

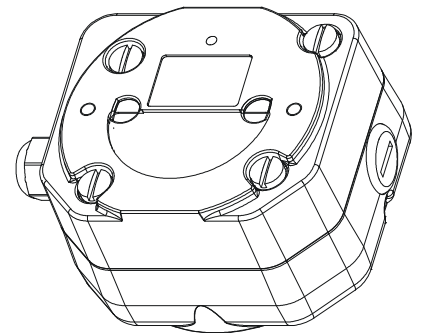
MR023
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MR150LA Loop Powered Flow Rate Transmitter

Instruction Sheet

Description

The MR150LA is a loop powered transmitter that accepts pulse inputs from flow meters and generates a linear 4-20mA output signal. The transmitter is housed in a weather proof aluminium housing that can be mounted on to any flow meter with appropriate adaptors or remote mounted using remote mount adaptor. The MR100 LCD display module can be fitted to the transmitter to provide an independent batch, total, rate display.



The MR150LA is microprocessor based and provides a number of advanced features

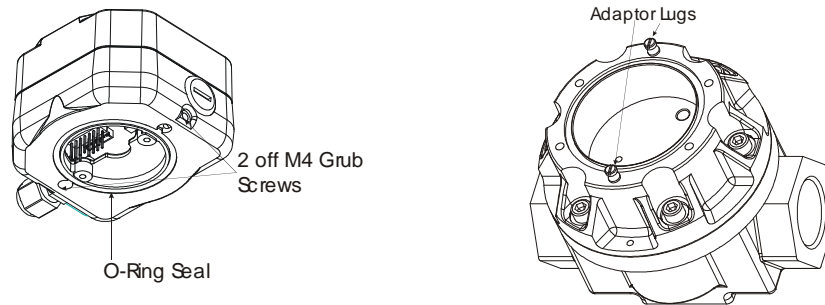
- Isolated 4-20ma current loop
- Opto Isolated outputs
 - Scaled pulse out
 - High flow rate alarm with adjustable debounce time
 - Low flow rate alarm with adjustable debounce time
- Pulse input from reed switches or low voltage inductive sensors (TM050B)
- Linearization of Macnaught turbine flow meters
- Local 0.4V to 2.0V output for field adjustment
- Field adjustment of basic functions using 3 button keypad
 - Zero
 - Span
 - Filter
 - High flow alarm
 - Low flow alarm
- Field calibration of D/A converter
- Programming of advanced options via PC interface.
- Direct mounting on all Flow meters
- Remote mount option for high or low temperature applications
- Rugged sealed aluminium housing to IP65



Mounting and Access

The MR150 mounts on to Macnaught meters using two grub screws and two mounting lugs. An o ring seal is fitted on the bottom face of the module for sealing to the meter. The mounting lugs can be mounted in two positions on the meter body allowing the module to be orientated at 90 degree increments with respect to the meter.

Note: M6/M10 to M100 require MR018 adapter ring (MR018S retrofit kit)



Electrical Connections

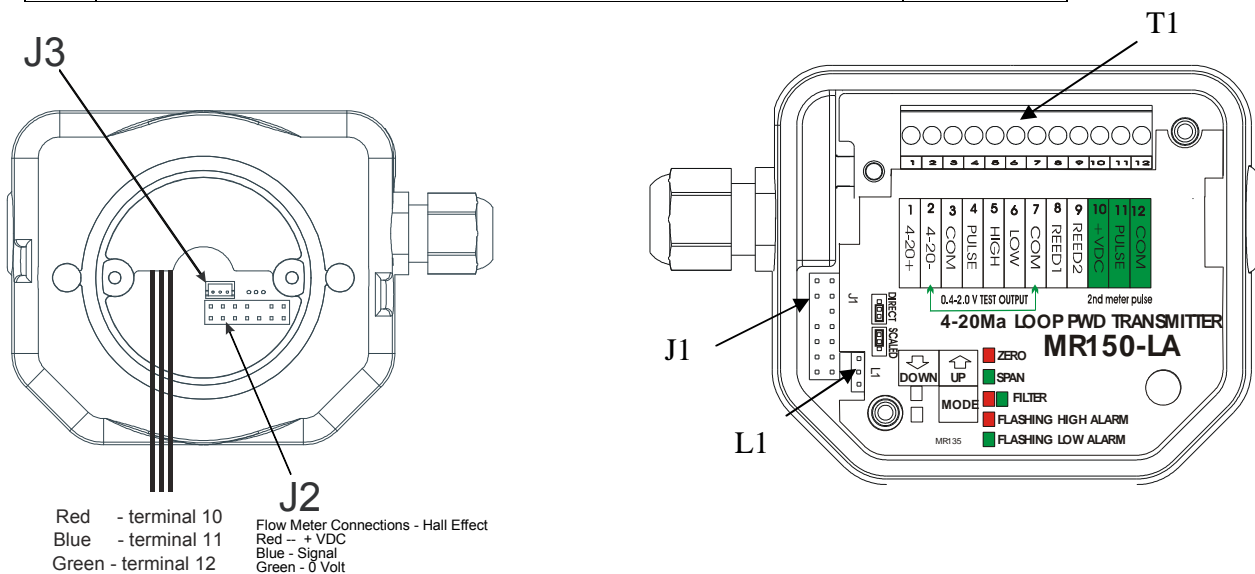
Cable Entry

Two M12x1.5 holes provide for cable entry via a standard M12 cable gland.

Electrical Connections

There are 4 electrical connectors and one jumper link

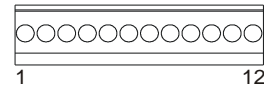
T1	Terminal strip 12 screw terminal 3.5 mm pitch	top
J1	Top inter-module connector 14 pin 0.1" header	Top
J2	Bottom inter-module connector 14 pin 0.1"pitch header	Bottom
J3	Meter input connector 1.5mm pitch 3 pin header	Bottom
L1	Pulse output selector link	top



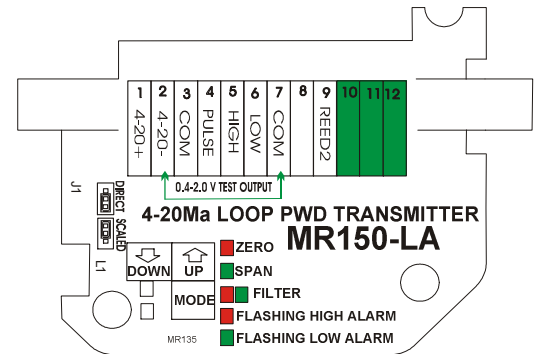
Connections

Terminal T1

Terminal		
1	4-20mA +Ve	
2	4-20Ma -Ve	0.4-2.0V test
3	Common Output	
4	Scaled pulse out	
5	High Flow Alarm	
6	Low Flow Alarm	
7	Common Pulse In	0.4-2.0V test
8	Pulse in (reed1)	
9	Reed2 (not used)	
10	+VDC	MSeries second
11	Pulse	pulser direct
12	Common or (-Neg)	pass through



Wire entry

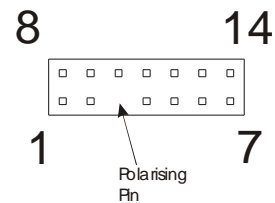


Jumper J1 & J2

Inter-module headers

Note pins marked NA are for factory programming and testing.

pin	Description	pin	Description
1	VBAT	8	VDD
2	GROUND	9	NA
3	Polarizing pin	10	+3V
4	PULSE IN	11	NA
5	NA	12	NOT CONNECTED
6	NA	13	NA
7	NA	14	NA

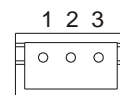


Jumper J3

Pulse input header

Note header is polarised

pin	Description
1	VDD
2	PULSE IN
3	GND



Link L1

Link L1 selects the signal connection to pin 4 off jumper J1, either a direct pulse from the flow meter or a scaled pulse from the MR150 can be selected.



In direct position the pulse input from the meter is connected to pin 4. In this arrangement when MR100 is connected to the MR150 via Jumper J1 the MR100 will work independent of the MR150 module and will count flow rate when no power is supplied to the MR150. The K factor for the MR100 must be set to the K factor for the flow meter.

In scaled position the scaled pulse out from the MR150LA is connected to pin 4 of jumper 1 and 2. In this arrangement an MR100 connected to the MR150 module via Jumper J1 will receive the scale pulse output from the MR150LA. If the MR150 has no power no pulse will be received via pin 4. The K factor for the MR100 must be set to match the scaled pulse output.

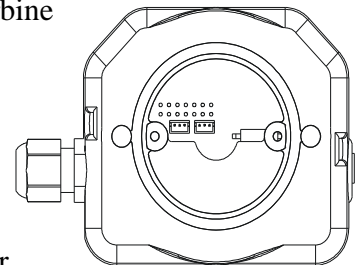
Pulse input.

The pulse input **MUST** be electrically isolated from ground. Failure to do so will result in a ground loop that can cause faulty operation of the module.

Typical reed switches are used for positive displacement type meters.

A low power inductive sensor module TM050A is available for Turbine meters. This connects via Jumper J2

Sensors such as hall switches cannot be powered directly from the Module due to the limited current capacity of the loop. Where Hall switches are required the MR150EA external powered module must be used, or the output from the hall isolated using an opto isolator or similar circuit.



Direct mount on flow meters

Macnaught flow meters can be ordered with the 4-20mA module fitted. Or the module can be direct mounted on any Macnaught flow meter using adaptor Kits.

Each kit includes adaptor flanges and cable and connector to fit to either J2 or J3. Note both are polarized and will only assemble in one orientation.

For applications where the meter is running at high or low temperatures the module can be mounted adjacent to the meter using the W Kit.

A reed switch can be connected via terminals 7 and 8 on Terminal T1.

Turbine amplifier

Fitting a TM050B allows the module to be mounted on any Macnaught turbine meter.

4-20mA Connection

The module is loop powered and requires a minimum 18V to operate. Maximum voltage is 30VDC. The power supply voltage must be adequate to ensure reliable operation of the module. The actual power supply voltage depends on the requirements of other components in the current loop.

Auxiliary outputs

Three additional outputs are provided

- Scaled pulse
- High flow rate alarm
- Low flow rate alarm

Outputs are optically isolated solid state relays maximum current is 100ma per output.

Programming and Customising

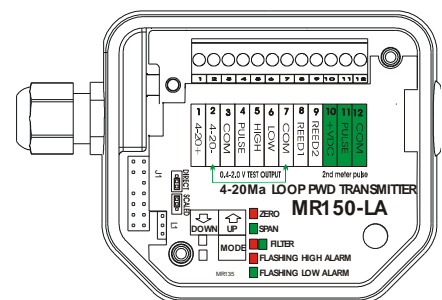
The transmitter uses a microcontroller. Settings are stored in an on board eeprom. These settings can be changed to customise the transmitter in two ways

1. Field programming using on board 3 button keypad. This allows adjustment of all key parameters in the field without the need for any external programmer.
2. Programming using a PC and an RS232 serial interface via Macnaught MR120 Programming adaptor and programming software. This allows all Parameters to be adjusted. Typically this is done in the factory before installation. However it can be done in the field using a Lap top PC.

NOTE The field adjustments should only be used for trimming adjustments to settings. The module must be programmed via a PC with settings for the meter it is to be fitted to.

Field Programming

The module has a 3 button keypad, a green and red LED and a 0.4-2.0V output to allow field adjustment of all key parameters. Both the factory and the field adjusted settings are stored in eeprom allowing the module to be returned to the factory setting at any time.



NOTE when using field adjustments the 4-20mA output may change to reflect the parameter being adjusted. (i.e. High alarm setting). Care should be taken to ensure that this does not effect any instrumentation or equipment connected to the transmitter

Field Adjustments

Local 0.4-2.0V Output

A local voltage output that follows the 4-20ma loop powered signal is provided between terminals 2 and 7 this allows local monitoring and adjustment of the output signal without the need to break the current loop.

Basic Programming

Zero, span, filter, high flow alarm and low flow alarm can be easily adjusted in the field without breaking the current loop using a multimeter to monitor the settings. Filter adjusts the transmitter's sensitivity to fluctuations in flow rate.

Resetting to Factory Settings

All factory settings are stored. Any field setting can be returned to the factory settings

- Select the mode/option using the mode button see (table 1)
- Press and hold mode button for 5 seconds. Red and green LEDs will flash to indicate value reset.
- Return to normal mode by pressing the mode button until both LEDs are off.

Use the Up and Down buttons to edit the setting for the mode. (They will auto-repeat if you hold them down and their effect accelerates every few seconds.

Setting Zero (4mA) and span (20 mA) to match flow through meter

Zero (4mA) and span (20mA) can be set to match the flow through the meter. This is useful where the desired flow rate can be easily adjusted.

Procedure

Set Zero (4mA)

1. Adjust the flow through the meter to match the desired setting for zero (4mA) flow.
2. press mode button to select Zero adjust mode (red Led on)
3. Press and hold mode and up button for 5 seconds . The red and green LEDs will flash. The value is set to the current flow rate.
4. press mode button to return to normal mode (both LEDs off)

Set Span(20mA)

1. Adjust the flow through the meter to match the desired setting for maximum (20mA) flow.
2. press mode button to select span adjust mode (green Led on)
3. Press and hold mode and up button for 5 seconds. The red and green LEDs will flash. The value is set to the current flow rate.
4. press mode button to return to normal mode (both LEDs off)

Setting High and low Alarm

The high alarm output switches when the flow rate rises above the high alarm set point.

The Low alarm output switches when flow rate falls below the low alarm set point.

The high and low alarms can be field adjusted by

1. select the alarm set mode by pressing the mode button
 - high alarm Red LED flashing
 - Low Alarm green Led flashing
2. The current output will change to the alarm set point

The set point can be changed in one of two ways

- Use the up down buttons to adjust the current value
- Set the flow rate through the meter to the rate required for the alarm setting
PRESS & HOLD THE Mode and up buttons simultaneously for 5 seconds. The red and green LEDs will flash to indicate acceptance of the setting.

When finished press mode button repeatedly to return to normal mode

Table 1 Summary of setting Options

Mode Option	Red LED	Green LED	Current Output	Up	Down	SPECIAL FUNCTION
Normal	Off	Off	Rate	-	-	None
Zero Adjust	ON	Off	Rate	-	-	Hold Mode+Up 5sec Sets 4mA= Rate
Span Adjust	Off	ON	Rate	-	-	Hold Mode+Up 5sec Sets 20mA= Rate
Filter Adjust	ON	ON	Rate	Filtering increases	Filtering decrease	None
High Flow Alarm	Flash	Off	High alarm setting	Alarm increases	Alarm decreases	Hold Mode+Up 5sec Sets low alarm = Rate
						Hold Mode+Dn 5secs Turns Low Alarm Off
Low Flow Alarm	Off	Flash	Low Alarm Setting	Alarm increases	Alarm decreases	Hold Mode+Up 5sec Sets low alarm = Rate
						Hold Mode+Dn 5secs Turns Low Alarm Off

D/A Converter Recalibration

The MR150 generates a linear 4-20mA output signal using a digital to analogue converter (D/A). Each MR150 is individually calibrated during manufacture and should never require any adjustments by customers.

Please do not change the D/A calibration! If you make incorrect settings, the MR150 may not be able to control pumps or other devices correctly! You will not be able to turn things completely off if the 4mA setting is too high. And many devices will shutdown and refuse to operate if they detect signals below 4mA or above 20mA.

Note D/A calibration must only be used for accurately setting the 4 and 20mA current levels
Note Do not change the calibration to try to set a non-zero flow rate for 4mA or to change the flow rate for the 20mA current. Use the procedures for setting Zero and Span instead
Note if either 4mA or 20mA calibration is changed, the output current will also change and all other settings will need to be readjusted.

If you measure the 4mA and 20mA settings and believe they are wrong, please remember:

- The MR150 factory calibration is performed using highly stable, high resolution equipment which has also been precisely calibrated. Unless your measuring equipment is similarly accurate and precise, the error is more likely to be in your own meter.
- Most hand-held current meters are not calibrated and are not as accurate as they appear to be. (Many show 3.5 digits, suggesting 0.1% accuracy, but may be only 1 - 2% accurate.)
- The output can “never” be set to exactly 4mA or 20mA because the MR150 uses a D/A converter which treats the 4-20mA range as a vast set of evenly-spaced discrete values (like steps in a tall building) and chooses the value closest to the desired value. However, the factory calibration uses the most appropriate values for the 4mA and 20mA settings.
- If you have set incorrect settings for Zero and Span, then you will not get the current you expect at the minimum and maximum flow rates. You can use the calibration procedure below to check the actual 4mA and 20mA currents, but be careful not to modify the calibration.
- After there has been a flow through the MR150, it may take quite a long time before the output signal completely settles down to idle at 4mA. (It may take many minutes if the flow was very slow before it stopped.) As a result, you can measure an output value that is slightly above 4mA until the MR150 considers the flow to have definitely ceased. To be sure that the MR150 is idle at 4mA, run a short fast flow through the MR150 and then stop the flow quickly - the output should soon drop suddenly to 4mA. Alternately, use the calibration procedure below to check the actual 4mA and 20mA currents, but again be careful not to modify the calibration.

Procedure

If necessary the D/A can be recalibrated in the field using the following procedure.

First you must access the hidden factory calibration mode:

- Press Reset (usually 3 times) to get to the mode with both LEDs On (Filter Adjust mode)
- Press the Up & Down buttons at exactly the same time, quickly and firmly. (This can take a few attempts to get right.) If successful, the two LEDs will flash on and off quickly, out of phase.
- Press Reset 3 times to get to the mode with both LEDs Off (Normal mode). (This must be done within 10 seconds to access the hidden factory calibration modes.)

Factory Mode	Red LED	Green LED	Current Output	Up Button	Down Button
Set 4 mA	Flash Fast	Off	4 mA	Current Increases	Current Decreases
Set 20 mA	Off	Flash Fast	20 mA		

Then you may change the calibration settings:

- Press Reset once to enter the “Set 4mA” factory mode. (Red LED flashes Fast.)
- If you want to change the 4mA setting:
 - Note the value of the current on your meter before you change anything.
 - Do not trust the readings in your meter to be absolutely correct. Just use your meter to check that the output current is changing in the way that you expect.
 - Press the Up or Down button once and check the new value on your meter. This value should indicate how much you have changed the 4mA output.
- Press Reset once to enter the “Set 20mA” factory mode. (Green LED flashes Fast.)
- If you want to change the 20mA setting, use the same process as the 4mA setting above.
- Press Reset again to return to Normal mode.
- If you want to make further adjustments then you must repeat the whole process.

Then you must verify that the changes to calibration are correct and that everything works:

- If you can, immediately measure and check the 4mA and 20mA settings are correct.
- Adjust the standard Field Settings (zero, span, filter, high and low flow alarms) again, since the recalibration will have changed the effect of these settings.
- Run the MR150 at minimum and maximum flow rates and verify that the pump (or other device) connected to the 4-20mA output signal operates correctly and without shutdown.
- Repeat the whole process if the recalibrated values are not ideal.

Factory Programming

The transmitter can be connected to a PC via an RS232 serial interface using (MR120 programming adaptor. A software program (Macnaught M125) allows interrogation of the transmitter and adjustment of all operating parameters.

Note The transmitter must be disconnected from the 4-20mA current loop and pulse input while programming.

How to Order

MR150 4-20mA Part Number structure							
Base Model	Power source	Fitting	Display	Size	Code	Description	
MR150	E	M	D	-	00	E	External powered
	L	R	G		01	L	Loop Powered
		W	E		04		
			N		07	M	Meter Mount
					10	R	Retrofit
						W	Wall mount
						D	MR100
						E	Standard or Deluxe Display
						N	No display
						00	Required for Remote units
						01	M05 / M1 / M2
						04	M4
						07	M7
						10	M6 to M100

General specifications

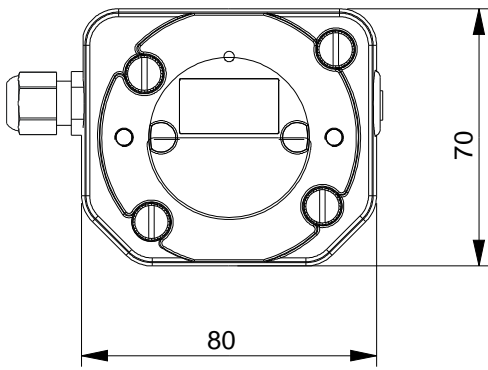
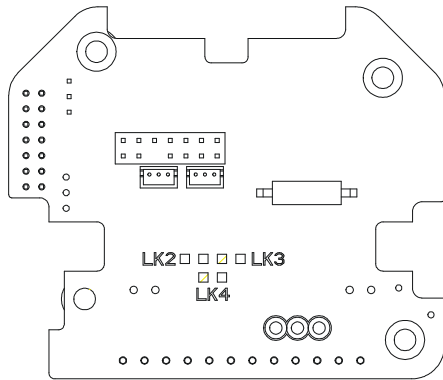
Housing		
	Size	80Wx70Lx50D
	Mounting	Direct or via adaptor
	Housing material	Aluminium
	Protection class	IP65

Electrical connections		
	External	3.5 mm pitch screw terminals
	Inter-module and programming	0.1"pitch header
	Pulse input	1.5 mm pitch connector 0.1" pitch header 3.5mm screw terminals

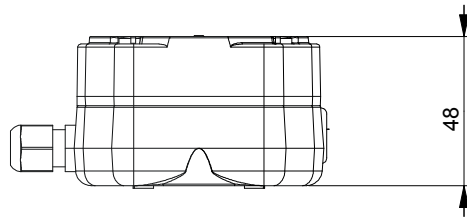
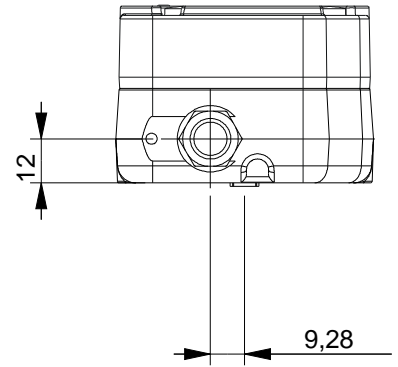
4-20mA Loop		
	Supply voltage	18V-30VDC
	Optional Supply Voltage	TBA
	Linearity	0.1%
	Ambient operating temperature	-10-+70°C
	Input	Reed switch (voltage free contact)
Software	Revision	9

Auxiliary outputs		
	Output type	Opto Isolated Sold state relay
	Input to output isolation	1500V rms
	Maximum on resistance	16 ohms
	Maximum load current	100 mA

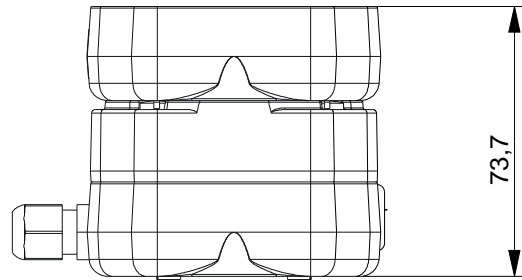
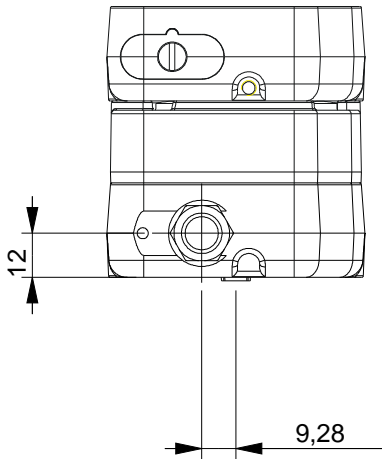
Underside view of circuit board



Dimensions



Dimensions with MR100 Display fitted



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