SIEMENS

Operating Manual
Edition 05/2006 - Revision 05

SITRANS F M MAGFLO®

Electromagnetic flowmeters
Transmitter types MAG 5000, MAG 6000

Technical Documentation (handbooks, instructions, manuals etc.) on the complete product range SITRANS F can be found on the internet/intranet on the following links:

English: http://www4.ad.siemens.de/WW/view/en/10806951/133300

Order no.: FDK-521H0739

SFIDK.PS.027.Z8.02

* N 8 3 R 9 1 4 1 *

1.1 Transmitter type MAG 5000 & MAG 6000

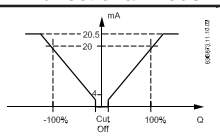
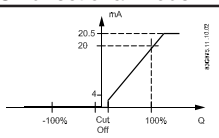
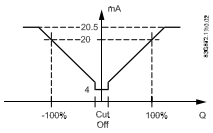
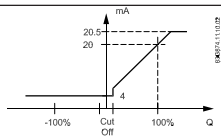
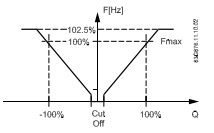
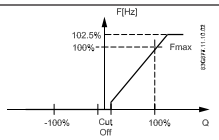
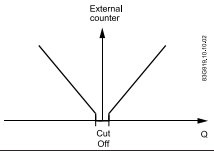
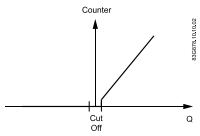
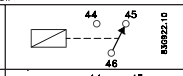
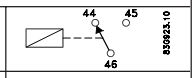
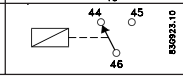
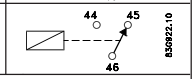
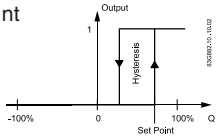
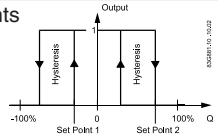
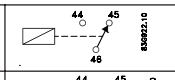
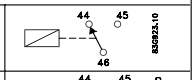
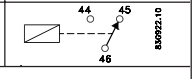
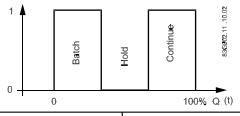
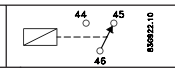
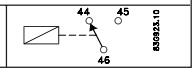

MAG 5000 accuracy 0.5%
MAG 6000 accuracy 0.25%

Current output		
	Current	0-20 mA, 4-20 mA or 4-20 mA + alarm
	Load	< 800 ohm
	Time constant	0.1-30 s adjustable
Digital output		
	Frequency	0-10 kHz, 50% duty cycle
	Time constant	0.1-30 s adjustable
	Active	24 V DC, 30 mA, 1 KΩ ≤ R_{load} ≤ 10 KΩ, short-circuit-protected
	Passive	3-30 V DC, max. 110 mA, 200 Ω ≤ R_{load} ≤ 10 KΩ
Relay	Time constant	Changeover relay, time constant same as current time constant
	Load	42 V AC/2 A, 24 V DC/1A
Digital input		11-30 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
Functions		Flow rate, 2 totalizers, low flow cut-off, empty pipe cut-off, flow direction, error system, operating time, uni/bidirectional flow, limit switches, pulse output, control for cleaning unit and batch[2])
Galvanic isolation		All inputs and outputs are galvanically isolated
Cut-off	Low flow	0-9.9% of maximum flow
	Empty pipe	Detection of empty pipe[1])
Totalizer		Two eight-digit counters for forward, net or reverse flow
Display		Background illumination with alphanumerical text, 3 × 20 characters to indicate flow rate, totalized values, settings and faults
		Reverse flow indicated by negative sign
	Time constant	Time constant as current output time constant
Zero point adjustment		Automatic
Electrode input impedance		> 1 x 10^{14} Ω
Excitation frequency		Sensor size depending pulsating DC current (125 mA)
Ambient temperature		Display version during operation: −20 to +50°C
		Blind version during operation: −20 to +60°C
		During storage: −40 to +70°C (RH max. 95%)
Custody transfer approval		PTB (cold water) 6.221 99.19 / DANAK OIML R75[2]) (hot water) / DANAK OIML R117[2]) (cold water/milk, beer etc.)
Communication		
	Standard	Prepared for client mounted add-on modules[2])
	Optional	HART, Profibus PA & DP, Modbus RTU, CANopen, DeviceNet as add-on module[2]), HART (MAG 5000)
Compact		
	Enclosure material	Fibre glass-reinforced polyamide
	Enclosure rating	IP 67 to EN 60529 and DIN 40050 (1 m w.g. for 30 minutes)
	Mechanical load	18-1000 Hz random, 3.17 G rms in all directions to EN 60068-2-36
19" insert		
	Enclosure material	Standard 19" insert of aluminium/steel (DIN 41494)
		Width: 21 TE
		Height: 3 HE
	Enclosure rating	IP 20 to EN 60529 and DIN 40050
	Mechanical load	Version: 1 G, 1-800 Hz sinusoidal in all directions to EN 60068-2-36
EMC performance		Emission: EN 50081-1 (Light industry)
		Immunity: EN 50082-2 (Industry)
Supply voltage		115-230 V AC +10% to −15%, 50-60 Hz
		11-30 V DC or 11-24 V AC
		Fuse: 250 V ~ 500 mA T
Power consumption		230 V AC: 17 VA
		24 V DC: 9 W, I_N = 380 mA, I_{ST} = 8A (30 ms)
		12 V DC: 11 W, I_N = 920 mA, I_{ST} = 4A (250 ms)

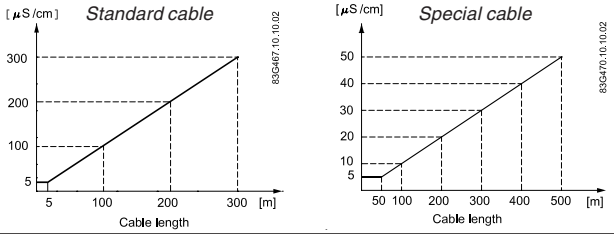
[1]) Special cable required in separate mounted installation

[2]) MAG 6000 only

1.2 Output characteristics MAG 5000 & MAG 6000

Output characteristics	Bidirectional mode	Unidirectional mode
0-20 mA		
4-20 mA		
Frequency		
Pulse output		
Relay	Power down 	Active 
Error relay	No error 	Error 
Limit switch or direction switch	1 set point 	2 set points 
	Low flow (Reverse flow) 	Intermediate flow 
	High flow (Forward flow) 	High flow/ Low flow 
Batch on digital output *(MAG 6000 only)*		
Batch on relay *(MAG 6000 only)*	Hold 	Batch 

1.3.1 Sensor cables and conductivity of medium

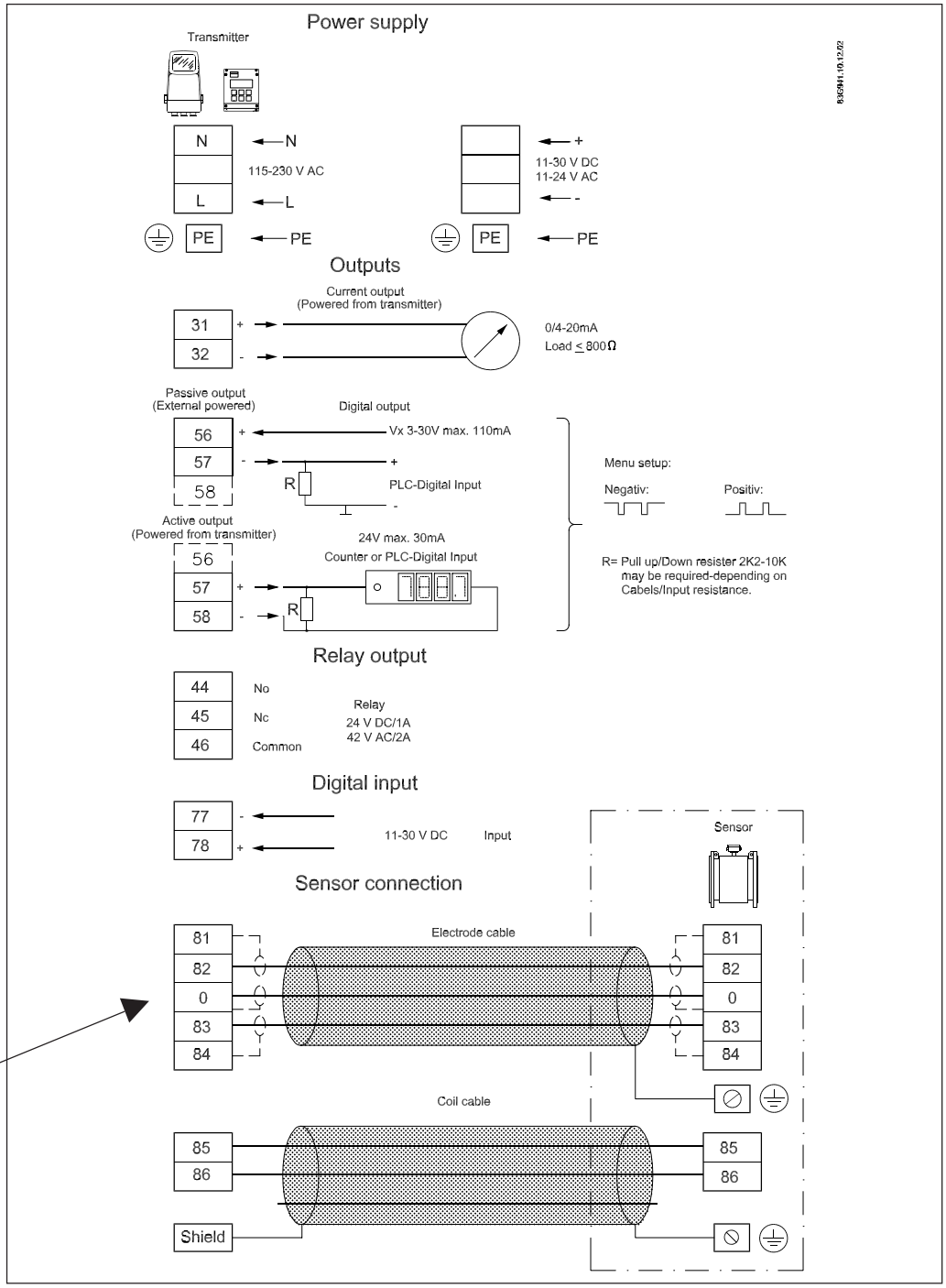
Conductivity of medium	**Compact installation:** Liquids with an electrical conductivity ≥ 5 µS/cm. For a conductivity between 5 and 10 µS/cm, the repeatability may degrade to ±0.5% of actual flow.
	Remote installation: 

Note For detection of empty sensor the min. conductivity must always be ≥ 20 µS/cm and the max. length of electrode cable when remote mounted is 50 metres. Special cable must be used. For remote mounting in Ex applications special cable cannot be used, empty sensor cannot be detected and the electrically conductivity must be ≥ 30 µS/cm.
For remote mounted CT installations the max. cable length is 200 metres.

1.3.2 Minimum accept data for cable

			Coil cable	*Electrode cable*
Basic data	No. of conductors		2	3
	Min. sqr. area		0.5 mm²	0.2 mm²
	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.

2.1 Transmitter MAG 5000 & MAG 6000 connection diagram



Note
Special cable with individual wire shields (shown as dotted lines) are only requried when using empty pipe function or long cables.
(See “Technical data”)

Potential Hazards / Grounding
The mains protective earth wire must be connected to the PE terminal in accordance with the diagram (class 1 power supply).

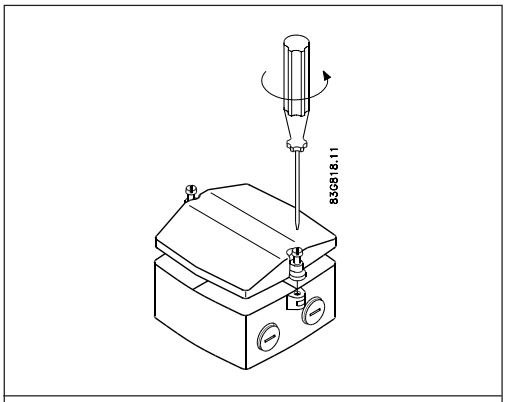
Mechanical counters
When mounting a mechanical counter to terminals 57 and 58 (active output), a 1000 µF capacitor must be connected to the terminals 56 and 58.
Capacitor + is connected to terminal 56 and capacitor – to terminal 58.

Output cables
If long cables in noise environment, we recommend to use screened cable.

Electrodes cables
Dotted connections only to be when using special electrode cable.

Mains supply 115 to 230 V AC from building installation Class II. A switch or circuit-breaker (max. 15 A) shall be included in the building installation. It must be in close proximity to the equipment and within easy reach of the operator, and it shall be marked as the disconnecting device for the equipment.

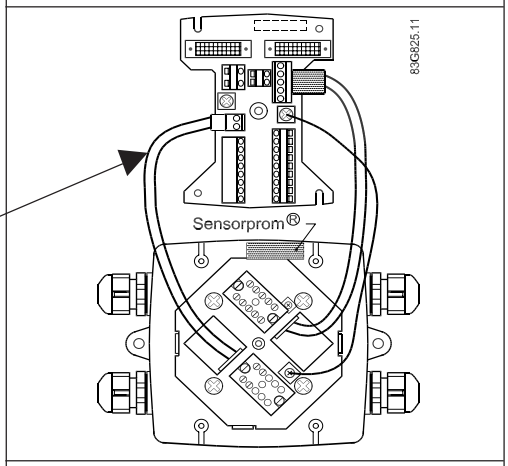
3.1 Compact installation MAG 5000 & MAG 6000 - *Compact polyamide*



Step 1
Remove and discard the terminal box lid of the sensor.

Fit the PG 13.5 cable glands for the supply and output cables.

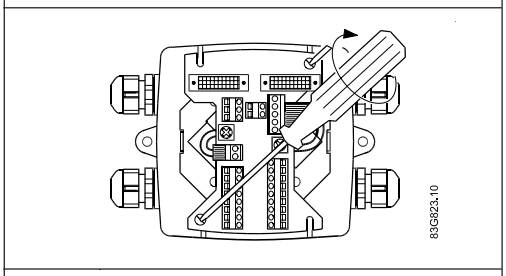
Step 2
Remove the two black plug assemblies for coil and electrode cables in the terminal box and connect them to their corresponding terminal numbers on the connection board.



Step 3
Connect an earth wire between PE on connection board and bottom of terminal box.
Connect the 2 pin connector and 3 pin connector as shown.

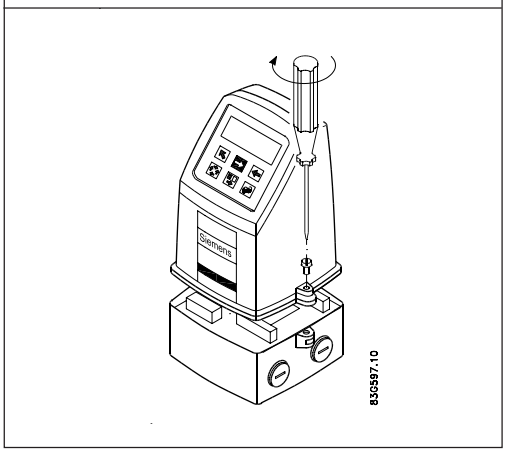
Note
In earlier version the 3 pin connector was a 5 pin connector.

Note
System will **not** register flow if black plugs are not connected to connection board



Step 4
Mount the connection plate in the terminal box. The SENSORPROM® unit connections will be established automatically when the connection plate is mounted in the terminal box.

Note
Check that your connection board lines up with the SENSORPROM® unit, if not, move the SENSORPROM® unit to the other side of the terminal box.

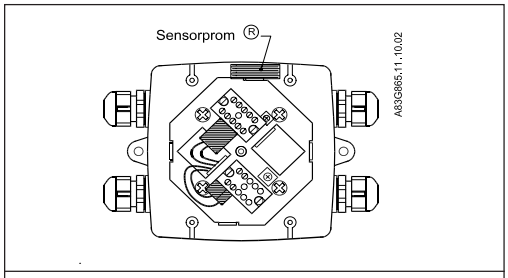


Step 5
Fit the supply and output cables respectively and tighten the cable glands to obtain optimum sealing.
Please refer to the wiring diagram “Electrical connections”.

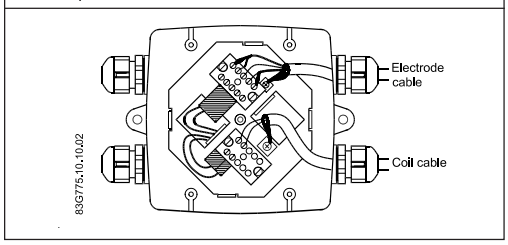
Mount the transmitter on the terminal box.

Caution
Exposing the transmitter to direct sunlight may increase the operating temperature above its specified limit, and decrease display visibilty

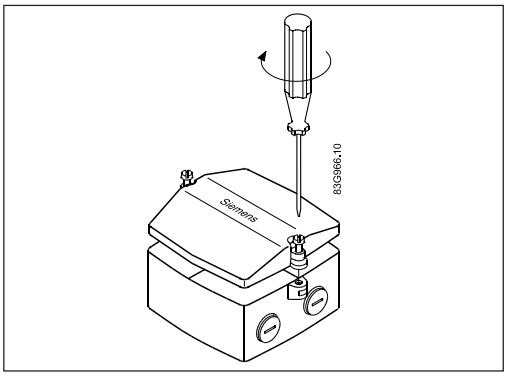
3.2.1 Remote installation - *At the sensor*



Remove the SENSORPROM® unit from the sensor and mount it on the connection plate in the transmitter.

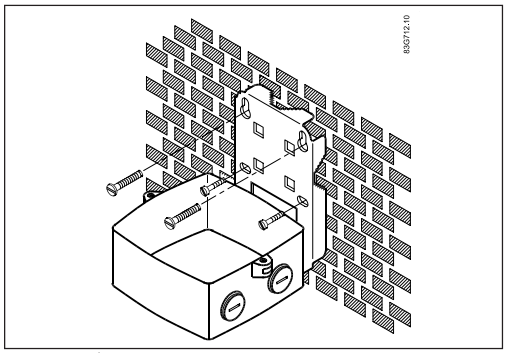


Fit and connect the electrode and coil cables as shown in “Electrical connections”.
The unscreened cable ends must be kept as short as possible.
The electrode cable and the coil cable must be kept separate to prevent interference.
Tighten the cable glands well to obtain optimum sealing.

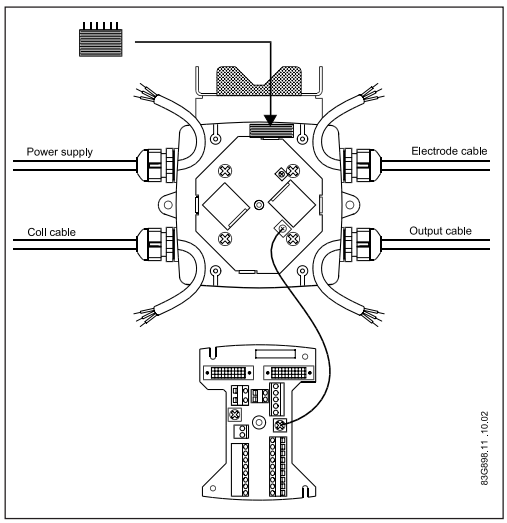


⚠ Mount the terminal box lid before power up.

3.2.2 Remote installation - *Wall mounting transmitter*



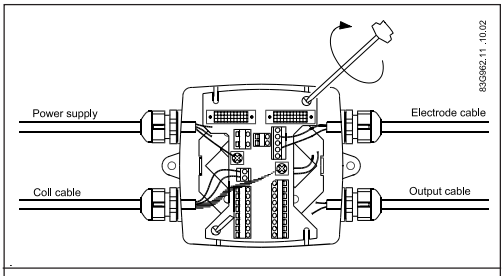
Mount wall bracket on a wall or on a pipe using ordinary hose clips or duct straps.



Take the SENSORPROM® memory unit from the sensor. Mount the SENSORPROM® unit in the wall mounting unit as shown. The text on the SENSORPROM® unit **must** face towards the wall bracket.

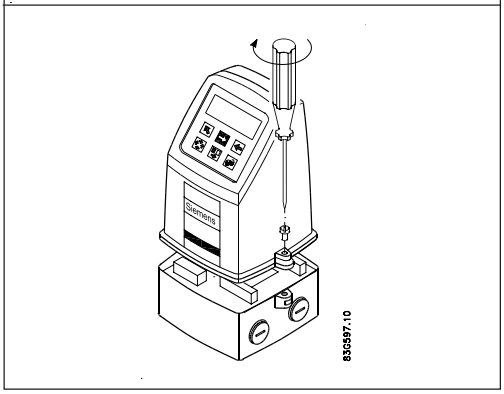
Mount an earth wire between PE on connection board and bottom of terminal box.

3.2.2 Remote installation - *Wall mounting transmitter* *(continued)*



Mount the connection plate in the terminal box. Fix the connection plate with the two diagonal opposite screws.

Fit the coil, electrode, supply and output cables respectively and tighten the cable glands to obtain optimum sealing. Please see the wiring diagram in “Electrical connections”.

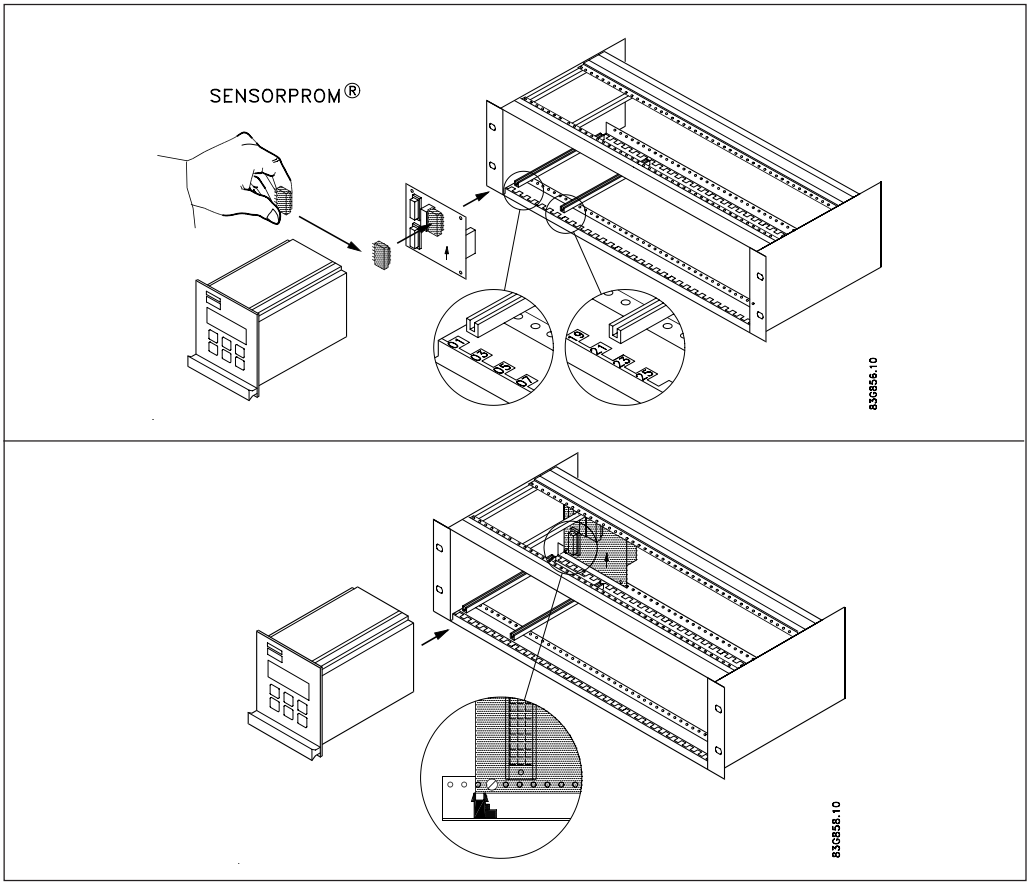


Mount the transmitter on the terminal box.

Caution
Exposing the transmitter to direct sunlight may increase the operating temperature above its specified limit, and decrease display visibilty

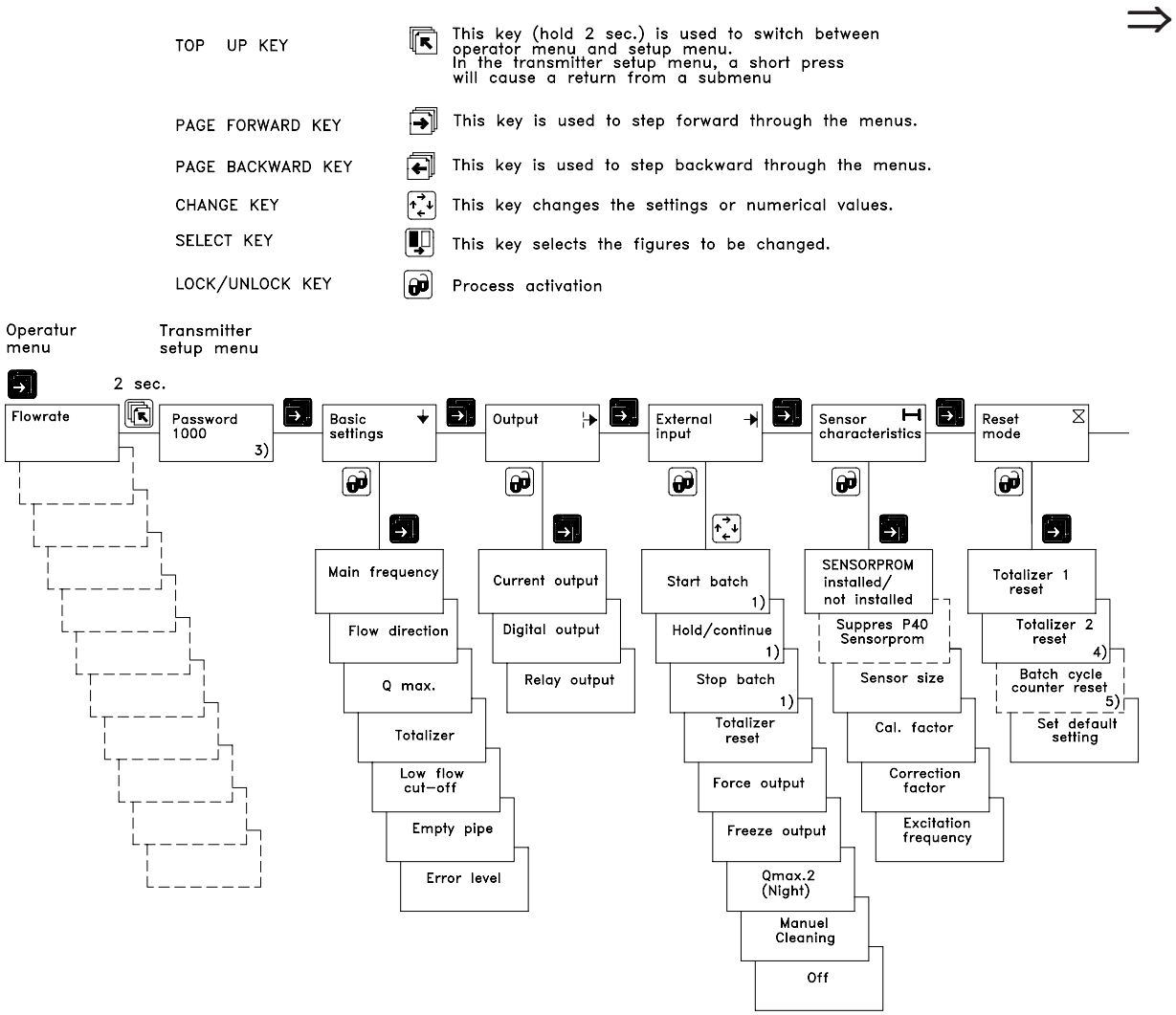
Attention
When remote mounted, power supply PE wire must be connected to PE terminal.
Coil cable shield must be connected to SHIELD terminal.
Use the supplied insulating tube to insulate the core shield.

3.2.3 Remote installation - *Transmitter in 19" insert*



1. Fit the SENSORPROM® memory unit on the connection board supplied with the transmitter. The SENSORPROM® unit is supplied with the sensor in the terminal box.
2. Mount the guide rails into the rack system as shown. Distance between guide rails is 20 TE. Guide rails are supplied with the rack system and not with the transmitter.
3. Mount the connection board as shown.
4. Connect the cables as shown under "Electrical connection".
5. Insert the transmitter into the rack system.

4.1 MAG 5000 & MAG 6000



1) Mag 6000 I only

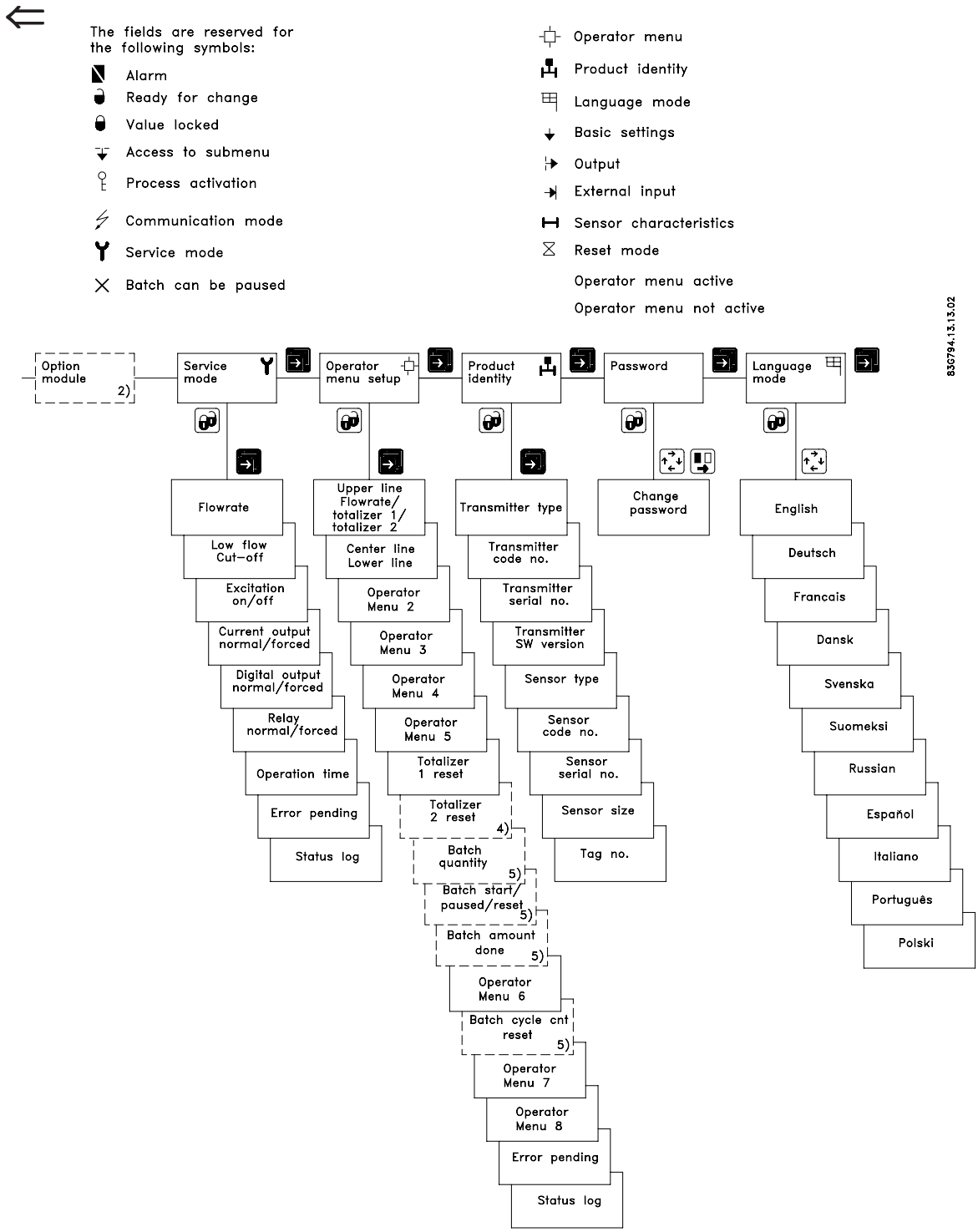
2) Add on module

3) Factory set password: 1000

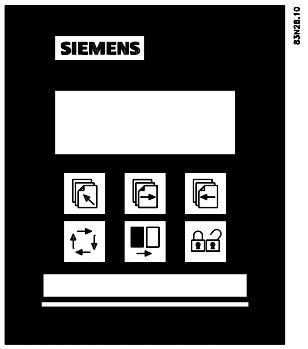
4) Not at Batch

5) At Batch only

4.1 MAG 5000 & MAG 6000 *(continued)*



4.2 Keypad and display layout



Keypad

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

TOP UP KEY		This key (hold 2 sec.) is used to switch between operator menu and setup menu. In the transmitter setup menu, a short press will cause a return to the previous menu.
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 backward through the menus.
CHANGE KEY		This key changes the settings or numerical values.
SELECT KEY		This key selects the figures to be changed.
LOCK/UNLOCK KEY		This key allows the operator to change settings and gives access to submenus.

Display

The display is alphanumerical and indicates flow values, flowmeter settings and error messages.

The upper line is for primary flow readings and will always show either flow rate, totalizer 1 or totalizer 2. The line is divided into 3 fields.

S: Sign field
P: Primary field for numerical value
U: Unit field

The centre line is the title line (T) with individual information according to the selected operator or setup menu.

The lowest line is the subtitle line (ST) which either will add information to the title line or keep individual information independent of the title line.

F: The alarm field.  **Two flashing triangles will appear by a fault condition.**

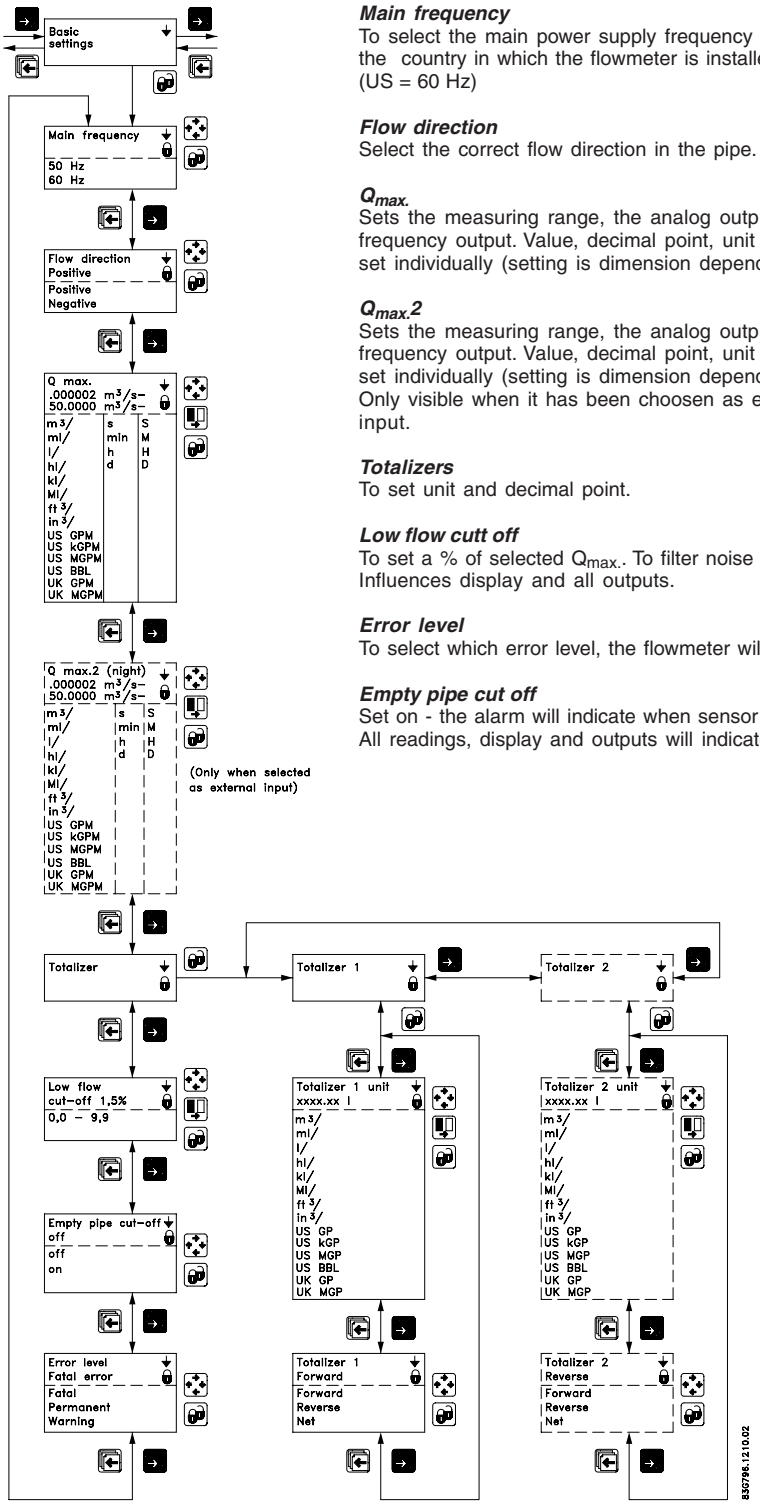
M: The mode field. The symbols indicate the following.

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

L: The lock field. Indicates the function of the lock key.

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

4.3.1 Basic settings



Main frequency
To select the main power supply frequency corresponding to the country in which the flowmeter is installed.
(US = 60 Hz)

Flow direction
Select the correct flow direction in the pipe.

$Q_{max.}$
Sets the measuring range, the analog outputs and the frequency output. Value, decimal point, unit and time can be set individually (setting is dimension dependent).

$Q_{max.}2$
Sets the measuring range, the analog outputs and the frequency output. Value, decimal point, unit and time can be set individually (setting is dimension dependent).
Only visible when it has been choosen as external digital input.

Totalizers
To set unit and decimal point.

Low flow cutt off
To set a % of selected $Q_{max.}$. To filter noise in the installation. Influences display and all outputs.

Error level
To select which error level, the flowmeter will detects an error.

Empty pipe cut off
Set on - the alarm will indicate when sensor is running empty. All readings, display and outputs will indicate zero.

Comma for flow rate, totalizer 1 and totalizer 2 can be individually positioned.

- open the respective window.
- ensure that the cursor is positioned below the comma. Use the SELECT KEY.
- move the comma to the requested position. Use the CHANGE KEY .

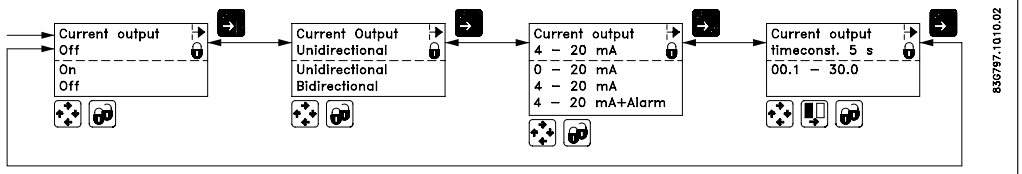
Units are changed by means of the CHANGE KEY with the cursor placed below the unit selected. Select units (cursor moved) by means of the SELECT KEY .

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

$Q_{max.}$ 2 - is only visible when it has been choosen as external input.

4.3.2 Outputs

Current output Proportional to flowrate (Terminal 31 and 32)

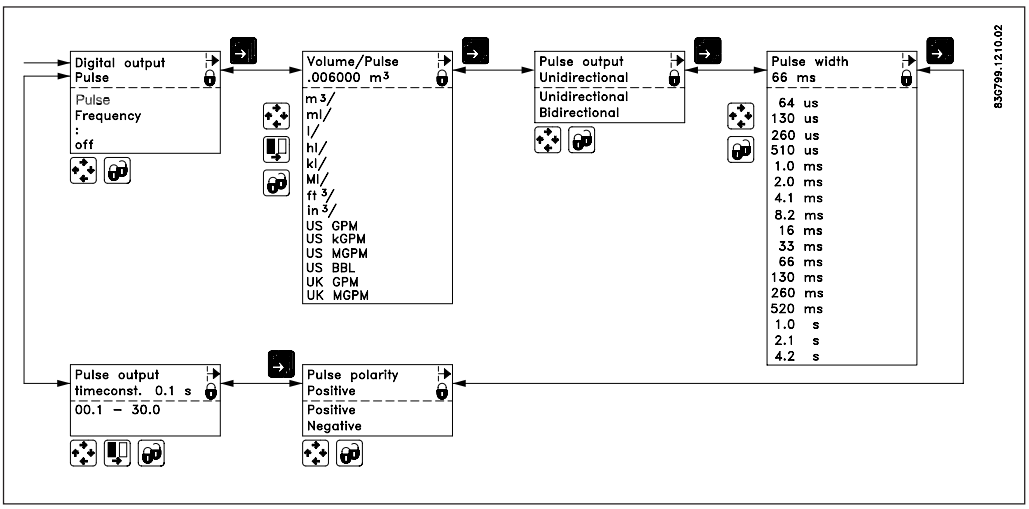


4 - 20 mA + alarm:
Current output gives the following mA, depending on what is selected as error level in basic settings.

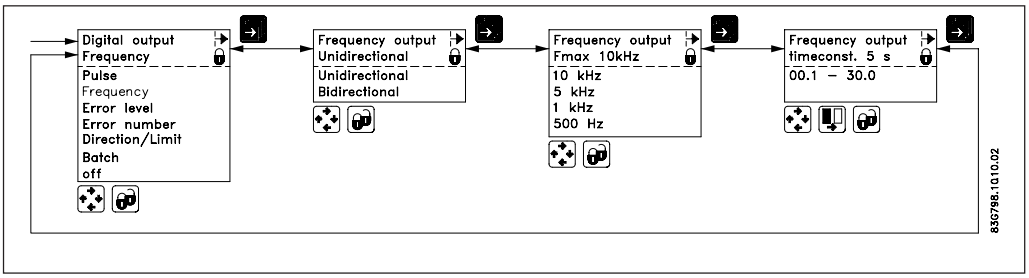
Fatal: 1.3 mA, permanent: 2 mA, warning: 3 mA

The current output must be set off when not used.

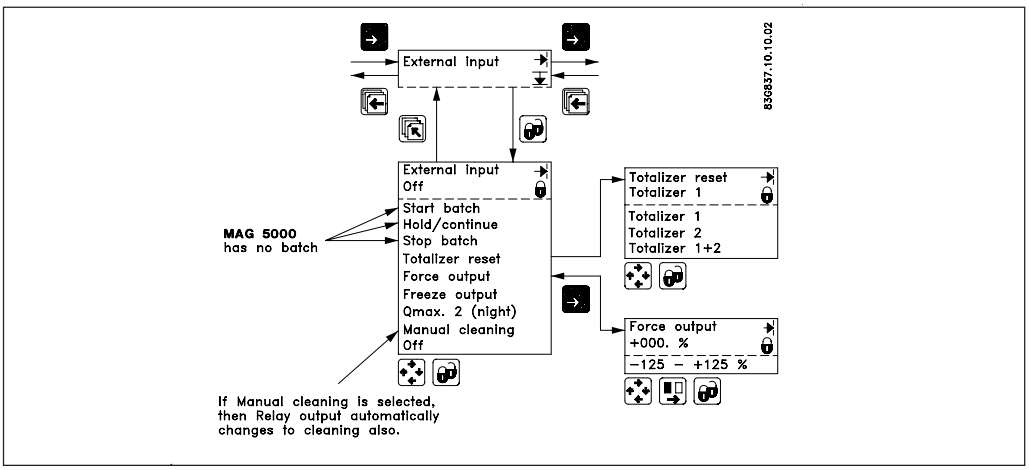
Digital output Pulse/volume (Terminal 56, 57, 58)



Digital output Frequency Proportional to flowrate (Terminal 56, 57, 58)



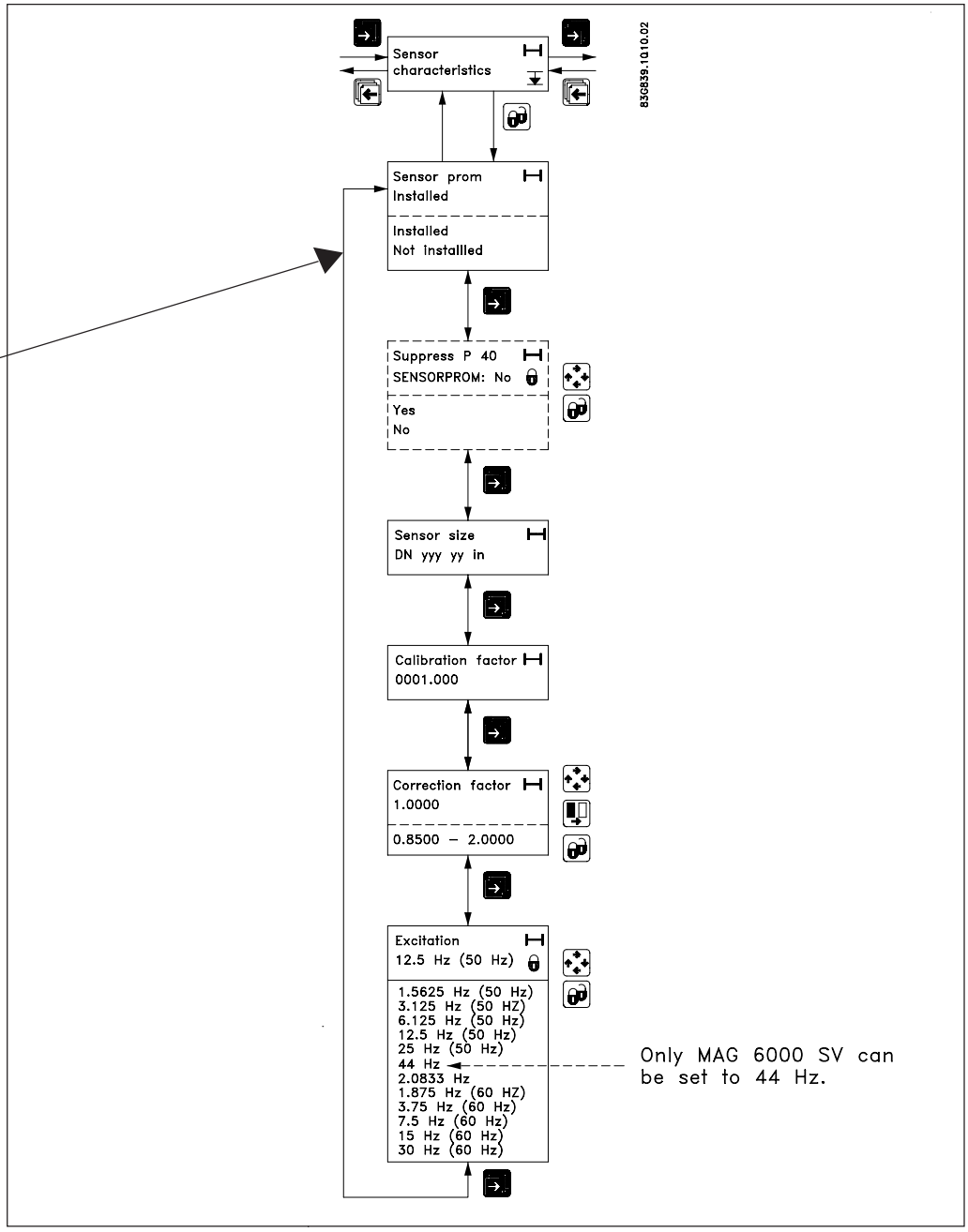
4.3.3 External input



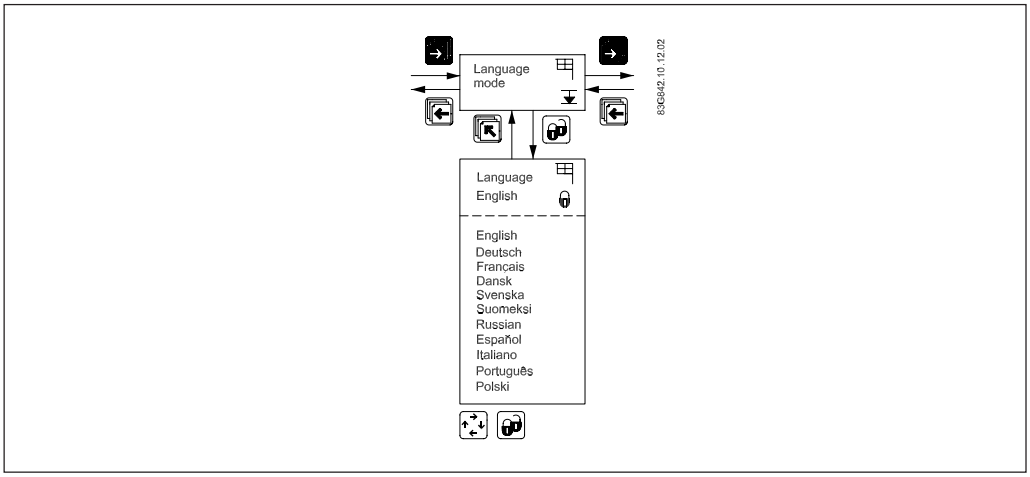
Batch control is available on MAG 6000 only.

4.3.4 Sensor characteristics

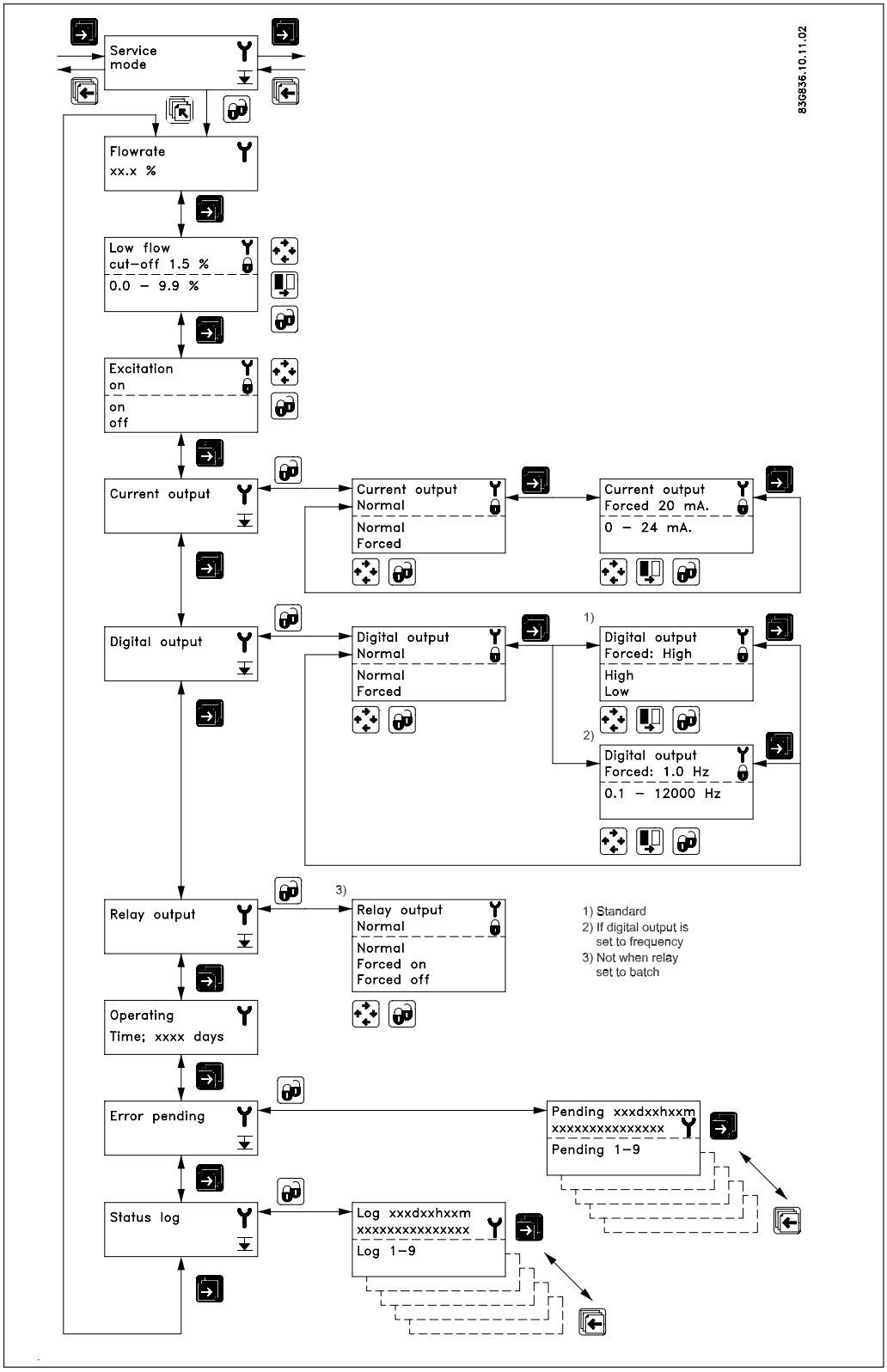
If “SENSORPROM not installed” is shown, refer to chapter 6 in the handbook (depending on type of mounting configuration).



4.3.5 Language mode



4.3.6 Service mode



All previous settings are reinitialised when service mode is exited using the top up key .

The error system

The error system is divided into an error pending list and a status log list. Time is gained as days, minutes and hours since the error has occurred. The first 9 standing errors are stored in error pending. When an error is removed it is removed from error pending. The latest 9 errors are stored in the status log. When an error is removed it is still kept in status log. Errors in status log is stored for 180 days.

Error pending and status log are accessible when enabled in the operator menu.

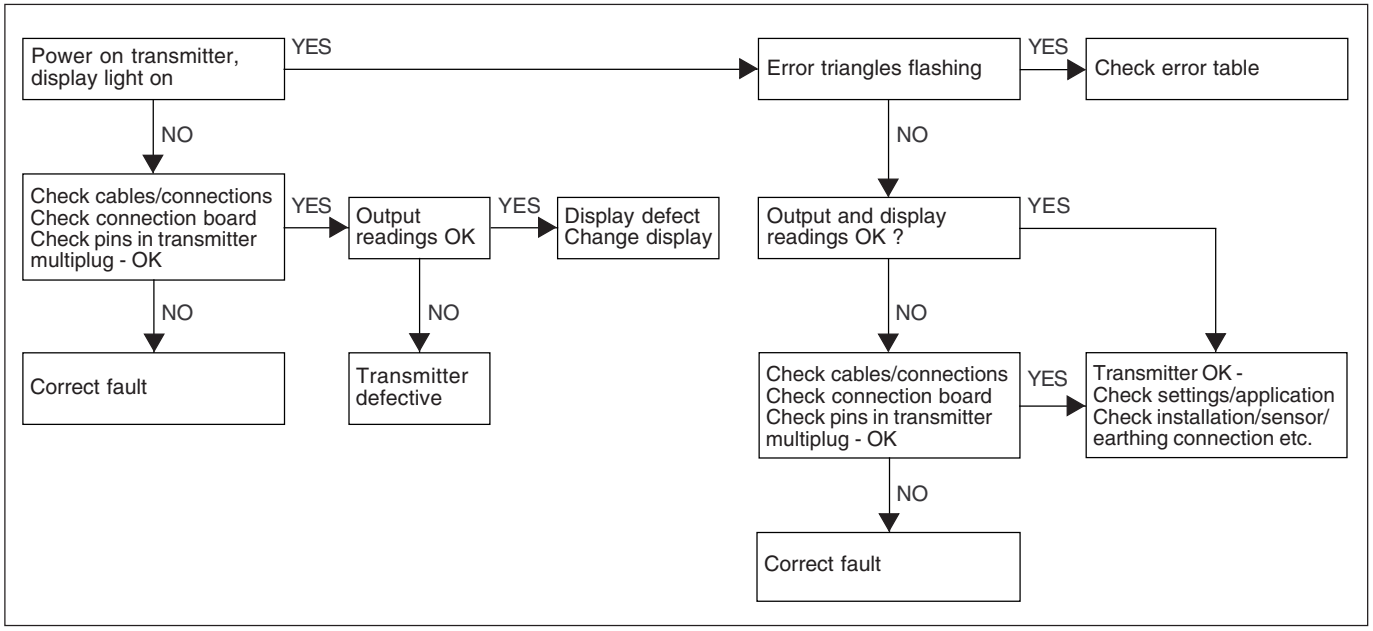
5. Service

Often problems with unstable/wrong measurements occur due to insufficient/wrong earthing or potential equalization. Please check this connection. If OK, the SITRANS F M MAGFLO® transmitter can be checked as described under 9.1 and sensor under 9.3 in the handbook.

5.1 Transmitter check list

When checking SITRANS F M MAGFLO® installations for malfunction the easiest method to check the transmitter is to replace it with another MAG 5000/6000 transmitter with a similar power supply.
A replacement can easily be done as all settings are stored in and downloaded from the SENSORPROM® unit - no extra settings need to be made.

If no spare transmitter is available - then check transmitter according to check table.



5.2 Trouble shooting MAG transmitter

Symptom	Output signals	Error code	Cause	Remedy
Empty display	Minimum		1. No power supply	Power supply Check MAG 5000/6000 for bended pins on the connector
			2. MAG 5000/6000 defective	Replace MAG 5000/6000
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
	Undefined	P42	1. No load on current output	Check cables/connections
			2. MAG 5000/6000 defective	Replace MAG 5000/6000
		P41	Initializing error	Switch off MAG 5000/6000, wait 5 s 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
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
		F61	Deficient SENSORPROM® unit	Replace SENSORPROM® unit
		F62	Wrong type of SENSORPROM® unit	Replace SENSORPROM® unit
		F63	Deficient SENSORPROM® unit	Replace SENSORPROM® unit
		F71	Loss of internal data	Replace MAG 5000/6000
	Maximum	W30	Flow exceeds 100% of $Q_{max.}$	Check $Q_{max.}$ (Basic Settings)
		W21	Pulse overflow • Volume/pulse too small • Pulse width too large	 Change volume/pulse 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

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