabled in the Guarded Access Menu. If the view feature for a particular hourmeter is not enabled, that hourmeter cannot be viewed from the Main Menu. For additional details, refer to Section 4.

Note: All active hourmeters are available for viewing in the Maintenance Menu.

Mode

The Mode Menu allows the operator to change the unit operating modes if allowed. Not all modes may appear depending on the settings selected from the Guarded Access Menu. For additional details, refer to Section 4.

- Turn Off Cycle Sentry Mode/Turn On Cycle Sentry Mode (If Cycle Sentry Mode is turned Off then the unit runs in Continuous Mode).
- Select temperature displays in either degrees Fahrenheit or degrees Celsius (if enabled).
- Open or close the optional Fresh Air Exchange vents (if feature is installed and enabled)
- Allow Keypad Lockout to be selected (if enabled).
- Start Sleep Mode (if enabled).
- Precision Temperature Control zone (PTC).

Pretrip

A Pretrip Test is used to confirm unit operation. This menu allows a Pretrip Test to be initiated by the operator. If the test is started with the engine or motor off, a full test including the non-running amp checks and the running performance tests are performed. If the test is started with the engine or motor running, only the running tests are performed. Test results are reported as PASS, CHECK, or FAIL. For additional details, refer to Section 4.

Electric Standby (Model 50 units only)

If the Electric Standby option is present and the Diesel to Electric Auto-switch feature is set NO, this feature allows the operator to manually select electric mode operation. This feature does not appear if the unit does not have the optional Electric Standby or if the Diesel to Electric Auto-switch feature is set YES. For additional details, refer to Section 4.

Diesel Mode (Model 50 units only)

If a unit equipped with electric standby is running in electric mode and the Electric to Diesel Auto-switch feature is set NO, this feature allows the operator to manually select diesel mode operation. This feature does not appear if the unit does not have optional Electric Standby or if the Electric to Diesel Auto-switch feature is set YES. For additional details, refer to Section 4.

Note: Auto-switch from electric to diesel is not recommended when the unit is running in electric mode indoors or when below deck on a ferry.

Adjust Brightness

This menu allows the operator to adjust the HMI Control Panel display backlight intensity as required by local conditions. If desired, the backlight can also be turned off. For additional details, refer to Section 4.

Time

This menu allows the operator to view the unit time and date. The time and date cannot be changed from this menu. The time and date is loaded from the HMI Control Panel to the Base Controller each time the unit is turned on. For additional details, refer to Section 4.

Maintenance Menu

Figure 39. Maintenance Menu Features (F020/6518)

| Maintenance Menu 1 of 4 | Maintenance Menu 2 of 4 |
|---|---|
| <p>HOURMETERS (View and Reset Time)</p> <ul style="list-style-type: none"> Total Hours Total Run Time Hours Engine Hours Electric Run Hours Zone 1 Run Time Hours Zone 2 Run Time Hours Zone 3 Run Time Hours Total Run Time Reminder #1 Hours Total Run Time Reminder #2 Hours Controller Power On Hours Pretrip Reminder Hours Engine Run Time Reminder #1 Hours Engine Run Time Reminder #2 Hours Electric Run Time Reminder #1 Hours Electric Run Time Reminder #2 Hours <p>GAUGES</p> <ul style="list-style-type: none"> Coolant Temperature Coolant Level Amps Battery Voltage Engine RPM Fuel Level Sensor (if configured) Discharge Pressure Suction Pressure ETV Position (if configured) I/O (Input Output State) <ul style="list-style-type: none"> High Speed Relay Run Relay Defrost Damper Oil Pressure Oil Level Run Relay Feedback Fuel Pressure Alternator Frequency Diesel/Electric Relay Electric Ready Input Electric Overload Hot Gas Bypass Condenser Inlet Solenoid Receiver Tank Inlet Pressure Solenoid Purge Valve Liquid Line Solenoid Z1 Liquid Line Solenoid Z2 Liquid Line Solenoid Z3 Hot Gas Solenoid Z1 Hot Gas Solenoid Z2 Hot Gas Solenoid Z3 Suction Line Solenoid Z1 Suction Line Solenoid Z2 Suction Line Solenoid Z3 | <p>SENSORS</p> <ul style="list-style-type: none"> Zone 1 Return Air Temperature Zone 1 Discharge Air Temperature Zone 1 Temperature Differential Zone 1 Evaporator Coil Temperature Zone 2 Return Air Temperature Zone 2 Discharge Air Temperature Zone 2 Temperature Differential Zone 2 Evaporator Coil Temperature Zone 3 Return Air Temperature Zone 3 Discharge Air Temperature Zone 3 Temperature Differential Zone 3 Evaporator Coil Temperature Ambient Air Temperature Spare 1 Temperature Spare 2 Temperature Spare 3 Temperature Datalogger Sensor 1 Temperature Datalogger Sensor 1 Temperature Datalogger Sensor 3 Temperature Datalogger Sensor 4 Temperature Datalogger Sensor 5 Temperature Datalogger Sensor 6 Temperature Board Temperature Sensor <p>ALARMS</p> <ul style="list-style-type: none"> Display all alarms Clear most alarms <p style="text-align: right;">~ Continued Next Page ~</p> <p style="text-align: right;">Not all menu features may appear</p> |

Figure 40. Maintenance Menu Features (F020/6518)

| Maintenance Menu 3 of 4 | Maintenance Menu 4 of 4 |
|---|---|
| <p>SERVICE TEST</p> <p>Test with Unit Running?</p> <p>Zone 1</p> <ul style="list-style-type: none"> Zone 1 Null Zone 1 Low Speed Cool Zone 1 High Speed Cool Zone 1 Low Speed Heat Zone 1 High Speed Heat Zone 1 Defrost Zone 1 Minimal Heat <p>Zone 2</p> <ul style="list-style-type: none"> Zone 2 Null Zone 2 Low Speed Cool Zone 2 High Speed Cool Zone 2 Low Speed Heat Zone 2 High Speed Heat Zone 2 Defrost Zone 2 Minimal Heat <p>Zone 3 (if installed)</p> <ul style="list-style-type: none"> Zone 3 Null Zone 3 Low Speed Cool Zone 3 High Speed Cool Zone 3 Low Speed Heat Zone 3 High Speed Heat Zone 3 Defrost Zone 3 Minimal Heat <p>INTERFACE BOARD TEST</p> <ul style="list-style-type: none"> Preheat Relay Buzzer Run Relay Condenser Inlet Solenoid Damper Output Indicator Light Alarm Light Diesel/Electric Relay Electric Heat High Speed Relay Receiver Tank Solenoid Alternator Excite Relay Purge Valve Zone 1 Liquid Line Solenoid Zone 1 Hot Gas Solenoid Zone 1 Suction Line Solenoid Fan Motor 2 Relay (not if configured DE) Zone 2 Damper Output (if configured DE) Drain Hose Heater Zone 2 Zone 2 Hot Gas Solenoid Zone 2 Suction Line Solenoid Zone 2 Liquid Line Solenoid Fan Motor 3 Relay Drain Hose Heater Zone 3 Zone 3 Hot Gas Solenoid Zone 3 Suction Line Solenoid Zone 3 Liquid Line Solenoid Hot Gas Bypass Valve | <p>Maintenance Menu</p> <p>4 of 4</p> <p>DISPLAY SELF TEST</p> <ul style="list-style-type: none"> LCD Test Keypad Test Backlight Test Brightness Test Buzzer Test Heater Output Serial E2 Datalog Flash RTC Update <p>EVACUATION TEST</p> <ul style="list-style-type: none"> Connect Battery Charger <p>SOFTWARE REVISION</p> <ul style="list-style-type: none"> Display Software Rev Controller Software Rev Supervisor Software Rev <p>SET TIME AND DATE</p> <ul style="list-style-type: none"> Hour Minutes Date Month Year <p style="text-align: center;">Not all menu features may appear</p> |

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Figure 41. Maintenance Menu Features (FA00/7B00)

| Maintenance Menu 1 of 4 | Maintenance Menu 2 of 4 |
|--|---|
| <p>HOURMETERS (View and Reset Time)</p> <ul style="list-style-type: none"> Total Hours Total Run Time Hours Engine Hours Electric Run Hours Zone 1 Run Time Hours Zone 2 Run Time Hours Zone 3 Run Time Hours Total Run Time Reminder #1 Hours Total Run Time Reminder #2 Hours Controller Power On Hours Pretrip Reminder Hours Engine Run Time Reminder #1 Hours Engine Run Time Reminder #2 Hours Electric Run Time Reminder #1 Hours Electric Run Time Reminder #2 Hours <p>GAUGES</p> <ul style="list-style-type: none"> Coolant Temperature Coolant Level Oil Pressure Oil Level Amps Battery Voltage Engine RPM Fuel Level Sensor (if configured) Discharge Pressure Suction Pressure ETV Position (if configured) I/O (Input Output State) <ul style="list-style-type: none"> High Speed Relay Run Relay Run Relay Feedback Alternator Excite Output Defrost Damper Alternator Frequency Diesel/Electric Relay Electric Ready Input Electric Overload Condenser Inlet Solenoid Receiver Tank Inlet Pressure Solenoid Purge Valve Liquid Line Solenoid Z1 Hot Gas Solenoid Z1 Suction Line Solenoid Z1 Liquid Line Solenoid Z2 Hot Gas Solenoid Z2 Suction Line Solenoid Z2 Drain Hose Heater Z2 Fan Output Z2 Liquid Line Solenoid Z3 Hot Gas Solenoid Z3 Suction Line Solenoid Z3 Drain Hose Heater Z3 Fan Output Z3 | <p>SENSORS</p> <ul style="list-style-type: none"> (if Easy Cargo enabled) <ul style="list-style-type: none"> Datalogger Sensor 1 Temperature Datalogger Sensor 2 Temperature Datalogger Sensor 3 Temperature Datalogger Sensor 4 Temperature Datalogger Sensor 5 Temperature Datalogger Sensor 6 Temperature Zone 1 Return Air Temperature Zone 1 Discharge Air Temperature Zone 1 Temperature Differential Zone 1 Evaporator Coil Temperature Zone 2 Return Air Temperature Zone 2 Discharge Air Temperature Zone 2 Temperature Differential Zone 2 Evaporator Coil Temperature Zone 3 Return Air Temperature Zone 3 Discharge Air Temperature Zone 3 Temperature Differential Zone 3 Evaporator Coil Temperature Ambient Air Temperature Spare 1 Temperature Spare 2 Temperature Spare 3 Temperature (if Easy Cargo disabled) <ul style="list-style-type: none"> Datalogger Sensor 1 Temperature Datalogger Sensor 2 Temperature Datalogger Sensor 3 Temperature Datalogger Sensor 4 Temperature Datalogger Sensor 5 Temperature Datalogger Sensor 6 Temperature Board Temperature Sensor <p>ALARMS</p> <ul style="list-style-type: none"> Display all alarms Clear most alarms <p>TELEMATICS STATUS</p> <p style="text-align: center;">~ Continued Next Page ~</p> <p style="text-align: right;">Not all menu features may appear</p> |

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Figure 42. Maintenance Menu Features (FA00/7B00)

| Maintenance Menu 3 of 4 | Maintenance Menu 4 of 4 |
|--|---|
| SERVICE TEST Test with Unit Running? Zone 1 Zone 1 Null Zone 1 Low Speed Cool Zone 1 High Speed Cool Zone 1 Low Speed Heat Zone 1 High Speed Heat Zone 1 Defrost Zone 1 Minimal Heat Zone 2 Zone 2 Null Zone 2 Low Speed Cool Zone 2 High Speed Cool Zone 2 Low Speed Heat Zone 2 High Speed Heat Zone 2 Defrost Zone 2 Minimal Heat Zone 3 (if installed) Zone 3 Null Zone 3 Low Speed Cool Zone 3 High Speed Cool Zone 3 Low Speed Heat Zone 3 High Speed Heat Zone 3 Defrost Zone 3 Minimal Heat INTERFACE BOARD TEST Preheat Relay Buzzer Run Relay Condenser Inlet Solenoid Damper Output Indicator Light Alarm Light Diesel/Electric Relay Electric Heat High Speed Relay Receiver Tank Solenoid Alternator Excite Relay Purge Valve Zone 1 Liquid Line Solenoid Zone 1 Hot Gas Solenoid Zone 1 Suction Line Solenoid Fan Motor 2 Relay (not if configured DE) Zone 2 Damper Output (if configured DE) Drain Hose Heater Zone 2 Zone 2 Hot Gas Solenoid Zone 2 Suction Line Solenoid Zone 2 Liquid Line Solenoid Fan Motor 3 Relay Drain Hose Heater Zone 3 Zone 3 Hot Gas Solenoid Zone 3 Suction Line Solenoid Zone 3 Liquid Line Solenoid Hot Gas Bypass Valve | DISPLAY SELF TEST LCD Test Keypad Test Backlight Test Brightness Test Buzzer Test Heater Output Serial E2 Datalog Flash RTC Update EVACUATION TEST Connect Battery Charger SOFTWARE REVISION Display Software Rev Controller Software Rev Supervisor Software Rev SET TIME AND DATE Hour Minutes Date Month Year UNIT SERIAL NUMBER REFRIGERANT TYPE |

Not all menu features
may appear

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Maintenance Menu Features

The Thermo King SR-2/SR-3 control system features many special technician functions. These functions are available from the Maintenance Menu. A brief explanation of each menu is included here.

Note: For complete details, refer to Section 4.

Accessing the Maintenance Menu

The Maintenance Menu is accessible from the Main Menu. From the Standard Display press the MENU key. The controller will display the Main Menu. From the first Main Menu display (either Alarms or Language) press and hold both the EXIT key and the key with no label above it for five seconds. After five seconds, the HMI will display the Maintenance Menu.

Hourmeters

This menu allows the technician to view all the active unit hourmeters, even if the Main Menu view has been disabled. The Maintenance Menu Hourmeter Display also allows the technician to reset the time on hourmeters with a programmed time limit.

Gauges

The Gauges Menu allows the technician to display operating information such as coolant level and temperature, engine RPM, battery amps, battery volts, and suction and discharge pressure. The I/O selection under Gauges indicates the named outputs as either On or Off. Some Gauges can also be viewed from the Service Test Mode and Interface Board Test Mode displays.

Note: This menu contains the same information as the Standard Display Soft Key Menu and Main Menu > Gauge Menu.

Sensors

The Sensors Menu allows the technician to display the reading of all unit temperature sensors as well as the calculated temperature differential.

Note: This menu contains the same information as the Standard Display Soft Key Menu and Main Menu > Sensors Menu.

Alarms

The Alarms display allows the technician to display any existing alarms. The technician can also clear most alarms from this menu.

A complete list of Alarm Codes including diagnostic procedures for each code is presented in Section 5.

Note: Some alarms are clearable in Guarded Access only. These alarms will not provide a Clear Soft Key if displayed from the Main Menu or Maintenance Menu. Refer to Section 4 for additional details.

Telematics Status

The Telematics Status Menu allows the technician to view any existing status messages from the TK BlueBox. Up to three messages will be displayed in order of severity. The messages will self-clear after the TK BlueBox detects the problem has been corrected. Refer to Section 4 for details.

Service Test Mode

The Service Test Mode Menu allows the unit to be forced to a known set of operating conditions in diesel or electric mode, regardless of setpoint or temperature sensor inputs. Service personnel can use this mode to troubleshoot the system under defined operating conditions. Service Test Mode can be used with the unit running or non-running. Any Shutdown Alarms that are present must be cleared before Service Test Mode is available. Refer to Section 4 for complete details.

Interface Board Test

Interface Board Test Mode allows individual relays or outputs to be energized. This permits service personnel to troubleshoot individual circuits under known conditions. Interface Board Test Mode can only be used with the unit in a non-running condition. If Interface Board Test Mode is entered with the diesel engine or electric motor running, the engine or motor will be shut down. Any Shutdown Alarms that are present must be cleared before Interface Board Test Mode is available. Refer to Section 4 for complete details.

Display Self Test

This menu allows the technician to perform a series of built in tests on the HMI Control Panel.

Evacuation Test

The Evacuation Test allows a full system evacuation to be performed. All normally closed valves are opened to allow the entire system to be completely evacuated before charging with refrigerant. If present, the ETV will be fully opened. If the battery voltage falls below acceptable limits, the operator is prompted to connect a battery charger to maintain sufficient battery voltage to hold all necessary valves open during the procedure. If the voltage from the battery charger rises above acceptable limits, the controller will be turned off to prevent damage to the electronics and/or system components.

Software Revision

The Software Revision Menu shows the software revision of the HMI Control Panel software, Base Controller software, and the Supervisor software.

Set Time and Date

The Set Time and Date Menu allows the system time and date to be checked and changed as required. The time and date is loaded from the HMI Control Panel to the Base Controller each time the unit is turned on.

Refrigerant Type

The Refrigerant Type feature allows the user to configure the unit refrigerant type so that it can be displayed in the Maintenance Menu. Unit Model must be configured as SLX or SLXi.

Unit Serial Number

Note: Only available on SLXi units.

The Unit Serial Number can be set for display in the Maintenance Menu using WinTrac 6.0 or later.

Guarded Access Menu

Figure 43. Guarded Access Menu Features (F020/6518)

| Guarded Access Menu 1 of 4 | Guarded Access Menu 2 of 4 |
|--|--|
| <p>Security Code (if enabled) Enter Access Code</p> <p>Programmable Features</p> <ul style="list-style-type: none"> Temperature Units (F) Pressure Units (PSIG) Restart Unit After Shutdown (Enabled) Setpoint High Limit Zone 1 (80°F) Setpoint Low Limit Zone 1 (-20°F) Setpoint High Limit Zone 2 (80°F) Setpoint Low Limit Zone 2 (-20°F) Setpoint High Limit Zone 3 (80°F) Setpoint Low Limit Zone 3 (-20°F) Running Fans in Null (Disabled) Fresh Frozen Range (15°F) Door Open Forces (Log Only) <ul style="list-style-type: none"> Door Open Timeout (HRS:MIN) Door Open Timeout Alarm (Enabled) Host Null (Disabled) Sleep Mode After Pretrip (Disabled) Rail Option (Disabled) <ul style="list-style-type: none"> Rail Alternate (Disabled) Limited Alarm Restarts (Disabled) Remote Device (Disabled) COM 1 Default Baud Rate (1200) COM 2 Default Baud Rate (9600) COM 3 Default Baud Rate (9600) Number of Limited Setpoint (0) <ul style="list-style-type: none"> Limited Setpoint # 1 (-13°F) Limited Setpoint # 2 (32°F) Limited Setpoint # 3 (37°F) Limited Setpoint # 4 (55°F) Demand Defrost on Temp Rises (Disabled) Extended ServiceWatch Logging (Disabled) <p>Main Menu Configuration</p> <ul style="list-style-type: none"> Add Keypad Lockout to Mode Menu (Disabled) Add Sleep to Mode Menu (Disabled) Show S2C on Mode Menu (Disabled) Keypad Lock PIN (No Code) Easy Cargo Sensor Access (Disabled) <p>Alarms</p> <ul style="list-style-type: none"> Display all alarms Clear all alarms except Alarm Code 64 | <p>Hourmeter Setup</p> <p>Program Hourmeter</p> <ul style="list-style-type: none"> Total Run Time Reminder #1 Hours (Off) Total Run Time Reminder #2 Hours (Off) Controller Power On Hours (Off) Pretrip Reminder Hours (Off) Engine Run Time Reminder #1 Hours (Off) Engine Run Time Reminder #2 Hours (Off) Electric Run Time Reminder #1 Hours (Off) Electric Run Time Reminder #2 Hours (Off) <p>Viewable Hourmeter Setup</p> <ul style="list-style-type: none"> Total Hours (Disabled) Total Run Time Hours (Enabled if Model 50) Engine Hours (Enabled) Electric Run Hours (Enabled if Model 50) Zone 1 Run Time Hours (Disabled) Zone 2 Run Time Hours (Disabled) Zone 3 Run Time Hours (Disabled) Total Run Time Reminder #1 Hours (Disabled) Total Run Time Reminder #2 Hours (Disabled) Controller Power On Hours (Disabled) Pretrip Reminder Hours (Disabled) Engine Run Time Reminder #1 Hours (Disabled) Engine Run Time Reminder #2 Hours (Disabled) Electric Run Time Reminder #1 Hours (Disabled) Electric Run Time Reminder #2 Hours (Disabled) <p>Sensor Calibration</p> <ul style="list-style-type: none"> Zone 1 Return Air Sensor Grade (5H) Zone 1 Discharge Air Sensor Grade (5H) Zone 2 Return Air Sensor Grade (5H) Zone 2 Discharge Air Sensor Grade (5H) Zone 3 Return Air Sensor Grade (5H) Zone 3 Discharge Air Sensor Grade (5H) Spare 1 Sensor Grade (5H) Spare 2 Sensor Grade (5H) Spare 3 Sensor Grade (5H) <p>Cycle Sentry Setup</p> <ul style="list-style-type: none"> Cycle Sentry Amps Level (5) Battery Sentry Voltage Level (12.2) <p>Defrost Setup</p> <ul style="list-style-type: none"> Defrost Interval In Range w/ Fresh Setpoint (6) Defrost Interval Not In Range w/ Fresh Setpoint (4) Defrost Interval In Range w/ Frozen Setpoint (6) Defrost Interval Not In Range w/ Frozen Setpoint (4) Maximum Defrost Duration (45) |

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**Not all menu features
may appear**

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Figure 44. Guarded Access Menu Features (F020/6518)

| Guarded Access Menu 3 of 4 | | | Guarded Access Menu 4 of 4 | | |
|---|--------------|---------------|---|--|--|
| Language Setup | | | Sensor Configuration (CargoWatch) (See CargoWatch description in Diagnostic Manual) | | |
| Default Language | | | Logging Interval (15 Minutes) | | |
| Enable Languages | | | Log Sensor 1 | | |
| HMI Rev 65xx | HMI Rev 66xx | HMI Rev 67xx | Sensor Logging (On) | | |
| English | English | English | Independent Sensor #1 Name (Log Sensor 1) | | |
| Spanish | Danish | Japanese | Out of Range Checking (Off) | | |
| French | Russian | | Italian Option (Available with sensor 1 only) (Off) | | |
| German | Norwegian | | Sensor Averaging (Off) | | |
| Italian | Swedish | HMI Rev 6830 | Log Sensor 2 | | |
| Dutch | Finnish | Mix and Match | Sensor Logging (On) | | |
| Portuguese | Polish | Languages | Independent Sensor #1 Name (Log Sensor 2) | | |
| Greek | Hungarian | | Out of Range Checking (Off) | | |
| Turkish | Romanian | | Sensor Averaging (Off) | | |
| Hebrew | Bulgarian | | Log Sensor 3 | | |
| Arabic | Czech | | Same as Sensor 2 | | |
| Access Code Setup | | | Log Sensor 4 | | |
| Enter Access Code | | | Same as Sensor 2 | | |
| OptiSet | | | Log Sensor 5 | | |
| Temperature Units (F) | | | Same as Sensor 2 | | |
| Setpoint High Limit Zone 1 (80°F) | | | Log Sensor 6 | | |
| Setpoint Low Limit Zone 1 (-20°F) | | | Same as Sensor 2 | | |
| Setpoint High Limit Zone 2 (80°F) | | | Digital In 1 | | |
| Setpoint Low Limit Zone 2 (-20°F) | | | Door Open Logging (On) | | |
| Setpoint High Limit Zone 3 (80°F) | | | Digital Input #1 Name (Digital Input #1) | | |
| Setpoint Low Limit Zone 3 (-20°F) | | | Digital In 2 | | |
| Number of Limited Setpoints | | | Same as Digital Input 1 | | |
| Limited Setpoint #1 Degrees | | | Digital In 3 | | |
| Limited Setpoint #2 Degrees | | | Same as Digital Input 1 | | |
| Limited Setpoint #3 Degrees | | | Countdown Timer (Off) | | |
| Limited Setpoint #4 Degrees | | | Conservative Log Count (Off) | | |
| Fresh Frozen Range | | | Unit Configuration | | |
| Range Limits | | | Engine Type (Yanmar 2.1) | | |
| OptiSet Range | | | Compressor Type (Recip) | | |
| Cycle Sentry (On) | | | ETV Configured (Yes) | | |
| Continuous (On) | | | Dual Evaporator Configuration (No) | | |
| Cycle Sentry Null Restart Temperature (5.0°F) | | | How Many Zones in This Unit? (2 or 3) | | |
| Cycle Sentry Door Open Forces (Log Only) | | | Zone 2 Evap Fans Configuration (3 Fans) | | |
| Cycle Sentry Run Fans in Null (Off) | | | Zone 3 Evap Fans Configuration (3 Fans) | | |
| Continuous Door Open Forces (Log Only) | | | Electric Standby Equipped? (Yes) | | |
| Continuous Run Fans in Null (Off) | | | Electric Heat Option (Yes) | | |
| Not all menu features may appear | | | Electric Motor Type (14HP) | | |
| | | | Diesel to Electric Autoswitch Enabled? (No) | | |
| | | | Electric to Diesel Autoswitch Enabled? (No) | | |
| | | | Unit Model (SB) | | |
| | | | Defrost Motor Equipped? (No) | | |
| | | | Fuel Sensor Type (None) | | |
| | | | Rear Remote Control (None) | | |
| | | | Rear Remote Control Action (Stand By) | | |
| | | | Pretrip/Sleep Switch Options (Disabled) | | |

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Figure 45. Guarded Access Menu Features (FA00/7B00)

| Guarded Access Menu 1 of 4 | Guarded Access Menu 2 of 4 |
|--|--|
| <p>Security Code (if enabled) Enter Access Code</p> <p>Programmable Features</p> <ul style="list-style-type: none"> Temperature Units (F) Pressure Units (PSIG) Restart Unit After Shutdown (Enabled) Setpoint High Limit Zone 1 (80°F) Setpoint Low Limit Zone 1 (-20°F) Setpoint High Limit Zone 2 (80°F) Setpoint Low Limit Zone 2 (-20°F) Setpoint High Limit Zone 3 (80°F) Setpoint Low Limit Zone 3 (-20°F) Running Fans in Null (Disabled) Fresh Frozen Range (15°F) Door Open Forces (Log Only) <ul style="list-style-type: none"> Door Open Timeout (HRS:MIN) Door Open Timeout Alarm (Enabled) Host Null (Disabled) Sleep Mode After Pretrip (Disabled) Rail Option (Disabled) <ul style="list-style-type: none"> Rail Alternate (Disabled) Discharge Pressure Setpoint (415 psi) Limited Alarm Restarts (Disabled) Remote Device (Disabled) COM 1 Default Baud Rate (1200) COM 2 Default Baud Rate (9600) COM 3 Default Baud Rate (9600) Number of Limited Setpoint (0) <ul style="list-style-type: none"> Limited Setpoint # 1 (-13°F) Limited Setpoint # 2 (32°F) Limited Setpoint # 3 (37°F) Limited Setpoint # 4 (55°F) Demand Defrost on Temp Rises (Disabled) Extended ServiceWatch Logging (Disabled) Cond Inlet Sol MOPD Option (Enabled) Cond Inlet Sol MOPD (200 psi) ServiceWatch Logging Interval (1 minute) Fresh Null Restart Temperature (5.0°F) Frozen Null Restart Temperature (5.0°F) High Ambient Discharge Pressure Control (Disabled) Precision Temperature Control Zone (2) CargoWatch Sensor 1 zone (1) CargoWatch Sensor 2 zone (1) CargoWatch Sensor 3 zone (1) CargoWatch Sensor 4 zone (1) CargoWatch Sensor 5 zone (1) CargoWatch Sensor 6 zone (1) Decimal Degree Setpoint (No) <p style="text-align: center;">Not all menu features may appear</p> | <p>Main Menu Configuration</p> <ul style="list-style-type: none"> Add Keypad Lockout to Mode Menu (Disabled) Add Sleep to Mode Menu (Disabled) Show SZC on Mode Menu (Disabled) Temperature Units to Mode Menu (Disabled) Precision Temperature Control Zone to Mode Menu (Disabled) Keypad Lock PIN (No Code) Easy Cargo Sensor Access (Disabled) <p>Alarms</p> <ul style="list-style-type: none"> Display all alarms Clear all alarms except Alarm Code 64 <p>Hourometer Setup</p> <p><u>Program Hourometer</u></p> <ul style="list-style-type: none"> Total Run Time Reminder #1 Hours (Off) Total Run Time Reminder #2 Hours (Off) Controller Power On Hours (Off) Pretrip Reminder Hours (Off) Engine Run Time Reminder #1 Hours (Off) Engine Run Time Reminder #2 Hours (Off) Electric Run Time Reminder #1 Hours (Off) Electric Run Time Reminder #2 Hours (Off) <p><u>Viewable Hourometer Setup</u></p> <ul style="list-style-type: none"> Total Hours (Disabled) Total Run Time Hours (Enabled if Model 50) Engine Hours (Enabled) Electric Run Hours (Enabled if Model 50) Zone 1 Run Time Hours (Disabled) Zone 2 Run Time Hours (Disabled) Zone 3 Run Time Hours (Disabled) <ul style="list-style-type: none"> Total Run Time Reminder #1 Hours (Disabled) Total Run Time Reminder #2 Hours (Disabled) Controller Power On Hours (Disabled) Pretrip Reminder Hours (Disabled) Engine Run Time Reminder #1 Hours (Disabled) Engine Run Time Reminder #2 Hours (Disabled) Electric Run Time Reminder #1 Hours (Disabled) Electric Run Time Reminder #2 Hours (Disabled) <p><u>Program Service Due Date</u></p> <ul style="list-style-type: none"> Engine Run Time Service Due Date <p>Sensor Calibration</p> <ul style="list-style-type: none"> Zone 1 Return Air Sensor Grade (5H) Zone 1 Discharge Air Sensor Grade (5H) Zone 2 Return Air Sensor Grade (5H) Zone 2 Discharge Air Sensor Grade (5H) Zone 3 Return Air Sensor Grade (5H) Zone 3 Discharge Air Sensor Grade (5H) Spare 1 Sensor Grade (5H) Spare 2 Sensor Grade (5H) Spare 3 Sensor Grade (5H) |

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Figure 46. Guarded Access Menu Features (FA00/7B00)

| Guarded Access Menu 3 of 4 | | | Guarded Access Menu 4 of 4 | | |
|---|--------------|---------------|---|--|--|
| Cycle Sentry Setup | | | Sensor Configuration (CargoWatch) (Continued) | | |
| Cycle Sentry Amps Level (5) Battery Sentry Voltage Level (12.6) Check Battery Condition Alarm (Enabled) Low Battery Voltage TimeOut in Minutes (30) CS Null Duration TimeOut in Minutes (5) | | | Log Sensor 2 Sensor Logging (On) Independent Sensor #1 Name (Log Sensor 2) Out of Range Checking (Off) Sensor Averaging (Off) | | |
| Defrost Setup | | | Log Sensor 3 Same as Sensor 2 | | |
| Defrost Interval In Range w/ Fresh Setpoint (6) Defrost Interval Not In Range w/ Fresh Setpoint (4) Defrost Interval In Range w/ Frozen Setpoint (6) Defrost Interval Not In Range w/ Frozen Setpoint (4) Maximum Defrost Duration (45) | | | Log Sensor 4 Same as Sensor 2 | | |
| Language Setup | | | Log Sensor 5 Same as Sensor 2 | | |
| Default Language | | | Log Sensor 6 Same as Sensor 2 | | |
| Enable Languages | | | Digital In 1 Door Open Logging (On) Digital Input #1 Name (Digital Input #1) | | |
| HMI Rev 7Bxx | HMI Rev 7Cxx | HMI Rev 7Dxx | Digital In 2 Same as Digital Input 1 | | |
| English | English | English | Digital In 3 Same as Digital Input 1 | | |
| Spanish | Danish | Japanese | Countdown Timer (Off) | | |
| French | Russian | Chinese | Conservative Log Count (Off) | | |
| German | Norwegian | | SOT on Setpoint (Disabled) | | |
| Italian | Swedish | HMI Rev 7Exx | Automatic Setpoint at Midnight (Disabled) | | |
| Dutch | Finnish | Mix and Match | | | |
| Portuguese | Polish | Languages | | | |
| Greek | Hungarian | | | | |
| Turkish | Romanian | | | | |
| Hebrew | Bulgarian | | | | |
| Arabic | Czech | | | | |
| Access Code Setup | | | Unit Configuration | | |
| Enter Access Code | | | Engine Type (Yanmar 2.1) Compressor Type (Recip) ETV Configured (Yes) | | |
| Sensor Configuration (CargoWatch) | | | How Many Zones in This Unit? (2 or 3) Zone 2 Evap Fans Configuration (3 Fans) | | |
| (See CargoWatch description in Diagnostic Manual) | | | Zone 3 Evap Fans Configuration (3 Fans) | | |
| Logging Interval (15 Minutes) | | | Electric Standby Equipped? (Yes) Electric Heat Option (Yes) Electric Motor Type (14HP) Diesel to Electric Autoswitch Enabled? (No) | | |
| Log Sensor 1 | | | Electric to Diesel Autoswitch Enabled? (No) Unit Model Defrost Motor Equipped? (No) Fuel Sensor Type (None) | | |
| Sensor Logging (On) Independent Sensor #1 Name (Log Sensor 1) Out of Range Checking (Off) Italian Option (Available with sensor 1 only) (Off) Sensor Averaging (Off) | | | Rear Remote Control (None) Rear Remote Control Action (Stand By) Pretrip/Sleep Switch Options (Disabled) 3rd Party Device Control (None) TracKing REB Fuel Level Sensor Type (None) TracKing REB Door Switch Enabled? (Disabled) Cargolink (Disabled) Refrigerant Type | | |
| Not all menu features may appear | | | 7B00/FA00 SR-3 Trailer M/T | | |

Guarded Access Menu Features

Note: The Guarded Access Menu allows the programmable unit features to be configured to user requirements.

The features presented in this section contain the following information:

- Control Rev: The controller software release in which the feature was first implemented.
- HMI Rev: The HMI software release in which the feature was first implemented.
- Choices: The selections that are available for the feature.
- Factory Set: Default setting from factory.
- Exceptions: Special considerations for use of the feature.
- Description: A brief description of the feature and its use.

For complete details, refer to Section 4 of this manual.

Security Code Protection

A security code can be set to restrict access to the Guarded Access Menu. If a security code is set, the technician will be prompted to enter the correct code when accessing the Guarded Access Menu. The security code is defaulted to No Code.

Accessing the Guarded Access Menu

From the Standard Display press the MENU key. The controller will display the Main Menu. From the first Main Menu display (either Language or Alarms) press and hold both the EXIT key and the key with no label above it for five seconds.

After five seconds, the controller will display the Maintenance Menu. Press the NEXT key until the Set Time and Date Menu appears. From the Set Time and Date Menu, press and hold both the EXIT key and the key with no label above it for five seconds.

The controller may display a Security Code challenge. If a Security Code has been set, the operator is prompted to enter the correct code using the "+" and "-" keys. When the correct code is set, press the YES key to enter the Guarded Access Menu. If the correct Security Code is not entered, access to the Guarded Access Menu will be denied.

If no Security Code has been set, the controller will enter the Guarded Access Menu directly.

Bypassing the Security Code

If a Security Code is set and the Guarded Access Menu must be accessed, the Security Code can be bypassed by entering "4444".

Leaving the Guarded Access Menu

When leaving the Guarded Access Menu, the Base Controller will automatically turn off and restart to configure the changes that may have been made. This power cycle is termed a controller "warm restart".

Programmable Features Menu

The Programmable Features Menu allows overall unit operation to be configured to specific end user requirements. These features are set to factory defaults when shipped, but can easily be changed to suit the end user's needs. Programmable features are designed to allow the user to customize some unit operating parameters without using OptiSet™.

Important: If a feature has been programmed in OptiSet, the HMI will display "Programmed in OptiSet", and the feature cannot be updated from this menu.

OptiSet is only available on units with HMI Control Panel Revision 6510-6512 software. OptiSet is not available and the OptiSet menus do not appear with HMI Control Panel Revision 6520 or 6530 software.

OptiSet Plus Temperature Profiles is not currently available on SR-2/SR-3 multi-temperature applications. However, OptiSet Plus for Unit Setup and CargoWatch Setup is available.



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Temperature Units

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | SR-2: 6510 and later SR-3: 6514 and later |
| Choices | FAHRENHEIT or CELSIUS |
| Factory Set | SB Units: FAHRENHEIT SLX Units: CELSIUS |
| Exceptions | If OptiSet is active, this feature is set from the OptiSet Menu. The setting selected is used for all ranges. |
| Description | The controller can be set to display temperatures in either degrees FAHRENHEIT or degrees CELSIUS. |

Pressure Units

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | PSIG, kPa, or BARS |
| Factory Set | PSIG |
| Exceptions | |
| Description | The controller can be set to display system refrigerant pressures in PSIG, kPa, or BARS. |

Restart Unit After Shutdown

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED, DISABLED, or CONTINUOUS |
| Factory Set | ENABLED |
| Exceptions | Use the CONTINUOUS option for rail applications only. |
| Description | Standard restart alarms become permanent shutdown alarms after several attempts to start and run. The CONTINUOUS feature is designed for rail applications where the unit runs unattended or is inaccessible for service. It allows unlimited restart attempts to be made if the following restart alarms occur: <ul style="list-style-type: none">• Alarm Code 10 High Discharge Pressure• Alarm Code 18 High Engine Coolant Temp• Alarm Code 63 Engine Stopped• Alarm Code 82 High Compressor Temp If restarts are disabled, the unit will shut down on the first alarm event. The following differences exist between a Standard Restart and a Continuous Restart alarm: <ul style="list-style-type: none">• Standard Restart alarms force a permanent shutdown if the alarm occurs a pre-determined number of times (usually three). Continuous Restart alarms allow an unlimited number of restarts for the four alarm codes listed above.• Standard Restart alarms typically use a 15 minute timer before a restart is allowed. Continuous Restart alarms use a 1-hour timer before a restart is allowed. |

Setpoint High Limit (for the indicated Zone)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |

| | |
|--------------------|---|
| Choices | Maximum is 90°F (32°C), Minimum is Setpoint Low Limit |
| Factory Set | 80°F (27°C) |
| Exceptions | If OptiSet is active this feature is set from the OptiSet Menu. The Setpoint High Limit setting selected is used for all ranges in the indicated zone. |
| Description | Setpoint High Limit allows the upper setpoint limit to be set to a maximum of 90°F (32°C) in one degree increments. The minimum setting is determined by the setting of Setpoint Low Limit. If the driver attempts to select a setpoint higher than the Setpoint High Limit, the display will show Setpoint Limit, indicating that the selected Setpoint High Limit has been reached. Setting Setpoint High Limit and the Setpoint Low Limit to the same temperature results in a single setpoint temperature available. If the Limited Setpoint feature is enabled, this setting is not used. This setting is zone specific. |

Setpoint Low Limit (for the indicated Zone)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | Minimum is -25°F (-32°C), Maximum is Setpoint High Limit |
| Factory Set | -20°F (-29°C) |
| Exceptions | If OptiSet is active this feature is set from the OptiSet Menu. The Setpoint Low Limit setting selected is used for all ranges in the indicated zone. |
| Description | The Setpoint Low Limit allows the lower setpoint limit to be set to a minimum of -25°F (-32°C) in one degree increments. The maximum setting available is determined by the setting of Setpoint High Limit. If the driver attempts to select a setpoint lower than the Setpoint Low Limit, the display will show Setpoint Limit, indicating that the selected Setpoint Low Limit has been reached. Setting the Setpoint High Limit and the Setpoint Low Limit to the same temperature results in a single setpoint temperature available. If the Limited Setpoint feature is enabled, this setting is not used. This setting is zone specific. |

Running Fans in Null

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | On or Off |
| Factory Set | Off |
| Exceptions | |
| Description | This feature allows the fans in a zone to run when the zone is in running null. This maintains airflow in the zone and is normally used with fresh loads. If this feature is Set OFF, the zone fans will not run when the zone is in running null. |

Fresh Frozen Range

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 24°F (-4°C) or 15°F (-9°C) |
| Factory Set | 15°F (-9°C) |



Section 3 - Software Description

| | |
|--------------------|--|
| Exceptions | If OptiSet is active, this feature is set from the OptiSet Menu. The setting selected is used for all ranges. |
| Description | <p>One set of general control specifications is used when operating in the Fresh range, and another set of general operating specifications is used when operating in the Frozen range. This feature allows the line between Fresh and Frozen ranges to be selected as either 15°F (-9°C) or 24°F (-4°C). All setpoints less than or equal to this value will be treated as frozen ranges. All setpoints greater than this value will be treated as Fresh ranges.</p> <p>The Frozen setpoint range is from the limit of the Setpoint Limit Low setting to the Fresh Frozen range setting. The Fresh setpoint range is from the limit of the Fresh Frozen range +1 degree to the setpoint high limit setting.</p> <p>When programming OptiSet, no range may include both Frozen and Fresh range setpoints. This value is the high value of the last frozen range programmed. The next range programmed will start at this value + 1 degree depending on the selection made above. Changing this feature will reset all OptiSet range values to default.</p> |

Door Open Forces

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | UNIT NULL, ZONE NULL, or LOG ONLY |
| Factory Set | LOG ONLY |
| Exceptions | If OptiSet is active this feature is set from the OptiSet Menu. The optional door switch must be installed. |
| Description | <p>This feature allows the Door Open action to be set. The setting applies to all zones fitted with door switches. If this feature is set UNIT NULL the Base Controller shuts the unit down and logs the door opening four seconds after the door is opened. If the any zone is in defrost when the door is opened, the defrost cycle will be completed before the unit shuts down.</p> <p>If this feature is set to ZONE NULL the Base Controller shuts the zone down and logs the door opening four seconds after the door is opened. The unit will remain running if any other zone requires cooling or heating. If the zone is in defrost when the door is opened, the defrost cycle will be completed before the zone shuts down. If all zone door switch inputs are open, the unit will be forced to NULL.</p> <p>If this feature is set LOG ONLY the door opening will be logged after four seconds but the unit will continue to run. Door openings are logged in both the CargoWatch and ServiceWatch data loggers. The door switch must be open or closed for four seconds before the event is logged to prevent false readings.</p> |

Door Open Timeout

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1:00 to 4:00 (Hours) in 10 Min Increments or OFF |
| Factory Set | OFF |
| Exceptions | If OptiSet is active this feature is set from the OptiSet Menu. The optional door switch must be installed. Only appears if the DOOR OPEN FORCES feature is set to ZONE NULL or UNIT NULL. |
| Description | <p>This feature allows the unit to restart if the door open time exceeds the set limit.</p> <p>Door Open Timeout for the selected range can be set to OFF or for a time limit from 1 to 4 hours, in 10-minute increments. If set to OFF the unit will remain off or in zone null until the door is closed. If a time period is selected the unit will restart and run after the time period elapses. It will continue to run even if the door is still open.</p> |

Host Null

| | |
|--------------------|------------------------|
| Control Rev | F020 and later |
| HMI Rev | 75C0 or 6518 and later |
| Choices | ENABLED or DISABLED |

| | |
|--------------------|---|
| Factory Set | DISABLED |
| Exceptions | |
| Description | If this feature is ENABLED, the "Turn Zone Off" label is added below the third soft key on the current Zone 1 Setpoint screen. This allows the user to turn Zone 1 Off, which places Zone 1 in Null and closes the defrost damper. The unit will continue to run and Zone 1 shows OFF instead of the setpoint on the Standard Display. It is similar to turning Zone 2 or 3 off. Note: This does not change the functions of the Remote (Flushmount) Control Panel. |
| | |

Sleep Mode After Pretrip

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | If the feature is set ENABLED, the unit will enter Sleep Mode after a Pretrip Test. If the feature is set DISABLED, the unit will not enter Sleep Mode after a Pretrip Test. |

Discharge Pressure Setpoint

| | |
|--------------------|---|
| Control Rev | C052 or F020 and later |
| HMI Rev | 75C1 and later |
| Choices | 380 to 440 PSIG |
| Factory Set | 420 PSIG |
| Exceptions | |
| Description | This feature allows the head pressure setpoint to be adjusted. This pressure determines when the base controller will enter a temporary operating mode to prevent unit shutdown. Do not change this setting unless instructed to do so. |

Water Temperature Setpoint

| | |
|--------------------|--|
| Control Rev | C000 or F000 and later |
| HMI Rev | 6510 and later |
| Choices | 180°F to 210°F (82°C to 99°C) |
| Factory Set | 210°F (99°C) |
| Exceptions | |
| Description | This feature allows the water temperature setpoint to be adjusted. This temperature determines when the base controller will enter a temporary operating mode to prevent unit shutdown. Do not change this setting unless instructed to do so. |

Rail Option

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |



Section 3 - Software Description

| | |
|--------------------|--|
| Exceptions | The optional fuel level switch must be installed. |
| Description | If the unit is a rail application, this feature is ENABLED. When the optional customer fuel level switch closes (supplies chassis ground to the base controller fuel level input), the unit will enter a Fuel Conserve Mode where the unit is forced to low speed operation only. If the unit is not a rail application, this feature should be DISABLED. |

Rail Alternate

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | Only available if RAIL OPTION is ENABLED. |
| Description | This feature changes the alerts criteria, defrost allowed temperature, and defrost termination temperature. It should only be used when specified by the customer. If rail alternate is enabled, a defrost cycle is allowed with an evaporator coil temperature less than or equal to 55 °F (13°C) and terminates at 70°F (21°C). |

Limited Alarm Restarts

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | Does not appear unless rail is disabled and restarts are enabled. |
| Description | <p>This feature modifies the ability to repeatedly clear certain alarms from the Main Menu or Operators Menu. If these alarms occur repeatedly, they may indicate a need for service to prevent unit or product damage. These alarms are as follows:</p> <ul style="list-style-type: none"> • Alarm Code 23 Cooling Cycle Fault • Alarm Code 24 Heating Cycle Fault • Alarm Code 32 Refrigeration Capacity Low • Alarm Code 82 High Comp Discharge Temp <p>Setting this feature to ENABLED will allow the above alarms to be cleared conventionally two times in a continuous 12 hour period. If any of these alarms are cleared more than two times in 12 hours, all subsequent occurrences can only be cleared from the Guarded Access Menu. This helps ensure that the alarms receive the attention of service personnel. The 12 hour timer is reset when any of the above alarms is cleared from the Guarded Access Menu. The 12 hour timer is not reset with a unit or controller power-down.</p> <p>Setting this feature DISABLED will allow the above alarms to be cleared conventionally an unlimited number of times.</p> |

Remote Device

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | Requires optional device - see below. |
| Description | Setting this feature to ENABLED allows an external device, such as TrackKing™, to start and stop a properly equipped unit. Setting this feature to DISABLED prevents this control. |
| | Important: The Remote Device feature should be set DISABLED before working on the unit if the unit is equipped with a device that allows it to be started and stopped from a remote location. |

HMI Control Panel COM 1 Default Baud Rate

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 BPS |
| Factory Set | 1200 |
| Exceptions | |
| Description | This feature allows the default baud rate to be selected for the HMI Control Panel COM Port 1. The setting of this feature should not be changed. |

HMI Control Panel COM 2 Default Baud Rate

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 BPS |
| Factory Set | 9600 |
| Exceptions | |
| Description | This feature allows the default baud rate to be selected for the HMI Control Panel COM Port 2. COM Port 2 is used by the CargoWatch printer. If a customer has a mixed fleet with both SR-2/SR-3 and μP-IV M/T controllers with DAS, the baud rate for COM 2 should be set to 2400. This will allow printing from both the SR-2/SR-3 and μP-IV controllers without changing the printer baud rate. The printer baud rate must be set to match the baud rate setting of the Com 2 Port. |

HMI Control Panel COM 3 Default Baud Rate

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 BPS |
| Factory Set | 9600 |
| Exceptions | |
| Description | This feature allows the default baud rate to be selected for the HMI Control Panel COM Port 3. COM port 3 is currently used by third party or other Telematics devices. The setting of this feature should not be changed. |

Number of Limited Setpoints (1-4 available)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 0, 1, 2, 3, or 4 |
| Factory Set | Limited Setpoint #1: -13°F (-25°C) Limited Setpoint #2: 32°F (0°C) Limited Setpoint #3: 37°F (3°C) Limited Setpoint #4: 55°F (13°C) |



Section 3 - Software Description

| Exceptions | |
|--------------------|--|
| Description | This feature allows programming of a limited number of predetermined setpoints to be made available to the driver. From 1 to 4 setpoints can be programmed. Setting this feature to [0] results in normal operation with all setpoints available from the setting of Setpoint Low Limit to Setpoint High Limit. As an example, if this feature is set to [3] then only three setpoints can be programmed. If the Limited Setpoints are set to -10°F, 35°F and 50°F then pressing the Up or Down keys when selecting a setpoint will scroll between these three setpoints only. No other setpoints are available. This feature is not zone specific. The Limited Setpoints selected are available in all zones. |

Demand Defrost on Temp Rises

| Control Rev | SR-2: C000 and later SR-3: F000 and later |
|--------------------|---|
| HMI Rev | 6510 and later |
| Choices | Disabled, 5°F /Minute (2.8°C)/Minute to 12°F/Minute (6.7°C)/Minute |
| Factory Set | Disabled |
| Exceptions | |
| Description | This feature will force a demand defrost in a zone if the temperature rises rapidly. This rapid temperature rise is typically caused when a zone access door is opened. The programmable temperature rise settings are from 5°F (2.8°C) per minute to 12°F (6.7°C) per minute in one degree increments. If the temperature rises more than the programmed rise, a demand defrost is forced in that zone. |

Extended ServiceWatch™ Logging

| Control Rev | SR-2: C000 and later SR-3: F000 and later |
|--------------------|--|
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | Enabling this feature forces the ServiceWatch data logger to record a timed log every time a zone operating mode changes. Enabling this feature allows for the logging of additional unit operating data. However, due to the additional logging, the data logger memory will be filled faster. If the memory is filled, subsequent logs will be written over the oldest data in the memory. If old data is written over by new data, the old data information is permanently lost. |

ServiceWatch™ Logging Intervals

| Control Rev | SR-2: C000 and later SR-3: F000 and later |
|--------------------|---|
| HMI Rev | 6510 and later |
| Choices | 1 Minute, 2 Minutes, 5 Minutes, 10 Minutes, 15 Minutes, 30 Minutes, 1 Hour, 2 Hours, or 4 Hours |
| Factory Set | DISABLED |
| Exceptions | |
| Description | This feature allows the user to select the logging interval for the ServiceWatch Data Logger. |

Condenser Inlet Solenoid Maximum Operating Pressure Differential (MOPD) Option

| | |
|--------------------|---|
| Control Rev | F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | ENABLED |
| Exceptions | Applies only to Multi-Temp units with MOPD ENABLED. |
| Description | This feature allows the user to select if preventive action will be taken if the Condenser Inlet Solenoid fails to open. If this feature is set ENABLED, preventive actions will be taken based on the description and pressure shown below. If the feature is set DISABLED, no preventive actions are taken. |

Condenser Inlet Solenoid Maximum Operating Pressure Differential (MOPD)

| | |
|--------------------|--|
| Control Rev | F000 and later |
| HMI Rev | 6510 and later |
| Choices | 100 PSIG, 200 PSIG, 300 PSIG, 400 PSIG |
| Factory Set | 200 PSIG |
| Exceptions | Applies only to Multi-temp units with MOPD ENABLED. |
| Description | This feature allows the user to select the Condenser Inlet Solenoid pressure differential value that will cause a preventive action to be taken should the solenoid fail to open. If the Condenser Inlet Solenoid MOPD option is enabled and the calculated Condenser Inlet Solenoid discharge pressure exceeds the value selected by this feature, the Zone 1 (Host) Hot Gas Solenoid will be energized for five seconds to reduce the discharge pressure. At the end of the five second interval, the Zone 1 Hot Gas Solenoid will be de-energized if there are no other requirements that require it to be energized. |

Null Restart Temperature

| | |
|--------------------|--|
| Control Rev | FA00 and later |
| HMI Rev | 7B00 and later |
| Choices | 2.7°C to 8.5°C (4.8°F to 15.2°F) for Fresh and Frozen range |
| Factory Set | 2.8°C (5.0°F) |
| Exceptions | SLXi units only. |
| Description | This feature determines the number of degrees above setpoint that the temperature can rise before the unit restarts in Cycle Sentry mode. The Null Restart Temperature can be adjusted in increments of 0.1°C (0.2°F). |

High Ambient Discharge Pressure Control

| | |
|--------------------|--|
| Control Rev | F020 and later |
| HMI Rev | 75C0 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | Unit Type = SLX Spectrum |
| Description | When HADPC is set to ENABLED, the unit will control the discharge pressure around a High Discharge Control Setting of 370 PSI when the ambient temperature rises above 40°C (104°F). |



Section 3 - Software Description

Precision Temp Control (PTC)

| | |
|--------------------|---|
| Control Rev | F031 and later |
| HMI Rev | 75C2 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED (F020) / ENABLED ZONE 2 (F031) |
| Exceptions | PTC is only allowed in one remote zone at a time. |
| Description | When enabled, Precision Temperature Control (PTC) pulses the Liquid Line Solenoid (LLS) in the selected zone as necessary to control the cooling capacity for more precise temperature control. |

| | |
|--------------------|---|
| Control Rev | FA00 and later |
| HMI Rev | 75C2 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | ENABLED |
| Exceptions | PTC is only allowed in one remote zone. |
| Description | This feature is ENABLED for Zone 2 for SLXi Spectrum units. When enabled, Precision Temperature Control (PTC) pulses the Liquid Line Solenoid (LLS) in the selected zone as necessary to control the cooling capacity for more precise temperature control. |

Decimal Degree Setpoint

| | |
|--------------------|---|
| Control Rev | F031 and later |
| HMI Rev | 75C2 and later |
| Choices | YES or NO |
| Factory Set | NO |
| Exceptions | SLXi units only. |
| Description | If this feature is set to YES, user should be able to select setpoint with increments and/or decrements of 0.1°C. If this feature is set to NO, user should be able to select setpoint with increments and/or decrements of 1.0°C. |

Main Menu Configuration Menu

The Main Menu Configuration Menu determines if the Keypad Lockout, Sleep Mode, and Single Zone (Multi-Temp) menus are visible in the Main Menu > Mode Menu. These features are set to factory defaults when shipped, but can easily be changed to suit the end user's needs.

Add Keypad Lockout to Mode Menu

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | When enabled, Keypad Lockout allows the operator to lock the keypad to prevent tampering. Pressing any soft key for five seconds will unlock the keypad. Setting this feature Enabled adds the Keypad Lockout feature to the Mode Menu. Setting this feature Disabled turns the Keypad Lockout feature off and removes the feature from the Mode Menu. |

Add Sleep to Mode Menu

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | When enabled, Sleep Mode allows the operator to place the unit in Sleep Mode from the Mode Menu. Setting this feature Enabled adds the Sleep Mode feature to the Mode Menu. Setting this feature Disabled removes the Sleep Mode feature from the Mode Menu. |

Show Single Zone Control on Mode Menu

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | Single Zone Control allows a Multi-Temp unit to be placed in Single Temperature operation. Typically, the bulkheads are taken down and the entire trailer is operated in the same manner as a single temperature unit. All evaporators will be operated in the same mode, (except for defrost) when this mode is active. The unit will control the entire trailer to a single temperature when this mode is active. Setting this feature Enabled places Single Zone Control in the Mode Menu. Setting this feature Disabled turns the Single Zone Control feature off and removes the feature from the Mode Menu. |

Add Temperature Units to Mode Menu

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | When Enabled, Add Temp Units to Mode Menu allows the operator to choose to display temperatures in either degrees Fahrenheit or degrees Celsius. Setting this feature Enabled adds the Select Temperature Units feature to the Mode Menu. Setting this feature Disabled removes the Select Temperature Units feature from the Mode Menu. |

Add Precision Temp Control Zone to Mode Menu

| | |
|--------------------|---|
| Control Rev | FA00 and later |
| HMI Rev | 7B00 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | When Enabled, the Precision Temp Control Zone selection will appear in the Mode Menu. This allows the user to access the Precision Temp Control Zone Menu through the Mode Menu in addition to accessing it though the Guarded Access > Programmable Features Menu. |



Section 3 - Software Description

Keypad Lock PIN

| | |
|--------------------|--|
| Control Rev | C052 or F020 and later |
| HMI Rev | 75C0 or 6518 and later |
| Choices | NO CODE or any value from 1 to 99999 |
| Factory Set | NO CODE |
| Exceptions | |
| Description | If this feature is set NO CODE, a code is not required to unlock the keypad if it has been locked. If a code from 1 to 99999 has been selected, this code must be entered in order to unlock the HMI keypad. The code should be recorded for future use. |

Easy Cargo Sensor Access

| | |
|--------------------|---|
| Control Rev | C052 or F020 and later |
| HMI Rev | 75C0 or 6518 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | If this feature is ENABLED, the Sensors Menu will be moved to before the Alarms Menu in the Main Menu. This allows the user to view the Sensor Screens with just two button presses. It is typically used to access the CargoWatch sensors. |

Alarm Display Menu

The Alarm Menu allows the technician to display and clear any existing alarms except alarms that auto-clear only. Refer to Section 4 for operating details. If an alarm condition still exists when the alarm is cleared, the alarm will be set again as soon as the alarm condition is detected.

A list of alarm codes including diagnostic procedures for each alarm code is presented in Section 5 of this manual.

Hourmeter Setup Menu

The Hourmeter Setup Menu allows the unit hourmeters to be configured to customer requirements. There are three sub-menus under the Hourmeter Setup Menu:

- Program Hourmeter
- Viewable Hourmeter Setup
- Program Service Due Date

Program Hourmeter Sub-Menu

The hourmeters listed below allow a time limit to be established for each programmable Hourmeter. These time limits are defined by the customer and are typically used as maintenance reminders. When a hourmeter time is exceeded, a stored alarm is set as a maintenance reminder. The hourmeter is cleared by means of a CLEAR soft key when viewing the hourmeters from the Guarded Access Menu. The hour meter elapsed time should be reset to 0. Hourmeters cannot be cleared from the Main Menu.

With the exception of Controller Power On Hours and Pretrip Reminder Hours, there are two hourmeters for each feature to allow two different maintenance intervals to be set.

The Program Hourmeter Sub-menu is used to set and clear the adjustable time limits for each Hourmeter, as required by a customer's maintenance program. The default time limit for all hourmeters is 100 hours. The hourmeters appear in the order shown.

Total Run Time Reminder # 1 Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | OFF, 1 to 99,999 |
| Factory Set | OFF |
| Exceptions | If a time limit is set and exceeded, Alarm Code 132 will be set as a stored alarm. |
| Description | Total Run Time Reminder #1 Hours is one of two hourmeters that track the total amount of time the unit has run in both diesel and electric mode. If a time limit is set and exceeded, Alarm Code 132 will be set as a stored alarm. This feature sets the meter limits for this programmable hourmeter. The default setting is OFF. Time limits start at 100 hours and can be decreased to 1 and then OFF or increased to a maximum of 99,999 hours. |

Total Run Time Reminder # 2 Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | OFF, 1 to 99,999 |
| Factory Set | OFF |
| Exceptions | If a time limit is set and exceeded, Alarm Code 133 will be set as a stored alarm. |
| Description | Total Run Time Reminder #2 Hours is one of two hourmeters that track the total amount of time the unit has run in both diesel and electric mode. If a time limit is set and exceeded, Alarm Code 133 will be set as a stored alarm. This feature sets the meter limits for this programmable hourmeter. The default setting is OFF. Time limits start at 100 hours and can be decreased to 1 and then OFF or increased to a maximum of 99,999 hours. |

Controller Power On Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | OFF, 1 to 99,999 |
| Factory Set | OFF |



Section 3 - Software Description

| | |
|--------------------|---|
| Exceptions | If a time limit is set and exceeded, Alarm Code 134 will be set as a stored alarm. |
| Description | Controller Power On Hours is the total amount of time the controller has been turned on. If a time limit is set and exceeded, Alarm Code 134 will be set as a stored alarm. This feature sets the meter limits for this programmable hourmeter. The default setting is OFF. Time limits start at 100 hours and can be decreased to 1 and then OFF or increased to a maximum of 99,999 hours. |

Pretrip Reminder Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | OFF, 1 to 99,999 |
| Factory Set | OFF |
| Exceptions | If a time limit is set and exceeded, Alarm Code 64 will be set as a stored alarm. |
| Description | Controller Power On Hours is the total amount of time since the last Pretrip Test was performed. If a time limit is set and exceeded, Alarm Code 64 will be set as a stored alarm. This feature sets the meter limits for this programmable hourmeter. The default setting is OFF. Time limits start at 100 hours and can be decreased to 1 and then OFF or increased to a maximum of 99,999 hours. |

Engine Run Time Reminder # 1 Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | OFF, 1 to 99,999 |
| Factory Set | OFF |
| Exceptions | If a time limit is set and exceeded, Alarm Code 128 will be set as a stored alarm. |
| Description | Engine Run Time Reminder #1 Hours is one of two hourmeters that track the total amount of time the unit has run in diesel mode. If a time limit is set and exceeded, Alarm Code 128 will be set as a stored alarm. This feature sets the meter limits for this programmable hourmeter. The default setting is OFF. Time limits start at 100 hours and can be decreased to 1 and then OFF or increased to a maximum of 99,999 hours. |

Engine Run Time Reminder # 2 Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | OFF, 1 to 99,999 |
| Factory Set | OFF |
| Exceptions | If a time limit is set and exceeded, Alarm Code 129 will be set as a stored alarm. |
| Description | Engine Run Time Reminder #2 Hours is one of two hourmeters that track the total amount of time the unit has run in diesel mode. If a time limit is set and exceeded, Alarm Code 129 will be set as a stored alarm. This feature sets the meter limits for this programmable hourmeter. The default setting is OFF. Time limits start at 100 hours and can be decreased to 1 and then OFF or increased to a maximum of 99,999 hours. |

Electric Run Time Reminder # 1 Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | OFF, 1 to 99,999 |
| Factory Set | OFF |
| Exceptions | If a time limit is set and exceeded, Alarm Code 130 will be set as a stored alarm. Only appears if the unit is configured as being equipped with optional electric standby. |
| Description | Electric Run Time Reminder #1 Hours is one of two hourmeters that track the total amount of time the unit has run in electric mode. If a time limit is set and exceeded, Alarm Code 130 will be set as a stored alarm. This feature sets the meter limits for this programmable hourmeter. The default setting is OFF. Time limits start at 100 hours and can be decreased to 1 and then OFF or increased to a maximum of 99,999 hours. |

Electric Run Time Reminder # 2 Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | OFF, 1 to 99,999 |
| Factory Set | OFF |
| Exceptions | If a time limit is set and exceeded, Alarm Code 131 will be set as a stored alarm. Only appears if the unit is configured as being equipped with optional electric standby. |
| Description | Electric Run Time Reminder #2 Hours is one of two hourmeters that track the total amount of time the unit has run in electric mode. If a time limit is set and exceeded, Alarm Code 131 will be set as a stored alarm. This feature sets the meter limits for this programmable hourmeter. The default setting is OFF. Time limits start at 100 hours and can be decreased to 1 and then OFF or increased to a maximum of 99,999 hours. |

Viewable Hourmeter Setup Sub-Menu

The hourmeters can be programmed to be visible or hidden from the Main Menu. The hourmeters continue to accumulate time even if the hourmeter view is hidden.

If an hourmeter view is set Enabled, that hourmeter will appear in the Hourmeter menu in both the Main Menu and Maintenance Menu. If the hourmeter view is set Disabled, the hourmeter is only viewable from the Maintenance Menu.

For Model 30 units, the default setting for the Engine Hours hourmeter is Enabled. The default setting for all other hourmeters is Disabled.

For Model 50 units, the default setting for the Total Unit Run Hours, Engine Hours, and Electric Run Hours hourmeters is Enabled. The default setting for all other hourmeters is Disabled.

The hourmeters appear in the order shown.

Total Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |



Section 3 - Software Description

| Exceptions | |
|--------------------|---|
| Description | The setting of this feature determines if the Total Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Total Run Time Hours (If Model 50)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | ENABLED if Model 50 |
| Exceptions | Only appears if the unit is configured as being equipped with optional electric standby. |
| Description | The setting of this feature determines if the Total Run Time Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Total Engine Run Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | ENABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Engine Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Electric Run Hours (If Model 50)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | ENABLED if Model 50 |
| Exceptions | Only appears if the unit is configured as being equipped with optional electric standby. |
| Description | The setting of this feature determines if the Electric Run Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Zone 1 Run Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Zone 1 Run Time Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Total Zone 2 Run Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Zone 2 Run Time Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Total Zone 3 Run Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Zone 3 Run Time Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Total Run Time Reminder # 1 Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Total Run Time Reminder # 1 Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Total Run Time Reminder # 2 Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Total Run Time Reminder # 2 Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |



Section 3 - Software Description

Controller On Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Controller Power On Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Pretrip Reminder Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Pretrip Reminder Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Engine Run Time Reminder # 1 Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Engine Run Time Reminder # 1 Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Engine Run Time Reminder # 2 Hours

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | The setting of this feature determines if the Engine Run Time Reminder # 2 Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Electric Run Time Reminder # 1 Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | Only appears if the unit is configured as being equipped with optional electric standby. |
| Description | The setting of this feature determines if the Electric Run Time Reminder #1 Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Electric Run Time Reminder # 2 Hours

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | Only appears if the unit is configured as being equipped with optional electric standby. |
| Description | The setting of this feature determines if the Electric Run Time Reminder #2 Hours hourmeter can be viewed from the Main Menu. If the hourmeter is Enabled, it can be viewed from the Main Menu. If it is Disabled, it cannot be viewed from the Main Menu but is visible from the Maintenance Menu. |

Sensor Calibration Menu

The Sensor Calibration Menu allows the operator to select the correct grade for all graded sensors. Sensor grades range from 1L through 9H. The sensors appear in the order shown.

Note: To verify proper operation, the grades must be properly set to match the actual sensor grades to prevent false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor.

Note: Spare Sensors 1 through 3 are graded sensors but an alarm code is not set if this sensor grade is set to 5H.

Zone 1 Return Air Sensor Grade

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | |
| Description | This feature is used to set the sensor grade for the Zone 1 Return Air Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |



Section 3 - Software Description

Zone 1 Discharge Air Sensor Grade

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | |
| Description | This feature is used to set the sensor grade for the Zone 1 Discharge Air Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |

Zone 2 Return Air Sensor Grade

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | |
| Description | This feature is used to set the sensor grade for the Zone 2 Return Air Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |

Zone 2 Discharge Air Sensor Grade

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | |
| Description | This feature is used to set the sensor grade for the Zone 2 Discharge Air Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |

Zone 3 Return Air Sensor Grade

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | Only appears if the unit is configured as being equipped with three zones. |
| Description | This feature is used to set the sensor grade for the Zone 3 Return Air Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |

Zone 3 Discharge Air Sensor Grade

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | Only appears if the unit is configured as being equipped with three zones. |
| Description | This feature is used to set the sensor grade for the Zone 3 Discharge Air Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |

Spare 1 Sensor Grade

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | If the optional Spare 1 Sensor is not present, this feature need not be set. |
| Description | This feature is used to set the sensor grade for the Spare 1 Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |



Section 3 - Software Description

Spare 2 Sensor Grade

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | If the optional Spare 2 Sensor is not present, this feature need not be set. |
| Description | This feature is used to set the sensor grade for the Spare 2 Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |

Spare 3 Sensor Grade

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1L - 9H |
| Factory Set | 5H |
| Exceptions | If the optional Spare 3 Sensor is not present, this feature need not be set. |
| Description | This feature is used to set the sensor grade for the Spare 3 Sensor. The default setting for a new Base Controller or after a ServiceWatch Base Controller cold start is 5H. This serves as a warning that the sensor grade is not set. The default grade of 5H is not a valid grade and will not be stamped on any sensor. If a sensor grade for a return air or discharge air sensor is set to grade 5H, the alarm code for that sensor and Alarm Code 92 Sensor Grade Not Set will occur. Alarm Code 92 is not set if a Spare Sensor is set to 5H. To verify proper operation, the grades must be properly set to match the actual sensor grades. Failure to do so may result in false alarm codes. Exercise care to properly identify the sensor grades. The best way to positively identify the sensor grade is to physically check the sensor grade printed on each graded sensor. |

Cycle Sentry Setup Menu

The Cycle Sentry Menu allows the unit defaults for Cycle Sentry Null and Sleep Null unit shut down on battery charge current and unit restart on battery voltage to be modified as desired by the customer.

Cycle Sentry Amps

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 2A to 8A in 1A increments |
| Factory Set | 5A |
| Exceptions | |
| Description | When operating in Cycle Sentry or Sleep Mode, the unit will automatically run to charge the battery until the charging current falls below this set limit. This occurs even if cooling, heating, or defrosting is not required. |

Cycle Sentry Battery Voltage

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000/FA00 and later |
| HMI Rev | 6550/7B00 and later |
| Choices | 11.8V to 12.6V in 0.1V increments |
| Factory Set | All Units: 12.2V SLXi Units: 12.6V (Q1 2017) |
| Exceptions | |
| Description | When operating in Cycle Sentry or Sleep Mode, the controller will monitor battery voltage and restart the unit to charge the battery, if the battery voltage falls below this set limit. This occurs even if cooling, heating, or defrosting is not required. |

Check Battery Condition Alarm

| | |
|--------------------|---|
| Control Rev | FA00 and earlier |
| HMI Rev | 7B00 and earlier |
| Choices | ENABLED or DISABLED |
| Factory Set | ENABLED |
| Exceptions | |
| Description | If Check Battery Condition Alarm is ENABLED, Alarm Code 159 Check Battery Condition will be set if indications exist that the battery may be about to fail. If this feature is set DISABLED, the battery condition check will be disabled and Alarm Code 159 Check Battery Condition will not be set. |

Low Battery Voltage Timeout in Minutes

| | |
|--------------------|--|
| Control Rev | FA00 and later |
| HMI Rev | 7B00 and later |
| Choices | 1 to 60 |
| Factory Set | 30 |
| Exceptions | |
| Description | If Check Battery Condition Alarm is ENABLED, this feature becomes available in Cycle Sentry Setup Menu to allow for adjustment of default Alarm Code 159 timeout settings. |

CS Null Duration Timeout in Minutes

| | |
|--------------------|--|
| Control Rev | FA00 and later |
| HMI Rev | 7B00 and later |
| Choices | 1 to 10 |
| Factory Set | 5 |
| Exceptions | |
| Description | If Check Battery Condition Alarm is ENABLED, this feature becomes available in Cycle Sentry Setup Menu to allow for adjustment of default Alarm Code 159 timeout settings. |



Section 3 - Software Description

Defrost Setup Menu

The Defrost Setup Menu allows the defrost operation to be configured for maximum performance.

- The evaporator coil temperature must be 45°F (7°C) or less to allow defrost. Defrost cycles will terminate at 58°F (14°C).
- If High Temperature Defrost is enabled, a defrost cycle is allowed with an evaporator coil temperature less than or equal to 55°F (13°C) and terminates at 70°F (21°C).

Defrost Interval In Range with Fresh Setpoint

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 2, 4, 6, 8 or 12 Hours |
| Factory Set | 6 Hours |
| Exceptions | |
| Description | This feature selects the timed interval between defrost cycles with Fresh range setpoints when the temperature is in range. This setting applies to all zones. |

Defrost Interval Not In Range with Fresh Setpoint

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 2, 4, 6, 8 or 12 Hours |
| Factory Set | 4 Hours |
| Exceptions | |
| Description | This feature selects the timed interval between defrost cycles with Fresh range setpoints when the temperature is not in range. This setting applies to all zones. |

Defrost Interval In Range with Frozen Setpoint

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 2, 4, 6, 8 or 12 Hours |
| Factory Set | 6 Hours |
| Exceptions | |
| Description | This feature selects the timed interval between defrost cycles with Frozen range setpoints when the temperature is in range. This setting applies to all zones. |

Defrost Interval Not In Range with Frozen Setpoint

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 2, 4, 6, 8 or 12 Hours |
| Factory Set | 6 Hours |

| Exceptions | |
|--------------------|---|
| Description | This feature selects the timed interval between defrost cycles with Frozen range setpoints when the temperature is not in range. This setting applies to all zones. |

Maximum Defrost Duration

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 30 or 45 Minutes |
| Factory Set | 45 Minutes |
| Exceptions | |
| Description | This feature selects the maximum time the unit can remain in a defrost cycle. A defrost cycle normally terminates when the evaporator coil temperature reaches 58°F (14°C). If the evaporator temperature does not reach this temperature, the defrost cycle will terminate after the elapsed time selected here. |

Language Setup Menu

This menu allows the display language or languages to be enabled as required. When a language is selected all subsequent displays are in that language.

The languages available are dependent on the software revision in the HMI Control Panel. Only one of the four software revisions can be installed, and only the languages in that revision are available. Other than language support, there is no difference between the software revisions. English is included in all HMI software versions.

There is an Enable Language screen for each language included in the installed HMI software version. English is included in all language sets and is factory set as Enabled. Only enabled languages will appear in the Main Menu Language selections. All languages other than English are factory set as Disabled. If only one language is enabled, the Language selection screen does not appear in the Main Menu.

Enable Language

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | Dependent on HMI software version |
| Factory Set | English only |
| Exceptions | |
| Description | This feature allows any or all of the included languages to be enabled. Only enabled languages will appear in the operators Language Menu. All languages other than English are factory set as Disabled. If only one language is enabled, the Language Selection Menu will not appear in the Main Menu. |

Access Code Setup Menu

This menu allows an Access code to be required for entry to the Guarded Access Menu. If a code is selected, an access code challenge will appear when entering the Guarded Access Menu. If the correct code is not entered, access is denied.

Note: A technician can bypass an unknown Access Code by entering "4444" and pressing the Enter key.



Section 3 - Software Description

Enter Access Code

The + and – keys are used to enter the desired Access Code. When the desired Access Code is displayed, the Enter Key is pressed to load the code. The code should be recorded for future use.

OptiSet™

The OptiSet™ Temperature Management System allows up to ten different temperature ranges to be defined and tailored for maximum operating efficiency, as determined by customer load requirements. The term "OptiSet" refers to both the programmable ranges and the features that can be tailored. OptiSet is programmed using the HMI Control Panel keypad.

OptiSet Availability

Original OptiSet is only available on units with HMI Control Panel Revision 6510 - 6512 software. OptiSet is not available and the OptiSet menus do not appear with HMI Control Panel Revision 6520 or 6530 software.

When using OptiSet with SR-2/SR-3 multi-temperature applications, setup is done via the keypad. There are two methods of using OptiSet with SR-2/SR-3 multi-temperature applications with HMI Control Panel Revision 6520 and later software.

1. Disconnect the existing HMI Control Panel and connect an HMI Control Panel loaded with Software Revision 6512. Use this HMI Control Panel to program OptiSet as desired. Reconnect the original HMI Control Panel with Software Revision 6520.
2. Flash load Software Revision 6512 to the existing HMI Control Panel. Program OptiSet as desired. Leave Software Revision 6512 loaded in the existing HMI Control Panel.

OptiSet™ Plus 2.0 or later may be used with some SR-2/SR-3 Trailer multi-temperature applications to retrieve, create, modify, and upload programmable feature settings to the SR-2/SR-3 Base Controller. OptiSet Plus is not currently available for use to program temperature ranges with SR-2/SR-3 multi-temperature applications.

Important: *Sensor grades must still be retrieved and set using the HMI Control Panel. Refer to Service Procedure A15A for details.*

Notes:

1. Refer to Service Procedure A02B for using WinTrac to retrieve and save programmable features settings from a unit.
2. Refer to Service Procedure A04B for using WinTrac to send programmable features settings to a unit.

OptiSet Reset

Note: Only on units with HMI Control Panel Revision 6510 - 6512 software.

OptiSet features may be reset to default settings several different ways. The following should be considered when changing OptiSet settings, to verify that all ranges are set as desired.

- If any OptiSet features have been previously set, an OptiSet Reset is provided at the beginning of the OptiSet menu to return all settings to the default values. If this OptiSet Reset feature is used, all OptiSet settings are returned to factory defaults.
- If any of the four OptiSet global features (Temperature Units, Setpoint High Limit, Setpoint Low Limit, and Fresh Frozen Range) are changed, all OptiSet settings are also returned to default settings.
- Ranges are programmed from the coldest range to the warmest range. If ranges have been programmed and any range is subsequently changed, the range that was changed and all warmer ranges are reset to defaults.

Programming OptiSet Features

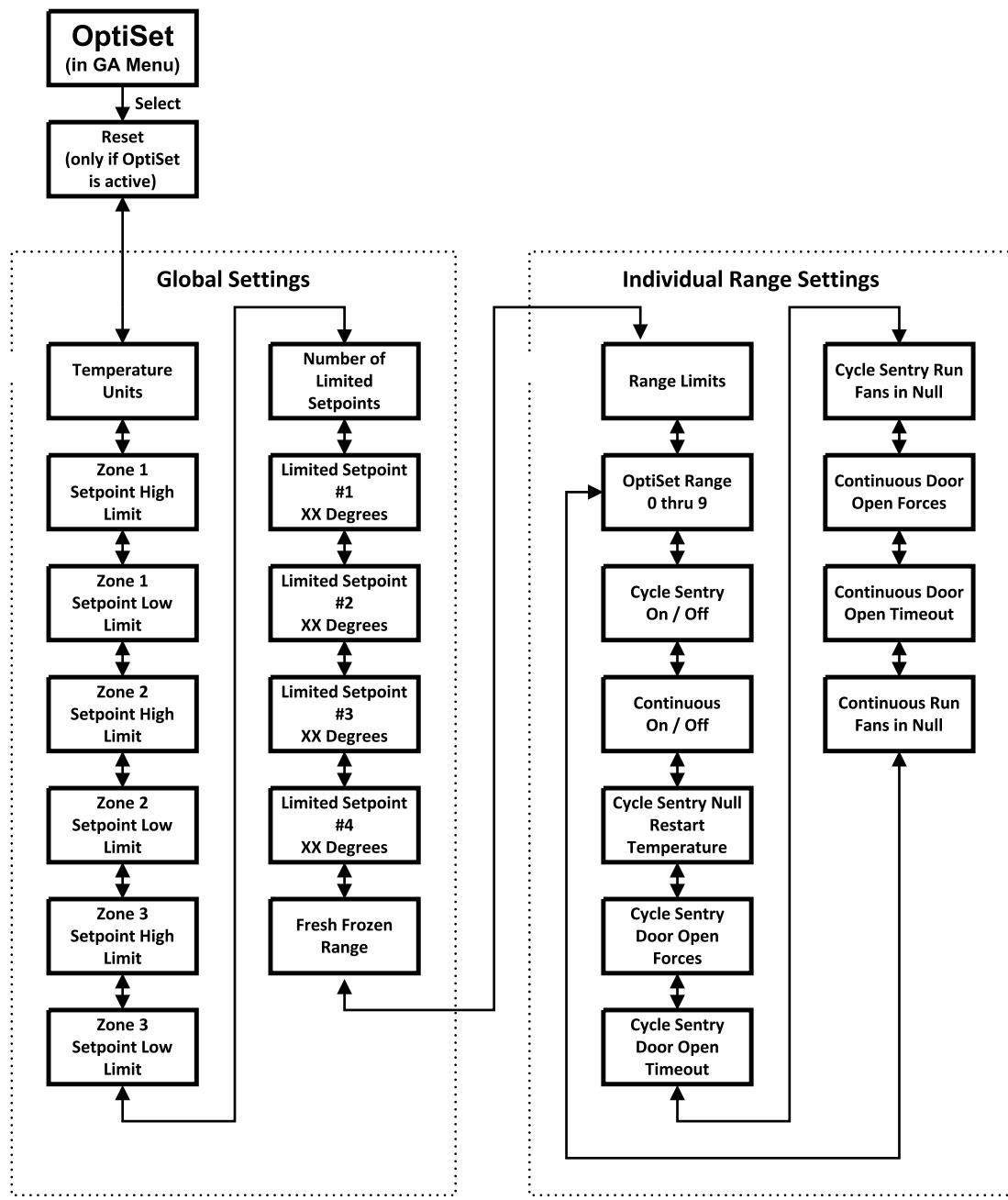
Note: Only on units with HMI Control Panel Revision 6510 - 6512 software.

The OptiSet features are programmed from the HMI Control Panel OptiSet Menu. Feature range values are programmable when required. Only valid programmable features will be displayed as determined by the setting of Economy Mode, Cycle Sentry Mode, and Continuous Mode. If a feature is not allowed, it will not be displayed.

OptiSet Features

Note: Only on units with HMI Control Panel Revision 6510 - 6512 software.

Figure 47. OptiSet Features



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OptiSet Global Features

Note: Only on units with HMI Control Panel Revision 6510 - 6512 software.

The global features listed below affect all other OptiSet ranges and settings. If any of these are changed, all existing OptiSet programmable settings are returned to the default settings. These settings are available in the HMI Programmable Features Menu. If OptiSet has been programmed, the Programmable Features screen will display "Programmed in OptiSet". Programming of the feature will not be allowed in the Programmable Features Menu.

- Temperature Units
- Setpoint High Limit (for the indicated zone)
- Setpoint Low Limit (for the indicated zone)
- Number of Limited Setpoints (1-4 available)
- Fresh Frozen Range
- Running Fans in Null

OptiSet Range Limits and Range Selection

These features allow the OptiSet ranges to be defined and selected. The operation of each of these ranges can be individually customized for optimum performance as determined by user requirements. Changing any range temperature limit will void all existing range settings above that range and will reset that range and all ranges above it to the default configuration. Up to ten programmable ranges can be defined as follows:

- All ranges must fall between the settings of Setpoint Low Limit and Setpoint High Limit.
- The first range starts at the setting of Setpoint Limit Low.
- The last range ends at the setting of Setpoint Limit High.
- The next range starts at the high temperature of the previous range plus one full degree.
- No range can include both fresh and frozen setpoints. The last frozen range ends at the setting of Fresh Frozen Range. The first fresh range starts at the setting of Fresh Frozen Range plus one full degree.
- One frozen range and one fresh range are set from the factory or after a cold start.

Range Limits (for all zones)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | Up to ten ranges, from 0 through 9 |
| Factory Set | Range 0 is from -25°F (-32°C) to 24°F (-4°C), Range 1 is from 25°F (-3°C) to 90°F (32°C) |
| Exceptions | |
| Description | Up to ten ranges (numbered from 0 to 9) can be programmed. Each range is defined by a minimum and maximum setpoint temperature. The first range programmed automatically starts at the setting of Setpoint Limit Low. The last range programmed automatically ends at the setting of Setpoint Limit High. All ranges programmed must be completely above or below the setting of Fresh/Frozen range. No range can contain both Fresh and Frozen setpoints. When programming ranges, the next range automatically begins one full degree (F or C) higher than the last range programmed. Changing any range temperature limit will void all existing range settings above that range and will reset that range and all ranges above it to the default configuration. The default setting is Range 0 (Frozen) and Range 1 (Fresh). |

OptiSet Range (for all zones)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |

| | |
|--------------------|---|
| Choices | Up to ten ranges, from 0 through 9 |
| Factory Set | |
| Exceptions | |
| Description | This feature selects one of the ranges established by Range Limits (above) to be programmed. The ranges available are as determined by the setting of the Range Limits feature above. There can be up to ten ranges. The first range to be programmed is Range 0. |

OptiSet Range Mode

Note: Only on units with HMI Control Panel Revision 6510 - 6512 software.

These settings allow the desired operating modes to be established for each range. The available modes are selected for the range being programmed. Cycle Sentry Mode and Continuous Mode are available. Either of these modes can be turned on or off for each range, but either Cycle Sentry or Continuous must be turned on. If more than one mode is available in a range, it can be selected using the Mode Menu or the Mode key.

The custom features for each range are determined by the modes selected for that range.

- Cycle Sentry Mode: A number of Cycle Sentry features can be customized if Cycle Sentry mode is allowed. These features are the same for both Frozen and Fresh ranges.
- Continuous Mode: A number of Continuous Mode features can be customized. These features are different with Frozen and Fresh ranges.

Cycle Sentry Mode (for selected range)

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | On or Off |
| Factory Set | On |
| Exceptions | |
| Description | This feature allows Cycle Sentry Mode to be turned On or Off for the selected range. If both Cycle Sentry and Continuous are turned On, they are selectable using the Mode key or the Main Menu on the HMI Control Panel. Cycle Sentry Mode automatically starts the unit when cooling, heating, or defrosting is required and stops the unit when all requirements are satisfied. In Diesel Mode operation, the unit also starts and stops as necessary to keep the engine warm and the unit battery charged. In Electric Mode operation, the unit starts and stops as necessary to keep the unit battery charged. If Cycle Sentry is set On, the Cycle Sentry OptiSet custom features are available. The Cycle Sentry OptiSet custom features are the same for Fresh and Frozen ranges. |

Continuous Mode (for selected range)

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | On or Off |
| Factory Set | On |
| Exceptions | |
| Description | This feature allows Continuous Mode to be turned On or Off for the selected range. If both Cycle Sentry and Continuous are turned On, they are selectable using the Mode key or Mode Menu on the HMI Control Panel. In Continuous Mode, the unit is started and continues to run, even if all requirements are satisfied. This provides constant airflow over and around the load. If Continuous is set On, the Continuous OptiSet custom features are available. The Continuous OptiSet custom features are different for Fresh and Frozen ranges. |



Section 3 - Software Description

OptiSet Cycle Sentry Mode

Note: Only on units with HMI Control Panel Revision 6510 - 6512 software.

The features shown can be modified in Cycle Sentry Mode operation. They are the same for Frozen and Fresh ranges.

Cycle Sentry Null Restart Temperature (for selected range)

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | 5.0°F (2.7°C) to 15.0°F (8.5°C) in 1° increments |
| Factory Set | 5.0°F (2.8°C) |
| Exceptions | |
| Description | This feature determines the number of degrees above setpoint that the temperature must rise before the unit restarts in Cycle Sentry Mode. With frozen range setpoints, the maximum restart limit can be no greater than 29°F (-1.6°C). This prevents melt damage with frozen cargo. The Null Restart Temperature below setpoint is a fixed value and cannot be changed. |

Cycle Sentry Door Open Forces (for selected range)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | UNIT NULL, ZONE NULL, or LOG ONLY |
| Factory Set | LOG ONLY |
| Exceptions | The optional door switch must be installed. |
| Description | This feature allows the Door Open action to be set. The setting applies to all zones fitted with door switches. If this feature is set UNIT NULL, the Base Controller shuts the unit down and logs the door opening four seconds after the door is opened. If any zone is in defrost when the door is opened, the defrost cycle will be completed before the unit shuts down. If this feature is set to ZONE NULL, the Base Controller shuts the zone down and logs the door opening four seconds after the door is opened. The unit will remain running if any other zone requires cooling or heating. If the zone is in defrost when the door is opened, the defrost cycle will be completed before the zone shuts down. If all zone door switch inputs are open, the unit will be forced to NULL. If this feature is set LOG ONLY, the door opening will be logged after four seconds but the unit will continue to run. Door openings are logged in both the CargoWatch and ServiceWatch data loggers. The door switch must be open or closed for four seconds before the event is logged to prevent false readings. |

Cycle Sentry Door Open Timeout (for selected range)

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | 1:00 to 4:00 (Hours) in 10 Min Increments or OFF |
| Factory Set | OFF |
| Exceptions | Only appears if the DOOR OPEN FORCES feature is set to ZONE NULL or UNIT NULL. |
| Description | This feature allows the unit to restart if the door open time exceeds the set limit. Door Open Timeout for the selected range can be set to OFF or for a time limit from 1 to 4 hours, in 10 minute increments. If set to OFF, the unit will remain off or in zone null until the door is closed. If a time period is selected, the unit will restart and run after the time period elapses. It will continue to run even if the door is still open. |

Cycle Sentry Run Fans in Null (for selected range)

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | On or Off |
| Factory Set | Off |
| Exceptions | |
| Description | This feature allows the fans in a zone to run when the zone is in running null. This maintains airflow in the zone and is normally used with fresh loads. If this feature is Set OFF, the zone fans will not run when the zone is in running null. |

OptiSet Continuous Mode

Note: Only on units with HMI Control Panel Revision 6510 - 6512 software.

The features shown can be modified in Continuous Mode operation. They are the same for Frozen and Fresh ranges.

Continuous Door Open Forces (for selected range)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | UNIT NULL, ZONE NULL, or LOG ONLY |
| Factory Set | LOG ONLY |
| Exceptions | The optional door switch must be installed. |
| Description | This feature allows the Door Open action to be set. The setting applies to all zones fitted with door switches. If this feature is set UNIT NULL, the Base Controller shuts the unit down and logs the door opening four seconds after the door is opened. If the any zone is in defrost when the door is opened, the defrost cycle will be completed before the unit shuts down. If this feature is set to ZONE NULL, the Base Controller shuts the zone down and logs the door opening four seconds after the door is opened. The unit will remain running if any other zone requires cooling or heating. If the zone is in defrost when the door is opened, the defrost cycle will be completed before the zone shuts down. If all zone door switch inputs are open, the unit will be forced to NULL. If this feature is set LOG ONLY, the door opening will be logged after four seconds but the unit will continue to run. Door openings are logged in both the CargoWatch and ServiceWatch data loggers. The door switch must be open or closed for four seconds before the event is logged to prevent false readings. |

Continuous Door Open Timeout (for selected range)

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | 1:00 to 4:00 (Hours) in 10 Min Increments or OFF |
| Factory Set | OFF |
| Exceptions | Only appears if the DOOR OPEN FORCES feature is set to ZONE NULL or UNIT NULL. |
| Description | This feature allows the unit to restart if the door open time exceeds the set limit. Door Open Timeout for the selected range can be set to OFF or for a time limit from 1 to 4 hours, in 10 minute increments. If set to OFF, the unit will remain off or in zone null until the door is closed. If a time period is selected, the unit will restart and run after the time period elapses. It will continue to run even if the door is still open. |



Section 3 - Software Description

Continuous Run Fans in Null (for selected range)

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 - 6512 only |
| Choices | On or Off |
| Factory Set | Off |
| Exceptions | |
| Description | This feature allows the fans in a zone to run when the zone is in running null. This maintains airflow in the zone and is normally used with fresh loads. If this feature is Set OFF, the zone fans will not run when the zone is in running null. |

Sensor Configuration Menu – CargoWatch™ Data Logger

The CargoWatch Data Logger is internal to the HMI Control Panel. This Data Logger conforms to European standard EN12830. The data logger supports up to six temperature sensors and three digital inputs. These sensors are optional sensors and are not the same as the temperature sensors used to control the unit. The CargoWatch Data Logger features the ability to customize logging parameters and enable product temperature checking. The CargoWatch Data Logger does not record unit sensors. Unit sensors and other unit operating data are recorded by the ServiceWatch™ Data Logger. The CargoWatch logger records the unit setpoint, operating mode, and shutdown alarms.

When shipped from the factory, CargoWatch sensors 1 and 2 are turned on to be logged and CargoWatch sensors 3 through 6 are turned off. Also, digital input 1 is turned on to be logged and digital inputs 2 and 3 are turned off. Sensors and digital inputs can be turned on, off, and configured using the CargoWatch menu in Guarded Access or by using the WinTrac™ Service Tool.

| |
|---|
| Sensor Configuration (CargoWatch) |
| Logging Interval (15 Minutes) |
| Log Sensor 1 (On) |
| Independent Sensor #1 Name (Log Sensor 1) |
| Out of Range Checking (Off) |
| Low (-10.8F or -23.7C) |
| High (10.8F or -11.7C) |
| Italian Option - Available with Sensor 1 only (Off) |
| Sensor Averaging (Off) |
| Log Sensor 2 (On) |
| Independent Sensor #1 Name (Log Sensor 2) |
| Out of Range Checking (Off) |
| Low (-10.8F or -23.7C) |
| High (10.8F or -11.7C) |
| Sensor Averaging (Off) |
| Log Sensor 3 (Off) Same features as Sensor 2 if On |
| Log Sensor 4 (Off) Same features as Sensor 2 if On |
| Log Sensor 5 (Off) Same features as Sensor 2 if On |
| Log Sensor 6 (Off) Same features as Sensor 2 if On |
| Digital In 1 (On) |
| Door Open Logging (On) |
| Digital Input #1 Name (Digital Input #1) |
| Digital In 2 (Off) Same as Digital Input 1 if On |
| Digital In 3 (Off) Same as Digital Input 1 if On |
| Countdown Timer (Off) |
| Conservative Log Count (Off) |
| SOT on Setpoint (Disabled) |
| Automatic SOT at Midnight (Disabled) |

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CargoWatch Sensor Programming

Logging Interval

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1 minute, 2 minutes and 5 to 60 minutes in 5-minute intervals |
| Factory Set | 15 Minutes |
| Exceptions | WinTrac is capable of setting additional intervals as short as one minute. |
| Description | This feature allows the desired logging interval to be set. |

Log Sensor for CargoWatch sensor 1, 2, 3, 4, 5, or 6

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ON or OFF |
| Factory Set | Sensors 1-2 ON, sensors 3-6 OFF |
| Exceptions | |
| Description | This feature allows the desired sensors to be logged. |

Independent Sensor Name for CargoWatch sensor 1, 2, 3, 4, 5, or 6

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------------|---|-------------------------------|-------------|---------------|-------|---------|-------|-----------|----------------------|---------------|----------------|--------------|---------------------------|-------------|------------------------------------|-----|---------------------|---------|------------------------|-------|---------------------------------|-----------------|------------------|------------------|---------------------|------------|------------------------------|------------|---------------|-------------|------------------|-----------|---------------------------|------------|------------|------|--------|------|---------------------------------------|-------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HMI Rev | 6510 and later | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Choices | See below | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Factory Set | Log Sensor 1 through 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Exceptions | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Description | This feature allows the desired sensor name to be specified. These names appear only on handheld printer reports. This aids in reading and understanding data logger printer reports. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Choices | <table> <tr> <td>Log Sensor 1, 2, 3, 4, 5 or 6</td> <td>Other Spare</td> </tr> <tr> <td>Spare Ambient</td> <td>Other</td> </tr> <tr> <td>Ambient</td> <td>Spare</td> </tr> <tr> <td>Spare Dry</td> <td>Spare USDA 1, 2 or 3</td> </tr> <tr> <td>Spare Chilled</td> <td>USDA 1, 2 or 3</td> </tr> <tr> <td>Spare Frozen</td> <td>Other Spare Discharge Air</td> </tr> <tr> <td>Spare Fresh</td> <td>Spare Discharge Air Zone 1, 2 or 3</td> </tr> <tr> <td>Dry</td> <td>Spare Discharge Air</td> </tr> <tr> <td>Chilled</td> <td>Other Spare Return Air</td> </tr> <tr> <td>Fresh</td> <td>Spare Return Air Zone 1, 2 or 3</td> </tr> <tr> <td>Spare Left Side</td> <td>Spare Return Air</td> </tr> <tr> <td>Spare Right Side</td> <td>Other Discharge Air</td> </tr> <tr> <td>Spare Side</td> <td>Discharge Air Zone 1, 2 or 3</td> </tr> <tr> <td>Spare Rear</td> <td>Discharge Air</td> </tr> <tr> <td>Spare Front</td> <td>Other Return Air</td> </tr> <tr> <td>Left Side</td> <td>Return Air Zone 1, 2 or 3</td> </tr> <tr> <td>Right Side</td> <td>Return Air</td> </tr> <tr> <td>Side</td> <td>Frozen</td> </tr> <tr> <td>Rear</td> <td>Independent Sensor 1, 2, 3, 4, 5 or 6</td> </tr> <tr> <td>Front</td> <td></td> </tr> </table> | Log Sensor 1, 2, 3, 4, 5 or 6 | Other Spare | Spare Ambient | Other | Ambient | Spare | Spare Dry | Spare USDA 1, 2 or 3 | Spare Chilled | USDA 1, 2 or 3 | Spare Frozen | Other Spare Discharge Air | Spare Fresh | Spare Discharge Air Zone 1, 2 or 3 | Dry | Spare Discharge Air | Chilled | Other Spare Return Air | Fresh | Spare Return Air Zone 1, 2 or 3 | Spare Left Side | Spare Return Air | Spare Right Side | Other Discharge Air | Spare Side | Discharge Air Zone 1, 2 or 3 | Spare Rear | Discharge Air | Spare Front | Other Return Air | Left Side | Return Air Zone 1, 2 or 3 | Right Side | Return Air | Side | Frozen | Rear | Independent Sensor 1, 2, 3, 4, 5 or 6 | Front | |
| Log Sensor 1, 2, 3, 4, 5 or 6 | Other Spare | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Ambient | Other | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ambient | Spare | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Dry | Spare USDA 1, 2 or 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Chilled | USDA 1, 2 or 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Frozen | Other Spare Discharge Air | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Fresh | Spare Discharge Air Zone 1, 2 or 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Dry | Spare Discharge Air | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chilled | Other Spare Return Air | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fresh | Spare Return Air Zone 1, 2 or 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Left Side | Spare Return Air | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Right Side | Other Discharge Air | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Side | Discharge Air Zone 1, 2 or 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Rear | Discharge Air | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spare Front | Other Return Air | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Left Side | Return Air Zone 1, 2 or 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Right Side | Return Air | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Side | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Rear | Independent Sensor 1, 2, 3, 4, 5 or 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Front | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



Section 3 - Software Description

Out of Range Checking (for current sensor)

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ON or OFF |
| Factory Set | ON |
| Exceptions | |
| Description | This feature allows the Out of Range Checking feature to be turned on or off. If Out of Range Checking is turned on, an alarm will be set if the temperature, as sensed by the specified sensor, is above or below setpoint by more than the number of degrees determined by the setting of LOW and HIGH programmable features. The out of range condition must exist for 1 hour before the alarm is set. A visual notification will be provided to the driver on the standard display, as shown below. |

Low

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | From -1.0° to -20.0° in 0.1 degree increments, in either Fahrenheit or Celsius. |
| Factory Set | -10.8°F (-6.0°C) |
| Exceptions | |
| Description | This feature allows the low limit for Out of Range Checking to be set. |

High

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | From 1.0° to 20.0° in 0.1 degree increments, in either Fahrenheit or Celsius. |
| Factory Set | 10.8°F (6.0°C) |
| Exceptions | |
| Description | This feature allows the high limit for Out of Range Checking to be set. |

Italian Option

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ON or OFF |
| Factory Set | OFF |
| Exceptions | This feature is available with Sensor 1 only. |
| Description | If this feature is turned ON, the driver is presented a visual "Out of Range Limit" notification and flashes the backlight if the box temperature rises above -15°C (5°F). The visual notification appears on the Standard Display as shown below. |

Sensor Averaging

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ON or OFF |
| Factory Set | OFF |
| Exceptions | |
| Description | If this feature is turned OFF, the temperature logged will be the actual instantaneous sensor reading at the time of log. If this feature is turned ON, the sensor is read once each minute. The sensor readings are averaged dependant on the setting of the Logging Interval feature selected above. For example, if the Logging Interval is 15 minutes the previous 15 sensor readings are averaged and logged instead of the actual instantaneous value. If the Logging Interval is set for 10 minutes, the previous 10 sensor readings are averaged and logged. |

Digital Input Programming

The digital inputs are used to log the door switch status.

Digital In for CargoWatch digital input 1, 2, or 3

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | Digital Input 1, 2, or 3 |
| Factory Set | |
| Exceptions | |
| Description | This feature allows the digital input to be programmed and selected. |

Door Open Logging

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | ON or OFF |
| Factory Set | Input 1 ON, inputs 2-4 OFF |
| Exceptions | |
| Description | This feature allows the desired digital inputs to be logged or ignored. |

Digital Input Name for CargoWatch digital input 1, 2, or 3

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | See below |
| Factory Set | Digital Input 1 through 3 |
| Exceptions | |



Section 3 - Software Description

| | | |
|--------------------|--|--|
| Description | This feature allows the desired input name to be specified. This aids in reading and understanding data logger downloads. All digital inputs are connected into the HMI. | |
| Choices | Digital Input 1, 2, or 3 Door Other Door Main Door Back Door Front Door Side Door Left Door Right Door Other Back Door Other Front Door | Other Side Door Other Left Door Other Right Door Fresh Door Other Fresh Door Frozen Door Other Frozen Door Chilled Door Other Chilled Door Dry Door Other Dry Door |

Countdown Timer

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6512 and later |
| Choices | OFF, 1 - 96 Hours |
| Factory Set | OFF |
| Exceptions | The Countdown Timer only affects the CargoWatch Data Logger. |
| Description | The Countdown Mode feature will keep the HMI Control Panel powered up for a user specified time period after the unit is turned off. Under these conditions the display and backlight are turned off to conserve unit battery power. Important: <i>The four Hard Keys will remain illuminated when the unit is in Countdown Mode. This is normal operation.</i> The CargoWatch data logger will continue to record data according to the current CargoWatch interval settings until the user specified time period expires. This allows data to be recorded during an interval where the unit is turned off. The programmable time intervals are OFF or from 1 Hour to 96 Hours. The default setting for Countdown Mode is OFF. |

Conservative Log Count

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6512 and later |
| Choices | OFF, 1 – 400 Logs |
| Factory Set | OFF |
| Exceptions | The Conservative Log Count only affects the CargoWatch Data Logger. |
| Description | The Conservative Mode can be utilized by the user after the Countdown Mode interval above has expired. When the Countdown Mode has expired, Conservative Mode (if programmed) allows the HMI Control Panel to be temporarily powered up according to the current CargoWatch interval settings to log an additional number of CargoWatch data logs. The HMI Control Panel will be powered up for approximately 30 seconds to perform each data log, and will then turn back off. The possible number of additional Conservative Mode CargoWatch data logs is from 1 Log to 400 Logs. The default setting for Conservative Mode is OFF. |

SOT on Setpoint

| | |
|--------------------|---------------------|
| Control Rev | F005 and later |
| HMI Rev | 6560 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |

| Exceptions | |
|--------------------|--|
| Description | If this feature is set ENABLED, a Start of Trip is sent to the ServiceWatch and CargoWatch Data Loggers after any setpoint change. If this feature is set DISABLED, a Start of Trip is not sent. |

Automatic SOT at Midnight

| | |
|--------------------|---|
| Control Rev | F005 and later |
| HMI Rev | 7580 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | This feature allows the user to configure the HMI to automatically set an SOT in the CargoWatch Data Logger when the time on the clock in the HMI reaches midnight. |

Unit Configuration Setup Menu

The Unit Configuration Setup Menu is used to specify the actual unit configuration. These features are set at the factory as required for each unit. Unit Type selection will affect available features and menu selections. Verify the selection is proper for the unit.

Alarm Code 111 Unit Not Configured Correctly

If the Base Controller detects a mismatch between unit connections and configuration selections, Alarm Code 111 will be set.

Unit Type

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6530 and later |
| Choices | TRUCK or TRAILER |
| Factory Set | To match unit as built. A Base Controller cold start will default this feature to TRAILER. |
| Exceptions | |
| Description | If this feature is changed, it is necessary to exit the Guarded Access Menu after making the change. This will reset the unit to the new setting. Failure to do so will result in the wrong selections to be present in other Guarded Access Menu settings. For example, if the feature was set to TRAILER and changed to TRUCK, the reset changes the TRAILER default settings to the TRUCK default settings. |
| Description | This feature allows the Unit Type to be selected. |

Engine Type

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | Yanmar 2.1 |
| Factory Set | Yanmar 2.1 |
| Exceptions | |
| Description | This feature allows the engine type to be selected. Only Yanmar 2.1 is available on trailer multi-temp units. |



Section 3 - Software Description

Compressor Type

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | |
| Factory Set | Recip |
| Exceptions | |
| Description | This feature allows the compressor type to be selected. Only Recip is available on trailer multi-temp units. |

ETV Configured

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | |
| Factory Set | YES |
| Exceptions | |
| Description | This feature is for SLX units only. |

Dual Evaporator Configuration

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | YES or NO |
| Factory Set | NO |
| Exceptions | If this feature is set to YES, Unit Model is forced to SB and Number of Zones is forced to 2. |
| Description | This feature enables the dual host evaporator (DE) configuration. |

How Many Zones in This Unit?

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 1, 2, or 3 |
| Factory Set | 2 |
| Exceptions | |
| Description | This feature specifies if the unit is equipped with two or three zones. If the unit is equipped with two zones, this feature should be set to 2. If the unit is equipped with three zones, this feature should be set to 3. |

Zone 2 Evap Fans Configuration

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 2, 3, 4, or 6 fans |

| | |
|--------------------|---|
| Factory Set | 3 |
| Exceptions | This screen only appears if the unit is configured for two or more zones. |
| Description | This feature is set to match the number of fans in the remote evaporator(s) used in Zone 2. |

Zone 3 Evap Fans Configuration

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 2, 3, 4, or 6 fans |
| Factory Set | 3 |
| Exceptions | This screen only appears if the unit is configured for three zones. |
| Description | This feature is set to match the number of fans in the remote evaporator(s) used in Zone 3. |

Electric Standby Equipped?

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | YES or NO |
| Factory Set | To match unit as built. A base controller cold start will default this feature to YES. |
| Exceptions | This setting will automatically be forced from "NO" to "YES" if the unit detects that electric supply power is connected to the unit. |
| Description | This feature specifies if the unit is equipped with optional electric standby. If the unit is equipped with electric standby, this feature should be set to YES. If the unit is not equipped with electric standby, this feature should be set to NO. |

Electric Heat Option

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | YES or NO |
| Factory Set | NO |
| Exceptions | Only appears if Model 50 unit and Electric Standby Equipped is set to YES. Note: Default is NO for SLX units and YES for SB units. |
| Description | This feature specifies if the unit is equipped with the electric heat option. If the unit is equipped with electric heat, this feature should be set YES. If the unit is not equipped with electric heat, this feature should be set NO. Electric heat is applicable to Zone 1 host evaporators only. |

Electric Motor Type

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | 12 HP or optional 19 HP |
| Factory Set | As built. A Base Controller cold start will default this feature to 12 HP. |



Section 3 - Software Description

| | |
|--------------------|--|
| Exceptions | Units equipped with SmartPower Electric Standby Option only. |
| Description | This feature specifies which motor is used on units equipped with the optional Smart Power Electric Standby. |

Diesel to Electric Auto Switch Enabled?

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | YES or NO |
| Factory Set | NO |
| Exceptions | Only appears if Model 50 unit and Electric Standby Equipped is set to YES. |
| Description | This feature allows the Auto Switch from Diesel to Electric feature to be enabled or disabled. If this feature is set YES, the unit will switch automatically to electric mode when standby power is connected. If the feature is set NO, the operator must manually switch the unit to electric mode using the HMI Control Panel Mode Menu or by following the HMI Control Panel prompts when standby power is connected. |

Electric to Diesel Auto Switch Enabled?

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | YES or NO |
| Factory Set | NO |
| Exceptions | Only appears if Model 50 unit and Electric Standby Equipped is set to YES. |
| Description | This feature allows the Auto Switch from Electric to Diesel feature to be enabled or disabled. If this feature is set YES, the unit will switch automatically to diesel mode when standby power is disconnected or fails. If the feature is set NO, the operator must manually switch the unit to diesel mode using the HMI Control Panel Mode Menu or by following the HMI Control Panel prompts when standby power is disconnected or fails. |
| Note: | <i>Auto-switch from electric to diesel is not recommended when the unit is running in electric mode indoors or when below deck on a ferry where engine operation is strictly prohibited.</i> |

Unit Model

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F031 and later |
| HMI Rev | 6510 and later |
| Choices | SB, Super II, SLX, SLXi Spectrum, SLXi Whisper Pro Spectrum |
| Factory Set | To match unit as built. A Base Controller cold start will default this feature to SB. |
| Exceptions | |
| Description | This feature allows the Unit Model to be selected. Set as appropriate for the unit. |

Defrost Motor Equipped?

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | YES or NO |
| Factory Set | To match unit as built. A Base Controller cold start will default this feature to NO. |

| Exceptions | |
|--------------------|---|
| Description | This feature specifies if the unit is equipped with a defrost solenoid or defrost motor. If the unit is equipped with a defrost motor, this feature should be set to YES. If the unit is not equipped with a defrost motor, this feature should be set to NO. If OptiSet Plus is active, this feature is set using WinTrac. Note: All SLX units are equipped with defrost motors and this feature must be set to YES. Note: A different SR-3 Base Controller is required for units equipped with a damper gear motor. The damper gear motor for the SR-3 Base Controller has added electronic circuitry to drive the gear motor. Refer to Section 7 for more details. |

Fuel Sensor Type

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | NONE, SOLID STATE, FLOAT, or SWITCH |
| Factory Set | NONE |
| Exceptions | |
| Description | This feature is used to select the type of fuel level sensor installed. If no fuel level sensor is installed, this feature should be set to NONE. |

Rear Remote Control Panel

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | NONE, COM 2 |
| Factory Set | NONE |
| Exceptions | |
| Description | This feature specifies if the unit is equipped with the optional flush mount Rear Remote Control Panel. If the unit is equipped with the flush mount Rear Remote Control Panel, this feature should be set to COM 2 and the flush mount Rear Remote Control Panel should be connected to the COM2 port on the base controller. If the unit is not equipped with a flush mount Rear Remote Control Panel, this feature should be set NONE. Refer to Section 4 for more information on using the Rear Remote Control Panel. |

Rear Remote Control Panel Action

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | STAND BY, RUN ALL ZONES, RUN LAST CONFIG |
| Factory Set | STAND BY |



Section 3 - Software Description

| | |
|--------------------|---|
| Exceptions | Only appears if Rear Remote Control Panel is set for COM 2. |
| Description | <p>If the Action is set to STAND BY, the unit will power up when the Rear Remote Control Panel ON key is pressed. The setpoints can be changed from the Rear Remote Control Panel <u>but the unit will not start and run. The unit must be started from the HMI Control Panel on the unit.</u> Pressing the Rear Remote Control Panel OFF key will power down the control system.</p> <p>If the Action is set to RUN ALL ZONES, the unit will automatically start and run all configured zones when the Rear Remote Control Panel ON key is pressed. The feature will automatically turn zones that are turned OFF to ON. Pressing a zone OFF key will turn that zone off. Pressing the remote control OFF key will power down the control system.</p> <p>If the Action is set to RUN LAST CONFIG, the unit will automatically start and run the unit in the last operating condition when the remote control ON key is pressed. The feature will not automatically turn zones that are turned OFF to ON. Pressing a zone ON or OFF key will turn that zone on or off. Pressing the remote control OFF key will power down the control system.</p> <p>Refer to Section 4 for more information on using the Rear Remote Control Panel.</p> |

Pretrip/Sleep Switch Options

| | |
|--------------------|--|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6510 and later |
| Choices | DISABLE, PRETRIP, SLEEP |
| Factory Set | DISABLE |
| Exceptions | |
| Description | <p>This feature is used to allow an optional Sleep or Pretrip switch to be connected to the base controller. A momentary contact switch is connected from chassis ground to the Controller Sensor Connector J7 pin 30. This feature determines the action resulting when this input is temporarily connected to chassis ground.</p> <p>DISABLE results in no action. If a switch is not connected, this feature should be set to DISABLE.</p> <p>PRETRIP will start a Pretrip Test in the same manner as starting the test from the Main/Mode menu.</p> <p>SLEEP will place the unit in Sleep Mode in the same manner as entering Sleep Mode from the Main/Pretrip menu.</p> |

3rd Party Device Control

| | |
|--------------------|---|
| Control Rev | SR-2: C000 and later SR-3: F000 and later |
| HMI Rev | 6530 and later |
| Choices | NONE, COM 1, COM 2 |
| Factory Set | NONE |
| Exceptions | |
| Description | This feature selects the communications port on the SR-3 Base Controller that will be used by a third party control device such as satellite communications. If the unit is not equipped with a third party device, this feature should be set to NONE. |

REB Fuel Level Sensor Type

| | |
|--------------------|--|
| Control Rev | F020 and later |
| HMI Rev | 75C1 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | Requires an REB and a fuel level sensor connected to the REB for the ENABLED setting to be applicable. |
| Description | This feature allows the user to configure the base controller to allow the fuel level sensor to be connected to the REB. |

REB Door Switch Enabled?

| | |
|--------------------|--|
| Control Rev | F020 and later |
| HMI Rev | 75C1 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | Requires an REB and a door switch connected to the REB for the ENABLED setting to be applicable. |
| Description | This feature allows the user to configure the base controller to allow the door switch to be connected to the REB. |

CargoLink

| | |
|--------------------|---|
| Control Rev | F020 and later |
| HMI Rev | 6518 and later |
| Choices | ENABLED or DISABLED |
| Factory Set | DISABLED |
| Exceptions | |
| Description | When ENABLED, this feature will allow the HMI to read the sensor data from the COM ports. |

Refrigerant Type

| | |
|--------------------|--|
| Control Rev | F030 and later |
| HMI Rev | 75C2 and later |
| Choices | 0 = NOT SET 1 = R452A 2 = R134A 3 = R404A |
| Factory Set | 0 = NOT SET |
| Exceptions | SLX units only. |
| Description | This feature allows the user to configure the unit refrigerant type so that it can be displayed in the Maintenance menu. |

Section 4 - Operation

HMI Control Panel

The Human/Machine Interface (HMI) Control Panel is connected to the microprocessor and is used to operate the unit and display unit information. The HMI communicates with the controller via a Controller Area Network (CAN) bus. The HMI also contains the CargoWatch data logger and is located on the control box door.

The HMI Control Panel consists of a display and 8 touch-sensitive keys. The display is capable of showing both text and graphics. The keys on the left and right sides of the display are "hard" (dedicated) or single function keys. The four keys under the display are termed "soft" keys. The functions of these keys change depending on the operation being performed. If a soft key is active, the current key function is shown in the display directly above the key.

Control Panel Display

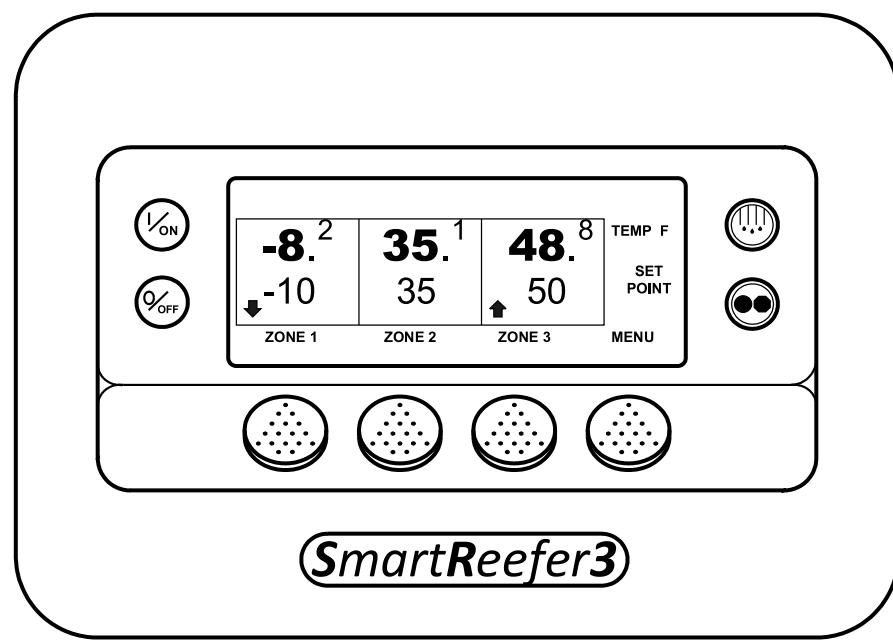
The display is used to present information to the operator. This information includes setpoint and temperature for each zone, unit or zone operating information, gauge readings, temperatures, and other information as selected by the operator.

The Standard Display of box temperature and setpoint for three zones is shown (Fahrenheit is shown as an example, Celsius display is similar). The lack of the Cycle Sentry Icon indicates the unit is running in Continuous Mode. Zone 1 has a setpoint of -10°F, and a return air temperature of -8.2°F. The downward pointing arrow shows this zone is cooling. Zone 2 has a setpoint of 35°F, and a return air temperature of 35.1°F. The absence of an arrow indicates that this zone is in null. Zone 3 has a setpoint of 50°F, and a return air temperature of 48.8°F. The upward pointing arrow shows this zone is heating.

Note: The zone temperature shown is always return air temperature.

Pressing the soft key under each zone allows the setpoint for that zone to be changed. In addition, the soft keys under Zone 2 and Zone 3 are used to turn those zones on and off. Pressing the soft key under MENU accesses the MAIN MENU.

Note: Zone 1 is always on when the control system is powered up.



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Display Icons

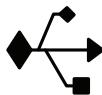
Display symbols or icons are used to present additional unit information.



Down-Pointing Arrow: (At the left side of the display) Shows the unit is cooling. If the arrow were pointing upward the unit would be heating.



CYCLE SENTRY/Continuous Mode: The unit is running in Cycle Sentry Mode as shown by the Cycle Sentry Icon in the upper right corner of the display. If the Cycle Sentry icon is not present, the unit is running in Continuous Mode.



USB: The USB Icon in the upper left corner of the display will appear when a USB device is connected to any of the USB Ports on the Unit Control Panel or inside the unit control box.

Hard Keys

The keys on either side of the display are dedicated or hard keys. Their function always remains the same.



On Key: Used to turn the host unit and Zone 1 on. First the display will briefly show the Thermo King Logo and then the statement "Configuring System - Please Wait". When the power-up sequence is complete, the display shows the Standard Display of box temperature and setpoint. For more information see "Turning the Unit On and Off" later in this section.



Off Key: Used to turn the host unit and Zone 1 off. First, the display will briefly show "System is Powering Down - Please Wait. Press On to Resume" and then "Off" will appear momentarily. When the power-down sequence is complete the display will be blank. For more information see "Turning the Unit On and Off" later in this section.

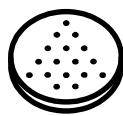


Defrost Key: Press this key to initiate a Manual Defrost cycle.



CYCLE SENTRY: Used to select Cycle Sentry Mode or Continuous Mode operation if allowed by OptiSet. For more information see "Selecting Cycle Sentry or Continuous Mode" later in this section.

Soft Keys



The four soft keys under the display are multi-purpose keys. Their function changes depending on the operation being performed. If a soft key is active the key function is shown in the display directly above the key. The keys are numbered from left to right, with Key 1 on the far left and Key 4 on the far right.

Typical soft key applications:

| | | | |
|---------------------------------|--------|------------|---------|
| MENU | + or - | HOURMETERS | EXIT |
| NEXT | SELECT | GAUGES | HELP |
| YES/NO | CLEAR | BACK | SENSORS |
| ZONE ON/OFF and SETPOINT CHANGE | | | |

Display Heater

The HMI Control Panel is equipped with a display heater. This heater is needed to make the display visible in very cold ambient temperatures.

The HMI has its own internal temperature sensor for the display heater. The heater is energized when the unit is turned on and the ambient temperature is below 29.4°F (-2°C). The heater turns off when the temperature sensed by the internal sensor rises above 37.4°F (+3°C). The heater draws from 1.4 to 1.7 amps when energized.

The colder the ambient temperature, the longer it will take for the heater to make the display visible on a cold startup. It may take 10-15 seconds for the display to appear with extremely cold temperatures.

Turning Unit On

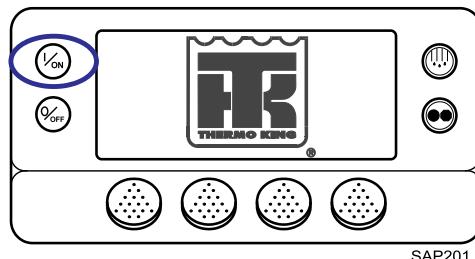
The unit is turned on by pressing the ON Key (Figure 48, p. 144) and off by pressing the OFF Key. When the On Key is pressed, the display briefly shows the THERMO KING Logo as the display initializes.

Important: *The ON Key must be held down until the Thermo King Logo appears. If the ON Key is not held down long enough (approximately ½ second), the display may flicker but the unit will not start up. If this occurs, hold the ON Key down until the Thermo King logo appears.*

Note: *With extremely cold ambient temperatures, it may take up to 15 seconds for the display to appear on initial startup.*

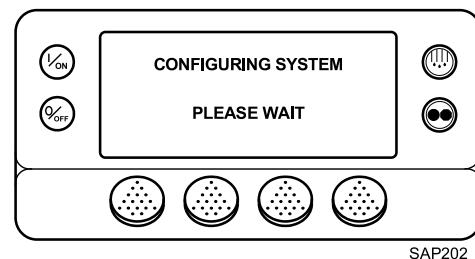
Note: *For multi-temperature applications, Zone 1 is turned on any time the host unit is turned on. Zone 1 is turned off when the host unit is turned off.*

Figure 48. ON Key



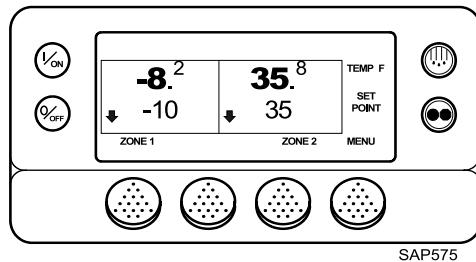
The startup screen (Figure 49, p. 144) appears while communications are established and the unit prepares for operation.

Figure 49. Startup Screen



When the unit is ready to run, the Standard Display appears.

Figure 50. Standard Display

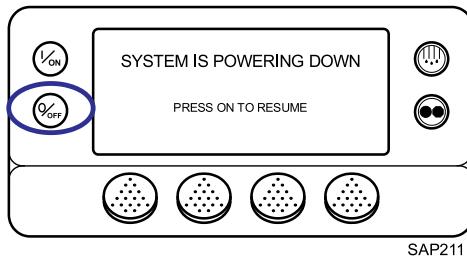


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Turning The Unit Off

Pressing the OFF Key stops unit operation. The unit shuts down immediately and the display briefly shows the power down message (Figure 51, p. 145).

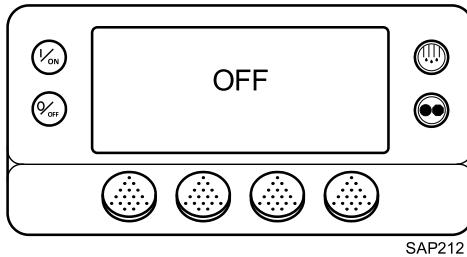
Figure 51. Power Down Message



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The display briefly shows OFF (Figure 52, p. 145) and then goes blank. To start the unit again, press the ON Key.

Figure 52. Display Shows OFF

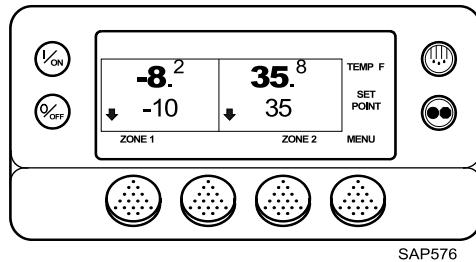


SAP212

Two Zone Standard Display

Note: Fahrenheit is shown, Celsius display is similar.

The Standard Display is the default display that appears if no other display function is selected. The Two Zone Standard Display shows the return air temperature and setpoint for two zones. The absence of the Cycle Sentry Icon at the top of the display shows that the unit is operating in Continuous Mode. The return air temperature for Zone 1 is -8.2°F with a -10°F setpoint. The down-pointing arrow indicates that Zone 1 is cooling. The return air temperature for Zone 2 is 35.8°F with a 35°F setpoint. The down-pointing arrow indicates that Zone 2 is also cooling. The soft key under each zone allows the setpoint for that zone to be changed. In addition, the soft key under Zone 2 is used to turn that zone on and off. The soft key labeled MENU allows the Main Menu to be selected.

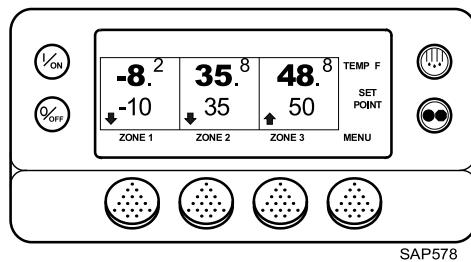
Figure 53. Two Zone Standard Display


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Three Zone Standard Display

Note: Fahrenheit is shown, Celsius display is similar.

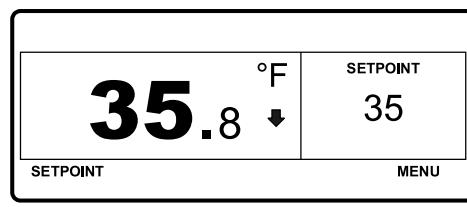
The Three Zone Standard Display adds a third zone and functions the same way as the Two Zone Standard Display, but with another temperature controlled zone. The absence of the Cycle Sentry Icon at the top of the display (Figure 54, p. 146) shows that the unit is operating in Continuous Mode. The return air temperature for Zone 1 is -8.2°F with a -10°F setpoint. The down-pointing arrow indicates that Zone 1 is cooling. The return air temperature for Zone 2 is 35.8°F with a 35°F setpoint. The down-pointing arrow indicates that Zone 2 is also cooling. The return air temperature for Zone 3 is 48.8°F with a 50°F setpoint. The up-pointing arrow indicates that Zone 3 is heating. The soft key under each zone allows the setpoint for that zone to be changed. In addition, the soft keys under Zone 2 and Zone 3 are used to turn those zones on and off. The soft key labeled MENU allows the Main Menu to be selected.

Figure 54. Three Zone Standard Display


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Single Zone Control Standard Display

This feature, if enabled in Guarded Access, allows Single Zone Control operation to be selected by choosing the Main Menu and then selecting Single Zone Control from the Mode Submenu. When this feature is selected, all zones will be forced on and will control to the same selected setpoint. The Single Zone Control Standard Display (Figure 55, p. 146) functions the same way as the other Standard Displays. The absence of the Cycle Sentry Icon at the top of the display shows that the unit is operating in Continuous mode. The box temperature for all zones is 35.8°F and all zones are controlling to a 35°F setpoint. The down-pointing arrow indicates that all zones are cooling. The soft key labeled Setpoint allows the setpoint for all zones to be changed. The soft key labeled Menu allows the Main Menu to be selected.

Figure 55. Single Zone Control Standard Display


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Operating the Unit in Single Zone Control Mode

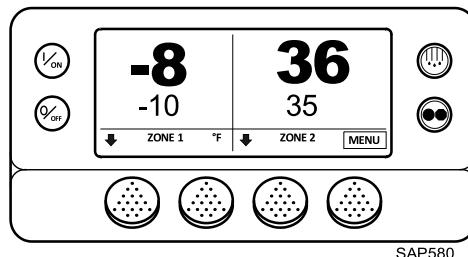
The following differences exist when operating the unit in Single Zone Control Mode:

- Single Zone Control Mode will appear in the Mode Menu only if the Single Zone Control feature has been enabled in the Guarded Access/Main Menu Configuration Menu. If the feature is enabled, Single Zone Control will appear in the Main Menu/Mode Menu.
- If Single Zone Control operation is selected, all zones will be forced on and will control to the same setpoint. The Zone 1 sensors are used to determine box temperature. All bulkheads should be taken down to create one large compartment. With the exception of defrost, the operating mode of each zone evaporator(s) will be the same when in this mode. Unit control is based on the temperature sensors of Zone 1.
- If Single Zone Control operation is selected, the Single Zone Standard Display provides only one soft key labeled Set Point. This allows the setpoint for all zones to be changed simultaneously.
- If Single Zone Control operation is selected, the individual zones cannot be turned off. The unit and all zones are turned On and Off simultaneously using the On and Off hard keys at the left side of the display.

The TemperatureWatch™ Display

The TemperatureWatch Display appears 2 1/2 minutes after the Standard Display appears so long as there is no key activity and no Check, Prevent, or Shutdown Alarms present. The TemperatureWatch screen will remain on until any key is pressed or a Check, Prevent, or Shutdown Alarm occurs. The TemperatureWatch Display shows the return air temperature and setpoint for each zone. Tents of a degree are not shown by the TemperatureWatch display. The large numbers allow unit conditions to be checked from a distance. Pressing any soft key returns the display to the Standard Display.

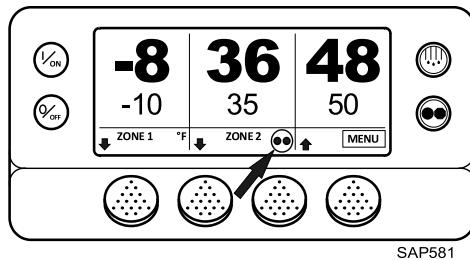
Figure 56. Two Zone TemperatureWatch Display



If an alarm condition (other than a Log Alarm) is present, the TemperatureWatch Display will not appear. If an alarm condition occurs while the TemperatureWatch Display is present, the display will return to the Standard Display. If the Defrost or Cycle Sentry keys are pressed, the display will return to the TemperatureWatch Display after defrost is initiated or the operating mode is changed.

In the Three Zone TemperatureWatch display (Figure 57, p. 147), the Menu soft key label covers the Zone 3 label. If the unit is operating in Cycle Sentry Mode, the Cycle Sentry icon will appear near Zone 2. If the unit is operating in Continuous Mode, the Cycle Sentry icon will not be present.

Figure 57. Three Zone TemperatureWatch Display

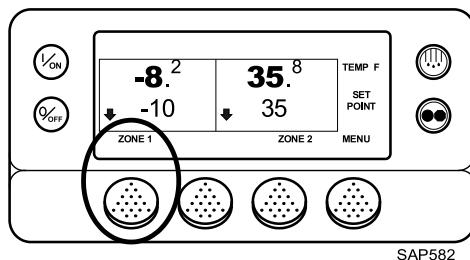


SAP581

Changing the Setpoint

If the TemperatureWatch display is shown, press any soft key to return to the Standard Display. From the Standard Display, press the ZONE soft key for the desired zone. Zone 1 is shown (Figure 58, p. 148).

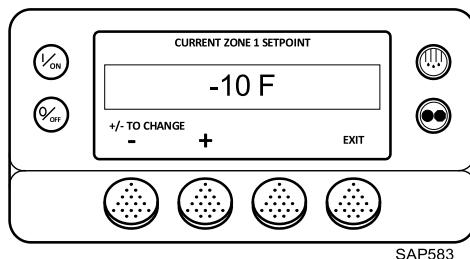
Figure 58. Zone 1



SAP582

The setpoint display appears as shown (Figure 59, p. 148).

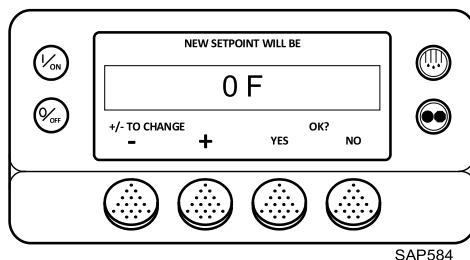
Figure 59. Setpoint Display



SAP583

The “-” and “+” soft keys are used to increase or decrease the setpoint until the desired setpoint is shown. The setpoint has been changed to 0°F using the “+” soft key as shown (Figure 60, p. 148).

Figure 60. Setpoint Changed

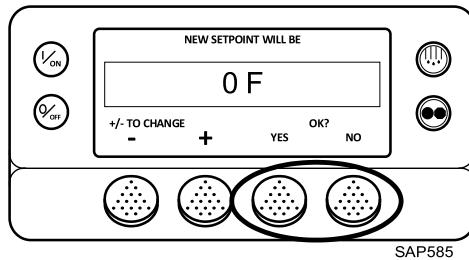


SAP584

The YES and NO soft keys confirm the setpoint change (Figure 61, p. 149). When the desired setpoint has been selected using the “+” and/or “-” soft keys, press the YES soft key to confirm

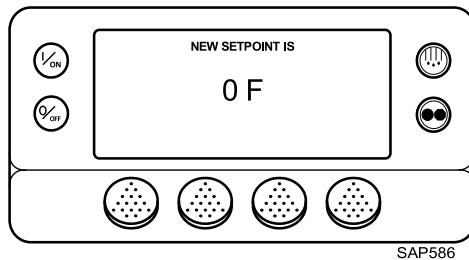
and load the new setpoint. If the setpoint is changed using the "+" or "-" soft keys, the change must be confirmed or rejected by pressing the YES or NO soft key within 10 seconds of changing the setpoint. A warning beep will sound after five seconds as a reminder. Failure to confirm the new setpoint by pressing YES or NO within 10 seconds of changing the setpoint will result in no setpoint change. If the setpoint is not confirmed, Alarm Code 127 Setpoint Not Entered is set, to indicate that the setpoint change was not completed.

Figure 61. YES and NO Keys



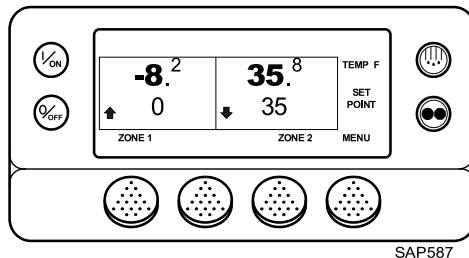
After the YES soft key has been pressed, the display will briefly show PROGRAMMING NEW SETPOINT - PLEASE WAIT. The display then confirms the new setpoint for two seconds (Figure 62, p. 149).

Figure 62. New Setpoint Confirmation



If the NO soft key is pressed, the display will briefly show SETPOINT NOT CHANGED and return to the Standard Display. The Standard Display will show the old setpoint.

Figure 63. Standard Display, New Setpoint



The display then returns to the Standard Display showing the new setpoint. The Zone 1 arrow now points up, to indicate that Zone 1 is heating.

Important: If the setpoint is changed using the "+" or "-" soft keys, the change must be confirmed or rejected by pressing the YES or NO soft key within 10 seconds of changing the setpoint.

- If the YES soft key is pressed, the setpoint change made with the "+" or "-" soft key is accepted, the setpoint changes, and the display returns to the Standard Display.
- If the NO soft key is pressed the setpoint change made with the "+" or "-" soft key is not accepted, the setpoint is not changed, and the display returns to the Setpoint Display.
- If the YES or NO soft key is not pressed within 10 seconds of making a change with the "+" or "-" soft key, the setpoint is not changed and the display returns to the Setpoint Display. The

display briefly shows [SETPOINT NOT CHANGED] and Alarm Code 127 Setpoint Not Entered is set, to indicate that the setpoint change was started but not completed.

Turning a Zone On and Off

Zone 1 will always be turned on any time the unit is turned on. Zone 2 and Zone 3 (if present) can be turned on and off as desired.

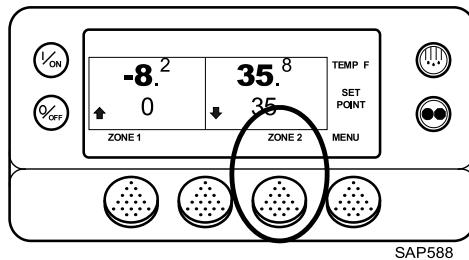
Note: If the feature "Host Null" is Enabled, Zone 1 can be turned off (software revisions F020, 75C0, 6518 and later).

The state of each zone is retained when the unit is turned off and on. For example, on a three zone unit if Zone 2 is turned off and Zone 3 is turned on and the unit is turned off, the zone states remain as they were. When the unit is turned back on Zone 2 will still be off and Zone 3 will still be on.

Note: Units equipped with a remote control may operate in a slightly different manner. Refer to Rear Remote Control Panel (Optional) for additional details.

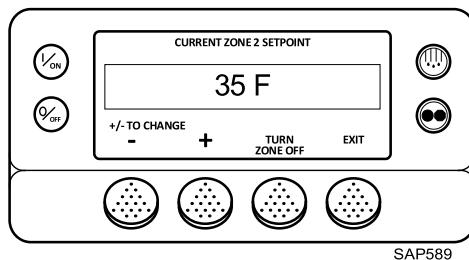
To turn Zone 2 or Zone 3 on or off, press the soft key under the desired zone. Zone 2 is selected (Figure 64, p. 150).

Figure 64. Zone 2 Selected



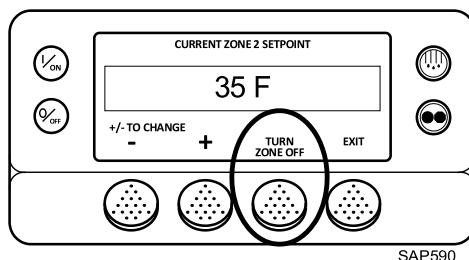
The Zone 2 setpoint display appears as shown (Figure 65, p. 150). If the zone is turned on, the third soft key will be labeled TURN ZONE OFF. If the zone is turned off, the third soft key will be labeled TURN ZONE ON. In this case TURN ZONE OFF is shown.

Figure 65. Zone 2 Setpoint Display



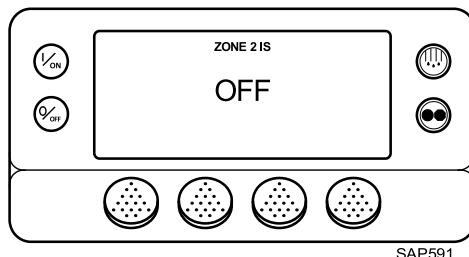
Press the TURN ZONE OFF soft key to turn the zone off (Figure 66, p. 150).

Figure 66. TURN ZONE OFF Soft Key



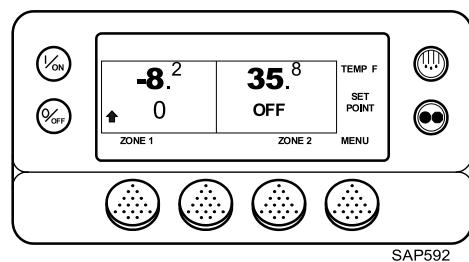
The display briefly shows PROGRAMMING ZONE ON/OFF - PLEASE WAIT. The display then confirms the new Zone 2 setting for several seconds (Figure 67, p. 151).

Figure 67. New Zone 2 Setting



The display returns to the Standard Display showing Zone 2 is off. The setpoint for Zone 2 has been replaced with OFF as shown (Figure 68, p. 151) to indicate that the zone is now off.

Figure 68. Zone Off



Starting the Diesel Engine

Diesel engine preheats and starts are automatic in both Continuous Mode and Cycle Sentry Mode. The engine will preheat and start as required when the unit is turned on. The engine preheat and start will be delayed in Cycle Sentry mode if there is no current need for the engine to run. If any keys are being pressed on the HMI Control Panel, the engine will not preheat and start until 10 seconds after the last key is pressed.

Note: If the unit is equipped with optional Electric Standby there may be some additional prompts before the engine will start. Refer to "Starting the Electric Motor" for details.

⚠ CAUTION

Risk of Injury!

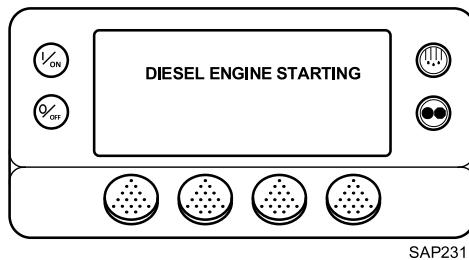
The engine may start automatically any time the unit is turned on.

NOTICE

Equipment Damage!

Never use starting fluid. Damage to the engine can occur.

When the engine is preparing to start, the HMI Control Panel will display the engine start screen as shown (Figure 69, p. 151). The preheat buzzer sounds during the engine preheat and crank sequence.

Figure 69. Engine Start Screen

After the engine is started, the display returns to the Standard Display of temperature and setpoint.

Starting the Electric Motor

Note: Units equipped with the Electric Standby option only.

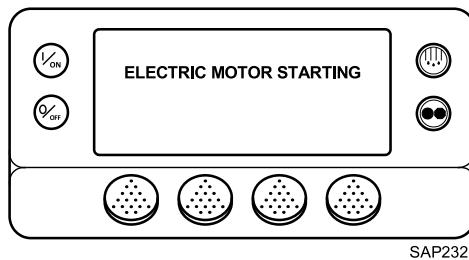
⚠ CAUTION

Risk of Injury!

The motor may start automatically any time the unit is turned on.

Electric motor starting is automatic in both Continuous Mode and Cycle Sentry Mode. The motor will start as required when the unit is turned on. If any keys are being pressed on the HMI Control Panel prior to the motor start, the motor start will be delayed until 10 seconds after the last key is pressed.

When the motor is preparing to start the HMI Control Panel will display the motor start screen ([Figure 70, p. 152](#)). The preheat buzzer sounds for 20 seconds before the electric motor starts.

Figure 70. Motor Start Screen

After the motor is started, the display returns to the Standard Display of temperature and setpoint.

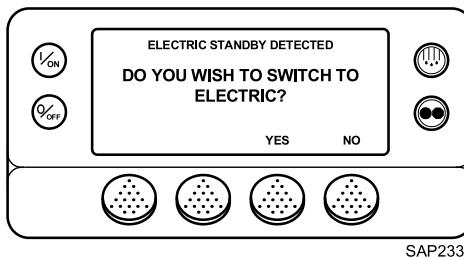
Switching from Diesel to Electric

Note: Units equipped with the Electric Standby option only.

If the Diesel to Electric Auto-Switch Enabled feature in Guarded Access is set YES, the unit will automatically switch to Electric Mode operation when standby power is connected and available.

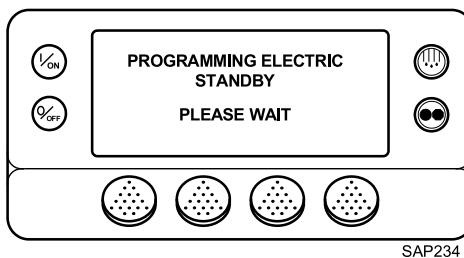
If the Diesel to Electric Auto-Switch Enabled feature in Guarded Access is set NO, the prompt screen ([Figure 71, p. 152](#)) will appear when standby power is connected and available.

Figure 71. Standby Power Connected



If NO is selected, the unit will continue to operate in Diesel Mode. If YES is selected, the display will briefly show the screen (Figure 72, p. 153).

Figure 72. YES Selected



Electric Mode operation will briefly be confirmed. If unit operation is required the electric motor will start as shown previously under STARTING THE ELECTRIC MOTOR.

If the Diesel to Electric Auto-Switch Enabled feature in Guarded Access is set NO, the unit can also be switched from Diesel mode to Electric mode operation using the Electric Standby Selection from the Main Menu as shown later in this section.

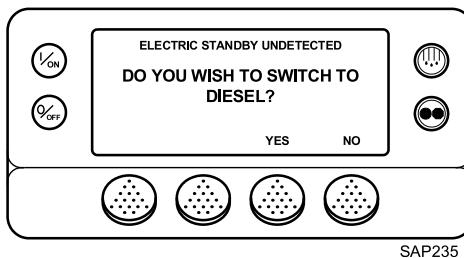
Switching from Electric to Diesel

Note: Units equipped with the Electric Standby option only.

If the Electric to Diesel Autoswitch Enabled feature in Guarded Access is set to YES, the unit will automatically switch to Diesel Mode operation when standby power is turned off or is no longer available.

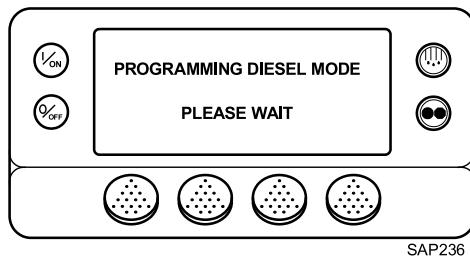
If the Electric to Diesel Autoswitch Enabled feature in Guarded Access is set to NO and standby power is disconnected or fails, the unit will not automatically switch to Diesel mode. This is primarily designed to prevent unauthorized diesel engine starts where engine operation is strictly prohibited. If the Electric to Diesel Autoswitch Enabled feature in Guarded Access is set to NO, the prompt screen shown (Figure 73, p. 153) will appear when standby power is turned off or is no longer available.

Figure 73. Standby Power is Off



If YES is selected, the display will briefly show the screen (Figure 74, p. 153).

Figure 74. YES Selected



Diesel Mode operation will briefly be confirmed. If unit operation is required, the diesel engine will start as shown previously in STARTING THE DIESEL ENGINE.

If the Electric to Diesel Autoswitch Enabled feature in Guarded Access is set to NO, the unit can also be switched from Diesel mode to Electric mode operation using the Diesel Selection from the Main Menu as shown later in this section.

Initiating a Manual Defrost Cycle

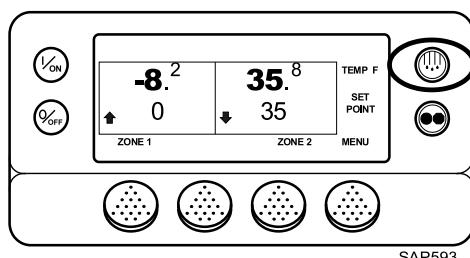
Defrost cycles are usually initiated automatically based on time or demand. Manual defrost is also available.

Manual defrost is only available if the zone is running and the zone evaporator coil temperature is less than or equal to 45°F (7°C). Other features such as door switch settings may not allow manual defrost under some conditions.

Note: If Rail Alternate is Enabled, a manual defrost cycle is available with temperatures less than or equal to 55°F (13°C).

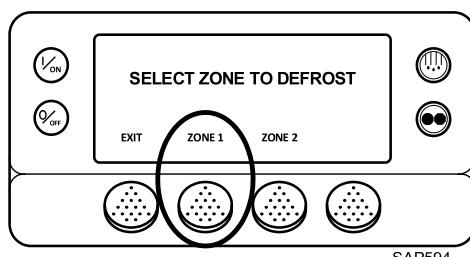
To initiate a manual defrost cycle, press the Defrost Key (Figure 75, p. 154).

Figure 75. Defrost Key



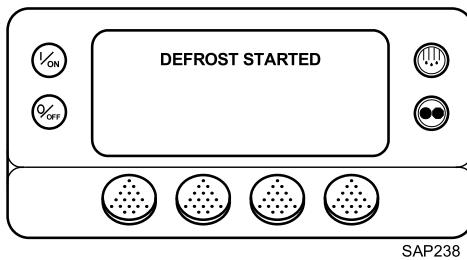
The display will briefly show [DEFROST]. The Zone Select display will appear. Zone 1 has been selected (Figure 76, p. 154).

Figure 76. Select Zone to Defrost



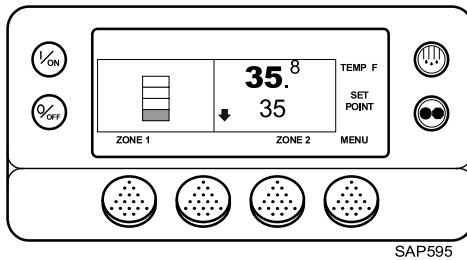
The display briefly shows [DEFROST], [PROGRAMMING DEFROST - PLEASE WAIT] and then [DEFROST STARTED] (Figure 77, p. 154).

Figure 77. Defrost Started



The display then shows the Defrost display. The bar indicator shows approximately the percentage of time remaining to complete the defrost cycle. The bar indicator below shows that the Zone 1 defrost cycle is approximately 25% complete (Figure 78, p. 155).

Figure 78. Bar Indicator



Terminating a Defrost Cycle

The defrost cycle terminates automatically when the coil temperature is greater than or equal to 58° F (14° C) or the defrost timer expires. Defrost can also be terminated by turning the unit off and back on.

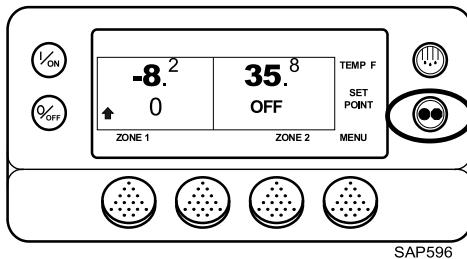
Note: If Rail Alternate is set YES, the defrost cycle terminates at 70° F (21° C) or if the defrost timer expires.

Selecting Cycle Sentry or Continuous Mode

When Cycle Sentry Mode is selected, the unit will start and stop automatically to maintain setpoint, keep the engine warm, and the battery charged. When Continuous Mode is selected, the unit starts automatically and runs continuously to maintain setpoint and provide constant airflow. Cycle Sentry or Continuous may not be available from the Mode Menu if OptiSet is in use. The Cycle Sentry/Continuous selection affects all zones.

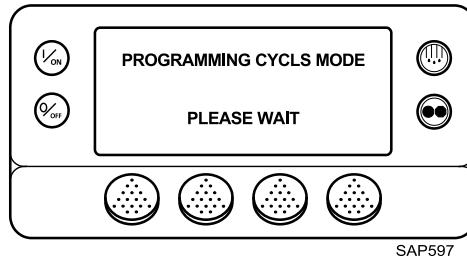
If allowed by OptiSet, Cycle Sentry or Continuous Mode is selected by pressing the Cycle Sentry/Continuous key. Continuous is shown at the top of the display. The absence of the Cycle Sentry icon indicates the unit is running in Continuous Mode (Figure 79, p. 155).

Figure 79. Cycle Sentry/Continuous Key



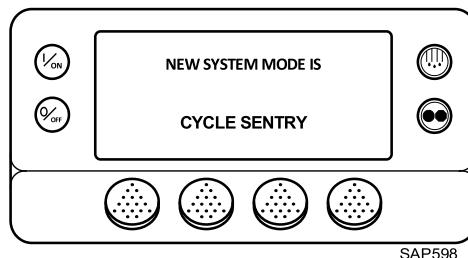
If the unit is in Continuous Mode, pressing the Cycle Sentry/Continuous key changes the mode from Continuous Mode to Cycle Sentry Mode. The display confirms the change (Figure 80, p. 155).

Figure 80. Programming Screen



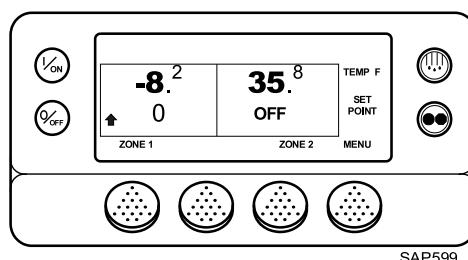
The new mode is confirmed for two seconds.

Figure 81. Cycle Sentry Mode



The display then returns to the Standard Display. In the example shown (Figure 82, p. 156), the unit is running in Cycle Sentry Mode by the Cycle Sentry icon at the top of the display.

Figure 82. Standard Display



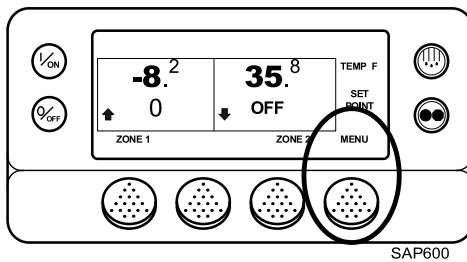
Pressing the Cycle Sentry/Continuous key again allows the operator to change back to Continuous Mode operation.

Important: If the unit is in Cycle Sentry null and the mode is switched to Continuous Mode, the unit will start automatically.

Using the Main Menu

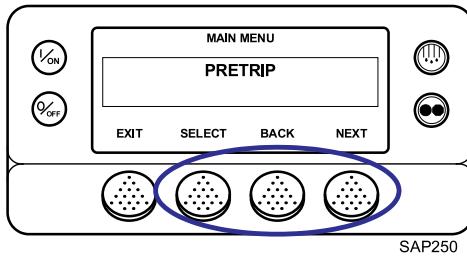
The Main Menu contains several additional submenus that allow the operator to view information and modify unit operation. To access the Main Menu press the MENU Key (Figure 83, p. 156).

Figure 83. Menu Key



The first Main Menu choice will appear. Press the NEXT and BACK Keys to scroll through the menu choices. When the desired selection is shown on the display, press the SELECT Key to access it. The Pretrip submenu is shown (Figure 84, p. 157). To return to the Standard Display, press the EXIT Key.

Figure 84. Pretrip Submenu



Main Menu Choices

Each of these Main Menu choices will be explained later in this section:

Flash Drive: If a properly configured USB Flash Drive is currently connected to the USB Port on the unit Control Panel, the Flash Drive Menu will appear as a Main Menu selection.

Languages: If more than one language is enabled from the Guarded Access > Language Menu, this menu item will appear.

Alarms: The Alarm Menu allows the operator to view any active alarms, and allows most alarms to be cleared.

Gauges: Allows the operator to view the unit gauges and the state of the Inputs and Outputs on both the Interface Board and Expansion Module (Multi-Temp).

Sensors: Allows the operator to view the unit temperature sensors. If CargoWatch sensors are installed, they can be viewed as well.

Data Logger: Allows the operator to set a Start of Trip marker to the CargoWatch and ServiceWatch data loggers and print the contents of the CargoWatch data logger.

Hourmeters: The Hourmeters Menu allows the operator to view the unit hourmeters that have the view feature enabled in the Guarded Access Menu.

Mode: The Mode Menu allows the operator to change the unit operating modes that have been enabled in Guarded Access.

Pretrip: Allows the operator to start a Pretrip Test. If an alarm is active, the Pretrip Test is not allowed and the operator is prompted to clear the alarm(s).

Electric Standby Option: The Diesel/Electric Standby selection from the Main Menu allows the operator to manually select diesel or electric mode operation on units equipped with the electric standby option.

Diesel Mode: If a unit equipped with electric standby is running in electric mode and the Electric to Diesel Auto-Switch feature is set NO, this feature allows the operator to manually select diesel mode operation. This feature does not appear if the unit does not feature optional Electric Standby or if the Electric to Diesel Auto-Switch feature is set YES.

Adjust Brightness: The brightness of the HMI Control Panel display can be adjusted to allow for changing ambient light conditions.

Time: The Time and Date held by the HMI Control Panel can be checked. Time and Date cannot be changed from the Main Menu.

USB Flash Drive

When a properly configured USB Flash Drive is connected to the USB Port on the unit Control Panel, the Flash Drive user interface will appear. The USB Flash Drive provides CargoWatch and ServiceWatch Data Logger downloads, flash loading the HMI Control Panel and Base Controller software, as well as sending and retrieving OptiSet Plus files. A USB Flash drive must be configured using WinTrac 5.1 or later before the flash drive can be used with SR-3 trailer units equipped with a USB Communications Port.

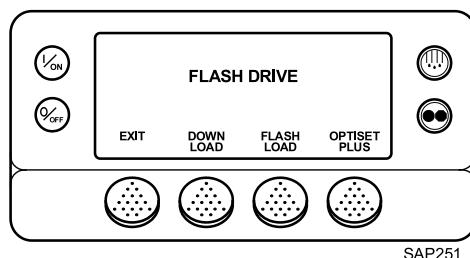
Using a properly configured and enabled flash drive, the following functions may be available:

- Download the ServiceWatch Data Logger
- Download the CargoWatch Data Logger
- Flash load Base Controller Software
- Flash load HMI Control Panel Software
- Send OptiSet Plus files
- Retrieve OptiSet Plus files

Inserting a USB Flash Drive

If a properly configured USB Flash Drive is inserted into the USB Port on the unit Control Panel, the Flash Drive Menu will automatically be shown on the HMI Control Panel. The HMI Control Panel will briefly show FLASH DRIVE and FLASH DRIVE DETECTED. The Flash Drive Menu will appear as shown ([Figure 85, p. 158](#)).

Figure 85. Flash Drive Menu

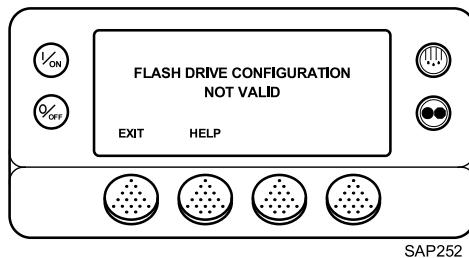


The Flash Drive Menu will time out after about 20 seconds. When the Flash Drive Menu times out, the Standard Display will appear. To go to the Standard Display, immediately press the EXIT Key.

If the Flash Drive has not been properly configured, it will not work when connected to the USB Port on the unit Control Panel and an error message will appear on the unit HMI Control Panel as shown ([Figure 86, p. 158](#)).

Note: On occasion some Flash Drives that have been configured using WinTrac may still show this message. If so, a different Flash Drive should be used.

Figure 86. Flash Drive Not Valid

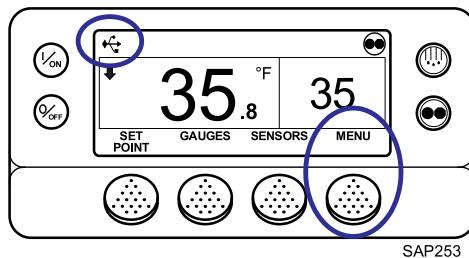


Accessing the Flash Drive Menu

If the USB Icon is present in the upper left corner of the display, a USB Flash Drive is connected to the unit USB Port on the Control Panel. To access the Flash Drive Menu when a USB Flash Drive is connected to the USB Port, press the MENU Key (Figure 87, p. 159).

Note: If a USB Flash Drive is not connected to the unit, the Flash Drive Menu feature will not appear in the Main Menu.

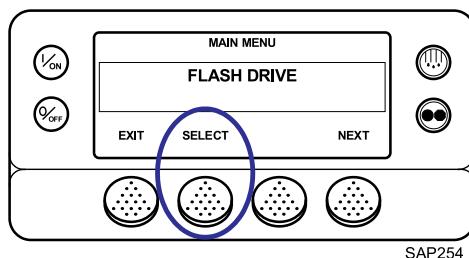
Figure 87. Menu Key



Note: The USB Icon will appear in the display when a USB Flash Drive is connected, even if the USB Flash Drive has not been configured using WinTrac.

The Main Menu Flash Drive selection will appear. Press the SELECT Key to choose the Flash Drive feature (Figure 88, p. 159).

Figure 88. Main Menu - Flash Drive

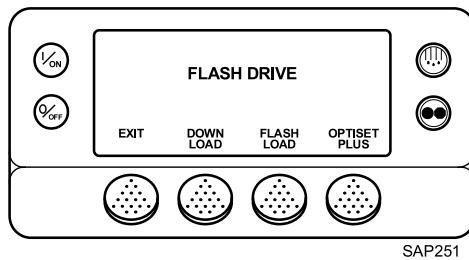


The Flash Drive Menu will appear (Figure 89, p. 159).

- To download the ServiceWatch or CargoWatch Data Loggers, press the DOWNLOAD Key.
- To flash load software to the Base Controller or HMI Control Panel, press the FLASHLOAD Key.
- To send or retrieve OptiSet Plus files, press the OPTISET PLUS Key.

Important: If a feature was not enabled when the Flash Drive was configured, the soft key for that feature will not be present.

Figure 89. Flash Drive Menu

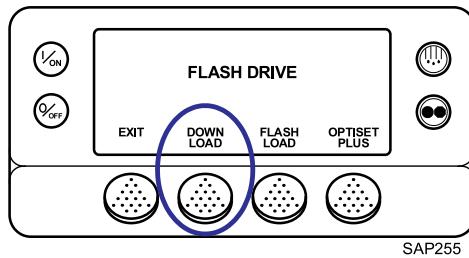


To exit to the Main Menu, press the EXIT Key.

Downloading the ServiceWatch or CargoWatch Data Loggers

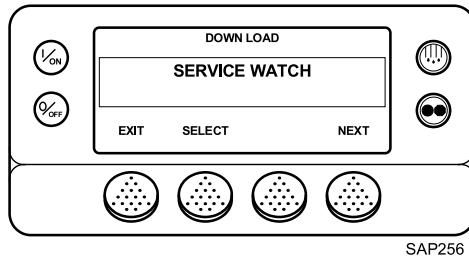
To download the ServiceWatch or CargoWatch Data Loggers, press the DOWNLOAD Key from the Flash Drive Menu as shown (Figure 96, p. 161).

Figure 90. Flash Drive Menu



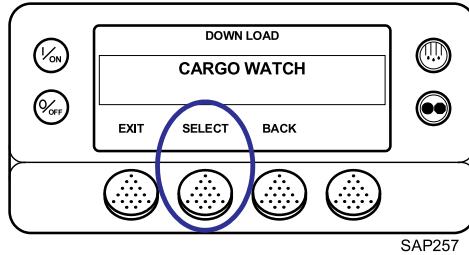
The DownLoad Menu will appear as shown (Figure 91, p. 160). To start the ServiceWatch Data Logger download, press the SELECT Key.

Figure 91. Download - ServiceWatch



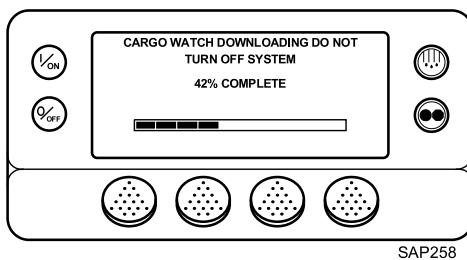
To choose the CargoWatch Data Logger for download, press the NEXT Key to display CARGOWATCH, and then press the SELECT Key to start the CargoWatch download (Figure 92, p. 160).

Figure 92. Download - CargoWatch



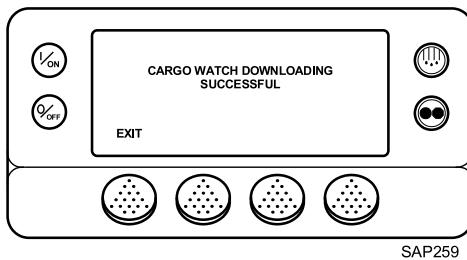
The download screen will appear. A progress bar indicates the download progress. The CargoWatch download screen is shown (Figure 93, p. 160).

Figure 93. CargoWatch Download



When the download is complete, the results are reported and the downloaded file is saved to the DOWNLOAD/CARGOWATCH folder on the USB Flash Drive. To return to the Down Load Menu press the EXIT Key (Figure 94, p. 161).

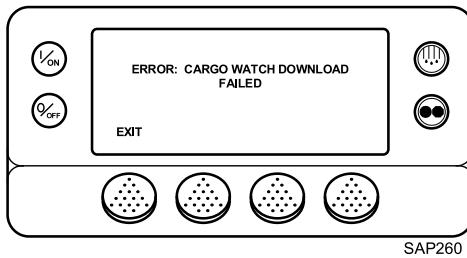
Figure 94. Download Successful



If the download fails, the screen shown (Figure 95, p. 161) will appear.

Note: The unit being downloaded must have a Trailer ID set by Wintrac. If a Trailer ID has not been assigned to the unit, this error will occur.

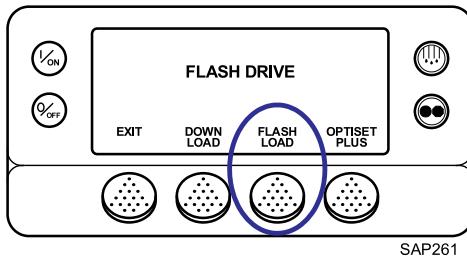
Figure 95. Download Failed



Flash Loading the Base Controller or HMI Control Panel

To flash load the Base Controller or HMI Control Panel, press the FLASHLOAD Key from the Flash Drive Menu (Figure 96, p. 161).

Figure 96. Flash Drive Menu

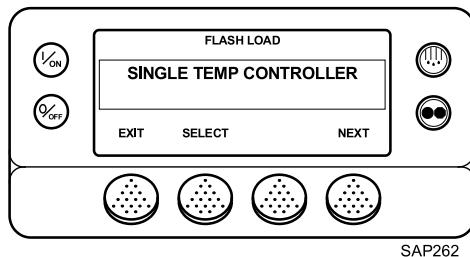


The Flash Load Menu will appear as shown (Figure 97, p. 161). The first component in the Flash Load Menu is SINGLE TEMP CONTROLLER/MULTI TEMP CONTROLLER. To flash load the

Section 4 - Operation

SINGLE TEMP CONTROLLER/MULTI TEMP CONTROLLER, press the SELECT Key (SINGLE TEMP CONTROLLER is shown as an example).

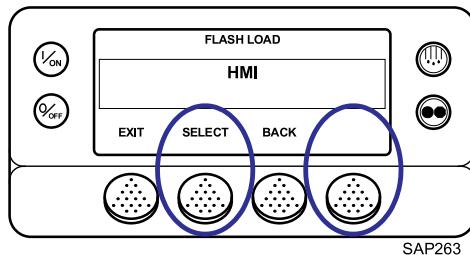
Figure 97. Flash Load Menu



SAP262

To flash load the HMI Control Panel, press the NEXT Key to display HMI, and then press the SELECT Key to start the HMI Control Panel flash load ([Figure 98, p. 162](#)).

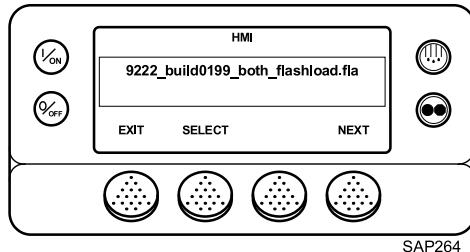
Figure 98. Flash Load Menu



SAP263

The HMI Flash Load Menu will appear. If there is more than one HMI flash load file on the Flash Drive, the NEXT Key will be present as shown ([Figure 99, p. 162](#)). If only one HMI flash load file is present on the Flash Drive, the NEXT Key will not appear. Pressing the NEXT Key will display the next flash load file.

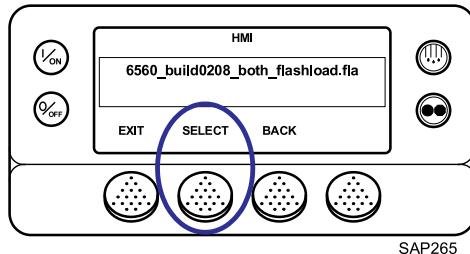
Figure 99. HMI Flash Load Menu



SAP264

Pressing the NEXT Key will display the next flash load file. Pressing the SELECT Key will flash load the file shown on the display to the HMI Control Panel ([Figure 100, p. 162](#)).

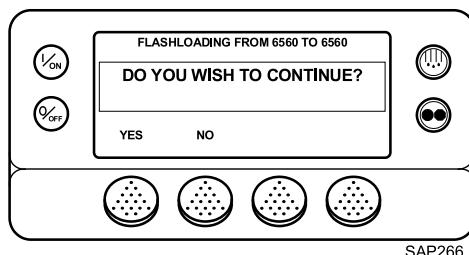
Figure 100. HMI Flash Load Menu



SAP265

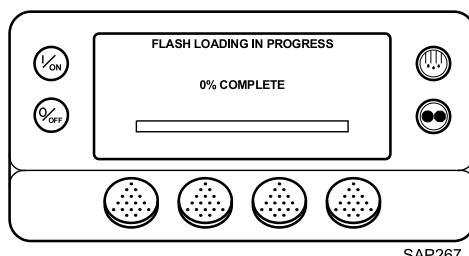
A confirmation screen will appear (Figure 101, p. 162). If the update shown is correct, press the YES Key.

Figure 101. Confirmation Screen



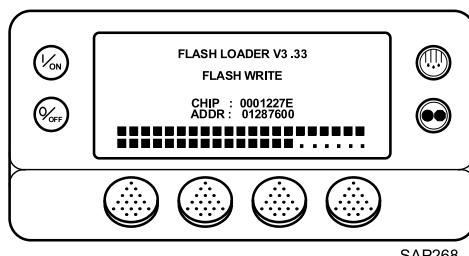
FLASH LOADING IN PROGRESS will be shown on the display while the flash load process initializes (Figure 102, p. 163). This process may take several minutes.

Figure 102. Progress Screen



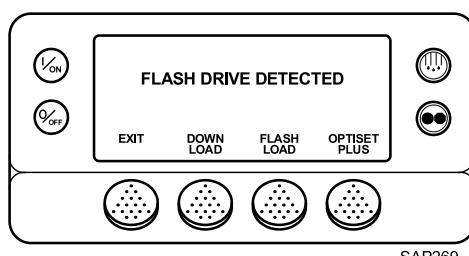
The Flash Load Display will appear (Figure 103, p. 163). Progress is indicated by means of the black boxes in the bottom two rows of the display.

Figure 103. Flash Load Display



When the flash load is complete, the TK Logo will briefly appear in the display. Then the CONFIGURING SYSTEM PLEASE WAIT message is shown as the system restarts. When the unit is ready to run, the Flash Drive Menu appears on the display (Figure 104, p. 163).

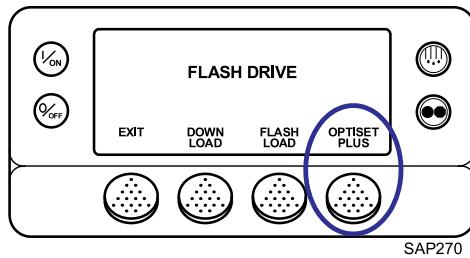
Figure 104. Flash Drive Menu



Sending OptiSet Plus Files

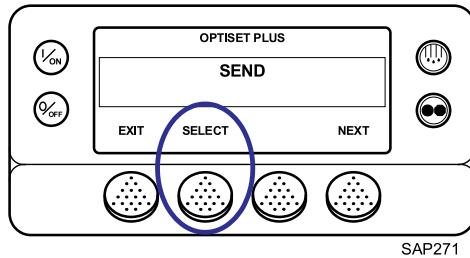
The Flash Drive allows OptiSet Plus configurations to be sent to the Base Controller. It also allows OptiSet Plus information to be retrieved as needed. To Send an OptiSet Plus Configuration File to the Base Controller, press the OPTISET PLUS Key (Figure 105, p. 163).

Figure 105. OPTISET PLUS Key



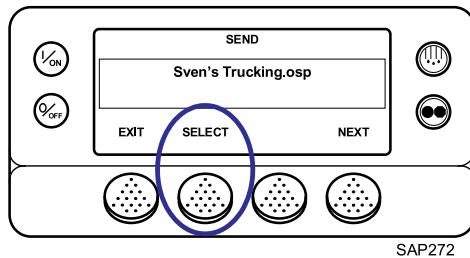
The SEND Menu is the first menu to appear as shown (Figure 106, p. 164). Press the SELECT Key to choose the SEND option.

Figure 106. Send Menu



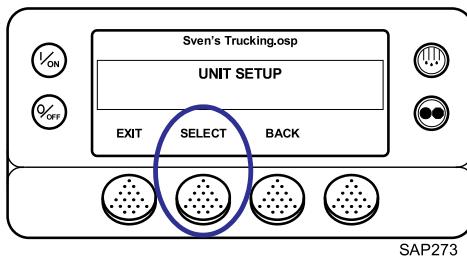
Press the SELECT Key to choose the SEND option (Figure 107, p. 164). The files available for uploading are shown, one at a time. If only one file is available, the NEXT Key and BACK Key will not be present. If more than one file is available, they can be chosen using the NEXT Key and BACK Key. When the desired file is shown, press the SELECT Key to choose it.

Figure 107. Send Option



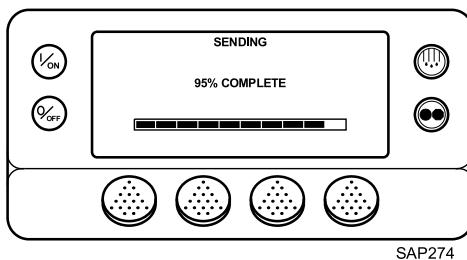
There is a brief pause to get and display the available choices. The NEXT Key and BACK Key are used to scroll through the possible choices. Choices are typically UNIT SETUP + TEMP PROFILES, TEMPERATURE PROFILES, and UNIT SETUP. When the desired choice is shown on the display, press the SELECT Key (Figure 108, p. 164).

Figure 108. Unit Setup



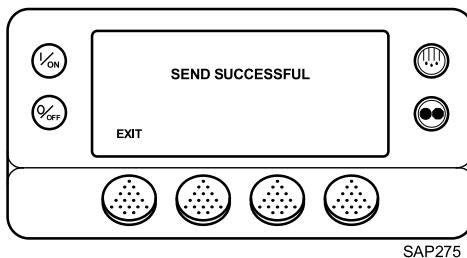
The Unit Setup information is sent to the Base Controller. A progress bar indicates percent completion ([Figure 109, p. 164](#)).

Figure 109. Progress Bar



A successful send is confirmed on the display ([Figure 110, p. 165](#)). Press the EXIT Key to return to the Flash Drive Menu.

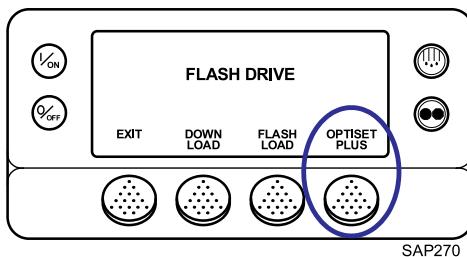
Figure 110. Send Successful



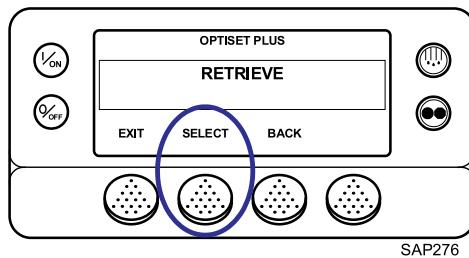
Retrieving OptiSet Plus Files

OptiSet Plus Configuration files can be retrieved for modification or for use with other units. To retrieve an OptiSet Plus Configuration File from the Base Controller, press the OPTISET PLUS Key ([Figure 111, p. 165](#)).

Figure 111. OPTISET PLUS Key

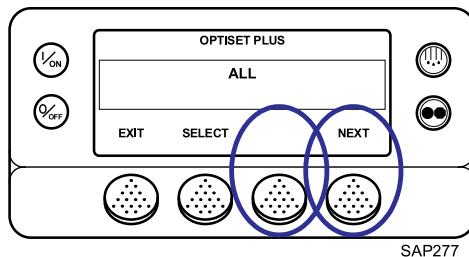


The SEND Menu is the first menu to appear as shown ([Figure 112, p. 165](#)). Press the NEXT Key to display RETRIEVE and press the SELECT Key to choose the RETRIEVE option.

Figure 112. Send Menu


The files available for retrieval are shown, one at a time. The NEXT Key and BACK Key are used to select the desired file. The first choice is ALL as shown (Figure 113, p. 165).

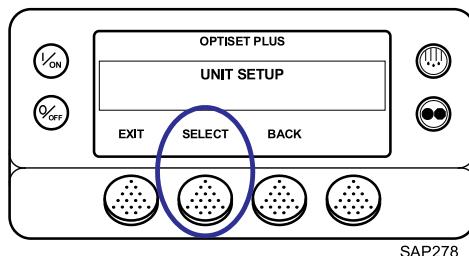
Note: The BACK Key will appear after the NEXT Key is pressed.

Figure 113. Retrieve Option


The following choices for ALL are available:

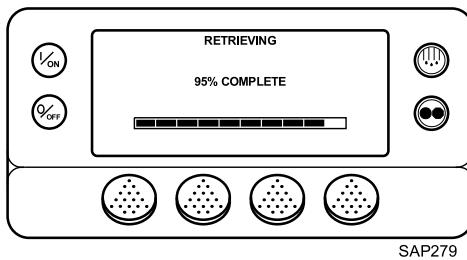
- CARGO SETUP + TEMP
- UNIT SETUP + TEMP PROFILES
- UNIT + CARGOWATCH SETUP
- TEMPERATURE PROFILES
- CARGOWATCH SETUP
- UNIT SETUP

When the desired file is shown, press the SELECT Key to choose it (Figure 114, p. 166).

Figure 114. Unit Setup - Select Key


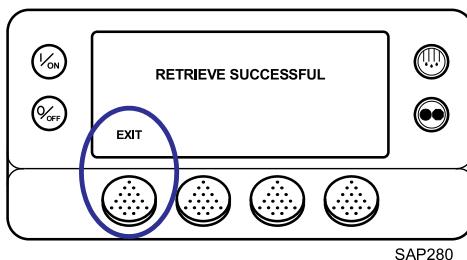
The desired file is retrieved and saved to the Flash Drive. A progress bar indicates percent completion (Figure 115, p. 166).

Figure 115. Progress Bar



A successful retrieval is confirmed on the display (Figure 116, p. 166). Press the EXIT Key to return to the Flash Drive Menu.

Figure 116. Retrieve Successful

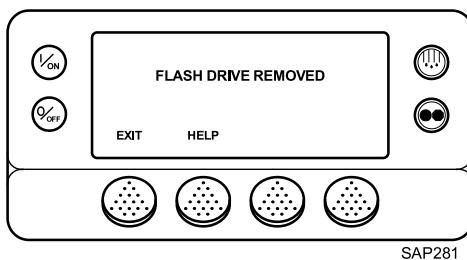


Removing a USB Flash Drive

Verify all USB Flash Drive operations have completed before removing the Flash Drive from the USB Port on the unit. To remove the USB Flash Drive, unplug it from the USB Port. The display shown (Figure 117, p. 167) will briefly appear, followed by the Standard Display. The USB Icon will no longer be present.

Important: Never remove the USB Flash Drive from the USB Port when it is actively doing a read or write operation.

Figure 117. Flash Drive Removed



Languages

If the Language Feature has been enabled from the Guarded Access Language Menu, an alternate language or languages can be selected from the Language Menu. After a new language is chosen, all displays will appear in that language. If the Language Feature has not been enabled, this menu does not appear. The default language is English. Only languages specifically enabled from the Guarded Access Language Menu are available.

Important: Exercise care when changing languages. Once changed, all HMI Control Panel displays will be in the new language. If the user is not familiar with the new language, problems may be experienced returning to the default language.

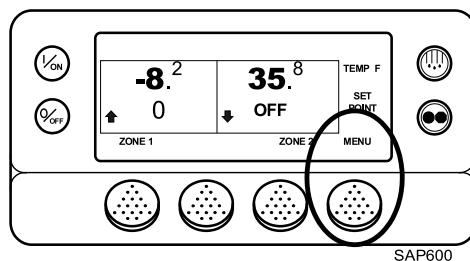
The languages available are dependent on the HMI Control Panel software revision. Other than the languages supported, software revisions 65/75/7Bxx, 66/76/7Cxx, 67/77/7Dxx, and 68/7Exx are identical.

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- Software Revision 65/75/7Bxx supports English, Spanish, French, German, Italian, Dutch, Portuguese, Greek, Turkish, Hebrew and Arabic.
- Software Revision 66/76/7Cxx supports English, Danish, Russian, Norwegian, Swedish, Finnish, Polish, Hungarian, Romanian, Bulgarian and Czech.
- Software Revision 67/77/7Dxx supports English, Japanese and Chinese.
- Software Revision 68/7Exx supports English, English and Spanish, or allows any five languages from Software Revision 65/75/7Bxx or 66/76/7Cxx to be selected. Japanese and Chinese are not available for use with this feature.

To select an alternate language, press the MENU Key (Figure 118, p. 167).

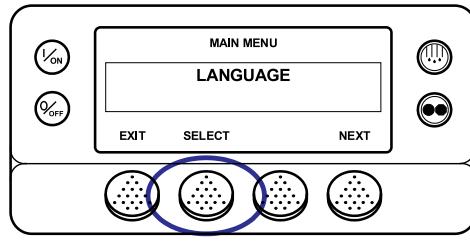
Figure 118. Menu Key



SAP600

If more than one language is enabled, the Language Menu is the first Main Menu item to appear as shown (Figure 119, p. 168). Press the SELECT Key to choose the Language Menu.

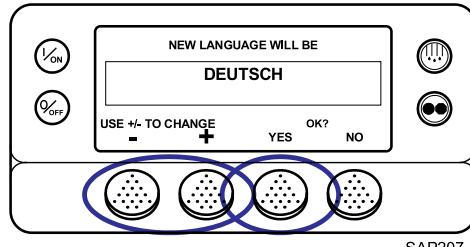
Figure 119. Main Menu - Language



SAP282

The Language Menu will appear as shown (Figure 120, p. 168). Press the + or – Keys to select the desired language. Only languages enabled from the Guarded Access Menu are available. When the desired language is shown, press the YES Key to confirm the choice.

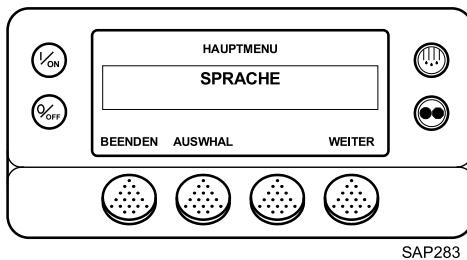
Figure 120. Language Menu



SAP207

The display will briefly show PROGRAMMING LANGUAGE - PLEASE WAIT in the new language. The display will then return to the Language Menu, but will show the new language (Figure 121, p. 168).

Figure 121. New Language



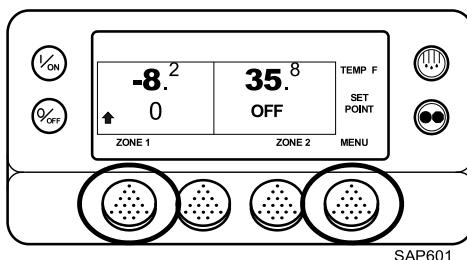
SAP283

Repeat the process to select a different language. To select a different Main Menu item press the NEXT Key. To return to the Standard Display press the EXIT Key.

Important: If necessary, English and all other languages in the software version may be accessed from the Standard Display.

Should it be necessary at any time to change to English or any other language in the installed software, return to the Standard Display and then press and hold the first and last soft keys for five seconds as shown (Figure 122, p. 168). The Standard Display is shown in Deutsch (German).

Figure 122. New Language



SAP601

Alarms

The Alarms Menu allows the operator to view all alarms and clear most alarms.

Refer to Section 5 for more information about alarm codes and their diagnosis.

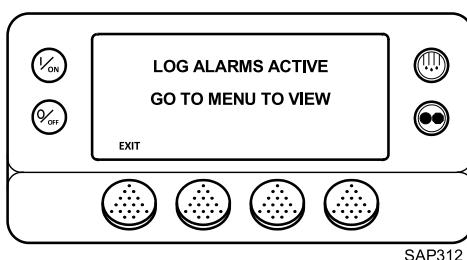
Log Alarms

Log Alarms are indicated for 30 seconds each time the unit is turned on. This level of alarm serves as a notice to take corrective action before a problem becomes severe. Maintenance items such as maintenance hourmeter time-outs are Log Alarms. The TemperatureWatch screen is not disabled if only Log Alarm(s) are active.

When the unit is turned on, the display will show the Thermo King Logo and then the "Configuring System" message. If Log Alarm(s) are present, the Log Alarm notice will appear on the display for 30 seconds as shown (Figure 123, p. 169). The remote indicator alarm light (if installed) will also be on during this period. After 30 seconds, the Standard Display will appear and the remote indicator alarm light will go off.

Note: The Alarm Icon does not appear on startup with Log Alarms present.

Figure 123. Log Alarms Exist



SAP312

Note: If required, an engine start may occur while the display above is shown. This is normal operation.

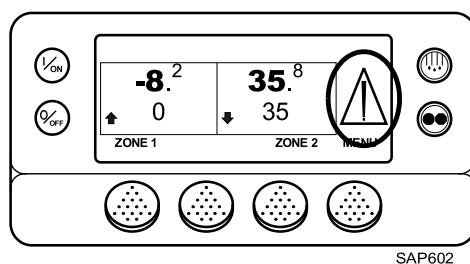
Check Alarms

Check Alarms are indicated by a steady alarm icon at the side of the display. If the alarm is specific to a zone, a smaller alarm icon will appear next to the affected zone. This level of alarm serves as a notice to take corrective action before a problem becomes severe. The unit will run with Check Alarms but some features and functions may be inhibited. The TemperatureWatch screen is disabled if a Check Alarm is active.

Unit Level Check Alarms

If the alarm pertains to the entire system (not an individual zone, e.g., Alarm Code 10), the alarm icon will appear at the right side of the display as shown (Figure 124, p. 169). Both Zone Specific and Unit Specific Alarms can exist at the same time.

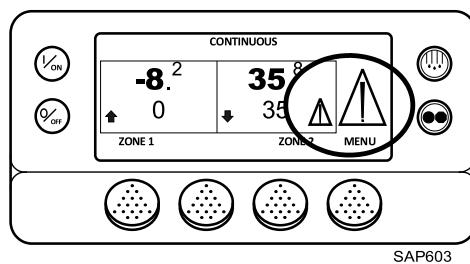
Figure 124. Alarm Icon



Zone Level Check Alarms

If the alarm is zone specific, the Alarm Icon will appear in the offending zone as shown (Figure 125, p. 170). Both Alarm Icons will be present. In the example, an alarm exists in Zone 2.

Figure 125. Alarm for Zone 2



Unit Level Prevent Alarms

Unit Level Prevent Alarms are also indicated by a steady alarm icon at the side of the display. The unit will be temporarily shut down if a Prevent Alarm is active. The unit will remain shut down for a timed restart interval or until the fault conditions are corrected and then restart. If the unit is in a temporary shutdown, Alarm Code 84 Restart Null will be present along with the associated Prevent Alarm. In most cases, the unit will restart with reduced performance to determine if continued operation is possible. If the alarm does not reoccur, the unit will then return to full performance. If the unit is operating with reduced performance, Alarm Code 85 Forced Unit Operation may also be present under some conditions. In general, if the alarm condition reoccurs a defined number of times, the alarm is set as a Shutdown Alarm and no further restarts are possible. The TemperatureWatch screen is disabled if a Unit Level Prevent Alarm is active.

Note: If the Restart After Shutdown feature in the Guarded Access Menu is set for CONTINUOUS, an unlimited number of restart attempts are allowed.

Zone Level Prevent Alarms

A Zone Level Prevent Alarm will force the affected zone into a temporary shutdown, but allow the unit to continue to run as required by the host unit or other zones. A small alarm icon will appear

next to the affected zone. If zone Prevent Alarms occur in all zones, the unit will be forced into a unit level Prevent Shutdown. The TemperatureWatch screen is disabled if a Zone Level Prevent Alarm is active.

Shutdown Alarms

If a Shutdown Alarm occurs while the unit is running, it will be indicated by all of the following:

- The Alarm Icon will appear.
- The display, backlight, and optional remote alarm light will flash on and off.
- The display will alternate from normal to inverted and back (light areas become dark and dark areas become light).

Unit Level Shutdown Alarms

Unit Level Shutdown Alarms will force the unit into shutdown. The unit will remain in shutdown until the Shutdown Alarm is manually cleared. Exceptions are some engine and electric Shutdown Alarms that become Log Alarms when switched to the alternate operating mode (diesel to electric or electric to diesel). The TemperatureWatch screen is disabled if a Unit Level Shutdown Alarm is active.

Zone Level Shutdown Alarms

A zone Shutdown Alarm will force the affected zone to shutdown, but allow the unit to continue to run as required by the host unit or other zones. A small alarm icon will appear next to the affected zone and blink with a period of half second on - half second off. If zone Shutdown Alarms occur in all zones, the unit will shut down and Alarm Code 114 Multiple Alarms - Can Not Run will be set.

Pretrip Alarms

If an alarm occurs during a Pretrip Test, the alarm code will be displayed as Pretrip Alarm XX, where XX is the alarm code.

Alarm Codes When Switching Between Diesel and Electric

If a Shutdown Alarm occurs that affects only diesel mode operation and the unit is switched to electric, the diesel mode Shutdown Alarm becomes an electric mode Log Alarm. This allows the unit to run in electric mode without clearing the Shutdown Alarm that is preventing diesel mode operation. If the unit is switched back to diesel mode, the alarm again becomes a diesel mode Shutdown Alarm and prevents unit operation.

In the same manner, if a Shutdown Alarm occurs that affects only electric mode operation and the unit is switched to diesel, the electric mode Shutdown Alarm becomes a diesel mode Log Alarm to allow diesel mode operation. If the unit is switched back to electric mode, the alarm reverts to an electric mode Shutdown Alarm and prevents unit operation. If the unit is configured for electric to diesel Auto-Switch, it automatically starts and runs in diesel mode if an electric shutdown occurs.

Clearing Alarm Codes

Most alarm codes can be cleared conventionally from the Alarm Menu using the CLEAR Key.

The following control and display sensor alarm codes can only be cleared from the Guarded Access Menu:

- Alarm Code 03 Check Control Return Air Sensor
- Alarm Code 04 Check Control Discharge Air Sensor

The following alarm codes clear automatically:

- Alarm Code 64 Pretrip Reminder - Clears when a Pretrip Test is performed.
- Alarm Code 84 Restart Null - Clears when the unit is no longer in a restart null due to a Prevent Alarm.
- Alarm Code 85 Forced Unit Operation - Clears when the unit is no longer running in a forced mode due to a Prevent Alarm.

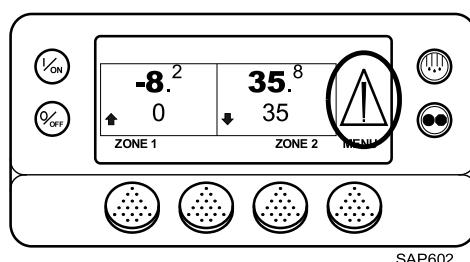
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- Alarm Code 91 Check Electric Ready Input - Clears automatically when electric power is restored.
- Alarm Code 92 Sensor Grades Not Set - Clears when the sensor grade is changed from 5H. If the Limited Alarm Restarts feature is enabled, the following additional alarm codes may only be cleared from the Guarded Access Menu. If this is the case, the CLEAR soft key will not appear if the alarms are displayed from the Main Menu or the Maintenance Menu.
 - Alarm Code 10 High Discharge Pressure
 - Alarm Code 23 Cooling Cycle Fault
 - Alarm Code 24 Heating Cycle Fault
 - Alarm Code 32 Refrigeration Capacity Low

Displaying and Clearing Alarm Codes

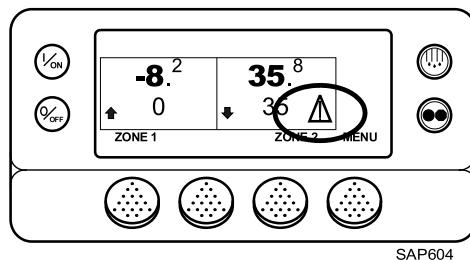
If an alarm condition occurs that is not zone specific, the Alarm Icon will appear in place of the textual information in the display as shown (Figure 126, p. 171).

Figure 126. Alarm Icon



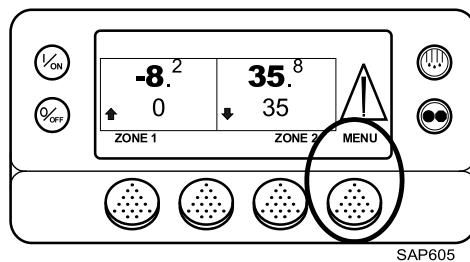
If the alarm condition is zone specific, the Alarm Icon will also appear in the appropriate zone. An alarm specific to Zone 2 is shown (Figure 127, p. 172).

Figure 127. Zone 2 Alarm



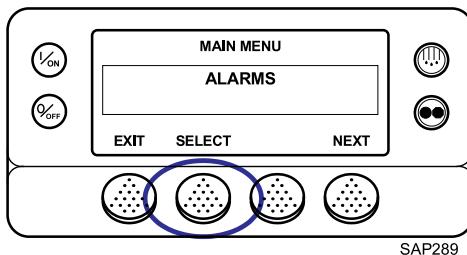
Alarms are displayed and cleared using the Alarm Menu. From the Standard Display, press the MENU soft key.

Figure 128. Menu Key



The Language Menu or Alarms Menu will appear. If the Language Menu appears press the NEXT Key to show the Alarms Menu. When the Alarms Menu is shown, press the SELECT Key (Figure 129, p. 172).

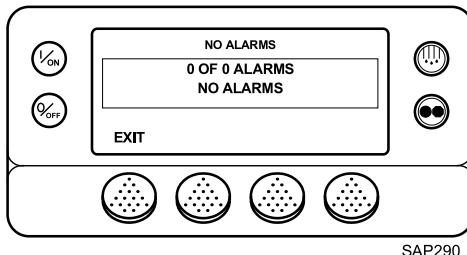
Figure 129. Select Key



SAP289

The Alarm Display will appear. If no alarms are present, NO ALARMS will be shown (Figure 130, p. 172).

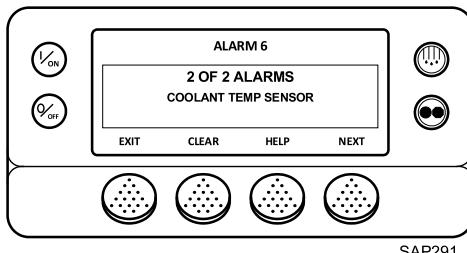
Figure 130. Alarms Menu



SAP290

If alarms are present, the quantity of alarms (if more than one) and the most recent alarm code number will be shown. In the example (Figure 131, p. 173), there are two alarms present. The most recent is Alarm Code 6. It indicates a problem with the coolant temperature sensor.

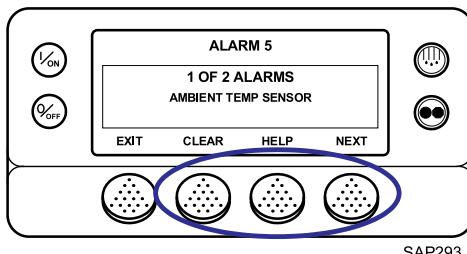
Figure 131. Alarms Menu



SAP291

After the alarm situation is resolved, press the CLEAR Key to clear the alarm. For additional information regarding the alarm shown on the display, press the HELP Key. To display the next alarm, press the NEXT Key (Figure 132, p. 173).

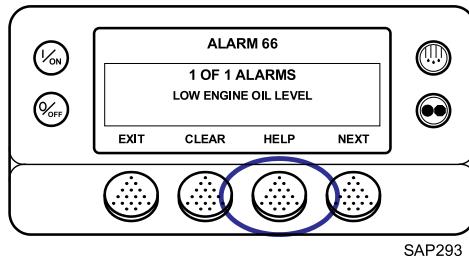
Figure 132. Clear, Help, Next Keys



SAP293

If a serious condition occurs, the unit will be shut down to prevent damage to the unit or the load. If this occurs, the display will show that the unit is shut down and display the alarm code that caused the shutdown. In the example (Figure 133, p. 173), the unit is shut down due to low oil level. For additional information regarding the alarm shown on the display, press the HELP Key.

Figure 133. Low Engine Oil Level Display



SAP293

A help message will appear. For the alarm shown above, the message "CHECK OIL LEVEL. IF UNIT IS SHUT DOWN, REPAIR IMMEDIATELY. OTHERWISE, REPORT ALARM AT END OF THE DAY" will be shown on the display. Check the oil level and add oil as required, clear the alarm and restart the engine.

To select a different Main Menu item, press the NEXT Key. To return to the Standard Display, press the EXIT Key again.

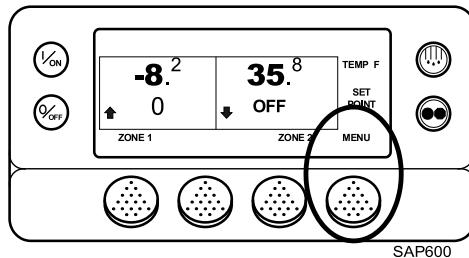
Important Alarm Notes

- If an alarm will not clear, the condition may still exist. If the alarm is not corrected, it will not clear or may be immediately set again.
- If an alarm cannot be cleared from the Main menu, the Clear Key will not appear. These alarms must be cleared from the Maintenance or Guarded Access Menus.
- All alarms must be viewed before any of the alarms can be cleared.

Gauges

Unit Gauges and I/O (Input/Output) State are viewed using the Gauges Menu. From the Standard Display, press the MENU soft key.

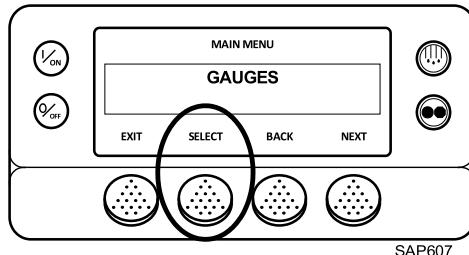
Figure 134. Menu Key



SAP600

The Language Menu or Alarm Menu will appear. Press the NEXT soft key as required to display the Gauges Menu. When the Gauges Menu is shown, press the SELECT soft key.

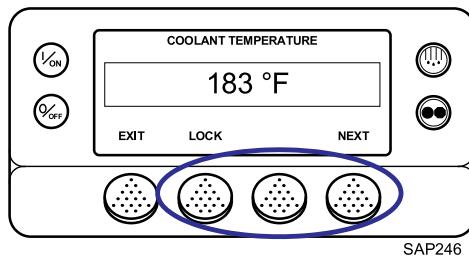
Figure 135. Gauges Menu



SAP607

The first Gauge Menu display will appear. Press the NEXT and BACK soft keys to scroll through the gauges. Pressing the LOCK soft key will lock the gauges on the display for fifteen minutes.

Figure 136. Gauge Display Locked



SAP246

To return to the Main Menu, press the EXIT Key. To return to the Standard Display, press the EXIT Key again.

Gauges Available

Note: Not all gauges may appear, dependent upon software revision, unit type, and configuration. On early versions of software, the Oil Pressure and Oil Level appear in the I/O Menu and the order may be different.

Coolant Temperature: Displays the temperature of the engine coolant.

Coolant Level: Displays the coolant level in the overflow tank.

Engine Oil Pressure: Displays the engine oil pressure as OK or LOW.

Engine Oil Level Switch: Displays the engine oil level as OK or LOW.

Amps: Displays the current flow in amps flowing to or from the unit battery.

Battery Voltage: Displays the voltage of the unit battery.

Engine RPM: Displays the engine speed in RPMs.

Fuel Level Sensor: Displays the fuel level if a fuel level sensor is installed.

Discharge Pressure: Displays the unit discharge pressure.

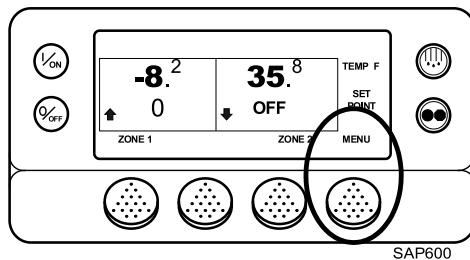
Suction Pressure: Displays the unit suction pressure.

I/O (Input/Output State): Displays the current state of the input/output devices listed here (shown as ON or OFF):

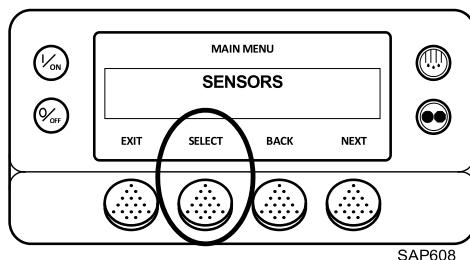
| | | |
|--------------------------|---------------------------------------|------------------------------|
| High Speed Relay | Electric Overload | Liquid Line Solenoid Zone 2 |
| Run Relay | Condenser Inlet Solenoid | Hot Gas Solenoid Zone 2 |
| Run Relay Feedback | Receiver Tank Inlet Pressure Solenoid | Suction Line Solenoid Zone 2 |
| Alternator Excite Output | Purge Valve | Drain Hose Heater Zone 2 |
| Defrost Damper | Liquid Line Solenoid Zone 1 | Liquid Line Solenoid Zone 3 |
| Alternator Frequency | Hot Gas Solenoid Zone 1 | Hot Gas Solenoid Zone 3 |
| Diesel/Electric Relay | Suction Line Solenoid Zone 1 | Suction Line Solenoid Zone 3 |
| Electric Ready Input | Drain Hose Heater Zone 1 | Drain Hose Heater Zone 3 |

Sensors

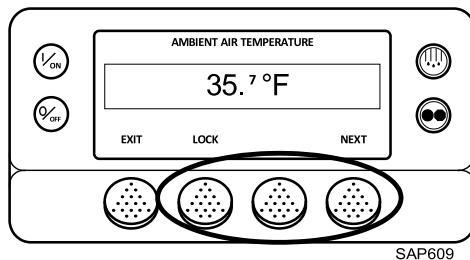
Unit temperature sensors are viewed using the Sensors Menu. From the Standard Display, press the MENU soft key.

Figure 137. Menu Key


The Language Menu or Alarm Menu will appear. Press the NEXT soft key as required to display the Sensors Menu. When the Sensors Menu is shown, press the SELECT soft key.

Figure 138. Sensors Menu


The first Sensors Menu display will appear. Press the NEXT and BACK soft keys to scroll through the sensors. Pressing the LOCK soft key will lock the sensor on the display.

Figure 139. Gauge Display Locked


The sensors available are shown below. Only configured and enabled sensors are shown. For example, if the unit is configured as a two zone unit, Zone 3 sensors are not shown. If the CargoWatch sensors are not enabled, they will not be shown. To return to the Standard Display press the EXIT soft key.

Zone 1 Return Air Temperature: Displays the temperature of the Zone 1 Return Air Sensor.

Zone 1 Discharge Air Temperature: Displays the temperature of the Zone 1 Discharge Air Sensor.

Zone 1 Temperature Differential: Displays the Zone 1 Temperature Differential.

Zone 1 Evaporator Coil Temperature: Displays the temperature of the Zone 1 Evaporator Coil sensor.

Zone 2 Return Air Temperature: Displays the temperature of the Zone 2 Return Air Sensor.

Zone 2 Discharge Air Temperature: Displays the temperature of the Zone 2 Discharge Air Sensor.

Zone 2 Temperature Differential: Displays the Zone 2 Temperature Differential.

Zone 2 Evaporator Coil Temperature: Displays the temperature of the Zone 2 Evaporator Coil sensor.

Zone 3 Return Air Temperature: Displays the temperature of the Zone 3 Return Air Sensor.

Zone 3 Discharge Air Temperature: Displays the temperature of the Zone 3 Discharge Air Sensor.

Zone 3 Temperature Differential: Displays the Zone 3 Temperature Differential.

Zone 3 Evaporator Coil Temperature: Displays the temperature of the Zone 3 Evaporator Coil sensor.

Ambient Air Temperature: Displays the temperature of the ambient air temperature sensor.

Spare 1 Temperature: Displays the temperature of the Spare 1 temperature sensor.

Spare 2 Temperature: Displays the temperature of the Spare 2 temperature sensor.

Spare 3 Temperature: Displays the temperature of the Spare 3 temperature sensor.

Data Logger Sensor 1 Temperature: Displays the temperature of the CargoWatch Data Logger 1 temp sensor.

Data Logger Sensor 2 Temperature: Displays the temperature of the CargoWatch Data Logger 2 temp sensor.

Data Logger Sensor 3 Temperature: Displays the temperature of the CargoWatch Data Logger 3 temp sensor.

Data Logger Sensor 4 Temperature: Displays the temperature of the CargoWatch Data Logger 4 temp sensor.

Data Logger Sensor 5 Temperature: Displays the temperature of the CargoWatch Data Logger 5 temp sensor.

Data Logger Sensor 6 Temperature: Displays the temperature of the CargoWatch Data Logger 6 temp sensor.

Board Temperature Sensor: Displays the temperature of the HMI control panel PC board.

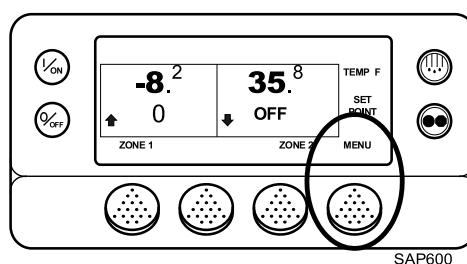
Data Logger (CargoWatch™)

The CargoWatch Data Logger is physically located in the HMI Control Panel. It can support up to six optional temperature sensors.

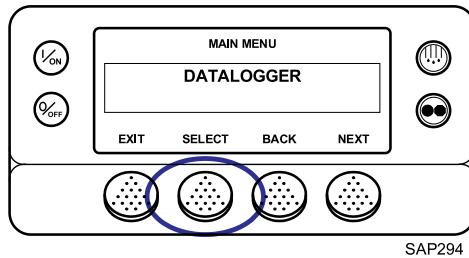
A Start of Trip can be sent to the unit ServiceWatch and CargoWatch Data Loggers. In addition, the CargoWatch Data Logger contents can be printed with a hand-held printer.

The ServiceWatch and CargoWatch Data Logger are accessed using the Data Logger Menu. From the Standard Display, press the MENU Key (Figure 140, p. 177).

Figure 140. Standard Display - Menu Key



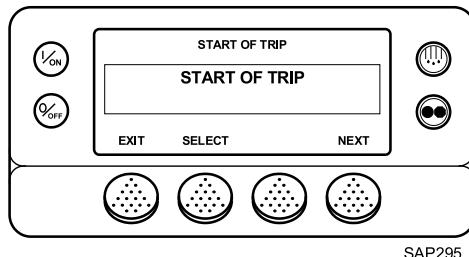
The Language Menu or Alarm Menu will appear (Figure 141, p. 177). Press the NEXT Key as required to display the Data Logger Menu. When the Data Logger Menu is shown, press the SELECT Key.

Figure 141. Main Menu - Data Logger


SAP294

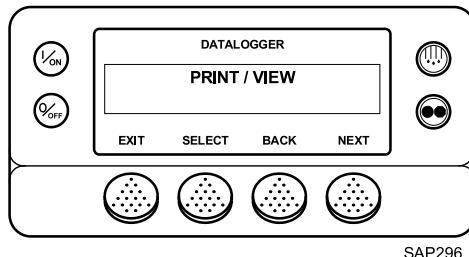
The first feature that appears is the Start of Trip ([Figure 142, p. 177](#)). To send a Start of Trip press the SELECT Key to select the feature, and then press it again to send the Start of Trip. The display will briefly show START OF TRIP COMPLETE to confirm that a Start of Trip marker was set in the data logger.

Note: *The start of trip marker is sent to both the CargoWatch and ServiceWatch data loggers.*

Figure 142. Start of Trip


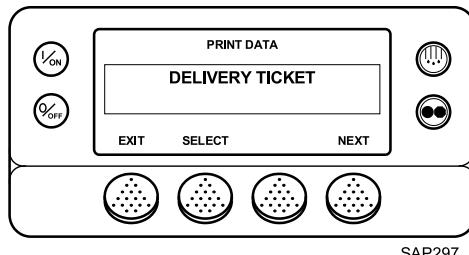
SAP295

Press the NEXT Key to select the PRINT / VIEW feature. The PRINT / VIEW screen will appear ([Figure 143, p. 178](#)).

Figure 143. Datalogger - Print/View


SAP296

Press the SELECT Key. The first PRINT / VIEW screen allows the operator to print a Delivery Ticket ([Figure 144, p. 178](#)). Pressing the SELECT Key will print a delivery ticket. The Delivery Ticket is a short ticket that shows delivery specific details including the current temperature ([Figure 145, p. 178](#)).

Figure 144. Print Data - Delivery Ticket


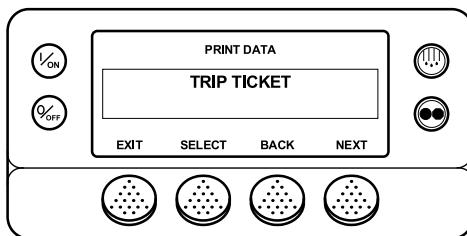
SAP297

Figure 145. CargoWatch Delivery Ticket

| | | | | |
|----------------------------|-------------------|-----|-----|------|
| UNIT SERIAL NUMBER: | xxxxxxxxxx | | | |
| CONTROLLER SERIAL NUMBER: | A00021506190T3 | | | |
| TRAILER ID: | xxxxxxxxxx | | | |
| CONTROLLER VERSION NUMBER: | B007 | | | |
| CONTROLLER TYPE: | SR2 | | | |
| DATALOGGER VERSION NUMBER: | 6512 | | | |
| TEMPERATURE UNITS: | FAHRENHEIT | | | |
| START: | 05/30/08 08:29:08 | | | |
| FINISH: | 05/30/08 09:18:33 | | | |
| SENSORS: | 2 | | | |
| SETPOINT: | 32.0 | | | |
| Sensor | Min | Ave | Max | Last |
| #1: | 35 | 35 | 35 | 35 |
| #2: | --- | --- | --- | --- |
| SENSOR #1: | LOG SENSOR 1 | | | |
| SENSOR #2: | LOG SENSOR 2 | | | |

SAP298

Pressing the NEXT Key allows the operator to print a Trip Ticket using a hand-held printer. Pressing the SELECT Key will print a Trip Ticket (Figure 146, p. 179). The Trip Ticket is a long ticket that shows details for the current trip including a temperature history (Figure 147, p. 179). The Trip Ticket is also called a Journey Ticket.

Figure 146. Print Data - Trip Ticket


SAP299

Figure 147. CargoWatch Trip Ticket

| | |
|----------------------------|-------------------|
| UNIT SERIAL NUMBER: | xxxxxxxx |
| CONTROLLER SERIAL NUMBER: | A00021506190T3 |
| TRAILER ID: | xxxxxxxx |
| CONTROLLER VERSION NUMBER: | B007 |
| CONTROLLER TYPE: | SR2 |
| DATALOGGER VERSION NUMBER: | 6512 |
| TEMPERATURE UNITS: | FAHRENHEIT |
| START: | 05/30/08 09:50:08 |
| FINISH: | 05/30/08 13:07:33 |
| SENSORS: | 1 |
| SETPOINT: | 32.0 |
| 30 - MAY - 2008 | |
| 1305 | 35.0 |
| 1250 | 35.2 |
| 1235 | 35.1 |
| 1220 | 35.2 |
| 1205 | 35.1 |
| 30 - MAY - 2008 | |
| 1150 | 35.0 |
| 1135 | 35.0 |
| 1120 | 35.0 |
| 1105 | 34.9 |
| 1050 | 35.0 |
| 1035 | 35.0 |
| 1020 | 35.0 |
| 1005 | 35.1 |
| 0950 | 35.1 |
| SENSOR #1: | LOG SENSOR 1 |
| SENSOR #2: | LOG SENSOR 2 |

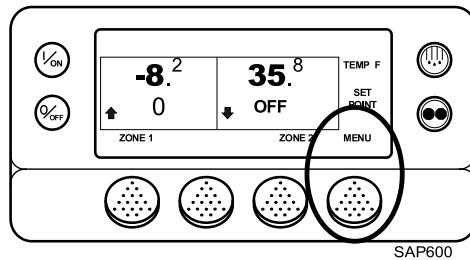
SAP300

To return to the Main Menu press the EXIT Key. To return to the Standard display press the EXIT Key again.

Hourmeters

The Hourmeters Menu allows the operator to view the unit hourmeters that have the view feature enabled in the Guarded Access Menu. If the view feature for a particular hourmeter is not enabled, that hourmeter will continue to accumulate time but cannot be viewed from the Main Menu. However, all hourmeters can be viewed from the Maintenance Menu, even if they are not enabled.

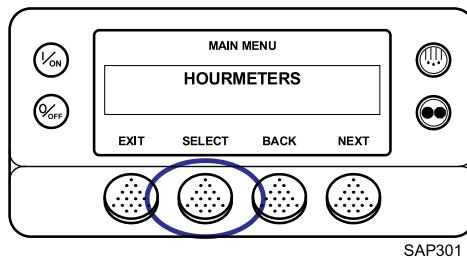
Hourmeters are displayed using the Hourmeter Display. From the Standard Display, press the MENU Key (Figure 148, p. 180).

Figure 148. Menu Key


SAP600

The Language Menu or Alarm Menu will appear. Press the NEXT Key as required to show the Hourmeter Menu (Figure 149, p. 180). When the Hourmeter Menu is shown press the SELECT Key. The Hourmeter Display will appear.

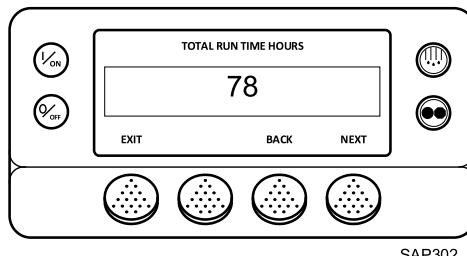
Figure 149. Main Menu - Hourmeters



SAP301

Press the NEXT or PREVIOUS Key to scroll through the hourmeters (Figure 150, p. 180).

Figure 150. Hourmeter Display



SAP302

Hourmeter names and definitions are shown in the table (Table 3, p. 180) in the order they appear. Only hourmeters enabled in the Guarded Access Menu will be shown. To return to the Standard Display, press the EXIT Key.

Only configured hourmeters that have been enabled in the Viewable Hourmeter Setup Menu will be shown.

Important: If a programmable hourmeter is not enabled or the view for that hourmeter is not turned on, it will not appear in the display sequence.

Table 3. Hourmeter Names and Definitions

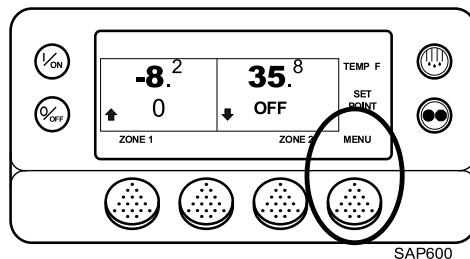
| Hourmeter Name | Definition |
|--------------------------|---|
| Total Hours | Total number of hours the unit has been turned on (protection hours). |
| Total Run Time Hours | Total number of hours the unit has run in both diesel and electric mode. |
| Total Engine Run Hours | Total number of hours the unit has run in diesel mode. |
| Total Electric Run Hours | Total number of hours the unit has run in electric mode. |
| Zone 1 Run Time Hours | Total number of hours Zone 1 has run in any mode. |
| Zone 2 Run Time Hours | Total number of hours Zone 2 has run in any mode. |
| Zone 3 Run Time Hours | Total number of hours Zone 3 has run in any mode. |
| Total Run Reminder 1 | User Programmable - The number of hours before a Total Unit Run Time Maintenance Reminder 1 occurs. |
| Total Run Reminder 2 | User Programmable - The number of hours before a Total Unit Run Time Maintenance Reminder 2 occurs. |
| Controller Power On | Total hours the controller and HMI Control Panel have been turned on. |

Table 3. Hourmeter Names and Definitions (continued)

| Hourmeter Name | Definition |
|---------------------|--|
| Pretrip Reminder | User Programmable - number of hours before a Pretrip Reminder occurs. |
| Engine Reminder 1 | User Programmable - The number of hours before an Engine Run Time Maintenance Reminder 1 occurs. |
| Engine Reminder 2 | User Programmable - The number of hours before an Engine Run Time Maintenance Reminder 2 occurs. |
| Electric Reminder 1 | User Programmable - The number of hours before an Electric Run Time Maintenance Reminder 1 occurs. |
| Electric Reminder 2 | User Programmable - The number of hours before an Electric Run Time Maintenance Reminder 2 occurs. |

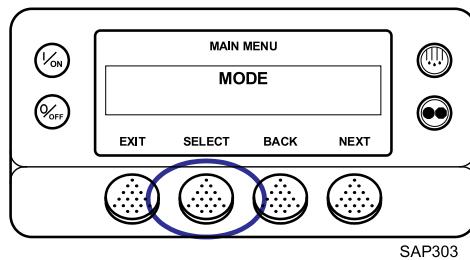
Mode

Mode changes are made using the Mode Menu. From the Standard Display, press the MENU soft key.

Figure 151. Menu Key


SAP600

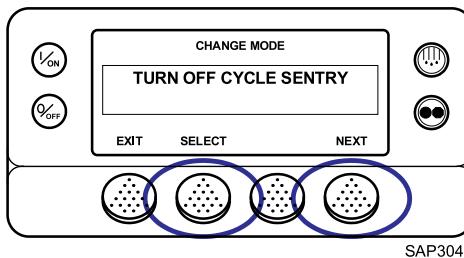
The Language Menu or Alarm Menu will appear. Press the NEXT soft key as required to display the Mode menu. When the Mode menu is shown, press the SELECT soft key.

Figure 152. Main Menu - Mode


SAP303

The first Mode menu screen will appear. To choose that function, press the SELECT soft key. To scroll through the Mode Menu, press the NEXT soft key. To return to the Standard Display press the EXIT soft key.

Figure 153. Change Mode



Various operating modes can be selected using the Mode Menu. Not all modes may be available, depending on OptiSet usage and settings of other programmable features. The following modes may be available.

Turn Cycle Sentry On or Off

Cycle Sentry Mode can be turned On or Off. If Cycle Sentry is turned off, the unit runs in Continuous Mode.

Single Zone Control - Multi Zone Control

If enabled in Guarded Access, Single Zone Control allows single temperature operation. If Single Zone Control operation is selected, all zones will be forced on and will control to the same setpoint. All bulkheads should be down to create one large compartment. Multi Zone Control allows separate control for each configured zone. For additional details, refer to (["Operating the Unit in Single Zone Control Mode," p. 147](#)).

Keypad Lockout

If enabled in Guarded Access, the keypad can be locked to prevent unauthorized use. If the keypad is locked, only the On and Off keys function. The keypad will remain locked even if the unit is turned off and back on. If Keypad Lockout is active, press and hold any soft key for five seconds to deactivate the feature.

Start Sleep Mode

If enabled in Guarded Access, Sleep Mode is used to keep the engine warm and the battery charged when the unit is not in use. When the unit is in Sleep Mode, the display will show "SLEEP" and the current time.

- Program Wakeup Time - This feature allows a wakeup time to be specified. When the selected time is reached, the unit will start and resume normal operation. If a Wakeup Time is selected, the following features are available:
 - Day to Wake Up - This feature allows the day the unit is to wake up to be specified.
 - Hour to Wake Up - This feature allows the hour the unit is to wake up to be specified.
 - Minute to Wake Up - This feature allows the minute the unit is to wake up to be specified.
 - Run Pretrip on Wake Up - This feature allows a Pretrip Test to be automatically run when the unit wakes up.

Pretrip

A Pretrip Test verifies unit operation. This display allows a Pretrip Test to be selected and initiated by the operator. If the Pretrip Test is entered with the unit shut down, a Full Pretrip Test with device amp checks will be performed. If the Pretrip Test is entered with the unit running in either diesel or electric mode, a Running Pretrip Test is performed. Test results are reported as PASS, CHECK, or FAIL when the Pretrip Test is completed.

Pretrip Test Conditions

- Current unit settings are saved and restored at the end of the Pretrip Test or if the unit is turned off and back on.
- All zones are forced on.

- A Pretrip Test can be run in either Diesel or Electric Mode.
- The unit will auto switch from Diesel Mode to Electric Mode or from Electric Mode to Diesel Mode during a Pretrip Test if these features are enabled and the auto switch conditions occur.

Conditions Where Pretrip Tests are Not Allowed

- If any Shutdown Alarms are present. Pretrip tests are allowed with some Check and Log Alarms.
- If the unit is in Sleep Mode.
- If the unit is in Service Test Mode, Interface Board Test Mode, or Evacuation Mode.

Pretrip Test Considerations

When performing a Pretrip Test, the following issues should be considered:

- If running a Pretrip Test on a trailer loaded with dry cargo, verify that proper airflow can occur around the load. If the load restricts airflow, false test results may occur. Also, these units have high refrigeration capacity which results in rapid temperature changes. Sensitive dry cargo may be damaged as a result.
- If running a Pretrip Test on a trailer that has just been washed down, the extremely high humidity inside the trailer may result in false test results.
- If running a Pretrip Test on a trailer loaded with sensitive cargo, monitor the load temperature during the test as normal temperature control is suspended during pre-trip operation.
- Always perform Pretrip Tests with the trailer cargo doors closed to prevent false test failures.

Pretrip Test Sequence

Pretrip tests proceed in the order shown below. A Full Pretrip Test includes all tests. A Running Pretrip Test is started with the engine or electric motor running and does not include the Amp Checks or Engine Start Check.

- **Amp Checks** - Each electrical control component is energized and the current drawn is confirmed as within specification.
- **Engine Start** - The Engine will start automatically.
- **Defrost** - If the coil temperature is below 45°F (7°C), a defrost cycle is initiated.
- **RPM Check** - The engine RPM in high and low speed is checked during the Cool Check.
- **Zone 1 Cool Check** - The ability of the zone to cool in low speed is checked.
- **Zone 1 Heat Check** - The ability of the zone to heat in low speed is checked.
- **Zone 1 Return to Cool Check** - The ability of the zone to return to cool mode is checked.
- **Zone 2 Cool Check** - The ability of the zone to cool in low speed is checked.
- **Zone 2 Heat Check** - The ability of the zone to heat in low speed is checked.
- **Zone 2 Return to Cool Check** - The ability of the zone to return to cool mode is checked.
- **Zone 3 Cool Check** - The ability of the zone to cool in low speed is checked.
- **Zone 3 Heat Check** - The ability of the zone to heat in low speed is checked.
- **Zone 3 Return to Cool Check** - The ability of the zone to return to cool mode is checked.
- **Report Test Results** - The test results are reported as PASS, CHECK, or FAIL when the Pretrip Test is completed. If test results are CHECK or FAIL, alarm codes will exist to direct the technician to the source of the problem.

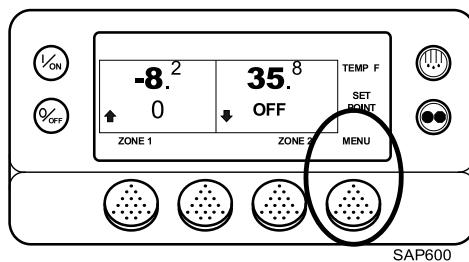
Performing a Pretrip Test

If a Pretrip Test is initiated with the engine shut down, a Full Pretrip Test will be performed. If a Pretrip Test is initiated with the engine or electric motor running, a Running Pretrip Test is performed.

- Before initiating a Pretrip Test, clear all alarm codes.
- To stop a Pretrip Test at any time, turn the unit off.

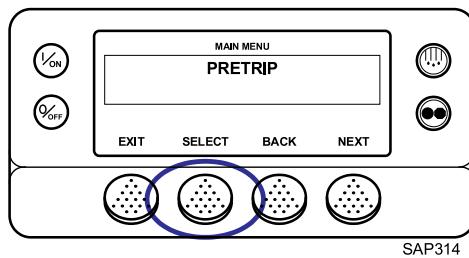
Pretrip Tests are initiated using the Pretrip Menu. From the Standard Display, press the MENU Key (Figure 154, p. 184).

Figure 154. Menu Key



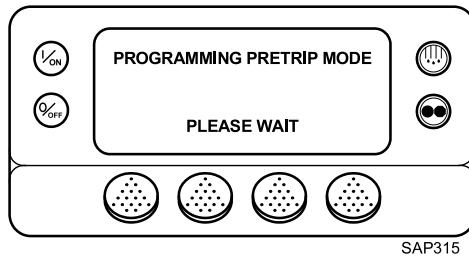
The Language Menu or Alarm Menu will appear. Press the NEXT Key as required to show the Pretrip Menu (Figure 155, p. 184). When the Pretrip Menu is shown, press the SELECT Key to start a Pretrip Test.

Figure 155. Pretrip Menu



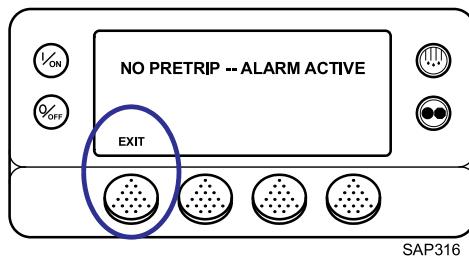
The display will briefly show PROGRAMMING PRETRIP MODE (Figure 156, p. 184). If the unit is not running, a Full Pretrip Test will be initiated. If the unit is running in either diesel or electric mode, a Running Pretrip will be performed.

Figure 156. Programming Pretrip Mode

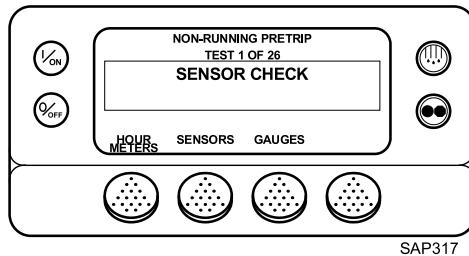


If all alarms were not cleared, a prompt appears as shown (Figure 157, p. 185). Exit the Pretrip Test, clear all alarms, and repeat the Pretrip Test.

Figure 157. Alarms Not Cleared



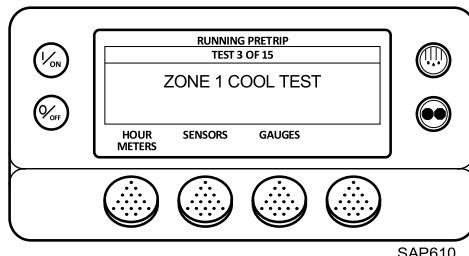
If all alarms were cleared, the Pretrip Test display appears (Figure 158, p. 185).

Figure 158. Pretrip Test


SAP317

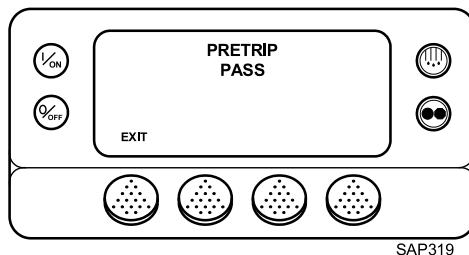
- The top line of the display indicates the unit is performing the non-running portion of the Pretrip Test.
- The second line measures test progress. The number of tests completed of the total number of tests to be performed is shown. In the example above, the unit is performing Test 1 of 26 Sensor Check.
- The soft keys may be used during the Pretrip Test to select the Hourmeter, Gauge, or Sensor Menus.
- To stop a Pretrip Test at any time, turn the unit off. This will generate Alarm Code 28 Pretrip Abort. Other alarm codes may also be generated. This is normal when the Pretrip Test is halted before completion.

When the non-running tests are complete, the unit will start automatically and continue with the Running Pretrip Test. In the example shown (Figure 159, p. 185), the unit is in the Running Pretrip and is performing Test 3 of 15 Zone 1 Cool Test.

Figure 159. Zone 1 Cool Test


SAP610

When all tests are complete, the results are reported as PASS, CHECK, or FAIL (Figure 160, p. 186). If the results are CHECK or FAIL, the accompanying alarm codes will direct the technician to the cause of the problem.

Figure 160. Pretrip Pass


SAP319

If the Pretrip Test results are CHECK or FAIL, the problem should be diagnosed and corrected before the unit is released for service.

Diesel/Electric Menu

The Diesel/Electric Standby selection from the Main Menu allows the operator to manually select diesel or electric mode operation. The unit can also be programmed to automatically select

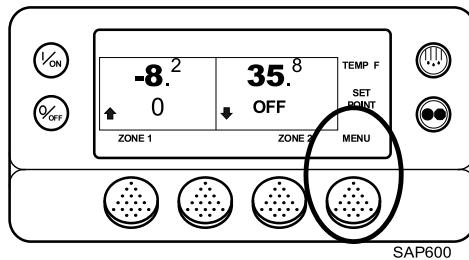
electric mode operation when standby power is available and to automatically select diesel mode operation if standby power fails or is removed. If the unit is programmed to switch automatically from diesel to electric and electric to diesel, these screens do not appear.

Switching from Diesel to Electric

If the unit is running in Diesel Mode and the Diesel to Electric Auto Switch Enabled feature in Guarded Access is set to YES, the unit will automatically switch to Electric Mode operation when standby power is connected and available. The screens shown below will not appear.

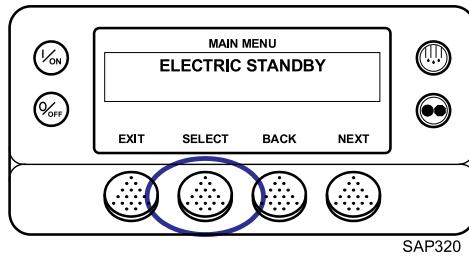
If the unit is running in Diesel Mode and the Diesel to Electric Auto Switch Enabled feature in Guarded Access is set to NO, the unit can be switched to Electric Mode using the Electric Standby selection from the Main Menu. From the Standard Display, press the MENU Key (Figure 161, p. 186).

Figure 161. Menu Key



The Language Menu or Alarm Menu will appear. Press the NEXT Key as required to show the Electric Standby selection. When the Electric Standby selection is shown (Figure 162, p. 186) press the SELECT Key.

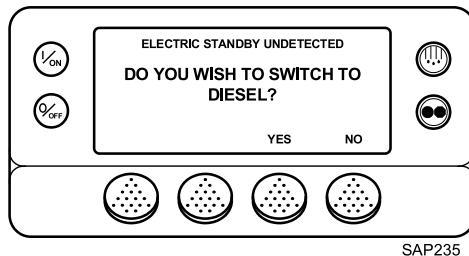
Figure 162. Electric Standby



If the unit has standby power available and is turned on, the electric standby run screen will appear. The new mode is then confirmed for 10 seconds. The unit will start and run in Electric Mode. If electric standby power is not available, the display will prompt for a return to Diesel Mode as shown (Figure 163, p. 187).

If the electric standby power source fails or is disconnected and manual switching to Diesel Mode is selected, the unit will prompt for a switch to Diesel Mode. Selecting YES will switch unit operation back to Diesel Mode. Pressing the NO Key will allow the unit to remain in Electric Mode even though standby power is not available. The unit will not run and Alarm Code 91 Check Electric Ready Input will be set as a Prevent Alarm.

Figure 163. Electric Standby Undetected



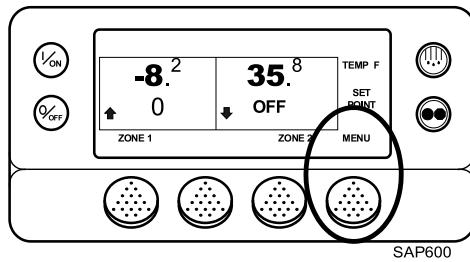
Switching from Electric to Diesel

If the unit is running in Electric Mode and the Electric to Diesel Auto Switch Enabled feature in Guarded Access is set to YES, the unit will automatically switch to Diesel Mode operation when standby power is no longer available. The screens shown below will not appear.

If the Diesel to Electric Auto Switch Enabled feature in Guarded Access is set to NO and standby power is disconnected or fails, the unit will not automatically switch to Diesel mode. This is primarily designed to prevent unauthorized diesel engine starts when the truck is indoors or on a ferry where engine operation is strictly prohibited.

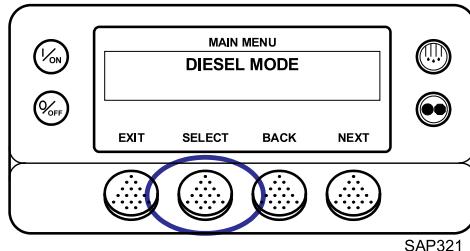
If the unit is running in Electric Mode and the Electric to Diesel Auto Switch Enabled feature in Guarded Access is set to NO, the unit can be switched to Diesel Mode using the Diesel selection from the Main Menu. From the Standard Display, press the MENU Key ([Figure 164, p. 187](#)).

Figure 164. Menu Key



The Language Menu or Alarm Menu will appear. Press the NEXT Key as required to show the Diesel Mode selection. When the Diesel Mode selection is shown press the SELECT Key ([Figure 165, p. 187](#)).

Figure 165. Diesel Mode



The new mode is confirmed for 10 seconds and the unit will return to Diesel Mode operation.

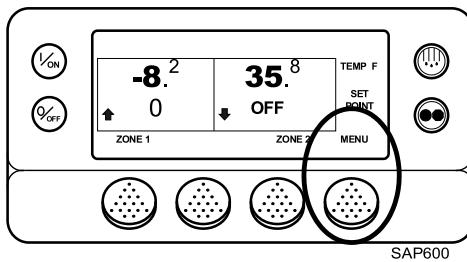
Adjust Brightness

The brightness of the HMI Control Panel display can be adjusted to allow for changing ambient light conditions. The choices available to the operator are HIGH, MEDIUM, LOW, and OFF. OFF actually results in a very dim screen suitable for low light conditions.

Important: Before replacing an HMI with no backlight, check the Adjust Backlight feature to verify the backlight is turned on.

Display brightness is adjusted using the Adjust Brightness Menu. From the Standard Display, press the MENU Key ([Figure 166, p. 188](#)).

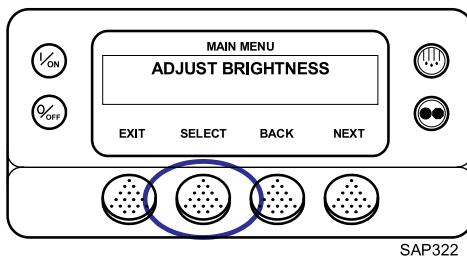
Figure 166. Menu Key



SAP600

The Language Menu or Alarm Menu will appear. Press the NEXT Key as required to show the Adjust Brightness Menu. When the Adjust Brightness Menu is shown press the SELECT Key (Figure 167, p. 188).

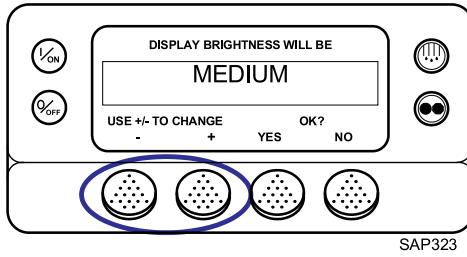
Figure 167. Adjust Brightness



SAP322

The Display Brightness Menu will appear as shown (Figure 168, p. 188). Press the + or – Keys to select the desired display brightness. When the desired brightness is shown press the YES Key to confirm the choice.

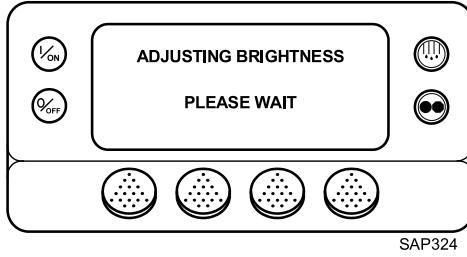
Figure 168. Display Brightness Menu



SAP323

The display (Figure 169, p. 189) will briefly show ADJUSTING BRIGHTNESS - PLEASE WAIT.

Figure 169. Adjusting Brightness

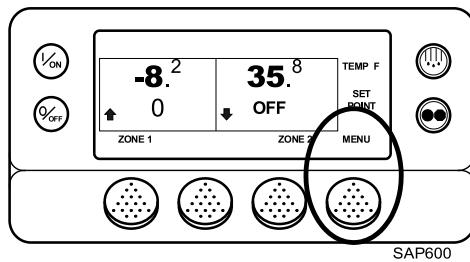


SAP324

Time

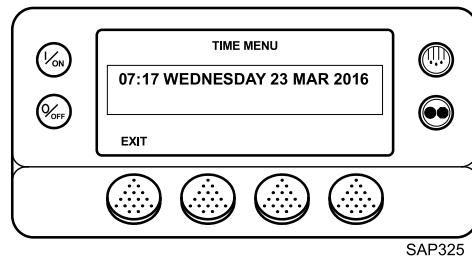
The Time and Date held by the Base Controller can be checked. Time and Date cannot be changed from the Main Menu. The time and date is accessed using the Main Menu. From the Standard Display, press the MENU Key (Figure 170, p. 189).

Figure 170. Menu Key



The Language Menu or Alarm Menu will appear. Press the NEXT Key as required to show the Time. When Time is shown press the SELECT Key. The current time and date will appear ([Figure 171, p. 189](#)).

Figure 171. Date and Time



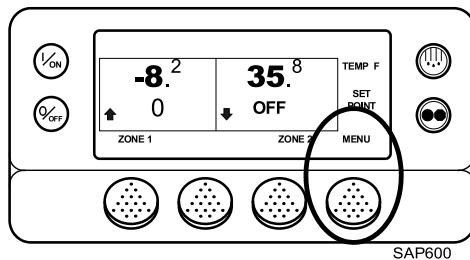
Using the Maintenance Menu

The Maintenance Menu contains features that allow the technician to view additional information, perform unit diagnostics using Service Test Mode and Interface Board Test Mode, and evacuate and charge the unit with refrigerant using Evacuation Mode. Software revisions can be checked and the time and date can be set.

Entering the Maintenance Menu

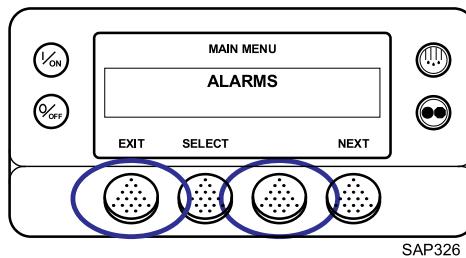
From the Standard Display, press the MENU Soft Key ([Figure 172, p. 190](#)).

Figure 172. Menu Key



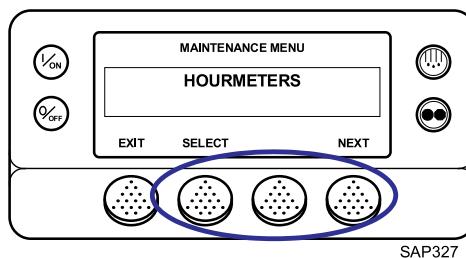
The Maintenance Menu is accessed from the first Main Menu screen that appears, either the Language Display or the Alarms Display. The Alarms Display is shown ([Figure 173, p. 190](#)). Press and hold both the unlabeled soft key and the Exit Key for five seconds.

Figure 173. Alarms Menu



The first Maintenance Menu feature will appear (Figure 174, p. 190). Press the NEXT and BACK Keys to scroll through the Maintenance Menu choices. When the desired choice is shown on the display, press the SELECT Key to access it.

Figure 174. Maintenance Menu



To return to the Standard Display press the EXIT Soft Key. The HMI Control Panel will automatically return to the Standard Display 30 seconds after the last key is pressed.

Maintenance Menu Choices

Hourmeters

The Hourmeters Menu allows the technician to view all the active unit hourmeters, even if the Main Menu view has been turned off. The Maintenance Menu Hourmeter Display also allows the technician to reset the time on hourmeters with a programmed time limit. Hourmeters can also be viewed from the Main Menu if enabled in Guarded Access. Refer to Using the Main Menu ("Hourmeters," p. 180) for detailed information.

Gauges

The Gauge Menu allows the technician to view the unit gauges. The Gauge Menu can also be accessed from the Standard Display and the Main Menu. Refer to ("Gauges," p. 174) for detailed information.

Sensors

The Sensors Menu allows the technician to view the unit temperature sensors. The Sensors Menu can also be accessed from the Standard Display and the Main Menu. Refer to ("Sensors," p. 175) for detailed information.

Alarms

The Alarms Menu allows the technician to view any active alarms, and also allows most alarms to be cleared. The Alarms Menu is also available from the Main Menu. Refer to Using the Main Menu ("Alarms," p. 169) for detailed information.

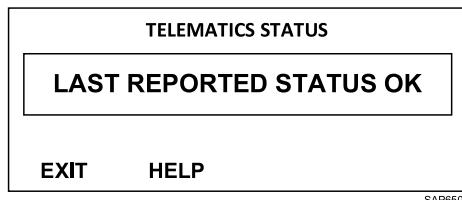
Telematics Status

Note: Only available with TK BlueBox installed.

Section 4 - Operation

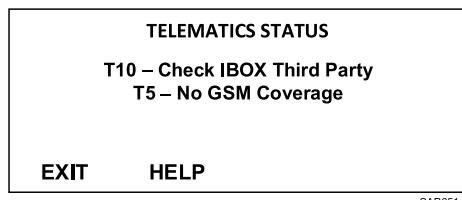
The Telematics Status Menu will appear in the Maintenance Menu if the Guarded Access > REB Type Configured is set to anything except NONE. Selecting it allows the user to check the status of the Telematics System. It will display descriptions of possible causes if it detects any problems. If no problems are detected, the screen shown below appears.

Figure 175. Status OK



If problems are detected, the screen shown below will display multiple descriptions. Press the HELP Key to display a help screen. Press the EXIT Key to return to the Maintenance Menu.

Figure 176. Status Descriptions



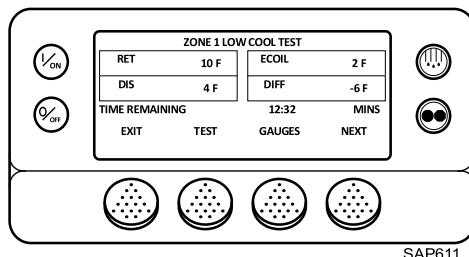
Service Test Mode

Service Test Mode allows the technician to force each zone to a known operating mode for diagnostic purposes. The unit can be either running or not running. The test will energize all control circuits required to operate the unit in the selected mode. If the unit is not running and a running test is selected, the unit will start after the test has been selected. If the unit is running and a running test is selected, the unit will shut down and restart in the selected mode. Each zone may be selected with a different operating mode to duplicate specific system operating conditions. For example: the unit may be configured to operate in cool/cool/cool, cool/heat/cool, cool/cool/defrost, etc.

Important: Service Test Mode is not allowed if any Shutdown Alarms exist or if the unit is in a Prevent Mode Shutdown Null (Alarm Code 84 is set). Clear all alarms before attempting to use Service Test Mode.

Choose Service Test by pressing the SELECT Key when SERVICE TEST is shown in the Maintenance Menu. Select Running or Non Running tests. The SERVICE TEST screen appears as shown (Figure 177, p. 192).

Figure 177. Service Test Display



The test shown is the Zone 1 Low Speed Cool test. Return, Discharge, and Evaporator Coil temperatures are shown. The Temperature Differential is also calculated and displayed.

- A test will remain active for 15 minutes. A countdown counter shows the time remaining for the test. If the test times out, it will terminate and the unit will be shut down (if running) and Alarm Code 54 Test Mode Timeout will be set.
- The GAUGES Key is used to scroll through the gauges.
- The TEST Key allows the various tests to be selected.
- The NEXT Key switches between zones to allow a different test mode to be selected for each zone.
- The EXIT Key terminates Service Test Mode and returns to the Maintenance Menu.

Not all tests are available on all units. Only tests used by the specific unit configuration will appear.

Table 4. Service Test Modes

| Zone 1 Null | Zone 2 Null | Zone 3 Null |
|------------------------|------------------------|------------------------|
| Zone 1 Low Speed Cool | Zone 2 Low Speed Cool | Zone 3 Low Speed Cool |
| Zone 1 High Speed Cool | Zone 2 High Speed Cool | Zone 3 High Speed Cool |
| Zone 1 Low Speed Heat | Zone 2 Low Speed Heat | Zone 3 Low Speed Heat |
| Zone 1 High Speed Heat | Zone 2 High Speed Heat | Zone 3 High Speed Heat |
| Zone 1 Defrost | Zone 2 Defrost | Zone 3 Defrost |
| Zone 1 Minimal Heat | Zone 2 Minimal Heat | Zone 3 Minimal Heat |

Service Test Mode Summary

Note: Refer to (Table 5, p. 193) for additional details.

- Service Test Mode operation is forced operation to allow system diagnosis to proceed under known conditions. All protection controls are active during Service Test Mode operation to prevent unit damage. All other controls (such as programmable features) are disabled when Service Test Mode is active.
- When a zone is cooling, the Liquid Line Solenoid (LLS) is energized (open), the Hot Gas Solenoid (HGS) is de-energized (closed), and the Suction Line Solenoid (SLS) is de-energized (open).
- When any zone is heating or defrosting, the Condenser Inlet Solenoid (CIS), Purge Valve (PV), and Receiver Tank Pressure Solenoid (RTPS) in the host unit may be energized. This depends on unit operating conditions as sensed by the Base Controller.
- When a zone is heating with no other zone cooling or defrosting, the Liquid Line Solenoid (LLS) is energized (open), the Hot Gas Solenoid (HGS) is energized (open), and the Suction Line Solenoid (SLS) is de-energized (open). If a defrost test is being performed in a host zone, the defrost damper will be energized (closed). If a defrost test is being performed in a remote zone, the evaporator fan motors will be de-energized.
- When a zone is in heat while another zone is in cool (reverse cycle heat), the Liquid Line Solenoid (LLS) for that zone is energized (open), the Hot Gas Solenoid (HGS) is energized (open), and the Suction Line Solenoid (SLS) is energized (closed).
- When a zone is in Null, the Liquid Line Solenoid (LLS) is de-energized (closed), the Hot Gas Solenoid (HGS) is de-energized (closed), and the Suction Line Solenoid (SLS) is de-energized (open). If the test is being performed in a host zone, the defrost damper will be closed. If the test is being performed in a remote zone, the evaporator fan motors will be de-energized.

Table 5. Service Test Mode Output States

| | Null | Low Speed Cool | High Speed Cool | Low Speed Heat | High Speed Heat | Defrost | Single Zone Heat |
|--------------------------------------|---|----------------|-----------------|--------------------------|--------------------------|--------------------------|------------------|
| UNIT DEVICES | | | | | | | |
| Condenser Inlet Solenoid (CIS) | | | | On or Off (Note 1) | On or Off (Note 1) | On or Off (Note 1) | |
| Receiver Tank Press Sol (RTPS) | | | | On or Off (Note 1) | On or Off (Note 1) | On or Off (Note 1) | |
| Purge Valve (PV) | | | | On or Off (Note 1) | On or Off (Note 1) | On or Off (Note 1) | |
| High Speed Solenoid (HS) | | | On | | On | | |
| Damper Solenoid (DS) (Note 2) | | | | | | On | |
| ZONE DEVICES | | | | | | | |
| Liquid Line Solenoid (LLS) | | On | On | On | On | On | On (Note 4) |
| Hot Gas Solenoid (HGS) | | | | On | On | On | On (Note 4) |
| Suction Line Solenoid (SLS) (Note 5) | | | | On if other zone in cool | On if other zone in cool | On if other zone in cool | |
| Fan Motors | Note 3 | On | On | On | On | | On (Note 4) |
| Drain Hose Heaters | | | | | | On | |
| Notes: | 1. These devices operate as required depending on system pressures and ambient temperature. 2. Damper solenoid on host unit and Zone 2 if unit is a DE. 3. Fan motors operate in Running Null. 4. Minimal Heat is allowed only if all other zones are in Null or Off. 5. Suction Line Solenoid is On only if another zone is cooling (Reverse Cycle operation). | | | | | | |

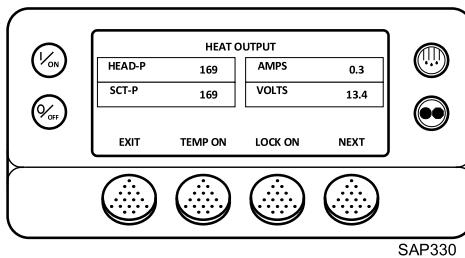
Interface Board Test

Interface Board Test Mode allows the technician to energize and de-energize individual control devices for diagnostic purposes. The unit cannot be running to use this test. If the test is entered with the unit running, the unit will shut down.

Important: Interface Board Test Mode is not allowed if any shutdown alarms exist or if the unit is in a Prevent Mode Shutdown Null (Alarm Code 84 is set). Clear all alarms before using Interface Board Test Mode.

Choose Interface Board Test by pressing the SELECT Key when INTERFACE BOARD TEST is shown in the Maintenance Menu. The Interface Board Test screen appears as shown (Figure 178, p. 194).

Figure 178. Interface Board Test



The test shown is the Heat Output Test. Discharge Pressure, Suction Pressure, Amps, and Volts are shown.

- The TEMP ON Key is used to momentarily energize the device.
- The LOCK ON Key energizes the device for 15 minutes. A countdown counter shows the time remaining for the test. If the test times out Alarm Code 54 Test Mode Timeout is set. Not all devices can be locked on.
- The UNLOCK Key unlocks the display and returns to the Interface Board Test.
- The EXIT Key returns to the Maintenance Menu.

Not all tests are available on all units. Only tests used by the specific unit will appear.

Interface Board Test Modes and Current Draw

Note: Device current will vary dependant on battery voltage and battery condition.

| Interface Board Test | Approximate Device Current Draw | Comments |
|------------------------------|---------------------------------|---|
| Preheat Relay | 65 - 80 Amps | Temporary On only |
| Buzzer | Negligible | Temporary On only |
| Run Relay | 0.5 - 1.0 Amps | |
| Alternator Excite Output | 0.1 - 0.7 Amps | |
| Damper Relay | 5.7 Amps | |
| Indicator Light | 0.1 Amps | |
| Alarm Light | 0.1 Amps | |
| Diesel/Electric Relay | 0.5 Amps | Not available if ER is high |
| Electric Heat | 0.1 Amps | |
| High Speed Relay | 4.0 Amps | |
| Condenser Inlet Solenoid | 1.3 - 1.6 Amps | |
| Receiver Tank Solenoid | 0.7 - 0.8 Amps | |
| Purge Valve | 0.7 - 0.8 Amps | |
| Zone 1 Liquid Line Solenoid | 2.3 Amps | |
| Zone 1 Hot Gas Solenoid | 1.5 Amps | |
| Zone 1 Suction Line Solenoid | 1.5 - 1.7 Amps | |
| Fan Motor Zone 2 Output | 8.0 Amps (Per Motor) | Depends on unit configuration |
| Zone 2 Liquid Line Solenoid | 1.3 Amps | Current doubles if Parallel Evaporators |
| Zone 2 Hot Gas Solenoid | 1.5 Amps | Current doubles if Parallel Evaporators |
| Zone 2 Suction Line Solenoid | 1.3 Amps | Current doubles if Parallel Evaporators |

| Interface Board Test | Approximate Device Current Draw | Comments |
|------------------------------|---------------------------------|---|
| Drain Hose Heater Zone 2 | 2.0 Amps (Each) | Current doubles if Parallel Evaporators |
| Fan Motor Zone 3 Output | 8.0 Amps (Per Motor) | Depends on unit configuration |
| Zone 3 Liquid Line Solenoid | 1.3 Amps | Current doubles if Parallel Evaporators |
| Zone 3 Hot Gas Solenoid | 1.5 Amps | Current doubles if Parallel Evaporators |
| Zone 3 Suction Line Solenoid | 1.3 Amps | Current doubles if Parallel Evaporators |
| Drain Hose Heater Zone 3 | 2.0 Amps (Each) | Current doubles if Parallel Evaporators |

Display Self Test

The Display Self Test allows the technician to perform a number of self tests on the unit HMI Control Panel. The tests available are shown below.

Choose Display Self Test by pressing the SELECT Soft Key when DISPLAY SELF TEST is chosen in the Maintenance Menu. The Display Self Test screen appears. Select a test from the Display Self Test Menu.

Available Tests:

- LCD Test - This test allows the technician to select a normal or inverted display. If inverted is chosen the display is reversed – segments that were turned on are now turned off and segments that were turned off are now turned on. The technician visually verifies that all display segments are functioning properly.
- Keypad Test - This test prompts the technician to press the four soft keys, the Defrost Key and the Cycle Sentry Key. Each time the requested key is pressed the next prompt is displayed, allowing the technician to verify proper operation of these keys.
- Backlight Test - This test allows the technician to turn the backlight on and off to confirm operation.
- Brightness Test - This test allows the technician to select Low, Medium or High backlight intensity.
- Buzzer Test - This test allows the technician to turn the HMI buzzer on and off to verify operation.
- Heater Output - This test allows the technician to turn the HMI display heater on and off.
- Serial E2 - This test allows the technician to perform an internal HMI memory test. The test takes less than one second and the results are reported as PASS or FAIL.
- Data Log Flash - This test allows the technician to perform an internal HMI CargoWatch data logger memory test. The test takes less than one second and the results are reported as PASS or FAIL.
- RTC Update - This test allows the technician to perform an internal HMI real time clock test. The test takes less than three seconds and the results are reported as PASS or FAIL.

Evacuation Test

This menu allows the technician to open all normally closed refrigeration system valves to evacuate and charge the unit with refrigerant. If the battery voltage falls below 13.0 Vdc the technician is prompted to connect a battery charger to maintain sufficient voltage to hold all valves open.

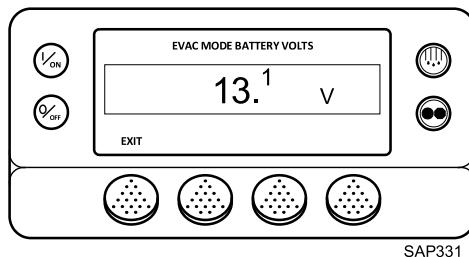
Important: *Evacuation mode has no time-out. The unit will remain in Evacuation Mode indefinitely unless the battery voltage becomes excessive.*

All selectable unit features will be disabled when in evacuation mode. Auto switch from diesel to electric or from electric to diesel is allowed, but unit will not start.

- **Evacuation mode is not allowed if:**
 - Any shutdown alarms are present.
 - The unit is in restart null.

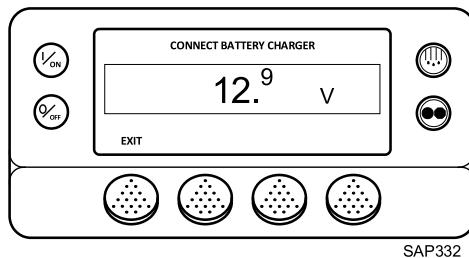
- The unit is in a start sequence.
- **When in evacuation mode:**
 - If the unit is running it will shut down automatically when entering Evacuation Mode.
 - Alarm Code 86 Check Discharge Pressure Sensor is disabled.
 - Alarm Code 87 Check Suction Pressure Sensor is disabled.
 - Door switch operation is disabled.

Choose Evacuation Test by pressing the SELECT Soft Key when EVACUATION TEST is shown by the Maintenance Menu. The Evacuation Test display shown below will appear and remain on the display so long as the battery voltage does not fall below 13.0 Vdc. All normally closed refrigerant valves are energized to the open position to allow system evacuation to effectively remove air and moisture from the refrigeration system.



SAP331

If the battery voltage falls below 13.0 Vdc, the technician is prompted to install a battery charger to guarantee sufficient voltage to keep all valves open during the evacuation process.



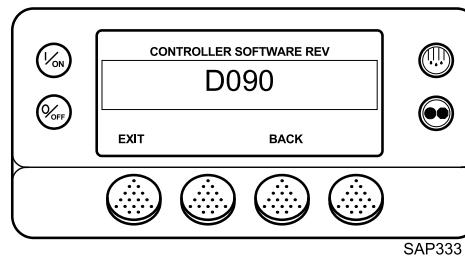
SAP332

If the voltage from the battery charger rises above 16 Vdc, the controller will be turned off to prevent damage to the electronics and/or system components. To exit Evacuation Mode, press the EXIT Soft Key or turn the unit off.

Software Revision

This menu allows the technician to view the current installed software revision for the HMI Control Panel and the Base Controller.

Choose Software Revision by pressing the SELECT Soft Key when SOFTWARE REVISION is shown by the Maintenance Menu. The Software Revision display appears as shown below.



SAP333

The NEXT and BACK Soft Keys allow the technician to scroll through the software revisions. Software revisions appear in the order shown below:

- Display Software Revision

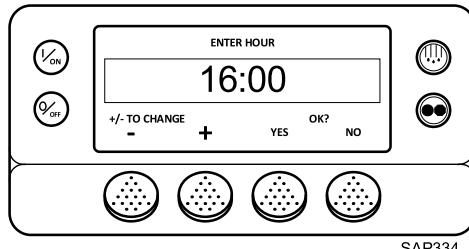
- Controller Software Revision
- Supervisor Software Revision (Determined by HMI Control Panel software revision)

The WinTrac™ Service Tool is used to flash software updates to the HMI Control Panel and Base Controller.

Set Time and Date

This menu allows the technician to view and change the HMI Control Panel clock/calendar.

Choose Set Time and Date by pressing the SELECT Soft Key when SET TIME AND DATE is shown by the Maintenance Menu. The Set Time and Date display appears as shown.



The - and + Soft Keys are used to change the hour as required. Pressing the YES Soft Key changes the hour to the selected time and then shows the next Time/Date screen. The screens appear in the order shown below:

- Hour
- Minute
- Date (Day)
- Month
- Year

Using the Guarded Access Menu

The Guarded Access Menu contains menus that allow the technician to check and change the unit's programmable features. These features are detailed in Section 3 of this manual. Service Procedure A02A explains how to display and record the Guarded Access programmable feature settings. Service Procedure A04A explains how to set the Guarded Access programmable features.

The Guarded Access programmable features can also be changed using the WinTrac™ Service Tool. Once created, the Unit Setup file can be transferred to a USB Flash Drive to send the file to the unit. For more information, refer to the WinTrac Service Tool help file.

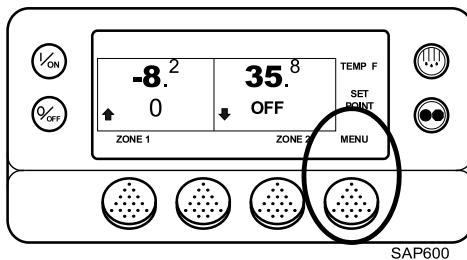
Important: *The Guarded Access Menu is entered from the last feature of the Maintenance Menu.*

The unit must not be running in order to enter the Guarded Access Menu. If the unit is running, entering Interface Board Test Mode from the Maintenance Menu will shut the unit down. Press the EXIT Key to return to the Maintenance Menu and continue scrolling to the end of the Maintenance Menu to enter the Guarded Access Menu.

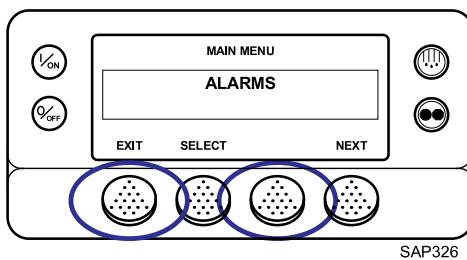
Entering the Guarded Access Menu

From the Standard Display, press the MENU Key.

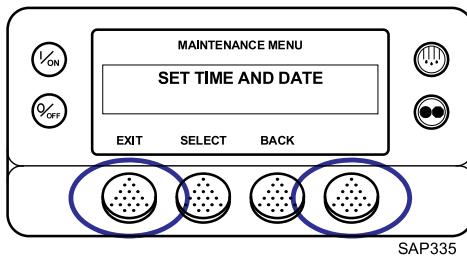
Figure 179. Menu Key



The Maintenance Menu is accessed from the first Main Menu screen that appears, either the Flash Drive Display, Language Display, or the Alarms Display. The Alarms Display is shown. Press and hold both the unlabeled soft key and the Exit Key for five seconds.

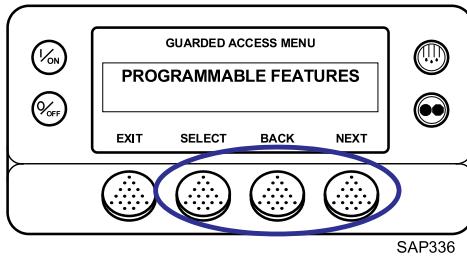


The Maintenance Menu will appear. Press the NEXT Key to scroll to Set Time and Date selection at the end of the Maintenance Menu choices. Press and hold both the unlabeled soft key and the Exit Key for five seconds.



Important: If a Security Code has been set, the correct code must be entered here to gain access to the Guarded Access Menu. If an Access Code is requested and the code is not known, enter 4444.

If an Access Code is not enabled or when the correct security code is entered (4444 always works), the first Guarded Access Menu feature will appear. Press the NEXT and BACK Keys to scroll through the Guarded Access Menu choices. When the desired choice is shown on the display, press the SELECT Key to access it.





Section 4 - Operation

Important: If Unit Type in the Guarded Access > Unit Configuration Menu is changed from trailer to truck or truck to trailer, it is necessary to exit the Guarded Access Menu after making the change. This will reset the software to the new setting. Failure to do so will cause the wrong selections to be present in other Guarded Access Menu settings. For example, if the feature was set TRAILER and changed to TRUCK, the reset changes the trailer settings to truck settings. Failure to do so would result in trailer feature settings being shown, even though the Unit Type had been changed to truck.

After the unit is reset, the Guarded Access Menu should be re-entered to complete other required feature changes.

The Unit Type default setting is (Trailer).

Note: A warm restart is performed when the Guarded Access Menu is exited. The unit is reconfigured so that any changes that were made from the Guarded Access Menu take effect.

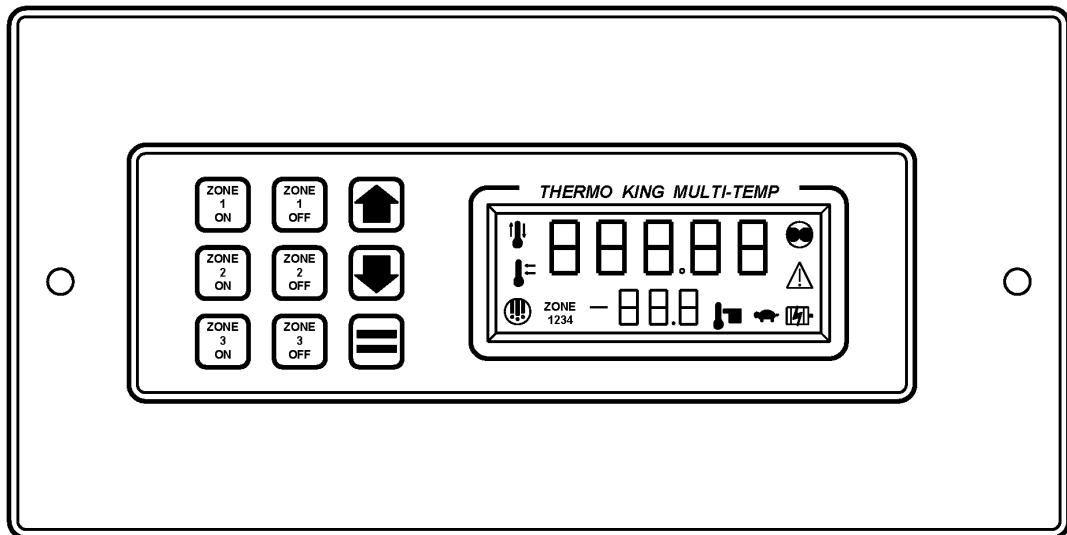
To return to the Standard Display, press the EXIT Key.

Rear Remote Control Panel (Optional)

The optional flush mount remote control panel is connected to the control system and is used to operate the unit from a remote location, typically the rear of the trailer. All remote control panels feature three zones. The third zone is not used on two zone applications.

When turned on, either the Standard Display for each installed zone or [STAnd by] will appear on the display. The zone being shown is identified by the zone icon.

Figure 180. Rear Remote Control Panel



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Important: The SR-2/SR-3 SPECTRUM remote control panel is capable of turning the control system on from a powered down condition. It is not necessary to turn the control system on using the unit HMI Control Panel before the remote control panel will operate.

Important: There are two versions of the flush mount rear remote control panel available. They can be identified by the color of the wide border around the actual control panel. SR-2/SR-3 SPECTRUM flush mount rear remote control panels have a blue border. up-IV Multi-Temp flush mount rear remote control panels have a black border. These versions are not interchangeable.

Remote Control Panel Functions

The remote control panel functions that are available are determined by the setting of the Rear Remote Control Action feature in the Guarded Access Unit Configuration menu. The Rear Remote Control Action feature will not appear and the remote control panel will not operate unless the Rear Remote Control feature is set for COM 2. Refer to Unit Configuration in Section 3 for details of these features.

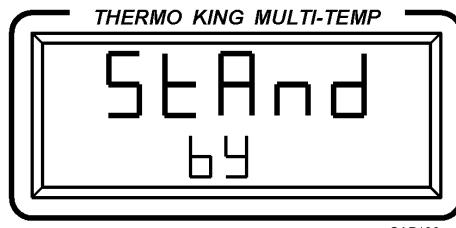
Stand By

If the Rear Remote Control Action feature is set for STAND BY, the following functions are available from the remote control panel:

- When powered up, the unit will not start and run. The unit must be started from the HMI Control Panel on the unit. The control system can only be powered up to change the setpoint (s).
- The control system can be powered up to change setpoints by pressing the ZONE 1 ON Key. If the control system is powered up from the rear control panel, both the rear control panel and the unit HMI control panel will display a stand by message as shown below.
- The setpoints can be changed in all installed zones.
- The installed zones can not be turned on or off.

Section 4 - Operation

- The control system can be powered down by pressing the ZONE 1 OFF Key.
- The unit can be started and run by pressing the unit HMI control panel ON Key.



Rear Remote Control Panel



Unit HMI Control Panel

Run All Zones

If the Rear Remote Control Action feature is set for RUN ALL ZONES, the following functions are available from the remote control panel:

- When powered up, the unit will start and run Zone 1 and all installed zones.
- The unit and Zone 1 can be powered up and will start and run by pressing the ZONE 1 ON Key. All installed zones will be turned on, even if they were previously turned off.
- The setpoints can be changed in all installed zones.
- The installed zones can be turned on or off.
- The unit can be powered down by pressing the ZONE 1 OFF Key.

Run Last Config

If the Rear Remote Control Action feature is set for RUN LAST CONFIG, the following functions are available from the remote control panel:

- When powered up, the unit will start and run Zone 1 and all installed zones that were turned on when the unit was last powered down. Zones that were turned off when the unit was last powered down will remain off.
- The unit and Zone 1 can be powered up and will start and run by pressing the ZONE 1 ON Key. All installed zones will be turned on if they were previously on, and remain off if they were previously off.
- The setpoints can be changed in all installed zones.
- The installed zones can be turned on or off.
- The unit can be powered down by pressing the ZONE 1 OFF Key.

Keypad

The nine touch sensitive keys are used to turn the unit and all installed zones on and off. They also allow the setpoint to be changed in all installed zones.



ZONE 1 ON KEY

Turns the unit on. Also turns Zone 1 on unless Rear Remote Control Action is set for STAND BY. It is not necessary to turn the host unit on for the remote control panel to operate.



ZONE 1 OFF KEY

Turns the unit off. Also turns Zone 1 off.



ZONE 2 ON KEY

Turns Zone 2 on unless Rear Remote Control Action is set for STAND BY.


ZONE 2 OFF KEY

Turns Zone 2 off.


ZONE 3 ON KEY

Turns Zone 3 on (if installed) unless Rear Remote Control Action is set for STAND BY.


ZONE 3 OFF KEY

Turns Zone 3 off (if installed).


UP ARROW KEY

Increases setpoint for the selected zone.


DOWN ARROW KEY

Decreases setpoint for the selected zone.


ENTER KEY

Loads the new setpoint for the selected zone.

Display

The display normally shows the Standard Display of return air temperature, setpoint, and zone. If a zone is turned on, the operating mode is also shown. If a zone is turned off, the display will show the return air temperature and OFF. The display shown ([Figure 180, p. 201](#)) here has all possible segments illuminated. The display icons are defined below.


Cool Icon

This icon appears when the unit is cooling.


Heat Icon

This icon appears when the unit is heating.


Modulation Icon

This icon appears when the unit is in modulation.


Defrost Icon

This icon appears when the unit is defrosting.


Cycle Sentry Icon

This icon appears when the unit is operating in Cycle Sentry mode.


Alarm Icon

This icon appears when an alarm condition has been detected.


Electric Standby Icon

This icon appears when the unit is operating in the optional electric standby mode.


Setpoint Icon

This icon appears when the setpoint is being shown in the display.


Not Used

This icon appears during a remote control panel test but is not currently used.

**ZONE
1234**
Zone Icon

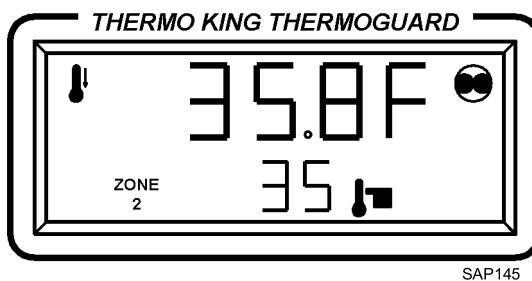
This icon indicates which zone is currently being shown on the display.

Reading a Typical Remote Standard Display

The Remote Standard Display for each installed zone will appear on the display for 10 seconds, then the next installed zone will appear. Only installed zones will appear. The Remote Standard Display shows the following information:

- Zone 2 is being shown in the display.
- Zone 2 is cooling.
- The unit is operating in Cycle Sentry Mode.
- The Zone 2 return air temperature is 35.8°F and the Zone 2 setpoint is 35°F.

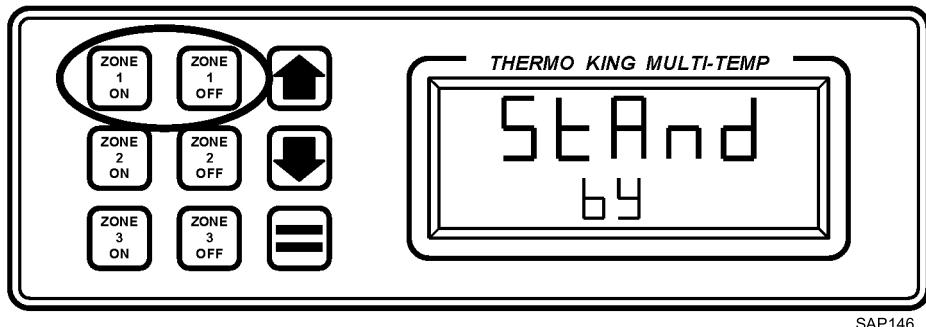
Figure 181. Remote Standard Display



SAP145

Turning the Unit and Zone 1 On or Off (Configured for STAND BY)

The control system is turned on by pressing the ON Key and off by pressing the OFF Key. When the ON Key is pressed, the remote display briefly shows all segments and STAnd by as shown. A stand by message will also appear on the unit HMI control panel display. All setpoints can be changed, but the unit will not start and run. The unit can be started and run by pressing the unit HMI control panel ON Key.

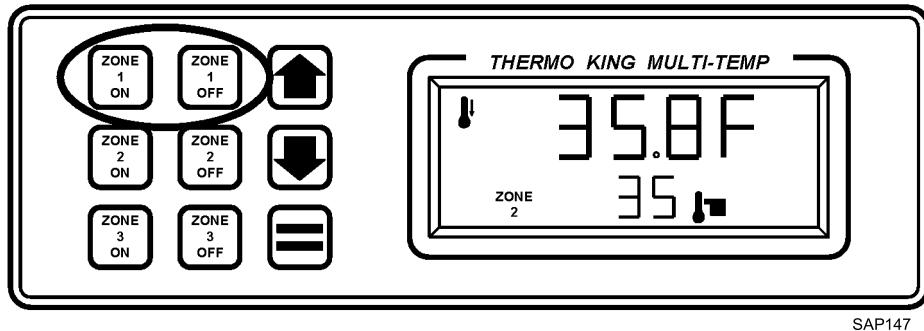


SAP146

Turning the Unit and Zone 1 On or Off (Configured for RUN ALL ZONES or RUN LAST CONFIG)

The unit and Zone 1 are turned on by pressing the ON Key and off by pressing the OFF Key. When the ON Key is pressed, the remote display briefly shows all segments and COn Flg as the

control system initializes. The Remote Standard Display will appear as shown. The unit will start and run if necessary.



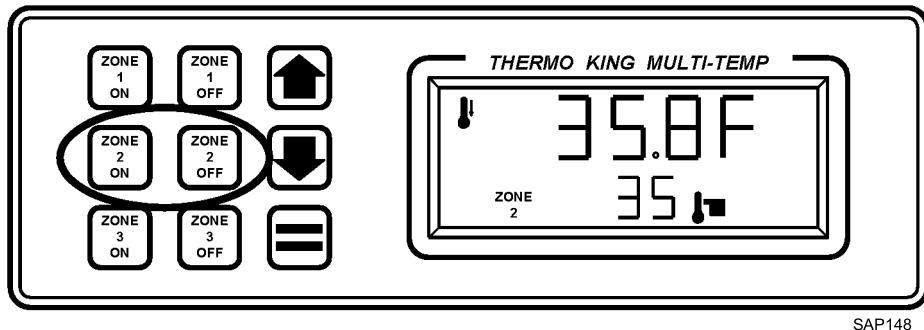
SAP147

Turning Remote Zones On and Off (Configured for STAND BY only)

The remote zones cannot be turned on and off - only the setpoints can be changed.

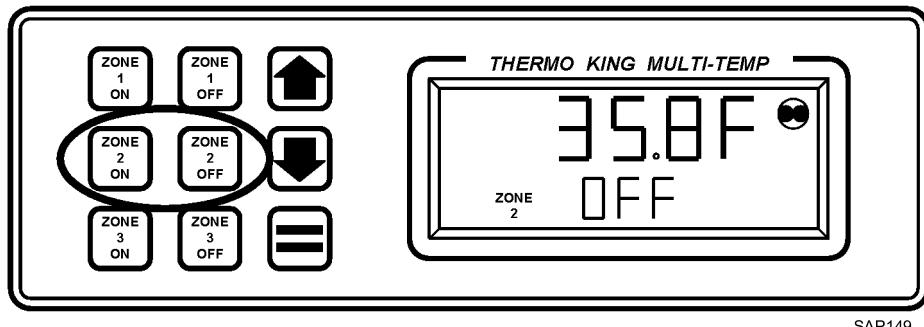
Turning Remote Zones On and Off (Configured for RUN ALL ZONES or RUN LAST CONFIG only)

Zone 2 and Zone 3 (if installed) are turned on by pressing the ON Key and off by pressing the OFF Key for the appropriate zone. When a zone is turned on, the return air temperature and setpoint is shown on the remote standard display for that zone. Zone 2 is shown turned on.



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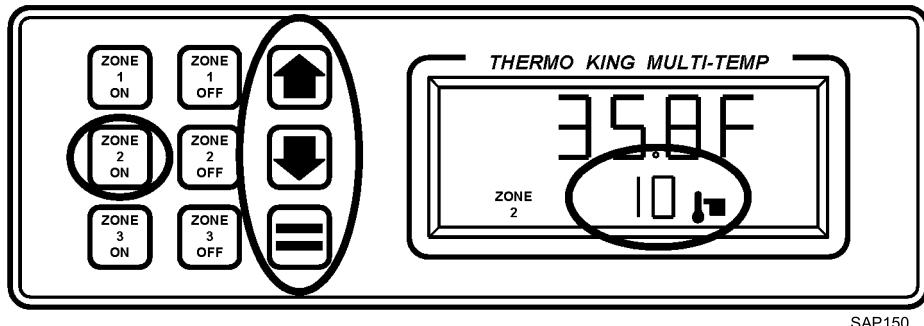
When a zone is turned off, the return air temperature and OFF is shown on the remote standard display for that zone. Zone 2 is shown turned off.



SAP149

Changing a Zone Setpoint

A zone must be currently shown on the display in order to change the zone setpoint.

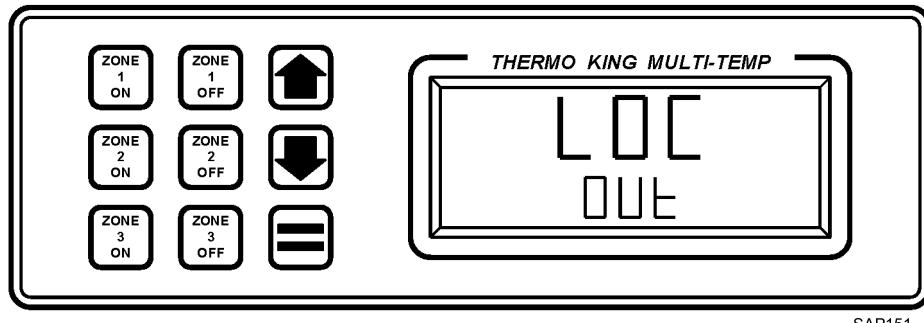


SAP150

1. Press the ON Key for the desired zone or wait until the desired zone is shown on the display. Pressing the ON Key will immediately display that zone. If the Rear Remote Control Action feature is set for RUN ALL ZONES or RUN LAST CONFIG, pressing the ON Key will also turn the zone on if it was not already on.
2. Immediately press the Up or Down Arrow Keys to select the desired setpoint for the selected zone.
3. When the desired setpoint for the selected zone is shown on the display, immediately press the Enter Key to load the new setpoint into the microprocessor. The display will briefly show [Lod] and then the new setpoint will reappear in the display.
***Important:** The Enter Key must be pressed or the setpoint will not be changed. The display will return to the Standard Display and the setpoint will return to the old setpoint in about 10 seconds if the Enter Key is not pressed.*
4. Confirm that the correct setpoint is set for each zone.

Remote Control Panel Lockout

During some control system functions such as Pretrip Tests, Service Test Mode, Output Test Mode, and while setting programmable features, the remote control panel may be locked out. If this is the case, the display shown will appear. The display will return to normal function when allowed by the control system.



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Section 5 - Diagnostics

SR-2/SR-3 Diagnostics

This section is devoted to diagnostic routines designed to help the technician quickly identify the cause of a problem and repair it using the correct tools, information, and procedures. It is important that the required procedures be followed exactly. Failure to do so may result in an incomplete repair.

The following hints will prove helpful:

- Download the ServiceWatch™ Data Logger using the WinTrac™ Service Tool. Review the data to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is set and cleared. This data can be very helpful in determining the cause of the alarm.
- Operators should record all alarm codes in sequence for reference. Alarm codes are displayed in order of occurrence, with the most recent alarm code displayed last.
- Every effort should be made to perform a Pretrip Test on a suspect unit. In almost all cases, the Pretrip Test will result in one or more alarm codes that will lead you directly to the problem.
- Clear all alarm codes before starting a Pretrip Test.
- If multiple alarm codes are present, diagnose and repair alarm codes caused by faulty components or control circuits first and repeat the full Pretrip Test. Diagnosing and repairing component or control circuit based alarms will often correct unit operation alarms such as reduced refrigeration capacity.
- Use Interface Board Test and Service Test Mode as appropriate to verify unit operation.
- Verify all connectors at the Base Controller, HMI Control Panel, and Expansion Module (if multi-temp unit) are properly seated.
- Verify all outboard harness connectors are properly seated.
- Verify all programmable features are set to the customer's specifications before releasing the unit for service.

Each alarm code presented in this section will have information that will assist the technician in the diagnostic procedure. Not all alarm codes will have all of the sub-topics listed below.

- Alarm Types: This topic will list the specific alarm type for the alarm code.
- Associated Alarm Codes: This topic will list any associated alarm codes that may appear and may be related to the alarm code or even another alarm code. For example, an Alarm Code 18 for engine overheat will often times have an Alarm Code 42 set at the same time indicating that the unit was forced to low speed. Another example would be that a unit shut down on an Alarm Code 10 for high discharge pressure. When the unit shut down it would also have set an Alarm Code 84 indicating that the unit will restart in a set period of time.

Note: *Not all associated alarm codes may be listed.*

- Component Description and Location: This topic will briefly describe the related component(s) and location(s).
- Circuit Description: This topic will briefly describe the circuit(s) involved.
- Considerations: This topic will give additional information that the technician may find useful.
- How Alarm is Set: This topic briefly describes how the alarm is set.
- How Alarm is Cleared: This topic briefly describes how the alarm is cleared.
- Diagnostic Procedure: This topic will list the specific diagnostic procedures to be followed by the technician.

Electrostatic Discharge

The following electrostatic precautions must be taken:

- Keep all Base Controllers, HMI Control Panels, and Expansion Modules (if multi-temp unit) in anti-static bags at all times.
- When working with electrical circuits that contain microprocessors, always wear an ESD wrist strap and connect the opposite end to the chassis ground or CH terminal. This precaution will prevent electrostatic discharge from damaging circuits.

Physical Protection

Protect any defective Base Controller, HMI Control Panel, or Expansion Module (if multi-temp unit) from physical damage by placing them in the shipping carton supplied with the replacement. They will be returned for failure analysis and possible remanufacture.

Corrective Actions As A Result Of Alarm Codes

Every effort should be made to perform a Pretrip Test on a unit suspected of having a defect. In almost all cases, the Pretrip Test will result in one or more alarm codes that will lead you directly to the problem.

Download the ServiceWatch Data Logger using the WinTrac™ Service Tool. Review the data to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is set and cleared. This data can be very helpful in determining the cause of the alarm.

Alarm Types

There are four types of alarms.

Log Alarms

Log Alarms are indicated for 30 seconds each time the unit is turned on. This level of alarm serves as a notice to take corrective action before a problem becomes severe. Maintenance items such as maintenance hourmeter time-outs are Log Alarms. The TemperatureWatch™ screen is not disabled if only Log Alarm(s) are active.

When the unit is turned on, the display will show the Thermo King Logo and then the "Configuring System" message. If Log Alarm(s) are present, the Log Alarm notice will appear on the display for 30 seconds. The remote indicator alarm light (if installed) will also be on during this period. After 30 seconds, the Standard Display will appear and the remote indicator alarm light will go off.

Note: The Alarm Icon does not appear on startup with Log Alarms present.

Check Alarms

Check Alarms are indicated by a steady alarm indication at the top of the display and the message "Service Required within 24 Hours". The Alarm Icon will appear. This level of alarm serves as a notice to take corrective action before a problem becomes severe. The unit will run with Check Alarms but some features and functions may be inhibited. The TemperatureWatch screen is disabled if a Check Alarm is active.

Unit Level Prevent Alarms

Prevent Alarms are indicated by a steady alarm indication.

- The alarm icon will appear.
- If installed, the optional remote indicator light will indicate an alarm condition exists.
- The unit may be temporarily shut down if a Prevent Alarm is active. The unit will remain shut down for a timed restart interval or until the fault conditions are corrected and then restart if necessary.
- If the unit is in a temporary shutdown, Alarm Code 84 will be present along with the associated Prevent Alarm.

- In some cases, the unit will restart with reduced performance to determine if continued operation is possible.
- If the unit is operating with reduced performance, Alarm Code 85 may also be present.

If the alarm does not reoccur with reduced performance, the unit will return to full performance. In general, if the alarm condition occurs a specified number of times in a specified time interval, the alarm is set as a Shutdown Alarm and no further restarts are possible.

Note: If the Restart After Shutdown feature in the Guarded Access Menu is set for CONTINUOUS, an unlimited number of restart attempts are allowed.

Zone Specific Prevent Alarms

A zone specific Prevent Alarm will force the affected zone into a temporary shutdown, but allow the unit to continue to run as required by the host unit or other zones.

- A small alarm icon will appear next to the affected zone.
- If installed, the optional remote indicator light will indicate an alarm condition exists.
- If zone specific Prevent Alarms occur in all zones, the unit will be forced into a unit level prevent shut down.
- The TemperatureWatch screen is disabled any time a zone specific Prevent Alarm is active.

Unit Level Shutdown Alarms

Shutdown Alarms are indicated by all of the following:

- The unit will be shut down.
- The alarm icon will appear.
- The display and backlight will flash on and off.
- The display will switch from normal to inverted and back (light areas become dark and dark areas become light.)
- If installed, the optional remote indicator light will indicate an alarm condition exists.

Unit level Shutdown Alarms will force the unit into shutdown. The unit will remain in shutdown until the Shutdown Alarm is manually cleared. Exceptions are some engine and electric Shutdown Alarms that become Log Alarms when switched to the alternate operating mode (diesel to electric or electric to diesel). The TemperatureWatch screen is disabled any time a unit level Shutdown Alarm is active.

Zone Specific Shutdown Alarms

A zone specific Shutdown Alarm will force the affected zone to shut down, but allow the unit to continue to run as required by the host unit or other zones.

- A small alarm icon will appear next to the affected zone and blink with a period of ½ second on - ½ second off.
- If zone specific Shutdown Alarms occur in all zones, the unit will shut down and Alarm Code 114 will be set.
- If installed, the optional remote indicator light will indicate an alarm condition exists.

Pretrip Alarm Codes

If an alarm occurs during a Pretrip Test the alarm code will be displayed as Pretrip Alarm XX, where XX is the alarm code.

Special Alarm Code Considerations

Pretrip Alarm Codes

If an alarm occurs during a Pretrip Test, the alarm code will be displayed as Pretrip Alarm XX, where XX is the alarm code.

Zone Off Alarm Codes

If the host unit is turned on, zone conditions are monitored even if the zone is turned off. For example, temperature sensor Alarm Codes 02, 03, and 04 can be set for a zone even when that zone is turned off.

Alarm Codes When Switching Between Diesel and Electric

If a Shutdown Alarm occurs that affects only Diesel Mode operation and the unit is switched to Electric Mode, the Diesel Mode Shutdown Alarm becomes an Electric Mode Log Alarm. This allows the unit to run in Electric Mode without clearing the Shutdown Alarm that is preventing Diesel Mode operation. If the unit is switched back to Diesel Mode, the alarm again become a Diesel Mode Shutdown Alarm and prevents unit operation.

In the same manner, if a Shutdown Alarm occurs that affects only Electric Mode operation and the unit is switched to diesel, the Electric Mode Shutdown Alarm becomes a Diesel Mode Log Alarm to allow Diesel Mode operation. If the unit is switched back to Electric Mode, the alarm reverts to an Electric Mode Shutdown Alarm and prevents unit operation.

Low Battery Voltage

If Alarm Code 61 Low Battery Voltage is set as a Shutdown Alarm, no subsequent alarm codes will be set with the exception of Alarm Code 28 Pretrip Abort.

Clearing Alarm Codes

Most alarm codes can be cleared conventionally from the Alarm Menu using the CLEAR soft key.

The following alarm codes can only be cleared from the Guarded Access Menu. The CLEAR soft key will not appear if the alarms are displayed from the Main Menu or the Maintenance Menu.

- Alarm Code 03 Check (Control) Return Air Sensor for all zones.
- Alarm Code 04 Check (Control) Discharge Air Sensor for all zones.
- Alarm Code 74 Controller Reset to Defaults.

The following alarm codes clear automatically:

- Alarm Code 64 Pretrip Reminder – Clears when a Pretrip Test is performed.
- Alarm Code 84 Restart Null – Clears when the unit is no longer in a restart null due to a Prevent Alarm.
- Alarm Code 85 Forced Unit Operation – Clears when the unit is no longer running in a forced mode due to a Prevent Alarm.
- Alarm Code 91 Check Electric Ready Input – Clears automatically when the unit starts running or the unit is switched to Diesel Mode.
- Alarm Code 92 Sensor Grades Not Set – Clears when all installed graded sensor grades are changed from 5H.

If the Limited Alarm Restarts feature is enabled, the following additional alarm codes may only be cleared from the Guarded Access Menu. If this is the case, the CLEAR soft key will not appear if the alarms are displayed from the Main Menu or the Maintenance Menu. Refer to the Limited Alarm Restarts feature in Section 3 for details.

- Alarm Code 10 High Discharge Pressure
- Alarm Code 23 Cooling Cycle Fault
- Alarm Code 24 Heating Cycle Fault
- Alarm Code 32 Refrigeration Capacity Low

General 0-200 Series Alarm Codes

The following 0-200 Series Alarm Codes are general alarms.

00 NO ALARMS EXIST

No action required.

02 CHECK EVAPORATOR COIL SENSOR (ZONE)

Alarm Type

Check (Shutdown during a Pretrip Test)

Associated Alarm Codes

13 Sensor Calibration Check

111 Unit Not Configured Correctly

Component Description and Location

This sensor is an un-graded sensor and does not require calibration. For SB units: The sensor is located on the evaporator coil suction header plate. For SLX units: The sensor is located at the top of the evaporator behind the panel below the evaporator blower outlet.

Circuit Description

This sensor circuit is a two wire circuit and is polarity sensitive. The Zone 1 sensor is connected to the Base Controller. Zone 2 and Zone 3 sensors are connected to the Expansion Module. The CTP (+) wire connects the Base Controller 35 pin sensor connector J3 Pin 25 to the blue sensor wire. The CTN (-) wire connects the Base Controller 35 pin sensor connector J3 Pin 14 to the brown sensor wire. The Zone 1 sensor wires are routed in the Sensor Harness. The Zone 2 and Zone 3 sensor wires are located in the Expansion Module Harness. The Zone 1 sensor is hard wired to the harness.

Considerations

1. Sensors should be positioned to minimize the potential for moisture entry where the wires enter the sensor shell. Mount sensors with the barrel up and the wires down wherever possible.
2. Sensor alarms are classified as either Soft Failures or Hard Failures.

A Soft Failure is defined as erratic operation or sensor drift that exceeds acceptable tolerances. If this occurs, the alarm code for the suspect sensor will be set along with Alarm Code 13. This indicates a potential problem that may not be immediately apparent, and also shows that a hard failure as defined below did not occur. Alarm Code 13 is always set if a soft failure occurs.

Note: *Alarm Code 13 can be cleared by the driver, while sensor Alarm Codes 03 or 04 can only be cleared from the Guarded Access Menu. If the unit has only Alarm Code 03 or 04 set when inspected, that alarm code may have been originally set with Alarm Code 13. Checking the ServiceWatch data logger download will indicate the conditions that existed when the failure occurred.*

A Hard Failure is defined by an out of range sensor reading, typically caused by an open or shorted sensor, connector, or harness conductor. The sensor display will show dashes if a hard failure occurs. If this occurs, only the alarm code for that sensor will be set (such as Alarm Code 03 if the control return air sensor failed). Alarm Code 13 will not be set if a hard failure occurs.

Note: *The controller may not be currently showing dashes for the sensor reading, but the alarm will be present when the unit is inspected. If a sensor alarm code is set, a failure did occur at some point. Checking the ServiceWatch data logger download will indicate when the hard failure occurred.*

3. The sensors located in remote evaporators have two harness connections. One connection point is located in the host evaporator section. The second connection is located in the remote evaporator. If remote zone alarm code is present, inspect both connectors for contamination and proper connection (e.g., pushed or damaged pins).

How Alarm is Set

1. If the sensor reading is 200°F (93°C) or over for 10 seconds, Alarm Code 02 is set as a Check Alarm. The sensor reading will display dashes [---] and may return to normal. This condition is termed a hard sensor failure.
2. If the sensor reading is -50°F (-46°C) or under for 10 seconds, Alarm Code 02 is set as a Check Alarm. The sensor reading will display dashes [---] and may return to normal. The -50°F (-46°C) check is ignored when the zone is in a Low Evaporator Coil Temperature Demand Defrost. This condition is termed a hard sensor failure.
3. If the differential between the coil and other sensors is too large when Alarm Code 02 is cleared, Alarm Code 02 and Alarm Code 13 are set as Check Alarms. This condition is termed a soft sensor failure.
4. If the sensor reading is erratic over time but does not go above 200°F (93°C) or below -50°F (-46°C), Alarm Code 02 and Alarm Code 13 are set as Check Alarms. This condition is termed a soft sensor failure.
5. If a valid sensor reading is detected in a zone that has not been configured, Alarm Code 02 is set as a Check Alarm and Alarm Code 111 is set as a Log Alarm.

How Alarm is Cleared

This alarm can be cleared manually. When the alarm is cleared, the return air sensors, discharge air sensors, and evaporator coil sensor must all read within 30°F (17°C) of each other. If they do not, it is assumed that the sensor reading is not accurate. The alarm code is not cleared and Alarm Code 13 will also be set. Also, if the sensor is over or under range when the alarm clear is attempted, the alarm will not be cleared.

If the alarm is set by #5 above, Alarm Codes 02 and 111 will clear automatically if the unit configuration is changed to allow the sensor in that zone or if the sensor is no longer exhibiting a valid reading.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

- **Alarm Code 02 (Sensor was out of range):**
 1. This is a hard failure. Display the sensor reading using the Sensor Menu. If the display shows [---], the sensor is defective and should be tested. If the condition still exists, check the sensor circuit for an open wire or short to ground (Refer to Service Procedure D01A). Check the Base Controller in accordance with Service Procedure A01A.
 2. If the display is normal proceed as shown below.
- **Alarm Code 02 and Alarm Code 13 (Sensor was reading erratically):**
 1. This is a soft failure. Review the ServiceWatch data logger and check the sensor reading at the time the alarm was set. Also, review the history to see if previous alarm codes exist that would indicate an intermittent problem. If the sensor appears to have read incorrectly, it should be replaced.
 2. If the problem reoccurs, check the sensor connector/sensor circuit in accordance with Service Procedure D01A.
- **Alarm Code 02 And Alarm Code 111 (Configuration Error):**
 1. Check unit configuration to confirm proper setting.
 2. Check the sensor circuit in accordance with Service Procedure D01A.
- **If all or many of the Sensor Codes (02, 03, 04, 05, 06, 11, 12 and 13) are set:**
 1. Verify Base Controller Sensor Connector J3 and the Expansion Module Sensor Connector are securely attached.
 2. Verify the CAN connector on the Expansion Module is securely connected (Zone 2 and Zone 3 specific alarms).
 3. Check the Base Controller in accordance with Service Procedure A01A.

03 CHECK (CONTROL) RETURN AIR SENSOR (ZONE)

Alarm Type

Check (Shutdown during a Pretrip Test)

Associated Alarm Codes

- 11 Unit or Zone Controlling on Alternate Sensor
- 12 Sensor Shutdown
- 13 Sensor Calibration Check
- 92 Sensor Grades Not Set
- 111 Unit Not Configured Correctly

Component Description and Location

This sensor is a graded sensor. The sensor grade must be set correctly to the actual grade of the sensor installed using the Guarded Access > Sensor Calibration Menu. Refer to Service Procedure A15A Temperature Sensor Grade Calibration. If the sensor grade is not set, Alarm Code 92 may be set. The sensor is located in the return air stream of the host unit or remote evaporator.

Circuit Description

This sensor circuit is a two wire circuit and is polarity sensitive. The RTP (+) wire connects the Base Controller 35 pin sensor connector J3 pin 1 to the blue sensor wire. The RTN (-) wire connects the Base Controller 35 pin sensor connector J3 pin 2 to the brown sensor wire. The Zone 1 sensor is connected to the Base Controller. Zone 2 and Zone 3 sensors are connected to the Expansion Module. The Zone 1 sensor wires are routed in the Sensor Harness. The Zone 2 and Zone 3 sensor wires are located in the Expansion Module Harness. The Zone 1 sensor is hard wired to the harness.

Considerations

1. The unit normally controls on return air temperature. If a problem occurs with the return air sensor, the unit will switch to Discharge Air Control. Alarm Code 03 and Alarm Code 11 will be set.
2. Sensor codes must be cleared from the Guarded Access Menu before Alarm Code 11 can be cleared.
3. Sensor grades must be correctly set to the actual grade of the sensor installed. Failure to do so may result in nuisance sensor alarm codes.
4. Sensors should be positioned to minimize the potential for moisture entry where the wires enter the sensor shell. Mount sensors with the barrel up and the wires down wherever possible.
5. Sensor alarms are classified as either Soft Failures or Hard Failures.

A Soft Failure is defined as erratic operation or sensor drift that exceeds acceptable tolerances. If this occurs, the alarm code for the suspect sensor will be set along with Alarm Code 13. This indicates a potential problem that may not be immediately apparent, and also shows that a hard failure as defined below did not occur. Alarm Code 13 is always set if a soft failure occurs.

Note: *Alarm Code 13 can be cleared by the driver, while sensor Alarm Codes 03 or 04 can only be cleared from the Guarded Access Menu. If the unit has only Alarm Code 03 or 04 set when inspected, that alarm code may have been originally set with Alarm Code 13. Checking the ServiceWatch data logger download will indicate the conditions that existed when the failure occurred.*

A Hard Failure is defined by an out of range sensor reading, typically caused by an open or shorted sensor, connector, or harness conductor. The sensor display will show dashes if a hard failure occurs. If this occurs, only the alarm code for that sensor will be set (such as Alarm Code 03 if the control return air sensor failed). Alarm Code 13 will not be set if a hard failure occurs.

Note: The controller may not be currently showing dashes for the sensor reading, but the alarm will be present when the unit is inspected. If a sensor alarm code is set, a failure did occur at some point. Checking the ServiceWatch data logger download will indicate when the hard failure occurred.

6. The sensors located in remote evaporators have two harness connections. One connection point is located in the host evaporator section. The second connection is located in the remote evaporator. If remote zone alarm code is present, inspect both connectors for contamination and proper connection (e.g., pushed or damaged pins).

How Alarm is Set

1. If the sensor reading is 200°F (93°C) or over for 10 seconds, Alarm Code 03 is set as a Check Alarm. The sensor reading will display dashes [---] and may return to normal. This condition is termed a hard sensor failure.
2. If the sensor reading is -50°F (-46°C) or under for 10 seconds, Alarm Code 03 is set as a Check Alarm. The sensor reading will display dashes [---] and may return to normal. This condition is termed a hard sensor failure.
3. If the differential between the return air temperature and other temperature sensors is too large when Alarm Code 03 is cleared, Alarm Code 03 and Alarm Code 13 are set as Check Alarms. This condition is termed a soft sensor failure.
4. If the sensor reading is erratic over time but does not go above 200°F (93°C) or below -50°F (-46°C), Alarm Code 03 and Alarm Code 13 are set as Check Alarms. This condition is termed a soft sensor failure.
5. If the sensor grade for this sensor is set to 5H, Alarm Code 03 and Alarm Code 92 are set as Check Alarms.
6. If a valid sensor reading is detected in a zone that has not been configured, Alarm Code 03 is set as Check Alarm and Alarm Code 111 is set as a Log Alarm.

How Alarm is Cleared

Note: This alarm can only be cleared manually from the Guarded Access menu.

When the alarm is cleared the return air sensors, discharge air sensors and evaporator coil sensor must all read within 30°F (17°C) of each other. If they do not, it is assumed that the sensor reading is not accurate. The alarm code is not cleared and Alarm Code 13 will also be set. Also, if the sensor is over or under range when the alarm clear is attempted, the alarm will not be cleared.

If the alarm is set by #5 above, Alarm Code 92 will clear automatically if the sensor grade is changed from 5H. If the sensor grade remains 5H, Alarm Code 92 can not be cleared.

If the alarm is set by #6 above, Alarm Codes 03 and 111 will clear automatically if the unit configuration is changed to allow the sensor in that zone or if the sensor is no longer exhibiting a valid reading.

Programmable Features

This is a graded sensor. The sensor grade must be correctly set in the Guarded Access Menu.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

- **Alarm Code 03 (Sensor was out of range):**

1. This is a hard failure. Display the sensor reading using the Sensor Menu. If the display shows [----], the sensor is defective and should be replaced. If the condition still exists, check the sensor circuit for an open wire or short to ground (Refer to Service Procedure D01A). Check the Base Controller in accordance with Service Procedure A01A.
2. If the display is normal, proceed as shown below.

- **Alarm Code 03 and Alarm Code 13 (Sensor drifted or was reading erratically):**



1. This is a soft failure. Review the ServiceWatch data logger and check the sensor reading at the time the alarm was set. Also, review the history to see if previous alarm codes exist that would indicate an intermittent problem. If the sensor appears to have read incorrectly, it should be replaced.
 2. Verify the sensor grades are set to the actual sensor grade.
 3. Check for an airflow obstruction and correct sensor mounting.
 4. If the problem reoccurs, check the sensor connector/sensor circuit in accordance with Service Procedure D01A.
- **Alarm Code 03 and Alarm Code 92 (Sensor grade set to 5H):**
 1. Verify and set the sensor grade.
 - **Alarm Code 03 And Alarm Code 111 (Configuration Error):**
 1. Check unit configuration to confirm the proper setting.
 2. Check the sensor circuit in accordance with Service Procedure D01A.
 - **If all or many of the Sensor Codes (02, 03, 04, 05, 06, 11, 12) are set:**
 1. Verify the 35 pin Base Controller sensor connector J3 is securely connected.
 2. Verify the 35 pin Expansion Module connector is securely attached.
 3. Verify the CAN connector on the Expansion Module is securely connected (Zone 2 and Zone 3 specific alarms).
 4. Check the Base Controller in accordance with Service Procedure A01A.

04 CHECK (CONTROL) DISCHARGE AIR SENSOR (ZONE)

Alarm Type

Check (Shutdown during a Pretrip Test)

Associated Alarm Codes

- 11 Unit or Zone Controlling on Alternate Sensor
- 12 Sensor Shutdown
- 13 Sensor Calibration Check
- 92 Sensor Grades Not Set
- 111 Unit Not Configured Correctly

Component Description and Location

This sensor is a graded sensor. The sensor grade must be set correctly to the actual grade of the sensor installed using the Guarded Access > Sensor Calibration Menu. If the sensor grade is not set, Alarm Code 92 may be set. Refer to Service Procedure A15A Temperature Sensor Grade Calibration. The sensor is located in the discharge air stream of the host unit or remote evaporator.

Circuit Description

This sensor circuit is a two wire circuit and is polarity sensitive. The DTP (+) wire connects the Base Controller 35 pin sensor connector J3 pin 24 to the blue sensor wire. The DTN (-) wire connects the Base Controller 35 pin sensor connector J3 pin 13 to the brown sensor wire. The Zone 1 sensor is connected to the Base Controller. Zone 2 and Zone 3 sensors are connected to the Expansion Module. The Zone 1 sensor wires are routed in the Sensor Harness. The Zone 2 and Zone 3 sensor wires are located in the Expansion Module Harness. The Zone 1 sensor is hard wired to the harness.

Considerations

1. If the unit is controlling on discharge air temperature and a problem occurs with either discharge air sensor, the unit will switch to Return Air Control and Alarm Code 11 will be set. The appropriate sensor alarm codes will also be set.
2. Sensor codes must be cleared from the Guarded Access Menu before Alarm Code 11 can be cleared.
3. Sensor grades must be correctly set to the actual grade of the sensor installed. Failure to do so may result in nuisance sensor alarm codes.
4. Sensors should be positioned to minimize the potential for moisture entry where the wires enter the sensor shell. Mount sensors with the barrel up and the wires down wherever possible.
5. Sensor alarms are classified as either Soft Failures or Hard Failures.

A Soft Failure is defined as erratic operation or sensor drift that exceeds acceptable tolerances. If this occurs, the alarm code for the suspect sensor will be set along with Alarm Code 13. This indicates a potential problem that may not be immediately apparent, and also shows that a hard failure as defined below did not occur. Alarm Code 13 is always set if a soft failure occurs.

Note: *Alarm Code 13 can be cleared by the driver, while sensor Alarm Codes 03 or 04 can only be cleared from the Guarded Access Menu. If the unit has only Alarm Code 03 or 04 set when inspected, that alarm code may have been originally set with Alarm Code 13. Checking the ServiceWatch data logger download will indicate the conditions that existed when the failure occurred.*

A Hard Failure is defined by an out of range sensor reading, typically caused by an open or shorted sensor, connector, or harness conductor. The sensor display will show dashes if a hard failure occurs. If this occurs, only the alarm code for that sensor will be set (such as Alarm Code 03 if the control return air sensor failed). Alarm Code 13 will not be set if a hard failure occurs.

Note: The controller may not be currently showing dashes for the sensor reading, but the alarm will be present when the unit is inspected. If a sensor alarm code is set, a failure did occur at some point. Checking the ServiceWatch data logger download will indicate when the hard failure occurred.

6. The sensors located in remote evaporators have two harness connections. One connection point is located in the host evaporator section. The second connection is located in the remote evaporator. If remote zone alarm code is present, inspect both connectors for contamination and proper connection (e.g., pushed or damaged pins).

How Alarm is Set

1. If the sensor reading is 200°F (93°C) or over for 10 seconds, Alarm Code 04 is set as a Check Alarm. The sensor reading will display dashes [---] and may return to normal. This condition is termed a hard sensor failure.
2. If the sensor reading is -50°F (-46°C) or under for 10 seconds, Alarm Code 04 is set as a Check Alarm. The sensor reading will display dashes [---] and may return to normal. This condition is termed a hard sensor failure.
3. If the differential between the discharge and other sensors is too large when Alarm Code 04 is cleared, Alarm Code 04 and Alarm Code 13 are set as Check Alarms. This condition is termed a soft sensor failure.
4. If the sensor reading is erratic over time but does not go above 200°F (93°C) or below -50°F (-46°C), Alarm Code 04 and Alarm Code 13 are set as Check Alarms. This condition is termed a soft sensor failure.
5. If the sensor grade for this sensor is set to 5H, both Alarm Code 04 and Alarm Code 92 are set as Check Alarms.
6. If a valid sensor reading is detected in a zone that has not been configured, Alarm Code 04 is set as a Check Alarm and Alarm Code 111 is set as a Log Alarm.

How Alarm is Cleared

Note: This alarm can only be cleared manually from the Guarded Access menu.

When the alarm is cleared, the return air sensors, discharge air sensors, and evaporator coil sensor must all read within 30°F (17°C) of each other. If they do not, it is assumed that the sensor reading is not accurate. The alarm code is not cleared and Alarm Code 13 will also be set. Also, if the sensor is over or under range when the alarm clear is attempted, the alarm will not be cleared.

If the alarm is set by #5 above, Alarm Code 92 will clear automatically if the sensor grade is changed from 5H. If the sensor grade remains 5H, Alarm Code 92 can not be cleared.

If the alarm is set by #6 above, Alarm Codes 03 and 111 will clear automatically if the unit configuration is changed to allow the sensor in that zone or if the sensor is no longer exhibiting a valid reading.

Programmable Features

This is a graded sensor. The sensor grade must be correctly set in the Guarded Access Menu.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

- **Alarm Code 04 (Sensor was out of range):**

1. This is a hard failure. Display the sensor reading using the Sensor Menu. If the display shows [----], the sensor is defective and should be replaced. If the condition still exists, check the sensor circuit for an open wire or short to ground (Refer to Service Procedure D01A). Check the Base Controller in accordance with Service Procedure A01A.

2. If the display is normal, proceed as shown below.

- **Alarm Code 04 and Alarm Code 13 (Sensor drifted or was reading erratically):**

1. This is a soft failure. Review the ServiceWatch data logger and check the sensor reading at the time the alarm was set. Also, review the history to see if previous alarm codes exist that would indicate an intermittent problem. If the sensor appears to have read incorrectly, it should be replaced.
 2. Verify the sensor grades are set to the actual sensor grade.
 3. Check for an airflow obstruction and correct sensor mounting.
 4. If the problem reoccurs, check the sensor connector/sensor circuit in accordance with Service Procedure D01A.
- **Alarm Code 04 and Alarm Code 92 (Sensor grade set to 5H):**
 1. Verify and set the sensor grade.
 - **Alarm Code 03 And Alarm Code 111 (Configuration Error):**
 1. Check unit configuration to confirm the proper setting.
 2. Check the sensor circuit in accordance with Service Procedure D01A.
 - **If all or many of the Sensor Codes (02, 03, 04, 05, 06, 11, 12) are set:**
 1. Verify the 35 pin Base Controller sensor connector J3 is securely connected.
 2. Verify the 35 pin Expansion Module connector is securely attached.
 3. Verify the CAN connector on the Expansion Module is securely connected (Zone 2 and Zone 3 specific alarms).
 4. Check the Base Controller in accordance with Service Procedure A01A.

05 CHECK AMBIENT TEMPERATURE SENSOR

Alarm Type

Check (Shutdown Alarm during a Pretrip Test)

Associated Alarm Codes

13 Sensor Calibration Check

Component Description and Location

This sensor is an un-graded sensor and does not require calibration. The sensor is located in the condenser air stream behind the condenser grill.

Circuit Description

This sensor circuit is a two wire circuit and is polarity sensitive. The ATP (+) wire connects the Base Controller 35 pin sensor connector J3 pin 3 to the blue sensor wire. The ATN (-) wire connects the Base Controller 35 pin sensor connector J3 pin 4 to the brown sensor wire. The wires are routed in the Sensor Harness. The sensor is connected to the sensor harness with a Deutsch connector.

Considerations

1. Sensors should be positioned to minimize the potential for moisture entry where the wires enter the sensor shell. Mount sensors with the barrel up and the wires down wherever possible.
2. Sensor alarms are classified as either Soft Failures or Hard Failures.

A Soft Failure is defined as erratic operation or sensor drift that exceeds acceptable tolerances. If this occurs, the alarm code for the suspect sensor will be set along with Alarm Code 13. This indicates a potential problem that may not be immediately apparent, and also shows that a hard failure as defined below did not occur. Alarm Code 13 is always set if a soft failure occurs.

Note: *Alarm Code 13 can be cleared by the driver, while sensor Alarm Codes 03 or 04 can only be cleared from the Guarded Access Menu. If the unit has only Alarm Code 03 or 04 set when inspected, that alarm code may have been originally set with Alarm Code 13. Checking the ServiceWatch data logger download will indicate the conditions that existed when the failure occurred.*

A Hard Failure is defined by an out of range sensor reading, typically caused by an open or shorted sensor, connector, or harness conductor. The sensor display will show dashes if a hard failure occurs. If this occurs, only the alarm code for that sensor will be set (such as Alarm Code 03 if the control return air sensor failed). Alarm Code 13 will not be set if a hard failure occurs.

Note: *The controller may not be currently showing dashes for the sensor reading, but the alarm will be present when the unit is inspected. If a sensor alarm code is set, a failure did occur at some point. Checking the ServiceWatch data logger download will indicate when the hard failure occurred.*

How Alarm is Set

1. If the sensor reading is 200°F (93°C) or over for 10 seconds, set alarm code 05 as a Check Alarm. The sensor reading will display dashes [---] and may return to normal. This condition is termed a hard sensor failure.
2. If the sensor reading is -50°F (-46°C) or under for 10 seconds, set alarm code 05 as a Check Alarm. The sensor reading will display dashes [---] and may return to normal. This condition is termed a hard sensor failure.
3. If the sensor reading is erratic over time but does not go above 200°F (93°C) or below -50°F (-46°C), Alarm Code 05 and Alarm Code 13 are set as Check Alarms. This condition is termed a soft sensor failure.

How Alarm is Cleared

This alarm is cleared manually. If the sensor is over or under range when the alarm clear is attempted, the alarm will not be cleared.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

- **Alarm Code 05 (Sensor was out of range) Only:**
 1. This is a hard failure. Display the sensor reading using the Sensor Menu. If the display shows [----], the sensor is defective and should be replaced. If the condition still exists, check the sensor circuit for an open wire or short to ground (Refer to Service Procedure D01A). Check the Base Controller in accordance with Service Procedure A01A.
 2. If the display is normal, proceed as shown below.
- **Alarm Code 05 and Alarm Code 13 (Sensor drifted or was reading erratically):**
 1. This is a soft failure. Review the ServiceWatch data logger and check the sensor reading at the time the alarm was set. Also, review the history to see if previous alarm codes exist that would indicate an intermittent problem. If the sensor appears to have read incorrectly, it should be replaced.
 2. Check for an airflow obstruction and correct sensor mounting.
 3. If the problem reoccurs, check the sensor connector/sensor circuit in accordance with Service Procedure D01A.
- **If all or many of the Sensor Codes (02, 03, 04, 05, 06, 11, 12) are set:**
 1. Verify the 35 pin Base Controller sensor connector J3 is securely connected.
 2. Check the Base Controller in accordance with Service Procedure A01A.

06 CHECK ENGINE COOLANT TEMPERATURE SENSOR

Alarm Type

Log, Check, or Shutdown (Shutdown during a Pretrip Test or if Alarm Code 37 Check Engine Coolant Level is set)

Becomes a Log Alarm if the unit is switched to electric operation

Associated Alarm Codes

N/A

Component Description and Location

This sensor is an un-graded sensor and does not require calibration. The sensor is located in the engine thermostat housing.

Circuit Description

This sensor circuit is a two wire circuit and is polarity sensitive. The WTP (+) wire connects the Base Controller 35 pin sensor connector J3 pin 26 to the blue sensor wire. The WTN (-) wire connects the Base Controller 35 pin sensor connector J3 pin 15 to the brown sensor wire. The wires are routed in the sensor harness. The sensor is connected to the harness with a Deutsch connector.

Considerations

Connectors should be positioned to minimize the potential for moisture entry where the wires enter the connector shell.

How Alarm is Set

1. If the sensor reading is 250°F (121°C) or over for 10 seconds, Alarm Code 06 is set as a Check Alarm. The sensor reading will display dashes [---] and may return to normal.
2. If the sensor reading is -50°F (-46°C) or over for 10 seconds, Alarm Code 06 is set as a Check Alarm. The sensor reading will display dashes [---] and may return to normal.

How Alarm is Cleared

This alarm is cleared manually. If the sensor is over or under range when the alarm clear is attempted, the alarm will not be cleared.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

- **Alarm Code 06 (Sensor was out of range) Only:**

1. This is a hard failure. Display the sensor reading using the Sensor Menu. If the display shows [----], the sensor is defective and should be replaced. If the condition still exists, check the sensor circuit for an open wire or short to ground. Refer to Service Procedure D01A. Check the Base Controller in accordance with Service Procedure A01A.

- **If all or many of the Sensor Codes (02, 03, 04, 05, 06, 11, and 12) are set:**

1. Verify that the 35 pin Base Controller sensor connector J3 is securely connected.
2. Check the Base Controller in accordance with Service Procedure A01A.

07 CHECK ENGINE RPM SENSOR

Alarm Type

Check

Associated Alarm Codes

N/A

Component Description and Location

The flywheel sensor is a proximity sensor that generates a pulse as each flywheel tooth passes the sensor. The Base Controller counts these pulses and performs the arithmetic necessary to convert the pulses into engine RPM. It is located on the flywheel housing above the starter.

Circuit Description

The flywheel sensor circuit is a two wire circuit and is not polarity sensitive. The FS1-01 wire connects the Base Controller 36 pin connector J7 pin 35 to one side of the flywheel sensor. The FS2-01 wire connects the Base Controller 36 pin connector J7 pin 36 to the other side of the flywheel sensor. The sensor wires are routed in the main harness.

How Alarm is Set

1. If the alternator frequency is greater than 100 Hz and oil pressure input is high but the RPM sensor indicates less than 800 RPM, Alarm Code 07 is set as a Check Alarm.
2. If the alternator frequency is greater than 100 Hz and oil pressure input is high but the RPM sensor indicates less than 300 RPM for four seconds, Alarm Code 07 is set as a Check Alarm.
3. If the RPM is less than 40 during an engine start attempt, Alarm Code 07 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Disconnect the sensor wires at the flywheel sensor. Check the AC voltage at the sensor with the engine running. If a small AC voltage (greater than 1.0 VAC) is not present, check the sensor adjustment. Turn the unit off and loosen the lock nut and turn the sensor in until it contacts the flywheel. Back the sensor out $\frac{1}{2}$ turn and tighten the lock nut. Start the unit and recheck the sensor voltage. If more than 1.0 VAC is still not present, the sensor is defective and must be replaced.
2. Disconnect the FS1-01 and FS2-01 connections and check the flywheel sensor continuity. The resistance between the flywheel sensor terminals should be approximately 250 to 300 ohms. Also check from each flywheel sensor terminal to ground. If either terminal is shorted to ground, the flywheel sensor is defective.
3. If AC voltage is present, disconnect the flywheel harness at the Base Controller and disconnect the flywheel sensor. Using a Fluke meter set for ohms, check for shorts to chassis ground on the FS1-01 and FS2-01 wires. If a short exists, examine the wiring harness for chaffed areas and repair, as required.
4. If no shorts to chassis ground exist, connect the FS1-01 wire to the FS2-01 wire at the sensor. Check continuity from FS1-01 to FS2-01 at the 36 pin Base Controller connector. The circuit should measure less than one ohm. If the circuit is open, check the harness using the wiring diagram for the unit.

09 HIGH EVAPORATOR TEMPERATURE

Alarm Type

Shutdown

Associated Alarm Codes

02 Check Evaporator Coil Sensor

Component Description and Location

This sensor is an un-graded sensor and does not require calibration. For SB units: The sensor is located on the evaporator coil suction header plate. For SLX units: The sensor is located at the top of the evaporator behind the panel below the evaporator blower outlet.

How Alarm is Set

If the unit is running and the evaporator coil temperature was greater than or equal to 155°F (68°C) or the discharge air temperature was greater than or equal to 135°F (57°C), Alarm Code 09 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check refrigeration system operation, especially in heat and defrost.
 - a. This alarm may be set if the hot gas solenoid is stuck in the open position.
 - b. This alarm can be set if a host evaporator defrost damper is stuck in the closed position.
 - c. This alarm can be set if a remote evaporator motor(s) are failed or are inoperable due to a faulty connection or Expansion Module output failure.
2. Check the evaporator fan for proper operation.
3. If both the coil temperature sensor and the discharge temperature sensor are failed, the defrost cycle is terminated on time. If this occurs, the unit may remain in defrost long enough to cause excessive evaporator coil temperature.
4. Check evaporator coil sensor operation in accordance with Alarm Code 02. If the evaporator coil sensor reads high due to a defective sensor, Alarm Code 09 may be set as a result.
5. The sensors located in remote evaporators have two harness connections. One connection point is located in the host evaporator section. The second connection is located in the remote evaporator. If a remote zone alarm code is present, inspect both connectors for contamination and proper connection (e.g., pushed or damaged pins).

10 HIGH DISCHARGE PRESSURE

Alarm Type

Prevent or Shutdown

Associated Alarm Codes

84 Restart Null

Component Description and Location

The High Pressure Cutout Switch (HPCO) is located on the compressor discharge manifold.

Circuit Description

The high pressure cutout circuit is a two wire circuit. The PHPC-01 wire connects the Base Controller 36 pin connector J7 pin 17 to one side of the high pressure cutout switch. The HPCO-01 wire connects the Base Controller 36 pin connector J7 pin 18 to the other side of the high pressure cutout switch. The switch is not polarity sensitive. The switch wires are routed in the Main Harness. The HPCO switch is connected to the Main Harness with a Deutsch connector.

Considerations

If the HPCO switch is open, it will always shut the unit down. The switch contacts break power to the Run Relay and Coil which prevents the fuel solenoid from energizing.

How Alarm is Set

1. If the HPCO switch opens, Alarm Code 10 is set as a Prevent Alarm. Two restart attempts will be made to allow continued operation at temporarily reduced performance. If, at the end of the two attempts full performance is not possible, the alarm is set as a Shutdown Alarm. The temporary shutdown period is 15 minutes. Alarm Code 84 is set along with Alarm Code 10 to indicate the unit is in a temporary shutdown mode.

If continuous restarts are enabled, a Shutdown Alarm is not set after two attempts. The temporary shutdown period is 60 minutes if continuous restarts are enabled. Alarm Code 84 is set along with Alarm Code 10 to indicate the unit is in a temporary shutdown mode.

If restarts are disabled, the alarm will be set as a shutdown on the first occurrence.

2. If the discharge pressure transducer exceeds a pre-set value (greater than 470 PSIG and less than 500 PSIG for five seconds) and the discharge pressure transducer is not failed, Alarm Code 10 is set as a Prevent Alarm. Two restart attempts will be made to allow continued operation at temporarily reduced performance. If, at the end of the two attempts full performance is not possible, the alarm is set as a Shutdown Alarm. The temporary shutdown period is 15 minutes. Alarm Code 84 is set along with Alarm Code 10 to indicate the unit is in a temporary shutdown mode.

If continuous restarts are enabled, a Shutdown Alarm is not set after two attempts. The temporary shutdown period is 60 minutes if continuous restarts are enabled. Alarm Code 84 is set along with Alarm Code 10 to indicate the unit is in a temporary shutdown mode.

If restarts are disabled, the alarm will be set as a shutdown on the first occurrence.

How Alarm is Cleared

1. The alarm can be cleared manually or may be reset if the condition no longer exists.
2. The alarm will clear automatically at the conclusion of a successful prevent routine.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the refrigeration system for high discharge pressure and correct as required.
2. Check the HPCO for proper operation with unit not running. Verify discharge pressure with gauge manifold. If discharge pressure is less than switch opening pressure (refer to Specifications), resistance across the switch contacts should read less than one ohm.



3. If HPCO checks good in Step 2, reconnect unit harness and check resistance at J7 pin 2 and 18. Resistance should read less than one ohm. A resistance of greater than one ohm indicates an open or high resistance.
4. Check the Base Controller High Pressure Cutout fuse F25.
5. Check the discharge pressure transducer for correct and accurate readings.
6. Check the refrigeration system valves for correct operation. A fault that prevents refrigerant flow from the system high side to the system low side may create high discharge pressure.
7. Review the ServiceWatch download in technician level view. The associated alarm data will show the status of the HPCO switch and the discharge pressure at the time the alarm was set. If this data indicates that the HPCO switch opened but the discharge pressure remained within acceptable limits, the actual problem is a defective HPCO switch or circuit, not high discharge pressure.
8. For SLX/SLXe units that are experiencing nuisance Alarm Code 10 issues, refer to Service Bulletin SB1012-1.

11 UNIT OR ZONE CONTROLLING ON ALTERNATE SENSOR**Alarm Type**

Zone Specific Check

Associated Alarm Codes

03 Check (Control) Return Air Sensor

12 Sensor Shutdown

Component Description and Location

See Associated Alarm Codes.

Circuit Description

See Associated Alarm Codes.

How Alarm is Set

If the Return Air Sensor has failed and the unit is controlling on the Discharge Air sensor, Alarm Code 11 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared automatically. The associated sensor alarm code must be cleared before Alarm Code 11 can be cleared.

If Alarm Code 12 is set, Alarm Code 11 will be auto cleared.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

Determine which sensor alarm codes are present. Proceed as shown for those alarm codes.

12 SENSOR SHUTDOWN (ZONE)

Alarm Type

Check or Shutdown

Associated Alarm Codes

03 Check (Control) Return Air Sensor

04 Check (Control) Discharge Air Sensor

Component Description and Location

See Associated Alarm Codes.

Circuit Description

See Associated Alarm Codes.

How Alarm is Set

Both return and discharge sensors in a zone have failed.

Zone with Fresh Range Setpoint:

1. With a fresh range setpoint and with only one zone running, the alarm is set as a unit Shutdown Alarm.
2. If more than one zone is running, a zone Shutdown Alarm will be set for the affected zone but the unit can continue to run as required by unit or other zone demands. The affected zone will be forced to zone null.
3. If the affected zone setpoint is changed to a frozen range setpoint, the zone will remain in zone shutdown.

Zone with Frozen Range Setpoint:

1. With a frozen range setpoint, the alarm is set as a zone Check Alarm and the zone will be forced into low speed cool.
2. If the affected zone setpoint is changed to a fresh range setpoint, the zone Check Alarm will become a zone Shutdown Alarm and the affected zone will be forced to zone null.

How Alarm is Cleared

This alarm is cleared automatically when the associated sensor Alarm Codes 03 and 04 are cleared.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

Determine which sensor alarm codes are present. Proceed as shown for those alarm codes.

13 SENSOR CALIBRATION CHECK

Alarm Type

Zone Specific Check

Associated Alarm Codes

02 Check Evaporator Coil Sensor

03 Check (Control) Return Air Sensor

04 Check (Control) Discharge Air Sensor

05 Check Ambient Temperature Sensor

65 Abnormal Temperature Differential

Component Description and Location

See Associated Alarm Codes.

Circuit Description

See Associated Alarm Codes.

Considerations

Sensor alarms are classified as either Soft Failures or Hard Failures.

A Soft Failure is defined as erratic operation or sensor drift that exceeds acceptable tolerances. If this occurs, the alarm code for the suspect sensor will be set along with Alarm Code 13. This indicates a potential problem that may not be immediately apparent, and also shows that a hard failure as defined below did not occur. Alarm Code 13 is always set if a soft failure occurs.

Note: *Alarm Code 13 can be cleared by the driver, while sensor Alarm Codes 03 or 04 can only be cleared from the Guarded Access Menu. If the unit has only Alarm Code 03 or 04 set when inspected, that alarm code may have been originally set with Alarm Code 13. Checking the ServiceWatch data logger download will indicate the conditions that existed when the failure occurred.*

A Hard Failure is defined by an out of range sensor reading, typically caused by an open or shorted sensor, connector, or harness conductor. The sensor display will show dashes if a hard failure occurs. If this occurs, only the alarm code for that sensor will be set (such as Alarm Code 03 if the control return air sensor failed). Alarm Code 13 will not be set if a hard failure occurs.

Note: *The controller may not be currently showing dashes for the sensor reading, but the alarm will be present when the unit is inspected. If a sensor alarm code is set, a failure did occur at some point. Checking the ServiceWatch data logger download will indicate when the hard failure occurred.*

How Alarm is Set

1. Evaporator Coil Sensor Check: If the evaporator coil, return, and discharge sensors do not read within a specified number of degrees of each other 20 minutes after a defrost cycle terminates, Alarm Code 13 is set as a Check Alarm. Alarm Code 02 will also be set.
2. Return and Discharge Sensor Check: If sensors drift apart, Alarm Code 65 is set. If the return and discharge sensors are reading erratically over a specified time. Alarm Code 13 will be set as a Check Alarm along with the alarm code for the erratic sensor (Alarm Code 03 or Alarm Code 04). If the erratic sensor cannot be determined and the temperature differential is greater than the allowable limits, Alarm Code 13 and Alarm Code 65 will be set.
3. Return, Discharge, Evaporator Coil and Ambient Sensor Check: If one or more of the return, discharge, evaporator coil or ambient sensors are reading erratically over a specified time, Alarm Code 13 will be set along with the alarm code for the erratic sensor (02, 03, 04, or 05).

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions



Section 5 - Diagnostics

relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

Determine which sensor Alarm Codes (02, 03, 04, or 05) are present along with Alarm Code 13. Proceed as shown for that Alarm Code.

15 CHECK INTAKE AIR HEATER

Alarm Type

Log, Check, or Shutdown

Associated Alarm Codes

62 Ammeter Out of Calibration

Component Description and Location

The intake air heater is located at the engine intake manifold.

Circuit Description

Power to the intake air heater is supplied by the H circuit. The associated Base Controller fuse is fuse F5. Intake air heater current is monitored by the Base Controller shunt.

How Alarm is Set

1. If the current draw is out of specification during an engine start, Alarm Code 15 is set as a Log Alarm if the current is below the minimum and the battery voltage is within specifications. The alarm is set as a Check Alarm if the current exceeds the maximum specification. Minimum preheat current for the Yanmar engine is 50 amps. Maximum preheat current for the Yanmar engine is 83 amps.
2. If the current draw is out of specification during a Pretrip Test, Alarm Code 15 is set as a Shutdown Alarm. Minimum preheat current on the Yanmar engine is 50 amps. Maximum preheat current on Yanmar engine is 83 amps.
3. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 15 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the operation of the preheat circuit using Interface Board Test Mode. LED 3 should illuminate. Current draw should be approximately 50-83 amps.
2. If the current draw is zero, check for an open heater, blown fuse F5, or defective K2 Preheat Relay.
3. If the current draw is low, check for low battery voltage or high circuit resistance.
4. If the current draw is in excess of 83 amps, check for a shorted intake air heater.
5. Check for battery voltage at the intake air heater when the preheat circuit is energized. The voltage should be above 11.2 volts. If the voltage is low, check the entire preheat circuit for excessive resistance due to burned preheat relay contacts or loose or corroded connections. Verify all connections are secure.
6. Verify the current values above with an external ammeter. If the values do not match, the shunt may be defective. Check the Base Controller in accordance with Service Procedure A01A.

17 ENGINE FAILED TO CRANK

Alarm Type

Log, Check, Prevent, or Shutdown in Diesel Mode; Log in Electric Mode

Associated Alarm Codes

20 Engine Failed to Start

63 Engine Stopped

84 Restart Null

How Alarm is Set

1. If the engine fails to reach 40 RPM or rises above and then falls below 40 RPM during the engine crank sequence, this alarm is set as a Prevent Alarm. Two attempts are made to crank, and Alarm Code 17 is set as a Shutdown Alarm.
2. An Alarm Code 17 that follows an Alarm Code 20/84 will be set as a Shutdown Alarm.
3. If Alarm Code 17 follows an Alarm Code 63 that has been cleared, only one crank attempt will be made.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the battery cables for clean and tight connections. Check the condition of the battery with a load tester (SB only) rated for the CCA of the battery.
2. Check available voltage on the 8S wire at the starter solenoid while the unit is going through a start sequence. A forced engine start can be attempted by switching to "continuous" run mode. If voltage is present during start attempt, either the starter is defective, the engine/compressor is locked, or a poor ground exists between the bell housing and the starter face (check for possible corrosion).
3. If no or low voltage is present on 8S during start attempt, verify LED 25 is illuminated during a start attempt.
4. If LED 25 is not illuminated, check F3 fuse.
5. Check 8S circuit from the controller to the starter for broken wire, loose crimps, or a pushed pin.
6. With the battery disconnected, attempt to turn the engine over with a breaker bar.
7. If a Model 50 Electric Standby unit, check for a failed clutch or seized electric motor.

18 HIGH ENGINE COOLANT TEMPERATURE

Alarm Type

Prevent or Shutdown in Diesel Mode

Log in Electric Mode

Associated Alarm Codes

42 Unit Forced to Low Speed

84 Restart Null

Considerations

This alarm becomes a Log Alarm if the unit is switched to Electric Mode. Alarm Code 18 alarm conditions will be monitored while the unit is operating in Electric Mode, and will auto-clear when the engine coolant temperature is reduced to a safe value.

How Alarm is Set

1. If the coolant temperature is greater than 225°F (107°C) for 30 seconds as determined by the coolant temperature sensor and the coolant level sensor is not indicating low coolant level, Alarm Code 18 is set as a Prevent Alarm. Two attempts will be made to allow continued operation at temporarily reduced performance. If, at the end of the two attempts full performance is not possible, the alarm is set as a Shutdown Alarm. The temporary shutdown period is 15 minutes. Alarm Code 84 is set along with Alarm Code 18 to indicate the unit is in a temporary shutdown mode.
If continuous restarts are enabled, a Shutdown Alarm is not set after two attempts. The temporary shutdown period is 60 minutes if continuous restarts are enabled. Alarm Code 84 is set along with Alarm Code 18 to indicate the unit is in a temporary shutdown mode. If restarts are disabled, the alarm will be set as a shutdown on the first occurrence.
2. If the coolant temperature is greater than 225°F (107°C) for 30 seconds as determined by the coolant temperature sensor and the coolant level sensor is indicating low coolant level, Alarm Code 18 is set as a Shutdown Alarm.

How Alarm is Cleared

1. The alarm can be cleared manually if the condition no longer exists. If condition still exists, it will reset.
2. The alarm will clear automatically at the conclusion of a successful prevent routine.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the engine water temperature using the Gauge Menu. If the temperature is above 225° F (107°C), check the engine cooling system to determine the cause of overheating.
2. Check for Alarm Code 37 as a related alarm.

! CAUTION

Hazardous Pressures!

Do not remove expansion tank cap while coolant is hot.

3. Check the engine coolant level. Bleed air from the cooling system if necessary.
4. Check the water pump drive belt.
5. Check the radiator for airflow and coolant flow restrictions.
6. Check the Water Temperature Sensor in accordance with Alarm Code 06.

19 LOW ENGINE OIL PRESSURE

Alarm Type

Shutdown in Diesel Mode

Log in Electric Mode

Associated Alarm Codes

31 Check Oil Pressure Switch

66 Low Engine Oil Level

Component Description and Location

The oil pressure switch is located at the side of the oil filter housing.

Circuit Description

The low oil pressure switch circuit is a single wire circuit. The 20B wire connects the Base Controller 36 pin connector J7 pin 28 to the low oil pressure switch. The switch is not polarity sensitive and is closed on low oil pressure. This applies chassis ground to the Base Controller. The switch wire is routed in the Main Harness.

Considerations

This alarm becomes a Log Alarm if the unit is switched to Electric Mode. It will again become a Shutdown Alarm if the unit is switched to Diesel Mode.

How Alarm is Set

If running in diesel mode and the oil pressure is low for 30 seconds, Alarm Code 19 is set as a Shutdown Alarm. If the low oil level switch is indicating low oil level when this occurs, Alarm Code 66 Low Engine Oil Level will also be set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check for Alarm Code 31 as a related alarm.
2. Check engine oil level.
3. Display the oil pressure when the unit is running, using the Gauge Menu. The oil pressure should be [OK]. If not, the switch may be stuck closed or the switch circuit may be shorted. If shorted, Alarm Code 31 would be active.
4. Verify the oil pressure switch is open with good oil pressure and closed with low oil pressure. The oil pressure switch should be closed when the engine is not running and open when the engine is running. Confirm using an ohmmeter.
5. Check the voltage of the 20B-01 wire at the 36 pin Base Controller connector J7 pin 28. Battery volts should be present when the engine is running.
6. Check the 20B wire in the Main Harness with an ohmmeter for continuity in accordance with Service Procedure H04A.
7. Connect an external oil pressure gauge and confirm that adequate oil pressure (20 psig or above) is present when the unit is running.

20 ENGINE FAILED TO START

Alarm Type

Log, Check, Prevent, or Shutdown in Diesel Mode

Log in Electric Mode

Associated Alarm Codes

15 Check Air Intake Heater

63 Engine Stopped Reason Unknown

84 Restart Null

Considerations

This alarm becomes a Log Alarm if the unit is switched to Electric Mode.

How Alarm is Set

1. If the engine failed to start after the starter motor was allowed to crank for the maximum allowed time, Alarm Code 20 is set as a Prevent Alarm. Two start attempts are normally made.
2. If the engine coolant sensor temperature is greater than 10°F (-12°C), the crank timer on the first start attempt is 15 seconds. The crank timer on the second start is 15 seconds.
3. If the engine coolant temperature is less than 10°F (-12°C), the crank timer on the first start attempt is six seconds. The crank timer on the second start is 30 seconds.

Notes:

1. *If Alarm Code 20 follows an Alarm Code 17/84, Alarm Code 20 will be set as a Shutdown Alarm.*
2. *If Alarm Code 20 follows an Alarm Code 63 alarm clear, only one crank attempt will be made.*

How Alarm is Cleared

1. The alarm can be cleared manually if the condition no longer exists. If condition still exists, it will reset.
2. The alarm will clear automatically at the conclusion of a successful prevent routine.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the unit fuel level.
2. Check fuel solenoid for proper operation, fuel pump, and fuel system electrically, mechanically and for fuel flow restrictions or blockages.
3. Check for cause of slow start or no start of the engine.
4. In cold ambient temperatures, check for fuel gelling.
5. Check for restricted air cleaner or air intake system.
6. Verify the intake air heater is operating properly, using Interface Board Test Mode.
7. If a Model 50 electric standby unit, check for a failed clutch or seized electric motor.

21 COOLING CYCLE CHECK (ZONE)

Alarm Type

Prevent

Associated Alarm Codes

23 Cooling Cycle Fault

84 Restart Null

85 Forced Unit Operation

Considerations

1. The zone may be heating when it should be cooling.
2. This is a Prevent Alarm. A second occurrence of this alarm will be set as Alarm Code 23 Cooling Cycle Fault Shutdown Alarm.
3. If restarts are disabled, Alarm Code 23 will be set as a Shutdown Alarm on the first occurrence of the alarm.

How Alarm is Set

If the unit or zone is exhibiting a heating temperature differential (ΔT) while operating in cool mode, Alarm Code 21 is set as a Prevent Alarm.

How Alarm is Cleared

The alarm is cleared automatically or manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check temperature differential by displaying the temperature differential, or by checking the difference between the return and discharge air temperature sensors.
2. Check refrigerant level.
3. Attach gauges and evaluate unit refrigeration system performance.
4. Verify that sensor grades are set correctly.
5. Check for proper air flow. Short cycling, caused by a blocked air flow path, may generate this code.
6. Check the zone hot gas valve. A defective valve that does not return to the cooling position may cause this alarm.

22 HEATING CYCLE CHECK (ZONE)

Alarm Type

Zone Specific Check or Prevent

Associated Alarm Codes

24 Heating Cycle Fault

84 Restart Null

85 Forced Unit Operation

Considerations

1. The zone may be cooling when it should be heating.
2. This is a Prevent Alarm. A second occurrence of this alarm will be set as Alarm Code 24 if the zone is operating in the fresh setpoint range.
3. The alarm is set as a Check Alarm if the unit is operating in the frozen setpoint range. Heat operation is locked out if an Alarm Code 24 is set in a unit that is operating in the frozen setpoint range.
4. If restarts are disabled, Alarm Code 24 will be set as a Shutdown Alarm on the first occurrence of the alarm.

How Alarm is Set

If the unit or zone is exhibiting a cooling temperature differential (ΔT) while operating in heat mode, Alarm Code 22 is set as a Prevent Alarm.

How Alarm is Cleared

The alarm is cleared automatically or manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check temperature differential by displaying the temperature differential, or by checking the difference between the return and discharge air temperature sensors.
2. Check refrigerant level.
3. Attach gauges and evaluate unit refrigeration system performance.
4. Verify that sensor grades are set correctly.
5. Check for proper air flow. Short cycling, caused by a blocked air flow path, may generate this code.
6. Check zone hot gas valve. A defective valve that does not shift to the heating position may cause this alarm.

23 COOLING CYCLE FAULT (ZONE)

Alarm Type

Zone Specific Shutdown

Associated Alarm Codes

21 Cooling Cycle Check

Considerations

1. The zone may be heating when it should be cooling.
2. This is a Shutdown Alarm. It is typically preceded by Alarm Code 21 Cooling Cycle Check.
3. If restarts are disabled, Alarm Code 23 will be set as a Shutdown Alarm on the first occurrence of the alarm.

How Alarm is Set

If the unit or zone was operating with a heating temperature differential (ΔT) while operating in cool mode and Alarm Code 21 has previously been set, Alarm Code 23 is set as a Shutdown Alarm. If the unit is in a Pretrip Test or Restarts are set DISABLED, Alarm Code 23 can be set without Alarm Code 21 having occurred.

If restarts are disabled, Alarm Code 23 will be set as a Shutdown Alarm on the first occurrence of the alarm.

How Alarm is Cleared

This alarm is cleared manually. If the Limited Alarm Restarts feature is active, Alarm Code 23 will be promoted to Guarded Access clear.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check temperature differential by displaying the temperature differential, or by checking the difference between the return and discharge air temperature sensors.
2. Check refrigerant level.
3. Attach gauges and evaluate unit refrigeration system performance.
4. Verify that sensor grades are set correctly.
5. Check for proper air flow. Short cycling, caused by a blocked air flow path, may generate this code.
6. Check zone hot gas valve for proper operation. A defective valve that does not return to the cooling position may cause this alarm.

24 HEATING CYCLE FAULT (ZONE)

Alarm Type

Shutdown

Associated Alarm Codes

22 Heating Cycle Check

Considerations

1. The zone may be cooling when it should be heating.
2. This is a Shutdown Alarm. It is typically preceded by Alarm Code 22 Heating Cycle Check.
3. If restarts are disabled, Alarm Code 24 will be set as a Shutdown Alarm on the first occurrence of the alarm.
4. The alarm cannot be in a zone operating in the frozen setpoint range. The alarm is set as a Check Alarm if the unit is operating in the frozen setpoint range. Heat operation is locked out if an Alarm Code 24 is set in a unit that is operating in the frozen setpoint range.

How Alarm is Set

If the unit or zone was operating with a cooling temperature differential (ΔT) while operating in heat mode and Alarm Code 22 has previously been set, Alarm Code 24 is set as a Shutdown Alarm. If the unit is in a Pretrip Test or Restarts are set DISABLED, Alarm Code 24 can be set without Alarm Code 22 having occurred.

If restarts are disabled, Alarm Code 24 will be set as a Shutdown Alarm on the first occurrence of the alarm.

How Alarm is Cleared

This alarm is cleared manually. If the Limited Alarm Restarts feature is active, Alarm Code 24 will be promoted to Guarded Access clear.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check temperature differential by displaying the temperature differential, or by checking the difference between the return and discharge air temperature sensors.
2. Check refrigerant level.
3. Attach gauges and evaluate unit refrigeration system performance.
4. Verify that sensor grades are set correctly.
5. Check for proper air flow. Short cycling, caused by a blocked air flow path, may generate this code.
6. Check zone hot gas valve. A defective valve that does not shift to the heating position may cause this alarm.

25 ALTERNATOR CHECK

Alarm Type

Log, Check, or Shutdown

Associated Alarm Codes

120 Check Alternator Excite Circuit

Considerations

The alternator excite voltage is controlled by the Alternator Excite Output. The Alternator Excite Output will supply alternator excite voltage after the engine starts.

How Alarm is Set

1. If the engine is running, oil pressure is good, charge amps are less than -1.0 amps, and battery volts are less than 13.2 volts for two and a half minutes, the alarm is set as a Check Alarm in normal operation and during a Pretrip Test, and as a Shutdown Alarm in Sleep Mode.
2. If the engine is running, oil pressure is good, and battery volts are greater than 16.0 volts, the alarm is set as a Check Alarm. If the voltage stays above 16.0 volts for two and a half minutes, the alarm is set as a Shutdown Alarm.
3. If the unit is running in electric, the alternator frequency is >100HZ, charge amps are less than -1.0 amps, and battery volts are less than 13.2 volts for two and a half minutes, the alarm is set as a Check Alarm in normal operation and during a Pretrip Test, and as a Shutdown Alarm in Sleep Mode.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check and adjust the alternator drive belt.
2. Start the engine or electric motor and check the battery voltage and amperage, using the Gauge Display in the Maintenance Menu. The voltage should be greater than 13.2 volts but less than 16 volts. Current flow should be greater than -1.0 amps.
3. Check the alternator connections.
4. Check the excitation voltage at the alternator. Excitation voltage should be equal to the battery voltage.
5. Check the operation of the Alternator Excite Output using Interface Board Test Mode. Verify the Alternator Excite LED 18 illuminates. The Alternator Excite Output will supply alternator excite voltage as soon as the engine starts.
6. Check the sense voltage at the alternator. Sense voltage should be equal to the battery voltage.
7. Check Fuse F20 on the Base Controller.
8. If the unit is equipped with a Prestolite alternator, verify that fuse F4 is in place on the Base Controller and is not open. Units equipped with a Bosch or a Thermo King alternator should not have fuse F4 installed on the Base Controller.
9. Check for good ground and bare metal connection with ground wire.

26 CHECK REFRIGERATION CAPACITY (ZONE)

Alarm Type

Zone Specific Check

Associated Alarm Codes

32 Refrigeration Capacity Low

85 Forced Unit Operation

Considerations

1. If all configured zones have an Alarm Code 26 set, a unit level Alarm Code 32 will be set.
2. If the unit is running in reduced capacity mode because of a Prevent Alarm and Alarm Code 26 is set, Alarm Code 85 is also set. Alarm Code 85 indicates the unit was forced into a reduced capacity mode.

How Alarm is Set

If the unit or zone heating or cooling capacity is reduced far enough below normal levels to indicate a refrigeration problem, Alarm Code 26 is set as a Check Alarm. The capacity loss is not significant enough to force the unit into shutdown mode.

How Alarm is Cleared

This alarm is cleared manually or automatically.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check zone temperature differential by displaying the temperature differential, or by checking the difference between the zone return and discharge air temperature sensors.
2. Check refrigerant level.
3. Attach gauges and evaluate unit refrigeration system performance.
4. Verify that sensor grades are set correctly.
5. Check for proper air flow. Short cycling, caused by a blocked air flow path, may generate this code.
6. Check the superheat for the affected zone evaporator(s).

28 PRETRIP OR SELF CHECK ABORT

Alarm Type

Shutdown

Associated Alarm Codes

The active associated alarm codes.

How Alarm is Set

If a Shutdown Alarm occurs during a Pretrip test, Alarm Code 28 is set and the unit is shut down. The alarm condition that caused the shutdown is also set. Alarm Code 28 is also set if the unit is turned off while a Pretrip Test is in progress or if the Pretrip Test is terminated by a communications command.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. This is a normal alarm any time the Pretrip Test is terminated before the completion of all tests.
2. Proceed with the corrective actions for any alarm codes that occurred.
3. After repairs, repeat the Pretrip Test. Refer to Section 4 for details.
4. If only Alarm Code 28 is set, the unit may have been turned off during a Pretrip Test, or the test may have been interrupted by a communications request. Clear the alarm and repeat the Pretrip Test.

29 DEFROST DAMPER CIRCUIT CHECK

Alarm Type

Check or Shutdown

Associated Alarm Codes

137 Damper Gear Motor Heater

Component Description and Location

The defrost damper is located in the discharge air stream at the top of the unit. It is closed during defrost to prevent warm air from being circulated over the load. For SB units: the damper solenoid is mounted just outside the discharge plenum and is connected to the damper door by means of mechanical linkage. For SLX units: the damper gear motor is mounted just outside the discharge plenum and is connected to the damper door by means of mechanical linkage.

DE Unit Only: DE units feature a split evaporator coil and two defrost dampers to serve two separate zones. Zone 1 is on the road side and Zone 2 is on the curb side. They are both located in the discharge air streams at the top of the unit and each is operated by a separate damper solenoid and linkage.

Circuit Description

SB Units: The Damper Solenoid circuit is a two wire circuit. The Damper Solenoid is energized by Relay K4 and Fuse F6 on the Base Controller. The 29 wire applies 12 VDC to one side of the Damper Solenoid to energize the solenoid. The CHD wire connects the other side of the solenoid to chassis ground at the ground plate near the unit battery. The solenoid is not polarity sensitive, but the suppression diode must be installed with the bar end of the diode toward the 29 wire. The wires are routed in the Main Harness.

SLX Units: The damper motor circuit is a two wire circuit and is energized by Relay K4 and Fuse F6 on the Base Controller. The GM- (black) wire is connected to one side of the damper gear motor and the GM+ (red) wire is connected to the other side of the gear motor. The motor wires are routed in the Main Harness.

DE Units: The Zone 1 damper circuit is as described above. The Zone 2 damper circuit is the same but is energized by the Expansion Module fan motor output that would otherwise be used by Zone 2 fans.

Considerations

1. The damper gear motor requires a Base Controller equipped with damper motor provisions.
2. Power for this circuit requires the run relay to be energized.

How Alarm is Set

1. If during a Pretrip Test the zone is configured with a damper solenoid and current is not between 2 to 10 amps when the solenoid is energized, Alarm Code 29 is set as a Check Alarm.
2. If during a Pretrip Test the zone is configured with a damper solenoid and current does not return to less than or equal to 0.5 amps when de-energized, Alarm Code 29 is set as a Shutdown Alarm.
3. If during a Pretrip Test the unit is equipped with a damper gear motor and the motor travel timer exceeds its limit and the motor stall current has not been exceeded, Alarm Code 29 is set as a Check Alarm.
4. If the unit is configured with a damper gear motor and a driver fault is detected, Alarm Code 29 is set as a Check Alarm.
5. Zone 2 DE Unit: If the zone is configured with a damper solenoid and current is not between 2 to 10 amps three seconds after the solenoid is energized, Alarm Code 29 is set as a Check Alarm. The defrost cycle will be terminated and no further defrost cycles are allowed until Alarm Code 29 is cleared.
6. Zone 2 DE Unit: If the zone is configured with a damper solenoid and current does not return to less than 0.5 amps three seconds after the solenoid is de-energized, Alarm Code 29 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

All Units: Check the operation of the damper door circuit using Interface Board Test Mode.

SB Units:

1. Use the HMI Control Panel amps gauge to check the current drawn by the damper solenoid while operating the damper door with Interface Board Test Mode. The current draw should be approximately 6 amps. (Damper Solenoid Only)
2. Energize the damper solenoid using Interface Board Test Mode and check for battery voltage on the 29 circuit. If voltage is present and no current was measured in the step above, replace the damper solenoid. (Damper Solenoid Only)
3. If the unit is not configured correctly, Alarm Code 137 occur instead of Alarm Code 29.

SLX Units:

1. Check the operation of the damper door gear motor circuit using Interface Board Test Mode. Verify LED 31 Damper Door Open and LED 32 Damper Door Close illuminate as required.
2. The initial (breakaway) current draw occurs over a very short period of time and cannot be accurately measured. Once the motor is running, the current draw should not exceed 0.8 amps.

30 DEFROST DAMPER STUCK (ZONE)

Note: SLX Units only.

Alarm Type

Check

Associated Alarm Codes

137 Damper Gear Motor Heater

Component Description and Location

The defrost damper door is located in the discharge air stream at the top of the unit. It is closed during defrost to prevent warm air from being circulated over the load. The Damper Gear Motor is mounted just outside the discharge plenum and is connected to the damper door by means of mechanical linkage.

Circuit Description

The damper motor circuit is a two wire circuit. The GM- (black) wire is connected to one side of the damper gear motor and the GM+ (red) wire is connected to the other side of the gear motor. The motor wires are routed in the Main Harness. The damper heater wires 8F-01 and CH-19 are also routed in the Main Harness.

Considerations

1. The damper gear motor requires a Base Controller equipped with damper motor provisions.
2. Power for this circuit requires the run relay to be energized.

How Alarm is Set

If the damper gear motor draws excessive current for a specified time, this alarm is set as a Check Alarm. This indicates that the damper is frozen or stuck.

How Alarm is Cleared

This alarm is cleared manually.

Note: When the alarm is cleared, the damper motor will be indexed to verify correct operation.

The damper door will first be positioned fully open and then fully closed. If the operating mode requires the damper door to be closed, it will remain closed. If the operating mode requires the damper door to be open, it will be repositioned open.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the operation of the damper door gear motor circuit using Interface Board Test. Verify LED 31 Damper Door Open and LED 32 Damper Door Close illuminate as appropriate.
2. The initial (breakaway) current draw occurs over a very short period of time and cannot be accurately measured. Once the motor is running, the current draw should not exceed 0.8 amps.
3. Check for ice buildup between the damper blade and damper housing. Breaking the ice may cause excessive current draw.
4. Check the door and linkage for binding, ice, or other restrictions to proper door operation.

31 CHECK OIL PRESSURE SWITCH

Alarm Type

Log or Shutdown in Diesel Mode

Log in Electric Mode

Associated Alarm Codes

19 Low Engine Oil Pressure

66 Low Engine Oil Level

Component Description and Location

The oil pressure switch is located at the side of the oil filter housing.

Circuit Description

The low oil pressure switch circuit is a single wire circuit. The 20B wire connects the Base Controller 36 pin connector J7 pin 28 to the low oil pressure switch. The switch is not polarity sensitive and is closed on low oil pressure. This applies chassis ground to the Base Controller. The switch wire is routed in the Main Harness.

Considerations

If this alarm is set as a Shutdown Alarm in diesel mode operation, it becomes a Log Alarm if the unit is switched to electric mode operation.

If the alarm exists in electric mode and the unit is switched to diesel, either condition #1 or #2 below apply.

How Alarm is Set

1. If the unit is in diesel mode but not running (Engine RPM < 40, Alternator frequency < 50), the oil level is good, and the oil pressure switch is not indicating low oil pressure, Alarm Code 31 is set as a Log Alarm.
2. If the unit is in diesel mode but not running (Engine RPM < 40, Alternator frequency < 50), the oil level is not good, and the oil pressure switch is not indicating low oil pressure, Alarm Code 31 is set as a Shutdown Alarm.
3. If the unit is running in electric mode and the oil pressure switch is not indicating low oil pressure, Alarm Code 31 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Display the oil pressure when the unit is not running, using the Gauge Menu. The oil pressure should show [LOW]. If not, the switch may be stuck open or the switch circuit may be open.
2. Check the 20B-01 wires in the controller harness with an ohmmeter for continuity in accordance with Service Procedure H04A.

32 REFRIGERATION CAPACITY LOW (ZONE)

Alarm Type

Shutdown

Associated Alarm Codes

26 Check Refrigeration Capacity

Considerations

Alarm Code 32 requires that Alarm Code 26 has been set first.

How Alarm is Set

If the unit heating or cooling capacity has degraded to the point where it has insufficient capacity to operate, Alarm Code 32 is set as a Shutdown Alarm. The unit's cooling or heating performance is considerably impaired and corrective actions such as defrost have failed to improve performance.

How Alarm is Cleared

This alarm is cleared manually. If the Limited Alarm Restarts feature is active, Alarm Code 32 will be promoted to Guarded Access clear.

If restarts are disabled Alarm Code 32 will be set as a Shutdown Alarm on the first occurrence of the alarm.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check temperature differential by displaying the temperature differential, or by checking the difference between the zone return and discharge air temperature sensors.
2. Check refrigerant level.
3. Attach gauges and evaluate unit refrigeration system performance.
4. Verify that sensor grades are set correctly.
5. Check for proper air flow. Short cycling, caused by a blocked air flow path, may generate this code.
6. Check the compressor and refrigeration system.

33 CHECK ENGINE RPM

Alarm Type

Check (Pretrip Only)

Associated Alarm Codes

07 Engine RPM Sensor

Considerations

Only checked during a Pretrip Test.

How Alarm is Set

1. If during a Pretrip Test the engine high speed RPM is not within the correct range for the unit configuration, Alarm Code 33 is set as a Check Alarm.
2. If during a Pretrip Test the engine low speed RPM is not within the correct range for the unit configuration, Alarm Code 33 is set as a Check Alarm.

Note: For engine RPM speeds, refer to Specifications.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check and adjust high speed in accordance with the Maintenance Manual for the unit.
2. Check and adjust low speed in accordance with the Maintenance Manual for the unit.
3. Check for a binding solenoid or disconnected linkage.
4. Verify the selected High and Low speeds match the programmed unit configuration.
5. Check the High Capacity settings in the Guarded Access – Unit Configuration Menu. Improper high capacity settings can cause this alarm.

Note: Use Service Test Mode to run the unit in high speed cool and low speed cool. Refer to Section 4 for details.

35 CHECK RUN RELAY CIRCUIT

Alarm Type

Shutdown

Associated Alarm Codes

N/A

Circuit Description

The K1 Run Relay, LED 6, and associated fuse are located on the Base Controller. The 7K circuit is internal within the Base Controller.

Power to the Run Relay circuit is supplied by fuse F25. Refer to the schematic diagram for the unit for complete circuit details.

When the Run Relay is energized, 8 circuit power is supplied to the 7K circuit. This alarm code indicates that 7K circuit digital input is not present when the Run Relay output is energized or that 7K power is present when the Run Relay is de-energized.

How Alarm is Set

1. If the Run Relay is energized and the 7K input is low at the Base Controller, Alarm Code 35 is set as a Shutdown Alarm.
2. If the Run Relay is not energized and the 7K input is high at the Base Controller for four seconds, Alarm Code 35 is set as a Shutdown Alarm.
3. If current draw is not between -0.5 to 5 amps when the Run Relay is energized during a Pretrip Test Amps Check, Alarm Code 35 is set as a Shutdown Alarm.
4. If current draw is not less than 0.5 amps when the Run Relay is de-energized during a Pretrip Test Amps Check, Alarm Code 35 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the Run Relay circuit fuse on the Base Controller. Power to the Run Relay circuit is supplied by the 7.5 amp fuse F25. Refer to the schematic diagram for the unit for complete circuit details.
2. Check to verify the K1 Run Relay LED 6 is energized.
3. Check the operation of the K1 Run Relay circuit using Interface Board Test Mode.
4. Check to verify the High Pressure Cutout Switch is closed (HPCO and PHPCO circuits).
5. Check for available voltage at HPCO and PHPCO wires. Battery volts should be present when the unit is turned on.
6. Review the ServiceWatch download. The associated alarm data will show the status of the 7K circuit when the alarm was set.

36 ELECTRIC MOTOR FAILED TO RUN

Alarm Type

Log, Check, Prevent, or Shutdown in Electric Mode

Log in Diesel Mode

Associated Alarm Codes

84 Restart Null

122 Check Diesel/Electric Circuit

Considerations

This alarm becomes a Log Alarm if the unit is switched to diesel.

How Alarm is Set

If the alternator frequency is less than 75 Hz for .3 seconds when the electric motor should be running, Alarm Code 36 is set as a Prevent Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

⚠ WARNING

Hazardous Voltage!

Units featuring optional Electric Standby utilize 460, 400, or 230 volt 3 phase AC electrical power any time the unit is operating in Electric Mode. This voltage potential is also present any time the unit is connected to a source of external standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

1. Check the motor, motor contactor, overload relay, and other associated electric standby motor circuitry. The internal pull coil/hold coil circuits in the contactor may be defective, requiring replacement of contactor.
2. Check the voltages at the phase detect module. Battery voltage should be present on the ER wire and the 8 wire.
3. Check the standby power voltage at the phase detect module. Standby power should be available at L1, L2, and L3.
4. Check the voltage at the motor contactor coils. Battery voltage should be present on either the 7EC or 7EB wire when the motor should be running.
5. Check for a reason that would prevent the motor from turning the alternator, such as slipping belts, clutch, etc.
6. Check the alternator as shown in Alarm Code 25.
7. Download and check the ServiceWatch data logger to determine the operating conditions present when the alarm code was set. Use the running Service Test Mode Feature to duplicate the operating conditions. The alternator frequency and engine RPM are logged in ServiceWatch and this information is viewable in technician mode. This information can be used to confirm the RPM sensor reading and alternator frequency when the alarm was set.

37 CHECK ENGINE COOLANT LEVEL

Alarm Type

Log, Check, or Shutdown in Diesel Mode

Log or Check in Electric Mode

Associated Alarm Codes

06 Engine Coolant Temperature Sensor

Circuit Description

Magnetic Switch: The two wire magnetic switch is actuated by a float inside the coolant expansion tank. The switch is closed if the coolant level is adequate. The two wire switch supplies +5 VDC from the CLP wire to the CLS wire when the coolant level is adequate. The circuit is opened if coolant level falls below an adequate level. This alarm will self-clear automatically if the coolant level rises above the sensor location. The wiring is located in the Main Harness via the CLS and CLP circuits.

Considerations

The Discharge Pressure Transducer, Suction Pressure Transducer, and Coolant Level switch each have a separate 5 Vdc power supply. A short circuit condition in one transducer or switch circuit should not affect the other circuits.

How Alarm is Set

1. If the engine coolant level input indicates low coolant level for three minutes and the unit is in Electric Mode, Alarm Code 37 will be set as a Log Alarm. If the engine coolant level input indicates low coolant level for three minutes and the unit is in Diesel Mode, Alarm Code 37 will be set as a Check Alarm. If the unit is switched to Electric Mode, this alarm remains a Check Alarm.
2. If Alarm Code 06 is set and the engine coolant level input indicates low coolant level for three minutes and the unit is in Electric Mode, Alarm Code 37 will be set as a Check Alarm. If Alarm Code 06 is set and the engine coolant level input indicates low coolant level for three minutes and the unit is in Diesel Mode, Alarm Code 37 will be set as a Shutdown Alarm.

How Alarm is Cleared

The alarm self-clears if coolant level input indicates good coolant level for three seconds. It can also be manually cleared.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

! CAUTION

Risk of Injury!

Exercise extreme care when checking hot coolant.

1. Check the engine coolant level. Verify coolant is above sensor when the coolant is cold.
2. Check the sensor connector for a pushed pin, loose pin crimp, or broken wire.
3. Check that +5 VDC is present between the (CLP-01) wire from the Base Controller and chassis ground.
4. Check the voltage between the (CLS-01) wire and chassis ground. Voltage should be +5 Vdc when the sensor or switch is submerged in coolant and less than +0.5 Vdc when the sensor or switch is not submerged.

Note: For additional information on testing the coolant level switch on SB units, refer to Service Bulletin TT379.

38 ELECTRIC PHASE REVERSED

Alarm Type

Shutdown in Electric Mode

Log in Diesel Mode

Associated Alarm Codes

03 Check Return Air Sensor

04 Check Discharge Air Sensor

90 Electric Overload

Considerations

1. This Shutdown Alarm becomes a Log Alarm if the unit is switched to diesel.
2. This alarm is disabled if Alarm Code 03 or Alarm Code 04 is set for the host unit sensors.

How Alarm is Set

Two phases are reversed on three phase standby power between the motor contactor and the motor or the motor is incorrectly wired. This will cause the compressor and condenser fan to rotate in the wrong direction. This is checked by monitoring the Zone 1 (host) evaporator temperature differential.

1. If the unit is running in Electric Mode in heat or cool for at least 15 minutes and then the temperature differential between return air temperature and discharge air temperature is greater than 50°F (10°C) and is still greater than 45°F (7°C) after five minutes, Alarm Code 38 is set as a Shutdown Alarm. The large temperature differential indicates the motor is rotating in the wrong direction.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

⚠ WARNING

Hazardous Voltage!

Units featuring optional Electric Standby utilize 460, 400, or 230 volt 3 phase AC electrical power any time the unit is operating in Electric Mode. This voltage potential is also present any time the unit is connected to a source of external standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

1. Check motor wiring to verify phase rotation is correct.
2. Confirm that the 7EC-01 wire is connected to the MCB motor contactor and the 7EB-01 wire is connected to the MCA motor contactor.
3. Check the voltages at the phase detect module. Battery voltage should be present on the 7EA wire and the 8 wire.
4. Check the standby power voltage at the phase detect module. Standby power should be available at L1, L2, and L3.
5. Confirm that the phase wiring between contactor MCA and MCB is correct.

39 CHECK WATER VALVE CIRCUIT

Note: SB Units only.

Alarm Type

Check (Pretrip Only)

Associated Alarm Codes

28 Pretrip Abort

111 Unit Not Configured Correctly

How Alarm is Set

The water valve is not currently used. However, the associated output is checked during the Non-running Pretrip Test to verify nothing has been mistakenly connected to it. The output is energized and then de-energized to verify that no device is connected to the circuit and that the Base Controller is operating properly.

1. If current flow is detected during the output energized phase of the Non-running Pretrip Test, Alarm Code 39 will be set as a Check Alarm and Alarm Code 111 will be set as a Log Alarm. The Non-running Pretrip Test will be allowed to complete.
2. If current flow is detected during the output de-energized phase of the Non-running Pretrip Test, Alarm Code 39 will be set as a Check Alarm, Alarm Code 111 be set as a Log Alarm and Alarm Code 28 will be set as a Shutdown Alarm. The Pretrip Test will be aborted.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check unit configuration to confirm proper setting.
2. Check the Base Controller wiring to verify that there is no connection to connector J7 pin 9.
3. Check the Base Controller in accordance with Service Procedure A01A.

40 CHECK HIGH SPEED CIRCUIT

Alarm Type

Pretrip Only: Log, Check, or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The high speed solenoid is located at the rear of the injector pump.

Circuit Description

The High Speed Solenoid circuit is a two wire circuit. The High Speed Solenoid is energized by Relay K3 and Fuse F6 on the Base Controller. The 7D wire applies 12 VDC to one side of the High Speed Solenoid to energize the solenoid. The CHHS wire connects the other side of the solenoid to chassis ground at the ground plate near the unit battery. The solenoid is not polarity sensitive, but the suppression diode must be installed with the bar end of the diode toward the 7D wire. The wires are routed in the main harness.

How Alarm is Set

1. If during a Pretrip Test the current is not between 2 to 8 amps when the solenoid is energized, Alarm Code 40 is set as a Check Alarm.
2. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 40 is set as a Shutdown Alarm. If current flow is detected during the output de-energized phase of the Non-running Pretrip Test, Alarm Code 40 is set as a Check Alarm and Alarm Code 28 will be set as a Shutdown Alarm. The Pretrip Test will be aborted.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the operation of the high speed circuit, using Interface Board Test Mode. Verify the High Speed Relay LED 5 illuminates. If LED 5 does not illuminate, the Base Controller may be defective. Check the Base Controller in accordance with Service Procedure A01A.
2. Use the HMI control panel amps gauge to check the current drawn by the high speed solenoid, while operating the high speed solenoid with Interface Board Test Mode. The current draw should be approximately 4.6 amps. If the current is greater than 8 amps, check the circuit for a shorted conductor or speed solenoid. If the current draw is zero, check Base Controller fuse F6. Refer to the unit wiring diagrams for wire numbers, locations, and additional details.
3. Energize the high speed solenoid using Interface Board Test Mode, and check for battery voltage on the 7D-01 circuit. If voltage is present at the solenoid terminals and no current was measured in the step above, replace the high speed solenoid. If voltage is not present at the solenoid terminals, check the high speed circuit conductors for continuity. Refer to the unit wiring diagrams for wire numbers, locations, and additional details.

41 CHECK ENGINE COOLANT TEMPERATURE

Alarm Type

Check

Associated Alarm Codes

42 Unit Forced to Low Speed

Considerations

Alarm Code 41 indicates the engine coolant temperature is above expected operating limits, but is not high enough to force a shutdown condition.

How Alarm is Set

If the engine coolant temperature rises above 210°F (98°C) and remains above 205°F (96°C) for 60 seconds, Alarm Code 41 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the engine coolant temperature by pressing the Gauge Key.

! CAUTION

Risk of Injury!

Exercise extreme care when checking hot coolant.

2. Check the engine coolant level.
3. Check the water pump drive belt.
4. Check the radiator for airflow or coolant flow blockage.
5. Download and check the ServiceWatch data logger information to determine the operating conditions that were present when the alarm code was set. Use running Service Test Mode to duplicate the operating conditions.

42 UNIT FORCED TO LOW SPEED

Alarm Type

Log

Associated Alarm Codes

10 High Discharge Pressure

18 High Engine Coolant Temperature

41 Check Engine Coolant Temperature

How Alarm is Set

If the unit has been forced to low speed operation as a result of high engine coolant temperature (210°F or 98°C) or high discharge pressure, Alarm Code 42 will be set as a Log Alarm. Alarm Code 10, 18, or 41 will also be set.

How Alarm is Cleared

Alarm will self-clear if unit returns to normal operation.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Troubleshoot as shown for the associated alarm code.
2. Download and check the ServiceWatch data logger information to determine the operating conditions that were present when the alarm code was set. Use running Service Test Mode to duplicate the operating conditions.

44 CHECK FUEL SYSTEM

Alarm Type

Shutdown

Associated Alarm Codes

96 Low Fuel Level

98 Check Fuel Level Sensor

Component Description and Location

Either float style or solid state style fuel level sensor must be installed and selected from Guarded Access > Unit Configuration > Fuel Sensor Type.

Low Fuel Shutdown must be enabled from Guarded Access > Unit Configuration > Low Fuel Shutdown.

Considerations

Alarm Code 44 Check Fuel System is not available if Guarded Access > Programmable Features > Rail Option is set ENABLED.

How Alarm is Set

If a fuel level sensor is enabled and fuel level falls to less than 7% (solid state) or 10% (float) of tank capacity for five minutes, Alarm Code 44 is set as a Shutdown Alarm.

How Alarm is Cleared

If this alarm is set as a Shutdown Alarm, manually clearing the alarm will demote it to a Check Alarm.

This alarm is cleared automatically when the fuel level is increased to more than 15% (solid state) or 20% (float) of tank capacity.

This alarm is cleared automatically if Alarm Code 98 is set.

This alarm is cleared automatically if the unit is switched to Electric Mode operation.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

Important: *Do not open the fuel system unless required.*

1. Check fuel tank level and fill as required.
2. Check fuel and/or fuel tank for contamination.
3. Check the fuel filter/water separator.
4. Check fuel level sensor for proper operation.

45 CHECK HOT GAS SOLENOID VALVE/HOT GAS BYPASS VALVE CIRCUIT

Check Hot Gas Solenoid (HGS) Valve Circuit

Alarm Type

Zone Specific Check or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The Zone 1 (host) hot gas solenoid is located in the evaporator section of the host unit. The remote zone hot gas solenoids are located in the remote evaporators.

Important: SR-3 units equipped with Software Revision F010 and earlier may experience occasional nuisance Alarm Code 45. Checking the ServiceWatch Data Logger will indicate the alarm set and fault current (FLTCT) of 1.5 to 1.8 amps (3.0 to 3.6 amps if equipped with parallel evaporators). Should this be the case, the Base Controller software should be updated to F012.

Note: If the unit is a DE unit, the Zone 2 hot gas solenoid is located in the host unit Zone 2 evaporator section.

Circuit Description

The hot gas solenoid circuit is a two wire circuit. Smart FETs in the Expansion Module energize the Hot Gas Solenoids for all zones. The HGSx wire applies 12 VDC to one side of the Hot Gas Solenoid to energize the solenoid. The CHHG wire connects the other side of the solenoid to chassis ground. All ground wires are run back to the unit ground plate. Solenoid valves in remote zones have supply circuits with connectors in the remote evaporator and at the host unit. The solenoid is not polarity sensitive. The wires are routed in the Main Harness or Expansion Module Harness. The circuits have connectors in the remote evaporator and at the host unit. Refer to the unit Wiring Diagram for wire numbers, locations, and additional details.

Considerations

1. For Spectrum units, verify the unit is not configured with ETV (Guarded Access > Unit Configuration > ETV Enabled must be set NO). The ETV feature on multi-temperature applications is used for SLX units only.
2. On systems with remote zone parallel evaporators, the respective Expansion Module hot gas valve output will supply power to both of the remote zone hot gas valves. The Pretrip and Smart FET current limits will be adjusted for the increased current drawn by parallel evaporators based on the zone configuration settings.
3. During a non-running Pretrip, the current draw is determined by the shunt reading feedback to the Base Controller.
4. During normal operation, the current draw is determined by the Smart FET feedback to the Base Controller.
5. If an alarm code is set during normal operation, the ServiceWatch Data Logger will list the alarm code, Fault Current (FLTCT), Battery Volts, and the Shunt Current. The FLTCT will be the high or low current draw as determined by the Smart FET feedback that caused the alarm code to set.

How Alarm is Set

Note: If Alarm Code 45 is set by the HGS, check the zone for which the alarm is triggered.

1. If during normal operation the current is greater than 3 amps or less than 0.5 amps at specified intervals after the solenoid is energized, Alarm Code 45 is set as a Check Alarm and the output is turned off. If the output circuit is shorted, it will be turned off immediately to protect the circuit and the alarm code will be set. Hot gas valve operation is not allowed until Alarm Code 45 is cleared. The zone will continue to run but with reduced performance until the condition is corrected and the alarm is cleared. If this condition occurs when the unit is in Evacuation Mode, Alarm Code 45 will be set as a Shutdown Alarm.
2. If during normal operation the current does not return to less than 0.5 amps at a specified interval after the solenoid is de-energized, Alarm Code 45 is set as a Check Alarm. Hot gas

valve operation is not allowed until Alarm Code 45 is cleared. The zone will continue to run but with reduced performance until the condition is corrected and the alarm is cleared.

3. If during a Pretrip Test the current is not between 0.5 to 3 amps (1.0 to 6 amps if parallel evaporators) when the solenoid is energized, Alarm Code 45 is set as a Check Alarm.
4. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 45 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. If $\text{FLTCT} = 3.0$ or 6.0 w/parallel evaporators, the circuit has high amp draw. Check for a shorted circuit or solenoid coil.
2. If FLTCT is less than 0.5 amps, the circuit has low amp draw. Check for high resistance or an open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Verify that the Expansion Module status LED (heartbeat LED) is flashing. If not, check the Expansion Module for proper operation in accordance with Service Procedure A01D.
2. If the Expansion Module Status LED is flashing, clear the alarm to reset the Smart FET. Check the operation of the hot gas circuit using Interface Board Test Mode. Verify the appropriate Expansion Module hot gas circuit LED illuminates. For Expansion Module LED identification, refer to the LED decal on the control box door. If the Expansion Module hot gas circuit LED illuminates, go to Step 3. If the Expansion Module hot gas circuit LED does not illuminate, go to Step 4.
3. If the Expansion Module hot gas circuit LED does not illuminate and the alarm is not present, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the hot gas solenoid, while operating the solenoid with Interface Board Test Mode. The current draw should be approximately 1.5 amps (3.0 amps if parallel evaporators). If the current is not within limits, check for high resistance or an open in the circuit or solenoid coil as shown in Step 4. Verify that all circuit connectors are secure.
4. If the Expansion Module hot gas circuit LED does not illuminate and the alarm is present, check for a shorted circuit or solenoid coil. Disconnect the Expansion Module 35 pin connector J1 and check the circuit with an accurate ohmmeter for a short circuit, open circuit or loose connection. The solenoid coil resistance should be approximately 8.3 ohms (4.1 ohms with parallel evaporators).
5. If no problems are found in steps 1-4 and the output LED does not illuminate, replace the Expansion Module.

Note: Confirm that the condition is not due to a faulty HGBV before replacing the Expansion Module. Refer to ("[Check Hot Gas Bypass Valve \(HGBV\) Circuit](#)," p. 258).

6. Confirm the unit configuration is correct. Verify unit is not configured with ETV (Guarded Access > Unit Configuration > ETV Enabled must be set NO). The ETV feature on multi-temperature applications is used for SLX units only.
7. To verify the multi-temperature refrigeration system operation of the hot gas solenoid, refer to Service Procedure R03A.

Check Hot Gas Bypass Valve (HGBV) Circuit

Alarm Type

Check or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The hot gas bypass solenoid is located in the condenser section next to the receiver tank. It is a normally closed valve. This valve is only used on units equipped with an ETV.

Note: *The hot gas bypass solenoid is only used when the host zone is operating in modulation cool, with all other zones switched off.*

Circuit Description

The hot gas bypass solenoid circuit is a two wire circuit. The HGB-01 wire connects the Base Controller Connector J7 Pin 5 to one side of the hot gas bypass solenoid. The CHHG wire connects the other side of the solenoid to chassis ground at the ground plate near the unit battery. The solenoid is not polarity sensitive. The switch wires are routed in the main harness. A Smart FET on the Base Controller supplies power to the HGB-01 circuit.

Considerations

Note: *Normal operation for the HGBV is in modulation cool.*

1. During a non-running Pretrip, the current draw is determined by the Base Controller shunt reading.
2. During normal operation, the current draw is determined by the Smart FET feedback to the Base Controller.

Note: *The hot gas bypass solenoid is only used when the host zone is operating in modulation cool, with all other zones switched off.*

3. If an alarm code is set during normal operation, the ServiceWatch Data Logger will list the Alarm Code, FLTCT (Fault Current), Battery Volts, and the Shunt Current. The FLTCT will be the high or low current draw as determined by the Smart FET feedback that caused the Alarm Code to set.

How Alarm is Set

Note: *The alarm will only be set while the host zone is operating in modulation cool, with all other zones switched off. The alarm will still be present in other operating modes if it has not been cleared.*

1. If during normal operation the current is greater than 3 amps or less than 0.5 amps at specified intervals after the solenoid is energized, Alarm Code 45 is set as a Check Alarm and the output is turned off. If the output circuit is shorted, it will be turned off immediately to protect the circuit and the alarm code will be set. Hot gas valve operation is not allowed until Alarm Code 45 is cleared. The zone will continue to run but with reduced performance until the condition is corrected and the alarm is cleared. If this condition occurs when the unit is in Evacuation Mode, Alarm Code 45 will be set as a Shutdown Alarm.
2. If during normal operation the current does not return to less than 0.5 amps at a specified interval after the solenoid is de-energized, Alarm Code 45 is set as a Check Alarm. Hot gas valve operation is not allowed until Alarm Code 45 is cleared. The zone will continue to run but with reduced performance until the condition is corrected and the alarm is cleared.
3. If during a Pretrip Test the current is not between 0.5 to 3 amps (1.0 to 6 amps if parallel evaporators) when the solenoid is energized, Alarm Code 45 is set as a Check Alarm.
4. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 45 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

To determine if the alarm code is for the hot gas bypass solenoid and not the hot gas solenoid, check the download to see if the alarm was generated during heat or defrost, or during modulation cool. If the alarm was generated while the unit was operating during heat or defrost, the HGS is at fault. If the alarm was generated while the unit was operating in modulation cool, the HGBV is at fault.

1. If $\text{FLTCT} = 3.0$ amps, the circuit has high amp draw. Check for a shorted circuit or solenoid coil.
2. If FLTCT is less than 0.5 amps, the circuit has low amp draw. Check for high resistance or an open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Clear the alarm to reset the Smart FET. Check the operation of the Hot Gas Bypass circuit using Interface Board Test Mode. Verify the Base Controller Hot Gas Bypass circuit LED illuminates. For Base Controller LED identification, refer to the LED decal on the control box door. If the Base Controller Hot Gas Bypass circuit LED illuminates, proceed to Step 2. If the Base Controller Hot Gas Bypass circuit LED does not illuminate, proceed to Step 3.
2. If the Base Controller Hot Gas Bypass circuit LED illuminates and Alarm Code 45 is set, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the Hot Gas Solenoid, while operating the solenoid with Interface Board Test Mode. The current draw should be approximately 1.5 amps. If the current is not within limits, check for high resistance or open in the circuit or solenoid coil as shown in Step 3. Verify that all circuit connectors are secure.
3. If the Base Controller Hot Gas Bypass circuit LED does not illuminate and Alarm Code 45 is set, check for a shorted circuit or solenoid coil. Disconnect the 36 pin Connector J7 and check the Hot Gas Bypass circuit at Pin 5 with an accurate ohmmeter for a short circuit, open circuit, shorts to ground, or loose connection. The solenoid coil resistance should be approximately 8.3 ohms.
4. If no problems are found in Steps 1-3 and the output LED does not illuminate, check the Base Controller in accordance with Service Procedure A01A.

Note: Confirm that the condition is not due to a faulty HGS before checking the Base Controller. Refer to (["Check Hot Gas Solenoid \(HGS\) Valve Circuit," p. 257](#)).

48 CHECK BELTS OR CLUTCH

Alarm Type

Shutdown

Associated Alarm Codes

N/A

Considerations

Applies to units equipped with electric standby only.

How Alarm is Set

The ratio between the engine RPM and alternator frequency is monitored. If these values are not in the proper ratio, it is an indication that drive belt slippage is occurring and Alarm Code 48 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check belts and clutch for condition, operation, and slippage.
2. Check for a stuck compressor.
3. Check alternator operation.
4. Check "W" circuit including resistor for continuity. Monitor with Wintrac or a frequency meter.
5. Check unit configuration if this alarm occurs on a Model 30 (diesel only) unit.
6. Verify the unit model is correctly configured. This alarm is dependant on the alternator drive pulley sizes used in the unit. The pulley sizes can vary between unit models.
7. Verify that the correct pulley is installed on the alternator. This code can occur if the alternator is replaced with an alternator with the wrong size pulley installed.
8. Download and check the ServiceWatch data logger to determine the operating conditions present when the alarm code was set. Use the running Service Test Mode Feature to duplicate the operating conditions. The alternator frequency and engine RPM are logged in ServiceWatch and this information is viewable in technician mode. This information can be used to confirm the RPM sensor reading and alternator frequency when the alarm was set.

50 RESET CLOCK

Alarm Type

Log

How Alarm is Set

This alarm indicates that power to the HMI control panel has been interrupted for an extended period and the hold capacitor for the clock/calendar has discharged. As a result, the clock/calendar is no longer accurate. Turning the unit on will recharge the hold capacitor in the HMI control panel.

How Alarm is Cleared

This alarm is cleared manually and automatically when time/date information is updated.

Diagnostic Procedure

1. Turn the unit on to recharge the hold capacitor in the Truck Premium Display (Truck) or HMI Control Panel (Trailer).
2. Reset the clock to the customer's time zone.

54 TEST MODE TIMEOUT

Alarm Type

Shutdown

Associated Alarm Codes

N/A

Considerations

The HMI will display the remaining test time. The timer can be reset by pressing the HMI test "Select" key while the respective Service Test Mode or Interface Board Test Mode test is active.

How Alarm is Set

1. If the unit has been in the same Service Test Mode function for 15 minutes, Alarm Code 54 is set as a Shutdown Alarm.
2. If the unit has been in the same Interface Board Test Mode function for 15 minutes, Alarm Code 54 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Clear the alarm and re-enter the test mode as necessary to complete the diagnosis or repair.

61 LOW BATTERY VOLTAGE

Alarm Type

Log or Shutdown

Associated Alarm Codes

N/A

Considerations

If Alarm Code 61 is set as a Shutdown Alarm, no subsequent alarm codes will be set with the exception of Alarm Code 28.

This alarm code can be set by either low voltage or excessive voltage conditions.

How Alarm is Set

1. If the unit is running, and battery voltage is less than 11.2 volts for three minutes, Alarm Code 61 is set as a Shutdown Alarm.
 2. If during the preheat cycle prior to an engine start the battery voltage is below 10.5 volts during an engine start, Alarm Code 61 is set as a Log Alarm.
- Note: The preheat output will have been de-energized prior to the alarm being set.*
3. If during a Pretrip Test the preheat amps check is not within limits, and battery voltage is less than 11.2 volts, Alarm Code 61 is set as a Shutdown Alarm.
 4. If during a Pretrip Test all outputs are de-energized, and battery voltage is not within limits, Alarm Code 61 is set as a Shutdown Alarm.
 5. If the unit is in Evacuation Mode, and battery voltage is greater than 17.0 volts for three minutes, Alarm Code 61 is set as a Shutdown Alarm.
 6. If three power-up and start attempts are made without a successful start, Alarm Code 61 is set as a Shutdown Alarm. This indicates that the battery voltage dropped low enough during the start sequence that the Base Controller powered down. This can also occur if the unit is turned on and off three times without allowing the unit to start.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check for discharged battery and charge as required.
2. Check the battery terminals for tightness and signs of corrosion.
3. Check battery cable connections between Base Controller and ground plate.
4. Check Base Controller 2, 2A, and CH connections for tightness and signs of corrosion.
5. Load test the battery, replace if necessary.
6. Check the unit ground plate connections for tightness and signs of corrosion.
7. With the engine running, check the battery voltage and charge rate using the Gauge Menu.
8. Check the operation of the alternator. Verify the belt is properly adjusted.
9. Review the ServiceWatch downloads to check for three start attempts and the reason for the start attempts.
10. Review the ServiceWatch data logger to determine the operating conditions present when the alarm code was set. The battery voltage, charge current, and alternator frequency are logged in ServiceWatch and this information is viewable in technician mode. This information can be used to determine which condition caused the alarm to be set.

62 AMMETER OUT OF CALIBRATION**Alarm Type**

Check or Shutdown (Pretrip Only)

Associated Alarm Codes

N/A

Considerations

The current shunt on the Base Controller is a surface mount device and is conformal coated for protection. Field resistance measurement of this circuit cannot be made.

How Alarm is Set

1. Shunt calibration check in Pretrip Test shows shunt circuit is out of calibration with all outputs de-energized.
2. Controller shunt current is out of range high (greater than 10 amps).

How Alarm is Cleared

This alarm is cleared manually or automatically.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the ServiceWatch download for abnormal ammeter readings or all dashes [- - -].
2. Check the current draw with the unit off and compare it to the reading of a clamp-on ammeter.
3. Check the Base Controller assembly in accordance with Service Procedure A01A.

63 ENGINE STOPPED

Alarm Type

Prevent or Shutdown in Diesel Mode

Log in Electric Mode

Associated Alarm Codes

17 Engine Failed To Crank

20 Engine Failed To Start

84 Restart Null

Considerations

Becomes a Log Alarm if unit is switched to Electric Mode.

If the Restart Unit After Shutdown feature is set for Continuous, the Shutdown Alarm condition is disabled and the interval between restart attempts is increased from 15 minutes to 1 hour.

Note: This feature is recommended only for rail application where the equipment is operated unattended for long periods of time. Refer to the Restart Unit After Shutdown feature in Section 3 for additional information.

How Alarm is Set

1. If the unit was running and still should be but has stopped, Alarm Code 63 is set as a Prevent Alarm. This is determined based on multiple factors, and can be caused by an intermittent condition. Three restart attempts will be made to allow continued operation at temporarily reduced performance. The time interval between restart attempts is 15 minutes. If at the end of the three attempts full performance is not possible, the alarm is set as a Shutdown Alarm. If the Restart Unit After Shutdown feature is set for Continuous, the Shutdown Alarm condition is disabled. If the Restart Unit After Shutdown feature is set for Disabled, the alarm will be set as a Shutdown Alarm on the first occurrence.
2. If Alarm Code 17 or Alarm Code 20 occurs after Alarm Code 63 is cleared, Alarm Code 63 will be set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually or automatically.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check for other alarm codes and proceed as indicated for each code.
2. Perform a Pretrip Test to determine cause for shutdown.
3. Verify the fuel level and check the fuel pump for proper operation.
4. Check the air cleaner and intake hose for obstructions.
5. Check the unit fuses.
6. Check the RPM sensor for proper operation.
7. Check Run Relay and fuel solenoid components and circuits.
8. Check for low battery voltage.
9. Verify all ground connections on the master ground plate are secure.
10. Check for a seized compressor or engine.
11. Review the ServiceWatch data logger information to determine the operating conditions that were present when the alarm code was set. Use the running Service Test Mode feature to duplicate the operating conditions as required. Unit operating data is logged in ServiceWatch and the data is viewable in technician mode.

64 PRETRIP REMINDER

Alarm Type

Log

Associated Alarm Codes

N/A

Considerations

The alarm is cleared when Pretrip Test is entered. If the Pretrip Test is not successful, the alarm will not be reset. If the Pretrip Test is not successful, diagnose and correct the fault.

Programmable Features

This feature must be programmed. Refer to Hourmeters in Section 3 for details.

How Alarm is Set

If a programmable hourmeter is set as a Pretrip Reminder and the hourmeter time expires, Alarm Code 64 is set as a Log Alarm.

How Alarm is Cleared

The alarm self-clears when a Pretrip Test is entered.

Diagnostic Procedure

1. Perform a Pretrip Test to confirm unit operation.
2. Reset the Pretrip Reminder hourmeter after a Pretrip Test is entered.

65 ABNORMAL TEMPERATURE DIFFERENTIAL (ZONE)

Alarm Type

Zone Specific Check or Shutdown

Associated Alarm Codes

13 Sensor Calibration Check

Considerations

1. Alarm Code 65 indicates that the temperature differential is abnormal based on expected unit capacity. It may be an indication of a drifting temperature sensor or an airflow restriction.
2. The temperature differential is monitored in both cool and heat mode. If the temperature differential becomes unrealistic, Alarm Code 65 is set. This alarm may result from incorrect sensor readings, if the defrost damper is stuck closed, if a remote evaporator fan motor(s) has failed, or as a result of severely restricted air flow.
3. Alarm Code 65 checks are not active during defrost mode and for 20 minutes after defrost.

How Alarm is Set

1. Alarm Code 65 is set if there is an abnormally large cooling or heating temperature differential and the offending sensor cannot be determined. Alarm Code 13 will also be set.
2. If Alarm Code 65 occurs with a frozen range setpoint, the alarm is set as a Check Alarm and the unit will be forced to low speed cool. If Alarm Code 65 occurs with a fresh range setpoint, the alarm is set as a zone Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the sensor connector at the affected remote evaporator for pushed or damaged pins.
2. Check the zone to host evaporator sensor connectors for pushed or damaged pins.
3. Check for blocked airflow in the affected zone.

66 LOW ENGINE OIL LEVEL

Alarm Type

Shutdown in Diesel Mode

Log in Electric Mode

Associated Alarm Codes

N/A

Component Description and Location

The switch is located on the top of the engine oil pan. The switch is open with full oil level and closed with low oil level.

Circuit Description

The wiring is located in the main harness via the OLS and CHOL circuits.

Considerations

A shutdown level Alarm Code 66 becomes a Log Alarm if the unit is switched from Diesel Mode to Electric Mode. A log level Alarm Code 66 becomes a Shutdown Alarm if the unit is switched from Electric to Diesel Mode.

How Alarm is Set

1. If the engine oil level switch indicates low engine oil for three minutes, Alarm Code 66 is set as a Shutdown Alarm.
2. If Alarm Code 66 is manually cleared and the engine oil level is still low, Alarm Code 66 is reset as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check and adjust the engine oil level as required.
2. Check the switch with an ohmmeter. It should be open when the oil level is satisfactory.
3. Check the harness wires OLS-01 and CHOL with an ohmmeter for continuity in accordance with Service Procedure H04A.

67 CHECK LIQUID LINE SOLENOID (ZONE)

Alarm Type

Zone Specific Check or Shutdown

Associated Alarm Codes

12 Sensor Shutdown

111 Unit Not Configured Correctly

114 Multiple Alarms - Can Not Run

Component Description and Location

The Zone 1 (host) liquid line solenoid is located in the condenser section of the host unit. The remote zone liquid line solenoids are located in the remote evaporators.

Note: If the unit is a DE, the Zone 2 liquid line solenoid is located in the host unit Zone 2 evaporator section.

Circuit Description

The Liquid Line Solenoid circuit is a two wire circuit. Refer to the unit wiring diagram for connector and pin number identification. The Zone 1 Liquid Line Solenoid is controlled from the Base Controller. The remote zone Liquid Line Solenoids are controlled from the Expansion Module (including Zone 2 on DE units).

Zone 1: The Liquid Line Solenoid is energized by Relay K8 and Fuse F11 (10A) on the Base Controller. The LLS wire applies 12 Vdc to one side of the Liquid Line Solenoid to energize the solenoid. The CHLL wire connects the other side of the solenoid to chassis ground at the ground plate near the unit battery. The solenoid is not polarity sensitive. The wires are routed in the Main Harness. Refer to the unit wiring diagrams for wire numbers, locations, and additional details.

Remote Zones: The Liquid Line Solenoid is energized by a Smart FET on the Expansion Module. The LLS wire applies 12 Vdc to one side of the Liquid Line Solenoid to energize the solenoid. The ground connection to the other side of the solenoid is given through SOL connectors on the terminal block and CH wire routed to the ground stud on the evaporator frame. All ground wires are run back to the host ground plate through CH and CH1 wires in the remote harness. The solenoid is not polarity sensitive. The circuits have connectors in the remote evaporator and at the host unit. Refer to the unit wiring diagrams for wire numbers, locations, and additional details.

Considerations

1. On systems with remote zone parallel evaporators, the respective Expansion Module Liquid Line Solenoid output will supply power to both of the remote zone Liquid Line Solenoids. The Pretrip and Smart FET current limits will be adjusted for the increased current drawn by parallel evaporators based on the zone configuration settings.
2. During a non-running Pretrip, the current draw is determined by the Base Controller shunt reading.
3. During normal operation, the current draw is determined by the Smart FET feedback to the Base Controller.
4. If an alarm code is set during normal operation, the ServiceWatch Data Logger will list the Alarm Code, Fault Current (FLTCT), Battery Volts, and the Shunt Current. The FLTCT will be the high or low current draw as determined by the Smart FET feedback that caused the alarm code to set.

How Alarm is Set

1. If during normal operation the current is greater than 3.0 amps or less than 0.5 amps (1.0 to 6 amps if parallel evaporators) at specified intervals after the solenoid is energized, Alarm Code 67 is set as a Check Alarm and the output is turned off. If the output circuit is shorted, it will be turned off immediately to protect the circuit and the alarm code will be set. Liquid Line Solenoid operation is not allowed until Alarm Code 67 is cleared. If this condition occurs when the unit is in Evacuation Mode, Alarm Code 67 will be set as a Shutdown Alarm.
2. If during normal operation the current does not return to less than 0.5 amps at a specified interval after the solenoid is de-energized, Alarm Code 67 is set as a Shutdown Alarm. If the

setpoint is in the frozen range and Alarm Code 67 and Alarm Code 12 are set, Alarm Code 114 will be set. In single zone frozen range operation, the unit will shut down. In multiple zone frozen range operation, the offending zone will shut down. The unit or zone will remain shut down until the alarms are cleared.

3. If during a Pretrip Test the current is not between 0.5 to 3 amps (1.0 to 6 amps if parallel evaporators) when the solenoid is energized, Alarm Code 67 is set as a Check Alarm.
4. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 67 is set as a Shutdown Alarm.
5. If during a Pretrip Test current draw for the zone being tested is normal and the zone is not configured, Alarm Code 67 and Alarm Code 111 are set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the ThermoServ Service Tool. Review the data to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

Note: For PTC units, disable PTC function for diagnostics.

1. If $\text{FLTCT} = 3.0$ amps (or 6.0 amps w/parallel evaporators), the circuit has high amp draw. Check for a shorted circuit or solenoid coil.
2. If FLTCT is less than 0.5 amps, the circuit has low amp draw. Check for high resistance or an open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Verify that the Expansion Module status LED (heartbeat LED) is flashing. If not, check the Expansion Module for proper operation in accordance with Service Procedure A01D.
2. If the Expansion Module Status LED is flashing, clear the alarm to reset the Smart FET. Check the operation of the liquid line circuit using Interface Board Test Mode. Verify the appropriate Expansion Module liquid line circuit LED illuminates. For Expansion Module LED identification, refer to the LED decal on the control box door. If the Expansion Module liquid line circuit LED illuminates, proceed to Step 3. If the Expansion Module liquid line circuit LED does not illuminate, proceed to Step 4.
3. If the Expansion Module liquid line circuit LED does not illuminate and the alarm is not present, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the liquid line solenoid, while operating the solenoid with Interface Board Test Mode. The current draw should be approximately 1.5 amps (3.0 amps if parallel evaporators). If the current is not within limits, check for high resistance or open in the circuit or solenoid coil as shown in Step 4. Verify that all circuit connectors are secure.
4. If the Expansion Module liquid line circuit LED does not illuminate and the alarm is present, check for a shorted circuit or solenoid coil. Disconnect the Expansion Module 35 pin connector J1 and check the circuit with an accurate ohmmeter for a short circuit, open circuit, or loose connection. The solenoid coil resistance should be approximately 8.3 ohms (4.1 ohms with parallel evaporators).
5. If no problems are found in steps 1-4 and the output LED does not illuminate, replace the Expansion Module.
6. Confirm the unit configuration is correct.
7. To verify the refrigeration system operation of the Liquid Line Solenoid, refer to Service Procedure R04A.

68 INTERNAL CONTROLLER FAULT

Alarm Type

Log, Check, or Shutdown

Associated Alarm Codes

N/A

How Alarm is Set

1. If a shutdown level internal fault occurs in the Base Controller, Alarm Code 68 is set as a Shutdown Alarm.
2. If a check level internal fault occurs in the Base Controller, Alarm Code 68 is set as a Check Alarm.
3. If a log level internal fault occurs in the Base Controller, Alarm Code 68 is set as a Log Alarm.

Diagnostic Procedure

1. Replace the Base Controller.
2. Return the failed Base Controller for failure analysis.

70 HOURMETER FAILURE

Alarm Type

Log

Associated Alarm Codes

N/A

How Alarm is Set

If one or more hourmeters exceeds 499,999 hours, Alarm Code 70 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

1. If the hourmeter readings are normal, perform a Cold Start in accordance with Service Procedure A07A.

Important: Any time a Cold Start is performed, the Base Controller must be set up using Service Procedure A04A. Failure to do so may result in the unit not operating to customer specifications.

2. If the code can now be cleared, proceed with Base Controller setup in accordance with Service Procedure A04A.

74 CONTROLLER RESET TO DEFAULTS

Alarm Type

Check

How Alarm is Set

If all the Base Controller programmable features have been reset to factory defaults, Alarm Code 74 is set as a Check Alarm. Alarm Code 74 is typically set by a cold start.

How Alarm is Cleared

This alarm can only be cleared from the Guarded Access Menu.

Diagnostic Procedure

1. Verify the Base Controller cold start jumper J101/J102 is in the correct (up) position. It should match the white mark on the Base Controller, at the side of the jumper. If the jumper is in the wrong position, a cold start will occur every time the unit is turned on.
2. Complete the Base Controller setup in accordance with Service Procedure A04A.

Important: *Any time Alarm Code 74 occurs, the Base Controller must be set up in accordance with Service Procedure A04A. Failure to do so may result in the unit not operating to customer specifications.*

Note: *If unit configuration is switched from Trailer to Truck, this alarm code could be set.*

- a. Alarm Code 74 will be cleared during the Base Controller setup.

77 CONTROLLER EPROM CHECKSUM FAILURE

Alarm Type

Shutdown

Associated Alarm Codes

N/A

How Alarm is Set

If a shutdown level internal memory fault has occurred in the Base Controller or Data Logger, Alarm Code 77 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm clears automatically if the condition is resolved.

Diagnostic Procedure

1. Replace the Base Controller.
2. Return the failed Base Controller for failure analysis.

79 INTERNAL DATA LOGGER OVERFLOW

Alarm Type

Log

How Alarm is Set

If too many data logger events occurred at once or if too many data logger events occurred during a download, Alarm Code 79 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

No corrective action is possible. This serves only as an indication that an event occurred that was not recorded by the data logger.

84 RESTART NULL

Alarm Type

Prevent

Associated Alarm Codes

- 10 High Discharge Pressure
- 17 Engine Failed to Crank
- 18 High Engine Coolant Temperature
- 20 Engine Failed to Start
- 21 Cooling Cycle Check
- 22 Heating Cycle Check
- 36 Electric Motor Failed to Run
- 42 Unit Forced To Low Speed
- 63 Engine Stopped
- 90 Electric Overload
- 91 Check Electric Ready Input
- 93 Low Compressor Suction Pressure

Considerations

1. This alarm is a secondary alarm that is set along with the associated primary alarm.
2. The alarm indicates that the unit is in a temporary ("prevent" or "restart null") shutdown. The alarm clears automatically if the condition does not re-occur.
3. Many of these actions include a "waiting period" (to allow the engine to cool down, a high pressure condition to subside or the like). The alarm code that caused the condition and Alarm Code 84 might be present to indicate that the Base Controller is taking a corrective action and that a restart will be attempted when conditions permit.
4. If the corrective action is successful, the original alarm code and Alarm Code 84 are cleared automatically. If the original alarm condition continues to occur, and the corrective actions taken by the Base Controller are not successful, the original alarm code remains. Alarm Code 84 is automatically cleared and the unit shuts down.
5. This alarm occurs if unit operation is not allowed as a result of the associated prevent alarm. For example, if a high discharge pressure condition shuts the unit down, a waiting period occurs to allow system pressures to equalize. A restart occurs when conditions permit.
6. If restarts are disabled, Alarm Code 84 is also disabled.
7. Most prevent alarms become Shutdown Alarm if three occurrences of the alarm occur within a set time period.
8. Alarm Codes 10, 18, and 63 are not promoted to shutdown level if the Continuous Restarts feature is enabled.
9. Alarm Codes 32 and 63 are promoted to guarded access clearable Shutdown Alarms if the Limited Restarts Feature is enabled and the Shutdown Alarm occurs three times with a 12 hour time period.
10. Some prevent alarms will result in modified unit operation after the alarm is self cleared. For example, Alarm Code 10 will result in Alarm Code 42 being set and the unit being forced to low speed for a one hour period.
11. If the unit is turned off while Alarm Code 84 is present the primary alarm becomes a Shutdown Alarm when the unit is turned back on.

How Alarm is Set

This alarm is set with the associated alarm that caused the condition.

How Alarm is Cleared

This alarm clears automatically if the condition is resolved.



Section 5 - Diagnostics

Diagnostic Procedure

Check for associated alarms and repair as required.

86 CHECK DISCHARGE PRESSURE SENSOR

Alarm Type

Check

Associated Alarm Codes

10 High Discharge Pressure

Circuit Description

The three wire discharge pressure sensor is supplied with +5 Vdc and ground from the Base Controller. The wiring is located in the Sensor Harness via the DPP, DPN, and DPI circuits.

Considerations

The Discharge Pressure Transducer, Suction Pressure Transducer and Coolant Level switch each have a separate 5 Vdc power supply. A short circuit condition in one transducer or switch circuit should not affect the other circuits.

The maximum discharge pressure that can be displayed is 500 psig. If the sensed pressure is greater than 500 psig, the HMI Control Panel will display [----] instead of the discharge pressure.

The minimum discharge pressure that can be sensed is -10 psig. If the sensed pressure is less than -10 psig, the HMI Control Panel will display [----] instead of the discharge pressure. The control system cannot determine if the minimum sensed pressure is the result of an electrical short or very low system pressure.

The Discharge Pressure Transducer will have a "500" on the body of the part. The Suction Pressure Transducer will have a "200" on the body of the part. They are not interchangeable.

How Alarm is Set

1. If the unit is not running and the discharge pressure transducer reading is greater than 500 psig for 10 seconds, Alarm Code 86 is set as a Check Alarm. If the unit is in a Pretrip Test, this alarm is set as a Shutdown Alarm.
2. If the unit is running, the ambient temperature is greater than 10°F (-12°C), and the discharge pressure transducer reading is less than +15 psig for 10 seconds, Alarm Code 86 is set as a Check Alarm. If the unit is in a Pretrip Test, this alarm is set as a Shutdown Alarm.
3. If Alarm Code 10 is cleared and the discharge pressure transducer reading is greater than or equal to 425 psig but less than 500 psig, Alarm Code 86 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually. Clearing the code will cause the unit to shut down and restart to check the transducer for proper operation by performing an ETV check.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the discharge pressure display using the Gauge Menu.
2. If the discharge pressure is not displayed by the Base Controller, unplug the transducer and check for +5 Vdc between DPP and DPN. If +5 Vdc is not present, check the Base Controller in accordance with Service Procedure A01A.
3. Check the harness wires DPP, DPN, and DPI for continuity using an ohmmeter.
4. Connect refrigeration gauges to verify that the sensor is displaying the correct pressure. Replace the sensor if required.

87 CHECK SUCTION PRESSURE SENSOR

Alarm Type

Check or Shutdown

Associated Alarm Codes

N/A

Circuit Description

The three wire suction pressure sensor is supplied with +5 Vdc and ground from the Base Controller. The sensor is located in the suction line and downstream of the ETV (if present). The wiring is located in the Sensor Harness via the SPP, SPN, and SPI circuits.

Considerations

The Discharge Pressure Transducer, Suction Pressure Transducer and Coolant Level switch each have a separate 5 Vdc power supply. A short circuit condition in one transducer or switch circuit should not affect the other circuits.

The maximum suction pressure that can be displayed is 200 psig. If the sensed pressure is greater than 200 psig, the HMI Control Panel will display [----] instead of the suction pressure. When the unit is off and the refrigerant pressures have equalized, the system pressure can exceed 200 psig when ambient temperatures are above 90°F (35°C). If this occurs the HMI Control Panel will display [----]. This is normal operation and no cause for concern.

The minimum suction pressure that can be sensed is -12 psig. If the sensed pressure is less than -12 psig, the HMI Control Panel will display [----] instead of the suction pressure.

If the sensor opens, the display will read -10 psig. An alarm may not be generated immediately but the unit will be forced to low speed due to low suction pressure.

The Suction Pressure Transducer will have a "200" on the body of the part. The Discharge Pressure Transducer will have a "500" on the body of the part. They are not interchangeable.

How Alarm is Set

1. If the unit is running and the suction pressure sensor reading is greater than 200 psig for 10 seconds, Alarm Code 87 is set as a Check Alarm. If the unit is in a Pretrip Test, this alarm is set as a Shutdown Alarm. If the suction pressure is greater than 200 psig, the sensor display will be dashes [----].
2. If the unit is running and the suction pressure sensor reading is less than -9 psig for 10 seconds, Alarm Code 87 is set as a Check Alarm. If the unit is in a Pretrip Test, this alarm is set as a Shutdown Alarm.
3. If suction pressure does not change ± 3 psig during the ETV test, Alarm Code 87 is set as a Check Alarm. If the unit is in a Pretrip Test, this alarm is set as a Shutdown Alarm.
4. If Guarded Access > Unit Configuration > ETV Enabled is set YES on a unit without ETV, Alarm Code 87 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually. Clearing the code will cause the unit to shut down and restart to check the transducer for proper operation by performing an ETV check.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. If the ServiceWatch Data Logger does not show an apparent reason for this alarm code to be set and the unit is a non-ETV unit, check to verify the Guarded Access > Unit Configuration > ETV Enabled is set NO.
2. Check the suction pressure display using the Gauge Menu. If the suction pressure is -10 psig, turn the unit off and allow the system refrigerant pressures to equalize. If the displayed suction pressure remains at -10 psig, the suction pressure transducer is defective and must be replaced.



3. Check the suction pressure display using the Gauge Menu. If the sensor reads [- - -] psig, turn the unit off and allow the system pressures to equalize.
 - a. If the actual suction pressure is less than 180 psig, but the displayed suction pressure remains at [- - -], the transducer is defective and must be replaced.
 - b. If the suction pressure is greater than 180 psig, the suction pressure transducer may be operating normally. Place the unit in full cool and allow the return air temperature to drop below 50°F (10°C). If the suction pressure display remains at [- - -], the transducer, controller power supply, or conductors are faulty.
4. If the suction pressure is not displayed by the Base Controller, unplug the transducer and check for +5 Vdc between SPP-01 and SPN-01. If 5 volts is not present, check the Base Controller in accordance with Service Procedure A01A.
5. Connect refrigeration gauges to verify that the sensor is not displaying the correct pressure. Replace the sensor.
6. Check the harness wires SPP-01, SPN-01, and SP-01 for continuity using an ohmmeter.

89 CHECK ELECTRONIC THROTTLING VALVE CIRCUIT

Alarm Type

Check or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The Electronic Throttling Valve (ETV) is located in the suction line behind the evaporator panel in SB units and in the condenser section of SL/SLX units.

Important: There are two different valves currently in use. They are connected in a similar manner, but the valve wire color codes are different for each valve. Refer to the unit schematic diagram for connection details.

Circuit Description

The ETV circuit consists of four wires from the ETV driver located on the Base Controller to the ETV. The harness wires to the valve are labeled EVA-01, EVB-01, EVC-01, and EVD-01. These wires are located in the main harness.

How Alarm is Set

The electrical test is performed before every engine or electric motor start. The running test is only performed when the unit restarts after a shutdown or prevent alarm or if the Base Controller senses a problem with either or both of the refrigerant pressure transducers. The running test is also performed when an engine start occurs during a Pretrip Test.

When Alarm Code 89 is cleared, the unit will shut down (if running) and perform a full ETV test to confirm proper ETV operation.

The alarm can be set during the non-running or running phases of the unit engine start routine.

1. During the non-running phase, the ETV driver outputs are checked for error conditions (ETV electrical test).
2. During the first phase of the running test, the ETV is nearly closed. The ETV closing is confirmed by a drop in suction pressure.
3. During the second phase of the running test, the ETV is opened. The ETV opening is confirmed by a rise in suction pressure.

How Alarm is Cleared

This alarm is cleared manually. The unit will shut down (if running) and perform a full ETV test to confirm proper ETV operation.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the suction and discharge pressures with unit not running, to determine if refrigerant charge appears adequate.
2. Check the electrical operation of electronic throttling valve circuit in accordance with Service Procedure G03A.
3. If the electronic throttling valve appears to function electrically, check the refrigeration system for low refrigerant, a frozen expansion valve, or a severe restriction in the suction side of the system.

90 ELECTRIC OVERLOAD

Alarm Type

Check or Prevent in Electric Mode

Log in Diesel Mode

Associated Alarm Codes

84 Restart Null

111 Unit Not Configured Correctly

Considerations

This alarm becomes a Log Alarm if the unit is switched from Electric Mode to Diesel Mode.

How Alarm is Set

Alarm conditions are only active when three phase power is connected (ER input is high).

1. This alarm will be set during Electric Mode operation if the Base Controller determines that the electric motor overload relay (EOL) has tripped.
2. If during a Pretrip Test the unit is not configured electric standby and the EOL input is low, Alarm Code 90 is set as a Check Alarm and Alarm Code 111 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

⚠ WARNING

Hazardous Voltage!

Units featuring optional Electric Standby utilize 460, 400, or 230 volt 3 phase AC electrical power any time the unit is operating in Electric Mode. This voltage potential is also present any time the unit is connected to a source of external standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

1. Check the electric motor for current draw. Refer to the motor nameplate for the Full Load Amperage rating (FLA) of the motor.
2. Check the setting of the motor overload relay. Refer to Specifications for settings.
3. Check the EOL-01 circuit for continuity from J6 pin 2 on the Base Controller to the overload relay.
4. Check for continuity between the overload relay terminals 95 and 96. The contacts should be normally closed.
5. Check the CHHV circuit for continuity to chassis ground.

91 CHECK ELECTRIC READY INPUT

Alarm Type

Prevent in Electric Mode

Log in Diesel Mode

Associated Alarm Codes

84 Restart Null

Considerations

This alarm becomes a Log Alarm if the unit is switched from Electric Mode to Diesel Mode.

How Alarm is Set

This alarm will only be set if the unit is configured for manual switchover from electric to diesel.

1. If Electric Mode operation is selected and the Base Controller determines that three phase standby power is not connected (ER input is low), Alarm Code 91 is set as a Prevent Alarm.
2. If unit switches from electric to diesel and auto switch from electric to diesel is enabled, Alarm Code 91 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared automatically when one of the two following actions occur:

1. The unit is auto switched or manually switched to Diesel Mode operation.
2. Three phase standby power is restored to the unit.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

⚠ WARNING

Hazardous Voltage!

Units featuring optional Electric Standby utilize 460, 400, or 230 volt 3 phase AC electrical power any time the unit is operating in Electric Mode. This voltage potential is also present any time the unit is connected to a source of external standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

1. Check the ER-01 circuit from the phase detect module for 12 volts to chassis ground when standby power is connected to the unit.
2. Check the 8 circuit at the phase detect module for 12 volts.
3. Check to verify standby power of the correct voltage is present at L1, L2, and L3 on the phase detect module.
4. With unit off, check the ER-01 circuit for continuity from J6 pin 5 on the Base Controller to the phase detect module.
5. If steps 1-4 above are correct, check the Base Controller in accordance with Service Procedure A01A.
6. If steps 1, 2, 4, or 5 above do not correct the fault, replace the phase detect module.

92 SENSOR GRADES NOT SET (ZONE)

Alarm Type

Check

Associated Alarm Codes

03 Return Control Air Sensor

04 Discharge Air Control Sensor

Considerations

The sensor grade must be set using the Sensor Calibration feature in the Guarded Access Menu. If the sensor grade is not properly set, the sensor reading will not be accurate. Grade 5H is set as the default grade on factory Base Controller and is used as an indication that the sensor grade has not been set.

Alarm Code 92 is not set for spare sensors. However, if used, spare sensors should be calibrated to achieve maximum accuracy.

How Alarm is Set

If any graded return or discharge sensor is in valid range and the sensor grade is set to grade 5H (default) when the unit power switch is turned on, Alarm Code 92 is set as a Log Alarm. The offending sensor alarm code (03 or 04) is also set.

How Alarm is Cleared

Clears automatically when the sensor grade is set to other than 5H. The offending sensor alarm code (03 or 04) must be manually cleared in Guarded Access after the sensor grades have been set.

Diagnostic Procedure

1. Verify actual sensor grades for all graded sensors.
2. Using this information, calibrate the sensors using the Sensor Calibration feature in the Guarded Access Menu. For additional details, refer to Service Procedure A15A.

93 LOW COMPRESSOR SUCTION PRESSURE

Alarm Type

Prevent or Shutdown

Associated Alarm Codes

84 Restart Null

87 Check Suction Pressure Sensor

Considerations

If Alarm Code 87 is set, Alarm Code 93 is disabled.

Previous SR-3 software revisions would allow high speed operation with only one of the remote evaporators running, even though the suction pressure was low. This could result in Alarm Code 93 being set, particularly if running in high speed with low ambient temperature. With Base Controller Software Revision F005 and later, the unit will be forced to low speed operation if low suction pressure occurs with only one remote evaporator running.

How Alarm is Set

If the compressor pressure is low as determined by the suction pressure sensor, Alarm Code 93 is set as a Prevent Alarm. Two attempts will be made to allow continued operation at temporarily reduced performance, including low speed operation and a forced defrost. If, at the end of the two attempts full performance is not possible, the alarm is set as a Shutdown Alarm. Alarm Code 84 is set along with Alarm Code 93 to indicate the unit is in a temporary shutdown mode.

How Alarm is Cleared

1. The alarm can be cleared manually if the condition no longer exists.
2. The alarm will clear automatically at the conclusion of a successful prevent routine.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. If the unit is equipped with an SR-3 Base Controller, refer to Considerations above.
2. Check refrigerant level.
3. Check for a liquid line restriction such as a plugged drier or expansion valve.
4. Check for a frosted or blocked evaporator coil. Initiate a manual defrost cycle to verify the coil is clear of ice.
5. If equipped, check ETV operation in accordance with Service Procedure G03A.
6. Using Interface Board Test Mode, check the liquid injection circuit for proper operation.

96 LOW FUEL LEVEL

Alarm Type

Log or Check

Associated Alarm Codes

98 Check Fuel Level Sensor

Considerations

This alarm is enabled only if the unit is configured with a fuel level sensor.

How Alarm is Set

1. If the fuel level indicated by the fuel level sensor falls to 15% (solid state) or 20% (float) of tank capacity, Alarm Code 96 is set as a Check Alarm.
2. If rail option is enabled and fuel level is below 50%, Alarm Code 96 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared automatically when the fuel level exceeds 25% (solid state) or 30% (float) of tank capacity.

This alarm is cleared automatically if fuel level is above 75% if rail option is enabled.

Diagnostic Procedure

Check fuel tank level and fill as required.

98 CHECK FUEL LEVEL SENSOR

Alarm Type

Check

Associated Alarm Codes

96 Low Fuel Level

Component Description and Location

The ultrasonic fuel level sensor (if used) is mounted to a flange on top of the fuel tank. The ultrasonic fuel level sensor consists of a sensor, a sensor tube (or focus tube), and two gaskets. The sensor is a transducer that emits ultrasonic sound waves. The sound waves reflect off the fuel in the sensor tube and return to the transducer. The transducer senses the reflected sound waves and determines the fuel level in the sensor tube.

Ultrasonic fuel level sensors are calibrated for use with fuel tanks of particular size and shape. Refer to the appropriate unit Parts Manual for the correct part numbers.

The ultrasonic fuel level sensor and the fuel gauge on the end of the fuel tank measure the fuel level differently. The ultrasonic fuel level sensor measures the actual volume of fuel in the tank. The fuel gauge measures the height of the fuel in the tank. Therefore, the fuel level at which fuel level sensor reading and the fuel gauge reading agree closely is at 50% or 1/2 full. The readings at other fuel levels may not agree as closely. If you think the ultrasonic fuel level sensor is not working correctly, the best thing to do is to check the output voltage as shown in step 4 below. The output voltage should be between approximately 1.0 VDC for an empty tank to 4.0 VDC for a full tank.

Considerations

This alarm is enabled only if the unit is configured with a fuel level sensor.

How Alarm is Set

Alarm is set when the fuel level sensor is determined to be out of range.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Use the GAUGES soft key to display the Fuel Level Sensor reading and compare it to the reading of the fuel gauge on the end of the fuel tank. The Fuel Level Sensor reading should be approximately 50% when the fuel gauge reads 1/2 full.
2. Check to verify that the Fuel Sensor Type is set to Solid State in Unit Configuration in the Guarded Access Menu.
3. Turn the unit on and check for battery voltage (12 VDC) between the 2PL (J3-12 pin) and FUELN (J3-35 pin) wires in the sensor harness at the J3 connector on the base controller. This is the input voltage. If battery voltage is not present, check the microprocessor.
4. If battery voltage is present, check the output voltage between the FLL (J3-23 pin) and FUELN (J3-35 pin) wires in the sensor harness at the J3 connector on the base controller. The voltage should be between 1 and 4 VDC depending on the fuel level as shown in the following table:

| Fuel Level | Output Voltage |
|------------|-----------------------|
| Empty | Approximately 1.0 Vdc |
| 1/2 Full | Approximately 2.5 Vdc |
| Full | Approximately 4.0 Vdc |

Note: The output voltages listed above are for the ultrasonic fuel level sensor designed to be used with the SR-2 and SR-3 Controllers. Other systems such as third party telematics systems may use sensors with slightly different output voltages. Refer to the sensor specifications for those sensors.

5. If the output voltage is incorrect, check the continuity of the wires that go from the J3 connector on the base controller to the sensor as shown in the following table and verify the connections are clean and tight.

Note: The sensor cable (or interconnect harness) wires are connected to the sensor wires with solder connections and heat shrink tubing during installation. Refer to the applicable Installation Manual for more information.

| J3 Connector Pin | Sensor Harness Wire | Sensor Cable Connector Pin | Sensor Cable Wire | Sensor Wire |
|------------------|---------------------|----------------------------|-------------------|-------------|
| 12 | 2PL | A | Green | Red |
| 23 | FLL | B | White | Yellow |
| 35 | FUELN | C | Black | Black |

6. If the wires have good continuity and the connections are clean and tight, replace the sensor.

105 CHECK RECEIVER TANK PRESSURE SOLENOID CIRCUIT**Alarm Type**

Check or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The Receiver Tank Pressure Solenoid is located in the host unit refrigeration section.

Circuit Description

The Receiver Tank Pressure Solenoid circuit is a two wire circuit. The Receiver Tank Pressure Solenoid is energized by a Smart FET on the Base Controller. The solenoid is not polarity sensitive. The RTPS wire applies 12 VDC to one side of the Receiver Tank Pressure Solenoid to energize the solenoid. The CHRT wire connects the other side of the solenoid to chassis ground at the ground plate near the unit battery. The solenoid is not polarity sensitive. The wires are routed in the Main Harness.

Considerations

During a non-running Pretrip, the current draw is determined by the shunt reading feedback to the Base Controller.

During normal operation, the current draw is determined by the Smart FET feedback to the Base Controller.

If an Alarm Code is set during normal operation, the ServiceWatch Data Logger will list the Alarm Code, FLTCT (Fault Current), Battery Volts, and the Shunt Current. The FLTCT will be the high or low current draw as determined by the Smart FET feedback that caused the Alarm Code to set.

How Alarm is Set

1. If during normal operation the current is greater than 3 amps or less than 0.5 amps at specified intervals after the solenoid is energized, Alarm Code 105 is set as a Check Alarm and the output is turned off. If the output circuit is shorted, it will be turned off immediately to protect the circuit and the alarm code will be set. Receiver Tank Pressure Solenoid operation is not allowed until Alarm Code 105 is cleared. The unit will continue to run but with reduced performance until the condition is corrected and the alarm is cleared. If this condition occurs when the unit is in Evacuation Mode, Alarm Code 105 will be set as a Shutdown Alarm.
2. If during normal operation the current does not return to less than 0.5 amps at a specified interval after the solenoid is de-energized, Alarm Code 105 is set as a Check Alarm. Receiver Tank Pressure Solenoid operation is not allowed until Alarm Code 105 is cleared.
3. If during a Pretrip Test the current is not between 0.5 to 3 amps when the solenoid is energized, Alarm Code 105 is set as a Check Alarm.
4. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 105 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. If FLTCT is greater than 3.0 amps, the circuit has excessive current flow. Check for a shorted circuit or solenoid coil.
2. If FLTCT is less than 0.5 amps, the circuit has low current flow. Check for high resistance or an open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Clear the alarm to reset the Smart FET. Check the operation of the receiver tank pressure solenoid circuit using Interface Board Test Mode. Verify the Base Controller receiver tank



pressure solenoid circuit LED illuminates. For LED identification, refer to the LED decal on the control box door. If the receiver tank pressure solenoid circuit LED illuminates, proceed to Step 2. If the receiver tank pressure solenoid circuit LED does not illuminate, proceed to Step 3.

2. If the receiver tank pressure solenoid circuit LED does illuminate and the alarm is not present, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the receiver tank pressure solenoid, while operating the solenoid with Interface Board Test Mode. The current draw should be approximately 0.7 amps. If the current is not within limits, check for high resistance or open in the circuit or solenoid coil as shown in Step 3. Verify that all circuit connectors are secure.
3. If the receiver tank pressure solenoid circuit LED does not illuminate and the alarm is present, check for a shorted circuit or solenoid coil. Disconnect the 36 pin connector J7 and check the circuit with an accurate ohmmeter for a short circuit, open circuit, or loose connection. The solenoid coil resistance should be approximately 17.0 ohms.
4. If no problems are found in steps 1-3 and the output LED does not illuminate, check the Base Controller assembly in accordance with Service Procedure A01A.
5. To verify the refrigeration system operation of the Receiver Tank Pressure Solenoid, refer to Service Procedure R08A.

106 CHECK PURGE VALVE CIRCUIT**Alarm Type**

Check or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The Purge Valve is located in the host unit condenser section.

Circuit Description

The Purge Valve circuit is a two wire circuit. The Purge Valve is energized by a Smart FET on the Base Controller. The PV wire applies 12 VDC to one side of the Purge Valve to energize the solenoid. The CHPV wire connects the other side of the solenoid to chassis ground at the ground plate near the unit battery. The solenoid is not polarity sensitive. The wires are routed in the Main Harness.

Considerations

During a non-running Pretrip, the current draw is determined by the shunt reading feedback to the Base Controller.

During normal operation, the current draw is determined by the Smart FET feedback to the Base Controller.

If an Alarm Code is set during normal operation, the ServiceWatch Data Logger will list the Alarm Code, FLTCT (Fault Current), Battery Volts, and the Shunt Current. The FLTCT will be the high or low current draw as determined by the Smart FET feedback that caused the Alarm Code to set.

How Alarm is Set

1. If during normal operation the current is greater than 3 amps or less than 0.25 amps at specified intervals after the solenoid is energized, Alarm Code 106 is set as a Check Alarm and the output is turned off. If the output circuit is shorted, it will be turned off immediately to protect the circuit and the alarm code will be set. Purge Valve operation is not allowed until Alarm Code 106 is cleared. The unit will continue to run but with reduced performance until the condition is corrected and the alarm is cleared. If this condition occurs when the unit is in Evacuation Mode, Alarm Code 106 will be set as a Shutdown Alarm.
2. If during normal operation the current does not return to less than 0.25 amps at a specified interval after the solenoid is de-energized, Alarm Code 106 is set as a Check Alarm. Purge Valve operation is not allowed until Alarm Code 106 is cleared.
3. If during a Pretrip Test the current is not between 0.25 to 3 amps when the solenoid is energized, Alarm Code 106 is set as a Check Alarm.
4. If during a Pretrip Test the current does not return to less than 0.25 amps when de-energized, Alarm Code 106 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. If FLTCT is greater than 3.0 amps, the circuit has excessive current flow. Check for a shorted circuit or solenoid coil.
2. If FLTCT is less than 0.25 amps, the circuit has low current flow. Check for high resistance or an open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Clear the alarm to reset the Smart FET. Check the operation of the purge valve circuit using Interface Board Test Mode. Verify the purge valve circuit LED illuminates. For Base Controller LED identification, refer to the LED decal on the control box door. If the purge valve circuit



LED illuminates, proceed to Step 2. If the purge valve circuit LED does not illuminate, proceed to Step 3.

2. If the purge valve circuit LED does illuminate and the alarm is not present, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the purge valve, while operating the valve with Interface Board Test Mode. The current draw should be approximately 0.7 amps. If the current is not within limits, check for high resistance or an open in the circuit or solenoid coil as shown in Step 3. Verify that all circuit connectors are secure.
3. If the purge valve circuit LED does not illuminate and the alarm is present, check for a shorted circuit or solenoid coil. Disconnect the 36 pin connector J7 and check the circuit with an accurate ohmmeter for a short circuit, open circuit, or loose connection. The valve coil resistance should be approximately 17.0 ohms.
4. If no problems are found in steps 1-3 and the output LED does not illuminate, check the Base Controller assembly in accordance with Service Procedure A01A.
5. To verify the refrigeration system operation of the Purge Valve, refer to Service Procedures R07A and R08A.

107 CHECK CONDENSER INLET SOLENOID CIRCUIT**Alarm Type**

Check or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The Condenser Inlet Solenoid is located in the host unit condenser section.

Circuit Description

The Condenser Inlet Solenoid circuit is a two wire circuit. The Condenser Inlet Solenoid is energized by a Smart FET on the Interface Board. The CIS wire applies 12 VDC to one side of the Condenser Inlet Solenoid to energize the solenoid. The CHCI wire connects the other side of the solenoid to chassis ground at the ground plate near the unit battery. The solenoid is not polarity sensitive. The wires are routed in the Main Harness.

Considerations

During a non-running Pretrip, the current draw is determined by the shunt reading feedback to the Base Controller.

During normal operation, the current draw is determined by the Smart FET feedback to the Base Controller.

If an Alarm Code is set during normal operation, the ServiceWatch Data Logger will list the Alarm Code, FLTCT (Fault Current), Battery Volts, and the Shunt Current. The FLTCT will be the high or low current draw as determined by the Smart FET feedback that caused the Alarm Code to set.

How Alarm is Set

1. If during normal operation the current is greater than 3 amps or less than 0.25 amps at specified intervals after the solenoid is energized, Alarm Code 107 is set as a Check Alarm and the output is turned off. If the output circuit is shorted, it will be turned off immediately to protect the circuit and the alarm code will be set. Condenser Inlet Solenoid operation is not allowed until Alarm Code 107 is cleared. The unit will continue to run but with reduced performance until the condition is corrected and the alarm is cleared. If this condition occurs when the unit is in Evacuation Mode, Alarm Code 107 will be set as a Shutdown Alarm.
2. If during normal operation the current does not return to less than 0.25 amps at a specified interval after the solenoid is de-energized, Alarm Code 107 is set as a Check Alarm. Condenser Inlet Solenoid operation is not allowed until Alarm Code 107 is cleared.
3. If during a Pretrip Test the current is not between 0.25 to 3 amps when the solenoid is energized, Alarm Code 107 is set as a Check Alarm.
4. If during a Pretrip Test the current does not return to less than 0.25 amps when de-energized, Alarm Code 107 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. If FLTCT is greater than 3.0 amps, the circuit has excessive current flow. Check for a shorted circuit or solenoid coil.
2. If FLTCT is less than 0.25 amps, the circuit has low current flow. Check for high resistance or an open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Clear the alarm to reset the Smart FET. Check the operation of the condenser inlet solenoid circuit using Interface Board Test Mode. Verify the condenser inlet solenoid circuit LED illuminates. For Base Controller LED identification, refer to the LED decal on the control box



door. If the condenser inlet solenoid circuit LED illuminates, proceed to Step 2. If the condenser inlet solenoid circuit LED does not illuminate, proceed to Step 3.

2. If the condenser inlet solenoid circuit LED does illuminate and the alarm is not present, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the condenser inlet solenoid, while operating the solenoid with Interface Board Test Mode. The current draw should be approximately 1.3 amps. If the current is not within limits, check for high resistance or an open in the circuit or solenoid coil as shown in Step 3. Verify that all circuit connectors are secure.
3. If the condenser inlet solenoid circuit LED does not illuminate and the alarm is present, check for a shorted circuit or solenoid coil. Disconnect the 36 pin connector J7 and check the circuit with an accurate ohmmeter for a short circuit, open circuit, or loose connection. The solenoid coil resistance should be approximately 9.6 ohms.
4. If no problems are found in steps 1-3 and the output LED does not illuminate, check the Base Controller assembly in accordance with Service Procedure A01A.
5. To verify the refrigeration system operation of the Condenser Inlet Solenoid, refer to Service Procedure R08A.

108 DOOR OPEN TIMEOUT

Alarm Type

Check

Associated Alarm Codes

N/A

Considerations

Changes in the door switch state are not recognized for four seconds. This is to prevent rapid unit operation changes if the door is ajar or the door switch is defective.

The unit will be restarted after the off timer expires.

How Alarm is Set

The following conditions must be met:

- The optional door switch must be installed.
 - The unit must be programmed (unit null, high speed lockout, or zone null, if multi-temp) to force the unit off/on door opening.
 - A maximum door open timeout must be programmed.
 - Door open timeout alarm set to enabled.
1. When door open timer expires, the unit will resume normal operation even if the door is still open. Alarm Code 108 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Download the ServiceWatch data logger and review the information to determine if the door switch is defective or if the door was left open for an extended period of time during loading or unloading of the trailer.
2. Check the operation of the door switches.

110 CHECK SUCTION LINE SOLENOID CIRCUIT (ZONE)

Alarm Type

Check or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The Suction Line Solenoid is located in the refrigeration section and the individual remote evaporators.

Note: If the unit is a DE, the Zone 2 Suction Line Solenoid is located in the host unit Zone 2 evaporator section.

Circuit Description

The Suction Line Solenoid circuit is a two wire circuit. The Suction Line Solenoids are energized by Smart FETs in the Expansion Module. The SLS wire applies 12 VDC to one side of the Suction Line Solenoid to energize the solenoid. The CHSL wire connects the other side of the solenoid to chassis ground. The solenoid is not polarity sensitive. The wires are routed in the Expansion Module Harness. The circuits have connectors in the remote evaporator and at the host unit.

Considerations

On systems with remote zone parallel evaporators, the respective Expansion Module Suction Line Solenoid output will supply power to both of the remote zone Suction Line Solenoids. The Pretrip and Smart FET current limits will be adjusted for the increased current drawn by parallel evaporators based on the zone configuration settings.

During a non-running Pretrip, the current draw is determined by the shunt reading feedback to the Base Controller.

During normal operation, the current draw is determined by the Smart FET feedback to the Base Controller.

If an Alarm Code is set during normal operation, the ServiceWatch Datalogger will list the Alarm Code, FLTCT (Fault Current), Battery Volts, and the Shunt Current. The FLTCT will be the high or low current draw as determined by the Smart FET feedback that caused the Alarm Code to set.

How Alarm is Set

1. If during normal operation the current is greater than 3 amps or less than 0.5 amps at specified intervals after the solenoid is energized, Alarm Code 110 is set as a Check Alarm and the output is turned off. If the output circuit is shorted, it will be turned off immediately to protect the circuit and the alarm code will be set. Suction Line Solenoid operation is not allowed until Alarm Code 110 is cleared. The unit will continue to run but with reduced performance until the condition is corrected and the alarm is cleared. If this condition occurs when the unit is in Evacuation Mode, Alarm Code 110 will be set as a Shutdown Alarm.

With a frozen range setpoint the following occurs:

- If in single zone operation, the unit runs normally.
- If in multi-zone operation and all the zones are running in cool, heat, or heat and defrost, the unit runs normally.
- If the offending zone requires heat and one or more zones are in cool, force the offending zone into null.
- If the offending zone requires defrost and one or more zones are in cool, force all zones in cool into running null. Zones will resume cooling after defrost in the offending zone is completed.

With a fresh range setpoint the following occurs:

- If in single zone operation, the unit runs normally.
- If in multi-zone operation and all the zones are running in cool, heat, or heat and defrost, the unit runs normally.

- If the offending zone requires heat or defrost and one or more zones are in cool, force all zones in cool into running null. Zones will resume cooling after heating and or defrost in the offending zone is completed.
- 2. If the current does not return to less than 0.5 amps three seconds after the solenoid is de-energized and the unit is in multi-zone operation, Alarm Code 110 is set as a Check Alarm. If the current does not return to less than 0.5 amps three seconds after the solenoid is de-energized and the unit is in single zone operation, Alarm Code 110 is set as a Shutdown Alarm.
- 3. If during a Pretrip Test the current is not between 0.5 to 3 amps (1.0 to 6 amps if parallel evaporators) when the solenoid is energized, Alarm Code 110 is set as a Check Alarm.
- 4. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 110 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. If FLTCT is greater than 3.0 amps or 6.0 amps w/parallel evaporators, the circuit has excessive current flow. Check for a shorted circuit or solenoid coil.
2. If FLTCT is less than 0.5 amps, the circuit has low current flow. Check for high resistance or an open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Verify that the Expansion Module status LED (heartbeat LED) is flashing. If not, check the Expansion Module for proper operation in accordance with Service Procedure A01D.
2. If the Expansion Module Status LED is flashing, clear the alarm to reset the Smart FET. Check the operation of the suction line solenoid circuit using Interface Board Test Mode. Verify the appropriate Expansion Module suction line solenoid LED illuminates. For Expansion Module LED identification, refer to the LED decal on the control box door. If the Expansion Module suction line solenoid circuit LED illuminates, proceed to Step 3. If the Expansion Module suction line solenoid circuit LED does not illuminate, proceed to Step 4.
3. If the Expansion Module suction line solenoid circuit LED does not illuminate and the alarm is not present, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the suction line solenoid, while operating the solenoid with Interface Board Test Mode. The current draw should be approximately 1.3 amps (2.6 amps if parallel evaporators). If the current is not within limits, check for high resistance or an open in the circuit or solenoid coil as shown in Step 4. Verify that all circuit connectors are secure.
4. If the Expansion Module suction line solenoid circuit LED does not illuminate and the alarm is present, check for a shorted circuit or solenoid coil. Disconnect the Expansion Module 35 pin connector J1 and check the circuit with an accurate ohmmeter for a short circuit, open circuit, or loose connection. The solenoid coil resistance should be approximately 9.6 ohms (4.8 ohms with parallel evaporators).
5. If no problems are found in steps 1-4 and the output LED does not illuminate, replace the Expansion Module.
6. Confirm the unit configuration is correct.
7. To verify the refrigeration system operation of the Suction Line Solenoid, refer to Service Procedures R05A and R06A.

111 UNIT NOT CONFIGURED CORRECTLY

Alarm Type

Log

Associated Alarm Codes

- 02 Check Evaporator Coil Sensor
- 03 Return Control Air Sensor
- 04 Discharge Air Control Sensor
- 29 Defrost Damper Circuit Check
- 30 Defrost Damper Stuck
- 45 Hot Gas Bypass Circuit
- 67 Check Liquid Line Solenoid Circuit
- 90 Electric Overload
- 110 Check Suction Line Solenoid Circuit
- 113 Check Electric Heat Circuit
- 121 Check PWM/Liquid Injection Circuit
- 122 Check Diesel/Electric Circuit
- 137 Damper Gear Motor Heater
- 143 Check Drain Hose Heater Output

How Alarm is Set

If a mismatch exists between the unit hardware configuration and the unit hardware as detected by the Base Controller, Alarm Code 111 is set as a Log Alarm

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

1. Verify actual unit configuration.
2. Set the unit configuration using the Unit Configuration sub-menu of the Programming Menu in accordance with Service Procedure A04A.
3. Verify correct Base Controller and software installed.

112 CHECK REMOTE FANS (ZONE)**Alarm Type**

Check or Shutdown

Associated Alarm Codes

114 Multiple Alarms - Can Not Run

Component Description and Location

The fans are located in the remote evaporator(s). The test values are determined by the type of remote evaporators and the actual unit configuration for number and type of evaporators in a zone.

Circuit Description

The evaporator fans are energized by Smart FETs in the Expansion Module. The blue wires connect the fan motor to chassis ground. All ground wires are run back to the unit ground plate. The wires are routed in the Expansion Module Harness. The circuits have connectors in the remote evaporator and at the host unit.

Considerations

Fan power is supplied from the Expansion Module. 2A power is connected to the Expansion Module at the 2A stud on the Module.

Remote evaporators will have two or three fan motors. Any zone can have a minimum of two fan motors and a maximum of six fan motors. An individual unit can support up to 12 fan motors.

On systems with parallel remote zone evaporators, the respective Expansion Module fan motor output will supply power to two fan motors. Refer to the applicable unit wiring diagram for details.

On systems with single remote zone evaporators, the respective Expansion Module fan motor output will supply power to one fan motor. Refer to the applicable unit wiring diagram for details.

On DE units, the Zone 2 fan motor output is used to operate the Zone 2 damper solenoid. Refer to Alarm Code 29 for additional details.

The Pretrip and Smart FET current limits will be adjusted for current draw based on the zone configuration settings.

The circuits have connectors in the remote evaporator and at the host unit.

How Alarm is Set

1. If during normal operation the current is not greater than 0.5 amps 2.5 seconds after the fan(s) are energized, Alarm Code 112 is set as a Check Alarm and the output is turned off.
 - a. If the unit is in single temperature operation and all fan motors have Alarm Code 112 set, Alarm Code 114 will be set as a Shutdown Alarm. If one or more fans are allowed to run, the unit will continue to run.
 - b. If the unit is in multi-temperature operation and all fan motors in a remote evaporator have Alarm Code 112 set, the remote evaporator will be forced into shutdown and all remote evaporator outputs for that evaporator will be forced off. Alarm Code 112 will be set as a zone Shutdown Alarm.
2. If during normal operation the current is greater than 18.0 amps 2.5 seconds after the fan(s) are energized, Alarm Code 112 is set as a Check Alarm and the output is turned off.
 - a. If the unit is in single temperature operation and all fan motors have Alarm Code 112 set, Alarm Code 114 will be set as a Shutdown Alarm. If one or more fans are allowed to run, the unit will continue to run.
 - b. If the unit is in multi-temperature operation and all fan motors in a remote evaporator have Alarm Code 112 set, the remote evaporator will be forced into shutdown and all remote evaporator outputs for that evaporator will be forced off. Alarm Code 112 will be set as a zone Shutdown Alarm.
3. If during normal operation the current is greater than 0.5 amps three seconds after the fan(s) are de-energized, Alarm Code 112 is set as a Check Alarm and the output is turned off.
 - a. All defrost functions are disabled until the alarm is cleared.

4. If during normal operation the current is greater than the Smart FET current limit one second after the fan(s) are energized, Alarm Code 112 is set as a Check Alarm and the output is turned off.
 - a. If the unit is in single temperature operation and all fan motors have Alarm Code 112 set, Alarm Code 114 will be set as a Shutdown Alarm. If one or more fans are allowed to run, the unit will continue to run.
 - b. If the unit is in multi-temperature operation and all fan motors in a remote evaporator have Alarm Code 112 set, the remote evaporator will be forced into shutdown and all remote evaporator outputs for that evaporator will be forced off. Alarm Code 112 will be set as a zone Shutdown Alarm.
5. If during a Pretrip Test the current is not within specification when the fans are energized, Alarm Code 112 is set as a Check Alarm.
6. If during a Pretrip Test the current does not return to less than 0.5 amps when the fans are de-energized, Alarm Code 112 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. $\text{FLTCT} = 20$. The circuit has high amp draw. Check for a shorted circuit or solenoid coil.
2. $\text{FLTCT} < 0.5$. The circuit has low amp draw. Check for high resistance or open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Verify that the Expansion Module status LED (heartbeat LED) is flashing. If not, check the Expansion Module for proper operation in accordance with Service Procedure A01D.
2. If the Expansion Module Status LED is flashing, clear the alarm to reset the Smart FET. Check the operation of the fan circuit using Interface Board Test Mode. Verify the appropriate Expansion Module fan circuit LED illuminates. For Expansion Module LED identification, refer to the LED decal on the control box door. If the Expansion Module fan circuit LED illuminates, proceed to Step 3. If the Expansion Module fan circuit LED does not illuminate, proceed to Step 4.
3. If the Expansion Module fan circuit LED does not illuminate and the alarm is not present, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the fan circuit, while operating the fans with Interface Board Test Mode. If the current is not within limits, check for high resistance or open in the circuit as shown in Step 4. Verify that all circuit connectors are secure.
4. If the Expansion Module fan circuit LED does not illuminate and the alarm is present, check for a shorted circuit. Disconnect the Expansion Module 6 pin connector J13 and check the circuit with an accurate ohmmeter for a short circuit, open circuit, or loose connection.
5. If no problems are found in steps 1-4 and the output LED does not illuminate, replace the Expansion Module.
6. Confirm the unit configuration is correct.

113 CHECK ELECTRIC HEAT CIRCUIT (ZONE)**Alarm Type**

Check or Shutdown (Pretrip Test Only)

Associated Alarm Codes

28 Pretrip Abort

111 Unit Not Configured Correctly

Circuit Description

The optional electric heat contactor (HC) is located on the high voltage tray. The contactor coil is powered by 7E from the Diesel/Electric relay. The coil is energized when 26E is grounded by the Base Controller.

Considerations

Electric Standby Equipped and Electric Heat Option both configured YES.

Not tested if unit is connected to external standby power.

Electric heat is applicable to the Host Zone evaporator on Model 50 trailer units only.

How Alarm is Set

This alarm is set if the measured shunt current is incorrect during a non-running pretrip test.

Current is measured with the output on and off.

1. The alarm is set as a Check Alarm if the current is not within specifications when the solenoid is energized.
2. The alarm is set as a Shutdown Alarm if the current does not return to zero when the device is de-energized.
3. The alarm is set as a Shutdown Alarm if the unit is not configured as a Model 50 unit and the current flow is within specifications when the solenoid is energized.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check for battery voltage at the 7E wire on the heater contactor.
2. Check the heater contactor coil for continuity.
3. Verify actual unit configuration.

114 MULTIPLE ALARMS - CAN NOT RUN**Alarm Type**

Shutdown

Associated Alarm Codes

Associated alarm indicating the cause of shutdown.

How Alarm is Set

If both pressure transducers are failed and Alarm Code 03 or 04 is set, Alarm Code 114 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually or automatically.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

Proceed as indicated for the associated alarm codes.

117 AUTO OR MANUAL SWITCH FROM DIESEL TO ELECTRIC**Alarm Type**

Log or Shutdown

Associated Alarm Codes

118 Auto or Manual Switch from Electric to Diesel

How Alarm is Set

1. If the unit is switched from diesel operation to electric operation during a Pretrip Test, Alarm Code 117 is set as a Log Alarm. The Pretrip Test will be restarted from the beginning in Electric Mode.
2. If the unit is switched from diesel operation to electric operation during a non-running Service Test Mode operation, Alarm Code 117 is set as a Shutdown Alarm.
3. If the unit is switched from diesel operation to electric operation during normal operation, this alarm is set as a Log Alarm for information only.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Information only. No action is required.

118 AUTO OR MANUAL SWITCH FROM ELECTRIC TO DIESEL**Alarm Type**

Log or Shutdown

Associated Alarm Codes

117 Auto or Manual Switch from Diesel to Electric

How Alarm is Set

1. If the unit is switched from electric operation to diesel operation during a Pretrip Test, Alarm Code 118 is set as a Log Alarm. The Pretrip Test will be restarted from the beginning in Diesel Mode.
2. If the unit is switched from electric operation to diesel operation during a non-running Service Test Mode operation, Alarm Code 118 is set as a Shutdown Alarm.
3. If the unit is switched from electric operation to diesel operation during normal operation, this alarm is set as a Log Alarm for information only.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Information only. No action is required.

120 CHECK ALTERNATOR EXCITE CIRCUIT

Alarm Type

Check or Shutdown

Associated Alarm Codes

N/A

Circuit Description

The Alternator Excite circuit is a single wire circuit. The EXC wire connects the Base Controller connector J7 pin 33 to the alternator excite terminal. The wire is routed in the main harness. A Smart FET on the Base Controller supplies power to the EXC circuit. LED 18 is turned on when the alternator excite output is energized.

Considerations

The alternator excite input is energized when the engine starts to supply excitation voltage to the alternator.

How Alarm is Set

1. If during normal operation the current is not within specifications (above 2 amps) three seconds after the alternator excite output is energized, Alarm Code 120 is set as a Check Alarm and the output is turned off. Alternator excite operation is not allowed until Alarm Code 120 is cleared. The unit will continue to run but with reduced performance until the condition is corrected and the alarm is cleared.
2. If during normal operation the current does not return to less than 0.5 amps three seconds after the alternator excite output is de-energized, Alarm Code 120 is set as a Check Alarm. Alternator excite operation is not allowed until Alarm Code 120 is cleared. The unit will continue to run but with reduced performance until the condition is corrected and the alarm is cleared.
3. If during a Pretrip Test the current is not within specifications when the alternator excite output is energized, Alarm Code 120 is set as a Check Alarm.
4. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 120 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the operation of the alternator excite circuit using Interface Board Test Mode. Verify the alternator excite circuit LED illuminates. If the alternator excite circuit LED 18 illuminates, proceed to Step 2. If the alternator excite circuit LED 18 does not illuminate, proceed to Step 3.
2. If the alternator excite circuit LED 18 does illuminate, check for 12 Vdc at the alternator excite terminal. If 12 Vdc is not present, check for a short circuit, open circuit, or loose connection.
3. If the alternator excite circuit LED 18 does not illuminate, check the circuit with an accurate ohmmeter for a short circuit, open circuit, shorts to ground, or loose connection.
4. Disconnect the EXC wire at the alternator and check for 12 Vdc when the engine is running. If 12 VDC is not present, check the EXC circuit for continuity.
5. Check the Base Controller in accordance with Service Procedure A01A.

121 CHECK PWM/LIQUID INJECTION CIRCUIT**Alarm Type**

Log or Shutdown (Pretrip Only)

Associated Alarm Codes

111 Unit Not Configured Correctly

How Alarm is Set

The PWM/Liquid Injection Circuit is currently not used. However, the associated output is checked during the Non-running Pretrip Test to verify nothing has been mistakenly connected to it. The output is energized and then de-energized to verify that no device is connected to the circuit and that the Base Controller is operating properly.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check unit configuration to confirm proper setting.
2. Check the Base Controller wiring to verify that there is no connection to connector J7 pin 10.
3. Check the Base Controller in accordance with Service Procedure A01A.

122 CHECK DIESEL/ELECTRIC CIRCUIT

Alarm Type

Check or Shutdown (Pretrip Test Only)

Associated Alarm Codes

N/A

Circuit Description

The Diesel/Electric circuit is energized by the Diesel/Electric Relay K5 on the Base Controller. The 7E wire supplies 12 VDC to the Phase Select Module to energize the appropriate Standby Motor contactor.

Considerations

The following is true on all units, even if Electric Standby is not present:

1. When the Diesel/Electric Relay is energized during a Pretrip Test, the Fuel Solenoid is de-energized. The current flow measured by the shunt should decrease to indicate that the Fuel Solenoid is actually de-energized. If the current flow does not decrease, the Fuel Solenoid was not de-energized and Alarm Code 122 is set. This is normal operation.
2. If the current flow decreases by less than 0.75 amps when the Fuel Solenoid is de-energized, the Fuel Solenoid is presumed to be de-energized and the Pretrip Test continues.
3. If the current flow decreases by more than 0.75 amps when the Fuel Solenoid is de-energized, Alarm Code 122 is also set. This indicates that the Fuel Solenoid is drawing excessive current. Alarm Code 35 is not set under these conditions.

How Alarm is Set

1. If during a Pretrip Test the unit is configured with Diesel/Electric Relay and current is less than 0.5 amps when the circuit is energized, Alarm Code 122 is set as a Check Alarm.
2. If during a Pretrip Test the zone is configured with Diesel/Electric Relay and current is greater than 0.5 amps of run relay reference when de-energized, Alarm Code 122 is set as a Shutdown Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the operation of the Diesel/Electric relay using Interface Board Test Mode in the Maintenance Menu. Verify the Diesel/Electric LED 7 illuminates.
2. Use the HMI control panel amps gauge to check the current drawn by the Diesel/Electric relay while operating the Diesel/Electric relay with Interface Board Test Mode. The current draw should be between 0.5 to 2 amps.
3. If Alarm Code 122 is set, check the current draw of the Fuel Solenoid using Interface Board Test Mode. If the current draw for the Fuel Solenoid decreases by more than 0.75 amps during the Diesel/Electric Relay Test, the Fuel Solenoid should be replaced.

Important: Do not replace the Base Controller without first confirming that Alarm Code 122 was not set by the Fuel Solenoid drawing current in excess of 0.75 amps.

Note: A replacement fuel solenoid can be plugged in but not physically installed and a Pretrip Test run to confirm the original fuel solenoid is the source of the problem.

127 SETPOINT NOT ENTERED**Alarm Type**

Check

Associated Alarm Codes

N/A

How Alarm is Set

If the setpoint was changed but the change was not confirmed by pressing the YES key, Alarm Code 127 is set as a Check Alarm. The setpoint has not been changed and has returned to the original setting.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Information only. Verify setpoint is adjusted properly.

128 ENGINE RUN TIME MAINTENANCE REMINDER #1**Alarm Type**

Log

Associated Alarm Codes

N/A

Considerations

The programmable hourmeter alarms can be cleared from the Guarded Access Menu only.

How Alarm is Set

If one of the user programmed hourmeters has exceeded the time limit, Alarm Code 128 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared from the Guarded Access Menu only.

Diagnostic Procedure

1. Perform required maintenance as dictated by owner requirements.
2. Reset the hourmeter limit after completion in accordance with Service Procedure A28A.

129 ENGINE RUN TIME MAINTENANCE REMINDER #2

Alarm Type

Log

Associated Alarm Codes

N/A

Considerations

The programmable hourmeter alarms can be cleared from the Guarded Access Menu only.

How Alarm is Set

If one of the user programmed hourmeters has exceeded the time limit, Alarm Code 129 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared from the Guarded Access Menu only.

Diagnostic Procedure

1. Perform required maintenance as dictated by owner requirements.
2. Reset the hourmeter limit after completion in accordance with Service Procedure A28A.

130 ELECTRIC RUN TIME MAINTENANCE REMINDER #1

Alarm Type

Log

Associated Alarm Codes

N/A

Considerations

The programmable hourmeter alarms can be cleared from the Guarded Access Menu only.

How Alarm is Set

If one of the user programmed hourmeters has exceeded the time limit, Alarm Code 130 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared from the Guarded Access Menu only.

Diagnostic Procedure

1. Perform required maintenance as dictated by owner requirements.
2. Reset the hourmeter limit after completion in accordance with Service Procedure A28A.

131 ELECTRIC RUN TIME MAINTENANCE REMINDER #2**Alarm Type**

Log

Associated Alarm Codes

N/A

Considerations

The programmable hourmeter alarms can be cleared from the Guarded Access Menu only.

How Alarm is Set

If one of the user programmed hourmeters has exceeded the time limit, Alarm Code 131 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared from the Guarded Access Menu only.

Diagnostic Procedure

1. Perform required maintenance as dictated by owner requirements.
2. Reset the hourmeter limit after completion in accordance with Service Procedure A28A.

132 TOTAL UNIT RUN TIME MAINTENANCE REMINDER #1**Alarm Type**

Log

Associated Alarm Codes

N/A

Considerations

The programmable hourmeter alarms can be cleared from the Guarded Access Menu only.

How Alarm is Set

If one of the user programmed hourmeters has exceeded the time limit, Alarm Code 132 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared from the Guarded Access Menu only.

Diagnostic Procedure

1. Perform required maintenance as dictated by owner requirements.
2. Reset the hourmeter limit after completion in accordance with Service Procedure A28A.

133 TOTAL UNIT RUN TIME MAINTENANCE REMINDER #2**Alarm Type**

Log

Associated Alarm Codes

N/A

Considerations

The programmable hourmeter alarms can be cleared from the Guarded Access Menu only.

How Alarm is Set

If one of the user programmed hourmeters has exceeded the time limit, Alarm Code 133 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared from the Guarded Access Menu only.

Diagnostic Procedure

1. Perform required maintenance as dictated by owner requirements.
2. Reset the hourmeter limit after completion in accordance with Service Procedure A28A.

134 CONTROLLER POWER ON HOURS**Alarm Type**

Log

Associated Alarm Codes

N/A

Considerations

The programmable hourmeter alarms can be cleared from the Guarded Access Menu only.

How Alarm is Set

If one of the user programmed hourmeters has exceeded the time limit, Alarm Code 134 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared from the Guarded Access Menu only.

Diagnostic Procedure

1. Perform required maintenance as dictated by owner requirements.
2. Reset the hourmeter limit after completion in accordance with Service Procedure A28A.

136 CHECK SPARE DIGITAL OUTPUTS

Alarm Type

Log or Check (Pretrip Only)

Associated Alarm Codes

N/A

How Alarm is Set

1. The Pretrip test indicates that a connection is made to a spare digital output and should not be.
2. Alarm Code 136 is set as a Log Alarm and the amp draw, battery volts, and number of spare digital output detected (if more than one output tested).

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Correct the wiring error.

137 DAMPER GEAR MOTOR HEATER

Note: Units with damper gear motor actuator only.

Alarm Type

Check

Associated Alarm Codes

30 Defrost Damper Stuck

Circuit Description

On units equipped with a damper gear motor, the damper solenoid output is used to control the motor heater.

Considerations

If the unit is not properly configured, Alarm Code 137 may occur instead of Alarm Code 29.

How Alarm is Set

Alarm Code 137 is set if the measured shunt current is incorrect during Non-running Pretrip. Current is measured with the output on and off.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Download the ServiceWatch data logger using WinTrac. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is set and cleared. This data can be very helpful in determining the cause of the alarm.

Check unit configuration.

141 AUTO-SWITCH DIESEL TO ELECTRIC DISABLED**Alarm Type**

Check

Associated Alarm Codes

36 Electric Motor Failed to Run

38 Electric Phase Reversed

90 Electric Overload

Considerations

When this alarm is set, the unit will remain in Diesel Mode operation even when connected to a fully functional electric standby power system.

How Alarm is Set

If the Autoswitch Diesel to Electric feature is enabled and the unit switches to Electric Mode operation and an Electric Mode Shutdown Alarm is already set, Alarm Code 141 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Check for associated alarms and repair as required.

143 CHECK DRAIN HOSE HEATER OUTPUT (ZONE)**Alarm Type**

Log, Check, or Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The drain hose heater is used on remote evaporators to keep the evaporator drain hose free of ice. They are located in the remote evaporator drain hoses.

Circuit Description

The drain hose heater circuit is a two wire circuit. Smart FETs in the Expansion Module energize the drain hose heaters for all remote zones on multi-temp units. The DHx wire applies 12 VDC to one side of the drain hose heater at the terminal strip. The other side of the drain hose heater connects to chassis ground in the evaporator. Drain hose heaters in remote zones have supply circuits with connectors in the remote evaporator and at the host unit. The heater is not polarity sensitive. Refer to the unit wiring diagrams for wire numbers, locations, and additional details.

Considerations

Drain hose heaters are used in remote zones only. On systems with remote zone parallel evaporators, the respective drain hose heater output will supply power to all of the zone heaters. On zones with a single evaporator, there are two heaters. On zones with parallel evaporators, there are four heaters.

On systems with remote zone parallel evaporators, the respective Expansion Module drain hose heater output will supply power to all of the drain tube heaters. The Pretrip and Smart FET current limits will automatically adjust for the increased current drawn by parallel evaporators based on the zone configuration settings.

How Alarm is Set

1. If during normal operation the current is not between 0.5 to 6 amps (1.0 to 12 amps if parallel evaporators) three seconds after the drain hose heater is energized, Alarm Code 143 is set as a Log Alarm (set as Shutdown Alarm if the condition occurs in Evacuation Mode) and the output is turned off. If the output circuit is shorted, it will be turned off immediately to protect the circuit and the alarm will be set. Zone drain hose heater operation is not allowed until Alarm Code 143 is cleared.
2. If during normal operation the current does not return to less than 0.5 amps three seconds after the drain hose heater is de-energized, Alarm Code 143 is set as a Check Alarm. Zone drain hose heater operation is not allowed until Alarm Code 143 is cleared.
3. If during normal operation the current is limited by the Smart FET due to excessive current draw one second after the drain hose heater is energized, Alarm Code 143 is set as a Check Alarm. Zone drain hose heater operation is not allowed until Alarm Code 143 is cleared.
4. If during a Pretrip Test the current is not between 0.5 to 6 amps (single evaporator) or 1.0 to 12 amps (parallel evaporators) when the drain hose heater is energized, Alarm Code 143 is set as a Check Alarm.
5. If during a Pretrip Test the current does not return to less than 0.5 amps when de-energized, Alarm Code 143 is set as a Shutdown Alarm.
6. If during a Pretrip Test the unit is not configured for the zone being tested and amp draw is greater than the allowable limit, Alarm Code 143 and Alarm Code 111 are set as Log Alarms.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. If $\text{FLTCT} >= 6$ (12 w/parallel evaporators). The circuit has high amp draw. Check for a shorted circuit or solenoid coil.
2. If $\text{FLTCT} < 0.5$. The circuit has low amp draw. Check for high resistance or open in the circuit or solenoid coil.

Indicator LED Diagnosis

1. Verify that the Expansion Module status LED (heartbeat LED) is flashing. If not, check the Expansion Module for proper operation in accordance with Service Procedure A01D.
2. If the Expansion Module Status LED is flashing, clear the alarm to reset the Smart FET. Check the operation of the drain hose heater circuit using Interface Board Test Mode. Verify the appropriate Expansion Module drain hose heater LED illuminates. For Expansion Module LED identification, refer to the LED decal on the control box door. If the Expansion Module drain hose heater circuit LED illuminates, proceed to Step 3. If the Expansion Module drain hose heater circuit LED does not illuminate, proceed to Step 4.
3. If the Expansion Module drain hose heater circuit LED does not illuminate and the alarm is not present, the circuit has high resistance or is open. Use the HMI Control Panel amps gauge to check the current drawn by the drain hose heater, while operating the drain hose heater with Interface Board Test Mode. The current draw should be approximately 0.5 to 6 amps (1.0 to 12 amps if parallel evaporators). If the current is not within limits, check for high resistance or an open in the circuit or heater as shown in Step 4. Verify that all circuit connectors are secure.
4. If the Expansion Module drain hose heater circuit LED does not illuminate and the alarm is present, check for a shorted circuit or heater. Disconnect the Expansion Module 35 pin connector J1 and check the circuit with an accurate ohmmeter for a short circuit, open circuit, or loose connection.
5. If no problems are found in steps 1-4 and the output LED does not illuminate, replace the Expansion Module.
6. Confirm the unit configuration is correct.

144 LOSS OF EXPANSION MODULE CAN COMMUNICATION**Alarm Type**

Log or Shutdown

Associated Alarm Codes

N/A

Circuit Description

The SR-2/SR-3 Control Platform utilizes CAN communications to pass information back and forth between the Base Controller, HMI Control Panel, and Expansion Module. These cables are connected as follows:

- J12 - Connects the Base Controller to the Expansion Module.
- J14 - Connects the Base Controller to the HMI Control Panel.

Note: Refer to the Wiring Diagram for details of each cable.

How Alarm is Set

If communication is lost between the controller and Expansion Module for five seconds, Alarm Code 144 is set as a Shutdown Alarm and de-energize all outputs.

How Alarm is Cleared

The alarm will clear automatically when communications are re-established.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check all CAN cables to verify they are connected securely.
2. Check the Base Controller in accordance with Service Procedure A01A.
3. Check the Expansion Module in accordance with Service Procedure A01D.

145 LOSS OF CONTROLLER "ON" FEEDBACK SIGNAL

Alarm Type

Log

Associated Alarm Codes

N/A

Circuit Description

The Base Controller "On" feedback signal is supplied by 8X power flowing through fuse F7 (2A) to pin 6 on the CAN connectors J12, J13, and J14. The power on pin 6 of CAN connector J14 flows to the HMI Control Panel pin 6. The presence of power at pin 6 of the HMI Control Panel indicates that power is present on the 8X circuits.

Active CAN communications indicate the K9 On/Off Relay is energized and the Base Controller is running. If CAN communications are active but power is not present at pin 6 of the HMI Control Panel, there is a problem with the 8XP or 8X circuit(s).

How Alarm is Set

If communications have been established between the Base Controller and a CAN connected device such as the HMI Control Panel and the device feedback input is low for three seconds, Alarm Code 145 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

1. Verify that fuse F7 is not blown. If fuse F7 is blown, check the 8XP circuit for shorts. This circuit supplies power to pin 6 of all the CAN communication ports (J12, J13, and J14) on the Base Controller. If necessary, check for shorts at any devices connected to any of the CAN ports.
2. Check for power at pin 6 of the HMI Control Panel. If power is not present, check for an open in the 8XP circuit from fuse F7 to pin 6 of the CAN communication ports.

146 SOFTWARE VERSION MISMATCH

Alarm Type

Shutdown

Associated Alarm Codes

111 Unit Not Configured Correctly

How Alarm is Set

If single temperature software is detected in a unit with a Multi-Temperature Expansion Module connected, Alarm Code 146 is set as a Shutdown Alarm. Alarm Code 111 will also be set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually. The alarm will also clear automatically if the correct version of Base Controller software is flash loaded.

Diagnostic Procedure

Flash load the correct software for the application.

Note: For the latest information, refer to the Software Compatibility Matrix available on iService:

For North America: TSA Info Central (Software & Downloads > Truck and Trailer > Microprocessors > Software Compatibility Matrix)

For EMEA: EMEA Info Central (Software Updates > Microprocessors > Compatibility Matrix)

147 MULTI-TEMP FAN SPEED CONTROL OUTPUT**Alarm Type**

Check

Associated Alarm Codes

N/A

How Alarm is Set

If the fan speed feedback control is not within 10% of the requested value, Alarm Code 147 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check that fan speed wires are connected correctly.
2. On remote zones with single evaporators, the fan speed output will be approximately zero volts during fresh setpoint operation and 4 to 5 volts during frozen operation.
3. On remote zones with dual evaporators, the fan speed output will be approximately 4 to 5 volts during fresh setpoint operation and 3 to 4 volts during frozen operation.

148 AUTO-SWITCH ELECTRIC TO DIESEL DISABLED**Alarm Type**

Check

Associated Alarm Codes

N/A

How Alarm is Set

If the Autoswitch Electric to Diesel feature is set yes and the unit switches to Diesel Mode operation and an Diesel Mode Shutdown Alarm is already set, Alarm Code 148 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Check for associated alarms and repair as required.

149 ALARM NOT IDENTIFIED

Alarm Type

Check

Associated Alarm Codes

N/A

Considerations

This alarm, if present, does not affect unit operation. It is an information only alarm. If set, this alarm code may not appear in either the CargoWatch or ServiceWatch Data Loggers.

How Alarm is Set

This alarm is set by the HMI if the alarm cannot be identified due to a communications error, or if the alarm count exceeds the number of alarms in the alarm queue. Alarm Code 149 is set as a Check Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Note: This alarm may not be able to be cleared from the Main or Guarded Access Menu. If Alarm Code 149 cannot be cleared, a Cold Start may be required to allow the alarm to be cleared.

Diagnostic Procedure

Download the ServiceWatch data logger using WinTrac. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is set and cleared. This data can be very helpful in determining the cause of the alarm.

1. Check and correct other existing alarms.
2. Perform a Base Controller Cold Start in accordance with Service Procedure A07A. Record the programmable settings before performing the Cold Start and reprogram all settings after the Cold Start is completed. Clear all alarm codes.
3. If this alarm is still set, it may not be possible to clear it. Should this be the case, consult the District or Area Service Manager for instructions on how to proceed.

150 OUT OF RANGE LOW (HMI)**Alarm Type**

Log

Associated Alarm Codes

N/A

Considerations

The CargoWatch temperatures and times that will cause an alarm to be set are user programmable. These CargoWatch Data Logger features are configured as required for the particular customer applications. Refer to the Sensor Configuration Menu - CargoWatch Data Logger in Section 3 for details.

This alarm is only logged in the CargoWatch Data Logger.

Verify the CargoWatch Data Logger is downloaded before installing HMI Control Panel software. The HMI Control Panel Cold Start will erase any existing data in the CargoWatch Logger.

How Alarm is Set

1. If the temperature falls below the user programmed temperature for the user programmed time interval, Alarm Code 150 is set as a Log Alarm.
2. If a CargoWatch sensor is open or shorted, Alarm Code 150 is set as a Log Alarm.
3. If Out of Range Checking is turned On and no CargoWatch sensors are connected, Alarm Code 150 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the CargoWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Determine the cause of low CargoWatch sensor temperature and correct as necessary.
2. Verify the CargoWatch Data Logger is downloaded before installing HMI Control Panel software. The HMI Control Panel Cold Start will erase any existing data in the CargoWatch Data Logger.
3. If no CargoWatch sensors are connected and the Out of Range feature is turned On, perform an HMI Control Panel Cold Start using the WinTrac Service Tool. The Cold Start will set the Out of Range Checking to Off.

Important: *Do not attempt a cold start using the Base Controller jumpers or with the download cable connected to the ServiceWatch port as this will restart the SR-3 Base Controller, not the HMI Control Panel.*

151 OUT OF RANGE HIGH (HMI)

Alarm Type

Log

Associated Alarm Codes

N/A

Considerations

The CargoWatch temperatures and times that will cause an alarm to be set are user programmable. These CargoWatch Data Logger features are configured as required for the particular customer applications. Refer to the Sensor Configuration Menu - CargoWatch Data Logger in Section 3 for details.

This alarm is only logged in the CargoWatch Data Logger.

Verify the CargoWatch Data Logger is downloaded before installing HMI Control Panel software. The HMI Control Panel Cold Start will erase any existing data in the CargoWatch Logger.

How Alarm is Set

1. If the temperature rises above the user programmed temperature for the user programmed time interval, Alarm Code 151 is set as a Log Alarm.
2. If a CargoWatch sensor is open or shorted, Alarm Code 151 is set as a Log Alarm.
3. If Out of Range Checking is turned On and no CargoWatch sensors are connected, Alarm Code 151 is set as a Log Alarm.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the CargoWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Determine the cause of high CargoWatch sensor temperature and correct as necessary.
2. Verify the CargoWatch Data Logger is downloaded before installing HMI Control Panel software. The HMI Control Panel Cold Start will erase any existing data in the CargoWatch Data Logger.
3. If no CargoWatch sensors are connected and the Out of Range feature is turned On, perform an HMI Control Panel Cold Start using the WinTrac Service Tool. The Cold Start will set the Out of Range Checking to Off.

Important: Do not attempt a cold start using the Base Controller jumpers or with the download cable connected to the ServiceWatch port as this will restart the SR-3 Base Controller, not the HMI Control Panel.

153 EXPANSION MODULE FLASH LOAD FAILURE**Alarm Type**

Shutdown

Associated Alarm Codes

N/A

Component Description and Location

The Expansion Module is located inside the control box.

Circuit Description

The Expansion Module allows the addition of up to two additional temperature controlled zones. The module provides the interface between the Base Controller and the Zone 1, Zone 2, and Zone 3 multi-temperature components such as sensors, solenoids, valves, and fan motors. It also provides over-current and short circuit protection for the associated circuits.

How Alarm is Set

The controller attempted to flash load the Expansion Module and was unsuccessful.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

The Expansion Module software is automatically flash loaded any time software is flash loaded to the SR-2/SR-3 or Base Controller. Software cannot be flash loaded directly to the Expansion Module, it is always part of an SR-2/SR-3 or Base Controller flash load. Refer to Service Procedure A46A for flash load details.

1. Check the CAN cable from J12 on the Base Controller to the 8 pin CAN connector on the Expansion Module. Verify connections are secure and all pins are fully seated in the connector.
2. Verify the Expansion Module heartbeat LED is illuminated.
3. Check Expansion Module in accordance with Service Procedure A01D.

159 CHECK BATTERY CONDITION

Alarm Type

Log

Associated Alarm Codes

N/A

Considerations

1. This feature is included in the Guarded Access Menu to provide users with an alarm which can indicate that the main system battery is not performing well (discharging very quickly). Applicable for both diesel and electric mode. The alarm can be enabled or disabled through the HMI Guarded Access Menu or preset using Optiset (default is disabled).
2. The counter will be cleared whenever any restart other than low voltage restart occurs. The counter will also be cleared whenever the timer expires.
3. The counter for consecutive low battery restarts will be cleared whenever any restart other than low voltage restart occurs. The counter for consecutive low battery restarts, which is different from the counter in #1 below, will be cleared when the timer expires.

How Alarm is Set

1. Three consecutive (i.e., counter is not cleared in-between) low battery voltage restarts will cause Alarm Code 159, if it occurs within an adjustable time frame (minimum = 1 minute, maximum = 60 minutes, default = 30 minutes) after C/S null entries.
2. Two consecutive low battery voltage restarts occurring within an adjustable time frame (minimum = 1 minute, maximum = 10 minutes, default = 5 minutes) after C/S null entries.

How Alarm is Cleared

This alarm is cleared manually.

Diagnostic Procedure

Always download the ServiceWatch data logger using the WinTrac Service Tool. Review the data using Technician Level to determine the conditions at the time the alarm was set. Conditions relevant to the alarm are recorded when the alarm is both set and cleared. This data can be invaluable when determining the cause of the alarm.

1. Check the battery and replace if necessary.
2. Review the ServiceWatch download to check the number of "Non-running" starts during Cycle Sentry operation (after C/S null entry).
3. Verify there are no third party devices connected to the unit which can drain the battery quickly due to a high current draw.

Section 6 - Service Procedures

A01A - Base Controller Functional Test

Purpose:

To confirm proper operation of the SR-3 Base Controller.

Materials Required:

- Multimeter

Operation:

Base Controller

- LED 21 Application Micro: Heartbeat - two flashes (approximately one second pause)

Important Notes:

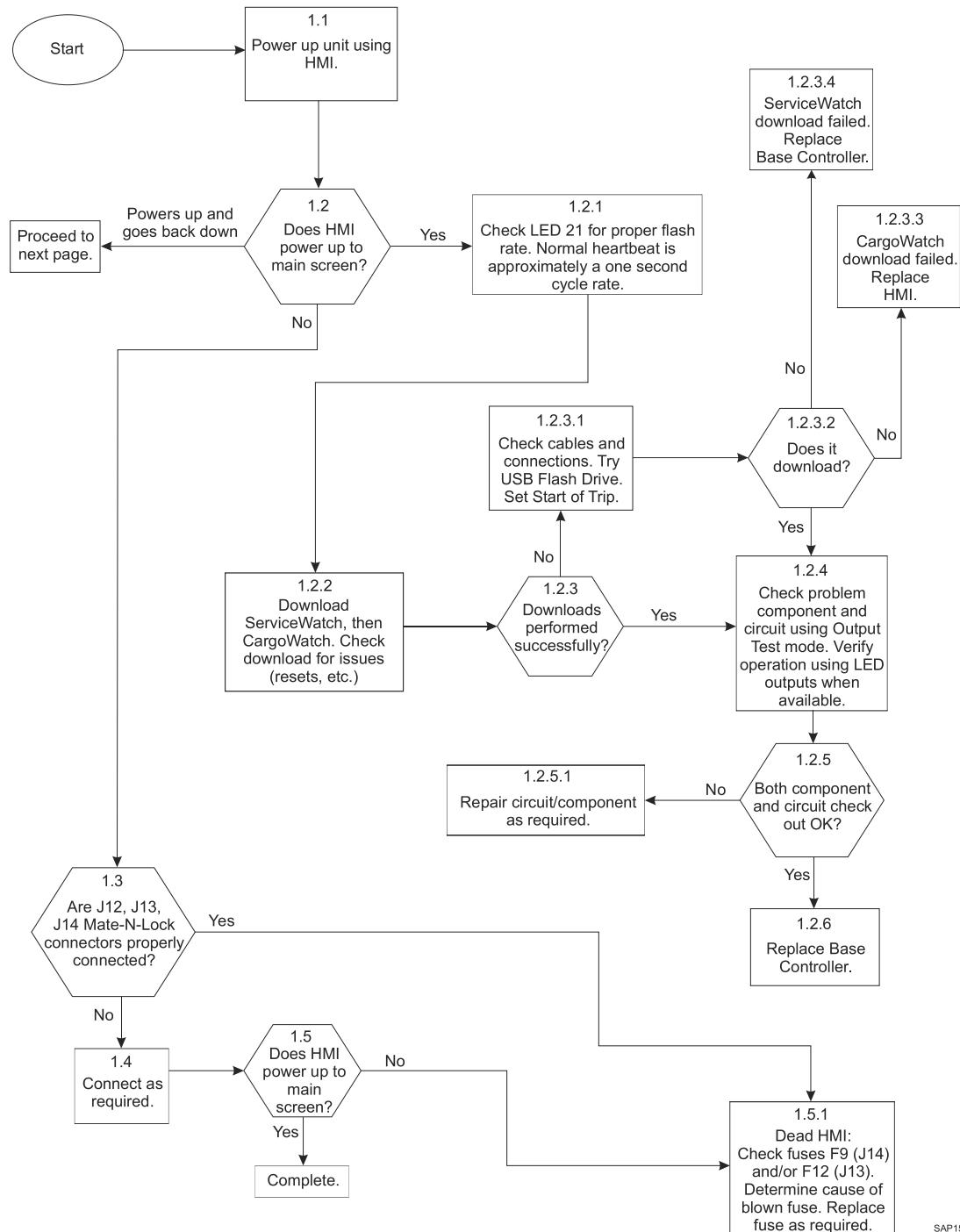
- Always do a quick visual inspection of all connectors to verify that they are seated prior to replacing a component. Correct any issue identified prior to completing the following Procedure. Check the following:

Note: Any external component attached to the Base Controller that is not properly operating may impact the operation of the Base Controller.

- Gaskets properly seated.
- Wires and pins properly seated into connector body.
- Loose pins, wires, or connections.
- Signs of corrosion on connectors, fuse holders, etc.
- If any open fuses, check harness for pinched/chafed wires or cut jackets.
- Battery terminals for loose connections.
- Security of frame grounds.
- F10 fuse correctly positioned (downward = normal). If F10 fuse is in bypass position (upward), auto start may result.
- This procedure only checks circuits, inputs, outputs, etc. For a complete automated test of the Base Controller, refer to Service Procedure A01A-1.

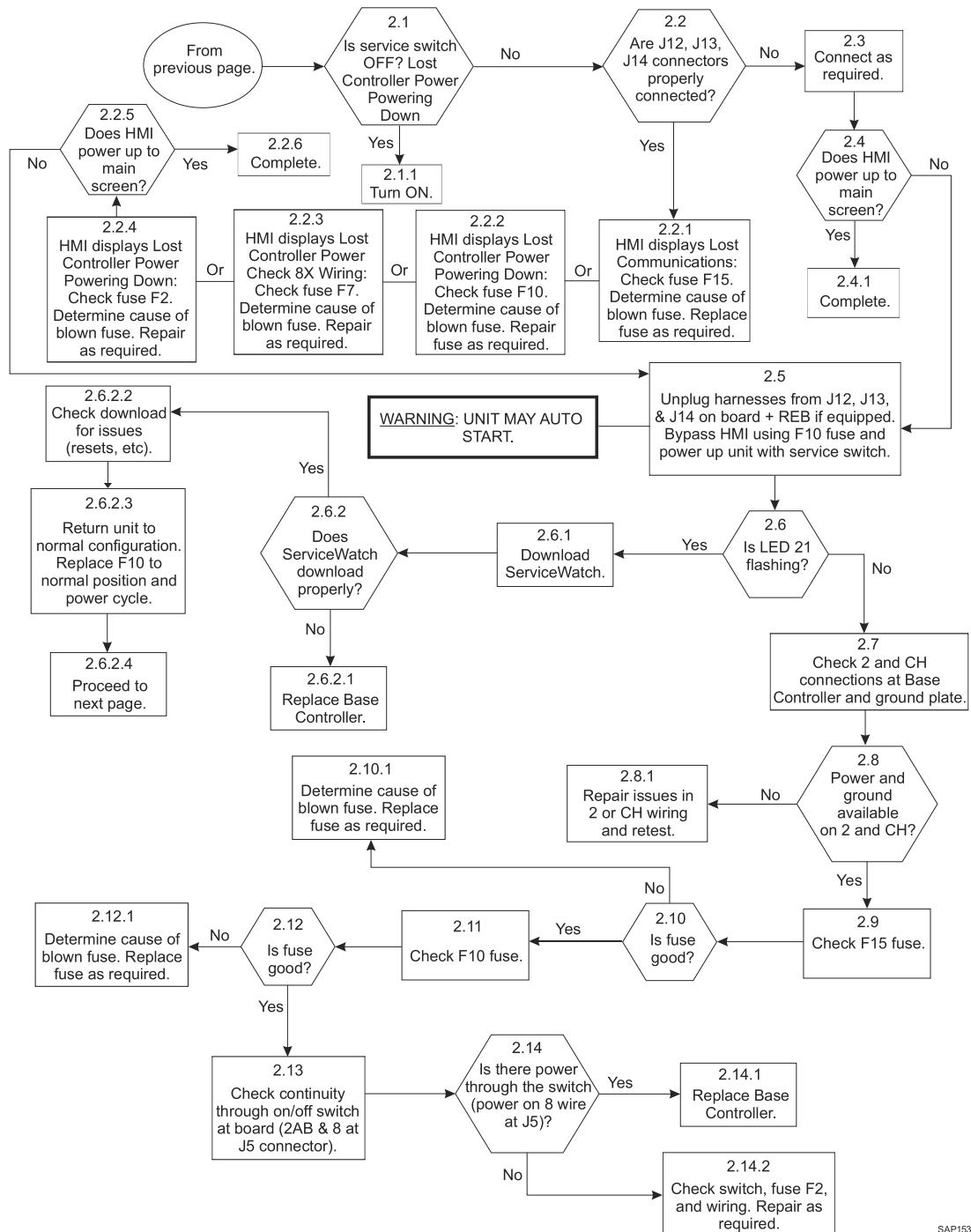
Procedure:

To complete this procedure, refer to the Figures on the following pages.

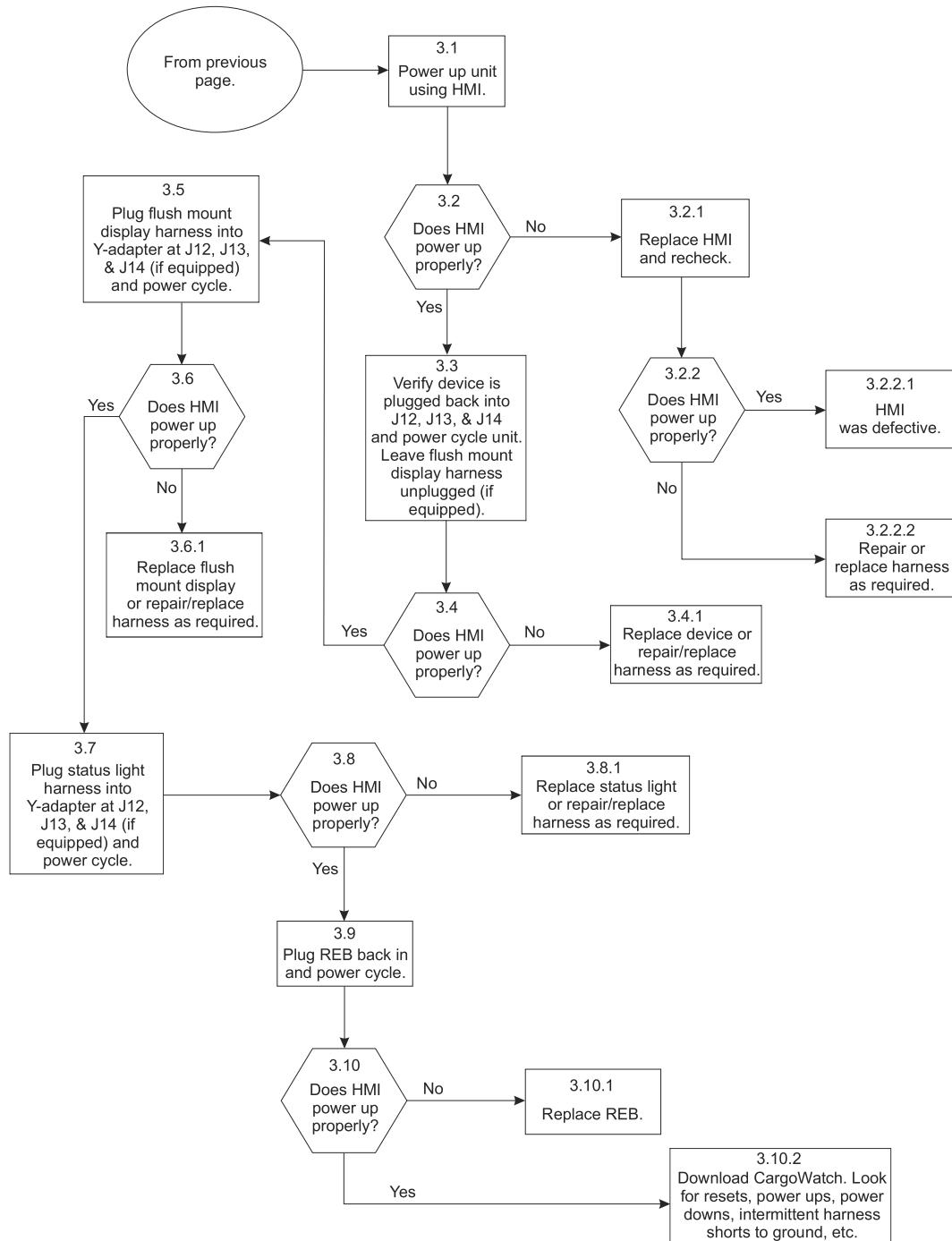
Figure 182. Base Controller Functional Test


SAP152

Figure 183. Base Controller Functional Test



SAP153

Figure 184. Base Controller Functional Test


SAP161

A01A-1 - Base Controller Automated Test

Purpose:

To confirm proper operation of the SR-3 Base Controller.

Materials Required:

Diagnostic Tool (P/N 204-1930)

Note: Refer to Section 7 for details.

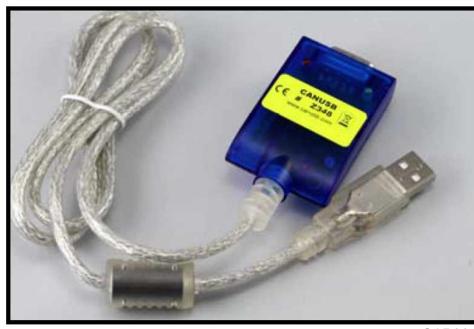
Operation:

Base Controller - LED 21 Application Micro (Heartbeat)

- Flashing once per second - Indicates normal Base Controller operation.
- Flashing several times per second - Indicates the Base Controller is in flash load mode. Flash loading the controller usually resolves this situation. If this condition cannot be resolved, the Base Controller may need to be replaced. Refer to the Regional Service Department if condition cannot be corrected.
- Always off - Indicates the Base Controller is not operating. This may occur for reasons other than a defective Base Controller. Verify power is available, all connections are secure, and harnesses are in good condition. Verify the unit battery is not dead. Check the unit fuses.
- Always on - Indicates the Base Controller is rebooting or is under test by the Diagnostic Tool. If this condition cannot be resolved, the Base Controller must be replaced.

Important Notes:

- The Diagnostic Tool Software provides detailed and illustrated on-screen instructions for connecting the Diagnostic Tool and performing the tests. Follow the instructions carefully. The instructions in this Service Procedure are intended to support the instructions provided by the software, not replace them.
- When using the Diagnostic Tool, supply power from a known good battery, a suitable power supply, or by connecting a battery charger to the unit battery. Low voltage caused by a low unit battery will affect the test results. The threshold for battery power influencing test results is about 11.5 Vdc.
- When testing a Base Controller, supply power to the Base Controller power connections as shown in the instructions. Do not supply power to the Diagnostic Tool. Supplying power to the Diagnostic Tool may result in a communication failure.
- If communications problems have been experienced with the components under test, the CAN Test should be performed. The CAN Test cannot be run without a USB to CAN Adaptor and a CAN Test Cable as shown below.



USB to CAN Adapter

SAP337



CAN Test Cable

SAP338

The USB Connector on the adaptor cable is attached to the test PC computer. The 9 Pin Connector on the blue adaptor body is attached to the CAN Test Cable.

The 9 Pin Connector on the cable is attached to the 9 pin connector on the USB to CAN Adaptor body. The Red J1 Connector is attached to the J1 Connector on the Blue Diagnostic Tool.

- Verify all connections are secure when attaching the tester and reconnecting the unit wiring harnesses.

- If a component fails the test, verify all wiring is correctly connected.
- Complete the SR-3 Control System Warranty Report (TK 54903-9-FO) if the repair is covered under warranty. This Warranty Report, as well as a printed copy of the Diagnostic Tool Test Report is necessary to process a warranty claim. In addition, appropriate ServiceWatch and CargoWatch data logger downloads that relate to the issue can be extremely helpful for failure analysis studies.

Procedure:

| Step | Action | Result | Comments |
|-------------|--|--|--|
| 1 | Turn the Microprocessor On/Off switch off. | | Failure to do so may damage the unit components. |
| 2 | Start the TK Diagnostic Tool software on the computer. | | The TK Diagnostic Tool Software provides illustrated step by step connection and test instructions. |
| 3 | Diagnostic Tool software version 4.x will prompt the technician to use the correct Diagnostic Tool. | | If the prompt does not appear, you are using software prior to Revision 4.1. This software will not test SR-3 Base Controller assemblies. |
| 4 | From the Diagnostic Tool software menu, select "SR-3 Series - English". | | |
| 5 | Left click RUN SELECTED TEST. | | |
| 6 | Confirm the test selection by left clicking RUN TEST WITH SERVICE REPORT. | | |
| 7 | Follow the prompts to connect the Diagnostic Tool to the unit Base Controller assembly and perform the test. | | |
| 8 | When the test is complete, the results will be reported on the computer. | | |
| 9 | If the assembly failed the test, check the test results for possible causes and correct as directed. | The test results will indicate if a problem exists with the Base Controller. | |
| 10 | Retest the assembly if necessary to confirm the test results. | | If the component fails the test, verify the wiring is correctly connected. |
| 11 | Record the data as requested by the test report. | | Complete the SR-3 Control System Warranty Report (TK 54903-9-FO) if the repair is covered under warranty. The form is included with the replacement component. |
| 12 | Print the test report for future use. | | A copy of the Diagnostic Tool Test Report is also necessary to process a warranty claim. |
| 13 | Disconnect the Diagnostic Tool and reconnect the unit harnesses and wires. | | Verify all connectors are secure and harnesses are properly routed and held in place with tie bands. |
| 14 | After repairs are completed, perform a Full Pretrip Test to confirm unit operation. | | |

A01B - HMI Control Panel Automated Test

Purpose:

To confirm proper operation of the HMI Control Panel.

Materials Required:

Diagnostic Tool (P/N 204-1930)

Note: Refer to Section 7 for details.

Important Notes:

- The Diagnostic Tool Software provides detailed and illustrated on-screen instructions for connecting the Diagnostic Tool and performing the tests. Follow the instructions carefully. The instructions in this Service Procedure are intended to support the instructions provided by the software, not replace them.
- When using the Diagnostic Tool, supply power from a known good battery, a suitable power supply, or by connecting a battery charger to the unit battery. Low voltage caused by a low unit battery will affect the test results. The threshold for battery power influencing test results is about 11.5 Vdc.
- When testing an HMI Control Panel, supply power to the Diagnostic Tool power connections as shown in the instructions.
- If communications problems have been experienced with the components under test, the CAN Test should be performed. The CAN Test cannot be run without a USB to CAN Adaptor and a CAN Test Cable as shown below.



USB to CAN Adapter SAP337



CAN Test Cable SAP338

The USB Connector on the adaptor cable is attached to the test PC computer. The 9 Pin Connector on the blue adaptor body is attached to the CAN Test Cable.

The 9 Pin Connector on the cable is attached to the 9 pin connector on the USB to CAN Adaptor body. The Red J1 Connector is attached to the J1 Connector on the Blue Diagnostic Tool.

- Verify all connections are secure when attaching the tester and reconnecting the unit wiring harnesses.
- If a component fails the test, verify all wiring is correctly connected.
- Complete the SR-3 Control System Warranty Report (TK 54903-9-FO) if the repair is covered under warranty. This Warranty Report, as well as a printed copy of the Diagnostic Tool Test Report is necessary to process a warranty claim. In addition, appropriate ServiceWatch and CargoWatch data logger downloads that relate to the issue can be extremely helpful for failure analysis studies.

Procedure:

| Step | Action | Result | Comments |
|------|--|--------|---|
| 1 | Turn the Microprocessor On/Off switch off. | | Failure to do so may damage the unit components. |
| 2 | Start the TK Diagnostic Tool software on the computer. | | The TK Diagnostic Tool Software provides illustrated step by step connection and test instructions. |



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| Step | Action | Result | Comments |
|------|---|--|--|
| 3 | Diagnostic Tool software version 4.x will prompt the technician to use the correct Diagnostic Tool. | | If the prompt does not appear, you are using software prior to Revision 4.1. This software will not test SR-3 HMI Control Panel. |
| 4 | From the Diagnostic Tool software menu, select "SR-3 Series - English". | Figure here | |
| 5 | Left click RUN SELECTED TEST. | | |
| 6 | Confirm the test selection by left clicking RUN TEST WITH SERVICE REPORT. | | |
| 7 | Follow the prompts to connect the Diagnostic Tool to the HMI Control Panel and perform the test. | | |
| 8 | When the test is complete, the results will be reported on the computer. | | |
| 9 | If the HMI Control Panel failed the test, check the test results for possible causes and correct as directed. | The test results will indicate if a problem exists with the HMI Control Panel. | |
| 10 | Retest the HMI Control Panel if necessary to confirm the test results. | | If the component fails the test, verify the wiring is correctly connected. |
| 11 | Record the data as requested by the test report. | | Complete the SR-3 Control System Warranty Report (TK 54903-9-FO) if the repair is covered under warranty. The form is included with the replacement component. |
| 12 | Print the test report for future use. | | A copy of the Diagnostic Tool Test Report is also necessary to process a warranty claim. |
| 13 | Disconnect the Diagnostic Tool and reconnect the unit harnesses and wires. | | Verify all connectors are secure and harnesses are properly routed and held in place with tie bands. |
| 14 | After repairs are completed, perform a Full Pretrip Test to confirm unit operation. | | |

A01C - HMI Control Panel Self Test

Purpose:

To confirm proper operation of the HMI Control Panel using the built in Display Self Test.

Operation:

The following procedure allows the technician to determine if the HMI Control Panel is operating properly using the built in HMI Self Tests.

Important Notes:

- Replace only one component at a time to verify the problem component is correctly identified.

Procedure:

| Step | Action | Result | Comments |
|-----------------------------|---|--------|----------|
| HMI Control Panel Self Test | | | |
| 1 | To access the Maintenance Menu, press the MENU key. | | |
| 2 | The Maintenance Menu is accessed from the first Main Menu screen that appears; either the Language Display or the Alarms Display. Press and hold both the unlabeled soft key and the Exit Key for five seconds. | | |
| 3 | The first Maintenance Menu feature will appear. Press the UP and DOWN Keys to scroll through the Maintenance Menu choices. When DISPLAY SELF TEST is shown on the display, press the SELECT Key to access it. | | |
| 4 | The DISPLAY SELF TEST menu appears. The available tests are shown below. | | |
| 5 | Press the UP and DOWN Keys to scroll through the Display Self Test Menu choices. | | |
| 6 | When DISPLAY SELF TEST is shown on the display, press the SELECT Key to access it. | | |
| 7 | When the individual test is complete another test can be selected. | | |
| 8 | When testing is finished press EXIT to return to the Maintenance Menu. | | |

Available Tests:

- **LCD Test** – This test allows the technician to select a normal or inverted display. If inverted is chosen the display is reversed – segments that were turned on are now turned off and segments that were turned off are now turned on. The technician visually verifies that all display segments are functioning properly.
- **Keypad Test** – This test prompts the technician to press the four soft keys, the Defrost Key and the Cycle Sentry Key. Each time the requested key is pressed the next prompt is displayed, allowing the technician to verify proper operation of these keys.
- **Backlight Test** – This test allows the technician to turn the backlight on and off to confirm operation.

- **Brightness Test** – This test allows the technician to select Low, Medium or High backlight intensity.
- **Buzzer Test** – This test allows the technician to turn the HMI buzzer on and off to verify operation.
- **Heater Output** – This test allows the technician to turn the HMI display heater on and off.
- **Unit On/Off Output Test** – This test allows the technician to turn the Unit On/Off output off. This turns the unit off to confirm that the output can be turned off. To restart the unit, press the On key.
- **SPR Digital Output Test** – This test allows the technician to turn digital output 2 on and off. This allows the operation of a device attached to this output to be checked.
- **Serial E2** – This test allows the technician to perform an internal HMI memory test. The test takes less than one second and the results are reported as PASS or FAIL.
- **Datalog Flash** – This test allows the technician to perform an internal HMI CargoWatch data logger memory test. The test takes less than one second and the results are reported as PASS or FAIL.
- **RTC Update** – This test allows the technician to perform an internal HMI real time clock test. The test takes less than three seconds and the results are reported as PASS or FAIL.

A01D - Expansion Module Test

Purpose:

To confirm proper operation of the SR-2/SR-3 Expansion Module using Interface Board Test Mode.

Materials Required:

- Multimeter

Operation:

This test assumes that a particular output is to be tested to verify proper operation.

Important Notes:

- Replace only one component at a time to verify the problem component is correctly identified.
- Under normal unit operation, the Smart FET and associated LED for that output will be turned off if an over-current or under-current condition exists.
- When using Interface Board Test Mode, the Smart FET and associated LED will be on if an under-current condition exists (such as an open solenoid coil). The Smart FET and associated LED will be off if an over-current condition exists (such as a short to ground).
- The Expansion Module communicates with the Base Controller via a CAN bus connection.

Procedure:

| Step | Action | Result | Comments |
|-------------|---|--|--|
| 1 | Turn the unit on and check the Expansion Module green Status LED. The green Status LED should be flashing once per second when the base controller is powered and operating normally. | If the Status LED is out or is not flashing, proceed to Step 2. If the Status LED is flashing once per second, proceed to Step 9. | |
| 2 | Verify the J2 8 pin CAN connector is securely attached to the Expansion Module and the Interface Board Connector. | | Power to operate the Expansion Module is supplied via the black and yellow wires in the J2 8 pin CAN connector. Chassis ground to operate the Expansion Module is supplied via the orange wire in the J2 8 pin CAN connector. This harness is connected to CAN connector J12 at the interface board. |
| 3 | Check fuse F8 on the interface board. | | Fuse F8 supplies 2A power via pin 5 (black wire) of the CAN connector to operate the Expansion Module logic. |
| 4 | Check for 12 Vdc at the Expansion Module CAN connector J12 pin 5 (black wire). If 12 Vdc is not present at J12 pin 5 (black wire), check the CAN harness for continuity. | | This step can be performed with the unit on or off. |
| 5 | Check fuse F7 on the interface board. | | Fuse F7 supplies 8X power via pin 6 (yellow wire) of the CAN connector to turn the Expansion Module on. |
| 6 | Check for 12 Vdc at the Expansion Module CAN connector J12 pin 6 (yellow wire). If 12 Vdc is not present at J12 pin 6 (yellow wire), check the CAN harness for continuity. | | This step must be performed with the unit on. |



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| Step | Action | Result | Comments |
|------|--|--|--|
| 7 | Check for chassis ground at the Expansion Module CAN connector pin 8 (orange wire). If chassis ground is not present at pin 8 (orange wire), check the CAN harness for continuity. | | |
| 8 | If steps 2 - 7 do not restore the flashing Status LED, replace the Expansion Module. | | |
| 9 | If the Status LED is flashing once per second, use Interface Board Test Mode to energize the desired output and lock it on. | The LED for the desired output should turn on. | Refer to Section 4 for information on operating Interface Board Test Mode. |
| 10 | If the desired output can be energized and the LED turns on using Interface Board Test Mode, check the associated output circuit for an open circuit. | | Verify all connectors are securely plugged in, the device coil is not open, and verify circuit harness continuity. |
| 11 | If the desired output LED will not turn on using Interface Board Test Mode, there may be a short in the associated circuit. | | If a short circuit condition exists, the output Smart FET will turn the output off even though the Expansion Module has turned it on. If this occurs, it will happen so fast the LED will not turn on or even blink. |
| 12 | Unplug the 35 pin J1 connector at the Expansion Module. | | Unplugging the 35 pin J1 connector also disconnects all remote zone temperature sensors. Alarm codes will be generated for these sensors. This is normal operation. |
| 13 | Use Interface Board Test Mode to energize the desired output and lock it on. | If the LED for the desired output does turn on with the 35 pin J1 connector unplugged, a short circuit exists in the associated circuit. | Troubleshoot the associated circuit for a short circuit condition such as a shorted solenoid coil or shorted wiring harness. |
| 14 | If the LED for the desired output does not turn on with the 35 pin J1 connector unplugged, replace the Expansion Module. | | |
| 15 | After repairs are completed, perform a Full Pretrip Test to confirm unit operation. | | |

A02A - Recording Existing Programmable Feature Settings

Purpose:

To retrieve and record the sensor grades and programmable feature settings of an SR-2/SR-3 Base Controller.

Materials Required:

- A copy of the Setup Sheet at the back of this Service Procedure.

Operation:

- The settings of the graded sensors and all programmable features must be retrieved before replacing a Base Controller/Interface Board or performing a Base Controller/Interface Board Cold Start. These settings will then be duplicated in the replacement Base Controller/Interface Board or after the Cold Start.
- The default settings are shown on the Setup Sheet at the back of this Service Procedure.
- If a sensor grade is not shown on the setup sheet, physically check the sensor to determine the grade. It is very important that sensor grades be set properly.
- Refer to Section 3 for a complete description of programmable features.

Procedure:

| Step | Action | Result | Comments |
|-------------|---|---|---|
| 1 | Turn the unit on. | | |
| 2 | Press the MENU key. | The Operator Menu appears. | Do not let the unit start. The Guarded Access Menu cannot be entered if the unit is running. |
| 3 | Press and hold both the EXIT and unlabeled soft key for five seconds. | The Maintenance Menu appears. | |
| 4 | Press the DOWN key as required to display the Software Revision Menu. Then press the SELECT key to enter the Software Revision Menu. | | |
| 5 | Use the UP and/or DOWN keys to scroll through the HMI Control Panel and Base Controller software revisions. | Record the software revisions on the Setup Sheet. | |
| 6 | When the software revisions have been recorded, press the EXIT key to return to the Maintenance Menu. | | |
| 7 | Press the UP and DOWN key as required to display the Set Time and Date Menu. Then press the SELECT key to enter the Set Time and Date Menu. | | The real time clock is located in the HMI Control Panel. The time is supplied to the Base Controller/Interface Board each time the unit is turned on. If the Base Controller/Interface Board is changed, the clock setting will be supplied to the Base Controller/Interface Board when the unit is turned on. If the HMI Control Panel is changed, the time and date must be checked and set if necessary. |
| 8 | Check the Time to determine the time zone used by the customer. | Record the time zone on the Setup Sheet. | Compare local time to unit time to determine time zone. |
| 9 | When the time zone has been recorded, press the EXIT key to return to the Maintenance Menu. | | |



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| Step | Action | Result | Comments |
|------|--|---|---|
| 10 | Verify the unit is not running. The unit will not enter the Guarded Access Menu if it is running. | | If the unit is running, scroll back and enter Interface Board Test Mode. This will cause the unit to shut down. Press the Exit key to return to the Maintenance Menu. Scroll back to the Set Time and Date Menu and proceed with the next step. |
| 11 | Press and hold both the EXIT and unlabeled key for five seconds. | The Guarded Access Menu appears. | If a Security Code is requested, enter the Security Code or [4444] to enter the Guarded Access Menu. |
| 12 | The Programmable Features Menu will appear. Press the SELECT key to enter the Programmable Features Menu. | | |
| 13 | Use the UP and/or DOWN keys to scroll through all settings in the Programmable Features Menu. | Record all Programmable Features settings on the Setup Sheet. | |
| 14 | When all Programmable Features settings have been recorded, press the EXIT key to return to the Guarded Access Menu. | | |
| 15 | Use the UP and/or DOWN keys to scroll to the next Guarded Access Menu. | | Use the Setup Sheet as a guide. |
| 16 | Use the SELECT key to enter the next Guarded Access Menu. | | Use the Setup Sheet as a guide. |
| 17 | Use the UP and/or DOWN keys to scroll through all settings in the Menu. | Record all Programmable Features settings on the Setup Sheet. | |
| 18 | Use the EXIT key to return to the Guarded Access Menu. | | |
| 19 | Continue to use Steps 15 – 18 as required to complete the Setup Sheet. | | The OptiSet Plus features will be retrieved at the end of this procedure using a separate OptiSet Plus Procedure. Refer to Service Procedure A47B Retrieving and Sending OptiSet Plus Configurations. |
| 20 | When all settings have been recorded, press the EXIT key to return to the Guarded Access Menu. | | |
| 21 | Press the EXIT key again to return to the Standard Display. | | |
| 22 | Download the ServiceWatch and CargoWatch data loggers. | | This information may be needed for diagnostics. |
| 23 | Download the OptiSet Plus settings using Service Procedure A47B using the WinTrac Service Tool. | | |



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Setup Sheet - XXxx Software:

Important: Not all features shown on the Setup Sheet may appear. This is dependent on hardware type, software revision, and unit settings.

SOFTWARE REVISION

| Function | Default Setting | Recorded Setting |
|---------------------------------|-----------------|------------------|
| HMI Control Panel | XXxx | |
| Base Controller/Interface Board | XXxx | |

SET DATE AND TIME

Compare local time to unit time to determine time zone. The real time clock is located in the HMI Control Panel. The time is supplied to the Base Controller each time the unit is turned on. If the Base Controller is changed, the clock setting will be supplied to the Base Controller when the unit is turned on. If the HMI Control Panel is changed, the time and date must be checked and set if necessary.

| Function | Default Setting | Recorded Setting |
|-----------|--------------------------|------------------|
| Time Zone | As specified by customer | |

SECURITY CODE

Note: If an unknown security code is set, use Security Code 4444 to gain access.

| Function | Default Setting | Recorded Setting |
|--|-----------------|------------------|
| Security Code as specified by customer | None | |

PROGRAMMABLE FEATURES

| Function | Default Setting | Recorded Setting |
|---|--------------------|------------------|
| Temperature Units | FAHRENHEIT/CELSIUS | |
| Pressure Units | PSI | |
| Restart Unit After Shutdown | ENABLED | |
| Setpoint High Limit Zone 1 | 80°F (27°C) | |
| Setpoint Low Limit Zone 1 | -20°F (-29°C) | |
| Setpoint High Limit Zone 2 | 80°F (27°C) | |
| Setpoint Low Limit Zone 2 | -20°F (-29°C) | |
| Setpoint High Limit Zone 3 | 80°F (27°C) | |
| Setpoint Low Limit Zone 3 | -20°F (-29°C) | |
| Running Fans in Null | DISABLED | |
| Fresh Frozen Range | 15°F (-9.4°C) | |
| Door Opened | ENABLED | |
| Door Open Forces | LOG ONLY | |
| Door Open Timeout (HRS:MIN) | OFF | |
| Sleep Mode After Pretrip | DISABLED | |
| Rail Option | DISABLED | |
| Rail Alternate (If Rail Option = ENABLED) | DISABLED | |
| Discharge Pressure Setpoint | 415 PSI | |

| Function | Default Setting | Recorded Setting |
|---|------------------------|-------------------------|
| Limited Alarm Restarts | DISABLED | |
| Remote Device | DISABLED | |
| COM 1 Default Baud Rate | 1200 | |
| COM 2 Default Baud Rate | 9600 | |
| COM 3 Default Baud Rate | 9600 | |
| Number of Limited Setpoints | 0 | |
| Limited Setpoint #1 | -13°F (-25°C) | |
| Limited Setpoint #2 | 32°F (0°C) | |
| Limited Setpoint #3 | 37°F (2.8°C) | |
| Limited Setpoint #4 | 55°F (12.8°C) | |
| Demand Defrost on Temp Rises | DISABLED | |
| Extended ServiceWatch Logging | DISABLED | |
| Cond Inlet Sol MOPD Option | ENABLED | |
| Cond Inlet Sol MOPD | 200 PSI | |
| ServiceWatch Logging Interval | 1 MINUTE | |
| Fresh Null Restart Temperature | 5°F (2.8°C) | |
| Frozen Null Restart Temperature | 5°F (2.8°C) | |
| High Ambient Discharge Pressure Control | DISABLED | |
| Precision Temperature Control Zone | OFF or 2 | |
| CargoWatch Sensor 1 zone | 1 | |
| CargoWatch Sensor 2 zone | 1 | |
| CargoWatch Sensor 3 zone | 1 | |
| CargoWatch Sensor 4 zone | 1 | |
| CargoWatch Sensor 5 zone | 1 | |
| CargoWatch Sensor 6 zone | 1 | |
| Decimal Degree Setpoint | NO | |

MAIN MENU CONFIGURATION

| Function | Default Setting | Recorded Setting |
|---|------------------------|-------------------------|
| Add Keypad Lockout to Mode Menu | DISABLED | |
| Add Sleep to Mode Menu | DISABLED | |
| Show SJC on Mode Menu | DISABLED | |
| Temperature Units to Mode Menu | DISABLED | |
| Precision Temperature Control Zone to Mode Menu | DISABLED | |
| Keypad Lock PIN | NO CODE | |
| Easy Cargo Sensor Access | DISABLED | |

HOURMETER SETUP - PROGRAM HOURMETER



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| Function | Default Setting | Recorded Setting |
|-----------------------------------|------------------------|-------------------------|
| Total Run Time Reminder # 1 Hours | OFF | |
| Total Run Time Reminder # 2 Hours | OFF | |
| Controller Power On Hours | OFF | |
| Pretrip Reminder Hours | OFF | |
| Engine Run Time Reminder # 1 | OFF | |
| Engine Run Time Reminder # 2 | OFF | |
| Electric Run Time Reminder # 1 | OFF | |
| Electric Run Time Reminder # 2 | 100 HOURS | |

HOURMETER SETUP - VIEWABLE HOURMETER SETUP

| Function | Default Setting | Recorded Setting |
|--|------------------------|-------------------------|
| Total Hours | DISABLED | |
| Total Run Time Hours | ENABLED | |
| Engine Hours | ENABLED | |
| Electric Hours | ENABLED | |
| Zone 1 Run Time Hours | DISABLED | |
| Zone 2 Run Time Hours | DISABLED | |
| Zone 3 Run Time Hours | DISABLED | |
| Total Run Time Reminder # 1 Viewing | DISABLED | |
| Total Run Time Reminder # 2 Viewing | DISABLED | |
| Controller Power On Hours | DISABLED | |
| Pretrip Reminder Hours | DISABLED | |
| Engine Run Time Reminder # 1 Viewing | DISABLED | |
| Engine Run Time Reminder # 2 Viewing | DISABLED | |
| Electric Run Time Reminder # 1 Viewing | DISABLED | |
| Electric Run Time Reminder # 2 Viewing | DISABLED | |

HOURMETER SETUP - PROGRAM SERVICE DUE DATE

| Function | Default Setting | Recorded Setting |
|----------------------------------|------------------------|-------------------------|
| Engine Run Time Service Due Date | DISABLED | |

SENSOR CALIBRATION

| Function | Default Setting | Recorded Setting |
|-----------------------------------|------------------------|-------------------------|
| Zone 1 Return Air Sensor Grade | 5H | |
| Zone 1 Discharge Air Sensor Grade | 5H | |
| Zone 2 Return Air Sensor Grade | 5H | |
| Zone 2 Discharge Air Sensor Grade | 5H | |
| Zone 3 Return Air Sensor Grade | 5H | |
| Zone 3 Discharge Air Sensor Grade | 5H | |
| Spare 1 Sensor Grade | 5H | |

| Function | Default Setting | Recorded Setting |
|----------------------|------------------------|-------------------------|
| Spare 2 Sensor Grade | 5H | |
| Spare 3 Sensor Grade | 5H | |

CYCLE SENTRY SETUP

| Function | Default Setting | Recorded Setting |
|--|------------------------|-------------------------|
| Cycle Sentry Amps | 5 AMPS | |
| Cycle Sentry Battery Voltage | 12.2 or 12.6 VOLTS | |
| Check Battery Condition Alarm | DISABLED | |
| Low Battery Voltage TimeOut in Minutes | 30 | |
| CS Null Duration TimeOut in Minutes | 5 | |

DEFROST SETUP

| Function | Default Setting | Recorded Setting |
|--|------------------------|-------------------------|
| Defrost Interval In Range with Fresh Setpoint | 6 HOURS | |
| Defrost Interval Not In Range with Fresh Setpoint | 4 HOURS | |
| Defrost Interval In Range with Frozen Setpoint | 6 HOURS | |
| Defrost Interval Not In Range with Frozen Setpoint | 4 HOURS | |
| Maximum Defrost Duration | 45 MINUTES | |

LANGUAGE SETUP (First Language = 65/75/7Bxx, Second Language = 66/76/7Cxx)

| Function | 65/75/7Bxx | 66/76/7Cxx | 67/77/7Dxx | Default Setting | Recorded Setting |
|------------------|-------------------|-------------------|-------------------|------------------------|-------------------------|
| Default Language | | | | ENGLISH | |
| Enable Language | English | English | English | ENABLED | |
| Enable Language | Spanish | Danish | Japanese | DISABLED | |
| Enable Language | French | Russian | Chinese Mandarin | DISABLED | |
| Enable Language | German | Norwegian | | DISABLED | |
| Enable Language | Italian | Swedish | | DISABLED | |
| Enable Language | Dutch | Finnish | | DISABLED | |
| Enable Language | Portuguese | Polish | | DISABLED | |
| Enable Language | Greek | Hungarian | | DISABLED | |
| Enable Language | Turkish | Romanian | | DISABLED | |
| Enable Language | Hebrew | Bulgarian | | DISABLED | |
| Enable Language | Arabic | Czech | | DISABLED | |

ACCESS CODE SETUP

| Function | Default Setting | Recorded Setting |
|-------------------|------------------------|-------------------------|
| Enter Access Code | NO CODE | |



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SENSOR CONFIGURATION (CargoWatch)

| Function | Default Setting | Recorded Setting |
|------------------|-------------------------|------------------|
| Logging Interval | 5 Minutes or 15 Minutes | |

CargoWatch Sensor Programming (Up to 6 sensors may be configured)

| Function | Default | 1 | 2 | 3 | 4 | 5 | 6 |
|-----------------------|--------------|---|---|---|---|---|---|
| Sensor Logging | On | | | | | | |
| Sensor Name | Log Sensor X | | | | | | |
| Out of Range Checking | OFF | | | | | | |
| Low Limit | -6° | | | | | | |
| High Limit | 6° | | | | | | |
| Italian Logging | OFF | | | | | | |
| Sensor Averaging | OFF | | | | | | |

Digital Input Programming (Up to 3 digital inputs may be configured)

| Function | Default | 1 | 2 | 3 |
|--------------------------------|------------------|---|---|---|
| Door Open Logging | 1 On, 2-3 Off | | | |
| Digital Input #X Name | Digital Input #X | | | |
| Countdown Timer | Off | | | |
| Conservative Log Count | Off | | | |
| SOT on Setpoint | DISABLED | | | |
| Automatic Setpoint at Midnight | DISABLED | | | |

UNIT CONFIGURATION

| Function | Default Setting | Recorded Setting |
|--|-----------------|------------------|
| Engine Type Is | Yanmar 2.1 | |
| Compressor Type Is | RECIP | |
| ETV Configured | YES | |
| Dual Evaporator Configuration | NO | |
| How Many Zones in This Unit | 2 or 3 | |
| Zone 2 Evap Fans Configuration | 3 | |
| Zone 3 Evap Fans Configuration | 3 | |
| Electric Standby Equipped | YES | |
| Electric Heat Option | NO | |
| Electric Motor Type | 14 HP | |
| Diesel to Electric Auto Switch Enabled | NO | |
| Electric to Diesel Auto Switch Enabled | NO | |
| Unit Model | As Built | |
| Defrost Motor Equipped | NO | |
| Fuel Sensor Type | NONE | |



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| Function | Default Setting | Recorded Setting |
|---|-----------------|------------------|
| Rear Remote Control | NONE | |
| Rear Remote Control Action (If Rear Remote installed) | Stand By | |
| Pretrip/Sleep Switch Options | DISABLED | |
| 3rd Party Device Control | NONE | |
| TracKing REB Fuel Level Sensor Type | NONE | |
| TracKing REB Door Switch Enabled? | DISABLED | |
| Cargolink | DISABLED | |
| Refrigerant Type | | |

A03A - Base Controller/Interface Board Replacement

Purpose:

To replace the Base Controller/Interface Board.

Materials Required:

- Cable ties

Operation:

The Base Controller/Interface Board is removed from the control box as an assembly.

Important Notes:

- It is very important that the correct Base Controller/Interface Board be used for replacement. Refer to Section 7 to determine the required Base Controller for the application.
- It is very important that the correct Base Controller software be used. Base Controllers are supplied from Service Parts with the most recent software at the time of manufacture. The anti-static shipping bags are also marked with pertinent information. Refer to Section 7 to determine the required Base Controller software for the application. Check the available software on Info Central for the current released software version.
- Some applications may require the 60 amp fuse be removed from the old Base Controller/Interface Board and installed in the replacement Base Controller/Interface Board.
- Verify the harnesses are reconnected properly and do not place excessive strain on the connectors. Secure the harnesses with cable ties as required.

Replacement Information:

The SR-3 Base Controller is compatible with and may be used to replace the combined SR-2 Base Controller and Interface Board assembly. The SR-3 Base Controller mounting base uses the same mounting hole pattern as did the SR-2 Base Controller. The connectors on the SR-3 Base Controller are located in approximately the same positions as they are on an SR-2 Interface Board. However, when replacing an SR-2 Base Controller/Interface Board with an SR-3 Base Controller, the wiring harness may need to be relocated slightly to reach the some of the connectors.

Procedure:

| Step | Action | Result | Comments |
|------|---|--------|--|
| 1 | Log the existing Base Controller/Interface Board settings using Service Procedure A02A. | | This information will be used to set up the replacement Base Controller. |
| 2 | Turn the unit off. | | |
| 3 | Disconnect standby power, if connected. | | |
| 4 | Disconnect the unit battery. | | Some circuits are directly connected to the unit battery. |
| 5 | Disconnect all harness connectors from the Base Controller/Interface Board assembly. | | |
| 6 | Remove the screws securing the Base Controller/Interface Board to the control box and remove the Base Controller/Interface Board assembly from the control box. | | |
| 7 | Install the new Base Controller/Interface Board assembly in the control box. | | |
| 8 | Reconnect all harness connectors to the Base Controller/Interface Board. | | Apply Super Lube as needed. Verify all connectors are securely mated and secure the harnesses with cable ties as required. |



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| Step | Action | Result | Comments |
|------|--|--------|--|
| 9 | Reconnect the unit battery. | | |
| 10 | Reconnect the standby power if needed. | | |
| 11 | Turn the unit on. | | The real time clock settings will be loaded from the HMI Control Panel when the unit is turned on. |
| 12 | Clear any alarm codes. | | |
| 13 | Set up all programmable features using Service Procedure A04A. | | |
| 14 | Run a Pretrip Test to verify proper unit operation. | | |



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A03B - HMI Control Panel Replacement

Purpose:

To replace the HMI Control Panel.

Materials Required:

- Cable ties

Operation:

The HMI Control Panel is removed from the control box door as an assembly.

Important Notes:

- It is very important that the correct HMI Control Panel software be used. HMI Control Panels are supplied from Service Parts with the most recent software at the time of manufacture. The anti-static shipping bags are also marked with pertinent information. Refer to Section 7 to determine the required HMI Control Panel software for the application. Check the available software on Info Central for the current released software version.
- Verify the harnesses are reconnected properly and do not place excessive strain on the connectors. Secure the harnesses with cable ties as required.

Procedure:

| Step | Action | Result | Comments |
|------|---|--------|---|
| 1 | Turn the unit off. | | |
| 2 | Disconnect standby power, if connected. | | |
| 3 | Disconnect the unit battery. | | |
| 4 | Disconnect the harness connector from the HMI Control Panel. | | |
| 5 | Remove the four screws securing the HMI Control Panel to the control box and remove the HMI Control Panel from the control box. | | |
| 6 | Install the new HMI Control Panel in the control box. | | |
| 7 | Re-connect the harness connector to the HMI Control Panel. Apply Super Lube as required. | | Verify all connectors are securely mated and secure the harnesses with cable ties as required. |
| 8 | Reconnect the unit battery. | | |
| 9 | Reconnect the standby power if needed. | | |
| 10 | Turn the unit on. | | The programmable feature settings will be loaded from the Base Controller when the unit is turned on. |
| 11 | Clear any alarm codes. | | |
| 12 | Check the setting of the real time clock and correct if necessary. | | The clock may be set from the Maintenance Menu or with the WinTrac Service Tool. |
| 13 | Run a Full Pretrip Test to verify proper unit operation. | | |

A03C - Expansion Module Replacement

Purpose:

To replace the Expansion Module.

Materials Required:

- Cable ties

Operation:

The Expansion Module is removed from the control box as an assembly. It has no user repairable parts.

Important Notes:

- Verify the harnesses are reconnected properly and do not place excessive strain on the connectors. Secure the harnesses with cable ties as required.

Procedure:

| Step | Action | Result | Comments |
|------|---|--------|--|
| 1 | Turn the unit off. | | |
| 2 | Disconnect standby power, if connected. | | |
| 3 | Disconnect the unit battery. | | The battery must be disconnected since the 2A wires on the expansion module are energized any time the battery is connected. |
| 4 | Disconnect the 35 pin expansion module connector, the 6 pin evaporator fan connector, and the 8 pin CAN connector. | | |
| 5 | Remove the hardware securing the expansion module to the control box and remove the expansion module. | | |
| 6 | Verify the unit battery is disconnected. Remove the 2A wires from the old expansion module one stud at a time and transfer them to the new expansion module. | | |
| 7 | Install the new expansion module in the control box using the existing hardware. | | |
| 8 | Reconnect the 35 pin expansion module connector, the 6 pin evaporator fan connector, and the 8 pin CAN connector. Apply Super Lube as required. | | Verify all connectors are securely mated and secure the harnesses with cable ties as required. |
| 9 | Reconnect the unit battery. | | |
| 10 | Reconnect the standby power if needed. | | |
| 11 | Turn the unit on. | | |
| 12 | Clear any alarm codes. | | |
| 13 | Run a Full Pretrip Test to verify proper unit operation. | | |

A04A - Programmable Feature Setup

Purpose:

To set the sensor grades and programmable features of an SR-2/SR-3 Base Controller/Interface Board to customer specifications.

Materials Required:

- A completed copy of the Setup Sheet at the back of Service Procedure A02A.

Operation:

- The settings of the graded sensors and all programmable features must be programmed after replacing a Base Controller/Interface Board or performing a Base Controller/Interface Board Cold Start.
- Refer to Section 3 for a complete description of programmable features.
- The default settings are shown on the appropriate Setup Sheet at the back of Service Procedure A02A.
- If a sensor grade is not shown on the setup sheet, visually check the sensor to determine the grade. It is very important that sensor grades be set properly.

Procedure:

| Step | Action | Result | Comments |
|------|--|---|---|
| 1 | Turn the unit on. | | |
| 2 | Press the MENU key. | The Operator Menu appears. | |
| 3 | Press and hold both the EXIT and unlabeled key for five seconds. | The Maintenance Menu appears. | |
| 4 | Press the NEXT key as required to display the Software Revision Menu. | | |
| 5 | Use the NEXT and/or BACK keys to scroll through the HMI Control Panel and Base Controller/Interface Board software revisions. | Verify the software revisions are as desired. | |
| 6 | When the software revisions have been verified, press the EXIT key to return to the Maintenance Menu. | | |
| 7 | Press the NEXT key as required to display the Set Time and Date Menu. Then press the SELECT key to enter the Set Time and Date Menu. | | The real time clock is located in the HMI Control Panel. The time is supplied to the Base Controller/Interface Board each time the unit is turned on. If the Base Controller/Interface Board is changed, the clock setting will be supplied to the Base Controller/Interface Board when the unit is turned on. If the HMI Control Panel is changed, the time and date must be checked and set if necessary. |
| 8 | Verify that the Time is set to the time zone used by the customer as shown on the setup sheet. | | |
| 9 | When the time zone has been verified, press the EXIT key to return to the Maintenance Menu. | | |



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| Step | Action | Result | Comments |
|------|---|---|---|
| 10 | Verify the unit is not running. The unit will not enter the Guarded Access Menu if it is running. | | If the unit is running, scroll back and enter Interface Board Test Mode. This will cause the unit to shut down. Press the Exit key to return to the Maintenance Menu. Scroll back to the Set Time and Date Menu and proceed with the next step. |
| 11 | Press and hold both the EXIT and unlabeled key for five seconds. | The Guarded Access Menu appears. | If a Security Code is requested, enter the Security Code or [4444] to enter the Guarded Access Menu. |
| 12 | The Programmable Features Menu will appear. Press the SELECT key to enter the Programmable Features Menu. | | |
| 13 | Use the NEXT and/or BACK keys to scroll through all the features in the Programmable Features Menu. | Set all Programmable Features settings to those shown on the Setup Sheet. | |
| 14 | When all Programmable Features have been set, press the EXIT key to return to the Guarded Access Menu. | | |
| 15 | Use the NEXT and/or BACK keys to scroll to the next Guarded Access Menu. | | Use the Setup Sheet as a guide. |
| 16 | Use the SELECT key to enter the next Guarded Access Menu. | | Use the Setup Sheet as a guide. |
| 17 | Use the NEXT and/or BACK keys to scroll through all settings in the Menu. | Set all menu settings to those shown on the Setup Sheet. | |
| 18 | Use the EXIT key to return to the Guarded Access Menu. | | |
| 19 | Continue to use Steps 15 – 18 as required to complete the Setup Sheet. | | The OptiSet features are set up using the WinTrac Service Tool. Refer to Service Procedure A47B. |
| 20 | When all settings have been recorded, press the EXIT key to return to the Guarded Access Menu. | | |
| 21 | Press the EXIT key again to return to the Standard Display. | | |
| 22 | Set up the OptiSet features using Service Procedure A47B. | | |
| 23 | Run a Pretrip Test to verify proper unit operation. | | |

A07A - Performing a Base Controller/Interface Board Cold Restart

Purpose:

To perform a Cold Restart on the Base Controller/Interface Board.

Materials Required:

- WinTrac™ Service Tool software loaded on a PC

Procedure:

Refer to the WinTrac Service Tool Tools Menu and select Cold Restart.

A07B - Performing an HMI Control Panel Cold Restart

Purpose:

To perform a Cold Restart on the HMI Control Panel.

Materials Required:

- WinTrac™ Service Tool software loaded on a PC

Procedure:

Refer to the WinTrac Service Tool Tools Menu and select Cold Restart.

A15A - Setting Unit Temperature Sensor Grade

Purpose:

To set the sensor grades of graded sensors.

Operation:

The following sensors are graded sensors and must be properly calibrated.

- For Single Temperature Units: The control and display return air temperature sensors and the control and display discharge air temperature sensors are graded sensors. The Spare 1 temperature sensor is also a graded sensor.
- For Multi-Temperature Units: The return air temperature sensors and discharge air temperature sensors for all zones are graded sensors. The three spare temperature sensors are also graded sensors.

Any time these sensors are replaced or a Cold Start is performed, the sensor grade must be correctly entered to verify optimum performance of the unit. The sensor grade is stamped on the barrel of each sensor. Failure to properly calibrate sensors may result in nuisance alarm codes.

Important Notes:

- Always record the marked sensor grades of any replacement return, discharge or spare temperature sensors. The grade is required to complete the sensor calibration procedure.
- If any return air temperature or discharge air temperature sensor grade is set to 5H, Alarm Code 92 will be set. Calibrating the sensor grades automatically clears Alarm Code 92. This alarm code does not apply to spare sensors. However, when used, spare sensors should still be calibrated to achieve maximum accuracy.

Procedure:

| Step | Action | Result | Comments |
|------|--|---|--|
| 1 | Verify and record the sensor grades of all return air, discharge air, and spare sensors (if used) by physically checking the sensor. | | Alarm Code 92 does not apply to spare sensors. However, when used, spare sensors should still be calibrated to achieve maximum accuracy. |
| 2 | Turn the unit on. | | |
| 3 | Press the MENU key. | The Main Menu appears. | |
| 4 | Press and hold both the EXIT and unlabeled key for five seconds. | The Maintenance Menu appears. | |
| 5 | Press the DOWN key as required to display the Set Time and Date Menu. | The Set Time and Date Menu appears. | |
| 6 | Press and hold both the EXIT and unlabeled key for five seconds. | The Guarded Access Menu appears. | |
| 7 | Press the DOWN key as required to display the Sensor Calibration Menu. | The Sensor Calibration Menu appears. | |
| 8 | When the Sensor Calibration Menu is shown, press the SELECT key to access the Sensor Calibration Menu. | The first graded sensor and the current grade appear. | |
| 9 | If necessary, use the UP and/or DOWN keys to select the sensor to be calibrated. | These keys scroll through all graded sensors installed on the unit. | Verify the correct sensor is selected. |
| 10 | When the sensor to be calibrated is shown on the display, press the SELECT key. | The Sensor Change Menu for the selected sensor will appear. | |
| 11 | Use the "+" and "-" keys to change the sensor grade to match the grade stamped on the sensor. | | |



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| Step | Action | Result | Comments |
|------|--|------------------------------|----------|
| 12 | When the correct grade is shown, press the YES key to confirm the choice. | | |
| 13 | If necessary, repeat steps 9 – 12 to change any other sensor grades that are not correct. | | |
| 14 | Press Exit to leave the Sensor Calibration Menu. | | |
| 15 | If graded sensor alarms exist (Alarm Codes 03 and/or 04), use the BACK key to return to the Alarms Menu in Guarded Access. | The Alarms Menu will appear. | |
| 16 | Press the SELECT key to enter the Alarms Menu. | | |
| 17 | Press the CLEAR key to clear the sensor alarms. | | |
| 18 | When finished, press the EXIT key several times or turn the unit off to exit the Sensor Calibration Menu. | | |

A26A - Welding on Units Equipped with Base Controllers

Purpose:

To prevent damage to the Base Controller/Interface Board and other components during welding operations.

Operation:

Electric welding generates high amperage currents that can damage electrical and electronic components. In order to minimize the possibility of damage the following procedures should be followed.

Before Welding:

| Step | Action | Result | Comments |
|------|---|--------|----------|
| 1 | Turn the unit off. | | |
| 2 | Disconnect standby power, if connected. | | |
| 3 | Disconnect both battery cables. | | |
| 4 | Connect the welder ground cable as close as possible to the area where the welding is to be performed. Move the welder ground cable as required. | | |

After Welding:

| Step | Action | Result | Comments |
|------|--|--------|----------|
| 1 | Reconnect both battery cables. | | |
| 2 | Reconnect the standby power if needed. | | |
| 3 | Perform a Pretrip Test to verify proper operation. | | |

A28A - Setting Unit Running Time Hourmeters

Purpose:

This procedure should be followed to set the fixed running time hourmeters such as Total Hours, Total Run Time Hours, Engine Hours, Electric Run Time Hours, and Zone Run Hours after replacing a Base Controller with a new replacement Base Controller.

Important Notes:

- Time can only be added if all hourmeters have less than 100 hours accumulated. If hourmeter time exceeds 100 hours, the hourmeter time can no longer be changed.
- If time in excess of 100 hours has been entered, the hourmeters can no longer be changed. Exercise care when changing these hourmeter settings. Verify the correct number of hours are selected for each hourmeter.
- Do not allow the three minute Guarded Access keypad timeout to occur during this procedure. If the keypad times out before all desired changes are made and a hourmeter exceeds 100 hours, the hourmeters can no longer be changed.
- Do not exit hourmeter setup until all hourmeters have been set as required. Once the hourmeter setup has been exited, this menu is locked out and the hourmeters can no longer be changed.

Procedure:

| Step | Action | Result | Comments |
|------|--|-----------------------------------|---------------------|
| 1 | Determine the number of hours to be set on each hourmeter. If the unit is a Model 50 unit, verify the total of Engine Hours and Electric Run Time Hours is equal to the number of hours to be set as Total Run Time Hours. | | |
| 2 | Turn the unit on. | | |
| 3 | Press the MENU key. | The Main Menu appears. | Press the MENU key. |
| 4 | Press and hold both the EXIT and unlabeled key for five seconds. | The Maintenance Menu appears. | |
| 5 | Press the NEXT key as required to display the Set Time and Date Menu. | | |
| 6 | Press and hold both the EXIT and unlabeled key for five seconds. If a Security Code is requested, enter the Security Code or [4444] to enter the Guarded Access Menu. | The Guarded Access Menu appears. | |
| 7 | Press the EXIT key to display the Hourmeter Setup Menu. | The Hourmeter Setup Menu appears. | |
| 8 | Press the SELECT key to choose the Hourmeter Setup Menu. | | |
| 9 | Press the SELECT key again to choose the Program Hourmeter Menu. | | |
| 10 | Press the EXIT key to scroll to the last item in the Program Hourmeter Menu. The NEXT key will disappear. | | |



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| Step | Action | Result | Comments |
|------|---|---|--|
| 11 | Press and hold both the EXIT and unlabeled key for five seconds. | This will add the non-programmable hourmeters to the menu <u>only if the number of hours in these hourmeters are less than 100 hours.</u> | Important: Do not exit the hourmeter setup or allow the Guarded Access keypad timeout to occur during this procedure. If the keypad times out and an hourmeter exceeds 100 hours, the hourmeters will be locked and can no longer be changed. |
| 12 | Use the NEXT and/or BACK keys to show the desired hourmeter. When the desired hourmeter is shown, press the SELECT key to chose it. | | |
| 13 | Change the value of the hourmeter by pressing the + or - keys. | | |
| 14 | When the correct number of hours is shown, press the YES key to accept the change. | | Important: If time in excess of 100 hours has been entered the hourmeters can no longer be changed. Exercise care when changing hourmeter settings. |
| 15 | Repeat Steps 12-14 as necessary to change the remaining hourmeters. | | |
| 16 | When all hourmeters are set, press the EXIT key to return to the Program Hourmeter Menu. | | Important: If time in excess of 100 hours has been entered the hourmeters can no longer be changed. Verify all settings are correct before leaving this menu. |

A46A - Flash Loading Base Controller/Interface Board Software

Purpose:

To update software for the Base Controller/Interface Board using a computer and the WinTrac Service Tool.

Materials Required:

WinTrac application software loaded on a computer.

Flash Loading using USB Flash Drive:

Units equipped with a USB Port can flash load Base Controller software using a WinTrac Service Tool configured USB Flash Drive. Refer to Section 4 for details.

Procedure:

Refer to the WinTrac Service Tool Tools Menu and select Flash Load.

A46B - Flash Loading HMI Control Panel Software

Purpose:

To update software for the HMI Control Panel using a computer and WinTrac Service Tool.

Materials Required:

WinTrac application software loaded on a computer.

Flash Loading using USB Flash Drive:

Units equipped with a USB Port can flash load HMI Control Panel software using a WinTrac Service Tool configured USB Flash Drive. Refer to Section 4 for details.

Procedure:

Refer to the WinTrac Service Tool Tools Menu and select Flash Load.

A47A - Programming OptiSet™ Features

Purpose:

To program OptiSet features.

Materials Required:

- A copy of the Setup Sheet at the end of this Service Procedure.

Important Notes:

- The settings of all OptiSet programmable features must be retrieved before replacing a Base Controller or performing a Cold Start. These settings will then need to be duplicated in the replacement Base Controller or after the Cold Start.
- Refer to Section 3 for a complete description of OptiSet programmable features.
- The default settings are shown on the Setup Sheet at the end of this Service Procedure.

Procedure:

| Step | Action | Result | Comments |
|------|--|---|--|
| 1 | Turn the unit on. | | Requires HMI Control Panel Software Revision 6512 or earlier. OptiSet is not supported with software revisions 6520 and later. |
| 2 | Press the MENU key. | The Alarm or Language selection of the Main Menu appears. | Do not let the unit start. The Guarded Access Menu cannot be entered if the unit is running. |
| 3 | Press and hold both the EXIT and unlabeled key for five seconds. | The Maintenance Menu appears. | |
| 4 | Press the NEXT key as required to display the Set Time and Date Menu. | | If the unit is running, scroll back and enter Interface Board Test Mode. This will cause the unit to shut down. |
| 5 | Press and hold both the EXIT and unlabeled key for five seconds. | The Guarded Access Menu appears. | If a Security Code is requested, enter the Security Code or [4444] to enter the Guarded Access Menu. |
| 6 | Press the NEXT key as required to choose the OptiSet Setup Menu. | | |
| 7 | When the OptiSet Menu is shown, press the SELECT key to access the Menu. | The Temperature Units display will appear. | Requires HMI Control Panel Software Revision 6512 or earlier. OptiSet is not supported with software revisions 6520 and later. |
| 8 | Use the NEXT and/or BACK keys to scroll through all settings in the OptiSet Global Features Menu. Use the SELECT key to choose the feature to change or read. Use the - and + keys to change the feature to the desired setting. Press the YES key to save the feature setting or the NO key to go back to change the setting. | | Set or record all OptiSet Global Features settings using the OptiSet Setup Sheet. For information on setting up OptiSet Global Features, refer to Section 3. The OptiSet Setup Sheet is located at the end of this Service Procedure. It is used to specify feature settings when setting up OptiSet or to record the existing settings when retrieving OptiSet feature settings. The OptiSet default settings are shown on the sheet. |

| Step | Action | Result | Comments |
|-------------|--|---------------|---|
| 9 | When the OptiSet Global Feature Settings are complete and the Range Limits Menu is shown, press the SELECT key to access the Menu. | | |
| 10 | Use the NEXT and/or BACK keys to choose the desired range and press the SELECT key. | | |
| 11 | The low limit of the range cannot be changed. It is shown for reference only. Press the NEXT key to display the upper limit for the range. | | |
| 12 | Press the SELECT key to choose the upper limit for the range. | | |
| 13 | Use the - and + keys to change the upper limit of the range to the desired setting. Press the YES key to load the setting or the NO key to go back to change the setting. | | |
| 14 | Repeat steps 10 – 13 to set up or read the range limits for all other ranges. | | Up to 10 ranges can be set up. |
| 15 | When all desired ranges have been set up, press the FINISH key to save all the ranges. | | |
| 16 | When the OptiSet Range Limits Settings are complete and the Range Select Menu is shown, press the NEXT or BACK keys to choose Range 0 and press SELECT to enter the range. | | |
| 17 | Press the YES key to confirm the range or the NO key to go back to choose a different range. | | |
| 18 | Use the NEXT and/or BACK keys to scroll through all feature settings in the OptiSet Range 0 Menu. Use the SELECT key to choose the feature to change or read. Use the - and + keys to change the feature to the desired setting. Press the YES key to save the feature setting or the NO key to go back to change the setting. | | Set or record all OptiSet Range 0 settings using the OptiSet Setup Sheet. For information on setting up OptiSet Ranges, refer to Section 3. |
| 19 | Repeat Steps 17 – 19 to set up or read the range features for all other ranges. | | |
| 20 | When all OptiSet features have been set or read, press the EXIT key to leave the OptiSet Menu. | | |

OptiSet Setup Sheet:
Table 6. OptiSet Global Feature Settings

| Function | Default Setting | Actual or Recorded Setting |
|----------------------------|------------------------|-----------------------------------|
| Temperature Units | FAHRENHEIT/CELSIUS | |
| Setpoint High Limit Zone 1 | 80°F (27°C) | |
| Setpoint Low Limit Zone 1 | -20°F (-29°C) | |

Table 6. OptiSet Global Feature Settings (continued)

| Function | Default Setting | Actual or Recorded Setting |
|-----------------------------|------------------------|-----------------------------------|
| Setpoint High Limit Zone 2 | 80°F (27°C) | |
| Setpoint Low Limit Zone 2 | -20°F (-29°C) | |
| Setpoint High Limit Zone 3 | 80°F (27°C) | |
| Setpoint Low Limit Zone 3 | -20°F (-29°C) | |
| Number of Limited Setpoints | 0 | |
| Limited Setpoint #1 | -13°F (-25°C) | |
| Limited Setpoint #2 | 32°F (0°C) | |
| Limited Setpoint #3 | 37°F (2.8°C) | |
| Limited Setpoint #4 | 55°F (12.8°C) | |
| Fresh Frozen Range | 15°F (-9.4°C) | |

Table 7. OptiSet Range Settings

| Range | Low Limit | High Limit |
|--------------|------------------|-------------------|
| Range 0 | -25°F (-31.6°C) | |
| Range 1 | | |
| Range 2 | | |
| Range 3 | | |
| Range 4 | | |
| Range 5 | | |
| Range 6 | | |
| Range 7 | | |
| Range 8 | | |
| Range 9 | | |

Table 8. OptiSet Range Feature Settings

| Function | De-fault Set-ting | Range 0 | Range 1 | Range 2 | Range 3 | Range 4 | Range 5 | Range 6 | Range 7 | Range 8 | Range 9 |
|---------------------------------------|--------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Cycle Sentry | ON | | | | | | | | | | |
| Continuous | ON | | | | | | | | | | |
| Cycle Sentry Null Restart Temperature | 5.0°F (-15°C) | | | | | | | | | | |
| Cycle Sentry Door Open Forces | LOG ONLY | | | | | | | | | | |
| Cycle Sentry Run Fans in Null | OFF | | | | | | | | | | |



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Table 8. OptiSet Range Feature Settings (continued)

| Function | De-fault Set-tинг | Range 0 | Range 1 | Range 2 | Range 3 | Range 4 | Range 5 | Range 6 | Range 7 | Range 8 | Range 9 |
|-----------------------------|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Continuous Door Open Forces | LOG ONLY | | | | | | | | | | |
| Continuous Run Fans in Null | OFF | | | | | | | | | | |

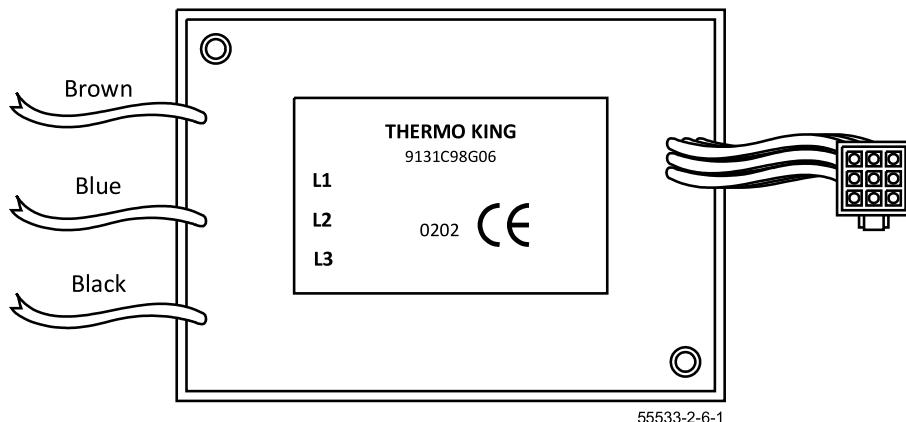
A48A - Phase Detect Module Operation and Diagnostics

Purpose:

To understand phase detect module operation and diagnostic procedures.

Description:

The phase detect module is designed to monitor three phase voltages from 160 volts AC to 510 volts AC.



⚠ WARNING

Hazardous Voltage!

Units featuring optional Electric Standby utilize 460, 400, or 230 volt 3 phase AC electrical power any time the unit is operating in Electric Mode. This voltage potential is also present any time the unit is connected to a source of external standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

Operation:

The brown, blue and black wires are used to sample the power at L1, L2 and L3 respectively. Operating power from 12 to 24 VDC is supplied to the module via the 8 wire and CH wire.

When the voltage sensed rises above 180 volts AC and all three phases are present the module ER wire will output 12-24 VDC after the conditions exist for 2 to 4 seconds. This signal informs the base controller that electric standby operation is possible. If the voltage drops below 160 volts AC or a phase is lost, the output is turned off after the condition exists for 8 to 10 seconds. The module continues to monitor the power and will again output 12-24 VDC within 2 to 4 seconds after the voltage rises above 180 volts AC and all three phases are present.

If phase rotation is L1, L2, L3, the 7EB wire will supply 12 to 24 VDC to energize the appropriate phase rotation contactor. If phase rotation is L1, L3, L2, the 7EC wire will supply a chassis ground to energize the appropriate phase rotation contactor. The 7EB and 7EC wires are interlocked to prevent both phase contactors from being energized at once.

Connections:

Connections to the module are shown in the tables below.

Table 9. Power Connections

| Input | Description |
|-------|--|
| 8F | Supplies nominal 12-24 volt DC power to the phase detect module. |
| CH | Chassis ground. |

Table 10. Inputs

| Input | Description |
|-------|---|
| L1 | This brown wire supplies standby power L1 to the phase detect module. |
| L2 | This blue wire supplies standby power L2 to the phase detect module. |
| L3 | This black wire supplies standby power L3 to the phase detect module. |

Table 11. Outputs

| Input | Description |
|-------|---|
| 7EH | With 12-24 VDC is supplied, then outputs 7EB and 7EC will be at 12-24 VDC. |
| 7EB | If phase rotation is L1, L2, L3 then this wire will provide 12-24 VDC to energize the appropriate phase rotation contactor. The 7EC wire is interlocked to prevent both phase contactors from being energized at once. |
| 7EC | If phase rotation is L1, L3, L2 then this wire will provide 12-24 VDC to energize the appropriate phase rotation contactor. The 7EB wire is interlocked to prevent both phase contactors from being energized at once. |
| ER | This wire will output 12-24 VDC 2 to 4 seconds after the voltage rises above 180 volts AC and all three phases are present. If the voltage drops below 160 volts AC or a phase is lost and the condition remains for 8 to 10 seconds, the output is turned off. The module continues to monitor and will again output 12-24 VDC 2 to 4 seconds after the power returns to normal (voltage rises above 180 volts AC and all three phases are present). |

Table 12. Connector Pinout

| Pin | Wire | Description |
|-----|--------|--|
| 1 | 8F | Power to Module |
| 2 | CH | Chassis ground |
| 3 | ER | Power OK |
| 4 | 7EH | Switches the 7EC and 7EB from grounding to power logic |
| 5 | 7EB | Phase A-B-C |
| 6 | 7EC | Phase A-C-B |
| 7 | Unused | |
| 8 | Unused | |
| 9 | Unused | |

Removal and Replacement:
⚠ WARNING
Hazardous Voltage!

Units featuring optional Electric Standby utilize 460, 400, or 230 volt 3 phase AC electrical power any time the unit is operating in Electric Mode. This voltage potential is also present any time the unit is connected to a source of external standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

1. Turn the unit off.
2. Disconnect the unit battery.
3. Disconnect the standby power.
4. Disconnect the three wires from the phase detect module at the motor contactor.
5. Unplug the phase detect module harness.
6. Remove the old phase detect module.

7. Install the new phase detect module.
8. Connect the new phase detect module wires to the upper contactor as follows:
 - a. Connect the brown wire to L1 on the contactor.
 - b. Connect the blue wire to L2 on the contactor.
 - c. Connect the black wire to L3 on the contactor.
 - d. Use crimp-on terminals as required.
 - e. Connect the plug on the short harness from the phase detect module.
9. Install the high voltage cover.
10. Secure wires and wire harnesses as required using cable ties.
11. Connect the unit battery.
12. Connect standby power.
13. Perform a Pretrip Test to verify proper operation.

Diagnostics:**⚠ WARNING****Hazardous Voltage!**

Units featuring optional Electric Standby utilize 460, 400, or 230 volt 3 phase AC electrical power any time the unit is operating in Electric Mode. This voltage potential is also present any time the unit is connected to a source of external standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

| Step | Action | Result | Comments |
|------|--|---|--|
| 1 | Plug the standby power cord into a known good standby power supply and turn the unit on. | | |
| 2 | Using a Fluke Meter, measure the standby voltage between phases L1 - L2, L2 - L3 and L3 - L1 at the input to the terminals where the Brown, Blue, and Black wires are connected. | The standby voltage between phases should be between 200 - 500 VAC. If not, repair as necessary to supply the needed voltage to the unit. | |
| 3 | Check the 8F and CH circuits to the phase detect module. 12-24 VDC must be present from 8F to CH. | If this power is not present, check the 8 circuit from the On/Off switch. | |
| 4 | If correct power is present in the test above, the ER circuit on the base controller should have 12-24 VDC present. | If power is not present, replace the phase detect module. | Removal and replacement of the phase detect module is detailed on a previous page. |
| 5 | If LED 7 on the base controller is illuminated, the 7EH circuit should have 12-24 VDC present. | If power is not present, check the Diesel/Electric Relay circuit on the base controller. | |
| 6 | If the unit is calling for operation (LED 7 illuminated), one of the phase select contactors should be energized. | If neither contactor is energized, check for 12-24 VDC. If voltage is not present, replace the phase detect module. | Removal and replacement of the phase detect module is detailed on a previous page. |

A49A - CargoWatch Data Logger

Purpose:

To understand, use, and diagnose the CargoWatch Data Logger.

Materials Required:

WinTrac application software loaded on a computer.

Description:

Allows the user to manage, download, and view CargoWatch data. Configure the CargoWatch Data Logger and sensor settings.

Procedure:

Refer to the WinTrac Service Tool USB Flash Drive Menu.

A50A - ServiceWatch Data Logger

Purpose:

To understand and use the ServiceWatch Data Logger.

Materials Required:

WinTrac application software loaded on a computer.

Description:

Allows the user to manage, download, and view ServiceWatch data. Configure the ServiceWatch Data Logger and sensor settings.

Procedure:

Refer to the WinTrac Service Tool USB Flash Drive Menu.

D01A - Temperature Sensor Test

Purpose:

To confirm the proper operation of the unit temperature sensors.

Materials Required:

- Fluke Digital Multimeter

Operation:

Both graded and ungraded sensors are used on SR-3 applications. Graded sensors are used to sense return air and discharge air temperatures. The spare sensor (if used) is also a graded sensor. Ungraded sensors are used to sense coil temperatures and ambient air temperature. Both graded and ungraded sensors are checked in the same manner.

Control Return Air Sensor:

These sensors monitor the temperature of the air returning to the evaporator coil. The sensors are located in the return air flow and are connected directly to the Base Controller/Interface Board connector J3. These sensors are graded sensors and must be replaced with graded sensors. The Base Controller/Interface Board must be calibrated to the actual grade of the installed sensor in order to operate properly. The Control Return Air Sensor is connected to the Base Controller/Interface Board via the RTP and RTN wires. When replacing a sensor, verify the sensors are connected properly.

Control Discharge Air Sensor:

These sensors monitor the temperature of the air leaving the evaporator coil. The sensors are located in the evaporator discharge air path and are connected directly to the Base Controller/Interface Board via connector J3. These sensors are graded sensors and must be replaced with graded sensors. The Base Controller/Interface Board must be calibrated to the actual grade of the installed sensor, in order to operate properly. The Control Discharge Air Sensor is connected to the Base Controller/Interface Board via the DTP and DTN wires. When replacing a sensor, verify the sensors are connected properly.

Hard and Soft Failure:

Sensor alarms can occur in the following ways:

- Hard Failure - is defined by an out of range sensor reading, typically caused by an open or shorted sensor. The sensor display will show dashes if a hard failure occurs. If this occurs only the alarm code for that sensor will be set. Alarm Code 13 will not be present. The controller may not be showing dashes for the sensor reading, but the alarm will be active when the unit is inspected. If a sensor alarm code is set, a failure did occur at some point. Checking a ServiceWatch Data Logger download at Technician Level may indicate when the hard failure occurred.
- Soft Failure - is defined by erratic operation or sensor drift that exceeds acceptable tolerances (sensor is out of calibration). If this occurs, the alarm code for the suspect sensor or sensors will be set along with Alarm Code 13. This indicates a potential problem that may not be immediately apparent, and that a hard failure as defined above did not occur. Checking a ServiceWatch Data Logger download at Technician Level may indicate when the soft failure occurred.

Procedure:

Note: Polarity must be considered when connecting temperature sensors. If the sensors are connected backwards, the display will show dashes (- - -). Refer to the schematic diagram or wiring diagram for the correct connections.

| Step | Action | Result | Comments |
|------|--|--------|----------|
| 1 | Disconnect the sensor to be replaced from the sensor harness. | | |
| 2 | If the sensor is a soft failure, replace the sensor and proceed to Step 8. | | |
| 3 | If the sensor is a hard failure, turn the unit on. | | |



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| Step | Action | Result | Comments |
|------|---|---|----------|
| 4 | Check the voltage at the sensor harness wires. | The voltage from the Base Controller/Interface Board must be from 4.90 to 5.10 volts DC with the sensor disconnected. | |
| 5 | If the voltage measured in Step 4 is correct, proceed to Step 8. | If resistance is near 0 ohms, replace the sensor. If resistance is high or reads OL, test and repair the harness as required. | |
| 6 | If the voltage measured in Step 4 is incorrect, unplug the sensor connector at the Base Controller/Interface Board and check the harness for shorts and open wires. | Test and repair the harness as required. Refer to Service Procedure H04A for additional information. | |
| 7 | If the harness passes inspection, check the Base Controller/Interface Board in accordance with Service Procedure A01A. | If the Base Controller fails the test, it must be replaced. | |
| 8 | If the failure is a soft failure or the voltage at the harness connector is correct, replace the sensor. | | |

D03A - Pressure Transducer Test

Purpose:

To confirm the proper operation of the suction or discharge pressure transducers.

Materials Required:

- Fluke Digital Multimeter

Operation:

The Base Controller has a separate 5 Vdc power supply for the Discharge Pressure Transducer, Suction Pressure Transducer, and Coolant Level switch. A short circuit condition in one transducer or switch circuit should not affect the other devices.

Discharge Pressure Transducers:

The maximum discharge pressure that can be displayed is 500 psig. If the sensed pressure is greater than 500 psig, the HMI Control Panel will display [----] instead of the discharge pressure.

The minimum discharge pressure that can be sensed is -10 psig. The control system cannot determine if the minimum sensed pressure is the result of an electrical short or very low system pressure.

Suction Pressure Transducers:

The maximum suction pressure that can be displayed is 200 psig. If the sensed pressure is greater than 200 psig, the HMI Control Panel will display [----] instead of the suction pressure. When the unit is off and the refrigerant pressures have equalized, the system pressure can exceed 200 psig when ambient temperatures are above 90°F (35°C). If this occurs, the HMI Control Panel will display [----]. This is normal operation and no cause for concern.

The minimum suction pressure that can be sensed is -12 psig.

If the suction pressure transducer opens, the display will read -10 psig. An alarm may not be generated immediately but the unit will be forced to low speed due to low suction pressure.

Pressure Transducer Identification:

The Discharge Pressure Transducer will have "500" on the body of the part. The Suction Pressure Transducer will have "200" on the body of the part. The transducers are not interchangeable.

Procedure:

| Step | Action | Result | Comments |
|------|---|---|---|
| 1 | Turn the unit on. | | |
| 2 | Access the Gauge Menu and display the suction pressure or discharge pressure. | The display should show the pressure reading for the transducer. If the transducer reading is obviously incorrect or the display shows [----], proceed as shown below. | Confirm the reading with refrigeration gauges as necessary. |
| 3 | Turn the unit off and disconnect the suction or discharge pressure transducer at the transducer plug. | | |
| 4 | Turn the unit on. | | |
| 5 | Check the voltage at the transducer harness connector. | The voltage between the DPP and DPN wires (Discharge Pressure) or SPP and SPN wires (Suction Pressure) must be from 4.90 to 5.10 Vdc. If the voltage is not present, proceed to Step 6. If the voltage is correct, proceed to Step 7. | |
| 6 | If the voltage is not present, check the harness continuity of the DPP-DPN or SPP-SPN wires. | If the continuity checks good and voltage is still not present, check the Base Controller in accordance with Service Procedure A01A. Replace the Base Controller if necessary. | |

| Step | Action | Result | Comments |
|-------------|---|---|--|
| 7 | If the voltage is correct, check the harness continuity of the DPI or SPI wires. | If the voltage is correct and the DPI or SPI wire has continuity, replace the transducer in question. | |
| 8 | Transducer circuit operation can be verified by installing a known good transducer in the center port of a gauge manifold. Connect the transducer to the unit wiring harness and check the gauge reading. | If the transducer in the gauge manifold reads properly, the unit transducer is bad. | Apply discharge or suction pressure to the test transducer via the gauge manifold center port. |

F01A - Oil Level Switch Check and Replacement

Purpose:

To test the oil level switch for proper operation.

Materials Required:

- Fluke Digital Multimeter

Operation:

The switch is open with the float up (indicating full oil level). The switch is closed with the float down (indicating low oil level).

Procedure:

| Step | Action | Result | Comments |
|------|---|---|--|
| 1 | Turn the unit off. | | |
| 2 | Disconnect the Deutsch connector at the switch. | | The oil level switch is located on the top of the oil pan. |
| 3 | Use an ohmmeter to check switch continuity. | With the oil above the "add" mark, the switch should be open. If the engine is six or more quarts low, the switch should be closed. | This check can be performed while changing the oil. |
| 4 | Reconnect the Deutsch connector. | | |

Replacing the Switch – Screw In Applications:

| Step | Action | Result | Comments |
|------|---|--------|--|
| 1 | Turn the unit off. | | |
| 2 | Disconnect the Deutsch connector at the switch. | | The oil level switch is located on the top of the oil pan. |
| 3 | Unscrew and remove the old switch. | | |
| 4 | Apply Teflon tape to the threads on the new switch. | | |
| 5 | Screw the new switch into the hole in the oil pan. Tighten until snug. Do not over-tighten. | | |
| 6 | Reconnect the Deutsch switch connector. | | |

F05A - Oil Pressure Switch Test

Purpose:

To test the oil pressure switch for proper operation.

Materials Required:

- Fluke Digital Multimeter

Procedure:

| Step | Action | Result | Comments |
|------|--|--|---|
| 1 | Connect a multimeter set for DC Volts between the 20B wire at the oil pressure shutdown switch and chassis ground. | | |
| 2 | Turn the unit on and observe the meter reading. | The voltage with the unit on and the engine not running should be zero. If there is voltage present, the switch is defective. | |
| 3 | Start the engine and observe the meter reading. | Battery voltage should be present when the engine is running. If the voltage is low or is zero, proceed to Step 4. | |
| 4 | With the unit running, disconnect the 20B wire from the switch. Measure the voltage from the 20B wire to chassis ground. | If the battery voltage is present on the wire, the switch is defective and should be replaced. If the voltage on the 20B wire is low or zero, there is a problem in the 20B circuit. | Check the 20B circuit as required to determine the cause. |

F07B - Magnetic Coolant Level Sensor Test

Purpose:

To confirm proper operation of the magnetic coolant level sensor.

Materials Required:

- Fluke Digital Multimeter

Operation:

A magnetic reed switch is used to determine the coolant level. This two wire switch is supplied with +5 Vdc from the Base Controller/Interface Board on the CLP wire (J7 Pin 15). The switch outputs +5 Vdc on the CLS wire (J7 Pin 16) when coolant level is above the sensor and less than 0 Vdc when the coolant level is below the sensor.

The switch is housed in an isolated chamber within the coolant tank. A magnetic float is located in the engine coolant adjacent to the switch chamber. The switch will open or close as the magnetic float falls or rises with the coolant level. The switch can be changed without removing coolant from the radiator. Exercise care when removing and installing the reed switch as the switch is enclosed in a glass shell.

Procedure:**! CAUTION****Hazardous Pressures!**

Do not remove expansion tank cap while coolant is hot.

| Step | Action | Result | Comments |
|------|--|---|--|
| 1 | Disconnect the switch and check the voltage between the CLP wire at the sensor harness connector and chassis ground for +5 Vdc. | +5 Vdc should be present between the CLP wire and chassis ground. If not, check the harness and connectors as required to determine the cause. | |
| 2 | If +5 Vdc is present at the sensor, check the voltage on the CLS wire at the sensor harness connector. | Less than 0.5 Vdc should be present when the coolant level is below the switch and +5 Vdc should be present when the coolant level is above the switch. If these voltages are not present, the sensor must be replaced. | |
| 3 | The switch is housed in an isolated chamber within the coolant tank. The switch can be changed without removing coolant from the radiator. | | Exercise care when removing and installing the reed switch as the switch is enclosed in a glass shell. Carefully pry the switch from the chamber in the coolant tank. To install the switch, carefully press it into the chamber by hand. |

F08A - Coolant Temperature Sensor Test

Purpose:

To test the coolant temperature sensor for proper operation.

Materials Required:

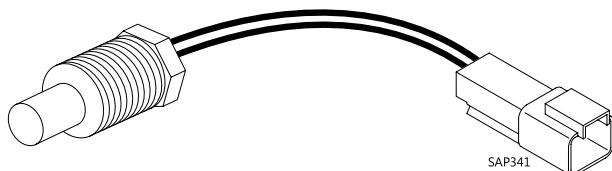
- Fluke Digital Multimeter

Procedure:

Note: Polarity must be considered when connecting temperature sensors. If the sensors are connected backwards, the display will show dashes (---). Refer to the schematic diagram or wiring diagram for the correct connections.

| Step | Action | Result | Comments |
|------|--|---|--|
| 1 | Turn the unit off. | | |
| 2 | Disconnect the sensor at the plug next to the sensor. | | |
| 3 | Turn the unit on. | The Standard Display will appear. | |
| 4 | Access the Gauge Menu and display Coolant Temperature. | The display for the Engine Coolant Temperature sensor should show dashes [---]. | If all the temperature sensors show dashes [---] without being disconnected, the Base Controller/Interface Board is defective. |
| 5 | Using a multimeter, check the voltage at the sensor plug on the harness. | The voltage must be from 4.90 to 5.10 volts DC. | |
| 6 | If the voltage at the harness connector is correct, replace the sensor. | | |
| 7 | If the voltage measured in Step 6 is incorrect, check the Base Controller/Interface Board in accordance with Service Procedure A01A. | If the Base Controller/Interface Board fails the test, it must be replaced. | |
| 8 | If the Base Controller/Interface Board passes the test, the problem is in the wiring harness. Test and repair the harness as required. | | |

Figure 185. Coolant Temperature Sensor



F09A - RPM Sensor Test and Adjustment

Purpose:

To test and adjust the RPM sensor.

Materials Required:

- Fluke Digital Multimeter

Operation:

The RPM sensor rarely fails but may require adjustment for proper operation.

Procedure:

| Step | Action | Result | Comments |
|------|--|--|---|
| 1 | Turn the unit off. | | |
| 2 | Remove the FS1 and FS2 wires from the sensor. | | |
| 3 | Check the sensor resistance using a multimeter. | The sensor resistance should be 250 to 300 ohms with the wires removed. If not, the sensor should be replaced. | |
| 4 | Loosen the lock nut, turn the sensor in until it contacts the ring gear on the flywheel, then back it out $\frac{1}{2}$ turn and tighten the lock nut. | | |
| 5 | Turn the unit on. | | |
| 6 | Using Service Test Mode, place the unit in High Speed Cool (HSC). | | For information on Service Test Mode, refer to Section 4. |
| 7 | Check the voltage across the sensor terminals with the FS1 and FS2 wires removed. | The voltage in high speed should read from <u>1.0 to 5.0 VAC</u> . | Set the meter to read <u>AC volts</u> . |
| 8 | If the required voltage is not present, replace the RPM sensor. If the required voltage is present, check the harness wires and repair as required. | | |
| 9 | Reattach the FS1 and FS2 wires to the sensor. | | Polarity is not important. |
| 10 | Access the Gauge Menu and display Engine RPM. | The display should show the engine RPM. | |
| 11 | If the RPM reading does not appear in the display, check the Base Controller/Interface Board in accordance with Service Procedure A01A. | | If the Base Controller/Interface Board fails the test, it must be replaced. |

G03A - Electronic Throttling Valve (ETV) Test

Purpose:

To confirm proper operation of the Electronic Throttling Valve.

Note: If the ETV must be changed, refer to the Maintenance Manual for the specific unit.

Materials Required:

- Fluke Digital Multimeter

Operation:

This procedure should be used to check the operation of the Electronic Throttling Valve (ETV) if Alarm Code 89 occurs. Alarm Code 89 indicates that refrigeration system pressures did not respond as expected when the Electronic Throttling Valve was opened and closed, or that an electrical fault with the ETV system was detected. This may be caused by a malfunction in the Electronic Throttling Valve or associated circuit or a refrigeration system problem such as low refrigerant level, frozen expansion valve or severe suction side restriction.

The ETV has two internal coils. The Base Controller operates the valve by energizing the coils with a variable frequency AC signal. The sequence in which the Base Controller energizes the coils determines the direction of travel and the frequency or "speed" of the signal determines the speed of valve motion (i.e., how fast the valve travels). Wires EVA and EVB energize one coil and wires EVC and EVD energize the other coil. The ETV circuits are protected by Smart FETs. Valve position may be monitored by using the Gauges key on the HMI. 0 indicates the valve is fully closed and 800 indicates the valve is fully opened.

Important: The LEDs on the Base Controller can be used to verify Base Controller output to the ETV.

Electronic Throttling Valve Types and Wire Color Codes:

The old style ETV does not have a removable connector on the valve. There is a sheathed cable consisting of colored wires that run from the valve to the Deutsch connector on the cable. The new style ETV has a change in design of the valve body and stepper motor. It also has an integrated four-pin Deutsch connector located at the end of the stepper motor (no harness). The new design allows for ease of service and a low torque setting, providing low strain to piping during service and repair work.

SR-3 Base Controllers feature yellow and green ETV LEDs located at the lower left edge of the board. These LEDs flash when a signal is being sent to the ETV. The LEDs flash rapidly for a brief period of time on initial startup and at a slower rate when the valve is opening or closing normally. If the LEDs are flashing, a signal is being sent to the ETV.

Figure 186. Electronic Throttling Valve

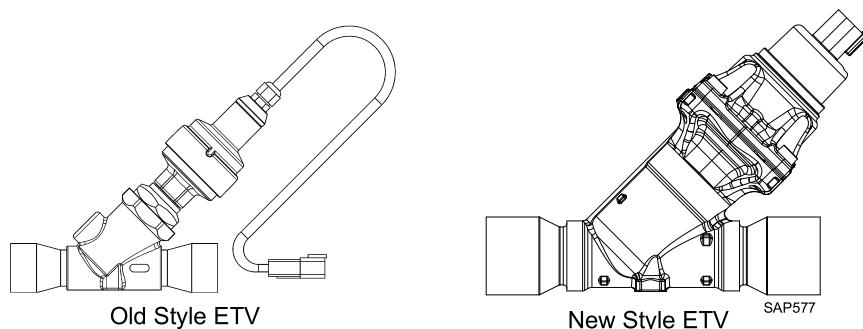


Table 13. ETV Harness Connections

| Old Style | | New Style |
|----------------|-------------|----------------|
| Harness Wire # | Wire Colors | Harness Wire # |
| EVA | Red | EVA |
| EVB | Green | EVB |

Table 13. ETV Harness Connections (continued)

| Old Style | | New Style |
|----------------|-------------|----------------|
| Harness Wire # | Wire Colors | Harness Wire # |
| EVC | White | EVC |
| EVD | Black | EVD |

Procedure:

| Step | Action | Result | Comments |
|------|---|---|---|
| 1 | Power down the unit and verify that all connectors are secure. | | |
| 2 | Disconnect Base Controller connector J7 and measure resistance between the EVA and EVB wires at the connector. <ul style="list-style-type: none"> • J7 Pin 24 – EVA wire • J7 Pin 23 – EVB wire | The resistance should be from 20 to 35 ohms. If the resistance is incorrect, check the EVA and EVB wires and connectors leading to the ETV. Verify the valve connector is properly attached to the valve. | Identify the associated pins on the ETV and check for continuity at the valve. If the resistance from the EVA and EVB pins directly on the valve is not from 20 to 35 ohms, the valve is defective. |
| 3 | Measure the resistance between EVA and ground, and EVB and ground (should be an open circuit). | | Neither pin should show a short to ground. |
| 4 | Measure resistance between the EVC and EVD wires at the connector. <ul style="list-style-type: none"> • J7 Pin 11 – EVC wire • J7 Pin 12 – EVD wire | The resistance should be from 20 to 35 ohms. If the resistance is incorrect, check the EVC and EVD wires and connectors leading to the ETV. Verify the valve connector is properly attached to the valve. | Identify the associated pins on the ETV and check for continuity at the valve. If the resistance from the EVC and EVD pins directly on the valve is not from 20 to 35 ohms, the valve is defective. |
| 5 | Measure the resistance between EVC and ground, and EVD and ground (should be an open circuit). | | Neither pin should show a short to ground. |
| 6 | Reconnect J7 to the Base Controller. | | |
| 7 | Disconnect the ETV from the main unit harness. | | |
| 8 | Set the multimeter to read AC (alternating current) voltage and connect the leads to the EVA and EVB wires in the main unit harness at the ETV. | | Check voltage between EVA and EVB, <u>not</u> the green and red wires attached to the ETV. |
| 9 | Turn the unit on and enter Evacuation Test from the Maintenance Menu. Pay attention to the ETV LEDs on the board. When all four LEDs appear to blink at the same time, read AC voltage between EVA and EVB. | AC voltage between EVA and EVB with the valve opening during Evacuation Test should be between 8-13 VAC. | Prior to the LEDs blinking, it is normal for the AC voltage read on the meter to fluctuate. Pay attention to voltage only when all four LEDs are blinking. The voltage read on the multimeter may be higher (up to 16 VAC) if a battery charger is connected to the unit. |
| 10 | Turn the unit off. | | |
| 11 | With the multimeter set to read AC volts, connect the leads to the EVC and EVD wires in the main unit harness at the ETV. | | Check voltage between EVC and EVD, <u>not</u> the white and black wires attached to the ETV. |



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| Step | Action | Result | Comments |
|------|---|--|---|
| 12 | Turn the unit on and enter Evacuation Test from the Maintenance Menu. Pay attention to the ETV LEDs on the board. When all four LEDs appear to blink at the same time, read AC voltage between EVC and EVD. | AC voltage between EVC and EVD with the valve opening during Evacuation Test should be between 6-10 VAC. | |
| 13 | Turn the unit off. | | |
| 14 | If the tests above were successful, the electronic throttling valve should be operational. If the tests were not successful, proceed with step 14. | | If the electronic throttling valve appears to function electrically and problems still exist, check the refrigeration system for low refrigerant, frozen expansion valve, a severe restriction in the low side of the system, or a mechanically failed ETV. |
| 15 | If the electronic throttling valve circuit is not functioning electrically, replace the controller. | | |

G04A - Electronic Throttling Valve (ETV) Mechanical Operation Test

Purpose:

To confirm proper mechanical operation of the Electronic Throttling Valve.

Note: If the ETV must be changed, refer to the Maintenance Manual for the specific unit.

Materials Required:

- Stepper Valve Tester

Operation:

This procedure should be used to check mechanical operation of the Electronic Throttling Valve (ETV) whenever an ETV is suspected faulty. Alarm Code 89 indicates that refrigeration system pressures did not respond as expected when the ETV was opened and closed, or that an electrical fault with the ETV system was detected. Other alarm codes may be generated if the ETV fails to regulate suction pressure, such as Alarm Codes 10 and 18. These alarms may be caused by a malfunction in the ETV or associated circuit.

The ETV contains a Stepper Motor that moves a piston located in the valve body. The piston position in the valve body determines the amount of refrigerant flow through the valve. Refrigerant flow through the valve is decreased as the piston is extended into the valve body. Suction pressure will drop as the amount of flow through the valve decreases. As the piston retracts, more refrigerant is able to flow through the valve and suction pressure increases.

The position of the ETV can be read in the Gauges Menu. A position of 0 indicates the piston is fully extended in the valve body and that the valve is fully closed. A position of 800 indicates the piston is fully retracted and that the valve is fully open.

Electronic Throttling Valve Types and Wire Color Codes:

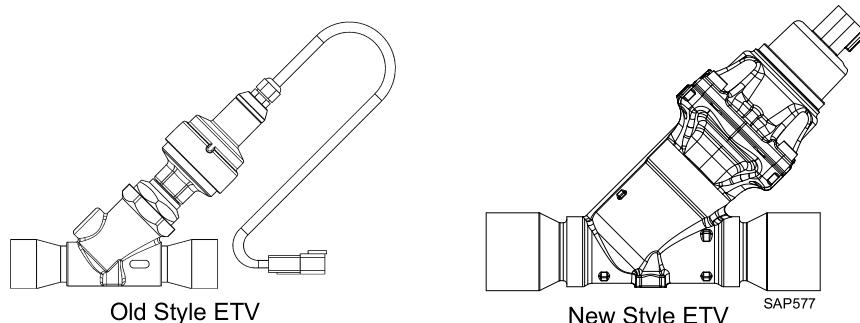
The old style ETV does not have a removable connector on the valve. There is a sheathed cable consisting of colored wires that run from the valve to the Deutsch connector on the cable. The Stepper Motor Tester is connected to the ETV using this Deutsch connector. A pigtail must be constructed in order to connect the tester to the ETV. The ETV may operate backwards if the connections are reversed. The new style ETV has a change in design of the valve body and stepper motor. It also has an integrated four-pin Deutsch connector located at the end of the stepper motor (no harness). The new design allows for ease of service and a low torque setting, providing low strain to piping during service and repair work.

When using the Stepper Motor Tester, the ETV position displayed on the HMI does not indicate actual valve position; the valve is being controlled manually by the tester. The unit harness from the Base Controller must be disconnected from the valve at the Deutsch plug in order to connect the ETV tester. The Base Controller will attempt to control the valve position but will be unable to since the valve is disconnected. The HMI will display requested ETV position, however, the valve will not respond to requests from the Base Controller and the displayed position will likely not be the actual position of the valve. Alarm Code 89 will likely not be generated in this case.

Important: DO NOT open the valve too far, this may cause a possible Alarm Code 10 in high ambient or stall the engine if in low speed.

The harness wire number, wire color on ETV, and binding post color on the tester are shown in the table ([Table 14, p. 373](#)).

Figure 187. Electronic Throttling Valve




THERMO KING
Section 6 - Service Procedures

Table 14. ETV Harness and Tester Connections

| Harness Wire # | Wire Color on ETV | Post Color on Tester |
|----------------|-------------------|----------------------|
| EVA-01 | Red | White |
| EVB-01 | Green | Black |
| EVC-01 | White | Red |
| EVD-01 | Black | Green |

Procedure:

| Step | Action | Result | Comments |
|------|--|---|--|
| 1 | Power down the unit. | | |
| 2 | Disconnect the ETV from the main unit harness and connect the ETV to the Stepper Motor Tester using a pigtail. | | |
| 3 | Set the tester to 50 steps per second and press the rocker switch to the "CLOSE" position for 10-15 seconds. | This closes the ETV. Near the end of 10-15 seconds you will hear the valve fully closing. | The LEDs on the tester will blink as the valve is being positioned. |
| 4 | Press the rocker switch to the "OPEN" position for 2-3 seconds. | This slightly opens the ETV and prevents the unit from running in a vacuum on startup. | ETV position displayed on the HMI will not be accurate as the tester is positioning the valve, not the base controller. |
| 5 | Turn the unit on and enter Service Test Mode in the Maintenance Menu. Select Engine Running Low Speed Cool. | The engine will start and the unit will enter low speed cool operation. | |
| 6 | While monitoring suction pressure in the Gauges menu on the HMI, press the tester rocker switch to the "OPEN" position for 3-5 seconds. | Suction pressure shown on the HMI should increase as the valve is being opened. | |
| 7 | While monitoring suction pressure on the HMI, press the tester rocker switch to the "CLOSED" position for 3-5 seconds. | Suction pressure shown on the HMI should decrease as the valve is being closed. | Suction pressure will go into a vacuum if the valve fully closes during this test. Depending on suction pressure, more than 3-5 seconds of closing the valve may be required to notice a pressure decrease. |
| 8 | Repeat steps 6 and 7 as necessary to confirm ETV operation. | | If suction pressure rises and falls when using the tester to position the ETV, the valve is mechanically functioning. Accomplish Service Procedure G03A to confirm electrical operation of the ETV circuit. |
| 9 | Turn the unit off. | | |
| 10 | If the suction pressure does not rise and fall when using the tester to position the ETV, the valve is likely failed. Check the unit for causes of low suction pressure and non-responsive suction pressure. | | Causes of low suction pressure include a restricted expansion valve, low charge or a heavily frosted evaporator coil. Causes of non-responsive suction pressure include an inoperative compressor or front seated suction service valve. |

H04A - Wiring Harness Continuity Test

Purpose:

To illustrate the correct procedures for checking harness continuity on equipment utilizing solid state devices.

Materials Required:

- Fluke Digital Multimeter
- Jumper wires as required

Important Notes:

- Do not use battery and light test tools to check continuity.
 - Using these devices may present excessive voltage or current to solid state devices, causing damage or destroying the solid state device.
- Never test a circuit to see if it is energized by tapping the circuit wire to ground and watching for a spark.
 - This will damage solid state components or blow a fuse.
- Use a high quality digital multimeter or an analog meter with high input impedance.
 - Older analog (needle type meter movement) meters and some inexpensive "mechanic tool box" meters present a large load to the circuit being tested. This can significantly alter the meter reading, especially when measuring small voltages or currents.

Procedure:

| Step | Action | Result | Comments |
|------|---|---|--|
| 1 | Locate the suspect circuit on the appropriate wiring diagram. | | |
| 2 | Isolate both ends of the circuit using the following methods as required: <ul style="list-style-type: none"> • Disconnect the appropriate connector at the Base Controller. • Disconnect the device connector at the device. • Remove the wire from the device terminal. | Important: Failure to isolate both ends may cause misleading results. | Harness connections are identified in the Service Procedures appropriate to the device in question. They may also be determined by referring to the appropriate wiring diagrams. |
| 3 | Using jumpers as required, connect each end of the circuit to a high quality multimeter. | The meter must show a very low resistance (less than 1.0 ohm), indicating circuit continuity. If not, the circuit is open or has excessive resistance. Troubleshoot the circuit to determine the cause using the wiring diagrams. | Verify the ohmmeter battery is good and the meter zeros with the leads held together to prevent misleading results. |
| 4 | After determining that the circuit passes a continuity test, remove one test meter lead and connect it to the chassis ground to check for a short to ground. | The meter should indicate an open circuit. If not, the circuit is shorted to ground. Troubleshoot the circuit to determine the cause using the wiring diagrams. | |

Section 7 - Service Information

SR-2 Base Controller & Interface Board

There are currently two different versions of the SR-2 Base Controller for multi-temperature applications and two different versions of the SR-2 Interface Board. These component versions are defined as SR-2/C (0T3) or SR-2/D (0T4). In addition, each version of the SR-2 Interface Board is available with or without provisions for defrost damper gear motor applications.

- SR-2 Interface Boards without provisions for defrost damper gear motor applications are used on SB applications.
- SR-2 Interface Boards with provisions for defrost damper gear motor applications are used on SL-400e and SLX applications.

Hardware Versions and Service Part Numbers

For the latest information, refer to the applicable Part Catalog (New) available on iService.

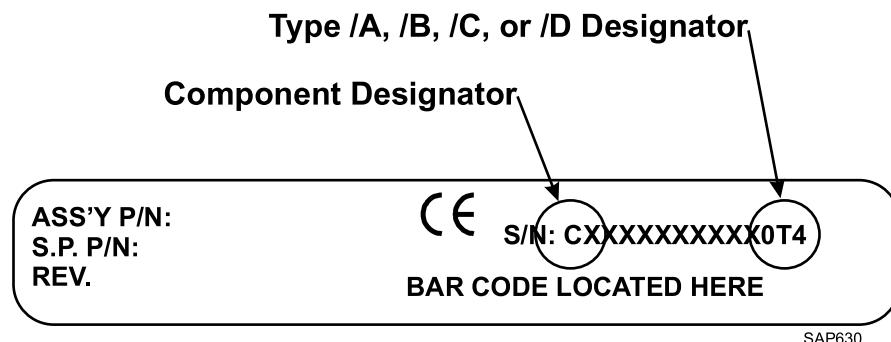
Identification

SR-2 Base Controllers and Interface Boards can be identified by checking the labels on each component. The component serial number is shown on each label. Factory assemblies will have matching serial numbers on all three labels, but matched numbers are not necessary for proper operation.

The first letter of the serial number defines the original component as a Base Controller, Interface Board, or a Base Controller/Interface Board Assembly. The last three digits of the serial number will show if the component is a SR-2/C or SR-2/D Base Controller, Interface Board, or Assembly.

- SR-2/A Serial number ends in "000" - Trailer Single Temp Applications only
- SR-2/B Serial Number ends in "0T2" - Trailer Single Temp Applications only
- SR-2/C Serial Number ends in "0T3" - Trailer Single Temp and Multi-Temp Applications
- SR-2/D Serial Number ends in "0T4" - Trailer Single Temp and Multi-Temp Applications

Note: A typical label is shown. The "C" indicates the device is a Base Controller and the "0T4" indicates that it is a SR-2/D Base Controller.



Location

The Base Controller label is located on the front surface of the base controller. It is necessary to remove the interface board from the base controller to read this label.

The Interface Board label is located on the back surface (solder side) of the interface board below the current shunts. It is necessary to remove the interface board from the base controller to read this label.

The label for a factory Base Controller/Interface Board Assembly is located on the front surface of the base controller J3 Sensor connector. It is visible without removing the interface board from the base controller.

Label Color

SR-2/A (000) and SR-2/B (0T2) Base Controllers, Interface Boards, and Assemblies with White Labels: SR-2/A (000) and SR-2/B (0T2) Base Controllers, Interface Boards, and Assemblies all have white labels and can be used on single temperature applications only.

SR-2/C (0T3) and SR-2/D (0T4) Base Controllers, Interface Boards, and Assemblies with White Labels: The labels on SR-2/C (0T3) and SR-2/D (0T4) Base Controllers, Interface Boards, and Assemblies that have been factory loaded with revision Bxxx Trailer Single-Temperature base controller software will have white labels on the base controller, interface board, and assembly. If required for use on a multi-temperature trailer application, an SR-2/C (0T3) or SR-2/D (0T4) Base Controller with Bxxx software can be flash loaded with revision Cxxx software.

SR-2/C (0T3) and SR-2/D (0T4) Base Controllers, Interface Boards, and Assemblies with Yellow Labels: The labels on SR-2/C (0T3) and SR-2/D (0T4) Base Controller/Interface Board assemblies that have been factory loaded with revision Cxxx Trailer Multi-Temperature base controller software will have yellow labels on the base controller, interface board, and assembly. If required for use on a single temperature trailer application, an SR-2/C (0T3) or SR-2/D (0T4) Base Controller with Cxxx software can be flash loaded with revision Bxxx software.

Note: The SR-2 Base Controller serial number is shown on a ServiceWatch Data Logger Tabular Report. Check the last three characters of the serial number for (000), (0T2), (0T3), or (0T4).

Hardware Requirements

SR-2 SPECTRUM SB Applications require SR-2/C (0T3) or SR-2/D (0T4) hardware.

SR-2 SPECTRUM SLX Applications require SR-2/D (0T4) hardware.

SR-2/C (0T3) Base Controller and Interface Board Details

SR-2/C (0T3) Base Controllers and Interface Boards were introduced for use with SR-2 Trailer multi-temperature applications. The SR-2/C (0T3) Base Controller supports the SR-2/C (0T3) Interface Board, Expansion Module, and other components necessary for SR-2 multi-temperature operation. SR-2/C (0T3) components also provide additional enhancements for SR-2 trailer single temperature applications such as ETV LEDs to indicate active ETV outputs. The SR-2/C (0T3) Interface Board has been enhanced and is not the same as the interface boards used on SR-2/A (000) and SR-2/B (0T2) applications.

- SR-2/C (0T3) Base Controllers and Interface Boards were used in production SR-2 SPECTRUM Trailer multi-temperature units from January of 2007 until approximately May 2009. SR-2/C (0T3) Base Controllers and Interface Boards were used with SR-2 trailer single temperature units starting in March of 2008 until approximately January 2009.
- SR-2/C (0T3) Base Controllers can use SR-2 C000 or later trailer multi-temperature software revisions.
- SR-2/C (0T3) Base Controllers can be used with trailer units equipped with Tier 2 engines.
- Some late production SR-2/C (0T3) Base Controllers used snap together assembly with the Interface Board. The snap together feature cannot be used to determine if the component is an SR-2/C (0T3) device.
- The SR-2/C (0T3) Interface Board is different than the SR-2/A Interface Board and SR-2/B Interface Boards.
- SR-2/C (0T3) Base Controllers and Interface Boards have serial numbers on the component label that end in (0T3).

SR-2/D (0T4) Base Controller and Interface Board Details

SR-2/D (0T4) Base Controllers and Interface Boards were introduced for use with both SR-2 Trailer Single Temperature and SPECTRUM Trailer Multi-Temperature applications. The SR-2/D (0T4) Base Controller provides additional enhancements for fuel level sensors and supports the latest damper gear motor specifications for SR-2 SPECTRUM SLX Multi-Temperature units. The SR-2/D (0T4) base controller also features snap together assembly with the Interface Board. The SR-2/D (0T4) Interface Board is identical to the SR-2/C (0T3) Interface Board.

- SR-2/D (0T4) Base Controllers and Interface Boards were used in production SR-2 SPECTRUM SB Trailer multi-temperature units starting May of 2009. SR-2 SPECTRUM SLX Trailer multi-temperature units will use SR-2/D (0T4) Base Controllers and Interface Boards as this hardware is required to support defrost damper gear motor enhancements. SR-2/D (0T4) Base Controllers and Interface Boards were used with SR-2 trailer single temperature units starting in January of 2009.
- SR-2/D (0T4) Base Controllers for trailer multi-temperature applications must use C010 or later software revisions.
- The SR-2/D (0T4) Interface Board is the same as the SR-2/C (0T3) Interface Board and is different than the SR-2/A Interface Board and SR-2/B Interface Boards.
- SR-2/D (0T4) Base Controllers and Interface Boards have serial numbers on the component label that end in (0T4).

SR-2 HMI Control Panel

Hardware Versions and Service Part Numbers

There are currently two versions of the SR-2 Trailer HMI Control Panel. These versions are defined as SR-2 HMI-1 Control Panels and SR-2 HMI-2 Control Panels.

For the latest information, refer to the applicable Part Catalog (New) available on iService.

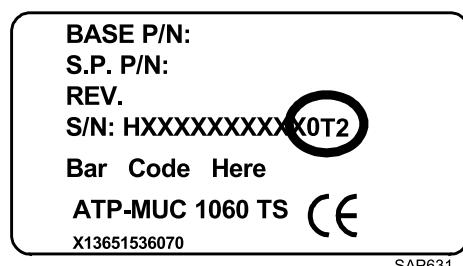
Identification

SR-2 HMI Control Panels can be identified by checking the labels on the device. The component serial number is shown on each label.

The first letter of the serial number defines the original component as an HMI Control Panel. The last three digits of the serial number will show if the component is a HMI-1 Control Panel or an HMI-2 Control Panel.

- HMI-1 Control Panel: Serial number ends in "000"
- HMI-2 Control Panel: Serial Number ends in "0T2"

A typical label is shown. The "H" indicates the device is an HMI Control Panel and the "0T2" indicates that it is an HMI-2 Control Panel.



Checking Serial Number using a CargoWatch Data Logger Download

The SR-2 HMI Control Panel serial number is shown on a CargoWatch Data Logger download. Check the last three characters of the serial number for "000" (HMI-1) or "0T2" (HMI-2).

Checking HMI Type using Software Revision

Check the software revision from the Software Revision feature in the Maintenance Menu. If a Supervisor Software revision is shown when scrolling through the software revisions, the device is an HMI-2 Control Panel. If no Supervisor Software revision is shown, the device is an HMI-1 Control Panel.

Hardware Requirements

All SR-2 Trailer multi-temperature applications require SR-2 HMI-2 (0T2) control panels.

SR-2 HMI-2 Control Panel Details

HMI-2 Control Panels were introduced for use with EPA Tier 2 engines. HMI-2 Control Panels feature a supervisor microprocessor that identifies and controls ON and OFF requests from other devices such as iBox and/or remote control panels. The HMI-2 Control Panel is capable of operating at lower battery voltages for short periods of time. This improves performance when the larger current requirements of EPA Tier 2 engine starter causes a voltage dip, particularly during engine starts in extremely low ambient temperatures or with a weak unit battery.

- HMI-2 Control Panels with Revision 6510 or later software must be used for multi-temperature applications.
- HMI-2 Control Panels feature a supervisor microprocessor that identifies and controls ON and OFF requests from other devices such as iBox and/or remote control panels. The Supervisor Software revision is determined by the HMI Control Panel software and cannot be changed independently. The current Supervisor Software revision is 120.
- HMI-2 Control Panels will show the Supervisor Software revision in the Software Revision display from the Maintenance Menu. HMI-1 Control Panels do not have a supervisor microprocessor and will not display a Supervisor Software Revision. Checking the Software Revisions from the Maintenance Menu can be used to determine if the HMI Control Panel is an HMI-1 (no Supervisor Software revision) or an HMI-2 (the Supervisor Software revision will appear).
- HMI-2 Control Panels have serial numbers on the component label that end in "0T2".

SR-3 Base Controller

Hardware Versions and Service Part Numbers

For the latest information, refer to the applicable Part Catalog (New) available on iService.

Label Identification

The label is located on the edge of the Base Controller Mounting Base. The label shows board Engineering Part Number, Service Part Number, and installed Software Revision. The Base Controller Serial Number for SR-3 applications ends in "3T1" as shown in the example below.



Software Requirements

Multi-temperature applications with SR-2 Base Controllers must use SR-3 Base Controller Software Revision Cxxx.

Multi-temperature applications with SR-3 Base Controllers must use SR-3 Base Controller Software Revision Fxxx.

Compatibility

The SR-3 Base Controller is 100% compatible with and may be used to replace the combined SR-2 Base Controller/Interface Board assembly. The SR-3 Base Controller mounting base uses the same mounting hole pattern as did the SR-2 Base Controller/Interface Board. The connectors on the SR-3 Base Controller are located in approximately the same positions as they are on an SR-2 Base Controller/Interface Board. However, when replacing an SR-2 Base Controller/Interface Board with an SR-3 Base Controller, the wiring harness may need to be relocated slightly to reach the some of the connectors.

For the latest information, refer to the Software Compatibility Matrix available on iService:

- For North America: TSA Info Central (Software & Downloads > Truck and Trailer > Microprocessors > Software Compatibility Matrix)

- For EMEA: EMEA Info Central (Software Updates > Microprocessors > Compatibility Matrix)

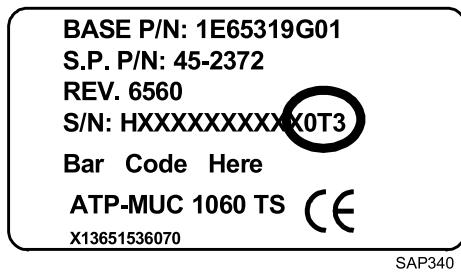
SR-3 HMI Control Panel

Hardware Versions and Service Part Numbers

For the latest information, refer to the applicable Part Catalog (New) available on iService.

Label Identification

The label is located on the back of the HMI Control Panel. The label shows Engineering Part Number, Service Part Number, and installed Software Revision. The HMI Control Panel Serial Number for SR-3 applications ends in "OT3" as shown in the example below.



Software Requirements

SR-3 HMI Control Panels used on SR-3 applications without USB capability must use HMI Control Panel Software Revision 6550 or later.

SR-3 HMI Control Panels used on SR-3 applications with USB capability must use HMI Control Panel Software Revision 6560 or later.

Compatibility

The SR-3 Control System uses essentially the same HMI Control Panel as does the SR-2 Control System. However, SR-3 HMI Control Panels feature 8 MB of memory and are marked Smart Reefer 3 on the lower front panel. The SR-2 HMI Control Panels feature 4 MB of memory. Other than memory, the SR-3 HMI Control Panel is compatible with and may be used to replace the SR-2 HMI Control Panel.

To properly identify if an HMI is 4 MB or 8 MB, check the label identification. If S/N ends in OT1 or OT2, the HMI is 4 MB. If S/N ends in OT3 or OT4, the HMI is 8 MB.

For the latest information, refer to the Software Compatibility Matrix available on iService:

- For North America: TSA Info Central (Software & Downloads > Truck and Trailer > Microprocessors > Software Compatibility Matrix)
- For EMEA: EMEA Info Central (Software Updates > Microprocessors > Compatibility Matrix)

Multi-Temperature Expansion Module

The Expansion Module (EM) is a hardware module that allows for operation of up to three temperature controlled zones. The module provides the interface between the Base Controller and the multi-temperature zone components such as sensors, solenoids, valves, and fan motors. It also provides over-current and short circuit protection for the associated circuits. The EM features 100% solid state outputs. All outputs are Smart FET outputs.

- The same Expansion Module is used on both SR-2 and SR-3 applications.
- Expansion Modules are used on multi-temperature applications only.
- The Expansion Module software is determined by the Base Controller multi-temperature software and cannot be changed independently. Expansion Module software is automatically updated when the Base Controller and Expansion Module establish communications.

For the latest information, refer to the applicable Part Catalog (New) available on iService.

SR-2/SR-3 Diagnostic Tool

An SR-2/SR-3 Diagnostic Tool with Diagnostic Tool Software 4.1 or greater is required to test the SR-3 Base Controller. It is available as a complete tool and also as an update kit for the SR-2 Blue Diagnostic Tool.

Features:

The SR-2/SR-3 Diagnostic Tool includes the following new features:

- Tests the SR-3 Base Controller.
- Tests the SR-3 USB Communications Port.
- Tests the SR-3 Base Controller and HMI Control Panel CAN Ports using a USB to CAN Adaptor.

Complete SR-2/SR-3 Diagnostic Tool:

The complete SR-2/SR-3 Diagnostic Tool is available as Service Part Number 204-1930. It includes the following:

- The Blue Diagnostic Tool. This component is the same as the Blue Diagnostic Tool supplied with earlier versions of the Diagnostic Tool.
- All cables supplied with previous Blue Diagnostic Tool.
- A USB Cable to connect the USB Port on the SR-3 Base Controller to a USB Flash Drive.
- A USB to CAN Adaptor. This adaptor is required to perform the CAN Test that is part of the new Diagnostic Tool.
- A CAN Test Cable to connect the USB to CAN Adaptor to the Diagnostic Tool J1 Connector.
- SR-2/SR-3 Diagnostic Tool Software Revision 4.x.
- Instructions and Storage Box.

SR-2/SR-3 Diagnostic Tool Upgrade Kit:

The SR-2/SR-3 Diagnostic Tool Upgrade Kit is available as Service Part Number 204-1931. It utilizes the current Blue SR-2 Diagnostic Tool hardware (Part Number 204-1196) and cables with no changes and includes the following:

- A USB Cable to connect the USB Port on the SR-3 Base Controller to a USB Flash Drive.
- A USB to CAN Adaptor. This adaptor is required to perform the CAN Test that is part of the new Diagnostic Tool.
- A CAN Test Cable to connect the USB to CAN Adaptor to the Diagnostic Tool J1 Connector.
- SR-2/SR-3 Diagnostic Tool Software Revision 4.x.
- Instructions.

SR-2/SR-3 Diagnostic Tool Software:

The diagnostic tool software is available through iService on the Thermo King TSA or EMEA Info Central website. Go to <http://www.thermoking.com/tk/index.asp>.

For North America: choose TSA Info Central and select Home > Software and Downloads > Truck and Trailer > PC Software > SR-2 and SR-3 Diagnostic Tool. For EMEA: choose EMEA Info Central and select Home > Software Updates > Tester Software > SR-2 and SR-3 Diagnostic Tool. It will take a few moments to load. Save and unzip the file to the desired directory on your computer. It will take a few moments to unzip and there will be several files as a result. If necessary, double click Setup.exe to install the software.

SR-2/SR-3 Power On/Off Control

There are two power on/power off control methods used with SR-2 based control systems. The method used is determined by the SR-2 HMI Control Panel. Power On functions operate the same on both SR-2 HMI-1 and SR-2 HMI-2 Control Panels. Power Off functions are different between SR-2 HMI-1 and SR-2 HMI-2 Control Panels. Also, more Power On/Power Off information is logged by the CargoWatch Data Logger with SR-2 HMI-2 Control Panels.

Important: SR-2 and SR-3 SPECTRUM Trailer multi-temperature applications use only SR-2 HMI-2 Control Panels.

HMI-2 Control Panel

HMI-2 Control Panels with software revision 6504 or later control power on and power off operations by the use of a Supervisor Microprocessor located in the HMI-2 Control Panel. Additionally, the HMI-2 Control Panel and the Supervisor Microprocessor will continue to operate with system voltages lower than those required by the HMI-1 Control Panel.

- Power on requests are initiated by turning on the HMI Control Panel. This in turn supplies a path to chassis ground to energize the On/Off Relay K9. The unit will turn on. This operates the same on both HMI-1 and HMI-2 Control Panels.
- With HMI-2 Control Panels, power off requests are controlled by removing the path to chassis ground to de-energize Relay K9.
- The CargoWatch Data Logger will document power on/off events and what device turned the power on/off (HMI Control Panel, SCOM, or an external device such as iBox).
- The circuit from the HMI-2 Control Panel Pin 34 to J14 pin 4 is labeled the ON - RED2 circuit. This circuit on the HMI-1 Control Panel is called the ON/OFF - RED2 circuit.
- The HMI-2 has an OFF circuit connected to Pin 33. This circuit turns the unit off whenever it is grounded by an external device, such as a Remote Control Panel or an iBox. This circuit is the OFF or OFF - YEL wire in the remote control harness that is routed from the control box to the evaporator.

Important: The HMI will not stay powered up if the OFF or OFF - YEL circuit is accidentally grounded.

Note: The HMI-2 will work on early SR-2 units that do not have this Off circuit, however the Off circuit feature is not functional for external devices.

HMI Control Panel - Unit Not Turned On

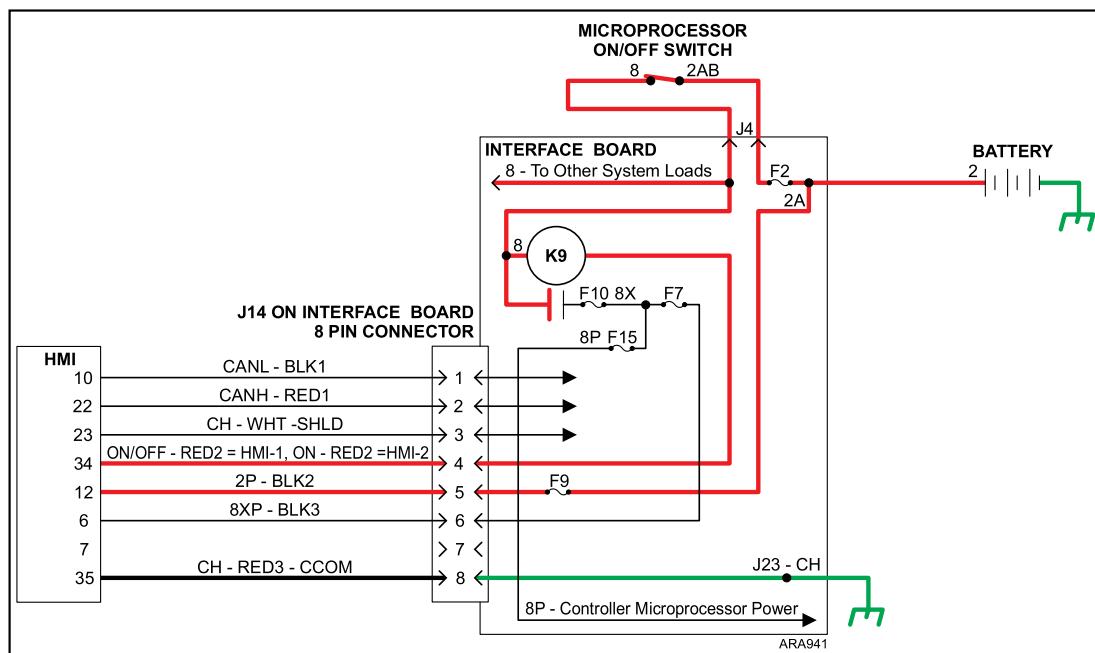
The diagram below shows the power conditions present before the unit has been turned on. The battery voltage is present at HMI Control Panel Pin 34 through the coil of the On/Off Relay K9 and the ON/OFF circuit.

Note: *HMI Control Panel Pin 12 will have power from the battery even if the Microprocessor On/Off Switch is turned off (open).*

Table 15. Schematic Diagram Text Color Definitions

| |
|--|
| CH chassis ground circuits are shown in green on the diagrams. |
| Power circuits are shown in red on the diagrams. |
| Other text colors are defined in the descriptions. |
| The Microprocessor On/Off Switch is turned on (closed). |

Figure 188. Unit is Turned Off - Microprocessor Power Switch On



HMI Control Panel - Turning The Unit On

The diagram (Figure 189, p. 384) shows the power conditions when the unit has been turned on by pressing the On Key.

1. Pressing the On Key of the HMI Control Panel turns the HMI microprocessor on. The HMI Control Panel microprocessor then supplies chassis ground to the ON/OFF circuit at HMI Control Panel Pin 34 by connecting it internally to HMI Control Panel Pin 35.
2. This energizes the On/Off Relay K9, which closes the normally open K9 contacts to supply power to the 8X, 8P, and 8XP - BLK3 circuits. The K9 LED 23 will illuminate to indicate the On/Off Relay K9 is energized. The 8P circuit signals the Base Controller to turn on. The Base Controller Heart Beat LED 21 will begin to flash, indicating that the Base Controller is powered up. The 8XP - BLK3 wire supplies feedback to Pin 6 of the HMI Control Panel that the Base Controller is powered up.
3. The unit will start and run as determined by the Base Controller programmable feature settings.

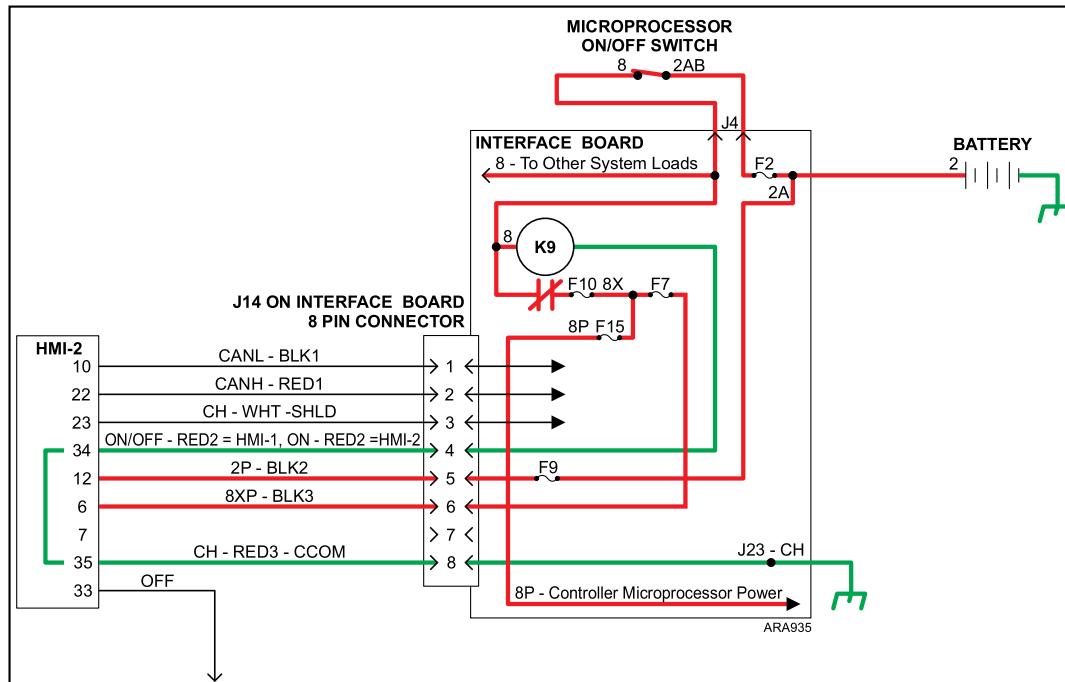
Notes:

1. *Battery power is present at HMI Control Panel Pin 12 even if the Microprocessor On/Off Switch is turned off (open).*
2. *The HMI Control Panel communicates with the Base Controller through the CAN (Controller Area Network) bus connections CANL - BLK1 and CANH - RED1. CAN is a standard serial communications protocol that allows communication between two or more devices. The circuit that connects devices is called the CAN Bus.*
3. *The HMI Control Panel monitors power on the 8X circuit through the 8XP - BLK3 circuit.*

Table 16. Schematic Diagram Text Color Definitions

| |
|--|
| CH chassis ground circuits are shown in green on the diagrams. |
| Power circuits are shown in red on the diagrams. |
| Other text colors are defined in the descriptions. |
| The Microprocessor On/Off Switch is turned on (closed). |

Figure 189. Turning the Unit On with HMI Control Panel



HMI Control Panel - Turning The Unit On From A Remote Control Panel

The diagram (Figure 190, p. 385) shows the power conditions present when the unit has been turned on by pressing the Remote Control Panel On Key on a unit equipped with an HMI Control Panel.

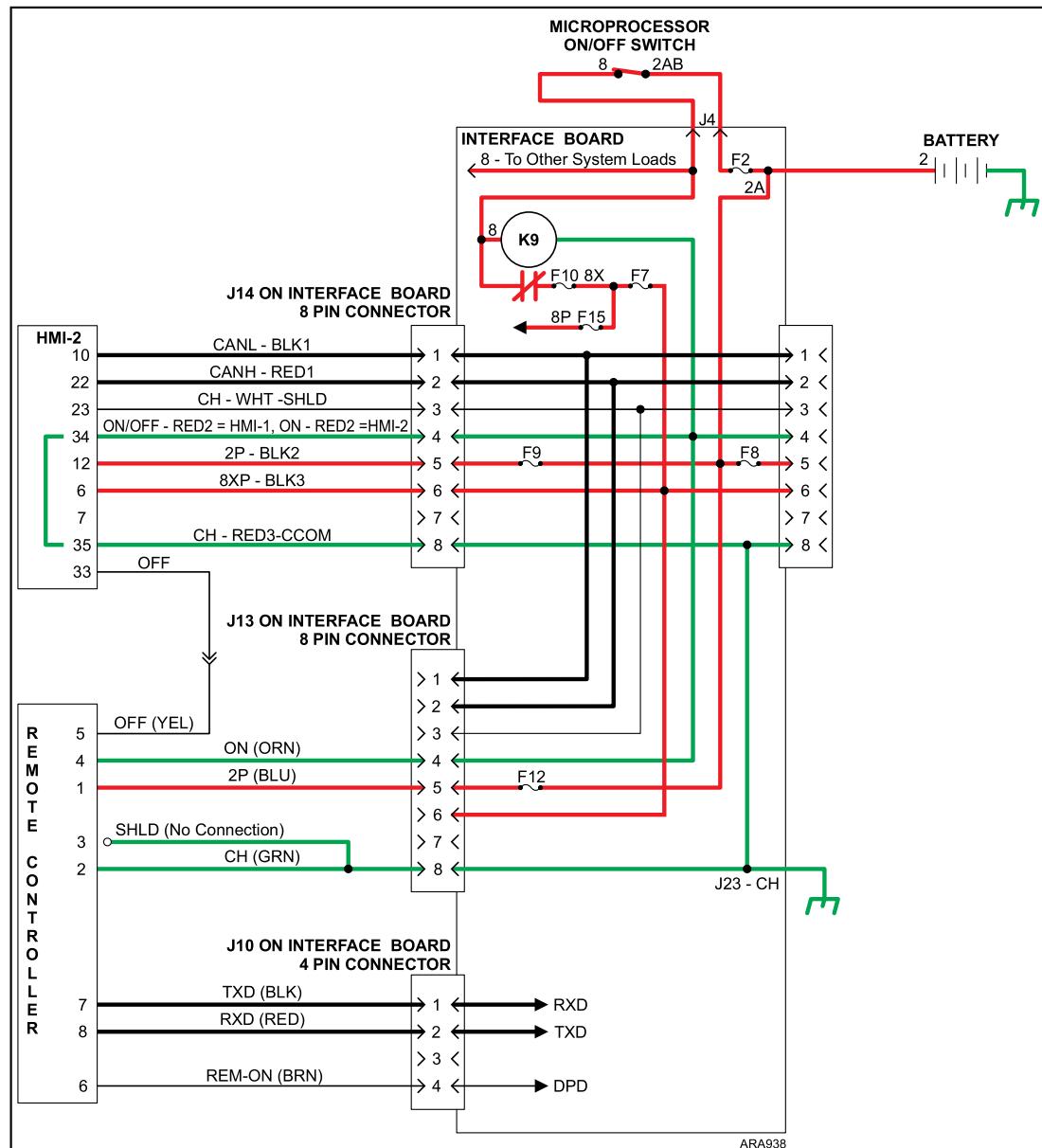
1. Pressing the Remote Control Panel On Key initiates turning the unit on by supplying chassis ground to the ON (ORN) circuit at the Remote Control Panel Pin 4 for five seconds. This turns the HMI Control Panel on and energizes the On/Off Relay K9. During this five second interval, the communications in steps 2 through 7 occur. After five seconds, the Remote Control Panel removes the ground from the ON (ORN) circuit but the On/Off Relay K9 is now provided a ground by the HMI Control Panel (step 7) and will remain on.
2. The HMI Control Panel powers up and displays the "REMOTE START-PLEASE WAIT" screen.
3. The HMI Control Panel sends a query via the CAN Bus to the Base Controller asking if the Remote Control Panel is attempting to turn the unit on.
4. The Base Controller sends a query via the RS-232 serial port (RXD and TXD circuits) to the Remote Control Panel asking if the Remote Control Panel is attempting to turn the unit on.
5. The Remote Control Panel will reply via the RS-232 serial port (RXD and TXD circuits) to the Base Controller that it is attempting to turn the unit on.
6. The Base Controller replies to the HMI Control Panel via the CAN Bus that the Remote Control Panel is attempting to turn the unit on.
7. The HMI Control Panel microprocessor supplies chassis ground to the ON/OFF circuit at HMI Control Panel Pin 34 by connecting it internally to HMI Control Panel Pin 35.
8. This energizes the On/Off Relay K9, which closes the normally open K9 contacts to supply power to the 8X, 8P, and 8XP - BLK3 circuits. The K9 LED 23 will illuminate to indicate the On/Off Relay K9 is energized. The 8P circuit signals the Base Controller to turn on. The Base Controller Heart Beat LED 21 will begin to flash, indicating that the Base Controller is powered up. The 8XP - BLK3 wire supplies feedback to Pin 6 of the HMI Control Panel that the Base Controller is powered up.

9. The unit will start and run as determined by the Base Controller and the Remote Control Panel programmable feature settings.

Table 17. Schematic Diagram Text Color Definitions

| |
|--|
| CH chassis ground circuits are shown in green on the diagrams. |
| Power circuits are shown in red on the diagrams. |
| Other text colors are defined in the descriptions. |
| The Microprocessor On/Off Switch is turned on (closed). |

Figure 190. Turning Unit On with HMI Control Panel and Remote Control Panel



Note: This simplified diagram does not show the remote controller harness connector located in the evaporator.

HMI Control Panel - Turning The Unit Off From A Remote Control Panel

The diagram (Figure 191, p. 387) shows the power conditions present when the unit has been turned off by pressing the Remote Control Panel Off Key on a unit equipped with an HMI Control Panel.

1. Pressing the Remote Control Panel Off Key momentarily supplies a chassis ground to the OFF circuit at the Remote Control Panel Pin 5 as shown by the green dashed lines. This causes the HMI Control Panel to begin to power down.
2. The HMI Control Panel powers down. This turns the unit off by removing the ground from the ON/OFF circuit at HMI Control Panel Pin 34 to de-energize the On/Off Relay K9 relay as shown by bold blue dashed lines.
3. When the On/Off Relay is de-energized, power is removed from the 8X, 8P, and 8XP - BLK3 circuits as shown in thin black on the diagram. When power is removed from the 8P circuit, this signals the Base Controller to turn off. The Base Controller Heart Beat LED 21 will stop flashing, indicating that the Base Controller is powered down.

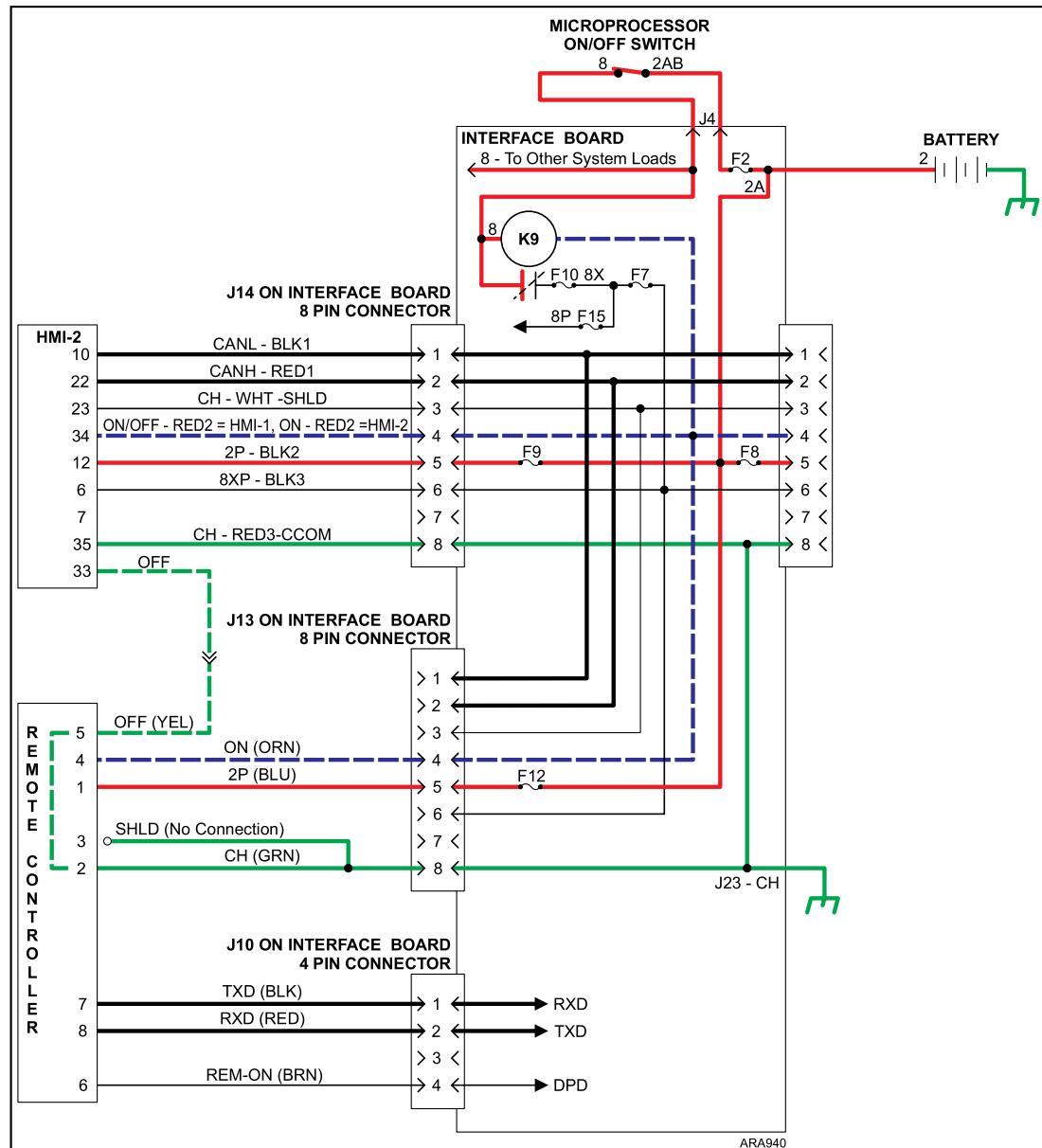
Notes:

1. If the OFF (YEL) circuit from the Remote Controller to the HMI Control Panel is not connected, the HMI Control Panel will power down by sending messages via the communication ports.
2. On SR-3 applications, the OFF Line is connected to CAN Connectors J12, J13, and J14 at Pin 7. The OFF Line is also connected to CAN Connector J98 Pin 10.

Table 18. Schematic Diagram Text Color Definitions

| |
|--|
| CH chassis ground circuits are shown in green on the diagrams. |
| Power circuits are shown in red on the diagrams. |
| Other text colors are defined in the descriptions. |
| The Microprocessor On/Off Switch is turned on (closed). |

Figure 191. Turning Unit Off with HMI Control Panel and Remote Control Panel



Remote Controller Harness

The remote controller harness is typically connected to J13 on the Interface Board and routed from the control box to the evaporator.

Note: A short circuit in either of the CAN wires in earlier remote controller harnesses will effectively shut CAN communications down. If this occurs, the HMI Control Panel will display "COMMUNICATIONS FAILURE – LOST CONTROLLER CONNECT".

Table 19. Remote Controller Connector

| Pin # | Wire # | Description |
|-------|------------------|--|
| 1 | 2P (BLU) | Battery power output fused by F12. |
| 2 | CH (GRN) | Chassis ground. |
| 3 | SHLD | This circuit shields the electrical system from electrical noise or interference by transferring it to a chassis ground. Note: There is no connection at the remote controller. |
| 4 | ON (ORN) | On Line output is grounded for five seconds when the On Key on the Remote Controller is pressed. This causes the HMI Control Panel to power up and check with the other components to verify that the SR-2 Base Controller should be powered up. |
| 5 | OFF (YEL) | Off Line output is used with the HMI-2, but not with the HMI-1. When the Off Key on the Remote Controller is pressed, this output is grounded, which deenergizes the K9 On/Off Relay. This powers down the HMI-2 Control Panel. |
| 6 | REM-ON (BRN) DPD | Remote On output is energized when the Remote Controller is on and powered up. Used by the SR-2 Controller to verify the Remote Controller status. |
| 7 | TXD (BLK) | Serial port connection used for communication with SR-2 Controller. |
| 8 | RXD (RED) | Serial port connection used for communication with SR-2 Controller. |

HMI Control Panel Messages/Causes

The following error messages will appear on the HMI Control Panel display if the stated conditions occur.

[SYSTEM IS POWERING DOWN]

Note: HMI-2 Control Panel.

If the HMI-2 Control Panel ON key is pressed and the TK Logo display is shown and then [SYSTEM IS POWERING DOWN] appears, the OFF Line between a remote control panel and the HMI-2 Control Panel is likely shorted to ground. The HMI-2 Control Panel will not remain powered up if the OFF Line is shorted to ground. The OFF Line (OFF – YEL wire) circuit is located in the remote control harness that is routed from the control box to the evaporator.

Note: In some cases, if the OFF Line (OFF – YEL wire) is shorted to ground, the HMI-2 Control Panel may not power up at all.

[SOFTWARE MISMATCH -- FLASHLOAD REQUIRED]

Note: HMI-1 or HMI-2 Control Panel.

This message indicates one of the following conditions has been detected:

- The HMI Control Panel is detecting a single temperature software revision (B0xx) in the SR-2 Base Controller and is also detecting the presence of a multi-temperature Expansion Module. This would occur if an SR-2 multi-temperature unit had single temperature (B0xx) software installed in the Base Controller. Multi-temperature Base Controller software revision (C0xx) must be flash loaded to the Base Controller.
- The HMI Control Panel is detecting a multi-temperature software revision (C0xx) in the SR-2 Base Controller and is not detecting the presence of a multi-temperature Expansion Module. This would occur if an SR-2 single temperature unit had multi-temperature (C0xx) software installed in the Base Controller. Single temperature Base Controller software revision (B0xx) must be flash loaded to the Base Controller.

[COMMUNICATIONS FAILURE -- LOST CONTROLLER CONNECT]

Note: HMI-1 or HMI-2 Control Panel.

This message indicates that the HMI Control Panel has not received any messages from the Base Controller for 20 seconds. The HMI Control Panel will stay powered up and try to re-establish communications with the Base Controller via the CAN Bus. This message can result from one of the following conditions:

- If there are open or shorted circuits on the CANL or CANH wires between the HMI Control Panel and the Base Controller CAN Bus circuits.
- If the CAN communications fail between the HMI Control Panel and Base Controller or if CAN communications are not operational.
- If the HMI Control Panel or Base Controller is defective.

[LOST CONTROLLER POWER]

Note: HMI-1 or HMI-2 Control Panel.

This message indicates that the HMI Control Panel has detected a loss of power on the 8XP circuit and that the Base Controller did not respond to messages from the HMI Control Panel for at least three seconds. If this occurs, the HMI Control Panel will display LOST CONTROLLER POWER -- POWERING DOWN and shut down. This message can result from one of the following conditions:

- If there are open circuits or bad connections on the 8XP and CAN Bus circuits between the HMI Control Panel and the Base Controller.
- If Fuse F10 is blown or if the K9 On/Off Relay on the Interface Board is defective.
- If the Base Controller is defective.

[CHECK 8X WIRING]

Note: HMI-1 or HMI-2 Control Panel with software revision 6510 or later.

If this message appears, it indicates that the HMI Control Panel has detected a loss of power on the 8XP circuit but CAN communications between the HMI Control Panel and the Base Controller still exist. This message can result if 8XP power is lost as a result of one of the following conditions:

- Loss of 8XP power could be caused by an open 8XP circuit or a bad connection between the HMI Control Panel and the Base Controller.
- Loss of 8XP power will occur if Fuse F7 on the Interface Board is blown.

Base Controller Software Revisions

The Base Controller software family for SR-2 multi-temperature applications is C0xx. The current multi-temperature SR-2 Base Controller software is available on Info Central. For North America: TSA Info Central Home > Software & Downloads > Truck and Trailer > Microprocessors > Trailer Microprocessor Updates. For ESA/EMEA: EMEA Info Central Home > Software Updates > Microprocessors > SR2 > Multi-Temp.

- Base Controller Software Revision C010 or later is required for units equipped with SR-2/D (0T4) Base Controllers. This includes all SPECTRUM SLX units.
- If the Language Mix and Match Feature (HMI Control Panel Software Revision 6830 or later) is to be used, then Base Controller Software Revision C010 or later is required.

Important: When necessary to flash load new software to a Base Controller, use the most recent revision available.

Important: Unless otherwise noted, software upgrades made to units with previous software revisions are not covered by a warranty labor allowance. The upgrades are made at the discretion of dealers and with the agreement of the unit owner or operator.

Table 20. Software Revision C000

| Dates | Features | Interchange With: |
|-----------------------------------|--|-------------------|
| Original Production to April 2009 | <ul style="list-style-type: none"> • Production release | Upgrade to C010 |

Table 21. Software Revision C001

| Dates | Features | Interchange With: |
|-------|---|-------------------|
| | <ul style="list-style-type: none"> • Field release only • Datapac modifications to add remote On/Off capability • Customer specific enhancements | |

Table 22. Software Revision C002

| Dates | Features | Interchange With: |
|-------|--|-------------------|
| | <ul style="list-style-type: none"> • Field release only • Defrost enhancements • Customer specific enhancements | |

Table 23. Software Revision C010

| Dates | Features | Interchange With: |
|---------------------------|--|--|
| Released 2nd Quarter 2009 | <ul style="list-style-type: none"> • Required for SR-2/D (0T4) Base Controller support • Enhanced defrost damper gear motor support for SPECTRUM SLX applications • Alarm Code 37 Check Engine Coolant Level must be cleared manually • Improved S-3 Remote Evaporator Fan Speed Control in Frozen Range • S-3 Remote Evaporator Variable Differential Defrost • Refer to Service Bulletin TT507 for details | All previous Required for SPECTRUM SLX applications |

Table 24. Software Revision C011

| Dates | Features | Interchange With: |
|---------------------------|--|--|
| Released 1st Quarter 2010 | <ul style="list-style-type: none"> • Released only for use with SPECTRUM SB Model 50 units with 24 HP motors • Will not be a factory or field release • Refer to Service Bulletin TT516 for details | Only for use with SPECTRUM SB Model 50 units with 24 HP motors |

Table 25. Software Revision C020

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 2nd Quarter 2010 | <ul style="list-style-type: none"> • Released only for use with SPECTRUM SB Model 50 units with 24 HP motors • Rear Remote Control power-up enhancements • Requires HMI Control Panel software revision 6540 or later • Refer to Service Bulletin TT527 for details | All previous |

Table 26. Software Revision C040

| Dates | Features | Interchange With: |
|---------------------------|--|-------------------|
| Released 2nd Quarter 2012 | <ul style="list-style-type: none"> • Enhanced Alarm Code 21 Cooling Cycle Check • Door Open forces High Speed Lockout • Configurable Alarm Code 108 Door Switch Timeout • Expansion Module enhancements • ETV support for SLX applications • Requires HMI Control Panel 6513 or later • Refer to Service Bulletin TT594 for details | All previous |

Table 27. Software Revision C050

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 4th Quarter 2012 | <ul style="list-style-type: none"> • ETV default setting changed to NO • Alarm Code 37 Check Engine Coolant Level must be cleared manually • Requires HMI Control Panel 6514 or later • Refer to Service Bulletin TT629 for details | All previous |

Table 28. Software Revision C051

| Dates | Features | Interchange With: |
|---------------------------|--|-------------------|
| Released 1st Quarter 2013 | <ul style="list-style-type: none"> • Field release • ETV default setting changed to NO • Alarm Code 37 Check Engine Coolant Level must be cleared manually • Requires HMI Control Panel 6514 or later • Refer to Service Bulletin TT646 for details | All previous |

Table 29. Software Revision C052

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 1st Quarter 2015 | <ul style="list-style-type: none"> • Field release • Unit will now stay in Continuous Run when auto-switching from Diesel to Electric • Unit will now hold the setpoint of the host (Zone 1) when switched to single zone control • High Ambient Discharge Pressure Control (HADPC) is configurable in programmable features for SLX/ SLXe units • Refer to Service Bulletin TT739 or SB1023 for details | All previous |

The Base Controller software family for SR-3 multi-temperature applications is F0xx/FAx. The current multi-temperature SR-3 Base Controller software is available on Info Central. For North America: TSA Info Central Home > Software & Downloads > Truck and Trailer > Microprocessors > Trailer Microprocessor Updates. For ESA/EMEA: EMEA Info Central Home > Software Updates > Microprocessors > SR3 > Multi-Temp.

Important: When necessary to flash load new software to a Base Controller, use the most recent revision available.

Important: Unless otherwise noted, software upgrades made to units with previous software revisions are not covered by a warranty labor allowance. The upgrades are made at the discretion of dealers and with the agreement of the unit owner or operator.

Table 30. Software Revision F000

| Dates | Features | Interchange With: |
|---|--|-------------------|
| Original Production to 2nd Quarter 2013 | <ul style="list-style-type: none"> • Production release • Same feature set as SR-2 Base Controller C050 • Refer to Service Bulletin TT636 for details | |

Table 31. Software Revision F005

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 2nd Quarter 2013 | <ul style="list-style-type: none"> • Field release • Forces low speed operation with low suction pressure • Refer to Service Bulletin TT653 or SB950 for details | All previous |

Table 32. Software Revision F010

| Dates | Features | Interchange With: |
|---------------------------|--|-------------------|
| Released 4th Quarter 2013 | <ul style="list-style-type: none"> • High Speed Lockout supported via telematics • Cycle Sentry/Continuous Mode setting will remain the same when unit is switched between Diesel and Electric • Refer to Service Bulletin TT684 or SB977 for details | All previous |

Table 33. Software Revision F012

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 1st Quarter 2014 | <ul style="list-style-type: none"> • Resolves nuisance Alarm Code 45 alarm codes • Refer to Service Bulletin TT700-1 or SB990 for details | All previous |

Table 34. Software Revision F020

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 2nd Quarter 2015 | <ul style="list-style-type: none"> • New Keypad Lock PIN added to Main Menu Configuration Menu • New Easy Cargo Sensor Access added to Main Menu Configuration Menu • Single zone control holds host setpoint • Engine start events logged • Associate sensors to zones • CargoLink support • OptiSet door operation • Host Null feature updated • Miscellaneous enhancements • Refer to Service Bulletin TT743-2 or SB1035 for details | All previous |

Table 35. Software Revision F030

| Dates | Features | Interchange With: |
|---------------------------|--|-------------------|
| Released 2nd Quarter 2016 | <ul style="list-style-type: none"> • Software solution to ETV not opening fully during EVAC mode • Software solution to Low Fuel Shutdown alarm (Alarm Code 44) not triggering to prevent unit running out of fuel • Software solution to nuisance Alarm Code 29 occurring regularly on start-up due to a timing issue • Software solution to nuisance Alarm Codes 105 and 106 as soon as one zone is entering heat mode and the other zone is in cool mode • Refer to Service Bulletin SB632 or SB1083 for details | All previous |

Table 36. Software Revision F031

| Dates | Features | Interchange With: |
|---------------------------|--|-------------------|
| Released 3rd Quarter 2016 | <ul style="list-style-type: none">• Alarm Code 45 enhancements• To eliminate any risk of nuisance alarms, F030 is no longer available to download from Info Central and we recommend that any F030 version be deleted• Refer to Service Bulletin SB632-1 or SB1103 for details | All previous |

Table 37. Software Revision FA00

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 1st Quarter 2017 | <ul style="list-style-type: none">• Supports SLXi unit models• Software split between SB and SLX units• Added Telematics Status in Maintenance Menu• Additions to Cycle Sentry Setup• Added Null Restart Temperature fresh and frozen features• Refer to Service Bulletin SB1114 for details | All previous |

HMI Control Panel Software Revisions

The HMI Control Panel software family for single temperature and multi-temperature applications is 65xx/75xx/7Bxx, 66xx/76xx/7Cxx, 67xx/77xx/7Dxx, and 68xx/7Exx. The four versions of software are identical other than the languages supported. The current SR-3 HMI Control Panel software is available on Info Central. For North America: TSA Info Central Home > Software & Downloads > Truck and Trailer > Microprocessors > Trailer Microprocessor Updates. For ESA/EMEA: EMEA Info Central Home > Software Updates > Microprocessors > HMI .

Important: When necessary to flash load new software to an HMI Control Panel, use the most recent revision available.

Important: Unless otherwise noted, software upgrades made to units with previous software revisions are not covered by a warranty labor allowance. The upgrades are made at the discretion of dealers and with the agreement of the unit owner or operator.

Table 38. HMI Control Panel Software Requirements

| SR-2 Base Controller Software and Other Requirements | HMI Control Panel Software |
|--|----------------------------|
| C010 with OptiSet | 6510 or later |
| C011 with OptiSet | 6510 or later |
| C040 with OptiSet | 6513 or later |
| C050 with OptiSet | 6513 or later |
| C051 with OptiSet | 6514 or later |
| C051 without OptiSet | 6530 or later |
| C051 with Language Mix and Match feature OptiSet | 6830 or later |
| C052 without OptiSet | 75C0 (8 MB only) |

Table 39. HMI Control Panel Software Requirements

| SR-3 Base Controller Software and Other Requirements | HMI Control Panel Software |
|--|----------------------------|
| F000 with OptiSet | 6514 or later |
| F000 without OptiSet | 7595 or later |
| F005 with OptiSet | 6514 or later |
| F005 without OptiSet | 7595 or later |
| F010 with OptiSet | 6516 or later |
| F010 without OptiSet | 75B0 or later |
| F012 with OptiSet (Base Controller F012 software can utilize HMI Control Panel software 6514 or later) | 6514 or later |
| F012 without OptiSet | 75B0 or later |
| F020 with OptiSet | 6518 |
| F020 without OptiSet | 75C0 or later (8 MB only) |
| F031 without OptiSet | 75C2 or later (8 MB only) |
| FA00 without OptiSet | 7B00 or later (8 MB only) |

Table 40. Software Revision 6510-6610-6710

| Dates | Features | Interchange With: |
|----------------------------|---|-------------------|
| January 2007 to April 2007 | <ul style="list-style-type: none"> • Support for trailer multi-temperature units. SR-2 multi-temperature trailer applications must use 6510 or later software • Refer to Service Bulletin TT426 for details | |

Table 41. Software Revision 6511-6611-6711

| Dates | Features | Interchange With: |
|---------------------------|--|-------------------|
| April 2007 to August 2007 | <ul style="list-style-type: none"> • Addressed multi-temperature issues • Corrected printer issues where the CargoWatch printer would print random characters • Refer to Service Bulletin TT439 for details | All previous |

Table 42. Software Revision 6512-6612-6712

| Dates | Features | Interchange With: |
|---|--|-------------------|
| August 2007 to September 2008 and October 2009 to Present Important: SR-2 Trailer Multi-Temp units were switched back to Software Revision 6512 effective October 2009. | <p>Important: The OptiSet features were removed from the Guarded Access Menu effective with HMI Control Panel Software Revision 6520 in September 2008. Software Revision 6512 must be used if OptiSet is to be available.</p> <ul style="list-style-type: none"> • Includes OptiSet Features in Guarded Access Menu • Added Third Party Device Control menu • Added Countdown Mode and Conservative Mode features to the CargoWatch Data Logger • Enhanced CargoWatch operation and printing to comply with European standards • Improved Alarm Code 61 operation if the alarm occurred during Evacuation Mode operation • Refer to Service Bulletin TT450 for details | All previous |

Table 43. Software Revision 6514/7595

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 1st Quarter 2013 | <ul style="list-style-type: none"> • Refer to Service Bulletin TT636 for details | 6516/75B0 |



Section 7 - Service Information

Table 44. Software Revision 6516/75B0

| Dates | Features | Interchange With: |
|---------------------------|---|-------------------|
| Released 4th Quarter 2013 | <ul style="list-style-type: none"> Support for High Speed Lockout Cycle Sentry/Continuous Mode saved Refer to Service Bulletin TT684 for details | |

Table 45. Software Revision 6518

| Dates | Features | Interchange With: |
|---------------------------|--|-------------------|
| Released 2nd Quarter 2015 | <ul style="list-style-type: none"> Host Null available Keypad Lock PIN enhancement New feature Easy Cargo Sensor Access Refer to Service Bulletin SB1033 for details | All previous |

Table 46. Software Revision 6520-6620-6720

| Dates | Features | Interchange With: |
|--|--|--|
| September 2008 to October 2009 Important: SR-2 Trailer Multi-Temp units were switched back to Software Revision 6512 effective October 2009. | <p>Important: The OptiSet features were removed from the Guarded Access Menu effective with HMI Control Panel Software Revision 6520 in September 2008. Software Revision 6512 must be used if OptiSet is to be available.</p> <ul style="list-style-type: none"> The OptiSet Menu is not present if the unit is configured as a multi-temp unit. OptiSet cannot be used on multi-temp trailer applications with this software. If OptiSet is to be used, HMI Control Panel Software Revision 6212 is recommended Unit Setup Files and CargoWatch Setup Files can be created and sent to both single temperature and multi-temperature units using OptiSet Plus Software and WinTrac If Engine Run Time Reminder #1 Hours exceeds the programmed limit, the HMI Control Panel display will show [SERVICE DUE] Refer to Service Bulletin TT484 for details | All previous Multi-temperature applications using OptiSet require HMI Control Panel Software Revision 6512 |

Table 47. Software Revision 75C0

| Dates | Features | Interchange With: |
|---------------------------|--|-------------------|
| Released 4th Quarter 2014 | <ul style="list-style-type: none"> Supports Keypad Lock PIN New feature High Ambient Discharge Pressure Control Refer to Service Bulletin TT720 or SB1022 for details | All previous |

Table 48. Software Revision 75C1

| Dates | Features | Interchange With: |
|---------------------------|---|--------------------------|
| Released 4th Quarter 2015 | <ul style="list-style-type: none"> • New feature Discharge Pressure Setpoint • Refer to Service Bulletin SB1050 for details | All previous |

Table 49. Software Revision 75C2

| Dates | Features | Interchange With: |
|----------------------------------|---|--------------------------|
| Released end of 3rd Quarter 2016 | <ul style="list-style-type: none"> • Added Check Battery Condition Alarm in Guarded Access • Added unit type for SLXi Whisper Pro Spectrum and SLXi Spectrum • New feature Refrigerant Type (SLX/ SLXi) • New feature Unit Serial Number (SLXi) • New feature Null Restart Temperature (SLXi) • New feature Decimal Degree Setpoint (SLXi) • Refer to Service Bulletin SB631-1, SB632-1, or SB1107 for details | All previous |

Table 50. Software Revision 7B00

| Dates | Features | Interchange With: |
|---------------------------|---|--------------------------|
| Released 1st Quarter 2017 | <ul style="list-style-type: none"> • Added Telematics Status in Maintenance Menu • Additions to Cycle Sentry Setup • Refer to Service Bulletin SB1107 and SB1115 for details | All previous |

Section 8 - Refrigeration Operation and Service Procedures

Multi-Temperature Refrigeration Principles and Components

Multi-Temperature System Features

- **Reverse Cycle Heat** - When the unit is operating in reverse cycle heat, the evaporator coil in the zone that is in heat or defrost mode is used as the condenser coil for the system. The Condenser Inlet Solenoid (CIS) energizes (closes) to stop refrigerant flow through the host unit condenser. The heating coil provides liquid refrigerant to other cooling zones. The suction line in the heating zone is closed and the liquid refrigerant is sent through a liquid return line to the system liquid line. In some cases, the direction of flow in the liquid line is reversed compared to cool mode. This only occurs when at least one other zone is operating in cool mode.
- All multi-temperature systems are capable of maintaining any temperature in any zone. They can also heat or cool in any zone at any time. These systems include conventional host units as well as Dual Evaporator (DE) systems.
- The multi-temperature refrigeration and control system is a very robust and complex system. As a result, it is difficult to predict the unit operating mode at any given moment. Service Test Mode allows the technician to force the unit to a known operating mode for diagnostic purposes.

Multi-Temperature Host Unit Solenoids and Valves

The Condenser Inlet Solenoid, Receiver Tank Pressure Solenoid, and Purge Valve are located in the condenser section of the host unit and serve all zones. They are controlled by zone requirements and are affected by the discharge pressure transducer. These three components are controlled by electrical outputs that are part of the Base Controller assembly.

For SLX Spectrum units equipped with Electronic Throttling Valve, the host unit includes one Hot Gas Bypass Valve located next to the Receiver Tank in the refrigeration line that connects the discharge line to the hot gas line. It is used in conjunction with the ETV, only when the host zone is operating in modulation cool, with all other zones switched off, and controlled by electrical outputs that are part of the Base Controller.

Condenser Inlet Solenoid (CIS)

This valve controls the flow of refrigerant to the host unit's condenser. This normally open solenoid is typically energized (closed) when any zone is operating in heat or defrost mode. The base controller may de-energize the condenser inlet solenoid as required to increase cooling capacity or control discharge pressure. This is determined by box temperature vs ambient temperature. The condenser inlet solenoid will be de-energized under the following conditions:

- If the refrigerant discharge pressure becomes excessive.
- If the temperature control algorithm allows low heating capacity to increase cooling capacity.

This solenoid is a normally open valve. The Base Controller will supply 12 volts from a Smart FET to energize (close) this valve.

Receiver Tank Pressure Solenoid (RTPS)

This normally closed valve is energized (open) when any zone is operating in heat or defrost mode and the refrigerant discharge pressure is low. It pressurizes the receiver tank to push stored liquid refrigerant into the system. This verifies adequate refrigerant is available to heat or defrost the zone. The Receiver Tank Pressure Solenoid is always energized at the same time as the Purge Valve (Purge Valve and Receiver Tank Pressure Solenoid are controlled by separate electronic outputs). As discharge pressure rises, the RTPS may de-energize to limit the amount of refrigerant available to the system. The Base Controller will supply 12 volts from a Smart FET to energize (open) the valve.

Purge Valve (PV)

This normally closed valve is energized (open) when any zone is operating in heat or defrost mode and the refrigerant discharge pressure is low. It allows liquid refrigerant trapped in the host unit condenser to be transferred to the system. This verifies adequate refrigerant is available to heat or defrost the zone. The Purge Valve is always energized at the same time as the Receiver Tank Pressure Solenoid valve (Purge Valve and Receiver Tank Pressure Solenoid are controlled by separate electronic outputs). As discharge pressure rises, the PV may de-energize to limit the amount of refrigerant available to the system. The Base Controller will supply 12 volts from a Smart FET to energize (open) the valve.

Hot Gas Bypass Valve (HGBV)

This normally closed valve is used in conjunction with the Modulation Valve or Electronic Throttling Valve to reduce the capacity of the unit during modulation and also aid suction pressure control. It is located in the refrigeration line that connects the discharge line to the hot gas line. The controller energizes (opens) the hot gas bypass valve when the unit reaches full modulation. The controller de-energizes (closes) the hot gas bypass valve when the modulation cycle ends. For SLXi units, the hot gas bypass solenoid will pulse when the unit is running Host only, which will help reduce fuel consumption.

Electronic Throttling Valve (ETV)

The ETV is a variable position valve operated by a stepper motor. The ETV is located in the suction line between the heat exchanger and the accumulator. The ETV controls the flow of refrigerant returning to the compressor, replacing the modulation valve and compressor throttling valve. During the Full Cool mode, the unit controller sends an electrical signal to adjust the ETV to maximize system cooling capacity. During Modulation Cool mode, the unit controller sends a signal to close the ETV a precise amount. This throttles the suction gas returning to the compressor and reduces the system cooling capacity to match the load requirements.

Multi-Temperature Evaporator Components

The Liquid Line Solenoid, Hot Gas Solenoid, and Suction Line Solenoid for each zone are located in the evaporator for that zone and are controlled by zone requirements. The remote evaporators also include the 12 Vdc electrical fans with electronic speed control and the drain hose heaters. With the exception of the Zone 1 Liquid Line Solenoid, these components are controlled by Smart FET outputs located in the Expansion Module. The Zone 1 Liquid Line Solenoid is controlled by an output on the Base Controller. This allows Zone 1 cool operation with a failed Expansion Module.

Liquid Line Solenoid (LLS)

The Liquid Line Solenoid is energized (open) any time cooling, heating, or defrosting is required in its zone. The valve is de-energized when the zone is in null or off to stop refrigerant flow in that zone. These solenoids are normally closed valves. The Liquid Line Solenoid for Zone 1 is controlled by relay K8 located on the Base Controller. The Liquid Line Solenoids for Zones 2 and 3 are controlled by Smart FET outputs on the Expansion Module. Relay K8 (Zone 1) or the Expansion Module (Zones 2 and 3) will supply 12 volts to energize (open) the respective valve.

Hot Gas Solenoid (HGS)

The Hot Gas Solenoid is energized (open) any time heating or defrosting is required in the zone. This makes hot gas from the compressor discharge and hot gas line available to the zone. These solenoids are normally closed valves and are controlled by Smart FET outputs located on the Expansion Module. The Expansion Module will supply 12 volts to energize (open) the respective valve.

Suction Line Solenoid (SLS)

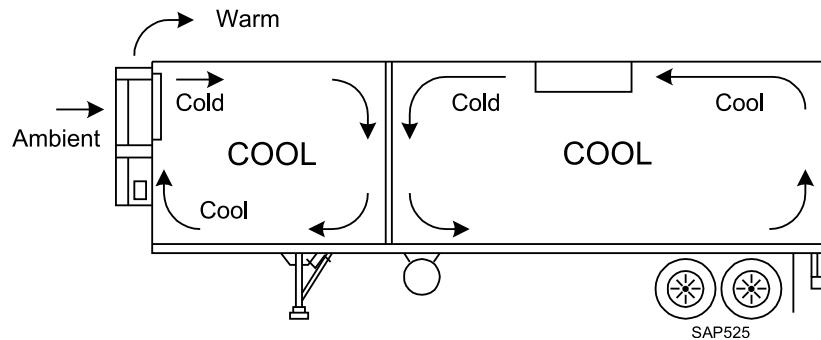
The Suction Line Solenoid is energized (closed) when its zone is operating in reverse cycle heat or defrost (Refer to Reverse Cycle Heat in "[Multi-Temperature System Features](#)," p. 400). The Suction Line Solenoid prevents refrigerant from escaping into the suction line. This causes the liquid refrigerant being condensed to flow through the liquid return line to the system liquid line. The Suction Line Solenoid is not energized (closed) if there are no other zones operating in cool mode. These solenoids are normally open valves and are controlled by Smart FET outputs

located on the Expansion Module. The Expansion Module will supply 12 volts to energize (close) the respective valve.

Multi-Temperature Operation

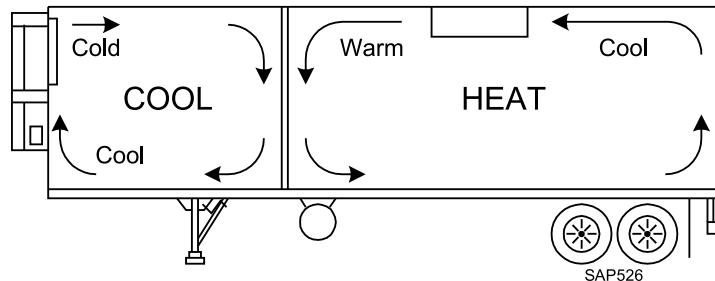
All Zones Cooling

When all zones are cooling, the host unit condenser is used to eliminate the heat from all zones. This is Conventional Cooling operation.



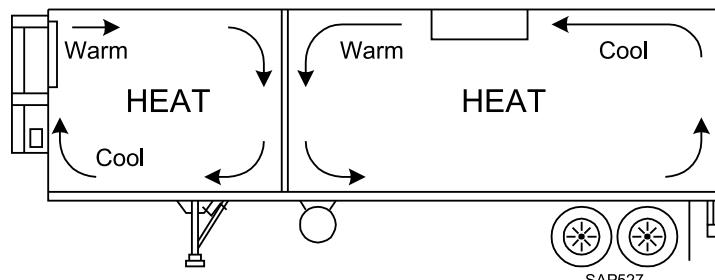
One Zone Cooling/One Zone Heating or Defrosting

When at least one zone is cooling and another zone is heating or defrosting, the evaporator in the heating zone is used as a condenser to remove the heat from the zone that is cooling. The host unit condenser is not used. This is Reverse Cycle operation.



All Zones Heating or Defrosting

When all zones are heating or defrosting, the host unit condenser is not used. This is Hot Gas Heat operation.



Solenoids and Valves

| Item | Smart FET | Solenoid Type | Null | Running Null | Cool | Z1 Cool Modulation | Heat and Defrost | Reverse Cycle Heat and Defrost | Reduced Reverse Cycle Heat and Defrost | Single Zone Heat (Note 3) |
|--|-----------|---------------|------|--------------|------------------|--------------------|----------------------|--------------------------------|--|---------------------------|
| Condenser Inlet Solenoid (CIS) (Note 1) | Yes | NO | | | | | Energized (closed) | Energized (closed) | Note 1 | Energized (closed) |
| Receiver Tank Pressure Sol (RTPS) (Note 1) | Yes | NC | | | | | Energized (open) | Energized (open) | Note 1 | |
| Purge Valve (PV) (Note 1) | Yes | NC | | | | | Energized (open) | Energized (open) | Note 1 | |
| Zone Liquid Line Solenoid (LLS) (Note 1) | Yes | NC | | | Energized (open) | Energized (open) | Energized (open) | Energized (open) | Energized (open) | Energized (open) |
| Zone Hot Gas Solenoid (HGS) | Yes | NC | | | | | Energized (open) | Energized (open) | Energized (open) | Energized (open) |
| Zone Suction Line Solenoid (SLS) | Yes | NO | | | | | | Energized (closed) | Energized (closed) | |
| Evaporator Fans | Yes | N/A | Off | On | On | | On (Off for defrost) | On (Off for defrost) | On | On |

Notes:

1. Reduced Reverse Cycle Heat is used to prevent excessive heating and to allow both the remote evaporator of the zone in heat and the unit condenser to be utilized by zones that are cooling.

If the setpoint in the heating zone is equal to or more than 20°F (-6.6°C) below the ambient temperature, the following valves are de-energized:

- Condenser Inlet Solenoid
- Purge Valve
- Receiver Tank Pressure Solenoid

The zone is in Reduced Reverse Cycle Heat.

If the setpoint in the heating zone becomes less than 15°F (-9.4°C) below the ambient temperature, the following valves are energized:

- Condenser Inlet Solenoid
- Purge Valve (dependent on discharge pressure)
- Receiver Tank Pressure Solenoid (dependent on discharge pressure)

The zone is in Normal Reverse Cycle Heat.

2. The fans in zones with fresh range setpoints will run in full speed if there are no more than three fans in a zone. If there are four or more fans per zone, the fan speed is reduced for power management. The fans in zones with frozen range setpoints will run at a lower speed than fans in fresh zones with four or more fans.

If the Run Fans in Null feature is enabled and the unit is running, when a zone is in running null, the zone fans will run for three minutes, shut down for three minutes, and then restart for three minutes. This maintains airflow in the zone and is normally used with fresh loads.

3. Single Zone Heat is used when there are no other zones operating in cool mode. The heating zone will use conventional hot gas heat.

Summary

- When a zone is cooling, the Liquid Line Solenoid (LLS) is energized (open), the Hot Gas Solenoid (HGS) is de-energized (closed), and the Suction Line Solenoid (SLS) is de-energized (open).
- When a zone is heating or defrosting in single zone heat, the Liquid Line Solenoid (LLS) is energized (open), the Hot Gas Solenoid (HGS) is energized (open), and the Suction Line Solenoid (SLS) is de-energized (open).

- When a zone is in reverse cycle heat, the Liquid Line Solenoid (LLS) is energized (open), the Hot Gas Solenoid (HGS) is energized (open), and the Suction Line Solenoid (SLS) is energized (closed).
- When a zone is in defrost with other zones cooling, the Liquid Line Solenoid (LLS) is energized (open) and the Hot Gas Solenoid (HGS) is energized (open). The Suction Line Solenoid (SLS) will be energized (closed) in the early stages of defrost but will be de-energized (open) as coil temperature rises. This will cause a temporary loss of capacity in the cooling zones.
- When a zone is in Null or running null, no zone valves are energized.
- When a zone is off, no zone valves are energized.

Transducers and Switches

Compressor Discharge Pressure Transducer

This transducer supplies the discharge pressure at the compressor to the base controller. This information is used by the software to determine which solenoids should be energized or de-energized.

Suction Pressure Transducer

This transducer supplies the suction pressure to the base controller. This information is used by the software to determine if the engine is allowed to operate at high speed.

High Pressure Cutout Switch

The high pressure cutout switch monitors the discharge pressure at the compressor. The switch is closed with normal pressures and will open with excessive pressures. The actual pressure is determined by the refrigerant used in the unit. The high pressure cutout is located on the compressor discharge manifold.

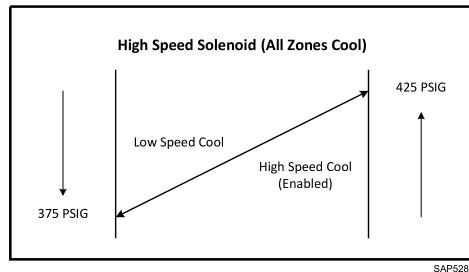
Discharge Transducer Pressure Control

The base controller monitors the discharge pressure of the compressor using the Discharge Pressure Transducer. This information is used to control unit operation.

Refrigeration Control

High Speed Solenoid (All Zones Cool)

When all zones are in cool mode, the base controller will enable the unit to run in high speed if required until the discharge pressure exceeds 425 psig. At that time the unit will be forced to low speed to prevent a shut down on high discharge pressure. When the discharge pressure drops below 375 psig, the base controller will enable the unit to go back to high speed if required.

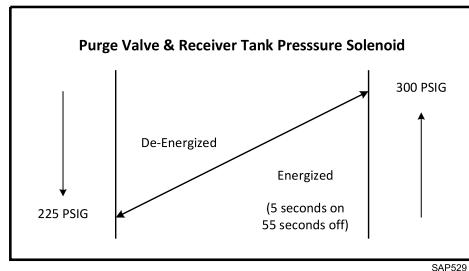


Purge Valve and Receiver Tank Pressure Solenoids

When any zone is in heat or defrost mode with the Condenser Inlet Solenoid energized, the base controller will energize the Purge Valve (PV) and Receiver Tank Pressure Solenoid (RTPS) until the discharge pressure exceeds 300 psig. At that time the unit will de-energize the solenoids. This controls the amount of refrigerant available when the unit is heating or defrosting. When the discharge pressure drops below 225 psig, the base controller will again energize the Purge Valve and Receiver Tank Pressure Solenoid to add additional refrigerant to the system.

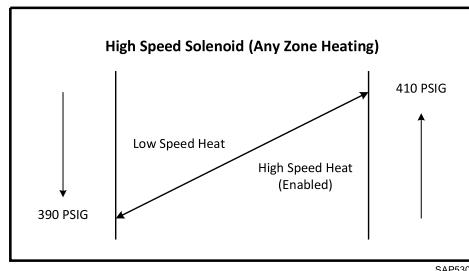
The Purge Valve and Receiver Tank Pressure Solenoid will be energized for five seconds and then de-energized for 55 seconds if the discharge pressure is between 225 and 300 psig.

Note: This only applies to heat or reverse cycle heat, not to reduced reverse cycle heat or defrost.



High Speed Solenoid (Any Zone Heating)

When any zone is in heat mode, the base controller will enable the unit to run in high speed heat if required until the discharge pressure exceeds 410 psig. At that time the unit will be forced to low speed heat to prevent a shut down on high discharge pressure. When the discharge pressure drops below 390 psig, the controller will enable the unit to go back to high speed heat if required.



Reduced Reverse Cycle Heat Control

Reduced Reverse Cycle Heat is used to prevent excessive heating and to allow both the remote evaporator of the zone in heat and the unit condenser to be utilized by zones that are cooling.

If the setpoint in the heating zone is equal to or more than 20°F (-6.6°C) below the ambient temperature, the following valves in that zone are de-energized:

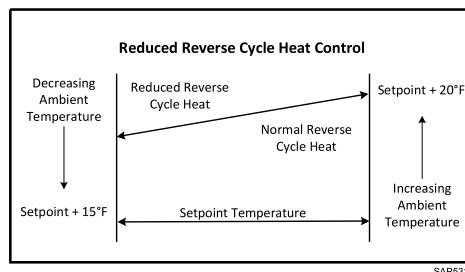
- Condenser Inlet Solenoid
- Purge Valve
- Receiver Tank Pressure Solenoid

The zone is in Reduced Reverse Cycle Heat.

If the setpoint in the heating zone becomes less than 15°F (-9.4°C) below the ambient temperature, the following valves are energized:

- Condenser Inlet Solenoid
- Purge Valve (dependent on discharge pressure)
- Receiver Tank Pressure Solenoid (dependent on discharge pressure)

The zone is in Normal Reverse Cycle Heat.

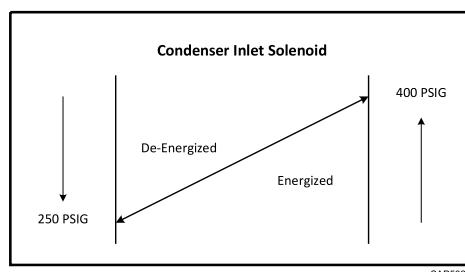


SAP531

Condenser Inlet Solenoid

When any zone is in heat or defrost mode, the base controller will energize the condenser inlet solenoid only when required to increase capacity. This is determined by box temperature vs ambient temperature.

When energized, the condenser inlet solenoid will stay energized until the discharge pressure exceeds 400 psig. At that time the condenser inlet solenoid is de-energized to prevent a shut down on high discharge pressure. When the discharge pressure drops below 250 psig, the controller will again energize the condenser inlet solenoid if required.



SAP532

R01A - Evacuation and Charging Procedure

Purpose:

To evacuate and charge a multi-temperature refrigeration system.

Materials Required:

- Thermo King Evacuation Station (P/N 204-725 or 204-744).
- Evacuation Station Operation and Field Application (TK 40612-2).

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.
- For additional information, refer to the appropriate Maintenance Manual.

! CAUTION**Service Procedure!**

Do not evacuate the system until it is leak free. A unit with less than full refrigerant charge should be leak checked and all leaks must be repaired.

Evacuation Procedure:

| Step | Action | Result | Comments |
|------|--|--|---|
| 1 | Verify all refrigerant has been recovered from the unit. | | Refer to Refrigeration Service Procedure R10A for refrigerant recovery details. |
| 2 | Connect a vacuum pump and gauge manifold for three-point evacuation to the suction service valve, discharge service valve, and receiver tank outlet valve. | | The use of the Thermo King Evacuation Station (P/N 204-725 or 204-744) is recommended. Refer to Evacuation Station Operation and Field Application (TK 40612-2) additional information. |
| 3 | Verify proper operation of the Evacuation Station as shown in the Evacuation Station Operation and Field Application (TK 40612). | | |
| 4 | Start the vacuum pump and mid-seat the suction service valve, discharge service valve, and receiver tank outlet valve. | | |
| 5 | Install service valve stem caps with seals and tighten them. | | The valve stems should remain capped while evacuating the unit. |
| 6 | Evacuate the unit to 500 microns, or the lowest achievable level between 500 and 1,000 microns. | | |
| 7 | Continue to evacuate the unit for one additional hour after reaching 500 microns, or the lowest achievable level between 500 and 1,000 microns. | This verifies complete evacuation of the remote evaporators and tubes. | |
| 8 | Close the Evacuation Station valve nearest the vacuum pump (V1) to isolate the vacuum pump from the system. Turn the vacuum pump off. | | |



Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|------|--|--|--|
| 9 | Observe the micron gauge. | The system pressure should remain below 2000 microns for five minutes. If the pressure does not hold, check for leaks (if a leak is suspected) or continue evacuation (if system is not dry). | |
| 10 | Restart the vacuum pump, open the Evacuation Station valve nearest the vacuum pump (V1) and repeat steps 6, 8, and 9 as required until system pressure remains below 2000 microns for five minutes. | | |
| 11 | When system pressure remains below 2000 microns for five minutes, restart the vacuum pump and open the Evacuation Station valve nearest the vacuum pump (V1). | | |
| 12 | With the vacuum pump running, back seat the suction and discharge service valves. Replace the valve cap, re-close the Evacuation Station valve nearest the vacuum pump (V1), and stop the vacuum pump. | | |
| 13 | Close valve V4. The unit is ready to charge. | | Do not exercise the service valves with the unit in a deep vacuum unless the vacuum pump is operating. |

Charging Procedure:

Note: The unit must be left in the Evacuation Test.

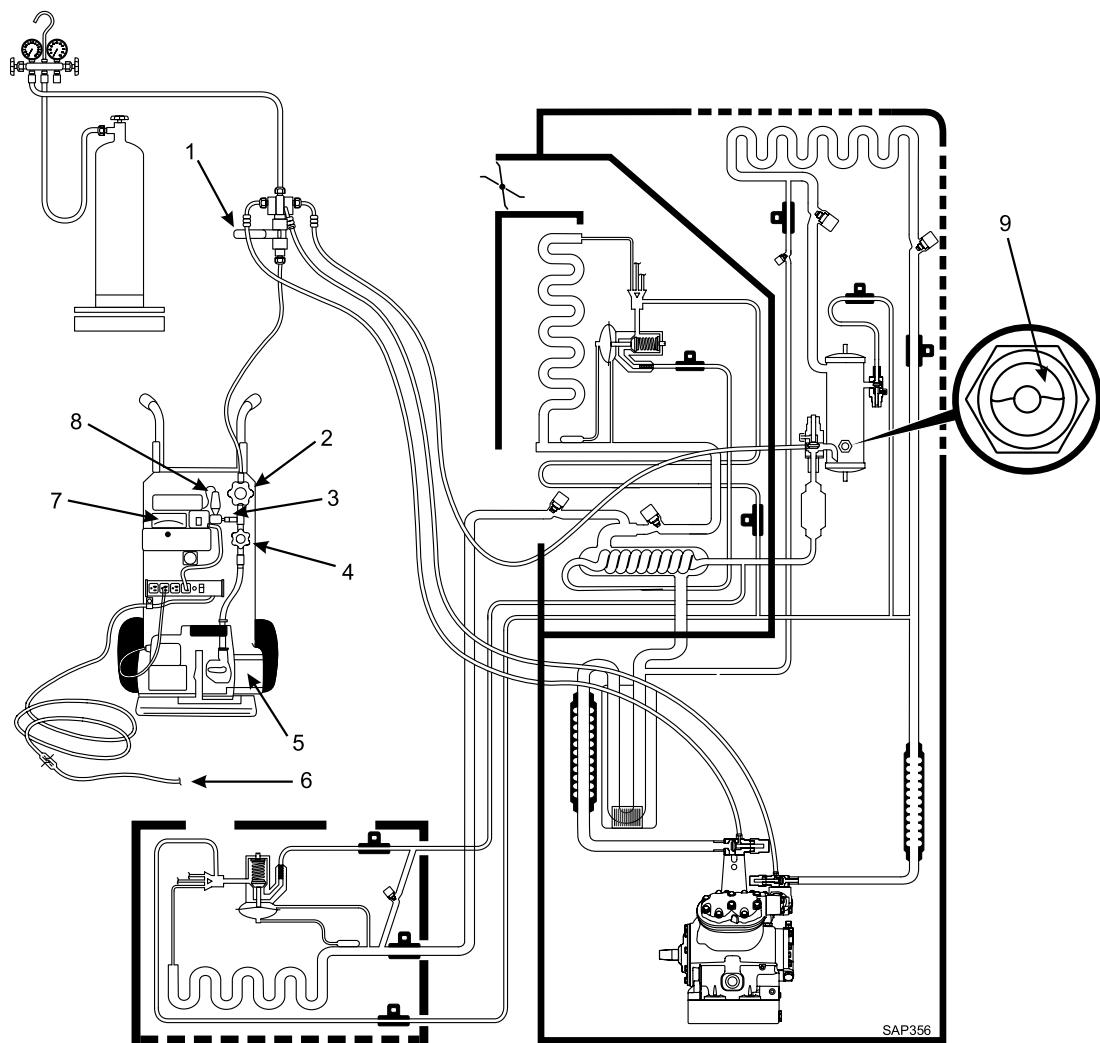
| Step | Action | Result | Comments |
|------|--|--------|---|
| 1 | Verify all compartment bulkheads are open. | | Ceiling mounted bulkheads should not be stored close to the evaporator outlets as this will restrict airflow. |
| 2 | Before charging system, verify refrigerant lines from the gauge manifold to refrigerant supply bottle have been evacuated or purged, the suction and discharge service valves are back seated, and receiver tank outlet valve is still open. | | |
| 3 | Set refrigerant supply bottle for liquid. Open gauge manifold hand valve and add a partial charge of R-404A through the receiver tank outlet valve. Add 14 lb (6.4 kg) to a unit with one remote evaporator. Add 15 lb (6.8 kg) to a unit with two remote evaporators. Do not add more than this. The remainder of charge will be added through suction service valve while unit is running. | | |
| 4 | Close gauge manifold hand valve. | | |
| 5 | Back seat (close) the receiver tank outlet valve. | | |

Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|-------------|---|---------------|--|
| 6 | Exit Evacuation Test by turning unit Off and then back On. | | |
| 7 | Turn all zones On and set all zone set points for lowest possible temperature to verify that all zones run in Cool mode. Allow unit to start. | | |
| 8 | Front seat suction service valve and allow compressor to pump down to 1 to 3 psi (7 to 21 kPa). Stop the unit. | | |
| 9 | Remove evacuation manifold hoses from receiver tank outlet valve, discharge service valve, and suction service valve. Replace and tighten service port and valve stem caps on receiver tank outlet valve. | | |
| 10 | Attach gauge manifold (with refrigerant supply bottle still connected) to compressor. Attach low side gauge to suction service valve. Mid-seat suction service valve. Attach high pressure gauge on to discharge service valve. Open discharge service valve to monitor discharge pressure. | | |
| 11 | Turn unit On, turn all zones On (with all zone set points set to the lowest possible temperature), and allow unit to start. | | |
| 12 | Observe suction pressure and slowly open gauge manifold hand valve to allow liquid refrigerant to flow into suction service valve. Control liquid flow so suction pressure increases 20 to 25 psi (138 to 172 kPa). Maintain a discharge pressure of 325 to 400 psi (2241 to 2758 kPa). | | |
| 13 | Add refrigerant until ball in receiver tank sight glass rises to middle of sight glass, then close gauge manifold hand valve. | | Verify liquid level does not rise above top of sight glass. |
| 14 | Continue to operate unit and monitor sight glass until all compartment temperatures are at or below 0 F (-18 C). | | |
| 15 | Check position of ball in receiver tank sight glass. If liquid level has dropped, add liquid refrigerant until level stabilizes near middle of sight glass. | | Do not exceed recommended refrigerant charge for unit model. |
| 16 | Close hand valve on refrigerant supply bottle. | | |
| 17 | Back seat discharge service valve. | | |
| 18 | Open both hand valves on gauge manifold. | | |
| 19 | Front seat suction service valve and allow compressor to pump down to 1 to 3 psi (7 to 21 kPa). Stop the unit. | | |

| Step | Action | Result | Comments |
|------|--|--------|----------|
| 20 | Remove gauge line from suction service valve and cap service port. | | |
| 21 | Remove gauge line from discharge service valve and cap service port. | | |
| 22 | Back seat suction service valve and cap valve stem. | | |
| 23 | Cap valve stem on discharge service valve. | | |
| 24 | Secure all gauge lines to gauge line anchors. | | |

Figure 192. Multi-Temp Evacuation and Charging (Two Zone Unit Shown Other Units Similar)



| | | | |
|---|-----------------------|---|---------------------------|
| 1 | V-4 | 6 | To AC Power |
| 2 | V-3 | 7 | Vacuum or Micron Gauge |
| 3 | V-2 | 8 | Thermistor |
| 4 | V-1 | 9 | Correct Refrigerant Level |
| 5 | Two-Stage Vacuum Pump | | |

R02A - Low Side Pump Down Test

Purpose:

To perform a low side pump down on a multi-temperature refrigeration system to test internal high side to low side seals.

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.

Procedure:

| Step | Action | Result | Comments |
|------|--|--|---|
| 1 | Attach the gauge set. | | |
| 2 | Set all zone setpoints for the lowest possible temperature to verify that all zones run in Cool Mode. | | Service Test Mode can be used to place all zones in Cool Mode. |
| 3 | Start and run all zones in Cool Mode for 10 minutes. Discharge pressure should be greater than 325 psig. | | Failure to operate the unit to normal temperature and pressure may yield unreliable results. |
| 4 | Front seat the receiver tank outlet valve and perform a low side pump down to a 20 - 25 inch vacuum. | | After several minutes of operation with suction pressure in a vacuum, the unit may shut down and Alarm Code 93 will be set. |
| 5 | Shut the unit down and observe the gauges. The low side should not rise above a 15 inch vacuum in less than two minutes. | If low side pressure does not hold, check the Receiver Tank Outlet Valve, Hot Gas Solenoids in all zones, Purge Valve, and the compressor valve plates for internal leaks. | The unit may already be shut down due to an Alarm Code 93. |
| 6 | If low side pressure holds, proceed with desired test. | | |



Section 8 - Refrigeration Operation and Service Procedures

R03A - Hot Gas Solenoid Test

Purpose:

To test the hot gas solenoid, and control circuit on a multi-temperature refrigeration system.

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.

Procedure:

| Step | Action | Result | Comments |
|------|--|---|---|
| 1 | Attach the gauge set. | | |
| 2 | Set all zone setpoints for the lowest possible temperature to verify all zones run in Cool Mode. | | Service Test Mode can be used to place all zones in Cool Mode. |
| 3 | Start and run all zones in Cool Mode for 10 minutes. Discharge pressure should be greater than 325 psig. | | |
| 4 | Front seat the receiver tank outlet valve and perform a Low Side Pump Down to a 20 - 25 inch vacuum. | | After several minutes of operation with suction pressure in a vacuum, the unit may shut down and Alarm Code 93 will be set. Refer to Refrigeration Service Procedure R02A for additional information. |
| 5 | Shut the unit down and observe the gauges. The low side should not rise above a 15 inch vacuum in less than two minutes. If low side pressure holds proceed with desired test. | If low side pressure does not hold check the Hot Gas Solenoids in all zones, Purge Valve, and the compressor valve plates for internal leaks. | |
| 6 | From the HMI, access the Maintenance Menu. | The display will show MAINTENANCE MENU. | |
| 7 | Use the NEXT key to choose INTERFACE BOARD TEST and press SELECT to load. | The display will show PREHEAT RELAY and gauge information. | |
| 8 | Press the NEXT key to choose ZONE 1 HOT GAS SOLENOID. | The display will show ZONE 1 HOT GAS SOLENOID and gauge information. | In zones with parallel evaporators, the solenoids will energize together. |
| 9 | Press the TEMP ON key. The display will show ZONE 1 HOT GAS SOLENOID ON for about three seconds. | The low side gauge should rise. If low side pressure does not rise, check the Hot Gas Solenoid for Zone 1. | Important: If suction and discharge pressure equalizes, it may be necessary to start the engine and allow the system to pump down to 20-25 inch vacuum before proceeding. |
| 10 | Press the NEXT key to choose ZONE 2 HOT GAS SOLENOID. | The display will show ZONE 2 HOT GAS SOLENOID and gauge information. | |



Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|------|--|--|--|
| 11 | Press the TEMP ON key. The display will show ZONE 2 HOT GAS SOLENOID ON for about three seconds. | The low side gauge should rise. If low side pressure does not rise, check the Hot Gas Solenoid for Zone 2. If the low side pressure rises proceed with test. In zones with parallel evaporators the solenoids will energize together. | Important: If suction and discharge pressure equalizes, it may be necessary to start the engine and allow the system to pump down to 20-25 inch vacuum before proceeding. |
| 12 | If the unit is equipped with three zones, press the NEXT key to choose ZONE 3 HOT GAS SOLENOID. | The display will show ZONE 3 HOT GAS SOLENOID and gauge information. | If a third zone is not present, proceed to step 14. |
| 13 | Press the TEMP ON key. The display will show ZONE 3 HOT GAS SOLENOID ON for about 3 seconds. | The low side gauge should rise. If low side pressure does not rise, check the Hot Gas Solenoid for Zone 3. If the low side pressure rises proceed with test. | In zones with parallel evaporators the solenoids will energize together. |
| 14 | Exit the Interface Board Test by pressing the EXIT key. | | |
| 15 | If no further testing is required, backseat all service valves, remove gauges, and securely replace valve stem covers with seals and service port caps before returning unit to service. | | |



Section 8 - Refrigeration Operation and Service Procedures

R04A - Liquid Line Solenoid/Liquid Return Check Valve Test

Purpose:

To test the liquid line solenoids and control circuits on a multi-temperature refrigeration system.

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.

Procedure:

| Step | Action | Result | Comments |
|------|--|--|--|
| 1 | Attach the gauge set. | | |
| 2 | Set all zone setpoints for the lowest possible temperature to verify all zones run in Cool Mode. | | Service Test Mode can be used to place all zones in Cool Mode. |
| 3 | Start and run all zones in Cool Mode for 10 minutes. Discharge pressure should be greater than 325 psig. | | |
| 4 | Front seat the receiver tank outlet valve and perform a Low Side Pump Down to 20 - 25 inch vacuum. | | After several minutes of operation with suction pressure in a vacuum, the unit will shut down and Alarm Code 93. Refer to Refrigeration Service Procedure R02A for additional information. |
| 5 | Shut the unit down and observe the gauges. The low side should not rise above a 15 inch vacuum in less than two minutes. If the low side pressure holds proceed with desired test. | If the low side pressure does not hold, check the Receiver Tank Outlet Valve, Hot Gas Solenoids in all zones, Purge Valve, and the compressor valve plates for internal leaks. | |
| 6 | Open (back seat) the receiver tank outlet valve and observe the gauges. If the low side pressure holds, proceed with test | The low side should not rise. If low side pressure does not hold, check the liquid line solenoids and liquid return check valves in all zones. | Leaking liquid return check valves will cause cooling problems. Leaking liquid line solenoids may allow cooling during null operation. |
| 7 | From the HMI, access the Maintenance Menu. | The display will show MAINTENANCE MENU. | |
| 8 | Use the NEXT key to choose INTERFACE BOARD TEST and press SELECT to load. | The display will show PREHEAT RELAY and gauge information. | |
| 9 | Press the NEXT key to choose ZONE 1 LIQUID LINE SOLENOID. | The display will show ZONE 1 LIQUID LINE SOLENOID and gauge information. | In zones with parallel evaporators the solenoids will energize together. |
| 10 | Press the TEMP ON key. The display will show ZONE 1 LIQUID LINE SOLENOID ON for about three seconds. | The low side gauge should rise. If low side pressure does not rise, check the Liquid Line Solenoid for Zone 1. | Verify the Receiver Tank Outlet Valve is open (back seated). Important: If suction and discharge pressure equalizes, it may be necessary to start the engine and allow the system to pump down to 20-25 inch vacuum before proceeding. |



Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|------|--|---|---|
| 11 | Press the NEXT key to choose ZONE 2 LIQUID LINE SOLENOID. | The display will show ZONE 2 LIQUID LINE SOLENOID and gauge information. | In zones with parallel evaporators the solenoids will energize together. |
| 12 | Press the TEMP ON key. The display will show ZONE 2 LIQUID LINE SOLENOID ON for about three seconds. | The low side gauge should rise. If low side pressure does not rise, check the Liquid Line Solenoid for Zone 2. If the low side pressure rises, proceed with test. | Important: If suction and discharge pressure equals, it may be necessary to start the engine and allow the system to pump down to 20-25 inch vacuum before proceeding. |
| 13 | If the unit is equipped with three zones, press the NEXT key to choose ZONE 3 LIQUID LINE SOLENOID. | The display will show ZONE 3 LIQUID LINE SOLENOID and gauge information. | In zones with parallel evaporators, the solenoids will energize together. If a third zone is not present, proceed to step 15. |
| 14 | Press the TEMP ON key. The display will show ZONE 3 LIQUID SOLENOID ON for about three seconds. | The low side gauge should rise. If low side pressure does not rise, check the Liquid Line Solenoid for Zone 3. If the low side pressure rises, proceed with test. | |
| 15 | Exit the Interface Board Test by pressing the EXIT key. | | |
| 16 | If no further testing is required, backseat all service valves, remove gauges, and securely replace valve stem covers with seals and service port caps before returning unit to service. | | |



Section 8 - Refrigeration Operation and Service Procedures

R06A - Suction Line Check Valve/Condenser Inlet Check Valve Test

Purpose:

To test the Suction Line Check Valves and Condenser Inlet Check Valve on a multi-temperature refrigeration system.

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.

Procedure:

| Step | Action | Result | Comments |
|------|--|--|---|
| 1 | Attach the gauge set. | | |
| 2 | Set all zone setpoints for the lowest possible temperature to verify that all zones run in Cool Mode. | | Service Test Mode can be used to place all zones in Cool Mode. |
| 3 | Start and run all zones in Cool Mode for 10 minutes or until stable. Discharge pressure should be greater than 325 PSIG. | | |
| 4 | Front seat the receiver tank outlet valve and perform a Low Side Pump Down to a 20 - 25 inch vacuum. | | After several minutes of operation with suction pressure in a vacuum, the unit may shut down and Alarm Code 93 will be set. Refer to Refrigeration Service Procedure R02A for additional information. |
| 5 | Shut the unit down and observe the gauges. The low side should not rise above a 15 inch vacuum in less than two minutes. If the low side pressure holds proceed with desired test. | If the low side pressure does not hold, check the Receiver Tank Outlet Valve, Hot Gas Solenoids in all zones, Purge Valve, and the compressor valve plates for internal leaks. | |
| 6 | Front seat the Bypass Service Valve on the receiver tank. | | |
| 7 | Bleed through the gauge manifold to the low side and establish a pressure of 5 - 20 PSIG. Close the hand valves on the gauge set. | | |
| 8 | Observe the low pressure gauge. | If the pressure on the gauge manifold drops within two minutes, check the suction line check valves for leaks under low pressure. | |
| 9 | If the low side pressure holds for two minutes, proceed with the test. | | |
| 10 | Equalize the system through the gauge manifold to the low side. Close the hand valves on the gauge set. | | |
| 11 | Observe both the low pressure and high pressure gauges. | If the pressure on the gauge manifold drops within two minutes, check the suction line check valves for leaks under high pressure. If high side pressure increases within two minutes, the condenser inlet check valve is leaking or the bypass service valve on the receiver tank is open or leaking. | |
| 12 | If the pressure holds for two minutes, proceed with the test. | | |

Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|-------------|--|--|---|
| 13 | From the HMI, access the Maintenance Menu. | The display will show MAINTENANCE MENU. | |
| 14 | Use the NEXT key to choose INTERFACE BOARD TEST and press SELECT to load. | The display will show PREHEAT RELAY and gauge information. | |
| 15 | Press the NEXT key to choose Zone 1 Hot Gas Solenoid. | The display will show ZONE 1 HOT GAS SOLENOID and gauge information. | |
| 16 | Press the TEMP ON key. The display will show ZONE 1 HOT GAS SOLENOID ON for about three seconds. | The high side gauge should fall. If high side pressure does not fall, check the suction line check valve for Zone 1. If the high side pressure does fall, proceed with test. | In zones with parallel evaporators, the solenoids will energize together. |
| 17 | Crack the bypass service valve on the receiver tank to charge the high side to no more than the pressure shown on the low side gauge. <u>Do not exceed the pressure shown on the low side gauge.</u> Front seat the bypass service valve. | | This is necessary to provide adequate pressure for the next test. |
| 18 | Press the NEXT key to choose Zone 2 Hot Gas Solenoid. | The display will show ZONE 2 HOT GAS SOLENOID and gauge information. | |
| 19 | Press the TEMP ON key. The display will show ZONE 2 HOT GAS SOLENOID ON for about three seconds. | The high side gauge should fall. If high side pressure does not fall, check the suction line check valve for Zone 2. If the high side pressure does fall, proceed with test. | In zones with parallel evaporators, the solenoids will energize together. |
| 20 | If the unit is equipped with three zones, crack the bypass service valve on the receiver tank to charge the high side to no more than the pressure shown on the low side gauge. <u>Do not exceed the pressure shown on the low side gauge.</u> Front seat the valve. | | If a third zone is not present, proceed to step 23. |
| 21 | Press the NEXT key to choose Zone 3 Hot Gas Solenoid. | The display will show ZONE 3 HOT GAS SOLENOID and gauge information. | |
| 22 | Press the TEMP ON key. The display will show ZONE 3 HOT GAS SOLENOID ON for about three seconds. | The high side gauge should fall. If high side pressure does not fall, check the suction line check valve for Zone 3. If the high side pressure does fall, proceed with test. | In zones with parallel evaporators, the solenoids will energize together. |
| 23 | Exit the Interface Board Test by pressing the EXIT key. | | |
| 24 | If no further testing is required, backseat all service valves, remove gauges, and securely replace valve stem covers with seals and service port caps before returning unit to service. | | |



Section 8 - Refrigeration Operation and Service Procedures

R07A - Purge Valve Test

Purpose:

To test the Purge Valve on a multi-temperature refrigeration system.

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.

Procedure:

| Step | Action | Result | Comments |
|------|--|--|---|
| 1 | Attach the gauge set. | | |
| 2 | Set all zone setpoints for the lowest possible temperature to verify that all zones run in Cool Mode. | | Service Test Mode can be used to place all zones in Cool Mode. |
| 3 | Start and run all zones in Cool Mode for 10 minutes or until stable. Discharge pressure should be greater than 325 PSIG. | | |
| 4 | Front seat the receiver tank outlet valve and perform a Low Side Pump Down to a 20 - 25 inch vacuum. | | After several minutes of operation with suction pressure in a vacuum, the unit may shut down and Alarm Code 93 will be set. Refer to Refrigeration Service Procedure R02A for additional information. |
| 5 | Shut the unit down and observe the gauges. The low side should not rise above a 15 inch vacuum in less than two minutes. If low side pressure holds proceed with desired test. | If low side pressure does not hold, check the Receiver Tank Outlet Valve, Hot Gas Solenoids in all zones, Purge Valve, and the compressor valve plates for internal leaks. | |
| 6 | From the HMI, access the Maintenance Menu. | The display will show MAINTENANCE MENU. | |
| 7 | Use the NEXT key to choose INTERFACE BOARD TEST and press SELECT to load. | The display will show PREHEAT RELAY and gauge information. | |
| 8 | Press the NEXT key to choose Purge Valve. | The display will show PURGE VALVE and gauge information. | |
| 9 | Press the TEMP ON key. The display will show PURGE VALVE ON for about three seconds. | The low side gauge should rise. If low side pressure does not rise, check the purge valve. | |
| 10 | Exit Interface Board Test by pressing the EXIT key. | | |
| 11 | If no further testing is required, backseat all service valves, remove gauges, and securely replace valve stem covers with seals and service port caps before returning unit to service. | | |

R08A - Condenser Inlet Solenoid/Receiver Tank Pressure Solenoid/Purge Check Valve Test

Purpose:

To test the Condenser Inlet Solenoid, Receiver Pressure Tank Solenoid, and Purge Check Valve on a multi-temperature refrigeration system.

Important Notes:

- This test will require the removal of some refrigerant using a recovery machine. Refer to Refrigeration Service Procedure R10A for details.
- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.

Preparation:

| Step | Action | Result | Comments |
|------|--|--|---|
| 1 | Attach the gauge set. | | |
| 2 | Connect a recovery machine to the receiver tank outlet valve service port using a manifold gauge set. | | The gauge set will allow the receiver tank pressure to be monitored. |
| 3 | Set all zone setpoints for the lowest possible temperature to verify that all zones run in Cool Mode. | | Service Test Mode can be used to place all zones in Cool Mode. |
| 4 | Start and run all zones in Cool Mode for 10 minutes or until stable. Discharge pressure should be greater than 325 PSIG. | | |
| 5 | Front seat the receiver tank outlet valve and perform a Low Side Pump Down to a 20 - 25 inch vacuum. | | After several minutes of operation with suction pressure in a vacuum, the unit may shut down and Alarm Code 93 will be set. Refer to Refrigeration Service Procedure R02A for additional information. |
| 6 | Shut the unit down and observe the gauges. The low side should not rise above a 15 inch vacuum in less than two minutes. If low side pressure holds proceed with desired test. | If low side pressure does not hold, check the Receiver Tank Outlet Valve, Hot Gas Solenoids in all zones, Purge Solenoid, and the compressor valve plates. | |

Condenser Inlet Solenoid Test:

| Step | Action | Result | Comments |
|------|---|---|----------|
| 1 | Front seat the bypass service valve on receiver tank. | | |
| 2 | From the HMI, access the Maintenance Menu. | The display will show MAINTENANCE MENU and HOURMETERS. | |
| 3 | Use the NEXT key to choose INTERFACE BOARD TEST and press SELECT to load. | The display will show PREHEAT RELAY and gauge information. | |
| 4 | Press the NEXT key to choose Condenser Inlet Solenoid. | The display will show CONDENSER INLET SOLENOID and gauge information. | |



Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|------|---|---|---|
| 5 | Press the LOCK ON key. The display will show CONDENSER INLET SOL LOCKED ON. | The condenser inlet solenoid is energized (the valve is closed). | The condenser inlet solenoid will remain energized (closed) for a maximum 15 minute timeout. If 15 minutes is exceeded, Alarm Code 54 will be set and the unit will exit Interface Board Test Mode. This is normal operation. If the test time is expected to exceed 15 minutes, this step must be repeated about every ten minutes to prevent timeout. |
| 6 | Start the recovery machine to remove refrigerant from the condenser and receiver tank and observe the receiver tank pressure. | | The refrigerant recovered will be added back into the system later. |
| 7 | Reduce the pressure at the receiver tank outlet valve to 100 psig below the starting pressure. Observe the high side gauge at the compressor discharge valve. The high side pressure should not change. | If high side pressure does not hold, check the condenser inlet solenoid for an internal leak. | |
| 8 | If the high side pressure holds, proceed with the next test. | The condenser inlet solenoid is not leaking internally. | |

Receiver Tank Pressure Solenoid Test:

| Step | Action | Result | Comments |
|------|---|---|----------|
| 1 | Backseat the bypass service valve on the receiver tank and observe the high side gauge at the compressor discharge valve. The pressure should not change. | If the high side pressure does not hold, check the receiver tank pressure solenoid for an internal leak. If the high side pressure holds, the receiver tank pressure solenoid is not leaking internally. Proceed with the next step. | |
| 2 | Disconnect the receiver tank pressure solenoid plug. Energize the receiver tank pressure solenoid for at least one half second by using jumper wires to apply +12 Vdc and chassis ground to the valve. Observe the high side gauge at the compressor discharge valve when the receiver tank pressure solenoid is energized. The pressure should fall. | If the high side pressure does not fall, check the receiver tank pressure solenoid for a valve that is stuck closed. If the high side pressure falls, reconnect the receiver tank pressure solenoid plug (the receiver tank pressure solenoid opens) and proceed with the next step. | |
| 3 | Press the UNLOCK key to de-energize (open) the condenser inlet solenoid. Observe the high side gauge at the compressor discharge valve. The pressure should fall. | If the high side pressure does not fall, check the condenser inlet solenoid for a valve that is stuck closed. If the high side pressure falls, the condenser inlet solenoid opens. Proceed with the next test. | |

Purge Check Valve Test:

Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|-------------|--|--|---|
| 1 | The CONDENSER INLET SOLENOID should still be shown on the display along with gauge information. | | |
| 2 | Press the LOCK ON key. The display will show CONDENSER INLET SOL LOCKED ON. | The condenser inlet solenoid is energized (the valve is closed). | The condenser inlet solenoid will remain energized (closed) for a maximum 15 minute timeout. If 15 minutes is exceeded, Alarm Code 54 will be set and the unit will exit Interface Board Test Mode. This is normal operation. If the test time is expected to exceed 15 minutes, this step must be repeated about every ten minutes to prevent timeout. |
| 3 | Pressurize the low side of the system using the refrigerant recovered earlier and observe the receiver tank pressure gauge. The pressure should not change. | If the receiver tank pressure changes, check the purge check valve for an internal leak. | |
| 4 | Exit the INTERFACE BOARD Test by pressing the EXIT key. | The condenser inlet solenoid is de-energized (open). | |
| 5 | If no further testing is required, backseat all service valves, remove gauges, and securely replace valve stem covers with seals and service port caps before returning unit to service. | | |



Section 8 - Refrigeration Operation and Service Procedures

R09A - Low Side Service Pump Down

Purpose:

To perform a service pump down on a multi-temperature refrigeration system to allow service of all low side components, compressor, discharge manifold, discharge vibrasorber, receiver tank pressure solenoid, and condenser inlet solenoid.

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.

Procedure:

| Step | Action | Result | Comments |
|------|--|---|---|
| 1 | Attach the gauge set. | | |
| 2 | Set all zone setpoints for the lowest possible temperature to verify that all zones run in Cool Mode. | | Service Test Mode can be used to place all zones in Cool Mode. |
| 3 | Start and run all zones in Cool Mode for 10 minutes or until stable. | | |
| 4 | Front seat the receiver tank outlet valve and perform a low side pumpdown to 20 - 25 inch vacuum. | | After several minutes of operation with suction pressure below -10 psig, the unit will shut down and Alarm code 93 will be set. Refer to Refrigeration Procedure R02A for additional information. |
| 5 | Front seat the receiver tank bypass service valve. | | |
| 6 | Shut the unit down and observe the gauges. The low side should not rise above a 15 inch vacuum in less than two minutes. | If low side pressure holds, proceed with desired test. If low side pressure does not hold, check the Receiver Tank Outlet Valve, Hot Gas Solenoids in all zones, Purge Solenoid, and the compressor valve plates for internal leaks. | If the low side pressure cannot be maintained below 15 PSIG, the refrigerant must be recovered before opening the system. Refer to Refrigeration Service Procedure R10A for details. |
| 7 | From the HMI, access the Maintenance Menu. | The display will show MAINTENANCE MENU. | |
| 8 | Use the NEXT key to choose INTERFACE BOARD TEST and press SELECT to load. | The display will show PREHEAT RELAY and gauge information. | |
| 9 | Press the NEXT key to choose Zone 1 Hot Gas Solenoid. | The display will show ZONE 1 HOT GAS SOLENOID and gauge information. | In zones with parallel evaporators, the solenoids will energize together. |
| 10 | Press the TEMP ON key. The display will show ZONE 1 HOT GAS SOLENOID ON for about three seconds. | The low side gauge should rise. If low side pressure does not rise, check the hot gas solenoid for Zone 1. Continue to press the TEMP ON key until the low side pressure is slightly above 0 psig. | This breaks the vacuum in the Zone 1 evaporator and checks the opening of the Zone 1 hot gas solenoid. If pressure does not rise, check the Zone 1 Hot Gas Solenoid. |
| 11 | Press the NEXT key to choose Zone 2 Hot Gas Solenoid. | The display will show ZONE 2 HOT GAS SOLENOID and gauge information. | In zones with parallel evaporators, the solenoids will energize together. |
| 12 | Press the TEMP ON key. The display will show ZONE 2 HOT GAS SOLENOID ON for about three seconds. | The low side gauge should rise. Continue to press the TEMP ON key until the low side pressure is slightly above the previous reading. If low side pressure does not rise, check the hot gas solenoid for Zone 2. If the low side pressure rises, proceed with test. | This breaks the vacuum in the Zone 2 evaporator and checks the opening of the Zone 2 hot gas solenoid. If pressure does not rise, check the Zone 2 Hot Gas Solenoid. |



Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|------|--|---|--|
| 13 | If the unit is equipped with three zones, press the NEXT key to choose Zone 3 Hot Gas Solenoid. | The display will show ZONE 3 HOT GAS SOLENOID and gauge information. | In zones with parallel evaporators the solenoids will energize together. If a third zone is not present, proceed to step 15. |
| 14 | Press the TEMP ON key. The display will show ZONE 3 HOT GAS SOLENOID ON for about three seconds. | The low side gauge should rise. Continue to press the TEMP ON key until the low side pressure is slightly above the previous reading. If low side pressure does not rise, check the hot gas solenoid for Zone 3. If the low side pressure rises, proceed with test. | This breaks the vacuum in the Zone 3 evaporator and checks the opening of the Zone 3 hot gas solenoid. If pressure does not rise, check the Zone 3 Hot Gas Solenoid. |
| 15 | If all zones are slightly greater than 0 psig, work can proceed on low side components in all zones, compressor oil level, and filter. | | If certain high side components need to be serviced, proceed to step 16. |
| 16 | To access the discharge manifold and compressor heads, front seat the discharge service valve. Open both gauge manifold hand valves. | High pressure trapped in the heads and manifold is dumped into the low pressure area of the low side. | |
| 17 | When service is complete, perform a low side evacuation, backseat all service valves, remove gauges, and securely replace valve stem covers with seals and service port caps before returning unit to service. | Add back any refrigerant which was recovered during the procedure. | Refer to Refrigeration Service Procedure R11A for details. |



Section 8 - Refrigeration Operation and Service Procedures

R10A - Refrigerant Recovery

Purpose:

To recover the refrigerant charge from a Multi-Temperature refrigeration system.

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions (back seat) before releasing the unit for service or performing another refrigeration service procedure.

Procedure (For a unit with an operating compressor):

| Step | Action | Result | Comments |
|------|--|---|--|
| 1 | Connect the refrigerant recovery equipment to recover from the suction and discharge service valves, and receiver tank outlet valve. | | Refer to the Operation Manual for your refrigerant recovery equipment. |
| 2 | If the compressor is operable, perform a low side pump down in accordance with Refrigeration Service Procedure R02A. | | |
| 3 | Recover the liquid refrigerant from the receiver tank. | | |
| 4 | To recover the remaining refrigerant vapor, mid-seat the suction service valve, discharge service valve, and receiver tank outlet valve. | | |
| 5 | Connect a battery charger to the unit battery. The battery charger must be capable of at least 15 amperes output. | This will maintain the charge level of the battery during the time required to recover the refrigerant charge. | Evacuation Test Mode is used to open the normally closed solenoid valves as required for evacuation. Failure to connect a battery charger may result in the battery voltage falling too low to operate reliably. |
| 6 | Turn the unit on but do not allow the engine or motor to start. Access the Maintenance Menu. | The display will show MAINTENANCE MENU and HOURMETERS. | Evacuation Test Mode is not available if the unit is running. Important: Evacuation Test is not available if the unit is running. If the unit is running, access the Maintenance Menu and select INTERFACE BOARD TEST. This will shut the unit down. Press EXIT to leave the INTERFACE BOARD TEST. Proceed with the next step. |
| 7 | Use the NEXT key to choose EVACUATION TEST and press SELECT to load. | The display will show EVAC MODE BATTERY VOLTS and the battery voltage. If the battery voltage falls below 13.0 volts, a prompt to connect a battery charger will appear on the display. | Evacuation Test Mode is not available if the unit is running. |

Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|------|--|--|---|
| 8 | All normally closed valves will be energized to allow the refrigerant to be recovered efficiently. | This prevents refrigerant from being trapped in the system. | Evacuation Test does not have a time limit. |
| 9 | Continue to recover the refrigerant as a vapor from all three points. | Continue recovery until system pressure will remain at or below 0 psig when the recovery machine is off. | If pressure rises above 0 psig, there is still refrigerant left in the system. Continue to recover. |

Procedure (For a unit with an inoperative compressor):

| Step | Action | Result | Comments |
|------|--|---|--|
| 1 | Connect the refrigerant recovery equipment to recover from the suction and discharge service valves, and receiver tank outlet valve. | | Refer to the Operation Manual for your refrigerant recovery equipment. |
| 2 | Mid-seat the receiver tank outlet valve, suction service valve, and discharge service valve. | | |
| 3 | Connect a battery charger to the unit battery. The battery charger must be capable of at least 15 amperes output. | This will maintain the charge level of the battery during the time required to recover the refrigerant charge. | EVACUATION MODE is used to open the normally closed valves as required for evacuation. Failure to connect a battery charger may result in the battery voltage falling too low to operate reliably. |
| 4 | Turn the unit on but do not allow the engine or motor to start. Access the Maintenance Menu. | The display will show MAINTENANCE MENU and HOURMETERS. | Evacuation Test Mode is not available if the unit is running. Important: Evacuation Test is not available if the unit is running. If the unit is running, access the Maintenance Menu and select INTERFACE BOARD TEST. This will shut the unit down. Press EXIT to leave the INTERFACE BOARD TEST. Proceed with the next step. |
| 5 | Use the NEXT key to choose EVACUATION TEST and press SELECT to load. | The display will show EVAC MODE BATTERY VOLTS and the battery voltage. If the battery voltage falls below 13.0 volts, a prompt to connect a battery charger will appear on the display. | Evacuation Test Mode is not available if the unit is running. |



Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|------|--|--|---|
| 6 | All normally closed valves will be energized to allow the refrigerant to be recovered efficiently. | This prevents refrigerant from being trapped in the system. | Evacuation Test does not have a time limit. |
| 7 | Continue to recover the refrigerant as a vapor from all three points. | Continue recovery until system pressure will remain at or below 0 psig when the recovery equipment is off. | If system pressure rises above 0 psig, there is still refrigerant left in the system. Continue to recover refrigerant until the system pressure remains below 0 psig when the recovery equipment is turned off. |

R11A - Low Side Evacuation

Purpose:

To evacuate the low side of a multi-temperature refrigeration system after performing a low side repair on a system that is charged with refrigerant. Refer to Refrigeration Service Procedure R09A Low Side Service Pumpdown.

Important Notes:

- When finished with this refrigeration service procedure, return all service valves to the normal operating positions before releasing the unit for service or performing another refrigeration service procedure.

Procedure:

| Step | Action | Result | Comments |
|------|---|--|--|
| 1 | After low side service is completed, verify refrigerant has been purged from the discharge line. | Discharge line must be purged to allow evacuation through the discharge and suction line. | Refer to Refrigeration Service Procedure R09A. |
| 2 | Attach gauge set and vacuum pump to the suction and discharge service valves. | | |
| 3 | Mid seat the suction and discharge service valve and open both hand valves of the gauge manifold. | | |
| 4 | Connect a battery charger to the unit battery. The battery charger must be capable of at least 15 amperes output. | This will maintain the charge level of the battery during the time required to evacuate and charge the unit. | Evacuation Test Mode is used to open the unit valves as required for proper evacuation. Failure to connect a battery charger may result in the battery voltage falling too low to operate reliably. |
| 5 | Disconnect the purge valve harness from its connector. | The purge valve will be disabled in Evacuation Mode. | Important: The purge valve must not be allowed to energize during evacuation. Failure to disable the purge valve will allow refrigerant contained in the condenser to escape to the low side of the refrigeration system. |
| 6 | Turn the unit on but do not allow the engine or motor to start. Access the Maintenance Menu. | The display will show MAINTENANCE MENU. | |
| 7 | Use the NEXT key to choose EVACUATION TEST and press SELECT to load. | The display will show Evacuation Mode and the battery volts. All required valves will energize. The purge valve should not energize. Verify the battery charger is turned on. The display will prompt the technician to connect a battery charger if the voltage falls below 13.0 volts. | |
| 8 | Turn on the vacuum pump. Allow to evacuate to at least a 25 inch vacuum. | Low side of the system is evacuated. High side of the system evacuated up to the condenser inlet check valve, purge valve, bypass hand valve, and receiver tank outlet hand valve. | Refrigerant is contained in the receiver tank and condenser by receiver tank hand valves, purge valve, and condenser inlet check valve. |



Section 8 - Refrigeration Operation and Service Procedures

| Step | Action | Result | Comments |
|------|---|--|---|
| 9 | Close both hand valves of the gauge manifold. Stop the vacuum pump. | | If continued evacuation is recommended or a leak has to be identified and repaired, a vacuum is not maintained. |
| 10 | Turn the unit off. Turn battery charge off and disconnect it from the unit. | Evacuation Mode will be exited. | |
| 11 | Verify a 25 inch vacuum or more is maintained. | If an acceptable vacuum level is maintained, proceed to step 12. | If an acceptable vacuum level is not maintained, continued evacuation is recommended or a leak has to be identified and repaired. |
| 12 | Backseat the receiver tank outlet and bypass hand valves. Start the unit to verify repairs and refrigerant level. | | A small amount of refrigerant may be required. |
| 13 | Remove the gauge manifold. Install and tighten all service valve caps and service port caps. | | |

Section 9 - Specifications

Engine

Table 51. SB Spectrum Units

| | | | | |
|--|---|---|--|--|
| Model | TK486V (Tier 2 through 2007, Interim Tier 4 through 2013) | | | |
| Number of Cylinders | 4 | | | |
| Cylinder Arrangement | In-line vertical, number 1 on flywheel end | | | |
| Firing Order | 1-3-4-2 | | | |
| Direction of Rotation | Counterclockwise viewed from flywheel end | | | |
| Fuel Type | No. 2 diesel fuel under normal conditions No. 1 diesel fuel is acceptable cold weather fuel | | | |
| Oil Capacity | 13 quarts (12.3 liters/litres) crankcase and oil filter Fill to full mark on dipstick | | | |
| Oil Type | API Classification CI-4 or better ACEA Rating E3 or better for Europe | | | |
| Oil Viscosity | 14°F to 122 F (-10°C to 50°C): SAE 15W-40 (Synthetic) 5°F to 104°F (-15°C to 40°C): SAE 15W-40 -13°F to 104°F (-25°C to 40°C): SAE 10W-40 -13°F to 86°F (-25°C to 30°C): SAE 10W-30 -22°F to 122°F (-30°C to 50°C): SAE 5W-40 (Synthetic) Below -22°F (-30°C): SAE 0W-30 (Synthetic) | | | |
| Engine RPM | Low Speed Operation | 1450 ± 25 RPM | | |
| | High Speed Operation | 2200 ± 25 RPM | | |
| Engine Oil Pressure | 18 psi (127 kPa) minimum in low speed 45 to 57 psig (310 to 390 kPa) in high speed | | | |
| Intake Valve Clearance | 0.006 to 0.010 in. (0.15 to 0.25 mm) | | | |
| Exhaust Valve Clearance | 0.006 to 0.010 in. (0.15 to 0.25 mm) | | | |
| Valve Setting Temperature | 70°F (21°C) | | | |
| Fuel Injection Nozzle Opening Pressure | 2800 to 3000 psi (19300 to 20700 kPa) | | | |
| Low Oil Pressure Switch (Normally Closed) | 17 ± 3 psi (117 ± 21 kPa) | | | |
| Engine Coolant Thermostat | 160°F (71°C) | | | |
| Engine Coolant Type | ELC (Extended Life Coolant), which is "RED" Use a 50/50 concentration of any of the following equivalents: Chevron Dex-Cool Texaco ELC Havoline Dex-Cool® Havoline XLC for Europe Shell Dexcool® Shell Rotella Saturn/General Motors Dex-Cool® Caterpillar ELC Detroit Diesel POWERCOOL® Plus | | | |
| NOTICE | | | | |
| System Contamination! | | | | |
| Do not add "GREEN" or "BLUE-GREEN" conventional coolant to cooling systems using "RED" Extended Life Coolant, except in an emergency. If conventional coolant is added to Extended Life Coolant, the coolant must be changed after 2 years instead of 5 years. | | | | |
| Coolant System Capacity | 7.5 quarts (7.1 liters/litres) | | | |
| Radiator Cap Pressure | 7 psi (48 kPa) | | | |
| Drive | Model 30 | Direct to compressor; belts to fans, alternator, and water pump | | |
| | Model 50 | Centrifugal clutch to compressor; belts to electric standby motor, fans, alternator, and water pump | | |



Section 9 - Specifications

Table 52. DE Spectrum Units

| | | |
|---|---|---------------|
| Model | TK486V (Tier 2 through 2007, Interim Tier 4 through 2013) | |
| Number of Cylinders | 4 | |
| Cylinder Arrangement | In-line vertical, number 1 on flywheel end | |
| Firing Order | 1-3-4-2 | |
| Direction of Rotation | Counterclockwise viewed from flywheel end | |
| Fuel Type | No. 2 diesel fuel under normal conditions No. 1 diesel fuel is acceptable cold weather fuel | |
| Oil Capacity | 13 quarts (12.3 liters/litres) crankcase and oil filter Fill to full mark on dipstick | |
| Oil Type | API Classification CI-4 or better ACEA Rating E3 or better for Europe | |
| Oil Viscosity | 14°F to 122 F (-10°C to 50°C): SAE 15W-40 (Synthetic) 5°F to 104°F (-15°C to 40°C): SAE 15W-40 -13°F to 104°F (-25°C to 40°C): SAE 10W-40 -13°F to 86°F (-25°C to 30°C): SAE 10W-30 -22°F to 122°F (-30°C to 50°C): SAE 5W-40 (Synthetic) Below -22°F (-30°C): SAE 0W-30 (Synthetic) | |
| Engine RPM | Low Speed Operation | 1450 ± 25 RPM |
| | High Speed Operation | 2200 ± 25 RPM |
| Engine Oil Pressure | 18 psi (127 kPa) minimum in low speed 45 to 57 psig (310 to 390 kPa) in high speed | |
| Intake Valve Clearance | 0.006 to 0.010 in. (0.15 to 0.25 mm) | |
| Exhaust Valve Clearance | 0.006 to 0.010 in. (0.15 to 0.25 mm) | |
| Valve Setting Temperature | 70°F (21°C) | |
| Fuel Injection Nozzle Opening Pressure | 2800 to 3000 psi (19300 to 20700 kPa) | |
| Low Oil Pressure Switch (Normally Closed) | 17 ± 3 psi (117 ± 21 kPa) | |
| Engine Coolant Thermostat | 160°F (71°C) | |
| Engine Coolant Type | ELC (Extended Life Coolant), which is "RED" Use a 50/50 concentration of any of the following equivalents: Chevron Dex-Cool Texaco ELC Havoline Dex-Cool® Havoline XLC for Europe Shell Dexcool® Shell Rotella Saturn/General Motors Dex-Cool® Caterpillar ELC Detroit Diesel POWERCOOL® Plus | |
| Coolant System Capacity | 7.5 quarts (7.1 liters/litres) | |
| Radiator Cap Pressure | 7 psi (48 kPa) | |
| Drive | Direct to compressor; belts to fans, alternator, and water pump | |

NOTICE

System Contamination!

Do not add "GREEN" or "BLUE-GREEN" conventional coolant to cooling systems using "RED" Extended Life Coolant, except in an emergency. If conventional coolant is added to Extended Life Coolant, the coolant must be changed after 2 years instead of 5 years.

Table 53. SLX Spectrum Units

| | |
|--------------|--|
| Model | TK486V |
| Fuel Type | Diesel fuel must conform to EN590 |
| Oil Capacity | 12.3 liters/litres crankcase and oil filter Fill to full mark on dipstick |

Table 53. SLX Spectrum Units (continued)

| | | |
|---|--|--|
| Oil Type | Petroleum Multi-grade Oil Synthetic Multi-grade Oil | API Type CI-4, ACEA Class E3 API Type CI-4, ACEA Class E3 (after first 500 hours) |
| Oil Viscosity | | -30°C to +0°C: SAE 5W-30 -25°C to +30°C: SAE 10W-30 -25°C to +40°C: SAE 10W-40 -15°C to +40°C (or -10°C to +50°C): SAE 15W-40 |
| Engine RPM | | 2000 +/- 25 RPM High Speed, 1250 +/- 25 RPM Low Speed (PIEK speed) |
| | | NOTICE Equipment Damage! Do NOT operate the engine in ANY unit more than 100 RPM over the high speed setting shown to avoid blower overspeed and/or damage. |
| Engine Oil Pressure | | 2.1 to 5.5 bar (30 to 80 psi) |
| Intake Valve Clearance | | 0.15 to 0.25 mm |
| Exhaust Valve Clearance | | 0.15 to 0.25 mm |
| Valve Setting Temperature | | 21°C |
| Timing Injection Pump | | 12° +/- 1° BTDC (timed on No. 1 cylinder, flywheel side) |
| Low Oil Pressure Switch (Normally Closed) | | 0.55 to 0.83 bar (8 to 12 psi) |
| High Coolant Temperature Switch | | Sensor - 101.7 to 107.2 C or higher (Shutdown) |
| Engine Coolant Thermostat | | 71°C |
| Engine Coolant Type | NOTICE System Contamination! Do not add "GREEN" or "BLUE-GREEN" conventional coolant to cooling systems using "RED" Extended Life Coolant, except in an emergency. If conventional coolant is added to Extended Life Coolant, the coolant must be changed after 2 years instead of 5 years. | |
| Coolant System Capacity | | 7.1 liters/litres with overflow tank 6.6 liters/litres with overflow tank (with Microchannel Coil) |
| Radiator Cap Pressure | | 0.48 bar (7 psi) |
| Drive | Model 30 | Direct to compressor; belts to fans, alternator, and water pump |
| | Model 50 | Centrifugal clutch to compressor; belts to electric standby motor, fans, and water pump |

Belt Tension

Table 54. SB Spectrum Units

| | | | |
|-----------------|--|-------------------------------------|--------------------|
| | | Tension No. on TK Gauge P/N 204-427 | |
| Model 30 | | New Belt | Field Reset |
| Alternator Belt | | 81 | 76 |



Section 9 - Specifications

Table 54. SB Spectrum Units (continued)

| | | | |
|----------------------------------|--|----------|----------|
| Lower Fan Belt (Engine to Idler) | | 88 | 84 |
| Upper Fan Belt (Fan to Idler) | | 88 | 85 |
| Model 50 | | | |
| Alternator Belt | 14 HP Electric Motor 24 HP Electric Motor | 83 80 | 80 76 |
| Compressor Drive Belts | | 94 | 91 |
| Fan Belt | 14 HP Electric Motor 24 HP Electric Motor | 91 90 | 88 86 |
| Water Pump Belt | | 74 | 71 |

Note: These are the field reset settings. Because it is sometimes difficult to use the TK Gauge 204-427 in the field, adjust each belt to allow 1/2 inch (13mm) deflection at the center of the longest span.

Table 55. DE Spectrum Units

| | | Tension No. on TK Gauge P/N 204-427 | |
|----------------------------------|--|-------------------------------------|-------------|
| | | New Belt | Field Reset |
| Alternator Belt | | 75 | 72 |
| Lower Fan Belt (Engine to Idler) | | 88 | 84 |
| Upper Fan Belt (Fan to Idler) | | 88 | 85 |

Note: These are the field reset settings. Because it is sometimes difficult to use the TK Gauge 204-427 in the field, adjust each belt to allow 1/2 inch (13mm) deflection at the center of the longest span.

Table 56. SLX Spectrum Units

| | | Use of Frequency Gauge P/N 204-1903 to measure frequency (Hz) is recommended. | |
|---|--|---|-------------|
| | | New Belt | Field Reset |
| Electric Motor/Compressor Drive Belt (Model 30) | Units fitted with original SLX clutch (up until build date 13 August 2013) | 73-76 | 67-72 |
| | Units fitted with SLX clutch tensioner retrofit (P/N 78-1884) | Use service tool P/N 204-2436 to set belt tension. Distance of 139.0 mm as set by service tool equates to 78-81 Hz for a new belt, and 69-73 Hz for a field reset belt. | |
| | Units fitted with SLXe/SLXi clutch tensioner (P/N 77-3189) | Use service tool P/N 204-2436 to set belt tension. Distance of 139.0 mm as set by service tool equates to 95 Hz for a new belt. | |
| Fan Drive Belt (Model 50) | | 106-118 | 95-108 |
| Water Pump Belt | Tension Number on TK Gauge 204-427 Field Reset: 35-40 | | |

Notes:

1. Use belt tension gauge TK 204-427 whenever possible to check belt tension. However, on some units and on some belts, it is difficult to use the gauge. Adjust these belts to allow 12mm deflection at the center of the longest span. New belts should be tensioned cold and tensioned cold again after 10 hours of unit operation.
2. SLX Spectrum units have one/two automatic tensioning fan drive belt systems, in order to drive the compressor and the evaporator fanshaft. SLX/SLXe only has one. The lower polygroove belt runs from the engine/compressor to the intermediate jackshaft (or electric motor, depending on the unit model). The upper polygroove belt links the intermediate jackshaft to the evaporator fanshaft, incorporating other belt driven components such as the condenser blowers and the alternator.

Refrigeration System

Table 57. SB Spectrum Units

| | | |
|-------------------------------------|---|---|
| Compressor | Thermo King X430L | |
| Refrigerant Type | ⚠ CAUTION Hazardous! Fluorinated Refrigerant gases should not be ventilated to the atmosphere. | |
| Compressor Oil Charge | 6.9 qt (6.6 liters/litres)* | |
| Compressor Oil Type | Polyol Ester type P/N 203-513 | |
| Mechanical Throttling Valve Setting | Model 30 Model 50 | 27 to 29 psi (186 to 200 kPa) 23 to 25 psi (159 to 172 kPa) |
| Heat/Defrost Method | Engine Operation Electric Operation | Hot gas Hot gas and electric heater strips (host only) |
| High Pressure Cutout | | 470 +7/-35 psi (3241 +48/-241 kPa) Automatic reset @ 375 ± 38 psi (2586 ± 262 kPa) |
| High Pressure Switch | Opens Closes | 300 +25/-0 psi (2068 +172/-0 kPa) 200 ± 20 psi (1379 ± 138 kPa) |

* When the compressor is removed from the unit, oil level should be noted or the oil removed from the compressor should be measured so that the same amount of oil can be added before placing the replacement compressor in the unit.

Table 58. DE Spectrum Units

| | | |
|-------------------------------------|---|--|
| Compressor | Thermo King X430L | |
| Refrigerant Type | ⚠ CAUTION Hazardous! Fluorinated Refrigerant gases should not be ventilated to the atmosphere. | |
| Compressor Oil Charge | 6.9 qt (6.6 liters/litres)* | |
| Compressor Oil Type | Polyol Ester type P/N 203-513 | |
| Mechanical Throttling Valve Setting | 27 to 29 psi (186 to 200 kPa) | |
| Heat/Defrost Method | Hot gas | |
| High Pressure Cutout | 470 +7/-35 psi (3241 +48/-241 kPa) Automatic reset @ 375 ± 38 psi (2586 ± 262 kPa) | |
| High Pressure Switch | Opens Closes | 300 +25/-0 psi (2068 +172/-0 kPa) 200 ± 20 psi (1379 ± 138 kPa) |

* When the compressor is removed from the unit, oil level should be noted or the oil removed from the compressor should be measured so that the same amount of oil can be added before placing the replacement compressor in the unit.



Section 9 - Specifications

Table 59. SLX Spectrum Units

| | | | | |
|--|---|---|--|--|
| Compressor | Thermo King X430LSC5 | | | |
| Refrigerant Charge | ⚠ CAUTION Hazardous! Fluorinated Refrigerant gases should not be ventilated to the atmosphere. | | | |
| Compressor Oil Charge | X430LSC5 | 4.10 liters/litres** 6.62 liters/litres (deep sump)** Note: Add 0.7 liter/litre for remote evaporator system tubing (with shallow sump). | | |
| Compressor Oil Type | Polyol Ester P/N 203-413 | | | |
| Throttling Valve Setting | SLX Spectrum (Model 30) SLX Spectrum (Model 50) | 1.86 to 2 bar (27 to 29 psi) 1.59 to 1.73 bar (23 to 25 psi) | | |
| High Pressure Cutout | Opens: 32.41 +/- 0.48 bar (470 +/- psi) Closes: Automatic reset @ 25.86 +/- 2.62 bar (375 +/- 38 psi) | | | |
| High Pressure Relief Valve | Opens: 34.48 +/- 3.45 bar (500 +/- 50 psi) Reset: 27.58 bar (400 psi) | | | |
| Heat/Defrost Method | Engine Operation Electric Operation | Hot gas Hot gas and electric heater strips (Model 50) | | |
| Electronic Defrost Termination Switch | Coil must be below 7°C for defrost initiation Coil must be above 14°C for defrost termination | | | |
| <small>* From January 2015. Refer to the refrigerant decal on the unit to confirm refrigerant type. <small>** When the compressor or compressor oil filter is removed from the unit, oil level should be noted or the oil removed from the compressor should be measured so that the same amount of oil can be added before placing the replacement compressor in the unit.</small></small> | | | | |
| Notes: <ol style="list-style-type: none"> SLXe units from January 2015 are available with R-404A or R-452A Refrigerants. Both of which comply with F-Gas legislation revision 2014 (Regulation (EC) No 517/2014). Verify the refrigerant type (label on outside of unit), and do not cross-contaminate. | | | | |

Electrical Control System

Table 60. SB Spectrum Units

| | |
|---|--|
| Voltage | 12.5 Vdc |
| Battery | One, Group C31, 12 volt battery (950 CCA recommended for operation below -15°F or -26°C) |
| Fuses | Refer to Section 2 |
| Battery Charging | Model 30/50 with 24 HP Motor Option, and Later Model 50 without 24 HP Motor Option: 12 volt, 37 amp, brush type, Thermo King Alternator (65 amp alternator optional) Early Model 50 without 24 HP Motor Option: 12 volt, 105 amp, brush type, Prestolite Alternator |
| Voltage Regulator Setting | 13.8 to 14.3 volts @ 77°F (25°C) |
| Note: Fuse F4 (Bypass resistor for Prestolite alternator) must be removed for the Thermo King alternator. Thermo King alternators are painted black. The label on Prestolite alternators states "Made in USA". | |

Table 61. DE Spectrum Units

| | |
|---|--|
| Voltage | 12.5 Vdc |
| Battery | One, Group C31, 12 volt battery (950 CCA recommended for operation below -15°F or -26°C) |
| Fuses | Refer to Section 2 |
| Battery Charging | 12 volt, 37 amp, brush type, Thermo King Alternator |
| Voltage Regulator Setting | 13.8 to 14.3 volts @ 77°F (25°C) |
| Note: Fuse F4 (Bypass resistor for Prestolite alternator) must be removed for the Thermo King alternator. Thermo King alternators are painted black. | |

Table 62. SLX Spectrum Units

| | |
|--|---|
| Voltage | 12.5 VDC (nominal) |
| Battery | Wet Cell: 12 volt, AHr Rating - 92AHrs, 760 Cold Cranking Amps at -18°C EON: 12 volt, AHr Rating - 64AHrs, 880 Cold Cranking Amps at -18°C |
| Fuses | Refer to Section 2. |
| Battery Charging (Alternator) | 120 ampere brush type |
| Voltage Regulator Setting (Alternator) | 13.8 to 14.2 volts @ 25°C |
| Fusible Link | 16 gauge wire (100 to 110 amperes) |
| Alternator/Regulator LED Diode | Used when replacing "Old Style" Integral Regulator Alternators with "New Style" Remote Regulator Alternators: 4.7 mFd 50 Vdc |
| Alternator/Output Capacitor | Used to Filter Electrical Interference on "Old Style" Integral Regulator Alternators: 0.5 mFd 100 Vdc |

Electrical Components

Table 63. SB Spectrum Units

| Note: Disconnect components from the unit circuit to check resistance. | | | |
|---|---|---------------------------------|--------------------------|
| Component | | Current Draw (Amps) at 12.5 Vdc | Resistance – Cold (Ohms) |
| Fuel Solenoid | Pull-in Coil Hold-in Coil | 35 to 45 0.5 | 0.2 to 0.3 24 to 29 |
| Damper Solenoid | | 5.7 | 2.2 |
| High Speed (Throttle) Solenoid | | 2.9 | 4.3 |
| Condenser Inlet Solenoid | | 1.3 | 9.6 |
| Liquid Line Solenoid in Host Unit | | 1.5 | 8.3 |
| Liquid Line Solenoids in Remote Units | | 1.3 | 9.6 |
| Hot Gas Solenoids | | 1.5 | 8.3 |
| Suction Line Solenoids | | 1.3 | 9.6 |
| Receiver Tank Pressure Solenoid | | 0.7 | 17.0 |
| Purge Valve | Units without 24 HP Motor Option Units with 24 HP Motor Option | 0.7 1.3 | 17.0 9.6 |
| Air Heater | | 70.0 to 89.0 | 0.14 |
| Starter Motor | | 350 to 475* | |
| * On-the-engine cranking check. Bench test is approximately 140 amps. | | | |



Section 9 - Specifications

Table 64. DE Spectrum Units

| Note: Disconnect components from the unit circuit to check resistance. | | | |
|---|------------------------------|--|---------------------------------|
| Component | | Current Draw (Amps) at 12.5 Vdc | Resistance – Cold (Ohms) |
| Fuel Solenoid | Pull-in Coil Hold-in Coil | 35 to 45 0.5 | 0.2 to 0.3 24 to 29 |
| Damper Solenoids (Each) | | 5.7 | 2.2 |
| High Speed (Throttle) Solenoid | | 2.9 | 4.3 |
| Condenser Inlet Solenoid | | 1.3 | 9.6 |
| Liquid Line Solenoid in Host Unit | | 1.5 | 8.3 |
| Liquid Line Solenoids in Remote Units | | 1.3 | 9.6 |
| Hot Gas Solenoids | | 1.5 | 8.3 |
| Suction Line Solenoids | | 1.3 | 9.6 |
| Receiver Tank Pressure Solenoid | | 0.7 | 17.0 |
| Purge Valve | | 0.7 | 17.0 |
| Air Heater | | 70.0 to 89.0 | 0.14 |
| Starter Motor | | 35 to 475* | |

* On-the-engine cranking check. Bench test is approximately 140 amps.

Table 65. SLX Spectrum Units

| Note: Disconnect components from the unit circuit to check resistance. | | | |
|---|------------------------------|--|---------------------------------|
| Component | | Current Draw (Amps) at 12.5 Vdc | Resistance – Cold (Ohms) |
| Starter Motor | | 350 to 475 (cranking) | |
| Air Heater | | 89.0 | 0.14 |
| Fuel Solenoid | Pull-in Coil Hold-in Coil | 35 to 45 0.5 or 1.0 | 0.2 to 0.3 24 to 29 |
| Throttle Solenoid | | 2.9 | 4.3 |
| Pilot Solenoid | | 0.7 | 17.0 |
| Condenser Inlet Solenoid | | 1.3 | 9.6 |
| Liquid Line Solenoid (Front and Rear) | | 1.3 | 9.6 |
| Hot Gas Bypass Solenoid | | 1.3 | 9.6 |
| Remote Hot Gas Solenoid | | 1.3 | 9.6 |
| Suction Line Solenoids | | 1.3 | 9.6 |
| Receiver Tank Pressure Solenoid | | 0.7 | 17.0 |
| Purge Valve | | 0.9 | 17.0 |
| Hot Gas Bypass Valve (Option) | SLXe/SLXi Only | 1.1 | 11.1 |

Electric Standby (Model 50 Units Only)

Electric Motor and Overload Relay

Table 66. SB Spectrum Units

| Voltage/Phase/Frequency | Horsepower | Kilowatts | RPM | Full Load (amps) | Overload Relay Setting (amps) |
|-------------------------|------------|-----------|------|------------------|-------------------------------|
| 230/3/60 | 14.0 | 10.4 | 1755 | 37.8 | 38 |
| 460/3/60 | 14.0 | 10.4 | 1755 | 18.9 | 20 |
| 460/3/60 | 24.0 | 17.9 | 3500 | 29 | 31 |

Electric Heater Strips (Optional)

Table 67. SB Spectrum Units

| | |
|------------|-------------------|
| Number | 3 |
| Watts | 1000 watts (each) |
| Resistance | 48 ohms (each) |

Standby Power Cord Requirements

Table 68. SB Spectrum Units

| | | |
|------------------------|--|---|
| Supply Circuit Breaker | 14 HP Motor 230/3/60 14 HP Motor 460/3/60 24 HP Motor 460/3/60 | 70 amps 40 amps 60 amps |
| Extension Cord Size | 14 HP Motor 230/3/60 | 8 AWG Power Cable, 25 to 50-foot length |
| | 14 HP Motor 230/3/60 | 6 AWG Power Cable, 75-foot length |
| | 14 HP Motor 460/3/60 | 10 AWG Power Cable, up to 75-foot length |
| | 24 HP Motor 460/3/60 | 8 AWG, 4-Conductor, 2000V, Type W Power Cable, up to 75-foot length |

Table 69. SLX Spectrum Units

| | | |
|------------------------|--|---|
| Supply Circuit Breaker | 190-230/3/50-60 380-460/3/50-60 | 70 ampere 40 ampere |
| Extension Cord Size | 190-230/3/50-60 380-460/3/50-60 | Up to 15m, 10mm ² Over 15m, 16mm ² Up to 15m, 6mm ² Over 15m, 10mm ² |

Electric Fuel Heater (Optional)

Table 70. SB Spectrum Units

| | | |
|------------------------|--|--|
| Electric Fuel Heater: | Resistance Current Draw at 12.5 Vdc Internal Thermostat Minimum Closing Temp Internal Thermostat Maximum Opening Temp | 0.9 to 1.1 Ohms 11.4 to 13.9 Amps 30°F (-1°C) 75°F (24°C) |
| W Fuse | | 3 Amps |
| Diesel Power Fuse | | 3 Amps |
| 2A/2FH Circuit Breaker | | 20 Amps, manual reset |



Section 9 - Specifications

Table 71. DE Spectrum Units

| | | |
|------------------------|--|--|
| Electric Fuel Heater: | Resistance Current Draw at 12.5 Vdc Internal Thermostat Minimum Closing Temp Internal Thermostat Maximum Opening Temp | 0.9 to 1.1 Ohms 11.4 to 13.9 Amps 30°F (-1°C) 75°F (24°C) |
| W Fuse | | 3 Amps |
| Diesel Power Fuse | | 3 Amps |
| 2A/2FH Circuit Breaker | | 20 Amps, manual reset |

Remote Evaporator

Refrigeration System

Table 72. SLX Spectrum Units

| | |
|----------------------|---|
| Evaporator Coil Type | Direct Expansion |
| Refrigerant Type | R-404A R-452A (released as an option January 2015) |
| Heat/Defrost Method | Hot Gas |

Electrical System

Table 73. SLX Spectrum Units

| | | |
|------------------------------|---------------------------------------|--|
| Control System Voltage | 12.5 Vdc | |
| Circuit Protection | Smart FETs in the Expansion Module | |
| Fan Motors (Each) | Power Rating RPM Full Load Amps | 0.13 hp (100 Watts) 2500 7.0 amps (per motor) (6.0 amps - S-2 from Jan 2012) |
| Remote Liquid Line Solenoid | Current Draw Resistance | 1.3 Amps (Units built from October 2015: the remote evaporator states "PTC" (remote Liquid line solenoid pulsing) - current draw remains the same) 9.6 Ohms |
| Remote Hot Gas Solenoid | Current Draw Resistance | 1.5 Amps 8.3 Ohms |
| Remote Suction Line Solenoid | Current Draw Resistance | 1.5 Amps 8.3 Ohms |
| Drain Heaters (Each) | Current Draw Resistance | 2.0 Amps 6.1 Ohms |

Section 10 - Diagrams

Diagram Index

The following table lists the SR-2/SR-3 control system schematic and wiring diagrams.

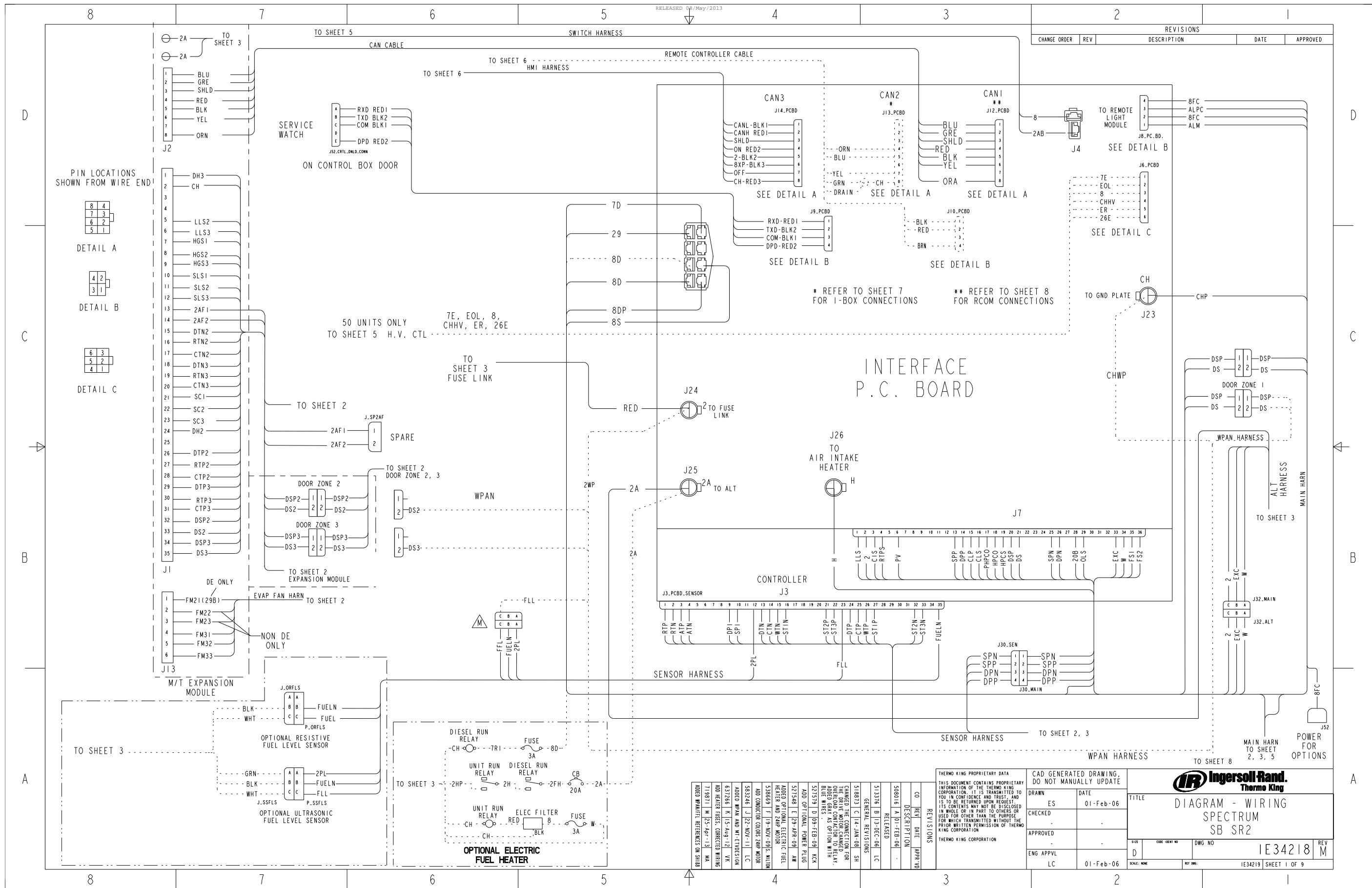
| Drawing No. | Title |
|-------------|---------------------------------|
| 1E34218 | Spectrum SB Wiring Diagram |
| 1E34219 | Spectrum SB Schematic Diagram |
| 1E42257 | Spectrum SLX Schematic Diagram |
| 1E42258 | Spectrum SLX Wiring Diagram |
| 3E31535 | Spectrum SLXi Schematic Diagram |



THERMO KING

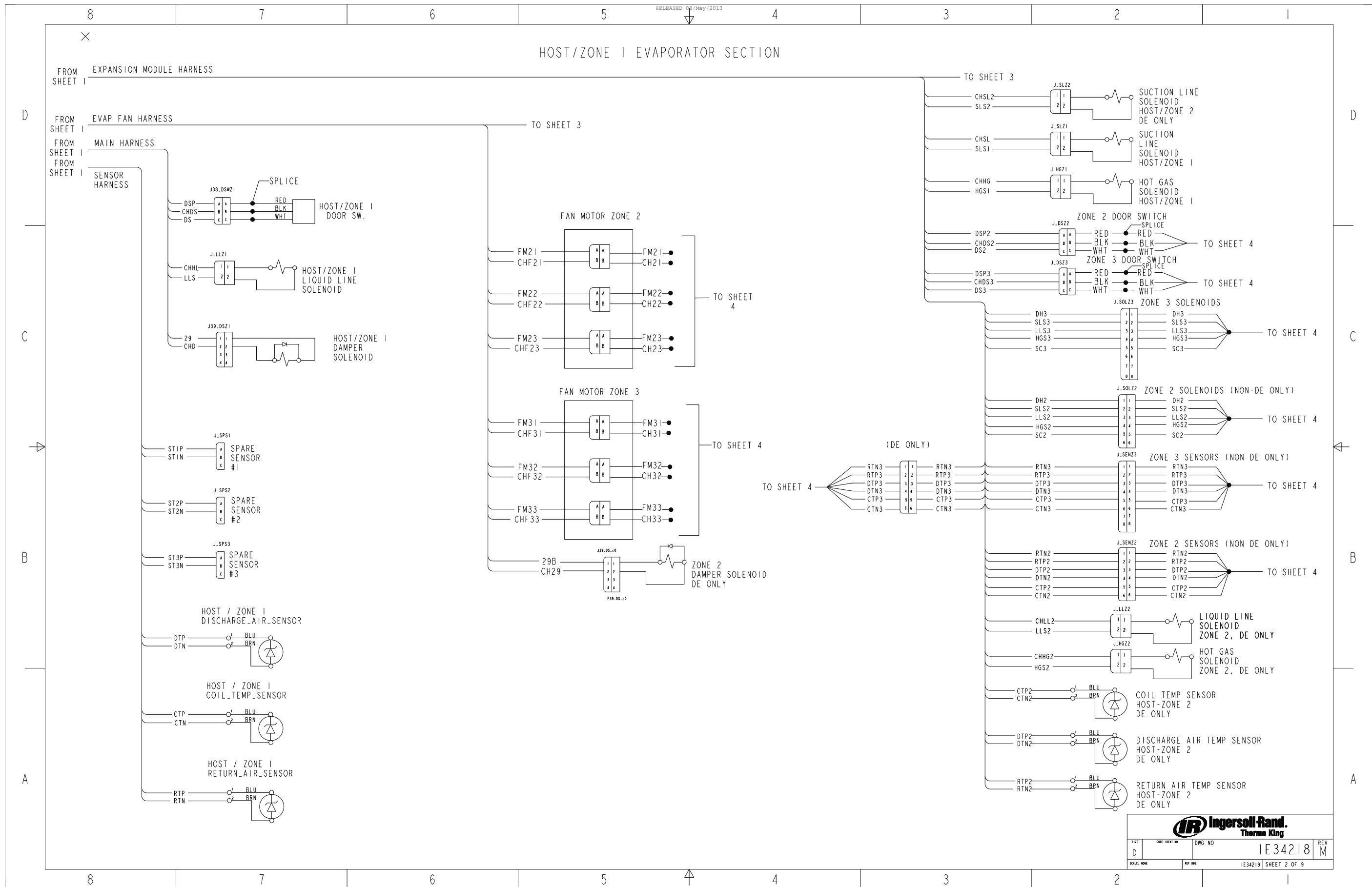
Section 10 - Diagrams

Figure 193. 1E34218 (Sheet 1 of 9)



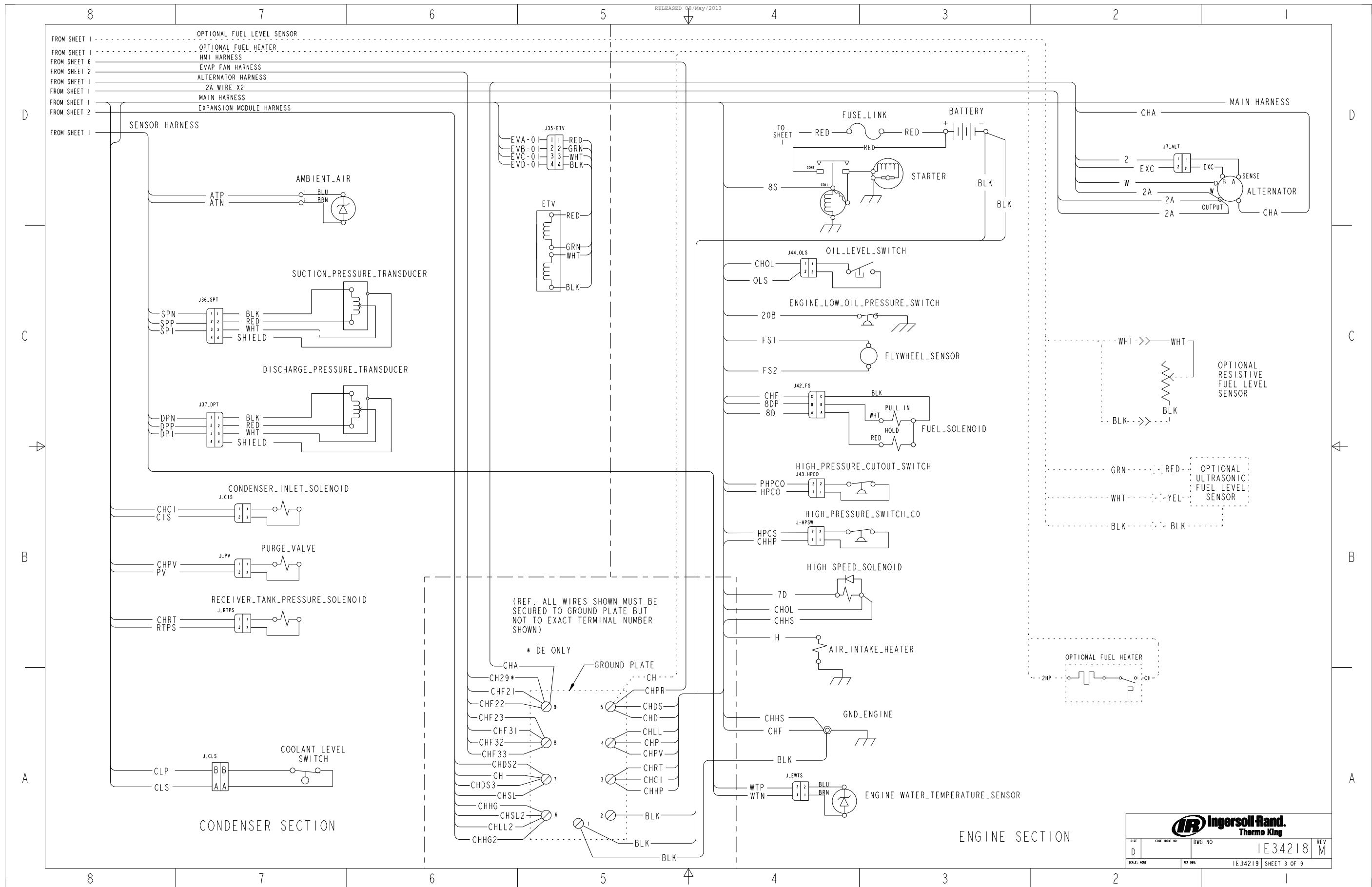
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Figure 194. 1E34218 (Sheet 2 of 9)



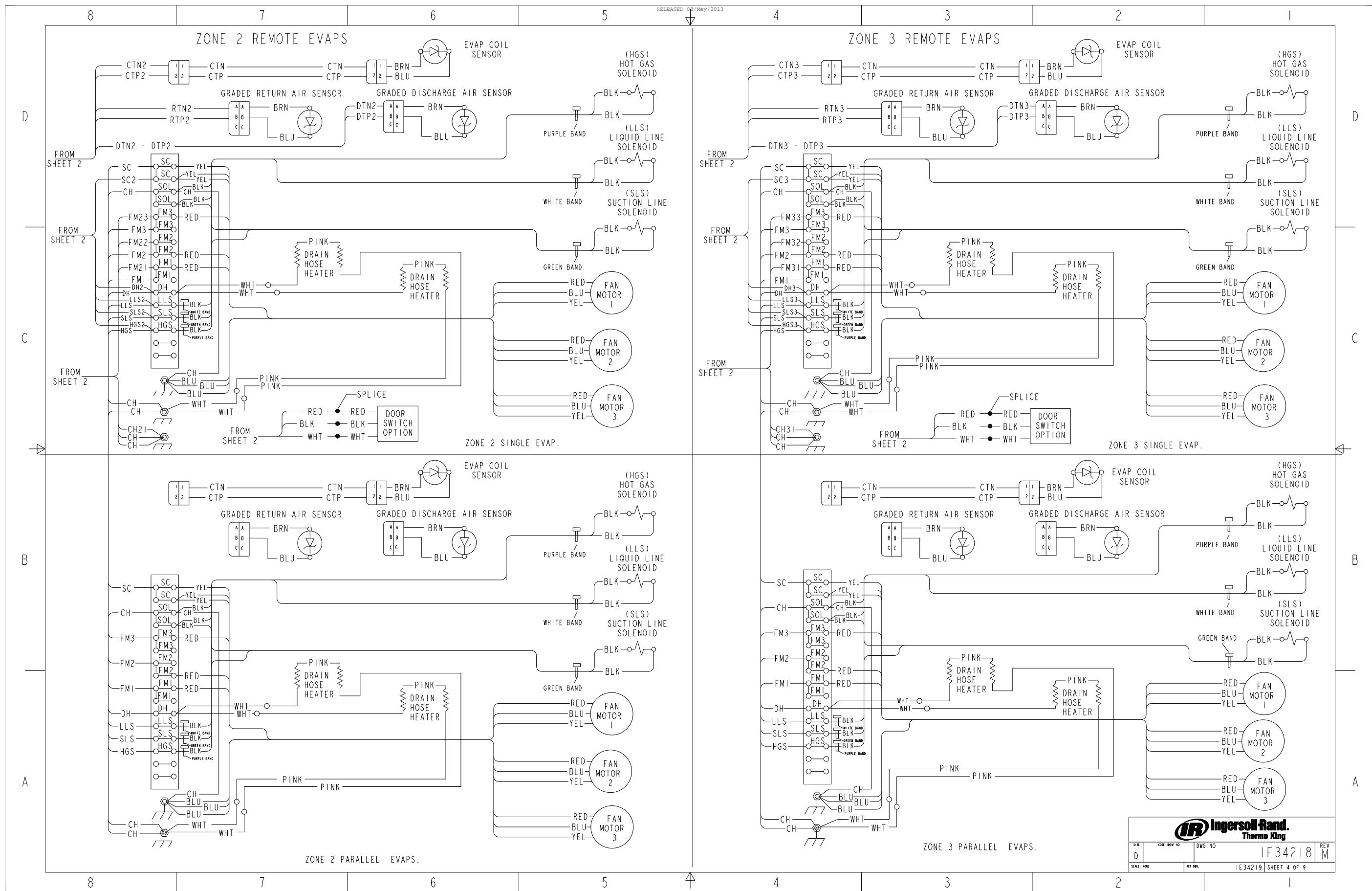
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Figure 195. 1E34218 (Sheet 3 of 9)



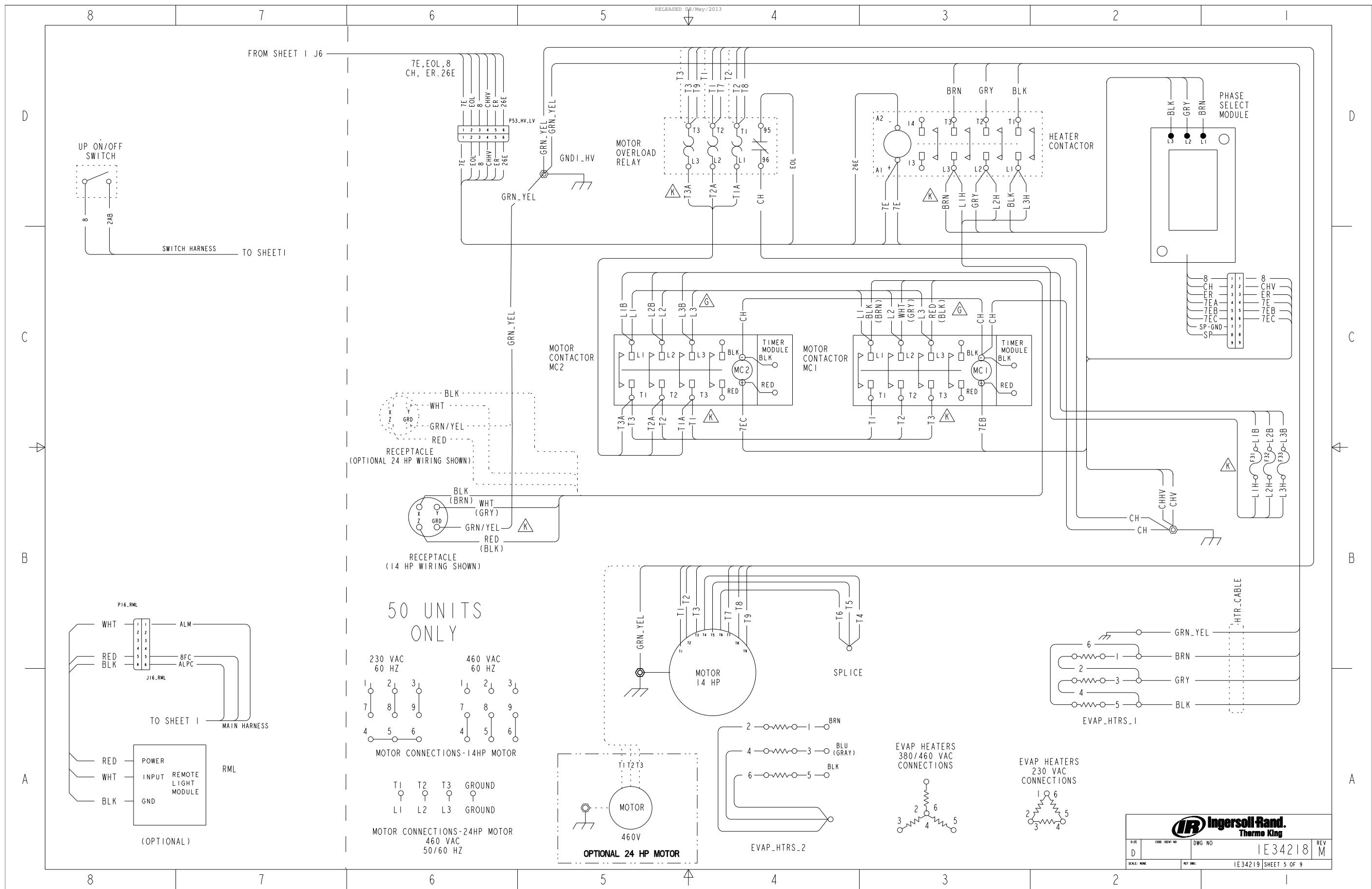
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Figure 196. 1E34218 (Sheet 4 of 9)



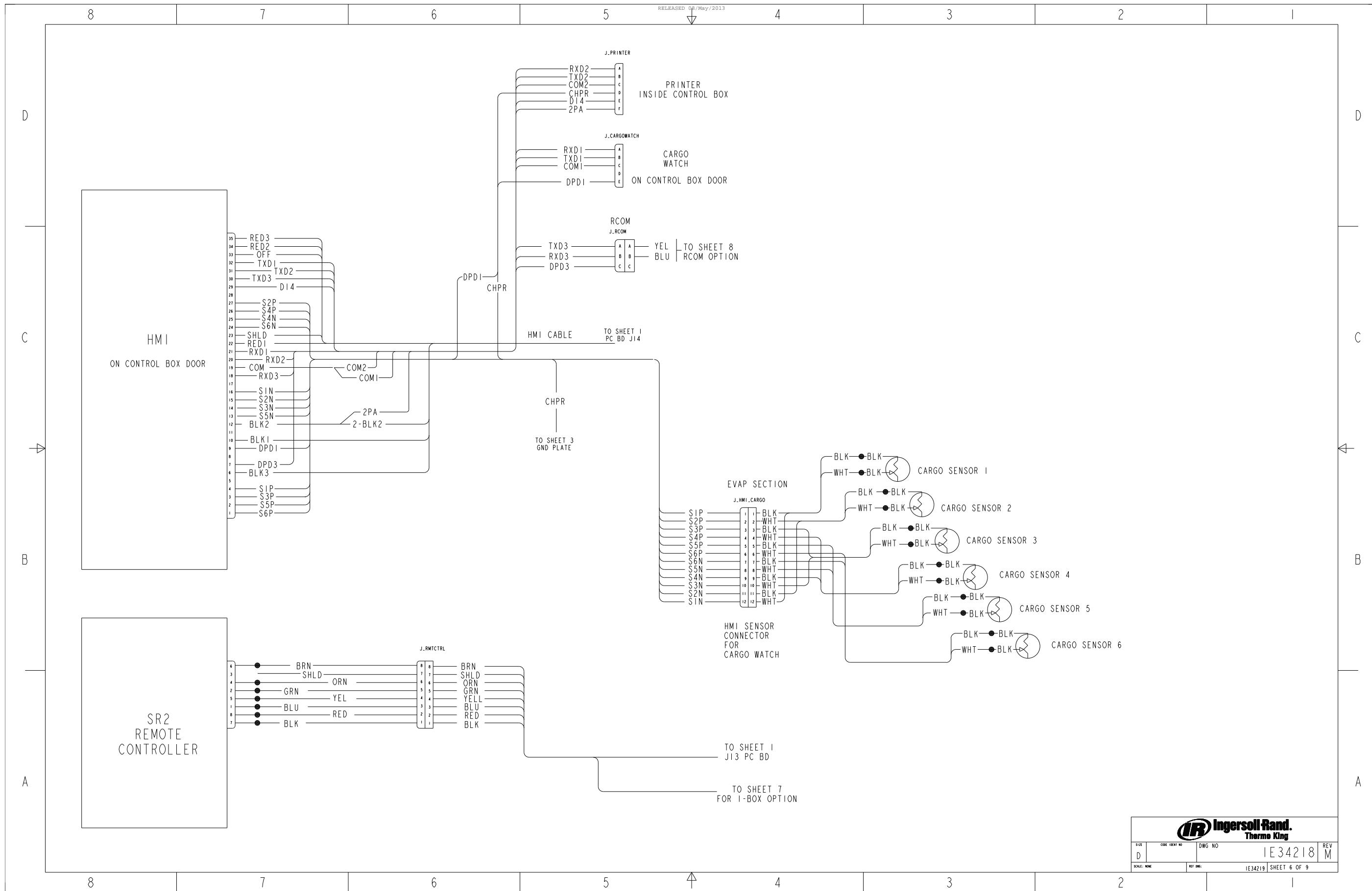
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Figure 197. 1E34218 (Sheet 5 of 9)



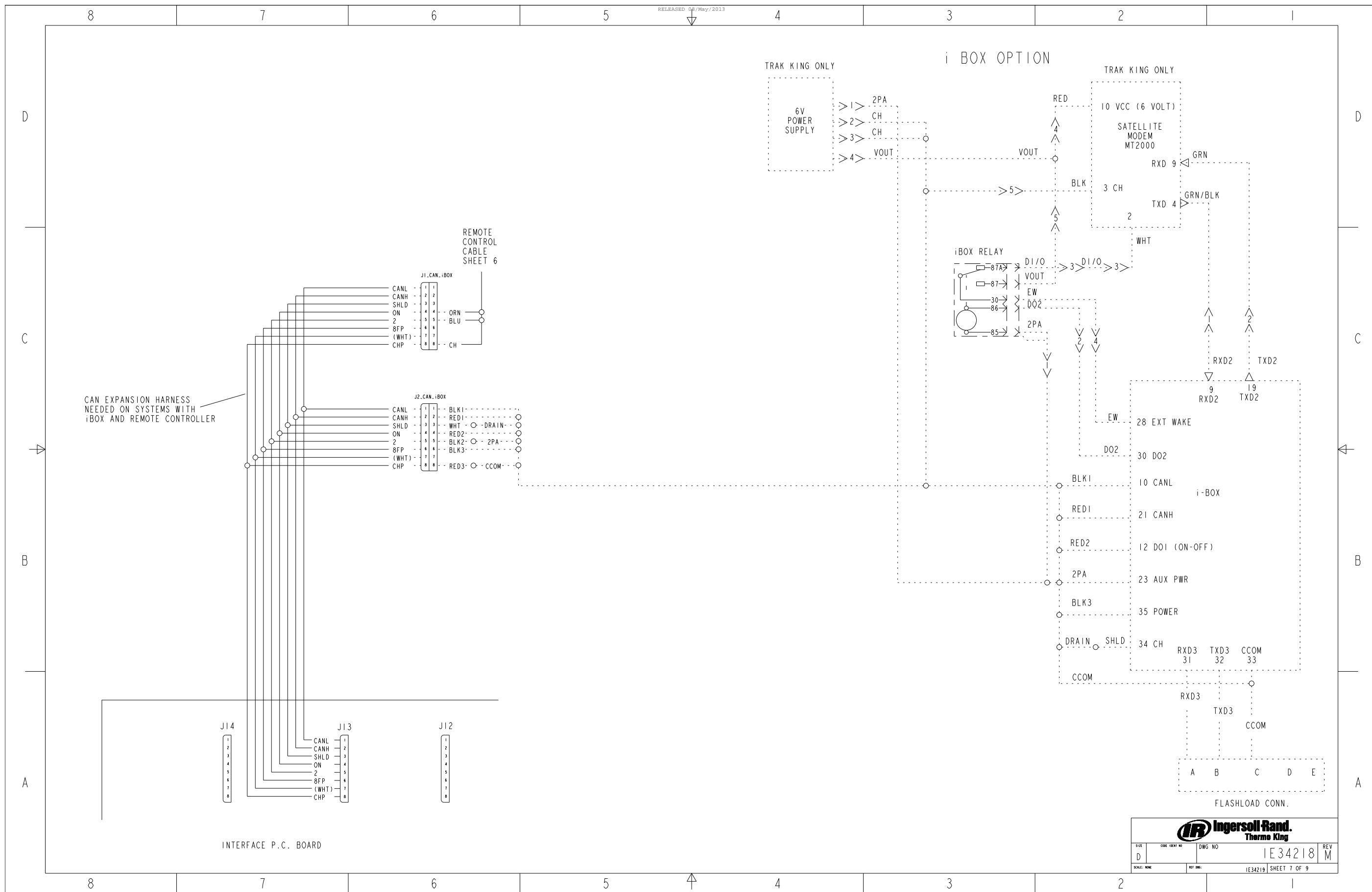
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Figure 198. 1E34218 (Sheet 6 of 9)



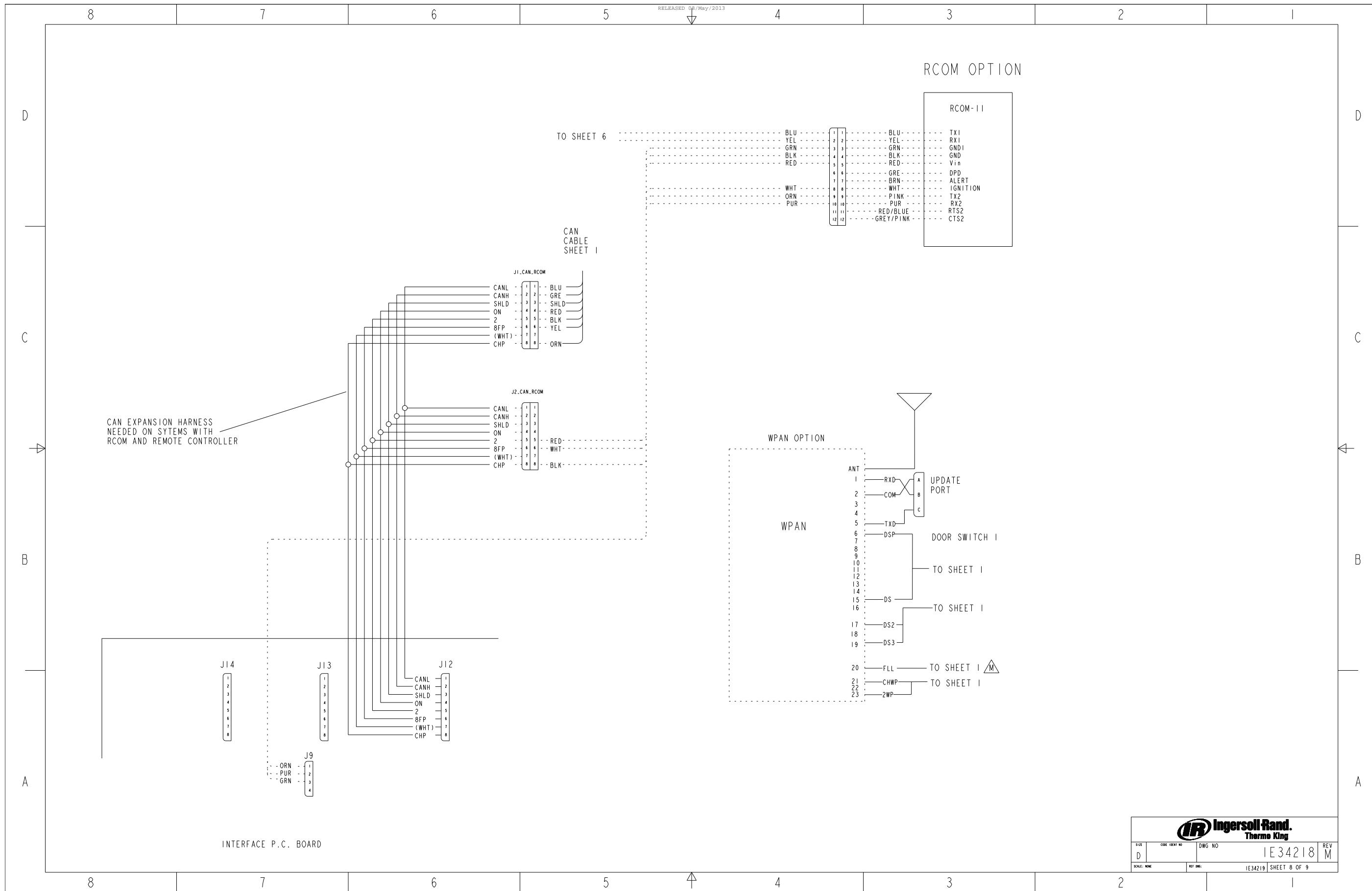
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Figure 199. 1E34218 (Sheet 7 of 9)



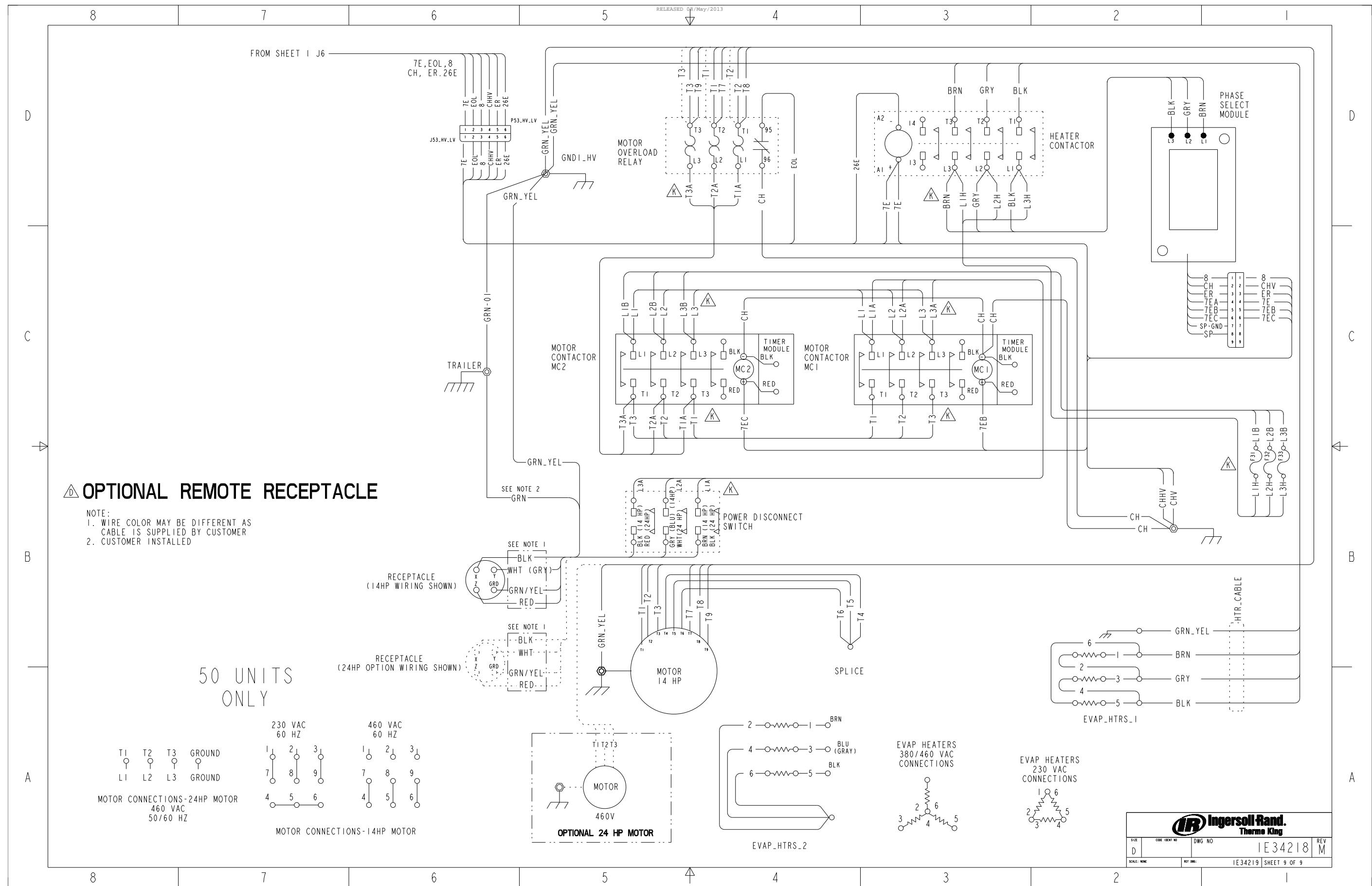
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Figure 200. 1E34218 (Sheet 8 of 9)



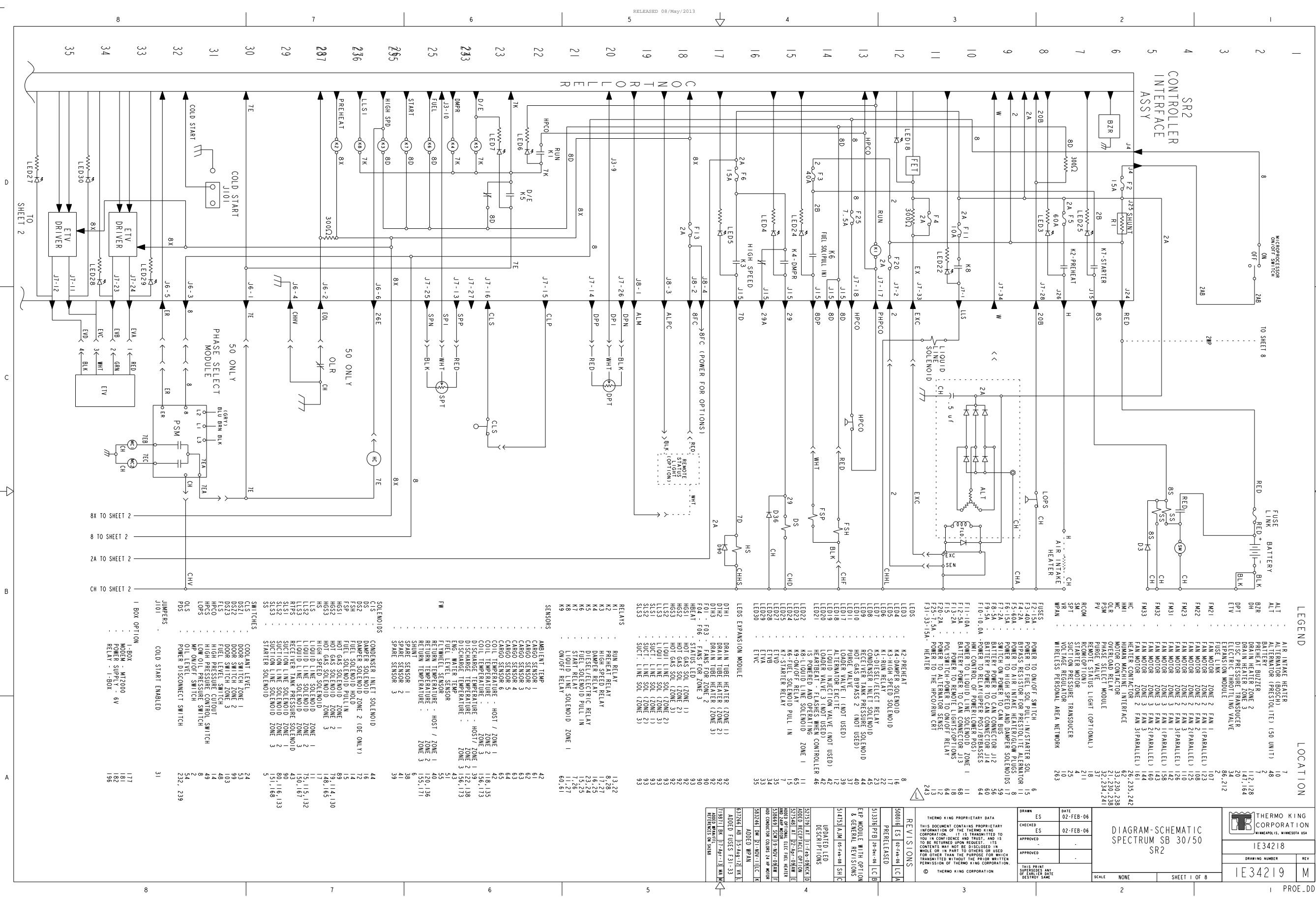
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Figure 201. 1E34218 (Sheet 9 of 9)



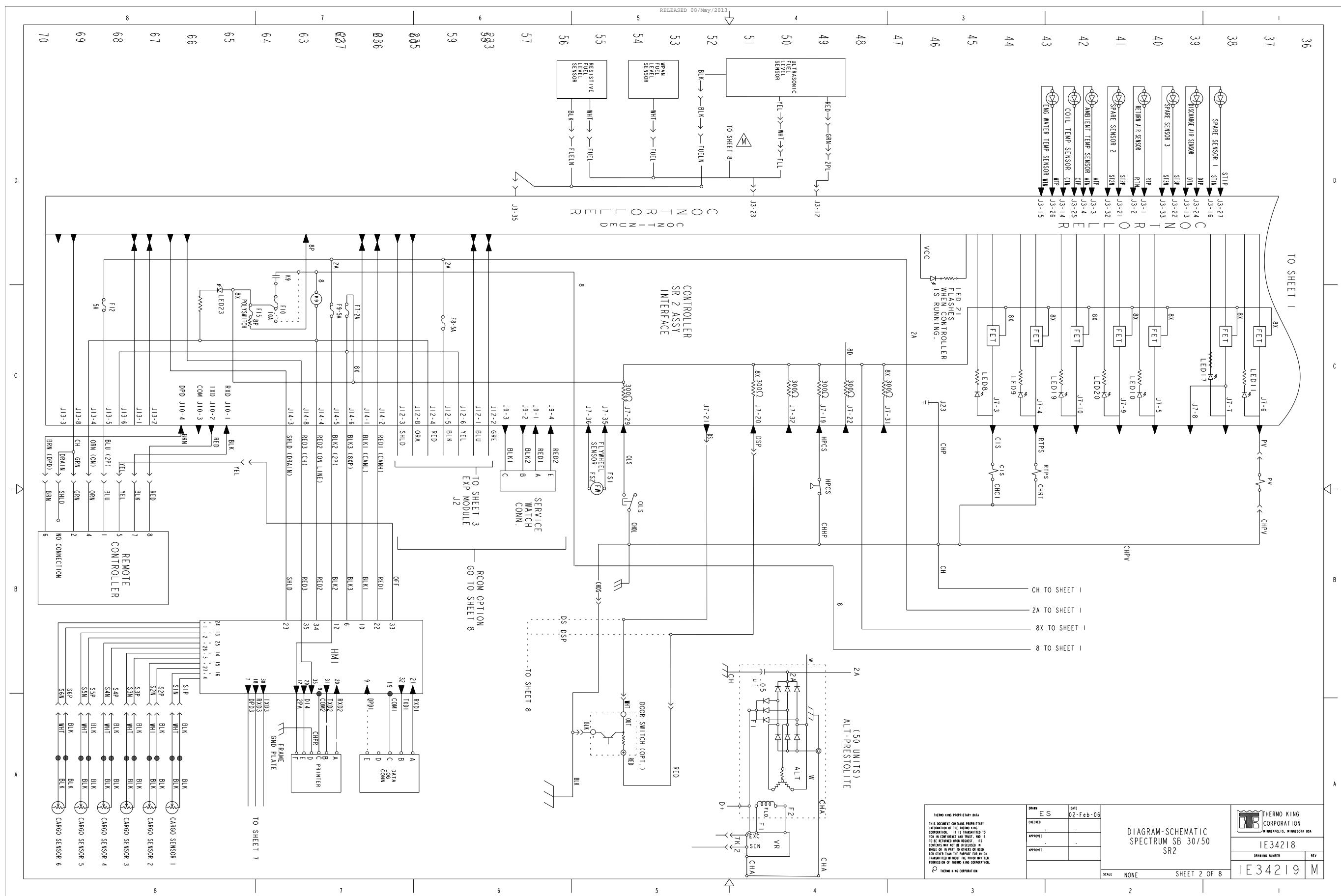
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Figure 202. 1E34219 (Sheet 1 of 8)



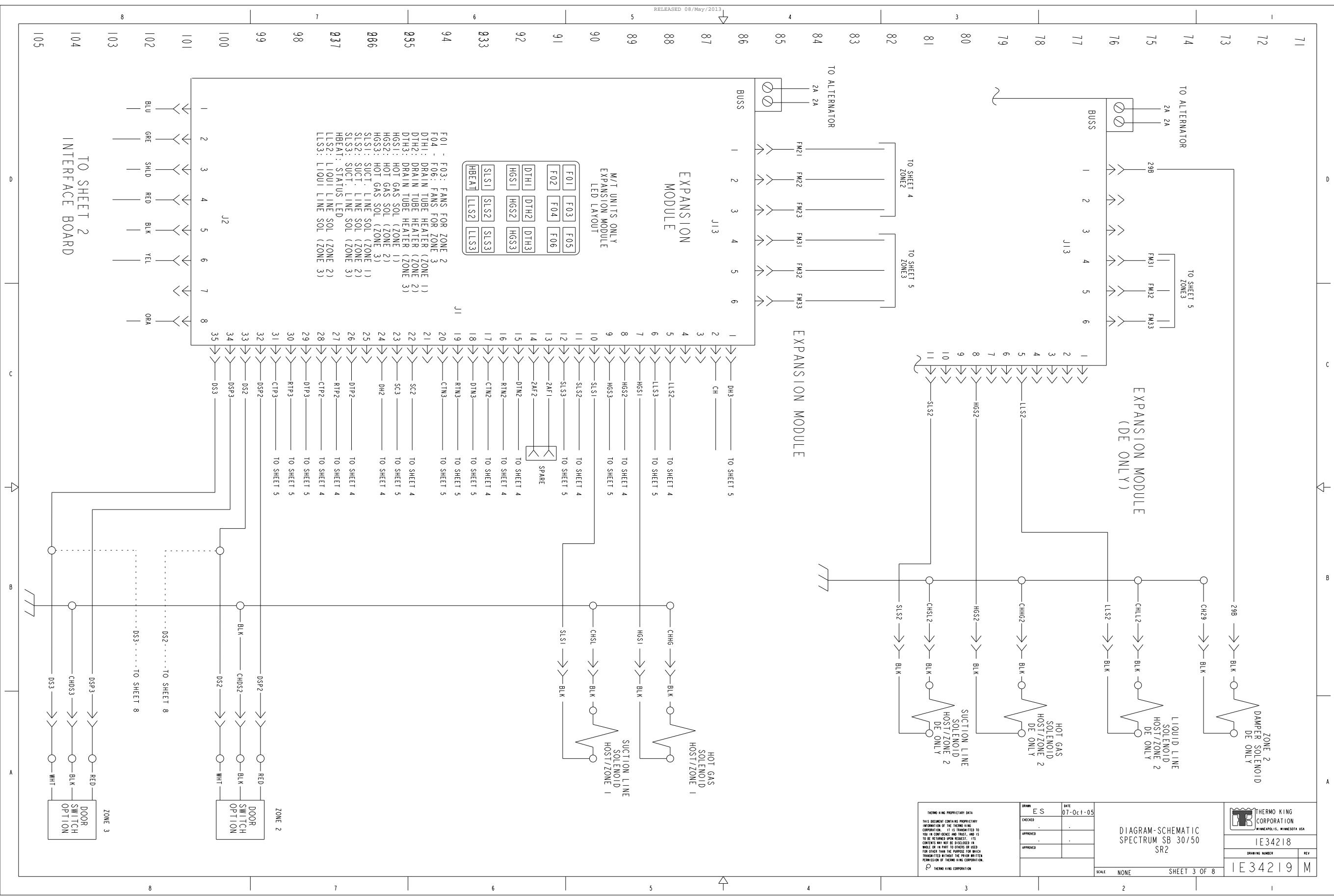
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Figure 203. 1E34219 (Sheet 2 of 8)



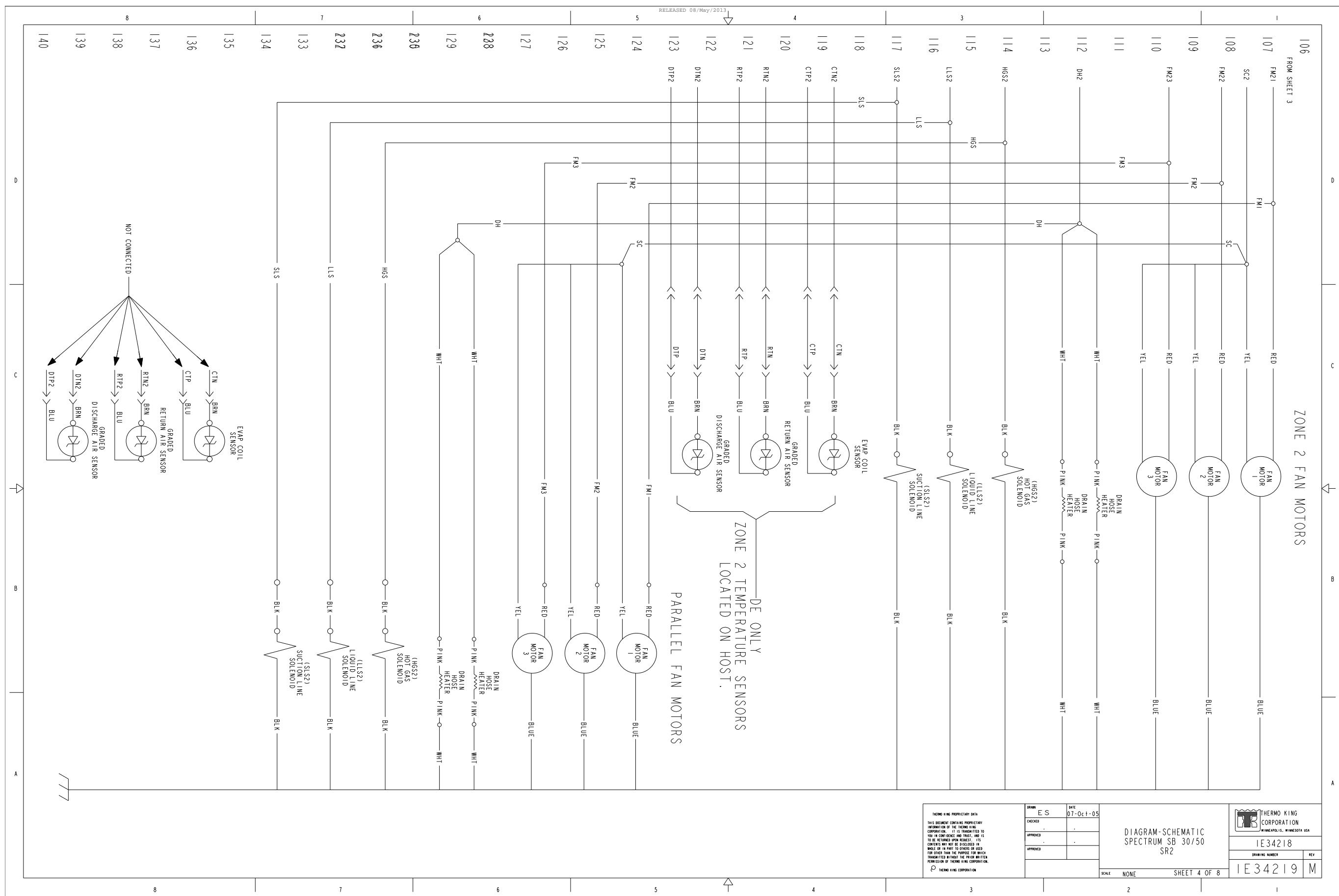
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Figure 204. 1E34219 (Sheet 3 of 8)



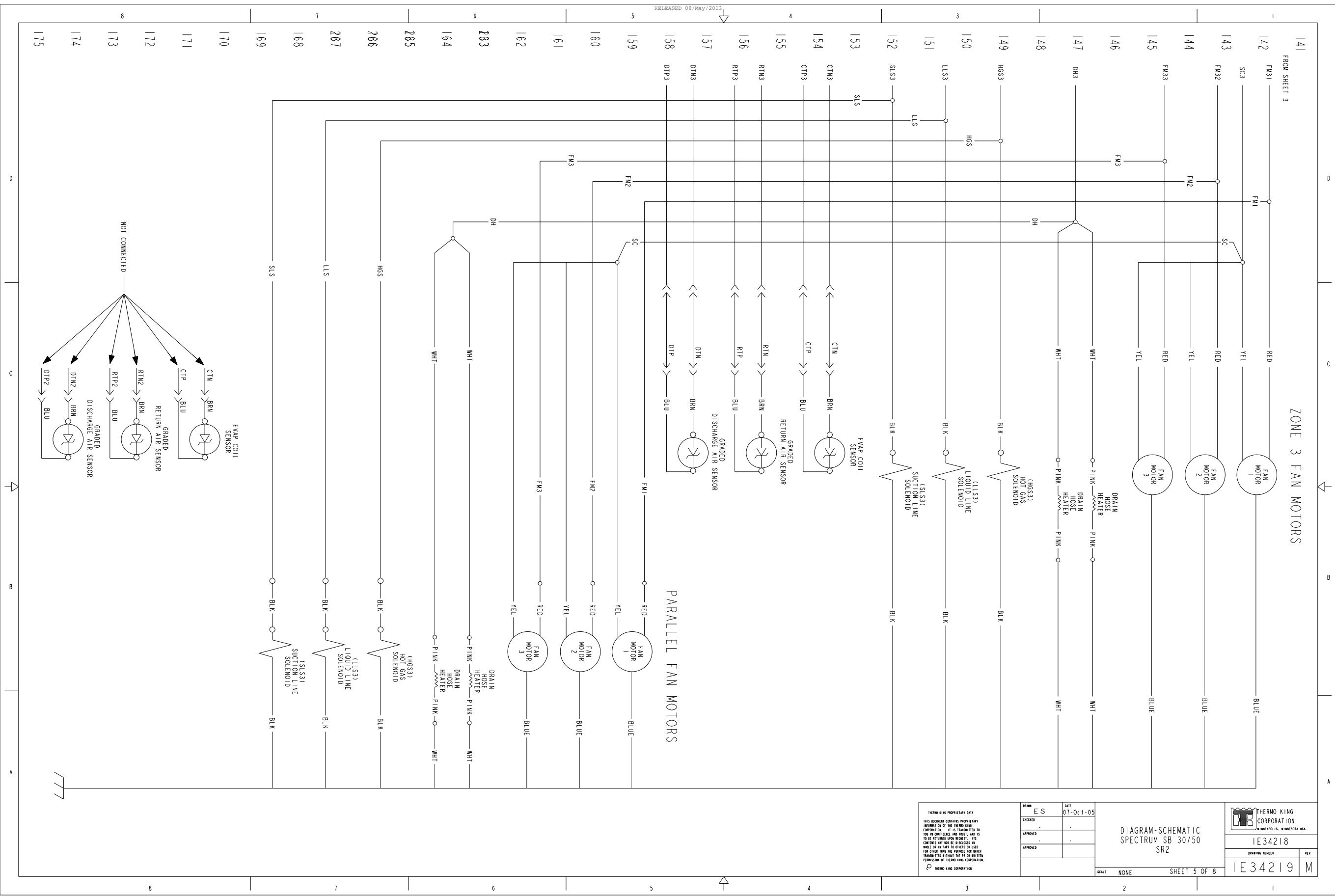
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Figure 205. 1E34219 (Sheet 4 of 8)



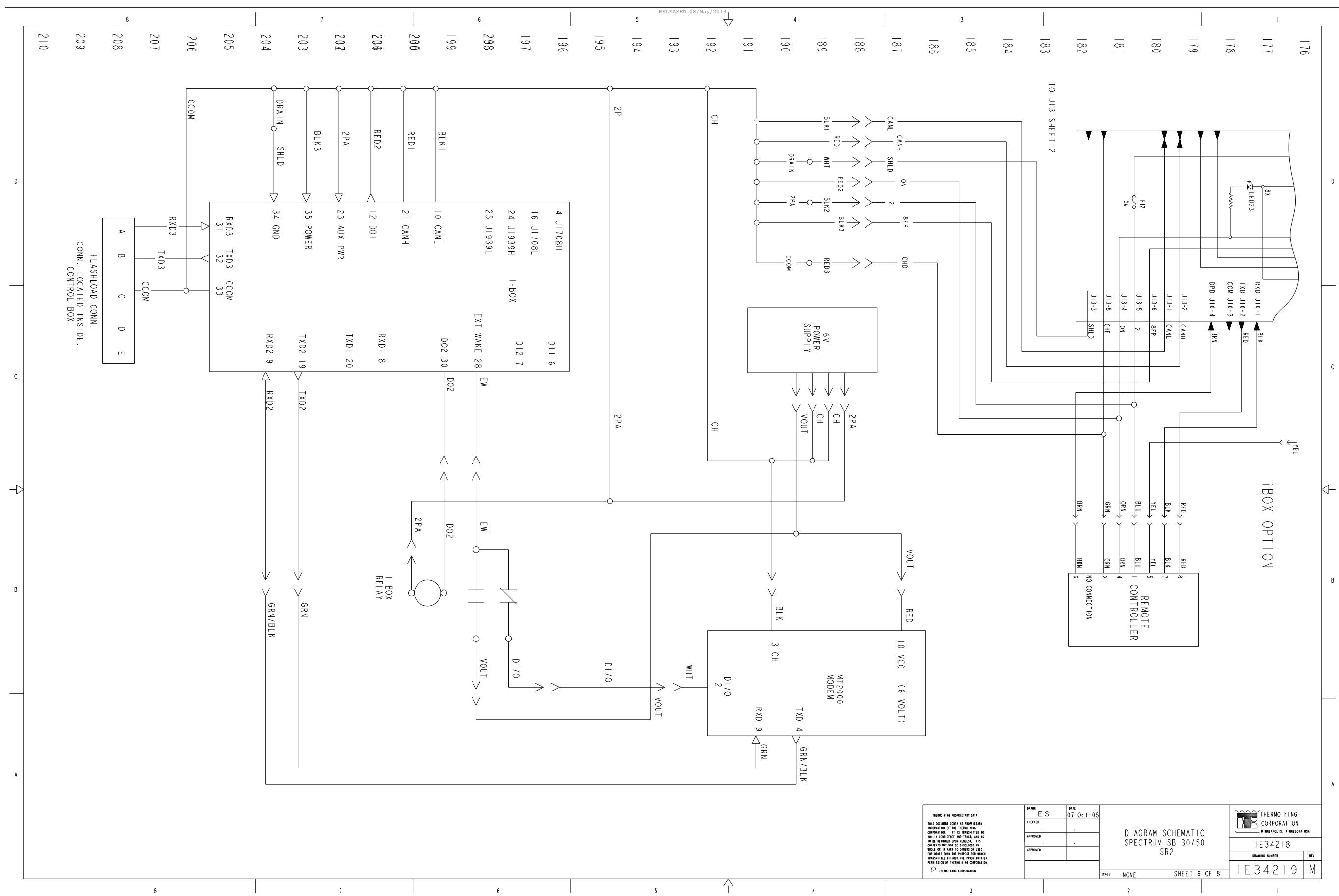
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Figure 206. 1E34219 (Sheet 5 of 8)



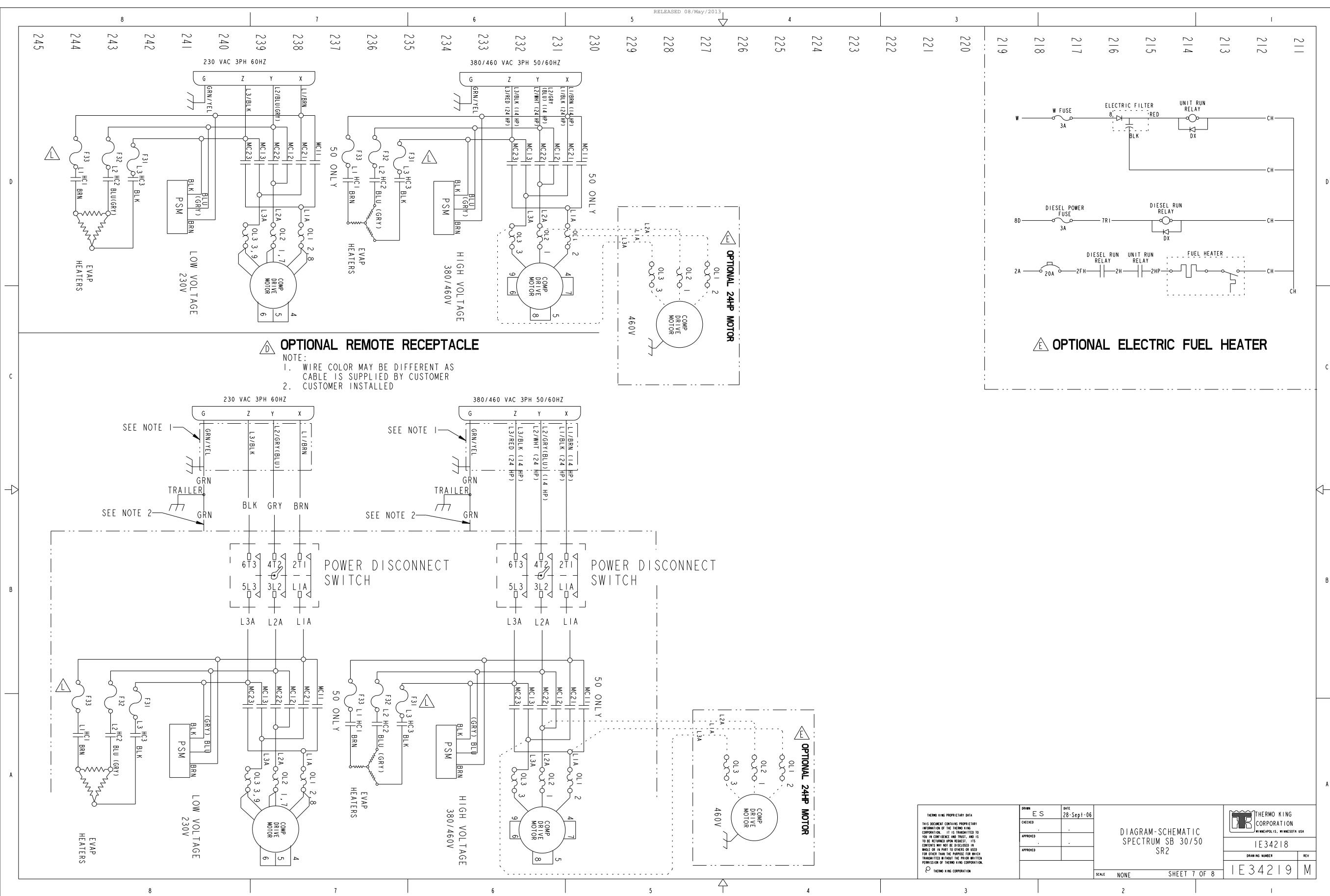
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Figure 207. 1E34219 (Sheet 6 of 8)



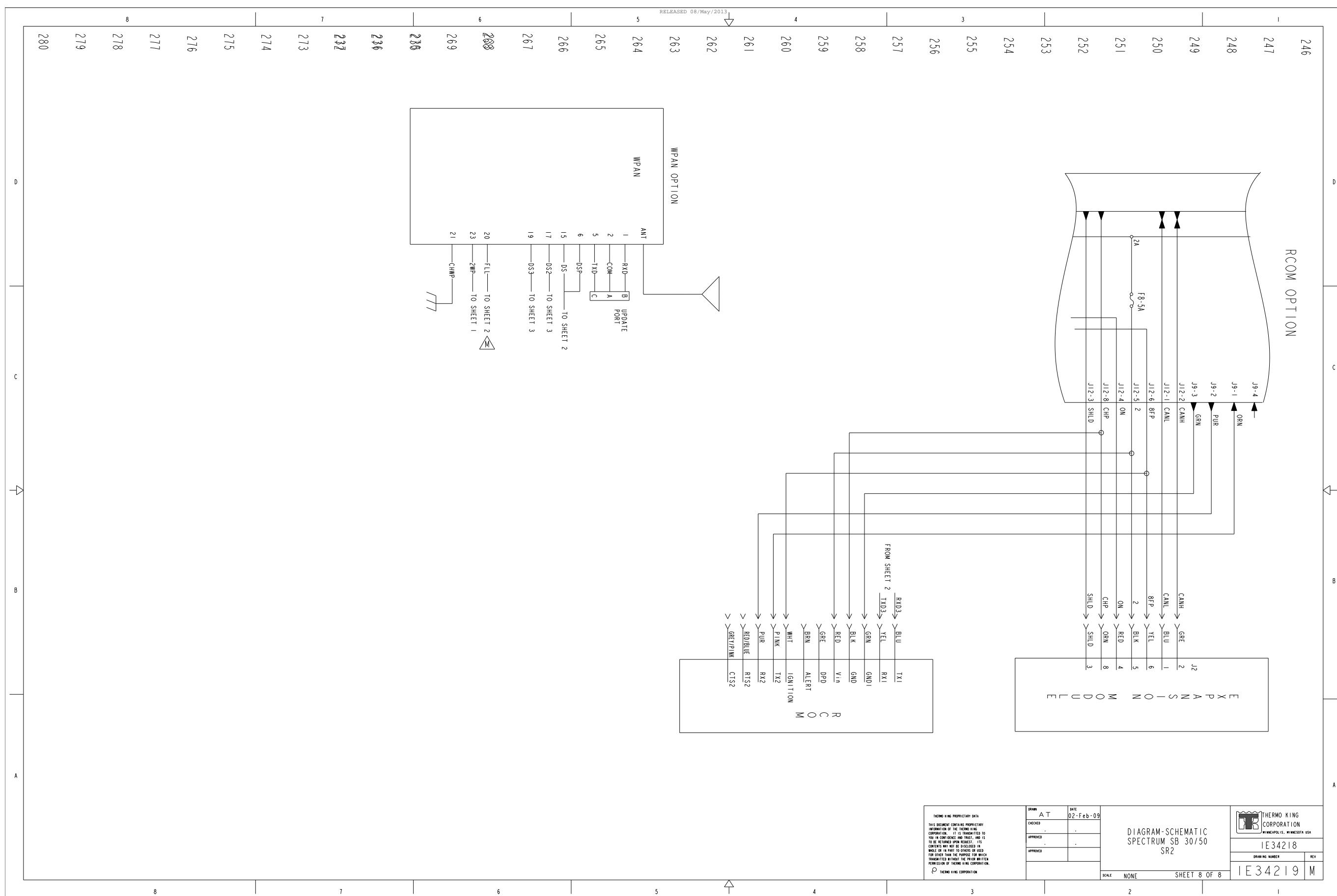
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Figure 208. 1E34219 (Sheet 7 of 8)



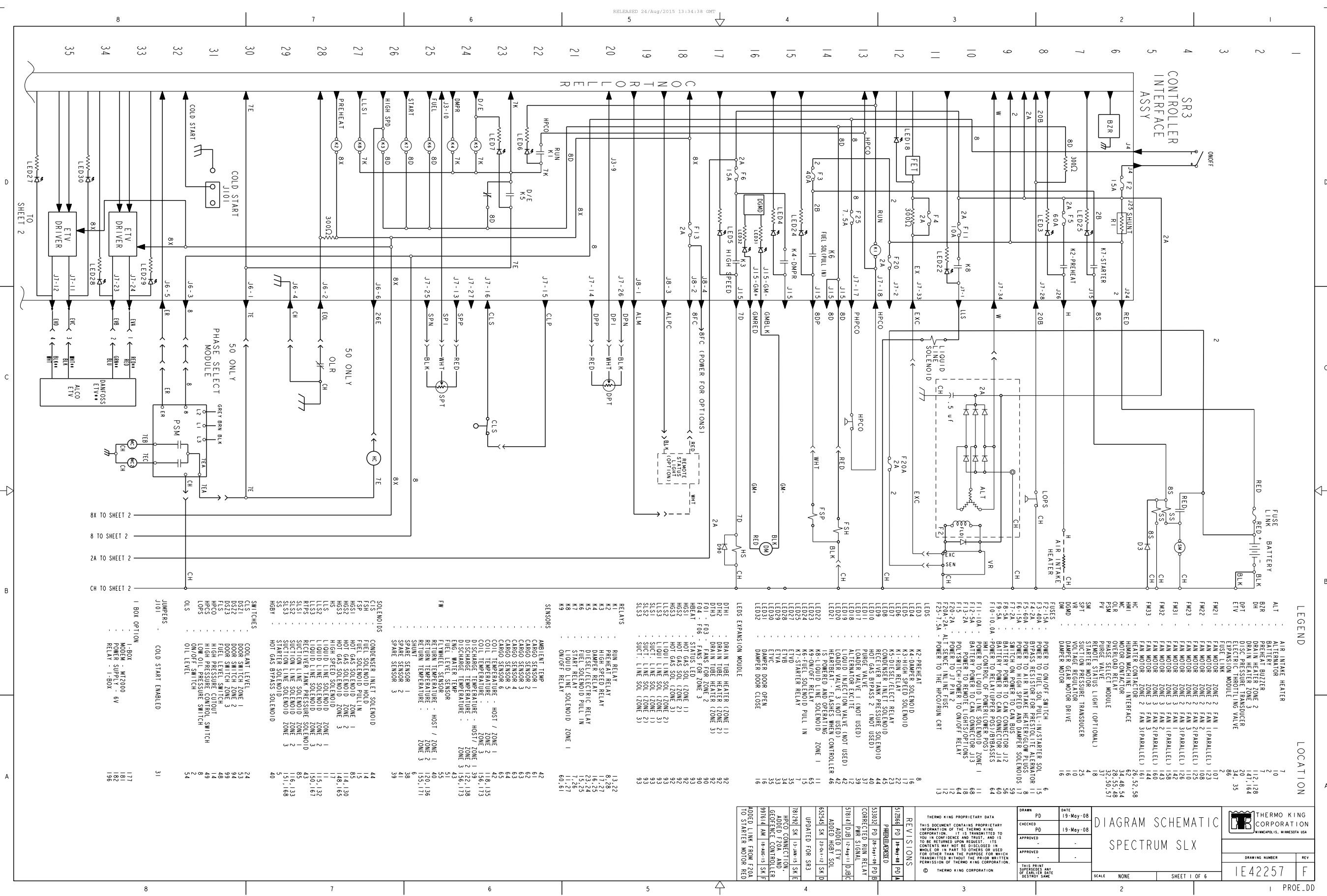
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Figure 209. 1E34219 (Sheet 8 of 8)



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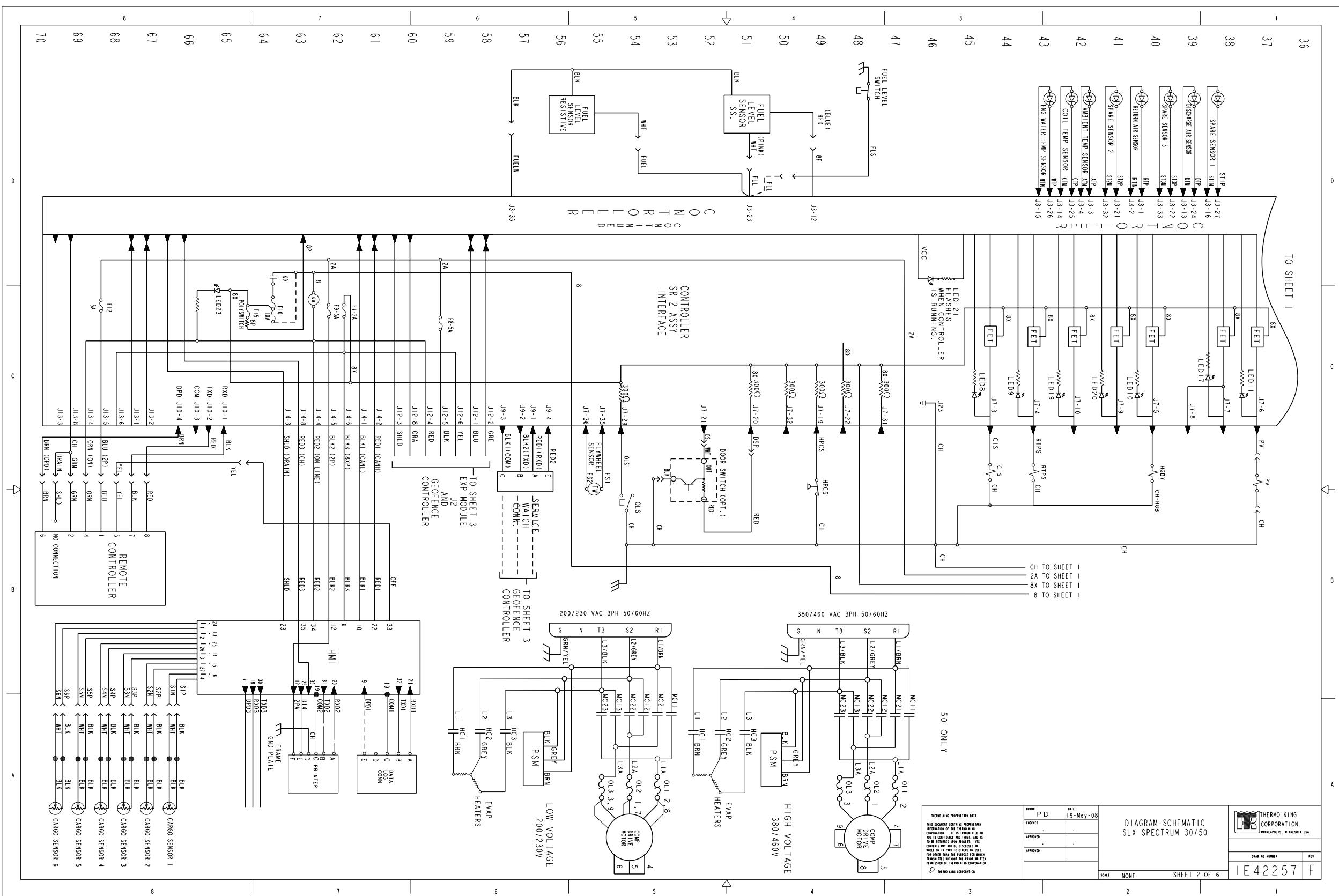
Figure 210. 1E42257 (Sheet 1 of 6)



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Figure 211. 1E42257 (Sheet 2 of 6)

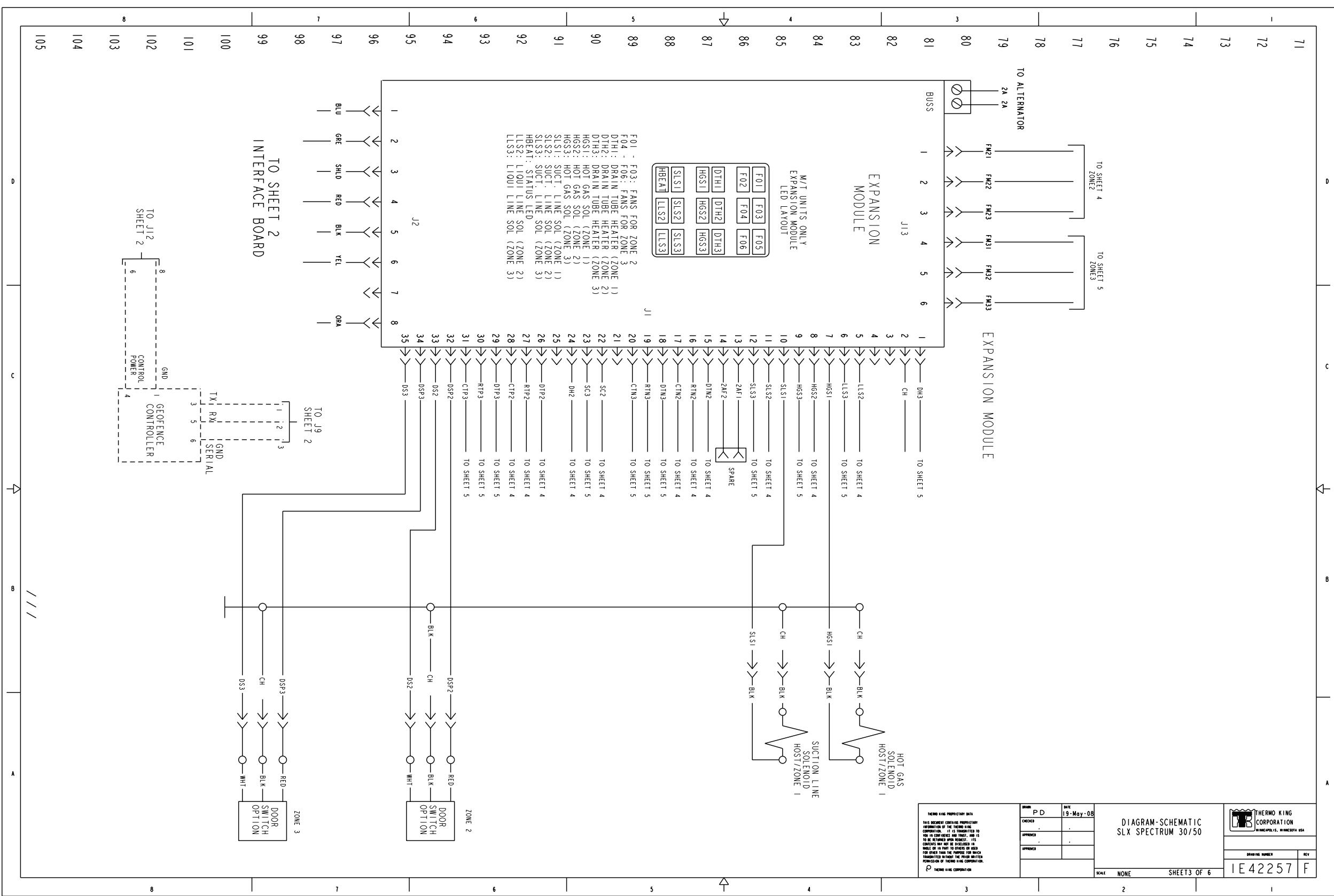
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Figure 212. 1E42257 (Sheet 3 of 6)

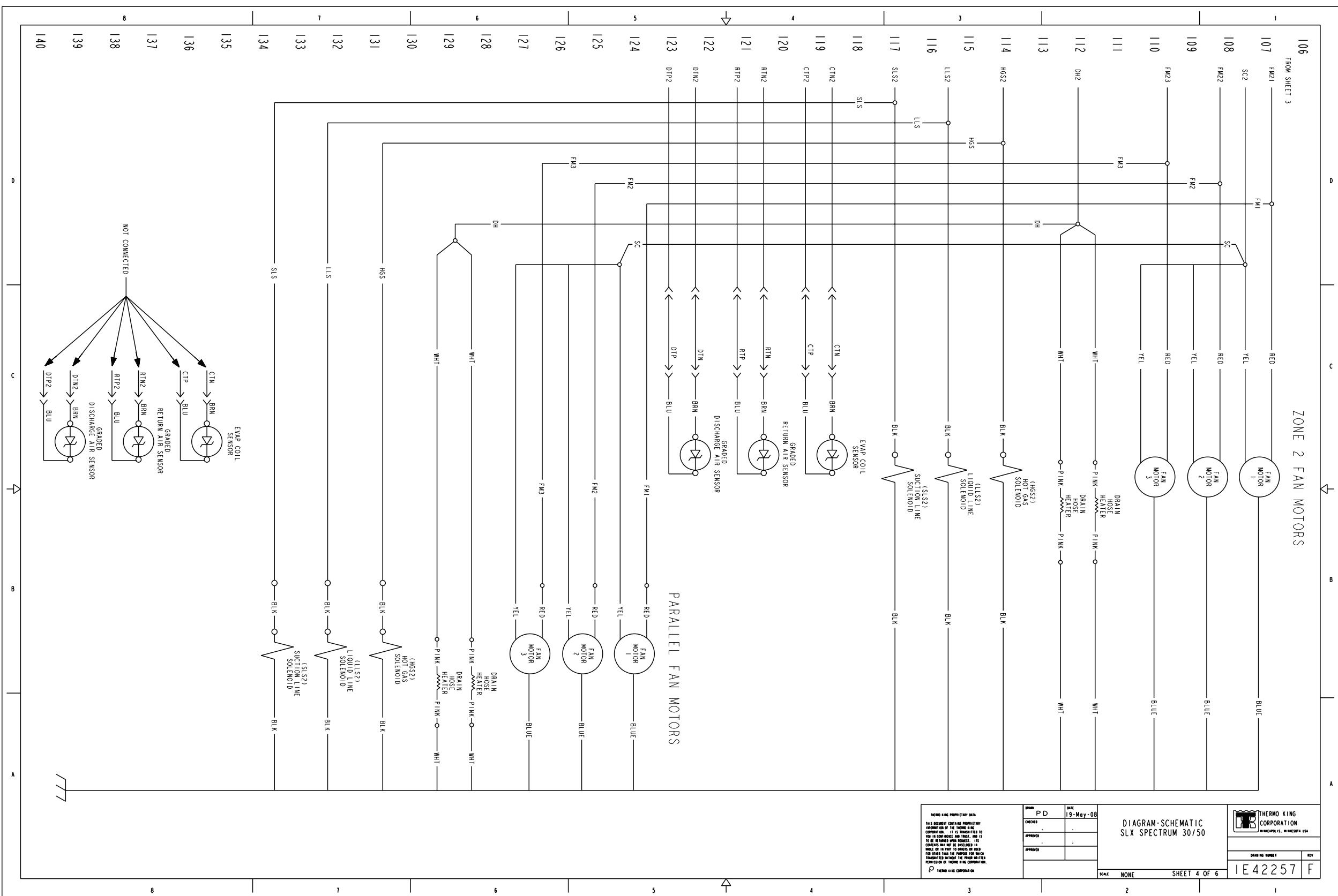
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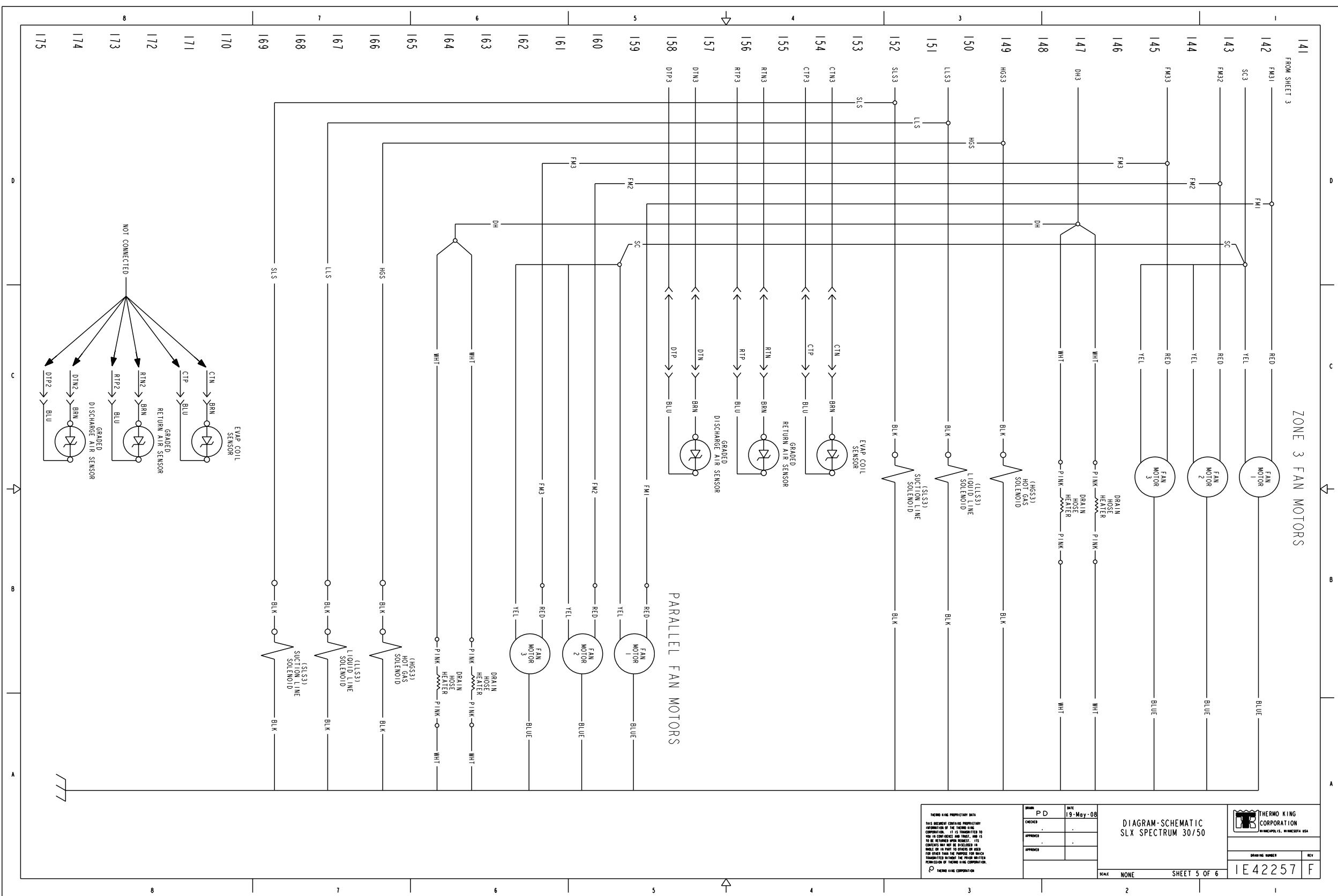
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Figure 214. 1E42257 (Sheet 5 of 6)

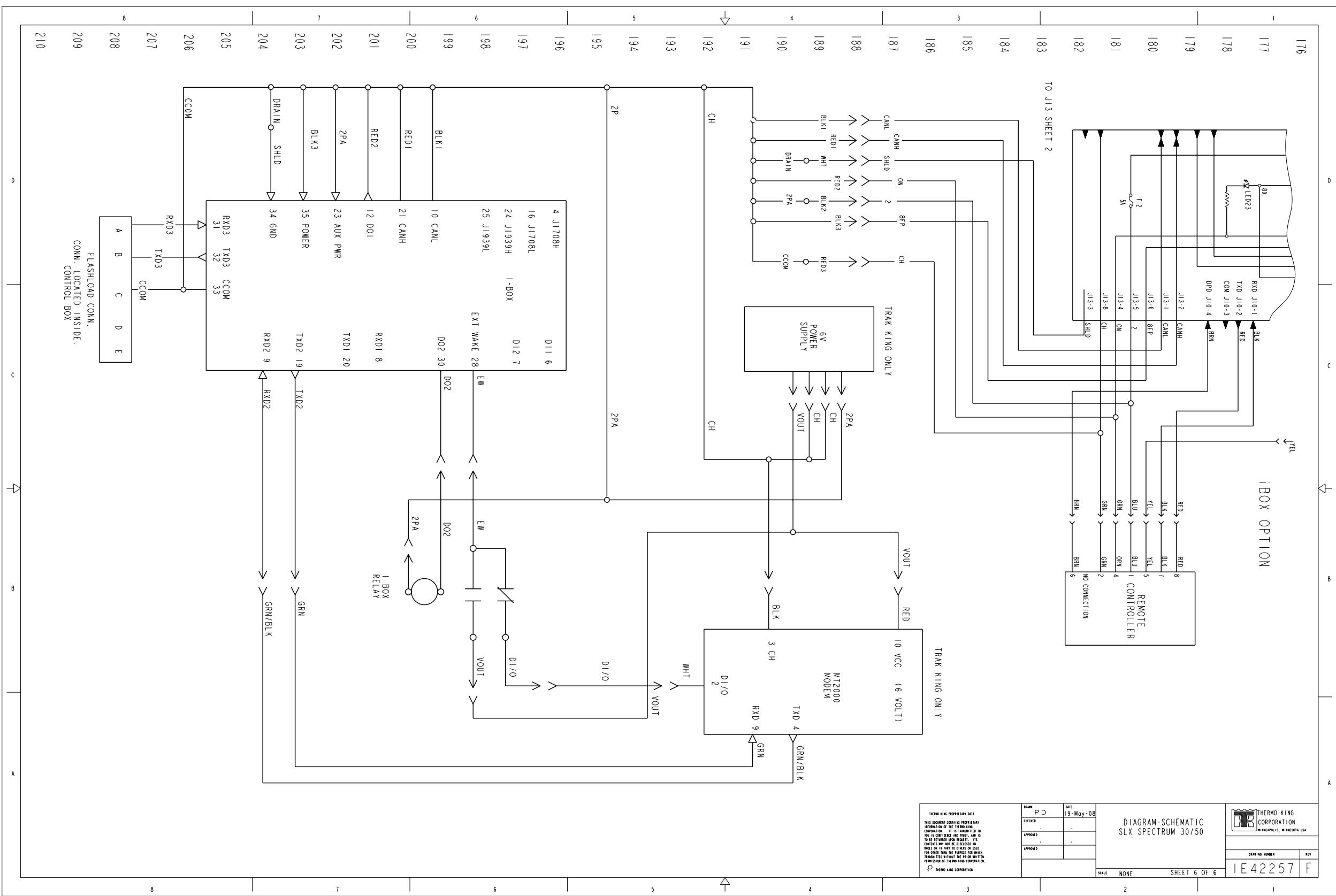
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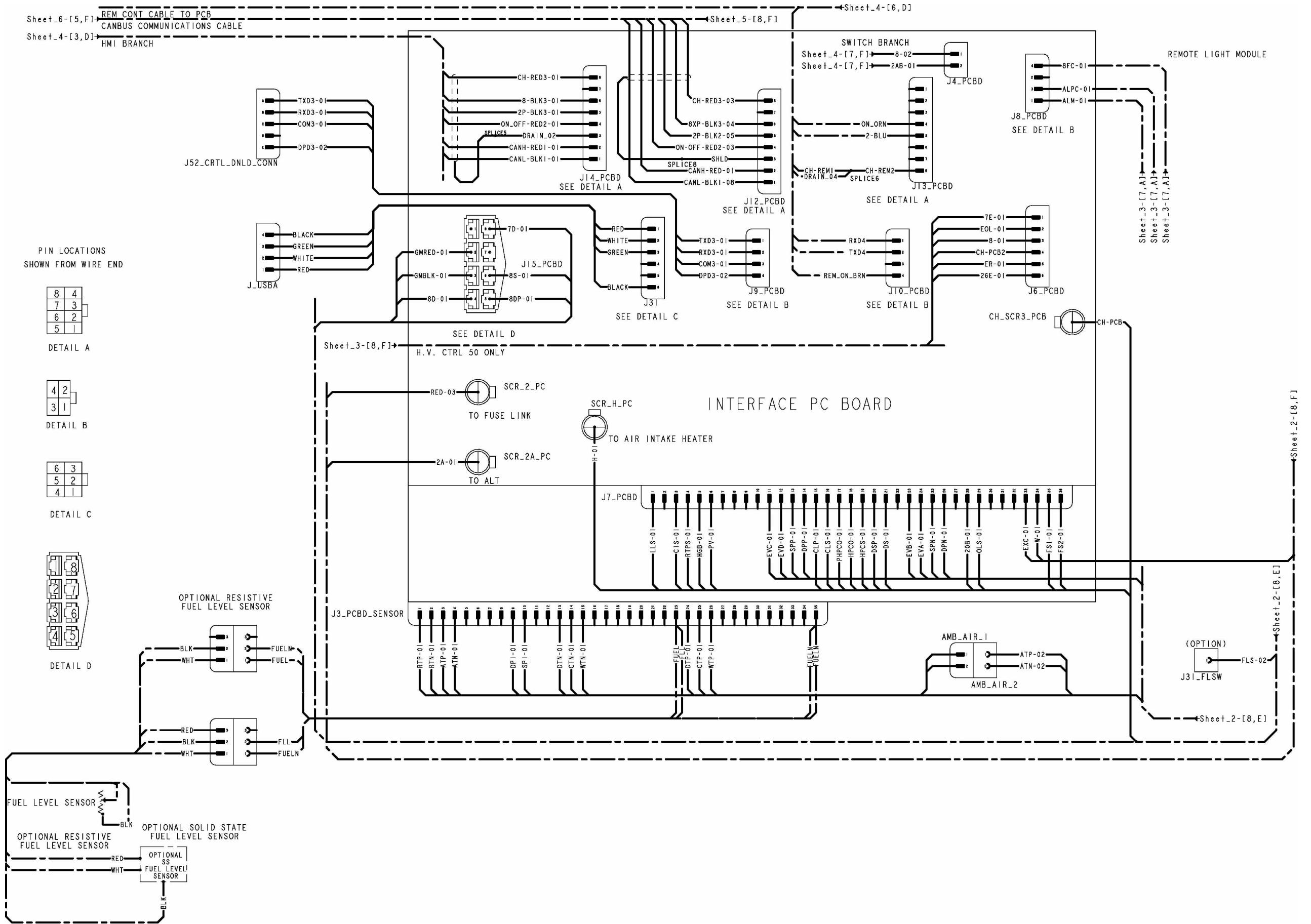
Figure 215. 1E42257 (Sheet 6 of 6)

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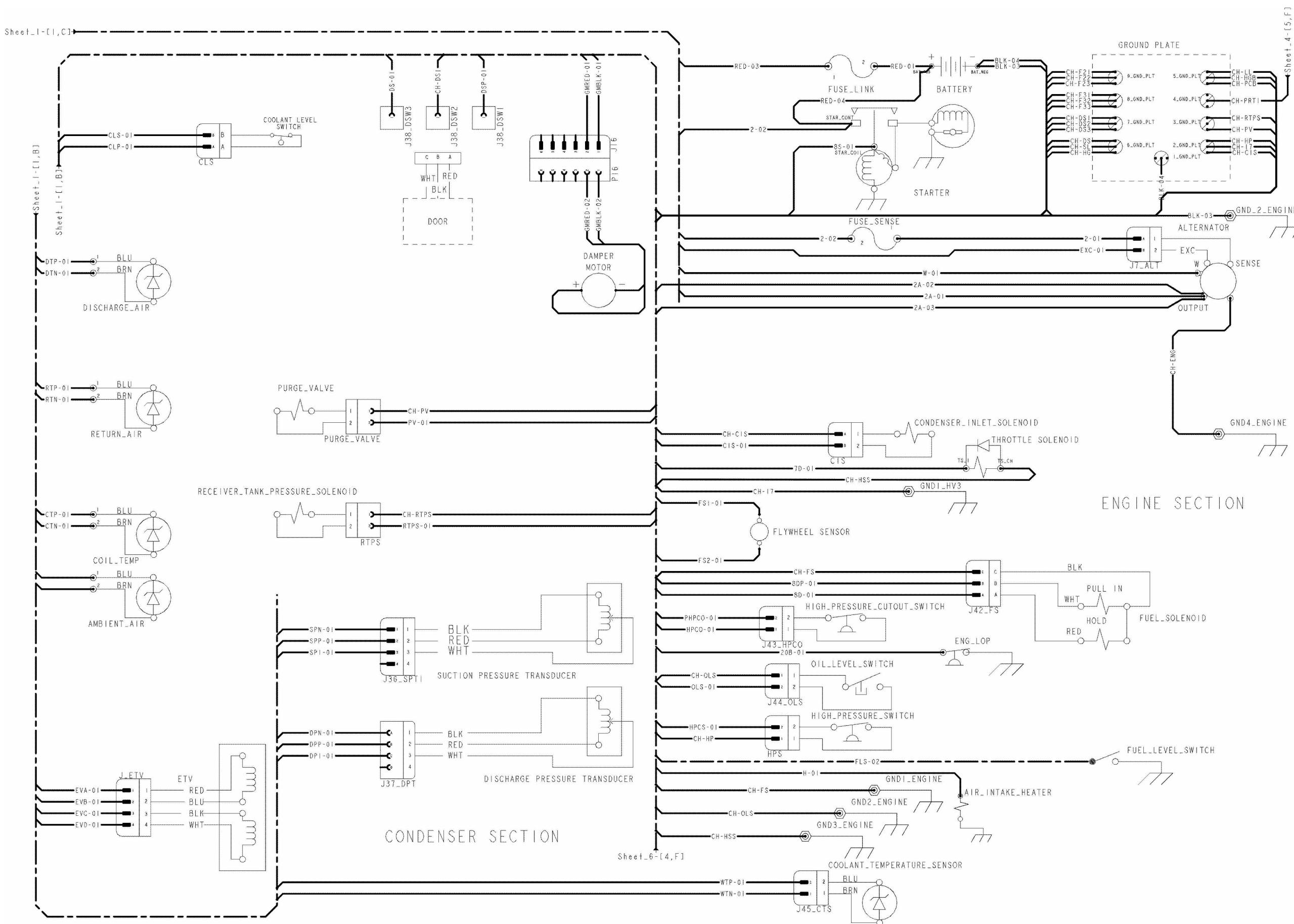
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Figure 216. 1E42258 (Sheet 1 of 6)



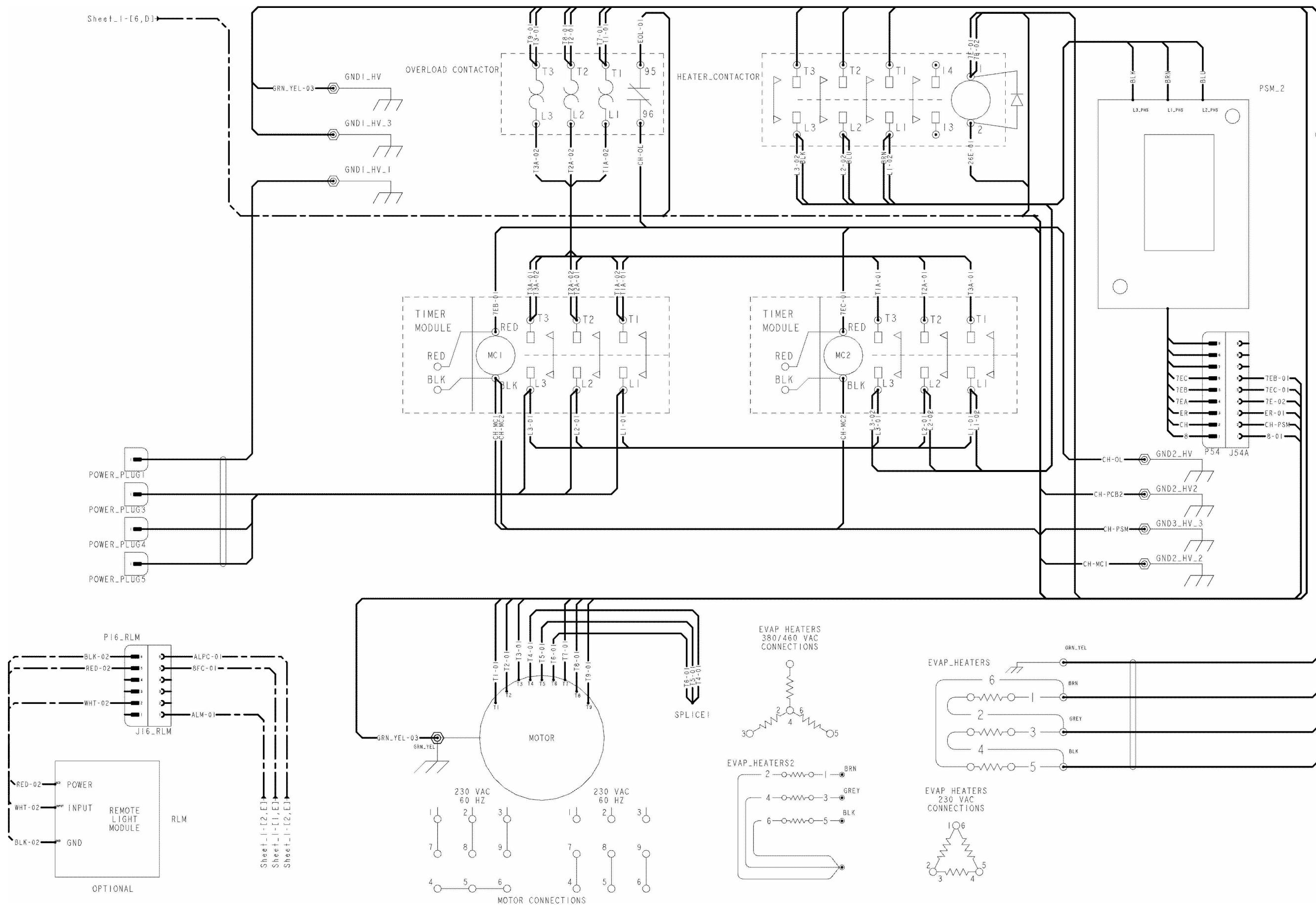
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Figure 217. 1E42258 (Sheet 2 of 6)



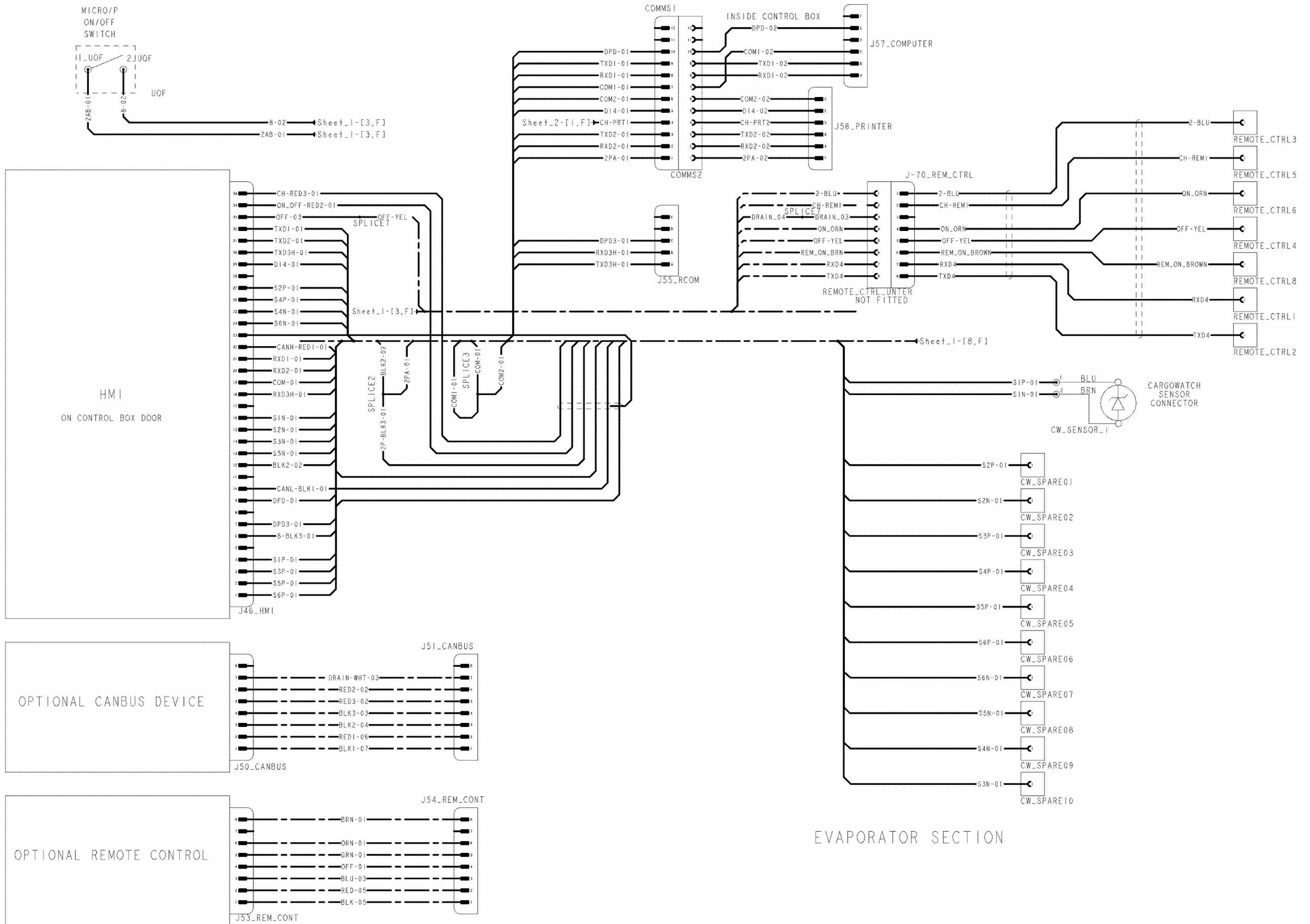
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Figure 218. 1E42258 (Sheet 3 of 6)



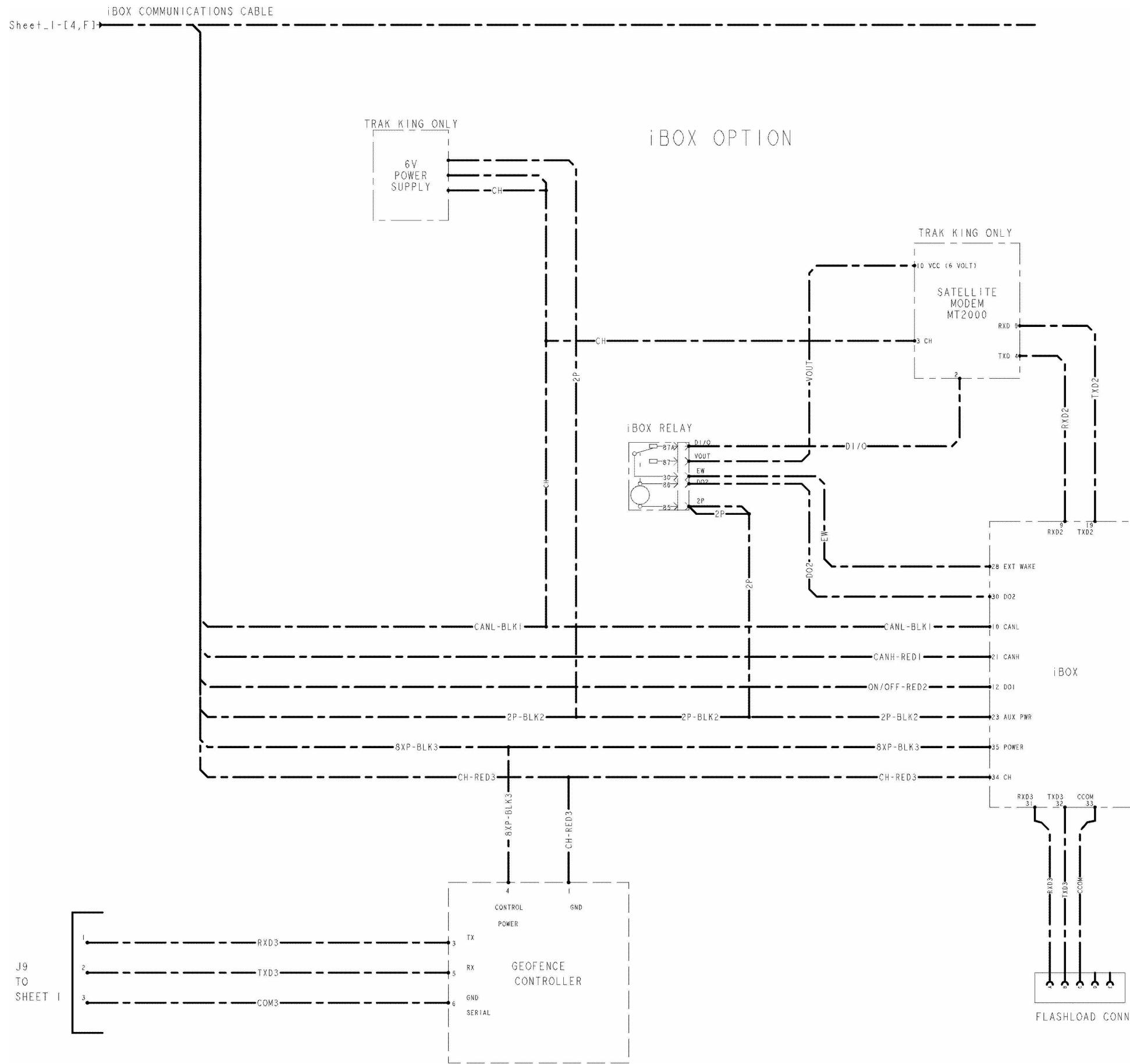
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Figure 219. 1E42258 (Sheet 4 of 6)



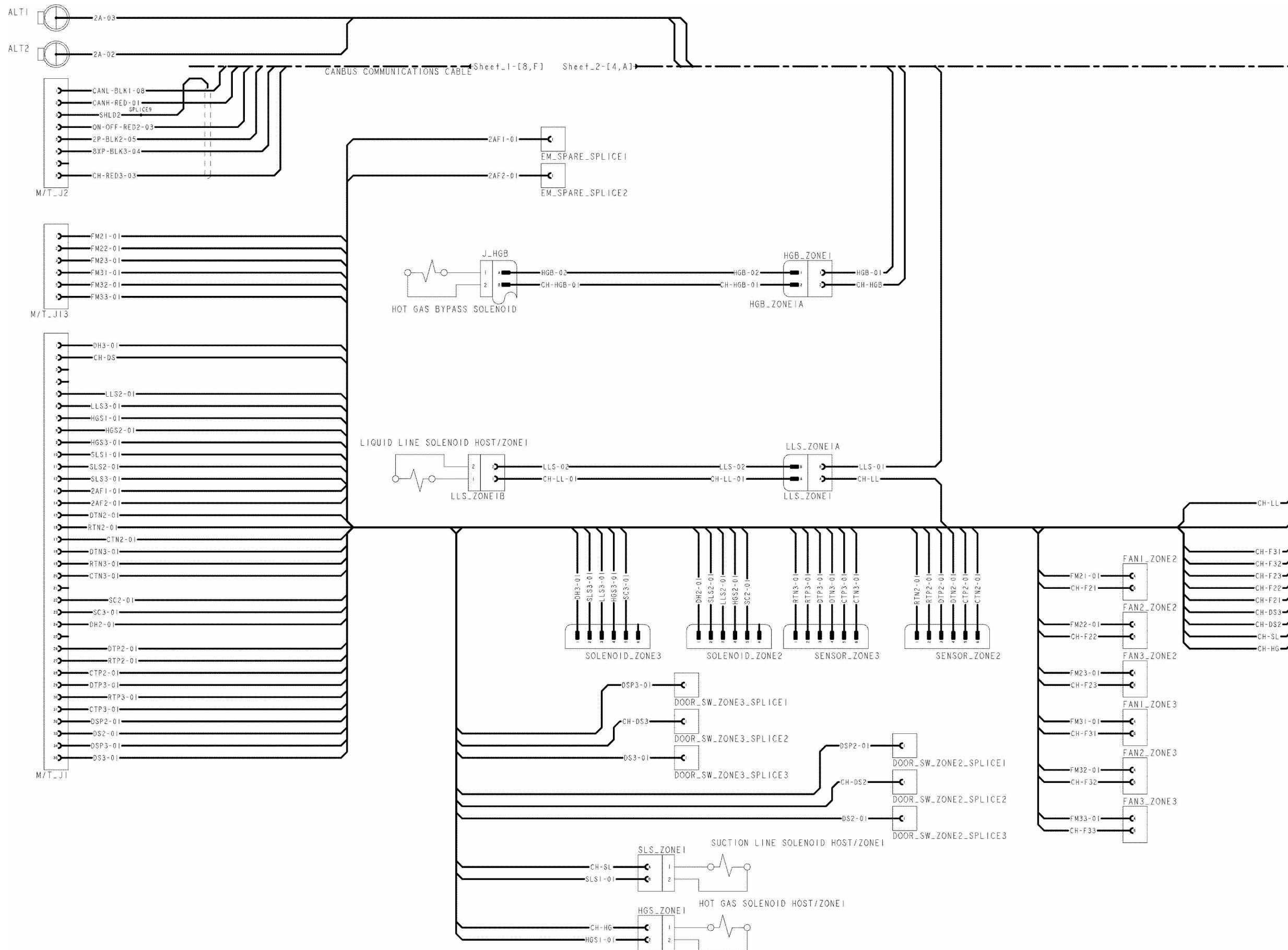
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Figure 220. 1E42258 (Sheet 5 of 6)



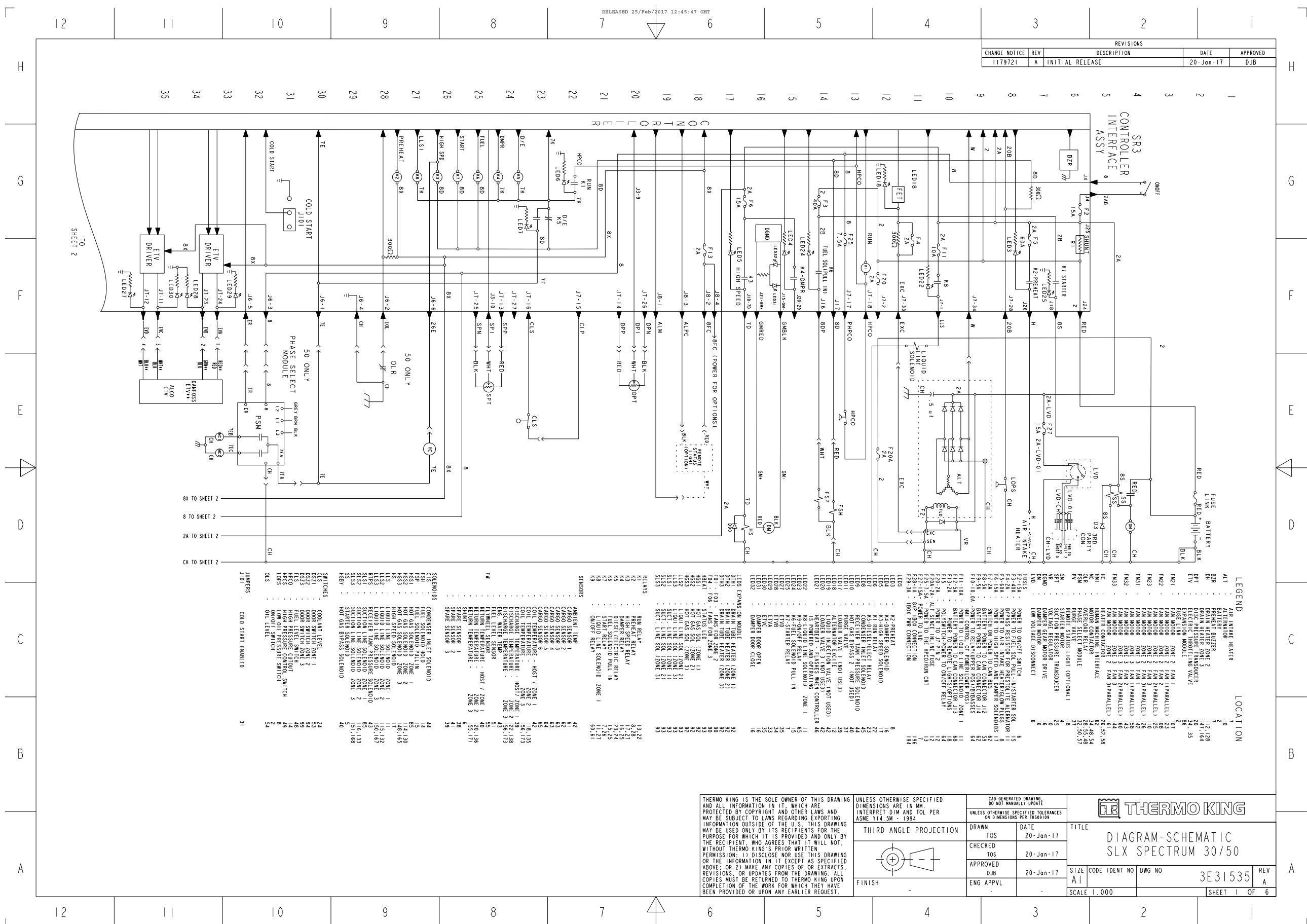
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Figure 221. 1E42258 (Sheet 6 of 6)



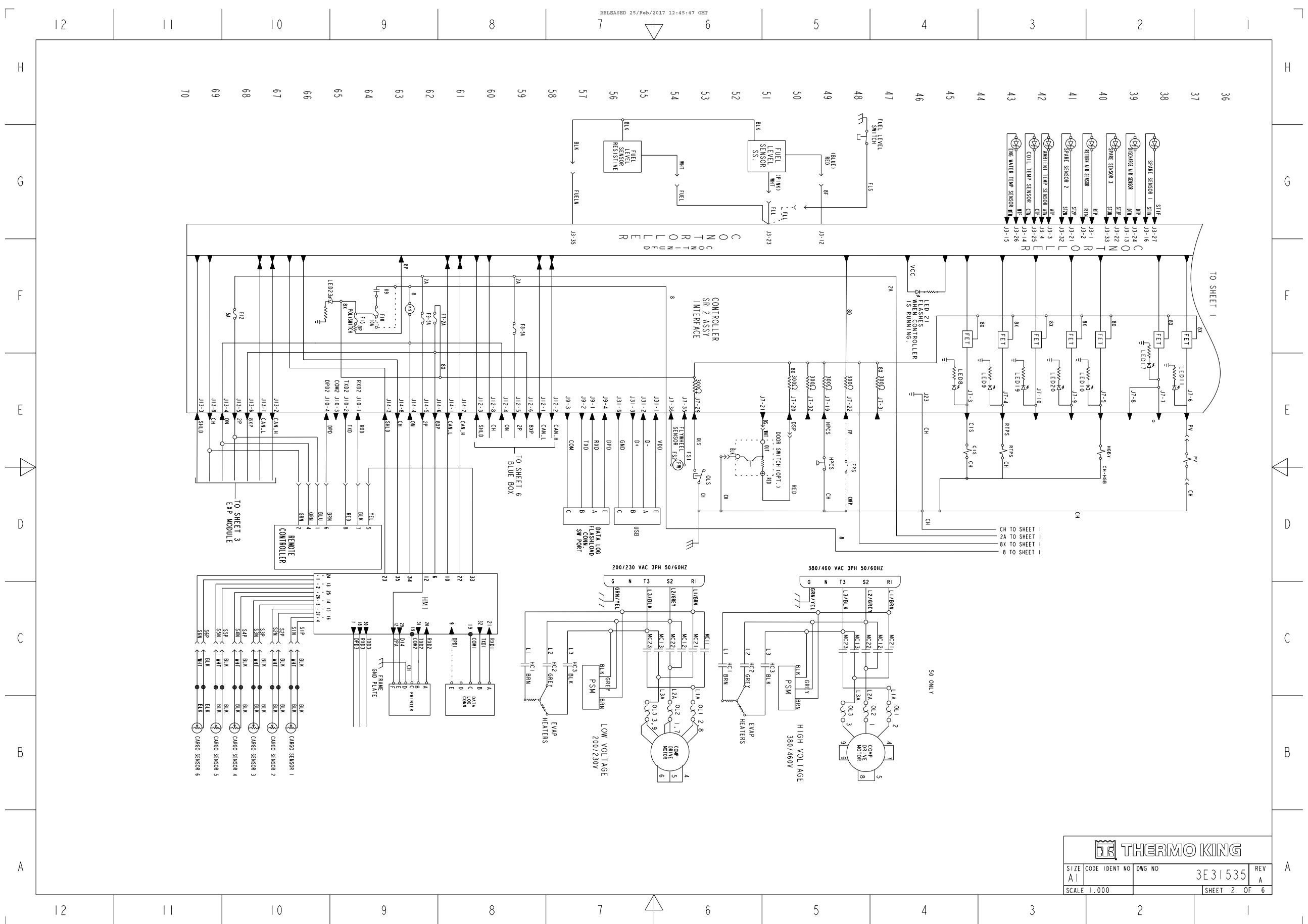
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Figure 222. 3E31535 (Sheet 1 of 6)



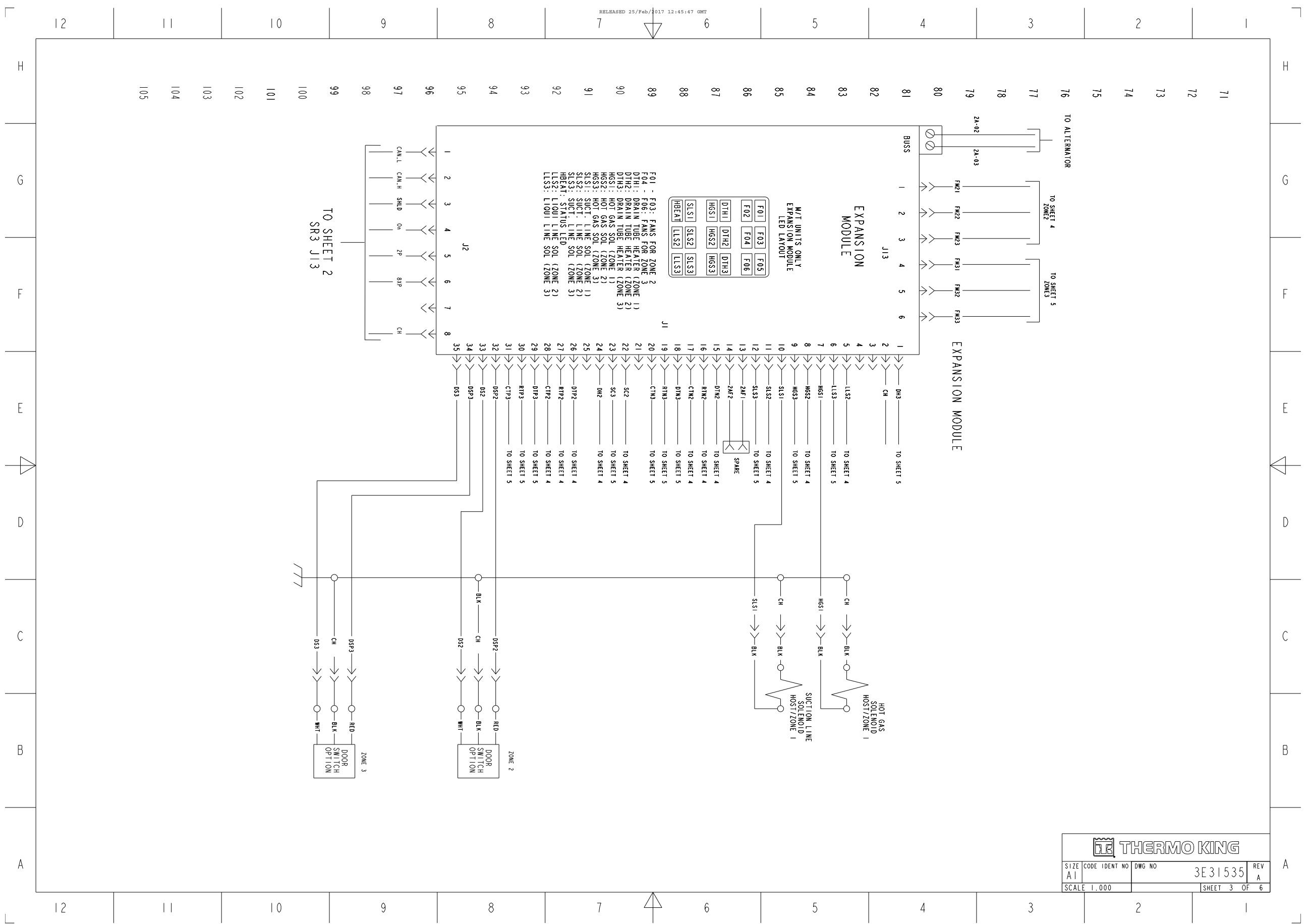
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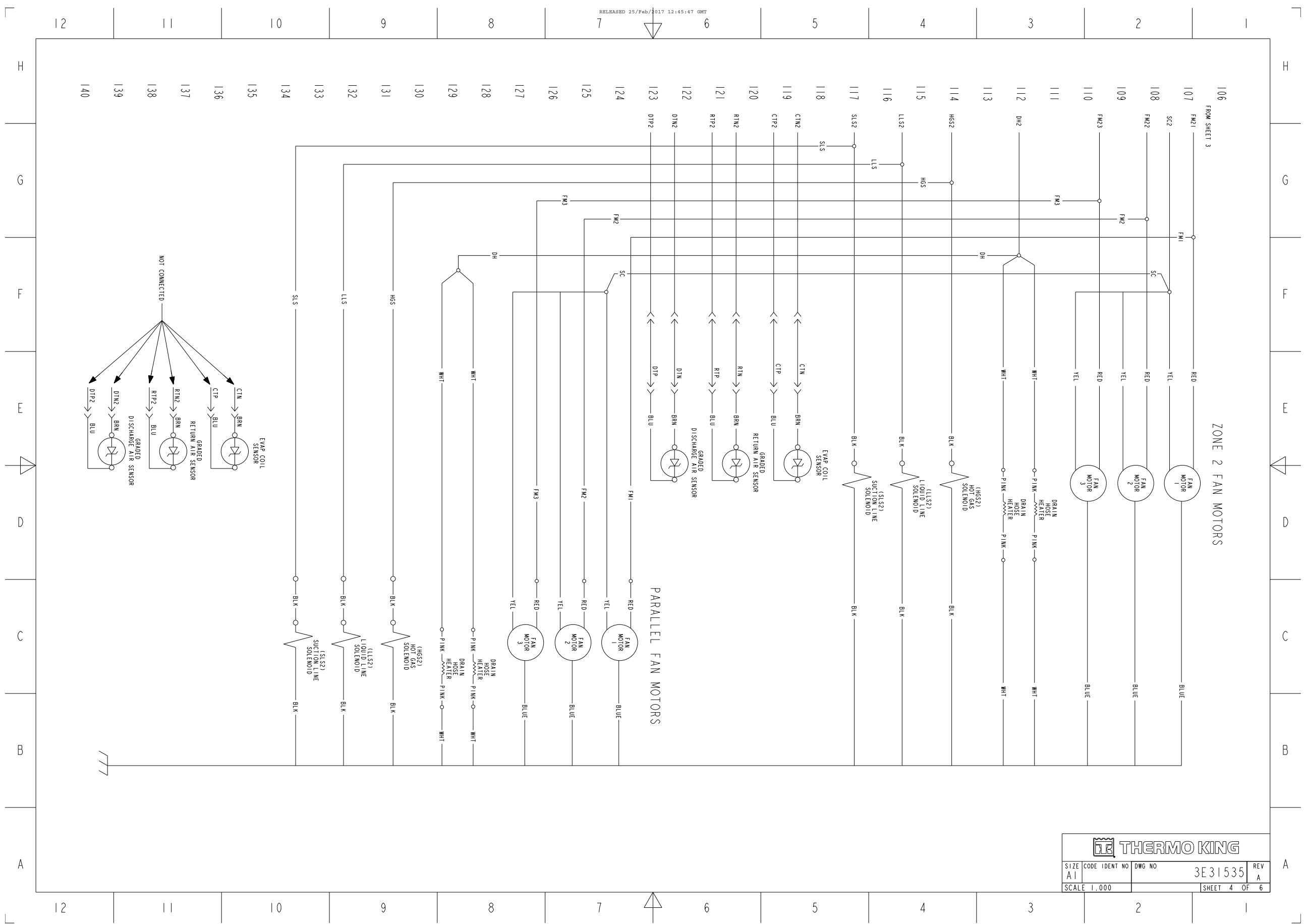
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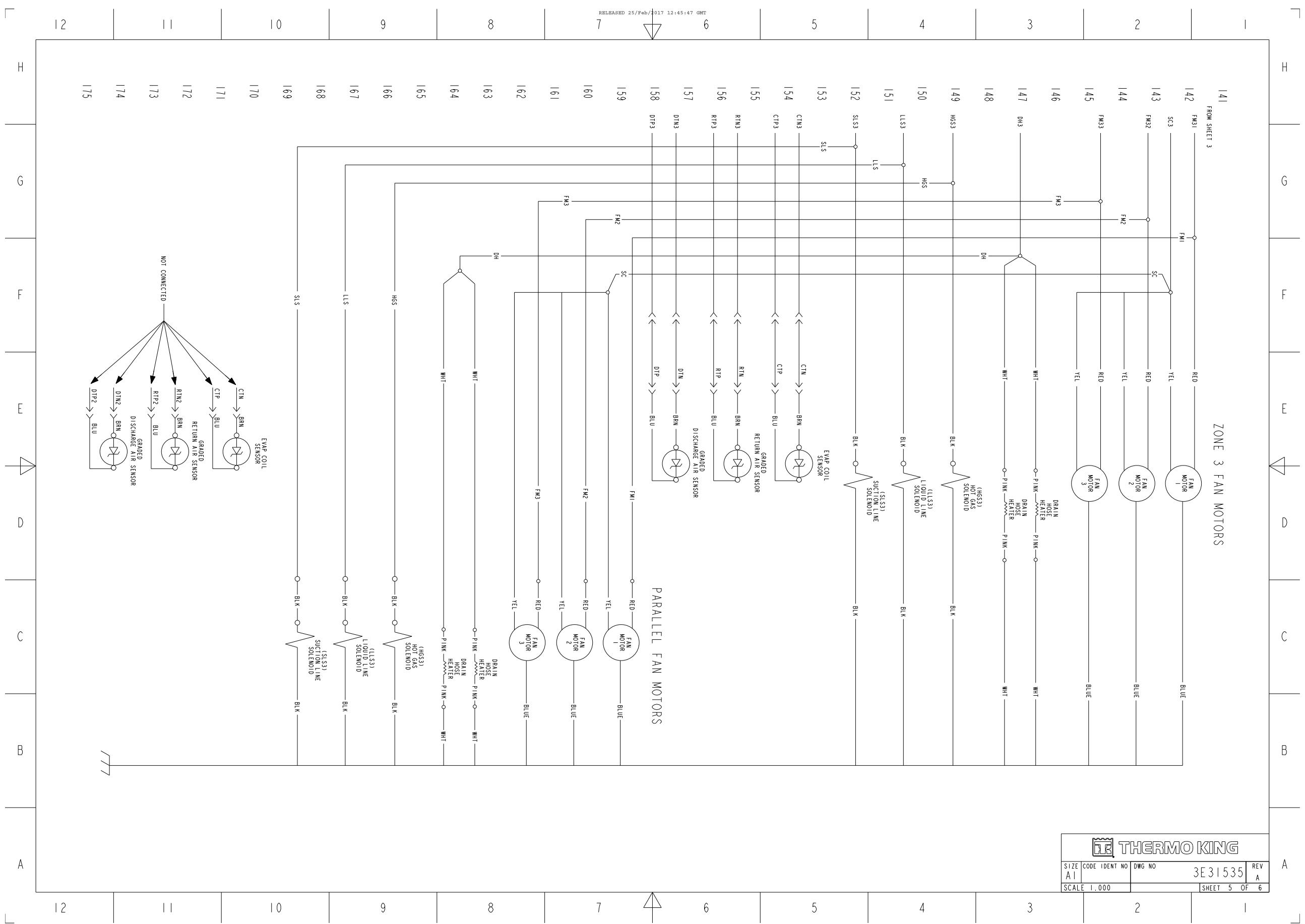
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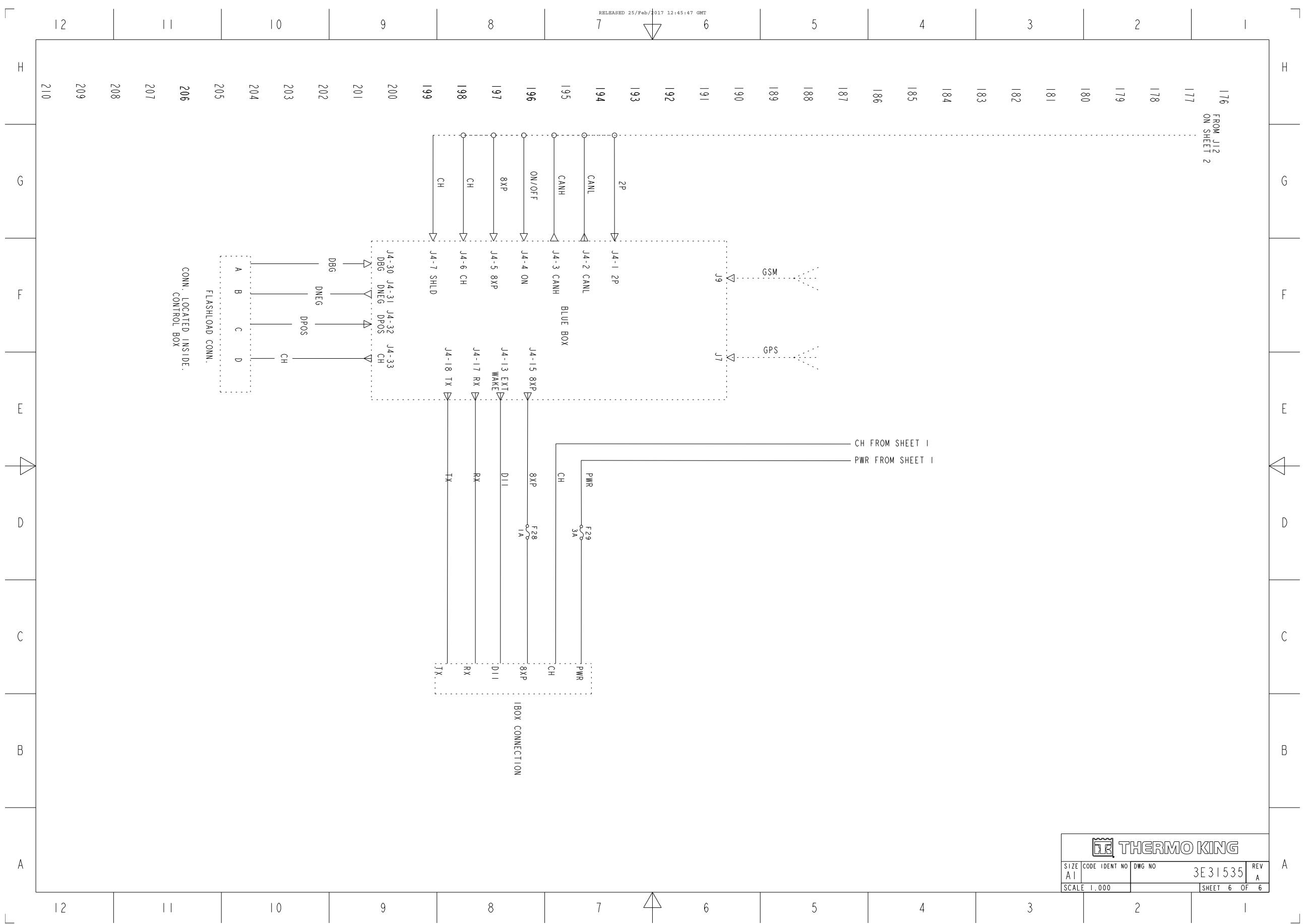
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Figure 226. 3E31535 (Sheet 5 of 6)



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Figure 227. 3E31535 (Sheet 6 of 6)





Notes



THERMO KING

Notes

Thermo King – by Trane Technologies (NYSE: TT), a global climate innovator – is a worldwide leader in sustainable transport temperature control solutions. Thermo King has been providing transport temperature control solutions for a variety of applications, including trailers, truck bodies, buses, air, shipboard containers and railway cars since 1938. For more information, visit www.thermoking.com or www.tranetechnologies.com.

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