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IS READ IN ITS ENTIRETY**

Zlinx series
Wireless Modbus I/O Modules

Models:
RT12-0044-ZP-12
RT12-2222-ZP-12
RT12-4444-9T-W20

Documentation Number: RT-12 series-4006m (pn#7331)

*This product designed and manufactured in Ottawa, Illinois USA
of domestic and imported parts by*



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RT12-4444-9T-W20



RT12-0044-ZP-S12



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Chapter 1 – Introduction

Theory of Operation

This manual will refer to two types of SCADA communications topologies, Peer to Peer (P2P) and Modbus.

The Peer to Peer topology consists of one “Master” and one “Slave” RTU. Analog and digital I/O is communicated between the Master and Slave.

The Modbus topology consists of one Modbus Master, and as many as 255 Modbus slaves. The Modbus master is responsible for requesting data from a respective Modbus slave.

The ‘RT’ series RTU’s have several unique functions and features and has been designed to replicate a wired sensor system. Transmission distances of up to 40 miles (64 km), (depending on the radio type and with modified antennas), user programmable sample/polling rates from 10 samples/sec to one sample every 20 seconds, programmable transmission retries, user programmable “full scale” engineering units allow users to enter full scale for a respective sensor, just to name a few.

The hardware architecture for RT series RTU’s are identical. Number of analog or digital I/O depends on the type of RTU. Each respective RTU has Bi-directional analog signal flow.

Other features include:

- Battery backup and in-circuit charging system,
- MODBUS-RTU-Slave Enhancements,
- Programmable main voltage failure alarm,
- Low and high input voltage alarm,
- Communications failure alarm,
- Programmable resting voltages on communication failure,
- Programmable Output to Active High or Low during Communications Failure,
- Report by exception if a respective input changes by a +/- percentage,
- Configurable Inputs to Digital, Frequency or Accumulator/Total.

An enhanced monitoring and configuration windows based program, allows you to configure each controller as well as monitor data.

Your system may consist of two RT type wireless analog bridges or RTU. In Peer to Peer mode, one controller must be programmed as the **master** and the other as the **slave**. It is critical that your system be programmed properly. Confirm your system configuration before using your system.

All configuration parameters may be retrieved by connecting to the respective device’s serial configuration port. The wireless type and other parameters may be adjusted or viewed.

For Peer-to-Peer mode, check and confirm the following:

___ Your system consists of one MASTER and one SLAVE. Do not allow two masters or two slaves to communicate with each other. The devices may communicate but a systems failure will occur.

___ Make sure the system ID’s and RF-Network ID’s match.

WARNING:

ID numbers for the Master and Slave must match and must not be repeated with any other Master/Slave pairs with the same RF-Network ID within the radio range of each respective wireless pair. Doing so will cause cross talk between master/slave pairs.

___ Make sure both Master and Slave have an antenna attached and installed correctly.

___ Make sure that the input power supply does NOT exceed 28 Vdc.

___ Make sure that the input power supply does NOT fall below 8.5 Vdc.

___ When power is applied to both the master and slave both units will communicate with each other.

For Modbus Slave RTU mode, check and confirm the following:

___ Your system does **not** consist of two RT RTU/devices with the same Slave ID numbers.

___ Each RTU/device has the same Radio ID and RF-Network ID numbers. Your Modbus Master device will need to be connected to our Packaged Modbus Modem (PMM) and will need to be configured with the same Radio ID and RF-Network ID numbers as the Modbus Slave devices. The PMM may be configured to allow for an RS-232 or RS-485 communications port.

Modbus Overview

This section is written for the person who will use the RT series RTU's with Modicon Modbus protocols for communication in Modicon programmable controller applications. It describes the different types of Modbus registers supported. The RT Series RTU's support Modbus, Slave RTU mode.

The Modbus protocol provides the internal standard that the Modicon controllers use for parsing messages. During communications on a Modbus network, the protocol determines how each controller will know its device address, recognize a message addressed to it, determine the kind of action to be taken, and extract any data or other information contained in the message.

All of the RT series RTU's use a common Modbus communications protocol. All data is sent and received raw units.

Engineering Note: It may be necessary to force your PLC or Modbus master device to delay between Modbus packet transmissions. Some devices transmit without a break in data packets. Because of the nature of half-duplex radio you may need to configure or program your device with a 30-50 mS delay between packets and a 1.5-2.0 second timeout.

Modbus Data: Some Modbus devices send data differently than others. This example shows Slave address 9, using function 3 and 16. It also shows the full data address of 40001. The RT series RTU's do not send the full address. The Modbus protocol allows a system to assume the data address based on the function type. This is true of all Modbus functions for the RT series RTU's.

```
09 03 9C 40 00 01 91 7E
09 10 9C 40 00 01 02 00 00 9E 54
```

```
09 = Slave 9
03 = Read Holding Registers
9C = Starting Address High -\
40 = Starting Address Low -/ 40001
00 = Number of Points High-\
01 = Number of Points Low -/ Read 1 Point
91 = Check Sum
7e = Check Sum
```

This is an example showing what data would look like for the RT series RTUs.

```
09 = Slave 9
03 = Read Holding Registers
00 = Starting Address High -\
00 = Starting Address Low -/ 40001
00 = Number of Points High-\
01 = Number of Points Low -/ Read 1 Point
91 = Check Sum
7e = Check Sum
```

Modbus Functions Supported

01 Read Coil Status: Reads the ON/OFF status of discrete outputs (0X references, coils) in the slave. Broadcast is not supported.

02 Read Input Status: Reads the ON/OFF status of discrete inputs (1X references) in the slave. Broadcast is not supported.

03 Read Holding Registers: Reads the binary contents of holding registers (4X references) in the slave. Broadcast is not supported.

04 Read Input Registers: Reads the binary contents of input registers (3X references) in the slave. Broadcast is not supported.

05 Force Single Coil: Forces a single coil (0X reference) to either ON or OFF.

06 Preset Single Register: Presets a value into a single holding register (4X reference).

15 (0F Hex) Force Multiple Coils: Forces each coil (0X reference) in a sequence of coils to either ON or OFF.

16 (10 Hex) Preset Multiple Registers: Presets values into a sequence of holding registers (4X references).

Modbus Register Maps

RT12-4444 Modbus Map

Function 1

00001 Digital Input 1
00002 Digital Input 2
00003 Digital Input 3
00004 Digital Input 4

Function 2

10001 Digital Input 1
10002 Digital Input 2
10003 Digital Input 3
10004 Digital Input 4

Function 3 (Holding Reg)

40001 AO 1
40002 AO 2
40003 AO 3
40004 AO 4
40005 Freq Input 1
40006 Freq Input 2
40007 Totalize 1 Low
40008 Totalize 1 High
40009 Totalize 2 Low
40010 Totalize 2 High
40011 Time to Save Counter

Function 4 (Inputs)

30001 AI 1 12bit
30002 AI 2 12bit
30003 AI 3 12bit
30004 AI 4 12bit
30005 Vin 10bit

RT12-0044 Modbus Map

Function 1

00001 Digital Input 1
00002 Digital Input 2
00003 Digital Input 3
00004 Digital Input 4

Function 2

10001 Digital Input 1
10002 Digital Input 2
10003 Digital Input 3
10004 Digital Input 4

Function 3 (Holding Reg)

40001 FQ1 (Input-1)
40002 FQ2 (Input-2)
40003 Totalize 1 Low
40004 Totalize 1 High
40005 Totalize 2 Low
40006 Totalize 2 High
40007 Time To Save Counter

Function 4 (Inputs)

30001 Main Vin 10Bit
30002 Batt Vin 10Bit

RT12-2222 Modbus Map

Function 1

00001 Digital Input 1
00002 Digital Input 2

Function 2

10001 Digital Input 1
10002 Digital Input 2

Function 3 (Holding Reg)

40001 AO 1
40002 AO 2
40003 Freq Input
40004 Freq-2/Input 1
40005 Freq-3/Input 2
40006 Total Count 1_Low
40007 Total Count 1_High
40008 Total Count 2_Low
40009 Total Count 2_High
40010 Time To Next Save

Function 4

30001 AI 1
30002 AI 2
30003 Battery Input
30004 Main Input

Peer to Peer Overview

Peer to Peer mode can be described as a Wireless Signal Replicator. The product line of RT series RTU's can be configured as a Peer to Peer device. Two of the same type RTU's are required to create a peer to peer system, one Master and one Slave.

The master or slave is determined by the way It is configured. The only difference between a master and slave is, the master is responsible for starting the communication process.

Both the master and slave must contain the same Radio ID and Subnet Value. Only the respective peer-to-peer systems may have the same Radio ID and RF-Network numbers. Failure to do so will cause erratic output voltages, AO's or Digital Outputs, DO's.

Each respective "RT" RTU device has the same number of Analog Inputs (AI's), Analog Outputs (AO's), Digital Inputs (DI's) and Digital Outputs (DO's).

The number and type of I/O will depend on the type of RTU. Each RTU, including I/O, is described in this manual.

Peer to Peer mode will allow you to transmit a 0-5 Vdc analog input, or a Digital Input, from a Master device to a Slave device and vice-versa. A master's analog or digital inputs, become a slave's analog or digital outputs, and vice-versa. This allows for a full-duplex, looped system.

An application example would be a remote PLC with the RT12-2222's analog and digital I/O connected to it, this RTU will be configured as a Master. The Slave device would monitor and control a water well system and would be connected to several sensors, pump status indicators, current sensor, etc.

The PLC will view the analog and digital signals from the slave device as if the PLC was connected directly to the several sensors, pump status indicators, current sensor, etc. See "Typical Application – Well Monitor and Control, Peer-to-Peer" in this manual.

Current Controller Settings

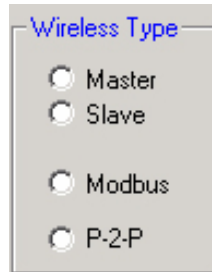
.... ID (0-255)
.... Polling Rate(sec. 0-20)
.... Retries (0-255)
.... RF-Network ID (0-6)

Tx Output Power

Get Setup Information From Device

Send Parameters To Device

Note: This section assumes that your computer is equipped with a serial port and you have installed the RT series configuration software.



To Connect to a Controller:

- 1) Install the configuration software (setup.exe).
- 2) Apply Power to the controller. The heartbeat/sanity LED will begin to FLASH.
- 3) Connect the programming cable to your PC's serial Port.
- 4) Launch the "Configuration" software.
- 5) You must select a communications port. Select "Comm", "Serial" then the desired serial port.
- 6) The "Connect" box will be Red.
- 7) Press the "Connect" Button. The "Asserting" check box will become checked.
- 8) If the software successfully connects to the controller,
- 9) The "Connect" check box will become checked and the "Connect" button will turn Green.
- 10) The software will begin retrieving configuration data from the controller you are connected to. If all data boxes are not filled in refer back to step #6 in this section.
- 11) The software will indicate the type of device, Master or Slave.
- 12) For further programming features see, "Configuration/Programming Software Setup."

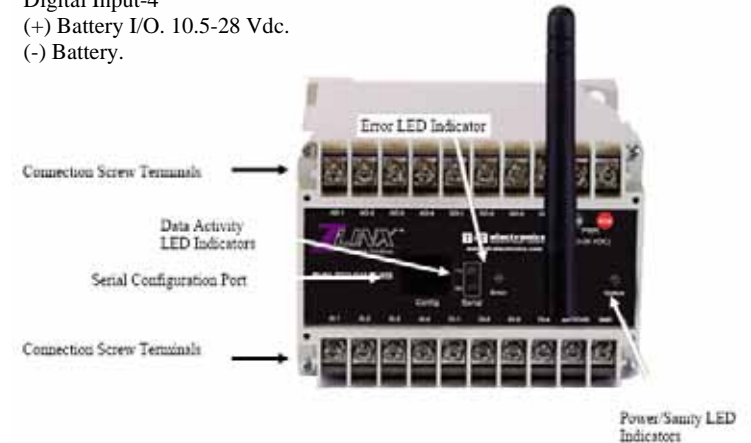
Chapter 2 – System Identification

RT12-4444-9T-W20 – Front Panel Identification

All analog voltage inputs and outputs are 12-bit, 0-5 Vdc. All digital inputs are from 0 to 12 Vdc. Digital inputs must fall to 0 Vdc as a LOW. Digital outputs are Open Drain.

Connection Screw Terminal Description

PIN	NAME	DESCRIPTION
1	AO 1	Analog Output-1
2	AO 2	Analog Output-2
3	AO 3	Analog Output-3
4	AO 4	Analog Output-4
5	DO 1	Digital Output-1
6	DO 1	Digital Output-2
7	DO 1	Digital Output-3
8	DO 1	Digital Output-4
9	GND	(-) Power Input. Ground.
10	PWR	(+) Power Input. 10-28 Vdc.
11	AI 1	Analog Input-1
12	AI 2	Analog Input-2
13	AI 3	Analog Input-3
14	AI 4	Analog Input-4
15	DI 1	Digital Input-1
16	DI 2	Digital Input-2
17	DI 3	Digital Input-3
18	DI 4	Digital Input-4
19	BAT	(+) Battery I/O. 10.5-28 Vdc.
20	GND	(-) Battery.



Power: 10.5~28 Vdc

Most DC power supplies rated from 10.5 to 28 Vdc @ 1000mA, will work with the RT12-4444-9T-W20. Do not use a power supply rated less than 1000mA. Doing so may cause the RT12-4444-9T-W20 to continuously reset. Make sure that the power supply voltage is maintained between the programmable HIGH and LOW supply voltage limits or an alarm may occur. If a rechargeable battery is used or if you are supplying voltage to a sensor using the same power used to power the RT12-4444-9T-W20, then the input voltage will need to be adjusted to the proper voltage to maintain respective equipment. Never exceed 28 Vdc. Damage by overheating to the controller will occur causing the system to malfunction.

Data Activity LED Indicators

The RT12-4444-9T-W20 RTU is equipped with four LED indicators. The RED/GREEN pair labeled "SERIAL", indicate data transmit and data received. The RED LED will blink when data is being transmitted The GREEN LED will blink any time data is received, this is true for the MASTER and SLAVE.

Link/Sanity LED Indicators

The yellow LED indicator labeled "Status" indicates proper system operation. The second yellow LED indicator, labeled "Error", will flash any time an alarm is programmed and the respective alarm is active.

Serial RS-232 Interface

Used to configure the RTU. See "Software Setup".

The **RT12-4444-9T-W20** has two rows of 10, screw type, connections. Using a common type screwdriver, loosen the respective terminal screw, insert the respective wire and tighten.

The front panel is stenciled with each Connection number. Listed below are the respective Connection numbers and Connection description.

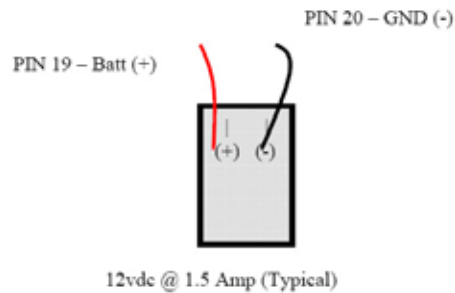
Connection Screw Terminals Description

- Pin 1: "AO 1" (+) Analog Output - 1, 0-5 Vdc
- Pin 2: "AO 2" (+) Analog Output - 2, 0-5 Vdc
- Pin 3: "AO 3" (+) Analog Output - 3, 0-5 Vdc
- Pin 4: "AO 4" (+) Analog Output - 4, 0-5 Vdc
- Pin 5: "DO 1" (+) Digital Output - 1, Open Drain, Active Low, Output
- Pin 6: "DO 2" (+) Digital Output - 2, Open Drain, Active Low, Output
- Pin 7: "DO 3" (+) Digital Output - 3, Open Drain, Active Low, Output
- Pin 8: "DO 4" (+) Digital Output - 4, Open Drain, Active Low, Output
- Pin 9: "GND" (-) Main Supply GROUND
- Pin 10: "VIN+" (+) Main Supply 10.5 to 28.0, Must be > 13.0 to Charge External Battery. **Do Not Exceed 28 Vdc**
- Pin 11: "AI 1" (+) Analog Input - 1, 0-5 Vdc
- Pin 12: "AI 2" (+) Analog Input - 2, 0-5 Vdc
- Pin 13: "AI 3" (+) Analog Input - 3, 0-5 Vdc
- Pin 14: "AI 4" (+) Analog Input - 4, 0-5 Vdc
- Pin 15: "DI 1" (+) Digital Input - 1, Active Low, 0~12 Vdc
- Pin 15: "DI 2" (+) Digital Input - 2, Active Low, 0~12 Vdc
- Pin 15: "DI 3" (+) Digital Input - 3, Active Low, 0~12 Vdc
- Pin 15: "DI 4" (+) Digital Input - 4, Active Low, 0~12 Vdc
- Pin 19: "Batt" (+) Battery Charge During Normal Main Power Input. Battery Backup during Main Power Fails.
- Pin 20: "GND" (-) Battery Ground

RT12-4444-9T-W20 – External Battery Back-up

Connecting an Optional External Backup Battery to RT12-4444-9T-W20

!WARNING: Use Caution When Connecting Any Rechargeable Battery to any of the RT series RTU's. Make sure that the BATTERY is NOT connected until the connection is made to the controller first. This will minimize the chance of damage to the controller if the charging wiring harness is connected incorrectly. Use only Nickel Cadmium 12Vdc and a minimum of 1.5 Amp Hour batteries. Use only fused cable. The RTU is internally fused as well.



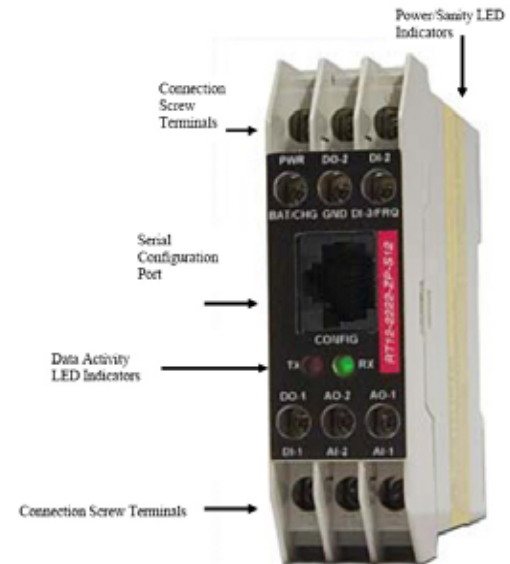
- 1) Connect the **RED** wire from the Charging wiring harness to pin **19**, “**BATT**” of the respective RTU device. The Master and Slave controllers are identical in wiring, features and programming. Be sure a 1 Amp FAST blow fuse is installed.
- 2) Connect the **BLACK** wire from the Charging wiring harness to pin **20**, “Gnd”, of the respective device.
- 3) Confirm the above instructions. If the connections are correct, connect the RED wire to the (+) of the battery and the black wire to the (-). The RTU will begin to operate.

RT12-2222-ZP-S12 – Front Panel Identification

All analog voltage inputs and outputs are 12-bit, 0-5 Vdc. All digital inputs are from 0 to 12 Vdc. Digital inputs must fall to 0 Vdc as a LOW. Digital outputs are Open Drain.

Connection Screw Terminal Description

PIN	NAME	DESCRIPTION
1	BATT	(+) Battery I/O. 10.5~28 Vdc
2	GND	(-) Battery
3	DI 3	Frequency Input. <5 KHz
4	PWR	(+) Power Input. 10~28 Vdc
5	DO 2	Digital Output-2
6	DI 2	Digital Output-2
7	DO 1	Digital Output-1
8	AO 2	Analog Output-2
9	AO 1	Analog Output-2
10	DI 1	Digital Input-1
11	AI 2	Analog Input-2
12	AI 1	Analog Input-1



Power: 10.5~28 Vdc

Most DC power supplies rated from 10.5 to 28 Vdc @ 200mA, will work with the RT12-2222-ZP-S12. Do not use a power supply rated less than 200 mA, doing so may cause the RT12-2222-ZP-S12 to continuously reset. Make sure that the power supply voltage is maintained between the programmable HIGH and LOW supply voltage limits or an alarm may occur. If a rechargeable battery is used or if you are supplying voltage to a sensor using the same power used to power the RT12-2222-ZP-S12, then the input voltage will need to be adjusted to the proper voltage to maintain respective equipment. Never exceed 28 Vdc damage, overheating to the controller will occur causing the system to malfunction.

Data Activity LED Indicators

The RT12-2222-ZP-S12 RTU is equipped with three LED indicators. The RED/GREEN pair labeled "RX" and "TX", indicate data transmit and data received. The RED LED will blink when data is being transmitted The GREEN LED will blink any time data is received.

Link/Sanity LED Indicators

The yellow LED indicator is located internally and indicates proper system operation. The second yellow LED indicator, labeled "Error", will flash any time an alarm is program and the respective alarm is active. The Status LED indicator may be seen through a small hole on the top of enclosure.

Serial RS-232 Interface

Used to configure the RTU. See "Software Setup".

The RT12-2222-ZP-S12 has two rows of 6, screw type, connections. Using a common type screwdriver, loosen the respective terminal screw, insert the respective wire and tighten.

The front panel is stenciled with each Connection PIN number. Listed below are the respective Connection numbers and Connection description.

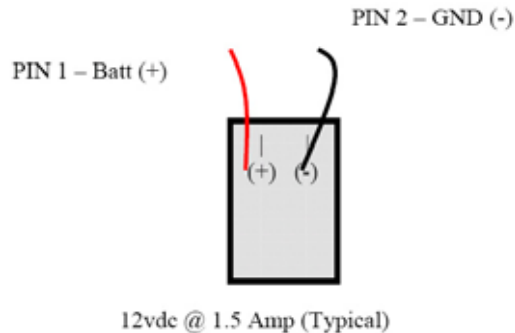
Connection Screw Terminals Description

- Pin 1: "Batt" (+) Battery Charge During Normal Main Power Input.
Battery Backup during Main Power Fails
- Pin 2: "GND" (-) Power and Battery Ground
- Pin 3: "DI 3" (+) Frequency Input. **Do Not Exceed 5 KHz**
- Pin 4: "PWR" VIN(+) Main Supply 10.5 to 28.0, Must be > 13.0 to Charge
External Battery. **Do Not Exceed 28 Vdc**
- Pin 5: "DO 2" (+) Digital Output - 2, Open Drain, Active Low, Output
- Pin 6: "DI 2" (+) Digital Input - 2, Active Low, 0~12 Vdc
- Pin 7: "DO 1" (+) Digital Output - 1, Open Drain, Active Low, Output
- Pin 8: "AO 2" (+) Analog Output - 2, 0-5 Vdc
- Pin 9: "AO 1" (+) Analog Output - 1, 0-5 Vdc
- Pin 10: "DI 1" (+) Digital Input - 1, Active Low, 0~12 Vdc
- Pin 11: "AI 2" (+) Analog Input - 2, 0-5 Vdc
- Pin 12: "AI 1" (+) Analog Input - 1, 0-5 Vdc

RT12-2222-ZP-S12 – External Battery Back-up

Connecting an Optional External Backup Battery to RT12-2222-ZP-S12

!WARNING! Use Caution When Connecting Any Rechargeable Battery to any of the RT series RTU's. Make sure that the BATTERY is NOT connected until the connection is made to the controller first. This will minimize the chance of damage to the controller if the charging wiring harness is connected incorrectly. Use only Nickel Cadmium 12Vdc and a minimum of 1.5 Amp Hour batteries. Use only fused cable. The RTU is internally fused as well.



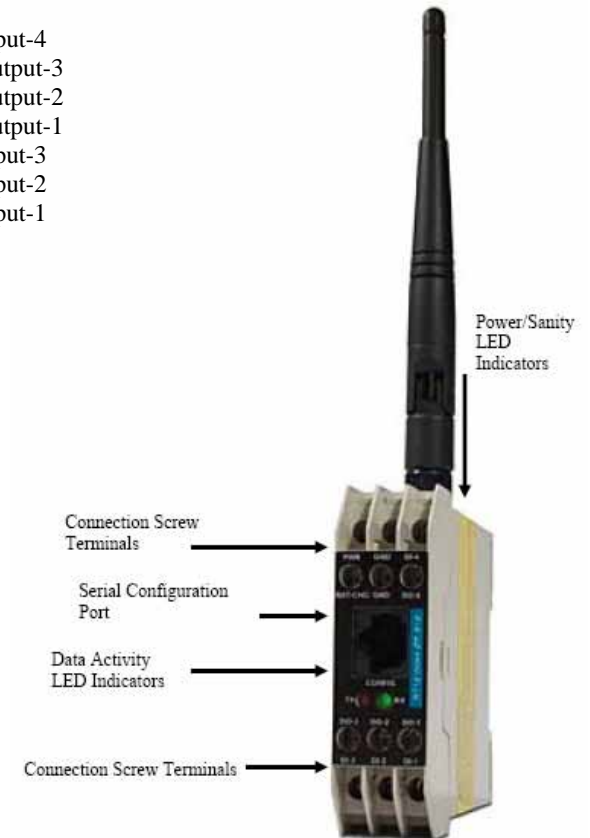
- 1) Connect the **RED wire** from the Charging wiring harness to pin **19**, “**BATT**” of the respective RTU device. The Master and Slave controllers are identical in wiring, features and programming. Be sure a 1 Amp FAST blow fuse is installed.
- 2) Connect the **BLACK wire** from the Charging wiring harness to pin **20**, “Gnd”, of the respective RTU.
- 3) Confirm the above instructions. If the connections are correct, connect the RED wire to the (+) of the battery and the black wire to the (-). The RTU will begin to operate.

RT12-0044-ZP-S12 – Front Panel Identification

All analog voltage inputs and outputs are 12-bit, 0-5 Vdc. All digital inputs are from 0 to 12 Vdc. Digital inputs must fall to 0Vdc as a LOW. Digital outputs are Open Drain.

Connection Screw Terminal Description

PIN	NAME	DESCRIPTION
1	BATT	(+) Battery I/O. 10.5~28 Vdc
2	GND	(-) Battery
3	DO 4	Digital Output-4
4	PWR	(+) Power Input. 10~28 Vdc
5	GND	Ground
6	DI 4	Digital Input-4
7	DO 3	Digital Output-3
8	DO 2	Digital Output-2
9	DO 1	Digital Output-1
10	DI 3	Digital Input-3
11	DI 2	Digital Input-2
12	DI 1	Digital Input-1



Power: 10.5~28 Vdc

Most DC power supplies rated from 10.5 to 28 Vdc @ 200 mA, will work with the RT12-0044-ZP-S12. Do not use a power supply rated less than 200 mA, doing so may cause the RT12-0044-ZP-S12 to continuously reset. Make sure that the power supply voltage is maintained between the programmable HIGH and LOW supply voltage limits or an alarm may occur. If a rechargeable battery is used or if you are supplying voltage to a sensor using the same power used to power the RT12-0044-ZP-S12, then the input voltage will need to be adjusted to the proper voltage to maintain respective equipment. Never exceed 28 Vdc damage, overheating to the controller will occur causing the system to malfunction.

Data Activity LED Indicators

The RT12-0044-ZP-S12 RTU is equipped with three LED indicators. The RED/GREEN pair labeled "RX" and "TX", indicate data transmit and data received. The RED LED will blink when data is being transmitted The GREEN LED will blink any time data is received.

Link/Sanity LED Indicators

The yellow LED indicator is located internally and indicates proper system operation. The second yellow LED indicator, labeled "Error", will flash any time an alarm is program and the respective alarm is active. The Status LED indicator may be seen through a small hole on the top of enclosure.

Serial RS-232 Interface

Used to configure the RTU. See "Software Setup".

The RT12-0044-ZP-S12 has two rows of 6, screw type, connections. Using a common type screwdriver, loosen the respective terminal screw, insert the respective wire and tighten.

The front panel is stenciled with each Connection number. Listed below are the respective Connection numbers and Connection description.

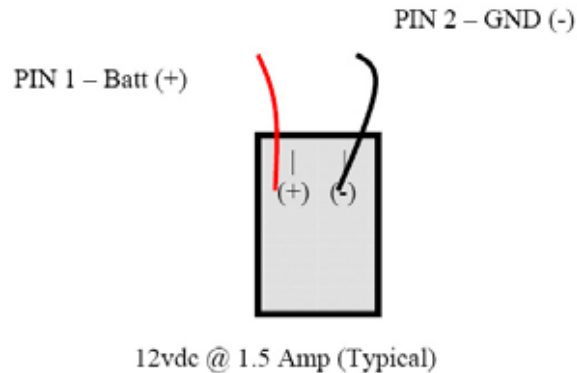
Connection Screw Terminals Description

- Pin 1: "Batt" (+) Battery Charge During Normal Main Power Input.
Battery Backup during Main Power Fails
- Pin 2: "GND" (-) Power and Battery Ground
- Pin 3: "DO 4" (+) Digital Output 4. Open Drain, Active Low, Output
- Pin 4: "PWR" VIN(+) Main Supply 10.5 to 28.0 Vdc, Must be > 13.0 to Charge External Battery. **Do Not Exceed 28 Vdc**
- Pin 5: "GND" (-) Main Supply GROUND
- Pin 6: "DI 4" (+) Digital Input - 4, 0-12 Vdc
- Pin 7: "DO 3" (+) Digital Output - 3, Open Drain, Active Low, Output
- Pin 8: "DO 2" (+) Digital Output - 2, Open Drain, Active Low, Output
- Pin 9: "DO 1" (+) Digital Output - 1, Open Drain, Active Low, Output
- Pin 10: "DI 3" (+) Digital Input - 3, 0-12 Vdc
- Pin 11: "DI 2" (+) Digital Input - 2, 0-12 Vdc
- Pin 12: "DI 1" (+) Digital Input - 1, 0-12 Vdc

RT12-0044-ZP-S12 – External Battery Back-up

Connecting an Optional External Backup Battery to RT12-0044-ZP-S12

!WARNING! Use Caution When Connecting Any Rechargeable Battery to any of the RT series RTU's. Make sure that the BATTERY is NOT connected until the connection is made to the controller first. This will minimize the chance of damage to the controller if the charging wiring harness is connected incorrectly. Use only Nickel Cadmium 12Vdc and a minimum of 1.5 Amp Hour batteries. Use only fused cable. The RTU is internally fused as well.

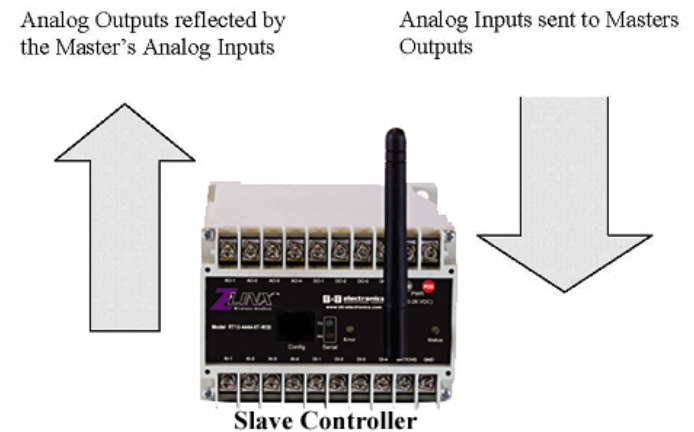
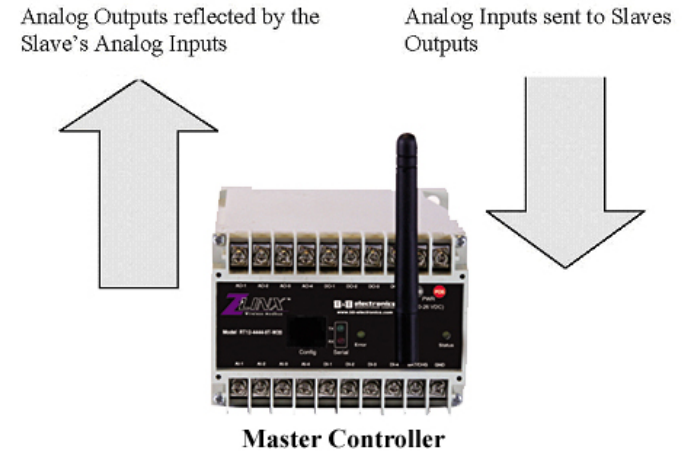


- 1) Connect the **RED wire** from the Charging wiring harness to pin **19, “BATT”** of the respective RTU device. The Master and Slave controllers are identical in wiring, features and programming. Be sure a 1 Amp FAST blow fuse is installed.
- 2) Connect the **BLACK wire** from the Charging wiring harness to pin **20, “Gnd”**, of the Respective RTU.
- 3) Confirm the above instructions. If the connections are correct, connect the RED wire to the (+) of the battery and the black wire to the (-). The RTU will begin to operate.

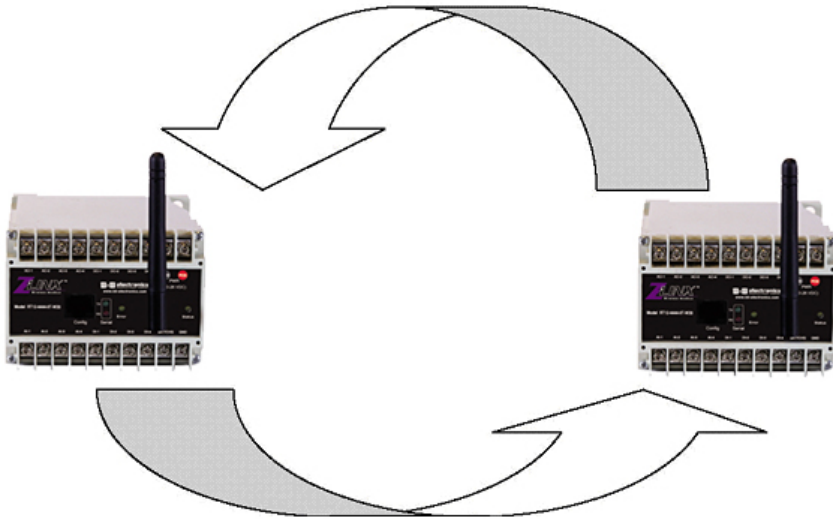
Hardware Set-up

Typical Application: Peer-to-Peer

Below is a typical overview of the communications method for the MASTER and SLAVE allow analog data to be passed from the master to the slave and vice-versa.



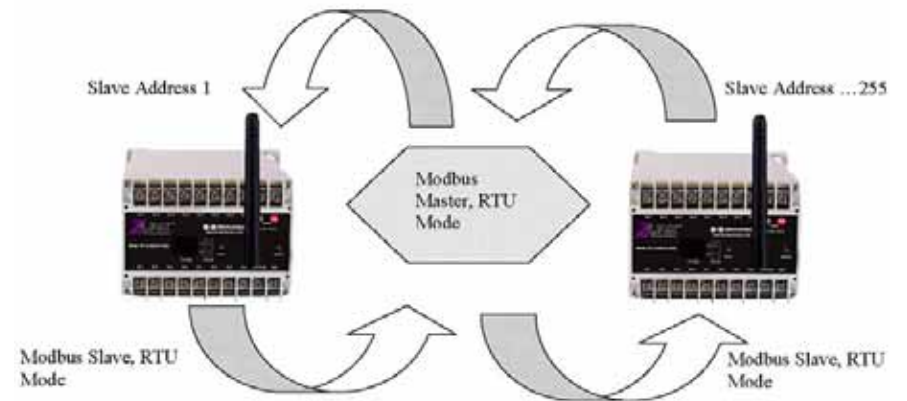
Typical Application: Peer-to-Peer



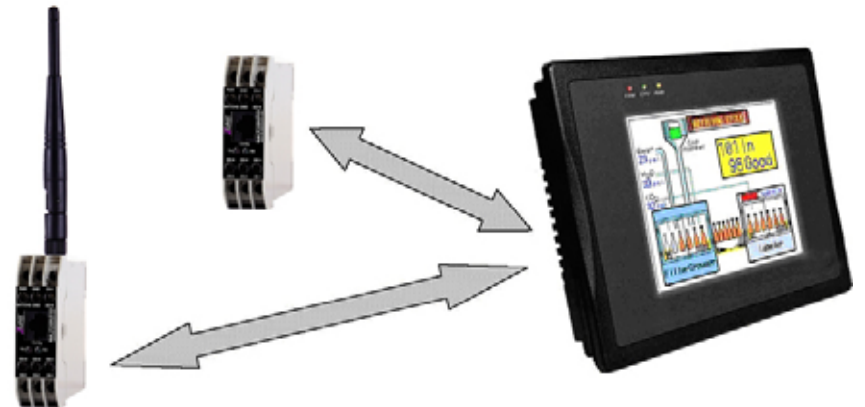
This typical application shows the INPUT voltage signals from the Master controller is sent to the Slave controller. The save output voltages reflect the Masters input voltages.

The Slave INPUT voltage signals are sent to the Master and converted to the Master's OUTPUT voltages signals and reflect the SLAVE inputs voltages.

Typical Application: Modbus

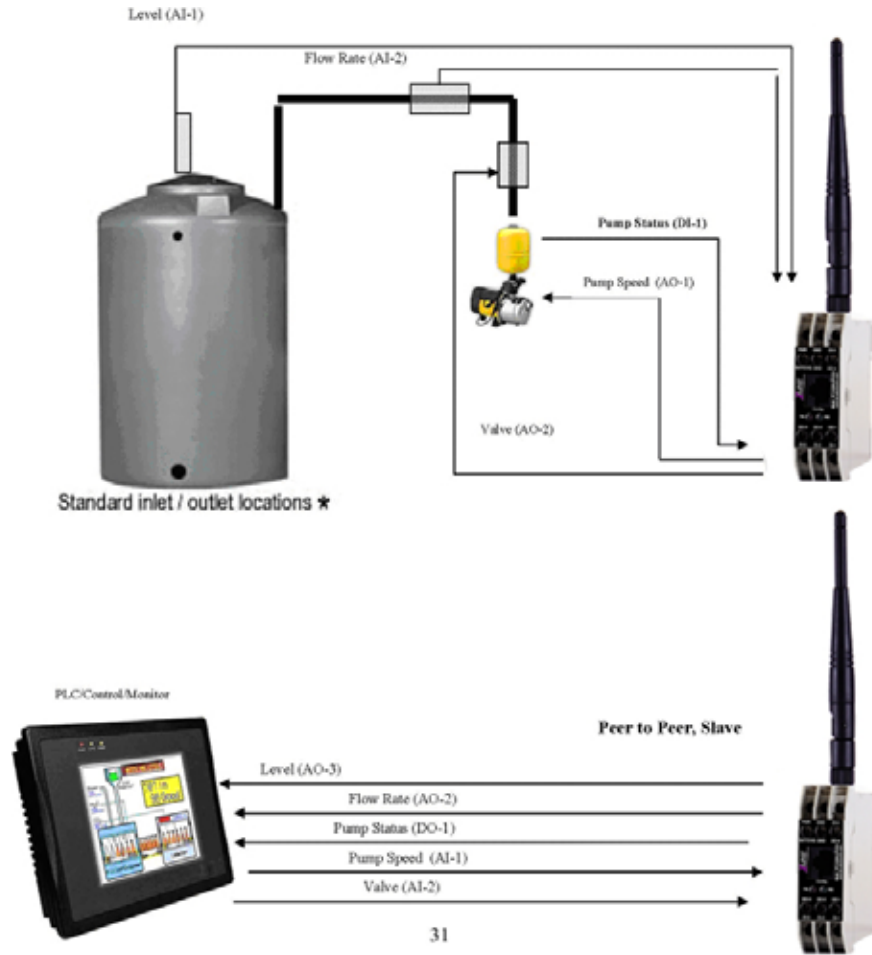


This typical application shows two Slave Modbus controllers. Modbus slave controller can be address from 1 to 255.



Typical Application: Well Monitor and Control (Peer-to-Peer)

Below is a typical Peer to Peer monitoring and control application.



Typical Application: Well Monitor and Control (Modbus)

Below is a typical Modbus monitoring and control application.



Typical Application: 4-20 mA to Voltage Conversion

This section will describe how a typical system is converted from a 4-20mA or 0-20mA current signal to a 1-5Vdc or 0-5Vdc voltage signal.

The RT series RTU's do not allow for a direct 4-20mA connection. A simple 250 Ohm, 1%, ¼ Watt, resistor from the input of the respective terminal to ground will convert the current signal to a voltage signal. If a 250 Ohm resistor is not available a 249 Ohm, 1%, ¼ Watt, resistor will work.

The same example is true for a 0-20mA current signal. The only exception is the voltage will swing from 0-5Vdc. If a current source is applied to a respective input without a resistor the data will not be correct and a signal error will occur.

The example below shows analog Input 1 converted from 4-20 to 1-5Vdc. Keep in mind, if an RTU is used in Peer to Peer mode, the receiving device will output a 1-5Vdc voltage on the respective output.



Configuration Cable Description

Serial cable used in configuration and connectivity of B&B Electronics' RT-series controllers.

Pin#	Connection (color)	Description
DB9-Pin#2	Green	TX
DB9-Pin#3	Red	RX
DB9-Pin#5	Yellow	GND
DB9-Pin#7	Black	CTS

-Use a straight-through, common, Category 5 cable (available from B&B Electronics) for connection to the RT-series RTU's.

Chapter 3 – Configuration & Programming

Configuration/Monitoring Software System Map

Programmable and monitoring features may be accessed using the configuration software. Programmable features such as polling rates, id number, subnets, labels, full scale engineering units, etc, may be easily changed. This section will show you many of the RT series features.

The configuration and monitoring software will allow you to save and load configuration profiles. The profile may be uploaded to the respective RTU.

To load a profile, from the task bar, select “Profile” --> “Load Profile” --> then select the desired file. The default file is “default_rt_config.cff”. It is recommended that you do not over-write this file.

To save a profile, from the task bar, select “Profile” --> “Save Profile” --> Name the file you wish to save, --> select “Save”.

The status bar at bottom of the main window shows what profile data is being displayed. “Profile = RTU” means the data being displayed was retrieved from the respective RTU. “Profile = File” means the data being displayed was retrieved from a file.

Note: Remember to ALWAYS confirm programming changes by pressing “Disconnect” then “Connect”. This will retrieve the programmed data from the respective RTU. Confirm each field within the main window “Controller Programming Parameters.”



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Configuration/Monitoring Software Main Page

During the initial start-up process you will need to select a serial port. Refer to your PC's users guide to select a valid serial port. The most common port selected is COM1 or COM2 but may differ on your computer. This will set the correct communications port for configuring, displaying or monitoring the controller.

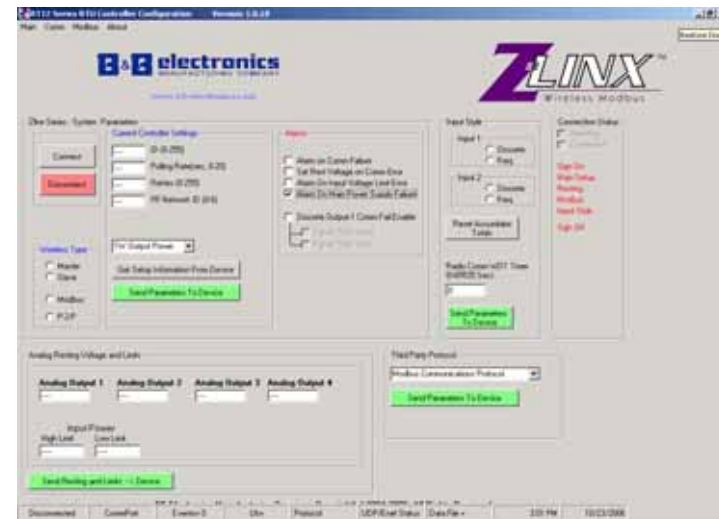
!WARNING! Connecting to a RTU device will disrupt the wireless communications. This will cause a communications failure on the opposing link. Depending on features selected, a communications error may cause your system to malfunction.

Note: The system must be connected to perform most of the functions described in the following sections.

!WARNING! Always confirm any changes that you make by disconnecting and re-connecting after a change or changes. This will allow the system to retrieve data from any RTU you're connected to and confirm changes.

Features supported are:

- Comm (Communications)
- About
- Profiles
- Communications WDT
- Third Party Communications
- Support
- About
- MODBUS Slave



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Controller Configuration

Selecting the “Get Setup Information From Device” button will allow you to view existing setup parameters saved by the master or slave controller. The task bar on the bottom of the Main screen should indicate “Profile = RTU”

This section will identify each parameter as well give a description of its respective function. This section assumes that the Monitoring software is loaded and running.

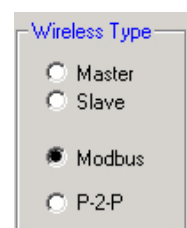
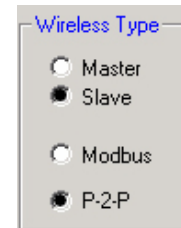
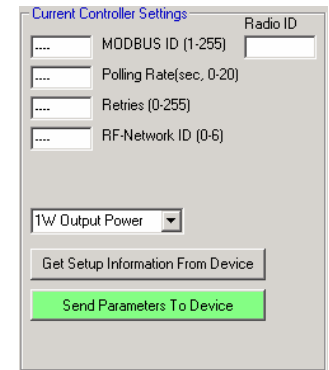
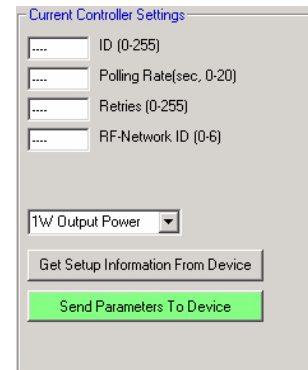
To capture/display data from the Master or Slave controller:

- Connect the serial programming cable into your computer’s serial communications port.
- Connect the remaining end of the programming cable into the programming jack labeled “Program”. Make sure the controller has powered applied.
- Press the “Connect” button. Keep in mind that the data flow between the controller being configured and its respective mate will stop. If the “Set Rest Voltage on Comm Error” is set on the mating controller, it will alarm and set the outputs to its programmed resting voltage.
- You may need to disconnect and connect several times to make a valid connection.
- When the software makes a connection with the controller the “Connected” indicator will show as “Marked”, the “Controller Time” and date will be displayed as well as all other data listed in each box. The “Connect” button will also turn green.

Current Controller Settings

This configuration block will allow you to set the respective RTU parameters such as ID, subnet, polling rate, etc. These settings are vital to the operation and performance of your wireless system.

Parameters not set correctly may cause the system to malfunction or not communicate. This block will affect different fields depending on the Wireless Type.

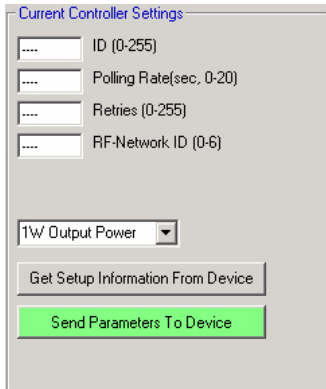


ID: Displays the current controller ID number between 0 and 255.

!WARNING! In Peer-to-Peer Mode, the ID numbers for the Master and Slave must match and must not be repeated with any other Master/Slave Pairs with the same RF-Network ID within the radio range of each respective wireless pair. Doing so will cause cross talk between master/slave pairs and may cause harm to the equipment attached.

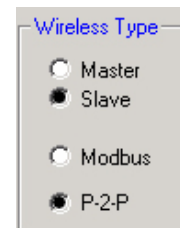
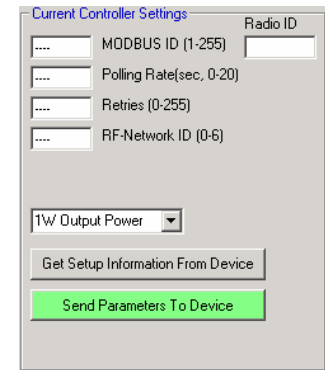
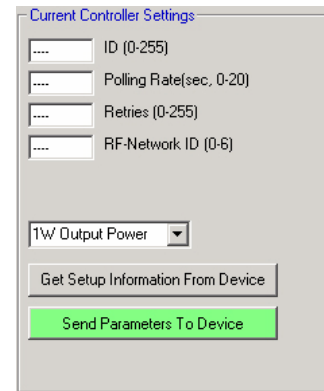
Polling Rate: In Peer-to -Peer mode, this parameter determines the sampling rate of data passed between the Master and Slave controllers. It is also the update rate for the Master and Slave’s analog and digital I/O. This parameter has no effect in Modbus mode. The Master is responsible for starting the communications process. Therefore the Polling rate is only configured on the Master controller.

If your system is configured on Peer-to-Peer mode, by default, if the Slave unit does not receive a response from the master within 20 seconds of any polling sequence, and if the "Set Rest Voltage On Comm Error" is enabled, an alarm will sound on the Slave unit and depending on alarm parameters set, would cause the Slave's outputs to be set with the user defined resting voltages.



Retries: In Peer-to-Peer mode, this parameter determines the number of consecutive failed polling attempts before a communications failure occurs. It is not recommended to set the number of retries higher than 10 attempts. Large numbers may cause an unnecessary delay in communications failure response time; a low number may cause the system to prematurely fail. This parameter has no affect in Modbus mode.

Output Power: This parameter determines the RF Power output on some RTU's. If a respective RTU does not support a variable RF power out the parameter will continue to display "Output Power".

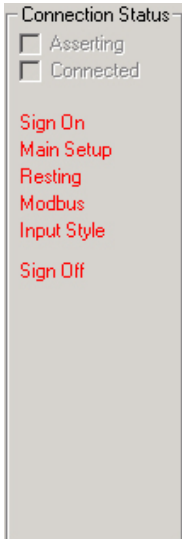


The "ID" field has a dual purpose, as the controller number when in peer-to-peer mode and the Modbus slave address field when in MODBUS mode.

If Modbus is selected, the Radio ID will automatically appear and the "ID" field will automatically change to "MODBUS ID."

If your controller is programmed in Modbus mode, the ID field will change to the Modbus Slave address. Valid addresses are from 1 to 255. Keep in mind that the Modbus master you are interfacing to may not support the full spectrum of slave address IDs. Please refer to your device user's manual.

Connecting / Disconnecting



Connection Status

Asserting

Connected

Sign On

Main Setup

Resting

Modbus

Input Style

Sign Off

Connect: Pressing the “Connect” button will force the software to make an attempt to connect to the controller your PC. The programming cable must be connected. The connect button will start RED and will remain RED until a connection is made.

The “Assert” check box will indicate “Checked” when the software makes the attempt to connect.

Once connected, the “Connected” check box will indicate, “Checked” and the “Connect” button will turn green.


Disconnect: Pressing the “disconnect” button will force the software to disconnect from the controller your PC is connected to. Both the “Assert” and “Connected” check boxes will indicate “Unchecked”.

NOTE: The controller must be “Disconnected” for the master and slave to communicate with each other.

You may need to make several attempts to connect. Make sure the “Connected” box is check and the “Connect” button is GREEN, before proceeding.

During the “Connect” process you will notice a series a check marks, in the “Update” configuration Block, located next to each of the subsystems. This is confirmation that the configuration software is collecting data from the respective RTU.

Master, Slave, Modbus, Peer-to-Peer



Wireless Type

Master

Slave

Modbus

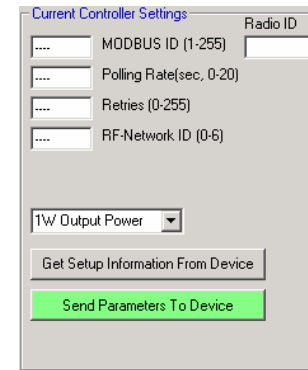
P-2-P

Master: If the controller you are connected to is a Master Peer to Peer device, the Wireless type will indicate “Master”.

Slave: If the controller you are connected to is a Slave Peer to Peer device, the Wireless type will indicate “Slave”.

MODBUS: If the controller you are connected to is in MODBUS mode the Wireless type will indicate “MODBUS”.

P-2-P: P-2-P is also Peer to Peer.



Current Controller Settings

MODBUS ID (1-255) Radio ID

Polling Rate(sec, 0-20)

Retries (0-255)

RF-Network ID (0-6)

1W Output Power

Get Setup Information From Device

Send Parameters To Device

If your system is configured as a Peer to Peer system, the system must consist of one Master and one Slave. The Master controller is responsible for starting the polling sequence.

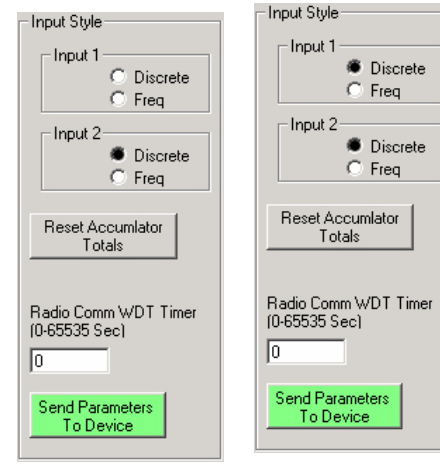
If your controller is configured as a MODBUS controller then typical Modbus, Slave, RTU, protocol applies. Do not allow for duplicate Slave address within the same system, unless It is on a separate Radio Id and/or RF-Network ID.

Modbus Configuration



The Modbus configuration menu will allow you to adjust the base address for the I/O to be displayed or controlled. When in Modbus mode, the radio ID number is within the Modbus configuration menu.

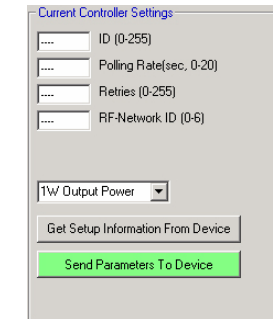
Digital Input Types



The RT series RTU's support the ability to configure DI-1 and DI-2 as Digital or Frequency/Accumulator inputs. Some RTU have an additional, dedicated, "Freq" input.

Clicking on a respective "Input" box, will check and uncheck, the respective input box.

If a respective Input Box is **Checked**, the input will be configured as a digital discrete input. To save this setting to the respective RTU, press the "Send Parameters To Device" button.

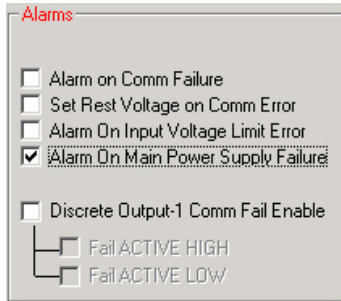


If a respective Input Box is **Unchecked**, the input will be configured as a Counter/Accumulator/Frequency input. To save this setting to the respective RTU, press the "Send Parameters To Device" button.

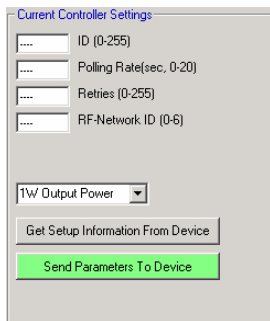
The Counter/Accumulator/Frequency mode is reserved for Modbus mode. The Accumulator and Frequency values are held in separate registers.

The RT12-4444 is equipped with a configurable communications watch dog timer. The timer was designed to detect the absence of data traffic will attempt to reset the communications system. Setting the timer to "0" will disable the timer. The timer is in seconds. To set the timer, make sure you are connected to the respective device, enter a timer value from 1 to 65535 and press "Send Parameters To Device". It is not recommended to enter a value smaller than 60.

RTU Alarms



The RT series RTU's have several types of alarms. Below is a description of each alarm. To modify or change any of the alarms, click on the respective box or boxes, and press the "Send Parameters To Device". Make sure you are "Connected". Alarms are local to the RTU. Each RTU has a built in beeper alarm. Most alarms will sound at the master as well as the slave units. Most of the alarms apply even in Modbus mode.



Update On Change: Not used at this time and is used for future enhancements.

Alarm On Comm Fail: If enabled, will sound an alarm on a Local RTU Level. If in peer to peer mode, the alarm may sound at the Master as well as the Slave. A communications failure is determined by repeated, consecutive, failed attempts made by the Master to contact the Slave unit. The number of attempts made depends on the parameter "Retries". The slave unit defaults to a 20 second time out if it does not make contact with the Master.

Set Rest Voltage on Comm Error: If enabled, will cause a local and remote alarm if a communications failure occurs. This will also force the analog outputs to the programmed "Analog Resting Voltages" and if enabled will cause the discrete output to be set to an active high or active low state. "Alarm On Comm Fail" must also be enabled. In Modbus mode, the comm. fail delay time is 2 minutes.

This parameter also applies if the respective RTU is configured as a Modbus Slave device.

Alarm On Input Voltage Limit Error: If enabled will cause a local and remote alarm if the main input voltage falls below or rises above your set limits. These limits are located in the same section "Analog Resting Voltages". This alarm will not affect any of the outputs; the alarm will cause an audible alarm.

Alarm On Main Power Supply Failure: If enabled will cause a local and remote alarm if the main input voltage completely fails. The backup battery MUST be connected for this function to operate properly or a communications failure will occur. This alarm will not affect any of the outputs; the alarm will cause an audible alarm.

Discrete Output-1 Comm Fail Output: If enabled and a communications alarm occurs, this parameter will cause DO-1, on all RT series RTU's, to become "Active High" or "Active Low". The Output level will depend on how the output is configured. If enabled, this output can not be controller in peer to peer or Modbus mode. This feature was added to notify other equipment of a communications failure. This feature may also be used to activate an external auditable or visual alarm, such as a Horn or Light.

Input Voltage Alarm Limits

Analog Resting Voltage and Limits

Analog Output 1	Analog Output 2	Analog Output 3	Analog Output 4
1.5	1.5	----	----

Input Power

High Limit	Low Limit
28	9.99

Send Resting and Limits --> Device

(Note: Four analog outputs available on specific RT-12 series models.)

The RT series RTU's is capable of monitoring its input voltage. This section will describe how to set and enable the "Input Voltage Alarm Limits".

If the "Alarm On Input Voltage Limit Error" is enabled and the INPUT supply voltage rises above the "High Limit" or falls below the "Low Limit" the respective RTU will sound an alarm.

The alarm will stop sounding when the input supply voltage returns to "normal" by returning between the +/- limits determined by the "High/Low Limit Dead Band". The "Normal" +/- limits are calculated by subtracting the "High/Low Limit Dead Band" from the "High limit" and adding the "High/Low Limit Dead Band" to the "Low Limit"

The configuration shown above will cause a HIGH alarm if the input supply voltage rises above 28.0 VDC and will return to normal when the input supply voltage falls to 26.01 VDC.

The configuration above will cause a LOW alarm if the input supply voltage falls below 9.99 VDC and will return to normal when the input supply voltage rises to 11.98 VDC.

Alarms	Current Controller Settings
<input type="checkbox"/> Alarm on Comm Failure <input type="checkbox"/> Set Rest Voltage on Comm Error <input type="checkbox"/> Alarm On Input Voltage Limit Error <input checked="" type="checkbox"/> Alarm On Main Power Supply Failure <input type="checkbox"/> Discrete Output-1 Comm Fail Enable <input type="checkbox"/> Fail ACTIVE HIGH <input type="checkbox"/> Fail ACTIVE LOW	ID (0-255) Polling Rate(sec, 0-20) Retries (0-255) RF-Network ID (0-6) TW Output Power Get Setup Information From Device Send Parameters To Device

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Analog Outputs Resting Voltage

Analog Resting Voltage and Limits

Analog Output 1	Analog Output 2	Analog Output 3	Analog Output 4
1.5	1.5	----	----

Input Power

High Limit	Low Limit
28	9.99

Send Resting and Limits --> Device

(Note: Four analog outputs available on specific RT-12 series models.)

This section applies to Peer to Peer and Modbus systems. In peer to peer mode, the master and slave communicate with each other and during the communication process they share information. In the event of a communication failure, the updating process will stop and if the Communications alarm is disabled the analog outputs for the master and slave will be the last valid update.

A communications error will occur if the number of consecutive failed polling attempts exceeds the programmed number of retries. This count is reset if even one valid communications update occurs before the number of retries expires and if the RTU is a Modbus device, a communications of 2 minutes must laps.

The analog output resting voltages provide a means to program the voltage outputs in the event of a communications error.

Due to the nature of wireless systems, communication failures may occur. The RT series RTU's allow you to program each of the analog outputs with a preset level in the event of a communications failure. Each analog output can be programmed with independent levels from 0 volts to 5 Vdc.

If the RTU is programmed to respond to a communications alarm and a communications failure occurs, the respective RTU will force the outputs with your preset levels. The outputs will return to normal once communications is reestablished.

To program the RTU to respond to communications failures select the "Set Rest Voltage on Comm Error" and update the configuration by pressing the "Send Changes To Device".

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(Note: Four analog outputs available on specific RT-12 series models.)

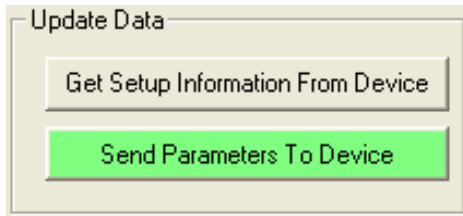
To program each analog resting output voltage, enter a voltage from 0.0 to 5.0, into each box representing Analog Output 1, Analog Output 2, Analog Output 3, and Analog Output 4. Then press “Send Resting and Limits → Device”. This data is saved and remains resident within the respective RTU. *This process is valid ONLY if the RTU is “Connected”.*

The respective RTU is also equipped with the ability to turn on or off its output if a Communications error occurs. This is true for the Master and Slave.

The output is an Open Drain output and should be used to sink not source current, 1Amp MAX. This typically means that the Output will supply a “Ground” to the device to turn it on or off.

The respective RTU also has the ability to control its respective Output during a communications failure. The output may be configured to an ACTIVE HIGH or ACTIVE LOW state during a communications failure. This can be useful as an alarm output or to turn a device on or off. A “Check” mark next to the “Discrete Output Comm Fail Enable” will force the output to an active HIGH or LOW, (depending on what is selected for an Active High or Active Low), during a communications failure. If you use the output to respond during a communications failure, you will not have control using the Modbus protocol. If you wish to use the output for something other than a comm. failure you will need to disable the “Discrete Output Comm Fail Enable”.

Updating/Sending Configuration to RTU



This section assumes the system is connected.

Pressing the “Get Setup Information From Device” will request information from the respective RTU you are connected to.

Once pressed, the MAIN form will remove data from all respective data fields and replace them with refreshed data.

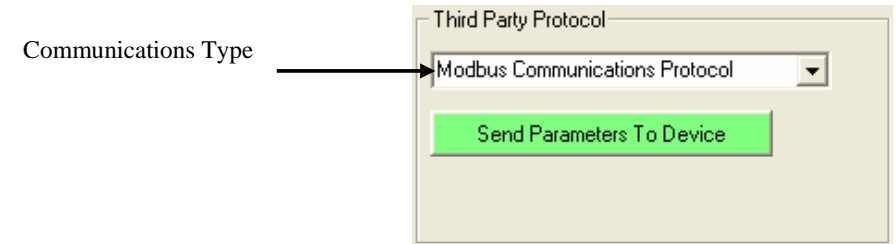
Pressing the “Send Changes To Device” will force the information located within the data fields into the respective RTU’s internal configuration.

!WARNING! Be sure that all the respective data fields are filled with the correct data. If a parameter is left blank the system will interpret the data as a ZERO “0”. This may cause your system to fail if parameter such as the ID or RF network is set incorrectly. Confirm all configuration data by requesting data from the respective RTU or Press the Disconnect then Connect to update and view the most current data.

Third Party Communications Protocol Support

Third party communications support was added to allow for different type of communications protocols such as Modbus RTU, etc. As we develop and enhance support of other protocols we will

To select a communications type, click on the communications type bar, select the type of communications then “Send Parameters To Device”.



Status Bar

Disconnected	Comm 1	Events=0	Ukn	UDP/Enet Status	Profile = File	7:37 PM	4/13/05
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The status bar is a quick view of system status. Functions such as connection status, communications port, number of event saved by the master or slave, profile type, time and date, etc.

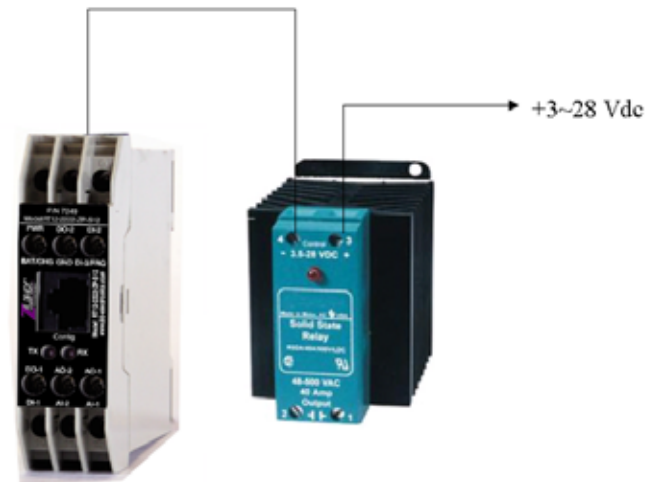
Profile status is an indicator of where data is being retrieved from, a file or the respective RTU.

Digital Outputs

Note: Third party communications protocols available as custom modifications.
(Contact B&B Electronics Mfg. Co. Inc.)

Depending on the RT12 you are configuring or using, it may be equipped with one or more digital outputs, (DO's). These outputs are typically high current outputs that will sink current, also known as "Low Side Drivers".

Typically, each digital output can sink up to 500 milliamps of current. Below is a typical digital output application.



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