

INST-FCM
Rev 2
11/2019



# MX12FCM - MX25FCM OVAL GEAR FLOWMETER FCM-SERIES

## 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 FCM Flow Meter with Pulse and Temperature outputs.

This Flow Meter has incorporated the oval gear principle 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 gear design.

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

Macnaught offers Advanced Flow Controllers for Display, Temperature Compensation Calculations & Various Outputs ( Analog, Pulse and Modbus)

Access the website by scanning the QR code below.



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

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## PRE-INSTALLATION CHECKS



### FLUID COMPATIBILITY

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 material, it is recommended that a Y or Basket type 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 pump at the end of each day.

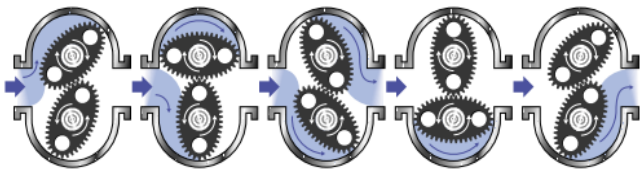
## OPERATING PRINCIPLE

Fluid passing through the meter causes the rotors to turn, as shown in the picture below. One of the rotors (the active rotor) is fitted with magnets.

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

The excitation of these sensors provides a 'Raw Pulse Output' which relates to the K-Factor. (e.g. KF 36 PPL= 36 pulses per litre of fluid passed)

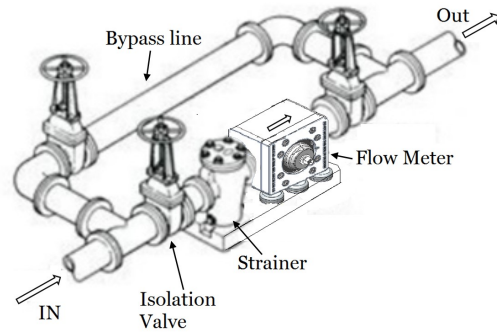
This Pulse Output Signal can either be fed directly to an external receiving element (e.g. Data Logger or PLC) or alternatively to an LC Display which conditions the Pulse input signal to display volume of fluid passed. (e.g. Display 1 Litre for every 36 pulses received)



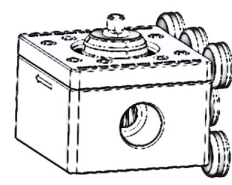
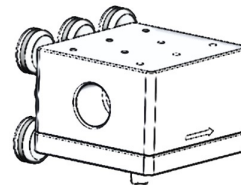
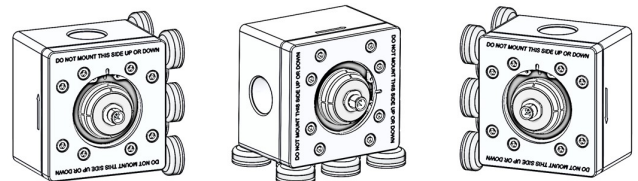
## INSTALLATION PROCEDURE

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)

## INSTALLATION PROCEDURE



2. Use a thread sealant on all pipe threads.  
**Caution:** Thread tape must not enter the meter, as it could stop flow meter's operation.
3. For pump applications ensure that the pipe work and the flow meter has the appropriate working pressure rating to match the pressure output of the pump. Refer to Flowmeter Specifications section for further details.
4. Install a wire mesh strainer, Y or basket type **250 micron / 60 mesh**, 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 arrow 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 diagram below for correct installation)  
**Note: Incorrect installation can cause premature wear of meter components.**
7. Do not over tighten meter connections. .



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 is decreasing.

## MAINTENANCE PROCEDURE

### DISASSEMBLY

**Note:** Maintenance can be carried out to the pulse output modules without having to remove or isolate the meter from the process line.

When maintenance to any other part of the meter is required, the meter must be isolated and the line pressure released. Refer to the exploded diagram on page 8 for parts identification.

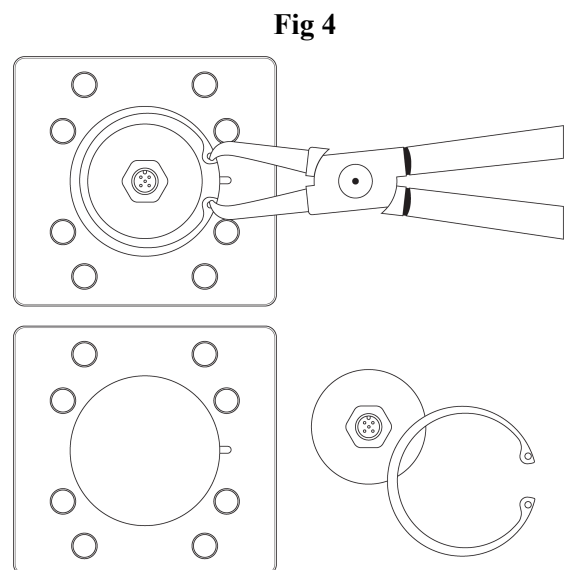
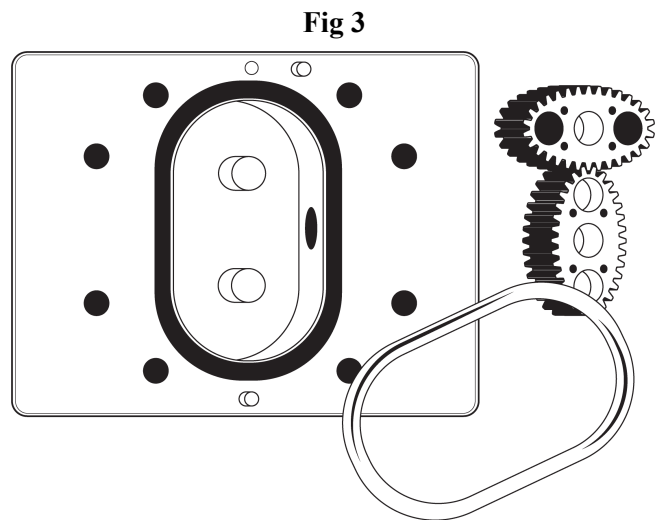
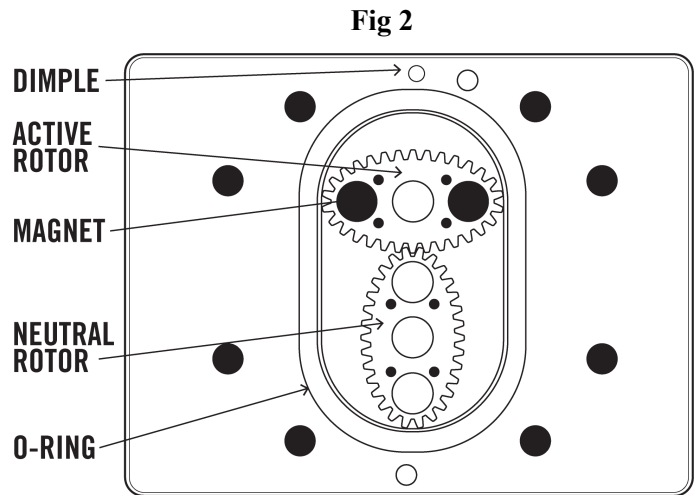
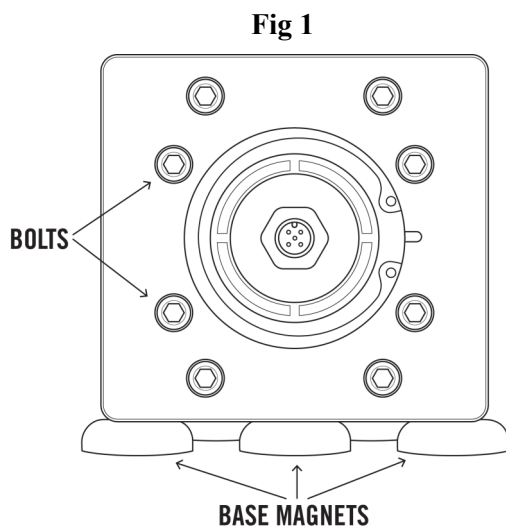
#### Mechanical parts:

**Note:** It is advisable to mark all components with a marker pen before disassembly, to ensure all the components are replaced to their correct position during the re-assembly process.

1. Remove the sensor cable by unscrewing the M8 connector.
2. Remove the Base magnets using a screwdriver.
3. Remove the meter cap by loosening the bolts (Fig 1)
4. Remove the O-Ring from the O-Ring groove. Wipe any grease and store in a clean place.
5. Remove the rotors from the meter body, make sure to mark the orientation of both rotors (Fig 2 and 3)

#### Electronic part(s):

1. The electronic pulser cap can be removed with the help of a circlip plier (Fig 4)



## RE-ASSEMBLY

1. Before re-assembling, check the condition of the rotors and O-Ring (replace if necessary).
2. There are two Rotor types. **Active** and **Neutral**. The *Active Rotor* is fitted with the magnets. They can be identified by running a metal object over the face (magnet side) of the rotor.

**Caution: The active rotor is always fitted near to the 'dimple' on the meter body (Fig 5)**

### Replace Active Rotor.

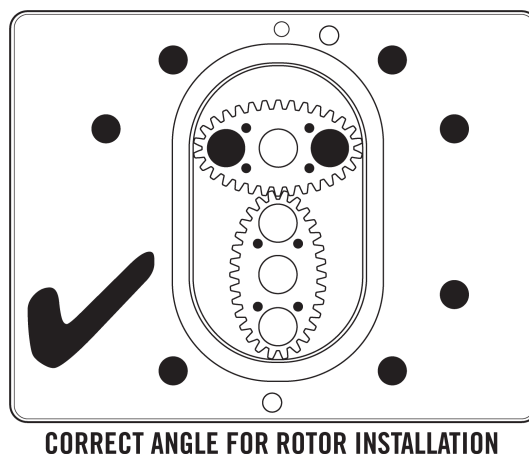
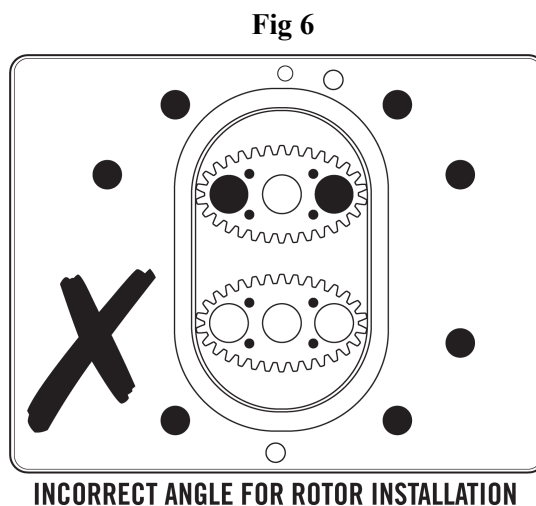
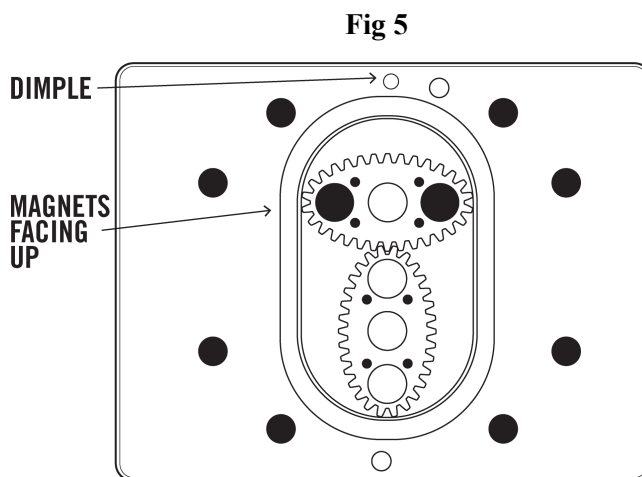
Check the magnet side of the rotor is "Facing up" as shown in the figure (Fig 5)

**Replace Neutral Rotor.** Install the neutral rotor in a similar fashion as active rotor, however the neutral rotor does not have magnets.

**Caution: Both rotors should be 90 degrees/ perpendicular to each other (Fig 6)**

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 one another.

3. Smear the O-Ring with a light film of grease. Replace the O-Ring into groove. The O-Ring will need to be replaced if it has grown or is damaged in anyway.
4. Replace the meter cap.
5. Insert the cap head screws and tighten in a diagonal sequence 1, 5, 7, 3, etc. (see Meter Torque Ratings, page 9)  
Install the electronic module using a circlip plier.
6. 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.
7. Install the base magnets and sensor cable.



## FLOWMETER SPECIFICATIONS

Series MX12FCM	Metric	US
Flow Range	2 to 30 LPM	0.5 to 8 GPM
K-Factor (Pulses per Unit of Measure)	Refer to Flowmeter Data Plate	
Port Size	3/4" G or 3/4" NPT	
Max Temperature	-40°C to 80°C	-40°F to 176°F
Maximum Operating Pressure	1034 kPa	150 psi
Accuracy of Reading	±0.1% with linearization & 7 point calibration	

Series MX25FCM	Metric	US
Flow Range	6 to 45 LPM	1.6 to 11.9 GPM
K-Factor (Pulses per Unit of Measure)	Refer to Flowmeter Data Plate	
Max Temperature	-40°C to 80°C	-40°F to 176°F
Port Size	1" G or 1" NPT	
Maximum Operating Pressure	1034 kPa	150 psi
Accuracy of Reading	±0.1% with linearization & 7 point calibration	

## ORDERING CODES

<b>MX12</b>	3/4" meter, 2 to 30 LPM (0.5 to 8 GPM), Hall Effect and Temp sensor		
<b>MX25</b>	1" meter, 6 to 45 LPM (1.6 to 11.9 GPM), Hall Effect and Temp sensor		
	<b>FCM</b>	Fuel Consumption & Measurement Series, ±0.1 Accuracy	
		-	Separator
		1	G threads
		2	NPT threads

↓                      ↓                      ↓                      ↓  
**MX12**                **FCM**                -                      2

Example Model Number: **MX12FCM-2**

## PULSER CAP AND CABLE SPECIFICATIONS

### PULSE OUTPUT

The FCM series flow meter is supplied with 2 x Hall Effect sensors to generate digital, square wave pulse output. These sensors are NPN (current sinking, open collector) type and they are equipped with a 4k7Ω pull-up resistor between signal and supply as standard.

Pulses can be used as an input to a Flow Controller for Display, Temperature Compensation calculations and Various Outputs (Analog, Pulse and Modbus)

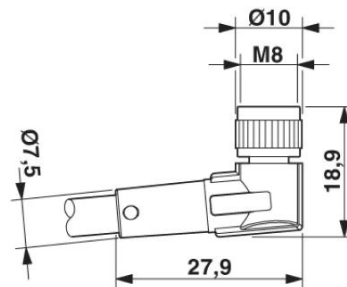
The pulser cap also has an RTD sensor for temperature measurement.

### PULSER CAP SPECIFICATIONS

Sensor Type	Parameter	Value
Hall Effect Sensor	Maximum Supply Current	7.5mA
	Maximum Output Current	25mA
	Operating Voltage	4.5V to 24V DC
	Transistor Type	Open-Collector NPN
Temperature Sensor	RTD	100 Ohm@0°C, TCR 3850ppm/°C, 1%

### CABLE AND CONNECTOR SPECIFICATIONS

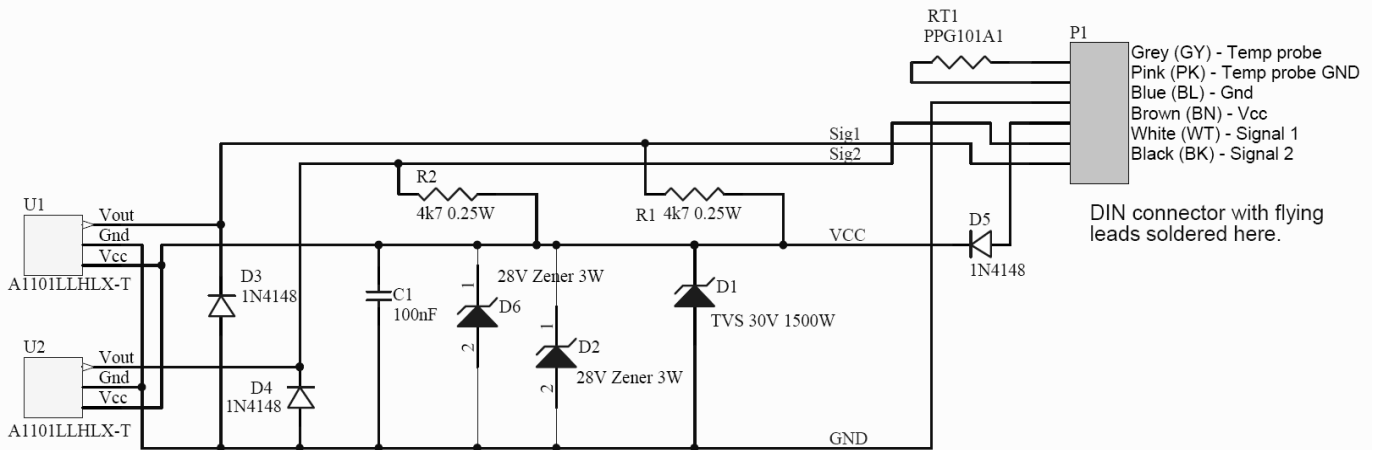
All FCM flow meters come with a sensor cable supplied



Parameter	Value
Connector	M8 (Right angle), female
Length of cable	5 metres
Rated Current/ voltage	1.5A/ 30 VDC
AWG signal line	24
Number of positions	6
Material of body	TPU (thermoplastic polyurethane)
Ambient temperature (operation)	-25°C - 90°C (plug and socket)

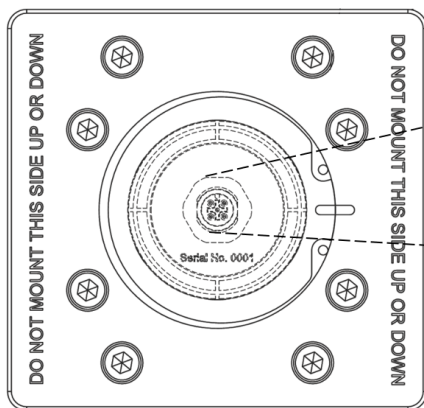
# CIRCUIT DRAWING AND PIN ASSIGNMENT

## CIRCUIT DRAWING



## PIN ASSIGNMENT - FLOW METER

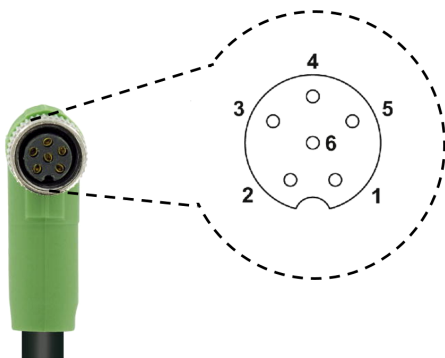
The sensor is equipped with M8 x 1 male connector (6 pins)



### DIN Connector pin designation and orientation

- 1 - Vcc
- 2 - Hall Effect Signal 1
- 3 - GND
- 4 - Hall Effect Signal 2
- 5 - PT100 Temperature Probe
- 6 - PT100 GND

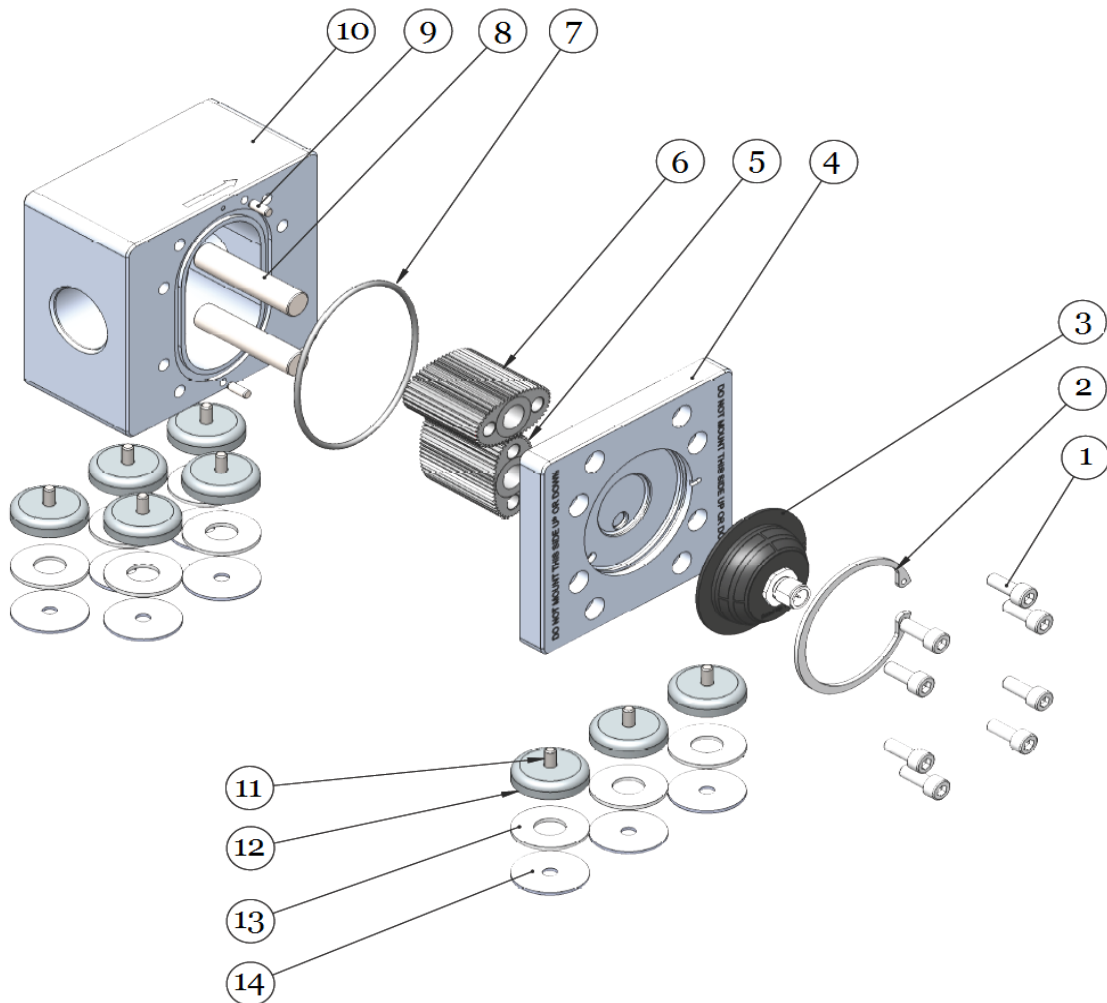
## PIN ASSIGNMENT - CABLE



Pin Number	Signal Name	Wire Colour
1	Vcc	Brown
2	Hall Effect signal 1	White
3	GND	Blue
4	Hall Effect signal 2	Black
5	PT100 temperature probe	Grey
6	PT100 GND	Pink



## EXPLODED DIAGRAM



## PARTS IDENTIFICATION

ITEM NO.	COMPONENT
1	METER CAP SCREWS
2	CIRCLIP
3	PULSER CAP
4	METER CAP
5	ROTOR (NEUTRAL)
6	ROTOR (ACTIVE)
7	METER CAP O-RING
8	ROTOR SHAFTS
9	LOCATION PINS
10	BODY
11	SCREWS FOR MOUNTING MAGNETS
12 -14	MOUNTING MAGNETS AND WASHERS

## TROUBLESHOOTING GUIDE

<b>Problem</b>	<b>Cause</b>	<b>Remedy</b>
Fluid is not flowing through the meter	a) Foreign material blocking the rotors b) Line strainer blocked c) Damaged rotors d) Meter connections over tightened e) Fluid is too viscous	a) Dissassemble the meter, clean the rotors and body chamber (strainer must be fitted in line) b) Clean the strainer c) Replace the rotors (Strainer must be fitted in line) d) Re-adjust connections e) Consult Macnaught
Reduced flow through meter	a) Strainer is partially blocked b) Fluid is too viscous	a) Clean the strainer b) Consult Macnaught
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 the 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) Magnets failed	a) Replace PCB Board b) Replace rotors

## METER CAP TORQUES

<b>Meter Torque Ratings</b>			
<b>Series</b>	<b>Pressure (psi)</b>	<b>Torque (Nm)</b>	<b>Lubrication</b>
<b>MX12FCM</b>	150	9 Nm	Yes
<b>MX25FCM</b>	150	9 Nm	Yes

## WETTED COMPONENTS

<b>Wetted Components</b>	<b>MX12FCM</b>	<b>MX25FCM</b>
<b>METER BODY (Item 10)</b>	Aluminium	Aluminium
<b>METER CAP (Item 4)</b>	Aluminium	Aluminium
<b>ROTORS (Items 5 and 6)</b>	PPS	PPS
<b>ROTOR SHAFTS (Item 8)</b>	Stainless Steel	Stainless Steel
<b>O-RING (Item 7)</b>	Fluorocarbon (FKM)	Fluorocarbon (FKM)

## SERVICE KITS

Below Service Kits are available to replace the components or service the flow meter.

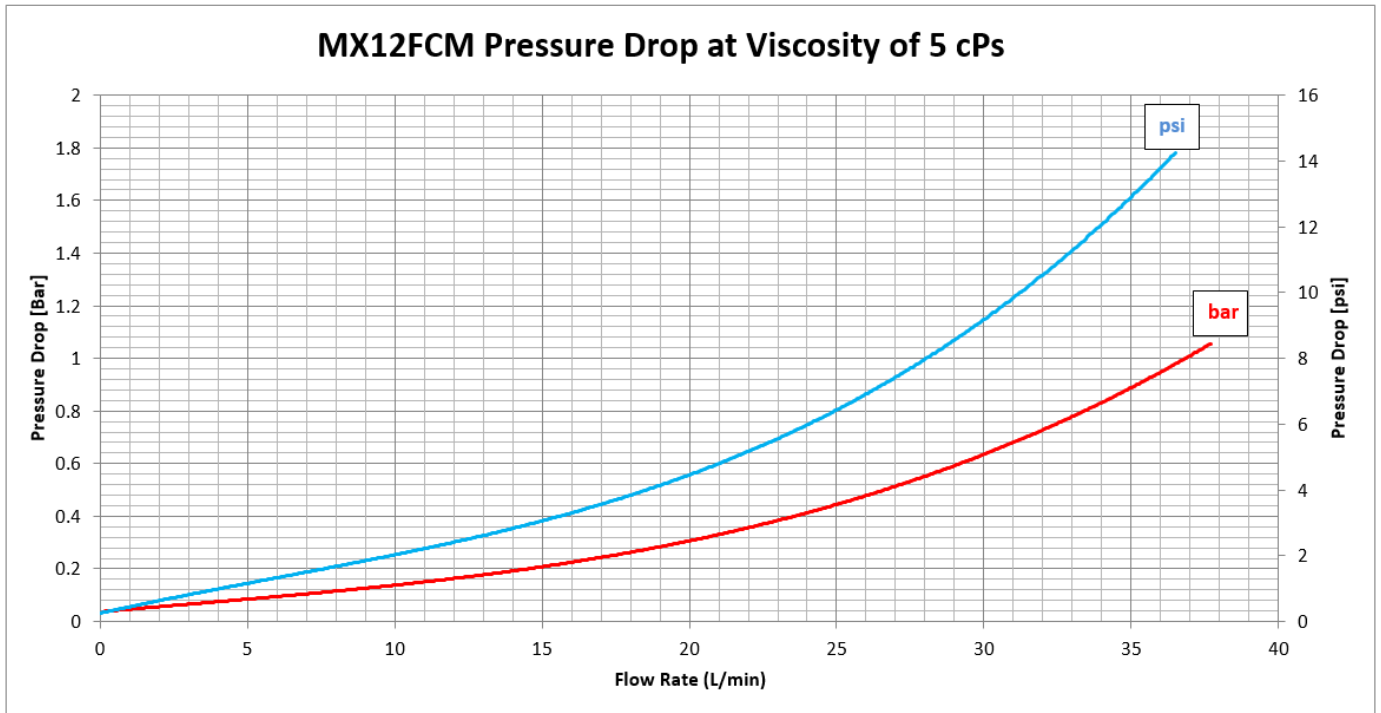
- **Rotor Kit**
  - Rotor assembly (includes Active and Neutral rotors, Meter Cap bolts and O-Ring)
- **Seal Kit**
  - Meter cap O-Ring
- **Pulser Kit**
  - Pulser cap

Service kits for MX12FCM		
DESCRIPTION	PART NUMBER	ITEM No. (Refer to page 8)
ROTOR KIT	MXS-12FCM-ROTOR	Item No. 1, 5, 6 and 7
SEAL KIT	MXS-12FCM-SEAL	Item No. 7
PULSER KIT	MXD-FCM	Item No. 3
CABLE (Length: 5 metres)	MXD-FCM-C6S	N/A

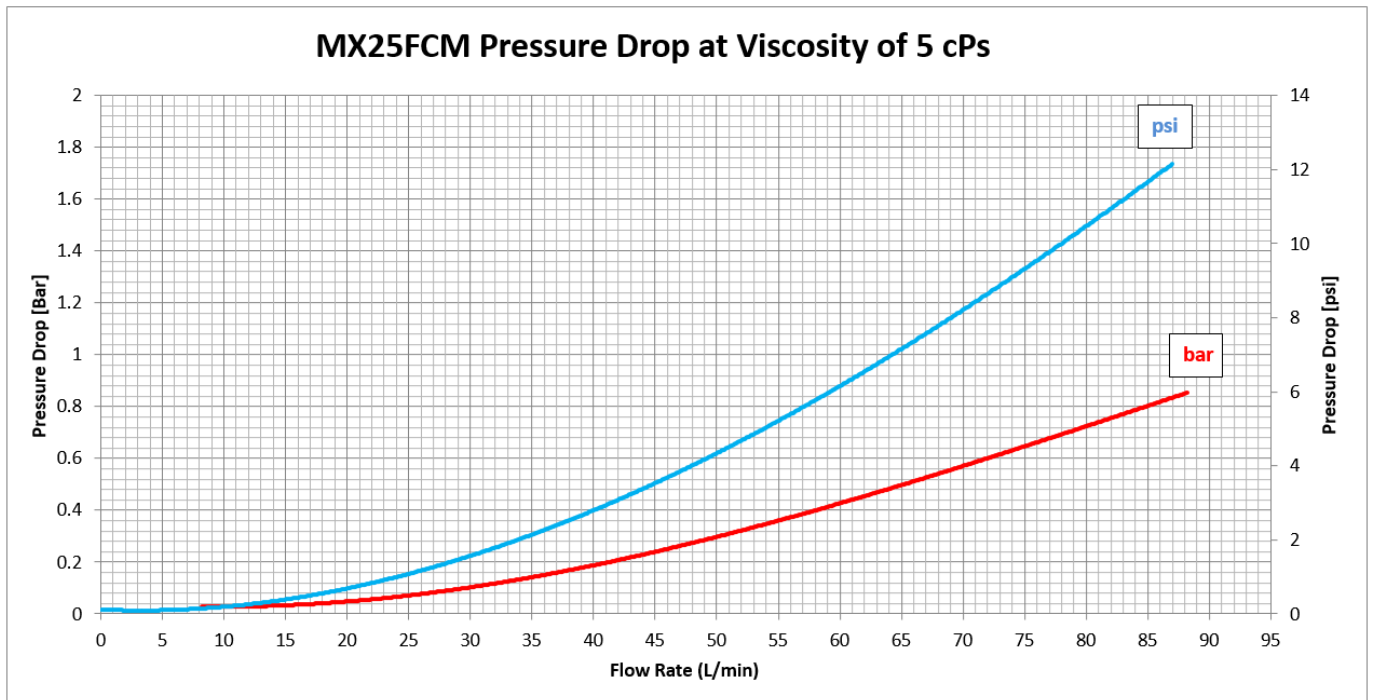
Service kits for MX25FCM		
DESCRIPTION	PART NUMBER	ITEM No. (Refer to page 8)
ROTOR KIT	MXS-25FCM-ROTOR	Item No. 1, 5, 6 and 7
SEAL KIT	MXS-25FCM-SEAL	Item No. 7
PULSER KIT	MXD-FCM	Item No. 3
CABLE (Length: 5 metres)	MXD-FCM-C6S	N/A

# PRESSURE DROP v FLOW RATE

## MX12FCM

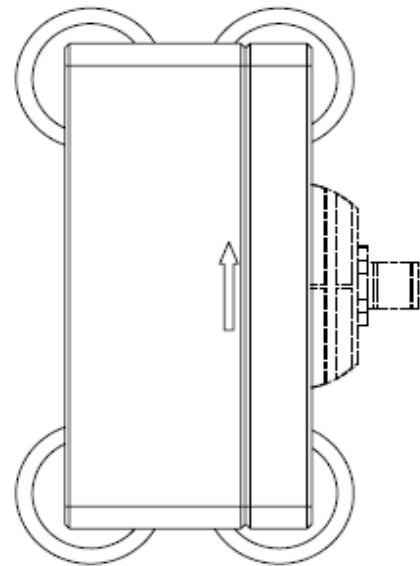
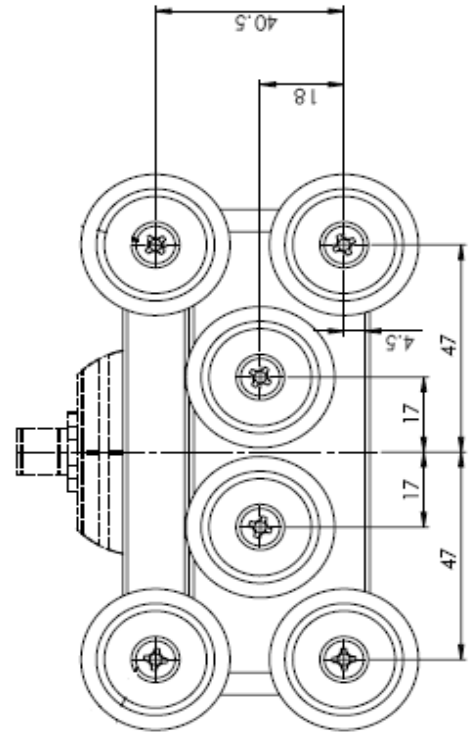
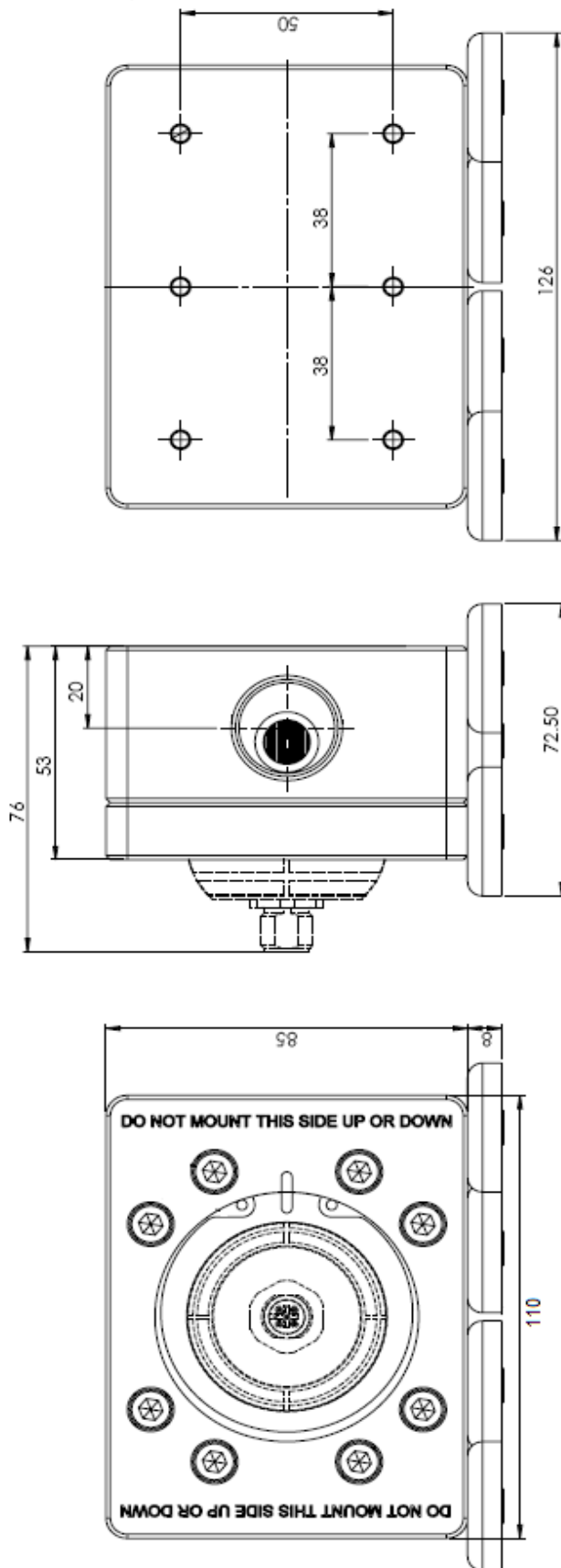


## MX25FCM



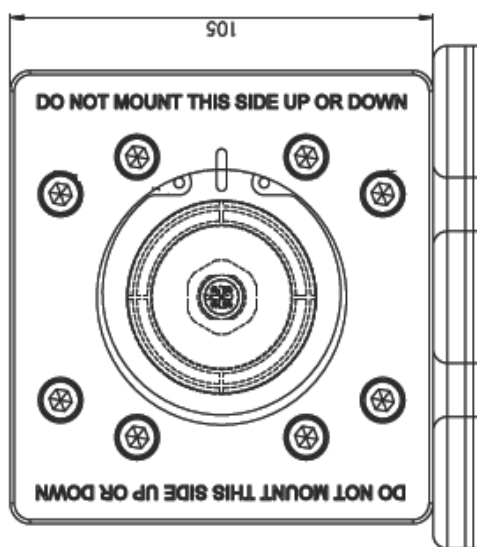
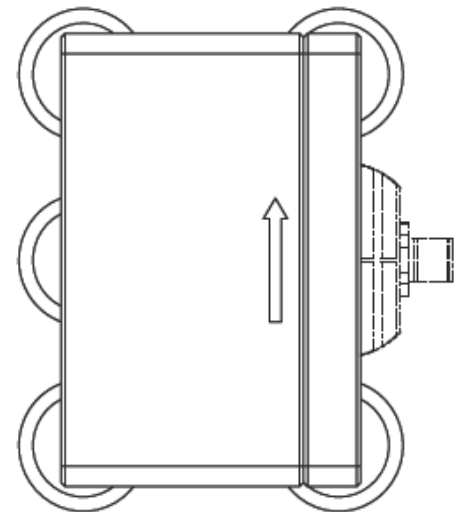
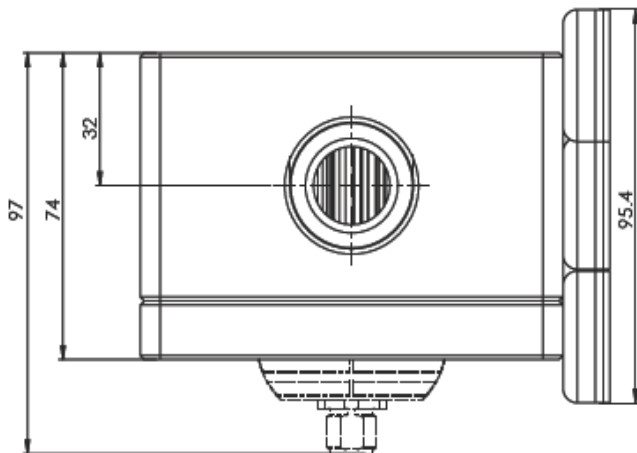
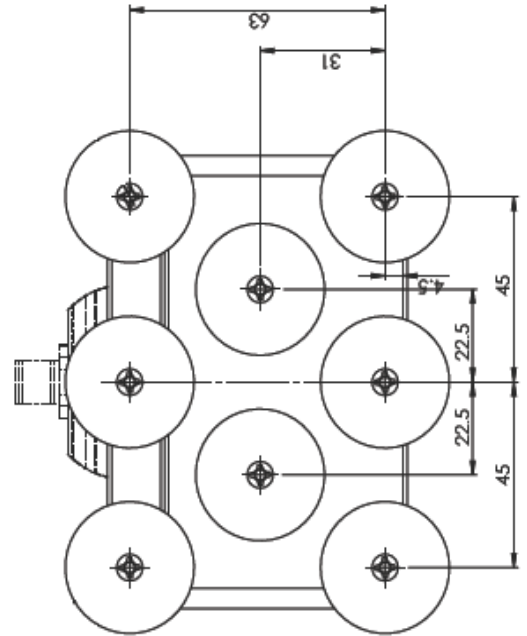
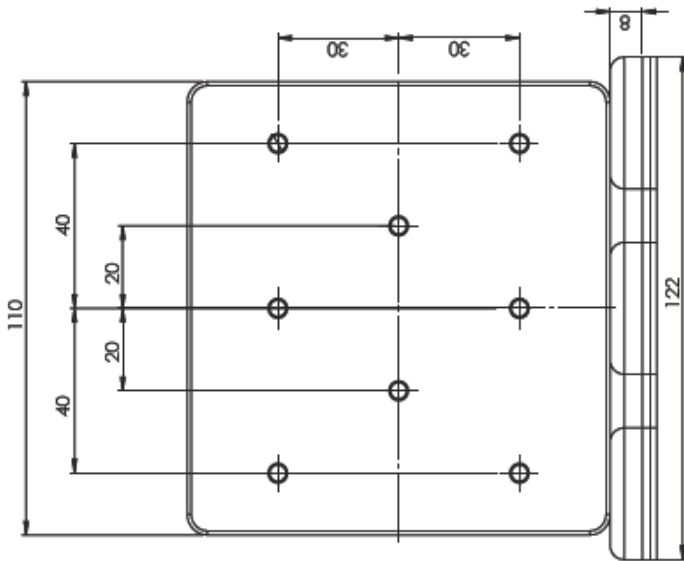
# DIMENSIONS

## MX12FCM



# DIMENSIONS

## MX25FCM



## FCC NOTICE

### **FCC Caution:**

“Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.”

### **FCC Statement:**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.”

## USER NOTES

## 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 wheeled 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.



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**Note:**

This product should be disposed of according to all applicable local and national government environment regulations and guidelines.

