Engineering Data

ED15063-2

Group: **Controls**

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MicroTech II®
Chiller Unit Controller
Protocol Information

Modbus® Protocol

- WSC Water-Cooled Centrifugal, Single-Compressor
- WDC Water-Cooled Centrifugal, Dual-Compressor
- WPV Water-Cooled Centrifugal, Single-Compressor
- HSC Water-Cooled Single-Compressor Centrifugal, Heat Recovery
- HDC Water-Cooled Dual-Compressor Centrifugal, Heat Recovery
- TSC Water-Cooled Single-Compressor Centrifugal, Templifier
- WMC Water-Cooled Centrifugal, Magnetic Bearing
- WCC Water-Cooled Centrifugal, Counterflow
- AGZ Air-Cooled Global Scroll
- ACZ Air-Cooled Scroll Condensing Unit
- WGZ Water-Cooled Global Scroll
- AGS Air-Cooled Global Screw
- WGS Water-Cooled Global Screw

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Limited Warranty

Consult your local McQuay Representative for warranty details. Refer to Form 933-43285Y. To find your local McQuay Representative, go to www.mcquay.com.

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Revision History

ED 15063-0	May 15, 2003	Preliminary release.
ED 15063-1	May 18, 2005	Added points for Solid State Starter – Current, Voltage, Power and Power Factor Corrected some incorrect register listings Changed doc to have only Holding Registers and Coils Added WGS and WMC data Added WMC, HSC HDC, and TSC to front page and Chiller Model table
ED 15063-2	Nov 22, 2005	Added WCC to front page and Chiller Model table Corrected Modbus Alarms table Added Compressor Current, Compressor Power and Compressor Voltage to the Compressor Select Table

Software Revision

This edition documents all versions of the standard MicroTech II® Chiller Unit Controller firmware and all subsequent revisions until otherwise indicated.

Reference Documents

Company	Number	Title	Source
McQuay International	IOMM WSC WDC	The McQuay DISTINCTION Series Single/Dual Compressor Centrifugal Chillers Installation, Operating and Maintenance Manual	www.mcquay.com
McQuay International	OM CentrifMicro II	MicroTech II Controller for Centrifugal Chillers and Templifiers Operating Manual	www.mcquay.com
McQuay International	IM 743	MicroTech II Chiller Unit Controller Modbus Communication Module Installation Manual	www.mcquay.com
McQuay International	IMM AGS IMM AGSB	GeneSys? Air-Cooled Screw Compressor Chiller	www.mcquay.com
McQuay International	IOMM ACZ/AGZ	Air-Cooled Scroll Condensing Unit & Air-Cooled Scroll Chiller w/Remote Evaporators Installation, Operation, and Maintenance Manual	www.mcquay.com
McQuay International	IOMM ACZ	Air-Cooled Scroll Condensing Unit Installation, Operation, and Maintenance Manual	www.mcquay.com
McQuay International	IOMM AGZ IOMM AGZ1	Air-Cooled Scroll Compressor Chiller & Air-Cooled Scroll Compressor Water Chiller Installation, Operation, and Maintenance Manual	www.mcquay.com
McQuay International	IOMM WGZ	Water-Cooled Scroll Compressor Chiller Installation, Operation and Maintenance Manual	www.mcquay.com
McQuay International	IOMM WPV	WPV Centrifugal Compressor Chillers Installation, Operating and Maintenance Manual	www.mcquay.com
McQuay International	OM AGS	GeneSys? Air-Cooled Screw Compressor Chiller Operation Manual	www.mcquay.com
McQuay International	IOMM TSC	MicroTech II Templifier Single Compressor Centrifugal Installation, Operation, and Maintenance Manual	www.mcquay.com
Gould, Inc.		Modbus® Application Protocol	www.Modbus.org
Gould, Inc.		Modbus Over Serial Line	www.Modbus.org

Introduction

This document contains the necessary information to incorporate a MicroTech II Chiller Unit Controller from McQuay International into your Building Automation System (BAS). It includes all necessary Modbus? variables and corresponding MicroTech II Chiller Unit Controller data points. Modbus terms and principles are not defined. Refer to the appropriate specifications for definitions and details.

Chiller Models

The following table lists the model designators of McQuay International Chiller units and the corresponding description.

WSC	Water-Cooled Centrifugal, Single-Compressor
WDC	Water-Cooled Centrifugal, Dual-Compressor
WPV	Water-Cooled Centrifugal, Single-Compressor
HSC	Water-Cooled Single-Compressor Centrifugal, Heat Recovery
HDC	Water-Cooled Dual-Compressor Centrifugal, Heat Recovery
TSC	Water-Cooled Single-Compressor Centrifugal, Templifier
WMC	Water-Cooled Centrifugal, Magnetic Bearing
WCC	Water-Cooled Centrifugal, Counterflow
AGZ	Air-Cooled Global Scroll
ACZ	Air-Cooled Scroll Condensing Unit
WGZ	Water-Cooled Global Scroll
AGS	Air-Cooled Global Screw
WGS	Water-Cooled Global Screw

Controller Data Points

The MicroTech II Chiller Unit Controller contains data points or unit variables that are accessible from three different user interfaces: the unit keypad/display, the Operator Interface Touch Screen, or a Modbus serial network. Not all points are accessible from each interface. This manual lists all important data points and the corresponding network path for each applicable interface. Refer to the applicable Operation Manual for keypad/display and Operator Interface Touch Screen details. See Reference Documents on page 4 for manual part numbers.

Modbus Protocol Information

Compatibility

The MicroTech II Chiller Unit Controller can be configured in an interoperable Modbus network. The controller must have the corresponding Modbus Communication Module installed.

The MicroTech II Chiller Unit Controller conforms to the Modbus Standards published at www.Modbus.org. See the Reference Documents on page 4.

Protocol Definitions

The Modbus protocol is a standardized Application Level (OSI Level 7) protocol used in interoperable Industrial Control networks. Modbus provides the communication infrastructure necessary to integrate products manufactured by different vendors and to integrate control services that are now independent.

It specifies how requests from the client are sent to a server and how servers reply. The client constructs a PDU (protocol data unit) and sends it to a specific server or broadcasts it to all servers. The PDU contains a function code that defines the action the client is requesting from the server(s). The PDU also includes a data field that further defines the action to the server, for example, the location of the data to be read.

A normal reply from a server includes the same function code and a response data field. In the case of a read operation, the response data field contains the requested data. In the case of a write operation, the response data field contains an echo of the write data of the request command. If the server detects an error in the transmission, the reply to the client includes and exception function code and the response data field contains an exception code.

Controllers can communicate on standard Modbus networks using one of two transmission modes: ASCII or RTU. Users select the serial port communication parameters (baud rate, parity mode, etc), during configuration of the controller. The mode and serial parameters must be the same for all devices on a Modbus network. Transmission mode determines how information is packed into the message fields and decoded. In RTU mode, each byte contains two hexadecimal characters, and in ASCII mode, each byte contains one ASCII character. ***The MicroTech II Chiller Unit Controller uses the RTU mode only.***

The MicroTech II Chiller Unit Controller uses the following data structure: 8 data bits, 1 or 2 stop bits, and no parity bit. It uses data transmission rates from 1200 to 19200 bps.

Valid Function Codes

The MicroTech II Chiller Unit Controller supports eight public function codes.

Function Code	Description	Definition
01 (0x01)	Read Coils	This function code reads status from 1 to 2000 contiguous coils in a remote device.
02 (0x02)	Read Discrete Inputs	This function code reads status from 1 to 2000 contiguous discrete inputs in a remote device.
03 (0x03)	Read Holding Registers	This function code reads the contents of a contiguous block of holding registers in a remote device.
04 (0x04)	Read Input Registers	This function code reads from 1 to approx. 125 contiguous input registers in a remote device.
05 (0x05)	Write Single Coil	This function code writes a single output to either ON or OFF in a remote device.
06 (0x06)	Write Single Register	This function code writes a single holding register in a remote device.
15 (0x0F)	Write Multiple Coils	This function code forces each coil in a sequence of coils to either ON or OFF in a remote device.
16 (0x10)	Write Multiple Registers	This function code writes a block of contiguous registers (1 to approx. 120 registers) in a remote device.

Valid Error Codes

The MicroTech II Chiller Unit Controller supports three error or exception codes.

Error Codes	Description	Definition
01	Illegal Function	The function code received in the query is not an allowable action for the server (or slave).
02	Illegal Data Address	The data address received in the query is not an allowable address for the server (or slave).
03	Illegal Data Value	A value contained in the query data field is not an allowable value for server (or slave).

Modbus Data Point

Each data point accessible from a Modbus network is described with a table that gives the data type and index. If the data point represents an enumerated variable, the enumerations are also listed.

Example Data Point: Chiller On Off

This output network variable indicates the current state of the chiller. The OFF state is represented by 0, and the ON state is represented by 1. (D2)

Data Type	Index	Measurement	Units	Valid Range
Coil	2	Chiller State	NA	0 = Off (Disable) 1 = On (Enable)

Data Type

Data is represented as either single-bit elements or 16-bit elements. A single-bit element is referred to as a Discrete Input when it refers to read-only data and as a Coil when it refers to read-write data. A 16-bit element is referred to as a Input Register when it refers to read-only data and as an Holding Register when it refers to read-write data.

Index

There can be as many as 65,536 elements of each data type in a Modbus device. Data elements are numbered from 1 to 65,536 in each type. Data elements are addressed with an index in the range from 0 to 65,535. The index is ***not*** the address of the data element in the unit controller memory. The index is used in Modbus PDUs to specify the location the data in the unit controller. This means, for example, that data element number 1 is addressed using index 0 in the PDU.

Valid Range

Some properties are standard data types and some are enumerated sets. If the property value represents a range of values, e.g., temperature or pressure, a range of values is given. If the property value is an enumerated set, all enumerated values and corresponding meaning are given.

Configuring the Unit Controller

The MicroTech II Chiller Unit Controller and the Modbus Communication Module together are designed, programmed, and configured at the factory to be a chiller unit controller accessible over a Modbus network. No additional programming is required to make this a chiller unit controller. The unit controller is ready to operate with the default values of the various parameters set at the factory. Default values may be changed with the unit keypad or via the network. Parameters must be adjusted to accommodate your particular network. See the appropriate Operation Manual for default values and keypad operating instructions and the Modbus Communication Module Installation Manual (see Reference Documents section for manual part numbers.)

Typical Application: Minimum Integration

When you have integrated the unit into your network, you can monitor and control unit operation from your workstation. At a minimum, you can:
• Display and monitor data points
• Turn the unit on or off
• Operate the unit safely

Set up the Unit for Network Control

Setup for Centrifugal Chiller MicroTech II Network Control:

1. Disable the chiller. The chiller should not be operating while performing this setup.
2. At the chiller touch screen interface panel:
   a. In the SETPOINTS MODE screen, set the #9 setpoint, BAS Protocol to Modbus. Use the Operator Password of "2001."
   b. In the SETPOINTS MODE screen, set the #3 setpoint, Control Source to Local
3. Verify with the chiller/control company technician that the chiller is operational on BAS.
4. In the SETPOINTS MODE screen, set the #3 setpoint, Control Source to BAS.

Setup for all Other Chillers MicroTech II Network Control:

1. Set the Set Unit Setpoint screen 1 initially to Source = Keypad.
2. Verify that Modbus is selected as the Protocol in the applicable menu screen shown in the table below.
3. Verify with the chiller/control company technician that the chiller is operational on a BAS.
4. Set the Unit Setpoint screen 1 to Source = Network.

Model	AGZ-A	ACZ-A	AGZ-B	ACZ-B	AGS-B	AGS-C	WGS	WGZ
Menu Screen	9	6	9	7	12	14	15	10
Password	2001	2001	2001	2001	8945	8453	8745	2001

NOTE: Models AGZ-A/B, ACZ-A/B, and WGZ have one unit controller, while models AGS-B/C and WGS have one unit controller and multiple circuit controllers. Unit settings for AGS-B/C and WGS models are adjusted on the unit controller.

Display Important Data Points

Typical workstation displays of MicroTech II Unit Controller attributes include the following significant data points (page number of detailed description in parenthesis). Each data point is identified with a number that also identifies it in the Comprehensive Data Point Tables. These data points are also shaded in the comprehensive tables so that you can distinguish them. References in the text of this section also identify these data points with a number and shading.

Table 1: Significant Data Points

No.	Configuration	No.	Temperatures	No.	Setpoints	No.	Alarms
1	Chiller Status (12)	5	Evaporator Entering Water Temperature (16)	9	Cool Setpoint (16)	11	Alarm Digital Output (20)
2	Chiller Mode Set-point (12)	6	6 Evaporator Leaving Water Temperature (16)	10	Capacity Limit Setpoint (11)	12	Clear Alarms (20)
3	Actual Capacity (11)	7	Condenser Entering Water Temperature (15)			13	Active Alarms (21)
4	Chiller Enable (11)	8	Condenser Leaving Water Temperature (15)				

You can display any number of additional data points based on job requirements or individual preference. See Modbus Data Points on page 7 for lists of all Modbus Variables available to the network. For a more detailed description of all available data points, see the Detailed Data Point Information section on page 11 of this document.

Comprehensive Data Point Tables

Modbus Data Points

Chiller Variables

Note: See the appropriate Operation Manual for specific data ranges and default values.

Network Control Property	Page	Read/ Write	Data Type	Description
Active Setpoint	12	R	Holding Register	-40°- 199°F
Actual Capacity (3)	12	R	Holding Register	0 - 160%
Capacity Limit (Output) (10)	12	R	Holding Register	0 - 160%
Capacity Limit Setpoint (10)	12	W	Holding Register	0 - 160%
Chiller Enable (Input) (4)	12	R/W	Coil	0=Off, 1=On
Chiller Limited	12	R	Coil	0=Not Limited, 1=Limited
Chiller Local/Remote	13	R	Coil	0=Remote, 1=Local
Chiller Mode Output	13	R	Coil	1=ICE, 2=COOL, 3=HEAT
Chiller Mode Setpoint	13	R/W	Holding Register	1=ICE, 2=COOL, 3=HEAT
Chiller On Off	13	R	Coil	0=Chiller Off, 1=Chiller On
***Chiller Status (1)**	**13**	**R**	**Holding Register**	**1=Off, 2=Start, 3=Run, 4=Pre-Shutdown, 5=Service**
Compressor Current	13	R	Holding Register	0 - 65,535
Compressor Discharge Temperature	14	R	Holding Register	-460°- 621°F
Compressor Percent RLA	14	R	Holding Register	0 -110%
Compressor Power	14	R	Holding Register	0 - 65,535
Compressor Run Hours	14	R	Holding Register	0 - 65,535
Compressor Select	15	R/W	Holding Register	See page 13
Compressor Starts	15	R	Holding Register	0 - 65,535
Compressor Suction Line Temperature	15	R	Holding Register	-40°- 244°F
Compressor Voltage	15	R	Holding Register	0 - 65,535
***Condenser Entering Water Temperature (7)**	**16**	**R**	**Holding Register**	**-40° - 244°F**
Condenser Flow Switch Status	16	R	Coil	0=No Flow, 1=Flow
***Condenser Leaving Water Temperature (8)**	**16**	**R**	**Holding Register**	**-40° - 244°F**
Condenser Pump Run Hours	16	R	Holding Register	0 - 65,535
Condenser Refrigerant Pressure	16	R	Holding Register	-3276.8 – 3276.7 psi
Condenser Saturated Refrigerant Temperature	16	R	Holding Register	-40° - 244°F
Condenser Water Flow Rate	16	R	Holding Register	0 - 65,535
Condenser Water Pump Status	17	R	Coil	0=Pump Off Request, 1=Pump On Request
***Cool Setpoint (9)**	**17**	**R/W**	**Holding Register**	**10? - 120°F**
***Evaporator Entering Water Temperature (5)**	**17**	**R**	**Holding Register**	**-40° - 244°F**
Evaporator Flow Switch Status	17	R	Coil	0=No Flow, 1=Flow
Evaporator Leaving Water Temperature for Unit(6)	17	R	Holding Register	-40° - 244°F
***Evaporator Leaving Water Temperature for Compressor**	**17**	**R**	**Holding Register**	**-40° - 244°F**
Evaporator Pump Run Hours	17	R	Holding Register	0 – 65,535
Evaporator Refrigerant Pressure	18	R	Holding Register	-3276.8 – 3276.7 psi
Evaporator Saturated Refrigerant Temperature	18	R	Holding Register	-40° - 244°F
Evaporator Water Flow Rate	18	R	Holding Register	0 - 65,535
Evaporator Water Pump Status	18	R	Coil	0=Pump Off Request, 1=Pump On Request
Heat Recovery Entering Water Temperature	18	R	Holding Register	-40° - 244°F
Heat Recovery Leaving Water Temperature	18	R	Holding Register	-40° - 244°F
Heat Setpoint	18	R/W	Holding Register	50° - 120°F

Network Control Property	Page	Read/ Write	Data Type	Description
Ice Setpoint	19	R/W	Holding Register	15? - 35°F, Default=25°F
Liquid Line Refrigerant Pressure	19	R	Holding Register	-22592 - 22591 psi
Liquid Line Refrigerant Temperature	19	R	Holding Register	-40°- 244°F
Oil Feed Pressure	19	R	Holding Register	-22592 - 22591 psi
Oil Feed Temperature	19	R	Holding Register	-40° - 244°F
Oil Sump Pressure	19	R	Holding Register	-22592 - 22591 psi
Oil Sump Temperature	19	R	Holding Register	-40° - 244°F
Outdoor Air Temperature	20	R	Holding Register	-40° - 244°F
Pump Select	20	R/W	Coil	0=Pump No. 1, 1=Pump No. 2
Run Enabled	20	R	Coil	0=OFF, 1=Run Allowed

*Boldface indicates data points required for typical minimum integration.

Chiller Alarm Variables

Network Control Property	Page	Read/ Write	Data Type	Description
Alarm Digital Output (11)	21	R	Coil	0-No Alarm, 1=Alarm
Clear Alarms (12)	21	R/W	Coil	0=Normal, 1=Clear Alarm
Active Alarms (13)	22	R	Holding Register	16 Holding Registers: Each bit representing an alarm condition

Detailed Data Point Information

This section lists the information (the data) that is available to the Industrial Control System via the Modbus RTU protocol. This information is used to safely operate and log the performance of the chiller. The systems integrator also uses this information when creating custom graphics.

Table 2: Data Points for Chiller Models

Data Point	WSC/WDC/WPV/WMC /WCC/HSC/TSC/HDC	AGZ	ACZ	WGZ	AGS	WGS
Active Alarms	X	X	X	X	X	X
Active Setpoint	X	X		X	X	X
Actual Capacity	X	X	X	X	X	X
Alarm Digital Output	X	X	X	X	X	X
Capacity Limit Output	X	X*	X*	X	X	X
Capacity Limit Setpoint	X	X*	X	X	X	X
Chiller Enable	X	X	X	X	X	X
Chiller Limited	X	X*	X*	X	X	X
Chiller Local/Remote	X	X	X	X	X	X
Chiller Mode Output	X	X	X	X	X	X
Chiller Mode Setpoint	X	X	X	X		X
Chiller On Off	X	X	X	X	X	X
Compressor Current***	X					X
Compressor Discharge Temperature	X				X	X
Compressor Percent RLA	X					
Compressor Power***	X					X
Compressor Run Hours	X	X	X	X	X	X
Compressor Select	X	X	X	X	X	X
Compressor Starts	X	X	X	X	X	X
Compressor Suction Line Temperature	X	X				X
Compressor Voltage***	X					X
Condenser Entering Water Temperature	X					X
Condenser Flow Switch Status	X					X
Condenser Leaving Water Temperature	X					X
Condenser Pump Run Hours	X					
Condenser Refrigerant Pressure	X	X	X	X	X	X
Condenser Saturated Refrigerant Temperature	X	X	X	X	X	X
Condenser Water Flow Rate	X					
Condenser Water Pump Status	X					X
Cool Setpoint	X	X		X	X	X
Evaporator Entering Water Temperature	X	X				X
Evaporator Flow Switch Status	X	X	X	X	X	X
Evaporator Leaving Water Temperature for Compressor	X					
Evaporator Leaving Water Temperature for Unit	X	X	X	X	X	X
Evaporator Pump Run Hours	X					
Evaporator Refrigerant Pressure	X	X	X	X	X	X
Evaporator Saturated Refrigerant Temperature	X	X	X	X	X	X
Evaporator Water Flow Rate	X					
Evaporator Water Pump Status	X	X		X	X	X
Heat Recovery Entering Water Temperature	X					
Heat Recovery Leaving Water Temperature	X					
Heat Setpoint	X					
Ice Setpoint	X	X		X	X	X
Liquid Line Refrigerant Pressure					X	
Liquid Line Refrigerant Temperature	X				X	
Network Clear Alarm	X	X	X	X	X	X
Oil Feed Pressure**	X					
Oil Feed Temperature**	X					
Oil Sump Pressure**	X					
Oil Sump Temperature**	X					
Outdoor Air Temperature		X	X	X		
Pump Select	X					
Run Enabled	X	X		X	X	X

*Dual circuit models only
**Not in WMC model
***Optional. Solid State Starter required

Active Setpoint

This output network variable indicates the current value of the setpoint temperature used to control the temperature of the Leaving Chilled Water or Leaving Hot Water. Based on the operating mode of the chiller, this value is derived from the Cooling Setpoint or the optional Heating Setpoint. The default mode is Cooling and is used unless changed by the Mode input. (A2)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40003	Temperature	°F x 10	-40°-199°F

Actual Capacity

This output network variable indicates the percent of capacity the chiller is currently producing. It may be more or less than the nominal capacity of the chiller. (A10)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40011	Percent of chiller capacity	% x 10	0% to 160%

Capacity Limit Output

This output variable is a measure of the ratio of operating capacity to full capacity expressed in percent. This level may be adjusted via an operator workstation or other network device, but cannot be adjusted above a factory-specified limit. It indicates the current value of the Capacity Limit (Input) data point. (A42)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40043	Percent of maximum capacity	% x 10	0% to 160%.

Capacity Limit Setpoint

Capacity Limit is a measure of the ratio of operating capacity to full capacity expressed in percent. The variable can set the operating value (input). This input network variable sets the maximum capacity level of the chiller. This level may be adjusted via an operator workstation or other network device, but cannot be adjusted above a factory-specified limit. (A3).

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40004	Percent of maximum capacity	% x 10	0% to 160%.

Chiller Enable

The Chiller Enable data point starts the chiller in a particular way. (D1)

Data Type	Index	Measurement	Units	Valid Range
Coil	2	Chiller State	NA	0 = Off (disable) 1 = On (enable)

Chiller Limited

This output network variable indicates the main running mode and states of the Chiller. The Limited network variable indicates whether conditions may exist that prevent the chiller from reaching setpoint. (D6)

Data Type	Index	Measurement	Units	Valid Range
Coil	7	Status	NA	0 = Not Limited 1 = Limited

Chiller Local/Remote

The Local/Remote network variable indicates whether the chiller is in local control or allowed to be controlled remotely over the network. (D5)

Data Type	Index	Measurement	Units	Valid Range
Coil	6	Mode	NA	0= Remote 1 = Local

Chiller Mode Output

This output data point indicates the current operating mode of the chiller. (I19)

Data Type	Index	Measurement	Units	Valid Range
Coil	40148	HVAC Mode	NA	1. ICE 2. COOL 3. HEAT

Chiller Mode Setpoint

The Chiller Mode data point sets the mode of operation of the chiller and provides the ability for another node on the network to place a chiller in another mode. (I17)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40146	HVAC Mode	NA	1. ICE 2. COOL 3. HEAT

Chiller On Off

This output network variable indicates the current state of the chiller. The OFF state is represented by 0, and the ON state is represented by 1. (D2)

Data Type	Index	Measurement	Units	Valid Range
Coil	3	Chiller State	NA	0 = Off 1 = On

Chiller Status

This output network variable indicates the main running mode and states of the Chiller. The mode provides the primary running states of a chiller and the state provides an indicator of other conditions present. (I18)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40147	Chiller State	NA	1. Off 2. Start 3. Run 4. Pre Shutdown 5. Service

Compressor Current

This output network variable indicates the compressor current of the compressor selected with Compressor Select on page 15. (A26)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40027	Electric Current	Amperes	0 -65,535

Compressor Discharge Temperature

This output network variable indicates the current compressor refrigerant temperature of the compressor selected with Compressor Select on page 15. (A19)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40020	Temperature	°F x 10	-460°-621°F

Compressor Percent RLA

This output network variable indicates the current percent RLA for the compressor motor of the compressor selected with Compressor Select on page 15. (A25)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40026	Percent RLA	% x 10	0 -110%

Compressor Power

This output network variable indicates the current compressor power of the compressor selected with Compressor Select on page 15. (A27)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40028	Electric Power	kiloWatts	0-65,535

Compressor Run Hours

This output network variable indicates the number of hours that the compressor motor of the compressor selected with Compressor Select on page 15 has been turned on. (I46)

Note: Value returned must be multiplied by 10 to give run hours.

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40175	Time	hours/10	0 -65,535

Compressor Select

This input network variable selects the compressor (number 1, 2, 3 or 4) that is interrogated. The controller returns the information for the selected compressor. You must first select a compressor then interrogate the selected compressor. This variable selects a compressor for the following variables. (I32)

Name	Page
Compressor Current	13
Compressor Discharge Temperature	14
Compressor Percent RLA	14
Compressor Power	14
Compressor Run Hours	14
Compressor Starts	15
Compressor Suction Line Temperature	15
Compressor Voltage	15
Condenser Refrigerant Pressure	16
Condenser Saturated Refrigerant Temperature	16
Evaporator Leaving Water Temperature for Compressor	17
Evaporator Refrigerant Pressure	18
Evaporator Saturated Refrigerant Temperature	18
Oil Feed Pressure	19
Oil Feed Temperature	19
Oil Sump Pressure	19
Oil Sump Temperature	19

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40161	Event Count	NA	0 -65,535

Compressor Starts

This output network variable indicates the number of times the compressor motor of the compressor selected with Compressor Select on page 15 has been started. (I45)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40174	Count	Starts	0 -65,535

Compressor Suction Line Temperature

This output network variable indicates the current suction line refrigerant temperature. There is a separate output for each compressor. See Compressor Select on page 15. (A15)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40016	Temperature	°F x 10	-40°-244°F

Compressor Voltage

This output network variable indicates the current compressor voltage of the compressor selected with Compressor Select on page 15. (A29)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40030	Electric Voltage	Volts	0 -65,535

Condenser Entering Water Temperature

This output network variable indicates the current temperature of the entering condenser water. (A7)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40008	Temperature	°F x 10	-40°-244°F

Condenser Flow Switch Status

This output network variable indicates the status of the water flow through the condenser. (D8)

Data Type	Index	Measurement	Units	Valid Range
Coil	9	Flow State	NA	0 = No Flow 1 = Flow

Condenser Leaving Water Temperature

This output network variable indicates the current temperature of the leaving condenser water. (A8)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40009	Temperature	°F x 10	-40°-244°F

Condenser Pump Run Hours

This output network variable indicates the number of hours that the selected condenser pump motor has been turned on. See Pump Select on page 16. (I48)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40177	Time	hours	0 -65,535

Condenser Refrigerant Pressure

This output network variable indicates the current refrigerant pressure in the selected condenser. There is a separate output for each compressor. See Compressor Select on page 16. (A21)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40022	Pressure (gauge)	psi x 10	-22592 - 22591 psi

Condenser Saturated Refrigerant Temperature

This output network variable indicates the current saturated refrigerant temperature in the condenser. There is a separate output for each compressor. See Compressor Select on page 16. (A20)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40021	Temperature	°F x 10	-40°- 244°F

Condenser Water Flow Rate

This output network variable indicates the rate of water flow through the condenser. (A24)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40025	Water Flow Rate	gallons per minute	0 -65,535

Condenser Water Pump Status

This output network variable indicates whether the selected pump has been commanded On or Off. See Pump Select on page 17. (D31)

Data Type	Index	Measurement	Units	Valid Range
Coil	32	Flow State	NA	0 = Pump Off Request 1 = Pump On Request

Cool Setpoint

This input property sets the temperature of the Leaving Chilled Water when the chiller is operating in the Cooling Mode. The Cooling mode is the normal mode of chiller operation, unless overridden by using the optional Mode variable to change to another mode. (A1)

Note: See the appropriate Operation Manual for specific data range and default value.

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40002	Temperature	°F x 10	10 - 120°F

Evaporator Entering Water Temperature

This output attribute indicates the temperature of the evaporator entering water temperature. (A4)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40005	Temperature	°F x 10	-40 - 245°F

Evaporator Flow Switch Status

This output network variable indicates the status of water flow through the evaporator. (D7)

Data Type	Index	Measurement	Units	Valid Range
Coil	8	Flow State	NA	0 = No Flow 1 = Flow

Evaporator Leaving Water Temperature for Unit

This output network variable indicates the current temperature of the Evaporator leaving chilled water. (A6)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40007	Temperature	°F x 10	-40° - 244°F

Evaporator Leaving Water Temperature for Compressor

This output network variable indicates the current temperature of the Evaporator leaving chilled water temperature of the compressor selected with Compressor Select on page 15. (A14)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40015	Temperature	°F x 10	-40°-244°F

Evaporator Pump Run Hours

This output network variable indicates the number of hours that the selected evaporator pump has been turned on. There is a separate output for each pump. See Pump Select on page 20. (I47)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40176	Event Count	Hours	0 - 65,535

Evaporator Refrigerant Pressure

This output network variable indicates the current refrigerant pressure in the evaporator. There is a separate output for each compressor. See Compressor Select on page 15. (A17)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40018	Pressure (gauge)	psi x 10	-22592 - 22591 psi

Evaporator Saturated Refrigerant Temperature

This output network variable indicates the current saturated refrigerant temperature in the evaporator. There is a separate output for each compressor. See Compressor Select on page 15. (A16)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40017	Temperature	°F x 10	-40° - 244°F

Evaporator Water Flow Rate

This output network variable indicates the rate of water flow through the evaporator. (A18)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40019	Water Flow Rate	gallons per minute	0 - 65,535

Evaporator Water Pump Status

This output network variable indicates whether the selected pump has been commanded On or Off. See Pump Select on page 20. (D29)

Data Type	Index	Measurement	Units	Valid Range
Coil	30	Flow State	NA	0 = Pump Off Request 1 = Pump On Request

Heat Recovery Entering Water Temperature

This output network variable indicates the current temperature of the water entering the heat recovery section. (A22)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40023	Temperature	°F x 10	-40° - 244°F

Heat Recovery Leaving Water Temperature

This output network variable indicates the current temperature of the water leaving the heat recovery section. (A23)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40024	Temperature	°F x 10	-40°-244°F

Heat Setpoint

This input network variable provides the heating setpoint when the chiller is operating in the heat mode. The value is ignored if the controller is in cooling mode. (A5)

Note: See the appropriate Operation Manual for specific data range and default value.

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40006	Temperature	°F x 10	50-120°F

Ice Setpoint

This input network property sets the temperature of the Leaving Chilled Water when the chiller is operating in the ice mode. (A50)

Note: See the appropriate Operation Manual for specific data range and default value.

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40051	Temperature	°F x 10	15 - 35°F

Liquid Line Refrigerant Pressure

This output network variable indicates the current liquid line refrigerant pressure. (A38)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40039	Pressure	psi x 10	–22592 - 22591 psi

Liquid Line Refrigerant Temperature

This output network variable indicates the current liquid line refrigerant temperature. (A36)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40037	Temperature	°F x 10	-40° - 244°F

Oil Feed Pressure

This output network variable indicates the current compressor oil feed pressure. There is a separate output for each compressor. See Compressor Select on page 15. (A32)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40033	Pressure	psi	–22592 - 22591 psi

Oil Feed Temperature

This output network variable indicates the current compressor oil feed temperature. There is a separate output for each compressor. See Compressor Select on page 15. (A34)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40035	Temperature	°F x 10	-40° - 244°F

Oil Sump Pressure

This output network variable indicates the current compressor oil sump pressure. There is a separate output for each compressor. See Compressor Select on page 15. (A33)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40034	Pressure	psi x 10	-22592 - 22591 psi.

Oil Sump Temperature

This output network variable indicates the current compressor oil sump temperature. There is a separate output for each compressor. See Compressor Select on page 15. (A35)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40036	Temperature	°F x 10	-40° - 244°F

Outdoor Air Temperature

This output network variable indicates the current outdoor air temperature. (A39)

Data Type	Index	Measurement	Units	Valid Range
Holding Register	40040	Temperature	°F x 10	-40° -2 44°F

Pump Select

This input network variable selects which pump (Number 1 or Number 2) supplies the data. The controller returns the information for the appropriate Condenser or Evaporator pump. You must first select a pump then interrogate the selected pump. See Condenser Pump Run Hours on page 16 and Evaporator Pump Run Hours on page 17. (D19)

Data Type	Index	Measurement	Units	Valid Range
Coil	20	Event Count	NA	0 = Pump #1 1 = Pump #2

Run Enabled

This output network variable indicates the main running mode and states of the Chiller. See Chiller Status on page 13 for details. The Run Enabled output network variable indicates that the chiller can start if operating conditions are met. (D2)

Data Type	Index	Measurement	Units	Valid Range
Coil	3	Chiller State	NA	0 = Off 1 = Run Allowed

Alarms

Alarm Classes
Modbus alarms in a MicroTech II unit controller are divided into three classes: Faults, Problems, and Warnings. Fault alarms have the highest severity level. Problem alarms have medium severity level. Warning alarms have the lowest severity level.

Fault Alarms
Fault alarms require an acknowledgment from the operator. These alarms indicate that the compressor is shut down.

Problem Alarms
Problem alarms do not cause compressor shutdown but limit operation of the chiller in some way.

Warning Alarms
A warning is enunciated whenever an abnormal condition exists which does not affect chiller operation.

Alarm Handling
One Modbus network variable indicates an alarm condition and one network variable clears alarms. To determine the particular alarm condition, you must read the status of the 16 Active Alarms Holding Registers.

Alarm Digital Output
This network output variable indicates whether an alarm condition has occurred. This variable must be polled for alarm notification. (D3)

Data Type	Index	Measurement	Units	Valid Range
Coil	4	NA	NA	0 = No Alarm 1 = Alarm

Clear Alarms
This input network variable clears all active alarms. It cannot clear all alarms in the Fault category (alarms that shut down the chiller). They would have to be cleared at the chiller panel. The alarms that cannot be cleared over the network (but can be cleared at the chiller) are: (D24)
- Low Evaporator Pressure
- High Condenser Pressure (by pressure sensor)
- High Condenser Pressure (by pressure switch)
- Low Oil Pressure
- Freeze Protection
- High Motor Temperature

Note: The above list is for centrifugal chillers. The flow loss alarm is the only alarm that can be remotely cleared on all other types of chillers.

Data Type	Index	Measurement	Units	Valid Range
Coil	25	NA	NA	0 = Normal 1 = Clear Alarm

Active Alarms

The Active Alarms Holding Registers contain a single bit for each alarm condition. You must read the status of these registers to determine the particular alarm condition indicated by the Alarm Digital Output. Table 3 defines the bit location for each alarm condition. (I1-I16)

Data Type	Index	Measurement	Units	Valid Range
Holding Registers	40130-40145	Alarm Condition	NA	0 = No Alarm 1 = Alarm

Table 3: Modbus Alarms

	Description	WSC WDC WPV WMC WCC HSC HDC TSC	AGZ	ACZ	WGZ	AGS	WGS	Holding Register	Bit
	Warnings								
1	Entering Condenser Water Temperature Sensor Fault	X						40130	1
2	Entering Evaporator Water Temperature Sensor Fault	X				X	X	40130	2
3	Liquid Line Refrigerant Temperature Sensor Fault	X						40130	3
4	Leaving Condenser Water Temperature Sensor Fault	X					X	40130	4
5	Repower After Power Loss 1					X	X	40130	5
6	Repower After Power Loss 2					X	X	40130	6
7	Repower After Power Loss 3					X[2]		40130	7
8	Repower After Power Loss 4							40130	8
9	(Expansion Alarm – Warning)					X		40130	9
	Problems								
10	Low Ambient Temperature Lockout		X	X	X	X	X	40130	10
11	High Condenser Pressure – Inhibit Loading Circuit 1		X[5]	X[3]	X	X	X	40130	11
12	High Condenser Pressure – Inhibit Loading Circuit 2		X[5]	X[3]	X	X	X	40130	12
13	High Condenser Pressure – Inhibit Loading Circuit 3					X[2]		40130	13
14	High Condenser Pressure – Inhibit Loading Circuit 4							40130	14
15	High Condenser Pressure – Unload		X[6]	X[4]				40130	15
16	High Condenser Pressure – Unload Circuit 1		X[5]	X[3]	X	X	X	40131	0
17	High Condenser Pressure – Unload Circuit 2		X[5]	X[3]	X	X	X	40131	1
18	High Condenser Pressure – Unload Circuit 3					X[2]		40131	2
19	High Condenser Pressure – Unload Circuit 4							40131	3
20	Condenser Water Freeze Protect Comp 1	X			X			40131	4
21	Condenser Water Freeze Protect Comp 2	X			X			40131	5
22	Condenser Water Freeze Protect Comp 3							40131	6
23	Condenser Water Freeze Protect Comp 4							40131	7
24	Condenser Pump #1 Fault	X						40131	8
25	Condenser Pump #2 Fault	X						40131	9
26	High Discharge Temperature Comp 1	X						40131	10
27	High Discharge Temperature Comp 2	X						40131	11
28	High Discharge Temperature Comp 3							40131	12
29	High Discharge Temperature Comp 4							40131	13
30	Entering Evap Temperature Sensor Fault (EWT reset active)	X						40131	14
31	Low Evaporator Pressure - Inhibit Loading		X[6]	X[4]				40131	15
32	Low Evaporator Pressure - Inhibit Loading Circuit 1	X	X[5]	X[3]	X	X	X	40132	0
33	Low Evaporator Pressure - Inhibit Loading Circuit 2	X	X[5]	X[3]	X	X	X	40132	1
34	Low Evaporator Pressure - Inhibit Loading Circuit 3					X[2]		40132	2
35	Low Evaporator Pressure - Inhibit Loading Circuit 4							40132	3
36	Low Evaporator Pressure – Unload		X[6]	X[4]				40132	4
37	Low Evaporator Pressure – Unload Circuit 1	X	X[5]	X[3]	X	X	X	40132	5
38	Low Evaporator Pressure – Unload Circuit 2	X	X[5]	X[3]	X	X	X	40132	6
39	Low Evaporator Pressure – Unload Circuit 3					X[2]		40132	7
40	Low Evaporator Pressure – Unload Circuit 4							40132	8
41	High Motor Current On Compressor #1	X						40132	9
42	High Motor Current On Compressor #2	X						40132	10
43	High Motor Current On Compressor #3							40132	11
44	High Motor Current On Compressor #4							40132	12
45	Evaporator Freeze Protect Comp 1	X						40132	13
46	Evaporator Freeze Protect Comp 2	X						40132	14
47	Evaporator Freeze Protect Comp 3							40132	15

48	Evaporator Freeze Protect Comp 4							40133	0
49	Evaporator Pump #1 Fault	X						40133	1
50	Evaporator Pump #2 Fault	X						40133	2
51	(Expansion Alarm – Problem)							40133	3
	Faults								
52	Outside Ambient Temperature Sensor Fault		X	X	X	X	X	40133	4
53	Compressor Current Overload Trip #1	X				X[1]	X	40133	5
54	Compressor Current Overload Trip #2	X				X[1]	X	40133	6
55	Compressor Current Overload Trip #3							40133	7
56	Compressor Current Overload Trip #4							40133	8
57	Motor Current Imbalance On Compressor #1	X				X[1]	X	40133	9
58	Motor Current Imbalance On Compressor #2	X				X[1]	X	40133	10
59	Motor Current Imbalance On Compressor #3							40133	11
60	Motor Current Imbalance On Compressor #4							40133	12
61	Low Motor Current Comp 1	X				X[1]	X	40133	13
62	Low Motor Current Comp 2	X				X[1]	X	40133	14
63	Low Motor Current Comp 3							40133	15
64	Low Motor Current Comp 4							40134	0
65	Motor Protection		X[6]	X[4]				40134	1
66	Motor Protection Circuit 1		X[5]	X[3]	X			40134	2
67	Motor Protection Circuit 2		X[5]	X[3]	X			40134	3
68	High Motor Temperature Comp 1	X				X[1]	X	40134	4
69	High Motor Temperature Comp 2	X				X[1]	X	40134	5
70	High Motor Temperature Comp 3							40134	6
71	High Motor Temperature Comp 4							40134	7
72	Phase Loss At Compressor 1	X[7]	X[5]	X[3]			X	40134	8
73	Phase Loss At Compressor 2	X[7]	X[5]	X[3]			X	40134	9
74	Phase Loss At Compressor 3							40134	10
75	Phase Loss At Compressor 4							40134	11
76	Phase Reversal At Compressor 1	X[7]					X	40134	12
77	Phase Reversal At Compressor 2	X[7]					X	40134	13
78	Phase Reversal At Compressor 3							40134	14
79	Phase Reversal At Compressor 4							40134	15
80	Overvoltage On Compressor 1	X[7]					X	40135	0
81	Overvoltage On Compressor 2	X[7]					X	40135	1
82	Overvoltage On Compressor 3							40135	2
83	Overvoltage On Compressor 4							40135	3
84	Undervoltage On Compressor 1	X[7]					X	40135	4
85	Undervoltage On Compressor 2	X[7]					X	40135	5
86	Undervoltage On Compressor 3							40135	6
87	Undervoltage On Compressor 4							40135	7
88	Condenser Pressure Sensor Fault		X[6]	X[4]				40135	8
89	Condenser Pressure Sensor Fault Circuit 1	X	X[5]	X[3]	X	X	X	40135	9
90	Condenser Pressure Sensor Fault Circuit 2	X	X[5]	X[3]	X	X	X	40135	10
91	Condenser Pressure Sensor Fault Circuit 3					X[2]		40135	11
92	Condenser Pressure Sensor Fault Circuit 4							40135	12
93	No Condenser Water Flow	X			X		X	40135	13
94	High Condenser Pressure		X[6]	X[4]				40135	14
95	High Condenser Pressure Circuit 1	X	X[5]	X[3]	X	X	X	40135	15
96	High Condenser Pressure Circuit 2	X	X[5]	X[3]	X	X	X	40136	0
97	High Condenser Pressure Circuit 3					X[2]		40136	1
98	High Condenser Pressure Circuit 4							40136	2
99	No Compressor Stop Comp 1	X						40136	3
100	No Compressor Stop Comp 2	X						40136	4
101	No Compressor Stop Comp 3							40136	5
102	No Compressor Stop Comp 4							40136	6
103	Discharge Temperature Sensor Fault Circuit 1	X				X	X	40136	7
104	Discharge Temperature Sensor Fault Circuit 2	X				X	X	40136	8
105	Discharge Temperature Sensor Fault Circuit 3					X[2]		40136	9
106	Discharge Temperature Sensor Fault Circuit 4							40136	10
107	High Discharge Temperature Circuit 1	X					X	40136	11
108	High Discharge Temperature Circuit 2	X					X	40136	12
109	High Discharge Temperature Circuit 3							40136	13
110	High Discharge Temperature Circuit 4							40136	14
111	Entering Condenser Water Temperature Sensor Fault				X		X	40136	15
112	No Evaporator Water Flow	X	X	X	X	X	X	40137	0
113	Evaporator Water Freeze Protect		X		X	X	X	40137	1
114	Low Evaporator Pressure		X[6]	X[4]				40137	2
115	Low Evaporator Pressure Circuit 1	X	X[5]	X[3]	X	X	X	40137	3
116	Low Evaporator Pressure Circuit 2	X	X[5]	X[3]	X	X	X	40137	4

117	Low Evaporator Pressure Circuit 3					X[2]		40137	5
118	Low Evaporator Pressure Circuit 4							40137	6
119	Evaporator Pressure Sensor Fault		X[6]	X[4]				40137	7
120	Evaporator Pressure Sensor Fault Circuit 1	X	X[5]	X[3]	X	X	X	40137	8
121	Evaporator Pressure Sensor Fault Circuit 2	X	X[5]	X[3]	X	X	X	40137	9
122	Evaporator Pressure Sensor Fault Circuit 3					X[2]		40137	10
123	Evaporator Pressure Sensor Fault Circuit 4							40137	11
124	Ground Fault Protection 1	X[7]	X[6]		X	X[1]	X	40137	12
125	Ground Fault Protection 2	X[7]	X[6]		X	X[1]	X	40137	13
126	Ground Fault Protection 3							40137	14
127	Ground Fault Protection 4							40137	15
128	Below Minimum Lift Pressure Circuit 1					X	X	40138	0
129	Below Minimum Lift Pressure Circuit 2					X	X	40138	1
130	Below Minimum Lift Pressure Circuit 3					X[2]		40138	2
131	Below Minimum Lift Pressure Circuit 4							40138	3
132	Liquid Line Pressure Sensor Fault Circuit 1					X		40138	4
133	Liquid Line Pressure Sensor Fault Circuit 2					X		40138	5
134	Liquid Line Pressure Sensor Fault Circuit 3					X[2]		40138	6
135	Liquid Line Pressure Sensor Fault Circuit 4							40138	7
136	Liquid Line Refrigerant Temperature Sensor Fault Circuit 1					X		40138	8
137	Liquid Line Refrigerant Temperature Sensor Fault Circuit 2					X		40138	9
138	Liquid Line Refrigerant Temperature Sensor Fault Circuit 3					X[2]		40138	10
139	Liquid Line Refrigerant Temperature Sensor Fault Circuit 4							40138	11
140	Re-Start Fault		X[6]	X[4]				40138	12
141	Re-Start Fault Circuit 1		X[5]	X[3]	X	X[1]	X	40138	13
142	Re-Start Fault Circuit 2		X[5]	X[3]	X	X[1]	X	40138	14
143	Re-Start Fault Circuit 3							40138	15
144	Re-Start Fault Circuit 4								0
145	Leaving Evaporator Water Temperature Sensor Fault		X		X	X	X	40139	1
146	Leaving Evaporator Water Temperature Sensor Fault Comp 1	X						40139	2
147	Leaving Evaporator Water Temperature Sensor Fault Comp 2	X						40139	3
148	Leaving Evaporator Water Temperature Sensor Fault Comp 3							40139	4
149	Leaving Evaporator Water Temperature Sensor Fault Comp 4							40139	5
150	Mechanical High Pressure		X[6]	X[4]				40139	6
151	Mechanical High Pressure Circuit 1	X	X[5]	X[3]	X	X	X	40139	7
152	Mechanical High Pressure Circuit 2	X	X[5]	X[3]	X	X	X	40139	8
153	Mechanical High Pressure Circuit 3					X[2]		40139	9
154	Mechanical High Pressure Circuit 4							40139	10
155	Low Oil Net Pressure Comp 1	X						40139	11
156	Low Oil Net Pressure Comp 2	X						40139	12
157	Low Oil Net Pressure Comp 3							40139	13
158	Low Oil Net Pressure Comp 4							40139	14
159	High Oil Feed Temperature Comp 1	X						40139	15
160	High Oil Feed Temperature Comp 2	X						40140	0
161	High Oil Feed Temperature Comp 3							40140	1
162	High Oil Feed Temperature Comp 4							40140	2
163	Low Oil Feed Temperature Comp 1	X						40140	3
164	Low Oil Feed Temperature Comp 2	X						40140	4
165	Low Oil Feed Temperature Comp 3							40140	5
166	Low Oil Feed Temperature Comp 4							40140	6
167	Oil Feed Temperature Sensor Fault Comp 1	X						40140	7
168	Oil Feed Temperature Sensor Fault Comp 2	X						40140	8
169	Oil Feed Temperature Sensor Fault Comp 3							40140	9
170	Oil Feed Temperature Sensor Fault Comp 4							40140	10
171	Low Oil Level Circuit 1					X	X	40140	11
172	Low Oil Level Circuit 2					X	X	40140	12
173	Low Oil Level Circuit 3					X[2]		40140	13
174	Low Oil Level Circuit 4							40140	14
175	High Oil Pressure Difference Circuit 1					X	X	40140	15
176	High Oil Pressure Difference Circuit 2					X	X	40141	0
177	High Oil Pressure Difference Circuit 3					X[2]		40141	1

178	High Oil Pressure Difference Circuit 4							40141	2
179	Oil Feed Pressure Sensor Fault Comp 1	X						40141	3
180	Oil Feed Pressure Sensor Fault Comp 2	X						40141	4
181	Oil Feed Pressure Sensor Fault Comp 3							40141	5
182	Oil Feed Pressure Sensor Fault Comp 4							40141	6
183	Oil Sump Pressure Sensor Fault Comp 1	X						40141	7
184	Oil Sump Pressure Sensor Fault Comp 2	X						40141	8
185	Oil Sump Pressure Sensor Fault Comp 3							40141	9
186	Oil Sump Pressure Sensor Fault Comp 4							40141	10
187	Oil Sump Temperature Sensor Fault Comp 1	X						40141	11
188	Oil Sump Temperature Sensor Fault Comp 2	X						40141	12
189	Oil Sump Temperature Sensor Fault Comp 3							40141	13
190	Oil Sump Temperature Sensor Fault Comp 4							40141	14
191	Phase Voltage Protection		X[6]	X[4]				40141	15
192	Starter Fault Compressor 1	X				X	X	40142	0
193	Starter Fault Compressor 2	X				X	X	40142	1
194	Starter Fault Compressor 3					X[2]		40142	2
195	Starter Fault Compressor 4							40142	3
196	No Starter Transition Comp 1	X				X[1]		40142	4
197	No Starter Transition Comp 2	X				X[1]		40142	5
198	No Starter Transition Comp 3							40142	6
199	No Starter Transition Comp 4							40142	7
200	No Oil Pressure Start Comp 1	X						40142	8
201	No Oil Pressure Start Comp 2	X						40142	9
202	No Oil Pressure Start Comp 3							40142	10
203	No Oil Pressure Start Comp 4							40142	11
204	Low Subcooling Circuit 1					X[2]	X	40142	12
205	Low Subcooling Circuit 2					X[2]	X	40142	13
206	Low Subcooling Circuit 3					X[2]		40142	14
207	Low Subcooling Circuit 4							40142	15
208	Surge High Suct SH-Running Comp 1	X						40143	0
209	Surge High Suct SH-Running Comp 2	X						40143	1
210	Surge High Suct SH-Running Comp 3							40143	2
211	Surge High Suct SH-Running Comp 4							40143	3
212	Surge High Suct SH-Starting Comp 1	X						40143	4
213	Surge High Suct SH-Starting Comp 2	X						40143	5
214	Surge High Suct SH-Starting Comp 3							40143	6
215	Surge High Suct SH-Starting Comp 4							40143	7
216	Suction Temperature Sensor Fault Circuit 1	X				X	X	40143	8
217	Suction Temperature Sensor Fault Circuit 2	X				X	X	40143	9
218	Suction Temperature Sensor Fault Circuit 3					X[2]		40143	10
219	Suction Temperature Sensor Fault Circuit 4							40143	11
220	Vanes Open No Start Comp 1	X[8]						40143	12
221	Vanes Open No Start Comp 2	X[8]						40143	13
222	Vanes Open No Start Comp 3							40143	14
223	Vanes Open No Start Comp 4							40143	15
224	(Expansion Alarm- Fault)	X				X	X	40144	0
225	COMP SHUTDOWN – Comp Fault #1							40144	1
226	COMP SHUTDOWN – Comp Fault #2							40144	2
227	COMP SHUTDOWN – Comp Fault #3							40144	3
228	COMP SHUTDOWN – Comp Fault #4							40144	4

[1]-AGS ‘C’ Vintage Only
[2]-AGS ‘B’ Vintage Only
[3]-ACZ Dual Circuit Only
[4]-ACZ Single Circuit Only
[5]-AGZ Dual Circuit Only
[6]-AGZ Single Circuit Only
[7]-Solid State Starter Option required. Not available on WMC.
[8]-Should be “No Start - Interlock Switch” on WMC chillers.

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