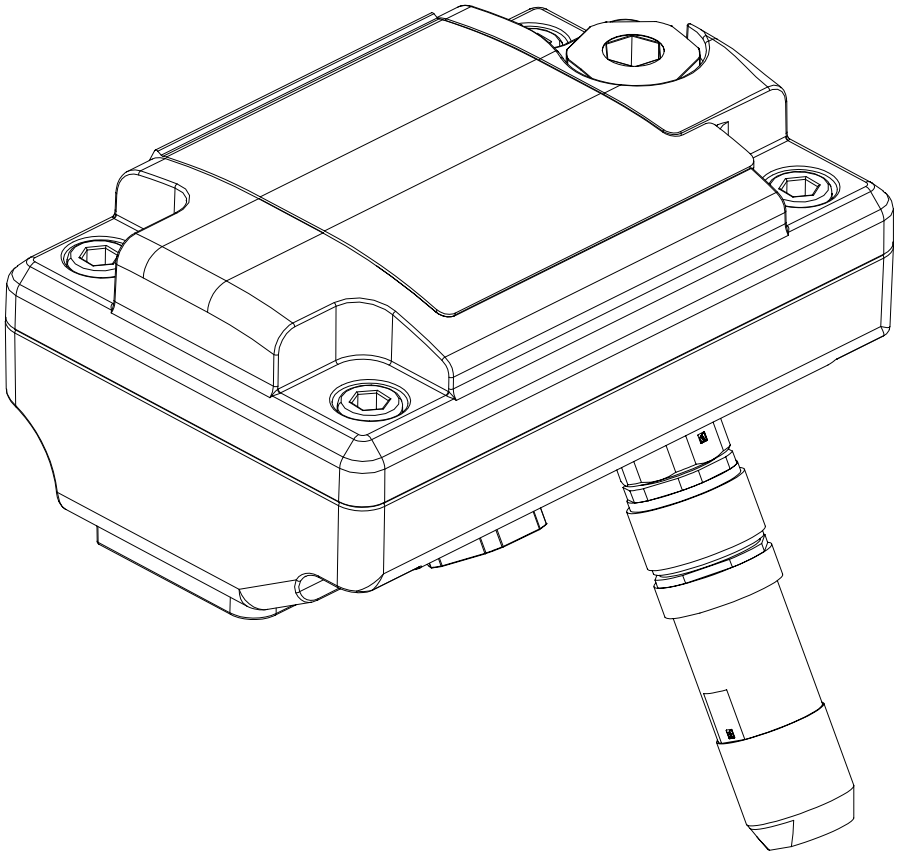
global.sensor.excellence



FM300 Converter

Operations and Maintenance Manual

Version 2026/02
ww.stssensors.com

Release number:

The characters of file name in bold type indicate the software version which the manual refers to; it is visualized at the instrument start up, or by specific function on diagnostic menu.

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Contents

Introduction

- These operating instructions and the description of device functions are provided as part of the scope of supply.
- They could be modified without prior notice. The improper use, possible tampering of the instrument or parts of it and substitutions of any components not original, renders the warranty automatically void.
- The flow meter realizes a measure with liquids of conductivity greater than 5µS/cm in closed conduits, and is composed of a converter (described in this manual) and a sensor (refer to the specific manual).
- The converter could be coupled directly on the sensor (compact version).

Safety Information

- Any other use than the one described in this manual affects the protection provided by the manufacturer and compromises the safety of people and the entire measuring system and is, therefore, not permitted.
- The manufacturer is not liable for damaged caused by improper or non-designated use.
- Transport the measuring device to the measuring point in the original packaging. In case of carton packaging it is possible to place one above the other but no more than three cartons. In case of wooden packaging do not place one above the other.
- Disposal of this product or parts of it must be carried out according to the local public or private waste collection service regulations.
- The electromagnetic flow meter must only be installed, connected and maintained by qualified and authorized specialists (e.g. electrical technicians) in full compliance with the instructions in these Operating Instructions, the applicable norms, legal regulations and certificates (depending on the application).
- The specialists must have read and understood these Operating Instructions and must follow the instructions it contains. If something isn't clear to you in these Operating Instructions, you must call the ISOIL service. The Operating Instructions provide detailed information about the instrument.
- The flow meter should only be installed after having verified technical data provided in this operating instructions and on the data plate.
- Specialists must take care during installation and use personal protective equipment as provided by any related security plan about risk assessment.
- Never mount or wire FM300 while it is connected to the power supply and avoid any liquid contact with the instrument's internal components.
- Before connecting the power supply check the safety equipment.
- Repairs may only be performed if a genuine spare parts kit is available and this repair work is expressly permitted.
- For the cleaning of the device use only a damp cloth.

Before starting up the equipment please verify the following:

- Power supply voltage must correspond to that specified on the data plate
- Electric connections must be completed as described
- Ground (earth) connections must be completed as specified

Safety Information

Verify periodically (every 3-4 months):

- The power supply cables integrity, wiring and other connected electrical parts
- The housing integrity
- The suitable tightness of the sealing elements
- The front panel integrity (display and keyboard)
- The mechanical fixing of the converter to the pipe or wall stand

Safety Convention

Danger Electric Shock

Warning

Precautions

Attention

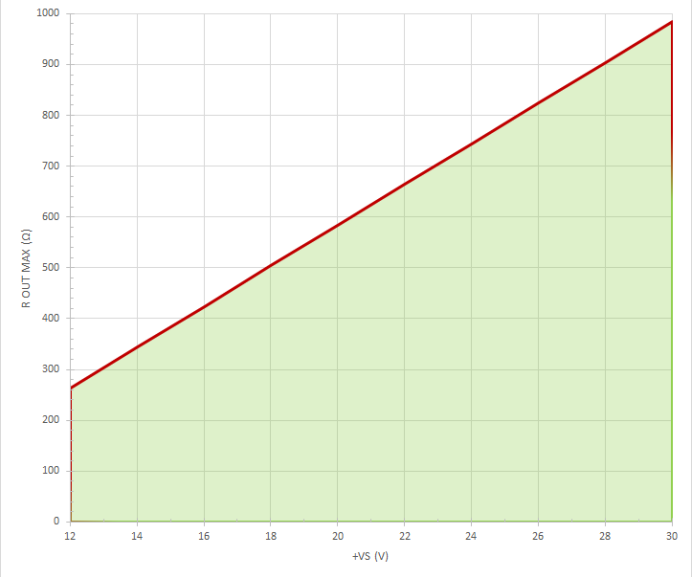
Technical Characteristics

Electrical Characteristic

Instrument classification: class I, IP67/IP68 installation category II, rated pollution degree 2.

Power supply voltage	Max power
min 10 / max 30 V	1 W

- Voltage variations must not exceed ±10% of the nominal one.
- Digital input/outputs are insulated up to 500V.
- 4-20mA max load: 500 Ω output not insulated from power supply.



Environmental Use Conditions

- The instrument can be installed inside or outside buildings
- Altitude: from –200m to 2000m (from -656 to 5602 feet)
- Humidity range: 0-100% (IP 67)

Environmental Temperature		
	Min*	Max
°C	- 20	60
°F	14	140

Liquid Temperature		
	Min*	Max
°C	-10	100
°F	14	212

* For discontinuous use, a thermostat heat source installation may be necessary.

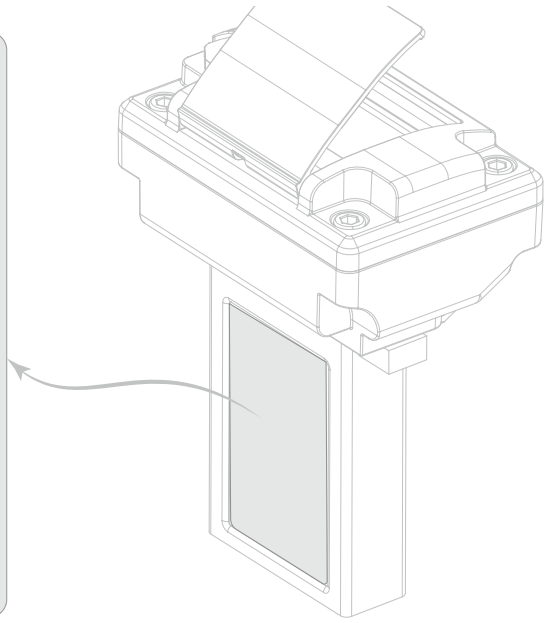
Measurements Tolerance

- Flow rate (volume) = ±0,05% o.r
- Out 4/20 mA = ± 0,08 % o.r
- Frequency Out = ± 0,08% o.r

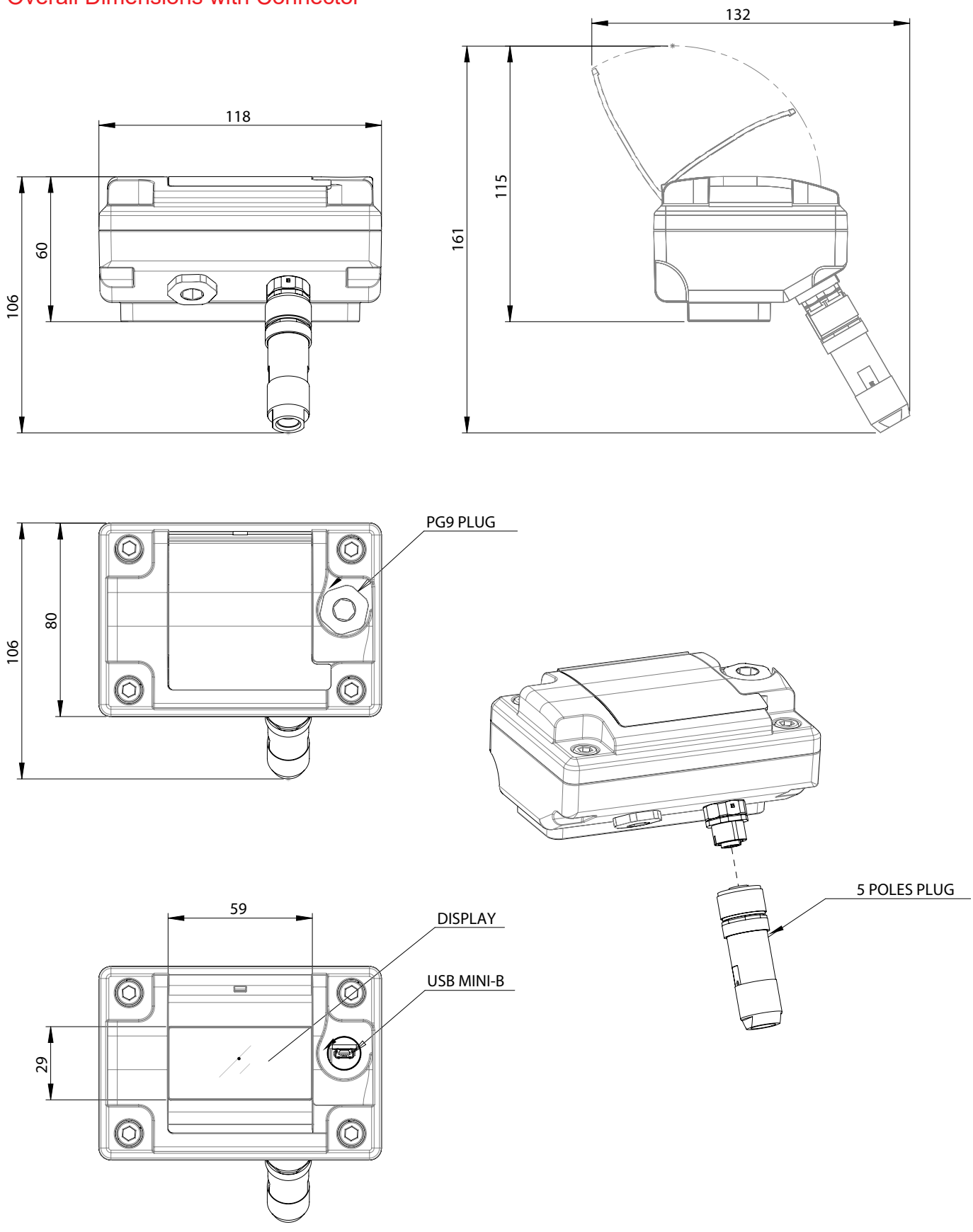
Data Plate

On the data plate there is some technical information

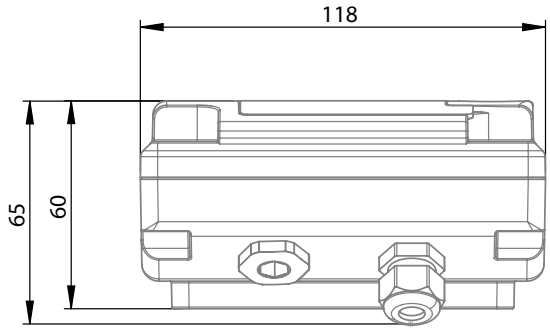
Conv.Mod.: Converter model
Conv.s/n: Converter serial number
Power S./MP: Power Supply/
Maximum Power consumption
Sensor Mod: Sensor model
Sens s/n: Sensor serial number
DN: Nominal diameter
PN: Nominal pressure
IP: Protection grade
Fittings: Process connections
Lining: Sensor lining
Max Temp.: Maximum liquid temperature
Electrodes: N° electrodes and materials
KA: KA
ITEM: Free for user

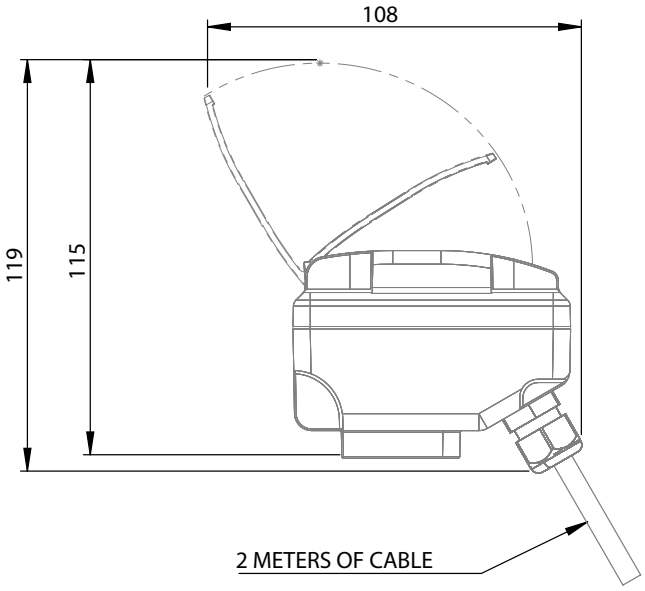


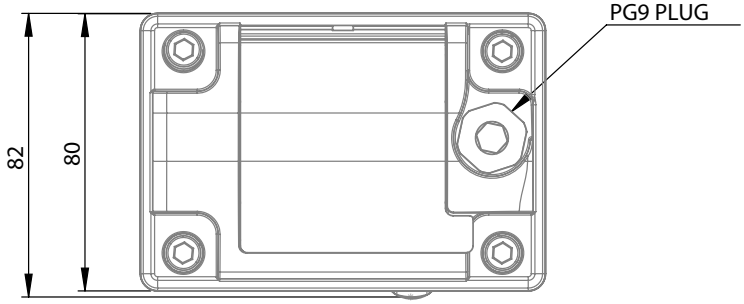
Overall Dimensions with Connector

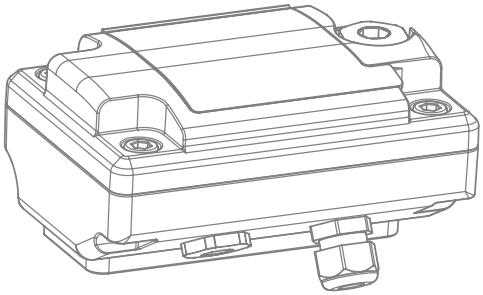


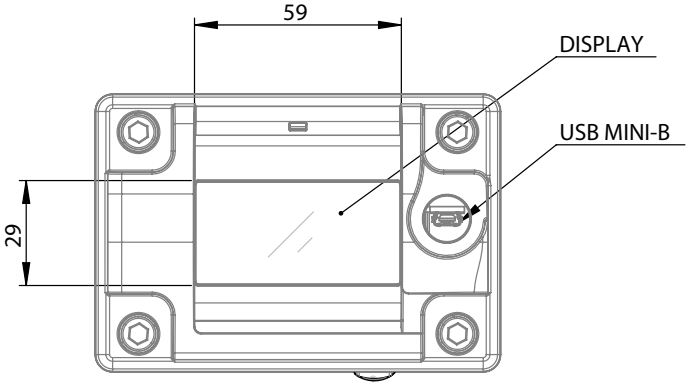
Overall Dimensions with Cable Gland





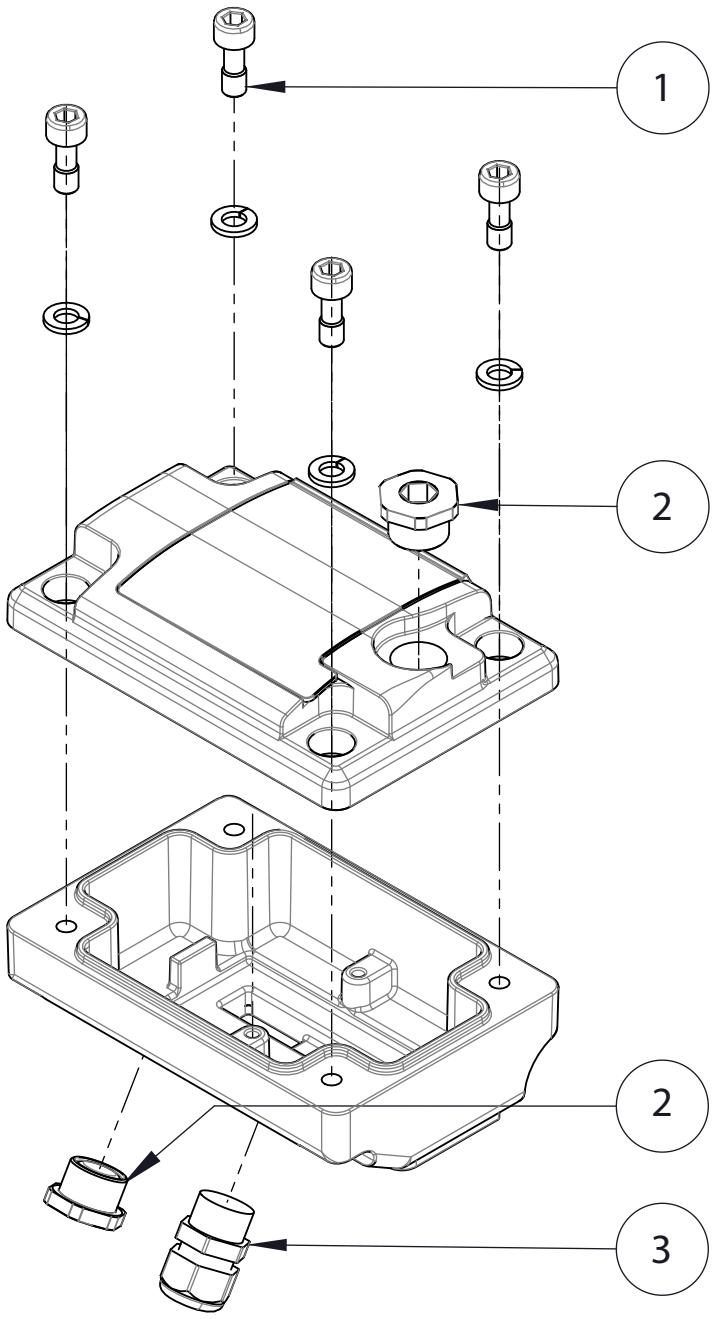




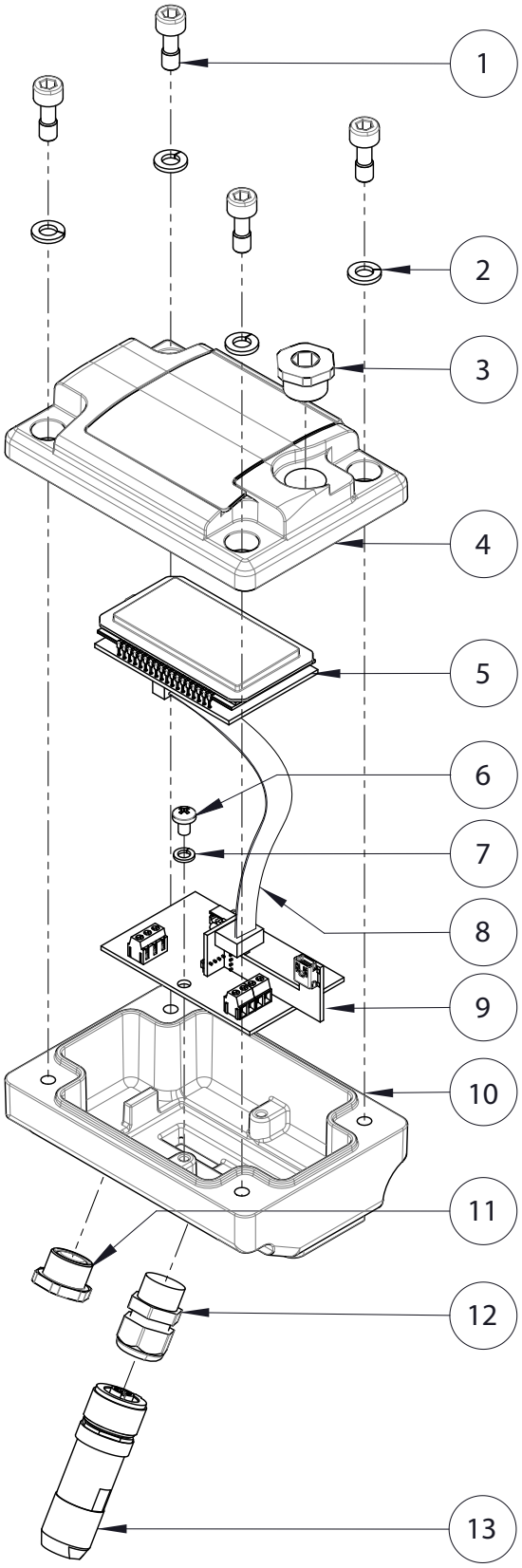


Torques

Position	Description	Tightening Torque
1	Screw M6x16	3.5 Nm
2	PG9 Plug	4 Nm
3	Cable Gland PG11	4 Nm



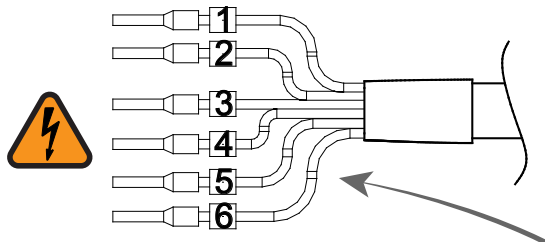
FM300 Exploded Layout

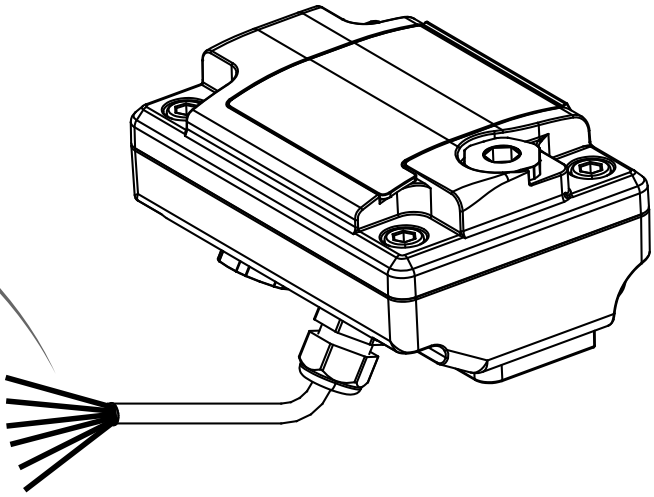


POS.	Description
1	Screw M6x16
2	Grower Ø6
3	PG9 Plug
4	Cover PA6 (Display version) Cover Painted Aluminium (Blind version) Cover AISI 304 JB Raw (Blind version) Cover AISI 304 JB Polished (Blind version)
5	Display
6	Screw M4x6 TC
7	Grower Ø4
8	Flat Cable
9	FM300 PCB
10	Housing in Painted Aluminium
	Housing in AISI 304 JB Raw
	Housing in AISI 304 JB Polished
11	PG9 Plug
12	Cable Gland PG11
13	5 Poles Connector Complete of Plug

Electrical Connections

Version with cable

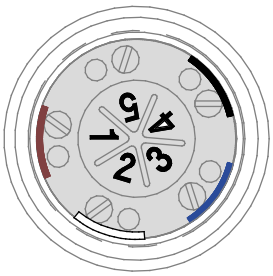


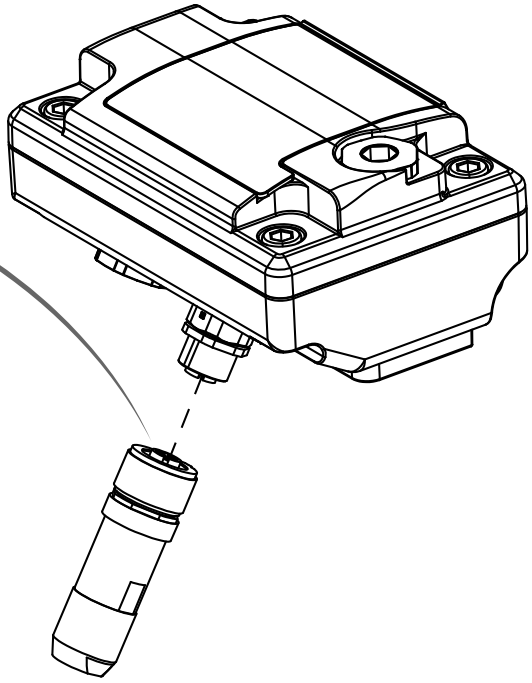


1 (+) POWER SUPPLY
2 (+) OUTPUT 1 / INPUT
3 (+) OUTPUT 2 (OPTIONAL)
4 (+) 4-20mA max load: 500Ω OUTPUT (OPTIONAL)
5 (-) POWER SUPPLY / OUTPUTS / INPUT
6 SHIELD (CONNECT TO GROUND)

PIN 5-6 TO BE CONNECT TO THE GROUND

Version with connector



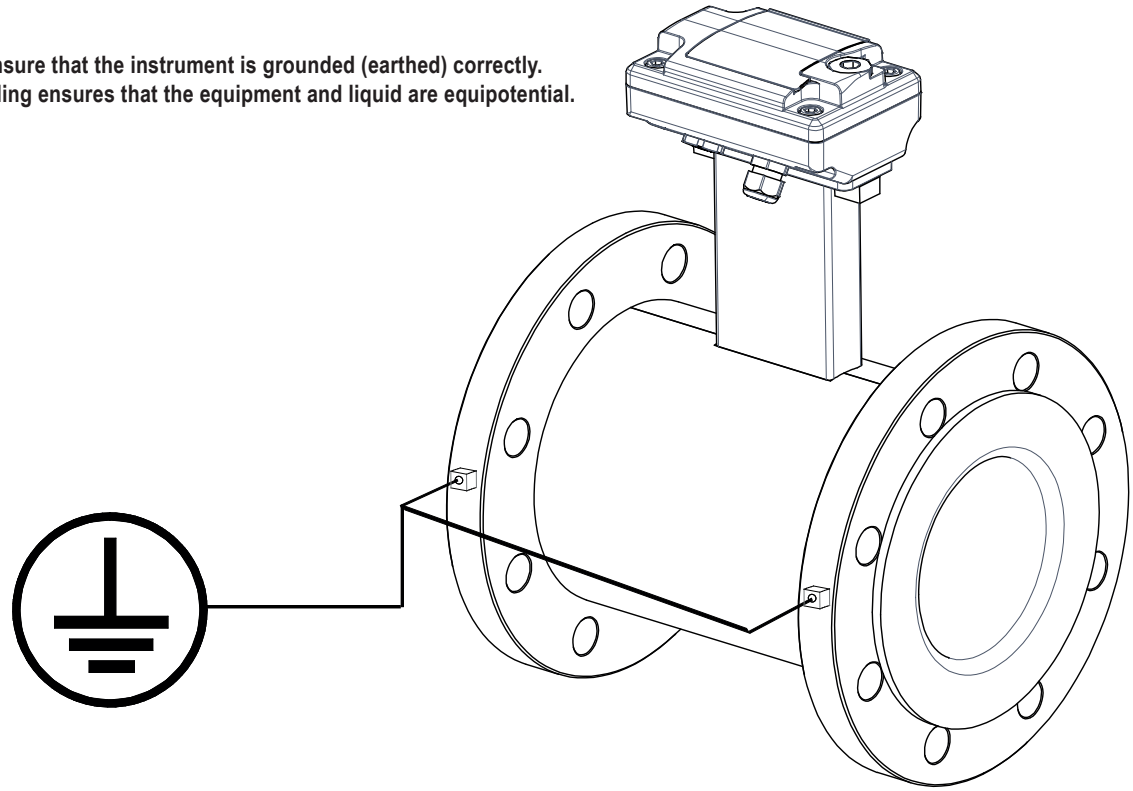


1 (+) POWER SUPPLY
2 (+) OUTPUT 1 / INPUT
3 (+) OUTPUT 2 (OPTIONAL)
4 (+) 4-20mA max load:500ΩOUTPUT (OPTIONAL)
5 (-) POWER SUPPLY / OUTPUTS / INPUT

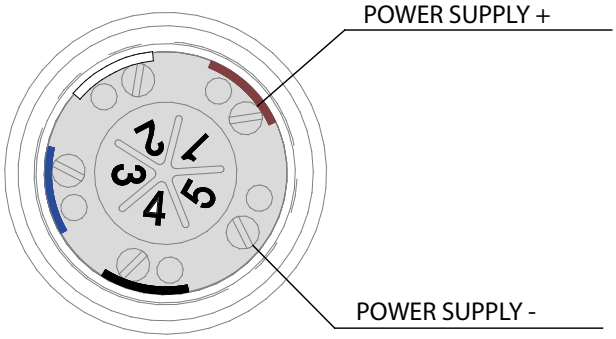
PIN 5 TO BE CONNECT TO THE GROUND

Grounding

ALWAYS ensure that the instrument is grounded (earthed) correctly.
The grounding ensures that the equipment and liquid are equipotential.



Power Supply



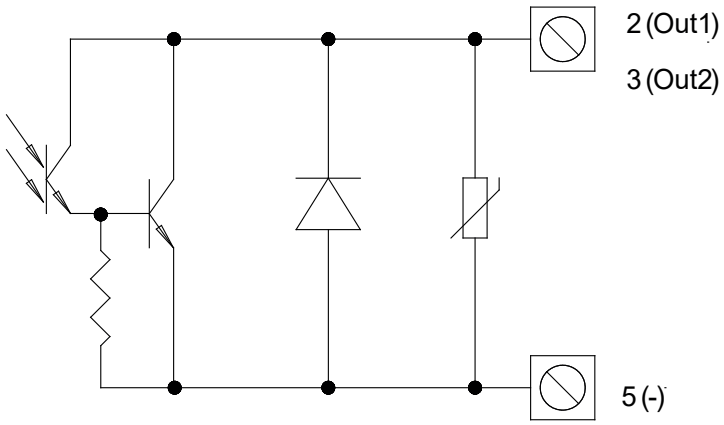
- Before connecting the power supply, verify that the main voltage is within the limits indicated on data plate.
- For the connections use only approved conductors, with fire-proof properties, whose section varies from 0.25 mm^2 to 2.50 mm^2, based on distance/ power; additionally fix the power supply wires with a additional fastening system located close to the terminal.
- The power supply line must be equipped with an external protection for overload current (fuse or automatic line breaker).
- Provide in close proximity the converter a circuit breaker easily accessible for the operator and clearly identified; whose symbols must conform to the electrical safety and local electrical requirements.
- Ensure that the component complies with the requirements of the standard for electrical safety distance.
- Check chemical compatibility of materials used in the connection security systems in order to minimize electrochemical corrosion.

Outputs Wiring

Digital Outputs

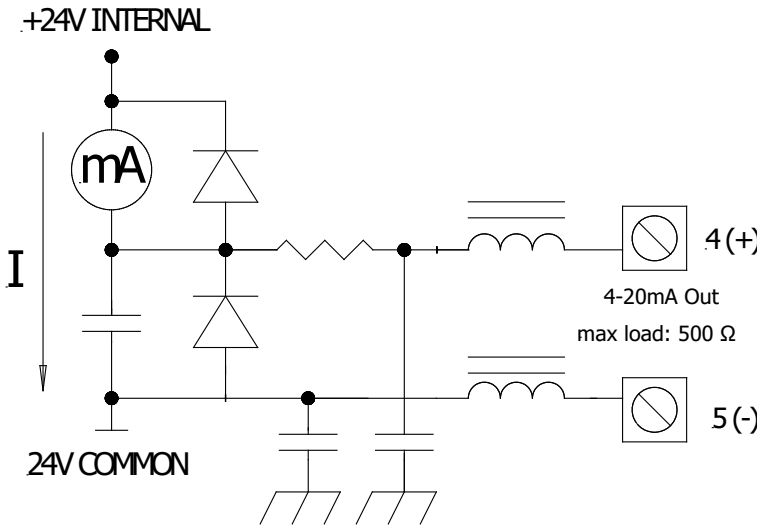
DIGITAL OUTPUTS

- Opto-insulated output
- Maximum switching voltage: 30V ⎓
- Maximum switching current: 100mA @ 25 °C
- Maximum saturation voltage between collector and emitter @100mA: 1.2V ⎓
- Maximum switching frequency (load on the collector or emitter, RL=470, VOUT=24V ⎓): 1250Hz
- Maximum reverse current bearable on the input during and accidental polarity reversion (VEC): 100mA
- Insulation from other secondary circuits: 500 V ⎓



ANALOG OUTPUT

- Maximum load 1000Ω
- Refresh frequency equal to the sample frequency
- Protected against persistent over voltages up to 30V ⎓

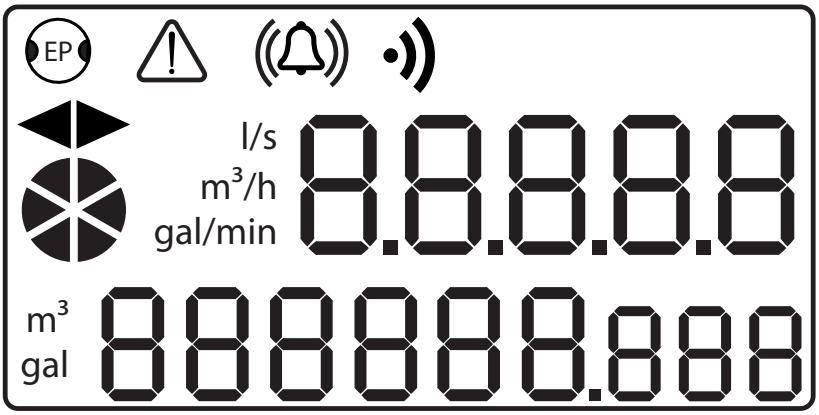


NOTE: shielded cables are recommended for input and output wiring

Display Visualization

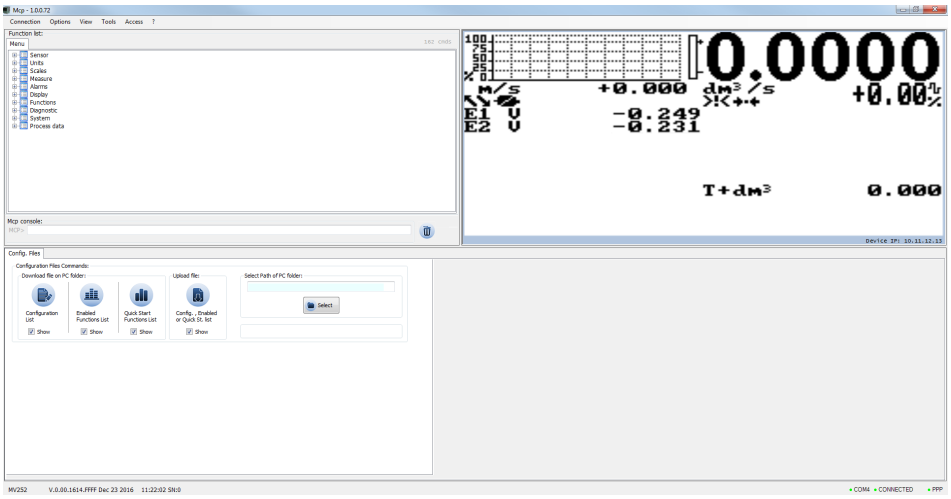
The direct exposure of the converter to the solar rays, could damage the liquid crystal display.
No display pages are provided.

EP	EMPTY PIPE WARNING
	ALARM WARNING
	PROCESS ALARM
	DATA TRANSMISSION
	FLOW DIRECTION
	ACTIVE FLOW RATE
l/s m^3/h gal/min	FLOW RATE UNIT OF MEASURE
m^3 gal	TOTALIZER UNIT OF MEASURE

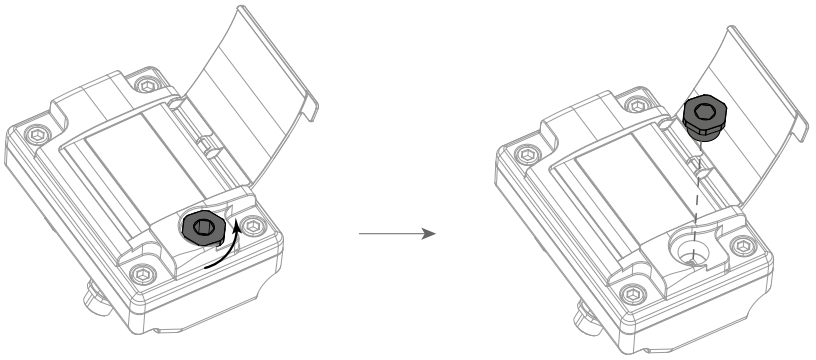


Access to The Configuration Menu

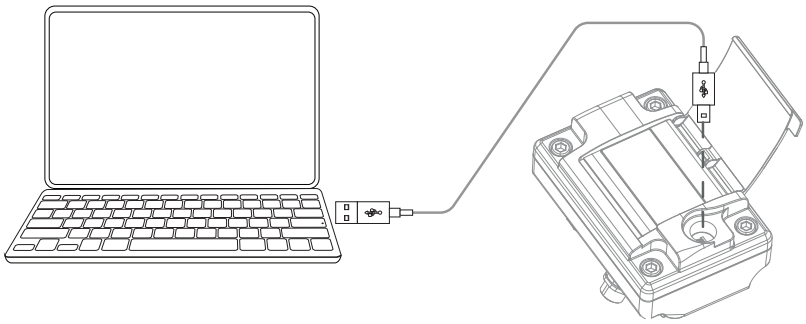
You can access the device configuration menu only by MCP interface. MCP is a software that can be installed on Microsoft Windows® and allows you to set all the functions of the converter and customize the menu. To use the MCP interface, see the user manual .



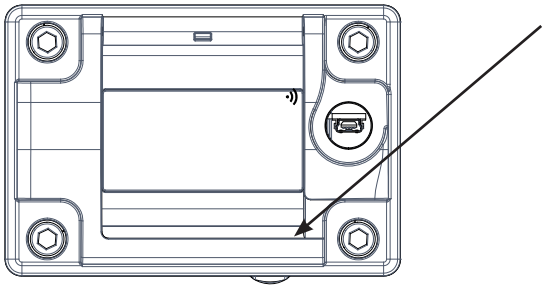
Remove the PG9 cap.



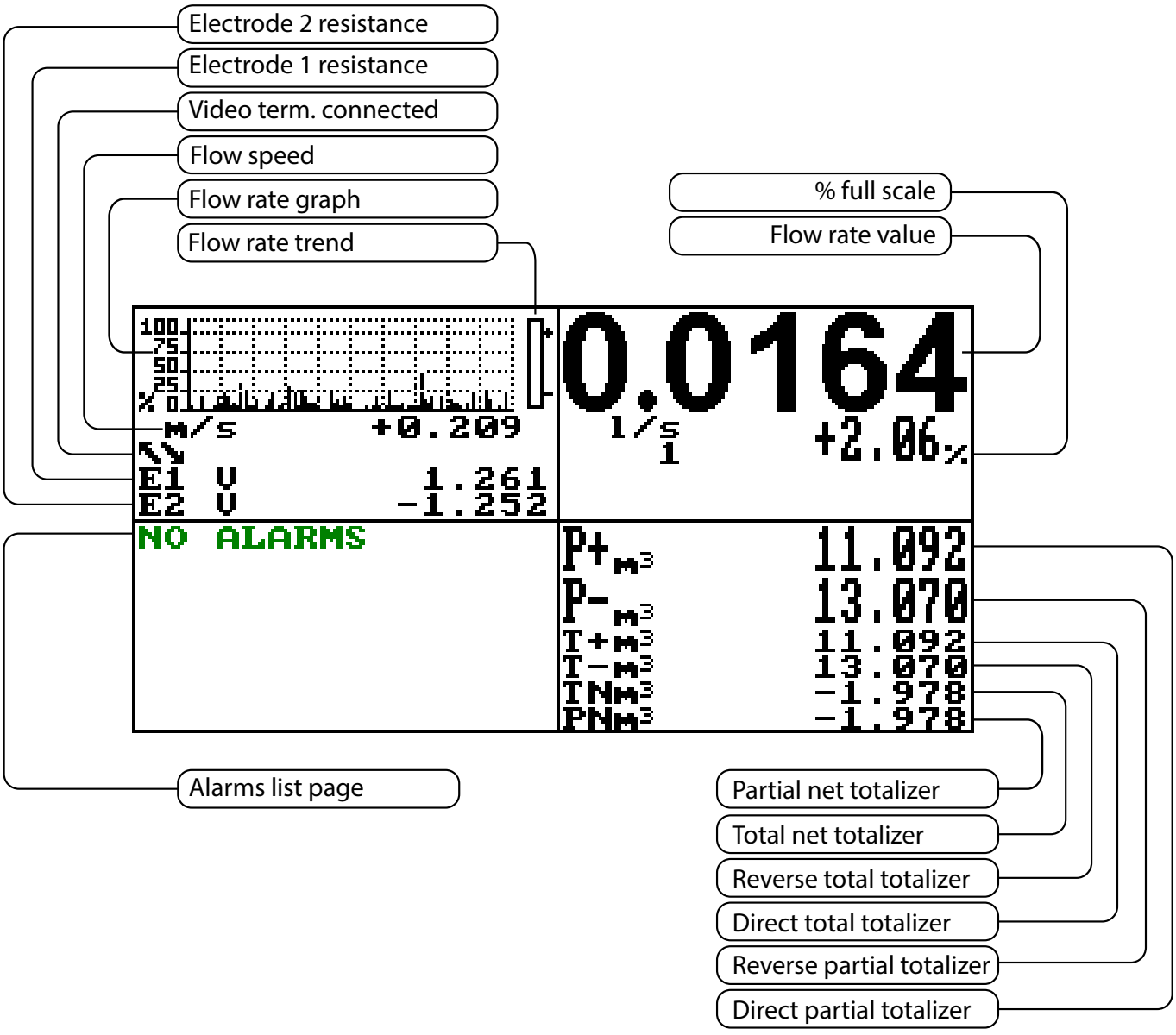
Connect USB cable type mini B. Verify connection simbol on display



Data Transmission and MCP Link Operational



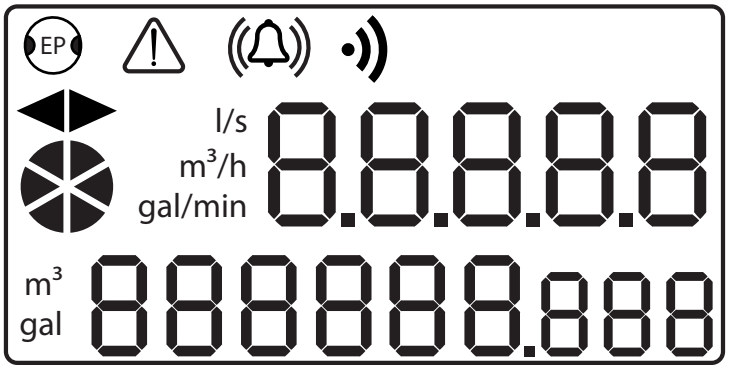
Start Visualization Pages on MCP Interface



Meaning of Flags on MPC Interface

Flag	Description
	Empty Pipe
	File Upload
	File Download
	Flow Rate Simulation (Flashing)
	Calibration (Flashing)
	Generic Alarm (Flashing)
	Signal Error
	Excitation Error
	Min Flow Alarm
	Max Flow Alarm
	Video Terminal Connected
	Flow Rate Overflow
	Pulse 1 Overflow
	Pulse 2 Overflow

Flow Rate and Totalizer Visualization



The FM300 can show a 5 digits display on flow rate field value; this mean the maximum and minimum flow rate values that can be shown on display are:

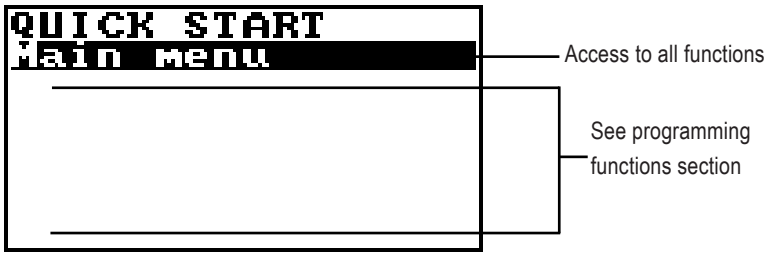
METRIC		
Unit of Measures	**Minimum**	**Maximum**
l/s	0.0267	0.6667
m^3	0.0960	2.4000

NO METRIC		
Unit of Measures	**Minimum**	**Maximum**
Gal/m	0.423	0.6667

The physical display provides the following units of measurement: l/s, m³/h, gal/mln, m³, gal.
Other units available at menus, selectable by MCP interface, they will not be displayed on the physical display, but will only display their numeric values.

Quick Start Menu

The user has immediate access to the Quick Start menu when the converter is powered up by pressing the Enter key. If access to the quick start menu does not occur, then it could be disabled using the function POS. 9.8 see page 23. The quick start menu is only displayed by MCP interface.

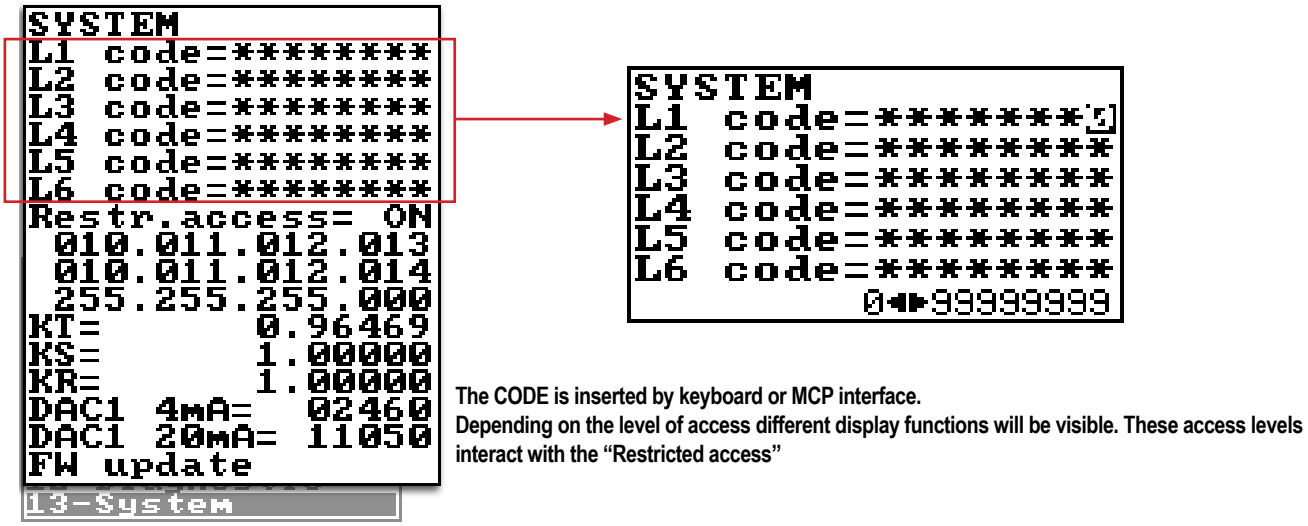


Converter Access Code

The access for programming the instrument is regulated by six access levels logically grouped.
Every level is protected by a different code.

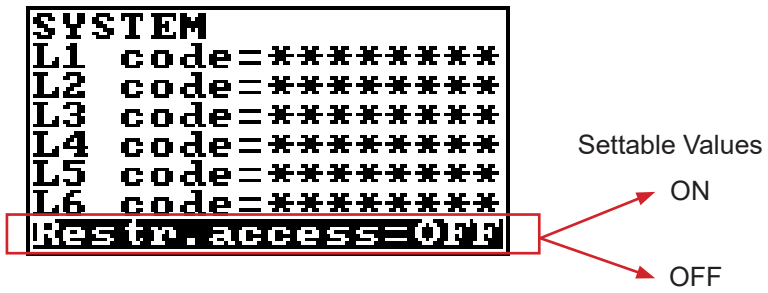
- Access Level 1-2-3-4 Freely programmable by user

Access Code Set : Menu 13 System



The CODE is inserted by keyboard or MCP interface.
Depending on the level of access different display functions will be visible. These access levels interact with the "Restricted access"

Restricted Access Set : Menu 13 System



Restrict = ON: Access permitted only to functions provided for a specific level;
Example: If the operator has a code of access level 3, after having set it, he can change only the functions with level 3 access.

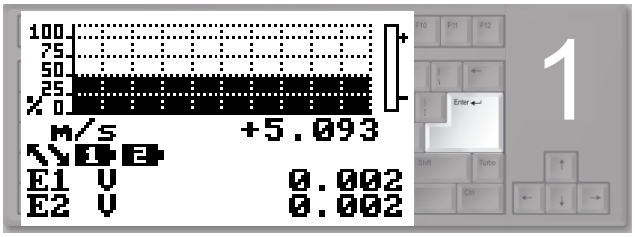
Restict = OFF: It enables to change functions for the selected level and ALL the functions with lower access level.
Example: If the operator has the code of level 3, after having set it, he can change all the functions at level 3 and those at lower levels.

* WARNING: take careful note of the customized code, since there is no way for the user to retrieve or reset it if lost.
Factory preset access codes:

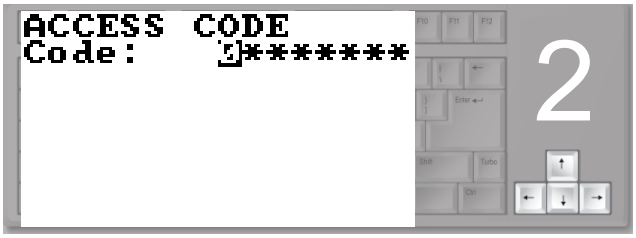
- L1: 10000000
- L2: 20000000
- L3: 30000000
- L4: 40000000

The following example shows how to change the Full scale by Quick Start menu; the second illustrates how to change the function by the Main menu.

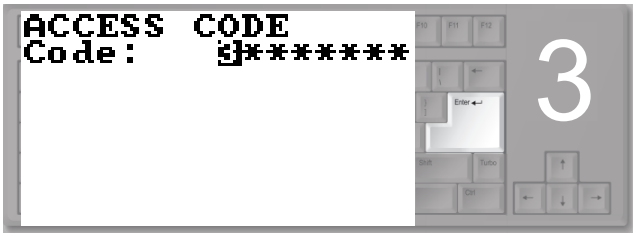
EXAMPLE: Modifying the full scale value from 4.0 L/s to 5.0 dm³/s,
from the "Quick start menu"



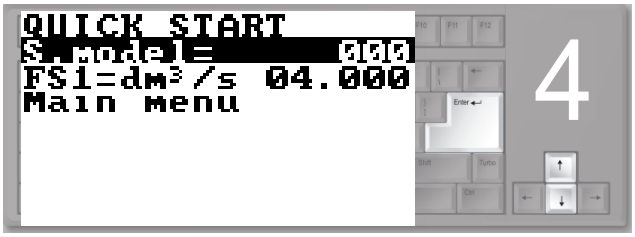
Press enter key to access in the "Quick Start menu"



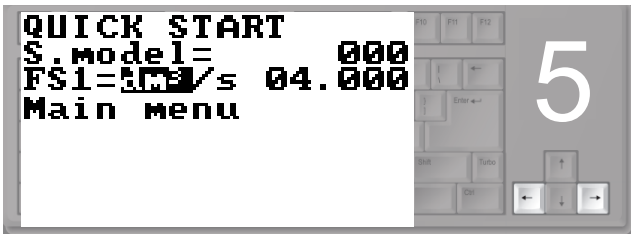
Use the right-left arrow keys to select the character and the up-down arrow key to assign the numeric value of the access code



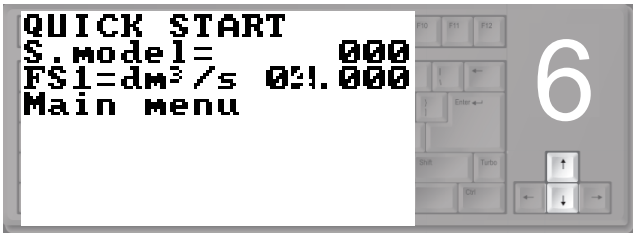
Press the enter key to confirm the access code



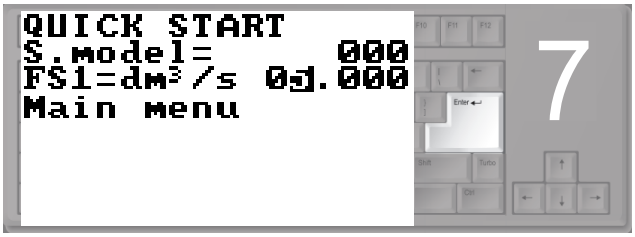
Select the FS1 function with the arrow keys
Press the enter key modify the function



Press the indicated arrow keys to select the character

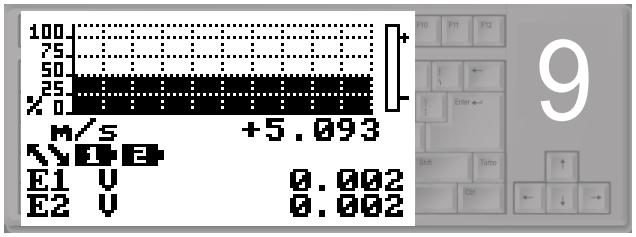


Press the arrow keys indicated to change the value



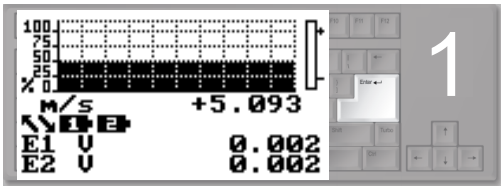
Press the enter button to confirm the changed value

Press the esc key to exit from to the "quick start menu" and return to the main page

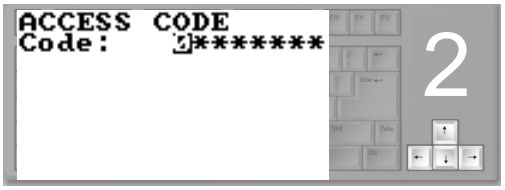


Main Page

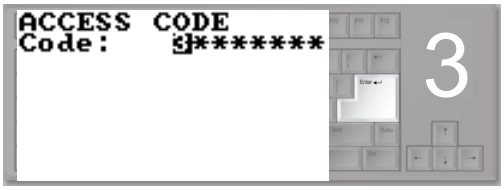
EXAMPLE: modifying the full scale value from 4.0 L/s to 5.0 dm³/s, from the “Main Menu” (quick start menu enabled)



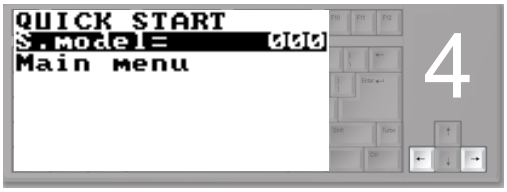
Press enter key to access in the “Quick Start menu”



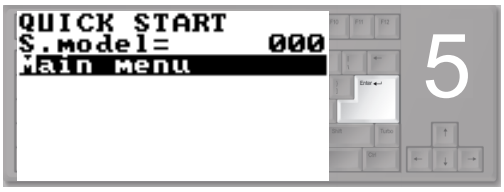
Use the right-left arrow keys to select the character and the up-down arrow key to assign the numeric value of the access code



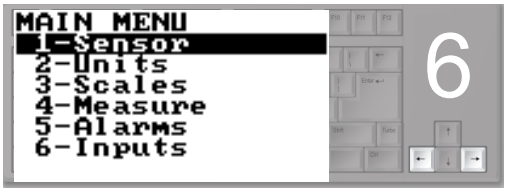
Press the enter key to confirm the access code



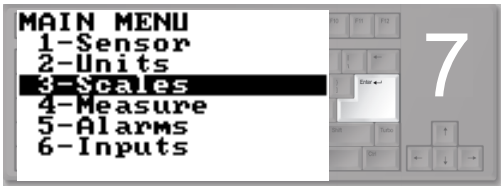
Select the Main Menu function with the arrow keys



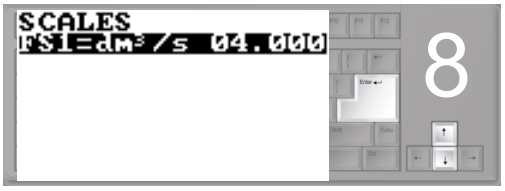
Press the enter key to access the main menu



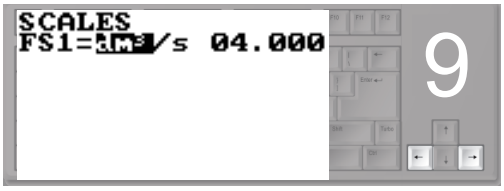
Select menu 3 with the arrow keys



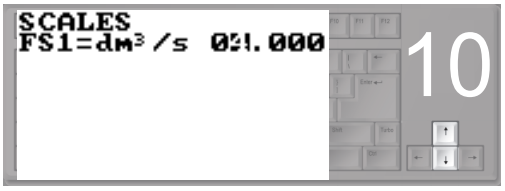
Press the enter key to access menu 3



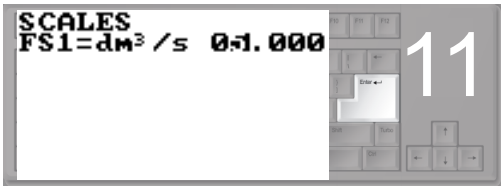
Select the FS1 function with the arrow keys
Press the enter key to confirm



Press the indicated arrow keys to select the character

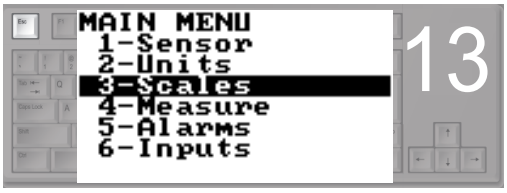


Press the indicated arrow keys to change the value

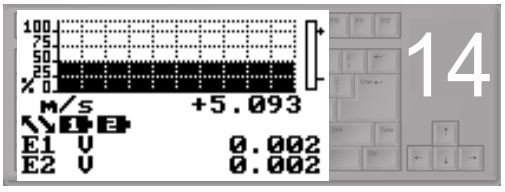


Press the enter key to confirm the changed value

Press the esc key to exit the “quick start menu”



Press the esc key to exit the menu and return to the main page



Main Page

Functions Menu

Sensor

```
MAIN MENU
 1-Sensor
 2-Units
```

UNITS

S. model =	0	1.1	Sensor's model
Lining =	UNSPEC.	1.2	Flow sensor lining material type
S. type =	FULL BORE	1.3	Sensor's type
U. type =	METRIC	1.4	Type of units for sensor's para.
Diam =	mm 00025.0	1.5	Sensor's nominal/real diameter
KA =	+00.9637	1.6	Sensor's coefficient KA
KA- =	-04.4904	1.7	Sensor's coefficient KA Negative
KZ =	+0000000	1.8	Sensor's coefficient KZ
KD=	+0000000	1.9	Sensor 's coefficient KD
Ins. position=	0	1.10	Insertion position
KP Dinamic=	OFF	1.11	KP dynamic calculation mode
Ki=	01.8727	1.12	Sensor's coefficient Ki
Kp=	01.0000	1.13	Sensor's coefficient Kp
KC=	1.00000	1.14	Sensor's coefficient KC
C.curr =	025.0	1.15	Sensor's excitation current
C.Reg.PB=	004	1.16	Current regulator Prop.Band
C.Reg.DK=	008	1.17	Current regulator Deriv.Const.
S. Freq.= Hz	50	1.18	Measure sampling frequency
E.P Detect=	ON	1.19	Enables the empty pipe detection feature
R max= kohm	0500	1.20	Empty pipe detection
S. err. delay=	010	1.21	Signal error delay (n.samples)
Sens. verify=	OFF	1.22	Automatic sensor verify enable
KL =	0.000000000	1.23	Coefficient KL values
Zero point cal.		1.24	Pipe hydraulic zero calibration

Units

```
MAIN MENU
 1-Sensor
 2-Units
 3-Scales
```

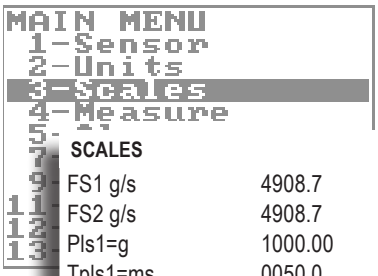
UNITS

Diam.	mm	2.1	Sens.diameter unit of measure
FR.unit	METRIC	2.2	Flow rate unit of measure type
PI1 unit	METRIC	2.3	Pulse 1 type unit of measure
PI2 unit	METRIC	2.4	Pulse 2 type unit of measure
T+ unit	METRIC	2.5	Total.T+ unit of measure type
T+ unit	g	2.6	Total.T+ unit of measure
P+ unit	METRIC	2.7	Total.P+ unit of measure type
P+ unit	g	2.8	Total.P+ unit of measure
T- unit	METRIC	2.9	Total.T- unit of measure type
T- unit	g	2.10	Total.T- unit of measure
P- unit	METRIC	2.11	Total.P- unit of measure type
P- unit	g	2.12	Total.P- unit of measure
Temp.unit	°C	2.13	Temperature unit of measure
Mass units	ON	2.14	Mass units enabling
Sg=kg/dm3	1.0000	2.15	Specific gravity coefficient

Functions Menu

The physical display provides the following units of measure: l/s, m^3/h, gal/mln, m^3, gal.
Other units available are selectable and visible only by MCP. If you choice one of this unit of measure, it will not be displayed on the physical display, but will be visible only its numeric value.

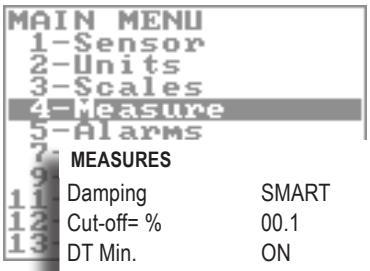
Scales



SCALES

FS1 g/s	4908.7	3.1	Full scale flow rate for range 1
FS2 g/s	4908.7	3.2	Full scale flow rate for range 2
Pls1=g	1000.00	3.3	Output 1 pulse volume value
Tpls1=ms	0050.0	3.4	Output 1 pulse time value
Pls2=g	1000.00	3.5	Output 2 pulse volume value
Tpls2=g	0050.0	3.6	Output 2 pulse time value
Frq1=Hz	1000.00	3.7	Output 1 full scale frequency
Frq2=Hz	1000.00	3.8	Output 2 full scale frequency

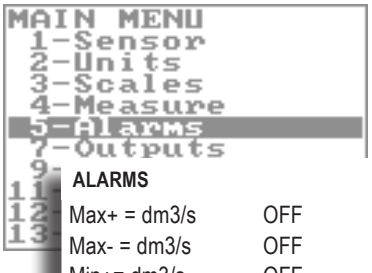
Measure



MEASURES

Damping	SMART	4.1	Measure damping digital filter
Cut-off= %	00.1	4.2	Measure cut-off threshold
DT Min.	ON	4.3	Automatic calibration verify
Autorange	ON	4.4	Automatic f.scale range change

Alarms

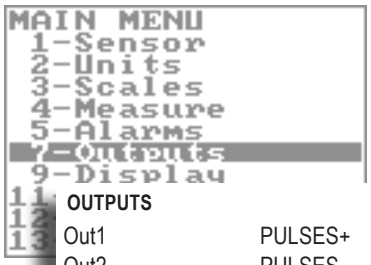


ALARMS

Max+ = dm3/s	OFF	5.1	Max.pos.flow r.alarm threshold
Max- = dm3/s	OFF	5.2	Max.neg.flow r.alarm threshold
Min+= dm3/s	OFF	5.3	Min.pos.flow r.alarm threshold
Min-= dm3/s	OFF	5.4	Min.neg.flow r.alarm threshold
Hysteresis=%	03	5.5	Hysteresis on alarm thresholds
mA v.alarm=%	000	5.6	Current value in case of alarm
Hz v.alarm=%	000	5.7	Frequency value in case of alarm

Functions Menu

Outputs

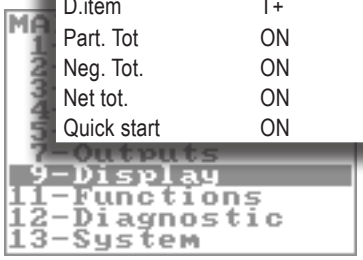


OUTPUTS

Out1	PULSES+
Out2	PULSES-
Out mA1	4_22 +/-
A1S	4.9087

7.1	Output 1 function selection
7.2	Output 2 function selection
7.3	Analog current output 1 range
7.4	Full scale value for analog out1

Display

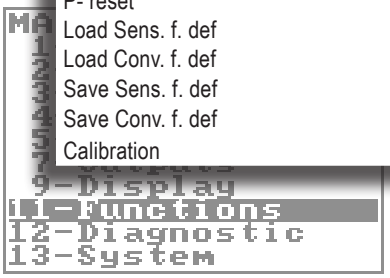


DISPLAY

Language	EN
Contrast	5
D.rate=Hz	5
D.item	T+
Part. Tot	ON
Neg. Tot.	ON
Net tot.	ON
Quick start	ON

9.1	Language for all messages
9.2	Display Contrast adjustment
9.3	Display refresh rate
9.4	2nd row display item choice
9.5	Partial totalizer enable
9.6	Negative totalizer enable
9.7	Net totalizer enable
9.8	Quick start menu enable

Functions



FUNCTIONS

T+ reset	
P+ reset	
T- reset	
P- reset	
Load Sens. f. def	
Load Conv. f. def	
Save Sens. f. def	
Save Conv. f. def	
Calibration	

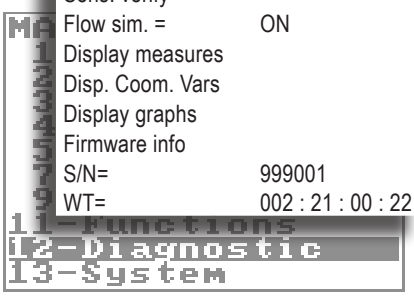
11.1	Totaliz.T+ reset function
11.2	Totaliz.P+ reset function
11.3	Totaliz.T- reset function
11.4	Totaliz.P- reset function
11.5	Load sensor factory default val.
11.6	Load converter factory def. val.
11.7	Save sensor factory default val.
11.8	Save converter factory default val.
11.9	Internal circuit calibration

Functions Menu

Diagnostic

DIAGNOSTIC

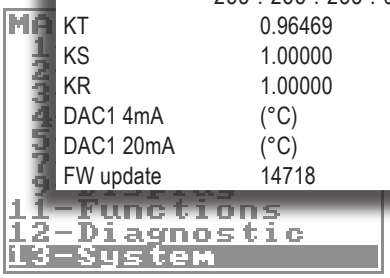
Self test		12.1	Self test diagnostic function
Sens. verify		12.2	Sensor verify diagnostic function
Flow sim. =	ON	12.3	Flow rate simulation enabling
Display measures		12.4	Display internal measured value
Disp. Coom. Vars		12.5	Display comm. diagnostic values
Display graphs		12.6	Display measure as graphs
Firmware info		12.8	Firmware version information
S/N=	999001	12.9	Board serial number (read only)
WT=	002 : 21 : 00 : 22	12.10	Total working time (read only)



System

SYSTEM

L1 code =	********	13.1	Access level 1 code
L2 code =	********	13.2	Access level 2 code
L3 code =	********	13.3	Access level 3 code
L4 code =	********	13.4	Access level 4 code
L5 code =	********	13.5	Access level 5 code
L6 code =	********	13.6	Access level 6 code
Restr. Access=	ON	13.7	Restricted access level
	010 . 011 . 012 . 013	13.8	Device IP network address
	010 . 011 . 012 . 014	13.9	Client IP network address
	255 . 255 . 255 . 000	13.10	Network mask
KT	0.96469	13.11	Calibration coefficient KT
KS	1.00000	13.12	Calibration coefficient KS
KR	1.00000	13.13	Calibration coefficient KR
DAC1 4mA	(°C)	13.14	DAC1 out 4mA calibration point
DAC1 20mA	(°C)	13.15	DAC1 out 20mA calibration point
FW update	14718	13.16	firmware update



Functions Description

Here below the explanation on how the rows of menu are described.

Menu visualized on the converter (from 1 to 13)

MENU 1 - SENSOR

(POS. 1.1) Sensor Model	*[S. model xxx]*	*AL4*	[SMODL]

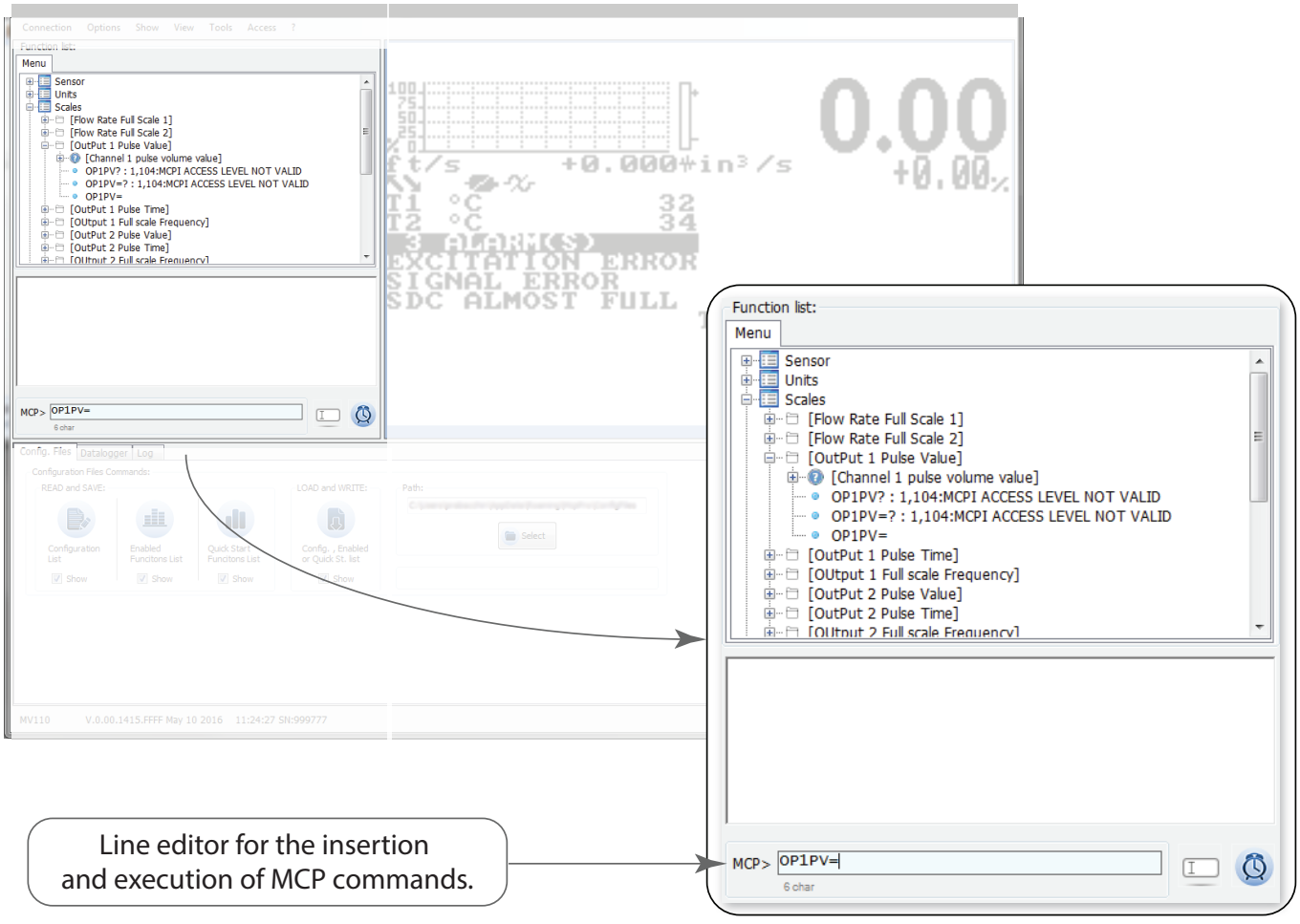
MCP command acronym

Function shown on device display

Access level

MCP command

The following picture describes where to find the name of the MCP functions in MCP-software.
More info see MCP manual.



Menu 1 - Sensor

(POS. 1.1) Sensor Model	[S. model xxx]	*AL4*	[SMODL]

Enter the first two characters of the serial number of the sensor as on the sensor label.

(POS. 1.2) Lining Material Type	[Lining= UNSPEC.]	*AL4*	[LIMAT]

Flow sensor lining material type (PFA; PU-TDI; ALON; PEEK; HR; PP; PA-11; PTFE-HT; PTFE)

(POS. 1.3) Sensor Type	[S. type= FULL BORE]	*AL4*	[STYPE]

Select the sensor type of full-bore or insertion.

(POS. 1.4) Sensor Units Type	[U.type= METRIC]	*AL2*	[SUTYP]

Select type of unit of measure of sensor's parameter. Values metric or imperial (inch).

(POS. 1.5) Pipe Diameter Value	[Diam.= mm xxx]	*AL4*	[PDIMV]

Select the nominal diameter of the sensor (0-2500). ND is written on the sensor label.

(POS. 1.6) Coefficient KA	[KA= + xx.xxx]	*AL4*	[CFFKA]

KA factor: calibration coefficient

(POS. 1.7) Coefficient KA	[KA= - xx.xxx]	*AL4*	[CFKAN]

KA factor: calibration coefficient for negative flow. This function is showed only if at least 1 negative KL value is set.

(POS. 1.8) Coefficient LK	[KZ= +/- xxxxx]	*AL4*	[CFFKZ]

Calibration Factor. KZ is located on the sensor label

(POS. 1.9) Coefficient KD	[KD= +/- xxxxx]	*AL4*	[CFFKD]

Calibration Dynamic Factor.

(POS. 1.10) Sensor Insertion Position	[Ins.position= x]	*AL4*	[SIPOS]

This function is active with POS.1.3 on "Insertion". See the insertion sensor manual for more details

(POS. 1.11) Sensor Insertion Dynamic KP	[KP dynamic= ON/OFF]	*AL4*	[SIPOS]

This function is active with POS.1.3 on "Insertion". See the insertion sensor manual for more details

(POS. 1.12) Coefficient Ki	[Ki= +/- xx.xxx]	*AL4*	[CFFKI]

This function is active with POS.1.3 on "Insertion". See the insertion sensor manual for more details

(POS. 1.13) Coefficient Kp	[Kp dynamic= +/- xxxxx]	*AL4*	[CFFKP]

This function is active with POS.1.3 on "Insertion". See the insertion sensor manual for more details

Menu 1 - Sensor

(POS. 1.14) Coefficient KC	[KC= +/- xx.xxx]	*AL4*	[CFFKC]

Calibration Factor. This function is activated if the sensor model is NOT present on the sensors table standard parameters.

(POS. 1.15) Coils Excitation Current	[C.Curr.= mA xxx.x]	*AL4*	[CEXCC]

Excitation coils current. This function is activated if the sensor model is NOT present on the sensors table standard parameters.

(POS. 1.16) Coils Regulator Proportional Band	[C.Reg.PB= xxx]	*AL4*	[CRPRB]

Current regulator parameter. This function is activated if the sensor model is NOT present on the sensors table standard parameters

(POS. 1.17) Coils Regulator Derivative Constant	[C.Reg. DK = xxx]	*AL4*	[CRDER]

Current regulator parameter. This function is activated if the sensor model is NOT present on the sensors table standard parameters

(POS. 1.18) Sampling Frequency	[S.Freq.= Hz xx]	*AL4*	[SFREQ]

Measure sampling frequency. This function is activated if the sensor model is NOT present on the sensors table standard parameters.

(POS. 1.19) Empty Pipe Detection Enable	[E.P.Detect= ON]	*AL3*	[EPDEN]

Enables the empty pipe detection function. This function is useful to keep the meter lock to zero when the pipe become empty.

(POS. 1.20) Empty Pipe Detection Threshold	[Z max= Kohm xxxx]	*AL4*	[EPDTH]

Maximum value of the electrodes resistance. This feature is enabled only if the function is ON 1.17 Empty Pipe Detection.

(POS. 1.21) Signal Error Alarm Time	[S.err.delay=m xxx]	*AL4*	[SEALT]

Delay before generating error. This function is useful to prevent unexpected lock to zero of measure caused by sporadic events (empty pipe, excitation error, signal error)

(POS. 1.22) Automatic Sensor verify enable	[Sens. verify= OFF]	*AL3*	[ASVFE]

Enable the Automatic sensor verification (see BIV optional function).

(POS. 1.23) Set KL values	[K=XX +/- XXXXXXXXX]	*AL4*	[SETKL]

This function is useful to keep the electrodes clean; the allowed values are: OFF, minimum, average and maximum. It is not recommended to use this function when the liquid has a conductivity less than 100µS/cm (set to OFF).

(POS. 1.24) Set KJ values	[Zero point cal.]	*AL4*	[SETKJ]

This feature appears only when are met the conditions established by the values assigned to functions DYNRT and DYNST, in detail:

- The flowrate is stable lower the value assigned to the function DYNRT.
- It must have elapsed at least the value assigned to the function DYNST after the last significant change of flow rate above the DYNRT value.

When the above conditions are met, the zero-point calibration function will appear on the display.
ALL THIS FUNCTIONS ARE RESERVED TO THE SERVICE, so the values assigned to these functions are not settable.

Menu 2 - Units

WARNING: The totalizer value is updated and changed depending on the setting of unit value.
The scale change may cause accuracy loss depending of rounding up.

For example, if T +=0,234 liters with 3 decimals, it become T +=0.001 m³ losing 0.234 liters in rounding up.

(POS. 2.1) Sensor Diameter Unit of Measure	[Diam.= mm]	*AL2*	[SDIUM]

Sensor diameter unit of measure (mm or inch)

(POS. 2.2) Flow Rate Unit of Measure Type	[FR unit= METRIC]	*AL2*	[FRMUT]

Flow rate type unit of measure. Select metric or not metric (Imperial units)

(POS. 2.3) PuLse 1 Unit of measure Type	[PL1 unit= METRIC]	*AL2*	[PL1UT]

This function is active with POS. 7.2 see page 23.
This function changes the choice of unit of measure 3.3 see page 23.
Pulse 1 type unit of measure: metric or not metric (Imperial units).

(POS. 2.4) PuLse 2 Unit of measure Type	[PL2 unit= METRIC]	*AL2*	[PL2UT]

This function is active with POS 7.2 see page 23.
This function changes the choice of unit of measure POS. 3.5 see page 8.
Pulse 2 type unit of measure: metric or not metric Imperial units).

(POS. 2.5) Totalizer Total Positive Unit of measure Type	[T+ unit= METRIC]	*AL2*	[TTPUT]

Setting total direct totalizer unit of measure type: metric or not metric Imperial units).
This function changes the values unit of measure on POS. 2.6 see page 21.

(POS. 2.6) Totalizer Total Positive Unit of Measure	[T+ unit= m³]	*AL2*	[TTPUM]

Setting total direct totalizer unit of measure.
This function visualized on visualization pages.

(POS. 2.7) Totalizer Partial Positive Unit of measure Type	[P+ unit= METRIC]	*AL2*	[TPPUT]

This function is active with POS. 9.5 see page 23 enabled.
Setting partial direct totalizer unit of measure type: metric or not metric (Imperial units).
This function changes the values unit of measure on POS. 2.8 see page 21
It is visualized on visualization pages.

(POS. 2.8) Totalizer Partial Positive Unit of Measure	[P+ unit= m³]	*AL2*	[TPPUM]

Setting partial direct totalizer unit of measure.
This function visualized on visualization pages.

(POS. 2.9) Totalizer Total Negative Unit of measure Type	[T- unit= METRIC]	*AL2*	[TTNUT]

This function is active with POS. 9.6 see page 23 enabled.
Setting total reverse totalizer unit of measure type: metric or not metric (Imperial units).
This function changes the values unit of measure on POS. 2.10 see page 21.
It is visualized on visualization pages.

(POS. 2.10) Totalizer Total Negative Unit of measure	[T- unit= m³]	*AL2*	[TTNUM]

Setting total reverse totalizer unit of measure.
This function visualized on visualization pages.

(POS. 2.11) Totalizer Partial Negative Unit of measure Type	[P- unit= METRIC]	*AL2*	[TPNUT]

This function is active with POS. 9.5 see page 23 , enable.
Setting partial reverse totalizer unit of measure type: metric or not metric (Imperial units).
This function changes the values unit of measure on POS. 2.12 see page 21.
It is visualized on visualization pages.

Menu 2 - Units

(POS. 2.12) Totalizer Partial Negative Unit of measure	[P- unit= m³]	*AL2*	[TPNUM]

Setting partial reverse totalizer unit of measure.
This function visualized on visualization pages.

(POS. 2.13) TeMPerature Unit of Measure	[Temp. unit= C°]	*AL2*	[TMPUT]

Setting temperature unit of measure.

(POS. 2.14) MaSS Units Enable	[Mass units= dm³]	*AL2*	[MSSUE]

Enable or Disable the selection of mass unit of full scale set.

(POS. 2.15) Volume to Mass Specific Gravity Coefficient	[Sg= Kg/dm³ x.xxxx]	*AL2*	[VMSGC]

Setting specific gravity coefficient. This Function is active with POS. 2.14 see page 21, enable.

Menu 3 - Scale

(POS. 3.1-2) Flow Rate Full Scale 1-2	[FS1-2= l/s xxxx.x]	*AL2*	[FRFS1-FRFS2]

The full scale is used to indicate to the maximum value meter's flow rate. The full scale should be chosen carefully as it's parameters are used for several other parameters. There are three fields to fill in order to set this parameter, from left to right: 1) unit of measure, 2) time unit of measure and 3) numeric value. The selection is made by positioning the cursor on the field to modify. To change the type unit of measure (metric, Imperial units, mass or volume) see menu2 units. The value of Fs1-2 depend nominal diameter POS. 1.5 see page 21 . The following tables shown the units of measure available and the conversion factor by comparison with 1dm3 and 1kg. The converter accepts any kind of combination of units of measure satisfying both the following conditions:

- Numeric field value 99999
- 1/25 fsmax ≤ numeric field value ≤ fsmax.

Where fsmax is the maximum full scale value corresponding to the sensor, equal to a 10m/s liquid speed. The unit of measures are shown as appear on the display. The Imperial units units are diversified by using capital and small characters.

Metric	
cm³	Cubic centimeter
ml	Milliliter
l	Liter
dm³	Cubic decimeter
dal	Decaliter
hl	Hectoliter
m³	Cubic meter
mL	Megaliter

Not Metric	
in³	Cubic inch
Gal	American gallon
ft³	Cubic foot
bbl	Standard barrel
BBL	Oil barrel
hf³	Hecto cubic feet
KGL	American Kilo gallon
kf³	Kilo cubic feet
ttG	Ten thousand gallons
IGL	Imperial gallon
IKG	Imperial Kilo gallon
Aft	Acre foot
MGL	Mega gallon
IMG	Imperial mega gallon

Mass Unit Not Metric	
Oz	Ounce
Lb	Pound
Ton	Short tons

Mass Unit Metric	
g	Gram
kg	Kilogram
t	Ton

When a measure mass unit is set, the specific gravity function is automatically enabled by the system. Please, note that the mass measure is heavily affected by the temperature. With certain liquids this may cause significant measurement errors. The following measure of time units can be selected:
s = second, **m** = minute, **h** = hour, **d** = day .

Menu 3 - Scale

Double full scale:

The instrument can be configured to have a double full scale: Fs1 and Fs2.
The enabling of double full scale and its selection can be done automatically, according to the range, see function "4.4" page 23. The instrument can indicate the used scale through output (see setting "SCALE" function 7.1 see page 23 and 7.2 see page 23)

Notes For Using The MCP Interface

The command FRFS1 =? and command FRS2 = ?, edited by MCP software, return a list of only the unit compatible with the nominal diameter set. If the sensor is insertion type and the diameter is zero, the only possible unit is m/s if the flow rate were chosen metric units, else f/s for the unit of measurement non metric.

(POS. 3.3-3.5) Output Pulse 1-2 **[Pls1-2= dm³ x.xxxxx]** ***AL2*** **[OP1PV-OP2PV]**

Pls1 and Pls2 are activated with POS. 7.1 see page 23 and POS. 7.2 see page 23 enabled and set to pulse value. This function allows the user to set a signal (a pulse) to be given from the converter when a defined amount of volume has passed through the sensor. To set the parameter, complete the 2 fields, from left to right:
1)unit of measure, 2) numeric value. The selection is performed by positioning the cursor in the field to be modified. To change the unit type (metric, imperial) see menu 2 units.
The value of Pls1-2 depends on nominal diameter units POS. 1.4 see page 21.
Only those units described in the function POS. 4.4 see page 23 are available to be selected.

(POS. 3.4-3.6) Output1-2 Pulse Time **[Tpls1-2= ms x.xxxxx]** ***AL2*** **[OP1PT-OP2PT]**

Pls1 and Pls2 are activated with POS. 7.1 see page 23 and POS. 7.2 see page 23 enabled and set to pulse value.
With the liquid volume to generate the pulse value set by the user. The user must set the corresponding duration of the pulse to be outputed. This value is expressed in milliseconds and has to be between 0.4 and 1250 ms. When the high frequency output is present, then the minimum value can type of device is connected to the converter, the user must verify that the set pulse duration is compatible with the external device processing such pulses. If, for example, an electro-mechanical pulse counter is connected, a minimum pulse time of 0.04 milliseconds can be set.
ATTENTION: The converter can not detect problems that may occur; firstly, the pulse is too long the coils may burn out, secondly, if the pulse is too short, the counter may not be able to function, causing damage of the output.

(POS. 3.7-3.8) Output full scale freq.1-2 **[Frq1-2= x.xxxxx]** ***AL2*** **[OU1FF-OU2FF]**

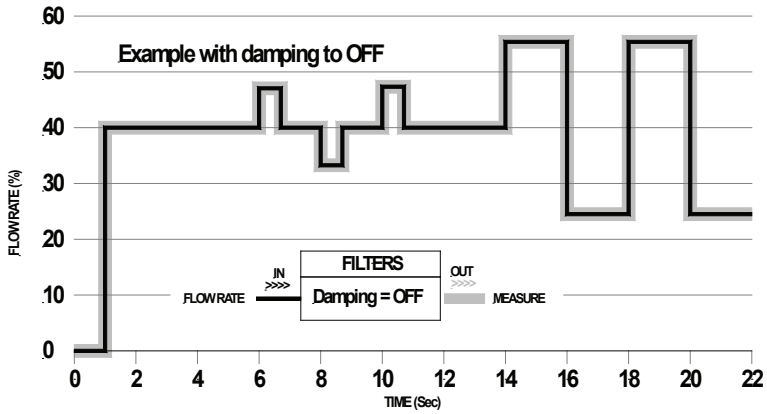
Frq1 and Frq2 are activated with POS. 7.1 see page 23 and POS. 7.2 see page 23 enabled and set to the value freq+/-/+-. Setting duration of the pulse generated on channel 1 and 2.

Menu 4 - Measure

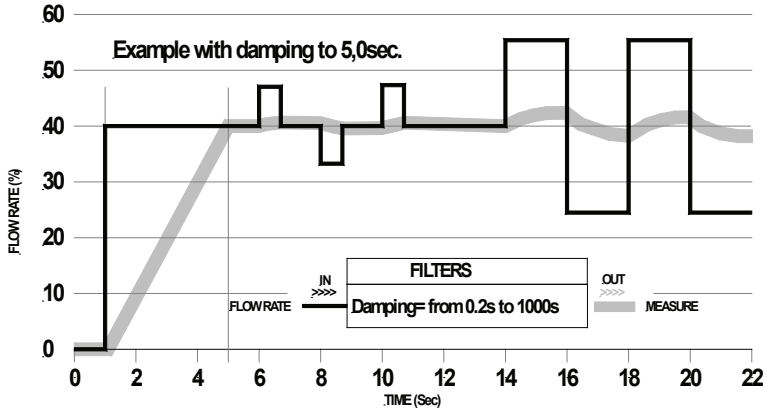
(POS. 4.1) Measure Filter DaMPing	[Damping=OFF/SMART/(TIME)]	*AL3*	[MFDMP]

This section of manual is extremely important because the correct setting of the filters allows to obtain a proper response of the instrument to the measured flow rate and the specific requirements of use; as a general rule, consider that, starting from Damping = OFF (no filter applied to the measure), successive values, introduce increasing damping. The following diagrams show the instrument's response to changes in flow rate from 0 to 100%, using the different settings of the damping function.

The SMART is an adaptive filter that adapts automatically to most of the processes (recommended value), making the response of the meter very ready to fast changes of flow and at the same time extremely precise and stable for slow variations. It may be convenient to use a constant damping filter time, where there is a pulsating flow (for example generated by peristaltic pumps). With longer times you get a mean value stable, while with short times the measure will closely follow the flow pulses, but consequently more unstable.
NOTE: If the rechargeable battery is active, the damping could be set only in "SMART".



Damping function(OFF). the meter follows the trend of fast changes in flow.



Damping mode based on time (fro 0.2s to 1000s) The measure is averaged over a number of samples determined by the value assigned to the dampening function. When the damping parameter is expressed in seconds, the filter works damping the measurement noise and sudden change of flow rate. Increasing the parameter of damping increases the stability of the measurement.

Menu 4 - Measure

(POS. 4.2) Measure Filter Cut-off Threshold	[Cut-off=% xxx]	*AL3*	[MFCUT]

Setting the low flow cutoff threshold. This function is useful to avoid that flows close to zero, due to the electrical noises from tiny movements of liquid (due for example to vibrations of the pipe) which cause an increasing of the totalizers. The allowed range for this function is 0-25% of full scale set. For most applications a value between 0.5 and 1% is recommended.

(POS. 4.3) Auto Calibration Verify Enable	[Cal.verify=ON]	AL3	[ACAVE]

This function enables an automatic verification of board's coefficients. As the converter performs continuously a large number of tests, we recommend to use this function only in presence of wide range of temperature. Instead it is NOT recommended to use it when the instrument is used in metering applications (batch).

(POS. 4.4) Auto Range Enable	[Autorange=ON/OFF]	AL3	[ARNGE]

This function enables the automatic change of scale. The meter may have two different working ranges in order to suit to the variable process conditions. In order to get the best results out of this function it is important range N.2 (Fs2) if enabled is bigger than N.1 (Fs1). When the flow rate increases and reaches the 100% of the full scale 1, then the meter automatically switches to scale 2. When the flow rate decreases again reaching a value on scale 2 equal to the 90% of full scale N.1, then the active scale is 1 again. Allowed values for this parameter: ON/OFF.

NOTE: when the autorange is enabled, is not allow to use the manual range change. This function does NOT increase the accuracy of the measure; its aim is to increase the resolution of 4/20 mA when the meter work at very low flow rates (typical case the flow rate of water distribution with daytime flow much higher than the night flow).

Menu 4 - Measure: Only MCP Functions

Measure Filter Cut-off Threshold 2	[MCP ONLY]	AL3	[MFCT2]

Setting the low flow cutoff threshold, it is similar to the function in POS. 4.2 see page 23. The value of this function is NOT visible on display but only with MCP command.

High Immunity INPuts	[H.imm. inp.]	AL4	[HIINP]

The HIINP function (INPut High Immunity filter) introduces a hardware filter to be used ONLY IN CASE OF ABSOLUTE NECESSITY, when the measure is absolutely unstable or it is NOT possible to make the measure, and every possible attempt to reduce or eliminate the noise do not give a positive result, with particular attention of instrument ground connection. When this function is activated (HIINP = ON) the measure will be influenced by an unavoidable error estimated around 1%.

DYNamic Sample Analysis	[MCP ONLY]	AL4	[DINSA]

Reserved to the service.

DYNamic Sample Time	[MCP ONLY]	AL4	[DYNST]

Reserved to the service.

DYNamic Range Threshold	[MCP ONLY]	AL4	[DYNRT]

Reserved to the service.

Menu 5 - Alarms

(POS. 5.1) Flow Rate Alarm Max Positive	[Max+=XXXXX]	AL3	[FRAXP]

Maximum value alarm set for direct flow rate set. When the flow rate value exceeds such a threshold, then an alarm message is generated. The value of this parameter is expressed in technical units and can be set from 0 to frmax, with resolution 1/250 of frmax.Setting this parameter to OFF disables the alarm start.

(POS. 5.2) Flow Rate Alarm Max Negative	[Max-=XXXXX]	*AL3*	[FRAXN]

Maximum value alarm set for reverse flow rate set. When the flow rate value exceeds such a threshold, then an alarm message is generated. The value of this parameter is expressed in technical units and can be set from 0 to frmax, with resolution 1/250 of frmax.Setting this parameter to OFF disables the alarm start.

(POS. 5.3) Flow Rate Alarm Min Positive	[Min+=XXXXX]	*AL3*	[FRANP]

Minimum value alarm set for reverse flow rate set. When the flow rate value falls below such a threshold, then an alarm message is generated. The value of this parameter is expressed in technical units and can be set from 0 to frmax, with resolution 1/250 of frmax.Setting this parameter to OFF disables the alarm start.

(POS. 5.4) Flow Rate Alarm Min Negative	[Min-=XXXXX]	*AL3*	[FRANN]

Minimum value alarm set for reverse flow rate set. When the flow rate value falls below such a threshold, then an alarm message is generated. The value of this parameter is expressed in technical units and can be set from 0 to frmax, with resolution 1/250 of frmax.Setting this parameter to OFF disables the alarm start.

(POS. 5.5) Alarm Thresholds Hysteresis	[Hysteresis=XXXXX]	AL3	[ATHYS]

Hysteresis threshold set for the minimum and maximum flow rate alarms. The value of this parameter is expressed in technical units and can be set from 0 to 1/250 of the fsmax at 10 m / s.

(POS 5.6) Current Output Value in Case of Failure	[mA V.alarm = % XXX]	*AL3*	[OCACV]

The output current signal can be specified by the user in case of failure of either, empty pipe, coils interrupted, or ADC error. The signal current is set as a percentage (0 to 125%) of the 0/4-20mA current. 125% corresponds to 24mA and does not depend on the selected range (0-20/4-20mA).

The NAMUR NE43 recommendation asks for a alarms signalling value for the current output lower than 3.6mA (<18%) or bigger than 21mA (>105%). It would then be preferable to set the value of this function at the 10%, so that the current value in case of the a.m. cases would be 2 mA, allowing the following diagnostics:

current < 2mA - 5%: line interrupted, power supply failure or faulty converter;
2mA -5% * current * 2mA + 5%: hardware alarm;
4mA * current * 20mA: normal working range;
20mA < current * 22mA: out of range, measure above 100% f.s.

(POS. 5.7) Frequency Output Value in Case of Failure	[Hz V.alarm=%XXX]	AL3	[OFACV]

This function is active with POS. 7.1 see page 23 and POS. 7.2 see page 24 enable to (FREQ.+, FREQ.-, FREQ.±)
To set the frequency value assigned to the on/off output in one or more of the following failure cases:

Empty pipe; Coils interrupted ; ADC error. Allowable range is from 0 to 125% of the frequency full scale value. Although there are no specific rules regulating cases such as these, it would be convenient to use the failure information as follows:

0% Hz * frequency * 100% f.s.: normal working range;
100% f.s. < frequency * 110% f.s.: overflow, measure above the 100% of the f.s.;
115% f.s. * frequency * 125% f.s.: hardware alarm condition.

Menu 7 - Outputs

(POS. 7.1) Output 1 Function [Out1=XXXXXX] *AL3* [OUT1F]

Function choice corresponding to digital Output 1. The functions are listed in the table below.

(POS. 7.2) Output 2 Function [Out2=XXXXXX] *AL3* [OUT2F]

Function choice corresponding to digital Output 2. The functions are listed in the table below.

Functions for Outputs 1 And 2

- **OFF:** DISABLE
- **MAX AL. +:** MAX DIRECT FLOW RATE OUTPUT (ENERGIZED = AL. OFF)
- **MIN AL. +:** MIN DIRECT FLOW RATE OUTPUT (ENERGIZED = AL. OFF)
- **MAX/MIN+:** MAX/MIN DIRECT FLOW RATE OUTPUT (ENERGIZED = AL. OFF)
- **MAX AL.-:** MAX INVERSE FLOW RATE OUTPUT (ENERGIZED = AL. OFF)
- **MIN AL.-:** MIN INVERSE FLOW RATE OUTPUT (ENERGIZED = AL. OFF)
- **MAX/MIN-:** MAX/MIN REVERSE FLOW RATE OUTPUT (ENERGIZED = AL. OFF)
- **MAX/MIN+/-:** MAX/MIN DIRECT / REVERSE FLOW RATE OUTPUT (ENERGIZED = AL. OFF)
- **P.EMPTY:** EMPTY PIPE ALARM OUTPUT (ENERGIZED = AL. OFF)
- **HARDW.AL.:** SUM OF ALL ALARMS ”energized interrupted ” AND ”error input signal ”
- **OVERFLOW:** OUT OF RANGE ALARM OUTPUT (ENERGIZED = FLOW RATE OK)
- **ALL ALARMS:** SUM OF ALL ALARMS POSSIBLE
- **EXT. COMM:** THE OUTPUT MAY HAVE A STATE DEPENDENT FROM AN EXTERNAL COMMAND
- (via MCP, MODBUS, etc.)
- **F.R. SIGN:** FLOW DIRECTION (ENERGIZED WHEN FLOW IS NEGATIVE)
- **SCALE:** INDICATION SCALE
- **FREQ.+:** FREQUENCY POSITIVE FLOW RATE
- **FREQ.-:** FREQUENCY NEGATIVE FLOW RATE
- **FREQ.+/-:** FREQUENCY POSITIVE/NEGATIVE FLOW RATE
- **PULSES.+:** PULSE POSITIVE FLOW RATE
- **PULSES.-:** PULSE NEGATIVE FLOW RATE
- **PULSES+/-:** PULSE NEGATIVE/POSITIVE FLOW RATE

(POS. 7.3) Analog Output 1 Configuration [Out mA1=X_XX XXX] *AL3* [AO1CF]

This function sets the current output 1 and 2. This function is optional and will not appear unless the option has been requested. There are three fields to modify for this function:

- Scale zero: 4 or 0mA
- Full scale: 20 or 22mA
- Field: + = positive, - = negative, blank = both, -0+ = central zero scale

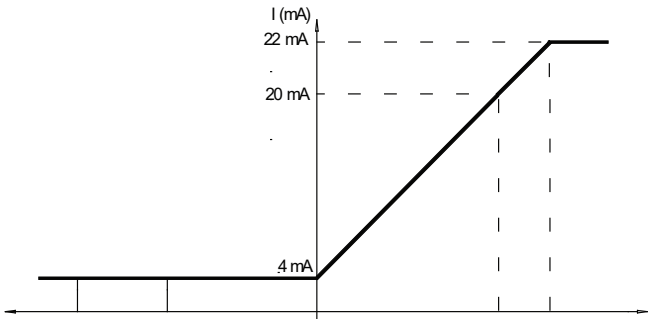
The values corresponding to the scale points are shown in the following chart:

Menu 7 - Outputs

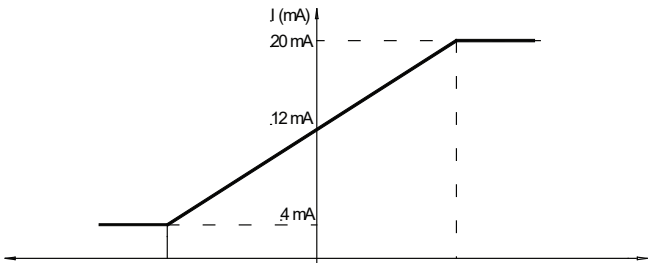
Current Values in mA Associate to the % Full Scale Value					
Possible Field	**Reverse Flow Value**		**Zero**	**Direct Flow Value**	
	≤-110%	-100%	0%	+100%	≥+110%
Out.mA = 0 ÷ 20 +	0	0	0	20	20
Out.mA = 0 ÷ 22 +	0	0	0	20	22
Out.mA = 4 ÷ 20 +	4	4	4	20	20
*Out.mA = 4 ÷ 22 +	4	4	4	20	22
Out.mA = 0 ÷ 20 -	20	20	0	0	0
Out.mA = 0 ÷ 22 -	22	20	0	0	0
Out.mA = 4 ÷ 20 -	20	20	4	4	4
Out.mA = 4 ÷ 22 -	22	20	4	4	4
Out.mA = 0 ÷ 20	20	20	0	20	20
Out.mA = 0 ÷ 22	22	20	0	20	22
Out.mA = 4 ÷ 20	20	20	4	20	20
Out.mA = 4 ÷ 22	22	20	4	20	22
Out.mA = 0 ÷ 20 –0+	0	0	10	20	20
Out.mA = 0 ÷ 22 –0+	0	1	11	21	22
**Out.mA = 4 ÷ 20 –0+	4	4	12	20	20
Out.mA = 4 ÷ 22 –0+	4	4.8	12.8	21	22

In hardware alarm conditions “HARDW AL.” (interrupted coils, empty pipe, measure error) the current value is programmed by the function “mA v.fault” (pos. 5.6) and it is expressed as percentage of a fixed current range, where: 0% = 0mA and 110% = 22mA.

* Example 1: out 4-22 +



** Example 2: out 4-20 –0+



(POS. 7.4) Analog Output 1 Full Scale **[A1S= dm/s x.xxxx]** ***AL3*** **[AO1FS]**

It allows to set the full scale value for analog output 1 independently from the main scale of the instrument.

Menu 9 - Display

(POS. 9.1) Layout Language	[Language= ITA/EN]	*AL1*	[LLANG]

Choice of the language. There are 8 languages available: GB = English, IT = Italian, TR = Turkish, PL = Polish, DE = German, FR = French, PT = Portuguese, ES = Spanish.

(POS. 9.2) Display Contrast	[Contrast= x]	*AL1*	[DCNTR]

Display contrast set. The contrast can change according to the room temperature. The allowed range is from 0 to 9.

(POS. 9.3) Display Refresh Frequency	[D.rate=Hz xx]	*AL1*	[DISRF]

Frequency of the display data update. This parameter effects only the display layout and not the response time of the meter itself. The possible choices are: 1/2/5/10 Hz.

(POS. 9.4) LCD Display Item Choice	[D. itemn= x]	*AL2*	[LCDIC]

Second row display item choice.

(POS. 9.5) Partial Totalizers Enable	[Part. tot= ON]	*AL2*	[PTOTE]

This function enables the display of partial totalizer in visualization pages.

(POS. 9.6) Negative Value Totalizers Enable	[Neg. tot= ON]	*AL2*	[NEGTE]

This function enables the display of negative totalizer in visualization pages.

(POS. 9.7) Net Value Totalizers Enable	[Net. tot= ON]	*AL2*	[NVTTE]

This function enables the display of net totalizer in visualization pages.

(POS. 9.8) Quick Start Menu Enable	[Quick start= ON]	*AL2*	[QSTME]

This function enables the quick start menu.

Menu 11 - Function

The following functions are activated by first pressing the “ENTER” and then the “ESC” when the screen appears “confirm” to start the function.

(POS. 11.1) Volume Totalizer Total Positive Reset	[T+ RESET= ON]	*AL3*	[VTTPR]

Reset total direct totalizer for direct flow rate (+).

(POS. 11.2) Volume Totalizer Partial Positive Reset	[P+ RESET= ON]	*AL3*	[VTPPR]

Reset total partial totalizer for direct flow rate (+).

(POS. 11.3) Volume Totalizer Total Negative Reset	[T- RESET= ON]	*AL3*	[VTTNR]

Reset total reverse totalizer for direct flow rate (-).

(POS. 11.4) Volume Totalizer Partial Negative Reset	[P- RESET= ON]	*AL3*	[VTPNR]

Reset partial reverse totalizer for direct flow rate (-).

(POS. 11.5) Load Factory Default Sensor Data	[Load sens.f.def= ON]	*AL3*	[LFDSD]

This function resets the parameters of the sensor factory default. To Load the saved files see function (11.7).

(POS. 11.6) Load Factory Default Converter Data	[Load conv.f.def= ON]	*AL3*	[LFDCD]

This function resets the parameters of the converter factory default. o Load the saved files see function (11.8).

(POS. 11.7) Save Factory Default Sensor Data	[Save sens.f.def= ON]	*AL6*	[SFDSD]

This function save the parameters of the sensor factory default.

(POS. 11.8) Save Factory Default Converter Data	[Save conv.f.def= ON]	*AL6*	[SFDCD]

This function saves the parameters as factory default.

(POS. 11.9) CALibration Immediate Command	[Calibration]	*AL5*	[CALIC]

Perform manually a board’s calibration. Press Enter and the message “ EXECUTE?” will be visualized on the display then press long the key Enter to proceed. Press any other key to delete the operation.
If the sensor table is valid, the calibration is performed also when one of the following paramenter has been change:

1. **SENSOR DIAMETER -> Menu Sensor 1**
2. **SENSOR MODEL -> Menu Sensor 1**
3. **Exc. CURRENT -> Menu Sensor 1**
4. **S. Freq. -> Menu Sensor 1**

To check the calibration status, active or inactive, type the command MCP Calic? and check as follows:

CALIC = 1 calibration in progress
CALIC = 0 calibration terminated

Menu 12 - Diagnostic

(POS. 12.1) AutoTest Immediate Command [Self Test] *AL3* [ATSIC]

Meter auto-test function. This function stops the normal functions of the meter and performs a complete test cycle on the measure input circuits and on the excitation generator. To activate this function, after select it, push key Enter, at the question: “CONFIRM EXEC.?” Long Push the same key to start auto-test, or any other key for delete operation. At the end of operation the converter will revert to one of the initial visualization pages. This function is automatically performed when switching on the device. This function restarts the converter.

(POS. 12.2) Sensor VERify Command [Sens. verify] *AL3* [SVERC]

This function performs a sensor verification. The function checks the coil leakage current (isolation test) and that also the sensor is connected and functioning within the normal operating limits.

(POS. 12.3) Measure SImulation Enable [Flow sim=ON] *AL3* [MSIEN]

Flow rate simulation enabling. With this function it is possible to generate an internal signal that simulates the flow rate, allowing the outputs and all the connected instruments test.

After enabling it, a ‘▲▼’ appears in the MCP screen below the flow rate indication.
Set: By pressing the “Enter” key on the computer keyboard with MCP started, compare the value to be set to% of flow, and pressing “Enter” again confirms the set value.

Finished: pressing the “Enter” key from the computer keyboard with MCP started, the flow simulation setting screen is displayed and pressing the “Esc” stops the simulation process.

(POS. 12.4) Diagnostic Measure Values [Display measures] *AL5* [DMVLS]

This Function shows the values of the various internal parameters as listed below:

```
VPS:V          4.7   CAL_G:          31.2103
+AVCC:V       +2.7   CAL_O:mA         -0.008
-AVCC:V       -2.7   CAL_R0:        0.99990
VIN1:V    +0.002     CAL_R1:        1.00501
VIN2:V    +0.002     SYS_F:MHz     50.0367
VIN_C:V   +0.002     CURR_K:        0.99399
VIN_D:V   -0.000     HFN_ADC:mV       0.004
C_C:mA     25.15     LFN_ADC:mV       0.001
C_V:V        0.6     MEAS_NB:%          0.12
C_VPK:V      1.1     CAL_I:mV         0.525
C_R:Ω       22.0     CAL_U:mV        16.296
C_PWR:W   0.014      PROC1:%          49.0
C_T:°C       -.-     PROC2:%          13.9
C_RT:ms      1.72    PROC3:%           6.8
C_LK:mA   0.000      PROC4:%           7.1
C_ST:            0   PROC5:%          23.0
S_VER.RSLT: 000      CPU_T:°C     +34.12
E1R:kΩ          00
E2R:kΩ          00
LFN_COM:V   0.01
LFN_DIF:V   0.00
```

(POS. 12.5) Diagnostic Communication Values [Disp. comm. vars] *AL5* [DCVLS]

Create a list of diagnostic values related to the instrument communication.

```
PPP_STATUS:    NETW  E_PPPFRM2:          0
MCPI_S:  ESTABLISH   E_IP_HDR1:          0
RxCNT:    1138022 89 E_IP_HDR2:          0
TxCNT:   1489758012  E_IP_HDR3:          0
E_SR_LINK:           E_IP_HDR4:          0
E_PAKTLEN:           E_IP_HDR5:          0
E_BFOVERR:           E_IP_HDR6:          0
E_TSPLAYR:           E_IP_HDR7:          0
E_PPPFRM1:           BROADCAST:         85
E_PPPFRM2:           E_IP_HDR9:          0
E_IP_HDR1:           E_TCPHDR1:          0
E_IP_HDR2:           E_TCPHDR2:          0
E_IP_HDR3:           E_UDPHDR1:          0
E_IP_HDR4:           E_UDPHDR2:          0
E_IP_HDR5:           E_UDPHDR3:          0
E_IP_HDR6:           E_ICMPHDR:          0
```

PPP link status
MCPI socket status

Following there are the states for the PPP link and MCPI to connect the device.

Following are the states for the PPP link and MCPI to connect the device.

PPP link status:

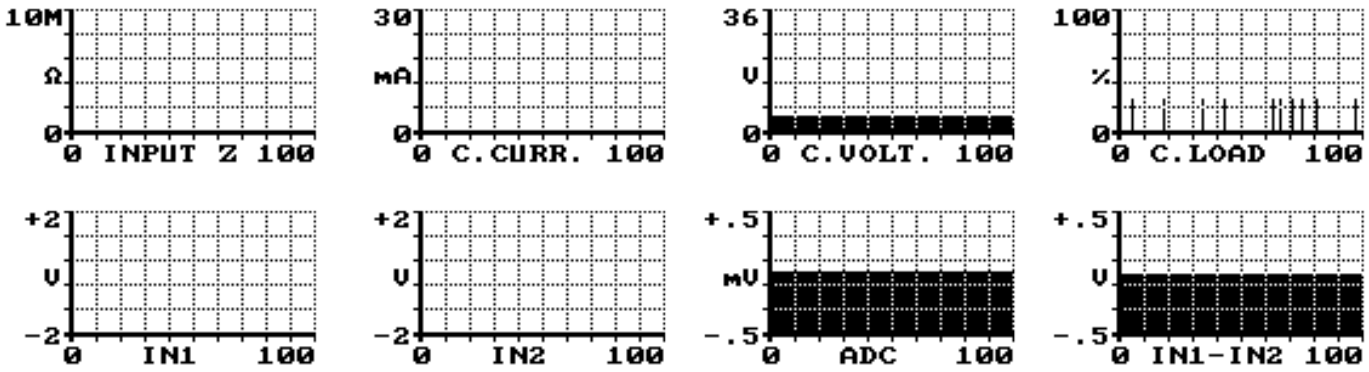
"UNDT" = undetermined
"DEAD" = dead, link down, persistent condition
"LCP" = LCP phase, transition condition
"AUTH" = Authentication phase, transition condition
"IPCP" = IP and DNS addressess assign phase, transition condition
"NETW" = network established (normal persistent condition when the link is UP)
"TERM" = link termination request, transition condition

MCPI link status:

"CLOSED" = socket closed
"ACCEPT" = socket awaiting for new connection
"ESTABLISH" = link established
"CLS_WAIT" = waiting for closure
"LAST_ACK" = lask ACK sent
"FIN_WAIT" = (see TCP/IP RFC documentation)
"TIME_WAIT" = (see TCP/IP RFC documentation)

(POS. 12.6) Oscilloscope Function **[Display graphs]** ***AL5*** **[OSCOP]**

This function displays graphs of input Z, C. current, C. Volt, C.Load, Input 1, Input 2, Input1-Input 2, Analog to Digital Converter.

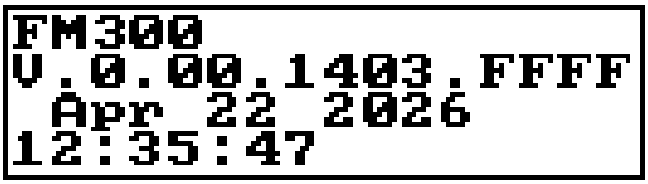


(POS. 12.7) Generic Sensor Set **[Gen.sens. set]** ***AL5*** **NO MCP COMMAND**

Automatic finding of a parameter set for a generic sensor.

(POS. 12.8) Model and Software Version **[Firmware info]** ***AL0*** **[MODSV]**

Firmware info version/revision.



(POS. 12.9) Serial Number **[S/N=xxxxxx]** ***AL0*** **[MODSV]**

View Board serial number. (read only)

(POS. 12.10) Total Working Time **[WT=xxxx: xx: xx: xx]** ***AL0*** **[TWKTM]**

View Total working time instrument. (read only)

Menu 12 - Diagnostic only MCP Functions

Diagnostic Function	[MCP only]	*AL0*	[DIAGF]

Runs of diagnostic functions in the converter and into the sensor as a function of numeric codes provided by the manufacturer.

Coil current mean real Value	[MCP only]	*AL0*	[CCMRV]

Measure Coil Current Mean Real Value.

Menu 13 - System

(POS. 13.1-2-3-4-5-6) Level n° Access Code	[Ln xxxxxxxx]	---	[L1ACD]-> [L6ACD]

This function enables or disables, for each access level code, the main menu functions.
Each level unlocks the functionality of the lower level. (Function 13.7 see page 24)
L1 code= ******** Access level value code 1 L4 code= ******** Access level value code 4
L2 code= ******** Access level value code 2 L5 code= ******** Access level value code 5
L3 code= ******** Access level value code 3 L6 code= ******** Access level value code 6

(POS. 13.7) ReStricted Access Rule Enable	[Restr. access= ON]	*AL6*	[RSARE]

Enable or disable access level code. If active displays only the functions related to the level entered access.

IP ADDRESS SETTING (13.8-9-10)

(POS. 13.8) Device IP address	[XXX.XXX.XXX.XXX]	*AL3*	[DIPAD]

Device IP network adress.

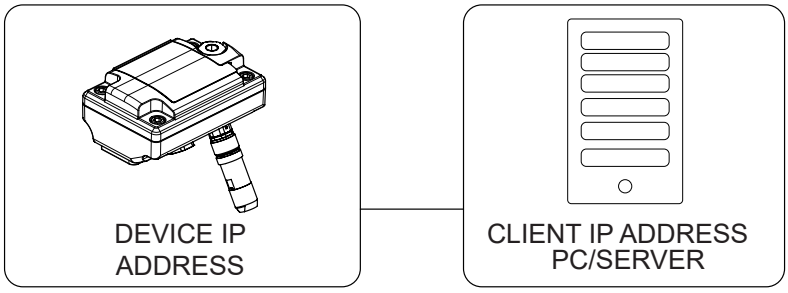
(POS. 13.8) Client IP address	[XXX.XXX.XXX.XXX]	*AL3*	[CIPAD]

Client IP network adress.

(POS. 13.10) Network mask	[XXX.XXX.XXX.XXX]	*AL3*	[NETMS]

Network mask.

Caution: Changes to the functions of the points 13.8-13.9-13.10 are enabled after the drive device restart (see function 12.1 Self test for restart converter).



(POS. 13.14) Coefficient KT	[KF=X.XXXXX]	*AL6*	[CFFKT]

Gain correction coefficient (calculated automatically).

Menu 13 - System

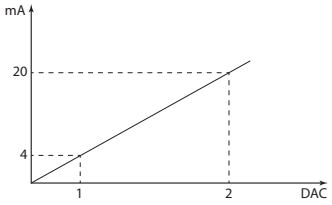
(POS. 13.15) Coefficient KS	[KF=X.XXXXX]	*AL5*	[CFFKS]

Correction coefficient constant instrumental.

(POS. 13.16) Coefficient KR	[KR=X.XXXXX]	*AL5*	[CFFKR]

Correction coefficient constant instrumental.

DIGITAL ANALOG CONVERTER (Correction Parameters)(13.17-18-19-20)



The diagram shows how the DAC4-4-20mA max load:500Ω parameters are setup. The DAC1 value corresponds to 4 mA corresponding to a zero flow rate, while the value of 20mA corresponds to a 100% of the flow rate.

(POS. 13.14) Current Output 1 Calibration Point 1	[DAC1 4mA =XXXXX]	*AL5*	[C1CP1]

DAC1 out 4mA calibration point. (current output1 calibration point 1)

(POS. 13.15) Current Output 1 Calibration Point 2	[DAC1 20mA=XXXXX]	*AL5*	[C1CP2]

DAC1 out 20mA calibration point. (current output1 calibration point 2)

(POS. 13.16) Firmware Update	[FW update]	*AL4*	[FWUPD]

Enable firmware update. The firmware can be upload to the SD card (name.file).
MCP interface is activated by the command FWUPD = name.file

Menu 13 - System: Only MCP Functions

Unique Identity Key	[MCP ONLY]	*AL0*	[UIKEY]

Device Unique Identity key.

Hardware Set	[MCP ONLY]	*AL0*	[HWSET]

Device hardware configuration.

Hardware Code	[MCP ONLY]	*AL0*	[HWCOD]

Device hardware code.

Calibration Execution Status Memory	[MCP ONLY]	*AL6*	[CALXM]

Calibration Execution status Memory. This function checks the instrument's internal calibration status.
CALXM=1 instrument calibrated correctly
CALXM=0 Invalid calibration / Calibration not completed (invalid calibration (if the function is zero, start the calibration function, MCP CALIC command).

Function Code Selection	[MCP ONLY]	*AL0*	[FCODS]

Select the function code.

Menu 13 - System: Only MCP Functions

Quick Start Function Selection	[MCP ONLY]	*AL6*	[QSFNS]

Select function for quick start menu.

Quick Start All Functions Selection	[MCP ONLY]	*AL6*	[QSAFS]

Select ALL function converter for quick start menu.

Quick Start Function Status List	[MCP ONLY]	*AL6*	[QSLST]

List quick start group functions.

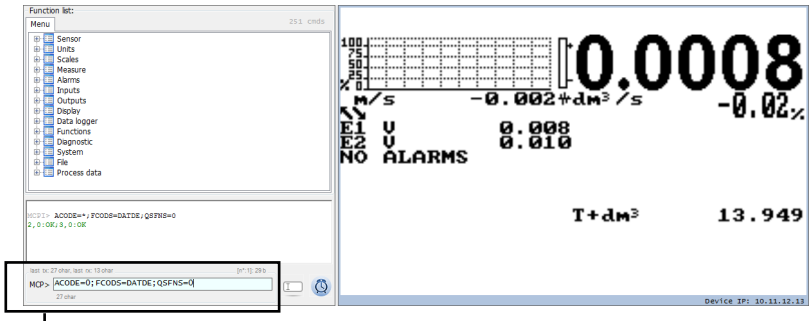
Function Enable Status List	[MCP ONLY]	*AL6*	[FSLST]

List enable status of functions.

Access Code	[MCP ONLY]	*AL0*	[ACODE]

Input the right access code.

Example set quick start menù function for mcp.



ACODE=0; FCODS=[MCP COMMAND]; QSFNS=1

- Access Code
- INSERT MCP Command of the function to be activated in the QS menu.
- Quick Start FuNction Selection

Link Terminate	[MCP ONLY]	*AL0*	[LTERM]

Terminate the PPP data link.

MCPI Session Quit	[MCP ONLY]	*AL0*	[MQUIT]

Quit the MCPI connection.

Functions List	[MCP ONLY]	*AL0*	[FLIST]

View list of all available converter functions.

Menu 13 - System: Only MCP Functions

Functions List Compact	[MCP ONLY]	*AL0*	[FLISC]

View compact list of all available converter functions.

Functions Menu Selection	[MCP ONLY]	*AL0*	[FMSEL]

Select menu for functions list.

Configuration List	[MCP ONLY]	*AL0*	[CFLST]

Configuration parameter list. The list with the status / values of the converter parameters.

Volume Totalizer Total Positive Set	[MCP ONLY]	*AL4*	[VTTPS]

This function allows to set the value of total positive totalizer.

Volume Totalizer Partial Positive Set	[MCP ONLY]	*AL4*	[VTPPS]

This function allows to set the value of partial positive totalizer.

Volume Totalizer Total Negative Set	[MCP ONLY]	*AL4*	[VTTNS]

This function allows to set the value of total negative totalizer.

Volume Totalizer Partial Negative Set	[MCP ONLY]	*AL4*	[VTPNS]

This function allows to set the value of partial negative totalizer.

Volume Total Positive Overflow Set	[MCP ONLY]	*AL4*	[VTPOS]

This function allows to set the overflow value of total positive totalizer.

Volume Partial Positive Overflow Set	[MCP ONLY]	*AL4*	[VPPOS]

This function allows to set the overflow value of partial positive totalizer.

Volume Total Negative Overflow Set	[MCP ONLY]	*AL4*	[VTNOS]

This function allows to set the overflow value of total negative totalizer.

Volume Partial Negative Overflow Set	[MCP ONLY]	*AL4*	[VPNOS]

This function allows to set the overflow value of partiall negative totalizer.

CPU MaX.recorded temperature	[MCP ONLY]	*AL6*	[CPUMX]

CPU max.recorded temperature.

CPU MiN.recorded temperature	[MCP ONLY]	*AL6*	[CPUMN]

CPU min.recorded temperature.

Menu 13 - System: Only MCP Functions

Calibration Offset Register 0	[MCP ONLY]	*AL6*	[COFR0]

Calibration offset register 0

Calibration Gain Register 0	[MCP ONLY]	*AL6*	[CGAR0]

Calibration gain register 0

Calibration Gain Register 1	[MCP ONLY]	*AL6*	[CGAR1]

Calibration gain register 1

Calibration Gain Register C	[MCP ONLY]	*AL6*	[CGAR2]

Calibration gain register C

Menu 15 - Process Data (Only MCP)

Output 1 Set	[MCP ONLY]	*AL0*	[OUT1S]

Set value for digital output 1

Output 2 Set	[MCP ONLY]	*AL0*	[OUT2S]

Set value for digital output 2

Digital Input 1 Status	[MCP ONLY]	*AL0*	[DIN1S]

Digital input 1 status read

Flow Rate Full Scale in Chosen Units	[MCP ONLY]	*AL0*	[FRFSN]

Flow rate full scale range number

Flow Rate Value Percentage	[MCP ONLY]	*AL0*	[FRVPC]

Flow rate value in percentage

Flow Rate Value Percentage Without Cut-off	[MCP ONLY]	*AL0*	[FRVPX]

Flow rate in percentage without cut-off

Flow Rate Value Binary Without cut-off	[MCP ONLY]	*AL0*	[FRVBX]

Flow rate in binary without cut-off

Flow Rate Value Technical Unit	[MCP ONLY]	*AL0*	[FRVTU]

Flow rate value in unit of measure

Volume Totalizer Total Positive Value	[MCP ONLY]	*AL0*	[VTTPV]

Totalizer T+ read value

Menu 15 - Process Data (Only MCP)

Volume Totalizer Partial Positive Value	[MCP ONLY]	*AL0*	[VTPPV]

Totalizer P+ read value

Volume Totalizer Total Negative Value	[MCP ONLY]	*AL0*	[VTTNV]

Totalizer T- read value

Volume Totalizer Partial Negative Value	[MCP ONLY]	*AL0*	[VTPNV]

Totalizer P- read value

Volume Totalizer Total Positive Overflow	[MCP ONLY]	*AL0*	[VTTPO]

Totalizer T+ number of overflows

Volume Totalizer Partial Positive Overflow	[MCP ONLY]	*AL0*	[VTPPO]

Totalizer P+ number of overflows

Volume Totalizer Total Negative Overflow	[MCP ONLY]	*AL0*	[VTTNO]

Totalizer T- number of overflows

Volume Totalizer Partial Negative Overflow	[MCP ONLY]	*AL0*	[VTPNO]

Totalizer P- number of overflows

CPU Temperature	[MCP ONLY]	*AL0*	[CPUTP]

CPU temperature

Liquid Velocity	[MCP ONLY]	*AL0*	[LQVEL]

Liquid velocity

Average Process Data Samples Number	[MCP ONLY]	*AL0*	[AVGSN]

Number of samples for averaged values

Alarm Status	[MCP ONLY]	*AL0*	[ALARM]

Active alarm(s) status

Sensor Test Result Code	[MCP ONLY]	*AL0*	[STSRC]

Sensor test result code

Main Power Status	[MCP ONLY]	*AL0*	[MPWRS]

Status of main power supply

Input Resistance	[MCP ONLY]	*AL0*	[INRES]

Equivalent Input resistance

Menu 15 - Process Data (Only MCP)

Input Voltages	[MCP ONLY]	*AL0*	[INVLS]

Electrodes input voltages

Sequence Number	[MCP ONLY]	*AL0*	[SEQNB]

This function allows to create a random sequential number to identify the MCP reply messages and verify that the messages are sent in the right sequence. The user can combine to MCP comand the command SEQNB=n, with a different n to every sent command.

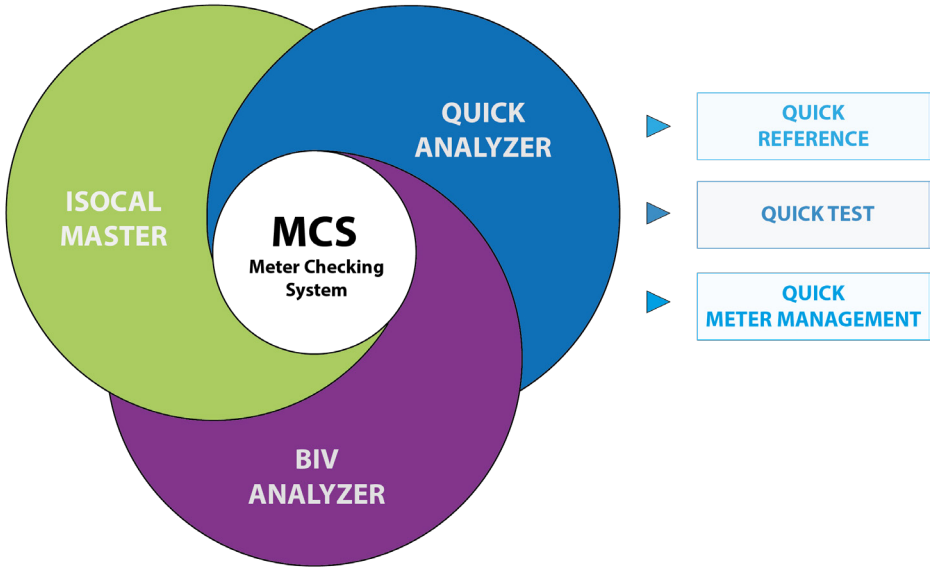
The reply that the meter will give, will include the same SEQNB sent number, so you can correctly match each reply with the respective request, maintaining control of the messages time line. With this function you can also monitor if there are missed messages or messages that have not been answered by the device.

Sensor Table Version	[MCP ONLY]	AL0	[STBLV]

Sensor's table version

MCS Software

Meter Checking System (MCS) Is a modular system that provides diagnostic activities. The system Is made up of multiple components: the enabled functions depend on the connected instrument..



MCS for FM300

When a FM300 is connected to MCS is possible to use only the section related to Quick analyzer (Blu section).

See the MCS software manual for more information.

Alarm Messages (Causes and actions to be taken)

Message	Causes	Action To Take
NO ALARMS	All works regularly	---
[000] SYSTEM RESTART	---	---
[005] F-RAM ERROR	Error writing / reading Flash-RAM	Contact the service
[006] EXCITATION ERROR	The circuit powering the sensor coils is interrupted/ open.	Check the connecting cables to the sensor.
[007] SIGNAL ERROR	The measure is strongly effected by external noise or the cable connecting the converter to the sensor is broken.	Check the status of the cables connecting the sensor, the grounding connections of the devices and the possible presence of noise sources.
[008] PIPE EMPTY	The measuring pipe is empty or the detection system has not been properly calibrated.	Check whether the pipe is empty or repeat the empty pipe calibration procedure.
[009] FLOW>MAX+	The flow rate is higher than the maximum positive threshold set.	Check the maximum positive flow rate threshold set and the process conditions.
[010] FLOW>MAX-	The flow rate is higher than the maximum negative threshold set.	Check the maximum negative flow rate threshold set and the process conditions.
[011] FLOW<MIN+	The flow rate is lower than the minimum positive threshold set.	Check the minimum positive flow rate threshold set and the process conditions.
[012] FLOW<MIN-	The flow rate is lower than the minimum negative threshold set.	Check the minimum negative flow rate threshold set and the process conditions.
[013] FLOW>FULL SCALE+	The flow rate is higher than the full scale positive value set on the instrument.	Check the full scale positive value set on the instrument and the process conditions.
[014] FLOW>FULL SCALE-	The flow rate is higher than the full scale negative value set on the instrument.	Check the full scale negative value set on the instrument and the process conditions.
[015] PULSE1>RANGE	The pulse generation output 1 of the device is saturated and cannot generate the sufficient number of impulses.	Set a bigger unit of volume or, if the connected counting device allows it, reduce the pulse duration value.
[016] PULSE2>RANGE	The pulse generation output 2 of the device is saturated and cannot generate the sufficient number of impulses.	Set a bigger unit of volume or, if the connected counting device allows it, reduce the pulse duration value.
[017] CALIBR.ERROR	Calibration Error	Contact the service
[018] SYSTEM FREQ.ERR	System Freq. Error	Contact the service
[019] B.DATA NOT INIT	Uninitialized data system	Contact the service
[020] FL.SENSOR ERROR	Flow rate sensor error	Contact the service

At the end of its lifetime, this product shall be disposed of in full compliance with the environmental regulations of the state in which it is located.

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