



Industrial Oval Gear Flowmeters  
with pulse output or electronic display

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## Operation Manual



## General Information

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This manual provides the necessary information for installation of your Oval Gear flowmeter; for information on any integral electronics or accessories fitted to your flowmeter please consult the relevant electronics or accessory manual. Your Oval Gear flowmeter should only be installed by persons familiar with local regulations, particularly those for workplace Health and Safety, or Hazardous Area regulations where relevant.

For best results, please make yourself familiar with the contents of all relevant product manuals prior to installation and commissioning. If further assistance is required please consult the distributor from whom you purchased your flowmeter.



### **CAUTION**

*Your flow-meter and any associated electronics are precision instruments, to avoid unnecessary damage please treat them with care.*

### **DISPOSAL WITHIN THE EUROPEAN UNION - WEEE**



- The WEEE Directive requires that this product be recycled when disposed of within the European Union
- The crossed out wheeled bin symbol shown in this manual signifies that this product should not be disposed of in general waste or landfill.
- Please contact the local dealer or national distributor from whom this product was purchased for information on recycling electronic equipment within your region.

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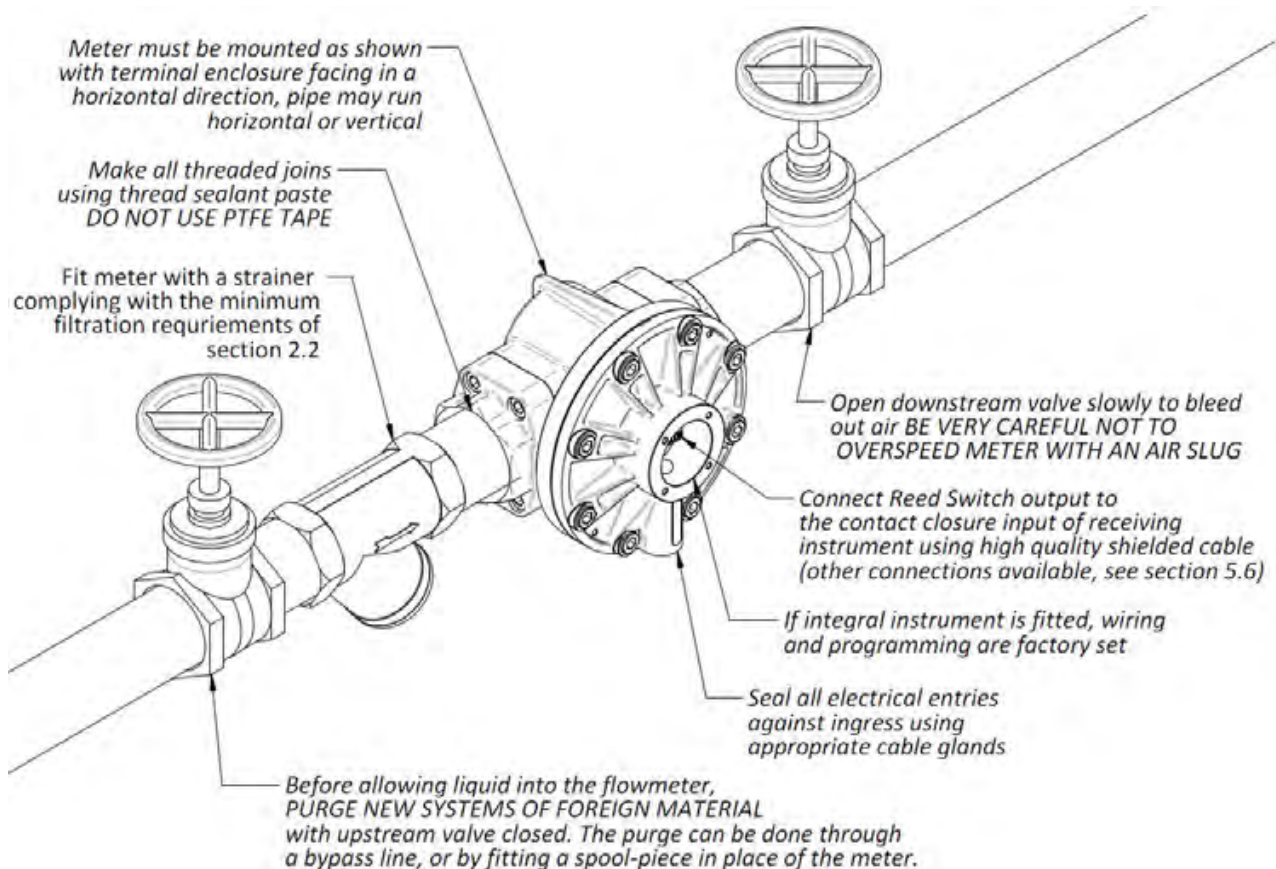
## Quick Start Guide

The 'quick start' instructions shown below are intended for users who are experienced in the use of flowmeters and who want to quickly set up their new meter with limited functionality, and start using their product right away. The 'quick start' instructions will allow the user to set up their meter without the risk of damage, allowing the use of the product while the complete instructions are read in detail at a later date.

### CAUTION

***Users installing product in Hazardous Areas must read this entire manual before installing their product.***

***Damage caused to meters by users who have only read the 'Quick Start Guide' will not be accepted as a justification for a warranty claim; if you are unsure, read the whole manual before installing your meter.***



# 1. Introduction

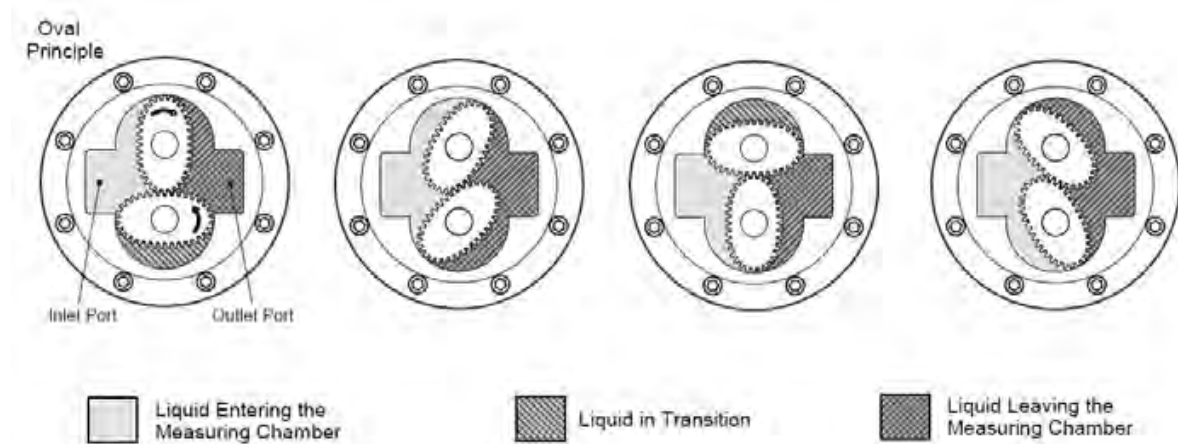
The Oval gear meter is a precise positive displacement flowmeter incorporating a pair of oval geared rotors. These meters are capable of measuring the flow of a broad range of clean liquids.

Stainless Steel flowmeters are suited to most liquid products and chemicals; including many water based liquids, acids, bases and salt solutions, and Aluminium meters are suitable for fuels, oils & most non-aggressive lubricating liquids.

Oval Gear flowmeters are available as blind meters with a pulse signal output capable of interfacing to most monitoring and control instrumentation, or the meter can be fitted with instruments such as totalisers, rate totalisers or batch controllers. These instruments also have monitoring and control output options including 4-20mA, scaled pulse, flow-rate alarms and batch control logic (*preset metering*).

## 1.1 Operating Principle

Oval Gear flowmeters are positive displacement devices where the passage of liquid causes two oval geared rotors to rotate within a precision measuring chamber. Each rotation of the Oval rotors will transmit 4 identical volumes of liquid from the meter inlet to outlet (*as shown in the diagram below*); providing electronic pulses via magnetic sensors to a digital instrument.



## 1.2 Specifications

### 1.2.1 Small Capacity Models

Model Prefix	004	006	008
Nominal Size	1/8" (4mm)	1/4" (6mm)	3/8" (8mm) <sup>1</sup>
Flow range <sup>2</sup> (USG/hr)	0.26 ~ 9.5	0.5 ~ 27	4 ~ 145
Flow range <sup>2</sup> (L/hr)	1.0 ~ 36	2 ~ 100	15 ~ 550
Accuracy (liquids ≥ 3cP)	± 1% of reading (± 0.2% with optional RT14) <sup>3</sup>		
Repeatability (liquids ≥ 3cP)	Typically ± 0.03%		
Temperature Range	-4°F ~ +250°F (-20°C ~ +120°C) <sup>4</sup>		
Pressure Ratings – PSI (Bar) – threaded meters only <sup>5</sup>			
Aluminium	220 (15)		
Stainless Steel	495 (34)		
Intermediate Pressure SS	1450 (100)		
High Pressure Models	5800 (400)		
Nominal Output Pulse Resolution – Pulses/USG (Pulses/Litre)			
Hall Effect	21200 (5600)	7950 (2100)	2690 (710)
Reed Switch	10600 (2800)	7950 (2100)	1345 (355)
High-Resolution Hall Option	42400 (11200)	15900 (4200)	-
Minimum Filtration	200 mesh (75 micron) <sup>6</sup>		

### 1.2.2 Medium Capacity Models

Model Prefix	015	025	040	050
Nominal Size	1/2" (15mm)	1" (25mm)	1.5" (40mm)	2" (50mm)
Flow range <sup>2</sup> (USG/min)	0.26 ~ 10.6	2.6 ~ 40	4 ~ 66	8 ~ 120
Flow range <sup>2</sup> (L/min)	1 ~ 40	10 ~ 150	15 ~ 250	30 ~ 450
Accuracy (liquids ≥ 3cP)	± 0.5% of reading (± 0.2% with optional RT14) <sup>3</sup>			
Repeatability (liquids ≥ 3cP)	Typically ± 0.03%			
Temperature Range	-4°F ~ +250°F (-20°C ~ +120°C) <sup>4</sup>			
Pressure Ratings – PSI (Bar) – threaded meters only <sup>5</sup>				
Aluminium	990 (68)	990 (68)	435 (30)	285 (20)
Intermediate Pressure Aluminium	-	2000 (138)	-	-
Stainless Steel	990 (68)	990 (68)	435 (30)	550 (38)
PPS (Ryton®)	-	Note 7	-	-
Intermediate Pressure Stainless Steel	1450 (100)	1450 (100)	725 (50)	725 (50)
High Pressure Stainless Steel	5800 (400)	5800 (400)	5800 (400)	4350 (300)
Nominal Output Pulse Resolution – Pulses/USG (Pulses/Litre)				
Hall Effect	636 (168)	405 (107)	212 (56)	99 (26)
Reed Switch	318 (84)	102 (27)	53 (14)	25 (6.5)
Quadrature Hall Option	636 (168)	204 (54)	106 (28)	49 (13)
Minimum Filtration	100 mesh (150 micron) <sup>6</sup>			

### 1.2.3 Large Capacity Models

Model Prefix	080	080E	100	100E
Nominal Size	3" (80mm)	3" (80mm)	4" (100mm)	4" (100mm)
Flow range <sup>2</sup> (USG/min)	10 ~ 200	13 ~ 260	20 ~ 400	40 ~ 660
Flow range <sup>2</sup> (L/min)	35 ~ 750	50 ~ 1000	75 ~ 1500	150 ~ 2500
Accuracy (liquids ≥ 3cP)	± 0.5% of reading (± 0.2% with optional RT14) <sup>3</sup>			
Repeatability (liquids ≥ 3cP)	Typically ± 0.03%			
Temperature Range	-4°F ~ +250°F (-20°C ~ +120°C) <sup>4</sup>			
Pressure Ratings – PSI (Bar) – threaded meters only <sup>5</sup>				
Aluminium	175 (12)	175 (12)	145 (10)	145 (10)
Stainless Steel	175 (12)	-	-	-
Nominal Output Pulse Resolution – Pulses/USG (Pulses/Litre)				
Hall Effect	40 (10.65)	22.7 (6.0)	16.6 (4.4)	8.5 (2.24)
Reed Switch	10 (2.65)	5.7 (1.5)	4.15 (1.1)	2.1 (0.56)
Quadrature Hall Option	20 (5.33)	11.4 (3.0)	8.3 (2.2)	4.24 (1.12)
Minimum Filtration	40 mesh (350 micron) <sup>6</sup>			

1. OM008H meter have a nominal port size of ¼" (6mm)
2. Maximum flow rate must be reduced with increased viscosity, maintain maximum pressure drop across the meter at below 14.5psi (1 Bar)
3. 0.2% accuracy achievable using RT14 with non-linearity correction and multi-point calibration.
4. Temperature range stated for standard pulse output meters; higher and lower temperature rating options are available. Meters fitted with integral instruments will have a reduced maximum temperature. OM008 meters fitted with PPS rotors are limited to +176°F (+80°C).
5. Flanged meter pressure rating is in accordance with applicable flange standard, or with threaded meter rating, whichever is lower.
6. Filtration requirements are for soft particles only; hard particles of any size are not acceptable.
7. Prior to June 2023 for the NPT model, and October 2023 for the BSP model rating is 5bar/73psi. After these dates the rating increased to 12bar / 174psi. If in doubt please read the ratings label on your meter.

### 1.2.4 Electrical Specifications

Standard Pulse Output Board		
Hall Effect Output	Output Type	NPN Open Collector
	Voltage Range	5 ~ 24V (dc)
	Current Draw	20mA Maximum
	Switching Current	10mA Maximum
Reed Switch Output	Output Type	Contact Closure
	Voltage	24V (dc) Maximum
	Current	50mA Maximum
	Recommended Maximums for Long Switch Life	5V (dc) @ 10mA
Reed Only Option (Intrinsically Safe Simple Apparatus)		
Reed Switch Output (per switch)	Voltage	24V (dc) Maximum <sup>1</sup>
	Current	16mA Maximum <sup>2</sup>
	Power	0.4W Maximum <sup>3</sup>

1. 30V (dc) maximum peak voltage allowed for non-hazardous (safe area) installations
2. Up to 200mA possible with internal current limit bypassed (not recommended, safe area only)
3. Up to 6W possible with internal current limit bypassed (not recommended, safe area only)

## 2. Installation

All flowmeters are inspected and calibrated prior to shipment, and are sent out in perfect condition. Should damage be present on receipt of the product please inspect the delivery packaging for visible mishandling and contact the parcel service / freight forwarder. Maintain any protective plugs/caps until installation.



### CAUTION

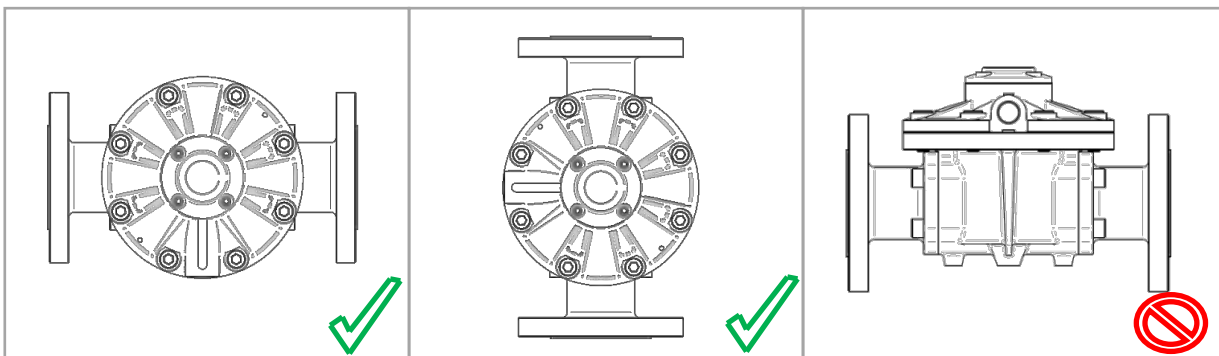
Please note that all flow-meters are calibrated with either **Castrol ISO4113** or **Exxsol D130** immediately prior to shipment, residual oil may be present; please take the appropriate precautions for health and safety. An MSDS is available from the manufacturer or via an internet search.

### 2.1 Mechanical Installation

Before installing your flowmeter, it is recommended that you confirm the meter is suitable for your application conditions such as; fluid compatibility with meter materials, flow rate, pressure, and temperature. Fluid entering the meter must remain a liquid at all times; avoid solidification or gelling of the metered medium. If hydraulic shock or pressure surges of any kind are possible, the system upstream of the meter must be fitted with a surge suppressor or pressure relief valve to protect the meter from damage.

#### 2.1.1 Installation Orientation

The flowmeter **MUST** be mounted with the rotor shafts in a horizontal plane. Failure to mount your Oval Gear flowmeter in the correct orientation (*as shown in the diagrams below*) will cause the weight of the rotors to bear down on the thrust bearings. The short term effects of incorrect mounting orientation will be a loss in accuracy, with long term effects ranging from reduced lifespan to fairly rapid catastrophic damage.



Liquid can flow in a horizontal direction, or a vertical direction, but in each case the rotor shafts must be in a horizontal plane. This is achieved by mounting the meter so that the terminal cover, or integral instrument display, is facing in a horizontal direction. For pulse output flowmeters the direction of flow is not important, as the output is non-directional.



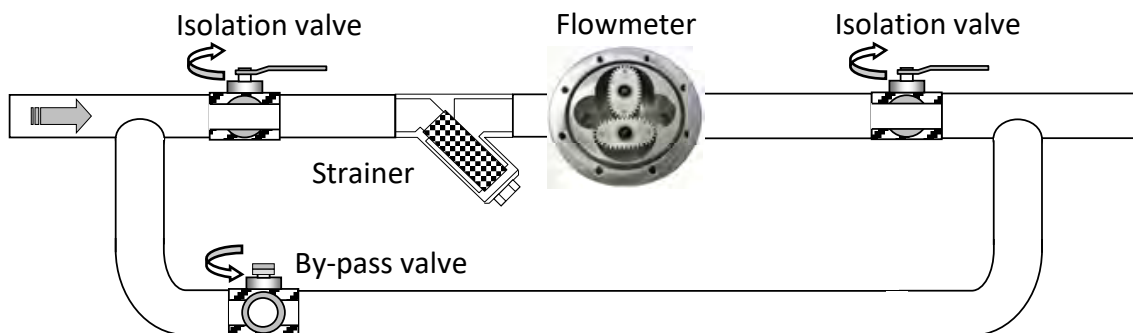
## 2.1.2 Piping Construction

It is preferred to install the flowmeter upstream of a flow control or shut-off valve, as the back pressure provided by the valve will be beneficial to system accuracy; do not operate a flowmeter directly discharging to atmosphere. Piping should be designed so that the flowmeter is full of liquid at all times; this is achieved by designing the inlet and outlet piping for the flowmeter to be lower than all surrounding piping.

For vertical installations the liquid should travel from bottom to top, i.e. it should rise vertically through the flowmeter. This will ensure that the flowmeter remains full of liquid and will stop air entrapment in the meter.

All piping surrounding your flowmeter should be well supported on secure footings, preferably at the point where the piping joins to the flowmeter; unsupported piping will cause severe pipe stress on the flowmeter.

The best piping designs provide a bypass line, as shown in the following diagram, which allows isolation of the flowmeter and strainer from the main process line. The benefits of installing a bypass line are that your system can be purged before start-up, and any maintenance on the flowmeter or strainer can be carried out quickly and economically without interrupting critical processes.



## 2.1.3 Mechanical Support

All flowmeters of nominal size 3" and 4" must have adequate mechanical support. Failure to adequately support the flowmeter and the connected piping may result in structural damage to the flowmeter housing. It is recommended that a solid structural support be provided at the first flange connection, on both sides of the flowmeter. If possible, the housing of the flowmeter can be directly supported, however piping should still be supported as close as possible to the flowmeter. It is never acceptable to support the flowmeter and use the housing of the flowmeter to support the weight of your piping.

### 2.1.4 Filtration / Straining

It is recommended to fit the inlet side of your flowmeter directly to a strainer of appropriate pipe size and mesh size. The minimum mesh size as shown in the specifications section of this manual should be adhered to where ever possible. When metering medium or high viscosity fluids it may be necessary to use a strainer one pipe size larger than the flowmeter nominal size, in order to limit the pressure drop across the strainer basket and maintain strainer efficiency (*i.e. a 1.5" strainer on a 1" meter*).

In systems where there is potential for hard particles of any size, the filtration levels of the system should be improved so as to eliminate the flow of hard particles through the meter. While soft particles may pass through the rotating meter components without damage (if they are small enough) hard particles are abrasive and will always cause rotor and bearing damage regardless of size.

### 2.1.5 Pipe Connections

When installing a flowmeter, it is important that no upstream pipe join between the flowmeter and the strainer are sealed using PTFE sealing tape. Lose pieces of PTFE tape are common causes of failure in new meter installations due to the tendency to wrap around the rotating components inside the meter. It is recommended that the sealing of pipe joins should be done with a sealing paste or liquid (*such as Loctite® 565 thread sealant paste*).

Flanged connections should be made using gaskets and bolting suitable for the metered liquid and the system pressure; flowmeters fitted with stainless steel flanges may be installed using metallic gaskets and high strength bolting if required. For meters fitted with Aluminium flanges it is only suitable to make pipe connections in accordance with the relevant flange standard requirements for cast iron flanges; gaskets according to ASME B16.5 Annex C gasket group 1a are recommended, and only low strength or intermediate strength bolting may be used.

For all flanged pipe connections to flowmeters it is essential that flange faces are well aligned and closely fitting.



#### **CAUTION**

***Flange bolts in Aluminium flanges should never be tightened to torque values greater than 110ft.lb (150Nm)***

### 2.1.6 Plastic Pipe Threads

When installing pipe fittings on a plastic flowmeter it is very easy to over tighten the threads and cause damage to the flowmeter housing. Over-tightened pipe fittings will create high levels of stress on the internal pipe thread of the plastic housing, which can lead to cracking of the housing. Cracked housings are not repairable, and not covered

under warranty. Stress on the internal pipe thread of the flowmeter housing is made worse when excessive amounts of PTFE thread tape are used.

When installing pipe fittings on a plastic flowmeter it is recommended to always use a pipe sealant paste that is compatible with plastic pipe fittings and with the liquid being measured. Install the pipe fittings to finger tight, and then tighten by a further 1 – 2 turns.

## 2.2 Electrical Installation

Two types of output are available from an Oval Gear flowmeter; NPN Hall Effect and Reed Switch (*contact closure*). Some meter configurations will have one of these outputs, some will have both; a flowmeter may be installed using any of the available outputs.

### 2.2.1 Wiring


All wiring of electrical outputs should use high quality instrument cable; twisted pair low capacitance shielded instrument cable (20AWG [0.5mm<sup>2</sup>] minimum) is recommended. Use only high temperature cable where process temperatures exceed 185 °F (85°C). The cable drain or screen should be terminated on a DC common or a specifically assigned shield terminal at the readout instrument end only; in order to protect the signal from mutual inductive interference. ***The cable shield at the meter end of the cable must be isolated with tape or similar, do not connect the cable shield to ground at the meter.***

The cable should not be run in a common conduit, or parallel with, power cables or high inductive load carrying cables; as interference will affect the transmitted pulse signal. Run all instrument cables in their own separate conduit. Where instrument cables must cross high power cables be sure that the cables intersect at 90 degrees in order to limit induced interference.

Do not combine any inductive loads on the same voltage supply as your flowmeter wiring, as these components are commonly sources of high frequency interference that may affect the quality of the output signals. Inductive loads on a common voltage source also have the potential for voltage spikes well in excess of the 24V (dc) limit of the flowmeter electronics.

***The maximum wire cross section that can be connected to the terminals of an Oval Gear pulse meter is 16AWG (1.5mm<sup>2</sup>).***

### 2.2.2 Hall Effect Outputs

The Hall Effect is a solid state 3 wire device which provides an open collector, NPN signal. The output of the Hall Effect must be fitted with a pull-up resistor between the signal output (  ) and the voltage supply. The Hall Effect output provides a square wave pulse signal, which alternates between ground potential and the DC voltage available at the pull-up resistor.

The NPN Hall Effect output is a reliable output type, producing a consistent output irrespective of supply voltage variations, temperature variations, or mechanical shock. The service life of the Hall Effect output is theoretically infinite, so long as it is protected from

high energy voltage spikes. Hall Effect outputs are protected against reverse polarity, and against low energy voltage spikes; however, they are not protected against constant over-voltage above the maximum limit of 24V (dc) ( $\pm 5\%$ ).

Many secondary flow instruments are fitted with an integral pull-up resistor, but if connecting the Hall Effect output to an electronic device that does not contain an integral pull-up resistor, one **MUST** be fitted by the installer. The pull-up resistor is connected between the signal terminal and the +VDC terminal; the recommended pull-up resistor value is 10k $\Omega$ , 2.4k $\Omega$  is the minimum value in a 24V (dc) system.

In low voltage systems using low pull-up resistor values, cases may occur where the voltage level at the terminal will not be low enough to trigger the low-level logic on receiving instruments. The equation below approximates the minimum pull-up resistor value required based on the pull-up voltage level, and the low logic voltage threshold of the instrument.

$$R_{pull-up} = \frac{112 * V_{pull-up}}{V_{low} - 0.05} - 102$$

$R_{pull-up}$  = Minimum value of pull-up resistor

$V_{pull-up}$  = Voltage that signal is being pulled up to

$V_{low}$  = Low logic voltage threshold

**Note:** The hall effect sensor circuitry incorporates 2 x 51 ohm resistors in series with the signal output.

### 2.2.3 Reed Switch Outputs

The reed switch output is a two wire normally-open SPST voltage free contact ideal for installations without power, or for use as a simple apparatus in hazardous area locations.

When using the reed switch output the liquid temperature must not change at a rate greater than 18°F (10°C) per minute, or the switch will be damaged. Reed switch reliability and lifetime are very dependent on the voltage and current used; reducing system voltage and switching current to a minimal value is recommended. Under ordinary conditions the service life of the reed switch will exceed 2 billion actuations when switching less than 5V (dc) and 10mA (*as is the case when used with any of the available Integral Instruments*)

## 2.2.4 Quadrature Pulse Outputs

The Quadrature Pulse (*QP*) output is an optional type of output that provides two independent Hall Effect outputs that are electrically 90 degrees out of phase. When installing a meter with Quadrature Pulse output it is important to remember that each output terminal is independent, and as such each will require its own pull-up resistor as described in Section 2.2.2 above.

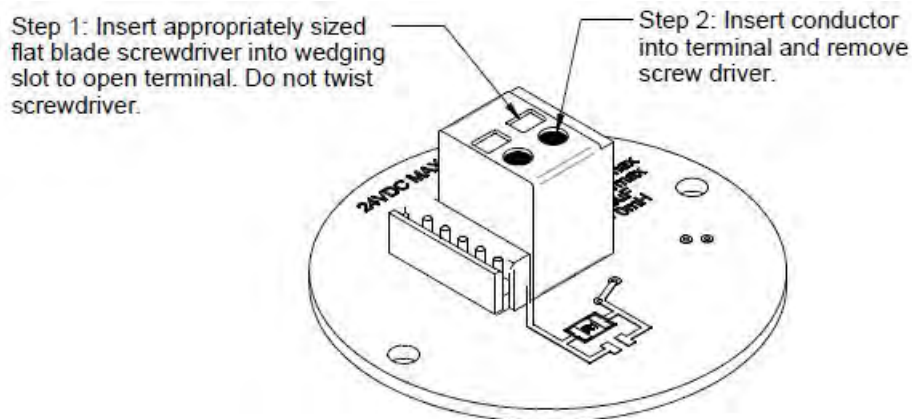
## 2.3 Making Electrical Connections

To gain access to the electrical connections on a meter without an instrument, you must first remove the terminal cover by removing the four cover screws with a **4mm Hex Key (Allen Key)**. When removing the terminal cover, take care not to damage or lose the O-Ring. Standard Pulse Output Boards utilise a pluggable terminal block which can be removed for fitment of wires. Reed Only Pulse Output Boards use Cage Clamp terminal blocks which require insertion of a screw driver into the wedging slot as show below. **All wiring requires a 0.1" (2.5mm) wide Flat Blade Screw Driver (or smaller).**

For meters fitted with an integral instrument refer to the instruments instruction manual that accompanied the meter.

***When refitting a terminal cover for a Flameproof (EXd) flowmeter the terminal cover screws must be tightened to a torque of 2.95ft-lb (4Nm). See section 2.7.3 for more details.***

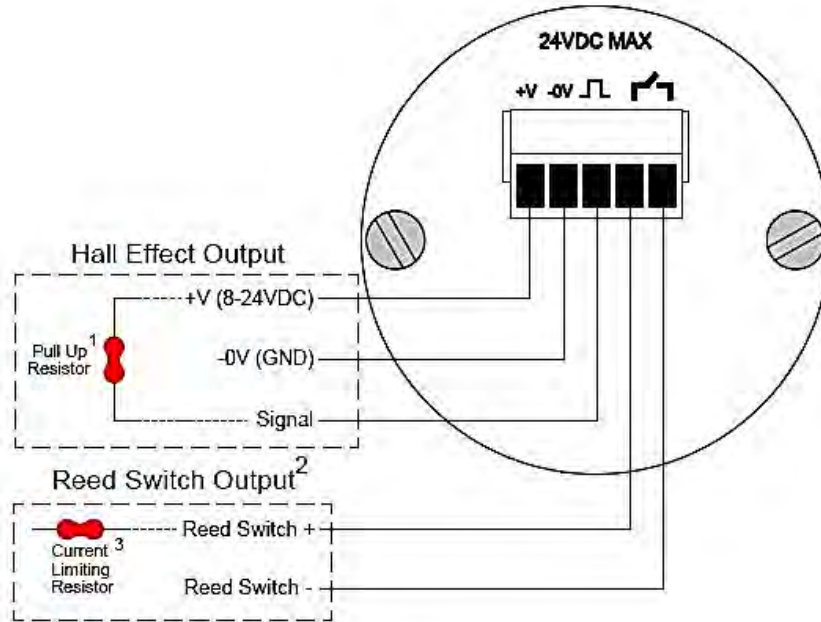
### **Connecting wiring to Reed Only Pulse Output Boards**



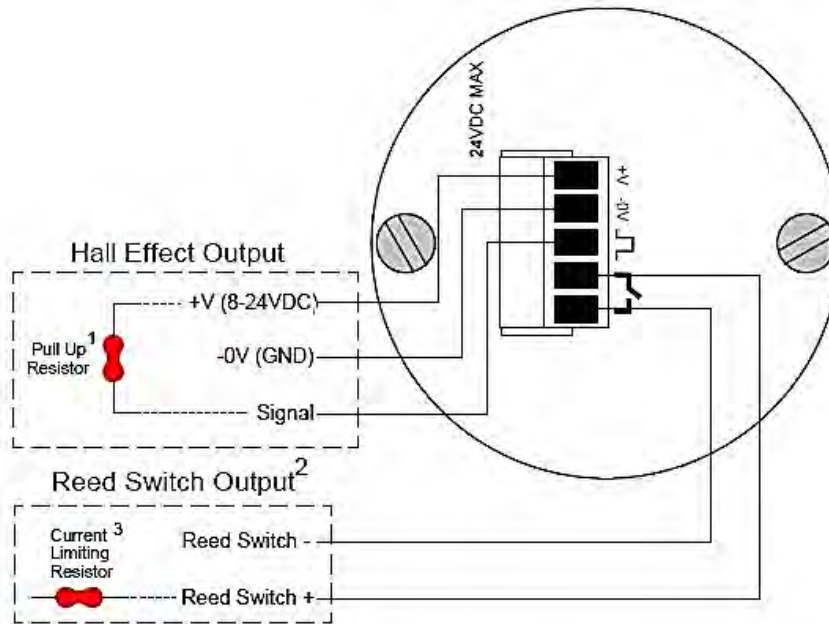
## 2.4 Wiring Diagrams

### 2.4.1 Standard Pulse Output Board

**Applicable Models: 004, 006, 008, 015, 025, 040, 050**



**Applicable Models: 080, 080E, 100, 100E**

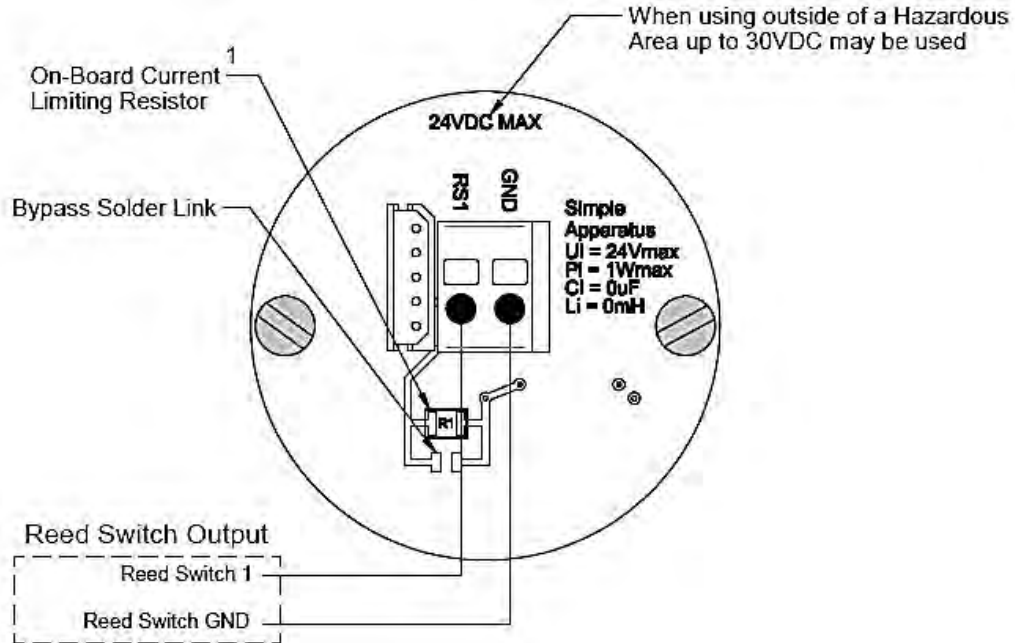


**Notes for Connection of standard Hall/Reed Pulse Output Boards**

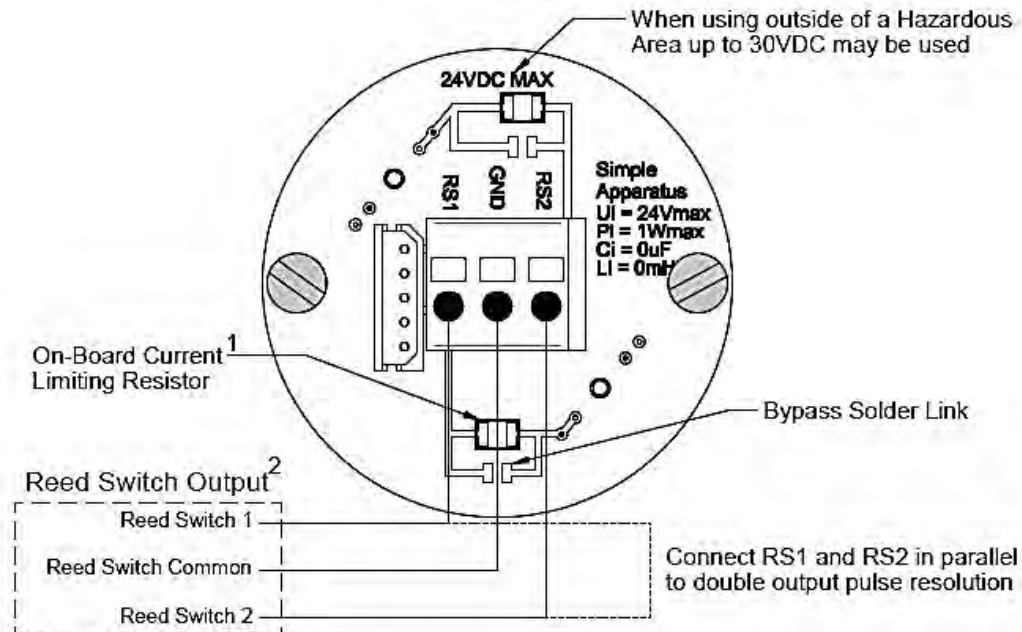
1. Pull up resistor required for operation of Hall Effect output; 10 k $\Omega$  is recommended. See section 2.2.2 for further information.
2. For installations subject to electrical noise; signal filtering can be enabled on the Reed Switch output by wiring the negative terminal of the reed switch (terminal 5) to the GND terminal (terminal 2). **When not using filtering on the Reed Switch output the polarity of the wiring is not important.**
3. Installing a current limiting resistor is recommended to extend the life of the Reed Switch device; 800 $\Omega$  is recommended as a minimum resistance value for a 24V system. **Resistor not required when connecting to battery powered flow instruments.**

## 2.4.2 Reed Only Pulse Output Board

**Applicable Models: 004,006,008**



**Applicable Models: 015,025,040, 050, 080, 080E, 100, 100E**



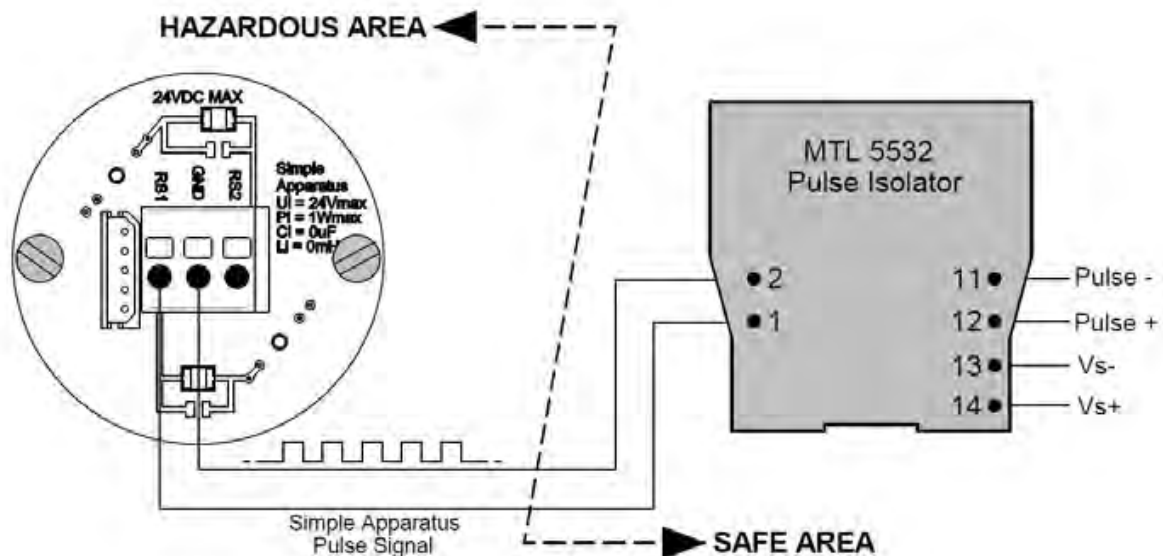


### Notes for Connection of Reed Only Pulse Output Boards

1. Reed Only pulse output boards are fitted with an on-board current limiting resistor which will limit the total power into the circuit to less than 1W at 24V (dc) (when using both outputs). This limitation provides perfect conditions for maximum Reed Switch service life, and is required for use as a Simple Apparatus within a Hazardous Area. When used in a Safe Area (non-hazardous) the current limiting resistor can be bypassed by joining the solder link on the top surface of the PCB, however this will reduce Reed Switch life. **Please note that it is the responsibility of the user to ensure that total power remains below 1W when used in a Hazardous Area.**
2. The output resolution from each Reed Switch is as per the calibration sheet delivered with the flowmeter; wiring the Reed Switch outputs in parallel will double the output resolution (**015 ~ 100 models only**).

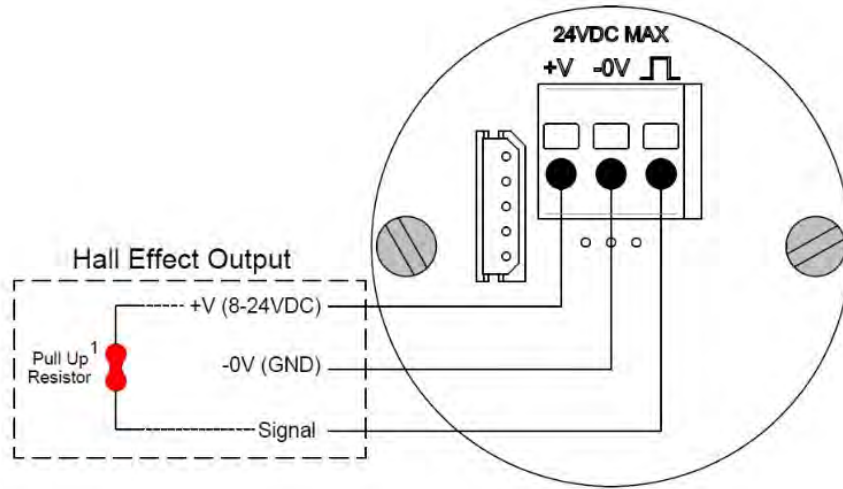
### 2.4.3 Reed Only Outputs as Simple Apparatus

When purchased with a ‘Reed Only’ output the meter can be wired as an Intrinsically Safe Simple Apparatus, **see section 2.7.4 for further explanation of simple apparatus**. The wiring diagram below shows wiring of the Reed Switch signal from a meter located in the hazardous area, to an MTL 5532 pulse isolator located in the safe area. The MTL pulse isolator is shown as it is a common choice; however other brands and models of isolator may be used in the same way provided they are designed for pulse or frequency signals. **Any barriers/isolators should only be installed after reading the manufacturer’s instruction manual.**

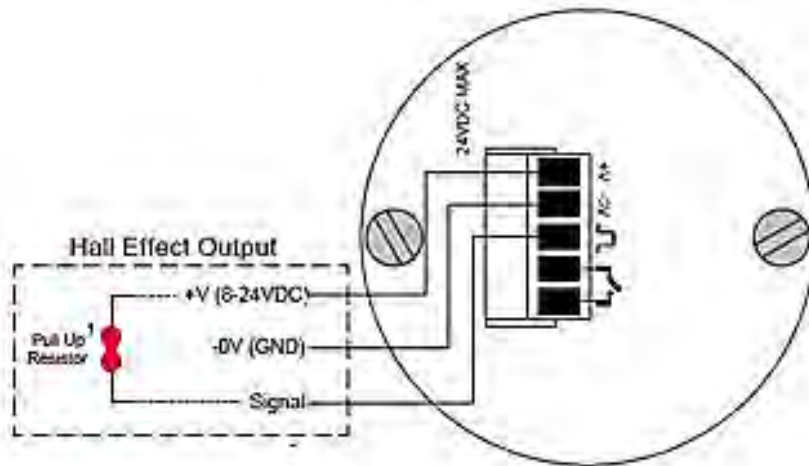


## 2.4.4 Hall Only Output

**Applicable Models: 004 ~ 015 Hall Only, 004 & 006 High Resolution Option**



**Applicable Models: 025, 040, 050, 080, 080E, 100, 100E**

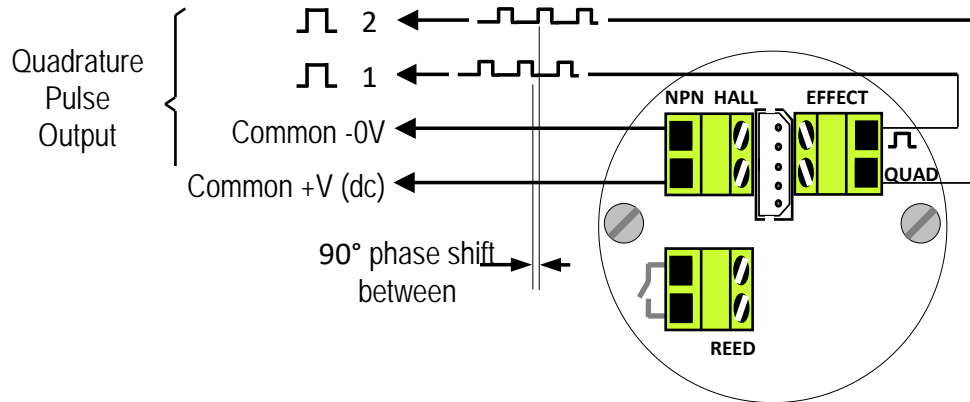


### Notes for Connection of Hall Only Pulse Output Boards

1. Pull up resistor required for operation of Hall Effect output; 10 k $\Omega$  is recommended. See section 2.2.2 for further information.

## 2.4.5 Quadrature Pulse Output

Quadrature Pulse Outputs may be wired directly to any flow instruments that accept quadrature signals for signal integrity verification (custody transfer applications) or for bi-directional flow.



## 2.5 Meter Calibration Factor (K-Factor, Scale Factor)

Each flowmeter is individually calibrated and supplied with a calibration certificate showing the number of pulses per unit volume (*e.g. pulses/Litre*) which is characteristic to individual outputs on your meter. Meters fitted with integral instruments will have the relevant K-factor entered into the program of the instrument at the factory.

## 2.6 Integral Instruments

If your flowmeter was purchased with an integral Rate Totaliser then the instrument will be factory wired for reed switch input into the instrument. If your flowmeter is fitted with an integral Batch Controller, the NPN (*open collector*) output from the Hall Sensor is factory wired and programmed. If you are unsure of the factory wiring of your instrument, remove the instrument bezel to check the wiring.

Unless programming details were provided at time of order, the instrument program will contain factory default parameters. Integral instruments will be programmed with the relevant K-factor for the meter, however all output(s) are turned OFF, and if required need to be turned ON and then configured to suit the application requirements.

## 2.7 Installations in Hazardous Areas

Installations in Hazardous Areas are applications where the utmost care is necessary in correctly selecting your flowmeter. If your flowmeter is to be used in a hazardous area it is important that it has been correctly selected for the specific explosive atmosphere in which it is to be used, and that installation be carried out by a **competent** person.

An Oval Gear flowmeter may be suitable for use in a hazardous area if it has been purchased as Flameproof (EXd), Reed Only (Simple Apparatus), or with an integral certified Intrinsically Safe instrument (EXi). **Before installation ensure your meter is suitable for the specific explosive gas or vapour present and the zone rating, gas group, and temperature classification of your installation**

For any installations measuring non-conductive liquids there may be a risk of electrostatic build-up in the liquid. It is recommended that the guidance in IEC TS 60079-32-1 is followed.


### 2.7.1 ATEX/IECEx Flameproof Flowmeters (Ex db)

ATEX/IECEx flameproof (Ex db) Oval Gear flowmeters are designed and certified for use in either Zone 1 or Zone 2 hazardous areas.


Flameproof flowmeters must be installed in accordance with hazardous area standards, which require the use of certified cable glands, sealed conduit connections, and armoured cable according to the international standards IEC/EN 60079:1 and IEC/EN 60079:14. The extent of special wiring installation is dependent on the zone and gas group.

ATEX/IECEx flameproof flowmeters are available with either of the following equipment ratings:

**Group IIB – Aluminium or Stainless Steel meters suitable for hazardous gas atmospheres in group IIB.**

	II 2 G EX d IIB T6...T3 Gb	
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**Group I/IIB – Stainless Steel meters suitable for mines subject to firedamp and gas atmospheres in group IIB.**

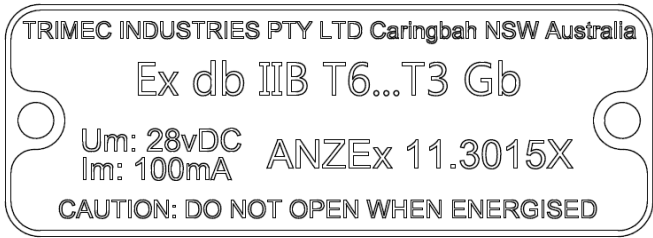
	I M2 Ex d I Mb II 2 G EX d IIB T6...T3 Gb	
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## 2.7.2 ANZEx Flameproof Flowmeters (Ex db)

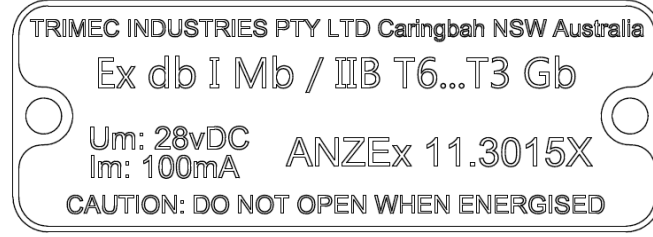
ANZEx flameproof (Ex db) Oval Gear flowmeters are designed and certified for use in either Zone 1 or Zone 2 hazardous areas in Australia and New Zealand, in locations where IECEx is not accepted.

ANZEx flameproof flowmeters are available with either of the following equipment ratings:

**Group IIB – Aluminium or Stainless Steel meters suitable for hazardous gas atmospheres in group IIB.**

<p>EX d IIB T6...T3 Gb</p>	 <p>TRIMEC INDUSTRIES PTY LTD Caringbah NSW Australia  Ex db IIB T6...T3 Gb  Um: 28vDC ANZEx 11.3015X  Im: 100mA  CAUTION: DO NOT OPEN WHEN ENERGISED</p>
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**Group I/IIB – Stainless Steel meters suitable for mines subject to firedamp and gas atmospheres in group IIB.**

<p>Ex d I Mb  EX d IIB T6...T3 Gb</p>	 <p>TRIMEC INDUSTRIES PTY LTD Caringbah NSW Australia  Ex db I Mb / IIB T6...T3 Gb  Um: 28vDC ANZEx 11.3015X  Im: 100mA  CAUTION: DO NOT OPEN WHEN ENERGISED</p>
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## 2.7.3 Conforming Standards

Flameproof flowmeters carrying ATEX/IECEx labels are certified in accordance with the following standards. Prior to installation or use, review the approval markings on the product and in this manual, as well as the conforming standards below, to confirm it is appropriate for your country/region and site classification.

### **ATEX Directive**

ATEX directive 2014/34/EU  
EN 60079-0:2012 + A11 : 2013  
EN 60079-1:2014

### **IECEx Scheme**

IEC 60079-0:2011 Edition 6.0  
IEC 60079-1:2014-06 Edition 7.0

## 2.7.4 Temperature Limits for Flameproof Flowmeters

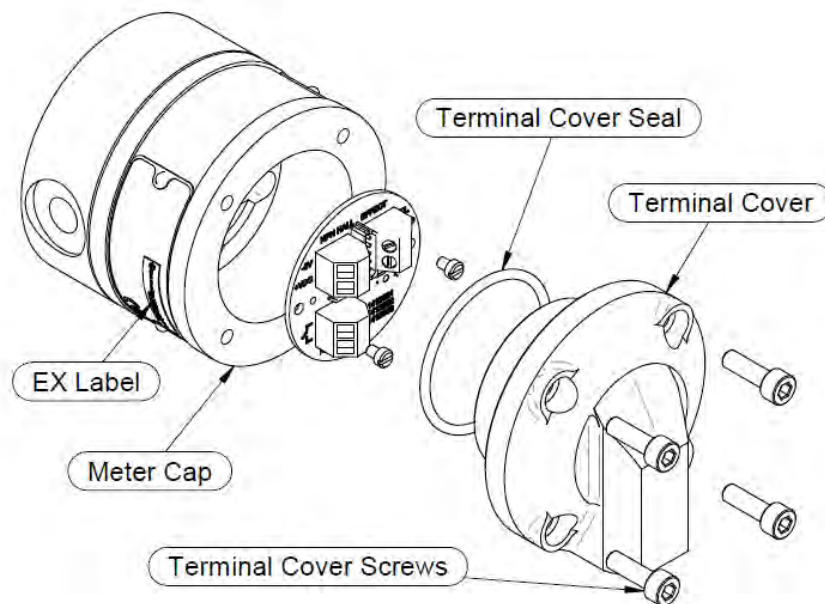
When operating a Flameproof meter, the process (liquid) temperature must be kept below the maximum limit which is allowed for the temperature class of the installation. This is a critical requirement for explosion safety. For ATEX/IECEX rated equipment refer to the table below to determine the temperature limits for a specific temperature class (*e.g. T6 installations must be kept below 158°F [70°C]*)

Process (Liquid) and Ambient Temperature Limits	
Marking	Allowable Temperature Range
EX d Mb	+14°F ≤ T ≤ +302°F (-10°C ≤ T ≤ +150°C)
EX d IIB T6 Gb	-40°F ≤ T ≤ +158°F (-40°C ≤ T ≤ +70°C)
EX d IIB T5 Gb	-40°F ≤ T ≤ +185°F (-40°C ≤ T ≤ +85°C)
EX d IIB T4 Gb	-40°F ≤ T ≤ +248°F (-40°C ≤ T ≤ +120°C)
EX d IIB T3 Gb	+14°F ≤ T ≤ +302°F (-10°C ≤ T ≤ +150°C)

## 2.7.5 Special Conditions of Use

The following conditions must be adhered to for use, service or maintenance of a Flameproof (EXd) flowmeter.

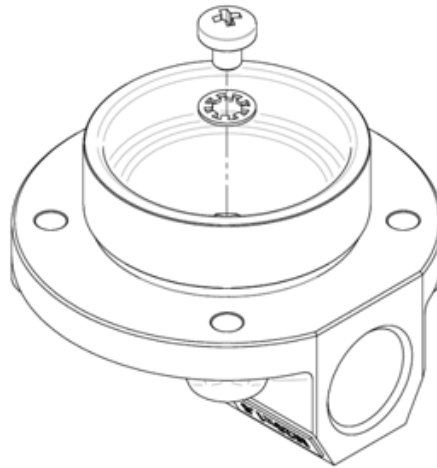
- **Flamepaths are not intended to be repaired, contact manufacturer.**
- The maximum allowable diametric clearance of the cylindrical joint between the terminal cover and the meter cap must not exceed 0.0059 inches (0.15mm).
- The property class of the hexagon socket head cap screws retaining the terminal cover must be A2-70 or higher; e.g. A4-80.
- Terminal covers screws must be torqued to a value of 2.95ft-lb (4Nm).



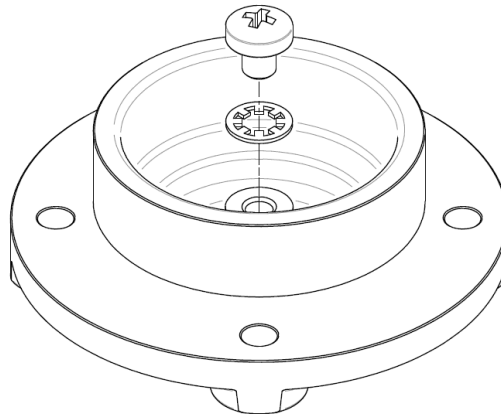
## 2.7.6 Earthing of Flameproof Flowmeters

A facility for the connection of an earthing conductor is provided inside the terminal cover of all flameproof (EXd) flowmeters, as per below diagrams. The earthing connection is fitted with a 5mm Philips head screw with a locking washer and allows for the fitment of a 5mm ring terminal.

***Applicable Models: 004, 006, 008, all High Pressure models***



***Applicable Models: 015,025,040, 050, 080, 080E, 100, 100E***



The use of the internal earth connection as the only earthing connection may be acceptable with wiring systems using steel wire armoured cable or metallic conduit. For all other installations an external earthing connection must be used which may be connected to the external threaded mounting holes on the flowmeter body or using metallic cable glands with earthing tags.

### 2.7.7 Intrinsically Safe Flowmeters (EX i)

Intrinsically safe flowmeters and instruments are designed and certified for use in zone 1, and zone 2; they function by limiting the power and energy available in the electrical equipment to a level that is low enough that it cannot ignite the hazardous atmosphere. Intrinsic safety installations are carried out in accordance with IEC/EN60079:14 and IEC/EN60079:25.

Intrinsically safe products may be installed with standard wiring carried in regular conduit; however **any wiring that crosses from a hazardous area to a safe area must pass through an appropriately certified Intrinsically Safe barrier/ isolator.**

If your meter is fitted with an integral intrinsically safe Instrument; installation must not be carried out before reading the Instrument product manual, and any supplementary manual (if applicable).

In regions that operated under ATEX or IECEx schemes, meters purchased with the 'Reed Only' option can be used as an Intrinsically Safe 'simple apparatus' if the reed switch output is used in conjunction with suitably certified associated equipment. The use of 'simple apparatus' is defined in the international standard EN60079:11 and in many countries/regions is allowed to be used in all hazardous areas with a temperature class of T4 provided it is wired to a certified Intrinsically safe receiving instrument within the same zone, or to a certified Intrinsically Safe barrier in the safe area.

***Pulse output flowmeters may be used with the following grouping:***

Ex ib IIB T4 Gb (Tamb<80°C)  
Zones 1 & 2

***Flowmeters fitted with an integral certified Intrinsically Safe instrument, use equipment grouping from the certified instrument.***



#### **CAUTION**

***Please consult with a hazardous area expert within your country/region before installing a simple apparatus flowmeter in a hazardous area installation to be sure this is allowed in the relevant national standards.***

***NEVER INSTALL AN OM025P PLASTIC FLOWMETER IN A HAZARDOUS AREA DUE TO THE RISK OF STATIC DISCHARGE.***



## 2.8 Commissioning

Once the meter has been mechanically and electrically installed in accordance with this instruction manual, the meter is ready for commissioning.

The newly installed meter must NOT be run until the piping is completely flushed of foreign materials. The most common foreign matter that is present in new or modified piping is; welding slag, grinding dust, sealing tape/compound, and surface rust. If your piping has been designed with a bypass line it will be easy to isolate your meter from the remainder of the system to flush out the majority of the piping. If you have not installed a bypass line around the meter, the best solution is to replace the meter with a spool-piece for the duration of the flushing procedure.

The other critical concern when commissioning a meter is the presence of air slugs; this is also a concern for any systems that have been shut down for long periods of time. ***Do not start up your system for the first time by opening all valves and turning on the pump.***

To safely start a meter for the first time, the best procedure is to eliminate the majority of the air volume in your piping system using the bypass line described earlier. After bleeding the majority of the air through the bypass line, the remainder of the air can be slowly passed through the meter by gently opening the flow control valve downstream of the meter. If a bypass line has not been incorporated into your system, and no alternative exists for bleeding air upstream of the meter, then the entire air volume of your piping will need to be bled very slowly through the valve downstream of the flowmeter.

Following the start-up procedure, and during the period of initial operation, it is recommended that the inlet strainer on your meter be inspected regularly, and cleaned if necessary, as it is possible that not all foreign material will be completely removed from your system during the initial flushing.

## 2.9 Fault Finding

Pulse meters have two distinct sections: the mechanical wetted section housing the rotors and the electrical section housing the pulse output board. Meters fitted with integral instruments have these two sections plus the instrument. The aim of fault finding is to trace the source of the fault to one of these sections. If a fault is traced to an instrument section, refer to the relevant instruction manual. ***Below are basic fault finding steps.***

***Step 1 - Check application, installation and set up;*** refer to installation sections for installation and application factors that may affect the meter operation including incorrect wiring. Check meter specifications for incorrect flow rate, temperature, pressure, or materials compatibility.

***Step 2 - Check for blockages;*** The most common cause of fault/unsatisfactory meter operation, particularly for new or altered installations, is due to blockage within the system or meter caused by foreign particles such as weld slag, sealing tape or compound, rust, etc.

***Step 3 - Ensure flow is present;*** No flow or lower than normal minimum flow may be attributed to a blocked strainer, jammed or damaged rotors within the flowmeter, a malfunctioning pump, closed valves or low liquid level in feeder tank.

***Step 4 - Ensure oval gears within meter are rotating;*** Rotation of the oval gears can be heard by holding a screw driver blade to the meter body and pressing the handle hard against the ear lobe. If necessary test the meter with the flow turned off and turned on to familiarize yourself with the audible rotation signature.

***Step 5 - Ensure pulses are being generated during flowing condition;*** a multi-meter is often not fast enough to distinguish the pulse train from the reed switch or Hall Effect sensor. An oscilloscope will allow you to view the output pulse train. When viewing the Hall effect sensor signal ensure a pull up resistor is installed between the pulse output and the supply voltage (refer electrical installation).

***Step 6 - Confirm Instrument Operation;*** if an associated instrument is connected to the flowmeter confirm its operation by simulating a pulse input onto the flow input terminals. In most instances, a contact closure on the flow input terminals is an adequate simulation.

## 2.10 Troubleshooting Guide

Symptom	Possible Cause	Solution
Meter Readings are High	Output Signal Interference	<ul style="list-style-type: none"> <li>- confirm shielded cable has been used</li> <li>- ground cable shield at instrument end only</li> <li>- isolate cable shield at flowmeter end</li> <li>- re-route cabling from high electrical energy sources, or power carrying cables such as valves and pumps/motors.</li> </ul>
	Entrained air or gas	<ul style="list-style-type: none"> <li>- Remove source of air or gas entrapment</li> <li>- Install an upstream air-eliminator</li> </ul>
	Pulsating Flow from reciprocating style pump	<ul style="list-style-type: none"> <li>- Increase back pressure on pump</li> <li>- Install a fast response one-way (check) valve, or a surge arrestor between pump and meter</li> <li>- Change pump style to a smooth delivery pump</li> </ul>
Meter Readings are Low	Damaged or worn rotors	Inspect, repair, clean, or replace rotors
	Damage or worn measuring chamber	Inspect measuring chamber for damage and consult manufacturer for advice.
	Output signal interference	<ul style="list-style-type: none"> <li>- Confirm correct wiring with shielded cable</li> <li>- Check all electrical connections for firmness and continuity</li> </ul>
No Output from Flowmeter	Rotors jammed	<ul style="list-style-type: none"> <li>- If meter has been recently field serviced, check that rotors are not installed upside-down or incorrectly meshed</li> <li>- Check for obstruction due to foreign particles</li> <li>- Clean, repair, or replace rotors</li> </ul>
	Meter incorrectly reassembled	Consult manufacturer for advice.
	No signal from Pulse Output Board	<ul style="list-style-type: none"> <li>- Check terminal connections</li> <li>- Ensure DC voltage is available at the terminals of the PCB, and pull-up resistor is fitted if Hall Effect output is used.</li> <li>- Ensure receiving instrument is configured correctly.</li> <li>- Check voltage/current are within maximum ratings</li> </ul>
Not Reading on Receiving Instrument	Faulty receiving instrument	<ul style="list-style-type: none"> <li>- Check hardware and software settings; DIP switches, terminal connections, and programming settings</li> <li>- Repair or replace receiving instrument</li> </ul>

### 3. Maintenance and Repairs

Adhering to the installation instructions is the most important requirement to ensure that your Oval Gear meter provides the maximum level of operational performance. Oval Gear meters are a mechanical device, and so will be subject to some wear and tear over their operational life except under ideal circumstances. The amount of normal wear that the meter will experience will be dependent on the operational conditions such as; flow rate, temperature, cleanliness of the liquid, lubricity of the liquid, and the amount of continuous duty required of the meter.

To maximise the operational availability of your meter, and reduce system downtime, a periodic maintenance and inspection regime should be used. Frequency of maintenance depends on the operational conditions of the meter and the criticality of the system; it is the user's responsibility to determine inspection frequency however the manufacturer can provide guidance.

For any installations that require in-situ cleaning (CIP); it is important that the cleaning or flushing procedures do not produce operating conditions that are outside of the acceptable flow rate, pressure, or temperature ratings of the meter. High temperature cleaning procedures that increase system temperature at a rate greater than 18°F (10°C) per minute may damage the reed switch output. Chemical compatibility of cleaning solutions should be checked against the materials of construction of the meter.

**Before undertaking meter maintenance ensure the following:**

*Associated alarm(s) or control output(s) are isolated so not to affect the process*

*Voltage supply is isolated from the meter*

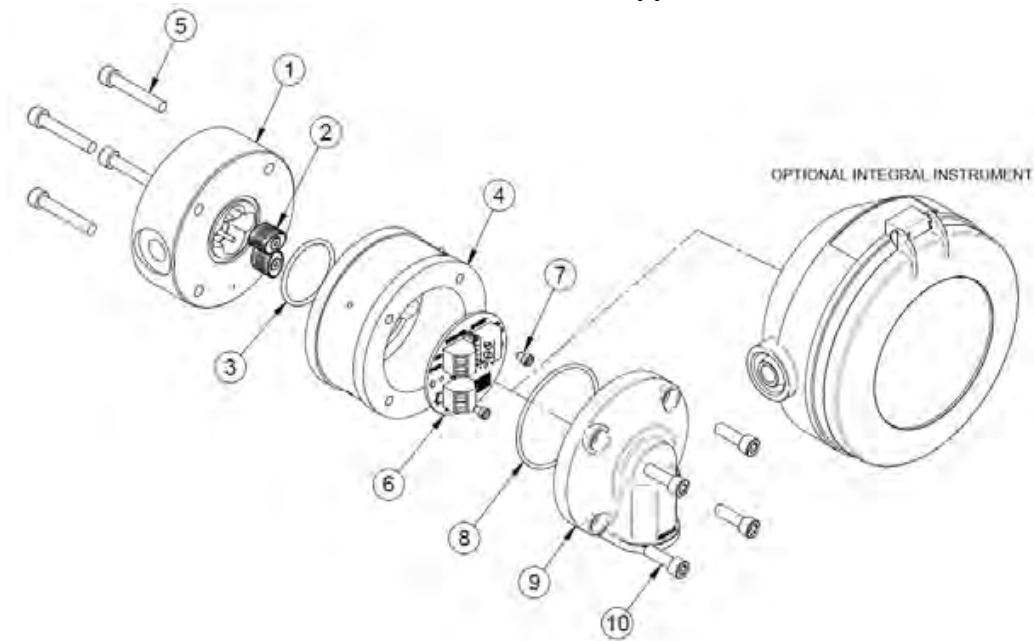
*Liquid supply to the meter is closed off*

*The meter is depressurised and liquid drained from the meter / pipeline*

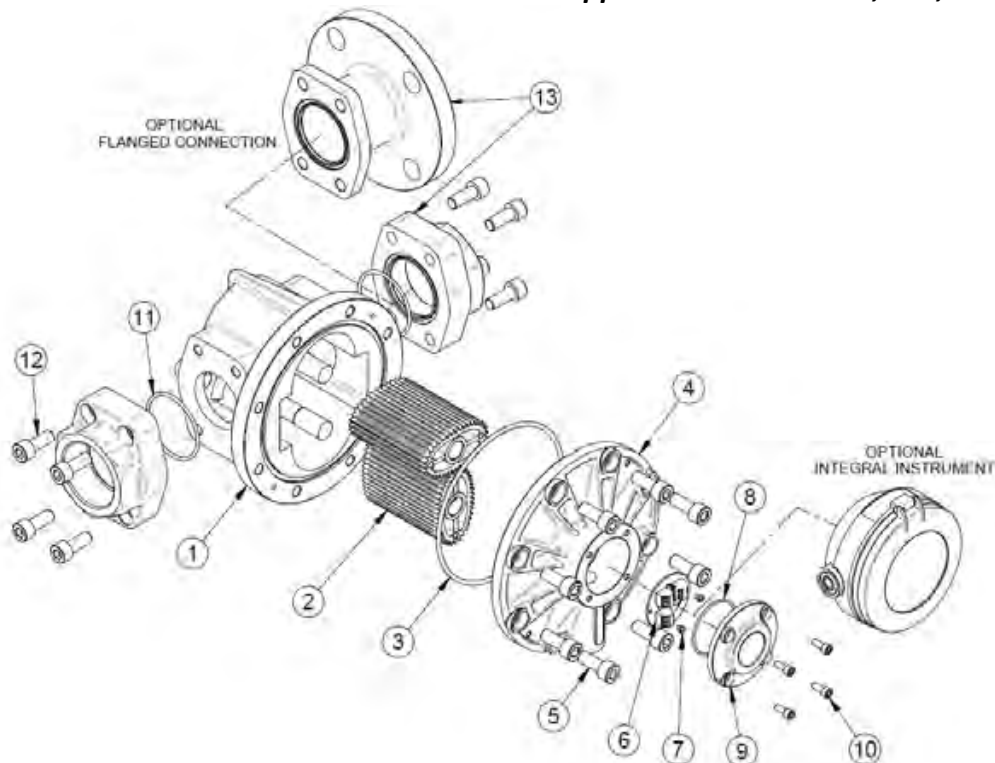
### 3.1 Parts Identification

For identification of the parts within your Oval Gear meter refer to the following images and tables.

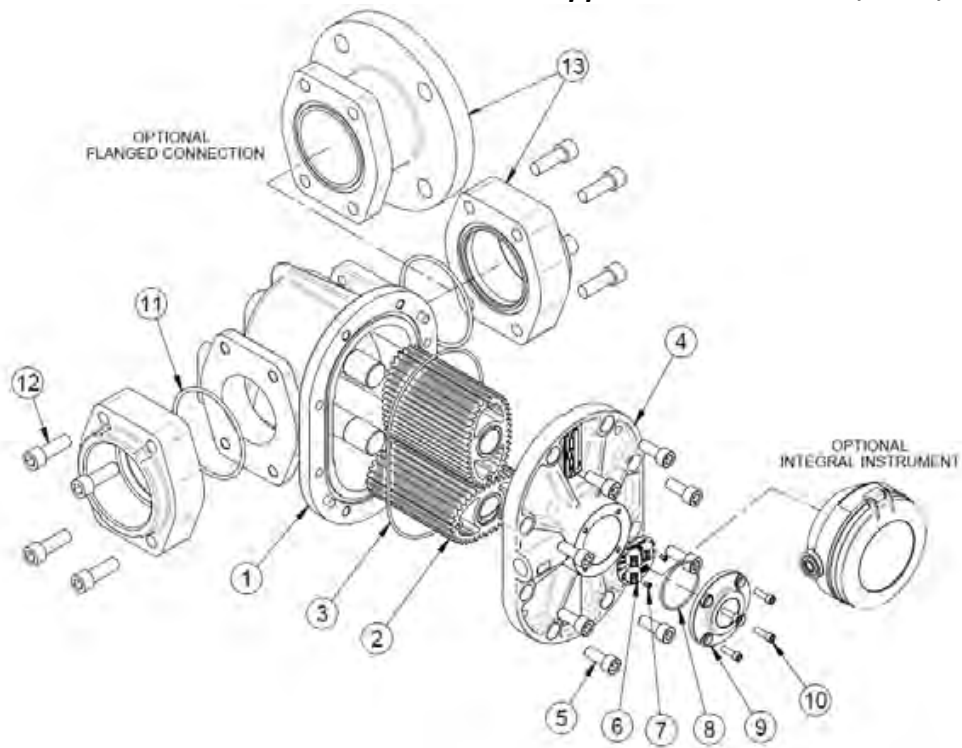
**Applicable Models: 004, 006, 008, 015**



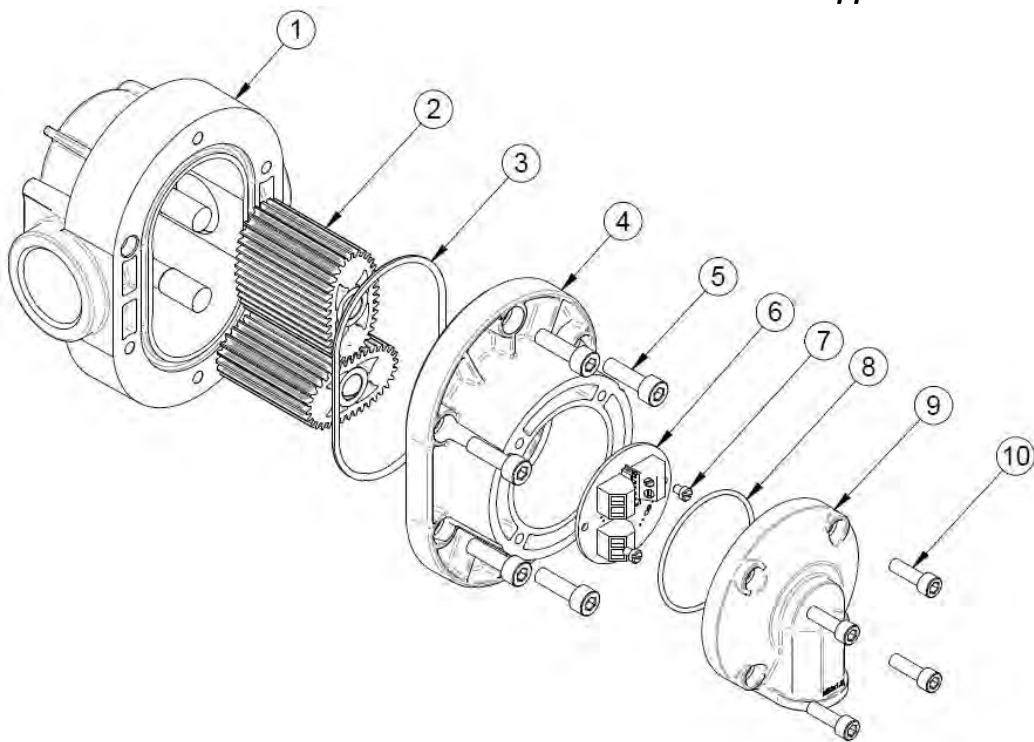
**Applicable Models: 025, 040, 050, 050E**



**Applicable Models: 080, 080E, 100, 100E**



**Applicable Models: 025P**



**Parts Identification Table**

Item No.	Description
1	Meter Body Assembly
2	Rotor Assembly
3	Meter Body O-Ring
4	Meter Cap
5	Meter Body Screw
6	Pulse Output Board
7	Pulse Output Board Screw
8	Terminal Cover O-Ring
9	Terminal Cover
10	Terminal Cover Screw
11	Flange Portion O-Ring
12	Flange Portion Screw
13	Flange Portion

## 3.2 Flowmeter Disassembly

If required to gain access to the meter terminals and pulse output board, undo the 4 cap screws (10), remove the terminal cover (9) carefully to avoid putting strain on the terminal connections. The pulse output board (6) can now be accessed and removed if necessary by removing the pulse output board screws (7).

To access the oval gear rotors, undo the meter body screws (5), and carefully pry the meter body apart avoiding misplacing or damaging the O-ring (3). The rotors (2) can now be removed and inspected.

If the meter is fitted with an integral instrument the instrument display assembly must be removed in order to gain access to the instrument terminal connections, instrument battery or pulse output board. This is achieved by undoing the 4 bezel screws and separating the display assembly from its base. Do not stress or damage the wires that connect the display assembly to the pulse output board. Take care not to misplace or damage O-ring(s). If required, the pulse output board can now be accessed; to remove the pulse output board first undo the screws that fix the instrument base to the flowmeter.

## 3.3 Flowmeter Inspection

Inspect O-rings for damage, chemical attack, deformity or any form of deterioration. Remove, inspect and clean the rotors, and check the measuring chamber for damage or scoring, the rotor shafts should NOT be loose or able to be rotated. Rotors should turn freely, and should spin without scraping or catching on any part of the meter body.

### 3.4 Re-assembly of Flowmeter

When re-installing the rotors the magnets MUST be correctly positioned so that they are facing the sensors located in the meter cap, for meters ranging from 004 to 015 sizes the magnets are inserted from the underside of the rotor so will not be visible when the rotors are installed. Meters from 025 size and larger will have the magnets visible from the top; if you are unsure of magnet location it is easiest to test using a small steel object such as a steel ruler or small screw driver.

Both rotors will only engage correctly if fitted precisely at an orientation of 90 degrees to each other. Rotate the rotors slowly by hand to ensure they are correctly fitted, at the same time check the rotor shafts & rotor bearings for wear. If you are able to rotate the engaged rotors through a complete 360, then you have installed them at the correct 90 degree angle.

Fit the O-ring into the groove and assemble the meter cap onto the meter body; small meters are visibly aligned using a small dimple on the top face of the meter cap and the underside of the meter cap. Larger meters are aligned using a location pin or a pair of dowel pins.

Fit the body cap screws (5) and tighten in a star sequence, then carryout a final tighten in the same sequence to a firm torque. This sequence and procedure ensures the meter bodies are assembled correctly and evenly. Fit the pulse output board, terminal cover or instrument as appropriate.



## 4. EU Declaration of Conformity

**Product Models:** OM Series Oval Gear Flowmeters

:

This declaration of conformity is issued under the sole responsibility of the manufacturer. Conformity is based on the application of the harmonised standards listed below, and where necessary through certification by a European Union Notified Body.

**2014/30/EU EMC Directive**

**Harmonised standards:** EN61326-1:2013

**2011/65/EU RoHS Directive**

**Harmonised standards:** EN50581:2012

**2014/68/EU Pressure Equipment Directive**

Compliance is declared according to Article 4, paragraph 3 – SEP

Annex II, table 3

Models OM050H, OM100A, and OM100E are PED compliant under SEP only for Group II liquids according to Annex II, table 4.

***When purchased as EXd these products are additionally in conformance with:***

**2014/34/EU ATEX Directive**

**ATEX certificate:** Sira05ATEX1296X

**Harmonised standards:** EN 60079-0:2012 (+A11:2013), EN 60079-1: 2014

**Notified Body for ATEX Type Examination:** CSA Group Netherlands B.V. (N.B. No. 2813)

**Notified Body for ATEX QAN:** CSA Group Netherlands B.V. (N.B. No. 2813)

Signed for and on behalf of the manufacturer:



Matthew Wyres,  
Engineering Manager  
Trimec Industries Pty. Ltd.

**Notes:**

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**Notes:**

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## Service & Warranty

For Technical Assistance, warranty replacement or repair in North or South America contact your Flomec Distributor

For Technical Assistance, warranty replacement or repair outside North or South America contact your Flomec Distributor