MULTISTACK

The Modular Water Chiller

BACnet Portal
Technical Manual

MULTISTACK WEB PORTAL

MS20/30/50 HEAT PUMP Application - BACnet over TCP/IP

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GENERAL DESCRIPTION

The Multistack WEB PORTAL is a device that acts as a translator between a Multistack COMPUT25 and the ASHRAE standard BACnet protocol.

SPECIFICATIONS

Power Supply Requirements for Portal: 24VAC ± 10%, 0.3 A (7.2 VA), 50-60 Hz.

Status Indication: Power, Run, and Error LED indicators. LED indicators for Transmit and Receive on each of the communication ports.

Battery: Seven-year lithium BR2325 battery provides a minimum of 10,000 hours of data retention during power outages.

Operating Temperature Range: 0-130°F (-17.8 to 54.4 °C).

Operating Humidity Range: 10-95% relative humidity, non-condensing.

Listed By: PAZX (UL 916), PAZX7 (cUL C22.2 No. 205-M1983), FCC Part 15- Subpart B-Class A.

COMMUNICATIONS WIRING

1. BAS Interface (10 baseT port):

The Multistack WEB PORTAL communicates with a Building Automation device or other devices via a BACnet over Ethernet connection. This connection is located in the upper left corner of the WEB PORTAL. The DIP SWITCHES located in the lower right corner of the portal are for addressing. They should already be set with switches 3 and 4 ON and switches 1, 2, and 5 OFF.

NOTE: The Customer or Building Automation provider is responsible for providing the CAT5 cable to connect to the building network.

2. COMPUT25 Interface (Port 2):

The Multistack WEB PORTAL talks directly to a Multistack COMPUT25 using a 3-wire EIA-232 connection. The WEB PORTAL has been factory configured with Port 2 set-up for communications to a COMPUT25. This port is the 5-pin terminal block located on the left hand side of the WEB PORTAL. A DB25-pin male serial cable connection is required at the COMPUT25. The maximum distance for this connection is 50 feet. Multistack provides a 6-foot serial cable to connect Port 2 of the WEB PORTAL to the RS-232 connector in the Multistack COMPUT25. (See Photo 1)

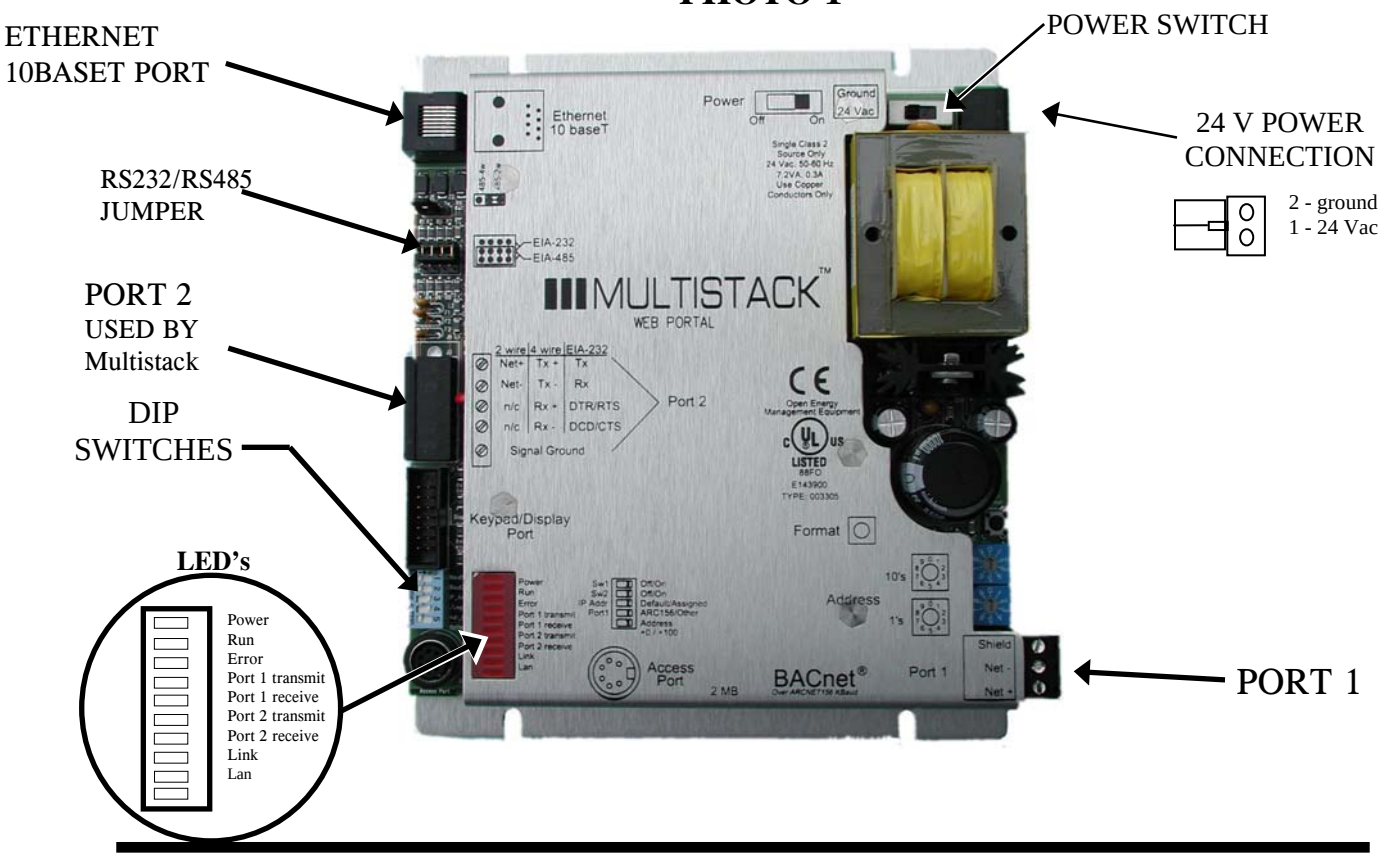
****The portal will be set up by Multistack to communicate to the COMPUT25 at 2400 baud, 8 bits, no parity, and 1 stop bit. THIS IS NOT ADJUSTABLE!!

Port 2 Pin-Out Designation

Multistack Portal Port 2		Comput25 (RS232 Port)
Pin 1 (TX)	———	Pin 2 (RX)
Pin 2 (RX)	———	Pin 3 (TX)
Pin 3 (DTR/RTS)	———	No Connection
Pin 4 (DCD/CTS)	———	No Connection
Pin 5 (GND)	———	Pin 7 (GND)

NOTE: Check to make sure that the RS232/ RS485 jumper is selected for EIA-232. This jumper is located adjacent to the 5-pin connector on the left hand side of the module (See Photo 1). With EIA-232 selected for Port 2, the 2 wire/4 wire jumper directly above the RS232/RS485 jumper can be ignored.

PHOTO 1



POWER WIRING

CAUTION: The WEB PORTAL is a Class 2 device (less than 30VAC, 100 VA maximum). Take the appropriate isolation precautions when mounting this device in a panel with non-Class 2 devices.

1. Turn the WEB PORTAL's power switch OFF (see Photo 1) to prevent the module from being powered up until proper voltage is verified.

2. Connect the power wires to the appropriate terminals maintaining proper polarity. The terminals are labeled Ground and 24 VAC.

2. Verify that 24 VAC is present at the power input terminals of the WEB PORTAL (See Photo 1). The voltage input should be between 21.6 VAC and 26.4 VAC.

3. Turn the WEB PORTAL's power switch ON, the Power, Run and Error LEDs should turn ON and the Run and Error LEDs begin blinking. The Error LED should then turn off. If this does not occur, turn the power switch OFF and check for wiring errors.

LED IDENTIFICATION

The Multistack Portal's LEDs are as follows (see Photo 1):

Power - portal is being supplied with power.
Run - 2 flashes/second indicates normal operation.
Error - lights when an error is detected. (Table 2)
Port 1 Transmit - lights when Port 1 receives data.
Port 1 Receive - lights when Port 1 transmits data.
Port 2 Transmit - lights when Port 2 receives data.
Port 2 Receive - lights when Port 2 transmits data.
Link - lights when the 10BaseT port has a link.
Lan - lights when the portal is communicating with then LAN

TABLE 2

RUN LED	ERROR LED	CONDITION
2 flashes per sec.	Off	All normal
2 flashes per sec.	2 flashes alternating	5 minute auto-restart delay after system error
2 flashes per sec.	2 flashes in sync, then pause	Module is configured with different baud rate than rest of network
2 flashes per sec.	On	Module halted after frequent system errors.
5 flashes per sec.	On	Contact Technical Support
5 flashes per sec.	Off	Download in progress.
7 flashes per sec.	7 flashes per sec.	Brownout recovery delay (10 seconds)
14 flashes per sec.	14 flashes per sec.	Brownout in progress (Supply voltage low)

BACnet over TCP/IP SETUP

Table 3 is a listing of all the points available in a Multistack Chiller. The **Object Identifier** is the description of each point. The other columns give a listing of the BACnet **Object Type**, **Object Instance, Object Enumeration, Action,** and **Reference Name**. BACnet **Object Type**'s are abbreviated as follows:

AV	R	Analog Value (Read Only)
AV	W	Analog Value (Write Only)
BV	R	Binary Value (Read Only)
BV	W	Binary Value (Write Only)

CONNECTION TYPE

The default CONNECTION TYPE for the BACnet over ETHERNET to the WEB PORTAL is a CAT5 Cable via a RJ-45 connector. This connector plugs into the Ethernet 10BaseT port. If this needs to be changed, please contact a Multistack Representative.

BACnet COMMUNICATION SETUP

The rate of communication between a BACnet device and the WEB PORTAL is third party dependant. The 10BaseT port on the WEB PORTAL is capable of sending information at 10 Mbps. This is not adjustable.

ETHERNET NETWORK

The WEB PORTAL may be connected directly to the Ethernet network using the 10BaseT port. To prevent circular routes, the WEB PORTAL will be configured only for BACnet/IP. The IP Network Number will be defaulted to **6100**. The BACnet/Ethernet router configuration will be disabled and the Ethernet Network number set to 0. If this settings needs to be changed, please contact a Multistack Representative

IP ADDRESS

The following is the IP Addressing scheme in the portal.

IP – 192.168.1.101
Subnet Mask – 255.255.255.0
Gateway – 0.0.0.0

If these settings need to be changed, please contact a Multistack Representative.

DEVICE INSTANCE

The device instance number is **610001**. If this setting needs to be changed, please contact a Multistack Representative.

POINTS LIST (Object Instance)

READ POINTS

 # OF COMPRESSORS - The total number of compressors in the system as set by the dip switch setting in the COMPUT25. (AV-1)

CAPACITY - How many compressors are on, compared to the total in the system. (AV-2)

DEMAND - Current load compared to maximum design load. This value is determined by the system entering load or source water temperature and the settings of the variables. (AV-3)

CURRENT FAULTS - How many compressors are in a fault condition. (AV-4)

OPERATING MODE – Tells the mode in which the chiller is currently operating. The value returned will be 0=Disabled, 1=Cooling, or 2/3=Heating. (AV-5)

ENT LOAD SYS TEMP - Entering Load Water System Temperature. (AV-6)

LEV LOAD SYS TEMP - Leaving Load Water System Temperature. (AV-7)

ENT SOURCE SYS TEMP - Entering Source Water System Temperature. (AV-8)

LEV SOURCE SYS TEMP - Leaving Source Water System Temperature. (AV-9)

C(X) SUCT. TEMP - Individual compressor suction temperature, where (X) is the compressor number. (See Table 3)

C(X) LLW TEMP - Individual compressor leaving load water temperature, where (X) is the compressor number. (See Table 3)

C(X) LSW TEMP - Individual compressor leaving source water temperature, where (X) is the compressor number. (See Table 3)

LEAD COMPRESSOR - The first compressor to start and the last compressor to turn off if available to run. (AV-20)

LOAD LIMIT - A percentage value to limit the system load. (AV-18)

UPPER SET POINT - The desired entering load/source water temperature (ENT CHW SYS TEMP) at full load.
(COOLING -AV-10) (HEATING – AV-14)

LOWER SET POINT - The desired leaving load/source water temperature (LEV CHW SYS TEMP) at full load.
(COOLING - AV-11) (HEATING – AV-15)

VSP (Variable Set Point) - A percentage value that is used to determine the no load point of the load/source water temperature.
(COOLING - AV-12) (HEATING – AV-16)

No Load LWT =
[(A Temp - B Temp) x C% ÷ 100] + BTemp

EXAMPLE: Cool Upper Set Point = 55, Lower Set Point = 45, VSP = 30%
NoLoad LWT = [(55-45) x 30 ÷ 100] + 45 = 48 °F

TDIFF (Delay Time) - A time in seconds which sets the amount of time between starts and stops of compressors. (COOLING - AV-13) (HEATING – AV-17)

FAIL INDIC (Failure Indicator) - A percentage value which provides for an output signal in the COMPUT25 whenever compressors of the indicated value have failed. A 0% setting will give an output signal after any failure within the system. (AV-19)

FLUSH TIME - The time in hours at which the DDRS-210A is cycled. (AV-21)

FLUSH DURATION - The time in seconds to set how long the DDRS-210A is energized. It is recommended to keep this value below 15 seconds for most instances. (AV-22)

MONTH - Current month as set in the COMPUT25. (AV-23)

DAY - Current day as set in the COMPUT25. (AV-24)

YEAR - Current year as set in the COMPUT25. (AV-25)

HOUR (TIME) - Current hour as set in the COMPUT25. (AV-26)

MINUTE (TIME) - Current minute as set in the COMPUT25. (AV-27)

The default settings for the previous System Variables are:

SYSTEM VARIABLE	DEFAULT
COOL UPSETPT	55 (°F)
COOL LOSETPT	45 (°F)
COOL VSP	50%
COOL TDIFF	90 (SEC)
HEAT UPSETPT	90 (°F)
HEAT LOSETPT	100 (°F)
HEAT VSP	50%
HEAT TDIFF	90 (SEC)
FLUSH TIME	12:00 (noon)
FLUSH DURATION	15 (SEC)
LOAD LIMIT	100%

FAULTS C(X) - Module fault information. This is an analog number which is coded to give the type of fault that has occurred on the INDIVIDUAL compressor circuit. In this definition, (X) represents the compressor number 1-24. Refer to the Table in the section entitled **FAULTS** for further information. (See Table 3)

FAULT (X) TYPE - This is an analog value which will represent the type of fault for each of the faults in the FAULT REVIEW. Refer to Tables in the section entitled **FAULT REVIEW** for further information. (See Table 3)

FAULT (X) COMP # - This value gives the compressor number that a fault occurred on. It will be a value between 0-24. A 0 value represents a system fault, while a value of 1-24 represents the compressor number of which the fault occurred on. (X) is the fault number in the FAULT REVIEW. Refer to Tables in the section entitled **FAULT REVIEW** for further information. (See Table 3)

COOL HRS @ XX% - This value relates the total cooling operating hours to the % load and is subdivided into 10% segments. (See Table 3)

HEAT HRS @ XX% - This value relates the total heating operating hours to the % load and is subdivided into 10% segments. (See Table 3)

MOST CURRENT FAULT – This value tells which fault in the fault review happened more recently than the others. To get the order of the fault review to compare with what is at the master controller, take this value and go backwards down the list using the FAULT (X) number.

Example: If the value for the MOST CURRENT FAULT was 7, then FAULT 7 information would be the most current fault and should match the value in position 20 at the master controller. The order of the fault from 20-1 would be 7, 6, 5, 4, 3, 2, 1, 20, 19, 18, 17, 16…..8. Therefore, FAULT 8 would be the oldest fault and the next fault position to be overwritten.

HEAT DELAY - A time in seconds, when the control is operating in Heating Mode and a compressor starts it will energized a reversing valve for the "Heat Delay Time". The compressor status screen will display "COOL" at the On/Off location during the Heat Delay Time.

ON/OFF STATUS - The present state of the chiller. (BV-1)

EX1 FAULT DISPLAY - Input in the COMPUT25 that disables the chiller and requires resetting at the COMPUT25 to resume operation. (BV-2)

EX2 REMOTE OFF - Input in the COMPUT25 that disables the chiller, no reset required to resume operation. Circuit acts just like an On/Off switch. (BV-3)

EX3 FAULT DISPLAY - Input in the COMPUT25 that disables the chiller and requires resetting at the COMPUT25 to resume operation. (BV-4)

EX4 FAULT DISPLAY - Input in the COMPUT25 that disables the chiller. No reset required. This EX4 input is a special input designed for use with a Power Phase Monitor (PPM). (BV-5)

LOW LW FLOW - Low Load Water Flow. Input in the COMPUT25 that disables the chiller and is intended to be used with the Load Water Flow Switch. Requires a reset and restart at the COMPUT25 to resume operation. (BV-6)

LOW SW FLOW - Low Source Water Flow. Input in the COMPUT25 that disables the chiller and is intended to be used with the Source Water Flow Switch. Requires a reset and restart at the COMPUT25 to resume operation. (BV-7)

LO LLW TEMP SYS - Low Leaving Load Water System Temperature Fault (Below 36 °F). Requires a reset and restart at the COMPUT25 to resume operation. (BV-8)

LO LSW TEMP SYS - Low Leaving Source Water System Temperature Fault (Below 36 °F). Requires a reset and restart at the COMPUT25 to resume operation. (BV-9)

COMP. (X) STATUS - The present state of each individual compressor, where (X) is the compressor number. This condition can be either ON or OFF. (See Table 3)

WRITE POINTS

ON/OFF CONTROL -This is the point that a BACnet device will control for ON or OFF operation. This point should be left ON anytime the BAS system wants the chiller running. (BV-34)

UPPER SET POINT - Input for changing the Upper Set Point variable in the COMPUT25. (COOLING - AV-184) (HEATING – AV-188)

LOWER SET POINT - Input for changing the Lower Set Point variable in the COMPUT25. (COOLING - AV-185) (HEATING – AV-189)

VSP (Variable Set Point) - Input for changing the VSP variable in the COMPUT25. (COOLING - AV-186) (HEATING – AV-190)

LOAD LIMIT - Input for changing the LOAD LIMIT in the COMPUT25. (AV-192)

TDIFF (Delay Time) - Input for changing the TDIFF variable in the COMPUT25. (COOLING - AV-187) (HEATING – AV-191)

FAIL INDICATOR - Input for changing the FAIL INDIC variable in the COMPUT25. (AV-193)

LEAD COMPRESSOR - Input for changing the LEAD COMP variable in the COMPUT25. (AV-194)

FLUSH TIME - Input for changing the FLUSH TIME variable in the COMPUT25. Hour only input for this setting. (AV-195)

FLUSH DURATION - Input for changing the FLUSH DURATION in the COMPUT25. This is a setting in seconds to set how long the DDRS-210A is energized. (AV-196)

OPERATING MODE – Input for changing the mode in which the chiller is currently operating. The value set can be 0=Disabled, 1=Cooling, or 2/3=Heating. (AV-197)

HEAT DELAY - A time in seconds, when the control is operating in Heating Mode and a compressor starts it will energized a reversing valve for the "Heat Delay Time". The compressor status screen will display "COOL" at the On/Off location during the Heat Delay Time. (AV-199)

THINGS TO CONSIDER FOR REMOTE START/STOP OF A MULTISTACK CHILLER

A Multistack chiller can be controlled On and Off by writing to BACnet Object Instance BV-34; ON/OFF CONTROL as described earlier, but this is not always the best procedure. This point is at the same level of priority as the keypad at the Master Control. If the BAS wants the chiller OFF, and a person near the chiller wants it ON, there could be a battle back and forth as to the condition of the chiller. When using this write point, the BAS system will need to also monitor BACnet Object Instance BV-1, ON/OFF STATUS. If the status of the chiller is OFF, then when the BAS system writes (B-34) ON the chiller will change to ON. This should then also change the status of BV-5 to ON. If the customer presses the ON/OFF push button at the chiller, the chiller will shut OFF, the ON/OFF STATUS (BACnet Object Instance BV-1) will change to OFF, even though the BAS system has ON/OFF CONTROL (BACnet Object Instance BV-34) set to ON. The BAS system will then have to turn ON/OFF CONTROL OFF for a short while, and then turn it back ON to get the chiller to start again. An alternate way to control the starting and stopping of a Multistack chiller is to use a "dry" set of contacts controlled by the BAS system. This set of contacts would then need to be wired into the Comput25, Master Control. A digital input for Remote Start/Stop is reserved at the Master Control and is labeled EX2. The BAS system can also monitor the status of EX2 by means of BACnet Object Instance (BV-3), EX2 REMOTE OFF. If this input is open, the Multistack chiller would be disabled, and nothing would be allowed to run. The EX2 input must be closed in order for the chiller to run.

FAULTS CONDITIONS

SYSTEM FAULTS DEFINITION

EX1 FAULT DISPLAY - Input in the COMPUT25 that disables the chiller and requires resetting at the COMPUT25 to resume operation.

EX2 REMOTE OFF - Input in the COMPUT25 that disables the chiller, no reset required to resume operation. This circuit acts just like an On/Off switch.

EX3 FAULT DISPLAY - Input in the COMPUT25 that disables the chiller and requires resetting at the COMPUT25 to resume operation.

EX4 FAULT DISPLAY - Input in the COMPUT25 that disables the chiller. No reset required. This EX4 input is a special input designed for use with a Power Phase Monitor (PPM).

LOW LW FLOW - Low Load Water Flow. Input in the COMPUT25 that disables the chiller and is intended to be used with the Load Water Flow Switch. Requires the user to reset the fault and restart the chiller at the COMPUT25 to resume operation

LOW SW FLOW - Low Source Water Flow. Input in the COMPUT25 that disables the chiller and is intended to be used with the Source Water Flow Switch. Requires the user to reset the fault and restart the chiller at the COMPUT25 to resume operation.

LOW LLW TEMP SYS - Low Leaving Load Water System Temperature Fault (Below 36°F). Requires the user to reset the fault and restart the chiller at the COMPUT25 to resume operation.

LOW LSW TEMP SYS - Low Leaving Source Water System Temperature Fault (Below 36°F). Requires the user to reset the fault and restart the chiller at the COMPUT25 to resume operation.

NOTE: System fault information is sent to BACnet devices in the form of digital inputs. Each system fault has a **BACnet Object Instance** assigned to it. There are eight different system faults, and they are assigned **BACnet Object Instances** BV2-9 (SEE TABLE 3). If the input is 'ON' then that particular fault is set. If the input is 'OFF' then that particular fault is cleared.

MODULE FAULTS DEFINITIONS

HP -High Pressure Cutout. Requires the user to reset the fault at both the HP control and the COMPUT25 to resume operation.

LP - Low Pressure Cutout. Requires the user to reset the fault at the LP control and the COMPUT25 to resume operation.

TH - Thermal Fault. This would occur if the motor protector sensed an overload in the compressor motor. It would also occur if any component in the motor protector circuit failed open. Requires the user to reset the fault at the COMPUT25 and on some units, at the overload relay also.

LOSUC - Low Suction Temperature. If during operation this temperature should drop to 25°F, the compressor will shut down. The temperature must rise back up to 30°F before the fault can be reset.

LOLLW - Low Leaving Load Water Temperature (Below 36°F). (Evaporator freeze protection) The temperature must rise back up to 40°F before the fault can be reset.

LOLSW - Low Leaving Source Water Temperature (Below 36°F). (Evaporator freeze protection) The temperature must rise back up to 40°F before the fault can be reset.

COMMUN - Communication Error between units.

NOTE: Module fault information for individual compressor circuits are sent to BACnet devices in the form of a analog number. The **Object Identifier** is labeled **FAULTS C(X)** where (X) is the compressor number in the system. There are four different conditions of a fault for a Multistack Portal. (Off mode) - This fault occurred while the circuit was not running. (Current) - This fault is still present, and corrective action must be taken. (Reset) - Fault can be reset and operation resumed by resetting the fault. (Record) - Fault has been reset, and the compressor is available to run. The following table lists the possible **module** faults in a Multistack system.

FAULTS C(X) Table

The following table is to decipher the FAULTS C(X), compressor faults. The integer value given at the point will coincide with a value in the table to give fault that is current or resetable.

FAULTS C(X)

OFF	CURRENT	RESET	FAULT
1	65	129	HP
2	66	130	LP
4	68	132	THERM
5	69	133	HP
6	70	134	LP
8	72	136	LOW LLW TEMP
16	80	144	LOW LSW TEMP
32	96	160	COMMUNICATION

FAULT REVIEW

The FAULT REVIEW can also be helpful in determining fault conditions that may be present in the COMPUT25. The COMPUT25 will store the most current 20 faults. Each fault has a type **[FAULT (X) TYPE]** and a compressor number **[FAULT (X) COMP]** associated with it.

The FAULT (X) TYPE is an analog number which will give the type of fault that has occurred, and is dependant upon the FAULT (X) COMP value. If the FAULT (X) COMP value is 1-24 then the following table applies, and the fault condition is a **Module** Fault.

FAULT (X) TYPE (Module)

RECORD	CURRENT/RESET	FAULT
0	64	LOSUCT
1	65	HP
2	66	LP
4	68	THERM
5	69	HP
6	70	LP
8	72	LOW LLW TEMP
16	80	LOW LSW TEMP
32	96	COMMUNICATION

If the FAULT (X) COMP value is 0 then the following table applies, and the fault condition is a **System** Fault.

FAULT (X) TYPE (System)

RECORD	CURRENT	RESET	FAULT
2	66	130	LOLSW TEMP
4	68		EX4 FAULT
8	72	136	LOLLW TEMP
16	80	144	LLW FLOW
32	96	160	LSW FLOW

The FAULT (X) COMP value is an analog value which is a number between 0-24. A 0 value represents a System Fault. A number of 1-24 represents a Module Fault, and is the compressor number that the fault has occurred on. The following is a list of examples.

EXAMPLES:

FAULT 1 TYPE = 72
FAULT 1 COMP# = 2

These numbers represent that Fault No. 1 in the FAULT REVIEW is a LOLLW on compressor #2, and the fault is CURRENT.

FAULT 2 TYPE = 8
FAULT 2 COMP# = 1

These numbers represent that Fault No. 2 in the FAULT REVIEW is a LOLLW on compressor #1, and the fault is in the RECORD mode.

NOTE: Since the FAULT (X) TYPE came back as a RECORD condition, it is not necessary to look at the FAULTS C(X) value to determine if the fault is in a RESET or CURRENT condition.

FAULT 5 TYPE = 130
FAULT 5 COMP # = 0

In this example, since FAULTS 5 COMP # equals 0, there would be no associated FAULTS C(X) number. Therefore, these numbers represent that Fault No. 5 is a SYSTEM FAULT (because F5COMP = 0). This SYSTEM FAULT would then be defined as a LOLSW TEMP in the RESETable mode.

FAULT 10 TYPE = 4
FAULT 10 COMP# = 0

Again, the FAULT (X) COMP # equals 0, therefore the numbers represent that Fault No. 10 is a SYSTEM FAULT, which is an EX4 FAULT in the RECORD mode.

NOTES

AV	R	Analog Value (Read Only)
AV	W	Analog Value (Write Only)
BV	R	Binary Value (Read Only)
BV	W	Binary Value (Write Only)

SHADED AREAS WILL NOT APPLY TO YOUR CHILLER.

Table 3

OBJECT IDENTIFIER	BACnet OBJECT TYPE	BACnet OBJECT ENUMERATION	BACnet ACTION	BACnet OBJECT INSTANCE	BACnet REFERENCE NAME
CAPACITY	AV	2	R	1	capacity_1
DEMAND	AV	2	R	2	demand_1
# OF COMPS	AV	2	R	3	num_of_compressors_1
CURRENT FAULTS	AV	2	R	4	current_faults_1
OPERATING MODE	AV	2	R	5	op_mode_read_1
ENT LOAD TEMP	AV	2	R	6	elw_sys_temp_1
LEV LOAD TEMP	AV	2	R	7	llw_sys_temp_1
ENT SOURCE TEMP	AV	2	R	8	esw_sys_temp_1
LEV SOURCE TEMP	AV	2	R	9	lsw_sys_temp_1
COOL UPSETPT	AV	2	R	10	cool_upsetpt_read_1
COOL LOWSETPT	AV	2	R	11	cool_lowsetpt_read_1
COOL VSP	AV	2	R	12	cool_vsp_read_1
COOL TDIFF	AV	2	R	13	cool_tdiff_read_1
HEAT UPSETPT	AV	2	R	14	heat_upsetpt_read_1
HEAT LOWSETPT	AV	2	R	15	heat_lowsetpt_read_1
HEAT VSP	AV	2	R	16	heat_vsp_read_1
HEAT TDIFF	AV	2	R	17	heat_tdiff_read_1
LOAD LIMIT	AV	2	R	18	load_limit_read_1
FAIL INDICATOR	AV	2	R	19	fail_indic_read_1
LEAD COMPRESSOR	AV	2	R	20	lead_comp_read_1
FLUSH TIME	AV	2	R	21	flush_time_read_1
FLUSH DURATION	AV	2	R	22	flush_duration_read_1
MONTH	AV	2	R	23	month_1
DAY	AV	2	R	24	day_1
YEAR	AV	2	R	25	year_1
HOUR	AV	2	R	26	hour_1
MINUTE	AV	2	R	27	minute_1
C1 SUCTION TEMP	AV	2	R	28	c1_suct_temp_1
C1 LLW TEMP	AV	2	R	29	c1_llw_temp_1
C1 LSW TEMP	AV	2	R	30	c1_lsw_temp_1
C2 SUCTION TEMP	AV	2	R	31	c2_suct_temp_1
C2 LLW TEMP	AV	2	R	32	c2_llw_temp_1
C2 LSW TEMP	AV	2	R	33	c2_lsw_temp_1
C3 SUCTION TEMP	AV	2	R	34	c3_suct_temp_1
C3 LLW TEMP	AV	2	R	35	c3_llw_temp_1
C3 LSW TEMP	AV	2	R	36	c3_lsw_temp_1
C4 SUCTION TEMP	AV	2	R	37	c4_suct_temp_1
C4 LLW TEMP	AV	2	R	38	c4_llw_temp_1

	BACnet				
	OBJECT	OBJECT		OBJECT	REFERENCE
OBJECT IDENTIFIER	TYPE	ENUMERATION	ACTION	INSTANCE	NAME
C4 LSW TEMP	AV	2	R	39	c4_lsw_temp_1
C5 SUCTION TEMP	AV	2	R	40	c5_suct_temp_1
C5 LLW TEMP	AV	2	R	41	c5_llw_temp_1
C5 LSW TEMP	AV	2	R	42	c5_lsw_temp_1
C6 SUCTION TEMP	AV	2	R	43	c6_suct_temp_1
C6 LLW TEMP	AV	2	R	44	c6_llw_temp_1
C6 LSW TEMP	AV	2	R	45	c6_lsw_temp_1
C7 SUCTION TEMP	AV	2	R	46	c7_suct_temp_1
C7 LLW TEMP	AV	2	R	47	c7_llw_temp_1
C7 LSW TEMP	AV	2	R	48	c7_lsw_temp_1
C8 SUCTION TEMP	AV	2	R	49	c8_suct_temp_1
C8 LLW TEMP	AV	2	R	50	c8_llw_temp_1
C8 LSW TEMP	AV	2	R	51	c8_lsw_temp_1
C9 SUCTION TEMP	AV	2	R	52	c9_suct_temp_1
C9 LLW TEMP	AV	2	R	53	c9_llw_temp_1
C9 LSW TEMP	AV	2	R	54	c9_lsw_temp_1
C10 SUCTION TEMP	AV	2	R	55	c10_suct_temp_1
C10 LLW TEMP	AV	2	R	56	c10_llw_temp_1
C10 LSW TEMP	AV	2	R	57	c10_lsw_temp_1
C11 SUCTION TEMP	AV	2	R	58	c11_suct_temp_1
C11 LLW TEMP	AV	2	R	59	c11_llw_temp_1
C11 LSW TEMP	AV	2	R	60	c11_lsw_temp_1
C12 SUCTION TEMP	AV	2	R	61	c12_suct_temp_1
C12 LLW TEMP	AV	2	R	62	c12_llw_temp_1
C12 LSW TEMP	AV	2	R	63	c12_lsw_temp_1
C13 SUCTION TEMP	AV	2	R	64	c13_suct_temp_1
C13 LLW TEMP	AV	2	R	65	c13_llw_temp_1
C13 LSW TEMP	AV	2	R	66	c13_lsw_temp_1
C14 SUCTION TEMP	AV	2	R	67	c14_suct_temp_1
C14 LLW TEMP	AV	2	R	68	c14_llw_temp_1
C14 LSW TEMP	AV	2	R	69	c14_lsw_temp_1
C15 SUCTION TEMP	AV	2	R	70	c15_suct_temp_1
C15 LLW TEMP	AV	2	R	71	c15_llw_temp_1
C15 LSW TEMP	AV	2	R	72	c15_lsw_temp_1
C16 SUCTION TEMP	AV	2	R	73	c16_suct_temp_1
C16 LLW TEMP	AV	2	R	74	c16_llw_temp_1
C16 LSW TEMP	AV	2	R	75	c16_lsw_temp_1
C17 SUCTION TEMP	AV	2	R	76	c17_suct_temp_1
C17 LLW TEMP	AV	2	R	77	c17_llw_temp_1

OBJECT IDENTIFIER	BACnet				
	OBJECT	OBJECT		OBJECT	REFERENCE
	TYPE	ENUMERATION	ACTION	INSTANCE	NAME
C17 LSW TEMP	AV	2	R	78	c17_lsw_temp_1
C18 SUCTION TEMP	AV	2	R	79	c18_suct_temp_1
C18 LLW TEMP	AV	2	R	80	c18_llw_temp_1
C18 LSW TEMP	AV	2	R	81	c18_lsw_temp_1
C19 SUCTION TEMP	AV	2	R	82	c19_suct_temp_1
C19 LLW TEMP	AV	2	R	83	c19_llw_temp_1
C19 LSW TEMP	AV	2	R	84	c19_lsw_temp_1
C20 SUCTION TEMP	AV	2	R	85	c20_suct_temp_1
C20 LLW TEMP	AV	2	R	86	c20_llw_temp_1
C20 LSW TEMP	AV	2	R	87	c20_lsw_temp_1
C21 SUCTION TEMP	AV	2	R	88	c21_suct_temp_1
C21 LLW TEMP	AV	2	R	89	c21_llw_temp_1
C21 LSW TEMP	AV	2	R	90	c21_lsw_temp_1
C22 SUCTION TEMP	AV	2	R	91	c22_suct_temp_1
C22 LLW TEMP	AV	2	R	92	c22_llw_temp_1
C22 LSW TEMP	AV	2	R	93	c22_lsw_temp_1
C23 SUCTION TEMP	AV	2	R	94	c23_suct_temp_1
C23 LLW TEMP	AV	2	R	95	c23_llw_temp_1
C23 LSW TEMP	AV	2	R	96	c23_lsw_temp_1
C24 SUCTION TEMP	AV	2	R	97	c24_suct_temp_1
C24 LLW TEMP	AV	2	R	98	c24_llw_temp_1
C24 LSW TEMP	AV	2	R	99	c24_lsw_temp_1
C1 FAULTS	AV	2	R	100	faults_c1_1
C2 FAULTS	AV	2	R	101	faults_c2_1
C3 FAULTS	AV	2	R	102	faults_c3_1
C4 FAULTS	AV	2	R	103	faults_c4_1
C5 FAULTS	AV	2	R	104	faults_c5_1
C6 FAULTS	AV	2	R	105	faults_c6_1
C7 FAULTS	AV	2	R	106	faults_c7_1
C8 FAULTS	AV	2	R	107	faults_c8_1
C9 FAULTS	AV	2	R	108	faults_c9_1
C10 FAULTS	AV	2	R	109	faults_c10_1
C11 FAULTS	AV	2	R	110	faults_c11_1
C12 FAULTS	AV	2	R	111	faults_c12_1
C13 FAULTS	AV	2	R	112	faults_c13_1
C14 FAULTS	AV	2	R	113	faults_c14_1
C15 FAULTS	AV	2	R	114	faults_c15_1
C16 FAULTS	AV	2	R	115	faults_c16_1
C17 FAULTS	AV	2	R	116	faults_c17_1

	BACnet				
	OBJECT	OBJECT		OBJECT	REFERENCE
OBJECT IDENTIFIER	TYPE	ENUMERATION	ACTION	INSTANCE	NAME
C18 FAULTS	AV	2	R	117	faults_c18_1
C19 FAULTS	AV	2	R	118	faults_c19_1
C20 FAULTS	AV	2	R	119	faults_c20_1
C21 FAULTS	AV	2	R	120	faults_c21_1
C22 FAULTS	AV	2	R	121	faults_c22_1
C23 FAULTS	AV	2	R	122	faults_c23_1
C24 FAULTS	AV	2	R	123	faults_c24_1
FAULT 1 COMP #	AV	2	R	124	fault_1_comp_1
FAULT 2 COMP #	AV	2	R	125	fault_2_comp_1
FAULT 3 COMP #	AV	2	R	126	fault_3_comp_1
FAULT 4 COMP #	AV	2	R	127	fault_4_comp_1
FAULT 5 COMP #	AV	2	R	128	fault_5_comp_1
FAULT 6 COMP #	AV	2	R	129	fault_6_comp_1
FAULT 7 COMP #	AV	2	R	130	fault_7_comp_1
FAULT 8 COMP #	AV	2	R	131	fault_8_comp_1
FAULT 9 COMP #	AV	2	R	132	fault_9_comp_1
FAULT 10 COMP #	AV	2	R	133	fault_10_comp_1
FAULT 11 COMP #	AV	2	R	134	fault_11_comp_1
FAULT 12 COMP #	AV	2	R	135	fault_12_comp_1
FAULT 13 COMP #	AV	2	R	136	fault_13_comp_1
FAULT 14 COMP #	AV	2	R	137	fault_14_comp_1
FAULT 15 COMP #	AV	2	R	138	fault_15_comp_1
FAULT 16 COMP #	AV	2	R	139	fault_16_comp_1
FAULT 17 COMP #	AV	2	R	140	fault_17_comp_1
FAULT 18 COMP #	AV	2	R	141	fault_18_comp_1
FAULT 19 COMP #	AV	2	R	142	fault_19_comp_1
FAULT 20 COMP #	AV	2	R	143	fault_20_comp_1
FAULT 1 TYPE	AV	2	R	144	fault_1_type_1
FAULT 2 TYPE	AV	2	R	145	fault_2_type_1
FAULT 3 TYPE	AV	2	R	146	fault_3_type_1
FAULT 4 TYPE	AV	2	R	147	fault_4_type_1
FAULT 5 TYPE	AV	2	R	148	fault_5_type_1
FAULT 6 TYPE	AV	2	R	149	fault_6_type_1
FAULT 7 TYPE	AV	2	R	150	fault_7_type_1
FAULT 8 TYPE	AV	2	R	151	fault_8_type_1
FAULT 9 TYPE	AV	2	R	152	fault_9_type_1
FAULT 10 TYPE	AV	2	R	153	fault_10_type_1
FAULT 11 TYPE	AV	2	R	154	fault_11_type_1

	BACnet				
	OBJECT	OBJECT		OBJECT	REFERENCE
OBJECT IDENTIFIER	TYPE	ENUMERATION	ACTION	INSTANCE	NAME
FAULT 12 TYPE	AV	2	R	155	fault_12_type_1
FAULT 13 TYPE	AV	2	R	156	fault_13_type_1
FAULT 14 TYPE	AV	2	R	157	fault_14_type_1
FAULT 15 TYPE	AV	2	R	158	fault_15_type_1
FAULT 16 TYPE	AV	2	R	159	fault_16_type_1
FAULT 17 TYPE	AV	2	R	160	fault_17_type_1
FAULT 18 TYPE	AV	2	R	161	fault_18_type_1
FAULT 19 TYPE	AV	2	R	162	fault_19_type_1
FAULT 20 TYPE	AV	2	R	163	fault_20_type_1
COOL HRS @ 0-9%	AV	2	R	164	lp_0_9_cool_1
COOL HRS @ 10-19%	AV	2	R	165	lp_10_19_cool_1
COOL HRS @ 20-29%	AV	2	R	166	lp_20_29_cool_1
COOL HRS @ 30-39%	AV	2	R	167	lp_30_39_cool_1
COOL HRS @ 40-49%	AV	2	R	168	lp_40_49_cool_1
COOL HRS @ 50-59%	AV	2	R	169	lp_50_59_cool_1
COOL HRS @ 60-69%	AV	2	R	170	lp_60_69_cool_1
COOL HRS @ 70-79%	AV	2	R	171	lp_70_79_cool_1
COOL HRS @ 80-89%	AV	2	R	172	lp_80_89_cool_1
COOL HRS @ 90-100%	AV	2	R	173	lp_90_100_cool_1
HEAT HRS @ 0-9%	AV	2	R	174	lp_0_9_heat_1
HEAT HRS @ 10-19%	AV	2	R	175	lp_10_19_heat_1
HEAT HRS @ 20-29%	AV	2	R	176	lp_20_29_heat_1
HEAT HRS @ 30-39%	AV	2	R	177	lp_30_39_heat_1
HEAT HRS @ 40-49%	AV	2	R	178	lp_40_49_heat_1
HEAT HRS @ 50-59%	AV	2	R	179	lp_50_59_heat_1
HEAT HRS @ 60-69%	AV	2	R	180	lp_60_69_heat_1
HEAT HRS @ 70-79%	AV	2	R	181	lp_70_79_heat_1
HEAT HRS @ 80-89%	AV	2	R	182	lp_80_89_heat_1
HEAT HRS @ 90-100%	AV	2	R	183	lp_90_100_heat_1
COOL UPSETPT	AV	2	W	184	cool_upsetpt_write_1
COOL LOWSETPT	AV	2	W	185	cool_lowsetpt_write_1
COOL VSP	AV	2	W	186	cool_vsp_write_1
COOL TDIFF	AV	2	W	187	cool_tdiff_write_1
HEAT UPSETPT	AV	2	W	188	heat_upsetpt_write_1
HEAT LOWSETPT	AV	2	W	189	heat_lowsetpt_write_1
HEAT VSP	AV	2	W	190	heat_vsp_write_1
HEAT TDIFF	AV	2	W	191	heat_tdiff_write_1
LOAD LIMIT	AV	2	W	192	load_limit_write_1

	BACnet				
	OBJECT	OBJECT		OBJECT	REFERENCE
OBJECT IDENTIFIER	TYPE	ENUMERATION	ACTION	INSTANCE	NAME
FAIL INDICATOR	AV	2	W	193	fail_indic_write_1
LEAD COMPRESSOR	AV	2	W	194	lead_comp_write_1
FLUSH TIME	AV	2	W	195	flush_time_write_1
FLUSH DURATION	AV	2	W	196	flush_duration_write_1
OPERATING MODE	AV	2	W	197	op_mode_write_1
MOST CURRENT FAULT	AV	2	W	198	mst_crnt_flt_1
HEAT DELAY	AV	2	R	199	heat_delay_read_1
HEAT DELAY	AV	2	W	200	heat_delay_write_1
ON/OFF STATUS	BV	5	R	1	on_off_ctrl_read_1
EX1 FAULT DISPLAY	BV	5	R	2	ex1_fault_1
EX2 REMOTE OFF	BV	5	R	3	remote_on_off_1
EX3 FAULT DISPLAY	BV	5	R	4	ex3_fault_1
EX4 FAULT DISPLAY	BV	5	R	5	ex4_fault_1
NO LW FLOW	BV	5	R	6	low_lw_flow_1
NO SW FLOW	BV	5	R	7	low_sw_flow_1
LOW LLW TEMP	BV	5	R	8	low_llw_temp_1
LOW LSW TEMP	BV	5	R	9	low_lsw_temp_1
C1 STATUS	BV	5	R	10	c1_status_1
C2 STATUS	BV	5	R	11	c2_status_1
C3 STATUS	BV	5	R	12	c3_status_1
C4 STATUS	BV	5	R	13	c4_status_1
C5 STATUS	BV	5	R	14	c5_status_1
C6 STATUS	BV	5	R	15	c6_status_1
C7 STATUS	BV	5	R	16	c7_status_1
C8 STATUS	BV	5	R	17	c8_status_1
C9 STATUS	BV	5	R	18	c9_status_1
C10 STATUS	BV	5	R	19	c10_status_1
C11 STATUS	BV	5	R	20	c11_status_1
C12 STATUS	BV	5	R	21	c12_status_1
C13 STATUS	BV	5	R	22	c13_status_1
C14 STATUS	BV	5	R	23	c14_status_1
C15 STATUS	BV	5	R	24	c15_status_1
C16 STATUS	BV	5	R	25	c16_status_1
C17 STATUS	BV	5	R	26	c17_status_1
C18 STATUS	BV	5	R	27	c18_status_1
C19 STATUS	BV	5	R	28	c19_status_1
C20 STATUS	BV	5	R	29	c20_status_1
C21 STATUS	BV	5	R	30	c21_status_1
C22 STATUS	BV	5	R	31	c22_status_1

	BACnet				
	OBJECT	OBJECT		OBJECT	REFERENCE
OBJECT IDENTIFIER	TYPE	ENUMERATION	ACTION	INSTANCE	NAME
C23 STATUS	BV	5	R	32	c23_status_1
C24 STATUS	BV	5	R	33	c24_status_1
ON/OFF CONTROL	BV	5	W	34	on_off_ctrl_write_1