DR9031

WIRELESS
POINT-TO-POINT TRANSCEIVER

SYSTEM CONTENTS

Your system includes this manual, two DR9031RX wireless receivers and two DR9031TX wireless transmitters.

The only prepared cables required are the coaxial cable that connect to the wireless products and the antennas. All other connections are field wiring from the plug-in terminal blocks to the user's input and output devices.

Antennas will be required for each product.

Check the labels of the transmitters to determine the type of analog inputs provided on each.

DESCRIPTION

The DR9031TX is an RF transmitter that will accept both analog and digital inputs in the form of contacts, open collector NPN transistors, or N channel MOSFET transistors.

A 12 bit A/D converter is used to digitize the analog data. Analog data and switch status is then transmitted to the companion DR9031RX receiver.

The DR9031RX receives RF signals from the DR9031TX Transmitter and reconstructs the analog signals and switch status. The analog signals are reconstructed as 4/20mA outputs.

When the transmitter has a dual channel input, the DR9031RX has a 4/20mA output for each channel. If the transmitter has a single channel analog input, the DR9031RX provides two 4/20mA outputs proportional to the single input.

Switch (digital) outputs are provided as isolated open collector NPN transistors.

A DIP Switch on the DR9031RX PC board allows selection of Normal Acting or Reverse Acting (failsafe) digital outputs. (See Figure 1)

The system can be ordered as a 908MHz, 923MHz, or 2.4GHz system. All three systems take advantage of the unlicensed ISM frequency bands. The radios use frequency hopping, spread spectrum technology to eliminate interference and to allow multiple transmitters to operate in the same locale without interference.

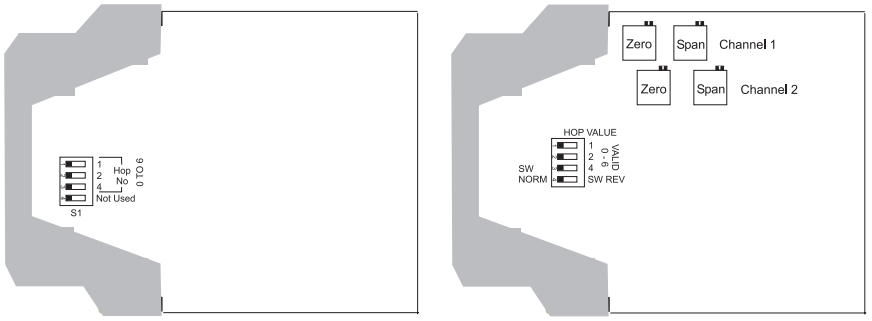
Each of the three frequency bands has 7 user selectable frequency hopping sequences to allow up to 21 transmitters to work in the same locale. The transmitter module hops through 25 channels with any 1 of 7 hop sequences per frequency band. A DIP Switch on the PC board is used to set the hopping sequence.

Both the DR9031TX and DR9031RX have transformer isolation between the circuits and power source, additionally, the DR9031TX dual channel DC input has individual input isolation for each channel. The isolation makes the product useful for measuring input signals with high common mode voltages and for breaking ground connections to eliminate ground loops.

The RTD and bridge inputs do not have input isolation, sincethe sensors are inherently isolated.

Pluggable screw terminal blocks allow easy wiring and removal of products.

All of the DR Series of products provide transient protection to help eliminate damage from lightning and from other transients created on the power and signal leads.



DR9031TX Switches DR9031 RX Switches and Potentiometers

Figure 1

HOP SEQUENCE SETTING

To operate as a system both the DR9031TX units must have the same Hop Sequence setting.

To set the Hop Sequence:

1. Remove the power and all connections from the unit.
2. Squeeze the two tabs that hold the case front section to the rear section and pull the case apart. The circuit board is attached to the front section and will slide out of the case.
3. Locate the 4 position DIP switch just inside of the front panel (See Figure 1). The switches work in binary.

   Switch 1 = Binary 1 (HOP 1)
   Switch 2 = Binary 2 (HOP 2)
   Switch 3 = Binary 4 (HOP 4)
   Switch 4 = Normal / Reverse Acting (DR9031 RX Only)

To set the Hop Sequence desired, close the switches as follows:

HOP SEQUENCE	CLOSE SWITCHES
0	All Switches Open
1	1
2	2
3	2, 1
4	3
5	3, 1
6	3, 2

Units are shipped from the factory with the HOP sequence set to "0".

INSTALLATION

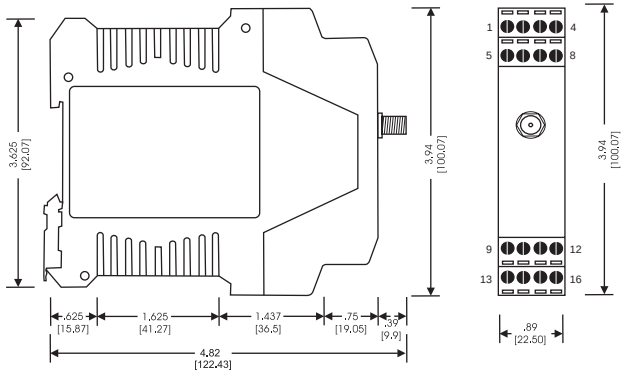
The DR Series of products mount on standard 35 mm DIN rails. Install by hooking the top of the case's latch onto the top of the DIN rail. Then push down on the case, letting it pivot on the DIN rail. The bottom slide of the mount will snap behind the rail and secure the product. To remove, insert a screwdriver into the hole on the metal latch on the bottom of the case, and pull the latch down until it allows the front of the case to be lifted up.

The enclosure depth must be deep enough to accommodate the antenna connector and cable. See Figure 2 for details of the case dimensions.

Note: Correctly identify the DR9031TX and DR9031RX and note power requirements before snapping onto the DIN Rail. Once installed the side label may not be visible. The transmitter has the antenna connector.

Mount the DR9031TX and the DR9031RX side by side on the DIN rail. Connect the two units with the supplied cable. The cable is symmetrical. Either end will fit either product.

Case Dimensions INCHES [mm]



Terminal Connections

DR9031TX-01 Dual DC Input

TERMINAL	CONNECTION
1	DC Input 1 +
2	DC Input 1 -
3	DC Input 2 +
4	DC Input 2 -
5	Switch 1 +
6	Switch 1 -
7	Switch 2 -
8	Switch 2 +
9	Switch 3 +
10	Switch 3 -
11	Switch 4 -
12	Switch 4 +
13	No Connection
14	No Connection
15	DC Power +
16	DC Power -

DR9031TX-02 Bridge Input

TERMINAL	CONNECTION
1	Input +
2	Input -
3	No Connection
4	Shield
5	Switch 1 +
6	Switch 1 -
7	Switch 2 -
8	Switch 2 +
9	Switch 3 +
10	Switch 3 -
11	Switch 4 -
12	Switch 4 +
13	10VDC Exc +
14	Exc -
15	DC Power +
16	DC Power -

DR9031TX-03 RTD Input

TERMINAL	CONNECTION
1	RTD +
2	RTD Common
3	RTD Common
4	Shield
5	Switch 1 +
6	Switch 1 -
7	Switch 2 -
8	Switch 2 +
9	Switch 3 +
10	Switch 3 -
11	Switch 4 -
12	Switch 4 +
13	No Connection
14	No Connection
15	DC Power +
16	DC Power -

DR9031RX

TERMINAL	CONNECTION
1	4/20mADC Output 1 +
2	4/20mADC Output 1 -
3	4/20mADC Output 2 +
4	4/20mADC Output 2 -
5	Switch 1 OC Collector
6	Switch 1 OC Emitter
7	Switch 2 OC Collector
8	Switch 2 OC Emitter
9	Switch 3 OC Collector
10	Switch 3 OC Emitter
11	Switch 4 OC Collector
12	Switch 4 OC Emitter
13	No Connection
14	No Connection
15	DC + or AC L1 Power
16	DC - or AC L2 Power

Figure 2

DR9031TX and RX Case Dimensions and Terminal Connections

CONNECTING TO THE DR9031TX TRANSMITTER

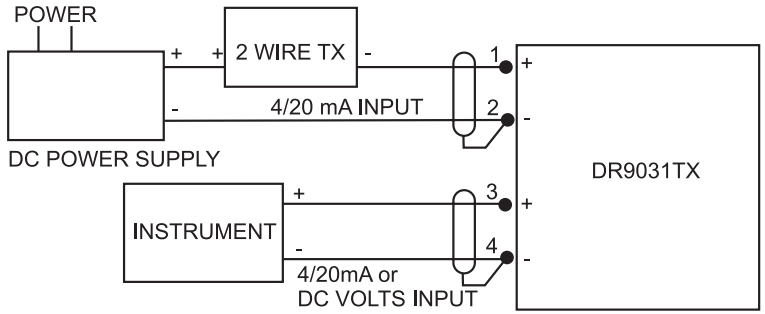
ANALOG INPUTS

The DR9031TX accepts dual DC, single RTD or single bridge analog inputs as noted on the label located on the right side of the product. Refer to this label to determine the input type and range that the product is configured to receive.

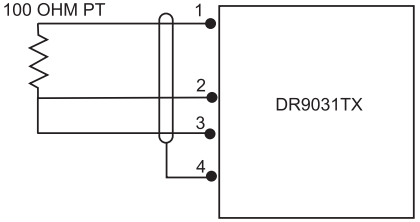
Figure 2 shows the terminal connections for the DR9031TX. The following diagram shows a typical configuration for wiring the analog input channels.

When wiring the input signal to the DR9031TX, certain precautions need to be made to insure a clean signal is provided. Twisted and shielded wire is recommended from the sensor or instrument output to the input of the DR9031TX transmitter. The twisting of the leads provides resistance to magnetic coupling which can occur if signal leads are run too close to conductors carrying AC currents. Shielding prevents capacitive coupling interference from devices such as SCR Drives, relay coils, and equipment such as welding machines. Connection of the shield should be only at the DR9031TX end and never at the sensor end or ground.

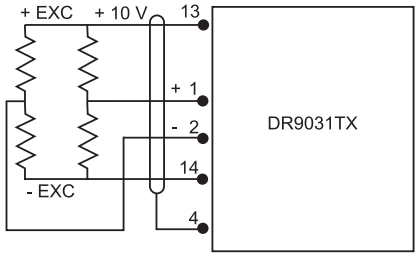
DUAL DC INPUT



RTD INPUT



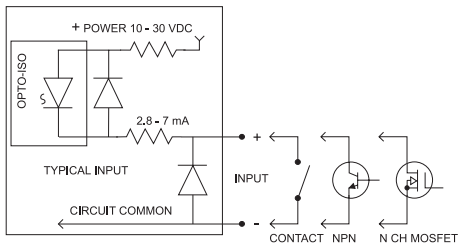
BRIDGE INPUT



SWITCH INPUTS (DR9011)

The DR9031TX accepts four discrete inputs. Refer to Figure 2 for location of the termination connections. These are dry contacts or open collectors that require no external supply voltage. The DR9031TX supplies voltage across the switch inputs equal to the power supply voltage. Applying external voltage across the switch inputs will result in damage to the DR9031TX and will void the warranty.

DIGITAL INPUT EXAMPLES



CONNECTING TO THE DR9031RX RECEIVER

ANALOG OUTPUTS

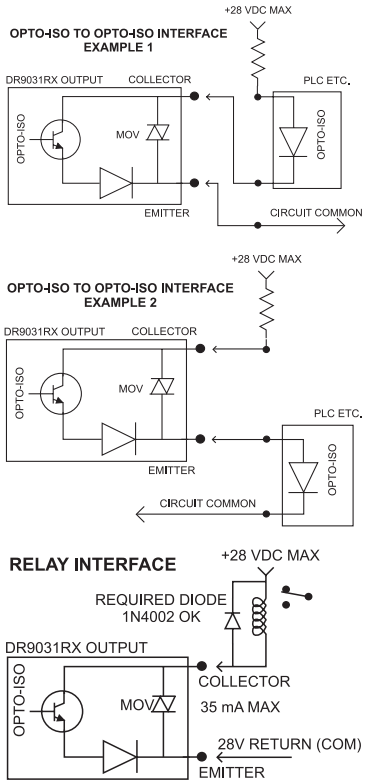
The DR9031RX outputs two 4/20mADC analog signals proportional to the inputs of the DR9031TX. The outputs are 12VDC compliant. Figure 2 shows the terminal connections for the DR9031RX.

SWITCH OUTPUTS (DR9031RX)

The DR9031RX provides four switch outputs as isolated open collector NPN transistors. Refer to Figure 2 for location of the termination connections. These are open collector transistors. Do not connect more than 28VDC across the terminals.

Two examples of connecting the DR9031RX optically isolated switch output to another optically isolated input are shown in the two images.

The third diagram shows a typical configuration for wiring a relay to the switch outputs. Do not exceed the current or voltage limit specified



CONNECTING POWER TO THE DR9031TX AND DR9031RX

WARNING: Before connecting power to either unit, read the label to ensure the correct power is being supplied.

Once the proper power requirement is determined for each unit, connect the power leads to the terminal connections as shown in Figure 2.

TERMINAL CONNECTIONS

Once wired, the terminal blocks can be unplugged as necessary for maintenance, eliminating the need for disconnecting all wiring. To remove the terminal blocks, simply pry the blocks off their connector pins using a small screwdriver inserted under the front edge of each terminal block.

CONNECTING THE ANTENNA TO THE DR9031TX

The antenna connects to the Reverse Polarity SMA (RPSMA) connector on the front panel of the DR9031TX. Large cable sizes (400, 600 size cable) should not be directly connected to the product unless the cable can be connected with no stress/strain on the front panel connector.

Three standard lengths and custom lengths of small diameter cable are available to connect the RF unit to a bulkhead connector.. Two bulkhead connectors are available. One allows mounting a whip antenna on the connector. The other allows a larger cable to be attached which can then be used from the bulkhead connector to the antenna.

When connecting the cable to the front panel connector, the connection should hand tight. Ensure that the connection is tight but use of a wrench to tighten beyond hand tight may damage the connector.

IMPORTANT:
Lightning is also a primary consideration when attaching outdoor antennas to the receiver. A grounded surge arrestor must be connected in the coax line between the antenna and the transmitter. Using an outdoor antenna without a surge suppressor will void the warranty.

NORMAL REVERSE ACTING SWITCHES/ALARM (DR9031RX ONLY)

Normal logic for the DR9031RX digital output is for the NPN transistor to conduct when a switch is closed at the DR9031TX transmitter input. Reverse logic will have the NPN transistor not conduct when the DR9031TX switch input is closed.

The digital outputs of the DR9031RX can be reversed by changing the 4th DIP switch setting. To change the switch settings remove all power from the DR9031RX. Squeeze the two tabs that hold the case front section to the rear section and pull the case apart. The circuit board is attached to the front section and will slide out of the case. Locate the 4 position DIP switch (see Figure 1). For Normal acting alarms, set DIP Switch 4 to SW NORM. For Reverse acting alarms (failsafe) set DIP Switch 4 to SW REV.

CALIBRATION

The system was factory calibrated and should not require field calibration. If field calibration is required Zero and Span adjustments can be made on the DR9031RX.

To make field adjustments to the product:

1. Connect a calibrator to the input terminals of the DR9031TX which supplies signals to the DR9031RX.

   NOTE: For Dual 4/20mADC units, calibrate each channel separately.

2. With all power removed from the DR9031RX squeeze the two tabs that hold the case front section to the rear section and pull the case apart just far enough to provide access to the Zero and Span pots located near the top edge of the board. The circuit board is attached to the front section and will slide out of the case. DO NOT REMOVE THE BOARD ANY FARTHER THAN NECESSARY TO ACCESS THE ADJUSTMENTS.

3. Secure the DR9031RX on a work bench or DIN Rail so that the Zero and Span adjustments are easily accessible and ensure that nothing other than the case is touching the circuit board. **WARNING: Once power is applied touching any part of the circuit board may result in electrical shock. Proceed with extreme caution.**

4. Connect an accurate current meter to the output terminal 1 and 2 of the DR9031RX.

5. Apply power to both units.

6. Watch to see that the green RX LED on the DR9031RX is flashing steady. If not refer to the section in this manual on Setting up the RF Link before proceeding.

7. Set the input at the DR9031TX for its zero scale and adjust the Channel 0 Zero control on the DR9031RX until the current meter reads a 4mADC output.

8. Set the input at the DR9031TX for its full scale and adjust the Channel 0 Span control on the DR9031RX until the current meter reads a 20mADC output.

9. Repeat once or twice until no further adjustment is required.

Repeat for the second analog channel (terminals 3 and 4).

OPERATION OF THE WIRELESS POINT-TO-POINT SYSTEM

Once all connections are made and power is applied no, other adjustments or controls are required. The red TX LED on the front panel of the DR9031TX should be flashing steady indicating that the unit is transmitting an RF signal. The green RX LED on the DR9031RX should be flashing steady indicating that the unit is receiving a RF signal.

SETTING UP THE RF LINK

The DR9031 system is designed to repetitively transmit data at a rate of approximately once per 120msec. The signal levels and switch status are sampled, digitized, and sent out through the DR9031TX.

With all antennas connected and installed the following step should be taken to ensure that DR9031RX is reliability receiving data.

1. Apply power to all units in the area. Remove power from the remote DR9031TX associated with the DR9031RX to ensure that the green RX LED is not flashing. If the RX LED is flashing, change HOP Sequences on the DR9031TX in this system and repeat this step.

2. Insure both of the DR9031TX's in the system are set to the same HOP Sequence. Apply power to all units. Check to see that the green RX LED is flashing steady on the DR9031RX. If the RX LED does not flash or is inconsistent then further steps are need to obtain a reliable RF signal. Continue to step 3.
3. If the RX LED does not flash or is inconsistent, the antennas, cables, and connectors for both the transmitter and receiver may need to be adjusted, changed or repaired.
   a. Verify that all antenna cables and connectors are continuous and not shorted. This includes any pigtail cables, bulkhead adapters, lightning surge arrestors, and extension cables.
   b. Inspect the antennas for damage. Note: Some antennas are shorted across the center pin to shield and some are open. Unless the antenna configuration is known, measuring resistances across the antenna is not useful.
   c. Verify that the antennas are mounted and aimed correctly. Omni antennas should be vertical and mounted above and free of obstructions. Yagi antennas should be pointrd at their companion antennas with the elements vertical. Use of topographical maps and satellite imaginary can be very helpful when aiming antennas.
   d. Verify that the signal path is clear. Any obstructions in the signal's Fresnel zone can reduce the signal strength. Often the signal can pass through or around trees, building, and machinery. All of these do reduce the signal strength and excessive obstruction will result in a weak signal. The signal will not penetrate earth. If the ground level rises up into and obstructs the Fresnel zone, the height of the antennas will need to be increased.
   e. Verify you have selected the proper antenna for the application. For helpwith antenna selection contact Wilkerson Instrument Company, Inc.

A copy of our Wireless Engineering Manual can be downloaded from www.wici.com or obtained from the factory by contacting sales@wici.com.

RF SIGNAL LOSS

If for any reason the RF signal is lost for 2 seconds or more the analog outputs of the DR9031RX will drop to below 4mADC. The switches will move to the failed position as defined by the 4th DIP Switch described above. Often applications will use one of the switch contacts as a failed RF signal alarm or they will monitor the analog value and alarm when the value drops below 4mADC.

OPEN SENSOR INPUT

The DR9031RX is design for an up scale burn out if the analog inputs of the DR9031TX become open. If the input load to the DR9031TX is removed the output of the DR9031RX will be above 20mADC. Applications use this feature to monitor the sensor status.

APPLICATIONS

The DR9031 system has numerous applications where data acquisition and control is necessary and the installation of signal wire between the locations is not practical or is cost prohibitive. This system has been successfully installed in many applications where a signal needs to be transmitted a short distance between machinery as well as longer range applications where signals are transmitted up to 20 miles. For multiple point data acquisition check out our Polling System. Visit http://www.wici.com or call Wilkerson Instrument Company, Inc. for more information on successful applications using Wireless products.

FCC WARNING

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

WARRANTY

The DR9031TX and DR9031RX carry a limited 5 year warranty (1 year on the radio module). In the event of a failure due to defective material or workmanship, the unit will be repaired or replaced at no charge.

SPECIFICATIONS

DR9031TX TRANSMITTER INPUTS

Dual DC Voltage or Current

Current	Voltage
Min Span = 1 mA	Min Span = 100 mV
Max Span = 50 mA	Max Span = 150 V
Accuracy	Linearity
±0.1% of span	±0.05% of span

Common Mode Rejection
= 100 dB, DC to 60 Hz

RTD Input – 100 ohm Pt
Min Span = 50°C
Max Span = RTD Limit
Linearity vs Temperature
= 0.1% / °C of span
Accuracy = ±0.1% of span

Bridge Input
Min Span = 0.5mV/V (10V excitation)
Max Span = 100mV/V
Linearity = ±0.05% of span
(referenced to V in)
Excitation Supply = 10.00V, 125mA max
(Drive four 330 ohm bridges in parallel)

Switch Input

Open Circuit Voltage	Closed Circuit Current
10 to 30 VDC	3 to 9 mA

I/O Data Rate Tx to Rx
Update Rate = 8/S

DR9031RX RECEIVER OUTPUT

Dual 4/20 mADC
12V Compliance
4 optically isolated Open Collector NPN transistors
28V Max
35mA Max

OPERATING TEMPERATURE

-13°F to 167°F / -25°C to 75°C

TEMPERATURE STABILITY

± (0.01% of span)/°C max

POWER

DR9031TX
12 or 24 VDC, 1.5 Watts Max
DR9031RX
12 or 24 VDC, 1.5 Watts Max

RADIO

Frequency
915 MHz Band
908 MHz (Standard)
923 MHz (Optional)
2.4GHz Band
2.4000 - 2.4835 GHz

Transmit Output Power
915 MHz Band
100mW (20dBm)
2.4GHz Band
50mW (17dBm)

Receiver Sensitivity
915 MHz Band
-110dBm
2.4GHz Band
-105dBm

Spread Spectrum Type,
Frequency Hopping, Direct FM
7 Hop Sequences per Frequency

Range (Line of Sight)
915 MHz Band
Up to 20 Mi. with high gain antennas
2.4GHz Band
Up to 10 Mi. with high gain antennas

Antenna Connector
Reverse Polarity SMA Female

CERTIFICATIONS

RF Module — FCC Part 15.247

SUPPORT

Wilkerson Instrument Company, Inc. wants to help you get the most from your system. If there is anything we can do, please call or fax us.

Telephone: 863-647-2000
Fax: 863-644-5318
Or, you can email us: sales@wici.com
Or you can visit our website:
www.wici.com

On the website you'll find application notes, product manuals, engineering manuals, and a complete listing of our products.

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