

Data Sheet

MX-SERIES OVAL GEAR FLOW METERS



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macnaught MX-Series Oval Gear Flow Meters



Features and Advantages

- ✓ From ¼" DN8 at 0.5LPH to 4" DN100 at 1200LPM
- ✓ For clean fluids from 1 to 1,000,000cps
- ✓ Ideal for high viscosity & non-Newtonian fluids
- ✓ Temperature range -40c to +150c
- ✓ Pressures to 138bar / 2000psi
- ✓ Minimal pressure drop even at high viscosities
- ✓ Anodised aluminium and 316 stainless steel bodies
- ✓ PPS (Ryton), 316 stainless steel and aluminium rotors
- ✓ FEP (Tefon™) and FKM (Viton™) seals
- ✓ 316 stainless steel shafts
- ✓ BSP, NPT, DIN PN16 and ANSI 150# connections
- ✓ +/-0.5% or +/-0.25% accuracy with 0.03% repeatability
- ✓ Unique M-Lock modular output connection system
- ✓ Change pulse or LCD modules in seconds
- ✓ Pulse output with reed switch and Hall Effect Sensor
- ✓ LCD displays with/without outputs & ATEX options
- ✓ Intrinsically safe models for Zone 1 applications
- ✓ Batching, fuel consumption & compensating displays
- ✓ No flow conditioning required – ideal with pulsating flow
- ✓ Install in any orientation – flow accepted in either direction
- ✓ Simple design, low maintenance, low cost of ownership
- ✓ 2 Year warranty with full spare parts availability

MX-Series Overview

The Most Versatile Oval Gear Flow Meter Ever Built

Combining revolutionary modular design, cutting-edge manufacturing and proven technology Macnaught's MX-Series redefines the standard for oval gear positive displacement flow meters. With multiple output and connection options, a viscosity range of 1 to 1,000,000cps from -40c to +150c at up to 2000psi over a flow range of 0.5LPH to 1200LPM, MX-Series is the most versatile oval gear flow meter ever built.

State-of-the-Art Manufacturing Delivers Improved Performance

To ensure dimensional stability MX-Series meter bodies are individually CNC machined from solid aluminium or stainless steel billet while oval rotors are precision engineered in PPS (Ryton), aluminium or stainless steel to exacting tolerances. To improve corrosion resistance with high water content fluids aluminium bodies are black anodised. The result is a reliable, high performance flow meter with exceptional accuracy, repeatability and durability.

Interchangeable Pulse and Display Modules

The unique M-Lock bayonet mounting system allows pulse and LCD display modules to be connected or removed from the meter body in seconds without having to dismantle the meter or remove it from service. Pulse modules are easily changed or replaced with LCD displays with a simple quarter-turn, a major advantage with a large installed meter base. Reed switch and Hall Effect Sensor are standard outputs with analogue and ATEX options. A comprehensive range of rate, total and batching LCD displays with output and ATEX options are available for both M-Lock and remote mounting.

Simple Construction means Minimal Maintenance

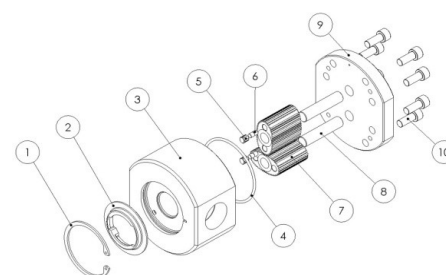
With moving parts limited to a pair of robust oval gear rotors maintenance on MX-Series meters is minimal keeping the cost of ownership low. If no signal is received the existing output module can be quickly replaced or an LCD attached for rapid fault-finding. If the meter requires maintenance it can be quickly and easily disassembled, serviced and reassembled on site without the need for special tools or skills. Spare parts are readily available for all MX-Series models.

Certified Quality Backed by a 2 Year Warranty

MX-Series meters are designed and manufactured exclusively by Macnaught in Australia under stringent ISO 9001 quality conditions. Meters are individually calibrated under ISO 17025 laboratory protocols before dispatch to determine their K-factor and to confirm that they meet the accuracy requirement of better than +/-0.5%. MX-Series meters have a 2 year factory warranty.

Wide Application Range – Ideal for Viscous Fluids

Oval gear meters are found wherever accurate and repeatable measurement of clean fluids is required. Common applications include fuels & fuel consumption, oils, solvents, inks, chemicals, petrochemicals, paints & coatings, additives, glues, syrups, hydraulics, silicones and foodstuffs. MX-Series meters are ideally suited to high viscosity applications, are immune to viscosity changes and require no flow conditioning allowing them to be installed where other technologies would fail.



Technical Specification

Manufacturer and Country of Origin

Macnaught Pty Ltd. Australia.

Series and Application

MX-Series with M-Lock modular output connection system.
For use with compatible clean fluids at up to 1,000,000cps.

Measurement Principle

Volumetric, oval gear positive displacement.

Models Available (Size, Flow Range >5cps <5cps)

06; 1/4" DN8, 0.5~100LPH >5cps/2~100LPH <5cps.
09; 1/4" DN8, 15~500LPH >5cps/25~500LPH <5cps.
12; 1/2" DN15, 2~30LPM >5cps/3~25LPM <5cps.
19; 3/4" DN20, 3~80LPM >5cps/8~70LPM <5cps.
25; 1" DN25, 6~120LPM >5cps/10~100LPM <5cps.
40; 1 1/2" DN40, 10~250LPM >5cps/15~235LPM <5cps.
50; 2" DN50, 15~500LPM >5cps/15~500LPM <5cps.
75; 3" DN80, 20~733LPM >5cps/60~600LPM <5cps.
100: 4" DN100, 120~1200LPM >5cps/220~1000LPM <5cps.
(At >1000cps maximum flow rate is reduced).

Materials of Construction by Category

P; Industrial; 316 St steel body, PPS (Ryton) rotors to 50P (316 St steel on 75P, option 06~50), FEP (Teflon) seal.
F; Fuels & Oils; AA610 Aluminium body, PPS (Ryton) rotors 06~50, AA610 aluminium rotors 75~100, FKM (Viton) seal.
S; Solvents; AA610 Aluminium body, 316 St steel rotors 06~25, AA610 aluminium rotors 40~100, FEP (Teflon) seal.
Ex; Intrinsically Safe; see P or S for materials.
Shafts; 316 St steel (all models).
Body finish; Aluminium; black anodised. St steel; natural.
Rotor bushes; PPS; none. Aluminium & St steel; carbon.
Magnets; samarium cobalt (SmCo) with 316 St steel fixing.

Accuracy, Calibration & Pressure Test

Accuracy; (+/-)0.5% full scale, (+/-)0.25% with 3 point calibration & reduced flow range.
Repeatability; 0.03%.
Calibration; single point (mid range), 3 point option.
Pressure test; optional (PED applies).

Process Connections

All models; BSP (Rp) or NPT female.
Models 25~100; ANSI 150# RF flanged, JIS 10k flanged or DIN PN16 flanged.

Rotor Options

Standard; <1000cps, PPS (Ryton) <80c F & P models, aluminium & st steel <120c S & P models.
High Viscosity; >1000cps, aluminium & st steel <120c.
High Temperature; >1000cps, st steel <150c.

Temperature Range

F Models; -20c ~+80c (dependent on output type).
S Models; -40c ~+120c (dependent on output type).
P Models; -40c ~+150c (dependent on output type).
EX Models; -40c ~+85c (dependent on output type).

ATEX Ratings

EX Models (body only); II 2 k Tx approved for Zone 1

Output Options (Meter Mounted using M-Lock)

A; Standard Pulse; 1 x reed switch & 1 x Hall Effect Sensor, <120c, IP67, 1m x 5 core fly lead (reed switch Yellow = +VE Green = -VE, Hall Effect Sensor Red = +VE White = Signal Black = -VE).

Reed Switch (mechanical); max current 500mA, max voltage 30vDC, max contact rating 10w, normally open, 1k8Ω resistor fitted, typ >10m operations @ 3vDC.
Hall Effect Sensor (solid state); max supply 7.5mA, max output 25mA, operating voltage 4.5~20vDC, open collector NPN, 1k8Ω resistor fitted (bypassable).

Approx K-factors; 06 = 1000PPL, 09 = 400PPL, 12 = 112PPL, 19 = 52PPL, 25 = 36PPL, 40 = 14.5PPL, 50 = 6.68PPL, 75 = 2.58PPL, 100 = 2.3PPL (pulses per litre).

B; NPN Open Collector; Ex ia IIC/T6 Class1 Zone 0, ATEX, CSA, FM, 5~30vDC, max 15mA, -40~+85c, st steel, IP67.

T; High Temperature; 4.5~30vDC, max 18mA, <150c.

D; PR LCD; flow rate & totals (1 reset), 7x12mm & 7x7mm digits, 3.6v Lithium battery, polypropylene housing, EEPROM memory, <60c, IP67.

E; PRA LCD; as D (PR) plus scalable pulse, (passive) analogue and alarm outputs.

F; ER LCD; flow rate and totals (1 reset), 7x17mm & 7x8mm digits, 3.6v Lithium battery, 16-30vDC external, EEPROM memory, aluminium housing, <80c, IP67.

G; ERA LCD; as F (ER) plus scalable pulse and (passive) analogue outputs.

H; ERB LCD; single stage batch controller, total & accumulated total, 16-30vDC (options), EEPROM memory, passive transistor output max 300mA@50vDC, aluminium housing, <80c, IP67.

N; NAMUR Sensor; II 1 G Ex Zone 0, II 1 D Ex Zone 20 ATEX, IECEx, 8~15vDC, max 5mA, -40~+85c, CuZn, IP67.

(Other options inc remote & ATEX rated LCD's available).

Pressure Drop

Typical 3psi with 10cps fluid at 50% of flow range.
Typical 1bar with 1000cps fluid at 100% of flow range.
See Pressure Drop graphs for full data (page 3).

Recommended Strainer Size

06 & 09 models; 74 micron/200 mesh.
12, 19, 25, 40 & 50 models; 250 micron/60 mesh.
75 & 100 models; 400 micron/40 mesh.

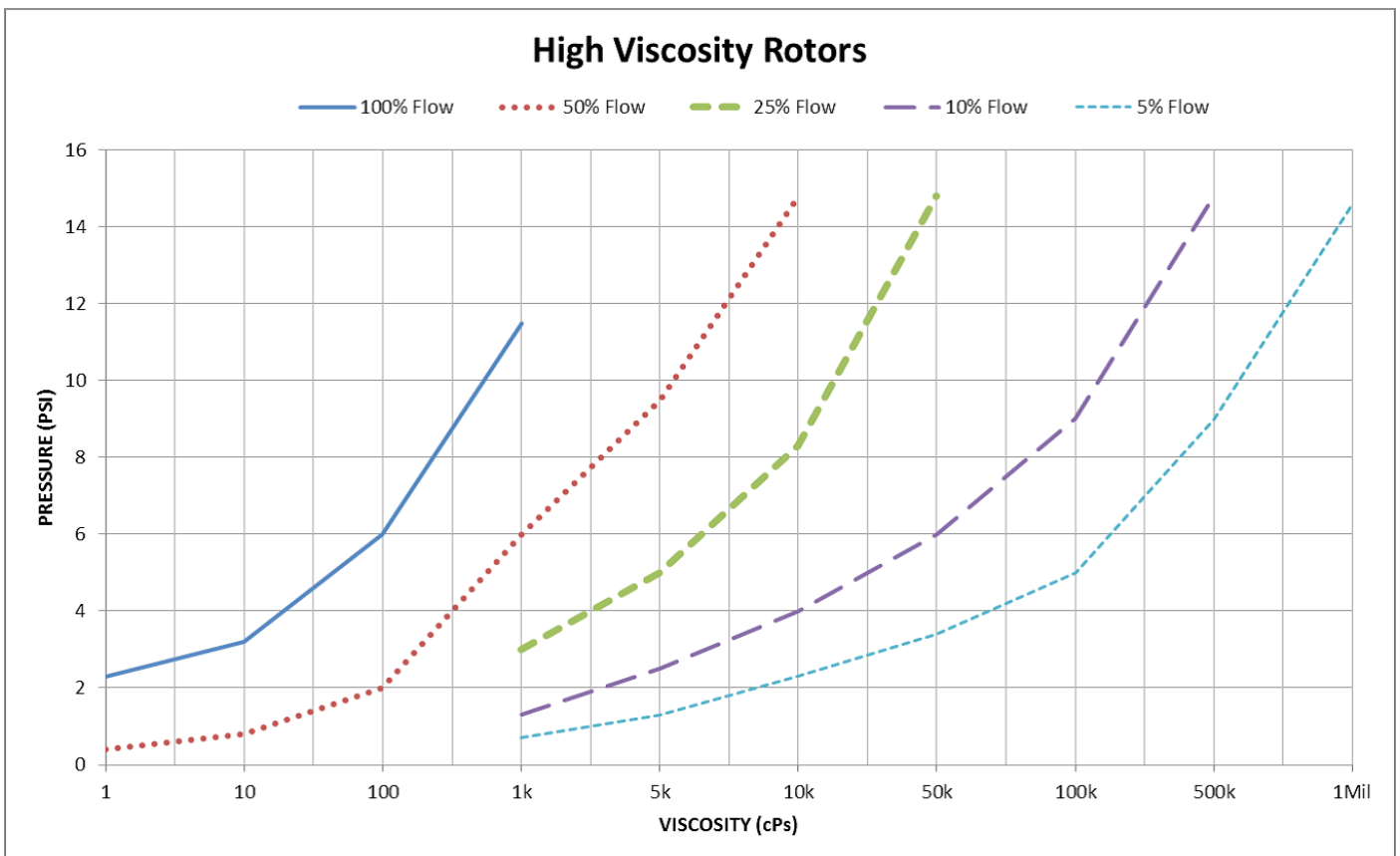
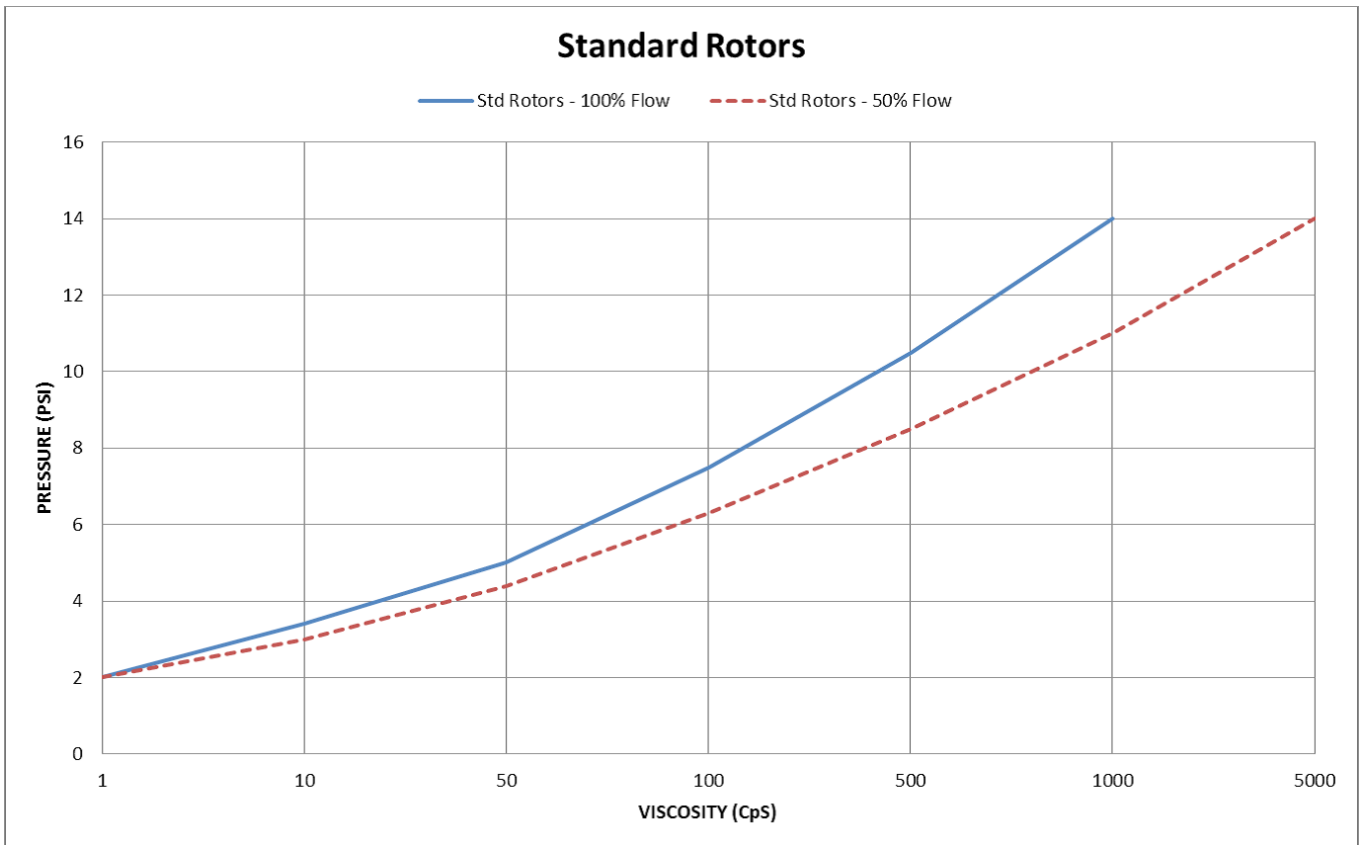
Installation

Any orientation; maintain rotor shafts in horizontal plane.
Meters accept flow in either direction.
Bypass recommended to allow servicing/removal.

Certifications

2006/42/EC Machinery Directive
97/23/EC Pressure Equipment Directive
2004/108/EC Electromagnetic Compatibility Directive
Dispose of in accordance with the 2002/96/EC WEEE Directive and the 2006/66/EC Batteries and Accumulators Directive.

MX-Series Pressure Drop Data



MX-Series Meter Model Guide

Series	Model No.	Size	Flow Range		Max Working Pressure	Average K-factor (PPL)	Accuracy & Repeatability		Available in (Category)			
			>5cps*	<5cps					P	F	S	Ex (P/S)
MX	06	1/4" DN8	0.5~100LPH	2~100LPH	69bar	1000	(+/-) 0.5% full range. (+/-) 0.25% reduced range.	0.03%	✓	✓	✓	✓
	09	1/4" DN8	15~500LPH	25~500LPH	69bar	400			✓	✓	✓	✓
	12	1/2" DN15	2~30LPM	3~25LPM	138bar	112			✓	✓	✓	✓
	19	3/4" DN20	3~80LPM	8~70LPM	138bar	52			✓	✓	✓	✓
	25	1" DN25	6~120LPM	10~100LPM	138bar	36			✓	✓	✓	✓
	40	1 1/2" DN40	10~250LPM	15~235LPM	83bar	14.5			✓	✓	✓	✓
	50	2" DN50	15~500LPM	15~500LPM	69bar	6.68			✓	✓	✓	✓
	75	3" DN80	20~733LPM	60~600LPM	12bar	2.58			✓	✓	✓	✓
	100	4" DN100	120~1200LPM	220~1000LPM	12bar	2.3			x	✓	✓	✓

* >1000 to <1,000,000cps the maximum flow rate is progressively reduced to maintain low pressure drop. High viscosity rotors must be used.

Industry Category (Series)	Body	Rotors	Seal	Shafts		
F	Fuels & Oils	Aluminium	PPS (Ryton)	Aluminium 75F~100F	FKM (Viton)	St Steel
P	Industrial	St Steel	PPS (Ryton) to 50P	St Steel on 75P option 06P~50P	FEP (Teflon)	St Steel
S	Solvents	Aluminium	St Steel	Aluminium 40S~100S	FEP (Teflon)	St Steel
Ex (P)	IS (Ex ia)	St Steel	St Steel		FEP (Teflon)	St Steel
Ex (S)	IS (Ex ia)	Aluminium	St Steel	Aluminium 40S~100S	FEP (Teflon)	St Steel

Process Connection		
1	BSP (Rp)	Models 06~100, all categories
2	NPT	
3	ANSI #150	
4	JIS 10K	Models 25~100, all categories
5	DIN PN16	

Rotor Type	
S	Standard; <1000cps, <80c F & P models, <120c S models
V	High Viscosity; >1000cps, P & S models only
T	High Temperature; <150c, P models only

Output Type (M-Lock Meter Mounted)	
A	Standard pulse; 1 x reed & 1 x Hall Effect Sensor
B	Intrinsically safe NPN pickup (Ex models only)
T	High Temperature; <150c (P models only)
D	PR; 12mm LCD, rate & totals
E	PRA; 12mm LCD, rate & totals, outputs
F	ER; 17mm LCD, rate & totals, ATEX option
G	ERA; 17mm LCD, rate & totals, outputs, ATEX option
H	ERB; 17mm LCD, batch controller, ATEX option
N	Intrinsically safe NAMUR pickup (Ex models only)

MX 25 P ~ 1 S A Example finished model number



Output A; Standard pulse (M-Lock connection)



Output D & E; PR & PRA 12mm LCD Displays (M-Lock connection)



Output F, G & H; ER, ERA & ERB 17mm LCD Displays (M-Lock connection)



Output B/N; Ex ia (Output T; High Temperature similar)

Available Options

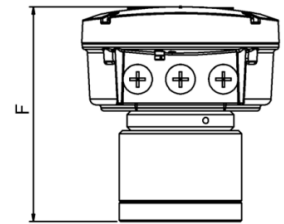
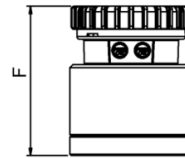
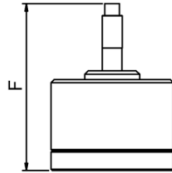
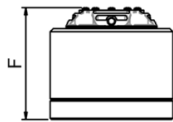
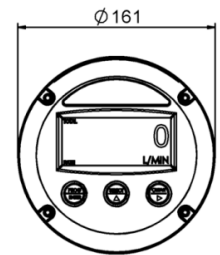
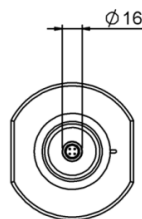
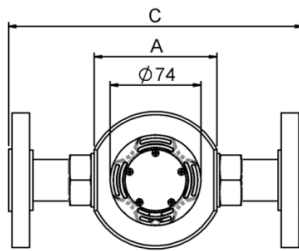
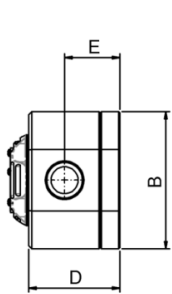
- 3 Point calibration test certificate (available at the time of ordering only)
- Single point pressure test (available at the time of ordering only)
- Remote mount LCD displays/batchers/ fuel consumption with/without outputs, ATEX options (requires standard pulse output on meter)
- Mesh Y strainers to suit all models, strainer/air eliminator combos DN25 to DN100
- Wall mounting brackets for 06, 09 and 12 models
- Standard pulsers can be replaced with any PR series or ER series LCD displays using the M-Lock connection system

MX-Series Dimensions - Models 06 to 50

TYPE A

TYPE T B N

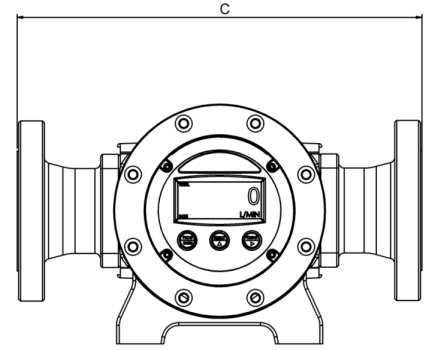
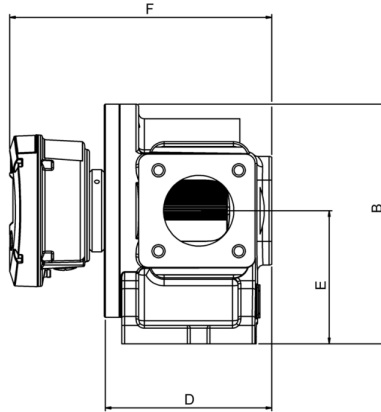
TYPE D E

TYPE F G H

PULSER - STANDARD
PULSER - Ex & HT
DISPLAY - PR
DISPLAY - ER


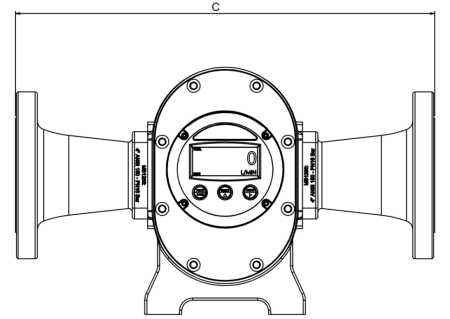
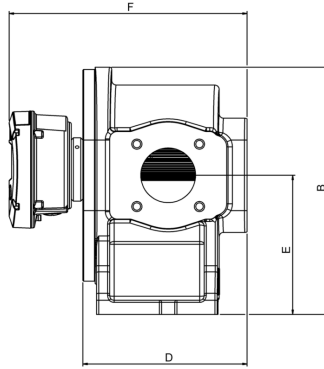
Model	Meter and Flange Dimensions (mm)					Pulser and Digital Display Heights (mm) (dimension F)				
	A	B	C	D	E	TYPE A	TYPE T	TYPE D, E	TYPE B, N	TYPE F, G, H
MX06	71	74	-	42	25	59	104	90	93	143
MX09	71	74	-	42	25	59	104	90	93	143
MX12	81	87	-	49	28	66	111	97	100	150
MX19	100	112	-	62	37	79	124	110	113	163
MX25	100	112	240	75	45	92	137	123	126	176
MX40	120	137	240	103	61	120	165	151	154	204
MX50	140	163	264	124	72	141	186	172	175	225

MX-Series Dimensions - Models 75 to 100

MX75



MX100

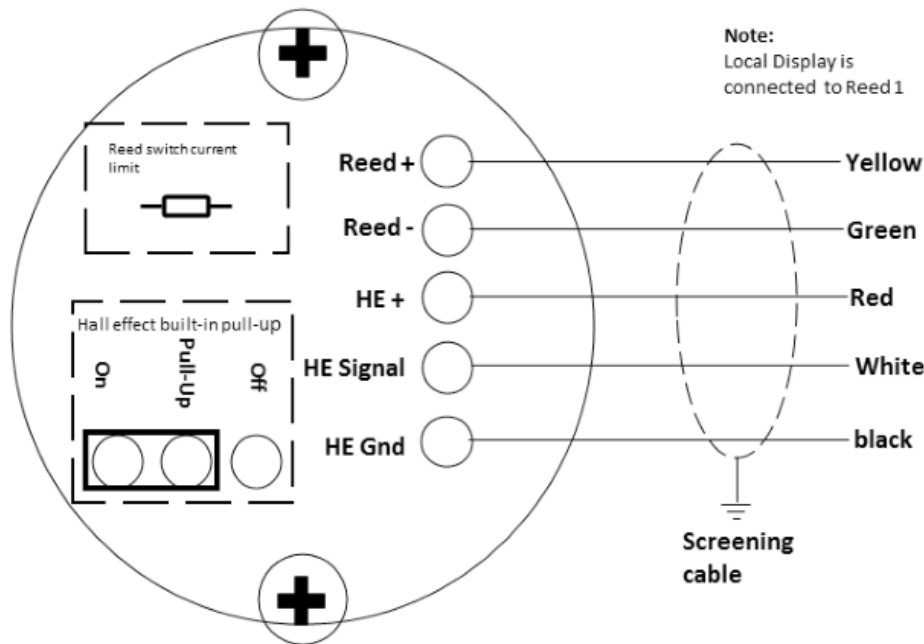


Model	Meter and Flange Dimensions (mm)						Pulsar and Digital Display Heights (mm) (dimension F)				
	FLANGE TYPE	PORT SIZE	B	C	D	E	TYPE A	TYPE T	TYPE D, E	TYPE B, N	TYPE F, G, H
MX075 Aluminium	ANSI	3"	254	435	179	141	196	241	227	230	280
	DIN			435							
	JIS			435							
	Rp			301							
	NPT			301							
MX075 Stainless Steel	ANSI	3"	254	344	179	141	196	241	227	230	280
	DIN			340							
	JIS			340							
	Rp			256							
	NPT			256							
MX100 Aluminium	ANSI	4"	340	583	225	191	242	287	273	276	326
	DIN			583							
	JIS			583							
	Rp	3"	302								
	NPT	3"	302								

Wiring Diagram – PCB for Output Types A, D, E, F, G, H


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 changeable 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 is by-passed first.



Output Signals	Specification		
Reed Switch (Mechanical Sensor)	Current	Maximum	500mA
	Voltage	Maximum	30v DC
	Contact Rating	Maximum (1)	10W
Hall Effect IC (Electronic Sensor)	Maximum Supply Current		7.5mA
	Maximum Output Current		25mA
	Operating Voltage		4.5v to 24v DC
	Transistor Type		Open Collector NPN




Bell Flow Systems Ltd
 7 & 15 Swan Business Centre
 Osier Way, Buckingham
 Buckinghamshire
 MK18 1TB

 +44 (0) 1280 817304
 +44 (0) 1280 817185
 sales@bellflowsystems.co.uk
 www.bellflowsystems.co.uk