HARSCO
RAIL

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Drone Tamper
w/Jupiter II Control System
Operation and Maintenance Manual

Model:DT-2A-J2

Catalog No. 5001030
December, 2010

- **THIS MANUAL CONTAINS VITAL INFORMATION FOR THE SAFE USE AND EFFICIENT OPERATION OF THIS MACHINE. CAREFULLY READ THIS MANUAL BEFORE USING THE MACHINE. FAILURE TO ADHERE TO THE INSTRUCTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.**

When this manual is received, record the machine serial number, engine serial number and all other information from the serial number tags in the spaces provided in the General Information Section for future reference, in case the serial number tags ever become unreadable.

A MANUAL MUST REMAIN WITH THE MACHINE. Additional or replacement manuals may be obtained by calling or writing Harsco Rail, Harsco Corporation.

All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. Harsco Rail, Harsco Corporation reserves the right to make changes at any time without notice.

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Printed in U.S.A.

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Preface

Conventions Used In This Manual

italics	Indicates references to other manuals, such as the *Parts Manual.*
bold	Indicates a control lever, pushbutton or toggle switch. Indicates button or switch..

NOTE

The note symbol is used to indicate additional information or special conditions you need to know about concerning a procedure or the machine.

The caution and warning symbols are used to alert you or call attention to a condition that could cause bodily injury or damage to the machine.

How To Use This Manual

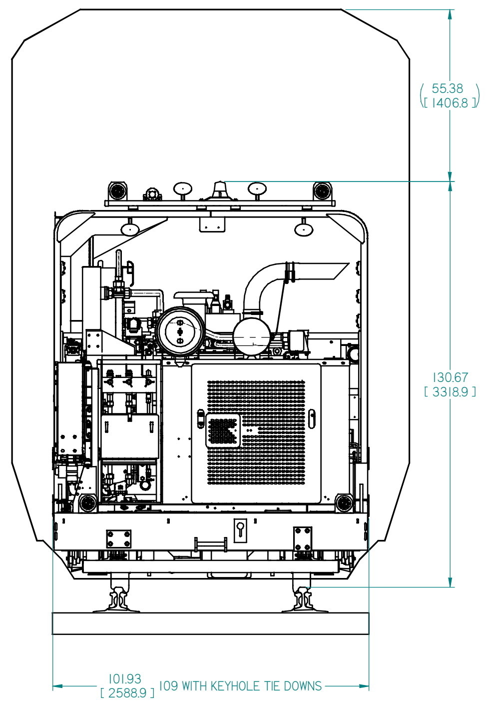
Make sure you read "Chapter 1" before you read any other chapters in this manual because it describes safety rules and safety features.

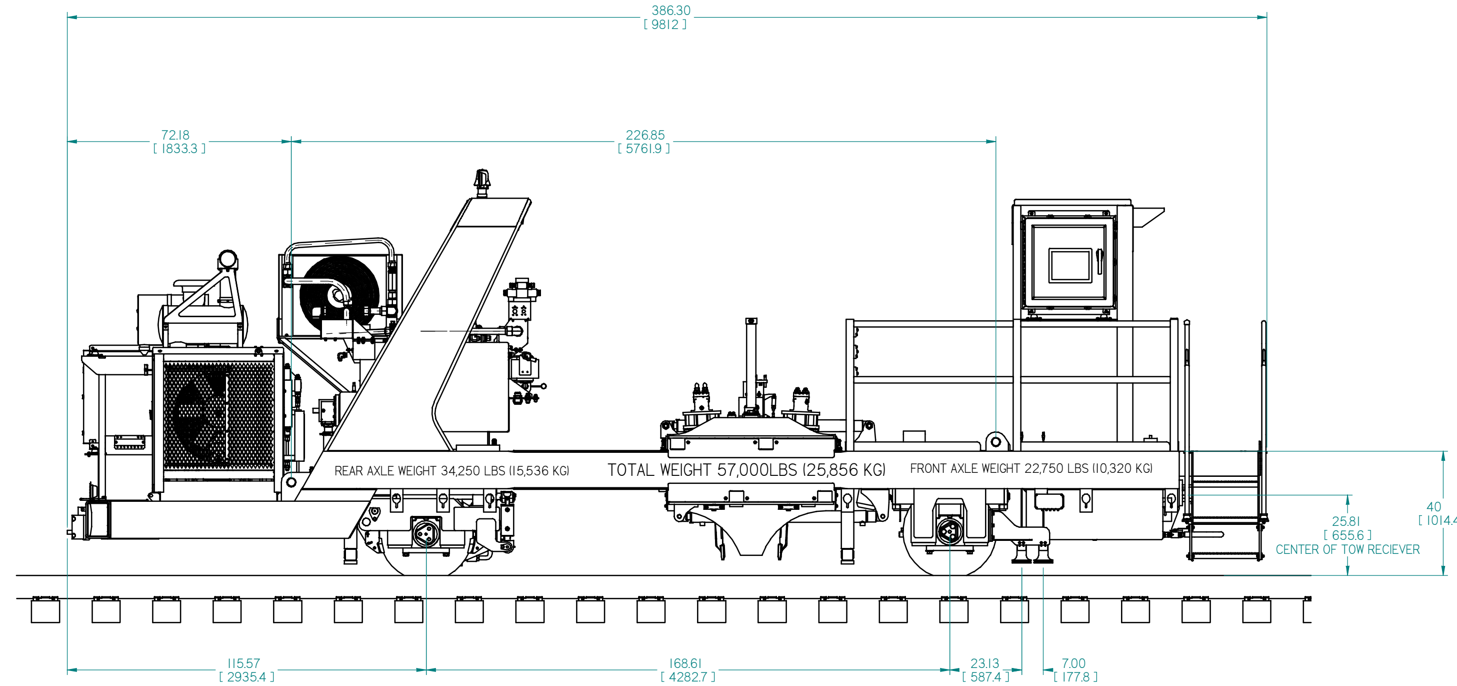
If you are **NOT** familiar with all of the machine components, make sure you read all of the chapters and all of the appendices before you try to operate the machine or perform maintenance or repairs on the machine.

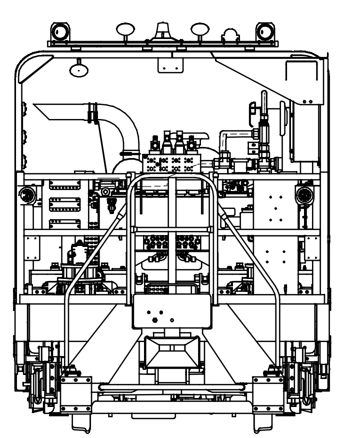
If you are already familiar with the machine, you should read all of the chapters that apply to the type of operation you need to perform, such as the procedure for starting and setting-up the machine for work. All references to left or right are determined from the rear *(engine end)* of the machine facing forward *(coupler end)*.

Contents

Physical Data







Inch
[mm]

SOLID EDGE DRAWING

CONFIDENTIAL

IMPLIED TOLERANCES
ALL DIMENSIONS ARE IN INCHES - TOLERANCE UNLESS OTHERWISE SPECIFIED

NOMINAL SIZE RANGE OVER	TO	INCH PLUS OR MINUS 2 PLACE DECIMAL	3 PLACE DECIMAL	NOMINAL SIZE RANGE OVER	TO	METRIC PLUS OR MINUS 1 PLACE DECIMAL	2 PLACE DECIMAL
0	6	.03	.005	0	150	.8	.13
6	24	.04	.008	150	600	1.0	.20
24	-	.06	.010	600	-	1.5	.25

UNLESS OTHERWISE SPECIFIED ALL MACHINED SURFACES WILL HAVE; A SURFACE FINISH OF 125 MICROINCHES ANGULAR TOLERANCE OF ± .50° CONCENTRICITY WITHIN .010

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED, ALL WELDS SHOULD ADHERE TO THE MOST CURRENT A.W.S WELDING STANDARDS

CHANGE	R/L	REVISION	DATE
			12-11-10

Description: COMPONENT LOCATION
Drawing Number:
Machine Type: DRONE TAMPER
Model:
Drawn: ecarter
Date Drawn: 12-11-10
Weight: 57,000 lbs
Scale: ----
APVD Desg: EC
APVD ChEng: EC
Mat'l: Error: No reference Error: No reference
Part Number: COMPONENT LOCATION
Size: E
Sheet: 1 of 1

HARSCO RAIL

Plotted by ecarter on 12/11/2010 physical data.dft

Model DT-2A-J2 Drone Tamper Specifications

Weights & Dimensions

Front Axle Weight.....22,750-lbs. (10,320-kg)
Rear Axle Weight.....34,250-lbs. (15,536-kg)
Machine Weight..... 57,000-lbs. (25,856-kg)

Length.....366.30 inches (9812 mm)
Width.....101.93 inches (2588.9 mm)
Height..... 130.67 inches (3318.9 mm)

Frame – Heavy duty, welded, steel construction.

Wheels and Axles - 28 inch (711 mm) cast steel (AAR profile) wheels on solid forged steel axles.

Brakes - Air operated tread-type shoe brakes with cobra-type shoes on all four wheels. Spring-applied, air-released, parking/emergency brake for automatic brake actuation in case of pressure loss.

Tamping Units - Four heavy duty vibrators drive 16 abrasion-resistant tamping tools. The hydraulically driven vibrators operate at 3,000 VPM (50 Hz) and develop a positive displacement of 3/8 inch (9.5 mm).

Engine - Cummins 8.3L Tier 3, electronic control charged air cooled and turbo-charged, 305 HP @ 2200 RPM.

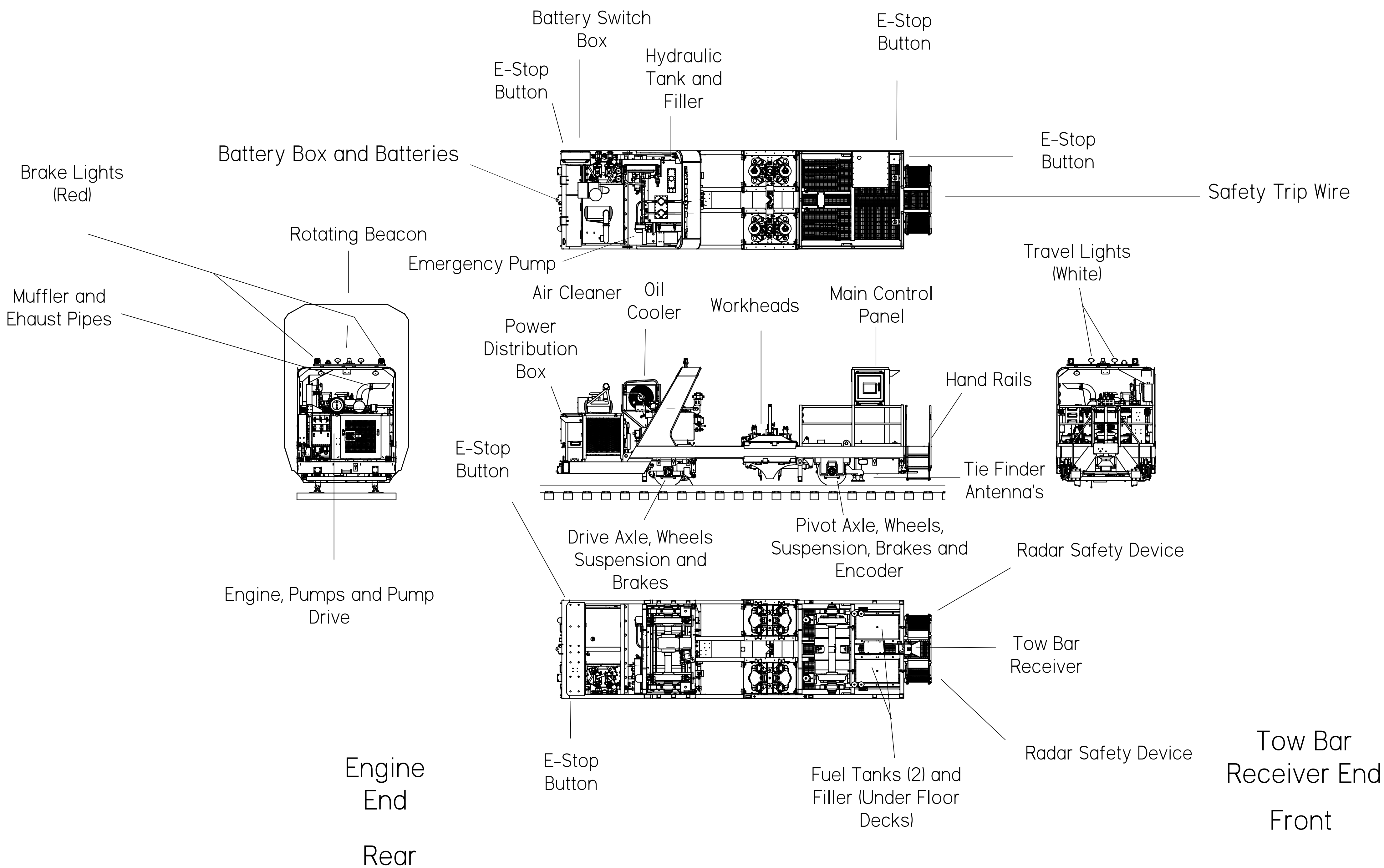
Controls - All working functions are under control of a Jupiter II Distributed Input/Output Control System with interactive operator interface.

24 VDC

Capacities:

Hydraulic Tank:	350 gal
Fuel Tanks (2)	100 gal ea
Total Fuel Capacity	200 gal

Drone Tamper
Component Location
Model DT-2A - J2



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CONFIDENTIAL	IMPLIED TOLERANCES	CHANGE	R/L	REVISION	DATE
		ECN-105904	A	RELEASE	7-14-10

ALL DIMENSIONS ARE IN INCHES - TOLERANCE UNLESS OTHERWISE SPECIFIED

NOMINAL SIZE RANGE OVER	TO	INCH PLUS OR MINUS 2 PLACE DECIMAL	3 PLACE DECIMAL	NOMINAL SIZE RANGE OVER	TO	METRIC PLUS OR MINUS 1 PLACE DECIMAL	2 PLACE DECIMAL
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6	24	.04	.008	150	600	1.0	.20
24	-	.06	.010	600	-	1.5	.25

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Description: Error: No reference
Drawing Number
Machine Type: Error: No reference
Model: Error: No reference
Drawn: ecarter Date Drawn: 7-14-10
Weight: Error: No reference Scale: ----
APVD Desg: EC APVD ChEng: EC
Mat'l: Error: No reference Error: No reference
Part Number: Error: No reference
Size: E Sheet: 1 of 1

HARSCO RAIL

SOLID EDGE DRAWING

Plotted by rpturner on 12/15/2010 component location.dft

DRONE TAMPER ENERGY CONTROL PROCEDURE

PURPOSE

This procedure informs appropriate personnel of the location and proper means of removal and restoration of electrical, mechanical, hydraulic and pneumatic energy for this machine. This procedure is provided to help protect personnel from the unexpected release of energy while performing maintenance, making adjustments or dealing with emergency shutdown conditions.

This procedure will be used by personnel responsible for lockout and tagout.

SCOPE

This procedure must comply with railroad safety rules. It is to be used in conjunction with an operator's manual, when servicing or repairing machine. Any alterations to this machine may invalidate this Energy Control Procedure and/or lockout tagout procedures.

MODEL DRONE	MANUFACTURER	Harsco Rail	ISSUE DATE	7/22/09
ENERGY SOURCES:			COMPRESSED AIR	X
	ELECTRICAL	24 VDC	MECHANICAL	X
	HYDRAULIC	X		
STORED ENERGY:				
	RAISED LOAD	X	COIL SPRINGS	X
	BATTERY	X	AIR TANK	X
	HYDRAULIC PRESSURE	X		

PROCEDURE TO REMOVE MACHINE FROM ENERGY SOURCE

1. The person who will be doing the maintenance or adjustments must familiarize themselves with the type of energy sources for this machine and understand fully the hazards of the energy.
2. Stop machine parking brake, will automatically set.
3. Lock Workheads, in the travel position unless one or more of these work components is the area to be worked on and the anticipated work will require the work component to be resting on the rail or ballast. Any work component not locked in travel position should be lowered until its full weight is on the rail or ballast.
4. Return throttle to idle position. (Throttle is the top right button of remote control)
5. Stop engine. (Ignition switch is located on Engine control panel)
6. Turn battery master switch to "OFF" position. (Switch is located inside the rear battery box on left side of machine)
7. Switch circuit breakers "OFF" in ECM breaker box. (Box is located near battery switch.)
8. Drain air system by pulling air reservoir drain valve control ring until all air pressure has escaped. (Air reservoir drain is located on left side near the front wheel)
9. Verify that all energy sources are de-energized by operating the controls to make sure the equipment will not operate (attempt to start engine).

PROCEDURE TO RESTORE MACHINE TO SERVICE

1. Check the machine and surrounding area to make sure all tools, etc. have been removed from machine.
2. Verify that everyone is clear of the machine while it is being restored to power.
3. Verify that all controls are in neutral or off position.
4. Turn battery master switch to "ON" position.
5. Switch cirtuit breakers "ON" in ECM breaker box.
6. Start engine then push "IN" the Jupiter Control button located on the left of the key switch.
7. Verify that all energy sources are energized by observing information on computer screen.
8. Test all functions of the machine which were affected by the repairs.

Chapter 1

Safety

Read this chapter before you attempt to operate or perform maintenance on the equipment described in this manual. This chapter describes the following:

- Safety rules
- Safety features
- Safety locks

Safety Rules

1. Follow all rules and regulations issued by your railroad concerning self-propelled track equipment.

2. Read this section very carefully and make sure you know what safety features and safety devices are provided with the equipment.

3. Carefully read all instructions, notes, cautions, and warnings that are provided in all other chapters in this manual.

4. Know the positions and functions of all controls before attempting to operate this machine.

5. Before operating the equipment, perform a visual inspection of the equipment components, and any attachments. Check for broken, loose, or worn parts.

6. Before starting the engine, check all fluid levels; engine oil, coolant, hydraulic oil and fuel. Keep FULL. Check for any leaks, loose or damaged parts, worn or damaged belts, and any change in engine appearance.

7. Before moving the machine on the track (travel), make sure all working components and attachments are secured by the appropriate safety devices, such as safety locks.

8. Activate the horn several times to alert all those in and around the machine that the machine is going to move, either forward or reverse.

9. Before moving or operating the equipment, make sure all personnel are safely away from the equipment.

10. Make sure the equipment and the engine have stopped and all work components are locked in their safety locks before performing service or maintenance tasks. Also, make sure the master battery switch is OFF. In addition, follow the Lockout, Tag Out procedure as stated by railroad standards.

11. Do not perform any welding (repairs) unless all electrical power to the equipment is turned OFF. Make sure the main battery switch is in the OFF position or the battery cables are disconnected.

Welding on the electronic Cummins QSCT3 8.3L engine is not recommended. Never connect the ground cable of the welder to the ECM.

12. Keep all equipment and components clean.

13. Do NOT allow personnel on the machine while it is working.

14. Always have a fire extinguisher on the machine and know how to use it. Inspect and have it serviced as recommended on its instruction plate.

15. Do not operate this machine without proper vision and hearing protection. **Failure to comply could result in serious injury**.

16. Follow ALL safety procedures as stated by railroad standards.

Safety Features

The following emergency shutdown systems are provided as standard equipment on this machine.

Emergency Engine Shutdowns

The engine has an **AUTOMATIC EMERGENCY SHUT-DOWN** system which is automatically activated if the engine oil pressure is too low or if the engine coolant temperature is too high. The engine used on this version of the Drone Tamper features an engine protection system. Critical engine temperatures and pressures are monitored and diagnostic faults are logged when an over or under normal conditions occurs. Two (2) indicator lights located in the main control box are provided to alert the operator when an out-of-range condition develops. The Check Engine light will blink or flash when an out-of-range condition continues to get worse. If the Stop Engine light comes on, the operator should shut down the engine as soon as possible to reduce the possibility of engine damage. The Stop Engine light will flash for 30 second to alert the operator that the engine is going to shut down.

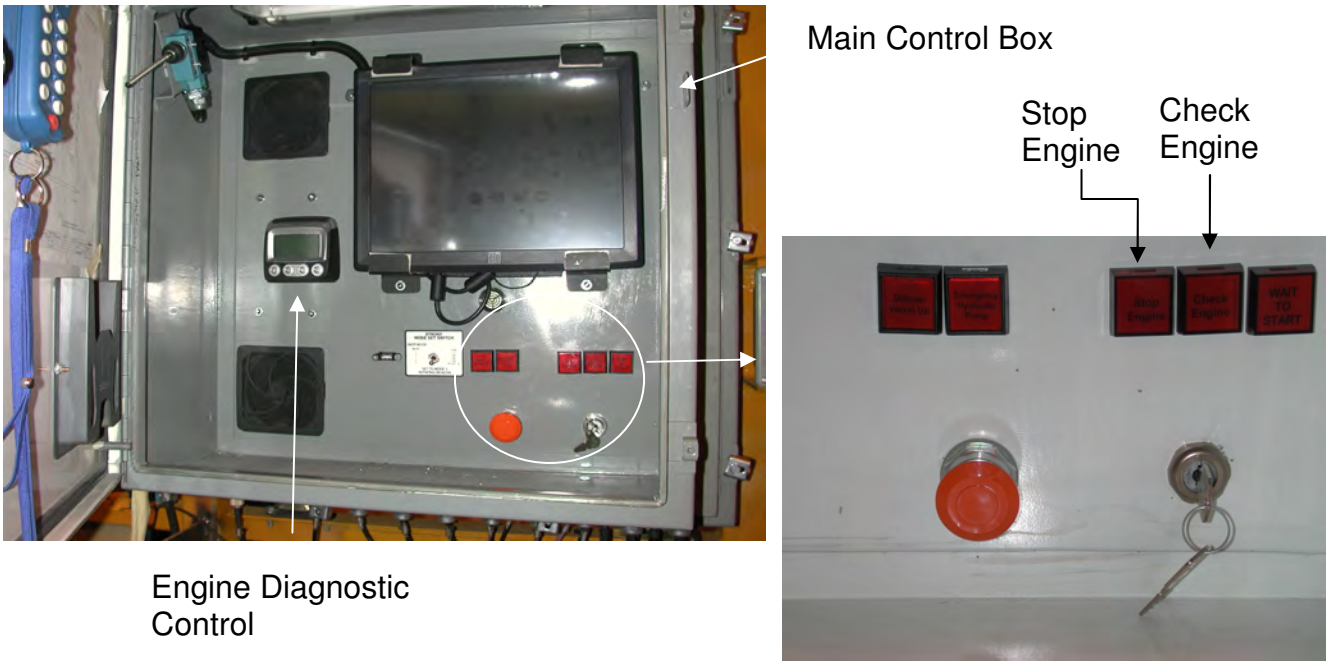


Figure 1-1 Check Engine and Stop Engine Indicator

An engine diagnostic control is also included in this model of the Drone Tamper. Refer to Figure 1-1

There are six (5) **MANUAL EMERGENCY ENGINE SHUT-DOWN** buttons that are mounted one each, on the 4 corners of the machine frame and 1 on the right side of the main control box. The top right push button located on the Hand Held Remote Control is provided for normal or emergency engine shut down. Refer to Figure 1-1 and 1-1A. In addition to the other E-stop buttons, 2 virtual push buttons located on the left side of the Main Screen of the of the Lead Machine and the Drone .

NOTE: The emergency shutdown push button initiating the shutdown MUST be reset to restart the engine. Pull out to reset. In addition, these e-stop buttons are displayed on the Radar/E-Stop Panel on the Main Screen of the Lead Machine and the Drone. The button initiating shut down will display in red. These buttons will be grayed out until activated.

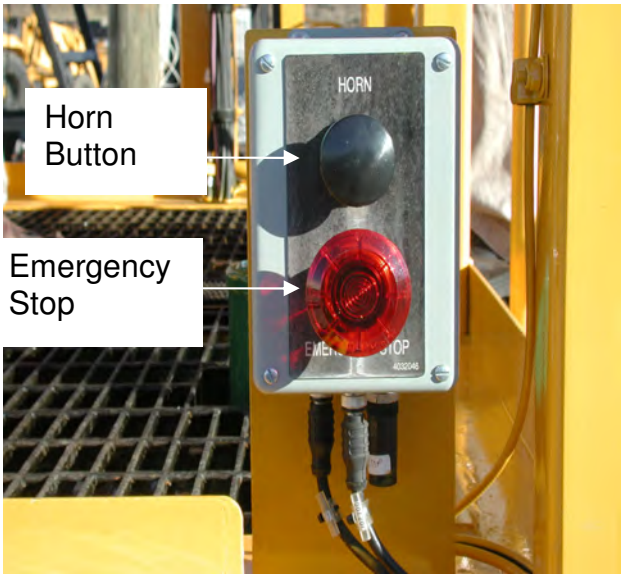


Figure 1-1A: E-Stop Button, Horn Button and Radar Detector location

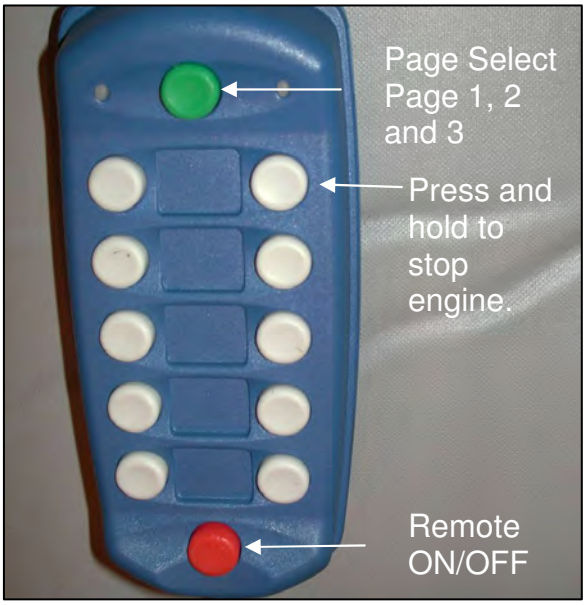
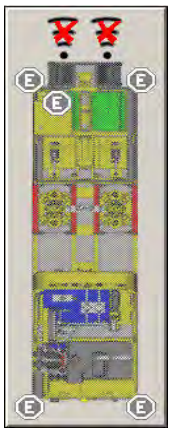


Figure 1-1B: Engine Stop on Hand Held Remote Control

NOTE: The emergency shutdown push button initiating the shutdown MUST be reset to restart the engine. Pull out to reset. In addition, these e-stop buttons are displayed on the Radar/EStop Panel on the Main Screen of the Lead Machine and the Drone. The button initiating shut down will display in red. These buttons will be grayed out until activated.

Figure 1-1C: Radar/Engine Stop Panel on the Main Screen of the Lead Machine and Drone



There are other conditions that can cause an automatic shutdown of the Drone Tamper engine such as:

- Engine operating outside of the operating parameters.
- A rapid loss of hydraulic pressure/fluid.
- Loss of communication from Hand Held Remote.
- Loss of wireless communication from the Lead Machine.

Use the STOP button on the Main Screen of the Lead Tamper to immediately shut down the engine on the Drone.

NOTE: Once the Drone engine is stopped, the Jupiter control system will need to be turned off before the engine can be restarted.

NOTE: If the Drone is NOT in radio communication when the stop button is pressed, an engine stop command will be sent whenever communication is reestablished.

Spring Parking Brakes

The Drone Tamper is fitted with air activated, Spring Applied type Brake system. Four (4) dual brake chambers are located one each wheel. The front two chambers are mounted

vertically and the two (2) on the rear are mounted horizontally. Controlled by Jupiter, the Spring Brakes will automatically apply when machine stops or if the air pressure in the braking system drops below 60 PSI.

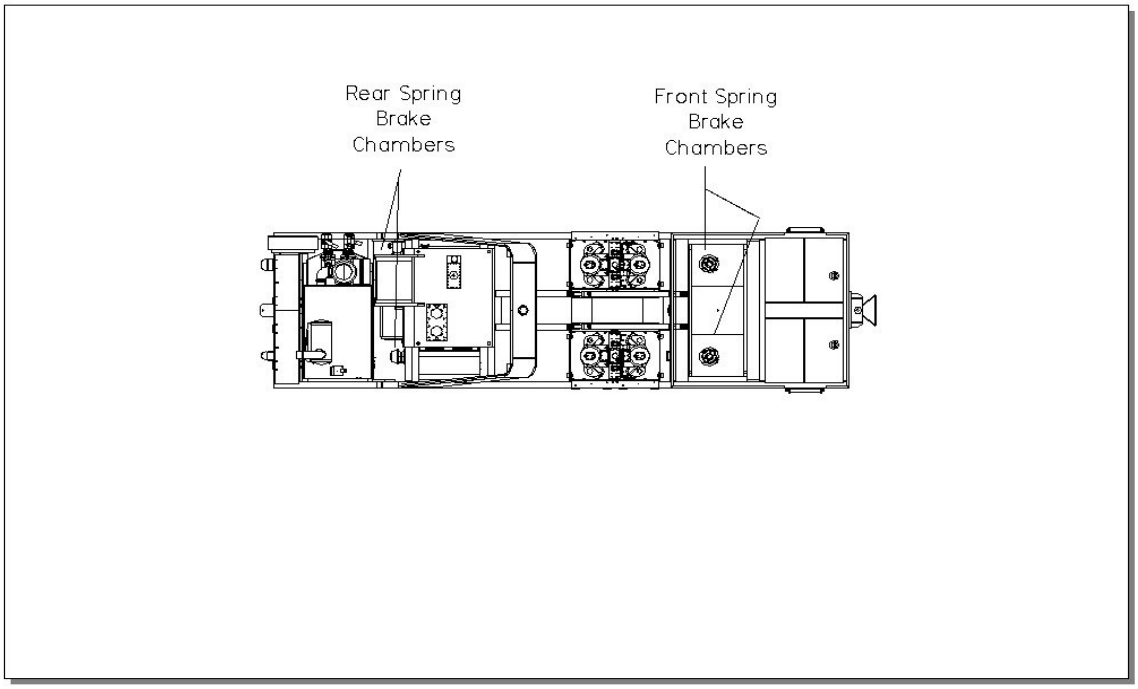


Figure 1-2

Emergency Pump ON/OFF Push Button

If there is a problem with the engine or the hydraulic system and the workheads are NOT in their safety locks, the emergency pump can be used to raise them to be secured in their safety locks. Press the **EMERGENCY PUMP ON/OFF PUSH BUTTON** (red) to activate (start) the emergency pump. The emergency pump switch is located on the main control box. Refer to Figure 1-3 and 1-4.

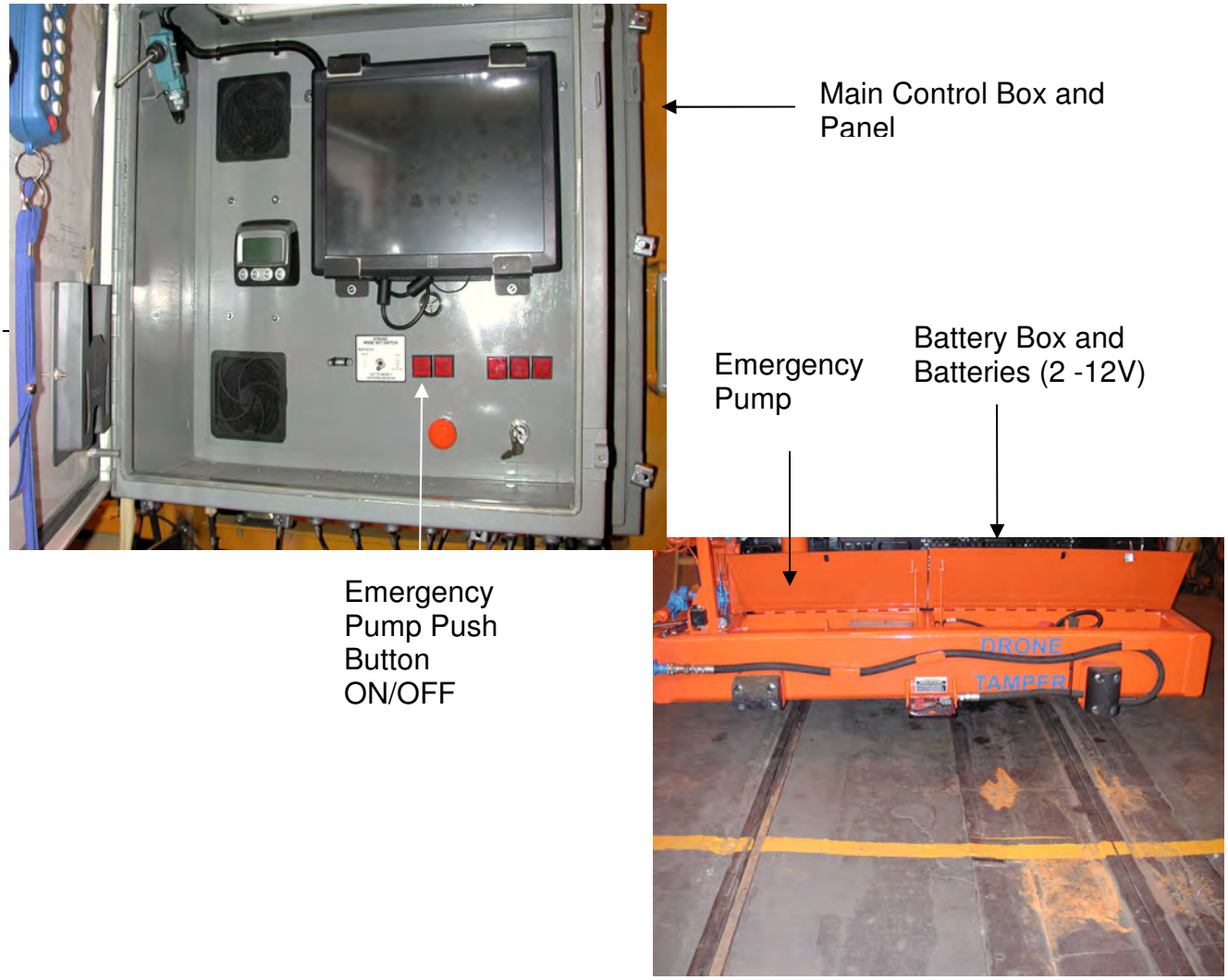


Figure 1-3 Emergency Pump Control Switch and Pump Location

With the pump started and the machine in *work mode*, use the Remote Control to raise the desired workhead into its safety lock. **Be sure to raise only one (1) workhead at a time.** NOTE: *If the computer is down, the valves must be activated manually*. When all of the workheads are secured in their safety locks, turn the emergency pump OFF.

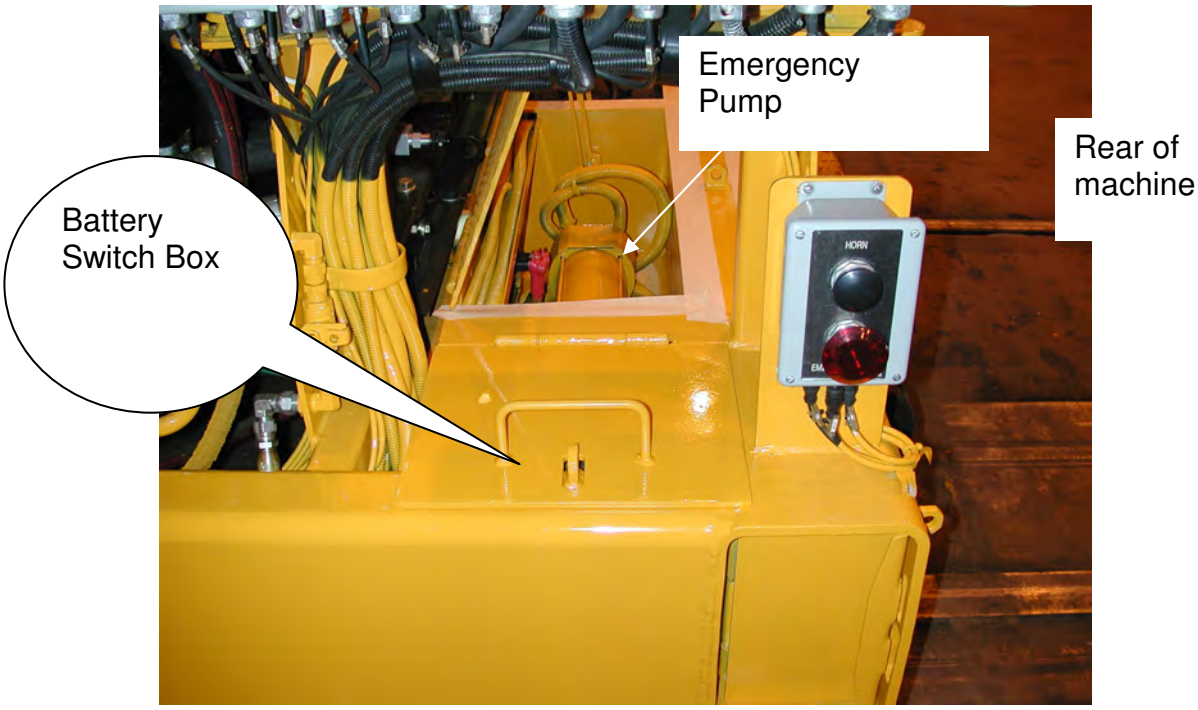


Figure 1-4 Emergency Pump and Battery Switch Location

NOTE

The EMERGENCY PUMP is mounted to a 24 VDC starter motor. DO NOT RUN the Emergency Pump longer than 1 minute when the pump is loaded (2500 PSI) or when NOT loaded more than 5 minutes. Allow the motor ample cooling time before restarting emergency pump.

The emergency pump ONLY provides enough oil (volume) to lift the work components, such as the work heads, into their safety locks. The emergency pump does NOT provide enough oil (volume) to move/travel the machine or to use the machine to perform work.
If you DO NOT have electrical power, you can manually shift the appropriate hydraulic valves to raise the components into their safety locks.

Safety Locks

All working components on the machine, such as the work heads, have safety locks, which should always be used to prevent damage to the machine when traveling and to prevent injury to personnel. Refer to Figure 1-5 for the general location of the Safety/Travel Locks.

Workhead Locks

Each workhead is equipped with a mechanical safety lock. Two (2) locks are used. These locks can be operated either pneumatically (by upfeeding the workheads twice using a pushbutton located on the hand held Remote Control or manually (by moving a lever mounted outside the machine on the carrier frame). These safety locks are used to prevent the downward movement of the workheads during travel or when they are NOT being used. When the workheads are locked, the workhead lock icon on the

main screen will appear gray as shown at right. If the workheads are unlocked, this icon will be yellow. Traction will stop and a alarm will sound if the workheads are low,

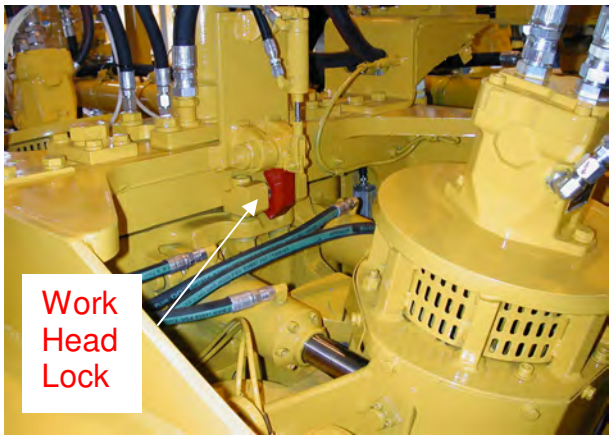


Figure 1-5

There are two (2) air operated, mechanical locks mounted one (1) on each workhead frame. They are used to secure the workheads for travel or when they are NOT in use. Refer to Figure 1-5.

Figure 1-6

The work heads should be placed in their safety locks for track travel, maintenance and repairs. Failure to lock the work heads may cause serious damage or bodily injury.

Steps, Hand Rails and Derail Bars

Sides steps have been added on the front of the current drone tamper models. This feature provides safe and easy access to the main control box and other components such as; the fuel tank, hydraulic tank and workheads. Hand or grab rails are also provided around the front of the machine frame. These features provide additional safe access to components when servicing or making repairs. In addition, Derail Bars are provided behind the front and rear wheels as standard equipment. Refer to Figure 1-11.

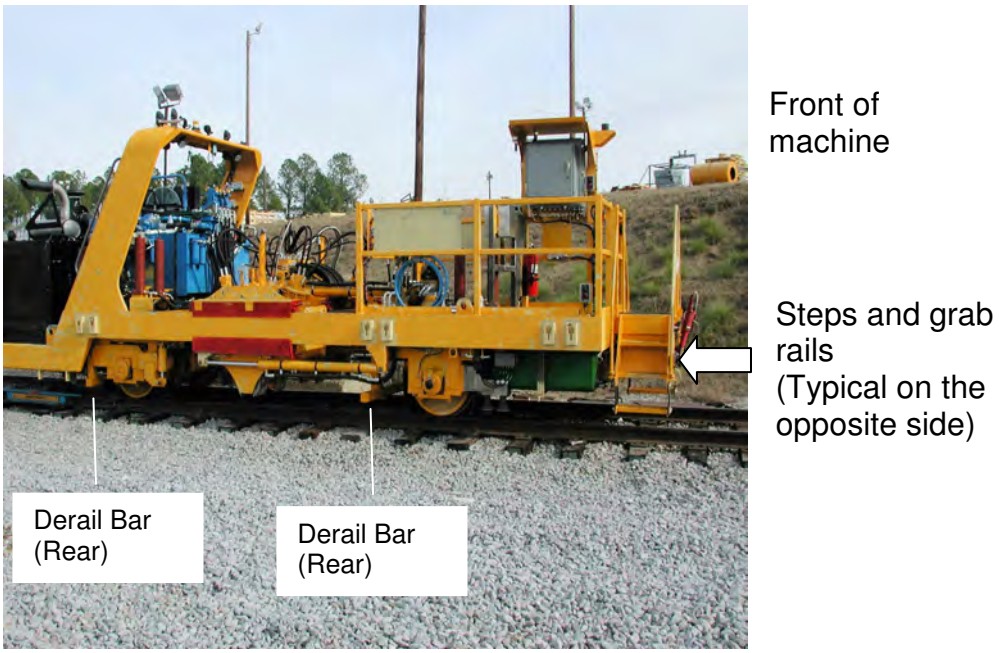


Figure 1-11

NOTE The front derail bar is hinged mounted on the model shown above. This feature allows quick loading and unloading of the Drone from trailers.

Radar Detectors

Two radar detectors are mounted on the front of the frame of the Drone; one on each side. These front facing detectors are Jupiter controlled and monitored by the Radar/E-stop panel on the Main Screen. This panel will show the status of the radar units and also the E-stop buttons. Refer to Figure 1-12 and 1-13.

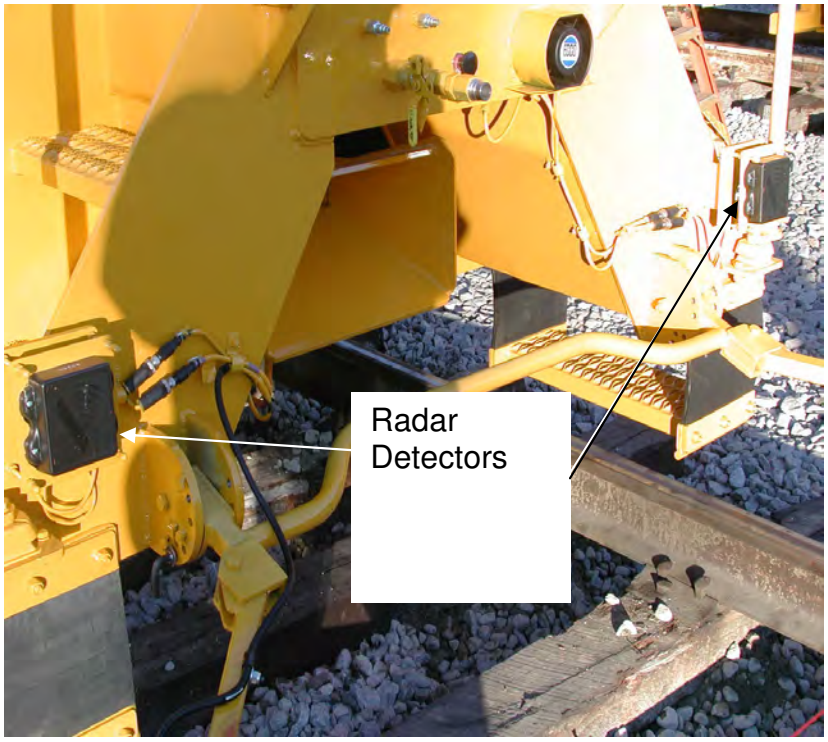


Figure 1-12

NOTE

In operation, if there is an intrusion into the Front Facing Radar detectors zones, the following sequence will commence.

- **At 20 ft** - An audible beeper alarm will sound.

- **As object gets closer** – The alarm rate will increase.

- **At 5 ft** - The Drone will stop. The spring applied brakes will apply, vibrators will stop, workheads will rise to “sleep idle position and the engine speed slow to idle.

Note: Once the intrusion is cleared, the Drone will automatically ramp up and proceed with work operations.

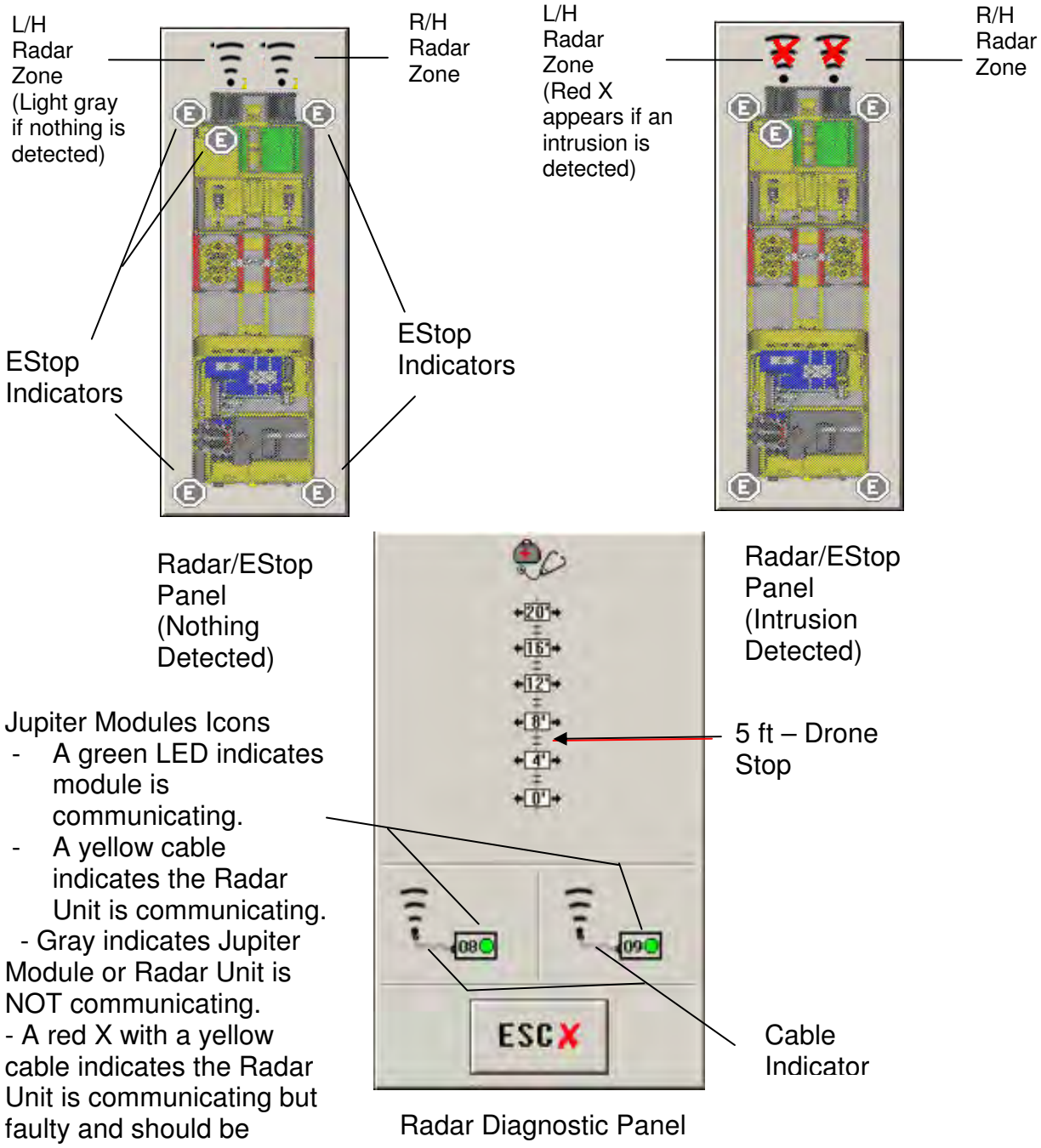

L/H Radar Zone (Light gray if nothing is detected)
R/H Radar Zone
EStop Indicators
EStop Indicators
L/H Radar Zone (Red X appears if an intrusion is detected)
R/H Radar Zone
Radar/EStop Panel (Nothing Detected)
Radar/EStop Panel (Intrusion Detected)
Jupiter Modules Icons
- A green LED indicates module is communicating.
- A yellow cable indicates the Radar Unit is communicating.
- Gray indicates Jupiter Module or Radar Unit is NOT communicating.
- A red X with a yellow cable indicates the Radar Unit is communicating but faulty and should be replaced.
20'
16'
12'
8'
4'
0'
5 ft – Drone Stop
08
09
ESC
Cable Indicator
Radar Diagnostic Panel

Figure 1-13

Safety Trip Wire (Traction Stop)

To provide coverage between and below the rails, the drone tamper is equipped with a traction stop trip wire mechanism on the front of the machine frame. This unit is raised and secured with locking pins on each side for travel. For set-up, remove the locking pin on each side and lower the arms and wire to a position about 1 ½ inches above the rails. Apply tension to the wire until the arrows in the tensioning indicator are centered on the line in the indicator window. This will indicate sufficient wire tension. Turn the shaft on the switch using an 8 mm wrench until the arrows are centered. Refer to Figure 14

Pull hard in the wire and reset the latch several times. If the arrows do NOT line up, tighten or loosen wire as needed until proper tension is achieved. Refer to Figure 14.

Figure 1-14A

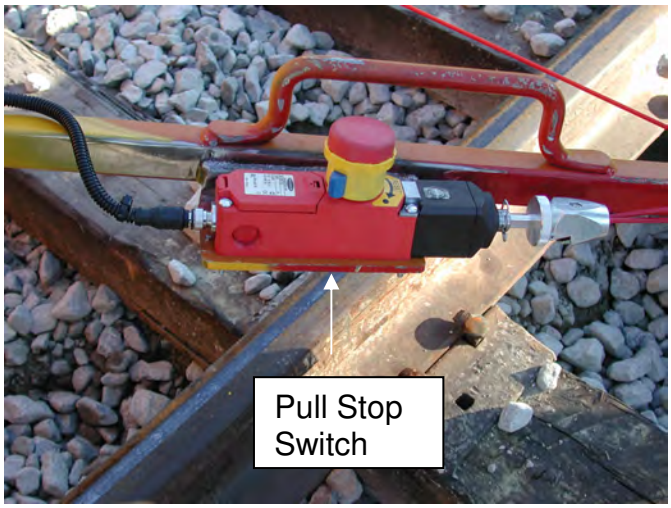


Figure 1-14B

Figure 1-14C

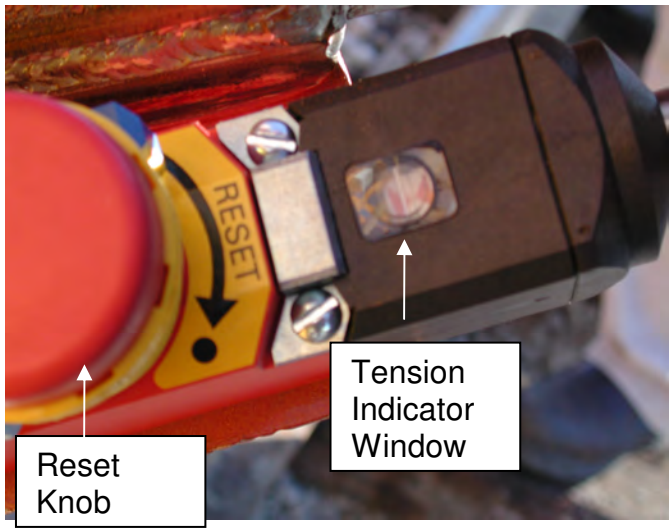


Figure 1-14D

Figure 1-14

NOTES

NOTES

Chapter 2

Controls

The Drone Tamper utilizes the following touch screens, hand held remote and the AutoMag Tie Finder option in conjunction with the Jupiter control system, provide control for its operation.

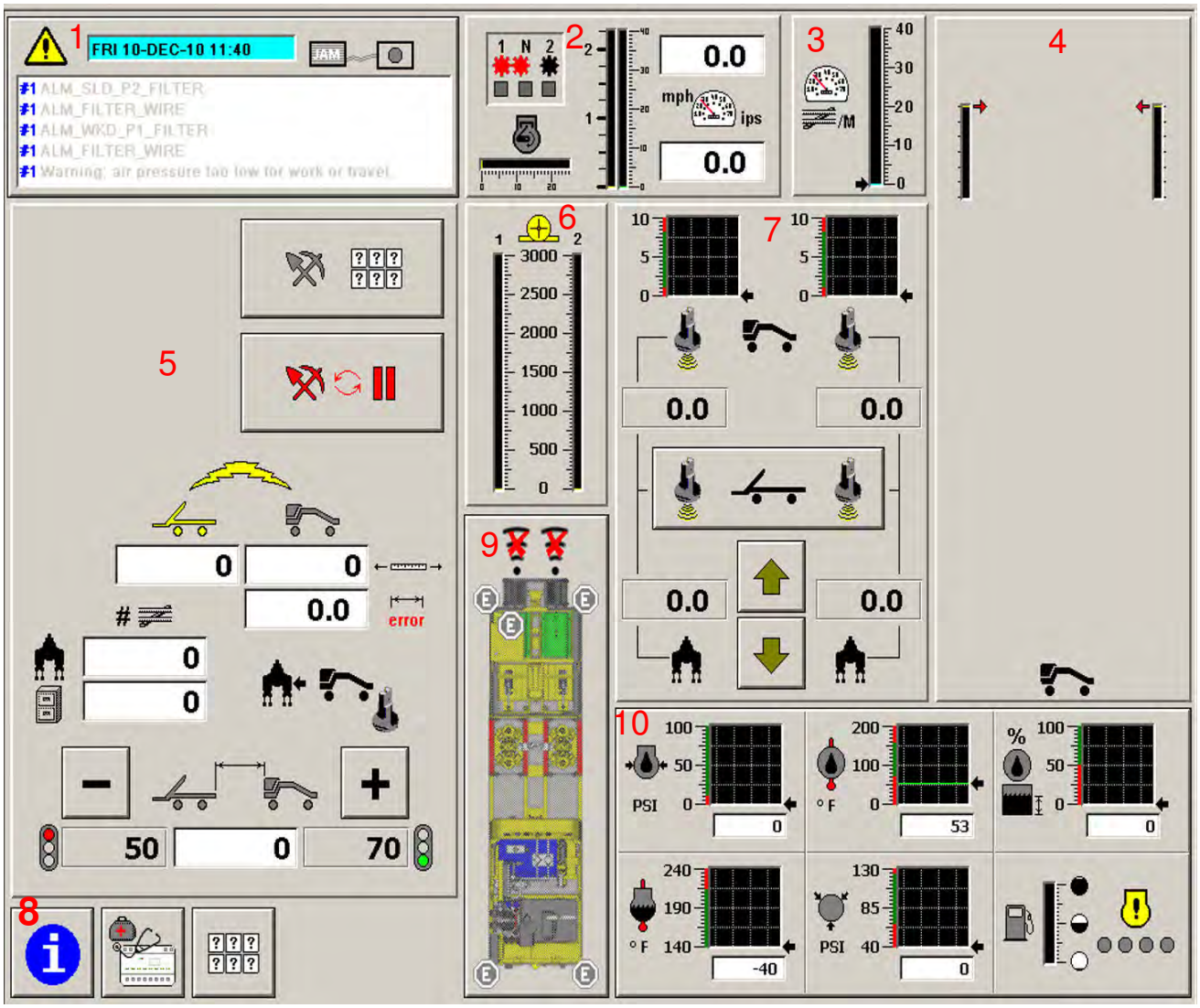


Figure 2-1: **Drone Main Screen** Located on the touch screen monitor located the inside the Main Control Box. Refer to Figure 2-3.

1. Alarm Panel
2. Drone RPM and Travel Speed Panel
3. Work Rate Panel
4. Tie Region Panel
5. Control Panel (Primary Drone)
6. Hydraulic Pumps Pressure Panel
7. AutoMag Probes Panel *(Tie Finder Antennas/Probes)*
8. Top Tool Bar Panel

9. Radar/Emergency Stops Panel
10. Engine Diagnostic Panel

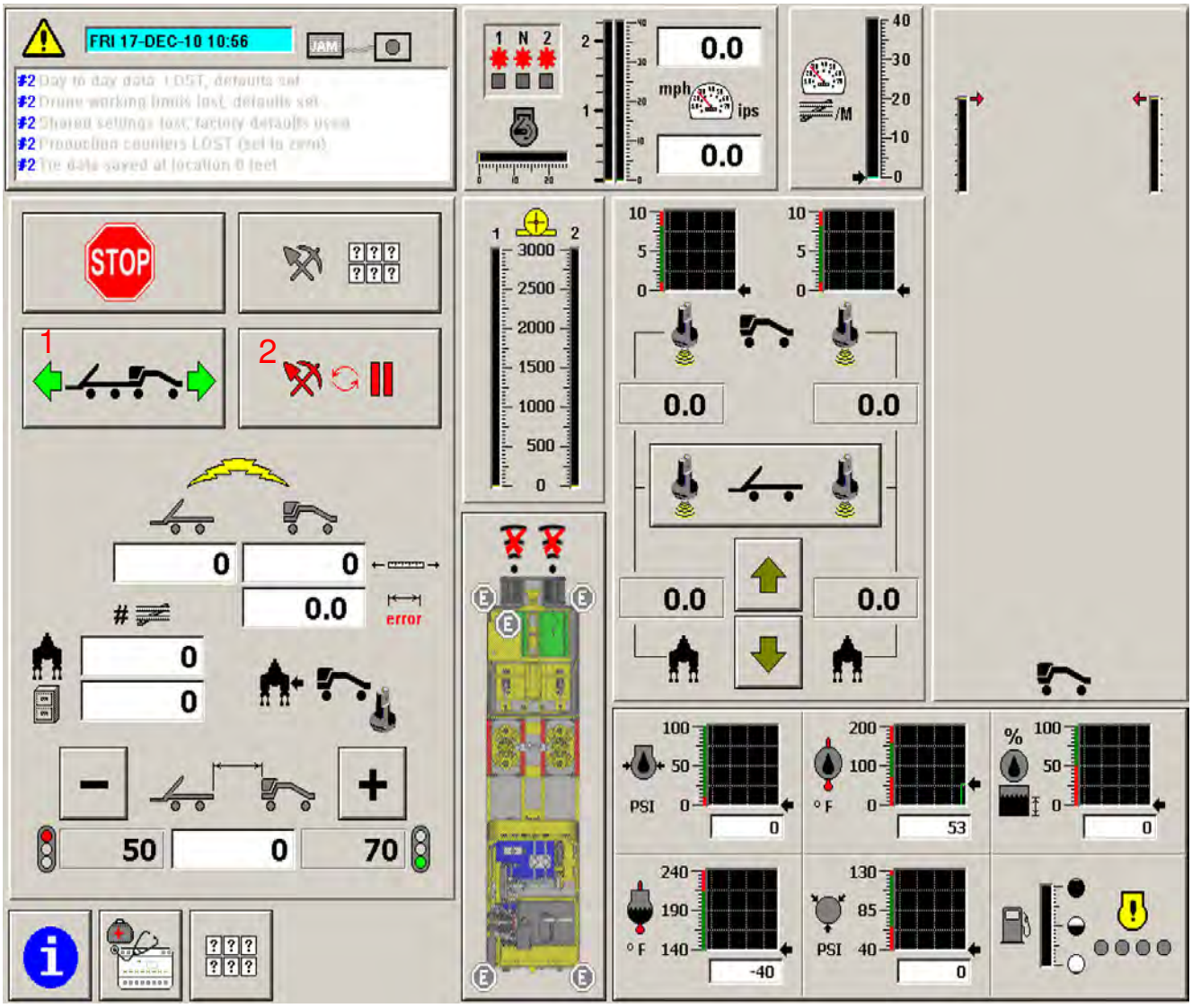


Figure 2-2: **Lead Machine Main Screen** (Located in the cab of the lead machine) Refer to Figure 2-4.

This screen is the same as the Drone Main Screen (Figure 2-1) except for the addition of 2 button added to the Control Panel; items 1and 2 on item 5.

1. Synchronize Button
2. Pause – Resume Button

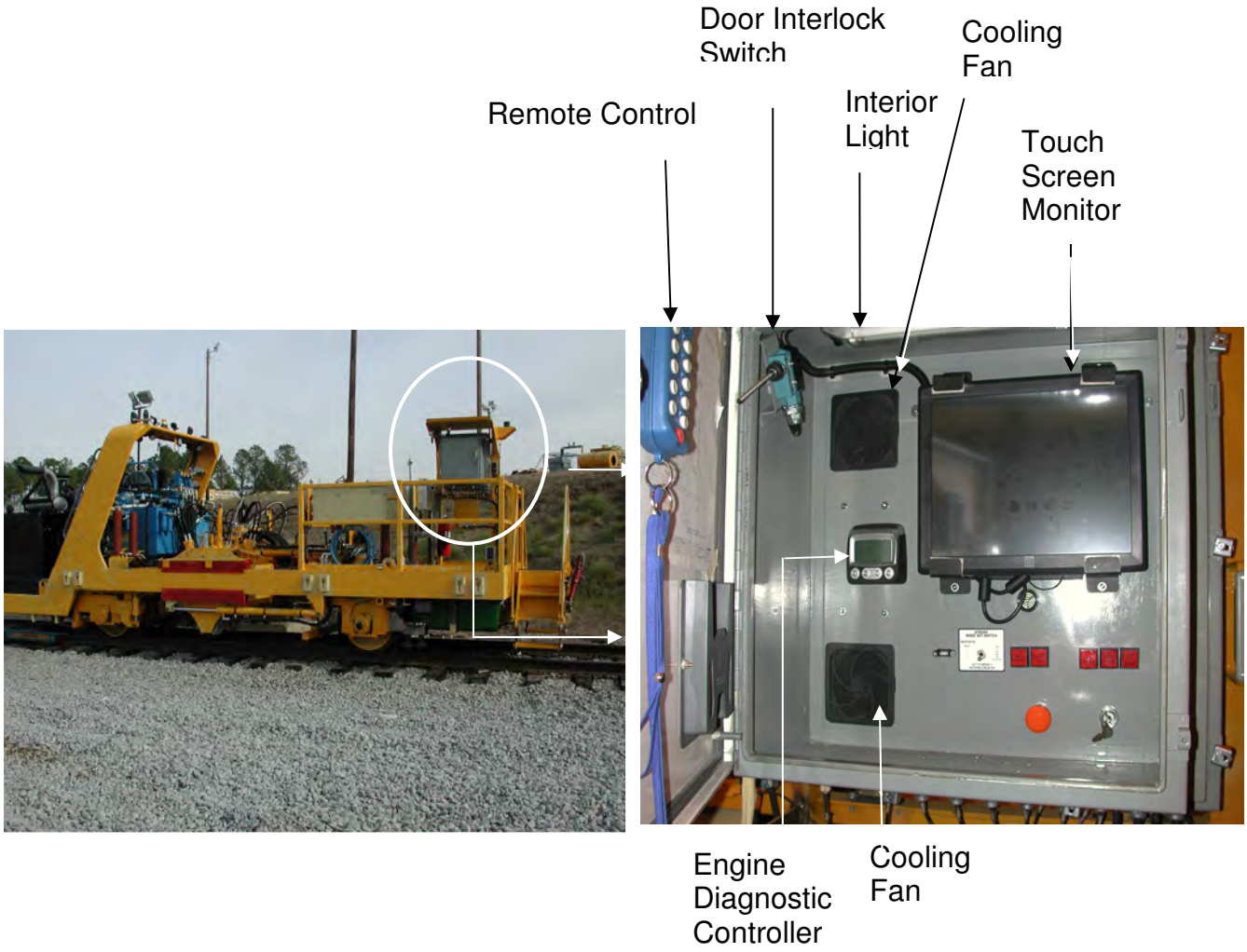


Figure 2-3: Main Control Box Location and Controls (Also

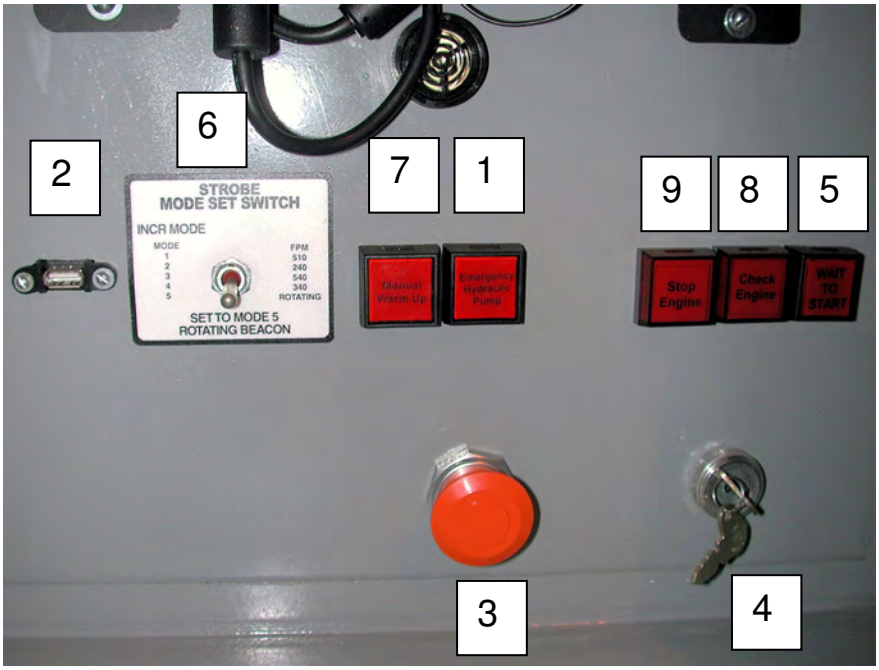


Figure 2-3A: Main Control Box Controls Cont'd

1. Emergency Pump Push Button ON/OFF
2. USB Port
3. Control System Interlock Switch (*Jupiter/Computer)* Push Button ON/OFF
4. Keyed Ignition Switch
5. Wait to Start Indicator Light **- Do NOT** try to start the engine if this is ON. This light MUST be OFF before starting the engine.
6. Beacon Control Switch
7. Manual Warm-up Switch ON/OFF
8. Check Engine indicator Light -This light will flash when out -of -range conditions occurs and continue to get worse.
9. Stop Engine Indicator Light – This light will flash for 30 seconds followed by engine shutdown.

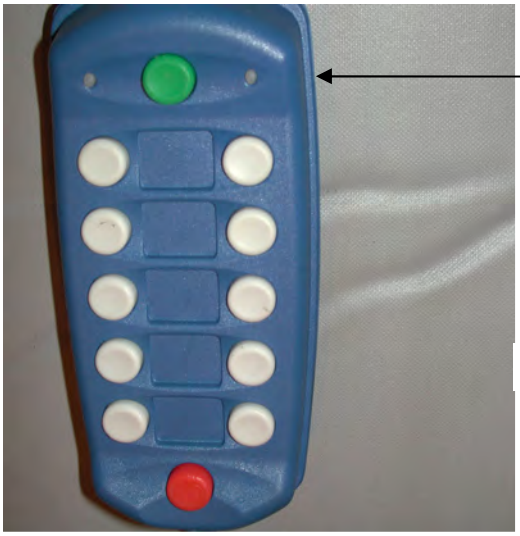
Main Control Box

Drone Touch Screen Monitor Location

Lead Machine Drone Touch Screen Monitor Location (In the cab)

Engine Control Panel (ECP)

Figure 2-4: Drone and Lead Machine Touch Screen Monitor Location



The unit has a magnetic back cover and D-ring cable which allows it to be stored in or on the Power Distribution Box when NOT in use. As shown in Fig 2-4.

Hand Held Remote Control /(Transmitter)

Receiver

Beacon

Antenna

Figure 2-4: Remote Control (Transmitter), Receiver, *Top Hat* Antenna and Beacon Location

Wireless Hand Held Remote Control

The wireless hand held remote can be used at any time to move, control or test the Drone, even if the associated Lead Tamper is turned off or out of radio range. **NOTE:** When the Drone is under the control of the Lead Tamper and operator via radio, turning on the hand held unit will take precedence. If working, the machine will enter the "work idle" mode waiting for commands. When turned off, control will return to the Lead Tamper and operator (if on and in radio range).

The wireless hand held remote has 12 pushbuttons. There is a green button at the top center of the unit and a red button at the bottom center. There are 10 more white buttons, five down each side.

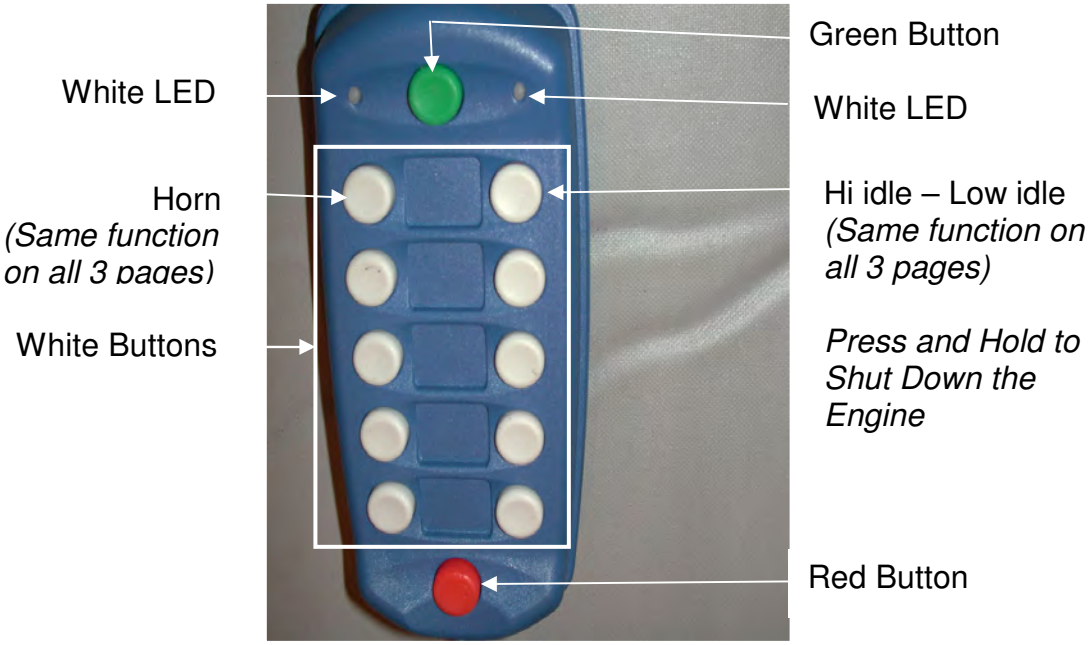


Figure 2-5: Remote Control

There are three "pages" of functions which provide a different set of controls or responses to 8 of the white buttons (the upper two white buttons are the same on each page).
Use the green button to activate the unit and the red button to turn the unit off. While the unit is active, a white LED will be flashing. If left on for a period of time without pushing any button, the unit will turn off.

When the unit is activated, page one (or the propel page) will be the selected page. The electric horn will also beep once to indicate this.

Pressing the green button again will select page two (the workhead page), the electric horn will beep twice to confirm the page. Pressing the green button again will select page three (the cycle page), the electric horn will beep three times to confirm this. Continuing to release and press the green button will cycle between the three pages with the electric horn beeping to indicate which page is selected.

The top left white button will sound all air horns while the button is held. This button has the same function on all three pages.

Momentarily press the top right white button to toggle engine speed between high-idle and low-idle. If this button is held down for more than a second, the engine will be shut down (note that the unit must be already active before doing this). Subsequently, it will be necessary to turn of the Jupiter control system before the engine can be restarted. This button has the same function on all pages.

The following three pages describe the controls for the Drone's hand held remote:

Hand Held Control Page One – Propel

	Green Button *Start or Page select*	
Horn		**Hi idle – Low idle**
Propel Forward		**Propel Faster**
Propel Reverse		**Propel Slower**
Left Workhead Forward		**Right Workhead Forward**
Left Workhead Reverse		**Right Workhead Reverse**
	Red Button *Turn off manual control*	

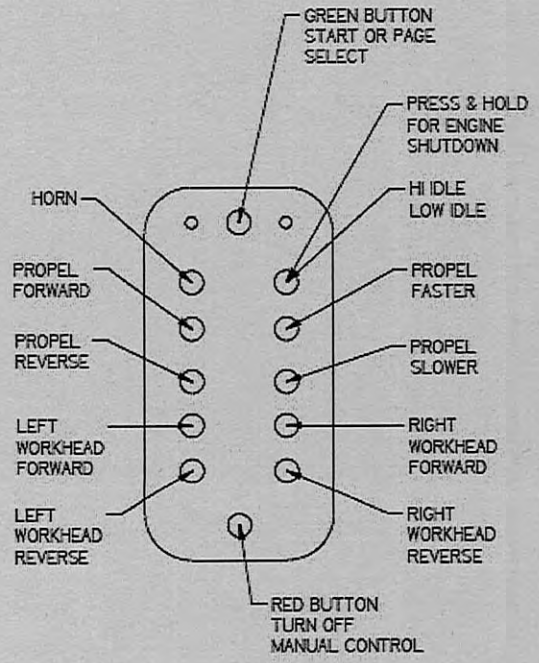
Propel Forward Press this button to release the brakes and move the machine in the forward direction. Release this button to stop the machine and apply the brakes.

Propel Reverse Release the brakes and move the machine in the reverse direction. Release this button to stop the machine and apply the brakes.

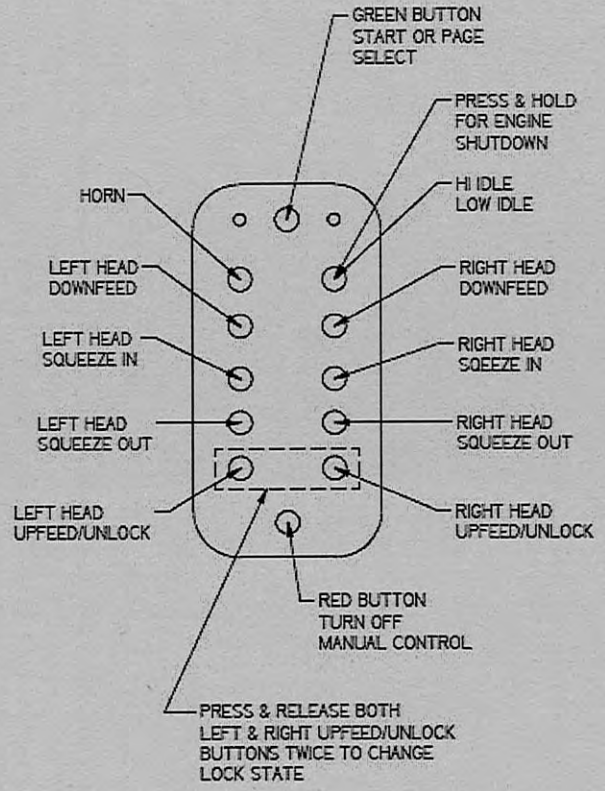
Propel Faster Holding this button while holding down the forward or reverse buttons, will command the machine to increase speed in the selected direction. The work propel valve when fully open will result in a speed of about 4 miles per hour. While this button is held, hydraulic pressure to the propel circuit will be steadily increased. When this button is released, the work propel valve opening will be held constant, but the hydraulic pressure will

REMOTE CONTROL BUTTON FUNCTION GUIDE

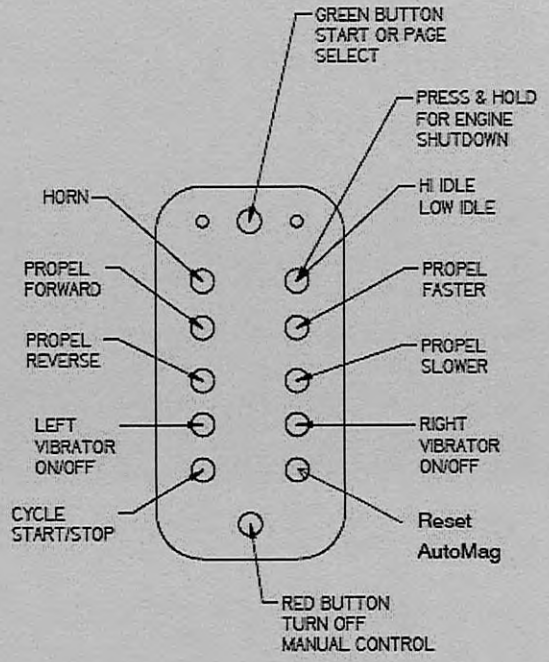
PAGE ONE - PROPEL



PAGE TWO - WORKHEADS



PAGE THREE - CYCLE



return to a level adequate for constant speed. It may be necessary to hold down this button when climbing ramps.

Propel Slower When this button is pressed (and the forward or reverse button continues to be held), the work propel valve will reduce speed until the minimum speed is being applied. To prevent sliding, it is preferable to use this button to reduce speed before releasing the forward/reverse button to stop the machine.

Workhead Forward Press the left or right button to move the left or right workhead forward towards the front or home position of the workheads.

Workhead Reverse Press the left or right button to move the left or right workhead rearwards away from the front or home position of the workheads.

NOTE: The workhead slider buttons on this page operate the slider valves with a fixed voltage and the cylinder position transducers are ignored. If a workhead slider moves erratically in cycle but smoothly using the wireless remote buttons, then a faulty cylinder position transducer is indicated.

Hand Held Control Page Two – Workheads

	Green *Start or Page Select*	
Horn		**Hi idle – Low idle**
Left Head Downfeed		**Right Head Downfeed**
Left Head Squeeze In		**Right Head Squeeze In**
Left Head Squeeze Out		**Right Head Squeeze Out**
Left Head Upfeed/Unlock		**Right Head Upfeed/Unlock**
	Red Button *Turn off manual control*	

The 8 white buttons on this page are used for manual workhead operations. To make it easier to remember, the sequence of operations from top to bottom is in the same sequence as a cycle, namely down-feed, squeeze-in, squeeze-out and up-feed.
To open or close the workhead locks, press and hold both workhead up-feed buttons twice.

Hand Held Control Page Three – Cycle

	Green *Start or Page Select*	
Horn		**Hi idle – Low idle**
Propel Forward		**Propel Faster**
Propel Reverse		**Propel Slower**
Left Vibrator On/Off		**Right Vibrator On/Off**
Cycle Start/Stop		**Reset, AutoMag Enable/Disable**
	Turn off manual control	

Propel Forward As for Page 1.

Propel Reverse As for Page 1.

Propel Faster As for Page 1.

Propel Slower As for Page 1.

Vibrator On/Off Use these buttons to turn the workhead vibrators on or off. NOTE: When cycle is started, the vibrators will automatically start and stop. These buttons are for test purposes.

Cycle Start/Stop Use this button to start or stop work in manual mode. If an automatic pattern has been selected, and there are tie location information available from the lead machine, the tamping pattern will be automatic. If a fixed pattern has been selected, position the machine (ensuring the heads are at their home position) so that the tools are just short to the first tie to be tamped in the fixed pattern before starting cycle.

NOTE: If the AutoMag probes have not previously passed over the first tie to be tamped using a fixed pattern, it will be necessary to back up the machine until the probes are behind this tie. Reset the AutoMag probes and move the machine forward until the tools are just short to the first tie to be tamped.

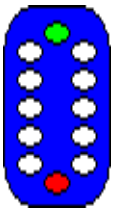
Figure 2-6: Lead Machine *(MK VI Tamper)* Left Console Keypad *(Refer to the 6700 operation manual if it is to be the lead machine)*

OPERATING THE DRONE

Automatic Mode

This mode is expected to be the preferred mode of operation that will require the least amount of operational supervision or monitoring. In this mode, the Drone will be controlled by the operator on the Lead machine. At startup, and after radio communication is reestablished, the work mode will be disabled (red work/pause button) and the Drone will be in a work-idle mode. Touch this button to enable or disable work. When enabled, the Drone can initiate forward movement (never reverse in automatic mode) and tamping provided the Drone is within the work limits (see below).

Manual Mode *(Using the Remote)*

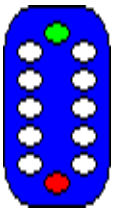


At any time, manual mode can be invoked by turning on the hand held remote control unit by pushing the green button on the unit. On the lead machine, this symbol indicates the lead operator no longer has control and that the Drone is being operated manually. The available commands will be treated in detail later. When moving the Drone or tamping with the Drone in manual mode, the automatic mode work limits are ignored. Only in this mode can the Drone be moved in reverse while disconnected from the Lead machine.

Every tie tamped (or marked for exclusion) by the lead machine will be recorded. As the Drone reaches each tie, the decision to tamp or skip the tie will be based on already knowing exactly what work the lead machine did at the same location. This allows the lead machine operator to vary the tamping pattern at any time knowing the Drone will automatically adjust its pattern to match as it reaches each such change.

Using the Lead Machine Tamping Pattern

Every tie tamped (or marked for exclusion) by the lead machine is recorded. When this data is selected (default) to be used by the Drone, as the Drone reaches each tie, the decision to tamp or skip the tie will be based on already knowing exactly what work the lead machine did at the same location. This allows the lead machine operator to vary the tamping pattern at any time knowing the Drone will automatically adjust its pattern to match as it reaches each such change.



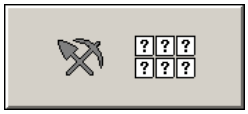
When the hand held remote is turned on, an icon will appear on the Drone interface screen to indicate an operator with the hand held remote has taken control. If cycle is initiated by the hand held unit, the applied pattern will continue to be according to what the Lead tamper did at the same location (even if the Lead tamper is shut down for repair.

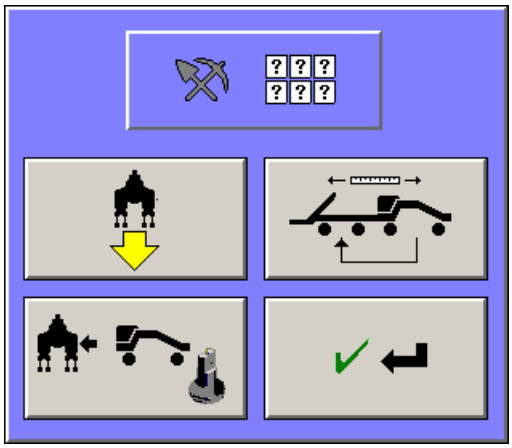
Fixed Tamping Pattern

In the event of a synchronization problem (such as an encoder problem on the Lead tamper), the Drone can be operated manually where the tamping pattern is fixed and initiated by the hand held remote.
In this mode, the hand held wireless remote is used to position the machine and start tamping. A fixed tamping pattern will be used and will repeat indefinitely. This mode will require the machine to be monitored to ensure the pattern remains in sync with the lead machine (unless every tie is being tamped). In addition, there may be locations on track that may require operator intervention. For example, there are several locations in a turnout that cannot be tamped by the Drone. Attempting to do so could damage the track, the machine, or both. Intervention may be required at other locations (cables, or other unusual features).

Selecting the Pattern Mode

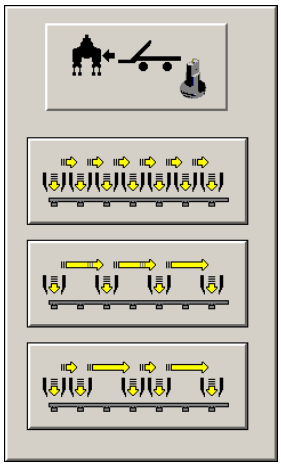
When the computer system is first turned on, the tamping pattern is assumed to be dictated by the lead machine. This mode is the default. To change the mode, use the “work options” button located at the top left of the main screen.





This will open the work options panel. Use the button at the bottom left of this panel to toggle between automatic and manual tamping pattern modes. On the panel shown, the button is indicating automatic mode. When this button is pressed to select a fixed pattern, an additional panel will appear to enable selection of the fixed tamping pattern to be used.

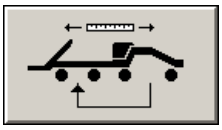
Select the pattern to be used, either every tie, every other tie, or two out of three ties.
The currently selected mode will also be visible on the main screen.



Starting Automatic Mode

1. Move the Drone and or lead tamper until the tow bar is fully engaged without the tow bar pin being engaged (this is normally the condition after travel mode).

2. If the AutoMag tie finder on the lead machine is not turned on, turn it on now. Note: if AutoMag was already on and the lead machine has been moved backwards, it will be necessary to turn it OFF, and then back ON to reset the probes.



3. Open the work options panel and press the synchronize button at the top right of this panel. The work options panel can then be closed.

Note: If the Drone is expected to start as soon as the separation between the machines reaches the work limits, you will need to press the "work enable" button if the icon on this button is red in color.

Using Automatic Mode

In automatic mode, the Drone will pretty much take care of itself. There are a couple of items to be aware of.

There is no need to select a tamping pattern or adhere to any sequence. The Drone will simply tamp any tie skipped by the lead machine (up to a maximum of two). The operator can change between skipping one, skipping two or tamping every tie (solid) at any time.

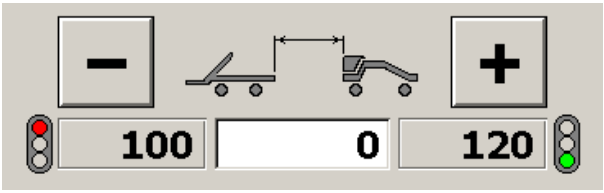
NOTE: the operator can backup to "re-pull" the track at any time. This might be necessary if, say, the cross-level is not holding. This will not cause any problems for the Drone within the range of thirty ties. Backing up by more than thirty ties may result in the Drone tamping ties already tamped by the lead, even so, this will not result in any tie being skipped by both machines.

If more than two ties are skipped by the lead machine, the Drone will also skip these ties (also, the heads on the Drone will be raised when the Drone reaches this location to ensure clearance of any possible obstacles).

There is an exclude button on the left arm console panel that can be used to indicate that ties skipped by the lead machine should also be skipped by the Drone. When this button is pressed, the exclude mode will be latched on (this will be acknowledged by a single short beep). As the lead machine moves forward, all ties that pass the workheads will be marked to be excluded by the Drone, tamped by the lead or not. Subsequently pressing the exclude button will turn this mode off (acknowledged by two short beeps). On the tie region view at the right side of the lead operator screen, an excluded tie will be marked as red.
If there is no tie for the Drone to tamp for more than two ties ahead of its location, it will raise heads to ensure safe clearance.

If there is no work ahead of the Drone for more than ten feet, the Drone will engage a higher work speed and alternately flash forward lights to indicate it is moving at a higher than normal rate.

Automatic Mode Work Limits



When work is enabled in automatic mode, the Drone will start and stop work according to work limits at the bottom left of the screen and the separation between the two machines. To change these limits, touch the distance you wish to change (it will highlight yellow) and press the adjacent “plus” or “minus” buttons to change the limit. A minimum distance of twenty feet between these distances is necessary (when increasing the stop limit, it may be necessary to increase the start limit first if the start limit is too close).

The icon on the work enable/disable button on the main screen will change as follows:

The Drone is in a “work idle” mode and is waiting for the separation between the machines to reach the “start work” work limit.

The Drone is working. If the separation between the two machines falls below the work stop limit, the machine will enter the “work idle” mode.

The Drone work mode is disabled. Press this button to enable work. If the machine separation is more than the start of work limit, the Drone will start work. Otherwise, it will wait until the start work limit is exceeded.

Manual Mode

When the hand held remote is turned on, tamping can be initiated from this device. If a fixed pattern has not been selected, the location of ties tamped by the lead machine will dictate which ties the Drone will tamp in exactly the same way as it does when being controlled by the Lead operator except that radio communication is not required and the work limits are ignored. This may be helpful if it became necessary to shut down the lead machine (repair, refuel or any other reason) and it is desirable to continue operation using the Drone to complete work already mapped out by the lead tamper.

Alternatively, a fixed pattern can be used in situations where synchronization has been lost there is work to be done or completed by the Drone. On the main screen, select manual mode and the required tamping pattern as described on earlier.
To use a fixed pattern, move the Drone using the Remote Controller on page 1 of the controller until the Drone probes are behind the first tie to be tamped by the Drone. If the workheads are not unlocked, unlock them using page 2 of the controller.

Use the Remote to move the machine forward until the home position of the workheads is just before the first tie to be tamped by the Drone.

Note: When tamping two ties out of three, position the machine just short to the first tie of the pair to be tamped.

On page 3, press the bottom left button to begin work. Press the same button to stop work (the tie being tamped will be completed before work stops).

Resuming Manual Mode

Every time manual mode is stopped, it will be necessary to position the home position of the workheads to just short to the first tie to be tamped by the Drone (for two of three, this tie should be the first of the pair). On page 3 of the Omnex control, press the bottom left button.

Chapter 3

Drone and Lead Machine Navigation Screens

The following Jupiter Screens are graphical representations of those found on the Drone Tamper and Lead Machine. The screens are the same with the exception being the addition of the Travel and Pause/Resume buttons on the Control Panel of the Lead Machine.

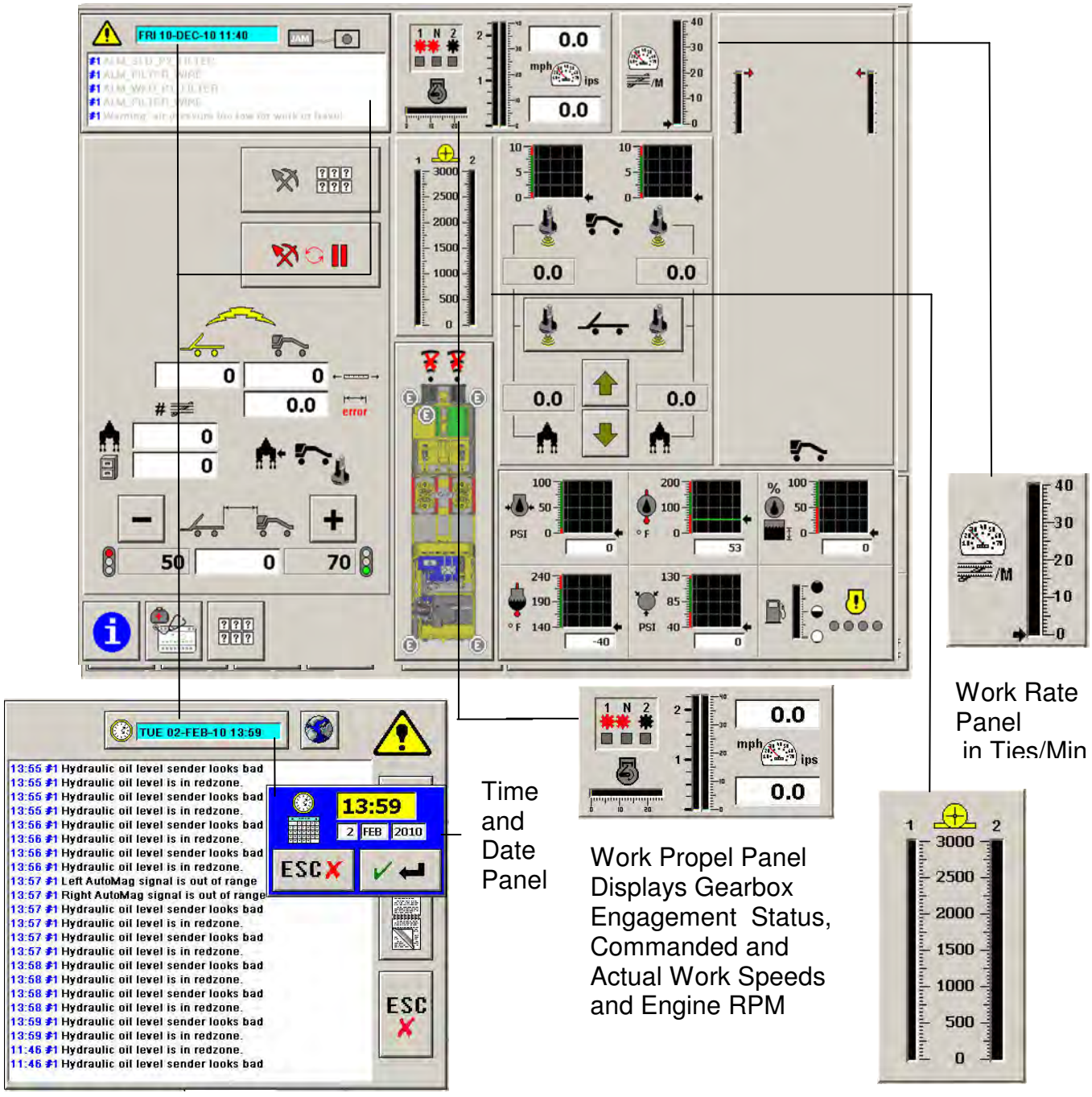
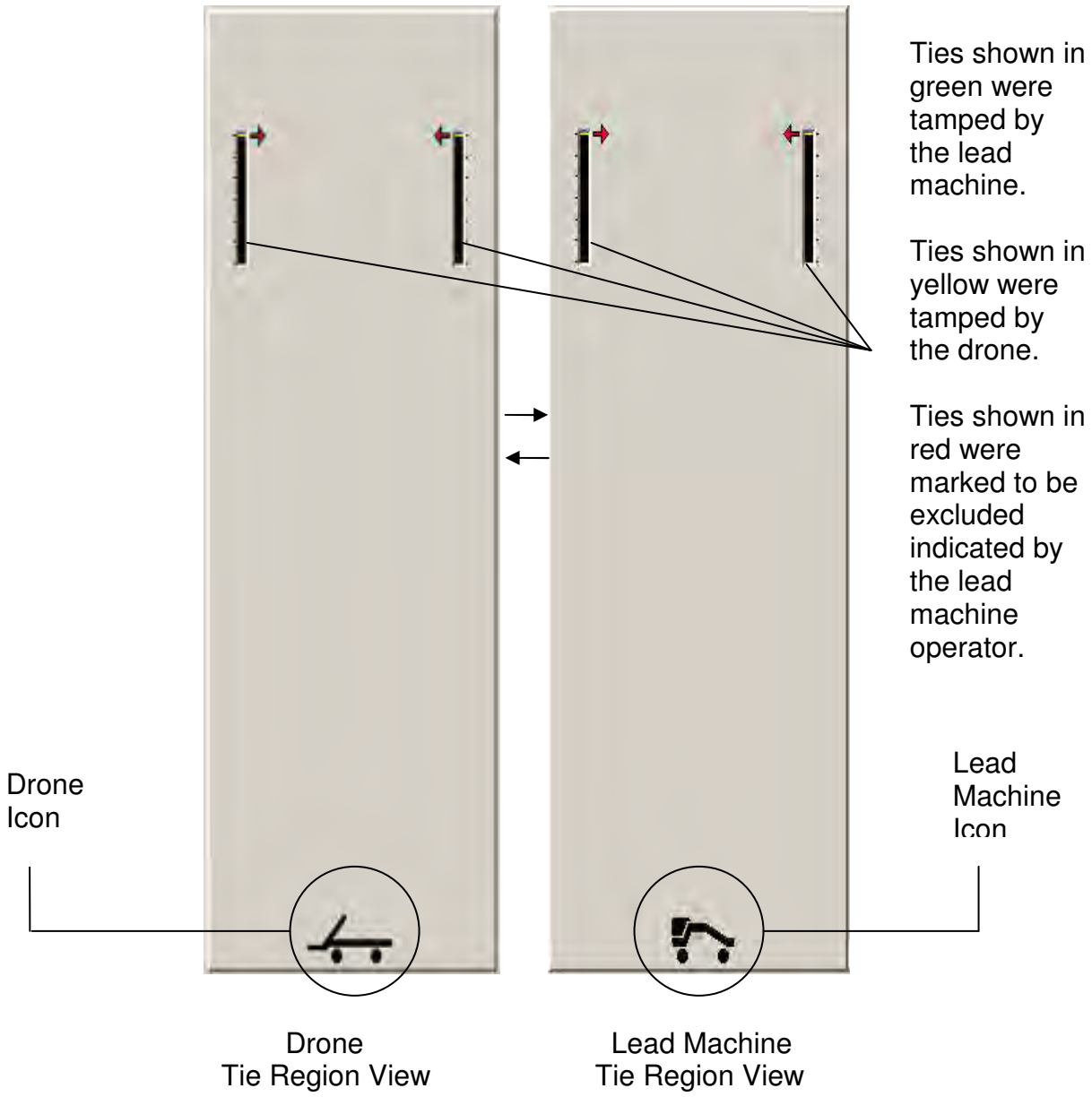


Figure 3-1



Touch anywhere on this panel to switch between ties found by the drone and ties found by the lead.

Figure 3-2

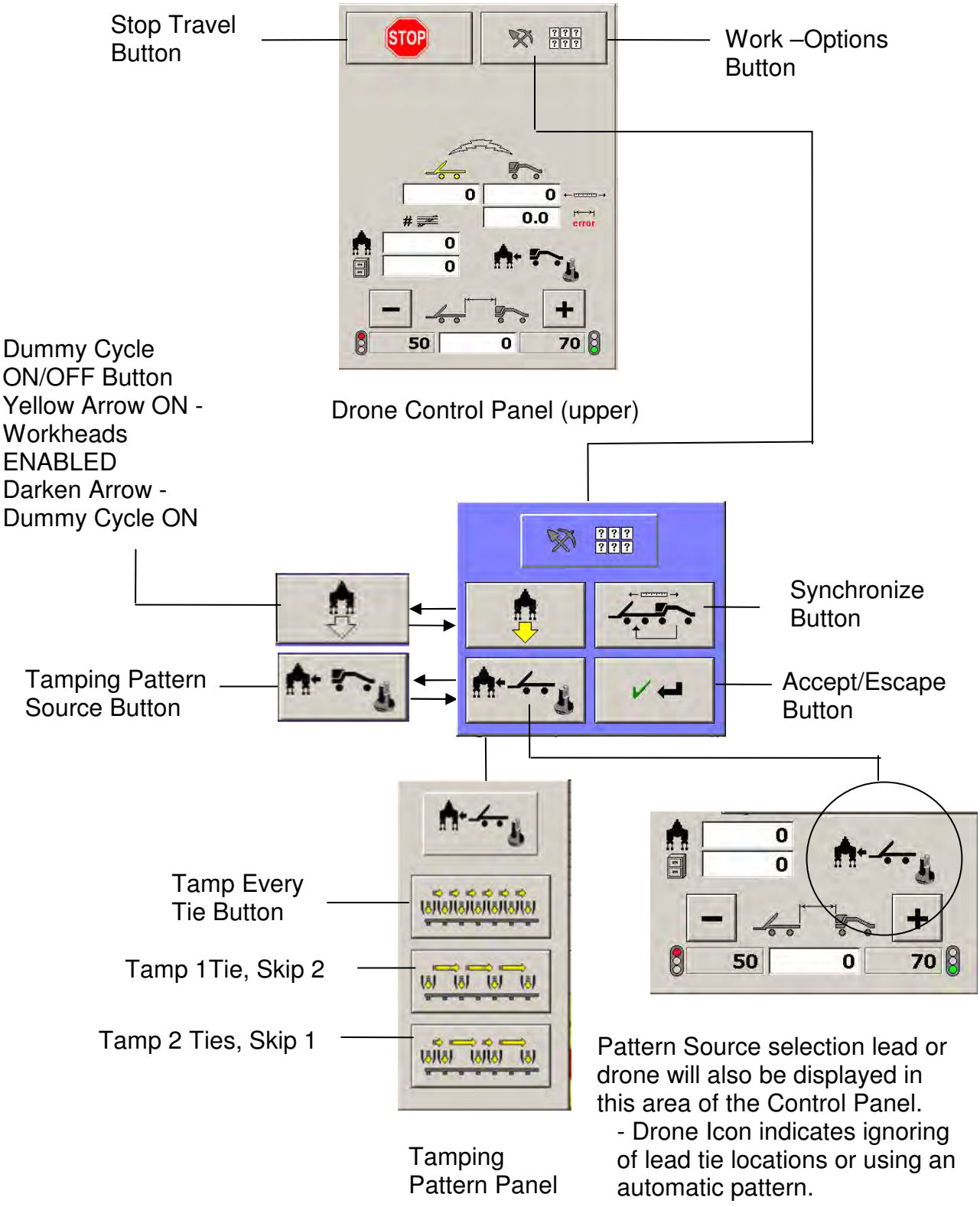

Stop Travel Button
Work –Options Button
STOP
0
0
0.0
error
0
0
50
0
70
Drone Control Panel (upper)
Dummy Cycle ON/OFF Button
Yellow Arrow ON - Workheads ENABLED
Darken Arrow - Dummy Cycle ON
Synchronize Button
Tamping Pattern Source Button
Accept/Escape Button
Tamp Every Tie Button
Tamp 1Tie, Skip 2
Tamp 2 Ties, Skip 1
Tamping Pattern Panel
0
0
50
0
70
Pattern Source selection lead or drone will also be displayed in this area of the Control Panel.
- Drone Icon indicates ignoring of lead tie locations or using an automatic pattern.

Figure 3-3

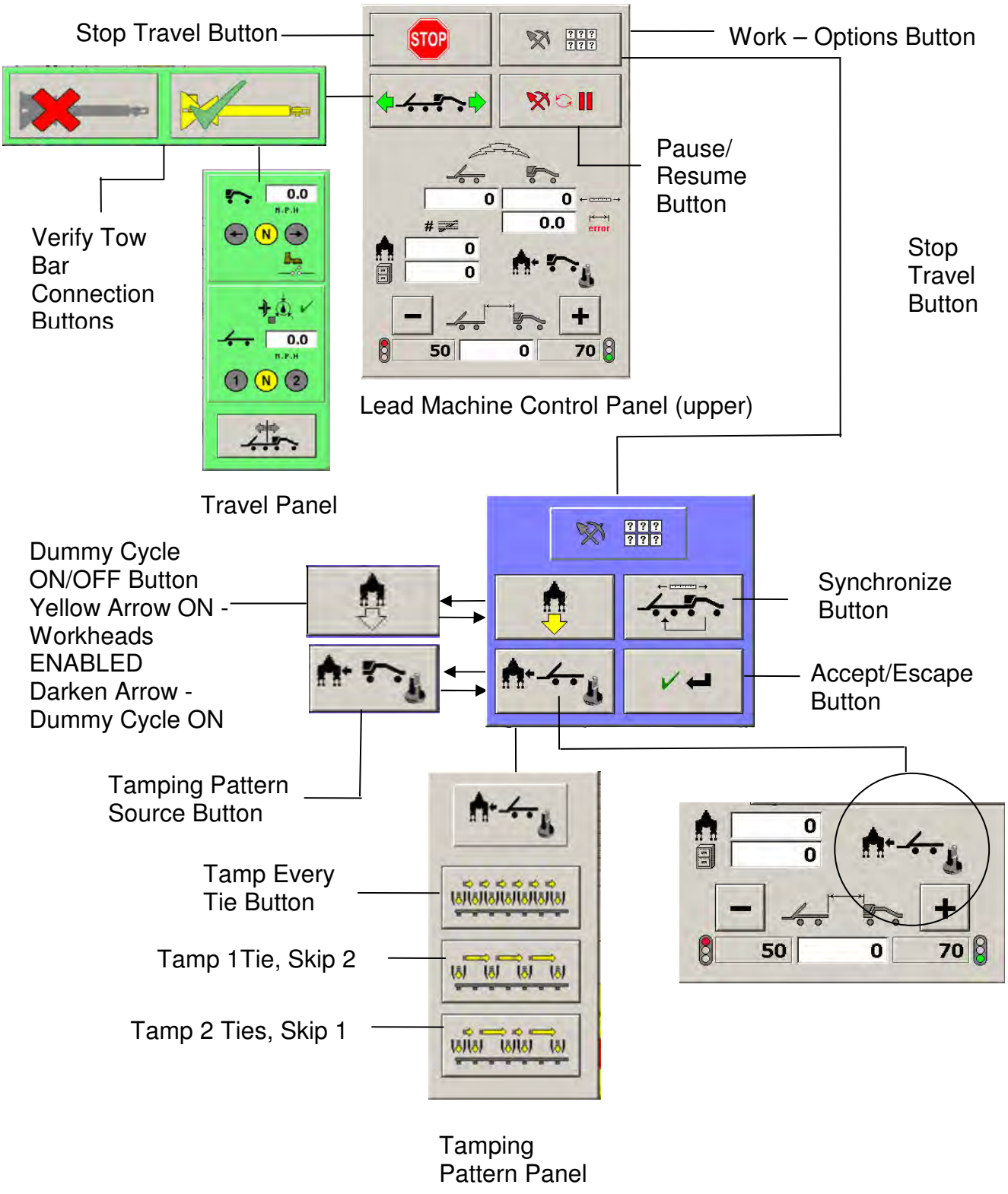
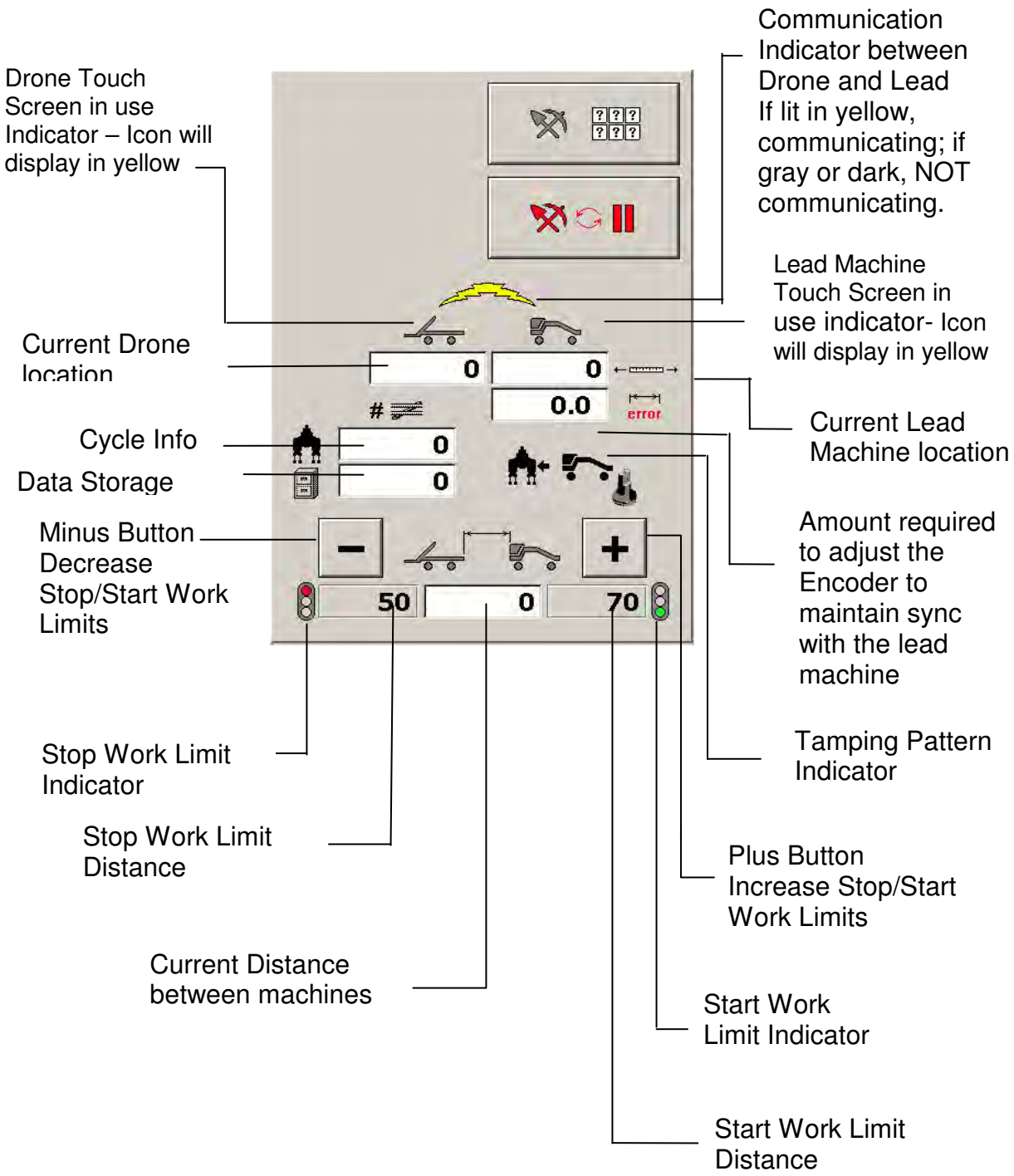

Stop Travel Button
Work – Options Button
Pause/
Resume
Button
Verify Tow
Bar
Connection
Buttons
Stop
Travel
Button
Lead Machine Control Panel (upper)
Travel Panel
Dummy Cycle
ON/OFF Button
Yellow Arrow ON -
Workheads
ENABLED
Darken Arrow -
Dummy Cycle ON
Synchronize
Button
Accept/Escape
Button
Tamping Pattern
Source Button
Tamp Every
Tie Button
Tamp 1Tie, Skip 2
Tamp 2 Ties, Skip 1
Tamping
Pattern Panel

Figure 3-4



Control Panel (lower)

Figure 3-5

Top Tool Bar Panel

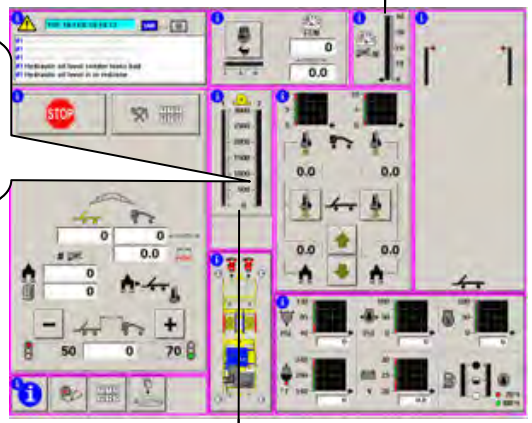
Help Button

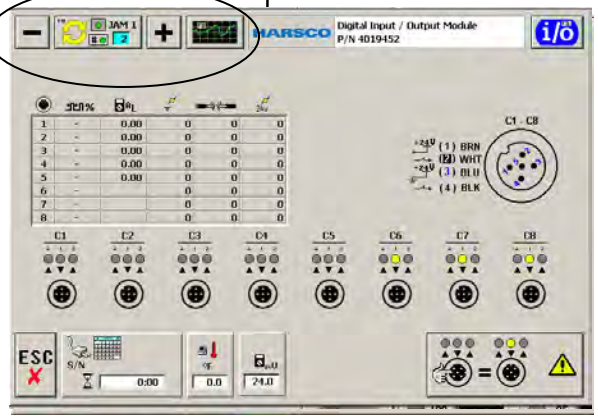
Diagnostic Button

Options /Misc Button

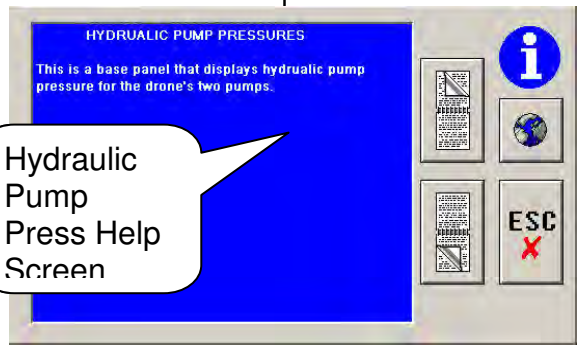
Touch the Help Button to display the Help Panel Screen then touch any panel to display help Info for that panel.

Hydraulic Pump Press Panel Selected





Diagnostics can be selected from the main screen and



Hydraulic Pump Press Help Screen

Scroll Back Thru Modules

Scroll Forward Thru Modules

Touch to Select Thumbnail or Detail Network Diagnostic Panels or Select the F8 for models w/keyboard

Figure 3-6

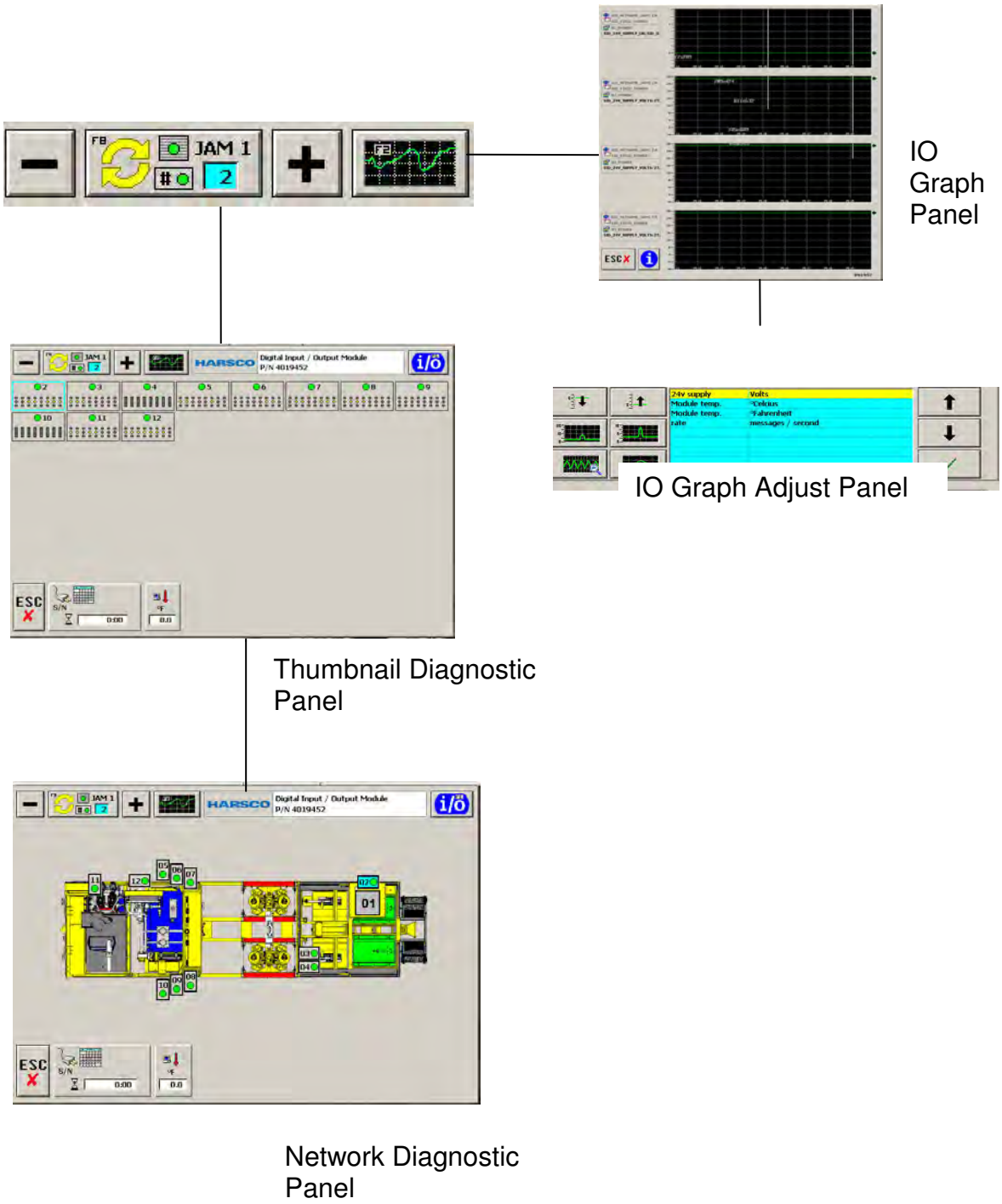

JAM 1
2
IO Graph Panel
IO Graph Adjust Panel
Thumbnail Diagnostic Panel
Network Diagnostic Panel

Figure 3-7

Top Tool Bar Panel Cont'd

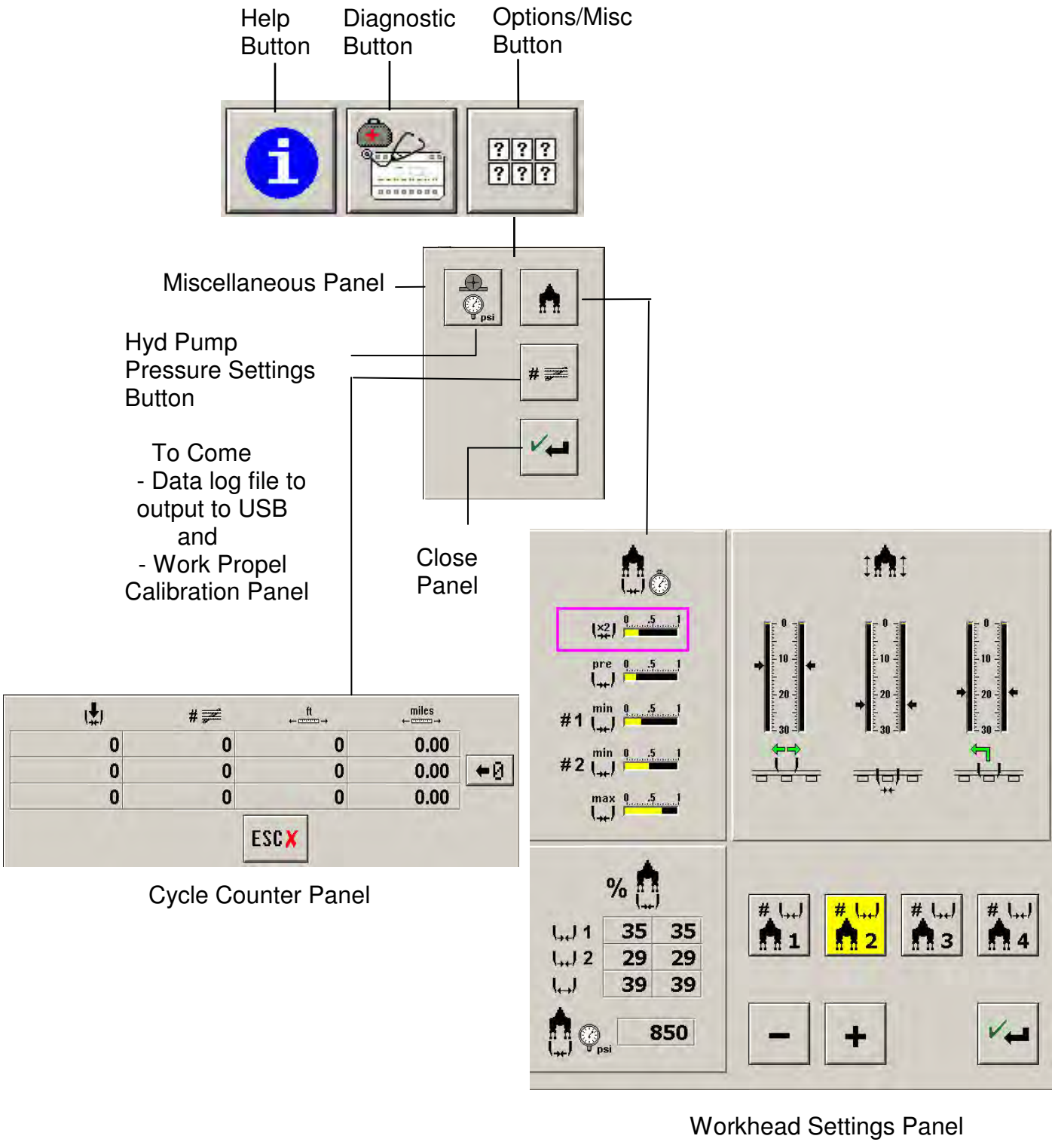
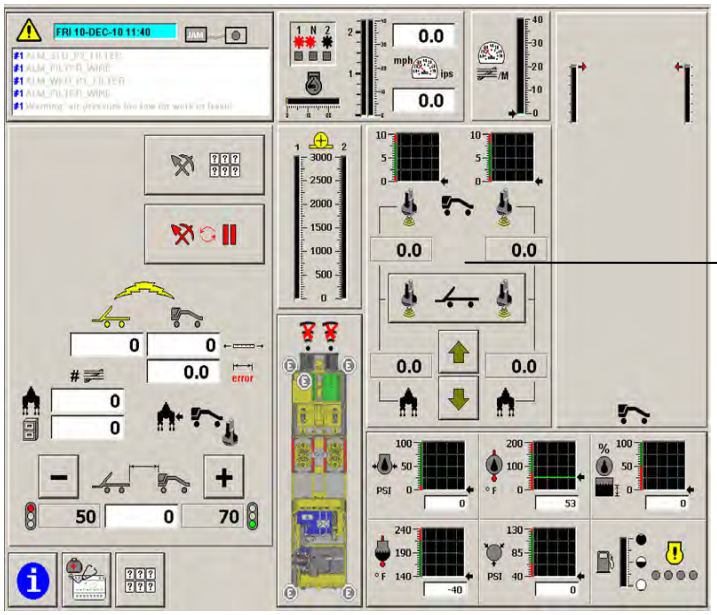
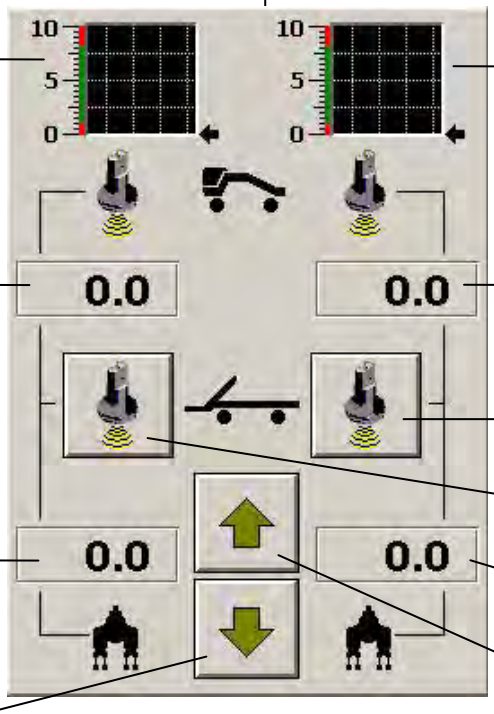


Figure 3-8

Main Screen





Automag Probe Panel

Figure 3-9

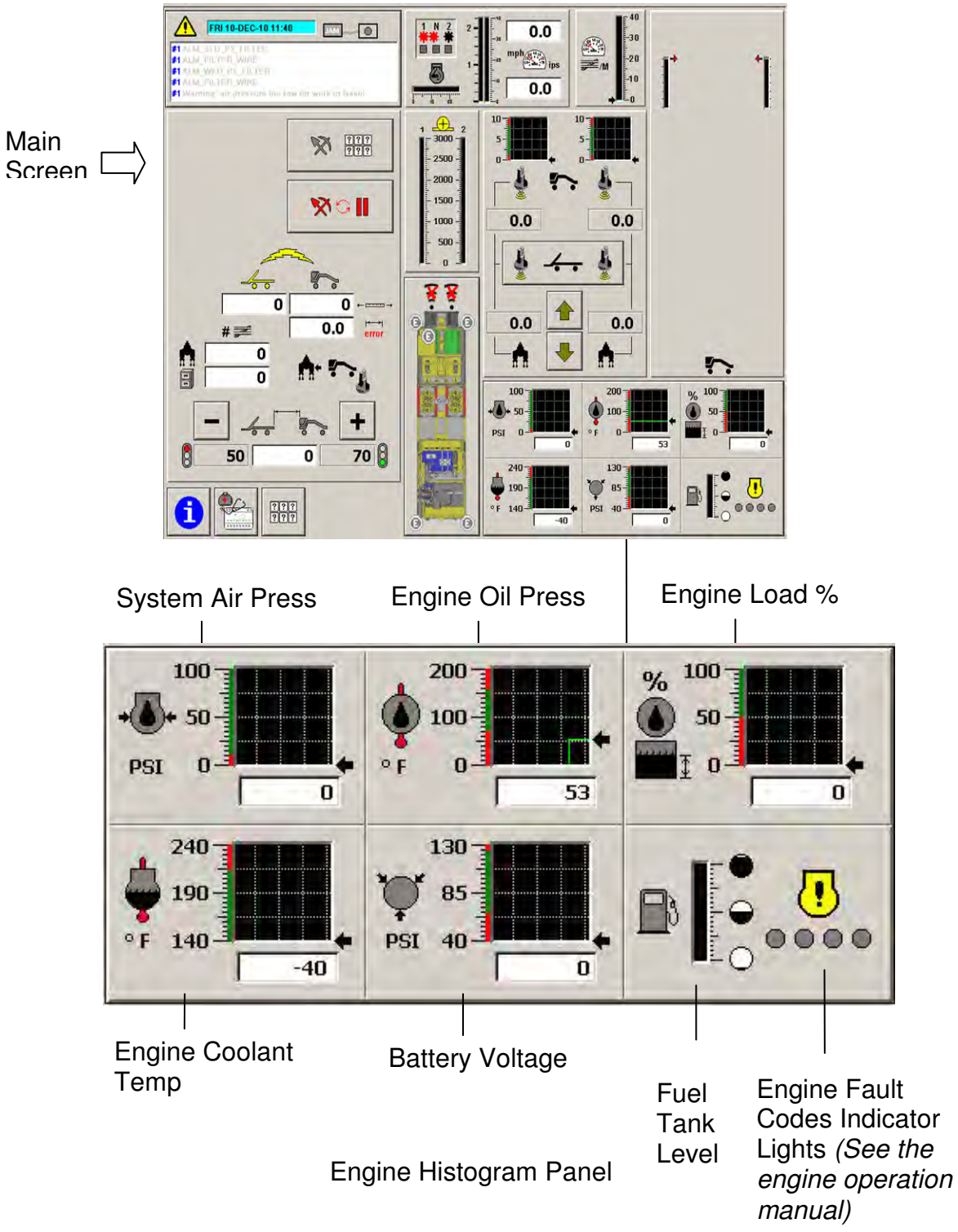

Main Screen
System Air Press
Engine Oil Press
Engine Load %
Engine Coolant Temp
Battery Voltage
Fuel Tank Level
Engine Fault Codes Indicator Lights *(See the engine operation manual)*
Engine Histogram Panel

Figure 3-10

Chapter 4

Drone Tamper Daily Checklist

Engine:

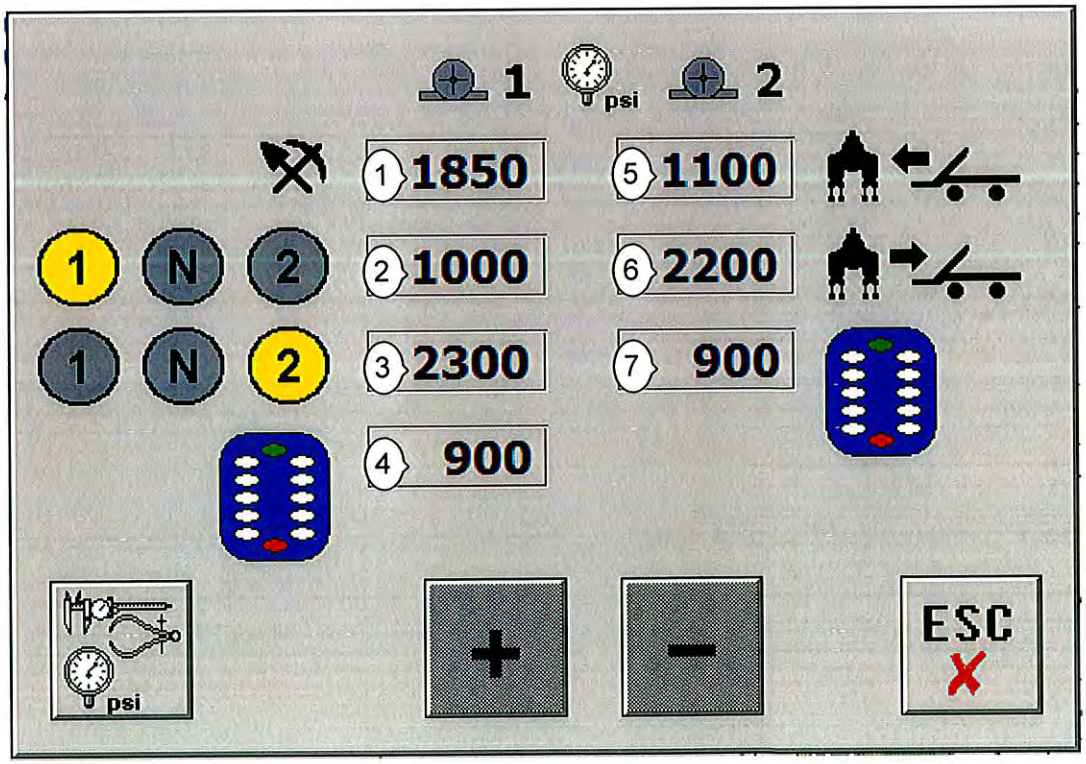
Check Engine Oil Level
Check Engine Coolant Level
Check Engine Air Filter condition indicator
Check for visible leaks of oil or water on engine
Check Fuel level and gauge indication
Check Pump Drive Oil level
Check Engine Area for loose hardware or damage

Hydraulic System:

Check Hydraulic Oil Level
Check Filter condition indicators

1. Check P1 Work Pressure 1850 psi
2. Check P1 1st Gear Pressure 1000 psi
3. Check P1 2nd Gear Pressure 2300 psi
4. Check P1 Omnex Control Pressure 900-1000 psi
5. Check P2 Workhead Rearward Pressure 1100-1200 psi
6. Check P2 Workhead Forward Pressure 2200-2400 psi
7. Check P2 Omnex Control Pressure 900 psi

Calibrate pressure conversion weekly or upon component change
Check hoses for chafing or damage



Pneumatic System:
Drain Water from Air Tank
Check for Air Leaks with engine shut off
Check System Pressure and cut-in & out pressures of Compressor
Check Cycle functioning of Air Dryer with Compressor cut-out
Check Air Regulator Pressure Setting
Check Horn Functionality
Check Brake Functionality
Check Failsafe Functionality

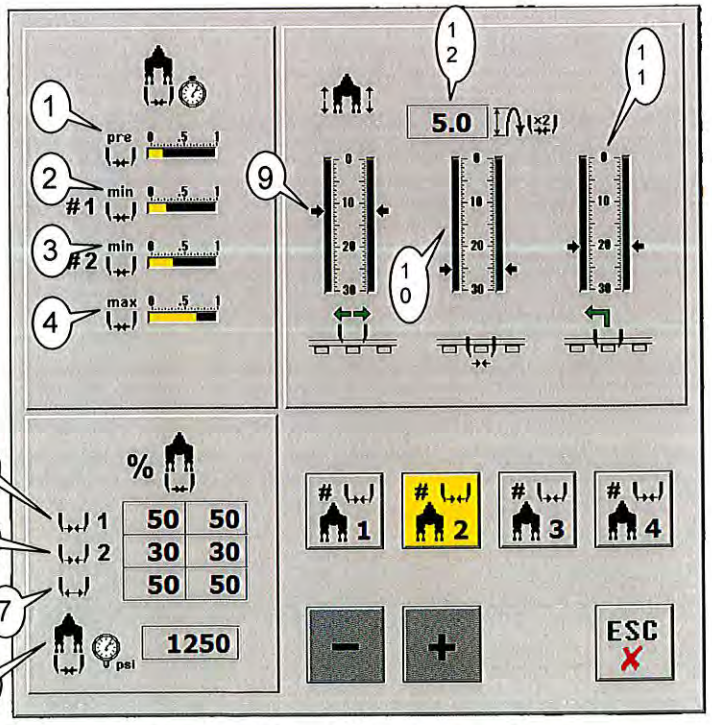
Electrics:
Check Battery Charging voltage
Check all head & tail lights
Check that no circuit breakers are tripped
Check Jupiter modules for faults & repair
Check Jupiter cables for damage & replace
Check functionality and aim of front radar units

Check Tamping Timer Set-up:
(Typical settings)

1. Pre-Squeeze: .3 seconds
2. #1 min: .3 seconds
3. #2 min: .4 seconds
4. Max: .7 seconds
5. % #1: 50
6. % #2: 30
7. % Sq Out: 50
8. Sq Psi: 850 - 1250

Check Workhead Depth Settings:

9. Upper Limits
10. Lower Limits
11. Clear Limits
12. Double Tamp
13. In the bottom right of this panel are 4 insertion count buttons. The selected number of insertions will be highlighted. When tamping between ties tamped by the lead tamper, the machine will not tamp less than the number of insertions used by the lead tamper.



Workheads:

Check Vibrator Oil Level
- Front Right
- Back Right
- Front Left
- Back Left

Check Workhead transducers for alignment and damage
Check Workhead Support Rollers for free motion, wear and alignment
Check Guide Rod Lubricator System for flow and condition
Visual check of all Workhead frame & vibrator bolts
Check Vibrator Squeeze Cylinder Pins for condition
Check Vibrator Vertical and Horizontal Pins for condition & Lubricate
Check Squeeze Cylinder Rods for excessive wetness
Check Workhead Vertical Cylinder for excessive wetness
Check Slider Cylinders for excessive wetness
Check wipers on between mainframe and workhead slides
Check hoses for leaks, wear and damage

Brakes & Drive Train:

Check Brake Linkages for missing or damaged or worn parts
Check Brake Shoe to Wheel Contact
Check for chaffed brake hoses & replace as required
Check Rear Drive Lube Oil

General Mechanical:

Check Tow Bar and Lock Cylinder on Lead Tamper
Check Air Lines between Drone & Lead Tampers

Starting the Drone

1. Make sure you read *"Chapter 1 Safety"*, before you attempt to start, move/travel or operate the machine.

2. Perform all the scheduled maintenance, such as checking the hydraulic oil, engine oil, diesel fuel and coolant levels, etc. Keep at FULL level. Additional information is provided in "Appendix A"

3. Visually check to make sure the **Spring Brake** is applied.

WARNING! If the Spring Brake is NOT applied, an unsafe condition could develop that may allow the machine to move or roll down a grade, resulting in damage or bodily injury.

NOTE

If the system air pressure drops below 70 PSI, an alarm will sound and a low air alarm message will appear on the Jupiter Main Screen. Should the air pressure continue to drop, the spring brakes will automatically activate, locking the front and rear wheels.

4. Make sure all work components are secured in their travel/safety locks.

5. Turn **ON** the **Battery Switches**, located in the battery switch box on the rear left side of the machine below the Power Distribution Box. Refer to Figure 4-1. A Positive (+) and Negative (-) type battery disconnect switches are used on the current Drone Tamper models. As shown in Figure 4-1A , these are 2 position ON/OFF switches.

NOTE

Positioned between the Positive and Negative switches is the Engine Control Module Circuit Breaker (ECM).

NOTE

Turning on the Battery Switches will NOT turn on the Jupiter Control System and the color monitor. A separate switch *(Control System Interlock)* located in the Main Control Box is provided for that function. Refer to Figure 4-2.

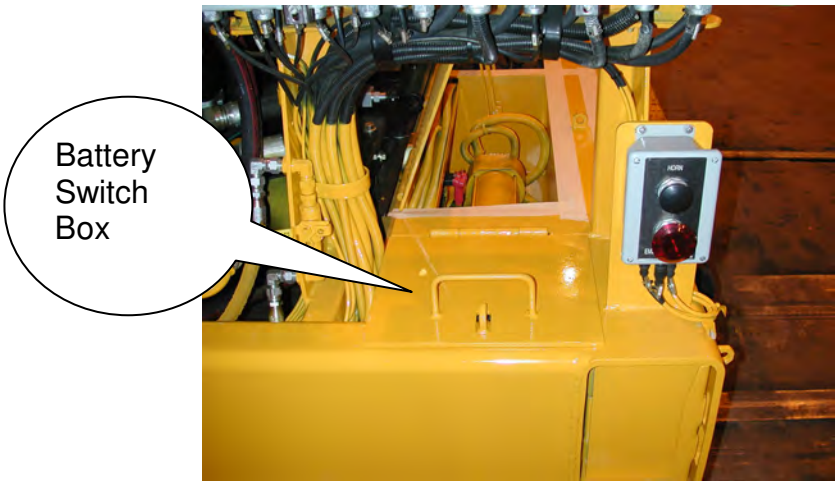


Figure 4-1

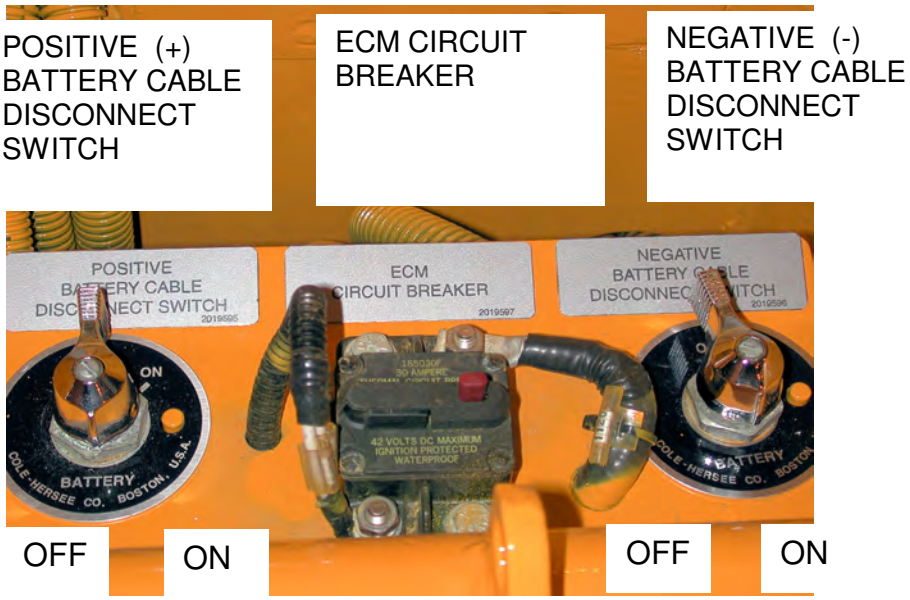


Figure 4-1A

6. Alert ALL personnel on and around the machine that the engine is about to start.

7. Locate the **Engine Start /Ignition Switch** inside the Main Control **Box** at the front left side of the machine. Refer to Figure 4-2. This is a spring loaded, 2 position switch.

8. Turn the **Engine Start /Ignition Switch** to the right to the 1st position. This will provide 24 volt DC power to the machine.

NOTE

As with other Harsco Rail machines with Tier 3 engines, a **Wait to Start Indicator** light (red) is provided. This indicator is located on the right side of the **Engine Start/Ignition Switch.** DO **NOT** try to start the engine if this light is FLASHING or remains ON. REMEMBER, The Wait To Start Indicator Light MUST be OFF before beginning the starting sequence.

In addition, two (2) indicator lights located in the main control box are provided to alert the operator when an out-of-range condition develops. The Check Engine light will blink or flash when an out-of-range condition continues to get worse. If the Stop Engine light comes on, the operator should shut down the engine as soon as possible to reduce the possibility of engine damage. The Stop Engine light will flash for 30 second to alert the operator that the engine is going to shut down.

9. Continue to turn the **Engine Start /Ignition Switch** to the right (clockwise) and release the ignition key immediately after the engine has started.

DO NOT ENGAGE THE STARTING MOTOR FOR MORE THAN 30 SECONDS. WAIT 2 MINUTES BETWEEN UNSUCCESSFUL ATTEMPTS. If engine does not start after three attempts (3 tries), refer to the engine operator's manual.

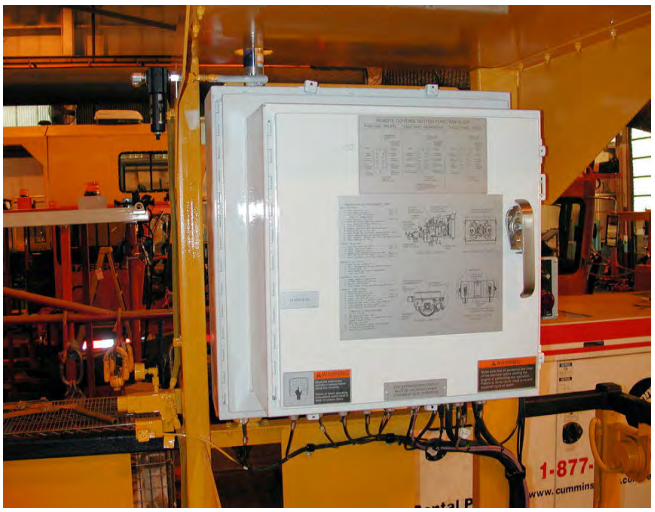
10. Once the engine has started, turn on the Jupiter Control System using the push button on located on left side of the **Engine Start /Ignition Switch.** Refer to Figure 4-2.

NOTE

The engine will NOT start if the **Control System Interlock /Jupiter Control Switch** is in the ON position.

NOTE

Allow the engine time to warm-up. Press This function is automatically controlled by the warm-up valve when the engine is running. The hydraulic tank temperature switch set at 70 degrees F will determine the need to run the warm-up mode. When the oil temperature in the hydraulic reservoir exceeds 70 degrees F and the switch closes, the warm-up mode shuts off automatically.



Main Control Box

Main Control Box – Inside

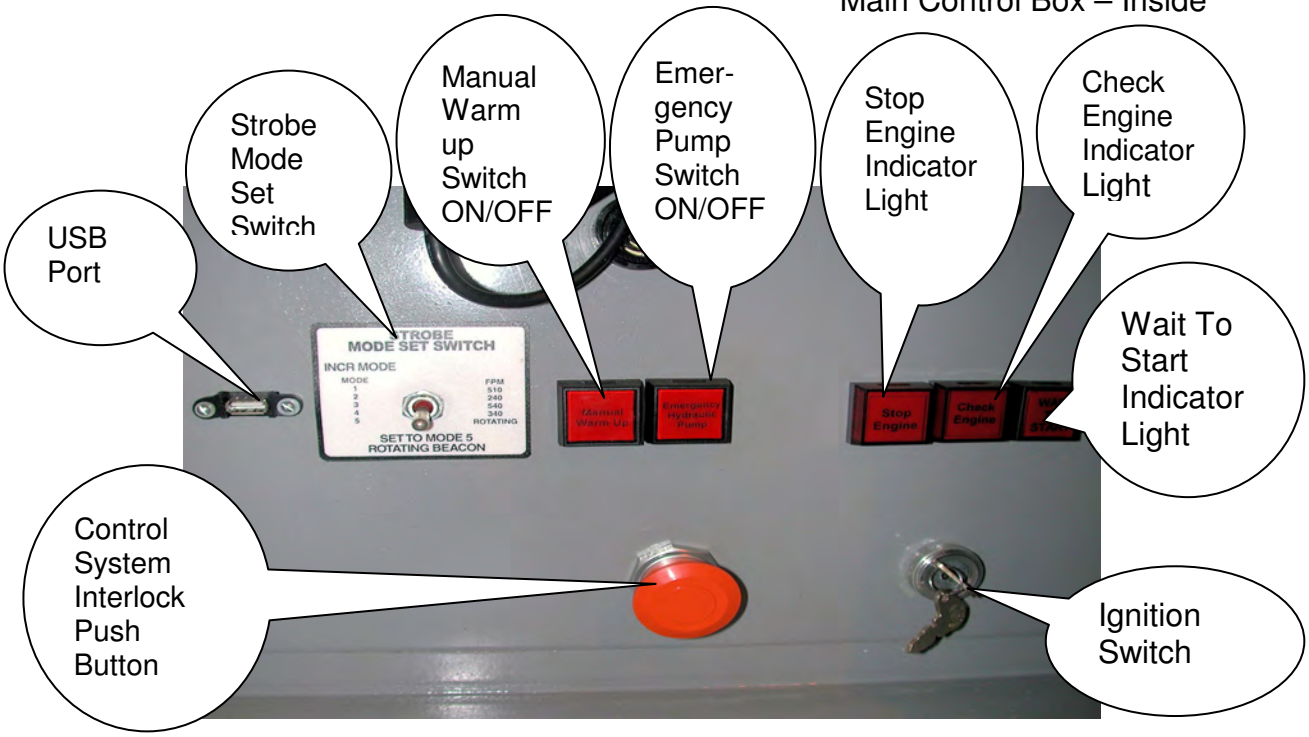
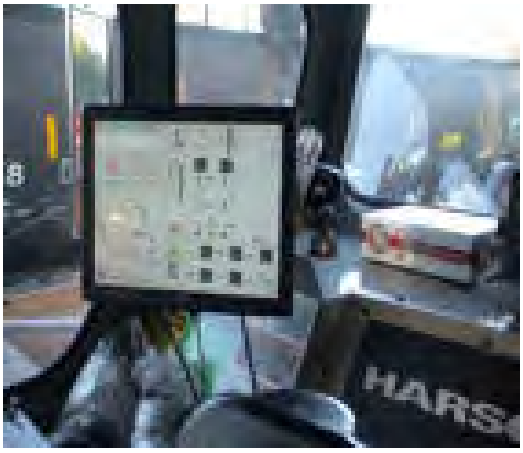


Figure 4-2

11. Locate the touch screen monitor on the inside of the Main Control Box. Refer to Figure 4-3.

12. Once Jupiter has booted up, check the Engine Diagnostic and the Alarms Panels to see if all system or operating properly and alarm no messages are present.

Drone Touch Screen Monitor Location



Lead Machine Monitor Location

Figure 4-3

NOTE

Check the **Lighting Bolt** located on the **Control Panel** of **Main Screen** to see if it is lit yellow. This will indicate that communication between the Drone and Lead has been established.

The Drone is now ready to hooked up to the Lead machine.

Hooking up the Drone to the Lead Machine

1. Locate and remove the hand held **Remote Control Unit** from the storage area. Refer to Figure 4-4.

NOTE

Enabling the hand held **Remote Control Unit** overrides control by the Lead Machine.

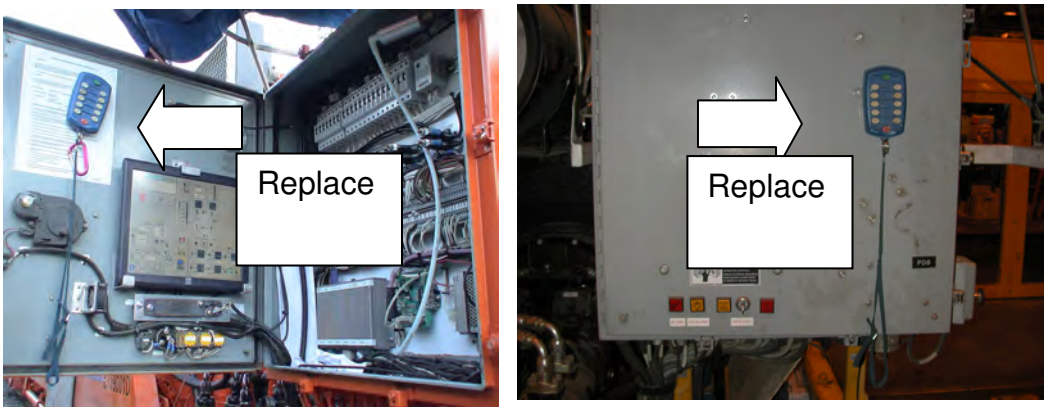


Figure 4-4

2. Turn ON the **Remote Control Unit** using the red push button. Refer to Figure 4-5 and Chapter 2 for further details.

3. A beeper alarm will sound indicating that the machine is now controlled by the remote control.

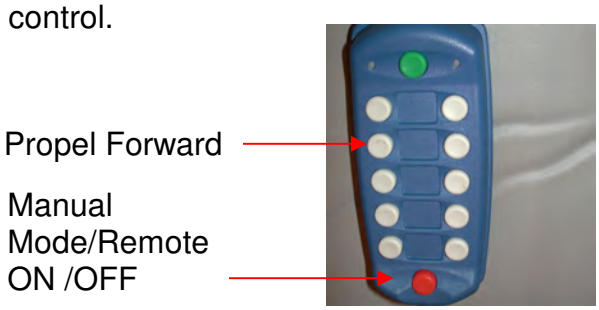


Figure 4-5

4. Alert ALL personnel on or around the Drone that the machine is about to move.

5. Once clearance is given, push and hold the **Propel Forward** button and slowly move the Drone towards the rear of the Lead Machine. Pushing the forward push button will release the brakes and propel the machine forward from 0 to 4 MPH. Stop the Drone at a position short of the Lead to allow the tow bar on the Lead to be positioned for coupling.

NOTE Anytime the forward or reverse push buttons are released, the brakes are automatically applied and the Drone will come to a stop.

6. With the tow bar in position and align with the Coupler on the Drone, alert ALL personnel that the machine is about to move.

7. Carefully and slowly move the Drone towards the tow bar. The design of the Drone coupler permits the tow bar to be automatically guided into position where an air cylinder engages the locking pin. Refer to Figure 4-6.

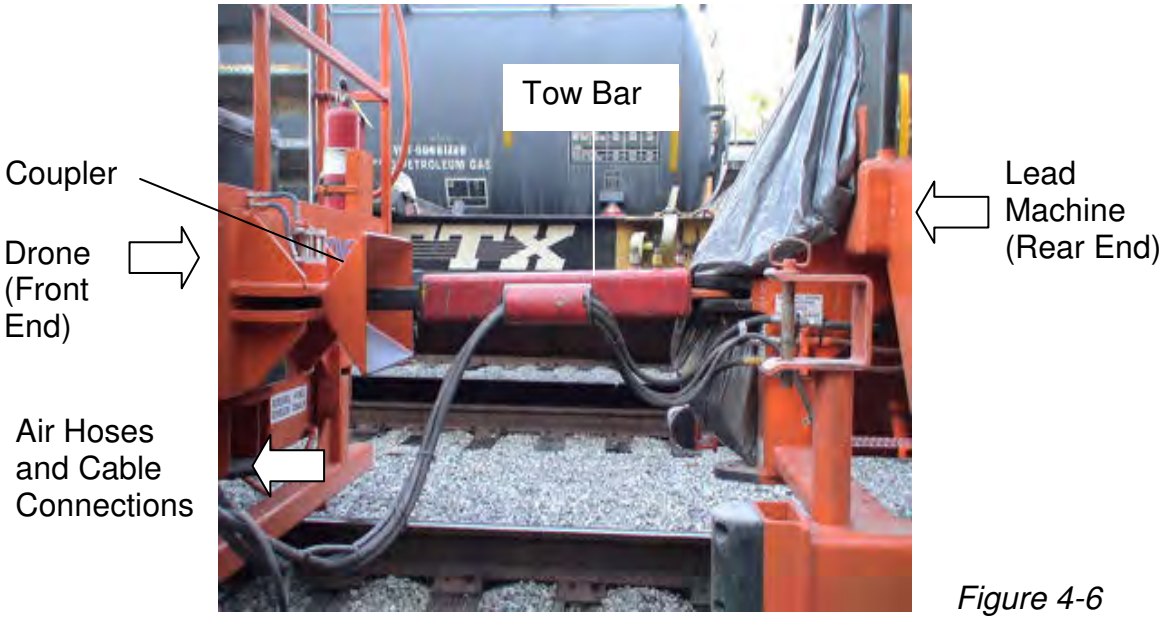


Figure 4-6

8. Check to make sure the coupler locking pin is engaged.

9. Connect the three color coded air lines on the Drone, equipped with male ends (quick coupling glad ends), are connected to the three color coded air lines equipped with female ends on the Lead Machine. Refer to Figure 4-6.

   Use the manual air valve to engage the tow bar locking pin. Check to make sure the locking pin is engaged by attempting to move the Drone in the reverse direction with the hand held remote control.

10. Connect the Tow Bar to the Lead Machine. Refer to Figure 4-7.

The Drone is now ready start travel.

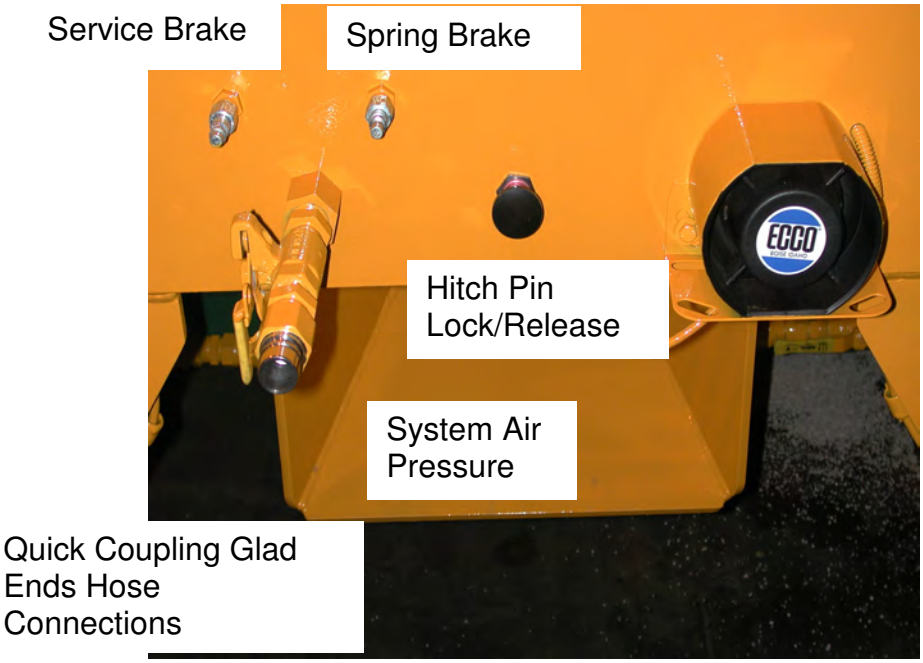


Figure 4-7

Lead Machine Hooking up to the Drone

1. The Lead machine backs up to the Drone to couple up. The coupler bar is automatically guided to the pin location where an air cylinder engages the locking pin.

2. Three color coded air lines on the Drone, equipped with male ends (quick coupling glad ends), are connected to the three color coded air lines equipped with female ends on the Lead Machine.

3. Connect the Tow Bar to the Lead Machine.

4. The Drone battery switch is manually turned on and the lead machine operator starts up the Drone engine and selects the hydraulic oil warm up mode while the Drone air system is being charged.

Disconnecting from the Lead Machine Work

1. The lead machine operator begins the procedure by selecting WORK mode on the Drone interface touch screen monitor.

2. Turn ON the hand held remote control unit using the green push button.

3. Verify that first gear is engaged on the Drone by attempting to move the Drone while the tow bar is still engaged.

4. Close the air ball valve and disconnect the three air lines from the lead machine according to the instruction decal.

5. Use the manual air valve to disengage the tow bar locking pin.

6. If the AutoMag tie finder on the lead machine is not turned on, turn it on now.

7. Alert ALL personnel on or around the Drone that the machine is about to move.

8. Once clearance is given, move the Drone Tamper rearward with the hand held remote control. Stop the Drone at a position so that the tow bar can be stored on the lead machine

.

9. Store the tow bar on the lead machine and connect the air lines to the dummy quick disconnects to secure the air lines.

10. Turn OFF the hand held remote control unit using the red push button. The Drone Tamper is now in automatic mode.

11. The lead machine operator can now commence work in automatic mode.

Towing the Drone Tamper

Follow the procedure as earlier outlined for hooking up the Drone Tamper to the lead machine.

- Make sure that the engine in running.

Do NOT unlock Towing Pin until the Lead Machine is in Work Mode.

- Place the lead machine and drone in Work Mode to calibrate the working distance between the two machines.
- Close the System Air Pressure ball valve. See Figure 4-7.
- Disconnect the three air lines. See Figure 4-7.
- Check again to make sure both machines are in Work Mode.
- Disconnect the Safety Wire. See Figure 4-6.
- Operate the push pull valve to remove the Towing Pin. If the Towing pin sticks, use the Remote Control Unit to rock the machine back and forth until the pin releases.

Travel

1. When coupled to the Lead machine and ready to travel, the operator will manually select the Drone travel mode switch.

2. Once the two machines are coupled up and through out the process of travelling to the work side, the brakes on both machines are released and applied from the control valve of the Lead Machine.

3. The Lead Machine and the Drone engines are both controlled from the Lead machine.

4. All the accessories on the Drone are manipulated from the Lead Machine via a two way wireless Ethernet communication system.

5. During travel the Drone assists the Lead Machine providing engine, hydraulic and pneumatic power for grades and braking.

Clearing for Trains, Lunch or Travel

1. Thru out the work day, it is frequently required to clear the track for incoming trains. Short notices are normally given to the gang to stop working and set up for clearing the track.

2. Depending on the proximities of secondary track switches or industrial sidings, the clearing movement can be short or long in distance.

3. In short clearing movements the Drone is instructed to stop working and lock up all of its working implements. Upon completion of this task, the Foreman can take control of the Drone via a remotely controlled switch box; he can move the machine to the nearest siding at the slow walking speeds of 4 to 5 MPH.

4. Once the Drone is in the clear, in the siding, the foreman remotely shuts down the machine. Anytime the machine is not instructed to move, the air brakes are automatically applied and it cannot roll or move. When the engine is shut down, the spring applied brakes will automatically engage the parking brake and the machine cannot roll or move.

5. When clearing for trains to remote sidings, the Drone is instructed to stop working and set itself up for travel.

6. The brakes are automatically applied, the engine RPM are lowered, the work heads squeeze out and up feed, the travel locks are energized and the work heads are then down fed to insure the locks are engaged.

7. The Drone is now waiting to be coupled up to the Lead Machine and start the travel mode.

8. Upon arrival to the parking siding, the Lead Machine operator shuts down both machines causing the spring applied parking brakes to engage.

Parking the Machine.

1. After arriving at the siding location, push the red button on the remote control. This function will cause the parking brakes to apply and the engine to shut down.

2. Turn off the Jupiter System by pushing IN the control button on the main control box.

3. Turn off the battery switch to kill power on the machine.
   If leaving the machine, pad lock ALL control box covers and doors on the machine.

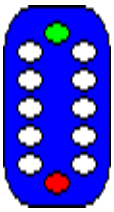
Chapter 5

OPERATING THE DRONE

Automatic Mode

This mode is expected to be the preferred mode of operation that will require the least amount of operational supervision or monitoring. In this mode, the Drone will be controlled by the operator on the Lead machine. At startup, and after radio communication is reestablished, the work mode will be disabled (red work/pause button) and the Drone will be in a work-idle mode. Touch this button to enable or disable work. When enabled, the Drone can initiate forward movement (never reverse in automatic mode) and tamping provided the Drone is within the work limits (see below).

Manual Mode *(Using the Remote)*

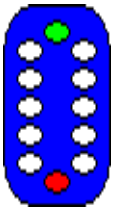


At any time, manual mode can be invoked by turning on the hand held remote control unit by pushing the green button on the unit. On the lead machine, this symbol indicates the lead operator no longer has control and that the Drone is being operated manually. The available commands will be treated in detail later. When moving the Drone or tamping with the Drone in manual mode, the automatic mode work limits are ignored. Only in this mode can the Drone be moved in reverse while disconnected from the Lead machine.

Every tie tamped (or marked for exclusion) by the lead machine will be recorded. As the Drone reaches each tie, the decision to tamp or skip the tie will be based on already knowing exactly what work the lead machine did at the same location. This allows the lead machine operator to vary the tamping pattern at any time knowing the Drone will automatically adjust its pattern to match as it reaches each such change.

Using the Lead Machine Tamping Pattern

Every tie tamped (or marked for exclusion) by the lead machine is recorded. When this data is selected (default) to be used by the Drone, as the Drone reaches each tie, the decision to tamp or skip the tie will be based on already knowing exactly what work the lead machine did at the same location. This allows the lead machine operator to vary the tamping pattern at any time knowing the Drone will automatically adjust its pattern to match as it reaches each such change.



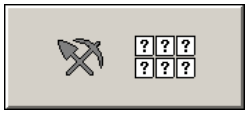
When the hand held remote is turned on, an icon will appear on the Drone interface screen to indicate an operator with the hand held remote has taken control. If cycle is initiated by the hand held unit, the applied pattern will continue to be according to what the Lead tamper did at the same location (even if the Lead tamper is shut down for repair.

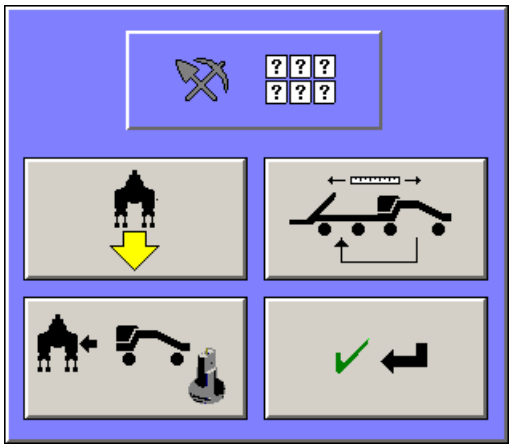
Fixed Tamping Pattern

In the event of a synchronization problem (such as an encoder problem on the Lead tamper), the Drone can be operated manually where the tamping pattern is fixed and initiated by the hand held remote.
In this mode, the hand held wireless remote is used to position the machine and start tamping. A fixed tamping pattern will be used and will repeat indefinitely. This mode will require the machine to be monitored to ensure the pattern remains in sync with the lead machine (unless every tie is being tamped). In addition, there may be locations on track that may require operator intervention. For example, there are several locations in a turnout that cannot be tamped by the Drone. Attempting to do so could damage the track, the machine, or both. Intervention may be required at other locations (cables, or other unusual features).

Selecting the Pattern Mode

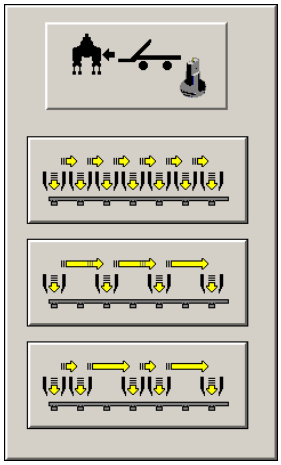
When the computer system is first turned on, the tamping pattern is assumed to be dictated by the lead machine. This mode is the default. To change the mode, use the “work options” button located at the top left of the main screen.





This will open the work options panel. Use the button at the bottom left of this panel to toggle between automatic and manual tamping pattern modes. On the panel shown, the button is indicating automatic mode. When this button is pressed to select a fixed pattern, an additional panel will appear to enable selection of the fixed tamping pattern to be used.

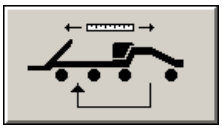
Select the pattern to be used, either every tie, every other tie, or two out of three ties.
The currently selected mode will also be visible on the main screen.



Starting Automatic Mode

1. Move the Drone and or lead tamper until the tow bar is fully engaged without the tow bar pin being engaged (this is normally the condition after travel mode).

2. If the AutoMag tie finder on the lead machine is not turned on, turn it on now. Note: if AutoMag was already on and the lead machine has been moved backwards, it will be necessary to turn it OFF, and then back ON to reset the probes.



3. Open the work options panel and press the synchronize button at the top right of this panel. The work options panel can then be closed.

Note: If the Drone is expected to start as soon as the separation between the machines reaches the work limits, you will need to press the "work enable" button if the icon on this button is red in color.

Using Automatic Mode

In automatic mode, the Drone will pretty much take care of itself. There are a couple of items to be aware of.

There is no need to select a tamping pattern or adhere to any sequence. The Drone will simply tamp any tie skipped by the lead machine (up to a maximum of two). The operator can change between skipping one, skipping two or tamping every tie (solid) at any time.

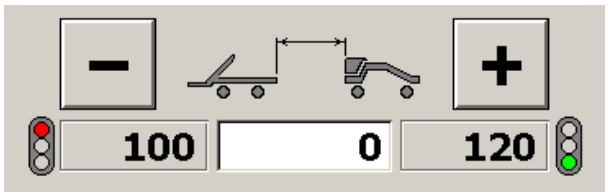
NOTE: the operator can backup to "re-pull" the track at any time. This might be necessary if, say, the cross-level is not holding. This will not cause any problems for the Drone within the range of thirty ties. Backing up by more than thirty ties may result in the Drone tamping ties already tamped by the lead, even so, this will not result in any tie being skipped by both machines.

If more than two ties are skipped by the lead machine, the Drone will also skip these ties (also, the heads on the Drone will be raised when the Drone reaches this location to ensure clearance of any possible obstacles).

There is an exclude button on the left arm console panel that can be used to indicate that ties skipped by the lead machine should also be skipped by the Drone. When this button is pressed, the exclude mode will be latched on (this will be acknowledged by a single short beep). As the lead machine moves forward, all ties that pass the workheads will be marked to be excluded by the Drone, tamped by the lead or not. Subsequently pressing the exclude button will turn this mode off (acknowledged by two short beeps). On the tie region view at the right side of the lead operator screen, an excluded tie will be marked as red.
If there is no tie for the Drone to tamp for more than two ties ahead of its location, it will raise heads to ensure safe clearance.

If there is no work ahead of the Drone for more than ten feet, the Drone will engage a higher work speed and alternately flash forward lights to indicate it is moving at a higher than normal rate.

Automatic Mode Work Limits



When work is enabled in automatic mode, the Drone will start and stop work according to work limits at the bottom left of the screen and the separation between the two machines. To change these limits, touch the distance you wish to change (it will highlight yellow) and press the adjacent “plus” or “minus” buttons to change the limit. A minimum distance of twenty feet between these distances is necessary (when increasing the stop limit, it may be necessary to increase the start limit first if the start limit is too close).

The icon on the work enable/disable button on the main screen will change as follows:

The Drone is in a “work idle” mode and is waiting for the separation between the machines to reach the “start work” work limit.

The Drone is working. If the separation between the two machines falls below the work stop limit, the machine will enter the “work idle” mode.

The Drone work mode is disabled. Press this button to enable work. If the machine separation is more than the start of work limit, the Drone will start work. Otherwise, it will wait until the start work limit is exceeded.

Manual Mode

When the hand held remote is turned on, tamping can be initiated from this device. If a fixed pattern has not been selected, the location of ties tamped by the lead machine will dictate which ties the Drone will tamp in exactly the same way as it does when being controlled by the Lead operator except that radio communication is not required and the work limits are ignored. This may be helpful if it became necessary to shut down the lead machine (repair, refuel or any other reason) and it is desirable to continue operation using the Drone to complete work already mapped out by the lead tamper.

Alternatively, a fixed pattern can be used in situations where synchronization has been lost there is work to be done or completed by the Drone. On the main screen, select manual mode and the required tamping pattern as described on earlier.
To use a fixed pattern, move the Drone using the Remote Controller on page 1 of the controller until the Drone probes are behind the first tie to be tamped by the Drone. If the workheads are not unlocked, unlock them using page 2 of the controller.

Use the Remote to move the machine forward until the home position of the workheads is just before the first tie to be tamped by the Drone.

Note: When tamping two ties out of three, position the machine just short to the first tie of the pair to be tamped.

On page 3, press the bottom left button to begin work. Press the same button to stop work (the tie being tamped will be completed before work stops).

Resuming Manual Mode

Every time manual mode is stopped, it will be necessary to position the home position of the workheads to just short to the first tie to be tamped by the Drone (for two of three, this tie should be the first of the pair). On page 3 of the Omnex control, press the bottom left button.

Chapter 6

HOW TO SHUT DOWN THE MACHINE

GENERAL

The main this chapter describes the recommended procedure for normal shut down and emergency shutdown of the machine.

Procedure

1. Make sure the brakes are applied.

If the brakes are not applied, an unsafe condition could develop that may allow the machine to move or roll down a grade, resulting in damage or bodily harm.

2. Let the engine idle for five minutes to cool down.
3. Secure all work components.
4 Using the Control System Interlock Control *(large red button)* in the Main Control Box, turn OFF the Jupiter System.
5. Turn OFF the engine by pressing and holding the engine stop button located on the remote control unit or turn the keyed ignition switch on the Main Control Box counter clockwise (left) to the OFF position.
6. If the machine has completed work for the day, turn off all the switches and remove the ignition key. Return the Remote Control unit the storage position inside the Main Control Box. Pad lock ALL control boxes. *(Main and Power Distribution)*
7. Turn the Battery Switches to the OFF position and close and pad lock the Battery Switch Box, Battery Box, Emergency Pump Box and the engine covers.
8. Release any moisture from the air reservoirs. The reservoir drains are located on the sides of the machine - pull the cable ring to release.

Emergency Shut Down (For Emergency Use ONLY)

The emergency shutdown or e-stop buttons are located on the 5 outside corners of the machine's frame, the remote control unit and on the main screen of the lead machine and the drone. When an emergency shutdown button is pressed, the engine will stop immediately.

> **NOTE**: Once the Drone engine is stopped, the Jupiter control system will need to be turned off before the engine can be restarted.

NOTE: On the Radar/Estop Panel the ESTOP buttons will show RED if the corresponding ESTOP on the machine is pressed. The button enabling the shutdown MUST be reset before the engine can be restarted.

Conditions for Emergency Shutdown

1. Engine oil spewing
2. Hydraulic failure

Conditions for Emergency Shutdown Cont'd

3. Water spewing from engine
4. Fire anywhere on the machine
5. Any unsafe condition

In general, the operators should use common sense when to use the EMERGENCY SHUTDOWN BUTTONS

Appendix A

LUBRICATION AND MAINTENANCE CHART

DAILY (8 HOURS)

1. CHECK ENGINE OIL.....(SPEC. B)
2. CHECK ENGINE COOLANT.....(SPEC. C)
3. FILL FUEL TANK IN EVENING.....(SPEC. A)
   (PREVENTS CONDENSATION)
4. CHECK HYDRAULIC OIL LEVEL.....(SPEC. F)
5. CHECK AIR CLEANER CONDITION INDICATOR
6. DRAIN WATER SEPARATOR ON ENGINE
7. TIGHTEN TAMPING BLADES
8. TIGHTEN VIBRATORY MOTOR MOUNTS AND BOLTS
9. DRAIN WATER OUT OF AIR TANKS
10. CHECK RETURN OIL INDICATORS (WORKEAD & HYD. TANK)
11. GREASE WORKHEAD AND VIBRATOR SHAFT PIVOTS
12. CHECK WORKHEAD CARRIAGE LUBE LINES FOR CRACKS OR LEAKS
13. CHECK VIBRATOR OIL LEVEL

WEEKLY (40 HOURS)

1. CHECK PUMP DRIVE OIL LEVEL.....(SPEC. D)
2. GREASE FRONT BRAKE PIVOTS.....(SPEC. E)
3. GREASE TOWBAR PIN BEARING
4. GREASE FRONT TRUNNION PIVOTS AND CHECK LUBE HOSES FOR CRACKS AND LEAKS.....(SPEC. E)
5. GREASE SUSPENSION PIVOTS & CYLINDERS.....(SPEC. E)

MONTHLY (150 HOURS)

1. CHECK BATTERY CONDITION
2. CHECK FAN BEARING, FAN AND ALTERNATOR BELTS
3. CLEAN RADIATOR FINS
4. CHECK CHARGE AIR PIPING & CONNECTIONS
5. CLEAN AIR FILTER

QUARTERLY (500 HOURS)

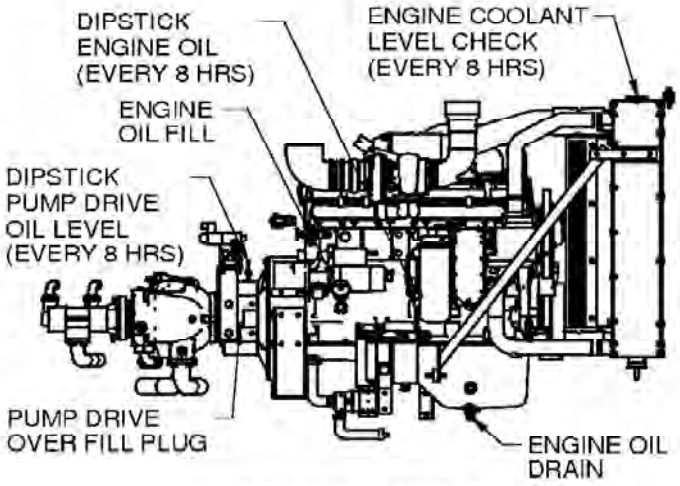
1. CHANGE ENGINE OIL AND FILTER
2. PERFORM COOLANT ADDITIVE TEST
3. REPLACE FUEL FILTERS
4. CHECK ENGINE COOLING AND AIR INTAKE HOSES FOR

ANNUALLY (1000 HOURS)

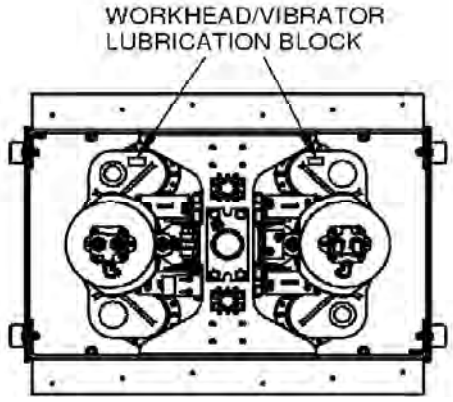
1. FLUSH OUT RADIATOR.....(SPEC. C)
2. CHANGE RETURN OIL FILTERS
3. CHANGE TRANSMISSION OIL.....(SPEC. D)
4. CHANGE PUMP DRIVE OIL.....(SPEC. D)
5. CHANGE STRAINERS IN HYDRAULIC TANK
6. HYDRAULIC TANK DRAIN, CLEAN, AND CHANGE OIL
7. CLEAN STRAINERS IN SERVO VALVES
8. CHECK HYDRAULIC PRESSURES AND SETTINGS

SERVICE SPECIFICATIONS

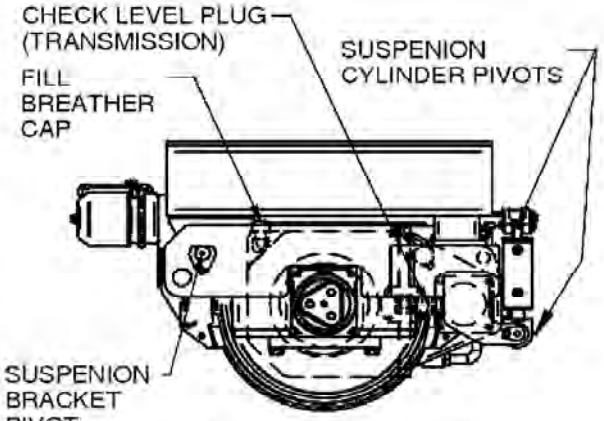
A. NO. 2-D FUEL OIL
B. SEE ENGINE OIL SPEC. LABEL
C. ETHYLENE GLYCOL-BASE YEAR ROUND ANTI-FREEZE/ SUMMER COOLANT SCA/DCA-A. MUST MEET CES 14603
D. EP-90 TRANSMISSION GREASE OR EQUIVALENT
E. LITHIUM MULTI-PURPOSE GREASE
F. MOBIL DTE 15M OR EQUIVALENT



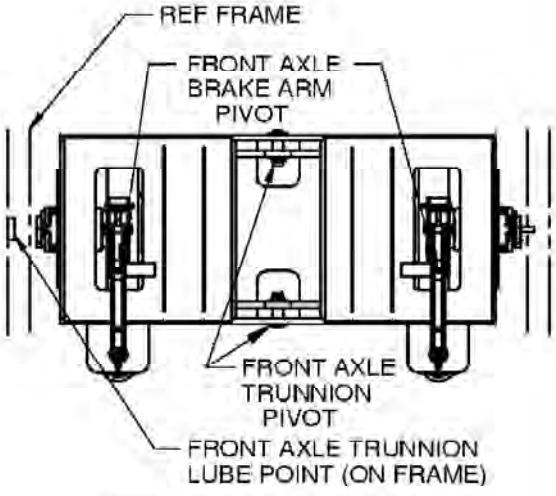
POWER UNIT LUBRICATION



WORKHEAD/VIBRATOR LUBRICATION



REAR DRIVE LUBRICATION



FRONT AXLE BRAKE ARM AND TRUNNION PIVOTS

Rope Pull Emergency Stop Switches Installation and Adjustment

Important Information

Regarding the Use of Rope Pull Emergency Stop Switches

In the United States, the functions that Banner rope pull emergency stop switches are intended to perform are regulated by the Occupational Safety and Health Administration (OSHA). Whether or not any particular rope pull switch installation meets all applicable OSHA requirements depends upon factors that are beyond the control of Banner Engineering Corp. These factors include the details of how the switches are applied, installed, wired, operated, and maintained.

Banner Engineering Corp. has attempted to provide complete application, installation, operation, and maintenance instructions. This information is found in the instruction manual packaged with each rope pull switch. Direct any questions regarding the use or installation of rope pull switches to the factory applications department at the telephone numbers or address shown below.

Banner Engineering Corp. recommends that rope pull emergency stop switches be applied according to the guidelines set forth in standards listed below. In addition, the user of Banner rope pull switches has the responsibility to ensure that all local, state, and national laws, rules, codes, and regulations relating to the use of Banner rope pull switches in any particular application are satisfied. Extreme care is urged that all legal requirements have been met and that all installations and maintenance instructions are followed.

Application Assistance

Toll Free: 1-888-3-SENSOR (1-888-373-6767)
Email: sensors@bannerengineering.com
Address: 9714 Tenth Avenue North
Minneapolis, MN 55441

U. S. Standards Applicable to Use of Emergency Stop Safety Modules

ANSI B11 — Standards for Machine Tools "Safety Requirements for the Construction, Care and Use"
Available from: Safety Director
AMT—The Association for Manufacturing Technology
7901 Westpark Drive
McLean, VA 22102
Tel.: 703-893-2900

NFPA79 — "Electrical Standard for Industrial Machinery (1997)"
Available from: National Fire Protection Association
1 Batterymarch Park, P.O. Box 9101
Quincy, MA 02269-9101
Tel.: 800-344-3555

ANSI/RIA R15.06 — "Safety Requirements for Industrial Robots and Robot Systems"
Available from: Robotic Industries Association
900 Victors Way, P.O. Box 3724
Ann Arbor, MI 48106
Tel.: 734-994-6088

European Standards Applicable to Use of Emergency Stop Safety Modules

ISO/TR12100-1&-2 (EN 292-1 & -2) — "Safety of Machinery—Basic Concepts, General Principles for Design Part 1: Basic Terminology, Methodology"; Part 2: Technical Principles and Specifications

ISO13849-1 (EN 954-1) — "Safety of Machines—Safety Related Parts of Control Systems"

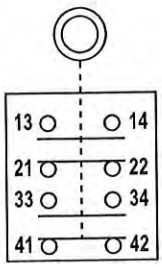
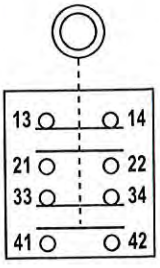
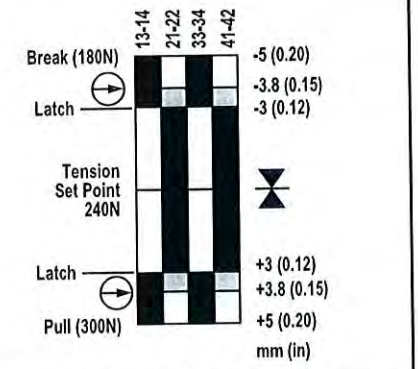
IEC/EN 60204-1 — "Electrical Equipment of Machines: Part 1: General Requirements"
Also, request a type "C" standard for your specific machinery.

ISO13850 (EN 418) — "Safety of Machinery—Emergency Stop Equipment Functional Aspects, Principles for Design"

IEC 60947-5-5 — "Electrical Emergency Stop Devices with Mechanical Latching Function"
Available from: Global Engineering Documents
15 Inverness Way East
Englewood, CO 80112-5704
Tel.: 800-854-7179

Rope Pull Emergency Stop Switches – RP-LS42F-75L.. Series

Models

Model†	E-Stop	Built-in Turnbuckle	Run Position	Cable Pulled/ Cable Break	Switching Diagram
RP-LS42F-75L	No	No			
RP-LS42F-75LE	Yes	Yes			
RP-LS42F-75LF	No	Yes			

NOTE: ⊖ This symbol for a positive-opening safety contact (IEC 60947-5-1) is used in the switching diagram to identify the point in actuator travel where the normally-closed safety contact is fully open.

WARNING ...
Not a Safeguarding Device

An Emergency Stop Device, including, but not limited to buttons, rope pulls and cable pulls, is not generally considered a safeguard; and does not alone fulfill U.S. or International requirements for safeguarding hazards associated with machinery.

The definition of safeguarding is the "protective measure using safeguards [guards or protective devices] to protect persons from the hazards which cannot reasonably be eliminated..." (ISO12100-1, 3.29 and 3.30).

A safeguard limits or eliminates an individual's exposure to a hazard (examples include interlocking devices, safety mats, safety light screens). An emergency stop is considered to be a complementary protective measure, which is neither an inherently safe design measure, nor safeguarding, but may be required as part of the safety related control system and risk reduction strategy (ISO12100-2, 4.5.1 and 4.5.2).

The user must refer to the relevant standard(s) to determine the safeguarding requirements for their particular situation.

Overview

Models RP-LS42F-75L.. are rope pull emergency stop switches in compact, limit switch-style housings made of high-impact thermoplast. When used with steel wire rope, they can provide emergency stop actuation along conveyors and similar machinery. Red PVC-covered 3 mm diameter wire rope is recommended (see page 10).

The switches have redundant contacts; terminals 21/22 and 41/42 are positive opening when there is a cable-pull or cable-brake situation. When used separately, these contacts provide inputs to a dual-channel safety module (see Figure 6). Terminals 21/22 and 41/42 can also be used individually to provide single-channel switching or as a single-channel input to a safety module. Terminals 13/14 and 33/34 are for monitoring purposes only (closed in a cable-brake/-pull situation).

When the rope is properly tensioned (240N), the red arrows are centered on the hash mark on the tension indicator window, the contacts at terminals 21/22 and 41/42 are closed, and the contacts at terminals 13/14 and 33/34 are opened (see Figures 1, 2 and 4).

These rope pull emergency stop switches are not generally considered safeguarding devices, in that they do not prevent or reduce exposure of individuals to a hazard. They provide the same function as other types of emergency stop switches.

All models feature "latching" operation. When the rope is pulled, the switch contacts 21/22 and 41/42 open and remain open until the built-in reset button is manually reset (see Figure 1).

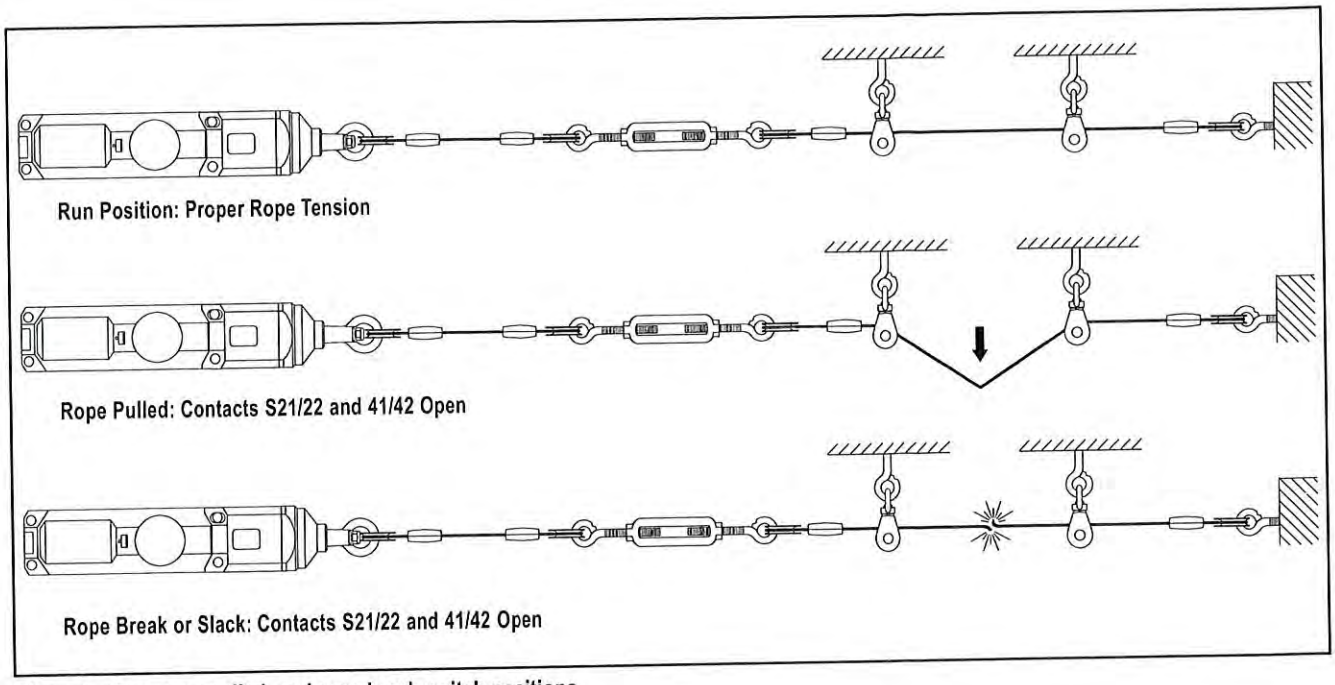


Figure 1. Run, rope pulled, and rope break switch positions

Mechanical Installation

Installation Guidelines

- The wire rope should be easily accessible and visible along its entire length. Markers or flags may be fixed on the rope to increase its visibility.
- Mounting points, including support points, must be rigid.
- The rope should be free of friction at all supports. Pulleys are recommended.
- Use only pulleys (not eye bolts) when routing the rope around a corner, or whenever direction is changed, even slightly.
- Never run rope through conduit or other tubing.
- Never attach weights to the rope.
- Temperature affects rope tension. The rope expands (lengthens) when temperature increases, and contracts (shrinks) when temperature decreases. Significant temperature variations require frequent checks of the tension adjustment.
- Do not exceed the maximum total rope length, as specified in Figure 3. Banner offers models for greater spans; contact the factory or visit www.bannerengineering.com for model selection.

Installation Procedure

1. Mount the switch securely on a solid, stationary surface.
2. Fasten an eye bolt at the opposite end of the rope span, up to 75 m (245') from the switch. The anchor for the eye bolt also must be solid and stationary, to withstand the constant tension and possible pull of the rope.
3. Assemble the rope, as shown in Figure 3. Keep the rope's PVC cover intact along its complete length.
4. Use pulleys (recommended) or eye bolts at each support point. A pulley must be used when routing the rope around a corner, regardless of the angle.

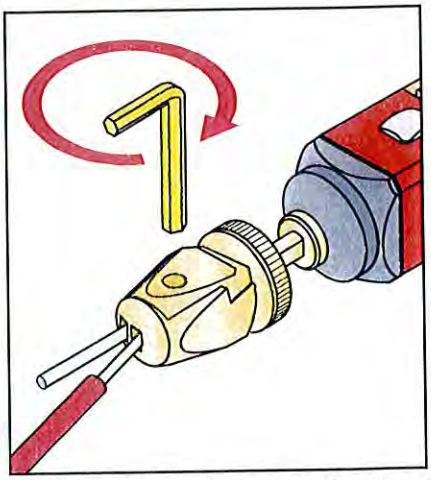
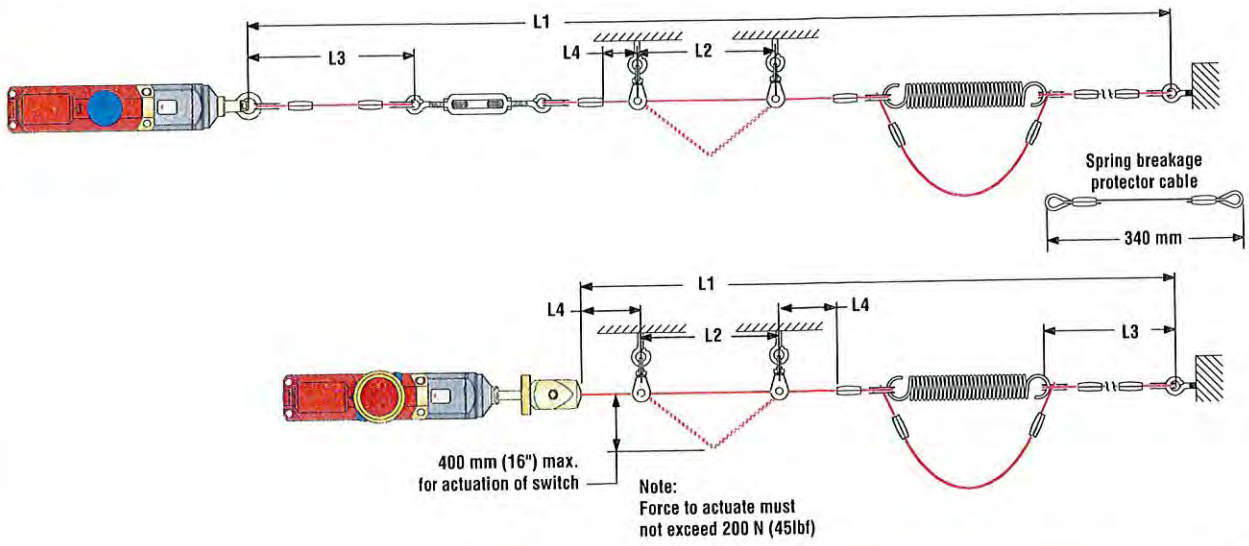


Figure 2. Tightening the rope into the internal turnbuckle (models RP-LS42F-75LE and RP-LS42F-75LF)



NOTE:
All hardware is supplied by the user. The switch mounting holes are on a mounting pattern of 30 x 124 millimeters, and accept M5 (#10) hardware.

Max. Total Length L1	Max. Distance Between Pulleys L2	Max. Distance To Spring/Turnbuckle L3*	Min. Distance Fitting to Pulley L4**
75 m (245')	3-5 m (10'-15')	150 mm (6")	150 mm (6")

*Closer, if possible
**Distance must allow necessary clearance to all mounting hardware

Figure 3. Assembly of rope and hardware (rope span components are listed on page 10)

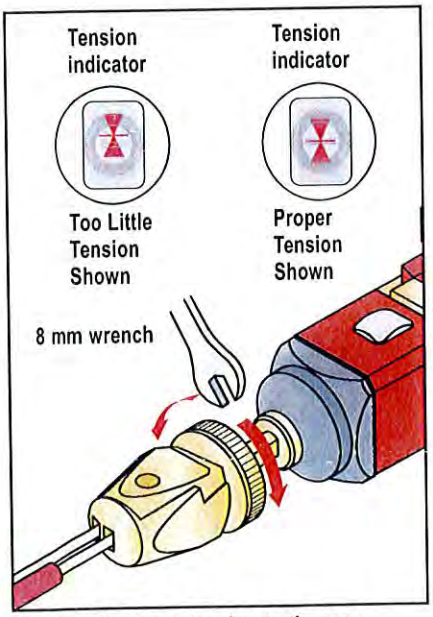


Figure 4. Applying tension to the rope (models RP-LS42F-75LE and RP-LS42F-75LF)

Installing Model RP-LS42F-75LE or RP-LS42F-75LF

These models have their own internal turnbuckle and clamp to tension the rope and to hold it in place. This innovative design provides for quick and easy rope fixing and tensioning, and means no external turnbuckle is required, nor is any additional clamp required at the switch end of the rope.

To install the rope at the switch end, strip away several inches of the cable covering, as shown in Figure 2. Loosen the set screw on the switch fitting, using a 4 mm hex wrench. Insert the cable into the center hole, and pull the cut end out from the side hole. When the tension is correct, tighten the set screw to hold the rope firmly in place.

Tensioning the Rope

After the rope span components are installed, apply tension to the rope until the arrows in the tensioning indicator are centered on the line in the indicator window (see Figure 4). This indicates sufficient rope tension. (Contacts 21/22 and 41/42 will close.)

Model RP-LS42F-75L: Turn the turnbuckle until the arrows are centered.

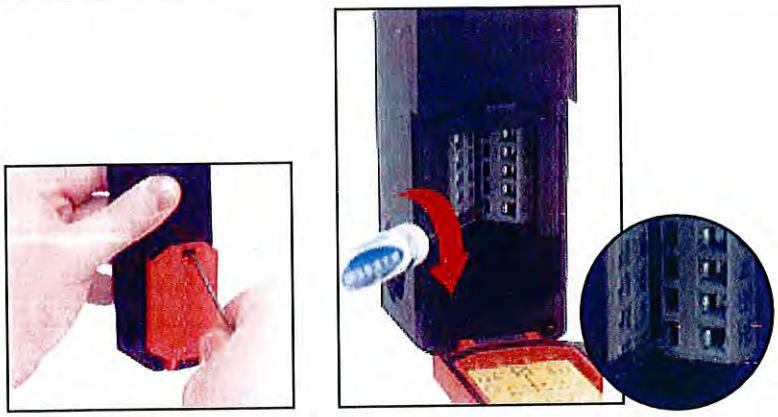
Models RP-LS42F-75LE and RP-LS42F-75LF: Turn the shaft of the switch using an 8 mm wrench as shown in Figure 4, until the arrows are centered.

Pull hard on the rope and reset the latch several times. If the arrows in the tensioning indicator window do not return to the correct position (centered on the line in the window), further tighten or loosen the rope tension as needed until proper tension is shown after such a reset.

Electrical Installation

Access to Wiring Chamber

The wiring chamber is accessed via the hinged door. Simply insert a flat-blade screwdriver, as shown in Figure 5, and pry gently down to open. Select the best wiring entrance and thread in the ½" x 14 NPSM conduit adapter (supplied), or the optional M20 x 1.5 cable gland (page 11). The switch knockout will break loose with the final turn of the conduit adapter or cable gland.



To open wiring chamber:
1. Insert the screwdriver blade into slot in cover to pry cover open.

To connect wires to terminals:
1. Insert the screwdriver blade into the slot below the desired wiring terminal.
2. Twist the screwdriver blade in the slot to open the terminal jaws; insert wire.
3. Hold wire in place and remove screwdriver.

Figure 5. Access to wiring chamber – use a small flat-blade screwdriver

Wiring

These switch models have redundant pairs of safety contacts, so they may be wired for either single-channel or dual-channel output to a safety module or E-stop circuit. Monitor contacts, in either case, may be wired as desired to an external alarm device.

Single-Channel Output: Wire contacts 21/22 or 41/42 together to the input of a safety module or E-stop circuit.

Dual-Channel Output: Wire contacts 21/22 and 41/42 independently to the two safety module inputs (see Figure 6).

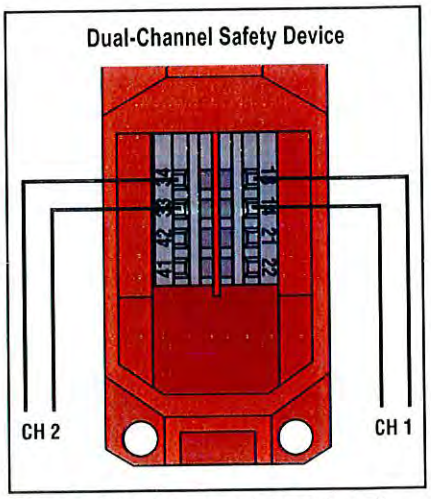


Figure 6. Wire the two switch contacts in series

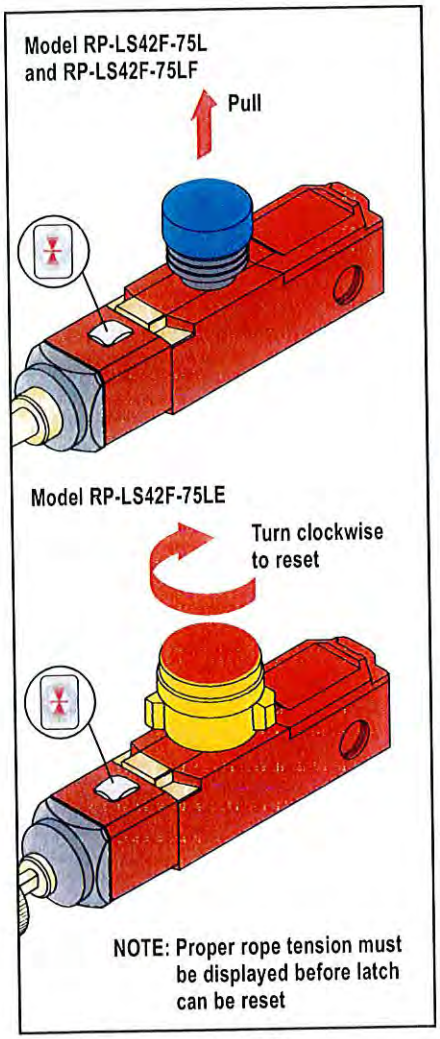


Figure 7. Resetting the latch

E-Stop Reset

E-Stop and Latch Reset
Following the pulling of the rope or the pressing of the E-stop button (model RP-LS42F-75LE), the latch must be reset. The procedure differs slightly between the two models. See Figure 6.

Models RP-LS42F-75L and RP-LS42F-75LF: Pull the blue reset button; the arrows should then be centered in the tensioning indicator window.

Model RP-LS42F-75LE: The E-stop can be reset only when proper tension is indicated. Turn the yellow knob clockwise until the blue arrow is in the "I" position (indicating that the latch has been reset). The latch should make an audible click when reset.

Maintenance

Each rope pull emergency stop installation should be tested for proper machine shutdown response at each shift change or machine setup by a *Designated Person**. In addition, a *Qualified Person** should check for proper rope tension, and adjust as needed, on a periodic schedule determined by the user, based upon severity of the operating environment and the frequency of switch actuations.

The pulleys and other moving parts associated with the rope should be periodically lubricated. If inspection reveals dirt on the rope pull switch or rope assembly, the dirt must be cleaned off and its cause must be eliminated. Replace the rope pull switch and/or rope assembly when any parts (including contacts) or assemblies are found to be damaged, broken, deformed, or badly worn.

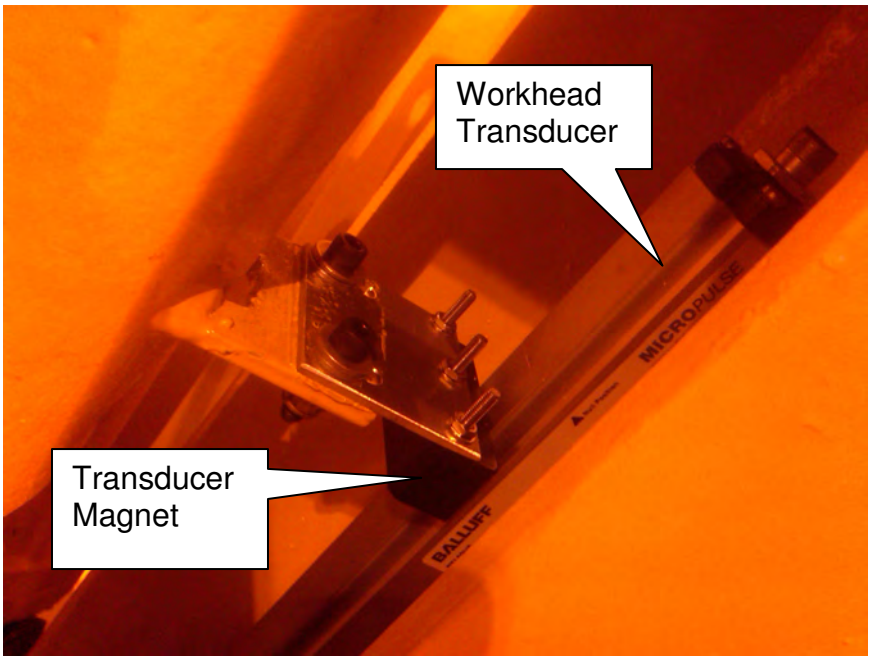
The rope pull switch and rope assembly should be replaced at specified intervals based upon the environment and operating conditions. Replacement of the rope pull switch and rope assembly should be considered after no more than 500,000 operations. Always test the control system for proper functioning under machine control conditions after maintenance or replacement of the rope pull switch.

* A *Designated Person* is identified in writing by the employer as being appropriately trained to perform a specified checkout procedure. A *Qualified Person* possesses a recognized degree or certificate or has extensive knowledge, training, and experience to be able to solve problems relating to the emergency stop rope pull switch installation.

Repairs

Banner rope pull emergency stop switches have no field-replaceable components. Contact the Banner Factory Application Engineering Group at the address or the numbers listed at the bottom of the back page. They will issue an RMA (Return Merchandise Authorization) number for your paperwork, and give you the proper shipping address.

Workhead Adjustments



Each workhead has a 30 inch linear transducer providing feedback for workhead positioning. The transducer puts out a 0 to +10 volt signal based upon the position of a magnet which is mounted on the workhead. The transducers are powered from +24 VDC which is provided by the Jupiter module to which they are connected, CAN04.

Viewing CAN04 using Jupiter Module Diagnostics will display the voltage coming from each of the workhead transducers, connectors C7 (left) and C8 (right). 0 volts is at the top of the transducer and 10 volts is at the bottom. When the workheads are up, the voltage from the transducers is around .3 to .7 volts.

Operation of the workheads can be monitored using the workhead diagnostics screen.

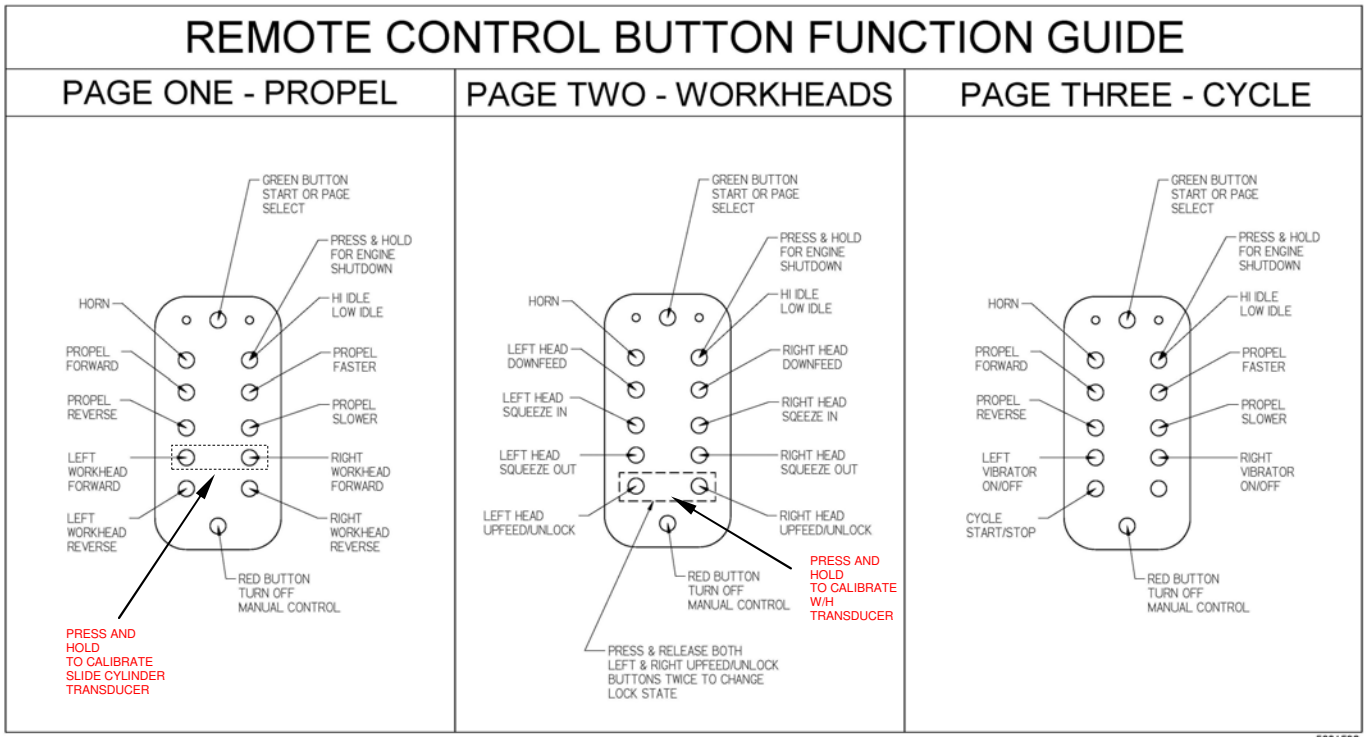
Workhead Depth Transducer Adjustments

Transducer Magnet: The distance from the magnet to the transducer should be in the range of 5 to 15 mm. Adjust to maintain this distance.

W/H Calibration using the hand held remote:

- Press the green button to turn the remote ON.
- Press the green button two times to enable page 2 on the remote. Each time the green button is pressed the electric horn will sound indicating what page of the remote is active. For example if you are on page one then a single beep of the horn would indicate page 1, two beeps page 2 and three for page 3.

- Press and hold the right and left upfeed buttons for approximately 15 seconds or until the horn sounds a continuous series of blasts indicating the calibration is complete.



W/H FOR/AFT SLIDE CYLINDERS

Each workhead has 2 slide cylinders that are used to position the heads forward and reverse. A smart cylinder (transducer) is used, one for each W/H to track the position and has a range of 48”. The lower cylinder does not contain a transducer.

Slide cylinder calibration using the hand held remote::

- Press the green button to turn the remote ON.
- Enter page one on the remote. To verify press the green button until 1 beep is heard indicating page one is active.
- Press and hold left and right workhead forward push buttons for approximately 15 seconds or until the horn sounds a continuous series of blasts indicating the calibration is complete.

Appendix B

Appendix B

Hydraulic System Troubleshooting

This section contains flow charts which can be used to troubleshoot a hydraulic system. Make sure you read this page before using the flow charts.

Excessive Noise Problem

Excessive noise means wear, alignment not correct, cavitation or air in the fluid. Contaminated fluid can cause a relief valve to stick and chatter. These noises may be caused by dirty filters or fluid, high fluid viscosity, excessive drive speed, low reservoir/tank level, loose input lines, or worn couplings.
If there is excessive noise, go to the circle labeled A in the flow chart.

Excessive Heat Problem

Excessive heat can be caused by a coupling that is not aligned properly and is placing an excessive load on bearings, by hydraulic fluids with a low viscosity, and by cavitation and slippage in a pump.
If there is excessive heat, go to the circle labeled D in the flow chart.

Flow Problem

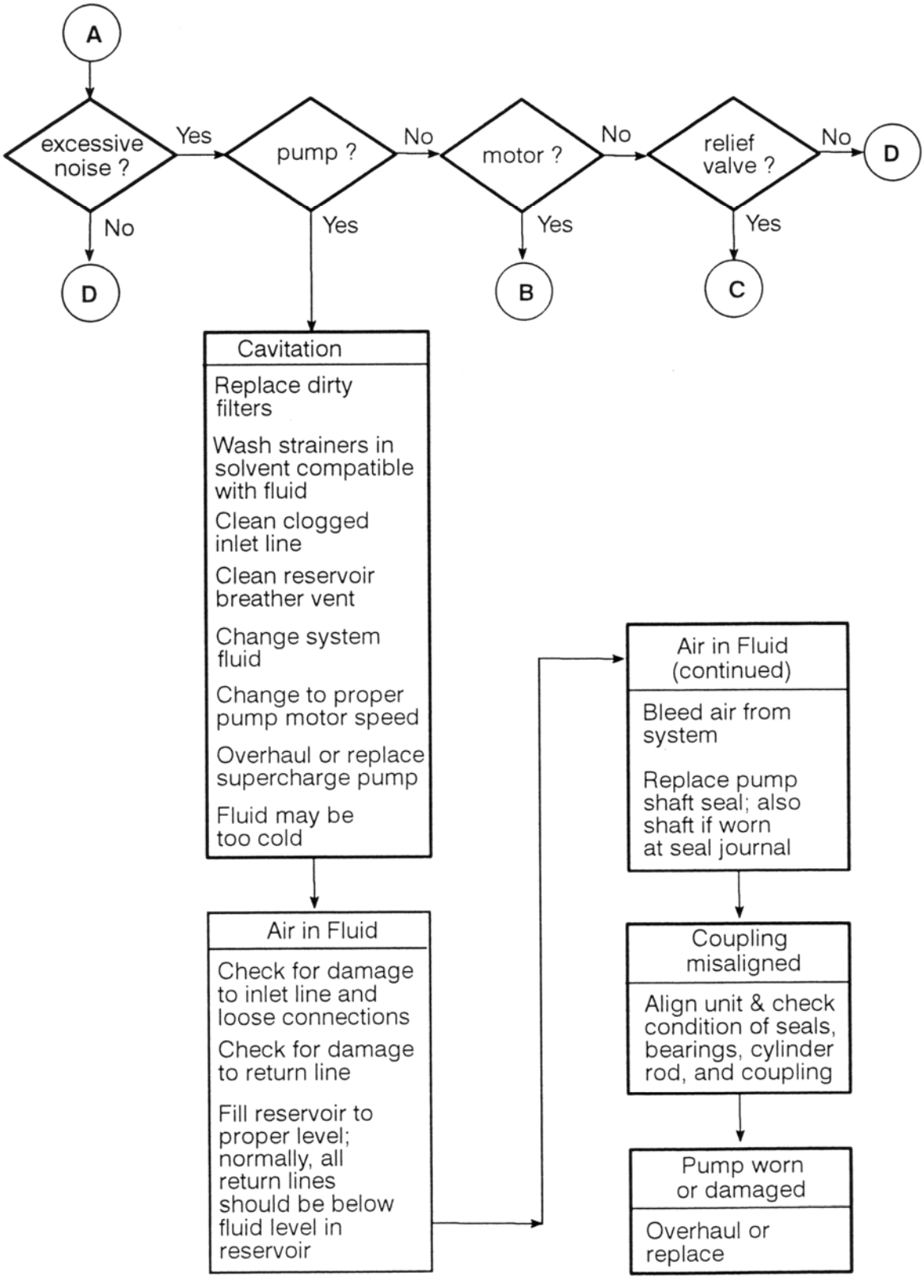
If the flow of hydraulic fluid is not correct, movement of the equipment may be slow, erratic, or excessive. Also, valves and other components may stick" and the equipment may overheat.
If the fluid flow is NOT correct, go to the circle labeled H in the flow chart.

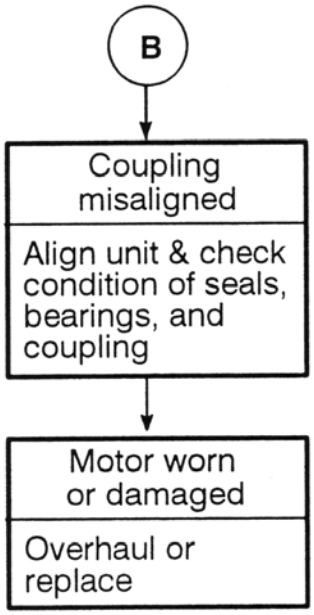
Pressure Problem

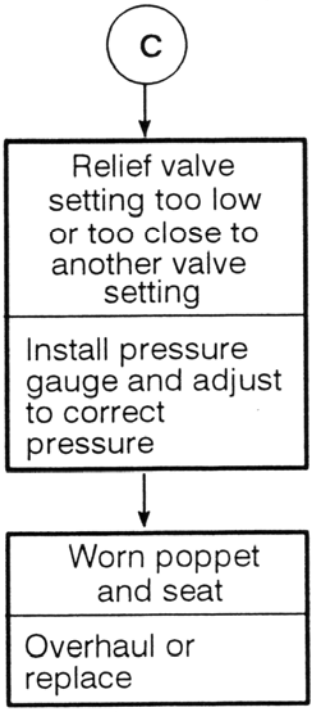
You should know the correct operating pressure and you should check and set the pressure periodically using a pressure gauge. The correct pressure should be the lowest pressure, which will permit the system to operate properly but below the maximum rating of the system.
If the pressure is NOT correct, go to the circle labeled K in the flow chart.

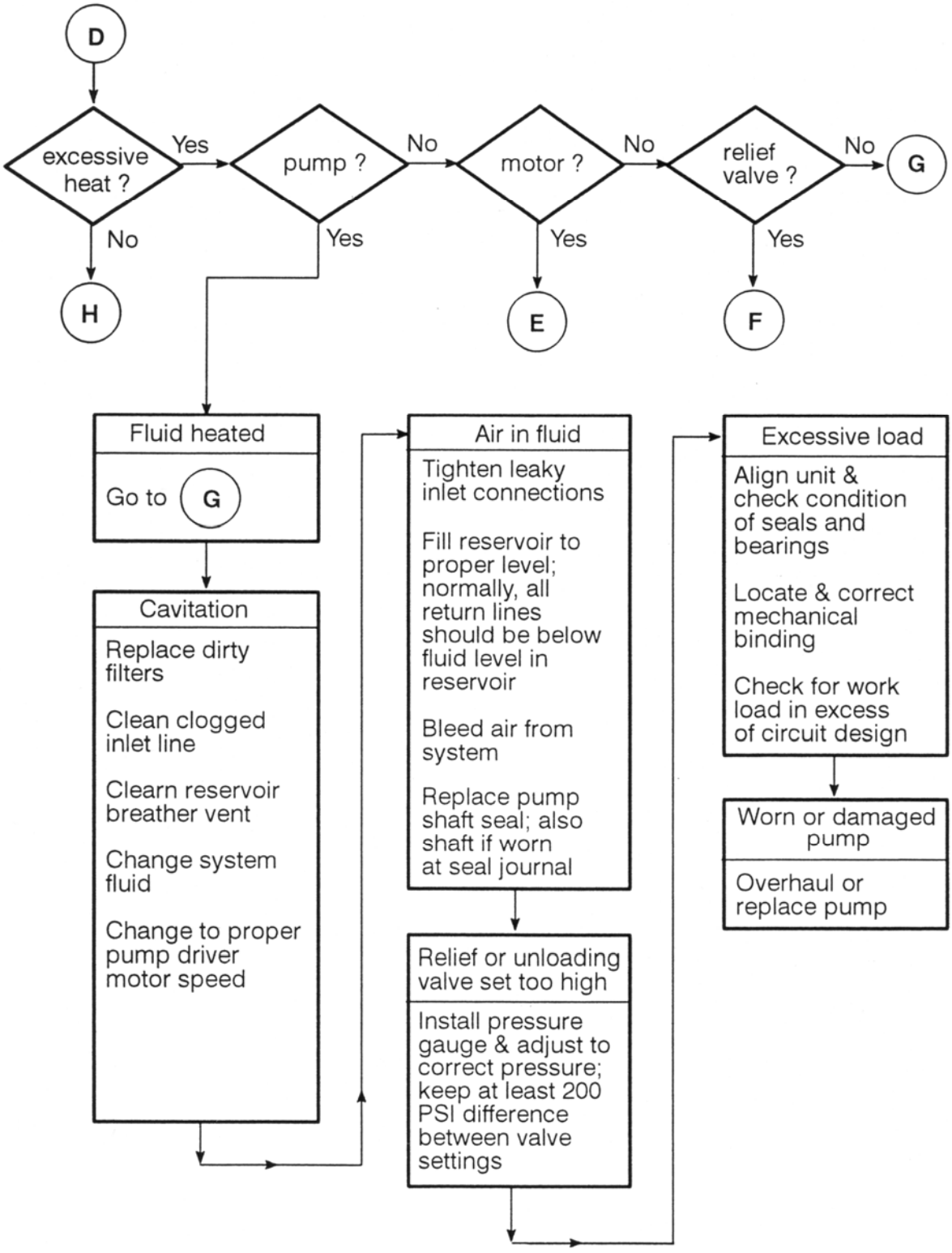
NOTE

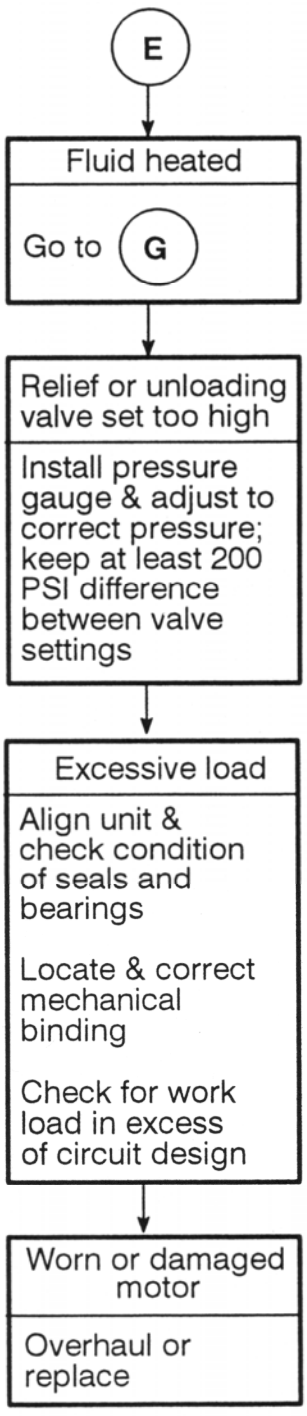
If the problem is NOT excessive noise or excessive heat, go to the circle labeled N in the flow chart.

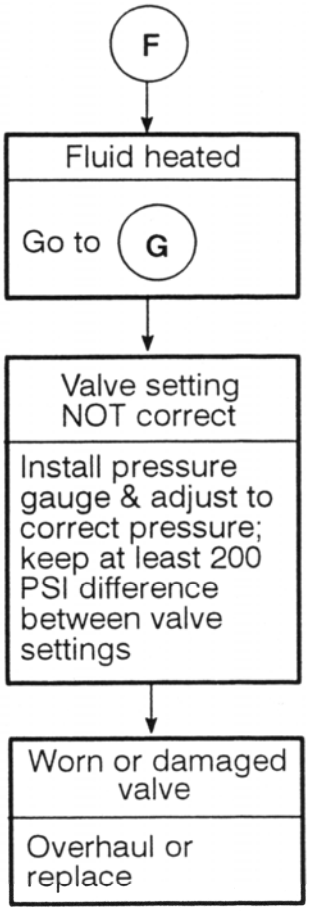

A
excessive noise ?
Yes
pump ?
No
motor ?
No
relief valve ?
No
D
No
D
Yes
B
Yes
C
Yes
Cavitation
Replace dirty filters
Wash strainers in solvent compatible with fluid
Clean clogged inlet line
Clean reservoir breather vent
Change system fluid
Change to proper pump motor speed
Overhaul or replace supercharge pump
Fluid may be too cold
Air in Fluid
Check for damage to inlet line and loose connections
Check for damage to return line
Fill reservoir to proper level; normally, all return lines should be below fluid level in reservoir
Air in Fluid (continued)
Bleed air from system
Replace pump shaft seal; also shaft if worn at seal journal
Coupling misaligned
Align unit & check condition of seals, bearings, cylinder rod, and coupling
Pump worn or damaged
Overhaul or replace

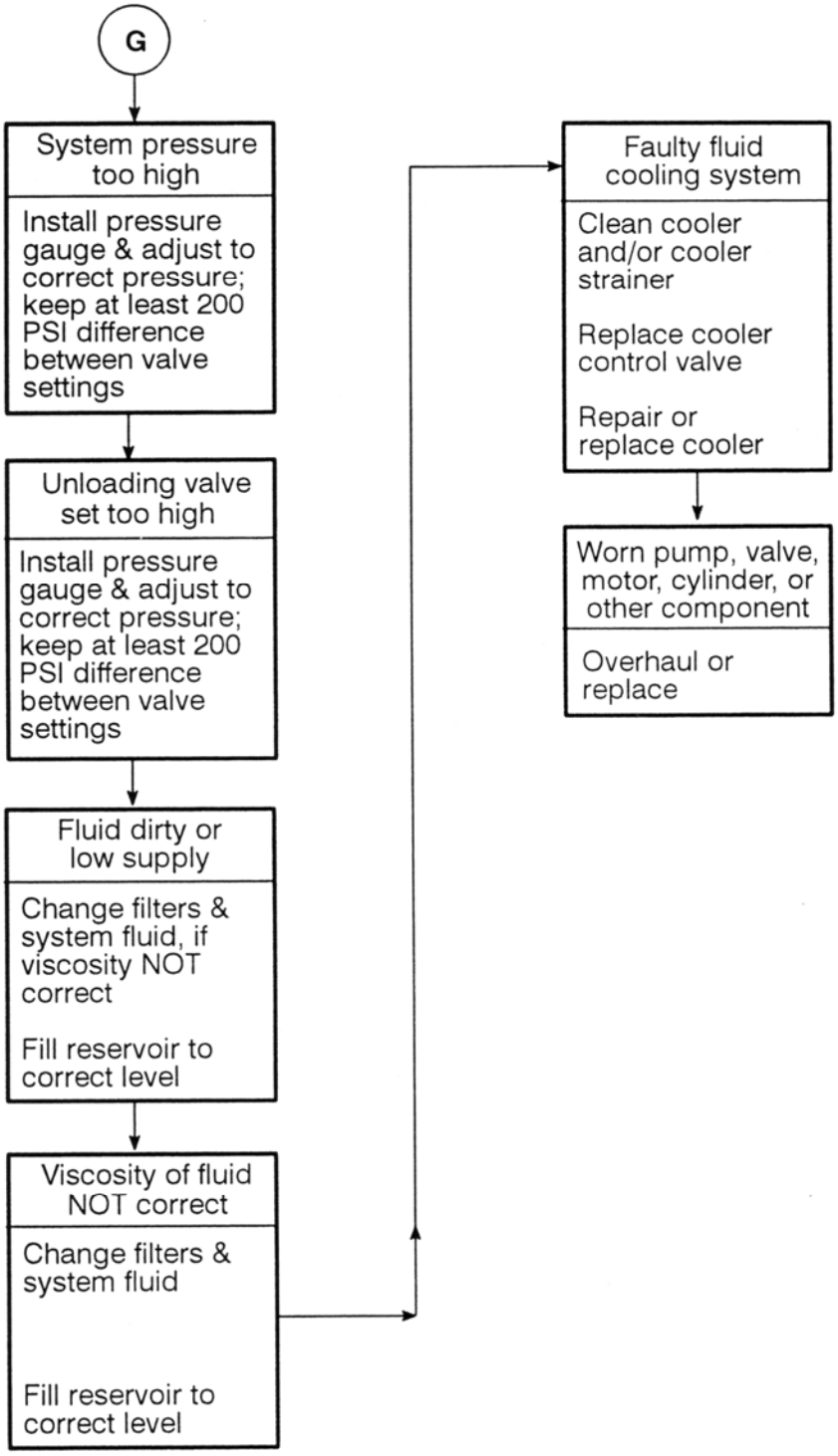

B
Coupling misaligned
Align unit & check condition of seals, bearings, and coupling
Motor worn or damaged
Overhaul or replace

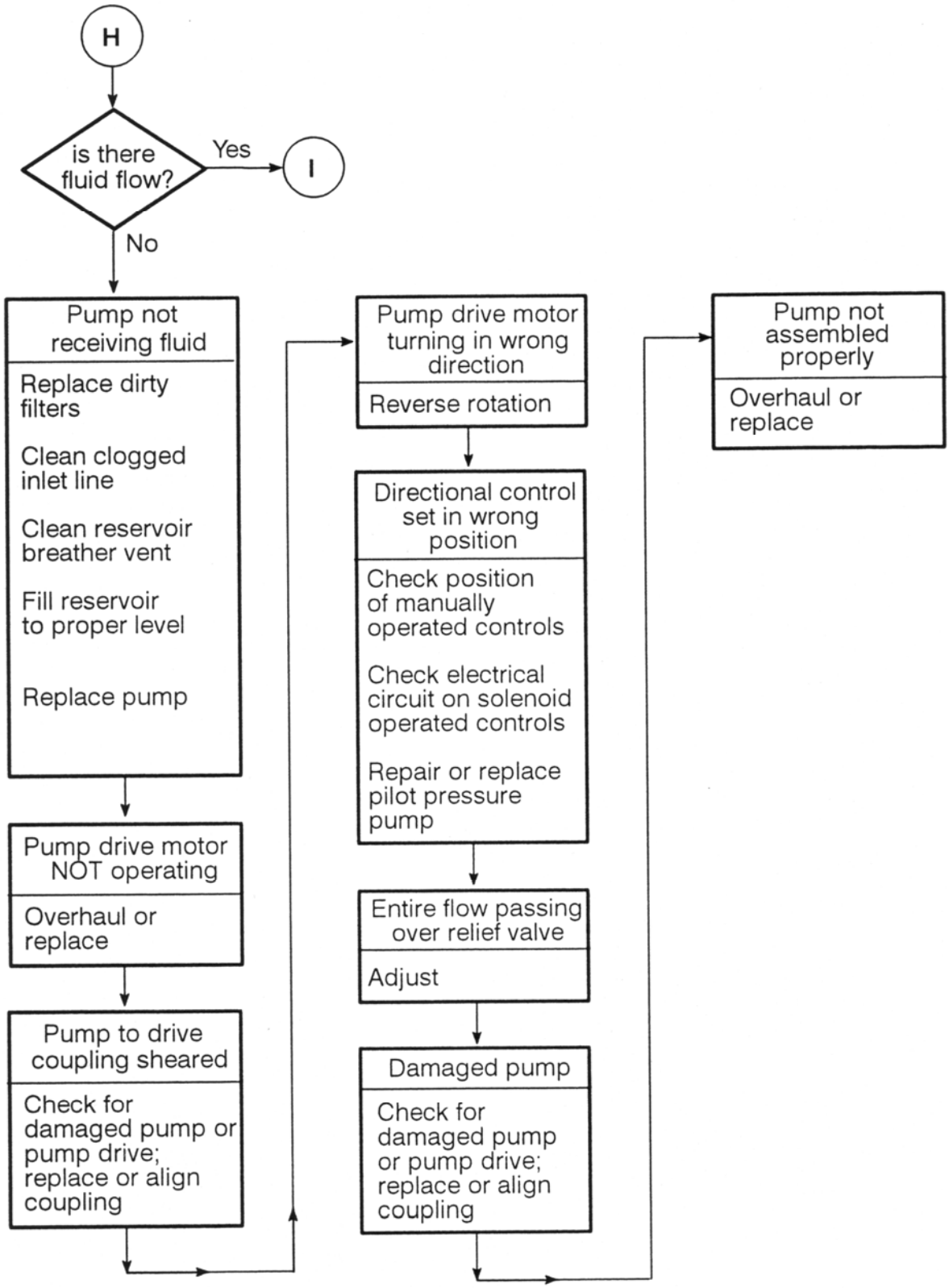

C
Relief valve setting too low or too close to another valve setting
Install pressure gauge and adjust to correct pressure
Worn poppet and seat
Overhaul or replace

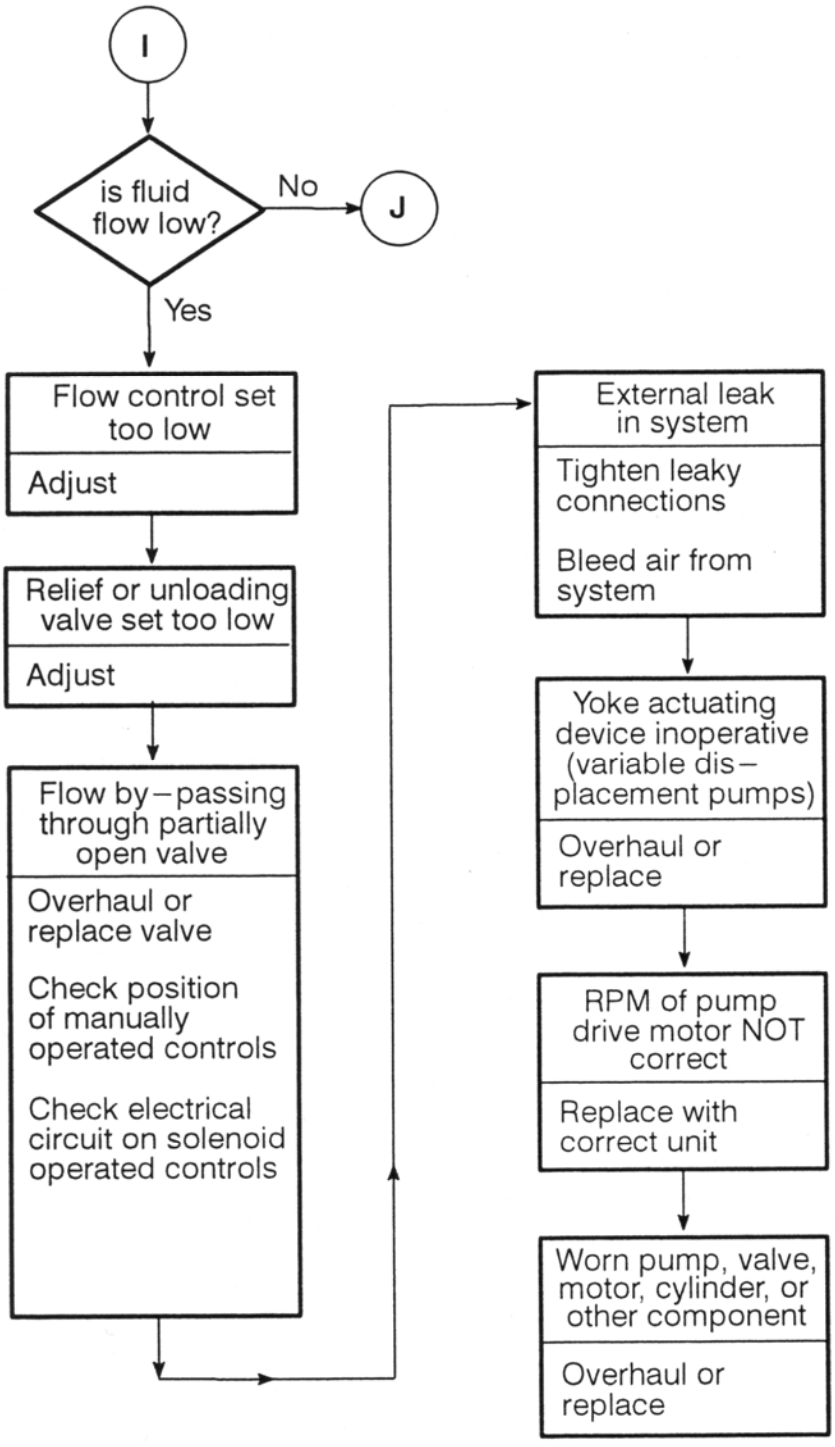

D
excessive heat ?
Yes
pump ?
No
motor ?
No
relief valve ?
No
G
No
Yes
Yes
Yes
H
E
F
Fluid heated
Go to G
Cavitation
Replace dirty filters
Clean clogged inlet line
Clearn reservoir breather vent
Change system fluid
Change to proper pump driver motor speed
Air in fluid
Tighten leaky inlet connections
Fill reservoir to proper level; normally, all return lines should be below fluid level in reservoir
Bleed air from system
Replace pump shaft seal; also shaft if worn at seal journal
Relief or unloading valve set too high
Install pressure gauge & adjust to correct pressure; keep at least 200 PSI difference between valve settings
Excessive load
Align unit & check condition of seals and bearings
Locate & correct mechanical binding
Check for work load in excess of circuit design
Worn or damaged pump
Overhaul or replace pump

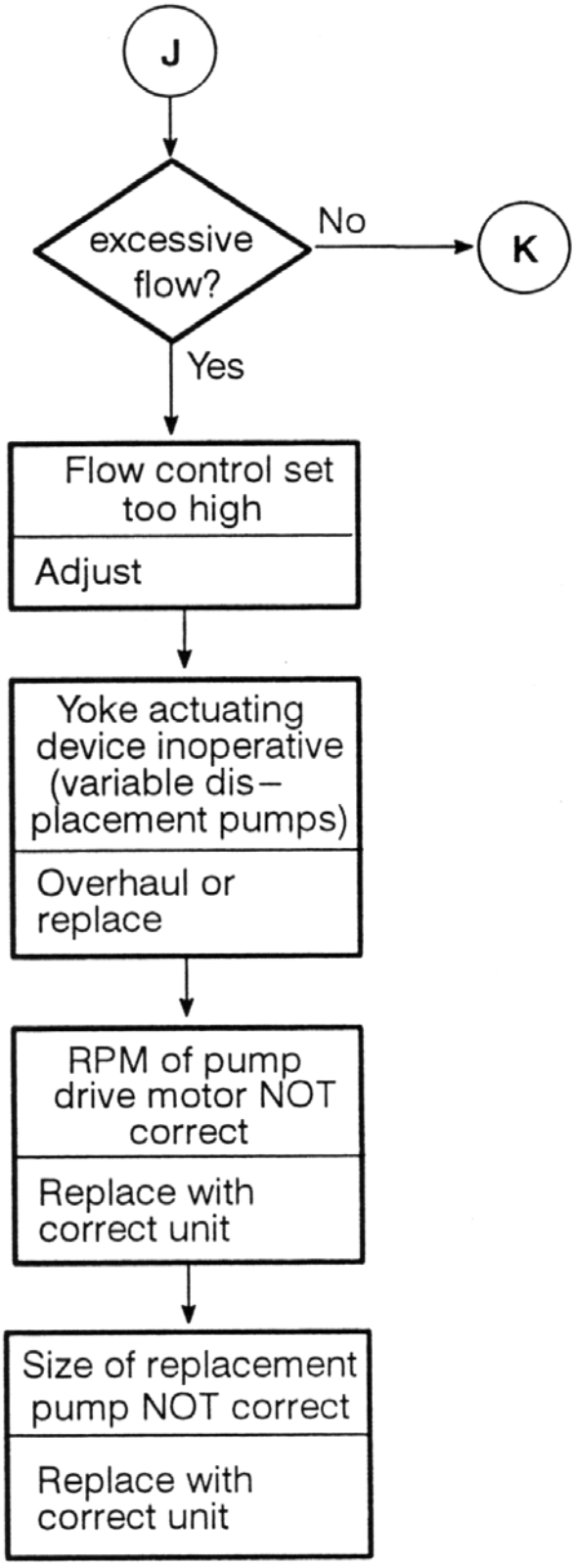

E
Fluid heated
Go to G
Relief or unloading valve set too high
Install pressure gauge & adjust to correct pressure; keep at least 200 PSI difference between valve settings
Excessive load
Align unit & check condition of seals and bearings
Locate & correct mechanical binding
Check for work load in excess of circuit design
Worn or damaged motor
Overhaul or replace

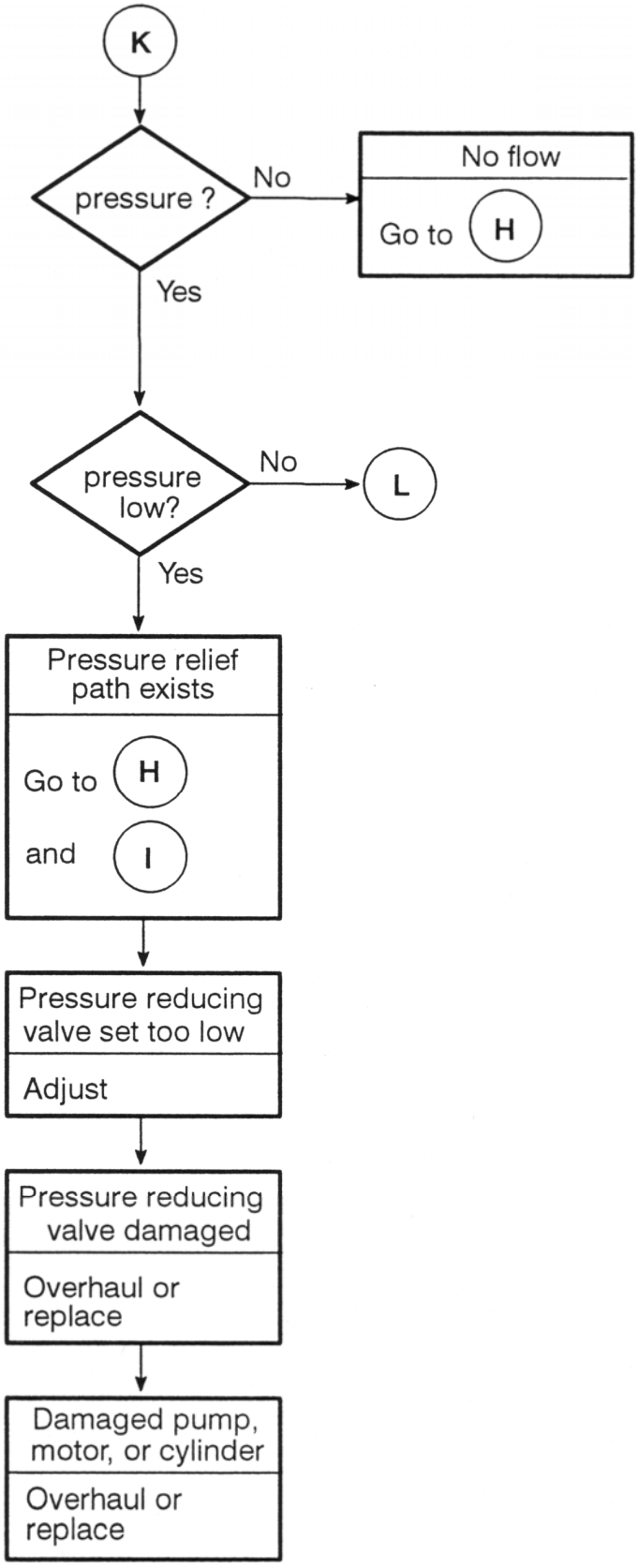

F
Fluid heated
Go to G
Valve setting NOT correct
Install pressure gauge & adjust to correct pressure; keep at least 200 PSI difference between valve settings
Worn or damaged valve
Overhaul or replace

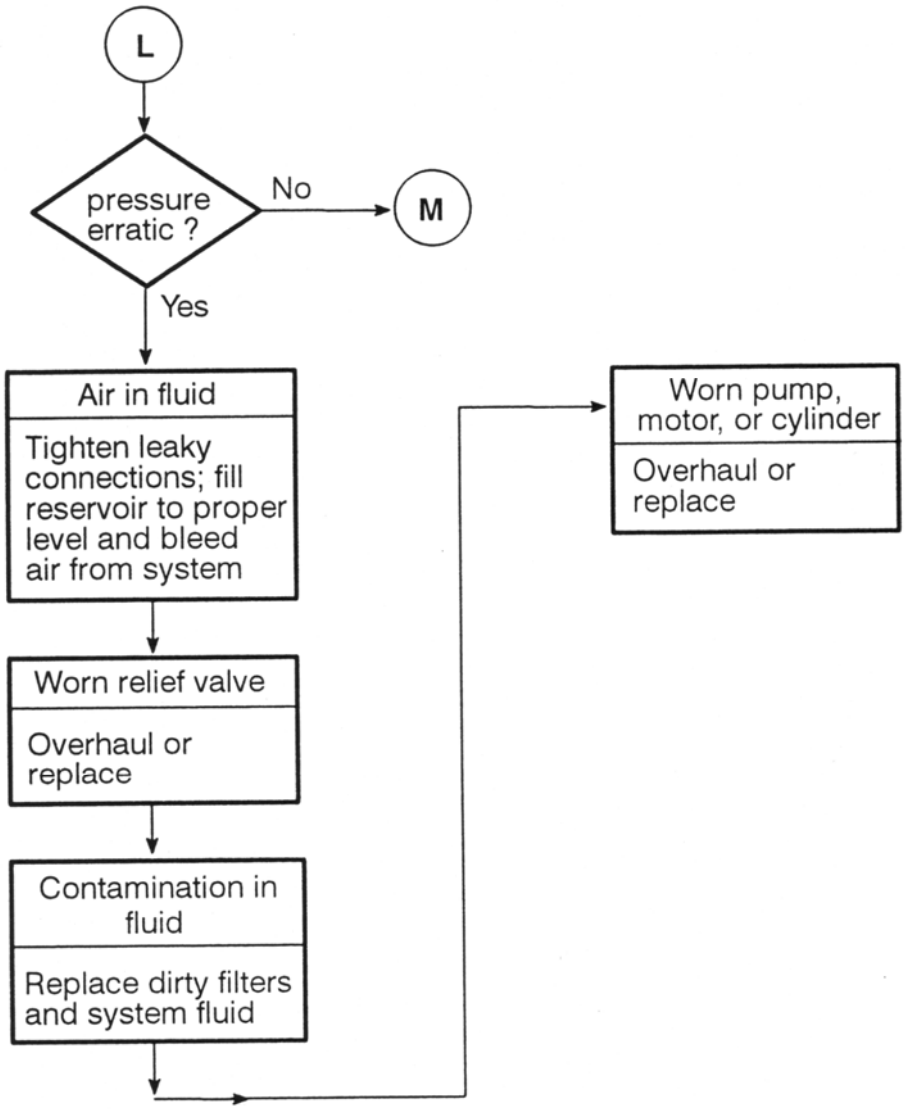

G
System pressure too high
Install pressure gauge & adjust to correct pressure; keep at least 200 PSI difference between valve settings
Unloading valve set too high
Install pressure gauge & adjust to correct pressure; keep at least 200 PSI difference between valve settings
Fluid dirty or low supply
Change filters & system fluid, if viscosity NOT correct
Fill reservoir to correct level
Viscosity of fluid NOT correct
Change filters & system fluid
Fill reservoir to correct level
Faulty fluid cooling system
Clean cooler and/or cooler strainer
Replace cooler control valve
Repair or replace cooler
Worn pump, valve, motor, cylinder, or other component
Overhaul or replace

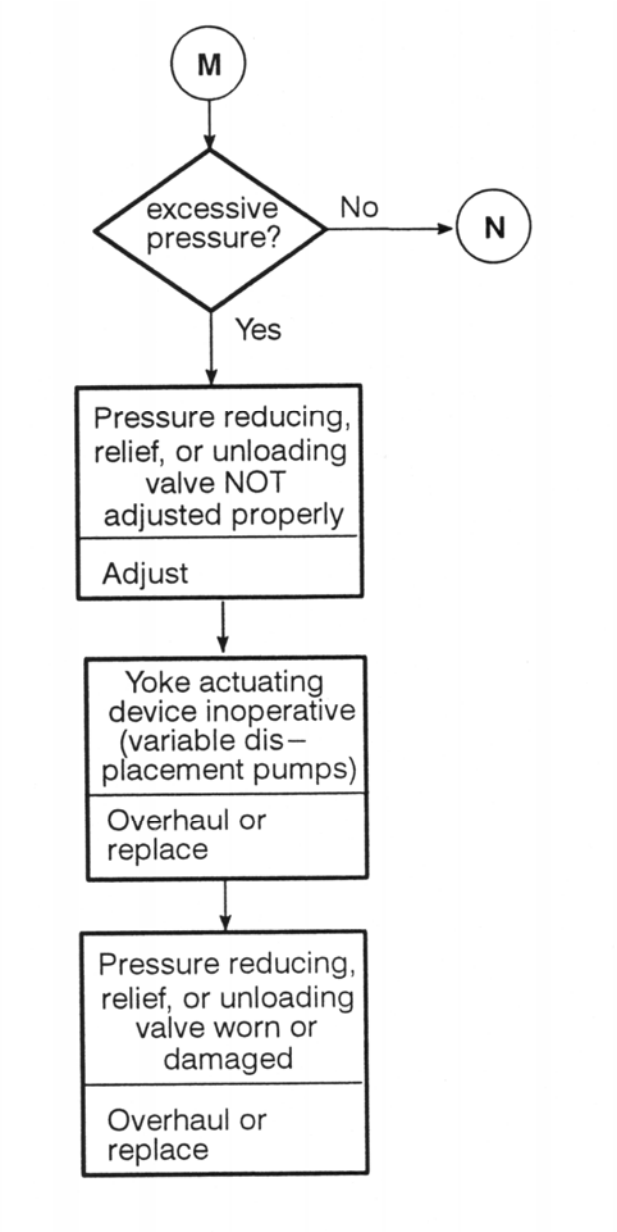

H
is there fluid flow?
Yes
I
No
Pump not receiving fluid
Replace dirty filters
Clean clogged inlet line
Clean reservoir breather vent
Fill reservoir to proper level
Replace pump
Pump drive motor NOT operating
Overhaul or replace
Pump to drive coupling sheared
Check for damaged pump or pump drive; replace or align coupling
Pump drive motor turning in wrong direction
Reverse rotation
Directional control set in wrong position
Check position of manually operated controls
Check electrical circuit on solenoid operated controls
Repair or replace pilot pressure pump
Entire flow passing over relief valve
Adjust
Damaged pump
Check for damaged pump or pump drive; replace or align coupling
Pump not assembled properly
Overhaul or replace

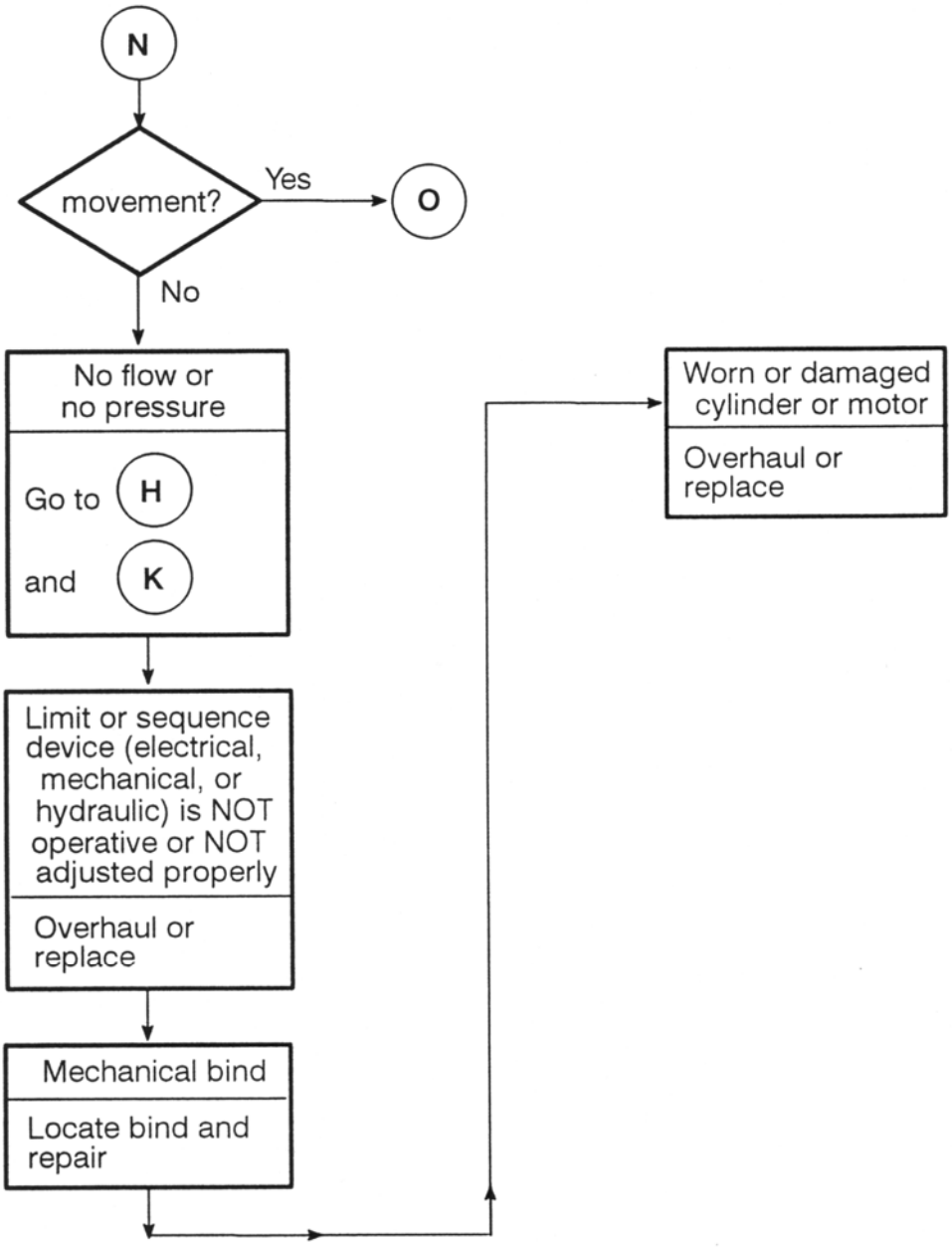

I
is fluid flow low?
No
J
Yes
Flow control set too low
Adjust
Relief or unloading valve set too low
Adjust
Flow by–passing through partially open valve
Overhaul or replace valve
Check position of manually operated controls
Check electrical circuit on solenoid operated controls
External leak in system
Tighten leaky connections
Bleed air from system
Yoke actuating device inoperative (variable dis–placement pumps)
Overhaul or replace
RPM of pump drive motor NOT correct
Replace with correct unit
Worn pump, valve, motor, cylinder, or other component
Overhaul or replace

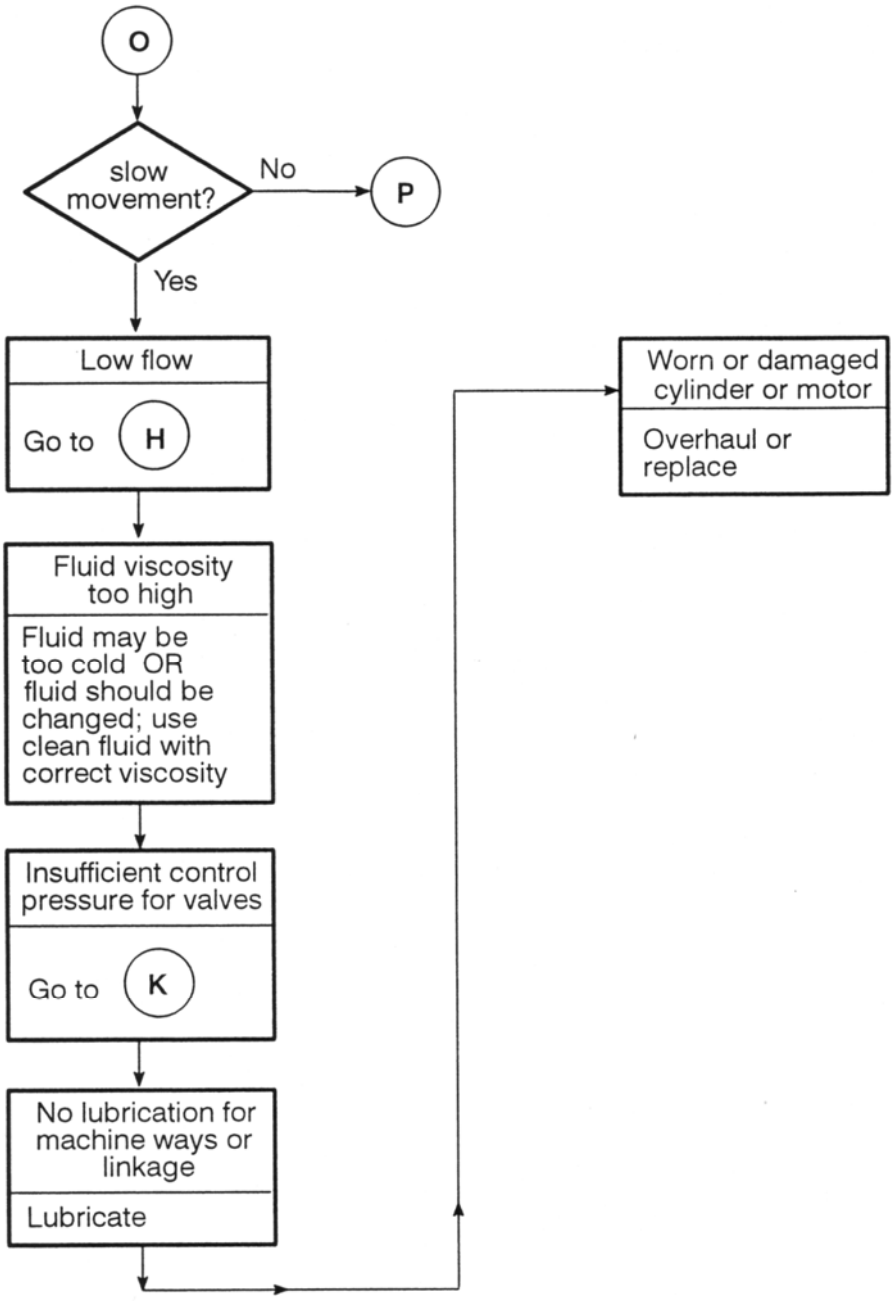

J
excessive flow?
No
K
Yes
Flow control set too high
Adjust
Yoke actuating device inoperative (variable dis–placement pumps)
Overhaul or replace
RPM of pump drive motor NOT correct
Replace with correct unit
Size of replacement pump NOT correct
Replace with correct unit

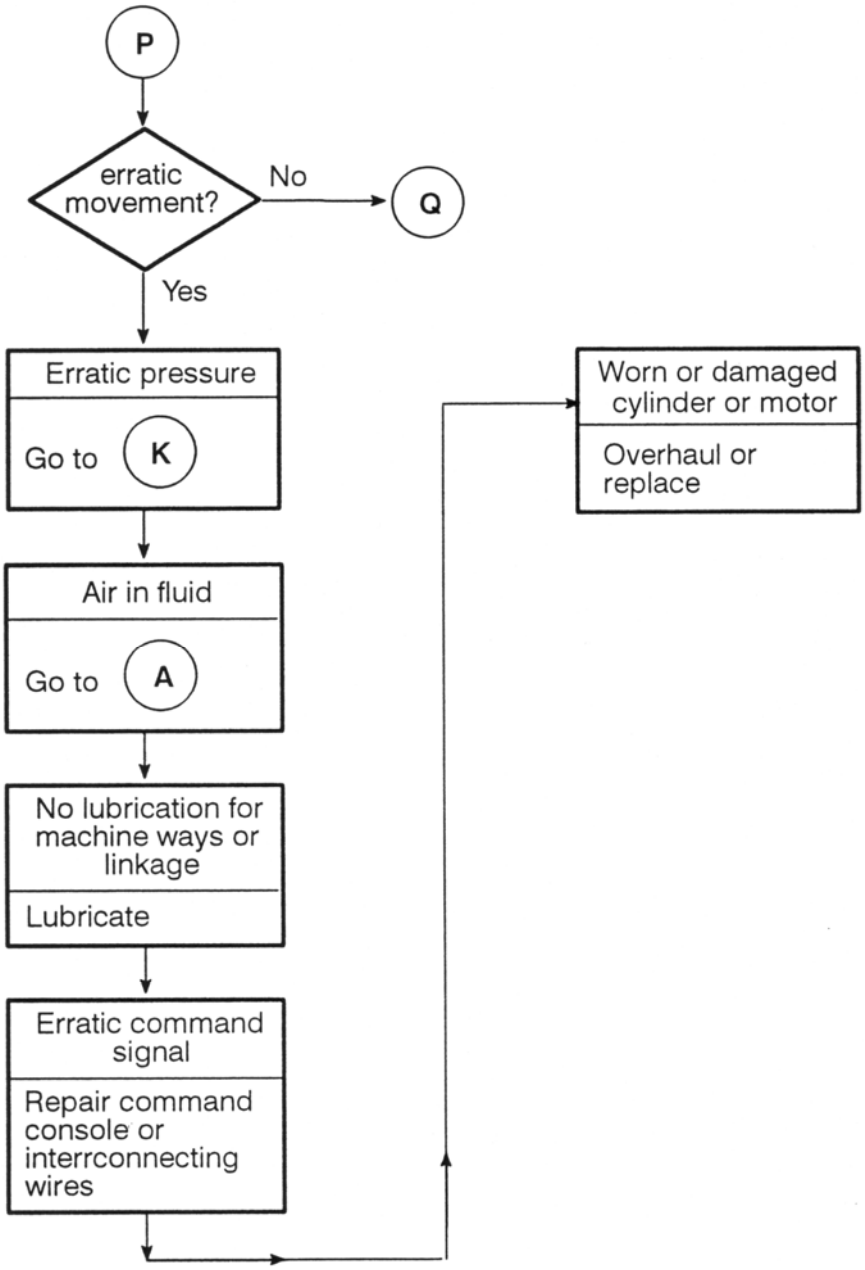

K
pressure ?
No
No flow
Go to H
Yes
pressure low?
No
L
Yes
Pressure relief path exists
Go to H
and I
Pressure reducing valve set too low
Adjust
Pressure reducing valve damaged
Overhaul or replace
Damaged pump, motor, or cylinder
Overhaul or replace

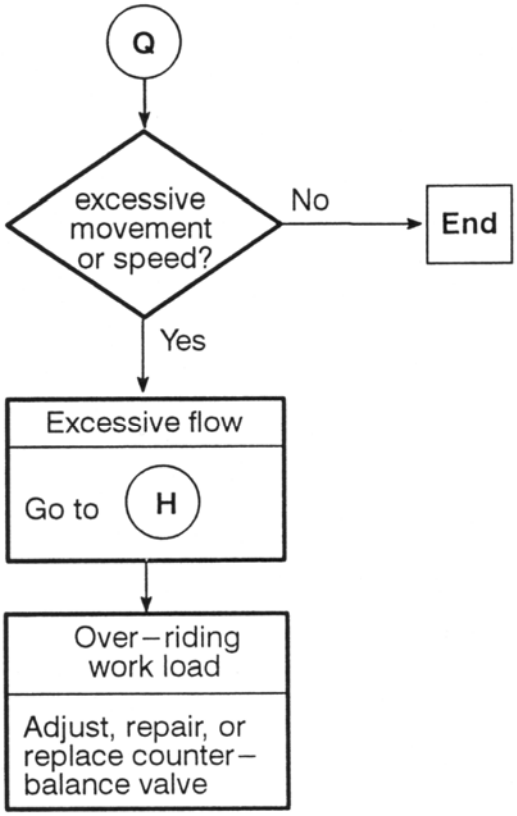

L
pressure erratic ?
No
M
Yes
Air in fluid
Tighten leaky connections; fill reservoir to proper level and bleed air from system
Worn relief valve
Overhaul or replace
Contamination in fluid
Replace dirty filters and system fluid
Worn pump, motor, or cylinder
Overhaul or replace


M
excessive pressure?
No
N
Yes
Pressure reducing, relief, or unloading valve NOT adjusted properly
Adjust
Yoke actuating device inoperative (variable dis–placement pumps)
Overhaul or replace
Pressure reducing, relief, or unloading valve worn or damaged
Overhaul or replace


N
movement?
Yes
O
No
No flow or no pressure
Go to H
and K
Limit or sequence device (electrical, mechanical, or hydraulic) is NOT operative or NOT adjusted properly
Overhaul or replace
Mechanical bind
Locate bind and repair
Worn or damaged cylinder or motor
Overhaul or replace


O
slow movement?
No
P
Yes
Low flow
Go to H
Fluid viscosity too high
Fluid may be too cold OR fluid should be changed; use clean fluid with correct viscosity
Insufficient control pressure for valves
Go to K
No lubrication for machine ways or linkage
Lubricate
Worn or damaged cylinder or motor
Overhaul or replace


P
erratic movement?
No
Q
Yes
Erratic pressure
Go to K
Air in fluid
Go to A
No lubrication for machine ways or linkage
Lubricate
Erratic command signal
Repair command console or interrconnecting wires
Worn or damaged cylinder or motor
Overhaul or replace


Q
excessive movement or speed?
No
End
Yes
Excessive flow
Go to
H
Over–riding work load
Adjust, repair, or replace counter–balance valve

Appendix C

HARSCO RAIL

JUPITER II

DESCRIPTION AND DIAGNOSTICS

ISSUED 8 - 2010

BULLETIN 1606

■ **THIS MANUAL CONTAINS VITAL INFORMATION FOR THE SAFE USE AND EFFICIENT OPERATION OF THIS MACHINE. CAREFULLY READ THIS MANUAL BEFORE USING THE MACHINE. FAILURE TO ADHERE TO THE INSTRUCTIONS COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.**

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A MANUAL MUST REMAIN WITH THE MACHINE. Additional or replacement manuals may be obtained by calling or writing Harsco Rail, Harsco Corporation.

All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. Harsco Rail, Harsco Corporation reserves the right to make changes at any time without notice.

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NOTES

1.1 Introduction

Jupiter II is Harsco Rail's newest generation of our Jupiter Control System developed to meet the demanding computer control requirements of railway maintenance equipment.

Jupiter II enhances the proven performance, ruggedness, reliability, speed, simplicity and diagnostic capability of the Jupiter Control System. The distributed I/O intelligent control system uses the Jupiter Application Master (JAM) to communicate with the Control Area Network (CAN) I/O Modules strategically positioned around the machine to be in close proximity to the devices with which they interact. Industrial network cables connect the CAN I/O modules.

One of the many features of Jupiter II is the comprehensive and powerful diagnostic capabilities to assist when isolating and correcting failures and knowing that every component is under continuous diagnostic scrutiny from the moment the computer is booted up. With these features, it is frequently possible to identify problems before they become disabling.

The "plug and play" capability of Jupiter allows modules to be exchanged between completely different machines with ease. All devices that connect to the Jupiter Control System incorporate connectors to facilitate rapid field replacement. The majority of the cables in the system are identical and vary only in length. Only a few spare cables, equal in length to the longest in actual use, need be carried to make it possible to replace any cable on a machine.

2.1 Jupiter Features

2.1.1 Comprehensive Diagnostics

Jupiter diagnostic capabilities can dramatically reduce electrical troubleshooting time required to restore machine operation. The use of graphical diagnostic screens in conjunction with the diagnostic features of each Jupiter module simplifies the job of the operator or technician. Operators/technicians can rapidly locate and solve most control system problems without the use of a schematic or multi-meter.

- All output channels detect and report short circuits
- Output channels monitor and display load current in Amps
- All digital I/O channels include status LED indicators
- Module status is monitored and reported in the case of failure
- Network communication is monitored and reported in case of failure
- Graphical diagnostics screens available

2.1.2 Simplified Electrical System

The use of Jupiter remote I/O devices helps simplify electrical systems through:

- The reduction of wires and wire terminations
- The use of quick disconnect cables
- Shorter wire runs
- Only 2 primary module types
- Like module types and cables are interchangeable

2.1.3 Improved Reliability

The rugged design of the Jupiter II modules improves the reliability of the electrical control system. Jupiter II modules are built to operate at extreme temperatures of -40° C to +70° C. All modules are IP67 rated (waterproof), CE labeled and fully potted for extreme vibrations. Premolded cables and cord sets eliminate field wiring and reduce the likelihood of open and / or short circuits. Each module provides a layer of electrical (and logical) isolation from the rest of the system thereby containing problems and simplifying repair. The increased capacity of output channels handles a wide range of load conditions.

2.1.4 Scalable Platform

The modular design of the Jupiter Control System makes it possible to install Jupiter on small machines as well as large complex machines. This feature will lead to a common control system on an entire fleet of machines. The use of common control system components that are interchangeable from machine to machine enables inventory reduction, common schematics, reduced service technician training and a common set of features and diagnostic tools between a wide variety of machines.

3.1 Jupiter Control System

3.1.1 Jupiter System Description - See Figure 1

The Jupiter Control System is used to control most operating functions on the machine. The main computer (host) is the Jupiter Application Master (JAM). Each machine has its own JAM box (1) and J42 Board (2), normally located in the cab on the machine. If two machines are coupled and operating together, the JAM boxes on both machines communicate with each other through an Ethernet cable connection. Each JAM is labeled as address #1 and is connected to its own J42 Board which provides the physical connection between the JAM and the Jupiter Network Modules on the machine.

The JAM contains a microprocessor that is responsible for distributing programming information to the other Jupiter modules on the machine. Specific software for the machine is loaded into the JAM at the factory. The software can be updated by connecting a memory device to one of the USB connections or by installing a different internal memory card.

All Jupiter controlled functions are displayed on the touch screen monitor and are controlled by the computer, either manually or automatically.

The Jupiter Network Modules are located at various positions on the machine, in close proximity to the components that they control or monitor. The four types of modules used are briefly described below:

Analog Input Module: The Analog Input Module is used with analog input devices that have a varying feed-back voltage such as: engine sensors, fuel gauges, position sensors, etc.

Digital Input / Output Module: The Digital Input / Output Module is used with digital input devices that when actuated, send a power signal back to the module. Examples of these devices are: limit switches, pressure switches, etc. The Digital Input / Output Module is also used with digital output devices that have two positions (On / Off) such as: valve coils, relays, lights, alarms, etc. or proportional output (PWM) controls.

HD Digital Input / Output Module: The HD (High Density) Digital Input / Output Module is used with digital input devices that when actuated, send a power signal back to the module. Examples of these devices are: limit switches, pressure switches, etc. The HD Digital Input / Output Module is also used with digital output devices that have two positions (On / Off) such as: valve coils, relays, lights, alarms, etc.

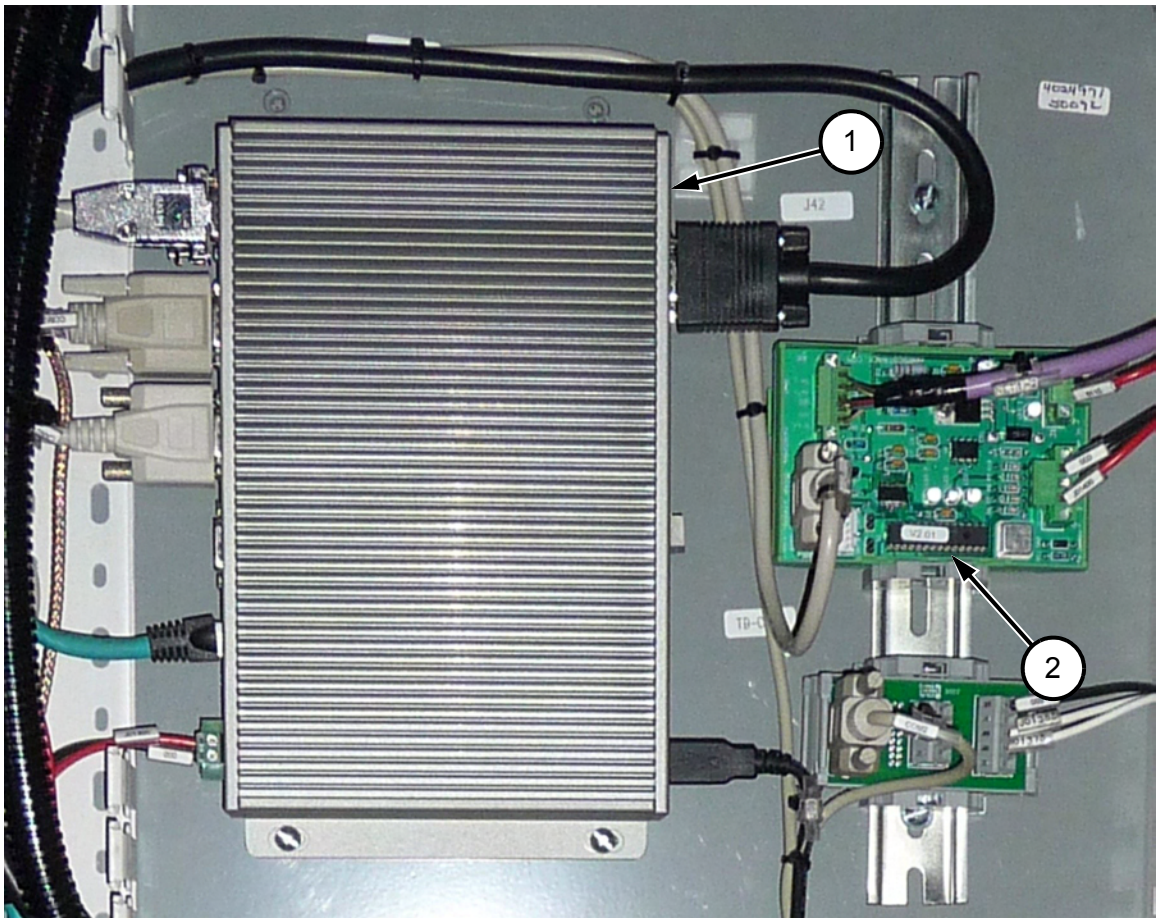
The HD Digital Input / Output Module interfaces with machine components much the same as the standard Digital Input / Output Module. One major difference is the HD Digital Input / Output Module offers 32 channels which can be either input or output channels depending on the software programing while the standard Digital Input / Output Module has 16 input channels and 8 output channels. The other major difference is how wires are connected to the module. The standard Digital Input / Output Module has eight 5 pin M12 connectors while the HD Digital Input / Output Module has 32 connectors where wires can be connected directly.

3.1 Jupiter Control System

3.1.1 Jupiter System Description - See Figure 1

Digital to Analog Output Module: The Digital to Analog Output Module is used to drive servo valves and other devices that r equire a precision volt age or cu rrent input for control. These devices may be driven in “open loop” fashion, where the JAM specifies the exact output to drive, or in “closed loop” fashion, w here the Digit al to Analog Output Module it self is provided with feedback information used to evaluat e the amount of error in it s ou tput signal relative to an output set point nominated by the JAM. Each plug on the Digital to Analog Output Module may be driven in open or closed loop fashion depending upon the application needs of the machine.

FIGURE 1
JUPITER APPLICATION MASTER (JAM) AND J42 BOARD



3.1 Jupiter Control System

3.1.2 Jupiter Diagnostics Overview

The diagnostic screens incorporated into the Jupiter can be used to troubleshoot electrical systems and electrical components that are controlled or monitored by Jupiter. In some applications, not all components and systems on the machine can be checked or monitored by Jupiter.

When the computer detects a fault in the Jupiter network on the machine, it will generate an alarm message that appears in the alarm panel on the computer monitor. The type of alarm message will determine the most practical troubleshooting procedure.

If an alarm message would appear such as "Low Fuel", then the first thing to check would be the fuel level in the fuel tank. If the fuel tank is not empty, then the Jupiter diagnostic screens would be used to check for short circuits, voltage problems, etc.

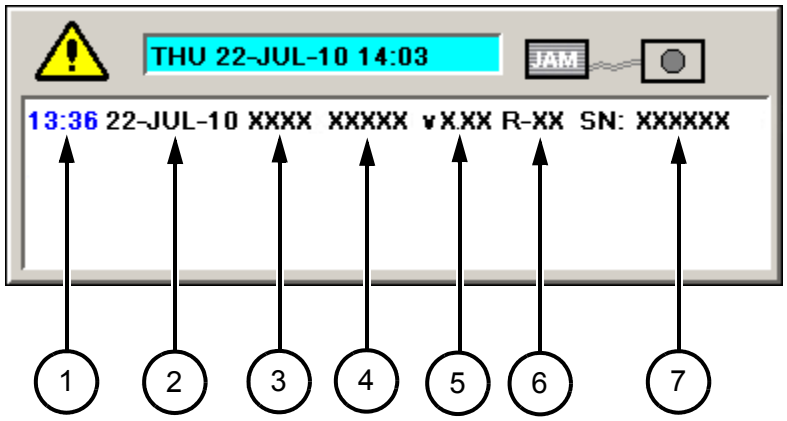
If an alarm message would appear such as "Output Module Open Circuit Detected", then the first thing to check would be the diagnostic screens to determine which module has the open circuit and what is causing the open circuit at that module. In most cases, when a fault occurs that can be checked by the diagnostic screens, the network diagnostic screen will automatically be displayed on the monitor. The operator can then select the detail view of the module on which the fault has occurred and determine where the open circuit is.

3.1 Jupiter Control System

3.1.3 Jupiter Software Information - See Figure 2

The Jupiter Control Syst em software in formation will be displayed on the Alarm Panel on the Main Screen and is usually the first entry after a successful boot-up. The boot-up time (1), date (2), machine name or number (3), program (4), version (5), revision (6) and machine serial number (7) will be displayed. Always have this in formation available when cont acting Harsco Rail for software assistance.

FIGURE 2
SOFTWARE INFORMATION DISPLAY



3.1 Jupiter Control System

3.1.4 JAM (Jupiter Application Master) - See Figures 3 and 4

The Jupiter Control System is used to control most operating functions on the machine. The main computer (host) is the Jupiter Application Master (JAM). The JAM box is normally located in the cab on the machine. If two machines are coupled and operating together, the JAM boxes on both machines communicate with each other through an Ethernet cable connection. Each JAM is labeled as address #1 and is connected to its own J42 Board which provides the physical connection between the JAM and the Jupiter Network Modules on the machine.

The JAM consists of the following:

(1) USB: These two connections can be used to connect USB devices to the JAM box.
(2) PC CARD: This PCMCIA memory card slot is NOT USED. An internal compact flash memory card stores the machine application software. See 3.1.4.1 Memory Card for removing or installing the compact flash memory card.
(3) RESET: The Reset Button is located inside a small hole below the PC Card eject button. It requires a tool small enough to be inserted through the hole to reset the JAM box. When the Reset Button is pressed and released, the JAM box will shut down and then reboot.
(4) POWER: This switch controls the power to the JAM box. Press the switch to power down the JAM box. Press the switch again to power up the JAM box.
(5) MIC: Microphone connection (not used).
(6) LINE IN: Audio / Video Input connection (not used).
(7) LINE OUT: Audio / Video output connection (not used).
(8) VGA: Video / Graphics connection for the Touch Screen Monitor.
(9) MS / KB: Mouse / Key Board connection (not used).
(10) COM 1: Serial port connection, dedicated to a Touch Screen Monitor (when used).
(11) COM 2: Serial port connection (machine dependent use).
(12) COM 3: Serial port connection to the Jupiter network J42 Board (when used).
(13) COM 4: Serial port connection (machine dependent use).
(14) Rx1, Rx2, Rx3 and Rx4: LED's for corresponding COM serial port. These will flash green when receiving data.
(15) Tx1, Tx2, Tx3 and Tx4: LED's for corresponding COM serial port. These will flash yellow when transmitting data.
(16) LAN 1: Ethernet connection.
(17) LAN 2: Ethernet connection.
(18) 24V - GND: Power / ground connection to the J42 Board.
(19) IDE: This LED will flash green when the compact flash memory card is transmitting and / or receiving data.
(20) BTRY: THIS LED will illuminate green when the JAM box batteries need to be replaced. See 3.1.4.2 Battery Replacement.
(21) PWR: This LED will illuminate green when 24V power is being supplied from J42 Board.

3.1 Jupiter Control System

3.1.4 JAM (Jupiter Application Master)

FIGURE 3
JAM - FRONT

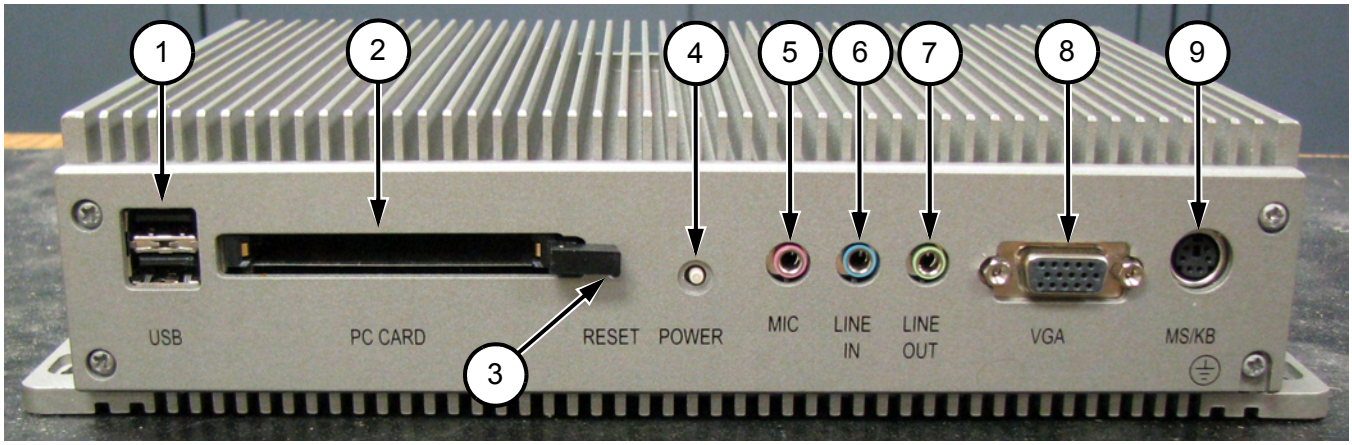
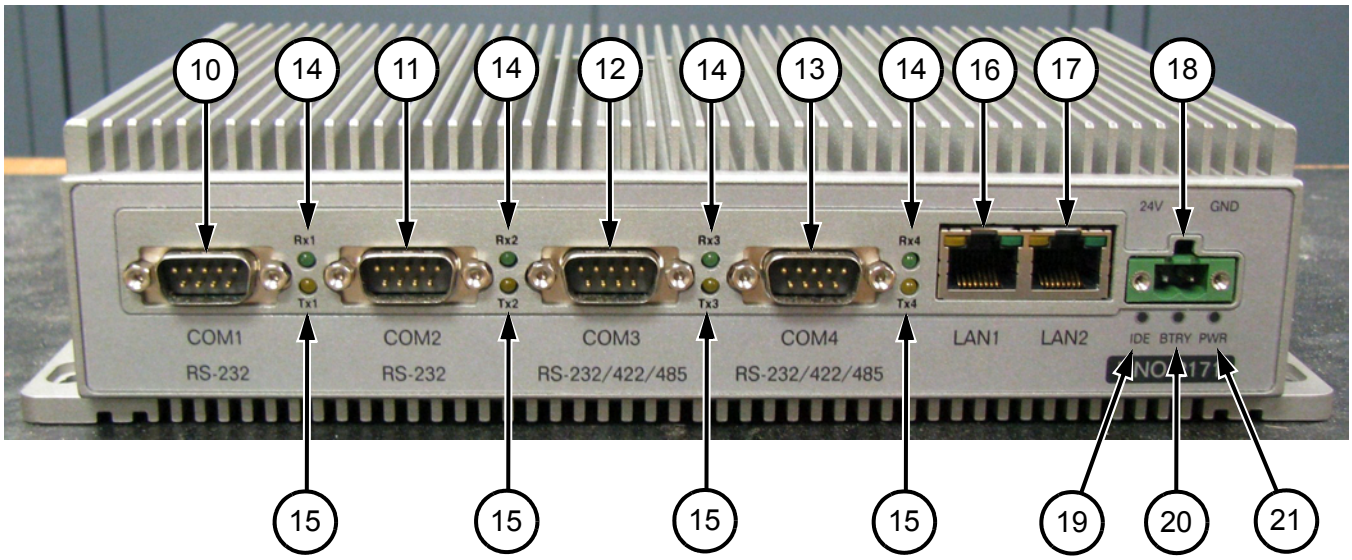


FIGURE 4
JAM - REAR



3.1 Jupiter Control System

3.1.4 JAM (Jupiter Application Master)

3.1.4.1 Memory Card - See Figures 5 and 6

The JAM box has an internal Compact Flash Memory Card. The memory card stores the operating system, bios configuration, all application programs and all data files (grinding patterns, etc.) for the machine.

If the JAM box should fail, the memory card can be removed from the failed JAM box and installed in a new JAM box.

1. Removing the memory card:

    a. Important: Make sure the JAM box is powered down. Make sure all electrical power to the JAM box is turned off (circuit breaker open, wires disconnected, etc.).

    b. Remove four screws (1) and cover plate (2) from the JAM box.

    c. Carefully remove the memory card (3) from the lower compact flash card slot. Important: The upper card slot (A) is for a PCMCIA memory card and is not used.

2. Installing the memory card:

    a. Install the memory card with vendor label down or towards the rear of the JAM box.

    b. Align the memory card in the lower card slot and carefully push it in until it is firmly seated.

    c. Replace cover plate (2) on the JAM box and secure with four screws (1).

3. Starting the program on the memory card:

    a. Turn on the electrical power to the JAM box (close circuit breakers, connect wires, etc.).

    b. Press the Power Button on the JAM box to power up the JAM box.

    c. As the system is booting up, the program on the memory card will be started.

    If the existing memory card was installed, the existing program version will be started and all of the data files that were previously stored will be used.

    If a different memory card was installed with a newer program version, the newer program version will be started and all of the data files will reset to the default settings.

    If a memory card is supplied with only the base files and no application software, the JAM will boot up to the Jupiter splash screen and display a circle with a slash through it to indicate that there is no software installed. The machine control software can be reloaded using an install.jam file from a memory stick and all of the data files will be reset to the default settings.

3.1 Jupiter Control System

3.1.4 JAM (Jupiter Application Master)

d. If a newer program version was installed, record the program version and date of installation in a safe place for future reference.

FIGURE 5
JAM - FRONT

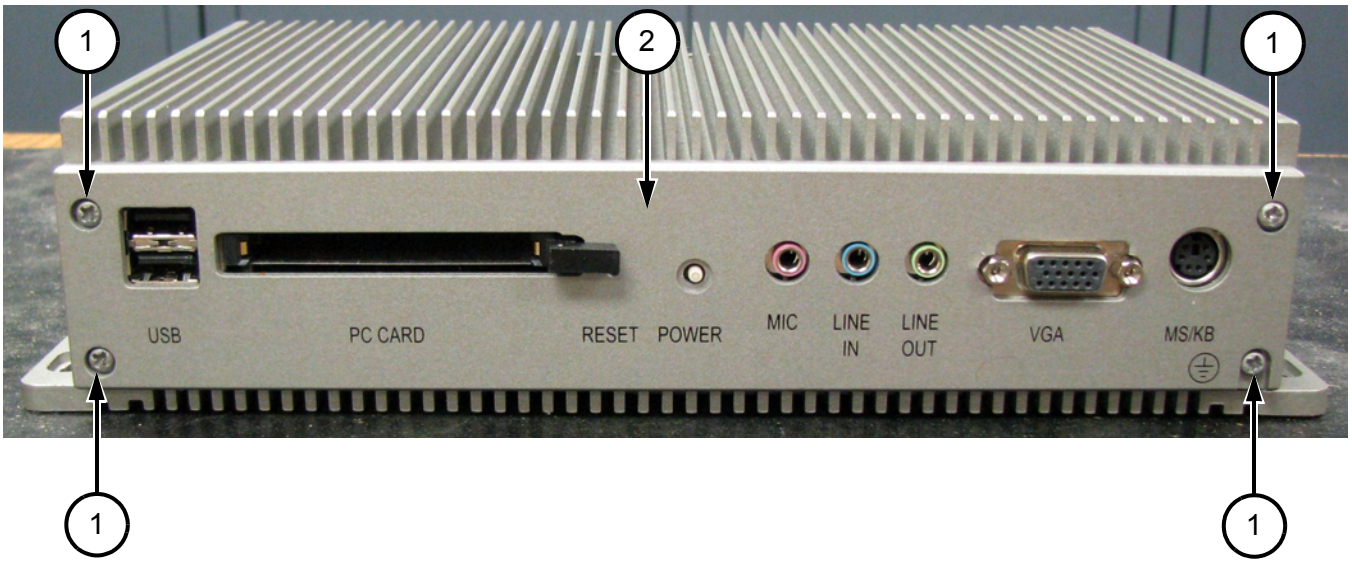
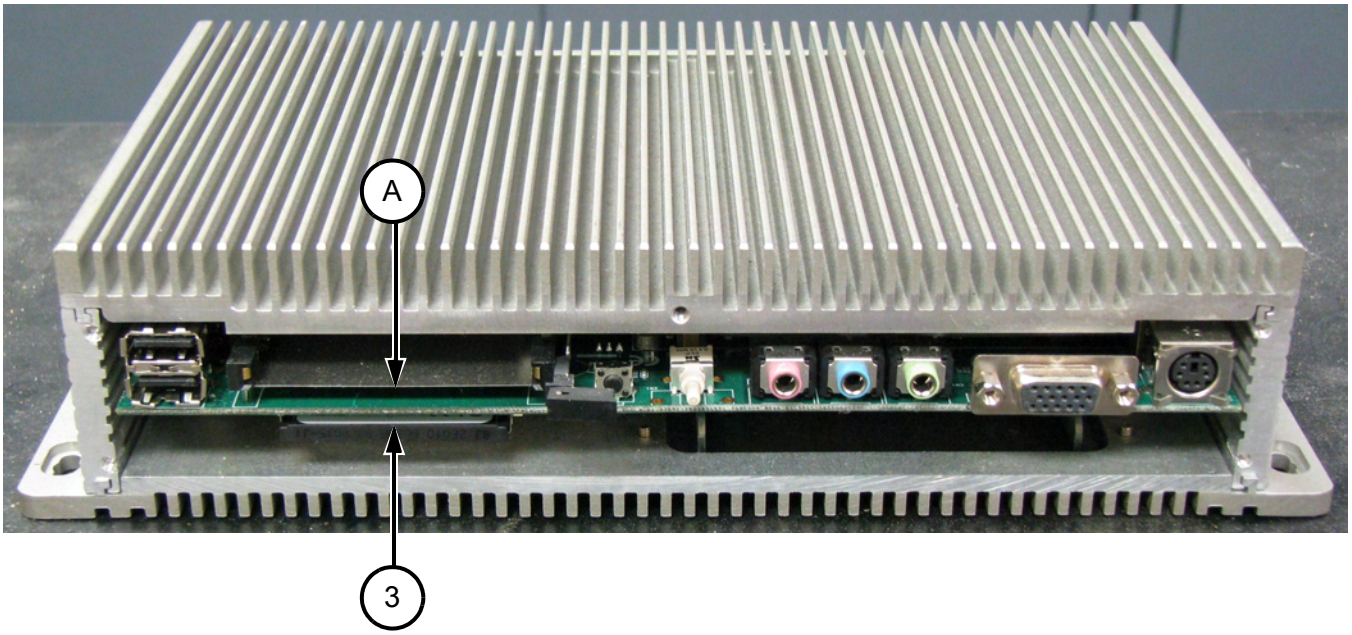


FIGURE 6
JAM - MEMORY CARD



3.1 Jupiter Control System

3.1.4 JAM (Jupiter Application Master)

3.1.4.2 Battery Replacement - See Figure 7

The JAM uses a Clock Battery and an SRAM Battery. Both batteries must be replaced when the BTRY LED illuminates on the JAM box.

Battery Specifications - BH1 Clock and BH2 SRAM:

Lithium Battery: BR2032 (Using a CR2032 battery is not recommended)
Output Voltage: 3 VDC

3.1.4.2.1 Replacing the batteries:

1. Important: It is recommended that batteries be replaced in a static free environment. Use of an Electro Static Discharge (ESD) pad and strap is recommended to help prevent damage to static sensitive devices on the circuit boards inside the JAM box.

2. Important: Make sure the JAM box is powered down. Make sure all electrical power to the JAM box is turned off (circuit breaker open, wires disconnected, etc.).

3. Carefully disassemble the JAM box to gain access to the back-side of the circuit board where the BH1 Clock Battery (1) and BH2 SRAM Battery (2) are located.

4. Carefully remove the existing BH1 Clock Battery (1) and BH2 SRAM Battery (2) from the battery holders on the board. Use care not to damage the battery holders or circuit board.

5. Be sure the new batteries meet the specifications shown above before installing the batteries.

6. Install the new BH1 Clock Battery (1) and BH2 SRAM Battery (2) in the battery holders on the circuit board. Use care not to damage the battery holders or circuit board.

7. Carefully re-assemble the JAM box.

8. Turn on the electrical power to the JAM box (close circuit breakers, connect wires, etc.).

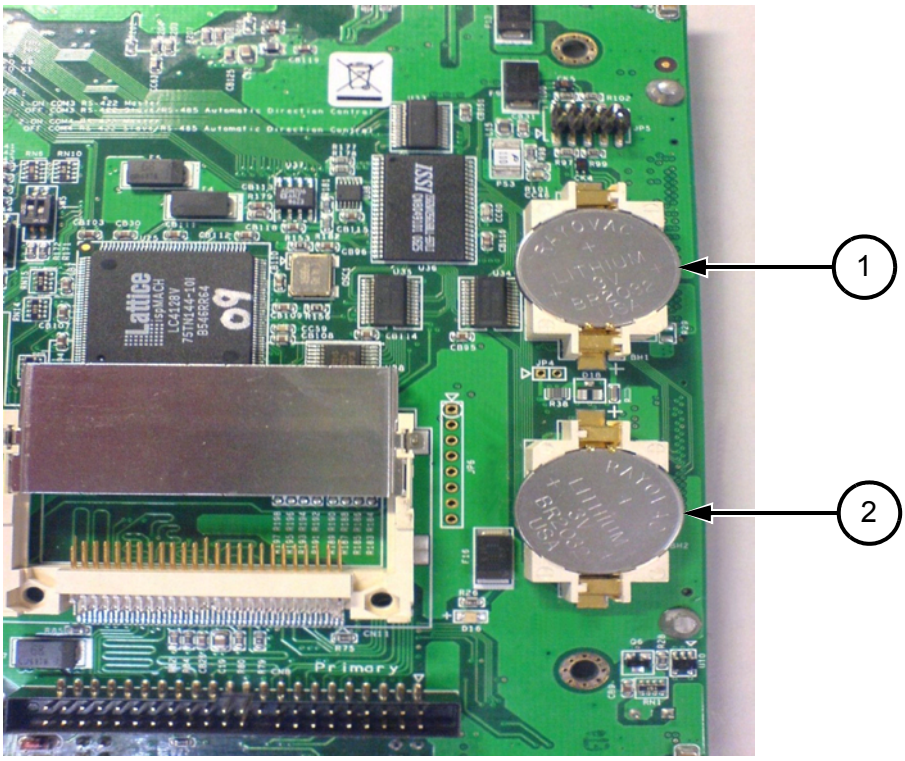
9. Press the Power Button on the JAM box to power up the JAM box.

10. Make sure the BTRY LED is not illuminated on the JAM box.

3.1 Jupiter Control System

3.1.4 JAM (Jupiter Application Master)

FIGURE 7
JAM BATTERIES



3.1 Jupiter Control System

3.1.5 J42 Board - See Figure 8

The J42 Board is located near t he JAM box. The J42 Board pr ovides the physical connection between the JAM and the Jupiter Network Modules on the machine. The J42 Board improves reliability and diagnostics through the following:

1. The connection to the 24 volt power on pin 2 of the Jupiter Network Cables (up to the first power distribution tee) is through the J42 Board.

2. The J42 Board provides the network connections between the JAM and the first Jupiter Module in the network (module #2).

3. The terminating resistor for the beginning of the network is located on the J42 Board.

4. The J42 Board has a signal oscillator that drives the “Daisy-Chain” signal on the Jupiter Network Cable which allows the first module in the network to establish its address. All "Daisy-Chain" inputs, outputs and connections between modules must be fully functional for each module to successfully establish its location in the network. Network module addressing is secure and network diagnostics are more comprehensive.

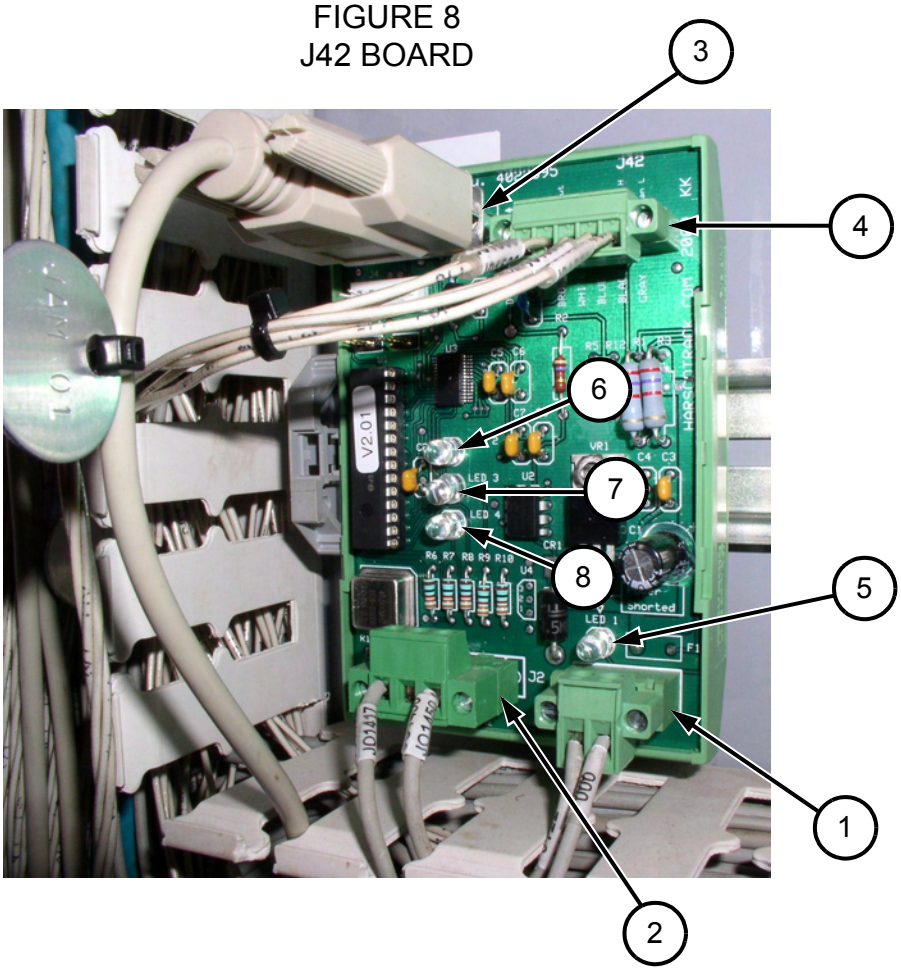
Connectors and LED’s on the J42 Board:

(1) J1: 24V Power In connector used for J42 Board.
(2) J2: 24V Power Out connector used for JAM.
(3) J3: Serial port connector used for JAM.
(4) J5: Jupiter connector used for first module (#2) in Jupiter network.
(5) LED 1 - Red: LED is off in normal state. See 3.1.5.1 J42 Board Status LEDs.
(6) LED 2 - Red: LED is off in normal state. See 3.1.5.1 J42 Board Status LEDs.
(7) LED 3 - Yellow: LED is off in normal state. See 3.1.5.1 J42 Board Status LEDs.
(8) LED 4 - Green: LED will flash in normal state. See 3.1.5.1 J42 Board Status LEDs.

3.1 Jupiter Control System

3.1.5 J42 Board

FIGURE 8
J42 BOARD



3.1 Jupiter Control System

3.1.5 J42 Board

3.1.5.1 J42 Board Status LEDs - See Figure 9

The LEDs on the J42 Board will illuminate and/or flash to help determine if CAN communication is good, or if there is a problem.

FIGURE 9
J42 BOARD STATUS LEDs

LED 1 Red	LED 2 Red	LED 3 Yellow	LED 4 Green	Flash Style	Status Description
Off	—	—	—	Red Off	Fuse F1 is OK (normal state).
On	—	—	—	Red On	Fuse F1 is open (short). After fuse cools and resets, LED will go out.
—	Flash	Off	Off	Red Flash	Bus warning (ack errors). Communication problem between JAM and Jupiter CAN bus network.
—	On	Off	Off	Red On	Buss off error. No communication between J42 Board and Jupiter CAN network.
—	Off	Flash	Off	Yellow Flash	Communication problem between JAM and J42 Board.
—	Off	On	Off	Yellow On	No communication between JAM and J42 Board.
—	Off	Off	Flash	Green Flash	Heart-beat (normal state). Slow rate when JAM is not transmitting or receiving data. Fast rate when JAM is transmitting or receiving data.
—	Off	On	Flash	Yellow On Green Flash	UART receiver framing or overrun error detected.
—	Off	Flash	Flash	Yellow and Green Flash Together	Checksum error while receiving JAM message.
—	Off	Flash	Flash	Yellow and Green Flash Alternately	Heart-beat time out error.
—	Off	Flash	On	Yellow Flash Green On	Can receive software buffer overflows detected.

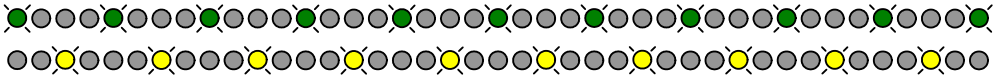
3.1 Jupiter Control System

3.1.5 J42 Board

3.1.5.2 Troubleshooting

1. Confirm the following:
   a. LED 1 is not illuminated.
   b. LED 4 is flashing green.
   c. The green "Run" LED on the faceplate of module #2 is flashing and the yellow "Download" LED indicator is not lit or indicating a daisy-chain error.
   d. The JAM is running and communicating with module #2.
   e. If the above 4 items are confirmed, the J42 Board is working.
2. If the JAM fails to start:
   a. Use a meter to check for the presence of 24 volts at J1 connector on the J42 Board. This is the input supply for the J42 Board. Without 24 volts at J1 connector, the system cannot function.
   b. Use a meter to check connector voltages at the JAM end of the cable between the J42 Board and the JAM. If the 5 volts is less than 4.85 volts or more than 5.15 volts, or the 12 volts is missing, check the connections. The cable and/or the J42 Board may need to be replaced.
3. If none of the status LED indicators ("Error", "Run" and "Download") on module #2 are illuminated or flashing:
   a. Use a meter to check for the presence of 24 volts at J1 connector on the J42 Board. This is the input supply for the J42 Board. Without 24 volts at J1 connector, the system cannot function.
   b. Disconnect the J3 connector (purple cable) from the J42 Board. Use a meter to test for the presence of 24 volts between pins 2 and 3. If 24 volts is present, the cable to module #2 and/or module #2, will need to be replaced.
4. After a module download, if the green Run LED and yellow Download LED on any or all of the modules are rapidly flashing in an alternating sequence, then the download may have been interrupted due to field power loss or faulty network connections. The alternating LED sequence observed on modules is illustrated in the timing diagram below. Any module displaying this LED sequence can no longer read inputs or write outputs until the module software is successfully loaded. Check cabling, connectors and the J42 connections and then reboot the JAM. After rebooting, the JAM will detect this fault condition from the modules and attempt to re-download to all modules. The JAM can be rebooted until this condition no longer persists on any module on the network.

Green Run LED:
Yellow Download LED:



3.1 Jupiter Control System

3.1.5 J42 Board

3.1.5.2 Troubleshooting

5. Although a Jupiter Network is made up of many separate cables, the wires that carry the network messages (pins 1, 4 and 5) are all continuously connected from the beginning of the network (JAM) to the end of the network (the module with the terminator and highest address number). A fault at one location on the network will typically affect all modules on the network. There are network communication errors when:

    a. The "Error" LED on one or more modules turns red from time to time.

    b. The green heartbeat status on the JAM module diagnostic screens turns red or gray erratically.

    c. The alarm message "Dead module detected" occurs (typically for more than one module).

6. For any combinations of the above, use the following procedure:

    a. The engine should be off.

    b. Disconnect J1 connector. The resistance across resistor R5 should be approximately 60 ohms. If this resistance is closer to 120 ohms, the terminator (or terminating resistor inside the terminator) on the CAN OUT connector of the last module on the network may be missing or not connecting properly. Reconnect J1 connector.

    c. Check the network (purple) cable for loose connections or damage. If no problems are found, do the following:

        1. Disconnect the network cable about halfway through the network from the "CAN 1 out" connector of the module chosen to be the temporary "last module". Move the terminating plug from the "CAN 1 out" connector of the last module to the "CAN 1 out" connector of the temporary "last module".
        2. If the modules that remain connected continue to show similar symptoms, divide the network approximately in half again.
        3. If the symptoms are not present, reconnect and disconnect about halfway through that part of the network most recently disconnected.
        4. Always move the terminating plug to the "CAN 1 out" connector of the temporary "last module".
        5. Continue in this way until the problem is narrowed down to a single module.

7. Where a problem is being caused by a bad connection, the action of disconnecting and connecting the network may fix the problem and give inconsistent and confusing results when using this method. Each time a disconnection is made, take advantage of the opportunity to check for internal corrosion and proper engagement.

8, After narrowing down the symptoms to a single module, the problem must lie with the "CAN 1 in" connection on the module, the cable to the upstream (lower CAN numbered) module, the "CAN 1 out" connection on the upstream module or the module itself.

3.1 Jupiter Control System

3.1.6 The Jupiter "Daisy-Chain" System

In order to troubleshoot the Jupiter System, it is important to understand how the "Daisy-Chain" system is used to address each module in the network.

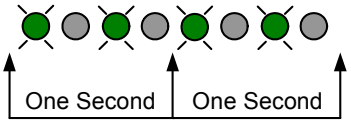
1. The typical Harsco Rail Jupiter control system installation consists of "Intelligent" Input / Output (I/O) modules in a distributed network, and a primary controller known as the Jupiter Application Master (JAM) box. The JAM box is a PC-based user-interface for video, touch-screen, keyboards, printers, etc. Under normal operation, it is also the master controller, handling the code execution for machine control and the communication back and forth with each module in the network. One of the benefits of “intelligent” modules is their ability to execute control code and communicate directly with other modules on the network, that is, to function as a “JAM”. When a module in the network takes over this “master” role this is known as Fallback Mode operation.

2. Should the Jupiter modules in a network fail to observe the JAM box as communicating with them, the lowest numbered module (typically module 2) will automatically take over as the fallback JAM. A subset of control code is often developed for fallback that then provides for basic control requirements to be performed, such as allowing the operator to pick up any deployed components and travel the machine away from the work site. On some machines the fallback operation is functional during the delay while the JAM box completes its boot process, while on others, a time out in the software prevents fallback operation until sufficient time has passed for the JAM box to finish booting. Therefore if the JAM box boot-up doesn’t succeed or the JAM box were to fail while in operation, the machine automatically enters fallback at that time.

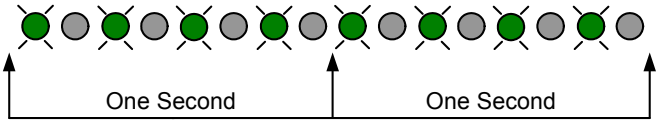
3. The standard blink rate of the LEDs is blink On and Off twice a second.

4. It is important when trouble shooting to know if the network is in Normal or Fallback Mode operation. This can be confusing to determine as a bad video signal or a bad JAM box can be confused from the operator's seat. The indication of a good Network without an operating/booted JAM box is the blink rate of the Green Run LED on Module 02 (the start of the network). The standard blink rate of On and Off twice a second will double and blink at a rate of On and Off four times a second on this module and this module only when in Fallback Mode. If any other modules in the Network blink at this rate it suggests a network or hardware problem. Specifically, as an example, if module 8 is blinking at the double rate of On and Off four times a second, would mean that module 8 does not recognize the JAM box or any other module with a lower address, modules 2 through 7, on the network and therefore has determined that it is the JAM.

NORMAL BLINK RATE



FALLBACK MODE BLINK RATE



3.1 Jupiter Control System

3.1.6 The Jupiter "Daisy-Chain" System

5. On each module, there are 5 pins in the M12 "CAN 1 in" and "CAN 1 out" connectors for the purple Jupiter network cables. Each pin on the input connector of a module is connected to the same numbered pin on the output connector with the single exception of pin 1 which is the "Daisy-Chain" signal. Pin 1 on the "CAN 1 in" connector is an input to the internal processor and pin 1 on the "CAN 1 out" connector is an output that can be driven by the internal processor. This allows the internal processor of a module to send data to the next module (higher address) in the network.

6. At startup, each module receives its network address from the previous module which it will internally store. It will then add 1 to this address and send it to the next module in the network and so on. In the case of the first module in the network (module 2), there is no module to provide it with its address. The J42 Board performs this function as well as providing proper terminations for all connections at the beginning of the module network.

7. If a module fails to establish its address at startup, it will resort to the address stored (from when the "Daisy-Chain" did succeed on a previous occasion) in the internal memory of the module. A "Daisy-Chain" failure is therefore not critical and the machine can be safely operated, for days if necessary, provided modules are not swapped around in the network (or replaced with a spare or new module). While continued operation is safe in the event of such a failure, correcting the problem should be a priority.

8. When a module on startup fails to receive its address on the "Daisy-Chain" input pin, it will abort any attempt to notify the next module of its address using the "Daisy-Chain" output pin.

5. Here are some important "Daisy-Chain" facts:

    a. While a module is waiting for the "upstream" module to send it the next address, the yellow Download LED remains solid and the green Run LED flashes rapidly. When the address has been received successfully, the yellow Download LED is turned off. If the "daisy-chain" signal is not present while the module is waiting for an address, the yellow Download LED remains solid ON and the green Run LED will be off.

    b. If the "daisy-chain" output signal from the upstream module on the network is not present while the module is waiting for an address, the yellow Download LED remains solid ON and the green Run LED will be off. When the "daisy-chain" process times out, the yellow Download LED will blink ON and OFF instep with the green Run LED to indicate there was a problem with the module's daisy-chain input signal. The module will use its internally stored address and instruct all the downstream modules to use their internally stored addresses as well. The LED sequence displayed a module having a daisy-chain input failure is illustrated in Figure 10, Timing Diagram. Note that only one of the three yellow LED sequences will be displayed depending upon the type of daisy-chain failure. Also note in the diagrams that the yellow LED goes off when the green LED goes off in each case.

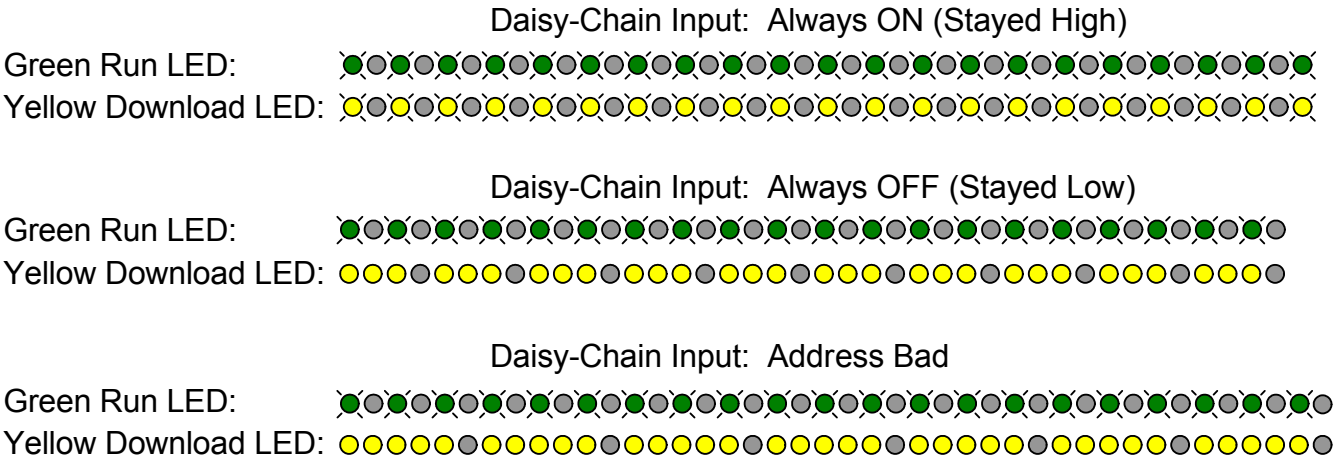
3.1 Jupiter Control System

3.1.6 The Jupiter "Daisy-Chain" System

c. If a module successfully receives its address on the "Daisy-Chain" input pin at startup and the received address does not match the internally stored address, the alarm "Address change (new or moved module)" will be reported. Because the new address will replace the internally stored address, this alarm will not be generated on the next startup. This alarm can be expected when modules are swapped around on a network and/or a module is replaced. This alarm does not indicate an error unless no module was moved or added.

d. After a module has established what address it will use, it will then check the type of module (Analog Input, Digital Input / Output, High Density Digital Input / Output, Digital to Analog Output) it is and that it matches the machine. If the module type is wrong for the address, the alarm "Incorrect module type" will be reported.

FIGURE 10
TIMING DIAGRAM



3.1 Jupiter Control System

3.1.7 Network Cable Identification - See Figure 11

The Jupiter network modules and components on the machine are connected by special pre-molded cables that consist of the following:

(1) Jupiter Network Cables: The cables are colored purple, have a M12 female connector on one end and a M12 male connector on the other end. The cables are available in different lengths and have an identification tag on both ends.

(2) Field Power Cables: The cables are colored black, have a M12 female connector on one end and a pigtail (loose wires) on the other end. The cables are available in different lengths and have an identification tag on one end.

(3) Input / Output Cables: The cables are colored black, have a M12 male connector on one end. The other end may have a M12 female connector (A), a pigtail (loose wires) (B), or a DIN connector (C). The cables are available in different lengths and have an identification tag on one or both ends.

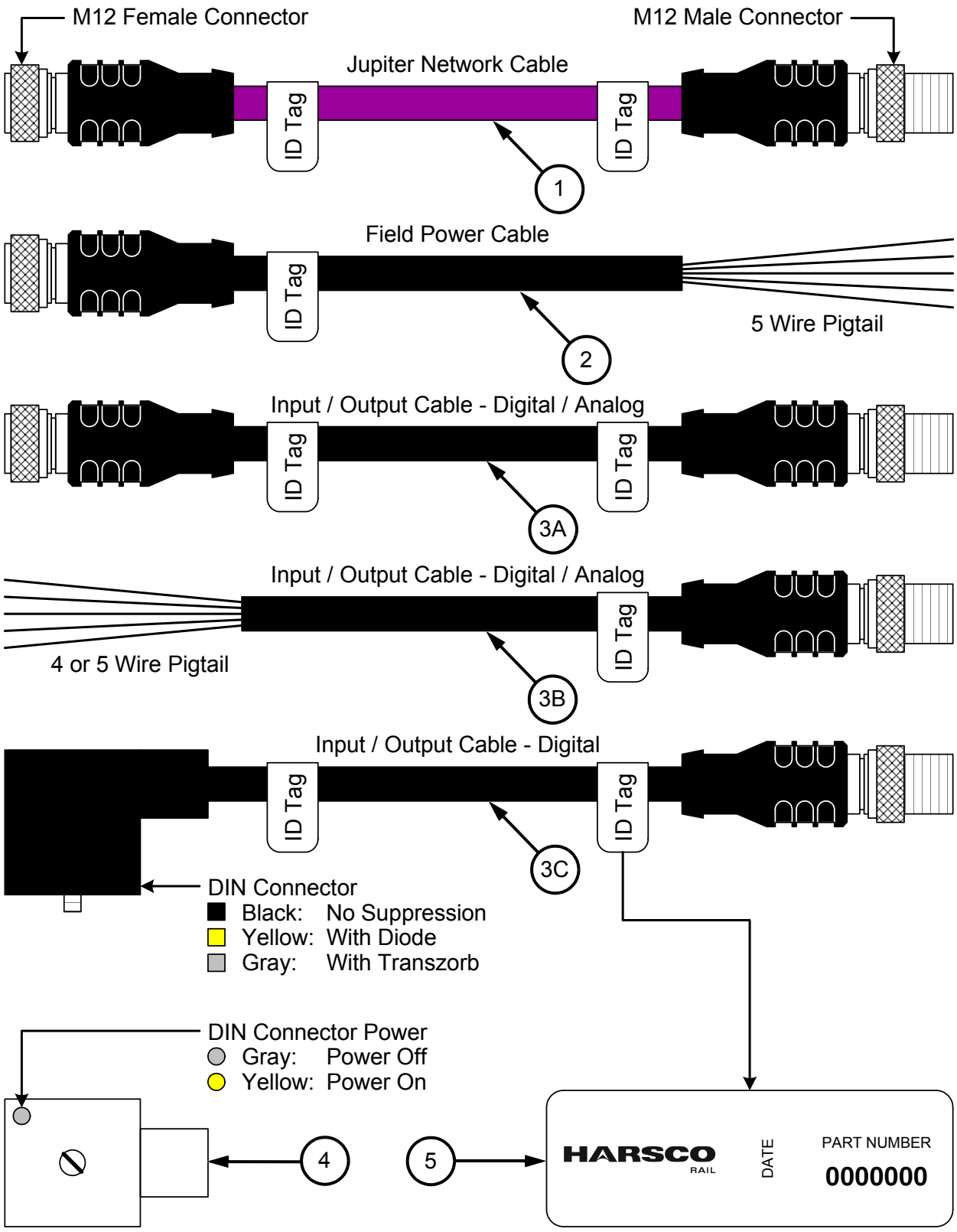
(4) DIN Connectors: The connectors are color coded that can be used to determine if the connector has no suppression, a diode, or a transzorb. The connector also has a power status LED that can be used to determine if power is available to the component when required.

(5) Identification Tags: Each cable has an identification tag on one or both ends of the cable that lists the cable part number and cable date of manufacture.

3.1 Jupiter Control System

3.1.7 Network Cable Identification

FIGURE 11
NETWORK CABLE IDENTIFICATION



3.1 Jupiter Control System

3.1.8 Network Cable Connections - See Figure 11

1. M12 Connector: To prevent damage to the module or component connector, loosen or tighten the cable end by hand only. DO NOT use pliers.

    a. To disconnect the cable end, loosen the cable end by hand. Pull the cable end straight out of the module connector.

    b. To connect the cable end, align the pins in the cable end with the module connector and push in. A raised bump (or tick mark) is located next to each of the connectors on the modules that can be used for pin alignment when connecting the mating cable to that connector. Turn the cable end to start the threads on the module connector and tighten by hand until it can no longer be turned. Wiggle the cable end slightly, push in and tighten again by hand until it can no longer be turned. Repeat this procedure until the cable end is securely tightened on the module connector.

2. Pigtail (Loose Wires):

    a. To disconnect the cable end, remove the wire cover from the component, if so equipped. Note which cable wires (colors, numbers, etc.) are connected to the component terminals. Disconnect the cable wires from the component terminals.

    b. To connect the cable end, connect the wires to the component terminals using the same wiring as before and/or the Electrical Schematics as reference. Be sure to wrap any unconnected wire ends with electrical tape so they do not short out. Install the wire cover securely on the component, if so equipped.

3. DIN Connector:

    a. To disconnect the cable end, remove the mounting screws from the DIN connector. Remove the DIN connector on the cable end from the mating DIN connector on the component.

    b. To connect the cable end, align the DIN connector on the cable end with the mating DIN connector on the component and install. Tighten the mounting screws in the DIN connector securely.

3.1 Jupiter Control System

NOTES

3.1 Jupiter Control System

3.1.9 Network Module Status LEDs - See Figure 12

All Jupiter Network Modules ha ve three Module S tatus LEDs on the front p anel labeled as follows:

Note: If no LEDs are displayed on a module when 24 volt power is applied, the module should be replaced.

- Error (Red)
- Run (Green)
- Download (Yellow)

1. During normal operation, the red Error and yellow Download LEDs will remain OFF and the green Run LED will flash at the normal rate of approximately 2 times a second.

   a. If the JAM should fail, the first module in the network after the JAM, Module #2, will operate in the fall back mode as the network master and its green Run LED will flash at a faster rate of approximately 4 times a second. The green Run LED on the other modules in the network will flash at their normal rate of approximately 2 times a second.

   b. If a network module should fail with the JAM operating properly, only the failed module will operate in the fall back mode and its green Run LED will flash at a faster rate of approximately 4 times a second.

2. The red Error LED will illuminate if any communication errors occur on the Jupiter Network. If the LED remains on, the module is unable to communicate and any outputs will switch to a safe state. This can be confirmed on the Diagnostic Screens by the absence of a heartbeat indicator for the module. Check to ensure that the purple network cables between the module and any adjacent modules are properly connected and not damaged. If the error persists, it will be necessary to replace the module.

3. The yellow Download LED will illuminate briefly when the Jupiter Control System is booted up. The yellow LED will flash when there is a program run error or when a daisy-chain address error has been detected. When a module is being programmed by the JAM, the yellow LED will flash rapidly. Do not turn off the Jupiter Computer during a programming phase until normal operation resumes. This programming phase lasts for several seconds and is automatically started under the following circumstances:

   a. The Jupiter Control System is being booted up for the first time after one or more modules have been replaced and the internal module programming does not match what is necessary for the machine.
   b. A Harsco Rail Technician has changed the machine software. This will usually result in all modules being re-programmed.

   Note: If the yellow Download LED remains on continuously, the internal programming of the module is faulty. Replace the module.

3.1 Jupiter Control System

3.1.9 Network Module Status LEDs - See Figure 12

4. For a properly functioning module, the Status LEDs will always flash. Failure to do so indicates a problem. In addition to the above mentioned LED descriptions, there are some additional interpretations of LED combinations:

FIGURE 12
NETWORK MODULE STATUS LEDs

Error Red	Run Green	Download Yellow	Flash Style	Status Description
Off	Off	Off	All Off	Cable not connected, cable connection loose, or cable defective. Tighten cable connection, or replace cable.
Off	Flash	Off	Green Flash	Normal Operation, successful daisy-chain on this power up. All upstream modules (lower addresses) can also be expected to be normal.
Off	Flash	Flash	Green and Yellow Flashing, Both Off Together	Daisy-chain input error on this module. Only downstream modules that also have a daisy-chain input error will display this sequence.
Off	Flash	Flash	Green and Yellow LEDs rapidly flashing alternating	Program run error, probably due to interrupted download.
Off	Flash	On	Green Flash Yellow On	This pattern occurs while waiting for the "upstream" module to send the "daisy-chain" signal to the next address.

1. The flash frequency for the above is approximately 2 times per second. For anything else, the above does not apply.
2. During power up, the yellow light will be ON while the module is waiting for the daisy-chain address from the upstream module. The daisy-chain process may take 4-5 seconds depending upon the total number of modules on the machine. The green light will also rapidly flash during this period if the daisy-chain input signal is being received from the upstream module.
3. Intermittent flashing of the Red Error light indicates BUS communication errors which are likely to affect all modules equally. Disconnect the network at various points until the problem is isolated.
4. For daisy-chain errors on power up, the fault lies with the first module to show a daisy chain fault, the daisy-chain output from its immediate upstream module (most likely), or a faulty Jupiter cable between them.

3.1 Jupiter Control System

3.1.10 Analog Input Module - See Figure 13

The Analog Input Module is used with analog input devices that have a varying feed-back voltage such as: engine sensors, fuel gauges, position sensors, etc. A raised bump (or tick mark) is located next to each of the connectors on the module that can be used for pin alignment when connecting the mating cable to that connector.

(1) CAN 1 in: This connector provides the Jupiter Network Program and the 24 Volts DC In for the Jupiter Network Circuit Board. The other end of the cable connected to this connector plugs into the CAN 1 out connector of the previous module in the network or the J42 Board.

(2) CAN 1 out: This connector sends the Jupiter Network Program and the 24 Volts DC Out to the next module in the network. When this module is the last module in the network, a special network module terminator is installed on this connector.

(3) CAN 2: This connector provides an independent network connection for communicating with secondary devices such as an engine electronic control module (ECM) and other CAN based devices.

(4) Field Power: This connector provides 24 Volts DC In for the Field Power Circuit Board and the C1 - C8 Connectors.

(5) C1 - C8: Each connector is capable of handling an analog input device. Each connector provides +10 and +24 Volts DC Outputs to the device and receives varying feed-back voltage from +10 to -10 Volts DC Inputs from the device depending upon the device.

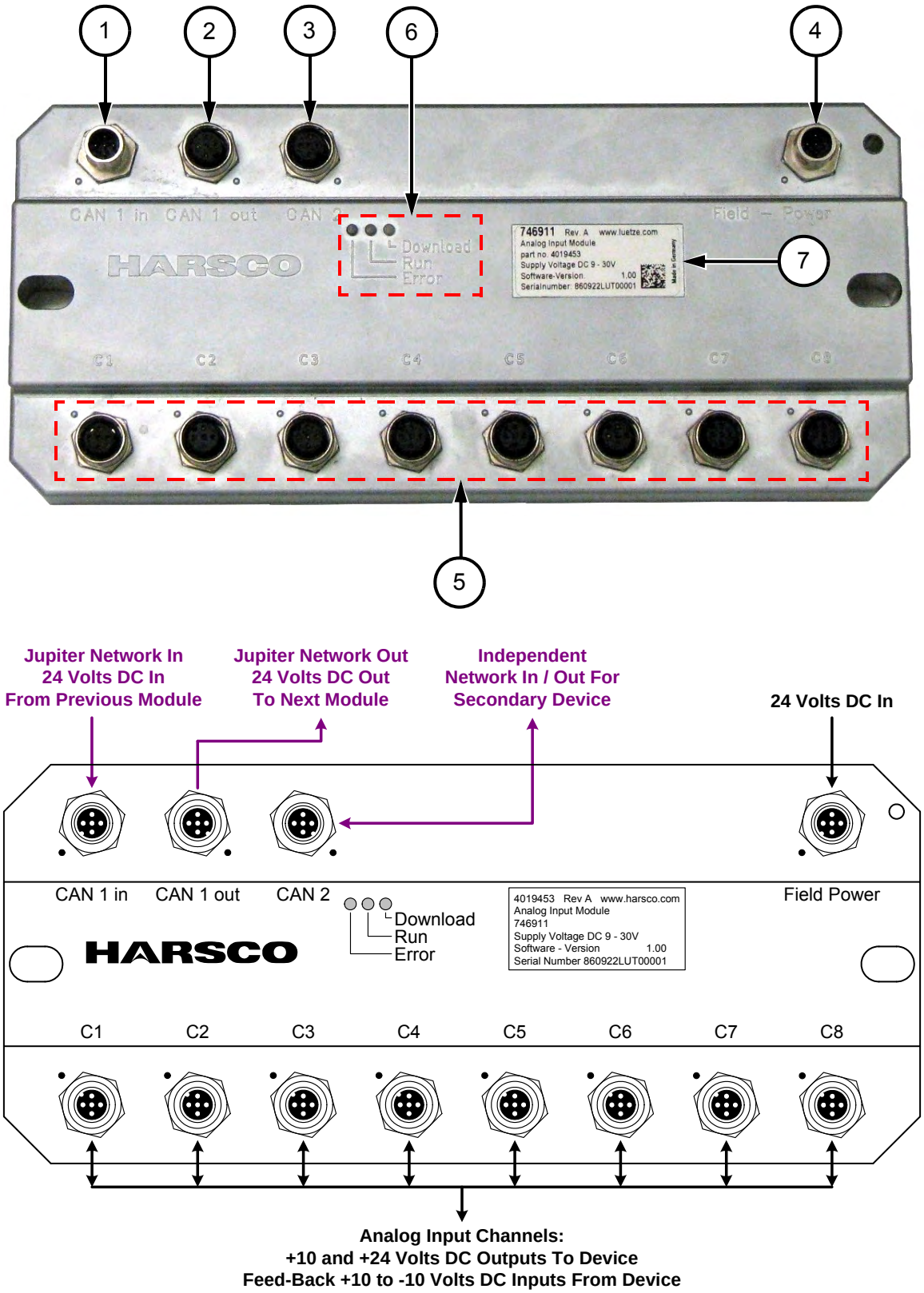
(6) Module Status LEDs: The module has a set of module status LEDs that can be used for troubleshooting. See 3.1.9 Network Module Status LEDs.

(7) Identification Tag: Each module has an identification tag that lists the module part number, serial number, date of manufacture, etc.

3.1 Jupiter Control System

3.1.10 Analog Input Module

FIGURE 13
ANALOG INPUT MODULE



3.1 Jupiter Control System

3.1.11 Digital Input / Output Module - See Figures 14 and 15

The Digital Input / Output Module is used with digital input devices such as limit switches, pressure switches, etc., that when actuated, send the power back to the module. The Digital Input / Output Module is also used with digital output devices that have two positions (On / Off), such as valve coils, relays, lights, alarms, etc. A raised bump (or tick mark) is located next to each of the connectors on the module that can be used for pin alignment when connecting the mating cable to that connector.

(1) CAN 1 in: This connector provides the Jupiter Network Program and the 24 Volts DC In for the Jupiter Network Circuit Board. The other end of the cable connected to this connector plugs into the CAN 1 out connector of the previous module in the network or the J42 Board.

(2) CAN 1 out: This connector sends the Jupiter Network Program and the 24 Volts DC Out to the next module in the network. When this module is the last module in the network a special network module terminator is installed on this connector.

(3) Field Power: These connectors provide 24 Volts DC In for the Field Power Circuit Board and the C1 - C8 Connectors.

(4) C1 - C8 and Channel Status LEDs: Each connector is capable of handling a digital input or output device. Each connector has a set of channel status LEDs that can be used for troubleshooting. See Figure 14.

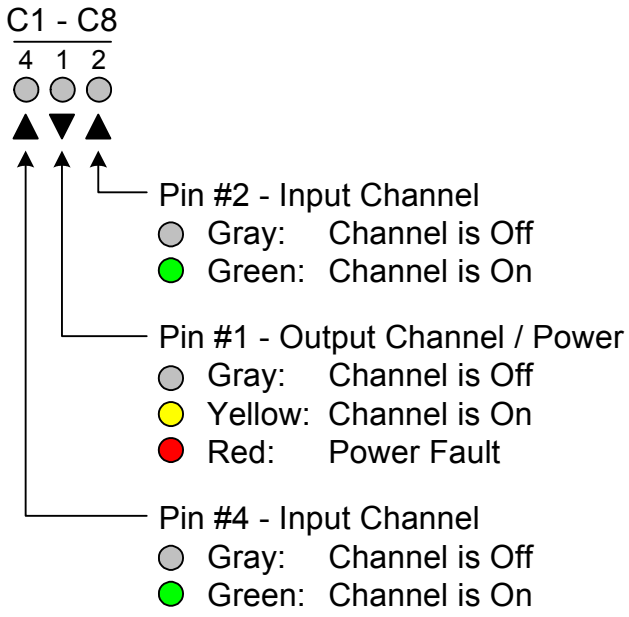
a. Input: Each connector is capable of receiving 24 Volts DC Inputs from the device.

b. Output: Each connector is capable of providing 24 Volts DC Outputs to the device. All outputs are Pulse Width Modulation (PWM) capable. PWM is a method of modifying digital output signals to simulate an analog voltage to control proportional valves and other proportional signal devices.

(5) Module Status LEDs: The module has a set of module status LEDs that can be used for troubleshooting. See 3.1.9 Network Module Status LEDs.

(6) Identification Tag: Each module has an identification tag that lists the module part number, serial number, date of manufacture, etc.

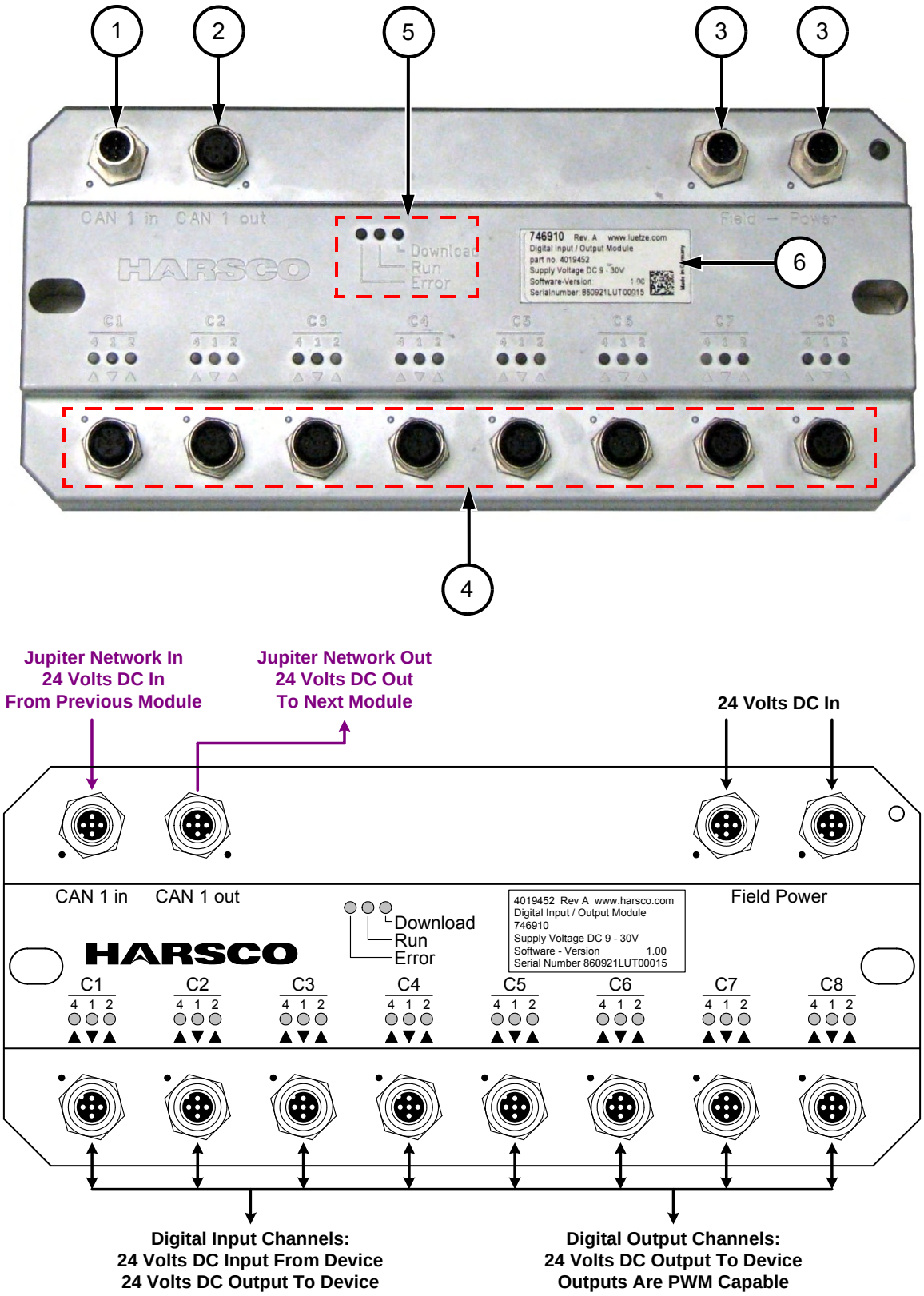
FIGURE 14
CHANNEL STATUS LEDs



3.1 Jupiter Control System

3.1.11 Digital Input / Output Module

FIGURE 15
DIGITAL INPUT / OUTPUT MODULE



3.1 Jupiter Control System

3.1.12 HD Digital Input / Output Module - See Figures 16 and 17

The HD (High Density) Digital Input / Output Module is used with digital input devices that when actuated, send a power signal back to the module. Examples of these devices are: limit switches, pressure switches, etc. The HD Digital Input / Output Module is also used with digital output devices that have two positions (On / Off) such as: valve coils, relays, lights, alarms, etc.

(1) CAN 1 in: This connector provides the Jupiter Network Program In and the 24 Volts DC In for the Jupiter Network Circuit Board. The other end of the cable connected to this connector plugs into the CAN 1 out connector of the previous module in the network or the J42 Board.

(2) CAN 1 out: This connector sends the Jupiter Network Program Out and the 24 Volts DC Out to the next module in the network. When this module is the last module in the network, a special network module terminator is installed on this connector.

(3) CAN 2: This connector provides an independent network connection for communicating with secondary devices such as; engine electronic control units (ECU) and other CAN based devices.

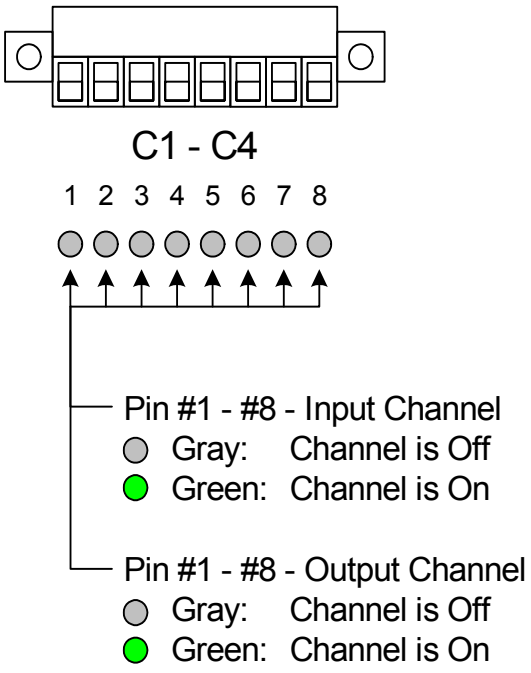
(4) Field Power: These connectors provide 24 Volts DC In for the Field Power Circuit Board and the C1 - C4 Connectors.

(5) C1 - C4 and Channel Status LEDs: Each connector is capable of handling up to eight digital input or output devices. Each connector has a set of eight channel status LEDs that can be used for troubleshooting. See Figure 16.
   a. Input: Each connector is capable of receiving 24 Volts DC Inputs from the device.
   b. Output: Each connector is capable of providing 24 Volts DC Outputs to the device.

(6) Module Status LEDs: The module has a set of module status LEDs that can be used for troubleshooting. See 3.1.9 Network Module Status LEDs.

(7) Identification Tag: Each module has an identification tag that lists the module part number, serial number, date of manufacture, etc.

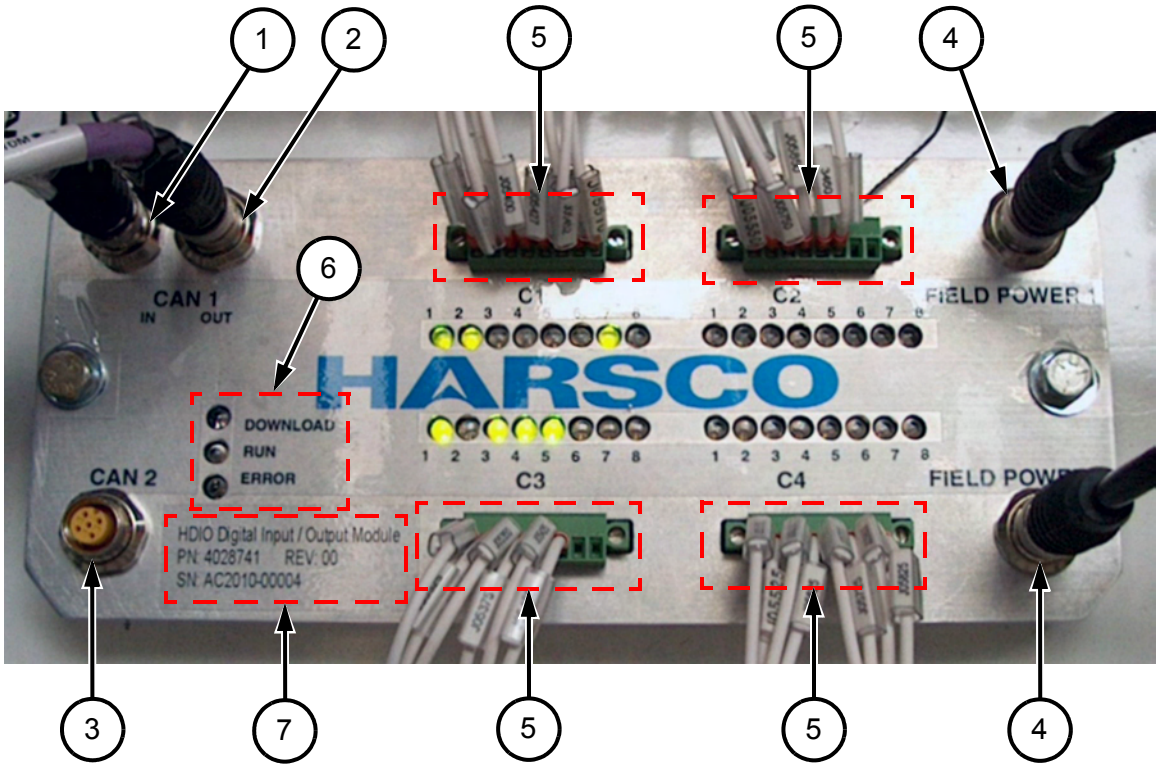
FIGURE 16
CHANNEL STATUS LEDs

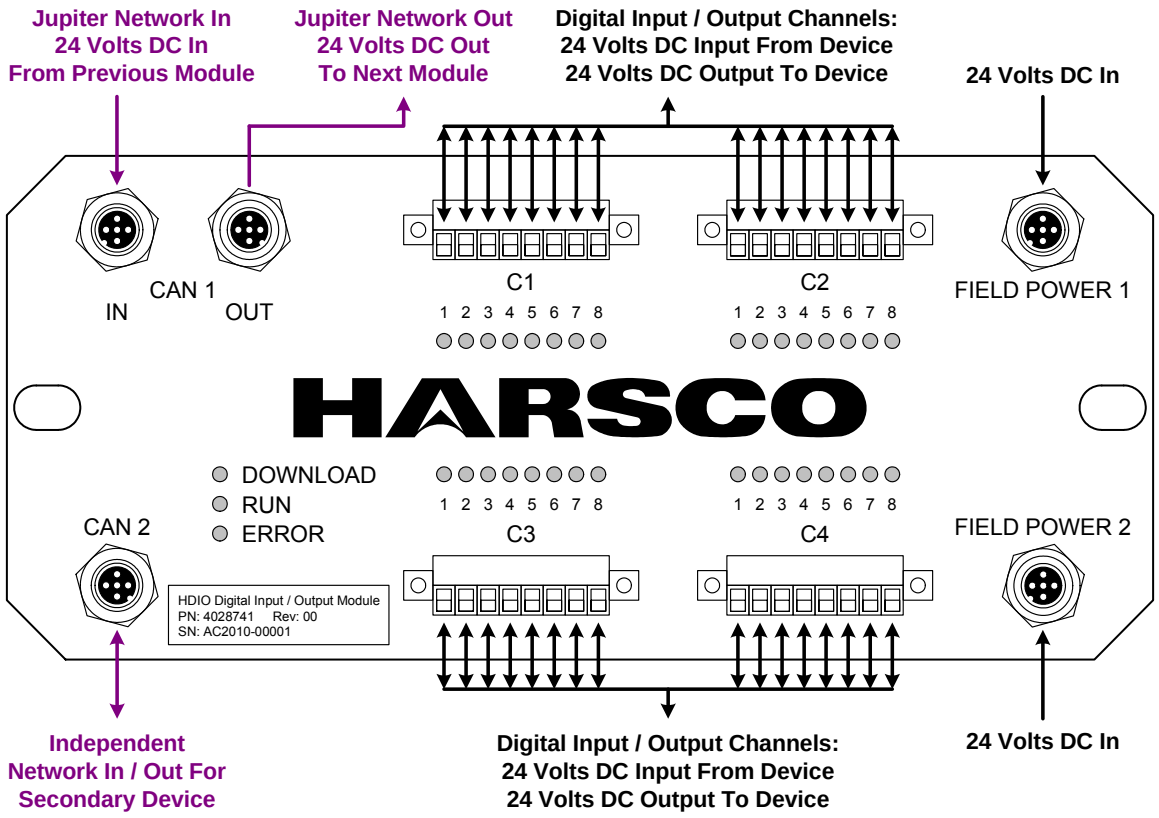


3.1 Jupiter Control System

3.1.12 HD Digital Input / Output Module

FIGURE 17
HD DIGITAL INPUT / OUTPUT MODULE





3.1 Jupiter Control System

3.1.13 Digital to Analog Output Module - See Figure 18

The Digital to Analog Output Module is used to drive servo valves and other devices that require a precision voltage or current input for control. These devices may be driven in "open loop" fashion, where the JAM specifies the exact output to drive, or in "closed loop" fashion, where the Digital to Analog Output Module itself is provided with feedback information used to evaluate the amount of error in its output signal relative to an output set point nominated by the JAM. Each plug on the Digital to Analog Output Module may be driven in open or closed loop fashion depending upon the application needs of the machine.

(1) CAN 1 in: This connector provides the Jupiter Network Program In and the 24 Volts DC In for the Jupiter Network Circuit Board. The other end of the cable connected to this connector plugs into the CAN 1 out connector of the previous module in the network or the J42 Board.

(2) CAN 1 out: This connector sends the Jupiter Network Program Out and the 24 Volts DC Out to the next module in the network. When this module is the last module in the network, a special network module terminator is installed on this connector.

(3) CAN 2: This connector provides a connection for an Analog Input Module. The Analog Input Module provides feedback information on this link that the Digital to Analog Output Module continuously uses to determine how to directly change its output signal.

(4) FIELD - POWER: This connector provides 24 Volts DC In for the Field Power Circuit Board and the C1 - C4 Connectors.

(5) C1 - C4 Connectors: Each connector is capable of providing + / - 10 Volts DC Outputs to the device.

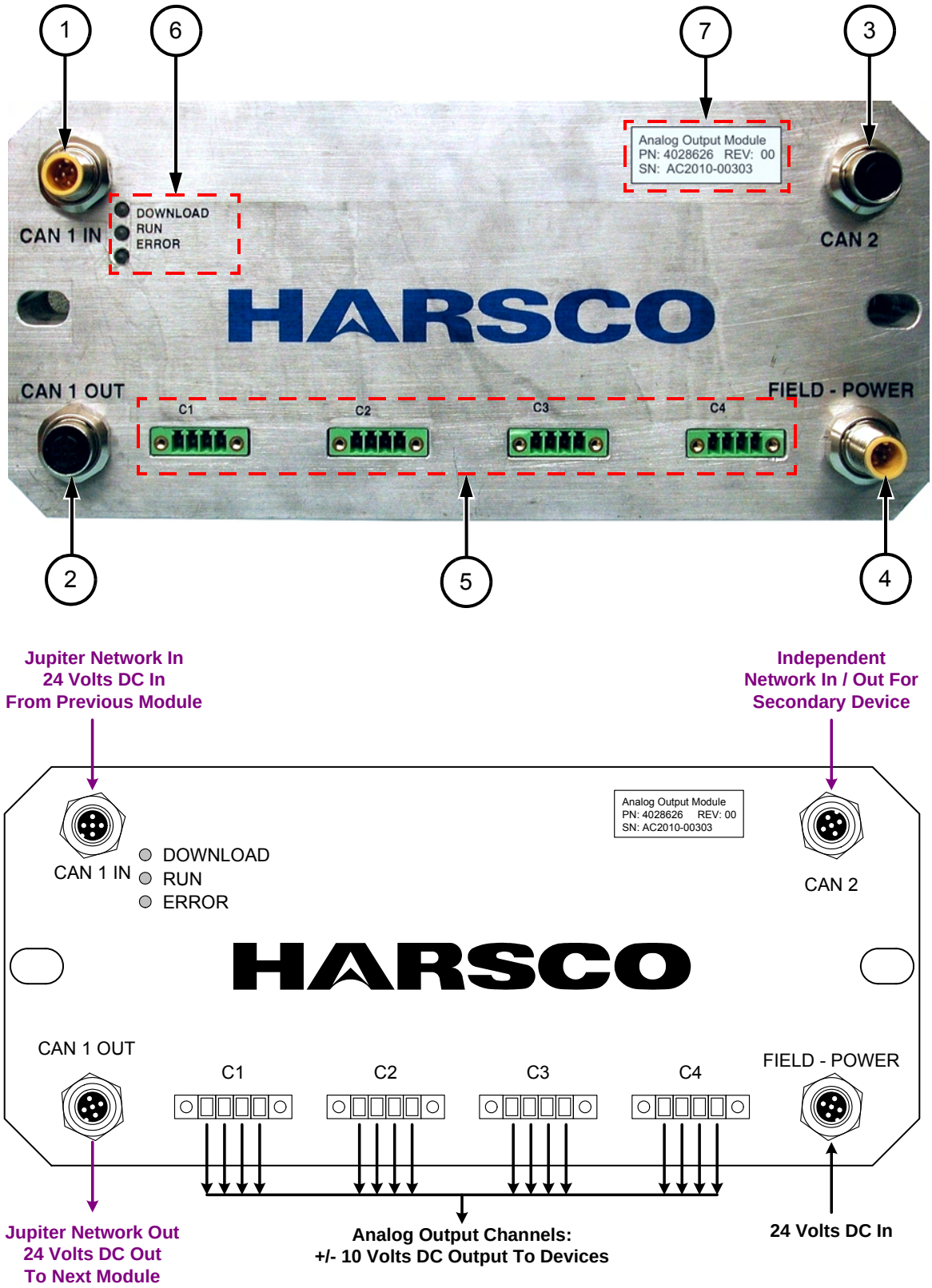
(6) Module Status LEDs: The module has a set of module status LEDs that can be used for troubleshooting. See 3.1.9 Network Module Status LEDs.

(7) Identification Tag: Each module has an identification tag that lists the module part number, serial number, date of manufacture, etc.

3.1 Jupiter Control System

3.1.13 Digital to Analog Module

FIGURE 18
DIGITAL TO ANALOG OUTPUT MODULE



3.1 Jupiter Control System

3.1.14 Power Distribution Tee - See Figures 19 and 20

The Power Distribution Tees are used to help prevent voltage drops in the Jupiter Network. The Power Distribution Tee connections are as follows:

(1) X1 CAN in: The cable from the CAN 1 out connector on the previous module in the network is connected to the X1 CAN in (1). The existing 24 Volt DC In power supply is terminated inside the tee while the Jupiter Network In program is passed through to the X2 CAN / Power out connector (2).

(2) X2 CAN / Power out: The cable from the X2 CAN / Power out (2) is connected to the CAN 1 in connector on the next module in the network. This cable continues the Jupiter Network Out program with a renewed 24 Volt DC power supply.

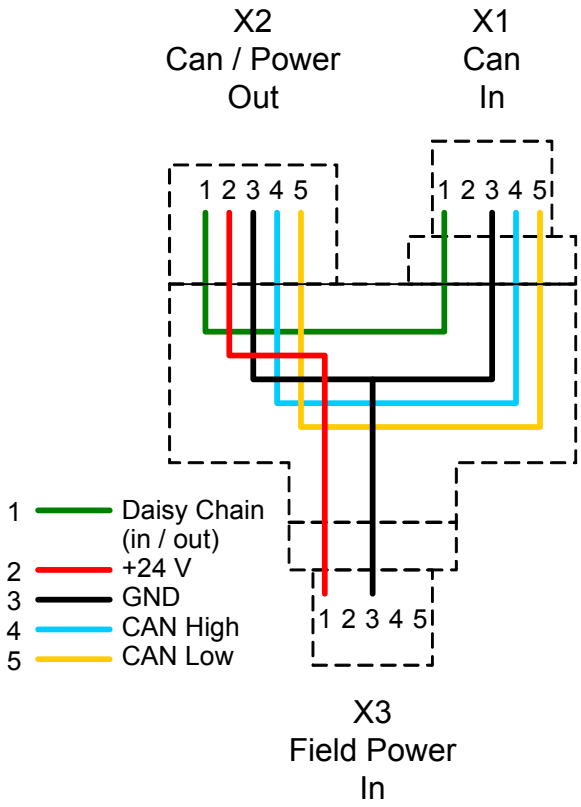
(3) X3 Field Power in: The cable connected to X3 Field Power (3) provides a renewed 24 Volt DC for the X2 CAN / Power out connector.

3.1 Jupiter Control System

3.1.14 Power Distribution Tee

FIGURE 19
POWER DISTRIBUTION TEE

FIGURE 20
POWER DISTRIBUTION TEE DETAIL

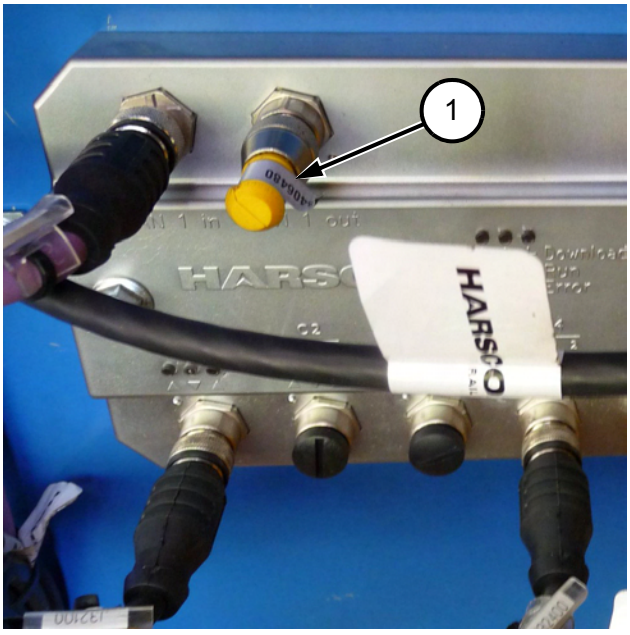


3.1 Jupiter Control System

3.1.15 **Network Terminator** - See Figures 21 and 22

The Network Terminator (1) must be installed on the CAN 1 out connector on the last module in the Jupiter Network. If the terminator is not present, Network communication will be compromised or may fail altogether.

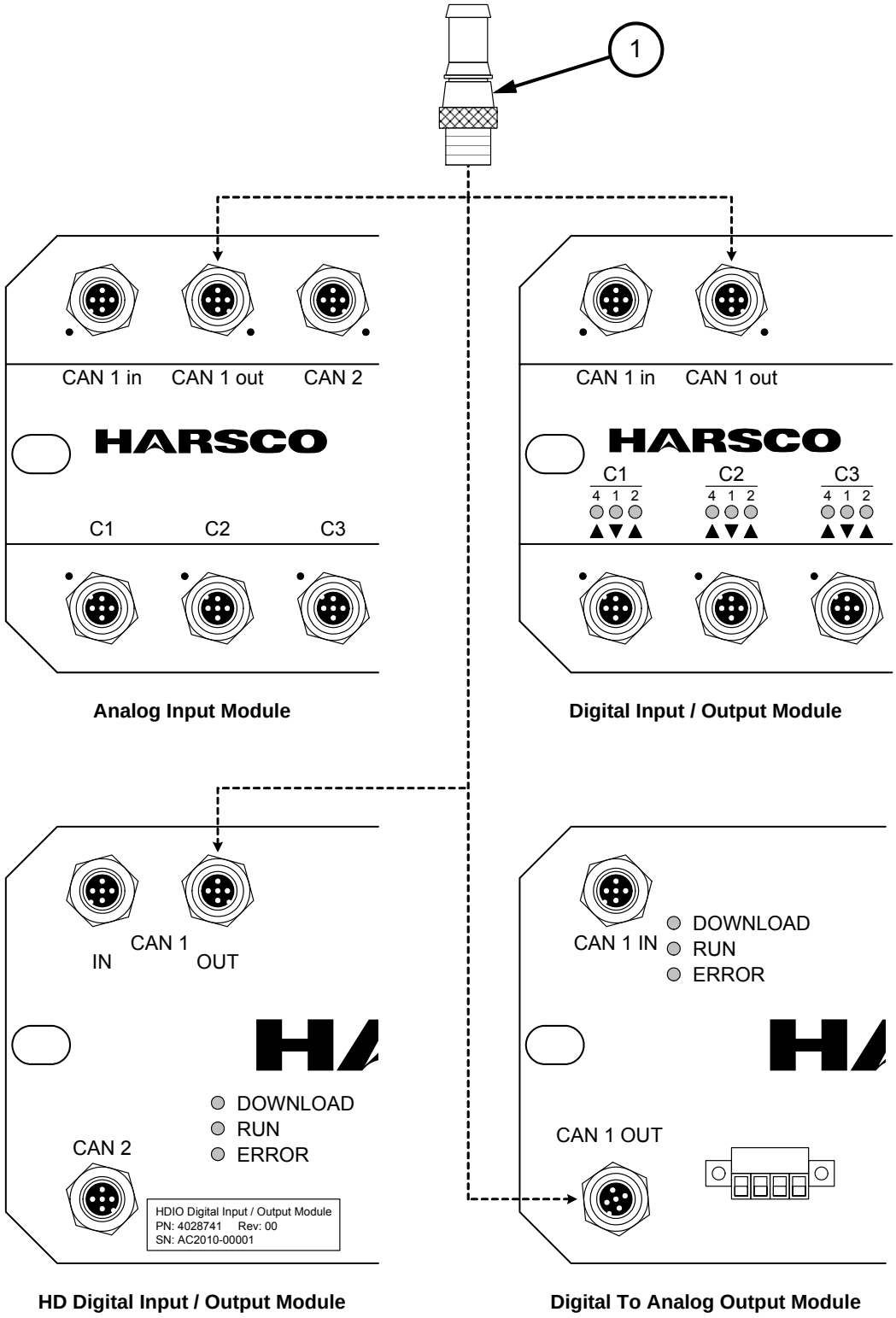
FIGURE 21
NETWORK TERMINATOR



3.1 Jupiter Control System

3.1.15 Network Terminator

FIGURE 22
NETWORK TERMINATOR



3.1 Jupiter Control System

3.1.16 Pass Through Splitter - See Figures 23 and 24

The Pass Through Splitter is only used with digital input channels. A single cable from a digital input channel of a network module is connected to (A). The cables from two separate devices such as proximity switches, pressure switches, etc. are connected to (1 and 2).

The two input channels #2 and #4 in the single cable (A) are routed to the separate cables (1 & 2) as follows:

Cable (A) input channel #2 is routed to both cable (1) and cable (2) input channel #2.
Cable (A) input channel #4 is routed to both cable (1) and cable (2) input channel #4.

(A) Cable "A" connection from any digital input channel of a network module.
(1) Cable #1 connection to 1st input device.
(2) Cable #2 connection to 2nd input device.

3.1 Jupiter Control System

3.1.16 Pass Through Splitter

FIGURE 23
PASS THROUGH SPLITTER

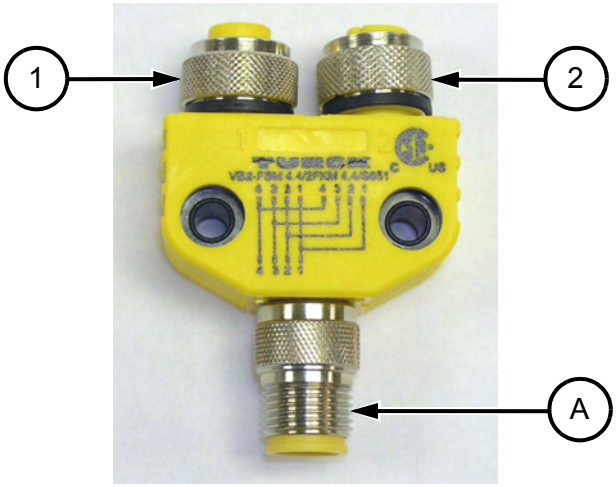
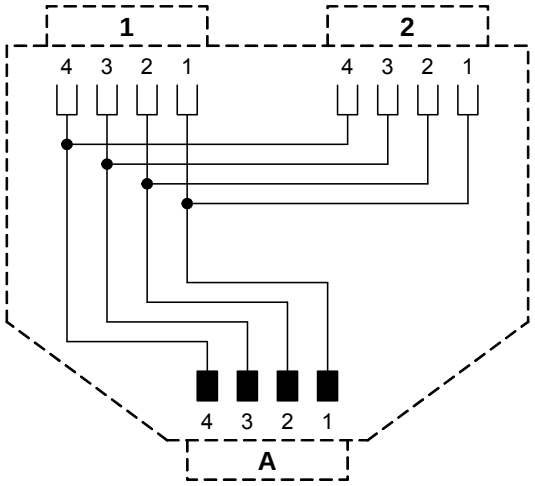


FIGURE 24
SPLITTER SCHEMATIC



3.1 Jupiter Control System

3.1.17 **Cross Over Splitter** - See Figures 25 and 26

Harsco Rail currently uses three different types of Cross Over Splitters. The splitter shown in Figure 5-25 is Harsco Rail part number 414260. The splitter shown in Figure 5-26 is Harsco Rail part number 3416296. The third splitter, not shown, is Harsco Rail part number 2011783. Cross Over Splitters #3416296 and #2011783 have cables molded to the splitter. The molded cable (A) is 1 meter (39 inches) long. Molded cables (1 and 2) are 0.3 meter (12 inches) long. Splitter #3416296 has LEDs while Splitter #2011783 does not have the LEDs. The Harsco Rail Cross Over Splitters #3416296 and #2011783 are used to help reduce the number of wire connections. All three splitters function the same.

FIGURE 25
CROSS OVER SPLITTER #414260

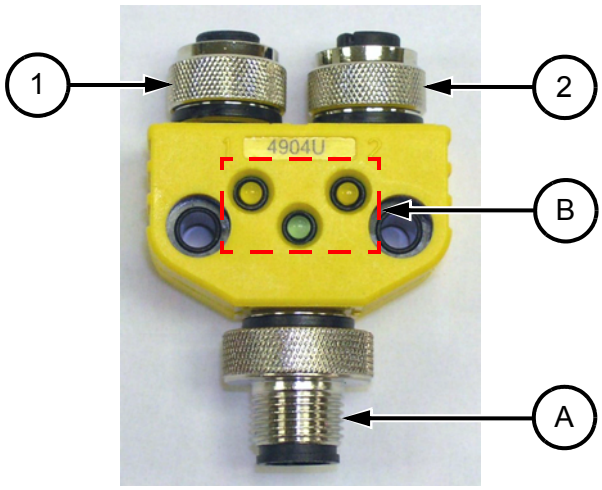
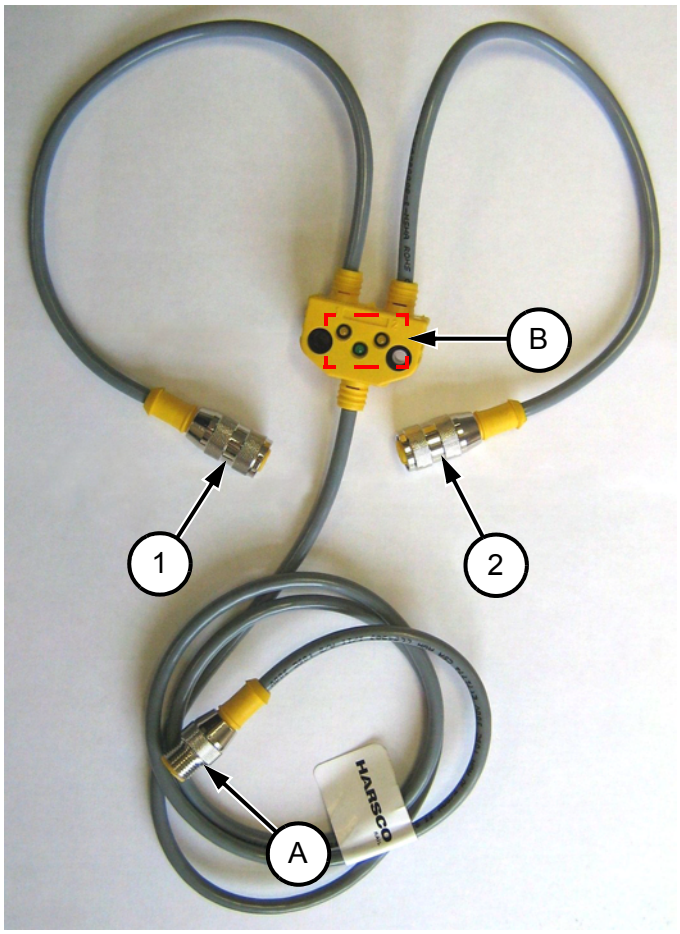


FIGURE 26
CROSS OVER SPLITTER #3416296



3.1 Jupiter Control System

3.1.17 Cross Over Splitter - See Figures 25, 26, 27 and 28

The Cross Over Splitter is only used with digital input channels. A single cable from a digital input channel of a network module is connected to (A). The cables from two separate devices such as proximity switches, pressure switches, etc. are connected to (1 and 2).

The two input channels #2 and #4 in the single cable (A) are routed to the separate cables (1 and 2) as follows:

Cable (A) input channel #4 is routed only to cable (1) input channel #4.
Cable (A) input channel #2 is routed only to cable (2) input channel #4.

(A) Cable "A" connection from any digital input channel of a network module.
(B) Cable "A" Status LEDs: See Figure 28.
(1) Cable #1 connection to 1st input device.
(2) Cable #2 connection to 2nd input device.

FIGURE 27
SPLITTER SCHEMATIC

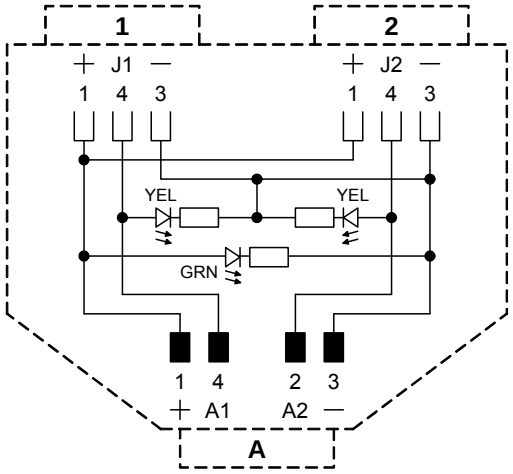
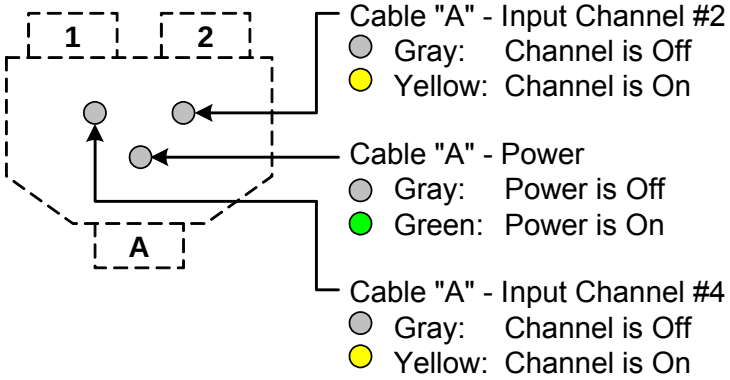


FIGURE 28
CABLE A STATUS LEDs



3.1 Jupiter Control System

3.1.18 Jupiter Breakout Box - See Figures 29 and 30

Note: The Jupiter Breakout Box shown below and on the following pages is for the previous version of Jupiter. The Jupiter Breakout Box for Jupiter II will be similar in appearance and function.

1. The Jupiter Breakout Box (1) (#4000552) can be used as a diagnostic tool for troubleshooting inputs and outputs to and from the Jupiter network modules, cables from the modules to the devices and the devices. The Jupiter Breakout Box has both male (2) and female (3) 5 pin connector cables.

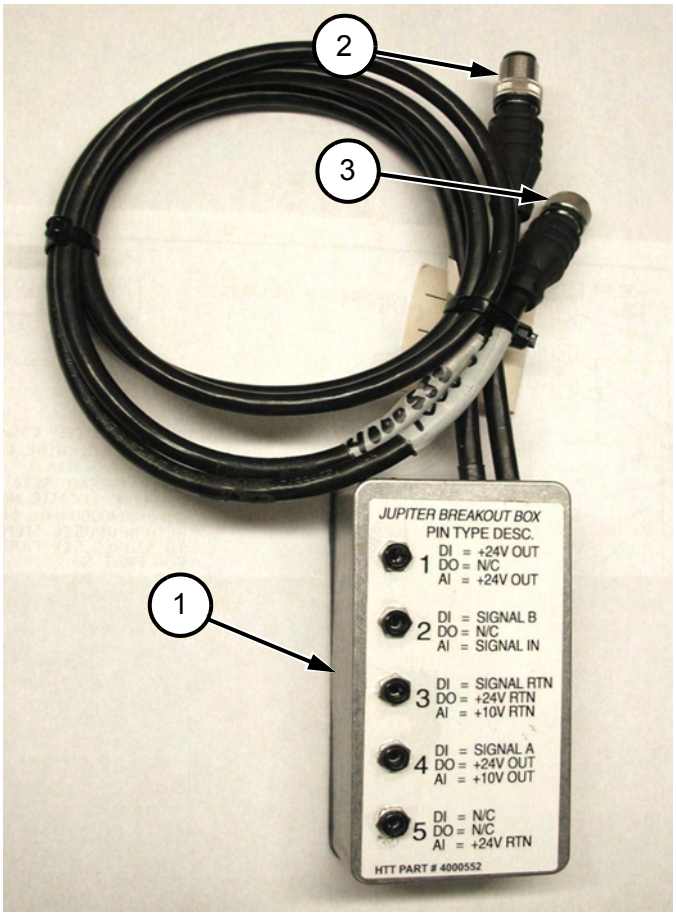
2. The Jupiter Breakout Box can be configured as follows:

   a. Connect the Jupiter Breakout Box male connector (2) to the module and the Jupiter Breakout Box female connector (3) directly to the device.

   b. Connect the Jupiter Breakout Box male connector (2) to the module and the Jupiter Breakout Box female connector (3) to the existing cable (4).

   c. Connect the Jupiter Breakout Box male connector (2) to the existing cable (4) and the Jupiter Breakout Box female connector (3) to the device.

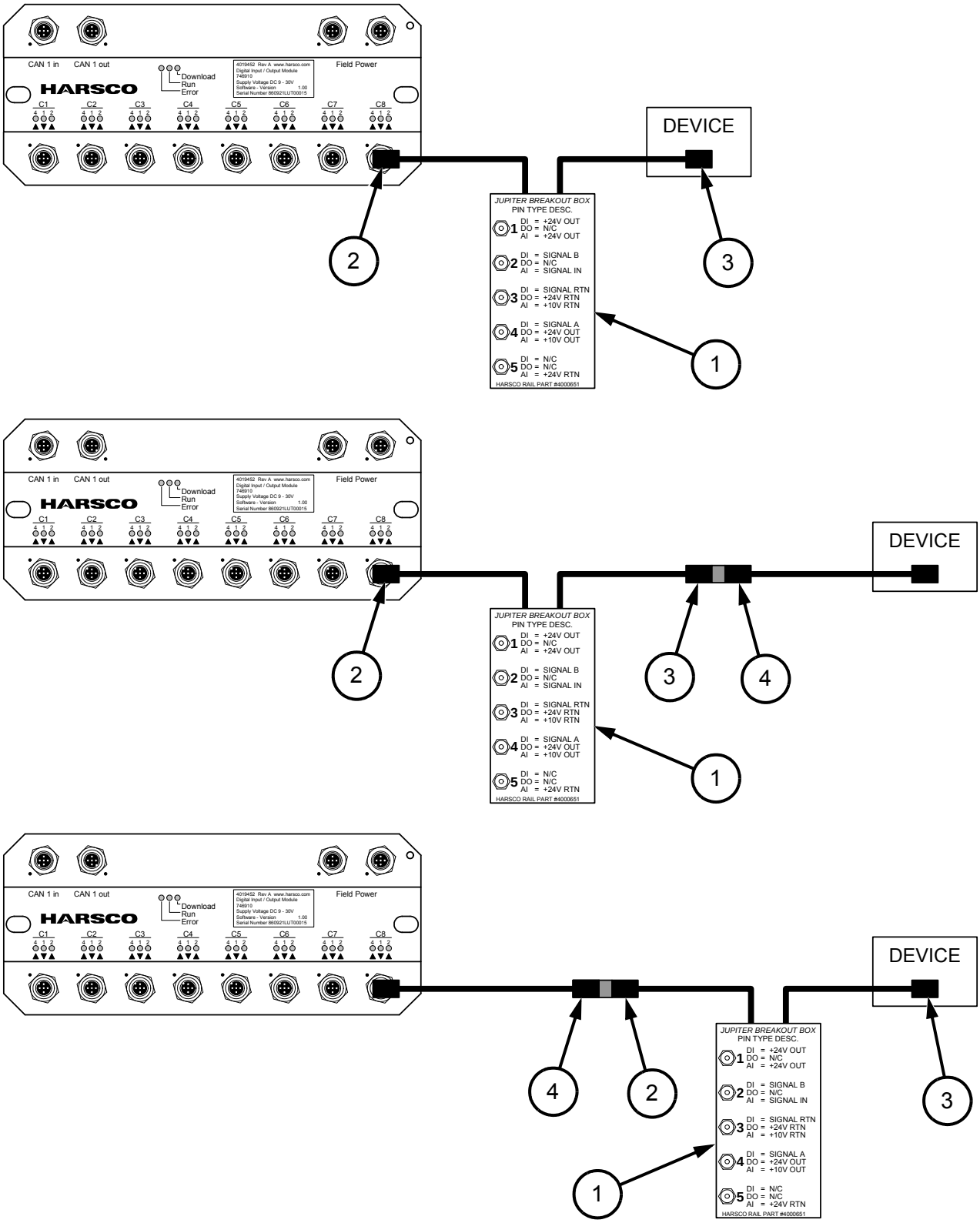
FIGURE 29
JUPITER BREAKOUT BOX



3.1 Jupiter Control System

3.1.18 Jupiter Breakout Box

FIGURE 30
JUPITER BREAKOUT BOX CONNECTIONS



3.1 Jupiter Control System

3.1.18 Jupiter Breakout Box - See Figures 31 and 32

3. Five voltage meter sockets are located on the left side of the Jupiter Breakout Box. Each socket, 1 through 5, can be used tocheck the voltage or signal at their respective pin / wire number of the module, cable or device.

4. With the Jupiter Breakout Box connected in a circuit between a Digital Input / Output Module and an active device, the voltage meter should indicate the following:

   Pin / wire # 1 - +24 volts out
   Pin / wire # 2 - Signal B in
   Pin / wire # 3 - +24 volts to ground (RTN)
   Pin / wire # 4 - Signal A in
   Pin / wire # 5 - No voltage or signal

5. With the Jupiter Breakout Box connected in a circuit between an Analog Input Module and an active device, the voltage meter should indicate the following:

   Pin / wire # 1 - +24 volts out
   Pin / wire # 2 - Signal in
   Pin / wire # 3 - +24 volts to ground (RTN)
   Pin / wire # 4 - +10 volts out
   Pin / wire # 5 - +10 volts to ground (RTN)

6. The Jupiter Breakout Box can also be connected in a circuit between the CAN 2 connector on a module and an active device, the voltage meter should indicate the following:

   Pin / wire # 1 - +24 volts to ground (RTN)
   Pin / wire # 2 - +24 volts out
   Pin / wire # 3 - CAN 2 ground
   Pin / wire # 4 - CAN 2 High
   Pin / wire # 5 - CAN 2 Low

3.1 Jupiter Control System

3.1.18 Jupiter Breakout Box

FIGURE 31
CONNECTOR PIN / WIRE NUMBER DETAIL

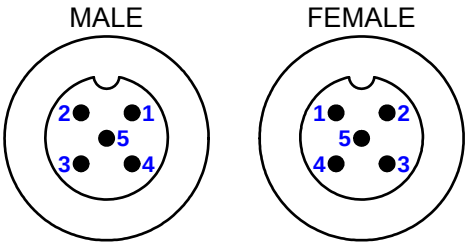
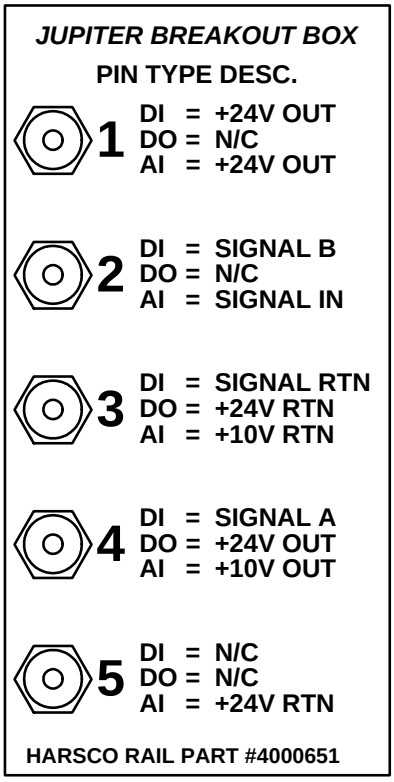


FIGURE 32
JUPITER BREAKOUT BOX



4.1 Jupiter Diagnostic Panels

4.1.1 Accessing Diagnostic Panels - See Figure 33

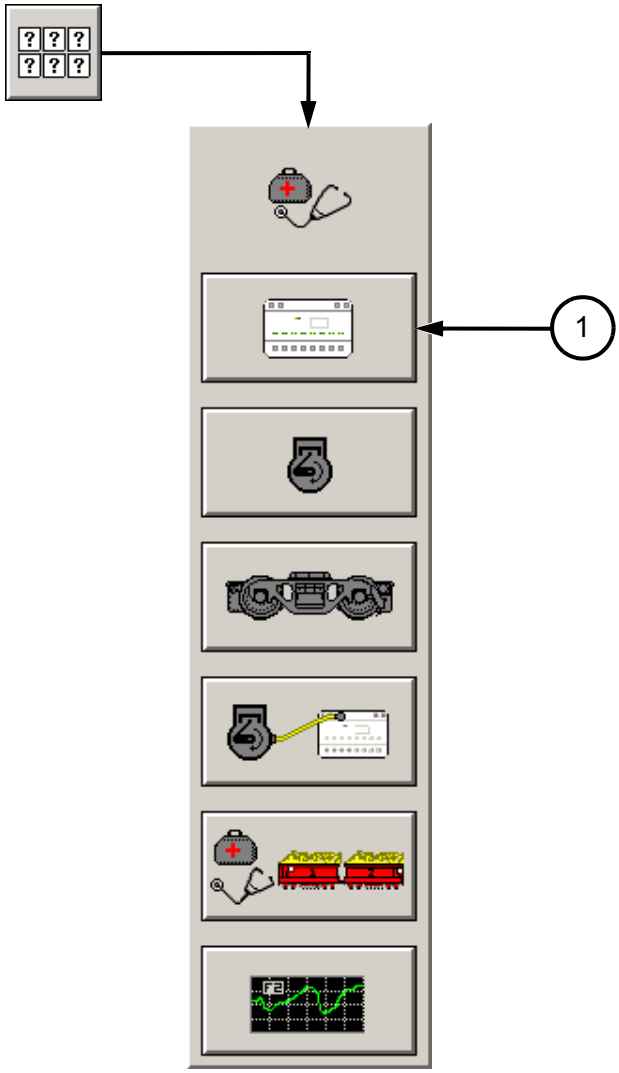
One of the new features of Jupi ter II is the use of the "F" keys on a keyboard. If a "F" key symbol is shown on the button on the monitor display and a key board is connected to the Jupiter computer, either the button can be pressed on the screen or the "F" key can be used to activate the button function.

The method of accessing the Jupiter Diagnos tic Panels will vary depending on the Jupiter application.

On Some applications, such as on a two car rail grinding consis t, the Miscella neous Tool Bar Button on the main screen is pressed to display the Diagnostics Panel.

Press the Network Diagnostic Button (1) to display the Network Diagnostic Panel. The Network View, Thumbnail View and Detailed Module Diagnostic Panels are accessible from the Network Diagnostic Panel.

FIGURE 33
TYPICAL RAIL GRINDER DIAGNOSTIC PANEL



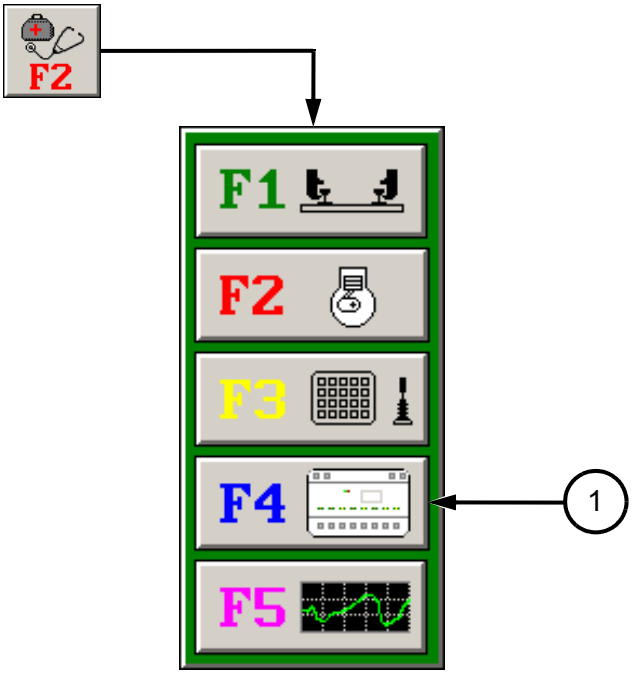
4.1 Jupiter Diagnostic Panels

4.1.1 Accessing Diagnostic Panels - See Figure 34

On other applications, such as the Mark IV T amper, pressing the Diagnostics Button on the Main Screen will display the Diagnostics Panel.

Press the Jupiter Diagnostic Button (1) to display the The Network View, Thumbnail View and Detailed Module Diagnostic Panels.

FIGURE 34
TYPICAL MARK IV DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.2 Network Diagnostic Button / Panel - See Figure 35

On Jupiter applications that have two or more cars and JAM's that make up the total machine consist, such as a two car rail grinder, pressing the Network Diagnostic Button will display the status of the communication network on all cars in the consist. In this example, the left side of the panel displays the communication network of Car #1. The right side of the panel displays the communication network of Car #2. The panel displays the following:

(1) Car Select Network Button: Press the button for Car #1 or Car #2 to display its Network View, Thumbnail View and Detailed Module Diagnostic Panels.

(2) JAM / Ethernet Network: Each JAM has a diagnostic LED that displays the status of communication between the JAM on each car.

- Green - JAM is communicating with the other JAM.
- Gray - JAM is not communicating with the other JAM.

(3) Module Network: Each module has a diagnostic LED that displays the status of communication between the module and the JAM in each car.

- Green - Module is communicating with the JAM and there are no network errors.
- Red - Module is communicating with the JAM and there are one or more errors.
- Gray - Module is not communicating with the JAM.

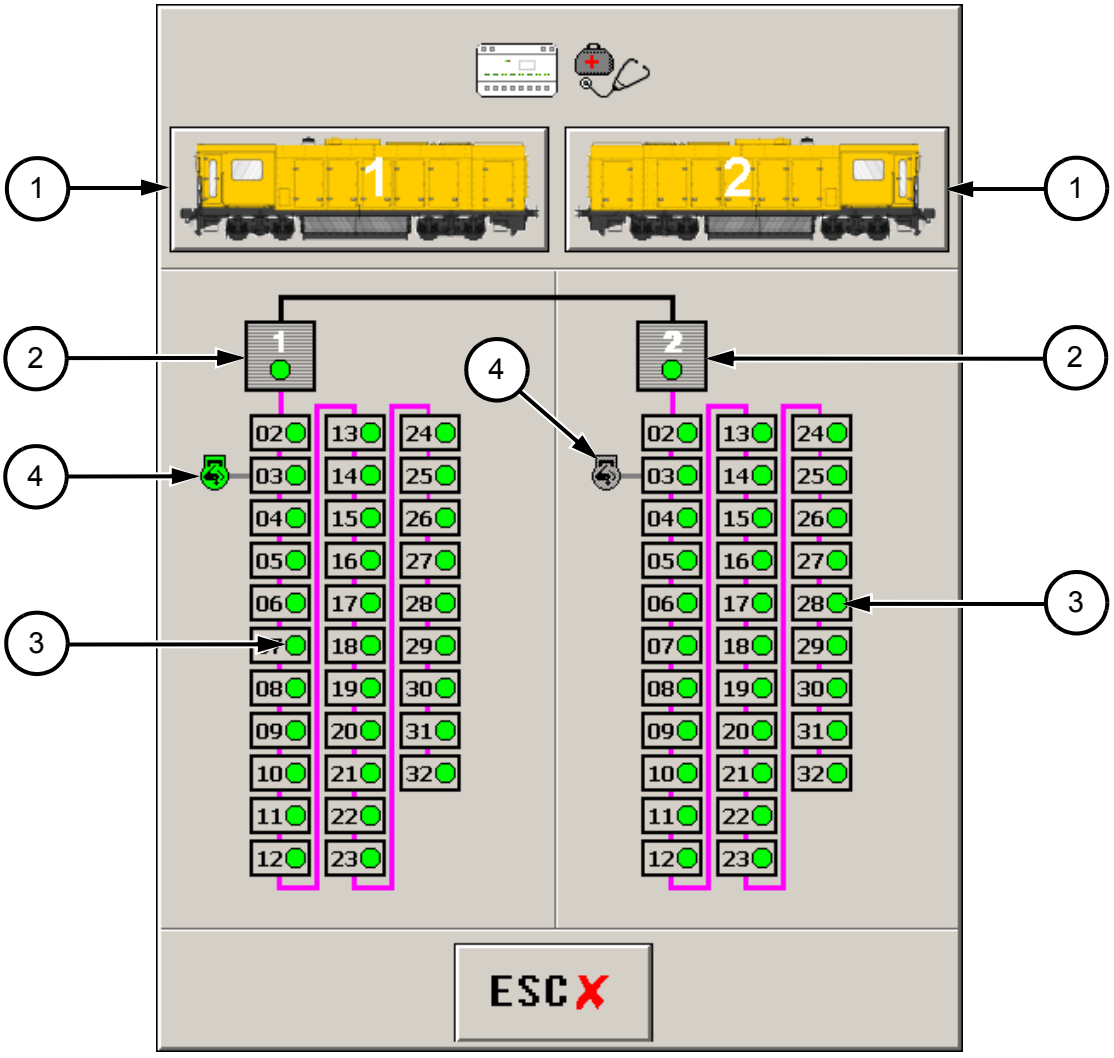
(4) Engine ECM Network: The engine icon displays the status of communication between the engine ECM and the host module in each car.

- Green - Engine ECM is communicating with the host module.
- Gray - Engine ECM is not communicating with the host module.

4.1 Jupiter Diagnostic Panels

4.1.2 Network Diagnostic Button / Panel

FIGURE 35
NETWORK DIAGNOSTIC PANEL



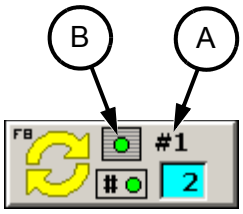
4.1 Jupiter Diagnostic Panels

The Jupiter II Diagnosti c Panels from the Mark IV T amper will be used in this manual to describe the panels. The Jupiter II panels on other machines will be similar in function but may not be displayed the same as these examples.

4.1.3 Network View Diagnostic Button / Panel - See Figure 36

Press the Jupiter Diagnos tic Button on the Diagnosti c Panel to display the Network View Diagnostic Panel. This panel displays the network from the top view of the machine. The front of the machine is towards the right side of the panel. The panel displays the following:

(1) Zoom Button: Press the Zoom Button or F8 key to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. This button displays the selected Network Module # (highlighted cyan) and the status of its Diagnostic LED.



If there is more than one JAM in the network, the JAM and network that is currently being displayed will be shown in the upper portion of the button. The Car / Machine # (A) and the status of its JAM Diagnostic LED (B) will be displayed.

(2) Minus (-) Button: Press the Minus (-) Button to select the previous module in the network.

(3) Plus (+) Button: Press the Plus (+) Button to select the next module in the network.

(4) Jupiter Application Master: Typically, the JAM is located in a junction box or console in the cab on the machine. The JAM contains the operating software and is labeled as address #1. Detailed information cannot be displayed for the JAM.

(5) Power Distribution Tee: The tee is used to help prevent voltage drops in the network by connecting a new power source.

(6) Network Modules: Each module is numbered and has a Diagnostic LED that displays its communication status with the JAM. The module's approximate location on the machine is also shown on the Network View Diagnostic Panel. The currently selected module will be highlighted cyan. Pressing any module on the Network View Diagnostic Panel will display the Detailed Module Diagnostic Panel for that module. The status of the Diagnostic LED is as follows:

- Green - Module is communicating with the JAM and there are no network errors.
- Red - Module is communicating with the JAM and there are one or more errors.
- Gray - Module is not communicating with the JAM.

(7) I/O Information Button: Press the button or F1 key to display an I/O Information Panel on the currently selected module (highlighted cyan) listing the connectors and input / output descriptions. See I/O Information Panel.

4.1 Jupiter Diagnostic Panels

4.1.3 Network View Diagnostic Button / Panel - See Figure 36

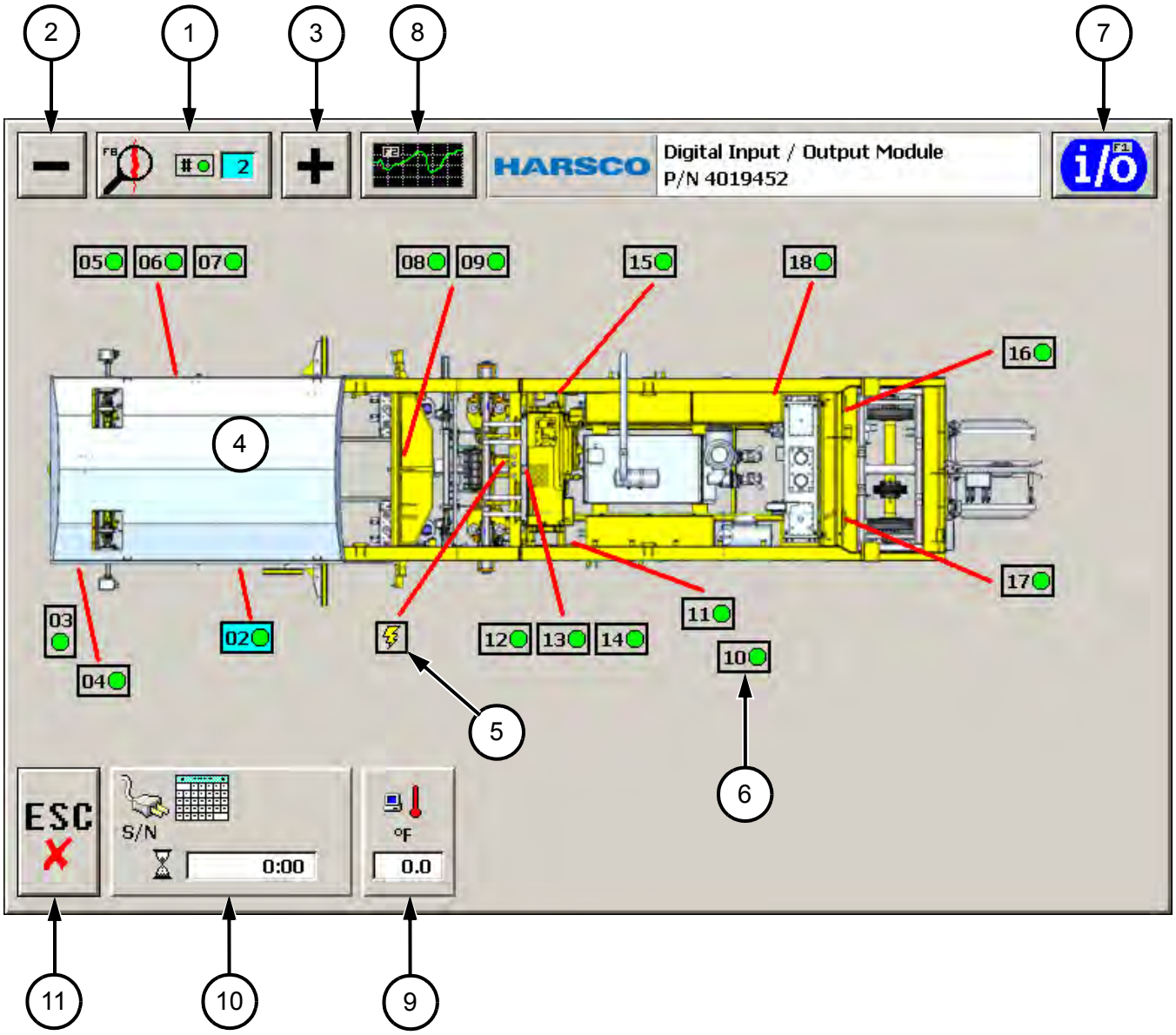
(8) I/O Graphing Button: Press the button or F2 key to display an I/O Graphing Panel on the currently selected module (highlighted cyan) to monitor the properties of up to four different channels. See I/O Graphing Panel.

(9) Core Temperature Box: The box displays the core temperature of the selected module.

(10) Module Information Box: The box displays the activation date and the total hours of operation for the displayed module.

(11) Escape Button: Press the Escape Button to remove this panel from the screen.

FIGURE 36
NETWORK VIEW DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.4 Thumbnail View Diagnostic Panel - See Figure 37

Press the Zoom Button (1) or F8 on the computer keyboard to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. The Thumbnail View Diagnostic Panel displays a quick view of all of the modules in the network. The panel displays the following:

(1) Zoom Button: Press the Zoom Button or F8 on the computer keyboard to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. This button displays the selected Network Module # (highlighted cyan) and the status of its Diagnostic LED.

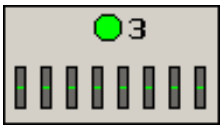
(2) Minus (-) Button: Press the Minus (-) Button to select the previous module in the network.

(3) Plus (+) Button: Press the Plus (+) Button to select the next module in the network.

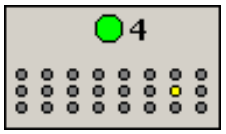
(4) Network Modules: Each module is numbered and has a Diagnostic LED that displays its communication status with the JAM. The currently selected module will be highlighted cyan. Pressing any module on the Network View Diagnostic Panel will display the Detailed Module Diagnostic Panel for that module. The status of the Diagnostic LED is as follows:

- Green - Module is communicating with the JAM and there are no network errors.
- Red - Module is communicating with the JAM and there are one or more errors.
- Gray - Module is not communicating with the JAM.

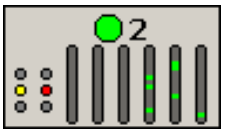
a. Analog Input Module: This thumbnail displays small voltage sliders. The sliders indicate the current voltage of the channels on the module which match the voltage sliders on the corresponding Detailed Module Diagnostic Panel.



b. Digital I/O Module: This thumbnail displays small channel LEDs. The LEDs indicate the status of the channels on the module which match the channel LED indicators on the corresponding Detailed Module Diagnostic Panel.



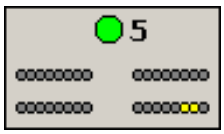
c. Digital I/O Module with Scanner Board: This thumbnail displays a column of 3 miniature LEDs for each of the configured direct outputs. The tiny LED in the center of the column illuminates yellow when the output is ON and dark gray when the output is OFF. The center LED is shown RED when the output channel has an I/O fault. The upper and lower LEDs do not illuminate. The columns display the current inputs for each of the scanned input plugs. Inputs that are on are displayed Green. Off channels are dark gray.



4.1 Jupiter Diagnostic Panels

4.1.4 Thumbnail View Diagnostic Panel - See Figure 37

d. HD (High Density) Digital I/O Module: This thumbnail displays small channel LEDs. The LEDs indicate the status of the channels on the module which match the channel LED indicators on the corresponding Detailed Module Diagnostic Panel.



e. Digital to Analog Output Module: The smallsliders on this thumbnail display a miniature view of the +/-10 volt output presently being driven on each connector.

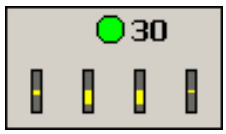
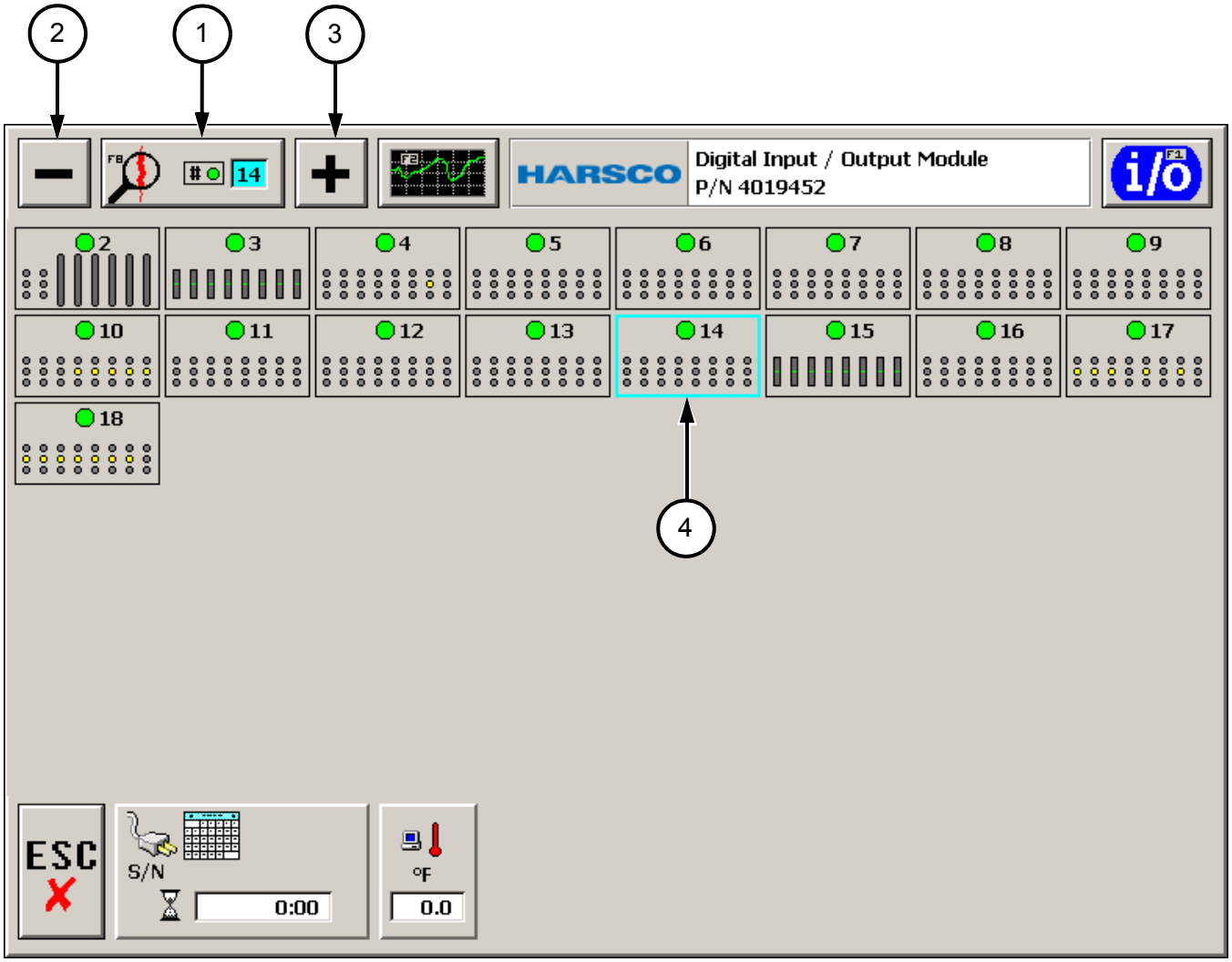


FIGURE 37
THUMBNAIL VIEW DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.4 Thumbnail View Diagnostic Panel - See Figure 38

(5) I/O Information Button: Press the button or F1 key to display an I/O Information Panel for the currently selected module (highlighted cyan) listing the connectors and input / output descriptions. See I/O Information Panel.

(6) I/O Graphing Button: Press the button or F2 key to display an I/O Graphing Panel for the currently selected module (highlighted cyan) to monitor the properties of up to four different channels. See I/O Graphing Panel.

(7) Core Temperature Box: The box displays the core temperature of the selected module.

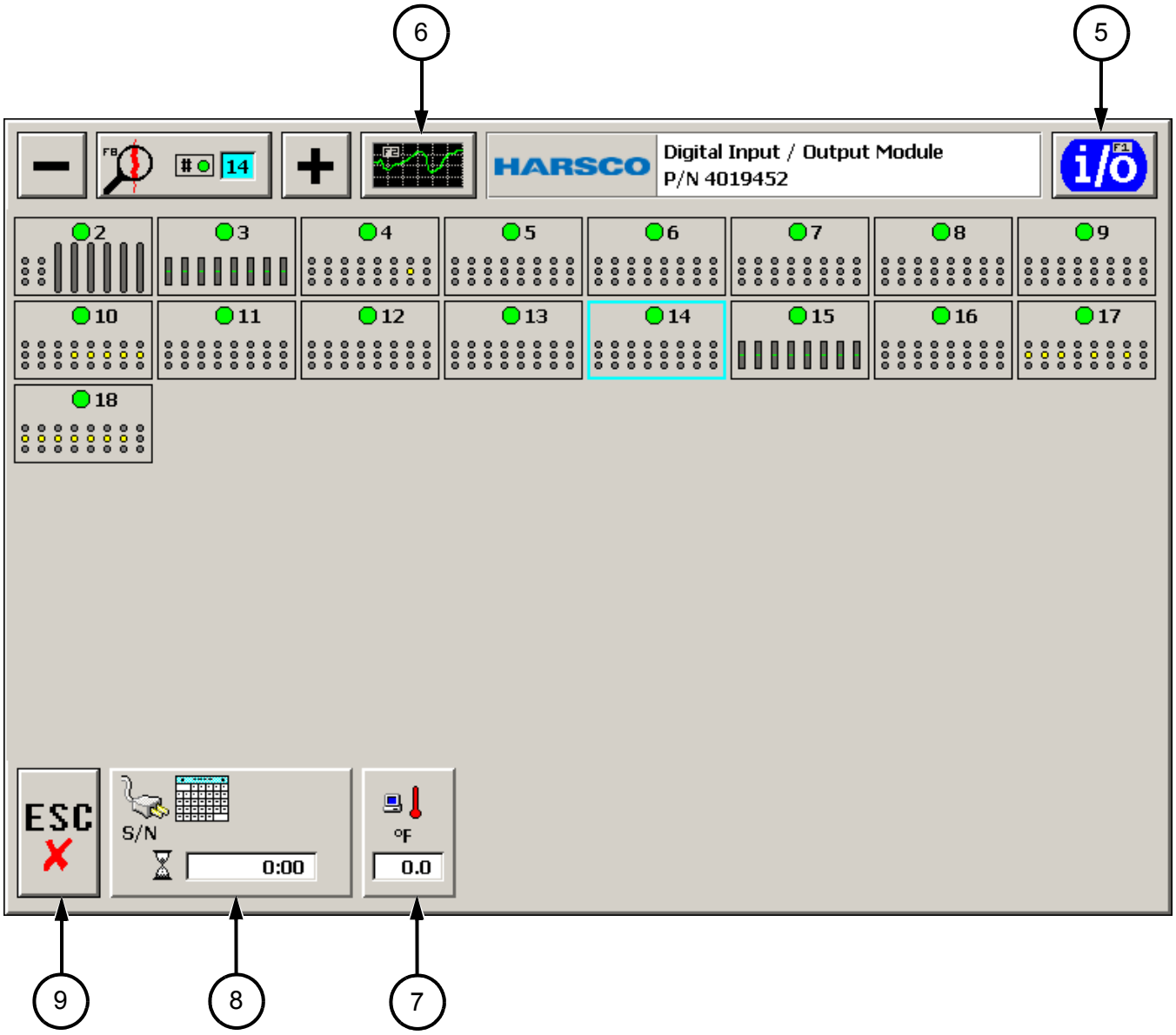
(8 Module Information Box: The box displays the module's manufacturing test date, the module serial number and the total hours of operation for the displayed module

(9) Escape Button: Press the Escape Button to remove this panel from the screen.

4.1 Jupiter Diagnostic Panels

4.1.4 Thumbnail View Diagnostic Panel

FIGURE 38
THUMBNAIL VIEW DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.5 Analog Input Module Diagnostic Panel - See Figure 39

Press the Zoom Button or F8 key to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. The Analog Module Diagnostic Panel displays diagnostic information for an analog input module. If the currently selected module is not communicating with the JAM, information boxes and sliders will not be visible. The panel displays the following:

(1) Zoom Button: Press the Zoom Button or F8 key to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. This button displays the selected Network Module # (highlighted cyan) and the status of its Diagnostic LED.

(2) Minus (-) Button: Press the Minus (-) Button to select the previous module in the network.

(3) Plus (+) Button: Press the Plus (+) Button to select the next module in the network.

(4) Information Table: The table displays from left to right; the connector number and the graphical digital signal value in volts.

(5) Connectors and Pin Identification (C1 - C8): A description of the connector pin layout is located above the connectors.

(6) I/O Information Button: Press the button or F1 key to display an I/O Information Panel for the currently selected module (highlighted cyan) listing the connectors and input / output descriptions. See I/O Information Panel.

(7) I/O Graphing Button: Press the button or F2 key to display an I/O Graphing Panel for the currently selected module (highlighted cyan) to monitor the properties of up to four different channels. See I/O Graphing Panel.

(8) 10 Volt Power Box: The box displays the status of the 10 volt power with the actual voltage displayed in the information box. A gray box indicates the voltage is within acceptable limits. A flashing yellow box indicates the voltage is not within acceptable limits.

(9) 24 Volt Power Box: The box displays the status of the 24 volt power with the actual voltage displayed in the information box. A gray box indicates the voltage is within acceptable limits. A flashing yellow box indicates the voltage is not within acceptable limits.

(10) Core Temperature Box: The box displays the core temperature of the displayed module.

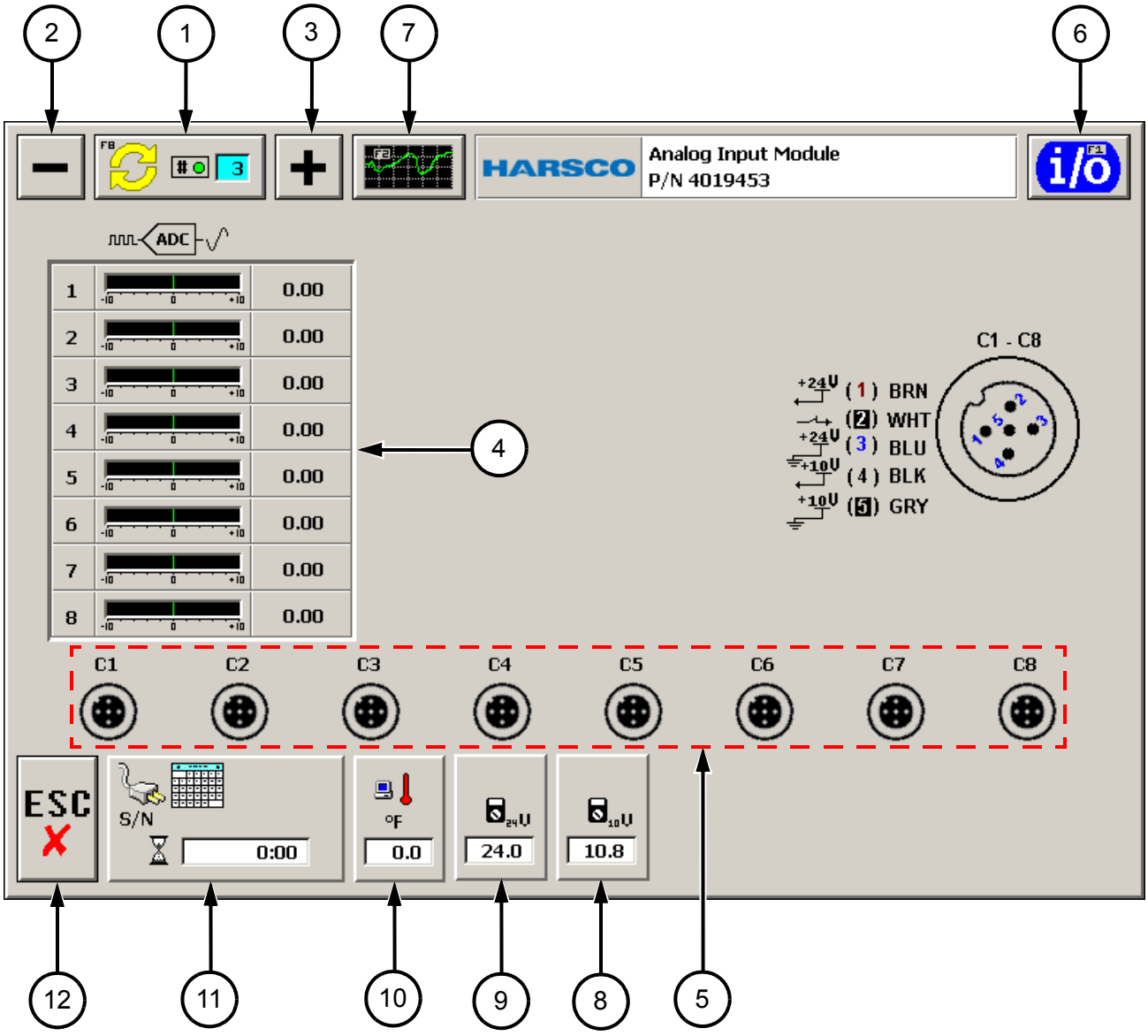
(11) Module Information Box: The box displays the activation date and the total hours of operation for the displayed module

(12) Escape Button: Press the Escape Button to remove this panel from the screen.

4.1 Jupiter Diagnostic Panels

4.1.5 Analog Input Module Diagnostic Panel

FIGURE 39
ANALOG INPUT MODULE DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.5.1 Analog Input Module Can 2 Diagnostic Panel - See Figure 40

The Analog Input Module can communicate with other analog input devices, such as an engine ECM, through its Can 2 connector. When connected, the Can 2 Diagnostic Panel is displayed in the upper right corner of the panel.

(13) Can 2 Diagnostic Panel: The diagnostic LED indicators show the communication status of the Can 2 link between the host module and the other device. The status of the LEDs are as follows:

(A) ERR LED Indicator:
- Gray - Normal operating state exists.
- Red - Bus error condition exists. Module cannot communicate with any target devices. This is often caused by a short circuit between the CAN H and CAN L wires somewhere in the network cabling or plugs. The TXD and RXD LEDs may also show solid red when a bus error condition exists. The WRN LED may blink during bus error conditions, indicating unsuccessful attempts to restart communication.

(B) WRN LED Indicator:
- Gray - Normal operating state exists.
- Red - Bus warning condition exists. Bus warnings often indicate broken or disconnected cables or incorrect wiring of the CAN H and CAN L signals. This condition may also occur briefly when there are intermittent communication errors detected between the module and one or more target devices. Incorrect target device address settings, bad hardware, or cable problems may be the cause.

(C) TXD LED Indicator:
- Green - Module has successfully transmitted at least one message to a target device.
- Red - Module transmissions were previously OK but presently faulty. A fault may occur when either the ERR or WRN LEDs are red or when a device on the Can 2 network cannot be contacted.
- Gray - Module has not yet transmitted a message.

(D) RXD LED Indicator:
- Green - Module is receiving messages from connected devices.
- Red - Module was receiving messages OK but presently faulty. A fault condition may arise when either the ERR or WRN LEDs are red or when the driver software on the module is receiving incorrect messages from devices on the Can 2 network.
- Gray - Module has not received a message yet.

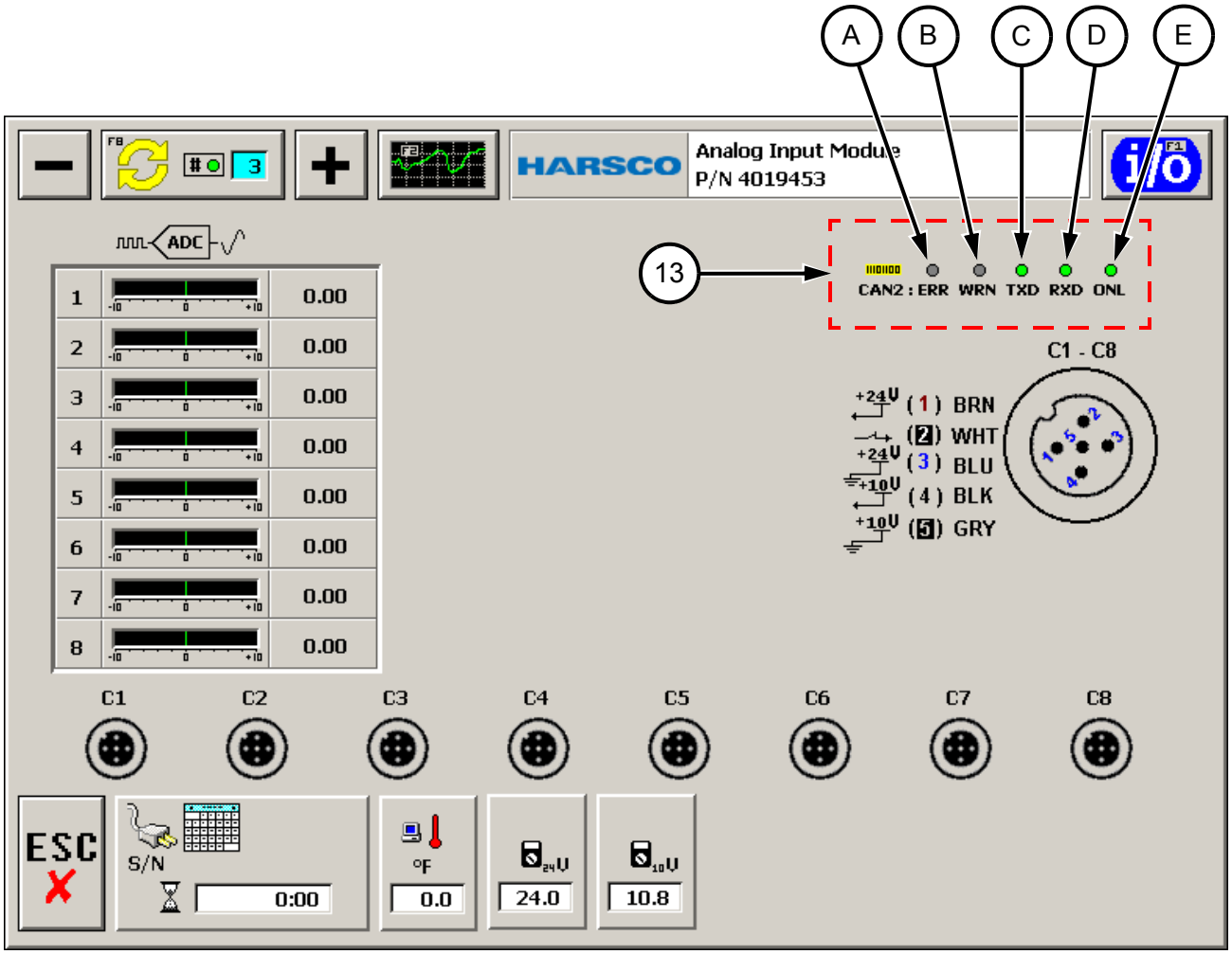
4.1 Jupiter Diagnostic Panels

4.1.5.1 Analog Input Module Can 2 Diagnostic Panel - See Figure 40

(E) ONL LED Indicator:
- Green - Module has established its online presence on the Can 2 network.
- Red - Module was previously online and is reconnecting.
- Gray - Module has not yet gone online.

The pins in the Can 2 plug are assigned as follows:
Pin 1 - field power common.
Pin 2 - 24V field power.
Pin 3 - CAN ground.
Pin 4 - CAN H signal.
Pin 5 - CAN L signal.

FIGURE 40
ANALOG INPUT MODULE CAN 2 DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.6 Digital Input / Output Module Diagnostic Panel - See Figure 41

Press the Zoom Button or F8 key to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. The Digital Input / Output Module Diagnostic Panel displays diagnostic information for a digital input / output module. If the currently selected module is not communicating with the JAM, information boxes and status LEDS will not be visible. The panel displays the following:

(1) Zoom Button: Press the Zoom Button or F8 key to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. This button displays the selected Network Module # (highlighted cyan) and the status of its Diagnostic LED.

(2) Minus (-) Button: Press the Minus (-) Button to select the previous module in the network.

(3) Plus (+) Button: Press the Plus (+) Button to select the next module in the network.

(4) Information Table (C1 - C8): The table displays from left to right, the connector number, channel number, PWM duty cycle, load in amperes, ground short circuit counts, open circuit counts, and 24V short circuit counts. A channel that has a short or open circuit will highlight yellow in the column box. When the short or open circuit has been corrected, it will highlight white. The computer must be re-booted to clear the short and/or open circuit counts from the table. The status of the short and open circuit column boxes are follows:

Gray - No Short Circuit On Connector.
Yellow - Short Circuit On Connector.
White - Short Circuit On Connector Has Been Corrected.

When a short circuit occurs, the module will immediately turn off the output channel for 2 seconds to protect the wiring and allow it to cool. After this 2 second period expires, the output will be reactivated if the JAM is still commanding the output ON. If the short circuit still exists, this cycle will repeat. In this case, the error counts will appear to clear and count up once every two seconds.

Open circuits are detected whenever an output is activated ON but not when the output is OFF. Some outputs on the machine may not draw sufficient current to accurately detect an open circuit (such as relays). Consult your machine handbook for information on specific channels that do not report open circuits.

A digital output module will latch and report the open circuit error status when it occurs. As long as the JAM is commanding the output ON, this open circuit status may clear and reactivate, and the error counter will increment in the diagnostic table. This condition indicates an intermittent open.

However, if the open circuit status was latched and the JAM turned OFF the output before continuity was restored, the open will continue to be reported on the diagnostic panel. The output must be turned ON again for the open status to be detected again and cleared when continuity is restored.

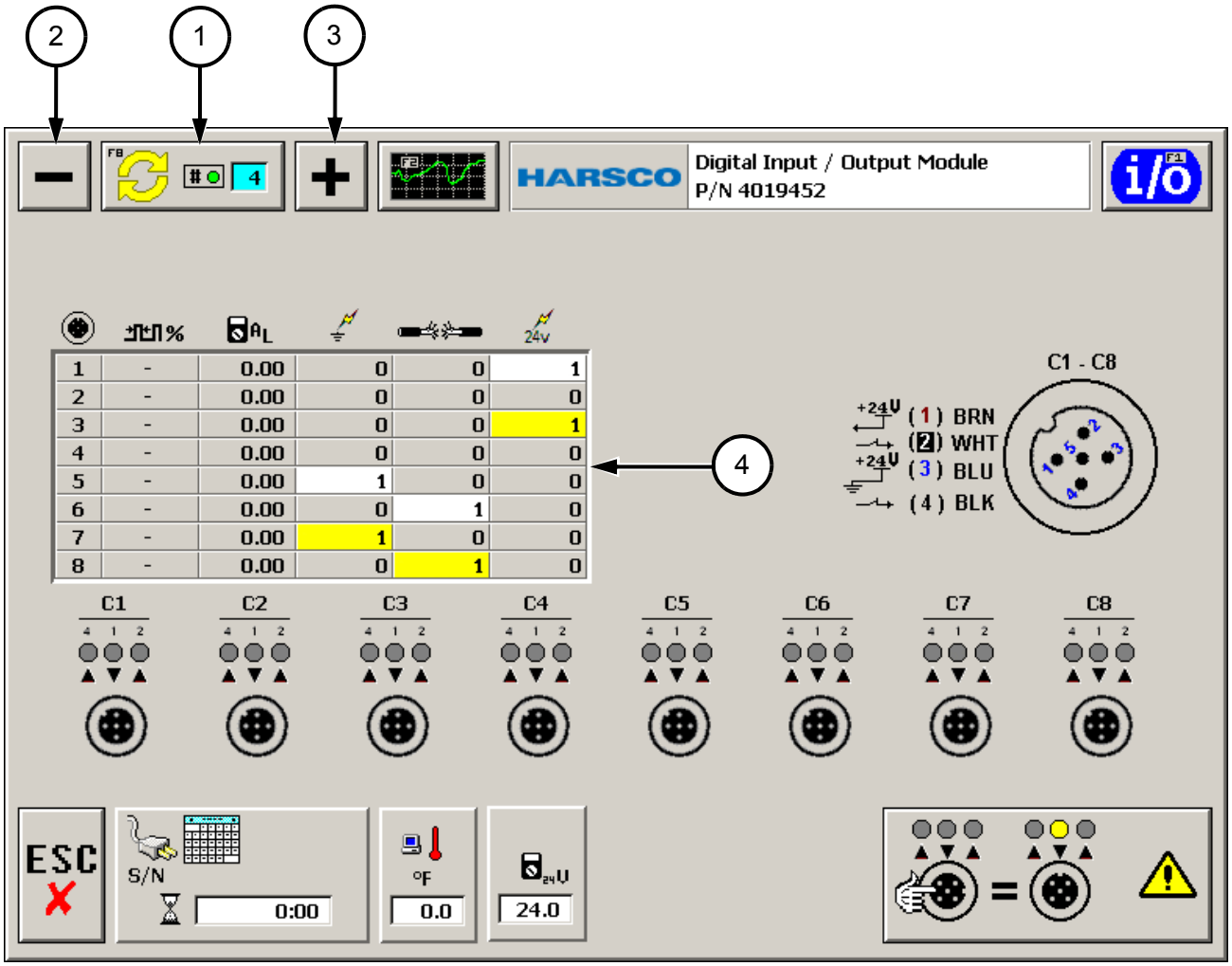
4.1 Jupiter Diagnostic Panels

4.1.6 Digital Input / Output Module Diagnostic Panel - See Figure 41

The “24 volt” short status is detected whenever the JAM is commanding the output OFF. This diagnostic means an outside source is powering the output when it should not be powered. Similar to an open circuit fault, a 24 volt short fault is latched and may clear while the output is OFF, and will persist while the output is ON until it is turned OFF again by the JAM.

The manual diagnostics can be used to manually test a channel having an open or 24 volt short in an attempt to clear a fault from the panel.

FIGURE 41
DIGITAL INPUT / OUTPUT MODULE DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.6 Digital Input / Output Module Diagnostic Panel - See Figure 42

(5) Connectors, Pins and Channel LEDs (C1 - C8): A description of the connector pin layout is located above the connectors. Each connector can be used as a digital input or output channel indicated by the direction of the Channel Arrows below the Channel LEDs. The Channel LEDs display the communication status of the connector's channels. The status of the Channel Arrows and Channel LEDs are as follows:

Input Channel LED Indicator and Arrow - Pin #2 or #4:
- Gray - Channel Is Off.
- Green - Channel Is On.

Output Channel LED Indicator and Arrow - Pin #1:
- Gray - Channel Is Off.
- Yellow - Channel Is On.
- Red - Power Fault.

(6) I/O Information Button: Press the button or F1 key to display an I/O Information Panel on the currently selected module (highlighted cyan) listing the connectors and input / output descriptions. See I/O Information Panel.

(7) I/O Graphing Button: Press the button or F2 key to display an I/O Graphing Panel on the currently selected module (highlighted cyan) to monitor the properties of up to four different channels. See I/O Graphing Panel.

(8) Diagnostic Button: Press the button to enable the Diagnostic Test Mode. The button will appear pressed in. Touch the desired Connector Icon, C1 - C8, (such as C8) to toggle the present state of the output channel (pin #1) to its opposite state. Thus, if the output is commanded by the JAM to be ON, pressing the connector icon will turn the output OFF, and vice versa.

When completed, press button (8) again to disable the Diagnostic Test Mode. The button will appear popped out.

- **THE MACHINE IS "LIVE" AND COMPONENTS MAY ACTIVATE WHEN IN THE DIAGNOSTIC TEST MODE. ENSURE ALL PERSONNEL ARE CLEAR OF POTENTIAL DANGEROUS AREAS AND THAT ALL APPROPRIATE SAFETY MEASURES ARE TAKEN PRIOR TO USING THE DIAGNOSTIC TEST MODE. FAILURE TO COMPLY COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.**

(9) 24 Volt Power Box: The box displays the status of the 24 volt power with the actual voltage displayed in the information box. A gray box indicates the voltage is within acceptable limits. A flashing yellow box indicates the voltage is not within acceptable limits.

4.1 Jupiter Diagnostic Panels

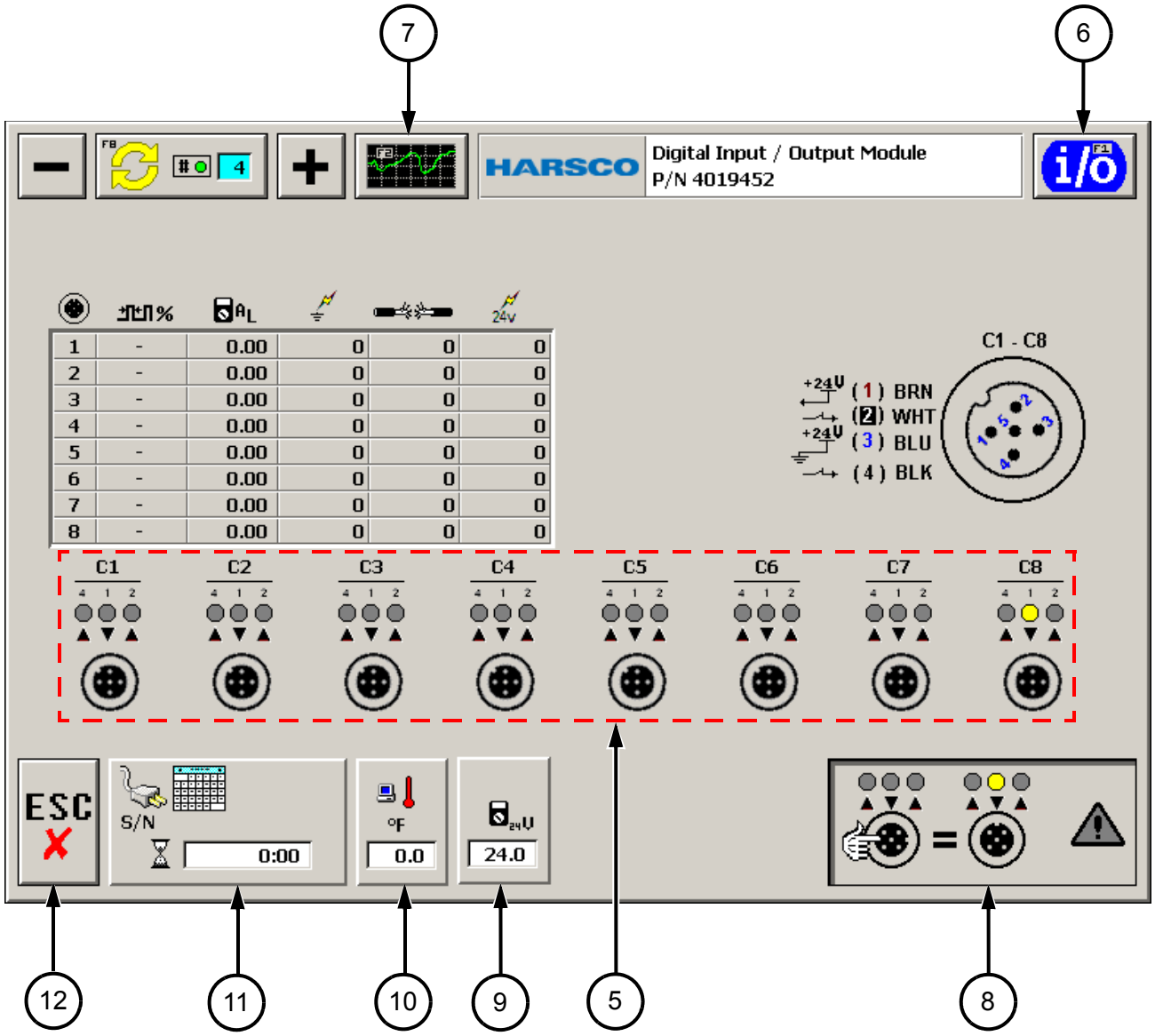
4.1.6 Digital Input / Output Module Diagnostic Panel - See Figure 42

(10) Core Temperature Box: The box displays the core temperature of the displayed module.

(11) Module Information Box: The box displays the activation date and the total hours of operation for the displayed module

(12) Escape Button: Press the Escape Button to remove this panel from the screen.

FIGURE 42
DIGITAL INPUT / OUTPUT MODULE DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.6.1 Digital Input / Output Module With Scanner Board - See Figure 43

1. On some Jupiter applications, a Digital Input / Output Module may have a “Scanner Board" attached. The board consumes all 8 of the Digital I/O output plugs and functions as a multiplex device that expands the digital input capability of this module from 16 inputs up to 128, 24 volt inputs. The inputs are deemed as “scanned” because the output on each plug is strobed temporarily to activate the corresponding input connector, at which time a snapshot of any active inputs is stored for that plug.

2. This board is primarily used to collect a lage number of inputs from devices such as toggle switches, buttons, and joysticks from an operator’s control console. Devices may be wired to any one of the eight “IC” plugs (1) depending upon the machine design. When an input signal is on, the LED (2) to the right of the input’s pin number is illuminated Green.

3. A machine may support special devices which may be connected via a ribbon cable to plugs (3) shown at the top and far right of this panel. Each input from one of these special devices shares an internal physical connection with a pin on an IC plug, so its diagnostic status is displayed on this pin even though it appears there is no wire connection to the actual pin on the IC plug.

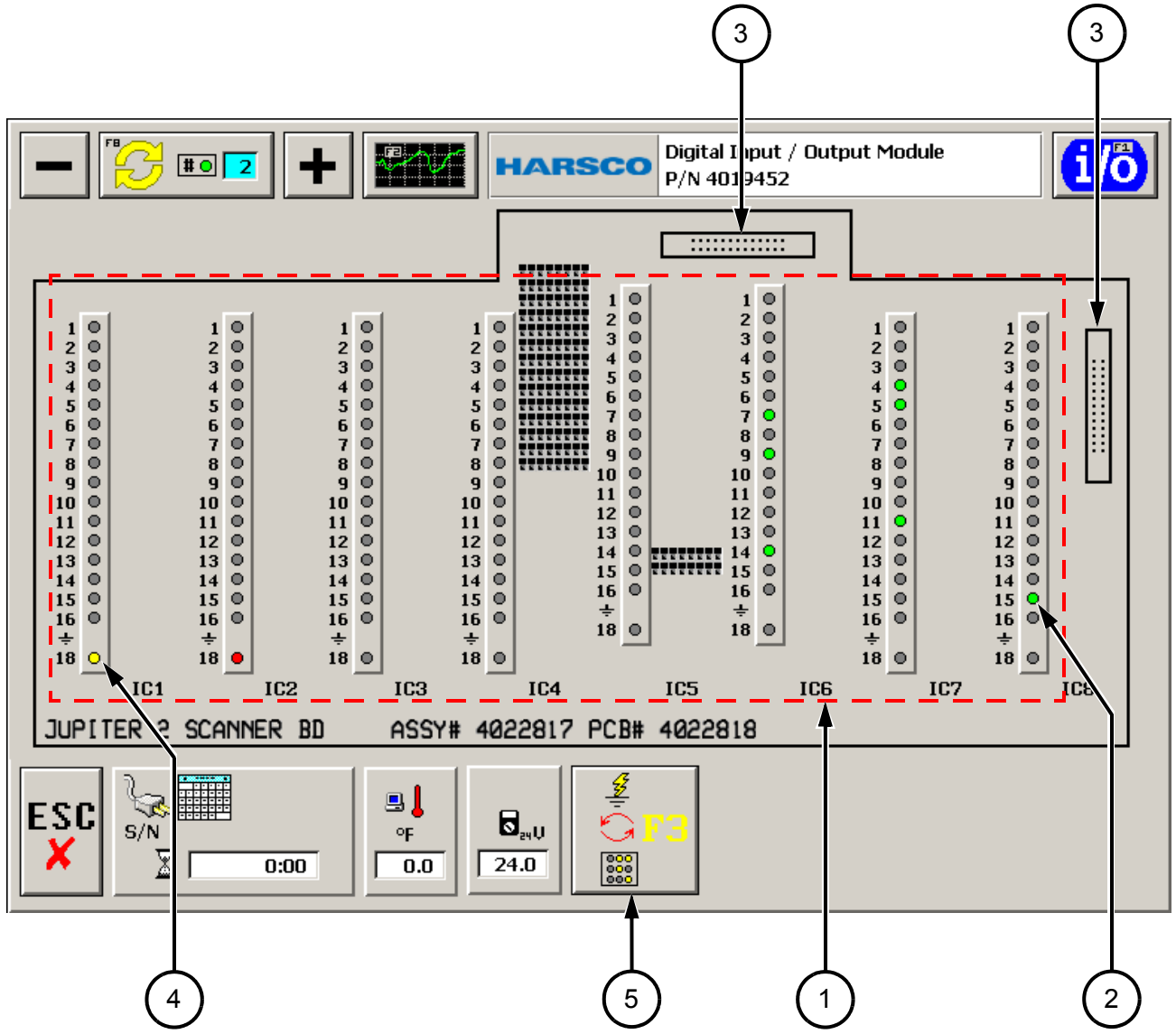
4. On some machines, an IC plug may have an output driven by pin 18 (4) on the IC plug. On the illustrated panel, IC1 and IC2 are configured to drive a direct output instead of scanning inputs from pins 1 through 16. The output is ON when the pin 18 LED is Yellow and OFF when the pin 18 LED is Gray. If an error is detected on the output, then the pin 18 LED will be illuminated Red.

5. To see details of any output errors, press the change view button (5). This button toggles the diagnostic view between the standard Digital Input / Output Module diagnostic display and the scanner board display. Pressing the F3 key will also activate this button. All other buttons on this panel function as they normally would on the standard Digital Input / Output Module Diagnostic Panel.

4.1 Jupiter Diagnostic Panels

4.1.6.1 Digital Input / Output Module With Scanner Board

FIGURE 43
DIGITAL INPUT / OUTPUT MODULE WITH SCANNER BOARD



4.1 Jupiter Diagnostic Panels

4.1.7 HD (High Density) Digital Input / Output Module Diagnostic Panel - See Figure 44

Press the Zoom Button or F8 key to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. The HD (High Density) Digital Input / Output Module Diagnostic Panel displays diagnostic information for a high density digital input / output module. If the currently selected module is not communicating with the JAM, information boxes and status LEDS will not be visible. The panel displays the following:

(1) Zoom Button: Press the Zoom Button or F8 key to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. This button displays the selected Network Module # (highlighted cyan) and the status of its Diagnostic LED.

(2) Minus (-) Button: Press the Minus (-) Button to select the previous module in the network.

(3) Plus (+) Button: Press the Plus (+) Button to select the next module in the network.

(4) Connectors, Pins and Channel LEDs (C1 - C4): Each connector has eight channels that can be used as a digital input or output channel indicated by the direction of the Channel Arrows below the Channel LEDs. The Channel LEDs display the communication status of the connector's channels. The status of the Channel Arrows and Channel LEDs are as follows:

Input Channel LED Indicator and Arrow:
▲
- Gray - Channel Is Off.
- Green - Channel Is On.

Output Channel LED Indicator and Arrow:
▼
- Gray - Channel Is Off.
- Yellow - Channel Is On.
- Red - Power Fault.

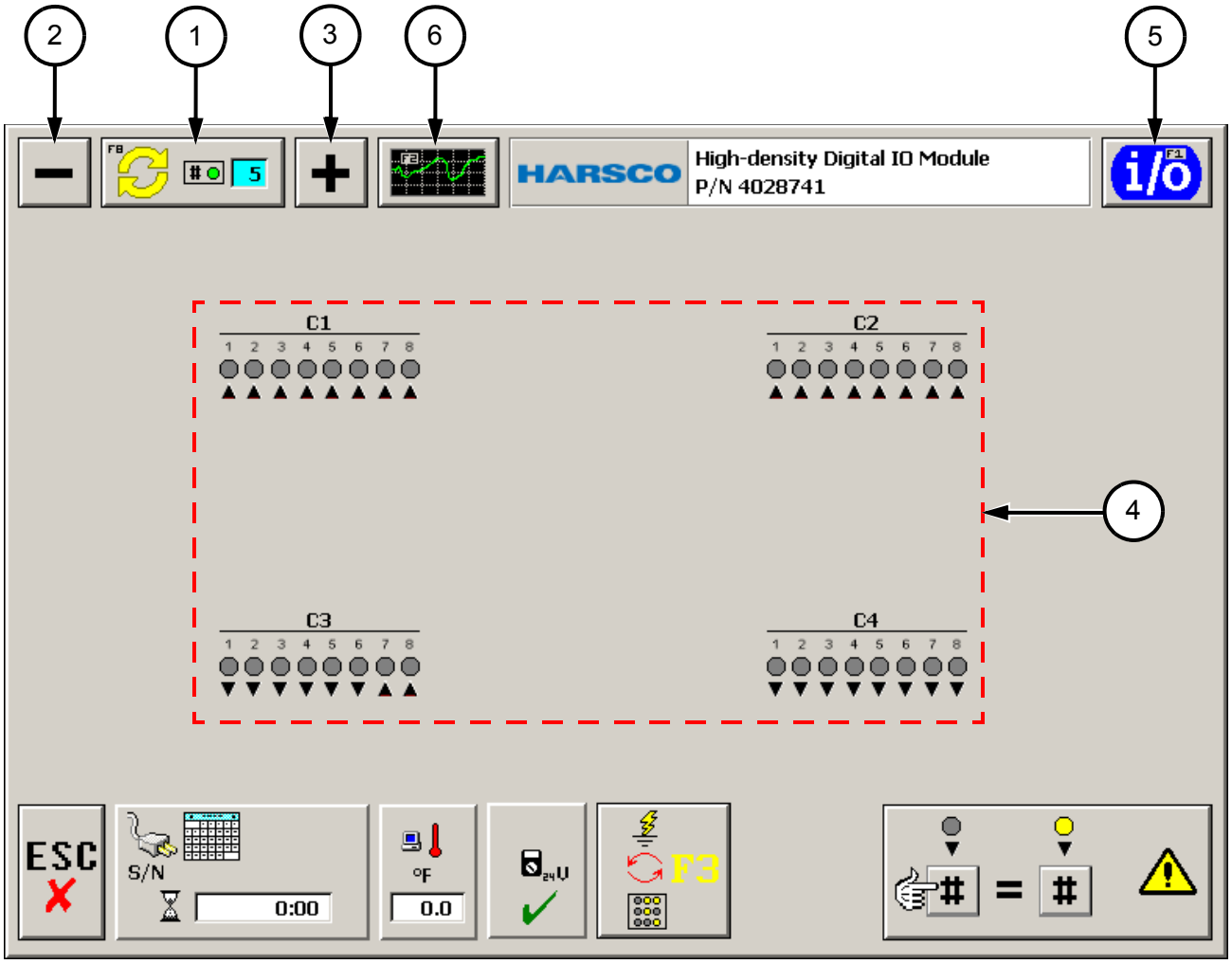
(5) I/O Information Button: Press the button or F1 key to display an I/O Information Panel on the currently selected module (highlighted cyan) listing the connectors and input / output descriptions. See I/O Information Panel.

(6) I/O Graphing Button: Press the button or F2 key to display an I/O Graphing Panel on the currently selected module (highlighted cyan) to monitor the properties of up to four different channels. See I/O Graphing Panel.

4.1 Jupiter Diagnostic Panels

4.1.7 HD (High Density) Digital Input / Output Module Diagnostic Panel

FIGURE 44
HD DIGITAL INPUT / OUTPUT MODULE DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.7 HD (High Density) Digital Input / Output Module Diagnostic Panel - See Figure 45

(7) Diagnostic Test Button: Press the button to switch between the Module Diagnostic Panel and the Module Diagnostic Test Panel. See 4.1.7.1 HD (High Density) Digital Input / Output Module Diagnostic Test Panel.

(8) Diagnostic Fault Button: Press the button to switch between the Module Diagnostic Panel and the Module Diagnostic Fault Panel. See 4.1.7.2 HD (High Density) Digital Input / Output Module Diagnostic Fault Panel.

(9) 24 Volt Power Box: The box displays the status of the 24 volt power. A gray box with a green " ✓ " symbol indicates the voltage is within acceptable limits. A flashing yellow box with a red " ✗ " symbol indicates the voltage is not within acceptable limits.

(10) Core Temperature Box: The box displays the core temperature of the displayed module.

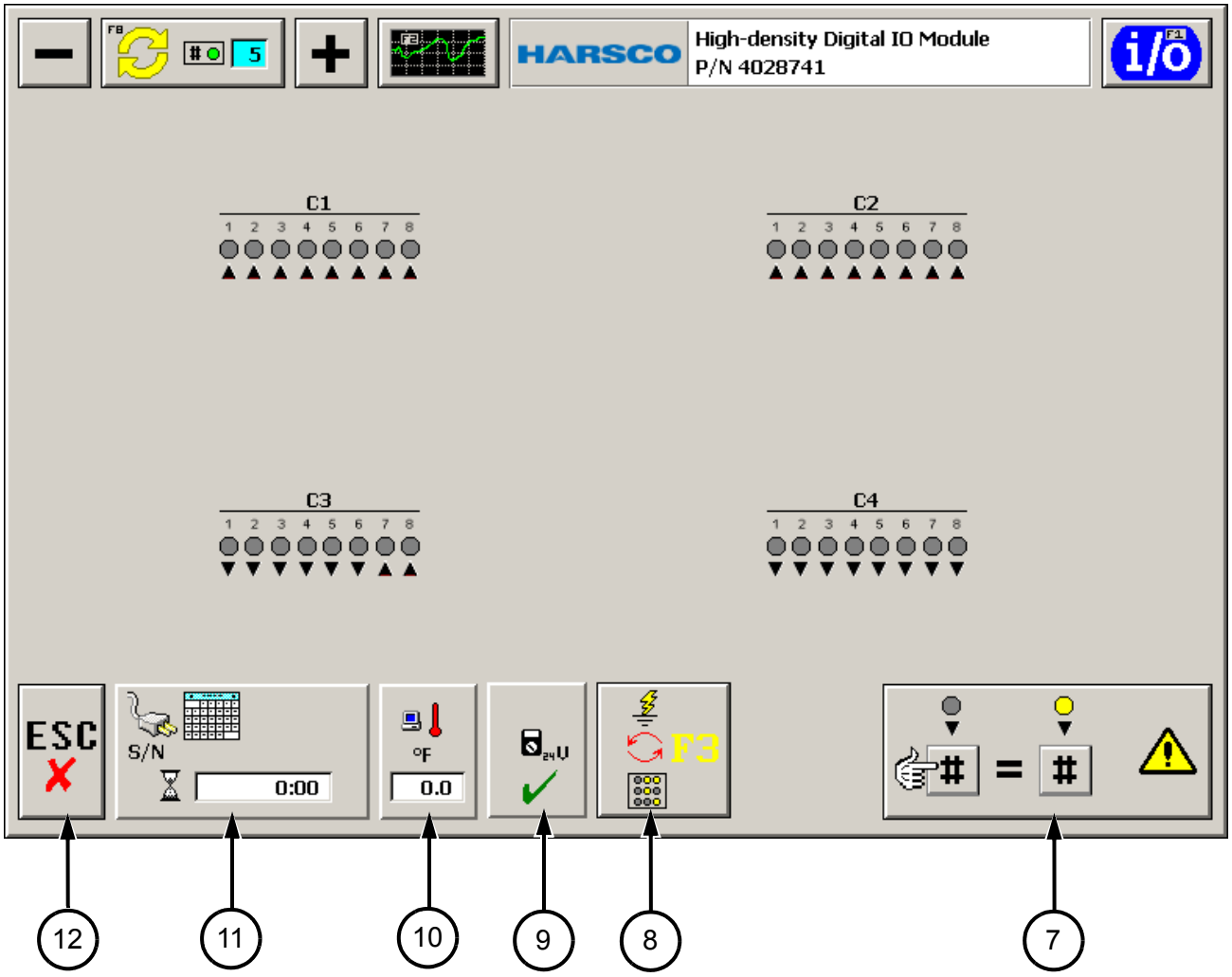
(11) Module Information Box: The box displays the activation date and the total hours of operation for the displayed module

(12) Escape Button: Press the button to remove this panel from the screen.

4.1 Jupiter Diagnostic Panels

4.1.7 HD (High Density) Digital Input / Output Module Diagnostic Panel

FIGURE 45
HD DIGITAL INPUT / OUTPUT MODULE DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.7.1 HD (High Density) Digital Input / Output Module Diagnostic Test Panel - See Figure 46

Press the Diagnostic Test Button (7) on the HD (High Density) Digital Input / Output Module Diagnostic Panel to display the Module Diagnostic Test Panel and enable the Diagnostic Test Mode. The button will appear as pressed in. Press the Diagnostic Test Button again to disable the Diagnostic Test Mode and return to the HD (High Density) Digital Input / Output Module Diagnostic Panel. The button will appear as popped out. The panel displays the following:

- **THE MACHINE IS "LIVE" AND COMPONENTS MAY ACTIVATE WHEN IN THE DIAGNOSTIC TEST MODE. ENSURE ALL PERSONNEL ARE CLEAR OF POTENTIAL DANGEROUS AREAS AND THAT ALL APPROPRIATE SAFETY MEASURES ARE TAKEN PRIOR TO USING THE DIAGNOSTIC TEST MODE. FAILURE TO COMPLY COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.**

(4) Connectors, Pins and Channel LEDs (C1 - C4): Each connector has eight channels that can be used as a digital input or output channel indicated by the direction of the Channel Arrows below the Channel LEDs. The Channel LEDs display the communication status of the connector's channels. The status of the Channel Arrows and Channel LEDs are as follows:

Input Channel LED Indicator and Arrow:
- Gray - Channel Is Off.
- Green - Channel Is On.

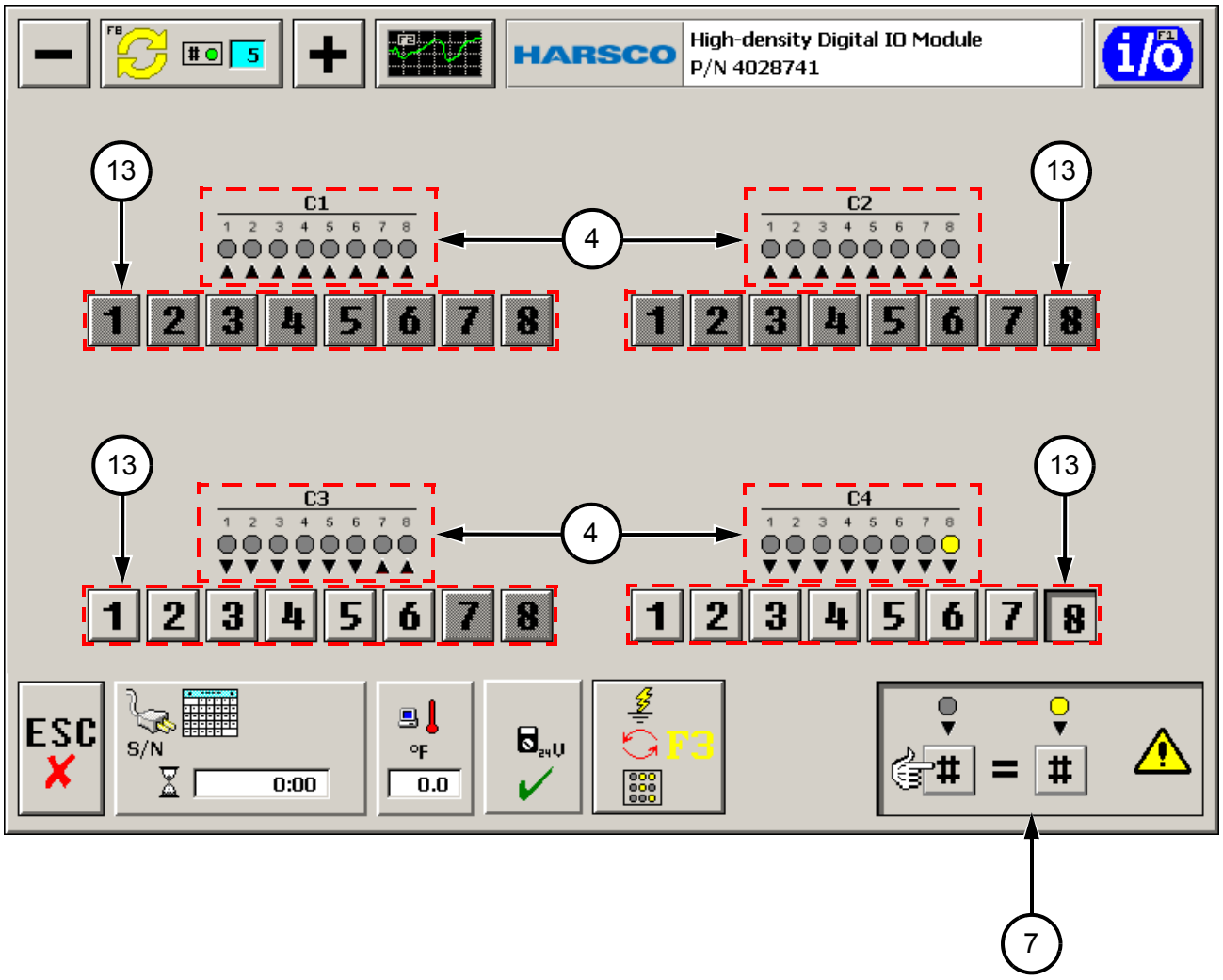
Output Channel LED Indicator an Arrow:
- Gray - Channel Is Off.
- Yellow - Channel Is On.
- Red - Power Fault.

(13) Channel Test Buttons (1 - 8): Each channel has a Diagnostic Test Button that will energize its output channel. If a channel is not used and/or if it is an input channel, the button (such as C4 - 1) will be a dark gray to indicate that it is not functional. If a channel is an output channel, the button (such as C4 - 5) will be a light gray to indicate that it is functional. To energize an output function, press and hold the button (such as C4 - 8). The button (such as C4 - 8) will appear as pressed in and its output channel LED will highlight yellow. When completed, release the button. The button will appear as popped out again.

4.1 Jupiter Diagnostic Panels

4.1.7.1 HD (High Density) Digital Input / Output Module Diagnostic Test Panel

FIGURE 46
HD DIGITAL INPUT / OUTPUT MODULE DIAGNOSTIC TEST PANEL



4.1 Jupiter Diagnostic Panels

4.1.7.2 HD (High Density) Digital Input / Output Module Fault Panel - See Figure 47

Press the Diagnostic Fault Button (8) on the HD (High Density) Digital Input / Output Module Diagnostic Panel to display the Module Diagnostic Fault Panel. Press the Diagnostic Fault Button again to return to the Module Diagnostic Panel. The panel displays the following:

(14) Fault Tables (C1 - C4): Each table displays from left to right, the connector number, channel number, ground short circuit counts, open circuit counts, and 24V short circuit counts. A channel that has a short or open circuit will highlight yellow in the column box. When the short or open circuit has been corrected, it will highlight white. The computer must be re-booted to clear the short and/or open circuit counts from the table. If a channel is not used, the table information for that channel will be blank with no information displayed. The status of the short and open circuit column boxes are follows:

Gray - No Short Circuit On Connector.
Yellow - Short Circuit On Connector.
White - Short Circuit On Connector Has Been Corrected.

When a short circuit occurs, the module will immediately turn off the output channel for 2 seconds to protect the wiring and allow it to cool. After this 2 second period expires, the output will be reactivated if the JAM is still commanding the output ON. If the short circuit still exists, this cycle will repeat. In this case, the error counts will appear to clear and count up once every two seconds.

Open circuits are detected whenever an output is activated ON but not when the output is OFF. Some outputs on the machine may not draw sufficient current to accurately detect an open circuit (such as relays). Consult your machine handbook for information on specific channels that do not report open circuits.

A digital output module will latch and report the open circuit error status when it occurs. As long as the JAM is commanding the output ON, this open circuit status may clear and reactivate, and the error counter will increment in the diagnostic table. This condition indicates an intermittent open.

However, if the open circuit status was latched and the JAM turned OFF the output before continuity was restored, the open will continue to be reported on the diagnostic panel. The output must be turned ON again for the open status to be detected again and cleared when continuity is restored.

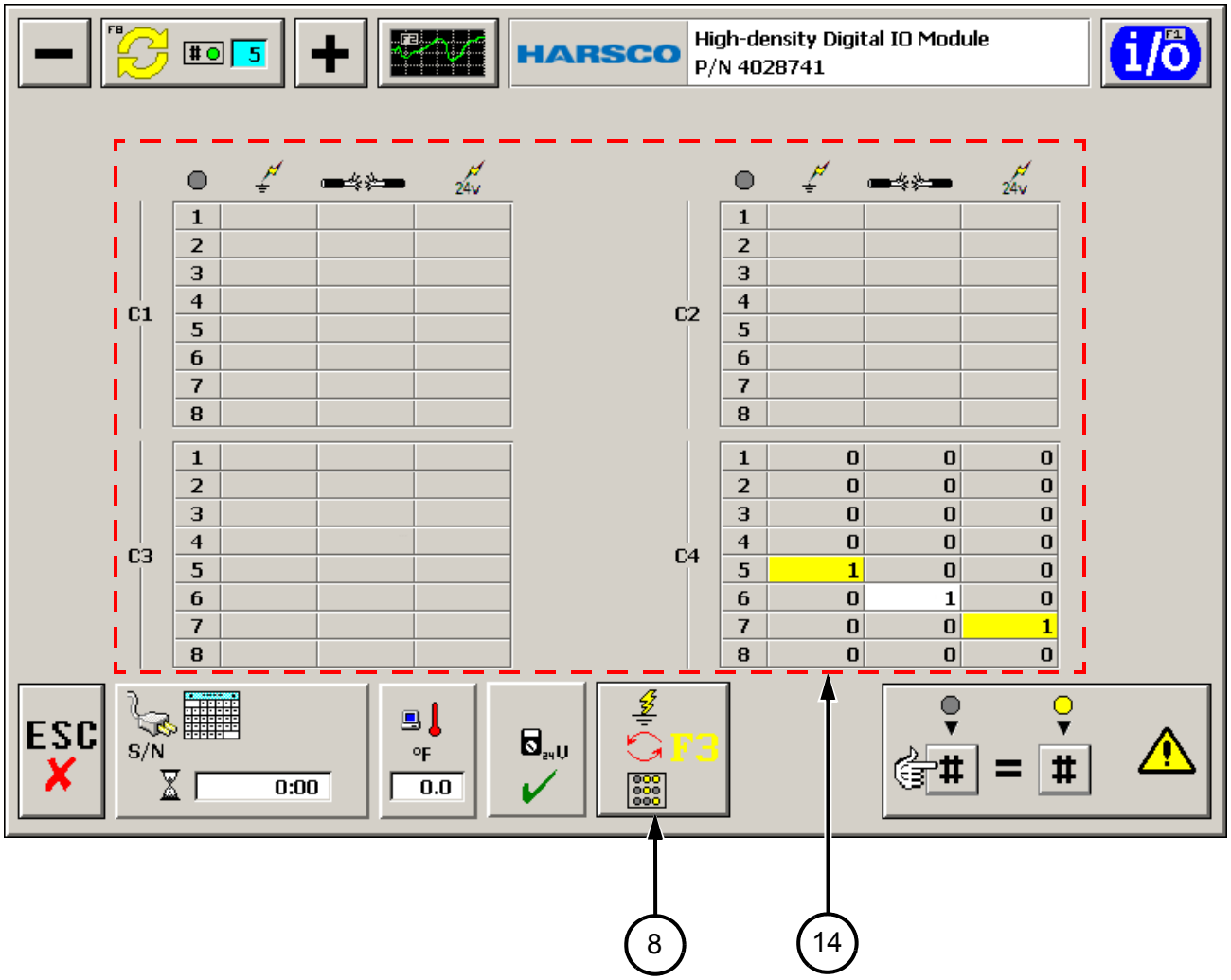
The “24 volt” short status is detected whenever the JAM is commanding the output OFF. This diagnostic means an outside source is powering the output when it should not be powered. Similar to an open circuit fault, a 24 volt short fault is latched and may clear while the output is OFF, and will persist while the output is ON until it is turned OFF again by the JAM.

The manual diagnostics can be used to manually test a channel having an open or 24 volt short in an attempt to clear a fault from the panel.

4.1 Jupiter Diagnostic Panels

4.1.7.2 HD (High Density) Digital Input / Output Module Fault Panel

FIGURE 47
HD DIGITAL INPUT / OUTPUT MODULE DIAGNOSTIC FAULT PANEL



4.1 Jupiter Diagnostic Panels

4.1.7.3 HD (High Density) Digital Input / Output Module Can 2 Diagnostic Panel - See Figure 48

The the HD (High Density) Digital Input / Output Module can communicate with other digital input / output devices, such as an engine ECM through its Can 2 connector. When connected, the Can 2 Diagnostic Panel is displayed in the upper right corner of the panel.

(15) Can 2 Diagnostic Panel: The diagnostic LED indicators show the communication status of the Can 2 link between the host module and the secondary device. The status of the LEDs are as follows:

(A) ERR LED Indicator:
- Gray - Normal operating state exists.
- Red - Bus error condition exists. Module cannot communicate with any target devices. This is often caused by a short circuit between the CAN H and CAN L wires somewhere in the network cabling or plugs. The TXD and RXD LEDs may also show solid red when a bus error condition exists. The WRN LED may blink during bus error conditions, indicating unsuccessful attempts to restart communication.

(B) WRN LED Indicator:
- Gray - Normal operating state exists.
- Red - Bus warning condition exists. Bus warnings often indicate broken or disconnected cables or incorrect wiring of the CAN H and CAN L signals. This condition may also occur briefly when there are intermittent communication errors detected between the module and one or more target devices. Incorrect target device address settings, bad hardware, or cable problems may be the cause.

(C) TXD LED Indicator:
- Green - Module has successfully transmitted at least one message to a target device.
- Red - Module transmissions were previously OK but presently faulty. A fault may occur when either the ERR or WRN LEDs are red or when a device on the Can 2 network cannot be contacted.
- Gray - Module has not yet transmitted a message.

(D) RXD LED Indicator:
- Green - Module is receiving messages from connected devices.
- Red - Module was receiving messages OK but presently faulty. A fault condition may arise when either the ERR or WRN LEDs are red or when the driver software on the module is receiving incorrect messages from devices on the Can 2 network.
- Gray - Module has not received a message yet.

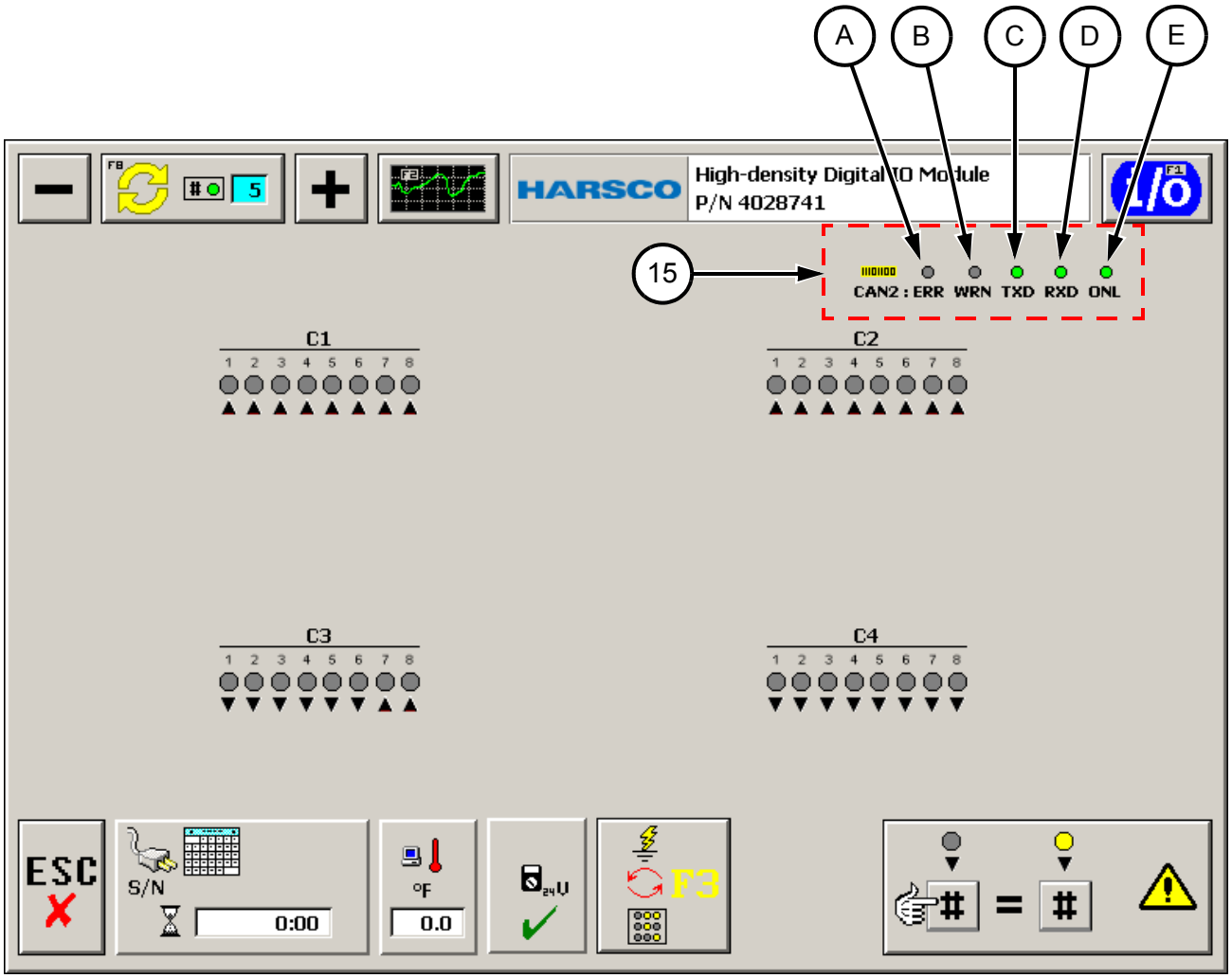
4.1 Jupiter Diagnostic Panels

4.1.7.3 HD (High Density) Digital Input / Output Module Can 2 Diagnostic Panel - See Figure 48

(E) ONL LED Indicator:
- Green - Module has established its online presence on the Can 2 network.
- Red - Module was previously online and is reconnecting.
- Gray - Module has not yet gone online.

The pins in the Can 2 plug are assigned as follows:
Pin 1 - field power common.
Pin 2 - 24V field power.
Pin 3 - CAN ground.
Pin 4 - CAN H signal.
Pin 5 - CAN L signal.

FIGURE 48
HD DIGITAL INPUT / OUTPUT MODULE CAN 2 DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.8 Digital to Analog Output Module Diagnostic Panel - See Figure 49

Some machines may be equipped with a Digital to Analog Output Module. The Digital to Analog Output Module is used to drive servo valves and other devices that require a precision voltage or current input for control. These devices may be driven in “open loop” fashion, where the JAM specifies the exact output to drive, or in “closed loop” fashion, where the Digital to Analog Output Module itself is provided with feedback information used to evaluate the amount of error in its output signal relative to an output set point nominated by the JAM. Each plug on the D2A module may be driven in open or closed loop fashion depending upon the application needs of the machine.

The Digital to Analog Output Module is designed to drive four independent output channels between -10 and +10 volts and -100 mA and +100 mA simultaneously on independent connector pins. Typically, the voltage output pin or current output pin is connected to the device being driven, but not both at the same time. In all cases, the current output is directly proportional to the output voltage (e.g. 100 mA = 10 v and -100 mA = -10 v).

4.1.8.1 Open Loop Mode Only

(1) Zoom Button: Press the Zoom Button or F8 key to switch between the Network View, Thumbnail View or Detailed Module Diagnostic Panels. This button displays the selected Network Module # (highlighted cyan) and the status of its Diagnostic LED.

(2) Minus (-) Button: Press the Minus (-) Button to select the previous module in the network.

(3) Plus (+) Button: Press the Plus (+) Button to select the next module in the network.

(4) Connectors and Pin Identification (C1 - C4): A description of the connector pin layout is located above the connectors, along the right side of the panel. Each analog output plug supports the voltage output on pin 3 and its ground connection on pin 4. The 100 mA current output connection is on pin 1 and its return connection is on pin 2. A voltmeter can be used to measure the voltage between pin 3 and pin 4 to determine the amount of current driven to a load connected on pin 1 (e.g. 5 volts measured = 50 mA output on pin 1).

(5) C1 - C4 Table: The Digital to Analog Output Module Diagnostic Panel displayed in Figure 49 illustrates a machine configuration where all four output channels are driven in open loop fashion by the JAM and there is no analog input module connected on CAN2 for feedback. The sliders on the right are disabled when there is no feedback module connected on the CAN2 connector.

In this configuration, the active sliders on the left indicate the actual voltage driven on each plug (C1 - C4), which is directly proportional to the milliamps driven on each plug. In open loop mode, the JAM is specifying the desired output voltage, even if the milliamps output pin is actually driving the load. A left slider is disabled if the corresponding plug is not used on the machine.

(6) I/O Information Button: Press the button or F1 key to display an I/O Information Panel on the currently selected module (highlighted cyan) listing the connectors and input / output descriptions. See I/O Information Panel.

4.1 Jupiter Diagnostic Panels

4.1.8 Digital to Analog Output Module Diagnostic Panel - See Figure 49

4.1.8.1 Open Loop Mode Only

(7) I/O Graphing Button: Press the button or F2 key to display an I/O Graphing Panel on the currently selected module (highlighted cyan) to monitor the properties of up to four different channels. See I/O Graphing Panel.

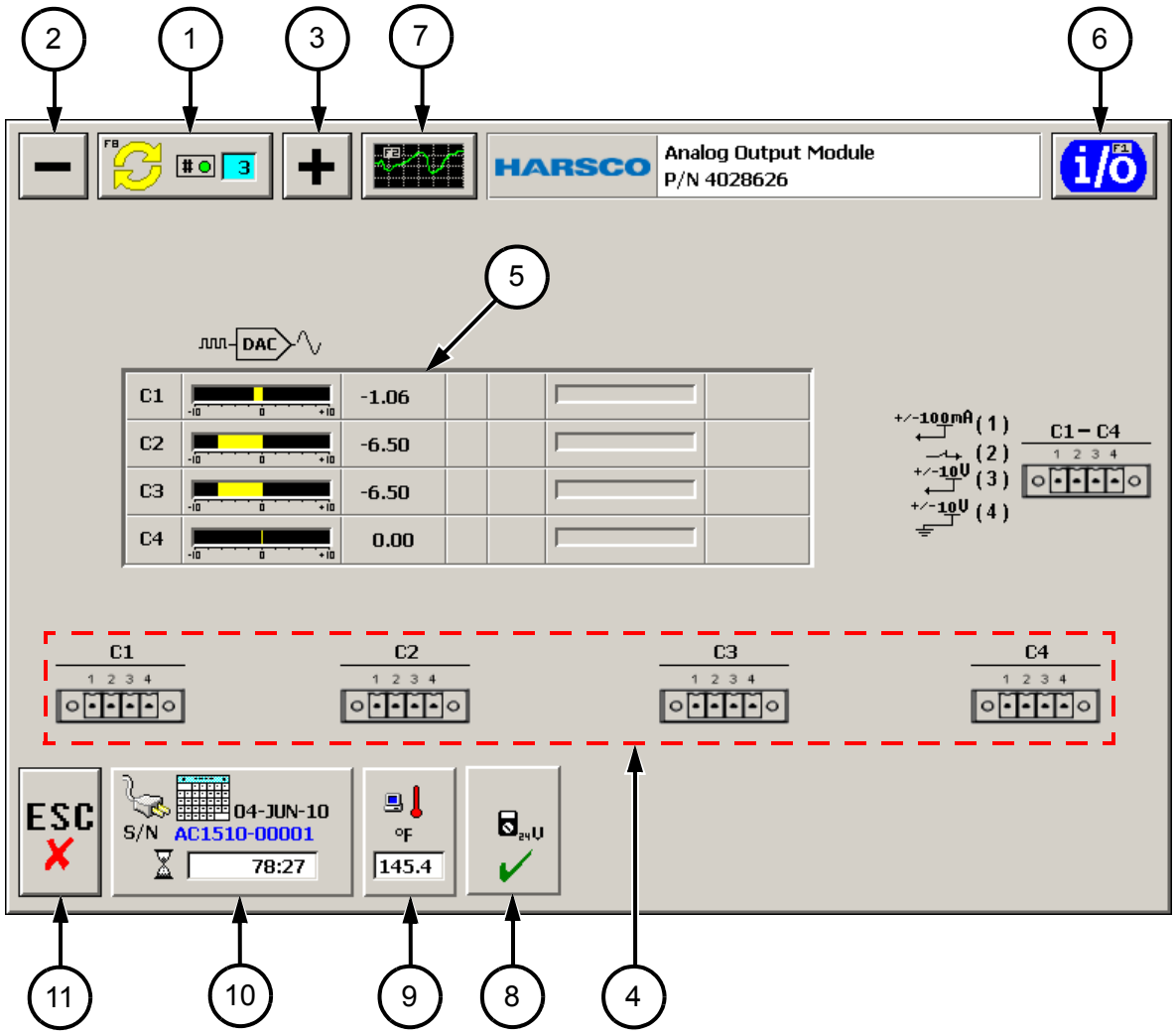
(8) 24 Volt Power Box: The box displays the status of the 24 volt power. A gray box with a green " ✓ " symbol indicates the voltage is within acceptable limits. A flashing yellow box with a red " ✗ " symbol indicates the voltage is not within acceptable limits.

(9) Core Temperature Box: The box displays the core temperature of the displayed module.

(10) Module Information Box: The box displays the activation date and the total hours of operation for the displayed module

(11) Escape Button: Press the button to remove this panel from the screen.

FIGURE 49
DIGITAL TO ANALOG OUTPUT MODULE DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.8 Digital to Analog Output Module Diagnostic Panel - See Figure 50

4.1.8.2 Open Loop Mode And / Or Closed Loop Mode

1. An analog input module can be connected to the Digital to Analog Output Module via a direct link over the CAN 2 connector. The analog input module provides feedback information on this link that the Digital to Analog Output Module continuously uses to determine how to directly change its output signal.

2. Figure 50 illustrates a machine configuration where an analog input module is connected on CAN2 to provide feedback for channels running in closed loop mode. In this case, C1 and C3 are presently driving a load in open loop mode and C2 and C4 are driving a load in closed loop mode. Depending on the machine software design, the JAM may optionally switch a channel into and out of closed loop mode at any time during the operation of the machine. Typically closed loop mode is entered when a machine work cycle is initiated.

3. On the C1 - C4 Sliders Table (5), the Digital to Analog output driven is displayed on the left and its corresponding Analog to Digital feedback channel status is displayed in the adjacent fields on the right. The arrow drawn in the center of each row is illuminated green when a Digital to Analog channel is using its corresponding Analog to Digital feedback channel in closed loop mode. A red " ✗ " symbol will be displayed over the arrow in the table for any channel that the JAM is commanding to use closed loop mode but one or all of the following conditions exist:

   a. The 24 volt field power to the module has been interrupted.
   b. The Digital to Analog module is not communicating at all with the JAM.
   c. The JAM is remote and not communicating with the local JAM over the Ethernet.
   d. There are CAN2 errors on the communication link between the Digital to Analog module and the Analog to Digital feedback module.
   e. The 24 volt field power to the Analog to Digital feedback module has been interrupted.
   f. The Digital to Analog module has detected errors in control parameters sent by the JAM.

4. The pointer (12) above each feedback channel slider indicates the JAM's desired set point relative to the feedback channel. The pointer is highlighted green when the channel is operating in closed loop mode.

5. The module icon (13) above the table indicates the module number of the analog input module providing the feedback via the CAN2 connection. Pressing this icon or the F3 key will display the module and its diagnostic status.

6. The Analog to Digital channel number used for feedback is displayed to the left of each feedback slider. This channel number may be changed by the JAM during machine operation. In some instances, a channel number "S1" through "S8" will indicate a value displayed that is a summation of values computed by the module, perhaps using several of the channel values provided by the Analog to Digital feedback module.

4.1 Jupiter Diagnostic Panels

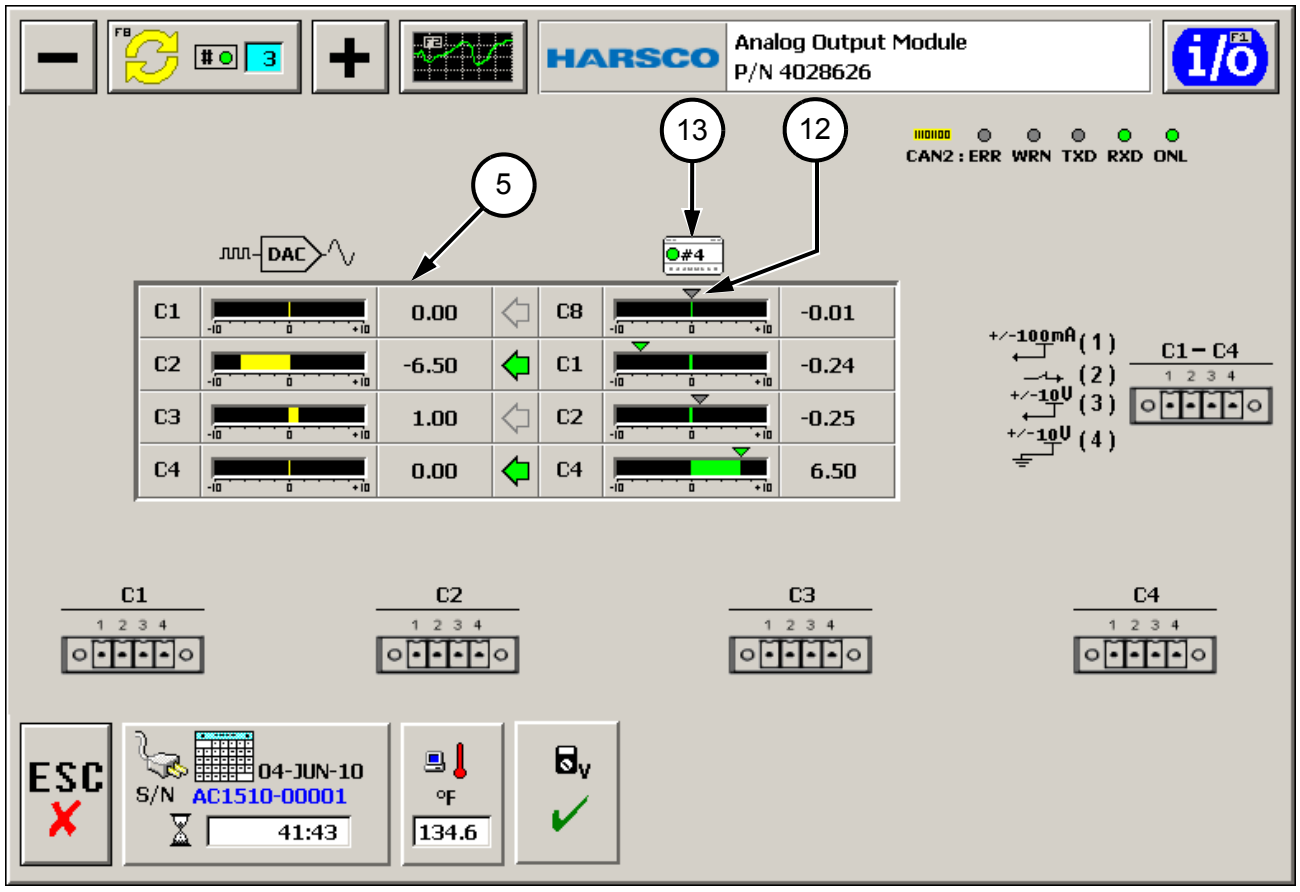
4.1.8 Digital to Analog Output Module Diagnostic Panel - See Figure 50

4.1.8.2 Open Loop Mode And / Or Closed Loop Mode

7. In the diagnostic screen example below, the Digital to Analog channel C2 has a set point of around -7 volts and is getting feedback from Analog to Digital channel C1, which is presently reading -0.24 volts. In the example, Digital to Analog channel C2 has not yet driven its output so that the feedback has reached the set point, while Digital to Analog channel C4 has already driven its output so that the desired set point is maintained.

8. The closed loop control software inside the Digital to Analog module evaluates the difference in the set point and the actual feedback values to determine the error in its output signal and continuously adjusts the Digital to Analog output so that the set point and the feedback values are identical. The Digital to Analog output values required are determined by the mechanical system in which the load is operating.

FIGURE 50
DIGITAL TO ANALOG OUTPUT MODULE DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.8 Digital to Analog Output Module Diagnostic Panel - See Figure 51

4.1.8.2 Open Loop Mode And / Or Closed Loop Mode

Any module using its CAN2 port to connect to another device will display a CAN2 status indicator in the upper right of its diagnostic panel. Thus, this indicator is displayed when an Analog to Digital module is configured on a machine to feedback to a Digital to Analog module, and the CAN2 diagnostic indicator is shown at the top right of both modules' diagnostics panel. The Digital to Analog module only receives data on CAN2, so only its RXD indicator is green when it is receiving feedback OK. The Analog to Digital feedback module only transmits channel data, so only its TXD indicator is green when it is transmitting feedback properly.

(14) Can 2 Diagnostic Panel: The diagnostic LED indicators show the communication status of the Can 2 link between the host module and the secondary device. The status of the LEDs are as follows:

(A) ERR LED Indicator:
- Gray - Normal operating state exists.
- Red - Bus error condition exists. Module cannot communicate with any target devices. This is often caused by a short circuit between the CAN H and CAN L wires somewhere in the network cabling or plugs. The TXD and RXD LEDs may also show solid red when a bus error condition exists. The WRN LED may blink during bus error conditions, indicating unsuccessful attempts to restart communication.

(B) WRN LED Indicator:
- Gray - Normal operating state exists.
- Red - Bus warning condition exists. Bus warnings often indicate broken or disconnected cables or incorrect wiring of the CAN H and CAN L signals. This condition may also occur briefly when there are intermittent communication errors detected between the module and one or more target devices. Incorrect target device address settings, bad hardware, or cable problems may be the cause.

(C) TXD LED Indicator:
- Green - Module has successfully transmitted at least one message to a target device.
- Red - Module transmissions were previously OK but presently faulty. A fault may occur when either the ERR or WRN LEDs are red or when a device on the Can 2 network cannot be contacted.
- Gray - Module has not yet transmitted a message.

(D) RXD LED Indicator:
- Green - Module is receiving messages from connected devices.
- Red - Module was receiving messages OK but presently faulty. A fault condition may arise when either the ERR or WRN LEDs are red or when the driver software on the module is receiving incorrect messages from devices on the Can 2 network.
- Gray - Module has not received a message yet.

4.1 Jupiter Diagnostic Panels

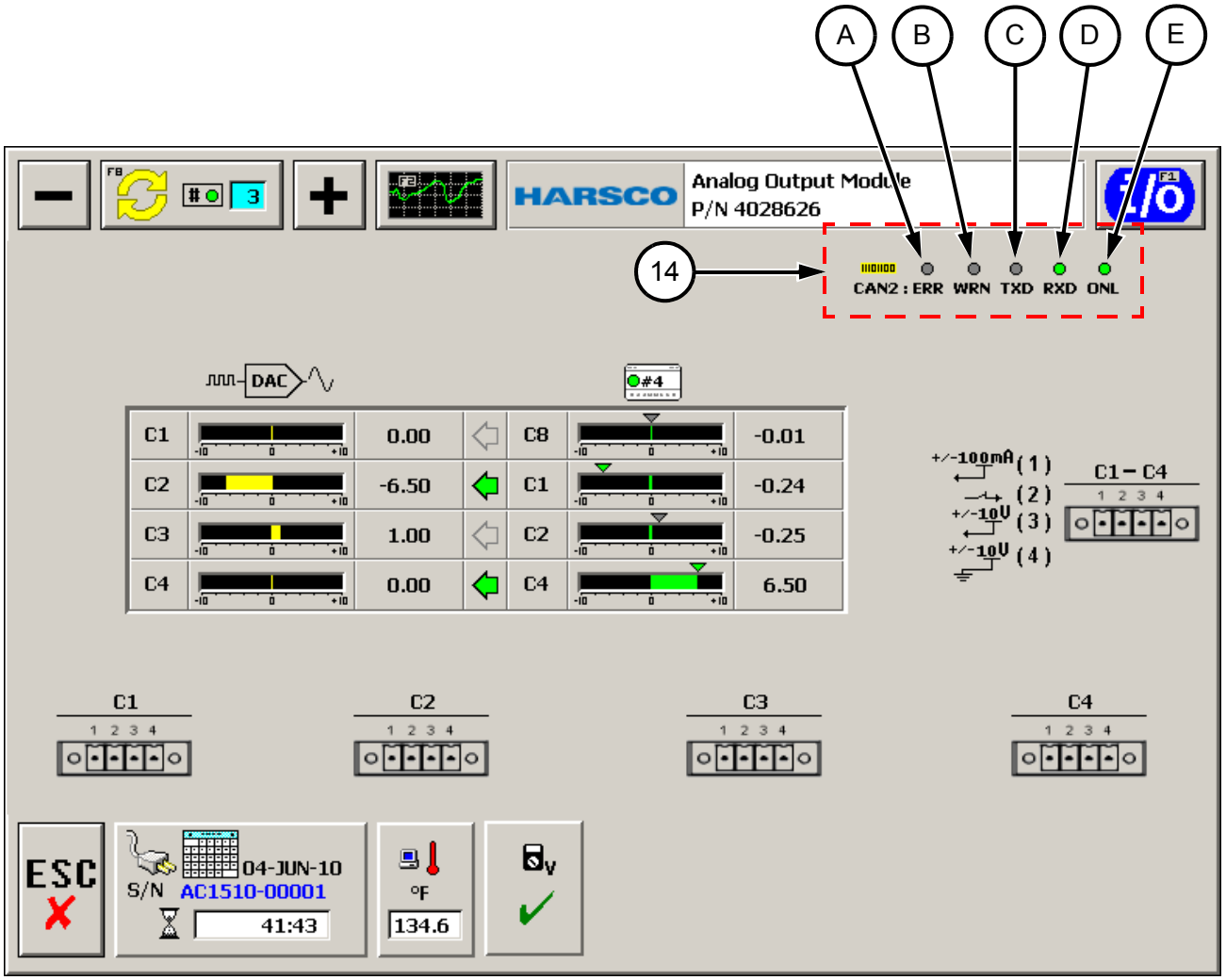
4.1.8 Digital to Analog Output Module Diagnostic Panel - See Figure 51

4.1.8.2 Open Loop Mode And / Or Closed Loop Mode

(E) ONL LED Indicator:
- Green - Module has established its online presence on the Can 2 network.
- Red - Module was previously online and is reconnecting.
- Gray - Module has not yet gone online.

The pins in the Can 2 plug are assigned as follows:
Pin 1 - field power common.
Pin 2 - 24V field power.
Pin 3 - CAN ground.
Pin 4 - CAN H signal.
Pin 5 - CAN L signal.

FIGURE 51
DIGITAL TO ANALOG OUTPUT MODULE DIAGNOSTIC PANEL



4.1 Jupiter Diagnostic Panels

4.1.9 I/O Information Panel - See Figure 52

Pressing the Input / Output (I/O) Information Button (1) on any of the Jupiter Diagnostic Panels will bring up the Input / Output (I/O) Information Panel. The Input / Output (I/O) Panel displays the following:

(2) The Car Number (if applicable), CAN Number and type of Module.

(3) The connector numbers and a description of the corresponding component that is associated with each connector.

(4) Use the Page Up or Page Down Buttons (4) to view I/O additional information for this module and other modules in the network.

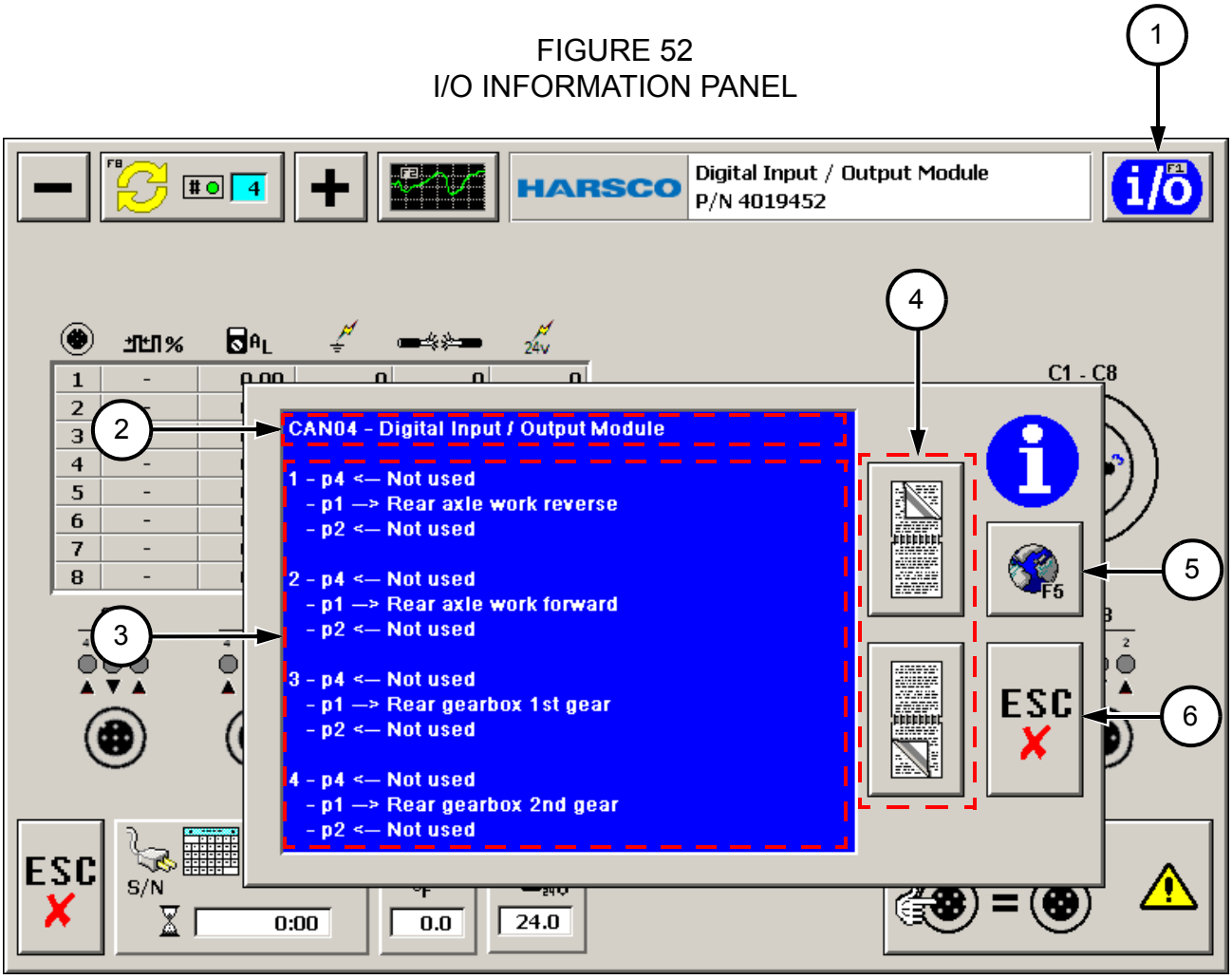
(5) Press the Globe Button or F5 key to change the displayed language.

(6) Press the Escape Button to remove this panel from the screen.

4.1 Jupiter Diagnostic Panels

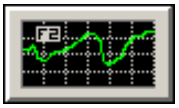
4.1.9 I/O Information Panel

FIGURE 52
I/O INFORMATION PANEL



4.1 Jupiter Diagnostic Panels

4.1.10 I/O Graphing Panel - See Figure 53



Press the I/O Graphing Button on any of the Jupiter Diagnostics Panels or the F2 key to display the I/O Graphing Panel on the screen. This panel may also be accessed from the Jupiter diagnostic drop-down panel. This panel is used to monitor the properties of up to four different channels on the network. The panel displays the following:

(1) Channel Button: The first line on the upper section of the Channel Button displays the Car Number (if applicable), CAN number, Connector number and Pin number. The second line on the upper section of the button displays the type of input / output that is being monitored.

The lower section of each Channel Button displays the circuit description and the actual value of the channel that is being monitored.

(2) I/O Graphs: The I/O Graphs display the actual value of the selected channel over a period of time by the use of a green line on the graph.

To monitor a different channel, touch any of the four Channel Buttons (1) to display the Channel Selection Panel.

Note: Only the four channels that are selected to be monitored record their data. When a new channel is selected to be monitored, the new channel data is displayed, starting at the time the new channel was selected. The previous channel data that was being recorded is replaced with the new channel data.

To adjust the amplitude setting or time line displayed on the I/O Graphs (2), touch on any of the four I/O Graphs (2) to display the I/O Graph Adjust Panel.

(3) The pointers (3) along the right side of the graphs indicate the present value of the selected channel.

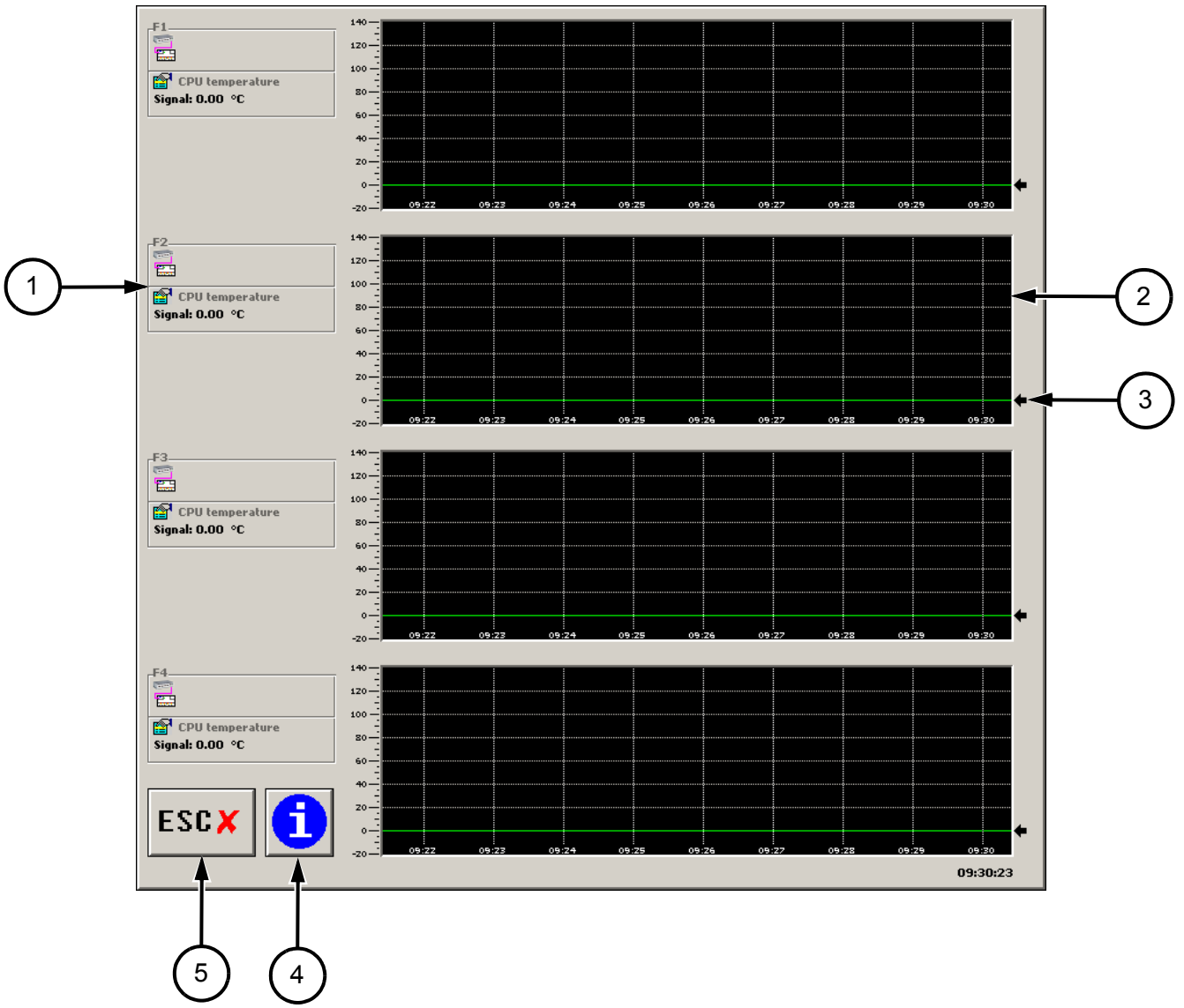
(4) Some Jupiter applications may include an Information Button for this panel. Press the Information Button (4) for the description of this panel.

(5) Press on the Escape Button (5) to remove this panel from the screen.

4.1 Jupiter Diagnostic Panels

4.1.10 I/O Graphing Panel

FIGURE 53
JUPITER INPUT / OUTPUT GRAPHING PANEL



4.1 Jupiter Diagnostic Panels

4.1.10 I/O Graphing Panel - See Figure 54

Touch anywhere on any of the four I/O Graphs to display the I/O Graph Adjust Panel. This panel is used to change and adjust the display of the graph. If a touchscreen or mouse are not being used, a PC keyboard or keypad buttons can be used to access the Graph Adjust Panels as well. Press and hold the function key (F1 to F4) for the desired channel's properties and then press the "zoom" key (F8 on the PC keyboard). You can also press and hold the zoom/F8 key first and then press the desired function key. This panel functions as follows:

Note: The I/O Graph Adjust Panel will automatically close after a few seconds if an action is not taken on the panel.

1. Use the Shift Zero Down (1) or Up (2) Buttons to move the 0 line displayed on the I/O Graph up or down. With a PC keyboard or keypads, the Page Down button shifts the 0 line down and the Page Up button shifts the 0 line up.

2. Use the Amplitude Decrease (3) or Increase (4) Buttons to adjust the amplitude setting displayed on the I/O Graph. With a PC keyboard or keypad, the Left Arrow (cursor) key decreases the amplitude, and the Right Arrow (cursor) key increases the amplitude.

3. Use the Time Decrease (5) or Increase (6) Buttons to adjust the time line displayed on the I/O Graph. The time line is adjustable from approximately 4 minutes to 3 hours. With a PC keyboard or keypad, the Minus "-" key increases the time period displayed and the Plus "+" key decreases the time period displayed.

4. The Property Selection Table (7) displays the available connector properties associated with this specific channel and connector type. The connector properties that is currently selected and being monitored is highlighted yellow.

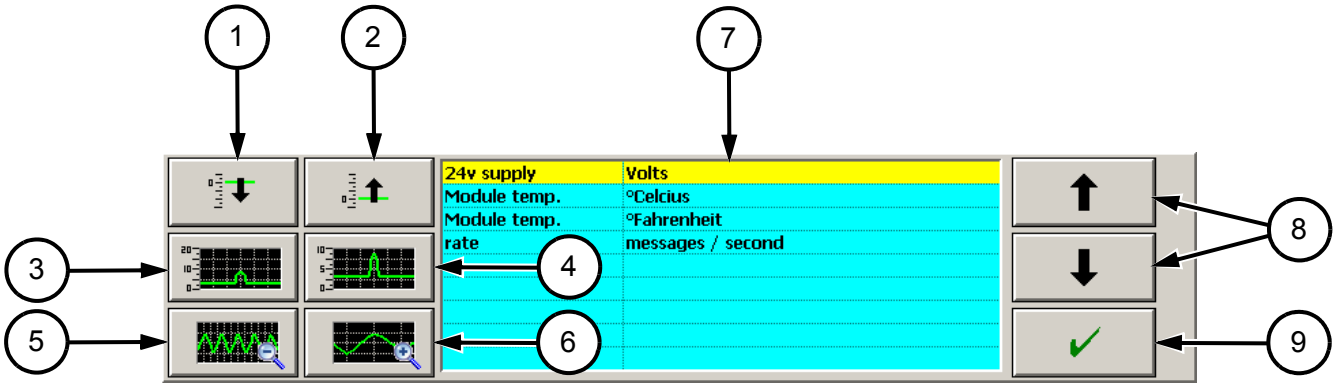
5. Touch the Property Selection Table (7) in the vicinity of the desired connector property that is to be monitored. Then use the Line Up or Down Buttons (8) to select and highlight yellow the desired connector property that is to be monitored. With a PC keyboard or keypads, the Up and Down arrow (cursor) keys are used to select the desired property from the table.

6. Press the Accept Button (10) or the Enter key to save any changes and remove this panel from the screen.

4.1 Jupiter Diagnostic Panels

4.1.10 I/O Graphing Panel

FIGURE 5-54
JUPITER INPUT / OUTPUT GRAPH ADJUST PANEL



4.1 Jupiter Diagnostic Panels

4.1.10 I/O Graphing Panel - See Figure 55

Touch any of the four Channel Buttons on the I/O Graphing Panel or the corresponding F1, F2, F3 or F4 keys to display the Channel Selection Panel. The Channel Selection Panel is used to select a different Channel (JAM Box, CAN Module, Connector and Pin) to monitor on the network. This panel functions as follows:

(1) The Channel Selection Table displays the JAM Box Name (if applicable), CAN Number, Connector Number, Pin Number, Circuit Function and Connected Device Description. The channel that is selected and being monitored is highlighted yellow.

(2) Use the Page Up or Down Buttons (2) to page the Selection Table up or down until the desired Channel is displayed.

(3) Touch the monitor screen near of the desired Channel to monitor. Then use the Line Up or Down Buttons (3) to select the channel. The selected channel will be highlighted yellow.

(4) Press the Accept Button (4) to save any changes and close the panel.

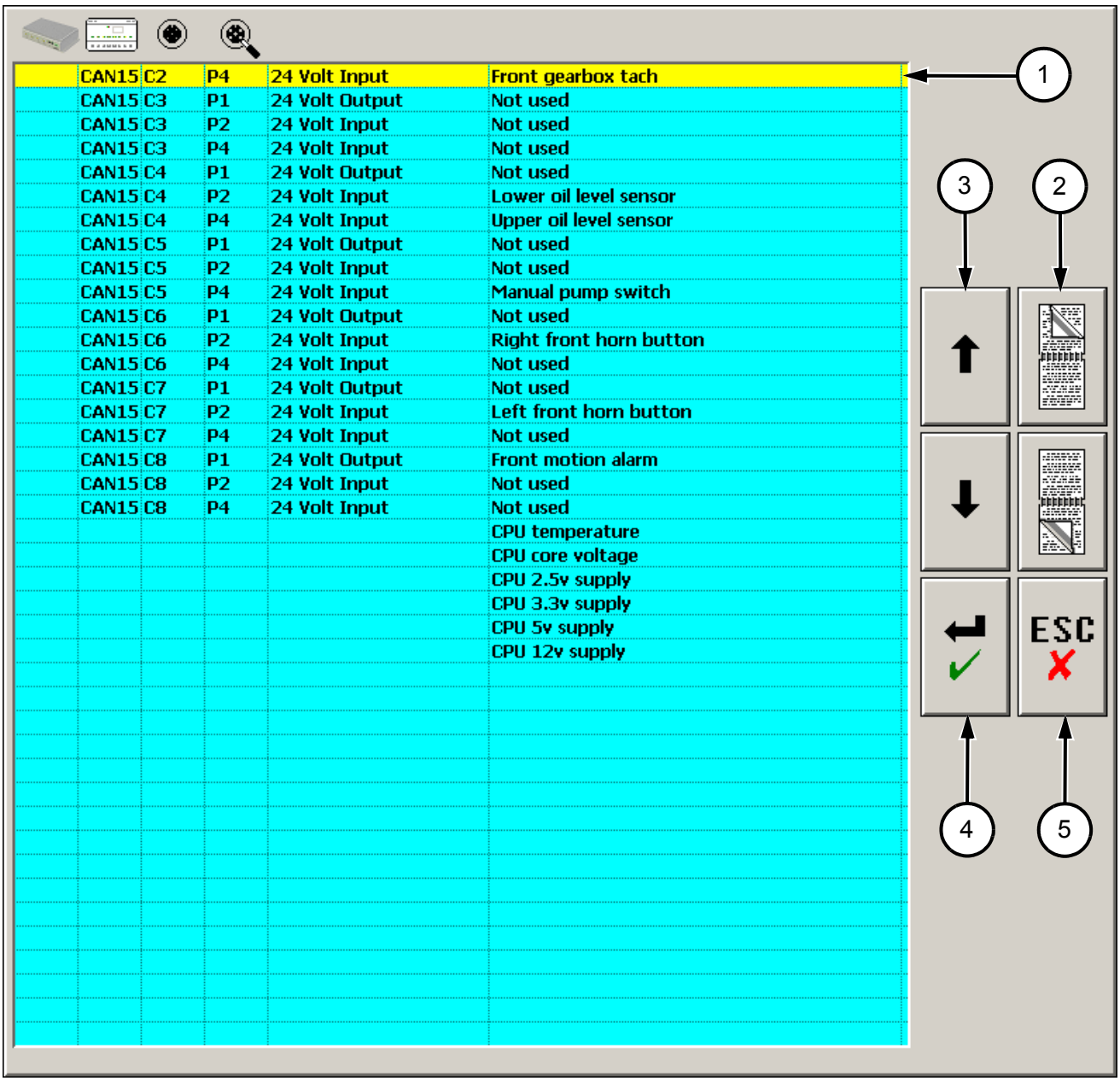
(5) Press the Escape Button (5) to discard any changes and close the panel.

If a different Channel was selected, the newly selected Channel will be displayed and monitored on the I/O Graph on the I/O Graphing Panel.

4.1 Jupiter Diagnostic Panels

4.1.10 I/O Graphing Panel

FIGURE 5-55
CHANNEL SELECTION PANEL



NOTES

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