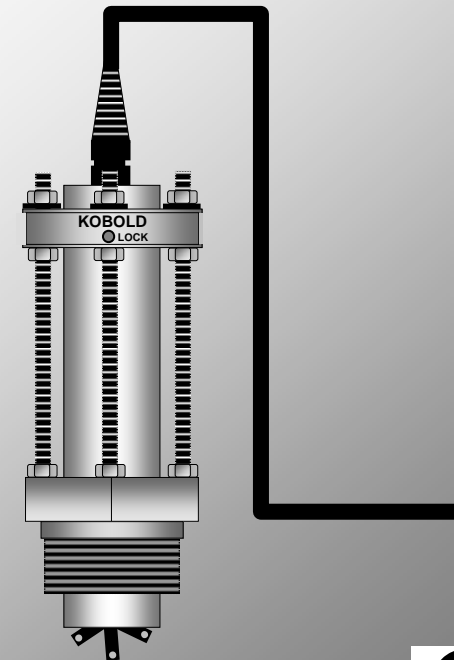KOBOLD
measuring
controlling
analysing

BI-DIRECTIONAL INSERTION FLOW TRANSDUCER
Model DOR

INSTRUCTION MANUAL

CE

IMPORTANT INFORMATION

Thank you for purchasing a Kobold Insertion Flowmeter. It is important that you read this manual to gain a full understanding of the capability and operational aspects of the equipment you are about to install.

This information is provided only to assist in the installation of the product and does not diminish your obligation to read the manual.

1. Select a location that meets the requirements as illustrated on the guideline sheet (please see the data sheet/order codes). An ideal installation would provide for 25 diameters of straight pipe upstream from the meter and 10 diameters downstream.

You will also need to know the pipe internal diameter (NB) and pipe wall thickness for calculation of the insertion depth. *(refer page 5.)* Non ideal installations may require in-situ calibration *(refer to the factory for details)*.

2. After screwing the flowmeter in place ensure the flow alignment mark located on the top positioning collar of the meter aligns with the flow in the pipe *(refer page 5)*. This ensures the paddle is correctly aligned to the flow.
Note. the meter is bi-directional so a flow direction arrow is <u>not</u> provided.

3. Calculate and adjust the height of the flowmeter *(refer page 5)*.

4. Electrical Installation depends on the model you have purchased.
If the dualpulse is fitted or supplied with a receiving instrument such as a totaliser or rate totaliser please refer to the appropriate manual and page 10 of this manual. For pulse output meters, select the appropriate output and wire to your receiving device. *(refer pages 7 to 9)*.

5. Calculate the flowmeter K *(scale)* factor to suit the installation. For ideal installations refer to page 11 or 12 or 13 of the flowmeter Manual. For non ideal installations the K-factor may be calculated by performing an in-situ calibration. Enter the appropriate K-factor into your receiving instrument.

1.1 Model no. designation
Please see the data sheet

1.2 Overview
Kobold insertion flow transducers provide a cost effective and simple means of measuring the flow of a wide range of low viscosity liquids. Installation is quick and inexpensive for pipe diameters ranging from 40mm to 900mm (1.5-36") and up to 2500mm (100") nominal bore for the Hot tap capable model DOR-52.

The flowmeter has a linear measuring range of 0.3~10.0 metres/sec. (1~33 ft/sec.). Minimum detectable flow velocity is 0.15 m/sec. (0.5 ft/sec.). When used in conjunction with the ZOD-Z3 flow rate totaliser NLC feature the linear flow range is extended down to 0.15 m/sec. (0.5 ft/sec.) with an improved linearity.

The flowmeter is constructed from 316 L (1.4404) stainless steel enabling use in many applications for metering water and low viscosity chemicals.

Two independent pulse outputs are standard & can directly input to a wide range of ancillary instruments, PLC's and computers. Both pulse outputs have a high level of immunity to electrical interference. Options include a reed switch.

1.3 Operating principle
Flow passes through a pipe causing the rotor to spin. Magnets installed in the rotor pass by pulse sensors within the transducer body & inturn this produces frequency outputs proportional to flow rate.

1.4 Specifications

Velocity measuring range (linear):	0.3...10 m/s equates to approx.0.25...49,000 l/s in DN40 to DN2500 pipes; 0.15...10 m/s when using the linearisation function of electronic type Z3
Linearity:	±1.5% with well est. flow profile
Repeatability:	±1% of f. s. at factory conditions and optimal straight runs
Max pressure:	80 bar
Temperature range:	-40…+100°C standard, see max.allowable medium temperature table for other options and restrictions

Material

Body:	stainless steel 1.4404 (316L)
Rotor:	PVDF or PEEK (depending on model)
Rotor shaft:	stainless steel 1.4404 (316L)
Bearing:	graphite/PTFE
Seals:	FPM (standard): -15…+200°C
	EPR (ethylene propylene rubber): -20…+120°C, for ketones only
	PTFE encapsulated FPM: -20…+200°C
	NBR (Nitril): -65…+125°C

Electronics

Output frequency at max. velocity:	220...240 Hz (hall effect and voltage output),
	73...80 Hz (reed switch output)
Supply voltage:	see electrical output specifications and electronics comparison table in the data sheet
Electronic features:	see electronics comparison table in the data sheet
Wiring (standard):	5 core, screened cable, length 3 meters
Transmission distance:	1,000 meters maximum, without integrated electronics
Cable entry (terminal box):	M20x1.5 (standard), 1/2" NPT adapter (optional)
Protection Class:	IP68 (cable connection),
	IP66/67 (all other electrical connections)
Straight piping requirement:	Minimum: 10xd (upstream), 5xd (downstream) Optimal: 25xd (upstream), 10xd (downstream)
Weight:	(approx., without electronics):
	1.6 kg (DOR-4), 2.5 kg (DOR-5)

2.0 INSTALLATION

2.1 Meter location

Choose an appropriate section of horizontal or vertical pipe as per the guidelines below. With vertical pipe installations the media should be pumped up through the pipe past the flow sensor so that any entrained air will pass freely.

The DOR flow sensor requires a fully developed turbulent flow profile to ensure maximum measurement accuracy and repeatability. This can be achieved by installing the DOR in a straight run of pipe. We recommend at least 10 but ideally 25 straight pipe diameters upstream & at least 5 but ideally 10 pipe diameters downstream of the flowmeter. Major obstructions such as pumps, valves or strainers will require longer straight runs before and after the flowmeter.

Major obstructions such as pumps,valves,reducers or strainers to be kept well outside the straight run pipe sections

10 pipe dia. minimum
25 pipe dia. prefered

5 pipe dia. min.
10 pipe dia. prefered
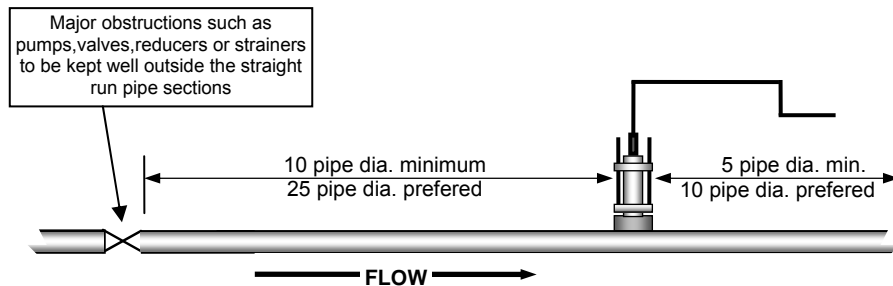
FLOW

2.2 Meter installation & orientation

Cut a 40mm diameter hole (1.6") on either the 2, 10 or 12 o'clock positions of the pipe. If there is any likelihood of air entrainment in a horizontal pipe do not locate the flow transducer in the 12 o'clock position.

12 o'clock | 2 o'clock

Other positions around the pipe are acceptable
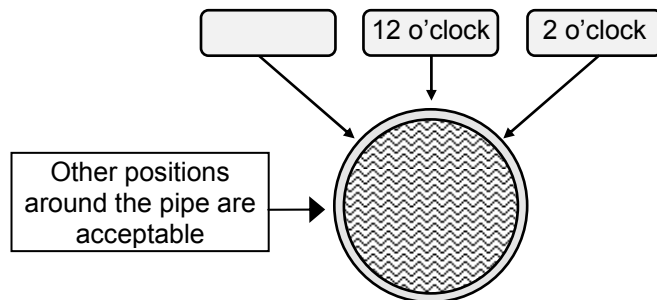
Install a female threaded weld on fitting (threadolet) or service saddle.
Wrap the threads of the flowmeter with PTFE tape or sealing compound & screw the unit into the installed fitting.

2.3 Height adjustment calculation

Calculate the adjustment height **A** for DOR-42 (or **AA** for the DOR-52) as follows:

A (for DOR-42) = 175mm (6.9") - (B + C + D)
AA (for DOR-52) = 420mm (16.5") - (B + C + D)

Where :
B = Distance between the top of the pipe & the top of the hex adaptor.
C = Pipe wall thickness
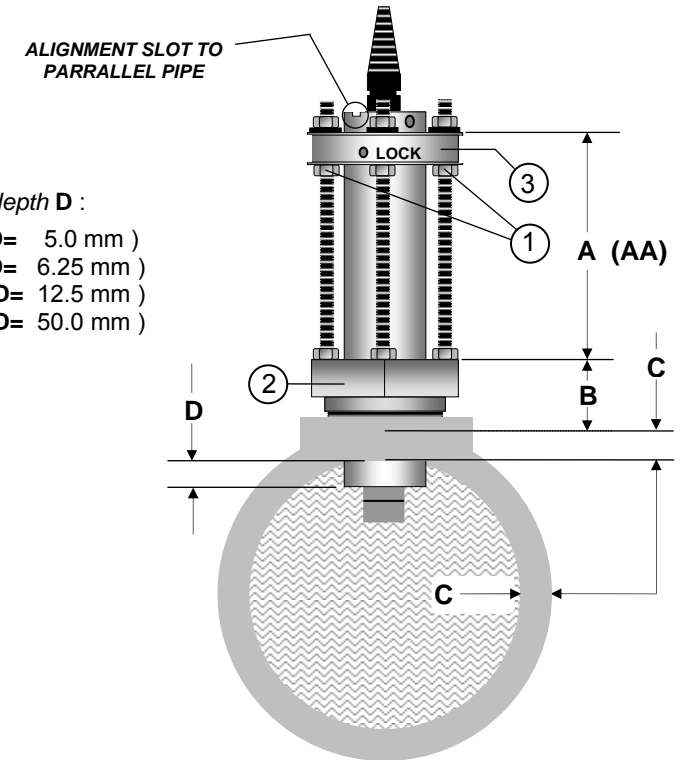**D** = Insertion depth (pipe ID ÷ 8)

ALIGNMENT SLOT TO PARRALLEL PIPE

LOCK

Examples of insertion depth **D** :

For 40mm pipe ID (**D=** 5.0 mm)
For 50mm pipe ID (**D=** 6.25 mm)
For 100mm pipe ID (**D=** 12.5 mm)
For 400mm pipe ID (**D=** 50.0 mm)

A (AA)

C

B

D

C

Turn the height adjustment nuts (1) as required so that the distance between the top of the hex adaptor (2) and the top of the positioning collar (3) equals your calculated distance **A** (for DOR-42) or **AA** for model DOR-52. Retighten the height adjustment nuts (1).

2.4 Flow direction orientation

The unit is bi-directional however the paddle must be aligned with the direction of flow.

Using a 2mm hex key (Allen key), unlock the locking screw located on the positioning collar (3) then insert the hex key (as a lever) in the body rotating hole located above the collar, turn the body until the alignment slot is parallel with the direction of pipe. Retighten the locking screw.

2.5 Hot tap installation
(model DOR-52)

Clean & lubricate screw threads before withdrawing the transducer body in order to avoid nut seizure

IMPORTANT
Before removing the DOR-52 from the installation first withdraw the transducer body to the maximum distance allowed by the three height adjusting threaded rods. This will enable the isolating valve to be fully closed without damaging the paddle.

If necessary extend valve port using a 2" nipple & socket combination to ensure the paddle is clear of the ball valve.

CAUTION : Hot tap installation should only be performed by qualified personal. Installation procedures should be in accordance with the safety rules, regulations and requirements applying to the territory in which the flow transducer is being installed.

2" ball or gate isolation valve.
(Allow min. 40mm I.D. to clear metering head)

2" Nipple

2" Weld-O-let (threadolet)

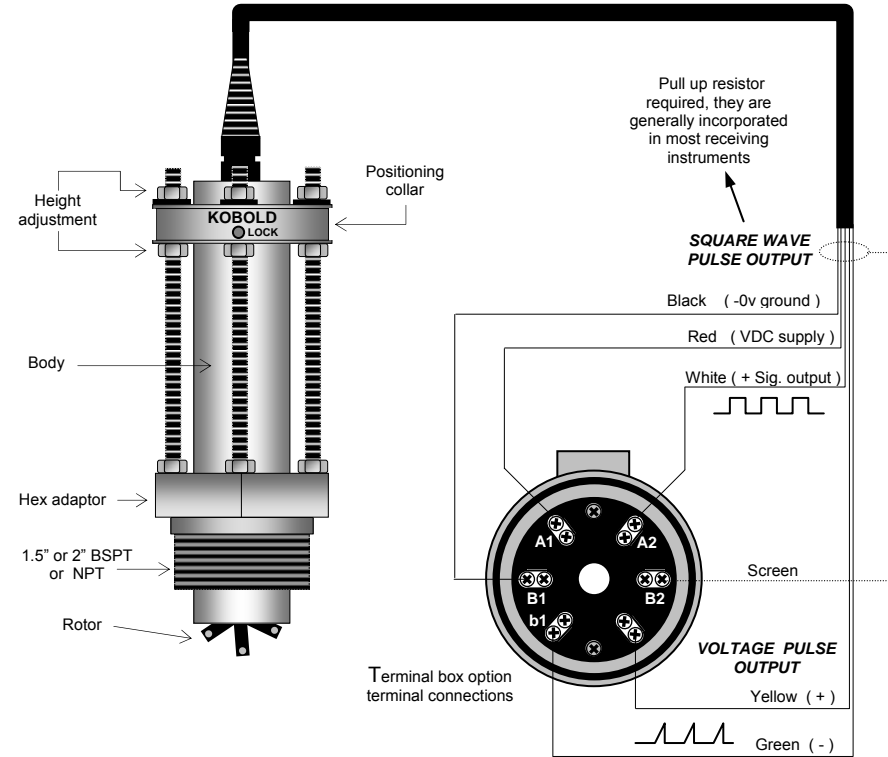Hot tap clearance hole in pipe wall to be a minimum of 40mm diameter (1.6").

FLOW
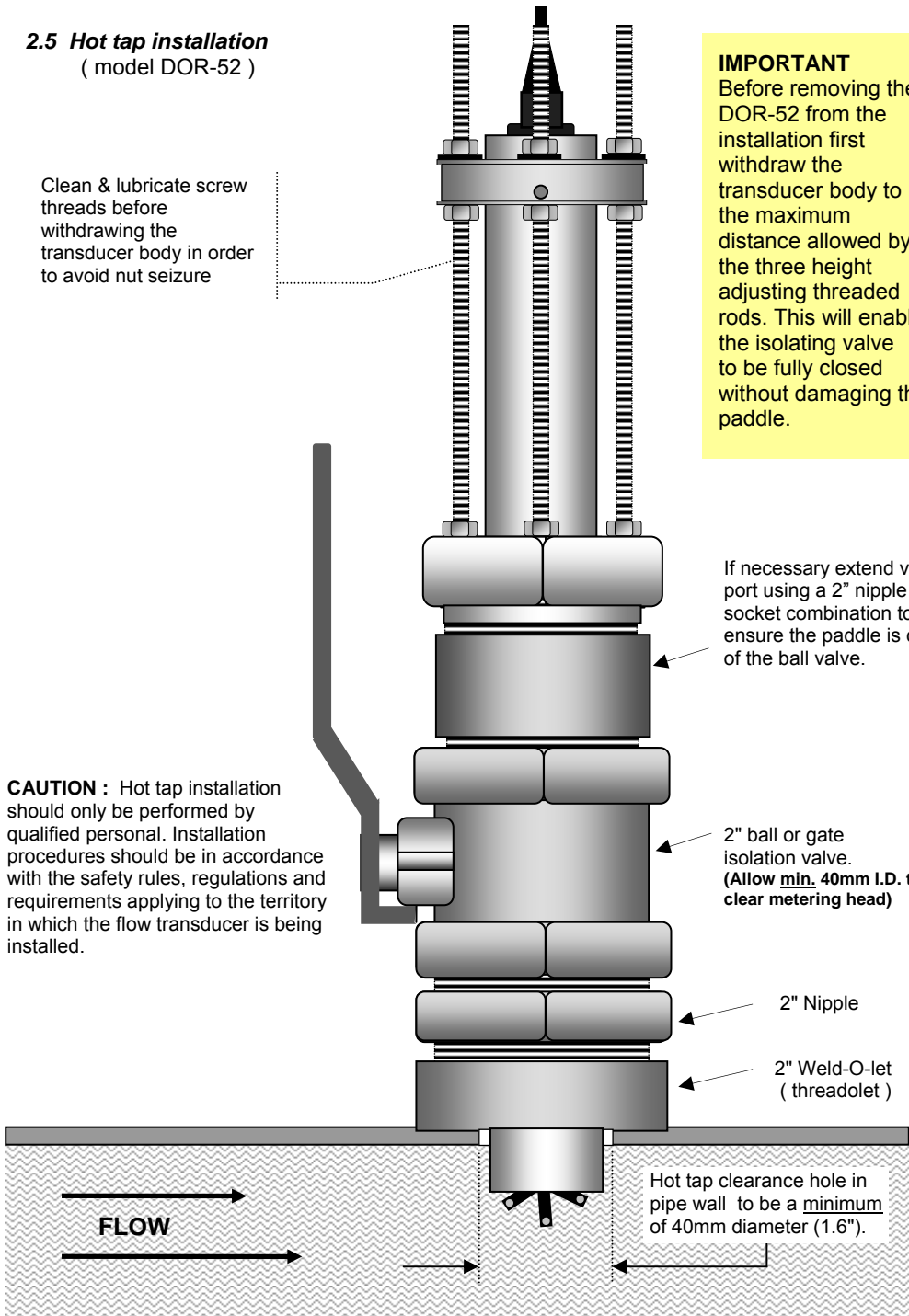
3.0 ELECTRICAL CONNECTIONS
(see page 9 for QP outputs)

3.1 Standard outputs

Conductor color coding also applies to the Non-magnetic sensor and high temperature output options

Height adjustment

Positioning collar

Body

Hex adaptor

1.5" or 2" BSPT or NPT

Rotor

Terminal box option terminal connections

Pull up resistor required, they are generally incorporated in most receiving instruments

SQUARE WAVE PULSE OUTPUT

Black (-0v ground)

Red   (VDC supply)

White (+ Sig. output)

Screen

A1   A2

B1   B2

b1

VOLTAGE PULSE OUTPUT

Yellow (+)

Green (-)

3.2 Optional Reed switch output

HAZARDOUS AREAS

The REED SWITCH output is classed as a "simple apparatus" as defined in the CENELEC standard EN50020 & recognized ATEX directive. It can be connected to an approved I.S. secondary instrument with both being located in the hazardous area.
The Reed Switch may also be connected through an approved I.S. barrier.

Note: The Reed switch produces 1/3rd the normal pulse output value (eg. 1/3 the standard K-factor)

REED SWITCH OUTPUT

Screen

To -0V

Yellow

Green
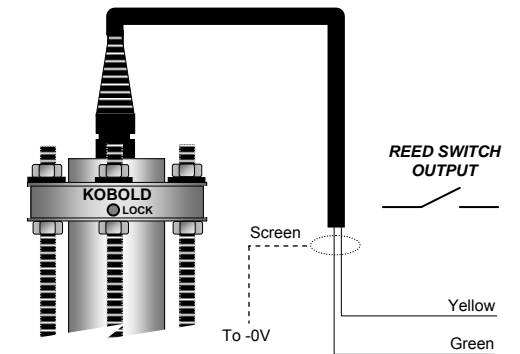
3.3 Instrument cable installation requirements

Use twisted multi-core low capacitance shielded instrument cable (22 AWG ~ 7x 0.3 stranded) for electrical connection between the flow meter and the remote instrumentation. The screen should be earthed at the readout instrument end only to protect the transmitted signal from mutual inductive interference.

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. Run the cable in separate conduit or with other low energy instrument cables .

3.4 Pulse output selection (standard outputs)

The standard flowmeter has two independent pulse output signals that are linearly proportional to volumetric flow rate. Pulse transmission can be up to 1000 metres (3300 ft). An optional I.S. Reed Switch output is available (see page 7).

<u>Voltage pulse</u> (pulse wire) <u>output</u>
A self generating pulse output which produces a strong 1.5 volt voltage spike of approximately 10 micro/second duration with no dependence on rotor speed.
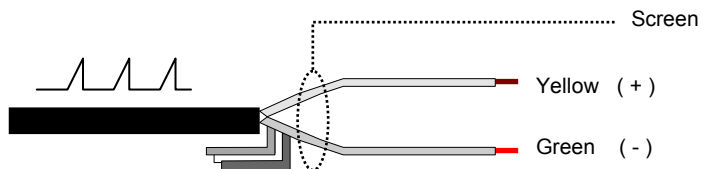

<u>Square Wave Pulse</u> (Hall sensor)   (also applies to non-magnetic & QP Hall outputs)
An NPN open collector transistor pulse output produced by a solid state Hall Effect device. This three wire device requires 5~24vdc and produces an NPN square wave output (20mA max. sink), pulse width is 2~75 mSec. The Hall output requires a pull up resistor, these are generally incorporated in most receiving instruments. For (QP) Quadrature pulse output refer details page 9.
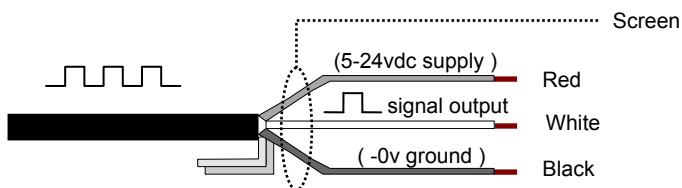
3.5 Quadrature outputs

DOR series flow meters supplied with the QP option produce two NPN open collector pulse outputs from two Hall Effect sensors. The outputs are " phase offset " in their timing so that external electronics are able to differentiate. These outputs may be used to assure output signal integrity or to measure bi-directional flow.
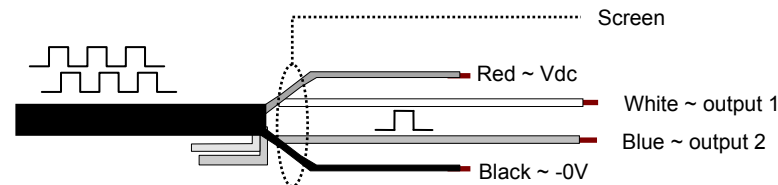
3.6 Bi-directional flow

The DOR flow transducer is capable of accurately measuring flow in both directions without modification. Meters fitted with the QP output option (quadrature pulse output) may be interfaced with the Pulse Discriminator Module (PD2). The PD2 accepts the Quadrature pulse inputs & from these will discriminate between forward & reverse flow. Two individual & proportional pulse outputs can then be sent to appropriate totalising registers or an Z3 add and subtract flow rate totaliser.

It is important to note that the Quadrature Pulse option has the same pulse resolution (pulses/unit volume) as a standard flowmeter for both forward & reverse outputs.

Flowmeter with QP outputs
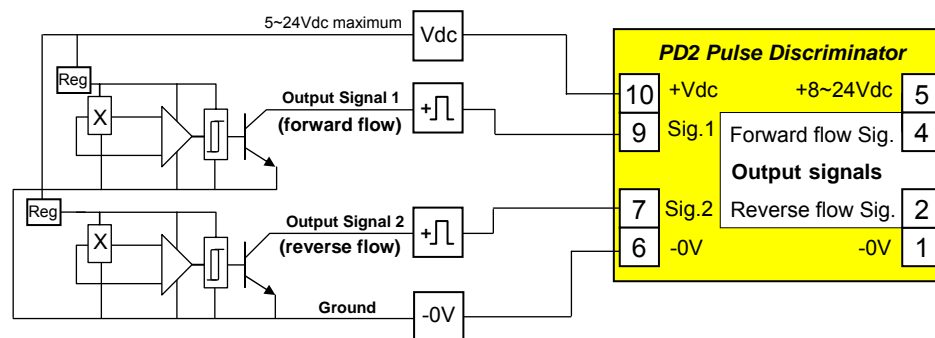
3.7 Voltage Pulse Connection to family instruments

Note: For other output styles see receiving instrument manual

Z3 & B1 SERIES INSTRUMENTS

All flow DIP switches in the OFF position

-0V (ground)

Z1 TOTALISER

DIP switch 1 in the ON position (2 Khz max.)

+ - gnd   +Vdc +⊓ -gnd
1 2 3   4   5   6

yellow

green

Screen

The flowmeter cable should not be run with other high energy cables (clause 3.3).

Flow instruments or a terminal box can be directly mounted to the flowmeter using ST4 (for DOR-42) or ST5 (DOR-52) mounting stem kits

KOBOLD ● LOCK

FLOMEC ● LOCK

4.0   K – FACTORS (calibration factors for meter)

The K-factor (pulses / litre, gallon etc.) will vary in relation to the bore size of the pipe in which the flowmeter is installed.

The K-factors and formula shown are a result of factory testing using smooth bore piping under ideal conditions. Variations to the given K-factors may occur when using rough bore piping or inadequate flow conditioning on either side of the flow transducer (refer clause 2.1). In these instances on site calibration may be used to determine the K-factor.

4.1 Flow transducer K- factors for common pipe sizes

Pipe detail		K-factors (standard K-factors for voltage & square wave outputs)					
NB	ID (#40)	Schedule 40 pipe - (#40)			Schedule 80 pipe - (#80)		
inches	mm	p / litre	p / m3	p / USgal	p / litre	p / m3	p / USgal
1.5"	40.9	18.678	18678	70.695	21.524	21524	81.468
2"	52.6	11.238	11238	42.534	12.818	12818	48.517
2.5"	62.7	7.880	7880	29.824	8.899	8899	33.682
3"	78.0	5.062	5062	19.161	5.676	5676	21.485
3.5"	90.2	3.768	3768	14.263	4.200	4200	15.896
4"	102	2.912	2912	11.021	3.233	3233	12.237
5"	128	1.839	1839	6.959	2.025	2025	7.665
6"	154	1.268	1268	4.798	1.402	1402	5.307
8"	203	0.719	719.0	2.721	0.787	787.2	2.980
10"	255	0.450	450.3	1.705	0.496	495.9	1.877
12"	303	0.316	316.0	1.196	0.347	347.4	1.315
14"	333	0.261	260.5	0.986	0.286	285.7	1.081
16"	381	0.198	198.0	0.750	0.217	217.0	0.821
18"	429	0.156	155.8	0.590	0.171	170.6	0.646
20"	478	0.125	125.4	0.475	0.138	137.8	0.521
24"	575	0.087	86.64	0.328	0.095	95.39	0.361

For other pipe sizes below 610mm (24") not listed above, use the graphs and apply the formula on the following pages (12 & 13).

4.2 K-factors for large pipes 460mm ID (18") and above use:

Pulses per litre   = $28647 \div$ pipe ID² (mm)
Pulses per M³   = $28647000 \div$ pipe ID² (mm)
Pulses per US gallon = $168.14 \div$ pipe ID² (inches)
Pulses per Imp. gallon = $201.94 \div$ pipe ID² (inches)

NOTE : K-factors for Reed Switch output option are 1/3 the standard factors of voltage pulse output.

4.3 Calculating K-factors (litres or m³)
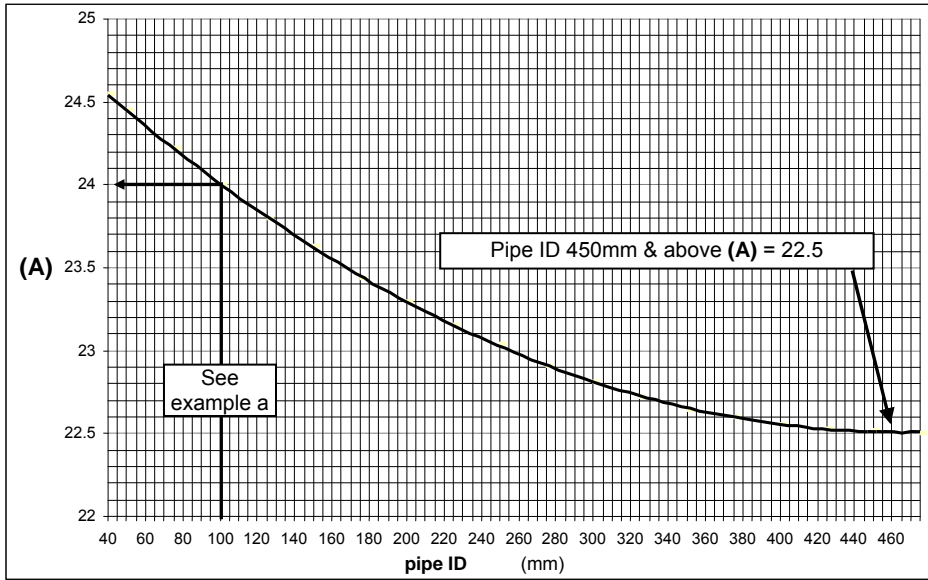
Calculate K-factor (pulses / litre) using the above graph and the metric constant of 1273.2 as follows :

$$\text{Pulses / litre} = \frac{1273.2 \times \textbf{(A)} \text{ from graph}}{\text{pipe ID}^2 \text{ (mm)}}$$

Example 'a' :
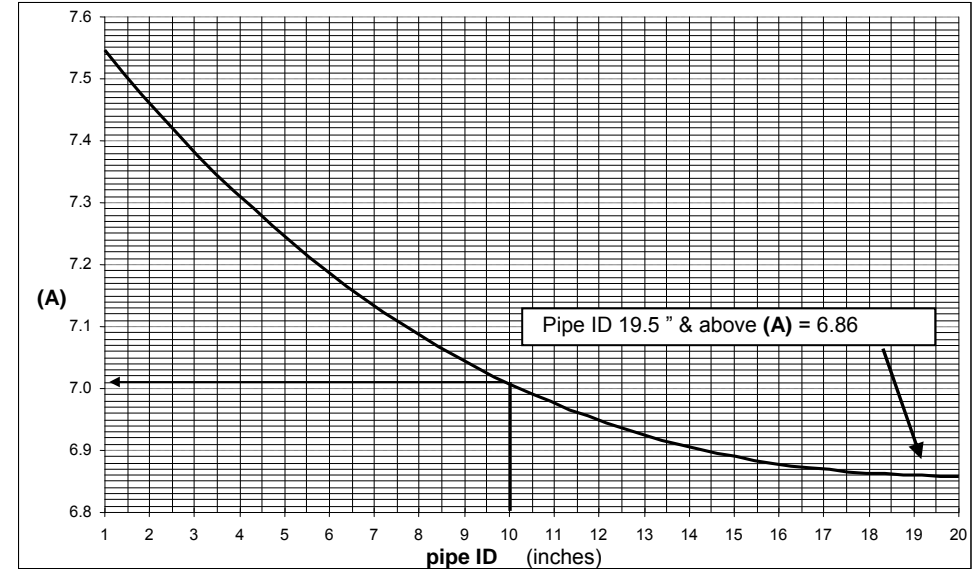K-factor for 100mm pipe: **1)** from graph 100mm ID **(A)** = 24.0

$$\textbf{2) pulses/litre.} = \frac{1273.2 \times 24.0}{10000} = \textbf{3.056} \text{ p/litre}$$

K-factor for m³   : multiply by 1000 eg.   K = 3056 p/m³
K-factor for megalitres   : multiply by 1000000 eg. K = 3056000 p/megalitre

NOTE : K-factors for Reed Switch output option are 1/3 the standard factors of voltage pulse output.

4.4 Calculating K-factors (US gallons)

Calculate K-factor (pulses / gallon) using the above graph and the volumetric constant of 24.51 as follows :

$$\text{Pulses / US gal.} = \frac{24.51 \times \textbf{(A)} \text{ from graph}}{\text{pipe ID}^2 \text{ (inches)}}$$

Example 'b' :
K-factor for 10" pipe: **1)** from graph 10" ID **(A)** = 7.01

$$\textbf{2) pulses/gal.} = \frac{24.51 \times 7.01}{100} = \textbf{1.718} \text{ p/gal}$$

NOTE : K-factors for Reed Switch output option are 1/3 the standard factors of voltage pulse output.

5.0 Declaration of Conformance

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

Bi-Directional Insertion Flow Transducer Model: DOR

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

97/23 EC Pressure Equipment Directive
Pressure Accessory – Insertion Flowmeter – No CE Marking
Article 3, Paragraph 3; Diagram 9, Piping, Group II Liquids
Article 3, Paragraph 3; Diagram 8, Piping, Group I Liquids – **with the following restrictions**

Connection Nominal Size	Maximum Pressure Rating For Group I Liquids
1.5" (40 mm)	50 bar
2" (50 mm)	40 bar

2002/96/EC Waste Electrical & Electronic Equipment (WEEE)

2002/95/EC Restriction of Hazardous Substances (RoHS)

Also the following EEC guidelines are fulfilled:

2004/108/EC EMC Directive – Electromagnetic Compatibility Directive

When fitted with an optional Reed Switch ONLY pulse output, which is classified as a simple apparatus, and when installed in accordance with Hazardous Area standards by a competent professional the product also complies with:

EN 60079-11: 2011 – Section 5.7
Equipment protected by Intrinsic Safety – Simple Apparatus

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

When fitted with an integral EX-ia certified instrument such as the ZOD-Z3 or ZOD-Z1, in combination with a Reed Switch only output, the product also complies with:

94/9/EC
ATEX Directive

Certificate about acknowledgement of quality assurance production
Certificate number: BVS 12 ATEX ZQS/E110
Certification body: DEKRA EXAM GmbH, notified body No 0158

SIRA 06 ATEX M348 – Only when equipped with integral ZOD-Z3 or ZOD-Z1 options
Issued by Sira Certification – United Kingdom

EN 13980:2002
Potentially Explosive Atmospheres – Application of Quality Systems

94/9/EC Articles IV and VII
ATEX Directive

Hofheim, 12. Nov. 2013

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

CE

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 Stock No. 596-602	*Farnell Components* 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)	**1 =** 3 x cable entry M20	**F3** = 8…24 VDC, Battery		
	KM[1] = integral mount	**2 =** 3 x cable entry 1/2" NPT	**F1**[2] = 110 VAC, 8…24 VDC	**0** = without	**0** = without
	PP = panel mount (IP20)	**0**[2] = screw terminal	**F0**[2] = 220 VAC, 8…24 VDC	**R** = 2 x Relay (for ZOD-B1K)	**S**[2] = silicone bezel boot

[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 : AOC enabled-disabled selection at programming level *(page 13)*.
compensation

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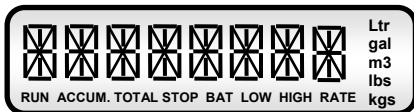
Full LCD display test feature illuminates all display segments and script text displays for 5 seconds when entering the program mode.

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 ")

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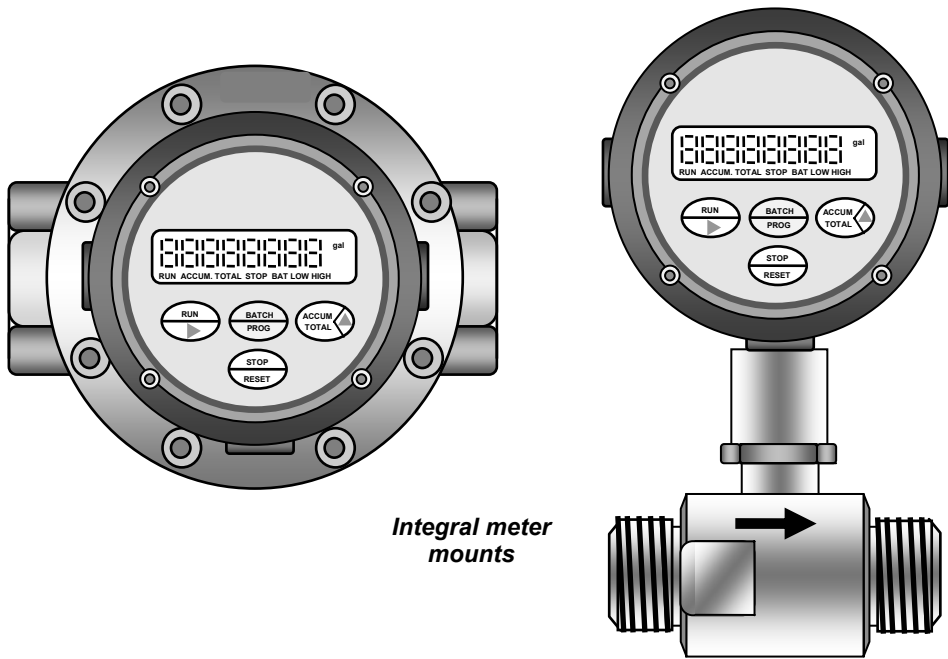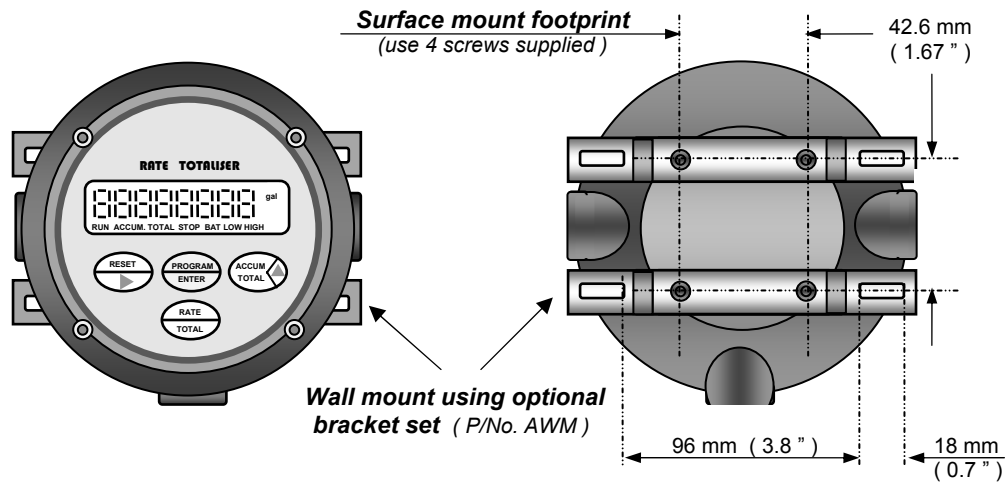
Wall mount using optional bracket set (P/No. AWM)

96 mm (3.8 ")

18 mm
(0.7 ")
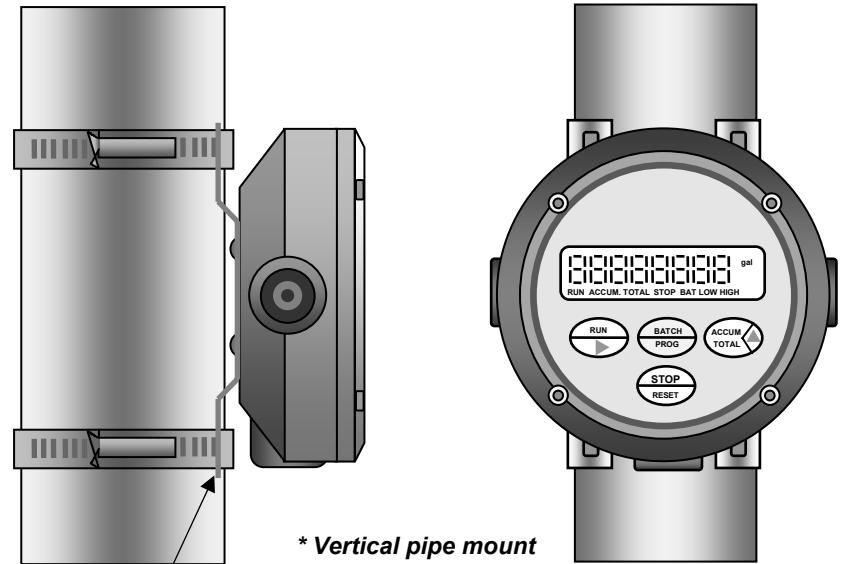
* Vertical pipe mount

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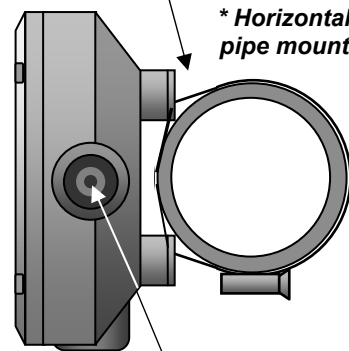
* Horizontal pipe mount

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)

Flow input switch functions

Factory set network default settings, do not change

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

Switch 2 : ON engages 1 meg Ω pull up resister

Switch 3 : ON engages 820Ω pull down resister

Flow Input

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

Factory set, do not change

Flow DIP switches 1 & 2 are <u>on</u>

Ground screen at -0V (5)

1	Network loop	Relay 2 (high)	14
2		Relay 1 (low)	13
3	Flow Input A	Batch status	12
4		Not used	11
5	-0V (ground)	Not used	10
6	+8~24Vdc in	Inhibit input	9
7	Pulse output	-0V (ground)	8

2. Voltage Pulse *(& pulse wires)*

Factory set, do not change

All flow DIP swithes <u>off</u>

1.1 ~ 30 Vdc

Ground screen at -0V (5)

N   S

1	Network loop	Relay 2 (high)	14
2		Relay 1 (low)	13
3	Flow Input A	Batch status	12
4		Not used	11
5	-0V (ground)	Not used	10
6	+8~24Vdc in	Inhibit input	9
7	Pulse output	-0V (ground)	8

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

Factory set, do not change

All flow DIP switches <u>off</u> (position switch 1 <u>ON</u> if unit is effected by line noise)

use twisted pairs

1	Network loop	Relay 2 (high)	14
2		Relay 1 (low)	13
3	Flow Input A	Batch status	12
4		Not used	11
5	-0V (ground)	Not used	10
6	+8~24Vdc in	Inhibit input	9
7	Pulse output	-0V (ground)	8

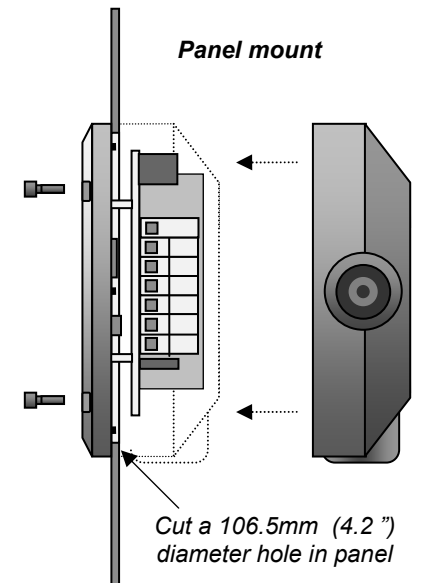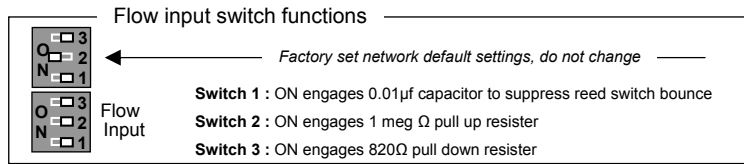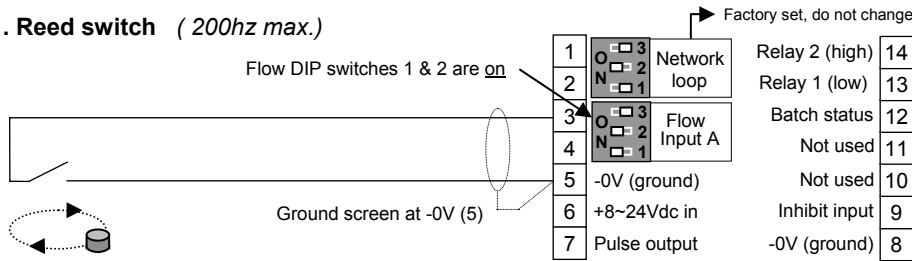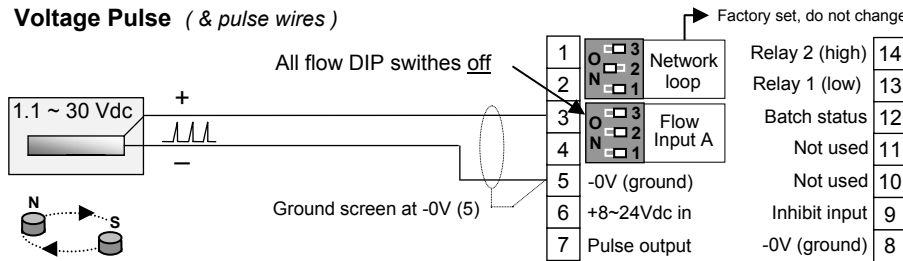## 3.2 *Flowmeter connections* (powered sensors)

4. Hall Effect *(open collector)*

Factory set, do not change

Flow input DIP SW2 is <u>on</u>

Hall effect

+ Signal out

- 0V ground

Vdc supply

Reg. Vdc

1	Network loop	Relay 2 (high)	14
2		Relay 1 (low)	13
3	Flow Input A	Batch status	12
4		Not used	11
5	-0V (ground)	Not used	10
6	+8~24Vdc in	Inhibit input	9
7	Pulse output	-0V (ground)	8

5. Namur *(inductive proximity switch)*

Factory set, do not change

Flow input DIP SW3 is <u>on</u>

NAMUR Inductive Proximity

Reg. Vdc

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

1	Network loop	Relay 2 (high)	14
2		Relay 1 (low)	13
3	Flow Input A	Batch status	12
4		Not used	11
5	-0V (ground)	Not used	10
6	+8~24Vdc in	Inhibit input	9
7	Pulse output	-0V (ground)	8

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

Factory set, do not change

Flow input DIP switches <u>off</u>

NOTE : Position a 100Ω, ¼W Resistor across terminals 3 & 5

Coil with pre-amp current modulated   B A

Reg.Vdc

1	Network loop	Relay 2 (high)	14
2		Relay 1 (low)	13
3	Flow Input A	Batch status	12
4		Not used	11
5	-0V (ground)	Not used	10
6	+8~24Vdc in	Inhibit input	9
7	Pulse output	-0V (ground)	8

3.3 *Wiring connections*

Powering & Remote switches *(remote keys)*

1	Network loop	Relay 2 high	14
2		Relay 1 low	13
3	Flow Input	Batch status	12
4		not used	11
5	-0V (ground)	not used	10
6	+8~24Vdc in	Run inhibit	9
7	No flow alarm	-0V (ground)	8

Reg.Vdc

use momentary contact
remote switches only

STOP
TOTAL
SET
RUN

Remote keys
15 16 17 18 19

| 15 | 16 | 17 | 18 | 19 |

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 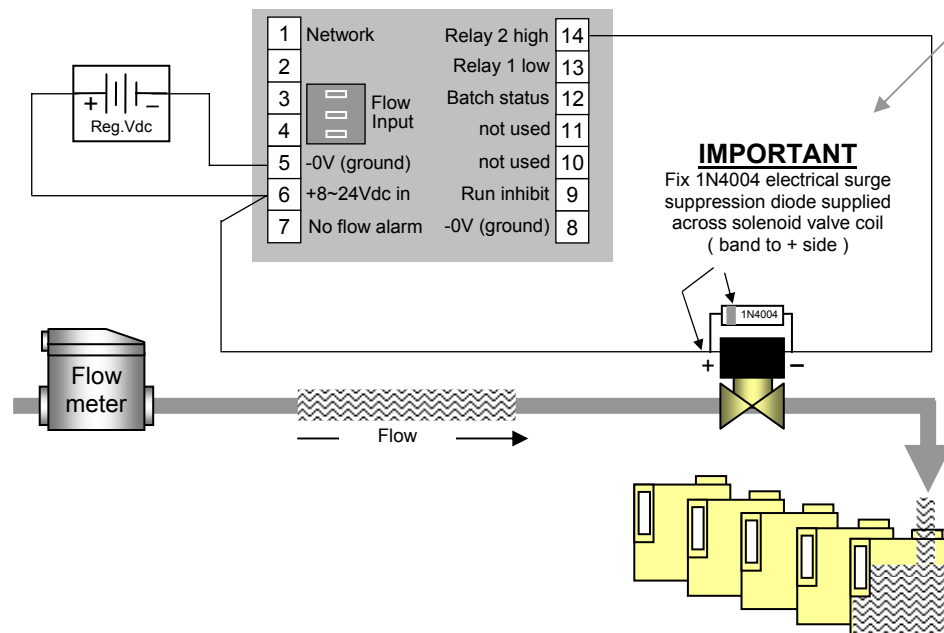frequencies may induce erroneous noise transients onto the signal. Run instrument cables in a separate conduit or with other instrument cables.
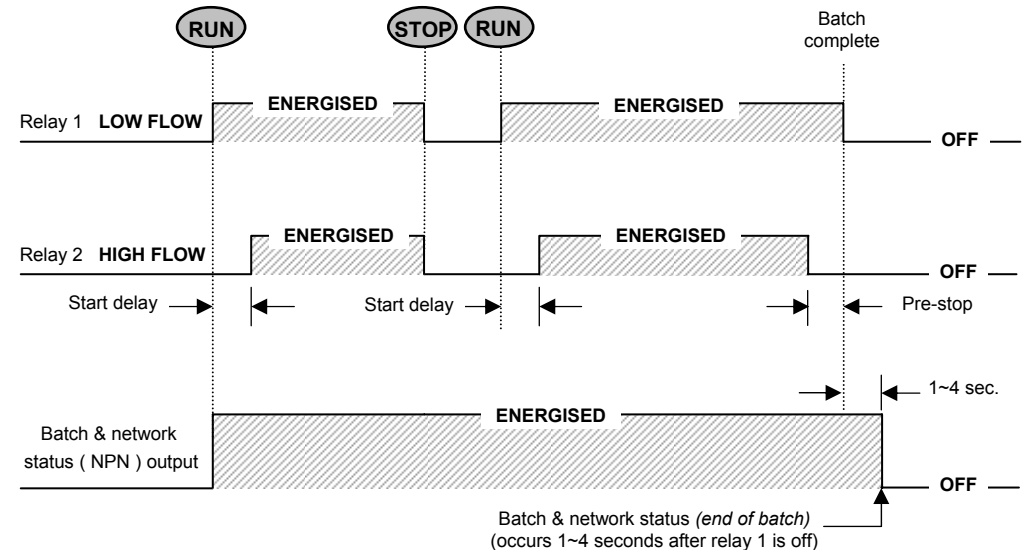
Single Stage Control *(use relay 1 or 2, relay 2 has pre-stop programming capability)*

1	Network	Relay 2 high	14
2		Relay 1 low	13
3	Flow Input	Batch status	12
4		not used	11
5	-0V (ground)	not used	10
6	+8~24Vdc in	Run inhibit	9
7	No flow alarm	-0V (ground)	8

Reg.Vdc

IMPORTANT
Fix 1N4004 electrical surge
suppression diode supplied
across solenoid valve coil
(band to + side)

1N4004
+   −

Flow
meter

Flow

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

1	Network	Relay 2 high	14
2		Relay 1 low	13
3	Flow Input	Batch status	12
4		not used	11
5	-0V (ground)	not used	10
6	+8~24Vdc in	Run inhibit	9
7	No flow alarm	-0V (ground)	8

Reg.Vdc

1N4004
+ **V1** −

1N4004
+ **V2** −

Flow
meter

Flow

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

RUN   STOP RUN   Batch complete

Relay 1 **LOW FLOW**   ENERGISED   ENERGISED   OFF

Relay 2 **HIGH FLOW**   ENERGISED   ENERGISED   OFF

Start delay   Start delay   Pre-stop

1~4 sec.

Batch & network
status (NPN) output   ENERGISED   OFF

Batch & network status *(end of batch)*
(occurs 1~4 seconds after relay 1 is off)

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 <u>YES</u> 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.
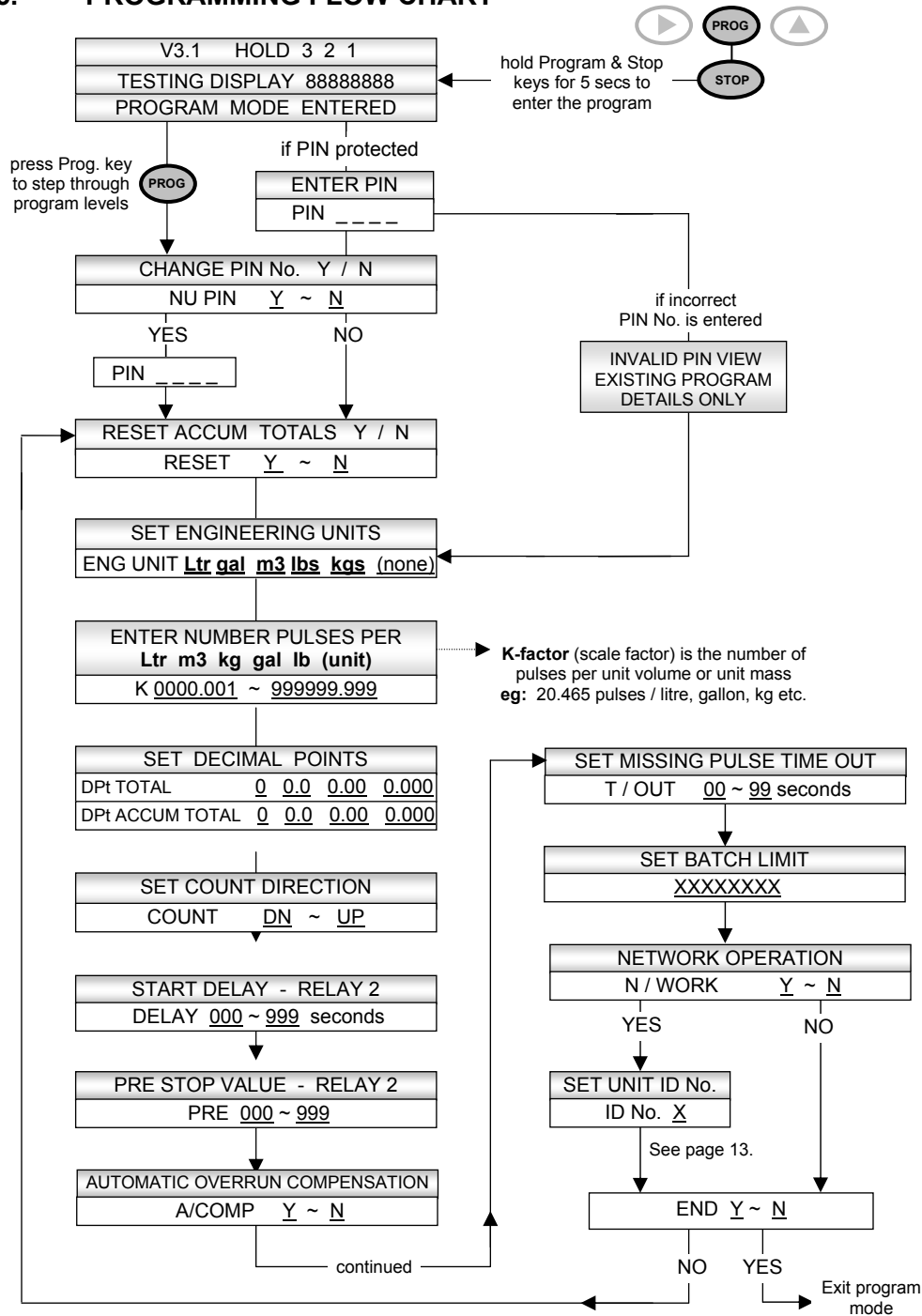
4.10 Batch Limit
To avoid entering excessive batch quantities, a maximum batch limit can be set at the program level. ZOD-B1 will not accept a batch value which exceeds the batch limit, on rejecting an excessive batch value the controller will scroll the message "BATCH VALUE EXCEEDS BATCH LIMIT" and default to the batch limit on entry (batch set).
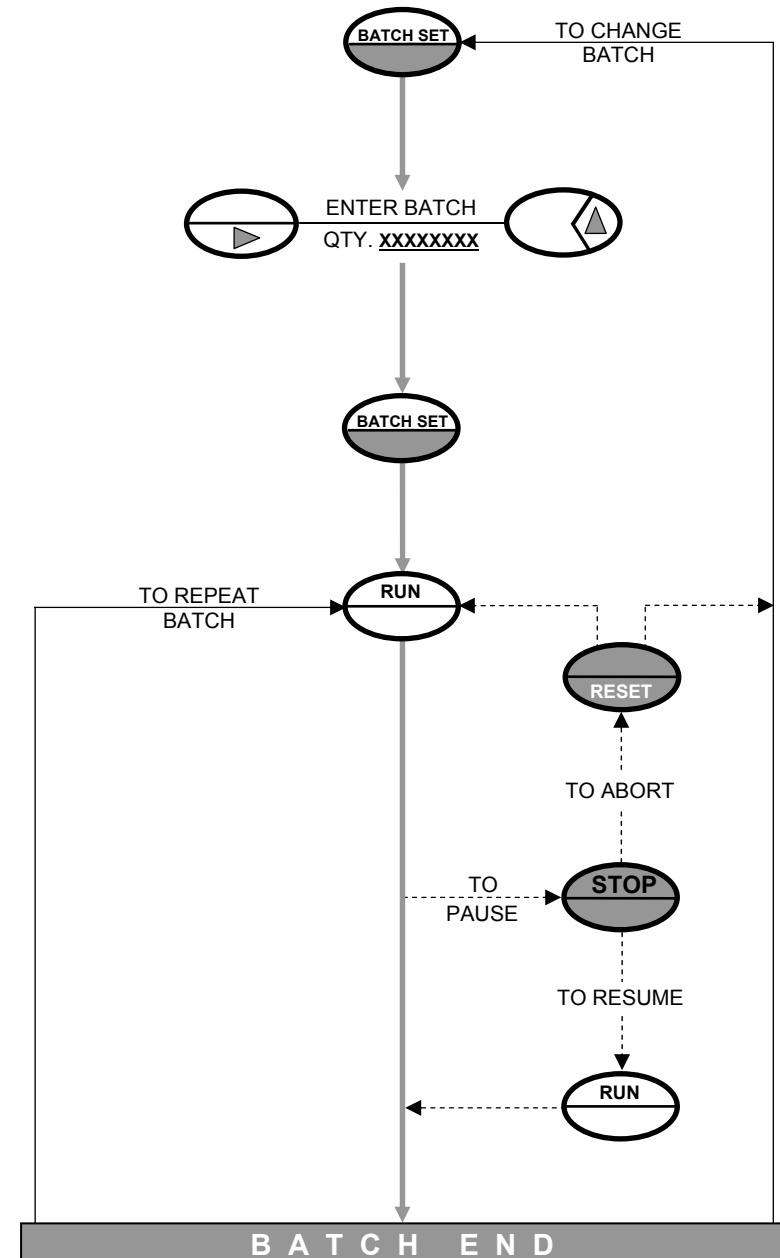
4.11 Controller networking ID number
Each controller can be given a networking ID number in the range of 1~9. Allocating an ID number other than 0 is only necessary when a number of controllers are to be networked together for interlocking purposes *(see page 18 for Controller Networking)*. Setting the 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

```
V3.1     HOLD  3  2  1
TESTING DISPLAY  88888888
PROGRAM  MODE  ENTERED
```

hold Program & Stop keys for 5 secs to enter the program

PROG

STOP

if PIN protected

```
ENTER PIN
PIN  _ _ _ _
```

press Prog. key to step through program levels

PROG

```
CHANGE PIN No.  Y / N
NU PIN    Y ~ N
```

if incorrect PIN No. is entered

```
INVALID PIN VIEW
EXISTING PROGRAM
DETAILS ONLY
```

YES   NO

```
PIN  _ _ _ _
```

```
RESET ACCUM  TOTALS  Y / N
RESET    Y ~ N
```

```
SET ENGINEERING UNITS
ENG UNIT  Ltr gal  m3 lbs  kgs  (none)
```

```
ENTER NUMBER PULSES PER
Ltr  m3  kg  gal  lb  (unit)
K 0000.001 ~ 999999.999
```

K-factor (scale factor) is the number of pulses per unit volume or unit mass
eg: 20.465 pulses / litre, gallon, kg etc.

```
SET  DECIMAL  POINTS
DPt TOTAL          0  0.0  0.00  0.000
DPt ACCUM TOTAL  0  0.0  0.00  0.000
```

```
SET MISSING PULSE TIME OUT
T / OUT    00 ~ 99 seconds
```

```
SET COUNT DIRECTION
COUNT    DN ~ UP
```

```
SET BATCH LIMIT
XXXXXXXX
```

```
START DELAY - RELAY 2
DELAY 000 ~ 999 seconds
```

```
NETWORK OPERATION
N / WORK        Y ~ N
```

YES   NO

```
PRE STOP VALUE - RELAY 2
PRE 000 ~ 999
```

```
SET UNIT ID No.
ID No.  X
```

See page 13.

```
AUTOMATIC OVERRUN COMPENSATION
A/COMP   Y ~ N
```

```
END  Y ~ N
```

continued

NO   YES

Exit program mode

BATCH SET

TO CHANGE BATCH

ENTER BATCH QTY. **XXXXXXXX**

BATCH SET

RUN

TO REPEAT BATCH

RESET

TO ABORT

STOP

TO PAUSE

TO RESUME

RUN

B A T C H   E N D

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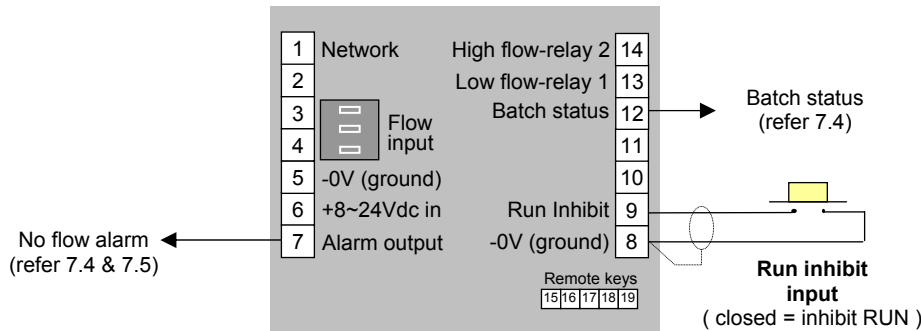
7.2 Alarm Output
An NPN/PNP selectable solid state output signal *(terminal 7)* is activated when the missing pulse detection feature detects a no flow condition *(refer 4.9).* NPN/PNP selection is to be in accordance with the connection options on the following page (17).

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).

IMPORTANT
For solenoid valve coils fix a 1N4004 electrical surge suppression diode across the coil (refer page 10)
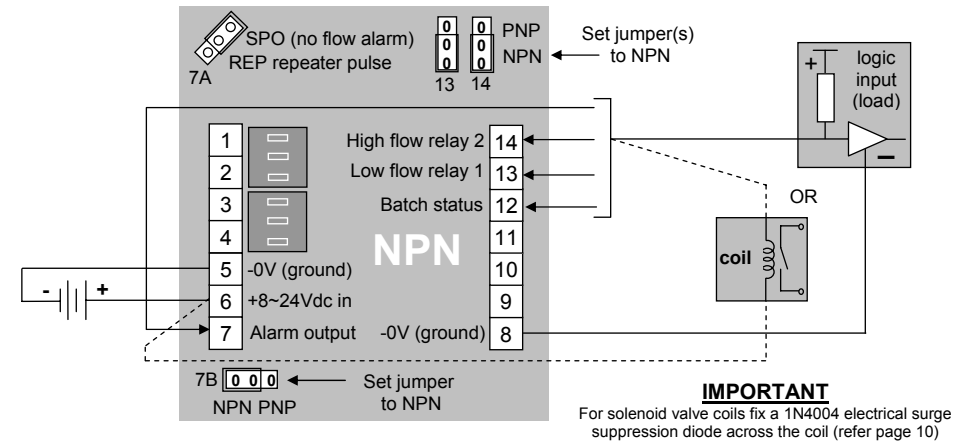
7.5 Current Sourcing outputs (PNP)
Current sourcing gets its name from the fact that it "sources current to a load". When activated the current flows from the output (7,13 & 14) into the load. When wired as below the output voltage pulse is the supply voltage of the load. The load would normally have an internal pull down resistor on its input as shown.
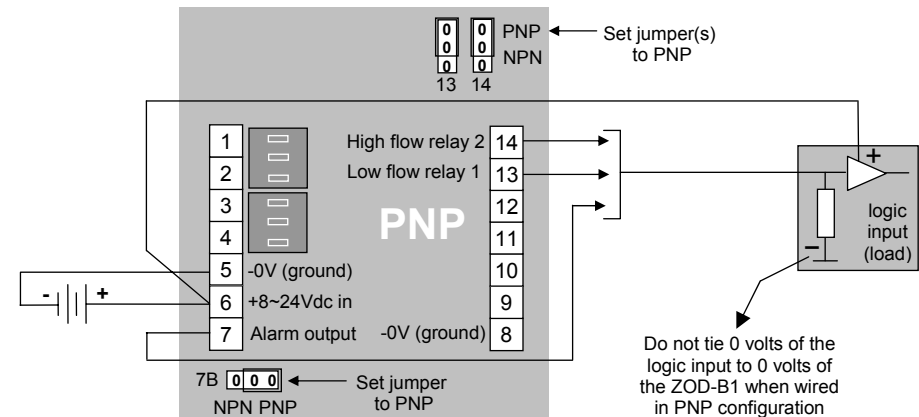
8.   CONTROLLER NETWORKING

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).

Multi point batching
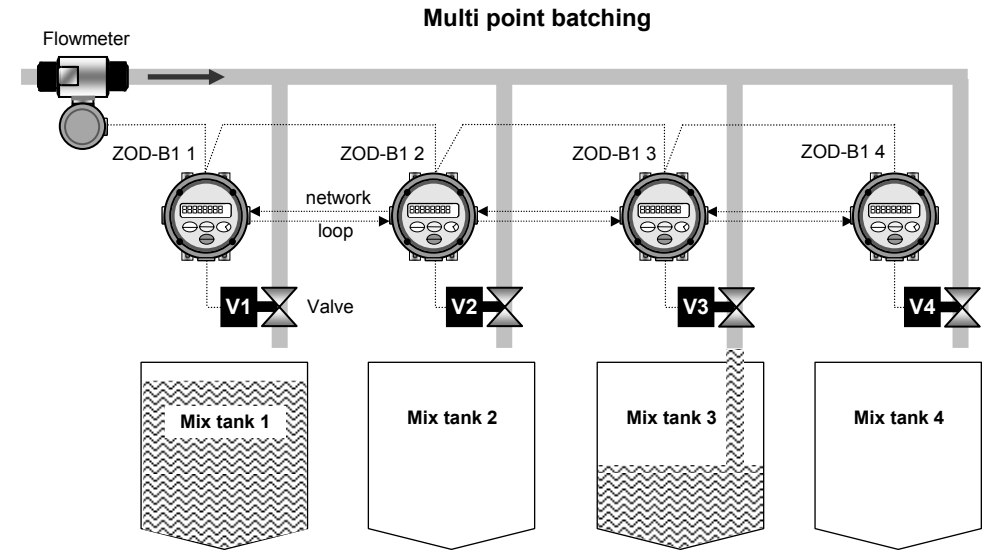
Network loop wiring

Multi product batching
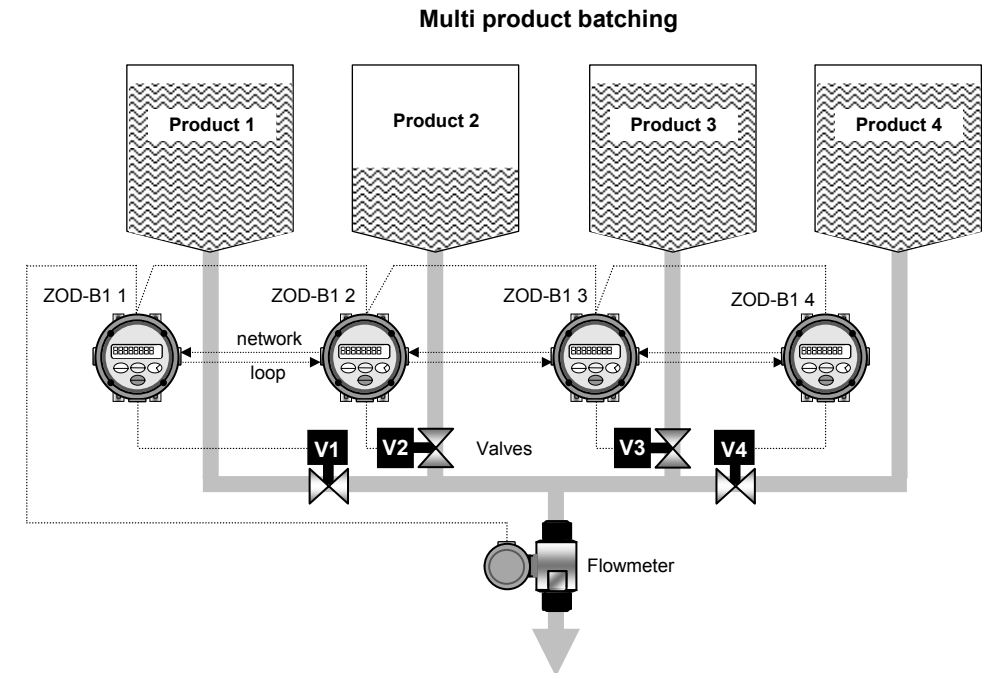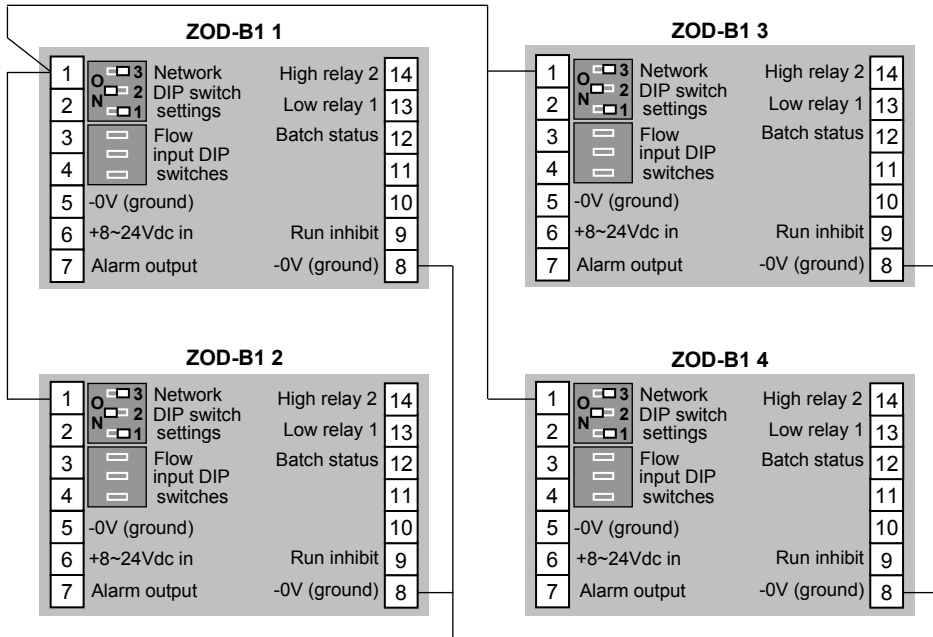
9.   REFERENCE INFORMATION

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

Universal Mount Series

ZOD-Z1 BATTERY TOTALISER

I N S T R U C T I O N   M A N U A L

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

↓

bt 11.
1.6
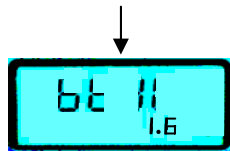
Replacement Batteries:

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

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.

2. OPERATION

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.

2.1 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.*
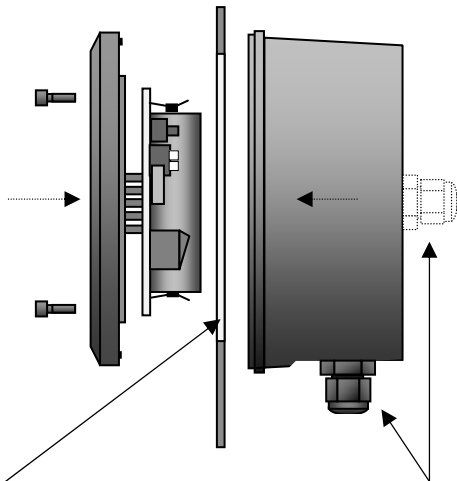
3.   INSTALLATION
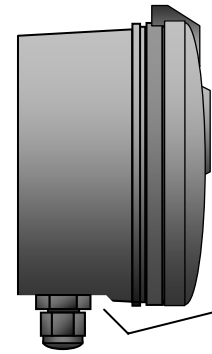
3.1   Mounting

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 <u>carefully</u> drill a 12.5mm (½") hole at bottom or rear of housing as shown on housing footprint detail on page **7**

Surface mount footprint   42.6mm   (1.67 ")

Use only the 4 special length self tapping screws supplied

If using the cable gland supplied <u>carefully</u> drill a 12.5mm (½") hole at the underside or from the inside rear of housing

Cable diameter range is 2.9~6.4mm (⅛~¼")
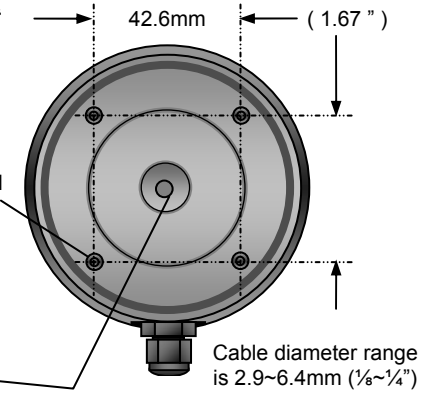
Wall - surface mount using optional bracket kit (P/No. AWM)

80 mm (3.15 ")   18 mm (0.7 ")

42.6 mm (1.7 ")
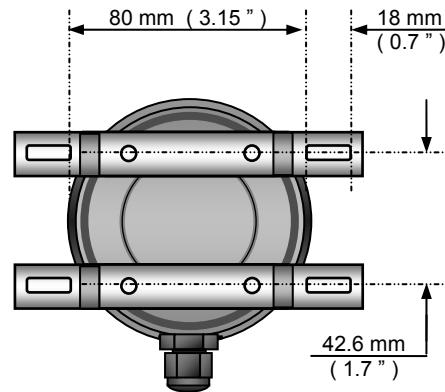
Pipe mounting (P/No. APM)

APM adaptor pipe mount kit is suitable for vertical or horizontal pipes
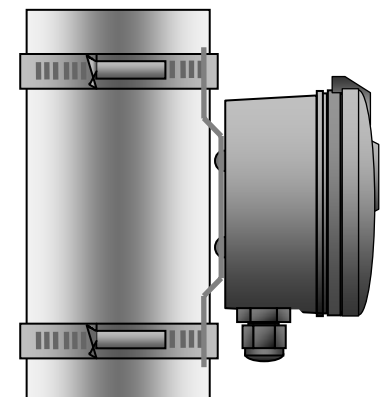
3.2 Flowmeter connections   (un-powered sensors)

3.2 Flowmeter connections   (powered sensors)

Reed switch input

ON
1 2 3
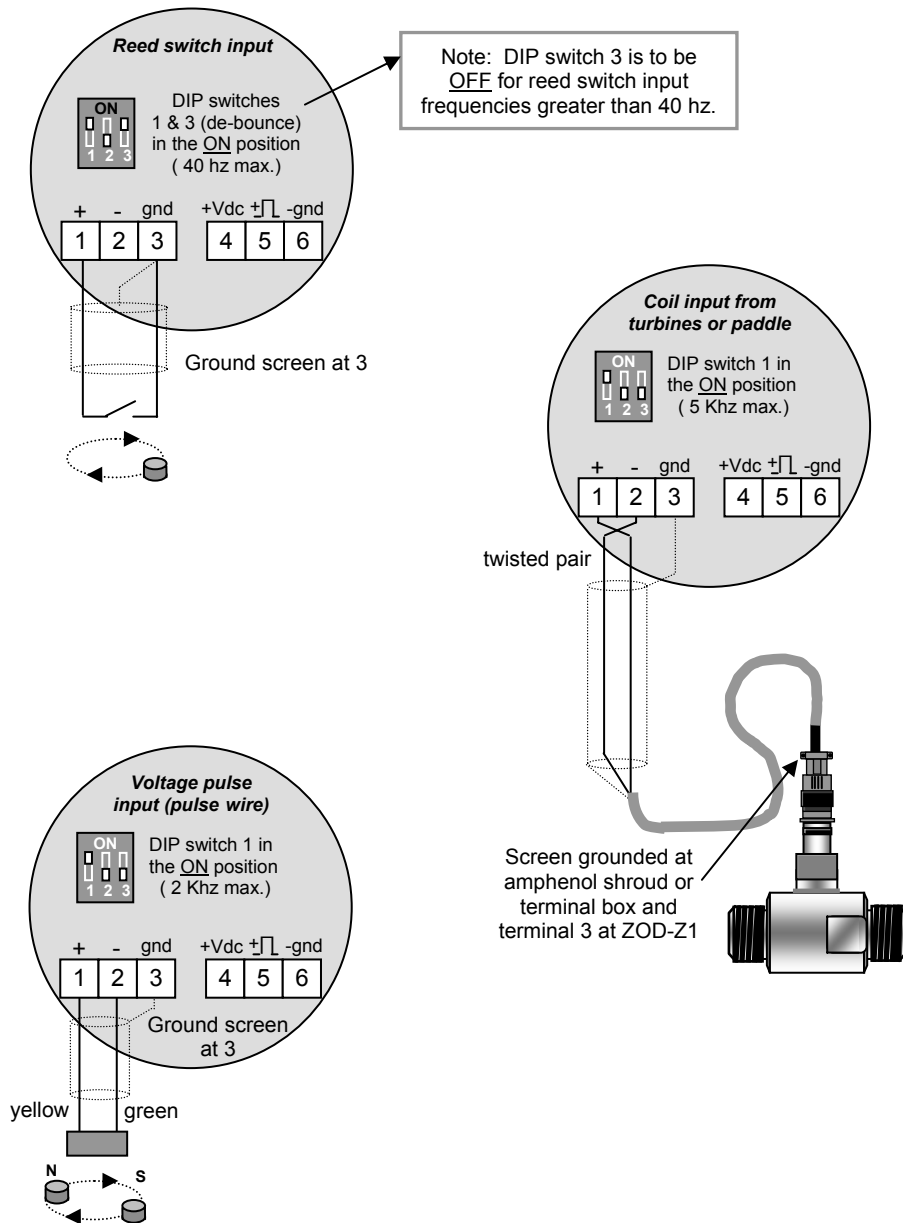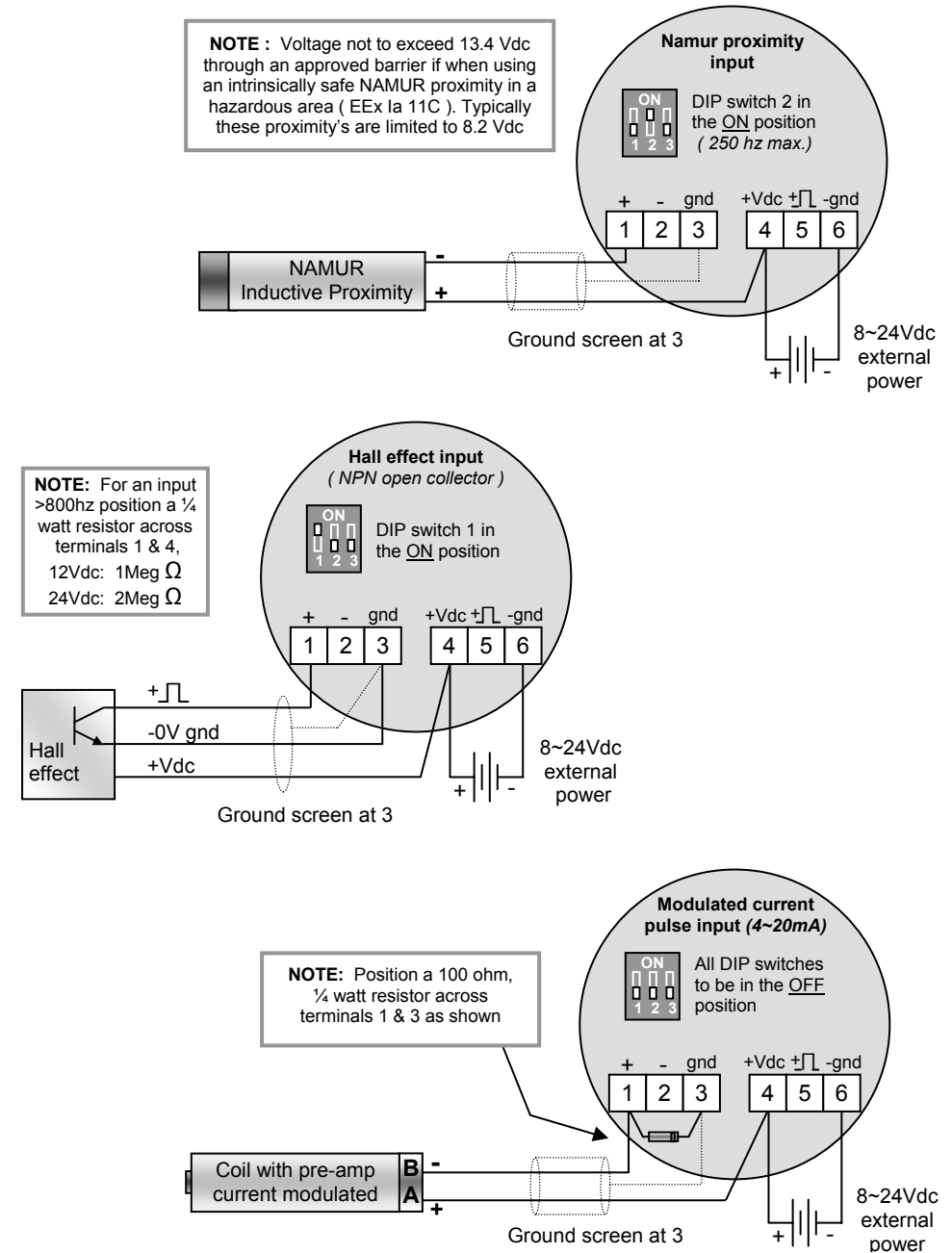
DIP switches 1 & 3 (de-bounce) in the <u>ON</u> position (40 hz max.)

Note: DIP switch 3 is to be <u>OFF</u> for reed switch input frequencies greater than 40 hz.

+   -   gnd   +Vdc ±⊓ -gnd
| 1 | 2 | 3 | | 4 | 5 | 6 |

Ground screen at 3

Coil input from turbines or paddle

ON
1 2 3

DIP switch 1 in the <u>ON</u> position (5 Khz max.)

+   -   gnd   +Vdc ±⊓ -gnd
| 1 | 2 | 3 | | 4 | 5 | 6 |

twisted pair

Screen grounded at amphenol shroud or terminal box and terminal 3 at ZOD-Z1

Voltage pulse input (pulse wire)

ON
1 2 3

DIP switch 1 in the <u>ON</u> position (2 Khz max.)

+   -   gnd   +Vdc ±⊓ -gnd
| 1 | 2 | 3 | | 4 | 5 | 6 |

Ground screen at 3

yellow   green

N   S

NOTE : Voltage not to exceed 13.4 Vdc through an approved barrier if when using an intrinsically safe NAMUR proximity in a hazardous area (EEx la 11C). Typically these proximity's are limited to 8.2 Vdc

Namur proximity input

ON
1 2 3

DIP switch 2 in the <u>ON</u> position *(250 hz max.)*

+   -   gnd   +Vdc ±⊓ -gnd
| 1 | 2 | 3 | | 4 | 5 | 6 |

NAMUR Inductive Proximity   -   +

Ground screen at 3

8~24Vdc external power
+ -

NOTE: For an input >800hz position a ¼ watt resistor across terminals 1 & 4, 12Vdc: 1Meg Ω 24Vdc: 2Meg Ω

Hall effect input *(NPN open collector)*

ON
1 2 3

DIP switch 1 in the <u>ON</u> position

+   -   gnd   +Vdc ±⊓ -gnd
| 1 | 2 | 3 | | 4 | 5 | 6 |

+⊓
-0V gnd
+Vdc

Hall effect

8~24Vdc external power
+ -

Ground screen at 3

NOTE: Position a 100 ohm, ¼ watt resistor across terminals 1 & 3 as shown

Modulated current pulse input *(4~20mA)*

ON
1 2 3

All DIP switches to be in the <u>OFF</u> position

+   -   gnd   +Vdc ±⊓ -gnd
| 1 | 2 | 3 | | 4 | 5 | 6 |

Coil with pre-amp current modulated   B -   A +

8~24Vdc external power
+ -

Ground screen at 3
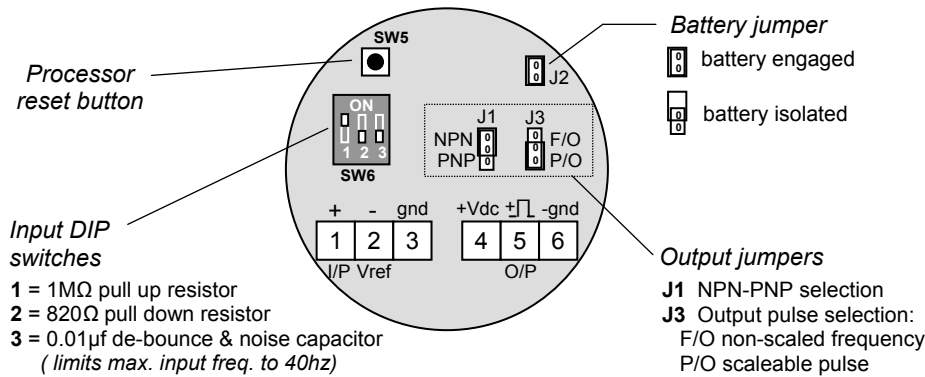
3.3   Wiring connections

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

Processor reset button

Battery jumper
 battery engaged

 battery isolated

Input DIP switches

1 = 1MΩ pull up resistor
2 = 820Ω pull down resistor
3 = 0.01µf de-bounce & noise capacitor
    (limits max. input freq. to 40hz)

Output jumpers

J1 NPN-PNP selection
J3 Output pulse selection:
   F/O non-scaled frequency
   P/O scaleable pulse

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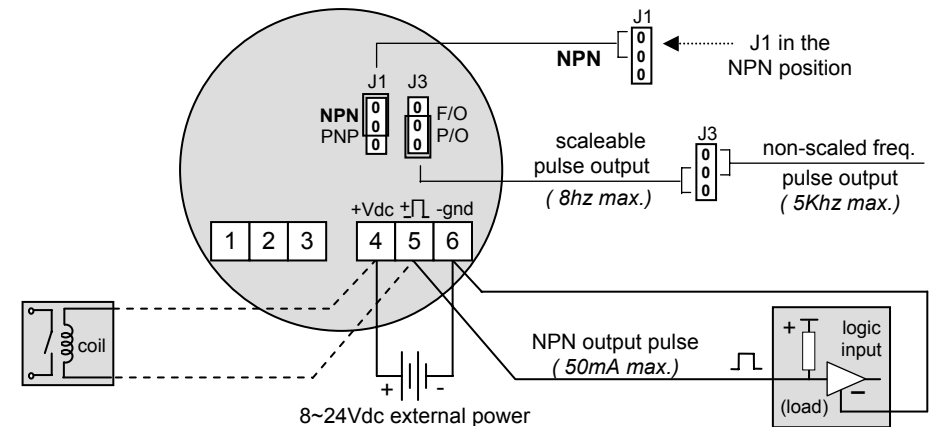
Current Sourcing outputs (PNP)
Current sourcing gets its name from the fact that it "sources current to a load". The current flows from the output *(terminal 5)* into the load. When wired as below the output voltage pulse is the supply voltage of the load. The load would normally have an internal pull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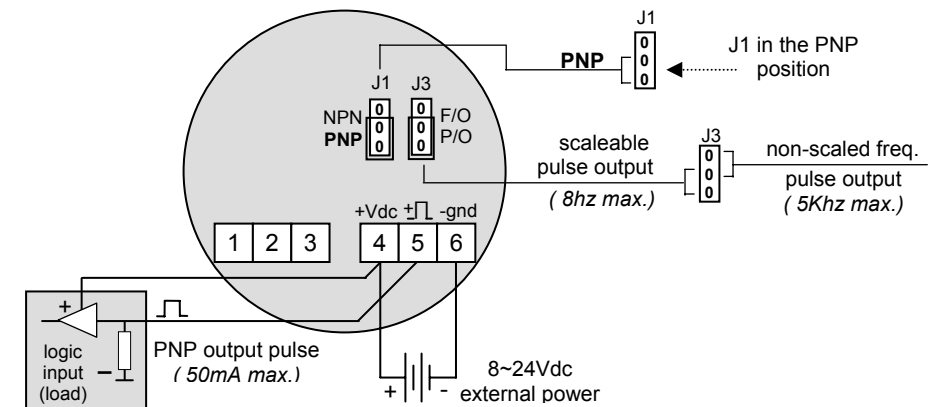
4.   PROGRAM PARAMETERS

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

Important: record program details overleaf ⟶
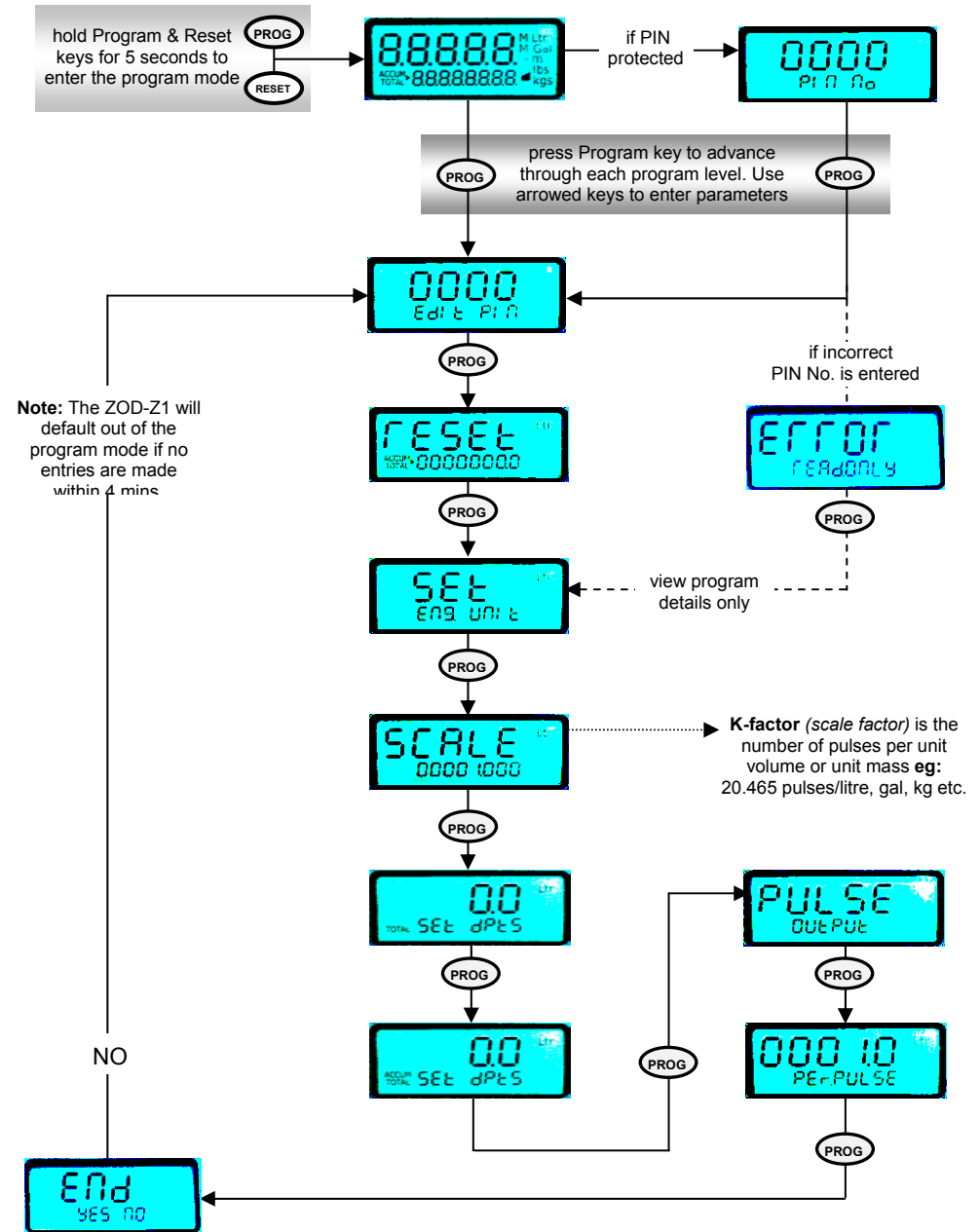
5.1   Program detail record

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
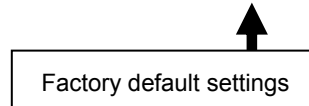
6.   TROUBLESHOOTING

 # 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.
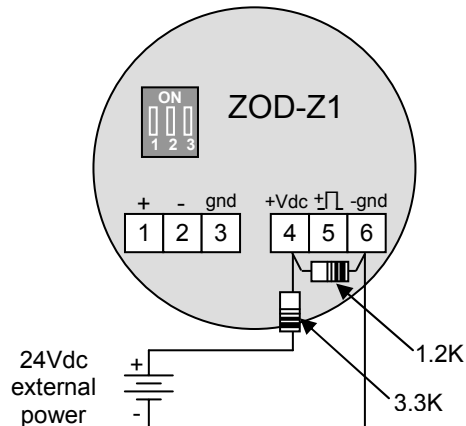
 # Display shows model number at all times.

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).*

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   M. Wenzel
General Manager   Proxy Holder

8.   ALPHABETICAL INDEX

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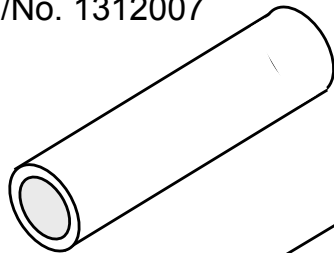
I.S. battery
Kobold P/No. 1412028
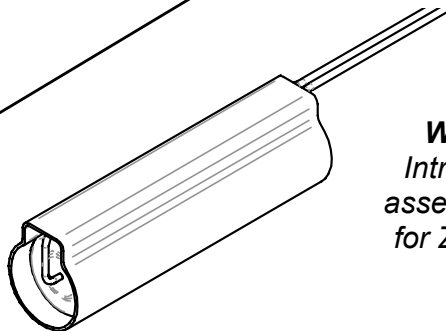
Warning : KOBOLD
Intrinsically safe battery
assembly only is approved
for ZOD-Z3 mounted in a
hazardous area.

Suitable non I.S. batteries also available from :

R S Components
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   Model number designation

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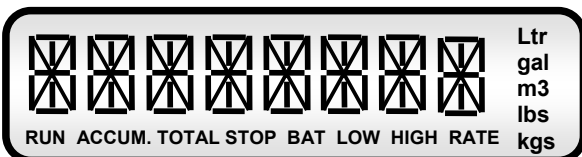
1.4 LCD displays

Full LCD display test feature illuminates all display segments and script text displays for 5 seconds when entering the program mode.
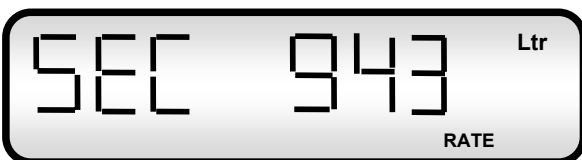
Rate display has flashing SEC, MIN, HR or DAY followed by up to 5 digits of rate programmable for up to 3 "floating" decimal places.
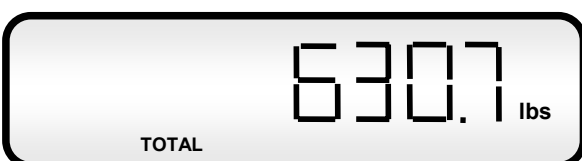
The 8 digit **Total** display is push button or remote resettable and can be programmed for up to 3 decimal places.

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.

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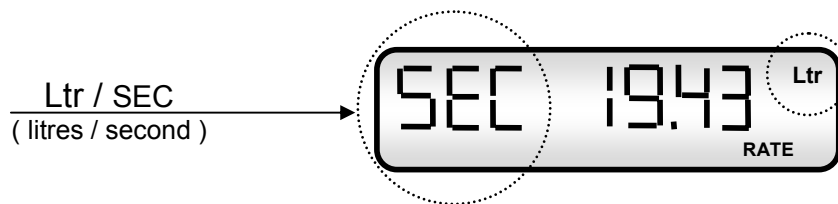
The minimum input frequency for rate display is 0.3hz reducing to 0.1hz If the low frequency cut-off is set to 0.1Hz *(see below) & 0.7Hz with NLC enabled.*

2.4 Low frequency cut-off

The low frequency cut-off is most commonly set to 0.0Hz *(disabled)* other than to:
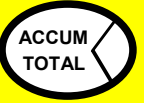
1) To display rate for input frequencies below 0.3hz, for example setting the cut-off at 0.1Hz the rate will continue to display for input frequencies as low as 0.1Hz *(one pulse every 10 seconds)*, such conditions often apply to flowmeters with low resolution pulse outputs (low frequency) or flowmeters 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

Surface mount footprint
(use 4 screws supplied)

42.6 mm
(1.67 ")

Wall mount using optional bracket set (ERS-ZOD-1522001)

96 mm (3.8 ")

18 mm
(0.7 ")

3.1 Remote Mounting *(continued)*

* Vertical pipe mount

RATE TOTALISER

gal

RUN ACCUM. TOTAL STOP BAT LOW HIGH

RESET ▶

PROGRAM / ENTER

ACCUM / TOTAL ◥

RATE / TOTAL

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

* Horizontal pipe mount

Panel mount

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

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)

Flow input A & B switch functions

Flow Input B

Flow Input A

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

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

Switch 2 : ON engages 1 meg Ω pull up resister

Switch 3 : ON engages 820Ω pull down resister

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

DIP switch 1 & 2 are <u>on</u>

Ground screen at -0V (5)

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	-0V (ground)		not used	10
6	+8~24Vdc in		not used	9
7	Pulse output		-0V (ground)	8

2. Voltage Pulse *(& pulse wires)*

All DIP swithes <u>off</u>

1.1 ~ 30 Vdc

Ground screen at -0V (5)

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	-0V (ground)		not used	10
6	+8~24Vdc in		not used	9
7	Pulse output		-0V (ground)	8

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

All DIP switches <u>off</u> (position switch 1 <u>ON</u> if unit is effected by line noise)

use twisted pairs

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	-0V (ground)		not used	10
6	+8~24Vdc in		not used	9
7	Pulse output		-0V (ground)	8

3.2 *Flowmeter connections* - powered sensors
(for I.S. installations refer to I.S. supplement)

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

DIP SW2 (pull up) is <u>on</u>

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

+ Signal out
- 0V ground
Vdc supply
Hall effect
Ground screen at terminal 5
Reg. Vdc

5. Namur *(inductive proximity switch)*

DIP SW3 (pull down) is <u>on</u>

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

NAMUR
Inductive Proximity

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

Ground screen at terminal 5
Reg. Vdc

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

DIP switches <u>off</u>

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

NOTE : Position a 100Ω, ¼W
Resistor across terminals 3 & 5

Coil with pre-amp
current modulated

B
A

Ground screen at terminal 5
Reg.Vdc

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.

8~24Vdc
regulated supply

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	-0V (ground)	not used	10
6	+8~24Vdc in	not used	9
7	Pulse output	-0V (ground)	8
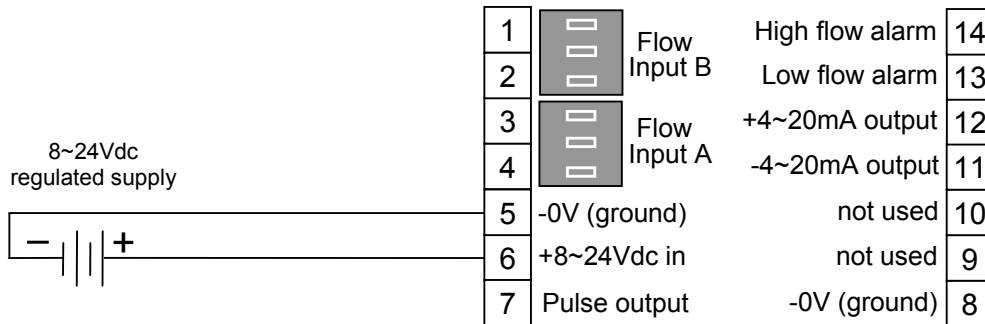
CAUTION :
Avoid using low cost
digital switch mode
power packs

Powering via 4~20mA loop
(Negative referenced)

Hall effect
+ Signal out
- Negative
Vdc supply

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

regulated 12~28 Vdc

Load

- - - - - - - - **Optional wiring**
Shows powering of a Hall Effect
device using the loop power
source if required.
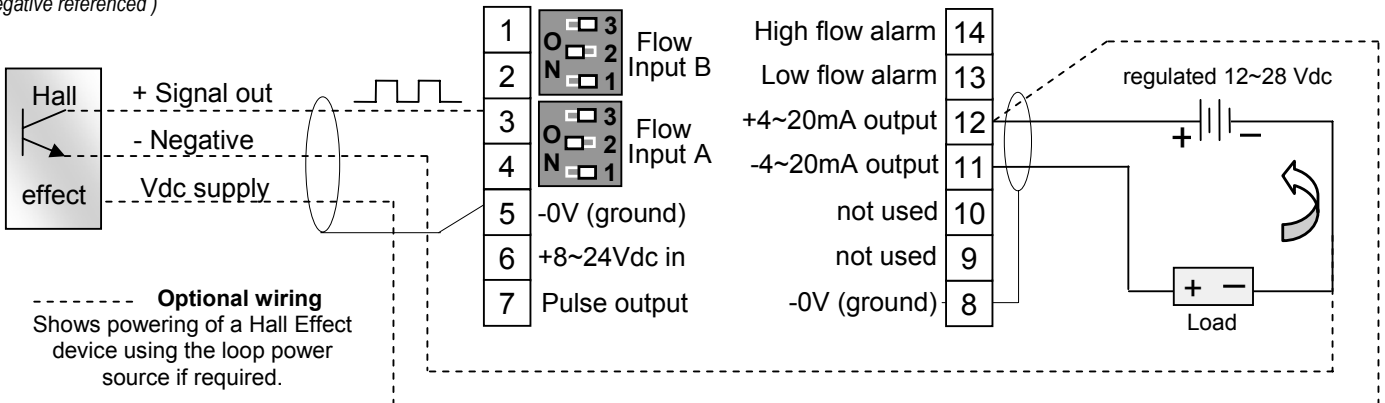
Loop load specification : **R = (V – 10) / 0.02**
where : **V** = loop voltage, **R** = max. load **Ω**

Powering via 4~20mA loop
(Positive referenced)

- - - - - - - - **Optional wiring**
When wired in this manner the one loop
power supply *(limited to 24Vdc)* may be
used to also power active flow sensors,
scaled pulse & alarm outputs at terminals
7, 13 & 14 & / or multiple RT's if required.
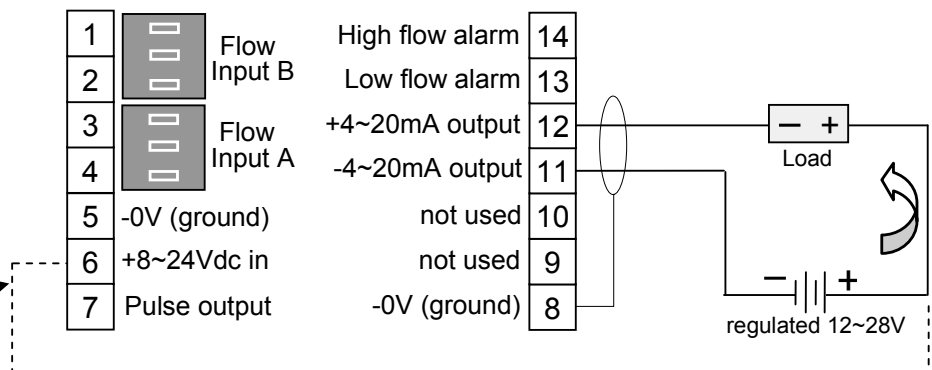
1	Flow Input B	High flow alarm	14
2		Low flow alarm	13
3	Flow Input A	+4~20mA output	12
4		-4~20mA output	11
5	-0V (ground)	not used	10
6	+8~24Vdc in	not used	9
7	Pulse output	-0V (ground)	8

Load

regulated 12~28V

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).
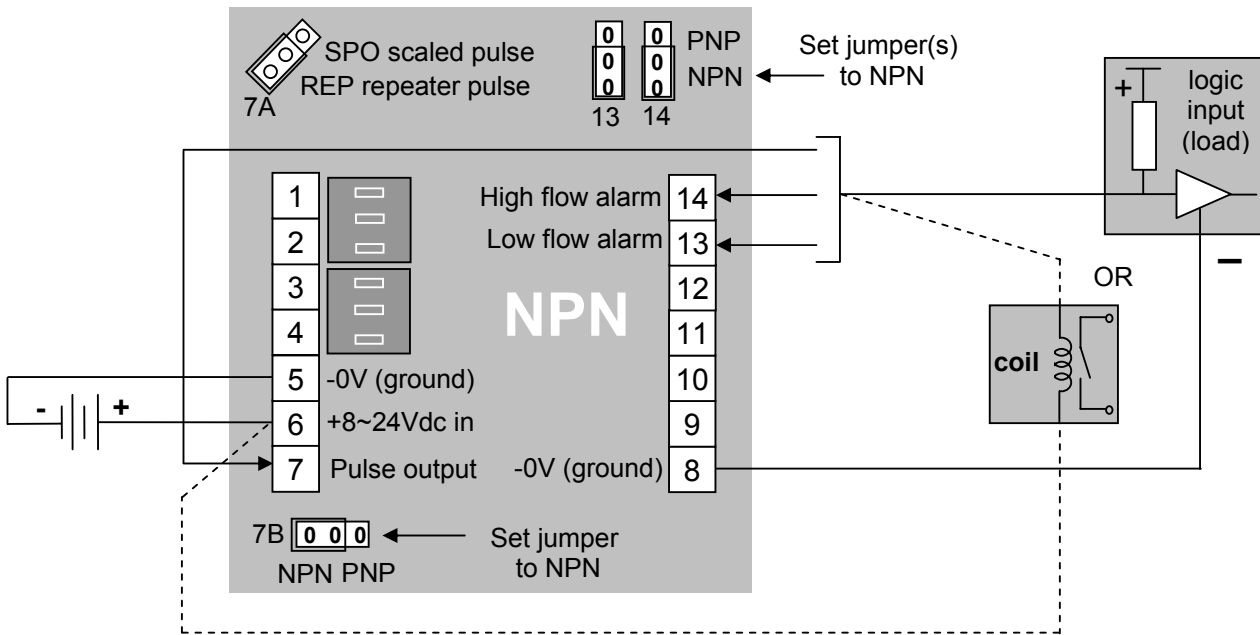
Current Sourcing outputs (PNP)

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.
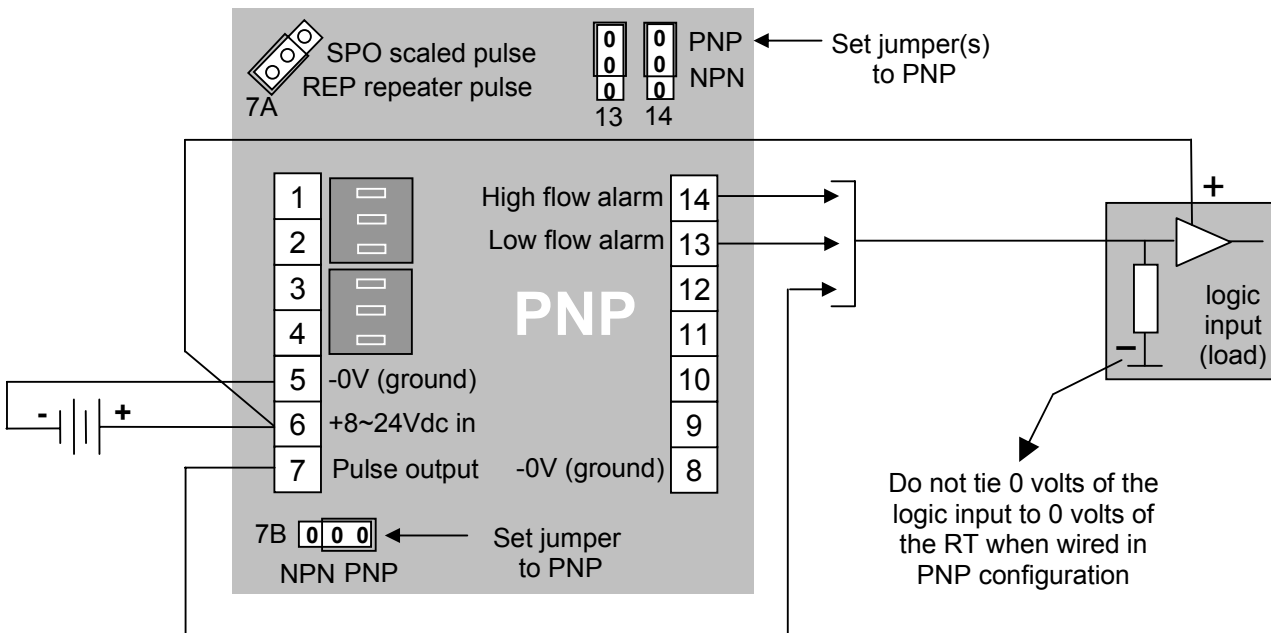
4.   PROGRAM PARAMETERS

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 <u>rate</u> display & <u>analog</u> 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)* <u>flow is always continually totalised.</u>

 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 <u>A+B</u>, <u>A-B</u> or <u>A÷B</u> *(ratio).*

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

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

          <u>A÷B</u> 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 1~7***

| ▶ | PROG | ▲ |

V3.2   HOLD 3 2 1

TESTING DISPLAY 88888888

PROGRAM MODE ENTERED

hold Program & Rate
keys for 5 secs to
enter the program

RATE

press Prog. key
to step through
program levels

PROG

if PIN protected

ENTER PIN

PIN * * * *

if incorrect
PIN No. is entered

L1   *CHANGE PIN No.   Y / N*

NU PIN   Y - N

YES   NO

PIN * * * *

INVALID PIN VIEW
EXISTING PROGRAM
DETAILS ONLY

L2   *RESET ACCUM TOTAL   Y / N*

RESET   Y - N

L3   *SET ENGINEERING UNITS*

ENG UNIT **Ltr gal m3 lbs kgs** *(none)*

L4   *ENTER NUMBER PULSES PER*
Ltr m3 kg gal lb *(unit of measure)*

0000000.001 ~ 9999999.999

K-factor *(scale factor)* is the number of
pulses per unit volume or unit mass
eg: 20.465 pulses / litre, gallon, kg etc.

L5   *SET DECIMAL POINTS*

DPt TOTAL	0 0.0 0.00 0.000
DPt ACCUM TOTAL	0 0.0 0.00 0.000
DPt RATE	0 0.0 0.00 0.000

R 0000.001 ~ 9999.999

WARNING on rate conversion factor (RCF)
This feature need only be programmed when
the total & rate engineering units are to be
different. **eg:** m3 for total and litres for rate

The conversion factor is the number needed
to convert to the required rate unit, some
examples are:

YES

L6   *RATE CONVERSION   Y / N*

RATECON   Y - N

NO

Total unit	Rate unit	Conversion factor
Cubic metres	Litres /	1000.000
US Barrels	USgal /	42.000
Imp. gallons	Litres /	4.546

L7   *SET TIME BASE FOR RATE*

Ltr gal etc / SEC MIN HR or DAY

continued ▶▶

NO

END
Y - N

program return

Saves & exits program ◀ YES

6.1   Program levels 8 ~ 13

L8	SET RATE DAMPENING
	DAMP 00 ~ 99 **RATE**

L9	SET LOW FREQUENCY CUT-OFF
	HERTZ 0.0 ~ 9.9

L10	OUTPUT PULSE REQUIRED Y / N
	PULSE Y - N

YES   NO

L11	ENTER No. OF _gal - litres_ etc PER OUTPUT PULSE
	OP XXXX . X

L12	NON LINEAR CORRECTION
	NLC Y - N

YES   NO

0F 0000.0 (set output freq. at point 0)
000000.000   (set K-factor at point 0)

1F 0000.0 (set output freq. at point 1)
000000.000   (set K-factor at point 1)

10 points from 0F up to 9F

9F 0000.0 (set output freq. at point 9)
000000.000   (set K-factor at point 9)

L13	CHANGE POWER MODE Y / N
	CHANGE Y - N (applicable under battery only)

YES   NO

1) ULTRA POWER SAVE 2) STANDBY 3) CONTINUOUS   (refer clause 4.10)

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)
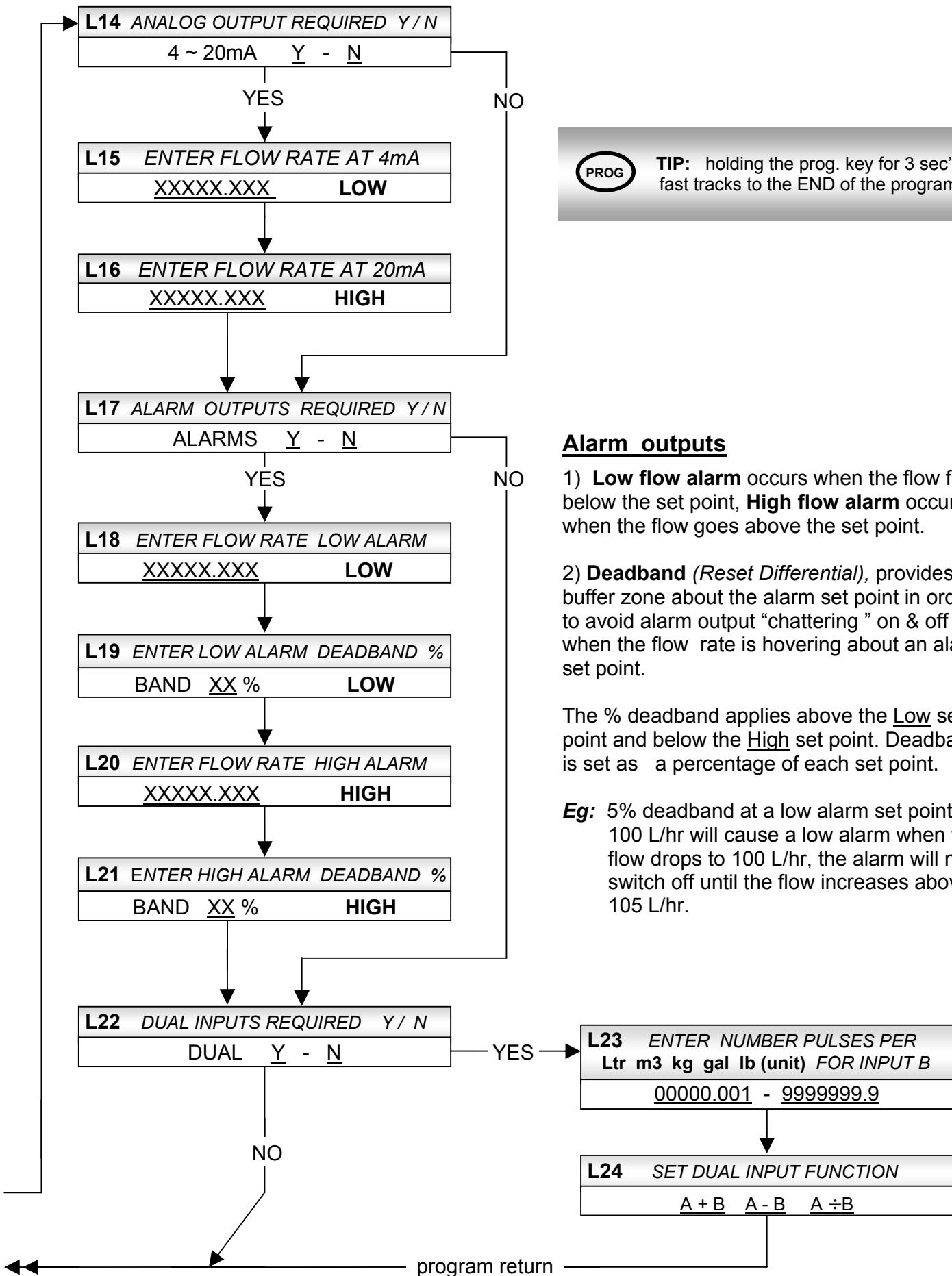
(overrides K-factor set at L4)

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.

continued ➤➤

program return

6.2 Program levels 14~24

L14 *ANALOG OUTPUT REQUIRED Y / N*

4 ~ 20mA   <u>Y</u> - <u>N</u>

YES   NO

L15   *ENTER FLOW RATE AT 4mA*

<u>XXXXX.XXX</u>   **LOW**

L16   *ENTER FLOW RATE AT 20mA*

<u>XXXXX.XXX</u>   **HIGH**

L17 *ALARM OUTPUTS REQUIRED Y / N*

ALARMS   <u>Y</u> - <u>N</u>

YES   NO

L18   *ENTER FLOW RATE LOW ALARM*

<u>XXXXX.XXX</u>   **LOW**

L19   *ENTER LOW ALARM DEADBAND %*

BAND   <u>XX</u> %   **LOW**

L20   *ENTER FLOW RATE HIGH ALARM*

<u>XXXXX.XXX</u>   **HIGH**

L21 E*NTER HIGH ALARM DEADBAND %*

BAND   <u>XX</u> %   **HIGH**

L22   *DUAL INPUTS REQUIRED   Y / N*

DUAL   <u>Y</u> - <u>N</u>   YES

NO

program return

L23   *ENTER NUMBER PULSES PER*
Ltr m3 kg gal lb (unit) *FOR INPUT B*

<u>00000.001</u> - <u>9999999.9</u>

L24   *SET DUAL INPUT FUNCTION*

<u>A + B</u>   <u>A - B</u>   <u>A ÷B</u>

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 <u>Low</u> set point and below the <u>High</u> set point. Deadband is set as   a percentage of each set point.
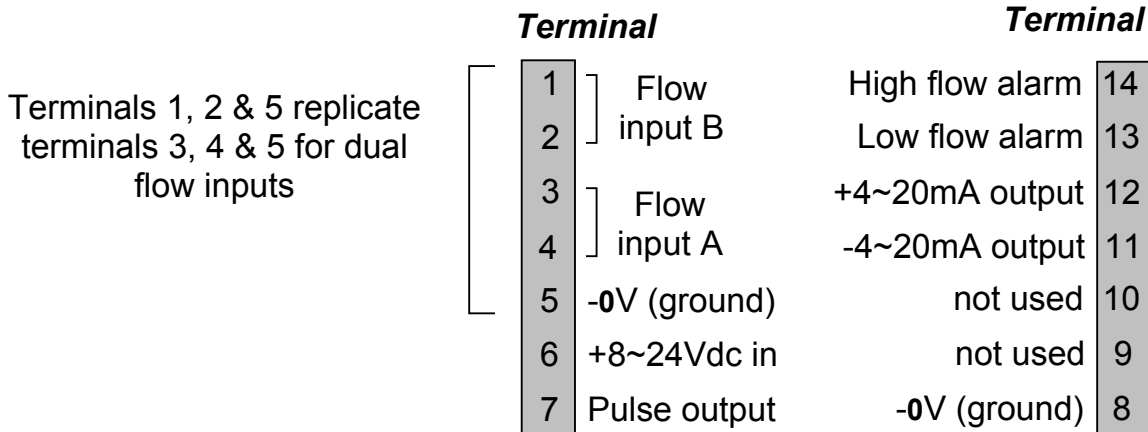
Eg: 5% deadband at a low alarm set point of 100 L/hr will cause a low alarm when the flow drops to 100 L/hr, the alarm will not switch off until the flow increases above 105 L/hr.
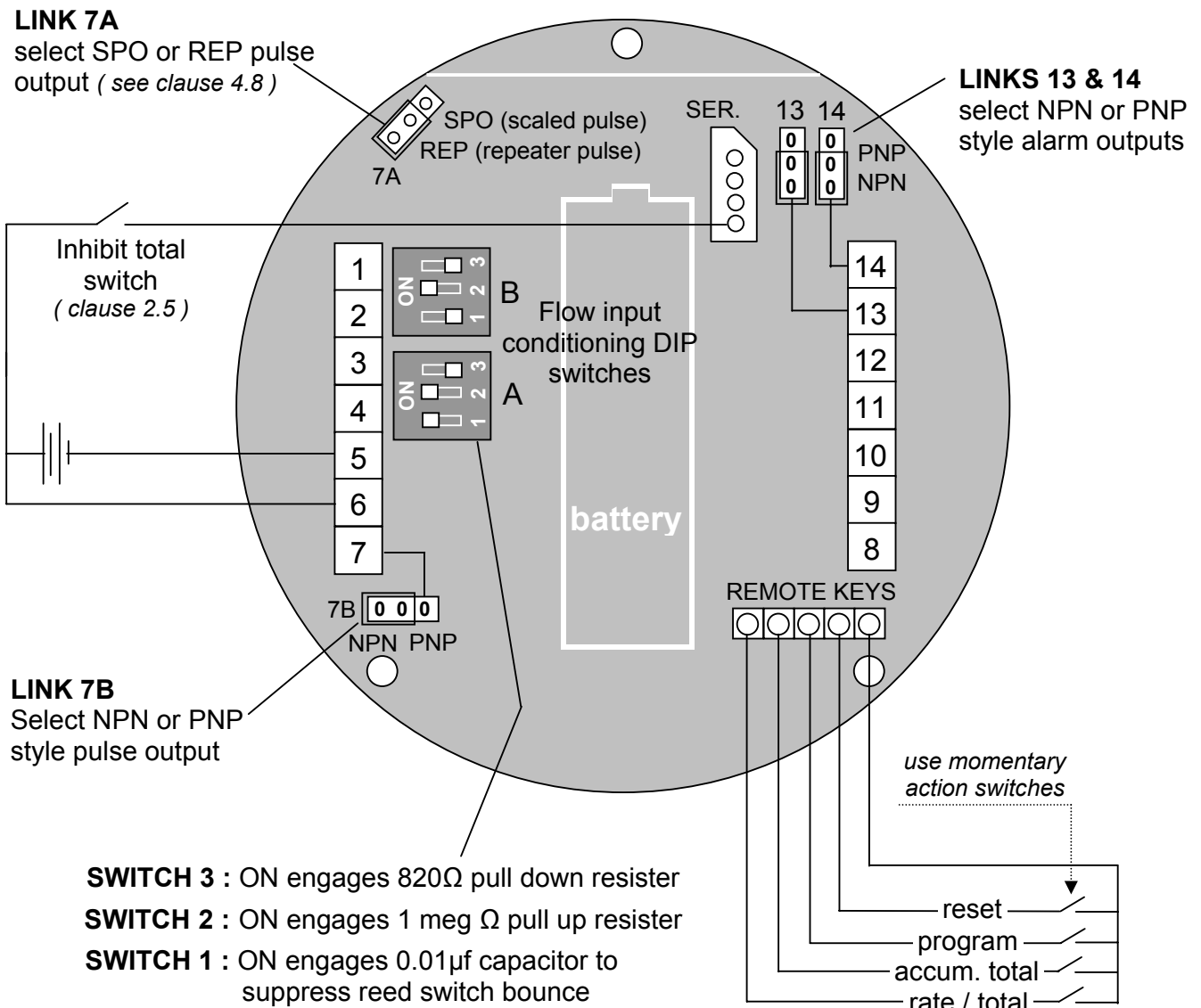
6.4   *Program detail record*   *Pencil your program details here*
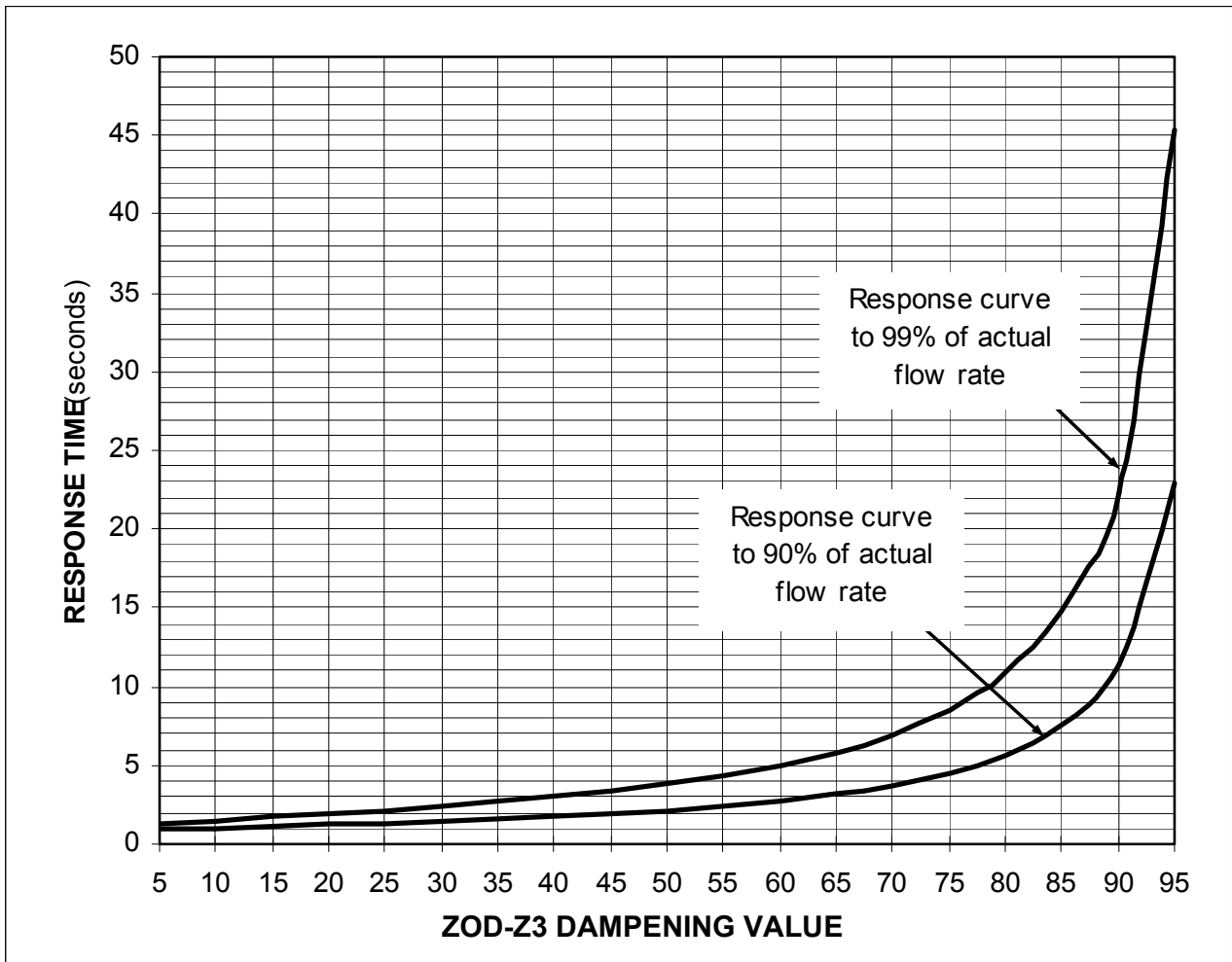
L1	User selected PIN No.				
L3	Engineering units				
L4	K-factor *(scale factor)*	K =			
L5	Decimal for reset Total	☐ 0	☐ 0.0	☐ 0.00	☐ 0.000
	Decimal for Accum. total	☐ 0	☐ 0.0	☐ 0.00	☐ 0.000
	Decimal for Rate	☐ 0	☐ 0.0	☐ 0.00	☐ 0.000
L6	Rate conversion factor	☐ yes ☐ no	RCF=		
L7	Time base for Rate	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

1	Flow input B
2	
3	Flow input A
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

Terminal

High flow alarm	14
Low flow alarm	13
+4~20mA output	12
-4~20mA output	11
not used	10
not used	9
-0V (ground)	8

Terminal layout - links & remote switch inputs

LINK 7A
select SPO or REP pulse output *(see clause 4.8)*

SPO (scaled pulse)
REP (repeater pulse)
7A

SER.

LINKS 13 & 14
select NPN or PNP style alarm outputs

13 14
PNP
NPN

Inhibit total switch
(clause 2.5)

B

A

Flow input conditioning DIP switches

battery

LINK 7B
Select NPN or PNP style pulse output

7B   NPN PNP

REMOTE KEYS

use momentary action switches

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

reset
program
accum. total
rate / total

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	M. Wenzel
General Manager	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
E-Mail: info.de@kobold.com
Internet: www.kobold.com

Version: K02/1010

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   M. Wenzel
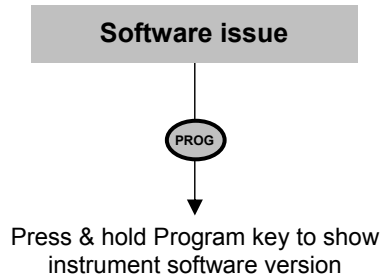General Manager   Proxy Holder

---

Universal Mount Series

Z5 FLOW RATE TOTALISER
with backlighting & flow alarms
I N S T R U C T I O N   M A N U A L

Software issue

PROG

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.
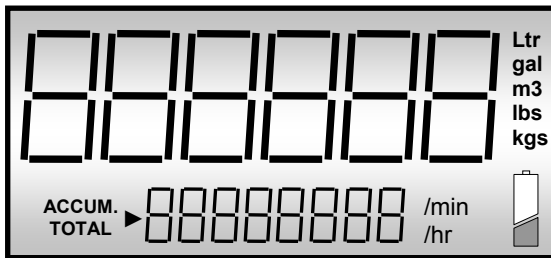
Features

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.

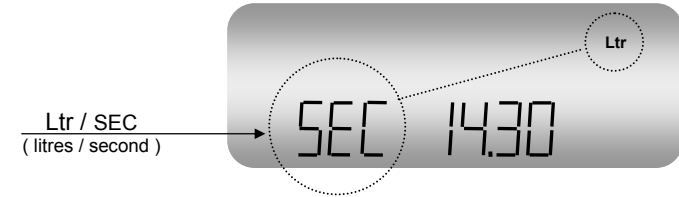## 2.   OPERATION

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.

Ltr / SEC
(litres / second)   SEC   14.30

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

42.6 mm
(1.67 ")
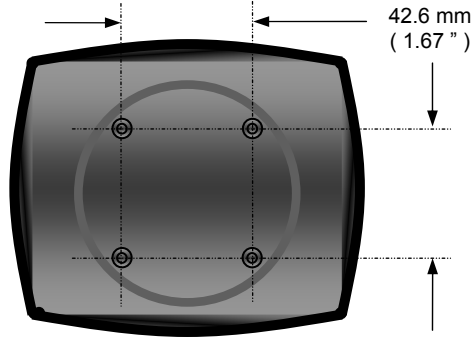
Wall mount bracket
Optional, P/No. AWM)

6.5 x 19mm
slots

RATE TOTALISER

Ltr
gal
m3
lbs
kgs

ACCUM.
TOTAL ▶   /min
              /hr

RATE   PROGRAM   ACCUM.
        ENTER   TOTAL

RESET   ce

42.6 mm
(1.67 ")

96 mm (3.8 ")

Panel mount options

Cut a 71mm x 83mm
(2.8 x 3.3 ") opening in panel.

Drill 4 holes to take
M4 screws on a
68.0 x 89.6mm pitch
(2.68" x 3.53")

See panel mount template page 18

Mount using 4 x M4 nuts
& washers, tap panel or
use rear case as shown

3 x M16 conduit entries
@ 30mm pitch
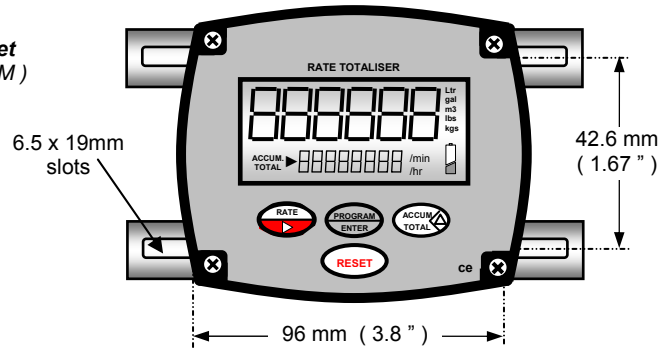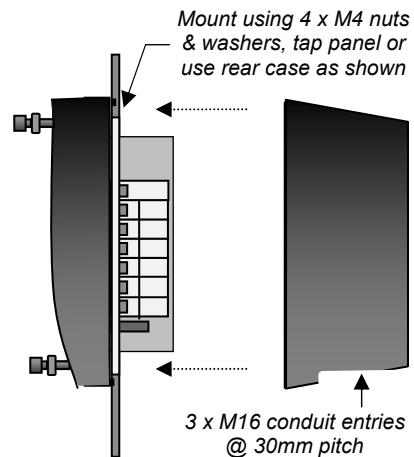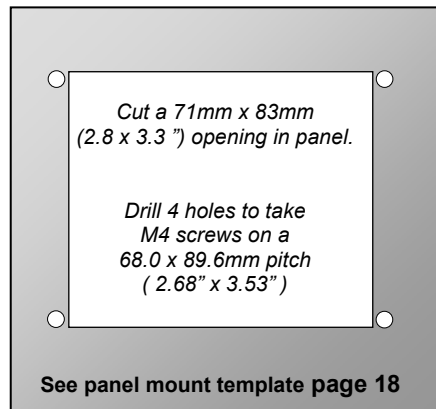
3.1 Remote Mounting (continued)

* Pipe mount

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

RATE TOTALISER

Ltr
gal
m3
lbs
kgs

ACCUM.
TOTAL ▶   /min
              /hr

RATE   PROGRAM   ACCUM.
        ENTER   TOTAL

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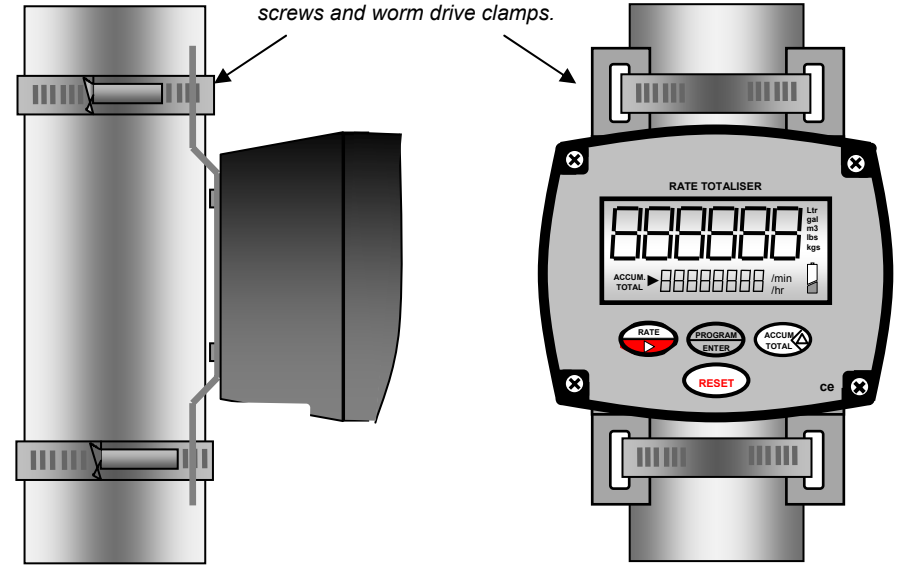
Optional facia protector, 3mm clear
polycarbonate plate with access port
for keys. Order P/No. 1306061.

*** Horizontal
pipe mount**
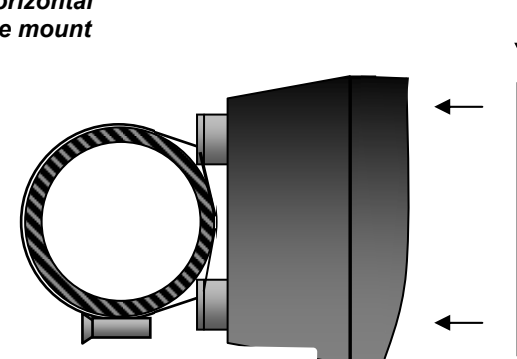
*3.2 **Flowmeter connections** -* unpowered sensors

DIP switch functions :

Flow Input — **3** | **Switch 3 :** ON engages 820Ω pull down resister
ON — **2** | **Switch 2 :** ON engages 1 meg Ω pull up resister
— **1** | **Switch 1 :** ON engages 0.01µf capacitor to suppress reed switch bounce

1. Reed switch

DIP switch 1 & 2 are on

Ground screen at -0V (5)

1	-0V (ground)
2	Remote reset
3	Flow Input (O N 3 2 1)
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

2. Voltage Pulse

1.1 ~ 30 Vdc

All DIP swithes off

Ground screen at -0V (5)

N → S

1	-0V (ground)
2	Remote reset
3	Flow Input
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

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

All DIP switches off (position switch 1 ON if unit is effected by line noise)

use twisted pairs

1	-0V (ground)
2	Remote reset
3	Flow Input
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

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

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

DIP SW2 (pull up) is on

Hall effect
+ Signal out
- 0V ground
Vdc supply

Ground screen at terminal 5

Reg. Vdc

1	-0V (ground)
2	Remote reset
3	Flow Input
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

5. Namur *(inductive proximity switch)*

DIP SW3 (pull down) is on

NAMUR Inductive Proximity

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

Ground screen at terminal 5

Reg. Vdc

1	-0V (ground)
2	Remote reset
3	Flow Input
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

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

DIP switches off

NOTE : Position a 100Ω, ¼W Resistor across terminals 3 & 5

Coil with pre-amp current modulated B A

Ground screen at terminal 5

Reg.Vdc

1	-0V (ground)
2	Remote reset
3	Flow Input
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

3.3 Wiring connections

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

CAUTION :
Avoid using low cost digital
switch mode power packs

8~24Vdc
regulated supply

1	-0V (ground)
2	Remote reset
3	Flow Input
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

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.
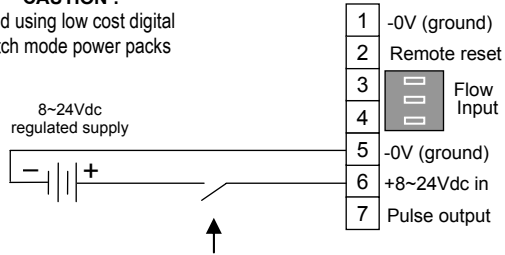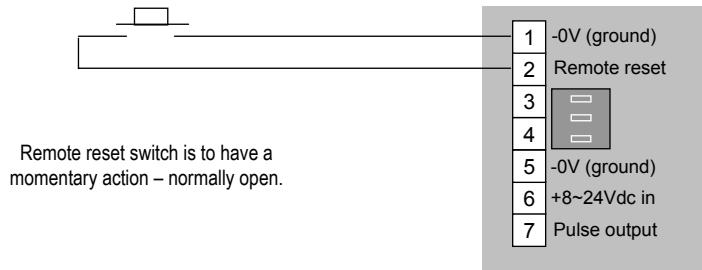
Remote reset switch

Remote reset switch is to have a momentary action – normally open.

1	-0V (ground)
2	Remote reset
3	
4	
5	-0V (ground)
6	+8~24Vdc in
7	Pulse output

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.
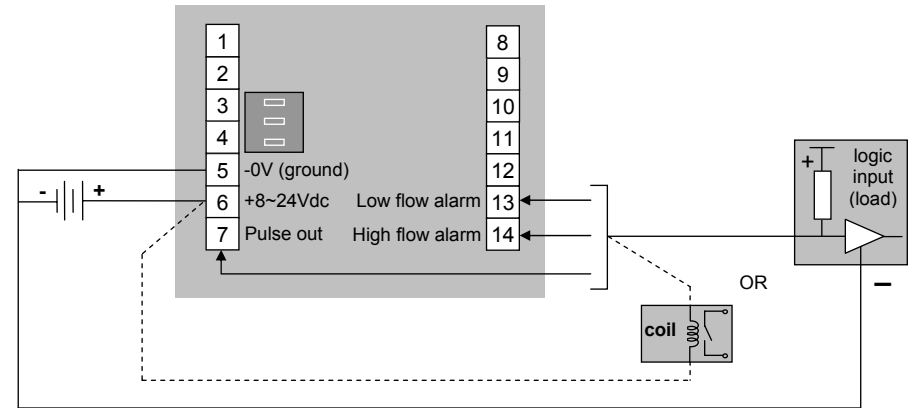
3.3 Wiring connections *(continued)*

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.

1		8	
2		9	
3		10	
4		11	
5	-0V (ground)	12	
6	+8~24Vdc	Low flow alarm	13
7	Pulse out	High flow alarm	14

logic input (load)

coil   OR

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 <u>rate</u> 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

ISSUE 1.0

HoLd
5 4 3 2 1

ProG
AccESSED

press Prog. key to step through program levels

PROG

if PIN protected

RATE ▶

PROGRAM ENTER

ACCUM TOTAL △

RESET

hold Program & Reset keys for 5 secs to access program mode

* * * *
Pin no.

* * * *
Nu Pin

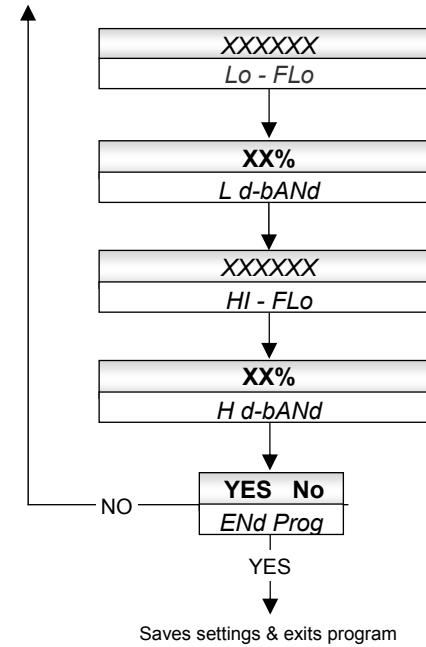if incorrect PIN No. is entered

rESEt
ACCUM TOTAL ▶ XXXXXXXX

Error
rEAdonLY

Ltr gal m3 lbs kgs (none)
Eng unit

Read only

S - FAct
00000.001 ~ 99999.999

S-factor *(K- factor)* is the number of pulses / unit volume or unit mass *eg:* 20.465 pulses / litre, gallon, kg etc.

0   0.0   0.00   0.000
dEc tot

0   0.0   0.00   0.000
dEc Accu

rAtE
PEr SEC, /min, /hr, dAy.

0   0.0   0.00   0.000
dEc rAtE

001 ~ 999
rESPonSE

Response to change in rate *(see rate dampening 4.6)*

0.0 ~ 50
cut oFF

Low frequency cut-off is generally set to 0.0Hz *(disabled)* for most applications other than those described at clause 2.4 .

PuLSE
Out **0001.0**

The scaleable pulse output is set as the number of litres, gallons etc per output pulse, see clause 4.8.

totAL   rAtE
toP diSP

Assign resettable total or rate to the large LCD top display
(see display priority 4.8)

Return to top of program

Continued over page

Return to top of program

XXXXXX
Lo - FLo

XX%
L d-bANd

XXXXXX
HI - FLo

XX%
H d-bANd

YES   No
ENd Prog

NO

YES

Saves settings & exits program

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.
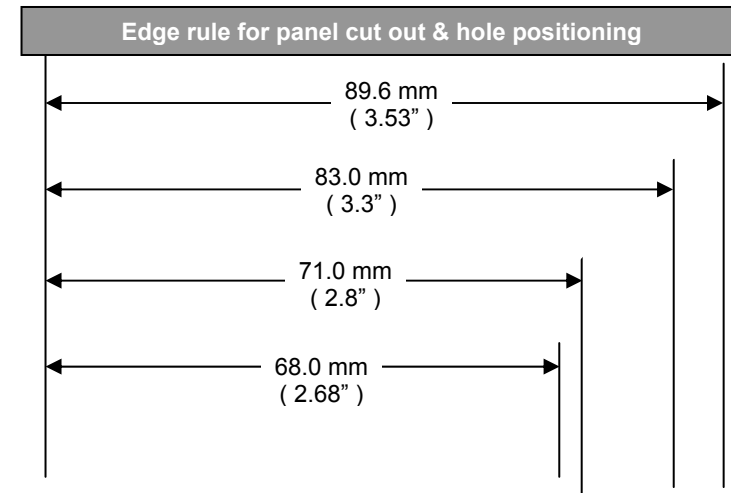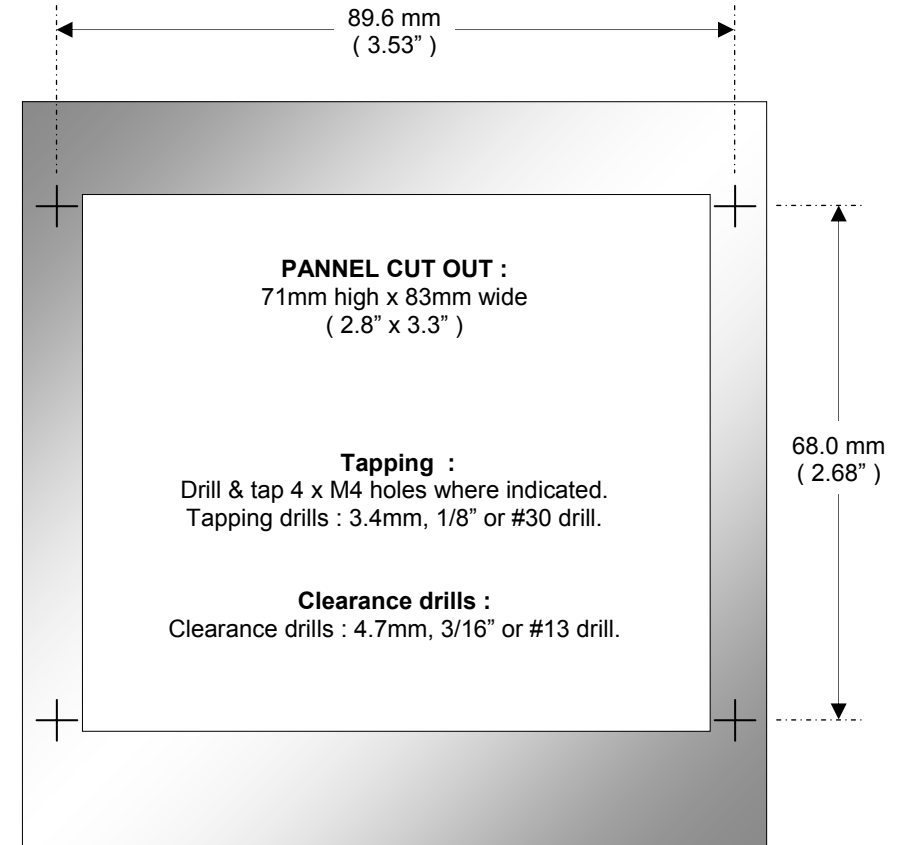
5.2   *Program detail record*

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

89.6 mm
(3.53”)

PANNEL CUT OUT :
71mm high x 83mm wide
(2.8” x 3.3”)

Tapping :
Drill & tap 4 x M4 holes where indicated.
Tapping drills : 3.4mm, 1/8” or #30 drill.

Clearance drills :
Clearance drills : 4.7mm, 3/16” or #13 drill.

68.0 mm
(2.68”)

Edge rule for panel cut out & hole positioning

89.6 mm
(3.53”)

83.0 mm
(3.3”)

71.0 mm
(2.8”)

68.0 mm
(2.68”)

8.   Instruction manual supplement
for
ELECTRONICS ZOD-Z3, ZOD-Z5 & ZOD-B1 WITH
OPTIONAL RELAY OUTPUT BOARD
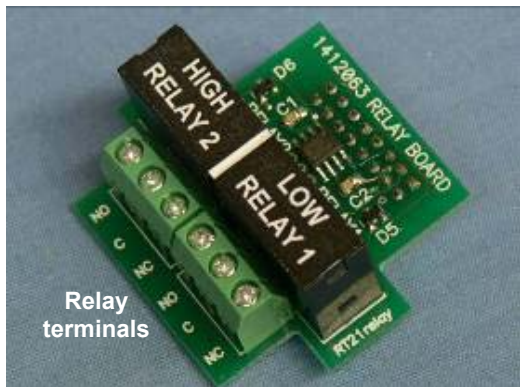
1. Overview
The Relay Control Output boards are an option for the flow rate totalisers and batch controller; they have two electro-mechanical SPCO relays instead of the solid state outputs of either instrument. The relays will switch higher loads (5 amps max.) to that of the solid state relays and provide 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.
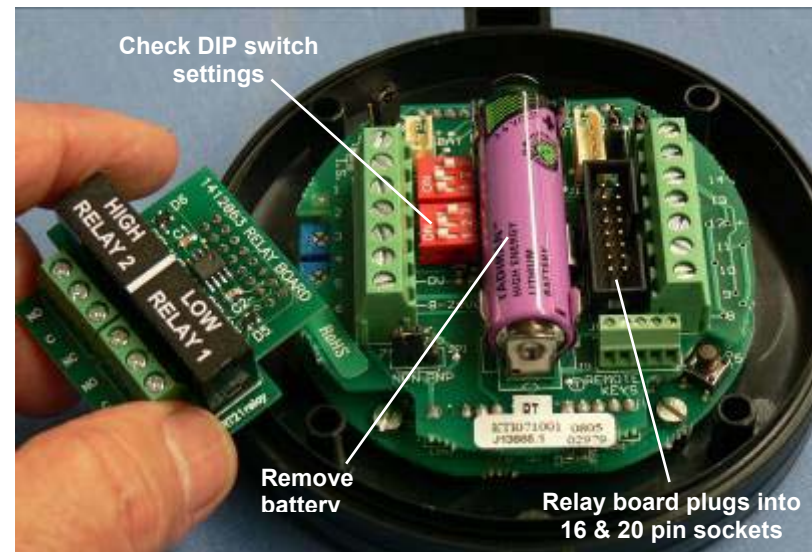
Relay control output board with two SPCO relays shown with a ZOD-Z3, N/O contacts are rated to 5A & the N/C contacts 3A max..
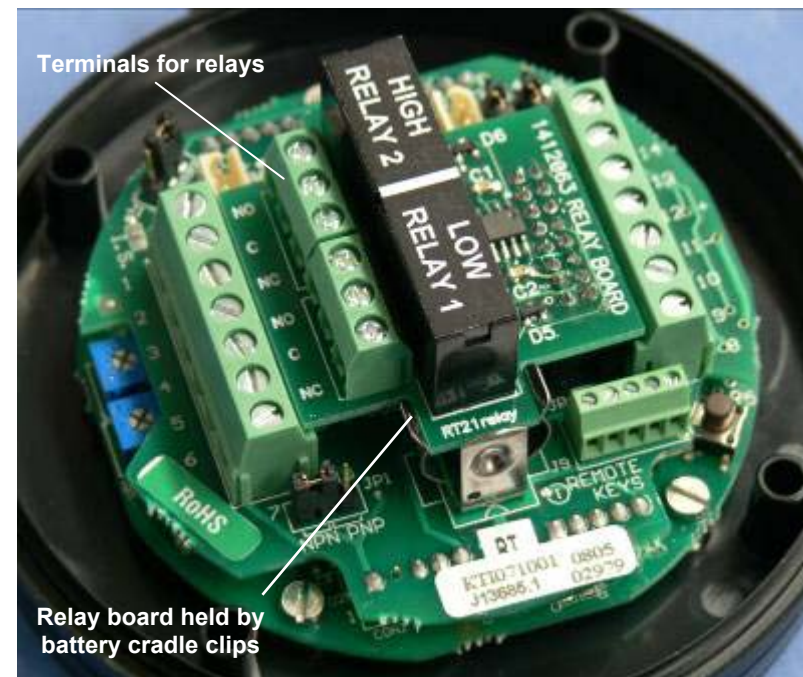
FI-420 Universal pulse processor board

Specifications

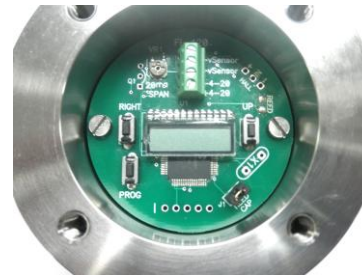|	
Programming	On board programming via three tactile push buttons.
Display	4 digit, seven segment LCD with 4 levels of contrast adjustment.
Input frequency *(Hall Effect & Coil)*	1.0 ~ 9999 Hz. *(frequencies below 1hz are not registered).*
(Reed Switch)	1.0 ~ 80.0 Hz. *(frequencies below 1hz are not 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.
Maximum loop powered voltage	28Vdc – absolute maximum *(reverse polarity protected).*
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 ³***(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.

LCD contrast has 4 settings (0~3) Press ▲ for best contrast.
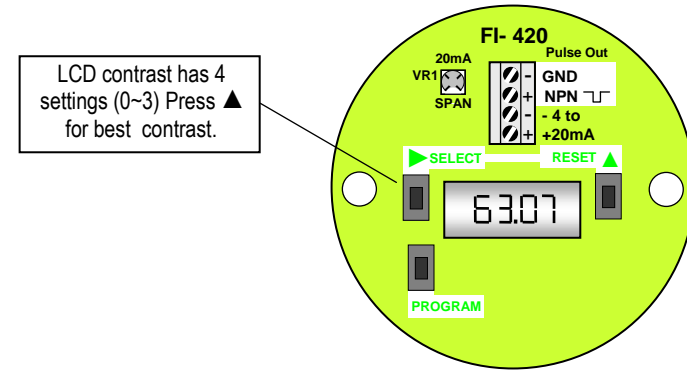
Touch key matrix	Function in run mode	Function in program mode
PROGRAM	Displays set function	Press & hold to enter program
► RIGHT	Adjusts LCD contrast	Selects digit to be set
▲ UP	Shows set point, divide factor or resets total	Changes value of selected digit

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.

NOTE : Include a 250Ω load resistor in circuit to protect output from overload.
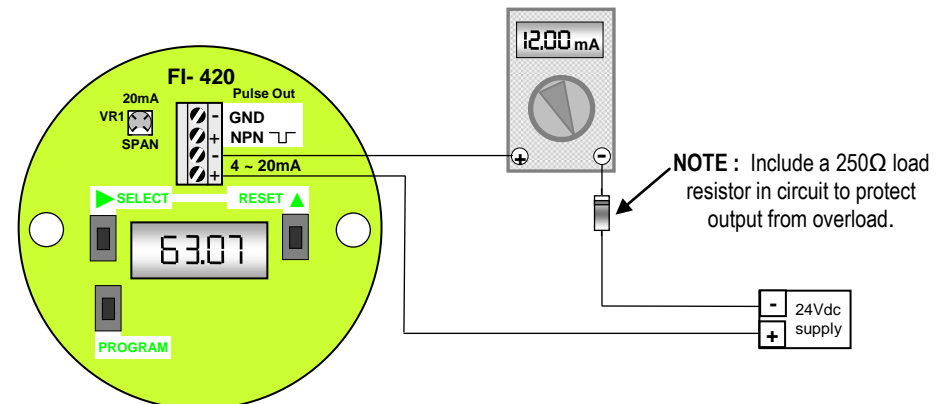
Electrical connections

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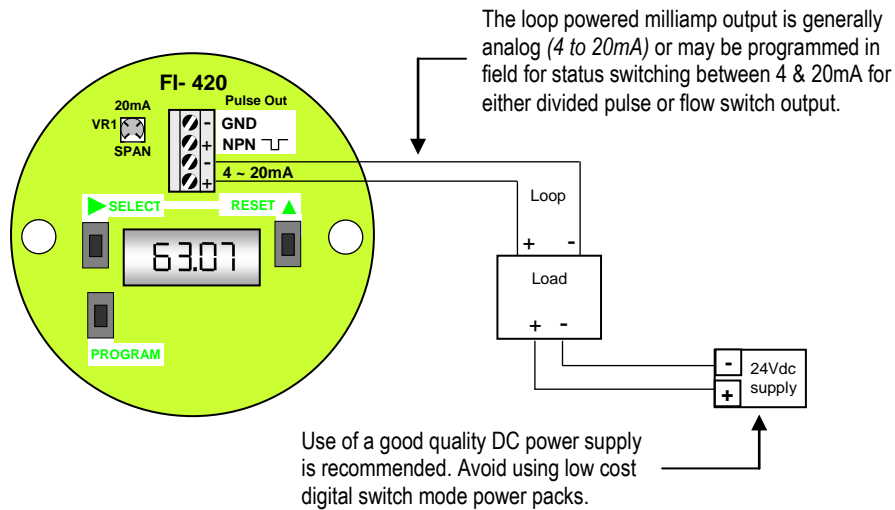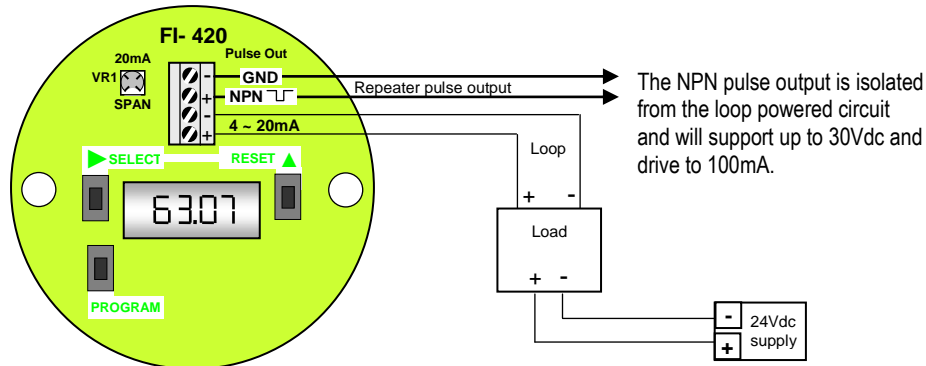 DC COMMON or a specifically assigned shield termination at the readout instrument end only in order to protect the transmitted signal from mutual inductive interference. <u>IMPORTANT</u>, tape off & isolate the shield at the flowmeter end of the cable.

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

The loop powered milliamp output is generally analog *(4 to 20mA)* or may be programmed in field for status switching between 4 & 20mA for either divided pulse or flow switch output.

Use of a good quality DC power supply is recommended. Avoid using low cost digital switch mode power packs.

loop wiring + repeater pulse output

The NPN pulse output is isolated from the loop powered circuit and will support up to 30Vdc and drive to 100mA.

Programming chart

Press & hold PROGRAM key for 3 seconds to enter program mode.

Press ▶ key to select function

F/I converter — 4-20 — PROGRAM — dE.CP — ▶ Position decimal point — PROGRAM — 63.07 — ▶ Select full ▲ scale frequency (Hz) — PROGRAM — rES.4 — Select ▲ response (sec) — PROGRAM — PL.04 — Select number ▲ of poles (1~32) — PROGRAM — SAvE — 15.30 Hz.

<u>Run mode</u> : display defaults to input frequency (Hz). Press ▲ to show Hz for 20mA.

Divider — d ivr — PROGRAM — 0376 — ▶ Select ▲ divider factor — PROGRAM — SAvE — 6085 Total

<u>Run mode</u> : display defaults to a totaliser (divided value). Press ▲ to reset totaliser.

Number of excitation poles **(NOP)** for each revolution of the primary measuring elements *(see page 2).*

Flow switch — FLo.S — PROGRAM — d.ECP — ▶ Position decimal point — PROGRAM — 8.437 — ▶ Select flow ▲ Switch point (Hz) — PROGRAM — db. 7 — Select % ▲ deadband (0~9) — PROGRAM — PL.04 — Select number ▲ of poles (1~32) — PROGRAM — SAvE — 2.630 Hz.

<u>Run mode</u> : display defaults to input frequency (Hz). Digits flash when in alarm condition. Press ▲ to show Hz set point.