Pribusin Inc.

Training and Applications Manual

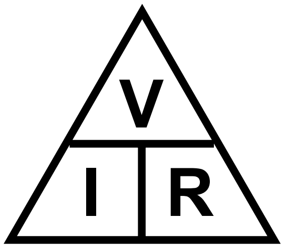
Pribusin Inc.

Section 1

Electronics Fundamentals

The Law of Mr. Georg Ohm - Ohm's Law

$$V = I \times R$$

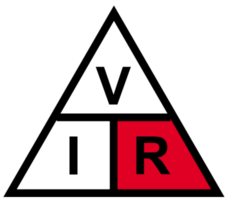


V=Voltage in Volts (V)
I=Current in Amps (A)
R=Resistance in Ohms (Ω)
(also called Load)

Mr. Ohm's Pyramid: To find any variable, cover it up and you have the right equation for that variable.

Example 1: Find the maximum allowable load in a 4-20mA loop.

Assume the loop is powered by a 24 VDC supply. Then,

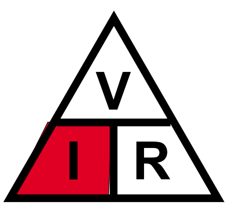


$$R = \frac{V}{I} = \frac{24}{0.020} = 1200 \text{ Ohms}$$

To allow for Power supply fluctuations a good idea is to use 20 VDC yielding a max. load of 1000 Ohms.

Example 2: Using a voltmeter to measure current in a 4-20mA loop.

Assume an instrument with a 250 ohm input impedance. Then,



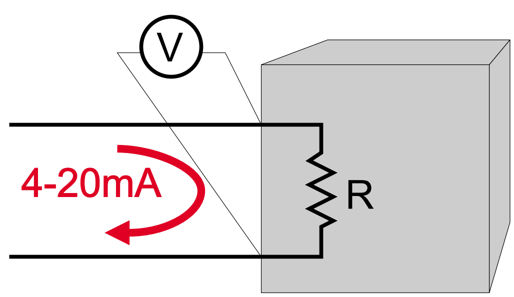
$$I = \frac{V}{R}$$

where, V=voltage measured across R
R=input impedance

If you measure a voltage of, say 3 volts accross R then,

$$I = \frac{V}{R} = \frac{3}{250}$$

$= 0.012$ Amps
$= 12$mA



Pribusin Inc.
3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

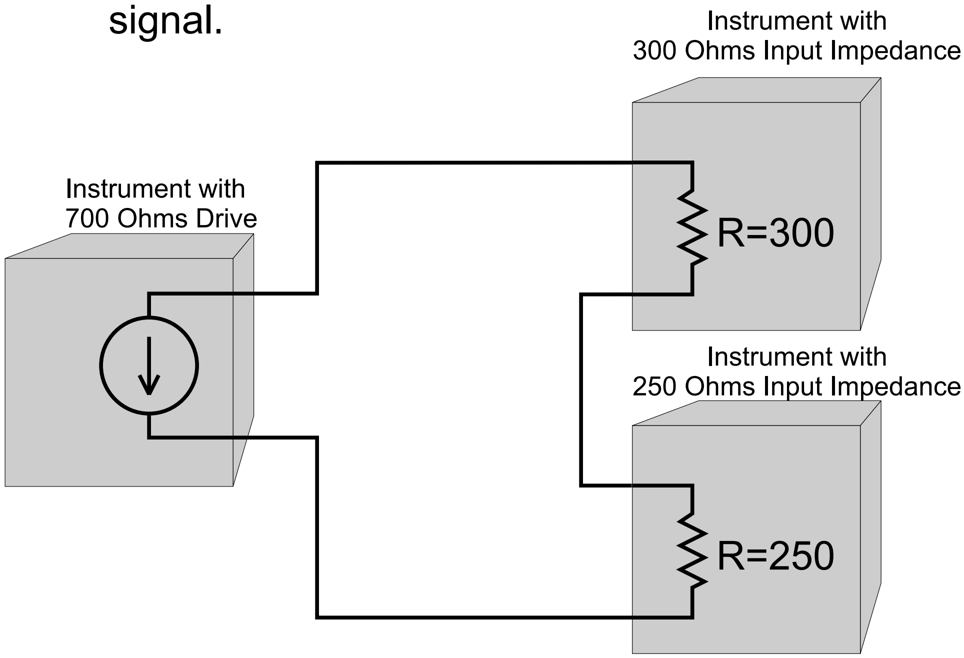
Drive vs. Impedance - Force vs. Resistance

Drive - The 'electric force' with which an output forces current into the loop

The output drive capability of an instrument is specified in ohms. This means that the total resistance of the 4-20mA loop connected to this output may not exceed this number.

Impedance - The resistance an input poses to this 'electric force'

The input impedance of an instrument is also specified in ohms. Adding together all input impedances of all units connected in the loop results in the total loop load. This figure cannot exceed the loop drive of the unit that provides the loop signal.



The total loop resistance in this loop is 300+250=550 ohms. The output drive of the left instrument is 700 ohms. This means that the output of the left instrument is almost loaded to capacity. No More instrument could be connected to this loop (except if its input impedance is less than or equal to 150 ohms).

Most of Pribusin's instruments have 1000 ohms output drive - some even have 1600 ohms drive. This allows you to connect many instruments to our outputs.

Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

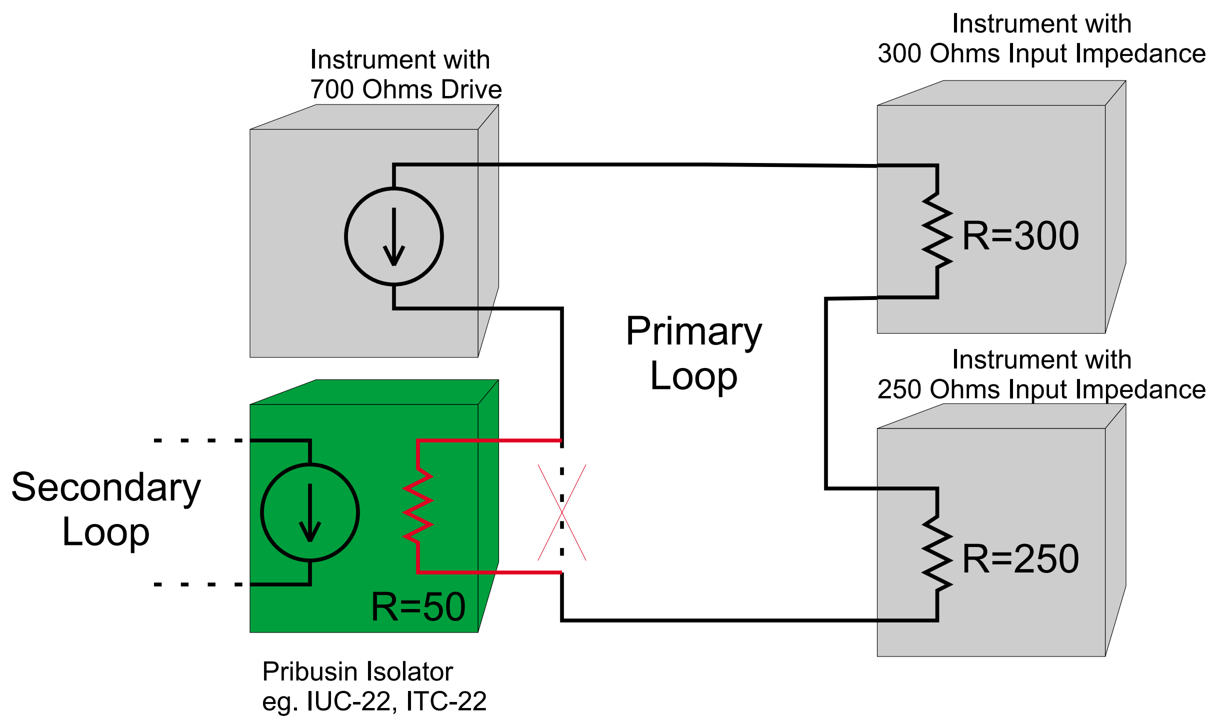
101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Increased Drive - A Simple Solution

If you need to connect an instrument into an already loaded loop you may find you're out of loop drive from the supplying instrument. Fortunately, Pribusin's ITC and IUC series can help increase your loop's drive by providing a secondary loop that is isolated from the primary and has its own loop drive characteristics.

The circuit below has a 550 ohm load on an output that can drive up to 700 ohms. This loop is almost loaded to capacity.



By adding a Pribusin Isolator into the Primary Loop the Primary Loop load increases by only 50 ohms to a total of 600 ohms. This is still well within the drive capability of the Primary Instrument.

BUT the Pribusin Isolator now provides a Secondary Loop with 1000 - 1600 ohms drive depending on the model used. In addition, this Secondary Loop is isolated from the Primary Loop to provide noise immunity and ground loop protection.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

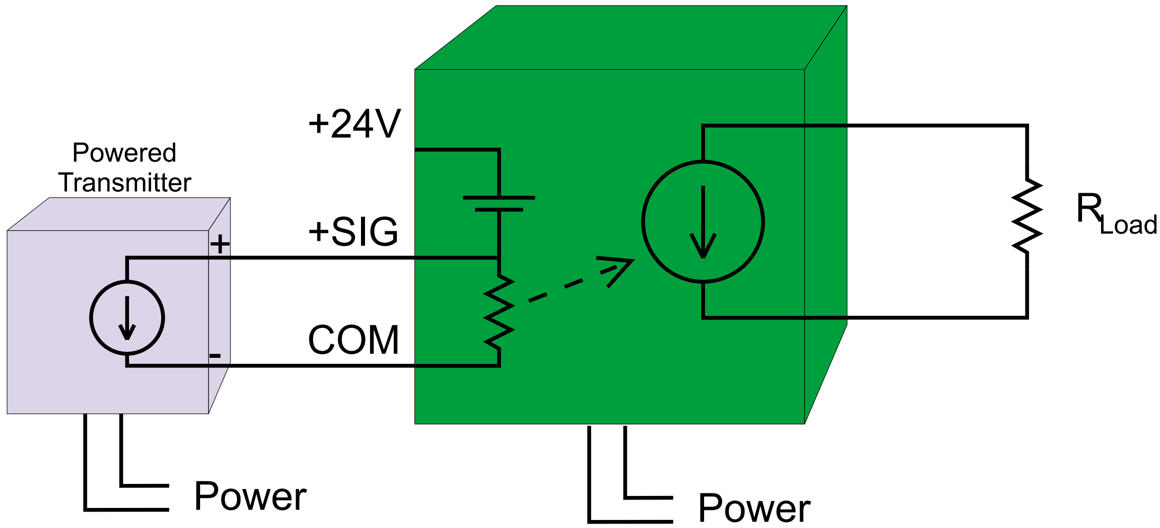
Pribusin Inc.

Section 2

Isolation

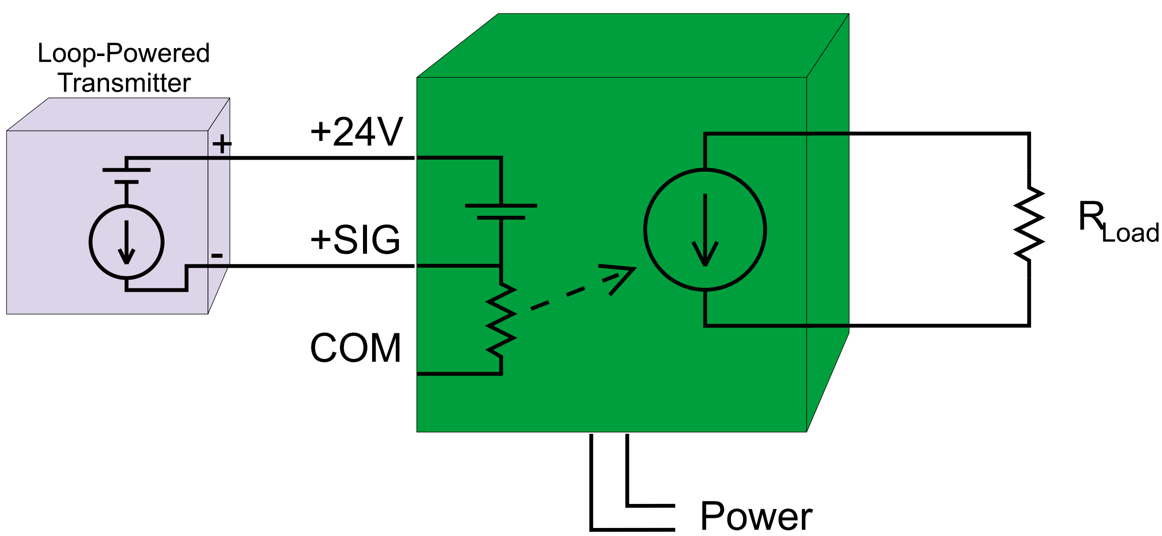
Isolator Types - Powered & Loop-Powered

1. Powered Isolators (eg. IUC, ITC): Normal Connection:



The 'Standard Connection' of a powered isolator requires the field transmitter to be powered on its own providing a powered 4-20mA loop. The input impedance (Z_{in}) of the isolator is independent of the output loop load (R_{Load}).

2. Powered Isolators (eg. IUC, ITC): Two-Wire Connection:



The 'Two-Wire Connection' of a powered isolator requires the field transmitter to be unpowered and obtain its power from the 4-20mA input loop of the isolator. The input impedance (Z_{in}) of the isolator is independent of the output loop load (R_{Load}).

Pribusin Inc.

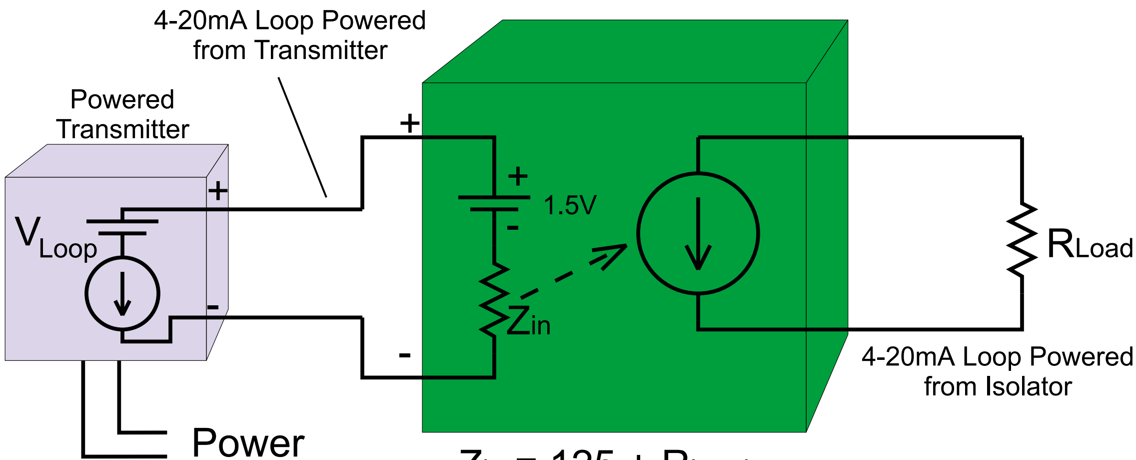
3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Isolator Types - Powered & Loop-Powered

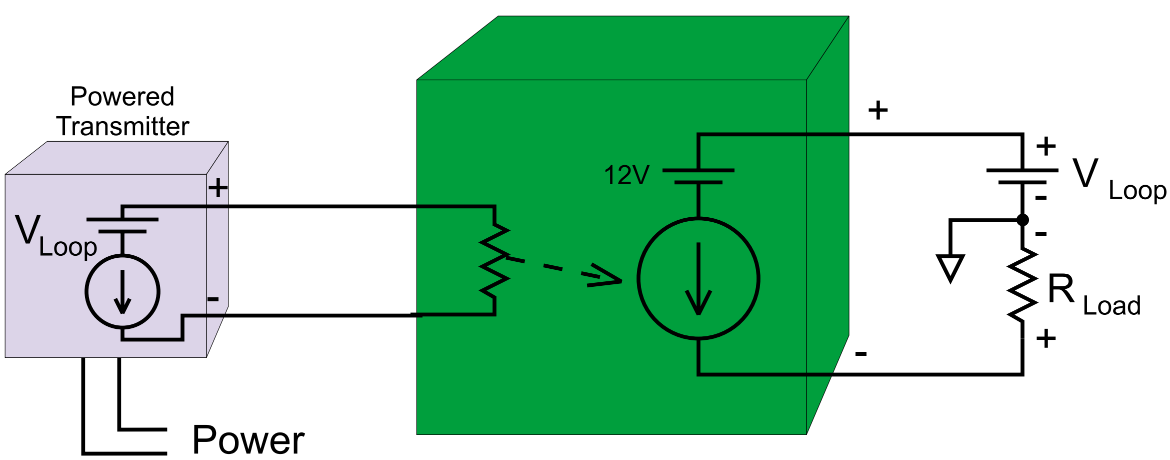
3. Input-Loop-Powered Isolators (eg. TWI-22 & TWI-22-TB)



$Z_{in} = 125 + R_{Load}$

In an Input Loop Powered Isolator the output loop is powered from the input loop. This means that the load in the output loop (R_{Load}) is reflected onto the input loop (Z_{in}) plus some resistance for the isolator itself. Be sure the input loop has enough drive. The isolator's loop drive is also limited.

4. Output-Loop-Powered Isolators (eg. TWI-MV22)



In an Output Loop Powered Isolator the input comes from a powered firld transmitter. A minimum of 12 Volts is required to operate the isolator. The -ve output is connected to the +ve input to the controller (R_{Load}). Sometimes the common -ve connection between V_{Loop} and R_{Load} is not even available at the controller end.

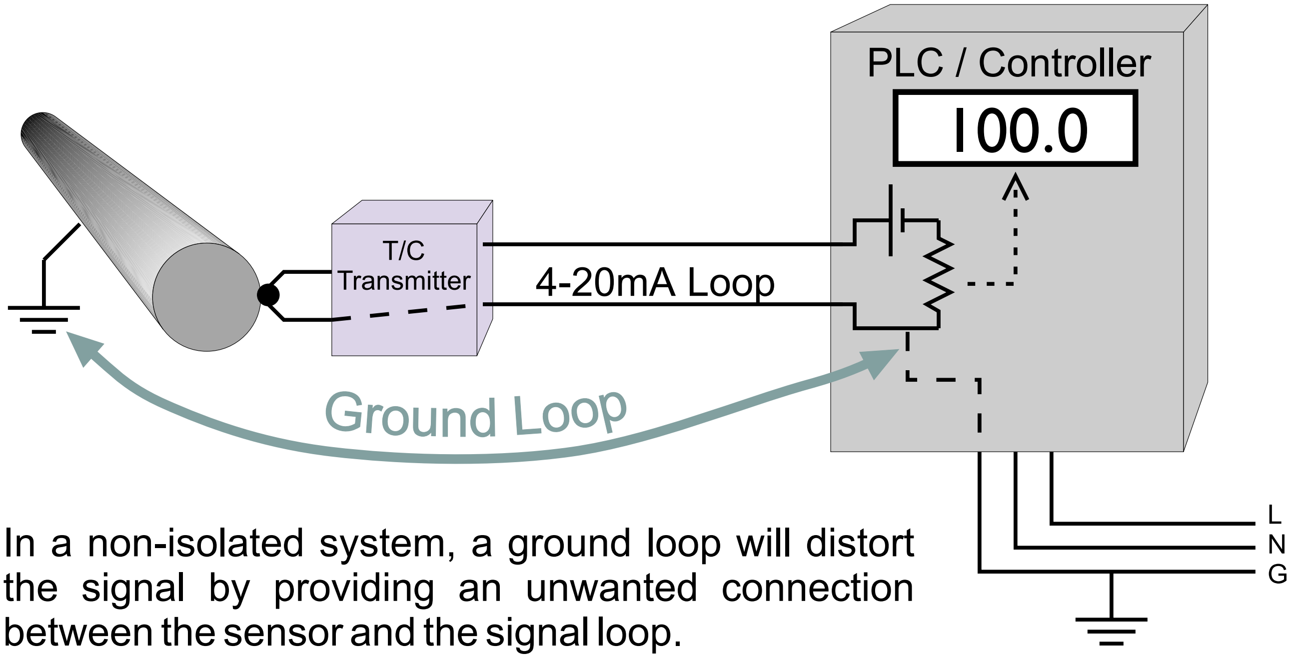
Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

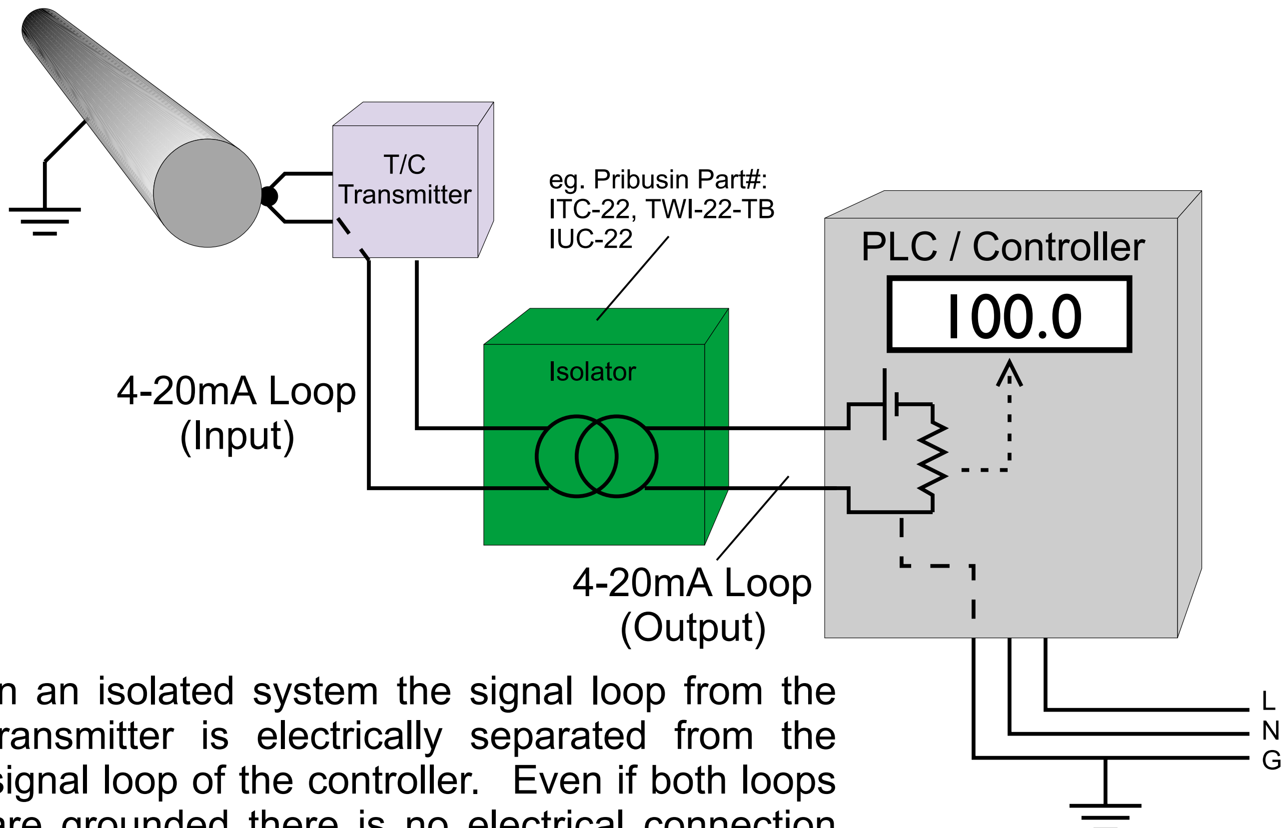
101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Isolation Example #1 - Ground Loops



In a non-isolated system, a ground loop will distort the signal by providing an unwanted connection between the sensor and the signal loop.



In an isolated system the signal loop from the transmitter is electrically separated from the signal loop of the controller. Even if both loops are grounded there is no electrical connection between them. Besides preventing ground loops, this also reduces noise in many applications.

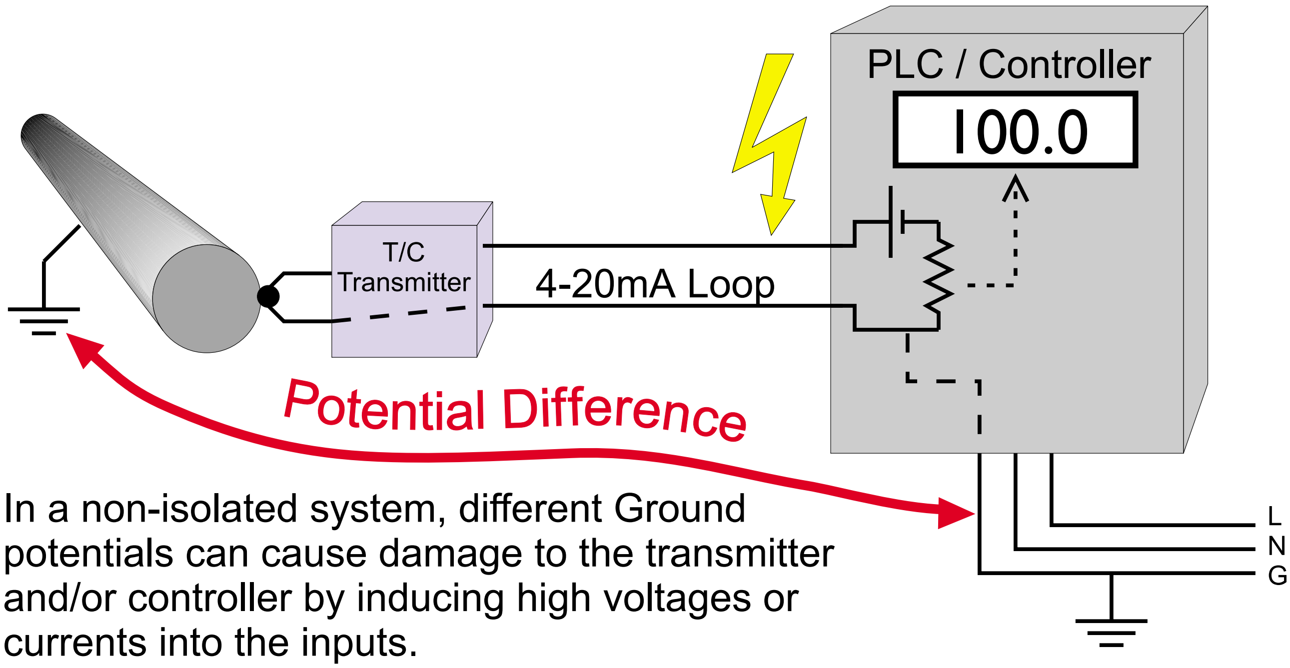
Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

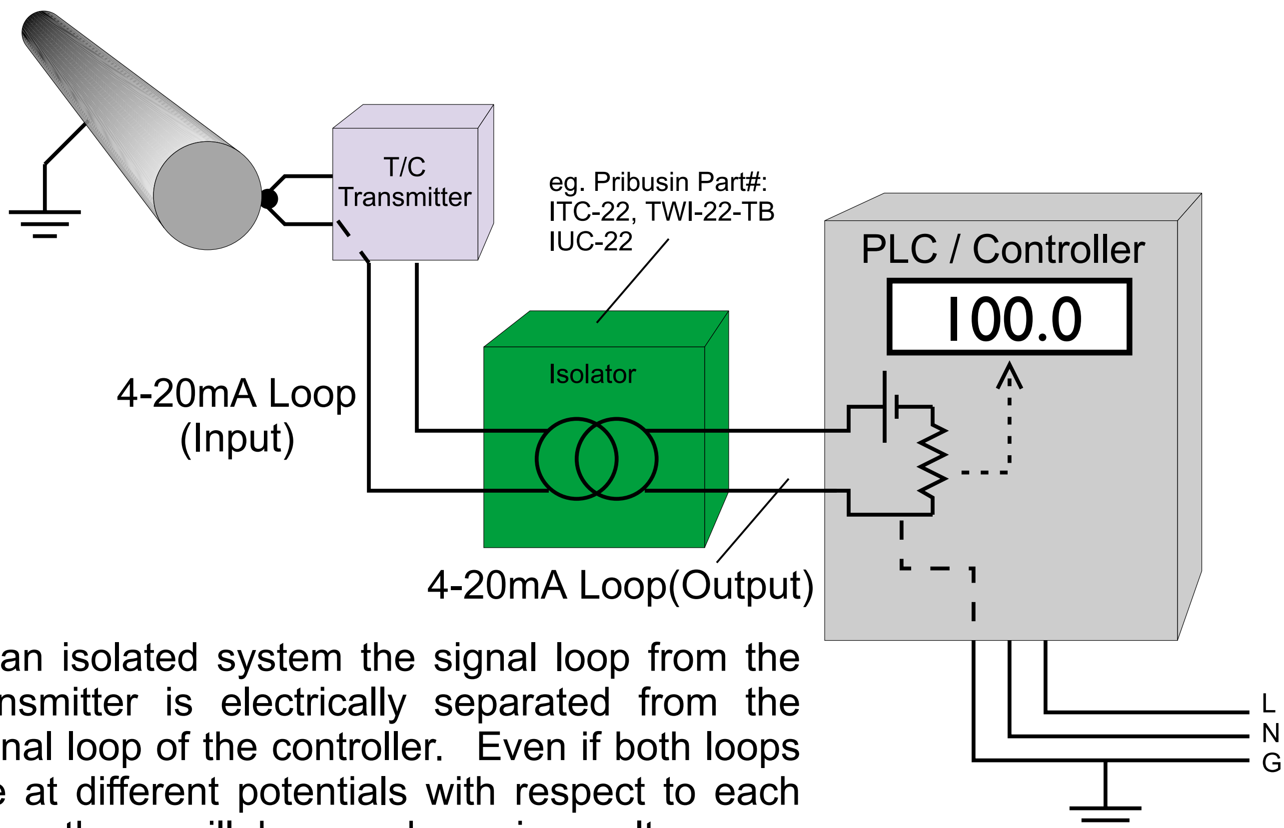
101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Isolation Example #2 - Ground Potentials



In a non-isolated system, different Ground potentials can cause damage to the transmitter and/or controller by inducing high voltages or currents into the inputs.



In an isolated system the signal loop from the transmitter is electrically separated from the signal loop of the controller. Even if both loops are at different potentials with respect to each other there will be no damaging voltages or currents induced into the input of the controller or the transmitter.

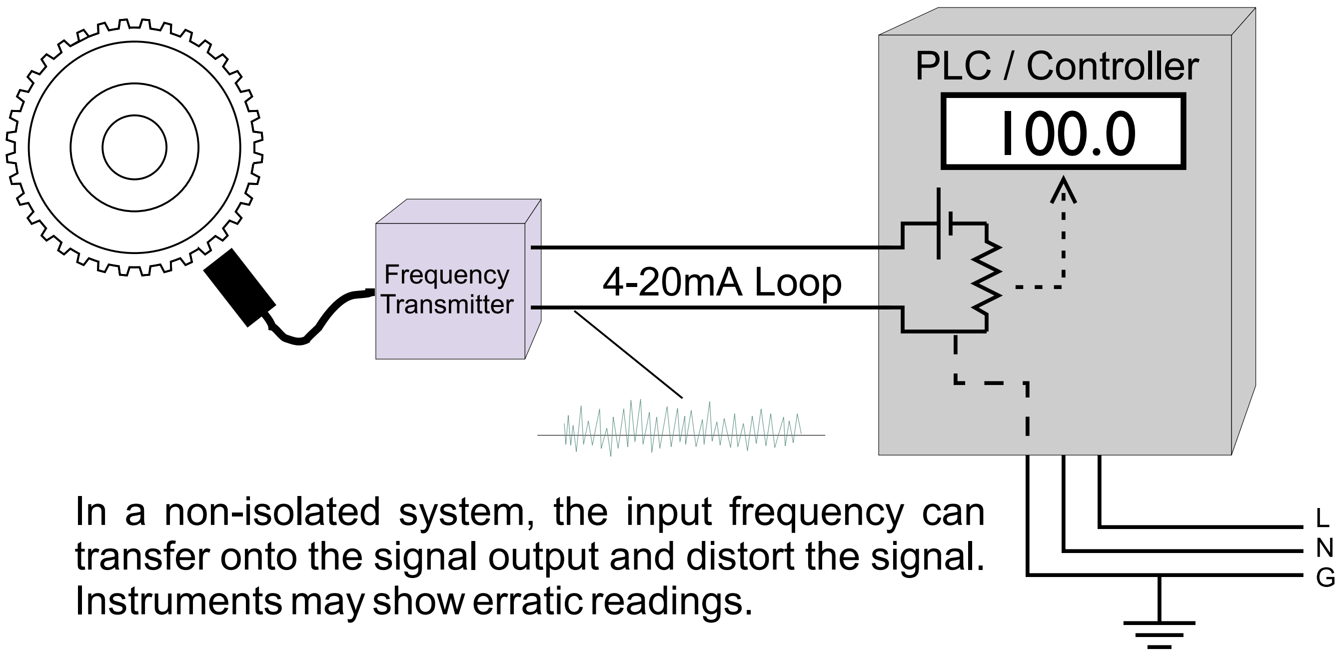
Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

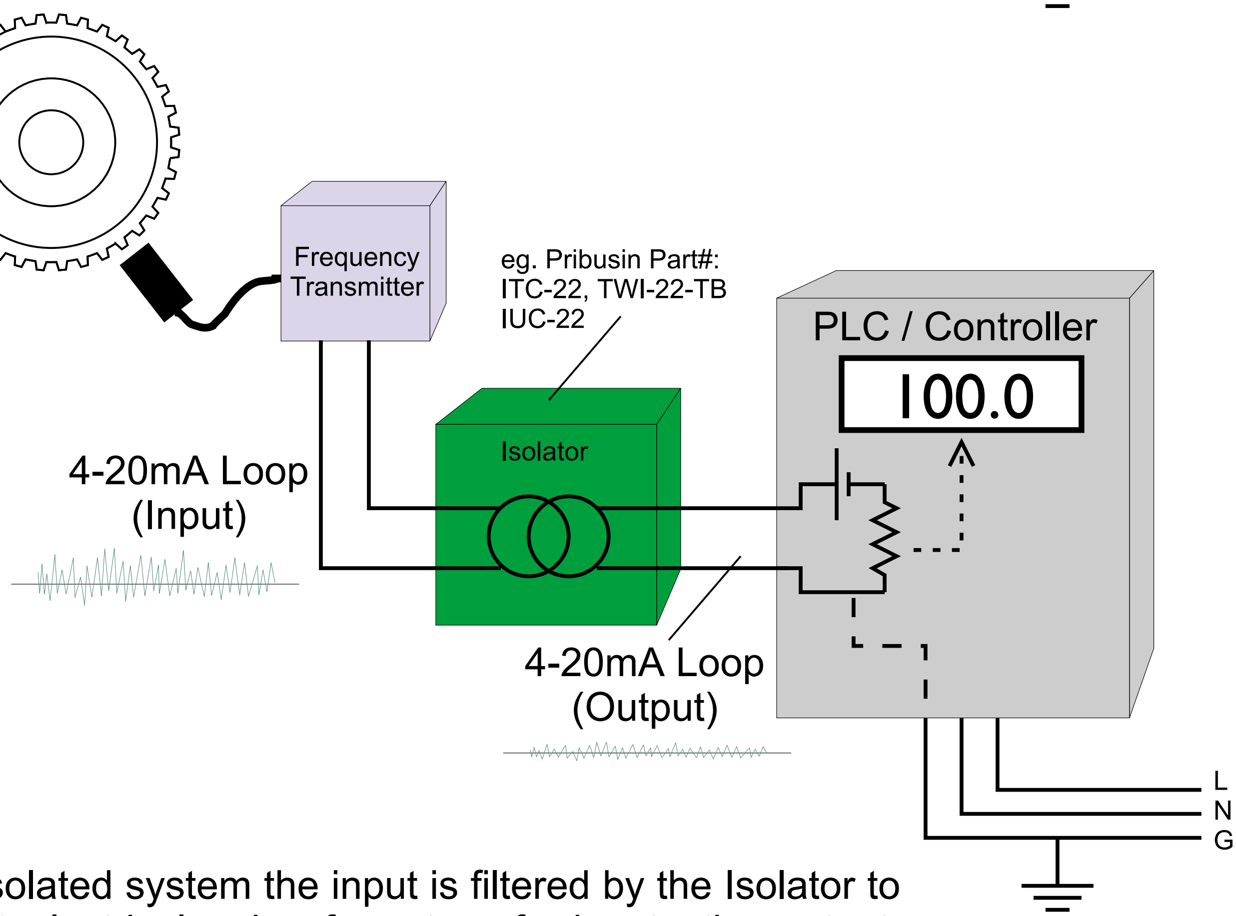
101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Isolation Example #3 - Electrical Noise



In a non-isolated system, the input frequency can transfer onto the signal output and distort the signal. Instruments may show erratic readings.



In an isolated system the input is filtered by the Isolator to prevent electrical noise from transferring to the output. Electrical noise filtered out includes *Common Mode* signals and *Differential Mode* signals.

Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Pribusin Inc.

Section 3

Alarm Trips

Setpoint Monitors - Alarming News

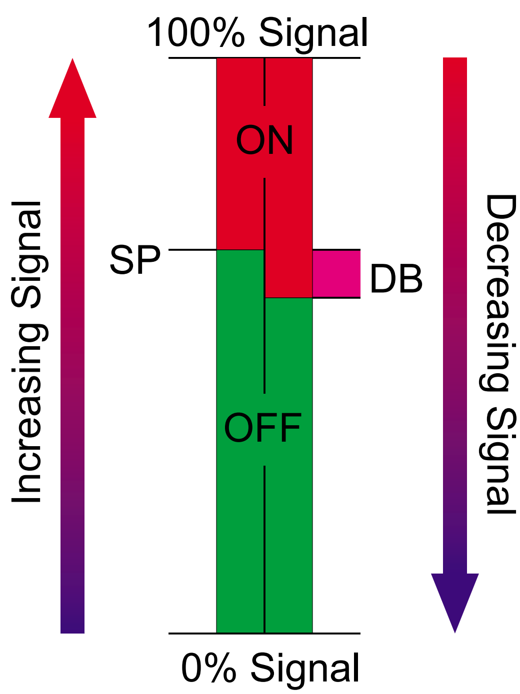
Setpoint Monitors have many different names. They are called Alarm Trips, Current Trips, Alarm Relays, Current Relays, and others. No matter what the name, they all perform one function: to signal an event that requires action to be taken. They all have a signal input and one or more relay contact outputs that are used to perform actions.

Trip Setpoint - This is the signal level at which the relay contact is activated to perform an action or indicate an event.

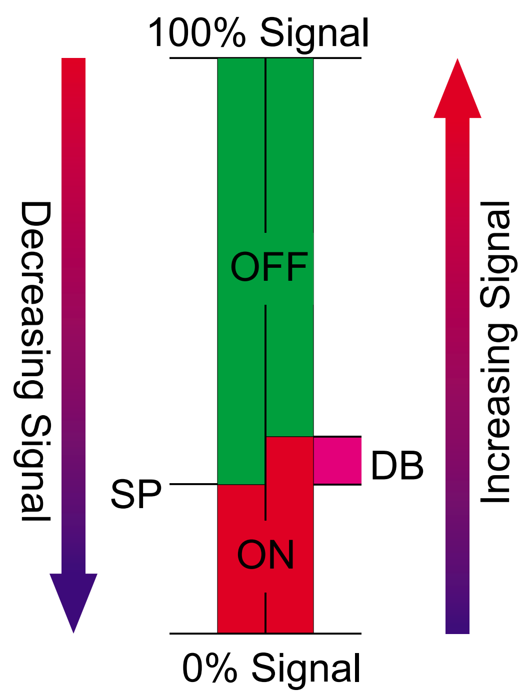
Deadband - This is the amount of *signal differential* at which the relay contact de-activates.

High vs. Low Trip - ***High Trip*** refers to an operating mode in which the relay contact becomes activated if the input level ***exceeds*** the Trip Setpoint. ***Low Trip*** refers to an operating mode in which the relay contact becomes activated if the input level ***falls below*** the Trip Setpoint.

High Trip



Low Trip



Pribusin Inc.
3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861
101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068
Web: http://www.pribusin.com
e-mail: info@pribusin.com

Setpoint Monitors - Setup Example

Pribusin's Setpoint Monitors have a unique variable adjustment method which makes them very easy to set up in the field. Each variable has a multi-turn potentiometer and a test jack associated with it. Each test jack read a voltage of 0-5VDC for a variable setting of 0-100%.

Use the Following equations to set the various variables:

Setpoint: $$\frac{\text{Setpoint (mA)} - 4\text{mA}}{16\text{ mA}} \times 5\text{ VDC} = \text{Test Jack Voltage}$$

Deadband: $$\frac{\text{Deadband (\%)}}{100\%} \times 5\text{ VDC} = \text{Test Jack Voltage}$$

Delay: $$\frac{\text{Delay (sec.)}}{60\text{ sec.}} \times 5\text{ VDC} = \text{Test Jack Voltage}$$

Example: A level probe delivers a 4-20mA signal of the level in a holding tank. The tank level is to be kept between a maximum level of 18mA and a minimum level of 7mA. A draining pump is to be turned on at 18mA and off at 7mA to accomplish this.

$$\frac{\text{Setpoint (mA)} - 4\text{mA}}{16\text{ mA}} \times 5\text{ VDC} = \frac{18\text{mA} - 4\text{mA}}{16\text{ mA}} \times 5\text{ VDC}$$

$$= 0.875 \times 5\text{ VDC}$$

$$= \underline{4.375\text{ VDC}}\text{ (Setpoint Test Jack)}$$

18mA = 87.5% , 7mA = 18.75%

Deadband = 87.5% - 18.75% = 68.75%

= 0.6875 x 5 VDC = 3.4375 VDC (Deadband Test Jack)

Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Pribusin Inc.

Section 4

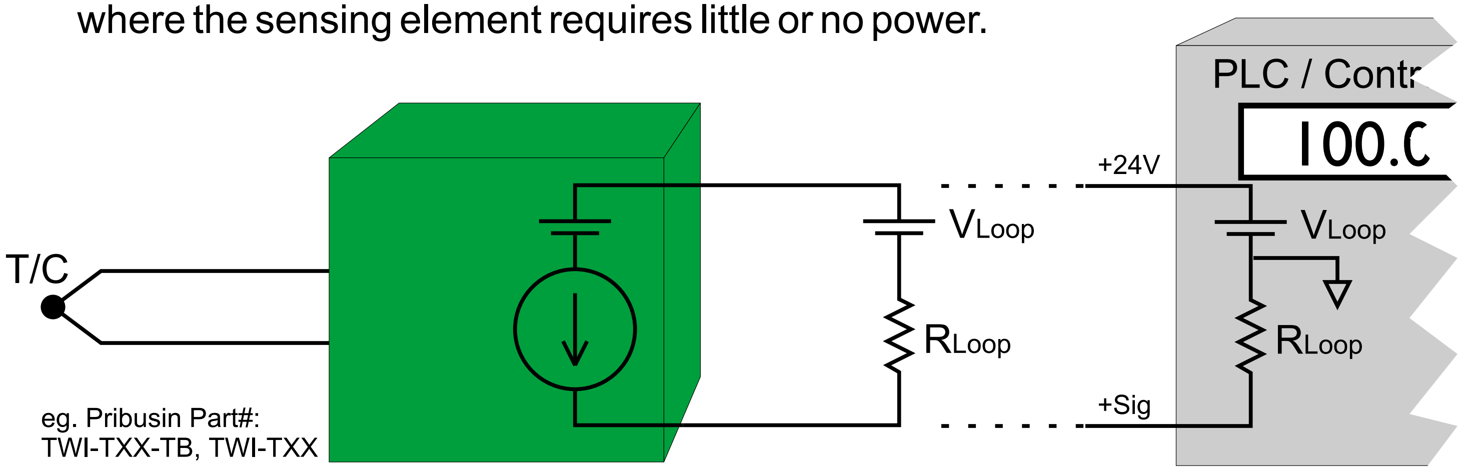
Two-Wire Instruments

Two-Wire Instruments - Theory of Operation

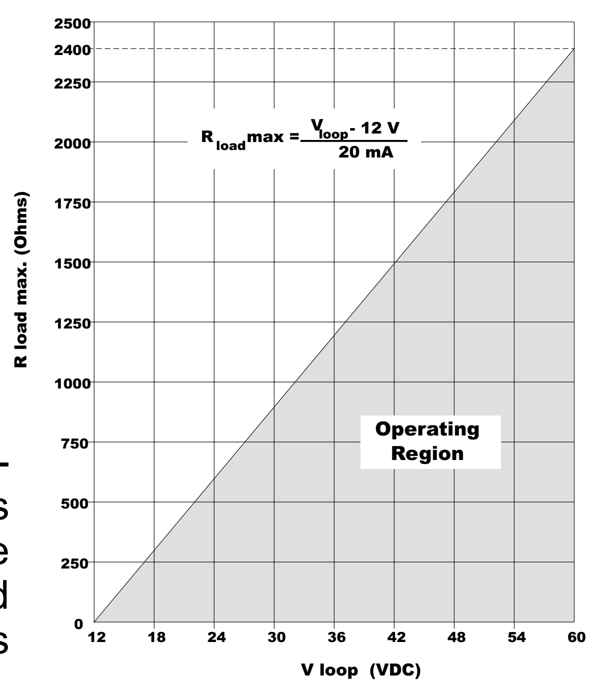
Two-Wire Instruments get their name from the 2 wires they use to get both power from a controller and deliver a signal back to it. Other instruments typically use 4 wires: 2 for power and 2 for the signal.

2-Wire Instruments work on 4-20mA loops ONLY !! They accomplish their task by taking a small amount of power from the loop to run themselves and then modulate the current running through them to represent a signal proportional to what they are measuring.

Typical 2-Wire Instruments are used for RTD, T/C, mV and isolation applications where the sensing element requires little or no power.



Because 2-wire instruments take some power from the loop, the amount of loop drive remaining depends on the power supply of the loop. The graph on the right shows the maximum loop load (R_{Load}) for given power supplies. If the maximum load is exeeded there will not be enough power for the 2-wire instrument. This graph is for Pribusin's TWI-XXX-TB series of instruments



2-wire instruments come in isolated and non-isolated types. Isolated types are preferred as they reduce the risk of ground loops and noise interferrence. Non-isolated types must be used with caution and only when the sensor is absolutely isolated itself.

Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Pribusin Inc.

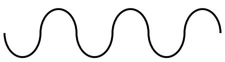
Section 5

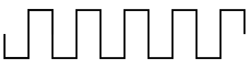
Frequency

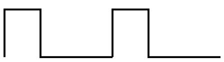
Frequency - The Up's and Down's of Mr. Hertz

Frequency is defined as a regularly ocurring event over a period of time. It is measured in Hertz (Hz) which is the count of these recurring event cycles in one second. In electronics, frequency is the fluctuation in voltage of a signal.

There are many types of frequency:


Sinusoidal - eg. AC House current

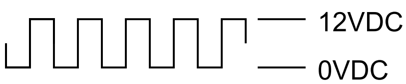

Square - eg. Rotary Flowmeters


Pulse Width Modulation - eg. Motor Drives

All Frequencies have 2 main identifying properties:

1. ***Amplitude*** - The voltage difference between extreme levels

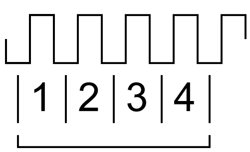
eg.



The amplitude is 12 Volts

2. ***Frequency*** - The number of cycles per second

eg.



1 second = 4cycles/second = 4Hz

Pribusin Inc.

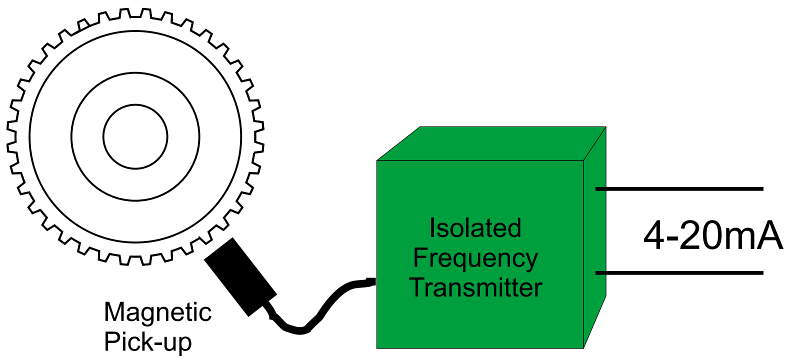
3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Use of Frequency - Application Examples

Example 1: Frequency is quite often used as a speed indicator of a motor or a rotating vane of a flowmeter. Typically, this frequency cannot be use in its raw form and must usually be converted to some sort of analog signal, ie. 4-20mA.

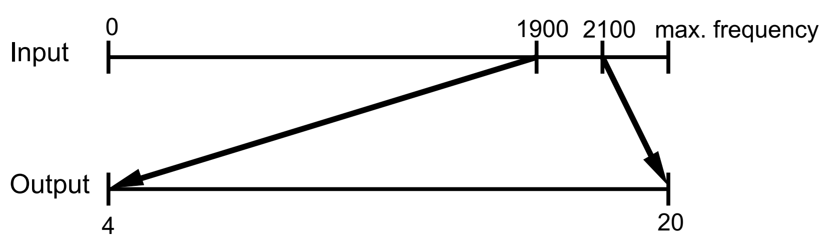


When converting frequency to an analog signal it is important to note that the output signal is zero-based. This means that a frequency of 0 Hz always results in a signal output of 0%. The upper frequency limit is the only adjustment. This upper limit frequency results in a 100% output signal.

Using Pribusin's Isolated Frequency Converter IUC-7X-FRX serves a dual purpose by achieving the desired conversion and isolating the input frequency from the analog output signal.

Example 2: Sometimes the speed of a motor must be monitored very closely and the above example would result in insufficient signal resolution. Using a Pribusin Frequency Window Converter allows a small portion of the frequency to be extracted and then converted to an analog signal.

Suppose a motor runs at 2000 RPM. It is to be monitored over a range of 1900-2100 RPM.



By setting up the Frequency Window Converter appropriately, a small portion of frequency can be extracted and expanded into a full 4-20mA (or any other) analog output.

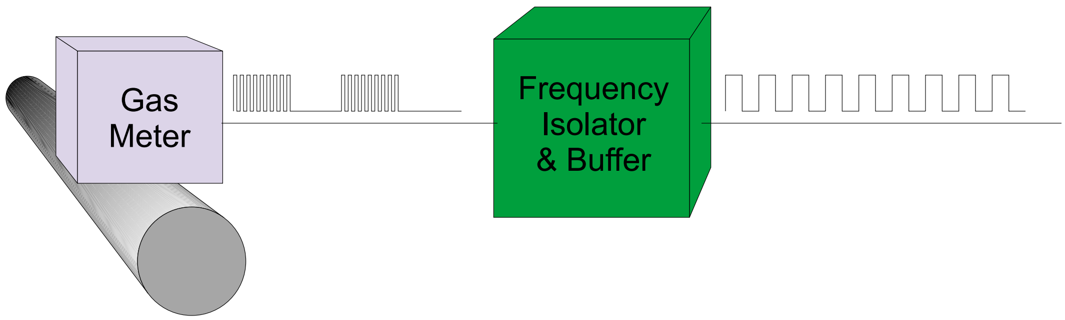
3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Use of Frequency - Application Examples

Example 3: Some Natural Gas Consumption meters produce a burst of pulses at a high rate. This rate is often too high for counters to measure.



A Pribusin Frequency Isolator with Buffer option can store up to 65535 incoming pulses at a fast rate and slowly pass them on to a slower counter or PLC input.

Pribusin Inc.
3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Pribusin Inc.

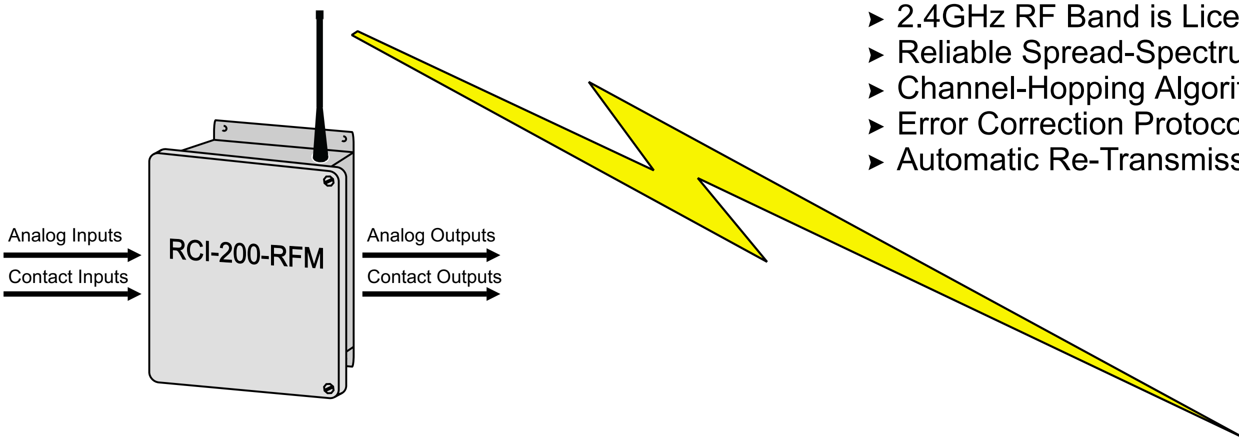
Section 6

Remote Telemetry

Wireless Telemetry - The Invisible Connection

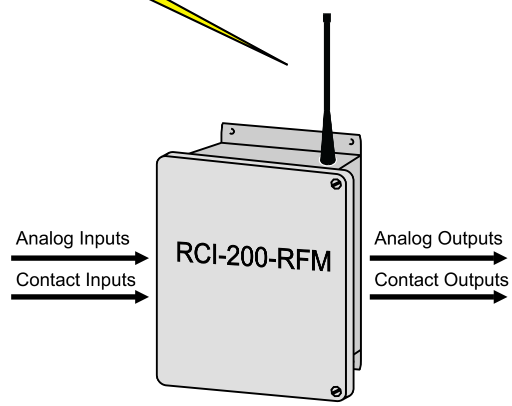
Wireless Radio Frequency (RF) telemetry offers a great advantage over other telemetry methods by making use of a cheap and easily accessible transmission medium - AIR. When properly installed, wireless systems are very reliable and require little, if any maintenance. Using a license-free RF band eliminates the need for obtaining a site license from the FCC.

- 2.4GHz RF Band is License Free
- Reliable Spread-Spectrum Radios
- Channel-Hopping Algorithm
- Error Correction Protocol
- Automatic Re-Transmission on Error



Spread-Spectrum Technology

Spread-Spectrum Technology uses more than one frequency to transmit data. The radios choose from over 500 channels between 2.4000GHz and 2.4835GHz. This RF band has been set aside specifically for the license-free operation of spread-spectrum radios.



Channel-Hopping

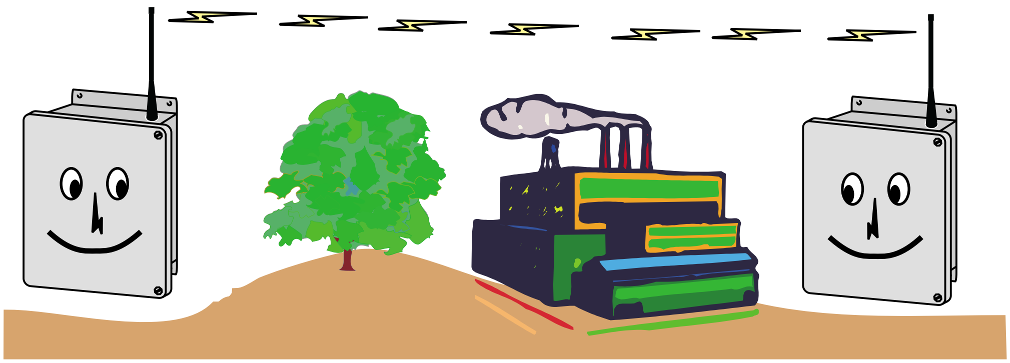
Spread-spectrum radios use channel-hopping technology to make use of the many available channels. Radios will use one channel for only ¼ of a second before jumping to another channel. This ensures that no one channel is ever occupied by one radio preventing another from using the channel. Each radio may use a different channel-hop-table thus allowing many radios to share the same RF band without interfering with one another. If two foreign radios should happen to make use of the same channel, a collision will be detected by both radios and they will each move onto a different channel and re-send their data.

Error-Correction & Re-Transmission

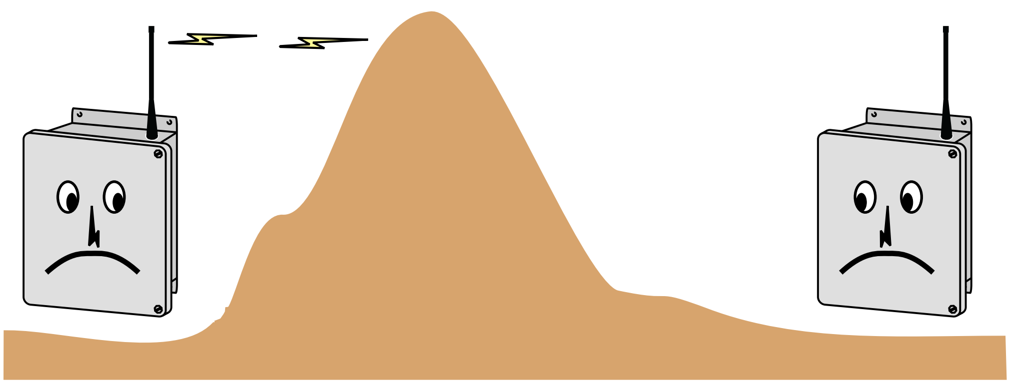
The radios use a comprehensive error checking algorithm to ensure that the transmitted data is indeed correct. If incorrect data was received, the receiver will instruct the sender to re-send the data until it has been received correctly. Since all data is transmitted in digital form there is no degradation in analog values when signal strength decreases. Forward error correction algorithms 'repair' any questionable data on the fly.

Wireless Telemetry - To see or not to see ...

As with any Radio Frequency (RF) system, the radio waves propagate best through the air. Obstruction such as buildings, walls, hills, trees etc. pose a potential hindrance to radio wave propagation (imagine your car radio going silent inside a tunnel). The ideal system is one where all radio antennas are in direct line-of-sight with one another. Although, radio waves may reflect off hard surfaces and find an alternate path that is not line-of-sight.



In the ideal system setup, both antennas can 'see' each other without any obstructions. This yields the greatest transmission distance and the most reliable signal conditions. This is called line-of-sight transmission.



If there is a large physical obstruction between the two antennas, the radio waves will be blocked. No transmission is possible in this case.

In many cases where there is no direct line-of-sight path between antennas, the RF signal may still get through by 'bouncing' off buildings or other solid structures. Signal strength must be taken into consideration here to determine if there is enough signal available for reliable transmission.

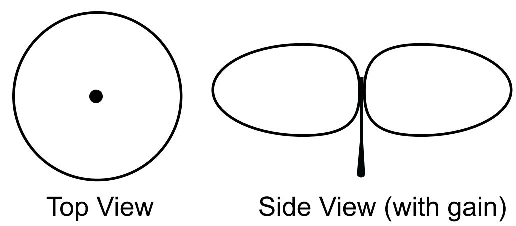
Wireless Telemetry - Antennas & Cable

One of the most important components of any RF system is the antenna. This is where the radio waves are sent on their way to the other radio. There are many different types of antennas for different applications. Ideally antennas are located outdoors and typically on a mast that clears all surrounding obstructions. Besides transmitting the radio waves, antennas can also act as 'radio wave amplifiers'.

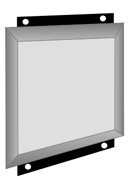
The cable that connects the antenna with the radio is equally important. Unfortunately, all cable poses a 'resistance' to the RF signal thereby limiting the amount of signal being transmitted by the antenna. Using low-loss coaxial cable and keeping this cable length short are two important considerations.

Omni-Directional Antenna

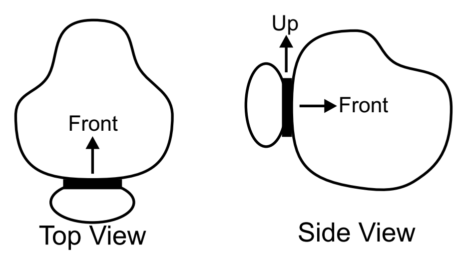
An Omni-Directional antenna is a non-directional antenna. It radiates equal amounts of radio wave energy in a spherical pattern. Higher gain antennas radiate in a 360° pattern that is flattened on top and bottom and looks more like a donut. These antennas are ideal for a host site that has several remote sites located in various directions.



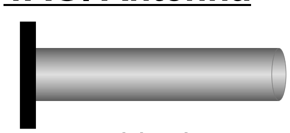
Panel Antenna



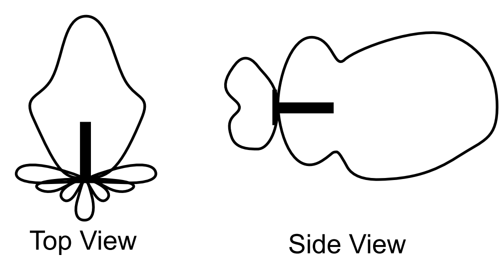
A panel antenna is a directional antenna that 'focuses' the radio wave energy into a beam which is aimed out the front of the antenna. Panel antennas have a high gain for greater distance transmissions and are great for a point-to-point RF system.



YAGI Antenna

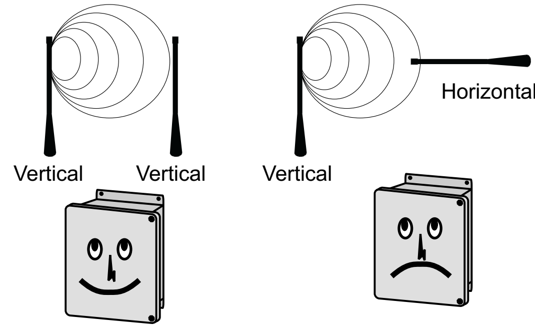


A Yagi antenna is a highly directional antenna that produces a very narrow beam of radio waves. These antennas provide the greatest distance transmission and obstruction penetration capability . Because of the narrow RF beam they are more difficult to align.



Antenna Polarization

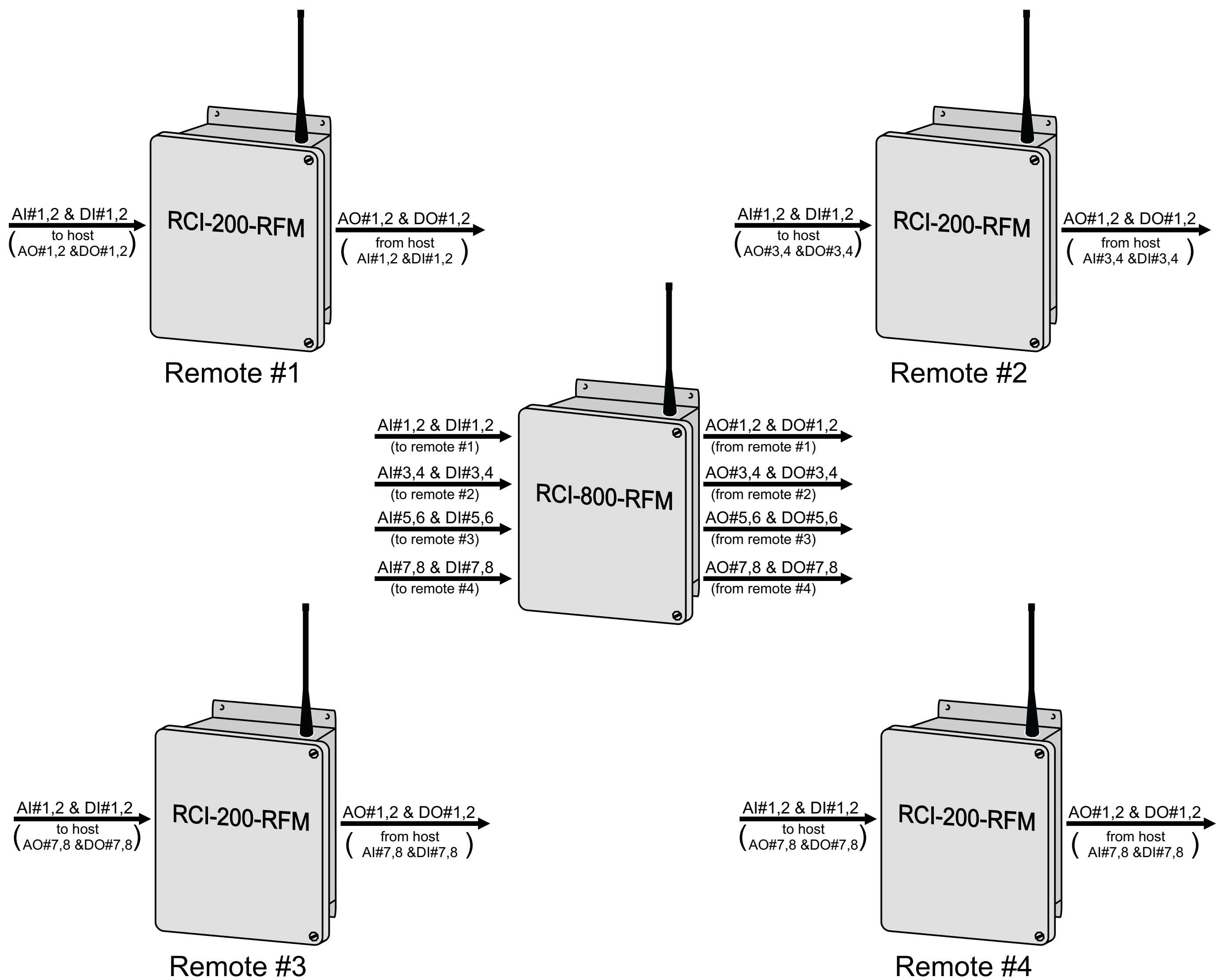
All antennas have a direction of polarization. This means that radio waves leaving an antenna are 'oriented' by the polarization of the antenna. Radio waves can only be received by an antenna of equal polarization. Directional antennas have a polarization marking (vertical or horizontal) and a direction arrow to indicate which way is UP. Omni-directional antennas can be mounted in any orientation so long as ALL antennas in the system are mounted the same way.



Wireless Telemetry - May I be Your Host ?

A simple telemetry system consists of just two devices: a local unit and a remote unit. However, many times there may be several remote sites that have data to be exchanged with a single local site. This setup is referred to as a host-to-multipoint system. An 8-channel RCI-800-RFM can act as a host for up to four 2-channel RCI-200-RFMs. If the RCI-200-RFMs are configured as single channel units, one RCI-800-RFM can host up to eight remotes.

Signals can be exchanged with all remotes in both directions just like in a point-to-point system.



Pribusin Inc.

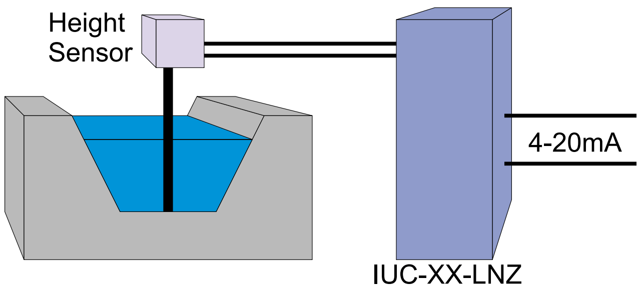
Section 7

Sample Applications

Sample Applications - Go with the Flow

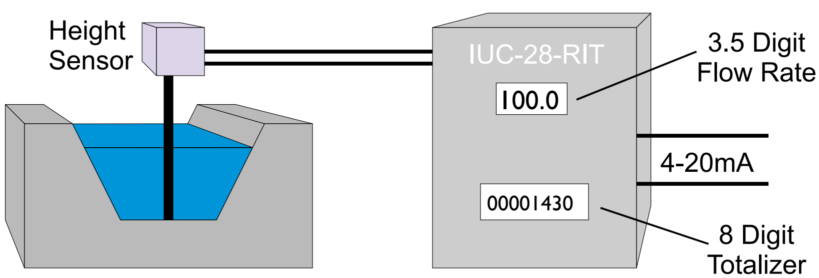
Measuring and controlling flows is a wide-spread applications field. Here are some applications where Pribusin's instruments have excelled.

Example 1: The flow of waste-water over a weir is to be determined and used to control a flow gate. The weir has a float with a sensor that returns a 4-20mA signal indicating the height of water over the weir.



By using a Pribusin Linearizer the height signal from the height sensor is converted to an actual flow signal indicating the amount of water flowing over the weir.

Example 2: Using the above example as a base, we may need to find the total amount of water flowing over that weir (or in a pipe) over a period of, say, a day. This may be used for performance records, billing, etc.



Using the IUC-28-RIT both functions of controlling the water flow and measuring it over a period of time can be accomplished together. The IUC-28-RIT comes in a NEMA4 type enclosure making it ideal for locations exposed to high moisture and occasional splash water.

Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

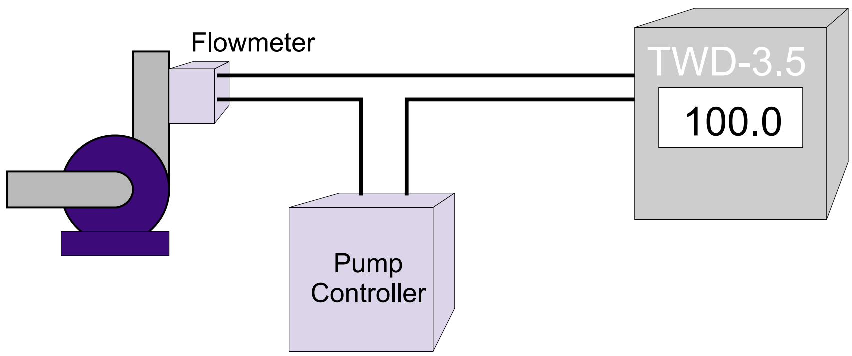
101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

Sample Applications - Displays of Truth

Most control applications never require operator intervention but in some cases it's important that an operator be able to verify the status of a process. For this, a display showing the process signal level can easily be added to the existing circuitry.

Example 1: A flowmeter on a pipe measures the flow rate of a liquid and controls a pump. Under certain circumstances an operator may have to intervene and manually control the pump. But the operator doesn't really know the flow rate under manual control.

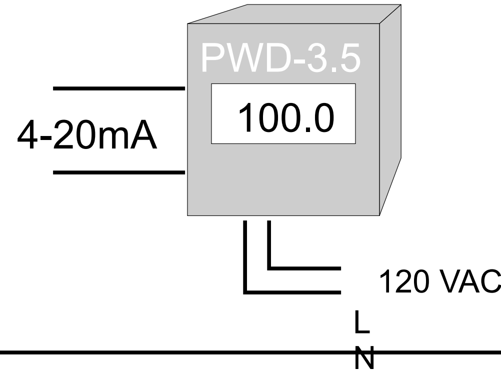


By using a Pribusin Two-Wire Display virtually no modifications are required in the loop other than splicing the display into the loop somewhere. Only 125 ohms of additional load are placed into the loop which is easily handled by most existing loops.

The display can be setup to display any range from 0-1999 complete with 3 decimal points. This makes it very easy to display meanigfull data on a certain process.

Example 2:

If not enough power is available in the loop to run a 2-wire display or if there is no loop an alternative is the TWD-3.5 which is the powered version. It has a built-in 24VDC supply to provide power to a field transmitter.



Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

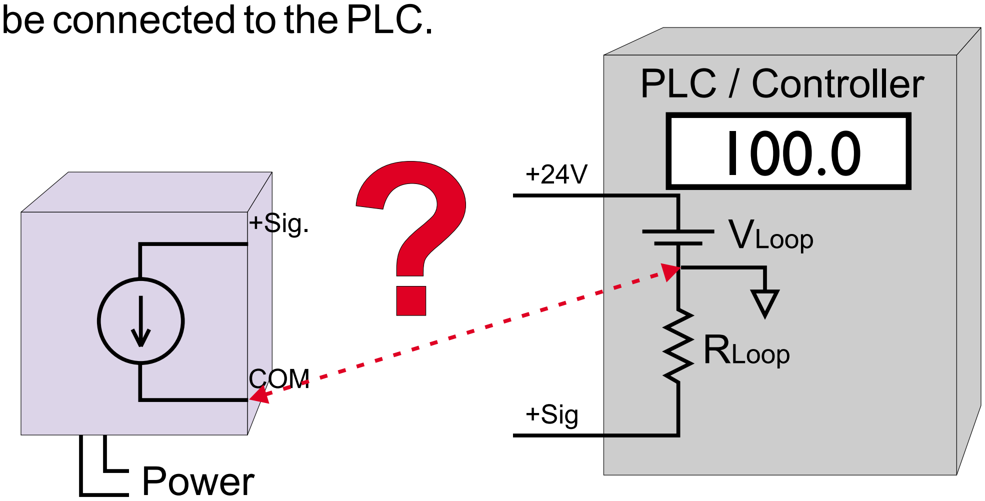
101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

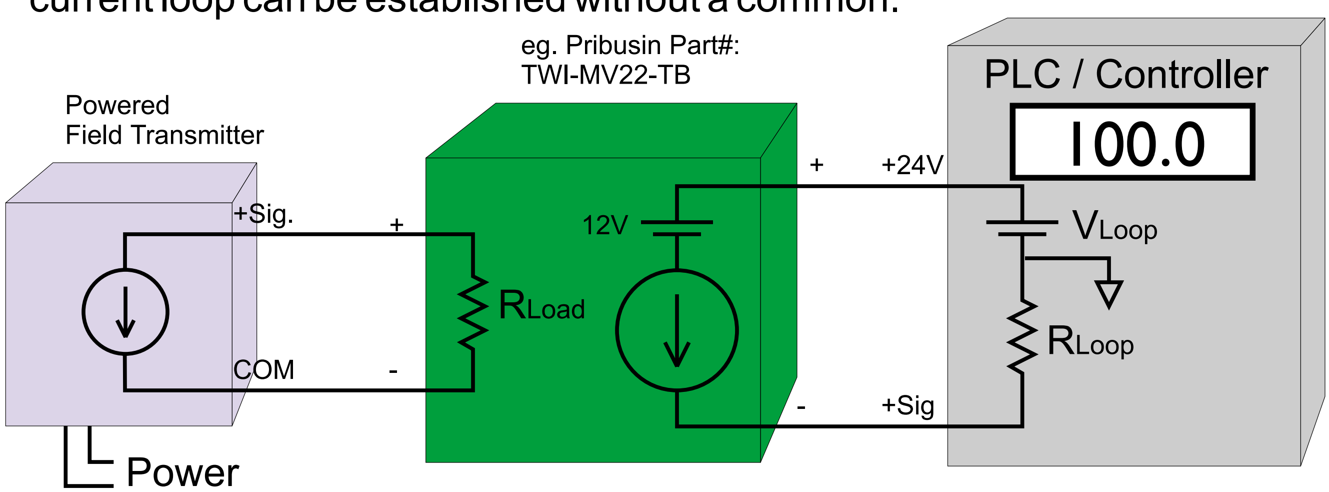
Sample Applications - Taming the PLC

Some PLC's have specialized inputs that can make it difficult to connect certain instruments. The most frequently encountered problem is one where the PLC input is designed to accept a 2-wire instrument only.

Example 1: A PLC has only a 2-wire input with terminals for +24V and +Signal. A powered field transmitter supplies a powered 4-20mA loop and is to be connected to the PLC.



The PLC has no external connection for the signal common. As a result a powered 4-20mA loop cannot be connected because no complete current loop can be established without a common.



(R_{Load} = 2.5 Ohms)

By using Pribusin's TWI-MV22-TB Isolator, the connection can be accomplished while at the same time isolating the two loops. From the PLC side, the TWI-MV22-TB isolator looks like a 2-wire instrument. From the field transmitter side, the isolator looks just like another loop load.

Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com

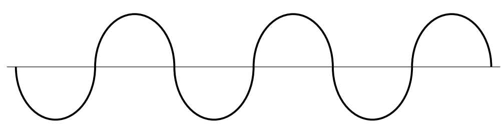
Sample Applications - Power Measurement

Various applications require the monitoring of power consumption. In a motor, for example, current draw is an indication of torque load. To prolong the life of the motor, a limit on the torque load may have to be adhered to. Other applications may require the monitoring of AC line voltage or total power comsumption (watts).

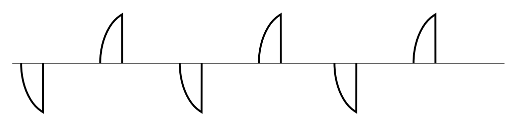
Average vs. RMS

For most loads an average value of voltage or current is sufficient. Applications such as motors, incandescent lights, heaters and linear power supplies have almost pure sine wave power waveforms. The average value provides a good indication of the actual value.

In applications where power switching is used, the resulting waveforms may not be sinusoidal. An average value would provide a poor representation of the actual value. A much better actual value comes from the Root-Mean-Square (RMS) of the waveform.



Pure-sine Wave: use Averaging



Switched Wave: use RMS

Voltage: When measuring voltages greater than 150VAC a potential transformer (P.T.) is required to reduce the voltage to around 120VAC.

Current: When measuring currents in excess of 5 Amps, a current transformer (C.T.) is required to reduce the current to a value of around 5 Amps.

CAUTION:

Current Transformers can be very dangerous if not handled correctly. If the Secondary side is disconnected without first shorting the terminals together, dangerously high voltages will result. These voltages can be several 1000 volts and can be deadly.

Pribusin Inc.

3938 Trade Center Drive
Ann Arbor, MI 48108 USA
Ph: (734) 677-0459
Fx: (734) 677-0861

101 Freshway Drive #57
Concord, Ont. L4K 1R9 Canada
Ph: (905) 660-5336
Fx: (905) 660-4068

Web: http://www.pribusin.com
e-mail: info@pribusin.com