

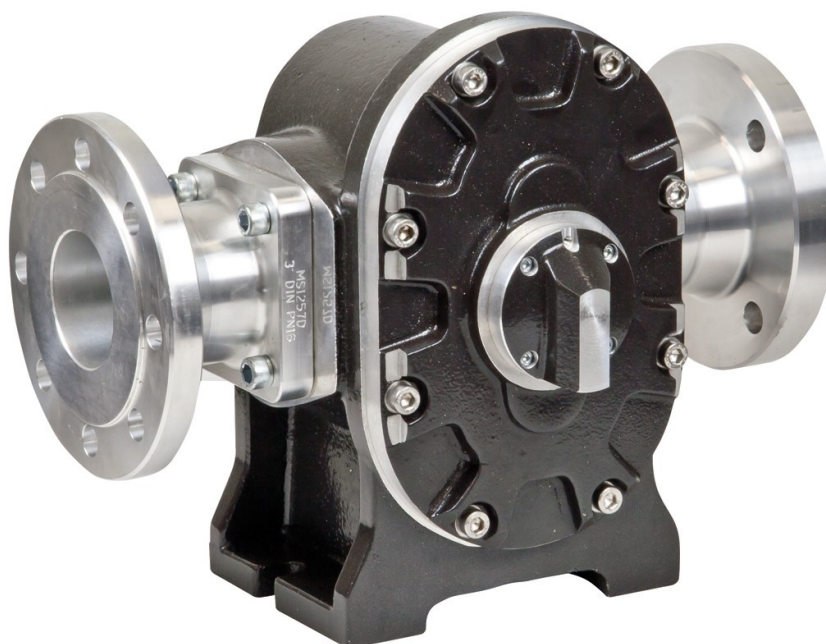
MXL-INST100
Rev 1
06/2013



# MODEL MX100

## 4" OVAL GEAR FLOWMETER

### INSTRUCTION MANUAL



#### To the Owner

Please read and retain this instruction manual to assist you in the operation and maintenance of this product.

This manual contains connection and operating instructions for the MX series Flowmeters with Pulse outputs.

Models with a Liquid Crystal Display have an additional LCD instruction manual supplied. If you need further assistance, contact your local representative or distributor for advice.

This Flow Meter has incorporated the oval rotor principal into its design. This is proven to be a reliable and highly accurate method of measuring flow. Exceptional repeatability and high accuracy over a wide range of fluid viscosities and flow rates are features of the oval rotor design.

With a low pressure drop and high pressure rating oval rotor flow meters are suitable for both gravity and (in-line) pump applications.

Macnaught offer a comprehensive set web based support materials to compliment this instruction manual.  
Access the website by scanning the QR code below.



[WWW.MACNAUGHT.COM.AU](http://WWW.MACNAUGHT.COM.AU)

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## IMPORTANT INFORMATION



### FLUID COMPATABILITY

Before use, confirm the fluid to be used is compatible with the meter. Refer to Industry fluid compatibility charts or consult your local representative for advice.



### STRAINER

To prevent damage from dirt or foreign matter it is recommended that a Y or Basket type 60 mesh strainer be installed as close as possible to the inlet side of the meter.

When a strainer is installed it should be regularly inspected and cleaned. Failure to keep the strainer clean will dramatically effect flow meter performance.

Contact your local representative for advice.



### AIR PURGE / LINE PRESSURE

To prevent damage caused by air purge slowly fill the meter with fluid.

To reduce pressure build-up turn off the at the end of each day.



### REED SWITCH

The reed switch can cause inaccurate rate counts when used with high speed counters. It is advised that a low speed counter is used or alternatively a denounce circuit be installed.

## OPERATING PRINCIPLE

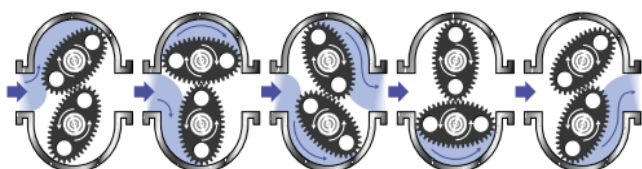
Fluid passing through the meter causes the rotors to turn, as shown below.

One of the rotors (the active rotor) is fitted with magnets.

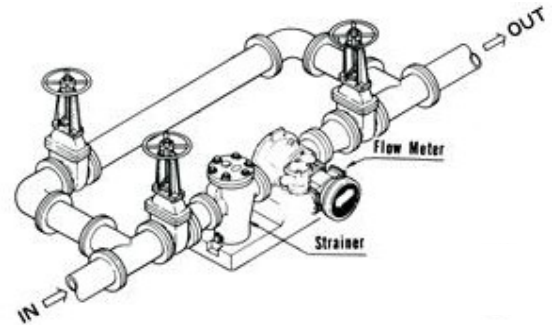
The passing of the magnets are picked up by the sensing elements (Reed and Hall Effect sensors) located in the Pulser Circuit Board.

The excitation of these switches provides a 'Raw Pulse Output' which relates to the K-Factor.  
(e.g.  $KF\ 2.3 = 2.3\ pulses\ per\ litre\ of\ fluid\ passed$ )

This Pulse Output Signal can either be fed directly to an external receiving element (e.g. Data Logger or PLC) or alternatively to an LC Display which conditions the Pulse input signal to display volume of fluid passed. (e.g. *Display 1 Litre per 2.3 pulses received*)



## INSTALLATION PROCEDURE



1) It is recommended that when setting up pipe work for meter installations a bypass line be included in the design. This provides the facility for a meter to be removed for maintenance without interrupting production. (see figure above)

2) Use thread sealant on all pipe threads.

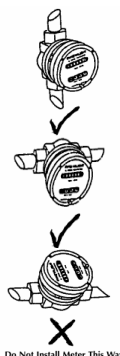
3) For pump applications ensure pipe work has the appropriate working pressure rating to match the pressure output of the pump. See Meter Specifications section for further details.

4) Install a wire mesh strainer, Y or basket type 40 mesh (400 micron), as close as possible to the inlet side of the meter.

5) Ensure that the meter is installed so that the flow of the liquid is in the direction of the arrows embossed on the meter body.

6) The meter can be installed in any orientation as long as the meter shafts are in a horizontal plane. (Refer to figures to the right for correct installation) The register assembly may be orientated to suit the individual.

Note: Incorrect installation can cause premature wear of meter components.



7) Do not over tighten meter connections. Note: Incorrect installation can cause premature wear of meter components.

8) It is important that after initial installation you fill the line slowly, high speed air purge could cause damage to the rotors.

9) Test the system for leaks.

10) Check the strainer for swarf or foreign material, after the first 200 litres check periodically, particularly if the flow rate decreases.

## MAINTENANCE PROCEDURE

### DISASSEMBLY

Ensure that the fluid supply to the meter is disconnected, and the line pressure is released before disassembly, with the exception for repair or maintenance to the LC Display or PCB where there is no necessity to isolate the meter from flow. Refer to the exploded parts diagram on subsequent pages for item numbers.

- 1) Pulse Caps Models: Undo the conduit connector, remove pulse cap and remove the wires from the pulse terminal board
- 2) Standard LC Display: Mark the display orientation with a marking pen, unscrew the four large screws on top of the LC Display. Carefully separate the LC Display from the plastic housing and disconnect the wires from the pulse terminal block. (Refer to additional LCD instruction manual accompanying these instructions). Remove the mounting adaptor plate and gasket.
- 3) Loosen the cap head screws that hold down the meter cap remove the screws, washers and lift off the cap.
- 4) Remove the o-ring from the o-ring groove in the meter cap.
- 5) Remove rotors.

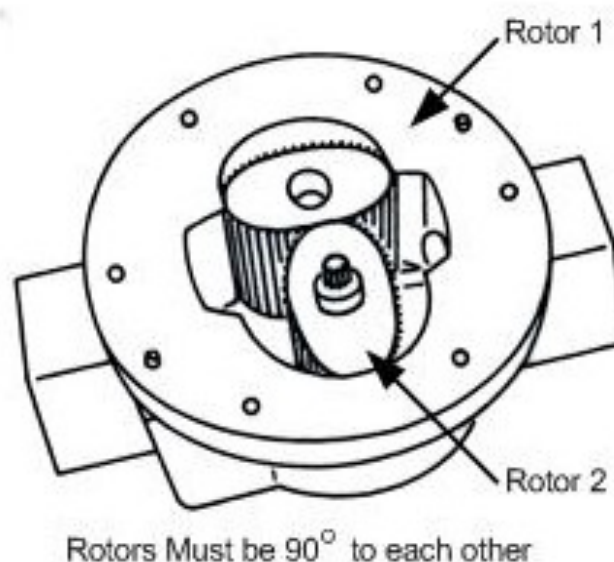
### REASSEMBLY

- 1) Before reassembling check the condition of the rotors (replace if necessary).
- 2) Check that the smooth side of the rotors (not the plug side) is facing you when inserting the rotors, the smooth side of the rotor is the magnet side. There is no difference between rotor one or rotor two.
- 3) Replace the rotors onto the shafts at 90 degrees to each other (refer Fig) and check their operation by turning either of the rotors. If the rotors are not in mesh correctly or do not move freely, remove one of the rotors and replace correctly at 90 degrees to the other rotor.
- 4) Re-check the operation of the rotors
- 5) Replace the o-ring into groove in the meter cap, if the o-ring has grown or is damaged in any way replace it with a new part.
- 6) Replace the meter cap making sure that the locating pin in the body lines up with the hole in the meter cap.

- 7) Insert the cap head screws and tighten in a diagonal sequence 1, 3, 2, 4, etc.

**Torque = 33 Nm**

- 8) The replacement of cables and connectors are a reversal of the disassembly procedure, replace conduit fitting if required.  
When replacing the Standard LC Display confirm the orientation marks made on disassembly are aligned then screw the register into place.
- 9) Test the meter by turning the rotors with a finger or by applying very low air pressure (no more than a good breath) to one end of the meter, before returning the meter to the line.



## FLOWMETER SPECIFICATIONS

### Flowmeter

		Metric	US
Flow Range	Below 5 cP	220 to 1000 LPM	60 to 250 GPM
	5 to 1000 cP	120 to 1200 LPM	30 to 300 GPM
K-Factor	(Sensor Pulses per Unit of Measure)	2.3 pulses/L	8.71 pulses/G
Max Temperature		-40°C - 120°C	40°F - 248°F
Maximum Operating Pressure <sup>1</sup>		1200 kPa	175 psi
Accuracy of Reading		±0.5%	

1. Conforms to Directive 97/23/EC—Cat 1

### High Viscosity Applications

Ensure the Flowmeter is fitted with 'High Viscosity Rotors' if the fluid being metered is 1000 cP or above

High Viscosity Rotors	For Fluids above 1000 Centipoise (cP)
<i>*Note: High Viscosity Rotor option available for models <b>MX100S</b></i>	

## ELECTRICAL SPECIFICATIONS

The MX Flow meter series is supplied with either a Blind Pulser and Digital Display option.

Please note the wiring diagrams in the following pages are for the **Blind Pulser Output Modules** and the **PCB** (Sensor Board), which is responsible for providing a Raw Pulse input to the LC display

If the Flow meter is supplied with an LC Display fitted, please consult the appropriate Instruction Manual, as advised below, for all programming and wiring instructions.

<b>Output option:</b>	type 'D'	type 'E'	type 'F'	type "G"	type "H"	
<b>Display Type :</b>	PR	PRA	ER	ERA	ERB	ERS ( <i>remote mount only</i> )
<b>Display Part Number:</b>	MXD-DS	MXD-ES	MXD-ES	MXD-GS	MXD-HS	ERS-RMP / ERS-RMA
<b>Instruction Sheet:</b>	DR013	DR014	MS574	MS392	MS476	MS351

### Analogue Output (4-20mA)

Analogue outputs are available as an auxiliary display signal by including either of the following LC displays with your flowmeter. These may be fitted to the meter or remote (wall mount) types.

**PRA** 12mm LC Display with analogue output module

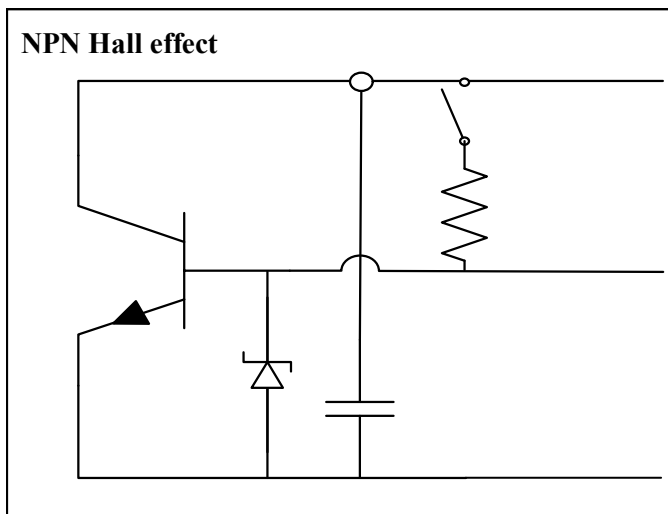
**ERA** 17mm LC Display with analogue output module

## Pulser Specifications

Output Signals	Standard Pulse Meter		2x Digital (Square Wave)
Reed Switch (Mechanical Sensor)	Current	Maximum	500mA
	Voltage	Maximum	30V DC
	Contact Rating	Maximum <sup>1</sup>	10W
Hall Effect IC (Electronic Sensor)	Maximum Current		7.5mA
	Operating Voltage		4.5V to 24V DC
	Transistor Type		Open-Collector NPN

1. Contact rating maximum is 10W. Neither current nor voltage maximums should be exceeded in achieving this.

NPN Hall effect



Red

+VE

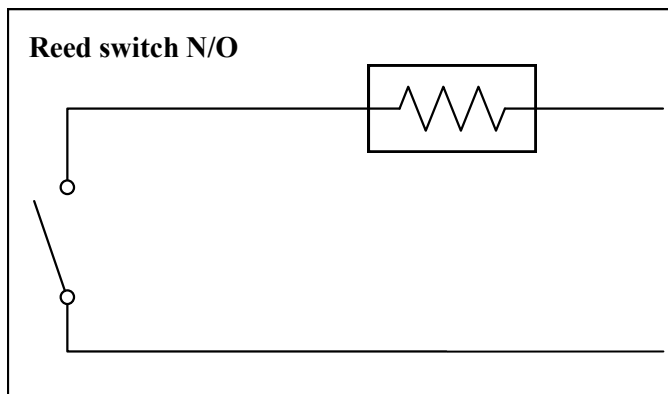
White

Signal

Black

-VE

Reed switch N/O



Green

+VE

Yellow

-VE

**Reed Switch**

To maximise the life of the reed switch contacts, the pulse board comes equipped with a 1k8Ω current limiting resistor in series with the reed switch as standard.

These resistors are user swappable should you require a different value for your system.

**NPN Open Collector Hall Effect Sensor**

The output for the hall effect sensor is NPN (current sinking, open collector). For correct operation, it is advisable to have a pull-up resistor installed.

The hall effect sensor is equipped with a 1k8Ω pull-up resistor between signal and supply as standard.

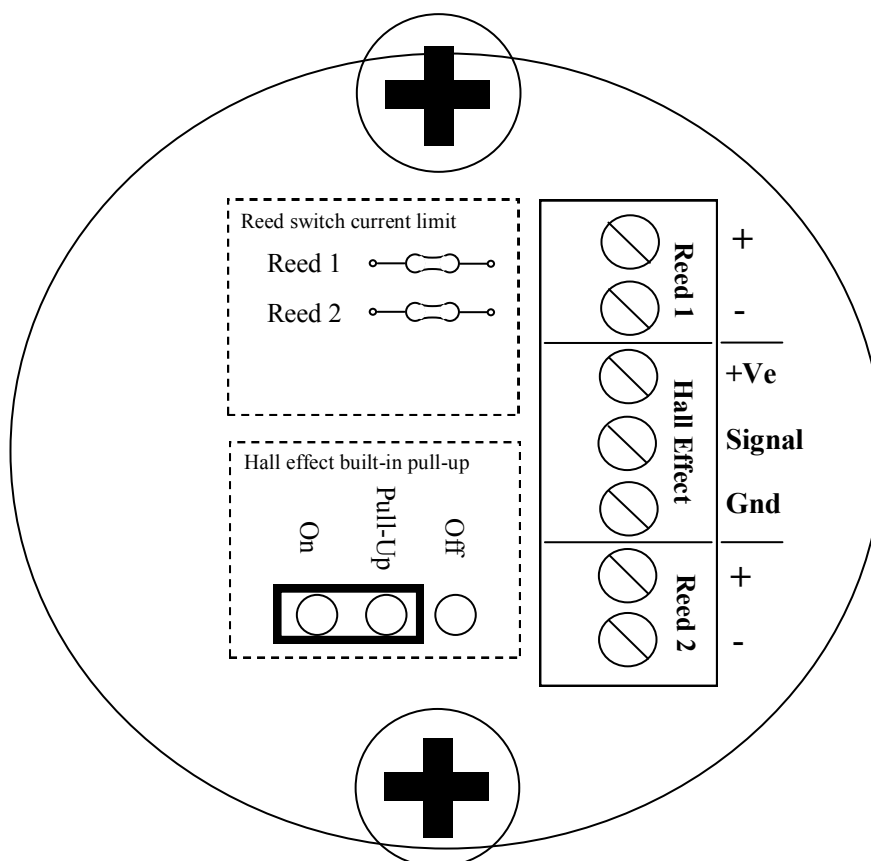
This in-built pull-up resistor can be bypassed by moving the jumper pin to the off position if required.

A pull-up resistor of your choosing can be installed between signal and supply, provided the in-built pull-up resistor be bypassed first.

**Pulser Specifications**

Output Signals	Standard Pulse Meter		2x Digital (Square Wave)
Reed Switch (Mechanical Sensor)	Current	Maximum	500mA
	Voltage	Maximum	30V DC
	Contact Rating	Maximum <sup>1</sup>	10W
Hall Effect IC (Electronic Sensor)	Maximum Current		7.5mA
	Operating Voltage		4.5V to 24V DC
	Transistor Type		Open-Collector NPN

1. Contact rating maximum is 10W. Neither current nor voltage maximums should be exceeded in achieving this.



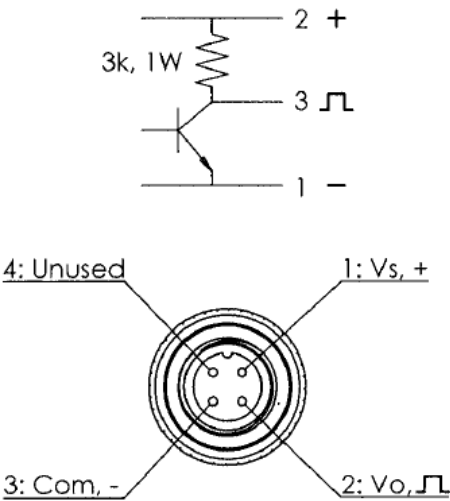
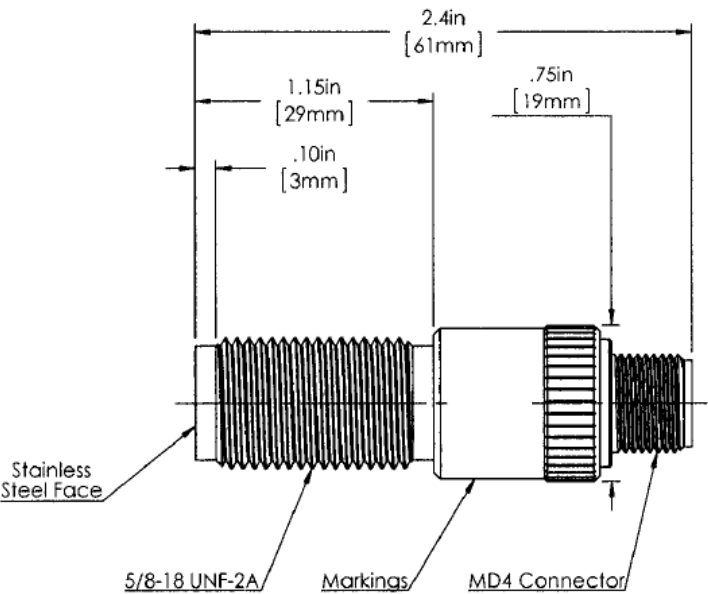
**Note:**  
Local Display is  
connected to Reed 1



**CAUTION:** This sensor must be installed with an approved safety barrier.

Pulser Specifications

SENSOR TYPE	Omni Polar	Open-Collector NPN
SPECIFICATIONS	Construction	Stainless Steel Housing
	Operating Voltage	5V to 30V DC
	Maximum Current	15mA
	Temperature Range	-40 - 85oC
		-40 - 185oF





<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
Fluid will not flow through meter	a) Foreign matter blocking rotors b) Line strainer blocked c) Damaged rotors d) Meter connections over tightened e) Fluid is too viscous	a) Dismantle meter, clean rotors (strainer must be fitted in line) b) Clean strainer c) Replace rotors (Strainer must be fitted in line) d) Re-adjust connections e) See specifications for maximum viscosity
Reduced flow through meter	a) Strainer is partially blocked b) Fluid is too viscous	a) Clean strainer b) See specifications for maximum viscosity
Meter reading inaccurate	a) Fluid flow rate is too high or too low b) Air in fluid c) Excess wear caused by incorrect installation	a) See specifications for minimum and maximum flow rates b) Bleed air from system c) Check meter body and rotors. Replace as required. Refer to installation instructions
Meter not giving a pulse signal	a) Faulty hall effect sensor b) Faulty reed switch c) Magnets failed	a) Replace PCB Board b) Replace PCB Board c) Replace magnets
LCD register not working	a) Battery not connected properly b) Battery flat c) Faulty wiring connections d) Faulty LC Display e) Faulty connection from LC Display	a) Check battery connections b) Replace battery c) Check wiring for loose or faulty connections d) Replace LC Display e) Check wiring connections

## MAINTAINENCE VIDEOS

Macnaught provides an comprehensive set of 'Maintenance Videos' to assist the end user in all aspects of service and/or repair of the Flowmeter range.

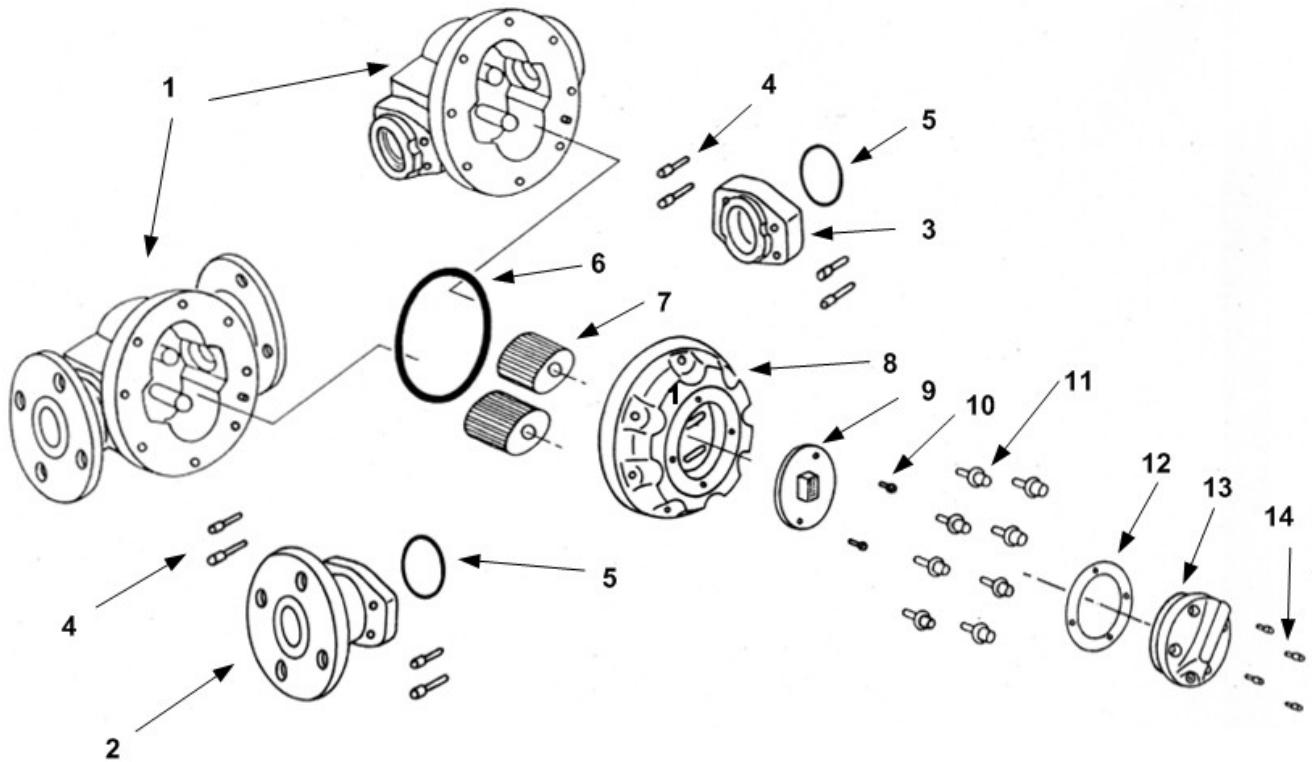
This web based resource can be accessed via the following URL

<http://www.macnaught.com.au/resources/>

Or by scanning the QR code below.



## EXPLODED DIAGRAM



## Parts Identification

Item No.	Part Description
1	Meter Body
2	Flanged Process Connection
3	Threaded Process Connection
4	Adaptor Bolts
5	Adaptor O-Rings
6	Meter Cap O-Ring
7	Rotor Set
8	Meter Cap
9	Printed Circuit Board
10	PCB Mounting Screws
11	Meter Cap Screws
12	Pulser Cap Gasket
13	Pulser Cap
14	Pulser Cap Screws

## SPARE PARTS KITS

**Spare Kit** options, for both Flowmeter and Display/Pulser modules, are available as replacement components.

- **Pulser Kit / LC Display Module**
  - Replacement PCB complete with M-Lock electronic housing.
  - LC Display module (Electronic housing not included)
- **Rotor Kit**
  - Rotor assembly (includes Meter Cap bolts and O-Ring)
- **Seal Kit**
  - O-Rings/Gaskets (includes Meter Cap Bolts)

SPARE KITS - FLOWMETER		MX100F	MX100S
ROTOR KIT	<i>Standard</i>	MXS100F-rotor	MXS100S-rotor
	<i>High Viscosity</i>		MXS100S-HVrotor
	<i>High Temp</i>		
SEAL KIT		MXS100F-seal	MXS100S-seal

SPARE KITS – DISPLAY AND PULSER MODULE				
Output Type	Description	Pulser Kit	Display Module only	Display/Pulser complete
Type A	Standard Pulser			MXD-AS
Type B	Intrinsically Safe			MXD-BS
Type C	Flameproof			MXD-CS
Type D	PR Digital Register	MXS-PCB-PR	MXS-DIS-PR	MXD-DS
Type E	PRA Digital Register	MXS-PCB-PR	MXS-DIS-PRA	MXD-ES
Type F	ER Digital Register	MXS-PCB-ER	MXS-DIS-ER	MXD-FS
Type G	ERA Digital Register	MXS-PCB-ER	MXS-DIS-ERA	MXD-GS
Type H	ERB Batch Controller	MXS-PCB-ER	MXS-DIS-ERB	MXD-HS
Type T	High Temperature			MXD-TS

## WETTED PARTS

WETTED PARTS	MX100F	MX100S
METER BODY	Alum	Alum
METER CAP	Alum	Alum
ROTORS - Standard	Alum	Alum
High Viscosity		Alum
ROTOR SHAFTS	St.St	St.St
ROTOR BUSHES		CA
O-RINGS	FKM	K

K - FEP/PTFE Encapsulated

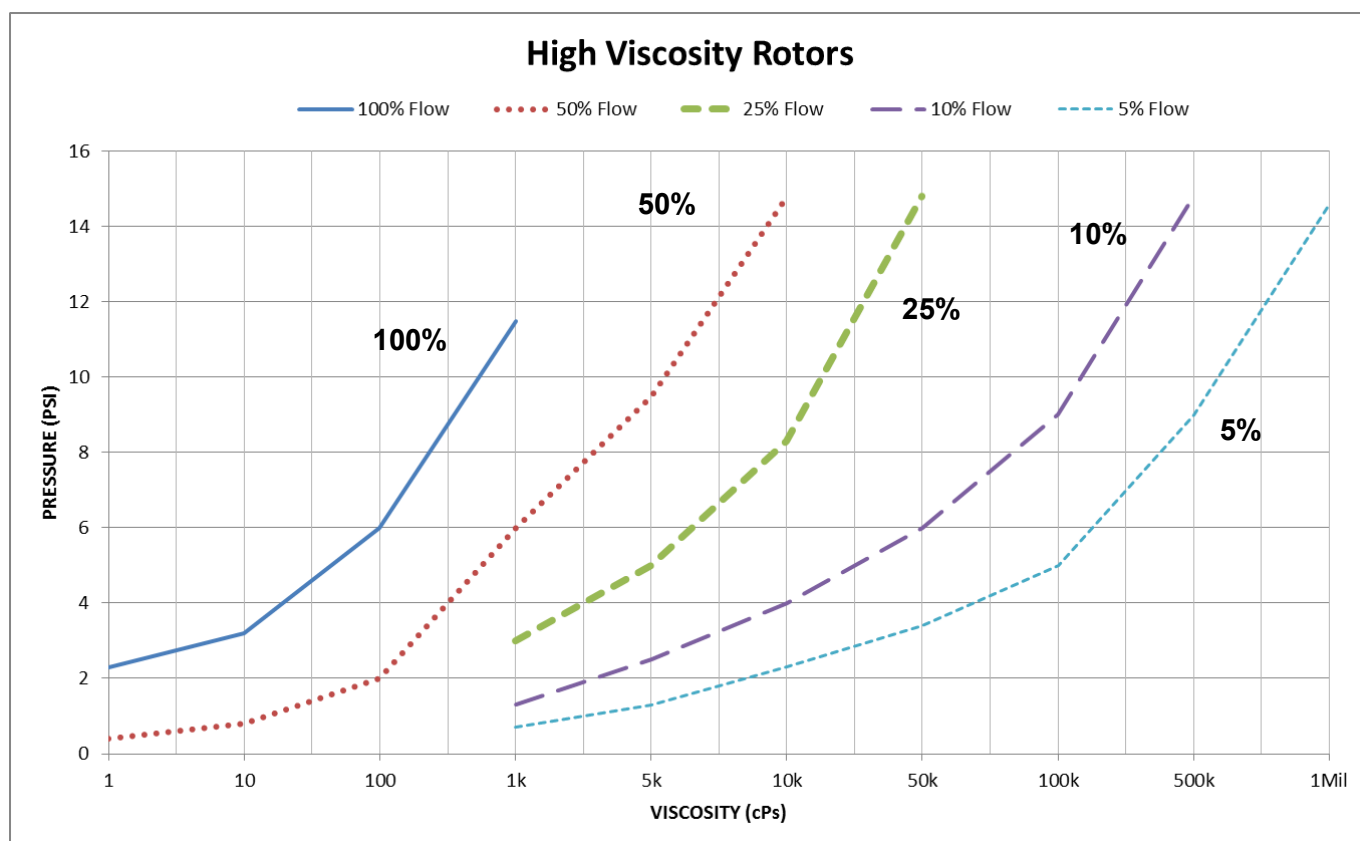
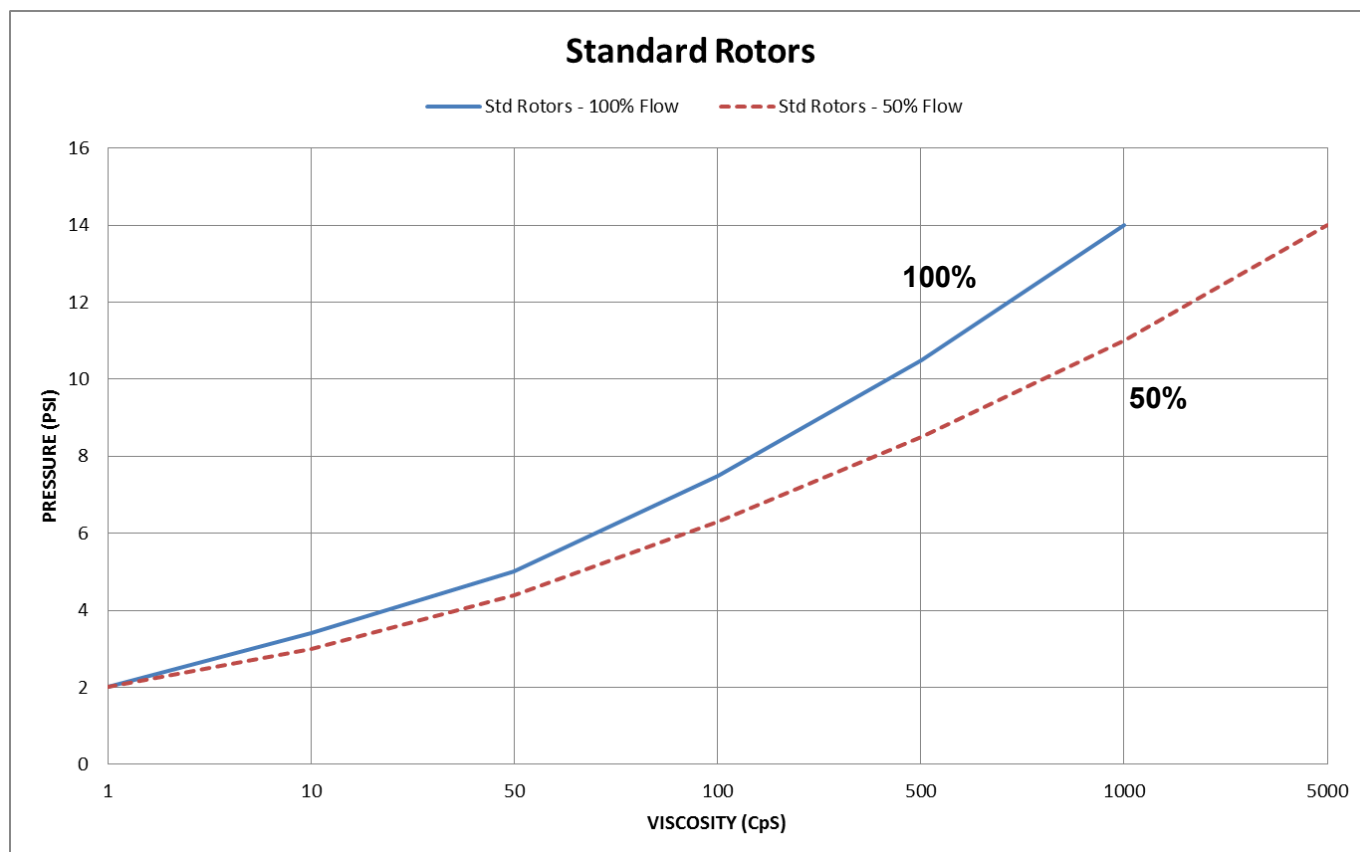
St.St - Stainless Steel 316 /304

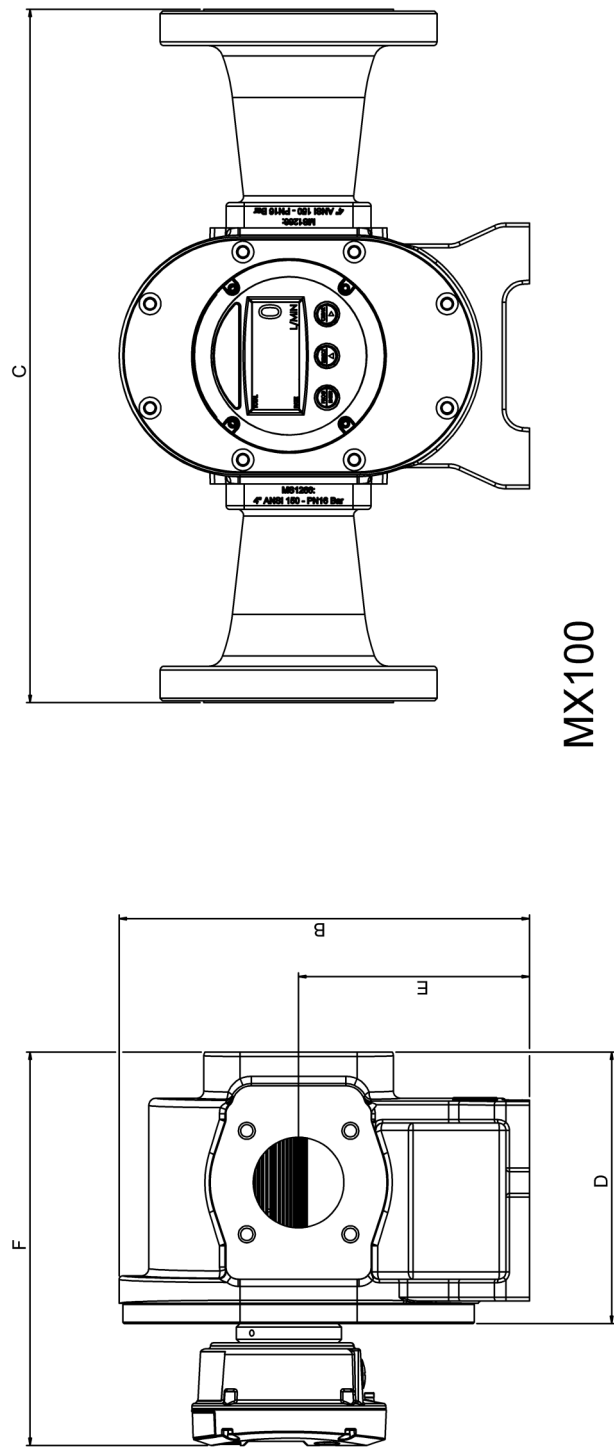
Alum - Aluminium AA610

CA - Carbon

FKM - Viton<sup>®</sup>

# PRESSURE DROP v's VISCOSITY

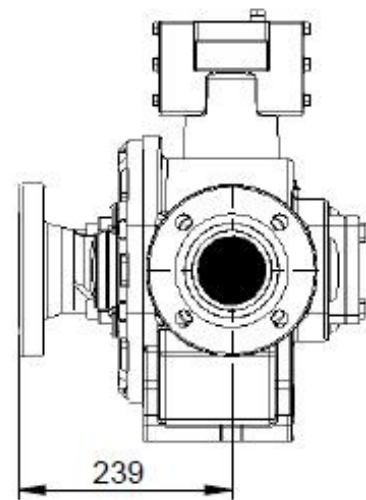
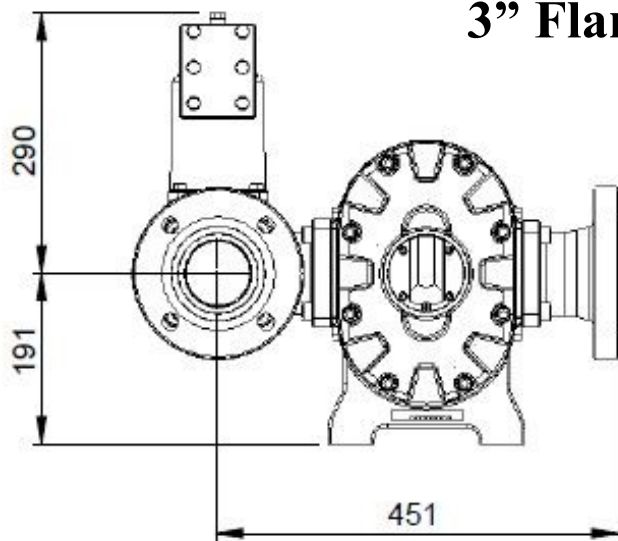




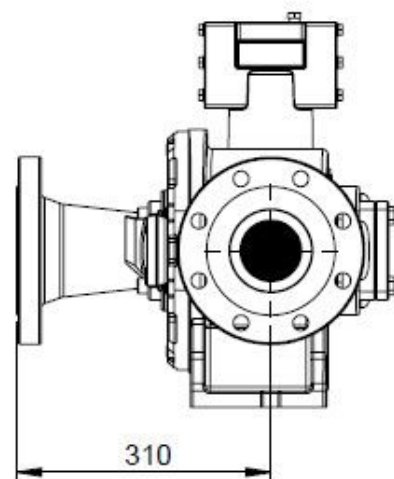
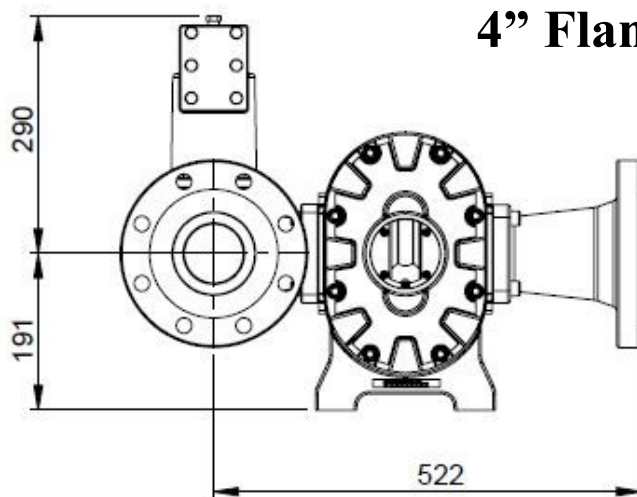
MX100

		METER AND FLANGE DIMENSIONS					PULSER AND DISPLAY HEIGHT - F					
METER SIZE		PORT SIZE	B	C	D	E	TYPE A	TYPE B	TYPE C	TYPE T	TYPE D,E	TYPE F,G,H
MX100 ALUMINIUM	ANSI	4"	340	436	225	191	242	276	283	287	273	326
	DIN	4"		436								
	JIS	4"		436								
	RP	3"		302								
	NPT	3"		302								

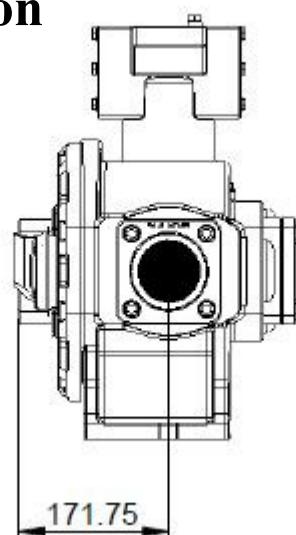
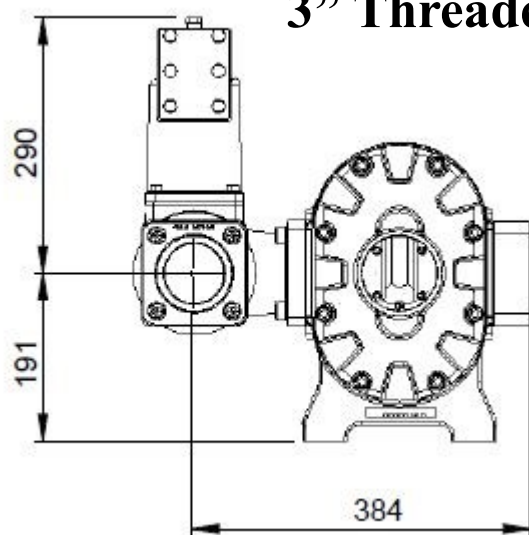
**3" Flange**



**4" Flange**



**3" Threaded Connection**









### **WEEE Directive - Waste Electrical and Electronic Equipment**



The WEEE Directive requires the recycling of waste electrical and electronic equipment in the European Union.

Whilst the WEEE Directive does not apply to some of Macnaught's products, we support its policy and ask you to be aware of how to dispose of this product.

The crossed out wheelie bin symbol illustrated and found on our products signifies that this product should not be disposed of in general waste or landfill.

Please contact your local dealer national distributor or Macnaught Technical Services for information on product disposal.

# EC Declaration of Conformity

In accordance with EN ISO 17050-2004

We: Macnaught Pty Ltd  
Of: 41-47 Henderson St  
Turrella NSW 2205  
AUSTRALIA

**Declare that:**

Macnaught Flow Meters prefixed MX, F, CR, M or S in accordance with the following Directive;  
*2006/42/EC Machinery Directive (and its amending directives)*

have been designed and manufactured to the following specifications;  
*EN ISO 12100:2010 Safety of Machinery*

**Declare that:**

Macnaught Flow Meters prefixed MX, F, CR, M or S with flange nominal bores sizes 1" to 6" inclusive in accordance with the following Directive;  
*97/23/EC Pressure Equipment Directive (and its amending directives)*

comply with the essential requirements of the Directive, classification Category 1 Group 1

**Declare that:**

Macnaught Flow Meter accessories prefixed DR, ER or PR as fitted to the Flow Meters or remotely mounted in accordance with the following Directive  
*2004/108/EC Electromagnetic Compatibility Directive (and its amending directives)*

have been designed and manufactured to the following specifications;  
*EN61326-1:2006 Electromagnetic Compatibility – Electrical equipment for measurement, control and laboratory use.*

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications.

The product complies with all essential requirements of the Directives.

This declaration is no longer valid if the unit is modified without our agreement.

Name: Steven Gavin  
Position: Operations Director  
Date: 21/06/2013  
Done at: Macnaught Pty Ltd  
41-49 Henderson St  
Turrella NSW 2205,  
AUSTRALIA



Issue 6  
QA-CN5573  
Issued by: Graham Wilson



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