



Technology Solutions

TEK-FLux 1400C

Utility Electromagnetic Flow Meter



Instruction Manual

Document Number: IM-1400C

Battery Powered



NSF



www.tek-trol.com

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

For technical assistance, contact

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Table of Contents

1	Safety Instructions	3
1.1	Intended Use	3
1.2	Safety Instructions from the Manufacturer	3
1.2.1	Disclaimer	3
1.2.2	Product Liability and Warranty	3
1.2.3	Information Concerning the Documentation	3
1.3	Safety Precautions	3
1.4	Handling and Storage Instructions	4
1.4.1	Handling Instructions	4
1.4.2	Storage	4
1.4.3	Nameplate	4
2	Product Description	5
2.1	Introduction	5
2.2	Measuring Principle and Operation	5
2.3	Flow Computation	6
2.4	Battery Description	7
2.4.1	Features	7
2.4.2	Battery Specifications	7
2.4.3	Applications	7
2.5	Specifications	8
2.6	Flow Range	9
2.7	Dimensional Drawings	9
2.7.1	Battery Powered	9
2.7.2	Line Powered	10
2.8	Model Chart	13
3	Installations	14
3.1	Pre-Installations Checks	14
3.2	Installation of Flow Tube	14
3.2.1	Selection of Mounting Locations	14
3.2.2	Typical Inline Mounting arrangements	16
3.2.3	Tightening of the flange bolts	16
3.2.4	Flow Tube Local Earthing / Grounding	17
3.2.5	Checking for sealing	17
4	Electrical Instructions	18
4.1	Instructions	18
4.2	Recommended Wiring Procedure for Battery	20
4.2.1	Line Powered Wiring	20
4.3	After making all the connections	21
5	Operations	21
5.1	Display Setting (Battery Powered)	21
5.1.1	Boot Up	21
5.1.2	Run Time	21
5.2	Interface (Line Powered)	22
5.2.1	Understanding the Menu operations	23

5.2.2	Menu and Modes of operation	24
5.2.3	Info Mode.....	25
5.2.4	Clear Mode.....	26
5.2.5	Program Mode	27
5.2.6	Configuration Mode	27
5.2.7	Flow Settings	28
5.2.8	Display Settings	29
5.2.9	Display Screens (Unidirectional Flow)	30
5.2.10	Display Screens (Bidirectional Flow).....	31
5.2.11	Communication Settings	32
5.2.12	Relay Output Settings.....	33
5.2.13	Pulse Output Settings.....	34
5.2.14	Digital Input Settings.....	35
5.2.15	Analog Output Settings	35
5.2.16	Diagnostics Mode.....	36
5.2.17	Batching Mode	37
5.2.18	Calibration Mode	38
5.3	Operational Precautions	38
5.4	User Interface	39
6	Display Screens	41
6.1	Power-on.....	41
6.2	Display Icons.....	41
6.3	Runtime.....	42
6.4	Menu.....	43
6.5	Menu > Basic	43
6.6	Menu > Comm	44
6.7	Menu > Calibration	44
6.8	Menu > Data Log.....	44
6.9	Menu > Info	45
6.10	Password.....	45
6.11	Menu > Basic > Parameters	45
6.12	Menu > Comm	46
6.13	Menu > Calibration > Parameters	47
7	Operational precautions.....	50
8	Troubleshooting	51
9	Annexure	52
9.1	Annexure 1: Flowmeter size v/s Flow Rate at Flow Velocity 3ft/s	52
9.2	Annexure 2: Dimensions	53
9.3	Annexure 3: Modbus Table	54

1 Safety Instructions

1.1 Intended Use

Tek-Flux 1400C Utility Electromagnetic Flow Meter is widely used in high-pressure applications with highly accurate and reliable measurements.

1.2 Safety Instructions from the Manufacturer

1.2.1 Disclaimer

The manufacturer will not be held accountable for any damage that happens by using its product, including, but not limited to, direct, indirect, or incidental and consequential damages. Any product purchased from the manufacturer is warranted by the relevant product documentation and our Terms and Conditions of Sale. The manufacturer has the right to modify the content of this document of any time with any reason without prior notice and will not be answerable for the possible consequence of changes.

1.2.2 Product Liability and Warranty

The operator shall have authority for the suitability of the device for the specific application. The manufacturer accepts no accountability for the consequences of misuse by the operator. A wrong installation or operation of the devices (systems) will cause the warranty to be void. The respective Terms and Conditions of Sale, which forms the basis for the sales contract, shall also apply.

1.2.3 Information Concerning the Documentation

To prevent any injury to the operator or damage to the device, it is essential to read the information in this document and the applicable national standard safety instructions. This operating manual consists of all the information that is required in various stages, such as product identification, incoming acceptance and storage, mounting, connection, operation and commissioning, troubleshooting, maintenance, and disposal.

1.3 Safety Precautions

You must read these instructions carefully before installing and commissioning the device. These instructions are an essential part of the product and must be kept for future reference. Only by observing these instructions, optimum protection of both personnel and the environment, as well as safe and fault-free operation of the device can be ensured. For additional information that is not discussed in this manual, contact the manufacturer.

The following safety symbol marks are used in this operation manual and on the instrument.



WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or severe injury



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



NOTE

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

1.4 Handling and Storage Instructions

The following information applies to the Tek-Flux 1400C Utility Electromagnetic Flow Meter.

1.4.1 Handling Instructions

- Do not lift the Flow Meter by the top-mounted Transmitter.
- Flow Meter of size 8"(200mm) and above always lift using eye bolts. Do not lift by its casing.
- Do not drag the Flow Tube with its lining facing the ground. It will damage the lining.
- Do not roll the Flow Tube over its flanges. It will damage the flanges along with Transmitter if it hits the ground on rolling.
- Always rest the Flow Meter only in its upright position on the pedestals provided and not on its casing.


1.4.2 Storage

If this product is to be stored for an extended period of time before installation, take the following precautions:

- Store your product in the manufacturer's original packing used for shipping.
- The storage location should comply with the following requirements:
 - Free from rain and water
 - Free from vibration and impact shock
 - At room temperature with minimal temperature and humidity variation
- Before storing a used flow meter, remove any fluid from the flow meter line completely. Properties of the instrument can change when stored outdoors.

1.4.3 Nameplate

Tek-Flux 1400C	
Utility Electromagnetic Flow Meter	
Model	Tek-Flux 1400C
Meter Factor K	_____
Flow Range	_____
Accuracy	_____
Lining Mt.	_____
Voltage	_____
S/N	_____
Size	_____
Work Press.	_____
Work Temp.	_____
Electrode Mt.	_____
Protection	_____


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2 Product Description

2.1 Introduction

Tek-Flux 1400C Utility Electromagnetic Flow Meter is widely used for high-pressure applications with highly accurate and reliable measurements. Tek-Flux 1400C is used to measure flow rate for various conductive liquids. This Inline Battery-Powered Magmeter is specially designed for applications where availability of electricity and power supply is unavailable. The Tek-Flux 1400C Magmeter provides 5 years battery life, which minimize the maintenance and enhance the productivity of smart measurements in field instruments.

2.2 Measuring Principle and Operation

Tek-Flux 1400C Utility Electromagnetic Flow Meter operates on the principle of Faraday's Law of Electromagnetic Induction. It describes the relationship between an electrical conductor and the voltage, which is generated by magnetic field. The induced voltage is directly proportional to the velocity of fluid flowing through a magnetic field and passes through the transmitter. The transmitter converts this voltage into a quantifiable flow velocity, where volumetric flow rate of the fluid is determined by the velocity.

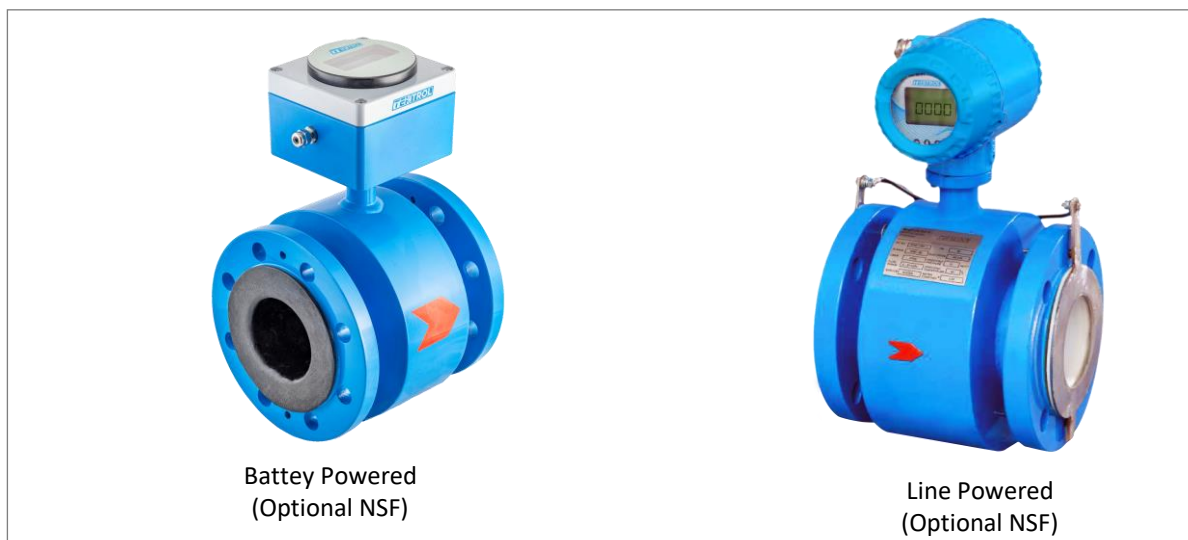


Fig 1: Tek-Flux 1400C Utility Electromagnetic Flow Meter

In an Electromagnetic Flow Meter, a magnetic field is generated by a pair of diametrically placed electrical coils. These electrical coils are mounted externally to the flow tube. As the conductive liquid passes through this Electromagnetic field, the force of the magnetic field causes the negatively and positively charged particles of the liquid to separate. This separation causes an induced voltage between the electrodes and the sensor. This induced voltage is directly proportional to the velocity and perpendicular to both the liquid flow and the electromagnetic field direction. The sensed voltage is further processed by the transmitter to provide a standardized output signal or displayed in an appropriate engineering unit.

2.3 Flow Computation

The flux density of the electromagnetic field and the distance between the electrodes are constant. Therefore, the induced voltage is the function of liquid velocity as below:

$$E = K \times B \times V \times D \quad \text{--- (1)}$$

Where,

E = Induced Voltage

K = Flow tube Constant

B = Magnetic Field Strength

v = Mean Flow Velocity

D = distance between Electrode

Volume flow is calculated by following equation:

$$Q = \bar{V} \times D^2 \times \pi/4 \quad \text{--- (2)}$$

Therefore, From Equation 1 and 2:

$$Q = \frac{E \times D \times \pi}{K \times B \times 4}$$

Hence, induced voltage or e.m.f is not affected by the physical properties of liquids like temperature, pressure, density along with conductivity above the minimum threshold level of measured liquid. When the pipe is completely full of liquid, the flow meter provides reliable and accurate measurements.

The electromagnetic field coil assembly is excited by the pulsed DC technique, which eliminates the noise and provides zero correction automatically.

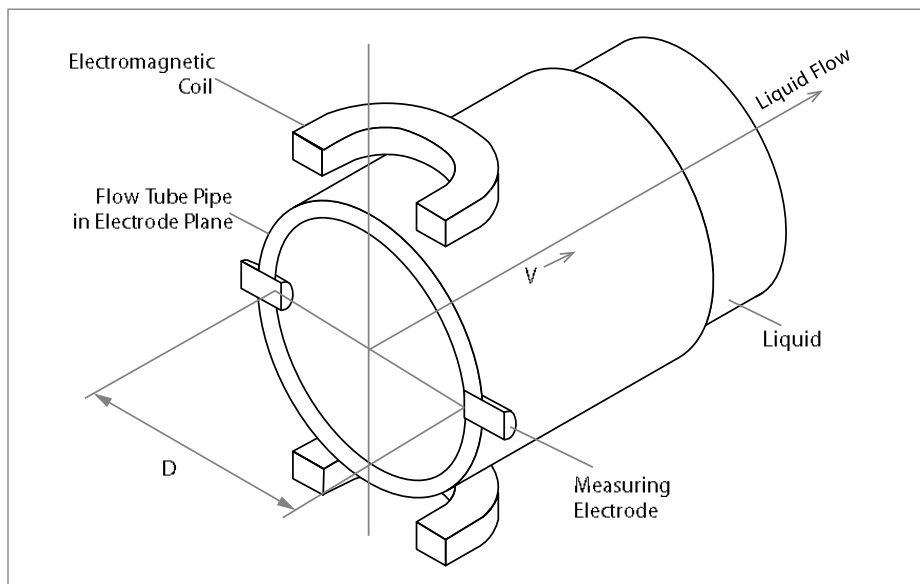


Fig 2: Measuring Principle of Tek-Flux 1400C

2.4 Battery Description

2.4.1 Features

- High and stable operating voltage.
- Excessive power and energy for the whole battery life.
- Superior drain capability.
- Higher power applications.
- Self-discharge rate is Low (less than 1% after 1 year of storage at 68°F).
- Battery life higher than 10 years, depending on the application.
- Hermetic glass-to-metal sealing.
- Eliminates leakage.
- Non-flammable electrolyte.
- Operation Safety.

2.4.2 Battery Specifications

Product Type	Cylindrical, Non-Rechargeable, Cell, D-Site
Chemistry	LiSOCl ₂
Voltage (Nominal)	3.6V
Capacity (Nominal)	19.0Ah
Certifications	UL 1642, UN 38.3
Class 9	Yes
Operating Temperature	-40°F to 160°F
Storage Temperature	-40°F to 160°F

2.4.3 Applications

Tek-Flux 1400C Utility Electromagnetic Flow Meter can be successfully deployed in a wide range of industrial liquid flow measurement applications:

- Chemical and Process Industries.
- Fertilizer Industries.
- Pharmaceutical Industries.
- Sugar and Beverage Industries.
- Paper and Pulp Industries.
- Aluminium and Steel Industries.
- Mining and Dredging Industries.
- Polymer Industries.
- Water and Wastewater Management.

2.5 Specifications

- **Battery Powered**

Accuracy	±0.5% (Standard)
Repeatability	±0.2% of Span
Nominal Diameter	2" to 12" (50 to 300mm)
Nominal Pressure	150# ANSI or 300# ANSI Flange
Working Temperature	Direct: -40 to 250°F (-40 to 120°C) Remote: -40 to 350°F (-40 to 180°C)
Electrode material	316 SS
Sensor Lining	Polypropylene
Display Version	Integral (Optional: Remote)
Measuring tube material	SS 304 Carbon Steel
Transmitter Material	Die Cast Aluminium
End connection	ANSI Flange
Measuring Range	0.7 to 39ft/s (0.2 to 12 m/s) Bidirectional
Output	Pulse and RS485 Modbus
Power Supply	Battery Powered 5 years' Battery Life
Protection Class for Sensor	Std. IP 65
Protection Class for Transmitter	IP 67
Installation	Inline flanged

- **Line Powered**

Accuracy	±0.5% (Standard); Optional 0.3%	
Measuring Range	0.2 to 12 m/sec Bi-directional	
Repeatability	±0.2% of Span	
Process Pressure	150# ANSI or 300# ANSI Flange	
Process Temperature	Integral: -40 to 250°F (-40 to 120°C) Remote: -40 to 350°F (-40 to 180°C)	
Operating Temperature	-40°F to 131°F (-40°C to 55°C)	
Operating Humidity	5-95% RH non-condensing	
Size	½" to 28" (10mm to 700mm)	
Output	4-20mA, Pulse, HART Modbus RS485	
Power Supply	16 to 60VDC or 80 to 300VAC/DC	
Protection Class	IP65 (Standard), IP68 (Optional for Flow Tube with Remote Transmitter)	
End Connection	ANSI Flange	
Electrode Material	316 SS	
Measuring Tube Material	SS304	
Housing Material	Carbon Steel	
Sensor Lining	Polypropylene	
Display Version	Integral or Remote	
Display Type	16 characters x 2 row LCD, 5 Digit Flow rate and 8 Digit Totalizer	
Units	Flow Rate	Totalizer
	LPS, LPM, LPH, LPD	L, MI, m ³
	MIps, MIpm, MIph, MIpd	MI

	cc/s, cc/m, cc/h, cc/d, m ³ /s, m ³ /m, m ³ /h, m ³ /d kg/s, kg/m, kg/h, kg/d t/s, t/m, t/h, t/d gps, gpm, gph, gpd Mgps, Mgpm, Mgph, Mgpd lgps, lgpm, lgph, lgpd lMgps, lMgpm, lMgph, lMgpd ft ³ /s, ft ³ /m, ft ³ /h, ft ³ /d lb/s, lb/m, lb/h, lb/d bbl/d, bbl/h, bbl/s	L, Ml, cc, m ³ L, Ml, m ³ kg, t T G, ft ³ Mg lg, ft ³ lMg g, lg, ft ³ lb bbl
Cable Length	30 Ft (Standard) Up to 150 Ft Maximum	
Terminal Connector	18 AWG to 22 AWG wire	

2.6 Flow Range

- Velocity range - 0.7 ft/sec for minimum and 40 ft/sec for maximum

Line Size in (mm)	USGPM		m ³ /hr		LPM		LPS	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/2" (15)	0.56	33.61	0.13	7.63	2.12	127.21	0.04	2.11
3/4" (20)	1	59.75	0.23	13.56	3.77	226.15	0.06	3.77
1" (25)	1.56	93.35	0.35	21.19	5.89	353.36	0.1	5.88
1 1/4" (32)	2.55	152.95	0.58	34.91	9.65	578.96	0.16	9.65
1 1/2" (40)	3.98	238.98	0.9	54.28	15.08	904.63	0.25	15.07
2" (50)	6.22	373.4	1.41	84.82	23.56	1413.19	0.39	23.56
2 1/2" (65)	10.52	631.06	2.39	143.28	39.82	2389.2	0.66	39.8
3" (80)	15.93	955.92	3.62	217.08	60.31	3618.55	1.01	60.3
4" (100)	24.89	1493.63	5.65	339.24	94.23	5653.99	1.57	94.22
5" (125)	38.9	2333.8	8.84	530.16	147.24	8834.38	2.45	147.24
6" (150)	56.01	3360.66	12.72	763.32	212.03	12721.5	3.53	212.02
8" (200)	99.58	5974.51	22.6	1356	376.93	22616	6.28	376.93
10" (250)	155.59	9335.18	35.2	2112	588.96	35337.5	9.82	588.96
12" (300)	224.04	13442.65	50.89	3053.16	848.1	50886	14.14	848.1

2.7 Dimensional Drawings

2.7.1 Battery Powered

Material of Construction	
Pipe Material	Carbon Steel
Electrode Material	316 SS
Flanges	Carbon Steel
Coil Housing	Carbon Steel
Flow Transmitter	Die Cast Aluminium
Liner	Polypropylene

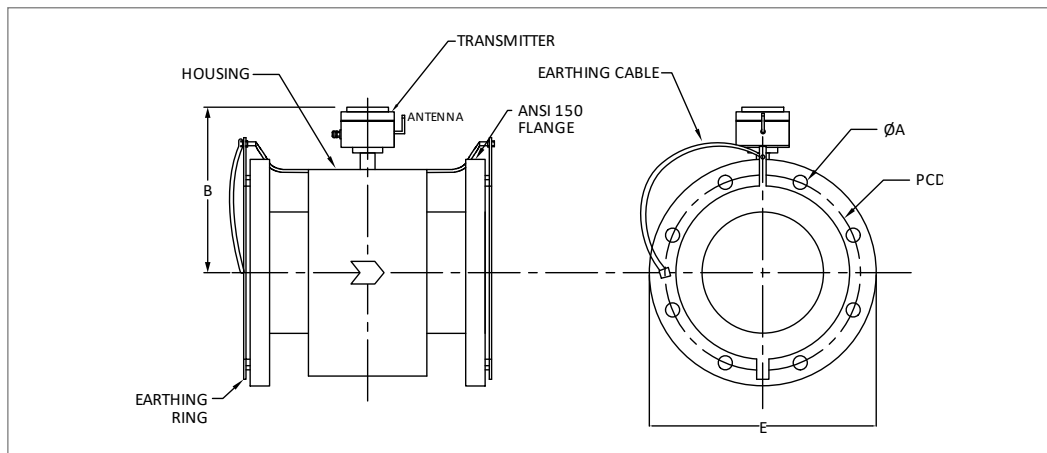


Figure 3: Battery Powered

Line Size in (mm)	D in. (mm)	B in. (mm)	E in. (mm)	Flange OD	PCD	Ø A X NO. OF HOLES
2"(50)	8" (200)	9 1/2" (239)	7" (175)	6" (150)	4 3/4" (121)	Ø19 X 4
2 1/2" (65)	8" (200)	9 3/4" (245)	7 1/2" (187)	7 1/4" (180)	5 1/2" (140)	Ø19 X 4
3" (80)	8" (200)	10 1/8" (253)	8 1/8" (203)	7 1/2" (190)	6" (152)	Ø19 X 4
4"(100)	10" (250)	10 3/4" (268)	9 1/4" (234)	9 1/4" (230)	7 1/2" (190)	Ø19 X 8
5" (125)	10" (250)	11 1/2" (287)	10 3/4" (272)	10 1/4" (255)	8 3/4"(216)	Ø23 X 8
6" (150)	12" (300)	12 1/4" (305)	12 1/4" (308)	11 1/4" (280)	9 1/2" (241)	Ø23 X 8
8" (200)	14" (350)	13 1/4"(331)	14 1/4" (359)	13 3/4" (345)	12" (298)	Ø23 X 8
10" (250)	16" (400)	14 1/4" (358)	16 1/2"(413)	16 1/4" (405)	14 1/2" (362)	Ø25 X 12
12" (300)	20" (500)	14 3/4" (368)	19 1/2" (485)	19 1/2" (485)	17 1/4" (432)	Ø25 X 12

2.7.2 Line Powered

- Flow Tube with Metal body

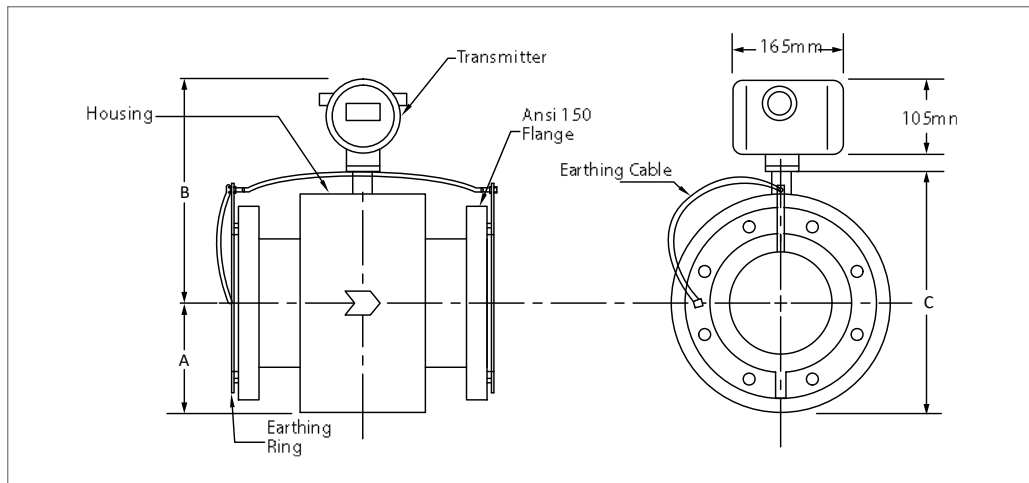


Fig 4: Integral Type

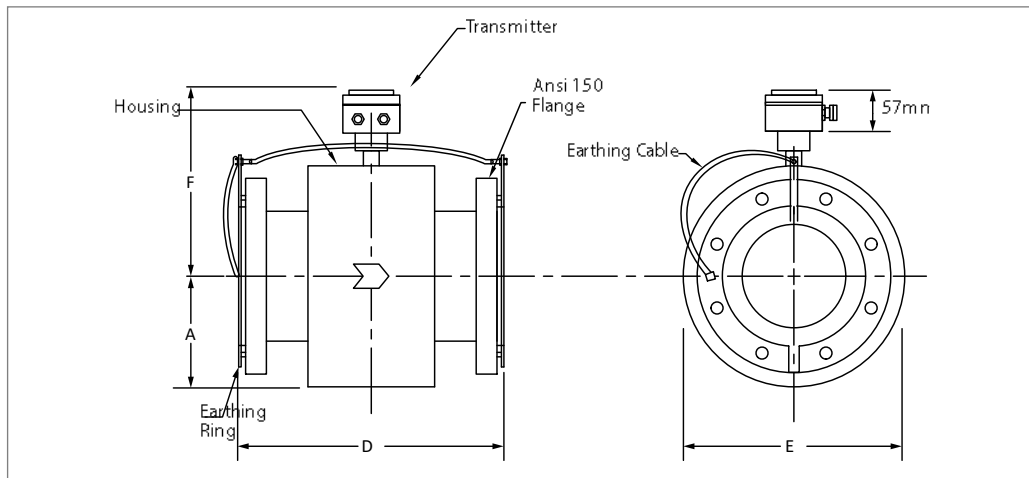


Fig 5: Remote Type

Line Size in (mm)	A in (mm)	B in (mm)	C in (mm)	D in (mm)	E in (mm)	F in (mm)
½" (15)	2 ¼" (58)	9 ¼" (233)	6 ½" (165)	8" (200)	4 ½" (115)	6 ½" (165)
¾" (20)	2 ¾" (70)	9 ¾" (245)	7 ½" (190)	8" (200)	5 ¼" (140)	7" (177)
1" (25)	2 ¾" (73)	9 7/8" (248)	7 ¾" (195)	8" (200)	5 ¾" (145)	7 ¼" (180)
2" (50)	3 ½" (88)	10 ½" (263)	9" (225)	8" (200)	7" (175)	7 ¾" (195)
2 ½" (65)	3 ¾" (94)	10 ¾" (269)	9 ½" (237)	8" (200)	7 ½" (187)	8" (201)
3" (80)	4 1/8" (104)	11" (277)	10 1/8" (253)	8" (200)	8 1/8" (203)	8 ¾" (209)
4" (100)	4 ¾" (117)	11 ¾" (292)	11 ¼" (284)	10" (250)	9 ¼" (234)	9" (224)
5" (125)	5 ½" (136)	12 ½" (311)	12 ¾" (322)	10" (250)	10 ¾" (272)	9 ¾" (243)
6" (150)	6 ¼" (154)	13 ¼" (329)	14 ¼" (358)	12" (300)	12 ¼" (308)	10 ½" (261)
8" (200)	7 ¼" (180)	14 ¼" (355)	16 ¼" (409)	14" (350)	14 ¼" (359)	11 ½" (287)
10" (250)	8 ¼" (207)	15 ¼" (382)	18 ½" (463)	16" (400)	16 ½" (413)	12 ½" (314)

12" (300)	9 ¾" (243)	15 ¾" (392)	20 ½" (510)	20" (500)	19 ½" (485)	13" (324)
14" (350)	10 ¾" (268)	17" (423)	22 ¾" (567)	20" (500)	21 ½" (535)	14 ¼" (355)
16" (400)	12" (298)	18" (448)	24 ¾" (621)	24" (600)	23 ¾" (595)	15 ¼" (380)
18" (450)	12 ¾" (318)	19" (474)	26 ¾" (666)	24" (600)	25 ½" (635)	16 ¼" (406)
20" (500)	14" (350)	20" (499)	29" (724)	24" (600)	28" (700)	17 ¼" (431)
24" (600)	16 ¼" (408)	23 ¼" (582)	34 ½" (865)	24" (600)	32 ½" (815)	20 ½" (514)
28" (700)	18" (448)	23 ½" (590)	35 ¼" (883)	28" (700)	35 ¾" (895)	20 ¾" (522)
32" (800)	20 ¼" (508)	26" (650)	40" (1000)	32" (800)	40 ½" (1015)	23 ¼" (582)
36" (900)	22 ¼" (558)	27 ¼" (683)	42 ¾" (1066)	36" (900)	44 ½" (1115)	24 ½" (615)
40" (1000)	24 ¼" (615)	29" (724)	48 ½" (1214)	40" (1000)	49 ¼" (1230)	26 ¼" (655)

Approximate Weight Chart							
Line Size (inch)	Line Size (mm)	Net Weight (lb)	Net Weight (kg)	Gross Weight with packaging (lb)	Gross Weight with packaging (kg)	Box Dimension in inch (for 1 Magmeter)	Box Dimension in mm (for 1 Magmeter)
1/2	15	11	5	26	12	23.6*15.4*17.4	600*390*440
3/4	20	13	6	26	12		
1	25	13	6	26	12		
1.25	32	18	8	31	14		
1.5	40	18	8	31	14		
2	50	22	10	35	16		
2.5	65	29	13	42	19		
3	80	33	15	46	21		
4	100	44	20	64	29		
5	125	57	26	70	32		
6	150	68	31	84	38		
8	200	99	45	154	70	24.6*23.2*22.8	625*540*580
10	250	136	62	209	95	26.8*23.4*25.2	675*590*635
12	300	211	96	286	130	29.7*26.2*28.2	750*660*710
14	350	253	115	330	150	34.7*27.3*28.6	875*690*720
16	400	341	155	418	190	35.7*32.5*31.74	900*820*800

18	450	352	160	440	200	36.9*31.4*32.7	930*790*825
20	500	506	230	616	280	37.7*34.5*32.9	950*870*830
24	600	682	310	814	370	44.4*41.26*33.73	1120*1040*850
28	700	836	380	990	450	45.8*39.7*36.5	1155*1000*920
32	800	1122	510	1298	590	46.4*46.4*51.42	1170*1170*1050
36	900	1320	600	1540	700	50.8*50.8*46.0	1280*1280*1160
40	1000	1892	860	2134	970	64.7*57.2*48.4	1630*1440*1220

2.8 Model Chart

Example	Tek-Flux 1400C	080	1	S	SS	1	2	PY	NSF	Tek-Flux 1400C-80-1-S-SS-1-2-PY-NSF
Series	Tek-Flux 1400C									Utility Magmeter
Size		15								1/2"
		25								1"
		40								1 ½"
		50								2"
		65								2 ½"
		80								3"
		100								4"
		150								6"
		200								8"
		250								10"
		300								12"
		450								18"
		500								20"
	600								24"	
	700								28"	
Transmitter			1							Direct Mount
			2							Remote Mount (comes with 30 ft. of cable)
Output				B						Pulse, Modbus RS-485 (Battery Powered)
				S						4-20mA HART, Pulse, Modbus RS-485
Electrodes					SS					316 SS
					X					Consult Factory
Process Connection						1				150# ANSI Flange
						3				300# ANSI Flange
Power Supply							1			Battery

							2		16 to 60 VDC
							3		80 to 300 VAC/VDC
Liner								PY	Polypropylene
Options								IP68	IP68 Submersible Sensor Rating (Remote Only)
								NSF	NSF Approved
								EA	Extended Accuracy (0.3%)

3 Installations

3.1 Pre-Installations Checks

- Re-confirm the compatibility of the process liquid with the materials of the Flow Tube liner and the electrodes as ordered by you.
 - Confirm the compatibility of all components i.e., if process liquid is a mixture of different components.
 - Check the compatibility of process liquids that contain harmful contaminants.
 - Note that the severity of corrosion of material is depending upon the temperature and the concentration of the process liquid.
 - Corrosion due to service liquid reduces the life of Flow Meter.
- Ensure that the selected Flow Meter size is suitable for the flow rate to be measured.
- Note that the velocity under normal conditions should be between 0.2 m/s and 12 m/s.
- Confirm that an appropriate Earth pit is available, which is close to the Flow Tube for proper Grounding.

3.2 Installation of Flow Tube

3.2.1 Selection of Mounting Locations

The Tek-Flux 1400C Utility Magmeter must be installed in the pipeline at a point which satisfies the following requirements.

- To avoid erratic measurement results, flow tube must be full of liquid.
- Ensure that the Electrodes axis is horizontal within ± 15 degrees.
- Ensure straight pipe lengths on both side of the flow tube (5D at upstream and 3D at downstream from the center of the flow tube).

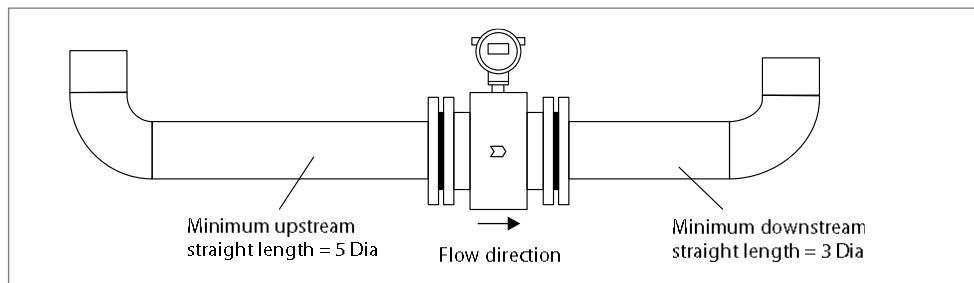


Fig 6: Straight Run Requirement

- Flow Tube may be installed in horizontal Pipelines preferably, with a slight upward gradient in the direction of flow.

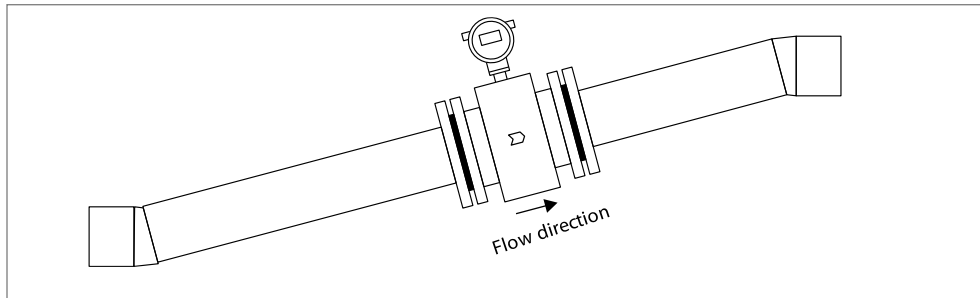


Fig 7: Horizontal Installation

- Never install the flow tube in empty or partially full pipeline.
- Never install the flow tube in vertical pipelines, where the liquid flow direction is downward.

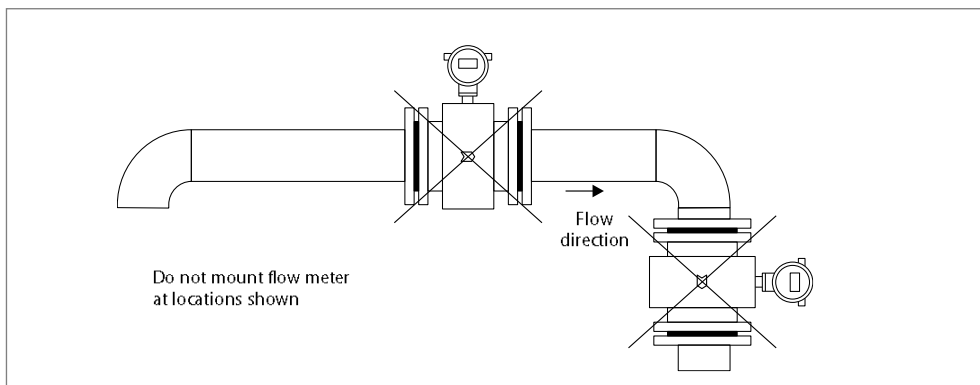


Fig 8: Vertical Installation with Liquid in the downward direction

- The piping layout must be preventing of any air content. The entrained air should be carried out of the flow tube by the liquid flow or by buoyancy at zero flow.
- Ensuring installation location in a way, that water or moisture does not enter the electrical terminations area.
- If the connecting pipeline is not electrically conducting or is lined with insulating material, strap the grounding rings to the detector head flanges at either end.

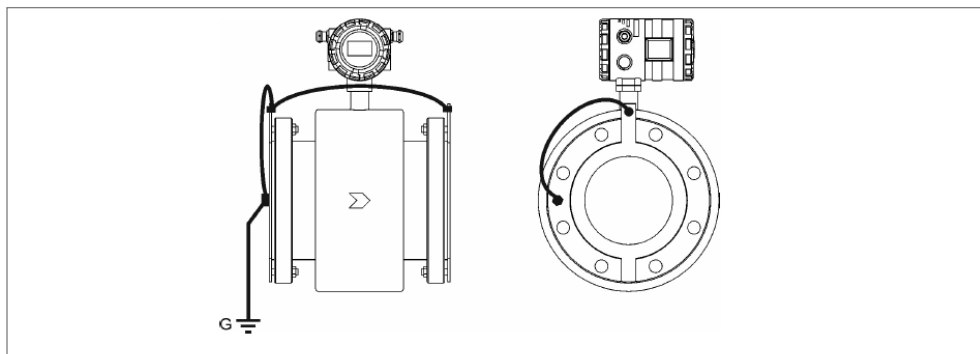


Fig 9: Strap the Grounding Rings

- Use empty pipe detection option to obtain correct flow status and prevent erratic output for completely draining out the process liquid.

3.2.2 Typical Inline Mounting arrangements

Inline mounting arrangement is shown in figure below.

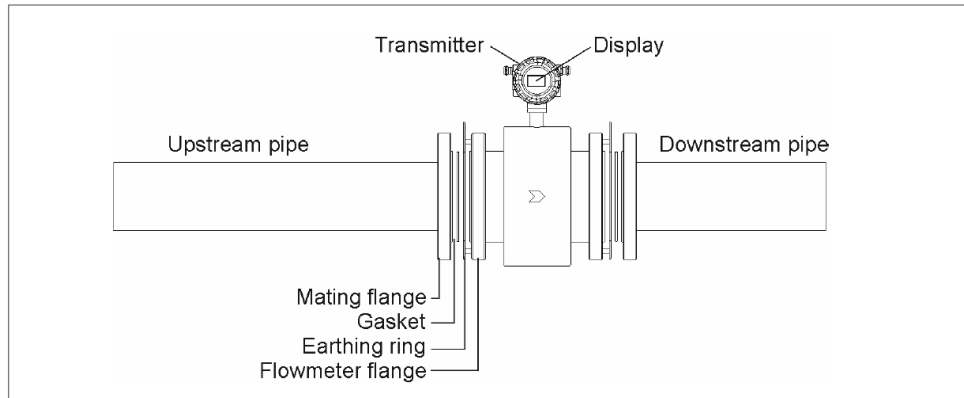


Fig 10: Inline Mounting

3.2.3 Tightening of the flange bolts

- Apply a thin layer of fresh industrial grease to the threads of the bolts prior to tightening.
- Tighten all the mounting bolts uniformly without any under or over tightening of the bolts.
- Tighten the bolts in a cross-sequence as per the order shown below for few flange sizes.

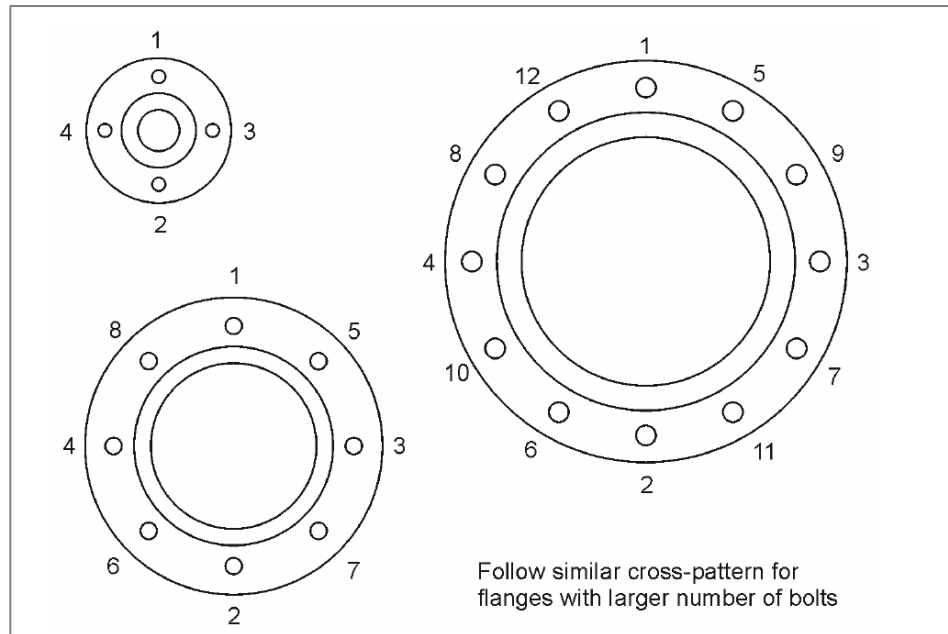


Fig 11: Tightening of the Flange Bolts

- Use Appropriate torque wench.

3.2.4 Flow Tube Local Earthing / Grounding

- A proper grounding of the Primary Head is essential to ensure proper functioning and accurate measurement of the Flow Meter.
- This ground is the reference ground for measurement and should not introduce any interference into the signal to be measured.
- Use 14AWG wire or higher conductor diameter cable for Earthing.
- To prevent any electrical interferences do not connect the ground of any other heavy electrical equipment to this ground.
- This ground functioning as the safety ground.

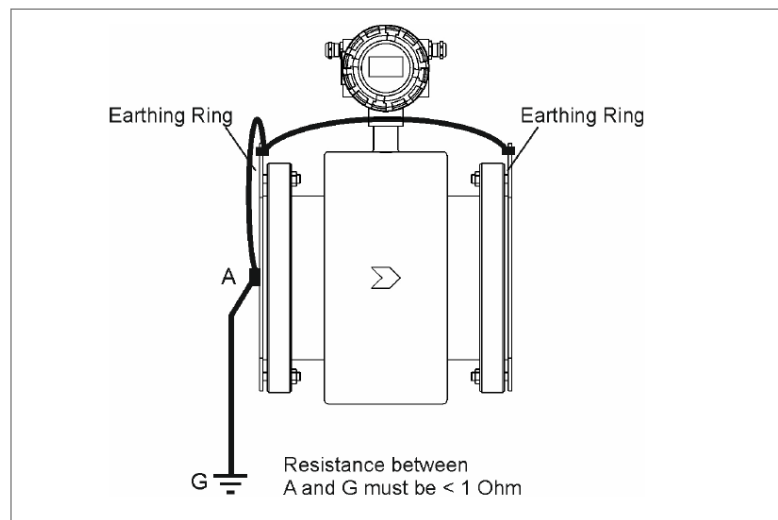


Fig 12: Flow Tube Earthing

3.2.5 Checking for sealing

Once the flow tube has been mounted, fill the pipeline preferably with water instead of process liquid for confirmation of leak free mounting.

If even minor leaks are noticed, following instructions are refer:

- Check the axial alignment of the flow tube with the upstream and downstream pipe lengths.
- Cleanliness of gasket.
- Use rating of gasket material and proper tightening of the bolts.
- After eliminating the leakages, allow the process liquid to pass through the pipeline.

4 Electrical Instructions

This section covers all electrical connection requirement. Electrical connection of the device must be carried out by trained; qualified specialists authorized to perform such work by the installation site.



WARNING

- Connect all electrical cables when the power is switched off. If the device does not have switch-off elements, then, overcurrent protection devices, lightning protection and/or energy isolating devices must be provided by the customer.
 - The device must be grounded to a spot in accordance with regulations in order to protect personnel against electric shocks.
-



NOTE

When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.

4.1 Instructions

- The Transmitter is delivered with a cable (pigtail) for making connections, so do not open the cover of the Transmitter.
- Install a junction box with an appropriate IP rating and mount it close to the Flow Meter at a distance that allows terminating the cable of the Transmitter.
- Never extend the Transmitter Cable to join another cable.
- Use ferrules for each wire and crimp the ends of the conductors with appropriate cable lugs.
- Before making various connections, understand how these connections are to be done.
- The Schematic is shown in figure 15.

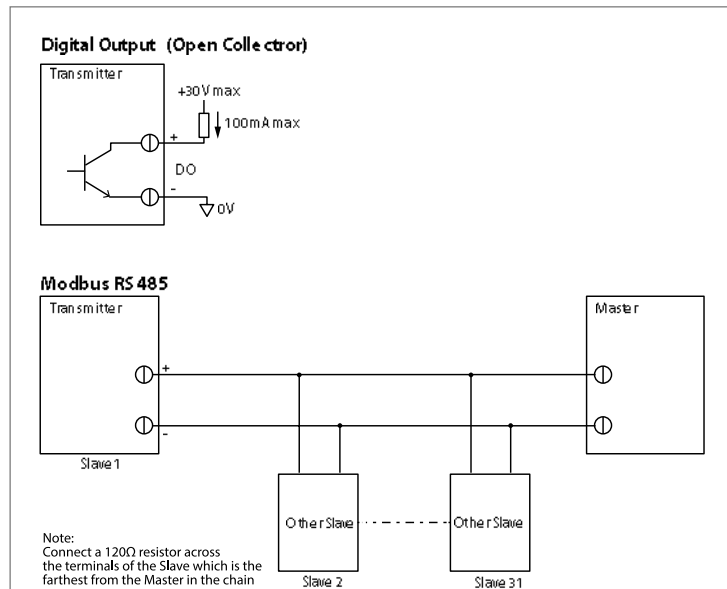
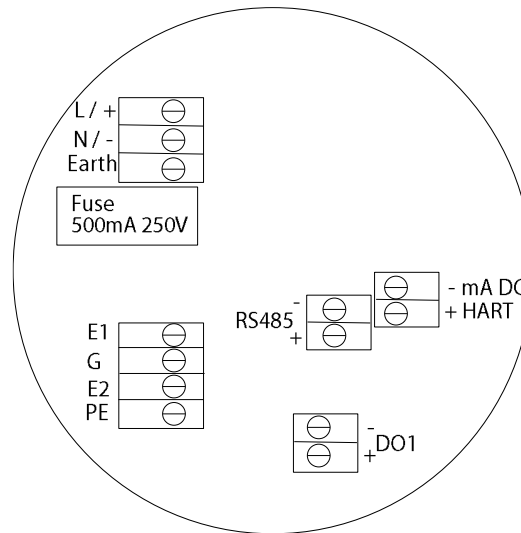


Fig 13: Connection Diagram

*Note:- Pull Up resistor value from 10K to 25K for measurement of pulse output. do not connect power supply without pull up resistor than may damage the circuit. Measure Output across Pull up resistor.



a. Refer to the following table for a description of the terminals.

Marking	Description	
L / +	110/ 230VAC	24 VDC
N / -	Neutral	0 VDC
E	Earth	
RS485 +	Modbus	
RS485 -		
DO1 +	Pulse Output	
DO1 -		
mA DC +	Current output	
mA DC -		

4.2 Recommended Wiring Procedure for Battery

Always install a junction box to make the connections as following:

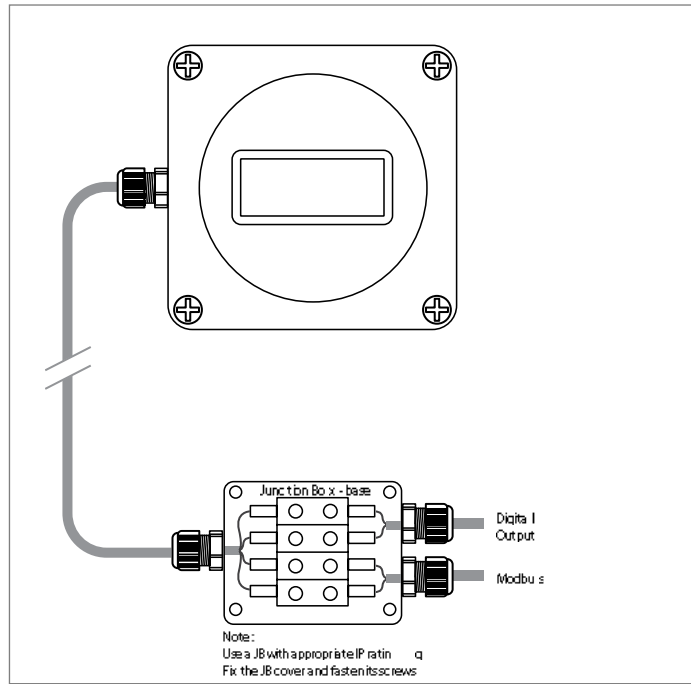
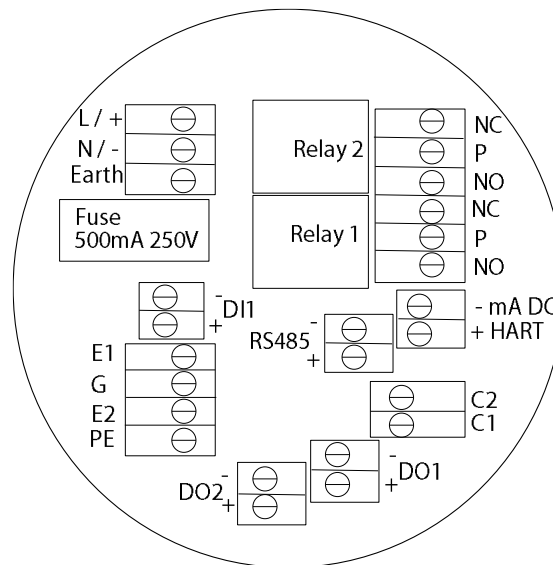


Fig 14: Junction Box

Table 1: Connection Description

Colour	Signal	Colour	Signal
Red	Open Collector	Yellow	RS485+
Black	0V	Green	RS485-

4.2.1 Line Powered Wiring



Refer to the following table for a description of the terminals.

Marking	Description		Marking	Description
L/+	110/ 230VAC	24 VDC	NC	Relay 2 contacts
N /-	Neutral	24 VDC	P	
E	Earth		NO	
RS485+	Modbus		NC	Relay 1 contacts
RS485-			P	
DI+	Digital input		NO	Digital output 1
DI -			DO1+	
mA DC+	Current output		DO1-	Digital output 2
mA DC-			DO2+	
			DO2-	

4.3 After making all the connections

- Confirm that installation has been done and completed, as described in this manual. Then, the Flow Meter is ready for operational use.
- Inspect and confirm that the O-rings and gaskets of the covers of the Transmitter.
- The Junction Box is intact and properly seated, and both the covers are well fastened.
- Allow the process liquid to start flowing through the Flow Tube.
- Ensure that the flow rate is within the specified limits for the Flow Meter.
- The excessive flow rate could damage the Flow Tube lining.
- The Transmitter is delivered in a powered-up condition, duly calibrated, and configured for the range of flow rate measurement as per your requirement.
- The Flow Meter will start indicating the flow rate and the totalized flow values alternately, drive the pulse output, and start communicating over the Modbus.

5 Operations

5.1 Display Setting (Battery Powered)

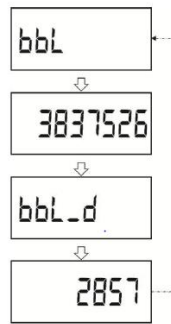
5.1.1 Boot Up

The Transmitter is delivered in a powered-up condition and hence you will not normally see this screen, except when connecting a replacement battery.



5.1.2 Run Time


The display indicates the parameter unit followed by the value of the flow rate and the totalised flow, respectively. This repeats in a scrolled manner. The example below considers barrels and barrels/day.

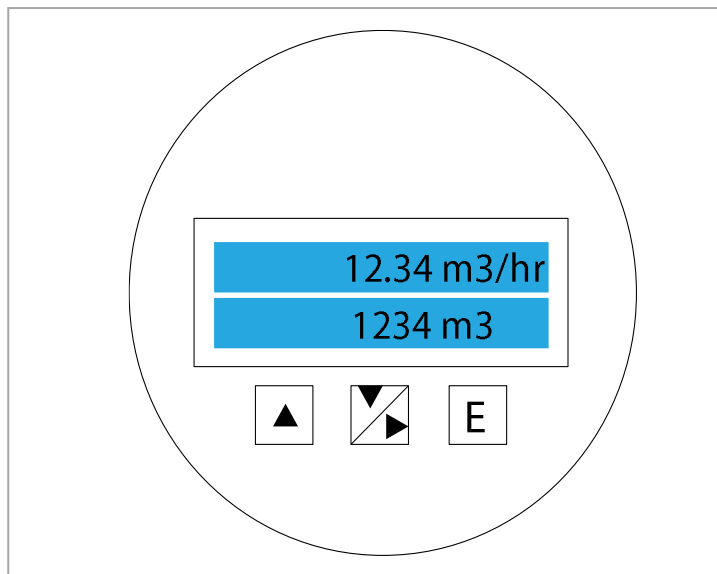


5.2 Interface (Line Powered)

The user Interface comprises of backlit LCD readout in a configuration 2 rows of 16 characters each, and a set of three tactile keys. The Flowmeter has different modes, and the LCD displays information relevant to each of the four modes - Run, Program, Info and Clear respectively.

The tactile keys in conjunction with the LCD, enable switching between different modes, reading static information and runtime values, setting and programming new values and selecting between certain functional options. This process of navigation takes you through different Screens - each Screen being a collection of information relevant to that particular Screen. The Screens are part of an internal Menu structure.

 To help you navigate through the above Menu, it is useful to understand the nature of the actions of the three tactile switches.



 UP key

- Move to the next option within a Menu level
- Increment the value of the digit by one
- Move to the next value of a parameter



DOWN/ RIGHT key

- Move to the previous option within a Menu level
- Decrement the value of the digit by one
- Move to the previous value of a parameter



DOWN /RIGHT key

- Move to the right digit
- Move from the rightmost digit to the leftmost



ENTER key

- Select the option presently being displayed
- Select the parameter presently being displayed for viewing and/or editing
- Set the value presently being displayed

5.2.1 Understanding the Menu operations

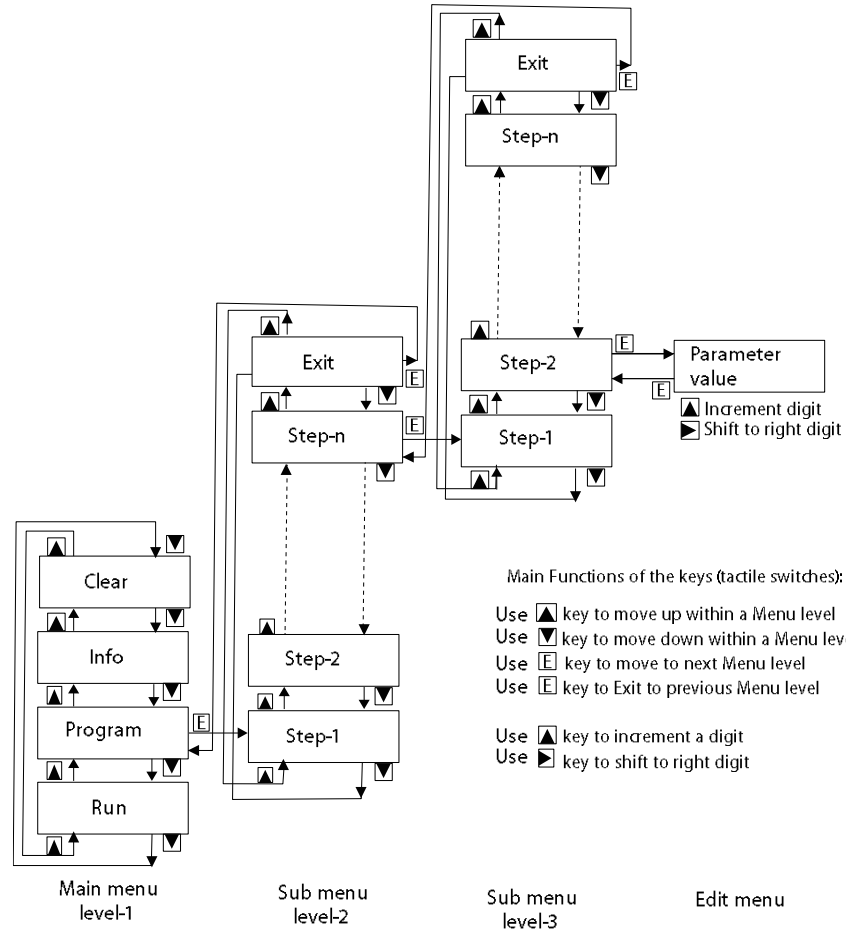


Please read this section before trying to operate the tactile switches to navigate through the Menu. The 6400 Menu has the following structure. At power ON, the Transmitter LCD momentarily indicates

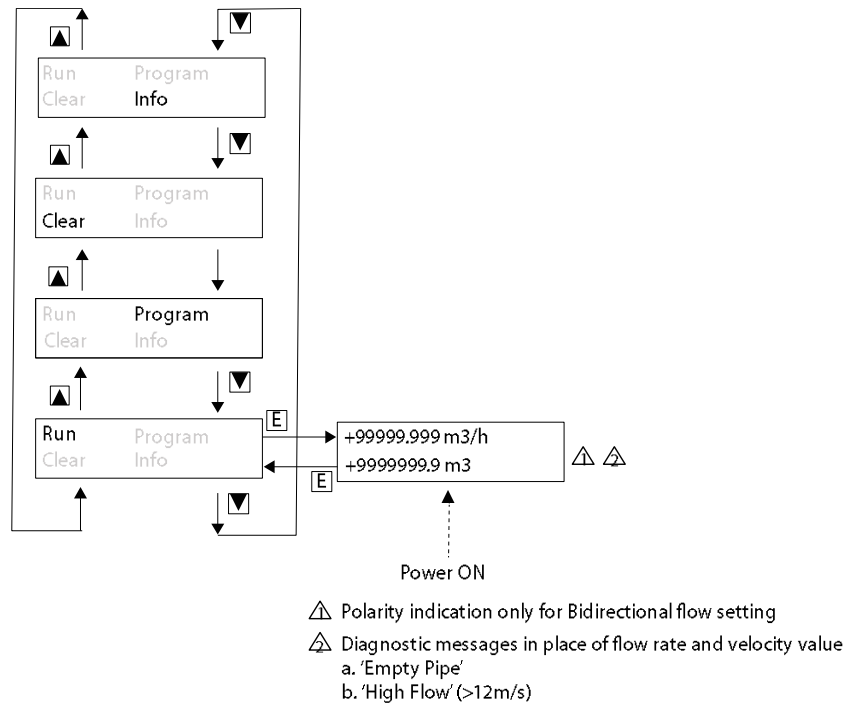
- The Flowmeter Model, then
- The Software Version number, then
- The RUN mode indicating the Flow rate, Totalized flow and Flow velocity depending on which parameters have been configured to be displayed.

Hit the ENTER key first to access the 4 main functions using the UP and DOWN keys: Run/ Program/ Info and Clear.

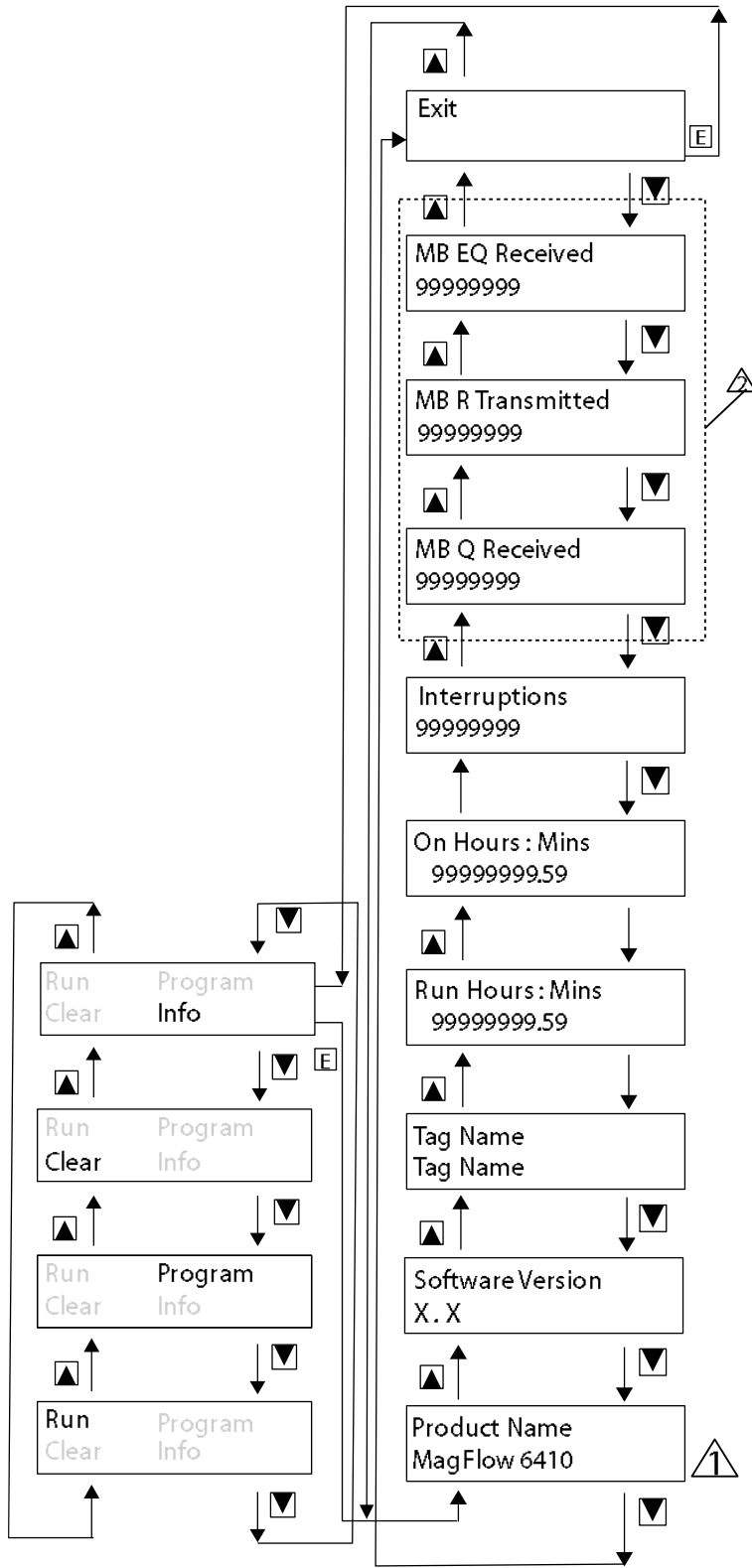
Simple explanation of how to navigate



5.2.2 Menu and Modes of operation

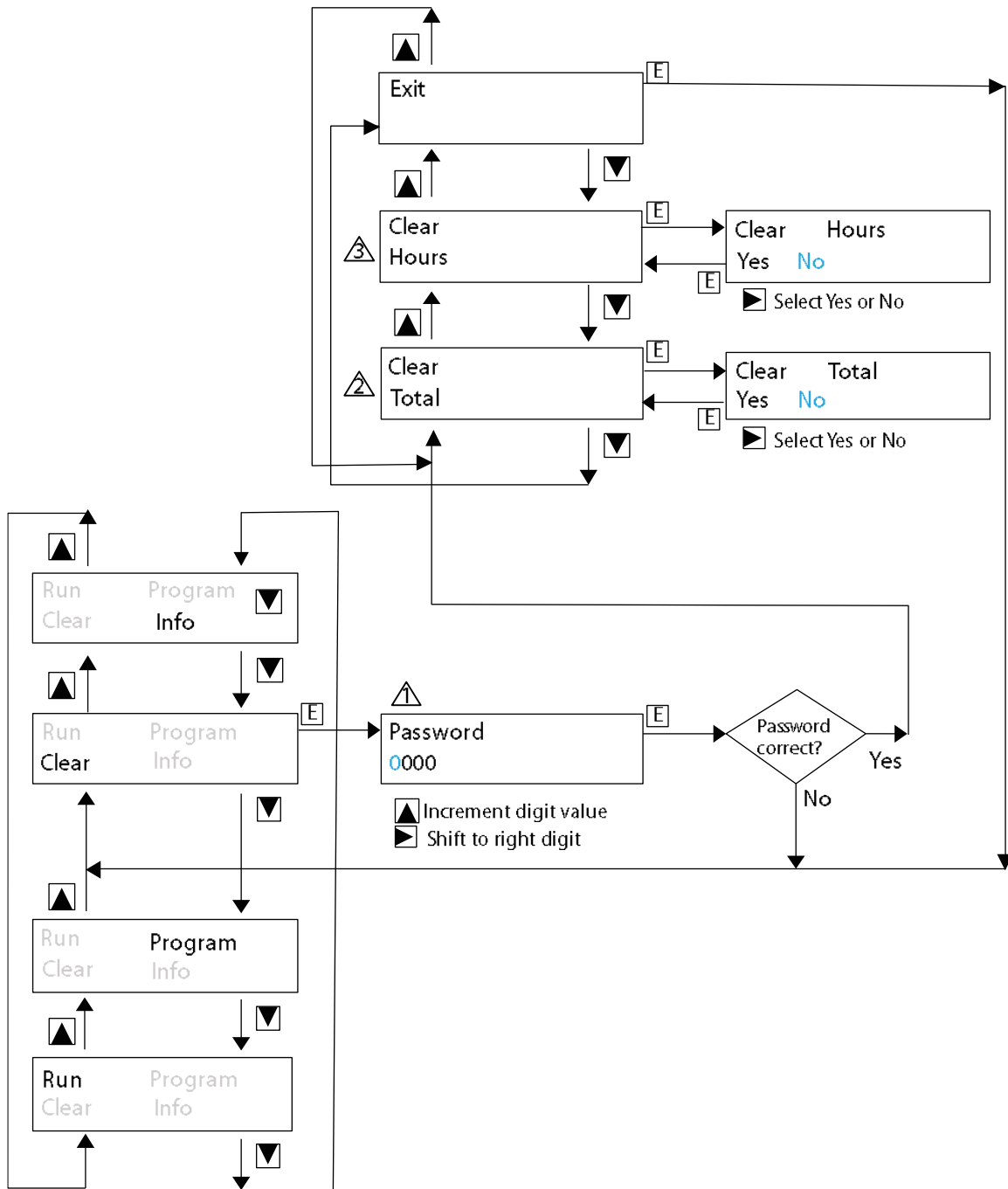


5.2.3 Info Mode



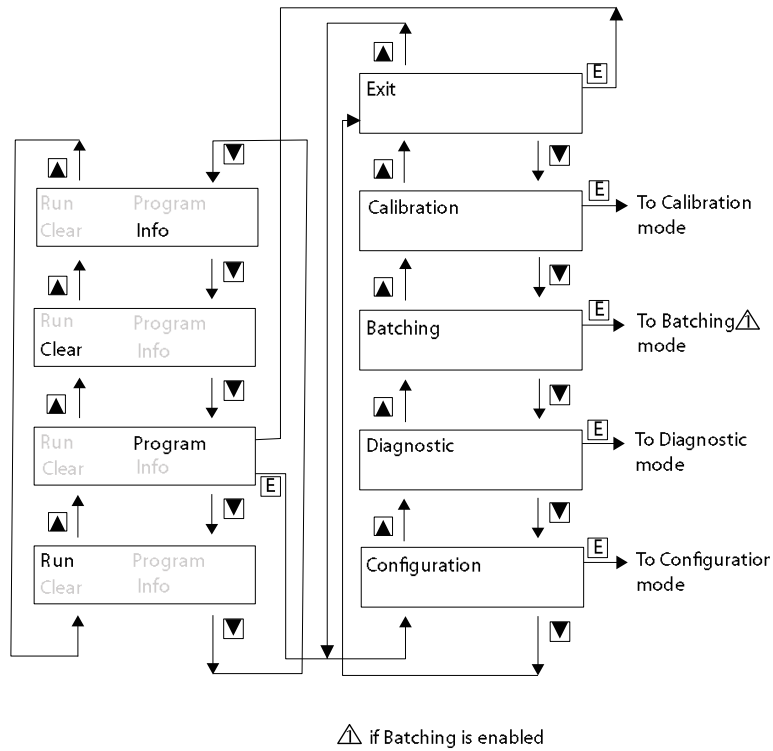
⚠ 'EcoMag 6420' displayed In case of model EcoMag 642C
 ⚠ Applicable when Communication 1s enabled

5.2.4 Clear Mode

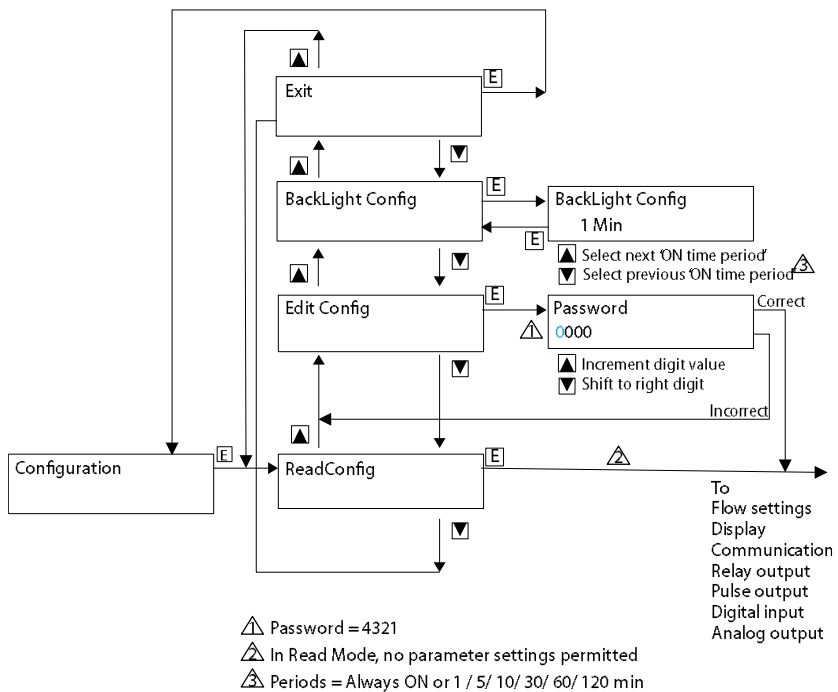


- ▲ Password= 0741
- ▲ Totaliser value can be cleared
- ▲ ON & RUN Hours, and Power Interruptions count can be cleared

5.2.5 Program Mode

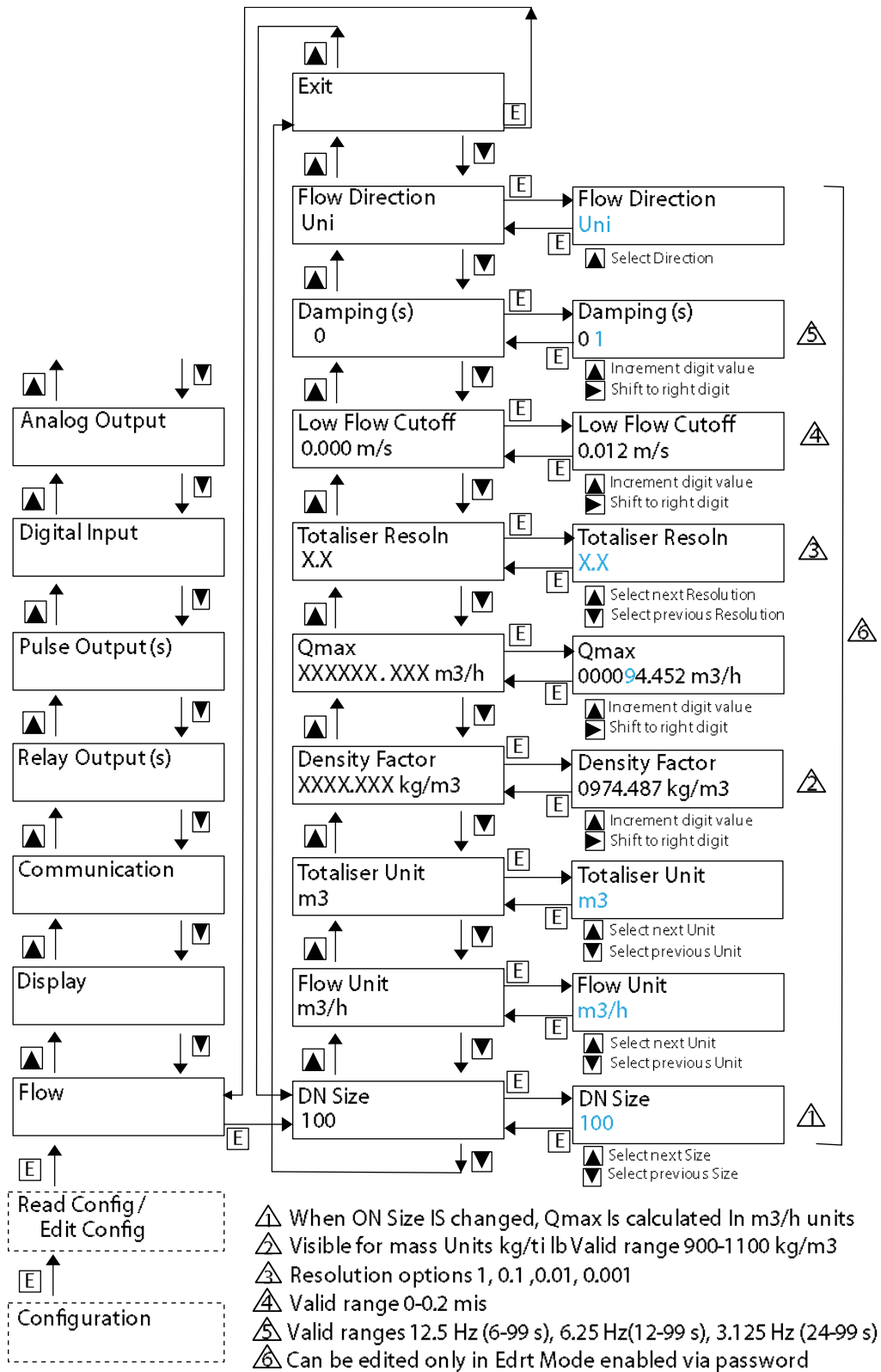


5.2.6 Configuration Mode

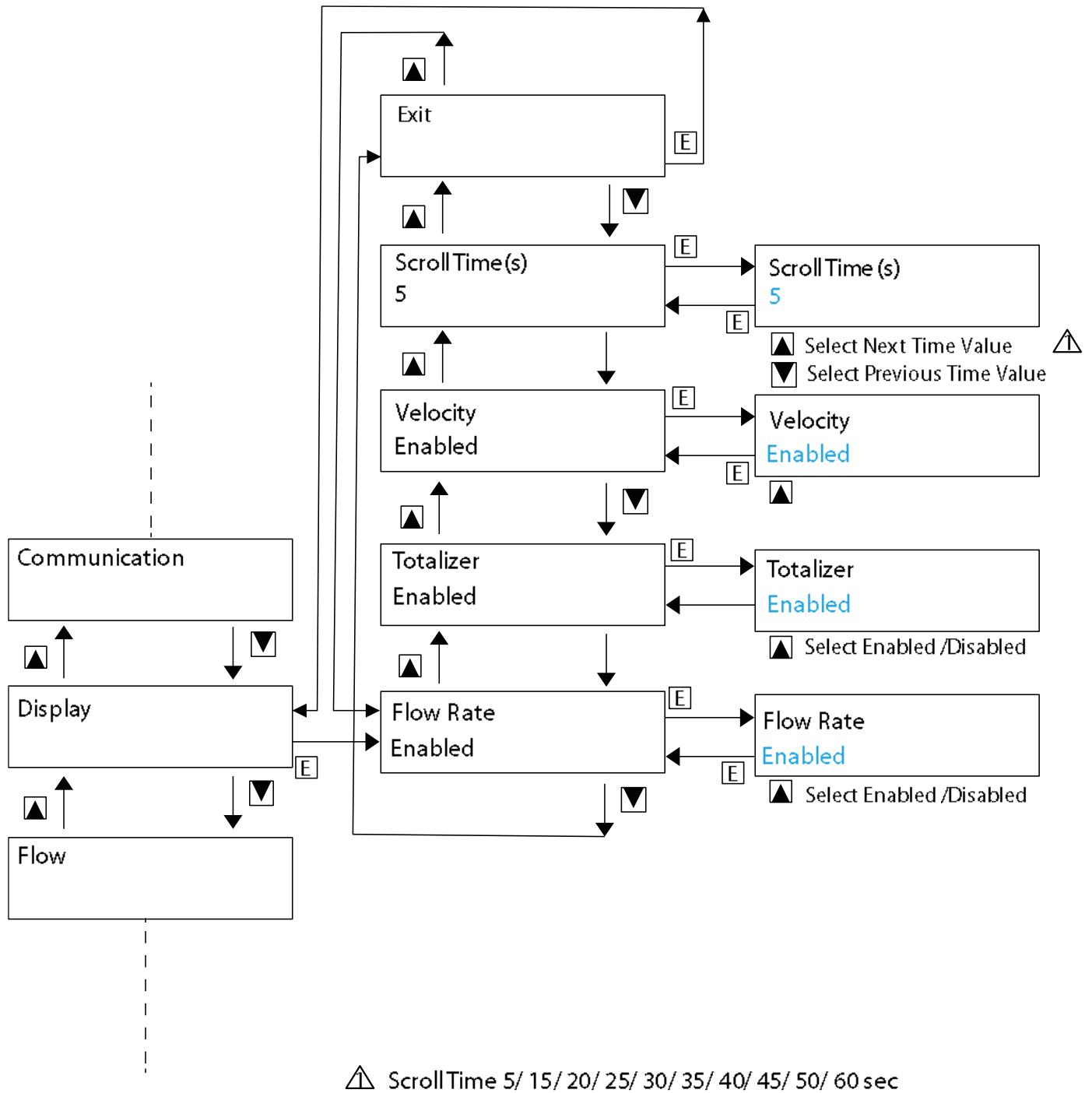


5.2.7 Flow Settings

For ON Size. Flow & Totaliser Unit options refer to the Specification chapter.



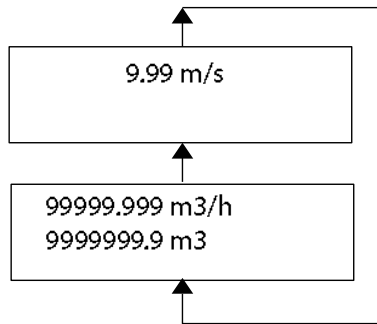
5.2.8 Display Settings



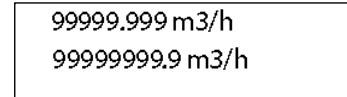
5.2.9 Display Screens (Unidirectional Flow)

- In case more than 2 parameters are programmed to be displayed, these will be displayed across multiple Screens.
- Each Screen will remain visible for the duration of the programmed Scroll Time.
- After that, the next Screen will be displayed.

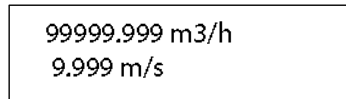
Enabled: Flow Rate, Total & Velocity



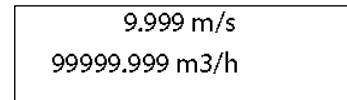
Enabled: only Flow Rate, Total



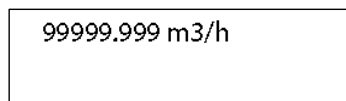
Enabled: only Flow Rate, Velocity



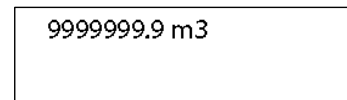
Enabled: only Velocity, Total



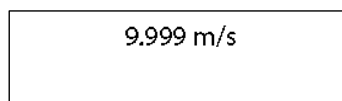
Enabled: only Flow Rate



Enabled: only Total



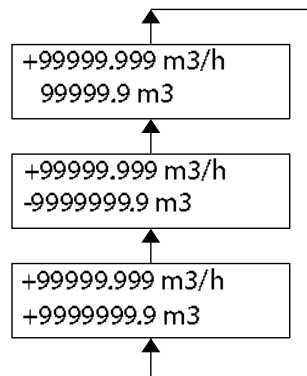
Enabled: only Velocity



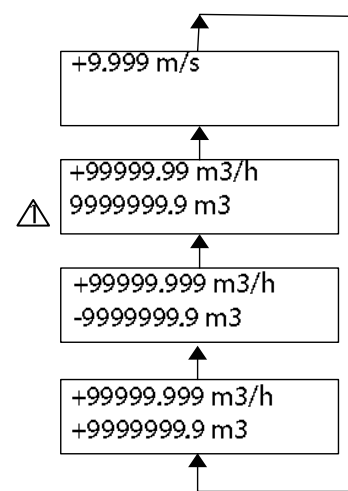
5.2.10 Display Screens (Bidirectional Flow)

- In case more than 2 parameters are programmed to be displayed, these will be displayed across multiple Screens. Each Screen will remain visible for the duration of the programmed Scroll Time.
- After that, the next Screen will be displayed.

Enabled: only Flow Rate, Total

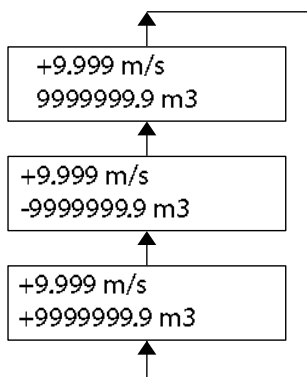


Enabled: Flow Rate, Total & Velocity

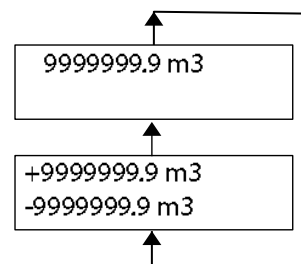


⚠ Net Totaliser

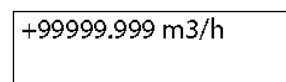
Enabled: only Velocity, Total



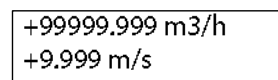
Enabled: only Total



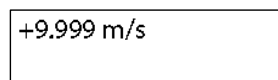
Enabled: only Flow Rate



Enabled: only Flow Rate, Velocity

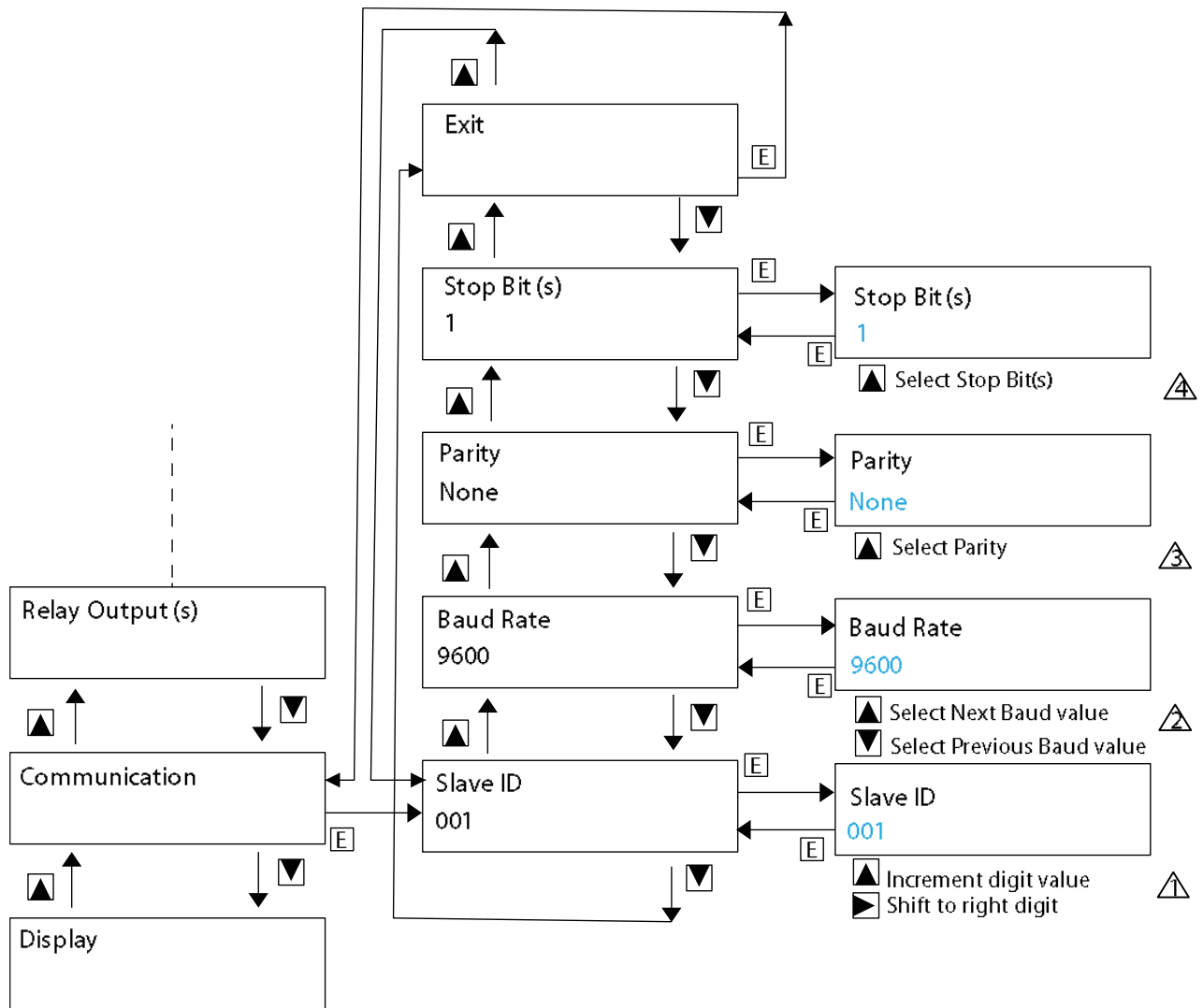


Enabled: only Velocity



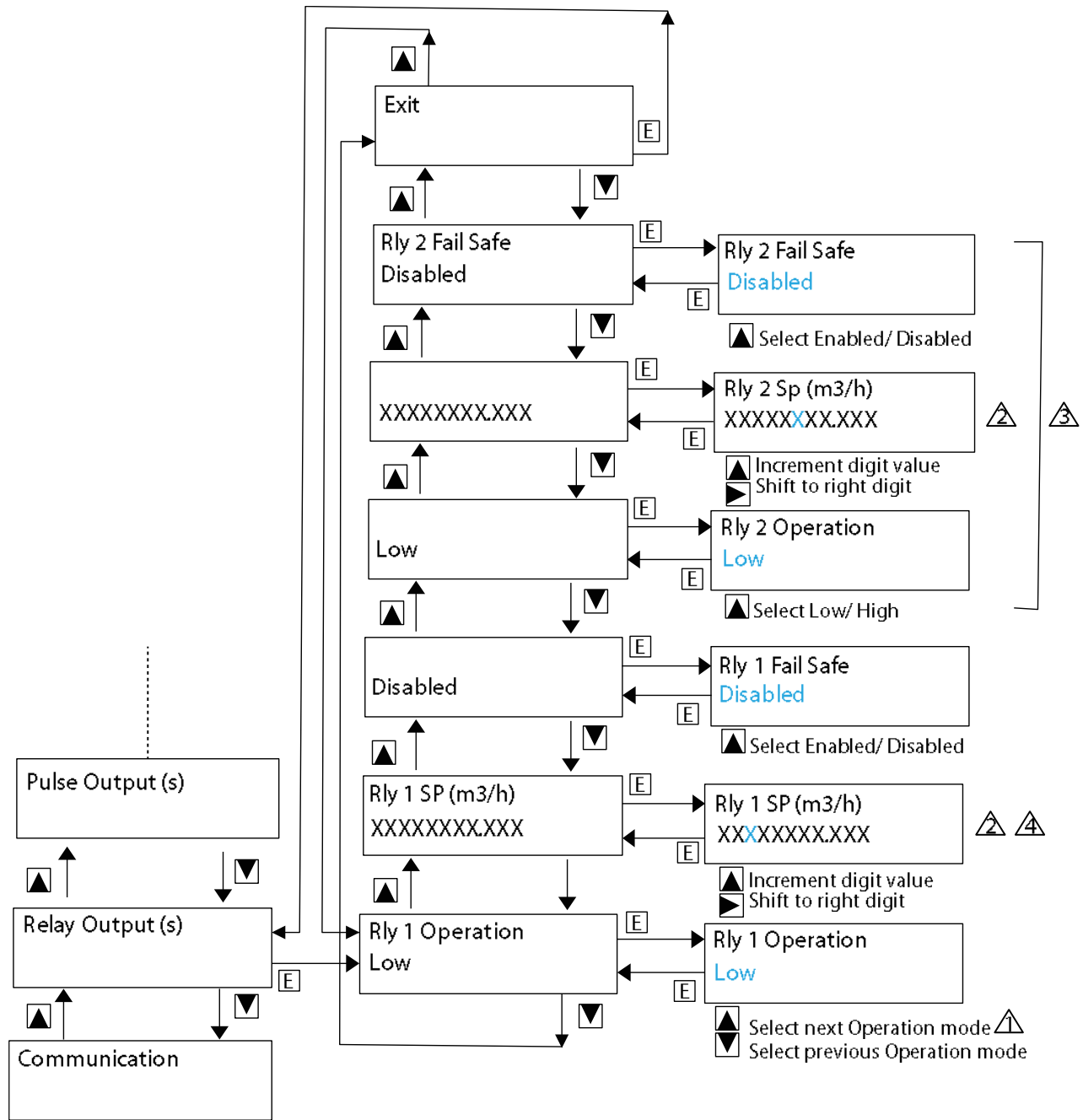
*Note: Indicated polarity of flow rate and velocity depends on actual flow direction.

5.2.11 Communication Settings



- ⚠ Slave ID 1 255
- ⚠ Baud Rate 2400/ 4800/19600/ 1 Q200138400
- ⚠ Parity Odd/ Even/ None
- ⚠ Stop Bits 1/ 2

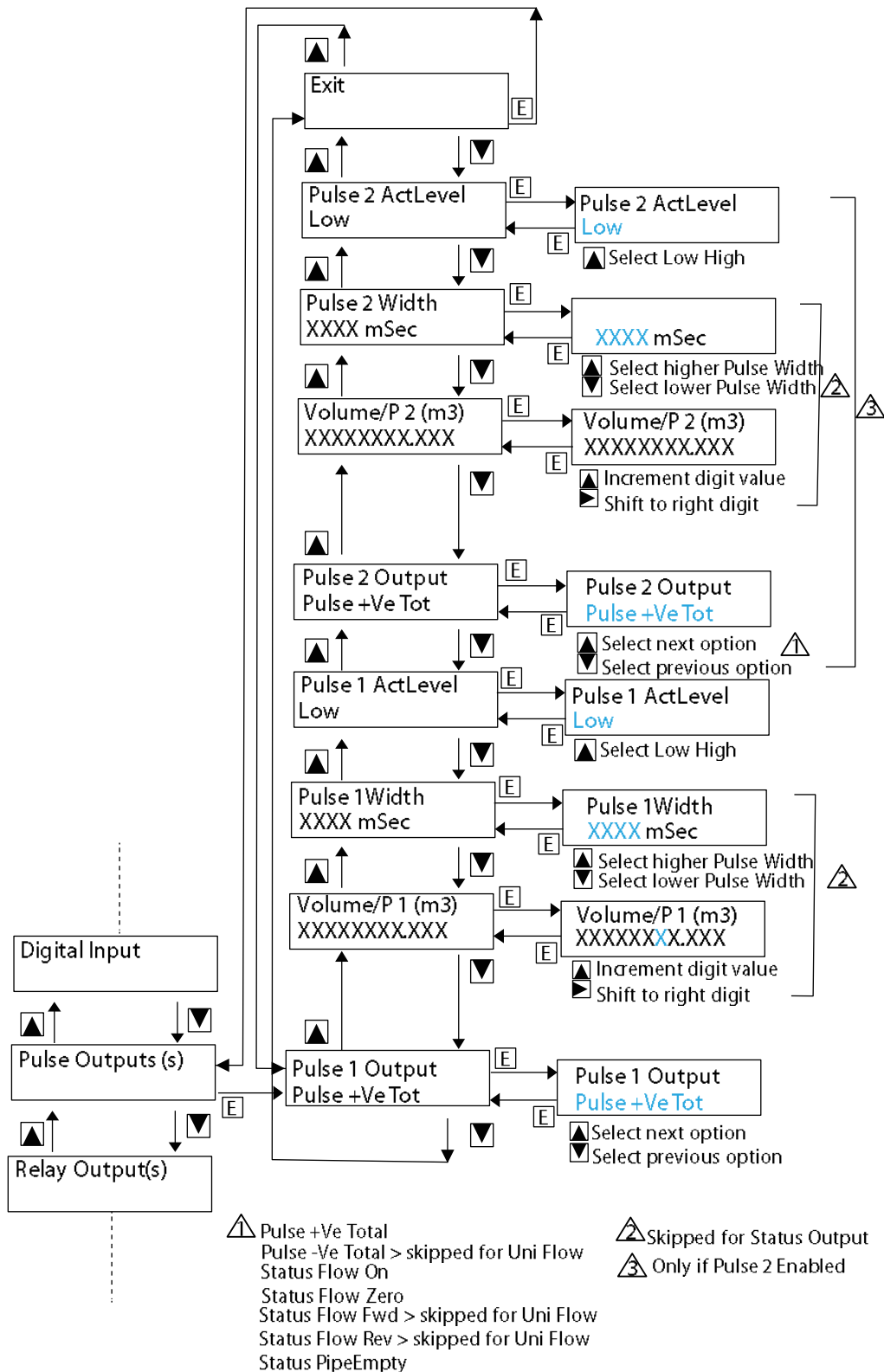
5.2.12 Relay Output Settings



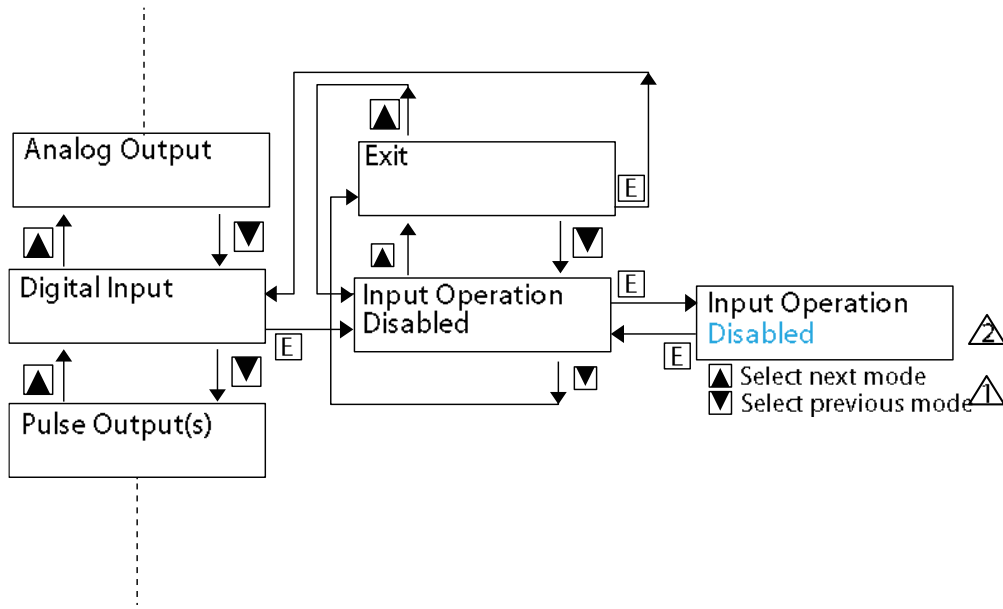
- △ Operation= Low/ High/ Batch Total (only Rly 1)
- △ X SP = Set Point, BC = Batch Count
- △ 2 Only for 2 Relay option
- △ BC "Batch Count, Operation = Batch Total

5.2.13 Pulse Output Settings

For Pulse Width value options refer to the Specification chapter

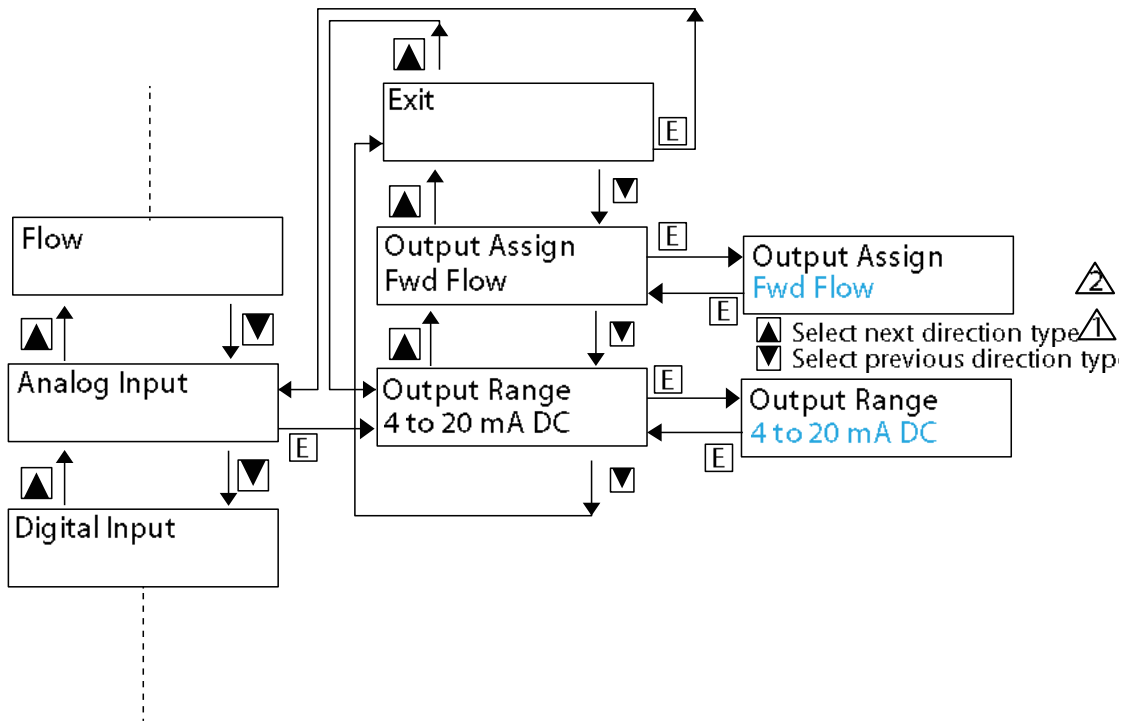


5.2.14 Digital Input Settings



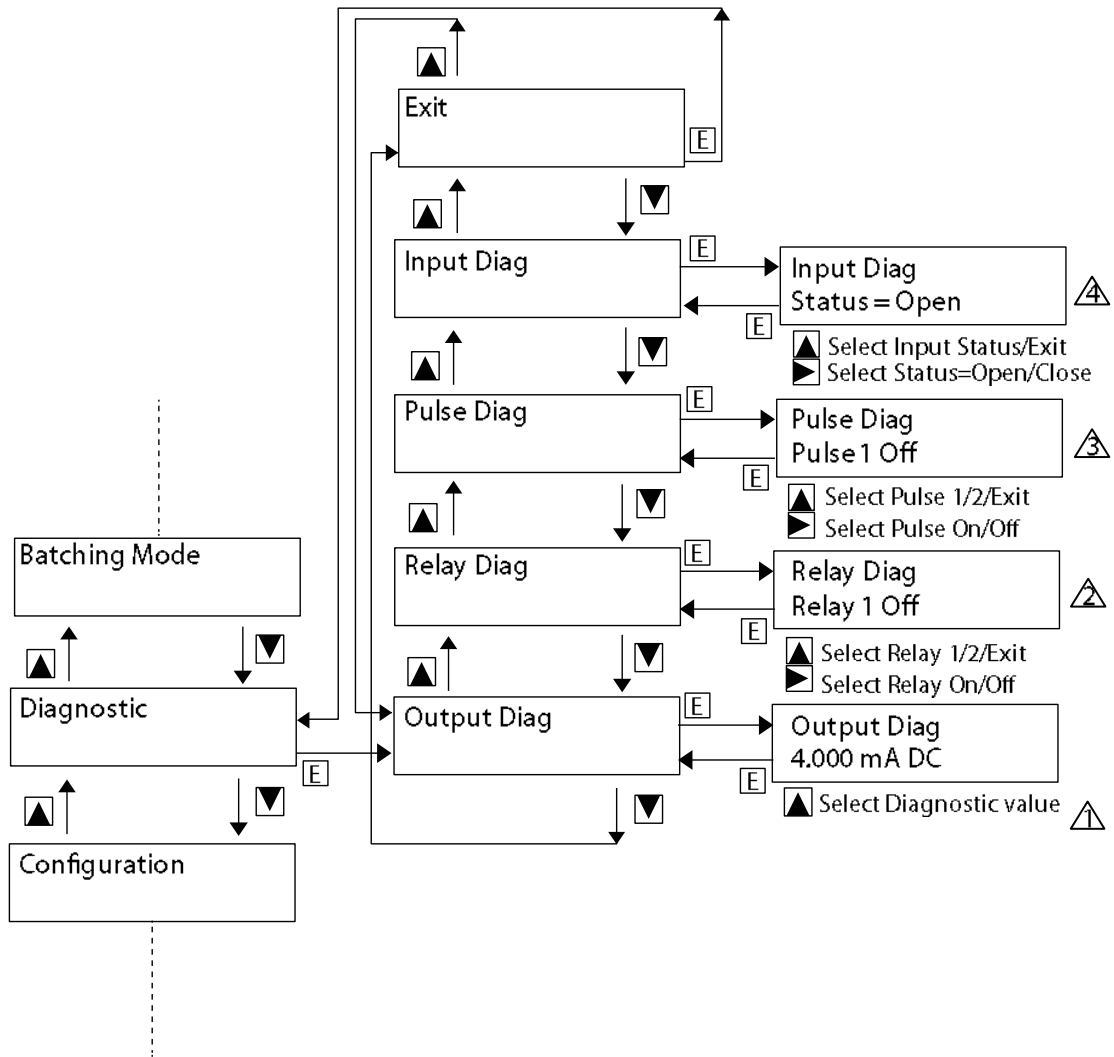
- ▲ Select Disabled/ Totaliser Reset/ Totaliser Stop/ Batching Star
- △ Applicable if Digital Input enabled

5.2.15 Analog Output Settings



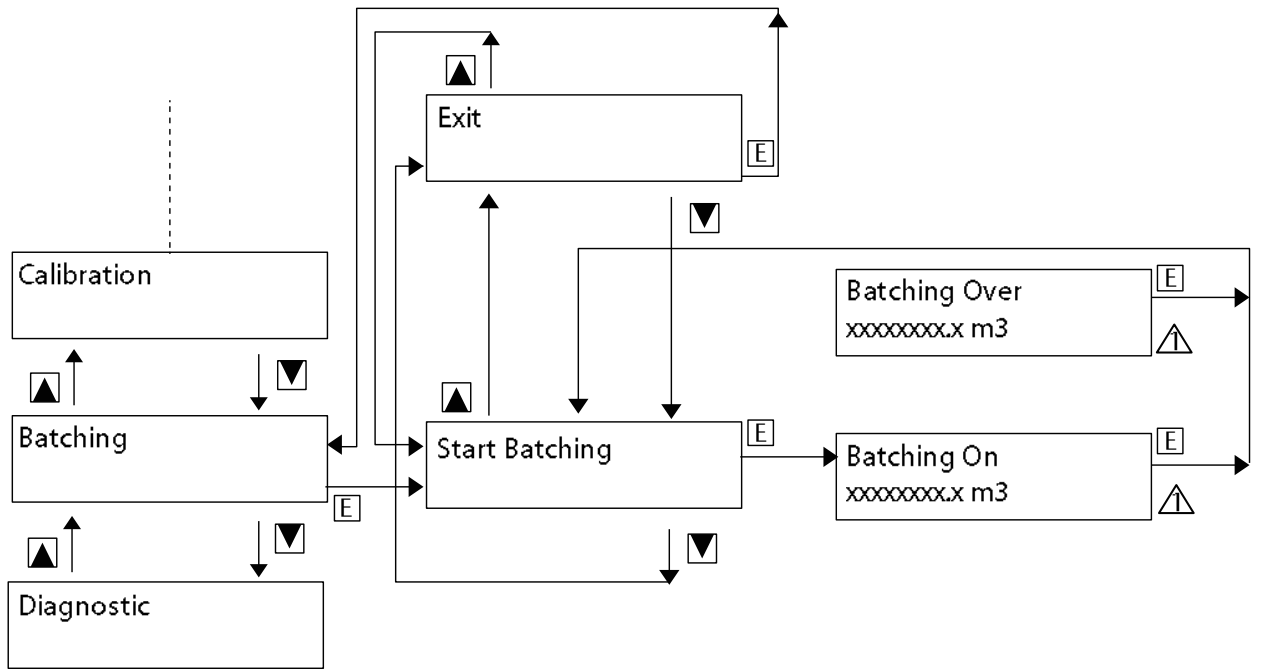
- ▲ Select Fwd Flow/ Rev Flow/ Rev+Fwd Flow
- △ Applicable if Bidirectional Flow enabled

5.2.16 Diagnostics Mode

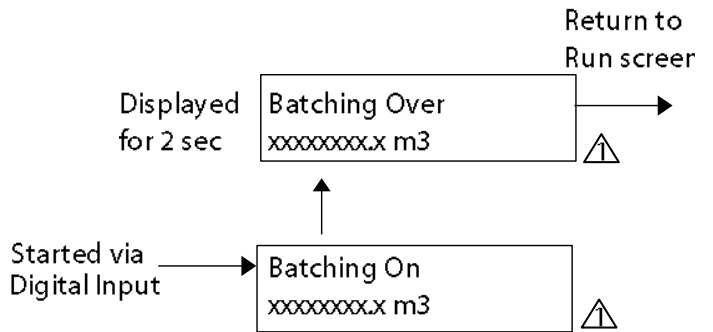


- ⚠ Diagnostic value = 4 000/ 12.000/ 20.000 mA DC/ Exit
- ⚠ Applicable if Relay Output(s) enabled
- ⚠ Applicable if Pulse Output(s) enabled
- ⚠ Applicable if Digital Input(s) enabled

5.2.17 Batching Mode



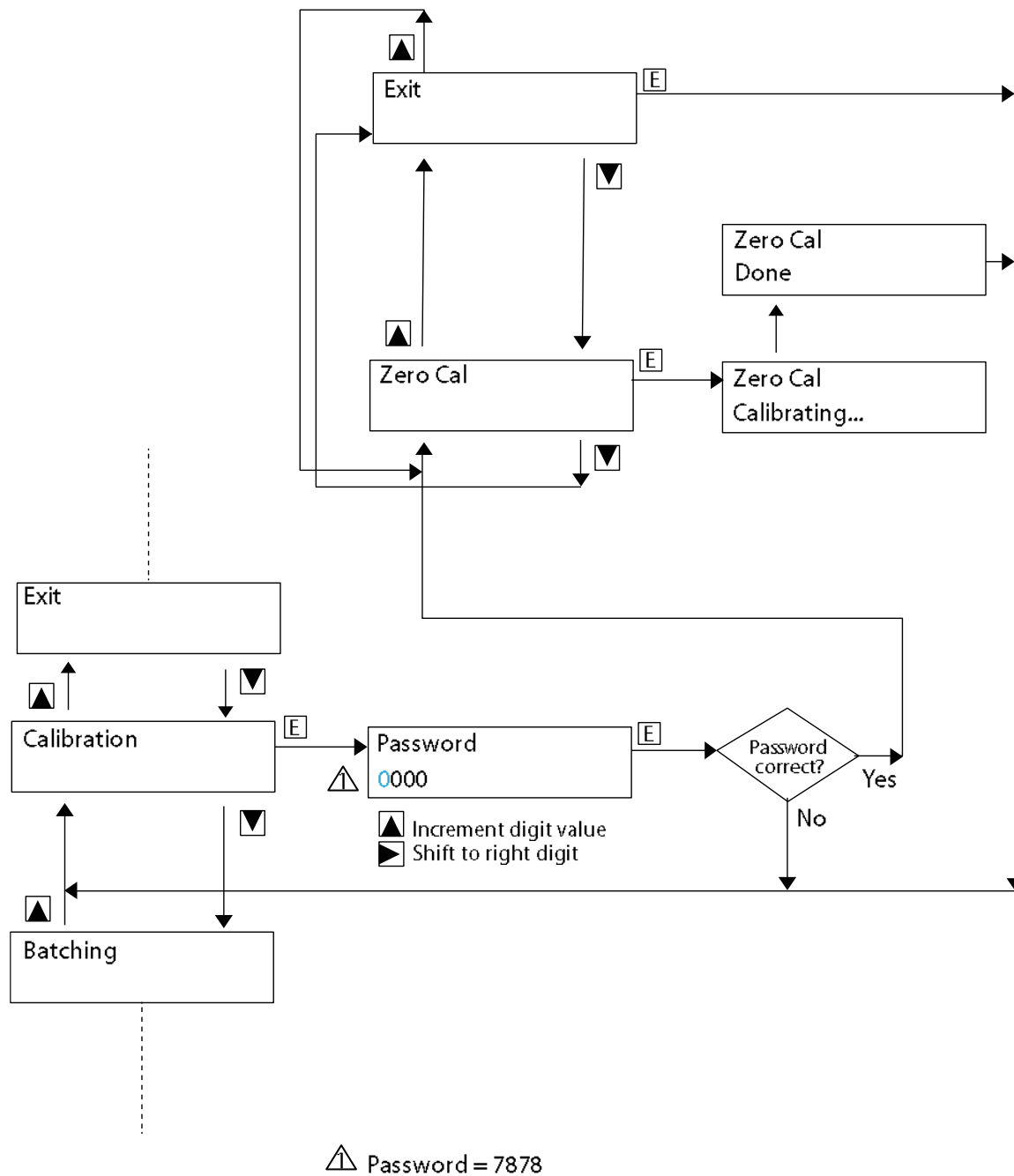
External Batch start



⚠ Resolution depends on the set Totaliser Resolution

Batch	Fail safe enabled	Fail safe disabled
Start	On (contact between Pole & NO)	Off (contact between Pole & NC)
Over	Off (contact between Pole & NC)	On (contact between Pole & NO)

5.2.18 Calibration Mode



5.3 Operational Precautions

- Keep the cover of the Transmitter well fastened.
- Take care of the O-ring or gasket to avoid damage and fixed adequately for effective sealing.
- Keep the cable gland nut tight and ensure that the cable is gripped uniformly around its circumference. This will prevent any ingress of moisture or water into the Transmitter.

- To avoid damage to the Flow Tube's lining, ensure that the process liquid is free of any abrasives at flow velocities that are close to the maximum flow rates. In case the liquid has abrasives, restrict the flow velocity to a value below 3 m/s.
- Measure and ensure that there is no source of a strong magnetic field near the Flow Tube. Such magnetic fields can interfere and alter the output signal of the Flow Meter.
- Follow these steps to check that the proper zero flow condition:
 - Stop the flow through the Flow Tube by shutting off the valve, which is immediately at the downstream of the Flow Tube.
 - This way, the Flow Tube will remain filled with liquid.
 - The display must be within 0.075% of the FS value.
- If the output is not within the above values, the possible causes can be:
 - Improper grounding.
 - Shifted zero will require Calibration.
 - Contaminated electrodes.

Note that the pulsed-DC technique of exciting the field coils ensures a stable zero or auto zeroing. It makes sure all other requirements are satisfied.

- The flowing liquid must be free of any gas bubbles as the presence of bubbles causes falsified output.

5.4 User Interface

The interface includes an easily readable LCD screen consisting of a parameter display area, measuring units and information icons. The menu can be operated by using a magnet, directed at the magnet sensing area, as shown in figure 15.

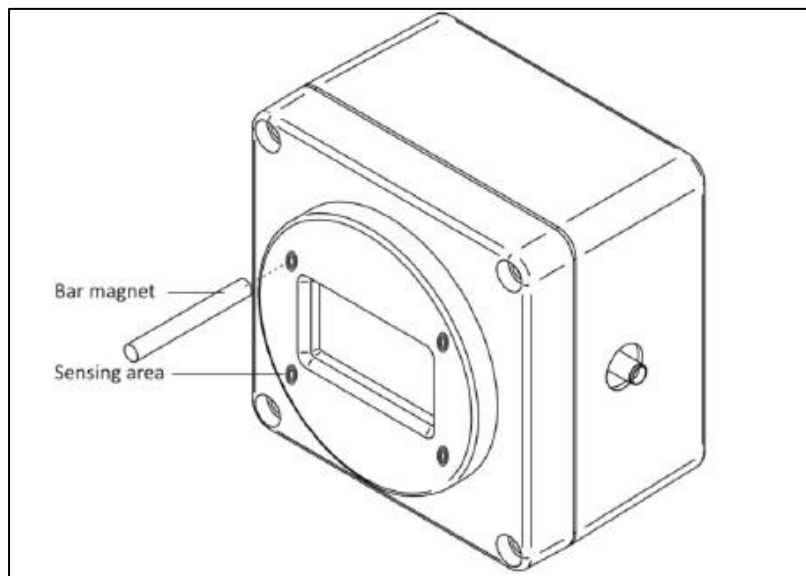


Fig 15: Operate Menu by Bringing Magnet Close or Touching the Sensing Area

The display is normally in the Run Mode and indicates the flow rate along with few other parameters and alerts if any. You can navigate the menu by using a bar magnet which

activates an internal magnetically sensitive keys located below the sensing areas (see figure 16).

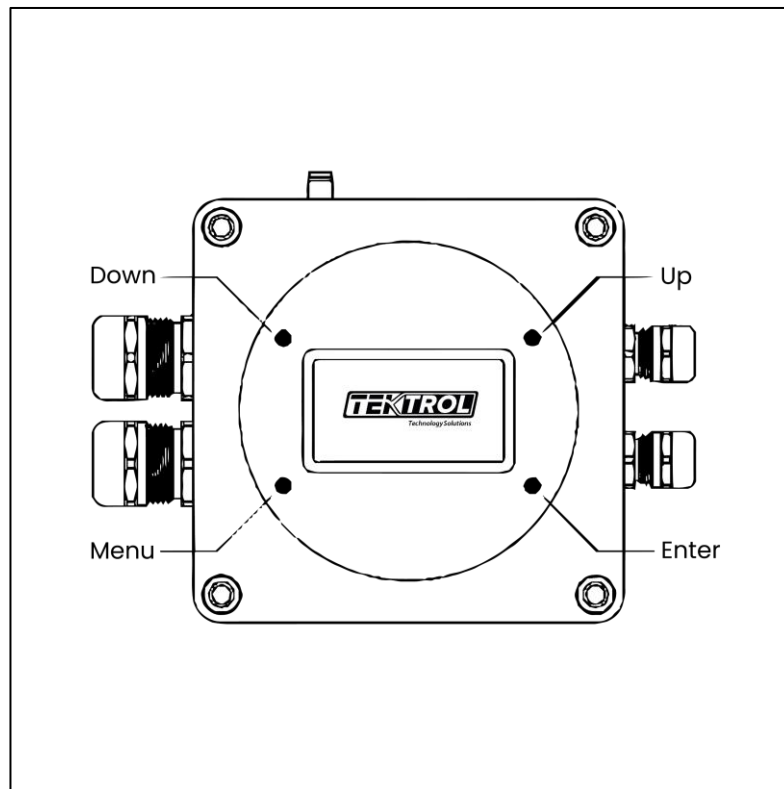


Fig 16: Magnet Sensing Area to Operate Internal Keys

Key	Function
MENU	Initiate the Parameter Setting mode Long Press to Exit Config Menu
ENTER	Select an option or save a numerical value Long press to enter Config Menu
UP	Move forward from one option to the next Increment a numerical value
DOWN	Move backward from one option to the previous Decrement a numerical value

6 Display Screens

6.1 Power-on



6.2 Display Icons

As part of the Runtime screens, the top status bar conveys certain information. The various icons and their meaning are described below.



Battery status
Indicates the battery charge level.



Signal strength
Indicates the cellular network signal strength.



Empty pipe alarm
Indicates that the pipe is empty.
This means that the water level within the flow tube is less than half. It will disappear when the flow tube is filled with water.



Excitation alarm
Indicates a problem with the connection between the coil and the electronic PCB. It will disappear after the coil is connected properly.



NOTE

If the empty pipe alarm occurs before the excitation problem, the excitation problem, the excitation alarm will not show up. Only after empty pipe alarm disappears, the excitation alarm will appear.

Q

Calibration mode

This indicates that when the flowmeter is started it works in the calibration mode. In the calibration mode, the excitation and sampling are carried out continuously. And the flow changes and reactions are relatively rapid. The flowmeter works in its maximum power state. The symbol will disappear when the set calibration mode time is complete.

T40

Calibration time (min)

The duration of calibration can be set through the menu. After the system is started up, it will work in the calibration mode by default. This symbol indicates the countdown, and will disappear when the number after the letter "T" reaches 0.

P25

Frequency (Hz)

The number after the letter "P" indicates the frequency of the pulse output when it is active.

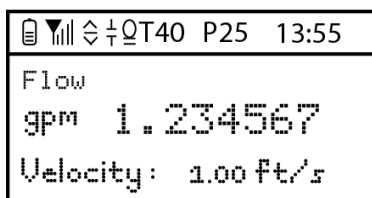
15:45

System time

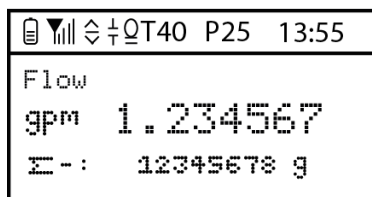
This indicates the current time. The system time can be set via RTC calibration menu.

6.3 Runtime

The status bar and instantaneous flow rate are displayed in all the Runtime screens. The other parameters are displayed on the different screens sequentially.



Velocity



Negative totalizer

P25 13:55	
Flow	
gpm	1.234567
Σ+:	12345678 g

Positive totalizer

P25 13:55	
Flow	
gpm	1.234567
Σ all:	12345678 g

Gross total flow

P25 13:55	
Flow:	0.000gpm
Σ +:	3.255g
Velocity:	0.000ft/s
	psi

All parameters

6.4 Menu

Menu password is 7678.

S E T	1. Basic
	2. Comm
	3. Calibration
	4. Data Log

S E T	5. Info
-------------	---------

6.5 Menu > Basic

S E T	1. Pulse
	2. Flow Unit
	3. Empty Pipe
	4. REVEN

6.6 Menu > Comm

S E T	1. IP 2. Sr. No. 3. Slave ID 4. Baud
-------------	---

S E T	5. Parity
-------------	-----------

6.7 Menu > Calibration

S E T	1. Auto Zero Cal 2. Zero Cal 3. Cal Time 4. Conu Factor
-------------	--

S E T	5. Sensot Factor 6. Sensor Factor1 7. Sensor Factor2 8. DN Size
-------------	--

S E T	9. Low Flow 10. Sampling 11. Damping 12. Reset Tot
-------------	---

S E T	13. RTC
-------------	---------

6.8 Menu > Data Log

ID:00000 00:15 01-01	
Flow:	0.000 gpm
Σ *:	3.255 g
Velocity:	0.000 ft/s
	psi

Log interval is fixed at 15 min. Hence 96 logs per day. ID00001 is the first valid log on the present year occurring at 00:15 on 1st Jan of the year.

ID:00015 00:15 01-01
No Record

In case of no log due to communication issues.

6.9 Menu > Info

Info
Model: MasBP 6440 U2 -Ver 1.0
Quit RST

6.10 Password

Password
0000
Esc Entr

Configuration access is provided to only Adept engineer

6.11 Menu > Basic > Parameters

Pulse
Value: 1 g
Quit -- ++ Entr

Flow Unit
Unit: gpm
Quit -- ++ Entr

Options L/h, m3/h

Empty Pipe
Threshold : 50
Quit -- ++ Entr

This is factory set. Not to be modified by user.

Reverse EN	
Disable	Enable
Quit --	++ Entr

6.12 Menu > Comm

IP	
014.143.045.232:02114	
<< --	++ >>

This is factory set. Not to be modified by user.

Sr.No.	
00000002115581	
<< --	++ >>

This is factory set. Not to be modified by user.

Slave ID	
001	
<< --	++ >>

Range 001 to 255.

Baud	
9600	
Quit --	++ Entr

Options 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 256000, 512000, 912000

Parity	
None	
Quit --	++ Entr

Options None, ODD, Even

i NOTE

The Stop Bit parameter is internally fixed at a value of 1.

6.13 Menu > Calibration > Parameters

Auto Zero Cal	
Factor: -2	LSB
Quit	RUN

Select 'Quit' if you do not want to perform Zero Calibration. Select 'RUN' to continue with Auto Zero Calibration.

Zero Cal	
Samp: 21	0.053 ft/s
Factor: 499	LSB
Quit --	++ Entr

This is factory set. Not to be modified by user.

Cal Time	
15 min	
Quit --	++ Entr

This is factory set. Not to be modified by user.

Conu Factor	
Velocity: 0.003 ft/s	
Factor: 1.1170	
<< --	++ >>

This is factory set. Not to be modified by user.

Sensor Factor	
Flow: 0.000000 gpm	
k : 1.6789	
<< --	++ >>

This is factory set. Not to be modified by user.

```
Sensor Factor1
-----
Velocity: 0.412 ft/s
k       : 0.9820
<<  --          ++  >>
```

This is factory set. Not to be modified by user.
Press Enter to set.

```
Sensor Factor1
-----
Set     : 0.412 ft/s
k       : 0.9820
<<  --          ++  >>
```

```
Sensor Factor2
-----
Velocity: 0.412 ft/s
k       : 0.9820
<<  --          ++  >>
```

This is factory set. Not to be modified by user.

```
Sensor Factor2
-----
Set     : 0.412 ft/s
k       : 0.9820
<<  --          ++  >>
```

```
DN Size
-----
      80
Quit  --          ++  Entr
```

This is factory set. Not to be modified by user.
Available options 25,32,40,50,65,80,100,125,150,200,250,300,
350,400,450,500,600,700,800,900,1000,1200

```
Low Flow
-----
LFC:  0.015 ft/s
Quit  --          ++  Entr
```

This can be set by user.

Sampling	
Interval:	1000 ms
Quit --	++ Entr

This is factory set. Not to be modified by user.

Damping	
Damping:	32
Quit --	++ Entr

This can be set by user.

Reset Tot		
+:	1234567	9
-:	34567	9
Σ:	120000	9

This can be set by user.

RTC	
2024-01-01	14:19:56
Quit --	++ Entr

This can be set by manually by user. This is also automatically set via GPRS communication.

7 Operational precautions

- Keep the cover of the Transmitter well fastened, taking care that the O-ring/gasket are undamaged and properly seated for effective sealing.
- Keep the nuts of the cable glands tight and ensure that the cables are gripped uniformly around their circumference to prevent any ingress of moisture or water into the Transmitter.
- To avoid damage to the Flow Tube's lining, ensure that the process liquid is free of any abrasives at flow velocities that are close to the maximum flow rates. In case the liquid has abrasives, restrict the flow velocity to a value below 9 ft/s
- Measure and ensure that there are no sources of strong magnetic field in the immediate vicinity of the Flow Tube. Such magnetic fields can interfere and alter the output signal of the Flowmeter.
- Follow these steps to check that the zero-flow condition is proper
 - Stop the flow through the Flow Tube by shutting off the valve which is immediately downstream of the Flow Tube.
 - This way the Flow Tube will remain filled with liquid.
 - The display must be within 0.075% of the FS value.
- If the output is not within above values, the possible causes can be
 - Improper grounding
 - Shifted zero. This will require Calibration. Contact Adept Support.
 - Contaminated electrodes

Note that the coil excitation technique ensures a stable zero or auto zeroing, provided all other requirements are satisfied.
- The flowing liquid must be free of any gas bubbles as the presence of bubbles causes falsified output.

8 Troubleshooting

Quick Checks

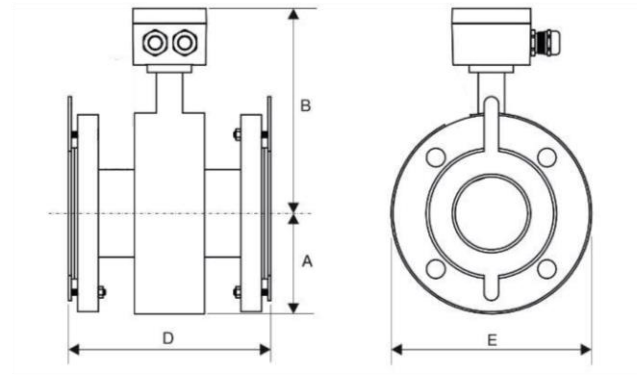
No.	Problem observed	Possible cause	Corrective action
1	Transmitter does not power up.	The internal battery has discharged	Contact Tek-trol Support.
2	Indicated flowrate appears locked at zero.	The liquid is flowing in the direction opposite to that marked on the Flow Tube.	Correct the direction of the flow.
3	Indicated flowrate is slightly above zero under zero flow condition.	<ul style="list-style-type: none"> a. The flow is not essentially zero. There exists a small amount of trickle flow b. Grounding is not proper. 	<ul style="list-style-type: none"> a. Force the flow to zero by completely shutting off the downside valve and check. b. Correct the grounding.
4	Indicated flowrate is not steady.	<ul style="list-style-type: none"> a. Flow itself is not steady but pulsating or irregular. b. Gas or air bubbles are present in the flowing liquid. c. The flowing liquid has a varying conductivity. 	<ul style="list-style-type: none"> a. Allow the flow to stabilize and then check. b. Identify and eliminate the cause of the air or gas bubbles, or wait until liquid is free of bubbles. c. Allow to flowing liquid to attain a stable conductivity. d. Correct the grounding.
5	Indicated flowrate alternates between very high and very low values.	Grounding is not proper.	Correct the grounding.
6	No pulse output.	<ul style="list-style-type: none"> a. The external connections are incorrect. b. External DC power supply absent. 	<ul style="list-style-type: none"> a. Check and correct the connections. b. Check and re-establish the supply.
7	No GPRS communication.	<ul style="list-style-type: none"> a. Signal strength low. b. Antenna not connected properly. c. SIM not installed properly. 	<ul style="list-style-type: none"> a. Correct wiring as per diagram. b. Set correct communication parameters
8	Modbus communication issues	<ul style="list-style-type: none"> a. Wiring is not correct. b. Communication settings are incorrectly set. 	<ul style="list-style-type: none"> ▪ Correct wiring as per diagram. ▪ Set correct communication parameters

9 Annexure

9.1 Annexure 1: Flowmeter size v/s Flow Rate at Flow Velocity 3ft/s

USGPM	DN Size	m ³ /h	LPM	LPS
7.779	25	1.766	29.45	0.490
12.75	32	2.909	48.25	0.804
19.92	40	4.523	75.39	1.256
31.12	50	7.068	117.8	1.963
52.59	65	11.94	199.1	3.317
79.66	80	18.09	301.6	5.025
124.47	100	28.27	471.2	7.852
194.48	125	44.18	736.2	12.27
280.06	150	63.61	1060.1	17.67
497.88	200	113.08	1884.7	31.41
777.93	250	176.69	2944.8	49.08
1120.2	300	254.43	4240.5	70.68
1524.8	350	346.31	5771.8	96.197
1991.5	400	452.32	7538.6	125.65
2520.5	450	572.47	9541.9	159.04
3111.7	500	706.75	11779	196.32
4480.9	600	1017.7	16962	282.70
6099.5	700	1385.2	23090	384.79
7966.0	800	1827.2	30453	507.54
10084	900	2289.9	38169	636.17
12447	1000	2840.8	47347	789.12
17923.5	1200	4070.8	67848	1130.8

9.2 Annexure 2: Dimensions



Note: All dimensions in mm

Inch (DN)	A Inch (mm)	B Inch (mm)	C Inch (mm)	D Inch (mm)	E Inch (mm)
25, 32	73	180	180	200	146
40, 50	88	195	195	200	175
65	94	201	201	200	187
80	102	209	209	200	203
100	117	224	224	250	234
125	136	243	243	250	272
150	154	261	261	300	308
200	180	287	287	350	359
250	207	314	314	400	413
300	Refer Notes below	324	324	500	Flange OD
350		355	355	500	
400		380	380	600	
450		406	406	600	
500		431	431	600	
600		479	479	600	
700		522	522	700	
800		582	582	800	
900		615	615	900	
1000		655	655	1000	
1200		754	754	1200	



NOTE

1. Tolerance for B is $\pm 0.16''$
2. Tolerance for D: $\frac{1}{2}''$ to $8'' \pm 0.17''$ | $10''$ and above $\pm 0.2''$
3. Refer respective flange OD for dimension E for sizes $12''$ and onward.
4. Dimension A for sizes $12''$ and onward is half of flange OD
5. Add a total of $0.25''$ for the two Linear protection rings to dimension 'D'.

9.3 Annexure 3: Modbus Table

The Flowmeter supports Modbus RTU protocol over RS 485. Available parameters are as follow.

The default communication parameters of RS 485 are N,8,1, and the baud rate are 9600.

Address In Hex	Data Type	Length (word)	Register Name	Register Description
0x0000	Long integer	2	flow rate	Divided by 1000, unit m/s
0x0002	Long integer	2	instantaneous traffic	Instantaneous flow divided by 1000, unit m ³ /h
0x0004	Long integer	2	Forward cumulative flow	Divide by 1000, the unit is fixed m ³
0x0006	Long integer	2	Reverse cumulative flow	Divide by 1000, the unit is fixed m ³
0x0008	Long integer	2	Net cumulative flow	Divide by 1000, the unit is fixed m ³
0x000A	Integer	1	Status register	Status register
0x000B	Integer	1	Empty register	Invalid value, cannot be read
0x000C	Integer	1	Pressure	Divided by 1000, the unit is fixed kg/cm ²
0x000D	Integer	1	MTP	Sampling detection value of whether the pipeline is empty
0x000E	Integer	1	Empty register	Invalid value, cannot be read
0x000F	Integer	1	Empty register	Invalid value, cannot be read




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