Engineering Data

ED 15121-1

Group: Controls

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MicroTech® III Pathfinder™ Air Cooled Chiller Unit Controller Protocol Information

Modbus® Protocol

- **Model AWS (with or without VFD)**

McQuay® International

a member of DAIKIN group

Table of Contents

TABLE OF TABLES

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.

Notice

McQuay International reserves the right to change any information contained herein without prior notice. The user is responsible for determining whether this product is appropriate for his or her application.

Revision History

ED 15121	October 2009	Preliminary release.
ED 15121-1	April 2010	Added points and alarms supported for AWS with VFD. Removed Evaporator Pump Maintenance Warning. This is not supported. Removed Compressor Maintenance Warning. These are not supported. Added the Option Controller Communication Failed warning alarm.

Software Revision

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

Reference Documents

Company	Number	Title	Source
McQuay International	IM 969	MicroTech III Modbus Communication Module Installation Manual	www.mcquay.com
McQuay International	IM 1002 (50Hz) IM 997 (60Hz)	Pathfinder™ Air Cooled Chiller Installation Manual	www.mcquay.com
McQuay International	OM 1051	Pathfinder Air Cooled Chiller Operation Manual	www.mcquay.com
Modbus-IDA.ORG		MODBUS Application Protocol Specification V1.1b	www.Modbus.org
Modbus-IDA.ORG		MODBUS over Serial Line Specification and Implementation Guide V1.02	www.Modbus.org

Introduction

This document contains the necessary information to incorporate a MicroTech® III Chiller Unit Controller from McQuay International into your Building Automation System (BAS). It includes all necessary Modbus® variables and corresponding MicroTech III 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.

AWS Air-Cooled World Screw

Controller Data Points

The MicroTech III Chiller Unit Controller contains data points or unit variables that are accessible from two different user interfaces: the unit keypad/display 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 details.

NOTICE

The MicroTech III Chiller Unit Controller maps additional Modbus registers that are not included in this document. These registers are for internal use only. Please contact McQuay Controls Customer Support at 866-462-7829 for assistance with Modbus integration.

Modbus Protocol Information

Compatibility

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

The MicroTech III Chiller Unit Controller conforms to the published Modbus standards. Refer to www.Modbus.org for more information.

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 III Chiller Unit Controller uses the RTU mode only.***

Valid Function Codes

The MicroTech III Chiller Unit Controller supports eight public function codes (see Table 1.) However, the MicroTech III Chiller Unit Controller contains only Holding Registers (4xxxx).

Table 1. Valid Function Codes

Function Code	Description	Definition
01 (0x01)	Read Coil Status	Reads the On/Off status of discrete outputs.
02 (0x02)	Read Input Status	Reads the On/Off status of discrete inputs.
03 (0x03)	Read Holding Registers	Used to read 1 to approximately 125 contiguous input registers in a remote device.
04 (0x04)	Read Input Registers	Reads the contents of input registers.
05 (0x05)	Force Single Coil	Force a single coil to on or off.
06 (0x06)	Write Single Register	Used to write a single holding register to a remote device.
15 (0x0F)	Write Multiple Coils	Forces each coil in a sequence of coils to either On or Off.
16 (0x10)	Write Multiple Registers	Used to write a block of 1 to approximately 120 contiguous registers in a remote device.

Valid Error Codes

The MicroTech III Chiller Unit Controller supports all exception codes. See Table 2 below for a description of valid error codes.

Table 2. Valid Error 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).
04	Slave Device Failure	An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.
05	Acknowledged	The server (or slave) is has accepted, and is processing, the request.
06	Slave Device Busy	The server (or slave) is busy processing a command. The client (or master) should retransmit when the server (or slave) is free.
08	Memory Parity Error	The server (or slave) attempted to read record file, but detected a parity error in the memory. The client (or master) can retry the request, but service may be required on the server (or slave) device.
0A	Gateway Path Unavailable	The gateway may be configured incorrectly or overloaded.
0B	Gateway Target Device Failed to Respond	No response from the target device.

Modbus Addressing

Each function code implies access to a specific Modbus reference set. Therefore, the leading digit is not included in the address field of a Modbus message. The Modbus Communication Module supports zero-based addressing. For example, holding register 40003 is addressed as 0002 in a Modbus message.

Modbus Data Point

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

When a variable spans multiple Holding Registers, it is important to know how the data is represented in those Holding Registers. This is best shown with an example. Let's use Compressor Run Hours. Circuit 1, compressor 1 run hours is located at holding registers 74-75 (40074-40075). If the operating hours is 99900 (0x0001 0x863C), the registers will be as follows:

- 74= 0x863C
- 75 = 0x0001

For strings, the interpretation differs. In this case, each holding register can contain two characters. If a string spans multiple registers, the first register (lowest register number) contains the 2 left-most characters of the string. Since the MicroTech III Chiller Unit Controller only supports Modbus RTU, use Appendix A: ASCII Character to translate the numerical data to their corresponding ASCII characters. An example of registers that contain string data is Application Version which is located at holding registers 334-338 (40334-40338). The following example shows the holding register and its value (in hexadecimal), followed by the ASCII character translation.

- 334= 0x3235
  - 0x32 = "2"
  - 0x35 = "5"
- 335= 0x3035
  - 0x30 = "0"
  - 0x35 = "5"
- 335= 0x3036
  - 0x30 = "0"
  - 0x35 = "6"
- 337= 0x3731
  - 0x37 = "7"
  - 0x31 = "1"
- 338= 0x3030
  - 0x30 = "0"
  - 0x30 = "0"

Application Version = 2505067100

Example Data Point: Chiller On/Off

This output data point indicates the current state of the chiller. The OFF state is represented by state = FALSE and value = 0. The other discrete states are represented by state = TRUE and value > 0.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	8	Chiller State	N/A	0=Off 1=On

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.
All of the Modbus registers defined in the MicroTech III Chiller Unit Controller are 16-bit Holding Registers. Some are read only (RO) and some are read-write (RW).

Holding Register

There are up to 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 of the data in the unit controller. This means, for example, that data element number 1 (ie, holding register 40001) is addressed using index 0 in the PDU.

In addition, the function code field portion of the message already specifies a 'holding register' operation. Therefore the '4xxxx' reference is implicit. This document follows this assumption and has published the holding registers without the implicit 4xxxx. For example, Holding Register 8 is actually Holding Register 40008.

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 III Chiller Unit Controller and the Modbus Communication Module ship with default parameter values. 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. See the MicroTech III Modbus Communication Module Installation Manual, IM 969, for details regarding network parameters available via the unit controller keypad/display. All documents are available on www.mcquay.com.

Typical Application: Minimum Integration

Display Important Data Points

Typical workstation displays of MicroTech III Chiller Unit Controller attributes include the following significant data points (page number of detailed description in parenthesis). Each data point is tagged with a number that identifies it in the Protocol Point Summary Tables. These particular data points are indicated with boldface type. Refer to Tables 4-8.

Table 3. Significant Data Points

No.	Configuration	No.	Temperatures	No.	Setpoints	No.	Alarms
1	Chiller Status (23)	5	Evaporator Entering Fluid Temperature (27)	9	Cool Setpoint – Network (26)	11	Warning Alarm Code(29)
2	Chiller Mode Setpoint – Network (23)	6	Evaporator Leaving Fluid Temperature (27)	10	Capacity Limit Setpoint – Network (21)	12	Problem Alarm Code(29)
3	Actual Capacity (20)					13	Fault Alarm Code(28)
4	Chiller Enable Setpoint (22)					14	Clear Alarms - Network(31)

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

Protocol Point Summary

The following section provides a summary of Modbus properties available from the MicroTech III Chiller Unit Controller. Tables 4-8 contain the complete list of chiller, circuit, compressor, pump, and miscellaneous data points respectively. The items shown in boldface represent the minimum integration properties (as identified previously in Table 3.)

Register Mapping

The Modbus Communication Module supports zero-based addressing. For example, holding register 40002 is addressed as 0001 in a Modbus message. The following tables assume 4xxxx addressing. For example, 1 will be holding register 40001.

Table 4. Chiller Data Points

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
Chiller Local/Remote	22	1	R	0=Remote, 1=Local
Chiller Enable Output	22	2	R	0=Disable, 1=Enable
Run Enabled	29	3	R	0=Off, 1= RunAllowed
Chiller Capacity Limited	21	4	R	0=Not Limited, 1=Limited
Alarm Digital Output	20	5	R	0=No Alarm, 1=Alarm
Evaporator Flow Switch Status	27	6	R	0=No Flow, 1=Flow
Chiller On/Off	23	8	R	0=Off, 1=On
Chiller Enable Setpoint (4)	**22**	**9**	**R/W**	**0=Disable, 1=Enable, 2=Null**
Clear Alarms – Network (14)	**23**	**10**	**R/W**	**0=Normal, 1=Clear Alarms, 2=Null**
Chiller Mode Output	22	11	R	1=Ice, 2=Cool, 3=Heat, 4=Cool/Heat Recovery, 5=Defrost
Active Setpoint	20	12	R	15.08°F to 149.9°F (-9.4°C to 65.5°C)
Actual Capacity (3)	**20**	**13**	**R**	**0 - 100%**
Active Capacity Limit Output	20	14	R	0 - 100%
Chiller Status (Chiller Run Mode) (1)	**23**	**15**	**R**	**1=Off, 2=Start, 3=Run, 4=Pre Shutdown, 5=Service**
Evaporator Entering Fluid Temperature (5)	**27**	**16**	**R**	**-40-230°F (-40-110°C)**
Evaporator Leaving Fluid Temperature (6)	**27**	**17**	**R**	**-40-230°F (-40-110°C)**
Outdoor Air Temperature	29	24	R	-40-230°F (-40-110°C)
Chiller Current	21	25	R	0-10,000 Amps
Warning Alarm Index	29	28	R	0=No Alarms 8=Bad setpoint override input 9=Bad demand limit input 11=Unit power restore 12=Circuit failed pumpdown 13=External Event 14 = Bad Current Limit Input 15=Option Controller Communication Failed

Problem Alarm Index	29	29	R	0=No Alarms
				64=RESTART DELAYED-Power Loss While Running Circuit #n
				65=START INHIBITED - Ambient Temperature Low
				67=INHIBIT LOAD – Condenser Pressure High Circuit #n
				69=UNLOAD – Condenser Pressure High Circuit #n
				76=INHIBIT LOAD - Evaporator Pressure Low Circuit #n
				78=UNLOAD - Evaporator Pressure Low Circuit #n
				79=UNLOAD - Comp Motor Current High Circuit #n, Comp #n
				84= INHIBIT LOAD-Comp Motor Current High Circuit #n, Comp #n

Fault Alarm Index	28	30	R	0=No Alarms
				127=COMP SHUTDOWN–Low pressure ratio #n
				128=COMP SHUTDOWN-Outside Air Temp Sensor Fault
				129=COMP SHUTDOWN-Current Overload Trip Circuit #n, Comp #n
				135=COMP SHUTDOWN–Motor Temp High Circuit #n
				136=COMP SHUTDOWN–Motor Temp Sensor Fault #n
				142=COMP SHUTDOWN-Condenser Pressure Sensor Fault #n
				145=COMP SHUTDOWN-Condenser Pressure High #n,
				147=COMP SHUTDOWN-Discharge Temp Sensor Fault #n

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description

				148=COMP SHUTDOWN-Discharge Temp High #n
				150=UNIT SHUTDOWN-Evaporator Water Flow Loss
				151=UNIT SHUTDOWN–Evaporator Leaving Water Temp Low (Freeze)
				153=COMP SHUTDOWN-Evaporator Pressure Low #n,
				155=COMP SHUTDOWN-Evaporator Pressure Sensor Fault #n
				161=COMP LOCKOUT-Number of Allowed Re-Starts Exceeded #n
				162=UNIT SHUTDOWN-Evaporator Leaving Water Temp Sensor Fault
				163=UNIT SHUTDOWN-Evaporator Entering Water Temperature Sensor Failure
				166=COMP SHUTDOWN-Mechanical High Pressure Trip #n
				172=COM SHUTDOWN-Oil Delta Pressure High Circuit #1, Comp #1
				173=COMP SHUTDOWN-Oil Feed Pressure Sensor Fault #n
				176=SHUTDOWN–Phase Voltage Protection
				177=COMP SHUTDOWN–Starter Fault Comp #n
				183=COMP SHUTDOWN-Suction Temp Sensor Fault #n
				187=COMP SHUTDOWN–Mechanical Low Pressure Trip #n
				188=Controller board offline Circuit #n
				189=COMP SHUTDOWN –No Pressure Change After Start
				190=COMP SHUTDOWN–No Pressure at Startup
				191=CIRCUIT SHUTDOWN–Evaporator Freeze Protection
				192=UNIT STOP–Emergency Stop Alarm
				193=UNIT STOP–Evaporator Water Temps Inverted
				194=UNIT STOP–External Alarm
				195=Evaporator Leaving Water Temperature 1 Sensor Fault
				196=Evaporator Leaving Water Temperature 2 Sensor Fault
				197=CIRCUIT SHUTDOWN-Evaporator 1 Freeze Protection
				198=CIRCUIT SHUTDOWN-Evaporator 2 Freeze Protection
				199=COMP SHUTDOWN-COMP VFD Fault Circuit #n, Comp #n
				200=COMP SHUTDOWN-COMP VFD Over Heat Fault Circuit #n, Comp #n
				201=COMP SHUTDOWN-COM ERROR With COMPRESSOR VFD Circuit #n, Comp #n
				202 = COMP SHUTDOWN-Low Discharge Superheat Circuit #n, Comp #n

Warning Alarm Code (11)	**29**	**31**	**R**	**0=No Alarms** **2049=Bad setpoint override input** **2305=Bad demand limit input** **2817=Unit power restore** **3105=Circuit 1 failed pumpdown** **3137=Circuit 2 Failed pumpdown** **3169=Circuit 3 failed pumpdown** **3201=Circuit 4 failed pumpdown** **3329=External Event** **3585=Bad Current Limit Input** **3841=Option Controller Communication Failed**
Problem Alarm Code (12)	**29**	**32**	**R**	**0=No Alarms,** **16418=RESTART DELAYED - Power Loss While Running Circuit #1** **16450=RESTART DELAYED - Power Loss While Running Circuit #2** **16482=RESTART DELAYED - Power Loss While Running Circuit #3** **16514=RESTART DELAYED - Power Loss While Running Circuit #4** **16642=START INHIBITED - Ambient Temperature Low** **16898=INHIBIT LOAD – Condenser Pressure High** **17186=INHIBIT LOAD – Condenser Pressure High Circuit #1** **17218=INHIBIT LOAD – Condenser Pressure High Circuit #2** **17250=INHIBIT LOAD – Condenser Pressure High Circuit #3** **17282=INHIBIT LOAD – Condenser Pressure High Circuit #4** **17698=UNLOAD – Condenser Pressure High Circuit #1** **17730=UNLOAD – Condenser Pressure High Circuit #2** **17762=UNLOAD – Condenser Pressure High Circuit #3** **17794=UNLOAD – Condenser Pressure High Circuit #4**

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
				19490=INHIBIT LOAD - Evaporator Pressure Low Circuit #1 19522=INHIBIT LOAD - Evaporator Pressure Low Circuit #2 19554=INHIBIT LOAD - Evaporator Pressure Low Circuit #3 19586=INHIBIT LOAD - Evaporator Pressure Low Circuit #4 20002=UNLOAD - Evaporator Pressure Low Circuit #1 20034=UNLOAD - Evaporator Pressure Low Circuit #2 20066=UNLOAD - Evaporator Pressure Low Circuit #3 20098=UNLOAD - Evaporator Pressure Low Circuit #4 20262=UNLOAD-Comp Motor Current High Circuit #1, Comp #1 20294=UNLOAD-Comp Motor Current High Circuit #2, Comp #1 20326=UNLOAD-Comp Motor Current High Circuit #3, Comp #1 21542=INHIBIT LOAD-Comp Motor Current High Circuit #1, Comp #1 21574=INHIBIT LOAD-Comp Motor Current High Circuit #2, Comp #1 21606= INHIBIT LOAD-Comp Motor Current High Circuit #3, Comp #1
Fault Alarm Code (13)	28	33	R	0=No Alarms 32551=COMP SHUTDOWN–Low pressure ratio Circuit #1, Comp #1 32583=COMP SHUTDOWN – Low pressure ratio Circuit #2, Comp #1 32615=COMP SHUTDOWN–Low pressure ratio Circuit #3, Comp #1 32647=COMP SHUTDOWN–Low pressure ratio Circuit #4, Comp #1 32771=COMP SHUTDOWN-Outside Air Temp Sensor Fault, 33063=COMP SHUTDOWN-Current Overload Trip Circuit #1, Comp #1 33095=COMP SHUTDOWN-Current Overload Trip Circuit #2, Comp #1 33127= COMP SHUTDOWN-Current Overload Trip Circuit #3, Comp #1 34599=COMP SHUTDOWN–Motor Temp High Circuit #1, Comp #1 34631=COMP SHUTDOWN-Motor Temp High Circuit #2, Comp #1 34663=COMP SHUTDOWN–Motor Temp High Circuit #3, Comp #1 34695=COMP SHUTDOWN–Motor Temp High Circuit #4, Comp #1 34855= COMP SHUTDOWN–Motor Temp Sensor Fault Circuit #1, Comp #1 34887= COMP SHUTDOWN–Motor Temp Sensor Fault Circuit #2, Comp #1 34919= COMP SHUTDOWN–Motor Temp Sensor Fault Circuit #3, Comp #1 34951= COMP SHUTDOWN–Motor Temp Sensor Fault Circuit #4, Comp #1 36391=COMP SHUTDOWN-Condenser Pressure Sensor Fault Circuit #1, Comp #1 36423=COMP SHUTDOWN-Condenser Pressure Sensor Fault Circuit #2, Comp #1 36455=COMP SHUTDOWN-Condenser Pressure Sensor Fault Circuit #3, Comp #1 36487=COMP SHUTDOWN-Condenser Pressure Sensor Fault Circuit #4, Comp #1 37159=COMP SHUTDOWN-Condenser Pressure High Circuit #1, Comp #1 37191=COMP SHUTDOWN-Condenser Pressure High Circuit #2, Comp #1 37223=COMP SHUTDOWN-Condenser Pressure High Circuit #3, Comp #1 37255=COMP SHUTDOWN-Condenser Pressure High Circuit

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
				#4, Comp #1 37671=COMP SHUTDOWN-Discharge Temp Sensor Fault Circuit #1, Comp #1 37703=COMP SHUTDOWN-Discharge Temp Sensor Fault Circuit #2, Comp #1 37735=COMP SHUTDOWN-Discharge Temp Sensor Fault Circuit #3, Comp #1 37767=COMP SHUTDOWN-Discharge Temp Sensor Fault Circuit #4, Comp #1 37927=COMP SHUTDOWN-Discharge Temp High Circuit #1, Comp #1 37959=COMP SHUTDOWN-Discharge Temp High Circuit #2, Comp #1 37991=COMP SHUTDOWN-Discharge Temp High Circuit #3, Comp #1 38023=COMP SHUTDOWN-Discharge Temp High Circuit #4, Comp #1 38403=UNIT SHUTDOWN-Evaporator Water Flow Loss, 38659=UNIT SHUTDOWN–Evaporator Leaving Water Temp Low (Freeze) 38915=COMP SHUTDOWN-Evaporator Pressure Low 39207=COMP SHUTDOWN-Evaporator Pressure Low Circuit #1, Comp #1 39239=COMP SHUTDOWN–Evaporator Pressure Low Circuit #2, Comp #1 39271=COMP SHUTDOWN-Evaporator Pressure Low Circuit #3, Comp #1 39303=COMP SHUTDOWN–Evaporator Pressure Low Circuit #4, Comp #1 39719=COMP SHUTDOWN-Evaporator Pressure Sensor Fault Circuit #1, Comp #1 39751=COMP SHUTDOWN-Evaporator Pressure Sensor Fault Circuit #2, Comp #1 39783=COMP SHUTDOWN-Evaporator Pressure Sensor Fault Circuit #3, Comp #1 39815=COMP SHUTDOWN-Evaporator Pressure Sensor Fault Circuit #4, Comp #1 41255=COMP LOCKOUT-Number of Allowed Re-Starts Exceeded Circuit #1, Comp #1 41287=COMP LOCKOUT-Number of Allowed Re-Starts Exceeded Circuit #2, Comp #1 41319=COMP LOCKOUT-Number of Allowed Re-Starts Exceeded Circuit #3, Comp #1 41351=COMP LOCKOUT-Number of Allowed Re-Starts Exceeded Circuit #4, Comp #1 41475=UNIT SHUTDOWN-Evaporator Leaving Water Temp Sensor Fault 41731=UNIT SHUTDOWN-Evaporator Entering Water Temp Sensor Failure 42535=COMP SHUTDOWN-Mechanical High Pressure Trip Circuit #1, Comp #1 42567=COMP SHUTDOWN-Mechanical High Pressure Trip Circuit #2, Comp #1 42599=COMP SHUTDOWN-Mechanical High Pressure Trip Circuit #3, Comp #1 42631=COMP SHUTDOWN-Mechanical High Pressure Trip Circuit #4, Comp #1 44327=COMP SHUTDOWN-Oil Feed Pressure Sensor Fault Circuit #1, Comp #1 44359=COMP SHUTDOWN-Oil Feed Pressure Sensor Fault Circuit #2, Comp #1 44391=COMP SHUTDOWN-Oil Feed Pressure Sensor Fault Circuit #3, Comp #1 44423=COMP SHUTDOWN-Oil Feed Pressure Sensor Fault Circuit #4, Comp #1 45059=SHUTDOWN-Phase Voltage Protection 45351=COMP SHUTDOWN–Starter Fault Comp Circuit #1, Comp #1

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
				45383=COMP SHUTDOWN–Starter Fault Comp Circuit #2, Comp #1 **45415=COMP SHUTDOWN–Starter Fault Comp Circuit #3, Comp #1** **45447=COMP SHUTDOWN–Starter Fault Comp Circuit #4, Comp #1** **46887=COMP SHUTDOWN-Suction Temp Sensor Fault Circuit #1, Comp #1** **46919=COMP SHUTDOWN-Suction Temp Sensor Fault Circuit #2, Comp #1** **46951=COMP SHUTDOWN-Suction Temp Sensor Fault Circuit #3, Comp #1** **46983=COMP SHUTDOWN-Suction Temp Sensor Fault Circuit #4, Comp #1** **47911=COMP SHUTDOWN–Mechanical Low Pressure Trip Circuit #1, Comp #1** **47943=COMP SHUTDOWN–Mechanical Low Pressure Trip Circuit #2, Comp #1** **47975=COMP SHUTDOWN–Mechanical Low Pressure Trip Circuit #3, Comp #1** **48007=COMP SHUTDOWN–Mechanical Low Pressure Trip Circuit #4, Comp #1** **48131=Unit Controller offline** **48163=Controller board offline Circuit #1** **48195=Controller board offline Circuit #2** **48227=Controller board offline Circuit #3** **48259=Controller board offline Circuit #4** **48419=COMP SHUTDOWN–No Pressure Change After Start Circuit #1** **48451=COMP SHUTDOWN–No Pressure Change After Start Circuit #2** **48483=COMP SHUTDOWN–No Pressure Change After Start Circuit #3** **48515=COMP SHUTDOWN–No Pressure Change After Start Circuit #4** **48675=COMP SHUTDOWN–No Pressure at Startup Circuit #1** **48707=COMP SHUTDOWN–No Pressure at Startup Circuit #2** **48739=COMP SHUTDOWN–No Pressure at Startup Circuit #3** **48771=COMP SHUTDOWN–No Pressure at Startup Circuit #4** **48935=COMP SHUTDOWN-Slide position sensor fault Circuit #1, Comp#1** **48967=COMP SHUTDOWN-Slide position sensor fault Circuit #2, Comp#1** **48999=COMP SHUTDOWN-Slide position sensor fault Circuit #3, Comp#1** **49031=COMP SHUTDOWN-Slide position sensor fault Circuit #4, Comp#1** **49155=UNIT STOP–Emergency Stop Alarm** **49411=UNIT STOP–Evaporator Water Temps Inverted** **49667=UNIT STOP–External Alarm** **49923=Evaporator Leaving Water Temp 1 Sensor Fault** **50179=Evaporator Leaving Water Temp 2 Sensor Fault** **50435=CIRCUIT SHUTDOWN-Evaporator 1 Freeze Protection** **50691=CIRCUIT SHUTDOWN-Evaporator 2 Freeze Protection** **50983=COMP SHUTDOWN-COMP VFD Fault Circuit #1, Comp #1** **51015=COMP SHUTDOWN-COMP VFD Fault Circuit #2, Comp #1** **51047=COMP SHUTDOWN-COMP VFD Fault Circuit #3, Comp #1** **51239=COMP SHUTDOWN-COMP VFD Over Heat Fault**

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
				Circuit #1, Comp #1 **51271=COMP SHUTDOWN-COMP VFD Over Heat Fault Circuit #2, Comp #1** **51303=COMP SHUTDOWN-COMP VFD Over Heat Fault Circuit #3, Comp #1** **51495=COMP SHUTDOWN-COM ERROR With COMP VFD Circuit #1, Comp #1** **51527=COMP SHUTDOWN-COM ERROR With COMP VFD Circuit #2, Comp #1** **51559=COMP SHUTDOWN-COM ERROR With COMP VFD Circuit #3, Comp #1** **51755 = COMP SHUTDOWN -Low Discharge Superheat Circuit #1, Comp #1** **51783 = COMP SHUTDOWN -Low Discharge Superheat Circuit #2, Comp #1** **51815 = COMP SHUTDOWN -Low Discharge Superheat Circuit #3, Comp #1**
Chiller Mode Setpoint – Network (2)	**23**	**34**	**R/W**	**0=Null, 1=Ice, 2=Cool, 3=Heat, 4=Cool/Heat Recovery.** The MicroTech III Chiller only supports Ice and Cool modes. If any other mode is written, the chiller will be set to Cool mode.
Cool Setpoint – Network (9)	**26**	35	**R/W**	24.98-60.08° F (-3.9-15.6° C) Default = 43.88° F (6.6°C)
Ice Setpoint - Network	28	36	R/W	15.08°-38.12°F (-9.4°-3.4°C) Default = 24.98°F (-3.9°C)
Capacity Limit Setpoint - Network (10)	**21**	**38**	**R/W**	**0 - 100%**

Boldface indicates data points required for typical minimum integration.

Table 5. Circuit Data Points

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
Circuit #1				
Condenser Refrigerant Pressure	26	39	R	0-410 psi (700 psi for R410A) 0-2827 kPa, (4826 kPa for R410A)
Condenser Saturated Refrigerant Temperature	26	40	R	-14.98-185°F (-26.1-85°C)
Evaporator Refrigerant Pressure	28	41	R	-349.97–349.97 psi (-2413 kPa – 2413 kPa)
Evaporator Saturated Refrigerant Temperature	28	42	R	-14.98-185°F (-26.1-85°C)
Circuit #2				
Condenser Refrigerant Pressure	26	43	R	0-410 psi (700 psi for R410A) 0-2827 kPa, (4826 kPa for R410A)
Condenser Saturated Refrigerant Temperature	26	44	R	-14.98-185°F (-26.1-85°C)
Evaporator Refrigerant Pressure	28	45	R	-349.97–349.97 psi (-2413 kPa – 2413 kPa)
Evaporator Saturated Refrigerant Temperature	28	46	R	-14.98-185°F (-26.1-85°C)
Circuit #3				
Condenser Refrigerant Pressure	26	47	R	0-410 psi (700 psi for R410A)0-2827 kPa, (4826 kPa for R410A)
Condenser Saturated Refrigerant Temperature	26	48	R	-14.98-185°F (-26.1-85°C)
Evaporator Refrigerant Pressure	28	49	R	-349.97–349.97 psi (-2413 kPa – 2413 kPa)
Evaporator Saturated Refrigerant Temperature	28	50	R	-14.98-185°F (-26.1-85°C)
Circuit #4				
Condenser Refrigerant Pressure	26	51	R	0-410 psi (700 psi for R410A) 0-2827 kPa (4826 kPa for R410A)
Condenser Saturated Refrigerant Temperature	26	52	R	-14.98-185°F (-26.1-85°C)
Evaporator Refrigerant Pressure	28	53	R	-349.97–349.97 psi (-2413 kPa – 2413 kPa)
Evaporator Saturated Refrigerant Temperature	28	54	R	-14.98-185°F (-26.1-85°C)

Table 6. Compressor Data Points

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
Circuit #1				
Compressor #1 Suction Refrigerant Temp	25	65	R	-40-230° F (-40°-110° C)
Compressor #1 Discharge Refrigerant Temp	24	68	R	-40°– 250°F (-40°– 121°C)
Compressor #1 Percent RLA	24	69	R	0-110%
Compressor #1 Current	24	70	R	0-10,000
Compressor #1 Voltage	25	71	R	0-15,000
Compressor #1 Power	24	72	R	0-3500 kW
Compressor #1 Starts	25	73	R	0 - 65,535
Compressor #1 Run Hours	25	74-75	R/W	0-999,999
Circuit #2				
Compressor #1 Suction Refrigerant Temperature	25	104	R	-40-230° F (-40°-110° C)
Compressor #1 Discharge Refrigerant Temp	24	107	R	-40°– 250°F (-40°– 121°C)
Compressor #1 Percent RLA	24	108	R	0-110%
Compressor #1 Current	24	109	R	0-10,000
Compressor #1 Voltage	25	110	R	0-15,000
Compressor #1 Power	24	111	R	0-3500 kW
Compressor #1 Starts	25	112	R	0 - 65,535
Compressor #1 Run Hours	25	113-114	R/W	0-999,999
Circuit #3				
Compressor #1 Suction Refrigerant Temperature	25	143	R	-40-230° F (-40°-110° C)
Compressor #1 Discharge Refrigerant Temp	24	146	R	-40°– 250°F (-40°– 121°C)
Compressor #1 Percent RLA	24	147	R	0-110%
Compressor #1 Current	24	148	R	0-10,000
Compressor #1 Voltage	25	149	R	0-15,000
Compressor #1 Power	24	150	R	0-3500 kW
Compressor #1 Starts	25	151	R	0 - 65,535
Compressor #1 Run Hours	25	152-153	R/W	0-999,999
Circuit #4				
Compressor #1 Suction Refrigerant Temperature	25	182	R	-40-230° F (-40°-110° C)
Compressor #1 Discharge Refrigerant Temp	24	185	R	-40°– 250°F (-40°– 121°C)
Compressor #1 Starts	25	190	R	0 - 65,535
Compressor #1 Run Hours	25	191-192	R/W	0-999,999

Table 7. Pump Data Points

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
Evaporator Pump #1 Run Hours	27	303-304	R/W	0-999,999
Evaporator Pump #1 Status	27	305	R	0=Pump Off Request, 1=Pump On Request
Evaporator Pump #2 Run Hours	27	306-307	R/W	0-999,999
Evaporator Pump #2 Status	27	308	R	0=Pump Off Request, 1=Pump On Request

Table 8. Miscellaneous Data Points

Network Control Property	Page	Holding Register (4xxxx)	Read/ Write	Description
Current Date & Time	26			
Year		309	R/W	
Month		310	R/W	1-12
Date		311	R/W	1-31
Day of Week		312	R	0 (Monday) – 6 (Sunday). Calculated by the controller.
Hour		313	R/W	0-23
Minute		314	R/W	0-59
Second		315	R/W	0-59
Units	29	316	R/W	0=English, 1=Metric
Chiller Model	23	317	R	
Chiller Location	22	318-327	R/W	These registers will be a numerical value and need to be translated to a string using Appendix A: ASCII Character on page 36. This will translate into a 20-character string. Unsupported characters are translated to a space.
Application Software Version	21	334-338	R	These registers will be a numerical value and need to be translated to a string using Appendix A: ASCII Character on page 36. This will translate into a 10-character string.

Alarm Data Points

The following section describes the alarm data points supported by the MicroTech III Chiller Unit Controller. The unit controller contains one holding register for every possible alarm. These holding registers are read only and can be used to determine if any particular alarm is active or not. These points are not described in the Detailed Data Point Information section. The alarms are defined as Warning, Problem, and Fault (see Alarms section for more details). Tables 9-11 display the holding register for each alarm.

Table 9. Warning Alarms

Holding Register (4xxxx)	Warning Alarms	Description
377	Bad setpoint override input	0=Normal, 1=Alarm
378	Bad demand limit input	0=Normal, 1=Alarm
740	Unit power restore	0=Normal, 1=Alarm
741	Circuit #1 failed pumpdown	0=Normal, 1=Alarm
742	Circuit #2 failed pumpdown	0=Normal, 1=Alarm
743	Circuit #3 failed pumpdown	0=Normal, 1=Alarm
744	Circuit #4 failed pumpdown	0=Normal, 1=Alarm
745	External event	0=Normal, 1=Alarm
814	Bad Current Limit Input	0=Normal, 1=Alarm
815	Option Controller Communication Failed	0=Normal, 1=Alarm

Table 10. Problem Alarms

Holding Register (4xxxx)	Problem Alarms	Description
384	RESTART DELAYED - Power Loss While Running Circuit #1	0=Normal, 1=Alarm
385	RESTART DELAYED - Power Loss While Running Circuit #2	0=Normal, 1=Alarm
386	RESTART DELAYED - Power Loss While Running Circuit #3	0=Normal, 1=Alarm
387	RESTART DELAYED - Power Loss While Running Circuit #4	0=Normal, 1=Alarm
388	START INHIBITED - Ambient Temperature Low	0=Normal, 1=Alarm
390	INHIBIT LOAD – Condenser Pressure High Circuit #1	0=Normal, 1=Alarm
391	INHIBIT LOAD – Condenser Pressure High Circuit #2	0=Normal, 1=Alarm
392	INHIBIT LOAD – Condenser Pressure High Circuit #3	0=Normal, 1=Alarm
393	INHIBIT LOAD – Condenser Pressure High Circuit #4	0=Normal, 1=Alarm
395	UNLOAD – Condenser Pressure High Circuit #1	0=Normal, 1=Alarm
396	UNLOAD – Condenser Pressure High Circuit #2	0=Normal, 1=Alarm
397	UNLOAD – Condenser Pressure High Circuit #3	0=Normal, 1=Alarm
398	UNLOAD – Condenser Pressure High Circuit #4	0=Normal, 1=Alarm
411	INHIBIT LOAD - Evaporator Pressure Low Circuit #1	0=Normal, 1=Alarm
412	INHIBIT LOAD - Evaporator Pressure Low Circuit #2	0=Normal, 1=Alarm

Holding Register (4xxxx)	Problem Alarms	Description
413	INHIBIT LOAD - Evaporator Pressure Low Circuit #3	0=Normal, 1=Alarm
414	INHIBIT LOAD - Evaporator Pressure Low Circuit #4	0=Normal, 1=Alarm
416	UNLOAD - Evaporator Pressure Low Circuit #1	0=Normal, 1=Alarm
417	UNLOAD - Evaporator Pressure Low Circuit #2	0=Normal, 1=Alarm
418	UNLOAD - Evaporator Pressure Low Circuit #3	0=Normal, 1=Alarm
419	UNLOAD - Evaporator Pressure Low Circuit #4	0=Normal, 1=Alarm
420	UNLOAD - Compressor Motor Current High Circuit #1, Compressor #1	0=Normal, 1=Alarm
422	UNLOAD - Compressor Motor Current High Circuit #2, Compressor #1	0=Normal, 1=Alarm
424	UNLOAD - Compressor Motor Current High Circuit #3, Compressor #1	0=Normal, 1=Alarm
780	INHIBIT LOAD - Compressor Motor Current High Circuit #1, Compressor #1	0=Normal, 1=Alarm
782	INHIBIT LOAD - Compressor Motor Current High Circuit #2, Compressor #1	0=Normal, 1=Alarm
784	INHIBIT LOAD - Compressor Motor Current High Circuit #3, Compressor #1	0=Normal, 1=Alarm

Table 11. Fault Alarms

Holding Register (4xxxx)	Fault Alarms	Description
440	COMPRESSOR SHUTDOWN - Low pressure ratio Circuit #1, Comp #1	0=Normal, 1=Alarm
442	COMPRESSOR SHUTDOWN - Low pressure ratio Circuit #2, Comp #1	0=Normal, 1=Alarm
444	COMPRESSOR SHUTDOWN - Low pressure ratio Circuit #3, Comp #1	0=Normal, 1=Alarm
445	COMPRESSOR SHUTDOWN - Low pressure ratio Circuit #4, Comp #1	0=Normal, 1=Alarm
446	UNIT SHUTDOWN - Outside Air Temperature Sensor Fault	0=Normal, 1=Alarm
447	COMPRESSOR SHUTDOWN - Current Overload Trip Circuit #1, Comp #1	0=Normal, 1=Alarm
449	COMPRESSOR SHUTDOWN - Current Overload Trip Circuit #2, Comp #1	0=Normal, 1=Alarm
451	COMPRESSOR SHUTDOWN - Current Overload Trip Circuit #3, Comp #1	0=Normal, 1=Alarm
478	COMPRESSOR SHUTDOWN - Motor Temperature High Circuit #1, Comp #1	0=Normal, 1=Alarm
480	COMPRESSOR SHUTDOWN - Motor Temperature High Circuit #2, Comp #1	0=Normal, 1=Alarm
482	COMPRESSOR SHUTDOWN - Motor Temperature High Circuit #3, Comp #1	0=Normal, 1=Alarm
483	COMPRESSOR SHUTDOWN - Motor Temperature High Circuit #4, Comp #1	0=Normal, 1=Alarm
509	COMPRESSOR SHUTDOWN - Condenser Pressure Sensor Fault Circuit #1, Comp #1	0=Normal, 1=Alarm
511	COMPRESSOR SHUTDOWN - Condenser Pressure Sensor Fault Circuit #2, Comp #1	0=Normal, 1=Alarm
513	COMPRESSOR SHUTDOWN - Condenser Pressure Sensor Fault Circuit #3, Comp #1	0=Normal, 1=Alarm
514	COMPRESSOR SHUTDOWN - Condenser Pressure Sensor Fault Circuit #4, Comp #1	0=Normal, 1=Alarm
517	COMPRESSOR SHUTDOWN - Condenser Pressure High Circuit #1, Comp #1	0=Normal, 1=Alarm
519	COMPRESSOR SHUTDOWN - Condenser Pressure High Circuit #2, Comp #1	0=Normal, 1=Alarm
521	COMPRESSOR SHUTDOWN - Condenser Pressure High Circuit #3, Comp #1	0=Normal, 1=Alarm
522	COMPRESSOR SHUTDOWN - Condenser Pressure High Circuit #4, Comp #1	0=Normal, 1=Alarm
529	COMPRESSOR SHUTDOWN - Discharge Temperature Sensor Fault Circuit #1, Comp #1	0=Normal, 1=Alarm
531	COMPRESSOR SHUTDOWN - Discharge Temperature Sensor Fault Circuit #2, Comp #1	0=Normal, 1=Alarm
533	COMPRESSOR SHUTDOWN - Discharge Temperature Sensor Fault Circuit #3, Comp #1	0=Normal, 1=Alarm
534	COMPRESSOR SHUTDOWN - Discharge Temperature Sensor Fault Circuit #4, Comp #1	0=Normal, 1=Alarm
535	COMPRESSOR SHUTDOWN - Discharge Temperature High Circuit #1, Comp #1	0=Normal, 1=Alarm
537	COMPRESSOR SHUTDOWN - Discharge Temperature High Circuit #2, Comp #1	0=Normal, 1=Alarm
539	COMPRESSOR SHUTDOWN - Discharge Temperature High Circuit #3, Comp #1	0=Normal, 1=Alarm
540	COMPRESSOR SHUTDOWN - Discharge Temperature High Circuit #4, Comp #1	0=Normal, 1=Alarm
542	UNIT SHUTDOWN - Evaporator Water Flow Loss	0=Normal, 1=Alarm
543	UNIT SHUTDOWN - Evaporator Leaving Water Temperature Low (Freeze)	0=Normal, 1=Alarm
545	COMPRESSOR SHUTDOWN - Evaporator Pressure Low Circuit #1, Comp #1	0=Normal, 1=Alarm
547	COMPRESSOR SHUTDOWN - Evaporator Pressure Low Circuit #2, Comp #1	0=Normal, 1=Alarm
549	COMPRESSOR SHUTDOWN - Evaporator Pressure Low Circuit #3, Comp #1	0=Normal, 1=Alarm
550	COMPRESSOR SHUTDOWN - Evaporator Pressure Low Circuit #4, Comp #1	0=Normal, 1=Alarm
552	COMPRESSOR SHUTDOWN - Evaporator Pressure Sensor Fault Circuit #1 Comp #1	0=Normal, 1=Alarm
554	COMPRESSOR SHUTDOWN - Evaporator Pressure Sensor Fault Circuit #2 Comp #1	0=Normal, 1=Alarm
556	COMPRESSOR SHUTDOWN - Evaporator Pressure Sensor Fault Circuit #3 Comp #1	0=Normal, 1=Alarm
557	COMPRESSOR SHUTDOWN - Evaporator Pressure Sensor Fault Circuit #4 Comp #1	0=Normal, 1=Alarm
583	COMPRESSOR LOCKOUT - Number of Allowed Re-Starts Exceeded Circuit #1, Comp#1	0=Normal, 1=Alarm
585	COMPRESSOR LOCKOUT - Number of Allowed Re-Starts Exceeded Circuit #2, Comp#1	0=Normal, 1=Alarm
587	COMPRESSOR LOCKOUT - Number of Allowed Re-Starts Exceeded Circuit #3, Comp#1	0=Normal, 1=Alarm
588	COMPRESSOR LOCKOUT - Number of Allowed Re-Starts Exceeded Circuit #4, Comp#1	0=Normal, 1=Alarm
589	UNIT SHUTDOWN - Evaporator Leaving Water Temperature Sensor Fault	0=Normal, 1=Alarm
590	Evaporator Leaving Water Temperature 1 Sensor Fault	0=Normal, 1=Alarm
591	Evaporator Leaving Water Temperature 1 Sensor Fault	0=Normal, 1=Alarm
592	CIRCUIT SHUTDOWN - Evaporator 1 Freeze Protection	0=Normal, 1=Alarm
593	CIRCUIT SHUTDOWN - Evaporator 2 Freeze Protection	0=Normal, 1=Alarm
601	COMPRESSOR SHUTDOWN - Mechanical High Pressure Trip Circuit #1, Comp #1	0=Normal, 1=Alarm
603	COMPRESSOR SHUTDOWN - Mechanical High Pressure Trip Circuit #2, Comp #1	0=Normal, 1=Alarm
605	COMPRESSOR SHUTDOWN - Mechanical High Pressure Trip Circuit #3, Comp #1	0=Normal, 1=Alarm

Holding Register (4xxxx)	Fault Alarms	Description
606	COMPRESSOR SHUTDOWN - Mechanical High Pressure Trip Circuit #4, Comp #1	0=Normal, 1=Alarm
637	COMPRESSOR SHUTDOWN - Oil Delta Pressure High Circuit #1, Comp #1	0=Normal, 1=Alarm
639	COMPRESSOR SHUTDOWN - Oil Delta Pressure High Circuit #2, Comp #1	0=Normal, 1=Alarm
641	COMPRESSOR SHUTDOWN - Oil Delta Pressure High Circuit #3, Comp #1	0=Normal, 1=Alarm
642	COMPRESSOR SHUTDOWN - Oil Delta Pressure High Circuit #4, Comp #1	0=Normal, 1=Alarm
643	COMPRESSOR SHUTDOWN - Oil Feed Pressure Sensor Fault Circuit #1, Comp #1	0=Normal, 1=Alarm
645	COMPRESSOR SHUTDOWN - Oil Feed Pressure Sensor Fault Circuit #2, Comp #1	0=Normal, 1=Alarm
647	COMPRESSOR SHUTDOWN - Oil Feed Pressure Sensor Fault Circuit #3, Comp #1	0=Normal, 1=Alarm
648	COMPRESSOR SHUTDOWN - Oil Feed Pressure Sensor Fault Circuit #4, Comp #1	0=Normal, 1=Alarm
661	SHUTDOWN – Phase Voltage Protection	0=Normal, 1=Alarm
662	COMPRESSOR SHUTDOWN - Starter Fault Compressor Circuit #1, Comp #1	0=Normal, 1=Alarm
664	COMPRESSOR SHUTDOWN - Starter Fault Compressor Circuit #2, Comp #1	0=Normal, 1=Alarm
666	COMPRESSOR SHUTDOWN - Starter Fault Compressor Circuit #3, Comp #1	0=Normal, 1=Alarm
667	COMPRESSOR SHUTDOWN - Starter Fault Compressor Circuit #4, Comp #1	0=Normal, 1=Alarm
698	COMPRESSOR SHUTDOWN - Suction Temperature Sensor Fault Circuit #1, Comp #1	0=Normal, 1=Alarm
700	COMPRESSOR SHUTDOWN - Suction Temperature Sensor Fault Circuit #2, Comp #1	0=Normal, 1=Alarm
702	COMPRESSOR SHUTDOWN - Suction Temperature Sensor Fault Circuit #3, Comp #1	0=Normal, 1=Alarm
703	COMPRESSOR SHUTDOWN - Suction Temperature Sensor Fault Circuit #4, Comp #1	0=Normal, 1=Alarm
711	COMPRESSOR SHUTDOWN - No Pressure at Startup Circuit #1	0=Normal, 1=Alarm
712	COMPRESSOR SHUTDOWN - No Pressure at Startup Circuit #2	0=Normal, 1=Alarm
713	COMPRESSOR SHUTDOWN - No Pressure at Startup Circuit #3	0=Normal, 1=Alarm
714	COMPRESSOR SHUTDOWN - No Pressure at Startup Circuit #4	0=Normal, 1=Alarm
717	COMPRESSOR SHUTDOWN - Mechanical Low Pressure Trip Circuit #1, Comp #1	0=Normal, 1=Alarm
719	COMPRESSOR SHUTDOWN - Mechanical Low Pressure Trip Circuit #2, Comp #1	0=Normal, 1=Alarm
721	COMPRESSOR SHUTDOWN - Mechanical Low Pressure Trip Circuit #3, Comp #1	0=Normal, 1=Alarm
722	COMPRESSOR SHUTDOWN - Mechanical Low Pressure Trip Circuit #4, Comp #1	0=Normal, 1=Alarm
723	Controller board offline Circuit #1 (Circuit number describes Control board number)	0=Normal, 1=Alarm
724	Controller board offline Circuit #2 (Circuit number describes Control board number)	0=Normal, 1=Alarm
725	Controller board offline Circuit #3 (Circuit number describes Control board number)	0=Normal, 1=Alarm
726	Controller board offline Circuit #4 (Circuit number describes Control board number)	0=Normal, 1=Alarm
734	Compressor Shutdown - Motor Temperature Sensor Fault Circuit #1, Comp #1	0=Normal, 1=Alarm
736	Compressor Shutdown - Motor Temperature Sensor Fault Circuit #2, Comp #1	0=Normal, 1=Alarm
738	Compressor Shutdown - Motor Temperature Sensor Fault Circuit #3, Comp #1	0=Normal, 1=Alarm
739	Compressor Shutdown - Motor Temperature Sensor Fault Circuit #4, Comp #1	0=Normal, 1=Alarm
746	Controller board offline Alm/Limit Ext Module	0=Normal, 1=Alarm
747	COMPRESSOR SHUTDOWN - No Pressure Change After Start Circuit #1	0=Normal, 1=Alarm
748	COMPRESSOR SHUTDOWN - No Pressure Change After Start Circuit #2	0=Normal, 1=Alarm
749	COMPRESSOR SHUTDOWN - No Pressure Change After Start Circuit #3	0=Normal, 1=Alarm
750	COMPRESSOR SHUTDOWN - No Pressure Change After Start Circuit #4	0=Normal, 1=Alarm
751	SHUTDOWN – Phase Voltage Protection Circuit #1	0=Normal, 1=Alarm
752	SHUTDOWN – Phase Voltage Protection Circuit #2	0=Normal, 1=Alarm
753	SHUTDOWN – Phase Voltage Protection Circuit #3	0=Normal, 1=Alarm
754	SHUTDOWN – Phase Voltage Protection Circuit #4	0=Normal, 1=Alarm
755	UNIT SHUTDOWN - Evaporator Entering Water Temperature Sensor Fault	0=Normal, 1=Alarm
756	COMPRESSOR SHUTDOWN - Slide position sensor fault Circuit #1, Comp#1	0=Normal, 1=Alarm
758	COMPRESSOR SHUTDOWN - Slide position sensor fault Circuit #2, Comp#1	0=Normal, 1=Alarm
760	COMPRESSOR SHUTDOWN - Slide position sensor fault Circuit #3, Comp#1	0=Normal, 1=Alarm
761	COMPRESSOR SHUTDOWN - Slide position sensor fault Circuit #4, Comp#1	0=Normal, 1=Alarm
762	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Fault Circuit #1, Comp #1	0=Normal, 1=Alarm
764	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Fault Circuit #2, Comp #1	0=Normal, 1=Alarm
766	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Fault Circuit #3, Comp #1	0=Normal, 1=Alarm
768	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Over Heat Fault Circuit #1, Comp #1	0=Normal, 1=Alarm
770	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Over Heat Fault Circuit #2, Comp #1	0=Normal, 1=Alarm
772	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Over Heat Fault Circuit #3, Comp #1	0=Normal, 1=Alarm
774	COMPRESSOR SHUTDOWN - COM ERROR With COMPRESSOR VFD Circuit #1, Comp #1	0=Normal, 1=Alarm
776	COMPRESSOR SHUTDOWN - COM ERROR With COMPRESSOR VFD Circuit #2, Comp #1	0=Normal, 1=Alarm
778	COMPRESSOR SHUTDOWN - COM ERROR With COMPRESSOR VFD Circuit #3, Comp #1	0=Normal, 1=Alarm
798	UNIT STOP - Emergency Stop Alarm	0=Normal, 1=Alarm
799	UNIT STOP - Evaporator Water Temperatures Inverted	0=Normal, 1=Alarm
800	UNIT STOP - External Alarm	0=Normal, 1=Alarm
808	COMP SHUTDOWN-Low Discharge Superheat Circuit #1, Comp #1	0=Normal, 1=Alarm
810	COMP SHUTDOWN-Low Discharge Superheat Circuit #2, Comp #1	0=Normal, 1=Alarm
812	COMP SHUTDOWN-Low Discharge Superheat Circuit #3, Comp #1	0=Normal, 1=Alarm

Detailed Data Point Information

The following section details the information (the data) available to the Building Automation System (BAS) via the Modbus RTU protocol.

Active Capacity Limit Output

Keypad Menu Path No Keypad Equivalent

This read only holding register is a measure of the ratio of operating capacity limit to full capacity expressed in percent. This value is the lowest of all limits specified by the operator, analog Demand Limit input, or Network Capacity Limit Setpoint.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	14	Percent of maximum capacity	% x 10	0-100%

Active Setpoint

Keypad Menu Path Main Menu_Active Setpt=

This read only holding register indicates the current setpoint used to control the chiller. Based on the operating mode of the chiller, this value is derived from the Cooling Setpoint, Ice Setpoint or Heating Setpoint (not available in MicroTech III Chiller Unit Controller). See "Chiller Mode Output" and "Chiller Mode Setpoint – Network". The default mode is Cool. There are three possible setpoints. See "Cool Setpoint – Network", "Heat Setpoint – Network" and "Ice Setpoint – Network".

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	12	Temperature	°F x 10 °C x 10	15.08°F to 149.9°F -9.4°C to 65.5°C

Actual Capacity

Keypad Menu Path Main Menu_Unit Capacity=

This read only holding register indicates the percent of maximum capacity the chiller is producing under the present operating conditions. At 100%, the chiller may be producing more or less than its nominal rating due to variations in operating conditions.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	13	Percent of chiller capacity	% x 10	0-100%

Alarm Digital Output

Keypad Menu Path No Keypad Equivalent

This read only holding register indicates whether an alarm condition has occurred. This variable must be polled for alarm notification.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	5	NA	N/A	0=No Alarm 1=Alarm

Application Software Version

Keypad Menu Path Main Menu_About Chiller_Unit S/N=

These read only holding registers indicate the software version of the application software.
The following example shows the holding register and its value (in hexadecimal), followed by the ASCII character translation.

- 334= 0x3235
  - 0x32 = "2"
  - 0x35 = "5"
- 335= 0x3035
  - 0x30 = "0"
  - 0x35 = "5"
- 335= 0x3036
  - 0x30 = "0"
  - 0x35 = "6"
- 337= 0x3731
  - 0x37 = "7"
  - 0x31 = "1"
- 338= 0x3030
  - 0x30 = "0"
  - 0x30 = "0"

Application Version = 2505067100

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	334-338	NA	N/A	1-10 Characters

Capacity Limit Setpoint - Network

Keypad Menu Path Main Menu_View/Set Unit_Status/Settings_Netwrk Cap Lim=

This read/write holding register 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. The default is 100%. This register is ignored by the chiller application if Chiller Local/Remote is set to Local.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	38	Percent of maximum capacity	% x 10	0-100%

Chiller Capacity Limited

Keypad Menu Path No Keypad Equivalent

This read only holding register indicates whether conditions may exist that prevent the chiller from reaching full capacity. If conditions exist that limit operation, the chiller may be prevented from reaching the Leaving Water Temperature setpoint.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	4	Status	N/A	0=Not Limited 1=Limited

Chiller Current

Keypad Menu Path Main Menu_View/Set Unit_Power Conservation_Unit Current=

This read only holding register indicates the average current of the chiller. Compressor currents may be added together to calculate this value.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	25	Electric Current	Amperes	0-10,000

Chiller Enable Output

Keypad Menu Path Main Menu_View/Set Unit_Status/Settings_Netwrk En SP=

This read only holding register indicates if operation of the chiller is disabled or enabled. If the chiller is disabled, it cannot run. If it is enabled, it is allowed to run.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	2	Chiller state	N/A	0=Disable 1=Enable

Chiller Enable Setpoint

Keypad Menu Path No Keypad Equivalent

This read/write holding register is used enable the chiller to run if operating conditions are satisfied, or disables the chiller from running. The default is Null which will cause Disable to be used provided nothing else is writing to this point. This register is ignored by the chiller application if Chiller Local/Remote is set to Local.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	9	Chiller State	N/A	0=Disable 1=Enable 2=Null

Chiller Local/Remote

Keypad Menu Path No Keypad Equivalent

This read only holding register indicates whether the chiller is in local control or allowed to be controlled remotely over the network. The value can only be changed locally. The values from the following variables are ignored in the chiller application if this variable is set to Local (1):

- Chiller Enable Setpoint
- Chiller Mode Setpoint – Network
- Cool Setpoint Network
- Ice Setpoint Network
- Capacity Limit Setpoint
- Clear Alarm Network

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	1	Mode	N/A	0=Remote 1=Local

Chiller Location

Keypad Menu Path No Keypad Equivalent

These read/write holding registers provides a description of the location. If the location is changed via Modbus, the change is written immediately to the unit controller. However, if the location is changed by an outside source (other than Modbus), then change will not be available via Modbus until power is cycled.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	318-327	Location	N/A	ASCII String up to 20 characters. The string cannot contain " or $ characters.

Chiller Mode Output

Keypad Menu Path Main Menu_View/Set Unit_Status/Settings_Netwrk Mode SP=

This read only holding register indicates the current operating mode of the chiller.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	11	HVAC mode	N/A	1=Ice 2=Cool 3=Heat 4=Cool/Heat Recovery 5=Defrost

Chiller Mode Setpoint - Network

Keypad Menu Path No Keypad Equivalent

This read/write holding register is used to change the operating mode of the chiller. The default is Null(0). A value of Null will cause the chiller to run in the Cool mode provided that nothing else is writing to this point. This register is ignored by the chiller application if Chiller Local/Remote is set to Local. It also only applies when Available Modes is set to Cool/Ice w/Glycol. Available Modes can also be found on the keypad. Only Ice and Cool modes are supported. If any other mode is written, the chiller will be set to Cool mode.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	34	HVAC Mode	N/A	0=Null 1=Ice 2=Cool 3=Heat 4=Cool/Heat Recovery

Chiller Model

Keypad Menu Path No Keypad Equivalent

This read only holding register indicates the model of the chiller.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	317	Chiller Model	N/A	TBD

Chiller On/Off

Keypad Menu Path No Keypad Equivalent

This read only holding register indicates the current state of the chiller. The OFF state is represented by state = FALSE and value = 0. The other discrete states are represented by state = TRUE and value > 0.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	8	Chiller State	N/A	0=Off 1=On

Chiller Status

Keypad Menu Path No Keypad Equivalent

This read only holding register indicates the unit status of the chiller.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	15	Chiller State	N/A	1=Off 2=Start 3=Run 4=Pre Shutdown 5=Service

Clear Alarms - Network

Keypad Menu Path No Keypad Equivalent

This read/write holding register clears all active alarms. Many alarms clear automatically (see MicroTech III Chiller Unit Controller Operation Manual for details). The following are the only alarms that can be cleared from the network:

- UNIT SHUTDOWN - Evaporator Water Flow Loss
- UNIT SHUTDOWN–Evaporator Leaving Water Temp Low (Freeze)
- CIRCUIT SHUTDOWN – Evaporator 1 Freeze Protection
- CIRCUIT SHUTDOWN – Evaporator 2 Freeze Protection

The default is Null, which will cause Normal to be used provided nothing else is writing to this point. This register is ignored by the chiller application if Chiller Local/Remote is set to Local.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	10	NA	N/A	0=Normal 1=Clear Alarm 2=Null

Compressor Current

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Comp 1_Current= OR
Main Menu_View/Set Circuit_Circuit #2_Comp 1_Current= OR
Main Menu_View/Set Circuit_Circuit #3_Comp 1_Current=

These read only holding registers indicate the average current of the compressor motor. For BACnet there is a separate variable for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Cir#1Cmp#1=70 Cir#2Cmp#1=109 Cir#3Cmp#1=148	Electrical Current	Amperes	0-10,000

Compressor Discharge Refrigerant Temperature

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Data_Discharge Temp= OR
Main Menu_View/Set Circuit_Circuit #2_Data_Discharge Temp= OR
Main Menu_View/Set Circuit_Circuit #3_Data_Discharge Temp= OR
Main Menu_View/Set Circuit_Circuit #4_Data_Discharge Temp=

These read only holding registers indicate the current refrigerant temperature discharged from the compressor. There is a separate holding register for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Cir#1Cmp#1=68 Cir#2Cmp#1=107 Cir#3Cmp#1=146 Cir#4Cmp#1=185	Temperature	°F x 10 °C x 10	-40°– 250°F, -40°– 121°C

Compressor Percent RLA

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Comp 1_Percent RLA= OR
Main Menu_View/Set Circuit_Circuit #2_Comp 1_Percent RLA= OR
Main Menu_View/Set Circuit_Circuit #3_Comp 1_Percent RLA=

These read only holding registers indicate the current percent RLA for the compressor motor of the compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Cir#1Cmp#1=69 Cir#2Cmp#1=108 Cir#3Cmp#1=147	Percent RLA	Percent	0-100%

Compressor Power

Keypad Menu Path No Keypad Equivalent

These read only holding registers indicate the current power of the compressor motor. There is a separate variable for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Cir#1Cmp#1=72 Cir#2Cmp#1=111 Cir#3Cmp#1=150	Electric Power	kiloWatts	0-3500

Compressor Run Hours

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Comp 1_Run Hours=OR
Main Menu_View/Set Circuit_ Circuit #2_Comp 1_Run Hours= OR
Main Menu_View/Set Circuit_ Circuit #3_Comp 1_Run Hours= OR
Main Menu_View/Set Circuit_ Circuit #4_Comp 1_Run Hours=

These read/write holding registers indicate the number of hours that the compressor motor has been turned on. There is a separate holding register for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	Cir#1Cmp#1=74-75 Cir#2Cmp#1=113-114 Cir#3Cmp#1=152-153 Cir#4Cmp#1=191-192	Time	Hours	0-999,999

Compressor Starts

Keypad Menu Path Main Menu_View/Set Circuit_ Circuit #1_Comp 1_No. Of Starts= OR
Main Menu_View/Set Circuit_ Circuit #2_Comp 1_No. Of Starts= OR
Main Menu_View/Set Circuit_ Circuit #3_Comp 1_No. Of Starts= OR
Main Menu_View/Set Circuit_ Circuit #4_Comp 1_No. Of Starts=

These read only holding registers indicate the number of times the compressor motor has been started. There is a separate holding register for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Cir#1Cmp#1=73 Cir#2Cmp#1=112 Cir#3Cmp#1=151 Cir#4Cmp#1=190	Count	Starts	0-65,535

Compressor Suction Refrigerant Temperature

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Data_Suction Temp= OR
Main Menu_View/Set Circuit_Circuit #2_Data_Suction Temp= OR
Main Menu_View/Set Circuit_Circuit #3_Data_Suction Temp= OR
Main Menu_View/Set Circuit_Circuit #4_Data_Suction Temp=

These read only holding registers indicate the current refrigerant temperature entering the compressor. There is a separate holding register for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Cir#1Cmp#1=65 Cir#2Cmp#1=104 Cir#3Cmp#1=143 Cir#4Cmp#1=182	Temperature	°F x 10 °C x 10	-40-230° F -40-110° C

Compressor Voltage

Keypad Menu Path No Keypad Equivalent

These read only holding registers indicate the average voltage of the compressor motor. There is a separate register for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Cir#1Cmp#1=71 Cir#2Cmp#1=110 Cir#3Cmp#1=149	Electric Voltage	VAC	0-15,000

Condenser Refrigerant Pressure

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Data_Cond Pressure= OR
Main Menu_View/Set Circuit_Circuit #2_Data_Cond Pressure = OR
Main Menu_View/Set Circuit_Circuit #3_Data_Cond Pressure = OR
Main Menu_View/Set Circuit_Circuit #4_Data_Cond Pressure =

These read only holding registers indicate the current condenser pressure. There is a separate holding register for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Circuit #1=39 Circuit #2=43 Circuit #3=47 Circuit #4=51	Pressure (gauge)	psi x 10 kPa x 10	0-410 psi (700 psi for R410A) 0-2827 kPa, (4826 kPa for R410A)

Condenser Saturated Refrigerant Temperature

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Data_Cond Sat Temp= OR
Main Menu_View/Set Circuit_Circuit #2_ Data_Cond Sat Temp = OR
Main Menu_View/Set Circuit_Circuit #3_ Data_Cond Sat Temp = OR
Main Menu_View/Set Circuit_Circuit #4_ Data_Cond Sat Temp =

These read only holding registers indicate the current saturated refrigerant temperature of the condenser. There is a separate holding register for each condenser.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Circuit #1=40 Circuit #2=44 Circuit #3=48 Circuit #4=52	Temperature	°F x 10 °C x 10	-14.98-185°F -26.1-85°C

Cool Setpoint - Network

Keypad Menu Path Main Menu_View/Set Unit_Status/Settings_Netwrk Cool SP=

This read/write holding register is used to change the Cooling setpoint from the network. It sets the temperature of the Leaving Chilled Fluid when the chiller is operating in the Cooling Mode. The default is 44°F. This register is ignored by the chiller application if Chiller Local/Remote is set to Local.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	35	Temperature	°F x 10 °C x 10	24.98-60.08° F (-3.9-15.6° C) Default = 43.88° F (6.6°C)

Current Date & Time

Keypad Menu Path (Chiller Date & Time) Main Menu_View/Set Unit_Date/TimeSchedules_Actual Time= AND
Main Menu_View/Set Unit_Date/TimeSchedules_Actual Date=

These read/write holding registers are used to synchronize the chiller's internal time clock with the BAS.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	309	Integer	Year	
RW Holding Register	310	Integer	Month	1-12
RW Holding Register	311	Integer	Date	1-31
RO Holding Register	312	Integer	Day of Week	0 (Monday) - 6 (Sunday)
RW Holding Register	313	Integer	Hour	0-23
RW Holding Register	314	Integer	Minute	0-59
RW Holding Register	315	Integer	Second	0-59

Evaporator Entering Fluid Temperature

Keypad Menu Path Main Menu_Evaporator EWT=

This read only holding register indicates the temperature of the fluid entering the evaporator.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	16	Temperature	°F x 10 °C x 10	-40-230° F -40-110° C

Evaporator Flow Switch Status

Keypad Menu Path No Keypad Equivalent

This read only output network indicates the status of the fluid flowing through the evaporator.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	6	Flow State	N/A	0=No Flow 1=Flow

Evaporator Leaving Fluid Temperature

Keypad Menu Path Main Menu_Evaporator LWT=

This read only holding register indicates the current temperature of the fluid leaving the evaporator.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	17	Temperature	°F x 10 °C x 10	-40-230° F -40-110° C

Evaporator Pump Run Hours

Keypad Menu Path Main Menu_View/Set Unit_Status/Settings_Evap Pmp 1 Hrs= AND
Main Menu_View/Set Unit_Status/Settings_Evap Pmp 2 Hrs=

These read/write holding registers indicate the number of hours that the pump motor has been turned on. There is separate holding register for each pump.

Pump #1

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	303-304	Time	Hours	0-999,999

Pump #2

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	306-307	Time	Hours	0-999,999

Evaporator Pump Status

Keypad Menu Path No Keypad Equivalent

These read only holding registers indicate if the pump has been commanded On or Off. There is a separate holding register for each pump.

Pump #1

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	305	Flow State	N/A	0=Pump Off Request 1=Pump On Request

Pump #2

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	308	Flow State	N/A	0=Pump Off Request 1=Pump On Request

Evaporator Refrigerant Pressure

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Data_Evap Pressure= AND
Main Menu_View/Set/Circuit_Circuit #2_Data_Evap Pressure= AND
Main Menu_View/Set/Circuit_Circuit #3_Data_Evap Pressure= AND
Main Menu_View/Set/Circuit_Circuit #4_Data_Evap Pressure=

These read only holding registers indicate the current refrigerant pressure in the evaporator. There is a separate holding register for each compressor.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Circuit #1=41 Circuit #2=45 Circuit #3=49 Circuit #4=53	Pressure (gauge)	psi x 10 kPa x 10	-349.97–349.97 psi -2413 kPa – 2413 kPa

Evaporator Saturated Refrigerant Temperature

Keypad Menu Path Main Menu_View/Set Circuit_Circuit #1_Data_Evap Sat Temp= AND
Main Menu_View/Set Circuit _Circuit #2_Data_Evap Sat Temp= AND
Main Menu_View/Set Circuit _Circuit #3_Data_Evap Sat Temp= AND
Main Menu_View/Set Circuit _Circuit #4_Data_Evap Sat Temp=

These read only holding registers indicate the current saturated refrigerant temperature of the evaporator. There is a separate holding register for each condenser.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	Circuit #1=42 Circuit #2=46 Circuit #3=50 Circuit #4=54	Temperature	°F x 10 °C x 10	-14.98-185°F -26.1-85°C

Fault Alarm Code

Keypad Menu Path No Keypad Equivalent

This read only holding register allows individual notification of the active fault code. The alarms are not ordered based on any priority. If multiple fault alarms are present at one time, this object will be set to the alarm that has the highest alarm code. This object is set to zero if no fault alarms are active.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	33	Active Fault Alarm	N/A	See the Active Alarms section on page 31 for details.

Fault Alarm Index

Keypad Menu Path No Keypad Equivalent

This read only holding register allows individual notification of the active fault index. The alarms are not ordered based on any priority. If multiple fault alarms are present at one time, this object will be set to the alarm that has the highest alarm index. This object is set to zero if no fault alarms are active.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	30	Active Warning Alarm	N/A	See the Active Alarms section on page 31 for details.

Ice Setpoint - Network

Keypad Menu Path Main Menu_View/Set Unit_Status/Settings_Netwrk Ice SP=

This read/write holding register is used to change the Ice setpoint from the network. It sets the temperature of the Leaving Chilled Fluid when the chiller is operating in the Ice Mode. The default is 25°F. This register is ignored by the chiller application if Chiller Local/Remote is set to Local.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	36	Temperature	°F x 10 °C x 10	15.08°-38.12°F -9.4°-3.4°C

Outdoor Air Temperature

Keypad Menu Path Main Menu_View/Set Unit_Temperatures_Outside Air=

This read only holding register variable indicates the current outdoor air temperature.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	24	Temperature	°F x 10 °C x 10	-40-230° F -40-110° C

Problem Alarm Code

Keypad Menu Path No Keypad Equivalent

This read only holding register allows individual notification of the active problem code. The alarms are not ordered based on any priority. If multiple problem alarms are present at one time, this object will be set to the alarm that has the highest alarm code. This object is set to zero if no problem alarms are active.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	32	Active Problem Alarm	N/A	See the Active Alarms section on page 31 for details.

Problem Alarm Index

Keypad Menu Path No Keypad Equivalent

This read only holding register allows individual notification of the active problem index. The alarms are not ordered based on any priority. If multiple problem alarms are present at one time, this object will be set to the alarm that has the highest problem index. This object is set to zero if no problem alarms are active.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	29	Active Warning Alarm	N/A	See the Active Alarms section on page 31 for details.

Run Enabled

Keypad Menu Path No Keypad Equivalent

This read only holding register indicates the running mode of the chiller. The Run Enabled output data point indicates that the chiller can start if operating conditions are met.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	3	Chiller State	N/A	0=Off, 1=RunAllowed

Units

Keypad Menu Path No Keypad Equivalent

This read/write holding register allows you to select the units that are being passed through Modbus.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	316	Units of Measure	N/A	0=English, 1=Metric

Warning Alarm Code

Keypad Menu Path No Keypad Equivalent

This read only holding register allows individual notification of the active warning code. The alarms are not ordered based on any priority. If multiple warning alarms are present at one time, this object will be set to the alarm that has the highest alarm code. This object is set to zero if no warning alarms are active.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	31	Active Warning Alarm	N/A	See the Active Alarms section on page 31 for details.

Warning Alarm Index

Keypad Menu Path No Keypad Equivalent

This read only holding register allows individual notification of the active warning index. The alarms are not ordered based on any priority. If multiple warning alarms are present at one time, this object will be set to the alarm that has the highest alarm index. This object is set to zero if no warning alarms are active.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	28	Active Warning Alarm	N/A	See the Active Alarms section on page 31 for details.

Alarms

Alarm Classes

Modbus alarms in a MicroTech III Chiller 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 or chiller is shut down.

Problem Alarms

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

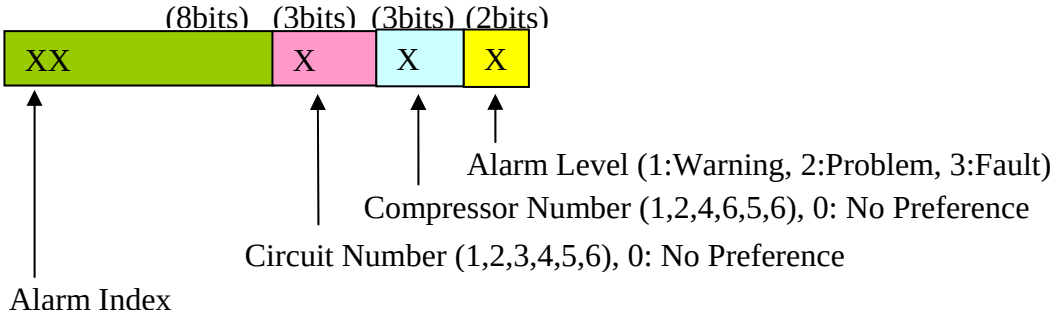
Warning Alarms

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

Alarm Handling

MicroTech III Chiller Unit Controllers can have alarms monitored by one of three methods: 1) individually by BACnet Binary Values, 2) using Alarm Digital Output, or 3) Alarm class.

1. To monitor alarms individually, read the value from the holding register for each alarm. Each alarm has its own holding register. If the value of the holding register is zero (0), the alarm is not active. If the holding register is one (1), the alarm is active.
2. To determine whether any alarm is active or not, read the Alarm Digital Output register, 40017. If the value of the holding register is zero (0), no alarms are active. If the holding register is one (1), there is at least one active alarm.
3. To monitor alarms by alarm class, read the holding register for the appropriate class (Warnings, Problems and Faults). Each class has two holding registers. One register reports the highest active Alarm Code and one reports the highest active Alarm Index. The alarm codes and alarm indexes are not ordered by priority. See Table 3 for more information. The Alarm Code is calculated in the following manner:



Alarm Digital Output

Keypad Menu Path No Keypad Equivalent

This read only output data point indicates whether an alarm condition has occurred. This variable must be polled for alarm notification.

Data Type	Holding Register	Measurement	Units	Valid Range
RO Holding Register	17	NA	N/A	0=No Alarm 1=Alarm

Clear Alarms - Network

Keypad Menu Path No Keypad Equivalent

This read/write holding register clears all active alarms. Many alarms are automatically clear. Of the alarms that need to be manually cleared, only those listed below can be cleared from the network:

- UNIT SHUTDOWN - Evaporator Water Flow Loss
- UNIT SHUTDOWN–Evaporator Leaving Water Temp Low (Freeze)
- CIRCUIT SHUTDOWN – Evaporator 1 Freeze Protection
- CIRCUIT SHUTDOWN – Evaporator 2 Freeze Protection

The default is Null, which will cause Normal to be used provided nothing else is writing to this point. This register is ignored by the unit controller if Chiller Local/Remote is set to Local.

Data Type	Holding Register	Measurement	Units	Valid Range
RW Holding Register	10	NA	N/A	0=Normal 1=Clear Alarm 2=Null

Active Alarms

Tables 12-14 show the registers needed to read each individual alarm, the alarm index, and the alarm code.

Table 12. Modbus Warning Alarms

Warning Alarms			
Alarm Class Monitoring		Individual Alarm Monitoring Holding Registers (0=Normal, 1=Alarm)	Alarm Description
Alarm Index (Holding Register 28)	Alarm Code (Holding Register 31)		
8	2049	377	Bad setpoint override input
9	2305	378	Bad demand limit input
11	2817	740	Unit Power Restore
12	3105	741	Circuit Failed Pumpdown - Circuit #1
	3137	742	Circuit Failed Pumpdown - Circuit #2
	3169	743	Circuit Failed Pumpdown - Circuit #3
	3201	744	Circuit Failed Pumpdown - Circuit #4
13	3329	745	External Event
14	3585	814	Bad Current Limit Input
15	3841	815	Option Controller Communication Failed

Table 13. Modbus Problem Alarms

Problem Alarms			
Alarm Class Monitoring		**Individual Alarm Monitoring**	
Alarm Index (Holding Register 29)	**Alarm Code (Holding Register 32)**	**Holding Registers (0=Normal, 1=Alarm)**	**Alarm Description**
64	16418	384	RESTART DELAYED - Power Loss While Running Circuit #1
	16450	385	RESTART DELAYED - Power Loss While Running Circuit #2
	16482	386	RESTART DELAYED - Power Loss While Running Circuit #3
	16514	387	RESTART DELAYED - Power Loss While Running Circuit #4
65	16642	388	START INHIBITED - Ambient Temperature Low
67	17168	390	INHIBIT LOAD – Condenser Pressure High Circuit #1
	17218	391	INHIBIT LOAD – Condenser Pressure High Circuit #2
	17250	392	INHIBIT LOAD – Condenser Pressure High Circuit #3
	17282	393	INHIBIT LOAD – Condenser Pressure High Circuit #4
69	17698	395	UNLOAD – Condenser Pressure High Circuit #1
	17730	396	UNLOAD – Condenser Pressure High Circuit #2
	17762	397	UNLOAD – Condenser Pressure High Circuit #3
	17794	398	UNLOAD – Condenser Pressure High Circuit #4
76	19490	411	INHIBIT LOAD - Evaporator Pressure Low Circuit #1
	19522	412	INHIBIT LOAD - Evaporator Pressure Low Circuit #2
	19554	413	INHIBIT LOAD - Evaporator Pressure Low Circuit #3
	19586	414	INHIBIT LOAD - Evaporator Pressure Low Circuit #4
78	20002	416	UNLOAD - Evaporator Pressure Low Circuit #1
	20034	417	UNLOAD - Evaporator Pressure Low Circuit #2
	20066	418	UNLOAD - Evaporator Pressure Low Circuit #3
	20098	419	UNLOAD - Evaporator Pressure Low Circuit #4
79	20262	420	UNLOAD - Compressor Motor Current High Circuit #1, Comp #1
	20294	422	UNLOAD - Compressor Motor Current High Circuit #2, Comp #1
	20326	424	UNLOAD - Compressor Motor Current High Circuit #3, Comp #1
84	21542	780	INHIBIT LOAD - Compressor Motor Current High Circuit #1, Comp #1
	21574	782	INHIBIT LOAD - Compressor Motor Current High Circuit #2, Comp #1
	21606	784	INHIBIT LOAD - Compressor Motor Current High Circuit #3, Comp #1

Table 14. Modbus Fault Alarms

Fault Alarms			
Alarm Class Monitoring		**Individual Alarm Monitoring**	
Alarm Index (Holding Register 30)	**Alarm Code (Holding Register 33)**	**Holding Registers (0=Normal, 1=Alarm)**	**Alarm Description**
127	32551	440	COMP SHUTDOWN - Low pressure ratio Circuit #1, Comp #1
	32583	442	COMP SHUTDOWN - Low pressure ratio Circuit #2, Comp #1
	32615	444	COMP SHUTDOWN - Low pressure ratio Circuit #3, Comp #1
	32647	445	COMP SHUTDOWN - Low pressure ratio Circuit #4, Comp #1
128	32771	446	UNIT SHUTDOWN - Outside Air Temp Sensor Fault
129	33063	447	COMPRESSOR SHUTDOWN - Current Overload Trip Circuit #1, Comp #1
	33095	449	COMPRESSOR SHUTDOWN - Current Overload Trip Circuit #2, Comp #1
	33127	451	COMPRESSOR SHUTDOWN - Current Overload Trip Circuit #3, Comp #1
135	34599	478	COMP SHUTDOWN – Motor Temp High Circuit #1, Comp #1
	34631	480	COMP SHUTDOWN – Motor Temp High Circuit #2, Comp #1
	34663	482	COMP SHUTDOWN – Motor Temp High Circuit #3, Comp #1
	34695	483	COMP SHUTDOWN – Motor Temp High Circuit #4, Comp #1
136	34855	734	COMP SHUTDOWN – Motor Temp Sensor Fault Circuit #1, Comp #1
	34887	736	COMP SHUTDOWN – Motor Temp Sensor Fault Circuit #2, Comp #1
	34919	738	COMP SHUTDOWN – Motor Temp Sensor Fault Circuit #3, Comp #1
	34951	739	COMP SHUTDOWN – Motor Temp Sensor Fault Circuit #4, Comp #1
142	36391	509	COMP SHUTDOWN - Condenser Pressure Sensor Fault Circuit #1, Comp #1
	36423	511	COMP SHUTDOWN - Condenser Pressure Sensor Fault Circuit #2, Comp #1
	36455	513	COMP SHUTDOWN - Condenser Pressure Sensor Fault Circuit #3, Comp #1
	36487	514	COMP SHUTDOWN - Condenser Pressure Sensor Fault Circuit #4, Comp #1
145	37159	517	COMP SHUTDOWN - Condenser Pressure High Circuit #1, Comp #1
	37191	519	COMP SHUTDOWN - Condenser Pressure High Circuit #2, Comp #1

Fault Alarms			
Alarm Class Monitoring		**Individual Alarm Monitoring**	
Alarm Index (Holding Register 30)	**Alarm Code (Holding Register 33)**	**Holding Registers (0=Normal, 1=Alarm)**	**Alarm Description**
	37223	521	COMP SHUTDOWN - Condenser Pressure High Circuit #3, Comp #1
	37255	522	COMP SHUTDOWN - Condenser Pressure High Circuit #4, Comp #1
147	37671	529	COMP SHUTDOWN - Discharge Temp Sensor Fault Circuit #1, Comp #1
	37703	531	COMP SHUTDOWN - Discharge Temp Sensor Fault Circuit #2, Comp #1
	37735	533	COMP SHUTDOWN - Discharge Temp Sensor Fault Circuit #3, Comp #1
	37767	534	COMP SHUTDOWN - Discharge Temp Sensor Fault Circuit #4, Comp #1
148	37927	535	COMP SHUTDOWN - Discharge Temp High Circuit #1, Comp #1
	37959	537	COMP SHUTDOWN - Discharge Temp High Circuit #2, Comp #1
	37991	539	COMP SHUTDOWN - Discharge Temp High Circuit #3, Comp #1
	38023	540	COMP SHUTDOWN - Discharge Temp High Circuit #4, Comp #1
150	38403	542	UNIT SHUTDOWN - Evaporator Water Flow Loss
151	38659	543	UNIT SHUTDOWN - Evaporator Leaving Water Temp Low (Freeze)
153	39207	545	COMP SHUTDOWN - Evaporator Pressure Low Circuit #1, Comp #1
	39239	547	COMP SHUTDOWN - Evaporator Pressure Low Circuit #2, Comp #1
	39271	549	COMP SHUTDOWN - Evaporator Pressure Low Circuit #3, Comp #1
	39303	550	COMP SHUTDOWN - Evaporator Pressure Low Circuit #4, Comp #1
155	39719	552	COMP SHUTDOWN - Evaporator Pressure Sensor Fault Circuit #1 Comp #1
	39715	554	COMP SHUTDOWN - Evaporator Pressure Sensor Fault Circuit #1 Comp #1
	39783	556	COMP SHUTDOWN - Evaporator Pressure Sensor Fault Circuit #1 Comp #1
	39815	557	COMP SHUTDOWN - Evaporator Pressure Sensor Fault Circuit #1 Comp #1
161	41225	583	COMP LOCKOUT - Number of Allowed Re-Starts Exceeded Circuit #1, Comp#1
	41827	585	COMP LOCKOUT - Number of Allowed Re-Starts Exceeded Circuit #2, Comp#1
	41319	587	COMP LOCKOUT - Number of Allowed Re-Starts Exceeded Circuit #3, Comp#1
	41351	588	COMP LOCKOUT - Number of Allowed Re-Starts Exceeded Circuit #4, Comp#1
162	41475	589	UNIT SHUTDOWN - Evaporator Leaving Water Temp Sensor Fault
163	41731	755	Evaporator Entering Water Temperature Sensor Failure
166	42535	601	COMP SHUTDOWN - Mechanical High Pressure Trip Circuit #1, Comp #1
	42567	603	COMP SHUTDOWN - Mechanical High Pressure Trip Circuit #2, Comp #1
	42599	605	COMP SHUTDOWN - Mechanical High Pressure Trip Circuit #3, Comp #1
	42631	606	COMP SHUTDOWN - Mechanical High Pressure Trip Circuit #4, Comp #1
172	44071	637	COMPRESSOR SHUTDOWN - Oil Delta Pressure High Circuit #1, Comp #1
	44103	639	COMPRESSOR SHUTDOWN - Oil Delta Pressure High Circuit #2, Comp #1
	44135	641	COMPRESSOR SHUTDOWN - Oil Delta Pressure High Circuit #3, Comp #1
	44167	642	COMPRESSOR SHUTDOWN - Oil Delta Pressure High Circuit #4, Comp #1
173	44327	643	COMP SHUTDOWN - Oil Feed Pressure Sensor Fault Circuit #1, Comp #1
	44359	645	COMP SHUTDOWN - Oil Feed Pressure Sensor Fault Circuit #2, Comp #1
	44391	647	COMP SHUTDOWN - Oil Feed Pressure Sensor Fault Circuit #3, Comp #1
	44423	648	COMP SHUTDOWN - Oil Feed Pressure Sensor Fault Circuit #4, Comp #1
176	45059	661	SHUTDOWN – Phase Voltage Protection (Unit)
	45091	751	SHUTDOWN – Phase Voltage Protection Circuit #1
	45123	752	SHUTDOWN – Phase Voltage Protection Circuit #2
	45155	753	SHUTDOWN – Phase Voltage Protection Circuit #3
	45187	754	SHUTDOWN – Phase Voltage Protection Circuit #4
177	45351	662	COMP SHUTDOWN - Starter Fault Compressor Circuit #1, Comp #1
	45383	664	COMP SHUTDOWN - Starter Fault Compressor Circuit #2, Comp #1
	45415	666	COMP SHUTDOWN - Starter Fault Compressor Circuit #3, Comp #1
	45447	667	COMP SHUTDOWN - Starter Fault Compressor Circuit #4, Comp #1
183	46887	698	COMP SHUTDOWN - Suction Temp Sensor Fault Circuit #1, Comp #1
	46919	700	COMP SHUTDOWN - Suction Temp Sensor Fault Circuit #2, Comp #1
	46951	702	COMP SHUTDOWN - Suction Temp Sensor Fault Circuit #3, Comp #1
	46983	703	COMP SHUTDOWN - Suction Temp Sensor Fault Circuit #4, Comp #1
187	47911	717	COMP SHUTDOWN - Mechanical Low Pressure Trip Circuit #1, Comp #1
	47943	719	COMP SHUTDOWN - Mechanical Low Pressure Trip Circuit #2, Comp #1
	47975	721	COMP SHUTDOWN - Mechanical Low Pressure Trip Circuit #3, Comp #1
	48007	722	COMP SHUTDOWN - Mechanical Low Pressure Trip Circuit #4, Comp #1
188	48131	746	Controller board offline - Unit
	48163	723	Controller board offline Circuit #1 (Circuit number describes Control board number)
	48195	724	Controller board offline Circuit #2 (Circuit number describes Control board number)
	48227	725	Controller board offline Circuit #3 (Circuit number describes Control board number)

Fault Alarms			
Alarm Class Monitoring		**Individual Alarm Monitoring**	
Alarm Index (Holding Register 30)	**Alarm Code (Holding Register 33)**	**Holding Registers (0=Normal, 1=Alarm)**	**Alarm Description**
	48259	726	Controller board offline Circuit #4 (Circuit number describes Control board number)

Fault Alarms			
Alarm Class Monitoring		**Individual Alarm Monitoring**	
Alarm Index (Holding Register 30)	**Alarm Code (Holding Register 33)**	**Holding Registers (0=Normal, 1=Alarm)**	**Alarm Description**
189	48419	747	COMP SHUTDOWN – No Pressure Change After Start Circuit #1
	48451	748	COMP SHUTDOWN – No Pressure Change After Start Circuit #2
	48483	749	COMP SHUTDOWN – No Pressure Change After Start Circuit #3
	48515	750	COMP SHUTDOWN – No Pressure Change After Start Circuit #4
190	48675	711	COMP SHUTDOWN – No Pressure At Startup Circuit #1
	48707	712	COMP SHUTDOWN – No Pressure At Startup Circuit #2
	48739	713	COMP SHUTDOWN – No Pressure At Startup Circuit #3
	48771	714	COMP SHUTDOWN – No Pressure At Startup Circuit #4
191	48935	756	COMP SHUTDOWN - Slide position sensor fault Circuit #1, Comp#1
	48967	758	COMP SHUTDOWN - Slide position sensor fault Circuit #2, Comp#1
	48999	760	COMP SHUTDOWN - Slide position sensor fault Circuit #3, Comp#1
	49031	761	COMP SHUTDOWN - Slide position sensor fault Circuit #4, Comp#1
192	49155	798	UNIT STOP – Emergency Stop Alarm
193	49411	799	UNIT STOP – Evaporator Water Temperature Inverted
194	49667	800	UNIT STOP – External Alarm
195	49923	590	Evaporator Leaving Water Temperature 1 Sensor Fault
196	50179	591	Evaporator Leaving Water Temperature 2 Sensor Fault
197	50435	592	CIRCUIT SHUTDOWN - Evaporator 1 Freeze Protection
198	50691	593	CIRCUIT SHUTDOWN - Evaporator 2 Freeze Protection
199	50983	762	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Fault Circuit #1, Comp #1
	51015	764	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Fault Circuit #2, Comp #1
	51047	766	COMPRESSOR SHUTDOWN - COMPRESSOR VFD Fault Circuit #3, Comp #1
200	51239	768	COMP SHUTDOWN - COMPRESSOR VFD Over Heat Fault Circuit #1, Comp #1
	51271	770	COMP SHUTDOWN - COMPRESSOR VFD Over Heat Fault Circuit #2, Comp #1
	51303	772	COMP SHUTDOWN - COMPRESSOR VFD Over Heat Fault Circuit #3, Comp #1
201	51495	774	COMP SHUTDOWN-COM ERROR With COMPRESSOR VFD Circuit #1, Comp #1
	51527	776	COMP SHUTDOWN-COM ERROR With COMPRESSOR VFD Circuit #2, Comp #1
	51559	778	COMP SHUTDOWN-COM ERROR With COMPRESSOR VFD Circuit #3, Comp #1
202	51751	808	COMP SHUTDOWN-Low Discharge Superheat Circuit #1, Comp #1
	51783	810	COMP SHUTDOWN -Low Discharge Superheat Circuit #2, Comp #1
	51815	812	COMP SHUTDOWN -Low Discharge Superheat Circuit #3, Comp #1

Appendix A: ASCII Characters Conversion Table

This table lists the ASCII characters and their decimal and hexadecimal numbers. **The MicroTech III Chiller Unit Controller does not support the characters in boldface type.** Also, non-printing characters, with the exception of the (Space) character, are not listed in this table and are not supported. Characters not supported are translated to a space.

Char	Decimal	Hexadecimal	Char	Decimal	Hexadecimal	Char	Decimal	Hexadecimal
(Space)	32	0x20	@	64	0x40	`	96	0x60
!	33	0x21	A	65	0x41	a	97	0x61
“	**34**	**0x22**	B	66	0x42	b	98	0x62
#	35	0x23	C	67	0x43	c	99	0x63
$	**36**	**0x24**	D	68	0x44	d	100	0x64
%	37	0x25	E	69	0x45	e	101	0x65
&	38	0x26	F	70	0x46	f	102	0x66
‘	39	0x27	G	71	0x47	g	103	0x67
(	40	0x28	H	72	0x48	h	104	0x68
)	41	0x29	I	73	0x49	I	105	0x69
*	42	0x2a	J	74	0x4a	j	106	0x6a
+	43	0x2b	K	75	0x4b	k	107	0x6b
‘	44	0x2c	L	76	0x4c	l	108	0x6c
-	45	0x2d	M	77	0x4d	m	109	0x6d
.	46	0x2e	N	78	0x4e	n	110	0x6e
/	47	0x2f	O	79	0x4f	o	111	0x6f
0	48	0x30	P	80	0x50	p	112	0x70
1	49	0x31	Q	81	0x51	q	113	0x71
2	50	0x32	R	82	0x52	r	114	0x72
3	51	0x33	S	83	0x53	s	115	0x73
4	52	0x34	T	84	0x54	t	116	0x74
5	53	0x35	U	85	0x55	u	117	0x75
6	54	0x36	V	86	0x56	v	118	0x76
7	55	0x37	W	87	0x57	w	119	0x77
8	56	0x38	X	88	0x58	x	120	0x78
9	57	0x39	Y	89	0x59	y	121	0x79
:	58	0x3a	Z	90	0x5a	z	122	0x7a
;	59	0x3b	[	91	0x5b	{	123	0x7b
<	60	0x3c	\	92	0x5c	|	124	0x7c
=	61	0x3d	]	93	0x5d	}	125	0x7d
>	62	0x3e	^	94	0x5e	~	126	0x7e
?	63	0x3f	_	95	0x5f			

Index

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