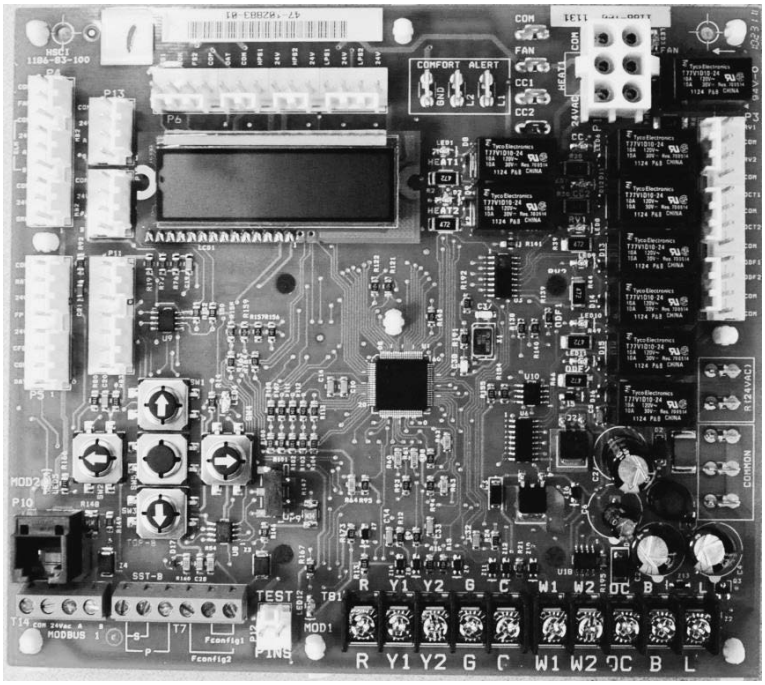
INSTALLATION INSTRUCTIONS
OPERATION INSTRUCTIONS
RTU-C CONTROL



RECOGNIZE THIS SYMBOL AS AN INDICATION OF IMPORTANT SAFETY INFORMATION!

⚠WARNING

THESE INSTRUCTIONS ARE INTENDED AS AN AID TO QUALIFIED, LICENSED SERVICE PERSONNEL FOR PROPER INSTALLATION, ADJUSTMENT AND OPERATION OF THIS UNIT. READ THESE INSTRUCTIONS THOROUGHLY BEFORE ATTEMPTING INSTALLATION OR OPERATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN IMPROPER INSTALLATION, ADJUSTMENT, SERVICE OR MAINTENANCE POSSIBLY RESULTING IN FIRE, ELECTRICAL SHOCK, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

c UL us LISTED

DO NOT DESTROY THIS MANUAL

PLEASE READ CAREFULLY AND KEEP IN A SAFE PLACE FOR FUTURE REFERENCE BY A SERVICEMAN

[ ] INDICATES METRIC CONVERSIONS

92-103249-01 -05
SUPERSEDES 92-103249-01-04

QUICK START – Units with Thermostat Control

Connect Room Thermostat (and Time Clock if used) to RTU-C rooftop unit controller circuit board. Follow Unit Installation Instructions obeying all safety guidelines. Replace any low voltage shields removed during the installation of the thermostat wires.

Connect line voltage power wires to the appropriate main power terminal block or disconnect. Connect gas lines for heater section (if applicable).

Apply power to Rooftop Unit.

Using Keypad and Display on RTU-C circuit board, take unit from "OFF" mode to "CONTROL BY THERMOSTAT" by following numbered instructions below. Refer to section 6.3 "MODE" page 40 of this manual for more detail.

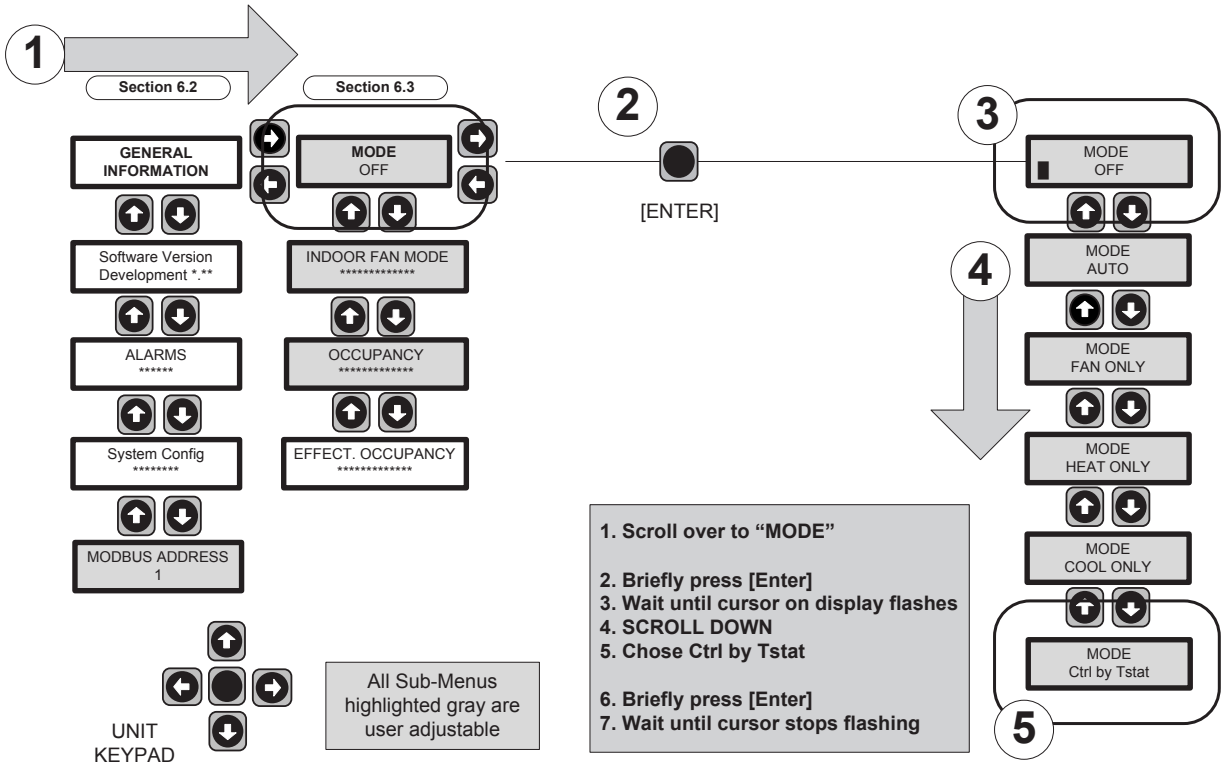


Figure 0-1

Check for any ALARMS on RTU-C Display. If any ALARMS are present, find source and clear ALARMS.

Scroll through the RTU-C Display using the Keypad and set to RUNTEST mode. Choose either Heating or Cooling runtest. Enter Password to start RUNTEST. Refer to "Initial Test Sequence" section 6.10 page 57.

Record temperatures and refrigerant pressures (if applicable) during the runtest. Check for any ALARMS on RTU-C Display. If any ALARMS are present, find source and clear ALARMS (section 6.12, page 58).

QUICK START – Units with BACnet Communication Card Accessory (RXRX-AY01)

Connect Zone Sensor to the RTU-C circuit board. Follow Unit Installation Instructions obeying all safety guidelines.

Connect BACnet Communication Card Accessory to the RTU-C rooftop unit controller circuit board. See section 8.3 page 92.

Connect RS-485 (2-wire) network cable to BACnet Communication Card. Follow Installation Instructions for Unit obeying all safety guidelines. Replace any low voltage shields removed during the installation of the sensor wires and communication cable.

Connect line voltage power wires to the appropriate main power terminal block or disconnect. Connect gas lines for heater section (if applicable).

Apply power to Rooftop Unit. Check for any ALARMS on RTU-C Display, find source and clear ALARMS.

Using Keypad and Display on RTU-C circuit board, take unit from "OFF" mode to "AUTO" by following numbered directions below. Refer to section 6.3 "MODE Screen" page 40 of this manual for more detail.

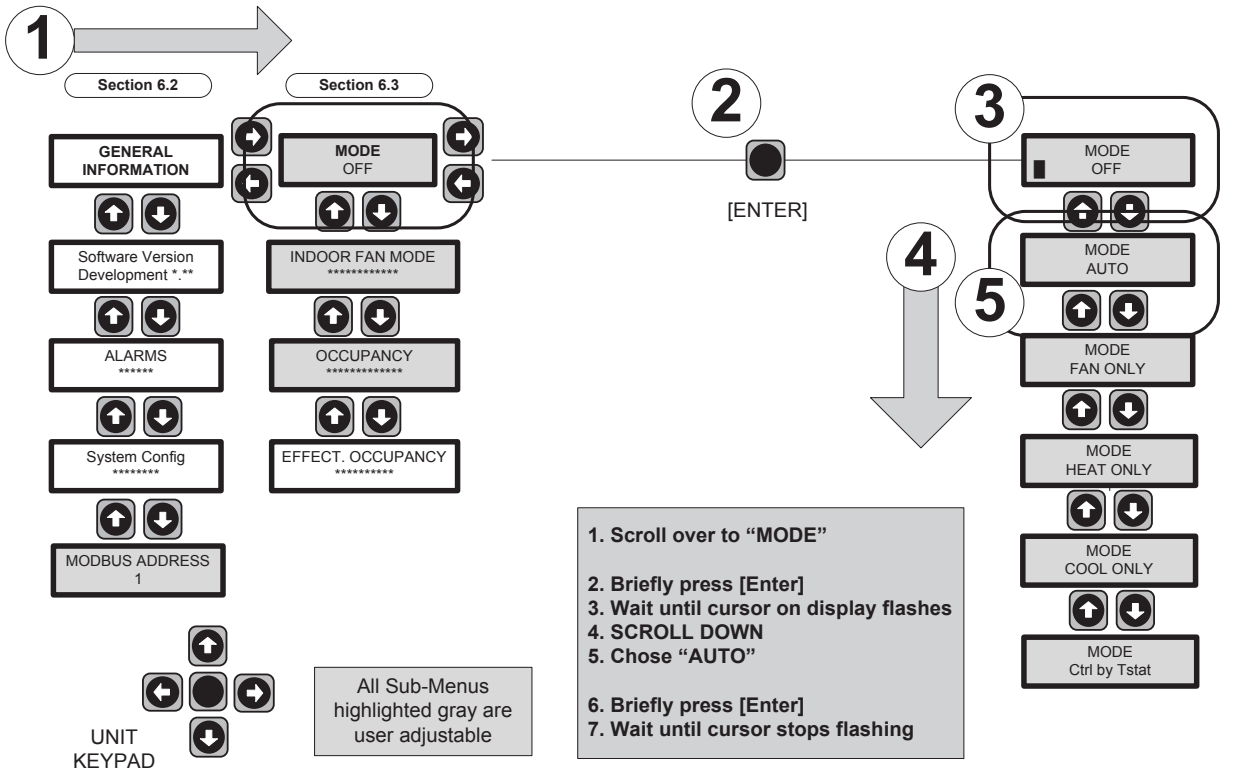


Figure 0-1

Using Keypad and Display on RTU-C circuit board, take unit from “Manual Occupied” mode to “Network” by following numbered directions below. THIS STEP MUST BE COMPLETED or the unit will not communicate and receive commands from the network.

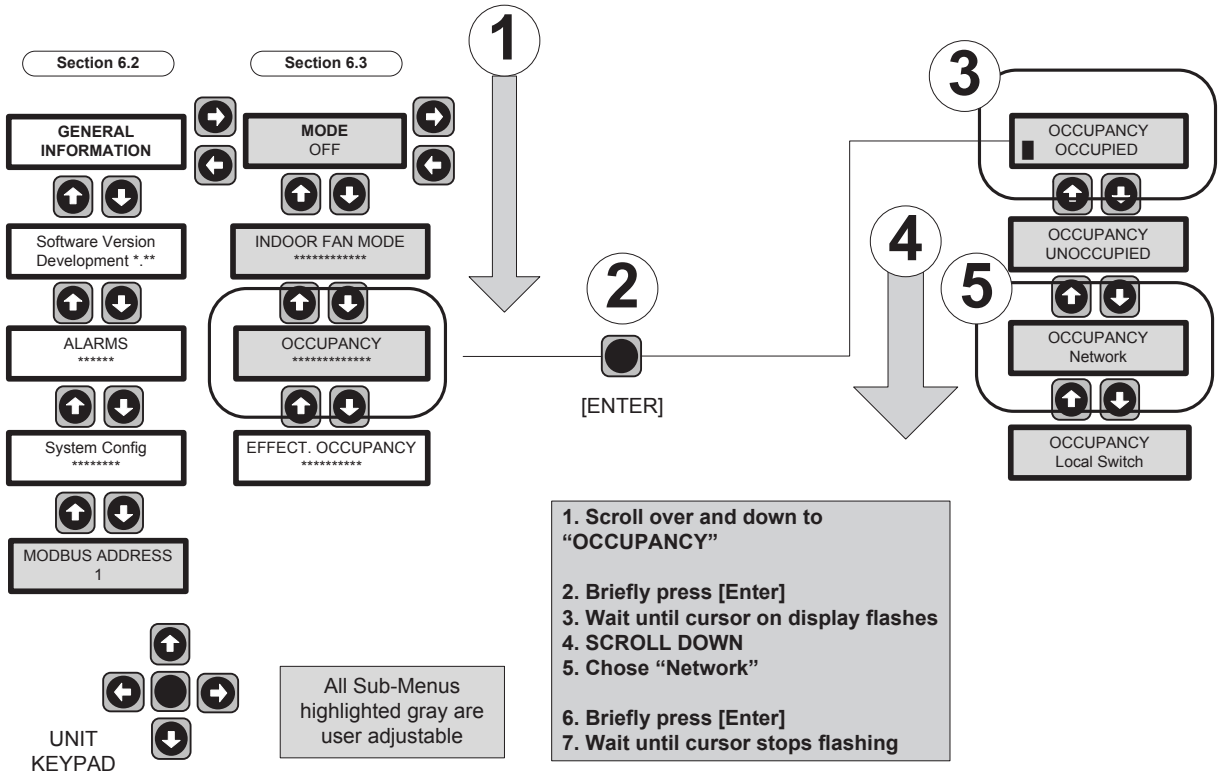


Figure 0-2

Check for any ALARMS on RTU-C Display. If any ALARMS are present, find source and clear ALARMS.

Scroll through the RTU-C Display using the Keypad and set to RUNTEST mode. Choose either Heating or Cooling runtest. Enter Password to start RUNTEST. Refer to “Initial Test Sequence” section 6.10 page 57.

Record temperatures and refrigerant pressures (if applicable) during the runtest.

Check for any ALARMS on RTU-C Display. If any ALARMS are present, find source and clear ALARMS (see section 6.12, page 58).

Using Laptop computer connected to RJ-11 jack on RXRX-AY01 accessory BACnet communication card, set device ID on communication card. Refer to section 8.3.4 “Integration” page 98 of this manual for more detail.

QUICK START – Units with LonWorks Communication Card Accessory (RXRX-AY02)

Connect Zone Sensor to the RTU-C circuit board. Follow Unit Installation Instructions obeying all safety guidelines.

Connect LonWorks Communication Card Accessory to the RTU-C rooftop unit controller circuit board. See section 8.3.3 page 96.

Connect RS-485 (2-wire) network cable to LonWorks Communication Card. Follow Installation Instructions for Unit obeying all safety guidelines. Replace any low voltage shields removed during the installation of the sensor wires and communication cable.

Connect line voltage power wires to the appropriate main power terminal block or disconnect. Connect gas lines for heater section (if applicable).

Apply power to Rooftop Unit. Check for any ALARMS on RTU-C Display, find source and clear ALARMS.

Using Keypad and Display on RTU-C circuit board, take unit from "OFF" mode to "AUTO" by following numbered directions below. Refer to section 6.3 "MODE Screen" page 40 of this manual for more detail.

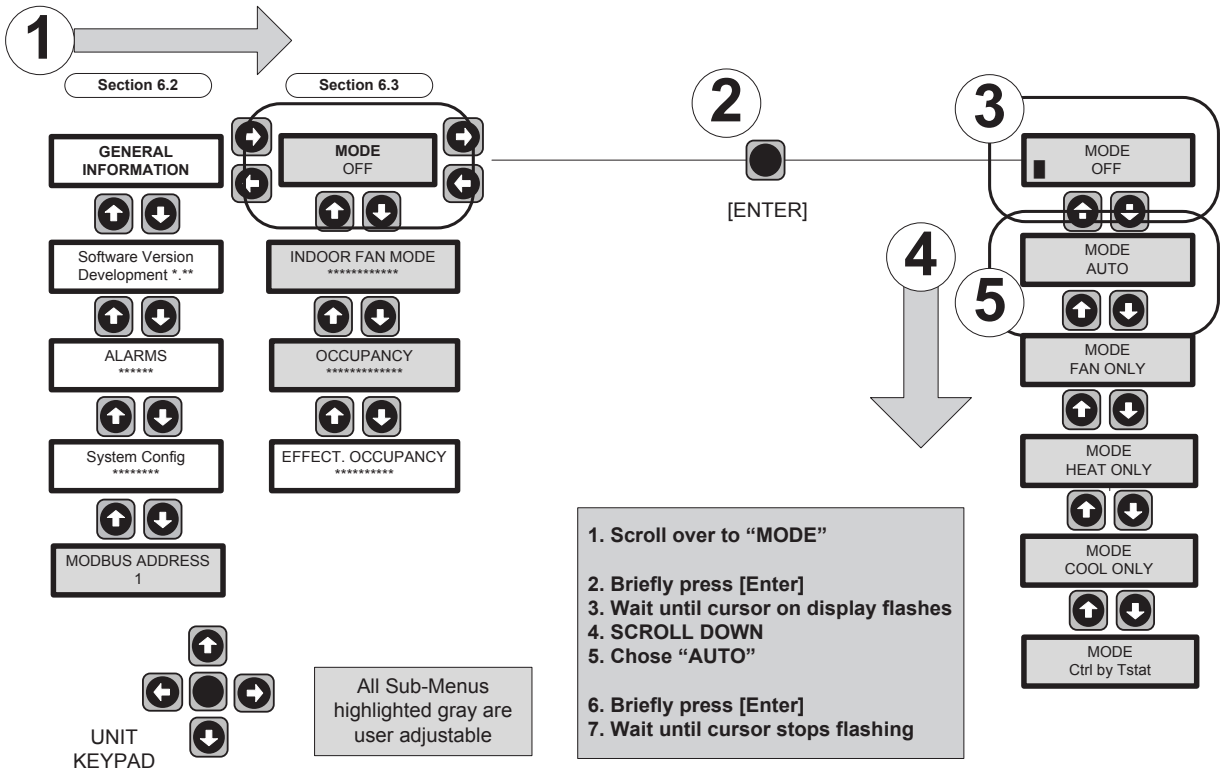


Figure 0-1

Using Keypad and Display on RTU-C circuit board, take unit from “Manual Occupied” mode to “Network” by following numbered directions below. THIS STEP MUST BE COMPLETED or the unit will not communicate and receive commands from the network.

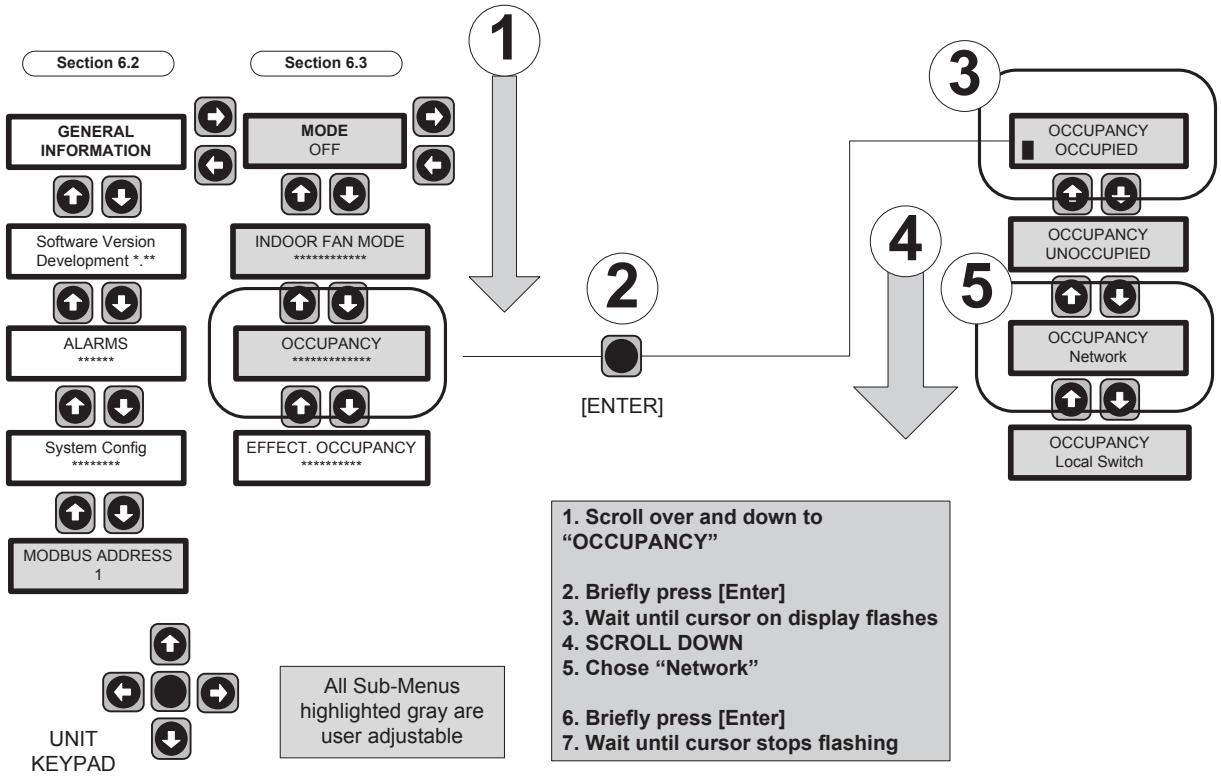


Figure 0-2

Check for any ALARMS on RTU-C Display. If any ALARMS are present, find source and clear ALARMS.

Scroll through the RTU-C Display using the Keypad and set to RUNTEST mode. Choose either Heating or Cooling runtest. Enter Password to start RUNTEST. Refer to “Initial Test Sequence” section 6.10, page 57.

Record temperatures and refrigerant pressures (if applicable) during the runtest.

Check for any ALARMS on RTU-C Display. If any ALARMS are present, find source and clear ALARMS (see section 6.12, page 58).

While monitoring communication network, press ID pin on communication card to send device ID on the communication card to the network. Refer to section 8.4.5 “Integration” page 115 of this manual for more detail.

Contents

RTU-C Control

1. General Information

Recognize this symbol as an indication of Important Safety Information!

WARNING

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WARNING

BEFORE BEGINNING ANY MODIFICATION, BE SURE MAIN DISCONNECT SWITCH IS IN THE "OFF" POSITION. FAILURE TO DO SO CAN CAUSE ELECTRICAL SHOCK RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH. TAG DISCONNECT WITH A SUITABLE WARNING LABEL.

CAUTION

Static sensitive components. Can cause equipment damage.

Discharge any static electrical charge by touching the bare metal inside the control panel before performing any service work. Never unplug cables, circuit board terminal blocks, or power plugs while power is applied to the panel.

NOTICE

This equipment generates, uses, and can radiate radio frequency energy and; if not installed and used in accordance with this instruction manual, may cause interference to radio communications. It 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. 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 their own expense.

The RKNL-C, RKNL-G 3 to 25 ton Package Gas Electric, RKNL-H 7 to 25 ton Package Gas Electric, RKHL-C 10 ton Package Gas Electric; RLNL-C 3 to 25 ton, RLNL-G 3 to 25 ton Package Air Conditioner, RLNL-H 7 to 25 ton Package Air Conditioner, RLHL-C 10 ton Package Air Conditioner, RJNL-C 3 to 10 Package Heat Pump and SLKL-C 7.5 to 25 Ton Package Air Conditioner each have a Rooftop Unit Controller (RTU-C) factory mounted and wired in their respective control panel. The RTU-C is a solid-state microprocessor-based control board that provides flexible control and extensive diagnostics for all unit functions. The RTU-C through proportional/Integral control algorithms performs specific unit functions that govern unit operation in response to zone conditions, system temperatures, system pressures, ambient conditions and electrical inputs. The RTU-C control features an LCD display and a five-button keypad for local configuration and direct diagnosis of the system.

Units with the integral Rooftop Unit Controller (RTU-C) are specifically designed to be applied in three distinct applications:

Third party Building Management System

In an application where a third party building management is in use or will be incorporated, units with the integral Rooftop Unit Controller (RTU-C) are communication compatible with the system that supports the BACnet Application Specific Controller device profile, LonMark Space Comfort Controller functional profile, or LonMark Discharge Air Controller functional profile. This is accomplished with a field installed BACnet or LonMark communication module.

BACnet Communication Module

The BACnet Communication Module allows communication between the RTU-C MODBUS network and the BACnet MSTP network. The communication module translates input and output variables between the RTU-C protocol and the BACnet protocol. The BACnet Communication module has been developed to communicate with the building automation systems that support the BACnet Application Specific Controller device profile. A zone sensor, a BACnet network zone sensor, a BACnet thermostat or DDC controller may be used to send the zone temperature or thermostat demands to the RTU-C.

The BACnet Communication Module is compatible with MSTP EIA-485 daisy chain networks communicating at 38.4 bps. It is compatible with twisted pair, shielded cables.

LonMark Communication Module

The LonMark Communication Module allows communication between the RTU-C MODBUS network and a LonWorks Network. The Communication module translates input and output variables between the RTU-C protocol and the LonTalk protocol. The LonTalk Communication Module has been developed to communicate with building automation systems that support the LonMark Space Comfort Controller (SCC) or Discharge Comfort Controller (DAC) functional profiles. A zone sensor, a LonTalk network zone sensor, or a LonTalk thermostat or DDC controller may be used to send the zone temperature or thermostat demands to the RTU-C.

The LonMark Communication Module utilizes an FTT-10A free topology transceiver communicating at 78.8 kbps. It is compatible with Echelon qualified twisted pair cable, Belden 8471 or NEMA Level 4 cables. The Module can communicate up to 1640 ft. with no repeater. The LONWORKS limit of 64 nodes per segment applies to this device.

Programmable 24 Volt Thermostat

Units with the integral Rooftop Unit Controller (RTU-C) are compatible with programmable 24 volt thermostat. Connections are made via conventional thermostat connection screw terminals. Extensive unit status and diagnostics are displayed on the LCD screen.

Zone sensor with time clock

Units with the integral Rooftop Unit Controller (RTU-C) are compatible with a zone sensor and mechanical or solid state time clock.

FEATURES

Each unit with the RTU-C has the following features:

Blower On/Off Delay
Adjustable time delay between blower on and off mode

Built-in Control Parameter Defaults
No programming required.

Compressor Time-off Delay
Adjustable time delay between compressor shutoff and start up

Dirty Filter Switch Input
The RTU-C will signal an increase in static pressure across the air filter, indicating a dirty filter condition.

On Board User Interface Display/Keypad
Displays control parameters, diagnostic codes, and sensor readings. The keypad allows scrolling through display menu and field configurable changes to be made.

Economizer Control
The economizer is controlled by the ELM (Economizer Logic Module) that comes with the economizer. The RTU-C communicates with the ELM for control, setpoint, and diagnostics. The RTU-C control has several choices for controlling the economizer. See Economizer Menu Screen. The ELM monitors the mixed air temperature, return air enthalpy (optional), minimum position set point (local or remote), power exhaust set point, CO_2 set point, CO_2, and outdoor enthalpy sensor, if selected, to control dampers to an accuracy of +/-5% of stroke. The actuator is spring returned to the closed position any time that power is lost to the unit. It is capable of delivering up to 44 inch pounds of torque and is powered by 24Vac.

Unit Diagnostics

The RTU-C monitors all sensors and functions related to unit operation to provide critical information and maintain diagnostic code information even if a power failure occurs.

Exhaust Fan Control Modes

Fans controlled by fresh air damper position. Setpoint is adjustable through the unit display and keypad.

Field Changeable Control Parameters

Over 50 different control parameters allow customization of the unit operation by changing delays, cooling stages, dead bands, and set points.

Minimum Compressor Run Time

Ensures proper oil return to the compressor.

Comfort Alert

The RTU-C control has two inputs to monitor optional Copeland Comfort Alerts. The inputs can provide the following information: Locked rotor, Open Circuits, Missing Phase, Reverse Phase, and Welded Contactor.

Smoke Alarm Mode

The input will shutdown the unit and requires manual resetting of power to the unit. The sensor is used to detect smoke due to fire in the air conditioning or ventilation ducts.

Lead Lag Compressor Operation

On units with two compressors, first stage (lead) compressor operation is based on compressor accumulated run time. After 100 hours of operation, the second stage compressor automatically becomes the lead compressor.

Staging

Depending on the unit controls up to 2 stages of cooling, 2 stages of gas heat, 2 stages of heat pump, and 2 stages of electric heat.

Active Protection

Provides active unit protection when any of the following occurs three times within a thermostat cycle: low pressure trip, high pressure trip, gas heat limit trip.

Thermostat Bounce Delay

Protects compressor from short cycling when mechanical thermostat is used.

Warm-up Mode Delay

Adjustable time that the economizer dampers are kept in the closed position during morning warm-up input.

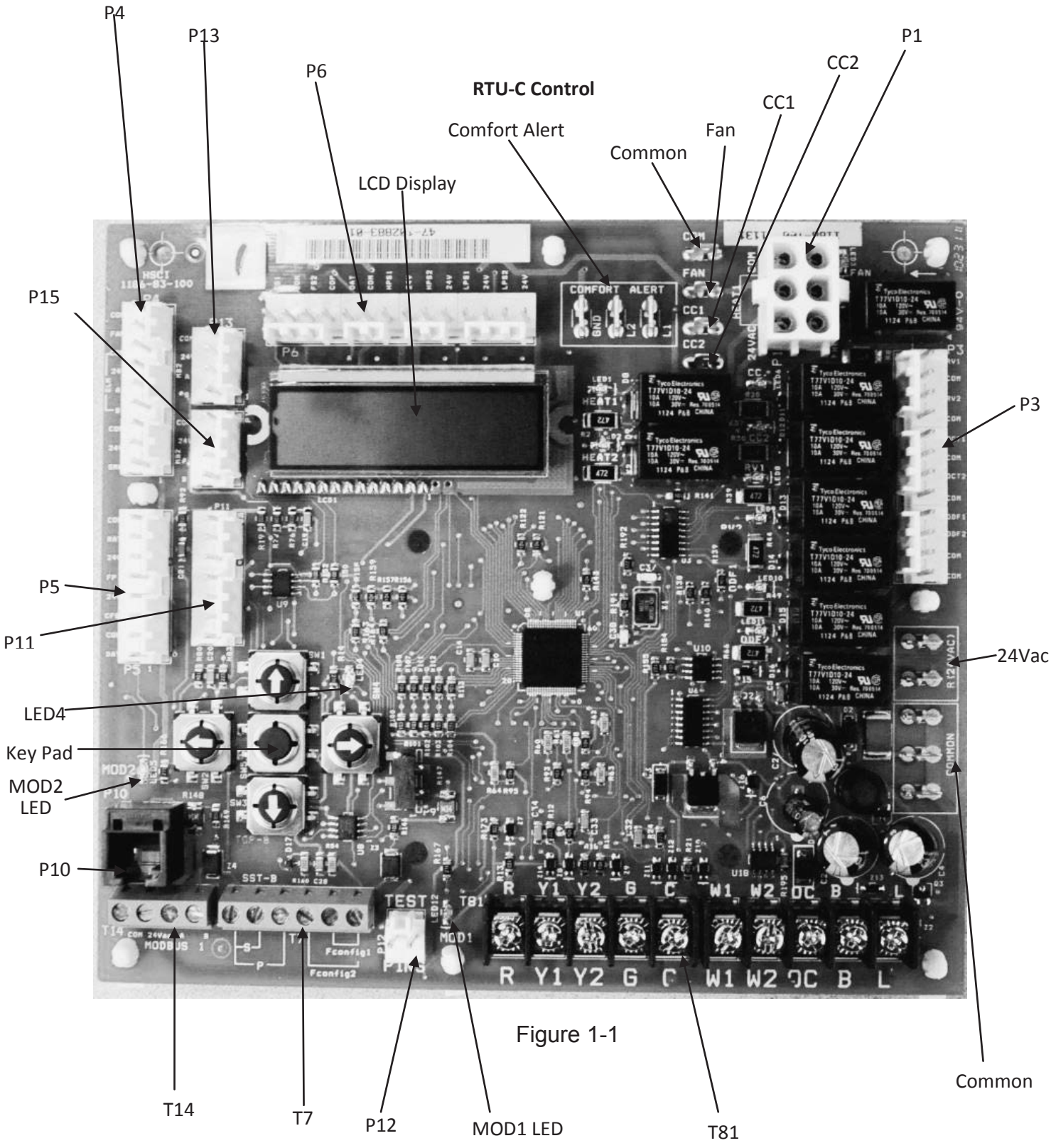

RTU-C Control
P4
P13
P6
P1
CC2
CC1
Comfort Alert
Fan
Common
LCD Display
P15
P3
P5
P11
24Vac
LED4
Key Pad
MOD2 LED
P10
T14
T7
P12
MOD1 LED
T81
Common
COMFORT ALERT
R Y1 Y2 G C W1 W2 OC B L
TEST
MODBUS

Figure 1-1

RTU-C Control
(See Fig 1-1)

P1	Electric heat connector.
Fan	Indoor blower motor connector.
CC1	Compressor1 connector.
CC2	Compressor 2 connector.
P3	Reversing valve 1, Reversing valve 2, Outdoor Coil temperature sensor 1, Outdoor Coil temperature sensor 2, Outdoor Fan 1, and Outdoor Fan 2 connector.
P4	Motorized Fresh Air Damper, Economizer Logic Module (ELM), and Smoke Detector connector.
P5	Return air temperature sensor, Fan proving switch, Clogged filter switch, and Discharge air temperature sensor connector.
P6	Freeze sensor 1, Freeze sensor 2, Outside air temperature sensor, High pressure switch 1, High pressure switch 2, Low pressure switch 1, and Low pressure switch 2 connector.
P10	RJ11 connector for factory run test (MODBUS1).
P11	Configurable pins used to set unit type.
P12	Test Pins to force defrost for heat pump models during factory run test, or during Field Commissioning (See Section 6.10 Initial Test Sequence).
P13	Connector to Integrated Furnace Control (IFC) – provides power and communication (MODBUS2) between RTU-C and IFC
P15	Connector to *e*SYNC™ control board – provides power and communication (MODBUS2) between RTU-C and *e*SYNC™ control.
T7	Field Installed Space Temperature Sensor with Setpoint and Override, Field configurable input 1, and Field configurable input 2 terminal block
T14	MODBUS1 terminal block [A= Data(-) Inverting pin, B = Data(+) Non-inverting pin]
T81	Thermostat screw terminals
Common terminals	Terminals used for 24 volt common connections & power supply
24 Volt terminals	Terminals used for 24 volt hot connections & power supply
Comfort Alert terminals	Terminals used to connect a Comfort Alert module
LED4	LED4 is blinking when the control has an ALARM present, solid when power is applied.
LED MOD2	LED5 is blinking when the control is communicating on the internal network (MODBUS2) between the IFC and/or economizer and/or *e*SYNC™ control.
LED MOD1	LED12 is blinking when the control is communicating (MODBUS1) between the RTU-C and field installed communication card, or external MODBUS network.

Table 1-1

2. Control Inputs

INPUTS			
1	ST - Space temperature	Thermistor 10kΩ	Field Installed (optional)
2	RAT - Return Air Temperature	Thermistor 10kΩ	Factory Installed
3	SAT - Supply Air Temperature	Thermistor 10kΩ	Factory Installed
4	OAT - Outside Air Temperature	Thermistor 10kΩ	Factory Installed
5	FS1 - Freeze Stat	Thermistor 10kΩ	Factory Installed
6	FS2 - Freeze Stat	Thermistor 10kΩ	Factory Installed
7	Field Configurable input #1	Thermistor 10kΩ	Field Installed (optional)
8	Field Configurable input #2	0-10 Vdc Analog input	Field Installed (optional)
9	SPA - Set point Adjustment	Resistance input	Field Installed (optional)
10	OCT1 – Outdoor Coil Temperature 1	Thermistor 10kΩ	Factory Installed
11	OCT2 – Outdoor Coil Temperature 2	Thermistor 10kΩ	Factory Installed
12	G - Thermostat fan input	24Vac	Field Installed (optional)
13	Y1 - Thermostat 1st stage compressor	24Vac	Field Installed (optional)
14	Y2 - Thermostat 2nd stage compressor	24Vac	Field Installed (optional)
15	W1 - Thermostat heating demand	24Vac	Field Installed (optional)
16	W2 - Thermostat heating demand	24Vac	Field Installed (optional)
17	B - Thermostat reversing valve	24Vac	Field Installed (optional)
18	HP1 - High Pressure Switch 1	24Vac	Factory Installed
19	LP1 - Low Pressure Switch 1	24Vac	Factory Installed
20	HP2 - High Pressure Switch 2	24Vac	Factory Installed
21	LP2 - Low Pressure Switch 2	24Vac	Factory Installed
22	Smoke Detector	24Vac	Factory or Field Installed
23	FP - Fan proving	24Vac	Factory Installed
24	CFS - Clogged Filter Switch	24Vac	Factory Installed
25	Occupied input	24Vac	Field Installed (optional)
26	L1 - Comfort Alert 1	Pulsed 24Vdc	Factory or Field Installed (optional)
27	L2 - Comfort Alert 2	Pulsed 24Vdc	Factory or Field Installed (optional)
28	Test pin	Pull-up resistor	
29	Configuration pins	Polarized Plug P11	Factory Installed

Table 2-1

2.1 Control Input descriptions

(1) ST – Space temperature - The space temperature sensor is used to measure the building zone temperature. Sensors should be located on an interior building wall.

(2) RAT – Return Air Temperature - The RTU-C control has a return air temperature input. This input is used to monitor system functionality and to provide diagnostics on how the system is operating. This sensor input can be used in place of the space temperature input. It also acts as a backup in case of a space temperature sensor failure.

(3) SAT – Supply Air Temperature - The RTU-C control has a supply air temperature input. This input is used to monitor system functionality and to provide diagnostics on how the system is operating.

(4) OAT - Outside Air Temperature - The outdoor air temperature sensor is factory installed in the unit to monitor the outside temperature. This temperature is used to control low ambient cooling lockout, high ambient heating lockout, demand defrost control calculations, and for *e*SYNC™ control functions.

(5) FS1 - Freeze Stat - When the thermistor reads a temperature below 37°F continuously for 15 minutes, the control will shutdown compressor #1 and continue to run the indoor blower. The system will return to normal operation when the thermistor reads a temperature above 42°F for 15 minutes.

(6) FS2 - Freeze Stat - When the thermistor reads a temperature below 37°F continuously for 15 minutes, the control will shutdown compressor #2 and continue to run the indoor blower. The system will return to normal operation when the thermistor reads a temperature above 42°F for 15 minutes.

(7) Field Configurable input #1 – Used for custom installation of a 10K ohm temperature sensor (e.g. discharge air temperature sensor installed in supply duct).

(8) Field Configurable input #2 - Used for custom installation of an analog input (e.g. 0-10Vdc input from outdoor airflow monitoring station or 0-10 Vdc indoor relative humidity sensor).

(9) SPA - Set point Adjustment - If the set point adjustment is enabled, than the control will consider a field-installed potentiometer input to determine occupied set points only. If the remote set point adjustment is enabled but the input reads an invalid number, the control will default back to the occupied set point selection.

(10) OCT1 – Outdoor Coil Temperature 1 – This is a thermistor input that is used to determine if a heat pump needs to initiate or terminate defrost. For non-heat pump models with the *e*SYNC™ control, this input is repurposed to measure the liquid line temperature for determination of refrigerant superheat. Models with dehumidification monitoring the liquid line temperature with this input.

(11) OCT2 – Outdoor Coil Temperature 2 - This is a thermistor input that is used to determine if a heat pump needs to initiate or terminate defrost.

(12) G - Thermostat fan input – This is a 24 volt input that is used to control the indoor fan when the RTU-C is used in conjunction with a thermostat.

(13) Y1 - Thermostat 1st stage compressor – This is a 24 volt input that is used to request the first stage of mechanical cooling when the RTU-C is used in conjunction with a thermostat.

(14) Y2 - Thermostat 2nd stage compressor - This is a 24 volt input that is used to request the second stage of mechanical cooling when the RTU-C is used in conjunction with a thermostat.

(15) W1 - Thermostat heating demand - This is a 24 volt input that is used to request the first stage of heating (electric heat or gas heat) when the RTU-C is used in conjunction with a thermostat.

(16) W2 - Thermostat heating demand - This is a 24 volt input that is used to request the second stage of heating (electric heat or gas heat) when the RTU-C is used in conjunction with a thermostat.

(17) B - Thermostat reversing valve - This is a 24 volt input that is used to request a change in the reversing valve position for heat pump mode when the RTU-C is used in conjunction with a thermostat. The reversing valve is energized in the heating mode.

(18 &20) HP1, HP2 - High Pressure Switch 1 & 2 - When the HPC is opened, the compressor for that circuit is turned off. The anti-short cycle delay will not allow the compressor to restart for a minimum of 3 minutes (default setting). If three consecutive open conditions occur during an active call for operation, the compressor will be locked out, a diagnostic message will appear on the LCD display and communicated to the network if applicable. Cycling the call for operation will restart the compressor. On dual compressor units only the affected compressor circuit is locked out.

(19 & 21) LP1, LP2 - Low Pressure Switch 1 & 2 - When the LPC is opened, the compressor for that circuit is turned off. The anti-short cycle delay will not allow the compressor to restart for a minimum of 3 minutes (default setting). The low pressure switch is ignored during defrost and for the first 90 seconds of compressor run time. If three consecutive open conditions occur during an active call for operation, the compressor will be locked out, a diagnostic message will appear on the LCD display, and an alarm will be sent to the Network if applicable. Cycling the call for operation will restart the compressor. On dual compressor units only the affected compressor circuit is locked out.

(22) Smoke Detector - The sensor is only applicable on units equipped with a smoke detector. The input will shutdown the unit and requires a manual reset. The sensor is used to detect smoke due to fire in the air conditioner or ventilation ducts.

(23)FP - Fan proving - The unit mounted fan proving switch monitors the pressure differential across the unit blower to detect when the indoor fan is blowing air. An alarm is sent to the LCD display (and Network if applicable) if the pressure differential indicates that the indoor blower is not operating. The control will also monitor the system and if the blower is running and is not required a fault will be sent to the RTU-C control.

(24) CFS - Clogged Filter Switch - The unit mounted clogged filter switch monitors the pressure differential across the return air filters. It is mounted in the filter section and is connected to the RTU-C control. A 24 Vac signal is sent to the LCD display if the pressure differential across the filters is equal to or greater than 0.5 i.w.c. The contacts will automatically open when the pressure differential across the filters decreases to approximately 0.4 i.w.c., the clogged filter output is operating, and the clogged filter switch has been closed for at least 2 minutes. The system will continue to operate regardless of the status of the filter switch.

(25) Occupied input (OC) - This is a 24 volt input that is used to control the occupancy (occupied or unoccupied mode) when the RTU-C is used in conjunction with a zone sensor and time clock. This input can also be connected to programmable thermostats with an occupancy output.

(26) L1, L2 - Comfort Alert - The RTU-C control has two inputs to monitor up to two compressor circuits using optional Copeland Comfort Alerts. The inputs can provide the following information: Locked rotor, Open Circuits, Missing Phase, Reverse Phase, and Welded Contactor. **Note: The Comfort Alert sends the Open Circuit Alarm (code 5) only after the fault has been sensed for a minimum of 4 hours.**

(28) Test pins – Shorting this input is used to force a defrost cycle for heat pump units during factory test mode.

(29) Configuration pins (P11) – The RTU-C Control features a pin header (P11) on board for the connection of a configuration key. This 7-position connector allows the control to determine the unit application mode without a menu entry. Table 2-2 describes the connections necessary for each one of the possible options. The configuration connector provides a quick and safe way of replacing boards while keeping the proper configuration of the unit.

#	P11 – Unit configuration	1	2	3	4	5	6	7
0	Cooling only – default							
1	Single stage Cooling with 2 stages EH	x	x					
2	Single stage HP/Cooling with 2 stages EH	x		x				
3	Single stage G/E(cool) with 1 stage GH	x			x			
4	2 stages G/E(cool) with 2 stages GH		x	x				
5	Single stage G/E(cool) with 2 stages GH		x		x			
6	2 stages cool with 2 stages EH			x	x			
7	2 stages HP/cool with 2 stages EH	x	x	x				
8	Single stage dual fuel	x	x		x			
9	2 stages dual fuel	x		x	x			
10	Single stage HP, 2 stages cool with 2 stages EH		x	x	x			
	Selection is made through the display	x	x	x	x			

Table 2-2

3. Control Outputs

OUTPUTS			
1	CC1 - Compressor output 1	24Vac	1.5A @ 24Vac, pilot duty
2	CC2 - Compressor output 2	24Vac	1.5A @ 24Vac, pilot duty
3	W1 - Heat output	24Vac	1.5A @ 24Vac, pilot duty
4	W2 - Heat Output	24Vac	1.5A @ 24Vac, pilot duty
5	G - Fan Output	24Vac	1.5A @ 24Vac, pilot duty
6	RV1 - Reversing Valve	24Vac	1.5A @ 24Vac, pilot duty
7	RV2 - Reversing Valve	24Vac	1.5A @ 24Vac, pilot duty
8	ODF1 - Outdoor Fan 1	24Vac	1.5A @ 24Vac, pilot duty
9	ODF2 - Outdoor Fan 2	24Vac	1.5A @ 24Vac, pilot duty
10	L - thermostat signal	24Vac	25mA loading

Table 3-1

3.1 System Output descriptions

(1) CC1 - Compressor output 1 - Energizes the compressor #1 contactor when required. The RTU-C control can monitor the system and respond to system faults and comfort alert inputs to shut down the compressors in the event of a failure.

(2) CC2 - Compressor output 2 - Energizes the compressor #2 contactor when required. The RTU-C control can monitor the system and respond to system faults and comfort alert inputs to shut down the compressors in the event of a failure.

(3) W1 - Heat output - Energizes the electric heat 1 relay when required to control the first stage of resistance electric heat.

(4) W2 - Heat Output - Energizes the electric heat 2 relay when required to control the second stage of resistance electric heat.

(5) G - Fan Output - Energizes the indoor fan relay unless a properly functioning IFC control is connected.

(6) RV1 - Reversing Valve – This output is used to energize reversing valve 1 in heating on heat pump models only. For non-heat pump models with humidity control this output is repurposed to switch the refrigerant liquid line solenoid valve. For non-heat pump models with the *e*SYNC™ control board, this output is repurposed to power an emergency water shut-off valve relay

(7) RV2 - Reversing Valve - This output is used to energize reversing valve 2 in heating on heat pump models only. For non-heat pump models with humidity control this output is repurposed to switch the refrigerant reheat solenoid valve.

(8) ODF1 - Outdoor Fan 1 - This output is used to de-energize outdoor fan 1 on heat pump models only. For non-heat pump models with humidity control this output is repurposed to allow Outdoor Fan Motor Speed Control (OFMC) while humidity control is active.

(9) ODF2 - Outdoor Fan 2 - This output is used to de-energize outdoor fan 2 on heat pump models only. For non-heat pump models with humidity control this output is repurposed to switch the refrigerant discharge line solenoid valve.

(10) L - thermostat signal – The “L” terminal will output a flash code to an indoor 24 V thermostat equipped with an “L” terminal.

4. Unit installation

Important – The RTU-C Control is shipped in the "OFF" Mode so units do not accidentally energize during installation. The commissioning of the rooftop unit therefore requires the configuration of the Mode menu prior to initial startup. See section 6.3.

The unit RTU-C control must have a thermostat or zone sensor input in order to operate the unit. If the zone sensor is not present, or has failed, the unit will use the return air temperature sensor to maintain the occupied setpoint. The flexibility of the unit mode capabilities depends upon the type of zone sensor or thermostat selected to interface with the RTU-C.

The following controls are available from the factory for field installation; refer to the unit's electrical schematic for the specific module connection:

Device	Model	Description
Standalone 24V Thermostat	(-)HC-TST3	Single stage – 1 Heat/1 Cool
Standalone 24V Thermostat	(-)HC-TST4	Multi Stage – 2 Heat/2 Cool – Can be used for Economizer Operation
Zone Sensor Module	(-)HC-ZNS1	Temperature Sensor & Timed Override Button
Zone Sensor Module	(-)HC-ZNS2	Temperature Sensor & Timed Override Button with Status Indicator
Zone Sensor Module	(-)HC-ZNS3	Temperature Sensor & Timed Override Button with Setpoint Adjustment
Indoor rh Sensor	(-)HC-ZNS4	Indoor Relative Humidity Sensor for Dehumidification
Indoor rh/Zone Sensor	(-)HC-ZNS5	Combination Indoor Relative Humidity Sensor & Space Temperature Sensor

(-) = R (Rheem) or U (Ruud)

WARNING

BEFORE BEGINNING ANY MODIFICATION, BE SURE MAIN DISCONNECT SWITCH IS IN THE "OFF" POSITION. DISCONNECT ALL ELECTRIC POWER, INCLUDING REMOTE DISCONNECT BEFORE SERVICING. FAILURE TO DO SO CAN CAUSE ELECTRICAL SHOCK RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH. FOLLOW PROPER LOCKOUT/TAG OUT PROCEDURES TO ENSURE THE POWER CANNOT BE INADVERTENTLY ENERGIZED.

4.1 Controls using 24 Vac

Before installing any connecting wiring, refer to the unit installation manual for AC conductor sizing guidelines "FIELD WIRE SIZE FOR 24 VOLT THERMOSTAT CIRCUITS", for the electrical access locations provided on the unit, and;

a. Use copper conductors unless otherwise specified.
b. Ensure that the AC control wiring between the controls and the unit's termination point does not exceed three (3) ohms/conductor for the length of the run.

NOTE: Resistance in excess of 3 ohms per conductor may cause component failure due to insufficient AC voltage supply.

c. Be sure to check all loads and conductors for grounds, shorts, and mis-wirings.
d. Do not run the AC low voltage wiring in the same conduit as the high voltage power wiring.
e. Some thermostat wire insulation has a voltage rating less than the line voltage. Route Thermostat Wire behind low voltage shield during unit installation per Figure 4-1. This is necessary to meet National Electrical Code (NEC) and UL 1995 (Underwriters Laboratories®, Inc.) requirements for separation of high and low voltage circuits.

4.2 Controls using DC Analog Input/Outputs (Standard Low Voltage Multi-conductor Wire)

Before installing any connecting wiring between the unit and components utilizing a DC analog input/output signal, refer to the unit installation manual for the electrical access locations provided on the unit.

a. Table 4-1 lists conductor guidelines when interconnecting the DC binary output devices and the system components utilizing a DC analog input/output signal to the unit. Use shielded cable for high EMI environments.

NOTE: Resistance in excess of 2.5 ohms per conductor can cause deviations in the accuracy of the controls.

b. Ensure that the wiring between controls and the unit's termination point does not exceed two and a half (2.5) ohms/conductor for the length of the run.
c. Do not run electrical wires transporting DC signals in or around conduit housing high voltage wires.
d. Most sensor wire insulation has a voltage rating less than the line voltage. Route Zone Sensor and Network Cable behind low voltage shield during unit installation per Figure 4-1. This is necessary to meet National Electrical Code (NEC) and UL 1995 (Underwriters Laboratories®, Inc.) requirements for separation of high and low voltage circuits.

Table 4-1 Zone Sensor Module Wire Guide

VENDOR	PART NUMBER	AWG	NUMBER OF CONDUCTORS	STRANDED / SOLID	LISTINGS
Honeywell/Genesis	4761	18	3	SOLID	18 AWG 3/C CL2P Thermostat
Honeywell/Genesis	4763	18	5	SOLID	18 AWG 5/C CL2P Thermostat
Honeywell/Genesis	3215	18	4	STRANDED	18 AWG 4/C Str OAS CMP-CL2P
Honeywell/Genesis	3280	22	2 PAIR	SOLID	22 AWG 2/PR Sol Shielded CMP-CL2P
Honeywell/Genesis	3281	22	2 PAIR	STRANDED	22 AWG STR 2/PR OAS CMP-CL2P

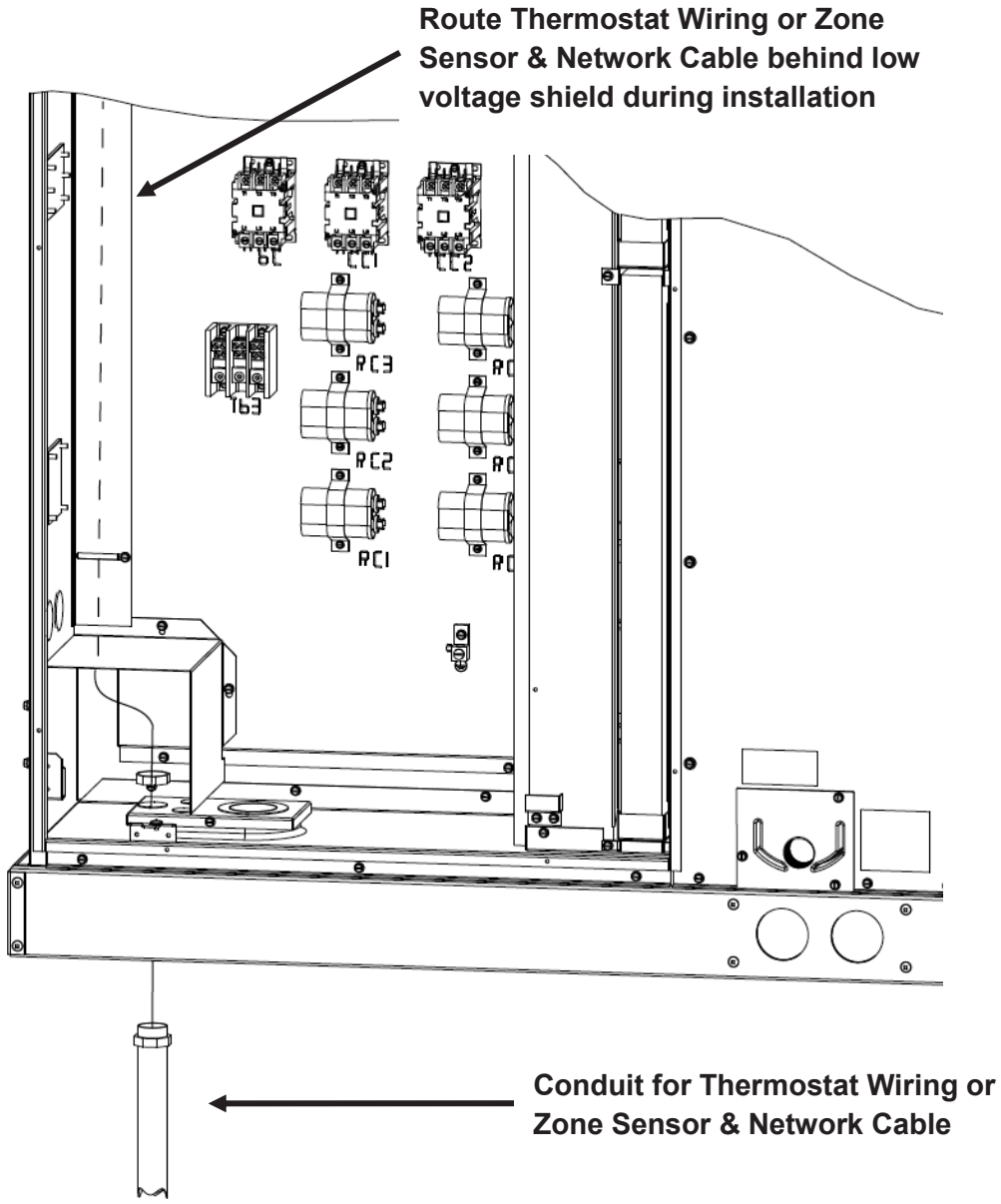

Route Thermostat Wiring or Zone Sensor & Network Cable behind low voltage shield during installation
RC3
RC2
RC1
Conduit for Thermostat Wiring or Zone Sensor & Network Cable

Figure 4-1

4.3 Stand alone with thermostat

Once Mode is set to “Control by Thermostat” the RTU-C will follow the commands from a regular 24Vac thermostat, according to the following convention:

G – Indoor fan

Y1 – First stage of compressor

Y2 – Second Stage of compressor

B – Reversing Valve, which is energized for heating operation

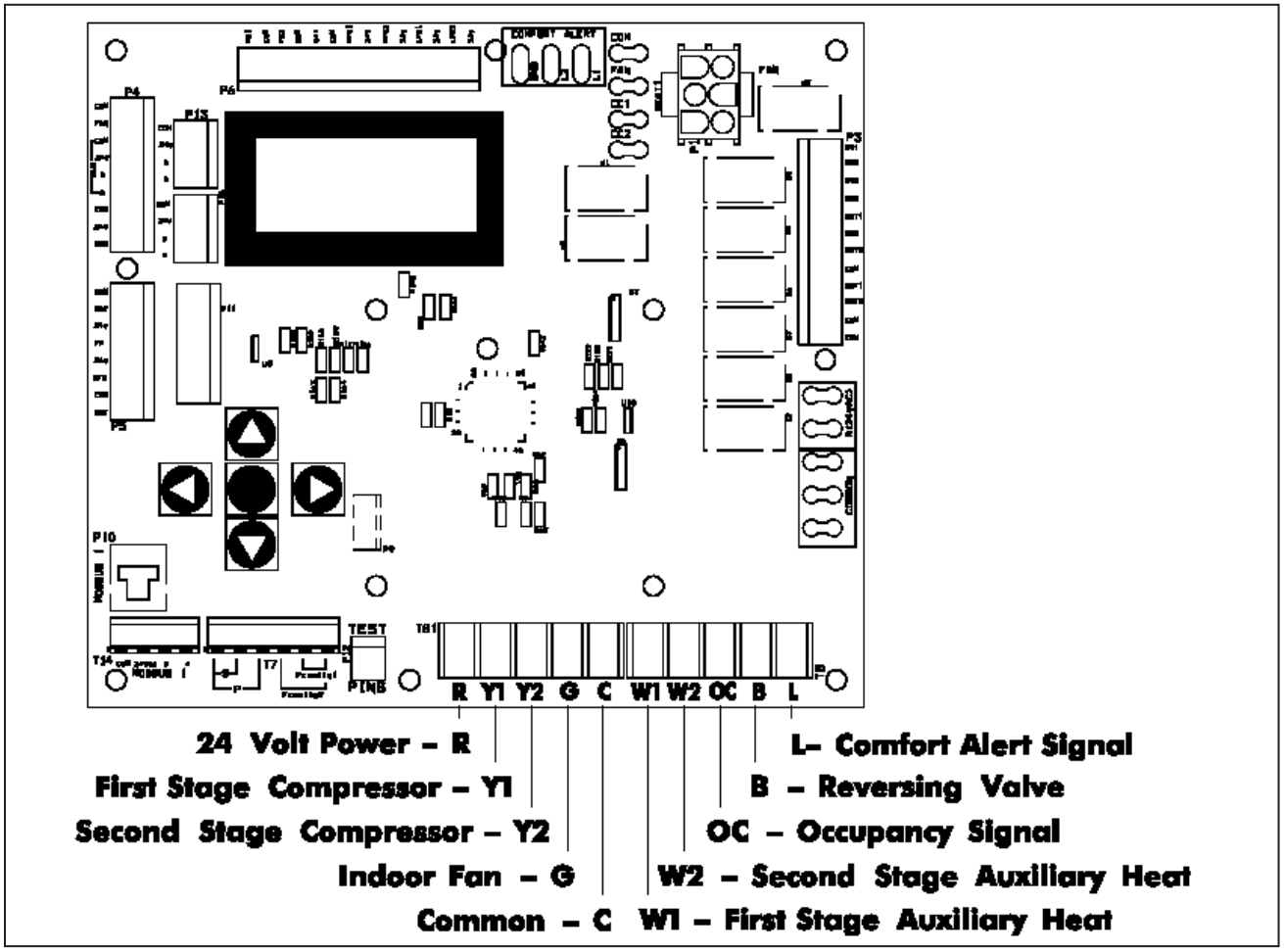
W1 – First Stage Auxiliary heat (electric or gas)

W2 – Second Stage Auxiliary heat (electric or gas)

L – Comfort Alert signal (output) or Flashing Alarm output

R & C – 24Vac

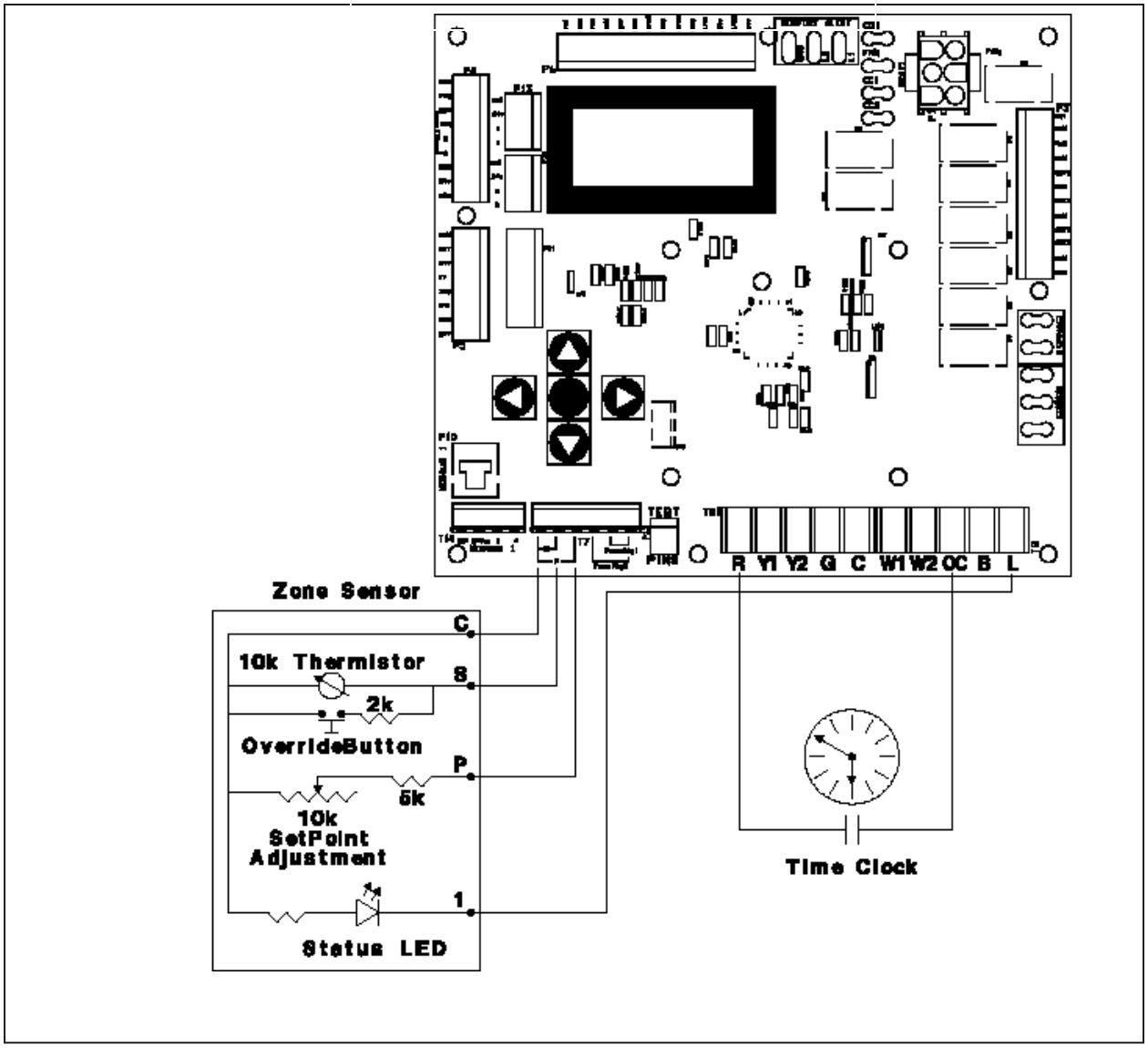
24 Volt Thermostat Inputs and Outputs



4.4 Stand alone with zone sensor and time clock

If Mode is set to any of the options other than “Off “and “Control By Thermostat”, the control will operate in Stand Alone mode or network using its local temperature sensors to determine demand. The system can be set up with a zone sensor to determine heat or cool demand and a solid state time clock to determine occupancy. (See section 6.3.3)

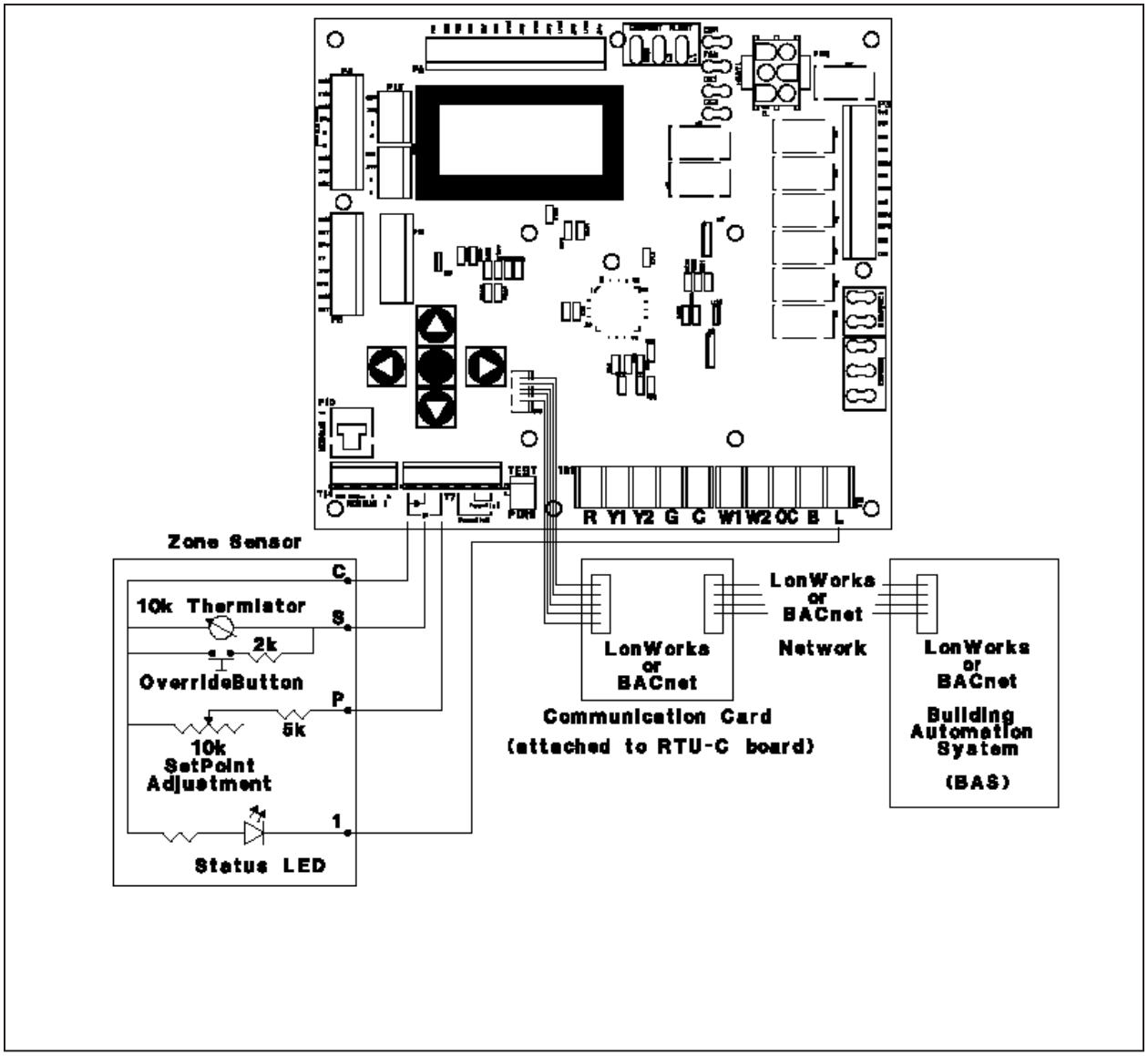
Stand alone with zone sensor and time clock



4.5 Zone sensor with BAS

If Mode is set to any of the options other than “Off “and “Control By Thermostat”, the control will operate in Stand Alone mode or network using its local temperature sensors to determine demand. The system can be set up with a zone sensor, RXRX-AY01 or RXRX-AY02 communication card, and 3rd party BAS that will be controlled from a central location.

Zone sensor with BAS

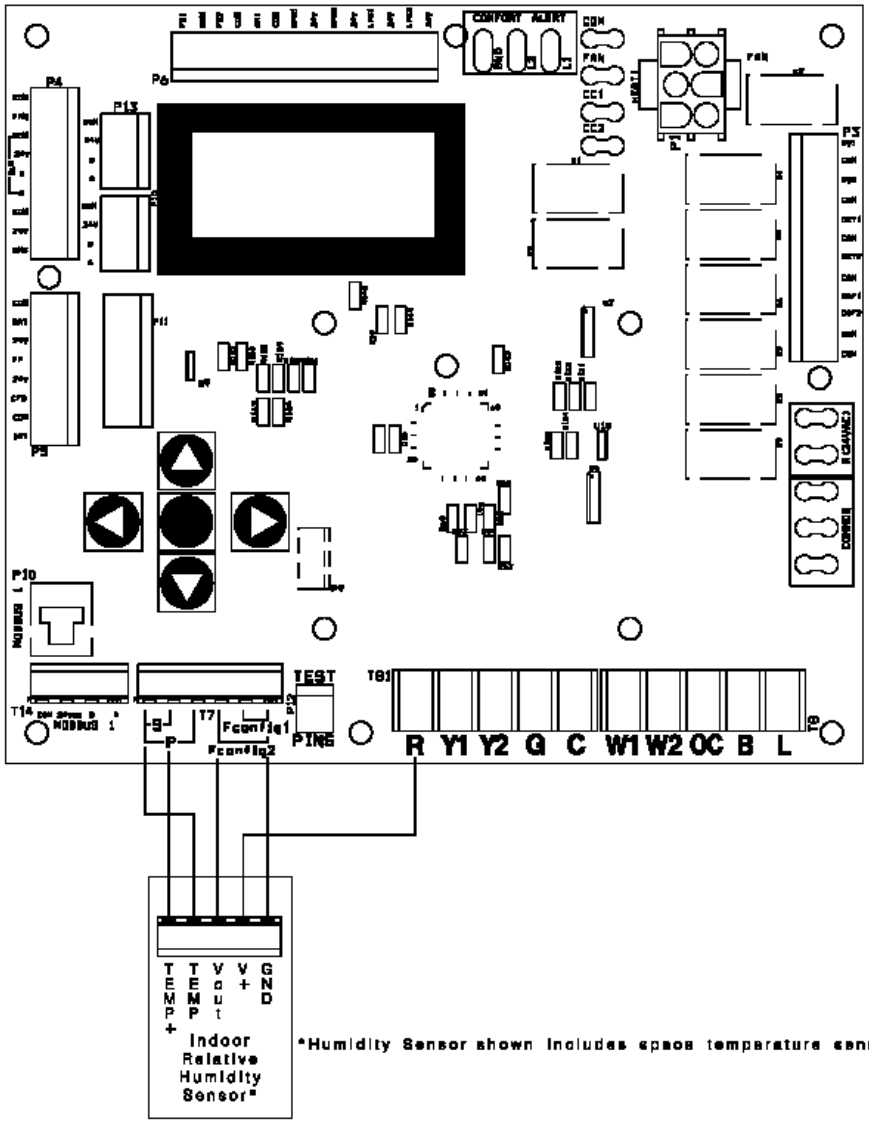


4.6 Indoor Relative Humidity Sensor

Field Configurable Input #2 can be used to connect an indoor relative humidity sensor that has a 0-10 Vdc output for a 0-100% indoor relative humidity input. The RKNL-G, RLNL-G models require this indoor relative humidity sensor to determine humidity control demand. Because this is a "powered" sensor an additional wire to the 24 Vac power supply from the unit is required. The "R" thermostat input can be used for this purpose. The indoor relative humidity sensor can be used along with thermostat control, a zone sensor with a time clock, or the RXRX-AY01 or RXRX-AY02 communication card and a 3rd party BAS that will be controlled from a central location.

Some models of the Indoor Relative Humidity Sensor (shown below) also have a space temperature sensor included eliminating the need for a separate zone sensor.

Indoor Relative Humidity Sensor with RTU-C



5. Sequence of operation

Important – The RTU-C Control is shipped with the control in the "OFF" mode so units do not accidentally energize during installation. The commissioning of the rooftop unit therefore requires the configuration of the Mode menu prior to initial startup. See section 6.3.1.

5.1 Cooling

When the RTU-C control receives a call for cooling via thermostat or zone sensor the first compressor stage energizes. After the indoor fan on delay (1-180 sec / default 10 sec) the indoor fan energizes. The indoor fan on delay starts when the call for cooling is initiated.

When used in local zone sensor mode of operation, the RTU-C control satisfies the set point using all or a partial number of stages available. When cooling demand exists, the RTU-C control will stage up in the following order: Economizer, First Stage Cooling, and Second Stage Cooling based on demand.

When used in local thermostat mode of operation, the RTU-C allows the thermostat to control the demand for cooling. When cooling demand exists, the RTU-C control will stage up in the following order: Economizer, First Stage Cooling. Only two stages will be allowed to energize, so if the economizer is active then the first stage mechanical cooling will become second stage and second stage mechanical cooling will not be used.

5.2 Heat

When in heating mode of operation, the RTU-C control satisfies the set point using all or a partial number of stages available. When heating demand exists, the RTU-C control will utilize heat sources in the following order of priority as available: Heat Pump, Gas Heat, and Electric.

When the heat demand requires multiple heating outputs at the same time, a minimum staging delay of 5 seconds between energizing and de-energizing heating outputs is necessary to prevent the inrush current startup of multiple loads. The inter stage is adjustable between 5 and 50 seconds.

The source of demand, like the other modes of operation, is a result of one of either thermostat or remote sensors.

5.3 Heat Pump

When the RTU-C control receives a call for heat pump via thermostat or zone sensor compressor 1 and reversing valve 1 energizes. After the indoor fan on delay (1-180 sec / default 10 sec) the indoor fan energizes. The indoor fan on delay starts when the call for heating is initiated.

During heat pump mode the control energizes the reversing valve along with the correspondent stages of compressor. Once the reversing valve is energized, it will remain energized until the unit exits the heat pump mode, thus avoiding the frequent noise associated with the equalization of the refrigerant pressure.

Whenever the system is equipped with reversing valves, the mechanical heating (heat pump) is considered the primary source of heat. Certain circumstances may prevent the heat pump from

operating, such as outdoor air temperature being below its set point, discharge air temperature below its set point, or alarms related to the compressor operation.

The heat pump operation is never available when the outdoor air temperature is below the low balance set point. Once the heat pump has been prevented from operating in such circumstances, it will only be available again if the outdoor air temperature exceeds the high balance set point. The control allows the user to adjust low and high balance set points through the display, as long as the selection provides a minimum difference of 5°F between the two. If for example the low balance set point was set at 35°F, the minimum high balance set point would be 40°F.

If the heating set point is not satisfied within the demand delay, additional stages of mechanical heating are engaged in operation. When those stages are complete, electric heat may work in conjunction with the compressors. However, if the secondary heat source is fossil fuel, the heat pump and gas furnace are exclusive and cannot work in conjunction with each other. As long as the outdoor air temperature is above the balance point, the heat pump will continue to operate without the Furnace, even if the set point is not satisfied. If the outdoor temperature crosses the low balance set point, then the heat pump will cease operation and the Furnace will be the only source of heat available to satisfy the effective ambient set point.

5.4 Integrated Furnace Control (IFC)

The IFC board will communicate to the RTU-C control via MODBUS interface.

5.4.1 Call for Heat

After a call for heat the IFC checks to ensure the high temperature limit and rollout switches are closed. If either is open, IFC responds with a fault code. If high limit and rollout switches are closed, the IFC checks that both sets of draft inducer pressure switches are open (some units have multiple low fire and multiple high fire draft inducers). If either pressure switch set is closed, the IFC will respond with a fault code and it will flash code "2" on the LED, waiting indefinitely for both sets of pressure switches to open. If both pressure switches are open, the IFC proceeds to pre-purge.

5.4.2 Pre-Purge

The IFC energizes the low inducer motor, flashes code "2" on LED, and waits for the low pressure switch to close. If the low pressure switch does not close within 3 minutes, the control will energize the high inducer and wait for both pressure switches to close. The IFC will light on high fire and remain on high fire for the remainder of the heat cycle.

When the low pressure switch has closed, the IFC stops flashing the LED and begins timing the 30 second pre-purge period. If flame is sensed as present during pre-purge, the IFC restarts the pre-purge time to require a full pre-purge after flame is removed. When pre-purge time has expired, the IFC begins the ignition trial.

5.4.3 Ignition Trial

The IFC energizes the gas valve and spark. The IFC ignores flame sense for the first 2 seconds of the ignition trial. If flame is not established within 7 seconds, the gas valve and spark is de-energized and

the IFC goes to an inter-purge. If flame is established, the spark is de-energized, the IFC energizes the high inducer (low inducer remains energized) and begins heat blower on delay.

5.4.4 Heat Blower On delay

The control waits for 45 second heat fan on delay and then energizes the indoor blower heat speed. If the blower is already energized by a call for cooling or continuous fan, or in a blower off delay period, the on delay is skipped and the blower remains energized. After the blower on delay time is complete, the control goes to high fire warm-up mode.

The high pressure switch is ignored during the heat blower on delay to give time for the high pressure switch to close if lighting on low fire.

5.4.5 High-fire warm-up

The IFC remains on high fire for 120 seconds after flame is established. If the RTU-C is calling for 2nd stage heat, the IFC remains in high heat. If the IFC lit on high fire because the low pressure switch did not close within 3 minutes, then the IFC remains on high fire for the entire call for heat regardless of 2nd stage thermostat call. If there is no RTU-C demand for 2nd stage heat when the 120 second time has expired, the IFC transitions from high heat to low heat.

5.4.6 Low Heat

IFC inputs are continuously monitored to ensure limit, rollout, and pressure switches are closed, flame is established, and the thermostat call for heat remains. Low gas, low inducer, and blower remain energized. If the RTU-C calls for 2nd stage heat (Hi Heat), the IFC transitions to high heat.

5.4.7 High heat

IFC inputs are continuously monitored to ensure limit, rollout, and pressure switches are closed, flame is established, and the RTU-C calls for heat remain. Low gas, high gas, low inducer, high inducer, and blower remain energized. If the RTU-C terminates the call for 2nd stage heat and the first stage call remains, the IFC transitions to low heat.

5.4.8 Low heat to high heat transition

When the RTU-C calls for 2nd stage heat after low heat is established, the IFC checks the high pressure switch. If the high pressure switch is closed, the IFC flashes "2" on the LED and waits indefinitely for the high pressure switch to open. When the high pressure switch is proven open, the IFC energizes the high inducer motor and waits for the pressure switch to close. If the high pressure switch does not close within 60 seconds, the control flashes "2" on the LED and de-energizes the high inducer motor for 5 minutes. The high inducer is re-energized after the 5 minute period for 60 seconds and the cycle repeats indefinitely until the high pressure switch closes. When the high pressure switch closes, the IFC energizes the high gas output and proceeds to high heat.

5.4.9 High heat to low heat transition

When the RTU-C ends the call for 2nd stage heat and the first stage call remains, the IFC de-energizes the high gas output. The high inducer remains energized for 60 seconds after the high gas de-energizes. The IFC proceeds to low heat.

5.4.10 Post Purge

When the RTU-C demand for heat is satisfied, the IFC immediately de-energizes the gas valve(s). The Inducer output(s) remains on for a 5 second post-purge period. The IFC continues the heat blower off delay.

5.4.11 Heat Blower off delay

The IFC de-energizes the Indoor blower motor 90 seconds after the call for heat terminated

5.4.12 Interrupted Call for heat

If the RTU-C demand for heat is removed before the ignition period, the IFC will immediately de-energize the inducer.

If the RTU-C demand for heat is removed after ignition has begun, the induced draft motor will run through a post purge and the indoor blower motor will run on heat speed for the delay off time.

5.4.13 Ignition Retry

If flame is not established on the first trial for ignition period, the induced draft motor remains energized and the IFC de-energizes the low gas valve. The IFC waits for a 60 second inter-purge period then attempts an ignition re-try. If the second ignition trial is unsuccessful, the IFC energizes the high inducer and waits indefinitely for the high pressure switch to close. When the high pressure switch closes, the IFC energizes the high gas output, interpurges 60 seconds and tries the 3rd and 4th ignition attempts on high fire.

If flame is not established on the fourth trial for ignition, the IFC de-energizes the high and low gas outputs and goes into lockout. IFC indicates a fault code through MODBUS and the LED flashes a fault code of "1" to indicate lockout is due to failed ignition.

5.4.14 Ignition Recycle

If flame is established and maintained during the trial for ignition period and then flame is lost, the gas valve is de-energized, the induced draft motor continues to run, and the control begins timing the pre-purge delay. The indoor blower motor will be energized and/or remain energized on heat speed for the delay off time.

When the pre-purge delay is over, the control energizes the spark and gas valve for an ignition attempt. If ignition is unsuccessful, the IFC will attempt up to 3 more retries as described above. The IFC will recycle up to 17 flame losses (16 recycles) within a single call for heat before going to lockout. The IFC flashes an error code of "1" if lockout is due to too many flame losses. (This is the same flash code as failed ignition.).

5.4.15 Open Limit switch

The limit switch is ignored unless a call for heat is present. If the limit switch opens while a call for heat is present, the indoor fan is energized on heat speed and both inducers are energized. The gas valve is de-energized if it was energized. The status LED will flash 3 times indicating the Limit switch is open. The blower and inducers will remain energized as long as the limit is open and there is a call for heat.

If the call for heat goes away while the limit switch is open, the induced draft motor will run through post purge and the indoor blower will run through the heat fan off delay. The status LED will return to steady on.

If the limit switch re-closes and the call for heat remains, the status LED will return to steady on and the IFC will begin a pre-purge time with high gas output energized to begin a re-ignition attempt. The indoor blower remains on (for the delay off time) through the re-ignition attempt.

5.4.16 Open Rollout switch

The rollout switch is ignored unless a call for heat is present and the limit switch is closed. If the rollout switch opens for more than 1 second, the indoor fan is energized on heat speed for a heat blower off delay period and the inducer motor is energized for a post-purge time period. The gas valve is de-energized if it was energized. The status LED flashes an error code of "5" indicating the rollout switch is open and the IFC is in lockout.

If the rollout switch re-closes before the call for heat goes away, the IFC will remain in lockout with the LED flashing an error code of "5". Lockout may be reset by conditions specified in section 5.4.21.

Note: Rollout switch open for less than 1 second will cause interrupted heat cycle from open PS, however it will not lock out.

5.4.17 Pressure switch

The pressure switches are ignored unless a call for heat is present and the limit and rollout switches are closed. When a call for heat occurs and either pressure switch is closed before the inducer is energized, the inducer will remain off and the control will flash an error code of "2" on the LED until both pressure switches open.

If either pressure switch opens before the ignition period, both induced draft motor will remain on, the high gas output will be de-energized, and the LED will flash an error code of "2". When both pressure switches are closed, the LED flash code is cleared, the high gas output is energized, and the control re-starts the pre-purge period.

If the low pressure switch opens after the gas valve has been energized, the control will de-energize both gas outputs and run the indoor blower on heat speed through the fan off delay. The low inducer remains energized and the high inducer energizes if it was not already energized. When both pressure switches re-close, the control begins the pre-purge period and re-ignites. If the call for heat goes away before the pressure switches close, both inducer motors are de-energized and the control goes to standby.

If the high pressure switch opens while in high heat and the low pressure switch remains closed, the control de-energizes the high gas output and attempts to reestablish high heat.

5.4.18 Call for Fan

When the RTU-C calls for continuous fan (Cont Fan) without a call for heat, the indoor fan is immediately energized. The fan remains energized as long as the call for fan remains without a call for heat.

The continuous fan operation continues to function while the control is in heat mode lockout.

5.4.19 Undesired Flame

If flame is sensed longer than 2 seconds while the gas valve is de-energized, the IFC shall energize both induced draft motors and indoor blower motor. When flame is no longer sensed, the induced draft motors and indoor blower motor will de-energize. The IFC will do a soft lockout, but will still respond to open limit and flame. The status LED shall flash a code of "4" when lockout is due to undesired flame. If there is no call for heat, or the call for heat is removed, lockout will reset.

5.4.20 Gas Valve relay fault

If the IFC senses the gas valve is energized for more than 1 second when the control is not attempting to energize the gas valve, or if the gas valve is sensed as not energized when it is supposed to be energized, then the IFC will lockout with the LED off. The IFC assumes either the contacts of the relay driving the gas valve have welded shut, or the sensing circuit has failed. The inducer is forced off to open the pressure switch to stop gas flow unless flame is present.

If the gas valve was sensed as closed when it should be open, and has not de-energized after the inducer was shut off for 15 seconds, then both inducers are re-energized to vent the unburned gas.

5.4.21 Soft Lockout

The IFC shall not initiate a call for heat while in lockout. A call for continuous fan operates as normal. The IFC will still respond to an open limit and undesired flame.

Lockout shall automatically reset after 1 hour. Lockout may be manually reset by removing the thermostat call for heat for more than 3 seconds or removing power from the control for more than 5 seconds.

5.4.22 Hard lockout

If the IFC detects a fault, the status LED will be de energized and the IFC will lockout as long as the fault remains. Hard lockout may be reset by removing power to the control for more than 5 seconds. Faults detected within the microcontroller continually re-test to see if they are hard failures. Failures detected within the flame sense or gas valve drive circuits re-test every 1 hour.

5.5 Electric Heat

The RTU-C control will always consider two available stages of electric heat, although installation may have only one.

The electric heat is energized whenever the demand for heat is not satisfied. The electric heat will work as primary or secondary heat source, depending on the unit configuration. If it is the primary heat source it will be staged on based on demand.

During electric heat operation the control does not delay energizing the indoor fan.

6. User Interface

6.1 Keypad

The right and left keys allow the user to select among the different groups of menus. The up and down keys allow the user to vertically scroll through sub-menus within the menu group. Up and down keys also allow the input of certain parameters (highlighted in Figure 6-3), such as set points and time delays. Before changing any parameters please see the appropriate sections and have a full understanding of what you are changing. This adjustment is only possible when a blinking cursor is over or next to the parameter to be adjusted. The blinking cursor is available for adjustable parameters after the user presses the center key (enter) while the value in question is shown on the display. Once the process of adjustment is made, the user must press the center key (enter) again for the change to take effect (Note: please pause for a second after changing the parameter before pressing the center key (enter) or the change may not be accepted). During the adjustment, either left or right keys work as "escape" so the parameter reverses back to its original value and the cursor is no longer visible.

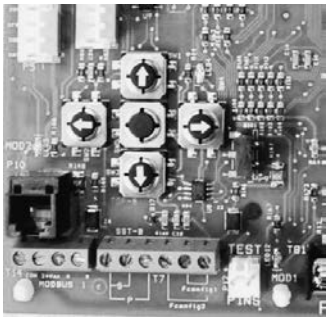


Figure 6-1

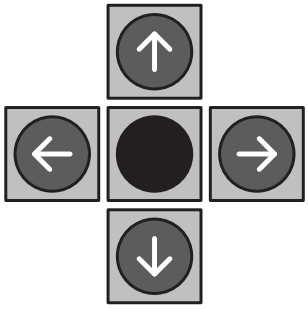
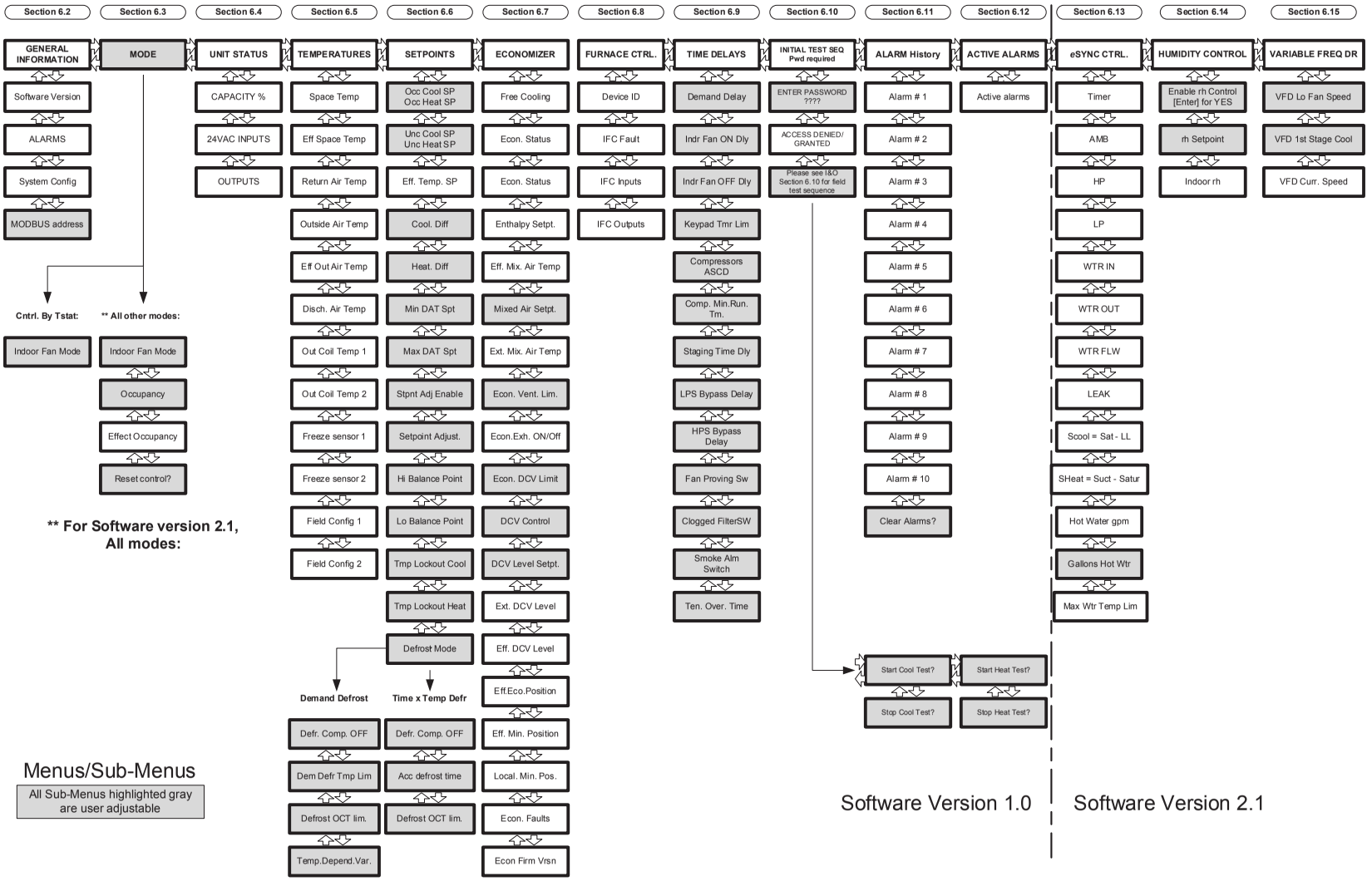


Figure 6-2


Section 6.2
Section 6.3
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Section 6.15
GENERAL INFORMATION
MODE
UNIT STATUS
TEMPERATURES
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FURNACE CTRL.
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INITIAL TEST SEQ Pwd required
ALARM History
ACTIVE ALARMS
eSYNC CTRL.
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VARIABLE FREQ DR
Software Version
ALARMS
System Config
MODBUS address
CAPACITY %
24VAC INPUTS
OUTPUTS
Space Temp
Eff Space Temp
Return Air Temp
Outside Air Temp
Eff Out Air Temp
Disch. Air Temp
Out Coil Temp 1
Out Coil Temp 2
Freeze sensor 1
Freeze sensor 2
Field Config 1
Field Config 2
Occ Cool SP
Occ Heat SP
Unc Cool SP
Unc Heat SP
Eff. Temp. SP
Cool. Diff
Heat. Diff
Min DAT Spt
Max DAT Spt
Stpnt Adj Enable
Setpoint Adjust.
Hi Balance Point
Lo Balance Point
Tmp Lockout Cool
Tmp Lockout Heat
Defrost Mode
Free Cooling
Econ. Status
Econ. Status
Enthalpy Setpt.
Eff. Mix. Air Temp
Mixed Air Setpt.
Ext. Mix. Air Temp
Econ. Vent. Lim.
Econ.Exh. ON/Off
Econ. DCV Limit
DCV Control
DCV Level Setpt.
Ext. DCV Level
Eff. DCV Level
Eff.Eco.Position
Eff. Min. Position
Local. Min. Pos.
Econ. Faults
Econ Firm Vrsn
Device ID
IFC Fault
IFC Inputs
IFC Outputs
Demand Delay
Indr Fan ON Dly
Indr Fan OFF Dly
Keypad Tmr Lim
Compressors ASCD
Comp. Min.Run. Tm.
Staging Time Dly
LPS Bypass Delay
HPS Bypass Delay
Fan Proving Sw
Clogged FilterSW
Smoke Alm Switch
Ten. Over. Time
ENTER PASSWORD ????
ACCESS DENIED/ GRANTED
Please see I&O Section 6.10 for field test sequence
Alarm # 1
Alarm # 2
Alarm # 3
Alarm # 4
Alarm # 5
Alarm # 6
Alarm # 7
Alarm # 8
Alarm # 9
Alarm # 10
Clear Alarms?
Active alarms
Timer
AMB
HP
LP
WTR IN
WTR OUT
WTR FLW
LEAK
Scool = Sat - LL
SHeat = Suct - Satur
Hot Water gpm
Gallons Hot Wtr
Max Wtr Temp Lim
Enable rh Control [Enter] for YES
rh Setpoint
Indoor rh
VFD Lo Fan Speed
VFD 1st Stage Cool
VFD Curr. Speed
Cntrl. By Tstat:
** All other modes:
Indoor Fan Mode
Indoor Fan Mode
Occupancy
Effect Occupancy
Reset control?
** For Software version 2.1, All modes:
Demand Defrost
Time x Temp Defr
Defr. Comp. OFF
Dem Defr Tmp Lim
Defrost OCT lim.
Temp.Depend.Var.
Defr. Comp. OFF
Acc defrost time
Defrost OCT lim.
Start Cool Test?
Stop Cool Test?
Start Heat Test?
Stop Heat Test?
Menus/Sub-Menus
All Sub-Menus highlighted gray are user adjustable
Software Version 1.0
Software Version 2.1

Figure 6-3

6.2 General Information Screen

This is the homepage of the system. The software version is programmed in the factory and cannot be changed. The item “Alarms” is dependent upon the existence of an alarm and it may display either “No Active Alarm” or “CHECK ALARMS!” Another screen outside this group shows the details of existing alarms. The option for system configuration is set with a configuration key from the factory. The MODBUS Address has a default value of “1” and should not be changed unless the RTU-C is directly connected to a Building Automation System (BAS) that uses MODBUS as the communication protocol.

GENERAL INFORMATION
Software Version X.X
Alarms No Active Alarm / CHECK ALARMS!
System Config 2stg COOL ONLY 1s Cool 2s Elec 1s HP/Cool 2s EL 1s G/E 1s G/H 2s G/E 2s GH 1s G/E 2s GH 2s Cool 2s Elec 2s HP/C 2s Elec 1stg Dual Fuel 2stg Dual Fuel 1sHP 2sCool 2sEH
MODBUS ADDRESS 1

Table 6-1

At power up or after a period of time of 5 minutes (display delay) without the selection of any buttons the system returns to a modified version of this screen, and resumes scrolling through the items of this group.

The modified general information screen automatically scrolls through the different menu items described in the following table, at 2-second intervals. When the user presses any button, the changing of screens stops until the display delay expires.

Software Version X.X
ALARMS No Active Alarm / CHECK ALARMS!
System Config xxxxxx
MODE OFF AUTO FAN ONLY HEAT ONLY COOL ONLY Ctrl by Tstat
UNIT STATUS STANDBY Fan Only COOL STG1 ECON COOL STG2 CC/ECO COOL STG1 COMP COOL STG2 COMP HEAT STG1 COMP HEAT STG2 COMP HEAT STG1 ELEC HEAT STG2 ELEC HEAT STG1 GAS HEAT STG2 GAS HEAT STG2 CC/ELE HEAT STG3 CC/ELE HEAT STG4 CC/ELE Defrost 1 Defrost 2

6.3 MODE Screen

The MODE screen determines whether the unit is connected to a network, a regular thermostat, or if it is just using its local sensors for controlling the temperatures . It also determines the indoor fan operation, whether it is operating in occupied mode, unoccupied mode, or tenant override and displays the effective occupancy.

MODE
OFF
AUTO
FAN ONLY
HEAT ONLY
COOL ONLY
Ctrl by Tstat
INDOOR FAN MODE
Continuous
Auto
Cont when occup.
OCCUPANCY
Occupied / Unoccupied / Network / Local Switch
EFFECT.OCCUPANCY
Occupied / Unoccupied / TntOverr XXX min
Reset control?
[Enter] for YES

Table 6-2

6.3.1 MODE

The Mode is available through network and user interface. The possible selections are:

- Off
- Auto
- Cooling only
- Heating only
- Fan Only
- Control by thermostat: not available through network. This is exclusive to the human interface.

Off mode is the default factory selection, so units do not accidentally energize during installation. The commissioning of the rooftop unit therefore requires the configuration of the Occupied Mode register prior to initial startup.

Auto mode is used with a zone sensor and solid state time clock.

6.3.2 INDOOR FAN MODE

The INDOOR FAN MODE is the option that decides the Indoor fan function. It includes the following options.

- Continuous
- Auto
- Cont. when occup.

Continuous is used if it is desired that the fan runs all the time regardless of Effect Occupancy. The Auto option allows the fan to cycle with the heat or cool call regardless of Effect Occupancy. The Cont. when occup. option lets the indoor fan run continuous when Effect Occupancy is occupied.

6.3.3 OCCUPANCY

The OCCUPANCY is only available through human interface and includes the following options:

- Manual Occupied
- Manual Unoccupied
- Network
- Local Switch

Manual Occupied and Manual Unoccupied have priority over other selections of occupancy. Those selections are not limited in time and the BAS system does not have the ability to change them.

If the end user desires to relinquish the occupancy control to the Building Automation System, they must set the Occupancy to “Network.”

The Local Switch option allows the determination of occupied mode through a hardwired 24Vac signal, identified as “OC” in connector T8. If that input is connected to “R” (24Vac), the unit is operating in occupied mode; otherwise it operates in unoccupied mode.

6.3.4 Effective Occupancy

Tenant Override, Occupied, or Unoccupied will be displayed depending on the actual mode. The RTU-C control allows separate adjustment of temperature set points and fan operation according to the building occupancy. This feature is only available when a thermostat is not controlling the ambient.

For the following sections, Occupied Mode implies that the calculation for demand utilizes occupied set points, which are used to satisfy the comfort in the ambient. Unoccupied mode utilizes unoccupied set points and is normally set to save energy during periods in which buildings are closed and unoccupied. Tenant Override Mode is a state in which the control utilizes occupied set points for a limited amount of time, after which it returns to unoccupied mode. To start Tenant Override, the user presses a button on

the space sensor for more than 2 seconds. The Tenant Override period is adjustable between 2 and 6 hours and it has priority over any other settings.

All set points are available via network and local human interface.

6.3.5 Reset control?

By pressing the [Enter] key, this feature enables one to reset all of the RTU-C adjustable menu items back to the factory "default" values.

6.4 UNIT STATUS Screen

The unit status screen shows basic information about the operation of the unit, such as actual mode of operation, capacity of cooling or heating, inputs, and outputs.

UNIT STATUS	
Mode	STANDBY Fan Only COOL STG1 ECON COOL STG2 CC/ECO COOL STG1 COMP COOL STG2 COMP HEAT STG1 COMP HEAT STG2 COMP HEAT STG1 ELEC HEAT STG2 ELEC HEAT STG1 GAS HEAT STG2 GAS HEAT STG2 CC/ELE HEAT STG3 CC/ELE HEAT STG4 CC/ELE Defrost 1 Defrost 2
CAPACITY Heating: / Cooling:	0 – 100%
24Vac Inputs	24Vac Inputs Y1 – ON/OFF Y2 – ON/OFF W1 – ON/OFF W2 – ON/OFF B – ON/OFF G – ON/OFF OCC – ON/OFF LPS1 – ON/OFF LPS2 – ON/OFF HPS1 – ON/OFF HPS2 – ON/OFF CFS – ON/OFF SMKS – ON/OFF FPS – ON/OFF
Outputs	OUTPUTS Compressor 1 – ON/OFF Compressor 2 – ON/OFF Rev Vlv 1 – ON/OFF Rev Vlv 2 – ON/OFF Heat 1 – ON/OFF Heat 2 – ON/OFF Outdr Fan 1 – ON/OFF Outdr Fan 2 – ON/OFF Indoor Fan – ON/OFF

Table 6-3

6.5 Temperature Screen

The temperature screen shows all available temperature readings in the system. If any sensors are not available, the control will either show “Sensor shorted” or “Sensor open” messages.

Temperatures
Space Temp XXX °F
Eff Space Temp XXX °F
Return Air Temp XXX °F
Outside Air Temp XXX °F
Eff Out Air Temp XXX °F
Disch. Air temp XXX °F
Outdoor Coil temp 1 XXX °F
Outdoor Coil temp 2 XXX °F
Freeze Sensor 1 XXX °F
Freeze Sensor 2 XXX °F
Field Config 1 XXX °F
Field Config 2 XXX V

Table 6-4

6.6 Set points Screen

These screens allow the input of desired cooling, heating, and defrost set points.

SETPOINTS		
Occ Cool Spt XXX °F Occ Heat Spt XXX °F	Cooling: 40 to 100°F, default 76°F Heating: 36 to 96°F, default 68°F	
Unc Cool Spt XXX °F Unc Cool Spt XXX °F	Cooling: 40 to 100°F, default 86°F Heating: 36 to 96°F, default 56°F	
Cool. Diff. X.X °F	0.5 to 9.9°F, default 1.0°F	
Heat Diff. X.X °F	0.5 to 9.9°F, default 1.0°F	
Min DAT Spt XXX °F	10 to 90°F, default 55°F	
Max DAT Spt XXX °F	50 to 120°F, default 55°F	
Stpnt Adj Enable	Enable / Disable	
Setpoint Adjust. XXX °F	36 to 100°F, default 76°F	
Hi Balance Point XXX °F	0 to 120°F, default 40°F	
Lo Balance Point XXX °F	0 to 120°F, default 5°F	
Tmp Lockout Cool XXX °F	0 to 50°F, default 35°F	
Tmp Lockout Heat XXX °F	70 to 145°F, default 90°F	
Defrost Mode	No Defrost Demand Defrost Time x Temperature Defrost	Default - Demand Defrost (heat pump models)
Time x Temp Defrost (conditional to previous selection)	Defr. Comp. OFF: 90sec to 1sec, default 3sec Acc defrost time: 90min to min 1min, default 60min Defrost OCT lim: 80°F to 50°F, default 70°F	
Demand Defrost (conditional to previous selection)	Defr. Comp. OFF: 90sec to 1sec, default 3sec Dem Defr Tmp Lim: 25°F to 45°F, default 35°F Defrost OCT lim: 80°F to 50°F, default 70°F Temp.Depend.Var: 15°F to 5°F, default 10°F	

Table 6-5

6.6.1 Set points

Set point is the desired temperature of comfort. The user has two ways to adjust the set point: (a) using the User interface, or (b) sending a command through the network. The set point selection will only be valid when the board is not connected to a thermostat.

The user can select occupied and unoccupied set points for both heating and cooling through either the display or the network. The selection through display does not allow the user to choose set points closer than the value of the dead band plus differential, so the control automatically changes the value of the set point not being adjusted. As an example, if the differential plus dead band equals to three degrees and the user is adjusting cooling set point at 72°F, the control will lower the heating set point to 69°F if the difference between the two is less than three.

If the remote set point adjustment is enabled, than the control will consider the hardwired potentiometer input to determine occupied set points only. If the remote set point adjustment is enabled but the input reads an invalid number, the control will default back to the occupied set point selection.

Network data takes precedence over local selections. In other words the control will follow a valid remote set point adjustment from the network, even if the remote set point adjustment is enabled and the hardwired input reading is valid.

The RTU-C will consider the hardwired potentiometer reading or the network remote set point adjustment as the cooling set point. It calculates the heating set point by subtracting dead band (2.0°F) and differential from the cooling set point.

6.6.2 Cooling Differential, Heating Differential, and dead band

Differential is the maximum difference allowed between the temperature reading and set point before the control considers a valid demand for cooling or heating. The differential is also valid for determining that the unit has satisfied demand. Depending of the mode of operation, the differential will either be added or subtracted from the set point to determine those points.

Dead band is the difference between cooling set point minus cooling differential and heating set point plus heating differential.

6.6.3 Min DAT Spt

Future Use —The Minimum DAT set point is used to create warnings in the system.

6.6.4 Max DAT Spt

Future Use —The Maximum DAT set point is used to create warnings in the system.

6.6.5 Stpnt Adj Enable

A wall-mounted room sensor with temperature setpoint adjustment, allowing occupants to directly control the space temperature, is available. If the set point adjustment is **ENABLED**, then the control will consider the hardwired potentiometer input (setpoint adjustment) to determine **OCCUPIED** set points only. If the remote set point adjustment is **ENABLED** but the input reads an invalid number, the control will default back to the occupied set point selection. If the feature is **DISABLED**, temperature setpoint adjustments to the wall-mounted room sensor are not considered. The system will function using the space sensor data and **OCCUPIED** settings.

6.6.6 Setpoint Adjust

This is the actual reading of the potentiometer set point of section 6.6.5.

6.6.7 Low Balance Point

If the outdoor air temperature is below the Low Balance Point temperature the control will prevent the operation of heat pump. The range of adjustment is from 0°F to 120°F and the Heat pump will reset when the outdoor air temperature rises above the Hi Balance Point.

6.6.8 Hi Balance Point

For explanation see Low Balance Point. The range of adjustment is from 0°F to 120°F.

6.6.9 Cooling Lockout Temperature

If the outdoor air temperature is below the cooling lockout temperature the control will prevent the operation of mechanical cooling. The default cooling lockout temperature is 35°F with a range of adjustment from 0°F to 50°F and the cooling lockout resets at 5°F above the set point. As an example, if the setting is 40°F and the compressors are not operating due to low outdoor air temperature, then the RTU-C will only allow the operation of mechanical cooling again once the OAT reading exceeds 45°F.

6.6.10 Heating Lockout Temperature

If the outdoor air temperature is above the Heating lockout temperature the control will prevent the operation of heating. The default heating lockout temperature is 90°F with a range of adjustment from 70°F to 145°F and the heating lockout resets at 5°F below the set point.

6.6.11 Defrost Operation

The control allows the selections of time versus temperature defrost control, demand-defrost control, or no defrost cycle. The user can opt for the default, which is demand defrost control, or change it to time versus temperature via Human System Interface (HSI) or network. The same applies for the no defrost operation.

During the defrost operation the low pressure switch is ignored.

6.6.12 Time x Temperature

The control accumulates compressor run time, based upon the compressor contactor output being energized. When the accumulated time reaches the selected defrost interval time (from 30 to 90 minutes), the control enters the defrost mode.

While in defrost, the control de-energizes the outdoor fan. The compressor de-energizes for the initial 3 seconds, which are configurable between 1 and 90 seconds. The control de-energizes the reversing valve and auxiliary heat outputs. It accumulates compressor run time while in the defrost mode. If the indoor thermostat is satisfied while the control is in the defrost mode (call for compressor de-energizes), the compressor is de-energized and the reversing valve is energized, and the control stops the defrost timer. When the compressor contactor output is energized once again, the defrost cycle and timer will resume at the point where the demand was satisfied.

6.6.13 Time x Temp Defrost Termination

The control terminates the defrost mode when the coil temperature reaches the limit of 50, 60, 70, or 80°F degrees (default 70°F), or 15 minutes of compressor run time has elapsed with the control in the defrost mode. The control immediately energizes the reversing valve and energizes the outdoor fan and the compressor de-energizes for 3 seconds (configurable between 1 and 90 seconds). The control resets the defrost interval timer and begins accumulating compressor run time for the next defrost cycle, based upon the compressor contactor output being energized with the defrost switch closed.

6.6.14 Demand Defrost

If the coil temperature is above the Defrost Temperature Limit, all defrost functions are disabled. The default value for the Defrost Temperature Limit is 35°F and the user can adjust it from 25°F to 45°F via Human System Interface (HSI) or network.

6.6.15 Defrost Calibration Mode

The control is considered un-calibrated when power is applied to the control, after cool mode operation and following a 14-minute time termination of a defrost cycle. Calibration of the controller occurs after a defrost cycle to ensure that there is no ice on the coil. During calibration, the temperature of both the coil and ambient sensors are measured to establish a Dry Coil Delta T.

When the controller is in an un-calibrated state, the controller should initiate a sacrificial defrost after 34 minutes of accumulated compressor runtime with coil temperature below Defrost Temperature Limit. The defrost cycle will terminate if the coil sensor reaches the selected termination temperature or after a 14 minute defrost. Once the sacrificial defrost has terminated, a clear coil (non-iced condition) is established by averaging coil temperature readings once a minute (for four minutes) starting on the fourth minute (stabilized coil condition, allowing system pressures and temperatures to stabilize) following termination of the last defrost.

At that point a Dry Coil Delta T at the particular outdoor ambient temperature can be determined.

After initial calibration has been completed, the controller prevents a defrost occurrence for 34 minutes of accumulated runtime in order to avoid unnecessary defrost operation due to system transient conditions.

6.6.16 Demand Defrost Operation

The need for a defrost cycle while in Demand Defrost operation is determined by one of two factors: Time or Frost Detection.

Should six hours of compressor run time elapse without a defrost cycle and the coil temperature is below the frost accumulation temperature, a defrost cycle will be initiated. The controller shall establish a new Dry Coil Delta T following termination of this defrost cycle. The compressor run time will be reset when the defrost cycle is complete.

The Frost Detection functionality of the control can be influenced by the Coil Temperature Dependent Variable, an adjustable value between 5 and 15°F. The Coil Temperature Dependent

Variable is set at 10°F by default. This has proven satisfactory for most applications. However, if the unit is not defrosting often enough the setting can be adjusted to a lower number to allow the unit to enter defrost a little quicker. If the unit is defrosting too often, the value can be adjusted to a larger number to allow the unit to enter defrost a little later. Before making any adjustments to the setting it is STRONGLY recommended that proper airflow and refrigerant charge be confirmed. Small, incremental, adjustments are recommended over larger ones.

6.6.17 Defrost Mode Activation

To activate a defrost sequence, the unit must be in the heating mode (for thermostat control the "B" thermostat input must be active), and the coil temperature must be below 35°F. When these conditions are met, the defrost enable timer tracks the compressor output, and accumulates compressor run time in the heating mode. If the unit is not in the heating mode (for thermostat control the "B" thermostat input is inactive), the defrost enable timer is cleared. If the coil temperature is above 35°F, the defrost enable timer is not cleared, but does not accumulate compressor run time. If the coil temperature is above the selected defrost termination temperature, the defrost enable timer will be cleared.

When the defrost enable timer reaches 34 minutes, the defrost mode is enabled. If the control is in the time/temperature defrost operation mode, defrost operation will be initiated immediately.

6.6.18 Defrost Mode Operation

When operating in the defrost mode, the control will temporarily deactivate the compressor contactor for an adjustable time of 1 - 90 seconds with a default value of 3 seconds. The control will activate the auxiliary heat outputs. The reversing valve shall de-energize. The condenser fan relay contacts will be closed, de-energizing the fan motor. The accumulated defrost time is monitored while in the defrost mode and compressor is energized.

When a defrost cycle has been initiated, if the call for heating is removed (for thermostat control units the Y thermostat input is removed), the current defrost cycle will be suspended, but the accumulated defrost time is frozen, and the control will resume defrost operation at the start of the next heating cycle (for thermostat control units, Y active, B active and coil temperature is below 35°F) without delay. The accumulated defrost time resumes when the compressor output is re-energized.

6.6.19 Defrost Mode Termination

Once a defrost mode has been initiated and the outdoor coil temperature exceeds the selected termination temperature, the control will immediately terminate the defrost cycle and reset the internal timing.

Once a defrost mode has been initiated, an internal timer shall count the time that the defrost mode is engaged and compressor is energized. After 14 minutes of operation in the defrost mode, the defrost sequence shall terminate immediately and reset internal timing regardless of the state of the coil sensor temperature.

If a defrost cycle had been terminated on time (rather than temperature), the next defrost cycle will be a sacrificial defrost (34-minutes after termination of the previous defrost).

6.7 Economizer

This screen shows the information available from the Economizer. When this device is not connected the control will show the word “UNAVAILABLE” on the second line of the display.

The Economizer uses controllable dampers to increase the amount of outside-air intake into the building whenever enabled and whenever outside air enthalpy is favorable for conditioning the ambient.

The RTU-C board communicates to the Economizer Logic Module (ELM) via RS485. Once the ELM receives communication from the main control indicating a cooling demand, the ELM will calculate the outdoor air enthalpy and determine if the economizer operation is favorable for conditioning the ambient. The Main control will read the status of the economizer and determine whether it is a valid stage for cooling or not.

If mechanical cooling is active and the enthalpy is favorable for ELM operation, the RTU-C will override the Economizer opening the damper 100%. ELM will regain control of the damper whenever mechanical cooling is no longer necessary.

If operating from a thermostat, the Economizer is the first stage of cooling. If the unit has two compressors available, the second stage will never be active as long as free cooling is available.

When the RTU-C is operating from its local temperature sensors, the Economizer is also a first stage of cooling, if free cooling is available. First and second stages of mechanical cooling may be necessary for satisfying the demand in case the temperature trend towards the set point is not large enough. Whenever mechanical cooling is active, RTU-C overrides the Economizer, opening the damper 100%.

6.7.1 *Demand Control Ventilation*

Economizer	**Adjustable Range**	**Default setting**
Econ. Status Economizer Available / Economizer Not Available		
Econ. Status Diff Enthalpy / Single Enthalpy		
Econ. Status Exh. Fan is ON/OFF		
* Enthalpy Setpt. A / B / C / D / E (not menu adjustable)	A / B / C / D / E	A
Eff.Mix.Air Temp XXX.X °F		
* Mixed Air Setpt. XXX.X °F	0 - 99	53.0
Ext.Mix.Air Temp XXX.X °F		
* Econ. Vent. Limit XXX %	0 - 100	0
* Econ.Exh. ON/OFF XXX %	0 - 100	25
* Econ. DCV Limit XXX %	0 - 100	0
DCV Control Enabled / Disabled	Enabled / Disabled	Disabled
* DCV Level Setpt. XXXX ppm	500 - 2000	700
Ext. DCV Level XXXX ppm		
Eff. DCV Level XXXX ppm		
Eff.Eco.Position XXX %		
Eff.Min.Position XXX %		
Local. Min. Pos. XXX %		
Econ. Faults DCV Sensor Fault OAE Sensor Fault RAE Sensor Fault MAT Sensor Fault Actuator Fault		
Econ Firm Vrsn		0103

Table 6-6

* Menus that are user adjustable

6.7.2 Econ. Status

This screen confirms if the enthalpy is acceptable for economization.

6.7.3 Econ. Status

This screen indicates if the system is using single or differential enthalpy.

6.7.4 Econ. Status

This screen gives the status of the exhaust fan.

6.7.5 Enthalpy Setpoint

The user has five levels to choose for the enthalpy set point. (Figure 6-4) indicates what each of those levels represents in the psychrometric chart. This setting determines the level at which economization is allowed. This setting is only adjustable at economizer potentiometer on the ELM.

6.7.6 Eff. Mix. Air Temp

This is the current value of mixed air temperature used for control.

6.7.7 Mix Air Setpt.

When the mixed air temperature falls below this set point, the freeze protection control will disable the mixed air control and close the outdoor damper to the effective minimum position.

6.7.8 Ext. Mix. Air Temp.

This screen corresponds to the raw, uncorrected real-time discharge air temperature sensor reading from the RTU-C.

6.7.9 Econ. Vent. Limit

The ventilation limit corresponds to a minimum position of the Economizer that complies with the minimum acceptable outside-air ventilation rate. The volumetric flow-rate of outside air required to provide healthful, comfortable conditions for occupants can be determined from building codes, ASHRAE standards, or standard practice. It is usually expressed in terms of volumetric flow-rate (cfm) per occupant or per unit floor area. The use of a CO_2 sensor can lower the ventilation limit by verifying that the indoor air quality is suitable for human occupancy, as described in the next section for Demand Control Ventilation.

The system allows the adjustment of the ventilation limit through four different methods, listed below in order of priority:

1. Network interface (BACnet, BAS, or LONWORKS)
2. Human Systems Interface (HSI)
3. Remote potentiometer
4. Direct adjustment through a potentiometer on ELM control.

6.7.10 Econ. Exh. ON/OFF

This screen allows the user to change the set point of what percentage the exhaust fan is energized.

6.7.11 Econ. DCV Limit

The economizer will allow the dampers to close more than the minimum position if the indoor air quality is not contaminated. The Econ. DCV Limit can be set from 0 to 100% but must be lower than the minimum position.

6.7.12 Econ. DCV Control

If connected to a CO_2 sensor, the ELM measures and regulates the amount of outdoor air supplied to the space in order to maintain the levels of carbon dioxide below the recommended 700ppm above the outdoor levels. In this case, CO_2 levels serve as a proxy for building occupancy and the rate of human-generated indoor pollutants.

Once the DCV is operating, the minimum damper position can then be lowered to the DCV ventilation limit. By default, this value is 50% of the ventilation limit, but the user has the option to adjust it through network or Human System Interface (HSI). The user also has the option to disable DCV altogether.

6.7.13 DCV Level Setpt.

The DCV level setpt is a selectable level of carbon dioxide that system does not allow to be exceeded. The set point is communicated to the economizer and the minimum ventilation position is changed in order to prevent the increase of CO_2.

6.7.14 Ext. DCV Level

This is the value RTU-C sends to the Economizer.

6.7.15 Eff. DCV Level

This is the actual DCV Level in ppm.

6.7.16 Eff. Eco. Position

This is the actual position of the economizer.

6.7.17 Eff. Min Pos.

This displays current value of the effective minimum damper position.

6.7.18 Local Min. Pos.

This displays the local minimum position that is set at the ELM.

6.7.19 Econ Faults

This screen displays any ELM sensor or actuator faults. Check for proper installation of the sensor or actuator, or replace the sensor or actuator so that the alarm is cleared. NOTE: The actuator fault must be present for at least 2 minutes with the unit powered, the indoor fan running, and the outside damper commanded open more than 0% before the alarm is set.

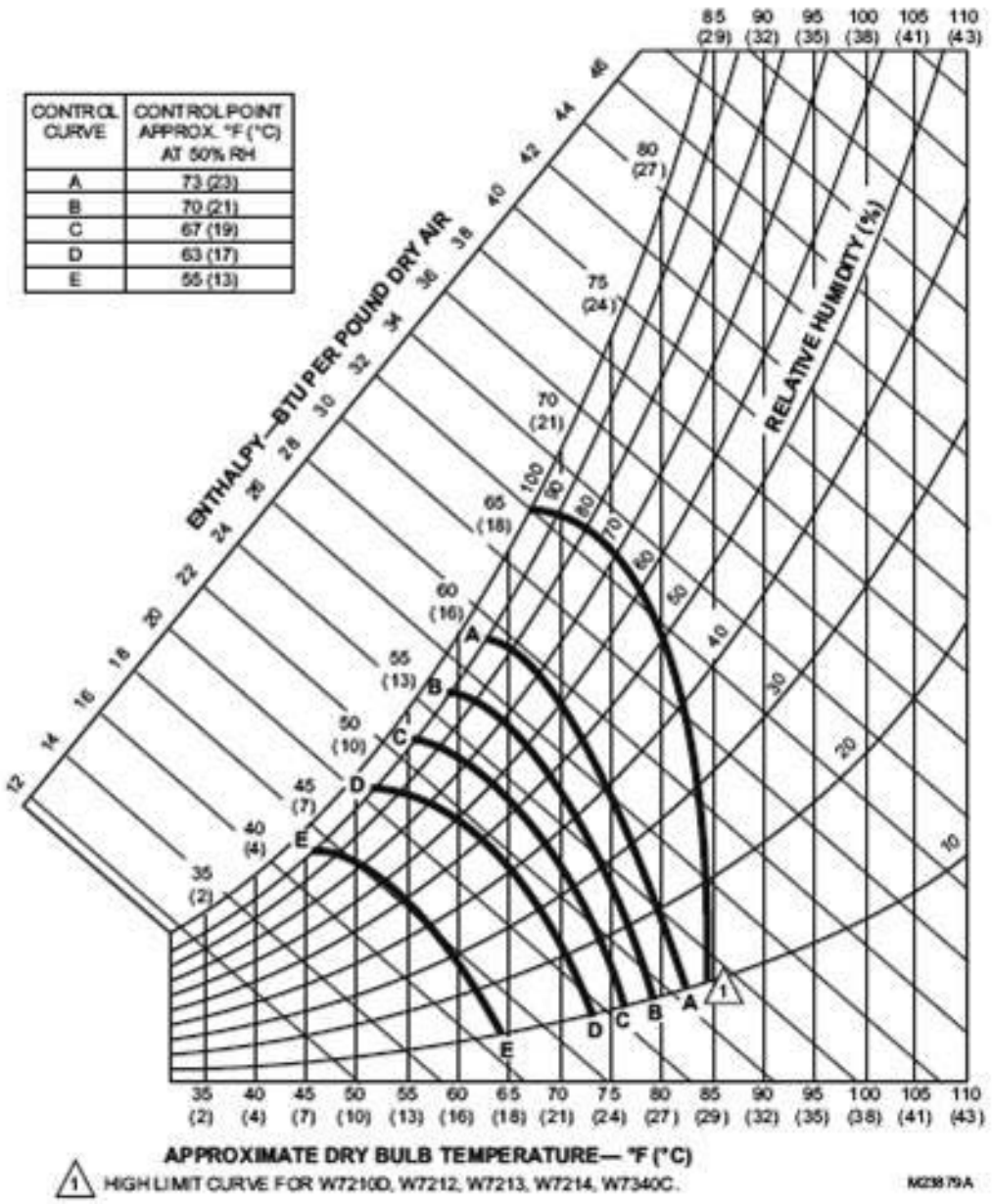

CONTROL CURVE
CONTROL POINT APPROX. °F (°C) AT 50% RH
A 73 (23)
B 70 (21)
C 67 (19)
D 63 (17)
E 55 (13)
ENTHALPY—BTU PER POUND DRY AIR
RELATIVE HUMIDITY (%)
APPROXIMATE DRY BULB TEMPERATURE— °F (°C)
1 HIGH LIMIT CURVE FOR W7210D, W7212, W7213, W7214, W7340C.
MG38179A

Figure 6-4

6.8 Integrated Furnace Control Screen

This screen shows the information available from the IFC board. When this device is not connected the control will show the word “UNAVAILABLE” on the second line of the display.

FURNACE CTRL.
Device ID
IFC Fault
IFC Inputs
IFC Outputs

Table 6-7

6.8.1 Device ID

This screen displays the IFC software version.

6.8.2 IFC Fault

This screen displays any IFC faults. The faults will also be displayed on the main RTU-C fault screen.

6.8.3 IFC Inputs

Status of IFC Inputs

6.8.4 IFC Outputs

Status of IFC outputs

6.9 Time Delays Screen

This screen allows the input of time constants of the system.

Time Settings	Adjustable Range	Default
Demand Delay	30– 1800 sec	300 sec
Indoor Fan On Delay	1sec – 180sec	10 sec
Indoor Fan Off Delay	1sec – 180sec	45 sec
Keypad auto scroll timeout	30sec – 10min	300 sec
Compressors ASCD (Anti Short Cycle Delay)	10sec – 30 min	180 sec
CMRT (Compressor Minimum Run Time)	1 – 20min	120 sec
Stage Delay	5 – 300 sec	5 sec
LPS (low pressure switch) bypass timer	10 – 90 sec	30 sec
HPS (high pressure switch) bypass timer	1 – 5 sec	2 sec

Fan Proving Switch	1sec – 180sec	20 sec
Clogged Filter Switch	1sec – 180sec	20 sec
Smoke Alarm Switch	1sec – 180sec	2 sec
Tenant Override	0 min – 360min	120 min

Table 6-8

6.9.1 Demand Delay

The demand delay is the time period in which the control compares set point to zone temperature readings and determines whether the current stage of either cooling or heating is sufficient to satisfy the set point. The demand delay is set by default at 5 minutes, and it can be configured between 30 seconds and 30 minutes.

6.9.2 Indoor Fan On Delay

The indoor fan on delay is the time delay before the fan is allowed to energize after a call for cool, heat, or fan only. This delay is ignored if the indoor fan is in continuous mode. In the heating mode, for electric heat models, there is not a delay; for gas heat models the delay is handled by the integrated furnace control (IFC).

6.9.3 Indoor Fan Off Delay

The indoor fan off delay is the time delay after a call for cool or heat is terminated. This delay is ignored for gas heat units or if the indoor fan is in continuous mode. For gas heat units, the indoor fan off delay is handled by the integrated furnace control (IFC).

6.9.4 Keypad auto scroll timeout

The keypad auto scroll timeout will keep the User Interface from returning to the general information screen for the selected time.

6.9.5 ASCD (Anti Short Cycle Delay)

The anti short cycle delay is an adjustable delay used to keep the compressor from re-energizing too quickly after a cycle. The delay time starts after the compressor de-energizes.

6.9.6 CMRT (Compressor Minimum Run Time)

The compressor minimum run time is an adjustable time used to ensure proper compressor oil return.

6.9.7 Stage Delay

The stage delay is an adjustable time that keeps the next stage of cooling or heat pump from energizing.

6.9.8 LPS (low pressure switch) bypass timer

The low pressure switch bypass timer is an adjustable time that the RTU-C ignores the low pressure switch after a call for cooling or heat pump.

6.9.9 HPS (high pressure switch) bypass timer

The high pressure switch bypass timer is an adjustable time that the RTU-C ignores the high pressure switch after a call for cooling or heat pump.

6.9.10 Fan Proving Switch

The fan proving switch bypass timer is an adjustable time that starts after the indoor fan is energized. The purpose of the timer is to give the indoor fan time to come up to speed.

6.9.11 Clogged Filter Switch

The clogged filter switch bypass timer is an adjustable time that can only be activated if the indoor fan is energized. If the clogged filter switch input is continuously closed until the time expires, the clogged filter alarm is tripped. The purpose of the delay is to prevent nuisance trips when the indoor fan is started or other pulsations in the airflow.

6.9.12 Smoke Alarm Switch

The smoke alarm switch is an input that will lock out the system when an open switch is detected for 2 seconds. To reset the system power must be cycled to the unit or an "all clear" signal must be communicated through the network.

6.9.13 Tenant Override

The RTU-C control allows separate adjustment of temperature set points and fan operation according to the building occupancy. This feature is only available when a thermostat is not controlling the space temperature. For the following sections, Occupied Mode implies that the calculation for demand utilizes occupied set points, which are used to satisfy the comfort in the space. Unoccupied mode utilizes unoccupied set points and is normally set to save energy during periods in which buildings are closed and unoccupied. Tenant Override Mode is a state in which the control utilizes occupied set points for a limited amount of time, after which it returns to unoccupied mode. To start Tenant Override, the user presses a button on the space sensor for more than 2 seconds.

6.10 Initial Test Sequence

The RTU-C control allows a technician to Field Commission a new or existing installation of a package unit with the RTU-C control. By entering a password (**5555**), the technician can select a cooling test or a heating test. If a cooling test was selected, the first stage of cooling is now energized for 5 minutes to check for alarms. At the end of the test, the temperature sensor readings are displayed. If the technician connected refrigerant gauges to the unit, the technician can record their gauge readings along with the sensor temperature readings for future reference or to calculate refrigerant superheat. If the unit has two stages of cooling, the next stage of cooling is now energized for 5 minutes to check for alarms. At the end of the test, the temperature sensor readings are displayed. If the technician connected refrigerant gauges to the unit, the technician can record their gauge readings along with the sensor temperature readings for future reference or to calculate refrigerant superheat for the second stage of cooling. Using the reading from the outdoor air temperature sensor and the refrigerant pressure and temperature readings, the technician can verify unit operation obeys the refrigerant charge chart. The RTU-C then de-energizes the second stage compressor, the first stage compressor, and finally the indoor fan. The test is then terminated. The heating test for heat pump units is similar to the cooling tests above except the reversing valve is energized for the test. Temporarily shorting across the "TEST PINS" (P12) on the RTU-C board during the heating test will cause the unit to go into the defrost mode. It will stay in defrost mode until the test terminates or the outdoor coil defrost termination temperature is

reached. Gas heat models use a similar test except the gas valves are energized and de-energized instead of the compressors. No temperature display is provided at the end of the gas heat test.

6.11 History of alarms

This screen shows the last 10 alarm occurrences of the system. A new alarm enters in position 1, shifting the other occurrences one position down.

The last position of the screen allows the user to clear the entire alarm history, by pressing the enter key.

ALARM HISTORY
Alarm #1
Alarm #2
Alarm #3
Alarm #4
Alarm #5
Alarm #6
Alarm #7
Alarm #8
Alarm #9
Alarm #10
CLEAR ALARMS? [Enter] for YES

Table 6-9

6.12 Current Alarms

This screen shows the current alarms of the system. A maximum of ten alarms can be displayed.

ACTIVE ALARMS
List of Active alarms

Table 6-10

6.13 *eSYNC™ Control*

This screen shows the information available from the *e*SYNC™ unit control board. When this device is not connected the control will show the word "UNAVAILABLE" on the second line of the display. The *e*SYNC™ control is only available on units that have the *e*SYNC™ (water heating) equipment factory installed.

***e*SYNC CTRL.**	
UNAVAILABLE STANDBY Return Oil Wtr Temp Check Wtr Sample Delay Water Heating Low Amb. Fault Test Override LOCKOUT Amb Sensor Fault Pump Purge	
Timer =	XXXX
AMB =	XXX
HP =	XXX
LP =	XXX
WTR IN =	XXX
WTR OUT =	XXX
WTR FLW =	XXX
LEAK =	XXX
SCool = Sat - LL XX°F=XXX°F-XXX°F	
SHeat = Suct - Satur XX°F=XXX°F-XXX°F	
Hot Water gpm XXX	
*Gallons Hot Wtr XXXXXXXX	
Max Wtr Temp Lim XXX	

Table 6-11

* Menus that are user adjustable

6.13.1 *Status Line*

The status line shows whether the *e*SYNC™ unit is running in the conventional air conditioning mode or the *e*SYNC™ (water heating) mode. If this device is not connected the control will show the word "UNAVAILABLE".

1. "STANDBY" is displayed when there is not a call for cooling.
2. "Return Oil" is displayed when the unit is in the air conditioning mode and a solenoid valve is energized to drain refrigerant from the inactive water-side heat exchanger for 120 seconds. If this is the first cooling call after the "STANDBY" mode, the system will switch directly to "Wtr Temp Check" mode without delay.
3. "Wtr Temp Check" is displayed when the *e*SYNC™ water circulation pump is running to check if water heating is required.
4. "Wtr Sample Delay" is displayed if the unit has sampled the inlet water temperature and water heating is not required, so an adjustable time delay starts.
5. "Water Heating" is displayed when the unit is in the *e*SYNC™ mode and is actively heating water.
6. "Low Ambient Fault" is displayed when the unit is in the air conditioning mode, but low outdoor air temperatures are causing the *e*SYNC™ control to cycle the outdoor fans on and off to maintain system pressure.
7. "Test Override" is displayed whenever the test pins on the *e*SYNC™ control are shorted. The control will then energize a solenoid valve to drain refrigerant from the inactive water-side heat exchanger and de-energize all other outputs. The control does not interpret any commands, inputs or outputs while the test pins are shorted.
8. When "Lockout" is displayed the *e*SYNC™ control de-energizes all outputs. A LED on the *e*SYNC™ control emits a flash sequence to indicate which alarm was issued and transmitted to the RTU-C. Only by resetting the power supply to the unit, or by issuing a "Clear All Alarms" to the RTU-C through the network will allow the control to recover from this mode.
9. "Ambient Sensor Fault" is displayed under this menu whenever the outdoor ambient sensor on the RTU-C does not provide a valid temperature reading. During this fault condition, the *e*SYNC™ water pump will run continuously until the ambient sensor is restored continuously for 6 seconds, at which time the *e*SYNC™ control will first switch to "Return Oil" mode and then normal operation. If during this fault condition, the refrigerant low pressure drops below 165 psig, then the control will enter the "Lockout" mode.
10. "Pump Purge" is displayed if the *e*SYNC™ water pump has not received a call for operation for more than 24 hours and is now running for 6 minutes to clear out stagnant water in the system.

6.13.2 Timer

After the *e*SYNC™ unit has been running for two minutes in the air conditioning mode, the *e*SYNC™ water circulation pump starts if water pressure is acceptable. After running for 1 minute the inlet water temperature is sampled to see if it is below the "Max Wtr Temp Lim" (default 95°F) temperature setpoint. If it is below the "Max Wtr Temp Lim" setpoint, then the unit switches to *e*SYNC™ mode. If it is above the setpoint, the unit continues in air conditioning mode and the timer resets for a (default) delay of 10 minutes before starting the pump again. The timer shows the actual status of this countdown.

6.13.3 AMB

This is the same value as the RTU-C outdoor air temperature sensor. If the outdoor air temperature is below 40°F then the unit will not operate in *e*SYNC™ (water heating) mode. If the outdoor air temperature is below 35°F, then the *e*SYNC™ water circulation pump starts and remains on until the outdoor air temperature rises above 37°F.

6.13.4 H P

The *e*SYNC™ control has a refrigerant pressure transducer that measures the refrigerant liquid line pressure for circuit #1. When in *e*SYNC™ (water heating) mode, if the refrigerant pressure reaches 570 psig, *e*SYNC™ mode is terminated and the unit reverts back to air conditioning mode until the 10 minute (default) timer setting for the next cycle has expired. When water heating mode starts, if the refrigerant pressure rises above 530 psig in less than one minute, an alarm is sent to the RTU-C. After three of these alarms within the same cooling call, *e*SYNC™ mode is locked out until power is removed from the unit or the alarm is cleared through the "Clear All Alarms" network command.

6.13.5 LP

The *e*SYNC™ control has a refrigerant pressure transducer that measures the refrigerant suction line pressure for circuit #1.

6.13.6 WTR IN

The *e*SYNC™ control monitors the water inlet temperature to the *e*SYNC™ unit. Before the *e*SYNC™ (water heating) mode starts, the "Wtr Temp Check" mode samples the inlet water temperature. If the water temperature is above the "Max Wtr Temp Lim" (default 95°F) temperature setpoint, then water heating mode cannot start and the unit reverts back to air conditioning mode.

6.13.7 WTR OUT

The *e*SYNC™ control monitors the water outlet temperature of the *e*SYNC™ unit. If the water outlet temperature exceeds 137°F during the *e*SYNC™ (water heating) mode, then water heating mode is terminated and the unit reverts back to air conditioning mode.

6.13.8 WTR FLW

The *e*SYNC™ control monitors the water pressure prior to entering the *e*SYNC™ (water heating) mode. If the water pressure is less than 5 psig, then water heating mode cannot start and the unit remains in air conditioning mode as long as a call for cooling is present. This protects the *e*SYNC™ water pump from damage if water is not present.

6.13.9 SCool = Sat - LL

Using the liquid line refrigerant pressure reading from the *e*SYNC™ control and the liquid line temperature reading from the RTU-C control, circuit #1 refrigerant subcooling is calculated and displayed on the RTU-C. The *e*SYNC™ control monitors the subcooling. If the subcooling is less than 4°F after 4 minutes, 30 seconds into the *e*SYNC™ (water heating) mode, water heating mode is terminated and operation reverts back to air conditioning mode. An alarm is sent to the RTU-C. After three of these alarms within the same cooling call, *e*SYNC™ mode is locked out until power is removed from the unit.

6.13.10 SHeat = Suct - Satur

Using the suction line refrigerant pressure reading from the *e*SYNC™ control and the suction line temperature reading from the RTU-C control, circuit #1 refrigerant superheat is calculated and displayed on the RTU-C. The *e*SYNC™ control monitors the superheat. If the superheat is more than 25°F after 4 minutes, 30 seconds into the *e*SYNC™ (water heating) mode, water heating mode is terminated and operation reverts back to air conditioning mode. An alarm is sent to the RTU-C. After three of these alarms within the same cooling call, *e*SYNC™ mode is locked out until power is removed from the unit.

6.13.11 Hot Water gpm

A spare input in available on the *e*SYNC™ control board which allows the addition of a field installed pulse type water meter (1 pulse/gallon) to monitor instanteous water usage in gallons per minute (GPM). By connecting a building management system (BMS) to the RTU-C, remote monitoring of water flow rate for establishing peak water heating load is possible.

6.13.12 Gallons Hot Wtr

As above, a spare input in available on the *e*SYNC™ control board which allows the addition of a field installed pulse type water meter (1 pulse/gallon). This input allows monitoring of hot water usage for verification of energy savings. By connecting a building management system (BMS) to the RTU-C, remote monitoring of water usage is possible. The value can be reset to zero by pressing the [ENTER] key.

6.13.13 Max Wtr Temp Lim

The *e*SYNC™ control has a self-adjusting temperature value for determining whether water heating is required. After a call for cooling, during the "Wtr Temp Check" mode, the *e*SYNC™ control uses a 95°F default value and compares this to the inlet water temperature. If the inlet water temperature is below 95°F, then *e*SYNC™ (water heating) mode is allowed. After one minute of operation during the water heating mode, the outlet water temperature of the *e*SYNC™ unit is recorded if the liquid line refrigerant pressure (HP) reaches 550 psig. The "Max Wtr Temp Lim" is then reset according to the table below:

Water Outlet Temperature @ 550 psig					Max Wtr Temp Limit
-	<	Water Outlet	<	105°F	85°F
105°F	<	Water Outlet	<	110°F	90°F
110°F	<	Water Outlet	<	115°F	95°F
115°F	<	Water Outlet	<	120°F	97°F
120°F	<	Water Outlet	<	-	100°F

Table 6-12

6.14 Humidity Control

This screen allows an indoor relative humidity sensor connected to the "Field Configurable Input #2" on the RTU-C control to monitor and control the indoor relative humidity on KNL-G or LNL-G units equipped with a factory installed refrigerant gas reheat system. This feature is not available on heat pump models.

HUMIDITY CONTROL		
	Adjustable Range	**Default**
*Enable rh Control [Enter] for YES	Enable/Disabled	Disabled
*rh Setpoint	35% - 100%	60%
Indoor rh		

Table 6-13

* Menus that are user adjustable

6.14.1 Enable rh Control

If an indoor relative humidity sensor (0-10 Vdc output) is connected to "Field Configurable Input #2" on the RTU-C control (see wiring diagram in Section 4.6), the sensor can be enabled by this menu item. If an indoor relative humidity sensor is not connected, and humidity control is enabled, an alarm will be activated, but the normal air conditioning function of the unit will not be affected.

Note1: Humidity Control is active only if the unit is in the "Occupied" mode.

Note2: For models with a factory installed refrigerant gas reheat system for humidity control, if humidity control is not enabled, higher than normal refrigerant subcooling may be observed during unit operation.

If an indoor relative humidity sensor is connected to "Field Configurable Input #2" on units not equipped with humidity control and humidity control is enabled, the unit operation is not affected, but unused output relays B1 -Reversing Valve, B2 - Reversing Valve, ODF1 - Outdoor Fan 1, ODF2 - Outdoor Fan 2 on the RTU-C control will be energized, or de-energized as if humidity control were present. Heat pump models configure the RTU-C control so that humidity control cannot be activated.

Note3: For models with a factory installed refrigerant gas reheat system for humidity control, lead-lag operation is disabled during reheat mode.

6.14.2 rh Setpoint

The indoor relative humidity setpoint can be adjusted from 35% to 100% with a default of 60% . If the indoor relative humidity exceeds the setpoint, the operation of the unit changes to humidity control mode, which will also activate the indoor fan, if it is not already running. The charts below explain the various modes available:

Units with Single Stage Cooling:

Mode	Compressor 1	Indoor Fan	Notes
Reheat	Reheat	High	Operates with (H1 only)
Cooling	Cool	High	Operates with (Y1) or (Y1 & H1)
Economizer1	Off	High	Operates with (Y1) only, ignores (H1)
Economizer2	On	High	Operates with (Y2) only, ignores (H1)

Definitions: H1 Indoor relative humidity is 2% or more above humidity set point.
Y1 First Stage Cooling Call from thermostat or network.

Table 6-14

Units with Two Stage Cooling:

Mode	Compressor 1	Compressor 2	Indoor Fan	Notes
Low Reheat	Reheat	Off	*1st Stage Cool Speed	Operates with (H1 only) or (H2 only)
High Reheat	Reheat	Cool	High	Operates with (Y1 & H2)
Low Cool - Low Fan	Cool	Off	*1st Stage Cool Speed	Operates with (Y1) or (Y1 & H1)
Low Cool - High Fan	Cool	Off	High	**Future Enhancement** - Operates with (Y1) or (Y1 & H1)
High Cool	Cool	Cool	High	Operates with (Y2) call - Ignores (H1 & H2)
Economizer1	Off	Off	Low	Operates with (Y1) only, ignores (H1, H2)
Economizer2	On	Off	High	Operates with (Y1&Y2) only, ignores (H1, H2)

Definitions: H1 Indoor relative humidity is 2% or more above humidity set point.
H2 Indoor relative humidity is more than 5% above humidity set point.
Y1 First Stage Cooling Call from thermostat or network.
Y2 Second Stage Cooling Call from thermostat or network.
* 1st Stage Cooling Speed has a default value of 50% of High Fan Speed

Table 6-15

6.14.3 Indoor rh

If humidity control is enabled and an indoor relative humidity sensor is connected, this is the actual indoor relative humidity measured by the sensor. The actual voltage output from the indoor relative humidity sensor can be read on "Field Configurable Input #2".

6.15 VARIABLE FREQ DR

This screen shows the information available when a Variable Frequency Drive (VFD) control board is connected to the RTU-C rooftop unit controller for speed control of the indoor blower. When this device is not connected the control will show the word “UNAVAILABLE” on the second line of the display. The VFD control is only available on units with a factory installed Variable Frequency Drive. To meet ASHRAE 90.1-2010, First Stage Cool and Fan Only speeds have a default setting of 50% airflow. Unit air balancing should be performed by adjusting the blower motor sheave at 100% airflow during a W1, W2, or Y2 call.

VARIABLE FREQ DR.		
UNAVAILABLE AVAILABLE	**Adjustable Range**	**Default**
*VFD Lo Fan Speed XXX%	50% - 100%	50%
*VFD 1st Stage Cool XXX%	50% - 100%	50%
VFD Curr. Speed XXX%		

Table 6-16

* Menus that are user adjustable

6.15.1 Status Line

The status line shows whether a VFD is available. If this device is not connected the control will show the word “UNAVAILABLE”.

6.15.2 VFD Lo Fan Speed

The Low Fan Speed, or "Continuous Fan Speed" is the percentage of full speed that the indoor fan is commanded to run when a "Fan Only" call is given by the Building Manager network (if connected) or the room thermostat. The Low Fan Speed can be adjusted between 50% and 100% of full fan speed and has a default value of 50% (a 50% reduction in fan speed is equal to a 50% reduction in airflow). Note: If the indoor fan is ramping up to speed from a dead stop, the Low Fan Speed will briefly ramp to 75% of full speed in order to "set" the fan proving switch and confirm proof of indoor airflow.

6.15.3 VFD 1st Stage Cool

This value is the percentage of full speed that the indoor fan is commanded to run on a 1st stage cooling call. For two-stage models equipped with Humidity Control, this is the indoor fan speed used for a high indoor relative humidity call without an additional 1st stage cooling call. The 1st stage cooling speed can be adjusted between 50% and 100% of full fan speed and has a default value of 50% (a 50% reduction in fan speed is equal to a 50% reduction in airflow). **Note: If the indoor fan is ramping up to speed from a dead stop, the Low Fan Speed will briefly ramp to 75% of full speed in order to "set" the fan proving switch and confirm proof of airflow.**

6.15.4 VFD Curr. Speed

This displays the actual speed of the indoor fan speed as a percentage of full speed.

7. RTU-C Alarm Table and Diagnostic Guide

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
No Active Alarm		0		
Locked Rotor Circuit 1	CA1	4	Comfort Alert Code 4. Circuit 1 shutdown and retry after Anti-Short Cycle Delay (ASCD). Maximum is 3 attempts.	• Low line voltage • Excessive Refrigerant in compressor • Seized bearings in compressor
Open Circuit 1	CA1	5	Comfort Alert Code 5. Circuit 1 shutdown and retry after ASCD. Note: This alarm is sent by the Comfort Alert Module only after the fault has been sensed for a minimum of 4 hours.	• Condensing unit power disconnect is open • Compressor circuit breaker or fuses are open • Compressor contactor has failed open • High pressure switch is open and requires manual reset • Broken supply wires or connector is not making contact • Unusually long compressor protector reset time due to extreme ambient temperature • Compressor windings are damaged
Missing Phase Circuit 1	CA1	6	Comfort Alert Code 6 Circuit 1 shutdown	• Compressor fuse is open on one phase • Broken wire or connector on one phase • Compressor motor winding is damaged • Utility supply has dropped one phase
Reverse Phase Circuit 1	CA1	7	Comfort Alert Code 7 Circuit 1 shutdown.	• Compressor running backward due to

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
				supply phase reversal
Welded Contactor Circuit 1	CA1	8	Comfort Alert Code 8 Run outdoor and indoor fans continuously for circuit 1 and change mode of operation to Unoccupied Auto. This procedure prevents the Space Temperature from reaching extreme values.	• Compressor contactor has failed closed • Thermostat demand signal not connected to module
Low Voltage Circuit 1	CA1	9	Comfort Alert Code 9. Shutdown and wait for voltage to return to operational levels.	• Control circuit transformer is overloaded • Low line voltage to compressor
Low Voltage	RTU-C	10	De-energize all relay outputs.	
FAILED IGNITION	IFC	11	IFC locks out for 1 hour	• Gas Valve Not Turned On • Little or No Supply Gas • Incorrect Manifold Pressure • No Ignition Source, Direct Spark Ignition
LOW FLAME SENSE	IFC	12	IFC flashes error code on LED, transmits the warning through the network, but otherwise operates normally	• Dirty Flame Sensor • Unit Not Properly Grounded • Incorrect Polarity • Flame Sensor Incorrectly Wired • Bad Flame Sensor
FLAME LOST	IFC	13	If lost 17 times within single call for heat, locks out for 1 hour. Otherwise retry ignition.	
UNEXPECTED FLAME	IFC	14	IFC Energizes inducer and main blower. Locks out for 1 hour	
AC Low Pressure Switch 1 Trip-LP1	RTU-C	20	If the low pressure switch trips 3 times within 120 minutes of operation during the same call for heating or cooling operation, the control will lock out compressor and outdoor fan operation. If the lock-out due to low pressure occurs at an outdoor ambient temperature below 5 °F, the control will automatically exit the	• Unit has low refrigerant charge • Indoor coil frozen(cooling mode) • Dirty indoor coil or filter (cooling mode) • Outdoor coil is frozen (heating mode) • Expansion valve in not operating correctly
AC Low Pressure Switch 2 Trip-LP2	RTU-C	21		

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
			lock-out mode when the outdoor ambient temperature rises above 5 °F. LPS is ignored during defrost.	

MAIN LIMIT OPEN	IFC	22	IFC Energizes inducer and main blower	• Burner Over Fired
				• Low Air Flow
				  ○ Dirty Filter
				  ○ Poor Duct Design
				  ○ Blocked Duct, Supply and/or Return
				  ○ Incorrect Blower Speed Selection

Clogged Filter Warning-CFS	RTU-C	24	RTU-C Displays warning.	• Dirty Filter
AC HI Pressure Switch 1 Trip-HP1	RTU-C	29	The RTU-C control recognizes an open high pressure switch after two seconds from its occurrence. Since the high pressure switch is wired in series with the compressor relay, the compressor shuts down immediately until the pressure switch is closed again AND the anti-short cycle delay is expired. Three occurrences of a high pressure switch within the same call will lock the circuit out. The lockout is reset by removing the call.	• Outdoor coil is dirty (heating mode) • Outdoor fan is not running (cooling mode) • Dirty indoor coil or filter (heating mode) • Indoor blower is not running (heating mode) • Liquid line restriction • Excessive refrigerant charge
AC HI Pressure Switch 2 Trip-HP2	RTU-C	30		
MANUAL RESET LIMIT SWITCH OPEN (Flame Rollout Switch)	IFC	33	IFC Runs blower for off delay, inducer for post-purge time and locks out for one hour	• Excessive Burner Pressure • Improper Venting • Incorrect Burner Orifices • Sooted Heat Exchanger • Bad Inducer Gasket • Bad Heat Exchanger
Locked Rotor Circuit 2	CA2	34	Comfort Alert Code 4. Circuit 2 shutdown.	• Low line voltage • Excessive Refrigerant

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
				in compressor • Seized bearings in compressor
Open Circuit 2	CA2	35	Comfort Alert Code 5. Circuit 2 shutdown and retry after Anti-Short Cycle Delay (ASCD). Note: This alarm is sent by the Comfort Alert Module only after the fault has been sensed for a minimum of 4 hours.	• Condensing unit power disconnect is open • Compressor circuit breaker or fuses are open • Compressor contactor has failed open • High pressure switch is open and requires manual reset • Broken supply wires or connector is not making contact • Unusually long compressor protector reset time due to extreme ambient temperature • Compressor windings are damaged
Missing Phase Circuit 2	CA2	36	Comfort Alert Code 6 Circuit 2 shutdown	• Compressor fuse is open on one phase • Broken wire or connector on one phase • Compressor motor winding is damaged • Utility supply has dropped one phase
Reverse Phase Circuit 2	CA2	37	Comfort Alert Code 7 Circuit 2 shutdown.	• Compressor running backward due to supply phase reversal
Welded Contactor Circuit 2	CA2	38	Comfort Alert Code 8 Run outdoor and indoor fans continuously for circuit 2 and change mode of operation to Unoccupied Auto. This procedure prevents the Space Temperature	• Compressor contactor has failed closed • Thermostat demand signal not connected to module

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
			from reaching extreme values.	
Low Voltage Circuit 2	CA2	39	Comfort Alert Code 9.	• Control circuit transformer is overloaded • Low line voltage to compressor
Duct High Limit Fault		41	Future implementation	
Invalid Thermostat selection		42	Indicates that a combination of thermostat inputs is invalid.	
PRESSURE SWITCH 1 CLOSED	IFC	44	Leave inducer de-energized until pressure switch open	• Bad Pressure Switch

PRESSURE SWITCH 1 OPEN	IFC	46	Energize inducer indefinitely until pressure switch closes or call for heat goes away.	• Blocked Vent
				• Undersized Vent
				• Water in Pressure Switch Tubing
				• Cracked Pressure Switch Tubing
				• Inducer Not Running or Not Running to Full Speed
				  ○ Low Line Voltage to Inducer Motor
				  ○ Bad Inducer Motor Capacitor
				  ○ Bad Inducer Motor Bearings
				• Bad Pressure Switch
				• Blocked Heat Exchanger

Freeze Sensor 1 Out of Range -FS1	RTU-C	47	When reading the temperature below 37°F continuously for 15 minutes, the control shuts down compressor and runs indoor fan continuously. After 15 minutes of continuous reading above 42°F, the control recovers from the alarm and resumes operation.	• If temperature is not below 37°F
				  ○ Replace the sensor
				  ○ Check sensor is installed correctly on control

Freeze Sensor 2	RTU-C	48	When reading the temperature	• If temperature is not

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
Out of Range -FS2			below 37°F continuously for 15 minutes, the control shuts down compressor and runs indoor fan continuously. After 15 minutes of continuous reading above 42°F, the control recovers from the alarm and resumes operation.	below 37°F o Replace the sensor o Check sensor is installed correctly on control
Freeze Sensor #1 Fail-FS1	RTU-C	49	Occurs when sensors are either open or shorted.	• Replace the sensor • Check sensor is installed correctly on control
Freeze Sensor #2 Fail-FS2	RTU-C	50		
Lockout Temperature – cooling	RTU-C	51	When the outdoor temperature drops below the cooling lockout temperature setpoint, the unit will prevent the compressor from operating in cool mode. Selectable range is between 30°F and 50°F, with a default of 35°F.	• Check to make sure the outdoor temperature is not below the set point • Replace the sensor
Lockout Temperature – heating	RTU-C	52	When the outdoor temperature exceeds the heating lockout temperature setpoint, the unit will prevent any source of heat from operating. Selectable range is between 70°F and 145°F, with a default of 90°F.	• Check to make sure the outdoor temperature is not above the set point • Replace the sensor
PRESSURE SWITCH 2 CLOSED	IFC	55	Leave inducer de-energized until pressure switch open	• Bad Pressure Switch
PRESSURE SWITCH 2 OPEN	IFC	57	Energize inducer indefinitely until pressure switch closes or call for heat goes away.	• Blocked Vent • Undersized Vent • Water in Pressure Switch Tubing • Cracked Pressure Switch Tubing • Inducer Not Running or Not Running to Full Speed o Low Line Voltage to Inducer Motor o Bad Inducer Motor Capacitor o Bad Inducer Motor Bearings

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
				• Bad Pressure Switch • Blocked Heat Exchanger
Running Blower Fault- Air Flow Switch Stuck	RTU-C	60	Unit continues to operate	• Replace the pressure switch

Blower Fault - Blower Not Running-FP	RTU-C	61	Complete unit shutdown.	• Indoor motor Not Running or Not Running to Full Speed
				  ○ Low Line Voltage to Indoor motor
				  ○ Bad Indoor motor Capacitor/winding
				  ○ Bad Indoor motor Bearings
				• Bad Pressure Switch
				• Broken belt
				• Indoor motor running backwards (3 phase)
				• Open internal motor protector

ELM - OAE Sensor Fail	ELM	64	The economizer logic module (ELM) has detected a failure of the outdoor air enthalpy sensor (OAE) located on the economizer	• Replace the sensor • Check sensor is installed correctly on control
ELM - RAE Sensor Fail	ELM	65	The economizer logic module (ELM) has detected a failure of the return air enthalpy sensor (RAE) located on the economizer	• Replace the sensor • Check sensor is installed correctly on control
ELM - MAT Sensor Fail	ELM	67		• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on control
ELM – CO_2 Sensor Fail	ELM	69		• DCV is enabled with no sensor • Replace the sensor

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
				• Check sensor is installed correctly on control
ELM Actuator Fault	ELM	70	The economizer logic module (ELM) has detected that when the outdoor air damper on the economizer was commanded to a position greater than 0% open, the actual damper position did not match after waiting for 2 minutes.	• Check the wiring from the economizer actuator to the feedback input on the economizer logic module (ELM) • Check power supply to the economizer actuator • Replace the actuator on the economizer.
Low Discharge Air Temp-DAT	RTU-C	71	Threshold is 30°F.	• Check to make sure the Discharge Air temperature is below the set point • Replace the sensor • Low refrigerant
High Return Air Temp-RAT	RTU-C	72	Threshold is 120°F.	• Check to make sure the Return Air temperature is not above the set point • Replace the sensor
Condenser Coil 1 Temp Sensor Fail-OCT1	RTU-C	74	No defrost operation, but unit continues to operate in either heating or cooling.	• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on control
Condenser Coil 2 Temp Sensor Fail-OCT2	RTU-C	75		
Return Air Sensor Fail-RAT	RTU-C	81	If the sensor has ever been installed to the unit, the alarm will be set if it becomes unavailable.	• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on control
Discharge Air Sensor Fail-DAT	RTU-C	82	If the sensor has never been installed to the unit, the alarm will be set if it becomes unavailable.	• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on control

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
Condenser Coil 1 Temperature Out of Range	RTU-C	83	No defrost operation, but unit continues to operate in either heating or cooling.	• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on control
Outdoor Air Temperature Sensor Fail-OAT	RTU-C	84	Control changes defrost to time x temperature mode. The heat source continues to be heat pump, independently of the outdoor air temperature. Additional heat sources are also available in case the demand is not satisfied. For *e*SYNC™ (water heating) units, the water pump is energized continuously until the sensor becomes available.	• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on control
Condenser Coil 2 Temperature Out of Range	RTU-C	85	No defrost operation, but unit continues to operate in either heating or cooling.	• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on control
Discharge Air Temperature Out of Range	RTU-C	87	If the sensor has ever been installed to the unit, the alarm will be set if it becomes unavailable.	• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on control
Emergency Stop Fault	RTU-C	88	Complete shutdown	Cannot be cleared by the "Clear All Alarms" command. Must be cleared by changing the Emergency Stop Fault network value.
Comm card mis-communication	RTU-C	90	Communication card failed to communicate with the RTU-C	• Check wire connection at both controls • Bad Comm card and/or RTU-C
RTU-C Mis-communication with IFC	IFC	91	IFC (integrated furnace control) failed to communicate with the RTU-C	• Check wire connection at both controls • Unplug economizer logic module (ELM); if problem disappears, check 4-wire connections on ELM. • Bad IFC and/or RTU-C

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
Internal Control Fault - RTU-C	RTU-C	93		
Internal Control Fault - IFC	IFC	94		
Space Sensor Alarm	RTU-C	95	If the space sensor fails open or shorted, the space sensor alarm will be set, but the control will continue to operate using the return air sensor in place of the space sensor. If the control has never sensed a valid space sensor input, it will assume no space sensor is present to be used, and not set the space sensor alarm. If a valid space sensor input is ever detected, the control will set a non-volatile flag to indicate the control should have and use a space sensor. When the non-volatile flag is set, the control will detect space sensor alarm conditions.	• Replace the sensor • Check sensor is installed correctly on control
Space Sensor & Return Sensor Fail	RTU-C	96	Indicate presence of the alarm and convert operation to indoor "fan only mode" if requested.	• Replace the sensors • Check sensors are installed correctly on control

Smoke Detection (Selectable Fault Response)	RTU-C	97	RTU-C reads the smoke detection input as open -- complete shutdown.	• If not due to a fire
				  ○ Replace the sensor
				  ○ Check sensor is installed correctly on control

*e*SYNC™ Water Pump Fault	ECB	101	Future Implementation	
*e*SYNC™ Water Leakage	ECB	102	The sensor in the water heating (*e*SYNC™) section of the unit has detected a water leak and stopped water heating operation. A relay output for an (optional) field installed water shutoff valve is energized.	• Check for loose or defective air vent valve on water discharge line of water heating section. • Check for water pump seal leakage. • Replace the sensor

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
				• Check sensor is installed correctly on control
*e*SYNC™ Low Water Pressure	ECB	103	NO ALARM IS SET; FUTURE IMPLEMENTATION POSSIBLE. The water pressure sensor measures potable water pressure in the water heating section and converts it to a 0-5Vdc signal. If the water pressure is below 5 psig, then water heating operation cannot begin. If the sensor becomes unavailable, then water heating operation terminates. Unit can continue to operate in cooling mode.	• Check sensor is installed correctly on control • The sensor has 3 wires that attach to the *e*SYNC™ control. Check for 5Vdc between the outer terminals at the *e*SYNC™ control. If 5Vdc is not present, replace the *e*SYNC™ control. • Replace the sensor
*e*SYNC™ Freeze Protection Mode	ECB	104	The outdoor ambient sensor on the RTU-C has detected outdoor ambient temperatures below 35°F. The water pump is energized continuously until the outdoor temperature rises above 38°F	• Replace the sensor • Check sensor is installed correctly on control • Check sensor location
*e*SYNC™ Solenoid Fault	ECB	105	At the beginning of each water heating cycle, if the high pressure sensor value exceeds 530 psig after 3 seconds but before 60 seconds are elapsed, an alarm is set.	• Check water pump operation , shut-off valves, etc. for adequate water flow. • Check for 24 Vac at control transformer. • Check for 24 Vac at 3-way refrigerant valve on *e*SYNC™ unit. • Increase water sample delay time using DIP switches on *e*SYNC™ control. • Replace 3-way refrigerant valve if sticking.
*e*SYNC™ Ambient Sensor Fault	ECB	106	Same as the Outdoor Air Temperature Sensor Fail on the RTU-C. The water pump is energized continuously until the sensor becomes available.	• Extreme temperatures • Replace the sensor • Check sensor is installed correctly on

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
				control
*e*SYNC™ Water Inlet Sensor Fault	ECB	107	If the sensor becomes unavailable, an alarm will be set and water heating operation terminates. Unit can continue to operate in cooling mode.	• Extreme temperatures • Check sensor is installed correctly on control • Replace the sensor
*e*SYNC™ Water Outlet Sensor Fault	ECB	108	If the sensor becomes unavailable, an alarm will be set and water heating operation terminates. Unit can continue to operate in cooling mode.	• Extreme temperatures • Check sensor is installed correctly on control • Replace the sensor
*e*SYNC™ Water Inlet and Outlet Sensor Fault	ECB	109	If both sensors become unavailable, an alarm will be set and water heating operation terminates. Unit can continue to operate in cooling mode.	• Extreme temperatures • Check sensors are installed correctly on control • Replace the sensors
*e*SYNC™ High Pressure Sensor Fault	ECB	110	The high pressure sensor measures liquid line refrigerant pressure on circuit #1 and converts it to a 0-5Vdc signal. If the sensor becomes unavailable, then water heating operation terminates and an alarm is set. Unit can continue to operate in cooling mode.	• Check sensor is installed correctly on control • The sensor has 3 wires that attach to the *e*SYNC™ control. Check for 5Vdc between the outer terminals at the *e*SYNC™ control. If 5Vdc is not present, replace the *e*SYNC™ control. • Replace the sensor
*e*SYNC™ Low Pressure Sensor Fault	ECB	111	The low pressure sensor measures suction line refrigerant pressure on circuit #1 and converts it to a 0-5Vdc signal. If the sensor fails, then water heating operation terminates and an alarm is set. Unit can continue to operate in cooling mode.	• Check sensor is installed correctly on control • The sensor has 3 wires that attach to the *e*SYNC™ control. Check for 5Vdc between the outer terminals at the *e*SYNC™ control. If 5Vdc is not present, replace the *e*SYNC™ control.

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
				• Replace the sensor
*e*SYNC™ Lockout Fault	ECB	112	If alarm 105, 115, 117 are initiated more than 3 times from unit power up, an alarm is sent and water heating mode is terminated until the alarm is cleared. The alarm can only be cleared by removing power to the unit or by sending a "Clear All Alarms" command through the BAS network.	• Check individual alarms
*e*SYNC™Low Subcooling – water heating mode	ECB	115	If 4 minutes after the 3-way refrigerant valve has shifted, low subcooling was continuously measured for more than 30 seconds during the water heating mode an alarm is issued. Unit exits *e*SYNC™ (water heating) mode and switches to air conditioning operation until the water sample delay timer expires.	• If low subcooling occurs after exiting the air conditioning mode, check wiring and verify operation of outdoor refrigerant coil (air side) solenoid • Check location of outdoor coil temperature sensor (liquid line temperature)
*e*SYNC™ Low Subcooling –air conditioning mode	ECB	116	If 4 minutes after the compressor starts or the 3-way refrigerant valve has shifted, low subcooling was continuously measured for more than 30 seconds during the air conditioning mode an alarm is issued. Unit operation continues.	• If low subcooling occurs after exiting the water heating mode, check wiring and verify operation of flat plate heat exchanger (water side) solenoid • Check location of outdoor coil temperature sensor (liquid line temperature) • Check refrigerant charge weight
*e*SYNC™ High Superheat – water heating mode	ECB	117	If 4 minutes after the 3-way refrigerant valve has shifted, high superheat was continuously measured for more than 30 seconds during the water heating mode an alarm is issued. Unit exits	• High internal building load • Expansion valve is not operating correctly

Alarm Designation	Origin	Code	Description	Status/Possible - Troubleshooting Information
			*e*SYNC™ (water heating) mode and switches to air conditioning operation until the water sample delay timer expires.	
*e*SYNC™High Superheat – air conditioning mode	ECB	118	If 4 minutes after the compressor starts or the 3-way refrigerant valve has shifted, high superheat was continuously measured for more than 30 seconds during the air conditioning mode an alarm is issued. Unit operation continues	• If high superheat occurs after exiting the water heating mode, check wiring and verify operation of flat plate heat exchanger (water side) solenoid • High internal building load • Expansion valve is not operating correctly
Low Pressure – Circuit 1 Problem - Lockout	RTU-C	220	If the low pressure switch trips 3 times within 120 minutes of operation during the same call for heating or cooling operation, the control will lock out compressor and outdoor fan operation. If the lock-out due to low pressure occurs at an outdoor ambient temperature below 5 °F, the control will automatically exit the lock-out mode when the outdoor ambient temperature rises above 5 °F. LPS is ignored during defrost.	• Unit has low refrigerant charge • Indoor coil frozen(cooling mode) • Dirty indoor coil or filter (cooling mode) • Outdoor coil is frozen (heating mode) • Expansion valve is not operating correctly
Low Pressure – Circuit 2 Problem - Lockout	RTU-C	221		
High Pressure– Circuit 1 Problem - Lockout	RTU-C	229	The RTU-C control recognizes an open high pressure switch after two seconds from its occurrence. Since the high pressure switch is wired in series with the compressor relay, the compressor shuts down immediately until the pressure switch is closed again AND the anti-short cycle delay is expired. Three occurrences of a high pressure switch within the same call will lock the circuit out. The lockout is reset by removing the call.	• Outdoor coil is dirty (heating mode) • Outdoor fan is not running (cooling mode) • Dirty indoor coil or filter (heating mode) • Indoor blower is not running (heating mode) • Liquid line restriction • Excessive refrigerant charge
High Pressure– Circuit 2 Problem - Lockout	RTU-C	230		

Table 7-1

8. BAS Communication

8.1 Introduction

The RTU-C features a serial port (MODBUS1 –on plug RJ11 and P9 and terminal T14) to communicate to an external system (BAS or Service Tool) via MODBUS protocol. The settings are as follows:

Parameter	Value
Baud	19200 bits/sec
Number of Bits	8 bits
Parity	None
Stop Bit	2

When the system is used with any other protocol (BACnet or LONWORKS) it will need a device for protocol conversion. One device could be the RXRX-AY01 (BACnet) or RXRX-AY02 (LonWorks) but; other protocol convertors may be used. The RXRX-AY01 (BACnet) or RXRX-AY02 (LonWorks) communication card shall use the P9 plug for connection.

8.2 MODBUS

8.2.1 MODBUS Table

The information on table 8.2.1 refers to the internal memory positions for the RTU-C board. External devices must use these addresses for receiving and transmitting information to the system.

The MODBUS standard begins addressing holding registers from 1. The actual register address value sent to the slave begins at 0. The addresses listed in the table are what the control sees in the actual packet. Add 1 to the addresses in the table when using generic MODBUS software.

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
L	MODBUS Address	0x0000	0x00FF	0x0001	0x0001	W
L	Mode of operation 0 = Off 1 = Auto Mode 2 = Fan Only 3 = Heat Only 4 = Cool Only 5 = Thermostat Control *For changing this parameter through network, use Remote Command, register 0x0005*	0x0001	0x0006	0x0000	0x0000	R

<table>
<tr><th>BAS Priority
L – low
M - Medium
H - High</th><th>Designation</th><th>Address</th><th>MAX</th><th>MIN</th><th>Default</th><th>R/W</th></tr>
<tr><td>L</td><td>Options
Bits:
0 – Time x Temp Defrost
1 – Demand Defrost
2 – Lead Lag (1 - circuits are reversed)
3 – Reserved
4 – Reserved
5 – Space Temp Sensor Installed
Bits 6 thru 15 – Reserved

In the example below, Defrost is "None" and Lead Lag is "enabled"

<table><tr><td colspan="8">Bits:</td></tr><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td colspan="8">Binary Value:</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td colspan="8">Hexadecimal Value:</td></tr><tr><td colspan="8">0x0004</td></tr></table></td><td>0x0002</td><td>0x7FFF</td><td>0x0000</td><td>0x0000</td><td>W</td></tr>
<tr><td>L</td><td>Control Outputs
Bits:
0 – Compressor 1
1 – Compressor 2
2 – Rev. Valve 1
3 – Rev Valve 2
4 – Elec Heat 1
5 – Elec Heat 2
6 – Out Fan 1
7 – Out Fan 2
8 – Indoor Fan</td><td>0x0003</td><td>0x7FFF</td><td>0x0000</td><td>0x0000</td><td>R</td></tr>
<tr><td>L</td><td>Control Inputs
Bits:
0 – Y1
1 – Y2
2 – W1
3 – W2
4 – B
5 – G
6 – OCC
7 – LPS1
8 – LPS2
9 – HPS1
10 – HPS2
11 – CFS
12 – SMKS
13 – FPS</td><td>0x0004</td><td>0x7FFF</td><td>0x0000</td><td>0x0000</td><td>R</td></tr>
</table>

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
H	Remote Command (Application Mode) 0 = Off 1 = Auto Mode 2 = Fan Only 3 = Heat Only 4 = Cool Only 5 = Thermostat Control * 6= Field Commissioning Mode * **Cannot write to 5 or 6*	0x0005	0x0004	0x0000	0x0000	W
H	Emergency Override (network shutdown) 0 = Disable Emergency Override 1 = Disable Emergency Override 2 = Disable Emergency Override 3 = Disable Emergency Override 4 = Enable Emergency Overide	0x0006	0x0004	0x0000	0x0000	W
H	Occupied Schedule Override 0 – Occupied 1 – Unoccupied 2 – Bypass 3 – NUL	0x0007	0x00FF	0x0000	0x0000	W
H	Current Alarm	0x0008	0x7FFF	0x0000	0x0000	R
H	Clear all alarms command	0x0009	0x0001	0x0000	0x0000	W
H	Clear specific alarm	0x000A	0x7FFF	0x0000	0x0000	W
M	Status	0x000B	0x0000	0x0000	0x0000	R
M	Cooling Capacity (%)	0x000C	0x0064	0x0000	0x0000	R
M	Heating Capacity (%)	0x000D	0x0064	0x0000	0x0000	R
M	Secondary Heating Capacity (%)	0x000E	0x0064	0x0000	0x0000	R
M	Economizer Capacity (%) Indicates the position of the damper.	0x000F	0x0064	0x0000	0x0000	R
M	Supply Fan Capacity (%)	0x0010	0x0064	0x0000	0x0000	R
M	Exhaust Fan Capacity (%)	0x0011	0x0064	0x0000	0x0000	R
M	Effective Occupancy 0 = Occupied 1 = Unoccupied 2 = Tenant Override	0x0012	0x0002	0x0000	0x0000	R
M	Occupied Schedule 0 = Occupied 1 = Unoccupied 2 = NUL	0x0013	0x00FF	0x0000	0x0000	W
L	Tenant Override Timer Limit (min)	0x0014	0x0168	0x0000	0x0078	W
M	Effective Space Temperature	0x0015	0x0000	0x0000	0x0000	R

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
M	Local Space Temperature (°F x 10 or °Cx10)	0x0016	0x0000	0x0000	0x0000	R
M	Remote Space Temperature Valid range: -40°F to 140°F (-40°C to 60°C). Values outside those limits are acceptable but they will force the control to operate with the local space temperature sensor.	0x0017	0x057D	0xFE6B	0x7FFF	W
M	Effective Outdoor Air Temperature (°F x10 or °C x 10)*	0x0018	0x0000	0x0000	0x0000	R
M	Local Outdoor Air Temperature (°F x10 or °C x 10)*	0x0019	0x0000	0x0000	0x0000	R
M	Remote Outdoor Air Temperature (°F x10 or °C x 10)*	0x001A	0x057D	0xFE6B	0x0000	W
M	Discharge Air Temperature (°F x10 or °C x 10)*	0x001B	0x0000	0x0000	0x0000	R
M	Return Air Temperature (°F x10 or °C x 10)*	0x001C	0x0000	0x0000	0x0000	R
M	Outdoor Coil Temperature 1 (°F x10 or °C x 10)*	0x001D	0x0000	0x0000	0x0000	R
M	Outdoor Coil Temperature 2 (°F x10 or °C x 10)*	0x001E	0x0000	0x0000	0x0000	R
M	Freeze Sensor 1 (°F x10 or °C x 10)*	0x001F	0x0000	0x0000	0x0000	R
M	Freeze Sensor 2 (°F x10 or °C x 10)*	0x0020	0x0000	0x0000	0x0000	R
M	Field Configurable input 1 (°F x10 or °C x 10)*	0x0021	0x0000	0x0000	0x0000	R
M	Field Configurable input 2 (Volts x10)	0x0022	0x0000	0x0000	0x0000	R
M	Effective Setpoint (°F x10 or °C x 10)* Shows the latest setpoint control. If unit is powered up and has never experienced any demand the control will respond with the invalid value 0x7FFF. The control will also respond with the invalid number if the thermostat control is active.	0x0023	0x0000	0x0000	0x0000	R
M	Local Setpoint Adjustment (°F x10 or °C x 10)*	0x0024	0x0000	0x0000	0x0000	R
L	Local Setpoint Adjustment Enable (°F x10 or °C x 10)*	0x0025	0x0001	0x0000	0x0001	W
M	Remote Setpoint Adjustment (°F x10 or °C x 10)*	0x0026	0x03ED	0x0163	0x02D0	W

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
L	Occupied Cooling Setpoint (°F x10 or °C x 10)*	0x0027	0x03ED	0x018B	0x02D0	W
L	Occupied Heating Setpoint (°F x10 or °C x 10)*	0x0028	0x03C5	0x0163	0x02B2	W
L	Unoccupied Cooling Setpoint (°F x10 or °C x 10)*	0x0029	0x03ED	0x018B	0x035C	W
L	Unoccupied Heating Setpoint (°F x10 or °C x 10)*	0x002A	0x035C	0x0163	0x0230	W
M	Not Used	0x002B	0x0000	0x0000	0x0000	R
M	Cooling Differential (°F x10 or °C x 10)*	0x002C	0x0063	0x0005	0x000A	W
M	Heating Differential (°F x10 or °C x 10)*	0x002D	0x0063	0x0005	0x000A	W
M	Minimum Discharge Air Temperature Setpoint (°F x10 or °C x 10)*	0x002E	0x0389	0x005F	0x0226	W
M	Maximum Discharge Air Temperature Setpoint (°F x10 or °C x 10)*	0x002F	0x04B5	0x01EF	0x0226	W
M	Remote Economizer Enable 0=disable free cooling; 1= enabled, 2=disabled	0x0030	0x0001	0x0000	0x0001	W
M	Remote Demand Control Ventilation Limit (%)	0x0031	0x0064	0x0000	0x0000	W
M	Economizer Remote Ventilation Limit (%)	0x0032	0x0064	0x0000	0x0000	W
M	Local Space CO_2 sensor (Effective DCV level)	0x0033	0x0000	0x0000	0x0000	R
M	Remote Space CO_2 sensor	0x0034	0x00C8	0x0000	0x0000	W
M	Economizer Remote DCV Level Setpoint (500 to 2000ppm) – ppm ÷ 10	0x0035	0x00C8	0x0032	0x0000	W
M	Exhaust Fan Remote On/Off Setpoint - %	0x0036	0x0064	0x0000	0x0019	W
M	Economizer Position	0x0037	0x0000	0x0000	0x0000	R
M	Economizer Fault	0x0038	0x0000	0x0000	0x0000	R
M	Economizer Control Register	0x0039	0x0000	0x0000	0x0000	R
M	Economizer Enthalpy Setpoint	0x003A	0x0000	0x0000	0x0000	R
M	Economizer Mixed Air Setpoint	0x003B	0x028E	0x01E0	0x0212	W
M	Economizer DCV Level Setpoint	0x003C	0x0000	0x0000	0x0000	R
M	Economizer Effective Ventilation Limit	0x003D	0x0000	0x0000	0x0000	R
M	Economizer External Mixed Air Temperature	0x003E	0x0000	0x0000	0x0000	R

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
M	Economizer Effective DCV limit (%)	0x003F	0x0000	0x0000	0x0000	R
M	Economizer Effective Mixed Air Temperature	0x0040	0x0000	0x0000	0x0000	R
M	Economizer Effective Minimum Damper Position	0x0041	0x0000	0x0000	0x0000	R
M	Economizer Local Minimum Damper position	0x0042	0x0000	0x0000	0x0000	R
M	Integrated Furnace Control ID and software version	0x0043	0x0000	0x0000	0x0000	R
M	IFC Input and Output Input – LSB bits bit 0 - Gas Valve Sense bit 1 - Unused bit 2 - Unused bit 3 - Unused bit 4 - Low Press. switch bit 5 - High Press. switch bit 6 - Limit Switch bit 7 - Rollout Switch Output – MSB bits bit 0 - 1st stg Gas valve bit 1 - 2nd Stage gas bit 2 - Low Inducer (Ind1 motor) bit 3 - High inducer (both motors running) bit 4 - Indoor Blower bit 5 - Spark control bit 6 - Unused bit 7 - Unused	0x0044	0x0000	0x0000	0x0000	R
M	Integrated Furnace Control Demand Time Override	0x0045	0x0000	0x0000	0x0000	R
M	Economizer communication timeout	0x0046	0x0000	0x0000	0x0000	R
M	Minimum outdoor air setpoint (not implemented)	0x0047	0x0000	0x0000	0x0000	R
M	Demand Delay (sec)	0x0048	0x0708	0x001E	0x012C	W
L	Defrost compressor run timer 1	0x0049	0xFFFF	0x0000	0x0000	R
L	Defrost compressor run timer 2	0x004A	0xFFFF	0x0000	0x0000	R
L	Time versus Temperature Defrost outdoor coil temperature (°F x 10)	0x004B	0x0325	0x01EF	0x02BC	W
L	Time versus Temperature Defrost Time (min)	0x004C	0x005A	0x0001	0x003C	W

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
L	Time versus Temperature defrost compressor delay (sec)	0x004D	0x005A	0x0001	0x0003	W
L	Demand Defrost Temp Limit (°F x10 or °C x 10)*	0x004E	0x01C2	0x00FA	0x015E	W
L	Temperature Dependent variable (demand defrost function) (°F x10 or °C x 10)*	0x004F	0x0096	0x0032	0x0064	W
L	RTU-C software revision Software revision Format: XXYY (in hexadecimal) XX – Major revision YY – Minor revision Example: Rev. 2.13, reads 0x020D	0x0050	0xFFFD	0x0000	0x0000	R
L	Integrated Furnace Control revision	0x0051	0x7FFF	0x0000	0x0000	R
L	Economizer logic module revision	0x0052	0x7FFF	0x0000	0x0000	R
L	Unit configuration (reading of configuration plug P11)	0x0053	0x000A	0x0000	0x0000	R
L	Not used	0x0054	0x0000	0x0000	0x0000	R
L	Alarm history indexer (used for internal mapping of alarm history)	0x0055	0x000A	0x0000	0x0000	W
L	Alarm history – position 1	0x0056	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 2	0x0057	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 3	0x0058	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 4	0x0059	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 5	0x005A	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 6	0x005B	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 7	0x005C	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 8	0x005D	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 9	0x005E	0x7FFF	0x0000	0x0000	W
L	Alarm history – position 10	0x005F	0x7FFF	0x0000	0x0000	W
L	High Balance Point (°F x10 or °C x 10)*	0x0060	0x04B5	0x0000	0x0190	W
L	Low Balance Point (°F x10 or °C x 10)*	0x0061	0x04B5	0x0000	0x0032	W
L	Indoor Fan On Timer Limit (sec)	0x0062	0x00B4	0x0001	0x000A	W
L	Indoor Fan Off Timer Limit (sec)	0x0063	0x00B4	0x0001	0x002D	W
L	Outdoor Fan On Timer Limit (sec)	0x0064	0x00B4	0x0001	0x000A	W
L	Outdoor Fan Off Timer Limit (sec)	0x0065	0x00B4	0x0001	0x000A	W
L	Keypad Timer Limit	0x0066	0x0258	0x001E	0x012C	W
L	Compressor Minimum Run Timer Limit	0x0067	0x04B0	0x000A	0x0078	W

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
L	Inter stage timer limit	0x0068	0x012C	0x0005	0x0005	W
L	Low Pressure Switch bypass timer (seconds)	0x0069	0x0078	0x000A	0x001E	W
L	High Pressure Switch bypass timer (seconds)	0x006A	0x0005	0x0001	0x0002	W
L	Not used	0x006B	0x7FFF	0x0000	0x0000	R
L	Fan Proving Switch timer (seconds)	0x006C	0x00B4	0x0001	0x0014	W
L	Clogged Air Filter Switch timer (seconds)	0x006D	0x00B4	0x0001	0x0014	W
L	Smoke Detector Switch timer (seconds)	0x006E	0x00B4	0x0001	0x0014	W
L	Lead-lag timer (amount of accumulated run time in minutes)	0x006F	0x7FFF	0x0000	0x0000	W
L	Temperature Lockout – cooling (°F or °C)	0x0070	0x01EF	0x0000	0x015E	W
L	Temperature Lockout – heating (°F or °C)	0x0071	0x03BB	0x02B7	0x0384	W
L	Anti Short Cycle Limit (seconds)	0x0072	0x0708	0x000A	0x00B4	W
L	EEPROM CRC High	0x0073	0x7FFF	0x0000	0x0000	R
L	EEPROM CRC Low	0x0074	0x7FFF	0x0000	0x0000	R
L	Communication Register Bits: 0 – Unit controller ready for communication (0 not ready, 1 ready) 1 – Unit controller was read (0 has not been read; 1 it has been read at least once at power up) 2 – Configuration parameter changed (0 not changed; 1 changed) 3 – Alarm available (0 not available, 1 is available)	0x0075	0x7FFF	0x0000	0x0000	W
L	HVAC Type DAC or SCC Not implemented – returns always zero	0x0076	0x7FFF	0x0000	0x0000	W
L	Remote Fan Capacity Not implemented – returns always null	0x0077	0x7FFF	0x0000	0x0000	R
L	Unit Support – determines unit of operation: imperial or SI 0 – SI 1 – Imperial	0x0078	0x0001	0x0000	0x0000	W
L	Serial number position #1 (ASCII code), 2 characters per address	0x0079	0x7FFF	0x8000	0x0000	W

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
L	Serial number position #2 (ASCII code), 2 characters per address	0x007A	0x7FFF	0x8000	NA	W
L	Serial number position #3 (ASCII code), 2 characters per address	0x007B	0x7FFF	0x8000	NA	W
L	Serial number position #4 (ASCII code), 2 characters per address	0x007C	0x7FFF	0x8000	NA	W
L	Serial number position #5 (ASCII code), 2 characters per address	0x007D	0x7FFF	0x8000	NA	W
L	Current alarm – position 1	0x007E	0x7FFF	0x0000	0x0000	R
L	Current alarm – position 2	0x007F	0x7FFF	0x0000	0x0000	R
L	Current alarm – position 3	0x0080	0x7FFF	0x0000	0x0000	R
L	Current alarm– position 4	0x0081	0x7FFF	0x0000	0x0000	R
L	Current alarm – position 5	0x0082	0x7FFF	0x0000	0x0000	R
L	Current alarm – position 6	0x0083	0x7FFF	0x0000	0x0000	R
L	Current alarm – position 7	0x0084	0x7FFF	0x0000	0x0000	R
L	Current alarm – position 8	0x0085	0x7FFF	0x0000	0x0000	R
L	Current alarm– position 9	0x0086	0x7FFF	0x0000	0x0000	R
L	Current alarm – position 10	0x0087	0x7FFF	0x0000	0x0000	R
L	Indoor Fan Occupancy 0 - Continuous 1 – Auto 2 - Cont when occupied	0x0088	0x0002	0x0000	0x0002	W
L	Freeze Protection High Limit	0x0089	0x025D	0x0127	0x01A4	R
L	Freeze Protection Low Limit	0x008A	0x025D	0x0127	0x0172	R
L	Factory Run Test Mode *(CAUTION - do not run unit unsupervised in this mode)*	0x008B	0x7FFF	0x0000	0x0000	W
L	Local Occupancy 0 - OCC 1 – UNOCC 2 - Network 3 - Local Switch	0x008C	0x0003	0x0000	0x0000	R
L	Compressor Run Time in hours	0x008D	0x7FFF	0x0000	0x0000	W
L	*e*SYNC™ Control Water Heating hour counter	0x008E	0x7FFF	0x0000	0x0000	W
L	*e*SYNC™ Control water inlet temperature	0x008F	0x7FFF	0x0000	0x0000	W
L	*e*SYNC™ Control water outlet temperature	0x0090	0x7FFF	0x0000	0x0000	W

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
L	eSYNC™ Control circuit 1 high side refrigerant pressure (psig)	0x0091	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Control circuit 1 low side refrigerant pressure (psig)	0x0092	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Control water leak value	0x0093	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Control 3-way valve cycle count	0x0094	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Control water pressure (psig)	0x0095	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Control fault code	0x0096	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Control version	0x0097	0x7FFF	0x0000	0x0000	W
L	Economizer Exhaust Setpoint	0x0098	0x0064	0x0000	0x0019	W
L	Defrost Compressor Run Timer 1	0x0099	0x7FFF	0x8000	0x0000	W
L	Demand Defrost State	0x009A	0x7FFF	0x8000	0x0000	W
L	Defrost Run Time 1	0x009B	0x7FFF	0x8000	0x0000	W
L	Outdoor coil Defrost Average	0x009C	0xFFFF	0x8000	0x0000	W
L	Outdoor Air Temp Defrost	0x009D	0xFFFF	0x8000	0x0000	W
L	Dry Coil Delta 1	0x009E	0xFFFF	0x8000	0x0000	W
L	Defrost Compressor Run Timer 2	0x009F	0x7FFF	0x8000	0x0000	W
L	Demand Defrost State 2	0x00A0	0x7FFF	0x8000	0x0000	W
L	Defrost Run Time 2	0x00A1	0x7FFF	0x8000	0x0000	W
L	Outdoor Coil Defrost Average 2	0x00A2	0x7FFF	0x8000	0x0000	W
L	Outdoor Air Temp Defrost 2	0x00A3	0x7FFF	0x8000	0x0000	W
L	Dry Coil Delta 2	0x00A4	0x7FFF	0x8000	0x0000	W
L	Tenant Override Timer	0x00A5	0x7FFF	0x8000	0x0000	W
L	Not used	0x00A6	0x7FFF	0x8000	0x0000	W
L	Comfort Alert inputs 0 - Both OFF 1 - #1 ON 2 - #2 ON	0x00A7	0x7FFF	0x8000	0x0000	W
L	Auxiliary Field communication timer	0x00A8	0x7FFF	0x8000	0x0000	W
L	Low byte - eSYNC™ control water meter pulse count	0x00A9	0xFFFF	0x0000	0x0000	R
L	High byte - eSYNC™ control water meter pulse count	0x00AA	0xFFFF	0x0000	0x0000	R
L	High byte - eSYNC™ control water meter pulse count - non volatile	0x00AB	0xFFFF	0x0000	0x0000	W
L	Low byte - eSYNC™ control water meter pulse count - non volatile	0x00AC	0xFFFF	0x0000	0x0000	W
L	eSYNC™ control water meter GPM	0x00AD	0x7FFF	0x0000	0x0000	W
L	Freeze Sensor 1 timer	0x00AE	0x7FFF	0x0000	0x0000	W

BAS Priority L – low M - Medium H - High	Designation	Address	MAX	MIN	Default	R/W
L	Freeze Sensor 2 timer	0x00AF	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Low Ambient formula result	0x00B0	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Control mode	0x00B1	0x7FFF	0x0000	0x0000	W
L	eSYNC™ Control Timer	0x00B2	0x7FFF	0x0000	0x0000	W

8.2.2 Service Tool (future)

The RTU-C Service Tool shall use MODBUS protocol via RJ11 for connection.

8.2.3 RTU-C Manager (future)

8.3 BACnet and Communication Module (RXRX-AY01)

The third party BACnet BAS shall drive the RTU-C via a BACnet / MODBUS Gateway (for example: Alerton BCM-MDBS) or a BACnet / MODBUS Convertor (for example: the RXRX-AY01 accessory communication card, Automated Logic-UPC). It shall use the MODBUS Table in section 8.2 to access the information.

NOTICE

Use this manual to physically install the BACnet communication module into the RTU-C unit controller and connect the unit controller to your network. Use the appropriate Protocol Information document, to integrate the unit into your network. The Protocol Information document contains addressing details, BACnet® protocol information, and a list of the data points available to the network. See section 9 “BAS Protocol Information (POINTS LIST)” and section 10 ”Protocol Implementation Conformance Statement (PICS)” of this manual.

8.3.1 Reference Documents

Number	Company	Title	Source
ANSI/ASHRAE 135-2001	American Society of Heating, Refrigerating and Air-Conditioning Engineers	BACnet® A Data Communication Protocol for Building Automation and Control Networks	www.ashrae.org

8.3.2 General Information

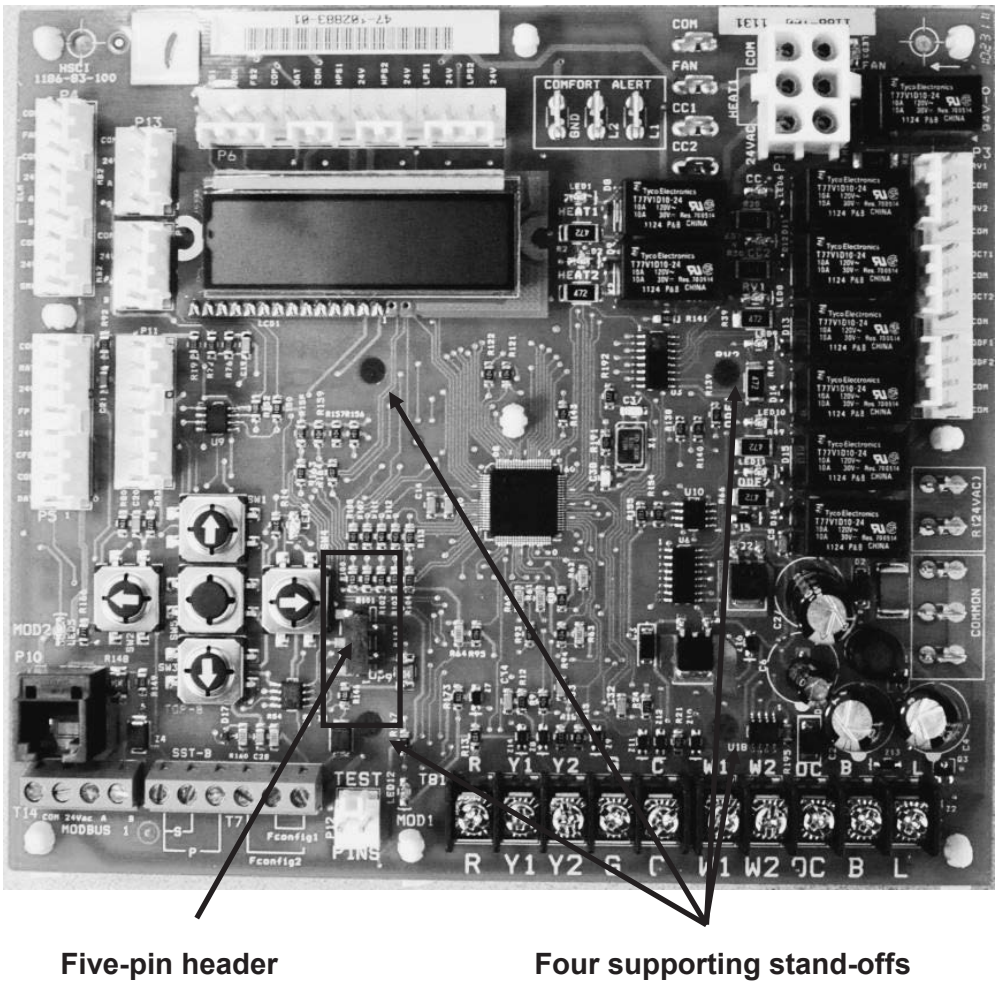
This manual contains the information you need to install the BACnet® Communication Module (RXRX-AY01) on a RTU-C Rooftop Unit Controller, incorporate it into the BACnet network, and maintain it.

8.3.2.1 Description

The BACnet Communication Module (RXRX-AY01) incorporates a RTU-C Unit Rooftop Unit into a BACnet local area network (LAN). It supports the BACnet MS/TP (EIA 485) data link layer (physical layer), BACnet over Ethernet (10Base-T), or BACnet/IP data link layers (physical layer).

The BACnet Communication Module is a printed circuit board that mounts directly on five pins on the top side of the RTU-C Rooftop Unit Controller (see Figure 8-1).

Figure 8-1. RTU-C Rooftop Unit Controller



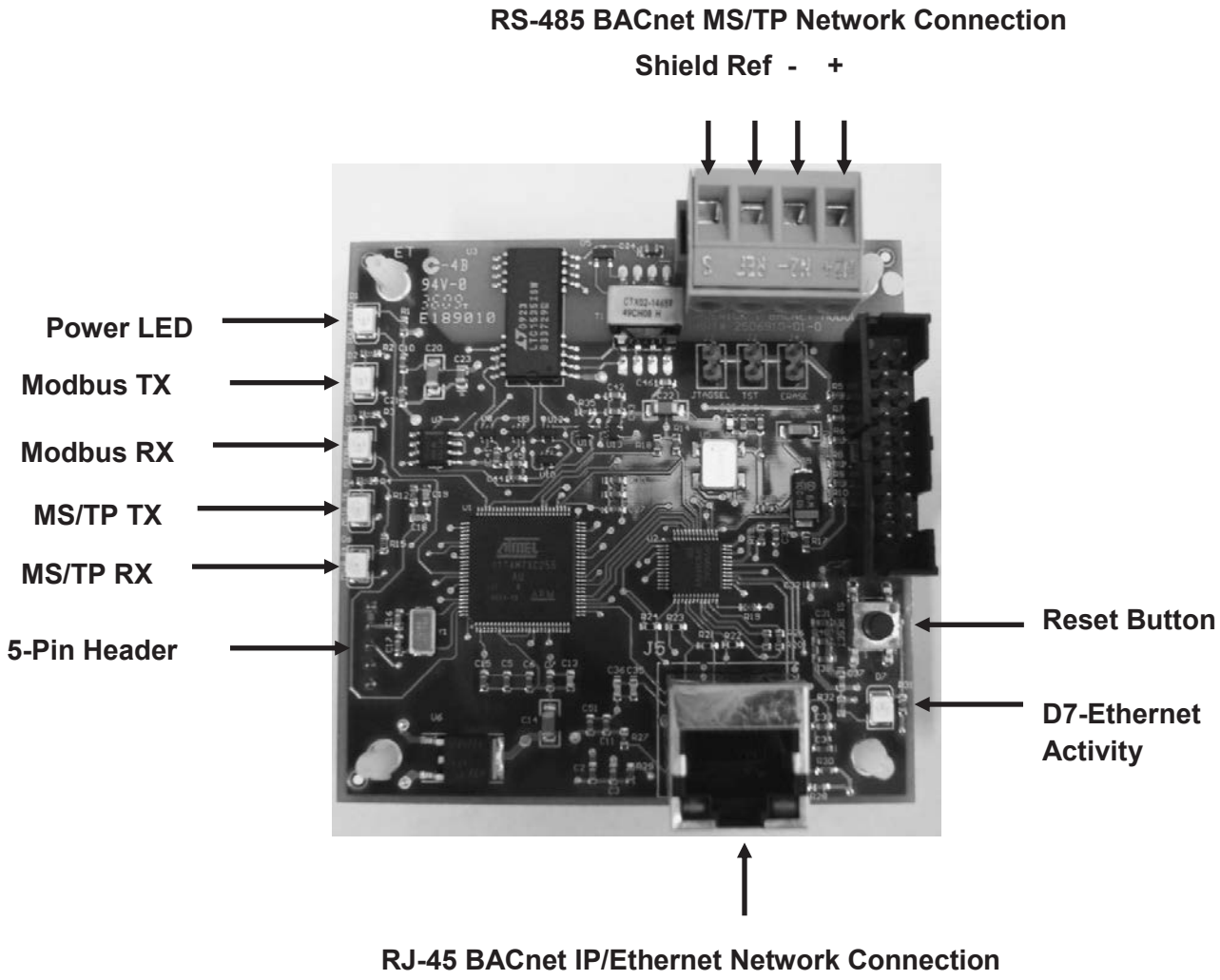
8.3.2.2 Application

The BACnet Communication Module connects the RTU-C Unit Rooftop Unit Controller to a building automation system (BAS) on a BACnet local area network. It is the interface for the exchange of BACnet objects between the network and the unit controller.

8.3.2.3 Component Data

Figure 8-2 shows the location of the major components of the BACnet Communication Module.

Figure 8-2. BACnet Communication Module Major Components



8.3.2.3.1 Reset Button

The reset button is used to reset BACnet addressing and configuration parameters. It is important to note that pressing the Reset button causes all BACnet data to revert to factory default values. For more information, see the Resetting the BACnet Communication Module section of this document.

8.3.2.3.2 Light Emitting Diodes (LEDs)

Six LEDs indicate communication activity and status of the BACnet Communications Module. These indicators are visible when the communication module is connected to the RTU-C Unit Rooftop Unit Controller and the unit is powered on (see Table 8-1 for descriptions of LED activity and Figure 8-2 for LED locations).

Table 8-1. LED Description of Activity

LED Title	LED Color	Meaning
Modbus TX	Green	LED flashes when data is being transmitted from the BACnet Communication Module to the unit controller
Modbus RX	Yellow	LED flashes when data is being sent to the BACnet Communication from the unit controller
MS/TP TX	Green	LED flashes when data is being transmitted via the MS/TP network
MS/TP RX	Yellow	LED flashes when data is received via the MS/TP network
Power	Green	This LED remains on when power is applied to the BACnet Communication Module
D7	Green	Ethernet activity LED

8.3.2.4 BACnet Connections

The RTU-C BACnet Communication Module supports BACnet MS/TP (Master Slave Token Passing), BACnet IP, or BACnet Ethernet network communication. All BACnet protocols are available on a single BACnet Communication Module.

8.3.2.5 BACnet IP/Ethernet Network Connection

An RJ-45 connector connects the BACnet Communication Module to the IP/Ethernet Network (see Figure 8-2).

8.3.2.6 BACnet MS/TP Network Connection

An RS-485 connector connects the BACnet Communication Module to the MS/TP network and has four pins: + , -, Ref, and Shield (see Figure 8-2).

8.3.3 Installation

The following section describes how to field install a new BACnet Communication Module or replace an existing BACnet Communication Module on the RTU-C Rooftop Unit Controller so that it can be incorporated into the BACnet network. The BACnet Communication Module is available for field installation only (see Specification Sheet for ordering information).

CAUTION

Electrostatic discharge hazard.

Can cause equipment damage.

This equipment contains sensitive electronic components that may be damaged by electrostatic discharge from your hands. Before you handle a communications module, you need to touch a grounded object, such as the metal enclosure, in order to discharge the electrostatic potential in your body.

WARNING

Electric shock hazard. Can cause personal injury or equipment damage.

This equipment must be properly grounded. Only personnel knowledgeable in the operation of the equipment being controlled must perform connections and service to the RTU-C Rooftop Unit Controller.

WARNING

BEFORE BEGINNING ANY MODIFICATION, BE SURE MAIN DISCONNECT SWITCH IS IN THE "OFF" POSITION. FAILURE TO DO SO CAN CAUSE ELECTRICAL SHOCK RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH. TAG DISCONNECT WITH A SUITABLE WARNING LABEL.

8.3.3.1 Contents of the BACnet Communication Module Kit (RXRX-AY01)

The following is the list of items included in the field-installed kit:

The BACnet Communication Module
Four plastic stand-offs
4-pin RS-485 network connector (MS/TP)
Installation Manual

8.3.3.2 Installing a new BACnet Communication Module

The BACnet Communication Module is mounted directly to the unit controller via the four stand-offs and 5-pin header. Follow the steps below to install a new BACnet Communication Module on the RTU-C Rooftop Unit Controller.

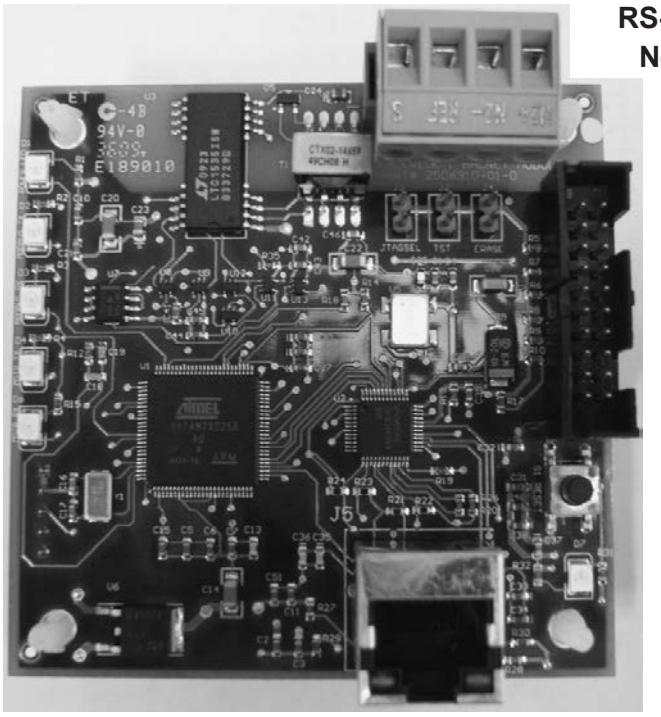
8.3.3.3 To install a new BACnet Communication Module

1. Remove power from the unit controller.
2. Connect the BACnet Communication Module to the unit controller's 5-pin header and then further secure the module to the four plastic support stand-offs (see Figure 8-1 and Figure 8-2).
3. Connect the BACnet Communication Module to the BACnet MS/TP or BACnet IP/Ethernet network.

a. For BACnet MS/TP, insert the proper network cable into the BACnet Communication Module's 4-pin RS-485 network connector (see Figure 8-2 and Figure 8-3).
b. For BACnet IP or Ethernet, insert the proper network cable into the BACnet Communication Module's RJ-45 network connector (see Figure 8-2 and Figure 8-3).

4. Apply power to the unit controller.

Figure 8-3. BACnet Communication Module Network Connections



8.3.3.4 Replacing an Existing BACnet Communication Module

Follow these steps to remove an existing BACnet Communication Module from the unit controller and replace it with a new BACnet Communication Module.

8.3.3.5 To Replace a BACnet Communication Module

1. Remove power from the unit controller.
2. Pull the network cable connector from the BACnet Communication Module (see Figure 8-3).
3. Grasp the BACnet Communication Module and carefully pull it from unit controller. It may be necessary to also remove the plastic stand-offs if they have been installed (see Figure 8-1and Figure 8-2).
4. Connect the BACnet Communication Module to the unit controller's 5-pin header and then further secure the module to the four plastic support stand offs (see Figure 8-1).
5. Connect the BACnet Communication Module to the BACnet MS/TP or BACnet IP/Ethernet network.
   a. For BACnet MS/TP, insert the proper network cable into the BACnet Communication Module's 4-pin RS-485 network connector (see Figure 8-3).
   b. For BACnet IP or Ethernet, insert the proper network cable into the BACnet Communication Module's RJ-45 network connector (see Figure 8-3).
6. Apply power to the unit controller.

8.3.4 Integration

Once the BACnet Communication Module has been properly installed on the unit controller, it is then necessary to adjust the communication interface settings to match your Building Automation System (BAS) requirements. Once that is complete, you can then integrate the unit controller into the BAS via a BACnet MS/TP or BACnet IP/Ethernet network.

The BACnet configuration process is described in the following section. Additional information about network parameters can be found in Table 8-2 as well as the BACnet Addressing section.

8.3.4.1 Configuring the BACnet Communication Module

The BACnet Communication Module may be configured and addressed using the BACnet Communication Module's browser-based user interface (further referred to as the BCM Configuration Tool). The BCM Configuration Tool is used for setting and adjusting network parameters for BACnet MS/TP, BACnet IP, or BACnet Ethernet networks.

The following sections describe how to open the BCM Configuration Tool, customize user settings, modify, test, and reset BACnet network parameters.

8.3.4.2 Required Tools

You need the following tools to configure the BACnet Communication Module for network operation:

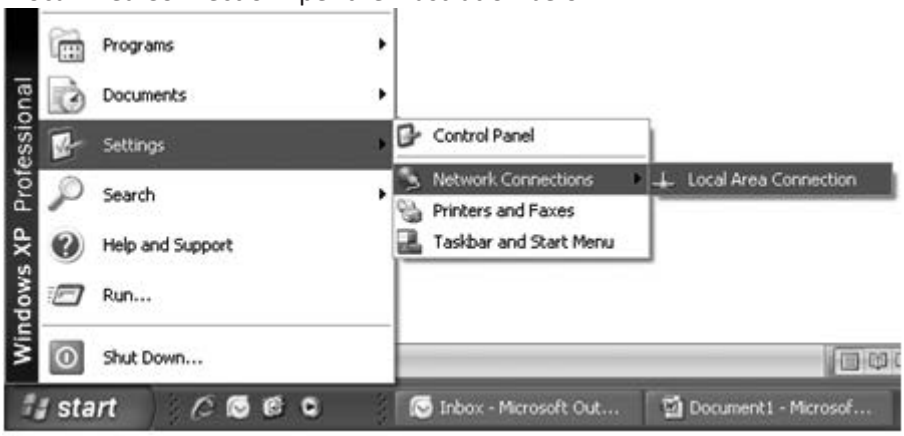
- PC with Ethernet card and TCP/IP protocol (required for BACnet IP or BACnet Ethernet)
- Internet Explorer® version 6.0 or later
- Ethernet Cable (either an Ethernet crossover cable or a standard Ethernet cable may be used)

8.3.4.3 Connecting to the BCM Configuration Tool

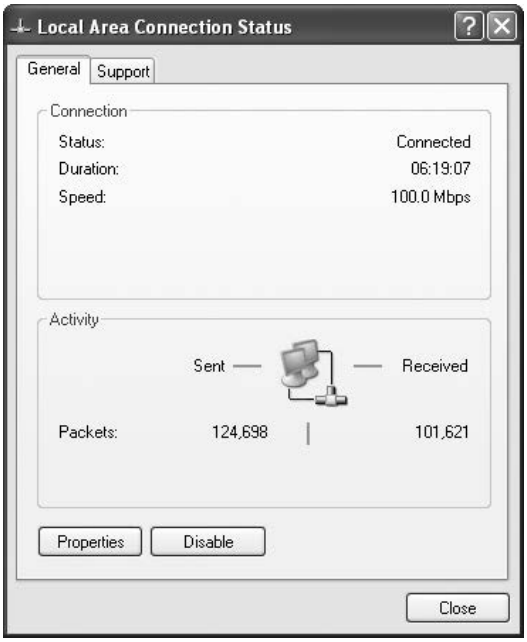
The BACnet Communication Module is configured using the BCM Configuration Tool's web-based user interface. Follow these steps to connect to the BCM Configuration Tool and adjust user name and password.

1. Verify that your PC is on the same subnet mask and similar (but not identical) IP address as the BACnet Communication Module (the steps shown below are for a PC with a Windows XP Professional operating system and may be different for other operating systems).

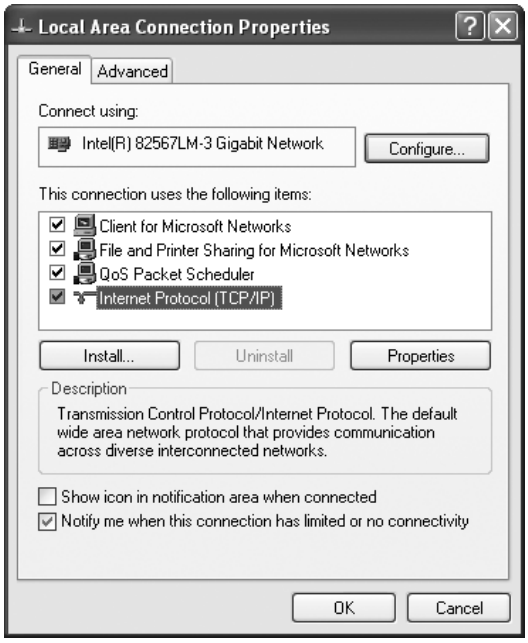
a. Go to the "start" menu, under "Settings" and then "Network Connections" and finally under "Local Area Connection" per the illustration below.



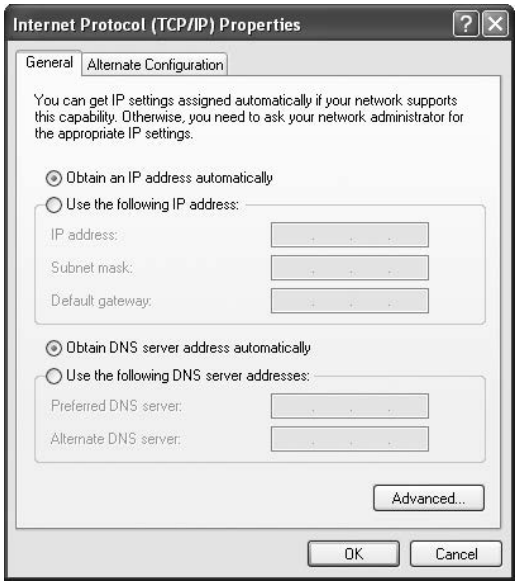
b. Click on the "Properties" button on the "General" tab as shown per the illustration to the right.



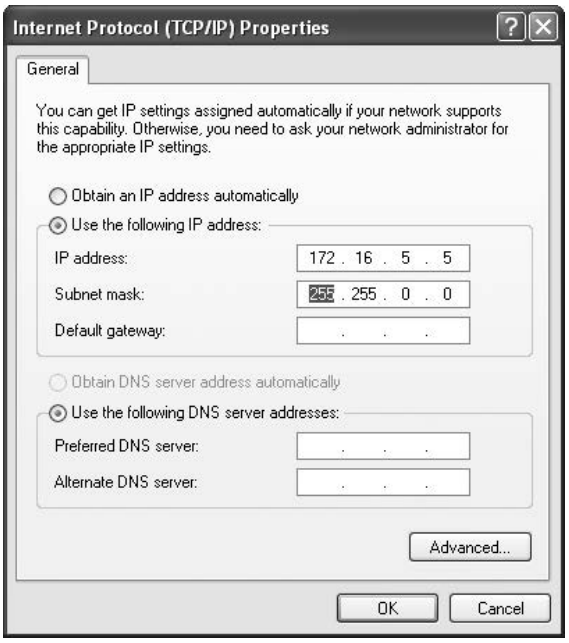
c. Click on "Internet Protocol (TCP/IP)" item and then click on the "Properties" button on the "General" tab as shown per the illustration to the right.



d. Note the existing network connections as shown on the "General" tab of the "Internet Protocol (TCP/IP) Properties" menu as shown per the illustration to the right. **Please record existing network settings. After configuring the BACnet communication card, the network must be returned to the original settings.**



e. Change the properties so that the PC network is on the same network as the BACnet communication card as shown below. Note that the new PC network address (172.16.5.5) is **NOT** the same as the default network address of the BACnet communication card which is (172.16.5.8). Once this has been done, save the settings. Now the PC and the BACnet card will be on a common network.



2. Confirm that the network cable is connected from the BACnet Communication Module to the PC
3. Open Internet Explorer and type in the IP address of the BCM Configuration Tool.

Note: The BACnet Communication Module ships with a default IP subnet mask (255.255.0.0) and IP address (172.16.5.8). It may be necessary to change the IP address and subnet mask of your PC to access the BCM Configuration Tool's user interface.

4. Once the BCM Configuration Tool's initial Login screen appears, you can then change the user name and password, if desired (see Figure 8-4). ***Note: If the Login screen does not appear, cycle main power to the unit to reset communication between the RTU-C and the communication card***.
   a. Type the default user name, which is "Administrator."
   b. Type the default password, which is "Admin."
   c. Click on the Submit button.

d. After a user name and password have been entered, the Main Menu screen appears (see Figure 8-5). The Main Menu provides the option to select either Administrator Settings or Communication Settings. The Administrator Settings screen allows alternation of the user name and password (see Figure 8-6). The Communication Interface Settings screen allows configuration of network parameters (see Figure 8-7 and following section titled Configuration using the BCM Configuration Tool).

e. To change the user name and/or password, press the Administrator Settings button.

f. Modify user name and password as desired.

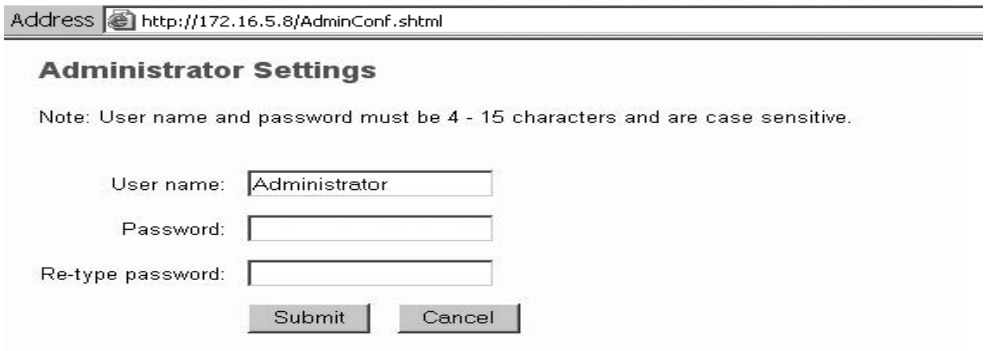
Note: Both the user name and password are case sensitive and must be 4-15 characters in length. They may be changed at any time in the Administrator Settings section of the user interface.

g. Once changes have been made to the Administrator Settings screen, a message appears to confirm that the changes have been accepted (see Figure 8-8).

Figure 8-4. BCM Configuration Tool Login Screen

Figure 8-5. BCM Configuration Tool Main Menu

Figure 8-6. BCM Configuration Tool Administrator Settings Screen



8.3.4.4 Configuration using the BCM Configuration Tool

Once the user name and password have been set, the BCM Configuration Tool can be used to view and adjust network parameters for the BACnet Communication Module. The following section describes how to change parameters necessary for BACnet addressing and initial network connection. These parameters are discussed in greater detail in Table 8-2.

1. After login, select the Communication Interface Settings option from the Main Menu screen (see Figure 8-5 and Figure 8-7).
2. Under the Device section, change the following values to meet the installation requirements:
   a. Device Name
   b. Device Instance
   c. Select the Communication Type (BACnet IP, BACnet Ethernet, or BACnet MS/P).
3. Modify other parameters under the BACnet IP or BACnet MS/TP section as required for your network.
4. Click on the Submit button.
5. Once changes have been made to the BACnet Communications Interface Settings screen, a message appears to confirm that the changes have been accepted (see Figure 8-8).

Figure 8-7. BCM Configuration Tool Communications Interface Settings Screen

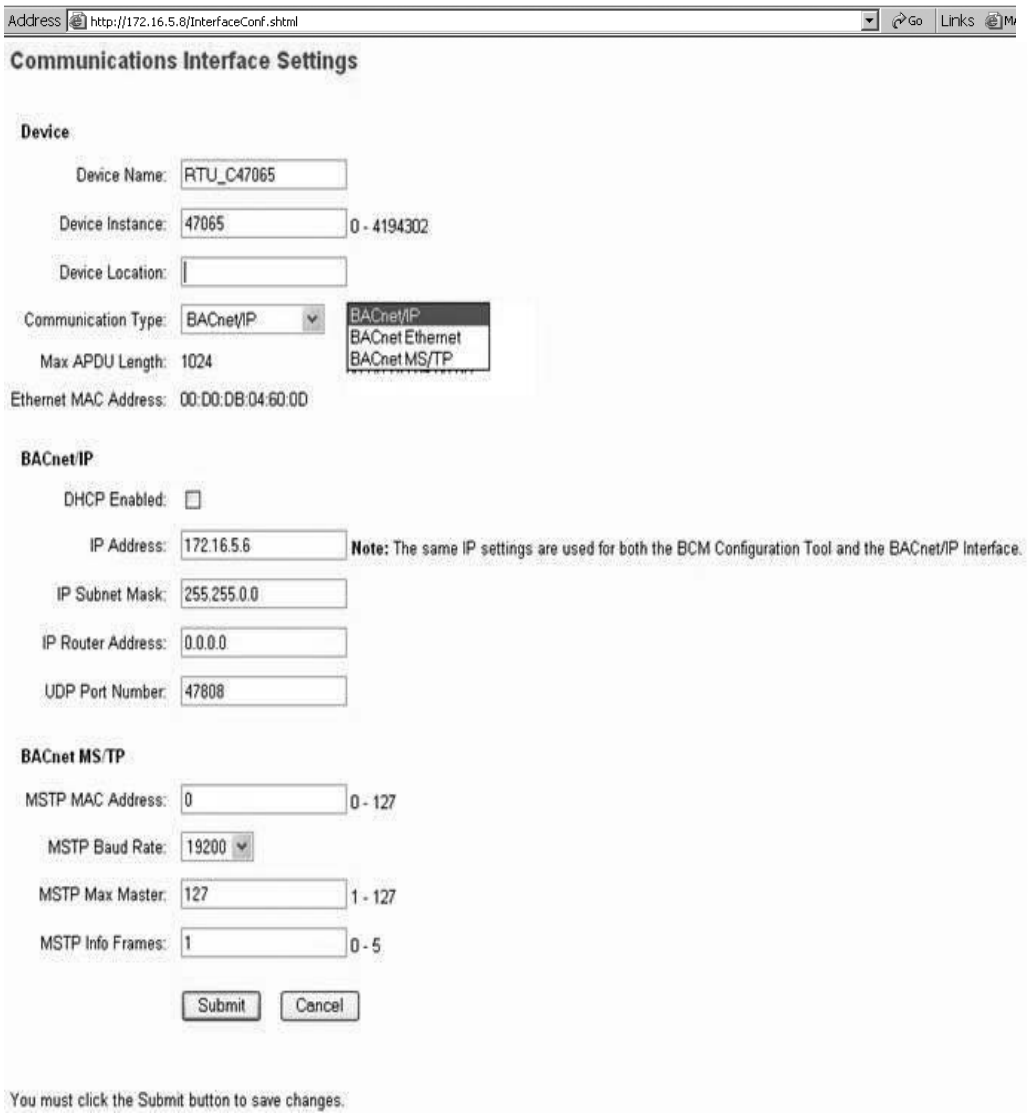


Figure 8-8. BCM Configuration Tool Settings Change Confirmation Screen

Table 8-2. Network Configuration Parameters

Parameter	Value (Range)/Definition	Initial Value/Note
Device Name	12 – 20 character Device Object Name. Change this value as needed to match installation parameters	RTU_C######### Where ######### is the Device Instance Number
Device Instance	0-4194302/Device Instance of the BACnet Communication Module	47065 for IP and Ethernet 3002 for BACnet MS/TP[1] Must be unique throughout the entire network
Device Location	0 – 31 characters. An optional BACnet property intended to indicate the physical location of the unit controller	Initial values is NULL or blank
Communication Type	1 – BACnet/IP 2 – BACnet/Ethernet 3 – BACnet MS/TP	1 – BACnet/IP
DHCP Enabled	Off-On/Dynamic Host Configuration Protocol (DHCP) is a network protocol that enables a server to automatically assign an IP Address	Default = disabled
IP Address	IP Address of the BACnet Communication Module	172.16.5.8
IP Subnet Mask	Subnet Mask of the BACnet Communication Module	255.255.0.0
IP Router Address	Internet Protocol Router Address	0.0.0.0
UDP Port Number	0 – 65535, (User Datagram Protocol) Identifies the application process in the destination unit	47808
MSTP MAC Address	0-127/ The MS/TP address of the BACnet Communication Module	0/ Each device on the BACnet network must have a unique MS/TP address
MSTP Baud Rate	9600-19200-38400-76800/ Data transfer speed	19200 bps
MSTP Max Master	0-127/ This variable specifies the highest possible address for master node and shall be less than or equal to 127	127
MSTP Info Frames	0-5/ This variable specifies the maximum number of information frames the BACnet Communication Module may send before it must pass the token	1

[1] The default device instance for BACnet MSTP is 3002 + the MAC address.

8.3.4.5 BACnet Addressing

The following section describes the common BACnet configuration parameters used to establish network communication between the unit controller and the BAS.

8.3.4.6 BACnet MS/TP

Common settings required for BACnet MS/TP configuration are: MS/TP MAC address, Device Instance, and Baud Rate.

The BACnet MS/TP Media Access Control (MAC) address is a one-octet address that must be set during the BACnet Communication Module configuration. The MAC address must be unique to the MS/TP network and have a valid range of 0-127. It is shipped set to a default value of 0.

8.3.4.7 BACnet IP

Common settings required for BACnet IP configuration are: IP Address, Subnet Mask, and Device Instance. The BACnet Communication Module is assigned a factory default IP address and Subnet Mask.

These are only temporary but are required so that the user knows what address to access the BACnet Communication Module in order to change network parameters. See your system administrator for the correct IP Address and Subnet Mask required for your network.

The BACnet/IP (B/IP) address of the RTU-C unit controller consists of the four-octet IP address followed by the two-octet UDP (User Datagram Protocol) port number. The BACnet/IP Address is a six-octet value analogous to a MAC (Media Access Control) address. The IP Address portion of the BACnet/IP address must be unique in the BACnet network segment. The default UDP port number in the unit controller is 47808 (BAC0 in hexadecimal).

8.3.4.7.1 Dynamic Host Configuration Protocol

The BACnet Communication Module supports Dynamic Host Configuration Protocol (DHCP) IP Addressing for BACnet IP networks.

By default, this feature is disabled. To configure the BACnet Communication Module to use the DHCP feature, select "DHCP Enabled" check box in the BACnet IP section of the Communications Interface Settings page (see Figure 8-7). In a DHCP-based network, the BACnet Communication Module automatically receives the required parameters from the DHCP server. Consult with your network administrator for the information on your network setting.

8.3.4.8 BACnet Ethernet

BACnet Ethernet requires configuration of the Device Instance.

The Ethernet MAC address of the BACnet Communication Module is a six-octet address assigned when it was manufactured. It is fixed and cannot be changed. Use this address to access the BACnet Communication Module on a BACnet over Ethernet network.

8.3.4.9 Testing Network Communication

You can determine whether your PC is properly configured to access the BACnet Communication Module. To test whether your computer is properly addressed to communicate with the BACnet Communication Module, follow these steps:

1. Make sure the PC has Subnet Mask 255.255.0.0 and similar (but not identical) IP Address as the BACnet Communication Module.
2. Open a DOS window (go to Start button\Programs\Accessories\Command Prompt.)
3. Type "ping 172.16.5.8" at the DOS prompt.
4. Press Enter.
5. Observe response. See Figure 8-9 for a successful response.

Figure 8-9. Successful Ping and Response

```
C:\>ping 172.16.5.8

Pinging 172.16.5.8 with 32 bytes of data:

Reply from 172.16.5.8: bytes=32 time=93ms TTL=63
Reply from 172.16.5.8: bytes=32 time=5ms TTL=63
Reply from 172.16.5.8: bytes=32 time=70ms TTL=63
Reply from 172.16.5.8: bytes=32 time=16ms TTL=63

Ping statistics for 172.16.5.8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 5ms, Maximum =  93ms, Average =  46ms

C:\>
```

8.3.4.10 Resetting the BACnet Communication Module

All settings that can be changed with the BCM Configuration Tool may be reset to factory defaults with the Reset Button (see Figure 8-2 for location of the Reset Button on the BACnet Communication Module). If the IP Address or the MAC Address has been lost or forgotten, the BACnet Communication Module can be reset to the default IP Address and Subnet Mask.

All settings from Administrator Settings and/or Communications Interface Settings screens are reset to factory defaults.

To activate the reset function, push the Reset Button while the BACnet Communication Module is attached to unit controller and while power is applied to both.

Note: The Power, Modbus TX, and Modbus RX LEDs all blink during regular operation. After the Reset Button is pushed, the Power LED will be solid green for a few seconds and the Modbus TX and Modbus RX LEDs will be blank for a few seconds.

8.3.5 Test Procedures

If attempts to communicate with the RXRX-AY01 card through the Ethernet port are unsuccessful, cycle the unit main power once to reset communication between the RTU-C and the RXRX-AY01.

If you can control the unit from the unit controller but you are not able to communicate with unit via the network, follows these steps:

- Check the network wiring
- Check the network parameters and verify that they are correct and that there are no duplicate devices on the network
- Check communications

8.4 *LONWORKS and Communication Module (RXRX-AY02)*

The third party LONWORKS BAS shall drive the RTU-C via a LONWORKS / MODBUS Gateway or a LONWORKS / MODBUS Convertor (for example: RXRX-AY02 Communication Card Accessory, Automated Logic-UPC). It shall use the MODBUS Table in section 8.2 to access the information.

NOTICE

Use this section of the manual to physically connect the communication module to the RTU-C unit controller and connect the unit controller to your network. Connections and service to unit controller must be performed only by personnel knowledgeable in the operation of the equipment being controlled. Use the appropriate Protocol Information document, to integrate the unit into your network. The Protocol Information document contains addressing details, LONWORKS® protocol information, and a list of the data points available to the network. See the Reference Documents section of this manual for Protocol Information document numbers.

8.4.1 *Reference Documents*

Number	Company	Title	Source
078-0014-01E	LONMARK Interoperability Association	LONMARK Layers 1-6 Interoperability Guidelines, Version 3.0	www.lonmark.org
078-0120-01E	LONMARK Interoperability Association	LONMARK Application Layer Interoperability Guidelines, Version 3.4	www.lonmark.org
078-0156-01G	Echelon® Corporation	LONWORKS® FTT-10A Free Topology Transceiver Users Guide	www.echelon.com
8500_20	LONMARK Interoperability Association	Space Comfort Controller Functional Profile	www.lonmark.org

8.4.2 *Trademark Notices*

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8.4.3 General Information

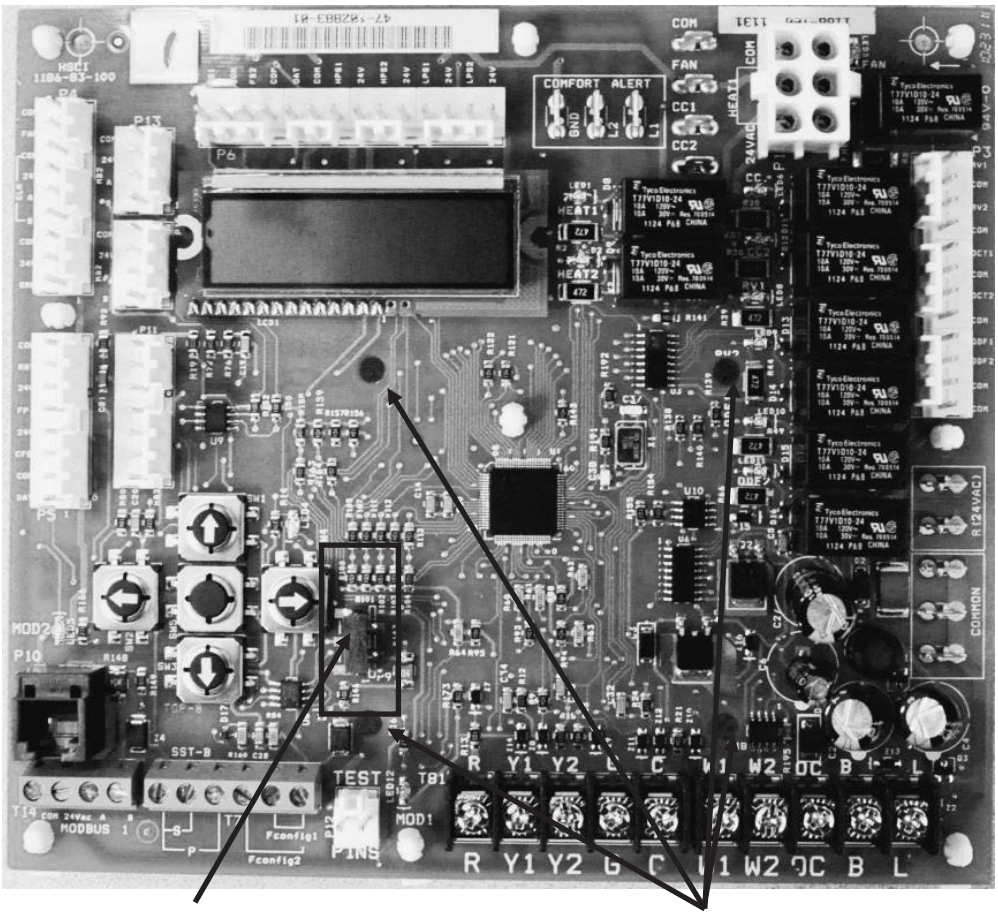
This section contains the information you need to install a LONWORKS Communication Module (RXRX-AY02) to the RTU-C Rooftop Unit Controller and integrate it into the network.

8.4.3.1 Description

A LONWORKS Communication Module provides the interface between The RTU-C Rooftop Unit Controller and a LONWORKS Local Operating Network (LON). It translates the LonTalk® variables used on the network to the variables used in the unit controller and vice versa. It translates in accordance with the LONMARK Functional Profile and is LonMark 3.4 certified. Profiles are interpreted in loaded programs (firmware).

The LONWORKS Communication Module is a printed circuit board that mounts directly on five pins on the top side of the RTU-C Rooftop Unit Controller (see Figure 8-10).

Figure 8-10. RTU-C Rooftop Unit Controller



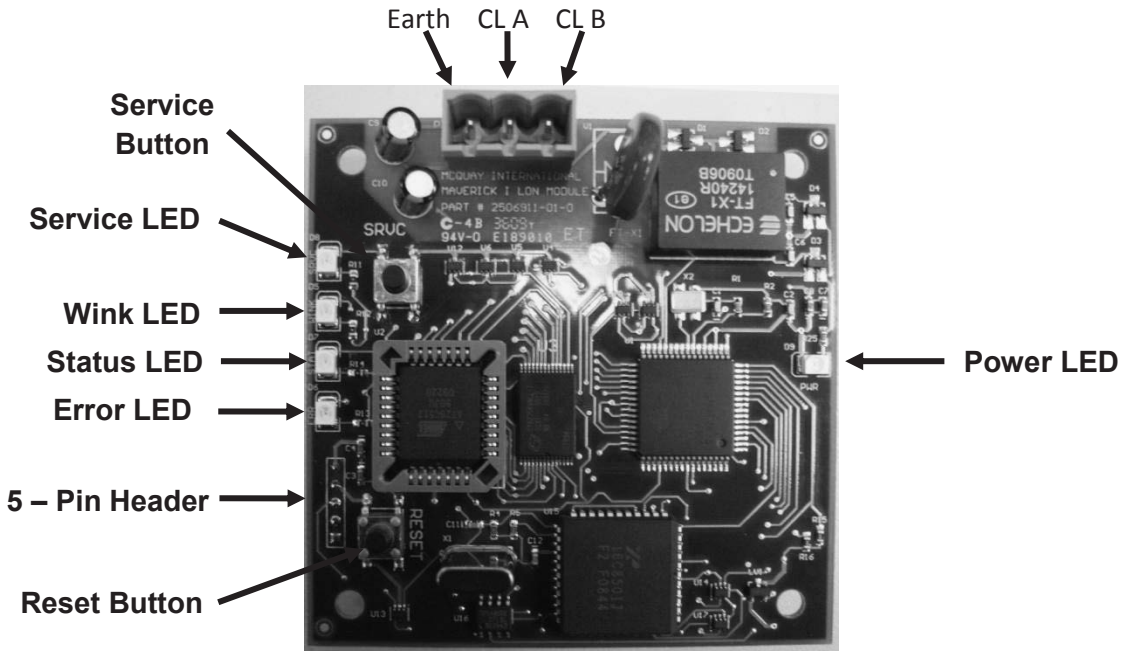
8.4.3.2 *Application*

A LONWORKS Communication Module connects the RTU-C Rooftop Unit Controller to the building automation system (BAS) on a LONWORKS network. It is the interface adapter for the exchange of LonTalk variables between the network and the unit controller. The LONWORKS Communication Module translates the LonTalk variables of the Space Comfort Control (SCC) profile into the native information of the unit controller.

8.4.3.3 *Component Data*

Figure 8-11 shows the location of the major components of the LONWORKS Communication Module.

Figure 8-11. LONWORKS Communication Module Major Components



8.4.3.4 *Service Pin*

The service pin generates a service-pin message that contains the Neuron® ID and the program code identification of the node. A service-pin message is a network message that is generated by a node and broadcast on the network. It can be used to commission the LONWORKS network (see Figure 8-11).

8.4.3.5 *Reset Pin*

Use the Reset button is to reset the LonWorks communication module application. Press the Reset button to revert all Network Variable (NV) parameters back to default values (see Figure 8-11).

Configuration variables do not change. See section 9.5, page 131 for a complete list of all network parameters.

The Reset button can also be used to clear network addressing parameters from a LonWorks communication module. For example, a module that has been previously installed on a network, and is then installed on a new network, can interfere with communications if the original LonWorks communication module has the same Subnet ID and/or Node Address as another module on the new network. To clear the network addressing data from the original module, press the Reset button and then immediately press and hold the Service Pin button for five seconds. When the Subnet ID and Node Address have been cleared, the green Service LED will flash on and off every two seconds.

8.4.3.6 Light Emitting Diodes (LEDs)

Five LEDs indicate communication activity and status of the LONWORKS Communication Module. These indicators can be seen when the LONWORKS Communication Module is connected to the RTU-C Rooftop Unit Controller (see Table 8-3).

Table 8-3. LED Activity Details

LED Label	LED Color	Meaning
SRVC	Yellow	This LED flashes approximately once a second when device is not commissioned. This LED activates when the Service pin is pressed. Otherwise, this LED is off when the device is commissioned but the Service pin has not been pressed.
WINK	Green	Winking is used to identify control on the network. The Wink LED will flash 2 times/second for 5 seconds when control is winking.
STAT	Green	The Status LED flashes when the unit controller transmits a request. When communicating properly with the unit controller, it flashes 6 times/second or faster. If communication between the unit controller and communication module is not responding properly, it flashes slower (approximately once per second) and the error LED will flash.
ERR	Red	The Error LED flashes when there is a mis-communication between the unit controller and communication module.
PWR	Green	The LED remains steady on when power is applied to the communication module.

8.4.3.7 LONWORKS Network Connector

The network connector connects the LONWORKS Communication Module to the LONWORKS FTT-10A bus (see Table 8-4).

Table 8-4. Network Connector Pin Descriptions

Pin	Function
CLB	FTT-10B
CLA	FTT-10A
Earth	Earth Ground

8.4.3.8 LonMark Profile Software

The LONWORKS Communication Module software translates the Standard Network Variable Types (SNVTs) and Standard Network Configuration Parameter Types (SCPTs) in accordance with the LONMARK

profiles used on the LONWORKS network into the variables and parameters used in the RTU-C Rooftop Unit Controller.

8.4.3.9 Neuron ID

The basis of the LONWORKS Communication Module is an Echelon Neuron integrated circuit. Each Neuron chip contains a globally (i.e., worldwide) unique, 48-bit serial number called the Neuron ID. The Neuron ID can be used to address the device on the LONWORKS network.

8.4.3.10 Transceiver

The Echelon Corporation Free Topology Transceiver (FTT-10A) is used to communicate on the LONWORKS network. The network topology may consist of a star, daisy-chain, or other topology. Data transmission rate on the network is 78 kbps (baud).

8.4.3.11 Specifications

Table 8-5 identifies the network specifications required for use with the LONWORKS Communication Module.

Table 8-5. LONWORKS Network Specifications

Characteristic	Description
Network Topology	Flexible Free Topology
Neuron Chip Processor	3150
Free Topology Transceiver (FTT-10A)	50051
Cable Types	TIA Category 5 (recommended)
Maximum Bus Length	1476 ft (450) meters per segment
Maximum Node Separation	820 ft (250 meters)
Data Transmission	Two-wire, half duplex
Data Transmission Rate	78 kbps (baud)

8.4.4 Installation

The following section describes how to field install a new LONWORKS Communication Module or replace an existing LONWORKS Communication Module on the RTU-C Rooftop Unit Controller so that it can be incorporated into the LONWORKS network. The LONWORKS Communication Module is available for field installation only (see Specification Sheet for ordering information).

⚠ CAUTION

Electrostatic discharge hazard.

Can cause equipment damage.

This equipment contains sensitive electronic components that may be damaged by electrostatic discharge from your hands. Before you handle a communications module, you need to touch a grounded object, such as the metal enclosure, in order to discharge the electrostatic potential in your body.

⚠ WARNING

Electric shock hazard. Can cause personal injury or equipment damage.

This equipment must be properly grounded. Only personnel knowledgeable in the operation of the equipment being controlled must perform connections and service to the RTU-C Rooftop Unit Controller.

⚠ WARNING

BEFORE BEGINNING ANY MODIFICATION, BE SURE MAIN DISCONNECT SWITCH IS IN THE "OFF" POSITION. FAILURE TO DO SO CAN CAUSE ELECTRICAL SHOCK RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH. TAG DISCONNECT WITH A SUITABLE WARNING LABEL.

8.4.4.1 Contents of the LONWORKS Communication Module Kit (RXRX-AY02)

The following is the list of items included in the field-installed kit:

The LONWORKS Communication Module
Four plastic stand-offs
3-pin network connector
Installation Manual

8.4.4.2 Installing a new LONWORKS Communication Module

Follow these steps to install a new LONWORKS Communication Module RTU-C Rooftop Unit Controller:

1. Remove power from the unit controller.
2. Connect the LONWORKS Communication Module to the unit controller's 5-pin header and then further secure the module to the four plastic support stand offs (see Figure 8-10).
3. Connect the LONWORKS Communication Module to the network (see Figure 8-11 and Figure 8-12).
   a. Connect one wire of the network cable to the CLA Pin of the connector plug.
   b. Connect the other wire to the CLB Pin of the connector plug.
4. Apply power to the unit controller.

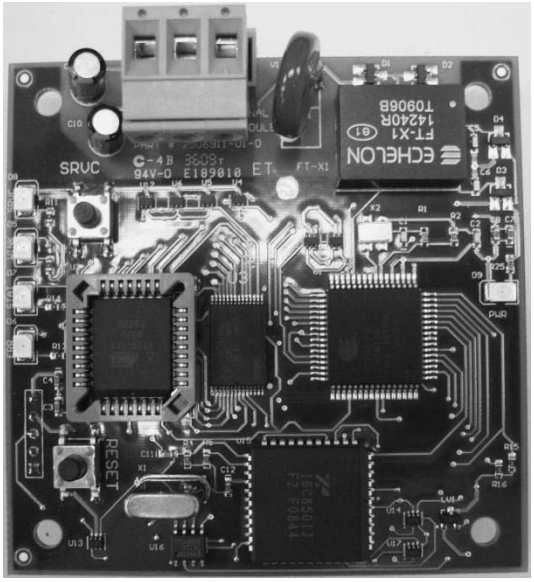
8.4.4.3 *Replacing an Existing LONWORKS Communication Module*

Follow these steps to remove an existing LONWORKS Communication Module from the unit controller and replace it with a new LONWORKS Communication Module:

1. Remove power from the unit controller.
2. Pull the network cable connector from the LONWORKS Communication Module.
3. Grasp the LONWORKS Communication Module and carefully pull it from unit controller. It may be necessary to also remove the plastic stand-offs if they have been installed (see Figure 8-10 and Figure 8-11).
4. Connect the LONWORKS Communication Module to the unit controller's 5-pin header and then further secure the module to the four plastic support stand offs (see Figure 8-10).
5. Connect the LONWORKS Communication Module to the network (see Figure 8-11 and Figure 8-12).
   a. Connect one wire of the network cable to the CLA Pin of the connector plug.
   b. Connect the other wire to the CLB Pin of the connector plug.
6. Apply power to the unit controller.

Figure 8-12. LONWORKS Communication Module Network Connection

Network Connection (shown with 3-pin connector inserted)



8.4.5 Integration

Once the LONWORKS Communication Module has been properly installed on RTU-C Unit Controller, it is then necessary to configure the unit controller for integration into a Building Automation System (BAS) via the LONWORKS network. The configuration process is described in the following section.

8.4.5.1 Connecting to the Network

After you have connected the LONWORKS Communication Module to the RTU-C Rooftop Unit Controller, you must connect it into the LONWORKS network. Each LONWORKS Communication Module is equipped with an FTT-10A transceiver for network communications. This transceiver allows for (1) free topology network wiring schemes using twisted pair (unshielded) cable and (2) polarity insensitive connections at each node. Free topology segments require termination for proper transmission performance.

Refer to Echelon LONWORKS FTT-10A Transceiver User's Guide for details regarding acceptable configurations, cabling requirements, terminations, and other requirements for proper connection of the unit to the LONWORKS network**.**

8.4.5.2 *LONWORKS* Network Addressing

Every Neuron Chip has a unique 48-bit Neuron ID or physical address. This address is generally used only at initial installation or for diagnostic purposes. For normal network operation, a device address is used.

Device addresses are defined at the time of network configuration. All device addresses have three parts. The first part is the Domain ID, designating the domain. Devices must be in the same domain in order to communicate with each other. The second part is the Subnet ID that specifies a collection of up to 127 devices that are on a single channel or a set of channels connected by repeaters. There may be up to 255 subnets in a domain. The third part is the Node ID that identifies an individual device within the subnet.

A group is a logical collection of devices within a domain. Groups are assembled with regard for their physical location in the domain. There may be up to 256 groups in a domain. A group address is the address that identifies all devices of the group. There may be any number of devices in a group when unacknowledged messaging is used. Groups are limited to 64 devices if acknowledged messaging is used.

A broadcast address identifies all devices within a subnet or domain.

8.4.5.3 Commissioning the Network

- To commission the device (i.e. LONWORKS Communication Module), press the service pin (see Figure 8-12). Doing so generates a service-pin message, which is broadcast on the network and contains the Neuron ID and the program code identification of the node.
- Next, use a LONWORKS network configuration tool, such as LonMaker®, to map the device Neuron ID to the domain/subnet/node logical addressing scheme when it creates the network image, the logical network addresses and connection information.

8.4.5.4 External Interface File (XIF) and NXE Files

LONMARK guidelines specify exact documentation rules so that proprietary configuration tools are not required to commission and configure LONWORKS devices. The LONWORKS Communication Module is self-documenting so that any LONWORKS network management tool can obtain all the information needed over the network to connect it into the system and to configure and manage it.

An external interface file (a specially formatted PC text file with the extension .XIF) is required, along with LONWORKS network management tool, so that you can design and configure the device prior to installation.

The NXE file contains the application image that is downloaded into the LONWORKS Communication Module.

The XIF and NXE files are available at http://www.lonmark.org/

8.4.5.5 Configuring the LONWORKS Communication Module

The LONWORKS Communication Module typically does not require configuration. The unit ships ready to operate with default values which can then be changed via the network. Refer to section 9.3.5.3 for descriptions of the available LONWORKS variables.

8.4.5.6 Resetting/Clearing the LonWorks Communication Module

It is possible to reset or clear network parameters values from the LONWORKS communication module.

Use the Reset button is to reset the LONWORKS communication module application. Press the Reset button to revert all Network Variable (NV) parameters back to default values. Configuration variables do not change. See section 9.5, page 131 for a complete list of all network parameters.

The Reset button can also be used to clear network addressing parameters from a LONWORKS communication module. For example, a module that has been previously installed on a network, and is then installed on a new network, can interfere with communications if the original LONWORKS communication module has the same Subnet ID and/or Node Address as another module on the new network. To clear the network addressing data from the original module, press the Reset button and then immediately press and hold the Service Pin button for five seconds. When the Subnet ID and Node Address have been cleared, the green Service LED will flash on and off every two seconds.

8.4.6 Test Procedures

If attempts to communicate with the RXRX-AY02 card are unsuccessful, cycle the unit main power once to reset communication between the RTU-C and the RXRX-AY02.

If you are unable to communicate to the LONWORKS Communication Module via the network:

- Check the network wiring.
- Check addressing.
    - Activate the Service Pin on the LONWORKS Communication Module to send the service message to the network. The service-pin message contains the Neuron ID and the program code identification of the node.

9. BAS Protocol Information (POINTS LIST)

This document contains the necessary information you need to incorporate a RTU-C into your building automation system. It lists all BACnet® properties, LONWORKS® variables, and corresponding unit Controller data points. It also contains the BACnet Protocol Implementation Conformance Statement (PICS) [see section 10]. BACnet and LONWORKS terms are not defined. Refer to the respective specifications for definitions and details.

9.1 Unit Controller Data Points

The RTU-C Rooftop Unit Controller contains data points or unit variables that are accessible from four user interfaces: the unit keypad, BACnet IP, BACnet Ethernet, BACnet MS/TP or a LONWORKS network. Not all points are accessible from each interface. This manual lists all important data points and the corresponding path for each applicable interface. Refer to the applicable section of this Manual for keypad details.

9.2 Protocols Supported

The RTU-C Rooftop Unit Controller can be configured in either an interoperable BACnet or LONWORKS network. The controller must have the corresponding network communication module installed. There are two network communication modules: one for BACnet and one for LONWORKS. The BACnet module supports BACnet IP, BACnet Ethernet, and BACnet MS/TP (Master/Slave Token Passing). The LONWORKS module supports the LonMark® SCC (Space Comfort Controller for rooftop) functional profile.

9.2.1 BACnet Protocol

BACnet is a standard communication protocol for Building Automation and Control Networks developed by the American National Standards Institute (ANSI) and American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) specified in ANSI/ASHRAE standard 135-2004. It addresses all aspects of the various systems that are applied to building control systems. BACnet provides the communication infrastructure needed to integrate products manufactured by different vendors and to integrate building services that are now independent. The RTU-C is tested according to the BACnet Testing Laboratory (BTL) Test Plan. It is designed to meet the requirements of the BACnet Standard (ANSI/ASHRAE 135-2004) as stated in the Protocol Implementation and Conformance Statement (PICS). However, it is not BTL listed.

9.2.2 LONWORKS Networks

A control network specification for information exchange built upon the use of LonTalk for transmitting data developed by the Echelon Corporation.

9.2.3 LonTalk Protocol

A protocol developed and owned by the Echelon Corporation. It describes how information should be transmitted between devices on a control network.

9.2.4 *LonMark Certification*

LonMark certification is an official acknowledgement by the LonMark Interoperability Association that a product communicates using the LonTalk protocol and transmits and receives data per a standard LonMark functional profile. The RTU-C Rooftop Unit Controller is LonMark 3.4 certified.

9.3 *Basic Protocol Information*

9.3.1 *Setting Network Communication Parameters*

Table 9-1 below describes the network parameters that should be configured so that the unit controller communicates properly with the BAS. There are various protocol options (BACnet IP/Ethernet, BACnet MS/TP or LONWORKS). Parameters are set differently depending on which communication module is ordered and shipped with the unit. Table 9-1 shows the factory default values.

The BACnet Communication Module (BCM) configuration tool, a web-based user interface, can be used to configure and address the BACnet parameters shown in Table 9-1.

Table 9-1. Parameter Settings

Parameter Name	BACnet IP/Ethernet	BACnet MS/TP	LONWORKS
IP Address	172.16.5.8	N/A	N/A
IP Subnet Mask	255.255.0.0	N/A	N/A
UDP Port Number	47808	N/A	N/A
IP Router Address (Gateway)	0.0.0.0	N/A	N/A
MSTP MAC Address	N/A	0	N/A
MSTP Baud Rate	N/A	19200	N/A
Type	BACnet IP or BACnet Ethernet	BACnet MS/TP	LonWorks
Device Instance Number	47065	3002*	N/A
Max Master	N/A	1	N/A
Max Info Frames	N/A	127	N/A
Max APDU Length	BACnet IP:1024 BACnet Ethernet: 1472	480	N/A
Device Object Name[1]	RTU_C##########	RTU_C##########	N/A

*The default Device Instance Number for BACnet MS/TP is 3002 plus the MAC address.

9.3.2 *BACnet Networks*

9.3.2.1 *Compatibility*

The RTU-C Rooftop Unit Controller conforms to the BACnet Standard (ANSI/ASHRAE 135-2004) as stated in the Protocol Implementation and Conformance Statement (PICS). See the BACnet Protocol Implementation Conformance Statement in Section 10 of this document.

9.3.2.2 *BACnet Objects*

RTU-C Rooftop Unit Controllers incorporate standard BACnet object types (i.e., object types defined in the BACnet Standard) that conform to the BACnet Standard. Each object has properties that control unit variables or data points. Some object types occur more than once in the RTU-C Rooftop Unit Controller; each occurrence or instance has different properties and controls different unit variables or data points. Each instance is designated with a unique instance index. Some properties can be adjusted (read/write properties, e.g., setpoints) from the network and others can only be interrogated (read-only properties, e.g., status information).

Each data point accessible from a BACnet network is described with a table that gives the Object Identifier, Property Identifier, Full BACnet Reference or path, and the Name enumeration of the property.

Note: The RTU-C Rooftop Unit Controller has been programmed with a Receive Heartbeat function for certain BACnet variables. If BACnet has not written to these values before, the Receive Heartbeat timer expires (default=0.0 seconds) then the variables will revert to either the default or to the value of the attached sensor. The Receive Heartbeat timer can be changed through the BACnet network. Setting the Receive Heartbeat value to zero (0) disables this feature.

9.3.2.3 *Example of BACnet Data Point*

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Binary Value	5	1	Present_Value	85
Full Reference				
RTU_C#########.ExhFanState.Present_Value				
Enumeration				
0 = Off 1 = On				

9.3.2.4 *Object Identifier*

Object Identifiers are each designated with an Object type as defined in the BACnet specification. The first column of the data point definition gives the object type. This object happens to be Return/Exhaust Fan Status.

The object identifier is a property of the object that you can read from the object. The name of the property is “Object_Identifier” and the property identifier is 85.

Each object in the RTU-C Rooftop Unit Controller has a unique identifier. BACnet object identifiers are two-part numbers of BACnet Object Identifier data type. The first part identifies the object type (the first 10 bits of the 32-bit BACnet Object Identifier [See ANSI/ASHRAE 135-2004 BACnet A Data Communication Protocol for Building Automation and Control Networks]). The first column of the data point definition gives the object type. The second part identifies the instances of that particular object type (the last 22 bits of the 32-bit BACnet Object Identifier).

The object identifier is shown in the data points listing as two numbers. The first number is shown in the Type ID column and designates the Object type enumeration. The second number is shown in the Instance column and designates the instance of that particular object type.

The object identifier is a property of the object that you can read from the object code. The name of the property is “Object_Identifier” and the property identifier is 85. The ASHRAE BACnet specification reserves the first 128 numbers for ASHRAE defined objects. Manufacturers may define additional object types and assign a number above 127 as long as they conform to the requirements of the ASHRAE BACnet specification.

Each object also has a name. Object names are character strings. The object name is a property of the object that you can read from the object. The name of the property is “Object_Name” and the property identifier is 77.

Objects are sometimes referred to as an object type and instance number as they are in the BACnet specification. The example object above would be: Binary Value, Instance 1.

9.3.2.5 Property Identifier

Each object has a number of properties or attributes. Each property has a unique identifier of BACnet Property Identifier data type. Property identifiers are an enumerated set; a number identifies each member. The Property Identifier enumeration number is shown in the Property ID column. In the example above the property identifier is 85.

9.3.2.6 Property Name

Each property also has a unique name. Property names are character strings and shown in the Property Name column. In the example above the property name is Present Value.

9.3.2.7 Full Reference

The full reference is the path of the property within the network where the RTU-C Rooftop Unit Controller resides. It is a character string equivalent to the object identifier and the property identifier. In the example above the full reference is RTU_C#########.FanOutput.Present Value.

9.3.2.8 Enumerated Values

Some properties are standard data types and some are enumerated sets. If the property value is an enumerated set, all enumerated values and corresponding meaning are given in the Enumeration column of the data point listing.

9.3.3 Unit Controller Device Object

Each BACnet compatible device must have one and only one BACnet Device Object.

9.3.3.1 Device Object Identifier

The RTU-C Rooftop Unit Controller Device Object Identifier uniquely specifies the unit within the network. The device object type for all devices is fixed by ASHRAE at 8. Therefore the device object instance number must be unique. The initial Device Object identifier is set at manufacturing. The device

object identifier can be read from the RTU-C Rooftop Unit Controller. The name of the property is "Object_Identifier" and the property identifier is 75. The initial device object instance number is 3002.

⚠ CAUTION

If another device in the network already has this object identifier (instance number), you must change the instance number of one device object, so that all devices in the network have a unique device identifier.

9.3.3.2 Device Object Name

The device object name specifies a device and must be unique in the network. The device object name for the RTU-C Rooftop Unit Controller device is RTU_C#########, where ######### is the device instance of the Unit Controller. The device object name must be unique throughout the entire network. If there are multiple Unit Controllers on the network, the device object name of each Unit Controller must be changed to have a unique device object name. To make the device object name unique, change the device instance, which must also be unique on the network. All objects include the device name and a period "." (RTU_C#########.) preceding the object name.

The device object name is also available to the network in the device. The property name is "Object_Name" and property identifier is 77. The device object name can only be made unique by changing the device instance. The RTU_C portion of the device name can only be changed via the BCM configuration interface.

9.3.3.3 Device Object Properties

The device object contains many other informative properties as shown in Table 2.

Table 9-2. RTU-C Rooftop Device Object Properties

Property	Identifier	Value	Data Type
Object Identifier	75		BACnetObjectIdentifier
Object Name	77	RTU_C#########.	CharacterString
Object Type	79	8	BACnetObjectType
System Status	112		
Vendor Name	121	McQuay International	CharacterString
Vendor Identifier	120	3	Unsigned16
Model Name	70	RTU_C	CharacterString
Comm Card Firmware Version	44	Variable	CharacterString
RTU-C Application Software Revision	12	Variable	CharacterString
Location	58		CharacterString
~~Description~~	~~28~~	~~Variable~~	~~CharacterString~~
Protocol_Version	98	1	Unsigned
Protocol_Revision	139	4	Unsigned
Protocol_Services_Supported	97		BACnetServicesSupported
Object_List	76		BACnetArray[N] of BACnetObjectIdentifier
Max_APDU_Length_Accepted	62	Variable	Unsigned 16
Segmentation_Supported	107	No-Segmentation	Unsigned
APDU_Timeout	11	Variable	Unsigned
Number_Of_APDU_Retries	73	Variable	Unsigned
Device_Address_Binding	30		List of BACnetAddressBinding
Database_Revision	155	1	Unsigned

9.3.4 BACnet Network Integration

9.3.4.1 Access to Properties

Object properties are accessible from the network by specifying the device object identifier, object identifier, and the property identifier. To access a property, you must specify the object identifier including the device object identifier or the object name including the device object name and the property identifier.

9.3.4.2 BACnet Communication Module IP Addressing Defaults

The BACnet/Internet Protocol (BACnet/IP) address of the BACnet Communication Module for the RTU-C Rooftop Unit Controller in a BACnet/IP network consists of the four-octet Internet Protocol address followed by the two-octet UDP (User Datagram Protocol) Port Number. The BACnet/IP address is a six-octet value analogous to a MAC (Media Access Control) address. The IP address portion of the BACnet/IP address must be unique in the BACnet/IP network segment.

RTU-C Rooftop Unit Controller defaults are:

UDP Port Number: 47808 (BAC0 in hexadecimal)

Internet Protocol Subnet Mask: 255.255.0.0

IP Address: 172.16.5.8.

The BACnet Communication Module supports DHCP (Dynamic Host Configuration Protocol) IP addressing. By default, this feature is disabled. To configure the BACnet Communication Module to use the DHCP feature, write 0.0.0.0 as the IP address using the BCM Configuration Tool's web-based user interface.

The RTU-C Rooftop Unit Controller can be incorporated into a BACnet/IP network dedicated to BACnet devices only or an Ethernet network shared with BACnet devices and other devices.

9.3.4.3 Shared Ethernet Networks (LAN) Integration

Integrating the RTU-C Rooftop Unit Controller into a shared Ethernet LAN requires close cooperation with the network administrator of the shared Ethernet network. The steps are as follows:

Obtain the IP Subnet Mask of the shared network from the network administrator.

Obtain the ***static*** IP Addresses for all RTU-C Rooftop Unit Controllers you are integrating into the shared network. Obtain the address of an IP Router or Gateway to use for sending IP messages to and from the BACnet IP subnets.

Once you have these, refer to Setting RTU-C Rooftop Unit Controller Communication Parameters in the Basic Protocol Information section of this document.

The communication type variable must be set to BACnet IP or BACnet Ethernet for BACnet communication to take place. The default value for this property is None.

9.3.4.4 BACnet MS/TP Network Configuration

A number of network configurations in the RTU-C Rooftop Unit Controller in a BACnet MS/TP Local Area Network (LAN) are set via the BACnet Communication Module (BCM) configuration interface, a web-based user interface. Please refer to Setting RTU-C Rooftop Unit Controller Communication Parameters in the Basic Protocol Information section of this document. Configurations include:

The BACnet MS/TP device address (Media Access Control [MAC] address). The default MAC Address is 0. This address must be unique and is determined during installation. After you set the MAC address you must cycle power (turn the controller off and then on again) to the controller in order for the new address to take effect.

The default data transmission rate is set to 19200 bps (baud). If necessary, change the baud rate to 9600, 19200, 38400, or 76800.

The communication type variable must be set to BACnet MS/TP. The default value for this property is BACnet IP.

9.3.4.5 BACnet Communication LEDs

The TX LED appears green when the communication module is transmitting data to the BACnet network. The RX LED appears green when the communication module is receiving data from the BACnet network. If both LEDs are on simultaneously, then communication is not established.

9.3.4.6 RTU-C Rooftop Unit Controller Configuration

The RTU-C Rooftop Unit Controller is ready to operate with the default values of the various parameters set at the factory. Default values may be changed with the RTU-C Unit Controller keypad or via the network.

9.3.4.7 Data Integrity

The integrity of some data depends on a valid network connection to maintain current values. The following data points require valid network updates within the Receive Heartbeat time (if not 0 seconds). If the data points shown in the table below are not updated within the receive heartbeat time then the RTU-C Rooftop Unit Controller reverts to the default values of the variable or to the value of the attached sensor. The table defines the effect on BACnet network variables if the Receive Heartbeat timer should expire without having been updated.

Table 9-3. Receive Heartbeat Variables and Behavior upon Expiration – BACnet

Data Point	BACnet Variable	Action when Heartbeat Timer Expires Without Update
Occupancy Scheduler Input	OccState	Powerup (3)
Application Mode	ApplicCmd	Auto (5)
Remote Discharge Fan Capacity Setpoint	SupFanCapInput	Invalid (0x7FFF)
Remote Space Temperature	SpaceTempInput	Invalid (0x7FFF)
Economizer Enable	EconEnable	Auto (0xFF)
Space Indoor Air Quality (IAQ)	SpaceIAQInput	Invalid (0x7FFF)

9.3.5 LONWORKS Networks

LONWORKS technology, developed by Echelon® Corporation, is the basis for LonMark interoperable systems. This technology is independent of the communications media. The LonMark Interoperable Association has developed standards for interoperable LONWORKS technology systems. In particular they have published standards for the Space Comfort Controller (SCC) functional profile. These profiles specify a number of mandatory and optional standard network variables and standard configuration parameters. This manual defines these variables and parameters available in the RTU-C Rooftop Unit Controller.

9.3.5.1 Compatibility

The RTU-C Rooftop Unit Controller with the LONWORKS communications module operates in accordance with the SCC functional profile of the LonMark Interoperability standard.

9.3.5.2 *LonWorks* Communication LEDs

The TX LED appears green when the communication module is transmitting data to the network. The network RX LED appears green when the communication module is receiving data from the network.

9.3.5.3 *LONWORKS* Variables

RTU-C Rooftop Unit Controllers incorporate LONWORKS network variables to access unit data points. The controller uses LONWORKS Standard Network Variable Types (SNVT) from each profile. Some data points can be adjusted (input network variables, nvi) (read/write attributes, e.g., setpoints) from the network and others can only be interrogated (output network variables, nvo) (read only attributes, e.g., status information). Configuration variables (nci) are included with the read/write attributes.

Each data point accessible from a LONWORKS network is described with a table that gives the LONWORKS Name, Profile, SNVT Type, and SNVT Index. If the variable is a configuration variable the table also includes the SCPT Reference and the SCPT Index.

9.3.5.4 Example of *LONWORKS* Data Point

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Index
nvoBldgStatPress	SCC	SNVT_press_p	113

9.3.5.5 *LONWORKS* Name

Each network variable has a name that you use to access the data point. This is the name of the variable from the profile. In the example above the name network variable is nvoBldgStatPress.

9.3.5.6 Profile

The profile column designates the RTU-C communication module that incorporates this network variable. The variable itself may not be a standard component of that particular profile, but the communications module does implement and it is available to the network.

9.3.5.7 SNVT Type

This column gives the name of the standard network variable type from the master list.

9.3.5.8 SNVT Index

This column gives the number of the standard network variable type from the master list.

9.3.5.9 SCPT Reference

This column gives the name of the Standard Configuration Parameter Type (SCPT) from the master list.

9.3.5.10 SCPT Index

This column gives the number of the Standard Configuration Parameter Type (SCPT) from the master list.

9.3.6 Network Considerations

9.3.6.1 Network Topology

Each RTU-C LONWORKS communication module is equipped with an FTT-10A transceiver for network communications. This transceiver allows for (1) free topology network wiring schemes using twisted pair (unshielded) cable and (2) polarity insensitive connections at each node. These features greatly simplify installation and reduce network commissioning problems. Additional nodes may be added with little regard to existing cable routing.

9.3.6.2 Free Topology Networks

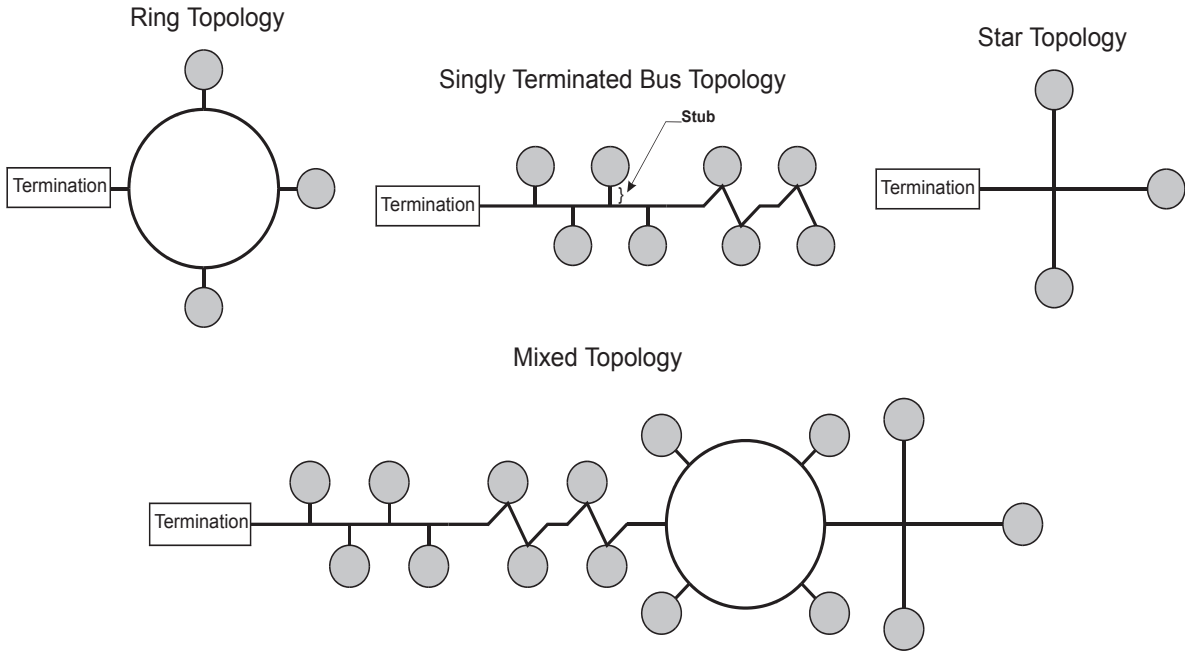
A LONWORKS "free topology network" means that devices (nodes) can be connected to the network in a variety of geometric configurations. For example, devices can be daisy-chained from one device to the next, connected with stub cables branching off from a main cable, connected using a tree or star topology, or any of these configurations can be mixed on the same network as shown in Figure 9-1. Free topology segments require termination for proper transmission performance. Only one termination is required. It may be placed anywhere along the segment**.** Refer to Echelon LONWORKS FTT-10A Transceiver User's Guide for further details (see Reference Documents section).

Free topology networks may take on the following topologies:

Bus
Ring
Star
Mixed – Any combination of Bus, Ring, and Star

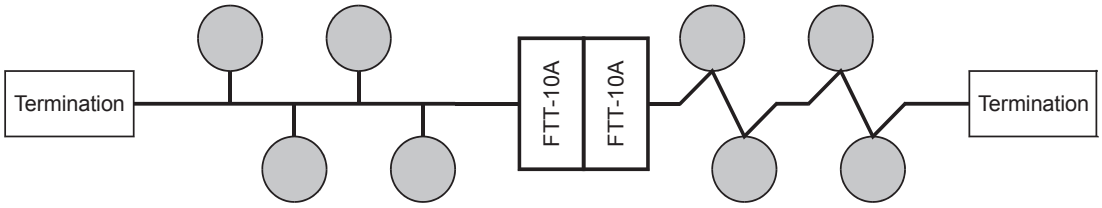
Note: Limitations to wire lengths apply and must be observed.

Figure 9-1. Singly Terminated Free Topology



A network segment is any part of the free topology network in which each conductor is electrically continuous. Each of the four diagrams is an illustration of a network segment. Some applications may require two or more segments; see "Free Topology Restrictions." If necessary, segments can be joined with FTT-10A-to-FTT-10A physical layer repeaters. See Figure 9-2. Refer to Echelon LONWORKS FTT-10A Transceiver User's Guide for further details.

Figure 9-2. Combining Network Segments with a Repeater



9.3.6.3 Free Topology Restrictions

Although free topology wiring is very flexible, there are restrictions. A summary follows; refer to the Echelon FTT-10A User's Guide for details.

1. The maximum number of nodes per segment is 64.
2. The maximum total bus length depends on the wire size:

Wire Size	Maximum Node-to-Node Length	Maximum Cable Length
24 AWG	820 ft (250 m)	1476 ft (450 m)
22 AWG	1312 ft (400 m)	1640 ft (500 m)
16 AWG	1640 ft (500 m)	1640 ft (500 m)

The longest cable path between any possible pair of nodes on a segment must not exceed the maximum node-to-node distance. If two or more paths exist between a pair of nodes (e.g., a loop topology), the longest path should be considered. Note that in a bus topology, the longest node-to-node distance is equal to the total cable length.

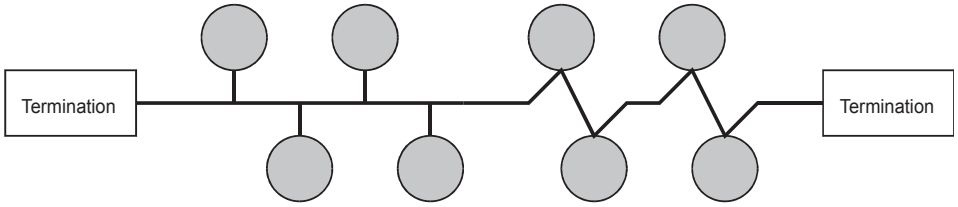
a. The total length of all cable in a segment must not exceed the maximum total cable length.
b. One termination is required in each segment. It may be located anywhere along the segment.

9.3.6.4 Doubly Terminated Networks

You can extend the maximum total cable length without using a repeater by using doubly-terminated network topology. See Figure 9-3. The trade-offs are (1) this network topology must be rigorously followed during the installation and subsequent retrofits and (2) two terminations must be installed at the ends of the bus for proper transmission performance. Refer to Echelon LONWORKS FTT-10A Transceiver User's Guide.

Note: Limitations to wire lengths apply and must be observed.

Figure 9-3. Doubly Terminated Network Topology



9.3.6.5 Doubly Terminated Topology Restrictions

The restrictions on doubly-terminated bus topology are as follows:

1. The maximum number of nodes per segment is 64.
2. The maximum total bus length depends on the wire size:

Wire Size	Maximum Cable Length
24 AWG	2952 ft (900 m)
22 AWG	4590 ft (1400 m)
16 AWG	8855 ft (2700 m)

3. The maximum stub length is 9.8 ft (3 m). The length of the cable harness stub is 7.2 ft (2.19 m).
   A stub is a piece of cable that is wired between the node and the bus. See Figure 9-1. Note that if the bus is wired directly to the node, there is no stub, and thus the stub length is zero. If you are wiring to a field terminal strip on a unit, be sure to account for any factory wiring between the terminal strip and the controller. This wiring is considered part of the stub.
4. Two terminations are required in each segment. One must be located at each end of the bus.

9.3.6.6 Network Cable Termination

LONWORKS network segments require termination for proper data transmission performance. The type and number of terminations depend on network topology. Refer to Echelon LONWORKS FTT-10A Transceiver User's Guide.

9.3.6.7 LonWorks Network Addressing

Every Neuron Chip has a unique 48-bit Neuron ID or physical address. This address is generally used only at initial installation or for diagnostic purposes. For normal network operation, a device address is used.

Device addresses are defined at the time of network configuration. All device addresses have three parts. The first part is the Domain ID, designating the domain. Devices must be in the same domain in order to communicate with each other. The second part is the Subnet ID that specifies a collection of up to 127 devices that are on a single channel or a set of channels connected by repeaters. There may be up to 255 subnets in a domain. The third part is the Node ID that identifies an individual device within the subnet.
A group is a logical collection of devices within a domain. Groups are assembled with regard for their physical location in the domain. There may be up to 256 groups in domain. A group address is the address that identifies all devices of the group. There may be any number of devices in a group when unacknowledged messaging is used. Groups are limited to 64 devices if acknowledged messaging is used. A broadcast address identifies all devices within a subnet or domain.

9.3.6.8 Commissioning the Network

Pressing the service pin, switch on the LONWORKS Communication Module, generates a service pin message, which contains the Neuron ID and the program code identification of the node. A service pin message is a network message that is generated by a node and broadcast on the network. It can be used to commission the LONWORKS network.

A network configuration tool maps device Neuron IDs to the domain/subnet/node logical addressing scheme when it creates the network image, the logical network addresses and connection information for all devices (nodes) on the network.

9.3.6.9 External Interface File (XIF)

LonMark guidelines specify exact documentation rules so that proprietary configuration tools are not required to commission and configure LONWORKS devices. The LONWORKS Communication Module is self-documenting so that any network management tool can obtain all the information needed over the network to connect it into the system and to configure and manage it. An External Interface File (a specially formatted PC text file with an extension .XIF) is also available so that any network tool can design and configure it prior to installation. XIF files are available on http://www.lonmark.org/

9.3.6.10 Resource Files

Resource Files provide definitions of functional profiles, type definitions, enumerations, and formats that can be used by network configuration tools such as Echelon's LonMaker® program. The RTU-C Rooftop Unit Controller supports the standard SCC functional profile. Additionally, certain RTU-C specific variables are defined for use with the RTU-C Rooftop Unit Controller. The Resource Files define the format of how these RTU-C specific variables are displayed when using a tool such as LonMaker. The Resource Files are available on http://www.lonmark.org/

9.3.7 Configuring the Unit Controller

The RTU-C Rooftop Unit Controller is ready to operate with the default values of the various parameters set at the factory. Many default values may be changed with the unit's keypad or via the network. See relevant sections of this Manual for default values and keypad operating instructions.

9.3.8 Data Integrity

The integrity of some data depends on a valid network connection to maintain current values. The following data points require a valid network connection if bound. If data points listed in Table 4 are not received within a specified time, then the controller reverts to local control. In the case of the LONWORKS communication module, the variables will revert to their default values.

Table 9-4. LONWORKS Receive Heartbeat Variables

Data Point	LONWORKS Variable	Action when Heartbeat Timer Expires Without Update
Occupancy Scheduler Input	nviOccSchedule.current_state	Powerup (0xFF)
Application Mode	nviApplicMode	Auto (0x00)
Remote Discharge Fan Capacity Setpoint	nviSupFanCap	Invalid (0x7FFF)
Remote Space Temperature	nviSpaceTemp	Invalid (0x7FFF)
Economizer Enable	nviEconEnable	Auto (0xFF)
Space Indoor Air Quality (IAQ)	nviSpaceIAQ	Invalid (0x7FFF)

9.4 Minimum Integration Requirements

When you have integrated the unit into your network, you can monitor and control unit operation from your workstation. This section gives you the basic information and outlines a procedure to set up the unit for network control.

9.4.1 Set up the Unit Controller for Network Control

A single BACnet or LONWORKS communication module can be field installed on the RTU-C Rooftop Unit Controller. No communication module is required if the RTU-C unit is operating stand-alone. The unit controller does not require configuration in order to establish network communication.

9.4.2 Display Important Data Points

Typical workstation displays of RTU-C Rooftop Unit Controller attributes include the following significant data points (page number of detailed description in parenthesis).

Table 9-5. Significant Data Points

Configuration	Temperatures	Setpoints	Clear Alarms
Unit State (165)	Discharge Air Temperature (138)	Unoccupied Cooling Setpoint (168)	Alarm Clearing (181)
Application Mode (136)	Return Air Temperature (156)	Occupied Cooling Setpoint (153)	
Effective Occupancy (148)	Effective Outdoor Air Temperature (154)	Unoccupied Heating Setpoint (169)	
Occupancy Mode (Occupany Schedule Override) (150)		Occupied Heating Setpoint (154)	

You can display any number of additional data points based on job requirements or individual preference. See the LONWORKS Variables section for all available LONWORKS Variables. See the BACnet Standard Objections for all available BACnet Objects. For a more detailed description of all available data points, see the Detailed Data Point Information section.

9.4.3 Network Off

The unit can be turned off over the network by writing to the (2) Application Mode. Writing AUTO to Application Mode allows the unit Controller to determine its mode of operation based on input conditions. Writing OFF to Application Mode shuts down the unit, etc.

The Emergency Override Mode Flag can also be used to shut down the unit from the network.

9.4.4 Network Occupancy Scheduling

Using the keypad, set OCCUPANCY to Network. Schedule unit operation over the network with the Occupancy Schedule network input. Switching from OCC, UNOCC, BYPASS (TntOvrd), or AUTO commands the unit into the mode you select.

9.4.5 Unit Controller Sequence of Operation

The sequence of operation for a RTU-C Rooftop Unit Controller depends on the control type.

9.5 Comprehensive Data Point Tables

These comprehensive data point tables contain the significant parameters of specific data points.

BACnet Standard Objects

Network Control Property	Page	Read Or Read/ Write	Object Type	Instance	Description
System					
Unit State	165	R	MSV	15	1=Off, 2=Start, 4=FanOnly, 6=Htg, 7=Econo, 8=Clg
BACnet Unit Support	168	R/W	MSV	16	BACnet network communicates in English or Metric units.
Cooling Capacity	138	R	AV	1	cooling capacity (%)
Heating Capacity Primary	143	R	AV	2	heating capacity primary (%)
Heating Capacity Secondary	143	R	AV	44	heating capacity secondary (%)
Economizer Capacity	139	R	AV	15	Feedback value (%)
Effective Supply Fan Capacity	161	R	AI	8	Current effective supply fan capacity (%)
Return/Exhaust Fan Capacity	156	R	AI	10	Current return or exhaust fan capacity (%)
Application Mode	136	R/W	MSV	5	1=Off, 2=HeatOnly, 3=CoolOnly, 4=FanOnly, 5=Auto
Emergency Override	141	R/W	MSV	10	1=Normal, 2=Shutdown
Indoor Fan Occupancy	142	R/W	MSV	49	1 = Continous Mode 2 = Cycle On in Heating/Cooling 3 = Continous in Occupied and Cycle in Unoccupied
Occupancy					
Effective Occupancy	148	R	MSV	6	1=Occ, 2=Unocc, 3=TntOvrd
Occupancy Schedule	151	R/W	MSV	8	.current_state: 1=Occ, 2=Unocc, 3=Powerup "Next State" field NOT USED "Time To Next State" field NOT USED
Occupancy Mode	150	R/W	MSV	7	1=Occ, 2=Unocc, 3=TntOvrd, 4=Standby (not used) 5=Auto.
Occupancy Schedule Override Setpoint	152	R/W	AV	3	Used when Occupancy Mode is set to Standby. This is the amount of time that the unit operates in the Bypass mode.
Temperature					
Effective Space Temperature	160	R	AI	3	Current effective space temperature.
Local Space Temperature	145	R	AV	4	Current reading of the local sensor
Remote Space Temperature	161	R/W	AV	28	Network input of Space Temp
Effective Outdoor Air Temperature	154	R	AI	4	Current effective temperature being used.
Local OA Temperature	144	R	AV	5	Current reading of the local sensor
Remote Outdoor Air Temperature Input	155	R/W	AV	29	Network input of Outdoor Air Temp (–10°C to 50°C)
Discharge Air Temperature	138	R	AI	1	Current reading of sensor
Return Air Temperature	156	R	AI	2	Current reading of sensor
Space Temperature Setpoints					
Effective Setpoint	139	R	AV	50	Current enable setpoint which the unit will use.
Local Space Temperature Setpoint	140	R	AV	51	Current reading of the local space sensor
Room Sensor Setpoint Enable	141	R/W	BV	65	Enable the use of the local hardwired setpoint adjustment
Remote Space Temperature Spt Adjust	165	R/W	AV	56	
Occupied Cooling Setpoint	153	R/W	AV	9	
Occupied Heating Setpoint	154	R/W	AV	11	
Unoccupied Cooling Setpoint	168	R/W	AV	10	
Unoccupied Heating Setpoint	169	R/W	AV	12	
Economizer					
Economizer Enable	162	R/W	MSV	32	1 = Disable Free Cooling, Enable Ventilation 2 = Enable Free Cooling, Enable Ventilation 3 = Auto (unit control decides) 4 = Disable All Economizer Functionality

Network Control Property	Page	Read Or Read/ Write	Object Type	Instance	Description
Demand Control Ventilation Limit	163	R/W	AV	53	Sets the minimum position setpoint when CO_2 override control is used.
Ventilation Limit	163	R/W	AV	54	Sets the maximum position setpoint when CO_2 override control is used.
Local Space CO_2	159	R	AI	13	This variable provides the concentration of CO_2 in the space (PPM).
Remote Space IAQ	160	R/W	AV	31	This input may be set by the network and is used for minimum OA damper control (500-2000 PPM).
Space CO_2 High Limit Setpoint	164	R/W	AV	48	500-2000ppm
Exhaust On/Off Setpoint	164	R/W	AV	55	0-100%
Dehumidification					
Space RH Configuration Setpoint	170	R/W	AV	65	This is the configuration setpoint used for dehumidification. This property available in communication modules v2.00+
Field Inputs					
Field Input 1	170	R	AV	61	This is the value from the unit controls field input 1. It's always a temperature value.
Field Input 2	171	R	AV	62	This is the value from the unit controls field input 2. The unit type, low range and high range are all configurable.
Field Input 2 Low Volt Range	171	R	AV	63	This configures the low voltage range for the value from the unit controls field input 2.
Field Input 2 High Volt Range	171	R	AV	64	This configures the high voltage range for the value from the unit controls field input 2.
Alarm Handling					
Current Alarm	182	R	AV	27	See the Alarm Table.
Clear All Alarms	181	R/W	BV	66	Clears all active alarms.
Clear One Alarm	182	R/W	AV	57	Clears the alarm that corresponds to the value entered.
Device Management					
Receive Heartbeat	155	R/W	AV	43	
Communication Module Software Version	158	R	Device	44	
RTU-C Application Version	158	R	Device	8	Application_Software_Version property of device object.
Integrated Furnace Controller Software Version	158	R	AV	45	
Honeywell Economizer Software Version	158	R	AV	46	

Note: Objects that appear in multiple locations on the keypad are only listed in the location they first appear on the keypad. Not all menus and items shown here will appear on keypad depending upon the specific unit configuration. Those that do not appear are not applicable to the unit.

LONWORKS Variables

Network Control Property	Variable Name	Page	SNVT/SCPT Index	Description
System				
Unit State	nvoUnitStatus	165	112	1=HEAT, 3=COOL, 6=OFF, 9=FAN_ONLY, 10=ECONMY, 14=DEHUMID, 0xFF=NUL
Cooling Capacity	nvoUnitStatus	138	112	nvoUnitStatus.cool_output(%)
Heating Capacity Primary	nvoUnitStatus	143	112	nvoUnitStatus.heat_output_primary(%)
Heating Capacity Secondary	nvoUnitStatus	143	112	nvoUnitStatus.heat_output_secondary(%)
Economizer Capacity	nvoUnitStatus	139	112	nvoUnitStatus.econ_output (%)
Effective Supply Fan Capacity	nvoUnitStatus	161	112	Current effective supply fan capacity (%) nvoUnitStatus.fan_output (%)
Return/Exhaust Fan Capacity	nvoExhFanStatus	156	95	.value Current return or exhaust fan capacity (%)
Application Mode	nviApplicMode	136	108	0=AUTO, 1=HEAT, 3=COOL, 6=OFF, 9=FAN_ONLY, 0xFF=NUL
Emergency Override	nviEmergOverride	141	103	0=NORMAL, 4=SHUTDOWN (other states not used)
Indoor Fan Occupancy	nviIndoorFanOcc	142	95	0 = Continous Mode 1 = Cycle On in Heating/Cooling 2 = Continous in Occupied and Cycle in Unoccupied
Occupancy				
Effective Occupancy	nvoEffectOccup	148	109	0=OCCUPIED, 1=UNOCCUPIED, 2=BYPASS, 3=STANDBY, 0xFF=NUL
Occupancy Schedule	nviOccSchedule	151	128	nviOccSchedule.current_state
Occupancy Mode	nviOccManCmd	150	109	0=OCCUPIED, 1=UNOCCUPIED, 2= BYPASS, 0xFF=NUL (AUTO)
Occupancy Schedule Override Setpoint	nciBypassTime	152	107/34	Used when nviOccManCmd is set to Standby.The amount of time that the unit operates in the Bypass mode
Temperature				
Effective Space Temperature	nvoSpaceTemp	160	105	Current effective space temperature.
Local Space Temperature	nvoLocalSpaceTmp	145	105	Current reading of the local space sensor
Remote Space Temperature	nviSpaceTemp	161	105	Network input of Space Temp
Effective Outdoor Air Temperature	nvoOutdoorTemp	154	105	Current effective temperature being used.
Local OA Temperature	nvoLocalOATemp	144	105	Current reading of the local outdoor air temperature sensor
Remote Outdoor Air Temperature	nviOutdoorTemp	155	105	Network input of Outdoor Air Temp
Discharge Air Temperature	nvoDischAirTemp	138	105	Current reading of sensor
Return Air Temperature	nvoRATemp	156	105	Current reading of sensor
Space Temperature Setpoints				
Effective Setpoint	nvoEffectSetpt	139	105	Current enable setpoint which the unit will use.
Local Space Temperature Setpoint	nvoSetpoint	140	105	Local setpoint output
Room Sensor Setpoint Enable	nciLocSptEnable	141	95	Enable the use of the local hardwired setpoint adjustment
Remote Space Temperature Spt Adjust	nviSetpoint	165	105	Adjusts effective heat enable and effective cool enable setpoint via the network. Effective Heat SP = nviSetpoint – 0.5 (Occupied_Cool – Occupied_Heat). Effective Cool SP = nviSetpoint + 0.5 (Occupied_Cool – Occupied_Heat).
Occupied Cooling Setpoint	nciSetpoints SCPTsetPnts	153	106/60	
Occupied Heating Setpoint	nciSetpoints SCPTsetPnts	154	106/60	
Unoccupied Cooling Setpoint	nciSetpoints SCPTsetPnts	168	106/60	
Unoccupied Heating Setpoint	nciSetpoints SCPTsetPnts	169	106/60	

Network Control Property	Variable Name	Page	SNVT/SCPT Index	Description
Economizer				
Economizer Enable	nviEconEnable	162	95	Enables or disables economizer via the state field. 1 = Disable Free Cooling, Enable Ventilation 2 = Enable Free Cooling, Enable Ventilation 3 = Disable All Economizer Functionality 255=Auto (unit control selects Enable Free Cooling, Enable Ventilation)
Demand Control Ventilation Limit	nviMinVentLim	163	81	Sets the minimum position setpoint when CO_2 override control is used.
Ventilation Limit	nviMaxVentLim	163	81	Sets the maxnimum position setpoint when CO_2 override control is used.
Local Space CO_2	nvoSpaceCO_2	159	29	0-2000ppm
Remote Space IAQ	nviSpaceIAQ	160	29	This input may be set by the network and is used for minimum OA damper control (0-2000 PPM).
Space CO_2 High Limit Setpoint	nciSpaceCO2Lim	164	29	0-2000ppm
Exhaust On/Off Setpoint	nciExhaustSpt	164	81	0-100%
Dehumidification				
Space RH Configuration Setpoint	nciSpaceRHSetpt	170	36	This is the configuration setpoint used for dehumidification.
Field Inputs				
Field Input 1	nvoFieldInput1	170	105	This is the value from the unit controls field input 1. It's always a temperature value.
Field Input 2	nvoFieldInput2	171	81	This is the value from the unit controls field input 2. The SNVT type is configurable using nciField2Type.
Configurable Input 2 Type	UCPTfieldInput	171	N/A	This configures the unit type, low range and high range for nvoFieldInput2.
Alarm Handling				
Current Alarm	nvoUnitStatus	182	112	nvoUnitStatus.in_alarm. See the Alarm Table.
Clear All Alarms	nviClearAllAlarm	181	8	Clears all clearable active alarms.
Clear One Alarm	nviClear1Alarm	182	8	Clears the clearable active alarm that corresponds to the value entered.
Device Management				
Receive Heartbeat	nciRcvHrtBt SCPTmaxRcvTime	155	107/48	
Send Heartbeat	nciSndHrtBt SCPTmaxSendTime	157	107/49	
Minimum Send Time	nciMinOutTm SCPTminSendTime	145	107/52	Defines min period of time between automatic network variable output time (reducing traffic on network)
Communication Module Software Version	UCPTcommDevMajVer & UCPTcommDevMinVer	157	165 and 166	Device Major and minor Version Numbers
RTU-C Application Version	UCPTunitDevMajVer & UCPTunitDevMinVer	158	165 and 166	
Integrated Furnace Controller Software Version	UCPTifcDevMajVer & UCPTifcDevMinVer	158	165 and 166	
Honeywell Economizer Software Version	UCPTeconDevMajVer & UCPTeconDevMinVer	158	165 and 166	
Location	(nciLocation)	159	36/17	Sets descriptive physical location information for the associated functional block or device
Object Status	nvoStatus	147	92	This variable is part of the Node Object and reports the status of the requested functional block in the device.
Object Request	nviRequest	145	93	This variable is part of the Node Object and requests a particular mode for a particular funcational block in the device. Only the required RQ_NORMAL, RP_UPDATE_STATUS AND RQ_REPORT_MASK are implemented.

Note: Objects that appear in multiple locations on the keypad are only listed in the location they first appear on the keypad. Not all menus and items shown here will appear on keypad depending upon the specific unit configuration. Those that do not appear are not applicable to the unit.

9.6 Detailed Data Point Information

The data points or properties (attributes) defined in this section reference data that is generated in the RTU-C Rooftop Unit Controller.

9.6.1 Application Mode

Keypad Menu Path Mode

This read/write attribute sets the unit in an application mode. In any type of operating environment, if the Application Mode is set to "Off", the rooftop unit will be turned off and remain off. In the unit controller, this setting has priority over any other setting or source of occupancy. When operating in a communicating environment, Application Mode must be set to Auto, Fan Only, Heat Only or Cool Only. Additionally, the keypad can set the Application Mode to Control By Thermostat. In this mode the network occupancy parameters are ignored.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
Mode	N/A	Unsigned	Enumerated	Yes	Auto

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Multi-State Value	19	5	Present_Value	85
Full Reference				
RTU_C#########.ApplicCmd.Present_Value				

Enumeration
1 = Off 2 = Heat 3 = Cool 4 = Fan Only 5 = Auto

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviApplicMode	DAC, SCC	Yes	SNVT_hvac_mode	108

Enumeration Definitions

Value	Identifier	Notes	MODBUS Enum
0	HVAC_AUTO	Controller automatically changes between application modes	1 = Auto
1	HVAC_HEAT	Heating only 0	3 = Heat Only
2	HVAC_MRNG_WRMUP	Not supported – reverts to HVAC_AUTO	
3	HVAC_COOL	Cooling only	4 = Cool Only
4	HVAC_NIGHT_PURGE	Not supported – reverts to HVAC_AUTO	
5	HVAC_PRE_COOL	Not supported – reverts to HVAC_AUTO	
6	HVAC_OFF	Controller not controlling outputs	0 = Off

Value	Identifier	Notes	MODBUS Enum
7	HVAC_TEST	Not supported – reverts to HVAC_AUTO	
8	HVAC_EMERG_HEAT	Not supported – reverts to HVAC_AUTO	
9	HVAC_FAN_ONLY	Air not conditioned, fan turned on	2 = Fan Only
10	HVAC_FREE_COOL	Not supported – reverts to HVAC_AUTO	
11	HVAC_ICE	Not supported – reverts to HVAC_AUTO	
12	HVAC_MAX_HEAT	Not supported – reverts to HVAC_AUTO	
13	HVAC_ECONOMY	Not supported – reverts to HVAC_AUTO	
14	HVAC_DEHUMID	Not supported – reverts to HVAC_AUTO	
15	HVAC_CALIBRATE	Not supported – reverts to HVAC_AUTO	
16	HVAC_EMERG_COOL	Not supported – reverts to HVAC_AUTO	
17	HVAC_EMERG_STEAM	Not supported – reverts to HVAC_AUTO	
0xFF	HVAC_NUL	Powerup	

Enumeration Correspondence

BACnet		LONWORKS	
5	Auto	0	HVAC_AUTO
2	Heat Only	1	HVAC_HEAT
2	Heat Only	2	HVAC_MRNG_WRMUP (not used)
3	Cool Only	3	HVAC_COOL
3	Cool Only	4	HVAC_NIGHT_PURGE (not used)
3	Cool Only	5	HVAC_PRE_COOL (not used)
1	Off	6	HVAC_OFF
5	Auto	7	HVAC_TEST (not used)
2	Heat Only	8	HVAC_EMERG_HEAT (not used)
4	Fan Only	9	HVAC_FAN_ONLY
3	Cool Only	10	HVAC_FREE_COOL (not used)
5	Auto	11	HVAC_ICE (not used)
5	Auto	12	HVAC_MAX HEAT (not used)
6	Econo	13	HVAC_ECONOMY (not used)
7	Dehumid	14	HVAC_ DEHUMID (not used)
5	Auto	15	HVAC_CALIBRATE (not used)
5	Auto	16	HVAC_EMERG_COOL (not used)
5	Auto	17	HVAC_EMERG_STEAM (not used)
5	Auto	0xFF	HVAC_NUL

1 Writing a state that is not used, causes the controller to control as if Auto was selected.

9.6.2 *Cooling Capacity*

Keypad Menu Path Unit Status/Capacity Cooling

This read-only property indicates the current percentage of unit maximum cooling capacity.
The BACnet property only applies to the subject data point. The LONWORKS variable covers six other data points: Unit State, Heating Capacity Primary, Heating Capacity Secondary, Effective Supply Fan Capacity, Economizer Capacity, and In Alarm.

Measurement	Units	Data Type	Valid Range	Default Value
Percent	%	Real LONWORKS: Structure	0-100%	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	1	Present_Value	85
Full Reference				
RTU_C#########. CoolOutput.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoUnitStatus.cool_output	SCC	Yes	SNVT_hvac_status	112

9.6.3 *Discharge Air Temperature*

Keypad Menu Path TEMPERATURES/Disch. Air Temp

This read-only property indicates the current reading of the unit discharge air temperature sensor.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real	-40.0°C…80.0°C -40.0°F…176.0°F	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Input	0	1	Present_Value	85
Full Reference				
RTU_C#########.DischAirTemp.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoDischAirTemp	DAC, SCC	Yes	SNVT_temp_p	105

9.6.4 Economizer Capacity

Keypad Menu Path Economizer/Eff.Eco.Position

This read-only attribute indicates the current economizer capacity.

The BACnet property reads only the subject attribute; however the LONWORKS variable is only a part of the LONWORKS Unit Status network variable. See Unit State for details of LONWORKS network variable.

The BACnet property only applies to the subject data point. The LONWORKS variable covers six other data points: Unit State, Cooling Capacity, Heating Capacity Primary, Heating Capacity Secondary, Effective Supply Fan Capacity, and In Alarm.

Measurement	Units	Data Type	Valid Range	Default Value
Percent	Percent	Real LONWORKS: Structure	0…100%	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	15	Present_Value	85
Full Reference				
RTU_C##########.EconOutput.Present_Value				

LonWorks

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoUnitStatus.econ_output	DAC, SCC	Yes	SNVT_hvac_status	112

9.6.5 Effective Setpoint

Keypad Menu Path SetPoints /Eff. Temp. SP

This read-only attribute monitors the effective temperature setpoint. It is always set equal to the current controlling setpoint (that was last calculated) depending on the current unit operating state (i.e. cooling or heating).

The Effective Setpoint Output depends on the Occupied Cooling Setpoint, the Occupied Heating Setpoint, and Temperature Setpoint Input. If the Temperature Setpoint Input (nviSetpoint) is set to a ***valid*** value:

Effective Cooling Enable Setpoint = Temperature Setpoint Input
+½(Occupied Cooling Enable Setpoint–Occupied Heating Enable Setpoint)

Effective Heating Enable Setpoint = Temperature Setpoint Input
-½(Occupied Cooling Enable Setpoint–Occupied Heating Enable Setpoint)

The Effective Setpoint Output (nvoEffectSetpt) equals Effective Heating Enable Setpoint when the control temperature is less than Occupied Heating setpoint + [1/2(Occupied Cooling Enable Setpoint–Occupied

Heating Enable Setpoint)]. It is set equal to the Effective Cooling Enable Setpoint when the control temperature is greater than the Occupied Cooling Enable Setpoint – [1/2(Occupied Cooling Enable Setpoint–Occupied Heating Enable Setpoint)].

If the Temperature Setpoint Input (nviSetpoint) is set to an ***invalid*** value:

Effective Cooling Enable Setpoint = Occupied Cooling Enable Setpoint

Effective Heating Enable Setpoint = Occupied Heating Enable Setpoint

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real	5.0°C…35.0°C 40.0°F…95.0°F	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	50	Present_Value	85
Full Reference				
RTU_C#########.EffectSetpt.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	Number
nvoEffectSetpt	SCC	Yes	SNVT_temp_p	105

9.6.6 Local Space Temperature Setpoint

Keypad Menu Path Setpoints/Setpoint Adjust.

This read-only attribute monitors the local temperature setpoint. It is always set equal to the current local setpoint.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real	10.0°C…35.0°C 50.0°F…95.0°F	NA

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	51	Present_Value	85
Full Reference				
RTU_C#########.Setpoint.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	Number
nvoSetpoint	SCC	Yes	SNVT_temp_p	105

9.6.7 *Room Sensor Setpoint Enable*

Keypad Menu Path Setpoints/Stpnt Adj Enable

This read/write property is used to enable or disable the local hardwired setpoint adjustment mounted on the room sensor.

Measurement	Units	Data Type	Valid Range	Default Value
State	NA	Unsigned	Enumerated	Enabled

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Binary Value	5	65	Present Value	85
Full Reference				
RTU_C#########.LocSetptEnable.Present_Value				

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Index	UCPT Reference
nciLocSptEnable	SCC	n/a	n/a	UCPTlocalSptEnable

Valid Range

value	Room Sensor Setpoint Enable
0	Remote (Disabled)
1	Local (Enabled)

9.6.8 *Emergency Override*

This read/write property shuts off the RTU-C Rooftop Unit Controller. If this property is set to Shutdown, the RTU-C Rooftop Unit Controller cannot start based on a time clock or any other means. The only way to start the RTU-C Rooftop Unit Controller is to change the value to Normal.

If a value other than EMERG_SHUTDOWN (4), is written, this variable reverts back to 0.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
N/A	N/A	Unsigned	Enumerated	No	Normal

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Multi-State Value	19	10	Present_Value	85
Full Reference				
RTU_C#########.EmergOverride.Present_Value				
Enumeration				
1 = Normal 2 = Shutdown				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviEmergOverride	DAC, SCC	No	SNVT_hvac_emerg	103

Enumeration Definitions

Value	Identifier	Notes
0	EMERG_NORMAL	No emergency mode
1	EMERG_PRESSURIZE	Emergency pressurize mode (not used)
2	EMERG_DEPRESSURIZE	Emergency depressurize mode (not used)
3	EMERG_PURGE	Emergency purge mode (not used)
4	EMERG_SHUTDOWN	Emergency shutdown mode
5	EMERG_FIRE	(not used)
0xFF	EMERG_NUL	Value not available

Enumeration Correspondence

BACnet		Lon	
1	Normal	0	EMERG_NORMAL
1	Normal	1	EMERG_PRESSURIZE
1	Normal	2	EMERG_DEPRESSURIZE
1	Normal	3	EMERG_PURGE
2	Shutdown	4	EMERG_SHUTDOWN
1	Normal	5	EMERG_FIRE
1	Normal	0xFF	EMERG_NUL

9.6.9 Indoor Fan Occupancy

Keypad Menu Path Mode / Indoor Fan Mode

Depending on the occupancy, this read/write property controls the cycling of the indoor fan. It can be set to run in continous mode, cycle on only when in heating/cooling or run continuously when in occupied and cycle in unoccupied.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
N/A	N/A	Unsigned	Enumerated	No	Unit control value

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Multi-State Value	19	49	Present_Value	85
Full Reference				
RTU_C#########.IndoorFanOcc.Present_Value				

Enumeration
1 = Continous Mode 2 = Cycle On in Heating/Cooling 3 = Continous in Occupied and Cycle in Unoccupied

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviIndoorFanOcc		No	SNVT_switch	95

Structure

typedef struct {
signed state Enumerated
unsigned value 0..255 (NOT USED)
} SNVT_switch;

Enumeration Definitions

State	Identifier	Notes
0	INDOORFAN_CONT	Continous Mode
1	INDOORFAN_CYCLE	Cycle On in Heating/Cooling
2	INDOORFAN_CONT_IN_OCC	Continous in Occupied and Cycle in Unoccupied

Enumeration Correspondence

BACnet		LONWORKS	
1	Continous Mode	0	INDOORFAN_CONT
2	Cycle On in Heating/Cooling	1	INDOORFAN_CYCLE
3	Continous in Occupied and Cycle in Unoccupied	2	INDOORFAN_CONT_IN_OCC

9.6.10 Heating Capacity Primary

Keypad Menu Path Unit Status/CAPY:Prim / Sec

This read-only attribute indicates the current percentage of unit primary maximum heating capacity.

The BACnet property reads only the subject attribute and only applies to the subject data point.

The LONWORKS variable is only a part of the LONWORKS Unit Status network variable. See Unit State for details of LONWORKS network variable. The LONWORKS variable covers six other data points: Unit State, Effective Supply Fan Capacity, Secondary Heating Capacity, Economizer Capacity, and In Alarm.

Measurement	Units	Data Type	Valid Range	Default Value
Heating Capacity Primary	Percent	BACnet: Real LonWorks: Structure	0.0…100.0%	N/A

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	2	Present_Value	85
Full Reference				
RTU_C#########.HeatOutput.Present_Value				

LONWORKS

LonWorks Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoUnitStatus.heat_output_primary	DAC, SCC	Yes	SNVT_hvac_status	112

9.6.11 Heating Capacity Secondary

Keypad Menu Path Unit Status/CAPY:Prim / Sec

This read-only attribute indicates the current percentage of unit secondary maximum heating capacity.

The BACnet property reads only the subject attribute and only applies to the subject data point.

The LONWORKS variable is only a part of the LONWORKS Unit Status network variable. See Unit State for details of LONWORKS network variable. The LONWORKS variable covers six other data points: Unit State, Effective Supply Fan Capacity, Secondary Heating Capacity, Economizer Capacity, and In Alarm.

Measurement	Units	Data Type	Valid Range	Default Value
Heating Capacity Secondary	Percent	BACnet: Real LonWorks: Structure	0.0…100.0%	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	44	Present_Value	85
Full Reference				
RTU_C#########.HeatOutputSec.Present_Value				

LONWORKS

LonWorks Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoUnitStatus.heat_output_secondary	DAC, SCC	Yes	SNVT_hvac_status	112

9.6.12 Local OA Temperature

Keypad Menu Path TEMPERATURES/Outside Air Temp

This read-only attribute indicates the current outdoor air temperature from the local outdoor air temperature sensor

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real	-40.0°C…80.0°C -40.0°F…176.0°F	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	5	Present_Value	85
Full Reference				
RTU_C#########.LocalOAT.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoLocalOATemp	DAC, SCC	Yes	SNVT_temp_p	105

9.6.13 Local Space Temperature

Keypad Menu Path TEMPERATURE/Space Temp

This read-only attribute indicates the current space air temperature from the local space air temperature sensor.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real	-40.0°C…80.0°C -40.0°F…176.0°F	N/A

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	4	Present_Value	85
Full Reference				
RTU_C#########.LocalSpaceT.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoLocalSpaceTmp	SCC	Yes	SNVT_temp_p	105

9.6.14 Minimum Send Time

This read/write configuration property defines the minimum period of time between automatic network variable output transmissions.

Measurement	Units	Data Type	Valid Range	Default Value
Time	Seconds	Real	0.0…6553.4 sec	0 Seconds

BACnet

No BACnet equivalent.

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Index	SCPT Reference	SCPT Index
nciMinOutTm	DAC, SCC	SNVT_time_sec	107	SCPTminSendTime	52

9.6.15 Object Request

This input network variable provides the mechanism to request an operation or a mode for a functional block within a device.

A request consists of an object ID (the **object_id** field) and an object request (the **object_request** field). The object ID is the functional block index for a functional block on the device. The Node Object functional block is index zero. The remaining functional blocks are numbered sequentially, starting with one.

The following functions are supported:

- **RQ_NORMAL** – If the specified functional block was in the disabled or overridden state, this request cancels that state, and returns the functional block to normal operation. If the functional block was already in the normal state, a request to enter the normal state is not an error. After device reset, the state of functional blocks on the device is application-specific. An **RQ_NORMAL** request that specifies the Node Object functional block index is a request for all functional blocks in the device to leave the disabled and overridden states.
- **RQ_UPDATE_STATUS** – Requests the status of the specified functional block to be sent to the **nvoStatus** output network variable. The state of the functional block is unchanged. An **RQ_ UPDATE_STATUS** request that specifies the Node Object functional block is a request for the status of the device and all functional blocks on the device. The status bits of the Node Object (with the exception of **invalid_request** and **invalid_id**) are defined to be the inclusive-OR of the status bits of all the other functional blocks in the device; with the possible addition of error conditions and other conditions attributed to the device as a whole, rather than to any individual functional block. For example, if **eedb_failure** is supported for the Node Object, then it should be set when reporting the Node Object functional block status whenever any of the functional blocks in the device reports communications failure, as well as when there is a communications failure at the device level.
- **RQ_REPORT_MASK –** Requests a *status mask* reporting the status bits that are supported by the specified functional block to be sent to the **nvoStatus** output network variable. A one bit in the status mask means that the device may set the corresponding bit in the object status when the condition defined for that bit occurs. A zero bit in the status mask means that the bit is never set by the device.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
Object Request	N/A	Structure	N/A	No	N/A

BACnet

No BACnet equivalent

LonWorks

LonWorks Name	Profile	Uses Heartbeat	SNVT Type	SNVT Number
nviRequest	Node Object	No	SNVT_obj_status	93

Structure

```
typedef struct {
      unsigned long        object_id;
      object_request_t     object_request;
} SNVT_obj_ request
```

Enumeration Definitions (object_request_t)

Value	Identifier	Notes
0	RQ_NORMAL	Enable object and remove override
1	RQ_DISABLED	Disable object (not supported)
2	RQ_UPDATE_STATUS	Report object status
3	RQ_SELF_TEST	Perform object self-test (not supported)
4	RQ_UPDATE_ALARM	Update alarm status (not supported)
5	RQ_REPORT_MASK	Report status bit mask
6	RQ_OVERRIDE	Override object (not supported)
7	RQ_ENABLE	Enable object (not supported)
8	RQ_RMV_OVERRIDE	Remove object override (not supported)
9	RQ_CLEAR_STATUS	Clear object status (not supported)
10	RQ_CLEAR_ALARM	Clear object alarm (not supported)
11	RQ_ALARM_NOTIFY_ENABLED	Enable alarm notification (not supported)
12	RQ_ALARM_NOTIFY_DISABLED	Disable alarm notification (not supported)
13	RQ_MANUAL_CTRL	Enable object for manual control (not supported)
14	RQ_REMOTE_CTRL	Enable object for remote control (not supported)
15	RQ_PROGRAM	Enable programming of special configuration properties (not supported)
16	RQ_CLEAR_RESET	Clear reset-complete flag (reset_complete) (not supported)
17	RQ_RESET	Execute reset-sequence of object (not supported)
-1(0xFF)	OC_NUL	Invalid Value

9.6.16 Object Status

This output network variable reports the status for any functional block on a device. It is also used to report the status of the entire device and all functional blocks on the device. A status update consists of an object ID (the **object_id** field) and multiple status fields. The object ID is the functional block index as described under **nviRequest**. If the object ID is zero, the status of the device itself and all functional blocks on the device is reported. The status fields are one-bit bitfields. The only supported status fields are the **report_mask**, **invalid_id**, and **invalid_request** fields; all other status fields are not 147eedback147.

- **invalid_request –** Set to one if an unsupported request code is received on the **nviRequest** input network variable.
- **invalid_id –** Set to one if a request is received for a functional block index that is not defined in the device. No further checking of the request code is required when set to one.
- **report_mask** Set to one if an **RQ_REPORT_MASK** request is received by the **nviRequest** input network variable, and the **nvoStatus** output network variable is set to contain the status mask. The *status mask* is an **nvoStatus** value that describes the status bits that are supported beyond the three mandatory status bits. The status mask consists of all fields in the **nvoStatus** output network variable, with the exception of the **report_mask**, **invalid_id**, and **invalid_request** fields. A one bit in the mask means that the functional block may set the corresponding bit in the **nvoStatus** output network variable when the condition defined for that bit occurs. A zero bit means that the functional block may never set the bit.

Measurement	Units	Data Type	Valid Range	Default Value
Object Status	N/A	Structure	N/A	N/A

BACnet

No BACnet equivalent

LONWORKS

LonWorks Name	Profile	Uses Heartbeat	SNVT Type	SNVT Number
nvoStatus	Node Object	No	SNVT_obj_request	92

Structure

```
typedef struct {
        unsigned long     object_id;
        unsigned          invalid_id;
        unsigned          invalid_request;
        unsigned          disabled;
        unsigned          out_of_limits;
        unsigned          open_circuit;
        unsigned          out_of_service;
        unsigned          mechanical fault;
        unsigned          feedback_failure;
        unsigned          over_range;
        unsigned          under_range;
        unsigned          electrical_fault;
        unsigned          unable_to_measure;
        unsigned          148eedb_failure;
        unsigned          fail_self_test;
        unsigned          self_test_in_progress;
        unsigned          locked_out;
        unsigned          manual_control;
        unsigned          in_alarm;
        unsigned          in_override;
        unsigned          report_mask;
        unsigned          programming_mode;
        unsigned          programming_fail;
        unsigned          alarm_notify_disabled;
        unsigned          reset_complete;
        unsigned          reserved2;
} SNVT_obj_status
```

9.6.17 Effective Occupancy

Keypad Menu Path Effect.Occupancy

This read-only property indicates which occupancy mode the unit is actually using. The unit controller calculates this. If the Occupancy Override Setpoint (not settable via the network) is set to Network then

the unit controller must calculate the mode according to the Effective Occupancy Output state table in the LonMark Space Comfort Controller document (see www.lonmark.org). The following is a modified state table based on that table.

Occupancy Schedule Override (nviOccManCmd) register 7 (See Notes 1 and 2)	Occupancy Schedule (nviOccSchedule) register 19	Effective Occupancy (nvoEffectOccup) register 18
Occupied	Don't Care	Occupied
Unoccupied	Don't Care	Unoccupied
Bypass	Occupied	Occupied
Bypass	Unoccupied	Bypass
Bypass	NUL	Occupied
NUL	Occupied	Occupied
NUL	Unoccupied	Unoccupied
NUL	NUL	Occupied

Note 1: Bypass can be initiated by Occupancy Schedule Override transitioning to Bypass. It remains in Bypass for the duration of the Local Bypass Time. The timer is reinitiated by another transition of the Occupancy Schedule Override to Bypass.

Note 2: If the bypass timer needs to be reset and the Occupancy Schedule Override is already in Bypass, then the communication module must a) set the Occupancy Schedule Override to Occupied, b) read the Occupancy Schedule Override register and verify that it is set to Occupied, then c) set the Occupancy Schedule Override to Bypass.

Measurement	Units	Data Type	Valid Range	Default Value
Occupancy	N/A	Unsigned	Enumerated	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Multi-State Value	19	6	Present_Value	85
Full Reference				
RTU_C#########. EffectOcc.Present_Value				

Enumeration
1. Occupied
2. Unoccupied
3. Bypass

LonWorks

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoEffectOccup	DAC, SCC	Yes	SNVT_occupancy	109

Enumeration Definitions

Value	Identifier	Notes
0	OC_OCCUPIED	Area is occupied
1	OC_UNOCCUPIED	Area is unoccupied
2	OC_BYPASS	Area is temporarily occupied for the bypass period
3	OC_STANDBY	Value not available
0xFF	OC_NUL	Value not available

Enumeration Correspondence

BACnet		LONWORKS	
1	Occupied	0	OC_OCCUPIED
2	Unoccupied	1	OC_UNOCCUPIED
3	Bypass	2	OC_BYPASS
1	Occupied	3	OC_STANDBY
1	Occupied	0xFF	OC_NUL

9.6.18 Occupancy Mode (Occupany Schedule Override)

This read/write property sets the RTU-C Rooftop Unit Controller Occupancy Mode. It overrides the occupancy schedule that the unit is using. Occupancy Schedule Override has priority over Occupancy Schedule and Remote Occupancy Sensor. It is typically sent by a wall-mounted occupant-interface module or a supervisory node to manually control occupancy modes, or to override the scheduled occupancy.

It is also the place where a local timed override hardwired input is monitored and used to place the unit in the Bypass mode - while it is in the Unoccupied mode. If the Timed Override button on the room sensor is pressed while the unit is in the Unoccupied mode, occupancy shall change to Bypass and the bypass timer (see Occupancy Schedule Override Setpoint) shall start counting down. When the timer reaches zero, occupancy shall change back to Unoccupied. Additional bypass requests (pressing the Timed Override button) resets the Bypass timer to the maximum value. A value of zero disables the feature. This network variable input should never be bound to a network variable that uses a Send Heartbeat function.

This input is used with nviOccSchedule to determine the Effective Occupancy Mode. Refer to Effective Occupancy for more information.

The way that the unit operates in the Bypass Mode is the same as it operates in Occupied Mode. Furthermore, the unit uses the occupied heating and cooling setpoints.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
Mode	N/A	Unsigned	Enumerated	No	Auto

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Multi-State Value	19	7	Present_Value	85
Full Reference				
RTU_C##########.OccManCmd.Present_Value				

Enumeration
1 = Occ 2 = Unocc 3 = Bypass 4 = NUL (Auto)

LonWorks

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviOccManCmd	DAC, SCC	No	SNVT_occupancy	109

LONWORKS Enumeration Definitions

Value	Identifier	Notes
0	OC_OCCUPIED	Area is occupied
1	OC_UNOCCUPIED	Area is unoccupied
2	OC_BYPASS	Area is temporarily occupied for the bypass period
3	OC_STANDBY	Value not available
0xFF	OC_NUL	Default after power-up (Auto)

Enumeration Correspondence

BACnet		LONWORKS	
1	Occupied	0	OC_OCCUPIED
2	Unoccupied	1	OC_UNOCCUPIED
3	Bypass	2	OC_BYPASS
1	Occupied	3	OC_ STANDBY
4	NUL	0xFF	OC_NUL

9.6.19 Occupancy Schedule

This input network variable is used to schedule a group of rooftop units that are coupled to one occupancy schedule. For example, there could be four rooftop units for a small office building and all four units could be tied to the same occupancy schedule starting at 8:00 AM and ending at 5:00 PM, Monday through Friday.

This read/write property commands the occupancy function of the RTU-C Rooftop Unit Controller when Occupancy Mode is set to NUL (Auto). It is typically sent by a scheduler or a supervisory node. SNVT_tod_event is a structure containing three parts.

Current_state, (required)
Next_state (not used)
Time_to_next_state (not used)
This network variable is used in conjunction with Optimal Start. This network variable can only be set via the network.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
State	N/A	Unsigned LONWORKS: structured	Enumerated	Yes	0xFF (NUL),

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Multi-State Value	19	8	Present_Value	85

Full Reference
RTU_C#########. OccState.Present_Value

Enumeration
1=Occ 2=Unocc 3= NUL (Powerup)

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviOccSchedule	DAC, SCC	Yes	SNVT_tod_event	128

Structure

```
typedef struct {
        occup_t         Current_state;          See Below
        occup_t         next_state;             Not Used
        unsigned long   time_to_next_state;     Not Used
}SNVT_tod_event
```

Field Definitions

Field	Data Point Reference	Units	Valid Range	Notes
current_state	Occupancy Scheduler Input	occup_t		current scheduled occupancy state
next_state	Occupancy Scheduler Next	occup_t		FIELD NOT USED
time_to_next_state	Occupancy Scheduler Time	Minutes	0 to 65534	FIELD NOT USED

Enumeration Definitions (occup_t)

Value	Identifier	Notes
0	OC_OCCUPIED	Area is occupied
1	OC_UNOCCUPIED	Area is unoccupied
2	OC_BYPASS	Not Used
3	OC_STANDBY	Not Used
0xFF	OC_NUL	Default after power-up

Enumeration Correspondence

BACnet		LONWORKS	
1	Occupied	0	OC_OCCUPIED
2	Unoccupied	1	OC_UNOCCUPIED
1	Occupied	2	OC_BYPASS
1	Occupied	3	OC_STANDBY
3	NUL	0xFF	OC_NUL

9.6.20 Occupancy Schedule Override Setpoint

Keypad Menu Path Time Delays/ Ten. Over. Time

This read/write configuration property defines the amount of time that the unit operates in the Bypass mode. Writing 0 disables the feature.

Measurement	Units	Data Type	Valid Range	Default Value
Time	Minutes	Real	0…360 min	120

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	3	Present Value	85
Full Reference				
RTU_C#########.OccSchOverrideSP.Present_Value				

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Index	SCPT Reference	SCPT Index
nciBypassTime	SCC	SNVT_time_min	107	SCPTbypassTime	34

9.6.21 Occupied Cooling Setpoint

Keypad Menu Path Setpoint/Occ Cool SP

This read/write configuration property sets the Occupied Cooling Setpoint.

The BACnet property only applies to the subject data point. The LONWORKS variable is a structure that covers three other data points: Unoccupied Cooling Setpoint, Occupied Heating Setpoint, and Unoccupied Heating Setpoint.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F/°C	Real LONWORKS: structured	4.4°C…37.7°C 40°F…100.0°F LonWorks: 40°F…95.0°F	72°F / 22°C

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	9	Present_Value	85
Full Reference				
RTU_C#########.OccCoolSP.Present_Value				

LONWORKS

LONWORKS Name	Profile	SCPT Reference	SCPT Index	SNVT Type	SNVT Index
nciSetpoints.Occupied_Cool	SCC	SCPTsetPnts	60	SNVT_temp_setpt	106

Structure

```
typedef struct {
    signed long    Occupied_cool;
    signed long    standby_cool;        Not Used
    signed long    Unoccupied_cool;
    signed long    Occupied_heat;
    signed long    standby_heat;        Not Used
    signed long    Unoccupied_heat;
} SNVT_temp_setpt;
```

9.6.22 Occupied Heating Setpoint

Keypad Menu Path Setpoint/Occ Heat SP

This read/write configuration property sets the Occupied Heating Setpoint.

The BACnet property only applies to the subject data point. The LONWORKS variable covers three other data points: Occupied Cooling Setpoint, Unoccupied Cooling Setpoint, and Unoccupied Heating Setpoint.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F/°C	Real LONWORKS : structured	2.2°C…35.5°C 36.0°F…96.0 °F LonWorks: 36°F…91.0°F	68°F / 20°C

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	11	Present_Value	85
Full Reference				
RTU_C#########. OccHeatSetpt.Present_Value				

LONWORKS

LONWORKS Name	Profile	SCPT Reference	SCPT Index	SNVT Type	SNVT Index
nciSetpoints.occupied_heat	SCC	SCPTsetPnts	60	SNVT_temp_setpt	106

Structure

```
typedef struct {
    signed long    Occupied_cool;
    signed long    standby_cool;        Not Used
    signed long    Unoccupied_cool;
    signed long    Occupied_heat;
    signed long    standby_heat;        Not Used
    signed long    Unoccupied_heat;
} SNVT_temp_setpt;
```

9.6.23 Effective Outdoor Air Temperature

Keypad Menu Path Temperatures/Eff Out Air Temp

This output network variable indicates the current value of the Outdoor Air Temperature for monitoring purposes. This value reflects the network input nviOutdoorTemp (if valid) or the value from a locally wired sensor.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F/°C	Real	-40.0°C…80.0°C -40.0°F…176.0°F	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Input	0	4	Present_Value	85
Full Reference				
RTU_C#########. EffectOAT.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoOutdoorTemp	DAC, SCC	Yes	SNVT_temp_p	105

9.6.24 Remote Outdoor Air Temperature

This input network variable is the measured Outdoor Air Temperature. Either a network sensor or a supervisory controller typically provides the value. When an outdoor air temperature sensor is locally wired to the unit controller, the nviOutdoorTemp has priority if a valid value is present.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
Temperature	°F/°C	Real	-40°C…50°C -40°F…122°F	Yes	327.67 (0x7FFF)

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	29	Present_Value	85
Full Reference				
RTU_C#########. OutdoorTempInput.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviOutdoorTemp	DAC, SCC	Yes	SNVT_temp_p	105

9.6.25 Receive Heartbeat

This read/write configuration property defines the maximum time that elapses after the last update to a specified network variable input before the communication module reverts to it default values.

Measurement	Units	Data Type	Valid Range	Default Value
Time	Seconds	Real	0.0…6553.4 sec	0.0 seconds

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	43	Present_Value	85
Full Reference				
RTU_C#########. ReceiveHrtBt.Present_Value				

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Index	SCPT Reference	SCPT Index
nciRcvHrtBt	DAC, SCC	SNVT_time_sec	107	SCPTmaxRcvTime	48

9.6.26 Return Air Temperature

Keypad Menu Path Temperatures/Return Air Temp

This read-only attribute indicates the current reading from the RTU-C unit return air temperature sensor. This value is used for control purposes.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real	-40.0°C…80.0°C -40.0°F…176.0°F	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Input	0	2	Present_Value	85
Full Reference				
RTU_C#########. EffectRAT.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoRATemp	DAC, SCC	Yes	SNVT_temp_p	105

9.6.27 Return/Exhaust Fan Capacity

This read-only attribute indicates the current return fan or exhaust fan capacity. This output network variable is used to monitor the status of the exhaust fan. If there is only on/off control, the expected capacity is 0% for off and 100% for on. If there is modulating fan speed control, the range is 0% to 100% (fan off to full speed). LONWORKS Only: When a value of 1 .. 200 is read then set the state field to 1, otherwise set it to 0.

Measurement	Units	Data Type	Valid Range	Default Value
Fan Capacity	Percent	Real LONWORKS: Structure	0…100%	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Input	0	10	Present_Value	85
Full Reference				
RTU_C#########. ExhFanCap.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoExhFanStatus.value	DAC, SCC	Yes	SNVT_switch	N/A

```
typedef struct {
    unsigned    value;    0–100%
    signed      state;    0=Off
                          1=On
} SNVT_switch;
```

9.6.28 *Send Heartbeat*

This read/write configuration property defines maximum period of time that expires before the specified network variable output is automatically updated.

Measurement	Units	Data Type	Valid Range	Default Value
Time	Seconds	Real	0.0…6553.4 sec	0.0 seconds

BACnet

No BACnet equivalent.

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Index	SCPT Reference	SCPT Index
nciSndHrtBt	DAC, SCC	SNVT_time_sec	107	SCPTmaxSendTime	49

9.6.29 *Communication Module Software Version*

This read configuration property is used to identify the application software, version and revision that have been installed in the communication module.

Measurement	Units	Data Type	Valid Range	Default Value
N/A	N/A	Real	0 .. 0xFFFF	NA

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Device	8	Variable	Firmware_Revision	44
Full Reference				
Firmware_Revision				

LONWORKS

LONWORKS Name	Profile	SNVT Type	SCPT Reference	SCPT Index
UCPTcommDevMajVer & UCPTcommDevMinVer	DAC, SCC	N/A	SCPT	165 and 166

9.6.30 Application Version

Keypad Menu Path General Information /Software Version

This read only attribute reflects the current Application Version of the RTU-C Rooftop Unit Controller.

Measurement	Units	Data Type	Valid Range	Default Value
N/A	N/A	Real	N/A	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Device	8	Variable	Application_Software_Version	12
Full Reference				
RTU_C#########. Application_Software_Version				

LONWORKS

LONWORKS Name	Profile	SNVT Type	SCPT Reference	SCPT Index
UCPTunitDevMajVer & UCPTunitDevMinVer	DAC, SCC	N/A	SCPT	165 and 166

9.6.31 Integrated Furnace Controller Software Version

Keypad Menu Path Furnace Ctrl/IFC Revision

This read only configuration property is used to identify the application software, version, and revision that have been installed in the integrated furnace controller.

Measurement	Units	Data Type	Valid Range	Default Value
N/A	N/A	Real	0 .. 0xFFFF	NA

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	45	Present_Value	85
Full Reference				
RTU_C#########. Integrated_Furnace_Controller_Software_Version.Present_Value				

LONWORKS

LONWORKS Name	Profile	SNVT Type	SCPT Reference	SCPT Index
UCPTifcDevMajVer & UCPTifcDevMinVer	DAC, SCC	N/A	SCPT	165 and 166

9.6.32 Honeywell Economizer Software Version

Keypad Menu Path Economizer /Econ Firm Vrsn

This read configuration property is used to identify the application software, version and revision that have been installed in the Honeywell Economizer.

Measurement	Units	Data Type	Valid Range	Default Value
N/A	N/A	Real	0 .. 0xFFFF	NA

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	46	Present_Value	85
Full Reference				
RTU_C#########. Honeywell_ Economizer_Software_Version.Present_Value				

LONWORKS

LONWORKS Name	Profile	SNVT Type	SCPT Reference	SCPT Index
UCPTeconDevMajVer & UCPTeconDevMinVer	DAC, SCC	N/A	SCPT	165 and 166

9.6.33 Location

This read/write configuration property is used to describe the location of the unit.

Measurement	Units	Data Type	Valid Range	Default Value
Name	character	ASCII character	any	0

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Device	8	Variable	Location	58
Full Reference				
RTU_C#########. Location				

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Index	SCPT Reference	SCPT Index
nciLocation	DAC, SCC	SNVT_str_asc	36	SCPTlocation	17

9.6.34 Local Space CO_2

This read-only attribute indicates the current space CO_2 level from an optional space CO_2 sensor. This value reflects the network input nviSpaceIAQ (if valid) or the value from a locally wired sensor if Min OA Type on the Min OA Damper menu is set to IAQ. The unit controller doesn't do any control using this value.

Measurement	Units	Data Type	Valid Range	Default Value
Concentration	Ppm	Real	0…2000 ppm	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Input	0	13	Present_Value	85
Full Reference				
RTU_C#########. EffectSpaceCO2.Present_Value				

LonWorks

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoSpaceCO2	SCC, DAC	Yes	SNVT_ppm	29

9.6.35 Remote Space IAQ

Keypad Menu Path Economizer /Ext.DCV Level

This read/write attribute indicates the current space CO_2 level from the network. This value takes priority over a locally wired sensor. The unit controller doesn't do any control using this value. The unit controller only passes this value to the ELM.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
Concentration	Ppm	Real	0…2000 ppm	Yes	32767 (0x7FFF)

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	31	Present_Value	85
Full Reference				
RTU_C#########.SpaceIAQInput.Present_Value				

LonWorks

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviSpaceIAQ	SCC, DAC	Yes	SNVT_ppm	29

LONWORKS: Set to 0 to set invalid.

9.6.36 Effective Space Temperature

Keypad Menu Path Temperatures/Eff Space Temp

This read-only attribute indicates the current value of the Space Temperature for monitoring purposes. This value reflects the network input nviSpaceTemp (if valid) or the value from a locally wired sensor.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real	-40.0°C…60.0°C -40.0°F…140.0°F	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Input	0	3	Present_Value	85
Full Reference				
RTU_C#########. EffectSpaceT.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoSpaceTemp	SCC	Yes	SNVT_temp_p	105

9.6.37 Remote Space Temperature

This read/write attribute indicates the current space or zone temperature that is written from the network. If this network value becomes unreliable, the temperature reverts to the value provided by the attached Space Temperature sensor.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
Remote Space Temperature	°F / °C	Real	-10.0°C…50.0°C 14.0°F…122.0°F	Yes	327.67 (0x7FFF)

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	28	Present_Value	85
Full Reference				
RTU_C#########. SpaceTempInput.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviSpaceTemp	SCC	Yes	SNVT_temp_p	105

9.6.38 Effective Supply Fan Capacity

Keypad Menu Path Unit Status/Indoor Fan (ON then 100%, OFF then 0%; with Variable Frequency Drive, shows actual speed requested by RTU-C)

This read-only attribute indicates the current Discharge Fan Capacity.

The BACnet property reads only the subject attribute and only applies to the subject data point.

The LONWORKS variable is only a part of the LONWORKS Unit Status network variable. See Unit State for details of LONWORKS network variable. The LONWORKS variable covers six other data points: Unit State, Primary Heating Capacity, Outdoor Air Damper Position, In Alarm and Secondary Heating Capacity (not used).

Measurement	Units	Data Type	Valid Range	Default Value
Fan Capacity	Percent	Real LONWORKS: Structure	BACnet: 0…100% LONWORKS: 0…100%	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Input	0	8	Present_Value	85
Full Reference				
RTU_C#########. FanOutput.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoUnitStatus.fan_output	DAC, SCC	Yes	SNVT_hvac_status	112

9.6.39 Economizer Enable

This read/write configuration property enables or disables economizer functionality for free cooling and also for ventilation for indoor air quality (IAQ). This property can be set to free cooling disabled/ ventilation enabled, both free cooling and ventilation enabled or both free cooling and ventilation disabled or Auto. When set to Auto, then the unit control decides; this will cause the unit control to enable free cooling and enable ventilation.

The LONWORKS point nviEconEnable has two properties; a State and a Value. Only the state field is reference.

Measurement	Units	Data Type	Valid Range	Default Value
State	NA	Unsigned LONWORKS: Structure	Enumerated	Auto

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Multi-State Value	19	32	Present_Value	85
Full Reference				
RTU_C#########.EconEnable.Present_Value				

Enumeration
1 = Disable Free Cooling, Enable Ventilation 2 = Enable Free Cooling, Enable Ventilation 3 = Auto (unit control decides) 4 = Disable All Economizer Functionality

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SCPT Reference	SCPT Index	SNVT Type	SNVT Index
nviEconEnable	DAC, SCC	Yes	NA	NA	SNVT_switch	95

Structure

typedef struct {
Signed state Enumerated:
0= Disable Free Cooling, Enable Ventilation
1= Enable Free Cooling, Enable Ventilation
2= Disable All Economizer Functionality
-1(0xFF)=Auto
unsigned value 0..255 (NOT USED)
} SNVT_switch;

Valid Range

State	Value	Economizer
0	N/A	Disable Free Cooling, Enable Ventilation
1	N/A	Enable Free Cooling, Enable Ventilation
2	N/A	Disable All Economizer Functionality
0xFF	N/A	Auto (unit control decides) (default)

9.6.40 Demand Control Ventilation Limit

Keypad Menu Path Economizer/Econ. DCV Limit

This read/write attribute indicates the current Demand Control Ventilation Limit from the network.

Measurement	Units	Data Type	Valid Range	Default Value
Percent	Percent	Real	0…100%	32,767 (0x7FFF)

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	53	Present_Value	85
Full Reference				
RTU_C#########. DemandControlVentLimit.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviMinVentLim	DAC, SCC	No	SNVT_lev_percent	81

9.6.41 Ventilation Limit

This read/write attribute indicates the current Ventilation Limit from the network.

Measurement	Units	Data Type	Valid Range	Default Value
Percent	Percent	Real	0…100%	32,767 (0x7FFF)

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	54	Present_Value	85
Full Reference				
RTU_C#########. VentLimit.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviMaxVentLim	DAC, SCC	No	SNVT_lev_percent	81

9.6.42 Space CO_2 High Limit Setpoint

Keypad Menu Path Economizer/DCV Level Setpt.

This read/write configuration property sets the space CO_2 Setpoint level. Network accepts a value 0, or from 500-2000 ppm. Writing 0 disables the CO_2 limit function of the controller.

Measurement	Units	Data Type	Valid Range	Default Value
Concentration	Ppm	Real	0, 500…2000 ppm	0

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	48	Present Value	85
Full Reference				
RTU_C#########.SpaceCO2HighLimitSpt.Present Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SCPT Type	SCPT Index
nciSpaceCO2Lim	DAC, SCC	No	SCPTlimitCO2	42

9.6.43 Exhaust On/Off Setpoint

Keypad Menu Path Economizer/Econ.Exh. ON/OFF

This read/write configuration property is used to set the setpoint on the Honeywell economizer that turns the exhaust fan off and on depending on the position of the damper.

Measurement	Units	Data Type	Valid Range	Default Value
Percent	%	Real	0…100%	25% = 5000

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	55	Present_Value	85

Full Reference
RTU_C#########. ExhOnOffSetpt.Present_Value

LONWORKS

LONWORKS Name	Profile	SCPT Reference	SCPT Index	SNVT Type	SNVT Index
nciExhaustSpt	DAC, SCC	SCPTminReturnExhaustFanCapacity	60	SNVT_lev_percent	81

9.6.44 Remote Space Temperature Spt Adjust

This read/write property is used in both BACnet and LONWORKS networks. If the value is valid and Room Sensor Setpoint Enable is set to Disabled (Network) then it is used in the calculation of the Effective Setpoint Output, otherwise the Effective Setpoint Output does not depend on this value.

Note: This value does not affect unoccupied setpoints.

Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
Temperature	°C/ °F	Real	10.0°C…35.0°C 50.0°F…95.0°F	No	32,767 (0x7FFF)

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	56	Present_Value	85
Full Reference				
RTU_C#########.RemoteSpaceSetpt.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nviSetpoint	SCC	No	SNVT_temp_p	105

9.6.45 Unit State

Keypad Menu Path Unit Status/Mode

This read-only property indicates the current unit operating status information.

Measurement	Units	Data Type	Valid Range	Default Value
Unit State	N/A	BACnet: unsigned LONWORKS: Structures	Enumerated	N/A

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Multi-State Value	19	15	Present_Value	85
Full Reference				
RTU_C#########. UnitStatus.Present_Value				

Enumeration
1=Off 2=Start 3=Recirc 4=Fan Only 5=MinDAT 6=Htg 7=Econo 8=Clg

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Number
nvoUnitStatus.Mode	DAC, SCC	Yes	SNVT_hvac_status	112

Structure

```
typedef struct {
    Hvac_t          mode;
    Signed long     heat_output_primary;
    Signed long     heat_output_secondary;
    Signed long     cool_output;
    signed long     econ_output;
    signed long     Fan_output;
    Unsigned        in_alarm;
} SNVT_hvac_status;
```

Field Definitions

Field	Data Point Reference	Valid Range	Notes
Mode	See below	Enumerated	compatible with SNVT_hvac_mode
Heat_output_primary	Primary Heating Capacity	-163.83 .. +163.83% (percentage of full scale)	primary heat output
Heat_output_secondary	Secondary Heating Capacity	-163.83 .. +163.83% (percentage of full scale)	secondary heat output
Cool_output	Cooling Capacity	-163.83 .. +163.83% (percentage of full scale)	cooling output
Econ_output	Out Door Air Damper Position	-163.83 .. +163.83% (percentage of full scale)	economizer output
Fan_output	Discharge Fan Capacity	-163.83 .. +163.83% (percentage of full scale)	fan output
in_alarm	In Alarm	0 = No Alarm 1-99 = Warning 100-199 = Problem 200-255 = Fault	Any non-zero value means unit is in alarm[1]

[1]The value assigned to each alarm is the same for both BACnet and LONWORKS applications. For these enumerations, refer to Current Alarm section.

LONWORKS (Mode) Enumeration Definitions

Enumeration Definitions (hvac_t)

Value	Identifier	Notes
0	HVAC_AUTO	Not Used
1	HVAC_HEAT	Unit State is Heat
2	HVAC_MRNG_WRMUP	Not Used
3	HVAC_COOL	Unit State is Cool
4	HVAC_NIGHT_PURGE	Not Used
5	HVAC_PRE_COOL	Not Used
6	HVAC_OFF	Unit State is either Off or Startup.
7	HVAC_TEST	Not Used
8	HVAC_EMERG_HEAT	Not Used
9	HVAC_FAN_ONLY	Air not conditioned, fan turned on
10	HVAC_FREE_COOL	Not Used
11	HVAC_ICE	Not Used
12	HVAC_MAX_HEAT	Not Used
13	HVAC_ECONOMY	Not Used
14	HVAC_DEHUMID	Not Used
15	HVAC_CALIBRATE	Not Used
16	HVAC_EMERG_COOL	Not Used
17	HVAC_EMERG_STEAM	Not Used
0xFF	HVAC_NUL	Off (control powerup)

Enumeration Correspondence

BACnet		LONWORKS	
2	Start	0	HVAC_AUTO (not used)
6	Htg	1	HVAC_HEAT
2	Start	2	HVAC_MRNG_WRMUP(not used)
8	Clg	3	HVAC_COOL
2	Start	4	HVAC_NIGHT_PURGE(not used)
2	Start	5	HVAC_PRE_COOL(not used)
1	Off	6	HVAC_OFF
2	Start	7	HVAC_TEST(not used)
2	Start	8	HVAC_EMERG_HEAT(not used)
4	Fan Only	9	HVAC_FAN_ONLY
2	Start	10	HVAC_FREE_COOL(not used)
2	Start	11	HVAC_ICE(not used)
2	Start	12	HVAC_MAX_HEAT(not used)
7	Econo	13	HVAC_ECONOMY
2	Start	14	HVAC_DEHUMID
2	Start	15	HVAC_CALIBRATE(not used)
2	Start	16	HVAC_EMERG_COOL(not used)
2	Start	17	HVAC_EMERG_STEAM(not used)
2	Start	0xFF	MODBUS Register reads 0xFF then BACnet converts to Start

9.6.46 BACnet Unit Support

This is a BACNET only variable that sets the units that are sent from the communication module to the BACnet network. Units can be either metric or English.

Measurement	Units	Data Type	Valid Range	Default Value
Unit Support	N/A	BACnet: Unsigned LONWORKS: Structures	Metric English	Metric

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Multistate Value	19	16	Present_Value	85
Full Reference				
RTU_C#########. UnitSupport.Present_Value				

Enumeration
1 = Metric 2 = English

LONWORKS

No LONWORKS equivalent.

9.6.47 Unoccupied Cooling Setpoint

Keypad Menu Path Setpoints/Unc Cool SP

This read/write configuration property sets the temperature above which the RTU-C Rooftop Unit Controller starts and provides cooling (night setup) during unoccupied periods. An optional space temperature sensor is required for unoccupied cooling operation. The BACnet property only applies to the subject data point. The LONWORKS variable is a structure that covers three other data points: Unoccupied Cooling Setpoint, Occupied Heating Setpoint, and Unoccupied Heating Setpoint.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real LONWORKS: Structures	4.4°C…37.7°C 40.0°F…100.0°F LonWorks: 40.0°F…95.0°F	85°F / 29.44°C

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	10	Present_Value	85
Full Reference				
RTU_C#########. UnoccCoolSetpt.Present_Value				

LONWORKS

LONWORKS Name	Profile	SCPT Reference	SCPT Index	SNVT Type	SNVT Index
nciSetpoints.unoccupied_cool	SCC	SCPTsetPnts	60	SNVT_temp_setpt	106

Structure

```
typedef struct {
    signed long    Occupied_cool;
    signed long    standby_cool;        Not Used
    signed long    Unoccupied_cool;
    signed long    Occupied_heat;
    signed long    standby_heat;        Not Used
    signed long    Unoccupied_heat;
} SNVT_temp_setpt;
```

9.6.48 Unoccupied Heating Setpoint

Keypad Menu Path Setpoints/Unc Heat SP

This read/write configuration property sets the temperature above which the RTU-C Rooftop Unit Comptroller starts up and provides unoccupied heating (night setback). An optional space temperature sensor is required for unoccupied heating. The BACnet property only applies to the subject data point. The LONWORKS variable is a structure that covers three other data points: Unoccupied Cooling Setpoint, Occupied Heating Setpoint, and Unoccupied Heating Setpoint.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real LONWORKS: Structures	2.2°C…35.5°C 36.0°F…96.0°F LonWorks: 36.0°F…91.0°F	55°F / 12.7°C

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	12	Present_Value	85
Full Reference				
RTU_C#########. UnoccHeatSetpt.Present_Value				

LONWORKS

LONWORKS Name	Profile	SCPT Reference	SCPT Index	SNVT Type	SNVT Index
nciSetpoints.unoccupied_heat	SCC	SCPTsetPnts	60	SNVT_ temp_setpt	106

Structure

```
typedef struct {
    signed long    Occupied_cool;
    signed long    standby_cool;        Not Used
    signed long    Unoccupied_cool;
    signed long    Occupied_heat;
    signed long    standby_heat;        Not Used
    signed long    Unoccupied_heat;
} SNVT_temp_setpt;
```

9.6.49 Space RH Configuration Setpoint

Keypad Menu Path Dehumidification/ Dehumidification Setpt.

This is the read/write configuration property that the network can use to set the space relative humidity configuration setpoint from the network. Writing 0 disables the dehumidification.function in the controller. This configuration setpoint does not have a corresponding relative humidity network input or relative humidity setpoint input. The relative humidity is read by the Field Input 2 hardwired input on the unit control board. To read the relative humidity value, Field Input 2 must be configured for 'percent' units. See Field Input 2 Configuration for details for selecting units. This property is available in communication modules v2.00+.

Measurement	Units	Data Type	Valid Range	Default Value
Relative Humidity	%	Real	0-100%	0%

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	65	Present Value	85
Full Reference				
RTU_C#########.SpaceRHCfgSpt.Present Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SCPT Type	SCPT Index
nciSpaceRHSetpt	SCC	No	SCPThumSetpt	36

9.6.50 Field Input 1

Keypad Menu Path Temperature / Field Config 1

This read-only attribute indicates the current value of the field input 1 that's located on the RTU-C controller board.

Measurement	Units	Data Type	Valid Range	Default Value
Temperature	°F / °C	Real	-40.0°C…80.0°C -40.0°F…176.0°F	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	61	Present_Value	85
Full Reference				
RTU_C#########. FieldInput1.Present_Value				

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	Number
nvo FieldInput1		No	SNVT_temp_p	105

9.6.51 Field Input 2

Keypad Menu Path Temperature / Field Config 2

This read-only attribute indicates the current value of the field configurable input 2 that's located on the RTU-C controller board. It is configured by using Field Input 2 Configuration. The unit type can be configured to be one of the following: percent, flow, temperature, PPM or pressure.

In BACnet, the unit type is configured by writing to this objects (AV 62) engineering unit type property. The low range and high range are configured by Field Input 2 Configuration.

In LonWorks, the unit type, low range and high range are all configured by using Field Input 2 Configuration.

Measurement	Units	Data Type	Valid Range	Default Value
percent flow flow temperature temperature PPM pressure pressure	% (default) liters/sec (metric) CFM (Imp) °C (metric) °F (Imp) PPM Pascals (metric) IWC (Imp)	Real	User Defined	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	62	Present_Value	85
Full Reference				
RTU_C#########. FieldInput2.Present_Value				

LONWORKS

This point can be configured to be one of the following SNVT types.

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	Number
nvo FieldInput2		No	SNVT_lev_percent SNVT_flow SNVT_temp_p SNVT_ppm SNVT_press_p	81 15 105 29 113

9.6.51.1 Field Input 2 Configuration

Keypad Menu Path N/A

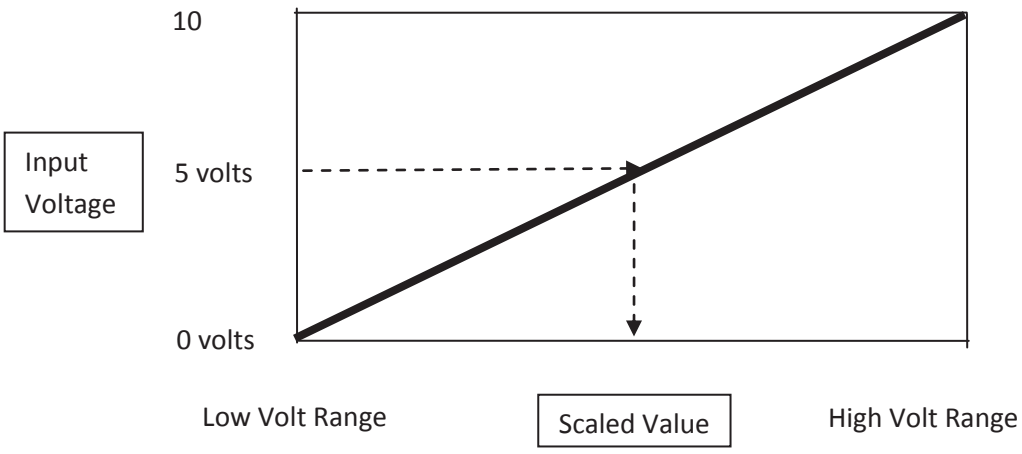
These read/write configuration properties configure the low scaled value and high scaled value for Field Input 2. LonWorks also configures the unit type used. In BACnet, the unit type is configured by writing to the Field Input 2 objects engineering unit type property. These properties are all stored in non-volatile memory.

Calculating the scaled value for a given voltage:

The input voltage from the field input 2 port, mounted on the unit control, is a voltage from 0 to 10 volts. The voltage value must be scaled to the desired units. The LowVoltRange is the desire scaled value at 0 volts. The HighVoltRange is the desire scaled value at 10 volts. These values must be entered in metric units. If a unit type of flow, temperature or pressure is selected and imperial units are selected then the values will be converted to imperial. The input voltage versus scaled value is assumed to be linear.

Scaled Value = (InputVoltage / 10 volts) * (HighVoltRange – LowVoltRange) + LowVoltRange

Note: for inverted voltage signal inputs the LowVoltRange value will be larger than the HighVoltRange value.



Measurement	Units	Data Type	Valid Range	Uses Heartbeat	Default Value
N/A	N/A	Unsigned	Enumerated	No	Percent

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	63	Present_Value	85
Full Reference				
RTU_C#########. FieldInput2LowVoltRange.Present_Value				

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	64	Present_Value	85

Full Reference
RTU_C#########. FieldInput2HighVoltRange.Present_Value

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Index	UCPT Reference
UCPTfieldInput	SCC	n/a	n/a	UCPTfieldInput

Structure

```
typedef struct {
    signed      UnitType;
    float       LowVoltRange;
    float       HighVoltRange;
} UNVT_field_input;
```

Enumeration Definitions

State	Identifier	Notes
0	FIELD2TYPE_PERCENT	Percent
1	FIELD2TYPE _FLOW	Flow
2	FIELD2TYPE _TEMPERATURE	Temperature
3	FIELD2TYPE _PPM	PPM
4	FIELD2TYPE _PRESSURE	Pressure

9.7 Alarms

Alarms are divided into three categories - Warnings, Problems, and Faults. These categories are prioritized with the Warnings being the least important and Faults being of the highest importance. When a unit enters into a fault alarm, the unit shuts down and requires a manual reset or power cycle before the unit will start again*. The following alarms are available. Alarms can be cleared by the network in two ways; by clearing each alarm individually or by clearing all alarms at the same time. The following sections describe the alarm categories, alarm monitoring, and alarm clearing.

Note*: an exception to this is the Low Voltage fault. The Low Voltage fault shuts down all relays, but, the fault will become inactive and relays will function as normal when the voltage returns to acceptable levels.

Alarm Category	Alarm Number Range	Action
Warning	1..99	Warnings will not alter and will not shutdown the unit
Problem	100..199	Problem alarms will alter the unit operation
Shutdown Fault	200..254	When the unit controller receives a fault alarm the unit responds by shutting down

9.7.1 Alarm Table

The following alarm numbers shall be used for alarms. The priorities of the alarms are defined by the alarm code number. The higher the alarm code number, the higher its priority.

Alarm Designation	Alarm Level	Alarm Code	Description
No Active Alarm		0	
Unspecified Alarms	Warning	1	If unit alarm number is not in the following table then code 1 is presented.
Clogged Filter Warning-CFS	Warning	24	RTU-C Displays warning.
Running Blower Fault- Air Flow Switch Stuck	Warning	28	Switch indicates airflow when fan commanded off.
Condenser Coil 1 Temperature Out of Range	Warning	30	No defrost operation, but unit continues to operate in either heating or cooling. Prevents water heating operation on *e*SYNC™ unit if warning is active.
Condenser Coil 2 Temperature Out of Range	Warning	31	No defrost operation, but unit continues to operate in either heating or cooling.
Discharge Air Temperature Out of Range	Warning	32	The alarm will be set if it becomes unavailable.
Invalid Thermostat selection	Warning	42	Indicates that a combination of thermostat inputs is invalid.
LOW FLAME SENSE	Warning	44	IFC flashes error code on LED, transmits the warning through the network, but otherwise operates normally

Alarm Designation	Alarm Level	Alarm Code	Description
Low Discharge Air Temp-DAT (future use)	Warning	71	Transmits warning through network if DAT is below setpoint.
High Return Air Temp-RAT	Warning	72	Threshold is 120°F.
*e*SYNC™ Water Pump Fault	Warning	77	Water pump fault occurred.
*e*SYNC™ Low Subcooling – Air Conditioning Mode	Warning	78	If 4 minutes after the compressor starts or the 3-way refrigerant valve has shifted, low subcooling was continuously measured for more than 30 seconds during the air conditioning mode an alarm is issued. Unit operation continues.
*e*SYNC™ High Subcooling – Air Conditioning Mode	Warning	79	If 4 minutes after the compressor starts or the 3-way refrigerant valve has shifted, high superheat was continuously measured for more than 30 seconds during the air conditioning mode an alarm is issued. Unit operation continues.
Return Air Sensor Fail-RAT	Warning	81	The alarm will be set if it becomes unavailable.
Discharge Air Sensor Fail-DAT	Warning	82	The alarm will be set if it becomes unavailable.
Comm Card Miscommunication	Warning	90	Communication card indicates miscommunication with the RTU-C.
RTU-C Miscommunication with IFC	Warning	91	RTU-C indicates miscommunication with the IFC, or a period of time has passed without communication.
Internal Control Fault – RTU-C	Warning	93	An internal fault occurred in the RTU-C.
Internal Control Fault – IFC	Warning	94	An internal fault occurred in the IFC.
FLAME LOST	Problem	101	If lost 17 times within single call for heat, locks out for 1 hour. Otherwise retry ignition.
Low Voltage Circuit 2	Problem	104	Comfort Alert Code 9. Shutdown circuit 2 and wait for voltage to return to operational levels
Low Voltage Circuit 1	Problem	105	Comfort Alert Code 9. Shutdown circuit 1 and wait for voltage to return to operational levels
Lockout Temperature – cooling	Problem	110	When the outdoor temperature drops below the cooling lockout temperature setpoint, the unit will prevent the compressor from operating in cooling mode.
Lockout Temperature – heating	Problem	111	When the outdoor temperature exceeds the heating lockout temperature setpoint, the unit will prevent any source of heat from operating.
Condenser Coil 2 Temp Sensor Fail-OCT2	Problem	120	No defrost operation, but unit continues to operate in either heating or cooling
Condenser Coil 1 Temp Sensor Fail-OCT1	Problem	121	No defrost operation, but unit continues to operate in either heating or cooling. Prevents water heating operation on eSYNC™ unit if warning is active.
ELM - OAE Sensor Fail	Problem	122	Can prevent operation of "free cooling" mode of the Economizer.
ELM - RAE Sensor Fail	Problem	123	Can prevent the operation of the Economizer.
ELM - MAT Sensor Fail	Problem	124	Can prevent the operation of the Economizer.
ELM – CO_2 Sensor Fail	Problem	125	Can prevent the operation of the Economizer.

Alarm Designation	Alarm Level	Alarm Code	Description
ELM Actuator Fault	Problem	126	The economizer logic module (ELM) has detected that the outdoor air damper on the economizer was commanded to a position greater than 0% open, but the actual damper position did not match after waiting for 2 minutes.
MANUAL RESET LIMIT SWITCH OPEN	Problem	129	IFC Runs blower for off delay, inducer for post-purge time and locks out for one hour
Open Circuit 2	Problem	131	Comfort Alert Code 5. Circuit 2 shutdown and retry after ASCD. Note: This alarm is sent by the Comfort Alert Module only after the fault has been sensed for a minimum of 4 hours.
Open Circuit 1	Problem	132	Comfort Alert Code 5. Circuit 1 shutdown and retry after ASCD. Note: This alarm is sent by the Comfort Alert Module only after the fault has been sensed for a minimum of 4 hours.
PRESSURE SWITCH 2 CLOSED	Problem	133	Leave inducer de-energized until pressure switch open
PRESSURE SWITCH 1 CLOSED	Problem	134	Leave inducer de-energized until pressure switch open
PRESSURE SWITCH 2 OPEN	Problem	135	Energize inducer indefinitely until pressure switch closes or call for heat goes away.
PRESSURE 1 SWITCH OPEN	Problem	136	Energize inducer indefinitely until pressure switch closes or call for heat goes away.
AC Low Pressure Switch 2 Trip-LP2	Problem	137	If the low pressure switch trips 3 times within 120 minutes of operation during the same call for cooling or heating operation, the control will lock out compressor and outdoor fan operation. If the lock-out due to low pressure occurs at an outdoor ambient temperature below 5 °F, the control will automatically exit the lock-out mode when the outdoor ambient temperature rises above 5 °F.
AC Low Pressure Switch 1 Trip-LP1	Problem	138	If the low pressure switch trips 3 times within 120 minutes of operation during the same call for cooling or heating operation, the control will lock out compressor and outdoor fan operation. If the lock-out due to low pressure occurs at an outdoor ambient temperature below 5 °F, the control will automatically exit the lock-out mode when the outdoor ambient temperature rises above 5 °F.

Alarm Designation	Alarm Level	Alarm Code	Description
Welded Contactor Circuit 2	Problem	141	Comfort Alert Code 8 Run outdoor and indoor fans continuously for circuit 2 and change mode of operation to Unoccupied Auto. This procedure prevents the ambient from reaching extreme temperatures.
Welded Contactor Circuit 1	Problem	142	Comfort Alert Code 8 Run outdoor and indoor fans continuously for circuit 2 and change mode of operation to Unoccupied Auto. This procedure prevents the ambient from reaching extreme temperatures.
Freeze Sensor 2 Out of Range - FS2	Problem	144	When reading the temperature below 37°F continuously for 15 minutes, the control shutdowns compressor and runs indoor fan continuously. After 15 minutes of continuous reading above 42°F, the control recovers from the alarm and resumes operation.
Freeze Sensor 1 Out of Range - FS1	Problem	145	When reading the temperature below 37°F continuously for 15 minutes, the control shutdowns compressor and runs indoor fan continuously. After 15 minutes of continuous reading above 42°F, the control recovers from the alarm and resumes operation.
Freeze Sensor #2 Fail-FS2	Problem	146	Occurs when sensors are either open or shorted. This can prevent the operation of the compressors.
Freeze Sensor #1 Fail-FS1	Problem	147	(described above)
AC HI Pressure Switch 2 Trip-HP2	Problem	148	The RTU-C control recognizes an open high pressure switch after two seconds from its occurrence. Since the high pressure switch is wired in series with the compressor relay, the compressor shutdowns immediately until the pressure switch is closed again AND the anti-short cycle delay is expired. Three occurrences of a high pressure switch within the same call will lock the circuit out. The lockout is reset by removing the call.
AC HI Pressure Switch 1 Trip-HP1	Problem	149	(described above)
Locked Rotor Circuit 1	Problem	151	Comfort Alert Code 4. Circuit 1 shutdown.
Missing Phase Circuit 1	Problem	152	Comfort Alert Code 6 Circuit 1 shutdown
Reverse Phase Circuit 1	Problem	153	Comfort Alert Code 7 Circuit 1 shutdown.
Locked Rotor Circuit 2	Problem	154	Comfort Alert Code 4. Circuit 2 shutdown.
Missing Phase Circuit 2	Problem	155	Comfort Alert Code 6 Circuit 2 shutdown

Alarm Designation	Alarm Level	Alarm Code	Description
Reverse Phase Circuit 2	Problem	156	Comfort Alert Code 7 Circuit 2 shutdown.
Low Pressure – Circuit 2 Problem – Lockout	Problem	158	Clearable: Can be cleared via the network. This fault can also automatically reset if the call for cooling is removed.
Low Pressure – Circuit 1 Problem – Lockout	Problem	159	Clearable: Can be cleared via the network. This fault can also automatically reset if the call for cooling is removed. This alarm can also be caused by the *e*SYNC™ Unit: The low pressure sensor measures suction line refrigerant pressure on circuit #1 and converts it to a 0-5Vdc signal. If the sensor becomes unavailable, then water heating operation terminates and an alarm is set. Unit can continue to operate in cooling mode.
High Pressure– Circuit 2 Problem – Lockout	Problem	166	Clearable: Can be cleared via the network. This fault can also automatically reset if the call for cooling is removed.
High Pressure– Circuit 1 Problem – Lockout	Problem	167	Clearable: Can be cleared via the network. This fault can also automatically reset if the call for cooling is removed. This alarm can also be caused by the *e*SYNC™ Unit: The high pressure sensor measures liquid line refrigerant pressure on circuit #1 and converts it to a 0-5Vdc signal. If the sensor fails, then water heating operation terminates and an alarm is set. Unit can continue to operate in cooling mode.
MAIN LIMIT OPEN	Problem	170	IFC Main Limit Open. To clear must cycle power or wait for 1 hour delay.
GAS VALVE SERVO CIRCUIT OPEN	Problem	171	Modulating furnace only
GAS VALVE SERVO FAULT	Problem	172	Modulating furnace only
NO GAS VALVE FEEDBACK	Problem	173	Modulating furnace only
FAILED IGNITION	Problem	174	IFC locks out for 1 hour
UNEXPECTED FLAME	Problem	175	IFC Energizes inducer and main blower. Locks out for 1 hour
*e*SYNC™ Water Inlet and Outlet Sensor Fault	Problem	176	If both sensors become unavailable, an alarm will be set and water heating operation terminates. Unit can continue to operate in cooling mode.
*e*SYNC™ Low Subcooling – water heating mode	Problem	177	If 4 minutes after the 3-way refrigerant valve has shifted, low subcooling was continuously measured for more than 30 seconds during the water heating mode an alarm is issued. Unit exits water heating mode and switches to air conditioning operation until the water sample delay timer expires.

Alarm Designation	Alarm Level	Alarm Code	Description
*e*SYNC™ High Superheat – water heating mode	Problem	178	If 4 minutes after the 3-way refrigerant valve has shifted, high superheat was continuously measured for more than 30 seconds during the water heating mode an alarm is issued. Unit exits water heating mode and switches to air conditioning operation until the water sample delay timer expires.
*e*SYNC™ Low Water Pressure	Problem	180	The water pressure sensor measures potable water pressure in the water heating section and converts it to a 0-5Vdc signal. If the water pressure is below 5 psig, then water heating operation cannot begin. If the sensor becomes unavailable, then water heating operation terminates. Unit can continue to operate in cooling mode.
*e*SYNC™ Solenoid Problem	Problem	183	At the beginning of each water heating cycle, if the high pressure sensor value exceeds 530 psig after 3 seconds but before 60 seconds are elapsed, an alarm is set.
eSYNC™ Water Inlet Sensor Problem	Problem	184	If the sensor becomes unavailable, an alarm will be set and water heating operation terminates. Unit can continue to operate in cooling mode.
Space Sensor Alarm	Problem	185	If the space sensor fails open or shorted, the space sensor alarm will be set, but the control will continue to operate using the return air sensor in place of the space sensor. If the control has never sensed a valid space sensor input, it will assume no space sensor is present to be used, and not set the space sensor alarm. If a valid space sensor input is ever detected, the control will set a non-volatile flag to indicate the control should have and use a space sensor. When the non-volatile flag is set, the control will detect space sensor alarm conditions.
*e*SYNC™ Water Outlet Sensor Problem	Problem	186	If the sensor becomes unavailable, an alarm will be set and water heating operation terminates. Unit can continue to operate in cooling mode.
Outdoor Air Temperature Sensor Fail-OAT	Problem	188	Control changes defrost to time x temperature mode. The heat source continues to be heat pump, independently of the outdoor air temperature. Additional heat sources are also available in case the demand is not satisfied.
*e*SYNC™ Freeze Protection Mode	Problem	197	The outdoor ambient sensor on the RTU-C has detected outdoor ambient temperatures below 35°F. The water pump is energized continuously until the outdoor temperature rises above 38°F.

Alarm Designation	Alarm Level	Alarm Code	Description
Low Voltage	Fault	201	De-energize all relay outputs. The fault will become inactive and relays will function as normal when the voltage returns to acceptable levels.
Blower Fault - Blower Not Running-FP	Fault	208	Complete unit shutdown. Clearable: Can be cleared via the network.
*e*SYNC™ Water Leakage	Fault	238	The sensor in the water heating (*e*SYNC™) section of the unit has detected a water leak and stopped water heating operation. A relay output for an (optional) field installed water shutoff valve is energized.
*e*SYNC™ Lockout Fault	Fault	239	If alarm 177, 178, 183 are initiated more than 3 times from unit power up, an alarm is sent and water heating mode is terminated until the alarm is cleared. The alarm can only be cleared by removing power to the unit or by sending a "Clear All Alarms" command through the BAS network.
Space Sensor & Return Sensor Fail	Fault	244	Leave indoor fan running if requested. Do not allow cooling or heating functions. Cannot be cleared via the network.
Smoke Detection (Selectable Fault Response)	Fault	248	RTU-C reads the smoke detection input as open -- complete shutdown. Cannot be cleared via the network.
Emergency Stop Fault	Fault	250	Complete shutdown. Clearable: Can be cleared via the network, but not through the "Clear All Alarms" command.

9.7.2 Alarm Monitoring

The RTU-C Unit Controller provides individual alarm identification through a unique value for each alarm. Alarms in a Rooftop Unit Controller are sorted by the severity of the alarm. The value assigned to each alarm is the same for both BACnet and LONWORKS applications.

9.7.2.1 BACnet

Alarms within a RTU-C Rooftop Unit Controller can be monitored by using the Current Alarm (AV 27) attribute. This attribute displays a value that corresponds to the highest priority alarm that is active. It is possible to have multiple active alarms, but only the highest priority is displayed in this attribute. For example, if there is a simultaneous Dirty Filter Warning (value of 24) and a Blower Not Running alarm (value of 208), then the Blower Not Running alarm (value of 208) will display in the Present_Value of AV because it is the higher priority alarm of the two. Once the Blower Not Running alarm condition is corrected and the alarm is cleared, the next highest priority active alarm value (in this example, value of

24 for Dirty Filter alarm) is displayed. The values for all alarms are described in the Alarm Table. If the Current Alarm (AV 27) displays a zero in the Present_Value property, there are no active alarms.

9.7.2.2 *LonWorks*

Alarms within a RTU-C Rooftop Unit Controller can be monitored individually by using the In Alarm attribute. The In Alarm attribute is part of the Unit Status Network Variable Output (i.e. nvoUnitStatus.in_alarm). This attribute displays a value that corresponds to the highest priority alarm that is active. It is possible to have multiple active alarms, but only the highest priority is displayed in this attribute. For example, if there is a simultaneous Dirty Filter Warning (value of 24) and a Blower Not Running alarm (value of 208), then the Blower Not Running alarm (value of 208) will display in nvoUnitStatus.in_alarm because it is the higher priority alarm of the two. Once the Blower Not Running condition is corrected and the fault is cleared, the next priority active alarm value (in this example, value of 24 for Dirty Filter alarm) is displayed. The values for all alarms are described in the Alarm section. If the attribute nvoUnitStatus.in_alarm displays a zero, there are no active alarms.

9.7.3 *Alarm Clearing*

Clearable active alarms are alarms that 1) are designated as clearable the Alarm Table, 2) have become active and 3) the condition that caused the alarm is no longer active.

9.7.3.1 *BACnet*

Alarms can be cleared via BACnet by using either of two BACnet objects. To clear all clearable active alarms, change the Present_Value property of Binary Value 4 (Clear All Alarms) to 1. To clear one clearable active alarm, change the Present_Value property of Analog Value 1029 (Clear One Alarm) to the value of the alarm you want to clear.

9.7.3.2 *LONWORKS*

Clearable active alarms can be cleared using either of two Network Variable Inputs (nviClear1Alarm or nviClearAllAlarm) of type SNVT_count. To clear all clearable active alarms, change nviClearAllAlarm to 1. To clear one clearable active alarm, change nviClear1Alarm to the value of the alarm you want to clear.

9.7.4 *Objects*

9.7.4.1 *Clear All Alarms*

This read/write property clears all clearable active alarms. Writing 1 to this variable clears all clearable active alarms. This variable reverts back to 0 when the alarms clear.

Measurement	Units	Data Type	Valid Range	Default Value
Alarms	NA	BACnet: unsigned LONWORKS: Structure	Enumerated	0

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Binary Value	5	66	Present Value	85

Full Reference
RTU_C#########.ClearAllAlarms.Present Value

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Number
nviClearAllAlarm	DAC, SCC	SNVT_count	8

9.7.4.2 Clear One Alarm

This read/write property clears one clearable active alarm. To clear a particular alarm, write the value corresponding to that alarm to this variable. This variable reverts back to 0 when the alarm clears.

Measurement	Units	Data Type	Valid Range	Default Value
Alarms	NA	BACnet: unsigned LONWORKS: Structure	Enumerated	0

BACnet

Object Identifier			Property	
Object Type	Type ID	Instance	Name	ID
Analog Value	2	57	Present Value	85
Full Reference				
RTU_C#########.ClearOneAlarm.Present Value				

Property Value
See alarms and alarm codes in Alarm Table.

LONWORKS

LONWORKS Name	Profile	SNVT Type	SNVT Number
nviClear1Alarm	DAC, SCC	SNVT_count	8

9.7.5 Current Alarm

This read-only attribute indicates the highest active alarm.

The BACnet property reads only the subject attribute and only applies to the subject data point.

The LONWORKS variable is only a part of the LONWORKS Unit Status network variable. See Unit State for details of LONWORKS network variable. The LONWORKS variable covers six other data points: Unit State, Primary Heating Capacity, Secondary Heating Capacity (not used), Discharge Fan Capacity, and Outdoor Air Damper Position.

Measurement	Units	Data Type	Valid Range	Default Value
Alarms	N/A	BACnet: unsigned LONWORKS: Structure	Enumerated	N/A

BACnet

Object Identifier			Property	
Object Type	**Type ID**	**Instance**	**Name**	**ID**
Analog Value	2	27	Present_Value	85
Full Reference				
RTU_C#########. Alarm.Present_Value				

Enumeration
See alarms and alarm codes in Alarm Table.

LONWORKS

LONWORKS Name	Profile	Uses Heartbeat	SNVT Type	SNVT Index
nvoUnitStatus.in_alarm	DAC, SCC	Yes	SNVT_hvac_status	112

Property Value
See alarms and alarm codes in Alarm Table.

9.8 BACnet Device Management

The following functions are specific to the BACnet device. These functions are used for maintenance and testing. A network management tool is typically used to issue the network commands.

9.8.1 DeviceCommunicationControl - Disable

The purpose of this command is to reduce network traffic for diagnostic testing of the BACnet network. When the BACnet Communication module receives a network command to Disable communications it stops communicating information to the network. An optional time may be specified for how long to suspend communications. The unit continues to operate during the Disabled state. A password of **1234** is required.

9.8.2 DeviceCommunicationControl - Enable

When the BACnet Communication module receives a network command to Enable communications it resumes communicating information to/from the network. A password of **1234** is required.

9.8.3 ReinitializeDevice (Reset)

The BACnet Communication module is capable of receiving a network ReinitializeDevice command to reboot itself (cold start or warm start). The functionality of a cold and warm start is the same and simply reboots the BACnet Communication Module. Reinitialize Device is implemented with a non-changeable password of **1234**.

10. Protocol Implementation Conformance Statement (PICS)

This section contains the Protocol Implementation Conformance Statement (PICS) for the RTU-C Rooftop Unit Controller as required by ANSI/ASHRAE (American National Standards Institute/American Society of Heating, Refrigeration, and Air Conditioning Engineers) Standard 135-2004, BACnet; A Data Communication Protocol for Building Automation and Control Networks.

BACnet Protocol Implementation Conformance Statement

Date:	December 2011
Vendor Name:	McQuay International
Product Name:	Rooftop Unit Controller
Product Model Number:	RTU-C
Applications Software Version:	2.0
Firmware Revision:	2.03
BACnet Protocol Revision:	Version 1 Revision 4

Product Description

The RTU-C Rooftop Unit Controller with optional BACnet Communication Module is a microprocessor-based controller designed to operate Rooftop units and be integrated into BACnet building automation systems.

The controller provides normal temperature, static pressure and ventilation control and alarm monitoring with alarm-specific component shutdown in critical system conditions. Access to temperatures, pressures, operating states, alarms, and control parameters are available through an equipment-mounted keypad/display and the BACnet control network.

BACnet Standardized Device Profile

- ☐ BACnet Operator Workstation (B-OWS)
- ☐ BACnet Building Controller (B-BC)
- ☐ BACnet Advanced Application Specific Controller (B-AAC)
- ☒ BACnet Application Specific Controller (B-ASC)
- ☐ BACnet Smart Sensor (B-SS)
- ☐ BACnet Smart Actuator (B-SA)

Refer to the section below entitled BACnet Interoperability Building Blocks (BIBBs) Supported for a complete listing of BIBBS.

BACnet Interoperability Building Blocks (BIBBs) Supported

BIBB Name	Designation
Data Sharing – ReadProperty – B	DS-RP-B
Data Sharing – ReadPropertyMultiple – B	DS-RPM-B
Data Sharing – WriteProperty – B	DS-WP-B
Data Sharing – WritePropertyMultiple – B	DS-WPM-B
Device Management – Dynamic Device Binding – B	DM-DDB-B
Device Management – Dynamic Object Binding – B	DM-DOB-B
Device Management – Dynamic Communication Control – B	DM-DCC-B
Device Management – ReinitializeDevice – B	DM-RD-B

Standard Object Types Supported

Object-Type	Creatable	Deleteable	Optional Properties Supported	Writable Properties Not Required To Be Writable
Analog Input	☐	☐	Description Reliability Min_Pres_Value Max_Pres_Value	
Analog Output	☐	☐	Description Reliability Min_Pres_Value Max_Pres_Value	Present_Value Relinquish Default
Analog Value	☐	☐	Description Reliability	Present_Value
Binary Input	☐	☐	Description Reliability Inactive_Text Active_Text	

Object-Type	Creatable	Deleteable	Optional Properties Supported	Writable Properties Not Required To Be Writable
Binary Output	☐	☐	Description Reliability Inactive_Text Active_Text	Present_Value Relinquish Default
Binary Value	☐	☐	Description Reliability Inactive_Text Active_Text	Present_Value
Device	☐	☐	Description Location	Description Location
Multi-state Input	☐	☐	Description Reliability State_Text	
Multi-state Output	☐	☐	Description Reliability State_Text	Present_Value Relinquish Default
Multi-State Value	☐	☐	Description Reliability State_Text	Present_Value

Note: Although all the above standard object types are supported they may not be used.

Data Link Layer Options

☒ BACnet IP, (Annex J)

☒ ISO 8802-3, Ethernet (Clause 7)

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

Segmentation Capability

☐ Segmented requests supported Window Size:

☐ Segmented responses supported Window Size:

Device Address Binding

Static Device Binding ☐ Yes

☒ No

Networking Options

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

☐ Annex H, BACnet Tunneling Router over IP

☐ BACnet/IP Broadcase Management Device (BBMD)

Does the BBMD Support registration by Foreign Devices? ☐ Yes ☒ No

Character Sets Supported

☒ ANSI X3.4 ☐ IBM /Microsoft DBCS ☐ ISO 8859-1

☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS C 6226

Note: Support for multiple character sets does not imply they can be supported simultaneously.

11. Revision History

Revision 01 12/23/2009 Add Unit Wiring Diagrams, LonWorks Communication Card Information Add BACnet Communication Card Information, Delete Outdoor Fan On Delay, Delete Outdoor Fan Off Delay. Delete Low Ambient Control field installed kit section. Add "Quick Start" reference section. Delete "(on heat speed if two speed blower)" in section 5.4.18. Add sensor temperature vs. resistance table. Changed the Low Discharge Air Temp (DAT) alarm setpoint from 40°F to 30°F. Changed the alarm 248 (Smoke Detection) from a non-clearable alarm to a clearable alarm via the network. Changed the alarm 250 (Emergency Stop Fault) from non-clearable alarm to a clearable alarm via the network. Corrected literature typographical errors for FS1 and FS2 alarm setpoints to 37°F trip and 42°F reset.

Revision 01 02/10/2010 Replace cover page to meet Rheem standards. Update BACnet Default device name to RTU_C#########. Changed section 7 RTU-C Alarm Table and Diagnostic Guide statement Low Pressure – Circuit 1 Problem – Lockout from "If the low pressure switch trips 3 times within 120 minutes of operation during the same call for heating operation" to "If the low pressure switch trips 3 times within 120 minutes of operation during the same call for heating or cooling operation". Updated Figure 8-7. Revised section 4.4 illustration to include status LED. Revised section 4.5 illustration to note that communication card was attached to RTU-C board, added status LED to illustration. Revised Figure 6-3 section 6.6. Under section 8.3.5 Test Procedures, add statement "If attempts to communicate through the Ethernet port with the RXRX-AY01 card are unsuccessful, cycle the unit main power once to reset communication between the RTU-C and the RXRX-AY01". Under section 8.4.6 Test Procedures, add statement "If attempts to communicate with the RXRX-AY02 card are unsuccessful, cycle the unit main power once to reset communication between the RTU-C and the RXRX-AY02". Revised section 6.6.16, Demand Defrost Operation, to clarify Coil Temperature Dependant Variable. Revised section 10.0 "Standard Object Types Supported".

Revision 02 3/10/2010 Section 2.1 outdoor air temperature sensor is not used for economizer operation, but for low ambient cooling lockout and high ambient heating lockout.

Revision 02 4/29/2010 Revise wiring diagrams in section 15 for units with gas heat to add wire between IFC (fan) terminal and RTU-C (fan) terminal. Revise Figure 6-3 to show new menu arrangement for section 6-3 and 6-4. Menu also clarified for heat pump defrost under section 6-6. Revise Figure 6-3 to expand field run-test menu. Modified QUICK START section 12, 13 and 14 to reflect menu changes made on Figure 6-3. Add note to section 6.1 to "pause" after pressing "Enter" key when making selections. Add note to section 6.2 to not change the default MODBUS Address. Added modified General Information screen to section 6.2. Added Defr. Comp. OFF to Table 6-5.

Revision 02 5/7/2010 Add #column and sort Table 2-1. Add alarm codes to table 7-1 to assist production run test. Clarify section 6.6.5.

Revision 03 6/13/2011 Revised MODBUS table so that all addresses and values are in Hexidecimal format, rather than a mixture of Hexidecimal and decimal numbers. Include new addresses

for *e*SYNC™ control. Add *e*SYNC™ menu descriptions to section 6.13. Add *e*SYNC™ function to outdoor air temperature sensor in section 2.1 Revised section 6.6.9 cooling lockout temperature minimum from 30°F to 0°F. Modify introduction to section 4 to clarify unit ships in "OFF" position.

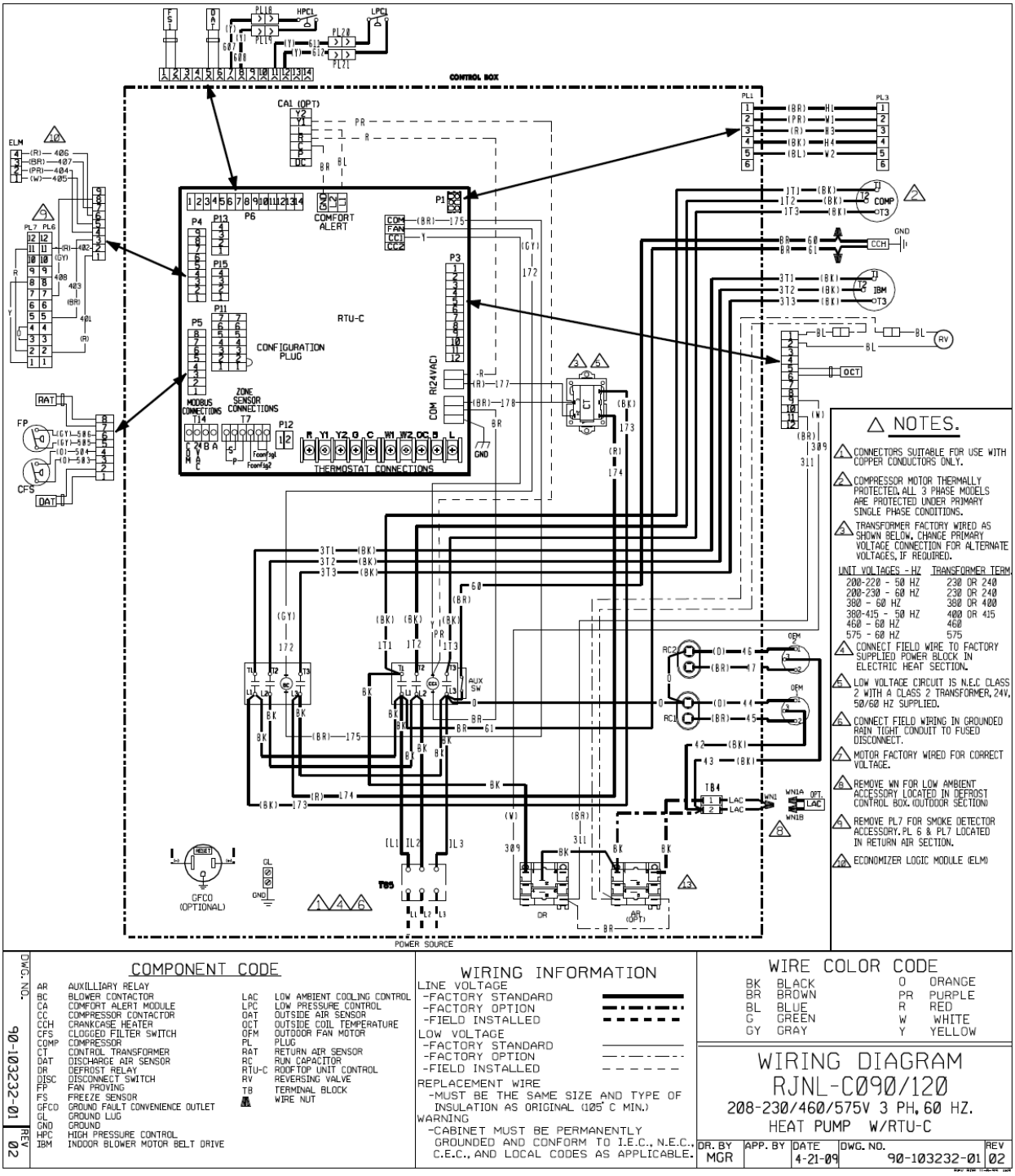
Revision 03 9/19/2011 Move Quick Start guide to front of I&O manual.

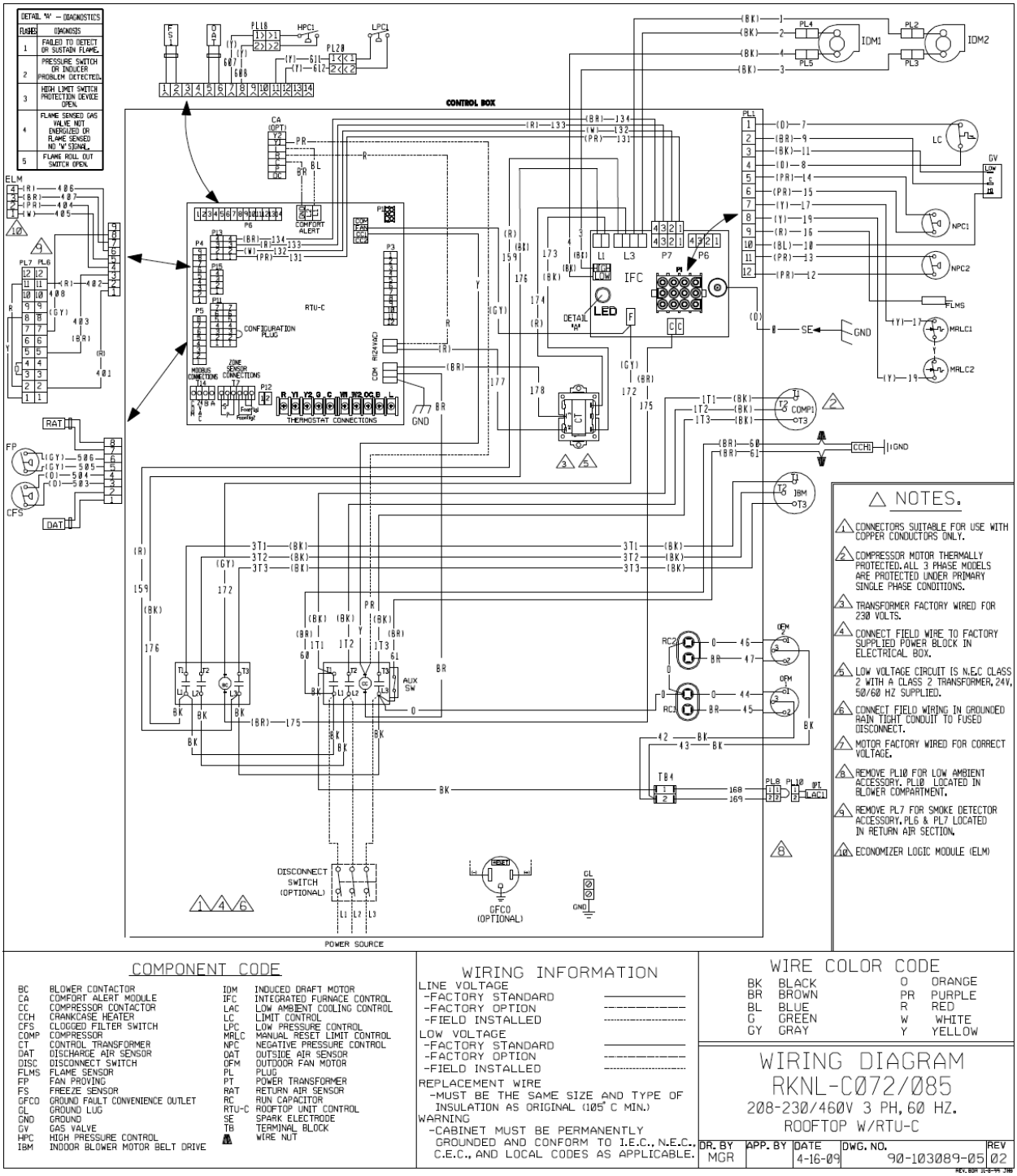
Revision 03 11/16/2011 Add new alarms to BACnet and LonWorks communication cards for *e*SYNC™ water heating unit. Changed Control Temperature Alarm from a Problem (195) to a fault (244). Alarms that are not recognized by the communication boards are now passed through instead of sending alarm 1. Added a network point to allow the network to command the indoor fan to either 1) run in continuous mode, 2) cycle on only when in heating or cooling or 3) run continuously when in occupied and cycle when unoccupied. Added network points for two field inputs that are on the unit control board. Field input 1 is always a temperature. Field input 2 is configurable. The value from the unit control is always a voltage from 0 to 10 volts. It can be configured for one of five unit types. It includes a configuration for the unit type, low range and high range. Updated wording in Economizer Enable section and added an enumeration to disable all economizer functionality. This was done to support a change in the unit control. The unit control now supports Disabled Free Cooling, Enabled Free Cooling or Disable all Economizer Functionality.

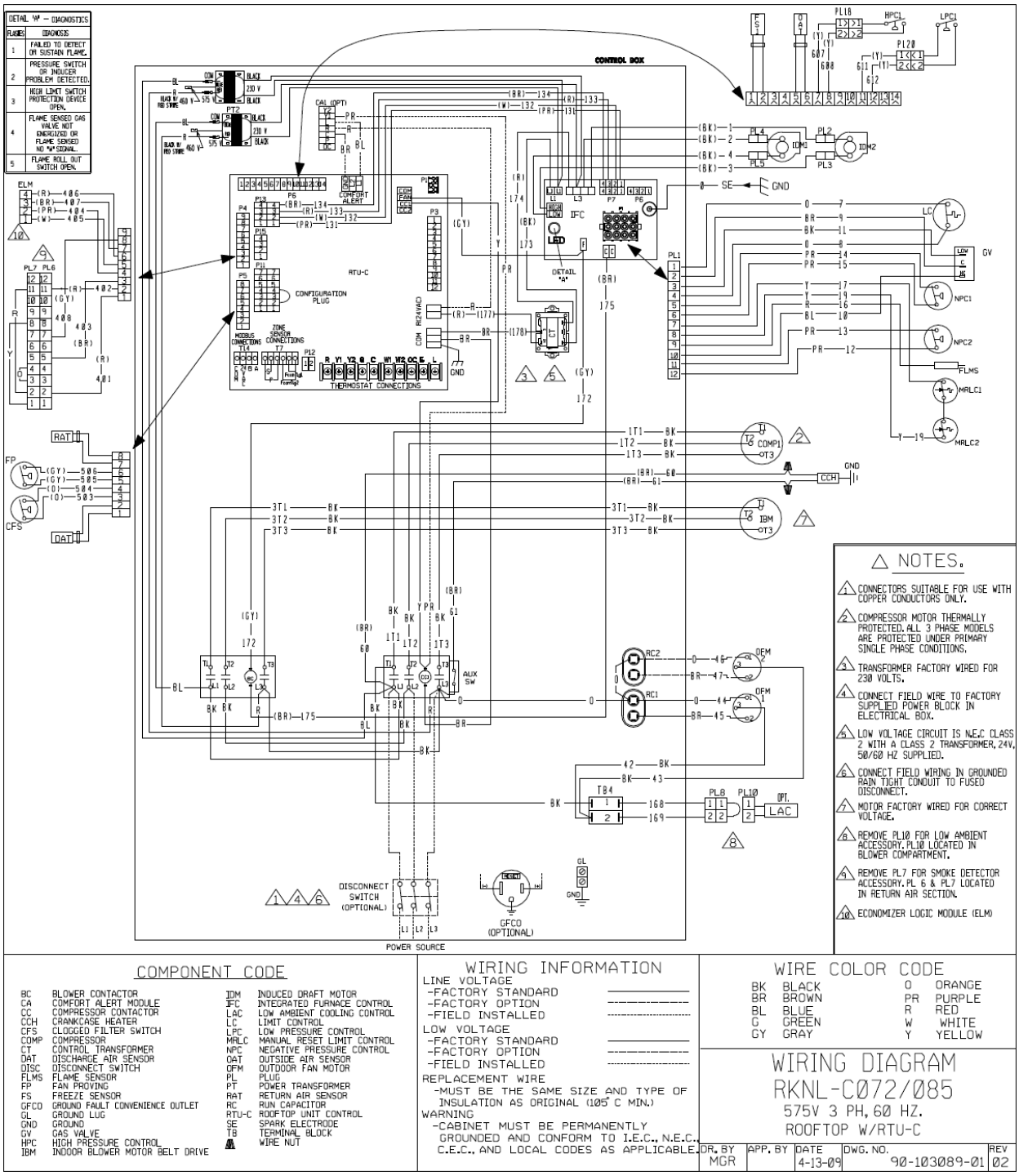
Revision 04 3/1/2012 Replace Figure 6-3 with new drawing showing added menu items for Variable Frequency Drive and Dehumidification options. Revise setpoints on Table 6-5 to address field complaints. Revise Heating Lockout Temperature range from 90 to 145°F, Revise MODBUS alarm 52. Change units of measure on Table 6-8 to match RTU-C display. Add Section 6.14 for Humidity Control feature. Add Section 6.15 for Variable Frequency Drive feature. Revise Alarm 112 on MODBUS table. Add table to clarify contents of MODBUS address 0x0002. Add Section 6.3.5 for new "Reset Control" command per customer request. Revise delay time on MODBUS alarms 115, 116, 117, 118. Revise BACnet or LonWorks communication card alarm 78, 79, 117, 178 for new delay time. Revise section 9.6.38 for Variable Frequency Drive changes.

Revision 04 3/16/2012 Add note about disabling lead-lag operation during reheat mode. Add economizer operation to reheat mode tables 6-14 and 6-15 in section 6.14.2. Update Table 9-2 by removing "Description" field. Update BACnet Protocol Implementation Conformance Statement (PICS) Section 10 with new version 2.03 software and 2.0 hardware. Revise description of output RV1, RV2, ODF1, ODF2 to accomodate *e*SYNC™ and reheat models. Revise description of input OCT1 for same. Add part numbers for indoor relative humidity sensor section 4.0. Revise wiring diagram section 4.6 per marketing request to include indoor relative humidity sensor with included space temperature sensor as standard. Remove "Description" from Table 9-2. Add "Dehumidification - Space RH Configuration Setpoint" to BACnet Standard Objects Table & LonWorks Variables Tables. Modify LonWorks Variables Table "Variable Name Communication Module Software Version, RTU-C Application Version, Integrated Furnace Controller Software Version, Honeywell Economizer Software Version". Change wiring diagram section to "Typical" to reduce number of pages.

12. Unit Wiring Diagrams (typical)




DETAIL "A" - DIAGNOSTICS
FLASHES
DIAGNOSIS
1 FAILED TO DETECT OR SUSTAIN FLAME.
2 PRESSURE SWITCH OR INDUCER PROBLEM DETECTED.
3 HIGH LIMIT SWITCH PROTECTION DEVICE OPEN.
4 FLAME SENSED GAS VALVE NOT ENERGIZED OR FLAME SENSED NO "W" SIGNAL.
5 FLAME ROLL OUT SWITCH OPEN.
CONTROL BOX
RTU-C
CONFIGURATION PLUG
COMFORT ALERT
ZONE SENSOR CONNECTIONS
MODBUS CONNECTIONS
THERMOSTAT CONNECTIONS
IFC
LED
IDM1
IDM2
COMP1
COMP2
IBM
LC
GV
NPC1
NPC2
FLMS
MRLC1
MRLC2
SE
GND
RAT
OAT
FP
CFS
CCH
DISCONNECT SWITCH (OPTIONAL)
GFCO (OPTIONAL)
POWER SOURCE
NOTES.
1 CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2 COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3 TRANSFORMER FACTORY WIRED FOR 230 VOLTS.
4 CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRICAL BOX.
5 LOW VOLTAGE CIRCUIT IS N.E.C. CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6 CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7 MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8 REMOVE PL10 FOR LOW AMBIENT ACCESSORY. PL10 LOCATED IN BLOWER COMPARTMENT.
9 REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL6 & PL7 LOCATED IN RETURN AIR SECTION.
10 ECONOMIZER LOGIC MODULE (ELM)
COMPONENT CODE
BC BLOWER CONTACTOR
CA COMFORT ALERT MODULE
CC COMPRESSOR CONTACTOR
CCH CRANKCASE HEATER
CFS CLOGGED FILTER SWITCH
COMP COMPRESSOR
CT CONTROL TRANSFORMER
DAT DISCHARGE AIR SENSOR
DISC DISCONNECT SWITCH
FLMS FLAME SENSOR
FP FAN PROVING
FS FREEZE SENSOR
GFCO GROUND FAULT CONVENIENCE OUTLET
GL GROUND LUG
GND GROUND
GV GAS VALVE
HPC HIGH PRESSURE CONTROL
IBM INDOOR BLOWER MOTOR BELT DRIVE
IDM INDUCED DRAFT MOTOR
IFC INTEGRATED FURNACE CONTROL
LAC LOW AMBIENT COOLING CONTROL
LC LIMIT CONTROL
LPC LOW PRESSURE CONTROL
MRLC MANUAL RESET LIMIT CONTROL
NPC NEGATIVE PRESSURE CONTROL
OAT OUTSIDE AIR SENSOR
OFM OUTDOOR FAN MOTOR
PL PLUG
PT POWER TRANSFORMER
RAT RETURN AIR SENSOR
RC RUN CAPACITOR
RTU-C ROOFTOP UNIT CONTROL
SE SPARK ELECTRODE
TB TERMINAL BLOCK
WIRE NUT
WIRING INFORMATION
LINE VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
LOW VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
REPLACEMENT WIRE
-MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)
WARNING
-CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.
WIRE COLOR CODE
BK BLACK
BR BROWN
BL BLUE
G GREEN
GY GRAY
O ORANGE
PR PURPLE
R RED
W WHITE
Y YELLOW
WIRING DIAGRAM
RKNL-C072/085
208-230/460V 3 PH, 60 HZ.
ROOFTOP W/RTU-C
DR. BY MGR
APP. BY
DATE 4-16-09
DWG. NO. 90-103089-05
REV 02



COMPONENT CODE

BC	BLOWER CONTACTOR	IDM	INDUCED DRAFT MOTOR
CA	COMFORT ALERT MODULE	IFC	INTEGRATED FURNACE CONTROL
CC	COMPRESSOR CONTACTOR	LAC	LOW AMBIENT COOLING CONTROL
CCH	CRANKCASE HEATER	LC	LIMIT CONTROL
CFS	CLOGGED FILTER SWITCH	LPC	LOW PRESSURE CONTROL
COMP	COMPRESSOR	MRLC	MANUAL RESET LIMIT CONTROL
CT	CONTROL TRANSFORMER	NPC	NEGATIVE PRESSURE CONTROL
DAT	DISCHARGE AIR SENSOR	OAT	OUTSIDE AIR SENSOR
DISC	DISCONNECT SWITCH	OFM	OUTDOOR FAN MOTOR
FLMS	FLAME SENSOR	PL	PLUG
FP	FAN PROVING	PT	POWER TRANSFORMER
FS	FREEZE SENSOR	RAT	RETURN AIR SENSOR
GFCO	GROUND FAULT CONVENIENCE OUTLET	RC	RUN CAPACITOR
GL	GROUND LUG	RTU-C	ROOFTOP UNIT CONTROL
GND	GROUND	SE	SPARK ELECTRODE
GV	GAS VALVE	TB	TERMINAL BLOCK
HPC	HIGH PRESSURE CONTROL		WIRE NUT
IBM	INDOOR BLOWER MOTOR BELT DRIVE		

WIRING INFORMATION

LINE VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED

LOW VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED

REPLACEMENT WIRE
-MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

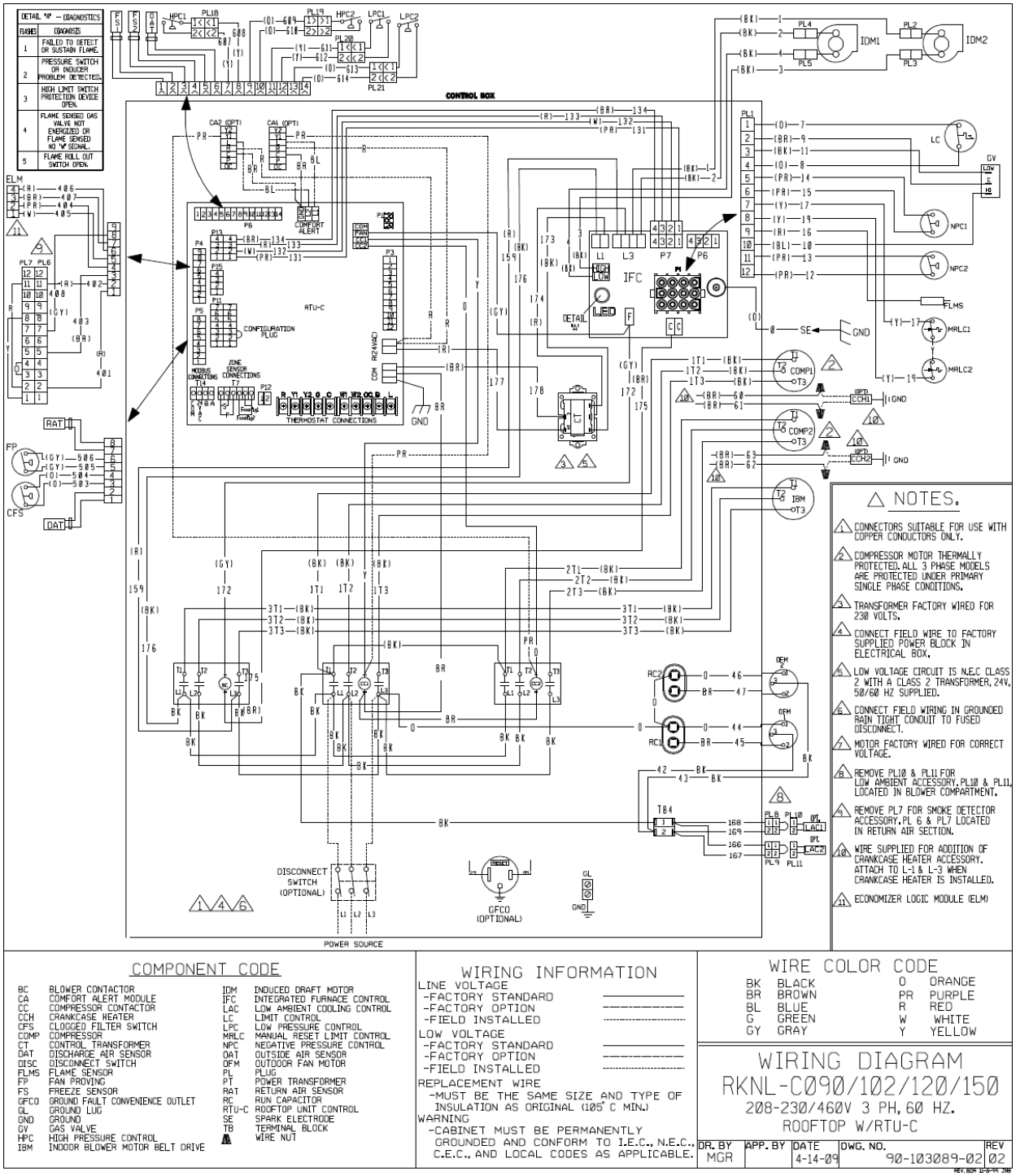
WARNING
-CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

WIRE COLOR CODE

BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
RKNL-C072/085
575V 3 PH, 60 HZ.
ROOFTOP W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
MGR		4-13-09	90-103089-01	02


DETAIL "A" - DIAGNOSTICS
FLASHES
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1 FAILED TO DETECT OR SUSTAIN FLAME.
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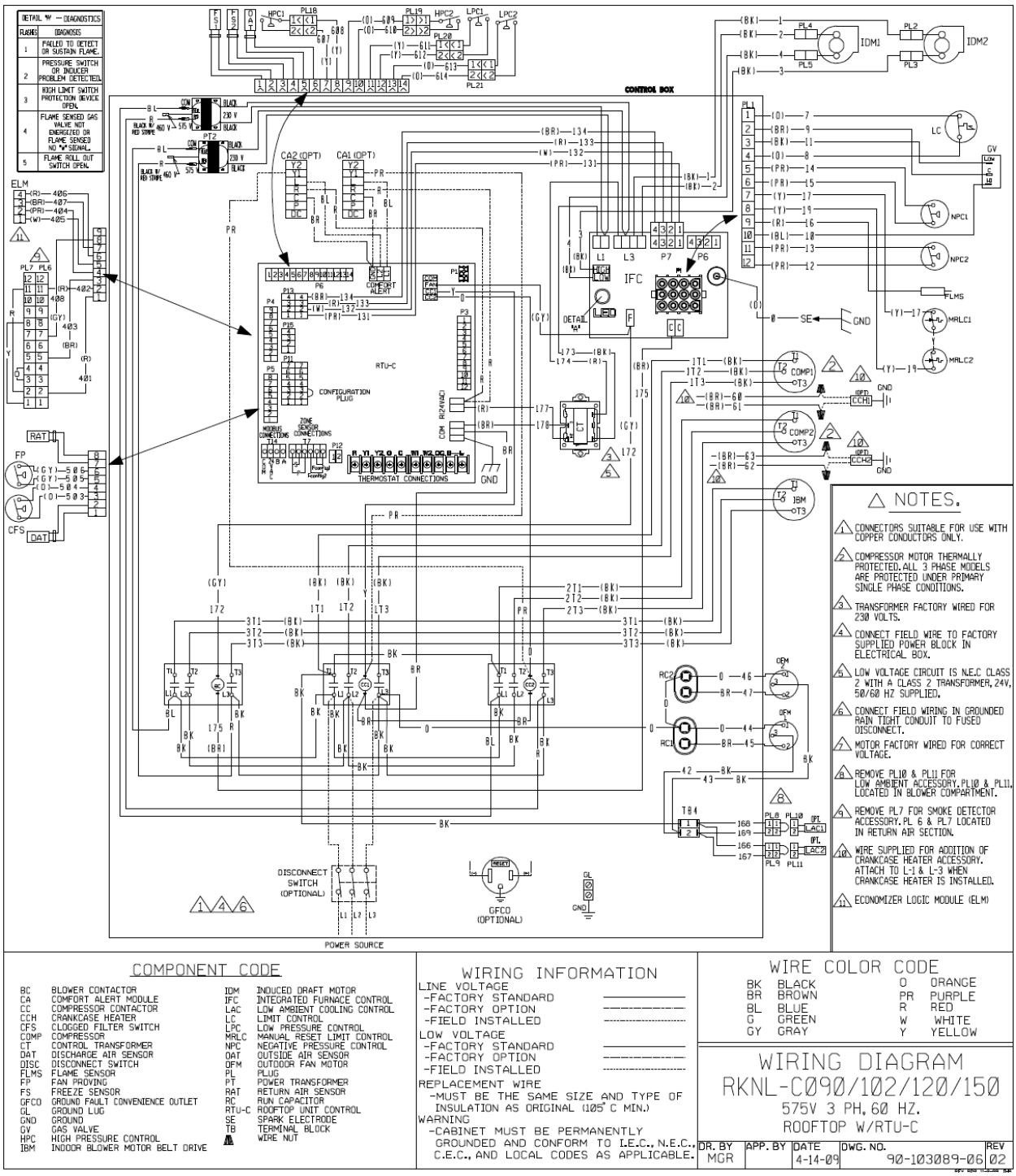
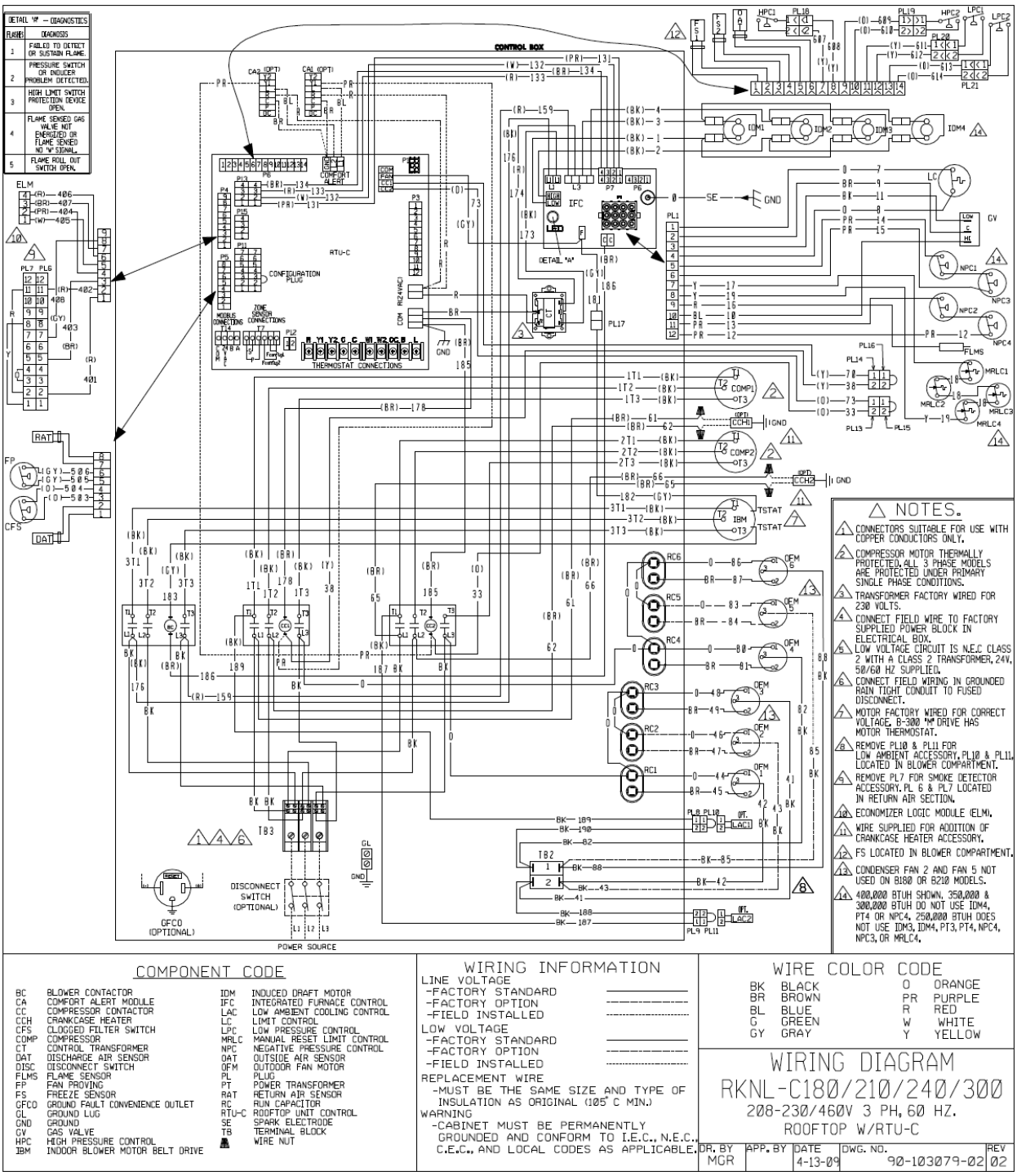
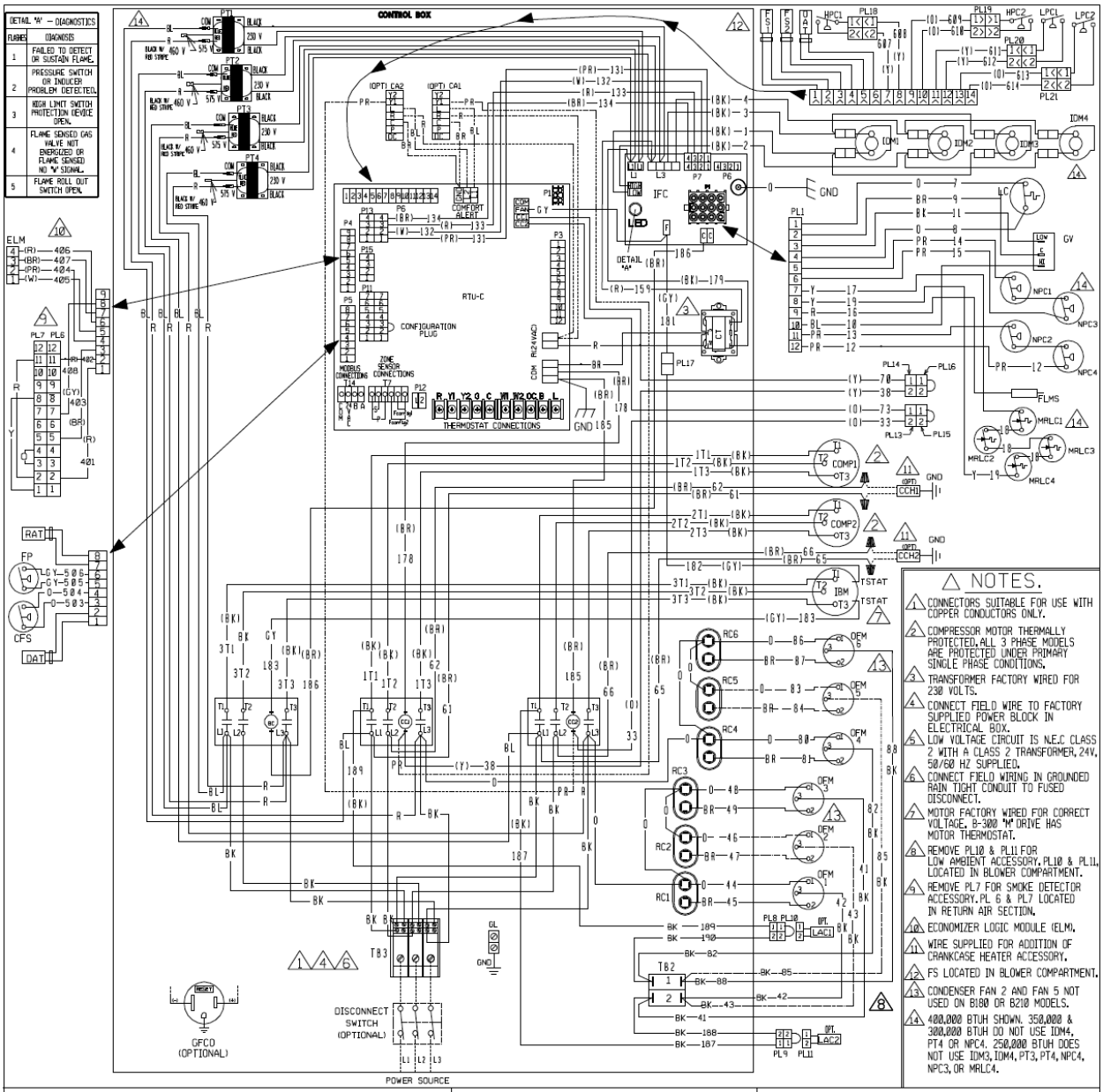
3 HIGH LIMIT SWITCH PROTECTION DEVICE OPEN.
4 FLAME SENSED GAS VALVE NOT ENERGIZED OR FLAME SENSED NO "W" SIGNAL.
5 FLAME ROLL OUT SWITCH OPEN.
CONTROL BOX
RTU-C
CONFIGURATION PLUG
THERMOSTAT CONNECTIONS
IFC
DETAIL "A"
LED
COMP1
COMP2
IBM
IDM1
IDM2
LC
GV
NPC1
NPC2
FLMS
MRLC1
MRLC2
ECH1
ECH2
RC1
RC2
OFM
TB4
PL8
PL10
PL9
PL11
LAC1
LAC2
DISCONNECT SWITCH (OPTIONAL)
GFCO (OPTIONAL)
POWER SOURCE
ELM
FP
CFS
RAT
DAT
NOTES.
1 CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2 COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3 TRANSFORMER FACTORY WIRED FOR 230 VOLTS.
4 CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRICAL BOX.
5 LOW VOLTAGE CIRCUIT IS N.E.C CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6 CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7 MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8 REMOVE PL10 & PL11 FOR LOW AMBIENT ACCESSORY. PL10 & PL11 LOCATED IN BLOWER COMPARTMENT.
9 REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10 WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY. ATTACH TO L-1 & L-3 WHEN CRANKCASE HEATER IS INSTALLED.
11 ECONOMIZER LOGIC MODULE (ELM)
COMPONENT CODE
BC BLOWER CONTACTOR
CA COMFORT ALERT MODULE
CC COMPRESSOR CONTACTOR
CCH CRANKCASE HEATER
CFS CLOGGED FILTER SWITCH
COMP COMPRESSOR
CT CONTROL TRANSFORMER
DAT DISCHARGE AIR SENSOR
DISC DISCONNECT SWITCH
FLMS FLAME SENSOR
FP FAN PROVING
FS FREEZE SENSOR
GFCO GROUND FAULT CONVENIENCE OUTLET
GL GROUND LUG
GND GROUND
GV GAS VALVE
HPC HIGH PRESSURE CONTROL
IBM INDOOR BLOWER MOTOR BELT DRIVE
IDM INDUCED DRAFT MOTOR
IFC INTEGRATED FURNACE CONTROL
LAC LOW AMBIENT COOLING CONTROL
LC LIMIT CONTROL
LPC LOW PRESSURE CONTROL
MRLC MANUAL RESET LIMIT CONTROL
NPC NEGATIVE PRESSURE CONTROL
OAT OUTSIDE AIR SENSOR
OFM OUTDOOR FAN MOTOR
PL PLUG
PT POWER TRANSFORMER
RAT RETURN AIR SENSOR
RC RUN CAPACITOR
RTU-C ROOFTOP UNIT CONTROL
SE SPARK ELECTRODE
TB TERMINAL BLOCK
WIRE NUT
WIRING INFORMATION
LINE VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
LOW VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
REPLACEMENT WIRE
-MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)
WARNING
-CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.
WIRE COLOR CODE
BK BLACK
BR BROWN
BL BLUE
G GREEN
GY GRAY
O ORANGE
PR PURPLE
R RED
W WHITE
Y YELLOW
WIRING DIAGRAM
RKNL-C090/102/120/150
208-230/460V 3 PH, 60 HZ.
ROOFTOP W/RTU-C
DR. BY MGR
APP. BY
DATE 4-14-09
DWG. NO. 90-103089-02
REV 02


DETAIL 'A' — DIAGNOSTICS
FLASHES DIAGNOSIS
1 FAILED TO DETECT OR SUSTAIN FLAME.
2 PRESSURE SWITCH OR INDUCER PROBLEM DETECTED.
3 HIGH LIMIT SWITCH PROTECTION DEVICE OPEN.
4 FLAME SENSED GAS VALVE NOT ENERGIZED OR FLAME SENSED NO "R" SIGNAL.
5 FLAME ROLL OUT SWITCH OPEN.
CONTROL BOX
IFC
RTU-C
CONFIGURATION PLUG
THERMOSTAT CONNECTIONS
DISCONNECT SWITCH (OPTIONAL)
GFCO (OPTIONAL)
POWER SOURCE
IDM1
IDM2
COMP1
COMP2
IBM
LC
NPC1
NPC2
FLMS
MRLC1
MRLC2
GV
HPC1
HPC2
LPC1
LPC2
CA2 (OPT)
CA1 (OPT)
ELM
FP
CFS
DAT
RAT
NOTES.
1 CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2 COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3 TRANSFORMER FACTORY WIRED FOR 230 VOLTS.
4 CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRICAL BOX.
5 LOW VOLTAGE CIRCUIT IS N.E.C CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6 CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7 MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8 REMOVE PL10 & PL11 FOR LOW AMBIENT ACCESSORY. PL10 & PL11 LOCATED IN BLOWER COMPARTMENT.
9 REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10 WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY. ATTACH TO L-1 & L-3 WHEN CRANKCASE HEATER IS INSTALLED.
11 ECONOMIZER LOGIC MODULE (ELM)
COMPONENT CODE
BC BLOWER CONTACTOR
CA COMFORT ALERT MODULE
CC COMPRESSOR CONTACTOR
CCH CRANKCASE HEATER
CFS CLOGGED FILTER SWITCH
COMP COMPRESSOR
CT CONTROL TRANSFORMER
DAT DISCHARGE AIR SENSOR
DISC DISCONNECT SWITCH
FLMS FLAME SENSOR
FP FAN PROVING
FS FREEZE SENSOR
GFCO GROUND FAULT CONVENIENCE OUTLET
GL GROUND LUG
GND GROUND
GV GAS VALVE
HPC HIGH PRESSURE CONTROL
IBM INDOOR BLOWER MOTOR BELT DRIVE
IDM INDUCED DRAFT MOTOR
IFC INTEGRATED FURNACE CONTROL
LAC LOW AMBIENT COOLING CONTROL
LC LIMIT CONTROL
LPC LOW PRESSURE CONTROL
MRLC MANUAL RESET LIMIT CONTROL
NPC NEGATIVE PRESSURE CONTROL
OAT OUTSIDE AIR SENSOR
OFM OUTDOOR FAN MOTOR
PL PLUG
PT POWER TRANSFORMER
RAT RETURN AIR SENSOR
RC RUN CAPACITOR
RTU-C ROOFTOP UNIT CONTROL
SE SPARK ELECTRODE
TB TERMINAL BLOCK
WIRE NUT
WIRING INFORMATION
LINE VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
LOW VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
REPLACEMENT WIRE
-MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)
WARNING
-CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.
WIRE COLOR CODE
BK BLACK
BR BROWN
BL BLUE
G GREEN
GY GRAY
O ORANGE
PR PURPLE
R RED
W WHITE
Y YELLOW
WIRING DIAGRAM
RKNL-C090/102/120/150
575V 3 PH, 60 HZ.
ROOFTOP W/RTU-C
DR. BY MGR
APP. BY
DATE 4-14-09
DWG. NO. 90-103089-06
REV 02


DETAIL "A" — DIAGNOSTICS
FLASHES DIAGNOSIS
1 FAILED TO DETECT OR SUSTAIN FLAME.
2 PRESSURE SWITCH OR INDUCER PROBLEM DETECTED.
3 HIGH LIMIT SWITCH PROTECTION DEVICE OPEN.
4 FLAME SENSED GAS VALVE NOT ENERGIZED OR FLAME SENSED NO 'W' SIGNAL.
5 FLAME ROLL OUT SWITCH OPEN.
CONTROL BOX
RTU-C
CONFIGURATION PLUG
THERMOSTAT CONNECTIONS
POWER SOURCE
DISCONNECT SWITCH (OPTIONAL)
GFCO (OPTIONAL)
NOTES.
1 CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2 COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3 TRANSFORMER FACTORY WIRED FOR 230 VOLTS.
4 CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRICAL BOX.
5 LOW VOLTAGE CIRCUIT IS N.E.C CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6 CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7 MOTOR FACTORY WIRED FOR CORRECT VOLTAGE. B-300 'M' DRIVE HAS MOTOR THERMOSTAT.
8 REMOVE PL10 & PL11 FOR LOW AMBIENT ACCESSORY. PL10 & PL11 LOCATED IN BLOWER COMPARTMENT.
9 REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10 ECONOMIZER LOGIC MODULE (ELM).
11 WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY.
12 FS LOCATED IN BLOWER COMPARTMENT.
13 CONDENSER FAN 2 AND FAN 5 NOT USED ON B180 OR B210 MODELS.
14 400,000 BTUH SHOWN. 350,000 & 300,000 BTUH DO NOT USE IDM4, PT4 OR NPC4. 250,000 BTUH DOES NOT USE IDM3, IDM4, PT3, PT4, NPC4, NPC3, OR MRLC4.
COMPONENT CODE
BC BLOWER CONTACTOR
CA COMFORT ALERT MODULE
CC COMPRESSOR CONTACTOR
CCH CRANKCASE HEATER
CFS CLOGGED FILTER SWITCH
COMP COMPRESSOR
CT CONTROL TRANSFORMER
DAT DISCHARGE AIR SENSOR
DISC DISCONNECT SWITCH
FLMS FLAME SENSOR
FP FAN PROVING
FS FREEZE SENSOR
GFCO GROUND FAULT CONVENIENCE OUTLET
GL GROUND LUG
GND GROUND
GV GAS VALVE
HPC HIGH PRESSURE CONTROL
IBM INDOOR BLOWER MOTOR BELT DRIVE
IDM INDUCED DRAFT MOTOR
IFC INTEGRATED FURNACE CONTROL
LAC LOW AMBIENT COOLING CONTROL
LC LIMIT CONTROL
LPC LOW PRESSURE CONTROL
MRLC MANUAL RESET LIMIT CONTROL
NPC NEGATIVE PRESSURE CONTROL
OAT OUTSIDE AIR SENSOR
OFM OUTDOOR FAN MOTOR
PL PLUG
PT POWER TRANSFORMER
RAT RETURN AIR SENSOR
RC RUN CAPACITOR
RTU-C ROOFTOP UNIT CONTROL
SE SPARK ELECTRODE
TB TERMINAL BLOCK
WIRE NUT
WIRING INFORMATION
LINE VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
LOW VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
REPLACEMENT WIRE
-MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)
WARNING
-CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.
WIRE COLOR CODE
BK BLACK
BR BROWN
BL BLUE
G GREEN
GY GRAY
O ORANGE
PR PURPLE
R RED
W WHITE
Y YELLOW
WIRING DIAGRAM
RKNL-C180/210/240/300
208-230/460V 3 PH, 60 HZ.
ROOFTOP W/RTU-C
DR. BY MCR
APP. BY
DATE 4-13-09
DWG. NO. 90-103079-02
REV 02



COMPONENT CODE

BC	BLOWER CONTACTOR
CA	COMFORT ALERT MODULE
CC	COMPRESSOR CONTACTOR
CCH	CRANKCASE HEATER
CFS	CLOGGED FILTER SWITCH
COMP	COMPRESSOR
CT	CONTROL TRANSFORMER
DAT	DISCHARGE AIR SENSOR
DISC	DISCONNECT SWITCH
FLMS	FLAME SENSOR
FP	FAN PROVING
FS	FREEZE SENSOR
GFCO	GROUND FAULT CONVENIENCE OUTLET
GL	GROUND LUG
GND	GROUND
GV	GAS VALVE
HPC	HIGH PRESSURE CONTROL
IBM	INDOOR BLOWER MOTOR BELT DRIVE
IDM	INDUCED DRAFT MOTOR
IFC	INTEGRATED FURNACE CONTROL
LAC	LOW AMBIENT COOLING CONTROL
LC	LIMIT CONTROL
LPC	LOW PRESSURE CONTROL
MRLC	MANUAL RESET LIMIT CONTROL
NPC	NEGATIVE PRESSURE CONTROL
OAT	OUTSIDE AIR SENSOR
OFM	OUTDOOR FAN MOTOR
PL	PLUG
PT	POWER TRANSFORMER
RAT	RETURN AIR SENSOR
RC	RUN CAPACITOR
RTU-C	ROOFTOP UNIT CONTROL
SE	SPARK ELECTRODE
TB	TERMINAL BLOCK
⚠	WIRE NUT

WIRING INFORMATION

LINE VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

LOW VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

REPLACEMENT WIRE
- -MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

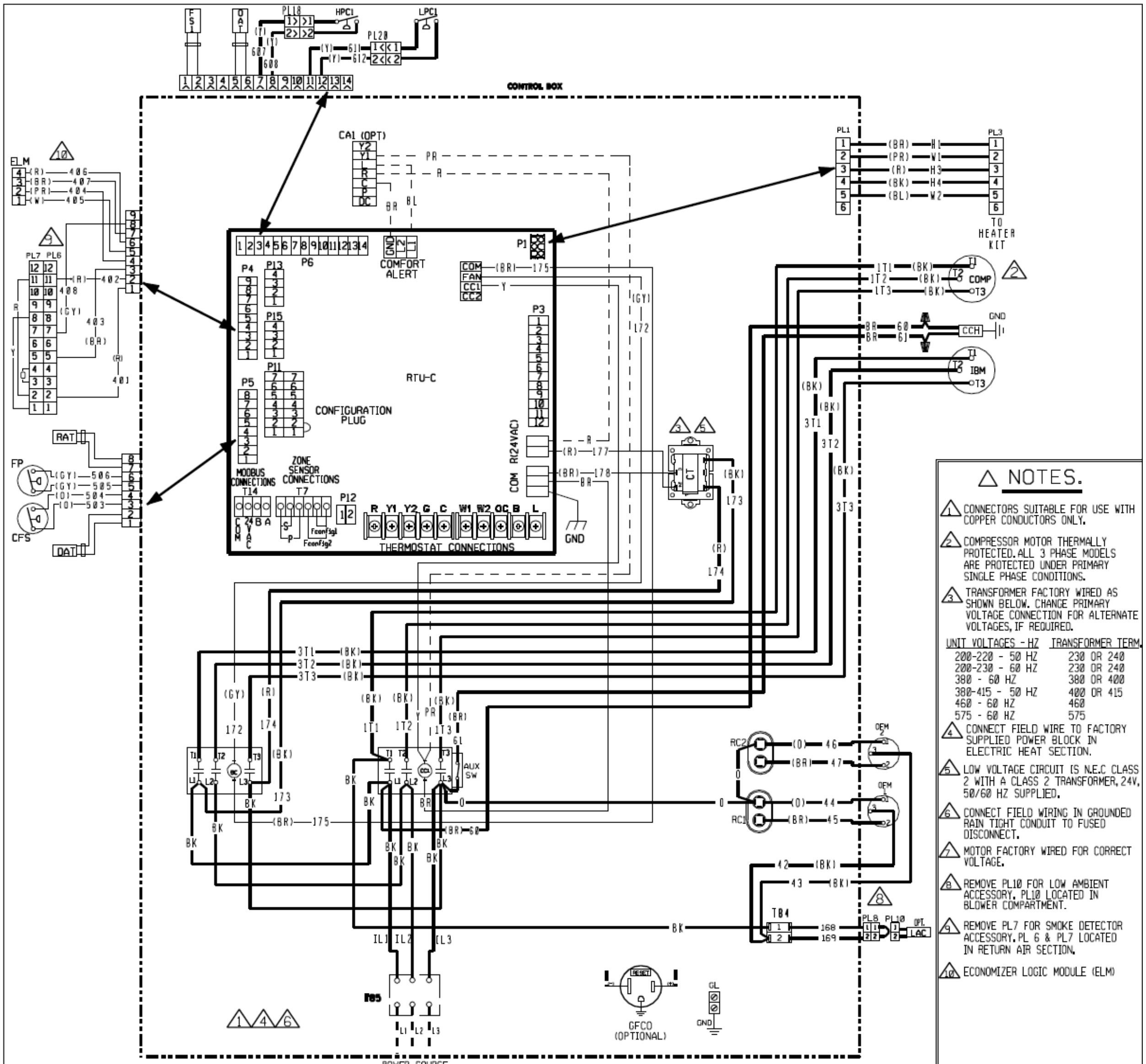
WARNING
- -CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

WIRE COLOR CODE

BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
RKNL-C180/210/240/300
575V 3 PH, 60 HZ.
ROOFTOP W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
MGR		4-8-09	90-103079-01	02



△ NOTES.

1. CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2. COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3. TRANSFORMER FACTORY WIRED AS SHOWN BELOW. CHANGE PRIMARY VOLTAGE CONNECTION FOR ALTERNATE VOLTAGES, IF REQUIRED.

UNIT VOLTAGES - HZ	TRANSFORMER TERM.
200-220 - 50 HZ	230 OR 240
200-230 - 60 HZ	230 OR 240
380 - 60 HZ	380 OR 400
380-415 - 50 HZ	400 OR 415
460 - 60 HZ	460
575 - 60 HZ	575

4. CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRIC HEAT SECTION.
5. LOW VOLTAGE CIRCUIT IS N.E.C CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6. CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7. MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8. REMOVE PL10 FOR LOW AMBIENT ACCESSORY. PL10 LOCATED IN BLOWER COMPARTMENT.
9. REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10. ECONOMIZER LOGIC MODULE (ELM)

DWG. NO. 90-103089-04 REV 01

COMPONENT CODE

BC	BLOWER CONTACTOR
CA	COMFORT ALERT MODULE
CC	COMPRESSOR CONTACTOR
CCH	CRANKCASE HEATER
CFS	CLOGGED FILTER SWITCH
COMP	COMPRESSOR
CT	CONTROL TRANSFORMER
DAT	DISCHARGE AIR SENSOR
DISC	DISCONNECT SWITCH
FP	FAN PROVING
FS	FREEZE SENSOR
GFCO	GROUND FAULT CONVENIENCE OUTLET
GL	GROUND LUG
GND	GROUND
HPC	HIGH PRESSURE CONTROL
IBM	INDOOR BLOWER MOTOR BELT DRIVE
LAC	LOW AMBIENT COOLING CONTROL
LPC	LOW PRESSURE CONTROL
OAT	OUTSIDE AIR SENSOR
OFM	OUTDOOR FAN MOTOR
PL	PLUG
RAT	RETURN AIR SENSOR
RC	RUN CAPACITOR
RTU-C	ROOFTOP UNIT CONTROL
TB	TERMINAL BLOCK
(symbol)	WIRE NUT

WIRING INFORMATION

LINE VOLTAGE
- FACTORY STANDARD
- FACTORY OPTION
- FIELD INSTALLED

LOW VOLTAGE
- FACTORY STANDARD
- FACTORY OPTION
- FIELD INSTALLED

REPLACEMENT WIRE
- MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

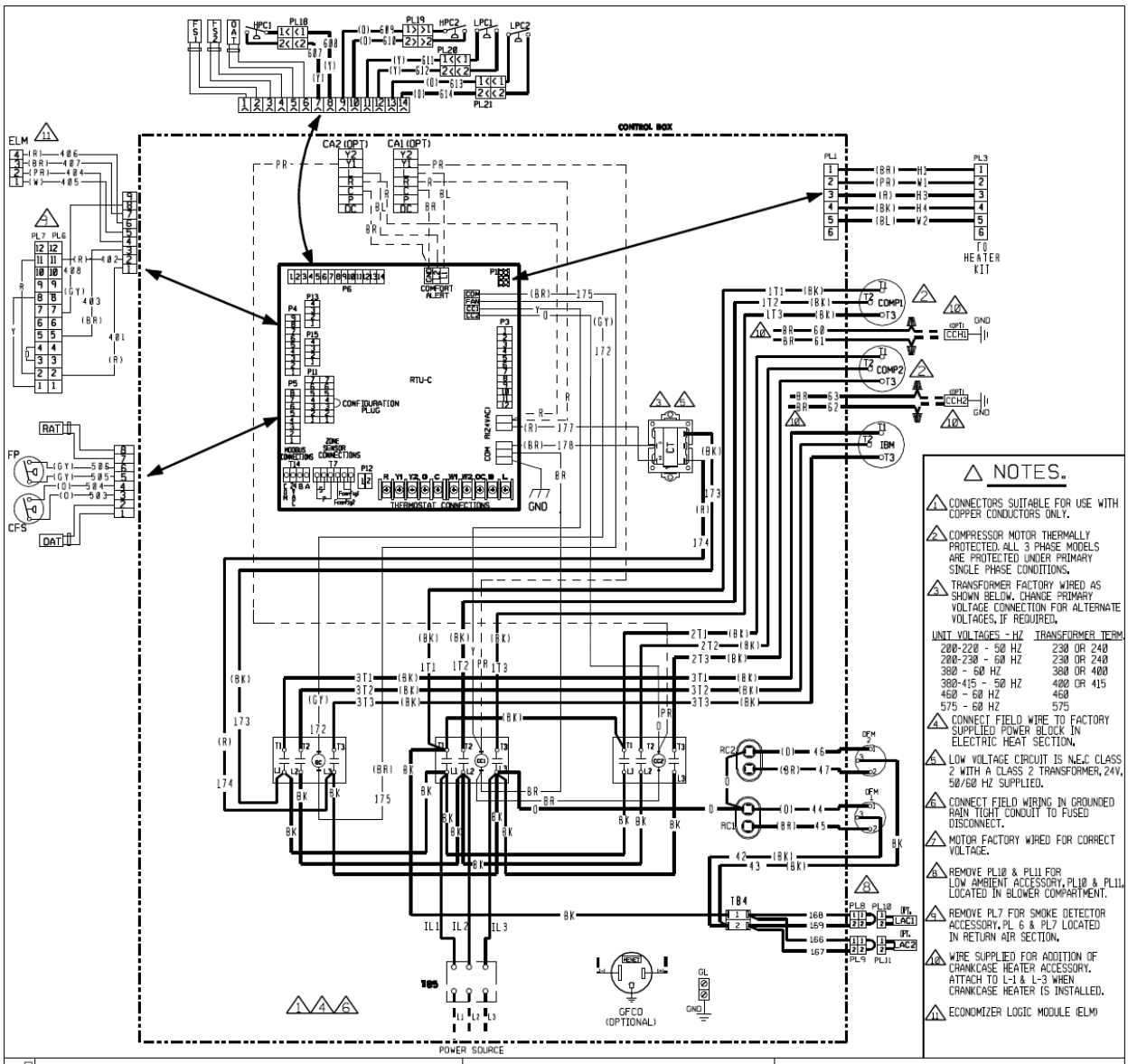
WARNING
- CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

WIRE COLOR CODE

BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
RLNL-C072/085
208-230/460/575V 3 PH, 60 HZ.
PACKAGED A/C W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
MGR		4-15-09	90-103089-04	01



NOTES.

1. CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2. COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3. TRANSFORMER FACTORY WIRED AS SHOWN BELOW. CHANGE PRIMARY VOLTAGE CONNECTION FOR ALTERNATE VOLTAGES, IF REQUIRED.

UNIT VOLTAGES - HZ	TRANSFORMER TERM
200-220 - 50 HZ	230 OR 240
200-230 - 60 HZ	230 OR 240
380 - 60 HZ	380 OR 400
380-415 - 50 HZ	400 OR 415
460 - 60 HZ	460
575 - 60 HZ	575

4. CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRIC HEAT SECTION.
5. LOW VOLTAGE CIRCUIT IS N.E.C. CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6. CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7. MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8. REMOVE PL10 & PL11 FOR LOW AMBIENT ACCESSORY, PL10 & PL11 LOCATED IN BLOWER COMPARTMENT.
9. REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10. WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY. ATTACH TO L-1 & L-3 WHEN CRANKCASE HEATER IS INSTALLED.
11. ECONOMIZER LOGIC MODULE (ELM)

COMPONENT CODE

BC	BLOWER CONTACTOR	LAC	LOW AMBIENT COOLING CONTROL
CA	COMFORT ALERT MODULE	LPC	LOW PRESSURE CONTROL
CC	COMPRESSOR CONTACTOR	OAT	OUTSIDE AIR SENSOR
CCH	CRANKCASE HEATER	OFM	OUTDOOR FAN MOTOR
CFS	CLOGGED FILTER SWITCH	PL	PLUG
COMP	COMPRESSOR	RAT	RETURN AIR SENSOR
CT	CONTROL TRANSFORMER	RC	RUN CAPACITOR
DAT	DISCHARGE AIR SENSOR	RTU-C	ROOFTOP UNIT CONTROL
DISC	DISCONNECT SWITCH	TB	TERMINAL BLOCK
FP	FAN PROVING	⚠	WIRE NUT
FS	FREEZE SENSOR		
GFCO	GROUND FAULT CONVENIENCE OUTLET		
GL	GROUND LUG		
GND	GROUND		
HPC	HIGH PRESSURE CONTROL		
IBM	INDOOR BLOWER MOTOR BELT DRIVE		

WIRING INFORMATION

LINE VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

LOW VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

REPLACEMENT WIRE
- -MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

WARNING
- -CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

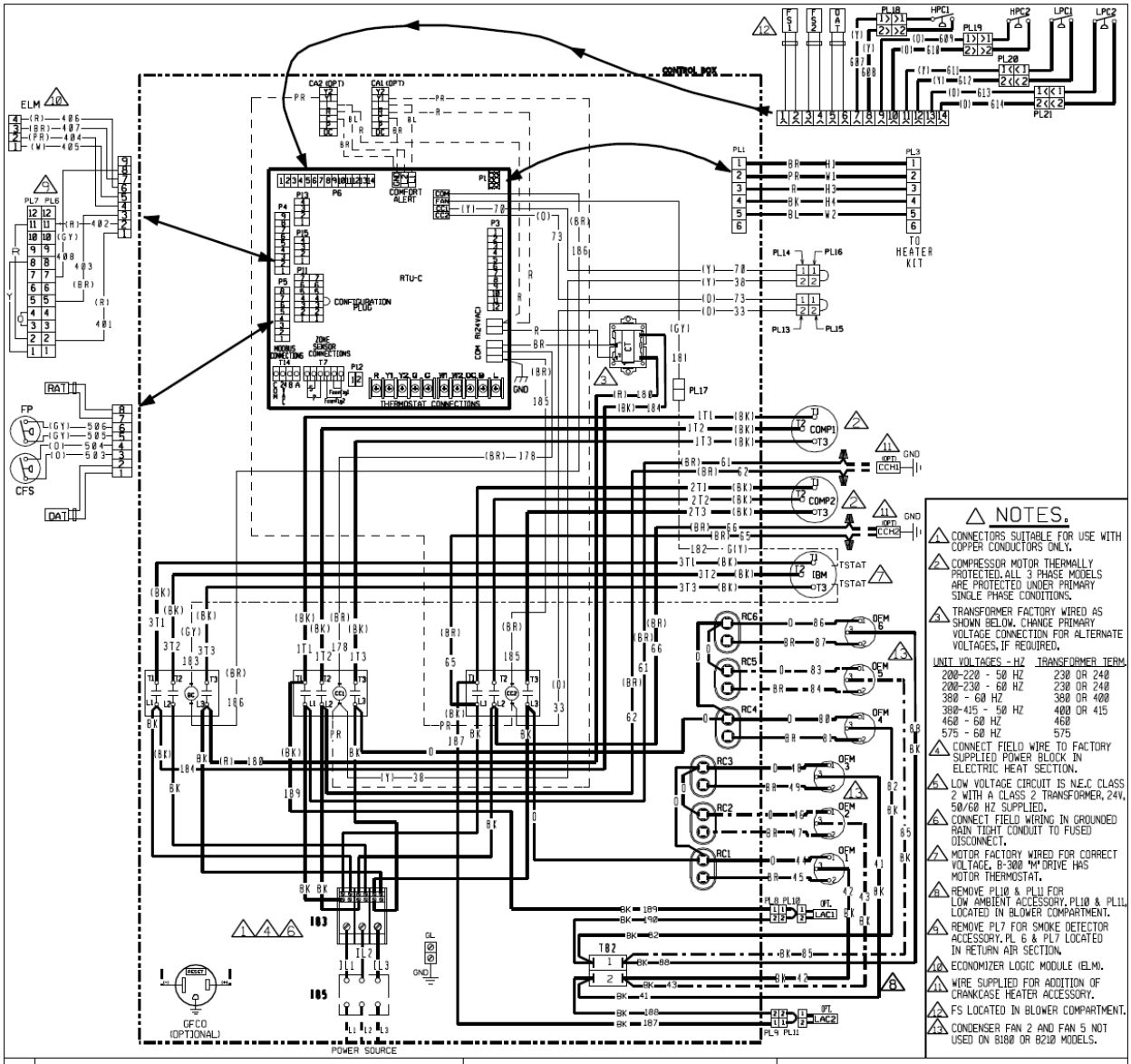
WIRE COLOR CODE

BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
RLNL-C090/102/120/150
208-230/460/575V 3 PH, 60 HZ.
PACKAGED A/C W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
MGR		4-15-09	90-103089-03	02

DWG. NO. 90-103089-03 REV 02



NOTES.

1. CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2. COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3. TRANSFORMER FACTORY WIRED AS SHOWN BELOW. CHANGE PRIMARY VOLTAGE CONNECTION FOR ALTERNATE VOLTAGES, IF REQUIRED.

UNIT VOLTAGES - HZ	TRANSFORMER TERM.
200-220 - 50 HZ	230 OR 240
200-230 - 60 HZ	230 OR 240
380 - 60 HZ	380 OR 400
380-415 - 50 HZ	400 OR 415
460 - 60 HZ	460
575 - 60 HZ	575

4. CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRIC HEAT SECTION.
5. LOW VOLTAGE CIRCUIT IS N.E.C CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6. CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7. MOTOR FACTORY WIRED FOR CORRECT VOLTAGE. B-300 "M" DRIVE HAS MOTOR THERMOSTAT.
8. REMOVE PL10 & PL11 FOR LOW AMBIENT ACCESSORY. PL10 & PL11 LOCATED IN BLOWER COMPARTMENT.
9. REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10. ECONOMIZER LOGIC MODULE (ELM).
11. WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY.
12. FS LOCATED IN BLOWER COMPARTMENT.
13. CONDENSER FAN 2 AND FAN 5 NOT USED ON B180 OR B210 MODELS.

COMPONENT CODE

BC	BLOWER CONTACTOR	LAC	LOW AMBIENT COOLING CONTROL
CA	COMFORT ALERT MODULE	LC	LIMIT CONTROL
CC	COMPRESSOR CONTACTOR	LPC	LOW PRESSURE CONTROL
CCH	CRANKCASE HEATER	OAT	OUTSIDE AIR SENSOR
CFS	CLOGGED FILTER SWITCH	OFM	OUTDOOR FAN MOTOR
COMP	COMPRESSOR	PL	PLUG
CT	CONTROL TRANSFORMER	RAT	RETURN AIR SENSOR
DAT	DISCHARGE AIR SENSOR	RC	RUN CAPACITOR
DISC	DISCONNECT SWITCH	RTU-C	ROOFTOP UNIT CONTROL
FP	FAN PROVING	TB	TERMINAL BLOCK
FS	FREEZE SENSOR		WIRE NUT
GFCO	GROUND FAULT CONVENIENCE OUTLET		
GL	GROUND LUG		
GND	GROUND		
HPC	HIGH PRESSURE CONTROL		
IBM	INDOOR BLOWER MOTOR BELT DRIVE		

WIRING INFORMATION

LINE VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

LOW VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

REPLACEMENT WIRE
- -MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

WARNING
- -CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

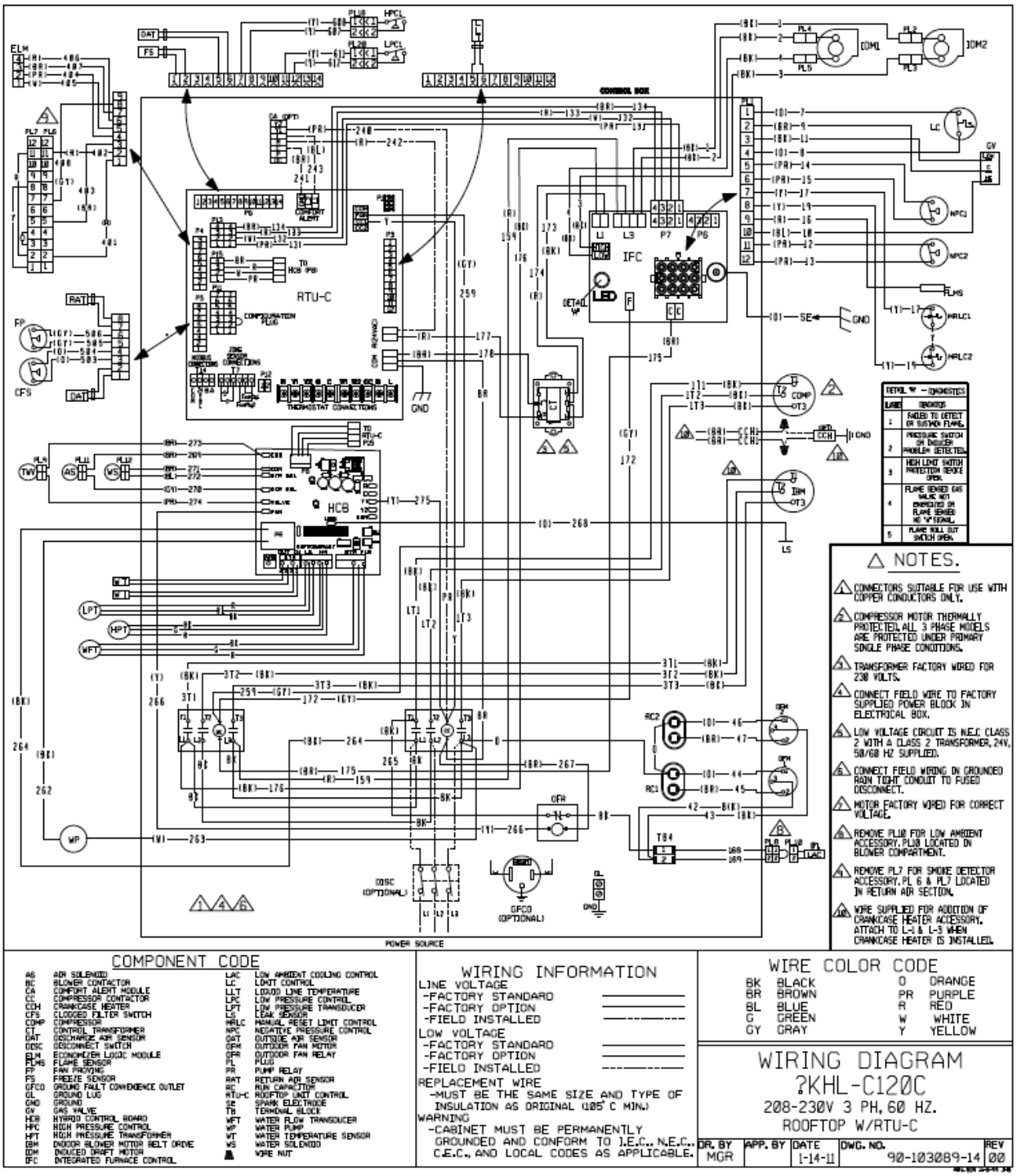
WIRE COLOR CODE

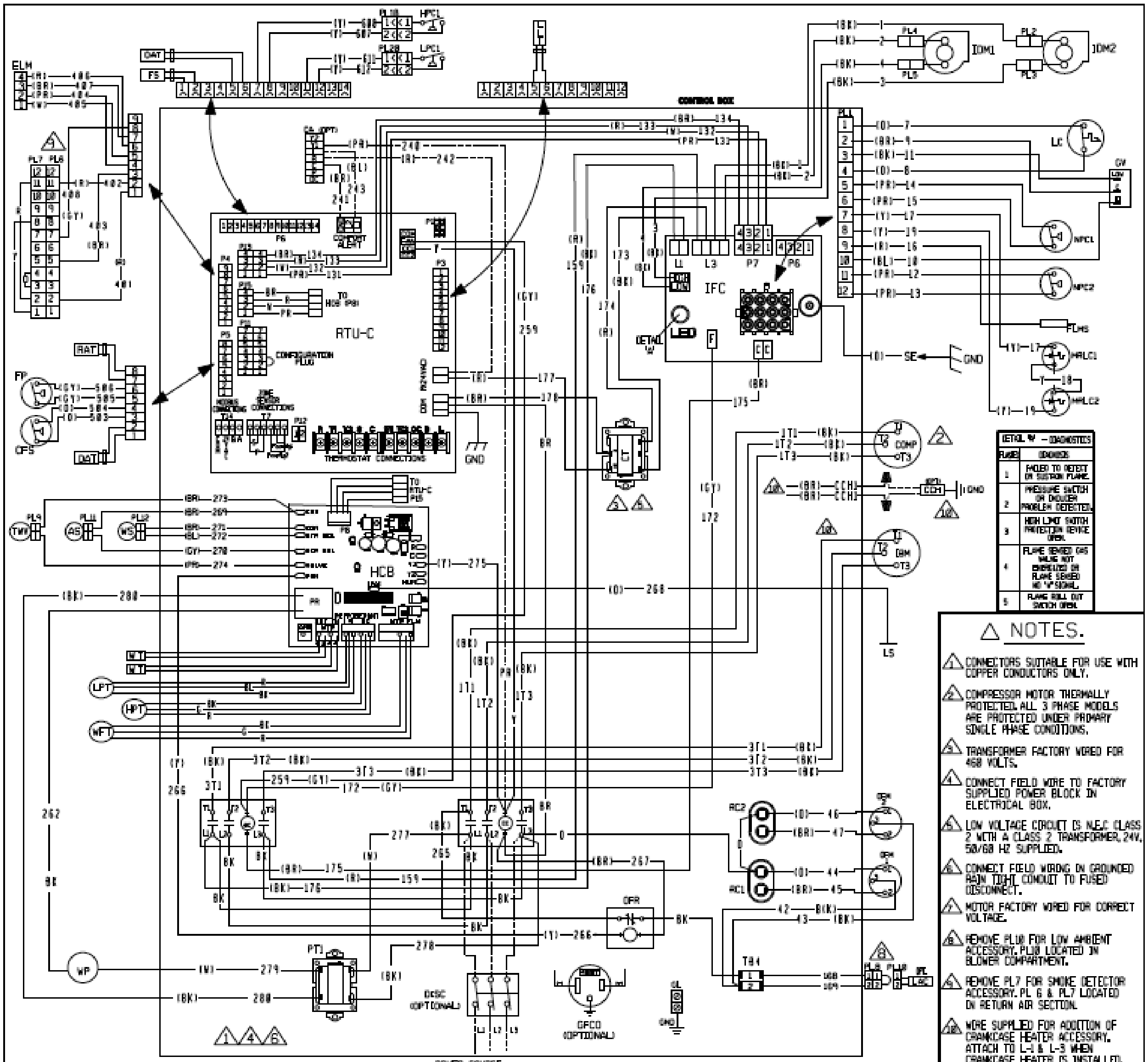
BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
RLNL-C180/210/240/300
208-230/460/575V 3 PH, 60 HZ.
PACKAGED A/C W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
MGR		4-13-09	90-103079-03	01

90-103079-03 REV 01


RTU-C
HCB
IFC
CONTROL BOX
POWER SOURCE
NOTES.
COMPONENT CODE
WIRING INFORMATION
WIRE COLOR CODE
WIRING DIAGRAM
?KHL-C120C
208-230V 3 PH, 60 HZ.
ROOFTOP W/RTU-C
DR. BY MGR
APP. BY
DATE 1-14-11
DWG. NO. 90-103089-14
REV 00



DETAIL "W" - DIAGNOSTICS	
FLASHES	DIAGNOSIS
1	FAILED TO DETECT OR SUSTAIN FLAME.
2	PRESSURE SWITCH OR INDUCER PROBLEM DETECTED.
3	HIGH LIMIT SWITCH PROTECTION DEVICE OPEN.
4	FLAME SENSED GAS VALVE NOT ENERGIZED OR FLAME SENSED NO "W" SIGNAL.
5	FLAME ROLL OUT SWITCH OPEN.

△ NOTES.

1. CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2. COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3. TRANSFORMER FACTORY WIRED FOR 460 VOLTS.
4. CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRICAL BOX.
5. LOW VOLTAGE CIRCUIT IS N.E.C. CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6. CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7. MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8. REMOVE PL10 FOR LOW AMBIENT ACCESSORY. PL10 LOCATED IN BLOWER COMPARTMENT.
9. REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10. WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY. ATTACH TO L-1 & L-3 WHEN CRANKCASE HEATER IS INSTALLED.

COMPONENT CODE

AS	AIR SOLENOID	LAC	LOW AMBIENT COOLING CONTROL
BC	BLOWER CONTACTOR	LC	LIMIT CONTROL
CA	COMFORT ALERT MODULE	LLT	LIQUID LINE TEMPERATURE
CC	COMPRESSOR CONTACTOR	LPC	LOW PRESSURE CONTROL
CCH	CRANKCASE HEATER	LPT	LOW PRESSURE TRANSDUCER
CFS	CLOGGED FILTER SWITCH	LS	LEAK SENSOR
COMP	COMPRESSOR	MRLC	MANUAL RESET LIMIT CONTROL
CT	CONTROL TRANSFORMER	NPC	NEGATIVE PRESSURE CONTROL
DAT	DISCHARGE AIR SENSOR	OAT	OUTSIDE AIR SENSOR
DISC	DISCONNECT SWITCH	OFM	OUTDOOR FAN MOTOR
ELM	ECONOMIZER LOGIC MODULE	OFR	OUTDOOR FAN RELAY
ELMS	FLAME SENSOR	PL	PLUG
FP	FAN PROVING	PR	PUMP RELAY
FS	FREEZE SENSOR	PT	POWER TRANSFORMER
GFCO	GROUND FAULT CONVENIENCE OUTLET	RAT	RETURN AIR SENSOR
GL	GROUND LUG	RC	RUN CAPACITOR
GND	GROUND	RTU-C	ROOFTOP UNIT CONTROL
GV	GAS VALVE	SE	SPARK ELECTRODE
HCB	HYBRID CONTROL BOARD	TB	TERMINAL BLOCK
HPC	HIGH PRESSURE CONTROL	WFT	WATER FLOW TRANSDUCER
HPT	HIGH PRESSURE TRANSDUCER	WP	WATER PUMP
IBM	INDOOR BLOWER MOTOR BELT DRIVE	WT	WATER TEMPERATURE SENSOR
IDM	INDUCED DRAFT MOTOR	WS	WATER SOLENOID
IFC	INTEGRATED FURNACE CONTROL	▲	WIRE NUT

WIRING INFORMATION

LINE VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

LOW VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

REPLACEMENT WIRE
- -MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

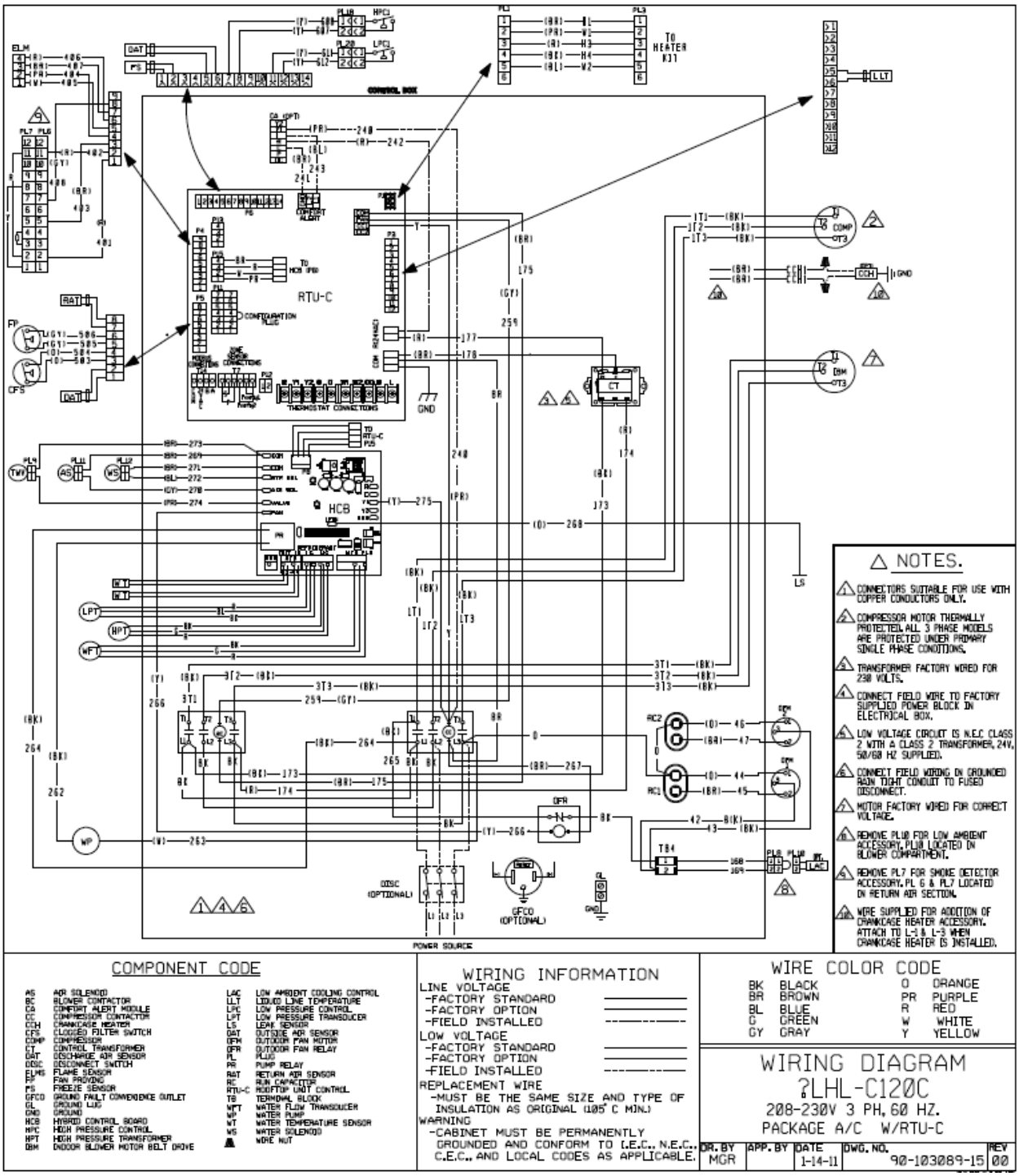
WARNING
- -CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

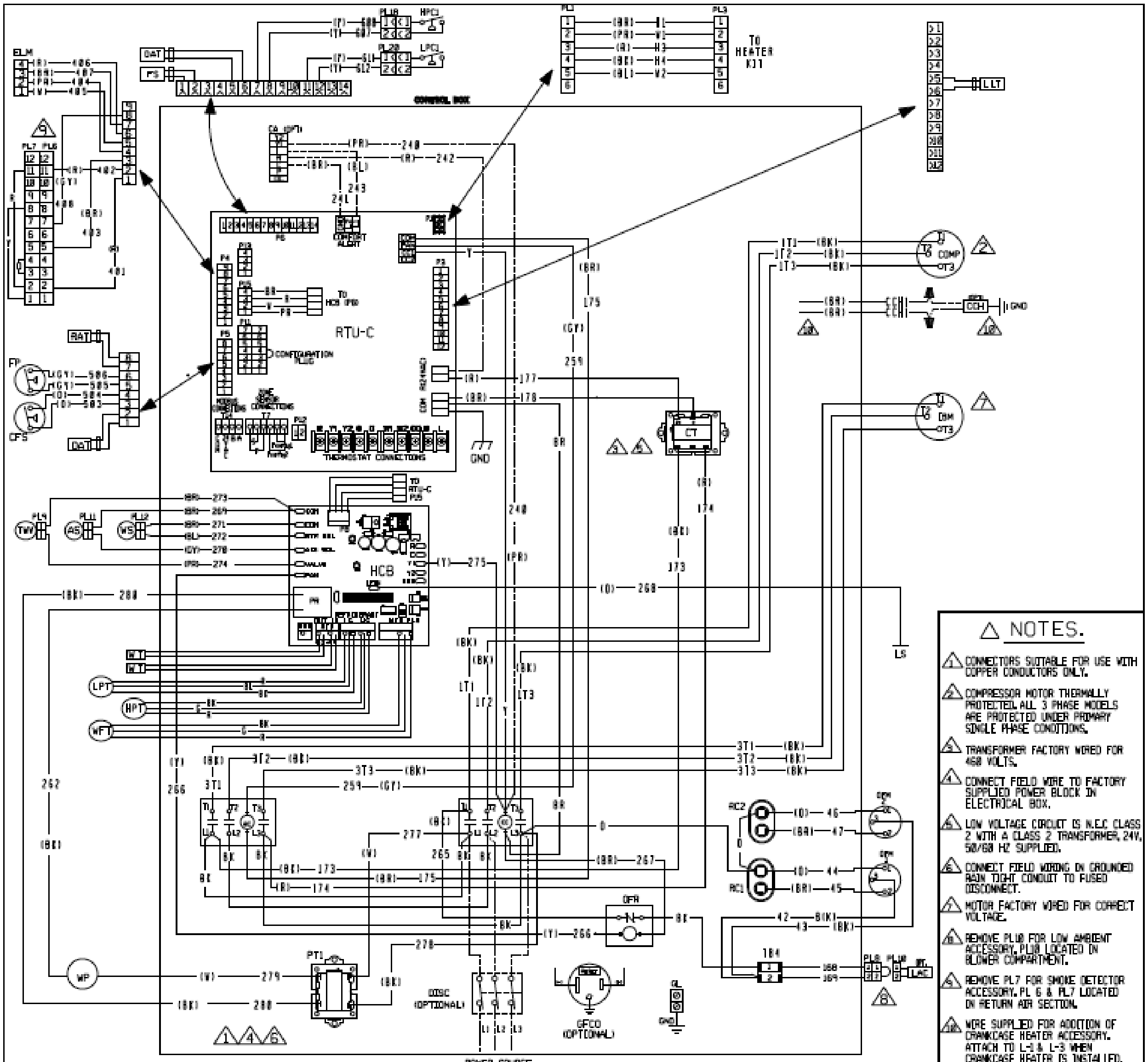
WIRE COLOR CODE

BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
?KHL-C120D
460V 3 PH, 60 HZ.
ROOFTOP W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
MGR		1-14-11	90-103089-16	00


RTU-C
HCB
CT
WP
GFCO (OPTIONAL)
ODSC (OPTIONAL)
TO HEATER KIT
POWER SOURCE
NOTES.
1. CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2. COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3. TRANSFORMER FACTORY WIRED FOR 230 VOLTS.
4. CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRICAL BOX.
5. LOW VOLTAGE CIRCUIT IS N.E.C. CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6. CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7. MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8. REMOVE PL18 FOR LOW AMBIENT ACCESSORY. PL18 LOCATED IN BLOWER COMPARTMENT.
9. REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10. WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY. ATTACH TO L-2 & L-3 WHEN CRANKCASE HEATER IS INSTALLED.
COMPONENT CODE
AS AIR SOLENOID
BC BLOWER CONTACTOR
CA COMFORT ALERT MODULE
CC COMPRESSOR CONTACTOR
CCH CRANKCASE HEATER
CFS CLOGGED FILTER SWITCH
COMP COMPRESSOR
CT CONTROL TRANSFORMER
DAT DISCHARGE AIR SENSOR
ODSC DISCONNECT SWITCH
FLMS FLAME SENSOR
FP FAN PROVING
FS FREEZE SENSOR
GFCO GROUND FAULT CONVENIENCE OUTLET
GL GROUND LUG
GND GROUND
HCB HYBRID CONTROL BOARD
HPC HIGH PRESSURE CONTROL
HPT HIGH PRESSURE TRANSFORMER
IBM INDOOR BLOWER MOTOR BELT DRIVE
LAC LOW AMBIENT COOLING CONTROL
LLT LIQUID LINE TEMPERATURE
LPC LOW PRESSURE CONTROL
LPT LOW PRESSURE TRANSDUCER
LS LEAK SENSOR
OAT OUTSIDE AIR SENSOR
OFM OUTDOOR FAN MOTOR
OFR OUTDOOR FAN RELAY
PL PLUG
PR PUMP RELAY
RAT RETURN AIR SENSOR
RC RUN CAPACITOR
RTU-C ROOFTOP UNIT CONTROL
TB TERMINAL BLOCK
WFT WATER FLOW TRANSDUCER
WP WATER PUMP
WT WATER TEMPERATURE SENSOR
WS WATER SOLENOID
WIRE NUT
WIRING INFORMATION
LINE VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
LOW VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED
REPLACEMENT WIRE
-MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)
WARNING
-CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO (,E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.
WIRE COLOR CODE
BK BLACK
BR BROWN
BL BLUE
G GREEN
GY GRAY
O ORANGE
PR PURPLE
R RED
W WHITE
Y YELLOW
WIRING DIAGRAM
?LHL-C120C
208-230V 3 PH, 60 HZ.
PACKAGE A/C W/RTU-C
DR. BY MGR
APP. BY
DATE 1-14-11
DWG. NO. 90-103089-15
REV 00



NOTES.

1. CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2. COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3. TRANSFORMER FACTORY WIRED FOR 460 VOLTS.
4. CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRICAL BOX.
5. LOW VOLTAGE CIRCUIT IS N.E.C CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6. CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7. MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8. REMOVE PL10 FOR LOW AMBIENT ACCESSORY. PL10 LOCATED IN BLOWER COMPARTMENT.
9. REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10. WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY. ATTACH TO L-1 & L-3 WHEN CRANKCASE HEATER IS INSTALLED.

COMPONENT CODE

AS	AIR SOLENOID	LAC	LOW AMBIENT COOLING CONTROL
BC	BLOWER CONTACTOR	LLT	LIQUID LINE TEMPERATURE
CA	COMFORT ALERT MODULE	LPC	LOW PRESSURE CONTROL
CC	COMPRESSOR CONTACTOR	LPT	LOW PRESSURE TRANSDUCER
CCH	CRANKCASE HEATER	LS	LEAK SENSOR
CFS	CLOGGED FILTER SWITCH	OAT	OUTSIDE AIR SENSOR
COMP	COMPRESSOR	OFM	OUTDOOR FAN MOTOR
CT	CONTROL TRANSFORMER	OFR	OUTDOOR FAN RELAY
DAT	DISCHARGE AIR SENSOR	PL	PLUG
DISC	DISCONNECT SWITCH	PR	PUMP RELAY
FLMS	FLAME SENSOR	PT	POWER TRANSFORMER
FP	FAN PROVING	RAT	RETURN AIR SENSOR
FS	FREEZE SENSOR	RC	RUN CAPACITOR
GFCO	GROUND FAULT CONVENIENCE OUTLET	RTU-C	ROOFTOP UNIT CONTROL
GL	GROUND LUG	TB	TERMINAL BLOCK
GND	GROUND	WFT	WATER FLOW TRANSDUCER
HCB	HYBRID CONTROL BOARD	WP	WATER PUMP
HPC	HIGH PRESSURE CONTROL	WT	WATER TEMPERATURE SENSOR
HPT	HIGH PRESSURE TRANSDUCER	WS	WATER SOLENOID
IBM	INDOOR BLOWER MOTOR BELT DRIVE	▲	WIRE NUT

WIRING INFORMATION

LINE VOLTAGE
- FACTORY STANDARD
- FACTORY OPTION
- FIELD INSTALLED

LOW VOLTAGE
- FACTORY STANDARD
- FACTORY OPTION
- FIELD INSTALLED

REPLACEMENT WIRE
- MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

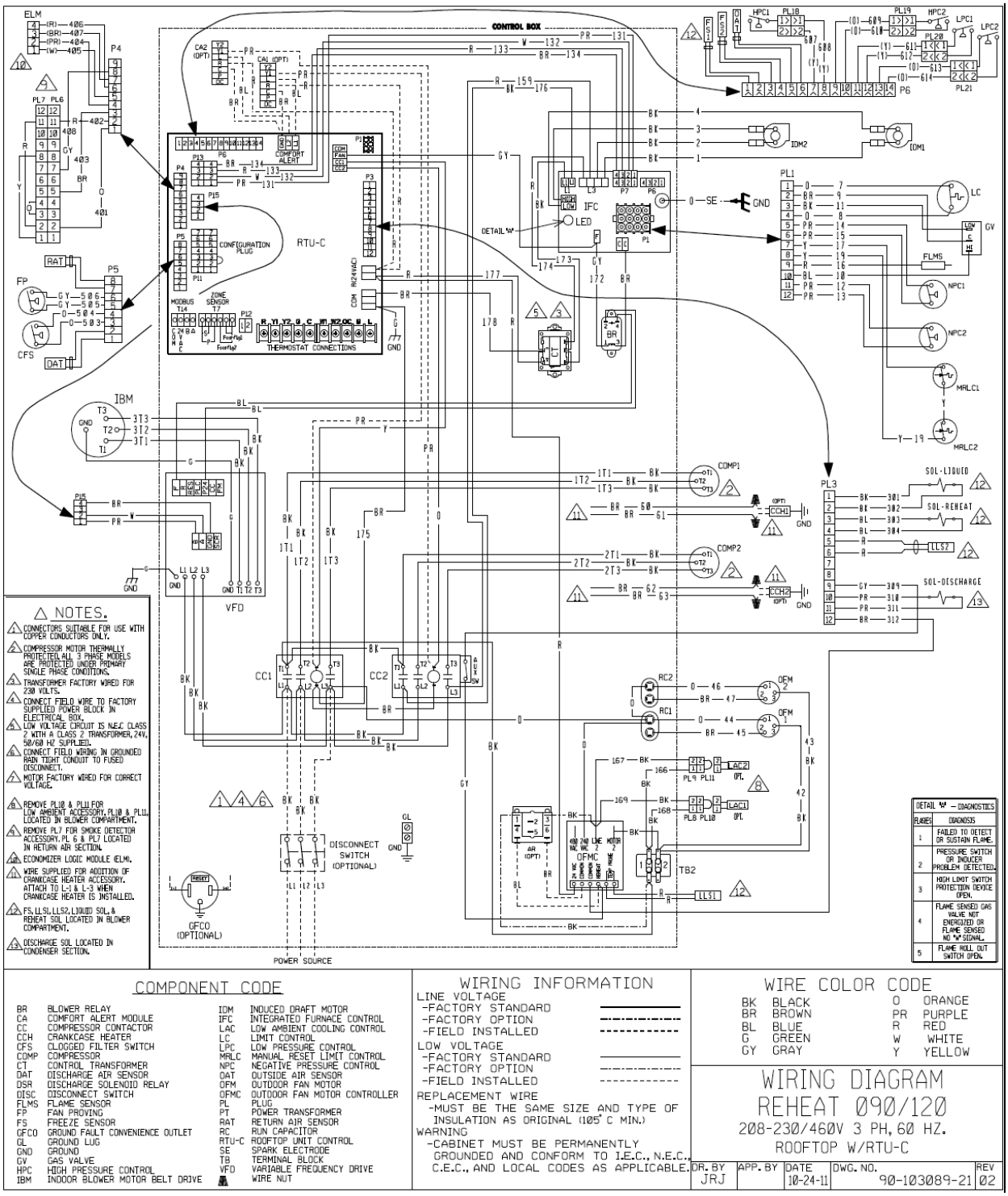
WARNING
- CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

WIRE COLOR CODE

BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
?LHL-C120D
460V 3 PH, 60 HZ.
PACKAGE A/C W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
MGR		1-14-11	90-103089-17	00



COMPONENT CODE

BR	BLOWER RELAY	IDM	INDUCED DRAFT MOTOR
CA	COMFORT ALERT MODULE	IFC	INTEGRATED FURNACE CONTROL
CC	COMPRESSOR CONTACTOR	LAC	LOW AMBIENT COOLING CONTROL
CCH	CRANKCASE HEATER	LC	LIMIT CONTROL
CFS	CLOGGED FILTER SWITCH	LPC	LOW PRESSURE CONTROL
COMP	COMPRESSOR	MRLC	MANUAL RESET LIMIT CONTROL
CT	CONTROL TRANSFORMER	NPC	NEGATIVE PRESSURE CONTROL
DAT	DISCHARGE AIR SENSOR	OAT	OUTSIDE AIR SENSOR
DSR	DISCHARGE SOLENOID RELAY	OFM	OUTDOOR FAN MOTOR
DISC	DISCONNECT SWITCH	OFMC	OUTDOOR FAN MOTOR CONTROLLER
FLMS	FLAME SENSOR	PL	PLUG
FP	FAN PROVING	PT	POWER TRANSFORMER
FS	FREEZE SENSOR	RAT	RETURN AIR SENSOR
GFCO	GROUND FAULT CONVENIENCE OUTLET	RC	RUN CAPACITOR
GL	GROUND LUG	RTU-C	ROOFTOP UNIT CONTROL
GND	GROUND	SE	SPARK ELECTRODE
GV	GAS VALVE	TB	TERMINAL BLOCK
HPC	HIGH PRESSURE CONTROL	VFD	VARIABLE FREQUENCY DRIVE
IBM	INDOOR BLOWER MOTOR BELT DRIVE		WIRE NUT

WIRING INFORMATION

LINE VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED

LOW VOLTAGE
-FACTORY STANDARD
-FACTORY OPTION
-FIELD INSTALLED

REPLACEMENT WIRE
-MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

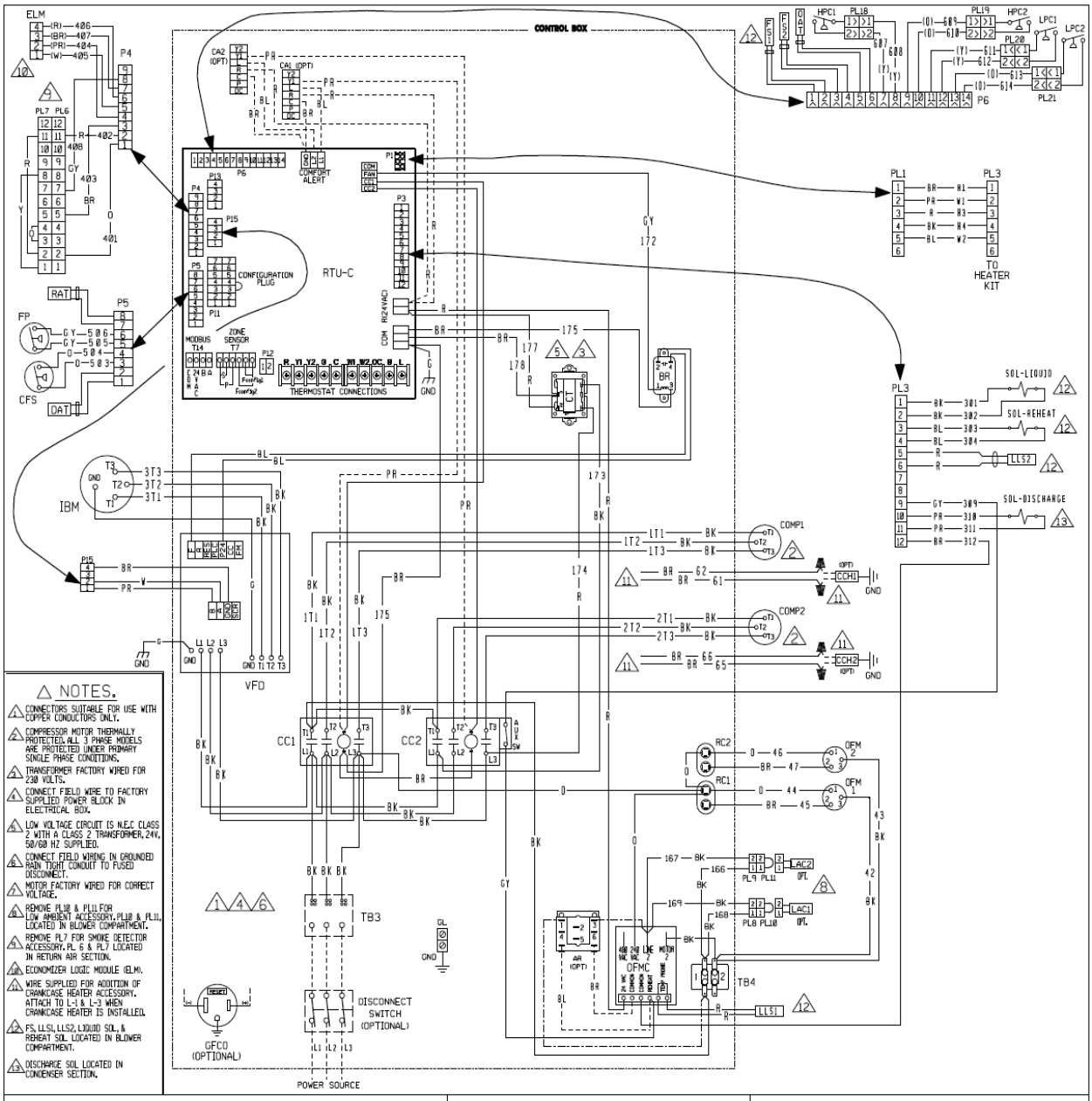
WARNING
-CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

WIRE COLOR CODE

BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
REHEAT 090/120
208-230/460V 3 PH, 60 HZ.
ROOFTOP W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
JRJ		10-24-11	90-103089-21	02



NOTES.

1. CONNECTORS SUITABLE FOR USE WITH COPPER CONDUCTORS ONLY.
2. COMPRESSOR MOTOR THERMALLY PROTECTED. ALL 3 PHASE MODELS ARE PROTECTED UNDER PRIMARY SINGLE PHASE CONDITIONS.
3. TRANSFORMER FACTORY WIRED FOR 230 VOLTS.
4. CONNECT FIELD WIRE TO FACTORY SUPPLIED POWER BLOCK IN ELECTRICAL BOX.
5. LOW VOLTAGE CIRCUIT IS N.E.C CLASS 2 WITH A CLASS 2 TRANSFORMER, 24V, 50/60 HZ SUPPLIED.
6. CONNECT FIELD WIRING IN GROUNDED RAIN TIGHT CONDUIT TO FUSED DISCONNECT.
7. MOTOR FACTORY WIRED FOR CORRECT VOLTAGE.
8. REMOVE PL18 & PL11 FOR LOW AMBIENT ACCESSORY. PL18 & PL11, LOCATED IN BLOWER COMPARTMENT.
9. REMOVE PL7 FOR SMOKE DETECTOR ACCESSORY. PL 6 & PL7 LOCATED IN RETURN AIR SECTION.
10. ECONOMIZER LOGIC MODULE (ELM).
11. WIRE SUPPLIED FOR ADDITION OF CRANKCASE HEATER ACCESSORY. ATTACH TO L-1 & L-3 WHEN CRANKCASE HEATER IS INSTALLED.
12. FS, LLS1, LLS2, LIQUID SOL. & REHEAT SOL LOCATED IN BLOWER COMPARTMENT.
13. DISCHARGE SOL LOCATED IN CONDENSER SECTION.

COMPONENT CODE

BR	BLOWER RELAY
CA	COMFORT ALERT MODULE
CC	COMPRESSOR CONTACTOR
CCH	CRANKCASE HEATER
CFS	CLOGGED FILTER SWITCH
COMP	COMPRESSOR
CT	CONTROL TRANSFORMER
DAT	DISCHARGE AIR SENSOR
DSR	DISCHARGE SOLENOID RELAY
DISC	DISCONNECT SWITCH
FP	FAN PROVING
FS	FREEZE SENSOR
GFCO	GROUND FAULT CONVENIENCE OUTLET
GL	GROUND LUG
GND	GROUND
HPC	HIGH PRESSURE CONTROL
IBM	INDOOR BLOWER MOTOR BELT DRIVE
LAC	LOW AMBIENT COOLING CONTROL
LC	LIMIT CONTROL
LPC	LOW PRESSURE CONTROL
OAT	OUTSIDE AIR SENSOR
OFM	OUTDOOR FAN MOTOR
OFMC	OUTDOOR FAN MOTOR CONTROLLER
PL	PLUG
RAT	RETURN AIR SENSOR
RC	RUN CAPACITOR
RTU-C	ROOFTOP UNIT CONTROL
TB	TERMINAL BLOCK
VFD	VARIABLE FREQUENCY DRIVE
	WIRE NUT

WIRING INFORMATION

LINE VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

LOW VOLTAGE
- -FACTORY STANDARD
- -FACTORY OPTION
- -FIELD INSTALLED

REPLACEMENT WIRE
- -MUST BE THE SAME SIZE AND TYPE OF INSULATION AS ORIGINAL (105° C MIN.)

WARNING
- -CABINET MUST BE PERMANENTLY GROUNDED AND CONFORM TO I.E.C., N.E.C., C.E.C., AND LOCAL CODES AS APPLICABLE.

WIRE COLOR CODE

BK	BLACK	O	ORANGE
BR	BROWN	PR	PURPLE
BL	BLUE	R	RED
G	GREEN	W	WHITE
GY	GRAY	Y	YELLOW

WIRING DIAGRAM
REHEAT Ø90/120
208-230/460V 3 PH, 60 HZ.
PACKAGED A/C W/RTU-C

DR. BY	APP. BY	DATE	DWG. NO.	REV
JRJ		10-24-11	90-103089-22	Ø2

13. Sensor Temperature vs. Resistance Table

TEMP °F	R (OHMS)	TEMP °F	R (OHMS)	TEMP °F	R (OHMS)	TEMP °F	R (OHMS)
1.4	81,662	77.0	10,000	150.8	2,011	224.6	561
3.2	77,162	78.8	9,571	152.6	1,943	226.4	546
5.0	72,940	80.6	9,164	154.4	1,876	228.2	531
6.8	68,957	82.4	8,776	156.2	1,813	230.0	517
8.6	65,219	84.2	8,407	158.0	1,752	231.8	503
10.4	61,711	86.0	8,056	159.8	1,693	233.6	489
12.2	58,415	87.8	7,720	161.6	1,637	235.4	476
14.0	55,319	89.6	7,401	163.4	1,582	237.2	463
15.8	52,392	91.4	7,096	165.2	1,530	239.0	450
17.6	49,640	93.2	6,806	167.0	1,480	240.8	437
19.4	47,052	95.0	6,530	168.8	1,431	242.6	425
21.2	44,617	96.8	6,266	170.6	1,385	244.4	413
23.0	42,324	98.6	6,014	172.4	1,340	246.2	401
24.8	40,153	100.0	5,803	174.2	1,297	248.0	390
26.6	38,109	100.4	5,774	176.0	1,255	249.8	379
28.4	36,182	102.2	5,546	177.8	1,215	251.6	369
30.2	34,367	104.0	5,327	179.6	1,177	253.4	359
32.0	32,654	105.8	5,117	181.4	1,140	255.2	349
33.8	31,030	107.6	4,918	183.2	1,104	257.0	340
35.6	29,498	109.4	4,727	185.0	1,070	258.8	332
37.4	28,052	111.2	4,544	186.8	1,037	260.6	323
39.2	26,686	113.0	4,370	188.6	1,005	262.4	315
41.0	25,396	114.8	4,203	190.4	974	264.2	305
42.8	24,171	116.6	4,042	192.2	944	266.0	300
44.6	23,013	118.4	3,889	194.0	915	267.8	293
46.4	21,918	120.2	3,743	195.8	889	269.6	285
48.2	20,883	122.0	3,603	197.6	861	271.4	278
50.0	19,903	123.8	3,469	199.4	836	273.2	272
51.8	18,972	125.6	3,340	201.2	811	275.0	265
53.6	18,090	127.4	3,217	203.0	787	276.8	259
55.4	17,255	129.2	3,099	204.8	764	278.6	253
57.2	16,464	131.0	2,986	206.6	742	280.4	247
59.0	15,714	132.8	2,878	208.4	721	282.2	241
60.8	15,000	134.6	2,774	210.2	700	284.0	235
62.6	14,323	136.4	2,675	212.0	680	285.8	230
64.4	13,681	138.2	2,579	213.8	661	287.6	224
66.2	13,071	140.0	2,488	215.6	643	289.4	219
68.0	12,493	141.8	2,400	217.4	626	291.2	214
69.8	11,942	143.6	2,315	219.2	609	293.0	209
71.6	11,418	145.4	2,235	219.9	595	294.8	204
73.4	10,921	147.2	2,157	221.0	592	296.6	199
75.2	10,449	149.0	2,083	222.8	576	298.4	194