



**PROCESS INSTRUMENT
SOLUTIONS**

MAG 5000 / 6000 & ASSOCIATED SENSORS INSTALLATION & FAULT FINDING GUIDE



THE LEADING PROCESS INDUSTRY SOLUTION PROVIDER

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A.0 Recommended Tools

Insulation Tester 500V.

Example

RS Pro, Insulation Tester 4000M Ω CAT III 1000 V

RS Stock No. 893-7913



Moving Coil Meter

Example

Maplin MT 2017 Large Analogue Multimeter

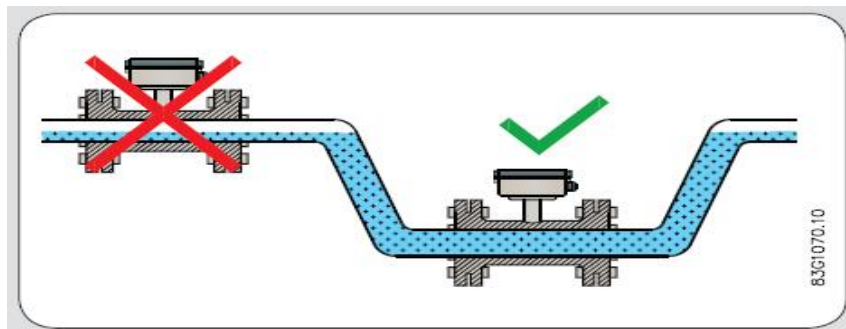
Code: N60LK



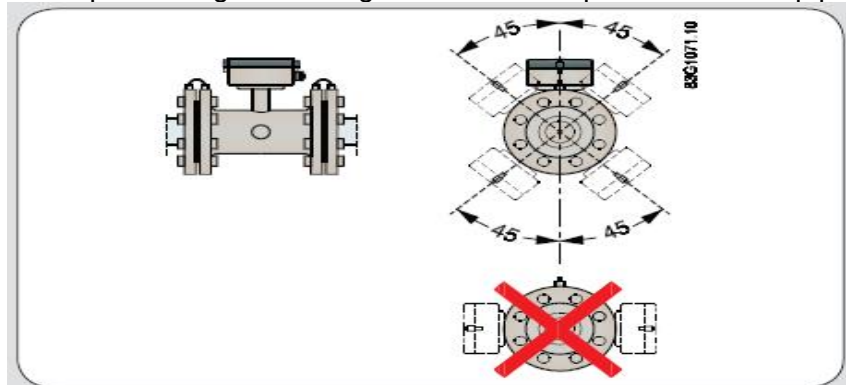
1.0 Mechanical Installation

1.1 Sensor Installation

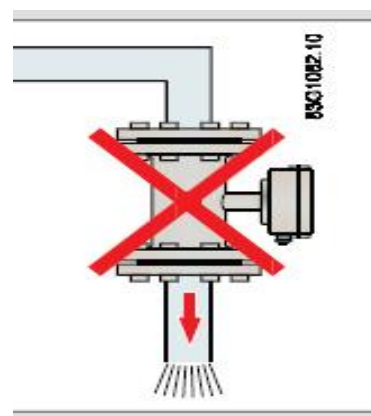
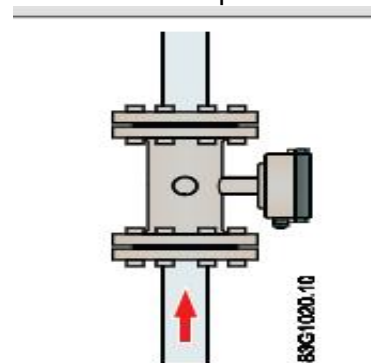
Sensor needs to be full at all times.



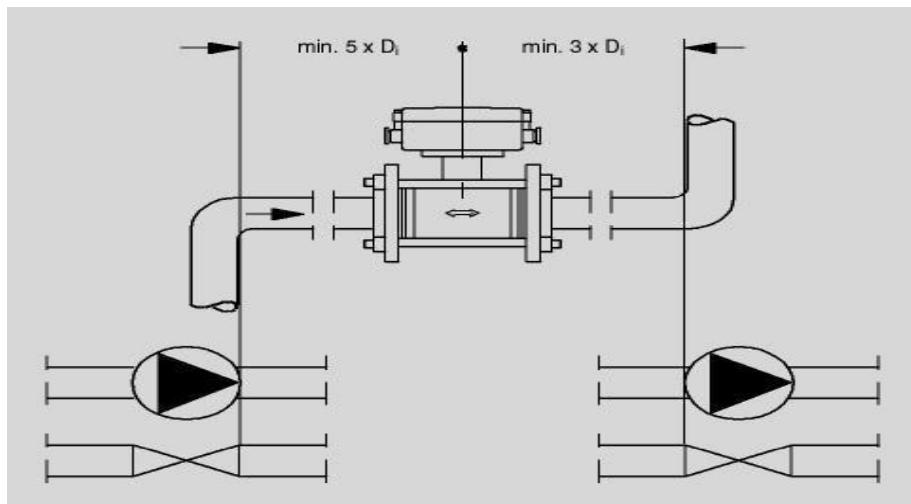
Avoid positioning measuring electrodes at top and bottom of pipe.



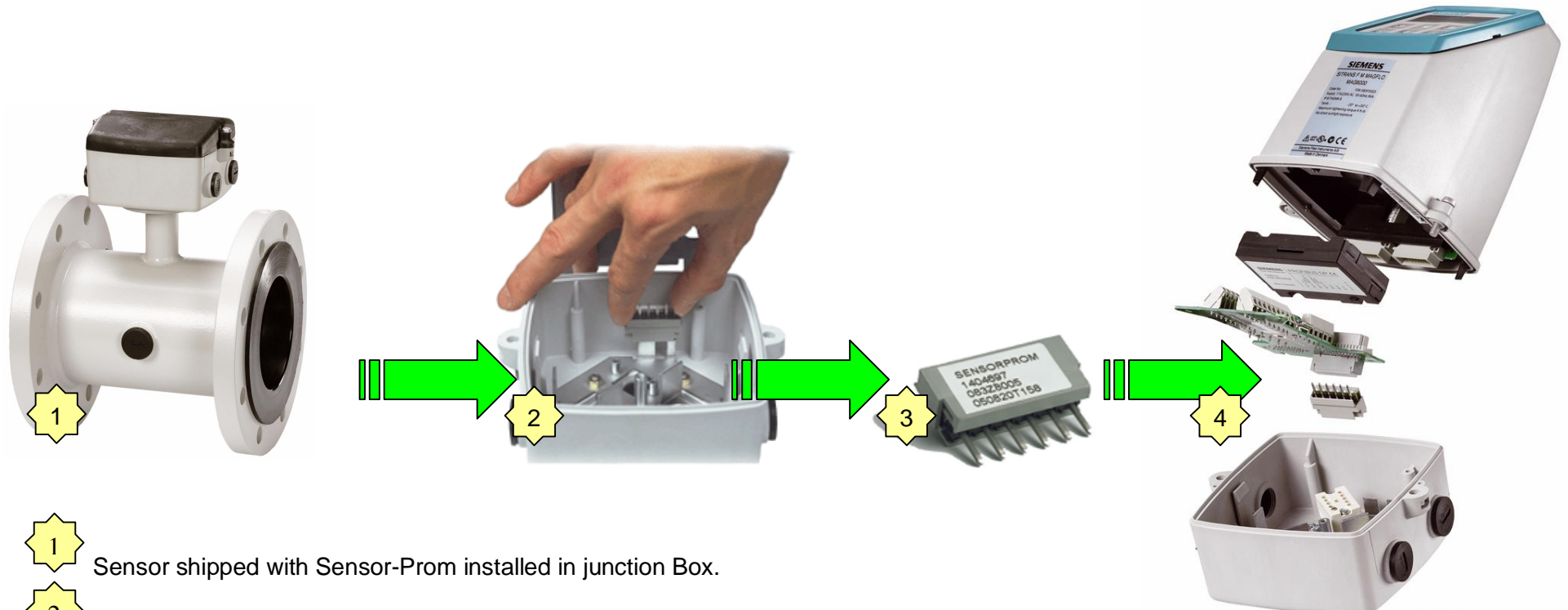
Vertical Pipes



Straight Diameters for optimum performance



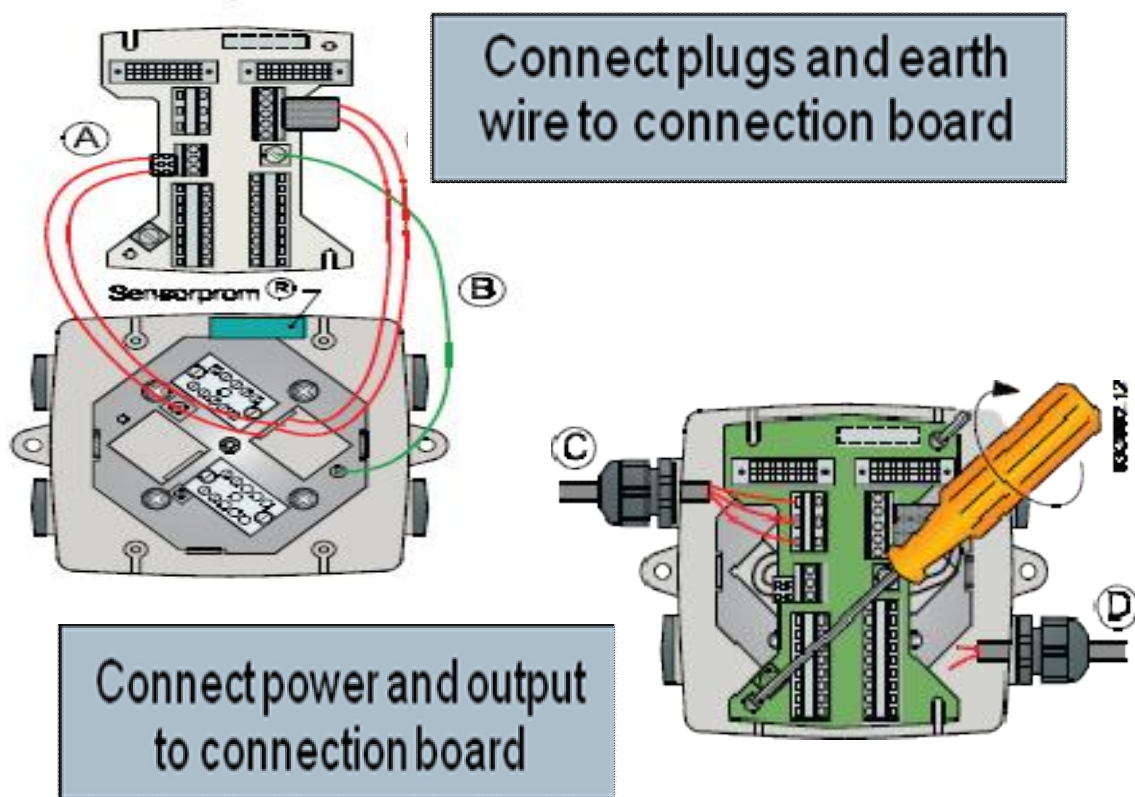
1.2 Sensor Prom Installation.



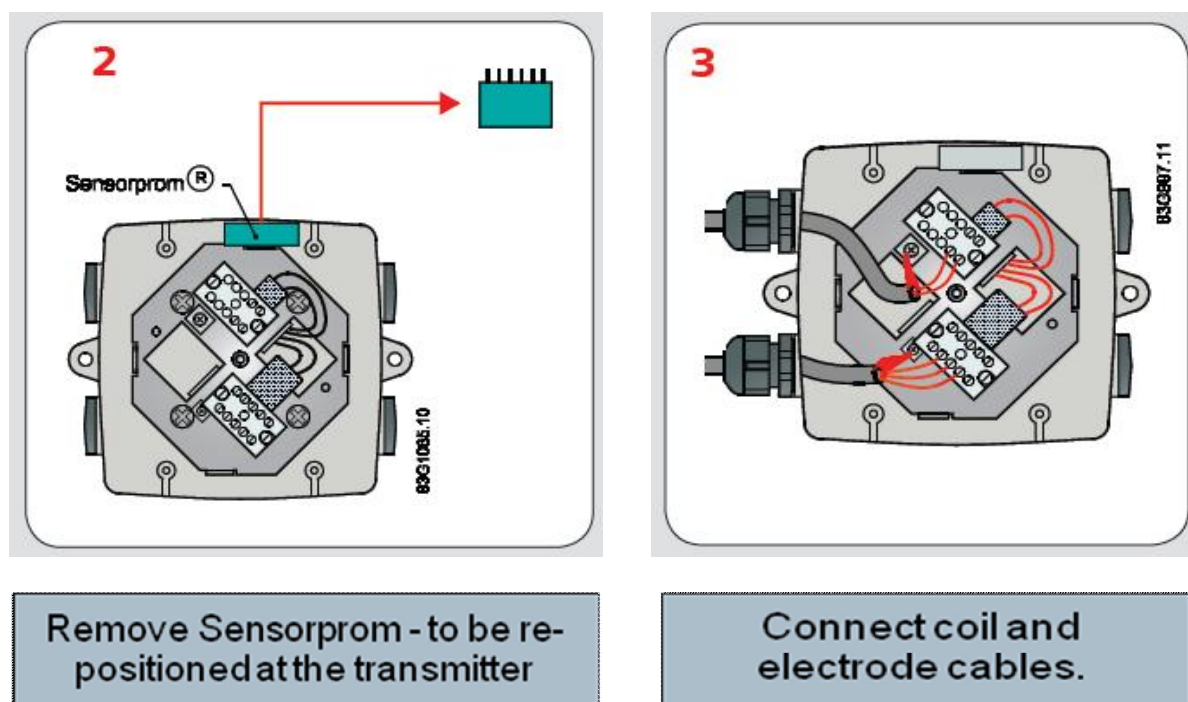
- 1 Sensor shipped with Sensor-Prom installed in junction Box.
- 2 Remove SensorProm before potting terminal box'
- 3 Make sure Sensor-Prom details match details of Magflow Sensor, Cal Factor & Serial Number
- 4 Install Sensor-Prom into transmitter REMOTE junction box (as shown).

2.0 Wire Connections

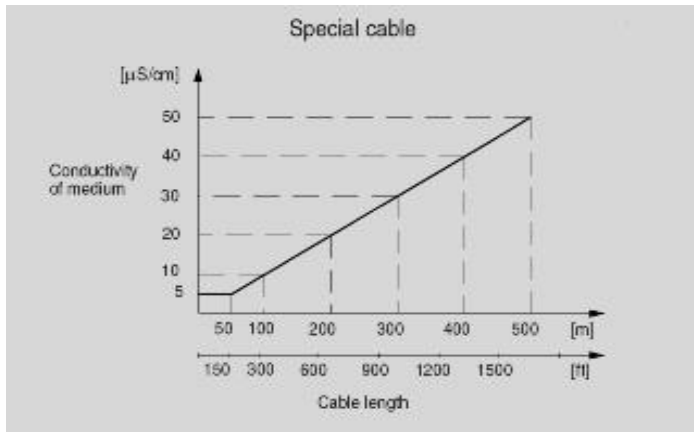
2.1 Wire Connections for Compact Sensor.



2.2 Wire Connections for Remote Sensor.



2.3 Cable Specifications

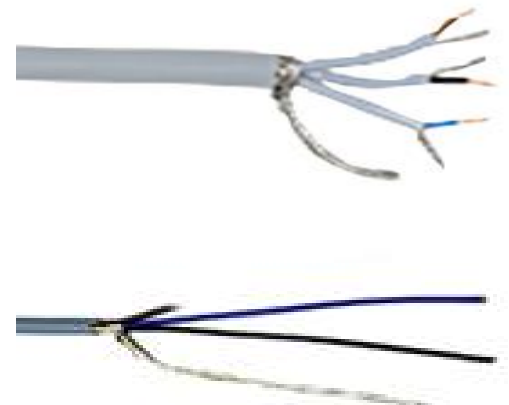
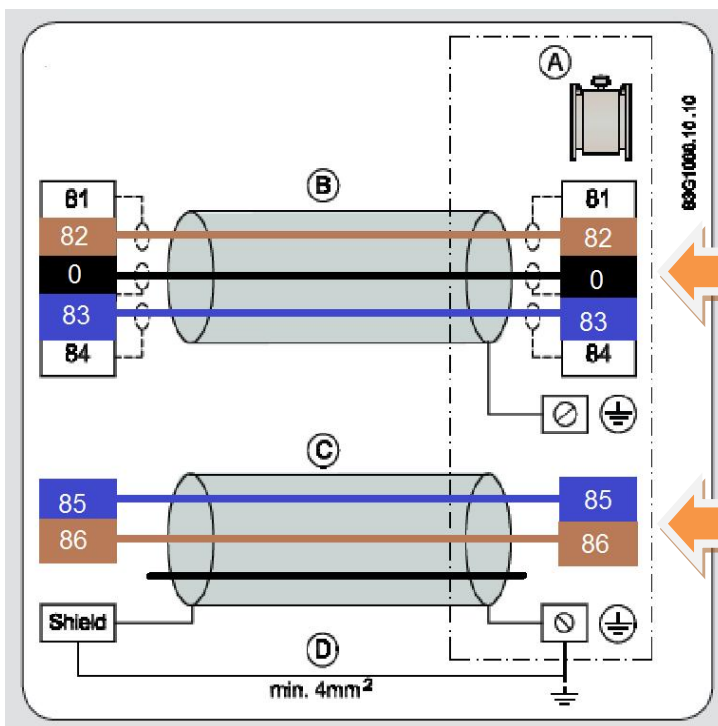


Double screened electrode cable
(81/82/0/83/84)

Use for long cable runs and/or empty pipe detection. See Appendix for cable kit part numbers.

Keep un-screened lengths to less than 50 mm

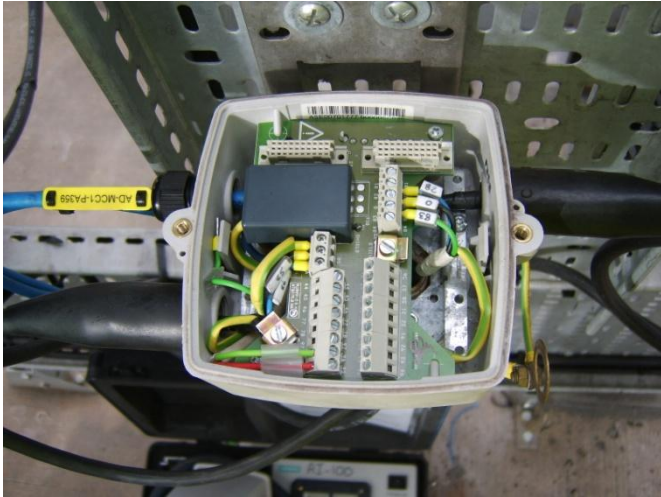
Colour Code for Factory Cable Kit.



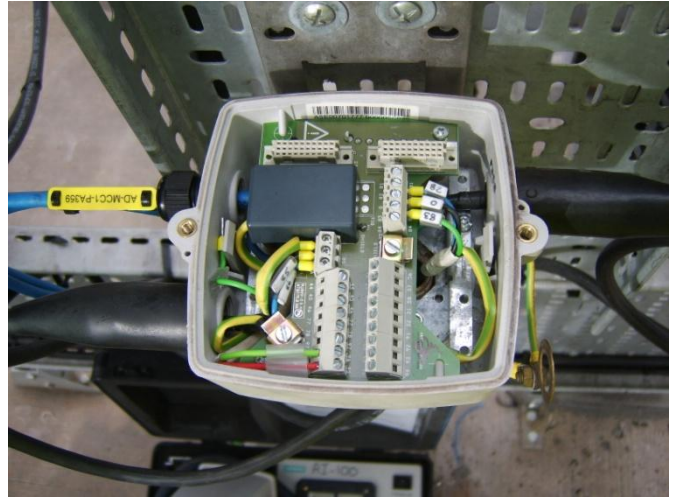
Reverses 85 & 86 connections at one end to correct flow direction.

Keep un-screened lengths to less than 50 mm

2.4 Examples of Good and Bad Installations.



Verificator insulation test failed

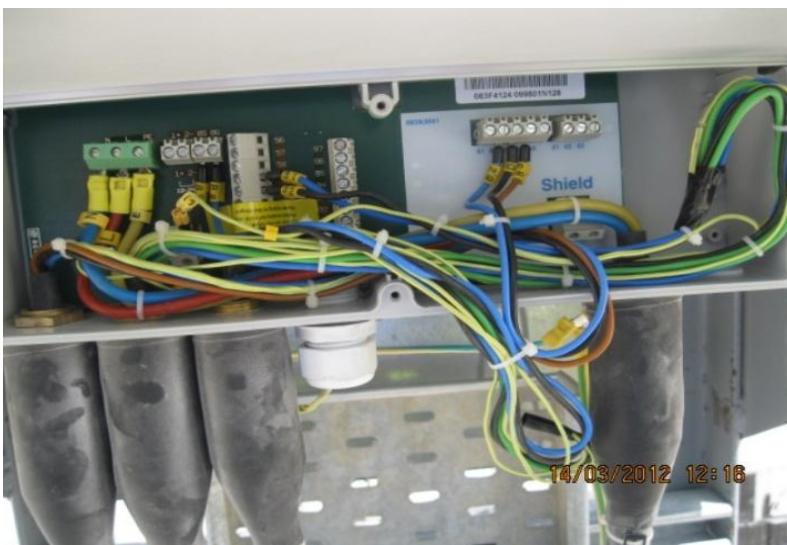


Verificator insulation test Passed



Wrong cable and un-screened
lengths greater than 50mm

Unstable readings and failed
Verification Insulation Test

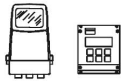


Wrong cable and un-screened
lengths greater than 50mm

Unstable readings and failed
Verification Insulation Test

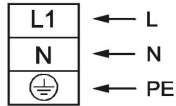
2.5 Overview of Transmitter Connections

Power supply Transmitter

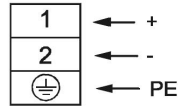


FM0002.01.02

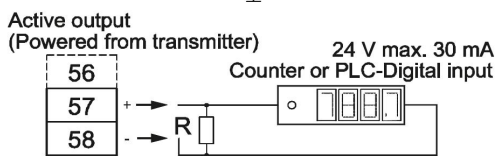
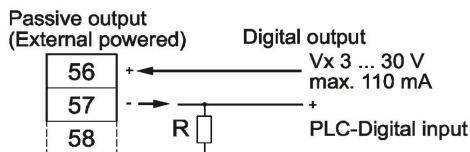
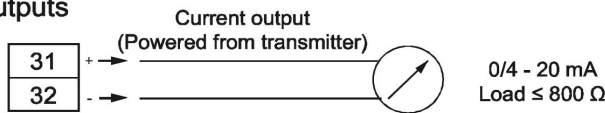
115 ... 230 V AC



11 ... 30 V DC/11 ... 24 V AC



Outputs



Menu setup

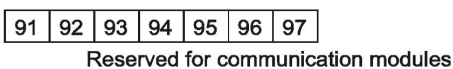
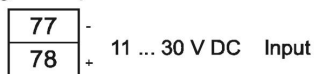
Negative: Positive:

R = Pull up/down resistor
1 ... 10 KΩ may be
required - depending on
Cables/Input resistance

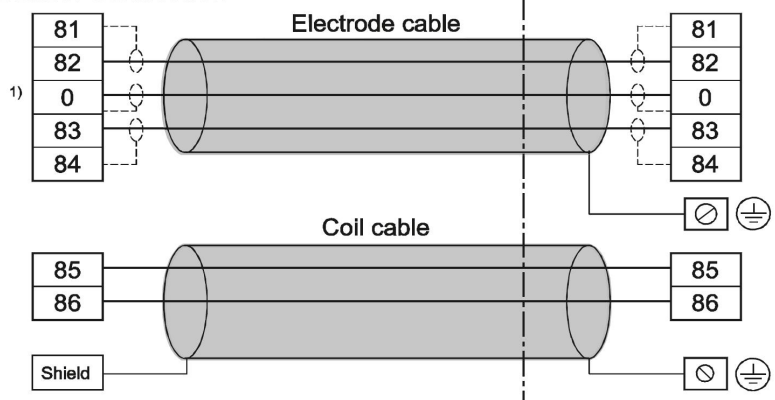
Relay output



Digital input



Sensor connection



Electrode connections – 82, 0, 83 standard configuration with **No empty pipe detection (EPD)**.

Terminals 81 and 84 used for empty pipe detection, and can only be used with Siemens supplied double screen cable. Screen cable at sensor end only. Keep **unscreened lengths to a maximum of 50mm**.

Coil connections - 85 – 86 standard screened cable can be used. Connect screen to earth and sensor and transmitter. **Keep unscreened lengths to a maximum of 50mm** to prevent corruption of electrode signal.

3.0 Parameters

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 from a submenu.



PAGE FORWARD KEY



This key is used to step forward through the menus.

PAGE 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.

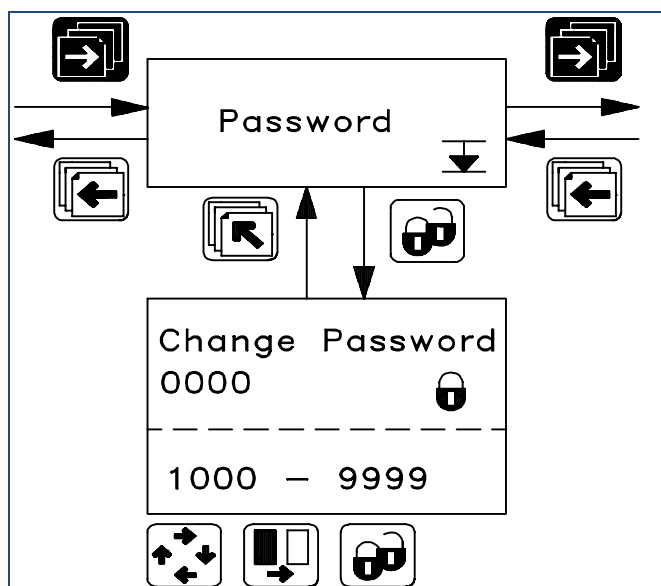
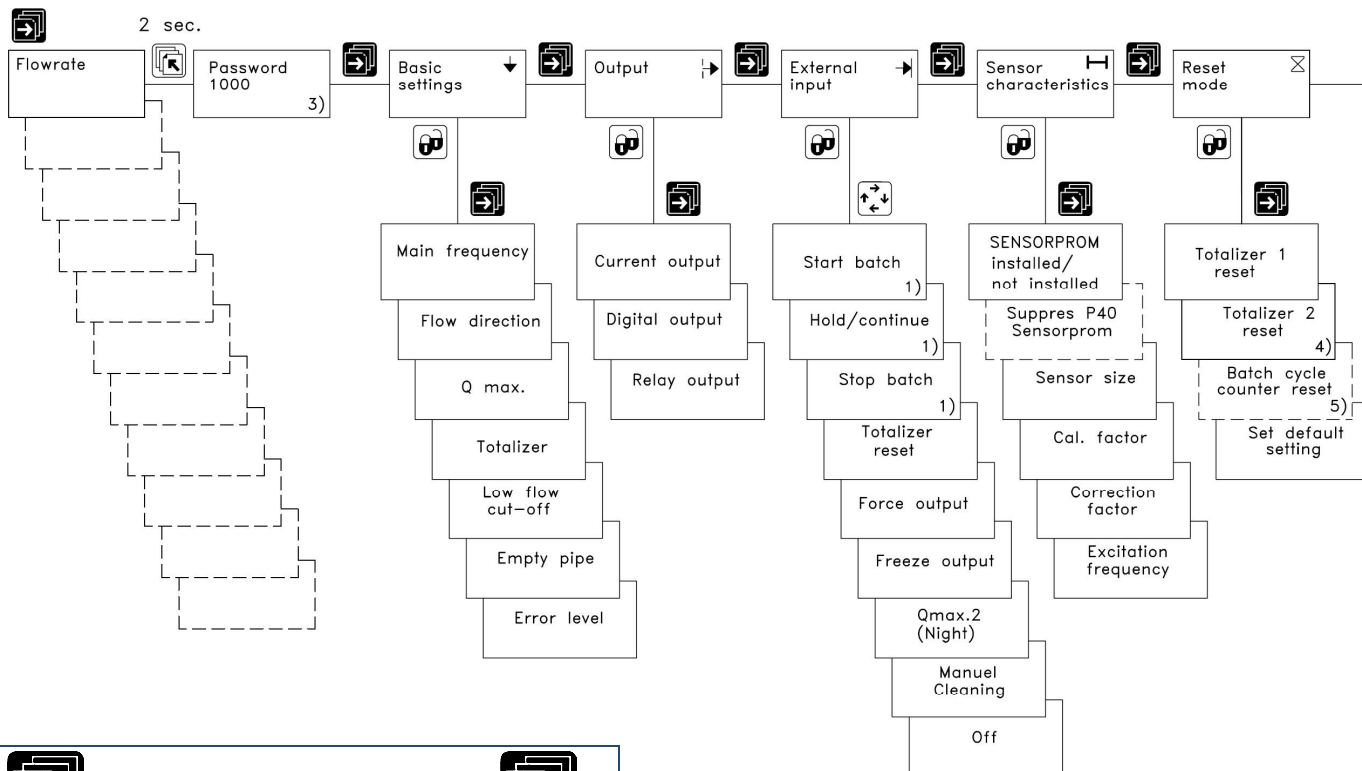
LOCK/UNLOCK KEY



Process activation

Operator menu

Transmitter setup menu



Factory password: 1000

The factory setting of 1000 can be re-established as follows:

- Switch off power supply
- Press the TOP UP (Top Left) key and switch on the power supply
- Release the key after ROM and RAM tests are completed

The user code is now reset to 1000.



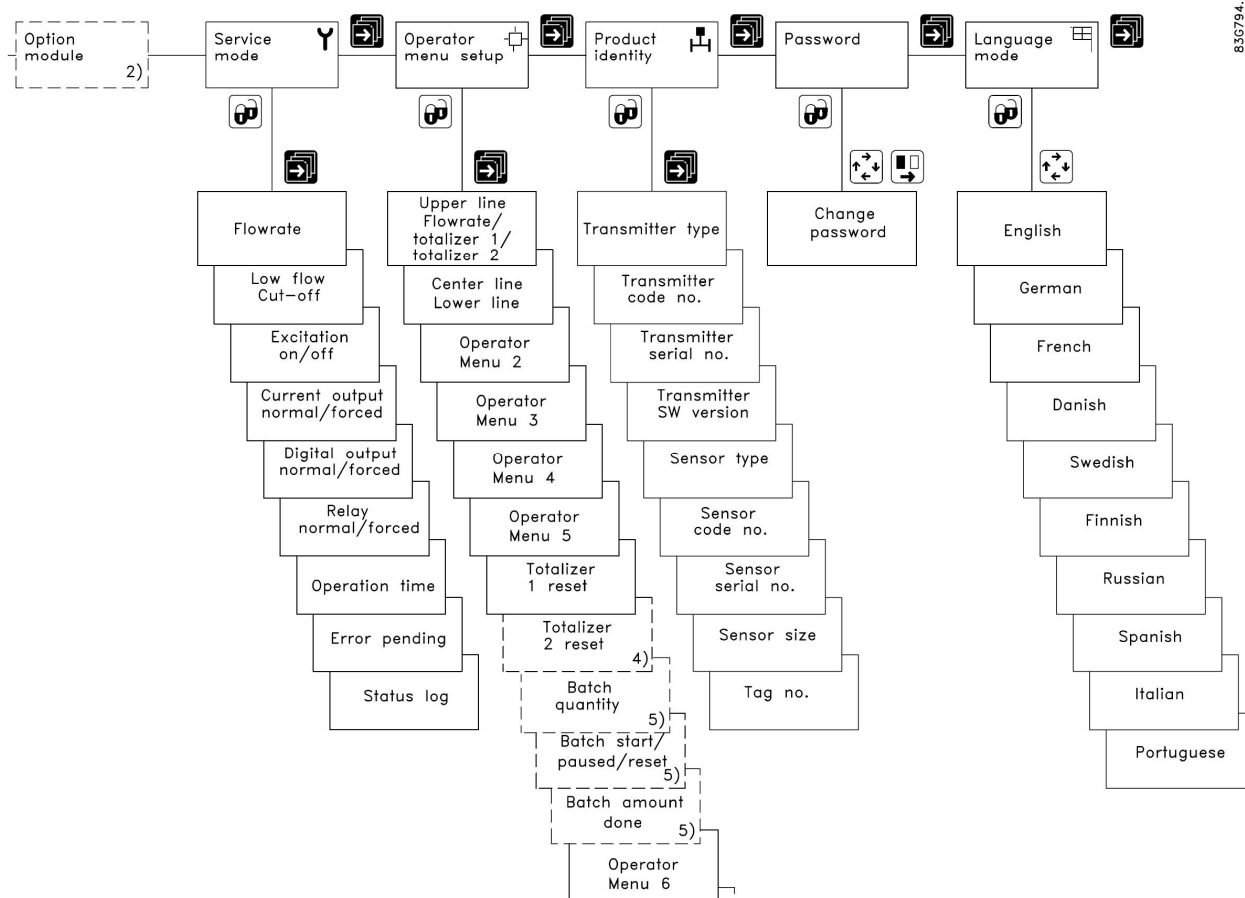
The fields are reserved for the following symbols:

- Alarm
- Ready for change
- Value locked
- Access to submenu
- Process activation
- Communication mode
- Service mode
- Batch can be paused

Operator menu

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

Operator menu not active



836794.10.11.02

The keypad is used to program 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



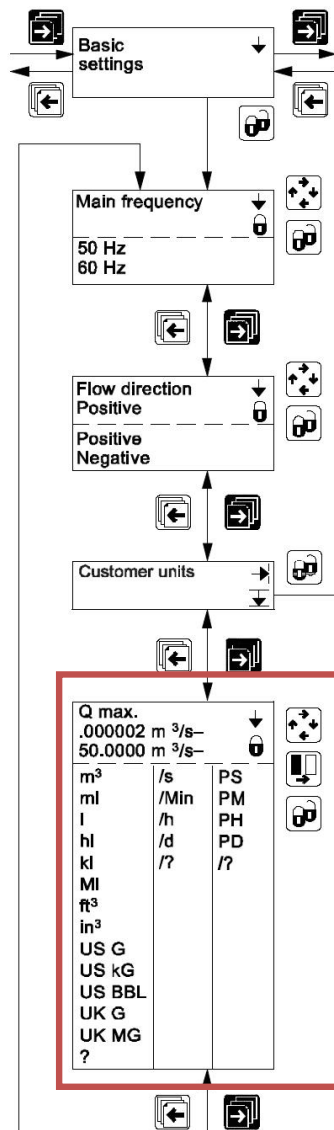
This key selects the figures to be changed.

LOCK/UNLOCK KEY

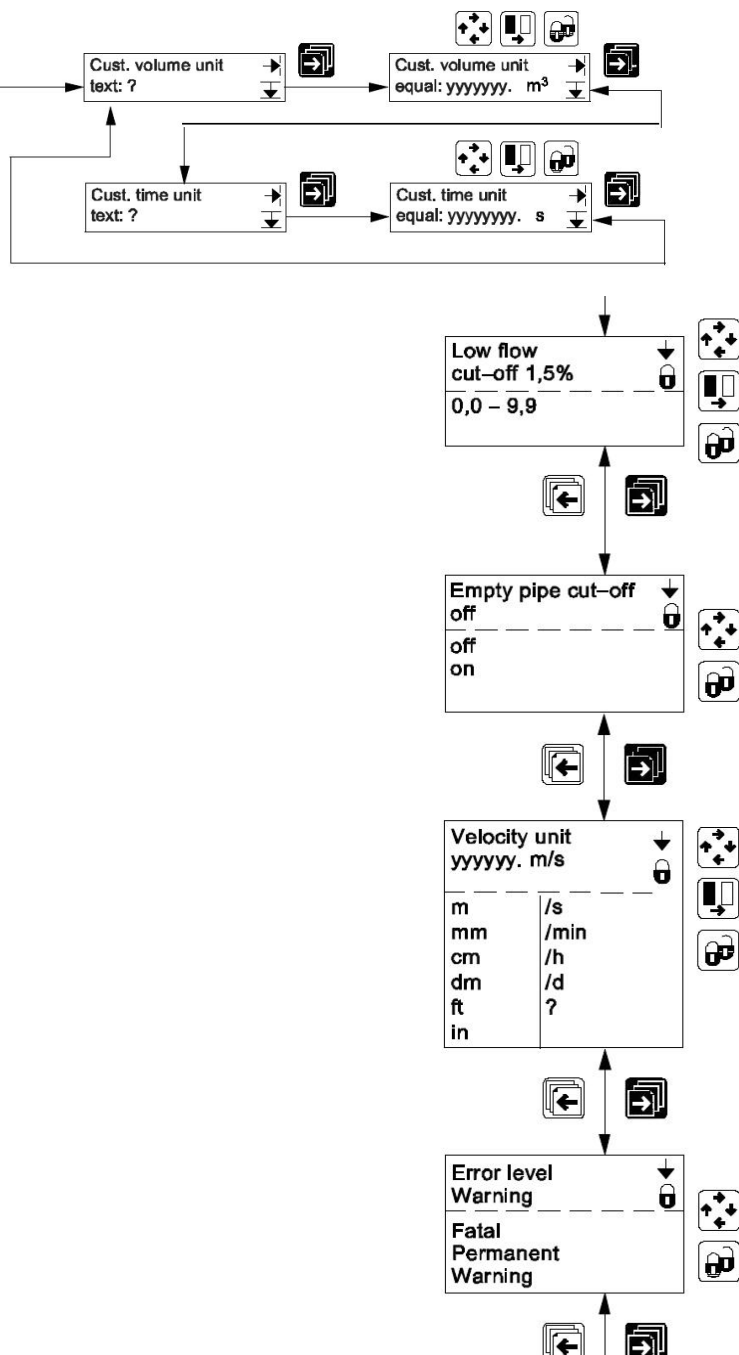


This key allows the operator to change settings, save changes and gives access to submenus.

3.1 Basic Settings

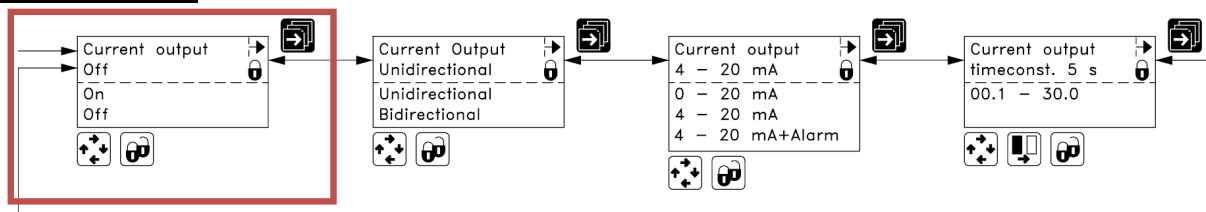


Parameter	Description
Main frequency	Selection of main power supply frequency corresponding to the country in which the flowmeter is installed (e.g. 60 Hz in America).
Flow direction	Selection of correct flow direction in pipe.
Customer units	Setting of user defined volume and time units.
Q _{max}	Setting 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.



3.2 Output Parameters

Current Output

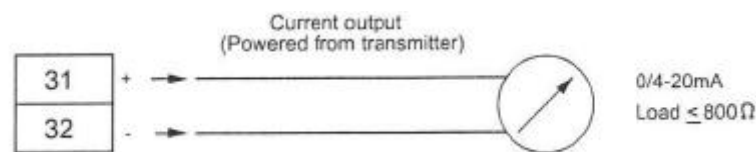


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4 - 20 mA + alarm:

Current output gives the following mA, depending on what is selected as error level in basic settings.

Fatal: 1 mA, permanent: 2 mA, warning: 3 mA



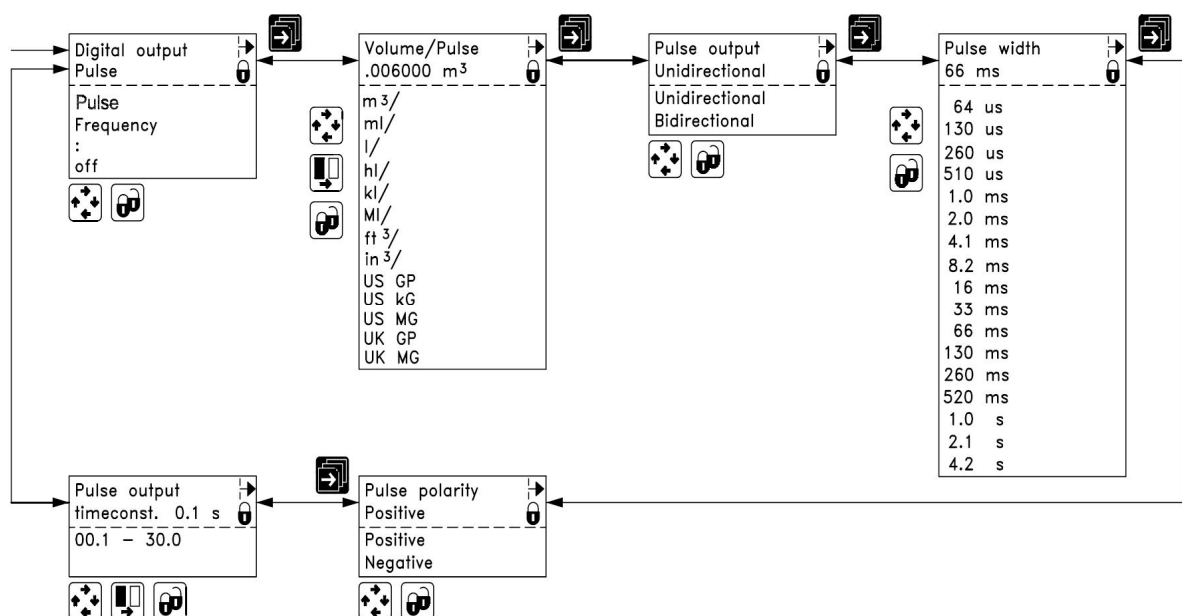
NOTE:

Current Output - "**Time Constant**" effects response time of unit, (Mag 6000/5000) not just the mA output.

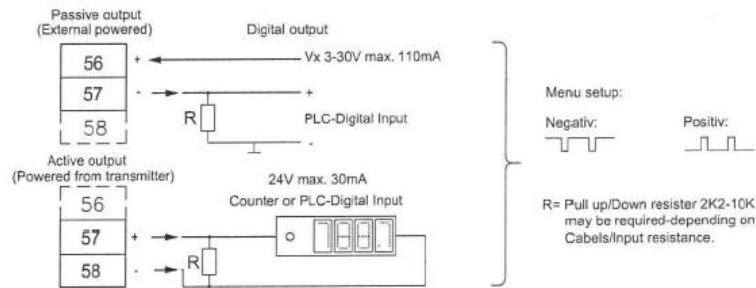
Time Constant can only be altered if mA is set to **ON**.

If the output terminals (31, 32) are not connected, Turn off mA output after adjusting "Time Constant", this will prevent P42 alarm. May require power re-cycle to clear alarm.

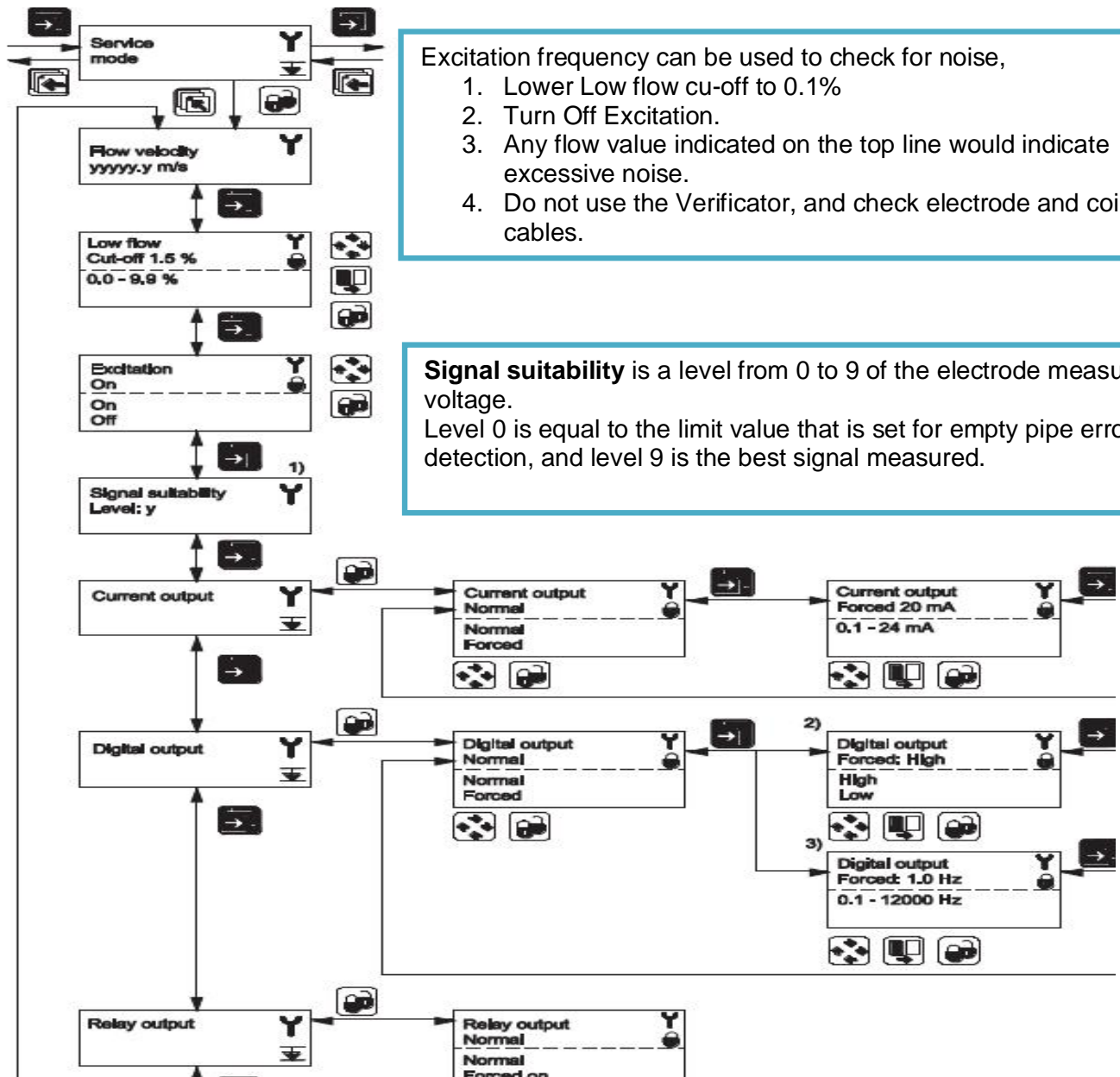
Digital Output Set to Pulsed



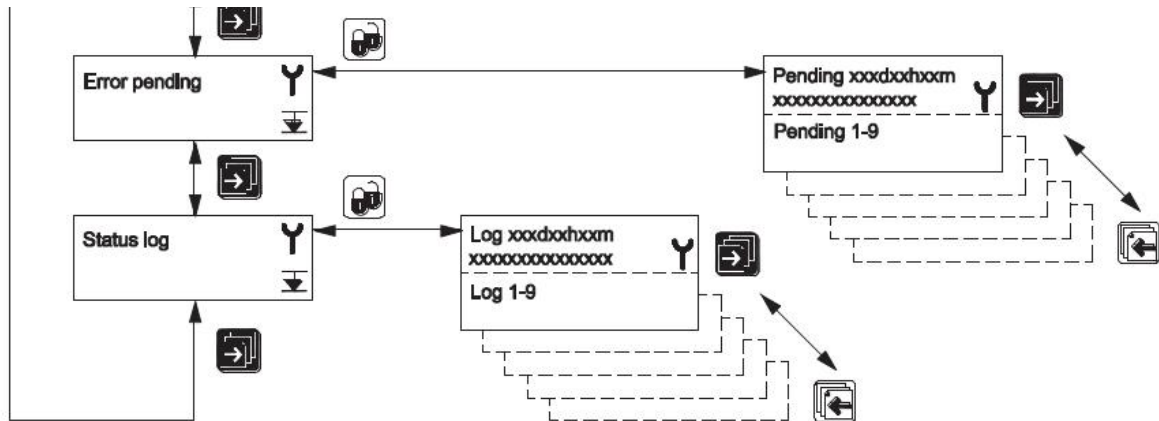
83G799.10.10.02



3.3 Service Menu



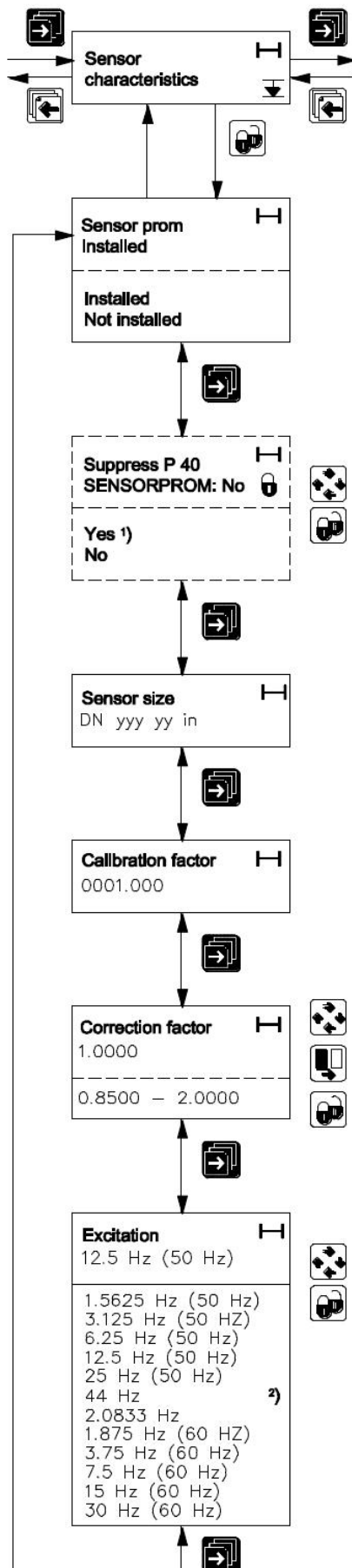
3.3 Service Menu Continued



The error system

- The error system is divided into an error **pending list** and a **status log list**. Time is gained as days, hours and minutes 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.

3.4 Sensor Characteristics



Sensorprom must be installed. If not all data can be programmed manually (*)

**If Sensorprom NOT installed
Error code 40 can be suppressed
Parameter is not visible when Sensor Prom installed**

**Sensor size – if no sensorprom is installed then sensor size must be programmed in metre. Eg, DN 100 = 0.100
Parameter "Read Only" when Sensor Prom**

**Calibration Factor from wet calibration – can be found on sensor label and calibration report.
Parameter "Read Only" when Sensor Prom installed**

**Correction Factor - must be 1.0000
To be changed in special conditions only**

**Excitation frequency according to Sensor size.
See Handbook for correct selection.
Parameter "Read Only" when Sensor Prom installed**

4.0 Fault Finding.

4.1 Error Codes.

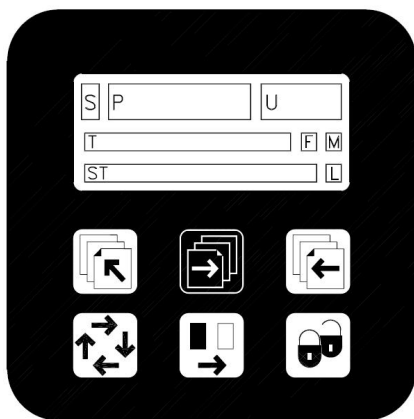
The converter system is equipped with an error and status log system with 3 groups of information.

1. Information without a functional error involved
2. Warnings which may cause malfunction in the application. The cause of the error may disappear on its own.
3. Permanent errors which may cause malfunction in the application. The error requires an operator intervention.
4. Fatal error which is essential for the operation of the flowmeter

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

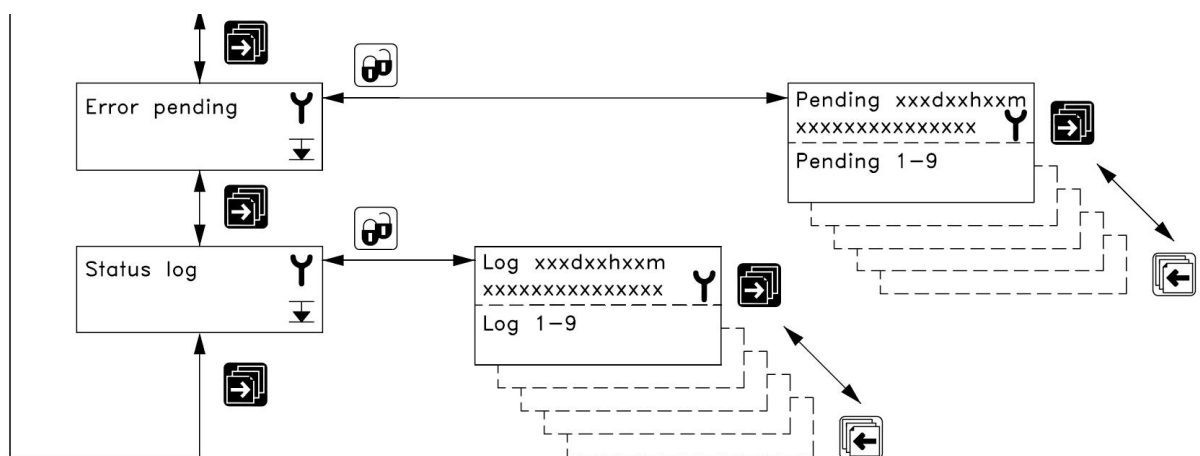
1. Error pending
2. Status log

 **Two Flashing Triangles indicate a Fault Condition**
The current Error can be viewed in run Mode



Press  Until Error Pending is Displayed

Error Logs Can be view under Service Mode



4.1 Error Codes Continued.

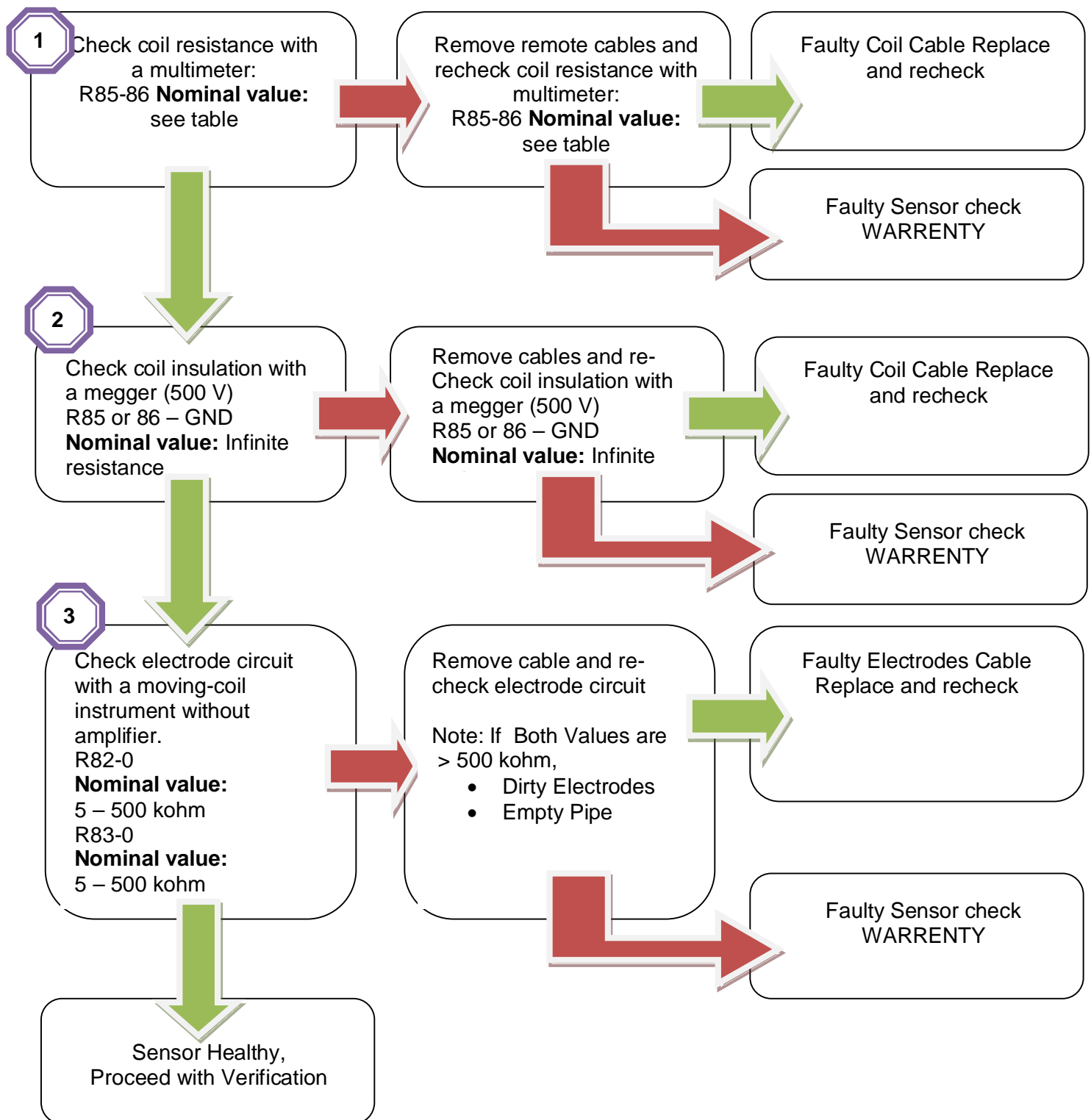
Symptom	Output signals	Error code	Cause	Remedy
Empty display	Minimum		1. No power supply	Power supply Check MAG 5000/6000 for bended pins on the connector
			2. MAG 5000/6000 defective	Replace MAG 5000/6000
No flow signal	Minimum		1. Current output disabled	Turn on current output
			2. Digital output 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 2. MAG 5000/6000 defective	Check cables/connections 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

W = Warning

P = Permanent

F = Fatal

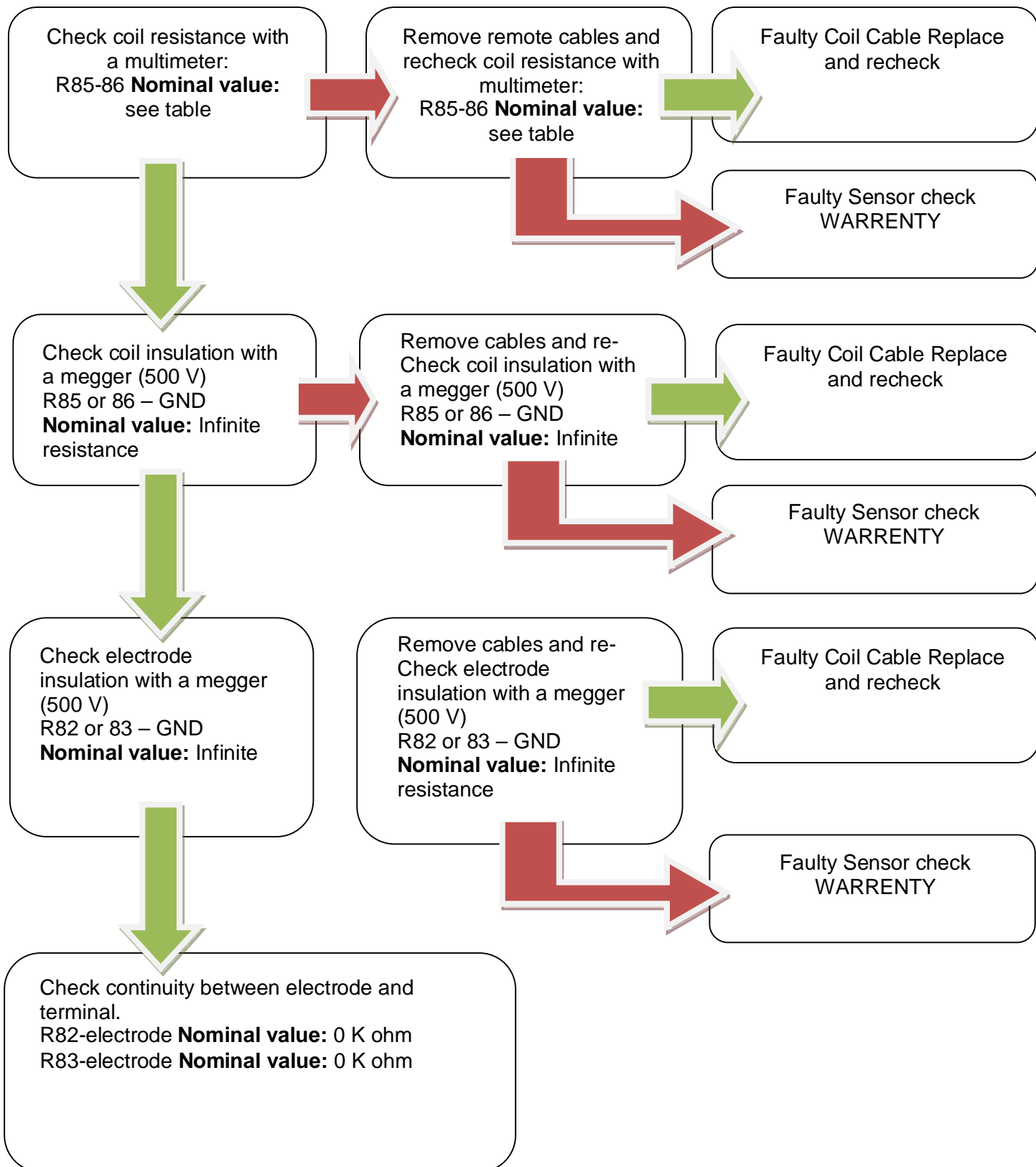
4.2 Sensor Fault Finding. (Sensor Full)



ATTENTION!

If there is leakage from MAG 1100/3100/3100 W or MAG 5100 W and the unit has been used to measure inflammable/explosive liquids, there might be a risk of explosion when checking with a megger.

4.3 Sensor Fault Finding. (Sensor Empty)



ATTENTION!

If there is leakage from MAG 1100/3100/3100 W or MAG 5100 W and the unit has been used to measure inflammable/explosive liquids, there might be a risk of explosion when checking with a megger.

4.4 Coil Resistance Table (Connections 85 & 86)

DN	Coil resistance					
	MAG 1100, MAG 1100F		MAG 3100, MAG 3100P,		MAG 5100 W	
	Resistance	Tolerance	Resistance	Tolerance	Resistance	Tolerance
					(Order no. 7ME6520)	
2	104 Ω	+/- 5	104			
3	104 Ω	+/- 5	104			
6	99 Ω	+/- 17	104			
10	99 Ω	+/- 17	104			
15 ¹⁾	91 Ω	+/- 9	104			
25	91 Ω	+/- 17	104	+/- 2	104	+/- 10
40	91 Ω	+/- 9	92	+/- 2	92	+/- 10
50	91 Ω	+/- 9	92	+/- 2	119.4	+/- 10
65	99 Ω	+/- 17	100	+/- 2	127	+/- 10
80	91 Ω	+/- 17	94	+/- 2	126	+/- 10
100	91 Ω	+/- 9	92	+/- 2	125	+/- 10
125			92	+/- 2	126	+/- 10
150			94	+/- 2	116	+/- 10
200			90	+/- 2	109	+/- 10
250			92	+/- 2	104	+/- 10
300			100	+/- 2	108	+/- 10
350			112	+/- 2	100	+/- 6
400			100	+/- 4	100	+/- 6
450			108	+/- 4	100	+/- 6
500			122	+/- 4	100	+/- 6
600			115	+/- 4	98	+/- 6
700			128	+/- 4	98	+/- 6
750			133			
800			128	+/- 4	98	+/- 6
900			131	+/- 4	98	+/- 6
1000			131	+/- 4	88	+/- 6
1100			126			
1200			130	+/- 4	88	+/- 6
1400			130			
1500			124			
1600			133			
1800			133			
2000			147			

1) On MAG 1100 DN 15 produced as from May 1999 the coil resistance must be 86 ohm, +8/-4 ohm.

All resistance values are at 20 °C.

The resistance changes proportionally 0.4% / °C.

5.0 Sitrans FM Magflo Verificator – Important Instructions

BEFORE VERIFICATION

Steps 1 to 5 below MUST be completed before verification is carried out

1. Make sure the Sitrans FM sensor is full of liquid and the flow meter is operating.
2. Switch off the power to the flow meter to be verified.
3. Remove the transmitter (Mag5000 or Mag6000).
4. Ensure sensor and transmitter are correctly earthed.
5. Insulation Check – Coils.
Using an insulation tester (megger), with 500v insulation voltage, check for correct insulation between the electromagnetic coils and ground.
Measure the resistance between terminal 85 and ground, then between terminal 86 and ground.
The resistance should be infinite (greater than 500 Megohms).

If the insulation test fails, DO NOT connect the Verificator to the flow meter.

Warning: Connecting to a flow meter which has failed insulation will damage the Verificator.

Typical repair cost: £2000.00 to £3000.00.

CONNECTING THE VERIFICATOR

Steps 6 to 9 MUST be done with power disconnected from both Verificator and flow meter.

6. Place the Verificator close to the transmitter.
7. Plug the 3 colour coded flying leads into the adaptor.
(Line up the plug and socket red dots and push firmly into place).
8. Place the adaptor onto the terminal box and secure the screws.
9. Plug the transmitter into the Verificator.

DURING VERIFICATION

10. Switch on the power to the Sitrans FM flow meter.
11. Turn on the Verificator power switch.
12. Wait for Verificator to display the “File #” list.
13. Choose the file name for the flow meter to be verified.
14. Press the “Go” key to start the test.

Refer to the Verificator manual for detailed information about the verification process and diagnostic messages.

Turn over for further instructions...

Important:

Do not press the keypad or change any settings on the transmitter during the verification process.

Never switch off power to the Verificator during a test, unless the test has been stopped (by pressing the “Esc” key).

AFTER VERIFICATION

15. When the verification is finished press “Go” to return to the main menu and automatically store the data.
16. Turn off the Verificator power switch.
17. Switch off the power to the Sitrans FM flow meter.
18. Remove the adaptor and re-fit the transmitter.
19. Switch on the power to the Sitrans FM flow meter.

Warning

Disconnection of the transmitter or the Verificator adaptor during a test may damage the Sensorprom module, the transmitter or the Verificator.

In normal use the Verificator power cable (maximum 2.5m) should be used in a workshop environment when downloading data to a PC following site verifications.

5.1 Verificator – Check List

Coil circuit (connections 85 & 86) must be Megger tested with reference to earth before using Verificator. Failure to comply too this procedure can result in damage to Verificator. If in doubt please contact Siemens.

There are a number of possible reasons why the Verificator may fail the Insulation test on a Magflo flowmeter. The most common reasons are listed below.

1.0 Converter Failed

1. Press ESC to end Verification
2. Replace MAG5000/MAG6000

2.0 Insulation Test Failed

2.1 Compact Mounted Converter

- 1 Black moulded coil and electrode connectors not mounted on the connection card.
- 2 The pipe is not full of fluid.
- 3 Moisture in the connection box.
- 4 Electrodes or coil circuit grounded. (Carry out sensor checks)

2.2 Remote mounted converter

- 1 The pipe is not full of fluid.
- 2 Meter body not grounded to the fluid. (Confirm if Magflo type has earthing electrodes or an earthing ring fitted).
- 3 Incorrect wiring connections of the coil and electrodes
- 4 Unscreened lengths of wire on the electrode circuit. Max unscreened 50mm (better with 25mm max) at any point including Junction Boxes and cabling inside panels.
- 5 Discontinuous screen in any Junction Boxes or panel terminations.
- 6 Incorrect cable being used i.e multi core (spare cores act as signal pick up aerials) or unscreened cables.
- 7 Two separate cables not used for coil and electrodes.
- 8 Screen on the coil cable not connected at both ends
- 9 Crimps used on wiring and poor connection made.
- 10 Moisture in either the sensor or remote electronic connection boxes.
- 11 Electrodes or coil circuit grounded. (Carry out sensor checks)
- 12 Lightning arresters in circuit. (These have a built in grounding circuit)
- 13 Crossed connection between two sensors i.e electrode connections made to a different converter to the one driving the coils.

If possible try a signal converter compact mounted in order to eliminate cable problems. From our experience incorrect cable installation is the main cause of Insulation failure when using the Verificator.

3.0 Sensor Failed – Magnetism Fault

Data relating to magnetic properties deviates from data stored in Sensor-prom

Trouble shooting may reveal: -

1. Short circuit within excitation coils or to ground, This may have damaged Verificator.
2. Bad or missing connection of coil cable.
3. Corrosion or loose connection within the magnetic circuit.
4. Foreign magnetic material within the flow sensor
5. Sensor-prom failed or corrupted (Indicated by error F61 on signal converter display)
6. Changing excitation frequency from default can cause a coil error change back to default while performing Verification.

6.0 Appendix.

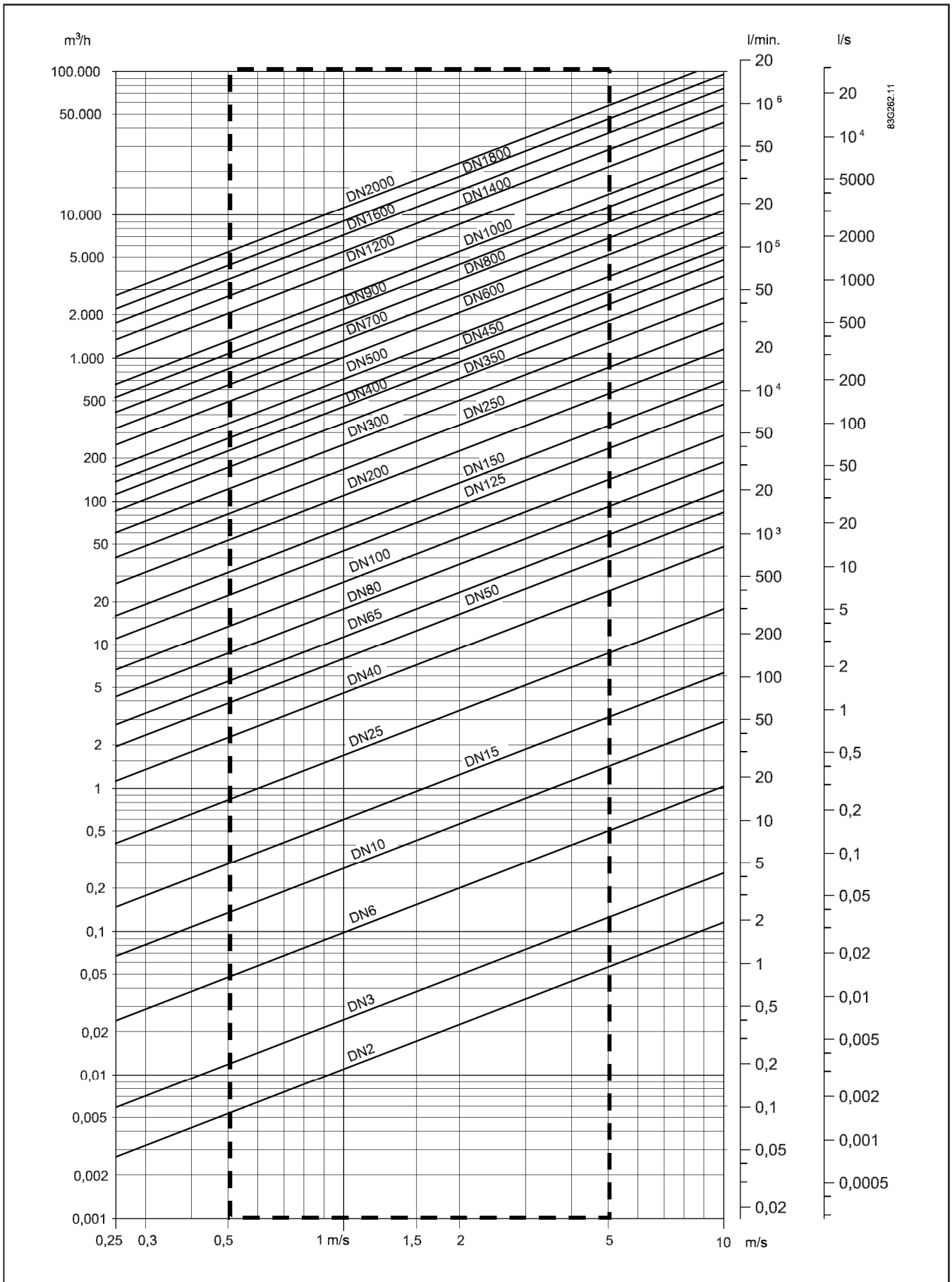
6.1 Flow Meter Check List, Compact.

Action	Passed
Check power connection for the Mag 6000, including earth connection	
Check Earth connection to bottom plate	
Ensure Sensor Prom is installed and serial number matches serial number on junction box	
Ensure Molded plug (2 pins) with indication 85 & 86 is connected to PCB with corresponding number.	
Ensure Molded plug (3 pins) with indication 82, 83 & 0 is connected to PCB with corresponding number.	
Insert Communication card into base of Mag 6000 transmitter if required.	
Test coil insulation at 500 Volts, measure 85, to earth, and 86 to earth.	
With Moving coil meter test electrode circuit (see page xx)	
Fit Mag 6000 transmitter and tighten 2 fixing screws.	
Turn on power and check for and errors.	

6.2 Flow Meter Check List, Remote.

Action	Passed
Check power connection the Mag 6000, including earth connection	
Remove Sensor Prom from sensor junction box	
Ensure Sensor Prom is installed in remote transmitter and serial number matches serial number on junction box of connected sensor	
Fit white terminal block to metal plate in sensor using x2 fixing screws.	
Fix Molded Plug into white terminal block in sensor ensuring all screw as tight	
Using recommended cable make wire connections in accordance with page xx. Ensure unscreened lengths in sensor and transmitter are less than 50mm.	
Insert Communication card into base of Mag 6000 transmitter if required.	
Test coil insulation at 500 Volts, measure 85, to earth, and 86 to earth.	
With Moving coil meter test electrode circuit (see page xx)	
Fit Mag 6000 transmitter and tighten 2 fixing screws.	
Turn on power and check for and errors.	

6.3 Sensor Operating Range



Ideal flow velocities between 0.5 and 5 m/sec meter will operate up to 10m/sec. — — — — —

Description	Siemens Reference
5m	A5E02296329
10m	A5E01181647
15m	A5E02296464
20m	A5E01181656
25m	A5E02296490
30m	A5E02296494
40m	A5E01181686
50m	A5E02296498
60m	A5E01181689
100m	A5E01181691
150m	A5E01181699
200m	A5E01181703
500m	A5E01181705

Steel Wired Armoured Cabling:

Cable kit with standard coil cable, 3 x 1.5 mm²/18 gage with shield PVC and electrode cable double shielded, 3 x 0.25mm² (-30 to +70 deg C).

Important: Due to the weight of the cable, armoured cabling is not suitable for pre-potted sensors.

Description	Siemens Reference
5m	SWA 5m
10m	SWA 10m
15m	SWA 15m
20m	SWA 20m
25m	SWA 25m
30m	SWA 30m
40m	SWA 40m
50m	SWA 50m
60m	SWA 60m
100m	SWA 100m
150m	SWA 150m
200m	SWA 200m
500m	SWA 500m



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