

ClimateTalk 2.0

Water Heater Application Profile

Document revision: 01
Release: June 12, 2013

Abstract

ClimateTalk is a universal language for innovative, cost-effective solutions that optimize performance, efficiency and home comfort. The ClimateTalk Open Standards define a set of messages and commands to enable interoperability, enhanced user interface, and machine to machine control independent of the physical layer connecting the devices.

This document defines the application requirements corresponding to OSI Layer 7 that are specific to a water heater subsystem operation and interaction with other devices on a ClimateTalk network.

Copyright © 2013 by the ClimateTalk Alliance
2400 Camino Ramon
Suite 375
San Ramon, CA 94583 USA

All rights reserved.

This document and the information contained herein are provided on an "AS IS" basis and ClimateTalk Alliance DISCLAIMS ALL WARRANTIES EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO (A) ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OF THIRD PARTIES (INCLUDING WITH-OUT LIMITATION ANY INTELLECTUAL PROPERTY RIGHTS INCLUDING PATENT, COPYRIGHT OR TRADEMARK RIGHTS) OR (B) ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE OR NON-INFRINGEMENT. IN NO EVENT WILL CLIMATETALK BE LIABLE FOR ANY LOSS OF PROFITS, LOSS OF BUSINESS, LOSS OF USE OF DATA, INTERRUPTION OF BUSINESS, OR FOR ANY OTHER DIRECT, INDIRECT, SPECIAL OR EXEMPLARY, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES OF ANY KIND, IN CONTRACT OR IN TORT, IN CONNECTION WITH THIS DOCUMENT OR THE INFORMATION CONTAINED HEREIN, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH LOSS OR DAMAGE. All Company, brand and product names may be trademarks that are the sole property of their respective owners.

This document is subject to change without notice.

Updates

This specification may be updated at any time and may be superseded by a more recent version or amended to from time to time. Users should be certain they are using the current ClimateTalk version and the latest revision of the documents.

The released versions of all specifications are available at <http://www.ClimateTalk.org>

Version History

ClimateTalk Version	Document Revision	Release Date	Comments
V 2.0	00	2013-01-18	Initial Release
V 2.0	01	2013-06-12	No changes. Revision increment for package release.

Contributors

The following is a list of ClimateTalk Alliance member companies that were actively engaged in the development of this standard:

A.O. Smith Water Products Company

Arzel Zoning Technology Inc.

ecobee inc.

eControls, Inc.

Emerson Electric Company

EWC Controls

Nogginhaus LLC

Research Products Corp.

Rheem Manufacturing Company

Zonefirst

Table of Contents

1.0	OVERVIEW	6
1.1	CLIMATE TALK MODEL	6
1.2	SCOPE	6
2.0	NORMATIVE REFERENCES	8
3.0	TERMINOLOGY	9
3.1	DEFINITIONS	9
3.2	ACRONYMS	10
3.3	WORD USAGE	11
4.0	INITIAL INSTALLATION REQUIREMENTS	12
4.1	CONFIGURATION	12
4.2	SYSTEM DETERMINATION	12
4.2.1	<i>Subsystem Capabilities</i>	<i>12</i>
4.3	NETWORK NODE LIST	12
4.3.1	<i>Node Type</i>	<i>13</i>
5.0	WARM AND COLD START PROCEDURES	14
5.1	TYPES OF START UP	14
5.2	COLD START PROCEDURE	14
5.3	WARM START PROCEDURE	14
5.3.1	<i>Warm Start Procedure – Water Heater</i>	<i>14</i>
6.0	EASE OF INSTALLATION REQUIREMENTS	15
6.1	DEVICE NAME ASSOCIATION	15
6.1.1	<i>Device Name Association Assumptions</i>	<i>15</i>
6.1.2	<i>Device Name Association Process</i>	<i>15</i>
6.2	AUTOMATIC SYSTEM VERIFICATION	17
6.3	IDENTIFICATION PARAMETERS	17
6.4	USER MENUS	18
6.5	SUBSYSTEM INSTALLATION TEST	18
7.0	NORMAL OPERATION	19
7.1	SUBSYSTEM FUNCTIONS	19
8.0	DIAGNOSTICS	20
8.1	FAULT REPORTING	20
8.2	SUBSYSTEM BUSY	20
8.3	PROACTIVE DIAGNOSIS	20
8.3.1	<i>System Operation Monitoring</i>	<i>21</i>
8.3.2	<i>Missing Subsystem</i>	<i>21</i>
8.3.3	<i>Missing Thermostat, User interface</i>	<i>21</i>
8.3.4	<i>Current Diagnostic Message</i>	<i>21</i>
8.3.5	<i>Informational Messaging</i>	<i>21</i>
9.0	WATER HEATER APPLICATION MESSAGE TYPES	22
9.1	WATER HEATER APPLICATION RECEIVED MESSAGE TYPES	22

9.2	WATER HEATER APPLICATION TRANSMITTED MESSAGE TYPES	23
10.0	REMOTE ACCESS	24
10.1	CONFIGURATION.....	24
10.2	OPERATIONAL STATUS	24
10.3	OPERATIONAL ABILITIES	24
10.3.1	<i>Control Commands with a restricted subset of allowed parameters.....</i>	<i>25</i>
10.3.2	<i>Water Heater Modify Command Codes</i>	<i>25</i>
11.0	WATER HEATER MESSAGE DATA INTERFACES	27
11.1	WATER HEATER CONFIGURATION MESSAGE DATA INTERFACE.....	27
11.2	WATER HEATER STATUS MESSAGE DATA INTERFACE	43
12.0	ANNEX A – BIBLIOGRAPHY	49

List of Figures

Figure 1 - OSI Layers for ClimateTalk Implementation	7
Figure 2 - Device Name Association Sequence Diagram	16

List of Tables

Table 1 – Passive Subsystems & Functions	12
Table 2 – Water Heater Application Received Messages	22
Table 3 – Water Heater Application Transmitted Messages	23
Table 4 – Remote Access Supported Operations	24
Table 5 – Example Water Heater Modify Commands	26
Table 6 – Water Heater Configuration Message Data Interface	27
Table 7 – Water Heater Status Message Data Interface	43

1.0 Overview

1.1 ClimateTalk Model

ClimateTalk is an open standard that defines a set of messages and commands to enable interoperability, enhanced user interface, and machine to machine control independent of the physical layer connecting the devices.

The messages and commands defined by ClimateTalk Information Model (CIM) are the presentation and application layers as defined by the OSI Model¹. ClimateTalk Applications are fully defined at Layer 7 of the OSI model by a combination of a Device Specific Application Profile, the Generic Application Specification and the Command Reference.

ClimateTalk messages can be carried over any physical medium following the OSI model. The ClimateTalk Presentation Layer defines how messages are executed over the various physical mediums in use.

CT-485 and CT-LWP are wired serial physical and network layers designed to support the formation of ClimateTalk networks and transport ClimateTalk messages, but other OSI based protocols – including wireless transports - can be used as well.

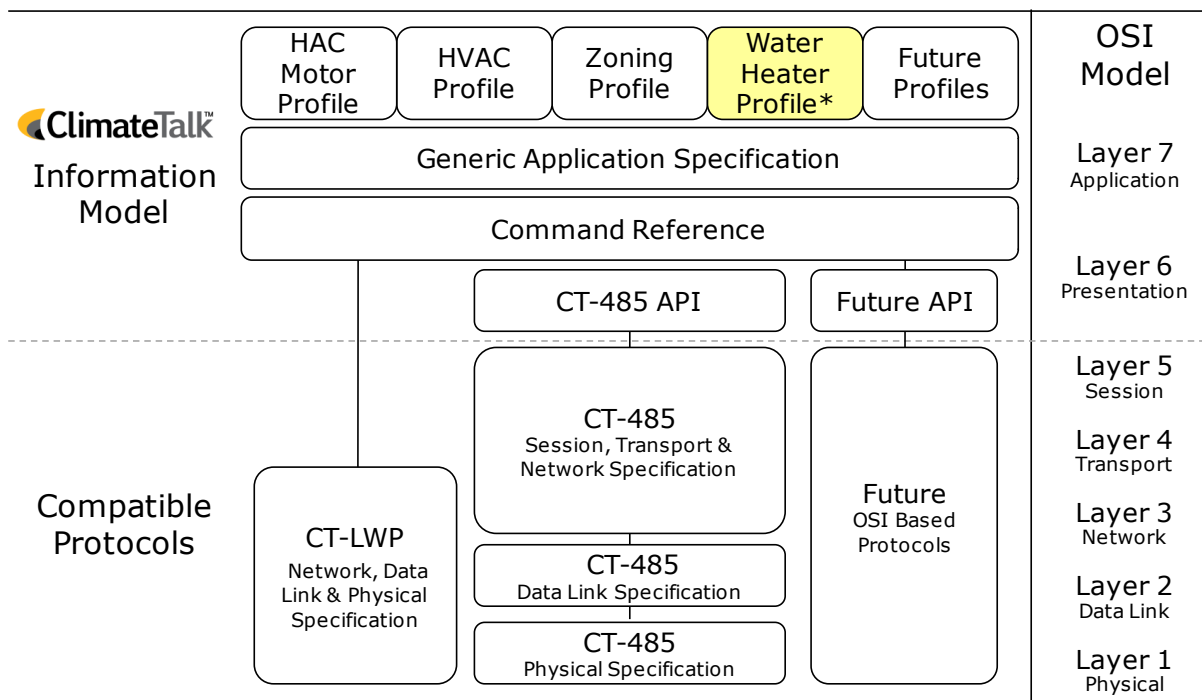
1.2 Scope

This document defines the specific application requirements for a Water Heater subsystem designed to ClimateTalk Open Standards. This profile defines how a water heater operates, monitors and interacts with other devices on a ClimateTalk network. This profile builds on the *Generic Application Specification* defining requirements common to all ClimateTalk enabled devices.

The ClimateTalk Open Standards package shown in Figure 1 - OSI Layers for ClimateTalk Implementation prescribes the mandatory requirements to ensure proper network formation of interoperable devices. Membership in the ClimateTalk Alliance as well as successful completion of mandatory conformance testing is required for listing a product as a ClimateTalk Certified Device.

¹ http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=20269

Figure 1 - OSI Layers for ClimateTalk Implementation



**This Document*

This profile also defines the testable requirements used to validate that a Water Heater is behaving properly within a ClimateTalk network. Each device must comply with the mandatory requirements defined in this document as well as all other ClimateTalk standards applicable to the device functionality.

2.0 Normative References

A good understanding of the most recent version of the following documents is required to apply the contents of this specification correctly.

ClimateTalk Generic Application Specification

ClimateTalk Command Reference

ClimateTalk CT-485 Application Protocol Interface

ClimateTalk CT-485 Networking Specification

ClimateTalk CT-485 Data Link Specification

ClimateTalk CT-485 Physical Specification

3.0 Terminology

3.1 Definitions

Attempt Delay	The amount of time a subsystem waits for a response from another subsystem to a request.
Balance Point	The outside temperature below which the thermostat will switch to alternate heating sources when the primary heat source is a heat pump.
Cold Start	A start of a subsystem from a state of not being powered to being powered.
Coordinator	ClimateTalk device which establishes the network and through which messages are routed.
Critical Fault	A subsystem with a critical fault is one that is not able to do its core functionality and is notifying the other subsystems for fault tolerant operation.
Minor Fault	A subsystem with a minor fault is one that has a fault but is still able to do its core functionality.
Profile	Set of rules governing the implementation of certain aspects of the protocol, which will include timings and communication rules to function properly.
Shared Data	Configuration is information for each subsystem on the network that is stored by multiple subsystems on the network. This allows for automatic configuration of replacement subsystems.
Subordinate	ClimateTalk subsystem node. Subordinates may not speak until spoken to by the coordinator.
User Interface Device	Any device capable of accessing, displaying, and modifying a user menu.
Warm Start	A re-start of a subsystem from a state where the subsystems need to return to idle and relearn the network. This is defined as receiving a network node list.

3.2 Acronyms

AC	Air Conditioner
AH	Air Handler
DBID	Database Identification
EU	Engineering Units
GW	Gateway
HP	Heat Pump
IEEE	Institute of Electrical and Electronics Engineers
IFC	Integrated Furnace Control
MDI	Message Data Interface
OAT	Outside Air Temperature
RAT	Return Air Temperature
SAT	Supply Air Temperature
SW	Software
SD	Shared Data
TSTAT	Thermostat
WH	Water Heater
XOVER	Crossover (Formerly Known as OBBI)
ZCTRL	Zone Controller
ZTC	Zone Temperature Control

3.3 Word Usage

The conventions used in this document are modeled after the definitions of the 2009 IEEE Standards Style Manual. The IEEE Standards Style Manual may be obtained from <http://standards.ieee.org/guides/style/>.

can	Equivalent to <i>is able to</i> or <i>is capable of</i> .
may	Equivalent to <i>is permitted to</i> or <i>is allowed to</i> . The use of <i>may</i> means that something is optional, and does not imply a requirement.
must	Used to describe situations where no other course of action is possible.
shall	Equivalent to <i>is required to</i> . Use of the word <i>shall</i> means that the specification shall be implemented exactly as described in order to ensure correct operation and interoperability with other devices.
should	Equivalent to <i>is recommended that</i> . This is used in situations where there are several possible options, but one option is preferable to the others.

4.0 Initial Installation Requirements

4.1 Configuration

Subsystems shall be auto-configurable over the network to facilitate system setup. A configuration request may be made to a water heater on the network. The reply data payload shall have enough well defined information to configure the water heater based on its actual capabilities.

Refer to Section 11.1 Water Heater Configuration Message Data Interface for a more specific bit-by-bit break down of the exact detail of the information sent back on the network by a Water Heater.

4.2 System Determination

A Water Heater is required to operate as a standalone controller and thus it does not need other systems to be active on a network to perform its operation. If a Water Heater detects other nodes on the network, it shall be able to provide its configuration data (defined in this document) and identification data (defined in the *ClimateTalk Command Reference*) when requested. The information may be used by other devices (for example: thermostat) to determine its capabilities and uniquely distinguish it from other Water Heaters on the network.

4.2.1 Subsystem Capabilities

Passive subsystems are nodes with no requirement other than to provide data for the active subsystem's application specific requirements. Examples of passive subsystems that might be part of a Water Heater system application are listed in Table 1 – Passive Subsystems & Functions.

Table 1 – Passive Subsystems & Functions

Subsystem	Function
Leak Sensor	Detects any leaks in the tank
Outdoor Sensor	Communicates the Outdoor temperature
CO Sensor	Detects any CO and alerts the subsystems

Other subsystems not included in the above list may be also connected to the network, and if available, can share data with the water heater subsystem.

4.3 Network Node List

Upon receiving a network node list from the network, the subsystem shall determine the actual network environment from the data payload. The list identifies the subsystem's own network status and what other nodes are active on the network.

A subsystem shall consider itself online only after receiving a node list with itself being identified in the node list. For devices where multiple instances of a subsystem can be on the network, the network node list message should be inspected to see which instance of the node in the node list corresponds to the subsystem receiving the message. Refer to Send Method 0 explanation in the *ClimateTalk Generic Application Specification* for more information.

If the subsystem is online and receives a network node list, the subsystem will initiate a warm restart. See Section 5.3 Warm Start Procedures for details.

4.3.1 Node Type

Each subsystem is assigned a node type. The node type is used by other subsystems to determine what devices are present on the network and therefore what functions the system is capable of performing.

Refer to the *ClimateTalk Command Reference* for the list of node types and their values.

5.0 Warm and Cold Start Procedures

The follow section defines the requirements for a Water Heater to become active on a ClimateTalk CIM network.

5.1 Types of Start Up

Two types of start-up are defined, cold start and warm start. A cold start occurs when the device is powered up initially or after a power failure. A warm start occurs when the device receives a new network node list from the coordinator.

5.2 Cold Start Procedure

All subsystems shall do the following:

- Start up in default state.
- Wait to receive a network node list.
- Enter into Warm Start procedure after a predefined time.
- On receiving the node list, do Warm Start Procedure.

5.3 Warm Start Procedure

The following procedures are defined for subsystems working with the Water Heater profile. These subsystems may include subsystem specified in other profiles.

5.3.1 Warm Start Procedure – Water Heater

- Check the network node list. Am I on the list?
- If no, skip the warm start procedure and continue with normal operation.
- If yes, continue on with the warm start procedure.

- Check to see if fault conditions exist.
- If no, transmit a Diagnostics Set – Clear message to the User Interface if it is available. Send the Diagnostics Set message to the thermostat.
- If yes, transmit a Diagnostics Set – Message to the User Interface if it is available. Send the Diagnostics Set message to the thermostat.

Subsystem is now considered to be a communicating node on the network.

6.0 Ease of Installation Requirements

The following section provides guidelines on how to simplify installation of this system.

6.1 Device Name Association

Device name association provides a method to name a device. Display user interfaces may use device names to help distinguish between several devices of the same node type.

6.1.1 Device Name Association Assumptions

The device name association defined in this section was developed with the following list of assumptions:

- Multiple water heaters may be installed on the same network.
- The user shall have the capability to change name association at any time.
- The network must contain a thermostat or a user interface capable of working with multiple water heater controls.
- Each water heater shall have a unique identifier (i.e. Identification Serial Number) that is stored in the device (Identification MDI requirement)
- The serial number is printed on a control label.
- Each water heater supports user menus. For instance a user menu may contain a list of selectable name options (Water Heater 1, Water Heater 2, Water Heater X, Upstairs, Downstairs, etc.

6.1.2 Device Name Association Process

The following information is required for the device name association process:

- Unique identifier of each water heater to be named

The reference to 'thermostat' in this section is for illustration only and represents any User Interface (UI) device capable of accessing and displaying a user menu.

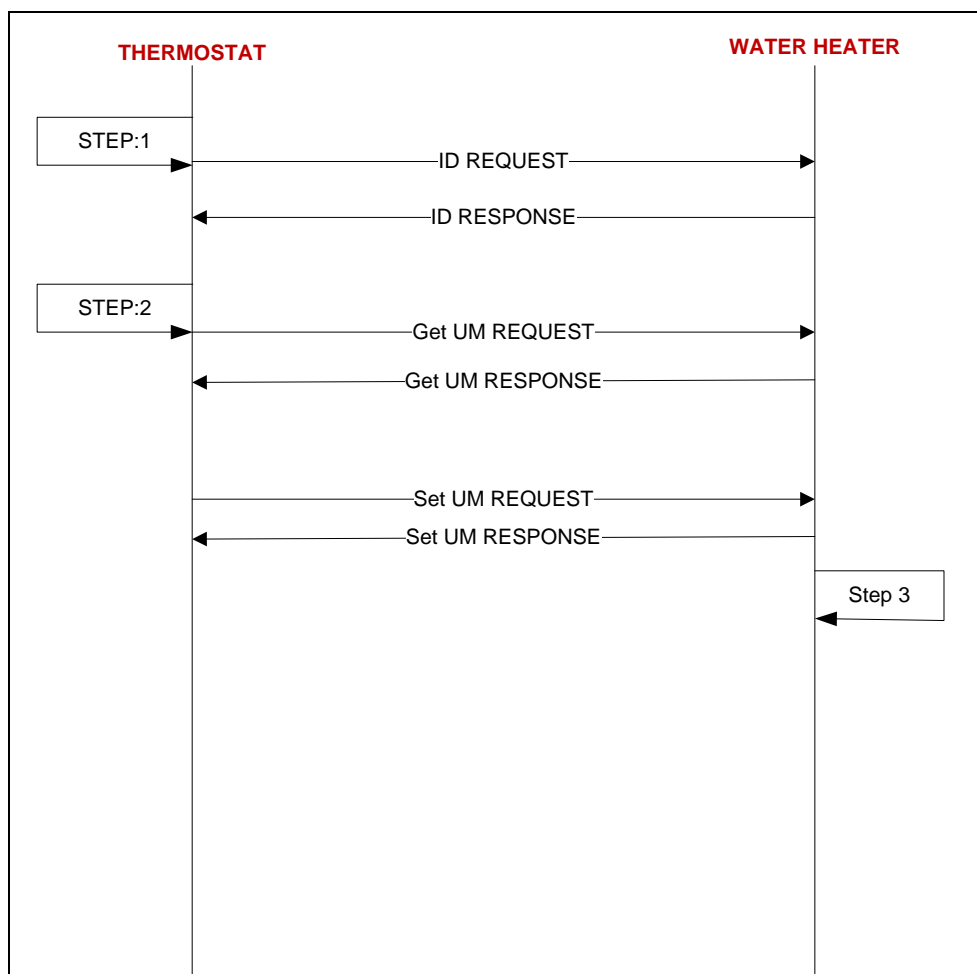


Figure 2 - Device Name Association Sequence Diagram

ID = Identification Message Data Interface (MDI) message
 UM = User Menu
 UI = User Interface

- Step 1:
 - Upon receiving a new network node list, UI shall initiate an ID Pull request of all available water heaters on the network.
 - Upon receipt of a valid ID pull response, the UI can use the Identification Data of each water heater on the network to uniquely identify them within the same network.
 - Included in the identification data is a unique Serial Number and an optional Control Name.
 - If the Control Name is populated it may be used for display purposes.
 - The default Control Name will be a NULL character = 0x00

- If the Control Name is not populated, the UI shall choose a display name that provides an indication of the name indicated by the node type and Serial Number.
- Step 2:
 - For a first time Control Name selection: User selects the device with a display name containing a Serial Number that matches the Serial Number on the device label.
 - The user would then navigate to a user menu provided by that water heater. This user menu shall offer the user the option to select from one of the names offered by the water heater. For instance, the Water Heater could offer options like Water Heater 1, Water Heater 2, Water Heater X, Upstairs, Downstairs, etc.
- Step 3:
 - After the water heater receives an indication of a successful user menu update, it shall update its Identification Control Name to match the name selected by the user.
 - Once the water heater has updated its Identification Control name, it shall initiate a warm restart. This will cause the coordinator to generate a new node list. This node list causes the thermostat to issue a Get Identification request per step 1 which provides the updated Control Name.

6.2 Automatic System Verification

The system may provide for verification of the installed system and give the installer feedback about problems that can be detected by the system and their resolution.

6.3 Identification Parameters

All subsystems shall store the following minimum identification information:

- ClimateTalk specification version number,
- Unique Serial Number
- Application software version number
- Application software revision number

Additional parameters are detailed in each subsystem's Identification MDI. This optional Identification MDI may include details such as installation date, address of installation, etc. that can be used during end of life or fault trend analysis. Additional details regarding Identification Data are contained in the *ClimateTalk Command Reference*.

All subsystems shall respond to an identification message request with a payload containing the Identification MDI. Note that the mandatory and optional part of the identification message are not demarcated by DBIDs, hence a subsystem not implementing any of the optional Identification parameters shall fill these bytes with Nulls. If the subsystem supports

the optional parameters, it shall accept an Identification Message Set with the values for these optional parameters.

A subsystem shall respond to an Identification Set Control command and set its identification parameters to the values contained in the data payload of the command. It also shall respond to an identification request with a payload containing the version numbers of the ClimateTalk Application, Software Version, Software Revision, and Unique Serial Number at the minimum.

6.4 User Menus

Water Heater shall support User Menu capabilities. Refer to *ClimateTalk Generic Application Specification* for requirements for implementing User Menu functionality.

6.5 Subsystem Installation Test

A display device can initiate a subsystem installation test on any subsystem by issuing a subsystem installation test control command. It is optional for the display device to support an interface to initiate and monitor a Subsystem Installation Test. It is also optional for subsystems to implement this feature. If a subsystem does not support a Subsystem Installation test and if it receives a request to perform one, it shall respond with an Unknown Application Message. The format of this message is defined in the *ClimateTalk Generic Application Specification* in the section on Error Reporting.

7.0 Normal Operation

7.1 Subsystem Functions

The water heater shall be capable of operation as a standalone subsystem. As such, no subsystem commands are required for operation.

8.0 Diagnostics

8.1 Fault Reporting

Subsystems shall report any faults to the thermostat or user interface device via a Set Diagnostics Message. For a water heater subsystem, the thermostat or the user interface is the primary controller. The water heater controller can transmit the fault message to other display devices on the network.

If the subsystem supports diagnostic messaging, then the subsystem is responsible for clearing fault messages when the fault has been resolved. Subsystems are also responsible for transmitting a diagnostic message at every Warm Restart.

All subsystems on the network may inform the contractor or home owner of any problem with its operation, usually through a message area on a display device.

There are two types of faults: major and minor. Major faults mean the subsystem is inoperable, minor faults mean the subsystem needs maintenance.

The diagnostic message shall indicate either a major fault code or a minor fault code, and include an alphanumeric message of up to 15 characters. See the *ClimateTalk Command Reference* for details on the diagnostic message format.

The fault code and node type in the transmitted fault message will be used by the display device to inform the installer or homeowner about the fault if display and alert functionality will allow.

8.2 Subsystem Busy

The subsystem may need to be placed in a debug state while installed in an active system. In order to inform the thermostat or user interface this condition has occurred, the subsystem shall transmit the Subsystem Busy control command to the thermostat or a user interface. The thermostat or user interface shall then initiate commands to put the subsystem in an idle mode. The thermostat or user interface may initiate the same command to other subsystems to put them in an idle state. The subsystem will need to refresh the command periodically to keep the subsystem in the idle state.

See the *ClimateTalk Command Reference* for more information regarding the Subsystem Busy control command.

8.3 Proactive Diagnosis

By understanding the configuration of the network, controlling subsystems may be able to identify imminent system faults prior to them being realized by the home owner.

8.3.1 System Operation Monitoring

If used in the network, a thermostat or a water heater controller does not directly control the water heater. But, if there is an user interface, that interface is responsible for ensuring the water heater subsystem(s) under its subnet is (are) working properly to maintain the tank temperature and/or any other home owner comfort feature.

Through issued control commands, and status checks, the user interface device may have more information on the system operational status than any other subsystem. Using information thus collected the user interface device may be designed to proactively notify the homeowner/installer of a mis-configured setup that would cause the system to not operate properly.

8.3.2 Missing Subsystem

The user interface device is responsible for detecting the active node types and requesting each subsystem's configuration to determine their capability. If a subsystem that was operational suddenly goes off the network without the user interface device having experienced a power outage, they could notify the homeowner/installer that an existing subsystem that went missing.

8.3.3 Missing Thermostat, User interface

At any time if the water heater detects that the user interface device is not active on the network, the application shall continue operating normally to maintain the tank temperature.

8.3.4 Current Diagnostic Message

Any subsystem may have the ability to individually query a fault message by an index to handle an advanced diagnostics display page. The subsystems may have the corresponding ability to respond to such a request with the current fault information.

8.3.5 Informational Messaging

Subsystems on the network can have the ability to send a display device an informative message that may be displayed on the normal operation of the displaying device.

For example, a water heater control can send a dynamic message of "leak detected" to a display device like a thermostat or a user interface. The display device will display this alpha-numeric informative message on the top level operational status instead of buried deep down in advance installer menu.

9.0 Water Heater Application Message Types

The tables below define the message types each subsystem shall support. Subsystems shall support the messages shaded in green. Subsystems may support additional, un-shaded messages provided the subsystem is capable of receiving or transmitting that message type. NA stands for a command that is not applicable for this application at this time. The format for responding to unsupported message types is defined in the *ClimateTalk Generic Application Specification*.

9.1 Water Heater Application Received Message Types

Table 2 – Water Heater Application Received Messages

Message Name	Subsystem
	Water Heater
Get Configuration	X
Get Status	X
Set Control Command	X
Set Display Message	
Set Diagnostics	
Get Sensor Data	X
Set Identification	X
Get Identification	X
Set Manufacturer Device Data	X
Get Manufacturer Device Data	X
Set Network Node List	X
Get User Menu	X ²
Set User Menu Update	X ³
Set Factory Shared Data to Application	NA

² All water heaters shall have the capability to provide user menu information.

³ All water heaters shall allow user interface devices to update its user menu information.

Message Name	Subsystem
	Water Heater
Get Shared Data from Application	NA
Set Echo Data	

9.2 Water Heater Application Transmitted Message Types

Table 3 – Water Heater Application Transmitted Messages

Message Name	Subsystem
	Water Heater
Get Configuration	
Get Status	
Set Control Command	
Set Display Message	X
Set Diagnostics	X
Get Diagnostics	
Get Sensor Data	
Get User Menu	
Set User Menu Update	
Set Echo Data	

10.0 Remote Access

The water heater shall have the capability of interacting with a diagnostics and/or gateway device to allow for remote updating of settings and access to system operational parameters. For subsystems to implement the water heater profile, the following sections shall be required for remote access.

10.1 Configuration

The water heater configuration could also be available from the network to determine if a set up parameter needs to be adjusted to allow for a simple diagnostics resolution.

10.2 Operational Status

The water heater could allow for the ability of its status to be requested for diagnostic indication.

10.3 Operational Abilities

A diagnostics or gateway device may want to interact with the network by requesting the water heater control to be put into whatever modes are being authorized by that requesting device.

The water heater shall support the ability to receive a control command from a diagnostic or gateway device and perform the operation requested.

Table 4 – Remote Access Supported Operations

Description	Restricted*	Code (Hex)	Code (Decimal)
Heat Set Point Temperature Modify		0x01	01
Heat Profile Change (Modify program schedule)		0x03	03
System Switch Modify	R	0x05	05
Fahrenheit/Celsius Display		0x0C	12
Real Time/Day Override		0x0F	15
Vacation Mode	R	0x15	21
High Alarm Limit Change		0x16	22
Low Alarm Limit Change		0x17	23

Description	Restricted*	Code (Hex)	Code (Decimal)
Reset Control		0x31	49
Program Interval Type Modification		0x3E	62
Communications Receiver On/Off		0x3F	63
Force Phone Number Display		0x40	64
Restore Factory Defaults		0x45	69
Keypad Lockout		0x4F	79
Test Mode		0x50	80
Subsystem Installation Test		0x51	81
Water Heater Modify (See 10.3.2 for defined options)		0xF0	240

* Control command codes with restricted subset of available parameters as defined in section 10.3.1 Control Commands with a restricted subset of allowed parameters

10.3.1 Control Commands with a restricted subset of allowed parameters

Some control commands define parameters that are not applicable to a water heater. This section lists the commands with options that are a subset of the parent control command.

10.3.1.1 System Switch Modify

The water heater shall have the ability to receive a new system mode to operate at until otherwise directed. This command modifies the current system switch state to either OFF, HEAT, COOL, AUTO, or EMER. For the water heater profile, only the OFF and HEAT options are supported.

10.3.1.2 Vacation Mode

Vacation mode has optional parameters for vacation heat set point and vacation cool set point. The water heater application shall only support the vacation heat set point.

10.3.2 Water Heater Modify Command Codes

Water Heater Modify commands are intended to be commands that can be used to modify water heater settings. In the future, corresponding control commands may be added to the global Command Reference documentation as more application profiles are added. Even if such a corresponding control command becomes available, all water heaters shall continue to use the established Water Heater Modify Command Codes. This is necessary to ensure backwards compatibility. Likewise, once a command has been established, its Water Heater Modify Command Code shall be maintained even if not used. All new Water Heater Modify

Command Codes shall be added in sequential order. When adding a command, a paragraph describing each command should be provided. Use the Command Reference Documentation as a guide.

A table which can be used as a starting point for adding Water Heater Modify Commands is located in Table 5.

Table 5 – Example Water Heater Modify Commands

Water Heater Modify Command Code		Description	Bytes in data field	Range
2 Bytes				
0x00	0x00	Some specific maximum setpoint change	1 byte	32-180F in 1 degree increments
0x01	0x00	Another specific setpoint change	1 byte	32-180F in 1 degree increments
0x02	0x00	Curtailment	1 byte	Format shown in table x
<i>Table is for Example Only</i>				

11.0 Water Heater Message Data Interfaces

This section defines MDIs specific to Water Heater Applications. Configuration Messages are defined in Section 11.1 and Status Messages are defined in Section 11.2. Refer to the *Command Reference* regarding definition for the Message Data Interface format and function.

11.1 Water Heater Configuration Message Data Interface

Table 6 – Water Heater Configuration Message Data Interface

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
0	61	0	0-7	Type of Water Heater	1 Byte		0 = UNKNOWN OR TO BE DETERMINED (--) 1 = Gas Water Heater 2 = Electric Water Heater 3 = Tankless Gas Water Heater 4 = Solar with Electric Heat Backup 5 = Heat Pump Water Heater 255 = Unknown or Unavailable
		1	0-7	Commercial/ Residential Water Heater	1 Byte		0 = Residential (Default) 1 = Commercial
		2	0-7	No of Heat Stages or Heating Elements	1 Byte		0 = Modulating System 1-254 - Number of Stages or Heating Elements 255 = Unavailable or N/A
		3	0-7	Maximum Allowed OEM Set-point	1 Byte	0 - 255	0 - 0xFE - degrees F - This is the maximum allowed set-point that the OEM shall allow the installer or user to set the Water Heater setpoint in degrees F. 0xFF = Unused or Unavailable
		4	0-7	Maximum Allowed Installer Set-point	1 Byte	0 - 255	0 - 0xFE - This is the maximum allowed set-point that the Installer or the user shall allow the Water Heater setpoint to be set to in degrees F 0xFF - Unused or Unavailable
		5	0-7	Maximum Allowed OEM Differential	1 Byte	0 - 255	0 - 0xFE - This is the maximum allowed differential that the OEM shall allow the installer or user to set the Water Heater differential

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
							in degrees F. 0xFF - Unavailable or Unused
		6	0-7	Maximum Allowed Installer Differential	1 Byte	0 - 255	0 - 0xFE - This is the maximum allowed differential that the Installer or the user shall allow the Water Heater setpoint to be set to in degrees F. 0xFF - Unused or Unavailable
		7	0-7	Capacity in Gallons	1 Byte	0 - 255	0 - 0xFE - Total tank capacity in gallons 0xFF - Unavailable
		8	0-7	Fuel Type	1 Byte		0 - Natural Gas 1 - Propane 2 - Electric 3 - ASHP 4 - GSHP 5 - Solar 255 - Other, not defined
		9	0-7	FVS Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		10	0-7	Flame Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		11	0-7	Pressure Switch	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		12	0-7	Number of Thermistors	1 Byte		0 - 0xFE - Number of thermistors available 0xFF - Unavailable
		13	0-7	Igniter Type	1 Byte		0 = Not Installed 1 = Hot surface Igniter 2 = Spark Igniter 255 = Unknown or N/A
		14	0-7	Gas Valve	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		15	0-7	Limit Switch	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		16	0-7	Vent Switch	1 Byte		0 = Not Installed 1 = Installed

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
							255 = Unavailable or N/A
		17	0-7	Condensate Overflow Switch	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		18	0-7	Water Leak Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		19	0-7	Compressor State	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		20	0-7	spare	1 Byte		
		21	0-7	spare	1 Byte		
		22	0-7	spare	1 Byte		
		23	0-7	spare	1 Byte		
		24	0-7	spare	1 Byte		
		25	0-7	Upper Element	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		26	0-7	Lower Element	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		27	0-7	Collector Pump	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		28	0-7	Maximum Allowed Lockout Time Period	1 Byte		0 = Not Allowed or 1 - 254 = Lockout time in minutes 255 = Indefinite.
		29	0-7	Vacation Mode Feature	1 Byte		0 = Unavailable 1 = Available. 255 = Unknown or N/A
		30	0-7	Setback Mode	1 Byte		0 = Unavailable 1 = Available. 255 = Unknown or N/A
		31	0-7	Inlet Water Temp. Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		32	0-7	HX Outlet Temp Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		33	0-7	Mixed Water Temp Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		34	0-7	Inlet Water Pressure Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		35	0-7	Outlet Water Pressure Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		36	0-7	Inlet Gas Pressure Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		37	0-7	Manifold Gas Pressure Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		38	0-7	Exhaust Temperature Sensor	1 Byte		0 = Not Installed 1 = Installed 255 = Unavailable or N/A
		39	0-7	Input Line Voltage Sensing	1 Byte		0 = Unavailable 1 = Available 255 = Unknown or N/A
		40	0-7	Collector Inlet Temperature Sensor	1 byte		0 = Unavailable 1 = Available 255 = Unknown or N/A
		41	0-7	Collector Outlet Temperature Sensor	1 byte		0 = Unavailable 1 = Available 255 = Unknown or N/A
		42	0-7	Upper/Outlet Temperature Sensor	1 byte		0 = Unavailable 1 = Available 255 = Unknown or N/A
		43	0-7	Lower/Inlet Temperature Probe Sensor	1 byte		0 = Unavailable 1 = Available 255 = Unknown or N/A
		44	0-7	spare	1 byte		
		45	0-7	spare	1 byte		
		46	0-7	spare	1 byte		

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		47	0-7	spare	1 byte		
		48	0-7	spare	1 byte		
		49-50	0-15	Max allowed Programmable Hold Time	2 Bytes		0 - 0xFFFE Hold time in minutes 0x FFFF - Unavailable or Unused
		51	0-7	Keypad Lockout Feature	1 byte		0 = Unavailable 1 = Available 255 = Unknown or N/A
		52	0-7	Real Time Clock Change Lockout Feature	1 byte		0 = Unavailable 1 = Real Time Clock Change Locked Feature Available
		53	0-7	Beeper Installed	1 byte		0 = Not Installed or Unavailable 1 = Installed
		54-55	0-15	Communications Fault Timer Setting	2 Bytes		30 to 900 Seconds (15Minutes). This indicates the time that the controls shall wait before reacting to a communication fault. 0xFFFF -
		56	0-7	Program Profile Type	1 byte		0 = Non-Programmable 1 = 7 Day 2 = 5-2 3 = 5-1-1 255 - Feature Unavailable
		57	0-7	Programmable Interval Type	1 byte		0 = Non- Programmable 1 = 2 Step 2 = 4 Step 255 = Feature Unavailable
		58	0-7	Daylight Savings Features Available	1 byte		0 = Daylight Savings Unavailable 1 = Daylight Savings Available
		59	0-7	GMT Offset (Hours)	1 byte		Signed Byte (Scale 4)
		60	0-7	Display Contrast	1 byte		0% (Lowest) to 100% (Highest)
1	112	0	7-0	Heat Profile - Mon - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		1	7-0	Heat Profile - Mon - MOR/OCC1 Temp	1 Byte		b7 reserved bit = 0 b6-b0 Set Point
		2	7-0	Heat Profile - Mon - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		3	7-0	Heat Profile - Mon - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		4	7-0	Heat Profile - Mon - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		5	7-0	Heat Profile - Mon - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		6	7-0	Heat Profile - Mon - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		7	7-0	Heat Profile - Mon - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		8	7-0	Heat Profile - Tue - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		9	7-0	Heat Profile - Tue - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		10	7-0	Heat Profile - Tue - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		11	7-0	Heat Profile - Tue - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		12	7-0	Heat Profile - Tue - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		13	7-0	Heat Profile - Tue - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		14	7-0	Heat Profile - Tue - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		15	7-0	Heat Profile - Tue - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		16	7-0	Heat Profile - Wed - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		17	7-0	Heat Profile - Wed - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		18	7-0	Heat Profile - Wed - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		19	7-0	Heat Profile - Wed - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		20	7-0	Heat Profile - Wed - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		21	7-0	Heat Profile - Wed - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		22	7-0	Heat Profile - Wed - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		23	7-0	Heat Profile - Wed - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		24	7-0	Heat Profile - Thur - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		25	7-0	Heat Profile - Thur - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		26	7-0	Heat Profile - Thur - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		27	7-0	Heat Profile - Thur - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		28	7-0	Heat Profile - Thur - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		29	7-0	Heat Profile - Thur - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		30	7-0	Heat Profile - Thur - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		31	7-0	Heat Profile - Thur - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		32	7-0	Heat Profile - Fri - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		33	7-0	Heat Profile - Fri - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		34	7-0	Heat Profile - Fri - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		35	7-0	Heat Profile - Fri - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		36	7-0	Heat Profile - Fri - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		37	7-0	Heat Profile - Fri - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		38	7-0	Heat Profile - Fri - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		39	7-0	Heat Profile - Fri - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		40	7-0	Heat Profile - W/E 1 - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		41	7-0	Heat Profile - W/E 1 - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		42	7-0	Heat Profile - W/E 1 - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		43	7-0	Heat Profile - W/E 1 - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		44	7-0	Heat Profile - W/E 1 - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		45	7-0	Heat Profile - W/E 1 - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		46	7-0	Heat Profile - W/E 1 - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		47	7-0	Heat Profile - W/E 1 - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		48	7-0	Heat Profile - W/E 2 - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		49	7-0	Heat Profile - W/E 2 - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		50	7-0	Heat Profile - W/E 2 - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		51	7-0	Heat Profile - W/E 2 - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		52	7-0	Heat Profile - W/E 2 - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		53	7-0	Heat Profile - W/E 2 - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		54	7-0	Heat Profile - W/E 2 - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		55	7-0	Heat Profile - W/E 2 - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		56	7-0	Cool Profile - Mon - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		57	7-0	Cool Profile - Mon - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		58	7-0	Cool Profile - Mon - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		59	7-0	Cool Profile - Mon - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		60	7-0	Cool Profile - Mon - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		61	7-0	Cool Profile - Mon - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		62	7-0	Cool Profile - Mon - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		63	7-0	Cool Profile - Mon - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		64	7-0	Cool Profile - Tue - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		65	7-0	Cool Profile - Tue - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		66	7-0	Cool Profile - Tue - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		67	7-0	Cool Profile - Tue - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		68	7-0	Cool Profile - Tue - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		69	7-0	Cool Profile - Tue - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		70	7-0	Cool Profile - Tue - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		71	7-0	Cool Profile - Tue - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		72	7-0	Cool Profile - Wed - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		73	7-0	Cool Profile - Wed - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		74	7-0	Cool Profile - Wed - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		75	7-0	Cool Profile - Wed - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		76	7-0	Cool Profile - Wed - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		77	7-0	Cool Profile - Wed - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		78	7-0	Cool Profile - Wed - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		79	7-0	Cool Profile - Wed - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		80	7-0	Cool Profile - Thur - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		81	7-0	Cool Profile - Thur - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		82	7-0	Cool Profile - Thur - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		83	7-0	Cool Profile - Thur - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		84	7-0	Cool Profile - Thur - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		85	7-0	Cool Profile - Thur - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		86	7-0	Cool Profile - Thur - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		87	7-0	Cool Profile - Thur - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		88	7-0	Cool Profile - Fri - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		89	7-0	Cool Profile - Fri - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		90	7-0	Cool Profile - Fri - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		91	7-0	Cool Profile - Fri - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		92	7-0	Cool Profile - Fri - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		93	7-0	Cool Profile - Fri - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		94	7-0	Cool Profile - Fri - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		95	7-0	Cool Profile - Fri - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		96	7-0	Cool Profile - W/E 1 - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		97	7-0	Cool Profile - W/E 1 - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		98	7-0	Cool Profile - W/E 1 - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		99	7-0	Cool Profile - W/E 1 - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		100	7-0	Cool Profile - W/E 1 - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		101	7-0	Cool Profile - W/E 1 - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		102	7-0	Cool Profile - W/E 1 - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		103	7-0	Cool Profile - W/E 1 - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		104	7-0	Cool Profile - W/E 2 - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		105	7-0	Cool Profile - W/E 2 - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		106	7-0	Cool Profile - W/E 2 - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		107	7-0	Cool Profile - W/E 2 - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		108	7-0	Cool Profile - W/E 2 - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		109	7-0	Cool Profile - W/E 2 - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		110	7-0	Cool Profile - W/E 2 - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		111	7-0	Cool Profile - W/E 2 - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
2	32	0	7-0	Heat Profile - Week - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		1	7-0	Heat Profile - Week - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		2	7-0	Heat Profile - Week - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		3	7-0	Heat Profile - Week - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		4	7-0	Heat Profile - Week - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		5	7-0	Heat Profile - Week - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		6	7-0	Heat Profile - Week - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		7	7-0	Heat Profile - Week - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		8	7-0	Heat Profile - W/E - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		9	7-0	Heat Profile - W/E - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		10	7-0	Heat Profile - W/E - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		11	7-0	Heat Profile - W/E - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		12	7-0	Heat Profile - W/E - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		13	7-0	Heat Profile - W/E - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		14	7-0	Heat Profile - W/E - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		15	7-0	Heat Profile - W/E - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		16	7-0	Cool Profile - Week - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		17	7-0	Cool Profile - Week - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		18	7-0	Cool Profile - Week - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		19	7-0	Cool Profile - Week - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		20	7-0	Cool Profile - Week - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		21	7-0	Cool Profile - Week - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		22	7-0	Cool Profile - Week - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		23	7-0	Cool Profile - Week - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		24	7-0	Cool Profile - W/E - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		25	7-0	Cool Profile - W/E - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		26	7-0	Cool Profile - W/E - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		27	7-0	Cool Profile - W/E - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		28	7-0	Cool Profile - W/E - EVE/OCC2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		29	7-0	Cool Profile - W/E - EVE/OCC2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		30	7-0	Cool Profile - W/E - NHT/UNO2 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		31	7-0	Cool Profile - W/E - NHT/UNO2 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
3	56	0	7-0	Heat Profile - Mon - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		1	7-0	Heat Profile - Mon - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		2	7-0	Heat Profile - Mon - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		3	7-0	Heat Profile - Mon - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		4	7-0	Heat Profile - Tue - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		5	7-0	Heat Profile - Tue - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		6	7-0	Heat Profile - Tue - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		7	7-0	Heat Profile - Tue - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		8	7-0	Heat Profile - Wed - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		9	7-0	Heat Profile - Wed - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		10	7-0	Heat Profile - Wed - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		11	7-0	Heat Profile - Wed - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		12	7-0	Heat Profile - Thur - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		13	7-0	Heat Profile - Thur - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		14	7-0	Heat Profile - Thur - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		15	7-0	Heat Profile - Thur - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		16	7-0	Heat Profile - Fri - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		17	7-0	Heat Profile - Fri - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		18	7-0	Heat Profile - Fri - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		19	7-0	Heat Profile - Fri - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		20	7-0	Heat Profile - W/E 1 - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		21	7-0	Heat Profile - W/E 1 - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		22	7-0	Heat Profile - W/E 1 - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		23	7-0	Heat Profile - W/E 1 - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		24	7-0	Heat Profile - W/E 2 - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		25	7-0	Heat Profile - W/E 2 - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		26	7-0	Heat Profile - W/E 2 - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		27	7-0	Heat Profile - W/E 2 - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		28	7-0	Cool Profile - Mon - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		29	7-0	Cool Profile - Mon - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		30	7-0	Cool Profile - Mon - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		31	7-0	Cool Profile - Mon - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		32	7-0	Cool Profile - Tue - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		33	7-0	Cool Profile - Tue - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		34	7-0	Cool Profile - Tue - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		35	7-0	Cool Profile - Tue - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		36	7-0	Cool Profile - Wed - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		37	7-0	Cool Profile - Wed - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		38	7-0	Cool Profile - Wed - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		39	7-0	Cool Profile - Wed - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		40	7-0	Cool Profile - Thur - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		41	7-0	Cool Profile - Thur - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		42	7-0	Cool Profile - Thur - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		43	7-0	Cool Profile - Thur - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		44	7-0	Cool Profile - Fri - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		45	7-0	Cool Profile - Fri - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		46	7-0	Cool Profile - Fri - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		47	7-0	Cool Profile - Fri - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		48	7-0	Cool Profile - W/E 1 - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		49	7-0	Cool Profile - W/E 1 - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		50	7-0	Cool Profile - W/E 1 - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		51	7-0	Cool Profile - W/E 1 - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		52	7-0	Cool Profile - W/E 2 - OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		53	7-0	Cool Profile - W/E 2 - OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		54	7-0	Cool Profile - W/E 2 - UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		55	7-0	Cool Profile - W/E 2 - UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
4	16	0	7-0	Heat Profile - Week - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		1	7-0	Heat Profile - Week - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		2	7-0	Heat Profile - Week - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		3	7-0	Heat Profile - Week - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		4	7-0	Heat Profile - W/E - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		5	7-0	Heat Profile - W/E - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		6	7-0	Heat Profile - W/E - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		7	7-0	Heat Profile - W/E - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		8	7-0	Cool Profile - Week - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		9	7-0	Cool Profile - Week - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		10	7-0	Cool Profile - Week - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		11	7-0	Cool Profile - Week - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		12	7-0	Cool Profile - W/E - MOR/OCC1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min

DB ID TAG	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		13	7-0	Cool Profile - W/E - MOR/OCC1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point
		14	7-0	Cool Profile - W/E - DAY/UNO1 Start Time	1 Byte		b7 reserved bit = 0, b6-b2 Hour b1,b0 15 Min
		15	7-0	Cool Profile - W/E - DAY/UNO1 Temp	1 Byte		b7 reserved = 0, b6-b0 Set Point

11.2 Water heater Status Message Data Interface

Table 7 – Water Heater Status Message Data Interface

DB ID Tag	DB ID Length	Byte	Bit	Description	Size	Range	Notes
0	81	1	0-7	Critical Fault	1 Byte		Critical fault Condition (Broken)
		2	0-7	Minor Fault	1 Byte		Minor Fault Condition (Maintenance)
		3	0-7	Tank Temperature	1 Byte	32-254F	0 = Undetermined; 255 = Probe fault
		4	0-7	Current Set Point	1 Byte	70-180F	degree F
		5	0-7	Max Allowed User Set Point	1 Byte	70-180F	degree F
		6	0-7	Control State	1 Byte		0 = Standby / Idle (For all types of WH) 1 = Pre-Purge (For Gas based WH) 2 = Igniter Warmup 3 = Ignition Activation 4 = Ignition Verification 5 = Inter-Purge 6 = Heating (For all types of WH) 7 = Post-Purge 8 = Fault (For all types of WH) 255 = Unused / Unavailable
		7	0-7	FVS Sensor Status	1 Byte		0 = Okay 1 = Fault 255 = Unavailable or N/A
		8	0-7	Flame Sensed Status	1 Byte		0 = False 1 = True 255 = Unavailable or N/A
		9	0-7	PSW Status	1 Byte		0 = Open 1 = Closed 255 = Unavailable or N/A
		10	0-7	Thermistor Status	1 Byte		0 = Okay 1 = Fault, Refer to Note - 3 255 = Unavailable or N/A
		11	0-7	Igniter Status	1 Byte		0 = Off 1 = On 255 = Unavailable/Not Installed

DB ID Tag	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		12	0-7	Gas Valve Status	1 Byte		0 = Gas Valve Closed 1 = Gas Valve Open 255 = Unavailable/Not Installed
		13	0-7	Call for Heat Status	1 Byte		0 = Idle 1 = Active 255 = Unavailable
		14	0-7	spare	1 Byte		
		15	0-7	spare	1 Byte		
		16	0-7	Inducer Status	1 Byte		0 = Off 1 = On 255 = Unavailable/Not Installed
		17	0-7	Limit Switch Status	1 Byte		0 = Open 1 = Closed 255 = Unavailable/Not Installed
		18	0-7	Vent Switch Status	1 Byte		0 = Open 1 = Closed 255 = Unavailable/Not Installed
		19	0-7	Condensate Overflow Status	1 Byte		0 = Okay 1 = Fault 255 = Unavailable / Not Installed
		20	0-7	Water Leak Sensor Status	1 Byte		0 = Okay 1 = Fault 255 = Unavailable / Not Installed
		21	0-7	Compressor State Status	1 Byte		0 = Okay 1 = Fault 255 = Unavailable / Not Installed
		22	0-7	spare	1 Byte		
		23	0-7	spare	1 Byte		
		24	0-7	spare	1 Byte		
		25	0-7	spare	1 Byte		
		26	0-7	spare	1 Byte		
		27	0-7	Upper Element Status	1 Byte		0 = Off 1 = On 255 = Unavailable/Not Installed

DB ID Tag	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		28	0-7	Lower Element Status	1 Byte		0 = Off 1 = On 255 = Unavailable/Not Installed
		29	0-7	Collector Pump Status	1 Byte		0 = Off 1 = On 255 = Unavailable/Not Installed
		30	0-7	Type of Lockout	1 Byte		0 = Normal Operations (not in a lockout); 1 = Permanent Lockout. (Note 6). 2 = Temporary Lockout (Note 5) 3 = Grid Smart Lockout (Note 4) 255 = Unavailable/Unused
		31		Lockout Time Period	1 Byte	0-254	0 = Not in Lockout/Unused/Unavailable 1 - 254 = Lockout time remaining in minutes 255 = Indefinite.
		32		Retry In Progress	1 Byte		0 = False 1 = True 255 = Unavailable
		33		Recycle In Progress	1 Byte		0 = False 1 = True 255 = Unavailable
		34		Vacation Mode Status	1 Byte		0 = Disabled 1 = Active 255 = Unavailable
		35		Setback Mode Status	1 Byte		0 = Disabled 1 = Active 255 = Unavailable
		36	0-7	Inlet Water Temp.	1 Byte	32-254F	degrees F; 255 = Invalid or Unused
		37	0-7	HX Outlet Temp	1 Byte	32-254F	degrees F; 255 = Invalid or Unused
		38	0-7	Mixed Water Temp	1 Byte	32-254F	degrees F; 255 = Invalid or Unused
		39	0-7	Inlet Water Press.	1 Byte	0-254psi	PSI; 255 = Invalid or Unused
		40	0-7	Outlet Water Press.	1 Byte	0-254psi	PSI; 255 = Invalid or Unused
		41	0-7	Inlet Gas Press.	1 Byte	0-25.4psi	PSI*10 (123 = 12.3psi); 255 = Invalid or Unused

DB ID Tag	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		42	0-7	Manifold Gas Press.	1 Byte	0-25.4psi	PSI*10 (123 = 12.3psi); 255 = Invalid or Unused
		43	0-7	Exhaust Temperature	1 Byte	0-2540F	degrees F/10 (23 = 230°F); 255 = Invalid
		44-45	0-15	Inducer Speed	2 Bytes	RPM	0 - 0xFFFFE - Inducer Speed in RPM 0xFFFF - Unused or Unavailable
		46	0-7	Gas Valve Position	1 byte	0-100%	0-100% increments for a modulating Gas Valve 255 = Invalid or N/A for non-modulating applications.
		47	0-7	Flow Control Position	1 byte	0-100%	0-100% increments for a control that can modulate the flow positions 255 = Invalid or N/A for non-modulating applications.
		48-49	0-15	Input Line Voltage	2 bytes	90 to max allowed voltage	0-0xFFFFE - This is the actual line voltage in Volts that the unit can report if it can measure the line voltage. 0xFFFF - Unavailable
		50		Input Line Voltage Status			0= Unavailable / Unused 1= Undervoltage detected. 2 = Normal Operating Voltage detected. 3 = Overvoltage detected
		51	0-7	Collector Inlet Temp	1 byte	32-254F	0- 254 - Temperature in F 255 = Invalid/Unused
		52	0-7	Collector Outlet Temp	1 byte	32-254F	0- 254 - Temperature in F 255 = Invalid/Unused
		53-54	0-15	Collector Pump Speed	2 bytes	RPM	0 - 0xFFFFE - Collector Pump Speed in RPM 0xFFFF - Unused or Unavailable
		55-56	0-15	Collector Flow Rate	2 bytes	GPM	1 - 0xFFFFE - Collector Flow Rate in GPM (this is the flow rate for heat collector systems) 0xFFFF - Unused or Unavailable
		57	0-7	Setback Heating Temp	1 byte	70-180F	70- 180 - Temperature in F 255 = Invalid/Unused
		58	0-7	Vacation Heating Temp	1 byte	32-254F	0- 254 - Temperature in F 255 = Invalid/Unused

DB ID Tag	DB ID Length	Byte	Bit	Description	Size	Range	Notes
		59-61	0-23	Total Number of Heating Cycles	3 Bytes	counts	0 - 0xFFFFFE 0xFFFFF - Unavailable or Unused
		62-65	0-31	Total Elapsed Time	4 Bytes	minutes	0 - 0xFFFFFFF - This is the total time that the water heater control is powered (Idle time + Active heating time) 0xFFFFFFF - Unavailable or Unused
		66-69	0-31	Total Heating Time	4 Bytes	minutes	0 - 0xFFFFFFF - This is the total time that the water heater control is in during active heating (when the Gas valve is turned ON or when the elements are turned ON) 0xFFFFFFF - Unavailable or Unused
		70	0-7	Upper/Outlet Temp Probe	1 Byte	32-254F	0- 254 - Temperature in F (Upper or Outlet Temp) 255 = Invalid/Unused
		71	0-7	Aux Temp Probe 1	1 Byte	32-254F	0- 254 - Temperature in F 255 = Invalid/Unused
		72	0-7	Aux Temp Probe 2	1 Byte	32-254F	0- 254 - Temperature in F 255 = Invalid/Unused
		73	0-7	Lower/Inlet Temp Probe	1 Byte	32-254F	0- 254 - Temperature in F (Lower or Inlet Temp) 255 = Invalid/Unused
		74	0-7	Number of Stages On Status	1 Byte	1-16	0 = Modulating System 1-254 - Number of Stages 255 = Unavailable or N/A
		75	0-7	Percent Modulation	1 Byte	0-100	0-100% increments for a control that can modulate the flow positions 255 = Invalid or N/A for non-modulating applications.
		76	0-7	Number of Heating Elements On Status	1 Byte	0-254	0- 254 Number of Heating elements on 255 = N/A or Unavailable
		77-80	0-31	Total Energy Usage	4 Bytes		0 - 0xFFFFFFF - This should be in KWH if a Gas Water Heater it should do the conversion locally and report the usage in KWH. This is the total energy used during

DB ID Tag	DB ID Length	Byte	Bit	Description	Size	Range	Notes
							active heating. 0xFFFFFFFF - Unavailable

12.0 Annex A – Bibliography

"TIA-485 (Revision A), Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems" *Telecommunications Industry Association*, 1998.

Zimmermann, Hubert (April 1980). "OSI Reference Model — The ISO Model of Architecture for Open Systems Interconnection". *IEEE Transactions on Communications*