SIEMENS

SITRANS F

Electromagnetic flowmeters SITRANS MAG 6000 I/6000 I Ex de

Operating Instructions

7ME693 (MAG 6000 I)

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

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1.1 Preface

These instructions contain all the information you need for using the device.

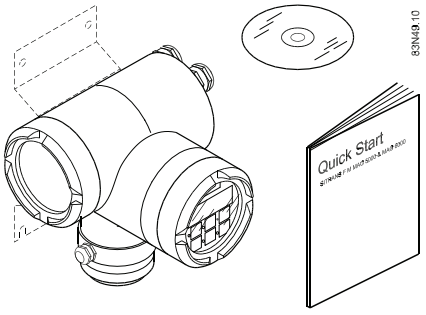
The instructions are aimed at persons mechanically installing the device, connecting it electrically, configuring the parameters and commissioning it, as well as service and maintenance engineers.

Note

It is the responsibility of the customer that the instructions and directions provided in the operating instructions are read, understood, and followed by the relevant personnel before installing the device.

1.2 Items supplied

- SITRANS F M MAG 6000 I or MAG 6000 I Ex de transmitter
- Wall mounting bracket (remote version)
- SITRANS F M literature CD containing software, certificates and device manuals
- Quick start guide



1.3 Revision history

The contents of these instructions are reviewed regularly and any corrections included in subsequent editions. We welcome all suggestions for improvement.

The following table lists the most important changes made to the documentation in the current and previous editions.

Edition	Remarks	HW version	SW version
08/2018	• Updated Safety Notes	08	4.08 X06
04/2016	• Various technical specifications updated • Control drawing updated	08	4.08 X06

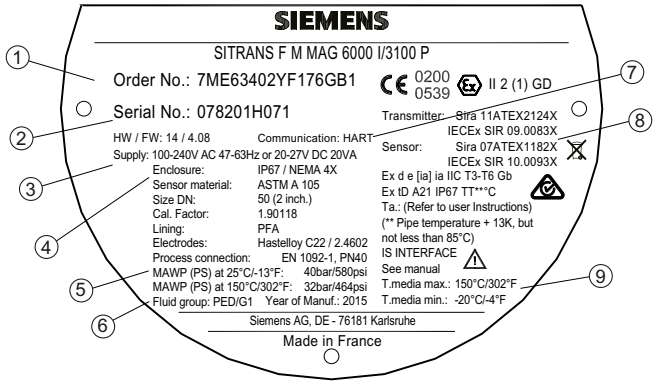
Edition	Remarks	HW version	SW version
01/2015	• Graphics, technical data and factory settings changed to comprise: – "BBL42" is displayed as the default setting in customer unit instead of "?". The unit can still be changed. – Improved minimum supply voltage for current output to 12 V. • Document revision identification changed according to new SIEMENS standard	06	4.08 X06
09/2012	• Enhanced current output function • Updated menu functions; possibility of showing user defined units in display • Updated ATEX approval • General update	06	4.07 X06
12/2011	• Updated ATEX approval • General update	04	4.07 X06
03/2011	• First edition • Transmitter upgrade information included	04	4.06 X06

1.4 Device identification

Inspection

1. Check for mechanical damage due to possible improper handling during shipment. All claims for damage are to be made promptly to the carrier.
2. Make sure the scope of delivery, and the information on the namelate corresponds to the ordering information

Identification



① Code number
② Serial number
③ Power supply
④ Enclosure rating
⑤ MAWP (Maximum Allowable Working Pressure) at defined temperature, e.g. 25 °C
⑥ Fluid group statement required by PED
⑦ Communication module dellivered with the flowmeter
⑧ Approvals
⑨ Media temperature

Figure 1-1 Example of MAG 6000 I Ex nameplate

1.5 Further Information

Product information on the Internet

The Operating Instructions are available on the documentation disk shipped with the device, and on the Internet on the Siemens homepage, where further information on the range of SITRANS F flowmeters may also be found:

Product information on the internet (http://www.siemens.com/flowdocumentation)

Worldwide contact person

If you need more information or have particular problems not covered sufficiently by these Operating Instructions, get in touch with your contact person. You can find contact information for your local contact person on the Internet:

Local contact person (http://www.automation.siemens.com/aspa_app/contactmenu.aspx?ci=yes&regid=DEF&lang=en)

Safety notes

2

2.1 General safety instructions

⚠ CAUTION
Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.
Only qualified personnel should install or operate this instrument.

Note

Alterations to the product, including opening or improper modifications of the product are not permitted.

If this requirement is not observed, the CE mark and the manufacturer's warranty will expire.

2.2 Laws and directives

General requirements

Installation of the equipment must comply with national regulations. For example EN 60079-14 for the European Community.

Instrument safety standards

The device has been tested at the factory, based on the safety requirements. In order to maintain this condition over the expected life of the device, the requirements described in these Operating Instructions must be observed.

Environmental conditions according to IEC61010-1:

- Indoor/Outdoor use
- Altitude up to 2000 m
- Maximum relative humidity 80% for temperatures up to 31°C (88 °F) decreasing linearly up to 50% relative humidity from 40 °C (104 °F)

- Overvoltage category II
- Pollution degree 2

NOTICE
Material compatibility Siemens Flow Instruments can provide assistance with the selection of wetted sensor parts. However, the full responsibility for the selection rests with the customer and Siemens Flow Instruments can take no responsibility for any failure due to material incompatibility.

CE marked equipment

The CE-mark symbolizes the compliance of the device with the following directives:

- EMC-directive 2004/108/EC
- Low voltage directive 2006/95/EC
- Pressure equipment directive (PED/DGRL) 97/23/EC
- ATEX Directive 94/9/EG

2.3 Installation in hazardous area

⚠ WARNING
Conditions for safe use Equipment used in hazardous areas must be Ex-approved and marked accordingly. It is required that the special conditions for safe use provided in the manual and in the Ex certificate are followed!

⚠ WARNING
Suitable hazardous area approval Make sure the hazardous area approval is suitable for the environment in which the device will be installed.

⚠ WARNING
"Flameproof enclosure" type of protection Only open devices with type of protection "Flameproof enclosure" in hazardous areas when the power to the device is turned off, otherwise there is a risk of explosion.

⚠ WARNING

Laying of cables

Cable for use in Zone 1 and 2 or 21 and 22 must satisfy the requirements for having a proof voltage > 500 V AC applied between the conductor/ground, conductor/shield and shield/ground.

Connect the devices that are operated in hazardous areas as per the stipulations applicable in the country of operation, e.g. for Ex "d" and "nA", permanent cables must be laid

⚠ WARNING

Requirements for meters used with transmitter

With intrinsically safe circuits, use only certified meters appropriate for the transmitter.

If a non-conforming supply unit is used, the "fail-safe" type of protection will no longer be effective and the approval certification will be invalid.

2.3.1 ATEX 2 GD approval

The device is approved for use in hazardous area and has certificate Sira 11ATEX2124X.

Remote transmitter version:

Ⓔx II 2(1) GD

EX d e [ia] ia IIC T6 Gb

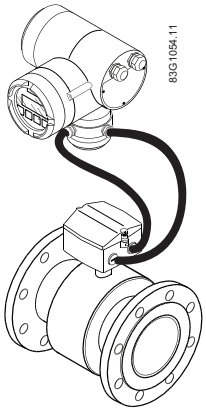
Ex tD A21 IP67 T85 °C

Ta -25 °C to 60 °C

Note

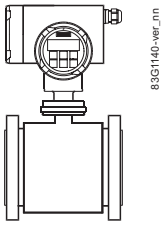
Markings for remote version only

These markings are for the Remote version only; the marking applicable to the Compact versions depend upon their construction. See the latest issues of certificates Sira 07ATEX3181X, Sira 07ATEX1182X and Sira 03ATEX3339X.



Compact transmitter version:

- Ex d e [ia] ia IIC T3-T6 Gb
  Ex tD A21 IP67 T** °C (** pipe temperature +13K, but not less than T85 °C
  (MAG 3100 / MAG 3100 P)
- Ex d e [ia] ia IIB T3-T6 Gb
  Ex tD A21 IP67 T** °C (** pipe temperature +18K, but not less than T85 °C
  (MAG 1100 / MAG 1100 F)



For sensors:

Refer to sensor certificates:

MAG 3100 / MAG 3100 P: Sira 07ATEX1182X (DN 15-DN300); Sira 03ATEX3339X (DN350-DN2000)

MAG 1100 / MAG 1100 F: Sira 07ATEX3181X

Safety parameters associated with the remote transmitter version

Table 2-1 Intrinsically safe data

Sensor electrode input (Terminals 0, 81, 82, 83, 84 - "ia circuits")		
	IIB	IIC
U_O	30 V DC	30 V DC
I_O	6.1 mA	6.1 mA
C_O	560 nF	66 nF
L_O	1 H	0.96 H
P_O	45.5 mW	45.5 mW

Sensor coil terminals	Terminal type
85 and 86	"e"

Power supply:

Parameter	MAG 6000 I Ex de
Supply	115 to 230 VAC or 18 to 30 VDC
Max. allowable supply voltage U_m (according to ATEX certificate)	264 V
Ambient temperature	-20 to +60 °C (-4 to 140 °F)
Enclosure	IP67 / NEMA 4X

⚠ WARNING

Fail-safe protection

With intrinsically safe circuits, use only certified meters appropriate for the transmitter.

If a non-conforming suuply unit is used, the "fail-safe" type of protection wil no longer be effective and the approval certification will be invalid.

User I/O interface

Remote MAG 6000 I: Model 7ME693-2BA4/5

Compact:

MAG 6000 I with MAG 3100 series: Model 7ME63x0-xxxxx-xD/E

Passive current (31, 32)		Active current (31, 32)			Relay (44, 45, 46)		Frequency/pulse (56, 57)		Profi (FISCO) (95, 96)		Digital input (77, 78)	
	IIC		IIB	IIC		IIC		IIC		IIC		IIC
U_i	28 V DC	U_O	30 V DC	30 V DC	U_i	30 V DC	U_i	28 V DC	U_i	17.5 V DC	U_i	30 V DC
I_I	100 mA	I_O	87.8 mA	87.8 mA	I_I	200 mA	I_I	100 mA	I_I	380 mA	I_I	
C_I	19.7 nF	C_O	557 nF	63 nF	C_I	3.3 nF	C_I	14.2 nF	C_I	0 nF	C_I	0 nF
L_I	36 µH	L_O	18.4 mH	4.6 mH	L_I	0 µH	L_I	36 µH	L_I	0 µH	L_I	0 µH
P_I	0.7 W	P_O	0.66 W	0.61 W	P_I	1.2 W	P_I	1.2 W	P_I	5.32 W	P_I	1.2 W

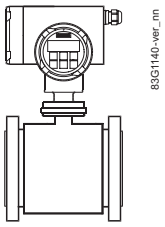
Special conditions for ATEX 2 GD

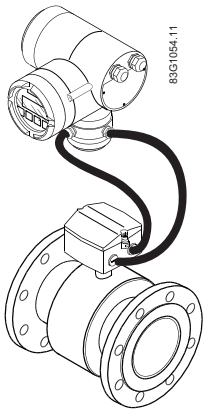
It is required that:

- The equipment is supplied with its current output (terminals 31 and 32) in "Passive mode only".
- The external connections to terminals 85 and 86 shall comply with the following:
  - The wire conductors shall have a cross-sectional area between 0.5 mm^2 and 2.5 mm^2.
  - No more than one single or multiple strand wire conductor shall normally be connected to each of the terminals. If multiple conductors are required, these shall be joined in a suitable manner, e.g. two conductors into a single insulated crimped boot lace ferrule.
  - The insulation on the wire conductors shall extend to within 1 mm of the metal of the terminal throat.
  - The terminal screws shall be tightened down with a torque between 0.4 Nm and 0.45 Nm.
- The equipment shall not be opened when an explosive gas or dust atmosphere may be present.
- The equipment internal circuits at the following terminals are not capable of withstanding a 500 V r.m.s. a.c. test to earth as required by clause 6.3.12 of EN 60079-11-2007. This must be taken into account in any equipment installation:
  Terminals 77 and 78 – Digital input.
  Terminals 95 and 96 – Foundation Fieldbus/Profibus (FISCO). (Not applicable to Model 7ME693-2BA6)
  Terminals 0, 81, 82, 83 and 84 – Sensor electrode input (Remote Version only).
- electrical connections are in accordance with national requirements for installation of electrical systems in hazardous areas, e.g. EN60079-14 in Europe.
- the protective cover for the power terminals is properly installed.
  When the device is de-energized, the power supply terminal room may be opened because the non-intrinsically safe power terminals are separately covered. Only remove protective cover when device is de-energized.
- sensor and transmitter are connected to the potential equalizing conductor.
- when protective earth (PE) is connected, no potential difference between the protective earth (PE) and the potential equalization (PA) can exist, even during a fault condition.

2.3.2 FM/CSA Class I, Zone 1 approval

Compact and remote versions





FM: Class I, Zone 1 IIC
CSA: Class I, Zone 1 IIC, Zone 21

User I/O interface

Remote MAG 6000 I: Model 7ME693-2BA4/5

Compact:

MAG 6000 I with MAG 1100: Model 7ME6110-xxx2x-xD/E

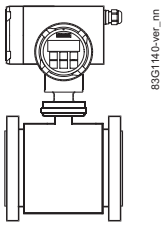
MAG 6000 I with MAG 1100 F: Model 7ME6140-xxx2x-xD/E

MAG 6000 I with MAG 3100 series: Model 7ME63x0-xxxxx-xD/E

Passive current (31, 32)		**Active current (31, 32)**			**Relay (44, 45, 46)**		**Frequency/pulse (56, 57)**		**Profi (FISCO) (95, 96)**		**Digital input (77, 78)**	
	IIB/IIC		IIB	IIC		IIB/IIC		IIB/IIC		IIB/IIC		IIB/IIC
U_i	28 V DC	U_O	30 V DC	30 V DC	U_i	30 V DC	U_i	28 V DC	U_i	17.5 V DC	U_i	30 V DC
I_I	100 mA	I_O	87.8 mA	87.8 mA	I_I	200 mA	I_I	100 mA	I_I	380 mA	I_I	
C_I	19.7 nF	C_O	557 nF	63 nF	C_I	7.5 nF	C_I	14.2 nF	C_I	0 nF	C_I	0 nF
L_I	36 µH	L_O	18.4 mH	4.6 mH	L_I	0 µH	L_I	36 µH	L_I	0 µH	L_I	0 µH
P_I	0.7 W	P_O	0.66 W	0.61 W	P_I	1.2 W	P_I	1.2 W	P_I	5.32 W	P_I	1.2 W

2.3.3 FM Class I, II, III, Div 1 approval

Compact version for MAG 3100/3100 P sensors DN 15 to 300 (½" to 12")



Hazardous area

Class I, Div. 1, Group A, B, C, D

User I/O interface

Passive current (31, 32)		Active current (31, 32)			Relay (44, 45, 46)		Frequency/pulse (56, 57)		Profi (FISCO) (95, 96)		Digital input (77, 78)	
	ABCD		CD	AB		ABCD		ABCD		ABCD		ABCD
U_i	28 V DC	U_O	30 V DC	30 V DC	U_i	30 V DC	U_i	28 V DC	U_i	17.5 V DC	U_i	30 V DC
I_I	100 mA	I_O	87.8 mA	86.8 mA	I_I	200 mA	I_I	100 mA	I_I	380 mA	I_I	
C_I	19.7 nF	C_O	557 nF	63 nF	C_I	3.3 nF	C_I	14.2 nF	C_I	0 nF	C_I	0 nF
L_I	36 µH	L_O	18.4 mH	4.6 mH	L_I	0 µH	L_I	36 µH	L_I	0 µH	L_I	0 µH
P_I	0.7 W	P_O	0.66 W	0.66 W	P_I	1.2 W	P_I	1.2 W	P_I	5.32 W	P_I	1.2 W

Notes from control drawing

1. The non-intrinsically safe terminals (power rail) must not be connected to a device which uses or generates more than 250/30 Vrms or DC.
2. The installation must meet the requirements of the National Electrical Code/Canadian Electrical Code.
3. Conduit seal is required within 460 mm (18") from MAG 6000 I in hazardous areas (Class I, Div. 1).

The control drawings are found on the CD-ROM shipped with the device and on the Siemens homepage at http://www.siemens.com/flowdocumentation.

See also

Control drawing (Page 97)

Description

3

3.1 Applications

The pulsed DC-powered magnetic flowmeters are suitable for measuring the flow of almost all electrically conductive liquids, pastes, and slurries with max. 40% solids.

The main applications can be found in the following sectors:

- Water and waste water
- Chemical and pharmaceutical industries
- Food & beverage industry
- Mining and cements industries
- Pulp and paper industry
- Steel industry
- Power generation; utility and chilled water industry

WARNING

This is a Class A product

In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

3.2 System components

The SITRANS F M flowmeter system includes:

- Transmitter (types: MAG 6000 I standard or Ex version in compact or remote configuration)
- Sensor (types: SITRANS F M MAG 1100/1100 HT/1100F, MAG 5100 W, MAG 3100 P/ 3100 or 3100 HT)
- Communication module (optional) (types: HART, PROFIBUS PA/DP, MODBUS RTU RS485, Foundation Fieldbus H1, Devicenet)

Communication solutions

The SITRANS F M platform enables fitting of add-on bus modules without loss of analog, pulse and relay outputs, and all modules can be fitted as true Plug & Play.

Standard transmitter:

- HART
- PROFIBUS PA and DP

- Foundation Fieldbus H1
- MODBUS RTU RS485
- Devicenet

Ex-transmitter:

- HART
- PROFIBUS PA
- Foundation Fieldbus H1

3.3 Design

The SITRANS F M MAG 6000 I/MAG 6000 I Ex de transmitter is designed for demands in the process industry. The robust cast aluminum housing provides superb protection, even in the most harsh industrial environments. Full input and output functionality is given even in the Ex version.

Compact version

Remote version

The transmitter is designed for either compact or remote installation in non-hazardous or hazardous areas.

Functions:

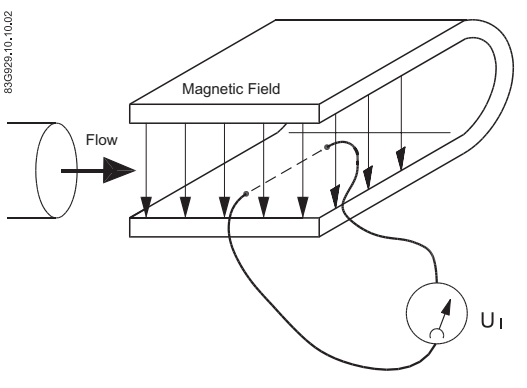
- Flow rate measurement
- 2 measuring ranges
- Display with 2 totalizers and keypad
- Low flow cut-off
- Analog, pulse/frequence and relay outputs
- Optional: additional digital communication modules
- Error and error log system
- Uni-/bidirectional flow
- Limit switches
- Integrated batch control

3.4 Features

- SENSORPROM® memory unit
  - All SITRANS F M electromagnetic flowmeters feature a unique SENSORPROM® memory unit which stores sensor calibration data as well as transmitter settings for the lifetime of the product.
  - At commissioning the flowmeter commences measurement without any initial programming.
  - The factory settings matching the sensor are stored in the SENSORPROM® unit. Also customer- specified settings are downloaded to the SENSORPROM® unit. Should the transmitter be replaced, the new transmitter will upload all previous settings and resume measurement without any need for re-programming.
- USM II "Plug & Play" add-on communication modules
  USM II - the Universal Signal Module with "Plug & Play" simplicity makes it easy to access and integrate the flow measurement with almost any control system. It ensures the flowmeter will be easy to upgrade to new communication platforms in the future, too.
- CAN communication
  The transmitter operates internally via an internal CAN communication bus. Signals are transferred through a signal conditioner to the display module and to/from internal/external option modules and the dialog module.
- Dialog module
  The display unit consists of a 3-line display and a 6-key keypad. The display shows a flow rate or a totalizer value as a primary reading and can be changed from the factory-set English to ten other languages. In the Operator menu setup it is possible to configure the display to show various different menus.
- Output module
  The output module converts flow data to analog, digital and relay outputs. The outputs are galvanically isolated and can be individually set to suit a particular application.

3.5 Theory of operation

The flow measuring principle is based on Faraday’s law of electromagnetic induction.



U_i = When an electrical conductor of length L is moved at velocity v, perpendicular to the lines of flux through a magnetic field of strength B, the voltage Ui is induced at the ends of the conductor

U_i = L x B x v

- Ui = Induced voltage
- L = Conductor length = Inner pipe diameter = k_1
- B = Magnetic field strength = k_2
- v = Velocity of conductor (media)
- k = k_1 x k_2

Ui = k x v, the electrode signal is directly proportional to the fluid velocity

Coil current module generates a pulsating magnetizing current that drives the coils in the sensor. The current is permanently monitored and corrected. Errors or cable faults are registered by the self-monitoring circuit.

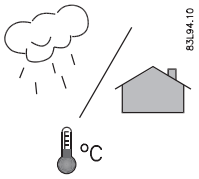
Input circuit amplifies the flow-proportional induced signal from the electrodes. The input impedance is extremely high: $>10^{14}$ Ω which allows flow measurements on fluids with conductivities as low as 5 µS/cm. Measuring errors due to cable capacitance are eliminated due to active cable screening.

Digital signal processor converts the analog flow signal to a digital signal and suppresses electrode noise through a digital filter. Inaccuracies in the transmitter as a result of long-term drift and temperature drift are monitored and continuously compensated for via the self-monitoring circuit. The analog to digital conversion takes place in an ultra low noise ASIC with 23 bit signal resolution. This has eliminated the need for range switching. The dynamic range of the transmitter is therefore unsurpassed with a turn down ratio of minimum 3000:1.

Installing/Mounting

4

This chapter describes how to install the flowmeter in the compact version as well as in the remote version.



SITRANS F flowmeters with minimum IP67/NEMA 4X enclosure rating are suitable for indoor and outdoor installations.

All sensors have an associated SENSORPROM® containing all necessary sensor data.

4.1 Installation safety precautions

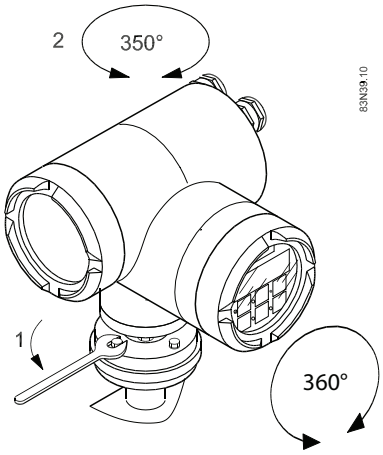
⚠ WARNING

High pressure hazard

In applications with working pressures/media that can be dangerous to people, surroundings, equipment or others in case of pipe fracture, we recommend that special precautions such as special placement, shielding or installation of a pressure guard or a safety valve are taken when the flowmeter is mounted.

4.2 Installation conditions

As the transmitter housing and the display can be oriented in all directions, reading and operating the flowmeter is possible under almost any installation conditions.



To ensure optimum flow measurement, attention should be paid to the following:

Vibrations

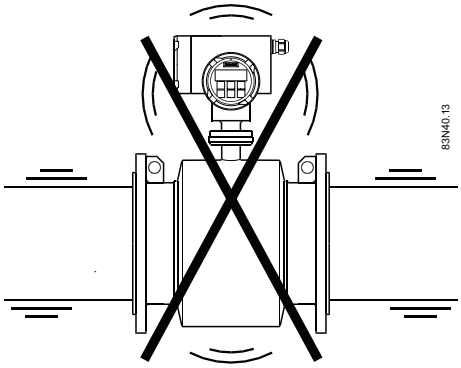


Figure 4-1 Avoid strong vibrations

In installation with strong vibrations remote installation of the transmitter is recommended.

4.3 Compact installation

The flowmeter is delivered with default factory settings and start measuring the flow rate after power-up. The SENSORPROM® is factory-mounted in the transmitter.

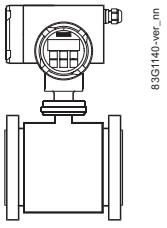


Figure 4-2 Compact installation

Note

To avoid too high tension on small sizes MAG 1100 sensors, transmitter must be supported.

4.4 Remote installation

For remote versions the SENSORPROM® has to be removed from the sensor terminal box and mounted in the remote transmitter.

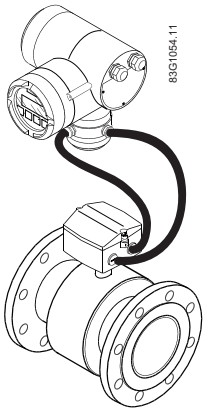
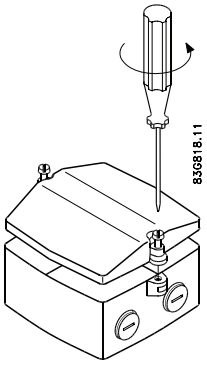


Figure 4-3 Remote installation

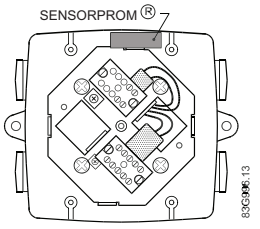
Cable length and type (as described in Cable requirements (Page 72)) must be used.

For installation conditions for sensors, see respective sensor operating instructions.

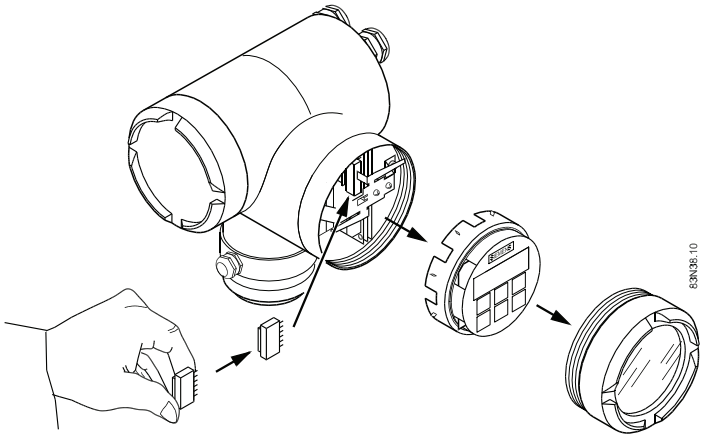
1. Remove sensor terminal box lid.



2. Remove SENSORPROM® unit from sensor terminal box.



3. Mount SENSORPROM® in remote transmitter.



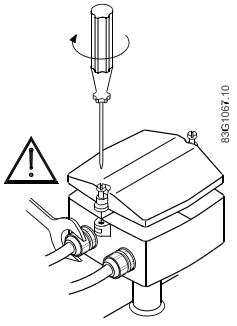
4. Fit M20 or ½" NPT cable glands on sensor terminal box.
5. Fit and connect electrode and coil cables as described in Connecting (Page 31).

Note

Unscreened cable ends must be kept as short as possible.

Electrode cable and coil cable must be kept separate to prevent interference.

6. Tighten cable glands and lid screws well to obtain optimum sealing.



⚠ WARNING

Mount terminal box lid before power up.

4.4.1 Wall mounting using standard mounting plate

1. Fit the mounting plate on the transmitter using the mounting material provided
2. Mount transmitter with mounting plate on the wall.

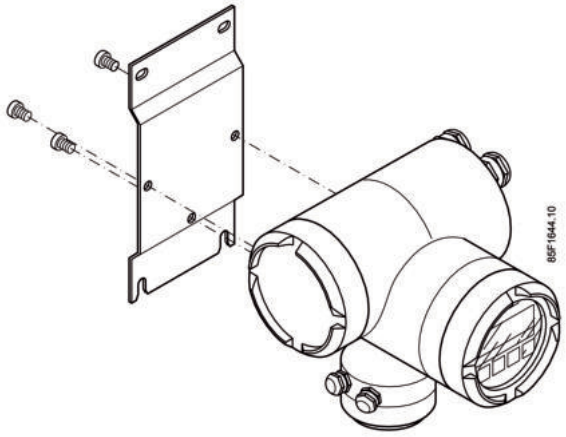


Figure 4-4 Standard mounting plate

For details on mounting plate, see Dimensions and weight (Page 67).

Note

The standard mounting plate is only suitable for wall mounting.

4.4.2 Pipe or wall mounting with assembly bracket

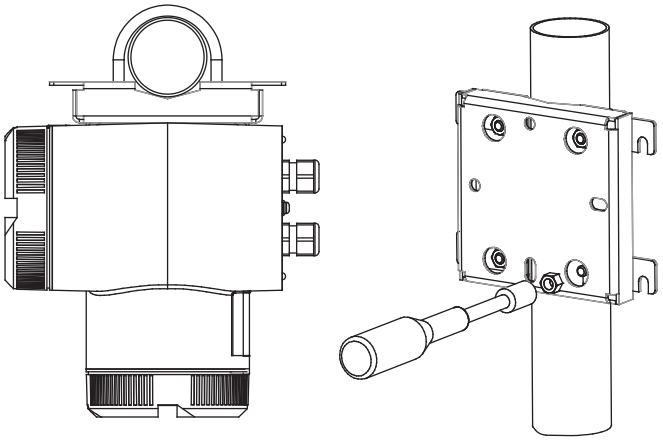
Optional pipe or wall mounting assembly bracket

Note

The assembly bracket is not part of the standard delivery and must be ordered separately.

Pipe mounting

1. Mount the assembly bracket on the pipe using the fastening brackets
2. Fasten the transmitter with the two screws provided.



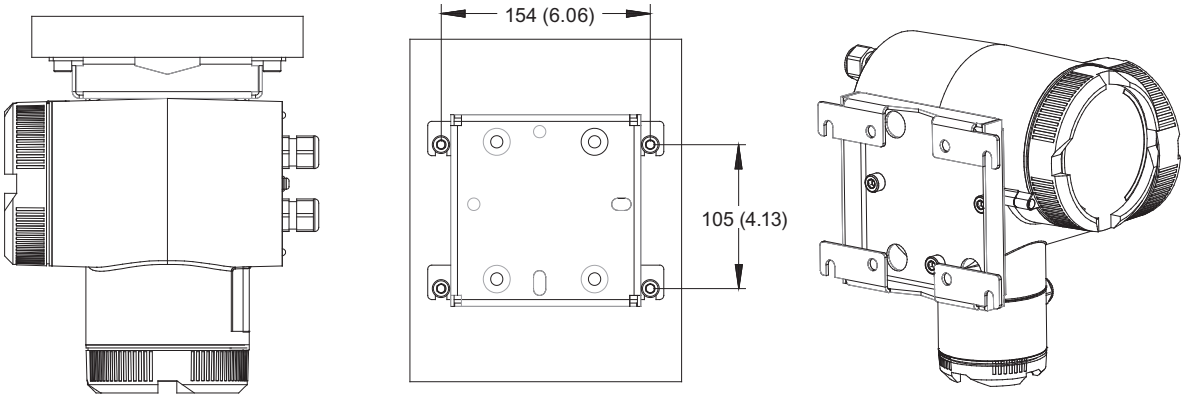
Pipe mounting with assembly bracket

Wall mounting

1. Fasten the assembly bracket to the back of the transmitter
2. Fasten the transmitter and assembly bracket to the wall

Note

The fastening brackets and nuts are not needed for wall mounting.



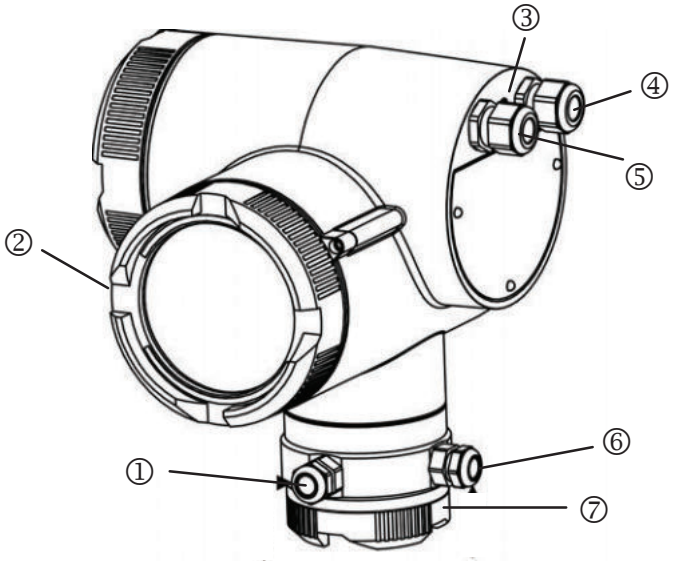
Wall mounting with assembly bracket. Dimensions in mm (inch).

Connecting

5

This chapter describes how to wire up the device without bus communication.

In order to wire up devices with communication modules, e.g. HART, Profibus PA or DP, Foundation Fieldbus, DeviceNet or MODBUS, refer to the Operating Instructions for relevant add-on module.



① Magnetic coil cable to sensor
② Terminal box for power supply and output signal cables
③ Potential equalization
④ Output signal cable
⑤ Power supply
⑥ Electrode cable to sensor
⑦ Terminal box for magnetic coil and electrode cables

Figure 5-1 Overview, Electrical connections

Cable specifications

- Only use cables with at least the same degree of protection as the sensor to install the sensor.
- The cable length from the cable gland to the terminals must be kept as short as possible. Cable loops in the terminal box must be avoided.
- To guarantee the IP 67/NEMA 4 degree of protection, use cables with external diameters matching the used cable glands.

5.1 Safety precautions

WARNING

Mains supply from building installation Overvoltage category II

A fused (max. 16 A) circuit breaker must be installed in close proximity to the equipment and within easy reach of the operator. It must be marked as the disconnecting device for the equipment.

WARNING

Field wiring installation

Ensure that the national regulations of the country in which the devices are installed are met.

WARNING

Qualified personnel

Only qualified personnel may carry out work on the electrical connections.

WARNING

Use in hazardous areas

Before opening the terminal box check that:

- No explosion hazard exists
- A fire department permission certificate has been issued
- All connection leads are potential free

Special requirements apply to the location and interconnection of sensor and transmitter. See "Installation in hazardous area"

WARNING

Maximum short circuit current

Only connect the device to a power supply which has a potential short circiut current equal or below of 35 A.

WARNING

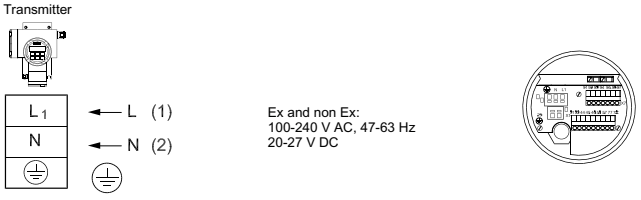
Danger of electric shock

Do **not** power up when lid is open.

Do **not** open lid while power is on, unless operating in an Ex ia environment.

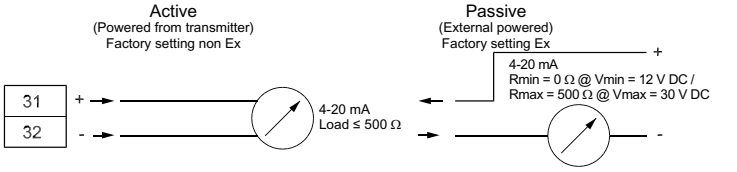
5.2 Electrical connection

Power supply

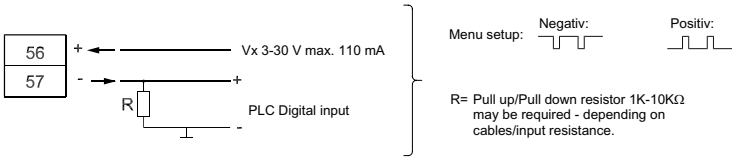


Outputs

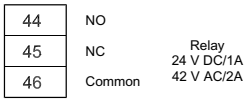
Current



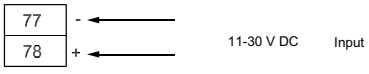
Digital



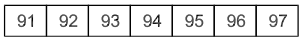
Relay



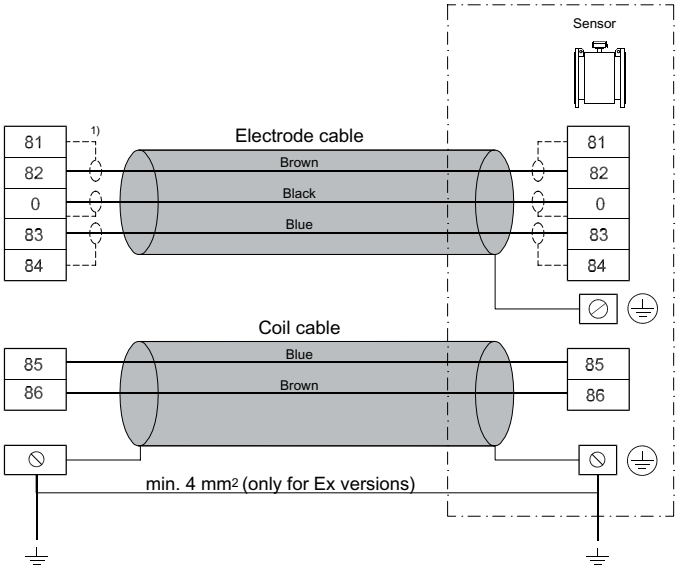
Digital input



Bus communication



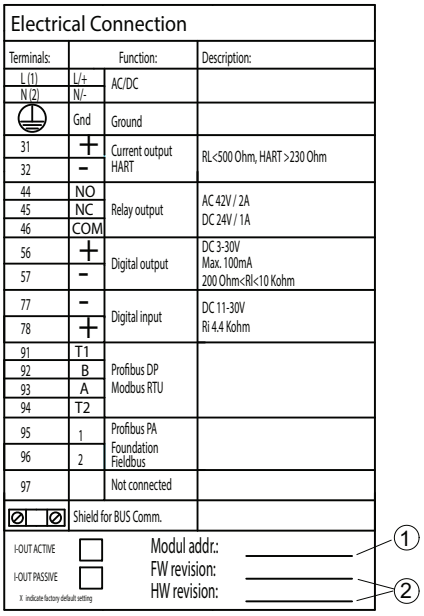
Sensor connection (remote transmitter)



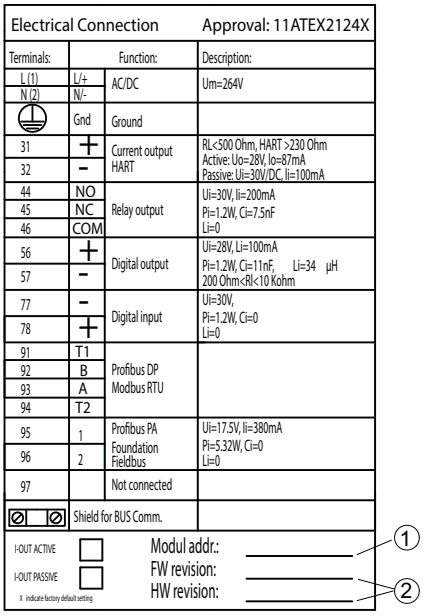
Electrical connection label

The electrical connection label is placed in the lid of the terminal box.

Non-Ex version



Ex version



① Fill in the address of the used communication module after installation

② Fill in the new FW and HW revisions in case spare part exchange

Note

Min. 4 mm² is only required for ATEX 2 GD and FM/CSA Class I, Zone 1/21 installations.

Note

Terminals 81 and 84 are only to be connected if special electrode cable with double screening is used, e.g. when empty pipe function or long cables are used.

Note

Special cable with individual wire shields (shown as dotted lines) are only required when using empty pipe function or long cables.

Note

All inputs and outputs are galvanically isoloated PELV circuits with 60 VDC isolation from each other and ground. Exception are sensor connections that are connected to ground.

⚠ WARNING

Grounding

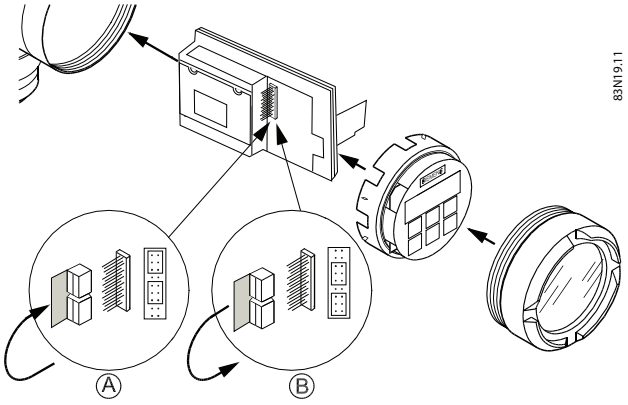
The mains protective earth wire must be connected to the PE terminal in accordance with the diagram (Protection class I).

NOTICE
HART communication
HART communication on active current output could be disturbed during operation in areas with a high frequency electromagnetic field

NOTICE
Ouptput cables
If long cables are used in noisy environments, it is recommended to use screened cables.

NOTICE
Electrode cables
Dotted connections are only to be made when using special electrode cables.

Active/passive current output



Pos	Active/Passive	Factory default
A	Active	MAG 6000 I
B	Passive	MAG 6000 I Ex version

Note

For Ex versions active or passive current output is preselected at ordering and cannot be changed.

Non-Ex versions can be connected as either active or passive.

Note

The factory default setting for the current output is marked by an "X" and can be found on a label on the back of the lid.

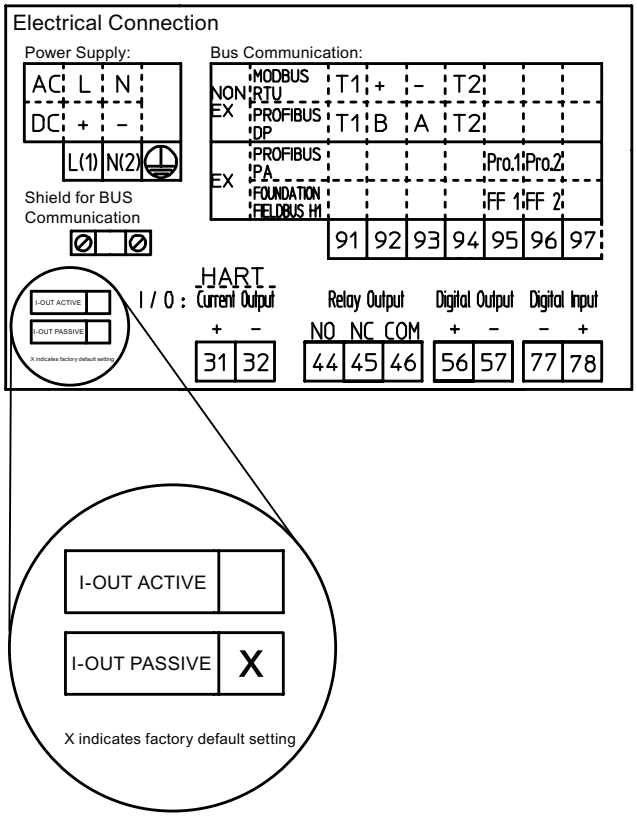


Figure 5-2 Example of label inside the lid

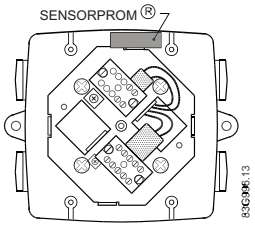
5.3 Connection of sensor and transmitter in remote version

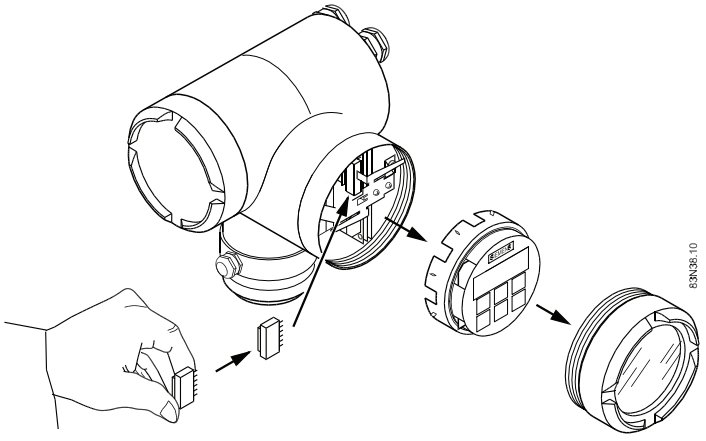
The following contains a short description of how to connect the sensor to the transmitter SITRANS F M MAG 6000 I. For more information refer to the Operating Instructions for the respective sensor.

Check that the serial numbers on the sensor and the SENSORPROM® unit are identical.

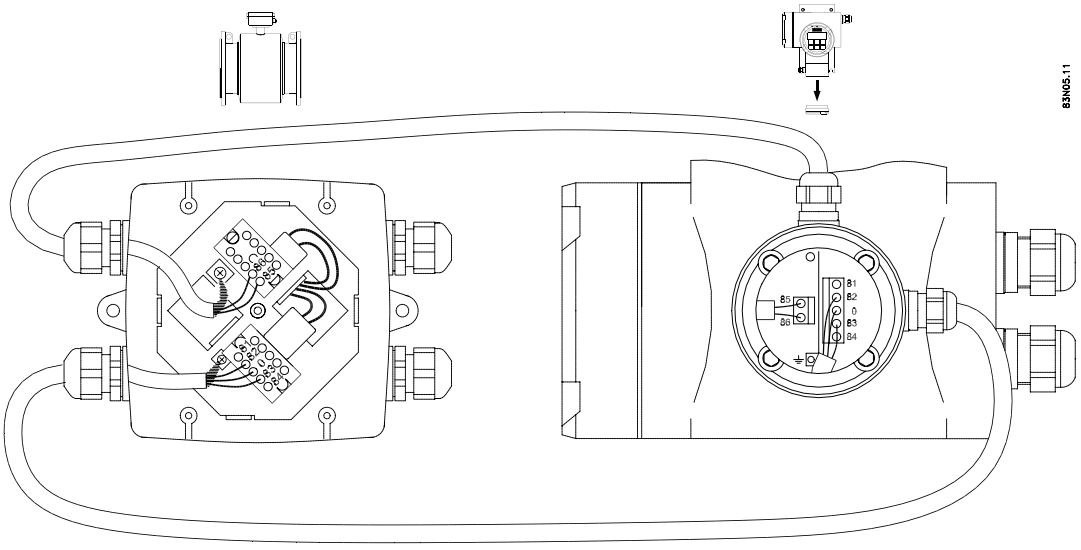
WARNING
Danger of electric shock
Do **not** power up when lid is open.
Do **not** open lid while power is on, unless operating in an Ex ia environment.

1. Relocate SENSORPROM® memory unit from sensor to transmitter terminal block.

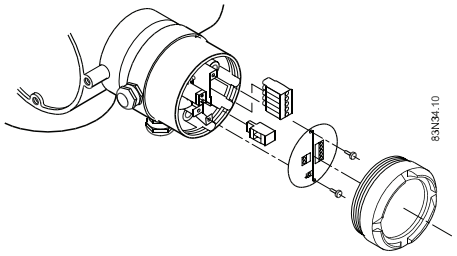




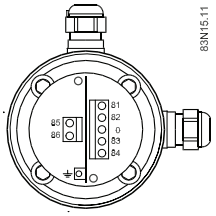
2. Fit coil and electrode cables through cable glands in sensor terminal box.



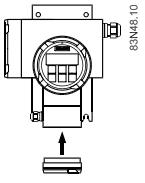
3. Connect signal and coil cables to transmitter as follows:



- Remove cover for connection board.
- Remove protection plate for connectors
- Remove the two connectors.
- Mount the two cables through the two cable glands and mount connectors on coil and electrode cables.
- Mount the two connectors on connection board; fit protection plate and fasten bolt.



1. Tighten all cable glands on sensor and transmitter to obtain optimum sealing.
2. Mount cover for connection board and mount lid on sensor.



3. Transmitter is ready to be powered up.

NOTICE
Avoid exposing transmitter to direct sunlight Exposing the transmitter to direct sunlight may increase the operating temperature above its specified limit, and decrease display visibility. In such case, protect the transmitter from direct sunlight.

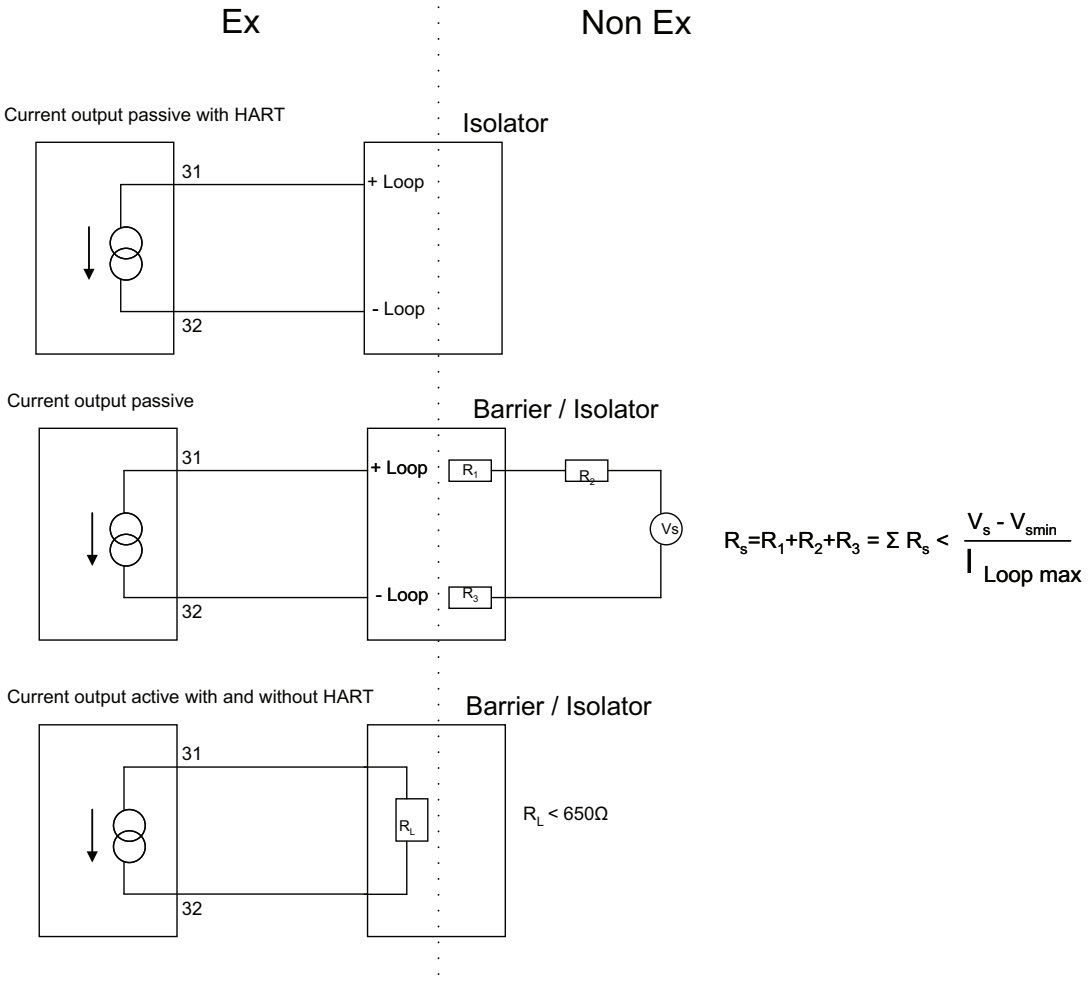
5.4 Wiring in hazardous area

Hazardous area applications

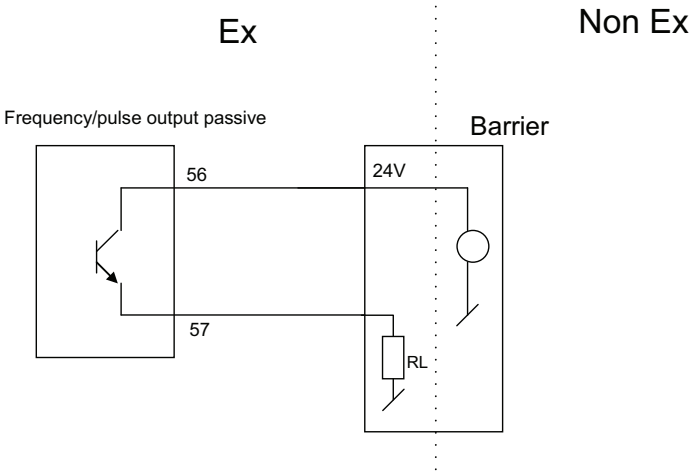
Special requirements apply to the location and interconnection of sensor and transmitter. See "Installation in hazardous area (Page 12)"

The following shows how to connect the device in various applications.

Current output in passive and active modes



Frequency/pulse output in passive mode



5.5 Connection of bus communication add-on modules

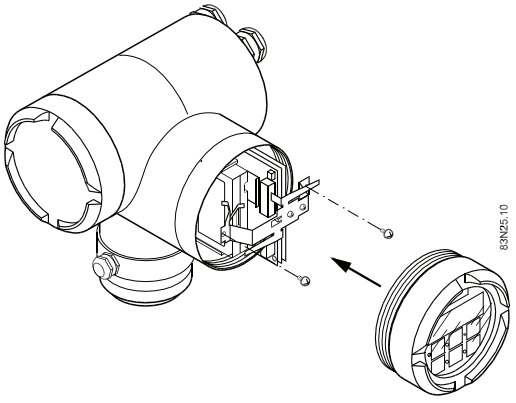
When the add-on module has been installed, the electrical connections are available on terminal rows 91-97.

For more information

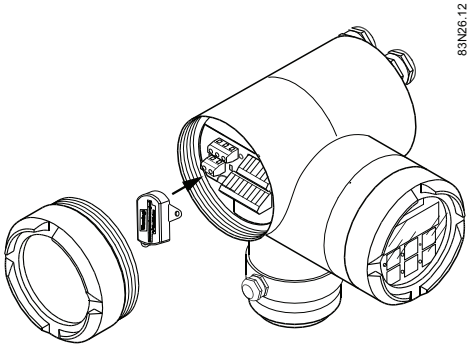
Refer to the relevant BUS communication Quick Start or Operating Instructions available at the SITRANS F literature CD or on the internet, at: www.siemens.com/flowdocumentation (www.siemens.com/flowdocumentation)

5.6 Reassembling the device

Ensure that the two screws (20 TORX) are tightened properly for correct assembly and proper ground connection.



Ensure sufficient insulation by covering power supply terminals with plastic cover. Fasten the plastic cover with two screws.



Commissioning

6

In this chapter it is described how to commission the device via the local user interface (LUI).

The display is described in details in section Local user interface (Page 41).

Furthermore, the following functions are described in details:

- Changing password (Page 43)
- Changing basic settings (Page 44)
- Changing operator menu setup (Page 47)
- Changing language (Page 48)

Detailed diagrams concerning the specific menu are shown in appendix menu diagrams (Page 75).

For factory settings, see Factory settings (Page 89).

6.1 Local user interface

With the capacitive touch keypad the device can be operated without opening the lid. An LED light gives feedback on accepted command.

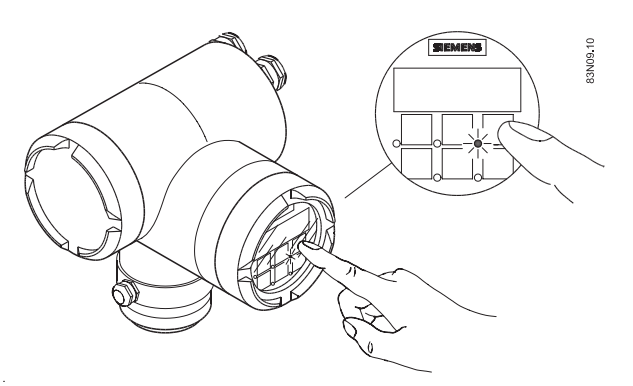


Figure 6-1 Local user interface

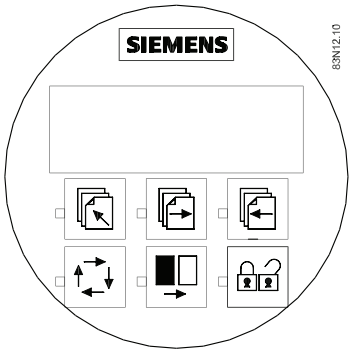


Figure 6-2 Capacitive touch keypad

Note

Isolate the device from power when removing the glass lid

If the glass lid is rotated during operation, the capacitive touch keypad automatically calibrates to align the distance from lid to keypad. To avoid any unintended programming during this calibration procedure, it is recommended to always isolate the device from power before removing the glass lid and until it is properly fixed to the device again.

Mode field symbols

	Communication mode		Language mode		Sensor characteristics
	Service mode		Basic settings		Reset mode
	Operator menu		Output		Operator-active
	Product identity		External input		Operator-inactive

Lock field symbols

	Ready for change		Access to submenu
	Value locked		RESET MODE: Zero setting of totalizers and initialization of setting

Keypad

The keypad is used to set the flowmeter. The keys function as follows:

TOP UP KEY		This key (when held for 2 sec.) is used to switch between operator menu and setup menu. In transmitter setup menu, a short press will cause a return to previous level.
FORWARD KEY		This key is used to step forward through the menus. It is the only key normally used by the operator.

BACKWARD KEY		This key is used to step backwards through the menus.
CHANGE KEY		With this key settings or numerical values are changed.
SELECT KEY		With this key figures to be changed are selected.
LOCK/UNLOCK KEY		This key enables the operator to change settings and it gives access to submenus.

6.2 Menu structure

The menu is built up of two parts. An **operator menu** and a **setup menu**, see also Menu diagrams (Page 75).

Operator menu

The operator menu is for daily operation. It can be customized in the operator menu setup in which the menus that are to be available to the operator are selected. The transmitter always starts up in operator menu No. 1. The forward  and the backward keys  are used to step through the operator menus.

Setup menu

The setup menu is for commissioning and service only. Access to the setup menu is gained by pressing the top up key  for 2 seconds. The setup menu operates in two modes:

- View mode
- Setup mode

View mode is a read-only mode. The pre-selected settings can only be scanned.

Setup mode is a read and write mode. The pre-selected settings can be scanned and changed. Access to the setup mode is password-protected. The factory set password is 1000.

Access to a submenu in the setup menu is gained by pressing the lock key  . Press the top up key  briefly to return to the previous menu. Press longer (2 sec.) to exit the setup menu and return to operator menu no. 1.

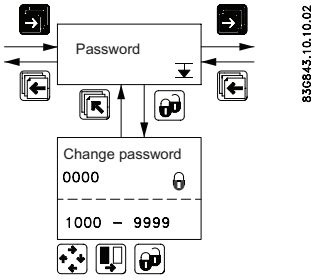
6.3 Changing password

The setup menu is password-protected in order to ensure that only authorized personnel can make any changes in transmitter settings.

Change password as follows:

1. Press top up key  for 2 sec.
2. Enter password.
3. Use forward key  or backward key  to reach password menu.
4. Press lock/unlock key  to unlock password.

5. Use select key and change key to change password.
6. Press lock/unlock key to confirm new password.
7. Press top up key two times to exit setup mode.



The factory-set password is 1000, but it can be changed to any value between 1000 and 9999.

Factory setting of password can be re-established as follows:

1. Switch off power supply.
2. While pressing top up key - switch on power supply.
3. Release top up key after 10 sec.

6.4 Changing basic settings

In the basic settings menu it is possible to set the following parameters:

Parameter	Description
Main frequency	Selection of main power supply frequency corresponding to the country in which the flowmeter is installed (e.g. 60 Hz in America).
Flow direction	Selection of correct flow direction in pipe.
Customer units	Setting of user defined volume and time units.
Q_{max}	Setting of measuring range, analog outputs and frequency output. Also individual dimension-dependent setting of value, decimal point, unit and time.
Q_{max} 2	Setting of measuring range, analog outputs and frequency output. Also individual dimension-dependent setting of value, decimal point, unit and time. This menu is only visible if chosen as external digital input.
Totalizer	Setting of unit and decimal point.
Low flow cut-off	Setting of a percentage of selected Q_{max}. This filters noise in installation reducing fluctuations in display and all outputs.
Empty pipe cut-off	When set to "On" the alarm will indicate when sensor is running empty. All readings, display and outputs, will indicate zero.
Velocity unit	Setting of velocity unit per time unit
Error level	Selecting error level at which flowmeter will detect an error.

Note

Totalizer 2 is not visible when batch is selected as digital output.

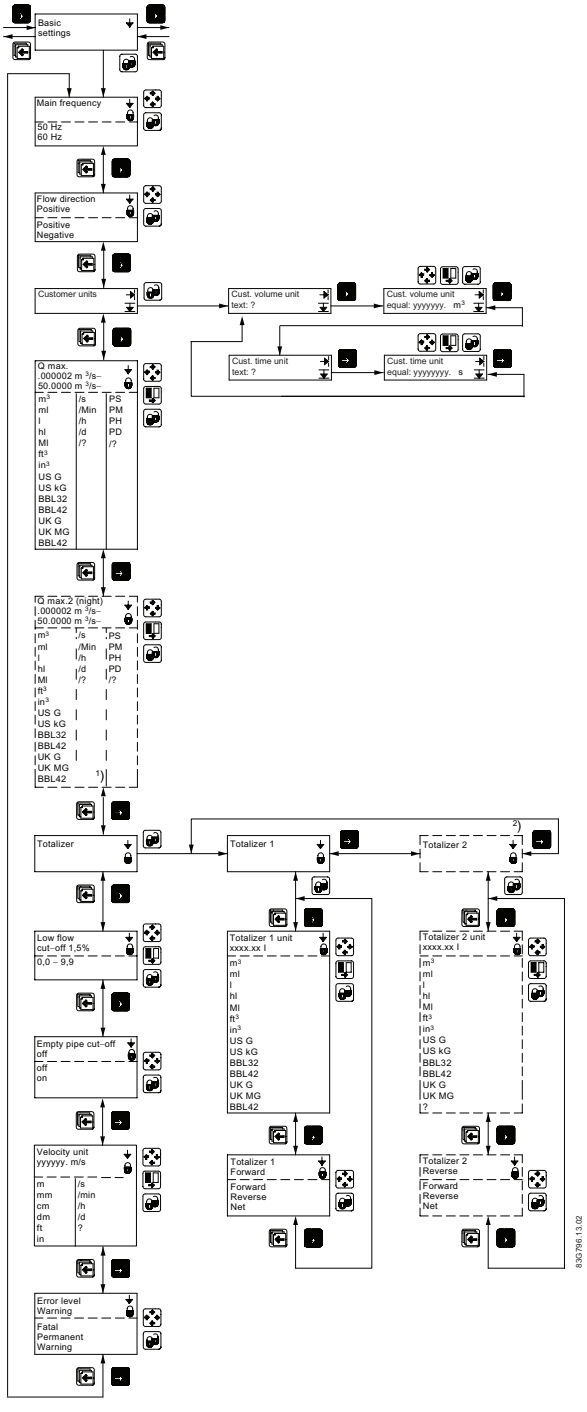
Note

Q_{max} 2 is visible only when chosen as digital input.

Change basic settings as follows:

1. Press top up key for 2 sec.
2. Enter password.
3. Use forward key to reach basic settings menu.
4. Press lock/unlock key to unlock settings.
5. Use forward key or backward key to reach relevant menu.
6. Press lock/unlock key to unlock settings.
7. Use select key and change key to change settings.
8. Press lock/unlock key to confirm new settings.

9. Repeat steps 5-8 to change other settings.
10. Press top up key ⬚ two times to exit setup mode.



Decimal point can be positioned and units set individually for flow rate in totalizer 1 and totalizer 2.

Changing decimal point position

1. Enter the respective totalizer menu.
2. Use select key to position cursor below decimal point.
3. Use change key to move decimal point to requested position.

Changing units

1. Use select key to position cursor below unit.
2. Press change key until requested unit is displayed.

6.5 Changing operator menu setup

In the operator menu the menus required for daily operation of the flowmeter are shown. It is possible to hide and change some of the menus in the operator menu. This is done in the operator menu setup menu, see diagram Operator menu setup (Page 86).

Customizing menus in operator menu

To customize the menus in the operator menu perform the following steps:

1. Press top up key for 2 sec.
2. Enter password.
3. Use forward key or backward key to reach operator menu.

Changing text in line 1

1. Press lock/unlock key to unlock setting.
2. Use change key to select desired text.
3. Press lock/unlock key to confirm selected text.

Note

If "Text" is selected in line 2, this line functions as a heading for the value shown in line 3. Otherwise it shows the actual value of the reading selected.

Enabling two readings

1. Use forward key to reach requested menu.
2. Press lock/unlock key to unlock setting.
3. Use select key to move cursor to upper line.
4. Use change key to select requested reading.
5. Press lock/unlock key to confirm selection.
6. Use select key to move cursor to line 3.

7. Use change key to select desired setting.
8. Press lock/unlock key to confirm new setting.
9. Repeat steps 1-8 for each requested menu.

Showing/hiding menus in operator menu

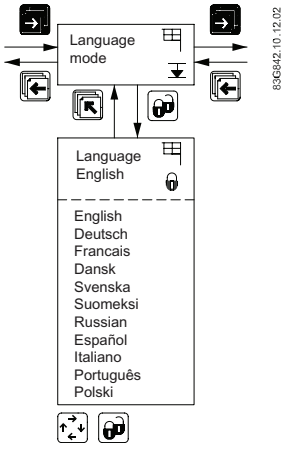
1. Use forward key to reach requested menu.
2. Press lock/unlock key to unlock setting.
3. Use select key to move cursor to √/÷ symbol.
4. Press change key to select visible (√) or hidden (÷).
5. Press lock/unlock key to confirm new setting.

6.6 Changing language

It is possible to change language in transmitter. Default language is English, but it can be changed to various other languages.

Change language as follows:

1. Press top up key for 2 sec.
2. Enter password.
3. Use forward key or backward key to reach language menu.
4. Press lock/unlock key to unlock language.
5. Use change key to select desired language.
6. Press lock/unlock key to confirm new language.
7. Press top up key two times to exit setup mode.



Functions

7

7.1 Introduction

This chapter describes the various menus of the transmitter in details. The menu diagrams are shown in appendix Menu diagrams (Page 75).

7.2 Output settings

Three outputs are available:

- Current output (range and time constant); terminals 31 and 32.
- Digital output (pulse, frequency, error, limit, or batch settings); terminals 56, 57, and 58.
- Relay output (error, limit, and batch settings); terminals 44, 45, and 46.

Current output

In the current output menu it is possible to select current output direction, range and time constant, see also Current output menu diagram (Page 79).

If current output "4-20 mA + Alarm" is selected, then alarm level and alarm differentiation may also be defined.

"Alarm level" defines if an alarm should be above 21 mA "High" or below 3.6 mA "Low".

"Alarm diff." defines whether or not the alarm should vary according to selected error level. Error level "Fatal". "Permanent" or "Warning" is selected in "Basic settings".

If Alarm differentiation is set to "Yes", depending on the Alarm level setting, the current output will show:

Alarm level	Output / Error level		
	Fatal	Permanent	Warning
Low	1.3 mA	2 mA	3 mA
High	23 mA	22 mA	21.5 mA

If Alarm differentiation is set to "No", depending on the Alarm level setting, the current output will show:

Alarm level	Output
Low	3.5 mA
High	22.6 mA

For setting of error level, see Error level menu diagram (Page 79).

If current output is not used, it must be set to "Off".

Digital output

Digital output can be used to configure various settings:

- Pulse (volume/pulse, pulse output, pulse width, pulse polarity, and time constant), see Pulse menu diagram (Page 79).
- Frequency (frequency output, max frequency, and time constant), see Frequency menu diagram (Page 79).
- Error settings (level and number), see Error level menu diagram (Page 79) and Error number menu diagram (Page 80).
- Limit settings (number of setpoints, setpoint settings, and hysteresis), see Direction/limit menu diagram (Page 80).
- Batch settings (quantity, time and counter settings, and time constant), see Batch menu diagram (Page 81).

Note

When relay is set to batch function, pulse/frequency is not available on digital output.

Relay outputs

Relay output can be used to configure various settings:

- Error settings (level and number), see Error level menu diagram (Page 79) and Error number menu diagram (Page 80).
- Limit settings (number of setpoints, setpoint settings, and hysteresis), see Direction/limit menu diagram (Page 80).
- Batch settings (quantity, time and counter settings, and time constant), see Batch menu diagram (Page 81).

See also

Current output (Page 78)

7.3 External input

By applying 11 … 30 V DC to terminals 77 and 78, it is possible to perform:

- Batch control (start, stop, hold/continue)
- Reset totalizer
- Force/freeze output
- Q_{max} 2 (night)

See external input menu diagram (Page 82).

7.4 Sensor characteristics

The sensor characteristics menu shows:

- If a SENSORPROM® is installed or not
- Suppress error P 40 (SENSORPROM® not installed)
- Sensor size
- Calibration factor
- Correction factor
- Excitation

See Sensor characteristics (Page 83).

Note

If a SENSORPROM is not installed, check the sensor characteristics to see if they match the product label and the previous customer settings.

7.5 Reset mode

The reset mode is used for resetting/presetting totalizers or for restoring the factory settings.

Resetting

1. Press top up key for 2 sec.
2. Enter password.
3. Use forward key or backward key to reach reset mode menu.
4. Press lock/unlock key to enter reset menu.
5. Press forward key to reach totalizer to be reset or default setting menu.
6. Press lock/unlock key to start resetting.

If restoring of factory settings (Page 89) is required:

1. Press lock/unlock key again to confirm destruction of customized settings.

See also reset menu diagram (Page 84).

7.6 Service mode

All outputs of the transmitter can be forced-controlled in the service mode menu, see Service mode (Page 85).

It is possible to check whether the outputs are functioning.

Error pending and status log lists are also accessible from this menu and the operating time (in days) can be read.

The forced control is stopped and all previous settings are reinitialized the moment the service mode is left by pressing top up key  .

Alarm, error, and system messages

8

8.1 Diagnostics

Error system

Transmitter system is equipped with an error and status log system with 4 groups of information.

(**I**) Information - system will continue to measure as normal, relay and current outputs will not be affected.

(**W**) Warning - system will continue to measure, but an event that may cause a system malfunction and require operator attention has occurred. The cause of the error may disappear on its own.

(**P**) Permanent error - may cause malfunction in the application and operator attention is required.

(**F**) Fatal error - is essential for the operation of the flowmeter. Immediate operator attention is required.

Two menus are available in service and operator menus for registration of information and errors.

- Error pending
- Status log

Note

Registration of errors in different modes

- In setup mode (local dialog) errors are entered only to Error pending list and not to Error log list, and not registered on physical outputs (current or relay).
- In service mode errors are entered to both Error pending and Error log lists, but not registered on physical outputs (current or relay).

Note

Power-off

Both error pending and status logs are reset at power-off.

Error pending

The first 9 pending errors are stored in the error pending list. When the error is corrected, it is removed from the error pending list.

The acceptance level for "error pending" can be individually configured to a particular application.

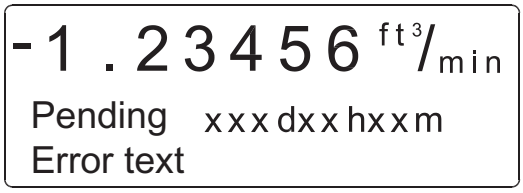
The acceptance level is set in the basic settings menu (Page 44).

Acceptance levels

The following three acceptance levels are selectable.

- Fatal error: Only fatal errors are registered as errors
- Permanent error: Permanent and fatal errors are registered as errors
- Warning (Default value): Warnings, permanent and fatal errors are registered as errors

Error information is displayed in title and subtitle lines, see display layout (Page 41). Title line will show time in days, hours and minutes since occurrence of error. Subtitle line will flash between an error text and a remedy text. Error text will indicate type of error (I, W, P or F), error number, and error text. Remedy text will inform operator of action to take to remove error.



Status log

The latest 9 errors are stored in the status log. Errors are stored in the status log for 180 days, even if they are corrected.

Alarm field

The alarm field on the display will always flash when an error is pending.

Error output

The digital and relay output can be activated individually error by error (error level). The relay output is default selected to error level. An output can also be selected to activate on a single error number.

The alarm field, error output and error pending always operate together.

Operator menu

Error pending and status log are as default enabled (√) in the operator menu.

8.2 List of error numbers

Error No.	*Error text* Remedy text	Comment	Output status	Input status
1	*I1 - Power on* OK	Device powered on	Active	Active
2	*I2 - Add-on module* Applied	A new module has been applied to the system	Active	Active
3	*I3 - Add-on module* Install	An add-on module is defect or has been removed. This can be an internal add-on module	Active	Active
4	*I4 - Param. corrected* OK	A less vital parameter in the transmitter has been replaced by its default value	Active	Active
20	*W20 - Totalizer 1* Reset manually	During initialisation the check of the saved totalizer value has failed. It is not possible to rely on the saved totalizer value anymore. The totalizer value must be reset manually in order to rely on future readings	Active	Active
20	*W20 - Totalizer 2* Reset manually	During initialisation the check of the saved totalizer value has failed. It is not possible to rely on the saved totalizer value anymore. The totalizer value must be reset manually in order to rely on future readings	Active	Active
21	*W21 - Pulse overflow* Adj. pulse settings	Actual flow is too big compared with pulse width and volume/pulse	Reduced pulse width	Active
22	*W22 - Batch timeout* Check installation	Duration of batching has exceeded a predefined maximum time	Batch output on zero	Active
23	*W23 - Batch overrun* Check installation	Batch volume has exceeded a predefined maximum overrun volume	Batch output on zero	Active
24	*W24 - Batch neg. flow* Check flow direction	Negative flow direction during batch	Active	Active
30	*W30 - Overflow* Adj. Q_{max}	Flow is above Q_{max} settings	Max. 120 %	Active
31	*W31 - Empty pipe*	Pipe is empty	Zero	Active
40	*P40 - SENSORPROM®* Insert/change	SENSORPROM® unit not installed	Active	Active
41	*P41 - Parameter range* Switch off and on	A parameter is out of range. The parameter could not be replaced by its default value. The error will disappear at the next power-on	Active	Active

Error No.	*Error text* Remedy text	Comment	Output status	Input status
42	*P42 - Current output* Check cables	Current loop is disconnected or the loop resistance is too big	Active	Active
43	*P43 - Internal error* Switch off and on	Too many errors occurred at the same time. Some errors are not detected correctly	Active	Active
44	*P44 - CT SENSORPROM®* Replace	SENSORPROM® unit has been used as CT version	Active	Active
49	*P49 - Protection violation* Switch off and on	Internal protection of the device has been violated.	Active	
60	*F60 - CAN comm. error* Transmitter/AOM	CAN bus communication error. An add-on module, the display module or the transmitter is defective	Zero	Inactive
61	*F61 - SENSORPROM® error* Replace	It is not possible to rely on the data in SENSOR-PROM® unit anymore	Active	Active
62	*F62 - SENSORPROM® ID* Replace	The SENSORPROM® unit ID does not comply with the product ID. The SENSORPROM® unit is from another type of product SITRANS F C, SITRANS F US etc.	Zero	Inactive
63	*F63 - SENSORPROM®* Replace	It is not possible to read from the SENSORPROM® unit anymore	Active	Active
70	*F70 - Coil current* Check cables	Coil excitation has failed	Active	Active
71	*F71 - Internal error* Replace transmitter	Internal conversion error in ASIC	Active	Active

Service and maintenance

9

Under ideal conditions the flowmeter will operate continuously with no manual adjustment or intervention required.

9.1 Maintenance

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover screws
- Reliability of power supply, lightning protection, and grounds

NOTICE
Repair and service must be carried out by Siemens authorized personnel only.

Note

Siemens defines flow sensors as non-repairable products.

9.2 Certificates

You can find certificates on the Internet at Certificates (https://www.siemens.com/processinstrumentation/certificates) or on an included DVD.

9.3 Technical support

If you have any technical questions about the device described in these Operating Instructions and do not find the right answers, you can contact Customer Support:

- Via the Internet using the **Support Request:**
  Support request (http://www.siemens.com/automation/support-request)
- Via Phone:
  - Europe: +49 (0)911 895 7222
  - America: +1 423 262 5710
  - Asia-Pacific: +86 10 6475 7575

Further information about our technical support is available on the Internet at
Technical support (http://support.automation.siemens.com/WW/view/en/16604318)

Service & Support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base online on the Internet at:

Service and support (http://www.siemens.com/automation/service&support)

There you will find:

- The latest product information, FAQs, downloads, tips and tricks.
- Our newsletter, providing you with the latest information about your products.
- Our bulletin board, where users and specialists share their knowledge worldwide.
- You can find your local contact partner for Industry Automation and Drives Technologies in our partner database.
- Information about field service, repairs, spare parts and lots more under **Services**.

Additional Support

If you have additional questions about the device, please contact your local Siemens representative and offices at:

Local contact person (http://www.automation.siemens.com/aspa_app/contactmenu.aspx?ci=yes&regid=DEF&lang=en)

9.4 Return procedures

Enclose the delivery note, the cover note for return delivery and the declaration of decontamination form on the outside of the package in a well-fastened clear document pouch.

Required forms

- **Delivery Note**
- **Cover Note for Return Delivery** with the following information
  Cover note (http://cache.automation.siemens.com/dnl/zY/zY0OTg1AAAA_16604370_TxtObj/Begleitschein_RW_AD.pdf)
  - product (ordering number)
  - number of devices or spare parts returned
  - reason for the return
- **Declaration of Decontamination**
  Declaration of Decontamination (http://pia.khe.siemens.com/efiles/feldg/files/Service/declaration_of_decontamination_en.pdf)
  With this declaration you certify *that the returned products/spare parts have been carefully cleaned and are free from any residues.*
  If the device has been operated together with toxic, caustic, flammable or water-damaging products, clean the device before return by rinsing or neutralizing. Ensure that all cavities are free from dangerous substances. Then, double-check the device to ensure the cleaning is completed.
  We shall not service a device or spare part unless the declaration of decontamination confirms proper decontamination of the device or spare part. Shipments without a declaration of decontamination shall be cleaned professionally at your expense before further proceeding.

You can find the forms on the Internet and on the CD delivered with the device.

Troubleshooting/FAQs

10

10.1 Troubleshooting guide

Symptom	Output signals	Error code	Cause	Remedy
Empty display	Minimum		1. No power supply	Power supply Check MAG 5000/6000/6000 I for bended pins on the connector
			2. MAG 5000/6000/6000 I defective	Replace MAG 5000/6000/6000 I
No flow signal	Minimum		1. Current output disabled	Turn on current output
			2. Digital output disabled	Turn on digital output
			3. Reverse flow direction	Change direction
		F70	Incorrect or no coil current	Check cables/connections
		W31	Measuring pipe empty	Ensure that the measuring pipe is full
		F60	Internal error	Replace MAG 5000/6000/6000 I
	Undefined	P42	1. No load on current output	Check cables/connections
			2. MAG 5000/6000/6000 I defective	Replace MAG 5000/6000/6000 I
		P41	Initializing error	Switch off MAG 5000/6000/6000 I, wait 5 sec. and switch on again
Indicates flow with no flow in pipe	Undefined		Measuring pipe empty	Select empty pipe cut-off
			Empty pipe cut-off is OFF	Ensure that the measuring pipe is full
			Electrode connection missing/ electrode cable is insufficiently screened	Ensure that electrode cable is connected and sufficiently screened
Unstable flow signal	Unstable		1. Pulsating flow	Increase time constant
			2. Conductivity of medium too low	Use special electrode cable
			3. Electrical noise potential between medium and sensor	Ensure sufficient potential equalization
			4. Air bubbles in medium	Ensure medium does not contain air bubbles
			5. High concentration of particles or fibres	Increase time constant

Symptom	Output signals	Error code	Cause	Remedy
Measuring error	Undefined		Incorrect installation	Check installation
		P40	No SENSORPROM® unit	Install SENSORPROM® unit
		P44	CT SENSORPROM® unit	Replace SENSORPROM® unit or reset SENSORPROM® unit with MAG CT transmitter
		P49	Protection violation	Switch off MAG 5000/6000/6000I, wait 5 sec. and switch on again.
		F61	Defective SENSORPROM® unit	Replace SENSORPROM® unit
		F62	Wrong type of SENSORPROM® unit	Replace SENSORPROM® unit
		F63	Defective SENSORPROM® unit	Replace SENSORPROM® unit
		F71	Loss of internal data	Replace MAG 5000/6000/6000 I
	Maximum	W30	Flow exceeds 100% of Q_{max}.	Check Q_{max} (Basic Settings)
		W21	Pulse overflow	
			Volume/pulse too small	Change volume/pulse
			Pulse width too large	Change pulse width
Measuring approx. 50%			Missing one electrode connection	Check cables
Loss of totalizer data	OK	W20	Initializing error	Reset totalizer manually
##### Signs in display	OK		Totalizer roll over	Reset totalizer or increase totalizer unit
Empty pipe error message when Empty pipe set to off	OK	W31	Empty pipe error	Switch off MAG 5000/6000/6000I, wait 5 sec. and switch on again

10.2 Transmitter check list

If unstable/wrong measurements occur, it is often due to insufficient/wrong earthing or potential equalization. If earthing connection is OK, check transmitter as described below, and sensor as described in sensor check lists (see the respective operating instructions).

As all settings are stored in and downloaded from the SENSORPROM®, replacement is easily done and no extra settings need to be made.

Check transmitter

Check transmitter according to the following check table:

Power on transmitter		
0	Display light on?	Yes ⇒ 1
		No ⇒ 2
1	Flashing error triangles?	Yes ⇒ Check error table
		No ⇒ 1.2
1.2	Output and display readings OK?	Yes ⇒ 1.2.1
		No ⇒ 1.2.2

Power on transmitter		
1.2.1	Transmitter OK	Check application Check installation/sensor/earthing connection etc.
1.2.2	Check cables/connections	OK ⇒ 1.2.1
		Not OK ⇒ correct fault
2	Check cables/connections	OK ⇒ 2.1
		Not OK ⇒ Correct fault
2.1	Output readings OK?	Yes ⇒ 2.1.1
		No ⇒ 2.1.2.
2.1.1	Display defective	Replace display
2.1.2	Transmitter defective	Replace transmitter

Note

Sensor check list

Check lists for sensors are included in the respective sensor operating instructions.

Technical data

11

11.1 Technical specifications

Technical specifications for MAG 6000 I standard and Ex version		
Mode of operation and design	Measuring principle	Electromagnetic with pulsed constant field
	Empty pipe	Detection of empty pipe (special cable required in remote mounted installation)
	Excitation frequency	Depends on sensor size
	Electrode input impedance	> 1 x 10^{14} Ω
Input	**Digital input**	11 to 30 V DC, R_i = 4.4 kΩ
	Activation time	50 ms
	Current	$I_{11\ V\ DC}$ = 2.5 mA, $I_{30\ V\ DC}$ = 7 mA
Output	**Current output**	
	Signal range	0 to 20 mA (active/passive)
	Active current output	R_{max} 500 Ω @ V_{max} 30 V DC
	Passive current output	R_{min} 0 Ω @ V_{min} 12 V DC R_{max} 500 Ω @ V_{max} 30 V DC
	Time constant	0.1 to 30 s, adjustable
	Digital output	
	Frequency	0 to 10 kHz, 50% duty cycle (uni/bidirectional)
	Time constant	0.1 to 30 s, adjustable
	Pulse (passive)	3 to 30 V DC, max. 110 mA (Ex version: max. 30 mA), 200 Ω ≤ R_i ≤10 kΩ (powered from connected equipment)
	Time constant	0.1 to 30 s, adjustable
	Relay output	
	Time constant	Changeover relay, same as current output
	Load	30 VAC/2 A, 24 VDC/1 A
Low flow cut off	0 ... 9.9% of maximum flow	
Galvanic isolation	All inputs and outputs are galvanically isolated PELV circuits with 60 VDC isolation from each other and ground. Exceptions are sensor connections that are connected to ground.	
Max. measuring error (incl. sensor and zero point)	MAG 6000 I/MAG 6000 I Ex de	±0.2% ± 1 mm/s [1)]

Technical specifications for MAG 6000 I standard and Ex version		
Rated operation conditions	**Ambient temperature**	
	Operation	Standard version -25 to +60 °C (-13 to +140 °F) Ex version: -25 to +60 °C (-13 to +140 °F)
	Storage	-40 to +70 °C (-40 to +158 °F)
	Mechanical load	18...1000 Hz random in x, y z, directions for 2 hours according to EN 60068-2-36 Transmitter: 1.14 grms
	Protection degree	IP67/NEMA 4X to IEC 60529 and DIN 40050 (1 mH_2O 30 min.)
	EMC performance	EN 61326
Display and keypad	Totalizer	Two eight-digit counters for forward, net or reverse flow
	Display	Background illumination with alphanumeric text, 3 x 20 characters to indicate flow rate, totalized values, settings and faults; Reverse flow indicated by negative sign
	Keypad	Capacitive touch keypad with LED light for feedback indication
	Time constant	Time constant as current output time constant
Design	Enclosure material	Die cast aluminum with corrosion-resistant Basic Polyester power coating (min 60 µM)
	Wall mounting bracket	Bracket enclosed for remote mounting
	Dimensions	See dimensional drawings
	Weight	See dimensional drawings
Power supply	Standard version:	100 to 230 VAC, 47 to 63 Hz 20 to 27 VDC
	Ex version:	100 to 230 VAC, 47 to 63 Hz 20 to 27 VDC
Power consumption	230 V AC: 21.5 VA 24 V DC: 12 W, I_N = 380 mA, I_{ST} = 1.5 A (10 ms)	
Certificates and approvals	Standard version	CE C-tick FM Class I, Div 2 FM Class I, Zone 2 CSA Class I, Div 2 CSA Class I, Zone 2
	Ex version	Ex d e [ia] ia IIC T6 Gb Ex tD A21 IP67 T85°C Ta -25°C to +60°C FM Class I, II, III, Div 1 [3)] FM Class I, Zone 1/21 CSA Class I, Zone 1/21

Technical specifications for MAG 6000 I standard and Ex version		
Cable entries (remote installation)	Standard version	2 x M25 (for supply/output) and 2 x M16 (for sensor connection) or 2 x ½" NPT (for supply/output) and 2 x M16 (for sensor connection)
	Ex version	2 x M20 (for supply/output) and 2 x M16 (for sensor connection) 2 x ½" NPT (for supply/output) and 2 x M16 (for sensor connection)
Communication	Standard version	HART, MODBUS RTU/RS485, Foundation Fieldbus H1, DeviceNet, and PROFIBUS PA/ DP add-on modules
	Ex version	HART, PROFIBUS PA and Foundation Field-bus H1available factory-mounted

[1] Depending on sensor

[2] Only with MAG 3100 / 3100 P sensors sizes DN 15 ... DN 300 (½" ... 12") compact

11.2 Dimensions and weight

Transmitter IP67/NEMA 4X compact die cast aluminum

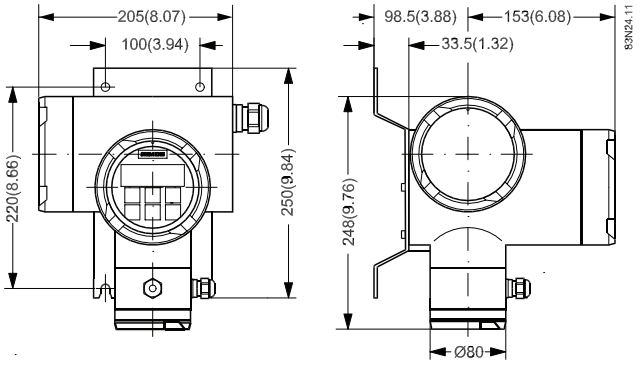


Figure 11-1 Transmitter dimensions shown in mm (inch)

Weight: MAG 6000 I/MAG 6000 I Ex de: 6 kg (13.5 lbs)

11.3 Accuracy

For accuracy reference conditions, see below.

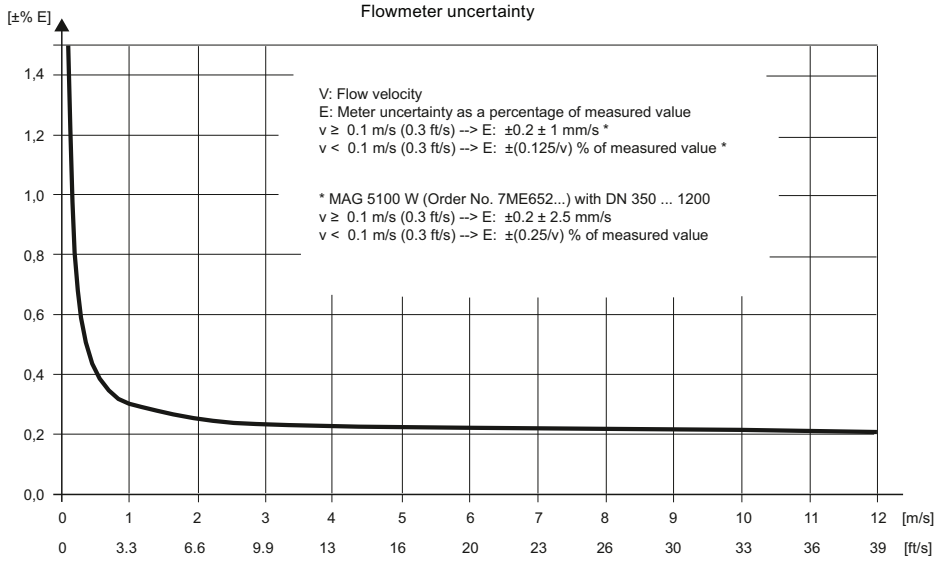


Figure 11-2 MAG 6000 I / MAG 6000 I Ex de with MAG 1100 (not PFA), MAG 1100 HT, MAG 1100 F (not PFA), MAG 5100 W, MAG 3100 P, MAG 3100 and MAG 3100 HT

Reference conditions

(ISO 9104 and DIN/EN 29104)

A calibration certificate is shipped with every sensor and calibration data are stored in SENSORPROM® memory unit.

Medium temperature	20 °C ± 10 K (68°F ± 18 °F)
Ambient temperature	25 °C ± 10 K (68°F ± 18 °F)
Supply voltage	U_n ± 1%
Warming-up time	30 minutes
Incorporation in conductive pipe section Inlet section Outlet section	 10 x DN (DN ≤ 1200/48") 5 x DN (DN > 1200/48") 5 x DN (DN ≤ 1200/48") 3 x DN (DN > 1200/48")
Flow conditions	Developed flow profile

Reference conditions for sensor calibration

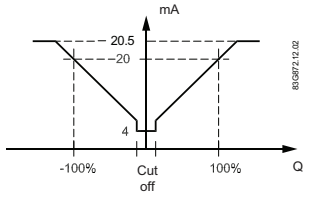
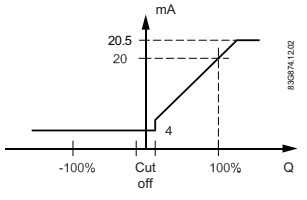
Current output	As pulse output ± (0.1% of actual flow + 0.05% FSO)
Effect of ambient temperature Display/frequency/pulse output Current output	 < ± 0.003% / °C act. < ± 0.005% / °C act.

Effect of supply voltage	< 0.005% of measuring value on 1% change
Repeatability	± 0.1% of actual flow for V ≥ 0.5 m/s (1.5 ft/s) and conductivity ≥ 10 µS/cm

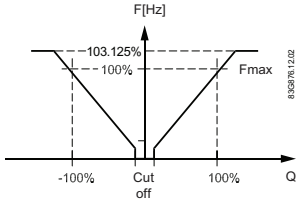
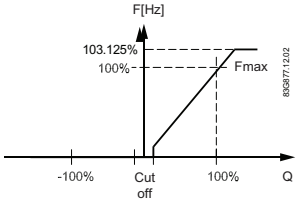
Additions in the event of deviations from reference conditions

11.4 Output characteristics

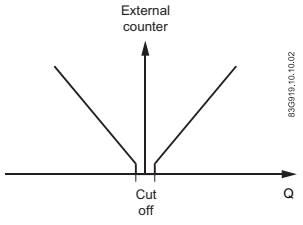
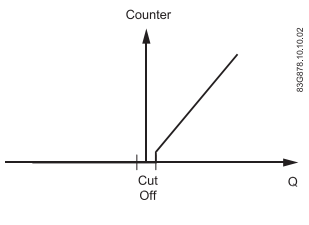
Current output

Output characteristics	Bidirectional mode	Unidirectional mode
4 to 20 mA		

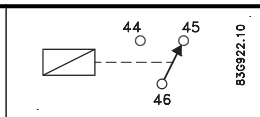
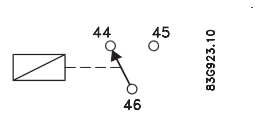
Frequency output

Bidirectional mode	Unidirectional mode
	

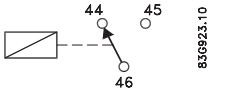
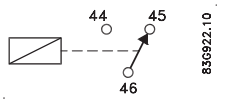
Pulse output

Bidirectional mode	Unidirectional mode
	

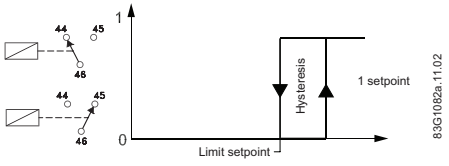
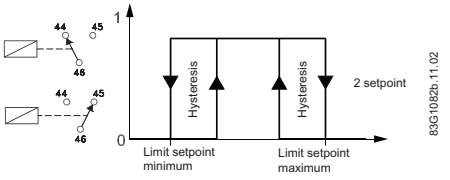
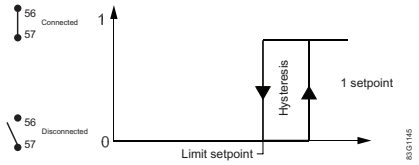
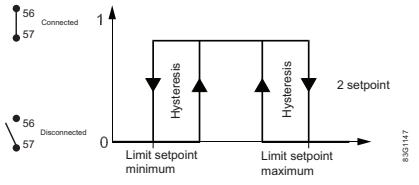
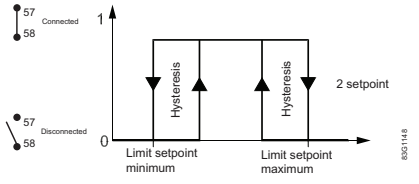
Relay output

Bidirectional mode		Unidirectional mode	
Power down		Active	

Error relay output

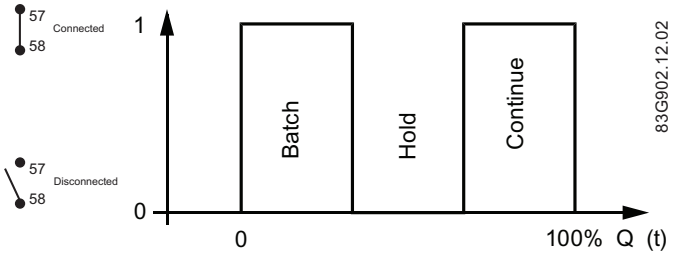
Bidirectional mode		Unidirectional mode	
No error		Error	

Limit switch (can be used as direction switch)

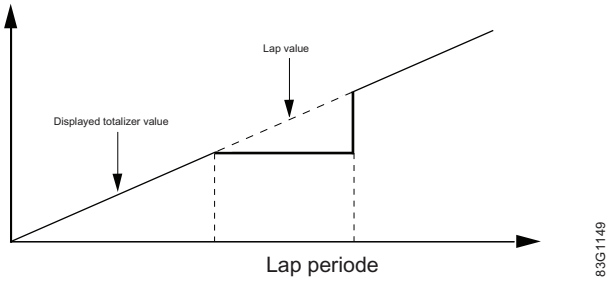
1 set point	2 set points
	
Passive Digital output	**Passive Digital output**
	
	

Batch on digital output

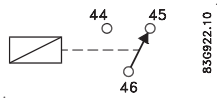
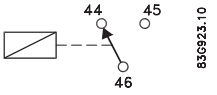
Unidirectional mode (forward flow only)



Totalizer lap



Batch on relay output

Unidirectional mode (forward flow only)			
Hold		Batch	

11.5 Cable data

Description

Electrode or coil cable (standard)	
Electrode cable, double shielded (for empty pipe detection or low conductivity fluids)	
Cable kit with standard coil cable and electrode cable double shielded (also available as low noise cable for MAG 1100 sensor)	

Technical data

		Standard cable (electrode/coil)	Double-shielded cable (electrode)
Basic data	No. of conductors	3	3
	Sqr. area	1.5 mm^2	0.25 mm^2
	Screen	Yes	Double
	Color code	Brown, blue, black	Brown, blue, black
	Outside color	Grey	Grey
	Ext. diameter	7.8 mm	8.1 mm
	Conductor	Flexible CU	Flexible CU
	Isolation material	PVC	PVC
Ambient temperature	Flexible installation	-5 to +70°C (23 to 158°F)	-5 to +70°C (23 to 158°F)
	Non-flexible installation	-30 to +70°C (-22 to 158°F)	-30 to +70°C (-22 to 158°F)
Cable parameter	Capacity	161.50 pF/m	-
	Inductance	0.583 µH/m	-
	L/R	43.83 µH/Ω	-

For more information on cable lengths, empty pipe detection, and conductivity, see Operating Instructions for relevant sensor.

11.6 Cable requirements

		Coil cable	Electrode cable
Basic data	No. of conductors	2	3
	Min. sqr. area	0.5 mm^2	0.2 mm^2
	Screen	Yes	Yes
	Max. capacitance	N/A	350 pF/m
Max. cable loop resistance	Media temperature:		
	< 100 °C	40 Ω	N/A
	> 200 °C	6 Ω	N/A
Cable glands on sensor	M20x1.5 gland - Cable ø 5 to 13 mm (0.20 to 0.51 inches)		
	½ NPT gland - cable ø 5 to 9 mm (0.20 to 0.35 inches)		

WARNING

Cable glands

For Ex zone 1 installations only certified cable glands with protection type "e" can be used for the power supply and the coil cable. The cable glands must be approved for the actual temperature and cable dimension.

Spare parts/Accessories

12

12.1 Ordering of spare parts

Ensure that your ordering data is not outdated. The latest ordering data is always available on the Internet: Catalog process instrumentation (http://www.siemens.com/processinstrumentation/catalogs)

12.2 Accessories

Description	Order number	
Safety clamp	7ME5933-0AC06	
Wall/pipe mounting bracket BI 2,5 DIN59382 X6Cr17	7ME5933-0AC05	
Communication modules for MAG 6000 I / MAG 6000 I Ex de		
HART	FDK-085U0321	
Modbus RTU/RS485	FDK-085U0234	
PROFIBUS PA Profile 3	FDK-085U0236	
PROFIBUS DP Profile 3	FDK-085U0237	
Devicenet	FDK-085U0229	
FOUNDATION Fieldbus H1	A5E02054250	

12.3 Spare parts

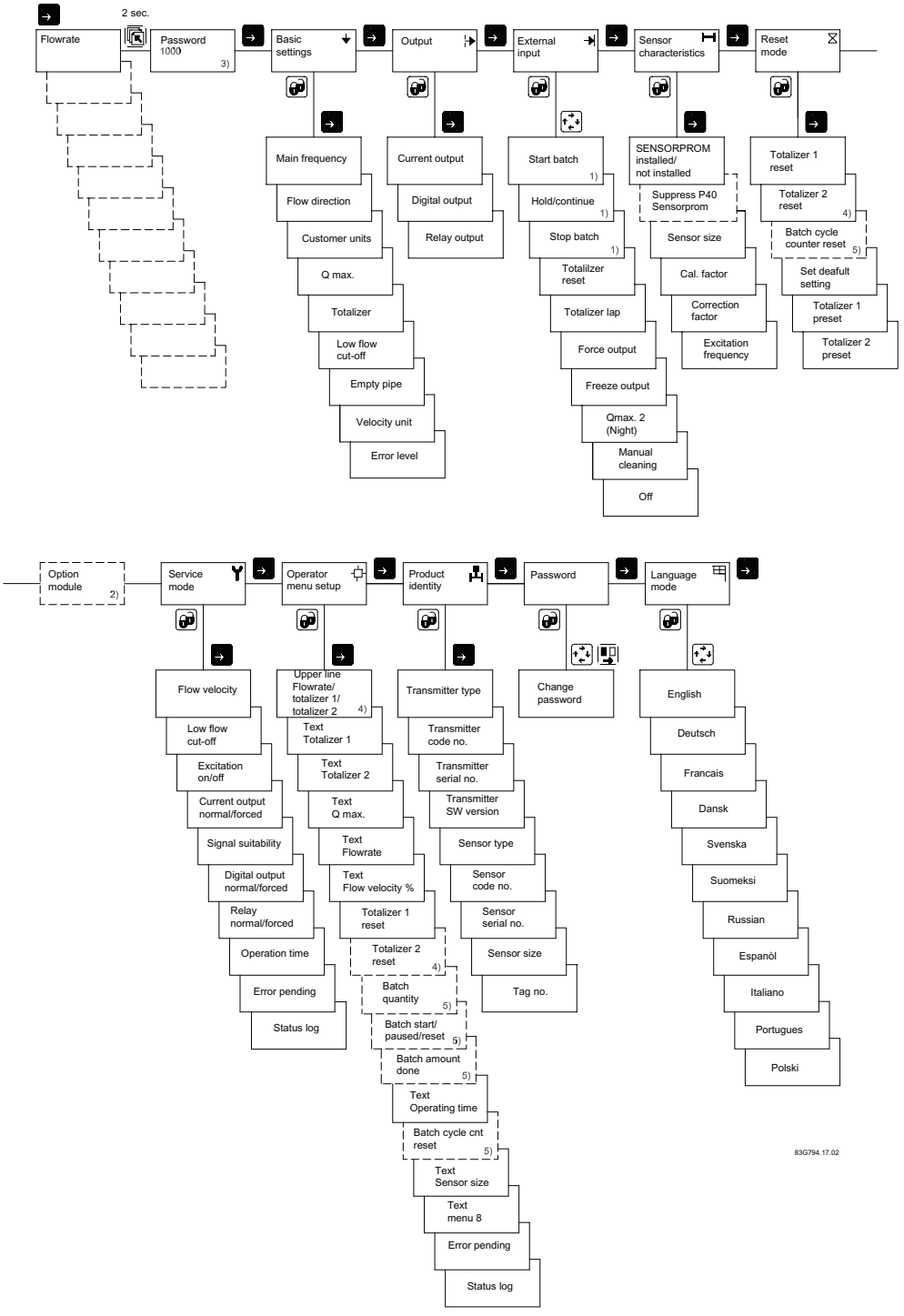
Description	Order number	
Standard wall mounting bracket Steel EN10088-2-1.4404	7ME5933-0AC04	
Display unit	FDK-085U3122	
Electronics cover with Ex glass plate	A5E02593565	
Cover for connection board incl. gasket (for remote version)	7ME5933-0AC02	
Cover for mains supply/communication including gasket	7ME5933-0AC03	

Menu diagrams

A

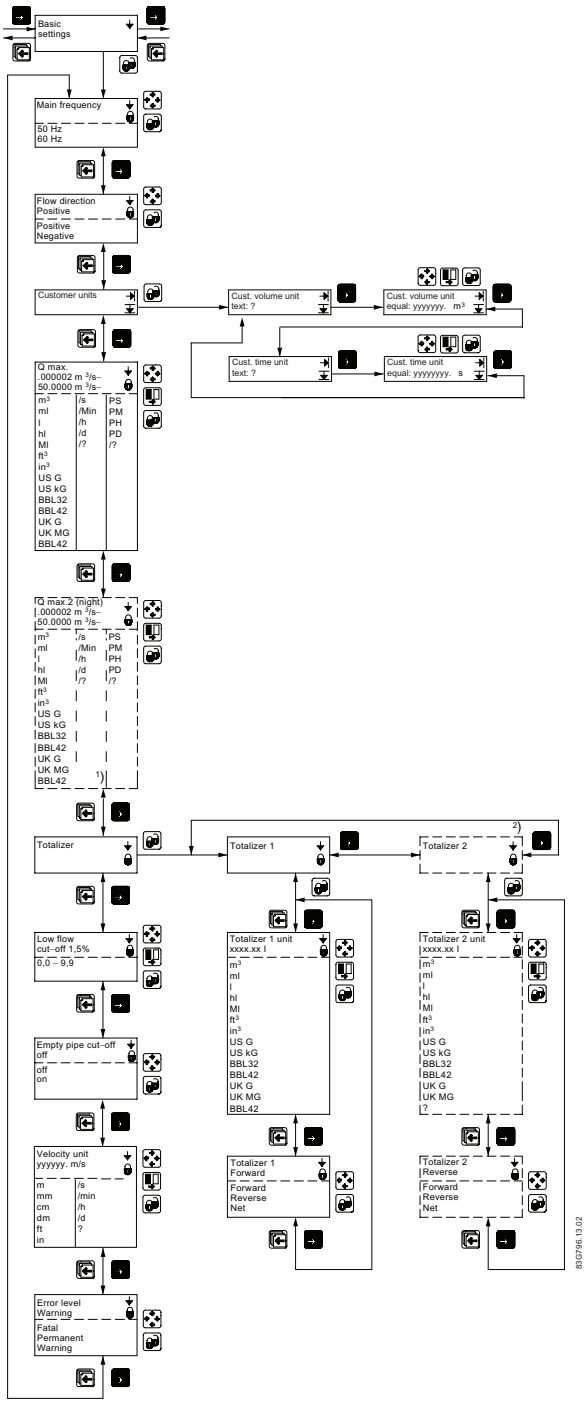
A.1 Transmitter menu overview

The menu diagrams shown on the following pages apply to MAG 5000/6000 as well as MAG 6000 I.



1) Not available in MAG 5000
2) Add-on module
3) Factory-set password: 1000
4) Not available when batch
5) Only available when batch

A.2 Basic settings

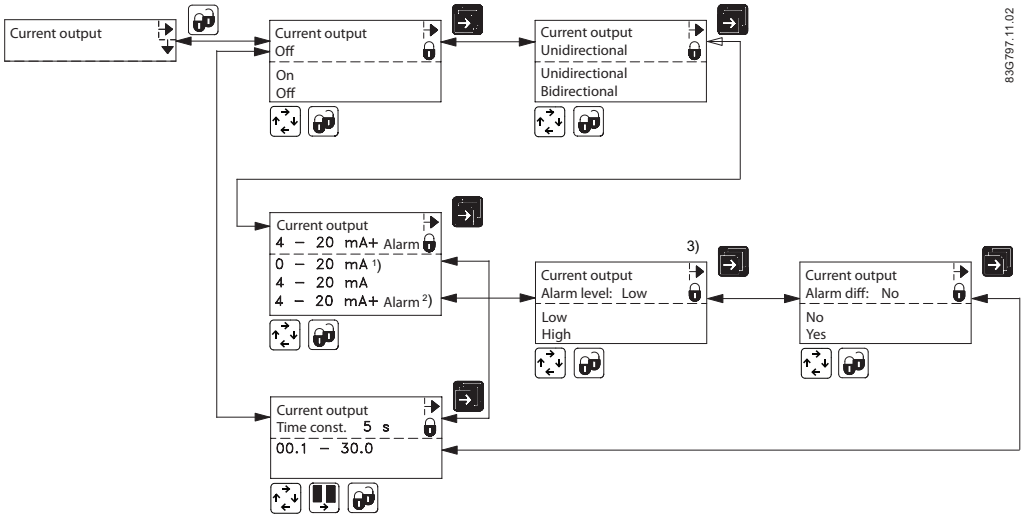


1) The unit "BBL42" in the volume unit list is placed on the space for the customer unit (former "?"). The unit is shown as "BBL42" with the fitting conversion factor of 0.158987 m^3, if not overwritten with customer's own unit text setup using PDM or ordered by using the Z-option Y20 in the ordering system.

   The customer unit in the time unit list is displayed as "?". Via PDM or Y20 option this could e.g. be chosen as year "y".

2) When batch is selected on digital output or relay, Totalizer 2 is not shown because it is controlled by the batch function.

A.3 Current output

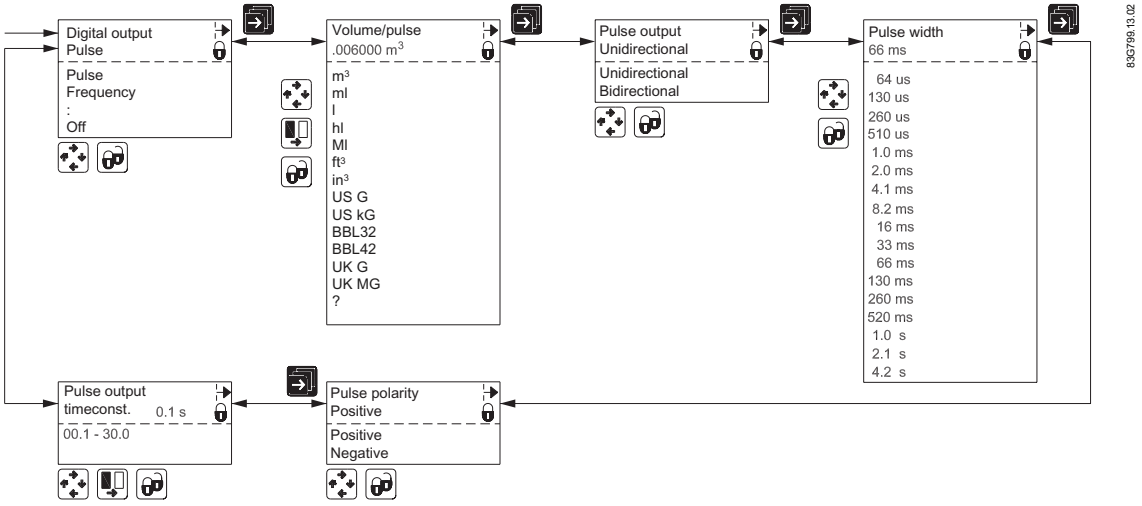


1) If HART communication is installed, it is not possible to set the output for 0-20 mA (even though the option is visible in the display). This is due to the fact that HART does not work if the output falls below 2-3 mA.

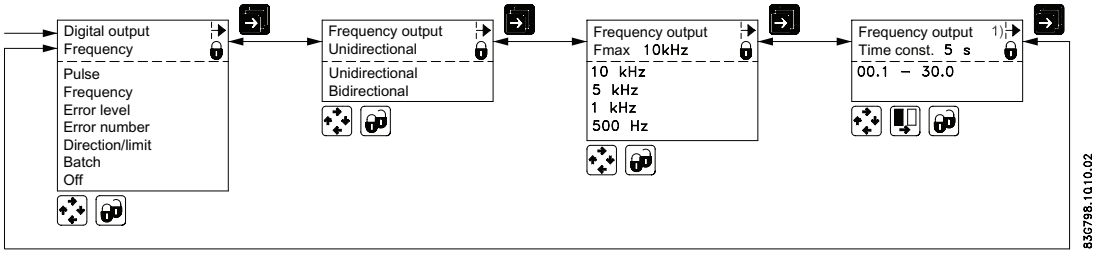
2) 4-20 mA + Alarm is the default setting for MAG 6000 I. For all other variants, the default setting is 4-20 mA.

3) For MAG 6000 I only: The controlling of alarm levels does not recognize if the jumper is mounted for passive output. Do not combine differentiation and low alarm level together with passive output. The output will try to pull down the level to 1.3 mA at fatal errors which is not possible for passive output.

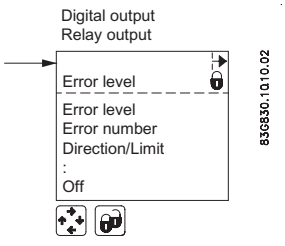
A.4 Digital output - pulse



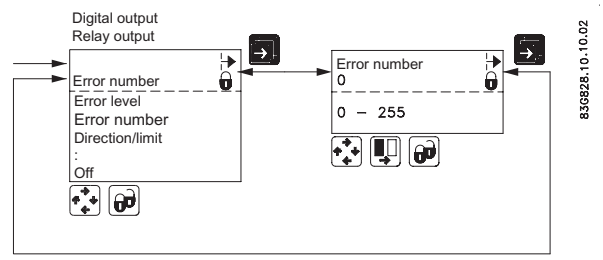
A.5 Digital output - frequency



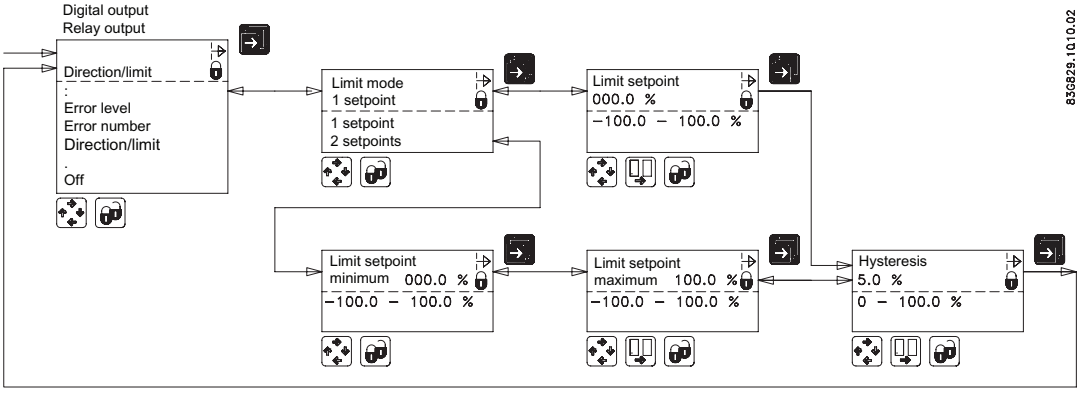
A.6 Error level



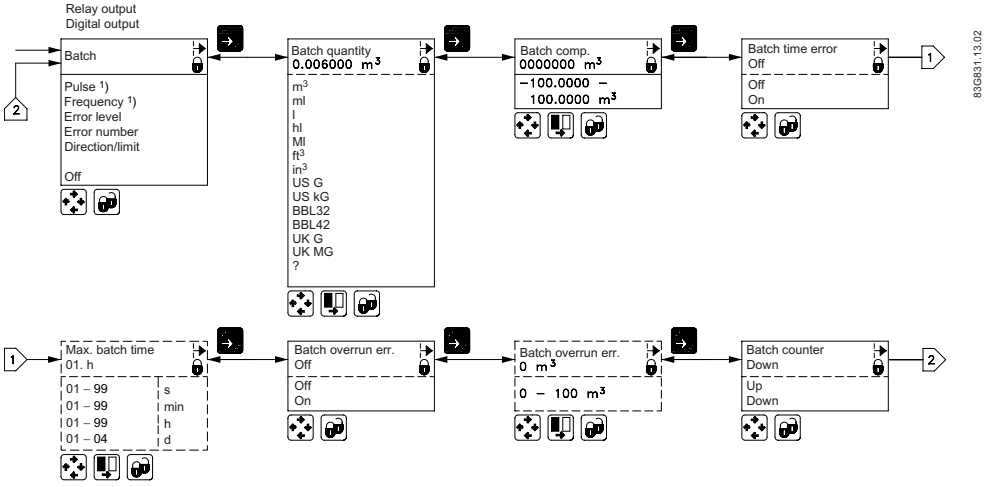
A.7 Error number



A.8 Direction/limit



A.9 Batch



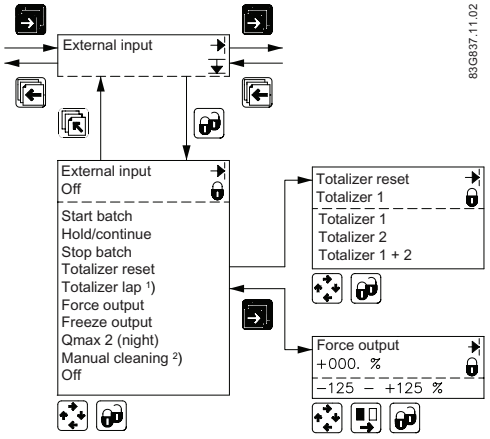
1) Visible only on Digital output.

Note

If batch function is chosen on the relay output, the digital output will be turned off if it has been set up for pulse, frequency or batch.

If digital output is set up for pulse, frequency or batch, then the relay output will be turned off if it has been set up for batch.

A.10 External input

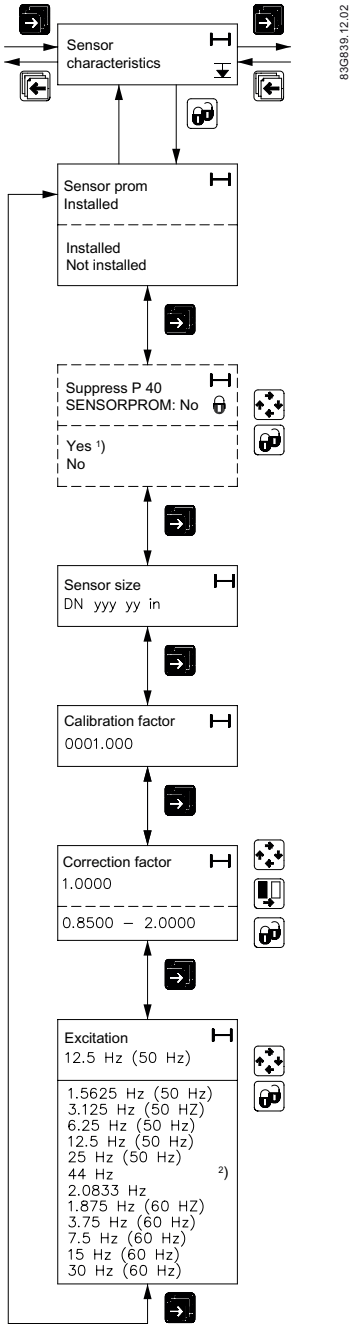


1) The value showing totalizer 1 on the display is frozen for as long as the digital output is activated. However, totalizer 1 continues counting, and when the digital input is released, the value on the display again follows totalizer 1.

2) MAG 6000 I cannot be equipped with cleaning unit. The cleaning option for relay output is however possible. When selecting function for MAG 6000 I relay output, the relay output has the same behavior as if cleaning unit was installed.

   The relay output of the transmitter determines when the relay is on by applying voltage for approximately 60 seconds. The metering is resumed after another 60 seconds when the cycle is complete. (The display is locked during this time). The time cycle can be set at 1 to 240 hours. If the cycle is set at for example three hours, the transmitter will be active every three hours.

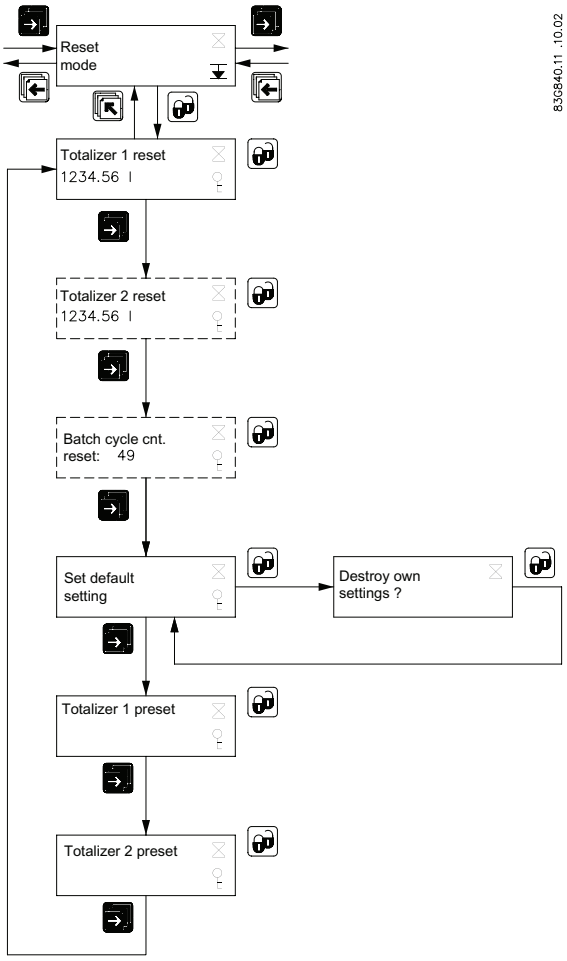
A.11 Sensor characteristics



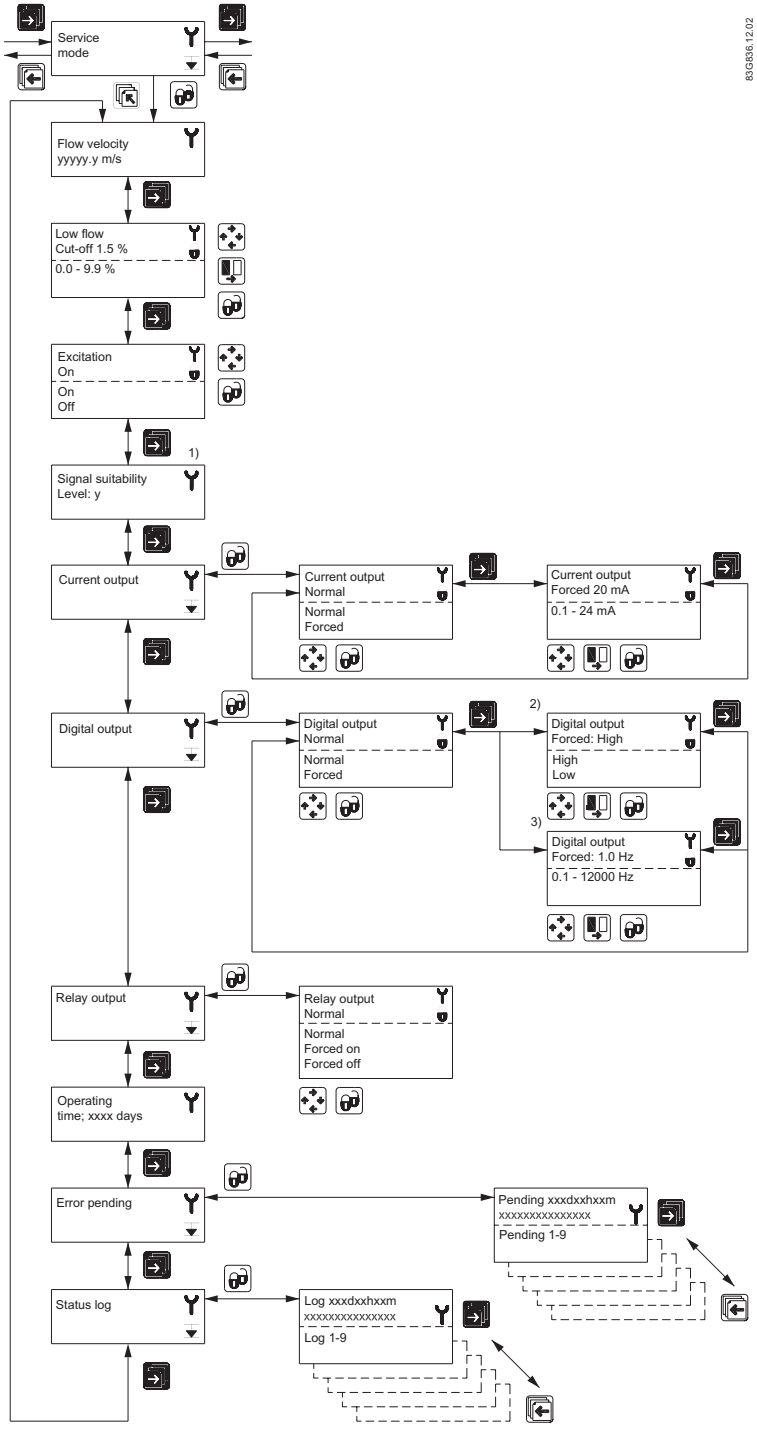
1) Error status (level or number) on an output is updated only at the time the error status changes (occurs or disappears). If P40 is suppressed after it has been detected (at power up), the output does not change state. In this case the power must be switched off/on to suppress the P40 error on the output.

2) The frequency can be set to 44 Hz in the MAG 6000 SV transmitter only.

A.12 Reset mode



A.13 Service mode

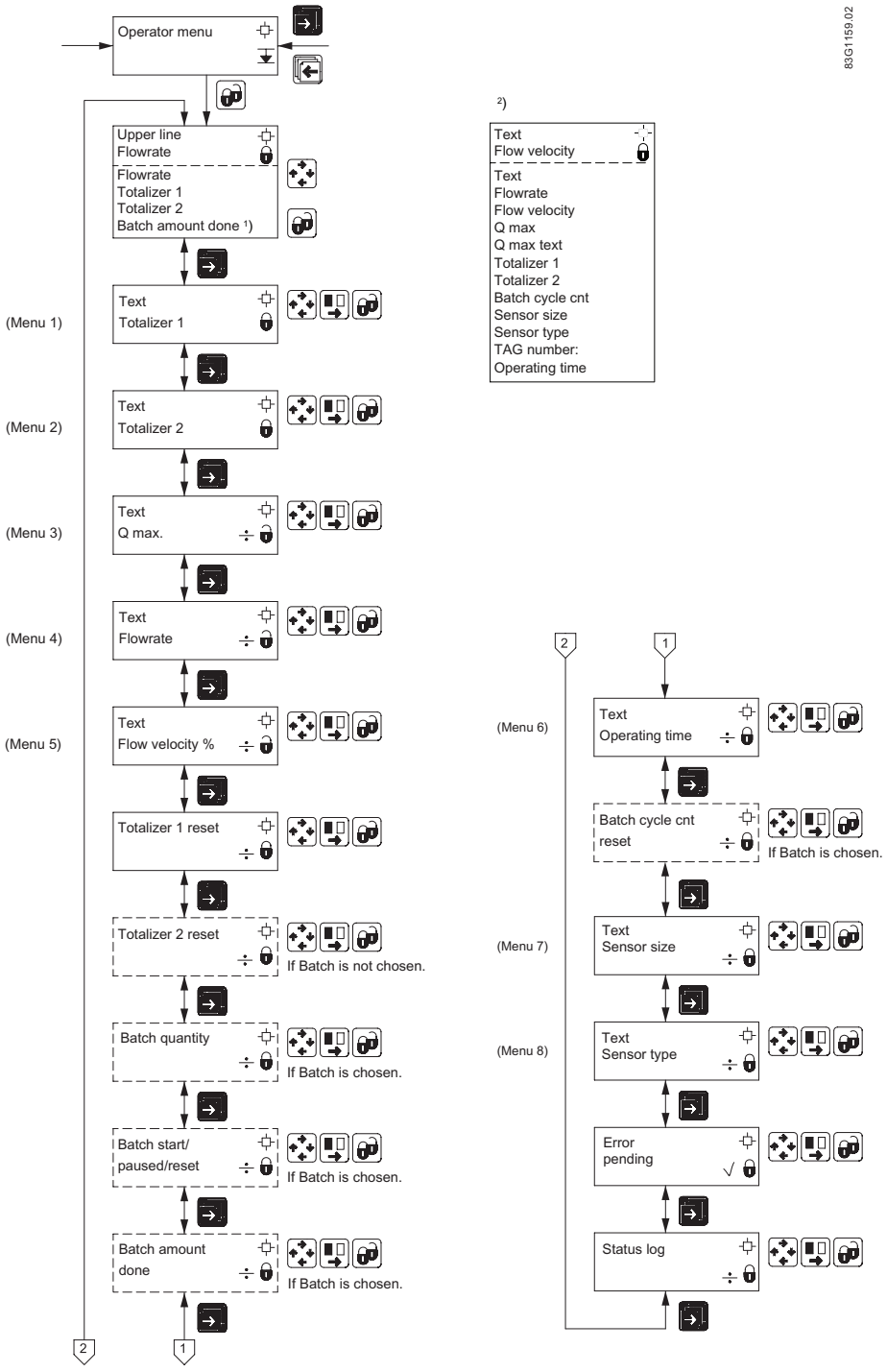


1) Signal suitability is a level from 0 to 9 of the electrode measured voltage. Level 0 is equal to the limit value that is set for empty pipe error detection, and level 9 is the best signal measured.

2) If digital output is set to pulse (standard).

3) If digital output is set to frequency.

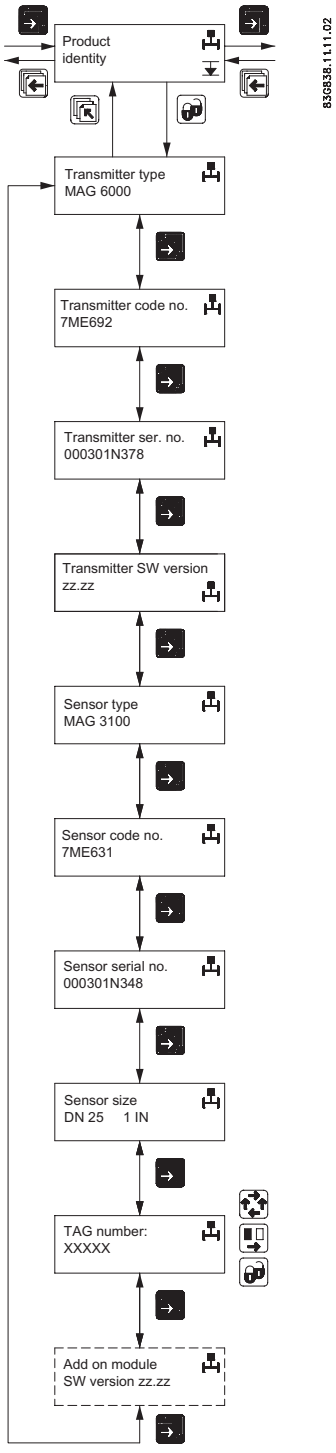
A.14 Operator menu setup



1) When selecting Batch amount for upper line, the upper line is initially blank. The amount done may not appear until the batch is started.

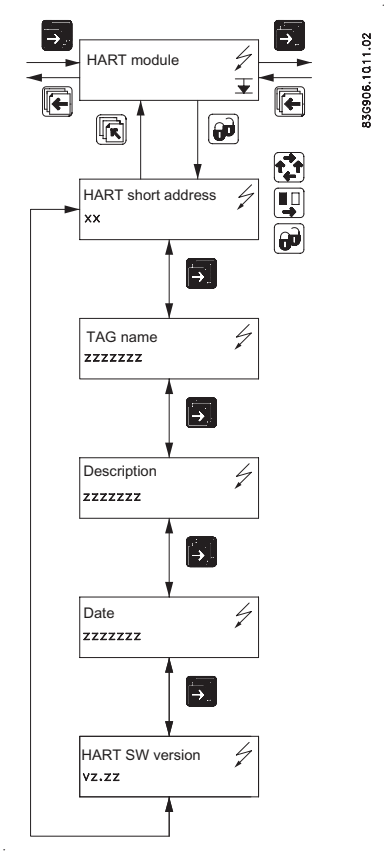
2) 'Text' means that the text for the chosen measured value is shown. For example, if textis chosen in line 2 and flow velocity is chosen in line 3, the text "Flow velocity " is shown in line2 and the measured flow velocity is shown in line 3.

A.15 Product identity



A.16 Add-on communication module

Example: HART



Note

Burst mode is not available with HART communication

Factory settings

B

B.1 Transmitter factory settings

The factory settings shown on the following pages apply to MAG 5000/6000 as well as MAG 6000 I.

Menu item	Parameter	Factory settings	Options	More info
Password	Password	1000	1000 to 9999	Changing password (Page 43)
Basic settings	Flow direction	Positive	Positive, negative	Changing basic settings (Page 44)
	Q_{max}	Sensor size dependent	Sensor size dependent	
	• *volume unit*	*Sensor size dependent*	*m^3, ml, l, hl, Ml, ft^3, in^3, US G, US kG, BBL32, BBL42, UK G, UK MG, ? (customer unit)*	
	• *time unit*	*Sensor size dependent*	*Sec., min., hour, day, ? (customer unit)*	
	Totalizer 1	Forward	Forward, reverse, net	
	• *Totalizer 1 unit*	*Sensor size dependent*	*m^3, ml, l, hl, Ml, ft^3, in^3, US G, US kG, BBL32, BBL42, UK G, UK MG, ? (customer unit)*	
	Totalizer 2	Reverse	Forward, reverse, net	
	• *Totalizer 2 unit*	*Sensor size dependent*	*m^3, ml, l, hl, Ml, ft^3, in^3, US G, US kG, BBL32, BBL42, UK G, UK MG, ? (customer unit)*	
	Low flow cut-off	1.5%	0 to 9.9%	
	Empty pipe	Off	On, Off	
	Velocity unit	m/s	m, mm, cm, dm, ft , in per s, min, h, d, ? (customer unit)	
	Error level	Warning	Fatal, permanent, warning	

Menu item	Parameter	Factory settings	Options	More info
Output	Current output	Off for MAG5000/ 6000	On/off, Unidirectional/bidirectional, 0 to 20 mA/ 4 to 20 mA/4 to 20 mA + Alarm	Output settings (Page 49)
	• *Alarm level*	*Low*	*High/Low*	
	• *Alarm diff.*	*No*	*Yes/No*	
	• *Time constant*	*5 s*	*0.1 to 30 s*	
	Digital output	Pulse	Error, direction/limit, batch, frequency, pulse, error number, off	Digital output - pulse (Page 79)
	Relay output	Error level	Error, direction/limit, cleaning, error number, off	Error level (Page 79)
	Direction/limit switch	Off	1 setpoint, 2 setpoints	Direction/limit (Page 80)
	• *Setpoints*	*0%*	*-100 to +100%*	
	• *Hysteresis*	*5%*	*0.0 to 100%*	
	Batch	Off		Batch (Page 81)
	• *Batch quantity*	*0*	*Sensor size dependent*	
	• *Batch compensation*	*0*	*-100 to +100 m^3*	
	• *Batch counter*	*Down*	*Up, down*	
	Frequency	Off	500 Hz, 1 kHz, 5 kHz, 10 kHz	Digital output - frequency (Page 79)
	• *Time constant*	*5 s*	*0.1 to 30 s*	
	Pulse	On		Digital output - pulse (Page 79)
	• *Pulse polarity*	*Positive*	*Positive, negative*	
	• *Pulse width*	*66 ms*	*64 µs 130 µs, 260 µs, 510 µs, 1.0 ms, 2.0 ms, 4.1 ms, 8.2 ms, 16 ms, 33, ms, 66 ms, 130 ms, 260 ms, 520 ms, 1.0 s, 2.1 s, 4.2 s*	
	• *Volume/pulse*	*Sensor size dependent*	*Dimension-dependent*	
	• *Time constant*	*0.1 s*	*0.1 to 30 s*	
External input	External input	Off	Batch, reset totalizer, freeze output, forced output, off	External input (Page 82)
	• *Batch*	*Start*	*Start, hold/continue, stop, Qmax 2*	
Sensor characteristics	Correction factor	1	0.85 to 2.00	Sensor characteristics (Page 83)
Language	Language	English	English, German, French, Danish, Swedish, Finnish, Spanish, Russian, Italian, Portuguese, Polish	Changing language (Page 48)

Menu item	Parameter	Factory settings	Options	More info
Operator menu	Primary field	Flow rate	Flow rate, Totalizer 1, Totalizer 2	Changing operator menu setup (Page 47)
	Title/subtitle lines	Flow rate	Flow rate, Flow velocity, Qmax, Totalizer 1, Totalizer 2, Totalizer 1 reset, Totalizer 2 reset, Batch start/paused/stop, Batch cycle counter, Batch cycle counter reset, Sensor size, Sensor type, Error pending, Status log, Tag No.	

B.2 50 Hz Dimension dependent Qmax

Table B-1 MAG 1100, MAG 1100 F, MAG 3100, MAG 3100 P and MAG 5100 W with M20 cable glands

DN	Q_{max}					
	Factory setting	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100 W (Order no. 7ME6580), MAG 3100, 3100 P		unit
mm (inch)		min.	max.	min.	max.	
2 ($^1/_{12}$)	30	-	-	3.903623	156.1448	l/h
3 ($^1/_8$)	70	-	-	6.361726	254.469	l/h
6 ($^1/_4$)	300	-	-	25.44691	1017.876	l/h
10 ($^3/_8$)	900	-	-	70.68584	2827.433	l/h
15 (½)	2000	-	-	159.0432	6361.725	l/h
25 (1)	5000	441.7865	17671.45	441.7865	17671.45	l/h
40 (1½)	12	1.130974	45.23893	1.130974	45.23893	m^3/h
50 (2)	20	1.574527	62.98107	1.767146	70.68583	m^3/h
65 (2½)	30	2.499681	99.98723	2.986477	119.459	m^3/h
80 (3)	50	4.003646	160.1458	4.523894	180.9557	m^3/h
100(4)	120	6.252163	250.0864	7.068584	282.7433	m^3/h
125 (5)	180	10.00647	400.2585	11.04467	441.7864	m^3/h
150 (6)	250	15.74527	629.8107	15.90432	636.1725	m^3/h
200(8)	400	24.93797	997.5184	28.27434	1130.973	m^3/h
250(10)	700	40.00377	1600.15	44.17865	1767.145	m^3/h
300 (12)	1000	62.50395	2500.157	63.61726	254469	m^3/h
350 (14)	1200	86.59015	3463.605	86.59015	3463.605	m^3/h
400 (16)	1800	113.0974	4523.893	113.0974	4523.893	m^3/h
450 (18)	2000	143.1389	5725.552	143.1389	5725.552	m^3/h
500 (20)	3000	176.7146	7068.583	176.7146	7068.583	m^3/h
600 (24)	4000	254.4691	10178.76	254.4691	10178.76	m^3/h
700 (28)	4500	346.3606	13854,42	346.3606	13854.42	m^3/h
750 (30)	5000	397.6079	15904.31	397.6079	15904.31	m^3/h
800 (32)	7000	452.3894	18095,57	452.3894	18095.57	m^3/h
900 (36)	9000	572.5553	22902,21	572.5553	22902.21	m^3/h
1000 (40)	12000	706.8584	28274.33	706.8584	28274.33	m^3/h
1050 (42)	12000	706.8584	28274.33	706.8584	28274.33	m^3/h

DN	Q_{max}*					
	Factory setting	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100 W (Order no. 7ME6580), MAG 3100, 3100 P		unit
mm (inch)		min.	max.	min.	max.	
1100 (44)	14000	855.986	34211.94	855.2986	3421194	m^3/h
1200 (48)	15000	1017.877	40715.04	1017.877	40715.04	m^3/h
1400 (54)	25000	-	-	1385.443	55417.69	m^3/h
1500 (60)	30000	-	-	1590.432	63617.25	m^3/h
1600 (66)	35000	-	-	1809.558	72382.29	m^3/h
1800 (72)	40000	-	-	2290.222	91608.84	m^3/h
2000 (78)	45000	-	-	2827.434	113097.3	m^3/h
2200 (90)	50000	-	-	3421,195	136847.7	m^3/h
2400 (96)	55000	-	-	4071.505	162860.1	m^3/h
2600 (102)	60000	-	-	4778.363	191134.4	m^3/h
280 (114)	65000	-	-	5541.77	221670.7	m^3/h
3000 (120)	70000	-	-	6361.726	254469	m^3/h

* The min. and max. amount values show mathematical values and do not indicate measurement accuracy

B.3 60 Hz Dimension dependent Qmax

Table B-2 **MAG 1100, MAG 1100 F, MAG 3100, MAG 3100 P and MAG 5100 W with ½" NPT cable glands**

DN	Q_{max}					
	Factory setting*	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100 W (Order no. 7ME6580), MAG 3100, 3100 P		unit
mm (inch)		min.	max.	min.	max.	
2 ($^1/_{12}$)	0.14	-	-	0.01718714	0.6874852	US GPM
3 ($^1/_8$)	0.31	-	-	0.02800984	1.120393	US GPM
6 ($^1/_4$)	1.4	-	-	0.1120394	4.481573	US GPM
10 ($^3/_8$)	4	-	-	0.3112204	12.44881	US GPM
15 (½)	9	-	-	0.7002459	28.0	US GPM
25 (1)	23	1.945128	77.80509	1.945128	77.80509	US GPM
40 (1½)	53	4.979526	199.181	4.979526	199.181	US GPM
50 (2)	89	6.932434	277.2973	7.78051	311.2203	US GPM
65 (2½)	133	11.00577	440.2305	13.14907	525.9624	US GPM
80 (3)	221	17.62753	705.1008	19.91811	796.7241	US GPM
100(4)	529	27.52745	1101.097	31.12204	1244.881	US GPM
125 (5)	793	44.05714	1762.285	48.62819	1945.127	US GPM
150 (6)	1101	69.32434	2772.973	70.02459	2800.984	US GPM
200 (8)	1762	109.7986	4391.941	124.48819	4979.525	US GPM

DN	Q_{max}					
	Factory setting*	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100 W (Order no. 7ME6580), MAG 3100, 3100 P		unit
mm (inch)		min.	max.	min.	max.	
250 (10)	3083	176.1313	7045.251	194.5128	7780.507	US GPM
300 (12)	4403	275.1967	11007.86	280.0984	11203.93	US GPM
350 (14)	5284	381.245	15249.79	381.245	15249.79	US GPM
400 (16)	7926	497.9526	19918.1	497.9526	19918.1	US GPM
450 (18)	8806	630.2213	25208.84	630.2213	25208.84	US GPM
500 (20)	13209	778.051	31122.03	778.051	31122.03	US GPM
600 (24)	17612	1120.394	44815.73	1120.394	44815.73	US GPM
700 (28)	19813	1524.98	60999.19	1524.98	60999.19	US GPM
750 (30)	22015	1750.615	70024.58	1750.615	70024.58	US GPM
800 (32)	3082	1991.811	79672.4	1991.811	79672.41	US GPM
900 (36)	39626	2520.885	100835.3	2520.885	100835.3	US GPM
1000 (40)	52835	3112.204	124488.1	3112.204	124488.1	US GPM
1050 (42)	52835	3112.204	137248.1	3112.204	124488.1	US GPM
1100 (44)	61641	3765.767	150630.6	3765.767	150630.6	US GPM
1200 (48)	66044	4481.574	179262.9	4481.574	179262.9	US GPM
1400 (54)	110072	-	-	6099.92	243996.7	US GPM
1500 (60)	1320867	-	-	7002.459	280098.3	US GPM
1600 (66)	154101	-	-	7967.242	318689.6	US GPM
1800 (72)	176115	-	-	10083.54	403341.5	US GPM
2000 (78)	198130	-	-	12448.82	497952.5	US GPM
2200 (90)	220144	-	-	15063.07	602522.6	US GPM
2400 (96)	242158	-	-	17926.3	717051.7	US GPM
2600 (102)	264173	-	-	21038.5	841539.8	US GPM
2800 (114)	286187	-	-	24399.68	975987	US GPM
3000 (120)	308201	-	-	28009.84	1120393	US GPM

* Factory setting sets Qmax to a metric unit (see previous table). The values here are converted to rounded off US GPM.

B.4 50 Hz Dimension dependent volume/pulse and batch

Table B-3 **MAG 1100, MAG 1100 F, MAG 3100, MAG 3100 P and MAG 5100 W with ½" NPT cable glands**

DN	Volume/pulse or batch quantity*				Factory setting		
	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100 W (Order no. 7ME6580), MAG 3100, 3100 P		Volume/ pulse & batch amount	Pulse & batch unit	Totaliz-er unit
mm (inch)	min.	max.	min.	max.			
2 ($^1/_{12}$)	-	-	3.61466 µl	94.75103 l	0.1	ml	ml
3 ($^1/_8$)	-	-	5.890487 µl	154.4155 l	0.1	ml	ml
6 ($^1/_4$)	-	-	23.56195 µl	617.6622 l	1	l	l
10 ($^3/_8$)	-	-	65.44985 µl	1.715728 m³	1	l	l
15 (½)	-	-	147.2622 µl	3.860389 m³	1	l	l
25 (1)	409.0616 µl	10.7233 m³	409.0616 µl	10.7233 m³	10	l	l**
40 (1½)	1.047198 ml	27.45165 m³	1.047198 ml	27.45165 m³	10	l	l**
50 (2)	1.457896 ml	38.21785 m³	1.636247 ml	42.89321 m³	10	l	l**
65 (2½)	2.31452 ml	60.67373 m³	2.765257 ml	72.48952 m³	100	l	l**
80 (3)	3.70708 ml	97.17886 m³	4.188791 ml	109.8066 m³	100	l	l**
100(4)	5.789039 ml	151.7561 m³	6.544985 ml	171.5728 m³	100	l	l**
125 (5)	9.265244 ml	242.8828 m³	10.22654 ml	268.0825 m³	100	l	m³
150 (6)	14.57896 ml	382.1785 m³	14.72622 ml	386.0389 m³	100	l	m³
200 (8)	23.09071 ml	605.309 m³	26.17994 ml	686.2913 m³	1	m³	m³
250 (10)	37.04053 ml	970.995 m³	40.90616 ml	1072.33 m³	1	m³	m³
300 (12)	57.87403 ml	1517.132 m³	58.90487 ml	1544.155 m³	1	m³	m³
350 (14)	80.17607 ml	2101.767 m³	80.17607 ml	210.7671 m³	1	m³	m³
400 (16)	104.7198 ml	2745.165 m³	104.7198 ml	2745.165 m³	1	m³	m³
450 (18)	132.536 ml	3474.35 m³	132.536 ml	3474.35 m³	1	m³	m³
500 (20)	163.6247 ml	4289.321 m³	163.6247 ml	4289.321 m³	10	m³	m³
600 (24)	235.6195 ml	6176.622 m³	235.6195 ml	6176.622 m³	10	m³	m³
700 (28)	320.7043 ml	8407.069 m³	320.7143 ml	8407.069 m³	10	m³	m³
750 (30)	368.1554 ml	9650.972 m³	368.1554 ml	9650.972 m³	10	m³	m³
800 (32)	418.8791 ml	10980.66 m³	418.8791 ml	10980.66 m³	10	m³	m³
900 (36)	530.1438 ml	13897.4 m³	530.1438 ml	13897.4 m³	10	m³	m³
1000 (40)	654.4985 ml	17157.28 m³	654.4985 ml	17157.28 m³	10	m³	m³
1050 (42)	654.4985 ml	17157.28 m³	654.4985 ml	17157.28 m³	10	m³	m³
1100 (44)	79.94321 ml	20760.31 m³	791.9432 ml	20760.31 m³	10	m³	m³
1200 (48)	942.4778 ml	24706.48 m³	942.4778 ml	24706.48 m³	10	m³	m³
1400 (54)	-	-	1.282817 l	33628.27 m³	10	m³	m³
1500 (60)	-	-	1.472622 l	38603.89 m³	10	m³	m³
1600 (66)	-	-	1.675517 l	43922.64 m³	10	m³	m³
1800 (72)	-	-	2.120576 l	55589.6 m³	10	m³	m³
2000 (78)	-	-	2.617994 l	68629.13 m³	10	m³	m³
2200 (90)	-	-	3.167773 l	83041.25 m³	10	m³	m³

DN	Volume/pulse or batch quantity*				Factory setting		
	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100 W (Order no. 7ME6580), MAG 3100, 3100 P		Volume/ pulse & batch amount	Pulse & batch unit	Totaliz- er unit
mm (inch)	min.	max.	min.	max.			
2400 (96)	-	-	3.769912 l	98825.9 m^3	10	m^3	m^3
2600 (102)	-	-	4.4241 l	115983. m^3	10	m^3	m^3
2800 (114)	-	-	5.131268 l	134513.1 m^3	10	m^3	m^3
3000 (120)	-	-	5.890487 l	154415.5 m^3	10	m^3	m^3

* The min. and max. amount values show mathematical values and do not indicate measurement accuracy.

** For CT devices the totalizer 1 unit is in m^3

B.5 60 Hz Dimension dependent volume/pulse and batch

Table B-4 **MAG 1100, MAG 1100 F, MAG 3100, MAG 3100 P and MAG 5100 W with ½" NPT cable glands**

DN	Volume/pulse or batch quantity			
	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100 W (Order no. 7ME6580), MAG 3100, 3100 P	
mm (inch)	US G min.	US G max.	US G min.	US G max.
2 ($^1/_{12}$)	-	-	0.00000095484069	25.03057
3 ($^1/_8$)	-	-	0.000001556102	40.79227
6 ($^1/_4$)	-	-	0.000006224408	163.1691
10 ($^3/_8$)	-	-	0.00001729003	453.2475
15 (½)	-	-	0.00003890255	1019.806
25 (1)	0.0001080627	2832.796	0.0001080627	2832.796
40 (1½)	0.0002766404	7251.96	0.0002766404	7251.96
50 (2)	0.0003851353	10096.08	0.0004322506	11331.18
65 (2½)	0.0006114314	16028.3	0.0007305034	19149.7
80 (3)	0.0009793068	25671.93	0.001106562	29007.84
100(4)	0.001529303	40089.74	0.001729003	45324.75
125 (5)	0.002447619	64162.85	0.002701566	70819.92
150 (6)	0.003851353	100960.8	0.003890255	101980.6
200 (8)	0.00609992	159905.7	0.006916009	181299
250 (10)	0.009785071	256509.7	0.01080627	283279.6
300 (12)	0.01528871	400784.1	0.01556102	407922.7
350 (14)	0.02118028	555228.2	0.02118028	555228.2
400 (16)	0.02766404	725196	0.02766404	725196
450 (18)	0.0350123	917826.2	0.0350123	917826.2
500 (20)	0.04322506	1133118	0.04322506	1133118

DN	Volume/pulse or batch quantity			
	MAG 5100 W (Order no. 7ME6520)		MAG 1100, MAG 1100 F, 5100 W (Order no. 7ME6580), MAG 3100, 3100 P	
mm (inch)	US G min.	US G max.	US G min.	US G max.
600 (24)	0.06224408	1631691	0.06224408	1631691
700 (28)	0.0847211	2220912	0.0847211	2220912
750 (30)	0.09725637	2549517	0.09725637	2549517
800 (32)	0.1106562	2900784	0.1106562	2900784
900 (36)	0.1400492	3671304	0.1400492	3671304
1000 (40)	0.1729003	4532475	0.1729003	4532475
1050 (42)	0.1729003	4532475	0.1729003	4532475
1100 (44)	0.2092093	5484294	0.2092093	5484294
1200 (48)	0.2489763	6526764	0.2489763	6526764
1400 (54)	-	-	0.3388844	8883651
1500 (60)	-	-	0.3890255	10198060
1600 (66)	-	-	0.4426246	11603130
1800 (72)	-	-	0.5601967	14685210
2000 (78)	-	-	0.6916009	18129900
2200 (90)			0.836837	21937170
2400 (96)			0.995906	26107050
2600 (102)			1.168806	30639530
2800 (114)			1.355538	35534600
3000 (120)			1.556102	40792270

Control drawing

C

C.1 Control drawing

A5E03828041A

FM Control drawing

MAG6000 I / MAG3100

Prod. family:	Transmitter				
Prod.gr.:	MAG6000 I	Fab. Group:	4838	FM Control Drawing MAG6000 I / MAG3100	Paper size: A4
		Date:	19-12-2013		
DS	07	Author:	G.Joergensen		Sheet 1 of 4
Init. Date		Check	John Beck Nyrup		
Editor	E.Breede	Department:	SFID	Part no.:	
		SIEMENS		Document no.: A5E03828041A	Type: ZUL

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SITRANS F M MAG6000 I and MAG3100 compact zone wiring

User I/O INTERFACE

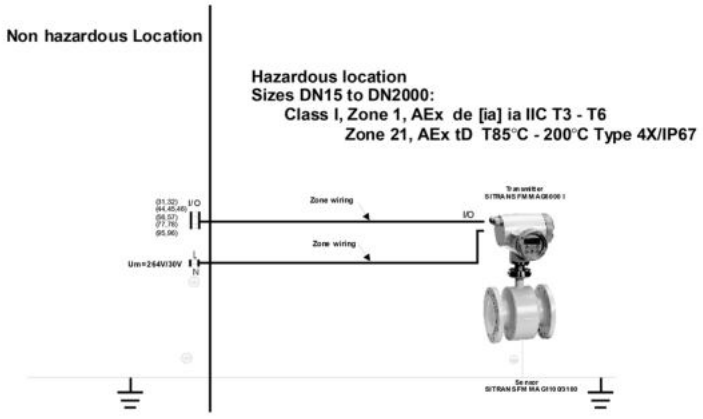
Current (31-32)		Relay (44,45,46)		Freq./pulse (56,57)		Prof. (95, 96) (FISCO)		Dig. Input (77,78)	
	IIB/IIC		IIB/IIC		IIB/IIC		IIB/IIC		IIB/IIC
Ui	30V	Ui	30V	Ui	28V	Ui	17.5V	Ui	30V
Ii	100mA	Ii	200mA	Ii	100mA	Ii	380mA	Ii	
Ci	22nF	Ci	7.5nF	Ci	11nF	Ci	0	Ci	0
Li	34µH	Li	0	Li	34µH	Li	0	Li	0
Pi	1W	Pi	1,2W	Pi	1,2W	Pi	5,32W	Pi	1,2W

1. No revision to drawing without prior FM Approval.
2. The Associated Apparatus must be FM Approved.
3. The FM Approved Associated Apparatus must be a linear output device.
4. Control equipment connected to Associated Apparatus must not use or generate more than 250 Vrms or Vdc.
5. Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
6. The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus when the following is true:
   - Vmax or Ui ≥ Voc, Vt or Uo;
   - Imax or Ii ≥ Isc, It or Io;
   - Pmax or Pi ≥ Po;
   - Ca or Co ≥ Ci + Ccable;
   - La or Lo ≥ Li + Lcable..
7. Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
8. Installation should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically Safe Systems for Hazardous(Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
9. See operating Instructions for SITRANS FM order no. A5E31638071 to complete installation

WARNING - The equipment shall not be opened when an explosive gas or dust atmosphere may by be present.

WARNING – Substitution of components may impair Intrinsic Safety.

WARNING – To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing



Housing of Transmitter and Sensor must always be connected as illustrated

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SITRANS F M MAG6000 I and MAG3100 remote Zone wiring

User I/O INTERFACE | **Sensor interface**

Current (31-32)		Relay (44,45,46)		Freq./pulse (56,57)		Prof. (95, 96) (FISCO)		Dig. Input (77,78)		Senor (0,81,82,83,84)			(85,86) Ex e	
	IIB/IIC		IIB/IIC		IIB/IIC		IIB/IIC		IIB/IIC		IIB		IIC		
Ui	30V	Ui	30V	Ui	28V	Ui	17,5V	Ui	30V	Uo	30V	Uo	30V	Um	70V
Ii	100mA	Ii	200mA	Ii	100mA	Ii	380mA	Ii		Io	6.1mA	Io	6.1mA		
Ci	22nF	Ci	7.5nF	Ci	11nF	Ci	0	Ci	0	Co	560nF	Co	66nF		
Li	34µH	Li	0	Li	34µH	Li	0	Li	0	Lo	1H	Lo	0.96H		
Pi	1W	Pi	1,2W	Pi	1,2W	Pi	5,32W	Pi	1,2W	Po	45.5mW	Po	45.5mW		

1. No revision to drawing without prior FM Approval.
2. The Associated Apparatus must be FM Approved.
3. The FM Approved Associated Apparatus must be a linear output device.
4. Control equipment connected to Associated Apparatus must not use or generate more than 250 Vrms or Vdc.
5. Associated apparatus manufacturer's installation drawing must be followed when installing this equipment.
6. The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus when the following is true:
   - Vmax or Ui ≥ Voc, Vt or Uo;
   - Imax or Ii ≥ Isc, It or Io;
   - Pmax or Pi ≥ Po;
   - Ca or Co ≥ Ci + Ccable;
   - La or Lo ≥ Li + Lcable..
7. Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
8. Installation should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically Safe Systems for Hazardous(Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
9. See operating Instructions for SITRANS FM order no. A5E31638071 to complete installation

WARNING - The equipment shall not be opened when an explosive gas or dust atmosphere may by be present.

WARNING – Substitution of components may impair Intrinsic Safety.

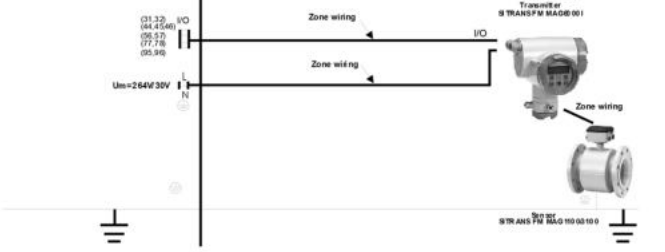
WARNING – To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing

Non hazardous Location

Hazardous location
MAG6000 I transmitter
Class I, Zone 1, AEx de [ia] ia IIC T6
Zone 21, AEx tD T85°C - 200°C Type 4X/IP67

MAG3100 Sensor Sizes DN15 to DN300:
Class I, Zone 1, AEx de ia IIC T3 - T6
Zone 21, AEx tD T85°C - 200°C Type 4X/IP67

MAG3100 Sensor Sizes DN350 to DN2000:
Class I, Zone 1, AEx e ia IIC T3 - T6
Zone 21, AEx tD T85°C - 200°C Type 4X/IP67



Housing of Transmitter and Sensor must always be connected as illustrated

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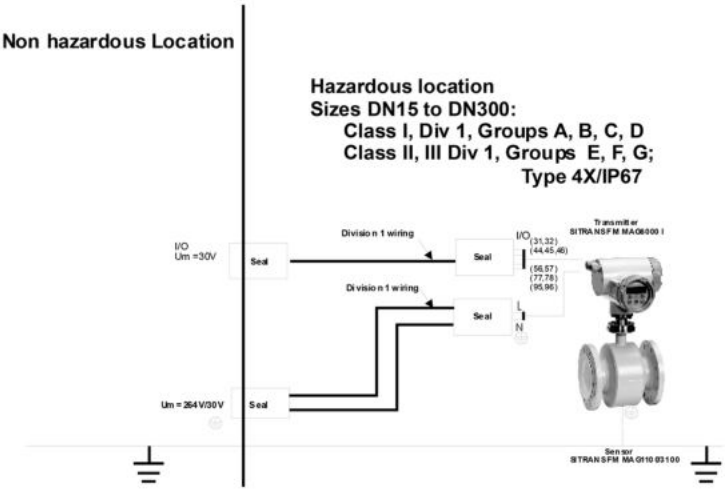
SITRANS F M MAG6000 I and MAG3100 compact Division wiring

1. No revision to drawing without prior FM Approval.
2. Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
3. Conduit seal must be installed within 18" of conduit entry and when transitioning between hazardous locations. .
4. Installation should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically Safe Systems for Hazardous(Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
5. See operating Instructions for SITRANS FM order no. A5E31638071 to complete installation

WARNING - The equipment shall not be opened when an explosive gas or dust atmosphere may by be present.

WARNING – Substitution of components may impair Intrinsic Safety.

WARNING – To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing



Housing of Transmitter and Sensor must always be connected as illustrated

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W