RTU-MP Controller

Integration Guide

A member of the United Technologies Corporation family · Stock symbol UTX · Catalog No. 48-50H-T-1SB · 1/27/2011

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Introduction

The RTU-MP controller was custom designed to be an integrated component of a Carrier rooftop unit. Its internal application programming provides optimum performance and energy efficiency.

RTU-MP enables the unit to run in a 100% stand-alone control mode (using space temperature and/or humidity sensors are not required), or it can communicate to the Building Automation System (BAS). On-board DIP switches allow you choose your protocol and baud rate; BACnet, Modbus, Johnson N2 or LonWorks.

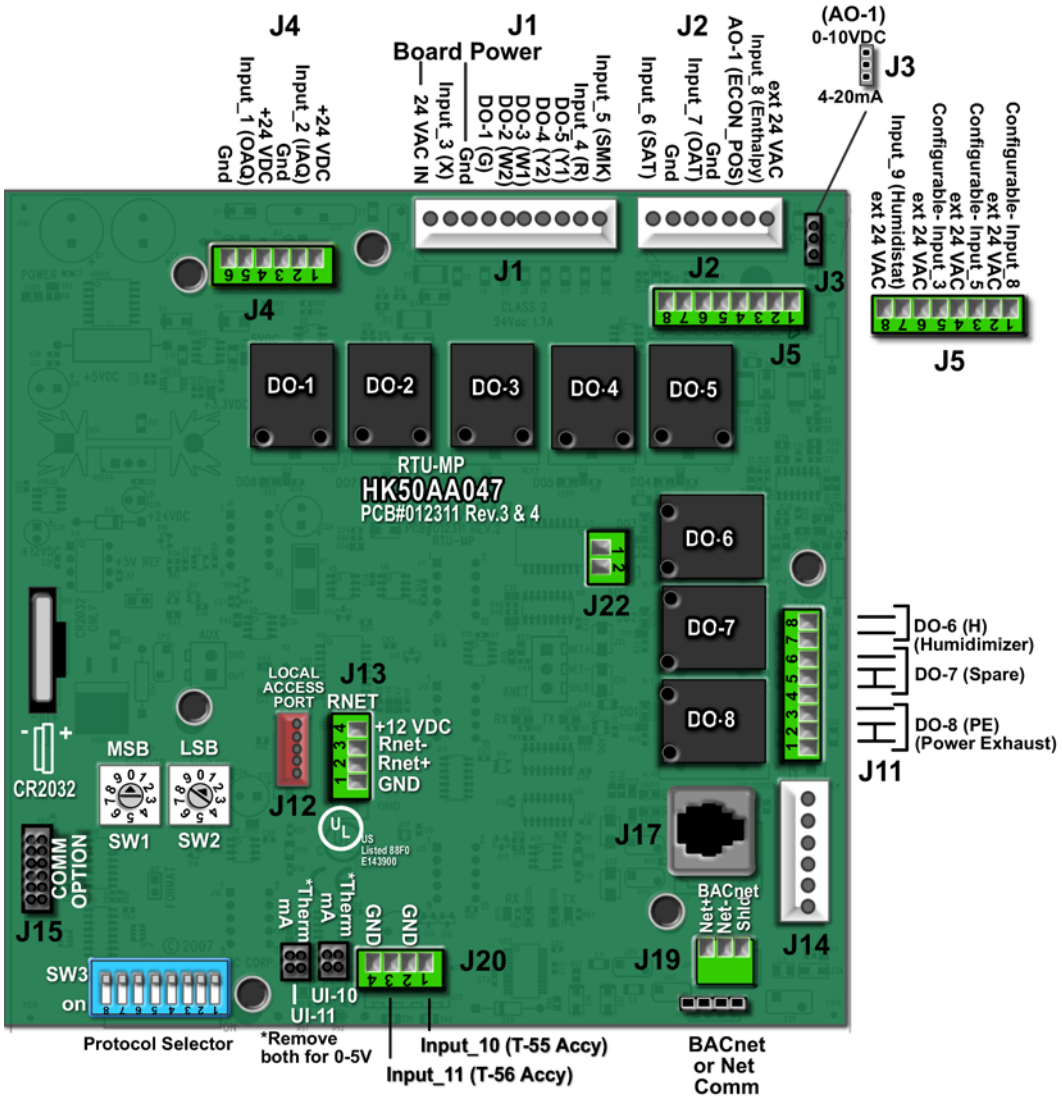
This document will serve as the reference guide for integrating RTU-MP into the BAS. It should be read thoroughly, understood, and all functions performed by the group installing or commissioning the BAS.

⚠ Warning!

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could cause personal injury, death, and/or equipment damage.

Disconnect all power to the unit before performing maintenance or service. Unit may automatically start if power is not disconnected.


J4
Input_1 (OAQ)
Gnd
+24 VDC
Input_2 (IAQ)
Gnd
+24 VDC
J1
Board Power
24 VAC IN
Input_3 (X)
Gnd
DO-1 (G)
DO-2 (W2)
DO-3 (W1)
DO-4 (Y2)
DO-5 (Y1)
Input_4 (R)
Input_5 (SMK)
J2
Input_6 (SAT)
Gnd
Input_7 (OAT)
Gnd
AO-1 (ECON_POS)
Input_8 (Enthalpy)
ext 24 VAC
(AO-1)
0-10VDC
4-20mA
J3
Input_9 (Humidistat)
ext 24 VAC
Configurable- Input_3
ext 24 VAC
Configurable- Input_5
ext 24 VAC
Configurable- Input_8
ext 24 VAC
J5
J1
J2
J3
J4
J5
DO-1
DO-2
DO-3
DO-4
DO-5
RTU-MP
HK50AA047
PCB#012311 Rev.3 & 4
DO-6
DO-7
DO-8
J22
J11
DO-6 (H)
(Humidimizer)
DO-7 (Spare)
DO-8 (PE)
(Power Exhaust)
LOCAL
ACCESS
PORT
J13
RNET
+12 VDC
Rnet-
Rnet+
GND
J12
CR2032
MSB
LSB
SW1
SW2
J17
BACnet
Net+
Net-
Shld
J19
J14
COMM
OPTION
J15
*Therm
mA
*Therm
mA
GND
GND
J20
SW3
on
UI-10
UI-11
Protocol Selector
*Remove
both for 0-5V
Input_10 (T-55 Accy)
Input_11 (T-56 Accy)
BACnet
or Net
Comm

Safety Considerations

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform the basic maintenance functions. All other operations should be performed by trained service personnel. When working on equipment, observe precautions mentioned in the literature, tags, and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes. Wear safety glasses and work gloves. Recognize safety information.

This is the safety-alert symbol ⚠. When you see this symbol on the unit, in the instructions or manuals, be alert to the potential for personal injury.

Understand the signal words **DANGER**, **WARNING**, and **CAUTION**. These words are used with the safety-alert symbol.

- **DANGER** identifies the most serious hazards which will result in severe personal injury or death.
- **WARNING** signifies a hazard which could result in personal injury or death.
- **CAUTION** is used to identify unsafe practices which may result in minor personal injury or product and property damage.
- **NOTE** is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ Warning!

ELECTRICAL SHOCK HAZARD

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Wiring Inputs and Outputs

RTU-MP Inputs and Outputs Table

Point Name	BACnet Object Name	Type of I/O	Connection Pin Numbers
Inputs			
Space Temperature Sensor	sptsens	AI (10K Thermistor)	J20 - 1, 2
Supply Air Temperature	sat	AI (10K Thermistor)	J2 - 1, 2
Local Outside Air Temperature Sensor	oatsens	AI (10K Thermistor)	J2 - 3, 4
Space Temperature Offset Pot	sptopot	AI (100K Potentiometer)	J2 - 3, 4
Indoor Air Quality	iaq	AI (4 - 20 ma)	J4 - 2, 3
Outdoor Air Quality	oaq	AI (4 - 20 ma)	J4 - 5, 6
Safety Chain Feedback	safety	DI (24 VAC)	J1 - 9
Compressor Safety	compstat	DI (24 VAC)	J1 - 2
Fire Shutdown	firedown	DI (24 VAC)	J1 - 10
Enthalpy Switch	enthalpy	DI (24 VAC)	J2 - 6, 7
Humidistat Input Status	humstat	DI (24 VAC)	J5 - 7, 8
Configurable Inputs			
Space Relative Humidity	sprh	AI (4-20 ma)	J4 - 2,3 or J4 - 5,6
Outside Air Relative Humidity	oarh	AI (4-20 ma)	J4 - 2,3 or J4 - 5,6
Supply Fan Status	fanstat	DI (24 VAC)	J5 - 1,2 or J5 - 3,4 or J5 5,6 or J5 - 7,8
Filter Status	filstat	DI (24 VAC)	J5 - 1,2 or J5 - 3,4 or J5 5,6 or J5 - 7,8
Remote Occupancy Input	remocc	DI (24 VAC)	J5 - 1,2 or J5 - 3,4 or J5 5,6 or J5 - 7,8
Outputs			
Economizer Commanded Position	econocmd	4-20ma	J2 - 5
Supply Fan Relay State	sf	DO Relay (24VAC , 1A)	J1 - 4
Compressor 1 Relay State	comp_1	DO Relay (24VAC , 1A)	J1 - 8
Compressor 2 Relay State	comp_2	DO Relay (24VAC , 1A)	J1 - 7
Heat Stage 1 Relay State	heat_1	DO Relay (24VAC , 1A)	J1 - 6
Heat Stage 2 Relay State	heat_2	DO Relay (24VAC , 1A)	J1 - 5
Power Exhaust Relay State	aux_2	DO Relay (24VAC , 1A)	J1 - 3
Dehumidification Relay State	humizer	DO Relay (24VAC , 1A)	J1 - 7, 8

Legend

AI - Analog Input **AO** - Analog Output

DI - Digital Input **DO** - Digital Output

*These inputs (if installed) take the place of the default input on the specific channel according to schematic. Parallel pins J5 - 1 = J2 - 6, J5 - 3 = J1 - 10, J5 - 5 = J1 - 2 are used for field installation.

Refer to the input configuration and accessory sections, unit Controls Operation, and Troubleshooting Instructions.

Communications wiring - protocols

Protocol Overview

Protocols are the communication languages spoken by control devices. The main purpose of a protocol is to communicate information in the most efficient method possible. Different protocols exist to provide different kinds of information for different applications.

In the BAS application, many different protocols are used, depending on manufacturer. Different protocols do not change the function of the controller, but, they typically require the owner to change systems or components in order to change from one protocol to another. The RTU-MP is an effective solution to minimize the amount of equipment change necessary to communicate with different protocols. Currently, the four most common protocols are: BACnet, Modbus, N2, and LonWorks.

The RTU-MP can be set to communicate using one of four different protocols: BACnet, Modbus, N2, or LonWorks. The default setting is BACnet. Switch 3 (**SW3**) on the board is used to set protocol and baud rate. Switches 1 and 2 (**SW1** and **SW2**) are used to set the board's network address. See the table below for the specific switch settings. The 3rd party connection to the RTU-MP is through port **J19** for BACnet, Modbus, and N2, and through **J15** for the LonWorks Option Card.

NOTES

- Changing protocol requires no programming or point assignment by the installer or operator.
- Power must be cycled after changing the **SW1** - **SW3** settings.

SW3 Switch Settings Table

		Protocol Selection						Baud Rate	
Protocol		**DS8**	**DS7**	**DS6**	**DS5**	**DS4**	**DS3**	**DS2**	**DS1**
BACnet MS/TP (Default)	**Master**	Unused	Off	Off	Off	On	Off	Select Baud	Select Baud
Modbus	**Slave**	Unused	Off	Off	On	On	Off	Select Baud	Select Baud
N2	**Slave**	Unused	Off	Off	Off	On	On	Off	Off
Lonworks		Unused	On	On	Off	On	Off	Off	On

Baud Selection Table

Baud Rate	SW3/DS2	SW3/DS1
9,600	Off	Off
19,200	On	Off
38,400	Off	On
76,800 (Default)	On	On

Configuring the RTU-MP for BACnet MS/TP

Refer to Appendix B of this document for the Protocol Implementation Conformance Statement, or download the latest from *http://www.bacnetassociation.org/BMAProductCatalog/Carrier/*.

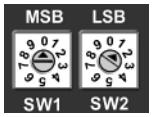
1 Turn **off** the RTU-MP's power.

NOTE Changes made to the switches when the RTU-MP is on will not take effect until the RTU-MP has been power cycled!

2 Using the rotary switches **SW1** and **SW2**, set a unique MS/TP MAC address for the RTU-MP. Set the **MSB** (**SW1**) switch to the tens digit of the address, and set the **LSB** (**SW2**) switch to the ones digit. Valid addresses are 01-99.

NOTE The rotary switches also determine the BACnet device instance of the controller on the BACnet network. The BACnet device instance is automatically generated based on the scheme 1600xx, where "16" is the BACnet vendor ID for Carrier Carrier Corporation, and xx equals the rotary switch address.

EXAMPLE To set the RTU-MP's MS/TP MAC address to 01, point the arrow on the **MSB** (**SW1**) switch to 0 and the arrow on the **LSB** (**SW2**) switch to 1. Internally, the BACnet device instance is automatically generated as 160001.



3 Set the **SW3** Comm Selector DIP switches **DS1** and **DS2** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate and communication settings for all controllers on the network segment. The RTU-MP is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

Baud Selection Table

Baud Rate	SW3/DS2	SW3/DS1
9,600	Off	Off
19,200	On	Off
38,400	Off	On
76,800	On	On

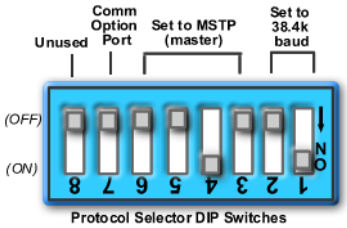
4 Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for BACnet MS/TP. See table and example below.

5 Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to MS/TP.

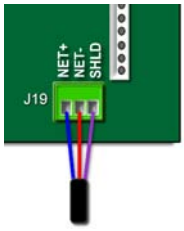
SW3 Protocol Switch Settings for MS/TP

DS8	DS7	DS6	DS5	DS4	DS3
Off	Off	Off	Off	On	Off

The following example shows the DIP Switches set for 38.4k, and MS/TP.



6 Connect the MS/TP network to the RTU-MP's **J19** port. Connect to **Net+**, **Net-**, and **SHLD**.



Wire specifications

- A dedicated 22 AWG to 18 AWG twisted pair wire (EIA 485)
- 2000 feet (610 meters) for 76.8 kbps
- Devices should be daisy chained and not star wired
- Attach a shield at the beginning or end of the network segment and not at every controller

NOTE Use the same polarity throughout the network segment.

7 Turn **on** the RTU-MP's power.

Configuring the RTU-MP for Modbus RTU

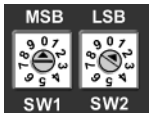
Refer to Appendix C of this document for the Modbus Protocol Implementation Conformance Statement (PICS).

1 Turn **off** the RTU-MP's power.

NOTE Changes made to the switches when the RTU-MP is on will not take effect until the RTU-MP has been power cycled!

2 Using the rotary switches, set a unique Modbus slave address for the RTU-MP. Set the **MSB** (**SW1**) switch to the tens digit of the address, and set the **LSB** (**SW2**) switch to the ones digit. Valid Modbus slave addresses are 01-99.

EXAMPLE To set the RTU-MP's Modbus slave address to 01, point the arrow on the **MSB** (**SW1**) switch to 0 and the arrow on the **LSB** (**SW2**) switch to 1.



3 Set the **SW3** Comm Selector DIP switches **DS1** and **DS2** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate and communication settings for all controllers on the network segment. The RTU-MP is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

Baud Selection Table

Baud Rate	SW3/DS2	SW3/DS1
9,600	Off	Off
19,200	On	Off
38,400	Off	On
76,800	On	On

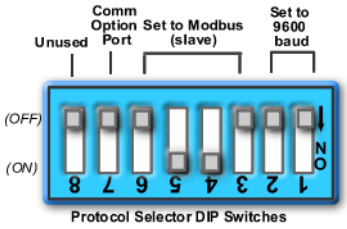
4 Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for Modbus. See example below.

5 Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to Modbus.

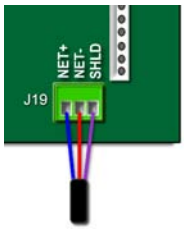
SW3 Protocol Switch Settings for Modbus

DS8	DS7	DS6	DS5	DS4	DS3
Off	Off	Off	On	On	Off

The following example shows the DIP Switches set for 9600 baud and Modbus.



6 Connect the Modbus EIA-485 network to the RTU-MP's **J19** port. Connect to **Net+**, **Net-**, and **SHLD**.



Wire specifications

- A dedicated 22 AWG to 18 AWG twisted pair wire (EIA 485)
- 2000 feet (610 meters) for 76.8 kbps
- Devices should be daisy chained and not star wired
- Attach a shield at the beginning or end of the network segment and not at every controller

NOTE Use the same polarity throughout the network segment.

7 Turn **on** the RTU-MP's power.

Configuring the RTU-MP for N2

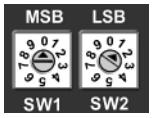
Refer to Appendix D of this document for the N2 Protocol Implementation Conformance Statement (PICS).

1 Turn **off** the RTU-MP's power.

NOTE Changes made to the switches when the RTU-MP is on will not take effect until the RTU-MP has been power cycled!

2 Using the rotary switches, set a unique N2 slave address for the RTU-MP. Set the **MSB** (**SW1**) switch to the tens digit of the address, and set the **LSB** (**SW2**) switch to the ones digit. Valid N2 slave addresses are 01-99.

EXAMPLE To set the RTU-MP's N2 slave address to 01, point the arrow on the **MSB** (**SW1**) switch to 0 and the arrow on the **LSB** (**SW1**) switch to 1.



3 Set the Comm Selector DIP switches **DS1** and **DS2** for the 9600 baud.

NOTE Use the same baud rate and communication settings for all controllers on the network segment. TheRTU-MP is fixed at 9600 baud, 8 data bits, No Parity, and 1 Stop bit.

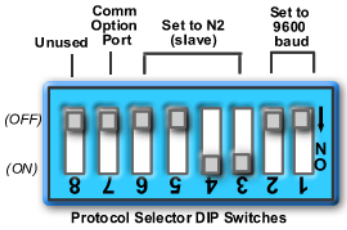
4 Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for N2. See example below.

5 Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to N2.

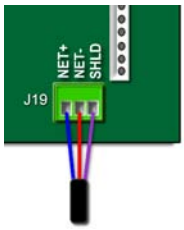
SW3 Protocol Switch Settings for N2

DS8	DS7	DS6	DS5	DS4	DS3
Off	Off	Off	Off	On	On

The following example shows the DIP Switches set for 9600 baud and N2.



6 Connect the N2 EIA-485 network to the RTU-MP's **J19** port. Connect to **Net+**, **Net-**, and **SHLD**.



Wire specifications

- A dedicated 22 or 24 AWG shielded twisted pair wire (EIA 485)
- Maximum wire length 2000 feet (610 meters) or 32 nodes
- Devices should be daisy-chained and not star-wired
- Attach the drain/shield wire to both ends of the network segment and through every controller

NOTE Use the same polarity throughout the network segment.

7 Turn **on** the RTU-MP's power.

LonWorks

⚠ Warning!

When you handle the LonWorks Option Card:

- Do not contaminate the printed circuit board with fingerprints, moisture, or any foreign material.
- Do not touch components or leads.
- Handle the board by its edges.
- Isolate from high voltage or electrostatic discharge.
- Ensure that you are properly grounded.

Refer to *Appendix E* (page 49) for the LonWorks Protocol Implementation Conformance Statement (PICS).

Configuring the RTU-MP for LonWorks Option Card

1 Turn **off** the RTU-MP's power.

NOTES

- Changes made to the switches when the RTU-MP is on will not take effect until the RTU-MP has been power cycled!
- The controller's rotary address switches are not used when the LON-OC is installed. That's because each LON-OC has a 48-bit Neuron ID that makes it unique on the LonWorks network.

2 Set the Comm Selector DIP Switches **DS1** and **DS2** on **SW3** for 38.4k Communications speed. This is the speed at which the LON-OC speaks to the RTU-MP. It is fixed at 38.4k.

3 Set the Comm Selector DIP Switches **DS3** through **DS6** on **SW3** for LonWorks. See example below.

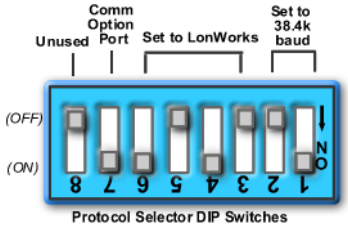
4 Set the Comm Selector DIP Switch **DS7** on **SW3** to the ON position to enable the LON-OC.

5 Leave Comm Selector DIP Switch **DS8** on **SW3** in the OFF position since it is not used.

SW3 Protocol Switch Settings for LonWorks

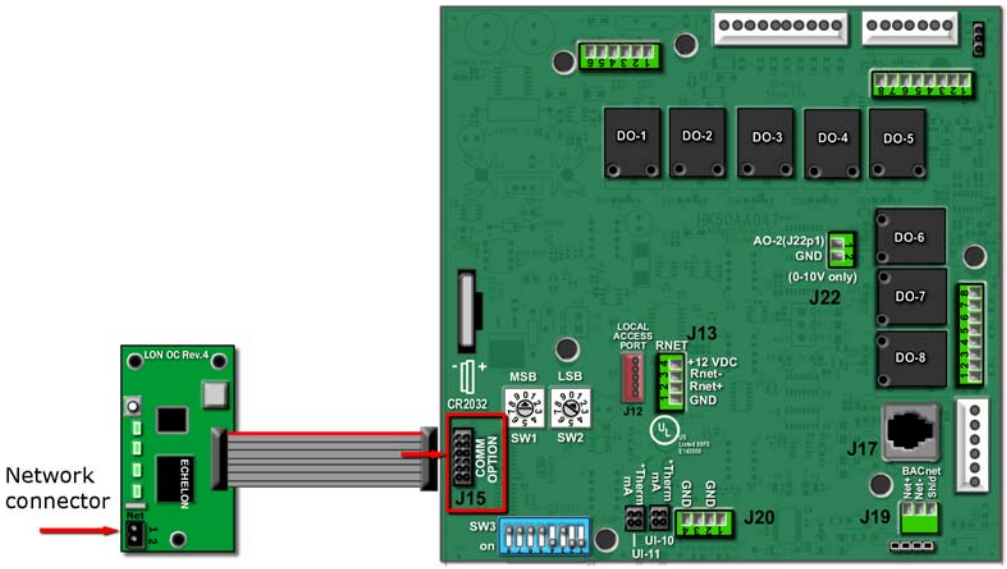
DS8	DS7	DS6	DS5	DS4	DS3
Off	On	On	Off	On	Off

The following example shows the DIP Switches set for 38.4k baud and the LON-OC enabled.



6 Plug the LON-OC's ribbon cable into Comm Option Port **J15** on the RTU-MP. See illustration below.

CAUTION! The controller must be **OFF** before being connected.



7 Turn **on** the RTU-MP's power.

8 Commision the RTU-MP for LonWorks communication. See instructions below.

Commissioning the RTU-MP for LonWorks communication

Before a device can communicate on a LonWorks network, it must be commissioned. Commissioning allows the system integrator to associate the device hardware with the LonWorks system's network layout diagram. This is done using the device's unique Neuron ID.

A network management tool such as Echelon's LonMaker is used to commission each device, as well as to assign addressing. Specific instructions regarding the commissioning of LonWorks devices should be obtained from documentation supplied with the LonWorks Network Management Tool.

When a new device is first commissioned onto the LonWorks network, the system integrator must upload the device's External Interface File (XIF) information. LonWorks uses the XIF to determine the points (network variables) that are available from a device. The RTU-MP has a set of predefined network variables. These variables can be bound or accessed by the network management tool.

NOTE Contact your local Carrier representative for a copy of the .XIF file.

The **Browse** feature of the Network Management Tool also allows you to read real-time values from the RTU-MP. The Network Management Tool allows you to test integration prior to binding the RTU-MP's network variables to other LonWorks nodes.

Local Access

BACview6 Handheld

The BACview6 Handheld (BV6H) is a keypad/display interface used to connect to the RTU-MP to access the control information, read sensor values, and test the RTU-MP. This is an accessory interface that does not come with the RTU-MP and can only be used at the unit.

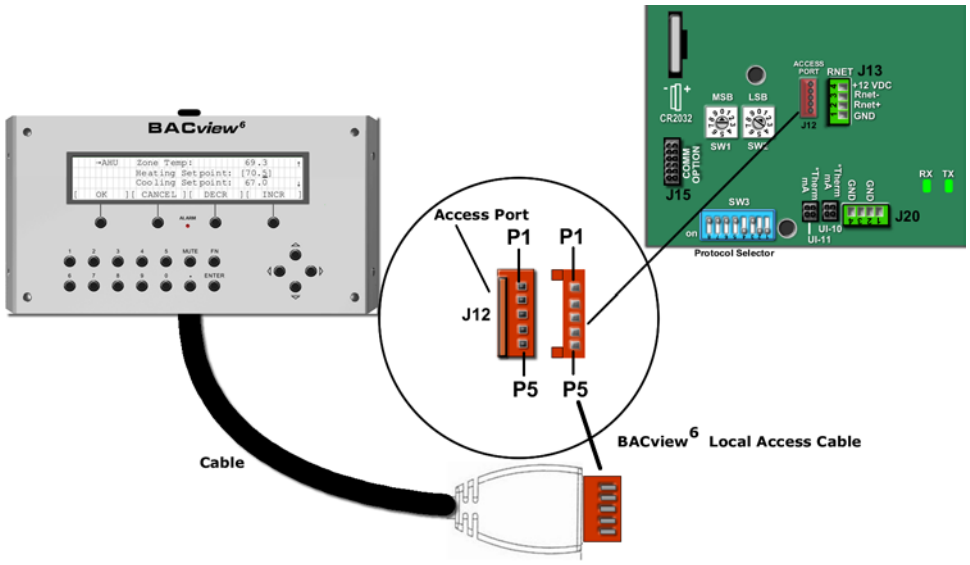
Connect the BACview6 to the RTU-MP's **J12** local access port.

There are 2 password-protected levels in the display (User and Admin).

- The User password is defaulted to 0000 but can be changed.
- The Admin password is 1111 and cannot be changed.

NOTES

- To adjust the contrast of the display, turn the contrast screw on top of the BACview6 clockwise to lighten the display or counterclockwise to darken it.
- There is a 10 minute auto logout if a screen is left idle.



Virtual BACview

Virtual BACview is a freeware software application that mimics the BACview6 Handheld. The USB Link cable (USB-L) is required to connect a computer to the RTU-MP board. The USB Link cable connects a PC's USB port to the **J12** local access port on the RTU-MP. This program functions and operates identical to the BACview Handheld.

Sequence of operation

The RTU-MP will control the compressor, economizer, and heating outputs based on its own space temperature input and setpoints. An optional CO2 IAQ sensor mounted in the space can influence the economizer minimum position.

The RTU-MP has its own hardware clock that is set automatically when the software is installed on the board. The default is to control to occupied setpoints all the time, until a type of occupancy control is set. Occupancy types are described in the scheduling section.

The following sections describe the operation for the functions of the RTU-MP. All point objects that are referred to in this sequence will be in reference to the objects, as viewed in BACview6 Handheld.

Scheduling

Scheduling is used to start heating or cooling (become occupied), based upon a day of the week and a time period and control to the occupied heating or cooling setpoints. Scheduling functions are located under occupancy determination and the schedule menu accessed by the Menu softkey. Your local time and date should be set for these functions to operate properly.

Five scheduling functions are available by changing the **Occupancy Source** to one of the following selections:

Always occupied

The unit will run continuously. This is the default configuration.

Local schedule

The unit will operate according to the schedule configured and stored in it. The local schedule is made up of three hierarchy levels that consist of: 2 Override, 12 Holiday, and 4 Daily schedules. These are only accessible by the BACview6 (BV6H) screen (handheld or virtual).

The **Daily schedule** is the lowest schedule in the hierarchy and is overridden by both the Holiday and Override schedule. It consists of a start time, a stop time (both in 24 hour format), and 7 days of the week, starting with Monday and ending with Sunday.

To select a Daily schedule,

1. Scroll to the **Schedules** menu from the **Menu** selection.
2. Enter the User password and change the **Occupancy Source** to **Local Schedule.**
3. Scroll down and over to the **Daily** menu and press **Enter**.
4. Press the **Next** softkey to choose one of the four **Daily** schedules.
5. Change the **Use?** point from **NO** to **YES** by selecting the point and pressing the **INCR** or **DECR** softkey.
6. Press the **OK** softkey and scroll to the start and stop times.
7. Edit these times following Steps 5 and 6.
8. Scroll down to **Days** section and highlight the days required for the Daily schedule by **INCR** or **DECR** softkeys.
9. Press the **OK** softkey.

The **Holiday schedule** is created to override the Daily schedule and identify a specific day and month of the year to start and stop the unit and to change control to the unoccupied heating and cooling setpoints.

1. Follow the above steps to turn on one of the 12 Holiday schedules and the start and stop times.
2. Select 1 of the 12 months and 1 of the 31 days of that month.

The RTU-MP will now ignore the Daily schedule for the specific day and time you selected and follow the Holiday Schedule for this period.

The **Override schedule** provides a temporary change in the occupied heating and cooling setpoints and forces the unit to the unoccupied heating and cooling setpoints. This would occur on a designated day and month and last during the start and stop time configured. The Override schedule is enabled by following the same steps as creating the Holiday schedule.

NOTE Push button override is only available when running a local or BACnet Schedule.

BACnet schedule

For use when a Building Automation System that supports native BACnet scheduling is scheduling the unit. With the Occupancy Source set to BACnet schedule, the BAS will control the unit through network communication and it's own scheduling function.

BAS On/Off

The BAS is scheduling the unit via an On/Off command to the BAS ON/OFF software point. The Building Automation System can be speaking BACnet, Modbus, or N2 and is writing to the BAS On/Off point in the open protocol point map.

DI On/Off

A hard-wired input on the RTU-MP will command the unit to start/stop. Inputs 3, 5, 8, and 9 on plug **J5** can be hard-wired to command the unit to start/stop.

NOTE Scheduling can either be controlled via the unit or the BAS, but NOT both.

Indoor Fan

The indoor fan will be turned on whenever any one of the following conditions is true:

- It is in the occupied mode - this will be determined by its own internal occupancy schedule
- Whenever there is a demand for cooling or heating in the unoccupied mode
- Whenever the remote occupancy switch is closed during **DI On/Off** schedule type or if occupancy is forced occupied by the BAS during BAS **On/Off** schedule type.

When transitioning from unoccupied to occupied, there will be a configured time delay of 5 to 600 seconds before starting the fan. The fan will continue to run as long as compressors, heating stages, or the dehumidification relays are on when transitioning from occupied to unoccupied, with the exception of Shutdown mode.

If Fire Shutdown, safety chain, SAT alarm or SPT alarm are active, the fan will be shutdown immediately, regardless of the occupancy state or demand.

The RTU-MP does not include controls/algorithms for additional building smoke-control functions such as smoke-purge, zone-pressurization or smoke-ventilation. Each of these requires a field-designed circuit to input the proper signals to the RTU-MP and to operate the following, as required by local fire codes:

- de-activation of smoke alarm signal
- RTU Indoor Fan
- RTU economizer
- RTU power exhaust

The RTU-MP has an optional Supply Fan Status input to provide proof of airflow. If this is enabled, the point will look for a contact closure whenever the Supply Fan Relay is on. If it is not enabled, then it will always be the same state as the Supply Fan Relay. The cooling, economizer, heating, dehumidification, CO2 and power exhaust routines will use this input point for fan status.

Cooling

The compressor outputs are controlled by the Cooling Control PID Loop and Cooling Stages Capacity algorithm. They will be used to calculate the desired number of stages needed to satisfy the space by comparing the Space Temperature (SPT) to the Occupied Cool Setpoint, plus the T56 slider offset, when occupied and the Unoccupied Cool Setpoint (UCSP), plus the T56 slider offset, if unoccupied. The economizer, if available, will be used for cooling in addition to the compressors.

The following conditions must be true in order for this algorithm to run:

- Indoor Fan has been ON for at least 30 seconds

- Heat mode is not active and the time guard between modes equals zero
- If occupied and the SPT >(occupied cool setpoint plus the T56 slider offset)
- Space Temperature reading is available.
- If it is unoccupied and the SPT > (unoccupied cool setpoint plus the T56 slider offset). The indoor fan will be turned on by the staging algorithm
- If economizer is available and active, and economizer open > 85% and SAT > (SAT low limit + 5°F) and SPT > effective set point + 0.5°F.
    - OR Economizer is available, but not active
    - OR Economizer is not available
- OAT > DX Lockout temperature

If all of the above conditions are met, the compressors will be energized as required, otherwise they will be de-energized.

There is a fixed 3 minute minimum on time and a 5 minute off time for each compressor output, as well as a 3 minute minimum time delay between staging up or down.

Any time the compressors are running, the RTU-MP will stage down the compressors if the SAT becomes less than the cooling low supply air setpoint. After a compressor is staged off, it may be started again after a normal time–guard period and the supply air temperature has increased above the low supply air setpoint.

After a compressor is staged off, it may be started again after a normal time-guard period and the supply air temperature has increased above the low supply air setpoint.

Economizer

The Economizer dampers are used to provide free cooling and Indoor Air Quality, if optional CO2 sensor is installed, when the outside conditions are suitable.

The following conditions must be true for economizer operation:

- Indoor Fan has been on for at least 30 seconds. S Enthalpy is Low if the Enthalpy input is enabled.
- SAT reading is available.
- OAT reading is available.
- SPT reading is available.
- OAT <= High OAT economizer lockout configuration (default = 75)
- OAT <= SPT

If any of the mentioned conditions are not true, the economizer will be set to its configured minimum position. The minimum damper position can be overridden by the IAQ routine described later in this section.

If the above conditions are true, the Economizer Control Master Loop will calculate a damper position value based on the following calculation:

Damper Position = minimum position + PID (SPT - econ setpoint). Econ setpoint is half way between the effective cool and heat setpoints. If the SAT drops below the cooling low supply air setpoint (+ 5°F), the economizer will ramp down to minimum position.

Power Exhaust

If an optional exhaust fan is used and controlled by the RTU-MP, it can be enabled based on damper position or by occupancy. If configured for continuous occupied operation, it will be energized whenever the controller is in the occupied mode and disabled when in the noccupied mode.

If configured for damper position control, it will be energized whenever the economizer exceeds the power exhaust setpoint and disabled when the economizer drops below the setpoint by a fixed hysteresis of 10%.

Energy Recovery

The RTU-MP does not contain additional specific controls for energy recovery devices. However, most energy recovery units are compatible with typical economizer and power exhaust inputs and outputs and can be used with the RTU-MP. See the specific energy recovery device input & output requirements for additional information.

Heating

The compressor outputs are controlled by the Heating Control PID Loop and Heating Stages Capacity algorithm. They will be used to calculate the desired number of stages needed to satisfy the space by comparing the SPT to the Occupied Heat Setpoint, the T56 slider offset when occupied, and the Unoccupied Heat Setpoint, plus the T56 slider offset, if unoccupied.

The following conditions must be true in order for this algorithm to run:

- Indoor Fan has been ON for at least 30 seconds.
- Cool mode is not active and the time guard between modes equals zero.
- If occupied and SPT <(occupied heat setpoint plus T56 slider offset)
- SPT reading is available
- If it is unoccupied and the SPT < (unoccupied heat setpoint plus T56 slider offset). The indoor fan will be turned on by the staging algorithm.
- OAT < High OAT lockout temperature.

If all of the above conditions are met, the heating outputs will be energized as required, otherwise they will be de-energized.

If the SAT begins to exceed the high supply air setpoint, a ramping function will cause the Heat Stages Capacity algorithm to decrease the number of stages until the SAT has dropped below the setpoint. There is a fixed one minute minimum on-time and a one minute off-time for each heat output. Heat staging has a 2 minute stage-up and 30 second stage-down delay.

Heat pump operation (if the Heat Pump RTU configuration is set to **YES**) is the same as above, except for the following:

- There is a fixed 3 minute on and 5 minute off-time for the first heat stage output, and a 1 minute on and 1 minute off-time for the second heat stage output.
- There is a 10 minute minimum stage-up delay if the heat demand is <= 3°F, and a 2 minute minimum stage-up delay if heat demand is > 3°F. The stage down delay is still 30 seconds.
- If the Compressor Safety Alarm is active, the second heat stage will come on with the first stage with no delay.

Indoor Air Quality

If the optional indoor air quality sensor is installed, the RTU-MP will attempt to maintain indoor air quality within the space at the user-configured differential setpoint by modulating the outdoor air damper/economizer. The set point is the difference between the indoor air quality and an optional outdoor air quality sensor.

If the outdoor air quality is not present, then a fixed value of 400ppm is used. The following conditions must be true in order for this algorithm to run:

- The mode is occupied.
- Indoor Fan has been ON for at least 30 seconds.
- Indoor Air Quality sensor has a valid reading

As air quality within the space changes, the minimum position of the economizer damper will be changed, thus allowing more or less outdoor air into the space, depending on the relationship of the indoor air quality to the differential setpoint.

If all the above conditions are true, the IAQ algorithm will run and calculates an IAQ minimum position value using a PID loop. The IAQ minimum damper position is then compared against the user-configured economizer minimum position and the greatest value becomes the final minimum damper position of the economizer output.

If the calculated IAQ minimum position is greater than the IAQ maximum damper position configuration, then it will be clamped to the configured value.

Dehumidification

The RTU-MP provides occupied and unoccupied dehumidification on units that are equipped with the Carrier Humidi-MiZer™ option from the factory. This requires a space relative humidity sensor or a humidistat for control.

The following conditions must be true for the dehumidification control to operate:

- The **Outside Air Temperature** is greater than the **Cooling Lockout Temperature** setpoint
- The **Indoor Fan** has been ON for at least 30 seconds
- The unit has a valid **Supply Air Temperature** input
- The unit has a valid **Space Temperature** input
- The unit has a valid **Space Relative Humidity Sensor** or **Humidistat** input
- Heat mode is not active and the time guard between modes has expired

When using a relative humidity sensor to control dehumidification, occupied and unoccupied dehumidification setpoints are used.

When using a humidistat, the setpoints are not used. The humidistat indicates a high-humidity condition.

When a high indoor relative humidity condition is indicated and the above conditions are satisfied, the RTU-MP enters the dehumidification mode, energizing the Humidi-MiZer™ output.

The mode continues until the space relative humidity falls below the active setpoint by a 5% fixed Hysteresis when a humidity sensor is used, or when there is no longer a call for dehumidification where a humidistat is used.

See the base unit / Humidi-MiZer™ operations manual for additional information.

Demand Limiting

If the RTU-MP receives a level **1** (one degree offset), **2** (two degree offset), or a **3** (4 degree offset) to the BACnet demand limit variable, the controller expands the heating and cooling setpoints by the configured demand limit setpoint value and remain in effect until the BACnet demand limit variable receives a **0** value.

Troubleshooting

The RTU-MP controller acts as an intelligent embedded thermostat to the rooftop unit, but can be monitored and controlled from a third party network. For this reason, there are 3 distinct components for troubleshooting.

The three parts to the system are:

- The mechanical systems of the rooftop unit
- The RTU-MP controller
- The third party network connected

Determining which component needs troubleshooting is the first step.

The RTU-MP controller can be used to troubleshoot itself with service test, communicating LED's, and built-in alarms, which are discussed in the unit Controls and Troubleshooting instructions. Disconnecting the RTU-MP from the unit control inputs can be valuable in determining whether the problem is related to the unit/equipment, the controller/equipment, or the controller/network. Generally, this should be the first step in troubleshooting operational problems. When disconnected from the unit control inputs, simple 24V signals can be used to activate the units G, Y1, Y2, W1, W2, etc. and verify proper unit operation. If the problem occurs without the RTU-MP connected, then the operator should begin troubleshooting the unit/equipment rather than the RTU-MP or network.

Third party network may also help in troubleshooting the controller and rooftop unit. Third party network troubleshooting may also be required.

LED's

The LED's indicate if the controller is speaking to the other devices on the network. The LED's should reflect communication traffic based on the baud rate set. The higher the baud rate, the more solid the LED's will appear.

The LED's on the RTU-MP show the status of certain functions.

If this LED is on...	Status is...
Power	The RTU-MP has power
Rx	The RTU-MP is receiving data from the network segment
Tx	The RTU-MP is transmitting data over the network segment
BO#	The binary output is active

NOTE If Tx is not lit, the MS/TP token is not being passed between controllers.

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is..
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with **Run** LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	Controller has just been formatted
2 flashes per second	On	Two or more devices on this network have the same network address
2 flashes per second	On	Firmware halted after frequent system errors or control programs halted

5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with **Run** LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with **Run** LED	Brownout
On	On	Failure. Try the following solutions: • Turn the RTU-MP off, then on. • Replace the RTU-MP.

BACnet MSTP

Check the following to troubleshoot your RTU-MP:

1. Verify that the BAS and controller are both set to speak the BACnet MS/TP protocol on the Comm Selector DIP switches **DS3 - DS6**.
2. Verify that the BAS and the controller are both set for the same baud rate:
   - Comm Selector DIP switches **DS2 and DS1**
   - By getting a Modstat of the controller through the BACview. Click and hold the **FN** key and then click the **.** key at the same time. Scroll to the bottom of the page to the section entitled **Network Communications** to view the active protocol and baud rate.
3. Verify that the BAS is configured to speak 2-wire EIA-485 to the controller. The BAS may have to configure jumper or DIP switches on their end.
4. Verify that the BAS and the controller have the same communication settings (8 data bits, No Parity, and 1 stop bit).
5. Verify proper connection wiring between the BAS and the controller.
6. Verify that the controller has a unique MAC address on the MS/TP bus. The controller's MS/TP MAC address is set by its rotary address switches.
7. Verify that the BAS is reading or writing to the proper BACnet objects in the controller. Refer to Appendix A for the points list for the controller.
8. Verify that the BAS is sending his requests to the proper MS/TP MAC address of our controller.
9. Present the BAS company with a copy of the controller's BACnet PICS so that they know which BACnet commands are supported. Refer to Appendix B for the BACnet PICS. In certain situations, it may be necessary to adjust the MS/TP Protocol timing settings through the BACview6.

It may be necessary to adjust the following two MS/TP Protocol timing settings through the BACview:

Max Masters - defines the highest MS/TP Master MAC address on the MS/TP network.

For example, if there are 3 master nodes on an MS/TP network, and their MAC addresses are 1, 8, and 16, then Max Masters would be set to 16 (since this is the highest MS/TP MAC address on the network).

This property optimizes MS/TP network communications by preventing token passes and "poll for master" requests to non—existent Master nodes.

In the above example, MAC address 16 would know to pass the token back to MAC address 1 instead of counting up to MAC address 127). Each MS/TP master node on the network must have their Max Masters set to this same value. The default is 127.

Max Info Frames - defines the maximum number of responses that will be sent when the RTU-MP receives the token.

Any positive integer is a valid number. The default is 10 and should be ideal for the majority of applications. In cases where the RTU-MP is the target of many requests, this number could be increased as high as 100 or 200.

NOTES

- MS/TP networks can be comprised of both Master and Slave nodes. Valid MAC addresses for Master nodes are 0 – 127 and valid addresses for Slave nodes are 0 - 254.
- If the third party attempts to communicate to the controller but does not get a response, make sure the controller is set as a BACnet MS/TP (m) master. The BACnet software asks the controllers, "Who Is?" This is to auto-locate devices on the network. Only controllers set as masters will answer this request.
- See Appendix A for Points Mapping tables.
- See Appendix B for the BACnet Protocol Implementation Conformance Statement (PICS).

Editing MS/TP Properties:

1 From the default screen, press any key to continue.

2 Click the **LOGIN** button and enter a password of 1111.

3 Click **OK**.

4 Click the **MENU** button.

5 Click the right arrow (**>**) to scroll over and down to the **Network** menu and press the **ENTER** button. The BACnet Settings are now shown, **Max Masters** and **Max Info Frames**.

If you want to edit **Max Masters:**

1 Click the **ENTER** button to enter edit mode.

2 Use arrow keys and keypad to either type in a new value (1-127), or click the **DECR/INCR** buttons to decrease/increase the value, respectively.

3 Click **OK** to accept the change.

If you want to edit **Max Info Frames:**

1 Click the down arrow and then press the **ENTER** button to enter edit mode.

2 Use arrow keys and keypad to either type in a new value (1-999), or hit the **DECR/INCR** buttons to decrease/increase the value, respectively.

3 Click **OK** button to accept the change.

Modbus

Check the following to troubleshoot your RTU-MP:

1 Verify that the BAS and controller are both set to speak the Modbus RTU protocol on the Comm Selector DIP switches **DS3 - DS6**.

2 Verify that the BAS and the controller are both set for the same baud rate:

- Comm Selector DIP switches **DS2 and DS1**
- By getting a Modstat of the controller through the BACview. Click and hold the **FN** key and then click the **.** key at the same time. Scroll to the bottom of the page to the section entitled **Network Communications** to view the active protocol and baud rate.

3 Verify that the BAS is configured to speak 2-wire EIA-485 to the controller. The BAS may have to configure jumper or DIP switches on their end.

4 Verify that the BAS and the controller have the same communication settings (8 data bits, No Parity, and 1 stop bit).

5 Verify proper connection wiring between the BAS and the controller.

6 Verify that the rotary address switches are set for the controller's unique slave address.

7 BAS must be reading or writing to the proper point addresses on the controller.

8 BAS is sending requests to the proper slave address of the controller.

NOTES

- Refer to Appendix A for the points/properties list.
- Refer to Appendix C for the Protocol Implementation Conformance Statement.

Modbus Exception Codes that might be returned from this controller

Codes	Name	Description
01	Illegal Function	The Modbus function code used in the query is not supported by the controller.
02	Illegal Data Address	The register address used in the query is not supported by the controller.
04	Slave Device Failure	The Modbus Master has attempted to write to a non-existent register or a read-only register in the controller.

Johnson N2

Check the following to troubleshoot your RTU-MP:

1 Verify that the BAS and controller are both set to speak N2 protocol:

- Comm Selector DIP switches **DS3 - DS6**
- By getting a Modstat of the controller through the BACview. Click and hold the **FN** key and then click the **.** key at the same time. Scroll to the bottom of the page to the section entitled **Network Communications** to view the active protocol and baud rate.

2 Verify that the BAS and the controller are both set for the same baud rate:
   - 9600 for N2
   - Comm Selector DIP switches **DS2 and DS1**
   - By getting a Modstat of the controller through the BACview. Click and hold the **FN** key and then click the **.** key at the same time. Scroll to the bottom of the page to the section entitled **Network Communications** to view the active protocol and baud rate.
3 Verify that the BAS is configured to speak 2-wire EIA-485 to the controller. The BAS may have to configure jumper or DIP switches on their end.
4 Verify that the BAS and the controller have the same communication settings (8 data bits, No Parity, and 1 stop bit).
5 Verify proper connection wiring between the BAS and the controller.
6 Verify that the rotary address switches are set for the controller's unique slave address.
7 BAS must be reading or writing to the proper point addresses on the controller.
8 BAS is sending requests to the proper slave address of the controller.

NOTE Refer to Appendix C for the Protocol Implementation Conformance Statement.

LonWorks

Check the following to troubleshoot your RTU-MP:

1 Verify that the BAS and controller are both set to speak the LonWorks protocol:
   - Comm Selector DIP switches **DS3 - DS6**
   - By getting a Modstat of the controller through the BACview. Click and hold the **FN** key and then click the **.** key at the same time. Scroll to the bottom of the page to the section entitled **Network Communications** to view the active protocol and baud rate.
2 Verify that the BAS and the controller are both set for the same baud rate:
   - 38.4k for LonWorks
   - Comm Selector DIP switches **DS2 and DS1**
   - By getting a Modstat of the controller through the BACview. Click and hold the **FN** key and then click the **.** key at the same time. Scroll to the bottom of the page to the section entitled **Network Communications** to view the active protocol and baud rate.
3 BAS must be reading or writing to the proper point addresses on the controller.
4 Verify that the Comm Option port is enabled on the controller. The Comm Option port setting must be set via **SW3** (switch **DS7**). It should be in the ON position to enable LonWorks communication.
5 Verify that controller has been properly commissioned onto the LonWorks network. Commissioning is done with a Network Management tool such as LonMaker and allows the system integrator to associate the controller with the LonWorks system's network layout diagram. This is done using the controller's unique Neuron ID. The Network Management tool is also used to upload the controller's .XIF file to determine the network variables that reside inside of the controller.
6 Use the **Browse** feature of the Network Management Tool to verify that you can communicate and get real-time values from the controller before connecting the BAS.
7 Once you have confirmed communications with the controller using the Network Management tool, connect the BAS.
8 Verify that the BAS is connected properly to the LON-OC's 2-wire TP/FT-10 Net port. The LON-OC's TP/FT-10 port is polarity insensitive. The BAS may have to configure jumper or DIP switches on their end to support TP/FT-10.

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

BACnet® is a registered trademark of ASHRAE. ASHRAE does not endorse, approve or test products for compliance with ASHRAE standards. Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of the BACnet manufacturers Association (BMA). BTL® is a registered trademark of the BMA.

Appendix A- Network Points List for the RTU-MP

APPENDIX A — NETWORK POINTS LIST
RTUP-MP Protocol Maps

				BACnet Info		Modbus Info		N2 Info		LonWorks Input		LonWorks Output	
Point Name	**Read Only**	**Units**	**Default Value**	**BACnet Point Name**	**BACnet Object ID**	**Modbus Register Type**	**Modbus Register#**	**N2 Network Point Type**	**N2 Network Point Address**	**SNVT Type**	**SNVT Name**	**SNVT Type**	**SNVT Name**
Space Temp / Zone Temp	✓	°F	n/a	lstat / zone_temp	AI:2001			AI	1				
Space Temp / Override Time Remaining		mins	n/a	lstat / override_time _remaining	AV:4001	float value	40003	ADF	1				
input_1	✓	none	n/a	input_1	AI:1001			AI	2				
input_2	✓	none	n/a	input_2	AI:1002			AI	3				
input_6	✓	°F	n/a	input_6	AI:1006			AI	4				
input_7	✓	°F	n/a	input_7	AI:1007			AI	5				
input_10	✓	°F	n/a	input_10	AI:1010			AI	6				
input_11	✓	none	n/a	input_11	AI:1011			AI	7				
input_3	✓	none	n/a	input_3	BI:1003			BI	1				
input_4	✓	none	n/a	input_4	BI:1004			BI	2				
input_5	✓	none	n/a	input_5	BI:1005			BI	3				
input_8	✓	none	n/a	input_8	BI:1008			BI	4				
input_9	✓	none	n/a	input_9	BI:1009			BI	5				
Compressor 1 Runtime	✓	hr	n/a	c1_runtime	AV:2101	float value	40019	ADF	3			SNVT_time_hour(124	nvoComp1Runtime
Compressor 1 Service Hours*		hr	0	c1_service	AV:4101	float value	40021	ADF	4				
Compressor 2 Runtime	✓	hr	n/a	c2_runtime	AV:2102	float value	40023	ADF	5			SNVT_time_hour(124	nvoComp2Runtime
Compressor 2 Service Hours*		hr	0	c2_service	AV:4102	float value	40025	ADF	6				
Cooling/Economizer Low SAT Setpoint		°F	50	sat_low	AV:3003	float value	40027	ADF	7				
Cooling Lockout Temp		°F	45	oatlcool	AV:4002	float value	40029	ADF	8				
Cooling Stages Active	✓	none	n/a	coolstgs	AV:2002	float value	40031	ADF	9			SNVT_count_inc(9)	nvoCoolStages
Demand Level		none	0	dmd_lev	AV:4006	float value	40033	ADF	10				
Economizer Commanded Position	✓	%open	n/a	econocmd	AV:2001	float value	40035	ADF	11			SNVT_lev_percent(81	nvoEconoCmdPos
Economizer High OAT Lockout		°F	75	oatlecon	AV:4004	float value	40037	ADF	12				
Economizer Minimum position		%open	20	economin	AV:4005	float value	40039	ADF	13				
Effective Cool Setpoint	✓	°F	n/a	effective_cool_sp	AV:2004	float value	40041	ADF	14			SNVT_temp_p(105)	nvoEffCoolSP
Effective Heat Setpoint	✓	°F	n/a	effective_heat_sp	AV:2005	float value	40043	ADF	15			SNVT_temp_p(105)	nvoEffHeatSP
Filter Runtime	✓	hr	n/a	flts_runtime	AV:2015	float value	40051	ADF	17			SNVT_time_hour(124	nvoFilterRuntime
Filter Service Hours		hr	600	flts_service	AV:4025	float value	40053	ADF	20				
Heating Hi SAT Setpoint		°F	120	sat_high	AV:3004	float value	40055	ADF	21				
Heating Lockout Temp		°F	65	oatlheat	AV:4003	float value	40057	ADF	22				
Heating Stages Active	✓	none	n/a	heatstgs	AV:2003	float value	40059	ADF	23			SNVT_count_inc(9)	nvoHeatStages
IAQ Greatest Minimum Damper Position		%open	50	iaq_max_dpr	AV:4011	float value	40061	ADF	24				
IAQ High reference @ 20mA (PPM)		ppm	2000	iaq_20ma	AV:4010	float value	40063	ADF	25				
IAQ low reference @ 4mA (PPM)		pp	0	iaq_4ma	AV:4009	float value	40065	ADF	26				

*Set to 0 to disable alarm notification

APPENDIX A — NETWORK POINTS LIST
RTUP-MP Protocol Maps

				BACnet Info		Modbus Info		N2 Info		LonWorks Input		LonWorks Output	
Point Name	**Read Only**	**Units**	**Default Value**	**BACnet Point Name**	**BACnet Object ID**	**Modbus Register Type**	**Modbus Register#**	**N2 Network Point Type**	**N2 Network Point Address**	**SNVT Type**	**SNVT Name**	**SNVT Type**	**SNVT Name**
Indoor Air Quality	✓	ppm	n/a	iaq	AV:2009	float value	40067	ADF	27			SNVT_ppm(29)	nvoIAQ
Local Outside Air Temperature Sensor	✓	°F	n/a	oatsens	AV:1001	float value	40069	ADF	28				
Maximum Differential CO2 Level		ppm	650	co2_stpt	AV:4012	float value	40071	ADF	29				
Minimum Setpoint Gap		°^F	5	sp_gap	AV:4016	float value	40073	ADF	30				
OAQ high reference @ 20mA (PPM)		ppm	2000	oaq_20ma	AV:4014	float value	40075	ADF	31				
OAQ low reference @ 4mA (PPM)		ppm	0	oaq_4ma	AV:4013	float value	40077	ADF	32				
Occupied Cool Setpoint		°F	74	occ_cool_sp	AV:4017	float value	40079	ADF	33	SNVT_temp_p(105)	nciOccCoolSP		
Occupied Dehumidification Setpoint		%rh	60	occ_dehum_setp	AV:4021	float value	40081	ADF	34	SNVT_lev_percent(81)	nciOccRHSP		
Occupied Heat Setpoint		°F	68	occ_heat_sp	AV:4018	float value	40083	ADF	35	SNVT_temp_p(105)	nciOccHeatSP		
Outdoor Air Quality	✓	ppm	n/a	oaq	AV:2010	float value	40085	ADF	36	SNVT_ppm(29)	nvoOAQ		
Outdoor Air Relative Humidity	✓	%rh	n/a	oarh	AV:2012	float value	40087	ADF	37	SNVT_lev_percent(81)	nvoOutsideRH		
Outside Air Temperature (BACnet)**		°F	n/a	oat	AV:4026	float value	40089	ADF	38	SNVT_temp_p(105)	nviOutsideTemp		
Outside Air Temperature (forcontrol)†	✓	°F	n/a	oa_temp	AV:2013	float value	40091	ADF	39	SNVT_temp_p(105)	nvoOutsideTem		
Power Exhaust Setpoint		%open	50	pesetpt	AV:4008	float value	40095	ADF	41				
Pushbutton Override Duration		hr	1	ovr_dur	AV:4023	float value	40099	ADF	43				
Sensor Override Time Remaining	✓	min	n/a	overtime	AV:2016	float value	40101	ADF	44				
Service Test Economizer		%open	0	test_eco	AV:3005			ADF	45				
Setpoint Adjustment	✓	°^F	n/a	sp_adj	AV:2017	float value	40105	ADF	46			SNVT_temp_p(105)	nvoSetPtAdjust
Setpoint Slider Range††		°^F	5	spo_range	AV:4015	float value	40107	ADF	47				
Space Relative Humidity	✓	%rh	n/a	sprh	AV:2011	float value	40111	ADF	49			SNVT_lev_percent(81	nvoSpaceRH
Space Temperature Offset Pot***	✓	°^F	n/a	sptopot	AV:2006	float value	40113	ADF	50				
Space Temperature Sensor***	✓	°F	n/a	sptsens	AV:2007	float value	40115	ADF	51			SNVT_temp_p(105)	nvoSpaceTemp
Start Delay		seconds	5	startdelay	AV:4007	float value	40117	ADF	52				
Supply Air Temperature	✓	°F	n/a	sat	AV:2008	float value	40119	ADF	53			SNVT_temp_p(105)	nvoSAT
Supply Fan Runtime	✓	hr	n/a	sf_runtime	AV:2014	float value	40121	ADF	54			SNVT_time_hour(124	nvoFanRuntim
Supply Fan Service Hours*		Hr	0	sf_service	AV:4024	loat value	40123	ADF	55				
Unoccupied Cool Setpoint		°F	85	unocc_cool_sp	AV:4019	float value	40125	ADF	56	SNVT_temp_p(105)	nciUnoccCoolSP		

* Set to 0 to disable alarm notification

** BACnet
Write Property =>deg F ; set OAT to desired temperature
=>NULL ; release control of OAT
N2, Modbus, LON
Set variable =>degF ; set OAT to desired temperature.
=>999 ; release control of OAT

*** These are being used with the T55/56 sensors

† Represents the OAT being used by the control algorithms.

†† The maximum +/— offset that can be produced with the T55/56 slider.
Example: **spo_range** = 5: **occ_cool_sp** = 74
The slider can adjust the setpoint from 69 (— 5) to 79 (+5)

††† Use start delay to effect a staggered start of multiple units following a power outage.

APPENDIX A — NETWORK POINTS LIST
RTUP-MP Protocol Maps

				BACnet Info		Modbus Info		N2 Info		LonWorks Input		LonWorks Output	
Point Name	**Read Only**	**Units**	**Default Value**	**BACnet Point Name**	**BACnet Object ID**	**Modbus Register Type**	**Modbus Register#**	**N2 Network Point Type**	**N2 Network Point Address**	**SNVT Type**	**SNVT Name**	**SNVT Type**	**SNVT Name**
Unoccupied Dehumidification Setpoint		%rh	95	unocc_dehum_setpt	AV:4022	float value	40127	ADF	57	SNVT_lev_percent(81)	nciUnoccRHSP		
Unoccupied Heat Setpoint		°F	60	unocc_heat_sp	AV:4020	float value	40129	ADF	58	SNVT_temp_p(105)	nciUnoccHeatSP		
BACnet Schedule*		on/off	n/a	bacnet_schedule	BV:4006	discrete out	1	BO	1				
BAS On/Off**		on/off	off	bas_on_off	BV:4005	discrete out	2	BO	2			SNVT_switch(95)	nviOccupied
Compressor 1 Relay State	✓	on/off	n/a	comp_1	BV:2101	discrete in	10006	BI	6			SNVT_switch(95)	nvoComp1Relay
Compressor 1 Runtime Clear†		on/off	off	c1_rt_clear	BV:4101	discrete out	3	BO	3				
Compressor 2 Relay State	✓	on/off	n/a	comp_2	BV:2102	discrete in	10007	BI	7			SNVT_switch(95)	nvoComp2Relay
Compressor 2 Runtime Clear††		on/off	off	c2_rt_clear	BV:4102	discrete out	4	BO	4				
Compressor Safety Status	✓	on/off	n/a	compstat	BV:2150	discrete in	10008	BI	8			SNVT_switch(95)	nvoCompStatusSw
Continuous Occupied Exhaust		on/off	off	occ_exh	BV:3009	discrete out	5	BO	5				
Dehumidification Relay State	✓	on/off	n/a	humizer	BV:2011	discrete in	10009	BI	9			SNVT_switch(95)	nvoDehumidRelay
Economizer Exists		on/off	off	econ_exist	BV:4001	discrete out	6	BO	6				
Enthalpy	✓	high/low	n/a	enthalpy	BV:2002	discrete in	10010	BI	10				
Enthalpy (BACnet)††		high/low	low	enthalpy_net	BV:4004	discrete out	7	BO	7				
Field Service Test		on/off	off	svc_test	BV:3010			BO	17				
Filter Status	✓	on/off	n/a	filtstat	BV:2004	discrete in	10011	BI	11			SNVT_switch(95)	nvoFilterStatus
Filter Timer Clear†		on/off	off	flts_rt_clear	BV:4003	discrete out	18	BO	18				
Fire Shutdown	✓	on/off	n/a	firedown	BV:2005	discrete in	10012	BI	12			SNVT_switch(95)	nvoFireShutdown
Heat Stage 1 Relay State	✓	on/off	n/a	heat_1	BV:2201	discrete in	10013	BI	13			SNVT_switch(95)	nvoHeat1Relay
Heat Stage 2 Relay State	✓	on/off	n/a	heat_2	BV:2202	discrete in	10014	BI	14			SNVT_switch(95)	nvoHeat2Relay
Humidistat Input Status	✓	on/off	n/a	humstat	BV:2006	discrete in	10015	BI	15			SNVT_switch(95)	nvoHumidistat
Local Schedule Status	✓	on/off	n/a	kp_sched_stat	BV:1001	discrete in	10016	BI	16				
Occupancy Status†††	✓	on/off	n/a	occ_status	BV:2008	discrete in	10017	BI	17			SNVT_switch(95)	nvoOccyStatus
Power Exhaust Relay State	✓	on/off	n/a	aux_2	BV:2012	discrete in	10018	BI	18			SNVT_switch(95)	nvoPwrExhRelay
Remote Occupancy Input	✓	on/off	n/a	remocc	BV:2007	discrete in	10019	BI	19			SNVT_switch(95)	nvoRemoteOccy
Service Test Compressor 1		on/off	off	test_c1	BV:3014			BO	19				

* *This is the current occupancy state of the BACnet schedule object. To control occupancy externally, use* ***bas_on_off*** *instead.*

** *Setpoint = OFF; Unoccupied*
= ON; Occupied

† *Set = ON to reset runtime counter.*
This point will automatically rest to OFF after runtime counter is cleared.

†† *Use this point to control enthalpy from the network.*
Set = OFF; enthalpy high
Set = ON; enthalpy low

††† *This is the current occupancy status used by the control algorithms.*
OFF = Unoccupied
ON = Occupied

APPENDIX A — NETWORK POINTS LIST
RTUP-MP Protocol Maps

				BACnet Info		Modbus Info		N2 Info		LonWorks Input		LonWorks Output	
Point Name	**Read Only**	**Units**	**Default Value**	**BACnet Point Name**	**BACnet Object ID**	**Modbus Register Type**	**Modbus Register#**	**N2 Network Point Type**	**N2 Network Point Address**	**SNVT Type**	**SNVT Name**	**SNVT Type**	**SNVT Name**
Service Test Compressor 2		on/off	off	test_c2	BV:3015			BO	20				
Service Test Dehumidification		on/off	off	test_hmz	BV:3017			BO	21				
Service Test Heat 1		on/off	off	test_h1	BV:3012			BO	22				
Service Test Heat 2		on/off	off	test_h2	BV:3013			BO	23				
Service Test Power Exhaust		on/off	off	test_x2	BV:3016			BO	24				
Service Test Supply Fan		on/off	off	test_sf	BV:3011			BO	25				
Supply Fan Relay State	✓	on/off	n/a	sf	BV:2010	discrete in	10020	BI	20			SNVT_switch(95)	nvoFanRelay
Supply Fan Runtime Clearr†		on/off	off	sf_rt_clear	BV:4002			BO	26				
Supply Fan Status	✓	on/off	n/a	fanstat	BV:2003	discrete in	10021	BI	21			SNVT_switch(95)	nvoFanStatus
System is shut down	✓	on/off	n/a	sys_down	BV:2001	discrete in	10022	BI	22				
Input 1 Function††		n/a	1	inp_01_func	MSV:3001	unsigned int	40131	ADI	1				
Input 2 Function††		n/a	1	inp_02_func	MSV:3002	unsigned int	40132	ADI	2				
Input 3 Function†††		n/a	2	inp_03_func	MSV:3003	unsigned int	40133	ADI	3				
Input 3 Switch Cfg‡		n/a	1	inp_03_sw	MSV:3013	unsigned int	40134	ADI	4				
Input 5 Function‡‡		n/a	2	inp_05_func	MSV:3005	unsigned int	40135	ADI	5				
Input 5 Switch Cfg‡		n/a	2	inp_05_sw	MSV:3015	unsigned int	40136	ADI	6				
Input 8 Function***		n/a	1	inp_08_func	MSV:3008	unsigned int	40137	ADI	7				

† Set = ON to reset runtime counter. This point will automatically rest to OFF after runtime counter is cleared.

†† Set = 1; no sensor
= 2; IAQ sensor
= 3;OAQ sensor
= 4; Space RH sensor
= 5; Outdoor RH sensor

††† Set = 1; no function
= 2; Compressor Safety
= 3; Fan status
= 4; Filter status
= 5; Remote occupancy

‡ Set = 1; Normally Open
= 2; Normally Closed

‡‡ Set = 1; no function
= 2; Fire Shutdown
= 3; Fan status
= 4; Filter status
= 5; Remote occupancy

*** Set = 1; no function
= 2; Enthalpy Switch
= 3; Fan status
= 4; Filter status
= 5; Remote occupancy

APPENDIX A — NETWORK POINTS LIST
RTUP-MP Protocol Maps

				BACnet Info		Modbus Info		N2 Info		LonWorks Input		LonWorks Output	
Point Name	**Read Only**	**Units**	**Default Value**	**BACnet Point Name**	**BACnet Object ID**	**Modbus Register Type**	**Modbus Register#**	**N2 Network Point Type**	**N2 Network Point Address**	**SNVT Type**	**SNVT Name**	**SNVT Type**	**SNVT Name**
Input 8 Switch Cfg*		n/a	1	inp_08_sw	MSV:3018	unsigned int	40138	ADI	8				
Input 9 Function**		n/a	2	inp_09_func	MSV:3009	unsigned int	40139	ADI	9				
Input 9 Switch Cfg*		n/a	1	inp_09_sw	MSV:3019	unsigned int	40140	ADI	10				
Number Of Compressor Stages†		n/a	1	nu_cl_stgs	MSV:4003	unsigned int	40141	ADI	11				
Occupancy Source††		n/a	1	occ_source	MSV:4002	unsigned int	40142	ADI	12	SNVT_count_inc(9)	nciOccySource		
Space sensor type†††		n/a	1	spt_type	MSV:4001	unsigned int	40143	ADI	13				
System Mode‡	✓	n/a	n/a	sysmode	MSV:2001	unsigned int	30001	ADI	14				
Unit Status‡‡	✓	n/a	n/a	unit_stat	MSV:2002	unsigned int	30002	ADI	15			SNVT_count_inc(9)	nvoUnitStatus
Analog Input Configuration Alarm	✓	n/a	n/a	an_cfg_alarm	BV:6002	discrete in	10023	BI	23				
CO2 Alarm	✓	n/a	n/a	co2_hi	BV:7016	discrete in	10024	BI	24				
Compressor 1 Runtime Alarm	✓	n/a	n/a	dx1_rntm	BV:7014	discrete in	10025	BI	25				
Compressor 2 Runtime Alarm	✓	n/a	n/a	dx2_rntm	BV:7015	discrete in	10026	BI	26				
Compressor Safety Alarm	✓	n/a	n/a	dx_compstat	BV:7013	discrete in	10027	BI	27			SNVT_switch(95)	nvoCompSafety-Alm
Filter Alarm	✓	n/a	n/a	filter	BV:7017	discrete in	10028	BI	28			SNVT_switch(95)	nvoFilterAlm
Fire Shutdown Alarm	✓	n/a	n/a	fire_alarm	BV:7007	discrete in	10029	BI	29			SNVT_switch(95)	nvoFireAlm
High Space Humidity	✓	n/a	n/a	sprh_hi	BV:7018	discrete in	10030	BI	30				

Set = 1; Normally Open
= 2; Normally Closed

** Set = 1; no function
= 2; Humidistat
= 3; Fan status
= 4; Filter status
= 5; Remote occupancy

Set = 1; One stage
= 2; Two stages
= 3; No cooling

†† Set = 1; Always Occupied
= 2; Local Schedule
= 3; BACnet Schedule
= 4; BAS On/Off
= 5; DIOn/Off

††† Set = 1; T55 Thermistor only
= 2; T56 Thermand setpoint
= 3; RS sensor

‡ Current system mode
1 = Disabled
2 = Test
3 = Run

‡‡ Unit status
1 = Off
2 = Fan Only
3 = Free Cooling
4 = Cooling
5 = Heating
6 = Dehumidification
7 = Test
8 = Shutdown

APPENDIX A — NETWORK POINTS LIST
RTUP-MP Protocol Maps

				BACnet Info		Modbus Info		N2 Info		LonWorks Input		LonWorks Output	
Point Name	**Read Only**	**Units**	**Default Value**	**BACnet Point Name**	**BACnet Object ID**	**Modbus Register Type**	**Modbus Register#**	**N2 Network Point Type**	**N2 Network Point Address**	**SNVT Type**	**SNVT Name**	**SNVT Type**	**SNVT Name**
High Supply Air Temp	✓	n/a	n/a	sat_hi	BV:7021	discrete in	10031	BI	31				
Indoor Air Quality Alarm	✓	n/a	n/a	iaq_alarm	BV:7005	discrete in	10032	BI	32			SNVT_switch(95)	nvoIAQAlm
Low Space Humidity	✓	n/a	n/a	sprh_lo	BV:7020	discrete in	10033	BI	33				
Low Supply Air Temp	✓	n/a	n/a	sat_lo	BV:7022	discrete in	10034	BI	34				
Outdoor Relative Humidity Sensor Alarm	✓	n/a	n/a	oarh_alarm	BV:7019	discrete in	10035	BI	35				
Outdoor Air Quality Alarm	✓	n/a	n/a	oaq_alarm	BV:7006	discrete in	10036	BI	36			SNVT_switch(95)	nvoOAQAlm
Outside Air Temperature Alarm	✓	n/a	n/a	oat_alarm	BV:7003	discrete in	10037	BI	37			SNVT_switch(95)	nvoOutsideTempAlm
Safety Chain Alarm	✓	n/a	n/a	safety_chain	BV:7023	discrete in	10038	BI	38			SNVT_switch(95)	nvoSafetyAlm
Setpoint Slider Alarm	✓	n/a	n/a	slide_alarm	BV:7002	discrete in	10039	BI	39				
Space Relative Humidity Sensor Alarm	✓	n/a	n/a	sprh_alarm	BV:7024	discrete in	10040	BI	40				
Space Temperature High Alarm	✓	n/a	n/a	spt_hi	BV:7010	discrete in	10041	BI	41				
Space Temperature Low Alarm	✓	n/a	n/a	spt_lo	BV:7012	discrete in	10042	BI	42				
Space Temperature Sensor Failure	✓	n/a	n/a	spt_alarm	BV:7001	discrete in	10043	BI	43			SNVT_switch(95)	nvoSpaceTempAlm
Supply Air Temperature Alarm	✓	n/a	n/a	sat_alarm	BV:7004	discrete in	10044	BI	44			SNVT_switch(95)	nvoSupplyTempAlm
Supply Fan Failed to Start	✓	n/a	n/a	sf_fail	BV:7008	discrete in	10045	BI	45				
Supply Fan in Hand	✓	n/a	n/a	sf_hand	BV:7009	discrete in	10046	BI	46				
Supply Fan Runtime Alarm	✓	n/a	n/a	sf_rntm	BV:7011	discrete in	10047	BI	47				
Switch Configuration Alarm	✓	n/a	n/a	sw_cfg_alarm	BV:6001	discrete in	10048	BI	48				

Appendix B - BACnet Protocol Implementation Conformance Statement

Date: 06/30/2008

Vendor Name: **Carrier**

Product Names: **RTU-MP**

Product Model Number: **RTU-MP**

NOTE: The enclosed PICS are accurate as of 6/30/08. The ALCProduct>'s latest supported function codes and capabilities are listed on the associated Protocol Implementation Conformance Statement (PICS), which can be found on the following website *http://www.bacnetassociation.org/BMAProductCatalog/Carrier/*.

BACnet Desription:

BACnet Master Slave/Token Passing (MS/TP) is used for communicating BACnet over a sub-network of BACnet-only controllers. This is the default Carrier communications protocol. Each RTU-MP acts as an MS/TP Master. The speed of an MS/TP network can range from 9600 to 76.8K baud. Physical Addresses can be set from 01 to 99.

Product Description:

The RTU-MP is a factory-installed rooftop controller that is capable of speaking multiple protocols.

BACnet Standardize Device Profile (Annex K): B-AAC

List of all BACnet Interoperability Building Blocks Supported (Annex K):

DS-RP-A	AE-N-I-B	SCHED-I-B	T-VMT-I-B	DM-DDB-A
DS-RP-B	AE-ACK-B		T-ATR-B	DM-DDB-B
DS-RPM-B	AE-ASUM-B			DM-DOB-A
DS-WP-B	AE-INFO-B			DM-DOB-B
DS-WP-B				DM-DCC-B
DS-WPM-B				DM-PT-A
DS–COV-A				DM-PT-B
DS–COV-B				DM-TS-B
DS–COVU-A				DM-UTC-B
DS–COVU-B				DM-RD-B
				DM-LM-B

Segmentation Capability:

Able to transmit segmented messages: (NO) Window Size:

Able to receive segmented messages: (NO) Window Size:

Standard Object Types Supported:

On a separate page, please list each standard Object Type supported (i.e., an object of this type may be present in the product). For each standard Object Type supported provide the following data:

1. Whether objects of this type are dynamically creatable using BACnet's CreateObject service
2. Whether objects of this type are dynamically deletable using BACnet's CreateObject service
3. List of all optional properties supported
4. List of all properties that are writable where not otherwise required by this standard

5. List of proprietary properties and for each its property identifier, datatype, and meaning
6. List of any property range restrictions

BACnet Data Link Layer Options

Data Link Layer Options:

☐☐☐BACnet IP, (Annex J)

☐☐☐Able to register as a Foreign Device

☐☐☐ISO 8802-3, Ethernet (Clause 7)

☐☐☐ANSI/ATA 878.1, 2.5 Mb ARCNET (Clause 8)

XX ANSI/ATA 878.1, RS-485 ARCNET (Clause 8) baud rate(s) 156k baud

XX MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800

☐☐ MS/TP slave (Clause 9), baud rate(s): 9600, 19200, 38400, 76800

☐☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): 9600, 19200, 38400, 76800

☐☐ Point-To-Point, modem, (Clause 10), baud rate(s): 9600, 19200, 38400, 76800

☐☐☐LonTalk, (Clause 11), medium: _____

☐☐☐Other:

Device Address Binding Methods Supported:

XX Send Who-Is, receive I-Am (BIBB DM-DDB-A)*

XX Receive Who-Is, send I-Am (BIBB DM-DDB-B)

XX☐Send Who-Has, receive I-Have (BIBB DM-DOB-A)*

XX Receive Who-Has, send I-Have (BIBB DM-DOB-B)

XX Manual configuration of recipient device's network number and MAC address.

☐☐None of the above

* Dynamic Binding is not supported when MS/TP is configured as a slave node.

*Networking Options:

☐☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

ARCNET-MS/TP, ARCNET-MS/TP-UDP/IP.

☐☐☐Annex H.3, BACnet Tunneling Router over UDP/IP

☐☐☐BACnet/IP Broadcast Messaging Device (BBMD)

Does the BBMD support registrations by Foreign Devices? ☐☐Yes ☐☐No

Character Sets Supported:

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

XX ANSI X3.4

XX IBM™/Microsoft™☐DBCS

XX ISO 8859-1

XX ISO 10646 (UCS-2)

XX ISO 10646 (ICS-4)

XX JIS C 6226

Analog Input

Analog Input, Analog Input (TLO), Analog Input (PTA), Analog Input (RS):			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions cov_increment deadband description device_type event_enable	event_time_stamps high_limit limit_enable low_limit max_pres_value min_pres_value	notification_class notify_type reliability resolution time_delay update_interval
4. Writeable Properties:	cov_increment deadband description device_type event_enable	high_limit limit_enable low_limit notification_class	notify_type out_of_service time_delay units
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	device_type	limited to 50 octets in length	
	present_value	limited by min_pres_value and max_pres_value properties	
	notification_class	must be valid notification_class	
	time_delay	0 to 4294967295	

Analog Output

Analog Output, Analog Output (FM), and Analog Output (PWM):	
1. Creatable?	NO
2. Deletable?	NO

Analog Output, Analog Output (FM), and Analog Output (PWM):			
3. Optional Properties Supported:	acked_transitions cov_increment deadband description device_type event_enable	event_time_stamps high_limit limit_enable low_limit max_pres_value min_pres_value	notification_class notify_type reliability resolution time_delay
4. Writeable Properties:	cov_increment deadband description device_type event_enable	high_limit limit_enable low_limit notification_class notify_type	out_of_service present_value relinquish_default time_delay units
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	device_type	limited to 50 octets in length	
	present_value	limited by min_pres_value and max_pres_value properties	
	relinquish_default	limited by min_pres_value and max_pres_value properties	
	notification_class	must be valid notification_class	
	time_delay	0 to 4294967295	

Analog Value (PAR)

Analog Value (PAR):			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions cov_increment deadband description device_type event_enable	event_time_stamps high_limit limit_enable low_limit notification_class	notify_type priority_array reliability relinquish_default time_delay
4. Writeable Properties:	cov_increment deadband description device_type event_enable	high_limit limit_enable low_limit notification_class notify_type	out_of_service present_value relinquish_default time_delay units
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	present_value	limited by min_pres_value and max_pres_value properties	

Analog Value (PAR):		
	relinquish_default	limited by min_pres_value and max_pres_value properties
	notification_class	must be valid notification_class
	time_delay	0 to 4294967295

Analog Value (RS)

Analog Value (RS):	
1. Creatable?	NO
2. Deletable?	NO
3. Optional Properties Supported:	reliability
4. Writeable Properties:	out_of_service present_value units
5. Proprietary properties:	None
6. Range Restrictions:	None

Analog Value (STAT)

Analog Value (STAT):			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions cov_increment deadband description event_enable	event_time_stamps high_limit limit_enable low_limit	notification_class notify_type reliability time_delay
4. Writeable Properties:	cov_increment deadband description event_enable	high_limit limit_enable low_limit notification_class	notify_type out_of_service time_delay units
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	notification_class	must be valid notification_class	
	time_delay	0 to 4294967295	

Binary Input

Binary Input:			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions active_text alarm_value change_of_state_count change_of_state_time description	device_type elapsed_active_time event_enable event_time_stamps inactive_text notification_class	notify_type reliability time_delay time_of_active_time_reset time_of_state_count_reset
4. Writeable Properties:	active_text alarm_value change_of_state_count description device_type	elapsed_active_time event_enable inactive_text notification_class	notify_type out_of_service polarity time_delay
5. Proprietary properties:	None		
6. Range Restrictions:			
	active_text	limited to 50 octets in length	
	change_of_state_count	0 to 4294967295	
	description	limited to 50 octets in length	
	device_type	limited to 50 octets in length	
	elapsed_active_time	0 to 4294967295	
	inactive_text	limited to 50 octets in length	
	notification_class	must be valid notification_class	
	time_delay	0 to 4294967295	

Binary Output

Binary Output:			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions active_text change_of_state_count change_of_state_time description device_type elapsed_active_time	event_enable event_time_stamps feedback_value inactive_text minimum_off_time minimum_on_time	notification_class notify_type reliability time_delay time_of_active_time_reset time_of_state_count_reset
4. Writeable Properties:	active_text change_of_state_count description device_type elapsed_active_time event_enable	inactive_text minimum_off_time minimum_on_time notification_class notify_type	out_of_service polarity present_value relinquish_default time_delay

Binary Output:		
5. Proprietary properties:	None	
6. Range Restrictions:		
	active_text	limited to 50 octets in length
	change_of_state_count	0 to 4294967295
	description	limited to 50 octets in length
	device_type	limited to 50 octets in length
	elapsed_active_time	0 to 4294967295
	inactive_text	limited to 50 octets in length
	minimum_off_time	0 to 4294967295
	minimum_on_time	0 to 4294967295
	notification_class	must be valid notification_class
	time_delay	0 to 4294967295

Binary Value (PAR), (CLOCK), and (STAT)

Binary Value (PAR) and Binary Value (CLOCK):			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions active_text alarm_value change_of_state_count change_of_state_time description elapsed_active_time	event_enable event_time_stamps inactive_text minimum_off_time minimum_on_time notification_class notify_type	priority_array reliability relinquish_default time_delay time_of_active_time_reset time_of_state_count_reset
4. Writeable Properties:	active_text alarm_value change_of_state_count description elapsed_active_time	event_enable inactive_text minimum_off_time minimum_on_time notification_class	notify_type out_of_service present_value relinquish_default time_delay
5. Proprietary properties:	None		
6. Range Restrictions:			
	active_text	limited to 50 octets in length	
	change_of_state_count	0 to 4294967295	
	description	limited to 50 octets in length	
	device_type	limited to 50 octets in length	

Binary Value (PAR) and Binary Value (CLOCK):		
	elapsed_active_time	0 to 4294967295
	inactive_text	limited to 50 octets in length
	minimum_off_time	0 to 4294967295
	minimum_on_time	0 to 4294967295
	notification_class	must be valid notification_class
	time_delay	0 to 4294967295

Binary Value (PAR), (CLOCK), and (STAT)

Binary Value (STAT):			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions active_text alarm_value change_of_state_count change_of_state_time description	elapsed_active_time event_enable inactive_text minimum_off_time minimum_on_time notification_class	notify_type reliability time_delay time_of_active_time_reset time_of_state_count_reset
4. Writeable Properties:	active_text alarm_value change_of_state_count description elapsed_active_time	event_enable inactive_text minimum_off_time minimum_on_time	notification_class notify_type out_of_service time_delay
5. Proprietary properties:	None		
6. Range Restrictions:			
	active_text	limited to 50 octets in length	
	change_of_state_count	0 to 4294967295	
	description	limited to 50 octets in length	
	elapsed_active_time	0 to 4294967295	
	inactive_text	limited to 50 octets in length	
	minimum_off_time	0 to 4294967295	
	minimum_on_time	0 to 4294967295	
	notification_class	must be valid notification_class	
	time_delay	0 to 4294967295	

Binary Value (MODULE ALARM)

Binary Value (MODULE ALARM):			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions alarm_value description	event_enable event_time_stamps notification_class	notify_type time_delay
4. Writeable Properties:	alarm_value event_enable notification_class		notify_type out_of_service time_delay
5. Proprietary properties:	None		
6. Range Restrictions:			
	notification_class	must be valid notification_class	
	time_delay	0 to 4294967295	

Calendar

Calendar:		
1. Creatable?	NO	
2. Deletable?	NO	
3. Optional Properties Supported:	description	
4. Writeable Properties:	date_list description	
5. Proprietary properties:	None	
6. Range Restrictions:		
	date_list	limited to 30 BACnetCalendarEntrys
	description	limited to 50 octets in length

Device

Device:	
1. Creatable?	NO
2. Deletable?	NO

Device:			
3. Optional Properties Supported:	active_vt_sessions apdu_segment_timeout daylight_savings_status description list_of_session_keys	local_date local_time location max_info_frames	max_master time_synchronization_recipients utc_offset vt_classes_supported
4. Writeable Properties:	apdu_segment_timeout apdu_timeout description local_date local_time	location max_info_frames max_master number_of_apdu_retries object_identifier	object_name time_synchronization_recipients utc_offset
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	location	limited to 50 octets in length	
	max_master	1 to 127	
	object_identifier	must be valid device identifier	
	object_name	limited to 50 octets in length	
	utc_offset	_780 to 780	

File

File:		
1. Creatable?	NO	
2. Deletable?	NO	
3. Optional Properties Supported:	description	
4. Writeable Properties:	archive description file_type	
5. Proprietary properties:	None	
6. Range Restrictions:		
	description	limited to 50 octets in length
	file_type	limited to 50 octets in length

Multi_State Value

Multi_State Value (PAR): **Multi_State Value (CLOCK):**			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions alarm_values description event_enable event_time_stamps	fault_values notification_class notify_type priority_array	reliability relinquish_default state_text time_delay
4. Writeable Properties:	alarm_values description event_enable fault_values	notification_class notify_type out_of_service	present_value relinquish_default time_delay
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	notification_class	must be valid notification_class	
	present_value	must be valid state	
	relinquish_default	must be valid state	
	time_delay	0 to 4294967295	

Multi_State Value (STAT)

Multi_State Value (STAT):			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions alarm_values description event_enable	event_time_stamps fault_values notification_class notify_type	priority_array reliability state_text time_delay
4. Writeable Properties:	alarm_values description event_enable	fault_values notification_class notify_type	out_of_service time_delay
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	notification_class	must be valid notification_class	
	present_value	must be valid state	
	time_delay	0 to 4294967295	

Notification Class

Notification Class:		
1. Creatable?	NO	
2. Deletable?	NO	
3. Optional Properties Supported:	description	
4. Writeable Properties:	ack_required description	priority recipient_list
5. Proprietary properties:	None	
6. Range Restrictions:		
	description	limited to 50 octets in length
	recipient_list	limited to 5 BACnetDestinations

Program

Program:		
1. Creatable?	NO	
2. Deletable?	NO	
3. Optional Properties Supported:	description description_of_halt instance_of	program_location reason_for_halt reliability
4. Writeable Properties:	description program_change program_location	
5. Proprietary properties:	None	
6. Range Restrictions:		
	description	limited to 50 octets in length
	program_location	limited to 50 octets in length

Schedule

Schedule (ENUM) and Schedule (UNS):			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	priority_for_writing description	exception_schedule priority_array	relinquish_default weekly_schedule

Schedule (ENUM) and Schedule (UNS):			
4. Writeable Properties:	description effective_period exception_schedule	present_value priority_for_writing	relinquish_default weekly_schedule
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	exception_schedule	limited to 30 BACnetSpecialEvents each being limited to 6 BACnetTimeValues	
	present_value	0 to 4294967295	
	relinquish_default	0 to 4294967295	
	weekly_schedule	limited to 6 BACnetTimeValues per BACnetDailySchedule	

Trend_log

Trend_log:			
1. Creatable?	NO		
2. Deletable?	NO		
3. Optional Properties Supported:	acked_transitions client_cov_increment cov_resubscription_interval current_notify_time description event_enable	event_time_stamps log_device_object_property log_interval notification_class notification_threshold	notify_type previous_notify_time records_since_notification start_time stop_time
4. Writeable Properties:	buffer_size client_cov_increment cov_resubscription_interval description event_enable	log_enable log_interval notification_class notification_threshold notify_type	record_count start_time stop_time stop_when_full total_record_count
5. Proprietary properties:	None		
6. Range Restrictions:			
	description	limited to 50 octets in length	
	log_interval	0 to 4294967295	
	notification_class	must be valid notification_class	
	notification_threshold	0 to 4294967295	
	record_count	can only be written to 0	
	total_record_count	can only be written to 0	

Appendix D: Johnson Controls N2 Protocol Implementation Conformance Statement

Date: 06/30/2008

Vendor Name: **Carrier**

Product Names: **RTU-MP**

Product Model Number: **RTU-MP**

Protocol Description:

N2 is not a standard protocol, but one that was created by Johnson Controls, Inc. that has been made open and available to the public. The speed of N2 network is limited to only 9600 baud. The N2 slave address can be set from 01 to 99.

Product Description:

The RTU-MP is a factory-installed rooftop controller that is capable of speaking multiple protocols. The RTU-MP controller speaks the Johnson N2 Open Protocol as described in the *Metasys N2 System Protocol Specification (for Vendors) document*, revision 6/13/96. Further details on the N2 supported implementation are described below.

Communication Types:	Baud rates:	Data Bits:	Parity:	Stop Bits:
2-wire EIA-485	9600	8	None	1

Network Point Types:
Analog Inputs (AI)
Binary Inputs (BI)
Analog Outputs (AO)
Binary Outputs (BO)
Internal Floats (ADF)
Internal Integers (ADI)
Internal Bytes (BD)

Protocol Commands:
Identify Device Type
Sync Time
Poll Without Acknowledge
Poll With Acknowledge
Read Analog Input
Read Binary Input

Read Analog Output
Read Binary Output
Read Internal Parameter
Write Analog Input
Write Binary Input
Write Analog Output
Write Binary Output
Write Internal Parameter
Override Analog Input
Override Binary Input
Override Internal Parameter
Override Release Request

Appendix C: Modbus Protocol Implementation Conformance Statement

Date: 06/30/2008

Vendor Name: **Carrier**

Product Names: **RTU-MP**

Product Model Number: **RTU-MP**

Protocol Description:

The RTU-MP controller speaks the Modicon Modbus RTU/ASCII Protocol as described in the *Modicon Modbus Protocol Reference Guide, PI-MBUS-300 Rev.J.* Further details on the Modbus implementation are described below.

Product Description:

The RTU-MP is a factory-installed rooftop controller that is capable of speaking multiple protocols.

Serial Transmission Mode:	Supported?
RTU	Slave only
ASCII	Not supported

Communication Types:	Baud rates:	Data Bits:	Parity:	Stop Bits:
2-wire EIA-485,	9600, 19200, 38400, 76800	8	None	1

Function Codes:	Purpose:	Used with Register Numbers:
01 – Read Coil Status	Read Discrete Outputs	00001 - 09999
02 – Read Input Status	Read Discrete Inputs	10001 - 19999
03 – Read Holding Registers	Read Holding Registers	40001 - 49999
04 – Read Input Registers	Read Input Registers	30001 - 39999
05 – Force Single Coil	Write Discrete Outputs (single)	00001 - 09999
06 – Preset Single Register	Write Holding Registers (single)	40001 - 49999
15 – Force Multiple Coils	Write Discrete Outputs	00001 - 09999
16 – Preset Multiple Coils	Write Holding Registers	40001 - 49999

Register Type:	Range:	Function Codes Used with this Register Type:
Float Value (FLOAT)	Single-Precision IEEE floating point value	3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register
Unsigned Integer (UINT)	0 - 65535	3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register

Signed Integer (SINT)	-32768 - 32767	3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register
Discrete Input (DI)	0 = Off, 1 = On	2 – Read Input Status
Discrete Output (DO)	0 = Off, 1 = On	1 – Read Coil Status 5 – Force Single Coil 15 – Force Multiple Coils

Appendix E: LonWorks Protocol Implementation Conformance Statement

Date: 06/30/2008

Vendor Name: **Carrier**

Product Names: **RTU-MP**

Product Model Number: **RTU-MP**

Product Description:

The RTU-MP is a factory-installed rooftop controller that is capable of speaking multiple protocols. When the LonWorks Option Card (LON-OC), is installed in the field, it enables the RTU-MP to communicate over a LonTalk network. The RTU-MP does not conform to a standard LonWorks profile, but is self-documenting and any network management tool can manage and configure it over the network. An external interface file (.XIF), is also available so that any network management tool can design and configure the RTU-MP prior to installation. Contact your Carrier representative for this .XIF file.

LonWorks is an open protocol that requires the use Echelon's Neuron microprocessor to encode and decode the LonWorks packets. In order to reduce the cost of adding the Echelon chip to every module, a separate LonWorks Option Card (LON-OC) was designed to connect to the RTU-MP.

This accessory card must be ordered separately and is connected by attaching its ribbon cable into the **J15** connector on the RTU-MP. The RTU-MP's baud rate (**DS1** and **DS2** on **SW3**) must be set to 38.4k to communicate with the LON-OC. The address switches (**SW1** and **SW2**) are not used with LonWorks.

Tranceiver Type: TP/FT 10

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