Operating Instructions

for

Gear Wheel Flow Meter

Model: DOM with pulse output

1. Contents

Manufactured and sold by:

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D-65719 Hofheim
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2. Note

Please read these operating instructions before unpacking and putting the unit into operation. Follow the instructions precisely as described herein.
The devices are only to be used, maintained and serviced by persons familiar with these operating instructions and in accordance with local regulations applying to Health & Safety and prevention of accidents.

When used in machines, the measuring unit should be used only when the machines fulfil the EWG-machine guidelines.

as per PED 97/23/EG

In acc. with Article 3 Paragraph (3), "Sound Engineering Practice", of the PED 97/23/EC no CE mark.

	Pipe	
	Table 8 Group 1 dangerous fluids	Table 9 Group 2 no dangerous fluids
DOM-H30	-	Art. 3, § 3
DOM-H35	-	Art. 3, § 3
and all the rest of DOM	Art. 3, § 3	Art. 3, § 3

3. Instrument Inspection

Instruments are inspected before shipping and sent out in perfect condition.
Should damage to a device be visible, we recommend a thorough inspection of the delivery packaging. In case of damage, please inform your parcel service / forwarding agent immediately, since they are responsible for damages during transit.

Scope of delivery:
The standard delivery includes:
- Gear Wheel Flow Meter model: DOM
- Operating Instructions

4. Regulation Use

Any use of the Gear Wheel Flow Meter model: DOM, which exceeds the manufacturer's specification may invalidate its warranty. Therefore, any resulting damage is not the responsibility of the manufacturer. The user assumes all risk for such usage.
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 water based products and chemicals and aluminum meters are suitable for fuels, fuel oils & lubricating liquids.

The flowmeter is available as a blind meter with pulse output capable of interfacing to most monitoring and control instrumentation or the meter can be fitted with or supplied with instruments such as totalisers, rate totalisers or batch controllers. These instruments also have monitoring and control output options including 4-20mA, scaled pulse, flowrate alarms and batch control logic (preset metering).

If your flowmeter is fitted or supplied with an instrument please also refer to the relevant instrument instruction manual.

These flowmeters can be installed within hazardous areas when ordered with optional Exd approval, or by using the reed switch pulse output in Intrinsically Safe loops or fitting Intrinsically Safe certified Instruments. Please consult the factory for the availability of flameproof models.

5. Operating Principle

The Oval gear are positive displacement flowmeters where the passage of liquid causes two oval geared rotors to rotate within a precision measuring chamber and with each rotation a fixed volume of liquid is displaced passing through the meter. Magnets embedded within the rotors initiate a high resolution pulse train output. The pulse output can be wired directly to process control and monitoring equipment or can be used as an input to instruments supplied with or fitted directly to the meter.

The benefits of this technology allow precise flow measurement and dispensing of most clean liquids irrespective of their conductivity, with other liquid characteristics having nil or minimal effect on meter performance. This metering technology does not require flow profile conditioning as required with alternative flow technologies making the installation relatively compact and low cost.

OPERATION :

Liquid travels around the crescent shaped chambers created by the rotational movement of the rotors

6. Mechanical Connection

6.1 General

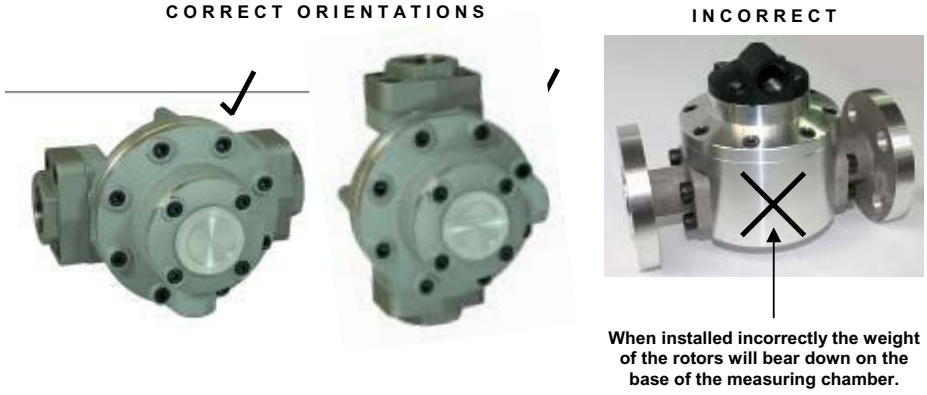
Prior to installing the meter check :
The fluid is compatible with the meter materials of construction using appropriate information such as fluid compatibility charts and site experience.
Application and process conditions are compatible with the meter specifications. Minimum and max. flows are within the meter specified range including any in-situ cleaning processes. When metering viscous liquids the maximum allowable flow may need to be reduced to ensure the pressure drop across the meter does not exceed 100 kPa (1 Barg, 15 PSIG).

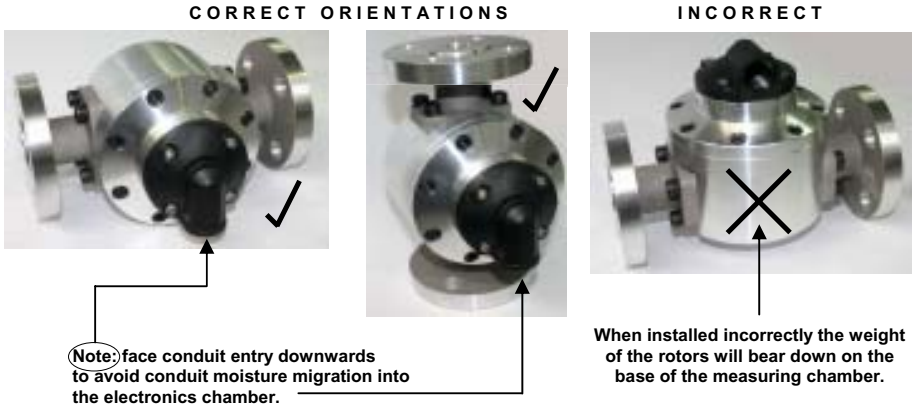
Process temperature and pressure does not exceed meter ratings.

The meter is not exposed to process temperatures and pressures that will cause the liquid medium to gasify (flash) within the meter.

6.2 Orientation

The flowmeter MUST be mounted so that the rotor shafts are in a horizontal plane. This is achieved by mounting the meter so that the terminal cover or integral instrument display, whichever is fitted, is facing in a horizontal direction. Note the terminal cover or instrument display can be rotated in 90 degree increments to provide access to the electrical entry and to allow the display orientation to suit the installation.





Liquid can flow into the meter from either a horizontal or vertical direction. For vertical flow installations the most common orientation is for the liquid to rise through the meter *(i.e. travel from bottom to top*) to assist in air or entrained gas elimination. The meter operation is independent of the liquid flow direction thus there is no markings for inlet or outlet.

6.3 Flow Conditioning and Locations

Strainer: It is recommended to INSTALL a strainer immediately upstream of (prior to) the meter. Strainers are available from the factory.

Recommended Filter:
DOM-x05…DOM-x15: < 75 µm Partikelgröße (200 mesh)
DOM-x20…DOM-x35: < 150 µm Partikelgröße (100 mesh)
DOM-x40…DOM-x60: < 350 µm Partikelgröße (45 mesh)

Flow conditioning: The flowmeter does not require any flow conditioning, therefore straight pipe runs before or after the meter are not required. If required, the pipe size about the meter can be altered to suit the installation.

Locations: The flowmeter is preferred to be fitted upstream of any flow control and/or shut off valve, this prevents free discharge from the meter and minimizes the risk of drainage and air entrapment which can result in erroneous readings or damage the meter on start up.

Process or safety critical meters should be installed in a by-pass section of pipe with isolation valves to enable the meter to be isolated and serviced as required. A by-pass installation also allows purging of the system during commissioning (see Commissioning).The meter must be appropriately rated and is typically located downstream (on the discharge side) of the pump.

If mounted outdoors ensure a suitable watertight gland or plug is used to seal any open electrical entries. In humid environments take precautions to avoid condensation build up within the electrical and/or instrument enclosure. It is good wiring practice for conduits to be connected from the bottom of an entry port, in this way condensation will gravitate away from any terminal housing.

Fluid state : Fluid entering the meter must remain a liquid at all times so protect the meter to avoid solidification or gelling of the metered medium. If meters are to be trace heated or jacketed in any way the maximum temperature rating of the meter must not be exceeded. Size the meter to avoid gasification of volatiles (flashing) within the liquid due to the pressure drop experienced within the system or within the meter.

Hydraulic shock: If pressure surges or hydraulic shock of any kind is possible, the system upstream of the meter must be fitted with a surge suppressor or pressure relief valve to protect the meter from damage. High frequency flow pulsations can damage the meter. Such pulsations can be caused by the injection profile in diesel engines. Most pulsations are removed with the installation of a suitable pulsation dampener.

7. Electrical Connection

7.1 Instrument Cable

Twisted pair low capacitance shielded instrument cable 7 x 0.3 mm (0.5 mm²) should be used for electrical connection between the flowmeter and remote instrumentation, use Belden® number 9363 or similar. The cable drain or screen should be terminated on a DC COMMON or a specifically assigned shield termination at the readout instrument end only in order to protect the transmitted signal from mutual inductive interference. IMPORTANT, tape off & isolate the shield at the flowmeter end of the cable.

The cable should not be run in a common conduit or parallel with power and high inductive load carrying cables as power surges may induce erroneous noise transients onto the transmitted pulse signal or cause damage to the electronics. Run the cable in separate conduit or with other low energy instrument cables. The maximum transmission distance is typically 1000 m (3300 Ft).

7.2 Hazardous area wiring

Intrinsically safe wiring including using the reed switch pulse output as simple apparatus, wiring to an Intrinsically Safe Instrument or wiring to the Exd explosionproof option(Exd IIB T4/T6) wiring techniques must be undertaken in accordance with the rules, regulations and requirements applying to the territory in which the meter is being installed. The meters should only be connected by qualified staff, the qualified staff must have knowledge of protection classes, regulations & provisions for the apparatus in hazardous areas. Only Exd certified conduit and cable glands with appropriate temperature limits should be used.

If the flowmeter is fitted with an intrinsically safe instrument refer to the appropriate manual & I.S. supplement for wiring of the instrument inputs and outputs.

Earthing lugs are located within the terminal housing cover and on the meter body. Use a separate earth within the cable making sure that the earth conductor does not come in contact with the cable shield / screen.
Use only high temperature cable at the flowmeter when the process temperature exceeds 85 ºC.

7.3 Pulse Output selection for pulse meters

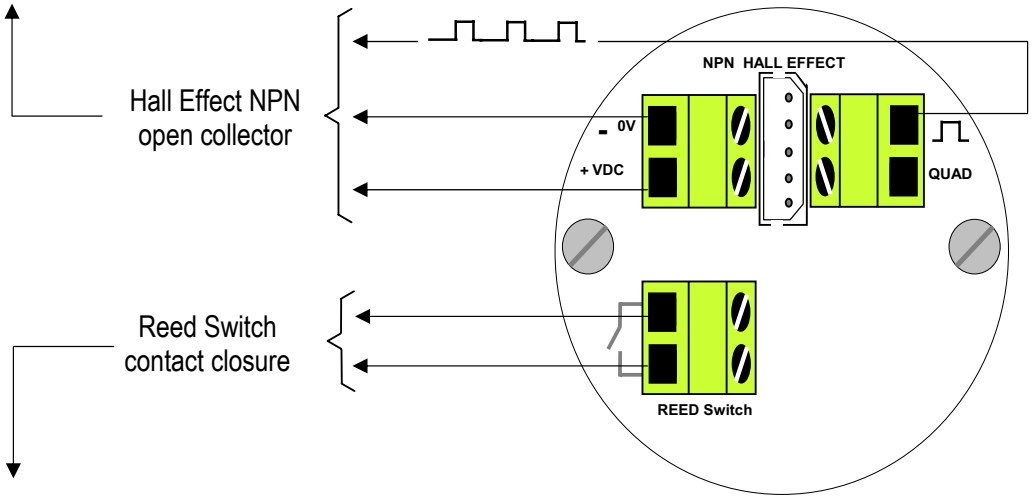
Two types of output are available on each meter, open collector from Hall Effect sensors or reed switch contact. Each output type is linearly proportional to volumetric flow and each pulse is representative of an equal volume of liquid.

7.3.1 Hall Effect Sensor Pulse Output

The Hall Effect Sensor is a high resolution solid state 3 wire device providing an un-sourced, open collector, NPN transistor output. The term “un-sourced” means that no voltage is applied to the output from within the flowmeter, it must be pulled to a ‘high’ or ‘on’ state by between 5~24 V_{DC} supplied from an external source, typically the receiving instrument.

The pulse output between signal ⎍ and -0V is a voltage square wave with the high level being the DC voltage available at the open collector ⎍ and the low level being -0 V.

The receiving instrument must incorporate a pull up resistor (typically greater than 10 KΩ in most instruments) which ties the open collector to the available DC voltage level when the Hall sensor is not energized. When energized the open collector output ⎍ is pulled to ground through the emitter (-0 V).



Hall Effect Sensor Pulse Output will not be available when ordering an instrument to be used in hazardous area as “simple apparatus” (e.g. when ordering electronic option “Z4”).

7.3.2 Reed Switch Pulse Output

The reed switch output is a two wire normally open SPST voltage free contact ideal for installations without power or for use in hazardous area locations when Intrinsically Safe (I.S.) philosophy is adopted. Note: when using the reed switch output the liquid temperature must not change at a rate greater than 10 ºC per minute (50 ºF per minute). In general the reed switch life will exceed 2 billion actuations when switching less than 5 V_{DC} @10mA as is the case when combined with the counter or batch electronic.

In case of intended use of a reed switch pulse output in hazardous area as “simple apparatus”, only option “R0” (reed only) should be ordered.

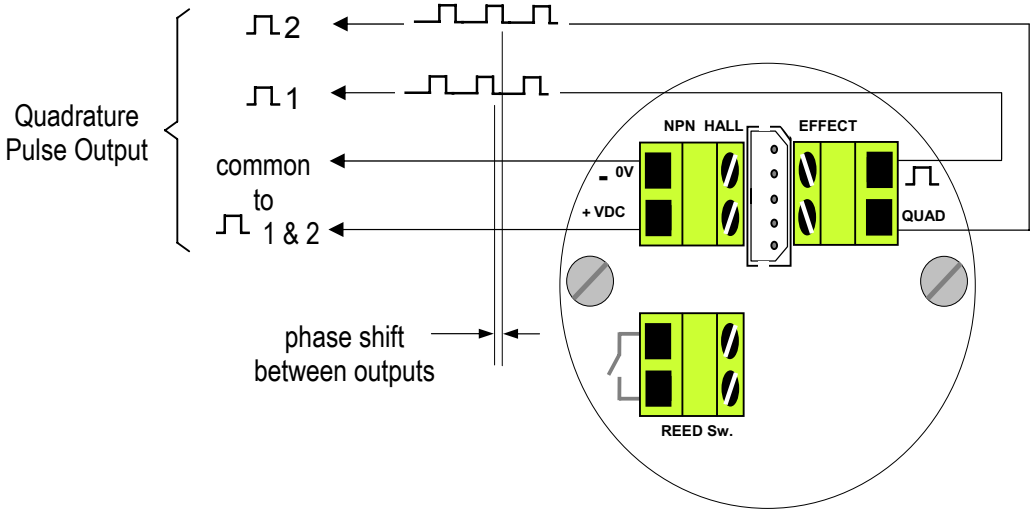
7.3.3 Quadrature (QUAD) Pulse Output

The diagrams below apply when the meter is fitted with the Quadrature pulse output option (two Hall Effect sensors arranged to give separate outputs out of phase with
one another).

The Quadrature output is typically suited to custody transfer applications where signal integrity verification is required, it is also used for metering bi-directional flow.

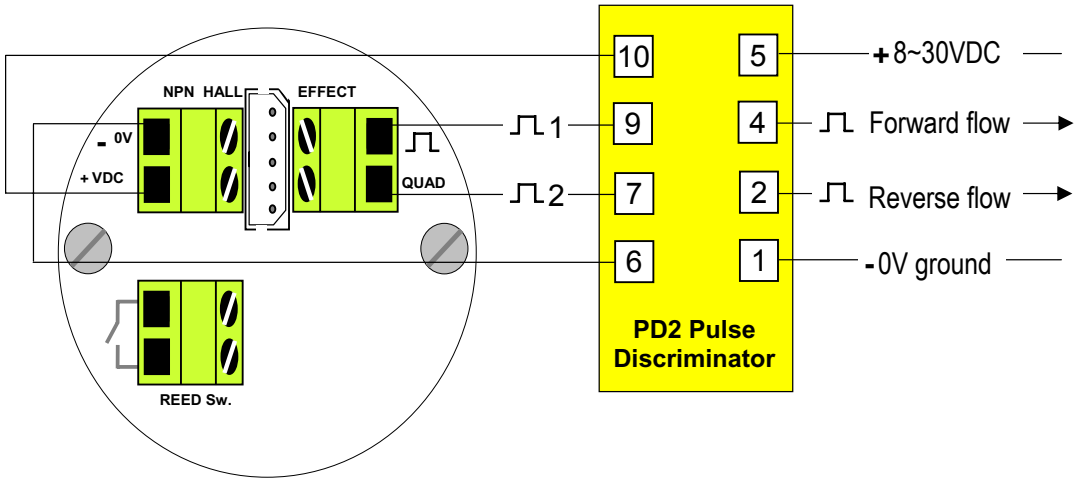
7.3.4 Signal integrity verification

Many fiscal transactions require the primary measuring device (flowmeter)
to have Quadrature outputs in order to detect any difference in the number of pulses from each input
(from ⎍ 1 & ⎍ 2) during delivery.



7.3.5 Bi-directional flow

Combining the Quadrature feature and model PD2 pulse discriminator module produces forward & reverse outputs both of which may be integrated to provide a “net” reading. The Z3 flow rate totaliser will take both output & will perform the “net” flow function.



7.4 Meters fitted with integral Instruments

If your flowmeter is fitted with an integral instrument such as a totaliser, rate totaliser or batch controller then the pulse output from the meter has been factory wired to the flow input of the readout instrument.

with LCD register

As a default the reed output is pre-wired and DIP switches set for a integral totaliser or rate/totaliser allowing self powered operation of the instrument displays.

Also by default the open collector output from the Hall Sensor is pre-wired and DIP switches set for a integral batch controller allowing high speed, solid state operation of the batch controller.

These defaults may vary at the customer request or for specific applications such as dual flow input or high or low flow so if unsure remove the instrument bezel to check the wiring.

The output(s) and function(s) available from a meter fitted with an integral instrument depends on the model of the instrument fitted and may include meter pulse repeater, prescaled pulse output, 4-20 mA flow output, flowrate alarms or single/dual stage batch control logic (preset controller).

Refer to the option in the meter model number and relevant instrument manual. Unless programming details were provided at time of order the instrument program will contain factory default parameters. Integral instruments will however be programmed with the relevant calibration factor (K factor or scale factor) for the meter.

Factory default settings can be found in the instrument instruction manual and it should be noted all output(s) are turned OFF and if required need to be turned ON then programmed to suit the application requirements.

7.4.1 Meter Calibration Factor (K or scale Factor)

Each flowmeter is individually calibrated and supplied with a calibration certificate showing the number of pulses per unit volume (eg pulses per litre or pulses per USgallon). Nominal figures are shown in the specification section of this manual.

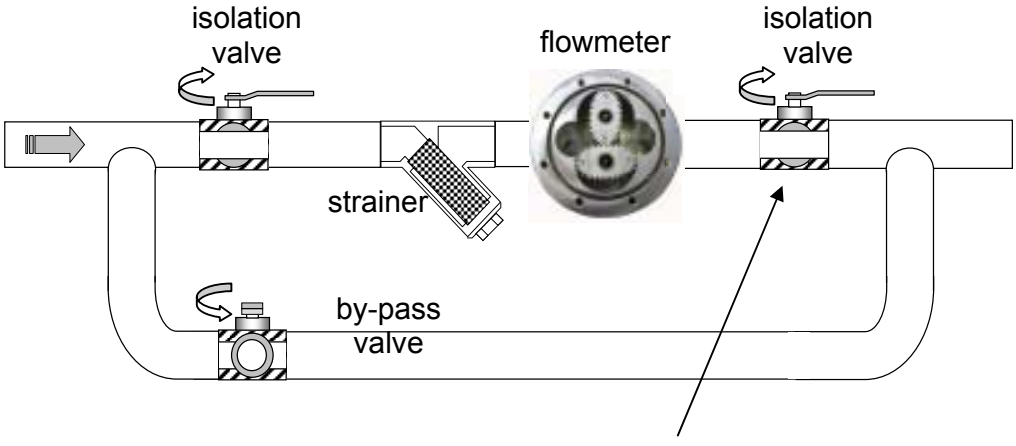
Meters fitted with Integral Instruments will have the relevant calibration factor entered into the program of the instrument. Please refer to relevant instrument manual for programming details.

8. Commissioning

Once the meter has been mechanically and electrically installed in accordance with this and any other relevant instrument manual(s) the meter is ready for commissioning.

The meter must NOT be run until the pipework is flushed of foreign matter, more often than not foreign matter is present after pipework fabrication or modification, weld slag, grinding dust, sealing tape & compound &/or surface rust are most common offenders.

Flushing can be undertaken by utilizing a by-pass or removing the meter from the pipework. If neither is practical then the meter rotors must be removed prior to flushing (refer to Maintenance section of this manual for disassembly).



After flushing or following long periods of shutdown the meter must be purged of air/vapour. This can be achieved by allowing the liquid to flow through the meter at a slow rate until all air/vapour is displaced. Never run the meter above its maximum flow or exceed 100 kpa (1 bar, 15 psi) pressure drop across the meter. Now the meter is ready for its operation to be confirmed by ensuring correct indication or operation at the receiving instrument(s). Refer if necessary to fault finding section of this manual.

9. Maintenance

Adhering to the installation instructions in this manual should ensure your meter provides the required operational performance. These are mechanical meters and a periodic maintenance and inspection regime will maximize the operational availability of the meter.

The frequency of maintenance depends on the application factors including liquid lubricity and abrasiveness and operational factors such as flowrate and temperature.

BEFORE undertaking meter maintenance ensure the following:

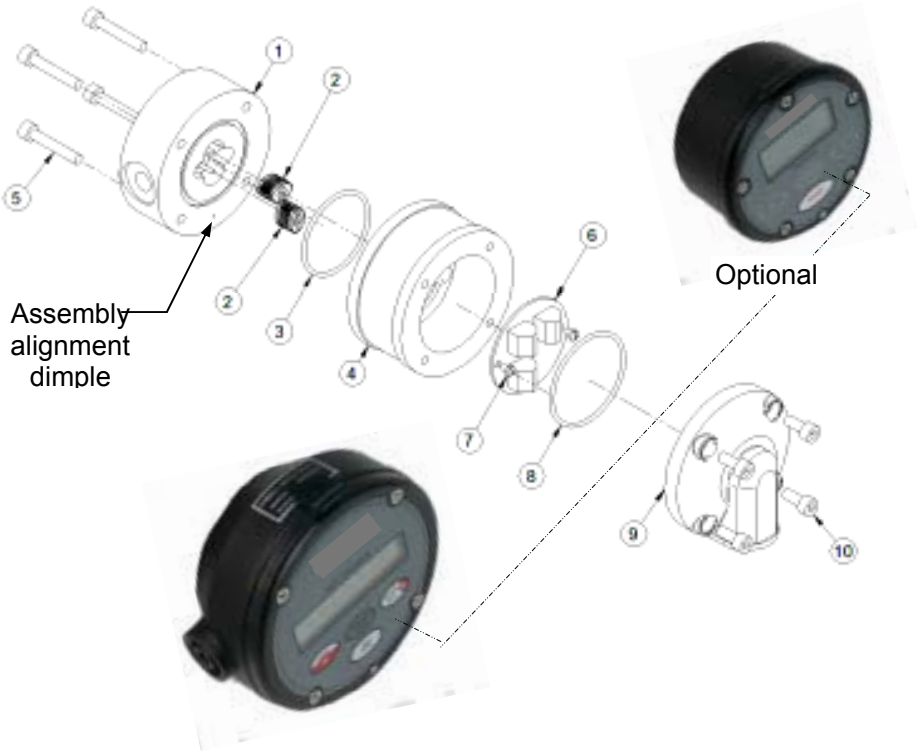
- Associated alarm(s) or control output(s) are isolated so not to affect the process.
- Voltage supply is isolated from the meter.
- Liquid supply to the meter is closed off.
- The meter is depressurized and liquid drained from the meter.

9.1 Disassembly of Pulse meter (Refer Exploded View)

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 (screws 7).

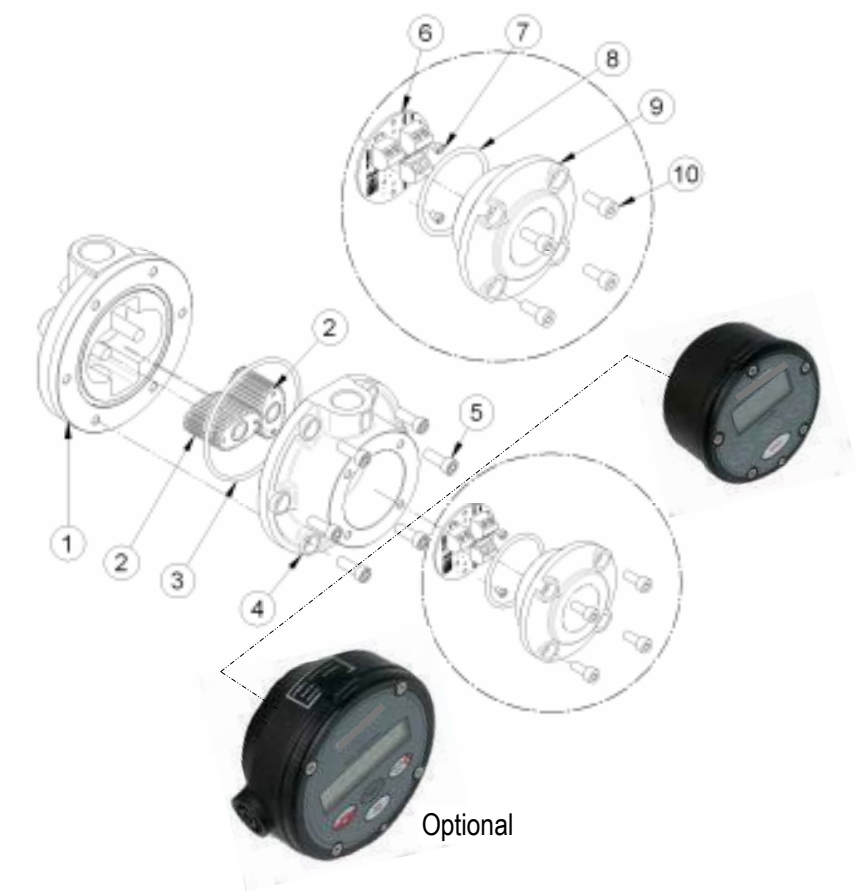
DOM-x05…DOM-x15

If required to gain access to the oval geared rotors undo the 4 body screws (5), carefully pry the meter body apart avoiding misplacing or damaging the O-ring (3) and rotors (2). Please note, for small capacity meters only *(4 mm & 6 mm)* items 1 & 4 are marked with a dimple and both dimples must align when reassembling, in addition for these small meters the rotor shaft located closest to the dimple must take the primary rotor which is the rotor fitted with magnet(s). For all other size meters the rotors are interchangeable between rotor shafts.



DOM-x20

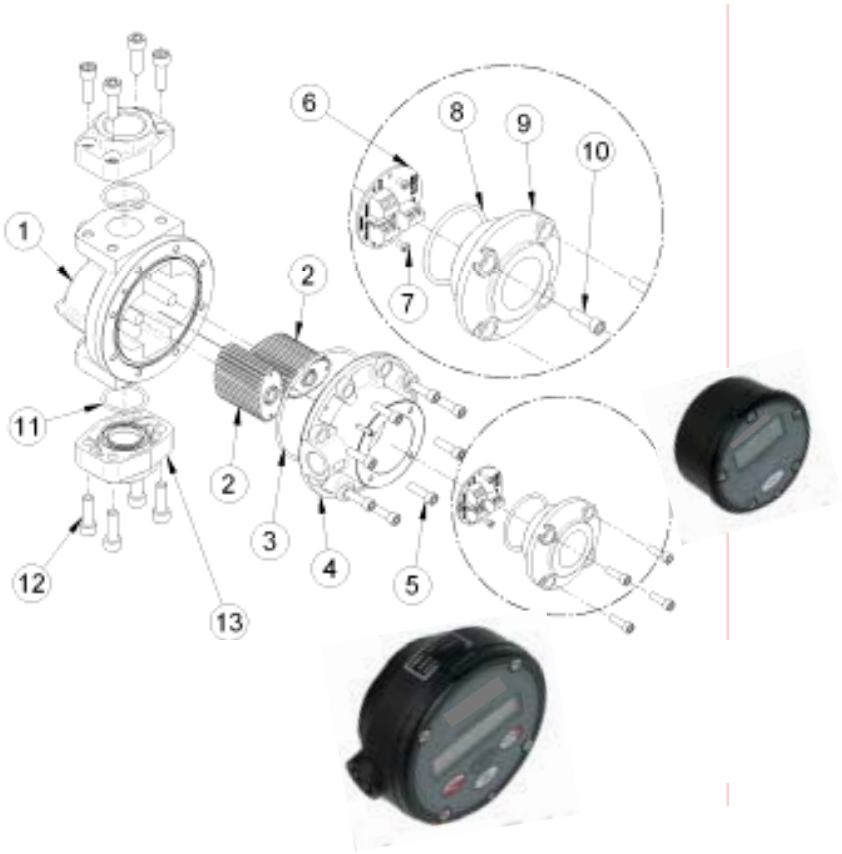
If required to gain access to the oval geared rotors undo the body screws (5), carefully pry the meter body apart avoiding misplacing or damaging the O-ring (3) and rotors (2).



DOM-x25… DOM-x40…

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 (screws 7).

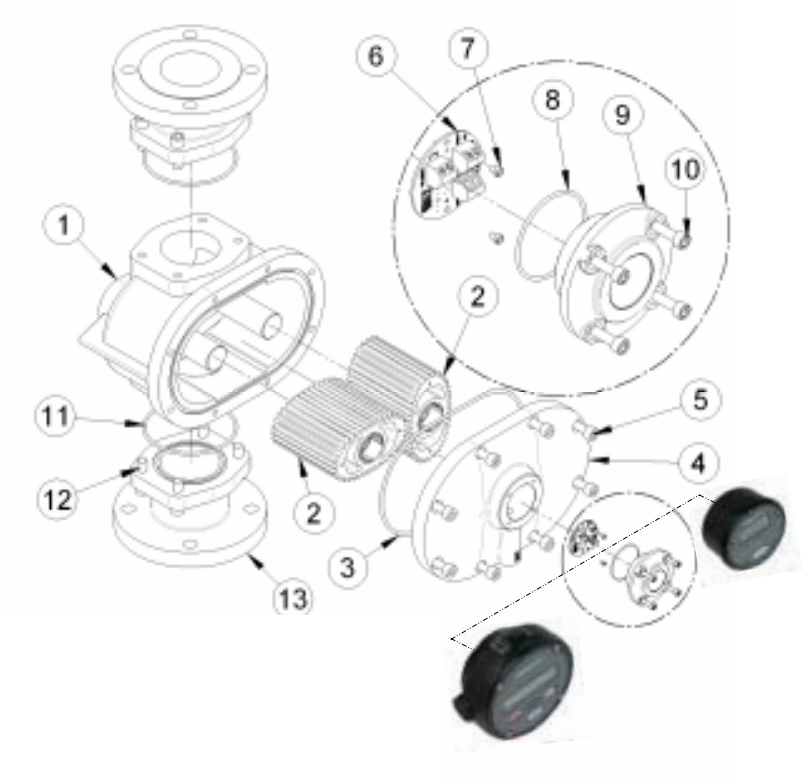
If required to gain access to the oval geared rotors undo the 8 body screws (5), carefully pry the meter body apart avoiding misplacing or damaging the O-ring (3) and rotors (2).



DOM-x45… DOM-x60…

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 (screws 7).

If required to gain access to the oval geared rotors undo the 8 body screws (5), carefully pry the meter body apart avoiding misplacing or damaging the O-ring (3) and rotors (2).



9.2 Dissassembly of meters fitted with an Instrument

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

9.3 Spare Parts

Please ask your next KOBOLD-Office
Internet: www.kobold.com

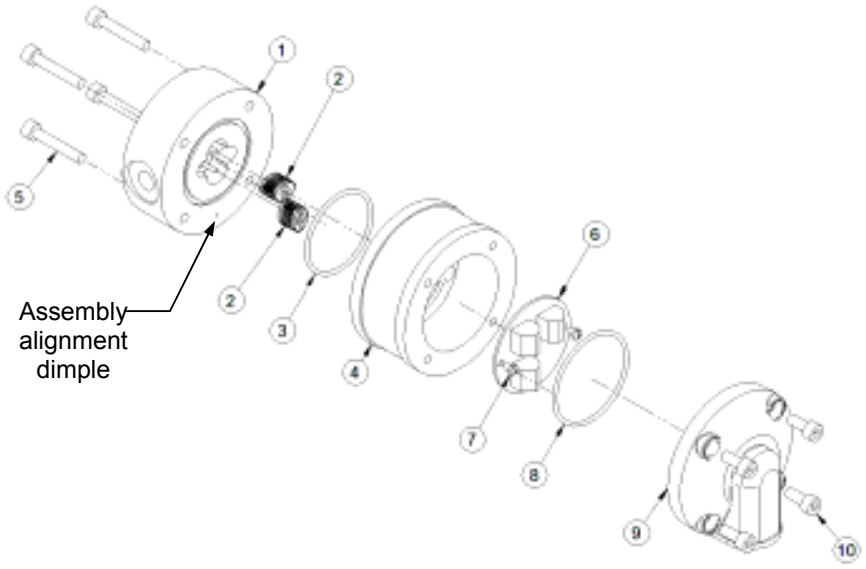
9.4 Inspection (refer Exploded View)

Inspect O-rings for damage, chemical attack, deformity or any form of deterioration.

Remove, inspect and clean the rotors, also check that the magnets have not been chemically attacked. Check the measuring chamber for damage or scoring & redress if necessary, the rotor shafts should NOT be loose or able to be rotated.

9.5 Re-assembly of pulse meter (Refer Exploded View)

DOM-x05…DOM-x15



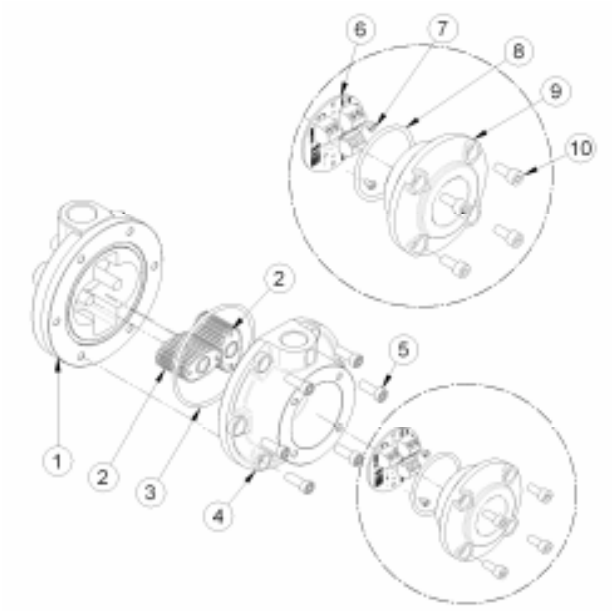
When re-installing the rotors all rotor magnets must be facing towards the pulse output board, magnets are concealed in all stainless steel rotors however their position can be detected using another magnet or ferrous object, aluminum rotors have visible magnets at the top of the rotors.

For small capacity meters (4 mm & 6 mm) re-install rotors by locating the dimple mark on the meter section which contains the rotor shafts. The shaft located closest to the dimple mark must be fitted with the driving rotor which is a rotor fitted with magnets. For larger meters (8 mm & above) the second rotor also contains magnets so either rotor may be fitted to either rotor shaft. 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.

Fit the O-ring into the groove and assemble the two parts of the meter (1 & 4), in the case of the small 4 mm & 6 mm meters ensure the dimples on each section (1 & 4) are aligned.

Fit the body cap screws (5) and tighten using a 1,3,2,4 sequence then torque in the same sequence to 3.5 Nm. This sequence and procedure ensures the meter bodies are assembled correctly and evenly. Fit the pulse output board, terminal cover or instrument as appropriate.

DOM-x20



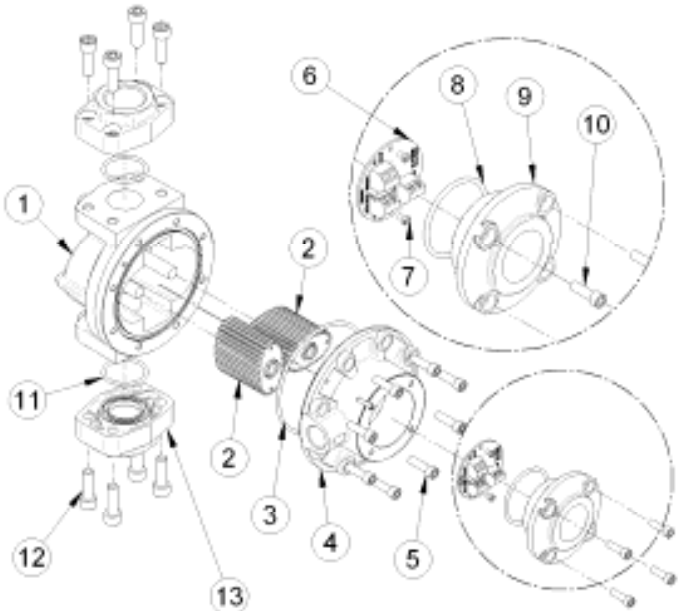
When re-installing the rotors all rotor magnets must be facing towards the pulse output board, magnets are concealed in all stainless steel rotors however their position can be detected using another magnet or ferrous object, aluminum rotors have visible magnets at the top of the rotors.

For meters (8 mm & above) both rotors contains magnets so either rotor may be fitted to either rotor shaft. 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.

Fit the O-ring into the groove and assemble the two parts of the meter (1 & 4)

Fit the body cap screws (5) and tighten using a 1,3,2,4 sequence then torque in the same sequence to 3.5 Nm. This sequence and procedure ensures the meter bodies are assembled correctly and evenly. Fit the pulse output board, terminal cover or instrument as appropriate.

DOM-x25…DOM-x40

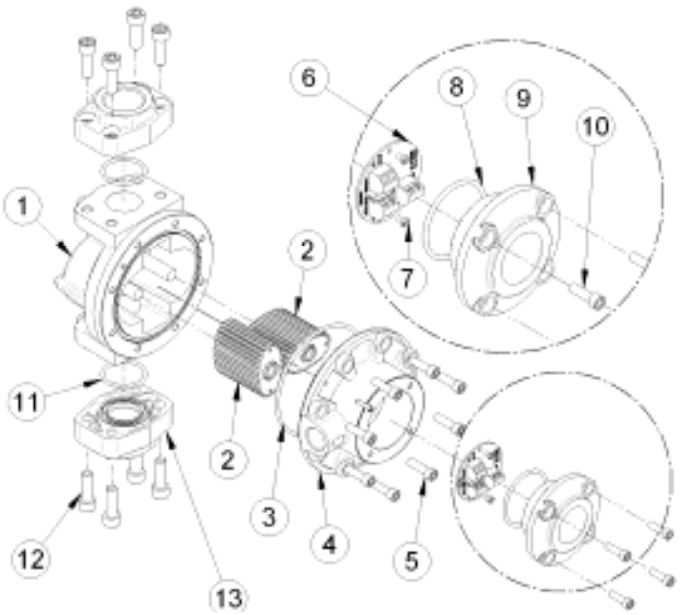


When re-installing the rotors all rotor magnets must be facing towards the pulse output board, magnets are concealed in all stainless steel rotors however their position can be detected using another magnet or ferrous object, aluminum rotors have visible magnets at the top of the rotors. Both rotors 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.

Fit the O-ring into the groove and assemble the two parts of the meter, the body & cap align with a location pin.

Fit the body cap screws (5) and tighten in a star sequence then torque in the same sequence to 3.5 Nm. This sequence and procedure ensures the meter bodies are assembled correctly and evenly. Fit the pulse output board, terminal cover or instrument as appropriate.

DOM-x45…DOM-x60



When re-installing the rotors all rotor magnets must be facing towards the pulse output board, magnets are concealed in all stainless steel rotors however their position can be detected using another magnet or ferrous object, aluminum rotors have visible magnets at the top of the rotors. 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.

Fit the O-ring into the groove and assemble the two parts of the meter, the body & cap align with a location pin.

Fit the body cap screws (5) and tighten in a star sequence then torque in the same sequence to 3.5 Nm. This sequence and procedure ensures the meter bodies are assembled correctly and evenly. Fit the pulse output board, terminal cover or instrument as appropriate.

10. Technical Information

Material:

DOM-A05...DOM-A15	
Body:	Aluminium
Gear wheels:	st. st. 1.4401
Bearing:	Ceramic
DOM-A20...DOM-A60	
Body:	Aluminium
Gear wheels:	Aluminium
Bearing:	Hardened steel rollers
DOM-S, DOM-H	
Body:	st. st. 1.4401 (SS 316)
Gear wheels:	st. st. 1.4401 (SS 316)
Bearing:	ceramic
DOM-D	
Body:	Ductile iron
Gear wheels:	Aluminium
Bearing:	Hardened steel rollers (only for lubricating fuels or oil)
O-Rings:	FPM (standard): -15...+120 °C EPR (Ethylene Propylene Rubber): -20...+120 °C (for ketones only) PTFE encapsulated FPM: -20...+120 °C NBR: -20...+100 °C
Cover:	glass reinforced nylon, st.st. (option)
Accuracy:	± 1 % of reading (DOM-x05...DOM-x15) ± 0,5 % of reading (DOM-x20...DOM-x35) ± 0,2 % of reading (DOM-x40...DOM-x60 turndown 15:1)
Repeatability:	typ. ±0.03 %
Protection class:	IP 66/67
Temperature range:	-20 °C...+80 °C for options Z and B and -20 °C…+120 °C for pulse output for options Z and B with cooling fins and for option M
Cable gland:	M 20x1.5 (standard), 1/2” NPT adapter (option)
Protection Approval:	
(Option Z4)	⟨Ex⟩II 2G EEx ia IIB T4 (-20°C ≤ Ta ≤ + 60°C)
(Options HE, DE)	⟨Ex⟩II 2G Ex d IIB T6 (-20°C ≤ Ta ≤ + 70°C)
	⟨Ex⟩II 2G Ex d IIB T4 (-20°C ≤ Ta ≤ + 120°C)
	⟨Ex⟩ I M2 Ex d I Mb *(Stainless Steel models only)*

Maximum pressure (threaded version):

Type	Maximum pressure [bar]			
	DOM-A..	DOM-S..	DOM-H..	DOM-D..
DOM-x05..	15	34	400	–
DOM-x10..	15	34	400	–
DOM-x15..	15	34	400	–
DOM-x20..	68 [1)]	68[1)]	400	–
DOM-x25..	68[1)]	68[1)]	400	–
DOM-x30..	30	30	400	–
DOM-x35..	20	38[2)]	300	–
DOM-x40..	12	–	–	–
DOM-x45..	12	12	–	12
DOM-x50..	12	–	–	-
DOM-x55..	10	–	–	10
DOM-x60..	10	–	–	-

with flanges, maximum pressure rating as above or as per flange rating, whichever is lower

1) restricted to max. 40 bar with options M1, M3

2) restricted to max. 30 bar with options M1, M3

12. 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. Also refer to Trouble Shooting Guide on following page.

Step 1 - Check application, installation and set up.
Refer to Mechanical Installation section for installation and application factors that may effect the meter operation including pulsation and air entrainment or incorrect meter selection including incorrect flow rate, temperature and pressure or materials compatibility. Refer to Electrical Installation for correct wiring.

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, 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 conditions.
A multimeter 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 pulse 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.

12.1 Trouble Shooting

Symptom	Possible cause	Solution
Meter readings are high	1. Output signal interference	1. Ground shield of signal cable
		2. Re-route cable from high electrical energy sources
	2. Entrained air or gas	1. Remove source of air or gas entrapment
		2. Install an upstream air eliminator
	3. Pulsating flow from reciprocating style pump	1. Increase back pressure on pump
		2. Install a fast response one way check valve
		3. Install a surge arrestor between pump & meter
		4. Re-calibrate meter in situ to compensate for pulsations
		5. Change pump style to smooth delivery type pump
Meter readings are low	1. Damaged or worn rotors	1. Inspect, repair, clean or replace rotors
	2. Damaged or worn measuring chamber	1. Inspect measuring chamber for damage - repair
		2. Check concentricity of rotor shafts within chamber
	3. Output signal interference	1. Ground shield of signal cable
		2. Re-route cable from high electrical energy sources
		3. Check all electrical terminations & wires for continuity.
No output from meter	1. Rotors fouled	1. Check that rounded teeth are towards base of chamber
		2. Check for obstruction due to foreign particles
		3. Clean, repair or replace rotors
	2. Meter incorrectly reassembled	1. See instructions for reassembly of meter with particular emphasis on positioning of rotors & magnets
	3. No output from output board	1. Check terminal connections & solder joints
		2. Ensure voltage is available at V_{DC} & 0 V and receiving instrument is fitted with a pull up resistor
		3. Replace output board
Not reading on readout instrument	1. Faulty receiving instrument	1. Check DIP switch settings & program data
		2. Check terminal connections & electrical continuity
		3. Repair / replace receiving instrument

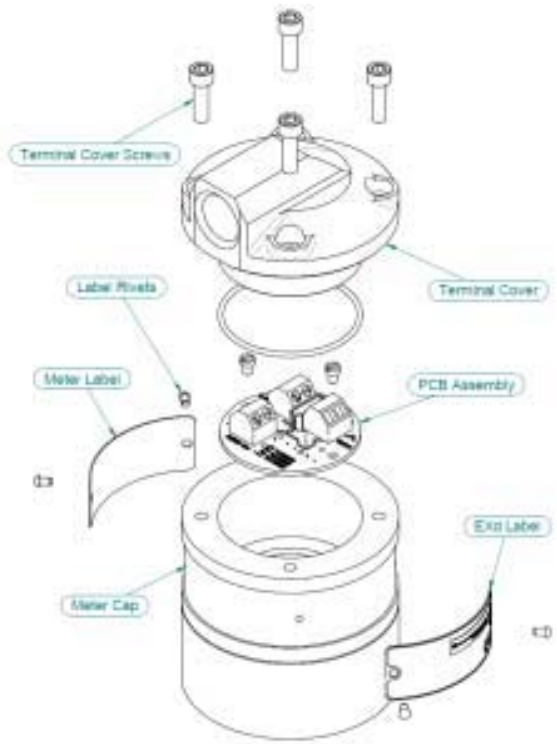
13. Exd Option

Products ordered with the optional Exd Explosionproof terminal enclosure are fitted with an Exd label plate (see image below) stating the relative apparatus grouping and temperature classification that applies to the flowmeter. The Exd label plate should be examined before installation or operation of this product. Apparatus groups are as follows:

Exd I: Apparatus for use in mines susceptible to fire-damp. Fire-damp is the natural gas given off by coal and carbonaceous strata in coal mines. **Stainless steel meters only** are suitable for use in Group 1, in accordance with IEC 60079-0:2004, clause 8.1.1, aluminum meters are **not** permitted in Group 1. When flowmeters carrying this label are to be used as a Group 1 (mines) apparatus, the surface temperature of the process fluid should not exceed 150ºC.

Exd IIB T4/T6: Apparatus for use in areas with an explosive gas atmosphere other than mines susceptible to fire-damp. Either aluminum or stainless steel flowmeters may be used in group II installations. When applied as a temperature class T6 apparatus the temperature of the process fluid passing through the flowmeter must be below 70ºC, and for temperature class T4 the temperature of the process fluid passing through the flowmeter must be below 120ºC.

Apparatus marked IIB are suitable for applications requiring Group IIB, or Group IIA apparatus. Exd certified apparatus should only be installed in hazardous areas according to the gas types to which they are certified.



Operational Notes:

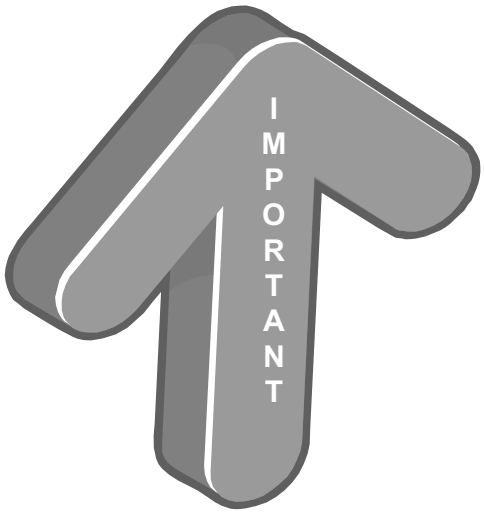
ISOLATE Exd APPARATUS AWAY FROM EXPLOSIVE ATMOSPHERES BEFORE REMOVING TERMINAL COVERS

The maximum allowable diametric clearance of the cylindrical joint between the terminal cover and the Exd meter cap must not exceed 0.15mm. If, through corrosion or wear, diametric clearance is increased to above 0.15mm, corroded or worn parts must be replaced.

The product does not comply with Exd requirements unless terminal covers are fully engaged and fastened. Do not use terminal cover screws of different size or grade to those originally fitted.

Each meter has been calibrated on mineral oil and will contain a small amount of oil residue.

The oil used is Castrol Diesel Calibration Fluid 4113 (product code 055830).



14. Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Gear Wheel Flow Meter Model: DOM

to which this declaration relates is in conformity with the standards noted below:

EN 60079-0: 2004
Electrical apparatus for explosive gas atmosphere - Part 0: General requirements

EN 60079-0: 2004
Electrical apparatus for explosive gas atmosphere - Part 1: Flameproof Enclosures

EN 13463-1: 2009
Non electrical equipment for use in potentially explosive atmospheres:

Applicable to the following Meters Model Numbers:
DN 4 (1/8”) to DN 100 (4”) Flowmeters with Electronic Pulse Output
DN 15 (1/2”) to DN 100 (4”) Flowmeters with M Series Mechanical Registers

EN 60529, DIN VDE 0470-1 1992-11
I.P. Ingress Protection Classifications

EN 61326-1: 2006-10
Electrical equipment for control, instrumentation technology and laboratory use – EMC requirements (Industrial area)

EN 61010-1: 2002-08
Safety requirements for electrical equipment for measurement, control, and laboratory use –

2008/35/EC Waste Electrical & Electronic Equipment (WEEE)

Also the following EEC guidelines are fulfilled:

2004/108/EG Electro Magnetive Compatibility
2006/95/EC Low Voltage Directive

Hofheim, 31. May 2011

H. Peters
General Manager

M. Wenzel
Proxy Holder

15. Manufacturers declaration – Switches for use in Explosive Atmospheres

Background

a) Simple apparatus such as Mechanical contact switches, Reed switches, Thermocouples, Resistive sensors & LED's may be employed in a hazardous area without certification provided that the device does not generate or store more than 1.2 V, 0.1 A, 20 µJ and 25 mW. This IEC definition is also now used in the USA & Canada.

b) The surface temperature of simple apparatus under normal or fault conditions must not exceed the ignition temperature of the gas, subject to the following very valuable exception.

c) Because the ability of hot surfaces to cause ignition depends on their size, simple apparatus having a surface area between 20 mm² and 100 mm² will be classified T4 when the matched output power of the interface device does not exceed:

1.3W into 40 ºC ambient
1.2W into 60 ºC ambient
1.0W into 80 ºC ambient

The 1.3 W / 40 ºC element of this European dispensation is now accepted in the USA and Canada. Switches (mechanical & reed switches) and junction boxes dissipate no power and are normally classifies T6 (85 ºC).

These simple apparatus can be installed freely in I.S. circuits, no certification is required.

Reed switch | Thermocouples | Resistive sensors | LED

Declaration

This declaration cites Kobold Messring GmbH as manufacturer of a range of propriety industrial flowmeters most of which incorporate one or more Reed switches qualifying as simple apparatus in accordance with European, USA & Canadian guidelines.

Hofheim, 31. May. 2011

H. Peters
General Manager

M. Wenzel
Proxy Holder

11. Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Batch Controller **Model: ZOD-B1K**

to which this declaration relates is in conformity with the standards noted below:

EN 60529, DIN VDE 0470-1 **1992-11**
I.P. Ingress Protection Classifications

EN 61326-1: 2006-10
Electrical equipment for control, instrumentation technology and laboratory use – EMC requirements (Industrial area)

EN 61010-1: 2002-08
Safety requirements for electrical equipment for measurement, control, and laboratory use
2008/35/EC Waste Electrical & Electronic Equipment (WEEE)

Also the following EWG guidelines are fulfilled:

2004/108EC **EMC Directive**
2006/95 EC **Low Voltage Directive**

Hofheim, 8. Nov. 2010

H. Peters
General Manager

M. Wenzel
Proxy Holder

Manufactured and sold by:
Kobold Messring GmbH
Nordring 22-24
D-65719 Hofheim
Tel.: +49(0)6192-2990
Fax: +49(0)6192-23398

K01/1110

Universal Mount Series

BATCH CONTROLLER Model ZOD-B1K

INSTRUCTION MANUAL

Software versions	
V 3.0	01.09.04
V 3.1	11.02.08

Replacement Battery:

Supplied battery

P/No. ERS-ZOD-1312007

3.6V x 2.4Ah AA
– Lithium Thionyl Chloride +
non - rechargeable cell

Suitable batteries also available from :

R S Components	***Farnell Components***
Stock No. 596-602	Order code 206-532

1.1 Model number designation

Order Details (Example: ZOD-B1KS1F300)

Model	Housing Type	Electrical connection/ Cable gland	Supply Voltage	Options	Mechanical protection
ZOD-B1	**KS** = universal mount (standard) **KM**[1] = integral mount	**1** = 3 x cable entry M20 **2** = 3 x cable entry 1/2" NPT	**F3** = 8…24 VDC, Battery **F1**[2] = 110 VAC, 8…24 VDC	**0** = without **R** = 2 x Relay (for ZOD-B1K)	**0** = without **S**[2] = silicone bezel boot
	PP = panel mount (IP20)	**0**[2] = screw terminal	**F0**[2] = 220 VAC, 8…24 VDC		

[1] order only when retrofitting a pulse meter
[2] only possible with ZOD-B1PP...

Part No.	ACCESSORIES FOR ABOVE SERIES: Model: ERS-ZOD-...
1522001	stainless steel wall mount kit
1522002	stainless steel 2" pipe mount kit
1522011	DOM series cooling fin kit for flowmeters with integral instruments
1522005	DOR & Turbine stem adaptor - metric *(M16 to M20)*
1522006	DOR & Turbine stem adaptor - USA *(M16 to 1/2" NPT)*
1323006	DOR-42 stem *(100mm effective height, threaded M16 male)*
1323011	DOR-52 stem *(350mm effective height, threaded M16 male)*
1412063	Relay contol output board with two SPCO relays

1.2 Specifications

Display :	8 digit alpha numeric LCD characters 9mm (0.35 ") high with second line sub script text. 8 digits totalising, 3 programmable decimal points, 5 digits for Total number of batches.
Functions :	Batch total, Accumulated total & Total number of batches (TNB).
Configuration :	Flow chart entry of data with scrolling English text prompts. User selectable 4 digit PIN number set-up protection. Programmable decimal points and K-factors. All programmed data and batch status are E^2PROM protected in the event of a power failure.
Signal Input :	Universal pulse/frequency input compatible with Reed switch, Hall effect, Namur proximity detectors, Pulse wire, voltage, current & Coil *(15mV P-P min).* Max. input frequency 10Khz.
Power requirement :	Regulated 12~24Vdc x 50mA *(add switched current).*
Battery :	3.6Vdc lithium battery annunciates a power loss & preserves batch settings & progress at time of power loss.
Control outputs :	Two independent NPN open collectors, 1A dc resistive load max. May be link configured for PNP to drive compatible logic circuits.
Alarm / pulse output :	NPN-PNP solid state alarm or non-scaleable pulse output @ terminal 7, (5000hz max.), 1A maximum drive capability.
Batch status output :	NPN open collector, 0.1A dc resistive load max. *(page 16).*
K-factor range :	Eg. Pulses/litre, gallon, lb etc. Programmable range is 0.001~ 9999999.999 with a floating decimal point during K-factor entry.
Engineering units :	Selectable Ltr, gal, m3, kgs, lbs *(maximum 8 digits of batch).*
Count direction :	Count UP or count DOWN selectable at program level.
Automatic overrun : compensation	AOC enabled-disabled selection at programming level (*page 13).*
Batch limiting :	Batch size limits can be set at programming level *(page 13).*
Run inhibit input :	Run key can be inhibited from an external source *(page 16).*
Network I/O :	A two wire loop system can link up to 9 individual batch controllers with one common flowmeter to provide an economical multi source/dispense interlocked batching system *(page 18)* .
Physical :	A) IP66 / 67 high impact glass reinforced Polyamide enclosure. B) 3 x M20 or ½" NPT female conduit entries. C) 125mm diameter (5") x 61mm deep (2.5") x 400g (0.9lb). D) Temperature range from -20ºC to +80ºC (-4ºF to +176ºF).

1.3 Overview

The ZOD-B1 is a dc powered high speed batch controller specifically designed for liquid batching using a flowmeter with a pulse or frequency output.

ZOD-B1 is push button programmable with PIN protection and an internal battery is provided allowing pre-programming without applying power. The large LCD provides batch quantity in selected engineering units, batch status and has scrolling English prompts to make programming easy.

Two independent output relays, the second with programmable start delay and pre-stop, enable pump and valve control or 2 stage flow phasing at the start and end of each batch. Precise batching is aided by Automatic Overrun Compensation which, when enabled, automatically manages variations in system time lags which could otherwise lead to discrepancies in dispensed quantity.

Safety features includes for an alarm output and automatic cessation of batching if no flow input is detected and programmable batch limiting protects against setting an oversize batch quantity. Scrolling messages on the LCD annunciate any alarm fault conditions.

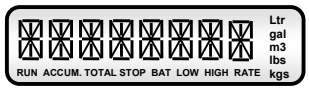
Control features include batch count up or down, remote operational switch interface, run inhibit interlock and batch status output. The ZOD-B1 is capable of networking with up to 9 batch controllers using one common flowmeter.

Environments

The ZOD-B1 is designed to suit harsh indoor and outdoor industrial environments & conforms to EMC directives. The housing is weatherproof to IP66/67 (Nema 4X) standards, UV resistant, robust glass re-enforced plastic with stainless steel screws & FKM O-ring seals.

ZOD-B1 can be mounted on a variety of flowmeters or as a stand alone instrument for wall, surface, pipe or panel mount. Various mounting kits are available.

1.4 LCD displays



Full LCD display test feature illuminates all display segments and script text displays for 5 seconds when entering the program mode.

Up to 8 digits of **Batch** quantity programmable for up to 3 decimal places. English prompts clearly show the status of the batch.

An 5 digit **TNB** display shows the Total number of batches dispensed since last reset *(reset of TNB and Accumulative Total is only possible whilst in the program mode).*

The 8 digit **Accumulative Total** display can be programmed for up to 3 decimal places. Reset is only possible when in the program mode which can be PIN protected for security.

2. OPERATION

2.1 Batch set : Pressing the Batch set key allows the user to enter a batch value by using the arrowed keys to select the appropriate digits and change their value. Pressing Batch set again enters & confirms that the new batch value has been entered.

2.2 Run : Press RESET then RUN to start the batch. If there are no interruptions the batch controller will automatically stop the batch once the batch value has been reached.

2.3 Stop : Pressing the STOP key at any time during the batch will cause the batcher to go into a "PAUSED " state and the output relays will be turned off. At this point the user can resume batching by pressing the RUN key or abort the batch by pressing the RESET key.

2.4 Batch Total : The batch value is displayed in all normal operational modes.

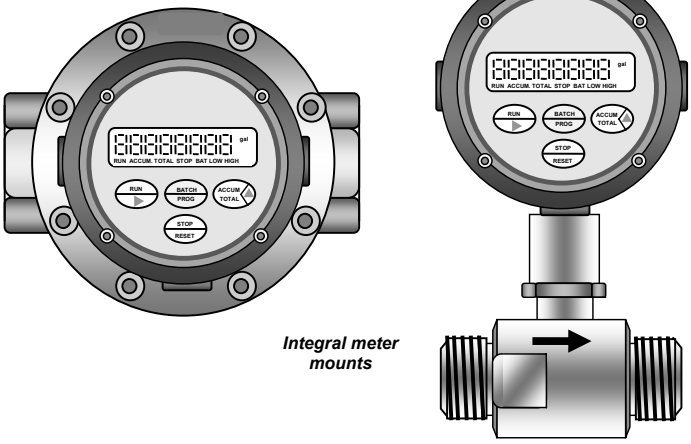
2.5 Accumulative Total : Accumulative total can be reset in the program mode. The accumulative total is displayed momentarily by pressing the ACCUM TOTAL key.

2.6 TNB display (Total number of batches) **:** ZOD-B1 will accumulate the total number of individual completed batches. Reset of TNB is simultaneous with the resetting of the Accumulative total in program mode. To view the TNB value simultaneously press & hold the two top right hand keys (Prog. & Accum Tot).

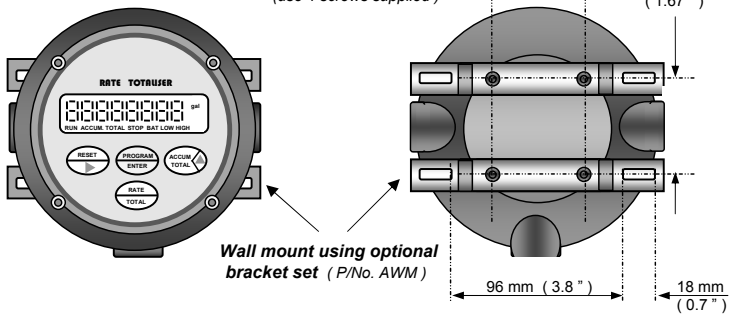
2.7 Keypad functions :

KEY	FUNCTION IN OPERATING MODE	FUNCTION IN PROGRAM MODE
BATCH SET	1) Enters & Exits the batch set mode. 2) May be pressed during batching to show batch pre-set value, this action will not interfere with the batch process.	No function
	Selects the digit to be Indexed (digit will flash)	Increments the selected digit (selected digit will be flashing)
RUN	1) Starts a batch 2) Resumes a batch if paused	No function
STOP	Pauses a batch during batching	Pressing PROG & STOP keys for 5 sec. gives entry to the program mode
RESET	1. Resets the batch to the last pre-set value. 2. Resets individual digits to zero when in the BATCH SET mode.	No function
ACCUM TOTAL	1) Displays Unit ID number followed by the Accumulative Total as the key is held. 2) Displays total number of batches (press Accum. Total & Prog. keys at the same time)	No function
PROGRAM	Pressing PROGRAM & ACCUM TOTAL keys displays the Total Number of Batches (TNB)	1) Pressing PROGRAM & STOP keys for 5 seconds gives entry to the program mode. 2) Steps you through the program ladder. 3) Holding for 3 secs. fast tracks to end prog.

3.1 Mounting



Integral meter mounts



Surface mount footprint
(use 4 screws supplied)

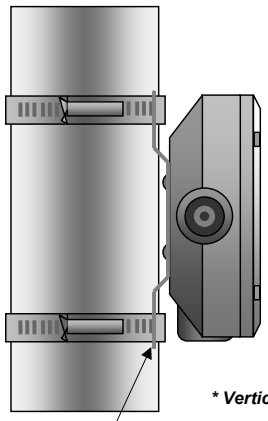
42.6 mm (1.67 ")

Wall mount using optional bracket set *(P/No. AWM)*

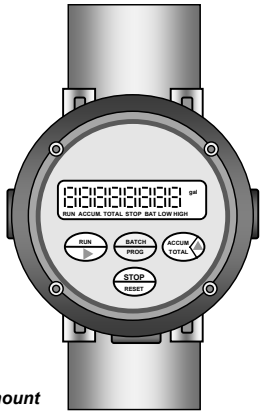
96 mm (3.8 ")

18 mm (0.7 ")

3.1 Mounting

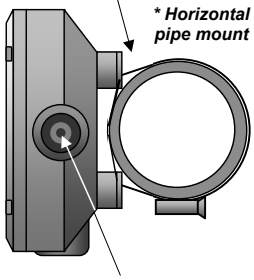


**** Vertical pipe mount***



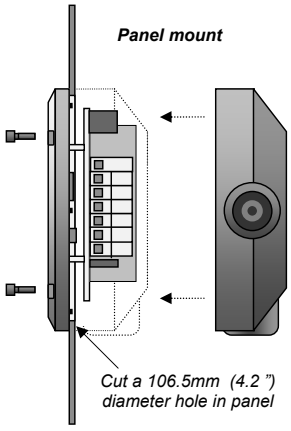
** order Pipe mount kit P/No. APM comprising two brackets, screws and worm drive clamps.*

**** Horizontal pipe mount***



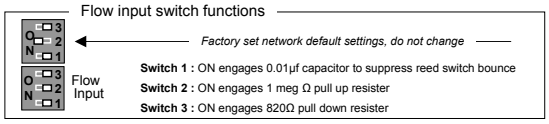
Conduit entries have an integral moulded seal, to remove break seal out using suitable lever (eg. screwdriver or rod)

Panel mount

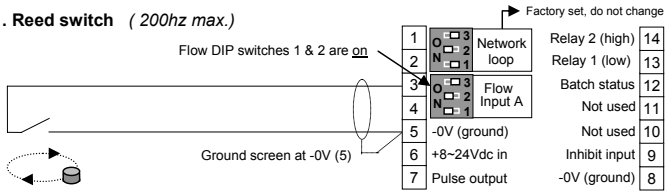


Cut a 106.5mm (4.2 ") diameter hole in panel

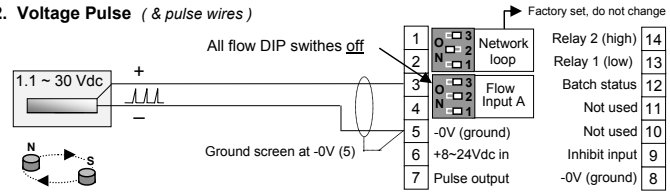
3.2 Flowmeter connections (un powered sensors)



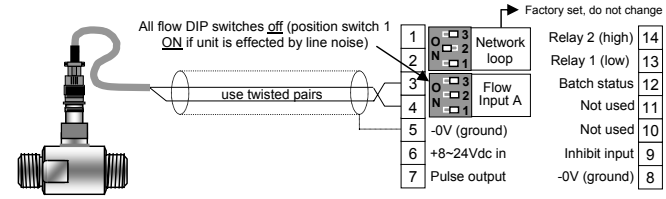
1. Reed switch *(200hz max.)*



2. Voltage Pulse *(& pulse wires)*

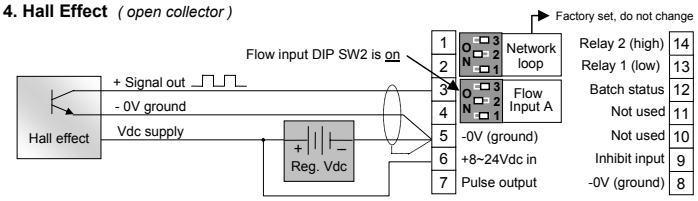


3. Coil *(Turbine & paddle style flowmeters)*

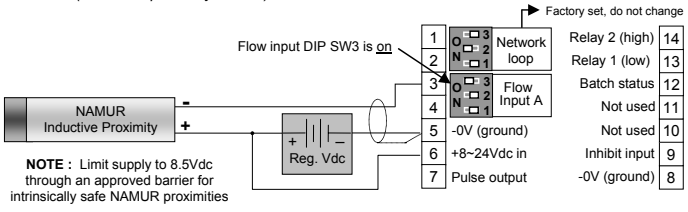


3.2 Flowmeter connections (powered sensors)

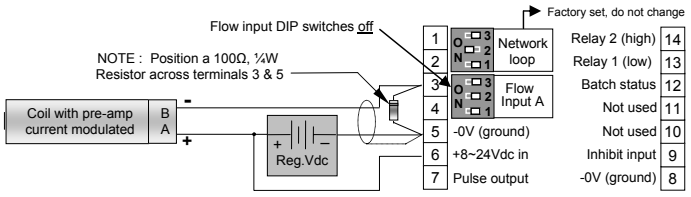
4. Hall Effect *(open collector)*



5. Namur *(inductive proximity switch)*

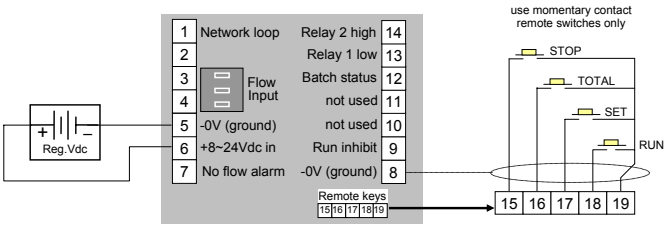


6. Current modulated pulse
(4mA to 20mA pulse amplitude)



3.3 Wiring connections

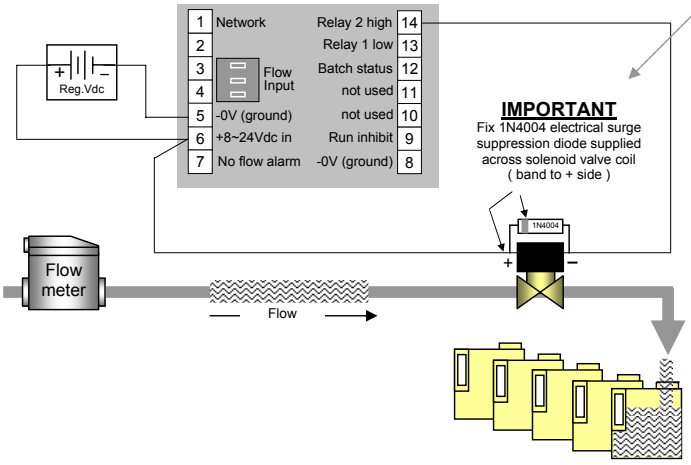
Powering & Remote switches *(remote keys)*



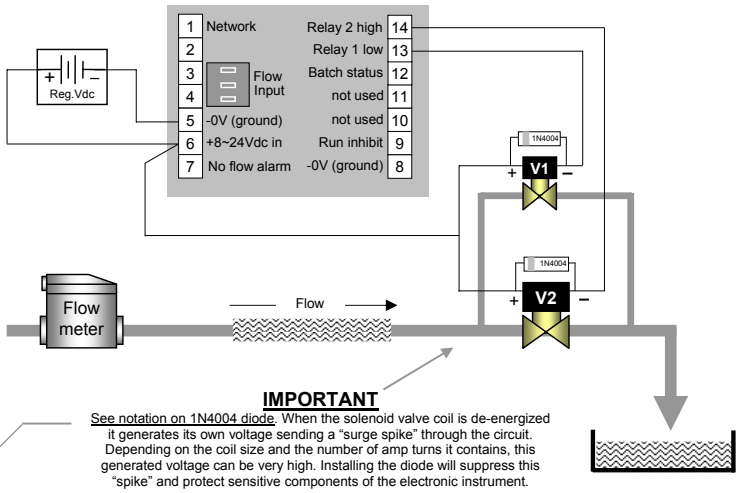
Wiring requirements : Use multi-core screened twisted pair instrument cable (0.25~0.5mm^2) for electrical connection between the ZOD-B1 and any flowmeter or remote switch input. The screen needs to be grounded at -0V (terminal 8), this is to protect the transmitted signal from mutual inductive interference.

Instrument cabling should not be run in a common conduit or parallel with power or high inductive load cables. Power surges & power line frequencies may induce erroneous noise transients onto the signal. Run instrument cables in a separate conduit or with other instrument cables.

Single Stage Control *(use relay 1 or 2, relay 2 has pre-stop programming capability)*



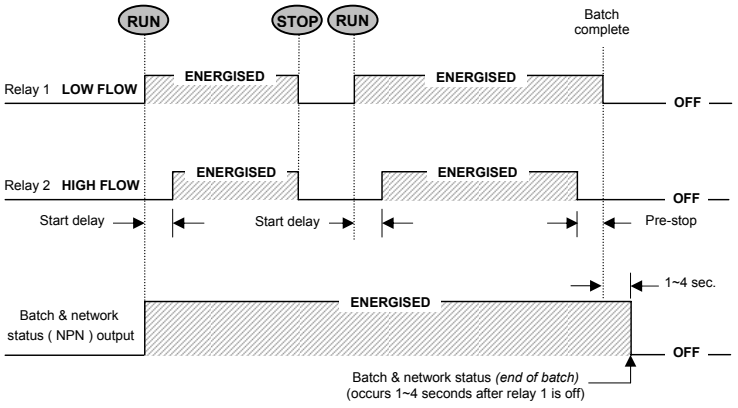
Two Stage Control *(using relays 1 & 2)*



IMPORTANT

See notation on 1N4004 diode. When the solenoid valve coil is de-energized it generates its own voltage sending a “surge spike” through the circuit. Depending on the coil size and the number of amp turns it contains, this generated voltage can be very high. Installing the diode will suppress this “spike” and protect sensitive components of the electronic instrument.

Relay Control Logic



4. PROGRAM PARAMETERS

4.1 PIN No. Program Protection
Any user defined PIN number other than 0000 will engage the program protection feature, failure to input the correct PIN number will deny the ability to change any of the program parameters but will allow the user to step through and view the existing program parameters.

Only one PIN number may be set but this can be changed at any time after gaining access through PIN entry. A second back up PIN number is installed at the factory should the programmed PIN be lost or forgotten. (refer bottom of page 19 for the back up PIN No.)

4.2 Resetting Accumulated Total & Total Number of Batches *(TNB)*
Resetting the Accumulated Total & Total Number of Batches (TNB) is done at "RESET ACCUMULATIVE TOTALS " in the program mode. Both Accumulated Total & TNB are reset if you select YES at this program level.

4.3 Engineering Units *(refer clause 1.4)*
Select from available Engineering units to right of the display. No engineering units denote NIL set allowing the user to set up the instrument with other units of measure which are not available on the ZOD-B1 LCD display.

4.4 K-factor *(scale factor)*
Enter K-factor starting with the most significant number, up to 7 prime numbers & 3 decimal numbers can be entered. Trailing decimal numbers move into view as digits to the right are progressively selected, any significant digits which may move from view remain functional.

4.5 Decimal Points
Up to three decimals points can be selected for Batch Total or Accumulative Total.

4.6 Count Direction
B1 can be programmed to count DOWN from a preset quantity or UP from zero.
Overruns in the count down mode will show with a minus sign in front of the overrun value.

4.7 Start Delay & Pre-Stop
Relay 2 can be programmed to turn on a time period after the run signal is given then turn off again a preset number of litres, gallons etc. before the end of the batch. These operational features provide greater control over the dynamics of the batching process through soft start and/or soft stop or phasing of the control valves and/or pump control.

The Start Delay can be set from 0 seconds (no delay) to 999 seconds. The pre-stop range is 0 (no pre-stop) to 999 units of measure (litres or gallons etc.).

4.8 Automatic Overrun Compensation (AOC)
Most batching applications will have an inherent end of batch overrun due mainly to the response time of the process valve. Overrun can be compensated by closing the valve slightly before the batch value is reached so that the exact batch value is achieved by the time that the system comes to rest.

ZOD-B1 has an Automatic Overrun Compensation feature which when enabled will assess the degree of overrun on previous batches and automatically alters the close timing of the process valve so that the exact batch value is reached. This feature should not be enabled on batch processes which are subject to erratic or inconsistent flow conditions.

4.9 Missing Pulse Detection
When a value other than 00 seconds is set at Time Out (T / OUT) in the program mode, ZOD-B1 will monitor for loss of flowmeter input signal at all times when either of the control relays 1 & 2 are energised. If no pulses are received within the time out period (0~99 sec.) the controller will de-energise both control relays and scroll a "NO INPUT" message across the LCD display, at the same time it will turn on the "no flow alarm" output at terminal 7*, (see page 17 for flow alarm connection detail).*

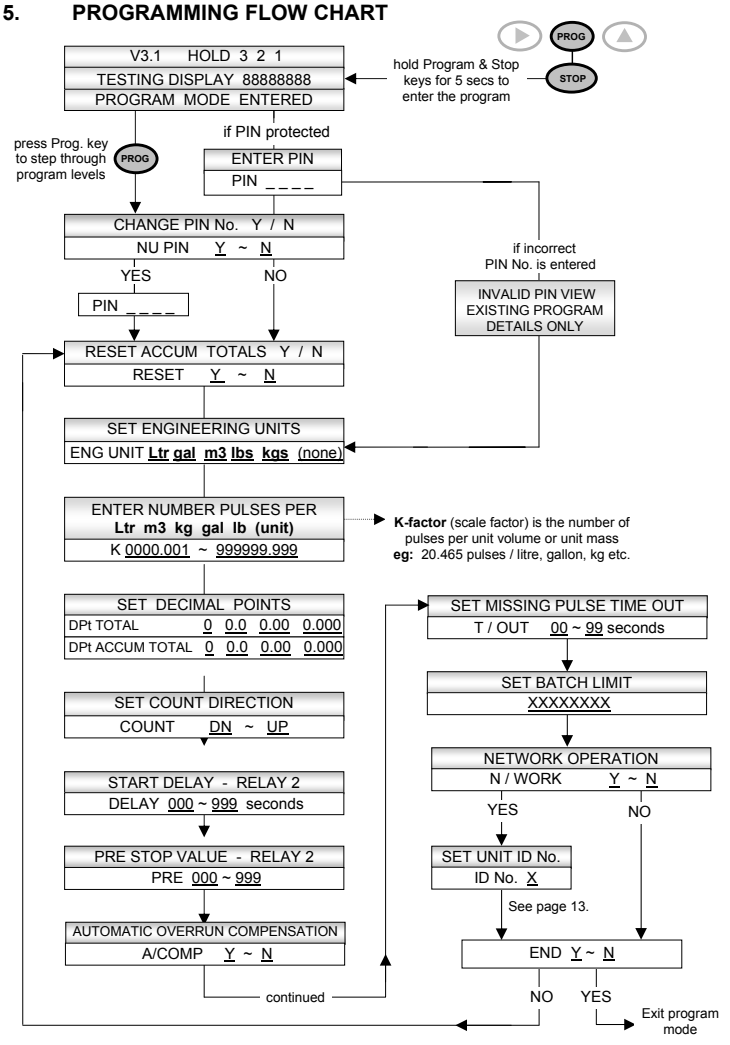
At "NO INPUT " the user must acknowledge the alarm condition by pressing the STOP key once, the operator then has the option of continuing the batch by pressing the RUN key or aborting the batch by pressing the RESET key which will return the controller to the original batch set value.

4.10 Batch Limit
To avoid entering excessive batch quantities, a maximum batch limit can be set at the program level. ZOD-B1 will not accept a batch value which exceeds the batch limit, on rejecting an excessive batch value the controller will scroll the message "BATCH VALUE EXCEEDS BATCH LIMIT" and default to the batch limit on entry (batch set).

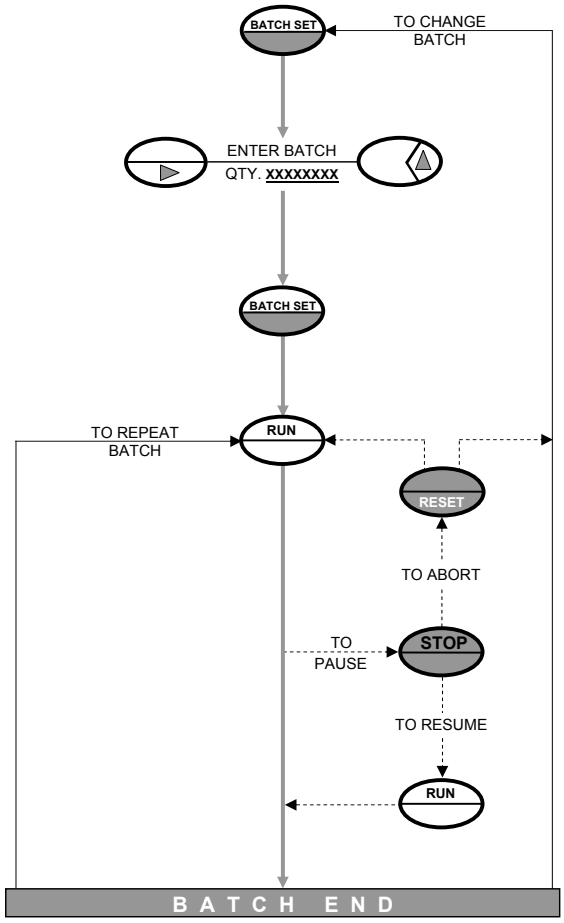
4.11 Controller networking ID number
Each controller can be given a networking ID number in the range of 1~9. Allocating an ID number other than 0 is only necessary when a number of controllers are to be networked together for interlocking purposes *(see page 18 for Controller Networking)*. Setting the ID number to zero inhibits this function.

Note : The instrument defaults out of the program mode if no program entries are made after 4 minutes.

5. PROGRAMMING FLOW CHART



6. BATCH OPERATING PROCEDURE

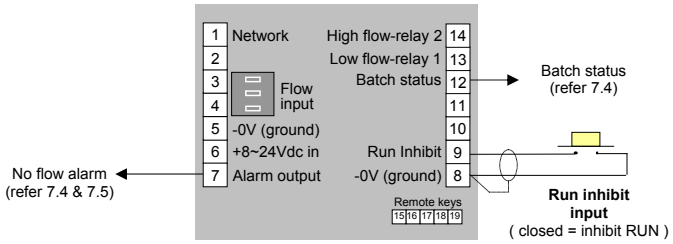


7. SECONDARY I/O

7.1 Batch Status Output

A solid state NPN output signal is switched on at terminal 12 when a batch is started, the signal remains on until the batch cycle is completely finished or the batch is stopped and aborted using the STOP & RESET keys.

The output is used to notify other control equipment when ZOD-B1 is in operation or is paused *(by pressing STOP)* or inhibited through an input at terminal 9 *(RUN inhibit),* the signal remains on under all three conditions. The signal can also be used to inhibit *(lock out)* other equipment whilst the controller is in use.



7.2 Alarm Output

An NPN/PNP selectable solid state output signal *(terminal 7)* is activated when the missing pulse detection feature detects a no flow condition *(refer 4.9).* NPN/PNP selection is to be in accordance with the connection options on the following page (17).

7.3 Run Inhibit Input

The RUN inhibit feature enables ZOD-B1 to interlock with other devices within the system or process when ZOD-B1 is in use.

When a contact is made across the Run inhibit input at terminal 9, a batch cannot be started and at the same time an “ENGAGED “ prompt will show on the LCD display. If the inhibit contact is made whilst a batch is running the batch will be paused. When the run function is inhibited it is still possible to enter a new batch quantity or review the accumulated totals but it will not allow the operator to RUN or re-start the batch until the inhibit input is released.

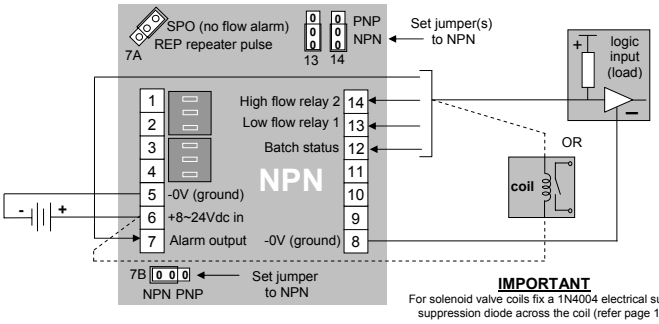
An example of this feature in practice is where a batch should not be allowed to RUN whilst a valve at another location is open.

7.4 Current Sinking outputs (NPN)

Current sinking derives its name from the fact that it “sinks current from a load”. When activated the current flows from the load into the appropriate output (terminals 7, 12, 13 & 14). NPN is the factory default configuration for the outputs. Refer to pages 10 & 11 for wiring control outputs.

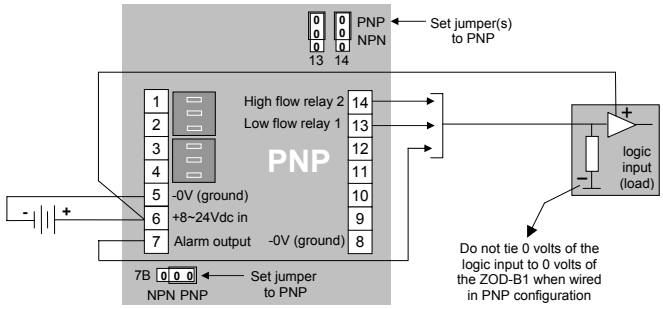
Driving a logic input ———— The output voltage pulse is typically the internal voltage of the load. The load would normally have an internal pull up resistor on its input as shown.

Driving a coil - - - - - - - The NPN style of output is to be used when driving a coil. The coil load is obtained by dividing the coil voltage by coil impedance (Ω), is expressed in amps & is not to exceed 100mA at terminals 7 & 12 or 1A at terminals 13 & 14. The coil voltage is connected across & must match the ZOD-B1 supply voltage & the appropriate output (terminals 7, 12, 13 & 14).



7.5 Current Sourcing outputs (PNP)

Current sourcing gets its name from the fact that it “sources current to a load”. When activated the current flows from the output (7,13 & 14) into the load. When wired as below the output voltage pulse is the supply voltage of the load. The load would normally have an internal pull down resistor on its input as shown.



8. CONTROLLER NETWORKING

ZOD-B1 has a unique networking feature which allows up to 9 individual batch controllers to be networked together with each being connected to one common flowmeter *(see opposite)*.

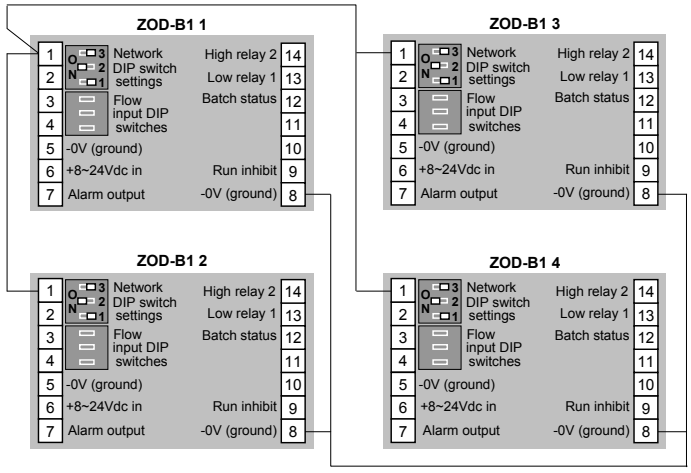
Typical applications are where one liquid is being dispensed to a number of individual outlets or a number of different liquids are to be batched via one common flowmeter. In either application each batch controller is wired to the same flowmeter but controls its own process control valve.

Networking takes place when any one controller is started, at this point the flowmeter input (count) is restricted to the controller in use, all other controllers will not count and their start function will be inhibited and an “ENGAGED” will scroll across the LCD display showing the ID number of the controller in use.

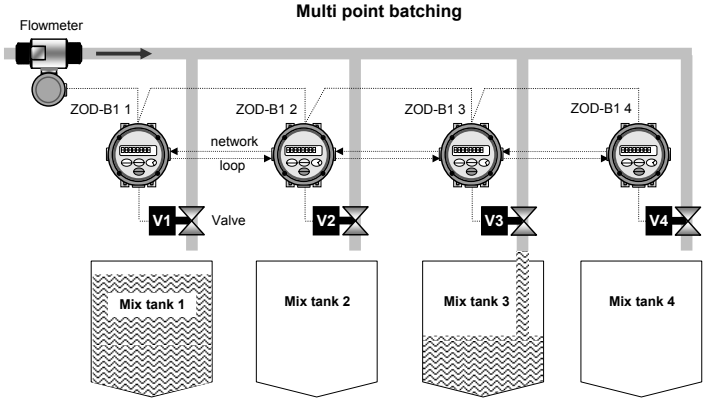
Batch entries can be made whilst individual batch controllers are inhibited (locked out) but they cannot be started until the controller in operation has completed its batch cycle.

For the network feature to work the network DIP switches must be set as shown & each batch controller MUST be programmed with an individual ID number other than 0 (zero).

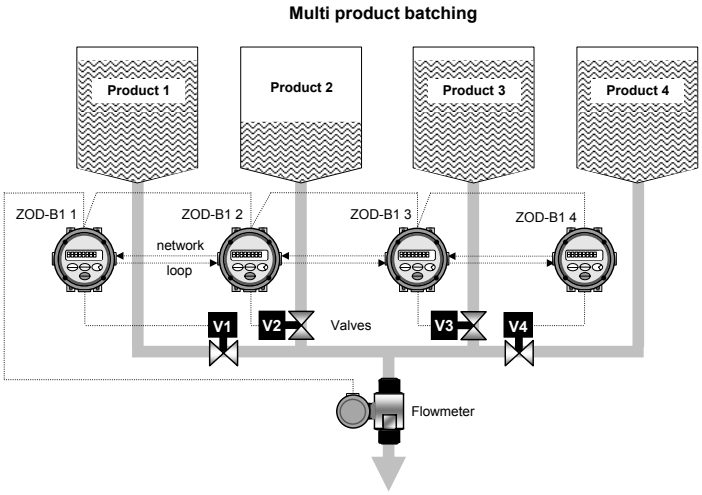
Network loop wiring



Multi point batching



Multi product batching



9. REFERENCE INFORMATION

9.1 *Program detail*

Pencil your program details here

User selected PIN No.	
Engineering units	
K-factor *(scale factor)*	K =
Decimal for batch total	☐ 000. ☐ 00.0 ☐ 0.00 ☐ .000
Decimal for Accum. total	☐ 000. ☐ 00.0 ☐ 0.00 ☐ .000
Count direction	☐ count DOWN ☐ count UP
Start delay on relay 2	seconds
Pre-stop value on relay 2	
Automatic overrun comp.	AOC ☐ yes ☐ no
Missing pulse time-out	seconds
Batch limit	
Unit ID number (1~9)	(0 = inhibit network function)

9.2 *Error messages:*

ZOD-B1 has a series of error messages which are scrolled across the LCD display when ever an error condition exists.

NO POWER	No power indicates that the instrument is on battery power only and needs to be supplied with an external power source in order to operate.
NO INPUT	No input (missing pulse detection) indicates that no pulses were received at the controller input within the time out period at any stage of the batch cycle. (see clause 4.9)
BATCH VALUE EXCEEDS BATCH LIMIT	The new batch value will not be accepted because it exceeds the maximum batch limit value. (see clause 4.10)
PRE-STOP EXCEEDS BATCH VALUE	The new batch value will not be accepted as it is less than the pre-stop value (clause 4.7)
WAIT	This message will show if the RUN button is pressed whilst the controller is in the process of assessing the degree of overrun from the previous batch when AOC is enabled.

9.3.1 *Back up PIN number* (see clause 4.1)

Cut from manual for increased security

Your back up 4 digit PIN number is 0502

10. ALPHABETICAL INDEX

Manufactured and sold by:

Kobold Messring GmbH
Nordring 22-24
D-65719 Hofheim
Tel.: +49(0)6192-2990
Fax: +49(0)6192-23398

Universal Mount Series

ZOD-Z1 BATTERY TOTALISER

INSTRUCTION MANUAL

K01/1010

To review software version No's press & hold program key

Replacement Batteries:

Factory supplied batteries :	
Non I.S. battery P/No. 1312007	

3.6V x 2.4Ah AA
Lithium Thionyl Chloride
non - rechargeable cell

Suitable non I.S. batteries also available from :	
R S Components Stock No. 596-602	***Farnell Components*** Order code 206-532

TABLE OF CONTENTS

1. INTRODUCTION

Model	Housing Type	Electrical connection/ Cable gland	Supply Voltage	Options	Mechanical protection
ZOD-Z1...	**KS =** universal mount (standard) **KM* =** integral mount	**0 =** cable gland supplied (suits 3...6 mm Ø cables)	**F3=** 8...24 V_{DC}, battery	**0=** without	**0=** without

*order only when retrofitting a pulse meter

1.2 Specifications

Display : 5 digit resettable LCD totaliser 7.5mm (0.3") high with second line 8 digit accumulative total display & text 3.6mm (0.15") high. 3 programmable decimal points with both display lines.

Signal Inputs : Universal pulse-frequency input compatible with Reed switch, Hall effect, Coil-sine *(20mV P-P min.),* Voltage or current pulse & Namur proximity detectors. Maximum input frequency is 5Khz for coils, 2.5Khz for Hall effect & current pulse inputs, 2Khz for voltage pulse devices & 500Hz for a Namur proximity sensor.

Powering : 3.6Vdc Ultra Lithium battery or I.S. battery pack supplied, life expectancy can be up to 7~10 years. Battery life reduces when connected with a coil input from turbine flowmeters. The ZOD-Z1 may also be externally powered from a regulated 8~24Vdc supply (see page 14 for special instructions regarding ghosting).

Pulse output : Scaleable or non-scaleable NPN-PNP selectable field effect output Transistor. Non scaleable pulse is particularly suitable for pre-amplifying pick-off coil inputs from turbine meters (5Khz. Max.).

The scaleable pulse output has a fixed pulse width of 60ms and therefore has a frequency limit of 8hz . Both pulse outputs have a 50mA maximum drive capability.

Physical : A) IP66/67 high impact, glass reinforced Polyamide enclosure.
B) Self drill cable gland entry at base & rear of the enclosure.
C) Overall 85mm diameter x 45mm deep x 175g (0.4lb).
D) Operating temperature -20ºC ~ +80ºC (-4ºF ~ +176ºF).

Configuration

Functions : Accumulated & Resettable totals, pre-amplifier pulse output & a scaleable pulse output. Low battery indication.

Configuration : Flow chart entry of data with English text prompts.
User selectable 4 digit PIN number program protection.
Programmable engineering units, decimal points and K-factors.
All programmed data protected with the battery.

K-factor range : Entered as pulses / litre, gallon, lb etc. Programmable range is 0.001~9,999,999.999 with a floating decimal point during K-factor (*scale factor)* entry.

Pulse output range : Entered as engineering units/pulse. Range is 0.1~9999.9 units/pulse.

Engineering units : Selectable Ltr, Gal, m3, kgs, lbs, MLtr & Mgal or no units of display.

1.3 Overview

The ZOD-Z1 series instruments are specifically designed for computing & displaying totals from flowmeters with pulse or frequency outputs. They are battery powered or can be powered by an external 8~24Vdc regulated or I.S. certified supply.

The instrument will display Resettable Total and an Accumulated Total in engineering units as programmed by the user. Simple PIN protected flow chart programming with English prompts guide you through the programming routine greatly reducing the need to refer to the manual.

Special Features

Standard : PIN Protection. Amplified non-scaled repeater or scaleable pulse output.
: NPN/PNP selectable pulse output.
Optional : Display backlighting *(needs external dc power for this option to illuminate).*
: Intrinsic Safety Certification to IECex scheme and ATEX directive.

Environments

The ZOD-Z1 series is designed to suit harsh indoor and outdoor industrial and marine environments. The robust housing is weatherproof to IP676 / IP67 standards, UV resistant, glass reinforced Polyamide with stainless steel screws & FKM O-ring seals.

Installation

Specifically engineered to be directly mounted on a variety of flowmeters, wall, surface or pipe mounted in the field or control room. Various mounting kits are available. The instrument is self powered using one 3.6Vdc lithium battery or I.S. battery pack, the pulse output option requires 8~24Vdc.

1.4 LCD display

Full LCD display test feature illuminates all characters and script text displays for 5 seconds when entering the program mode.

The 5 digit **Total** display is front panel resettable and can be programmed for up to 3 decimal places.

Engineering units are selected during the initial programming routine.

Battery condition indicator shows only when battery is low, battery life can last up to 7~10 years.

The 8 digit **Accumulative Total** display can be programmed for up to 3 decimal places. Reset is only possible when in the program mode which can be PIN protected for security.

2. OPERATION

2.1 Resettable Total

Pressing the RESET key will cause the large 5 digit total to reset to zero. The reset function is possible at any time during counting.

2.2 Accumulative Total

There are 8 digits in the accumulative total display, these can only be reset in the program mode or can be protected by enabling the PIN protection feature at the front end of program mode.

2.3 Keypad functions

KEY	FUNCTION IN OPERATING MODE	FUNCTION IN PROGRAM MODE
RESET	Resets the 5 digit resettable total display to zero.	Resets the 8 digit accumulative total display to zero. Resets internal K-factor (scale factor) to zero
PROGRAM ENTER	1. Pressing the Program & Reset keys for 5 seconds enters you into the program mode. 2. Displays model & software revision No.	1. Each press steps you through each level of the program chart. 2. Holding for 3 seconds fast tracks to the END of the program from any program level.
▶	No function	Selects the digit to be set, the selected digit will be "flashing " indicating that it can be incremented.
▲	No function	Increments the selected digit each time that it is pressed.

2.4 Battery replacement

The instrument draws very little power and will run for many years* without the need to replace the battery. A battery condition indicator on the LCD display will appear when the battery is low, if the low battery is not replaced the programmed detail & totals will be lost.

When changing the battery a small capacitor within the instrument will maintain the programmed detail & totals in memory for up to 10 seconds providing sufficient time for the battery change to take place. Changing the battery whilst flow is taking place could cause loss of the programmed detail. It is advisable to record program details prior to battery change.

** The battery can last 7~10 years depending on application & environment.*

2.5 Processor reset button

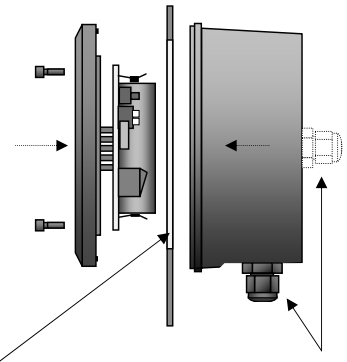
Should the instrument be corrupted by an electrical hit the processor can be reset by pressing the black re-boot button located above the red DIP switch block on the input interface board *(refer page 10). This procedure does not effect totals or programmed data.*

3. INSTALLATION

3.1 Mounting

Integral meter mounting

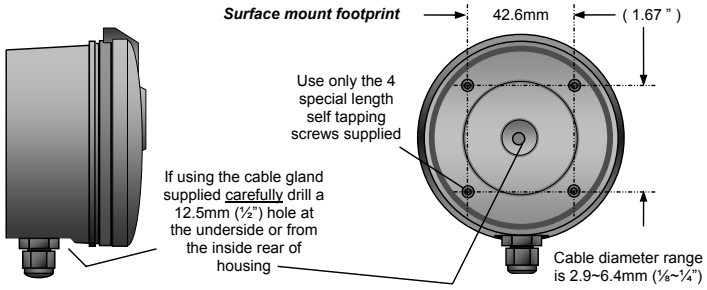
Panel mounting



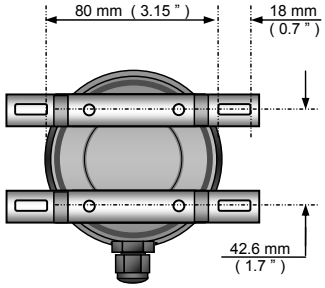
Cut a 75mm (3") dia. hole in panel. Existing O-ring seals against panel face

If using the cable gland supplied carefully drill a 12.5mm (½") hole at bottom or rear of housing as shown on housing footprint detail on page **7**

Surface mount footprint

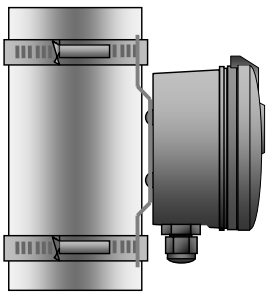


Wall - surface mount using optional bracket kit *(P/No. AWM)*

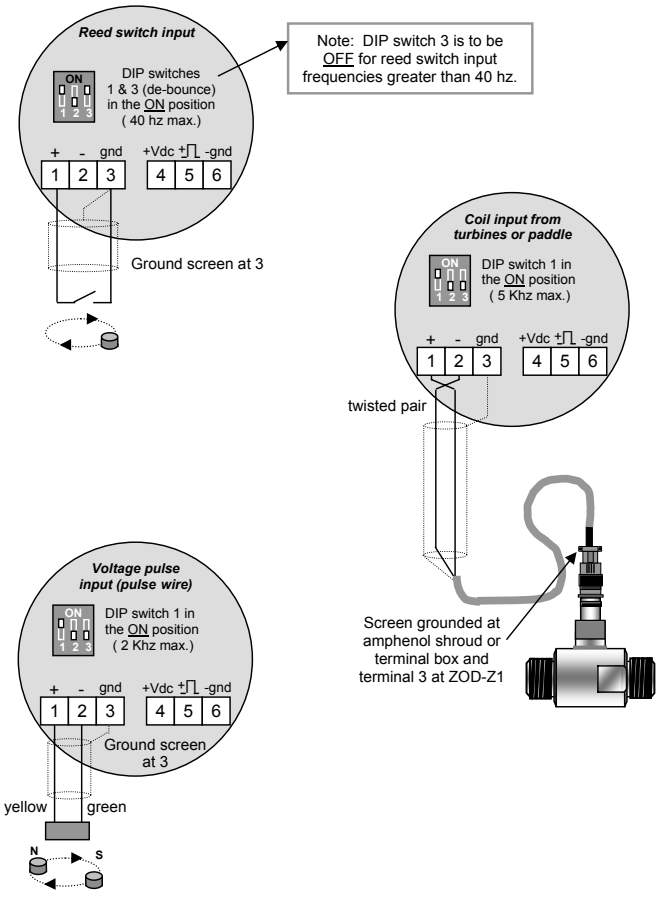


Pipe mounting *(P/No. APM)*

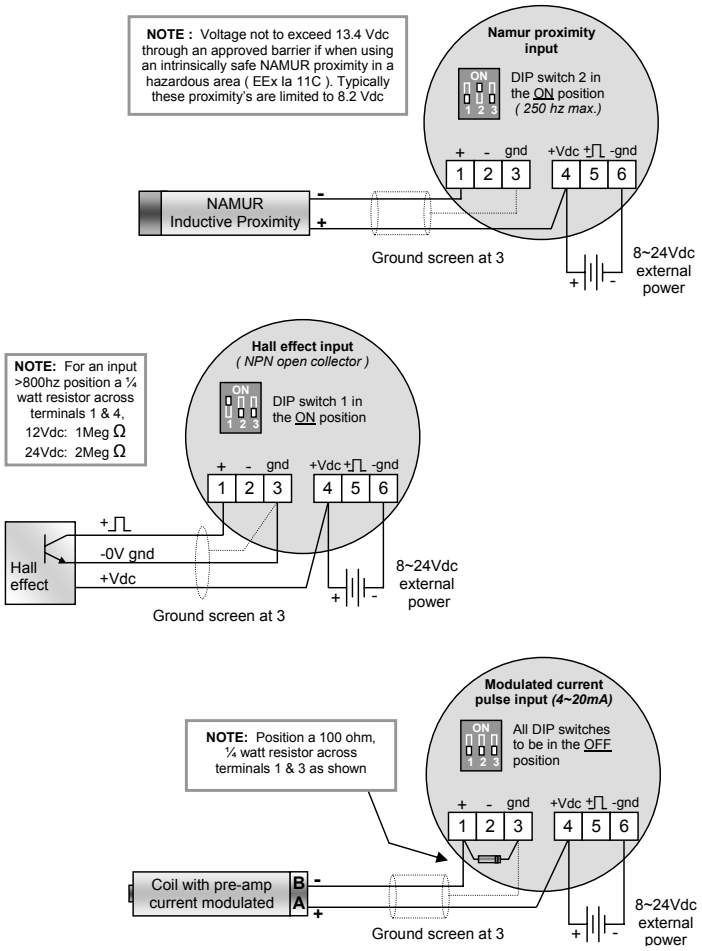
APM adaptor pipe mount kit is suitable for vertical or horizontal pipes



3.2 Flowmeter connections (un-powered sensors)



3.2 Flowmeter connections (powered sensors)

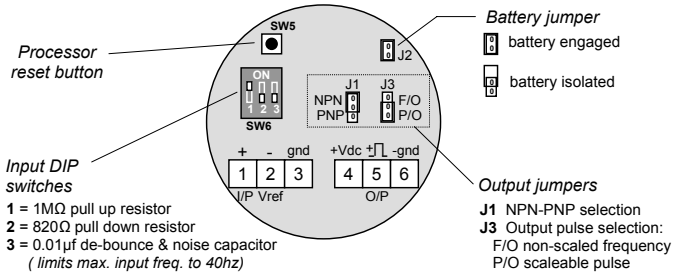


3.3 Wiring connections

Terminal designation

1	+	I/P	Flow input pulse signal
2	-	Vref.	Flow input *(coils & voltage type inputs)*
3	gnd	GND	Flow input *(pulse type inputs)*
4	+Vdc	+Vdc	External power , *+8~24Vdc (see P14)*
5	+⎍	O/P	Output pulse *(J1 & J3 selectable)*
6	-gnd	GND	External power

Interface board layout



Wiring practice

Use multi-core screened twisted pair instrument cable (0.5mm^2) for electrical connection between the instrument and any remote flowmeter or receiving instrument. The screen needs to be earthed to the signal ground or the receiving instrument, this is to protect the transmitted signal from mutual inductive interference. Do <u>not</u> earth the screen at both ends of the cable.

Instrument cabling is not be run in a common conduit or parallel with power and high inductive load carrying cables, power surges & power line frequencies may induce erroneous noise transients onto the signal. Run instrument cables in a dedicated low energy, low voltage conduit.

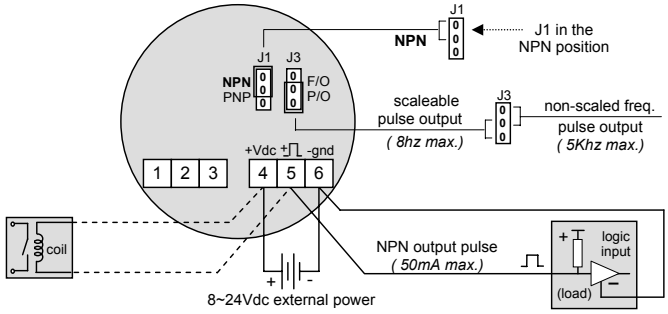
3.3 Wiring connections - pulse outputs

Current Sinking outputs (NPN)

Current sinking derives its name from the fact that it "sinks current from a load". The current flows from the load into the appropriate output (terminal 5).

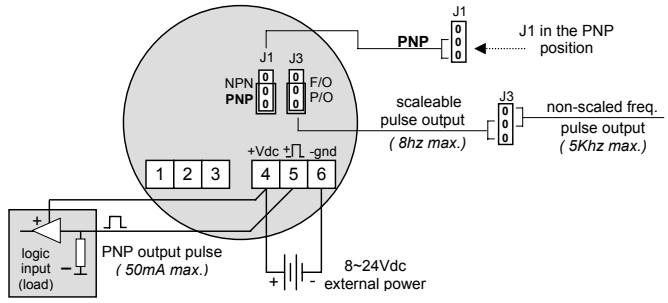
Driving a logic input ——— The output voltage pulse is typically the internal voltage of the load. The load would normally have an internal pull up resistor on its input.

Driving a coil - - - - - - - The NPN style of output is to be used when driving a coil. The coil load is obtained by dividing the coil voltage by coil impedance (Ω), is expressed in amps & is not to exceed 0.1A. The coil voltage is connected across, & must match, the ZOD-Z1 supply voltage & the output (5).



Current Sourcing outputs (PNP)

Current sourcing gets its name from the fact that it "sources current to a load". The current flows from the output *(terminal 5)* into the load. When wired as below the output voltage pulse is the supply voltage of the load. The load would normally have an internal pull down resistor on its input.



4. PROGRAM PARAMETERS

4.1 PIN No. Program Protection
The option exists to protect the programmed detail & Accum. Total with a user selected four digit PIN No. *(0000 represents no PIN protection)*. If activated the user must input the correct PIN No., failure to do so will deny access to change any of the program parameters or reset the Accumulative Total but will allow the user to step through and view the program details.

Only one PIN number may be set but this can be changed at any time after gaining access through PIN entry. A second back up PIN number is installed at the factory should the programmed PIN be lost or forgotten**.** *(refer page 14 for the back up PIN No.)*

4.2 Resetting Accumulated Total
Resetting the accumulated total can only be done within the program mode.

4.3 Engineering Units *(refer clause 1.4)*
Select from available Eng. units to right of the display. The ZOD-Z1 can display in engineering units not available on the LCD display by programming to "no eng. units" and a suitable K-factor.

4.4 K-factor (scale factor)
Enter K-factor starting with the most significant number, up to 8 prime numbers & 3 decimal numbers can be entered. Trailing decimal numbers move into view as digits to the right are progressively selected, any significant digits which may move from view remain functional.

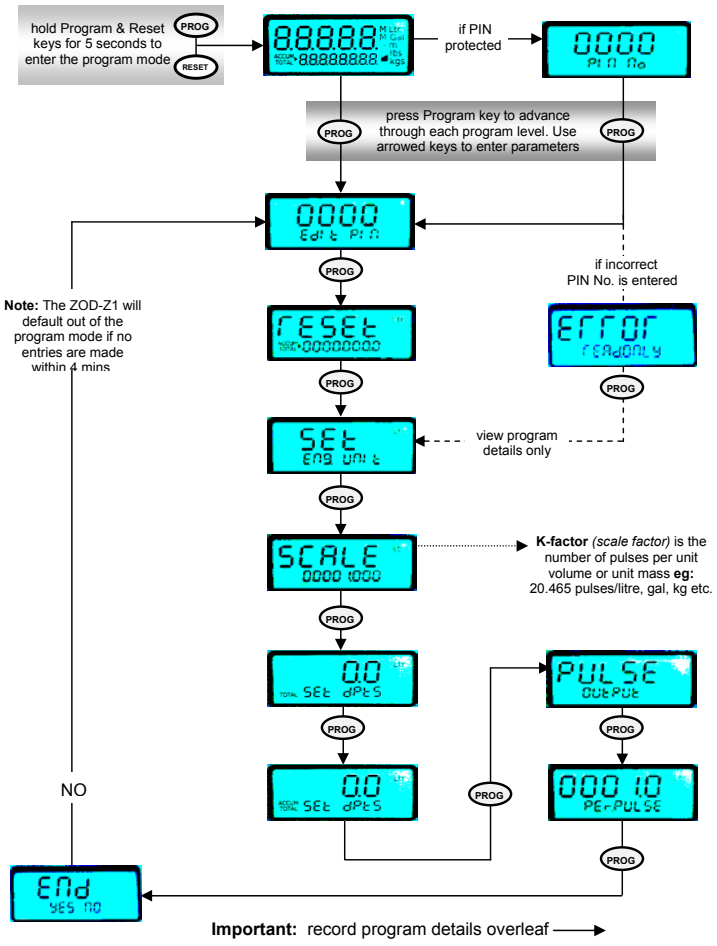
4.5 Pulse output
The pulse output is NPN-PNP link selectable via jumper **J1**. It is also selected at jumper **J3** to act as a non-scaled pre-amplified pulse output or scaleable pulse output, maximum load is 50mA.

Non-scaled pulse output:
The un-scaled repeater pulse output represents one pulse out for each input pulse from the primary measuring element *(flowmeter)*. This output acts as an input signal pre-amplifier particularly suitable for pick-up coil inputs up to 5Khz. The duty cycle of the output adopts the duty cycle of the input. The ZOD-Z1 needs to be externally powered for this feature to operate (see page 11).

Scaleable pulse output :
The fully scaleable pulse output is programmable as the number of litres / gallons etc. per output pulse *Eg.* 0.1 litres/pulse, 10 litres/pulse, 100 gallons/pulse. Range is 0.1 ~ 9999.9 Eng. unit/pulse. The ZOD-Z1 needs to be externally powered for this feature to operate (p11).

The scaleable pulse output is suitable only for remote integration due to the spasmodic nature of its output frequency, it is limited to 8hz. Should the potential incidence of this output exceed 8hz it can continue to count after flow has stopped until such time as the processor buffer has completed integration. Most scaleable pulse output requirements are low frequency due to down scaling and therefore not effected by the buffer count effect.

5. PROGRAMMING FLOW CHART



5.1 Program detail record

If not powered for more than 10 seconds the programmed detail & Accumulated Total will be lost from the processor memory, it is advisable to record your programmed detail below. Specific instructions on changing the battery without loss of program detail are given at clause 2.4, page 5.

Pencil your program details here

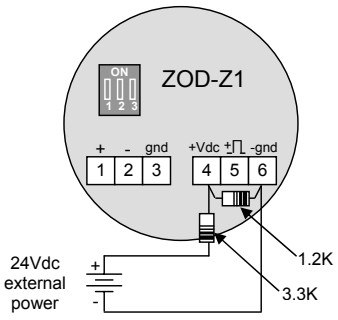
User selected PIN No.					0000
Engineering units					litres
K-factor (scale factor)	K =				1.000
Decimal for reset total	☐ 0	☐ 0.0	☐ 0.00	☐ 0.000	0.0
Decimal for Accum. total	☐ 0	☐ 0.0	☐ 0.00	☐ 0.000	0.0
Output pulse value					0001.0

Factory default settings

6. TROUBLESHOOTING

 # No display.
Check position of the battery jumper J2 *(see interface board layout page 10)* & check battery contact connections. Replace battery.

 # Display ghosting under external power.
The LCD display will "ghost" when the instrument is powered from an external 24Vdc power supply, this is corrected by including two ¼ watt resistors (1.2K & 3.3K) on the input power source as shown below.



 # Display shows model number at all times.

example

The instrument has not been fully programmed after power up, enter the program mode & enter program parameters, be sure to exit the program mode before the 4 minute no data entry time out or the instrument will revert back to model number display.

 # Display ghosting under external power.
The LCD display will "ghost" when the instrument is powered from an external 24Vdc power supply, this is corrected by including two ¼ watt resistors (1.2K & 3.3K) on the input power source as shown below.

 # Scaleable pulse output counts on after flow has stopped.
The scaled pulse output has exceeded its output limit of 8Hz. Allow the memory buffer to catch up or increase the pulse value - number of litres etc. per pulse, *(clause 4.5, p12.)*

 # Display shows random characters.
The instrument may have taken an electrical "hit", press the processor reset button *(p10)*.

Cut from manual for increased security

Your back up 4 digit PIN number is 0220

7. Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Battery Totaliser Model: ZOD-Z1

to which this declaration relates is in conformity with the standards noted below:

Optional for Equipment intended for use in Potentially Explosive Atmospheres:
ATEX Directive **94/9/EC**

EN 50014: 1997 + Amds. 1 & 2 Intrinsically Safe Electronics (I.S.) – Optional

EN 50020: 2002 Intrinsically Safe Electronics (I.S.) – Optional

EN 60529, DIN VDE 0470-1 1992-11
I.P. Ingress Protection Classifications

EN 61326-1: 2006-10
Electrical equipment for control, instrumentation technology and laboratory use – EMC requirements (Industrial area)

EN 61010-1: 2002-08
Safety requirements for electrical equipment for measurement, control, and laboratory use –

2008/35/EC Waste Electrical & Electronic Equipment (WEEE)

Also the following EEC guidelines are fulfilled:

2004/108EC EMC Directive
2006/95 EC Low Voltage Directive

Hofheim, 18. Oct. 2010

H. Peters
General Manager

M. Wenzel
Proxy Holder

8. ALPHABETICAL INDEX

KOBOLD

Universal Mount Series

ZOD-Z3 FLOW RATE TOTALISER

INSTRUCTION MANUAL

Software version	
V 3.2	16.12.04
V 3.3	27.04.07

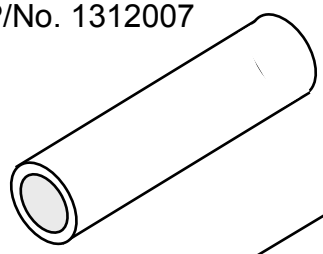
PROG

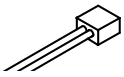
Press & hold Program key to show
instrument model & software version

Replacement Batteries:

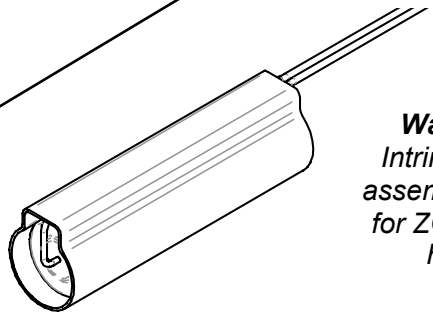
KOBOLD supplied batteries :

Non I.S. battery
KOBOLD P/No. 1312007





I.S. battery
Kobold P/No. 1412028



Warning : *KOBOLD Intrinsically safe battery assembly only is approved for ZOD-Z3 mounted in a hazardous area.*

Suitable non I.S. batteries also available from :

R S Components	***Farnell Components***
Stock No. 596-602	Order code 206-532

3.6V x 2.4Ah AA
- Lithium Thionyl Chloride +
non - rechargeable cell

TABLE OF CONTENTS

1.1 Model number designation

Model	Housing Type	Electrical connection/ Cable gland	Supply Voltage	Options	Mechanical protection
ZOD-Z3…	**KS** = universal mount (standard) **KM**[1)] = integral mount	**1** = 3 x cable entry M20 **2** = 3 x cable entry 1/2" NPT	**F3** = 8…24 VDC, Battery **F1**[2)] = 110 VAC, 8…24 VDC **F0**[2)] = 220 VAC, 8…24 VDC	**0** = without **R**[3)] = 2 x Relay (for ZOD-Z3K) **E**[3)] = EExia IIB T4	**0** = without
	PP = panel mount (IP20)	**0**[2)] = screw terminal			**S**[2)] = silicone bezel boot

[1)] order only when retrofitting a pulse meter
[2)] only possible with ZOD-Z3PP...
[3)] only possible with ZOD-Z3K... Options "R" and "E" cannot be combined

Part No.	ACCESSORIES FOR ABOVE SERIES
ERS-ZOD-1522001	stainless steel wall mount kit
ERS-ZOD-1522002	stainless steel 2" pipe mount kit
ERS-ZOD-1522011	DRT series cooling fin kit for flowmeters with integral instruments
ERS-ZOD-1522005	DOR & Turbine stem adaptor - metric *(M16 to M20)*
ERS-ZOD-1522006	DOR & Turbine stem adaptor - USA *(M16 to 1/2" NPT)*
ERS-ZOD-1323006	DOR-42 stem *(100mm effective height, threaded M16 male)*
ERS-ZOD1323011	DOR-52 stem *(350mm effective height, threaded M16 male)*
ERS-ZOD-1322071	3/4" BSPF fixed stem for Turbine flowmeters *(3/4" BSPF to M16)*
ERS-ZOD-132822101	1" NPTF universal swivel stem for Turbine flowmeters *(3/4" BSPF to M16)*
ERS-ZOD-1334001	DC switch mode DIN mount power supply - 100~240Vac input
ERS-ZOD-1412063	Relay contol output board with two SPCO relays

1.2 Specifications

Display : 8 digit alpha numeric LCD characters 9mm (0.35 ”) high with second line sub script text, 8 digits totalising, 5 digits rate. Programmable 0~3 decimal places for all displays.

Signal Input : Universal pulse/frequency input compatible with Reed switch, Hall effect, Namur proximity detectors, Pulse wire, voltage, current & Coil *(15mV P-P min).* Max. input frequency 10Khz.

Minimum input frequency for rate display is 0.1hz with low frequency cut off feature enabled, 0.3hz when disabled & 0.7hz if the non-linearity feature is enabled. Totals have no minimum.

Battery power : Battery life expectancy can be up to 5~10 years when programmed with the unique “Ultra Power Save” sleep cycle. Battery life reduces when connected with a coil input from turbine flowmeters. Rate display defaults to total display 4 minutes after pressing the rate key in order to conserve battery power. *(reverse polarity protected)*

External power : Regulated 8~24Vdc x 150mA or 4~20mA loop powered.

Memory : All programmed & accumulated data is stored permanently in non-volatile memory.

Pulse output : NPN-PNP transistor, scaleable (50hz max.) or non-scaleable (5000hz max.), 1A maximum drive capability.

Analog output : Two wire loop powered, 12~28Vdc into 100~900Ω loop load, accuracy +/-0.25% FS, key entry programming of Zero & Span.

Alarm outputs: Two NPN-PNP selectable FET *(transistors)* programmable low & high flow alarm with adjustable deadband *(reset differential).* Maximum drive 100mA resistive load. 24Vdc max.

Physical :
A) IP66 / 67 high impact glass reinforced Polyamide enclosure.
B) 3 x M20 or ½” NPT female conduit entries.
C) 125mm diameter (5”) x 61mm deep (2.5”) x 400g (0.9lb).
D) Temperature range from -20ºC to +80ºC (-4ºF to +176ºF).

Configuring : PIN protected data entry with scrolling English text prompts.

K-factor range : Eg. Pulses/litre, gallon, lb etc. Programmable range is 0.001~ 9999999.999 with a floating decimal point during K-factor entry.

Engineering units : Selectable Ltr, gal, m3, kgs, lbs (total). /sec,min,hr or day *(rate).*

Rate conversion : Enables the rate to be displayed in different engineering units to that of the totals **eg**: totals in barrels *(oil)* & rate in US gallons.

Battery modes : Ultra power save, standby or continuous display selectable.

Dual Input option :Programmable for computations of A+B, A-B, or A∋B *(ratio).*

1.3 Overview

The ZOD-Z3 is specifically designed for computing, displaying and transmitting totals and flowrate from flowmeters with pulse or frequency outputs.

The instrument will display Flow Rate, Resettable Total and an Accumulated Total in engineering units as programmed by the user. Simple flow chart programming with scrolling English prompts guide you through the programming routine greatly reducing the need to refer to the instruction manual. All user program data is retained if the battery is removed.

Environments

The ZOD-Z3 is weatherproof to IP66/67 (Nema 4X) standards, UV resistant glass reinforced Polyamide with stainless screws & FKM O-ring seals.The instrument suits harsh indoor and outdoor environments & conforms to EMC directive 89/336/EEC Electro Magnetic Compatibility.

Features

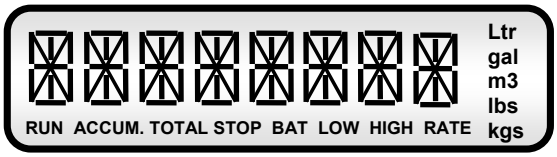
10 point Linearisation, PIN Protection, NPN/PNP selectable autoranging pulse outputs *(scaled or un-scaled),* Low frequency cut-off, Battery conservation mode, 4~20mA output, High / Low flow alarms with adjustable deadbands, Dual inputs. Optional I.S. certification to ATEX directive, for conforming standards refer to I.S. supplement.

Conforming standards include: EN 61326 *(immunity in industrial locations)*
EN 62326 *(emissions in industrial locations)*
EN 60529 *(degrees of protection [IP])*

Installation

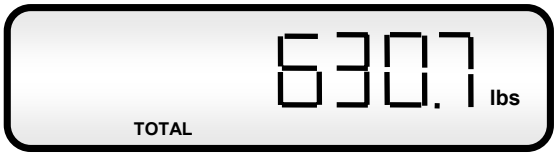
Specifically engineered to be directly mounted on a variety of flowmeters, wall or surface mounted, pipe or panel mounted. Various mounting kits are available. The instrument can be self powered or may be powered by an external dc supply or two wire loop powered.

1.4 LCD displays



Full LCD display test feature illuminates all display segments and script text displays for 5 seconds when entering the program mode.

Rate display has flashing SEC, MIN, HR or DAY followed by up to 5 digits of rate programmable for up to 3 “floating” decimal places.



The 8 digit **Total** display is push button or remote resettable and can be programmed for up to 3 decimal places.

The 8 digit **Accumulative Total** display can be programmed for up to 3 decimal places. Reset is only possible when in the program mode which can be PIN protected for security.

2. OPERATION

2.1 Accumulative Total

Accumulative total can be reset at L2 in the program mode. The accumulative total can be displayed momentarily or continuously through use of the front panel ACCUM TOTAL key.

Momentary display : Accumulative total is displayed only whilst the key is held pressed.

Latching display : To have the accum. total display latch when key is pressed simply press & hold the ACCUM TOTAL key for 10 seconds, the display will then latch each time the key is pressed. Holding the accumulative total key again for 10 seconds will revert this key function back to a momentary action.

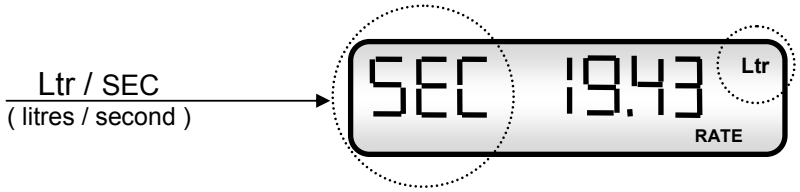
2.2 Resettable Total *(also see page 18 for remote reset feature)*

The display toggles between Rate & Total when the RATE-TOTAL key is pressed.

Pressing the RESET key whilst displaying total will cause the total to reset to zero.

2.3 Rate display

When rate is displayed the leading three alpha characters on the left of the display "flash " the time base for rate **eg**. rate /SEC. rate /MIN. rate /HR. or rate /DAY. Decimal points float to provide good resolution & rangeability.



The minimum input frequency for rate display is 0.3hz reducing to 0.1hz If the low frequency cut-off is set to 0.1Hz *(see below) & 0.7Hz with NLC enabled.*

2.4 Low frequency cut-off

The low frequency cut-off is most commonly set to 0.0Hz *(disabled)* other than to:

1) To display rate for input frequencies below 0.3hz, for example setting the cut-off at 0.1Hz the rate will continue to display for input frequencies as low as 0.1Hz *(one pulse every 10 seconds)*, such conditions often apply to flowmeters with low resolution pulse outputs (low frequency) or flowmeters with a high operational turndown *(maximum to minimum flow rate).*

2) Inhibit the integration & registration of "apparent flow" which at times may be encountered on mobile installations where the movement of the vehicle or dead heading a pulsating pump may cause spurious flow signals which are not attributed to actual flow.

3) Inhibit the integration & registration of flow at input frequencies below what is considered the minimum accurate flow rate of the primary flow element *(flowmeter)*.

Caution: If the low frequency cut-off is set to any value other than 0.0Hz then the integration of rate and total will cease at frequencies on or below the set value (HERTZ).

2.5 Inhibit total *(see wiring schematic page 18)*

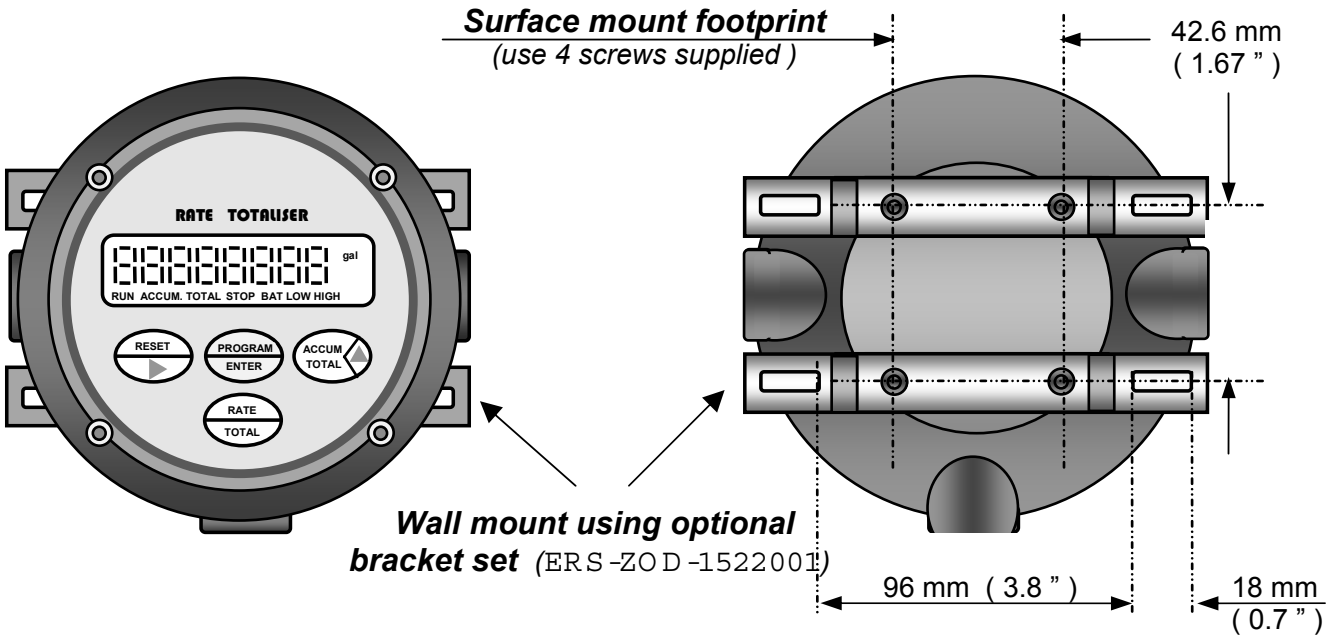
With the remote "inhibit total" switch closed the ZOD-Z3 with display flow rate but at the same time will inhibit the resettable & accumulative totalising functions.

2.6 Keypad function matrix

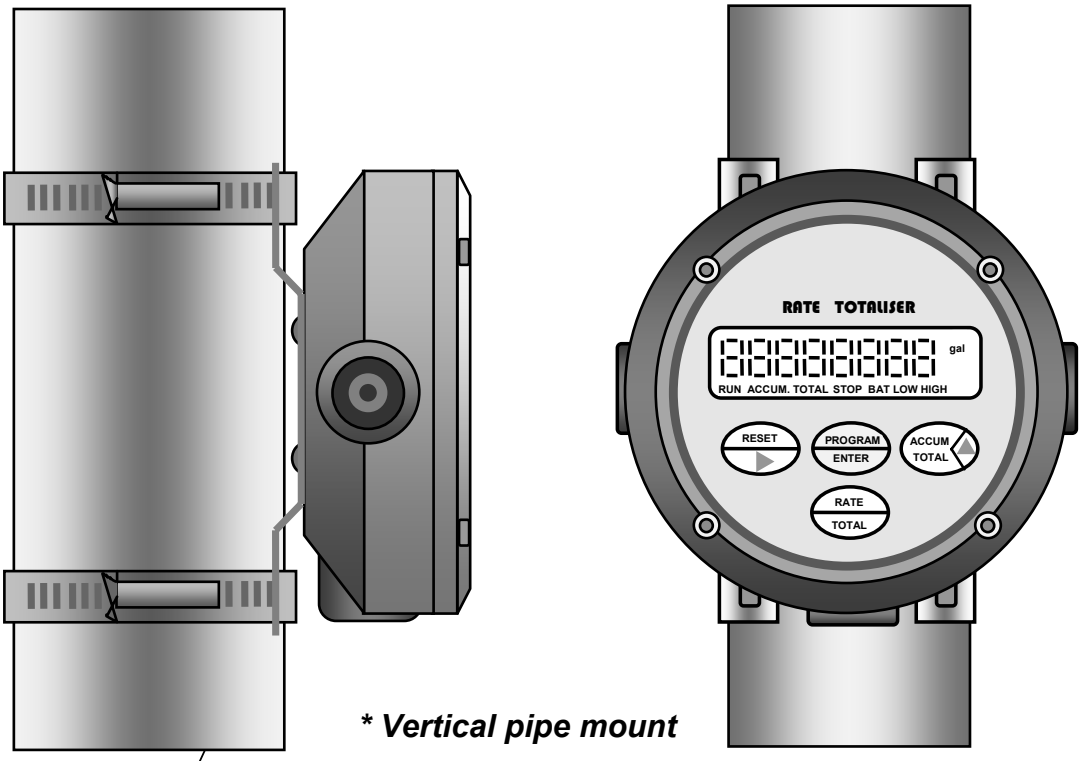
KEY	FUNCTION IN OPERATING MODE	FUNCTION IN PROGRAM MODE
ACCUM TOTAL	Displays Accumulative Total when pressed. *(refer clause 2.1 for options)*	No function
RATE TOTAL	Toggles between Rate & resettable Total displays.	No function
RESET	Resets the resettable total display to zero when it is being displayed.	No function
PROGRAM ENTER	1) Pressing the Prog. & Rate/Total keys for 5 seconds enters you into the program mode. 2) Displays model & software revision No.	1) Each press steps you through each level of the program chart. 2) Holding for 3 seconds fast tracks to the end of the program from any program level.
▶	No function	Selects the digit to be set, the selected digit will be "flashing " indicating that it can be incremented.
▲	No function	Increments the selected digit each time that it is pressed.

3. INSTALLATION

3.1 Remote Mounting



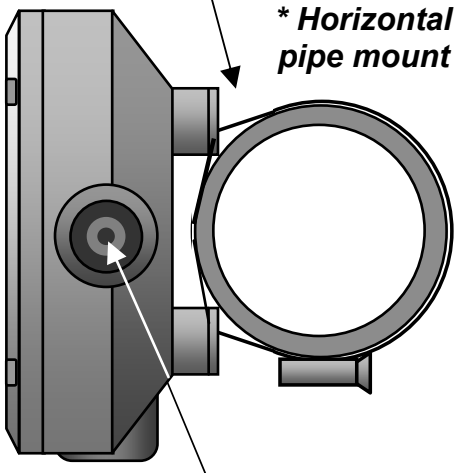
3.1 Remote Mounting *(continued)*



**** Vertical pipe mount***

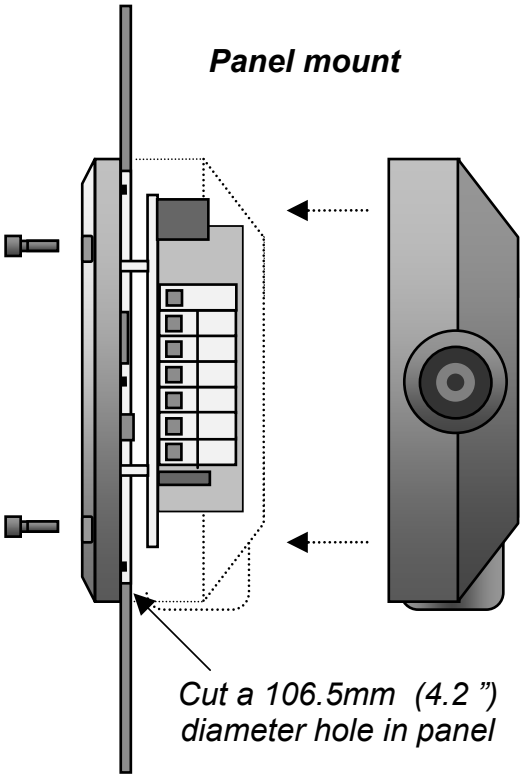
** order Pipe mount kit P/No.* ERS-ZOD-152202 *comprising two brackets, screws and worm drive clamps.*

**** Horizontal pipe mount***



Conduit entries have an integral moulded seal, to remove break seal out using suitable lever (eg. screwdriver or rod)

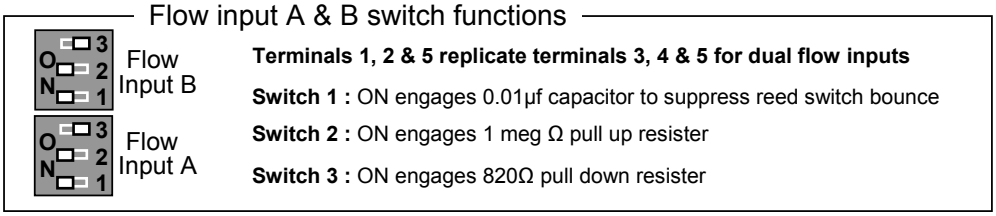
Panel mount



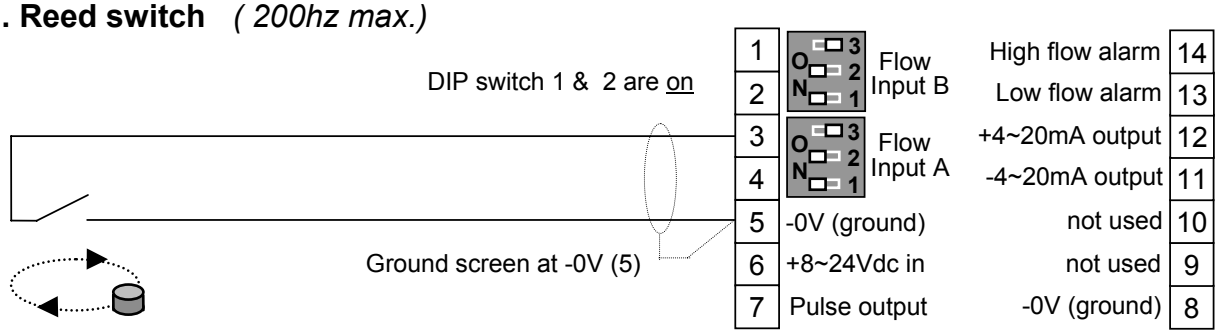
Cut a 106.5mm (4.2 ") diameter hole in panel

3.2 Flowmeter connections - unpowered sensors

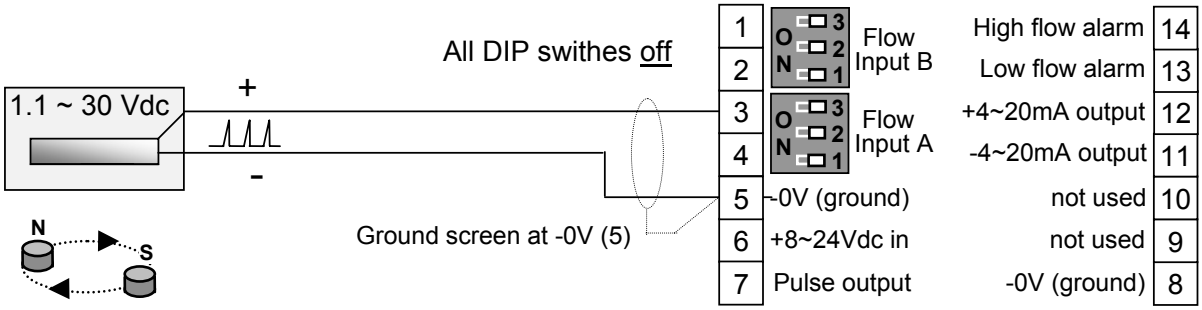
(for I.S. installations refer to I.S. supplement)



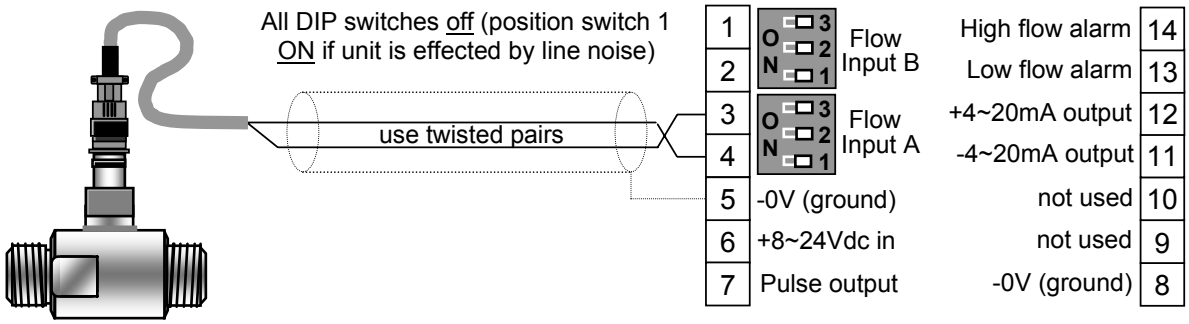
1. Reed switch *(200hz max.)*



2. Voltage Pulse *(& pulse wires)*



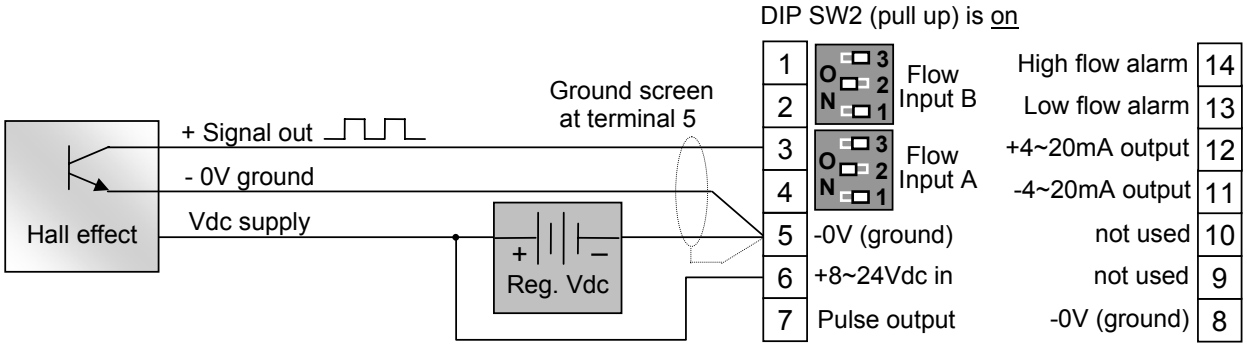
3. Coil *(Turbine & paddle style flowmeters – minimum 15mV p-p)*



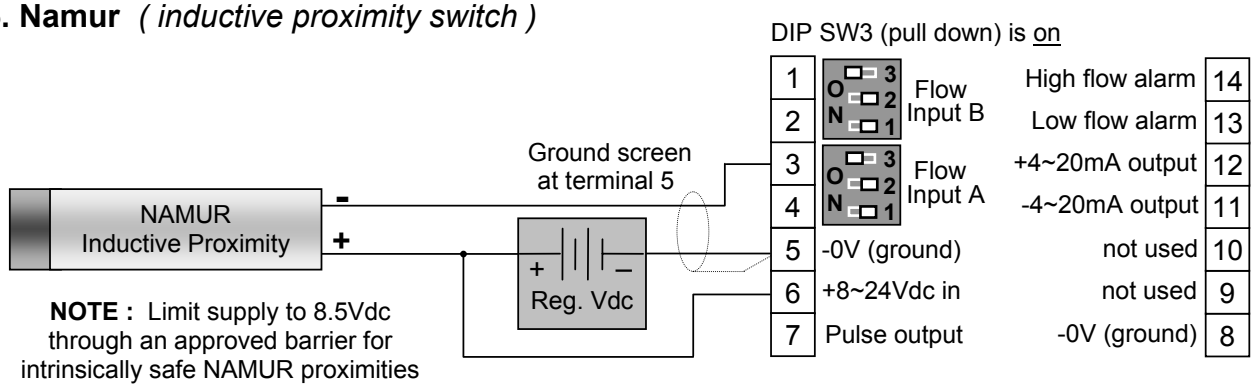
*3.2 **Flowmeter connections*** - powered sensors

(for I.S. installations refer to I.S. supplement)

4. Hall effect *(5~24Vdc open collector)*

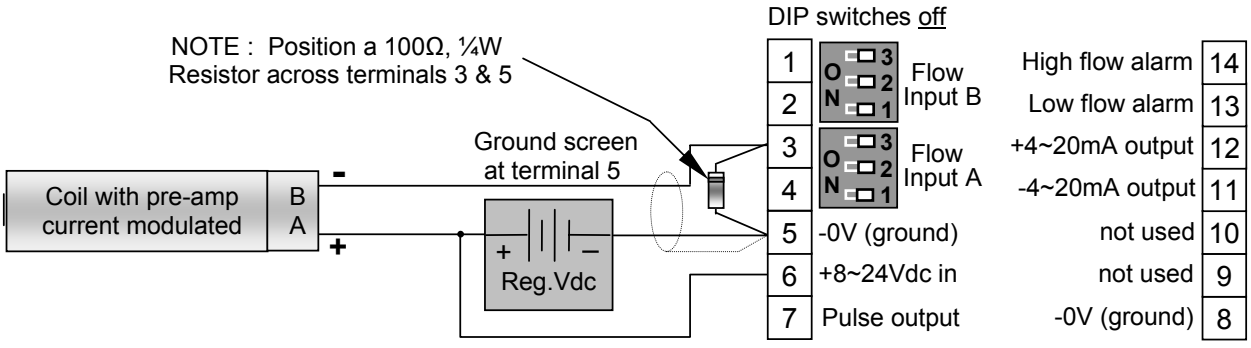


5. Namur *(inductive proximity switch)*



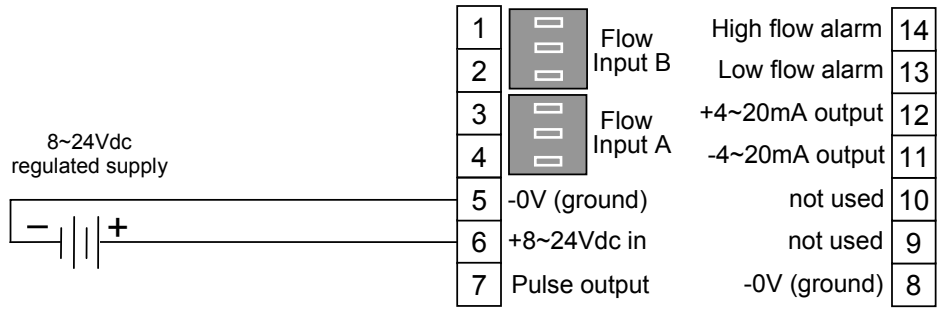
NOTE : Limit supply to 8.5Vdc through an approved barrier for intrinsically safe NAMUR proximities

6. Current modulated pulse *(4mA to 20mA pulse amplitude)*



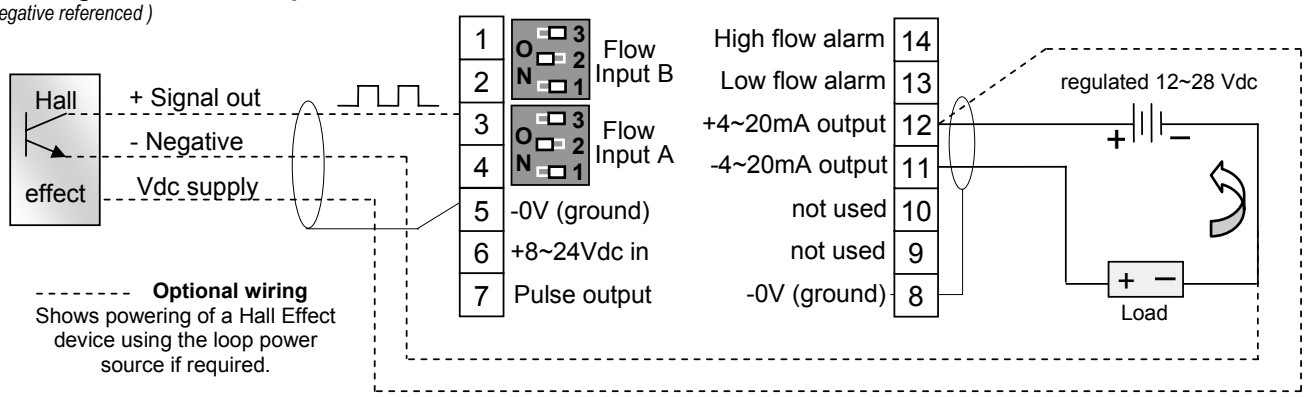
3.3 Wiring connections *(for I.S. installations refer to I.S. supplement)*

External DC powering – required for powered flow sensors, flow alarms or pulse outputs & dual flow inputs.



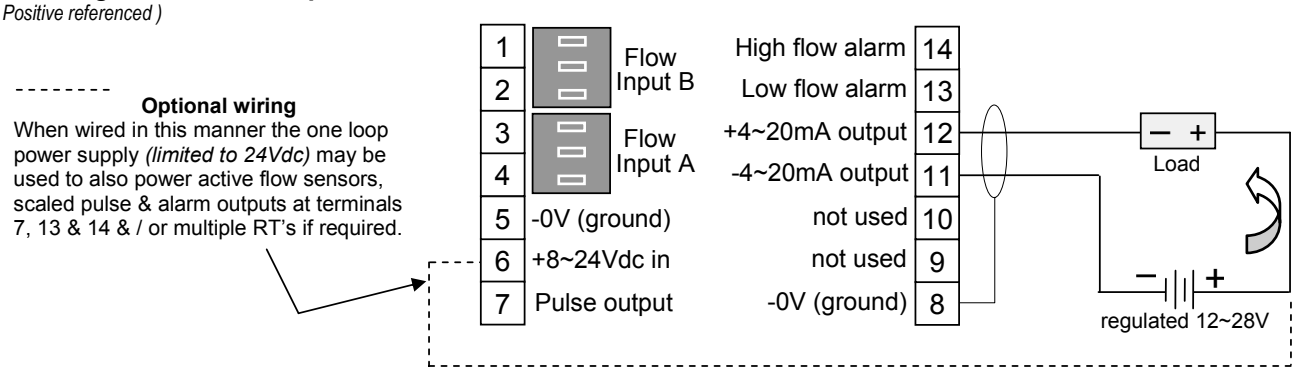
CAUTION :
Avoid using low cost digital switch mode power packs

Powering via 4~20mA loop
(Negative referenced)



Loop load specification : **R = (V – 10) / 0.02**
where : **V** = loop voltage, **R** = max. load **Ω**

Powering via 4~20mA loop
(Positive referenced)



Wiring requirements : Use multi-core screened twisted pair instrument cable (0.25 – 0.5mm^2) for electrical connection between the ZOD-Z3 and any remote flowmeter or receiving instrument. The screen needs to be earthed to the signal ground of the receiving instrument only to protect the transmitted signal from mutual inductive interference.

Instrument cabling should not be run in a common conduit or parallel with power and high inductive load carrying cables, power surges & power line frequencies may induce erroneous noise transients onto the signal. Run instrument cables in a separate conduit or with other instrument cables.

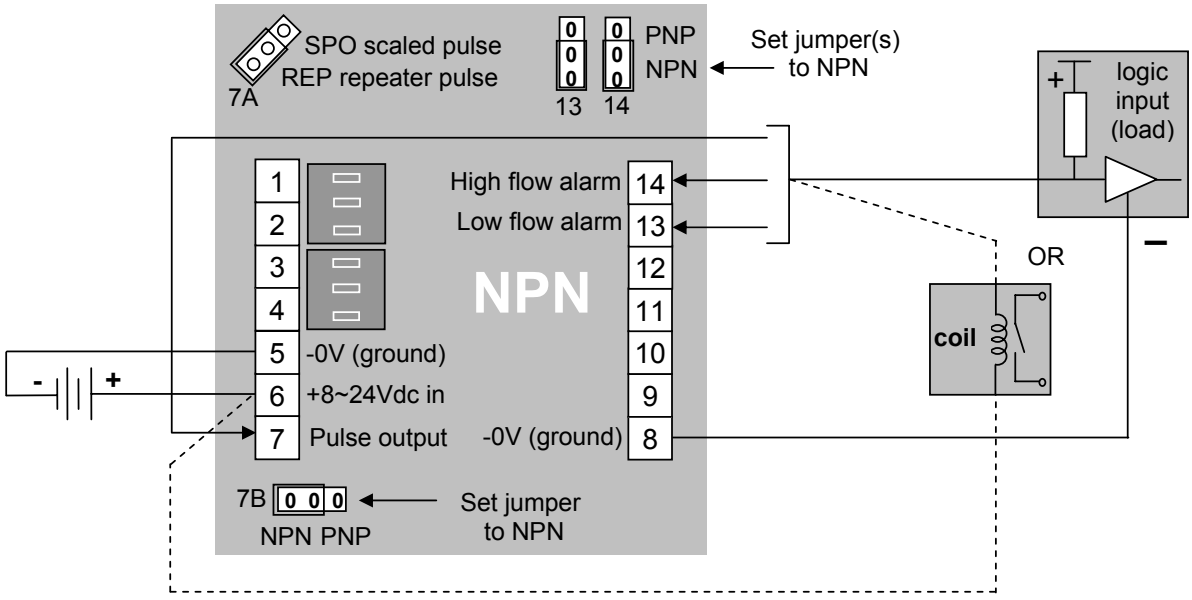
Pulse & Alarm Outputs

Current Sinking outputs (NPN)

Current sinking derives its name from the fact that it “sinks current from a load”. When activated the current flows from the load into the appropriate output (7,13 & 14).

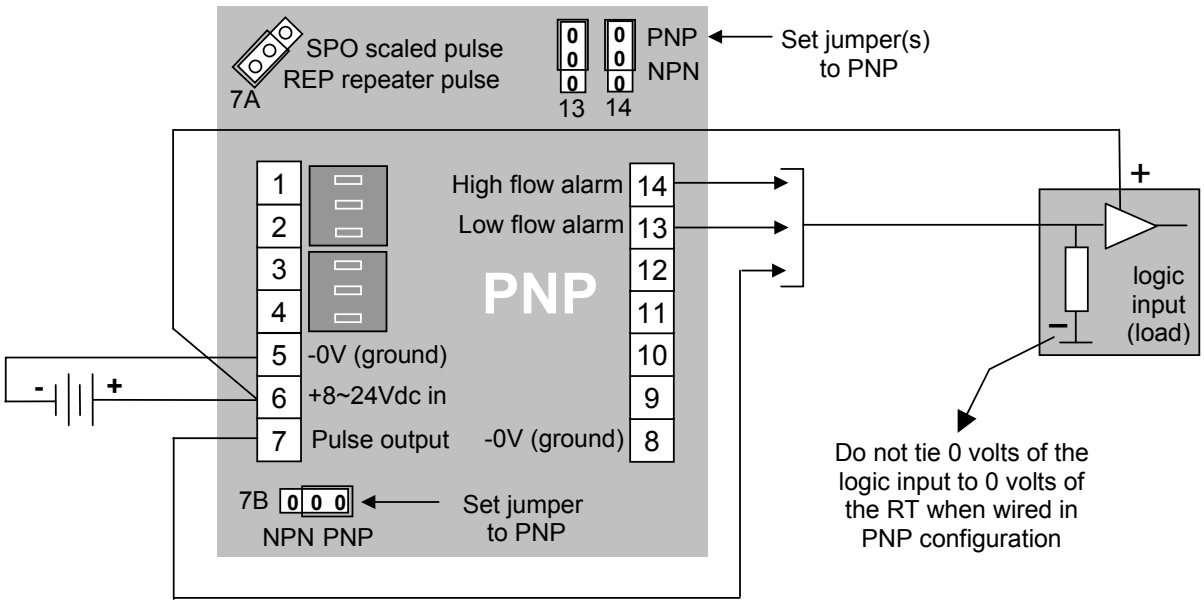
Driving a logic input ———— The output voltage pulse is typically the internal voltage of the load. The load would normally have an internal pull up resistor on its input as shown.

Driving a coil - - - - - - - The NPN style of output is to be used when diving a coil. The coil load is obtained by dividing the coil voltage by coil impediance (Ω), is expressed in amps & is not to exceed 0.1A. The coil voltage is connected across & must match the ZOD-Z3 supply voltage & the output (7,13 & 14).



Current Sourcing outputs (PNP)

Current sourcing gets its name from the fact that it “sources current to a load”. When activated the current flows from the output (7,13 & 14) into the load. When wired as below the output voltage pulse is the supply voltage of the load. The load would normally have an internal pull down resistor on its input as shown.



4. PROGRAM PARAMETERS

Note: *The ZOD-Z3 defaults out of the program mode if no programming entries are made after 4 minutes.*

4.1 PIN No. Program Protection

Any user defined PIN number other than 0000 will engage the program protection feature, failure to input the correct PIN number will deny the ability to change any of the program parameters but will allow the user to step through and view the existing program parameters.

Only one PIN number may be set but this can be changed at any time after gaining access through PIN entry. A second back up PIN number is installed at the factory should the programmed PIN be lost or forgotten. *(refer bottom of page 17 for the back up PIN No.)*

4.2 Resetting Accumulated Total

Resetting the accumulated total can only be done at level 2 (L2) in the program mode.

4.3 Engineering Units *(refer clause 1.4)*

Select from available Engineering units to right of the display. For other engineering units set display to show no engineering units & program a suitable K-factor.

4.4 K-factor (scale factor)

Enter K-factor starting with the most significant number, up to 7 whole numbers & 3 decimal numbers can be entered. Trailing decimal numbers move into view as digits to the right are progressively selected, any significant digits which may move from view remain functional.

4.5 Rate conversion factor

A rate conversion feature is available & is explained at level 6 in the program chart *(page 14). When enabled the analog output under rate conversion needs to be programmed in relation to the "TOTAL" engineering units.*

4.6 Rate dampening

Dampening is available to smooth out fluctuating flow input signals in order to provide a stable rate display & analog output. Most input signal are reasonably stable and need only a low setting value of 40 to 70 *(see response graph on page 19).*

4.7 Low frequency cut-off This feature is explained in clause 2.4 *(page 5).*

4.8 Pulse Outputs *(for this feature the ZOD-Z3 must be externally powered as per page 10)* The pulse output is link selectable as a scaleable pulse or non-scaled repeater pulse & NPN *(current sinking)* or PNP *(current sourcing)* style pulse capable of switching up to 1 amp. Pulse scaling, when selected, is set as the number of litres / gallons etc. per output pulse *Eg.* 0.1 litres/pulse, 10 litres/pulse, 100 gallons/pulse. Range is 0.1 - 9999.9 Eng.unit/pulse. The totalising display visually slows to two updates/sec. if the scaled pulse output is selected. The pulse width *(pulse duration 1:1)* automatically adjusts to the output frequency defaulting to a maximum pulse width of 300 milliseconds at frequencies below 1.66hz. To calculate pulse width at higher frequencies use: 1000 ÷ (hz x 2) = pulse width in milliseconds.

4.9 Non Linearity Correction (NLC) - *Linearisation*

Linearisation enables the instrument to correct for known inaccuracies in a flowmeter thereby improving the overall accuracy and in many cases increasing the effective flow range *(turndown)* of the flowmeter. Refer to program level L12, page 15 for setting NLC points. NLC can be used without external power however, battery life is reduced according to usage.

4.10 Presetting battery power levels

When the instrument is operated under battery power only a special "Power Mode" program option will appear at level 13 within the programming routine. A choice of three battery power modes enable maximisation of the battery life according to operational requirements:

Ultra Power Save: Typically selected if reading the register infrequently. The display scrolls a Prompt "PRESS ANY KEY", when a key is pressed display wakes up for 4 minutes then returns to sleep mode* greatly extending the battery life.

Standby : Display becomes active whenever a key is pressed or product flows through the flowmeter. Display returns to sleep mode* after 4 minutes of no flow input or key actions, prompt then returns to "PRESS ANY KEY".

Continuous: Display is active at all times resulting in reduced battery life. Display reverts from Rate to Total after 4 minutes to reduce battery draw.

***** In sleep mode *(and programming mode)* flow is always continually totalised.

When the battery voltage is low a battery low indicator will appear on the display.

5. ADDITIONAL PROGRAM PARAMETERS

5.1 Analog Output *(loop powered)*

The loop powered 4~20mA output can be spanned anywhere within the flow meter range. Testing the current loop is available during programming when 4mA will output at programming level L15 and 20mA will output at level L16 *(page 16).).* **Note.** If using the Rate Conversion Factor (RCF) the span for 20mA must be set in relation to the total units, not the rate units.

5.2 ***Flow Alarms*** *(The ZOD-Z3 must be externally powered as per page 10)* Two flow alarm FET *(transistor)* outputs may be programmed for Low & High flow alarms.

5.3 Flow Alarm Deadband

Alarms are NPN/PNP link selectable. An adjustable deadband *(reset differential)* provides a trip buffer zone about the set point in order to overcome alarm "chattering" when the flow rate is fluctuating close to the alarm set point. Deadband is entered as % of each set point value *(refer to page 16 for an example).*

5.4 Dual Flow Inputs *(see also page 20 for complete description)*

When externally powered at terminals 5 & 6 the ZOD-Z3 accepts inputs from two sources (input **A** & input **B**), a separate scaling factor is entered for the second flow input, the instrument is then programmed for one of the dual input functions of A+B, A-B or A∋B *(ratio).*

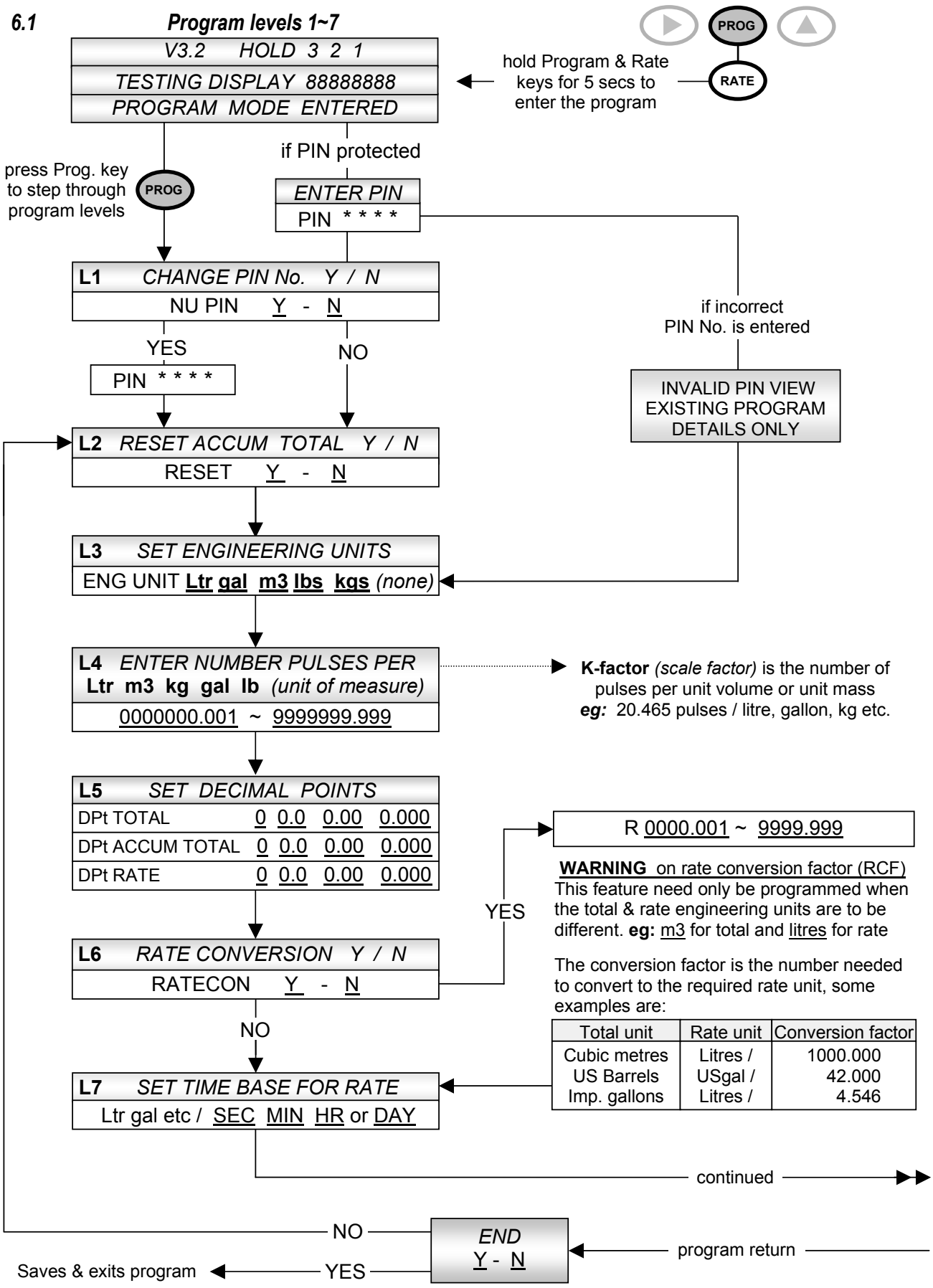
A+B Both inputs are added and displayed as one for Rate & Totals.

A-B Input B is subtracted from input A & the difference is displayed for both Rate & Totals.

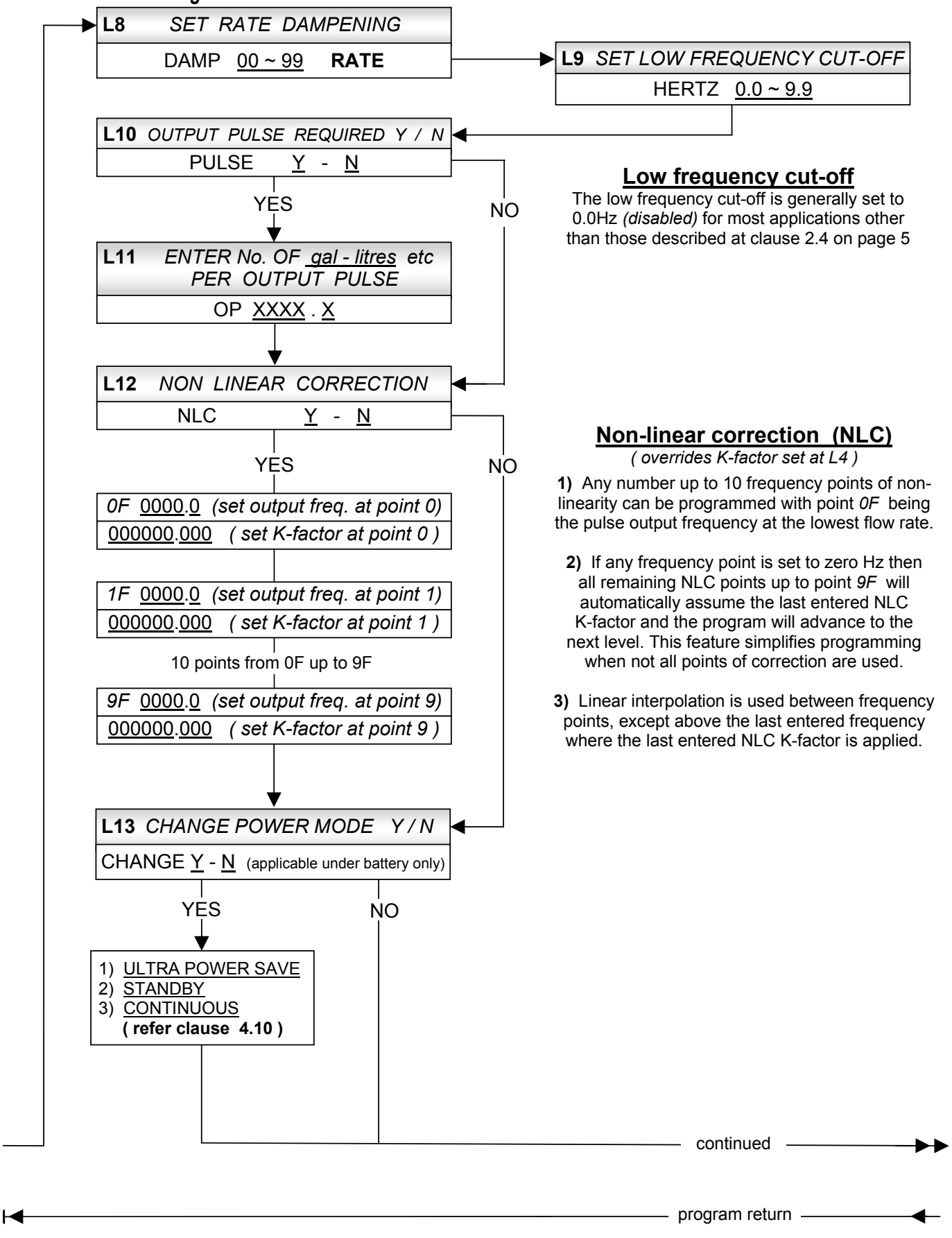
A∋B Totalises A & B separately & Rate is a function of A∋B to give instantaneous ratio.

Note : - When using A & B inputs the functions of Scaled Pulse output, Alarm set points and the Analog output are relevant to resultant computation between A & B. - The analog output of function A∋B can be used as an input for ratio control.

6. PROGRAMMING



6.1 Program levels 8 ~ 13



Low frequency cut-off

The low frequency cut-off is generally set to 0.0Hz *(disabled)* for most applications other than those described at clause 2.4 on page 5

Non-linear correction (NLC)

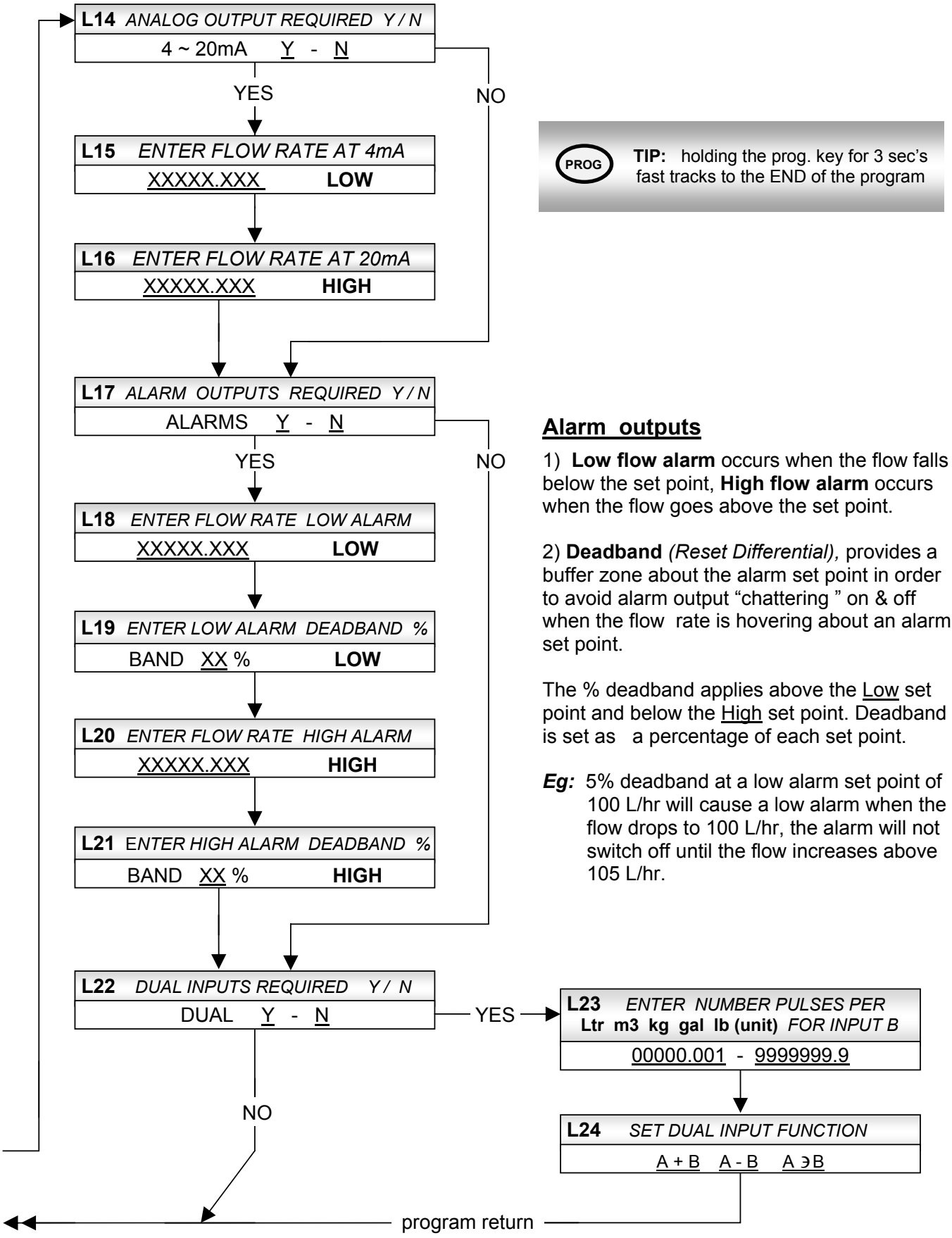
(overrides K-factor set at L4)

1) Any number up to 10 frequency points of non-linearity can be programmed with point *0F* being the pulse output frequency at the lowest flow rate.

2) If any frequency point is set to zero Hz then all remaining NLC points up to point *9F* will automatically assume the last entered NLC K-factor and the program will advance to the next level. This feature simplifies programming when not all points of correction are used.

3) Linear interpolation is used between frequency points, except above the last entered frequency where the last entered NLC K-factor is applied.

6.2 Program levels 14~24



PROG **TIP:** holding the prog. key for 3 sec's fast tracks to the END of the program

Alarm outputs

1) **Low flow alarm** occurs when the flow falls below the set point, **High flow alarm** occurs when the flow goes above the set point.

2) **Deadband** *(Reset Differential),* provides a buffer zone about the alarm set point in order to avoid alarm output "chattering " on & off when the flow rate is hovering about an alarm set point.

The % deadband applies above the Low set point and below the High set point. Deadband is set as a percentage of each set point.

Eg: 5% deadband at a low alarm set point of 100 L/hr will cause a low alarm when the flow drops to 100 L/hr, the alarm will not switch off until the flow increases above 105 L/hr.

6.4 ***Program detail record***

Pencil your program details here

L1	User selected PIN No.		
L3	Engineering units		
L4	K-factor *(scale factor)*	K =	
L5	Decimal for reset Total	☐ 0 ☐ 0.0 ☐ 0.00 ☐ 0.000	
	Decimal for Accum. total	☐ 0 ☐ 0.0 ☐ 0.00 ☐ 0.000	
	Decimal for Rate	☐ 0 ☐ 0.0 ☐ 0.00 ☐ 0.000	
L6	Rate conversion factor	☐ yes ☐ no	RCF=
L7	Time base for Rate	Units / ☐ Sec ☐ Min ☐ Hr ☐ Day	
L8	Rate dampening		
L9	Low frequency cut-off	Hertz =	
L10	Pulse output	☐ yes ☐ no	L11 pulse value =
L12	Non linear correction	☐ yes ☐ no	
	- frequency 0	0F Hz	K-factor =
	- frequency 1	1F Hz	K-factor =
	- frequency 2	2F Hz	K-factor =
	- frequency 3	3F Hz	K-factor =
	- frequency 4	4F Hz	K-factor =
	- frequency 5	5F Hz	K-factor =
	- frequency 6	6F Hz	K-factor =
	- frequency 7	7F Hz	K-factor =
	- frequency 8	8F Hz	K-factor =
	- frequency 9	9F Hz	K-factor =
L13	Power mode	☐ Ultra save ☐ Standby ☐ Continuous	
L14	Analog output	☐ yes ☐ no	
L15	- zero set point	4mA @	
L16	- span set point	20mA @	
L17	Alarm outputs	☐ yes ☐ no	
L18	- low set point	@	
L19	- low deadband	percentage	%
L20	- high set point	@	
L21	- high deadband	percentage	%
L22	Dual flow inputs	☐ yes ☐ no	
L23	- K-factor for B input	K =	
L24	- dual input function	☐ A+B ☐ A-B ☐ A∋B	

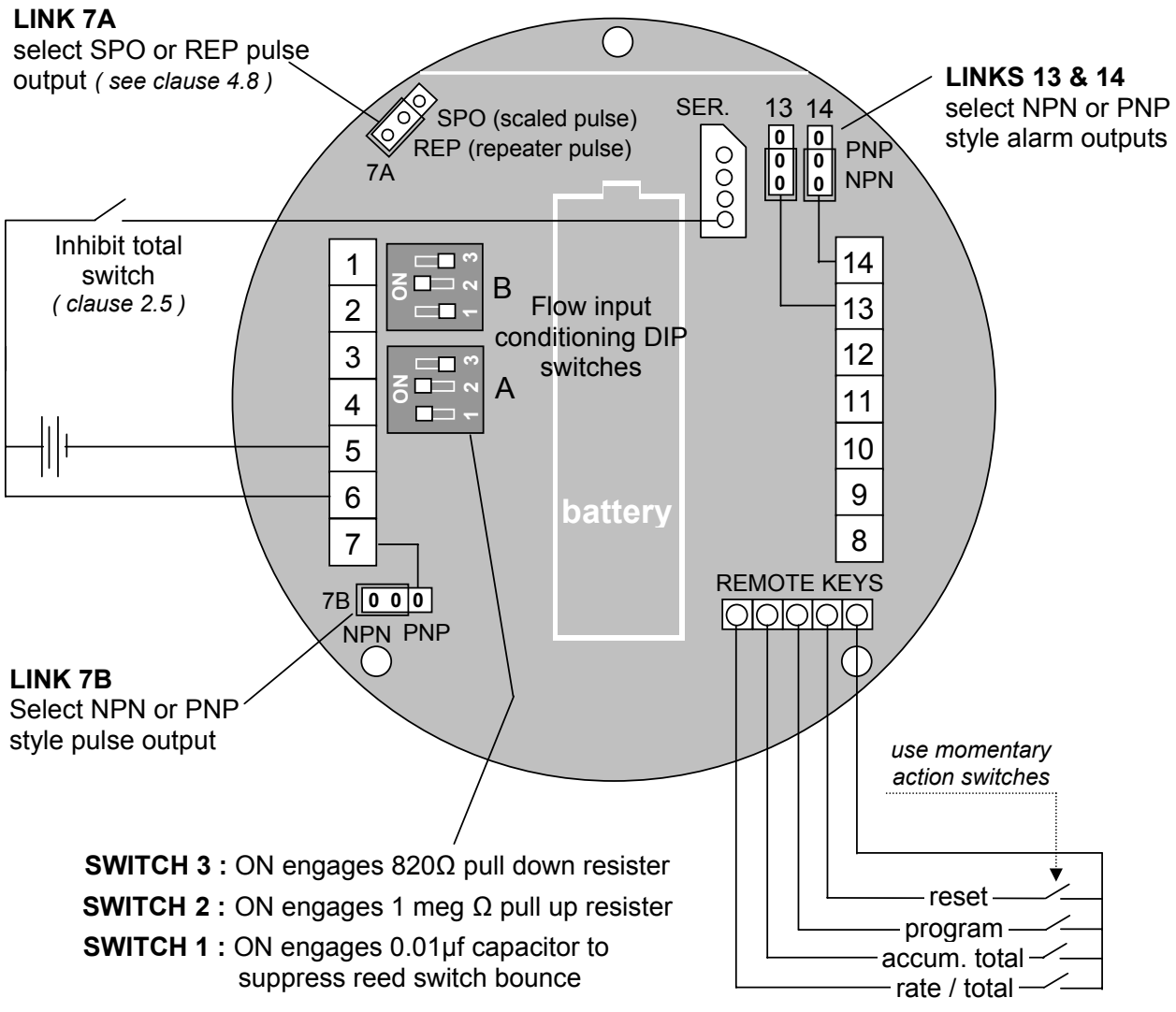
Your back up 4 digit PIN number is <u>1820</u>

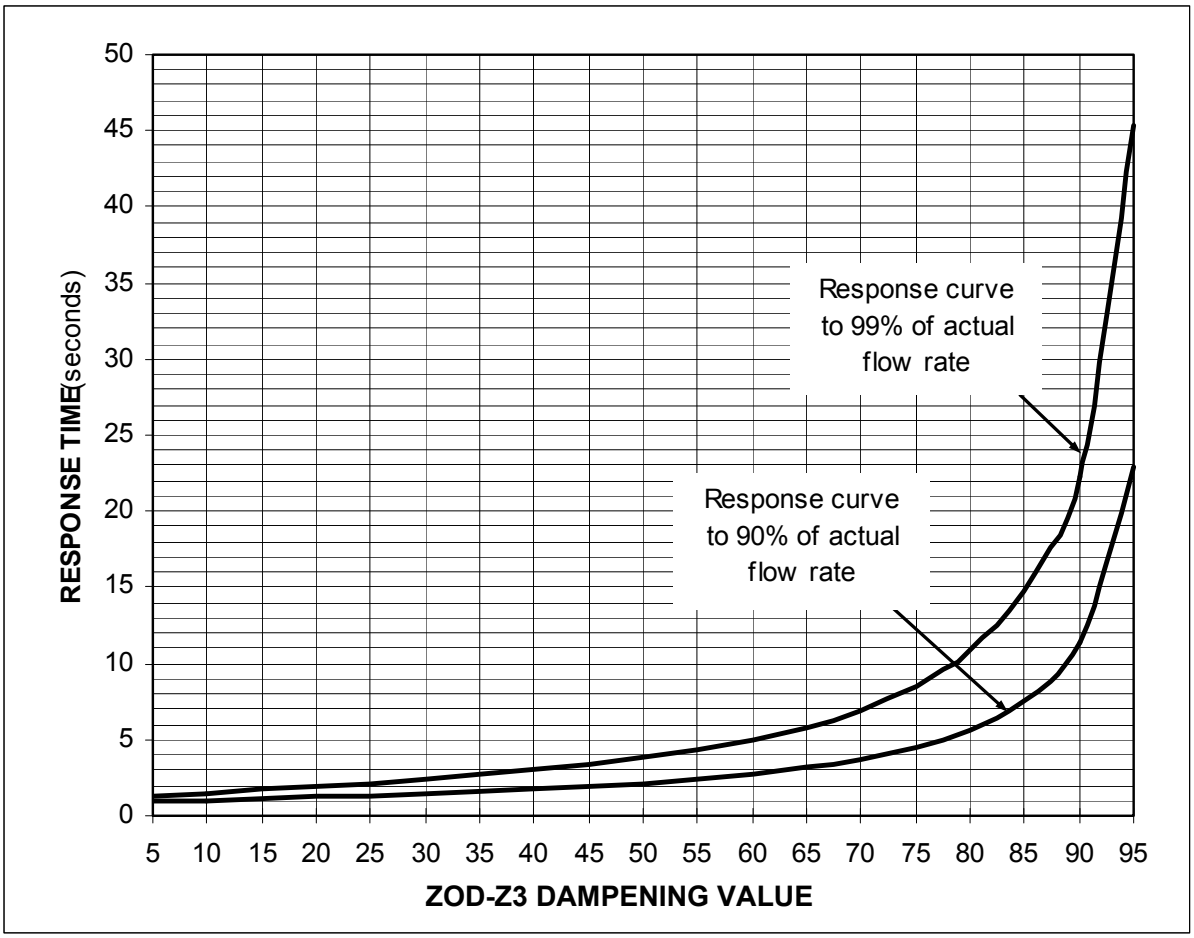
7. TERMINAL DESIGNATION

Terminals 1, 2 & 5 replicate terminals 3, 4 & 5 for dual flow inputs

Terminal		*Terminal*	
1	Flow input B	High flow alarm	14
2		Low flow alarm	13
3	Flow input A	+4~20mA output	12
4		-4~20mA output	11
5	-**0**V (ground)	not used	10
6	+8~24Vdc in	not used	9
7	Pulse output	-**0**V (ground)	8

Terminal layout - links & remote switch inputs





Rate dampening value verses time to reach new reading *(for an instantaneous change in actual flow rate).*

Dual flow inputs

When externally powered at terminals 5 & 6 the ZOD-Z3 provides a dual flow input feature which can be configured for one of three available functions of A+B, A-B or A÷B (ratio).

The dual flow inputs are referred to as “INPUT A” at terminals 3 & 4 and ”INPUT B” at terminals 1 & 2.

Function A+B

Both inputs are added together and displayed as one for Rate, Resettable & Accumulative Totals.

Displays	**Rate**	**:** The total of A+B flow rates displayed as one rate.
	Reset Total	**:** The total of A+B totals displayed as one total.
	Accum. Total	**:** The total of A+B accum.totals displayed as one total.
Outputs	**Scaled Pulse**	**:** Scaled pulse value is relative to the totalised values.
	Alarms	**:** Alarms are taken relative to the displayed rate.
	Analog Output	**:** 4~20mA output is proportional to the displayed rate.

Function A-B

Input B is subtracted from input A, the resultant is displayed as one for Rate, Resettable & Accumulative Totals.

Displays	**Rate**	**:** The difference of A-B flow rates displayed as one rate
	Reset Total	**:** The difference of A-B totals displayed as one total.
	Accum. Total	**:** The difference of A-B accum.tot. displayed as one total.
Outputs	**Scaled Pulse**	**:** Scaled pulse value is relative to the totalised values.
	Alarms	**:** Alarms are taken relative to the displayed rate.
	Analog Output	**:** 4~20mA output is proportional to the displayed rate.

Function A÷B

Input A is divided by input B, the resultant is displayed as an instantaneous Ratio, Resettable & Accumulative Totals are independently displayed for both A & B inputs.

Displays	**Rate**	**:** The resultant Ratio between A÷B flow rates displayed as an instantaneous Ratio.
	Reset Total input A	**:** The total of input A.
	Reset Total input B	**:** The total of input B.
	Accum. Total input A	**:** The Accumulative total of input A.
	Accum. Total input B	**:** The Accumulative total of input B.
Outputs	**Scaled Pulse**	**:** The scaled pulse output relates to input A .
	* **Alarms**	**:** Alarms are taken relative to the displayed ratio.
	* **Analog Output**	**:** 4~20mA output is proportional to the displayed ratio.

∉ **Note:** The alarm and analog outputs for the A÷B function are set in the initial stages of programming in relation to rate units eg: setting the analog output range to 4mA = 00.000 litres/min and 20mA = 10.000 litres/min, the analog output will be proportional to the ratio rate display of 0.000~10.000 (eg. 4mA @ 0.000 and 20mA @ 10.000). The same set up analogy applies to the alarm settings.

7. Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Flow Rate Totaliser Model: ZOD-Z3K

to which this declaration relates is in conformity with the standards noted below:

Optional for Equipment intended for use in Potentially Explosive Atmospheres:
ATEX Directive **94/9/EC**

EN 50014: 1997 + Amds. 1 & 2 Intrinsically Safe Electronics (I.S.) – Optional

EN 50020: 2002 Intrinsically Safe Electronics (I.S.) – Optional

EN 60529, DIN VDE 0470-1 1992-11
I.P. Ingress Protection Classifications

EN 61326-1: 2006-10
Electrical equipment for control, instrumentation technology and laboratory use – EMC requirements (Industrial area)

EN 61010-1: 2002-08
Safety requirements for electrical equipment for measurement, control, and laboratory use –

2008/35/EC Waste Electrical & Electronic Equipment (WEEE)

Also the following EEC guidelines are fulfilled:

2004/108EC EMC Directive
2006/95 EC Low Voltage Directive

Hofheim, 18. Oct. 2010

H. Peters
General Manager

M. Wenzel
Proxy Holder

8. ALPHABETICAL INDEX

Manufactured and sold by:

Kobold Messring GmbH
Nordring 22-24
D-65719 Hofheim
Tel.: +49(0)6192-2990
Fax: +49(0)6192-23398

IMRTSUP-1810

Universal Mount Series

ZOD-Z3 FLOW RATE TOTALISER

INSTRUCTION MANUAL SUPPLEMENT

for

INTRINSICALLY SAFE ZOD-Z3 INSTRUMENT

ATEX approval

The name of the manufacturer :	KOBOLD Messring GmbH
Address :	Nordring 22-24, 65719 Hofheim,Germany
The type identification (as appropriate) : *Rate Totaliser*	Model ZOD-Z3*******
Other marking required by Directive 94/9/EC	CE 0158 Ex II 2G
The certification code :	EEx ia IIB T4 (-20°C ≤ T_a ≤ +60°C)
Ambient temperature range :	(-20°C ≤ T_a ≤ +60°C)
The ATEX *certificate number :*	Sira 10ATEX2214X

Supplementary Instructions for Intrinsically Safe (I.S.) ZOD-Z3 Series Instruments

Index

1. General

These instructions must be read in addition to the ZOD-Z3 Instruction Manual if you have purchased an ATEX I.S. certified ZOD-Z3 series instrument and intend installing it in a hazardous environment for which it is approved.
The I.S. certified instrument may be stand alone or fitted to a flowmeter.

2. Conforming Standards

The I.S. ZOD-Z3 series instruments are certified in accordance with the ATEX directive. Prior to installation, review the certification marking on the instrument label to confirm it is appropriately certified for your region, suits the site classification and complies with your hazardous area philosophy.

ATEX Directive
Complies with ATEX directive 94/9/EC
Conforms to Standards
EN50014:1997 + Amendments 1 & 2 and EN 50020:2002

Instruments have also been assessed against the Essential Health and Safety requirements (ESHR's) as defined in European Directive 94/9/EC for ⟨Ex⟩ II 2 G.

The instruments are certified for "ia" (intrinsically safe) protection suitable for gas group IIA, IIB and temperature class T1 to T4 in an ambient temperature of -20 to +60 deg C and are suitable for installation in Group II, Zone 1 and 2 areas.

The instruments have also been tested to IEC60529 and comply with a protection rating of IP66/67.

3. Overview

The certified ZOD-Z3 series is an I.S. indicator providing a display of flowrate, accumulated total and resettable total. It can be battery powered and/or dc powered via an approved associated apparatus such as an I.S. isolator.

In addition, when externally powered the certified ZOD-Z3 series provides the choice of one output from the list below;

Loop Powered 4~20mA output proportional to flow rate (model ZOD-Z3…)

Low flow rate alarm (model ZOD-Z3…)

High flow rate alarm (model ZOD-Z3…)

High or Low flow rate alarm (model ZOD-Z3…)

Scaled pulse output for remote totalisation (model ZOD-Z3…)

Flowmeter pulse amplifier (model ZOD-Z3…)

4. Mechanical Installation *(also refer ZOD-Z3 series Instruction manual)*

There are additional installation requirements to the Instruction Manual for certified ZOD-Z3 series instruments in accordance with the ESHR's as defined in annex II of the ATEX directive 94/9/EC.

The ambient temperature must be within the limits -20 to +60 deg C.

The instruments must be installed to prevent mechanical and thermal stresses and to prevent an attack from existing or foreseeable aggressive substances.

The instrument case is not considered to be an electrostatic risk, however the equipment must not be installed in a position where it may be subjected to an excessive air flow or subjected to rubbing that may cause an electrostatic build up.

In all installations appropriate local rules, regulations and directives governing instrument selection, installation practices and requirements must be followed.

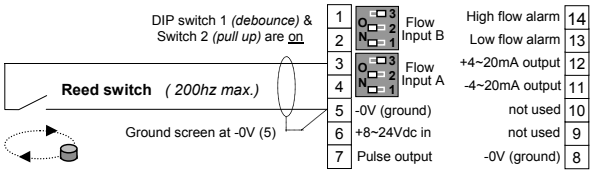
5. Electrical Installation

5.1 Inputs

The I.S. ZOD-Z3 series can accept pulse or frequency inputs from a variety of flowmeters. When the I.S. ZOD-Z3 is purchased as part of a flowmeter the appropriate input is normally pre-wired at the factory. The common input types are listed below.

5.1.1 Un-powered inputs

Reed switch inputs are defined as simple apparatus under the ATEX directive. A reed switch input can be wired directly into the ZOD-Z3 series instrument without further certification.

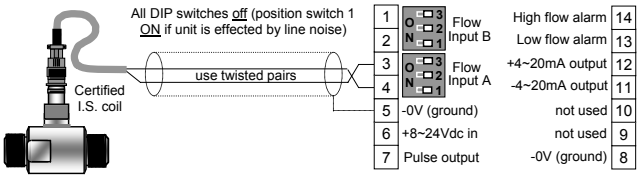


Connect across terminals 1 & 5 when using the flow input B with the model ZOD-Z3.
If it is a preference to dc power the ZOD-Z3 refer to Outputs Section of this supplement.

5.1.2 Self Exciting Inputs

Non amplified Pick off coils from turbine meters are examples of this type of input. Pick-off coils must be I.S. certified and the entity parameters of the coil must not be less than the entity parameters of the ZOD-Z3 series instrument being:

Vi of the sensor must be greater than or equal to 28 Vdc
Ii of the sensor must be greater than or equal to 100mA
Pi of the sensor must be greater than or equal to 0.7W



Connect across terminals 1 & 2 when using the flow input B with the model ZOD-Z3.
If it is a preference to dc power the ZOD-Z3 refer to Outputs Section of this supplement.

5.1.3 Inputs requiring power from the ZOD-Z3 series

Examples of this type of sensor are open collector output from a Hall Sensor, pre-amplified coils from turbine meters or Namur inductive proximities. Examples are where the voltage required to power the sensor originates from the associated apparatus via the ZOD-Z3 instrument.

These sensors must be certified and the entity parameters of the sensor must not be less than the entity parameters of the ZOD-Z3 series instrument being:

Vi of the sensor must be greater than or equal to 28 Vdc
Ii of the sensor must be greater than or equal to 100mA
Pi of the sensor must be greater than or equal to 0.7W

The power to the ZOD-Z3 series instrument must come from a certified source *(commonly known as associated apparatus)*. The entity parameters of the associated apparatus must not exceed those of the ZOD-Z3 series instrument being:

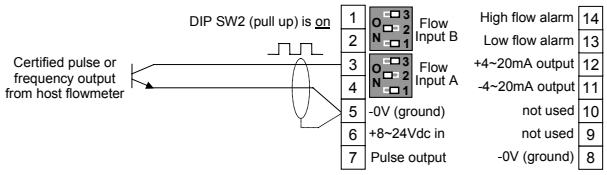
Voc of the associated apparatus must be less than or equal to 28Vdc
Isc of the associated apparatus must be less than or equal to 100mA
Pout of the associated apparatus must be less than or equal to 0.7W

The associated apparatus may also be used to retransmit an output from the ZOD-Z3 series instrument to the safe area. *(refer to Output Section in this supplement for wiring examples)*

5.1.4 Other Inputs

The ZOD-Z3 series can also accept isolated pulse/frequency outputs from a powered device such as an open collector or voltage free contact from a mass or electromagnetic flowmeter. These devices must be appropriately certified and the pulse/frequency output must be isolated and have certified entity parameters not less than the entity parameters of the ZOD-Z3 series instrument being:

Vi of the flowmeter pulse/frequency output must be greater than or equal to 28 Vdc
Ii of the flowmeter pulse/frequency output must be greater than or equal to 100mA
Pi of the flowmeter pulse/frequency output must be greater than or equal to 0.7W



Connect across terminals 1 & 5 when using the flow input B with the model ZOD-Z3.
If it is a preference to dc power the ZOD-Z3 refer to Outputs Section of this supplement.

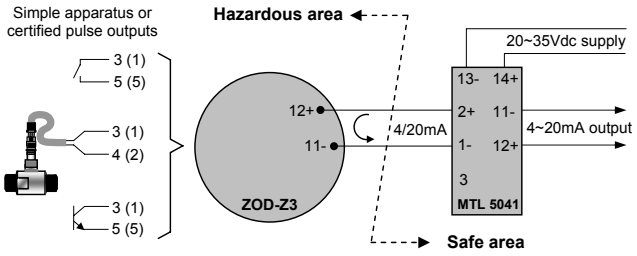
5.2 Outputs

The ZOD-Z3 series instruments are certified to provide one of the following outputs. To obtain an output external power is required to be sourced from a certified associated apparatus located in the safe area. In all cases the entity parameters of the associated apparatus must not exceed those of the ZOD-Z3 series instrument being:

Voc of the associated apparatus must be less than or equal to 28Vdc
Isc of the associated apparatus must be less than or equal to 100mA
Pout of the associated apparatus must be less than or equal to 0.7W

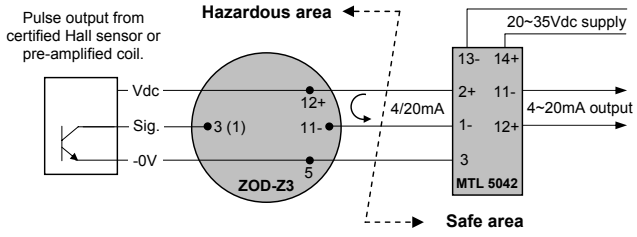
5.2.1 Two wire 4-20mA loop powered output

This configuration is used when the flow input does not require power from the ZOD-Z3.
Terminal designations in parenthesis ( ) refer to the B flow input on the model ZOD-Z3.



5.2.2 Three wire 4-20mA Output

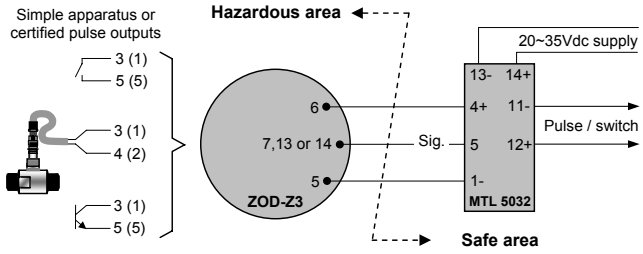
This configuration is used when the flow input requires power from the ZOD-Z3.
Terminal designations in parenthesis ( ) refer to the B flow input on the model ZOD-Z3.



5.2.3 Pulse *(Pre-amplified or Scaled Pulse)* or Flow alarm Output when the flow input does not require power from the ZOD-Z3 *(refer ZOD-Z3 manual for input DIP switch settings)*

ZOD-Z3 jumpers 7B, 13 and 14 must be set to PNP.
Terminal 7 is pre-amplified pulse (frequency) if jumper 7A is set to "REP"
Terminal 7 is scaled pulse output if jumper 7A is set to "SPO"
Terminal 13 is low flow alarm output.
Terminal 14 is high flow alarm output.

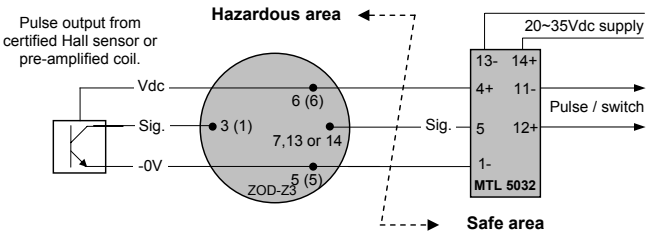
Terminal designations in parenthesis ( ) refer to the B flow input on the model ZOD-Z3.



5.2.4 Pulse *(Pre-amplified or Scaled Pulse)* or Flow alarm Output when the flow input requires power from the ZOD-Z3 *(refer ZOD-Z3 manual for input DIP switch settings)*

ZOD-Z3 jumpers 7B, 13 and 14 must be set to PNP.
Terminal 7 is pre-amplified pulse (frequency) if jumper 7A is set to "REP"
Terminal 7 is scaled pulse output if jumper 7A is set to "SPO"
Terminal 13 is low flow alarm output.
Terminal 14 is high flow alarm output.

Terminal designations in parenthesis ( ) refer to the B flow input on the model ZOD-Z3.



5.3 Associated Apparatus
The wiring examples illustrated in this supplement are based on MTL 5000 series I.S. Isolators. Alternative isolators with suitable entity parameters are permitted to be used with the ZOD-Z3 instruments. Refer to manufacturers catalogues for full specifications.

5.4 Wiring
In addition to the wiring requirements of the ZOD-Z3 Instruction Manual, appropriate local rules, regulations and directives governing wiring practices for I.S. installations must be followed. These include but are not limited to cable lengths, segregation, routing and identification of I.S. cabling.

With regards to cable selection and allowable length the associated apparatus capacitance and inductance parameters must not be exceeded by the sum of the capacitances and the sum of the inductances within the loop.

When calculating allowable cable length use the capacitance and inductance values of the ZOD-Z3 of 0.335 microF and 0mH respectively.

By way of example when using a 5032 MTL isolator and assuming cable parameters of 100pF/m & 1µH/m the maximum allowable transmission distance is calculated to be 550m (1800ft). If a 5041 MTL isolator is used the allowable transmission distance increases to 3150m (6600ft) assuming the same cable parameters.

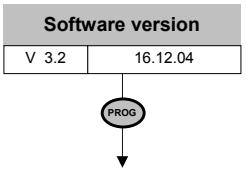
Certain regions such as Europe allow the inductance/resistance ratio of the cable to be used instead of the sum of the inductances. In this case the cable inductance/resistance ratio must be lower than the maximum inductance/resistance ratio permitted by the associated apparatus.

5.5 DIP switch and Jumpers
Refer to ZOD-Z3 Instruction Manual for location, full description & settings of DIP switches & Jumpers.

6. Programming
Refer to ZOD-Z3 Instruction Manual for programming of your ZOD-Z3.

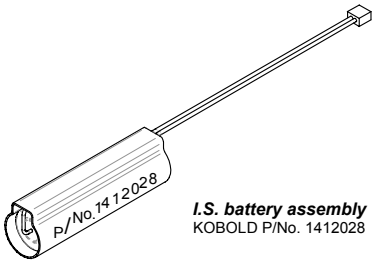
7. Service
The only serviceable item within the instrument is the battery pack and can be replaced insitu. Only the certified I.S. battery assembly P/No. 1412028 can be used and is available from the locations listed at the end of the ZOD-Z3 Instruction Manual.

8. Repair
The ZOD-Z3 series instruments must only be repaired by trained personnel using approved spares. Instruments requiring repair must therefore be returned to one of the locations listed at the end of the ZOD-Z3 Instruction Manual.



Press & hold Program key to show instrument model & software version

Replacement Battery:



I.S. battery assembly
KOBOLD P/No. 1412028

Warning : *KOBOLD Intrinsically safe battery assembly P/No. 1412028 only is approved for* ZOD-Z3 *instruments mounted in a hazardous area.*

9. Declaration of Conformance

We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Flow Rate Totaliser Model: ZOD-Z5

to which this declaration relates is in conformity with the standards noted below:

Optional for Equipment intended for use in Potentially Explosive Atmospheres:
ATEX Directive **94/9/EC**

EN 50014: 1997 + Amds. 1 & 2 Intrinsically Safe Electronics (I.S.) – Optional

EN 50020: 2002 Intrinsically Safe Electronics (I.S.) – Optional

EN 60529, DIN VDE 0470-1 1992-11
I.P. Ingress Protection Classifications

EN 61326-1: 2006-10
Electrical equipment for control, instrumentation technology and laboratory use – EMC requirements (Industrial area)

EN 61010-1: 2002-08
Safety requirements for electrical equipment for measurement, control, and laboratory use –

2008/35/EC Waste Electrical & Electronic Equipment (WEEE)

Also the following EEC guidelines are fulfilled:

2004/108EC EMC Directive
2006/95 EC Low Voltage Directive

Hofheim, 17. Sep. 2010

H. Peters
General Manager

M. Wenzel
Proxy Holder

Universal Mount Series

Z5 FLOW RATE TOTALISER

with backlighting & flow alarms

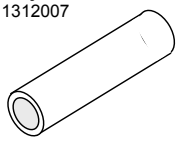
INSTRUCTION MANUAL

Software issue

Press & hold Program key to show instrument software version

Replacement Batteries:

battery
P/No. 1312007



Suitable batteries also available from :	
R S Components Stock No. 596-602	***Farnell Components*** Order code 206-532

3.6V x 2.4Ah AA
– Lithium Thionyl Chloride +
non - rechargeable cell

TABLE OF CONTENTS

1.1 Order Details

Model	Housing Type	Electrical connection/ Cable gland	Supply Voltage	Options	Mechanical protection
ZOD-Z5...	**KS =** universal mount (standard) **KM* =** integral mount	**2 =** 3 x cable gland entry 1/2" NPT **3 =** 3 x cable gland entry M16	**F3 =** 8...24 V_{DC}, battery	**0 =** without **R =** 2xRelays	**0 =** without **P =** display protection plate

*order only when retrofitting a pulse meter

1.2 Specifications

Display : Large backlit 6 digit numeric display with LCD characters 17mm (0.67 ") high, second line of 8 digits x 7mm high totalising plus 5 digits of rate indication. Programmable 0~3 decimal places for all displays.

Signal Input : Universal pulse/frequency input compatible with Reed switch, Hall effect, Namur proximity detectors, voltage, current & Coil *(15mV P-P min).* Max. input frequency 5Khz.

Minimum input frequency for rate display is 0.1hz with low frequency cut off feature enabled, totals have no minimum input frequency when low frequency cut off is set to zero.

Battery power : The unit draws about 70µA under battery, life expectancy is generally 3 years. Battery life reduces when rate is more often displayed & there is no external power connected.. Rate display defaults to total display 1 minute after pressing the rate key in order to conserve battery power. *(reverse polarity protected)*

Battery condition is continuously monitored internally, the instrument runs on 3.6Vdc, the battery icon illuminates when the battery output falls below 3.1Vdc, at this point the instrument will continue to operate for a short period but the battery should be change as soon as possible, batteries are readily available from all major electronic component suppliers (see page 2 for details).

External power : Regulated 8~24Vdc x 50mA minimum.

Memory : All programmed & accumulated data is stored permanently in non-volatile memory.

Pulse output : NPN transistor, scaleable, 5Khz max. 100mA maximum drive capability.

Physical :
A) IP66 / 67 aluminum alloy with 0.3% magnesium (6% is maximum for mine sites).
B) 3 x M16 x 1.5 female conduit entries.
C) 114mm (4.5") wide x 96mm (3.8") high x 62mm deep (2.5") x 480g (1lb).
D) Temperature range from -20ºC to +80ºC (-4ºF to +176ºF).

Configuring : PIN protected data entry.

K-factor range : (scale factor) Eg. Pulses/litre, gallon, lb etc. Programmable range is 0.001~ 99,999.999 with a floating decimal point during K-factor entry.

Engineering units : Selectable Ltr, gal, m3, kgs, lbs (total). /sec, /min, /hr or /day *(rate)*.

1.3 Overview

The instrument will display Flow Rate, Resettable Total and an Accumulated Total in engineering units as programmed by the user. Simple flow chart programming prompts you through the programming set up greatly reducing the need to refer to the instruction manual. All user program data is retained if the battery is removed.

Environments

The instrument is weatherproof to IP66/67 (Nema 4X) standards, constructed in ADC12 aluminum alloy with stainless screws & FKM O-ring seals.The instrument suits harsh indoor and outdoor environments & conforms to EMC directive 89/336/EEC Electro Magnetic Compatibility.

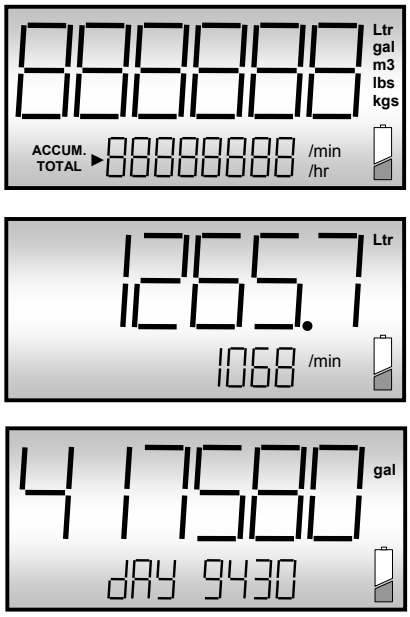
Features

PIN Protection, NPN scaleable pulse output, Low frequency cut-off, display priority & large backlit digital display *(backlighting enabled under external DC power only).*

Installation

Specifically engineered to be directly mounted on a variety of flowmeters, wall or surface mounted, pipe or panel mounted. Various mounting kits are available. The instrument can be self powered or may be powered by an external dc supply or two wire loop powered.

1.4 LCD displays



Full LCD display test feature illuminates all display segments and script text displays for 5 seconds when entering the program mode.

Resetable Total This large 6 digit display can be programmed for up to 3 decimal places.

Accumulative Total The 8 digit display can be programmed for up to 3 decimal places. Reset is only possible when in the program mode which can be PIN protected for security.

Rate display Rate is displayed with a flashing time base of either SEC, /min, /hr or dAy followed by up to 5 digits of rate, these are programmable for up to 3 "floating" decimal places.

Time bases of units /SEC & units /dAy are displayed to the left of the digital display whilst units /min & /hr are to the right of the rate digits as shown.

Backlighting The LCD backlight feature will only work from an external dc power source in the range of 8~24Vdc.

2. OPERATION

2.1 Accumulative Total

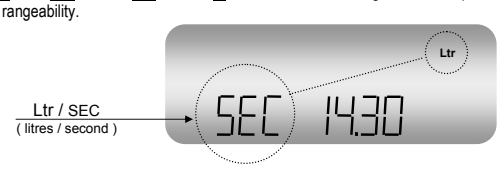
Accumulative total can be reset in the program mode. The accumulative total is displayed by pressing the ACCUM TOTAL key.

2.2 Resettable Total

The resettable total display remains visible at all times & may be reset at any time by pressing the reset button for 1~2 seconds.

2.3 Rate display The second line display toggles between Rate & Accumulative Total as the appropriate keys are pressed. The instrument will default out of the rate mode after 1 minute when under battery power, this is to conserve the battery as the unit draws more current when it needs to calculate rate. Under external power the instrument will remain on Rate or Accumulative Total as they are selected.

When rate is displayed the leading three alpha characters on the left of the display "flash " the time base for rate **eg**. rate /SEC. rate /dAy. & rate /min. or rate /hr to the left of the rate digits. Decimal points float to provide good resolution & rangeability.



The minimum input frequency for rate display is 0.25hz reducing to 0.1hz If the low frequency cut-off is set to 0.1Hz *(see clause 4.7).*

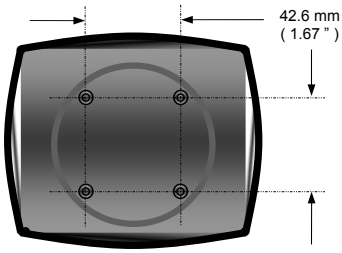
2.4 Keypad function matrix

KEY	FUNCTION IN OPERATING MODE	FUNCTION IN PROGRAM MODE
ACCUM TOTAL	Displays Accumulative Total when pressed.	No function
▲	No function	Increments the selected digit each time that it is pressed.
RESET	Resets the resettable total display to zero when pressed for 1~2 seconds.	Resets the accumulative total display to zero.
PROGRAM ENTER	1) Pressing the Prog. & Reset keys for 5 seconds enters you into the program mode. 2) Displays model & software revision No.	Each press steps you through each level of the program.
RATE ▶	Displays flow rate when pressed	Selects the digit to be set, the selected digit will be "flashing " indicating that it can be incremented.

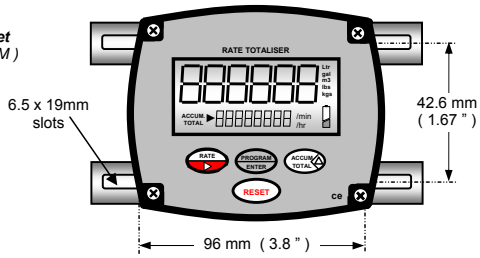
3. INSTALLATION

3.1 Remote Mounting

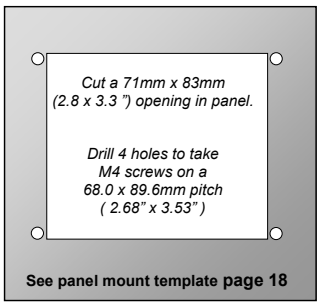
Surface mount footprint
use 4 x M3 screws supplied



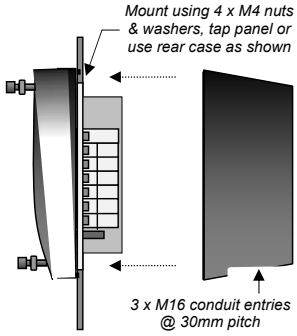
Wall mount bracket
Optional, P/No. AWM)



Panel mount options



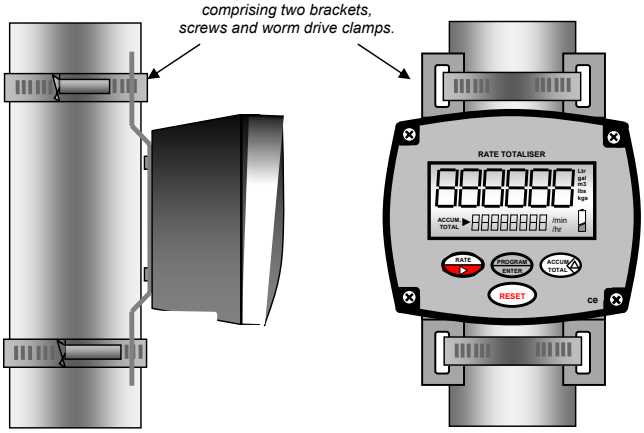
See panel mount template page 18



3.1 Remote Mounting *(continued)*

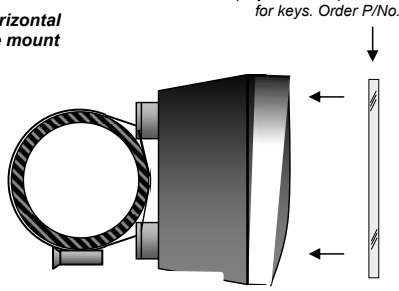
**** Pipe mount***

** order Pipe mount kit P/No. APM comprising two brackets, screws and worm drive clamps.*



**** Horizontal pipe mount***

Optional facia protector, 3mm clear polycarbonate plate with access port for keys. Order P/No. 1306061.



3.2 Flowmeter connections - unpowered sensors

DIP switch functions :

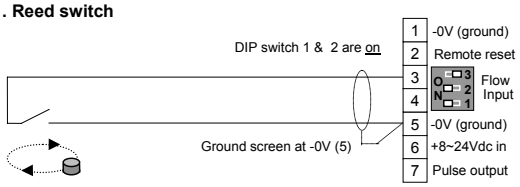
Flow Input — ON — 3 2 1

Switch 3 : ON engages 820Ω pull down resister

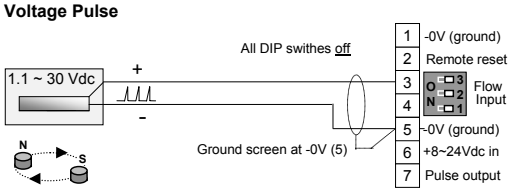
Switch 2 : ON engages 1 meg Ω pull up resister

Switch 1 : ON engages 0.01µf capacitor to suppress reed switch bounce

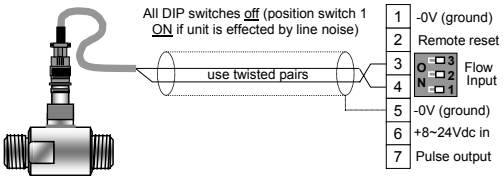
1. Reed switch



2. Voltage Pulse

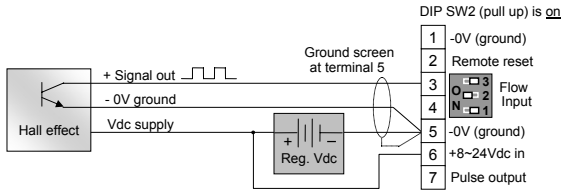


3. Coil *(Turbine & paddle style flowmeters – minimum 15mV p-p)*

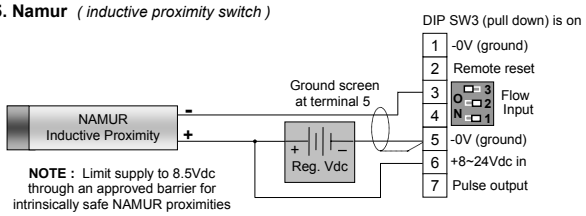


3.2 Flowmeter connections - powered sensors

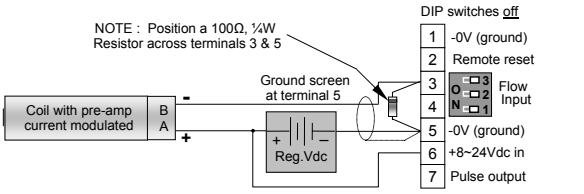
4. Hall effect *(5~24Vdc open collector)*



5. Namur *(inductive proximity switch)*

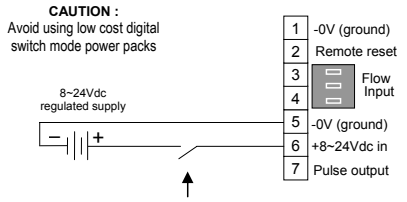


6. Current modulated pulse *(4mA to 20mA pulse amplitude)*



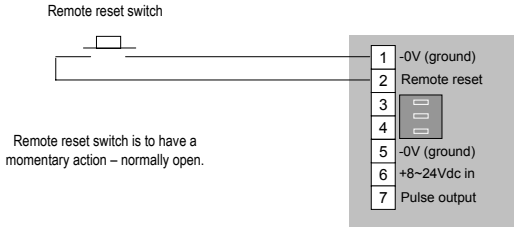
3.3 Wiring connections

External DC powering – required for powered flow sensors, display backlighting or pulse outputs.



Note : Powering the instrument from an external DC source will cause the backlighting feature to turn on, if this is not desirable at all times then install a power isolation switch in series with the DC power source as shown.

Remote reset
Terminals 1 & 2 cater for the connection of a remote reset switch, this will reset the 6 digit resettable totaliser display but does not effect the 8 digit Accumulative totaliser. The remote switch needs to have a momentary contact action only.



Wiring requirements : Use multi-core screened twisted pair instrument cable (0.25 – 0.5mm^2) for electrical connection between the RT and any remote flowmeter or receiving instrument. The screen needs to be earthed to the signal ground of the receiving instrument only to protect the transmitted signal from mutual inductive interference.

Instrument cabling should not be run in a common conduit or parallel with power and high inductive load carrying cables, power surges & power line frequencies may induce erroneous noise transients onto the signal. Run instrument cables in a separate conduit or with other instrument cables.

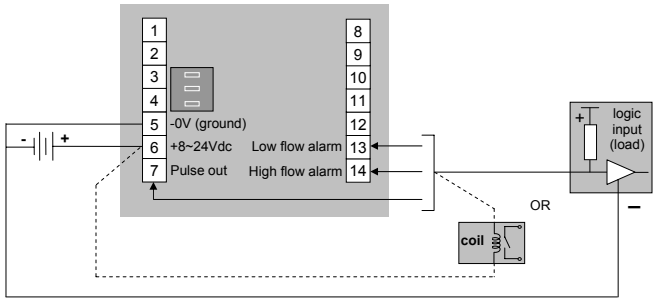
3.3 Wiring connections *(continued)*

Pulse & Alarm Output *(for this feature the instrument must be externally powered as per page 12)*

The scaled pulse output is in the form of an NPN *(current sinking)* style pulse capable of switching up to 100mA.
Current sinking derives its name from the fact that it "sinks current from a load". When activated the current flows from the load into the appropriate output (terminals 7, 13 & 14).

Pulse scaling is set as the number of litres / gallons etc. per output pulse *Eg.* 0.1 litres/pulse, 10 litres/pulse, 100 gallons/pulse. Range is 0.1 - 9999.9 Eng.unit/pulse.

The pulse width *(pulse duration)* of the output pulse automatically mirrors the cyclic width of the incoming pulse, for example 5Hz input frequency would produce a scaled pulse output with a duration ≤200ms, for 100Hz input the output pulse duration would be ≤10ms.



Driving a logic input ———— The output voltage pulse is typically the internal voltage of the load. The load would normally have an internal pull up resistor on its input as shown.

Driving a coil - - - - - - - The coil load is obtained by dividing the coil voltage by coil impediance (Ω), is expressed in amps & is not to exceed 0.1A. The coil voltage is connected across & must match the RT supply voltage & the output (7,13 & 14).

4. PROGRAM PARAMETERS

Note: *The instrument defaults out of the program mode if no programming entries are made after 4 minutes.*

4.1 PIN No. Program Protection
Any user defined PIN number other than 0000 will engage the program protection feature, failure to input the correct PIN number will deny the ability to change any of the program parameters but will allow the user to step through and view the existing program parameters.

Only one PIN number may be set but this can be changed at any time after gaining access through PIN entry. A second back up PIN number is installed at the factory should the programmed PIN be lost or forgotten.
(refer bottom of page 16 for the back up PIN No.)

4.2 Resetting Accumulated Total
Resetting the accumulated total can only be done in the program mode.

4.3 Engineering Units
Select from available Engineering units to right of the display *(refer clause 1.4)*, for other engineering units set display to show no engineering units & program a suitable K-factor.

4.4 K-factor (scale factor)
Enter K-factor at S-Fact, up to 5 whole numbers & 3 decimal numbers can be entered using the arrowed keys.

4.6 Rate response
Adjustable response *(rate dampening)* is available to smooth out fluctuating flow input signals in order to provide a stable rate display. Most input signal are reasonably stable and need only a low setting value of 001 to 004. The response number (ranged 001~999) represents the number of pulse intervals (duration between each pulse) that the processor averages and displays the rate as calculated.

As a general rule it would be best to apply a response number which is a multiple of the number of pulses a meter produces for each cycle of its primary measuring element, for example a rotating element may produce 4 pulses per revolution so 004, 008, 012 or 016 would be ideal response settings whereas a turbine meters with high resolution pulse outputs would require response settings like 050, 100, 200 or in some cases involving high frequency pulse outputs eg. 500hz, the response number would be set to say 999.

4.7 Low frequency cut-off
The low frequency cut-off is most commonly set to 0.0Hz *(disabled)* other than to:

1) To display rate for input frequencies below 0.25hz, for example setting the cut-off at 0.1Hz the rate will continue to display for input frequencies as low as 0.1Hz *(one pulse every 10 seconds)*, such conditions often apply to flowmeters with low frequency pulse outputs.

2) Inhibit the integration & registration of "apparent flow" which at times may be encountered on mobile installations where the movement of the vehicle or dead heading a pulsating pump may cause spurious flow signals which are not attributed to actual flow.

3) Inhibit the integration & registration of flow at input frequencies below what is considered the minimum accurate flow rate of the primary flow element *(flowmeter)*.

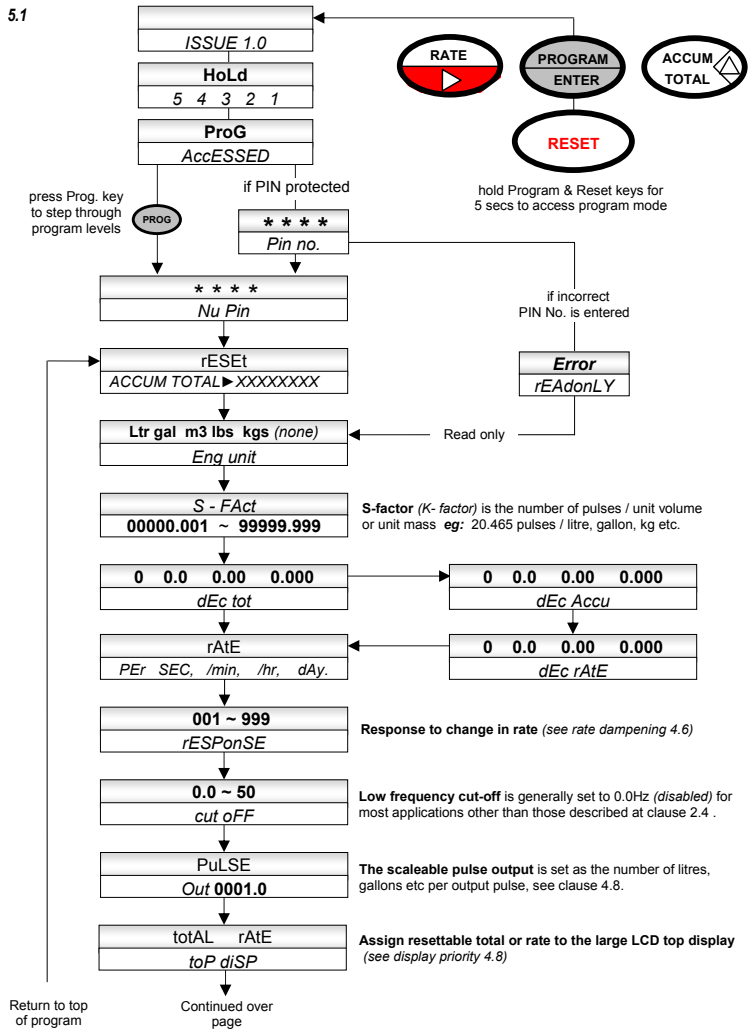
Caution: If the low frequency cut-off is set to any value other than 0.0Hz then the integration of rate and total will cease at frequencies on or below the set frequency value.

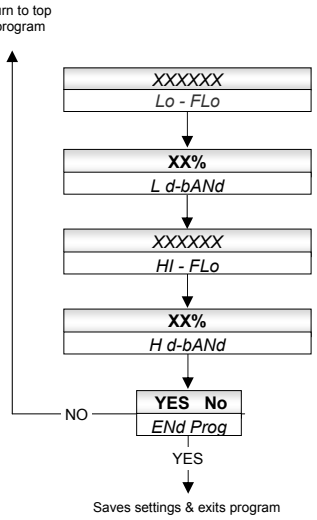
4.8 Display priority *The large digits at the top of the display can be programmed to show either flow rate or resettable total. When flow rate is selected at the top display the rate key can be used to cycle between rate, reset total & accumulate total, in this mode the instrument will default from rate to reset & accumulative totals after 1 minute, external power must be applied if required to display rate at top display continuously.*

4.9.1 Flow Alarms *(The RT must be externally powered as per page 12)* Two flow alarm FET *(transistor)* outputs may be programmed for Low & High flow alarms. An optional plug in alarm board is available having dual SPDT 5 amp electro-mechanical contacts.

4.9.2 Flow Alarm Deadband
An adjustable deadband *(reset differential)* provides a trip buffer zone about the set point in order to overcome alarm "chattering" when the flow rate is fluctuating close to the alarm set point. Deadband is entered as % of each set point value *(refer to page 17 for an example)*.

5.1





Optional alarm outputs

1) **Low flow alarm** *(Lo-Flo)* occurs when the flow falls below the set point, **High flow alarm** *(Hi.Flo)* occurs when the flow goes above the set point.

2) **Deadband** *(d-bANd) or Reset Differential,* provides a buffer zone about the alarm set point in order to avoid alarm output "chattering " on & off when the flow rate is hovering on or about an alarm set point.

The % deadband applies above the Low set point and below the High set point. Deadband is set as a percentage of each set point.

Eg: 5% deadband at a low alarm set point of 100 L/hr will cause a low alarm when the flow drops to 100 L/hr, the alarm will not switch off until the flow increases above 105 L/hr.

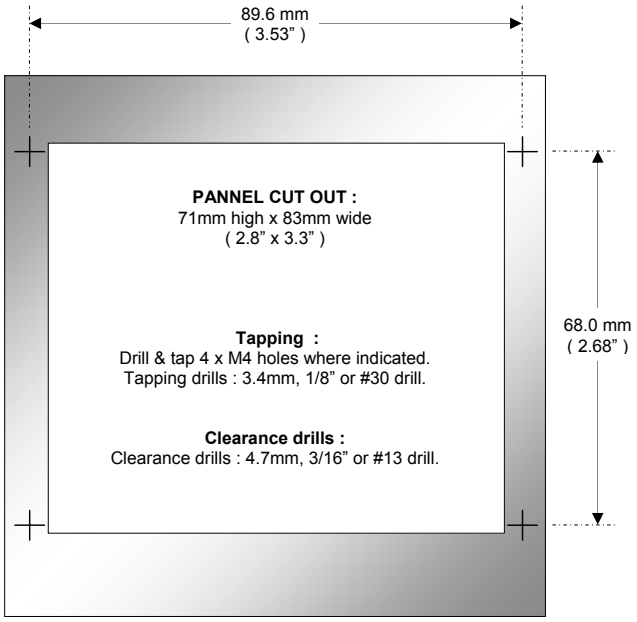
5.2 Program detail record

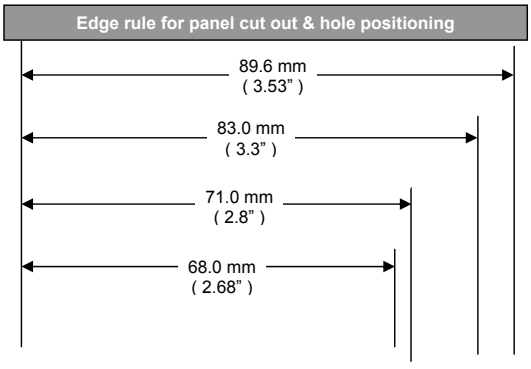
Pencil your program details here

User selected PIN No.	
Engineering units	
K-factor *(scale factor)*	K =
Decimal for reset Total	☐ 0 ☐ 0.0 ☐ 0.00 ☐ 0.000
Decimal for Accum. total	☐ 0 ☐ 0.0 ☐ 0.00 ☐ 0.000
Decimal for Rate	☐ 0 ☐ 0.0 ☐ 0.00 ☐ 0.000
Time base for Rate	Units / ☐ Sec ☐ Min ☐ Hr ☐ Day
Rate response	
Low frequency cut-off	Hertz =
Scaled pulse output	1 pulse =
Low flow alarm	Set at : Deadband %
High flow alarm	Set at : Deadband %

Your back up 4 digit PIN number is 1820

8. ALPHABETICAL INDEX

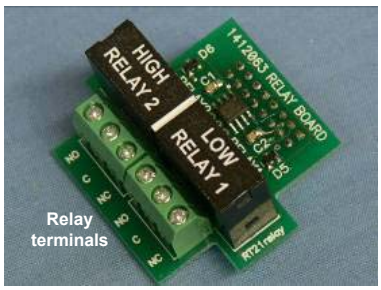




8. Instruction manual supplement

for

ELECTRONICS ZOD-Z3, ZOD-Z5 & ZOD-B1 WITH OPTIONAL RELAY OUTPUT BOARD



1. Overview

The Relay Control Output boards are an option for the flow rate totalisers and batch controller; they have two electro-mechanical SPCO relays instead of the solid state outputs of either instrument. The relays will switch higher loads (5 amps max.) to that of the solid state relays and provide electrical isolation between the switched output and the instruments circuitry. This option cannot be used in Intrinsically Safe environs.

Once plugged into the 16 pin socket (ZOD-Z3 & ZOD-B1) or 20 pin socket (ZOD-Z5), the solid state outputs at terminals 13 & 14 then cannot be used, the installer must make his control terminations at the relay board terminals marked NO (normally open), C (common) & NC (normally closed), DC & AC voltages may be switched at these terminals *(generally the active is switched)*.

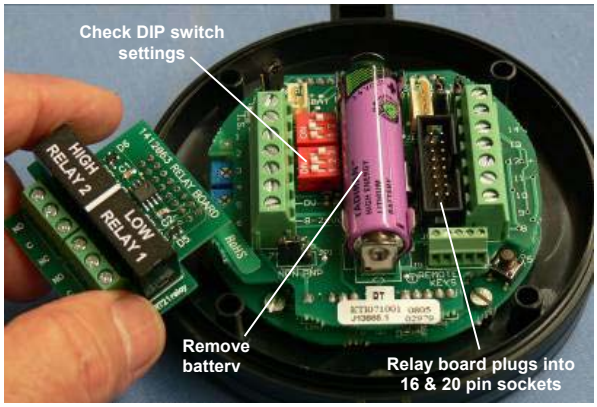
2. Installing relay board

First check (and set if necessary) the positions of the flow input DIP switches adjacent terminals 1~4 on the instrument PC board *(see pages 9~10 in the relevant instrument instruction manual for setting options)*.

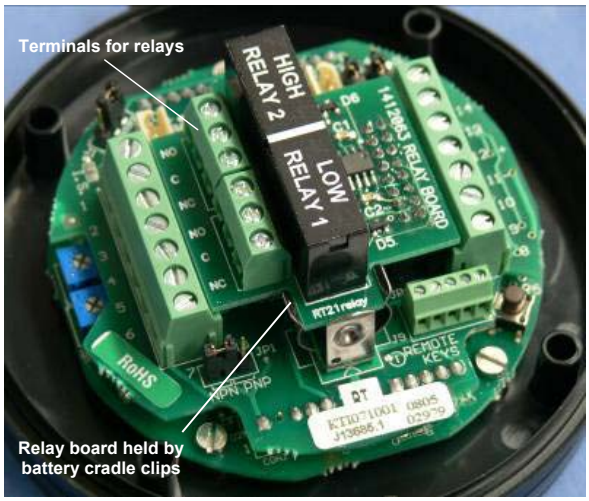
As the relay control output board requires external DC power (12~24Vdc at terminals 5 & 6) the instrument battery is no longer required. With no external power applied remove the battery to enable the relay board to be plugged into place using the battery cradle as the retaining mechanism, apply slight pressure to the board as you spread the battery cradle clips to embrace the relay PC board. The assembly is now ready to be wired.

3. Operation

The relay board has a voltage dropping circuit which limits the relay coil drive voltage to 12Vdc irrespective of the external supply to the instrument. When the external supply exceeds 12Vdc the largest component of this circuit will become hot to touch, this is a normal condition as the circuit dissipates the excess input voltage.



Relay control output board with two SPCO relays shown with a ZOD-Z3, N/O contacts are rated to 5A & the N/C contacts 3A max..



Each meter has been calibrated on mineral oil and will contain a small amount of oil residue.

The oil used is Castrol Diesel Calibration Fluid 4113 (product code 055830).

Declaration of Conformance
We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Gear Wheel Flow Meter Model: DOM

to which this declaration relates is in conformity with the standards noted below:

EN 60079-0: 2004
Electrical apparatus for explosive gas atmosphere - Part 0: General requirements

EN 60079-0: 2004
Electrical apparatus for explosive gas atmosphere - Part 1: Flameproof Enclosures

EN 60529, DIN VDE 0470-1 1992-11
I.P. Ingress Protection Classifications

EN 61326-1: 2006-10
Electrical equipment for control, instrumentation technology and laboratory use – EMC requirements (Industrial area)

EN 61010-1: 2002-08
Safety requirements for electrical equipment for measurement, control, and laboratory use –

2008/35/EC Waste Electrical & Electronic Equipment (WEEE)

Also the following EEC guidelines are fulfilled:

2004/108/EG Electro Magnetive Compatibility
2006/95/EC Low Voltage Directive

Hofheim, 30. Sep. 2010

H. Peters
General Manager

M. Wenzel
Proxy Holder

K01/1110

SEE OVER

OVAL GEAR

Medium capacity positive displacement flowmeters

INSTRUCTION MANUAL

Model : **DOMx20 with mechanical register M1**

CE

General

1.1 Overview

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 water based products and chemicals and aluminum meters are suitable for fuels, fuel oils & lubricating liquids.

The Kobold range includes a blind meter with pulse output capable of interfacing to most monitoring and control instrumentation or the blind meter can be fitted with or supplied with instruments such as totalisers, rate totalisers or batch controllers.These instruments also have monitoring and control output options including 4-20mA, scaled pulse, flowrate alarms and batch control logic *(preset metering*).

The flowmeter covered by this manual is fitted with a mechanical totaliser with either a 3 digit or 4 digit resettable totaliser.

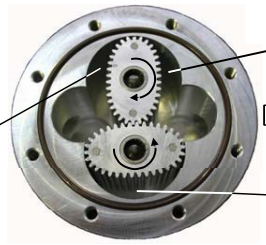
1.2 Operating Principle

The Oval gear are positive displacement flowmeters where the passage of liquid causes two oval geared rotors to rotate within a precision measuring chamber and with each rotation a fixed volume of liquid is displaced passing through the meter. The motion of the rotors is transmitted to the mechanical register totaliser via an interfacing reduction gear train & dynamic seal assembly.

The benefits of this technology allow precise flow measurement and dispensing of most clean liquids irrespective of their conductivity, with other liquid characteristics having nil or minimal effect on meter performance. This metering technology does not require flow profile conditioning as required with alternative flow technologies making the installation relatively compact and low cost.

OPERATION :

Liquid travels around the crescent shaped chambers created by the rotational movement of the rotors



1.3 Order Codes

Thread Connection (Example: **DOM-A05H R1 1 H0**)

Meas. range [L/min]	Connection female	Housing material			O-ring material	Electronics	Option
		Aluminium	Stainless steel	Ductile iron			
0.5 - 36 L/h	G ⅛	**DOM-A05H R1**	**DOM-S05H R1**	–		**H0** = Hall sensor (NPN)/ reed switch pulse output **D0** = Quad Hall sensor 2 phased outputs (NPN) **Z1** = dual LCD totaliser, pulse output (ZOD-Z1) **Z3** = LCD totaliser, rate, outputs: 4-20 mA, alarm, pulse (ZOD-Z3) **Z4** = Electronics "Z3" + ATEX, **Z5** = dual LCD totaliser/rate, outputs: alarm, pulse (ZOD-Z5) **B1** = LCD batch controller, totaliser, pulse output (ZOD-B1) **M1** = mech. totaliser 3-digit* **M3** = mech. totaliser 4-digit* **XX** = special option, specified in clear text	**0** = without **A**** = coupled with air eliminator-strainer ZAL **C** = cooling fin for LCD electronic **D**** = option A + C **R**** = option A + check valve **E**** = option R + C **S***= special cut rotors for higher viscosities **Y** = special option (specify in clear text)
2 - 100 L/h	G ¼	**DOM-A10H R2**	**DOM-S10H R2**	–			
15 - 550 L/h	G ⅜	**DOM-A15H R3**	**DOM-S15H R3**	–	**1** = FPM (standard) **2** = EPR **3** = PTFE encaps. FPM **4** = NBR		
1 - 40	G ½	**DOM-A20H R4**	**DOM-S20H R4**	–			
10 – 150	G 1	**DOM-A25H R6**	**DOM-S25H R6**	–			
15 – 250	G 1½	**DOM-A30H R8**	**DOM-S30H R8**	–			
30 – 450	G 2	**DOM-A35H R9**	**DOM-S35H R9**	–			
50 - 580	G 2	**DOM-A40H R9**	–	–			
35 - 750	G 3	**DOM-A45H RB**	**DOM-S45H RB**	**DOM-D45H RB**			
50 - 1000	G 3	**DOM-A50H RB**	–	–	**1** = FPM (standard) **2** = EPR **4** = NBR		
75 - 1500	G 4	**DOM-A55H RC**	–	**DOM-D55H RC**			
150 - 2500	G 4	**DOM-A60H RC**	–	–			

For NPT connection change „DOM-xxxx Rx..." into „DOM-xxxx Nx"
* not for DOM-x05, -x10, -x15, 3-digit recommended for DOM-x20, -x25, 4-digit recommended for DOM-x25 and larger
** not available for DOM-x05, -x10, -x15, -x20, only available for DOM-A...
*** only available for DOM-A20... to DOM-A60..., DOM-S15... to DOM-S35.... and DOM-D...

Flange Connection (Example: **DOM-A45H F8 1 Z3 C**)

Meas. range [L/min]	Connection DIN flange PN16	Housing material			O-ring material	Electronics	Option
		Aluminium	Stainless steel	Ductile iron			
10 - 150	DN 25 / 1"	**DOM-A25H F6**	**DOM-S25H F6**	–		**H0** = Hall sensor (NPN)/ reed switch pulse output **D0** = Quad Hall sensor 2 phased outputs (NPN) **Z1** = dual LCD totaliser, pulse output (ZOD-Z1) **Z3** = LCD totaliser, rate, outputs: 4-20 mA, alarm, pulse (ZOD-Z3) **Z4** = Electronics "Z3" + ATEX, **Z5** = dual LCD totaliser/rate, outputs: alarm, pulse (ZOD-Z5) **B1** = LCD batch controller, totaliser, pulse output (ZOD-B1) **M1** = mech. totaliser 3-digit* **M3** = mech. totaliser 4-digit* **XX** = special option, specified in clear text	**0** = without **A**** = coupled with air eliminator-strainer ZAL **C** = cooling fin for LCD electronic **D**** = option A + C **R**** = option A + check valve **E**** = option R + C **S***** = special cut rotors for higher viscosities **Y** = special option (specify in clear text)
15 - 250	DN 40 / 1½"	**DOM-A30H F8**	**DOM-S30H F8**	–	**1**= FPM (standard) **2**= EPR **3**= PTFE encaps. FPM **4**= NBR		
30 - 450	DN 50 / 2"	**DOM-A35H F9**	**DOM-S35H F9**	–			
50 - 580	DN 50 / 2"	**DOM-A40H F9**	–	–			
35 - 750	DN 80 / 3"	**DOM-A45H FB**	**DOM-S45H FB**	**DOM-D45H FB**			
50 - 1000	DN 80 / 3"	**DOM-A50H FB**	–	–	**1**= FPM (standard) **2**= EPR **4**= NBR		
75 - 1500	DN 100 / 4"	**DOM-A55H FC**	–	**DOM-D55H FC**			
150 - 2500	DN 100 / 4"	**DOM-A60H FC**	–	–			

ANSI-150 RF flange change "DOM-xxxx Fx..." into "DOM-xxxx Ax",
ANSI-300 RF flange change "DOM-xxxx Fx..." into "DOM-xxxx Bx" (only 1", 1½, 2")
*3-digit recommended for DOM-x25, 4-digit recommended for DOM-x25 and larger
** only available for DOM-A...
*** only available for DOM-A..., DOM-S25... to DOM-S35.... and DOM-D

2.0 Installation

2.1 Mechanical Installation *Prior to installing the meter check :*

The fluid is compatible with the meter materials of construction using appropriate information such as fluid compatibility charts and site experience.

Application and process conditions are compatible with the meter specifications. Minimum and max. flows are within the meter specified range including any in-situ cleaning processes. When metering viscous liquids the maximum allowable flow may need to be reduced to ensure the pressure drop across the meter does not exceed 100 kPa *(1 Barg, 15 PSIG).*

Process temperature and pressure does not exceed meter ratings.

The meter is not exposed to process temperatures and pressures that will cause the liquid medium to gasify (flash) within the meter.

2.1.1 Meter & totaliser orientation

The flowmeter MUST be mounted so that the rotor shafts are in a horizontal plane. This is achieved by mounting the meter so that the mechanical display is facing the user in a horizontal direction, it should never point towards the sky or towards the ground. If installed incorrectly the weight of the rotors will bear down on the lower end of the measuring chamber.

CORRECT ORIENTATION

Liquid can flow into the meter from either a horizontal or vertical direction. For vertical flow installations the most common orientation is for the liquid to rise through the meter *(i.e. travel from bottom to top*) to assist in air or entrained gas elimination. Be sure to observe flow direction (inlet & outlet markings).

Each meter is supplied from the factory with the totaliser orientated to suit horizontal pipe runs, should the installation have a vertical pipe run the totaliser may be rotated 90º or 180º to change direction of flow direction, this is done by removing front & rear bezel screws (16), the counted wheel assembly can then be removed to access & remove the 4 housing screws (10) then rotate the housing (6) to the desired position, there will be a degree of resistance as you rotate the housing as it contains a large O-ring seal. Pay particular attention to the positioning of the following bevel, this must engage the drive bevel gear, when in position hold a screw driver blade against the reset knob seal (7) as you rotate the reset knob to flair the seal into the counter bore position. Replace the register bezel (14) and caps screws (16).

2.1.2 Flow Conditioning and Locations

Strainer : It is recommended to INSTALL a 100mesh *(150 micron)* strainer immediately upstream of (prior to) the meter. Strainers are available from the factory.

Flow conditioning : The flowmeter does not require any flow conditioning, therefore straight pipe runs before or after the meter are not required. If required, the pipe size about the meter can be altered to suit the installation.

Locations : The flowmeter is preferred to be fitted upstream of any flow control and/or shut off valve, this prevents free discharge from the meter and minimizes the risk of drainage and air entrapment which can result in erroneous readings or damage the meter on start up.

Process or safety critical meters should be installed in a by-pass section of pipe with isolation valves to enable the meter to be isolated and serviced as required. A by-pass installation also allows purging of the system during commissioning *(see Commissioning).*The meter must be appropriately rated and is typically located downstream *(on the discharge side)* of the pump.

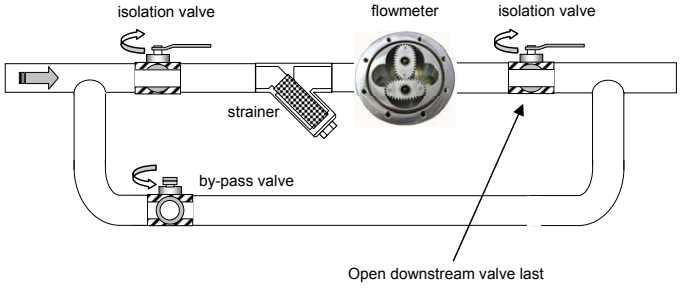
Fluid state : Fluid entering the meter must remain a liquid at all times so protect the meter to avoid solidification or gelling of the metered medium. If meters are to be trace heated or jacketed in any way the maximum temperature rating of the meter must not be exceeded. Size the meter to avoid gasification of volatiles *(flashing)* within the liquid due to the pressure drop experienced within the system or within the meter.

Hydraulic shock : If pressure surges or hydraulic shock of any kind is possible, the system upstream of the meter must be fitted with a surge suppressor or pressure relief valve to protect the meter from damage. High frequency flow pulsations can damage the meter. Such pulsations can be caused by the injection profile in diesel engines. Most pulsations are removed with the installation of a suitable pulsation dampener.

3.0 Commissioning Once the meter has been mechanically installed the meter is ready for commissioning.

The meter must NOT be run until the pipework is flushed of foreign matter, more often than not foreign matter is present after pipework fabrication or modification, weld slag, grinding dust, sealing tape & compound &/or surface rust are most common offenders.

Flushing can be undertaken by utilizing a by-pass or removing the meter from the pipework. If neither is practical then the meter rotors must be removed prior to flushing *(refer to Maintenance section of this manual for disassembly).*



After flushing or following long periods of shutdown the meter must be purged of air/vapour. This can be achieved by allowing the liquid to flow through the meter at a slow rate until all air/vapour is displaced. Never run the meter above its maximum flow or exceed 100kpa (1 bar, 15psi) pressure drop across the meter. Now the meter is ready for its operation to be confirmed by ensuring correct indication on the mechanical display. Refer if necessary to fault finding section of this manual.

4.0 Maintenance Adhering to the installation instructions in this manual should ensure your meter provides the required operational performance. These are mechanical meters and a periodic maintenance and inspection regime will maximize the operational availability of the meter.

The frequency of maintenance depends on the application factors including liquid lubricity and abrasiveness and operational factors such as flowrate and temperature.

BEFORE undertaking meter maintenance ensure the following :

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

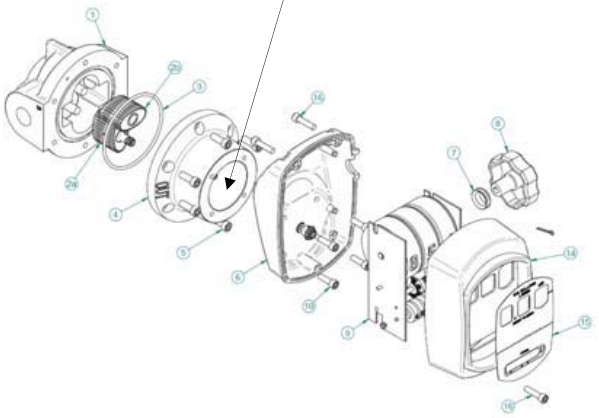
The meter is isolated from any source of supply of liquid upstream or downstream.

The meter is depressurized and liquid drained from the meter.

4.1 Disassembly of meter *(Refer Exploded View)* To gain access to the oval geared rotors undo the 8 body screws (5), carefully pry the meter body apart avoiding misplacing or damaging the O-ring (3) and rotors (2).

If required to gain access to the internals of the mechanical register & under gear (within meter cap [4]), remove the front & rear bezel screws (16), the totaliser assembly can then be removed to access & remove the 4 housing screws (10), remove register base assembly to expose the under gears :

"BEWARE THAT REMOVAL OF ITEM (6) WILL EXPOSE A WETTED CHAMBER WHICH COULD BE UNDER PRESSURE".



4.2 Inspection *(refer Exploded View)* Inspect O-rings for damage, chemical attack, deformity or any form. Remove, inspect & clean the rotors, check that the primary rotor gear pinion for any damage. Check the measuring chamber for damage or scoring & redress if necessary, the rotor shafts should NOT be loose or able to be rotated.

Inspect the under gears & gear shafts for any wear or damage, check that the gear train rotates freely & that the circlips are in place. Check that the transition gear shaft & bevel gear rotate freely in the register base (6).

4.3 Re-assembly of meter *(refer Exploded View)* When **r**e-installing the rotors the primary rotor with gear pinion must be fitted to the shorter of the two rotor shafts . 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.

Fit the O-ring into the groove and assemble the two parts of the meter, the body & cap align in one position only, this is dictated by the rotor pinion in the 1st rotor.

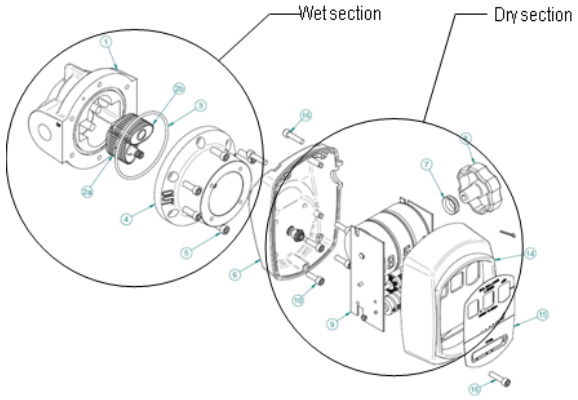
Fit the body cap screws (5) and tighten in a star sequence then torque in the same sequence to 3.5 Nm. This sequence and procedure ensures the meter bodies are assembled correctly and evenly. Fit the register assembly with maintaining original orientation if so desired.

4.4 SPARE PARTS *(refer exploded view)*

Item	*Description*	DOM-x20
1	**Body assembly with rotor shafts**	Part No.
	aluminum - BSP	1401118
	aluminum - NPT	1401100
	stainless steel - BSP	1401119
	stainless steel - NPT	1401101
2a#	**Primary rotor assembly**	
	aluminum rotor + bearings + pinion	1424136
	stainless steel rotor + bearings + pinion	1424158
2b#	**Secondary rotor assembly**	
	aluminum rotor + bearings	1424137
	stainless steel rotor + bearings	1424159
3	**Body O-ring** *(O-ring size)*	
	FPM *(standard)*	BS150V
	EPR	BS150E
	PTFE	BS150T
	Perbunan	BS150B
4	**Meter cap**	
	aluminum with gear train - LITRES	1402096
	aluminum with gear train - GALLONS	-
	stainless steel with gear train - LITRES	1402109
	stainless steel with gear train - GALLONS	-
5	**Body screw** *(screw size)*	
	stainless steel socket head	M6 x 16
6	**Register base assembly**	
	suit 3 digit register	1402070
	suit 4 digit register	1402077
7	**Reset knob seal**	
	lip seal	1304005
8	**Reset knob**	
	knob with split pin	1506003
9	**Totaliser assembly**	
	suit 3 digit register	1432003
	suit 4 digit register	1432004
10	**Register base screws** *(screw size)*	
	socket head	M5 x 16
14	**Register bezel with cap screws**	
	suit 3 digit register	1302092
	suit 4 digit register	1302111
15	**Register facia**	
	suit 3 digit register	1306027
	suit 4 digit register	1306028
16	**Cap screw** *(screw size)*	
	stainless steel socket head	M5 x 20

*= recommended spares*

5.0 Fault Finding Meters have two distinct sections: the mechanical wetted section housing the rotors and reduction gear assembly & the mechanical dry section from the register base (6) out. The aim of fault finding is to trace the source of the fault to one of these two sections.



Below are basic fault finding steps. Also refer to Trouble Shooting Guide on following page.

Step 1 - *Check application, installation and set up.*
Refer to Mechanical Installation section for installation and application factors that may effect the meter operation including pulsation and air entrainment or incorrect meter selection including incorrect flow rate, temperature and 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, malfunctioning pump, closed valves or low liquid level in feeder tank.

Step 4 - *Ensure oval gears within meter are rotating.*
If the register is not totalizing first that the rotors are rotating 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. If the rotors are rotating then the problem will most probably be somewhere within the reduction gear assembly (within items 4 & 6) or totaliser assembly (9).

5.1 TROUBLE SHOOTING

Symptom	*Possible cause*	*Solution*
Meter readings are high	1. Entrained air or gas	1. Remove source of air or gas entrapment 2. Install an upstream air eliminator
	2. Pulsating flow from reciprocating style pump	1. Increase back pressure on pump 2. Install a fast response one way check valve 3. Install a surge arrestor between pump & meter 4. Re-calibrate meter in situ to compensate for pulsations 5. Change pump style to smooth delivery type pump
Meter readings are low	1. Damaged or worn rotors	1. Inspect, repair, clean or replace rotors
	2. Damaged or worn measuring chamber	1. Inspect measuring chamber for damage - repair 2. Check concentricity of rotor shafts within chamber
Register no totalising	1. Rotors fouled	1. Check that rounded teeth are towards base of chamber 2. Check for obstruction due to foreign particles 3. Clean, repair or replace rotors
	2. Meter incorrectly reassembled	1. See instructions for reassembly of meter with particular emphasis on positioning of rotors & magnets
	3. Gear train jamed	1. Inspect, repair, clean or replace gear train

Notes

Each meter has been calibrated on mineral oil and will contain a small amount of oil residue.

The oil used is Castrol Diesel Calibration Fluid 4113 (product code 055830).

Declaration of Conformance
We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Gear Wheel Flow Meter Model: DOM

to which this declaration relates is in conformity with the standards noted below:

EN 60079-0: 2004
Electrical apparatus for explosive gas atmosphere - Part 0: General requirements

EN 60079-0: 2004
Electrical apparatus for explosive gas atmosphere - Part 1: Flameproof Enclosures

EN 60529, DIN VDE 0470-1 1992-11
I.P. Ingress Protection Classifications

EN 61326-1: 2006-10
Electrical equipment for control, instrumentation technology and laboratory use – EMC requirements (Industrial area)

EN 61010-1: 2002-08
Safety requirements for electrical equipment for measurement, control, and laboratory use –

2008/35/EC Waste Electrical & Electronic Equipment (WEEE)

Also the following EEC guidelines are fulfilled:

2004/108/EG Electro Magnetive Compatibility
2006/95/EC Low Voltage Directive

Hofheim, 30. Sep. 2010

H. Peters
General Manager

M. Wenzel
Proxy Holder

K01/1110

SEE OVER

OVAL GEAR

Medium capacity positive displacement flowmeters

INSTRUCTION MANUAL

Models : **DOM-A25, DOM-A30, DOM-A35 & DOM-A40, DOM-S25, DOM-S30 & DOM-S35 with with mechanical register M1**

General

1.1 Overview

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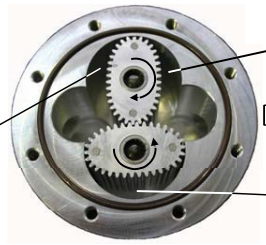

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1 - 40	G ½	**DOM-A20H R4**	**DOM-S20H R4**	–			
10 – 150	G 1	**DOM-A25H R6**	**DOM-S25H R6**	–			
15 – 250	G 1½	**DOM-A30H R8**	**DOM-S30H R8**	–			
30 – 450	G 2	**DOM-A35H R9**	**DOM-S35H R9**	–			
50 - 580	G 2	**DOM-A40H R9**	–	–			
35 - 750	G 3	**DOM-A45H RB**	**DOM-S45H RB**	**DOM-D45H RB**			
50 - 1000	G 3	**DOM-A50H RB**	–	–	**1** = FPM (standard) **2** = EPR **4** = NBR		
75 - 1500	G 4	**DOM-A55H RC**	–	**DOM-D55H RC**			
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Flange Connection (Example: **DOM-A45H F8 1 Z3 C**)

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15 - 250	DN 40 / 1½"	**DOM-A30H F8**	**DOM-S30H F8**	–	**1**= FPM (standard) **2**= EPR **3**= PTFE encaps. FPM **4**= NBR		
30 - 450	DN 50 / 2"	**DOM-A35H F9**	**DOM-S35H F9**	–			
50 - 580	DN 50 / 2"	**DOM-A40H F9**	–	–			
35 - 750	DN 80 / 3"	**DOM-A45H FB**	**DOM-S45H FB**	**DOM-D45H FB**			
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75 - 1500	DN 100 / 4"	**DOM-A55H FC**	–	**DOM-D55H FC**			
150 - 2500	DN 100 / 4"	**DOM-A60H FC**	–	–			

ANSI-150 RF flange change "DOM-xxxx Fx..." into "DOM-xxxx Ax",
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** only available for DOM-A...
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Process temperature and pressure does not exceed meter ratings.

The meter is not exposed to process temperatures and pressures that will cause the liquid medium to gasify (flash) within the meter.

2.1.1 Meter & totaliser orientation

The flowmeter MUST be mounted so that the rotor shafts are in a horizontal plane. This is achieved by mounting the meter so that the mechanical display is facing the user in a horizontal direction, it should never point towards the sky or towards the ground. If installed incorrectly the weight of the rotors will bear down on the lower end of the measuring chamber.

Correct Orientation

Liquid can flow into the meter from either a horizontal or vertical direction. For vertical flow installations the most common orientation is for the liquid to rise through the meter *(i.e. travel from bottom to top*) to assist in air or entrained gas elimination. Be sure to observe flow direction (inlet & outlet markings).

Each meter is supplied from the factory with the totaliser orientated to suit horizontal pipe runs, should the installation have a vertical pipe run the totaliser may be rotated 90 degrees by removing front & rear bezel screws (16), the counted wheel assembly can then be removed to access & remove the 4 housing screws (10) then rotate the housing (6) to the desired position.

2.1.2 Flow Conditioning and Locations

Strainer : It is recommended to INSTALL a 100mesh *(150 micron)* strainer immediately upstream of (prior to) the meter. Strainers are available from the factory.

Flow conditioning : The flowmeter does not require any flow conditioning, therefore straight pipe runs before or after the meter are not required. If required, the pipe size about the meter can be altered to suit the installation.

Locations : The flowmeter is preferred to be fitted upstream of any flow control and/or shut off valve, this prevents free discharge from the meter and minimizes the risk of drainage and air entrapment which can result in erroneous readings or damage the meter on start up.

Process or safety critical meters should be installed in a by-pass section of pipe with isolation valves to enable the meter to be isolated and serviced as required. A by-pass installation also allows purging of the system during commissioning *(see Commissioning).*The meter must be appropriately rated and is typically located downstream *(on the discharge side)* of the pump.

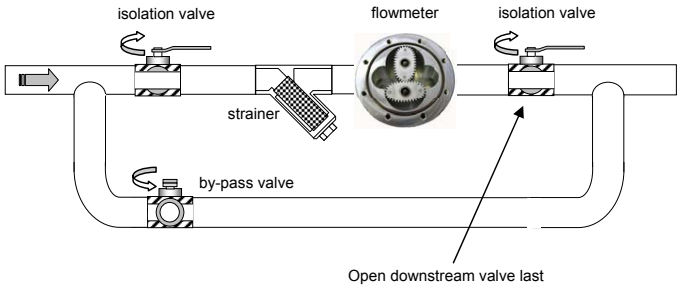
Fluid state : Fluid entering the meter must remain a liquid at all times so protect the meter to avoid solidification or gelling of the metered medium. If meters are to be trace heated or jacketed in any way the maximum temperature rating of the meter must not be exceeded. Size the meter to avoid gasification of volatiles *(flashing)* within the liquid due to the pressure drop experienced within the system or within the meter.

Hydraulic shock : If pressure surges or hydraulic shock of any kind is possible, the system upstream of the meter must be fitted with a surge suppressor or pressure relief valve to protect the meter from damage. High frequency flow pulsations can damage the meter. Such pulsations can be caused by the injection profile in diesel engines. Most pulsations are removed with the installation of a suitable pulsation dampener.

3.0 Commissioning Once the meter has been mechanically installed the meter is ready for commissioning.

The meter must NOT be run until the pipework is flushed of foreign matter, more often than not foreign matter is present after pipework fabrication or modification, weld slag, grinding dust, sealing tape & compound &/or surface rust are most common offenders.

Flushing can be undertaken by utilizing a by-pass or removing the meter from the pipework. If neither is practical then the meter rotors must be removed prior to flushing *(refer to Maintenance section of this manual for disassembly).*



After flushing or following long periods of shutdown the meter must be purged of air/vapour. This can be achieved by allowing the liquid to flow through the meter at a slow rate until all air/vapour is displaced. Never run the meter above its maximum flow or exceed 100kpa (1 bar, 15psi) pressure drop across the meter. Now the meter is ready for its operation to be confirmed by ensuring correct indication on the mechanical display. Refer if necessary to fault finding section of this manual.

4.0 Maintenance Adhering to the installation instructions in this manual should ensure your meter provides the required operational performance. These are mechanical meters and a periodic maintenance and inspection regime will maximize the operational availability of the meter.

The frequency of maintenance depends on the application factors including liquid lubricity and abrasiveness and operational factors such as flowrate and temperature.

BEFORE undertaking meter maintenance ensure the following :

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

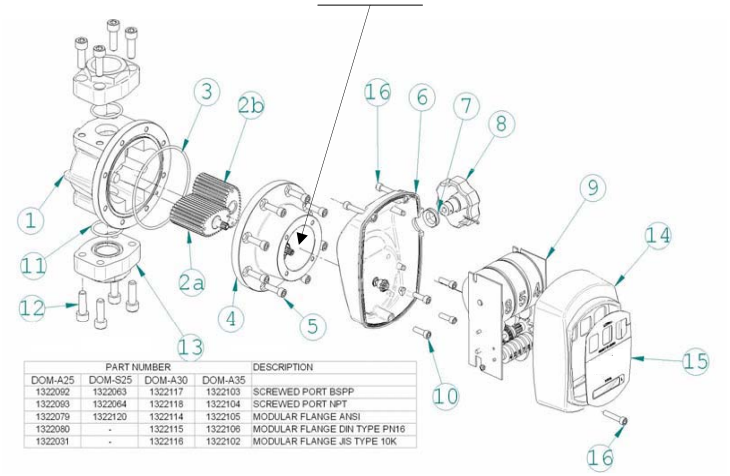
The meter is isolated from any source of supply of liquid upstream or downstream.

The meter is depressurized and liquid drained from the meter.

4.1 Disassembly of meter *(Refer Exploded View)* To gain access to the oval geared rotors undo the 8 body screws (5), carefully pry the meter body apart avoiding misplacing or damaging the O-ring (3) and rotors (2).

If required to gain access to the internals of the mechanical register & under gear (within meter cap [4]), remove the front & rear bezel screws (16), the totaliser assembly can then be removed to access & remove the 4 housing screws (10), remove register base assembly to expose the under gears :

"BEWARE THAT REMOVAL OF ITEM (6) WILL EXPOSE A WETTED CHAMBER WHICH COULD BE UNDER PRESSURE".



PART NUMBER				DESCRIPTION
DOM-A25	DOM-S25	DOM-A30	DOM-A35	
1322092	1322063	1322117	1322103	SCREWED PORT BSPP
1322093	1322064	1322118	1322104	SCREWED PORT NPT
1322079	1322120	1322114	1322105	MODULAR FLANGE ANSI
1322080	-	1322115	1322106	MODULAR FLANGE DIN TYPE PN16
1322031	-	1322116	1322102	MODULAR FLANGE JIS TYPE 10K

4.2 Inspection *(refer Exploded View)* Inspect O-rings for damage, chemical attack, deformity or any form. Remove, inspect & clean the rotors, check that the primary rotor gear pinion for any damage. Check the measuring chamber for damage or scoring & redress if necessary, the rotor shafts should NOT be loose or able to be rotated.

Inspect the under gears & gear shafts for any wear or damage, check that the gear train rotates freely & that the circlips are in place. Check that the transition gear shaft & bevel gear rotate freely in the register base (6).

4.3 Re-assembly of meter *(refer Exploded View)* When re-installing the rotors the primary rotor with gear pinion must be fitted to the shorter of the two rotor shafts . 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.

Fit the O-ring into the groove and assemble the two parts of the meter, the body & cap align in one position only, this is dictated by the rotor pinion in the 1st rotor.

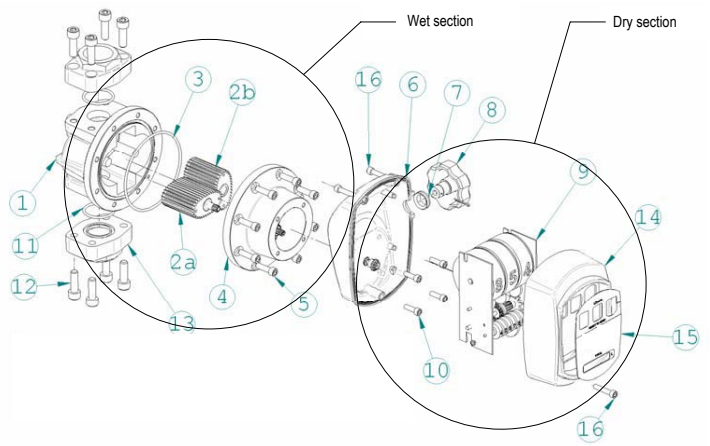
Fit the body cap screws (5) and tighten in a star sequence then torque in the same sequence to 3.5 Nm. This sequence and procedure ensures the meter bodies are assembled correctly and evenly. Fit the register assembly with maintaining original orientation if so desired.

4.4 SPARE PARTS *(refer to exploded view)*

Item	*Description*	DOM-x25	DOM-x30	DOM-x35
1	**Body assembly with rotor shafts**	Part No.		
x	A - aluminum	1501010	1501012	1501013
x	S - stainless steel	1501011	-	-
2a	**Primary rotor assembly**			
	aluminum rotor + bearings + pinion	1424119	1424127	1424112
	stainless steel rotor + bearings + pinion	1424109	-	-
2b	**Secondary rotor assembly**			
	aluminum rotor + bearings	1424120	1424128	1424113
	stainless steel rotor + bearings	1424110	-	-
3	**Body O-ring**	*(size BS153)*	*(size BS245)*	*(size BS253)*
	FKM *(standard)*	13031531	13032451	13032531
	PTFE	13031533	13032453	13032533
4	**Meter cap**			
	aluminum with gear train - LITRES	1402069	1402084	1402072
	aluminum with gear train - GALLONS	1402071	1402085	1402086
	stainless steel with gear train - LITRES	1402075	-	-
	stainless steel with gear train - GALLONS	1402076	-	-
5	**Cap screw**	*(M6 x 20)*	*(M10 x 25)*	*(M10 x 25)*
	stainless & aluminum bodies	130806112	130810104	130810104
6	**Register base assembly**			
	suit 3 digit register	1402070		
	suit 4 digit register	1402077		
7	**Reset knob seal**			
	lip seal	1304005		
8	**Reset knob**			
	knob with split pin	1506003		
9	**Totaliser assembly**			
	suit 3 digit register	1432003		
	suit 4 digit register	1432004		
10	**Register base screws**			
	M5 x 16	130805101		
11	**Flange portion O-ring**	*(size BS123)*	*(size BS136)*	*(size BS140)*
	FKM	13031231	13031361	13031401
	PTFE	13031233	13031363	13031403
12	**Flange portion screw**	*(M8 x 25)*		
	socket head screw for threaded portions	130808101	130810110	*(M14 x 40)*
	socket head screw for flanged portions	130808101	130810105	*(M10 x 30)*
13	**Flange portion**	*refer diagram opposite*		
14	**Register bezel with cap screws**			
	suit 3 digit register	1302092		
	suit 4 digit register	1302111		
15	**Register facia**			
	suit 3 digit register	1306027		
	suit 4 digit register	1306028		
16	**Cap screw**			
	M5 x 20	130805126		

Recommended spare parts : Item 2 rotor assembly set
Item 3 body O-ring

5.0 Fault Finding Meters have two distinct sections: the mechanical wetted section housing the rotors and reduction gear assembly & the mechanical dry section from the register base (6) out. The aim of fault finding is to trace the source of the fault to one of these two sections.



Below are basic fault finding steps. Also refer to Trouble Shooting Guide on following page.

Step 1 - *Check application, installation and set up.*
Refer to Mechanical Installation section for installation and application factors that may effect the meter operation including pulsation and air entrainment or incorrect meter selection including incorrect flow rate, temperature and 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, malfunctioning pump, closed valves or low liquid level in feeder tank.

Step 4 - *Ensure oval gears within meter are rotating.*
If the register is not totalizing first that the rotors are rotating 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. If the rotors are rotating then the problem will most probably be somewhere within the reduction gear assembly (within items 4 & 6) or totaliser assembly (9).

5.1 TROUBLE SHOOTING

Symptom	*Possible cause*	*Solution*
Meter readings are high	1. Entrained air or gas	1. Remove source of air or gas entrapment 2. Install an upstream air eliminator
	2. Pulsating flow from reciprocating style pump	1. Increase back pressure on pump 2. Install a fast response one way check valve 3. Install a surge arrestor between pump & meter 4. Re-calibrate meter in situ to compensate for pulsations 5. Change pump style to smooth delivery type pump
Meter readings are low	1. Damaged or worn rotors	1. Inspect, repair, clean or replace rotors
	2. Damaged or worn measuring chamber	1. Inspect measuring chamber for damage - repair 2. Check concentricity of rotor shafts within chamber
Register no totalising	1. Rotors fouled	1. Check that rounded teeth are towards base of chamber 2. Check for obstruction due to foreign particles 3. Clean, repair or replace rotors
	2. Meter incorrectly reassembled	1. See instructions for reassembly of meter with particular emphasis on positioning of rotors & magnets
	3. Gear train jamed	1. Inspect, repair, clean or replace gear train

Notes

Declaration of Conformance
We, KOBOLD Messring GmbH, Hofheim-Ts, Germany, declare under our sole responsibility that the product:

Gear Wheel Flow Meter Model: DOM

to which this declaration relates is in conformity with the standards noted below:

EN 60079-0: 2004
Electrical apparatus for explosive gas atmosphere - Part 0: General requirements

EN 60079-0: 2004
Electrical apparatus for explosive gas atmosphere - Part 1: Flameproof Enclosures

EN 60529, DIN VDE 0470-1 1992-11
I.P. Ingress Protection Classifications

EN 61326-1: 2006-10
Electrical equipment for control, instrumentation technology and laboratory use – EMC requirements (Industrial area)

EN 61010-1: 2002-08
Safety requirements for electrical equipment for measurement, control, and laboratory use –

2008/35/EC Waste Electrical & Electronic Equipment (WEEE)

Also the following EEC guidelines are fulfilled:

2004/108/EG Electro Magnetive Compatibility
2006/95/EC Low Voltage Directive

Hofheim, 30. Sep. 2010

H. Peters
General Manager

M. Wenzel
Proxy Holder

K01/1110

OVAL GEAR

Large capacity positive displacement flowmeters

INSTRUCTION MANUAL

Models: **DOM-A45, DOM-A50, DOM-A55, DOM-A60**
DOM-S45 with mechanical register M3

CE

General

1.1 Overview

The Oval gear meter is a precise positive displacement flowmeter incorporating a pair of oval geared rotors. The meters are suitable for fuels, fuel oils & lubricating liquids.

The Kobold range includes a blind meter with pulse output capable of interfacing to most monitoring and control instrumentation or the blind meter can be fitted with or supplied with instruments such as totalisers, rate totalisers or batch controllers.These instruments also have monitoring and control output options including 4-20mA, scaled pulse, flowrate alarms and batch control logic *(preset metering*).

The flowmeter covered by this manual is fitted with a mechanical totaliser with either a 4 digit resettable totaliser.

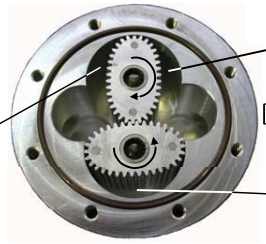
1.2 Operating Principle

The Oval gear are positive displacement flowmeters where the passage of liquid causes two oval geared rotors to rotate within a precision measuring chamber and with each rotation a fixed volume of liquid is displaced passing through the meter. The motion of the rotors is transmitted to the mechanical register totaliser via an interfacing reduction gear train & dynamic seal assembly.

The benefits of this technology allow precise flow measurement and dispensing of most clean liquids irrespective of their conductivity, with other liquid characteristics having nil or minimal effect on meter performance. This metering technology does not require flow profile conditioning as required with alternative flow technologies making the installation relatively compact and low cost.

OPERATION :

Liquid travels around the crescent shaped chambers created by the rotational movement of the rotors



1.3 Order Codes

Thread Connection (Example: **DOM-A05H R1 1 H0**)

Meas. range [L/min]	Connection female	Housing material			O-ring material	Electronics	Option
		Aluminium	Stainless steel	Ductile iron			
0.5 - 36 L/h	G ⅛	**DOM-A05H R1**	**DOM-S05H R1**	–		**H0** = Hall sensor (NPN)/ reed switch pulse output **D0** = Quad Hall sensor 2 phased outputs (NPN) **Z1** = dual LCD totaliser, pulse output (ZOD-Z1) **Z3** = LCD totaliser, rate, outputs: 4-20 mA, alarm, pulse (ZOD-Z3) **Z4** = Electronics "Z3" + ATEX, **Z5** = dual LCD totaliser/rate, outputs: alarm, pulse (ZOD-Z5) **B1** = LCD batch controller, totaliser, pulse output (ZOD-B1) **M1** = mech. totaliser 3-digit* **M3** = mech. totaliser 4-digit* **XX** = special option, specified in clear text	**0** = without **A**** = coupled with air eliminator-strainer ZAL **C** = cooling fin for LCD electronic **D**** = option A + C **R**** = option A + check valve **E**** = option R + C **S***** = special cut rotors for higher viscosities **Y** = special option (specify in clear text)
2 - 100 L/h	G ¼	**DOM-A10H R2**	**DOM-S10H R2**	–			
15 - 550 L/h	G ⅜	**DOM-A15H R3**	**DOM-S15H R3**	–	**1** = FPM (standard) **2** = EPR **3** = PTFE encaps. FPM **4** = NBR		
1 - 40	G ½	**DOM-A20H R4**	**DOM-S20H R4**	–			
10 – 150	G 1	**DOM-A25H R6**	**DOM-S25H R6**	–			
15 – 250	G 1½	**DOM-A30H R8**	**DOM-S30H R8**	–			
30 – 450	G 2	**DOM-A35H R9**	**DOM-S35H R9**	–			
50 - 580	G 2	**DOM-A40H R9**	–	–			
35 - 750	G 3	**DOM-A45H RB**	**DOM-S45H RB**	**DOM-D45H RB**			
50 - 1000	G 3	**DOM-A50H RB**	–	–	**1** = FPM (standard) **2** = EPR **4** = NBR		
75 - 1500	G 4	**DOM-A55H RC**	–	**DOM-D55H RC**			
150 - 2500	G 4	**DOM-A60H RC**	–	–			

For NPT connection change „DOM-xxxx Rx..." into „DOM-xxxx Nx"
* not for DOM-x05, -x10, -x15, 3-digit recommended for DOM-x20, -x25, 4-digit recommended for DOM-x25 and larger
** not available for DOM-x05, -x10, -x15, -x20, only available for DOM-A...
*** only available for DOM-A20... to DOM-A60..., DOM-S15... to DOM-S35.... and DOM-D...

Flange Connection (Example: **DOM-A45H F8 1 Z3 C**)

Meas. range [L/min]	Connection DIN flange PN16	Housing material			O-ring material	Electronics	Option
		Aluminium	Stainless steel	Ductile iron			
10 - 150	DN 25 / 1"	**DOM-A25H F6**	**DOM-S25H F6**	–		**H0** = Hall sensor (NPN)/ reed switch pulse output **D0** = Quad Hall sensor 2 phased outputs (NPN) **Z1** = dual LCD totaliser, pulse output (ZOD-Z1) **Z3** = LCD totaliser, rate, outputs: 4-20 mA, alarm, pulse (ZOD-Z3) **Z4** = Electronics "Z3" + ATEX, **Z5** = dual LCD totaliser/rate, outputs: alarm, pulse (ZOD-Z5) **B1** = LCD batch controller, totaliser, pulse output (ZOD-B1) **M1** = mech. totaliser 3-digit* **M3** = mech. totaliser 4-digit* **XX** = special option, specified in clear text	**0** = without **A**** = coupled with air eliminator-strainer ZAL **C** = cooling fin for LCD electronic **D**** = option A + C **R**** = option A + check valve **E**** = option R + C **S***** = special cut rotors for higher viscosities **Y** = special option (specify in clear text)
15 - 250	DN 40 / 1½"	**DOM-A30H F8**	**DOM-S30H F8**	–	**1**= FPM (standard) **2**= EPR **3**= PTFE encaps. FPM **4**= NBR		
30 - 450	DN 50 / 2"	**DOM-A35H F9**	**DOM-S35H F9**	–			
50 - 580	DN 50 / 2"	**DOM-A40H F9**	–	–			
35 - 750	DN 80 / 3"	**DOM-A45H FB**	**DOM-S45H FB**	**DOM-D45H FB**			
50 - 1000	DN 80 / 3"	**DOM-A50H FB**	–	–	**1**= FPM (standard) **2**= EPR **4**= NBR		
75 - 1500	DN 100 / 4"	**DOM-A55H FC**	–	**DOM-D55H FC**			
150 - 2500	DN 100 / 4"	**DOM-A60H FC**	–	–			

ANSI-150 RF flange change "DOM-xxxx Fx..." into "DOM-xxxx Ax",
ANSI-300 RF flange change "DOM-xxxx Fx..." into "DOM-xxxx Bx" (only 1", 1½, 2")
*3-digit recommended for DOM-x25, 4-digit recommended for DOM-x25 and larger
** only available for DOM-A...
*** only available for DOM-A..., DOM-S25... to DOM-S35.... and DOM-D

2.0 Installation

2.1 Mechanical Installation *Prior to installing the meter check :*

The fluid is compatible with the meter materials of construction using appropriate information such as fluid compatibility charts and site experience.

Application and process conditions are compatible with the meter specifications. Minimum and max. flows are within the meter specified range including any in-situ cleaning processes. When metering viscous liquids the maximum allowable flow may need to be reduced to ensure the pressure drop across the meter does not exceed 100 kPa *(1 Barg, 15 PSIG).*

Process temperature and pressure does not exceed meter ratings.

The meter is not exposed to process temperatures and pressures that will cause the liquid medium to gasify (flash) within the meter.

2.1.1 Meter & totaliser orientation

The flowmeter MUST be mounted so that the rotor shafts are in a horizontal plane. This is achieved by mounting the meter so that the mechanical display is facing the user in a horizontal direction, it should never point towards the sky or towards the ground. If installed incorrectly the weight of the rotors will bear down on the lower end of the measuring chamber.

CORRECT ORIENTATION

Liquid can flow into the meter from either a horizontal or vertical direction. For vertical flow installations the most common orientation is for the liquid to rise through the meter *(i.e. travel from bottom to top*) to assist in air or entrained gas elimination. Be sure to observe flow direction (inlet & outlet markings).

Each meter is supplied from the factory with the totaliser orientated to suit horizontal pipe runs, should the installation have a vertical pipe run the totaliser may be rotated 90 degrees by removing front & rear bezel screws (16), the counted wheel assembly can then be removed to access & remove the 4 housing screws (10) then rotate the housing (6) to the desired position.

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Strainer : It is recommended to INSTALL a 40mesh *(350 micron)* strainer immediately upstream of (prior to) the meter. Strainers are available from the factory.

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Process or safety critical meters should be installed in a by-pass section of pipe with isolation valves to enable the meter to be isolated and serviced as required. A by-pass installation also allows purging of the system during commissioning *(see Commissioning).*The meter must be appropriately rated and is typically located downstream *(on the discharge side)* of the pump.

Fluid state : Fluid entering the meter must remain a liquid at all times so protect the meter to avoid solidification or gelling of the metered medium. If meters are to be trace heated or jacketed in any way the maximum temperature rating of the meter must not be exceeded. Size the meter to avoid gasification of volatiles *(flashing)* within the liquid due to the pressure drop experienced within the system or within the meter.

Hydraulic shock : If pressure surges or hydraulic shock of any kind is possible, the system upstream of the meter must be fitted with a surge suppressor or pressure relief valve to protect the meter from damage. High frequency flow pulsations can damage the meter. Such pulsations can be caused by the injection profile in diesel engines. Most pulsations are removed with the installation of a suitable pulsation dampener.

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The meter must NOT be run until the pipe work is flushed of foreign matter, more often than not foreign matter is present after pipe work fabrication or modification, weld slag, grinding dust, sealing tape & compound &/or surface rust are most common offenders.

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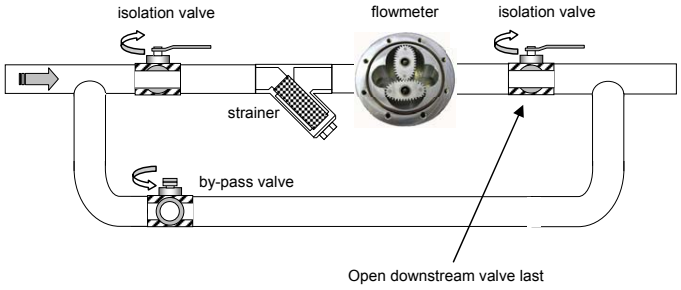

After flushing or following long periods of shutdown the meter must be purged of air/vapour. This can be achieved by allowing the liquid to flow through the meter at a slow rate until all air/vapour is displaced. Never run the meter above its maximum flow or exceed 100kpa (1 bar, 15psi) pressure drop across the meter. Now the meter is ready for its operation to be confirmed by ensuring correct indication on the mechanical display. Refer if necessary to fault finding section of this manual.

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The frequency of maintenance depends on the application factors including liquid lubricity and abrasiveness and operational factors such as flowrate and temperature.

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

The meter is isolated from any source of supply of liquid upstream or downstream.

The meter is depressurized and liquid drained from the meter.

4.1 Disassembly of meter *(Refer Exploded View)* To gain access to the oval geared rotors undo the 8 body screws (5), carefully pry the meter body apart avoiding misplacing or damaging the O-ring (3) and rotors (2).

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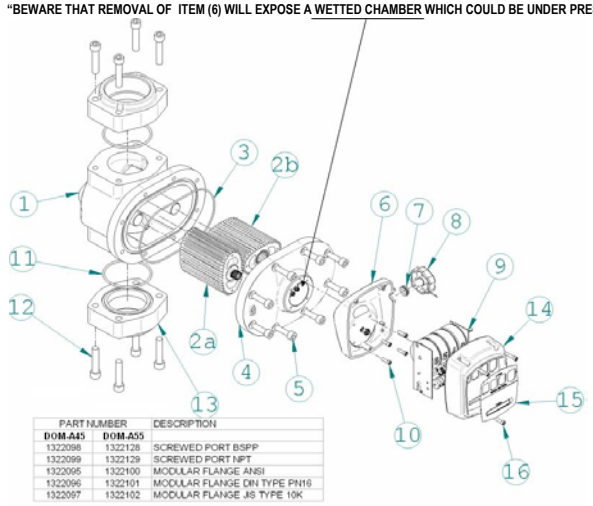


PART NUMBER		DESCRIPTION
DOM-A45	DOM-A55	
1322098	1322128	SCREWED PORT BSPP
1322099	1322129	SCREWED PORT NPT
1322095	1322100	MODULAR FLANGE ANSI
1322096	1322101	MODULAR FLANGE DIN TYPE PN16
1322097	1322102	MODULAR FLANGE JIS TYPE 10K

4.2 Inspection *(refer Exploded View)* Inspect O-rings for damage, chemical attack, deformity or any form. Remove, inspect & clean the rotors, check that the primary rotor gear pinion for any damage. Check the measuring chamber for damage or scoring & redress if necessary, the rotor shafts should NOT be loose or able to be rotated.

Inspect the under gears & gear shafts for any wear or damage, check that the gear train rotates freely & that the circlips are in place. Check that the transition gear shaft & bevel gear rotate freely in the register base (6).

4.3 Re-assembly of meter *(refer Exploded View)* When re-installing the rotors the primary rotor with gear pinion must be fitted to the shorter of the two rotor shafts . 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.

Fit the O-ring into the groove and assemble the two parts of the meter, the body & cap align in one position only, this is dictated by the rotor pinion in the 1st rotor.

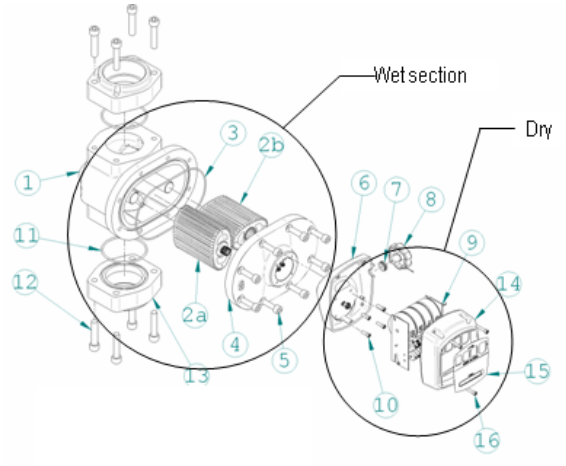
Fit the body cap screws (5) and tighten in a star sequence then torque in the same sequence to 3.5 Nm. This sequence and procedure ensures the meter bodies are assembled correctly and evenly. Fit the register assembly with maintaining original orientation if so desired.

4.4 SPARE PARTS *(refer exploded view)*

Item	Description	DOM-x45	DOM-A50	DOM-A55	DOM-A60
1	**Body assembly with rotor shafts**	Part No.	Part No.	Part No.	Part No.
	aluminum	1401143	1401144	1401145	1401137
	stainless steel body without rotor shafts	1301129	-	-	-
2a#	**Primary rotor assembly**				
	aluminum rotor + bearings + pinion	1424114	1424130	1424121	1424165
	stainless steel rotor + bearings + pinion	1424214	-	-	-
2b#	**Secondary rotor assembly**				
	aluminum rotor + bearings	1424115	1424131	1424122	1424166
	stainless steel rotor + bearings	1424215	-	-	-
3#	**Body O-ring** *(O-ring size)*				
	FKM *(standard)*	BS260V	BS267V	BS267V	BS267V
	EPR	BS260E	BS267E	BS267E	BS267E
	PTFE	BS260T	BS267T	BS267T	BS267T
	buna-N	BS260B	BS267B	BS267B	BS267B
4	**Meter cap**				
	aluminum with gear train	1402074	1402089	1402078	1402130
	stainless steel with gear train	1402146	-	-	-
5	**Body screw** *(screw size)*				
	stainless steel socket head	M10 x 35	M10 x 35	M10 x 35	M10 x 35
6	**Register base assembly**				
	suit 3 digit register	1402070	1402070	1402070	1402070
	suit 4 digit register	1402077	1402077	1402077	1402077
7	**Reset knob seal**				
	lip seal	1304005	1304005	1304005	1304005
8	**Reset knob**				
	knob with split pin	1506003	1506003	1506003	1506003
9	**Totaliser assembly**				
	suit 3 digit register	1432003	1432003	1432003	1432003
	suit 4 digit register	1432004	1432004	1432004	1432004
10	**Register base screws** *(screw size)*				
	stainless steel socket head	M5 x 16	M5 x 16	M5 x 16	M5 x 16
11	**Flange portion O-ring** *(O-ring size)*				
	FKM	BS237V	BS237V	BS140V	BS140V
	PTFE	BS237T	BS237T	BS140T	BS140T
12	**Flange portion screw** *(screw size)*				
	socket head screw for threaded portions	M12 x 55	M12 x 55	M12 x 50	M12 x 50
	socket head screw for flanged portions	M12 x 35	M12 x 35	M12 x 35	M12 x 35
13	**Flange portion**				
	BSP threaded	1322098	1322098	1322128	1322128
	NPT threaded	1322099	1322099	1322129	1322129
	ANSI-150 flanged	1322095	1322095	1322100	1322100
	DIN flanged PN16 *(stainless steel only)*	1322096	1322096	1322101	1322101
14	**Register bezel with cap screws**				
	suit 3 digit register	1302092	1302092	1302092	1302092
	suit 4 digit register	1302111	1302111	1302111	1302111
15	**Register facia**				
	suit 3 digit register	1306027	1306027	1306027	1306027
	suit 4 digit register	1306028	1306028	1306028	1306028
16	**Cap screw** *(screw size)*				
	stainless steel socket head	M5 x 20	M5 x 20	M5 x 20	M5 x 20
17	**Optional**				
	back pressure wafer check valves	1422013	1422013	1422014	1422014

*= recommended spares*

5.0 Fault Finding Meters have two distinct sections: the mechanical wetted section housing the rotors and reduction gear assembly & the mechanical dry section from the register base (6) out. The aim of fault finding is to trace the source of the fault to one of these two sections.



Below are basic fault finding steps. Also refer to Trouble Shooting Guide on following page.

Step 1 - *Check application, installation and set up.*
Refer to Mechanical Installation section for installation and application factors that may effect the meter operation including pulsation and air entrainment or incorrect meter selection including incorrect flow rate, temperature and 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 flow meter, malfunctioning pump, closed valves or low liquid level in feeder tank.

Step 4 - *Ensure oval gears within meter are rotating.*
If the register is not totalizing first that the rotors are rotating 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. If the rotors are rotating then the problem will most probably be somewhere within the reduction gear assembly (within items 4 & 6) or totaliser assembly (9).

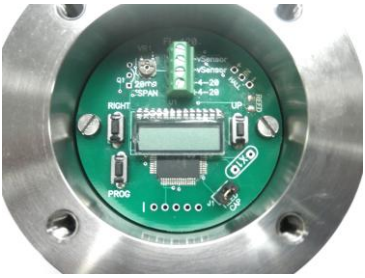
5.1 TROUBLE SHOOTING

Symptom	*Possible cause*	*Solution*
Meter readings are high	1. Entrained air or gas	1. Remove source of air or gas entrapment 2. Install an upstream air eliminator
	2. Pulsating flow from reciprocating style pump	1. Increase back pressure on pump 2. Install a fast response one way check valve 3. Install a surge arrestor between pump & meter 4. Re-calibrate meter in situ to compensate for pulsations 5. Change pump style to smooth delivery type pump
Meter readings are low	1. Damaged or worn rotors	1. Inspect, repair, clean or replace rotors
	2. Damaged or worn measuring chamber	1. Inspect measuring chamber for damage - repair 2. Check concentricity of rotor shafts within chamber
Register no totalising	1. Rotors fouled	1. Check that rounded teeth are towards base of chamber 2. Check for obstruction due to foreign particles 3. Clean, repair or replace rotors
	2. Meter incorrectly reassembled	1. See instructions for reassembly of meter with particular emphasis on positioning of rotors & magnets
	3. Gear train jamed	1. Inspect, repair, clean or replace gear train

Notes

FI-420 Universal pulse processor board

INSTRUCTION MANUAL SUPPLEMENT



Specifications

Programming	On board programming via three tactile push buttons.
Display	4 digit, seven segment LCD with 4 levels of contrast adjustment.
Input frequency *(Hall Effect & Coil)*	1.0 ~ 9999 Hz. *(frequencies below 1hz are not registered).*
(Reed Switch)	1.0 ~ 80.0 Hz. *(frequencies below 1hz are not registered).*
Input sensor types	Reed switch, Hall Effect, pulse wire or reluctance coil *(turbine meter).*
Milliamp outputs	1) Analog 4 ~ 20mA, *(600Ω maximum drive capability @ 28Vdc).*
	2) Modulated between 4 and 20mA *(divided pulse & flow switch).*
Pulse repeater output	Isolated NPN square wave, 30Vdc x 100mA maximum load.
Loop powered voltage	1) 18 - 25Vdc continuous (24Vdc recommended)
	2) Maximum peak Voltage 28Vdc
Accuracy	+/- 0.3% of span.
Response	Programmable 1~9 seconds.
Full scale limit	20mA internally limited *(over range defaults to 0mA).*
Temperature range	-10ºC ~ +80ºC.
Processor	8 bit processing via 256 step Pulse Width Modulation
Resolution	62uA.*(frequencies above 99.99 Hz are processed as whole numbers).*
Program protection	All programmed & accumulated data is stored in non-volatile memory.

Overview

The FI-420 is a non volatile field programmable pulse converter which may be set to function as either a frequency to current converter (F/I), a pulse divider or a single point flow rate alarm device for high or low flow rate detection. The instrument also has an NPN pulse output which mirrors input pulse frequency, this two wire signal may be used for remote totalisation and/or rate indication.

The instrument is specifically designed to fit within the terminal housing of any of the propriety flowmeters or may be adapted to other styles of meters including Turbine and Insertion Paddle wheel flowmeters.

In all three functions, the output signal remains as a milliamp signal as follows:

Function 1 = frequency to current (F/I), 4 ~ 20mA proportional to flow rate, spanned as desired.
Function 2 = frequency divider, divider range 1~9999, output is 4mA (pulse low) and 20ma (pulse high), 25hz max.
Function 3 = frequency (flow rate) alarm, output is 4mA (no alarm condition) and 20ma (flow rate alarm condition).

Calibration

The philosophy behind the processor board rests on the origin of the flow input signal being expressed in terms of frequency rather than K-factor (scale factor) however, in order to derive the relevant frequency the user must work from the flowmeters known K-factor, these are in most cases available from the respective flowmeters calibration sheet or given as a nominal with some inferential style flowmeters such as insertion paddle wheel meters.

Some programming examples for each function are shown below.

Programming examples :		**Program set points**		
Meter K-factor *	Flow rate **	F/I converter	divider *** *(divisor)*	Flow alarm
2816	30 litres / hr	23.47 hz	*(282 or 2816)*	23.47 hz
102.7	600 litres / hr	17.12 hz	*(103)*	17.12 hz
52.44	220 LPM	192 hz	*(52 or 524)*	192 hz
14.31	220 LPM	52.47 hz	*(143)*	52.47 hz
4.412	1550 LPM	110 hz	*(44 or 441)*	110 hz

(*) *Flowmeter K-factor from calibration report or established tests.*

(**) *Flow rate for 20mA full scale output (no decimal position above 99.9 hz).*

(***) *Minimum divisor depends on acceptable error levels by the user.*

Input configurations

The processor board is produced in two configurations, the most common is supplied fitted with a loop powered Hall Effect pick up, this model is typically supplied with positive displacement flowmeters. The second configuration board does not have a Hall Effect device but has the facility to accept either a reed switch, coil or pulse wire input via hard wire solder pad connection. Unless otherwise requested at time of order placement the unit is pre-programmed at the factory to produce 20mA at the maximum flow rate of the associated flowmeter.

Function configuration

Frequency to current (F/I) Produces 4 ~ 20mA analog output proportional to flow rate. Programming requires the setting of a decimal point for frequency resolution eg. 1.000hz, 10.00hz, 100hz or 1000hz followed by the full scale frequency to produce 20mA output then finally a response time in seconds. The response time is used to smooth out fluctuating flow rate in order to provide a stable current output. Most input signals are reasonably stable and only need a low setting value of 1 to 3 seconds *(9 sec. is maximum),* these are step changes to the analog output signal, for example a response setting of 2 seconds would cause the processor to update the output every 2 seconds. The final setting covers the number of poles **(NOP)** of magnetic flux associated with the primary measuring elements, for example an Oval PD flowmeter may typically have 1, 2 or 4 magnetic poles per revolution, a Turbine flowmeter may have from 5 to 20 turbine blades, this feature compensates for any inherent cyclic variations in the flux density field of each pole which could otherwise produce an unstable output. Setting the NOP (or multiples of the NOP for even better stability) enables the processor to average the input readings thereby maximizing accuracy and repeatability of the output.

The span adjustment *(20mA)* is preset at the factory and should have no need to be adjusted there after.

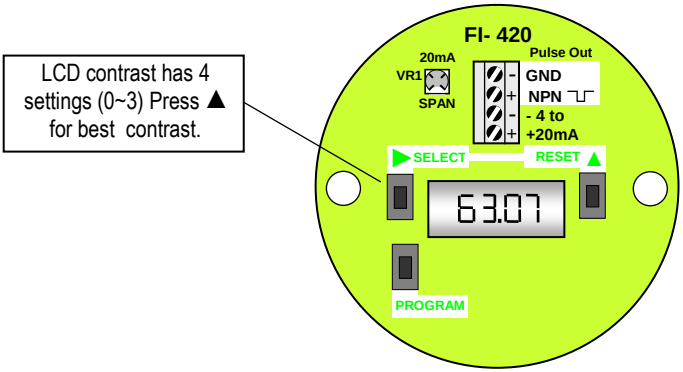
In run mode the LCD defaults to display the flowmeter input frequency which is used during calibration.

Frequency (flow rate) alarm Output is current modulated between 4mA *(no alarm condition)* and 20ma *(flow rate alarm condition)* when the input frequency reaches the alarm set point frequency. Programming requires the setting of a decimal point for frequency resolution eg. 5.243hz, 52.43hz, 524hz or 5243hz followed by the input frequency at which the flow alarm is to change status, next the deadband is set as a percentage of the frequency switch point. Deadband provides a variable trip buffer zone about the set point in order to overcome alarm "chattering" when the flow is fluctuating close to the set point. Deadband is expressed as 0~9% of the set point (hz). The final setting covers the number of poles (NOP) of magnetic flux associated with the primary measuring elements, for example an Oval PD flowmeter may typically have 1, 2 or 4 magnetic poles per revolution, a Turbine flowmeter may have from 5 to 20 turbine blades, this feature compensates for any inherent cyclic variations in the flux density field of each pole which could otherwise produce an unstable output. Setting the NOP (or multiples of the NOP for even better stability) enables the processor to average the input readings thereby maximizing accuracy and repeatability.

In run mode the LCD defaults to display the flowmeter input frequency which is used during alarm set point checks.

Frequency divider A limited divider range of 1~9999 suits most smaller capacity flowmeters having a high resolution pulse output generally in excess of 100 pulses per litre, gallon etc. often in situations where the output is used for totalising. Other applications can include dosing control signals or general output frequency reduction. Programming simply requires the setting of the appropriate divisor number (between 0001 & 9999). The divided pulse output is limited to 25hz. The output is current modulated between 4mA and 20mA.

In run mode the LCD defaults to function as an output totaliser & may be reset at any time.



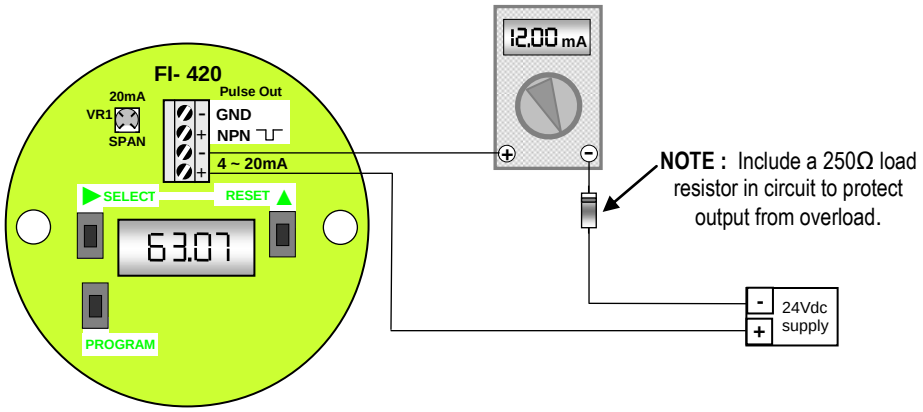
Touch key matrix	Function in run mode	Function in program mode
PROGRAM	Displays set function	Press & hold to enter program
▶ RIGHT	Adjusts LCD contrast	Selects digit to be set
▲ UP	Shows set point, divide factor or resets total	Changes value of selected digit

Touch key operation

The 3 touch keys need to be operated slowly with deliberate action as the processor cyclic routine is some what slow & at times may miss a sharp key action, this is not to be interpreted as an intermittent fault.

Testing output with a multimeter

Wire in accordance with the diagram shown. Test output in proportion to frequency input for the 16mA span (4~20mA = 16mA span, 20mA being full scale [FS] range), for example, if 100hz were to produce 20mA then 50hz should produce 12mA, 25hz should produce 8mA & 10hz 5.6mA.

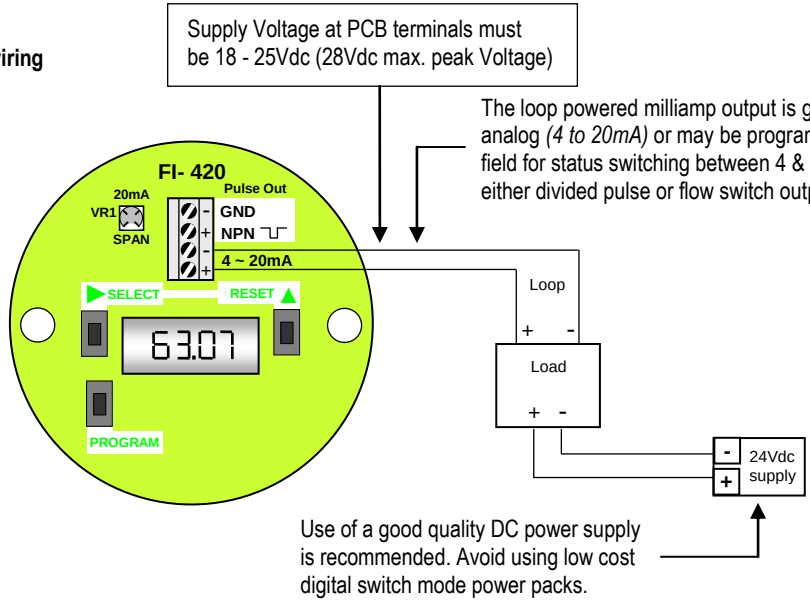


Electrical connections

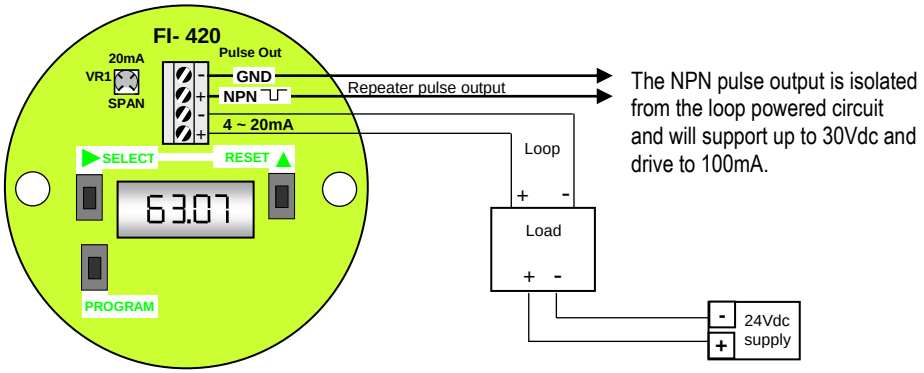
Twisted pair low capacitance shielded instrument cable 7 x 0.3mm *(0.5mm²)* should be used for electrical connection between the flowmeter and remote instrumentation (Belden® number 9363 or similar). The cable drain or screen should be terminated on a DC COMMON or a specifically assigned shield termination at the readout instrument end only in order to protect the transmitted signal from mutual inductive interference. IMPORTANT, tape off & isolate the shield at the flowmeter end of the cable.

The cable should not be run in a common conduit or parallel with power and high inductive load carrying cables as power surges may induce erroneous noise transients onto the transmitted pulse signal or cause damage to the electronics. Run the cable in a separate conduit or with low energy instrument cables only.

loop wiring



loop wiring + repeater pulse output



Programming chart