

Building **Energy Solutions** and **Technology**

A leader in energy efficiency building systems technologies for the past 10-years, Bes-Tech, Inc. was founded on proven scientific engineering processes and technologies that best manage a building's temperature and humidity, reduce peak energy demands, minimize energy usage, and maximize energy efficiencies; lowering the overall building carbon footprint.



Digi-RTU 1.1

User Manual

Publication Number DRTU11-3250-0001

November 2018



COPYRIGHT NOTICE

Bes-Tech, Inc. checked words believed to be registered trademarks with authoritative sources. No investigation has been made of common-law trademark rights because such investigation is impractical. Words known to be trademarks are followed with a ™ symbol, and words known to be registered trademarks are followed with a ® symbol. The inclusion of any word in this document does not constitute affirmation on the part of Bes-Tech concerning proprietary rights. Do not regard comments in this document as affecting the validity of any trademark.

© 2018 by Bes-Tech, Inc. All Rights Reserved. No part of this book covered by the copyrights hereon may be reproduced or copied in any form or by any means – graphic, electronic, or mechanical, including photocopying, taping or information storage and retrieval systems – except as expressly permitted by the 1976 Copyright Act or with written permission of the publisher.

Direct all correspondence and inquiries to:

Documentation Department
Bes-Tech
6916 N. 97th Circle, Bldg. B, Suite J
Omaha, NE 68122

This page left blank intentionally.

TABLE OF CONTENTS

COPYRIGHT NOTICE	I
TABLE OF CONTENTS.....	III
TABLE OF FIGURES	V
TABLE OF TABLES	VI
SAFETY NOTICES AND DECLARATIONS	VII
SAFETY	VII
DISCLAIMER.....	VII
HOW TO USE THIS DOCUMENT	VIII
LIST OF SYMBOLS	VIII
LIST OF CONVENTIONS	VIII
INTRODUCTION TO THE DIGI-RTU	1
TYPES OF DIGI-RTU AND APPLICATIONS.....	1
BENEFITS OF DIGI-RTU	2
DIGI-RTU STANDARD FEATURES.....	2
MODEL NUMBER DESCRIPTION NOMENCLATURE.....	2
DIGI-RTU SPECIFICATIONS	3
DIGI-RTU OPERATING ENVIRONMENT.....	3
LOW VOLTAGE FIELD WIRING SCHEMATIC DIAGRAM	4
RTU.....	4
HEAT PUMP.....	6
OPERATION AND SERVICE.....	8
SYSTEM CONTROL	8
<i>Thermostat Control Option</i>	<i>8</i>
<i>BAS Control Option.....</i>	<i>8</i>
SEQUENCE OF OPERATION	8
<i>Fan/Cooling/Heating Calls</i>	<i>8</i>
<i>Call Signal Flow Path.....</i>	<i>9</i>
<i>Speed Control.....</i>	<i>10</i>
<i>Economizer Control</i>	<i>11</i>
<i>DCV Control.....</i>	<i>11</i>
<i>Power Exhaust Fan Control</i>	<i>11</i>
<i>Demand Response.....</i>	<i>11</i>
RTU MAINTENANCE AND SERVICE WITH DIGI-RTU INSTALLED	12
<i>Functional Test.....</i>	<i>12</i>
<i>Safety Test.....</i>	<i>12</i>
<i>Cleaning Coils</i>	<i>12</i>
RECOMMENDED MAINTENANCE	13
<i>Conductors and Wirings.....</i>	<i>13</i>
<i>Terminals.....</i>	<i>13</i>
<i>Sensor Probes.....</i>	<i>13</i>

DRTU11-3250-0001

VFD.....	13
DIAGNOSTIC AND STATUS LEDS ON THE DIGI-RTU	14
PMC CONTROL BOARD	14
1018 I/O STRIP	15
INSTALLED MODULE LED LOCATIONS	16
DIAGNOSIS LED INDICATORS.....	17
TROUBLESHOOTING.....	19
DIGI-RTU SIGNAL PATH.....	19
DIGI-RTU TROUBLESHOOTING CASE STUDIES.....	19
<i>Compressor will not start, but indoor fan runs</i>	19
<i>RTU will not run</i>	20
<i>Digi-RTU Communication Errors</i>	20
<i>Overall Troubleshooting Procedure</i>	20
DIGI-RTU MCT TOOL	21
DIGI-RTU MODBUS-RTU COMMUNICATION REGISTER LIST	25
SERIAL COMMUNICATION SPECIFICATIONS.....	25
MODBUS REGISTERS	25
MONITORING/CONTROL REGISTERS	27
BUILDING MANAGEMENT SYSTEM CONTROLS	29
BES-TECH PRODUCT WARRANTY	31
DIGI-RTU® WARRANTY REGISTRATION FORM	33
CONTACT INFORMATION	34
STREET ADDRESS	34
PHONE NUMBERS	34
E-MAIL ADDRESS	34
WEBSITE	34

TABLE OF FIGURES

Figure 1: Overview of Digi-RTU 1

Figure 2: Digi-RTU Nomenclature..... 3

Figure 3: Digi-RTU low voltage wiring schematics-RTU 4

Figure 4: Digi-RTU low voltage wiring schematics-Trane RTU 5

Figure 5: Digi-RTU low voltage wiring schematics –Heat Pump..... 6

Figure 6: Digi-RTU low voltage wiring schematics – Trane Heat Pump..... 7

Figure 7: Digi-RTU call signal flow path 9

Figure 8: Digi-RTU Main Control Board. 14

Figure 9: Digi-RTU 1018 I/O Board. 15

Figure 10: Installed Module LED Locations. 16

Figure 11: Digi-RTU Control Module..... 17

Figure 12: Digi-RTU Relay Module..... 18

Figure 13: USB to RS-485 Converter..... 21

Figure 14: Selecting Serial Port. 21

Figure 15: Auto Detect Devices Pop Up..... 22

Figure 16: Digi-RTU Control Module..... 22

Figure 17: Status Value of Digi-RTU Operation Parameters. 23

Figure 18: Status Value of Digi-RTU Operation Parameters. 24

TABLE OF TABLES

No table of figures entries found.

SAFETY NOTICES AND DECLARATIONS

This manual provides the basic product information and guidelines for the proper operation, service, and maintenance of the Digi-RTU 1.1 units. Bes-Tech recommends that individuals maintaining, or servicing the Digi-RTU 1.1 units read this manual in its entirety before attempting to service, or use the device. In the event a problem occurs while operating the Digi-RTU, first consult the appropriate section of this manual. If the issue cannot be resolved in this manner, contact Bes-Tech at the address or phone number listed at the bottom of each page.

Bes-Tech appreciates suggestions for improving this manual or product.

Safety

Never operate the Digi-RTU without first reading and understanding this manual to ensure safe and proper operation of the unit. Using the Digi-RTU in a manner not specified by the manufacturer may impair the protection provided by the equipment.

Disclaimer

Bes-Tech, Inc. reserves the right to change the content of this manual without prior notice. The manufacturer does not make any representations or warranties (implied or otherwise) regarding the accuracy and completeness of this document and shall, in no event, be liable for any loss of profit or any commercial damage, including but not limited to special, incidental, consequential, or other damage.

HOW TO USE THIS DOCUMENT

The chapters of this document are broken down into functionality portions of the Digi-RTU. Every chapter includes an introduction that provides a synopsis of the chapter's content. The sections divide the Digi-RTU information of each chapter into logical and useful segments.

List of Symbols

	The pointing hand signifies an important feature of Digi-RTU.
	The alarm signifies a step or action that could potentially cause harmful/undesired results.
	The caution sign signifies a step or action that could produce unwanted but not harmful results.
	The note icon signifies additional text included for clarity.

List of Conventions

<u>Bold underlined</u>	This font style indicates a word or phrase requiring emphasis.
<i>Bold italics</i>	This font style indicates a new term.
<u><i>Italics Underlined</i></u>	This font style indicates a reference to the title and publication number (as appropriate) of a document containing additional information about the subject being discussed.
Bold	This font style indicates function names, field names, button names, and menu paths.
<i>Italics</i>	This font style indicates a reference to a section or figure included in this document.
<u><i>Blue Underlined</i></u>	This font style indicates a link to the listed chapter, graphic, or other entity.
<u><i>Bold Italics</i></u>	
→	An arrow separates menu levels (for example, File → Open)
[]	Brackets [] indicate other options for performing a step.
+,	The plus key “+” indicates hot key or shortcut key combinations. The comma separates a series of hot key combinations.
Times New Roman	This font style indicates hot keys and menu shortcuts.
Courier New	This font style indicates examples and statements that are to be typed exactly as stated in the document text.
Franklin Gothic Book	This font style indicates window names.
<u>1 2 3 4 5</u>	Numbers that are <u>bold and underlined</u> indicate procedural steps.

INTRODUCTION TO THE DIGI-RTU

A Digi-RTU is a **Heating, Ventilation, and Air Conditioning (HVAC)** rooftop unit control kit that is both a demand management and energy usage device. It is designed to improve the energy efficiency of a rooftop unit and solve the common noise, humidity, and frequent on/off issues of a rooftop unit through modulating the capacity of a rooftop unit to match the cooling or heating loads by regulating both supply air fan and compressor speed, and the number of compressors in operation.

The optimizer technology uses a **variable frequency drive (VFD)** to modulate both the indoor fan and the compressor speed of the **rooftop unit (RTU)**. A traditional RTU switches on and off—going through what is known as a “hunting” cycle—instead of operating continuously. By modulating fan and compressor speeds, the optimizer eliminates this hunting cycle. The result is lower demand, reduced energy use and a longer life for the RTU.

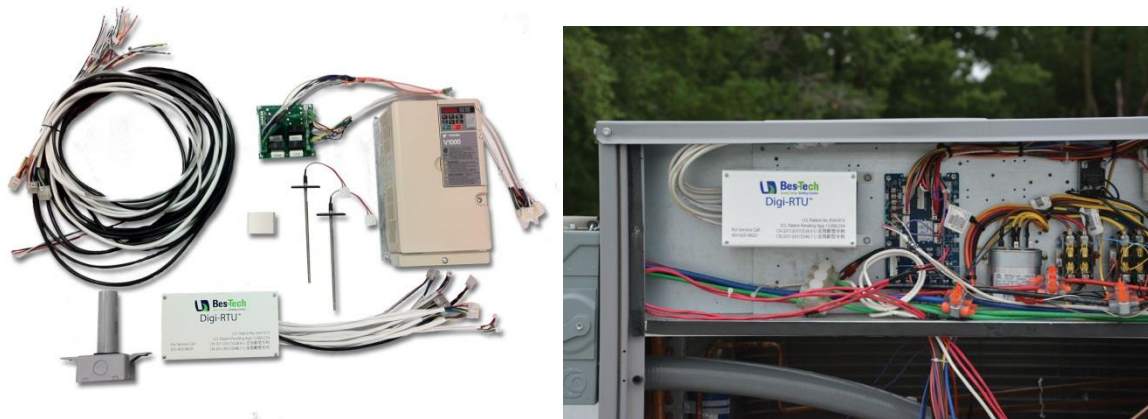


Figure 1: Overview of Digi-RTU

Types of Digi-RTU and Applications

Digi-RTU consists of the following components:

- Digi-RTU control module assembly.
- Digi-RTU relay module assembly.
- Digi-RTU VFD assembly.
- Digi-RTU supply air temperature sensor assemblies.
- Digi-RTU return air temperature sensor.
- Digi-RTU economizer/DCV kit assemblies (optional for unit with economizer).

Digi-RTU is designed for single zone package RTUs and air source heat pumps from 3 to 50 tons that control up to 2 cooling stages and 2 heating stages. Digi-RTU also applies to multiple-zone units with bypass dampers.

The existing thermostat/BAS controller initiates the call for G/Y1/Y2/W1/W2 to the RTU. The Digi-RTU intercepts the fan/compressor call from RTU controller. The Digi-RTU piggybacks

the W1 call at the RTU terminal strip. The Digi-RTU sends the fan/compressor call to fan/compressor contactor, and PEFan call to power exhaust fan relay if RTU equipped with power exhaust fan.

The outdoor fan operation follows the existing rooftop unit control. The Digi-RTU does not have direct control of the speed for the outdoor fan.

For heat pump units, the Digi-RTU does not directly control over the reversing valve.

Benefits of Digi-RTU

- Better maintains room temperature and humidity.
- Reduces peak electricity demand by up to 50%.
- Reduces electricity consumption by 40%~80%.
- Reduces compressor cycling and extends its service life.
- Reduces maintenance costs.
- Reduces noise at the conditioned space.

Digi-RTU Standard Features

Digi-RTU standard features include:

- Compressor and indoor fan speed modulation.
- Equipment capacity modulation to maintain the space temperature at its set point.
- Integrated economizer control.
- Demand controlled ventilation (with return air **Carbon Dioxide (CO₂)** sensor).
- Work with any existing wired programmable thermostat.
- RS485 Modbus RTU communication to third party controller.
- Ideally designed for single-zone or multi-zone rooftop units with one heating or cooling set-point.
- Multi-level demand response through digital or binary input signal

Model Number Description Nomenclature

Figure 2 illustrates the nomenclature used to designate Digi-RTU models.

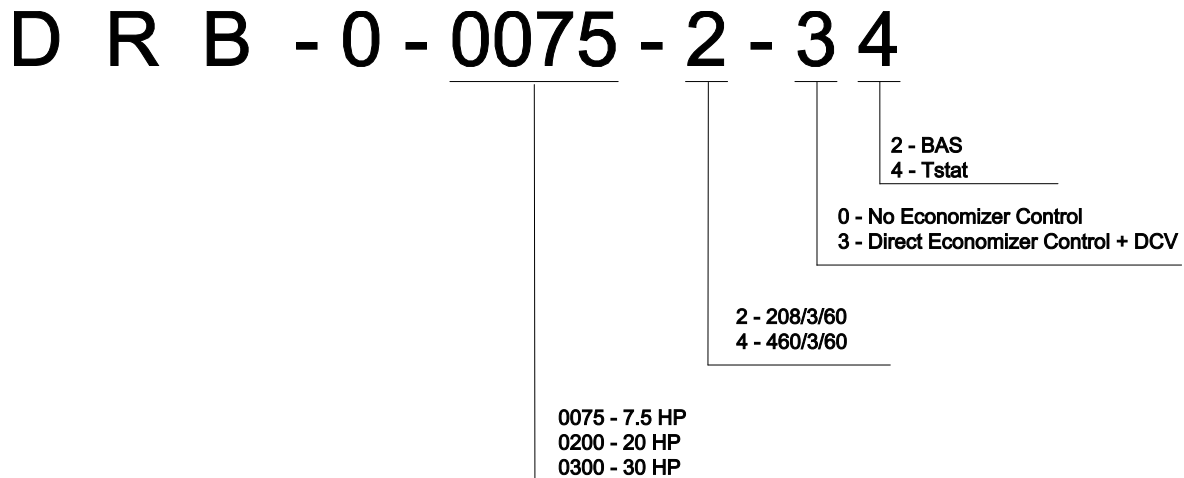


Figure 2: Digi-RTU Nomenclature

 This product only applies for single zone systems or multi-zone systems treated as single zone.

Digi-RTU Specifications

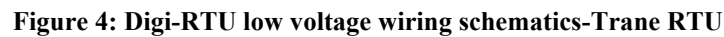
- **Input Voltage** - 200-240VAC/3ph/50 or 60Hz, 380-480VAC/3ph/50 or 60Hz.
- **Inputs/Outputs** - 24VAC inputs from rooftop units, 24VAC outputs to rooftop units.
- **Communication Bus** - RS-485, Modbus RTU communication protocol, 18-AWG twisted pair shielded wire with stranded tinned copper conductors, maximum total wire length is 1000 ft.

Digi-RTU Operating Environment

- Operating Temperature: Controller: -30°F to 150°F (-34.4°C to 65.5°C).
VFD: 14°F to 104°F (-10°C to 50°C).
- Storage Temperature: -40°F to 140°F (-40°C to 60°C).
- Operating Humidity: 10 to 95% non-condensing.
- Indoor/outdoor use: NEMA 12 enclosure.

RTU





RTU11-3250-0001

Heat Pump

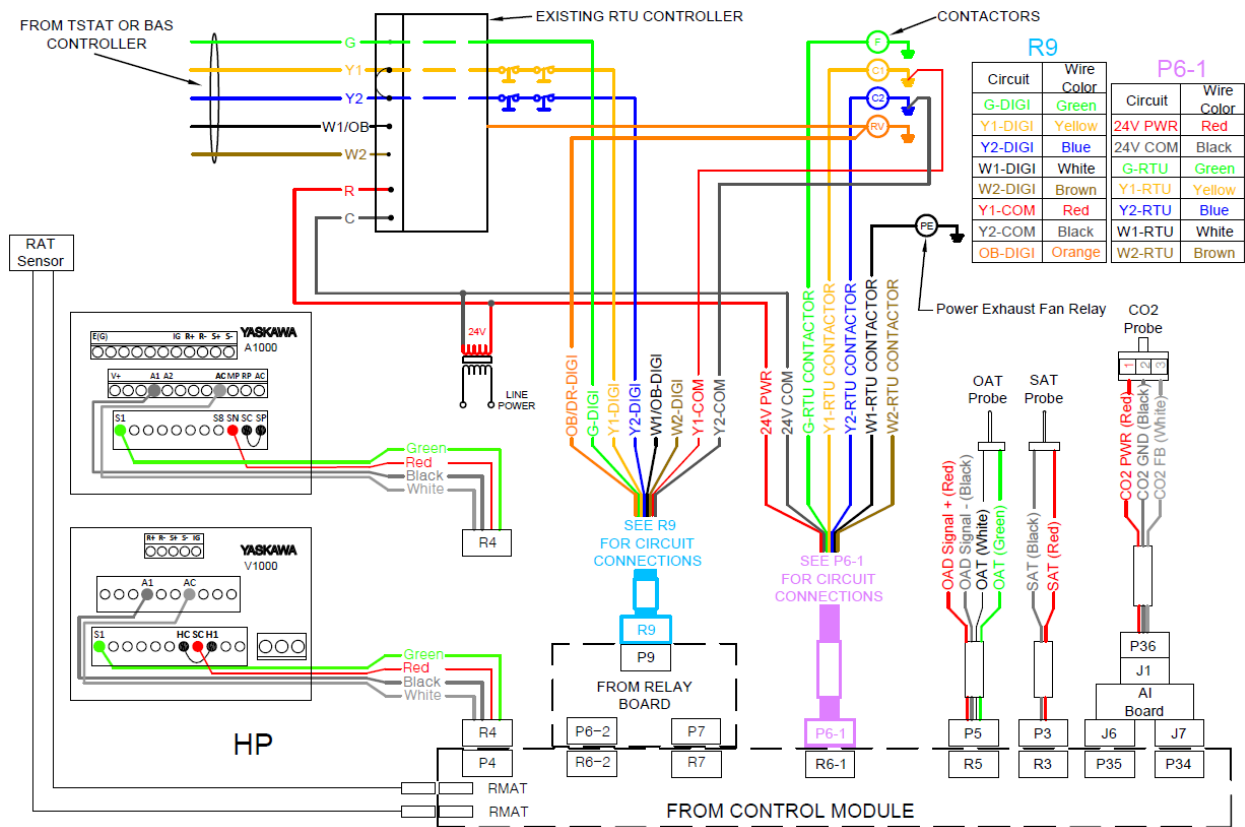


Figure 5: Digi-RTU low voltage wiring schematics –Heat Pump

RTU11-3250-0001

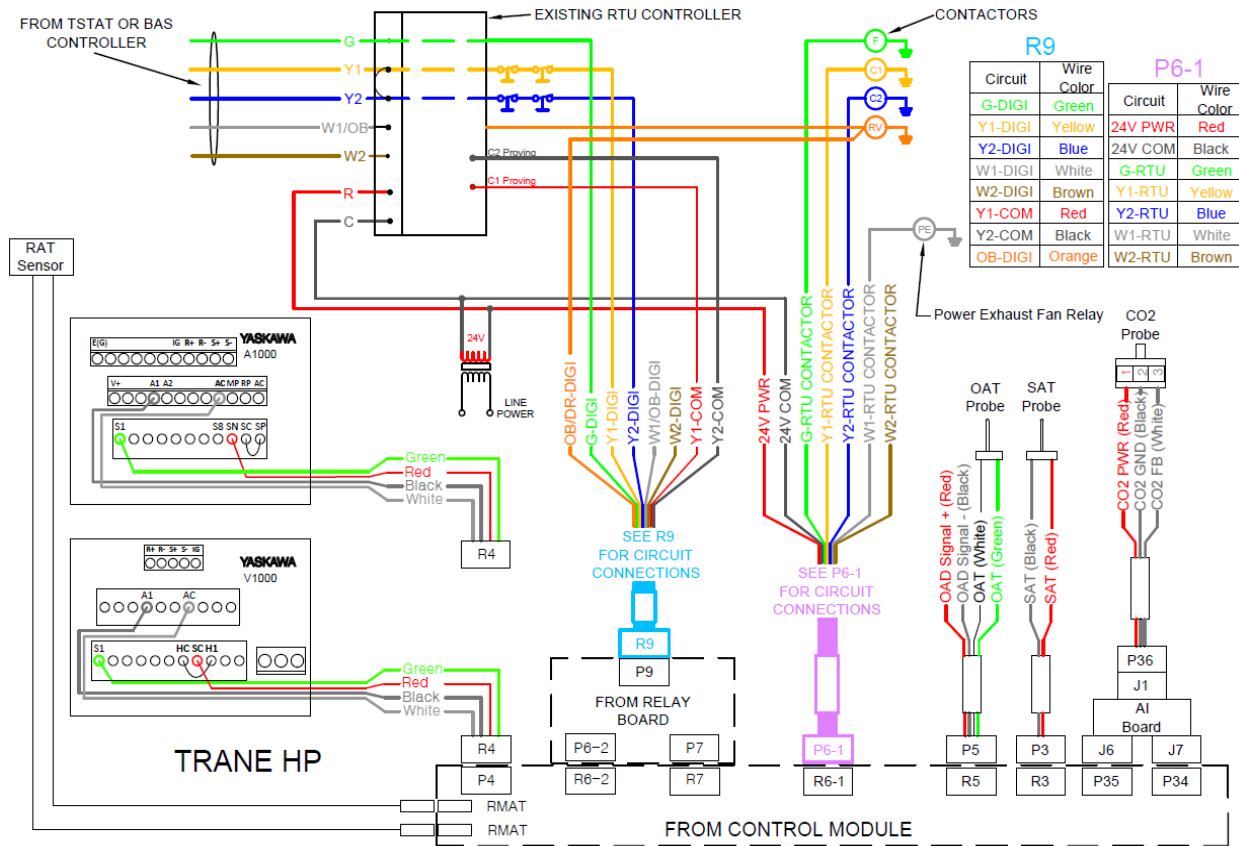


Figure 6: Digi-RTU low voltage wiring schematics – Trane Heat Pump

OPERATION AND SERVICE

The operation and service procedures for the Digi-RTU follow below.

System Control

Thermostat Control Option

The following is the system control for typical thermostats:

- **Cool:** If the system status of the thermostat is set to **Cool**, the rooftop unit is in cooling mode.
- **Heat:** If the system status of the thermostat is set to **Heat**, the rooftop unit is in heating mode.
- **Cool & Heat (Auto):** If the system status of the thermostat is set to **Cool & Heat (Auto)**, the system determines the heating or cooling mode based on the bias between the room temperature and the set point. If the room temperature is higher than the set point plus the deadband, the system is in cooling mode. On the contrary, if the room temperature is lower than its set point minus the deadband, the system is in heating mode.
- **Off:** If the system status of the thermostat is set to **Off**, the rooftop unit does not respond to the temperature of the room.
- **Fan Control:** The fan has two control modes and can operate in either control mode in any of the above system modes.
 - ▶ **Auto:** If the fan is in **Auto** mode, it shall only operate when a need for either heating or cooling is required.
 - ▶ **On:** The fan runs continuously, regardless of the operational status of cooling or heating.

BAS Control Option

BAS controller makes decision on the heating/cooling mode based on the room temperature and its set point. If the room temperature is higher than the cooling set point plus a band, then it is in cooling mode. When the room temperature is lower than the heating set point minus a band, then it is in heating mode. The fan operation mode is also determined at the BAS controller based on the fan ON or fan AUTO setting, and occupied or unoccupied status.

Sequence of Operation

The sequence of operation for various Digi-RTU equipment and components follows below.

Fan/Cooling/Heating Calls

The thermostat or BAS controller initiates the G/Y1/Y2/W1/W2 call to the RTU. After RTU receive the G/Y1/Y2 (Y2 is jumped with Y1 at RTU terminal board) call, it calls for fan/compressor(s). Digi-RTU intercepts the fan/compressor(s) calls and then passes them to the

RTU11-3250-0001

fan/compressor contactors. After RTU receives the W1 call, it kicks on the heater 1. After RTU receives the W2 call, it kicks on the heater 2.

Call Signal Flow Path

Initiating a fan call causes the Digi-RTU to intercept the fan call from the unit and stop the VFD. The Digi-RTU then drives a **binary output (BO)** to activate the fan contactor. When the Digi-RTU receives confirmation that the fan contactor has closed the Digi-RTU start the VFD and ramps up and modulates the VFD speed.

When the system switches from running fan only to running fan and one compressor, Digi-RTU intercepts the compressor call from the unit and stops the VFD. Then it closes the BO for the first compressor and the compressor contactor closes while the fan contactor stays closed. After verifying the compressor contactor is closed, the Digi-RTU starts the VFD, ramps up and modulates the VFD speed.

When the system stages up the compressors, the Digi-RTU intercepts the next compressor call from the unit and stops the VFD. Then it closes the BO for the corresponding compressor and the compressor contactor closes while the closed contactor(s) remain closed. After verifying the new-started compressor contactor has closed, the Digi-RTU starts the VFD, ramps up and modulates the VFD speed.

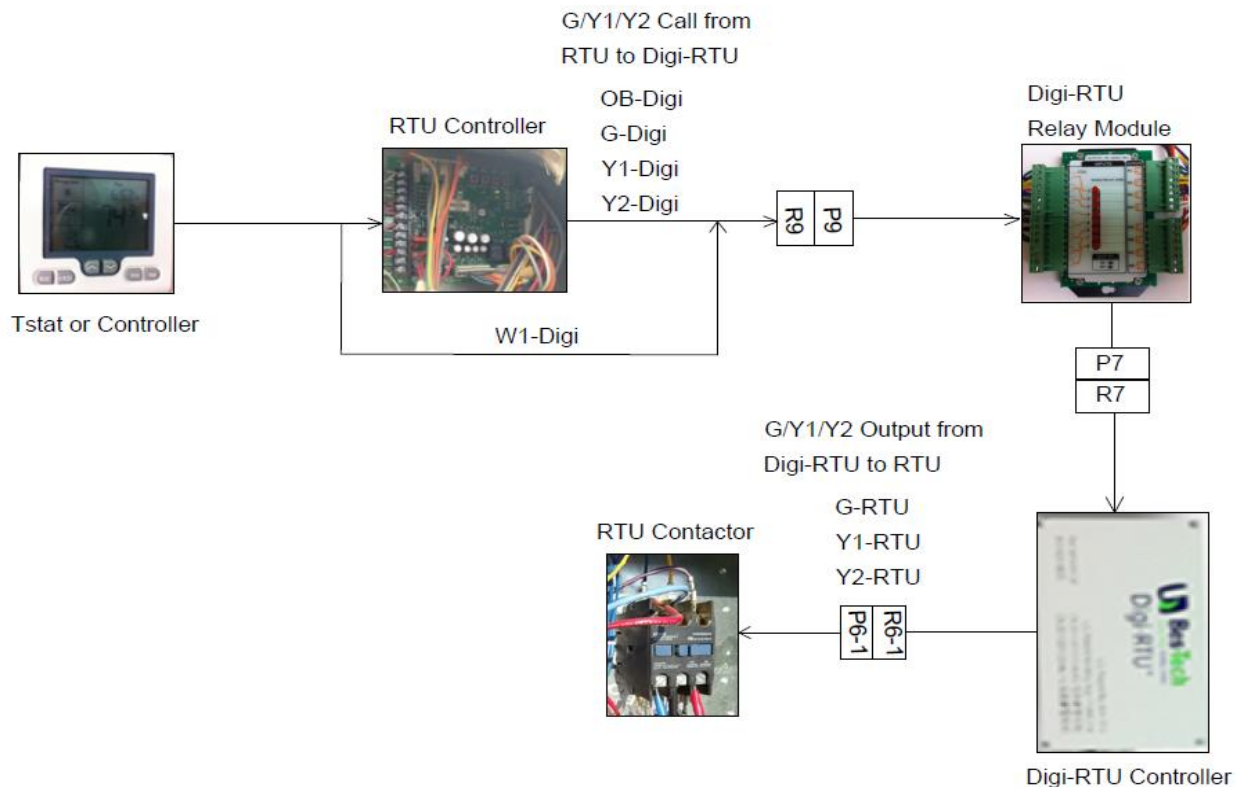


Figure 7: Digi-RTU call signal flow path

RTU11-3250-0001

 Digi-RTU does NOT stop the VFD if it receives a gas heat or electric heat call.

 Digi-RTU does NOT stop the VFD if one RTU component (except for the fan) is commanded from **ON** to **OFF**.

The following sequence is an example of how the Digi-RTU intercepts the fan, compressor and heater calls for a 2-stage unit.

- Fan (G) Call from the unit – VFD stops → 1018 BO-1 of Digi-RTU control module activates → Indoor Fan Contactor closes → VFD starts.
- Compressor 1 (Y1) Call from the unit → VFD stops → 1018 BO-2 of Digi-RTU control module activates → Compressor 1 Contactor closes → VFD starts.
- Compressor 2 (Y2) Call from the unit → VFD stops → 1018 BO-3 of Digi-RTU control module activates → Compressor 2 Contactor closes → VFD starts.
- Gas/Electric Heat 1 (W1) Call → VFD ramp up speed.

 The VFD enters **Stop** mode under the following conditions:

- No fan or compressor calls are being made.
- A compressor or fan is about to turn on.
- A compressor was tripped off by a unit performance fault.

Speed Control

Digi-RTU directly controls the speed of the RTU indoor supply air fan and compressor(s). Digi-RTU does NOT control the speed of the outdoor fan or modulate the heating capacity of the electric heater using VFD.

- **Fan Only:** If there is a fan call only, Digi-RTU keeps the fan running at a constant fan-only speed.
- **Compressor Cooling/Heating:** If a compressor is called on, as in cooling for a conventional RTU, or in both cooling and heating for a heat pump, Digi-RTU controls the indoor fan and compressor speed based on the difference between the return air temperature and its set point. The greater this temperature difference, the faster the fan and compressor speed.
- **Gas/Electric Heating:** If the gas or electric heating is called on, as in a conventional RTU, the fan speed modulates to maintain the supply air temperature set point. The larger the supply air temperature above the set point, the higher the fan speed.
- **Supply Air Temperature Low Limit Protection:** To protect indoor coils from freezing and causing low suction pressure at low cooling load, the supply fan speed increases if the current fan speed is less than a preset speed and supply air temperature is less than the low limit.
- **Supply Air Temperature High Limit Protection** (for heat pump only): To protect the indoor coil from heating damage and causing compressor high head pressure at low

RTU11-3250-0001

heating load, the supply fan speed increases if the current fan speed is less than a preset speed and supply air temperature is greater than the high limit.

Economizer Control

Digi-RTU applies integrated dry-bulb changeover economizer control strategy. When it is in cooling mode and the outdoor air temperature is below the economizer high limit, Digi-RTU opens the OA damper for free cooling. When outdoor air temperature is between supply air temperature set point and economizer high limit, the OA damper is modulated to maintain the supply air temperature set point while compressor(s) is brought on as needed. When outdoor air temperature is between supply air temperature set point and the economizer low limit, the OA damper is modulated to maintain the supply air temperature set point. The compressor(s) are lockout when outdoor air temperature is below the compressor lockout temperature. During the economizer mode, the fan speed is staged based on the load condition.

DCV Control

When return air CO₂ is above the DCV high limit and economizer is off, the Digi-RTU modulates the OA damper to maintain the return air CO₂ set point. When the OA dampers reach the high limit and the return air CO₂ is still above the DCV high limit, Digi-RTU modulate the indoor fan speed to maintain the return air CO₂ set point.

When fan is off and return air CO₂ is above the DCV high limit during occupied time, the Digi-RTU kicks on the indoor fan and opens OA damper until the return air CO₂ is below the DCV high limit by a control band.

Power Exhaust Fan Control

When it is in economizer mode and the OA damper position is greater than 65% (adjustable), then the Digi-RTU starts the power exhaust fan.

When it is in economizer mode and the OA damper position is less than 50% (adjustable), then the Digi-RTU stops the power exhaust fan.

Demand Response

Digi-RTU can perform Demand Response (DR) through Modbus or binary input signal.

When Digi-RTU receives DR signal through the Modbus from third party controller, the third party controller sends the DR enable, the demand limiting level, and the DR time duration to Digi-RTU. When the demand limiting level is higher than the compressor cooling minimum speed, Digi-RTU runs the HVAC unit at the set demand limiting speed. When the demand limiting level is between a predetermined load limiting minimum level and compressor minimum speed level, Digi-RTU runs the unit at the compressor minimum speed for a time that does not exceed a predetermined time limit. Then Digi-RTU locks out the compressor for a predetermined time period before the next operation cycle starts. When the demand limiting level is below the

RTU11-3250-0001

predetermined load limiting minimum level, Digi-RTU locks out the compressor and runs the indoor fan at the fan minimum speed.

When the demand limiting level is lower than the fan minimum speed, Digi-RTU shuts off the HVAC unit.

When Digi-RTU receives DR signal through the binary input, based on the demand limiting setting on the MCT, Digi-RTU runs the HVAC unit the same way as in Modbus DR mode.

RTU Maintenance and Service with Digi-RTU Installed

Functional Test

When perform RTU cooling and heating functional test, simply jumper 24VC to the Y1/Y2/W1/W2 terminal on RTU board or thermostat strip to bring on the cooling and heating stages.

When perform cooling and heating test, the VFD speed shall be overridden to 60Hz by changing VFD parameter d2-02 to 100%. The VFD speed can also be overridden by using Digi-MCT software. Make sure to change the parameter back to the normal after the test.

When perform the defrost cycle test for heat pump, the VFD speed shall be overridden to 60Hz as well.

If the economizer is available, refers to Digi-RTU economizer control strategy to perform economizer functional testing. The Digi-RTU OAT probe is installed inside the outdoor air intake hood.

Safety Test

The following RTU safeties are disabled after install Digi-RTU: fan proving safety, compressor proving safety, and phase protection. Digi-RTU itself provides the same safeties to RTU. Other RTU safeties are untouched.

Cleaning Coils

When perform the coil cleaning (evaporator coil, condenser coil), ensure that the Digi-RTU VFD and control module are protected from liquid getting inside.

RECOMMENDED MAINTENANCE

Periodic inspection every 3-6 months is recommended to check the Digi-RTU operation.

Conductors and Wirings

Inspect wiring and connections for discoloration, damage, or heat stress, inspect wire insulation and shielding for wear.

Terminals

Inspect terminals for stripped, damaged, or loose connections.

Sensor Probes

Inspect the sensor probe for loose mounting, loose wiring connection.

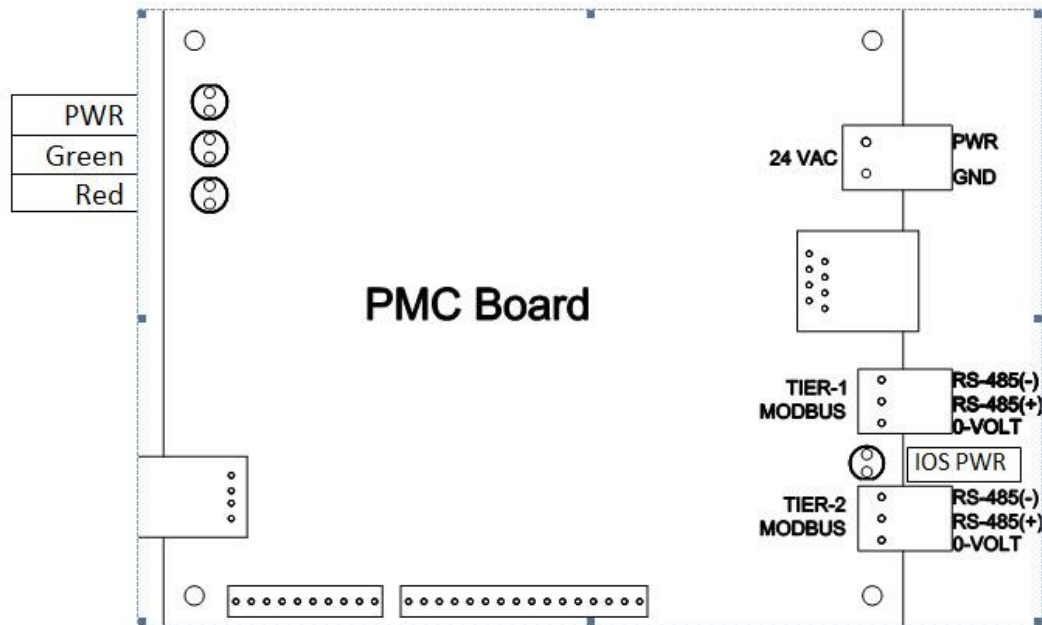
VFD

Inspect VFD terminals for stripped, damaged or loose connections. Check for tightness. Inspect VFD cooling fan for abnormal oscillation or unusual noise, or damaged or missing fan blades. Inspect for duct or other foreign materials collected on the heat sink surface. Inspect air intake and exhaust openings. They must be free from obstruction and properly installed. Replace the VFD cooling fan every three (3) to five (5) years.

DIAGNOSTIC AND STATUS LEDS ON THE DIGI-RTU

The Bes-Tech Digi-RTU *Performance Monitoring and Control (PMC)* and *Input/Output (I/O)* boards (1018 board) and *Relay Board* are fitted with *Light-Emitting Diodes (LEDs)* that are used to ascertain the status and diagnose problems. The figures below show the LED locations and functions.

PMC Control Board



Name	Function
PWR	This LED shows when that the board is powered
Green	This LED shows when the program is running
Red	This LED shows when the program is can't start or has a lack of power
IOS PWR	This LED shows when the RS-485 chips are functioning

Figure 8: Digi-RTU Main Control Board.

1018 I/O Strip

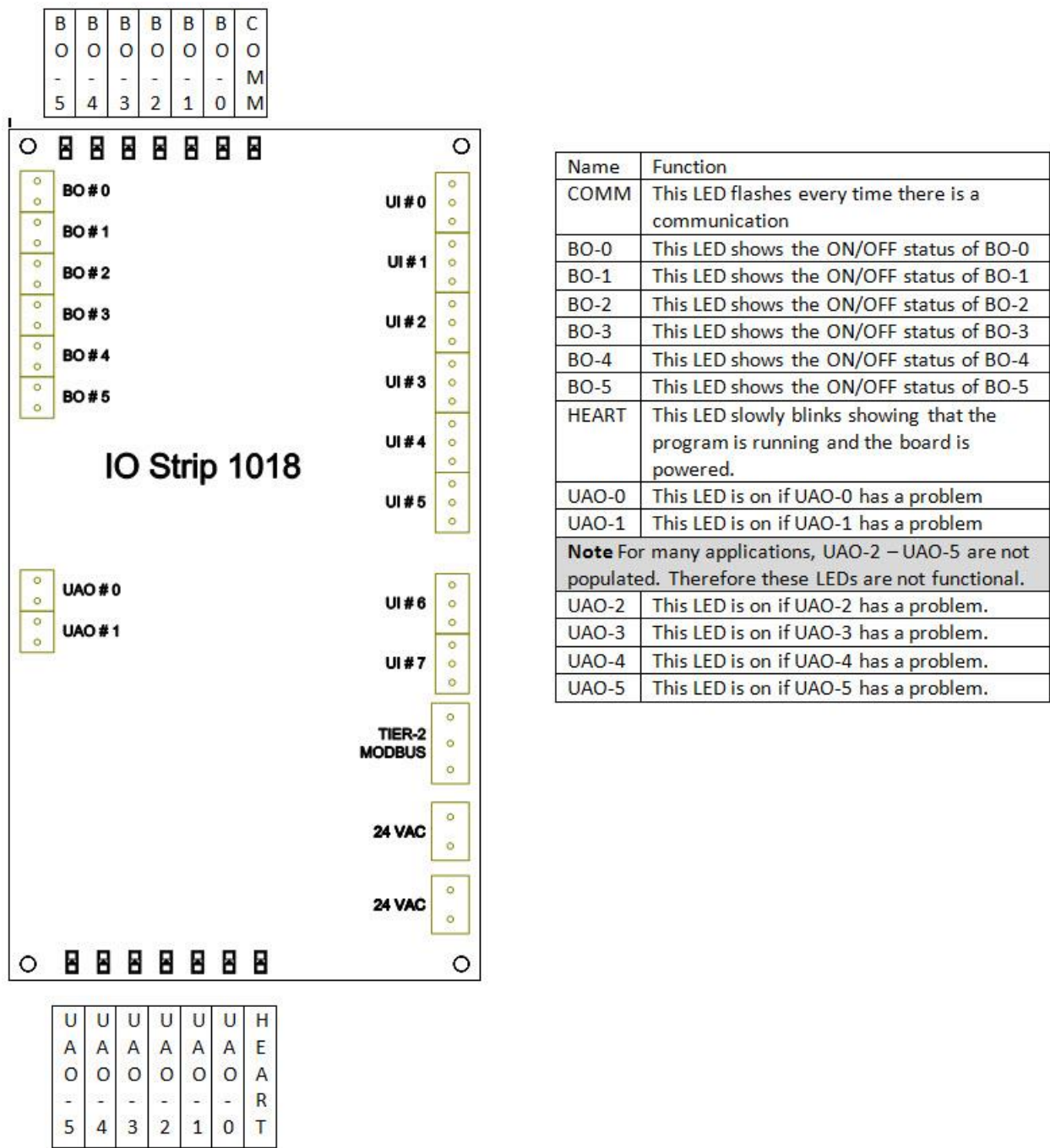


Figure 9: Digi-RTU 1018 I/O Board.

RTU11-3250-0001

Installed Module LED Locations

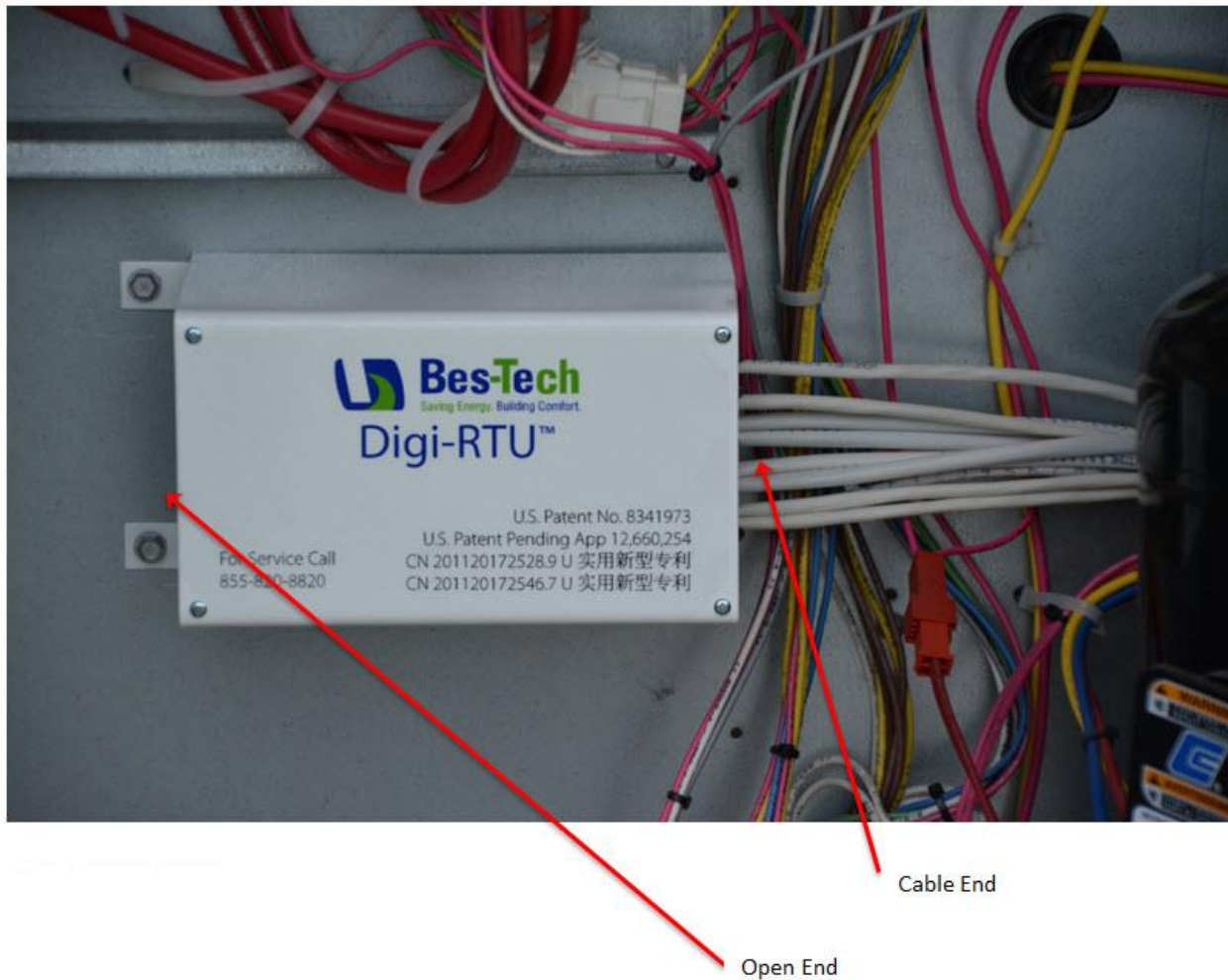


Figure 10: Installed Module LED Locations.

RTU11-3250-0001

Diagnosis LED Indicators

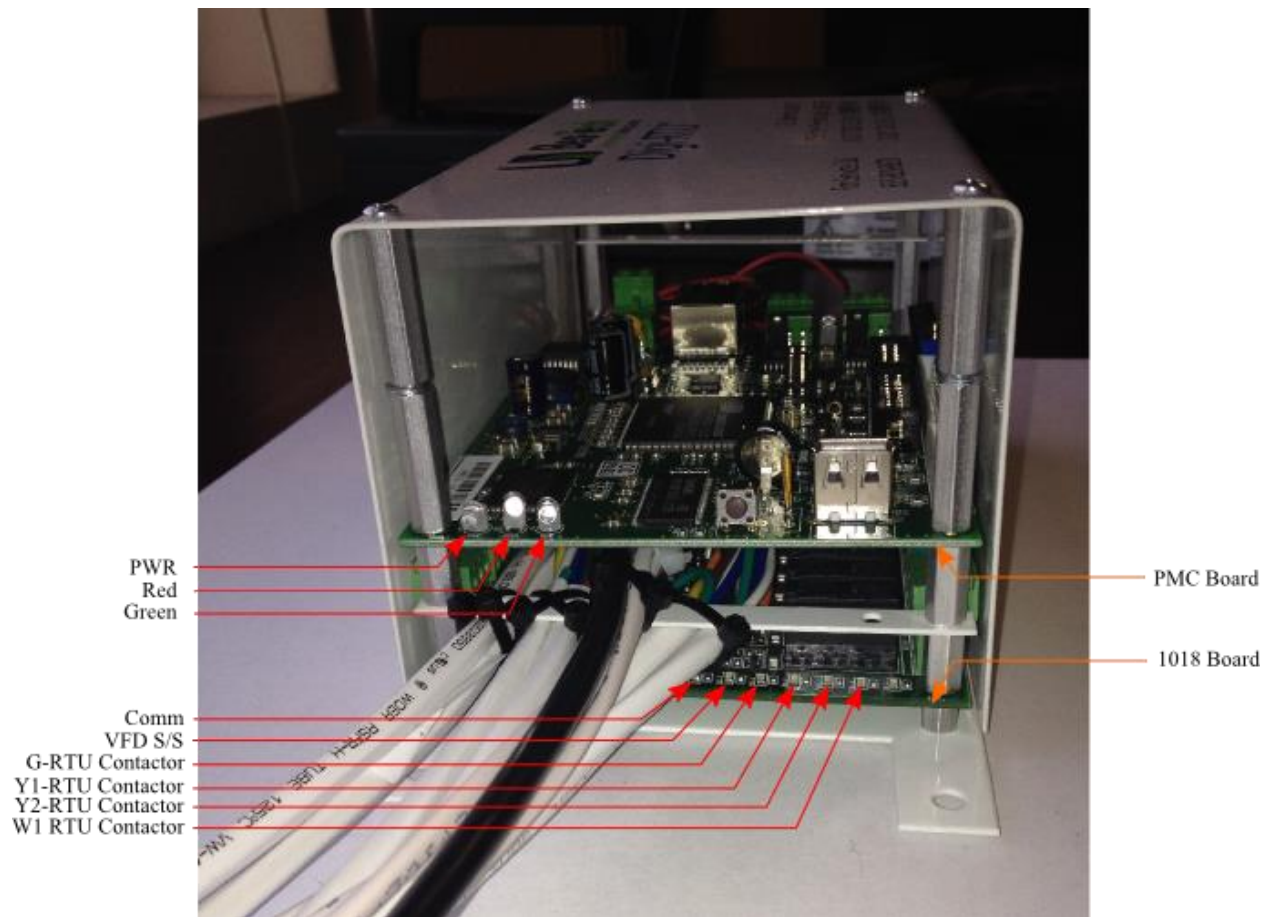


Figure 11: Digi-RTU Control Module

RTU11-3250-0001

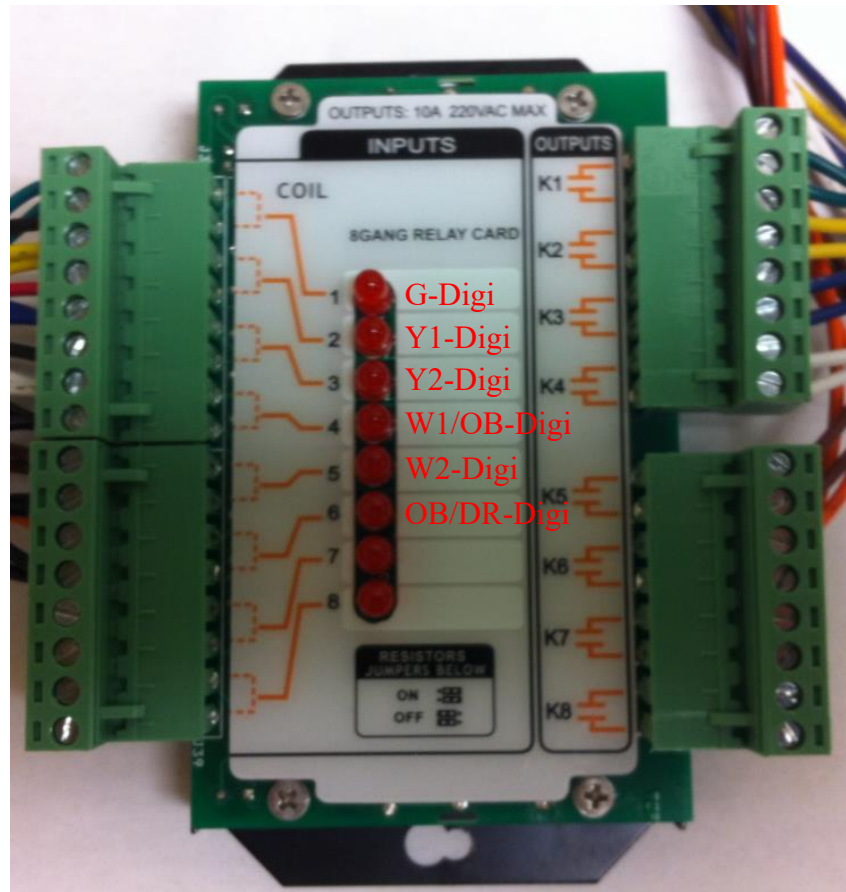


Figure 12: Digi-RTU Relay Module

TROUBLESHOOTING

This chapter presents resolutions to problems that may occur while operating the Digi-RTU.

Digi-RTU Signal Path

1. G, Y1, W1 (for RTU), W1/OB (for HP) calls are made by existing/new thermostat or BAS controller or master controller or master thermostat to the RTU control terminal board. W2 call is made by Digi-RTU controller.
2. The Y2 call is made when Y1 call is made by jumping Y1 call to Y2 terminal at RTU control terminal board.
3. RTU controller send out 24VC fan call and compressor call to Digi RTU relay board.
4. Digi RTU relay board corresponding relay input coil is energized (the LED light is on) and Digi-RTU controller receive the fan call and compressor call inputs.
5. Digi RTU controller turn on the BO for fan and compressor (LEDs on the bottom 1018 board) and there are 24VC goes to fan contactor and compressor contactor.
6. The W1 call signal goes to Digi RTU relay board as inputs.
7. Digi RTU relay board corresponding relay input coil is energized (the LED light is on) and Digi-RTU controller receive the W1 call input.

Digi-RTU Troubleshooting Case Studies

Compressor will not start, but indoor fan runs

Check whether Digi RTU has compressor call output (the BO light on?)

1. If Yes, then
 - a. Check whether there is 24VC on compressor contactor.
 - b. Check whether there is power to compressor.
 - c. Check for compressor overheat protection.
 - d. Check the compressor winding for short or open.
2. If No, then
 - a. Check whether there is 24VC on Y1 or Y2 at RTU terminal strip
 - b. Check whether economizer is on
 - c. Check whether the relay input Y1 or Y2 LED light on
 - d. Check whether there is fan proving switch
 - e. Check whether there is compressor lockout circuit

RTU11-3250-0001

RTU will not run

1. Check whether there is power to RTU
2. Check for RTU control transformer failure
3. Check for blown fuse on RTU main control board
4. Check for any RTU error codes
5. Check whether there is G/Y1/Y2/W1/W2 call on RTU terminals
6. Check whether there is any phase monitor/protection device
7. Check whether VFD has fault
8. Check VFD control wiring

Digi-RTU Communication Errors

1. The I/O boards: 1018 has a communication indicator LED on the board. Proper communication is indicated by 2 to 3 blinks and a flicker every 8-10 seconds.
2. One flicker every 8-10 seconds indicates a communication error.
 - a. Verify the Modbus address on the I/O boards: **High=0, Low=2 for 1018**. If incorrect, then correct it.
 - b. Verify proper polarity and connection of the communication cable.
 - c. Connect Digi-MCT directly to communication port on the I/O board. Verify baud rate is **9600** and parity is **8-N-1**.

Overall Troubleshooting Procedure

1. Check for any RTU power failure
2. Check for any blown fuse or failed control transformer of RTU
3. Check for any RTU error code
4. Check for any RTU safety protections
5. Check for any VFD faults
6. Check field wiring for secure connection
7. Check field wiring without mistakes
8. Reset RTU power
9. Replace the RTU control module

DIGI-RTU MCT TOOL

Set the Digi-RTU control module parameters based on the system configuration. The tool used to set the system parameters in the control module is the **Digi-MCT (Modbus Configuration Tool)** software. The software is available from Bes-Tech, and requires a laptop with Windows XP or later. Connection to the Digi-RTU control module is through the USB to RS-485 converter shown in *Figure 13*. This converter is also available from Bes-Tech.



Figure 13: USB to RS-485 Converter.

Connect the USB cable to the laptop, and connect the RS-485 cable to the Digi-RTU control module on the plug labeled **R25 (or P27)** plug.

Once the Digi-MCT program files have been obtained from Bes-Tech, place all files in a newly created directory on the laptop. Start the Digi-MCT program by double-clicking on the Digi-MCT application file.

Once the Digi-MCT program starts, select the correct serial port as shown in *Figure 14*.

Tip: click the refresh button a few times to make sure the correct COM port is shown in the drop down list.

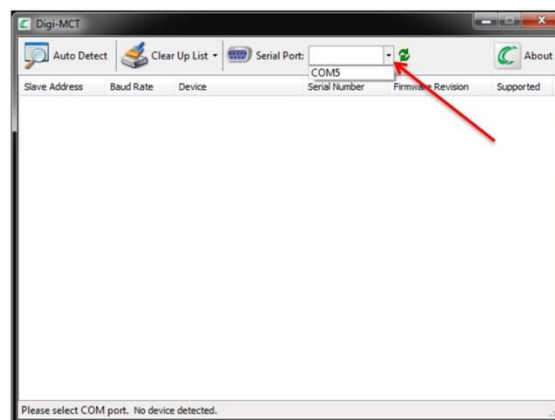


Figure 14: Selecting Serial Port.

Click on the **Auto Detect** button on the top left. The **Auto Detect Devices** menu pops up as shown in *Figure 15*.

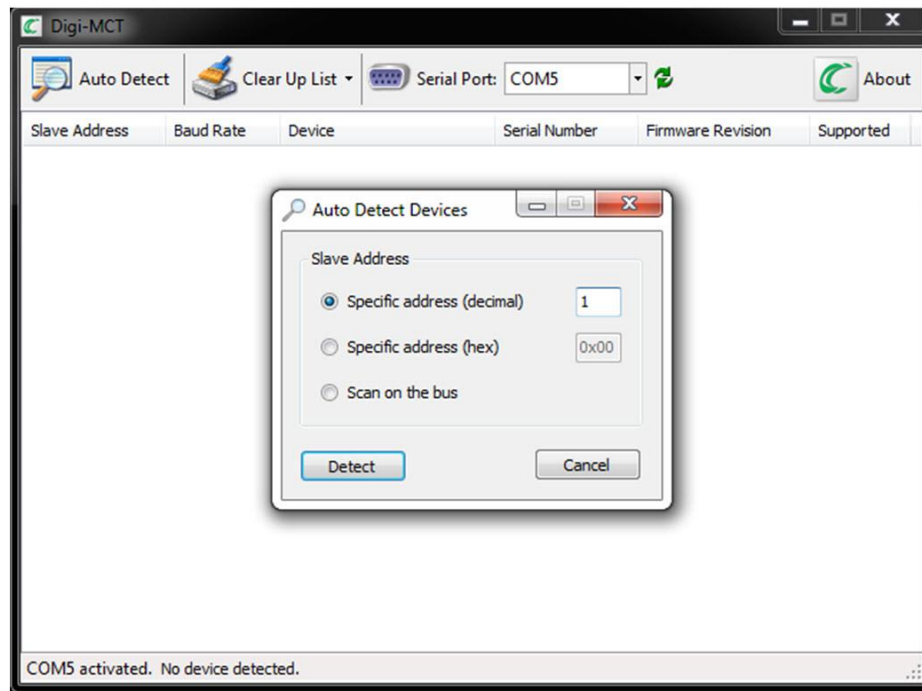


Figure 15: Auto Detect Devices Pop Up.

Click the button for the **Specific address (decimal)** and enter a value of **1** as shown in *Figure 15*. Click the **Detect** button.

Double-click on the Digi-RTU control module after it displays on the screen as shown in *Figure 16*.

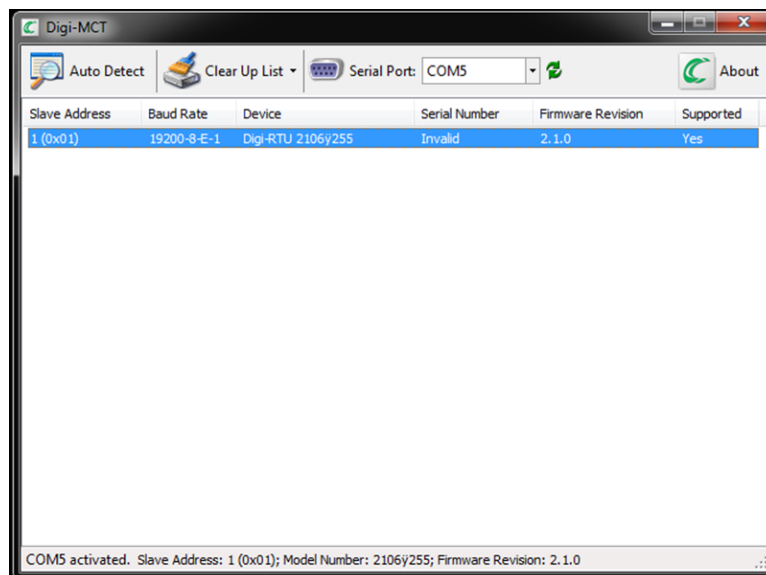


Figure 16: Digi-RTU Control Module.

The **Digi-RTU Configuration** window opens. Click on the **Current Value** tab and check the status value of Digi-RTU operation parameters shown on the left hand side of the screen in *Figure 17*.

The right hand side of the **Current Values** screen shows the override parameters and configuration parameters.

The screenshot shows the 'Current Values' tab of the Digi-RTU Configuration window. The window is divided into several sections:

- Digi Inputs:**
 - G Digi Input: **On**
 - Y1 Digi Input: **Off**
 - Y2 Digi Input: **Off**
 - W1 Digi Input: **Off**
 - O/B Status: **Off**
 - DR BI Value: **Off**
- Analog Inputs:**
 - SAT: **62.0° F**
 - OAT: **96.7° F**
 - CO2 PPM: **0 ppm**
 - Space Sensor RMat: **76.0° F**
- BO Outputs:**
 - G Status: **On**
 - Y1 Status: **Off**
 - Y2 Status: **Off**
 - W2 Status: **Off**
 - PEFanValue: **Off**
 - VFD Command: **On**
- Analog Outputs:**
 - VFD Speed: **20.0 Hz**
 - OA Damper: **0 %**
- Operation Status:**
 - Thermostat Mode: **0: Off**
 - Status: **Normal**
 - Demand Response: **Off**
 - Cooling Load: **0.00**
 - Heating Load: **-1.00**
 - IOS1018-1 Revision: **1.4.5**
- VFD Monitoring:**
 - VFD Current: **0.0 Amps**
 - VFD Power: **0.0 kW**
 - VFD Fault: **0**
 - VFD Alarm: **0**
 - VFD Rated Current: **0.0 Amps**
 - VFD Feedback Speed: **0.0 Hz**
- Override Values:**
 - VFD Speed Override: **60.1** Hz
 - OA Damp Override: **101** % Open
- BMS Parameters:**
 - BMS Room Air Temp: **10.0** Deg F
 - BMS Room Setpoint: **10.0** Deg F
- Demand Response Parameters:**
 - BMS Spd Limit Percent: **0.50**
- Fault Code:**
 - 0x0000: **NO_ERROR**
 - Total Tier2 Comm Error: **8**

At the bottom of the window, there are buttons for 'OK', 'Refresh', 'Apply', and 'Reset Device'.

Figure 17: Status Value of Digi-RTU Operation Parameters.

If the Tstat or BAS provides the binary Demand Response signal to Digi-RTU, user can click on the “Setup” tab and configure the demand response strategy for Digi-RTU as following:

Set the BI Spd Limit Percent according to the demand response control requirement.

DRTU11-3250-0001

If the BI Spd Limit is higher than the compressor minimum speed ratio of 0.67, which is calculated as the minimum speed default of 40Hz divided by 60Hz, the compressor will run at a speed ratio equal to the BI Spd Limit level.

If the BI Spd Limit is higher than a predetermined limit of 0.13 given a minimum speed of 40Hz and a minimum compressor operation time of 3min, the compressor will be cycled to ensure the BI Spd limit level.

If the BI Spd Limit is lower than 0.13, the unit will run the fan only during the DR event.

If the BI Spd Limit is lower than 0.06, it will shut off the unit during DR event.

The screenshot shows the 'Setup' window for a Digi-RTU. The 'Setup' tab is selected, indicated by a red arrow. The window is divided into several sections:

- Digi-RTU Config:**
 - Unit Type: RTU (0x00)
 - Digi-RTU Option: SS/Existing Stat (0xC)
 - HP Reversing Valve: ENERGIZE_ON_COOL
 - Economizer Enable: OP Control (0x01)
 - DCV Enable: Off (0x00)
 - Num of Heat: 2
 - HP Aux Heat Avail: NO (0x00)
 - PEFan Enable: ON (0x01)
 - Zone Sensor: YES (0x01)
 - Stage 2 Wait Long: 10 Sec
- CO2 / DCV Settings:**
 - CO2 Deadband: 100 PPM
 - CO2 Setpoint: 1000 PPM
 - OAD High Limit: 40 % Open
 - IAQ VFD Max Speed: 48.0 Hz
- Tier 1 Communication Setup (BMS only):**
 - Slave Address: 1
 - Baud Rate: 19200 bps
 - Data-Parity-Stop Bits: 8-E-1
 - Extra Delay Time: 0 ms
- Min/Max Speed Setup:**
 - Fan Only Speed: 20.0 Hz
 - Comp Cool Min Speed: 40.0 Hz
 - HP Comp Htg Min Speed: 45.0 Hz
 - Maximum VFD Speed: 60.0 Hz
- Economizer Setup:**
 - Comp LockOut OAT: 0.0 Deg F
 - Econ OAT High Limit: 65.0 Deg F
 - OA Damp Min: 0 % Open
 - OA Damp Min Out: 2000 uA/mV
 - OA Damp Max Out: 10000 uA/mV
 - Econ oadHL SAT High: 58.0 Deg F
 - Econ oadHL SAT: 47.0 Deg F
 - Econ RMAT Inc LL: 0.7 Deg F
 - Econ RMAT Inc ML: 1.2 Deg F
 - Econ RMAT Inc HL: 2.0 Deg F
- EC Fan Control Setup:**
 - VFD Analog Output Min: 0 uA/mV
 - VFD Analog Output Max: 10000 uA/mV
- Demand Response Setup (highlighted with a red box):**
 - DR Method Selection: BMS (0x00)
 - BI Spd Limit Percent: 0.60

Buttons at the bottom: OK, Refresh, Apply, Reset Device.

Figure 18: Status Value of Digi-RTU Operation Parameters.

After make changes, click **Apply** then **OK**. Exit the MCT software tool by clicking on the red button with the X on it.

DIGI-RTU MODBUS-RTU COMMUNICATION REGISTER LIST

Serial Communication Specifications

The following table shows the MODBUS-RTU communication specifications.

Serial Communication Specifications

Supported baud rates	2400, 4800, 9600, 19200, 38400 bps
Coding system	8-bit binary
Bits per byte	1 start bit 8 data bits, LSB first Configurable parity and stop bits (8-N-1/8-N-2/8-E-1/8-O-1)
Error checking	CRC (using polynomial value 0xA001)
Supported function codes	0x03 (Read Holding Registers) 0x04 (Read Input Registers) 0x06 (Preset Single Register) 0x10 (Preset Multiple Registers)

MODBUS Registers

The following table shows the MODBUS registers accessible by the user. Use these registers to acquire device information and measurement values, read and change settings, etc. All Registers below are holding registers.

MODBUS Registers Description

Address	R/ W	Type	Description
40001 (0x000)	R	UINT16	Manufacturer's Identifier Register 40001 holds a constant decimal value of 17219 (0x4343) indicating that the device is a DTL product.
40002 (0x001)	R	UINT16	Model Number Register 40002 holds a constant decimal value of 8450 (0x2102) indicating the model number of the device.
40003 (0x002)	R	UINT16	Generation and Variation Code Register 40003 holds an ASCII character 'B' in the higher byte, and an 8-bit integer (depending on the barometer option) in the lower byte.
40004 (0x003)	R	UINT16	Firmware Revision Number Register 40004 holds the firmware revision number as 16 bits in the format MMMM mmmm RRRRRRRR, where 'M', 'm' and 'R' stand for major, minor and revision number bits respectively. For example, hex value 0x101F stands for revision number "1.0.31".

MODBUS Registers Description

Address	R/ W	Type	Description																								
PCBA Manufacturing Date Code																											
40005 (0x004)	R	UINT16	Register 40005 holds the PCBA manufacturing date code as two bytes. The first byte stands for the year, and the second byte stands for the week, e.g. hex value 0x082C stands for date code 0844, which means the device is manufactured in week 44, 2008.																								
PCBA Serial Number																											
40006 (0x005)	R	UINT16	Register 40006 holds the PCBA serial number.																								
Tier 1(BAS) Serial Communication Address																											
40009 (0x008)	R/W	UINT16	Register 40009 holds the address of the tier 1 Modbus communication serial port. The new setting will be applied at next start up (power-on or reset). The factory default setting is 0x01.																								
Tier 1(BAS) Serial Communication Settings																											
Register 40010 holds the baud rate and parity/stop bit settings of the tier 1 modbus serial communication port. The valid values are shown below: The factory default setting is 0x0802: 19200-8-E-1.																											
40010 (0x009)	R/W	UINT16	<table><tr><th colspan="2">Higher Byte</th><th colspan="2">Lower Byte</th></tr><tr><td>0x01</td><td>2400 bps</td><td>0x00</td><td>8-N-1</td></tr><tr><td>0x02</td><td>4800 bps</td><td>0x01</td><td>8-N-2</td></tr><tr><td>0x04</td><td>9600 bps</td><td>0x02</td><td>8-E-1</td></tr><tr><td>0x08</td><td>19200 bps</td><td>0x03</td><td>8-O-1</td></tr><tr><td>0x10</td><td>38400 bps</td><td></td><td></td></tr></table>	Higher Byte		Lower Byte		0x01	2400 bps	0x00	8-N-1	0x02	4800 bps	0x01	8-N-2	0x04	9600 bps	0x02	8-E-1	0x08	19200 bps	0x03	8-O-1	0x10	38400 bps		
			Higher Byte		Lower Byte																						
			0x01	2400 bps	0x00	8-N-1																					
			0x02	4800 bps	0x01	8-N-2																					
			0x04	9600 bps	0x02	8-E-1																					
			0x08	19200 bps	0x03	8-O-1																					
0x10	38400 bps																										
The new setting will be applied at next start up (power-on or reset).																											
Device Reset																											
40011 (0x00A)	W	UINT16	Register 40011 is a special (write only) register used to reset the device via RS-485 bus. If the value 21930 (0x55AA) is written to this register, the device will restart immediately.																								
Tier 2(I/O) Serial Communication Settings																											
Register 40015 holds the baud rate and parity/stop bit settings of the tier 2 Modbus serial communication port. The valid values are shown below: The factory default setting is 0x0802: 9600-8-N-1.																											
40015 (0x00E)	R/W	UINT16	<table><tr><th colspan="2">Higher Byte</th><th colspan="2">Lower Byte</th></tr><tr><td>0x01</td><td>2400 bps</td><td>0x00</td><td>8-N-1</td></tr><tr><td>0x02</td><td>4800 bps</td><td>0x01</td><td>8-N-2</td></tr><tr><td>0x04</td><td>9600 bps</td><td>0x02</td><td>8-E-1</td></tr><tr><td>0x08</td><td>19200 bps</td><td>0x03</td><td>8-O-1</td></tr><tr><td>0x10</td><td>38400 bps</td><td></td><td></td></tr></table>	Higher Byte		Lower Byte		0x01	2400 bps	0x00	8-N-1	0x02	4800 bps	0x01	8-N-2	0x04	9600 bps	0x02	8-E-1	0x08	19200 bps	0x03	8-O-1	0x10	38400 bps		
			Higher Byte		Lower Byte																						
			0x01	2400 bps	0x00	8-N-1																					
			0x02	4800 bps	0x01	8-N-2																					
			0x04	9600 bps	0x02	8-E-1																					
			0x08	19200 bps	0x03	8-O-1																					
0x10	38400 bps																										
Extra Communication Delay																											
40017 (0x010)	R/W	UINT16	Register 40017 holds an unsigned integer value from 0 to 100, defining the extra communication delay in milliseconds (0 to 100 ms). The factory default setting is 0: no extra delay.																								

Monitoring/Control Registers

The following registers are used for monitoring or controlling the Digi-RTU unit through a Building Automation System(BMS)

Address	R/W	Type	Description
G Status			
40257 (0x100)	R	UINT16	Register 40257 holds the current G call. A value of 1 represents a call for G to be on, and a value of 0 represents a call for the G to be off.
Y1 Status			
40258 (0x101)	R	UINT16	Register 40258 holds the Y1 Call. A value of 1 represents a call for Y1 to be on, and a value of 0 represents a call for Y1 to be off.
Y2 Status			
40259 (0x102)	R	UINT16	Register 40259 holds the Y2 Call. A value of 1 represents a call for Y2 to be on, and a value of 0 represents a call for Y2 to be off.
W2 Status			
40260 (0x103)	R	UINT16	Register 40260 holds the W2 Call. A value of 1 represents a call for W2 to be on, and a value of 0 represents a call for W2 to be off.
PE Fan Status			
40261 (0x104)	R	UINT16	Register 40261 holds the PE Fan Call. A value of 1 represents a call for PE Fan to be on, and a value of 0 represents a call for PE Fan to be off.
VFD Speed			
40263 (0x106)	R	UINT16	Register 40263 holds the current commanded VFD speed. The register holds a value between 0 and 600 representing a speed between 0 and 60.0 Hz with one decimal place.
Outdoor Air Damper			
40264 (0x107)	R	UINT16	Register 40264 holds the current value of the outdoor air damper position.
OB Status			
40273 (0x110)	R	UINT16	Register 40273 holds the OB Call. A value of 1 represents a call for OB to be on, and a value of 0 represents a call for OB to be off.
W1 Status			
40277 (0x114)	R	UINT16	Register 40277 holds the W1 Call. A value of 1 represents a call for W1 to be on, and a value of 0 represents a call for W1 to be off.
Supply Air Temperature			
40279 (0x116)	R	UINT16	Register 40279 holds the current supply air temperature in degrees Fahrenheit. The register holds a value between 0 and 511 representing a temperature between 0 and 511 °F.

			Outdoor Air Temperature
40280 (0x117)	R	UINT16	Register 40280 holds the current value of the outdoor air sensor in degrees Fahrenheit. The register holds a value between 0 and 511 representing a temperature between 0 and 511 °F.
			CO2 Parts Per Million
40281 (0x118)	R	UINT16	Register 40281 holds the current value of the CO2 ppm
			SS_RMAT
40282 (0x119)	R	UINT16	Register 40282 holds the space sensor type Room air temperature. The register holds a value which is 10 times of the real temperature.
			Current Heating/Cooling Mode
			Register 40305 holds the current mode of the RTU system. The valid values are represented below.
40305 (0x130)	R	UINT16	Value
			0x0000 Off Mode
			0x0001 Heat Mode
			0x0002 Cool Mode
			Status of Current Mode
			Register 40306 holds the current run mode of the system
40306 (0x131)	R	UINT16	Value
			0x0000 Normal
			0x0001 Startup
			0x0002 Oil return
			0x0003 Economizer
			0x0004 Fault
			0x0005 Overload Protection
0x0006 Defrost			
			Cooling Load
40308 (0x133)	R	UINT16	Register 40308 hold the amount of cooling the system requires. The register holds a value between -100 and 100 representing an amount of cooling needed between -1 and 1 with two decimal places.
			Heating Load
40309 (0x134)	R	UINT16	Register 40309 holds the amount of heating the system requires. The register holds a value between -100 and 100 representing an amount of cooling needed between -1 and 1 with two decimal places.
			SS_RMAT_Cool_SP
43890 (0xF31)	R	UINT16	Register 43890 holds the space sensor type room air temperature cooling set point. The register holds a value which is 10 times of the real cooling set point.

43891 (0xF32)	R	UINT16	SS_RMAT_Heat_SP	
			Register 43891 holds the space sensor type room air temperature heating setpoint. The register holds a value which is 10 times of the real heating set point.	
40307 (0x132)	R	UINT16	Demand Response Mode	
			Register 40307 holds the current run status of the demand response mode. A value of 1 means its active fan only and a value of 2 means cooling can be active	
40321 (0x140)	R	UINT16	System Fault Code	
			Register 40321 holds the current system fault information. This value is a bit masked value with each bit taking on a different error. A value of 0 represents no error in the system.	
			Bit	
			0x0001	TStat Comm
			0x0002	IO Comm
			0x0004	VFD Comm
40545 (0x220)	R/W	UINT16	0x0008	CO2 Fault
			0x0800	VFD Fault
40609 (0x260)	R/W	UINT16	VFD Speed Override	
			Register 40545 holds the VFD speed override value. The register holds a value between 0 and 600 representing a speed between 0 and 60.0 Hz with one decimal place. Any value above 600 will be interpreted as no override.	
40801 (0x320)	R/W	UINT16	Outdoor Air Damper Override	
			Register 40609 holds the override value for the outdoor air damper. Any value over 100 is interpreted as no override.	
40806 (0x325)	R/W	UINT16	Control Band	
			Register 40801 holds the control band for speed control when using BMS or Modbus thermostats. This number is limited to numbers between 1 through 4.	
			Space Sensor Control Band	
			Register 40806 holds the control band for speed control when using Space Sensor or Existing thermostats. The register holds a value between 10 and 50 representing a number between 1 and 5 with one decimal place.	

Building Management System Controls

The following registers are for the BAS to use to control the temperature and the temperature set point for a BAS controlled thermostat.

Address	R/W	Type	Description
44097 (0x1000)	W	UINT16	Demand Response Start Register 44097 holds the start command for starting the control sequence for demand response. Any number above 0 will start the sequence. Note that the timer will not be reset if sent again and is treated as a second start signal when the first one is finished.
44098 (0x1001)	R/W	UINT16	Demand Response Limit Register 44098 holds the percentage limit that the system will reduce the speed by. The register holds a number between 0 and 100 representing a number between 0 and 100%.
44099 (0x1002)	R/W	UINT16	Demand Response Time Register 44099 holds the amount of time the system will run for when given the demand response start signal. The time range that can be given is 0 to 600 minutes.
44433 (0x1150)	R/W	UINT16	Room Air Temperature BMS control Register 44433 holds the control of the room air temperature when the BMS is in control of the thermostat. The register holds a value between 0 and 1200 representing a temperature between 0 and 120°F with one decimal place.
44434 (0x1151)	R/W	UINT16	Room Air Temperature Set Point BMS control Register 44434 holds the control of the room air temperature set point when the BMS is in control of the thermostat. The register holds a value between 0 and 1200 representing a temperature between 0 and 120°F with one decimal place.
44435 (0x1152)	R/W	UINT16	SAT BMS Control Register 44435 holds the control of the supply air temperature when the BMS is in control of the sensor. The register holds a minimum value of 0. A value of 120 is represented a temperature of 120°F.

BES-TECH PRODUCT WARRANTY

“Bes-Tech Product” includes Digi-RTU, Digi-SAH, Digi-CARC, Digi-CRAH, and Digi-VAV.

1. Building Energy Solutions & Technology, Inc. d.b.a. Bes-Tech, Inc. (hereinafter Bes-Tech), warrants that at the time of shipment, new and unused products sold by Bes-Tech shall be free from defects in materials and workmanship. Bes-Tech warrants that for a period of one (1) year from the date of the product shipment. If any part is found to be defective, Bes-Tech will, at its sole discretion and as Buyer's exclusive remedy, either repair, or replace the part. The product will be warrantied only if the product is used under normal conditions for which it was designed and installed, operated and maintained in accordance with Bes-Tech's instructions, and in accordance with generally accepted industrial practices. Products repaired or replaced during the warranty period shall be covered only for the duration of the original warranty period. Buyer's sole remedy for a breach of this warranty is limited to further service, a refund, or credit of the amount paid by Buyer, at Seller's option.
2. Bes-Tech's warranty obligation shall be conditional upon receipt by Bes-Tech of written notice of any alleged defects within sixty (60) days after discovery. Bes-Tech will not be responsible for unauthorized repairs to any products, even if defective. Bes-Tech shall not be responsible for any products which have been altered, abused, misused, improperly installed, repaired, for any loss, damage, defect, claim, or non-performance resulting from or attributable to Buyer's modifications. Longer warranty periods do not apply, except as agreed in writing and signed by an authorized Bes-Tech representative.
3. Where Buyer orders non-stock products or parts manufactured by a third-party, Bes-Tech will pass through to Buyer any warranty of the manufacturer. As to such items, Buyer's sole remedy for breach of warranty shall be the remedy offered by and available from the manufacturer, if any.
4. Bes-Tech's warranty herein is in lieu of and excludes all other Bes-Tech warranties. Bes-Tech disclaims all other warranties, whether express, implied, or statutory, including but not limited to any implied warranties of merchantability and/or fitness for a particular purpose or use.
5. Under no circumstances shall Bes-Tech be liable to Buyer or any entity for any special, indirect or consequential damages. Whether the damages arise from breach of contract, tort, negligence, misrepresentation, strict liability, including lost profits, impairment of goods, work stoppage or otherwise, or in any way arising out of or related to products or services supplied by Bes-Tech or any transaction to which these standard terms apply. The maximum liability of Bes-Tech, includes, but is not limited to, with respect to the design, manufacture, sale, delivery, resale, inspection, assembly, installation, testing, repair, replacement, maintenance, use of any product, or the performance of any service, and shall not exceed the terms of maintenance, use of any product, or the performance of any service and shall not exceed the purchase price paid to Bes-Tech.

The following warranty terms and conditions apply only to Digi-RTU, Digi-CRAC, and Digi-SAH, not to Digi-CRAH or Digi-VAV.

6. *Thirty (30) days compressor and fan motor warranty:* this product warranty, expressly and solely for parts, shall cover for a period of thirty (30) days, damage caused to the compressor(s) and indoor air fan motor of the unit on which the Digi-RTU/CRAC/SAH was installed, against damage directly caused by improper installation or caused by the function of Digi-RTU/CRAC/SAH, This warranty only applies to equipment when installed by a Bes-tech Authorized agent. This thirty (30) day warranty is only for parts.
 - o Compressor and fan 2-years old or less are reimbursed 100%
 - o Compressor and fan greater than 2 years and less than 5 years old are reimbursed at 50%
 - o Compressor and fan greater than 5 years old and less than 7.5 years are reimbursed at 25%
7. *Extended Warranty:* Bes-Tech warrants that for an extended period from the date the Digi-RTU/CRAC/SAH installation, if the Digi-RTU/CRAC/SAH and/or compressor are found to be defective, Bes-Tech will, at its sole discretion and as Buyer's exclusive remedy, either repair or replace the Digi-RTU/CRAC/SAH and/or compressor; The Digi-RTU/CRAC/SAH will be warrantied only if the product is used under normal conditions for which it was designed and installed, operated and maintained in accordance with Bes-Tech's instructions and in accordance with generally accepted industrial practices. Products repaired or replaced

DRTU11-3250-0001

during the warranty period shall be covered by the foregoing warranty for the remainder of the original warranty period. Buyer's sole remedy for a breach of this extended warranty is limited to further service, a refund, or credit of the amount paid by Buyer, at Seller's option. This extended warranty is only for parts.

8. The extended warranty is subjected to the following constraints and fee structure:
- For compressors less than five (5) years old, the annual extended warranty fee is 6% of the Digi-RTU cost. The maximum extended warranty is five (5) years. For compressors less than seven and half (7.5) years old but greater than five (5) years old, the annual extended warranty fee is 8% of the Digi-RTU cost. The maximum extended warranty is three (3) years.
 - For compressors less than ten (10) years old but greater than 7.5 years old, the annual extended warranty fee is
 - 10% of the Digi-RTU cost. The maximum extended warranty is two (2) years.

DIGI-RTU® WARRANTY REGISTRATION FORM

Complete the following information and email it after products installed to warranty@bes-tech.net

Buyers will receive a confirmation for the registration.

Products Installation (Building) location:

Address:

City: State:
ZIP Code: Country:

Contact Name:
Phone#: () Email:

Dealer or Installer or Service Information:

Address:

City: State:
ZIP Code: Country:

Contact Name:
Phone#: Email:

Project Name:

Unit Tag #	Unit Manufacturer	Unit Model Number	Bes-Tech Product Serial #	Bes-Tech Product Firmware	Installation Date

If you bought extended warranty, finish following form

How many years extended warranty on the compressor?

Unit Tag #	Compressor #	Compressor Manufacturer	Compressor Model	Compressor Serial#

CONTACT INFORMATION

Please contact Bes-Tech, Inc. using one of the following methods:

Street Address

Omaha, Nebraska 6916 N. 97th Circle, Bldg. B, Suite J, MB. 13
Corporate Headquarters Omaha, NE 68122

San Jose, California 2635 North 1st Street, Suite 118
San Jose, CA 95134

Phone Numbers

Omaha, Nebraska Tel: 402.502.2340
Corporate Headquarters Fax: 402.502.2283

San Jose, California Tel: 408.824.1344

Product Support Tel: 402-625-3624

E-mail Address

Sales: sales@bes-tech.net

Product Support: Support@bes-tech.net

Warranty and Claims: warrantyandclaims@bes-tech.net

Website

<http://www.bes-tech.net/>