User's Manual

Magnetic Flowmeter AY6410 Installation Manual

IM-AY6410-00

Magnetic Flowmeter
AY6410

This manual outlines the basic guidelines for installation and wiring procedures. For the items which are not covered in this manual, read the user's manuals and the general specifications as listed in Table 1.1.

Contents

1 2 3 4 5 6 7 8

adept
A Yokogawa Company

IM-AY6410-00
1st Edition

1. Introduction

This manual provides the basic guidelines for installation, wiring procedures and basic operation of Magnetic Flowmeter AY6410 with HART and Modbus protocol. For the items which are not covered in this manual, read the applicable user's manuals and general specifications as listed in Table 1.1. These documents can be downloaded from the YOKOGAWA's website. To ensure correct use of the product, read these manuals thoroughly and fully understand how to operate the product before operating it. For method of checking the model and specifications, read Chapter 2 and general specifications as listed in Table 1.1.
Website address: https://www.yokogawa.com/solutions/products-and-services/measurement/field-instruments-products/flow-meters/magnetic-flowmeters/

Table 1.1 Manual and General Specifications List

Model	Document Title	Document No.
AY6410	Read Me First	RMF-AY6410-00
	Installation Manual	IM-AY6410-00 (this manual)
	General Specifications	GS-AY6410-00 [Size: 10 to 1800 mm], GS-AY6410-01 [Size: 25 to 400 mm]

■ Precautions Related to the Protection, Safety, and Alteration of the Product

The following safety symbol marks are used in this manual and product.

WARNING

A WARNING sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death of personnel.

CAUTION

A CAUTION sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

IMPORTANT

An IMPORTANT sign denotes that attention is required to avoid damage to the product or system failure.

NOTE

A NOTE sign denotes information necessary for essential understanding of operation and features.

The following symbols are used in the Product and the manual to indicate the accompanying safety precautions:

Protective earthing connection point

Caution
This symbol indicates that the operator must refer to an explanation in the user's manual in order to avoid the risk of injury or death of personnel or damage to the product.

- For the protection and safe use of the product and the system in which this product is incorporated, be sure to follow the instructions and precautions on safety that is stated in this manual whenever you handle the product. Take special note that if you handle the product in a manner that violates these instructions, the protection functionality of the product may be damaged or impaired. In such cases, YOKOGAWA and Adept do not guarantee the quality, performance, function, and safety of product.
- When installing protection and/or safety as lighting protection devices and equipment for the product and control system or designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of the processes and lines that use the product and the control system, the user should implement these using additional devices and equipment.
- This product is not designed or manufactured to be used in critical applications that directly affect or threaten human lives. Such applications include nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities, and medical equipment. If so used, it is the user's responsibility to include in the system additional equipment and devices that ensure personnel safety.
- Do not modify this product.
- YOKOGAWA and Adept will not be liable for malfunctions or damage resulting from any modification made to this product by the customer.
- The product should be disposed of in accordance with local and national legislation/regulations.

■ Regarding This User's Manual

- This manual should be provided to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without YOKOGAWA's written permission.
- YOKOGAWA and Adept makes no warranty of any kind with regard to this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, inform the nearest YOKOGAWA sales office or Adept sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made products.
- Note that changes in the specifications, construction, or component parts of the product may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.
- This manual is intended for the following personnel;
  Engineers responsible for installation and wiring of the product.
  Personnel responsible for normal daily operation of the product.
- To ensure correct use, read this manual and the applicable manuals as listed in Table 1.1 thoroughly before starting operation. Read the general specifications as listed in Table 1.1 for its specification.

■ Trademarks:

- HART is a registered trademark of FieldComm Group.
- Modbus is a registered trademark of AEG Schneider.
- All companies and product names mentioned in this manual are trade names, trademarks or registered trademarks of their respective companies.
- In this manual, trademarks or registered trademarks are not marked with ™ or ®.

1.1 For Safe Use of Product

For the protection and safe use of the product and the system in which this product is incorporated, be sure to follow the instructions and precautions on safety that is stated in this manual whenever you handle the product. Take special note that if you handle the product in a manner that violated these instructions, the protection functionality of the product may be damaged or impaired. In such cases, YOKOGAWA and Adept shall not be liable for any indirect or consequential loss incurred by either using or not being able to use the Product.

(1) General

- The transmitter complies with IP67, and the sensor complies with IP67/IP68.
- This product is designed for indoor and outdoor use.

CAUTION

Operation of this product in a residential area may cause radio interference, in which case the user is required to take appropriate measures to correct the interference.

IMPORTANT

The minimum ambient temperature is limited by the minimum fluid temperature of the sensor (the lining). For more information, read the applicable general specifications as listed in Table 1.1.
The Flowmeter may be used in an ambient humidity where the relative humidity ranges from 0 to 95%.

WARNING

- **Purpose of use**
  This product is the Magnetic Flowmeter for use of measuring the liquid flow. Do not use this product for other purposes.

WARNING

- Installation, wiring and maintenance of the magnetic flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to installation, wiring and maintenance.
- Wiring work should be carried out using appropriate wires, sleeves, crimping, and torque. Use terminal with insulating cover for the power supply wiring and protective grounding wiring. Do not pull the wires excessively in order to prevent electric shocks caused by their damage.
- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- Ensure that the power supply is off in order to prevent electric shocks.
- When opening the cover, wait for more than 20 minutes after turning off the power. Only expert engineer or skilled personnel are permitted to open the cover.
- When opening and closing the transmitter cover, be sure to handle the transmitter cover carefully so that there are no damage and foreign matter adhesion at its threads and O-ring.
- This product employs the parts which are affected by a function damage caused by static electricity. Thus, you should do the antistatic work using an anti-static wrist band for it and be careful to avoid touching each electrical parts and circuitry directly.
- When connecting the wiring, check that the supply voltage is within the range of the voltage specified for this product before connecting the power cable. In addition, check that no voltage is applied to the power cable before connecting the wiring.
- To prevent electric shocks, ensure the electrical wiring cover is completely attached after the wiring work.
- To prevent electric shocks, do not apply voltage exceeding the rated limits to each input/output terminals.

IMPORTANT

- When closing the cover, close it with both hands until the cover does not turn in order to bring the housing and cover into tight contact.
- Tighten while confirming that the cover rotates smoothly.

(2) Installation

WARNING

- The magnetic flowmeter is a heavy product. Be careful that no damage is caused personnel through accidentally dropping it, or by exerting excessive force on the magnetic flowmeter. When moving the magnetic flowmeter, always use a trolley and have at least two people carry it.
- Do not apply excessive weight, for example, a person stepping on the magnetic flowmeter.
- The magnetic flowmeter must be installed within the specification conditions.
- **Connect the Protective Earthing Connection Point**
  Ensure to connect the protective grounding to prevent electric shock before turning on the power.
- **Do Not Impair the Protective Earthing**
  Never cut off the internal or external protective grounding wire or disconnect the wiring of the protective grounding terminal. Doing so invalidates the protective functions of the product and poses a potential shock hazard.
- **Do Not Operate with Defective Protective Earthing**
  Do not operate the product if the protective earthing might be defective. Also, ensure to check them before operation.
- **Do Not Operate in an Explosive and Corrosive Atmosphere**
  Do not operate the product in the presence of flammable gas, vapors, or combustible dust in general use. Select the explosion protection type under the explosion-proof environment. Operate the product in compliance with appropriate explosion-proof certificate in the presence of flammable gas or combustible dust. Prolonged use in a highly dense corrosive gas (H2S, SOx, etc.) will cause a malfunction.
- **Ground the Product before Making External Connections**
  Connect the protective earthing before connecting to the item under measurement or control unit.
- **Damage to the Protection**
  Operating the product in a manner neither described in this manual nor the manuals as listed in Table 1.1 may damage the product's protection.

WARNING

- The flowmeter should be installed away from electrical motors, transformers, and other power sources in order to avoid interference with measurement.
- Install an external switch or circuit breaker as a means to turn the power off.
  Locate this switch either near the product or in other places facilitating easy operation. Affix a "Power Off Equipment" label to this external switch or circuit breaker.
- All procedures relating to installation must comply with the electrical code of the country where it is used.

(3) Wiring

WARNING

- In cases where the ambient temperature exceeds 50°C, use external heat resistant wiring with a maximum allowable temperature of 70°C or above.
- When wiring the conduits, pass the conduit through the wiring connection port, and utilize the waterproof gland to prevent water from flowing in. Install a drain valve at the low end of the vertical pipe, and open the valve regularly.
- Do not connect cables outdoors in wet weather in order to prevent damage from condensation and to protect the insulation, e.g. inside the terminal box of the flowmeter.
- The transmitter case should be removed by Adept's qualified personnel only. Opening the transmitter case is dangerous, because some areas inside the product have high voltages.
- The protective earthing must be connected securely at the terminal with the ground mark to avoid danger to personnel.

(4) Operation

WARNING

Be sure to enable the write protect function to prevent the overwriting of parameters after finishing parameter setting.

(5) Maintenance

WARNING

- When the magnetic flowmeter is processing hot fluids, the product itself may become extremely hot. Take sufficient care not to get burnt.
- Where the fluid being processed is a toxic substance, avoid contact with the fluid and avoid inhaling any residual gas, even after the product has been taken off the piping line for maintenance and so forth.
- If dirt, dust or other substances surfaces on the glass of display cover, wipe them clean with a soft dry cloth.
- Maintenance of this flowmeter should be implemented in a maintenance service shop where the necessity tools and environment condition are provided.
  The necessity of this environmental condition is that ambient temperature is 5 to 40 °C (the maximum relative humidity is 80 % for temperature 5 to 31 °C, and decreasing linearly to 50 % relative humidity at 40 °C).

(6) Modification

- Do not modify this product.
- YOKOGAWA and Adept will not be liable for malfunctions or damage resulting from any modification made to this product by the customer.

(7) Product Disposal

The product should be disposed of in accordance with local and national legislation/regulations.

(8) Ambient Temperature:

0 to 55 °C

(9) Ambient Humidity:

0 to 95 %

1.2 Warranty

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurred during the warranty period shall basically be repaired free of charge.
- In case of problems, the customer should contact the YOKOGAWA representative or Adept representative from which the product was purchased, or the nearest YOKOGAWA office or Adept office.
- If a problem arises with this product, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- Responsible party for repair cost for the problems shall be determined by YOKOGAWA or Adept based on our investigation.
- The Purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:
  - Improper and/or inadequate maintenance by the purchaser.
  - Failure or damage due to improper handling, use or storage which is out of design conditions.
  - Use of the product in question in a location not conforming to the standards specified by YOKOGAWA or Adept, or due to improper maintenance of the installation location.
  - Failure or damage due to modification or repair by any party except YOKOGAWA or Adept or an approved representative of YOKOGAWA or Adept.
  - Malfunction or damage from improper relocation of the product in question after delivery.
  - Reason of force majeure such as fires, earthquakes, storms/floods, thunder/lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.

1.3 Combination for Remote Sensor and Remote Transmitter

IMPORTANT

Be sure to use the Transmitter and Sensor in the combination as shipped.

2. Receiving and Storage

When the product is delivered, check visually that no damage has occurred during transportation. Also check that all flowmeters mounting hardware shown below is included.
The following parts are shipped with the Sensor installed.

- Cable Glands:
  Integral type 1set (2pcs)
  Remote type 1set (4pcs)

2.1 Handling

Observe the following handling instructions.

- Do not lift the Flowmeter by the top-mounted Transmitter (Integral type)
- Do not lift the Flow Sensor by the top-mounted Terminal Box (Remote type).
- Always lift the Flowmeter of DN 200 and above, using the eye bolts. Do not lift by its casing.
- Do not drag the Flow Sensor with its lining facing the ground. This will damage the lining.
- Do not roll the Flow Sensor over its flanges. This will damage the flanges and also Transmitter or the Terminal Box if it hits the ground on rolling.
- Always rest the Flowmeter only in its upright position on the pedestals provided and not on its casing.

2.2 Storage Precautions

When the Flowmeter is not in use

- plug the cable glands of Transmitter
- fasten the display side and terminals side covers of the Transmitter
- fasten the cover of the Terminal Box (Remote type) adequately

This will prevent ingress of moisture or water that could either lower the performance or damage the internal electronics.
When the Flowmeter is not in use over extended periods of time, drain the liquid out of the Flow Sensor.
When storing the Flowmeter, cover the flanges and the Earthing rings with wooden covers to protect the lining from any damage.

2.3 Disposal of Electrical and Electronic Equipment

In conformance with the e-wastes (Management and Handling) Rules, published by the Government of India, this device may not be disposed of in domestic / municipal waste. This also applies to countries outside India as per their specific requirements.
Please dispose of this product in accordance with local regulations at the authorised, qualified collecting point specified for electrical and electronic equipment. If you have any questions, please contact the responsible authority in your area.
Should this device be passed on to other parties (for private or professional use), the content of this regulation must also be related.
Thank you for your contribution to environmental protection.

3. Installation

WARNING

Installation of the magnetic flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to installation.

3.1 Pre-installation checks

- Re-confirm the compatibility of the process liquid with the materials of the Flow Sensor liner and the electrodes as ordered by you.
  - If the process liquid is a mixture of different components, confirm the compatibility of all the components.
  - Make sure that the electrical conductivity of the liquid is > 20 µS/cm.
  - Many process liquids are designated by generic names. But these may contain certain contaminants in traces. These traces may also be harmful to the Flowmeter. Therefore, check the compatibility of such traces as well.
  - Note that the severity of corrosion of materials depends upon the temperature and the concentration of the process liquid.
  - The corrosion due to service liquid will reduce the life of the Flowmeter.
- Confirm that the available supply voltage and its frequency (for AC supply) are in accordance with the specifications of the Flowmeter.
- Ensure that the selected Flowmeter 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 for proper Grounding.

Installation Location Precautions

Select the installation location with consideration to the following items to ensure long-term stable operation of the product.

■ Ambient Temperature:

Avoid installing the product in locations with constantly fluctuating temperatures. If the location is subject to radiant heat from the plant, provide heat insulation or improve ventilation.

■ Atmospheric Condition:

Avoid installing the product in a corrosive atmosphere. In situations where this is unavoidable, consider ways to improve ventilation and to prevent rainwater from entering and being retained in the conduit pipes.

■ Vibrations or Shocks:

Avoid installing the product in a place subject to shocks or vibrations.

3.2 Piping Design Precautions

IMPORTANT

Design piping correctly, referring to the following to prevent damage to sensors and to assure accurate measuring.

NOTE

This section describes the remote sensor as an example. The same attention must be paid to the integral flowmeter.

(1) Location

IMPORTANT

Install the flowmeter in a location where it is not exposed to direct sunlight. The minimum ambient temperature is limited by the minimum fluid temperature of the sensor (the lining). For more information, read the applicable general specification as listed in Table 1.1.

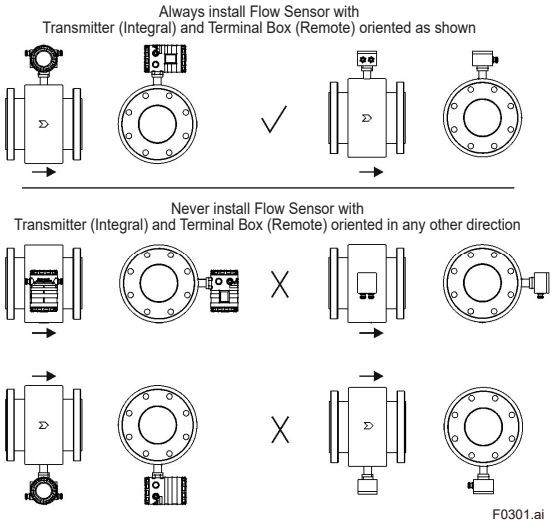
(2) Noise Avoidance

IMPORTANT

The flowmeter should be installed away from electrical motors, transformers, and other power sources in order to avoid interference with measurement. When installing two or more magnetic flowmeters, provide a distance of enough each other.

(3) Important instruction for Empty Pipe detection

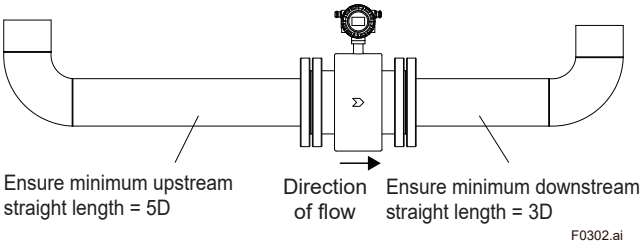
The Empty Pipe detection feature will function only if the Flow Sensor is installed with the Transmitter (Integral) and Terminal Box (Remote) oriented as shown. Do not orient in any other direction.



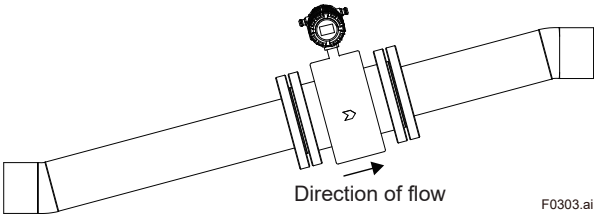
(4) Selection of mounting locations

The Magnetic Flowmeter AY6410 must be installed at a point in the pipeline which satisfies the following requirements. AY6410 model is shown for illustration purposes.

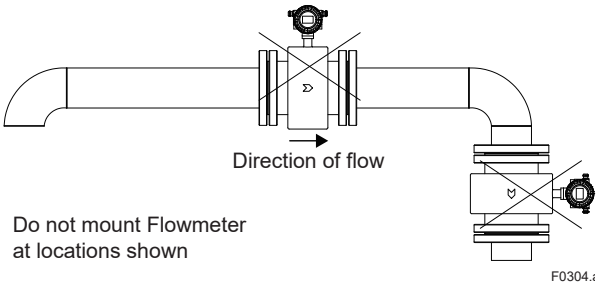
- The flow sensor must be full of liquid to avoid erratic measurement results.
- Ensure that the Electrodes axis is horizontal within ±15 degrees.
- Ensure straight pipe lengths on either ends of the flow sensor – five times pipe diameter length of piping upstream and three times pipe diameter downstream from the center of the flow sensor.



- The flow sensor may be installed in horizontal pipelines preferably with a slight upward gradient in the direction of flow.



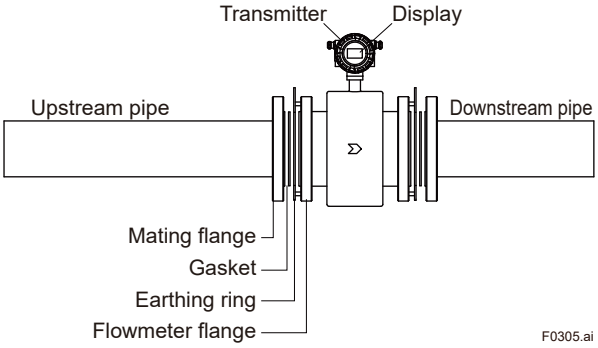
- Never install the flow sensor that will cause it to remain empty or partially full. Never install the flow sensor in vertical pipelines with the liquid flow in the downward direction.



- The piping layout must prevent any build-up of air. Any entrained air should be carried out of the flow sensor by the liquid flow or by buoyancy at zero flow.
- Ensure that installation location is such 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 earthing rings to the sensor head flanges at either end.
- If for some reason, the complete draining out of process liquid at zero flow is unavoidable, use empty pipe detection option to obtain correct flow status and prevent erratic output.

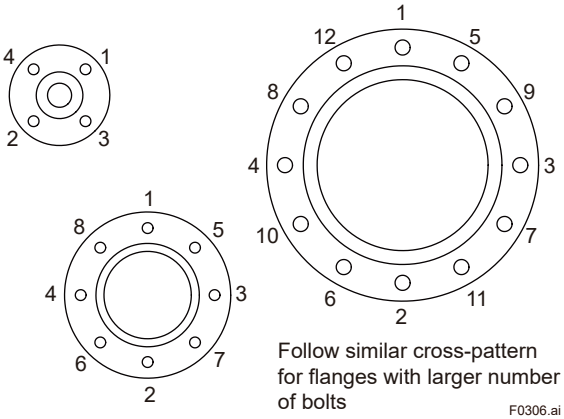
(5) Typical inline mounting arrangement

The AY6410 Flow Sensor mounting is as follows. Integral variant is shown for illustration purpose.



(6) Tightening of the flange bolts

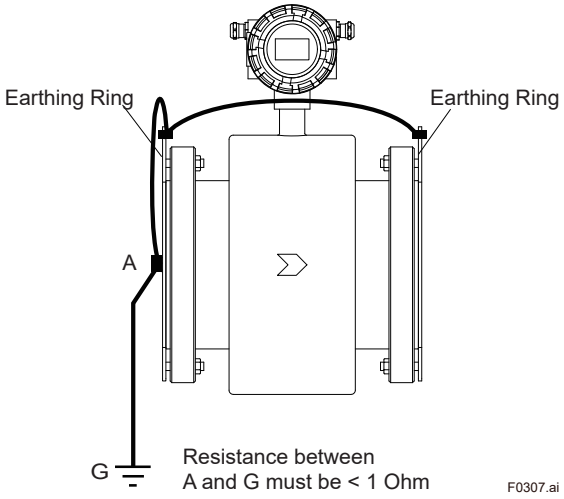
Apply a thin layer of fresh industrial grease to the threads of the bolts prior to tightening. Tighten all the mounting bolts uniformly without under or over tightening of any of the bolts. Tighten the bolts in a cross-sequence as per the order shown below for few flange sizes.



Use an appropriate torque wrench. During the first pass, tighten to approximately 50 %, during the second pass to approximately 80 % and only during the third pass to 100% of the maximum torque.

(7) Flow Sensor Local Earthing / Grounding

- A proper grounding of the Primary Head is very important to ensure proper functioning and accurate measurement by the Flowmeter.
- This ground is the reference ground for measurement and should not introduce any interference into the signal to be measured.
- Use 2.5 mm^2 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 also functions as the safety ground.



(8) Checking for sealing

Once the flow sensor has been mounted, fill the pipeline gradually (preferably) with water instead of process liquid and confirm that the entire mounting is leak-free.
If even minor leaks are noticed, check the axial alignment of the flow sensor with the upstream and downstream pipe lengths, cleanliness of gasket, the rating of gasket material and proper tightening of the bolts. After eliminating the leakages, allow the process liquid to pass through the pipeline.

(9) Service Area

Select locations where there is adequate space to service installing, wiring, overhauling, etc.

3.3 Handling Precautions

WARNING

The magnetic flowmeter is a heavy product. Be careful that no damage is caused to personnel through accidentally dropping it, or by exerting excessive force on the magnetic flowmeter. When moving the magnetic flowmeter, always use a trolley and have at least two people carry it.

NOTE

This section describes the remote sensor as an example. The same attention must be paid to the integral flowmeter.

3.3.1 General Precautions

(1) Precaution during Transportation

The magnetic flowmeter is packed tightly. When it is unpacked, pay attention to prevent damaging the flowmeter. To prevent accidents while it is being transported to the installing location, transport it to the site in its original packing.

(2) Avoid Shocks from Impact

CAUTION

Care should be taken not to drop the flowmeter or expose it to excessive shock. In particular, be careful not to subject the flange surface to shock. This may lead to lining damage which will result in inaccurate readings.

(3) Flange Protection Covers

IMPORTANT

Keep the protective covering (i.e. the corrugated cardboard or other cushioning material) in place over the flange except when mounting the flowmeter to the pipe.

(4) Terminal Box Cover

IMPORTANT

As it is possible that the insulation will deteriorate, do not open the terminal box cover until it is time to wire it.

(5) Long-term Non-use

IMPORTANT

It is not desirable to leave the flowmeter unused for a long term after installation. If this situation is unavoidable, take care of the flowmeter by observing the following.

- **Confirmation of sealing conditions for the flowmeter**

Confirm that the terminal box screw and cable entries are well sealed. Equip the conduit piping with drain plugs or waterproof glands to prevent moisture or water from penetrating into the flowmeter through the conduit.

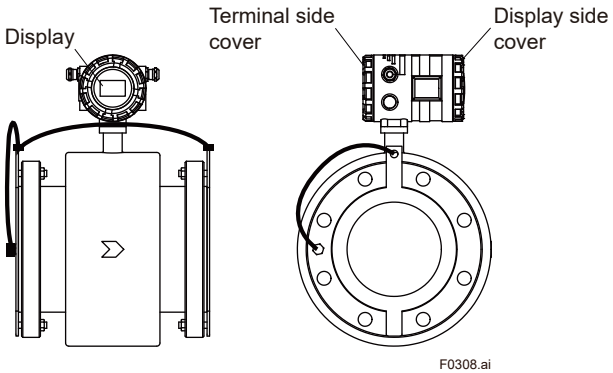
- **Regular inspections**

Inspect the sealing conditions as mentioned above, and the inside of the terminal box at least once a year.
Also, due to rain, etc. when it is suspected that water may have penetrated into the inside of the flowmeter, perform supplementary inspections.

3.4 Transmitter Installation

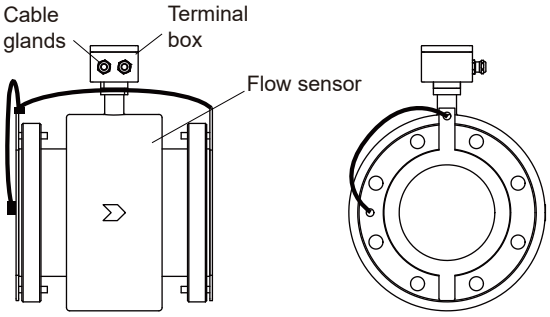
3.4.1 Integral type Transmitter

- In case of an Integral Type Flowmeter, the Transmitter comes pre-mounted atop the Flow Sensor and therefore gets physically installed along with the Flow Sensor. Install the flow sensor as described in the section 3 ‘Installation’.
- The images below show the Integral Type Transmitter mounted on the Flow Sensor in case of AY6410.



3.4.2 Remote type Transmitter

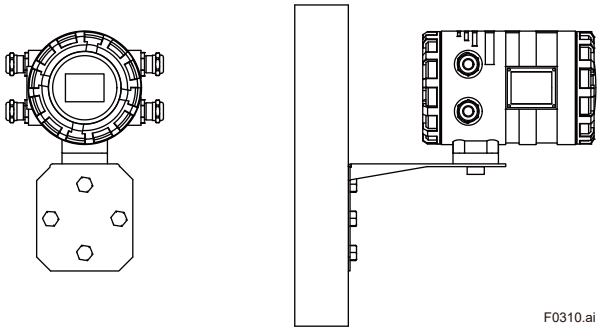
- In case of a Remote Type Flowmeter, a Terminal Box comes pre-mounted atop the Flow Sensor. The Coil and Electrodes cable is delivered by connecting it to the Terminal Box. The Transmitter along with its Mounting Bracket is delivered separately.
- The images below show only the Terminal Box mounted on the Flow Sensor in case of AY6410.



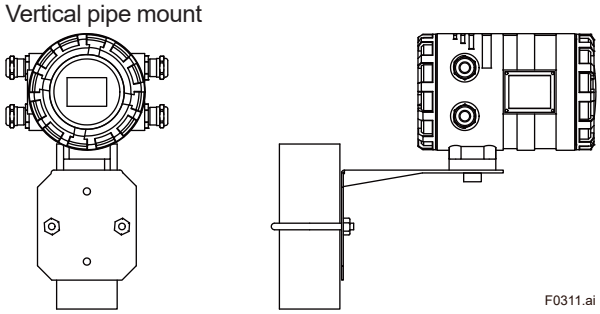
F0309.ai

- For the Remote Type Flowmeter as well, install the Flow Sensor as described in the section 'Installing the Flow Sensor'.
- Ensure that the pre-connected Coil and Electrodes cable does not get damaged during this installation.
- Fix the Transmitter mounting bracket onto a horizontal or vertical 2" NB pipe. Alternatively, fix the bracket directly onto a wall.
- You can rotate the Transmitter around its mounting axis to set a suitable viewing angle.

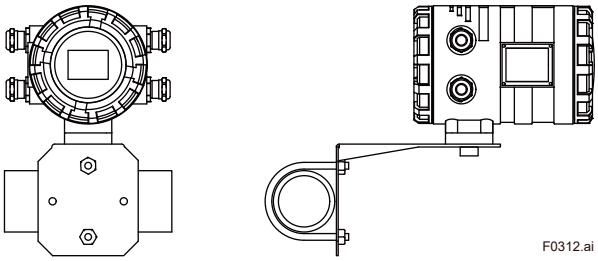
Wall mount


F0310.ai

Vertical pipe mount


F0311.ai

Horizontal pipe mount


F0312.ai

3.4.3 Protecting the Transmitter

Provide a weather-shade/ canopy to protect the Transmitter from direct exposure to sunlight, rain or any other dropping fluids. This will help enhance the useful life of the Transmitter.

4. Electrical connections

4.1 Instructions for connecting cables

- Always use cables of the following specifications.
  - Power:3 core, 1 mm^2, PVC/ PTFE sheathed cable
  - Current Output: 2 core, 1 mm^2, PVC/PTFE sheathed cable
  - Coil and Electrodes (Remote Type): as supplied with Flow Sensor

IMPORTANT

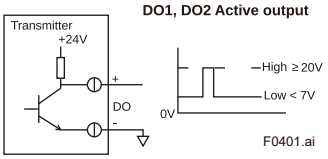
Never extend the Coil and Electrodes cable by joining another cable.

- Use ferrules for each wire and crimp the ends of the conductors with appropriate cable lugs.
- Disassemble the cable gland nut and pull out the rubber sleeves.
- Run the required cable through the nut and rubber sleeve which fits snugly over the cable.
- Then pass it through the cable gland and terminate it onto the appropriate terminals.
- Press-in the rubber sleeve into the gland cone and then tighten the cable gland nut.
- Ensure that the cable is tightly clamped.
- Run the following sets of cables through physically separated cable trays and trenches.

Set 1	Set 2	Set 3
Power	Coils	Current output
Relay outputs	Electrodes	Digital output
		RS 485

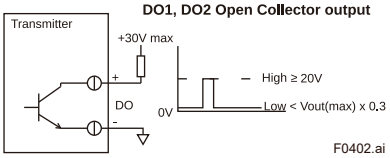
- Before making the various Input-Output connections, understand the manner in which these connections are to be done.

DO1, DO2 Active output



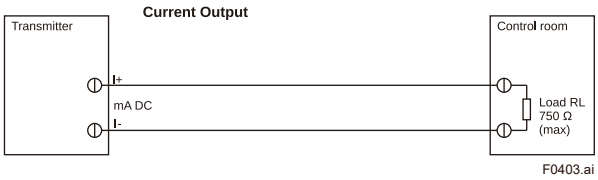
F0401.ai

DO1, DO2 Open Collector output



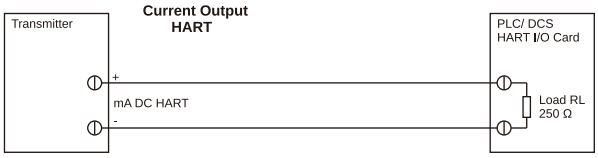
F0402.ai

Current Output



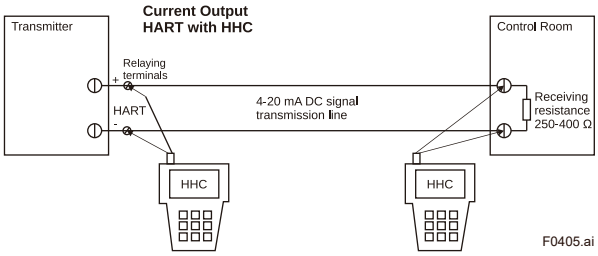
F0403.ai

Current Output HART



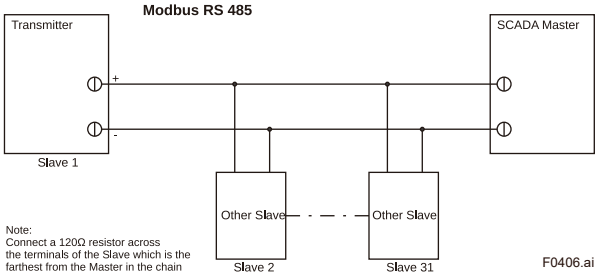
F0404.ai

Current Output HART with HHC



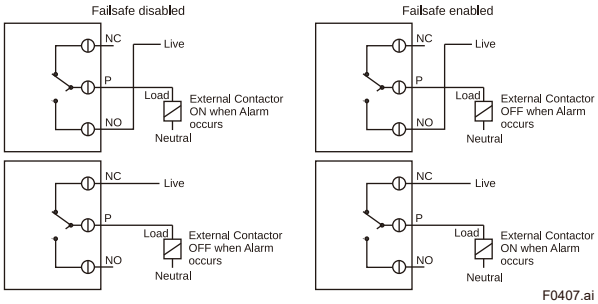
F0405.ai

Modbus RS 485



F0406.ai

Relay 1, Relay 2 Output



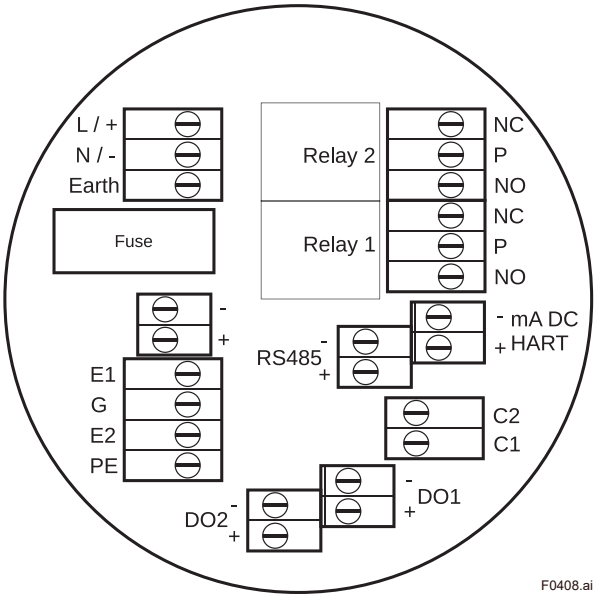
F0407.ai

4.2 Integral Transmitter terminals

- Unscrew the rear cover of the Transmitter. Read the operating Power Supply voltage indicated on the tag plate, and confirm that the available power supply matches the Transmitter's requirement.
- Make the field connections to the terminals as indicated in the following image.
- There is a difference in some parts depending on communication interface.

IMPORTANT

Note that the Coils and Electrodes are internally pre-wired.



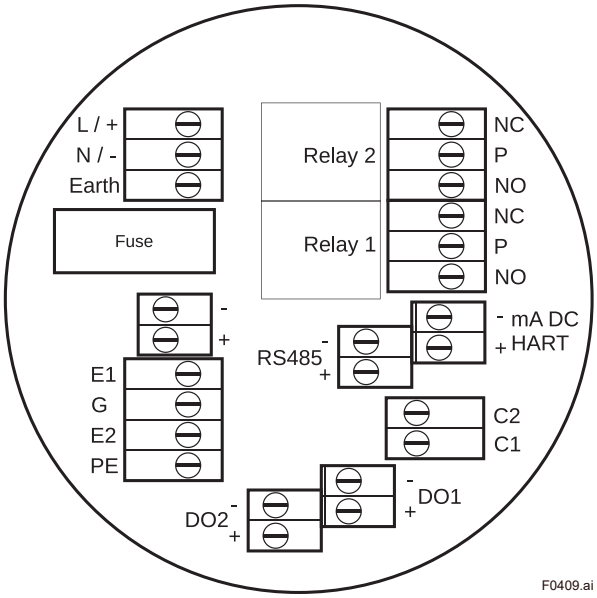
- Refer to the following table for a description of the terminals.

Marking	Description		Marking	Description
L / +	100 - 240 VAC	24 VDC	NC	Relay 2 contacts
N / -	Neutral	0 VDC	P	
E	Earth		NO	
RS485 +	Modbus		NC	Relay 1 contacts
RS485 -			P	
mA DC +	Current output*		NO	
mA DC -			DO1 +	Digital output 1
			DO1 -	
			DO2 +	Digital output 2
			DO2 -	

* When selecting C5 or C11 for the communication interface, this terminal is use to be HART communication.

4.3 Remote Transmitter terminals

- In case of a Remote Type Flowmeter, only a Terminal Box comes pre-mounted atop the Flow Sensor. The Transmitter is mounted on the Mounting Bracket as described earlier.
- In the case of the remote type, the wiring of terminal box and cable is completed at the factory prior to shipment.
- Unscrew the rear cover of the Transmitter. Read the operating Power Supply voltage indicated on the Tag Plate, and confirm that the available power supply matches the Transmitter's requirement.
- Make the field connections to the terminals as indicated in the following image.
- There is a difference in some parts depending on communication interface.



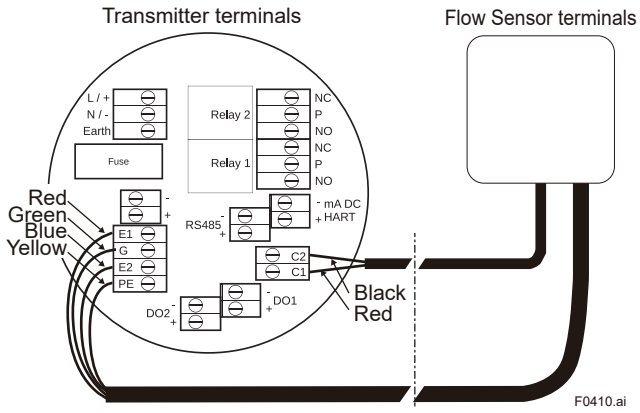
- Refer to the following table for a description of the terminals.

Marking	Description		Marking	Description
L / +	100 - 240 VAC	24 VDC	NC	Relay 2 contacts
N / -	Neutral	0 VDC	P	
E	Earth		NO	
C1, C2	Coils		NC	Relay 1 contacts
E1, E2	Electrodes		P	
G	Electrode ground		NO	
PE	Empty Pipe electrode		mA DC +	Current output*
RS485 +	Modbus		mA DC -	
RS485 -			DO1 +	Digital output 1
			DO1 -	
			DO2 +	Digital output 2
			DO2 -	

* When selecting C5 or C11 for the communication interface, this terminal is use to be HART communication.

IMPORTANT

Connect the other end of the supplied Coil and Electrodes cable to the Electrodes (E1, E2, G, PE) and Coils (C1, C2) Terminals in the Transmitter. Match the Ferrule markings on the supplied cable to the Terminal markings in the Transmitter. The maximum permissible length of this cable is 80 meters.



4.4 After making all the connections

- Inspect and confirm that the O-ring of the rear cover is appropriately seated and is not damaged. Then align its threads properly against those of the Transmitter. Engage the threads, rotate and fix the cover by screwing it completely till the O-ring is effectively compressed. This will prevent any ingress of moisture or water into the Transmitter enclosure.
- Inspect and confirm that the Gasket of the Terminal Box cover is appropriately seated and is not damaged. Then align its sealing surface with that of the Terminal Box base. Engage the screw threads, rotate and fix the cover by screwing it completely till the Gasket is effectively compressed. This will prevent any ingress of moisture or water into the Terminal Box.

4.5 Powering up the Flowmeter

Confirm that installation has been done and completed as described in this manual. Then, the Flowmeter is ready for operational use.
Switch-on the mains power to the Transmitter. The Transmitter is delivered duly calibrated and configured for the range of flow rate measurement, as ordered by you. Allow the process liquid to start flowing through the Flow Sensor. Ensure that flow rate is within the specified limits for the Flowmeter. Excess flow rate could damage the Flow Sensor lining.
The Flowmeter will start indicating the flow rate and driving the current output proportional to the flow rate

5. Basic Operating Procedures

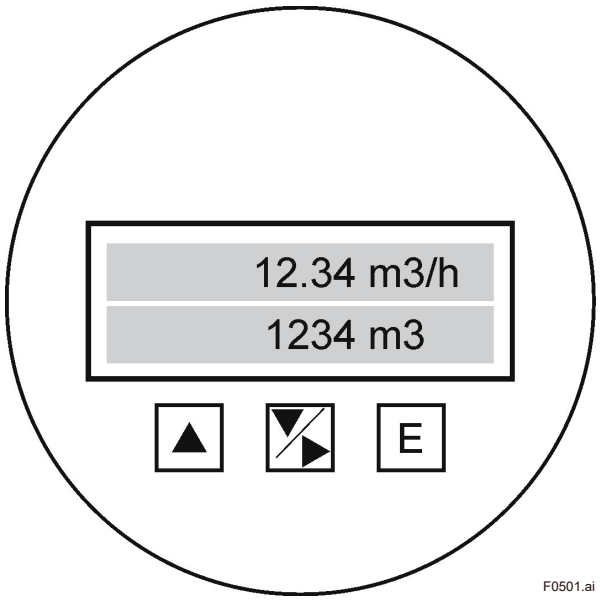
5.1 User interface

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.

IMPORTANT

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



F0501.ai

Switch	Indicate of switch	Function
[▲]	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 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
[▶]	RIGHT key	• Move to the right digit • Move from the rightmost digit to the leftmost
[E]	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 Understanding the Menu operations

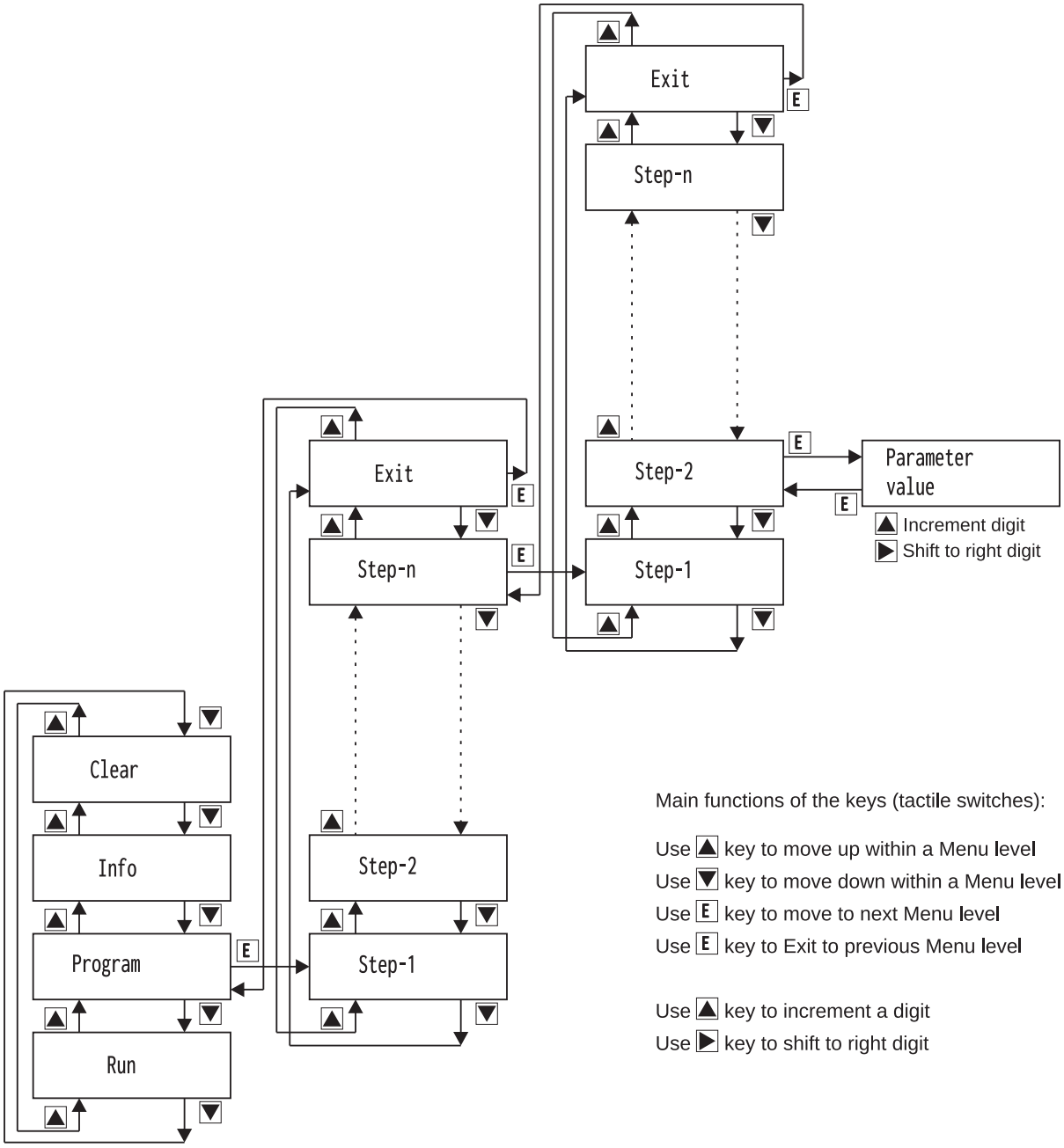
IMPORTANT

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

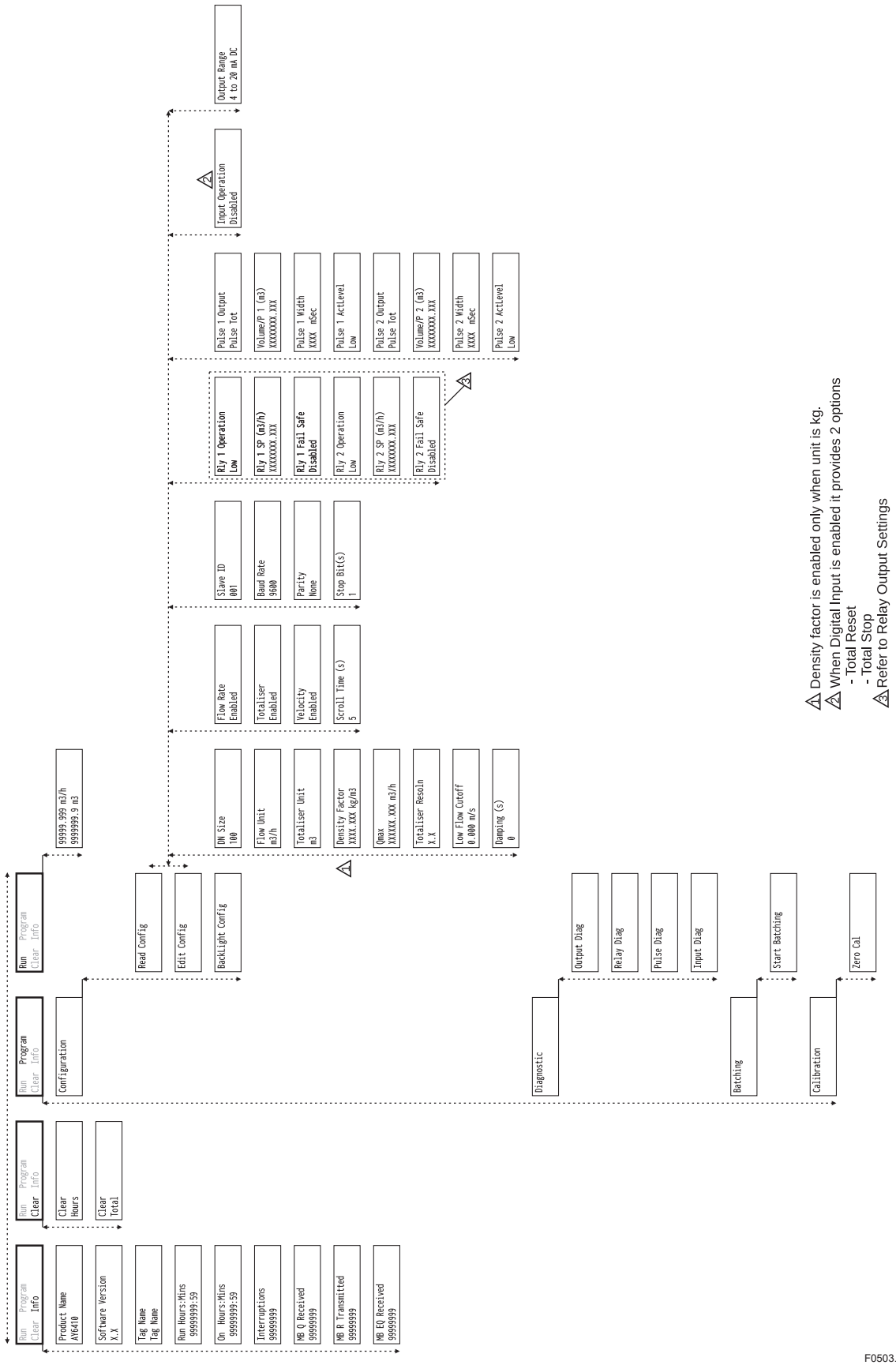
- the Flowmeter Model, then
- the Software Version number, then
- the RUN mode indicating the Flow rate, Totalized flow and Flow velocity depending on which parameters have been configured to be displayed.

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

5.2.1 Simple explanation of how to navigate



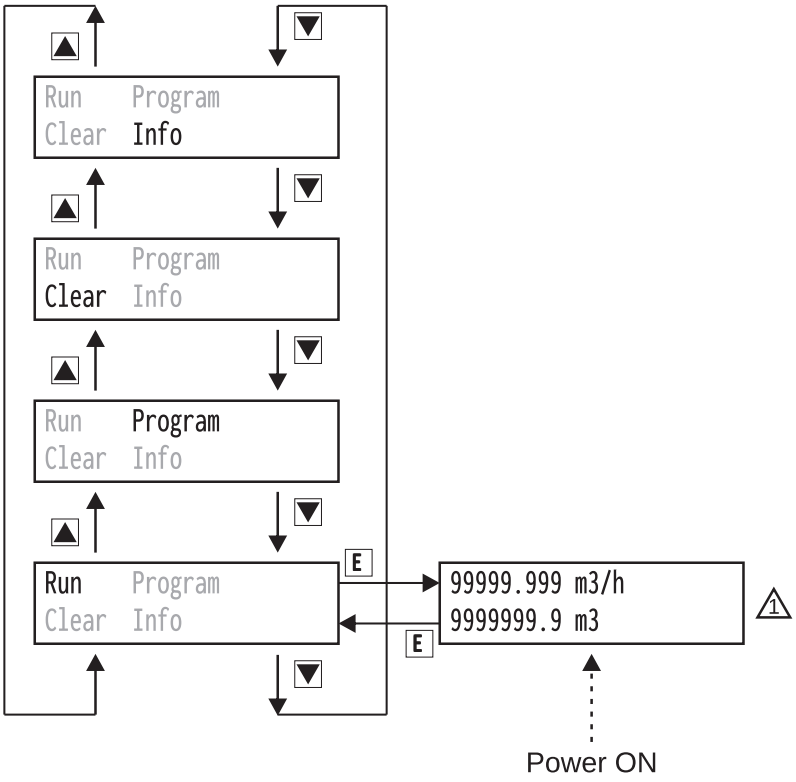
5.2.2 Menu Overview



F0503.ai

5.3 Menu and Modes of operation

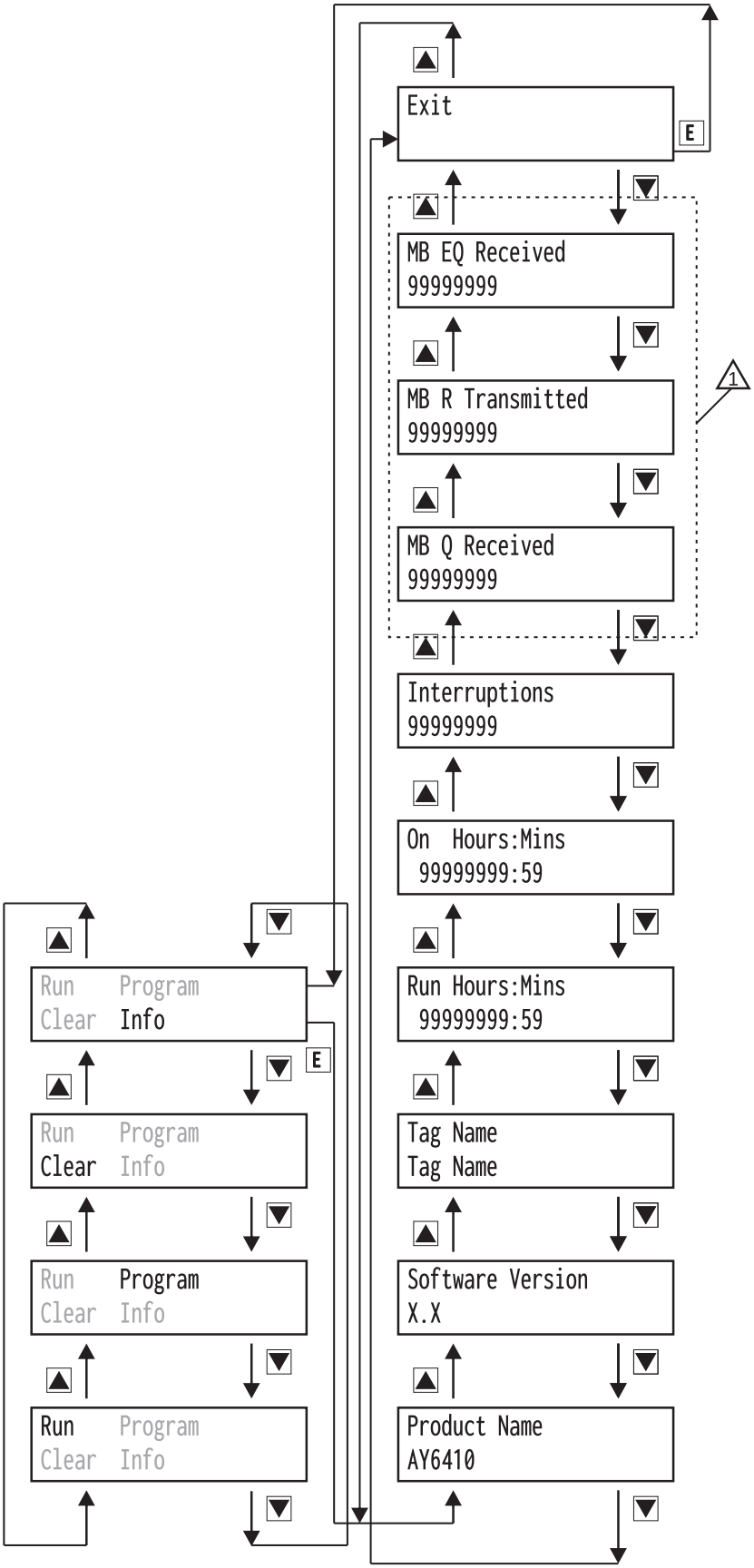
5.3.1 Run Mode



1 Diagnostic messages in place of flow rate and velocity value -
a. 'Empty Pipe'
b. 'High Flow' (>15 m/s)

F0504.ai

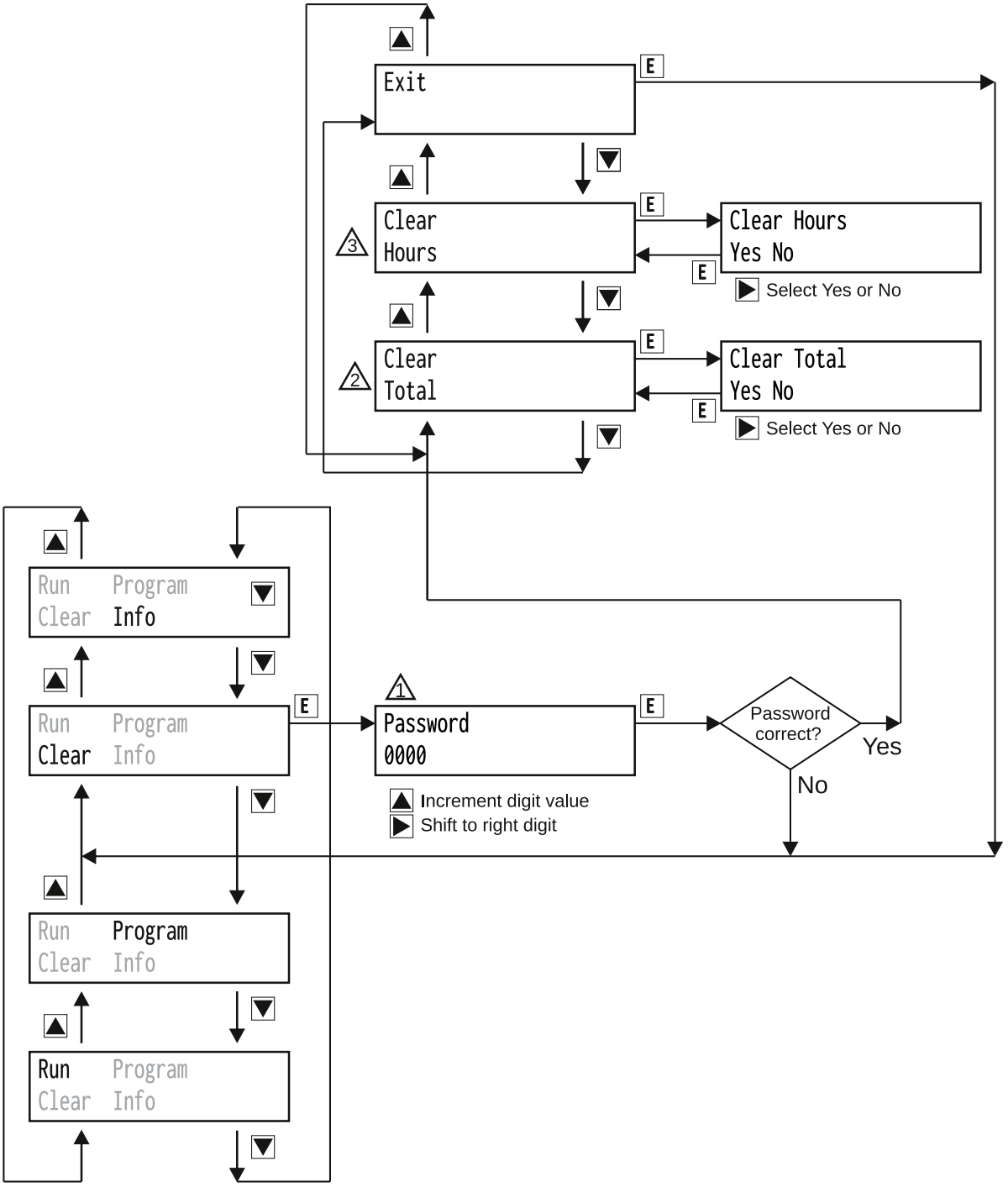
5.3.2 Info Mode



1 Applicable when Communication is enabled

F0505.ai

5.3.3 Clear Mode



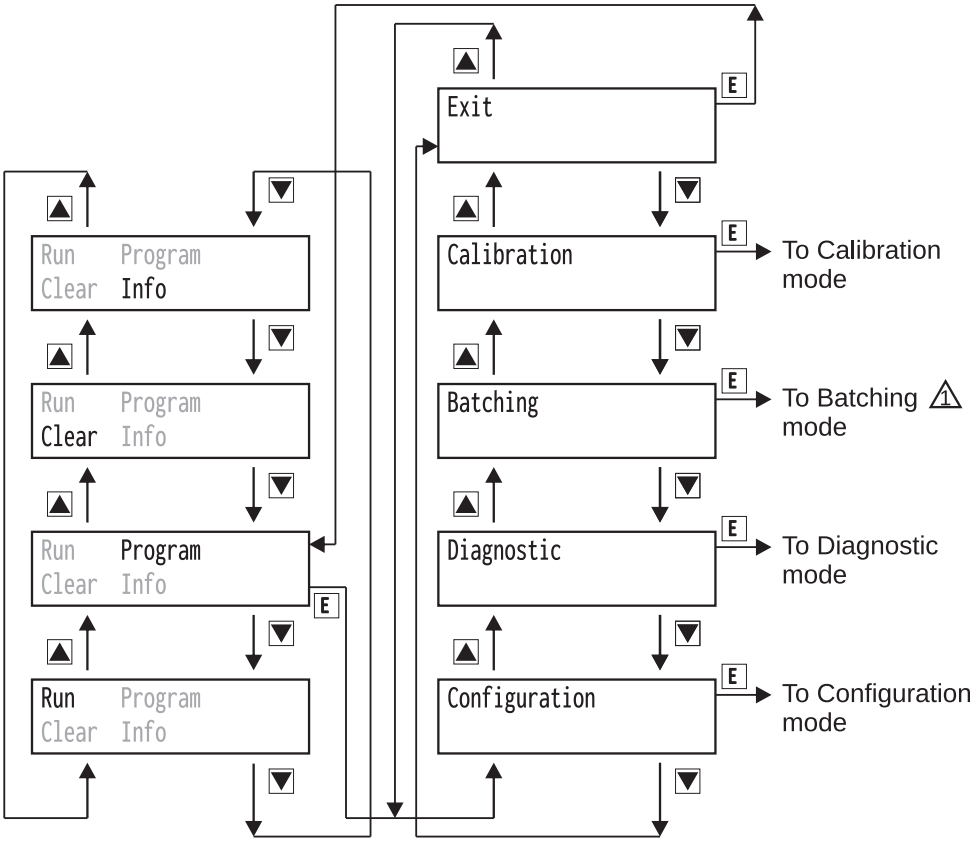
1 Password = 0741

2 Totaliser value can be cleared

3 ON & RUN Hours, and Power Interruptions count can be cleared

F0506.ai

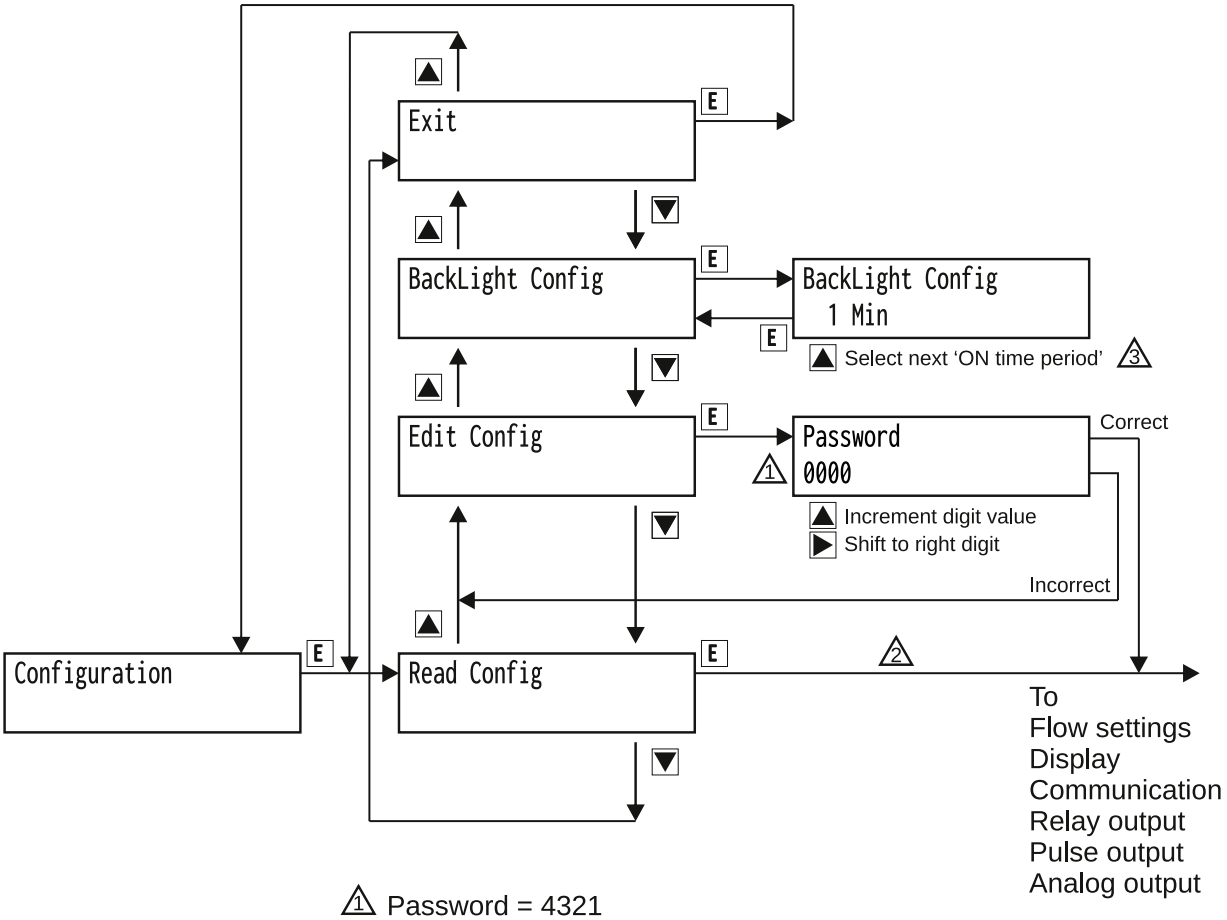
5.3.4 Program Mode



⚠1 If Batching is enabled.
Set “Rly 1 Operation” to “Batch Total” in “Relay Output Settings”.

F0507.ai

5.3.5 Configuration Mode

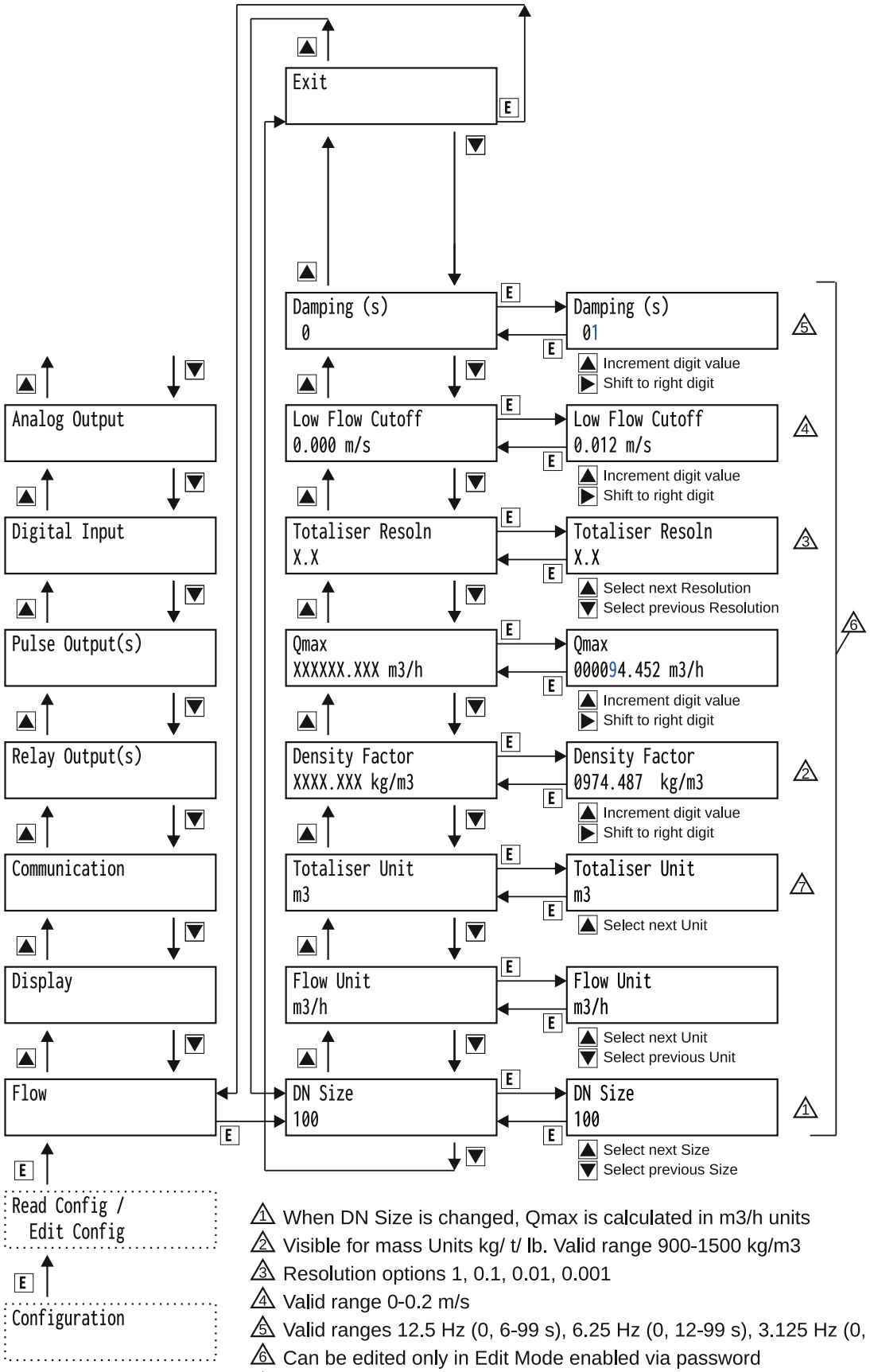


1 Password = 4321
2 In Read Mode, no parameter settings permitted
3 Periods = Always ON or 1/ 5/ 10/ 30/ 60/ 120 min

F0508.ai

5.3.6 Flow Settings

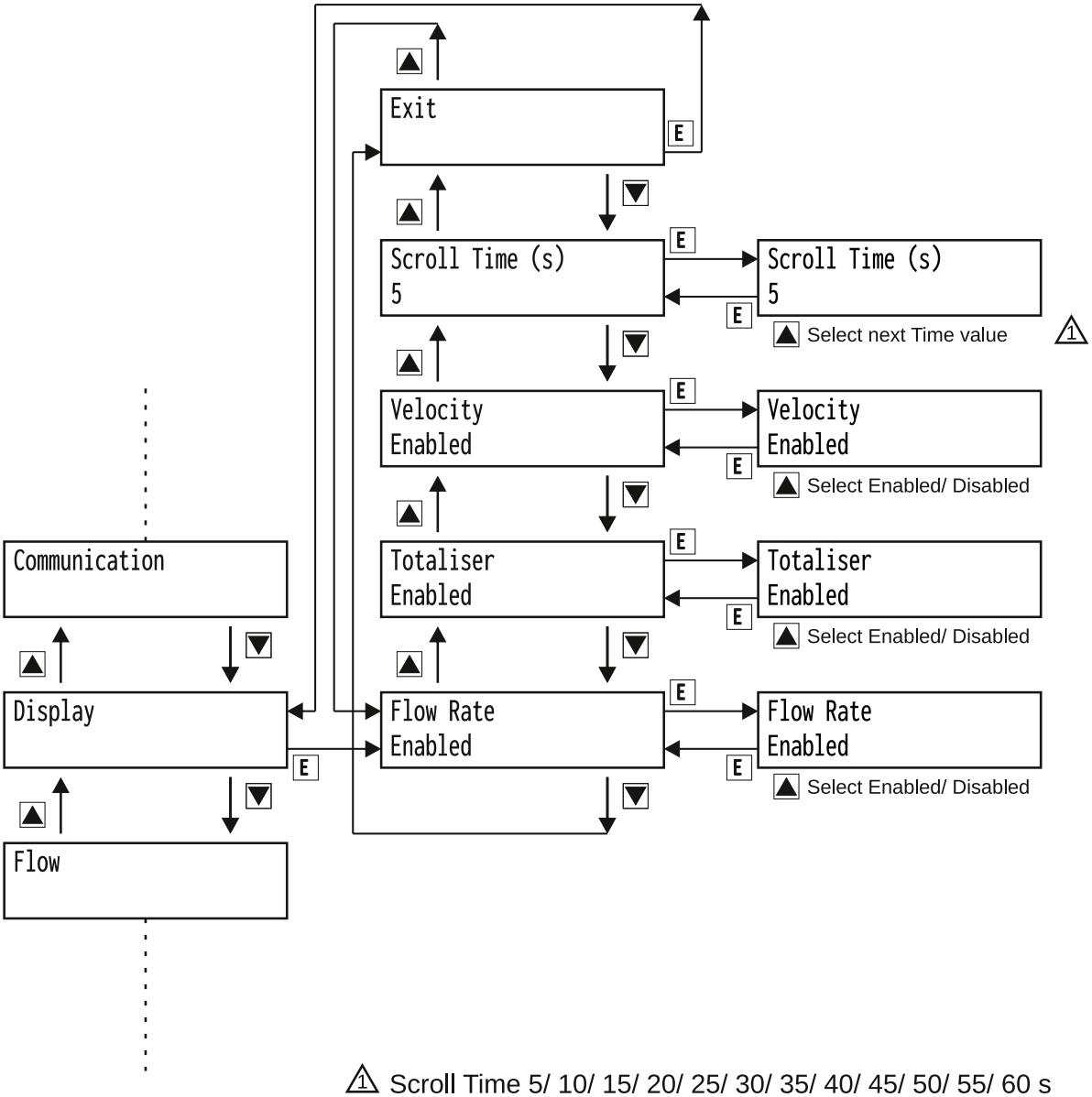
for DN Size, Flow & Totaliser Unit options refer to the Specification chapter



1. When DN Size is changed, Qmax is calculated in m3/h units
2. Visible for mass Units kg/ t/ lb. Valid range 900-1500 kg/m3
3. Resolution options 1, 0.1, 0.01, 0.001
4. Valid range 0-0.2 m/s
5. Valid ranges 12.5 Hz (0, 6-99 s), 6.25 Hz (0, 12-99 s), 3.125 Hz (0, 24-99 s)
6. Can be edited only in Edit Mode enabled via password
7. Changing Totaliser Unit during runtime may reset Totaliser value

F0509.ai

5.3.7 Display Settings

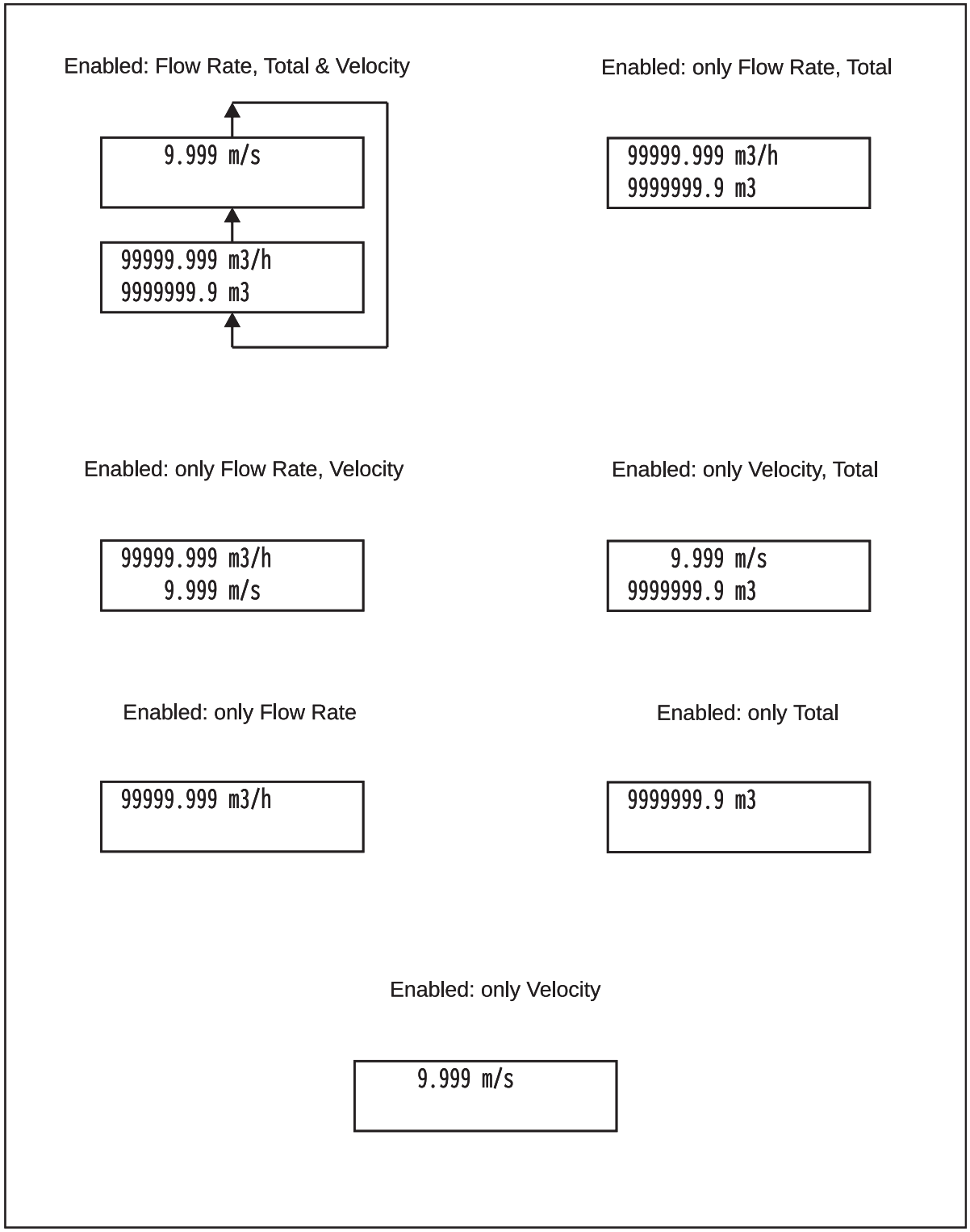


1 Scroll Time 5/ 10/ 15/ 20/ 25/ 30/ 35/ 40/ 45/ 50/ 55/ 60 s

F0510.ai

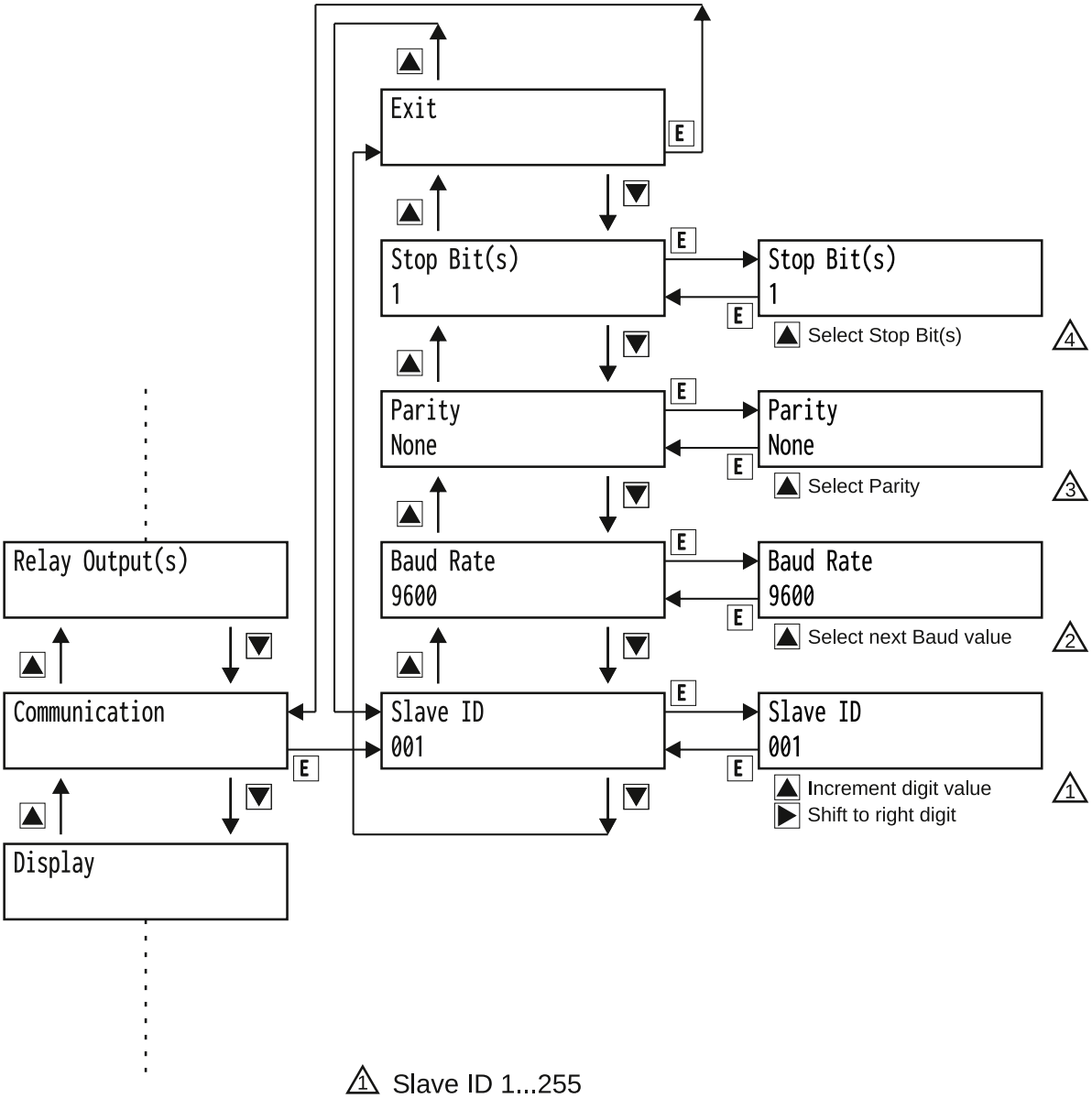
5.3.8 Display Screens

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.



F0511.ai

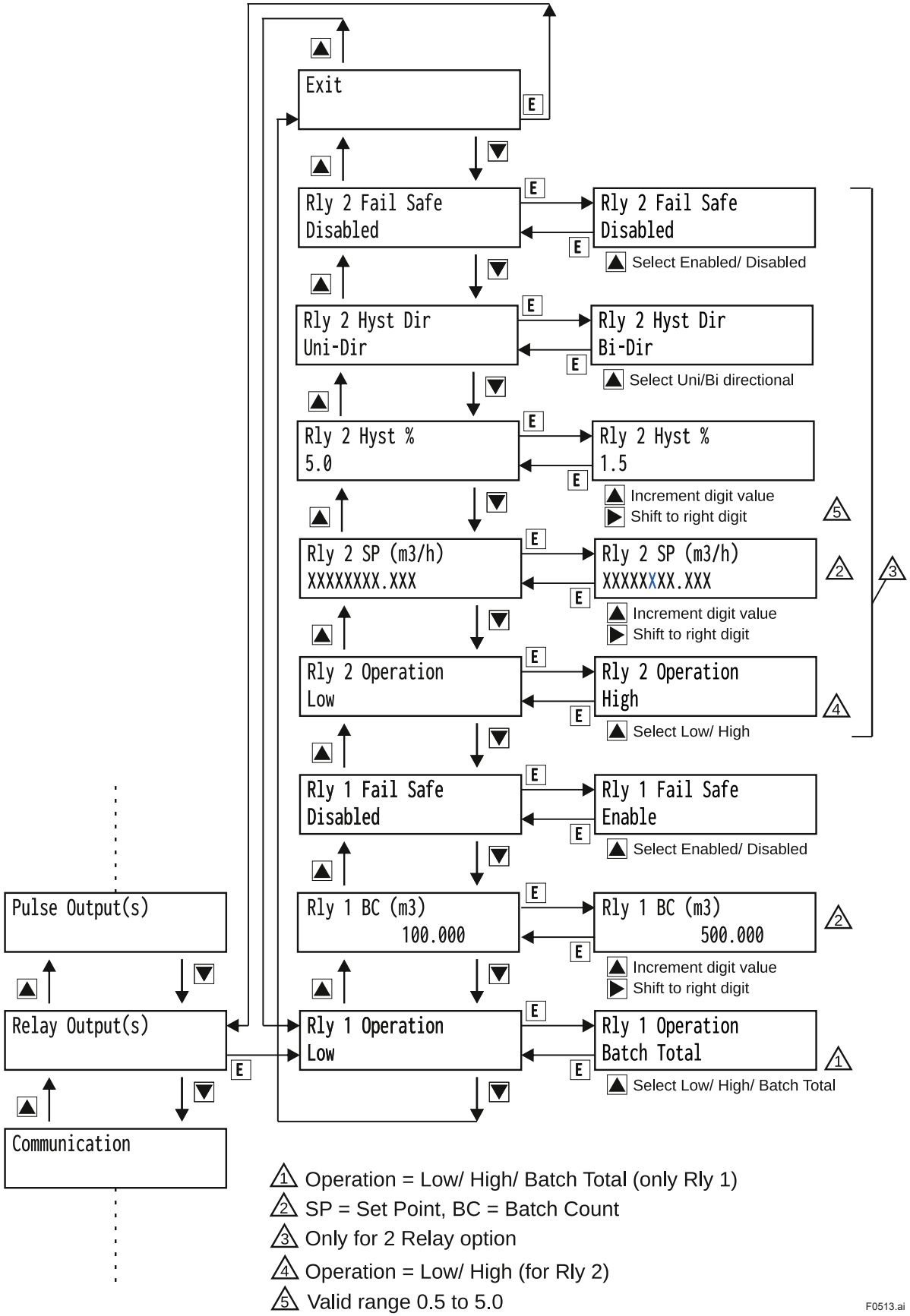
5.3.9 Communication Settings



1. Slave ID 1...255
2. Baud Rate 2400/ 4800/ 9600/ 19200/ 38400
3. Parity Odd/ Even/ None
4. Stop Bits 1/ 2

F0512.ai

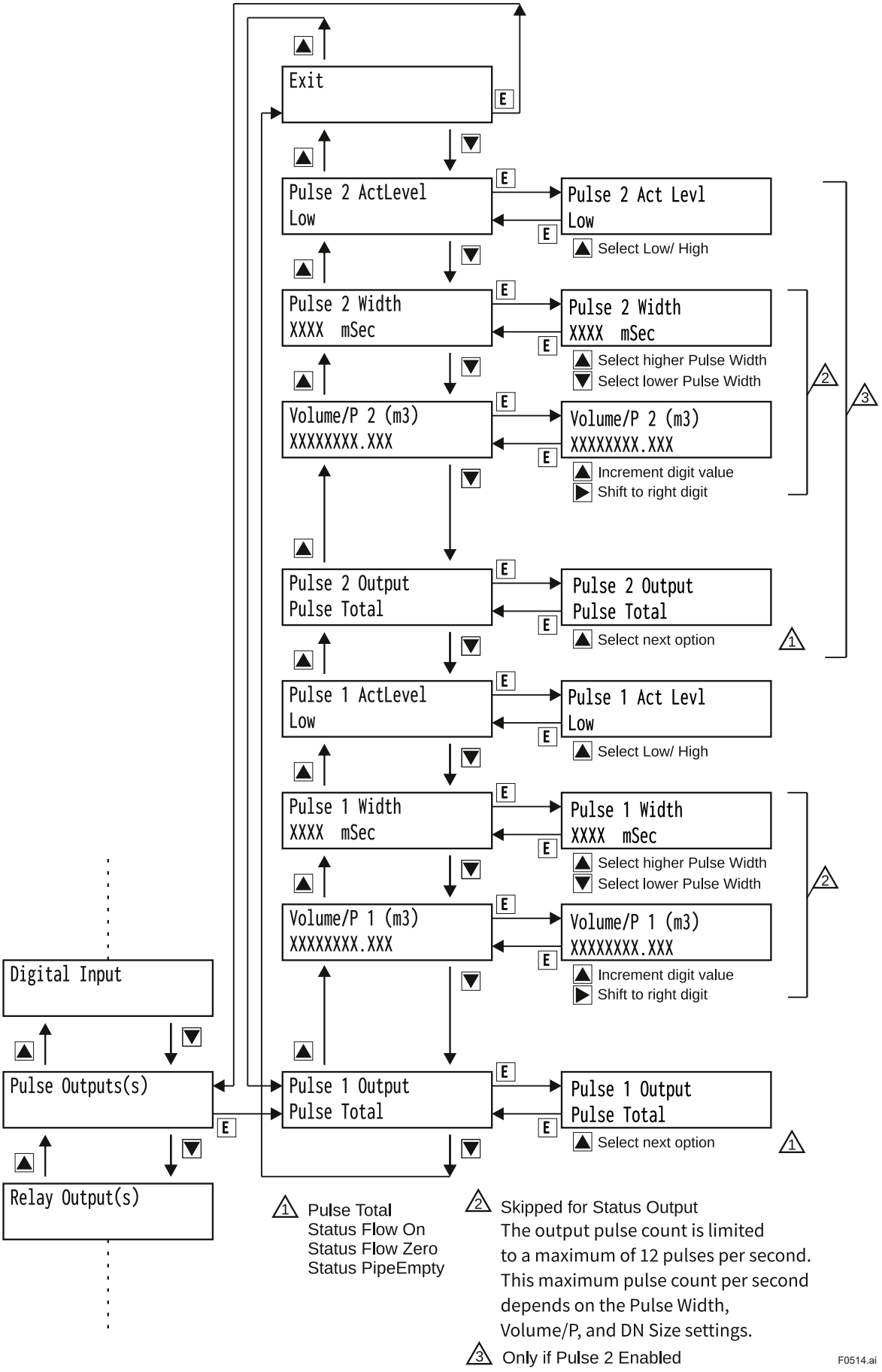
5.3.10 Relay Output Settings



1 Operation = Low/ High/ Batch Total (only Rly 1)
2 SP = Set Point, BC = Batch Count
3 Only for 2 Relay option
4 Operation = Low/ High (for Rly 2)
5 Valid range 0.5 to 5.0

F0513.ai

5.3.11 Pulse Output Settings



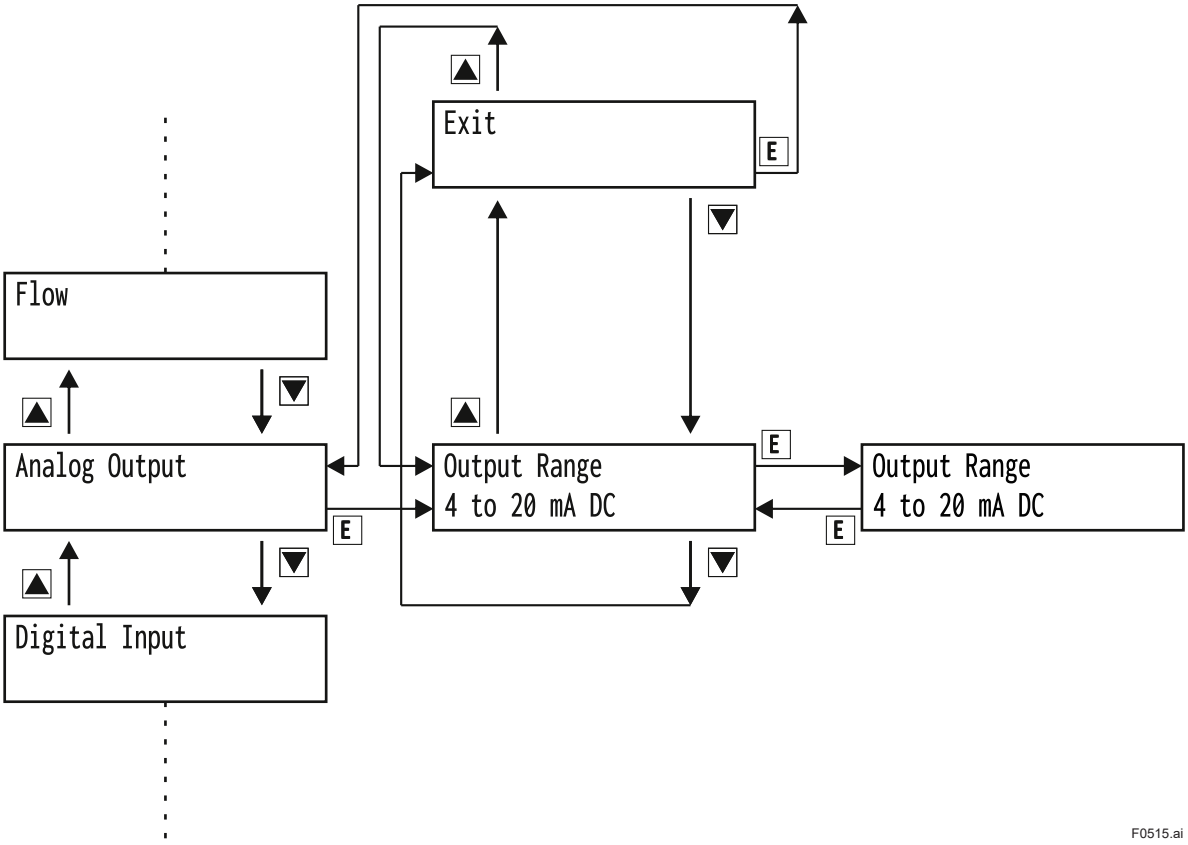
1 Pulse Total
Status Flow On
Status Flow Zero
Status PipeEmpty

2 Skipped for Status Output
The output pulse count is limited to a maximum of 12 pulses per second. This maximum pulse count per second depends on the Pulse Width, Volume/P, and DN Size settings.

3 Only if Pulse 2 Enabled

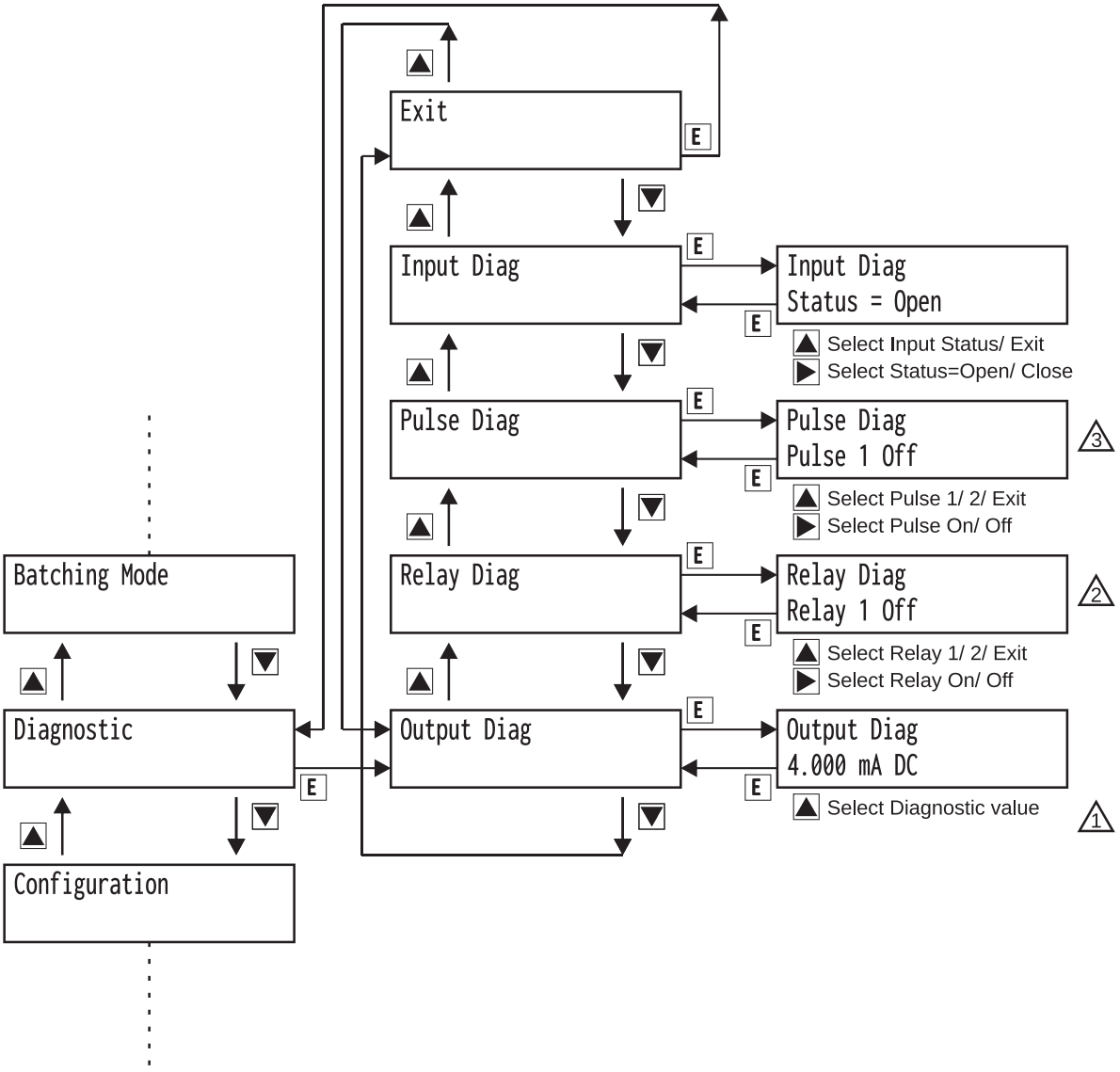
F0514.ai

5.3.12 Analog Output Settings



F0515.ai

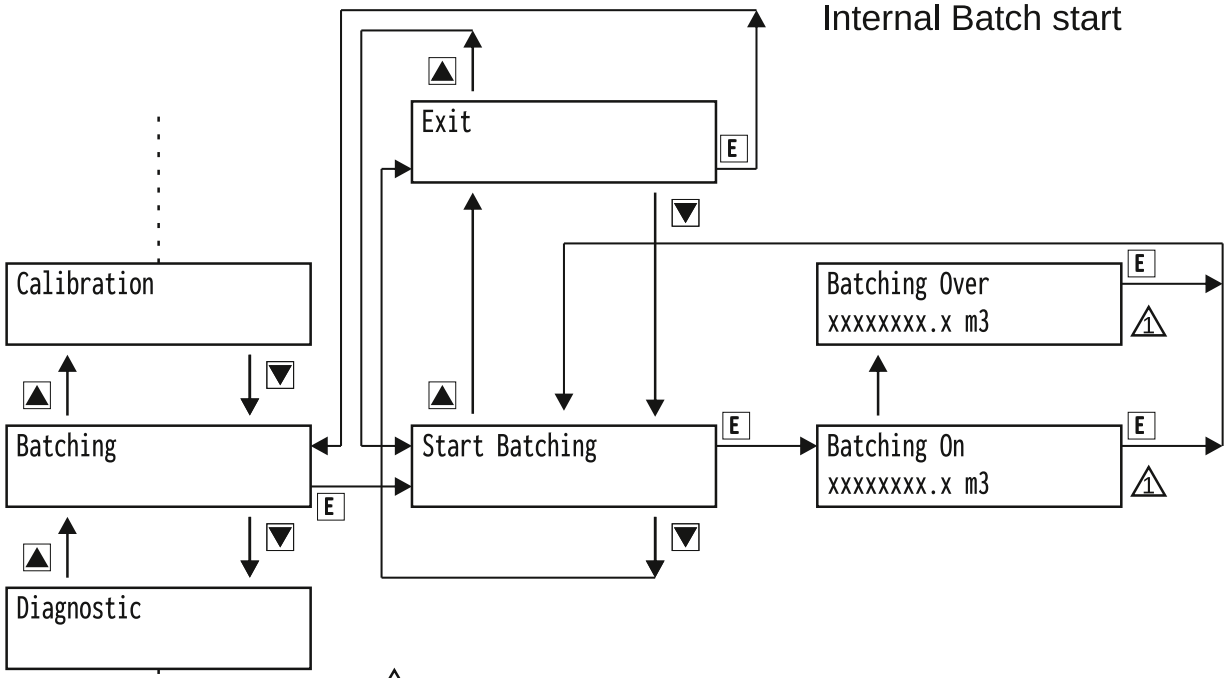
5.3.13 Diagnostics mode



1 Diagnostic value = 4.000/ 12.000/ 20.000 mA DC/ Exit
2 Applicable if Relay Output(s) enabled
3 Applicable if Pulse Output(s) enabled

F0516.ai

5.3.14 Batching mode

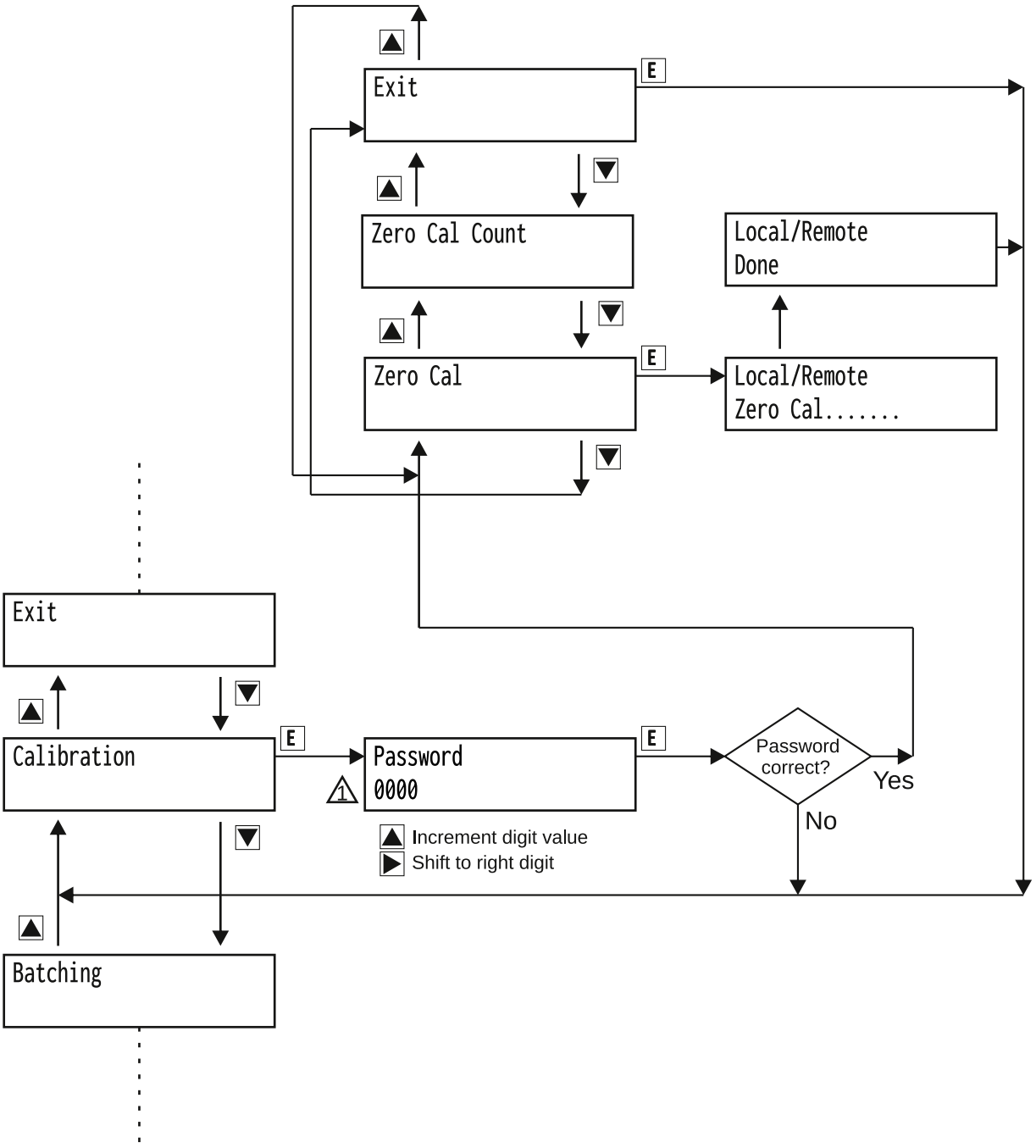


1 Resolution depends on the set Totaliser Resolution

Batch	*Failsafe enabled*	*Failsafe disabled*
Start	On (contact between Pole & NO)	Off (contact between Pole & NC)
Over	Off (contact between Pole & NC)	On (contact between Pole & NO)

F0517.ai

5.4 Calibration mode



1 Password = 7878

F0518.ai

5.4.1 Just before Zero calibration

Zero calibration is carried out to ensure that the output for zero flow is 0 % (i.e., 4 mA).
To ensure the electromagnetic flow meter is compatible with the operating conditions, this procedure must be performed after the piping has been installed.

5.4.2 Performing Zero calibration

Zero calibration should only be carried out when the sensor has been filled with measurement fluid and the fluid velocity is completely zero by closing the valve.

6. Operational precautions

- The Terminal Box of the Flow Sensor in case of a Remote Transmitter is designed for field applications and use. However, it is advisable to protect it from exposure to direct sunlight and rain, by installing a weather shade over it. Likewise, the Transmitter is designed for field applications and use. However, it is advisable to protect it from exposure to direct sunlight and rain, by installing a weather shade over it. This will help extend the useful life of the Flowmeter as a whole.
- Keep the covers of the Transmitter and that of the Terminal Box well fastened, taking care that the O-rings and Gaskets are undamaged and properly seated for effective sealing.
- Keep the cable gland nuts tight and ensure that the cables are gripped uniformly around their circumference to prevent any ingress of moisture or water into the Transmitter and Terminal Box.
- Ensure that the Mains power supply is stable, without any surges & spikes and well within the specified range.
- To avoid damage to the Flow Sensor'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 are no sources of strong magnetic field in the immediate vicinity of the Flow Sensor. 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 Sensor by shutting off the valve which is immediately downstream of the Flow Sensor.
  - This way the Flow Sensor will remain filled with liquid.
  - Keep the Transmitter powered ON.
  - Measure the output signal.
- If the output is not stable, the possible causes can be
  - Improper grounding
  - Shifted zero. In this case follow the Calibration mode.
  - Contaminated electrodes
- The flowing liquid must be free of any gas bubbles as the presence of bubbles causes falsified output.

7. Troubleshooting

7.1 Quick checks

No.	Problem observed	Possible cause	Corrective action
1	Transmitter does not power up.	a. Fuse has blown. b. The mains power supply is not as specified.	a. Replace the fuse if found to be blown. b. Ensure that the mains power supply is within ±15 % of the value specified on the Nameplate.
2	The output current is not 4 mA DC under zero flow condition.	a. The flow is not essentially zero. There exists a small amount of trickle flow. b. Grounding is not proper.	a. Force the flow to zero by completely shutting off the downside valve and check. b. Correct the grounding.
3	Output current is not steady.	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. d. Grounding is not proper.	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.
4	Output current not proportional to flow.	Qmax values may not be set properly.	Set the Qmax to values correctly corresponding to 20 mA.
5	Display alternates between High Flow and Empty pipe.	Grounding is not proper.	Correct the grounding.
6	Modbus communication issues	a. Wiring is not correct. b. Communication settings are incorrectly set.	a. Correct wiring as per diagram. b. Set correct communication parameters
7	Pulse is not available.	a. Pulse settings are not correct. b. Pulse type is not known.	a. Correct Pulse settings in respective DO section. b. Check your ordering for Active or Open Collector Output.

8. Modbus Table

The Flowmeter supports Modbus RTU protocol over RS 485. Available parameters are as follow.
When accessing a parameter, use the address obtained by subtracting 1 from the address shown in the Modbus Table.
Read Holding Registers (Function 3)

Address in Decimal	Data Type	Data Size		Register Name	Register Description	
		Words	Bytes			
Run Parameters Registers (double)						
101	double	4	8	Velocity	Flow Velocity (m/s or f/s depends upon unit selected)	
105		4	8	Flow Rate	Flow Rate Positive or Negative	
109		4	8	Pos Totaliser	Positive Totaliser	
113		4	8	Neg Totaliser	Negative Totaliser	
117		4	8	Net Totaliser	Net Totaliser	
123	ulong	2	4	Flow Status	1 = Flow Zero 2 = Flow On	3 = High Flow 4 = Pipe Empty
Run Parameters Registers (float)						
131	float	2	4	Velocity	Flow Velocity (m/s or f/s depends upon unit selected)	
133		2	4	Flow Rate	Flow Rate Positive or Negative	
135	ulong	2	4	Pos Totaliser	Positive Totaliser, Resolution as per setting	
137		2	4	Neg Totaliser	Negative Totaliser, Resolution as per setting	
139		2	4	Net Totaliser	Net Totaliser, Resolution as per setting	
143		2	4	Flow Status	1 = Flow Zero 2 = Flow On	3 = High Flow 4 = Pipe Empty
Run Parameters Registers (signed long integer)						
161	slong	2	4	Velocity	Flow Velocity (m/s or f/s depends upon unit selected), Resolution 0.001	
163		2	4	Flow Rate	Flow Rate Positive or Negative, Flow Rate value < 100000, Resolution 0.0001 Flow Rate value ≥ 100000, Resolution 1	
165	ulong	2	4	Pos Totaliser	Positive Totaliser, Resolution as per setting	
167		2	4	Neg Totaliser	Negative Totaliser, Resolution as per setting	
169		2	4	Net Totaliser	Net Totaliser, Resolution as per setting	
173		2	4	Flow Status	1 = Flow Zero 2 = Flow On	3 = High Flow 4 = Pipe Empty

Revision Information

- Title : Magnetic Flowmeter AY6410 Installation Manual
- Manual No. : IM-AY6410-00

Edition	Date	Page	Revised Item
1st	Mar. 2026	—	New publication