Wireless Analog/Digital Link Transmitter/Receiver Set MCR-RAD-...

Class I, Div. 2 approved

Installation Instructions 1473A

October 2001

Features

- Wireless conduit for one 4-20 mA and two digital signals
- Range: 600 – 1000 feet in-plant, no line-of-sight
- Easy to use, wire in – wire out, no setup or programming
- Frequency Hopping Spread Spectrum technology (Interference free operation)
- License free 902-928 MHz ISM band
- 1 watt transmit power
- 17.5 mm wide DIN-rail mount transmitter and receiver (Optional 120 Vac version for direct conduit mounting)
- Class I, Division 2 approved for hazardous area installation (UL, CUL and CSA approved)

MCR-RAD General Description

The Phoenix Contact MCR-RAD is an integrated radio & I/O module designed to eliminate cable and conduit for one 4-20 mA current loop and two digital signals in harsh industrial environments. This unique addition to the Phoenix Contact signal conditioning line utilizes 902-928 MHz ISM band spread spectrum frequency hopping technology to guarantee a license free, interference free link between remote devices and the control room. Costly cable and conduit runs on new projects, or retrofitting of existing systems, are eliminated and replaced with a maintenance free, reliable and versatile wireless solution. Common applications include monitoring/control of pressure, level, temperature, flow, switching and alarms in situations where cable and conduit are either impossible or too costly to install, for example, retrieving pressure readings from a device on the other side of a railway track.



Figure 1. Wireless Analog/Digital Link Transmitter/ Receiver Set MCR-RAD

The modules are available as a transmitter/receiver pair and come factory programmed, calibrated and tested as a set. Further switch configuration and programming are not required. Each set is given a unique address at the factory enabling multiple MCR-RAD systems to work independently in the same area without interference. The transmitter and receiver are powered separately by a 12-30 Vdc source (power supply, battery, solar etc). Quick and easy to install, the process signals are simply wired to the input terminals of the transmitter and output via wires connected to the receiver. No wiring is required in between. Typical in-plant range is 600 – 1,000 feet with no line-of-sight, much farther with outdoor applications.

Both the transmitter and receiver are DIN-rail mountable and with their dimensions of 102 mm (length) x 114.5 mm (height) x 17.5 mm (width) (4” x 4.5” x 0.7”) they offer a small wireless solution for every control cabinet. The MCR-RAD provides LED indicators for digital input/output signal status at both radios and radio link status at receiver.

As an option, weatherproof transmitters mounting directly to ½ inch NPT conduit are also available for AC or DC power sources. The MCR-RAD transmitter and receiver pair is UL/CUL listed and approved for Class I, Division 2 installation.

What is Frequency Hopping Spread Spectrum Technology?

Prior to its introduction to Industrial, Scientific and Medical (ISM) use in 1987, this technology was used by the military for battlefield communications and weapons control due to its extreme tolerance of interference, and the difficulties it presented to those wishing to jam or intercept it. The key elements for the success of these radios are: a) their ability to frequency hop, b) their use of powerful narrowband signals (highest transmit power available under FCC guidelines), and c) their reliance on the redundant nature of the data being sent. Broadcasting within the 902-928 MHz band, MCR-RAD radios transmit the status of their inputs on one frequency, then hop to transmit again on a different frequency. Hopping approximately every 20 milliseconds, the status of their inputs is updated 50 times per second in an interference free environment. In an industrial application, where interference is encountered from a variety of sources, EMI, motors, arc welders, etc., some hops will be affected. Anticipating interference the MCR-RAD receivers' error-check the data packet on every hop. When corrupted packets are received they discard the bad data and, hopping in synch with their transmitters, they look for the next clean update, which is then output. Since interference is encountered in most industrial applications it is assumed that all updates will not get through. Even so, if only 50 to 75% of the packets make it through unscathed this is more than adequate to update pressure, level, temperature, flow, ON/OFF and alarm.

MCR-RAD System Components

The standard MCR-RAD-DIN system includes the following items (see Figure 1):

One MCR-RAD-T-DIN – a 12-30 Vdc DIN-rail mount transmitter

One MCR-RAD-R-DIN – a 12-30 Vdc DIN-rail mount receiver

Two 3 ¼" wave whip antennas, each with 6' of RG174 cable. The antennas can be mounted on an "L" bracket (also supplied) inside or outside a cabinet.

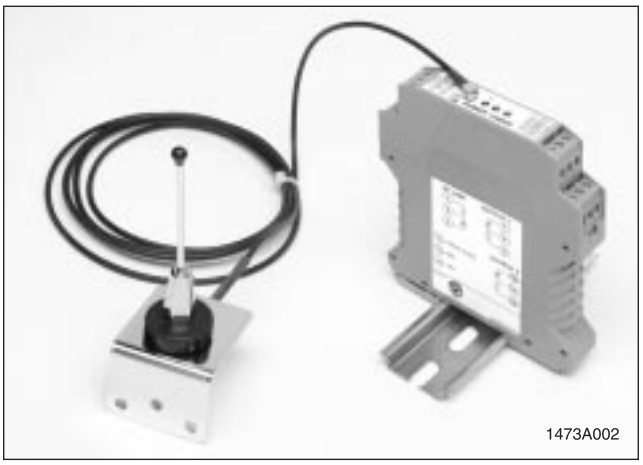


Figure 2. DIN-rail mounted units with antennas



Figure 3. weather proof transmitter

For applications where a weatherproof housing is required for a field mounted transmitter two options are available:

1) **The MCR-RAD-T-DC –** a 12-30 Vdc NEMA 4X conduit mount (½" NPT) transmitter.

2) **The MCR-RAD-T-AC –** a 110-240 Vac NEMA 4X conduit mount (½" NPT) transmitter that includes a 24 Vdc power supply for powering loop.

(information available upon request)

When either of these transmitters are chosen they are paired with an MCR-RAD-R-DIN 12-30 Vdc DIN-rail mount receiver. In this case, two different antennas are supplied, a 3" antenna mounting directly to the transmitter, and the standard 3 ¼" wave whip antenna with 6' of RG174 cable for the receiver.

MCR-RAD-T Transmitter Diagnostics

MCR-RAD-T-DIN:

- RF LED is solid green when unit is transmitting normally.
- LEDs 1 and 2 show status of digital inputs 1 and 2. Solid green = ON.

MCR-RAD-T-DC: (optional weatherproof DC system)

- Green LED on top of unit is solid green when unit is transmitting normally.
- This unit does not have LEDs for digital inputs.

MCR-RAD-T-AC: (optional weatherproof AC system)

- Green LED on top of unit is solid green when unit is transmitting normally.
- This unit does not have LEDs for digital inputs.

MCR-RAD-R-DIN Receiver Diagnostics

- The receiver features an RF link relay (alarm) that closes when RF link is established and locked with the transmitter. This provides solid indication (to PLC or other monitoring equipment) of the wireless link.
- RF link LED blinks once every 2 seconds when receiver is ON but transmitter is either OFF, or out of range.
- RF link LED continually blinks very rapidly when marginal signal is being received. This is an indication that one or both radios should have their antennas moved to an area where they will get better reception.
- RF link LED blinks occasionally (random). This is an indication that interference is being encountered on some hops. This will not affect the performance of the radio and the installation should be considered successful.
- RF LED is solid when an extremely secure link is established.
- LEDs 1 and 2 show status of digital outputs 1 and 2. Solid green = ON.

Default Output Status

As default the 4-20 mA analog signal on the receiver is designed to maintain last state. The default status of the two digital outputs is to also maintain last state.

For diagnostics and alarm purposes the RF link output can be used to drop the 4-20 mA to 0 mA if the analog output is wired through the RF link contact (or with an external relay) - this gives you 0 mA when the link is lost. The RF link relay can be used to turn ON/OFF one or both of the digital outputs by wiring them through the RF link contact (or an external relay connected to it) - this gives you options for the digital outputs when link is lost.

Transmitter Wiring Diagrams

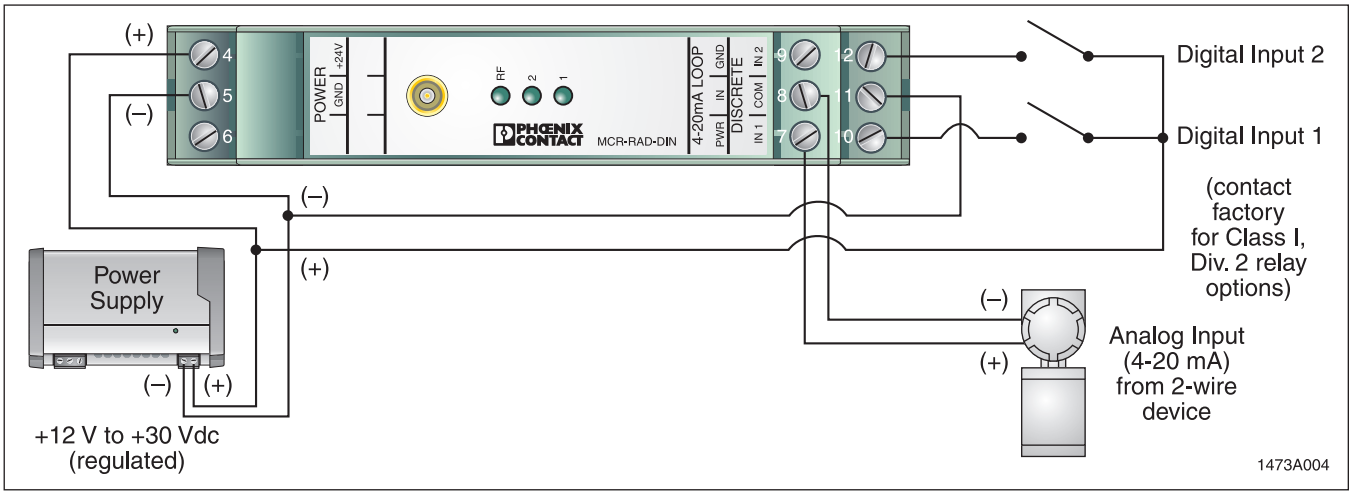


Figure 4. 2 Wire Field device (4-20 mA) and 2 digital signals

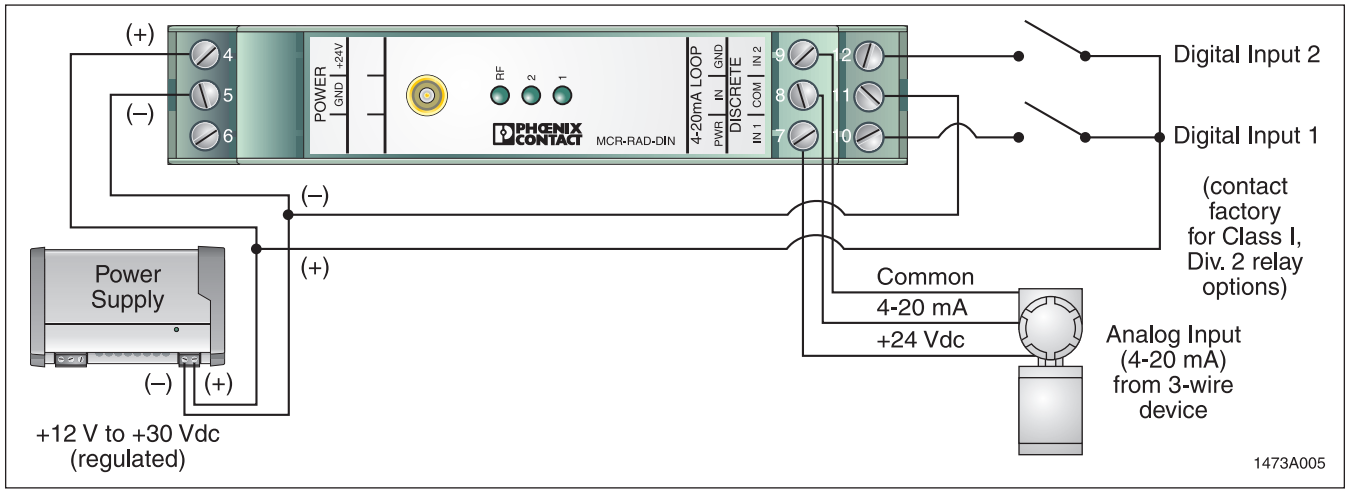


Figure 5. 3 Wire Field device (4-20 mA) and 2 digital signals

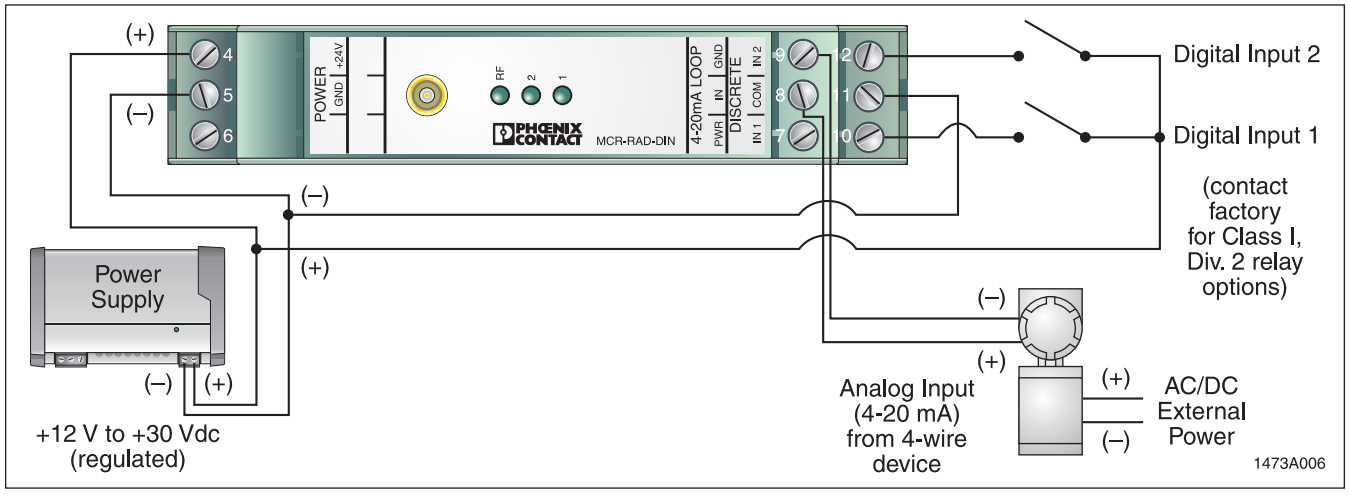


Figure 6. 4 Wire Field device (4-20 mA) and 2 digital signals

Receiver Wiring Diagram

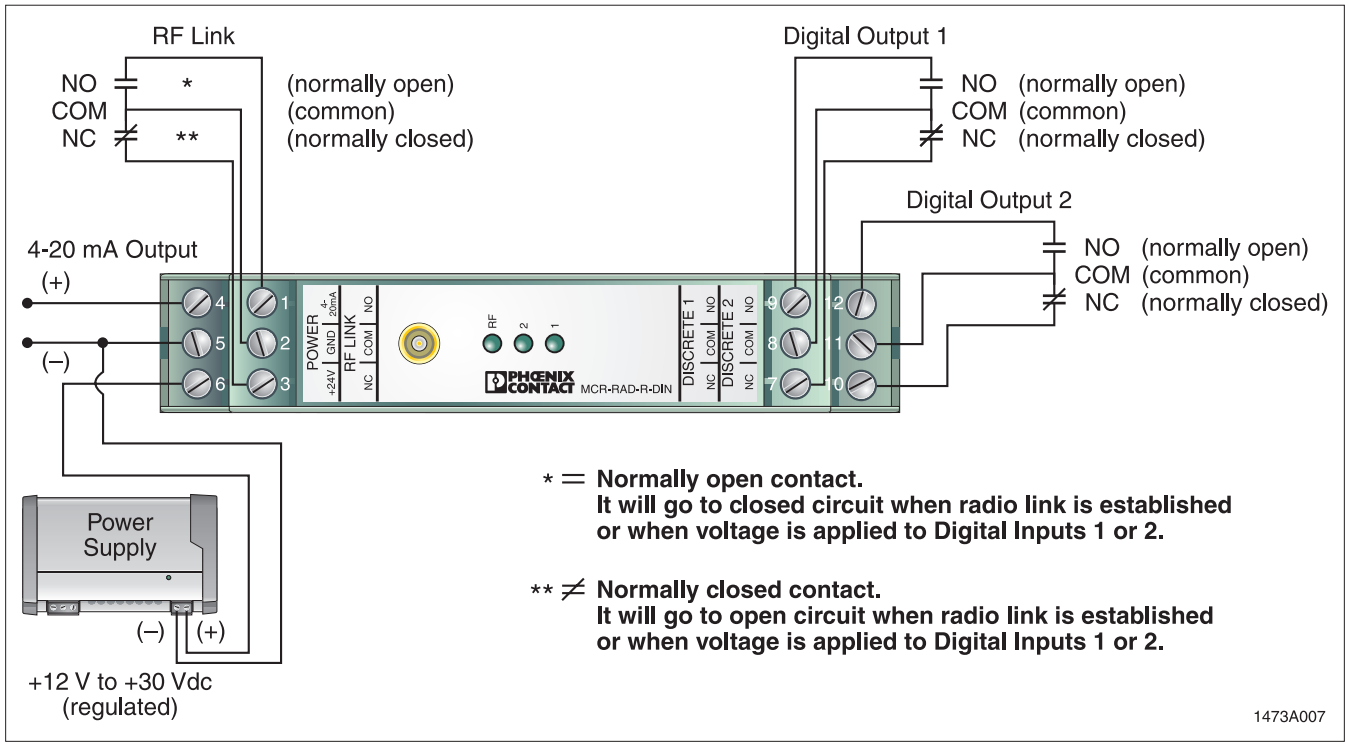


Figure 7. Receiver Wiring Diagram



If used in a Class I, Div. 2 area, do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Specifications

Table 1. Technical Specifications

MCR-RAD-Transmitter

Transmit power ..... 1 watt

Range ..... 600-1000 feet, in-plant, no line of sight
4-5 miles, line-of-sight, flat terrain, raised antennas
20+ miles, line-of-sight, flat terrain, professional propagation study, installation and directional antennas

Frequency ..... 902-928 MHZ

Power source ..... 12 V to 30 Vdc (regulated)

Power consumption ..... 8.4 watt peak, 1.8 watt average (350 mA @ 24 Vdc peak, 75 mA @ 24 Vdc average)

Inputs ..... 1 x 4-20 mA analog (250 Ω input impedance)
2 x 5 to 30 Vac/dc digital
(for 120 Vac discrete inputs use relays to convert to specified voltage levels. Consult factory for relay options)

MCR-RAD-Receiver

Frequency ..... 902-928 MHZ

Power Source ..... 12 V to 30 Vdc (regulated)

Power consumption ..... 3 watt (125 mA @ 24 Vdc)

Outputs ..... 1 x 4-20 mA analog (12-bit resolution)
3 x 120 Vac 0.5 A digital (dry contact)

Max. Loop Impedance ... 450 to 1350 Ω for power supply voltages of 12-30 Vdc

$$\text{Maximum Loop Impedence} = \frac{(\text{Supply Voltage} - 3)\text{V}}{20\ \text{mA}}$$

Repeatability 0.02%

Accuracy ..... 0.2% of full scale

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Table 2. General Specifications

Temperature range ..... -40° to 70°C (-40° to 158°F)

Humidity ..... 0-95% non-condensing

Dimensions ..... 102 x 114 x 17.5 (mm)
4 x 4.5 x 0.7 (inch)

Mounting ..... DIN-rail

Environmental ..... NEMA 1

Approvals ..... UL listed (Class 1, Division 2 Groups A, B, C and D) CSA approved

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Ordering Information

Part Description	Part Number
MCR-RAD-DIN System	**56 03 12 1**
MCR-RAD-R-DIN (receiver only)	**56 51 95 6**
Optional AC and DC weather-proof transmitter systems	
MCR-RAD-AC System	**56 03 11 9**
MCR-RAD-DC System	**56 03 12 0**

Accessories Ordering Information

Part Description	Part Number
MINI-PS-120-230AC/24DC/0-65 (universal voltage input 650 mA, 24 Vdc power supply)	**29 38 49 7**
Class I, Div. 2 Approved Power Supplies	
QUINT PS 120AC/24DC/1(1A,24VDC)	**56 02 77 1**
QUINT PS 120AC/24DC/ 2.5(2.5A,24VDC)	**56 02 76 9**
CM50-PS120/230/24DC/2.5IF	**29 39 42 5**
CM125-PS120/230/5IF	**29 39 52 2**
Class I, Div. 2 Approved Signal Converters	
MCR-T/UI-E (thermocouple or RTD to 4-20 mA converter)	**28 14 11 3**
MCR-C-UI/UI-DCI (converters for current to voltage or vice versa)	**28 10 91 3**
MCR-S1/5-UI-SW-DCI-NC (transducer for 0-11 A AC/DC)	**28 14 73 1**
MCR-S10/50-UI-SW-DCI-NC (current transducer for 0-55 A AC/DC)	**28 14 74 4**
MCR-F-UI-DC (frequency converter for 0-120 kHz)	**28 14 60 5**



The Phoenix Contact control system MCR-RAD is a frequency hopping spread spectrum radio designed for professional installation and integration with other products. When installed with the provided antenna, the system integrator needs to make sure the MCR-RAD's FCC label, or a copy of that FCC label, is clearly visible on the outside of the integrated product. The MCR-RAD is approved to operate within the 900 MHz ISM Band under Part 15 of the FCC Rules & Regulations.

FCC: This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

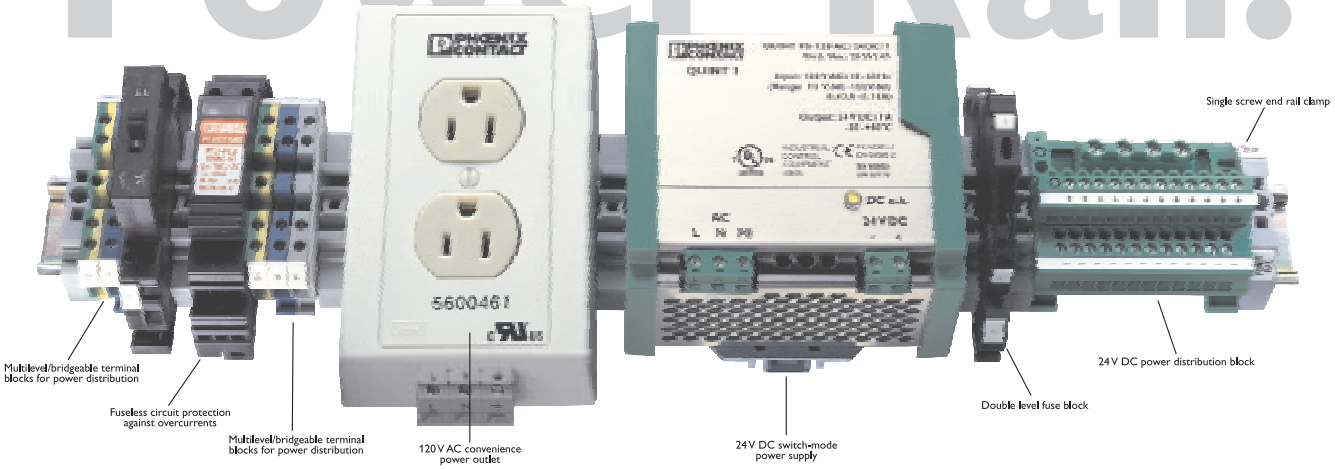
(1) This device may not cause harmful interference,

and

(2) This device must accept interference received, including interference that may cause undesired operation.

Changes or modifications not expressly authorized by Phoenix Contact could void the user's authority to operate the equipment. The system integrator may only use antennas that have been tested and approved with this radio to maintain the FCC approval. If a system integrator uses non-approved antenna they are responsible for obtaining their own FCC certification.

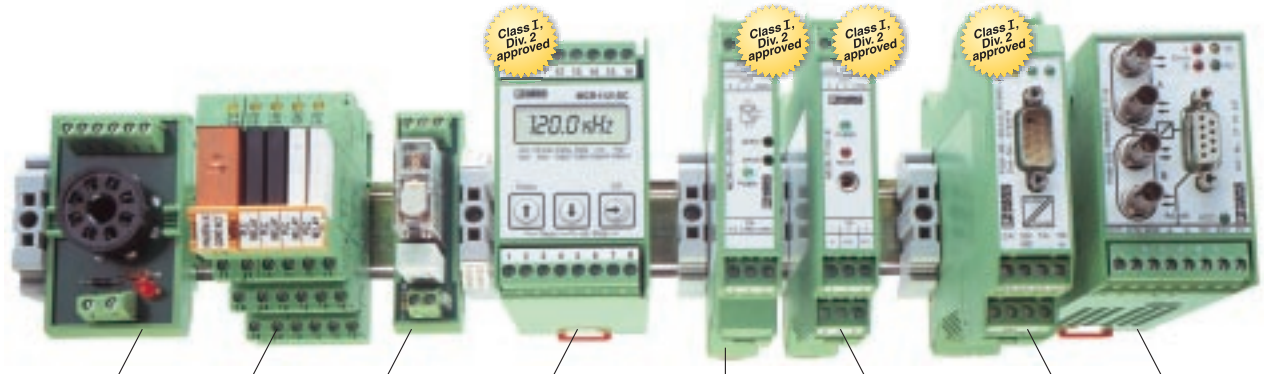
Power Rail.



For more information on Power Rail alternatives from Phoenix Contact, check out our website: **www.powerrail.com**

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I/O Enhancers



For more information on I/O enhancers from Phoenix Contact, check out our website: **www.iorail.com**

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