



## DATASHEET

- Isolate any instrument current loop to 1500Vac.
- Powered by the current loop - no power supply required.
- Lowest volt drop <3 Volts at 20 mA (2,5V Typical).
- Load independent – no field calibration ever required.
- Unique internal clamp protects against open circuit.
- Reverse polarity and overload protection



### Features

- High 1kohm load capability
- High 0.1% Accuracy
- High 11.25mm per channel packing density
- High 11.25mm per channel packing density

- Unique internal clamp can protect against open circuit. Internal 250 ohm resistor for 1-5V input to PLC's etc.
- Easy DIN rail or surface mounting

### Overview

The **OMNITERM LPI and LPD** are loop powered isolating current repeaters specifically designed to isolate instrument current loops from circulating ground currents that can cause system inaccuracies, or at worst, instrument failure. Insert in any 4-20mA current loop to isolate the instruments in the loop. The current applied to the input is repeated on the isolated output, and the load present on the output is reflected back to the input. No separate power source is required.

undesirable, an internal clamp is provided in the LPI model which, when connected, ensures that the current loop is not broken if the load is disconnected, such as unplugging the input terminations of a PLC or RTU.

### Part of the Omniterm Range

Forming part of OMNIFLEX's extensive OMNITERM range of signal conditioning and signal isolation products, the OMNITERM LPI and LPD are designed to be DIN rail or surface mounted.

### Application

In many applications there is a need to convert the 4-20mA into 1-5Volts for an RTU, PLC or DCS etc. This is normally inconvenient because the precision resistor needs to be sourced, mounted and wired independently without causing loop errors. To overcome this obstacle, the LPI version also includes a precision 250 ohm resistor that can be connected into the circuit to convert the output into 1-5V within the module

### Description

The Omniterm LPI is a single loop isolator in a 22.5mm wide DIN rail mount housing with extensive additional connection features, while the LPD is a dual loop isolator that fits two separate channels into the same 22.5mm width for high density applications.

### Typical Applications

- Isolate instruments in the same current loop
- Prevent ground loops and eliminate loop errors
- Isolate RTU's, PLC's, SCADA I/O from the field loop.
- Isolate two-wire transmitter loops from local 24V
- Isolate grounded chart recorders from the field loop
- Isolate grounded control valves from the transmitter
- Can be used with two-wire or four-wire transmitters
- Isolate and convert two-wire field devices to 1-5V

### High Accuracy

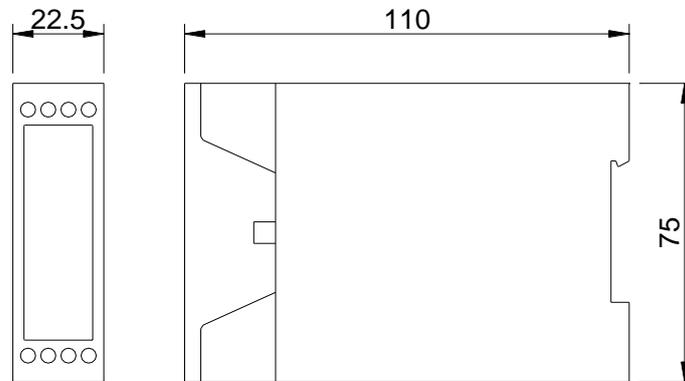
These second-generation products utilise advanced electronic techniques to achieve high accuracy with minimum loop losses and zero field calibration.

Because of the faithful nature in which the output impedance is reflected back to the input, an open circuit on the output will cause an open circuit on the input. In cases where this is

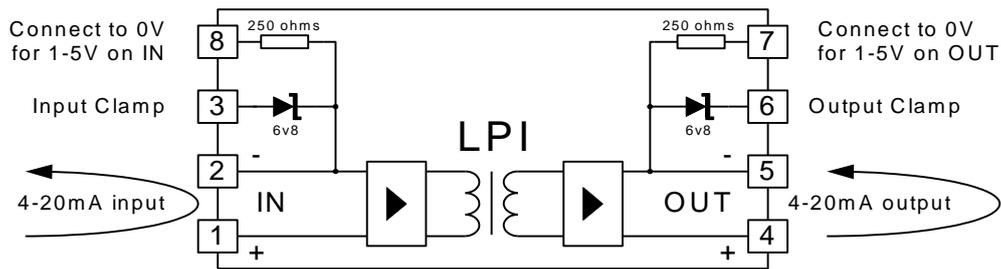




## Mechanical Layout

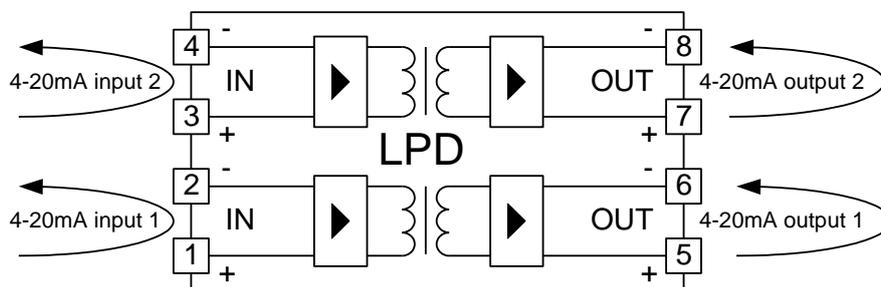


## Connection Diagram



**Terminal Configuration of Omniterm LPI (Model C2063B)**

[NB: Note terminal numbering is out of order to be backward compatible with the model C2063]



**Terminal Configuration of Omniterm LPD (Model C2462A)**



## Specifications

Inputs	
Operating Current Range	4-20mA
Absolute maximum current range	0-50mA
Input voltage	27V maximum
Maximum volt drop in loop	3 volts at 20mA
Max. equivalent insertion loop resistance	150 $\Omega$ at 20mA

Output	
Output current	Matches input current
Min. load impedance (externally connected)	100 $\Omega$ or 2 Volts
Max. load resistance (without open circuit clamp connected)	1k $\Omega$ at 20 mA for 24Volts Supply

Performance	
Accuracy at 20°C and 250 $\Omega$ load	< 20uA between 4 and 20mA
Effect of load impedance	< 0.1%/100 $\Omega$ 0,05%/100 $\Omega$ typical
Effect of Temperature	< 100ppm/°C
Response time 10-90% of 20mA into 250 $\Omega$	20ms typical

Open Circuit Clamp (when connected on LPI only)	
<b>See application examples 5 and 6 for connection details</b>	
Maximum voltage across input when output open circuit	<8 volts
Maximum working load impedance allowed with clamp connected.	250 ohms

Internal 250 $\Omega$ Resistor when connected (LPI only)	
Resistance	250 $\Omega$ $\pm$ 0.1%
Resistance change with temperature	50ppm/°C

Temperature		
Storage	-20 to +70°C	
Operating	0 to +60°C	

Isolation	
Isolation Test Voltage	1500Vrms Input to Output

Weight		
	LPI Model C2063B	LPD Model C2462A
Unpacked	115g approx.	160g approx.
Packed	140g approx.	185g approx.

Compliance to Standards	
Safety	EN 60950:1995
Emissions	EN55011 & EN50081-2:1994 Gr1 Class A
Immunity – ESD	IEC 61000-4-2:1995, level 3
Immunity – RF Fields	IEC 61000-4-3:1995, level 3
Immunity – Fast Transients	IEC 61000-4-4:1995 1 kV – input/output lines
Functional Safety to (IEC 61508)	Suitable for use in SIL1 Applications. See Separate Reliability Datasheet RDC2063

Housing	
Dimensions(w x h x d )	22.5mm x 75mm x 110mm
Material	ABS Flammability Class HB as per UL94
Terminals	Screw-clamp - 2.0mm <sup>2</sup> wire size max.

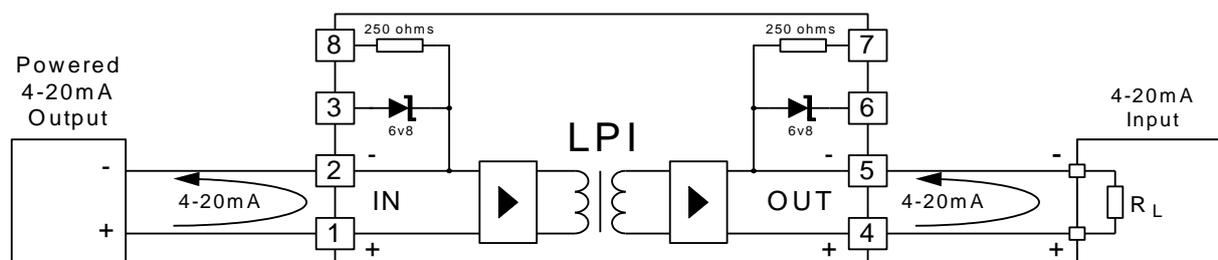
Housing	
Order Code	Description
C2063B	Omniterm LPI Loop Powered Isolator
C2462A	Omniterm LPD Dual Loop Powered Isolator





## Application Examples

### Application 1: Using the LPI to isolate a powered 4-20mA transmitter output from a resistive load



This is the basic circuit for inserting a Loop Powered Isolator (LPI) into a current loop. The LPI can simply be “cut” into any existing current loop to isolate the current transmitter from the load.

NOTE: The “IN” side of the LPI is always connected to the side of the loop supplying the loop power.

The LPI will consume less than 3 Volts of the available loop voltage. This is equivalent to inserting less 150 ohms of additional resistance into the current loop.

To determine the maximum loop resistance that you can tolerate in your cabling, apply the following formula:

$$R_{MAX} = R_T - R_L - 150$$

where:

$R_{MAX}$  is the maximum resistance in the loop without causing measurement error.

$R_T$  is the maximum load resistance that the current transmitter can drive.

$R_L$  is the total resistance of all loads in the loop (excluding the LPI)

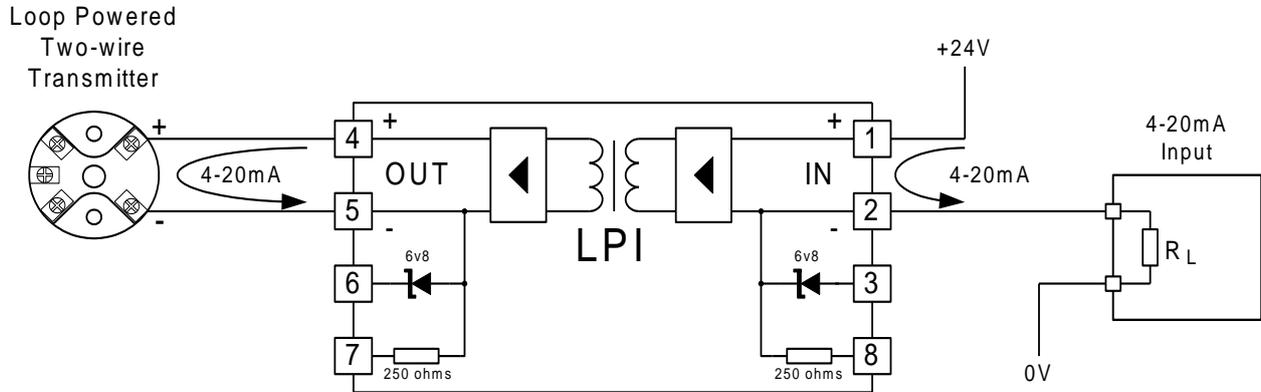
For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).





Application 2: Using the LPI to isolate a field mounted 4-20mA two-wire transmitter from a PLC, RTU or DCS



This is the basic circuit for isolating a field-mounted two-wire transmitter from the control circuitry using an LPI. The LPI can simply be “cut” into any existing two-wire current loop to isolate the transmitter from the panel power supply.

NOTE: The “IN” side of the LPI is always connected to the side of the loop supplying the loop power, so in this application the two-wire transmitter is connected to the OUT terminals of the LPI.

Because of the 2mm<sup>2</sup> wire size capability of the LPI terminals, the LPI can also act as the field interface terminals, saving you the extra termination and wiring cost. For multiple loops where space is a concern, use the LPD dual module. (See Application 7, 8 and 9)

The LPI will consume less than 3 Volts of the available loop voltage. This is equivalent to inserting less 150 ohms of additional resistance into the current loop.

To determine the maximum loop resistance that you can tolerate in your cabling, apply the following formula:

$$R_{MAX} = \frac{(V_{Smin} - V_{Tmin} - 3)}{.02} - R_L$$

where:

- R<sub>MAX</sub> is the maximum resistance in the loop without causing measurement error (in Ohms).
- V<sub>Smin</sub> is the minimum voltage of the power supply used to drive the loop (in Volts).
- V<sub>Tmin</sub> is the minimum voltage required by the two-wire transmitter for operation (in Volts).
- R<sub>L</sub> is the total resistance of all loads in the loop (excluding the LPI) (in Ohms)

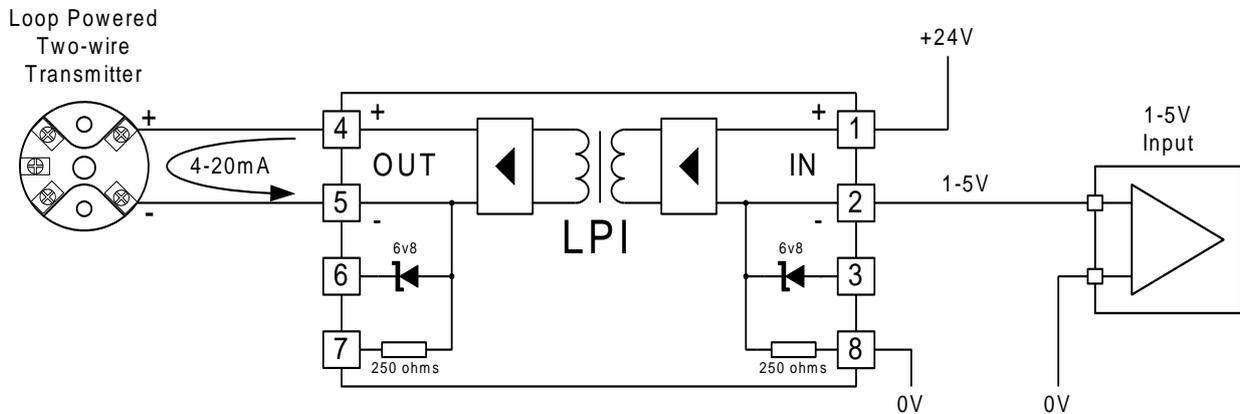
For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).





**Application 3: Using the LPI's internal resistor with a 2 wire transmitter to provide 1-5V to a PLC/RTU/DCS**



There are many cases when using 4-20mA inputs to your PLC or RTU or DCS is inconvenient. For example:

1. Your analogue input does not support 4-20mA, and mounting an external resistor is inconvenient.
2. Your analogue input has plug in terminals, and you do not want to lose power to your field transmitter or disrupt the loop if the terminal block is unplugged.

In these cases you can use the internal resistor on the IN side of the LPI to conveniently convert your 4-20mA signal into a 1-5V signal.

For the most accurate result, ensure that the 0V reference of the LPI (terminal 8), and the 0V reference of your analogue input are referenced to the same point.

NOTE: The "IN" side of the LPI is always connected to the side of the loop supplying the loop power, so in this application the two-wire transmitter is connected to the OUT terminals of the LPI.

Because of the 2mm<sup>2</sup> wire size capability of the LPI terminals, the LPI can also act as the field interface terminals, saving you the extra termination and wiring cost.

The LPI will consume less than 3 Volts of the available loop voltage. This is equivalent to inserting less 150 ohms of additional resistance into the current loop.

To determine the maximum loop resistance that you can tolerate in your cabling in this application, apply the following formula:

$$R_{MAX} = \frac{(V_{Smin} - V_{Tmin})}{.02} - 400$$

where:

R<sub>MAX</sub> is the maximum resistance in the loop without causing measurement error (in Ohms).

V<sub>Smin</sub> is the minimum voltage of the power supply used to drive the loop (in Volts).

V<sub>Tmin</sub> is the minimum voltage required by the two-wire transmitter for operation (in Volts).

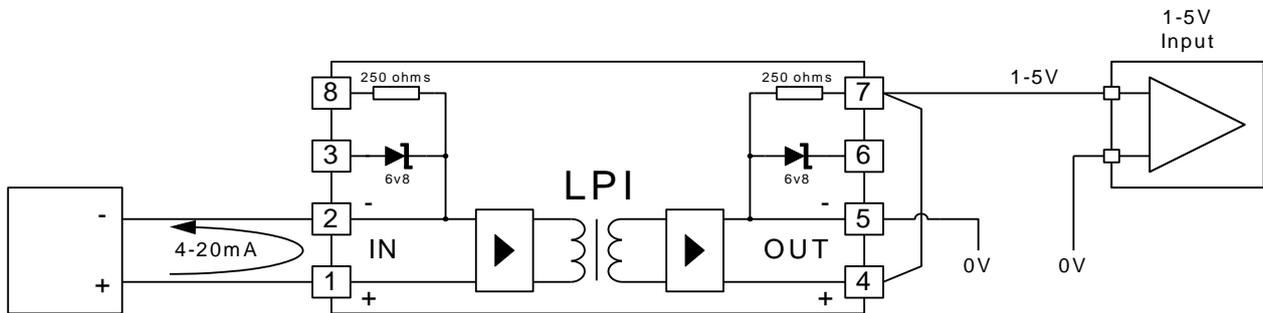
For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).





**Application 4: Using the LPI's internal resistor with a 4 wire transmitter to provide 1-5V to a PLC/RTU/DCS**



There are many cases when using 4-20mA inputs to your PLC or RTU or DCS is inconvenient. For example:

1. Your analogue input does not support 4-20mA, and mounting an external resistor to convert the signal to 1-5V is inconvenient.
2. Your analogue input has plug in terminals, and you do not want to lose power to your field transmitter or disrupt the loop if the terminals are unplugged.

In these cases you can use the internal resistor on the OUT side of the LPI to conveniently convert your 4-20mA signal into a 1-5V signal.

For the most accurate result, ensure that the 0V reference to the LPI (terminal 5), and the 0V reference of your analogue input are referenced to the same point.

NOTE: The "IN" side of the LPI is always connected to the side of the loop supplying the loop power, so in this application the four-wire transmitter is connected to the IN terminals of the LPI.

Because of the 2mm<sup>2</sup> wire size capability of the LPI terminals, the LPI can also act as the field interface terminals, saving you the extra termination and wiring cost.

The LPI will consume less than 8 Volts of the available loop voltage – 3 volts in the LPI, and 5 volts across the 250 ohm resistor. This is equivalent to inserting less than 400 ohms of total resistance into the current loop.

To determine the maximum loop resistance that you can tolerate in your cabling in this application, apply the following formula:

$$R_{MAX} = R_T - 400$$

where:

$R_{MAX}$  is the maximum resistance in the loop without causing measurement error (in Ohms).

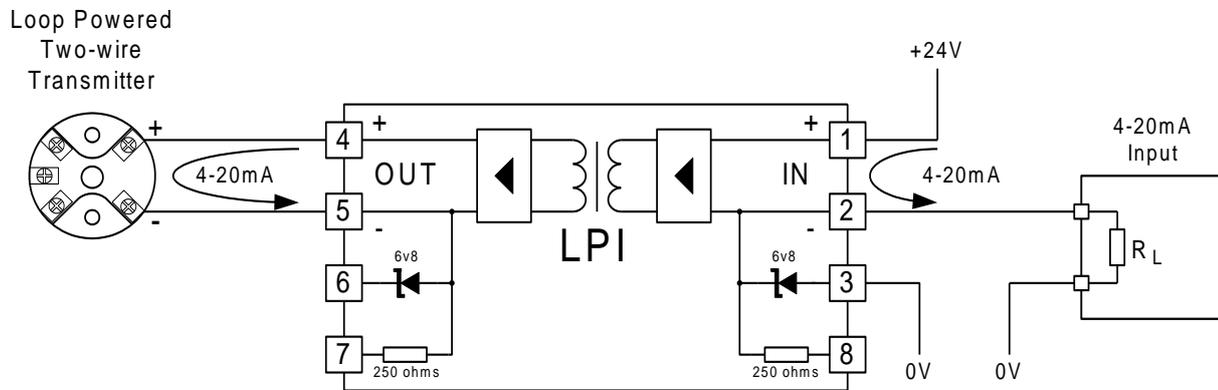
$R_T$  is the maximum load resistance that the current transmitter can drive (in Ohms).

For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).



**Application 5: Using the LPI's internal clamp with a 2 wire transmitter to protect the loop against open circuit.**



There are cases, when using 4-20mA inputs to your PLC, RTU or DCS, where it is important that the current loop is not disrupted when the analogue input to your PLC or RTU or DCS is unplugged or disconnected.

In these cases you can use the internal clamp of the LPI to protect the loop from open circuit if your PLC or RTU or DCS input is unplugged or disconnected.

This is simply achieved by connecting the input clamp terminal 3 to your 0V reference. If the analogue input to your PLC or RTU or DCS is disconnected, the current will be diverted to 0V through the clamp, saving the current loop from disconnection.

The voltage across the LPI will be clamped to 6.8Volts in this condition – only slightly higher than the normal operating voltage of 1-5 Volts. This higher clamp voltage should be used when calculating maximum allowable loop resistance.

NOTE: The “IN” side of the LPI is always connected to the side of the loop supplying the loop power, so in this application the two-wire transmitter is connected to the OUT terminals of the LPI.

Because of the 2mm<sup>2</sup> wire size capability of the LPI terminals, the LPI can also act as the field interface terminals, saving you the extra termination and wiring cost.

To determine the maximum loop resistance of your cabling that you can tolerate in your loop with the clamp in operation, apply the following formula:

$$R_{MAX} = \frac{(V_{Smin} - V_{Tmin})}{.02} - 500$$

where:

R<sub>MAX</sub> is the maximum resistance in the loop without causing measurement error (in Ohms).

V<sub>Smin</sub> is the minimum voltage of the power supply used to drive the loop (in Volts).

V<sub>Tmin</sub> is the minimum voltage required by the two-wire transmitter for operation (in Volts).

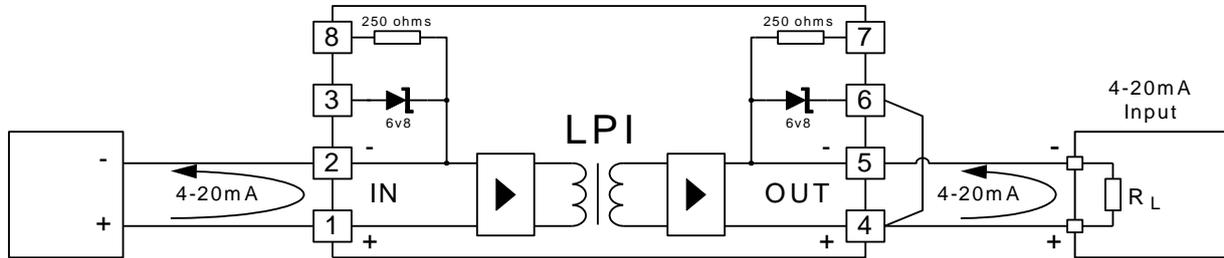
For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).





**Application 6: Using the LPI's internal clamp with a 4 wire transmitter to protect the loop against open circuit.**



When using 4-20mA inputs to your PLC, RTU or DCS, there are cases where it is important that the current loop is not disrupted when the analogue input to your PLC or RTU or DCS is unplugged or disconnected.

In these cases you can use the internal clamp of the LPI to protect the loop from open circuit if your PLC or RTU or DCS input is unplugged or disconnected.

In four-wire current transmitter applications this is simply achieved by connecting the output clamp terminal 6 to the current output terminal 4 of the LPI. If the analogue input to your PLC or RTU or DCS is disconnected, the current will be diverted through the clamp, saving the current loop from disconnection.

The voltage across the LPI will be clamped to 6.8Volts in this condition – slightly higher than the normal operating voltage of 1-5 Volts. This higher clamp voltage should be used when calculating maximum allowable loop resistance.

NOTE: The "IN" side of the LPI is always connected to the side of the loop supplying the loop power, so in this application the four-wire transmitter is connected to the IN terminals of the LPI.

Because of the 2mm<sup>2</sup> wire size capability of the LPI terminals, the LPI can also act as the field interface terminals, saving you the extra termination and wiring cost.

To determine the maximum loop resistance of your cabling that you can tolerate in your loop with the clamp in operation, apply the following formula:

$$R_{MAX} = R_T - 500$$

where:

R<sub>MAX</sub> is the maximum resistance in the loop without causing measurement error (in Ohms).

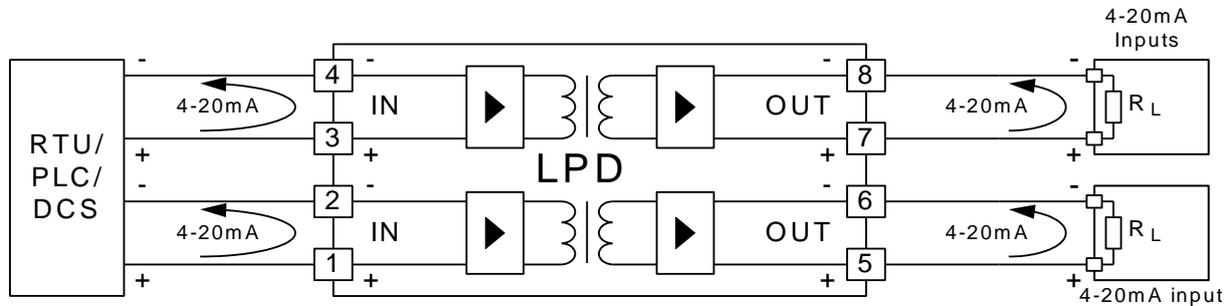
R<sub>T</sub> is the maximum load resistance that the current transmitter can drive (in Ohms).

For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).



Application 7: Using the LPD to isolate multiple 4-20mA Outputs from a PLC or DCS



In this application, the LPD can be inserted directly into the 4-20mA output loops between the transmitter and the load.

Each LPD circuit will consume less than 3Volts from the loop. For loop resistance calculation purposes this is equivalent to inserting an additional resistance of 150 ohms into the current loop.

NOTE: The "IN" side of the LPD is always connected to the side of the loop supplying the loop power, and so in this application, the Transmitter outputs are connected to the IN side of the LPD.

Because of the 2mm<sup>2</sup> wire size capability of the LPI terminals, the LPI can also act as the field interface terminals, saving you the extra termination and wiring cost.

To determine the maximum loop resistance of your cabling that you can tolerate in your loop, apply the following formula:

$$R_{MAX} = R_T - R_L - 150$$

where:

R<sub>MAX</sub> is the maximum resistance in the loop without causing measurement error (in ohms).

R<sub>T</sub> is the maximum load resistance that the current transmitter can drive (in ohms).

R<sub>L</sub> is the total resistance of all loads in the loop (excluding the LPI) (in Ohms)

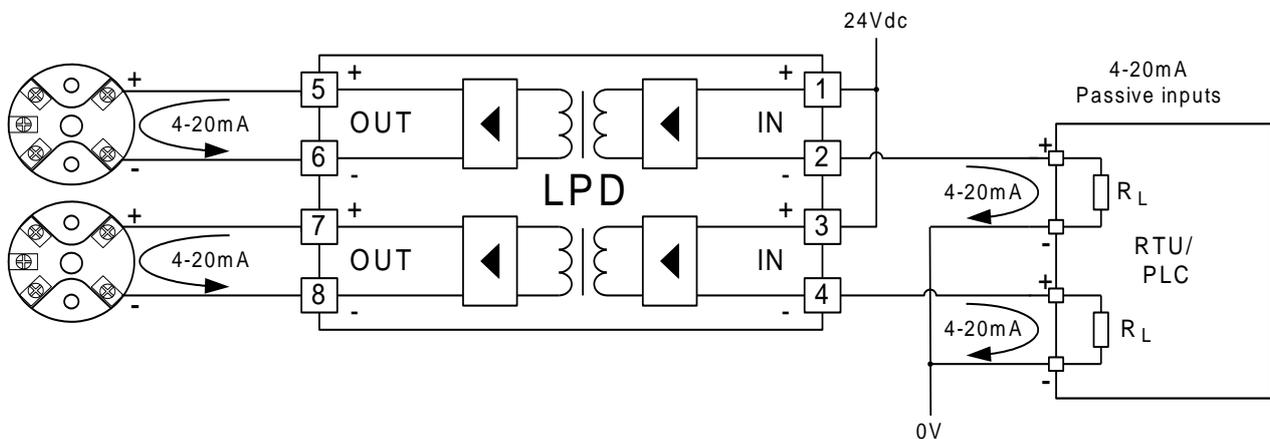
For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).





Application 8: Using the LPD to isolate multiple 4-20mA inputs to a PLC or RTU (with passive inputs)



In this application, the LPD can be inserted directly into the 4-20mA input loops between the field mounted two-wire transmitter and the PLC or RTU input.

Each LPD circuit will consume less than 3Volts from the loop. For loop resistance calculation purposes this is equivalent to inserting an additional resistance of 150 ohms into the current loop.

NOTE: The "IN" side of the LPD is always connected to the side of the loop supplying the loop power, and so in this application, the two-wire transmitters are connected to the OUT side of the LPD.

Because of the 2mm<sup>2</sup> wire size capability of the LPD terminals, the LPD can also act as the field interface terminals, saving you the extra termination and wiring cost.

To determine the maximum loop resistance of your cabling that you can tolerate in your loop, apply the following formula:

$$R_{MAX} = \frac{(V_{Smin} - V_{Tmin})}{.02} - R_L - 150$$

where:

$R_{MAX}$  is the maximum resistance in the loop without causing measurement error (in Ohms).

$V_{Smin}$  is the minimum voltage of the power supply used to drive the loop (in Volts).

$V_{Tmin}$  is the minimum voltage required by the two-wire transmitter for operation (in Volts).

$R_L$  is the resistance of the PLC/RTU input (in Ohms)

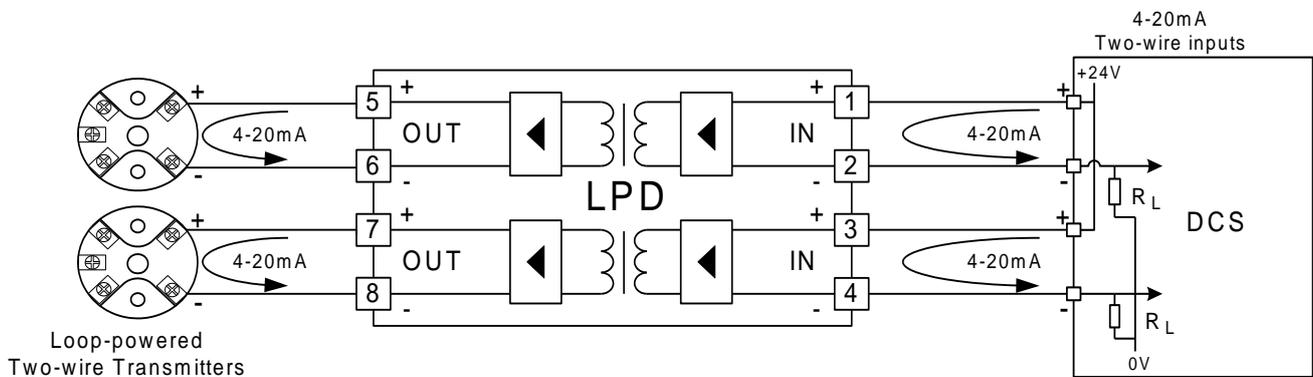
For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).





Application 9: Using the LPD to isolate multiple 4-20mA inputs to a DCS with active (two-wire tx) inputs.



In this application, the LPD can be inserted directly into the 4-20mA input loops between the field mounted two-wire transmitter and the DCS input.

Each LPD circuit will consume less than 3Volts from the loop. For loop resistance calculation purposes this is equivalent to inserting an additional resistance of 150 ohms into the current loop.

NOTE: The "IN" side of the LPD is always connected to the side of the loop supplying the loop power, and so in this application, the two-wire transmitters are connected to the OUT side of the LPD.

Because of the 2mm<sup>2</sup> wire size capability of the LPD terminals, the LPD can also act as the field interface terminals, saving you the extra termination and wiring cost.

To determine the maximum loop resistance of your cabling that you can tolerate in your loop, apply the following formula:

$$R_{MAX} = \frac{(V_{Smin} - V_{Tmin})}{.02} - R_L - 150$$

where:

$R_{MAX}$  is the maximum resistance in the loop without causing measurement error (in Ohms).

$V_{Smin}$  is the minimum voltage of the power supply used to drive the loop (in Volts).

$V_{Tmin}$  is the minimum voltage required by the two-wire transmitter for operation (in Volts).

$R_L$  is the resistance of the PLC/RTU input (in Ohms)

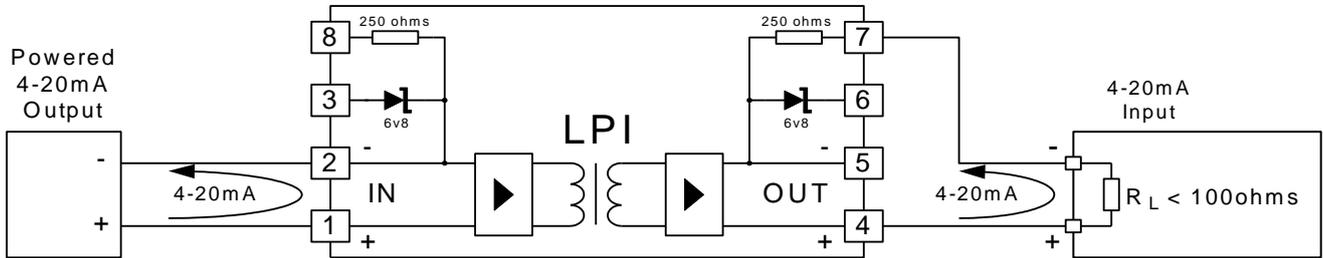
For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).





Application 10: Dealing with zero loop resistance when using the LPI.



The LPI is optimised to minimise the effective inserted loop impedance, but does require a minimum of 100 ohms of load impedance, (or 2 volts) on the output to maintain operation.

In some applications, when using four-wire transmitters, the load being driven is lower than this minimum value, and additional load needs to be inserted into the output loop to bring the minimum load up to the required 100 ohms.

One solution for this is to use the internal 250 ohm resistor to provide this additional resistance. When connected as shown in the diagram above, the internal resistor is used in series with the current loop to provide an additional 250 ohms of loop resistance. This brings the LPI back into specification without the need for any additional resistors.

NOTE: The "IN" side of the LPI is always connected to the side of the loop supplying the loop power, so in this application the four-wire transmitter is connected to the IN terminals of the LPI.

Because of the 2mm<sup>2</sup> wire size capability of the LPI terminals, the LPI can also act as the field interface terminals, saving you the extra termination and wiring cost.

To determine the maximum loop resistance of your cabling that you can tolerate in your loop with the clamp in operation, apply the following formula:

$$R_{MAX} = R_T - R_L - 400$$

where:

$R_{MAX}$  is the maximum resistance in the loop without causing measurement error (in Ohms).

$R_T$  is the maximum load resistance that the current transmitter can drive (in Ohms).

$R_L$  is the resistance of the connected load (in Ohms)

For reliable operation over the long term, you should design for less initial cable resistance than this maximum value. This provides a safety factor to account for increase in resistance of terminations and wiring with age/weathering etc.

A sensible value to use for this safety factor would be 100 ohms (equal to 2 Volts at 20mA).

