ISOIL ML210 CONVERTER
For use with
ELECTROMAGNETIC FLOWMETERS

ML210 CONVERTER MANUAL

Including Installation Instructions for

M/MS SERIES ELECTROMAGNETIC FLOWMETERS

CE

April 2005
VER 3.0x

ML 210 - Version X.XX
The software version is displayed when powering up the converter.

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INTRODUCTION

- This manual is an integral part of the product. Please read carefully since it contains important information for the safe use and maintenance of the equipment.
- The technical information and the relative products of this manual are subject to change without notice.
- The flow meter must be used for the use it has been built for. The improper use or tampering of the instrument or parts of it and substitutions of any components not original makes the warranty void.
- The manufacturer is considered responsible only if the instrument in used in its original configuration.

The manual is presented in two sections:

Section 1: **SENSORS**
Section 2: **CONVERTERS**

DECLARATION OF CONFORMITY

According to ISO / IEC Guide 22 and EN 45014
Product's name: **Electromagnetic flow meter**

Converter model: **ML100 – ML110 (HV, LV versions)**
Option: **all applicable**

Sensor model: **M501 - MS 501 - MS 1000 - MS 2410 - MS 2500 - MS 3700 - MS 3770**

ISOIL INDUSTRIA S.P.A. declares that the above-mentioned products satisfy the following requirements:

Safety: **EN61010**, dielectric strength = 4 kV, installation category II, IP67

EMC:

EN55011 (150 kHz – 30 MHz): Group 1, Class **B**
EN55011 (30 MHz – 1GHz): Group 1, Class **B**
IEC 1000-4-2: **6 kV** CD, **8 kV** AD
IEC 1000-4-3 (f = 80 MHz – 1 GHz, antenna at 3 m, AM modulation 1kHz 80%): **10 V/m**
IEC 1000-4-3 (f = 900MHz, antenna at 3 m, AM modulation 200 Hz 100%): **10 V/m**
IEC 1000-4-4: **4 kV** on all ports
IEC 1000-4-5: (**2kV** differential / 4kV common mode) on main supply port
IEC 1000-4-6 (f = 150 kHz – 80 MHz, AM modulation 1 kHz 80%): **10 V**
IEC 1000-4-11

INDEX

SAFETY

LEGEND

Dangerous voltage, may cause severe electric shock

General warning

Precautions

- Before using the instrument, always make a sure connection to ground.

- Avoid any attempt to repair the instrument. If the instrument is not functioning properly, please contact an authorized service center.

SECTION 1 - SENSORS

CONVERTER/SENSOR COMPATIBILITY CHART

		SENSORS							REMOTE UNIT	
		MS 500	MS 1000	MS 2410	MS 2500	MS 3700 MS 3770	MS 5000	MS 4000	MT 200	IF 2
CONVERTERS	ML 190	●	●	●	●	●	●		●	●
	ML 200	●	●	●	●	●	●			●
	ML 201	●	●	●	●	●	●			●
	ML 202	●	●	●	●	●	●			●
	ML 191	●	●	●	●	●	●		●	●
	ML 210	●	●	●	●	●	●			●
	ML 211	●	●	●	●	●	●			●
	ML 212	●	●	●	●	●	●			●
	ML 400 SA/HA							●		
	ML 100/110		●		● *(1)*	●	●		●	●
	ML 3 - F1	●		●					●	●

● COMPATIBLE COUPLING

(1) UP TO ND 400

DIAMETER SELECTION

The suitable nominal diameter can be determined by means of the table below.
The flow velocity is also determined by the fluid properties:

- For "aqueous" solutions, full-scale velocity should be within: 1 to 33 fps
- For fluids tending to form deposits within the measuring section velocity should be above 6.5 fps.
- For abrasive fluids the velocity must be less than 6.5 fps.

	MEASURING RANGE				
ND*	**min. 1 fps**	**max. 33 fps**	**ND***	**min. 1 fps**	**max. 33 fps**
1/8"	0.06 gpm	1.12 gpm	**12"**	341.8 gpm	11,213 gpm
1/4"	0.14 gpm	4.49 gpm	**14"**	465.2 gpm	15,262 gpm
1/2"	0.85 gpm	28.3 gpm	**16"**	607.6 gpm	19,934 gpm
3/4"	1.52 gpm	49.84 gpm	**18"**	768.9 gpm	25,229 gpm
1"	2.37 gpm	77.87 gpm	**20"**	949.4 gpm	31,147 gpm
1.5"	6.08 gpm	199.3 gpm	**24"**	1367 gpm	44,852 gpm
2"	9.49 gpm	311.5 gpm	**26"**	1604 gpm	52,639 gpm
3"	24.30 gpm	797.4 gpm	**30"**	2136 gpm	70,082 gpm
4"	37.97 gpm	1246 gpm	**34"**	2744 gpm	90,016 gpm
6"	85.44 gpm	2803 gpm	**38"**	3076 gpm	100,918 gpm
8"	151.9 gpm	4984 gpm	**42"**	4187 gpm	137,360 gpm
10"	237.3 gpm	7787 gpm	**48"**	5468 gpm	179,409 gpm

*ND = Nominal Diameter

INTERNAL DIAMETER OF SENSORS*

Sensor	ND	PTFE Lining
	1/8″	0.12″
MS 501	1/4″	0.24″
	1/2"	0.59"
	3/4"	0.75″
	1/8″	0.12″
	1/4″	0.24″
	1/2"	0.59"
MS	3/4"	0.75″
2410	1″	0.95″
	1.5″	1.50″
	2″	1.97″
	3″	2.84″
	4″	3.82″

Sensor	ND	Lining		
		PP	PTFE	Ebonite
MS 1000	1″	0.87″	0.91″	
	1.5″	1.34″	1.18″	
	2″	1.77″	1.89″	
	3″	2.91″	2.95″	
	4″	3.78″	3.90″	
	6″	5.91″	5.91″	
	8″		7.99″	7.99″
	10″		10.12″	10.12″
	12″		12.13″	12.13″
	14″		13.39″	13.39″
	16″		15.35″	15.35″

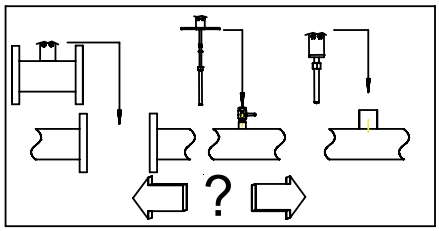
Sensor	DN mm	DN in	Lining (inches)						
			PP	PTFE					
				145 psi	230 psi	360 psi	580 psi	ANSI 150	ANSI 300
MS 2500	25	1	0.87		0.91		0.91	0.91	0.91
	40	1.5	1.34		1.18		1.18	1.18	1.18
	50	2	1.77		1.89		1.89	1.89	1.89
	80	3	2.91		2.95		2.95	2.95	2.95
	100	4	3.78		3.90		3.90	3.90	3.90
	150	6	5.91		5.91		5.91	5.91	5.83
	200	8		7.99	7.99	7.84	7.76	7.99	7.68
	250	10		10.12	10.12	9.97	9.88	10.12	9.80
	300	12		12.13	12.13	11.97	11.73	12.13	11.81
	350	14		13.39	13.39	13.15	12.99	13.39	12.80
	400	16		15.35	15.35	15.12	14.80	15.35	14.65
	450	18		17.28	17.21			17.28	16.65
	500	20		19.29	19.21			19.29	18.43
	600	24		23.23	23.23			23.23	22.05
	650	26						25.28	
	700	28		27.20	25.97				
	800	32		30.63					
	900	36		35.12					
	1000	40		38.98					

Sensor	DN mm	DN in	Lining (inches)						
			Ebonite						
			145 psi	230 psi	360 psi	580 psi	925 psi	ANSI 150	ANSI 300
MS 2500	25	1							
	40	1.5							
	50	2							
	80	3							
	100	4							
	150	6							
	200	8	7.99	7.99	7.84	7.76	7.60	7.99	7.68
	250	10	10.12	10.12	9.97	9.88	8.98	10.12	9.80
	300	12	12.13	12.13	11.97	11.73	10.67	12.13	11.81
	350	14	13.39	13.39	13.15	12.99	11.81	13.39	12.80
	400	16	15.35	15.35	15.12	14.80	13.54	15.35	14.65
	450	18	17.28	17.21				17.21	16.65
	500	20	19.29	19.21				19.21	18.43
	600	24	23.23	23.23				23.23	22.05
	650	26						7.99	
	700	28	27.20	25.97					
	800	32	30.63						
	900	36	35.12						
	1000	40	38.98						

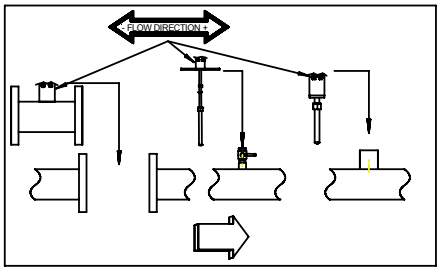
* Internal diameter is approximate and may vary with liner material thickness. ALL sensors are wet calibrated to measure proper flow volume despite variations in liner thickness. The Ka factor shown on the sensor label compensates each sensor for proper flow volume regardless of ID variations.

GENERAL INSTALLATION INFORMATION

Flow direction

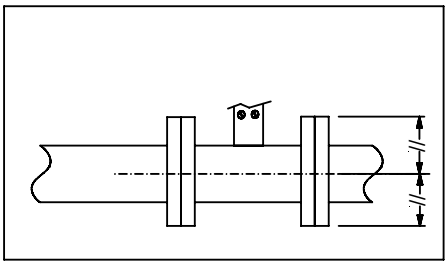


Before installing the sensor determine the direction of the liquid in the pipe.

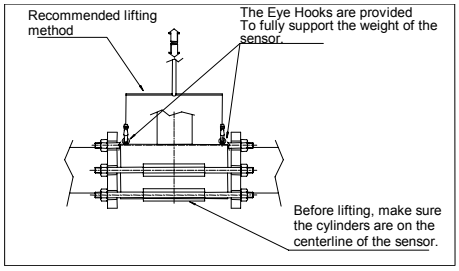


The sign of the flow rate is positive, when the flow direction is moving from – to + as printed on the direction tag.

If after installation it becomes necessary to reverse the sign of the flow, it is sufficient to reverse the sign of the coefficient (Ka). See the converter instructions in section 1 of this manual.



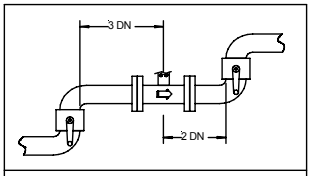
Before tightening the flange nuts make sure that the ends of the sensor are coaxial to those of the pipe.



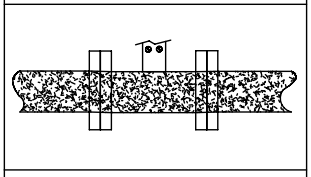
Method of lifting recommended for all sensors equipped with eyebolt.
For the MS 1000 sensor we recommend the use of centering cylinders (available on request).

M501, MS500-1000-2410-2500

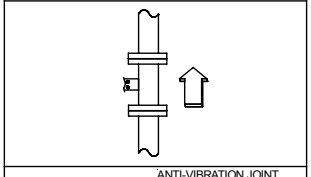
ALWAYS



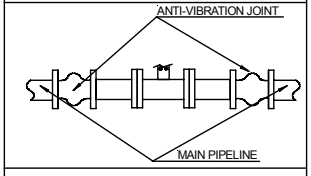
Install the sensor away from curves and hydraulic accessories.



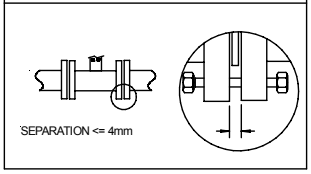
During operation the pipe must be completely full of liquid, or completely empty.



For vertical installations it is preferable to have an ascending flow.

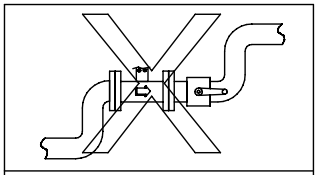


For installations in long pipelines, please use anti-vibration joints.

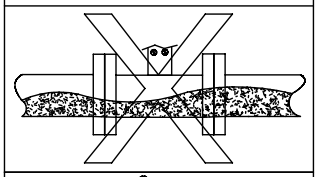


Before tightening the nuts bring the flange of the piping and the flange of the sensor as close as possible.

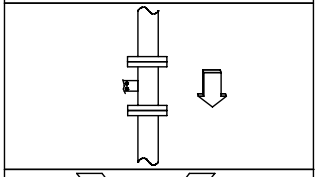
AVOID



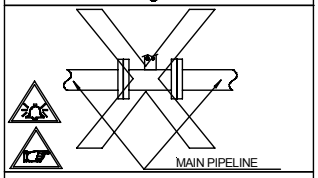
Avoid installation near curves or hydraulic accessories.



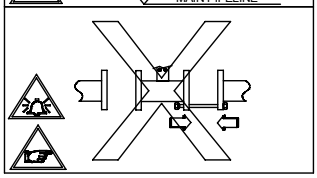
Avoid use with the pipe partially empty.



For vertical installations with descending flow direction contact the manufacturer



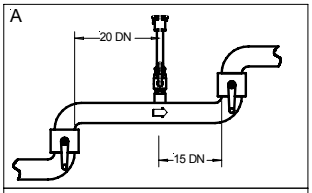
Avoid the installation of the sensor in a long pipeline, without any support of the same.



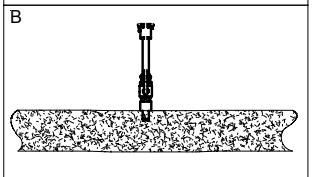
Avoid drawing the flange and counter flange together using the closing force of the nuts.

MS 3700-3770

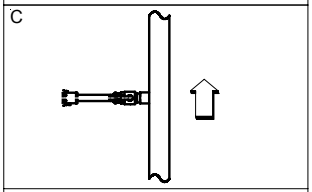
ALWAYS



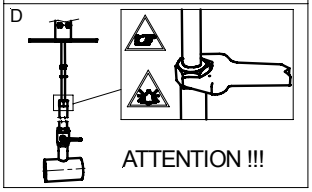
Install the sensor away from curves and hydraulic accessories.



During operation the pipe must be completely full of liquid, or completely empty.

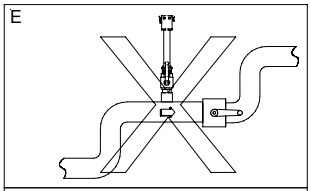


For vertical installations it is preferable to have an ascending flow.

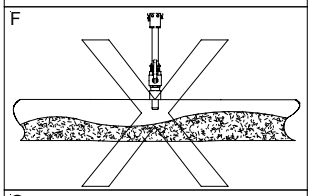


Before opening the ball valve tighten the fixing nut.

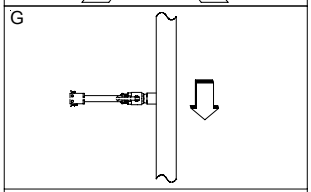
TO AVOID



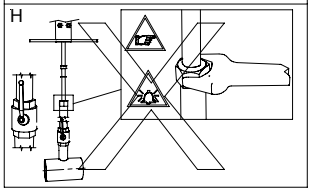
Avoid installation near curves or hydraulic accessories.



Avoid operation with the pipe partially empty.



For vertical installations with descending flow direction contact the manufacturer.



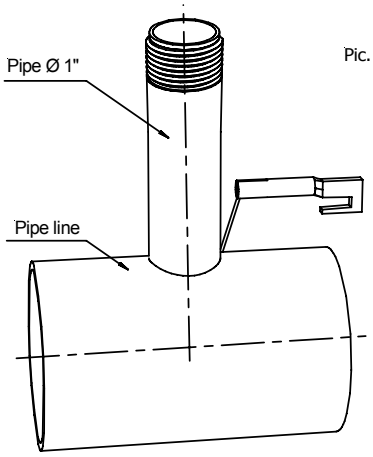
Opening the ball valve before tightening the fixing nut could cause the expulsion of the sensor from the pipeline.

The illustrations in figures A-B-C-E-F-G are also valid for the MS 3770 insertion sensor.

MS 3770 SENSOR POSITIONING

1

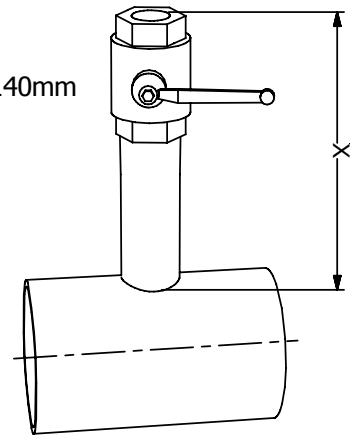
Pic. 1



- Weld a 1"Ø pipe to the pipeline. ATTENTION: verify "X" dimension (pic. 2).

2

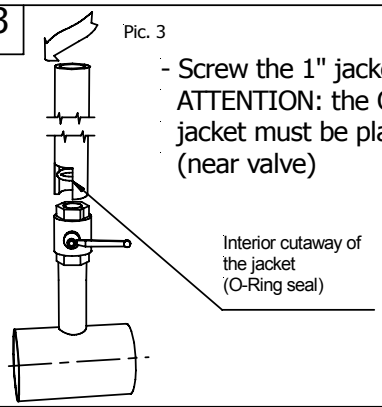
Pic. 2



Screw the valve Ø 1" to the welded pipe

3

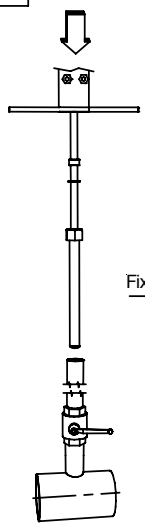
Pic. 3



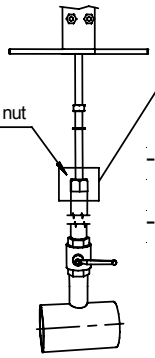
- Screw the 1" jacket to the valve ATTENTION: the O-Ring in the jacket must be placed underside (near valve)

4

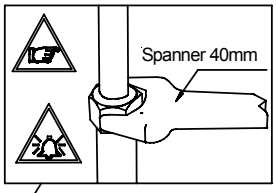
Pic. 4



Pic. 5



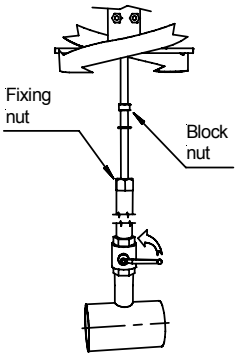
Pic. 6



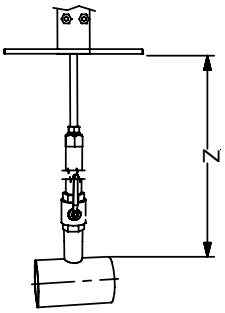
- Insert the sensor with valve closed
- Tighten the fixing nut with wrench (pic. 6)

5

Pic. 7

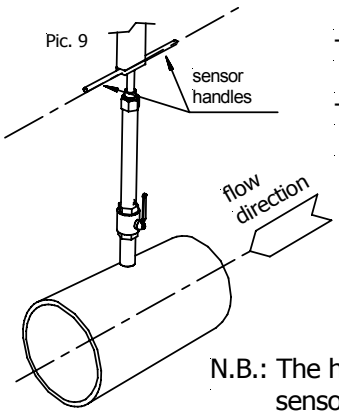


Pic. 8



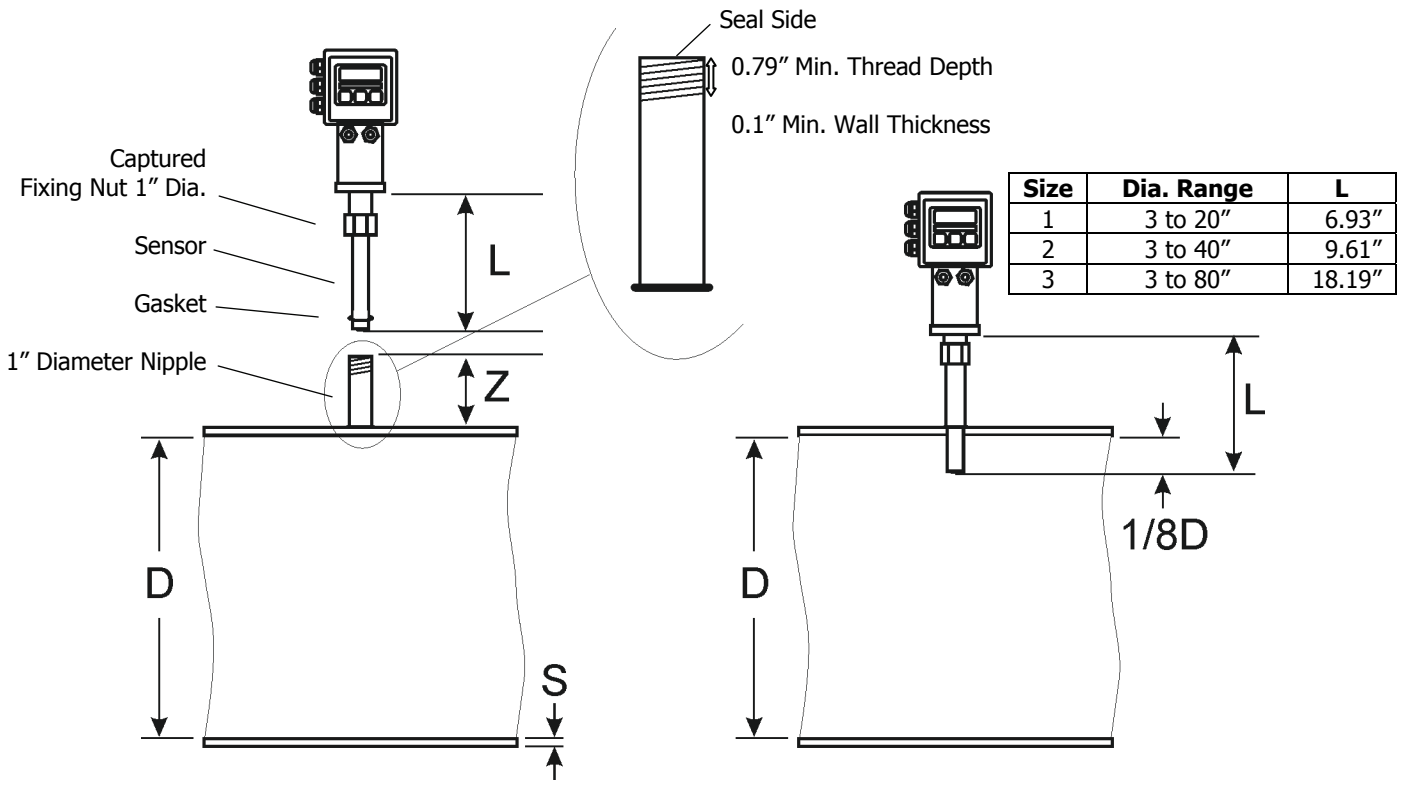
- Open the valve
- Screw the sensor up to "Z" dimension
- Verify that it lines up (pic. 9)
- Tighten the block nut mantaining the aligment

Pic. 9



N.B.: The handles of the insertion sensor are removeable

MS 3770 ASSEMBLY INSTRUCTIONS



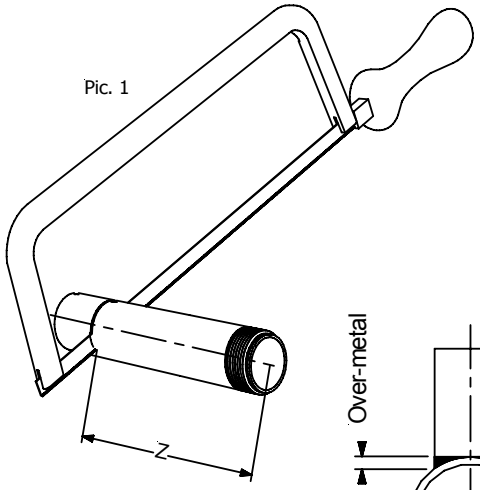
Size	Dia. Range	L
1	3 to 20"	6.93"
2	3 to 40"	9.61"
3	3 to 80"	18.19"

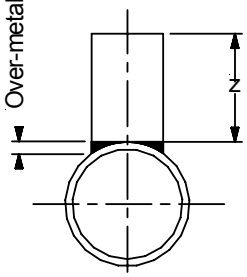
Z = L – S – 1/8D – 1.26"

Typical 3770 sensor installation using a pipe saddle. Shown here with integral ML110 Converter.

MS 3770 SENSOR POSITIONING

Pic. 1



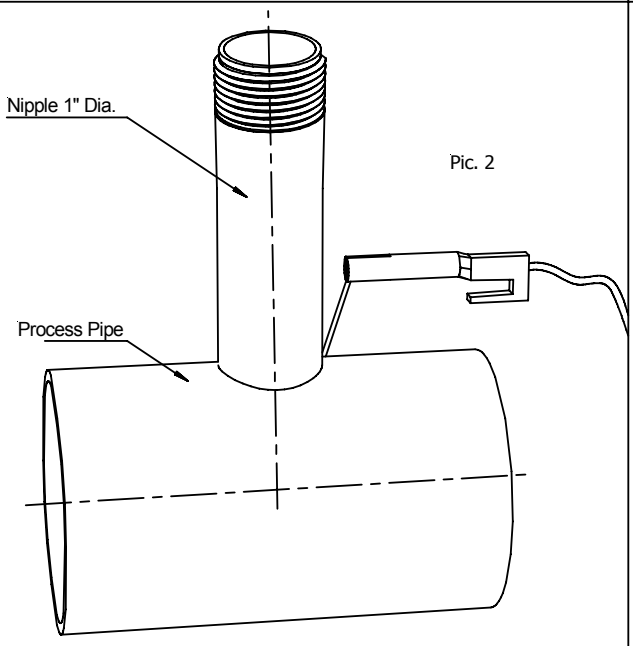


Cut the 1" installation nipple to the appropriate length ("Z") based on the following:

Z = L – S – 1/8D - 1.26

Where:
L=Sensor Length
S=Wall Thickness
D=Inside Dia. Of Process Pipe

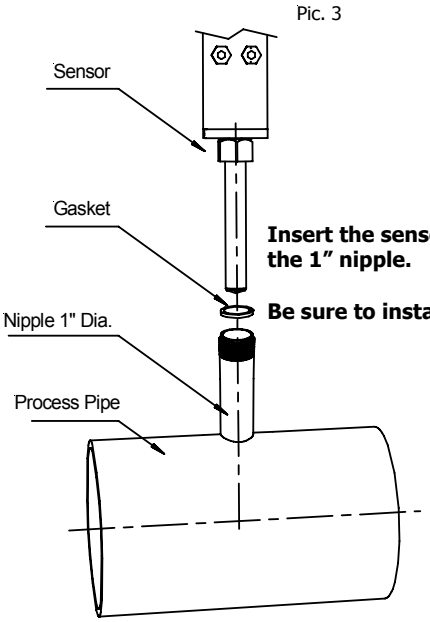
If the nipple is to be welded onto the process pipe leave one end unthreaded. For mounting on a Thread-O-Let or saddle both ends must be threaded.



Pic. 2

Weld the nipple to the process pipe (or thread it on if using a Thread-O-Let or saddle).

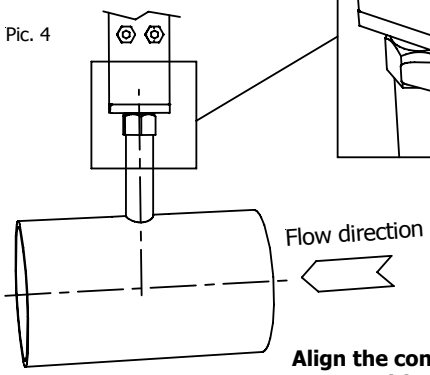
Pic. 3



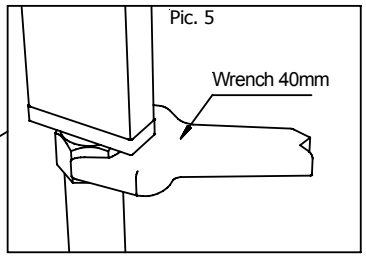
Insert the sensor through the 1" nipple.

Be sure to install the gasket.

Pic. 4

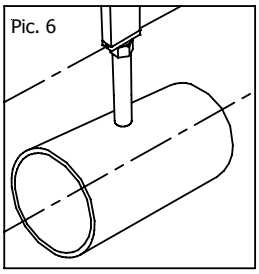


Pic. 5



Align the connector box on the sensor with the process pipe as shown in pic. 6.

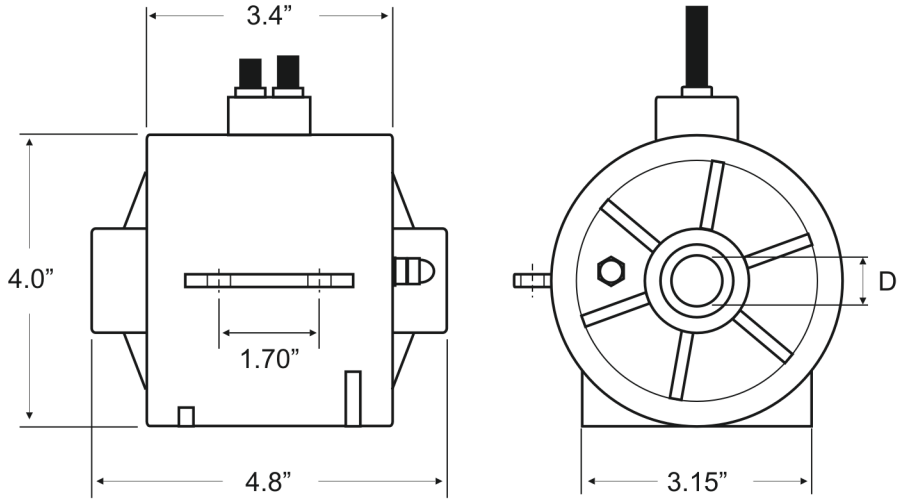
Pic. 6



Tighten the sensor fixing nut (pic. 5) while maintaining the alignment of the sensor.

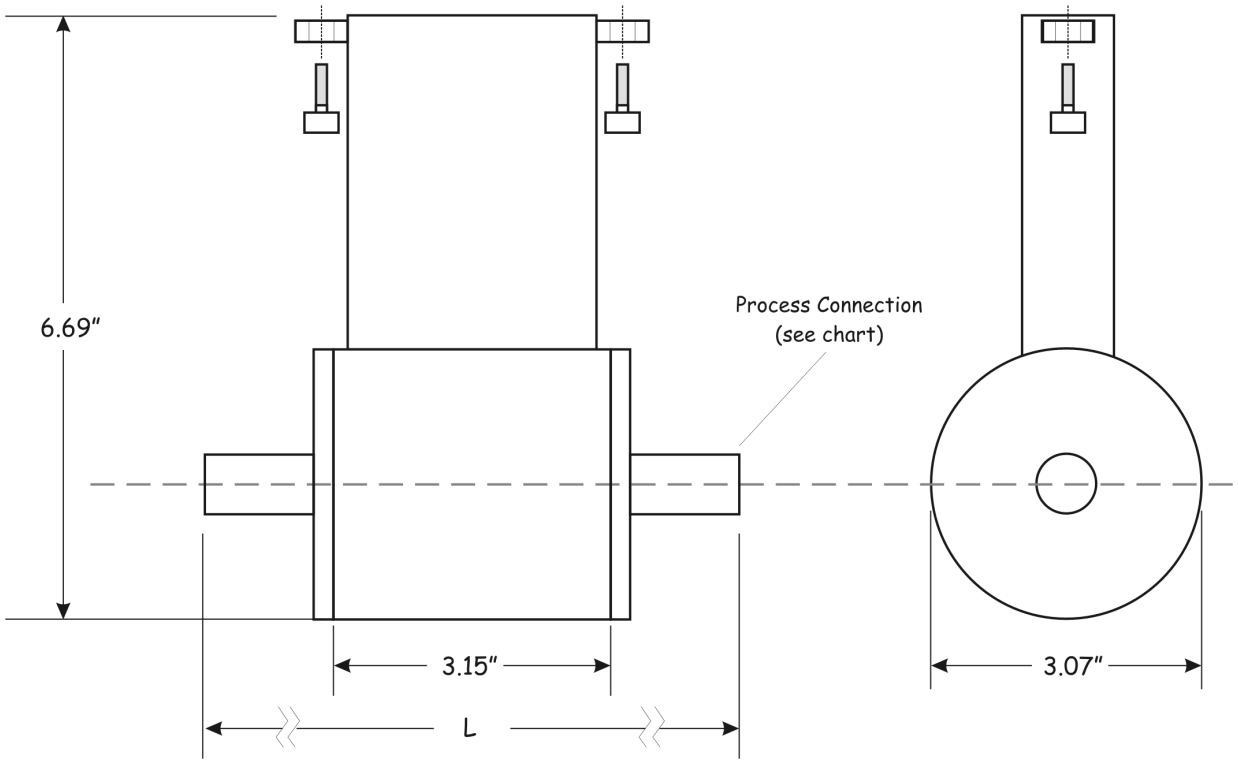
The sensor fixing nut must be tightened sufficiently to seal the gasket.

M501 OVERALL DIMENSIONS



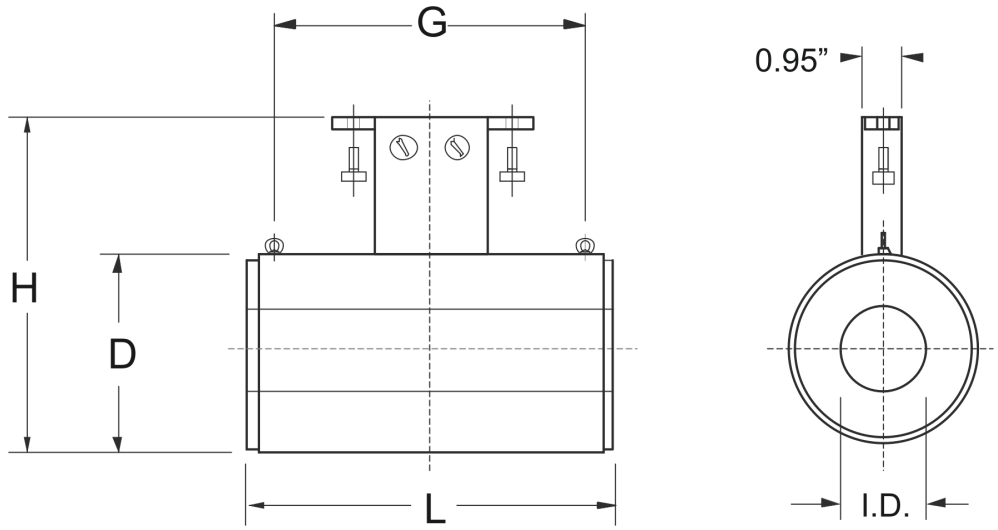
	Sensor Size (D above)				
CHARACTERISTICS	**1/8"**	**1/4"**	**1/2"**	**3/4"**	**1"**
Minimum Flow (gpm @ 1 ft/s)	.06	0.14	0.85	1.52	2.37
Maximum Flow (gpm @ 33 ft/s)	1.12	4.49	28.03	49.84	77.87
Process Connectors (FNPT)	1/4"	3/8"	3/4"	3/4"	1"

MS501 OVERALL DIMENSIONS



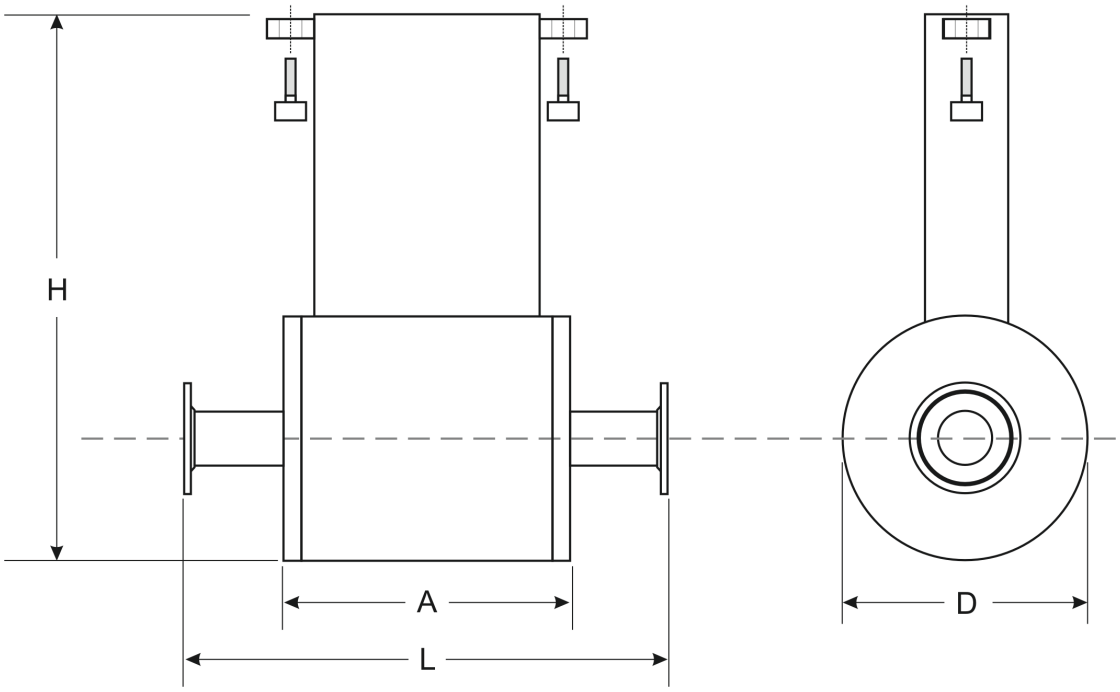
	Sensor Size				
CHARACTERISTICS	**1/8"**	**1/4"**	**3/8"**	**1/2"**	**3/4"**
Min flow rate (gpm @ 1 ft/sec)	0.034	0.14	0.38	0.85	1.52
Max flow rate (gpm @ 33 ft/sec)	1.12	4.49	12.46	28.03	49.84
Weight (lbs.)	4.85	4.85	4.85	4.85	4.85
Length (L above) w/Tri-Clamp Fittings	5.00	5.00	5.00	5.00	5.00
Length (L above) w/NPT Fittings	4.72	4.72	4.72	4.72	4.72

MS1000 OVERALL DIMENSIONS



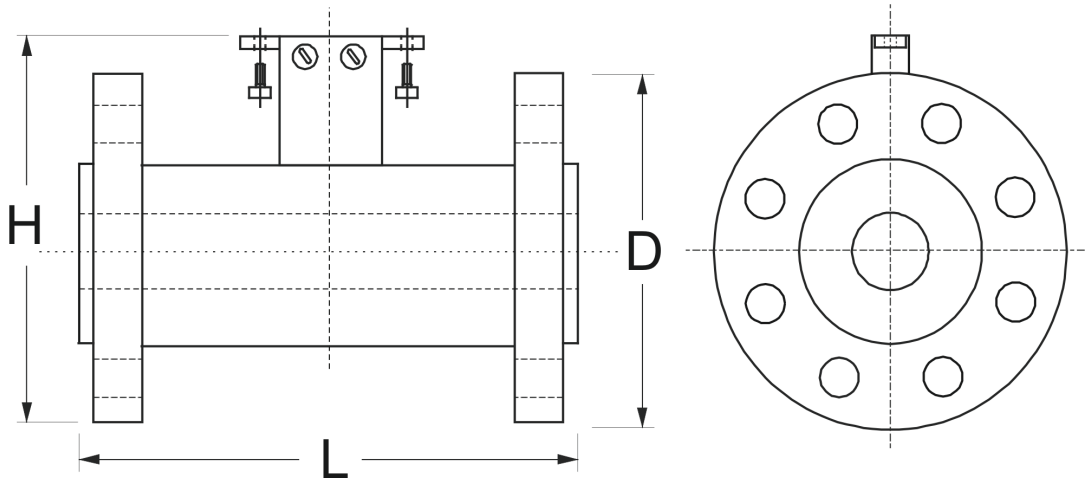
	Sensor Size										
CHARACTERISTICS	1″	1-1/2″	2″	3″	4″	6″	8″	10″	12″	14″	16″
Min flow rate (gpm @ 1 ft/sec)	2.37	6.08	9.49	24.30	37.97	85.44	151.9	237.3	341.8	465.2	607.6
Max flow rate (gpm @ 33 ft/sec)	77.9	199.3	311.5	797.4	1246	2803	4984	7787	11213	15262	19934
Weight (lbs.)	2.7	4.0	4.4	8.4	11.0	18.1	40.1	52.9	59.5	70.6	86.0
Length (L above)	3.94	3.94	3.94	5.91	5.91	7.09	7.87	9.84	11.81	13.78	15.75
Height (H above)	5.79	6.34	6.97	8.23	9.25	11.46	14.25	16.42	18.39	20.75	22.80
Lifting Ring Distance (G above)	-	-	-	-	-	-	5.67	7.64	9.61	11.58	13.54

MS2410 OVERALL DIMENSIONS



	Sensor Size									
CHARACTERISTICS	**1/8”**	**1/4"**	**3/8”**	**1/2"**	**3/4"**	**1”**	**1-1/2”**	**2”**	**3”**	**4”**
Min flow rate (gpm @ 1 ft/sec)	0.034	0.14	0.38	0.85	1.52	2.37	6.08	9.49	24.30	37.97
Max flow rate (gpm @ 33 ft/sec)	1.12	4.49	12.46	28.03	49.84	77.9	199.3	311.5	797.4	1246
Length (L above)	5.04	5.04	5.04	5.04	5.04	7.09	7.09	7.09	7.87	7.87
Height (H above)	6.96	6.96	6.96	6.96	6.96	6.69	7.48	8.19	9.21	9.21
Body Diameter (D above)	2.99	2.99	2.99	2.99	2.99	2.99	3.50	4.88	5.51	6.61
Body Length (A above)	3.03	3.03	3.03	3.03	3.03	3.94	3.94	3.94	3.94	3.94

MS2500 OVERALL DIMENSIONS



	SENSOR SIZE										
CHARACTERISTICS	**1″**	**1-1/2″**	**2″**	**3″**	**4″**	**6″**	**8″**	**10″**	**12″**	**14″**	**16″**
Min flow rate (gpm @ 1 ft/sec)	2.37	6.08	9.49	24.30	37.97	85.44	151.9	237.3	341.8	465.2	607.6
Max flow rate (gpm @ 33 ft/sec)	77.9	199.3	311.5	797.4	1246	2803	4984	7787	11,213	15,262	19,934
Length (L above)	7.87	7.87	7.87	7.87	9.84	11.81	13.78	17.72	19.68	21.65	23.62
Height (H above)	7.13	8.15	8.74	10.20	11.34	13.43	15.79	18.15	20.75	22.91	25.16
Flange Dia. (D above)	4.24	5.00	5.98	7.52	9.02	10.98	13.50	15.98	19.02	20.98	23.50

	SENSOR SIZE								
CHARACTERISTICS	**18″**	**20″**	**24″**	**26″**	**30″**	**34″**	**36″**	**42″**	**48″**
Min flow rate (gpm @ 1 ft/sec)	768.9	949.4	1367	1604	2136	2744	3076	4187	5468
Max flow rate (gpm @ 33 ft/sec)	25,229	31,147	44,852	52,639	70,082	90,016	100,918	137,360	179,409
Length (L above)	23.62	23.62	23.62	25.59	29.53	33.46	35.43	39.37	47.24
Height (H above)	25.16	29.57	34.09	36.26	40.63	45.24	47.48	54.37	58.66
Flange Dia. (D above)	23.50	27.52	32.01	34.25	38.74	43.74	45.98	52.99	57.28

SENSORS OPERATING TEMPERATURE

Maximum liquid temperature with converter mounted separately

SENSOR WITH EBONITE LINING								SENSOR WITH PP LINING								SENSOR WHITH PTFE LINING							
Liquid temp.				Amb. Temp.				Liquid temp.				Amb. Temp.				Liquid temp.				Amb. Temp.			
Min.		Max		Min.		Max		Min.		Max		Min.		Max		Min.		Max		Min.		Max	
°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
0	32	80	176	-5	23	60	140	0	32	60	140	0	32	60	140	-20	-4	150	302	-10	14	60	140

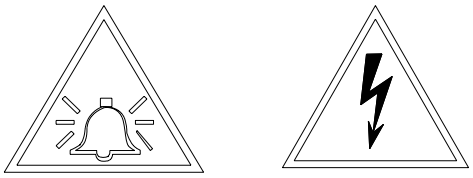
BEFORE STARTING UP THE INSTRUMENT PLEASE VERIFY THE FOLLOWING:

- Ground connections must be installed as described on the following pages.

VERIFY PERIODICALLY:

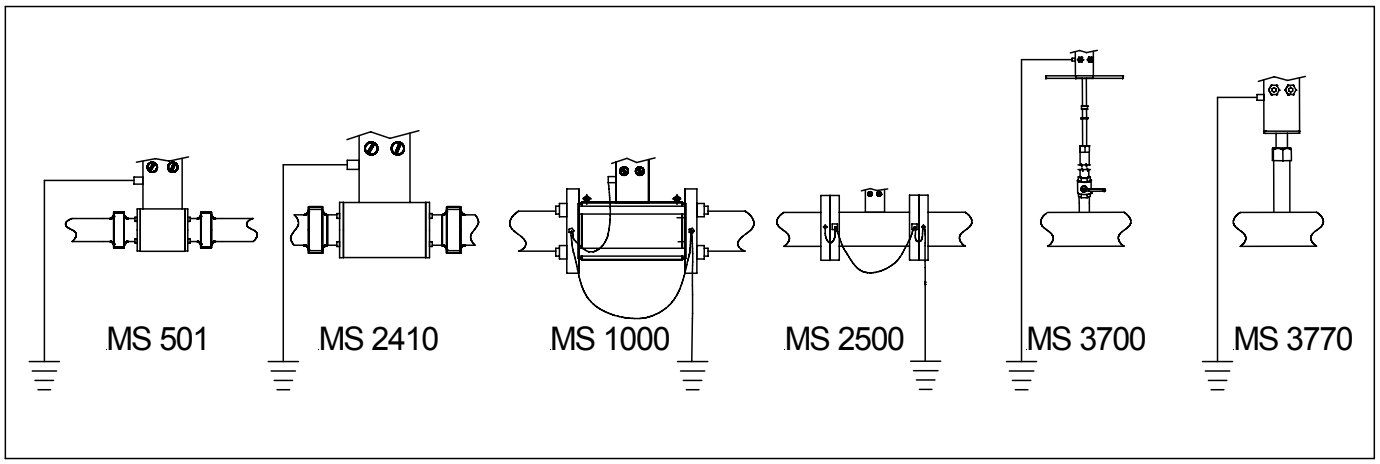
- The integrity of the power supply cables, wiring and other electrical parts connected.
- The tightening of the sealing elements (cable gaskets, covers, etc.)
- The mechanical mounting of the instrument on the pipe or on the wall stand.

GROUNDING INSTRUCTIONS



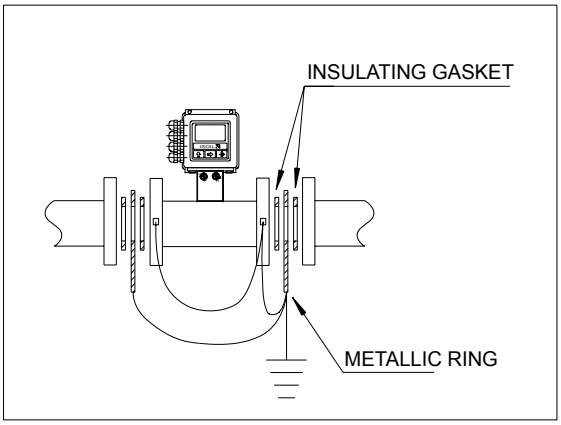
IMPORTANT: For correct operation of the meter ALWAYS connect the sensor and converter to ground.

Grounding with METALLIC (conductive) pipe



Grounding with INSULATED (non-conductive) pipe

For sensors MS501-1000-2500, in the installations listed below, see the following instructions:

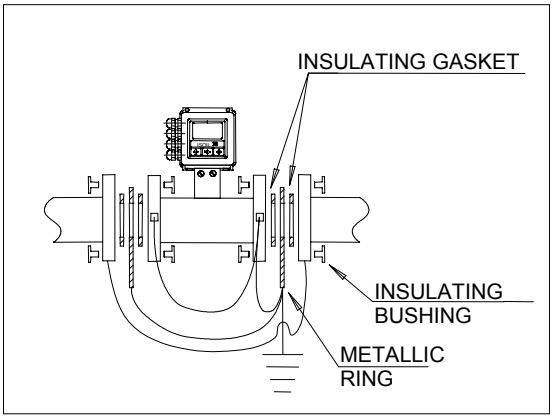


If the sensor has to be mounted on a pipe made of an insulating material, then for grounding purposes of the liquid there are two choices:

- Install two metallic grounding rings (available on request) between the sensor flanges and the counter flanges of the pipe line;

or:

- Use a sensor with the additional grounding electrode.

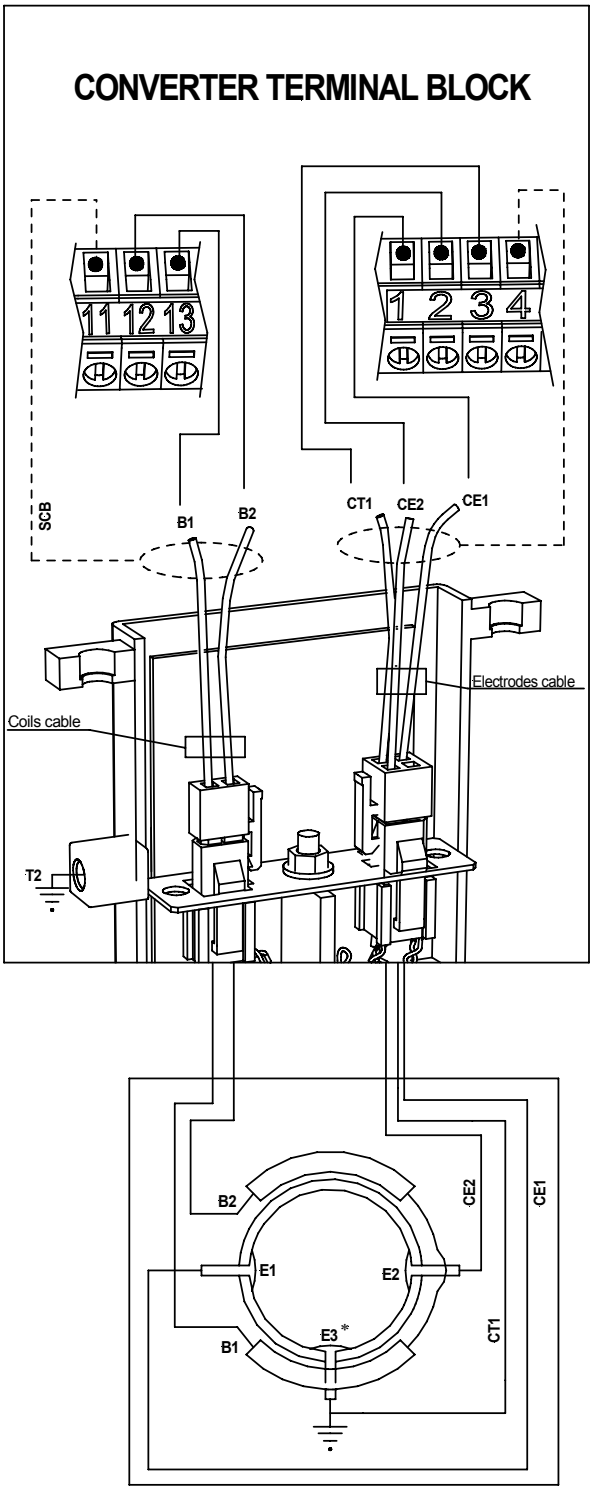


If the sensor must be install in the piping with cathode protection, some precautions should be taken:

- Grounding metallic rings should be provided to ground the liquid.

- The sensor should be insulated from the piping, using a gasket between the rings and the sensor and insulating bushings for the tightening tie rods.

VERIFICATION TEST OF ELECTRICAL SENSOR CONNECTIONS



CONTINUITY TEST

The test will verify the integrity of the conductors inside of the sensor.

Necessary tools:
- Multimeter

TEST	MEASURE		VALUE OF MEASURE
	TERMINAL 1	TERMINAL 2	
COILS	B1	B2	BETWEEN 50 AND 300 Ω
ELECTRODE	E1 E2 *E3	CE1 CE2 CT1	<0,5 Ω
COMMON	CT1	T2	<0,5 Ω
* Optional electrode			

INSULATION TEST

The test will verify the insulation of the electric circuits from metallic parts of the sensor.

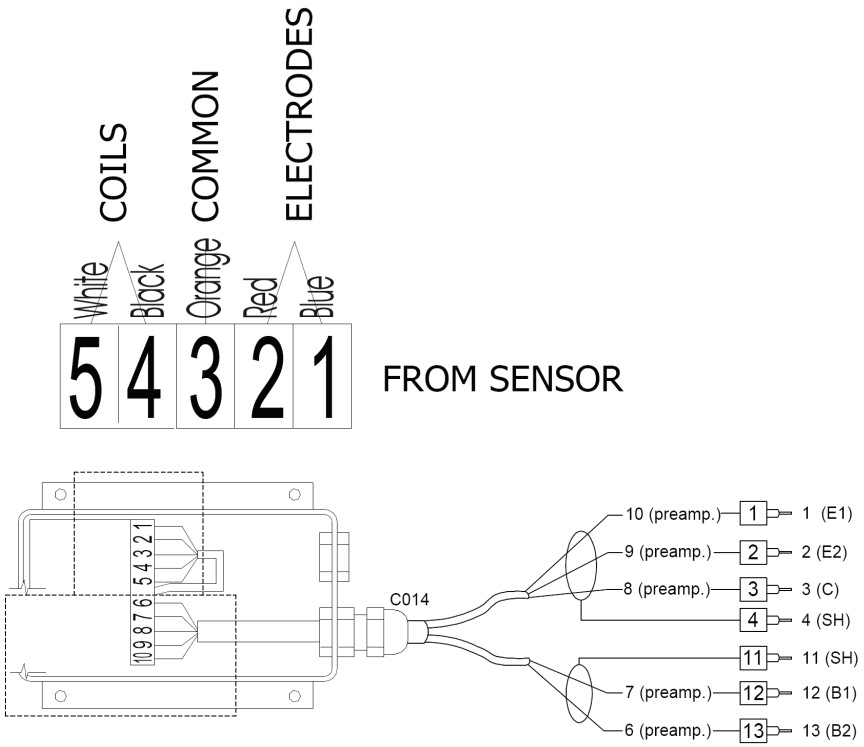
Necessary tools:

- Insulation meter (Megger)
  proof recommended voltage : 500Vdc
  measurable recommended resistance > 1999M Ω

TEST	MEASURE		VALUE OF MEASUREMENT
	TERMINAL 1	TERMINAL 2	
COILS	B1 B2	CT1	>1999 M Ω
ELECTRODES	CE1 CE2	CT1	>1999 M Ω
ELECTRODES/COILS CIRCUIT	CE1 CE2	B1 B2	>1999 M Ω
INSULATION SHIELD COILS CABLE	SCB	B1 B2 T2	>1999 M Ω
INSULATION SHIELD ELECTRODES CABLE	SCE	CE1 CE2 CT1 T2	>1999 M Ω

SAIT002C

OPTIONAL SENSOR PREAMPLIFIER WIRING



	OPERATING PRESSURE (PSI)									
Kpa	1000		1600			2500		4000		6400
psi	140		260			350		600		1000
ND	PTFE	EBONITE	PTFE	EBONITE	PP	PTFE	EBONITE	PTFE	EBONITE	EBONITE
1"			18		14	18		18		29
1.25"			32		21	32		32		39
1.5"			39		27	39		39		53
2"			50		38	50		50		60
2.25"			66		55	33		33		43
3"			39		30	39		39		46
4"			43		41	61		61		64
5"			57		52	83		83		109
6"			80		78	100		100		160
8"	109	91	73	61		99	83	132	110	172
10"	91	76	103	86		151	125	197	165	238
12"	105	88	129	108		148	124	205	171	234
14"	127	106	151	126		239	199	311	260	355
16"	160	134	208	173		314	262	457	381	460
18"	143	119	207	173						
20"	165	137	282	235						
24"	238	198	419	350						

Tighten uniformly in diagonally opposite sequence

The torques listed are applicable to flanges UNI 2223, DIN 2501, BS 4504, ANSI B16.5

The use of flange gaskets (DIN 2690) is required.

SECTION 2 – ML 210 CONVERTER

SAFETY

LEGEND

Dangerous voltage, terminals identified by this symbol are subject to variable voltages and cause electric shock

Dangerous voltage, may cause severe electric shock

General warning

Precautions

- Before using the instrument, always make a sure connection to ground

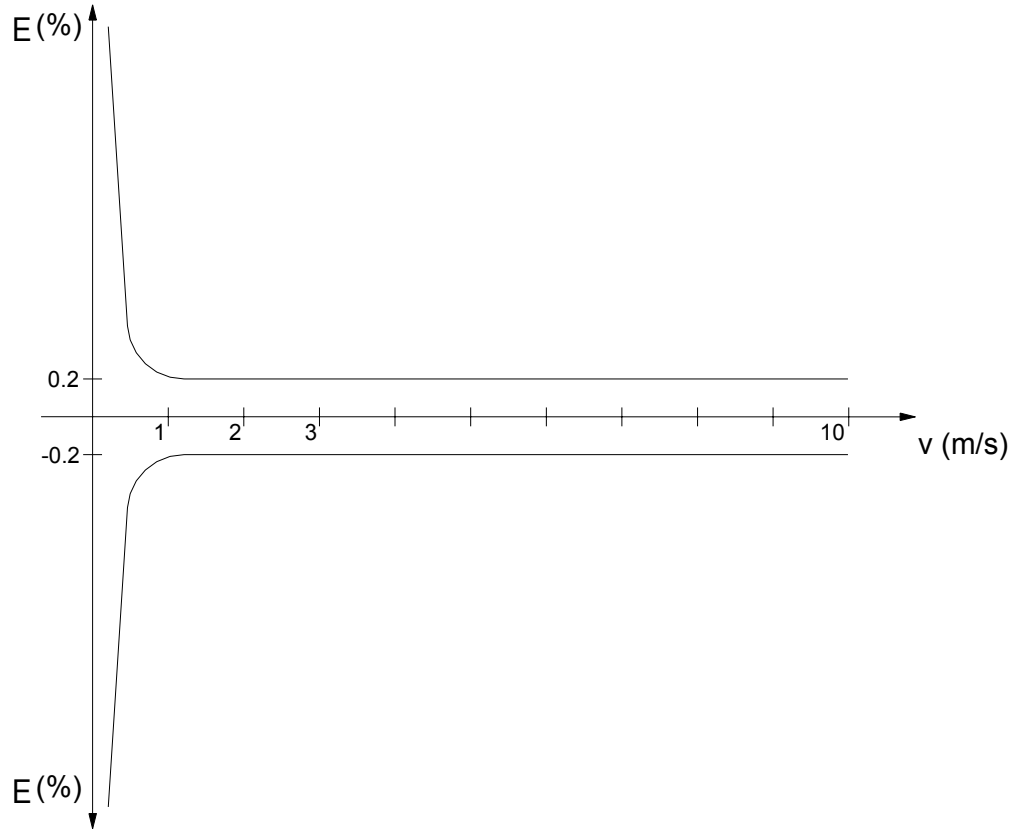
- Verify that the mains voltage is the same written on the tag plate of the converter

- Pay attention not to connect the power supply to the outputs or the other terminals

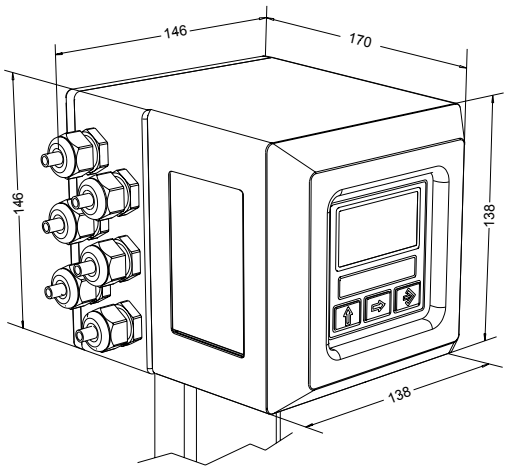
- When the electric connections are completed, close carefully the instruments rear cover

- Avoid any attempt to repair the instrument. If the instrument is not functioning properly, please call the nearest service center.

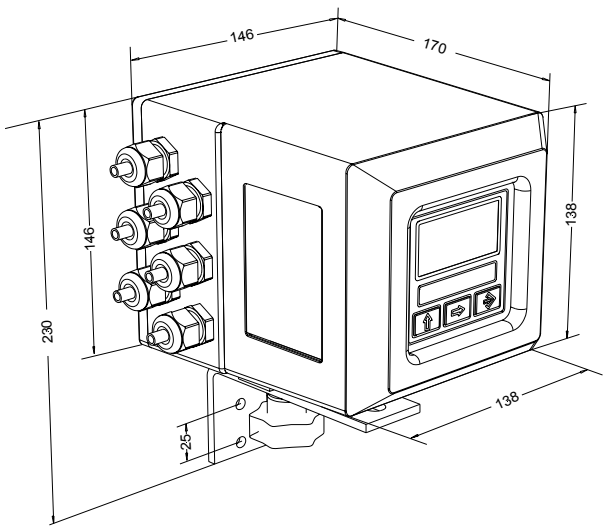
ERROR CURVE FOR ML 210 CONVERTERS



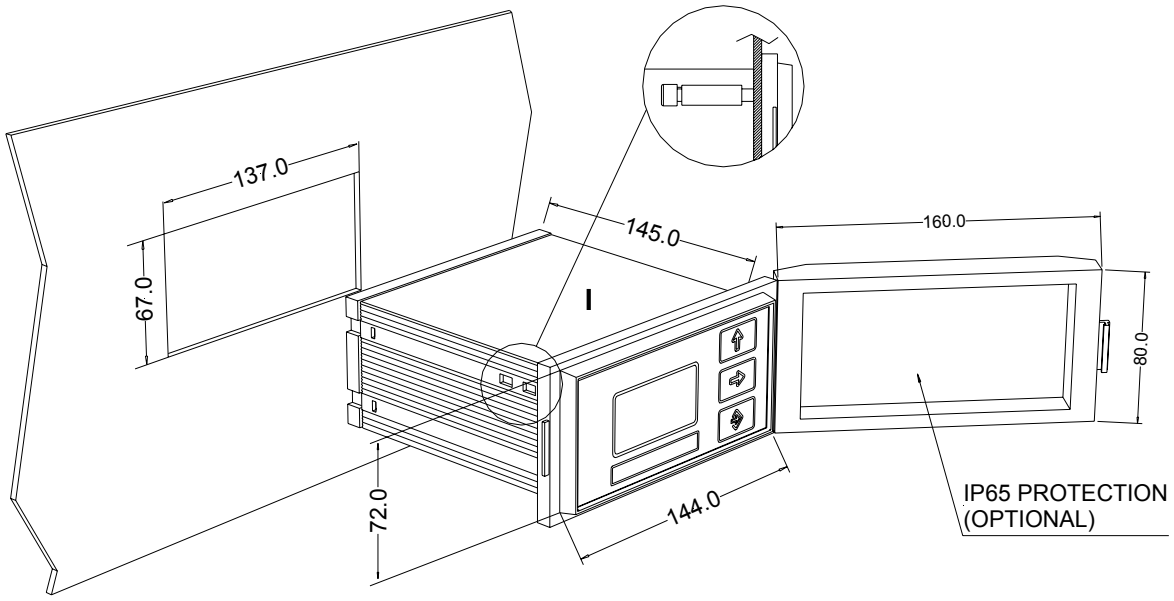
OVERALL DIMENSIONS OF CONVERTER ML210



Compact Version



Wall Mount Version



Panel Mount Version

ELECTRICAL CHARACTERISTICS

Classification of the instrument: class I, IP 65, category of installation II

Power supply version	Power supply voltage	Power supply frequency	Pmax	current max
HV	90-265 Vac	44-66 Hz	3W/5VA	35 mA
LV	11.5-60 Vdc 15-45 Vac	0-44-66 Hz	3W/5VA	300 mA
LLV	10-35 Vdc	na	20 W	1.5 A

Input/output isolation:

- Inputs and outputs are insulated up to 500V
- The 4-20 mA output (optional) is electrically connected to the ON/OFF outputs and with the power supply (24VDC) of the outputs.

ENVIRONMENTAL CONDITIONS OF USE

- The instrument can be installed inside or outside of buildings, but protect against direct sunlight exposure.
- Altitude: from –200 a 6000 m (from -656 to 19685 feet)
- Humidity range: 0-98%
- Line voltage range: (see table on technical characteristics)

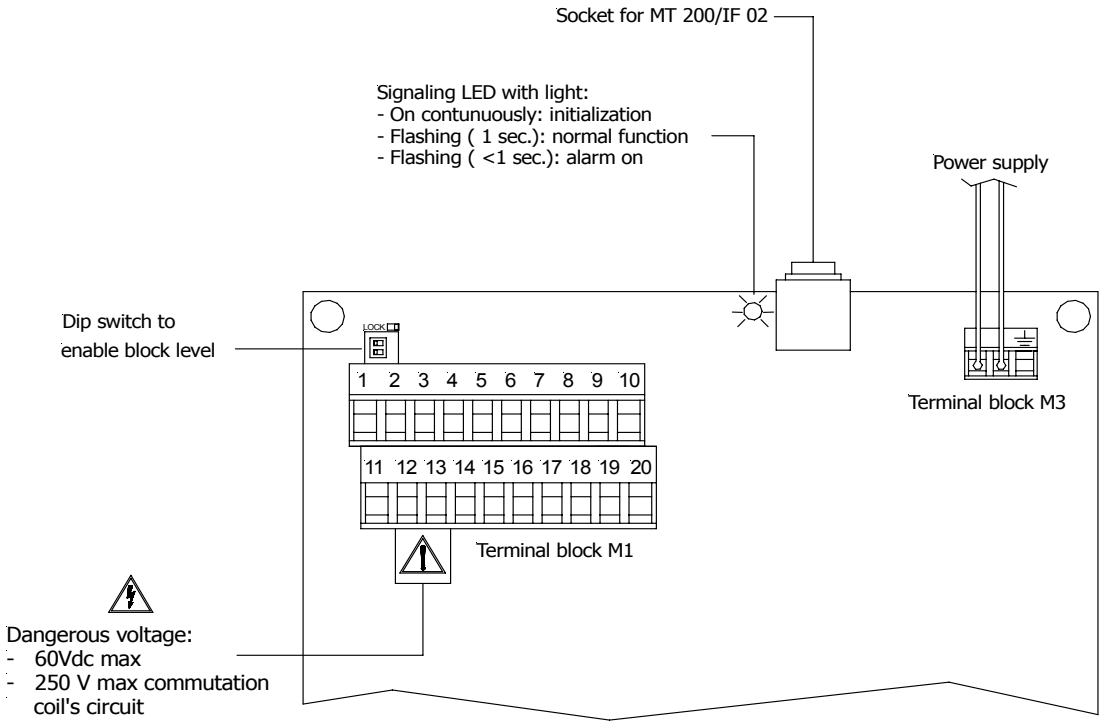
OPERATING TEMPERATURE OF THE CONVERTER

CONVERTER ML210			
Ambient Temperature			
Min.		Max	
°C	°F	°C	°F
-20*	-4*	60	140

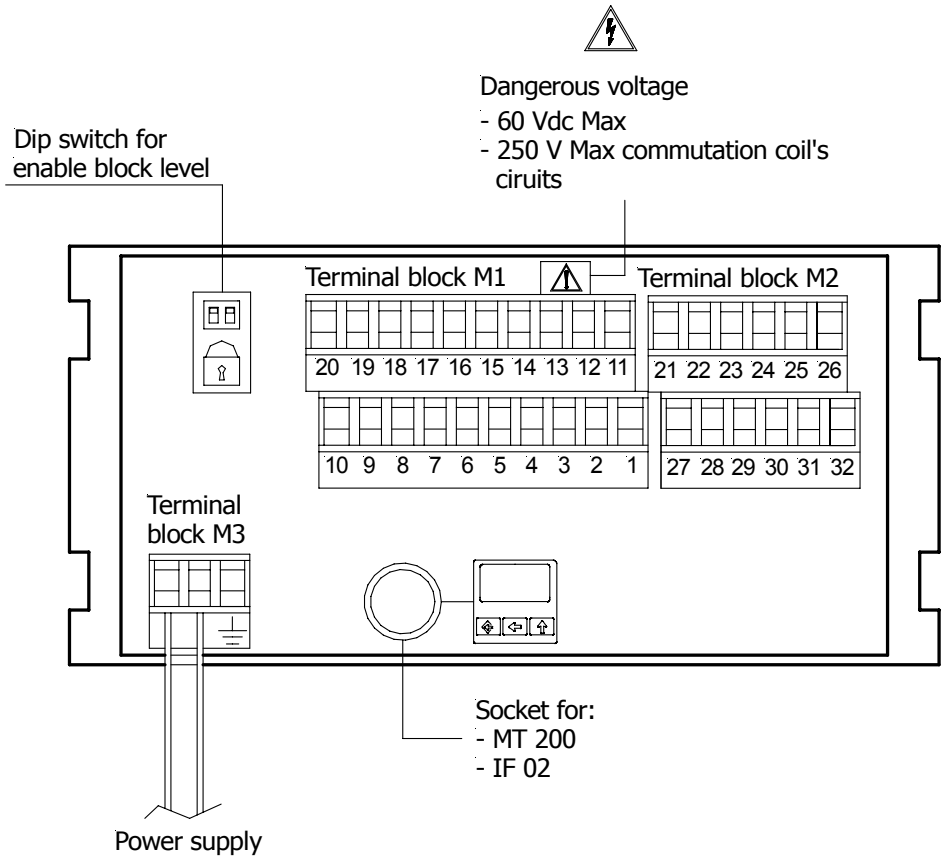
* For intermittent use, it is necessary to install a heater.

INTERNAL VIEW OF THE CONVERTER

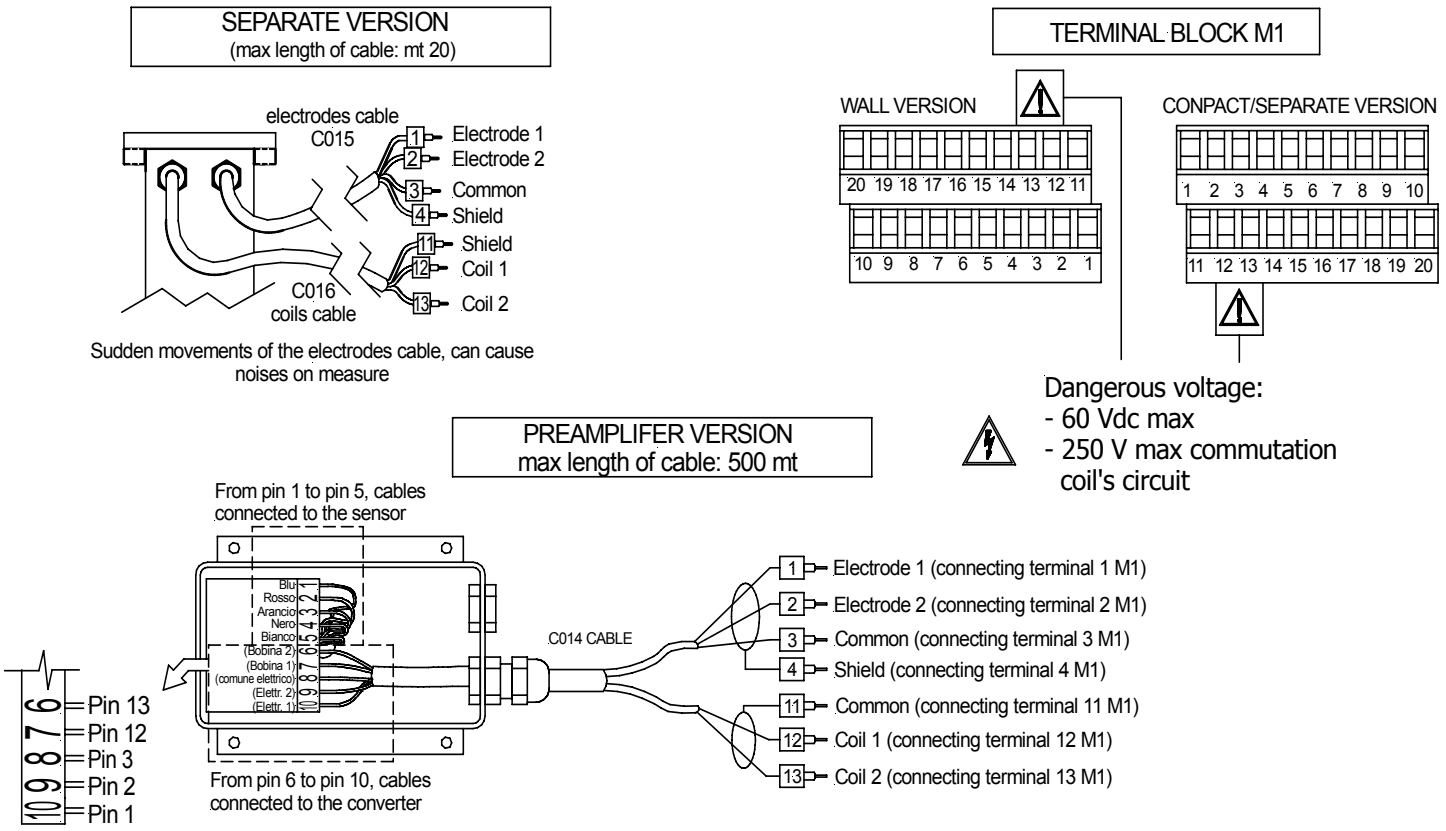
TERMINAL BLOCK M1 FOR COMPACT/SEPARATE VERSIONS



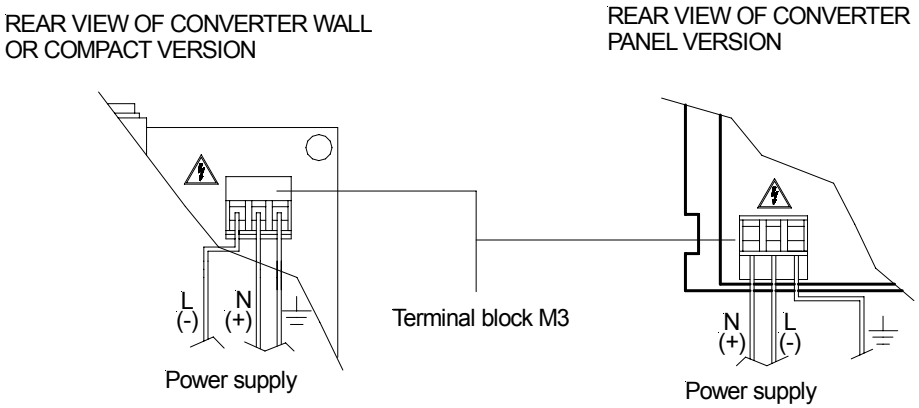
TERMINAL BLOCK M1 FOR PANEL VERSIONS



ELECTRICAL CONNECTIONS SENSOR-CONVERTER



CONVERTER POWER SUPPLY



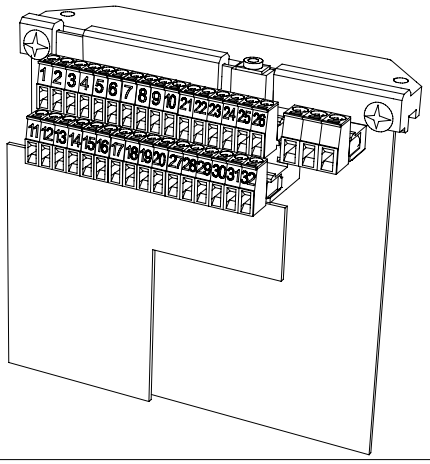
- Before connecting the power supply, verify that the main voltage falls between the limits indicated on the nametag plate.
- ***IMPORTANT: Converters on DC power supply line (LLV version: 10-35 Vdc) are not protected against reverse polarity.***
- Use only approved wiring conductors, with fireproof properties.
- The power supply line must be equipped with external current overload protection (fuse or automatic line breaker with limiting capacity not greater than 10 A).
- Provide in proximity to the instrument a circuit breaker that must be easily accessible from the operator and clearly identified.

Note: For information concerning the characteristics of the meter's power supply, see the section: Technical Characteristics.

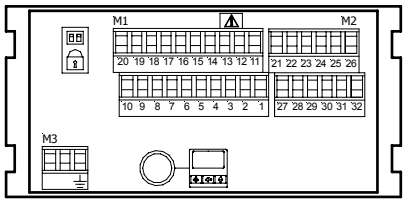
INPUT/OUTPUT

CONVERTER TERMINAL BLOCKS WITH MODULES
(EXCLUDED RELE MODULES)

SEPARATE/COMPACT

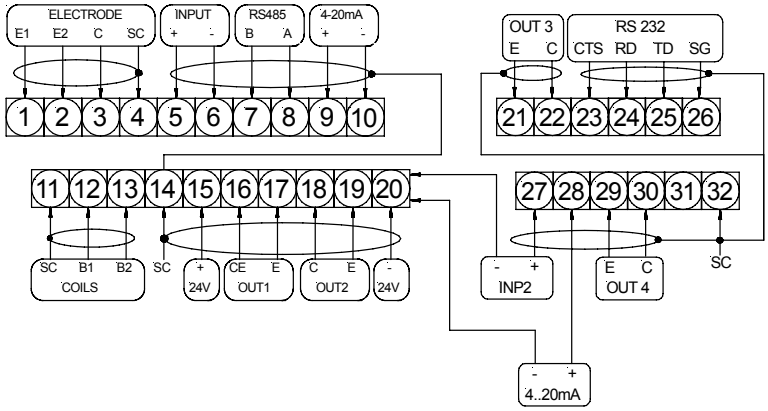


PANEL



OPTIONAL MODULES (NO RELAY MODULE)

ME200: 2 programmable on/off outputs
ME201: 1 programmable on/off output + 1 high frequency output
ME202: 1 0/4…20mA output + 2 programmable on/off output
ME203: 1 RS232 port + 2 programmable on/off outputs
ME204: 1 RS232 port + 2 programmable on/off outputs + 1 0/4…20mA output
ME220: see the manual

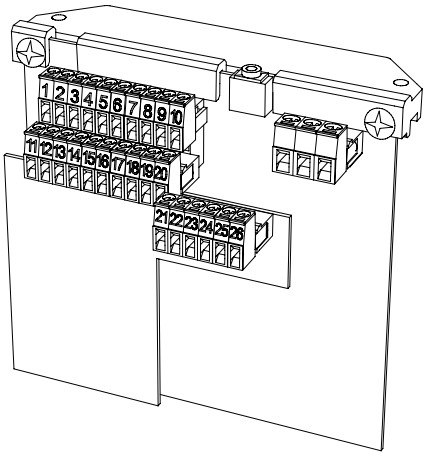


LEGEND:
SC: Cable shield, electrically connected to ground and to the housing.
CTS: Input terminal of the signal "CLEAR TO SEND" of the RS232 port.
RD: Input terminal of the signal "RECEIVE DATA" of the RS232 port.
TD: Output terminal of the signal "TRASMIT DATA" of the RS 232 port.
SG: Terminal "SIGNAL GROUND" common to all signals of the RS232 port.
C: Terminal connected to the collector of the transistor of the on/off output.

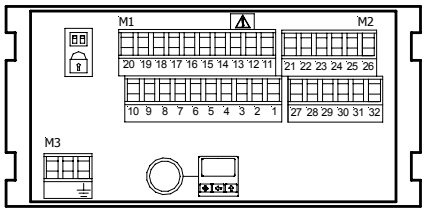
The module name is shown when powering on the converter.

CONVERTER TERMINAL BLOCKS WITH RELE MODULES

SEPARATE/COMPACT

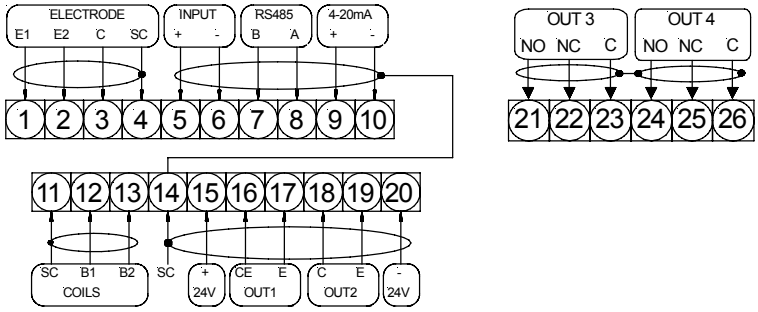


PANEL



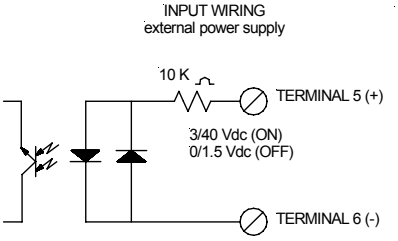
OPTIONAL RELAY MODULE

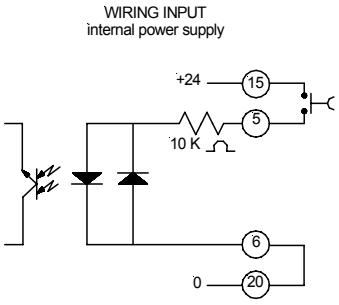
ME205: 2 relay outputs with 1 NO + 1 NC contact each, 2A 60Vac, 60W/125Va
ME207: 2 relay outputs with 1 NO + 1 NC contact each, 2A 250Vac, 60W/125Va



LEGEND:
SC: Cable shield, electrically connected to ground and to the housing.
C: Relay – common.
NC: Normally closed contact.
NO: Normally open contact.

INPUT OPERATION STAGE





Sampling Frequency	Tmin
10 Hz	220 ms
20 Hz	110 ms
50 Hz	45 ms
80 Hz	30 ms
150 Hz	15 ms

IMPORTANT: the time T must be ≥ to Tmin

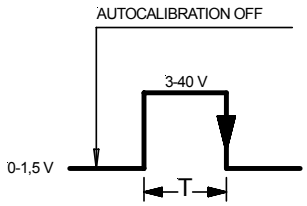
The input functions can be divided into three groups:

1) Only assignable functions to input 1.
2) Functions that act directly on the inputs independently from the selected input.
3) Only assignable functions to input 1 and only to input 2, which have interactions between them.

Remember that activation of any batch functions may automatically disable the operation of other functions. The list of such functions is shown in the Batch Section.

INPUT OPERATION STAGE (GENERIC FUNCTIONS)

AUTO-CALIBRATION FROM REMOTE INPUT



Tmin<T<1sec. = autocalibration
T > 1 sec. = Autozero

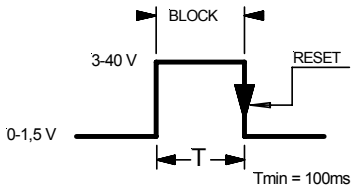
Necessary conditions for enable the function

POS. 5.7 ENABLED

POS. 5.9 (batch on input 1) DISABLED

POS. 5.10 batch functions assign to input 2 (optional) DISABLED

RESET TOTALIZER FROM REMOTE INPUT

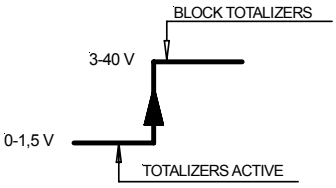


Necessary conditions for enable the function

POS. 5.1 ÷ 5.4 ENABLED at least one

This function is even assignable to the input 2

BLOCK TOTALIZERS FROM REMOTE INPUT



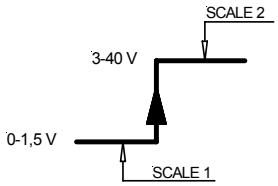
Necessary conditions for enable the function

POS. 5.6 ENABLED

POS. 12.5 (auto-batch) DISABLED

POS. 12.7 (batch consent) DISABLED

RATE CHANGE FROM REMOTE INPUT



Necessary conditions for enable the function

POS. 5.8 ENABLE

POS. 5.9 (batch on input 1) DISABLED

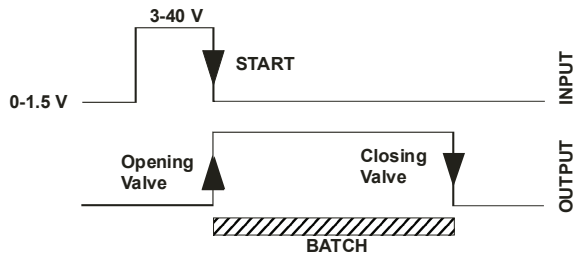
POS. 5.10 batch functions assign to input 2 (optional) DISABLED

POS. 6.1-6.4 end-batch functions assign to output 2 1 e/o 2 DISABLED

N.B.: THE FUNCTIONS POINT OUT ABOVE ARE ENABLED ONLY ON INPUT 1

OPERATION STAGE ON INPUT 1 OR 2 (BATCH FUNCTION)

START BATCH FROM REMOTE INPUT

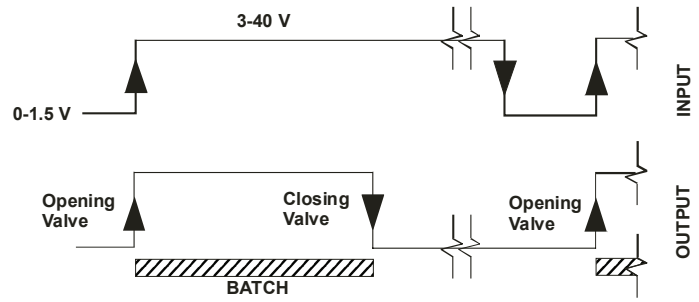


Necessary conditions to enable the function

POS 5.9 ENABLED or POS 5.10 on batch

POS 6.1 or 6.4 on end batch

START BATCH FROM CONSENT (REMOTE)



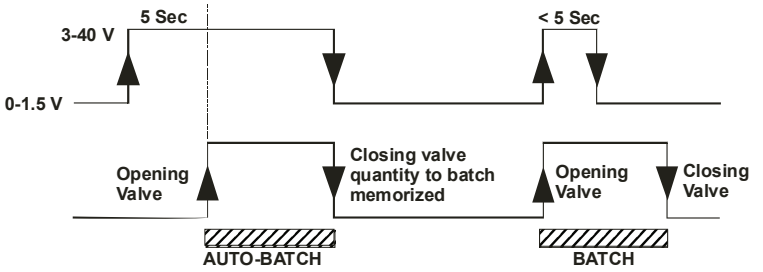
Necessary conditions to enable the function

POS 5.9 ENABLED or POS 5.10 on batch

POS 6.1 or 6.4 on end batch

POS 12.7 (CONSENT MODE) ENABLED

START BATCH FROM REMOTE INPUT WITH AUTO-BATCH ENABLED



Necessary conditions to enable the function

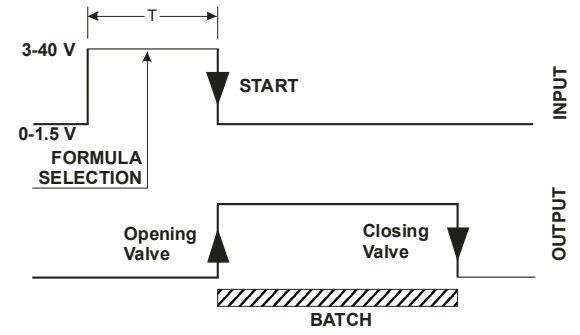
POS 5.9 ENABLED or POS 5.10 on BATCH

POS 6.1 or 6.4 on END BATCH

POS 12.5 (auto-batch) ENABLED

POS 12.7 (consent mode) DISABLED

START FROM REMOTE INPUT WITH AUTOMATIC SELECTION OF FORMULA 00/03



T= 100ms +/-5.0ms to select the formula 00
T= 200ms +/-5.0ms to select the formula 01
T= 300ms +/-5.0ms to select the formula 02
T= 400ms +/-5.0ms to select the formula 03

In case of Stop Batch from the remote input the time of the input pulse must be > 50ms

Necessary conditions to enable the function

POS 5.9 ENABLED or POS 5.10 on BATCH

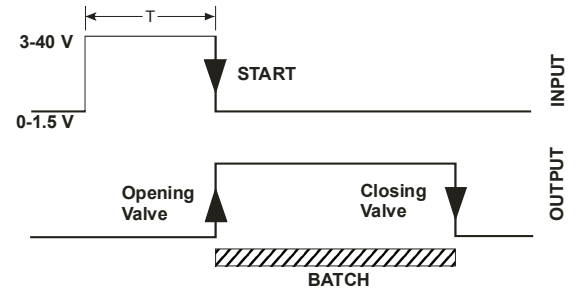
POS 6.1 or 6.4 on END BATCH

POS 12.6 (automatic selection of formula) ENABLED

POS 12.7 (consent mode) DISABLED

POS 5.10 function of formula selection 00/01 assigned to input 2 (optional) DISABLED

START BATCH FROM REMOTE INPUT 1
RESET T2 ENABLED ON REMOTE INPUT 1



T BETWEEN 1 AND 4 = RESET TOTALIZER
T<1 = START AND RESET TOTALIZER

Necessary conditions to enable the function

POS 5.9 (batch on input 1) ENABLED

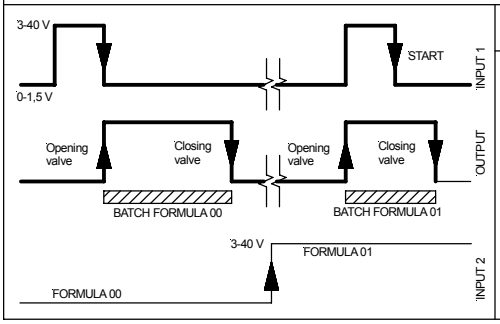
POS 6.1 or 6.4 on END BATCH

POS 5.2 (reset P+) ENABLED

N. B. THE ACTIVATION OF BATCH FUNCTIONS ON INPUT 2 PREVENTS THE ACTIVATION OF BATCH FUNCTIONS ON INPUT 1

OPERATION STAGE ON INPUT 1 AND 2 (BATCH FUNCTION)

**START BATCH ON RREMOTE INPUT 1 STOP FROM OUTOUT
SELECTION FORMULA 00 O 01 FROM REMOTE INPUT 2**



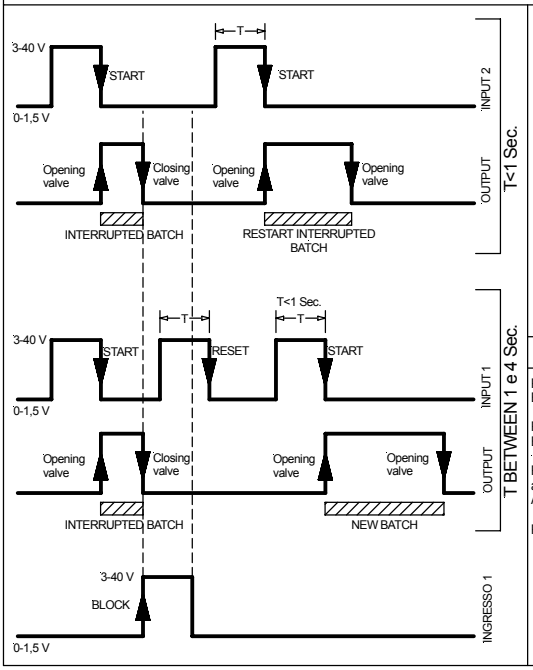
Necessary conditions for enable the function

POS. 5.9 ENABLED

POS. 6.1 or 6.4 on
AND BATCH

POS. 5.10 function of formula selection 00/01 assigned to input 2 (optional) ENABLED

**BLOCK TOTALIZER FROM REMOTE INPUT 1
START BATCH FROM REMOTE INPUT 2**



The block of totalizer always determine the interruption of the batch. Exciting again the input 2 is been able to get 2 results:

1) T< 1Sec = restart interrupted batch

2) T between 1 e 4 Sec = reset interrupted batch. N.B.: will be necessary give a new impulse of start to the input 2 (T< 1Sec) for begin a new batch

Necessary conditions for enable the function

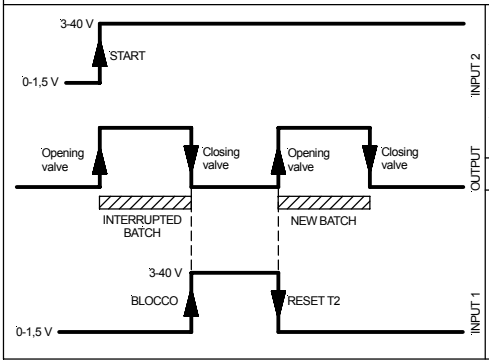
POS. 5.6 (Block totalizer) ENABLE

POS. 6.1 OR 6.4 on
END BATCH

POS. 5.10 funzione di dosaggio attribuita ad ingresso 2 (optional) ABILITATA

POS. 5.2 (P+) ABILITATA

**BLOCK AND RESET TOTALIZER FROM REMOTE INPUT 1
START BATCH FROM REMOTE INPUT 2
CONSENT MODE TO BATCH ENABLE**



The block of the totalizer always determines the stop of batch. With the function of reset T2 enable on descent front of input 1 comes reset the totalizer of the batch in course. therefore the presence of the consent or a new pulse on the input 2 they will determine the start of a new batch

Necessary conditions for enable the function

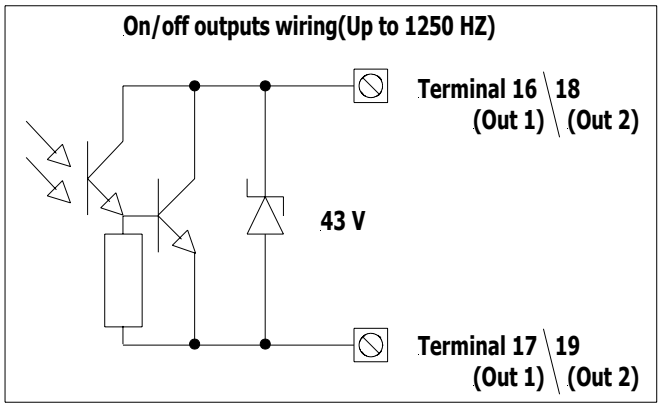
POS. 5.6 (Block totalizer) ABILITATO

POS. 5.10 function of batch assigned to input 2 (optional) ENABLE

POS. 12.7 (consent mode) ENABLE

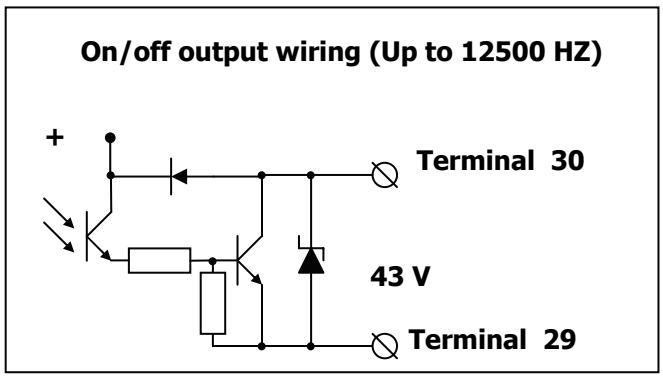
POS. 5.2 (P+) ENABLE

TECHNICAL CHARACTERISTICS - ON/OFF OUTPUTS WIRING (UP TO 1250 HZ)



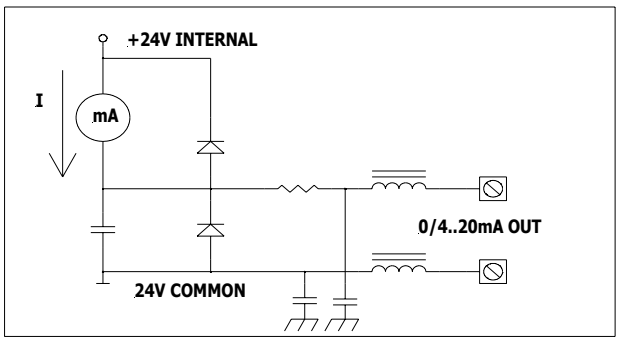
- Opto-isolated output with floating collector and emitter terminals
- Maximum switching voltage: 40 Vdc
- Maximum switching current: 100 mA
- Maximum saturation voltage between collector and emitter @100mA: 1,2V
- Maximum switching frequency (load on the collector or emitter, RL=470Ω, VOUT=24Vdc): 1250 Hz
- Maximum reverse current bearable on the input during and accidental polarity reversion (VEC): 100 mA
- Insulation from other secondary circuits: 500 Vdc

On/off output wiring (Up to 12500 HZ) (high frequency): only with ME 201 module



- Opto-isolated output with floating collector and emitter terminals freely connectable. In order to get the maximum performances it is necessary to connect the emitter to the common terminal of the outputs (0V), while the load has to be on the collector. This output is internally connected to the power supply source 24 Vdc available on the terminal block.
- Maximum switching voltage: 40Vdc
- Maximum switching current: 100mA
- Maximum saturation voltage between collector and emitter @ 100mA, load on the collector and internal power supply: 0,3V
- Maximum saturation voltage between collector and emitter @ 100mA, load on the emitter and internal power supply: 3V
- Maximum switching frequency, load on the collector and internal power supply: (RL=470Ω, VOUT=24Vdc): 12500Hz
- Maximum switching frequency, load on the emitter or external power supply: (RL=470Ω, VOUT=24Vdc): 2500Hz
- Insulation from the other secondary circuits (except 24V and 4…20mA outputs): 500 Vdc

TECHNICAL CHARACTERISTICS - ANALOG OUTPUT (0-4/20 mA)



- Opto-isolated output
- Maximum load 1000 ohms
- Maximum voltage without load 27 VDC
- Refresh frequency is the same of the sample frequency of the connected sensor
- Protected against persistent over-voltages to 30 VDC

GENERAL:

BEFORE STARTING UP THE INSTRUMENT PLEASE VERIFY THE FOLLOWING:

- Power supply voltage must correspond to that specified on the name plate
- Electric connections must be wired as described in this manual
- Ground connections must be properly installed

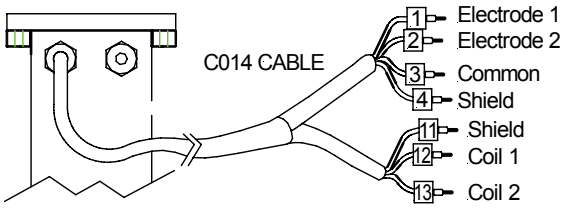
PARTICULAR INDICATIONS:

When the instrument is powered, if the converter exhibits different operating conditions from the last shutdown, it initiates a verification cycle of the converter while displaying an incrementing diagnostic number from 0 through 90. When the diagnostic is complete an error number will be displayed referencing the chart at the back of this manual. A text message will also be displayed on the alarm screen (to view alarms, from the main display screen press the UP arrow key)

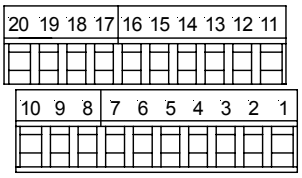
ELECTRICAL CONNECTIONS MS SERIES SENSOR TO CONVERTER

SENSOR SEPARATE VERSION
(max length of cable: mt 20)

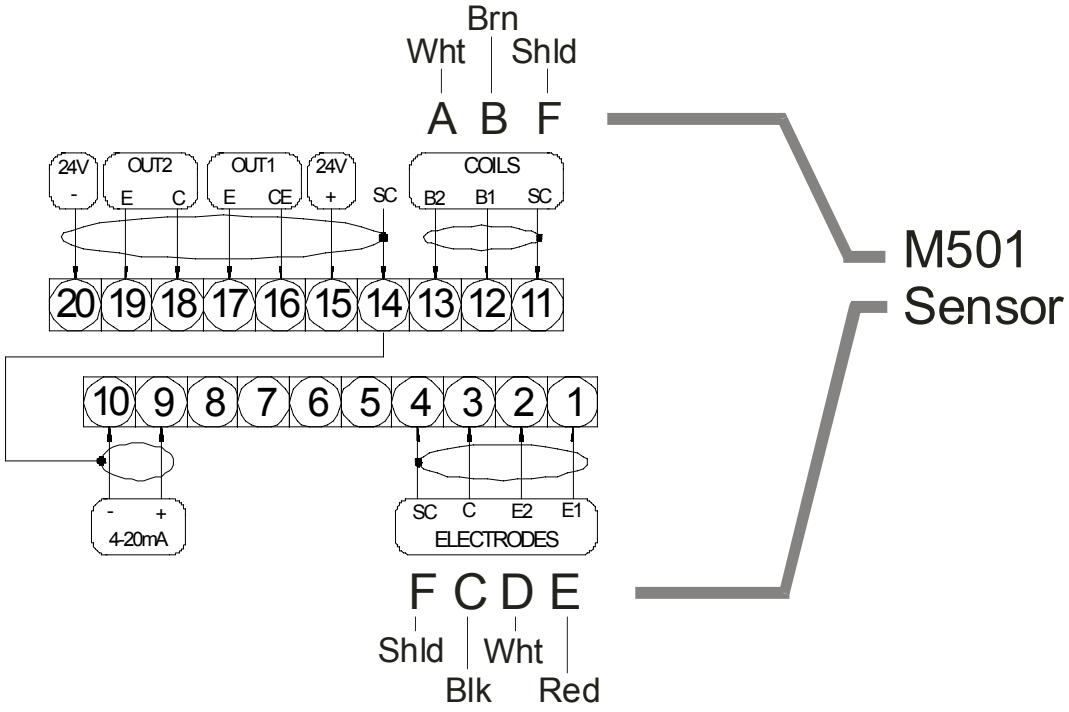
CONVERTER TERMINAL BLOCK M1



Sudden movements of the cable, can cause measurement noise



ELECTRICAL CONNECTIONS M501 SENSOR TO CONVERTER



PROGRAMMING THE ML210 BY KEYBOARD OR IF2 CABLE

The ML 210 programming keyboard is performed using three keys:

UP and DOWN ARROW Keys

SHORT PRESS (< 1 SECOND):
- Increases the numeric figure or the parameter selected by the cursor
- Goes to the previous subject on the menu

LONG PRESS (> 1 SECOND):
- Decreases the numeric figure or the parameter selected by the cursor
- Goes to the next subject on the menu

RIGHT and LEFT ARROW Keys

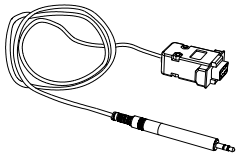
SHORT PRESS (< 1 SECOND):
- Moves the cursor rightwards on the input field
- Goes to the following subject of the menu
- Change the display of the process data

LONG PRESS (> 1 SECOND):
- Moves the cursor leftwards on the input field
- Goes to the previous subject on the menu

ENTER and EXIT keys

SHORT PRESS (< 1 SECOND):
- Enters/leaves the selected function
- Enables the main menu for the instrument configuration
- Cancels the selected function under progress

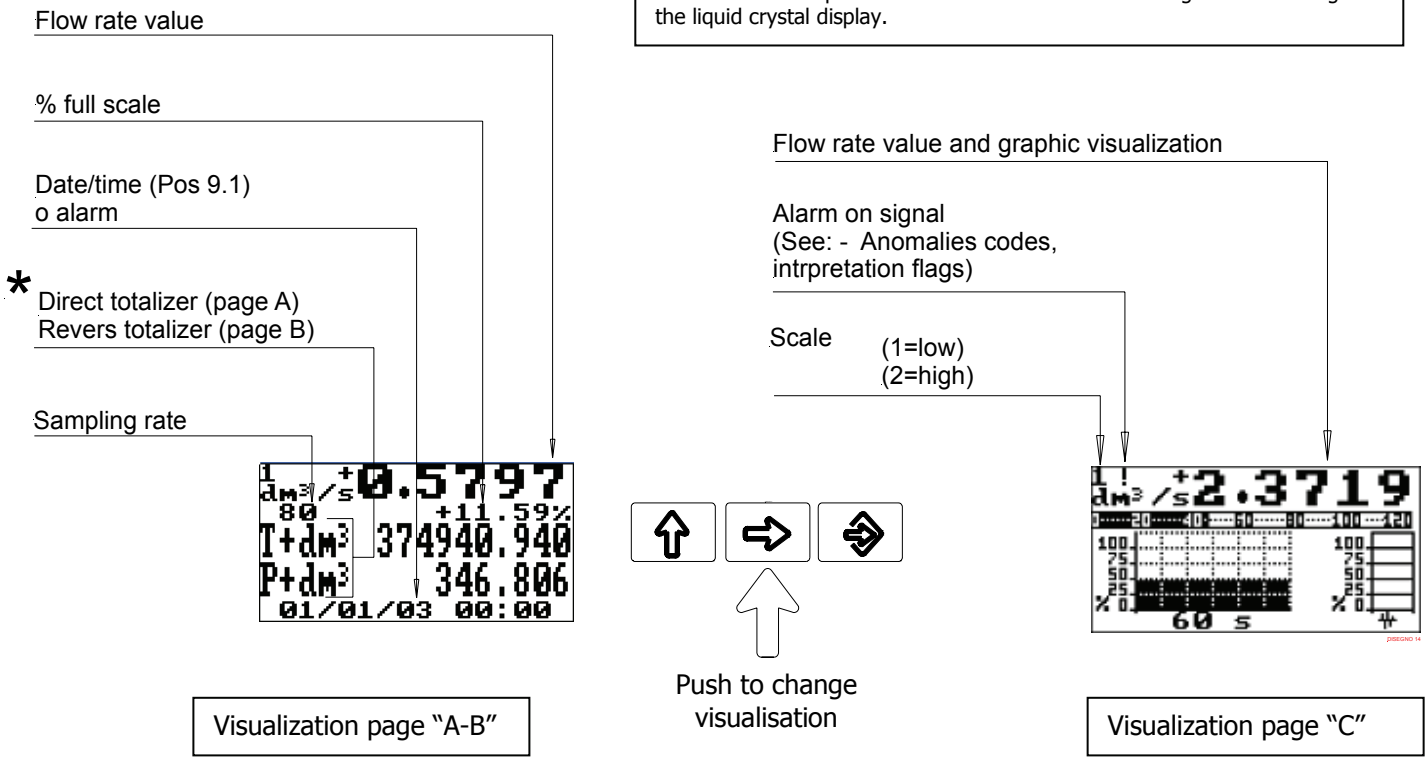
LONG PRESS (> 1 SECOND):
- Exits the current menu
- Enables the totalizer reset request (when enabled)
- Confirms the selected function



IF 2

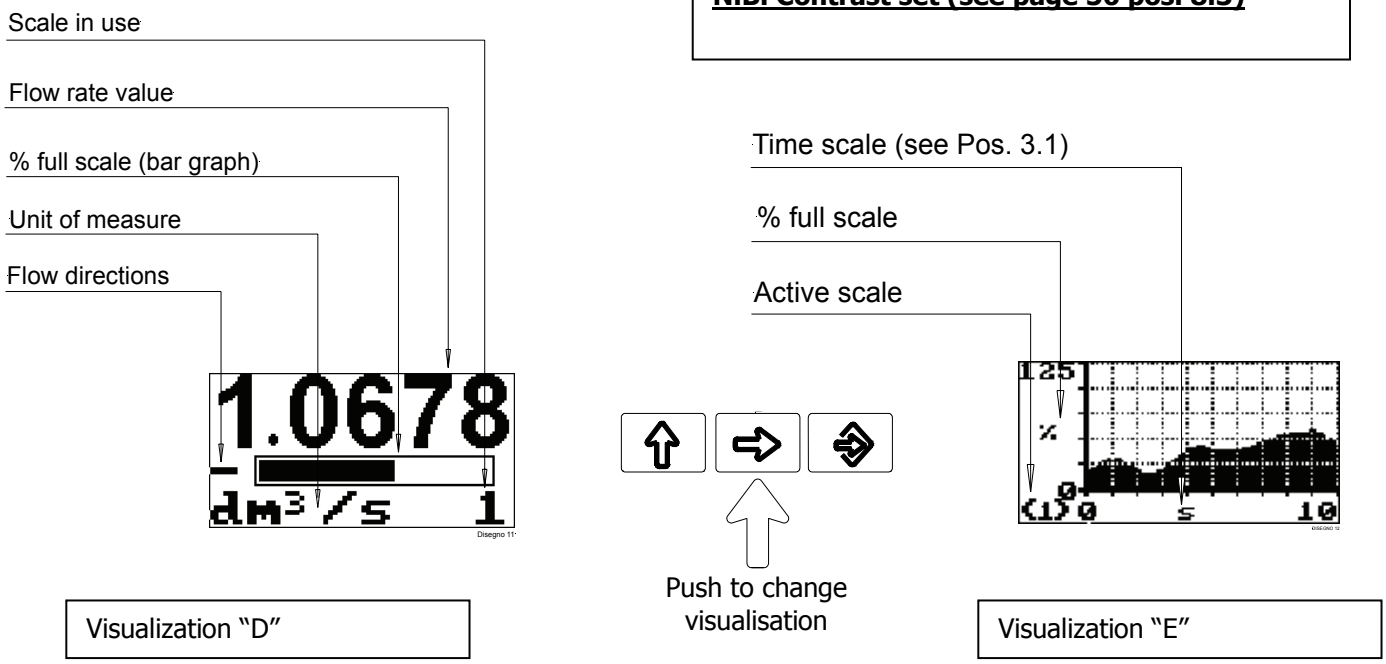
NOTE: When the serial interface IF2 is connected to a PC the keyboard and the display will be represented on the PC's screen. The meaning of the prompts (shown at left and in the following sections) is the same for both devices.

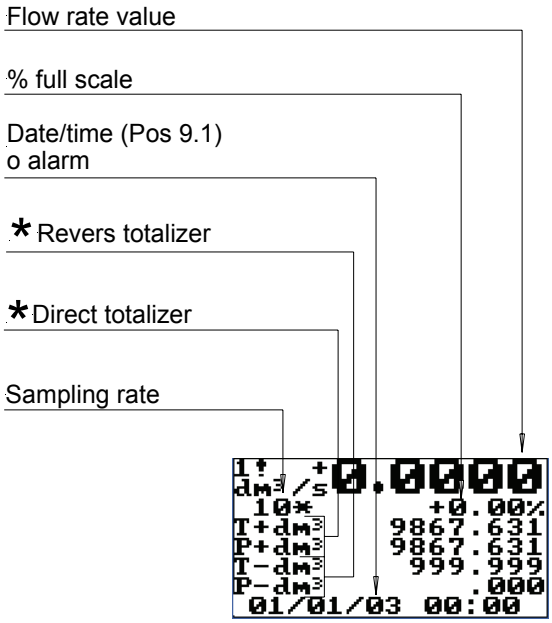
ATTENTION: Exposure of the converter to direct sunlight could damage the liquid crystal display.



* The maximum number shown from the totalizer is 999 999 999 independently from the number of decimal selected. Beyond this value the totalizer are reset.

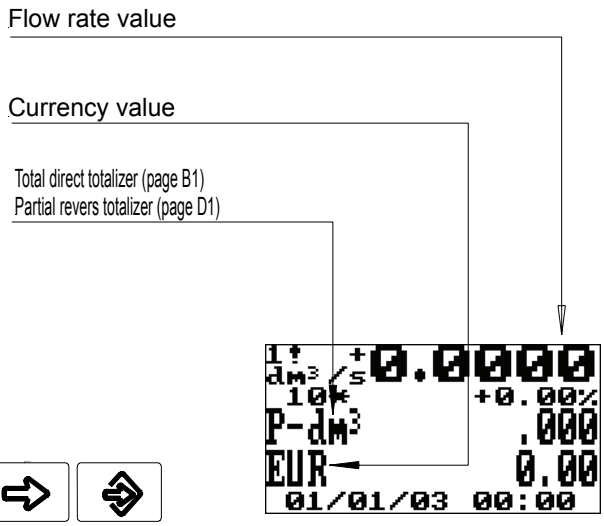
N.B. Contrast set (see page 56 pos. 8.3)





Visualization "A1"

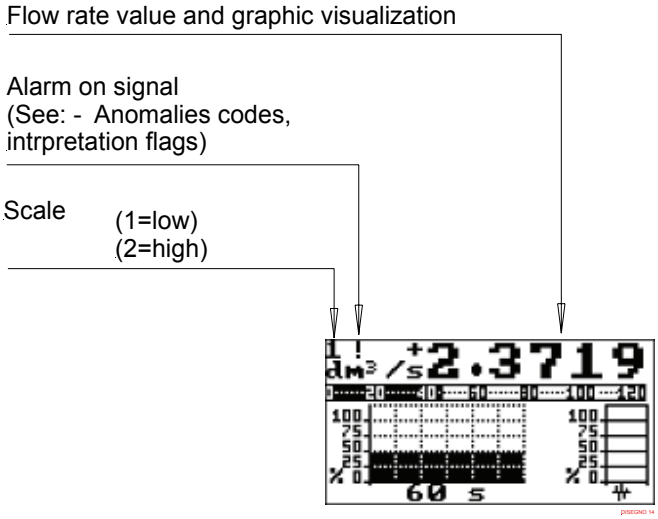
WITH CURRENCY FUNTION ENABLE



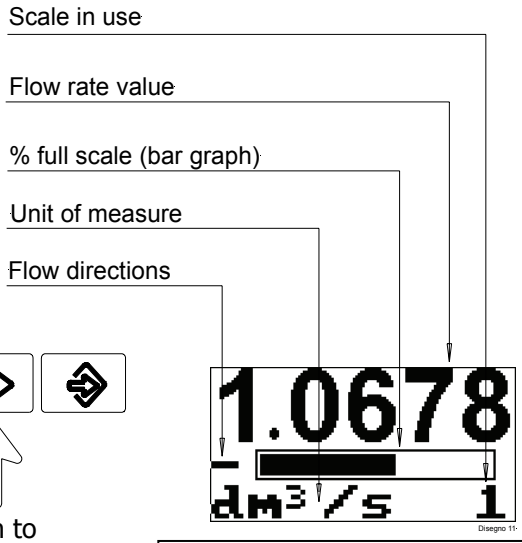
Visualization "B1-D1"

Push to change visualisation

* The maximum number shown on the totalizer is 999,999,999 independent from the number of decimal selected. Beyond this value the totalizers are reset.



Visualization "C1"



Push to change display

Visualization "E1"

MANUFACTURER PRE-SETTINGS

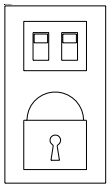
The converter is programmed and delivered according to the following STANDARD configuration:

- Dip switch: ON (Switch positioned close to the lock symbol)
- Security level: 3 (pos. 11.2)
- Access code L" = 11111 (pos. 11.1)

With such a pre-setting, when powered on, the instrument will show one of the 4 visualization pages (pict. A-B-C-D on pages 23-26). By pressing the button ⏎ you can get to the "Quick start menu":

The "Quick start menu" may be set without entering any access code (see example 1 on page 30).

To enter the Main Menu, position the cursor on the word "Main menu" and press the button ⏎; then enter the level 2 access code L" = 11111 and press the key ⏎.
All the functions of the converter are now available, apart those reserved to the service (access code of higher level).



Dip switch

ACCESS CODES

The information of this manual are related to all the functions available with L2 security level.
All the functions available through access codes of higher level are protected and reserved to the service.

Access code description: L2 (menu "11 Internal Data)

A) **with code L2 = 11111** (with this code only) you access the "Quick start menu".

B) **with code L2 = 22222** (with this code only) you disable the request of code L2 and you can proceed with the programming without entering any access code (up to L2 security level)
NOTE: the availability of the functions is related to the selected block.

C) * with L2 customized (freely chosen by the user) you can proceed programming all the functions up to L2 security level, entering its code whenever you enter the Main menu

***ATTENTION**: take note very carefully of the customized code you have chosen, since there is no way for the user to retrieve it if it is forgotten.

BLOCK LEVELS

If for several reasons you need to change the level of block of the instrument, follow the steps:

- Set the dip switch on OFF position (opposite side than the lock symbol, see pict. on previous page)
- Access the Main Menu.
- Press several times the key , till you reach the menu "11: Internal data" and then press
- Press the key and to enter the function "Block level"
- Choose the desired level of block by pressing the key and confirm the choice by pressing the key

To enable the level of block you selected place back the DIP switch to the original ON position marked with a lock symbol (see pict. On page 27)

The available levels of block are the following:

Level 0: it completely disables the access to the functions. You can perform the following functions through the keyboard:
Changing the display mode
Dosing Start/stop (when such a function is enabled)
Data printing (when such a function is enabled)

Level 1: it enables the access to the following functions:
Totalizers re-setting
Dosing functions modifications

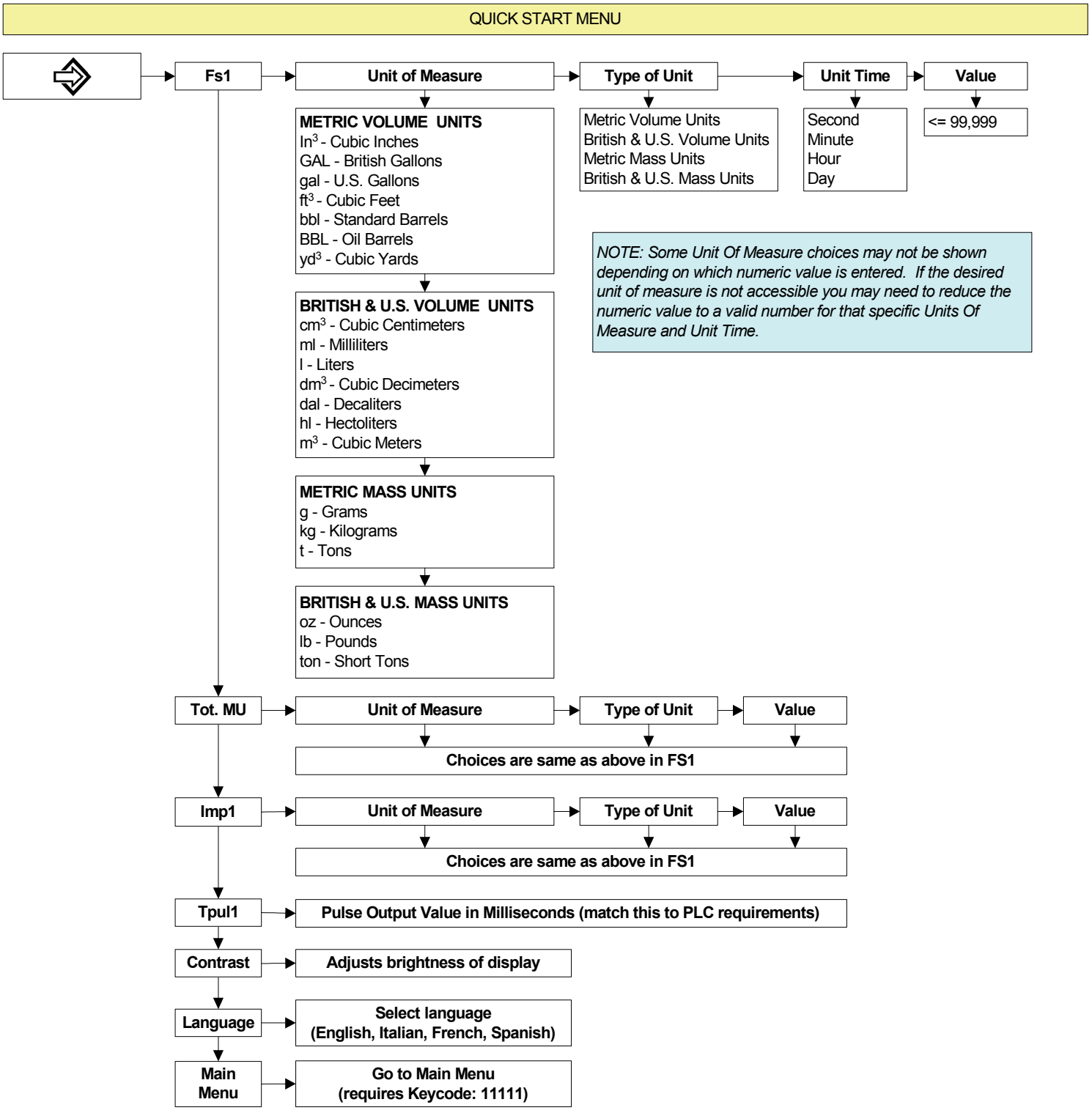
Level 2: it enables the access to the following functions:
Quick start menu (see code level 2 = 11111)
Scale (full enabling)
Display (partial enabling)
Diagnostics (partial enabling)

Livello 3: it enables the access to all the functions of level 2

When the Dip-switches are on OFF position, all the functions are enabled.

The functions requiring an access code higher than L2 are reserved to the service.

QUICK START MENU



ACCESS CONFIGURATION MENU

From any display page push this key: 

To choose a menu item push: 

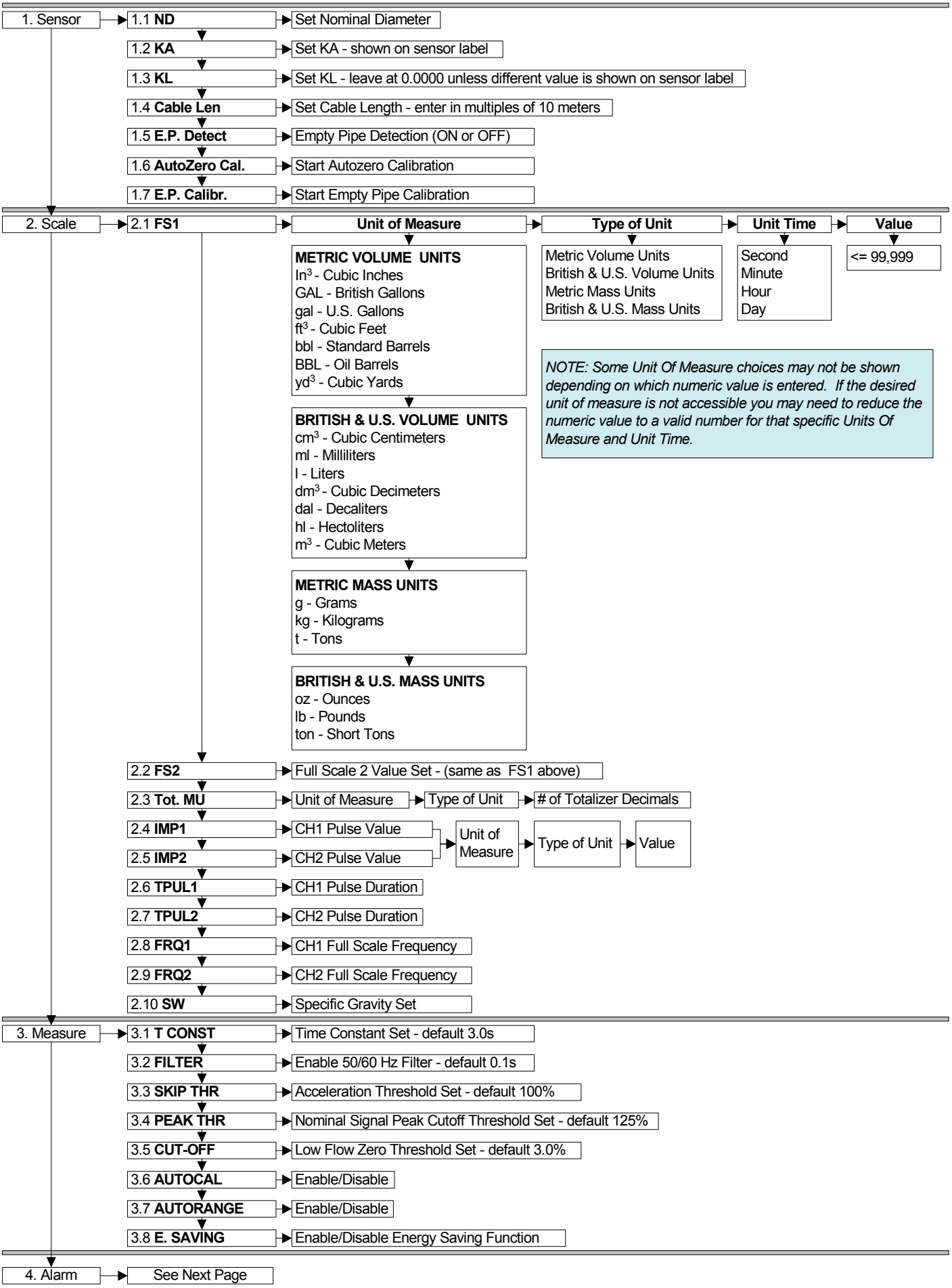
To enter a menu item: 

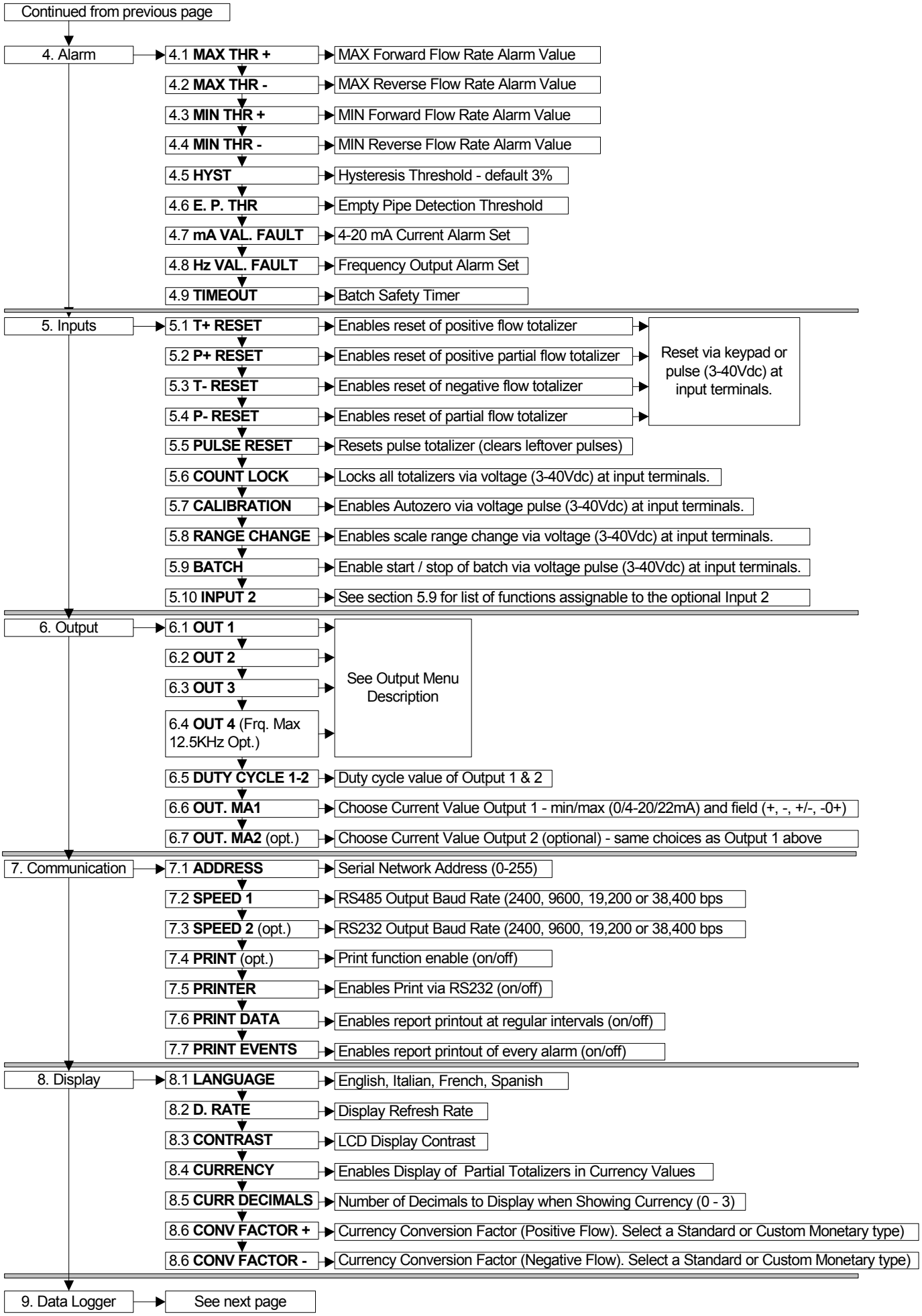
EXAMPLES

EX. 1 Set full scale from QUICK START menu	Ex. 2 Set full scale from main menu
FROM DISPLAY PAGES PUSH ENTER:  `FS1=  Gal/m  0012.5`  choose the **volume unit** with the key:  in³, GAL, Gal, ft³, Bbl, yd³...  choose the **type of unit** with the key:  • Metric volume units • British or American volume units • Metric mass units • British or American mass units  choose the **time unit of measure** with the  key: s, m, h, d, Set the numeric value with the  key: Use the  key: to move to the numeric side 	FROM DISPLAY PAGES PUSH ENTER:  KEYCODE: 00000   `FS1=  Gal/m  0012.5`  choose the **volume unit** with the key:  in³, GAL, Gal, ft³, Bbl, yd³...  choose the **type of unit** with the key:  • Metric volume units • British or American volume units • Metric mass units • British or American mass units choose the **time unit of measure** with the  key: s, m, h, d, Set the numeric value with the  key: Use the  key: to move to the numeric side 

MAIN MENU PROGRAM FUNCTION FLOW CHART

Note: Some functions are only displayed if you have enabled other functions or with the insertion of additional modules.




Continued from previous page
4. Alarm
4.1 MAX THR +
MAX Forward Flow Rate Alarm Value
4.2 MAX THR -
MAX Reverse Flow Rate Alarm Value
4.3 MIN THR +
MIN Forward Flow Rate Alarm Value
4.4 MIN THR -
MIN Reverse Flow Rate Alarm Value
4.5 HYST
Hysteresis Threshold - default 3%
4.6 E. P. THR
Empty Pipe Detection Threshold
4.7 mA VAL. FAULT
4-20 mA Current Alarm Set
4.8 Hz VAL. FAULT
Frequency Output Alarm Set
4.9 TIMEOUT
Batch Safety Timer
5. Inputs
5.1 T+ RESET
Enables reset of positive flow totalizer
5.2 P+ RESET
Enables reset of positive partial flow totalizer
5.3 T- RESET
Enables reset of negative flow totalizer
5.4 P- RESET
Enables reset of partial flow totalizer
Reset via keypad or pulse (3-40Vdc) at input terminals.
5.5 PULSE RESET
Resets pulse totalizer (clears leftover pulses)
5.6 COUNT LOCK
Locks all totalizers via voltage (3-40Vdc) at input terminals.
5.7 CALIBRATION
Enables Autozero via voltage pulse (3-40Vdc) at input terminals.
5.8 RANGE CHANGE
Enables scale range change via voltage (3-40Vdc) at input terminals.
5.9 BATCH
Enable start / stop of batch via voltage pulse (3-40Vdc) at input terminals.
5.10 INPUT 2
See section 5.9 for list of functions assignable to the optional Input 2
6. Output
6.1 OUT 1
6.2 OUT 2
6.3 OUT 3
6.4 OUT 4 (Frq. Max 12.5KHz Opt.)
See Output Menu Description
6.5 DUTY CYCLE 1-2
Duty cycle value of Output 1 & 2
6.6 OUT. MA1
Choose Current Value Output 1 - min/max (0/4-20/22mA) and field (+, -, +/-, -0+)
6.7 OUT. MA2 (opt.)
Choose Current Value Output 2 (optional) - same choices as Output 1 above
7. Communication
7.1 ADDRESS
Serial Network Address (0-255)
7.2 SPEED 1
RS485 Output Baud Rate (2400, 9600, 19,200 or 38,400 bps
7.3 SPEED 2 (opt.)
RS232 Output Baud Rate (2400, 9600, 19,200 or 38,400 bps
7.4 PRINT (opt.)
Print function enable (on/off)
7.5 PRINTER
Enables Print via RS232 (on/off)
7.6 PRINT DATA
Enables report printout at regular intervals (on/off)
7.7 PRINT EVENTS
Enables report printout of every alarm (on/off)
8. Display
8.1 LANGUAGE
English, Italian, French, Spanish
8.2 D. RATE
Display Refresh Rate
8.3 CONTRAST
LCD Display Contrast
8.4 CURRENCY
Enables Display of Partial Totalizers in Currency Values
8.5 CURR DECIMALS
Number of Decimals to Display when Showing Currency (0 - 3)
8.6 CONV FACTOR +
Currency Conversion Factor (Positive Flow). Select a Standard or Custom Monetary type)
8.6 CONV FACTOR -
Currency Conversion Factor (Negative Flow). Select a Standard or Custom Monetary type)
9. Data Logger
See next page

Continued from previous page

9. Data Logger	9.1 **DATE / TIME**	Real Time Clock dd/mm/yy hh:mm
	9.2 **ACQUISITION**	Enables Data Logging (on/off)
	9.3 **INTERVAL** (hrs)	Sampling Time Interval for Data Logging (1, 2, 3, 6, 8, 12, 24 or 48 hours)
	9.4 **DISPLAY DATA**	Displays Logged Data in Scrollable Window
	9.5 **DISPLAY EVENTS**	Displays Logged Event Data in Scrollable Window (up to 64 events)
	9.6 **CLEAR DATA**	Permanently Deletes All Logged Data
	9.7 **CLEAR EVENTS**	Permanently Deletes All Logged Event Data
10. Diagnostic	10.1 **CALIBRATION**	Enable Calibration of the Meter (EXECUTE? Press ⇳ for 3 sec to proceed)
	10.2 **SELF TEST**	Enable Self Test* of the Meter (EXECUTE? Press ⇳ for 2 sec to proceed)
	10.3 **SIMULATION**	Enable Flow Rate Simulation (On/Off) - When enabled return to main display and press the ⇨ key for 2 sec to set desired value. Press ⇳ for 2 sec to return to normal operation.
		* Self Test is same test that is performed on meter power up.
11 Internal Data	11.1 **L2 KEYCODE**	Enter Level 2 Access Code (11111 for quick start menu, 22222 to disable Quick Start and allow access to Main Menu without needing Access Code. XXXXX to enter custom Quick Start code >>> !! IMPORTANT - DO NOT FORGET THE CUSTOM CODE, IT CANNOT BE RETRIEVED!!
	11.2 **BLOCK LEVEL**	Allows Access to Various Blocks (groupings) of Menu Choices. See the Block Levels section for details.
	11.3 **LOAD FACTORY**	Recall Factory Default Presets as Programmed from Factory
	11.4 **LOAD USER**	Load Saved User Settings - as saved in step 11.5 below
	11.5 **SAVE USER**	Saves the current program as the User Settings
	11.6 **KS**	Set KS Value
12 Batch	12.1 **N. SAMPLES**	Enter Number of Batch Cycles to be Used for Automatic Batch Compensation. 0 = Manual Batch Size Compensation.
	12.2 **DIFF THR=%**	% Limit of Compensation. Defines the Max Difference between 12.3 and 12.1
	12.3 **V COM**	Compensation Value is the Difference Between the Set Batch Value and the Quantity that includes the System Delays (valve closing, pump stop, motor stop, etc.)
	12.4 **V PRE**	Prebatch Value - Portion of Batch Volume during which the Pre-batch Output is Enabled.
	12.5 **AUTO BATCH**	Stores batch volume based on time period of voltage input.
	12.6 **BM AUTO SEL**	Allows selection of up to 4 batch formulas. Choice is determined by length of input pulse.
	12.6 **CONS MODE**	Enables the start and the stop of the batch using a static signal applied to the input instead of a pulse.

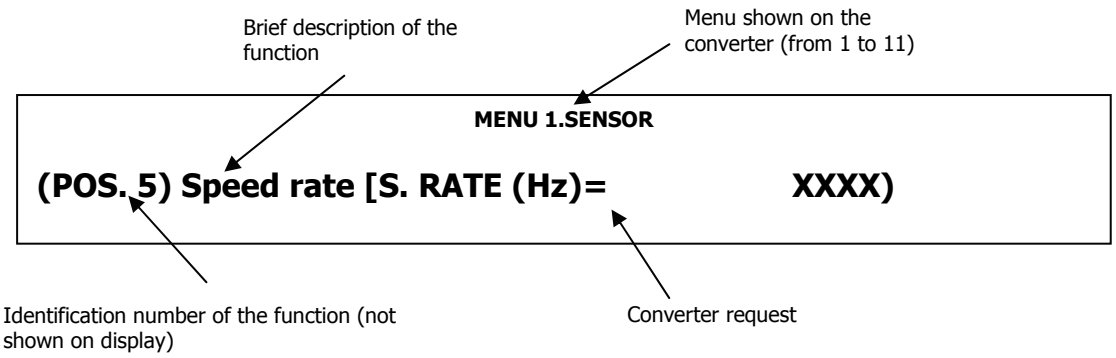
NOTE: The Batch menu is only available if BATCH is turned on in menu 5.9

Service Diagnostics:
10.4 Electrodes Test
10.5 Display Data
10.6 Zero

Service Diagnostics:
11.6 - Memory Reset
11.7 - Serial Number
11.8 - Hours
11.9 - KT
11.10 - KR
11.11 - KS
11.12 - Zero
11.13 - DAC1 20mA
11.14 - DAC1 4mA
11.15 - Data Logger
11.16 - Input
11.17 - DAC1
11.18 - RS485

PROGRAM FUNCTION MENU

(Description of functions accessible with level access < 3)



MENU 1. SENSOR

(POS. 1.1) Nominal diameter Sensor [ND= XXXX]
Sensor nominal diameter. Enter the value shown on the plate on the sensor.
The value has to be within the range from 0 to 3000 mm.

Note: if you want to know the velocity of the liquid passing through the sensor, set this parameter to 0. The instrument will show the liquid speed expressed in meters per second (m/s).
Important: in this case all the totalized values will be expressed in metres (m) and will then be without any meaning

(POS. 1.2) Coefficient KA [KA= ±X.XXXX]
Coefficient KA set. This parameter is calculated during the sensor calibration and stands for a signal amplification value. It has to be set at the value shown in the plate on the sensor.

(POS. 1.3) Coefficient KL [KL= ±X.XXXX]
Coefficient KL set. Leave the value at default (+0.0000). Set a different value only if shown in the plate on the sensor.

(POS. 1.4) Length cable [CABLE LEN.=m XXX]
Set the length of the cable connecting the sensor to the converter (measure unit: meters).
N.B.: the length must be set in multiple of 10m

(POS. 1.5) Test "empty pipe" [E.P. DETECT= XXX]
This function enables or disables the empty pipe detection feature. Remember that in the case of noise in the cable or on the electrodes this system may fail and therefore should be used carefully. To determine the empty/full pipe condition the signal is analysed within a one second time window. If the pipe is detected to be empty, then the measurement is locked. For proper operation a calibration of this function should be performed as described below. Its value has to be either ON or OFF.

(POS. 1.6) "Autozero" calibration [AUTOZERO CAL.]
This function enables or disables the automatic zero calibration system. To perform the sensor calibration it is absolutely necessary that the sensor be **full** of liquid and that the liquid is perfectly **still**. Even a very small movement of the liquid may affect the result of this function, and consequently, the accuracy of the system.

Once you are sure the above conditions are fulfilled (and when the percentage flow rate value on the display is stable) press the down-arrow key ⇩ for more than one second.

Check that the percentage flow rate value goes to zero, otherwise repeat the operation again.

When the value is stable at zero, then press ⇨ key

(POS. 1.7) "Empty pipe" calibration [E.P. CALIBR.]
This function enables/disables the automatic calibration procedure of the empty pipe detection function. Before enabling this function, the Empty Pipe test should be enabled first as described above. Before performing this function, the sensor has to be completely filled with liquid so that both the lining and the electrodes are wetted. The sensor then has to be emptied again and then you should press the key ⇨: the operation will have to be confirmed by pressing the key ⇦ or cancelled by pressing the key ⇨.

Performing this function determines the Emtpy Pipe Threshold value which can also be manually inputted (see item POS. 4.4 "E.P.THR").

MENU 2. SCALES

(POS. 2.1) Full scale no. 1 [FS1=*dm³/S* X.XXXX]

Full-scale value set for range No. 1. There are four fields needed in order to set this parameter, from left to right: 1) volume unit of measure, 2) type of unit, 3) time unit of measure and 4) numeric value. The selection is made by positioning the cursor on the field to modify. To change the type of unit of measure (metric, British or American, mass or volume) the cursor has to be positioned on the "/" (slash) symbol (field No. 2). When the nominal diameter is set to zero it is only possible to modify the numeric field, since the unit of measure stays at m/sec.

The following tables show the units of measure available and the conversion factor by comparison with 1 dm^3 and 1 kg. The converter accepts any kind of combination of units of measure satisfying both the following conditions:

- Numeric field value $\leq$ 9999
- $^1/_{25}$ $fs_{max} \leq$ numeric field value $\leq fs_{max}$. where fs_{max} is the maximum full scale value corresponding to the sensor, equal to a 10 m/sec liquid speed.

The units of measure are shown as they appear on the display. Note that the British and American units are designated by using capital and small characters.

Metric units of measure

cm^3	0.001	Cubic centimetre
ml	0.001	Millilitre
l	1.000	Litre
dm^3	1.000	Cubic decimetre
dal	10.000	Decalitre
hl	100.000	Hectolitre
m^3	1000.000	Cubic metre

British or American volume unit of measure

in^3	0.0163871	Cubic inch
GAL	4.545771	British gallon
Gal	3.785333	American gallon
ft^3	28.31685	Cubic foot
Bbl	119.238	Standard barrel
BBL	158.984	Oil barrel
yd^3	764.555	Cubic yard

Metric mass units of measure

G	0.001	Gram
Kg	1.000	Kilogram
T	1000.000	Ton

British and American mass units of measure

Oz	0.028350	Ounce
Lb	0.453591	Pound
Ton	907.18	short tons

When a mass unit of measure is set, the specific gravity function is automatically enabled by the system. Please, note that temperature affects the mass measurement significantly and therefore with certain liquids this may cause considerable measurement errors.

The units of measure of time may be chosen among the following values: **s** = second, **m** = minute, **h** = hour, **d** = day.

(POS. 2.2) Full scale n. 2 [FS2=*dm³/s* X.XXXX]

Full scale set for scale N.2. Please, refer to the previous function as far as its description is concerned.
This function is identical to the previous one (POS. 2.1 Full scale n. 1) and is enabled by the system only when the relevant input or output functions are enabled as well (See item POS. 3.7 AUTORANGE.)

(POS. 2.3) Unit of measure and number of decimal totalizers [UM.tot:dm³ X.XXX]
Setting the unit of measure and number of decimals for the totalizer display.
To set the unit of measure, position the cursor on field of the actual unit of measure; To set the type of unit, position the cursor on the blank space between the unit of measure and the numeric value; To set the number of decimals shown on the totalizers position the cursor on the numeric field and choose one of the possible combinations: 1000-01.00-001.0-00001.

(POS. 2.4) Pulse value channel 1 and unit of measure of the totalizers [IMP1=*dm³* X.XXXXX]
Setting of the volume corresponding to each pulse of channel 1 and totalizer unit of measure. There are three fields to fill in to set this parameter, from left to right: 1) unit of measure, 2) type of unit of measure and 3) numeric value. The selection is performed by positioning the cursor on the field to modify. To change the type of unit of measure (metric, British or American, mass or volume) just position the cursor on the blank space between the unit of measure and the numeric value. When the nominal diameter is set to zero, it is only possible to modify the numeric field since the unit of measure stays at meters (m). The possible units of measure are those described above in POS. 2.1.
This function is active only if the pulse output on channel 1 has been enabled (see item POS. 6.1 OUT1).

(POS. 2.5) Pulse value channel 2 and unit of measure of the totalizers [IMP=*dm³* X.XXXXX]
Setting the volume corresponding to each pulse of channel 2 and totalizers unit of measure.
This function is identical to the previous one and is active only if the pulse emission on channel 1 has been set as enabled (see Function POS. 6.2).

(POS. 2.6) Pulse duration channel 1 [TPUL1=ms XXXX.XX]
Setting the duration of the pulse generated on channel 1. Its value is expressed in milliseconds and has to be between 0.4 and 9999.99. When the optional high frequency output option is present, then the minimum value can go down to 0.04 milliseconds.
ATTENTION: since the instrument cannot detect which type of device it is connected to, it is up to the user to verify the set pulse duration is compatible with the external device processing such pulses. If, for example, an electro-mechanical pulse counter is connected, then two kind of problems may occur: if the pulse is too long than the totalizer coils may overheat or, if it too short, the counter may not count, even damaging the converter output.
This function is only active when the pulse output function on channel 1 is enabled.

(POS. 2.7) Pulse duration channel 2 [TPUL2=ms XXXX.XX]
Setting of the duration of the pulse generated on channel 2. Its value is expressed in milliseconds and has to be between 0.4 and 9999.99. When the optional high frequency output is present, then the minimum value can go down to 0.04 milliseconds.
ATTENTION: use care in selecting the pulse duration as mentioned above.
This function is only active when the pulse emission function on channel 2 is enabled.

(POS. 2.8) Full scale frequency channel 1 [FRQ1=Hz XXXXX.X]
Full-scale frequency set for channel 1. Its value is expressed in Hertz and is between 1.0 and 1000.0. When the high frequency output is present the maximum value may go up to 10000.0.
ATTENTION: use care in selecting the frequency as mentioned above.
This function is only enabled when the frequency generation mode on channel 1 is active.

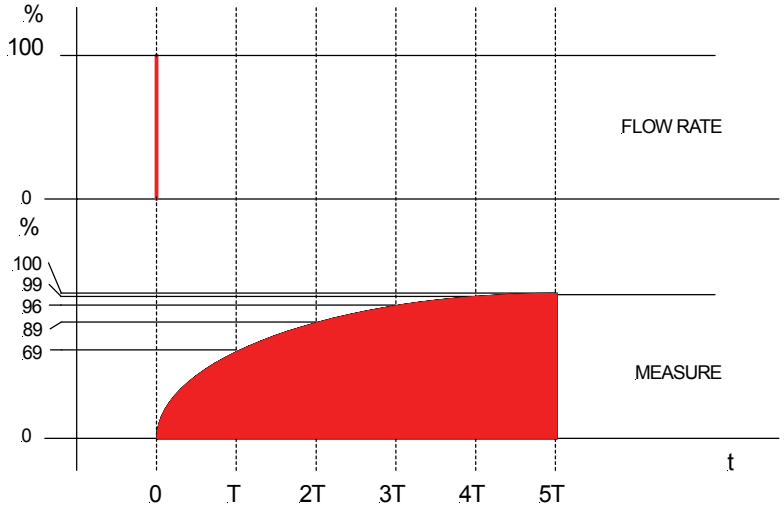
(POS. 2.9) Full scale frequency channel 2 [FRQ2=Hz XXXXX.X]
Full-scale frequency set for channel 2. Its value is expressed in Hertz and is between 1.0 and 1000.0.
ATTENTION: use care in selecting the frequency as mentioned above.
This function is only enabled when the frequency generation mode on channel 2 is active.

(POS. 2.10) Specific gravity [SW=Kg/dm³ XX.XXXX]
Specific gravity set. Its value is expressed in Kilogram per cubic decimetre and has to be within the range from 0.0001 to 99.9999.
This function is active only if a mass unit of measure has been selected.

MENU 3. MEASURE

(POS. 3.1) Time constant [TCONST=s XXXX.X]

Time constant set. This parameter affects the integrating filter making the instrument response quicker or slower, according to the set value. A higher value corresponds to a more stable but slower response, a smaller value the opposite. The most common values are from 1 to 5 seconds. The value of this parameter has to be within the range from 0 (integral filter disabled) to 6000.0 seconds. The following diagram shows the response of the instrument for a flow rate variation from 0 to 100% within the T time constant period:



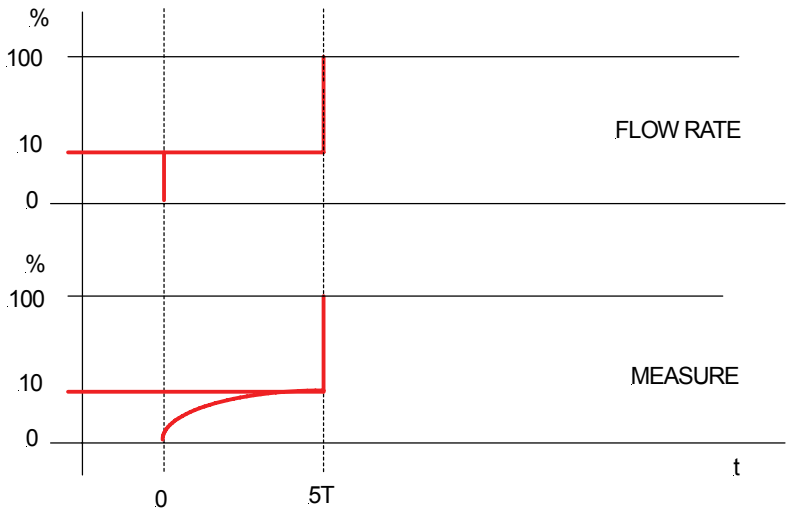
(POS. 3.2) Set filter 50/60Hz [FILTER=S 1/0.2]

Filter on the power supply frequency. This value can be set to 0.2 s ("fast" measure) or to 1 s (greater filter effect of noise in the liquid).

(POS. 3.3) Acceleration threshold [SKIP THR=% XXX]

Acceleration threshold set. The acceleration threshold stands for the limit beyond which a flow rate variation determines an immediate response at the output, without being filtered by the time constant. This system allows the instrument to have an immediate response in case of big variations of the flow rate, filtering (and delaying) the response to small variations. This results in a very stable measurement, ready to follow the process. The value is set as a percentage of the full-scale value from 0 to 125%. If such a value is set to zero any flow rate variation bigger than 0.5% of the full-scale value will immediately affect the outputs.

The following diagram shows the instrument response in two cases: a flow rate variation from 0 to 10% completely absorbed by the time constant effect and a variation from 10% to 100% exceeding the acceleration threshold and then immediately sent to the output. In actual fact there is always a minimum time between the measure acquisition and the output update.



(POS. 3.4) Peak cut off threshold [PEAK THR=% XXX]
Anomalous signal pick cut off threshold set. This parameter allows you to set the maximum value of deviation of the actual measure sample by comparison with the average one. If the new value is higher than the set limit, than such a value is "cut" to the limit value. This function is used to make the meter less sensitive to big perturbations on the flow rate measure, as may happen when there are solids in suspension in the liquid hitting against the electrodes causing high electrical noise. The permitted values of this function go from 0 to 125 % and are referred to the full-scale value. If this parameter is set to zero the peak detection function is disabled and any new measurement will be accepted and processed as-is by the converter.

(POS. 3.5) Low flow zero threshold [CUT-OFF=% XX.X]
Low flow zero threshold set. When the flow rate value falls below this parameter the flow rate is assumed to be zero and is set to such a value by the converter. This parameter can be set from 0 to 25.0% of the full-scale value. When this parameter is set to zero this function is disabled.

(POS. 3.6) Auto-calibration [AUTOCAL= ON/OFF]
Enables or disables the auto-calibration function. When enabled the converter performs a calibration cycle once every hour. During such a cycle the measurement is "frozen" at the latest measured value. The calibration lasts from 8 to 15 seconds and completely removes the thermal derivation error effects on the measurement. It is recommended to enable this function if the instrument undergoes strong temperature variations during operation.

When the meter is used in batch applications and if you want to compensate temperature drift effects, then the automatic calibration procedure is recommended before any batch process enabling it via the external on/off input. This is because during the calibration cycle the meter does not register any flow rate variation.
Allowed values for this parameter: ON / OFF.

(POS. 3.7) Automatic scale change enable [AUTORANGE= ON/OFF]
Enables/disables the automatic change of scale. The meter has two different working ranges to handle variable process conditions. In order to get the best results it is important that range No. 2 is bigger than No. 1. When the flow rate increases and reaches 100% of full scale 1, then the meter automatically switches to scale No. 2. When the flow rate decreases again reaching a value on scale 2 equal to 90% of full scale No. 1, then the active scale is No. 1 again. Allowed values for this parameter: ON / OFF.

(POS. 3.8) Energy saving enable [E.SAVING= ON/OFF]
Automatic energy saving function enable. This function is used when the instrument is powered by a battery or solar cells, which provide energy savings of up to 60-80%. The energy consumption is controlled by the ratio between the measuring cycles powering the coils and the cycles without powering the coils. When the flow rate is stable the number of "off" cycles is higher than the "on" ones, so that the average consumption is significantly reduced. If the flow rate suddenly changes, then the meter switches to a higher number of measuring cycles (in order to get a higher response time), then switching off the cycles as soon as the flow rate becomes stable again.

If the flow rate varies below the "acceleration threshold" percentage value, then the meter continues with "off" cycles, but as soon as the flow rate value exceeds such a threshold, the meter switches back to a higher number of measuring

cycles again. The speed that the meter switches the excitation cycles on and off is different: from a constant flow rate to a variable one it is a very fast process, while from variable flow rate to a stable one such a process is much slower.
Allowed values for this parameter: ON/OFF.

NOTE: to optimize this function it is recommended that you choose a value for the acceleration threshold within 10-15%

MENU 4. ALARMS

(POS. 4.1) Maximum flow rate threshold [MAX THR=% XXX]
Maximum flow rate value alarm set. When the flow rate value exceeds such a threshold **as absolute magnitude (i.e. not considering the sign)**, then an alarm message is generated. The value of this parameter is expressed as a percentage of the full-scale value and may be set from 0 to 125%. Setting this parameter to zero will disable the alarm generation.

(POS. 4.2) Maximum direct flow rate threshold [MAX THR=% XXX]
Maximum value alarm set for **reverse** flow rate (-). When the flow rate value exceeds such a threshold, then an alarm message is generated. The value of this parameter is expressed as a percentage of the full scale value and may be set from 0 to 125%. Setting this parameter to zero disables the alarm generation.

(POS. 4.3 Minimum flow rate threshold [MIN THR=% XXX]
Minimum flow rate value alarm set. When the flow rate value falls below such a threshold **as absolute magnitude (i.e. not considering the sign)**, then an alarm message is generated. The value of this parameter is expressed as percentage of the full-scale value and may be set from 0 to 125%. Setting this parameter to zero will disable the alarm generation.

(POS. 4.4) Minimum flow rate threshold [MIN THR-=% XXX]
Minimum value alarm set for **reverse** flow rate (+). When the flow rate value falls below such a threshold, then an alarm message is generated. The value of this parameter is expressed as a percentage of the full scale value and may be set from 0 to 125%. Setting this parameter to zero disables the alarm generation.

(POS. 4.5) Hysteresis [HYST=% XX]
Hysteresis threshold set for the minimum and maximum flow rate alarms.

(POS. 4.6) "Empty pipe" detection threshold [E.P.THR= XXX]
Empty pipe detection threshold set. The value of this parameter is automatically set by the function "Empty pipe calibration" within the menu SENSOR.

(POS. 4.7) Current output value in case of failure [mA VAL.FAULT =% XXX]
Setting of the value the 0/4-20 mA current output in the case of one of the following failures:

- Empty pipe
- Coils interrupted
- ADC error

The allowed range is from 0 to 120% of the 0-20 mA scale, 120% corresponds to 24 mA and does not depend on the selected range (0-20 / 4-20 mA).
Typical recommendations suggest an alarm signalling value for the current output lower than 3.6 mA (<18%) or bigger than 21 mA (>105%). It would then be preferable to set the value of this function at 10%, so that the current value in case of the failures shown above would be 2 mA, allowing the following diagnostics:

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

(POS. 4.8) Frequency output value in case of failure [Hz VAL.FAULT=% XXX]
Setting of the value the frequency output has to be in the case of one of the following failures:

- Empty pipe
- Coils interrupted
- ADC error

The allowed range is from 0 to 125% of the frequency full-scale value.
Although there are no specific rules regulating cases like this one, 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.

This function is active only when one of the outputs is set as frequency.

(POS. 4.9) Batch safety timer [TIMER S=S X.XX]
With this function it is possible to set a maximum time for the batch function; over this time an alarm will be generated. This function is useful when you need control one or both of the followings condition:

- batch valve open and flow rate is zero
- batch valve closed and flow rate differente to zero

When this alarm is activated, the batch operation and the power supply of the valve are aborted. The values of this function are from 0 to 25.5 seconds and it is active only if one or more of the batch functions are enable.

MENU 5.INPUT

(POS. 5.1) Total Totalizer + reset enable [T+ RESET = ON/OFF]
Total direct (positive) flow totalizer reset enable. When this function is active, the totalizer may be reset by applying a voltage to the on/off input or via the keyboard.

(POS. 5.2) Partial + totalizer reset enable [P+ RESET = ON/OFF]
Partial direct (positive) flow totalizer reset enable. See the previous function.

(POS. 5.3) Total – totalizer reset enable [T- RESET = ON/OFF]
Total reverse (negative) flow totalizer reset enable. See the previous function.

(POS. 5.4) Partial – totalizer reset enable [P- RESET = ON/OFF]
Partial reverse (negative) flow totalizer reset enable. See the previous function.

N.B.: To reset of the totalizer from the keyboard:
From the main display screens push the ⇨ for more than 2 sec. Set the request L2 CODE and then press the ⇨ key.
The totalizer enabled for zeroing will display the question "RESET TOTALIZ.?". Push for more than 2 sec, the ⇨ key to proceed with the zeroing. Push any other key to cancel this operation.

(POS. 5.5) Enable pulse reset [PULS.RESET= ON/OFF]
Enables resetting of the totalizer via an external pulse.

(POS. 5.6) Totalizers counting lock enable [COUNT LOCK= ON/OFF]
Totalizers counting lock command enable. When this function is active, applying a voltage on the on/off input terminals the system stops the totalizers no matter what the flow rate is. (see from page 17).

(POS. 5.7) "Autozero" calibration external command enable [CALIBRATION= ON/OFF]
Autozero calibration external command enable. When this function is active, applying a voltage on the on/off input terminals the meter performs an autozero calibration cycle.
ATTENTION: if the voltage pulse is less than 1 sec., the meter performs a calibration cycle for compensation of possible thermal drifts. If the voltage pulse is more than 1 sec, the meter performs a zero calibration of measure. This function enables/disables the automatic zero calibration system. It is necessary to perform this function at the first sensor installation or after a long period that the sensor has been empty. To perform the function it is absolutely necessary the sensor is full of liquid and that the liquid is staying perfectly still. Even very small movement of the liquid may affect the result of this function, and consequently, the accuracy of the system.

(POS. 5.8) Range change external command enable [RANGE CHANGE= ON/OFF]
Range change external command enable. When this function is enabled, applying a voltage on the on/off input terminals the meter switches to the second measuring range (Fs2).
N.B.: the Autorange function disables the manual range change (see pos. 3.7)

(POS. 5.9) Batch start/stop external command enable [BATCH= ON/OFF]
Batch start/stop external command enable. (see "BATCH FUNCTIONS")

(POS. 5.10) Functions assigned to input 2 [ING.2= XXXXXX]
Choice of the function to associate the input 2. The functions are listed in the table below.
Attention: the input 2 is optional

FUNCTION FOR INPUT 2

OFF: DISABLE
T+ RESET: RESET TOTAL DIRECT TOTALIZER FOR DIRECT FLOW RATE (+)
P+ RESET: RESET PARTIAL DIRECT TOTALIZER FOR DIRECT FLOW RATE (+)
T- RESET: RESET TOTAL REVERSE TOTALIZER FOR REVERSE FLOW RATE (-)
P- RESET: RESET PARTIAL REVERSE TOTALIZER FOR REVERSE FLOW RATE (-)
DOSAGE: START/STOP BATCH
SELECTION MD: STATIC SELECTION OF FORMULA

MENU 6. OUTPUT

(POS. 6.1) Choice of the function corresponding to on/off output 1 [OUT1= XXXXXX]
Choice of the function corresponding to digital Output 1. The functions are listed in the table below.

(POS. 6.2) Choice of the function corresponding to on/off output 2 [OUT2= XXXXXX]
Choice of the function corresponding to digital Output 2. The functions are listed in the table below.
Attention: Output 2 is optional and is mounted on an optional add on module.

(POS. 6.3) Choice of the function corresponding to on/off output 3 [OUT3= XXXXXX]
Choice of the function corresponding to digital Output 3. The functions are listed in the table below.
Attention: Output 3 is Optional and is mounted on an optional add on module.

(POS. 6.4) Choice of the function corresponding to on/off output 3 [OUT4= XXXXXX]
Choice of the function corresponding to digital Output 4. The functions are listed in the table below.
This is the only output which can reach a 12.5 KHz frequency.
Attention: Output 4 is Optional and is mounted on an optional add on module.

FUNCTION FOR OUTPUT 1, 2, 3 or 4

OFF: DISABLED
#1PULS+: PULSE ON CHANNEL 1 FOR POSITIVE FLOW RATE
#1PULS-: PULSE ON CHANNEL 1 FOR NEGATIVE FLOW RATE
#1PULS±: PULSE ON CHANNEL 1 FOR POSITIVE AND NEGATIVE FLOW RATE
#2PULS+: PULSE ON CHANNEL 2 FOR POSITIVE FLOW RATE
#2PULS-: PULSE ON CHANNEL 2 FOR NEGATIVE FLOW RATE
#2PULS±: PULSE ON CHANNEL 2 FOR POSITIVE AND NEGATIVE FLOW RATE
#1FREQ+: FREQUENCY CHANNEL 1 FOR POSITIVE FLOW RATE
#1FREQ-: FREQUENCY CHANNEL 1 FOR NEGATIVE FLOW RATE
#1FREQ±: FREQUENCY CHANNEL 1 FOR POSITIVE AND NEGATIVE FLOW RATE
#2FREQ+: FREQUENCY CHANNEL 2 FOR POSITIVE FLOW RATE
#2FREQ-: FREQUENCY CHANNEL 2 FOR NEGATIVE FLOW RATE
#2FREQ±: FREQUENCY CHANNEL 2 FOR POSITIVE AND NEGATIVE FLOW RATE
SIGN: FLOW DIRECTION OUTPUT (ENERGISED = -)
RANGE: RANGE INDICATION OUTPUT (ENERGISED = SCALE 2)
MAX AL: MAX FLOW RATE OUTPUT (ENERGISED = AL. OFF)
MIN AL: MIN FLOW RATE OUTPUT (ENERGISED = AL. OFF)
MAX+MIN: MAX AND MIN FLOW RATE ALARM OUTPUT (ENERGISED = AL. OFF)
EMPTY PIPE: EMPTY PIPE ALARM OUTPUT (ENERGISED = FULL PIPE)
OVERFLOW: OUT OF RANGE ALARM OUTPUT (ENERGISED = FLOW RATE OK)
HW ALARM: CUMULATIVE ALARM OUTPUT interrupt coils, empty pipe, measure error (ENERGISED = NO ALARMS)

(POS. 6.5) duty cycle value for output pulses/frequency [OUT.1= XXXXXX]
The duty cycle function defines the time ratio between ON and OFF state when frequency output are used: 50% it means that the ON phase will be the same of OFF phase, 60% it mean that the phase ON will be 60 % and phase OFF will be 40% of the total cycle time.

When pulses output are used, the duty cycle define the OFF phase because the ON phase it's already set with the function "PULSE DURATION"(see menu "SCALE"). In this case if is setting for example the duty cycle at 50% and the pulse duration to 50ms, the OFF phase will be the same of ON phase. The formula for calculate the minimum time of the OFF phase and the time of total cycle is the following:

- T. total cycle= 100 x (pulse duration in ms)/ (duty cycle)
- T. OFF phase = T. total cycle - pulse duration

Note: If the value of the function is set to 0 the issue of the pulses happens in synchronous mode with the flow rate therefore when is uses the function in frequency DOESN'T set the duty cycle to 0. The function is active only if one output is on pulse and/or frequency

(POS. 6.6) Function and the range of current output n.2 [OUT.mA2=X÷XX ±] (OPTIONAL)

Choice of the function and the range of current output N.1. The current output N.1 is **optional and it is** mounted on the main board. There are three fields to modify for this function:

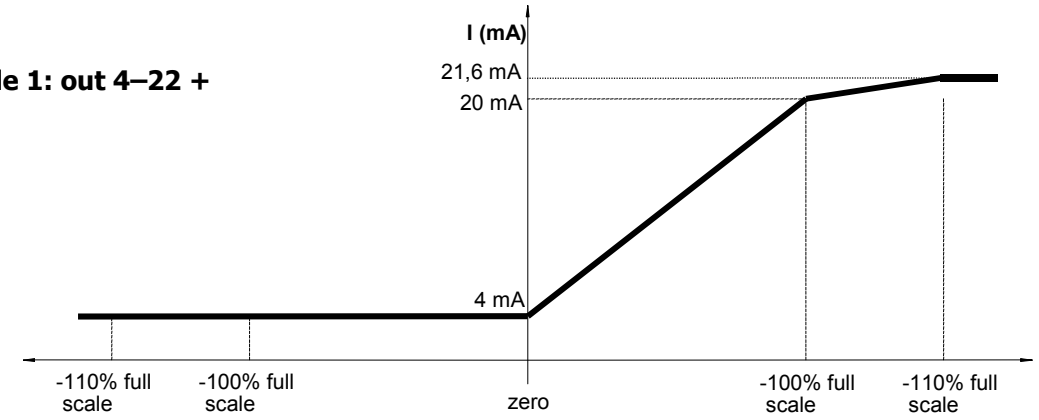
- Scale zero: **4** or **0** mA
- Full scale: **20** or **22** mA
- Field: **+** = positive, **-** = negative, ± = both, -0+ = central zero scale

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

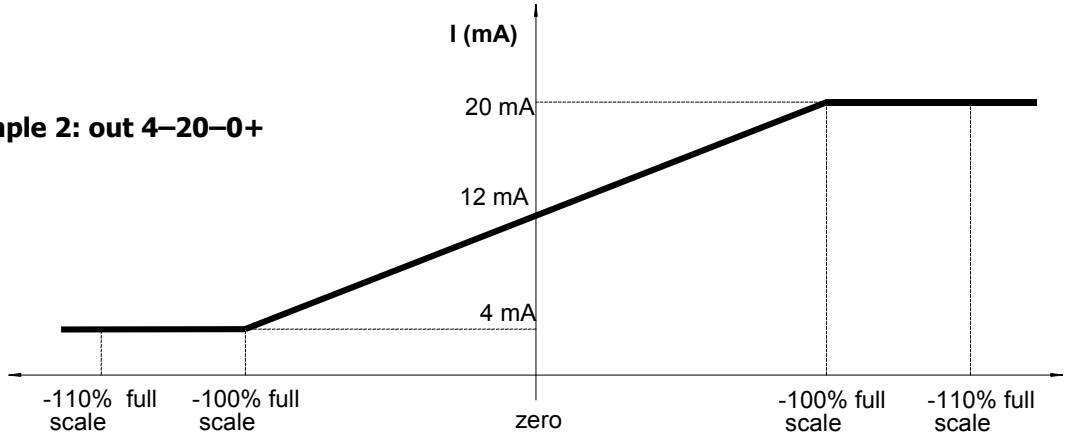
	CURRENT VALUES IN mA ASSOCIATE TO THE % VALUE OF FULL SCALE				
	POSSIBLE FIELD	REVERSE FLOW VALUE		ZERO	DIRECT FLOW VALUE	
		≤ -110%	-100%	0%	+100%	≥+110%
	OutmA = 0–20 +	0	0	0	20	20
	OutmA = 0–22 +	0	0	0	20	22
	OutmA = 4–20 +	4	4	4	20	20
Example 1 page 36 →	OutmA = 4–22 +	4	4	4	20	21.6
	OutmA = 0–20 -	20	20	0	0	0
	OutmA = 0–22 -	22	20	0	0	0
	OutmA = 4–20 -	20	20	4	4	4
	OutmA = 4–22 -	21.6	20	4	4	4
	OutmA = 0–20 ±	20	20	0	20	20
	OutmA = 0–22 ±	22	20	0	20	22
	OutmA = 4–20 ±	20	20	4	20	20
	OutmA = 4–22 ±	21.6	20	4	20	21.6
	OutmA = 0–20–0+	0	0	10	20	20
	OutmA = 0–22–0+	0	1	11	21	22
Example 2 page 36 →	OutmA = 4–20–0+	4	4	12	20	20
	OutmA = 4–22–0+	4	4.8	12.8	20.8	21.6

In hardware alarm conditions "HW ALARM" (interrupt coils, empty pipe, measure error) the current value is programmed by the function "mA VALL. FAULT" (Pos. 4.5) and it is expressed as a percentage of a fixed current range, where: 0% = 0 mA and 110% = 22 mA.

Example 1: out 4–22 +



Example 2: out 4–20–0+



(POS. 6.7) Choice of the function and the range of current output n.2 [OUTmA2= X÷XX±]
Choice of the function and the range of current output N.2. Please refer to the previous function for the possible choices. The current output N.2 is **optional and it is** mounted on the main board.

MENU 7.COMMUNICATION

(POS. 7.1) Network address set [ADDRESS= XXX]
Network address set. The address is to identify the instrument when connected via serial interface. The allowed values are from 0 to 255.

(POS. 7.2) RS485 serial interface communication speed [SPEED1= XXXXX]
Serial interface communication speed for the RS485 output. This parameter may be set to one of the following values: 2400, 9600, 19200 or 38400 bps.

(POS. 7.3) RS232 serial interface communication speed/programming [SPEED2= XXXXX]
Serial interface communication speed for the RS232 output. This parameter may be set at one of the following values: 2400, 9600, 19200 and 38400 bps.
The RS232 port is optional and it is mounted on an optional module.

(POS. 7.4) Print function enable [PRINT= ON/OFF]
Print function enable. The print functions allow the automatic printout once every programmed interval of the process data (flow rate, volumes, alarms, batch quantities, date and time). The printing may also be printed manually upon an operator's request. This function requires the RS 232 output.

N.B.: for information on the protocols communications, refer to MI 200 manual.

(POS. 7.5) Printer connections [PRINTER= ON/OFF]
With the function enabled the meter to sends formatted data compatible with a serial printer out via the optional RS232 port.

(POS. 7.6) Print process data [PRINT DATA= ON/OFF]
With the function enable, the meter allows printing of the data process on regular intervals.

(POS. 7.7) Print alarm events [PRINT EVENTS= ON/OFF]
With the function enable, the meter prints every alarm status.

MENU 8. DISPLAY

(POS. 8.1) Language [LANGUAGE= XX]
Choice of the programming language. There are 4 languages available: **E** = English, **I** = Italian, **F** = French, **S** = Spanish.

(POS. 8.2) Display refresh frequency set [D. RATE=Hz X]
Set the frequency the data on the display are refreshed at. This parameter affects only the display layout and not the response time of the meter itself. The possible choices are: 0.1 – 0.2 – 0.5 – 1, 2, 5 or 10 Hz.

(POS. 8.3) Display contrast set [CONTRAST= X]
Display visual contrast set. The contrast can change in relation to ambient temperature. The set values are from 0 to 15. This function is updated only when leaving the function itself.
Contrast also set can be change from the main display pages by pushing the ⇨ key for 8 seconds or more. In this way the contrast set menu will be visualized at the release of the key.

(POS. 8.4) Enable conversion currency [CURRENCY= ON/OFF]
The activation of this function displays the values of the partial totalizers in the selected unit of currency.

(POS. 8.5) Decimal currency [CURR DECIM= X]
This function allows the choice of the number of decimals to use for the display of the numerical currency value. The allowed values are from 0 to 3. The function is active only if the currency function is enabled (POS. 8.4).

(POS. 8.6) Conversion factor for direct flow rate totalizer [*EUR/dm³+* = X]
Sets the value of currency conversion for direct totalizer (positive). There are three fields to set for this parameter, from left to right:

1) Monetary token
2) Default/personalized monetary token
3) Conversion coefficient. To make the selection, place the cursor over the field to modify. The monetary token may be selected from one of the 7 predetermined monetary tokens (standard ISO 4217-REV81) or your choice of any three characters (numbers or letters):

   EUR = Eur
   USD = USA dollar
   CAD = Canadian dollar
   AUD = Australian dollar
   GPB = English pound
   CHF = Swissfranc
   JPY = Japanese yen.

To select your own characters, the cursor has to be positioned on the symbol "/" (field N. 2)

(POS. 8.7) Conversion factor for reverse flow rate totalizer [*EUR/dm³-* = X]
Sets the value of conversion / currency for reverse totalizer (negative)
Refer to the previous function.

MENU 9. DATA LOGGER

(POS. 9.1) Date and time set [🕐 = dd/mm/yy hh:mm]
Date and time set. If the optional real time clock module is present, then the time setting is preserved even when the power supply is off, otherwise it is frozen till the power supply is back. For example, if the power supply has been off for one hour, when switched on the instrument will be one hour late. The calendar is valid till year 2091.
N.B.: date and time are visualized on display only if the data logger is enabled (Pos 9.2).

(POS. 9.2) Automatic data logging enable [ACQUISITION= ON/OFF]
Automatic data logging enable for volume values. The data are sampled every time interval set in the following function.

(POS. 9.3) Data logging time interval set [INTERV.(h)= X]
Sampling time interval for the data logging function and data printing. The allowed values are: 1, 2, 3, 6, 8, 12, 24, 48 hours.

(POS. 9.4) Logged data display [DISPLAY DATA]
Displaying of the data stored in the data logger. With this function it is possible to scroll through the stored data.

(POS. 9.5) Alarm events visualization [DISPLAY EVENTI]
Visualization function of the events. With this function it is possible to visualize in succession all of the alarm events collected during the operation of the meter up to a maximum of 64 events.

(POS. 9.6) Logged data cancel [CLEAR DATA]
Logged data cancel function. With this function the storage memory is completely cleared.

(POS. 9.7) Reset alarm events [CLEAR EVENTS]
Resets all alarm events.

MENU 10. DIAGNOSTIC

(POS. 10.1) Meter "calibration" [CALIBRATION]
Enables the calibration of the meter. The activation of this function happens by pressing the key during the display of this menu option. The following question will be displayed: "EXECUTE?" press the key for more of two seconds to confirm. Press any other key to stop the operation.

(POS. 10.2) "Autotest" function enable [SELF TEST]
Meter auto-test function. This function stops the normal functioning of the meter and performs a complete test cycle on the measurement input circuits and on the excitation generator. To activate this function, after selecting it, push the key, at the question: "EXECUTE?" push the key for more than 1 second to start the auto test, or any other key to delete the operation. The result of the test is shown on the display. At the end of the operation error messages will be displayed (explained in Appendix A.) or you will return to the main display screen. This function is also automatically performed when switching the device on.

(POS. 10.3) Flow rate simulation enable [SIMULATION]
Flow rate simulation enable. With this function it is possible to enable the generation of an internal signal, which is applied to the input terminals simulating the flow rate, allowing you to the test the outputs and all of the connected instruments.

After enabling flow rate simulation you must return to the main display screen to set the flow rate to the desired value:

- Set Value: push the key for more than 1 second from one of the four main display pages. Set the desired value by moving left or right to the desired digit and using the up or down keys to change its value.
- Start Simulation: push the key to set the desired value
- Stop Simulation: push the key for more than 1 second from one of the four main display pages and then push the key for more than 1 second.

(POS. 10.4) Electrodes Test [Service Use - Requires Keycode L3]

MENU 11. INTERNAL DATA

(POS. 11.1) Level 2 access code set [L2 KEYCODE= XXXXX]
Level 2 access code. This code is programmable by the user within the range 00001 - 65535. Setting a value of 22222 means that the access code for levels lower than level 3 is disabled.

(POS. 11.2) Block level [LOCK LEVEL =X]

Block level function can be set from 0 to 3. Every level enables and disables the use of specific functions.
N.B.: the block levels are enabled only if the dip-switches on the back of converter are on (turn on the small levers towards the symbol of the padlock)

(POS. 11.3) Load Factory Pre-settings [LOAD FACT PRES.]
Loads the pre-set factory default program. Any previous programming is cancelled and all settings are set to the manufacturer's standard values.

(POS. 11.4) Load User Pre-settings [LOAD USER PRES.]
This function recalls the values saved by the user.

(POS. 11.5) Save User Pre-settings [SAVE USER PRES.]
This function saves the current programming as the "user pre-settings".

(POS. 11.5)	**Save Factory Pre-settings**		**[Service - Requires Keycode L3]**
(POS. 11.6)	**Memory reset**		**[Service - Requires Keycode L3]**
(POS. 11.7)	**Serial Number**	**[Serial nbr= XXXXX]**	**[Service - Requires Keycode L5]**
(POS. 11.8)	**Hours**	**[Hours= XXXXXX]**	
(POS. 11.9)	**KT**	**[KT= XXXXX]**	**[Service - Requires Keycode L4]**
(POS. 11.10)	**KR**	**[KR= XXXXX]**	**[Service - Requires Keycode L3]**
(POS. 11.11)	**KS**	**[KS= XXXXX]**	
(POS. 11.12)	**Zero**	**[Zero= XXXXX]**	**[Service - Requires Keycode L3]**
(POS. 11.13)	**DAC1 20 mA**	**[20mA= XXXXX]**	**[Service - Requires Keycode L3]**
(POS. 11.14)	**DAC1 4 mA**	**[4 mA= XXXXX]**	**[Service - Requires Keycode L3]**
(POS. 11.15)	**Data Logger**	**[DLOGGER= ON/OFF]**	**[Service - Requires Keycode L4]**
(POS. 11.16)	**Input**	**[INPUT= ON/OFF]**	**[Service - Requires Keycode L4]**
(POS. 11.17)	**DAC1**	**[DAC1= ON/OFF]**	**[Service - Requires Keycode L4]**
(POS. 11.18)	**RS485**	**[RS485= ON/OFF]**	**[Service - Requires Keycode L4]**

MENU 12. BATCH

Menu displayed only with batch active (output on batch and/or pos. 5.9 enable or 5.10 on batch)

(POS. 12.1) Number of batch samples [N.SAMPLES= XXX]
Number of batch cycles to define the value of compensation. This function determines automatically the average value for automatic compensation of system delay (POS. 9.3). Set this function to ZERO for manual introduction of the compensation value.

(POS. 12.2) % limit of compensation [DIFF.THR=% XXX]
This value defines the percentage of maximum difference between the value of compensation set (see pos. 12.3) and the value of compensation defined with the function 9.1. Over this threshold the new value of compensation will automatically be set (if the number of batch samples is different than zero)

(POS. 12.3) Compensation value [V.COM.= XX.XXX]
This value, expressed in the same unit of measure as the selected volume, is the result of the difference between the batch value set and the quantity of product disbursed and compensates for the delays of the system (closing of valves, stopping of pumps, stopping of motors, etc.)
Attention: if you need to manually set the value of compensation, set to ZERO the number of batch samples (POS. 12.1)

(POS. 12.4) Prebatch value [V.PRE.= XX.XXX]
Sets the volume of liquid at which you want to enable the pre-batch. At the pre-batch volume "V Pre" the output (if enabled) is de-energized. This value is constant for all quantities to batch and must be set in the current unit of measure of volume. The pre-batch function is useful when you need fast and accurate fillings.

(POS. 12.5) Enable/disable auto-batch function [AUTO BATCH= ON/OFF]
Applying a voltage on the on/off input terminals for more than 5 seconds the valve, driven from the meter, opens until voltage is applied on the input. When the product has reached the desired volume/level, removing voltage from the input: the meter closes and the valve remembers the volume of product disbursed in the current memory batch (see "BATCH FUNTIONS"); the value obtained with this procedure will be the volume of each subsequent batch. To modify this value, repeat the operations above.
This procedure sets the safety timer to 1.25 times more than the time employed to reach the batch quantity; it also will reset the counter of the number of the batch.

(POS. 12.6) Automatic selection of batch formula [BM AUTO SEL= ON/OFF]
The function allows the automatic selection of the first 4 formulas based on the duration of the pulse at the start of the batch (see page 16 "Input operation stage"). This function is active only if the function "cons. Mode" has not been enabled (POS. 12.7). Besides activating this function automatic compensation of the batch volume is also excluded the (the value of the parameter "N.medie" (POS. 12.1) will be automatically set to zero). However it is possible to manually add compensation by entering the desired value on parameter "V.com" (POS. 12.3)

(POS. 12.7) Static consent of batch [Cons. mode= ON/OFF]
The function enables the start and the stop of the batch using a static signal applied to the input instead of a pulse ("input operation stage"), this signal will stay applied through the entire batch. This function automatically disables the functions "BM AUTO SEL" (POS. 12.6) and " AUTO BATCH" (POS. 12.5).

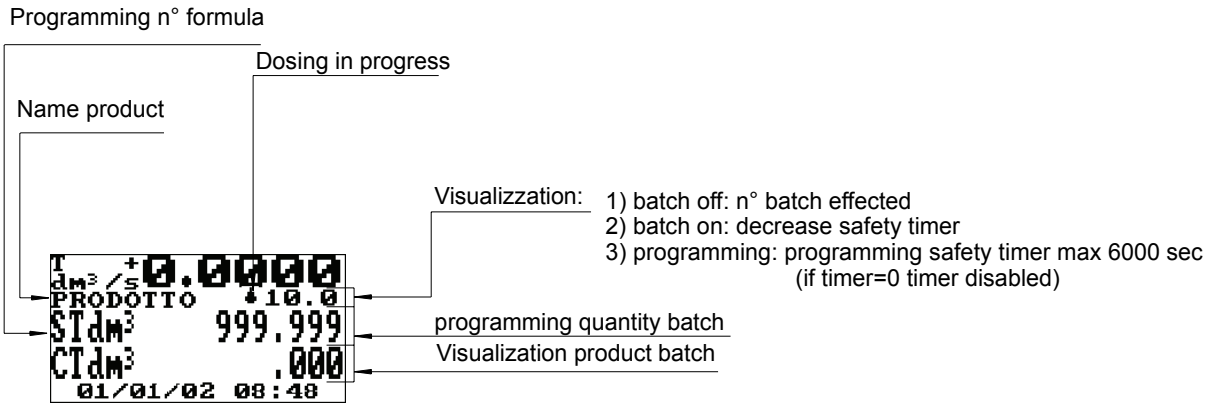
BATCH FUNCTION

ENABLE BATCH

Enable one of the following functions to enable and program the batch on the converter:

POS. 5.9-5.10: START/STOP batch from input
POS. 6.1-6.2: assign one of the functions to one of two outputs

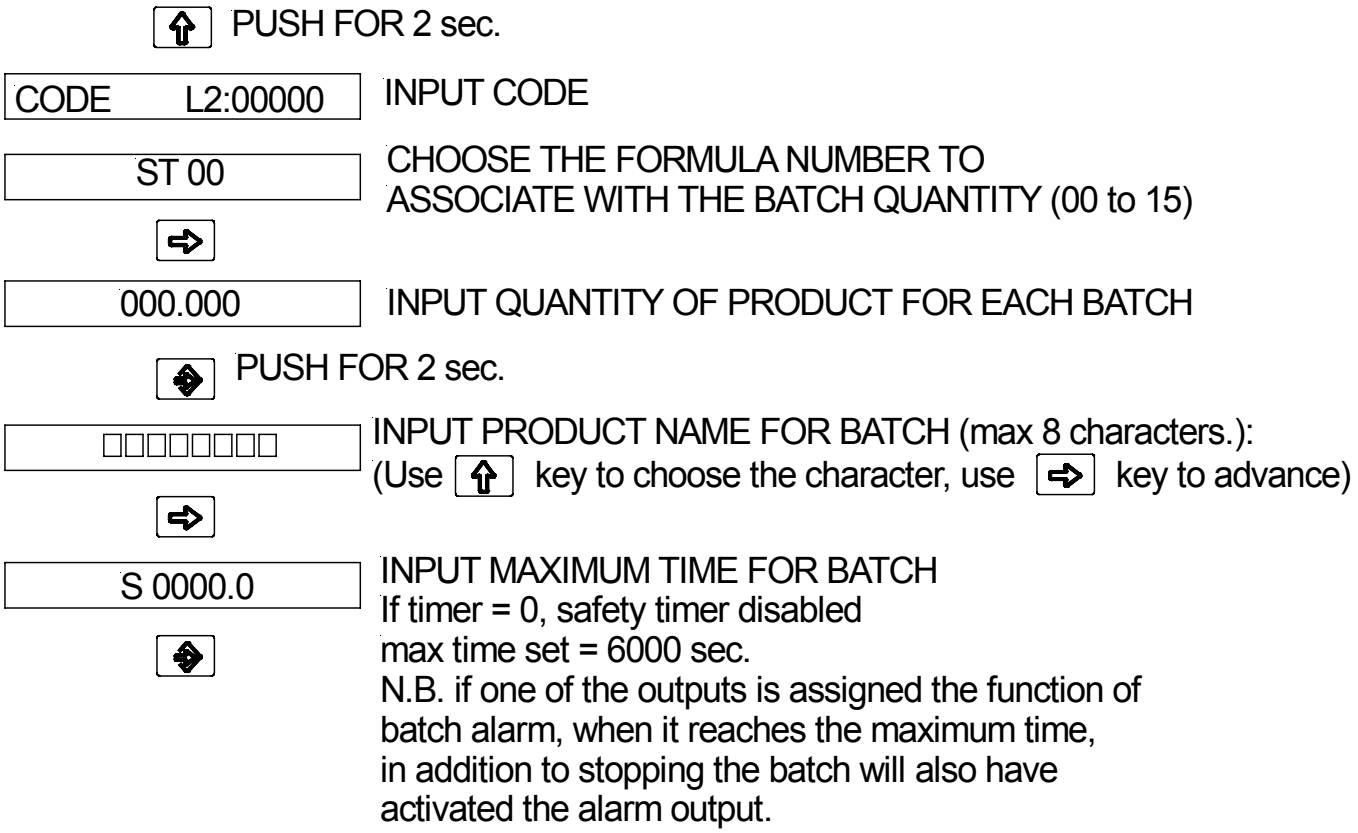
DISPLAY PAGE ON SCREEN WITH IF2 SERIAL INTERFACE AND BATCH FUNCTION ENABLE



N.B.: For each formula you can associate:

- Product quantity
- Product name
- Maximum time for batch (safety time for each formula)

After activating the batch function from display page on previous page:



START STOP BATCH

START: it is possible activate the start of batch in two different ways:

1) ***From remote input:*** by assigning the functions of start/stop batch to the input 1 (POS. 5.9) or input 2 (POS. 5.10) and using the input/s.

2) ***From keyboard:*** short pressing of the ⇧ key.

N.B.: the start of batch from the keyboard is always on the trailing edge (release of the button) and is not available with the function of batch consent (POS. 12.7)

STOP: the stop of a batch could be caused by three events:

1) **From keyboard or remote input** (manual stop): in this case the procedures for the stop are the same as listed for the start

2) **End batch:** in this case the stop of a batch will have been activated from an output signal at the end of the batch quantity

3) **Maximum time of batch:** if a maximum time for batch is set and this has been exceeded, the batch stops independently from the batch quantity.

Notes:

- With the serial cable IF2 during the batch is shown on the display the symbol of the active batch and the name of the formula.
- When the output of a batch is enabled, push the ⇧ key for more than 5 seconds, and the output will remain energized until the key releases. On the display, on CT and ST totalizers appear the following text:

  !! VALVE !!
  !! OPENED !!

IMPORTANT NOTES

The start of a batch disables any function listed below:

*: IF USED ON INPUT 1 **: VALUE TO 0		POS 9.4 AUTO BATCH	POS 9.5 BM AUTO SEL	POS 5.3 BLOCK TOTALIZER	POS 9.1 N. SAMPLES	POS 5.6 INPUT 1 ON START/STOP BATCH	POS 3.7-5.5 AUTO RANGE CHANGE OR FROM INPUT	POS 3.8 ENERGY SAVING	POS 5.4 CALIBRATION
POS 9.4	AUTO BATCH			*DISABLE					
POS 9.5	BM AUTO SEL				**DISABLE				
POS 9.6	CONS. MODE	DISABLE	DISABLE	*DISABLE					
POS 5.6	INPUT 1 ON START/STOP BATCH						DISABLE	DISABLE	DISABLE
POS 5.7	INPUT 2 ON START/STOP BATCH					DISABLE	DISABLE	DISABLE	DISABLE
POS 5.7	BM SELECT		DISABLE		**DISABLE				
POS 6.1-6.2	OUTPUT ON END BATCH						DISABLE		

ACTS ON

To optimize the performance of the meter used in a batch application, it is recommended to set it as close as possible to the characteristics of the process, choosing the most opportune values of time constant (pos. 3.1) and acceleration threshold (pos. 3.2).

APPENDIX A - ALARM MESSAGES, CAUSES AND ACTIONS TO BE TAKEN

Message	Cause	Action to take
MAX ALARM	The flow rate is higher than the maximum threshold set	Check the maximum flow rate threshold set and the process conditions
MIN ALARM	The flow rate is lower than the minimum threshold set	Check the minimum flow rate threshold set and the process conditions
FLOW RATE >FS	The flow rate is higher than the full scale value set on the instrument	Check the full scale value set on the instrument and the process conditions
PULSE/FREQ>FS	The pulse generation output of the device is saturated and cannot generate	Set a bigger unit of volume or, if the connected counting device allows it, reduce the pulse duration value
EMPTY PIPE	The measuring pipe is empty or the detection system has not been properly calibrated	Check whether the pipe is empty or perform again the empty pipe function calibration procedure
BATCH ALARM	Batch interrupted for the followings condition: - Timer batch expired before the end of the batch. - Batch valve open and flow rate to zero for a time longer than the safety timer set. - Batch valve closed and flow rate different from zero for a time longer than the safety timer set	Verify: presettings system condition
INPUT NOISY	The measure is strongly effected by external noise or the cable connected the converter to the sensor is broken	Check the status of the cables connecting the sensor to the converter, the grounding connections of the devices or the possible presence of strong and anomalous noise sources
EXCITATION FAIL	The coils or the cable connecting the sensor to the converter are interrupted	Check the status of the cables connecting the sensor to the converter
CURR. LOOP OPEN	The output 0/4...20mA on-board or optional is not connected correctly or on a correct load	Verify if the load is applied to the output (max 1000 ohm). To disable the alarm preset the "mA VAL.FAULT" value (menu alarm) to 0.
P.SUPPLY FAIL	Problem on the internal power supply	Verify if the value of power supply it's that suitable in the data label of the converter

Error Codes & Interpretation Of Error Flags

CODES	ERROR DESCRIPTIONS	ACTION TO TAKE
0001	Problem with watch-dog circuit	CONTACT SERVICE
0002	Wrong configuration work data in EEPROM	
0004	Wrong configuration safety data in flash EEPROM	
0008	Defective EEPROM	
0010	Defective keyboard (one or more keys are pressed during the test)	
0020	Reference voltage out of range	
0100	Initialization error ADC primary of system	
0200	Timeout calibration input (input circuit is broken)	
0400	Gain input stage is out of range	Check the status of the cables connecting the sensor to the converter, the grounding connections of the devices or the possible presence of strong and anomalous electrical noise sources.
0800	Interruption coils circuit	Check the status of the cables connecting the sensor to the converter.

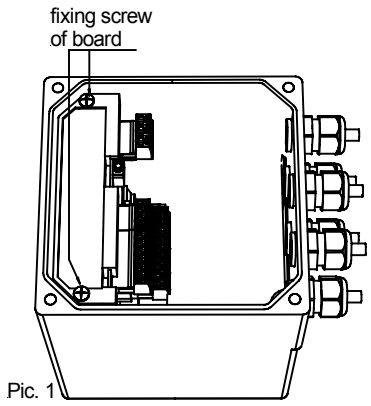
MEANING OF ERROR FLAGS	
FLAG	**DESCRIPTION**
M	Alarm max activated
m	Alarm min activated
!	- Interruption coils circuit - Signal error - Empty pipe
C	Calibration active
S	Simulation active

APPENDIX B - MAINTENANCE OF THE INSTRUMENT

VERIFY PERIODICALLY:

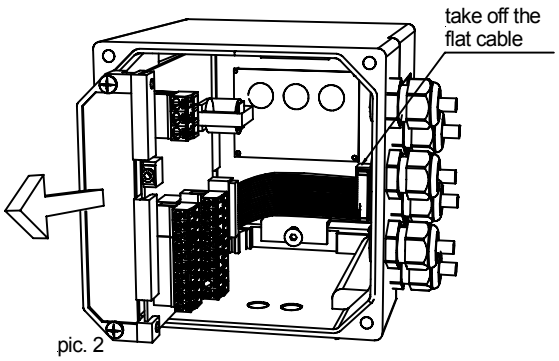
- The integrity of the power supply cables, wiring and other electrical parts connected.
- The integrity of the instrument's housing (this must not have bruises or other damages that may compromise the hermetical sealing).
- The tightening of the sealing elements (cable glands, covers, etc.).
- The integrity of the front panel (display and keyboard), damage may compromise the sealing.
- The mechanical attachment of the instrument to the pipe or on the wall stand.

APPENDIX C - DISPLAY ROTATION



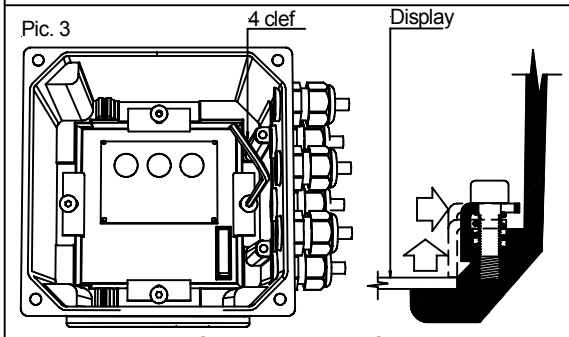
Pic. 1

- Unscrew the screws suitable in pic. 1



pic. 2

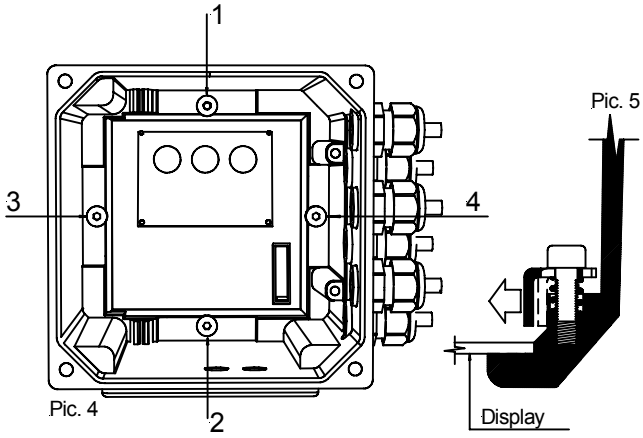
- Lift the board, take off the flat cable from the display pic. 2 and extract definitely the board from the box



Pic. 3

- Unscrew the fixing screw of display to allow the shift of the angular and the extraction of the display

N.B.: don't unscrew entirely the screw



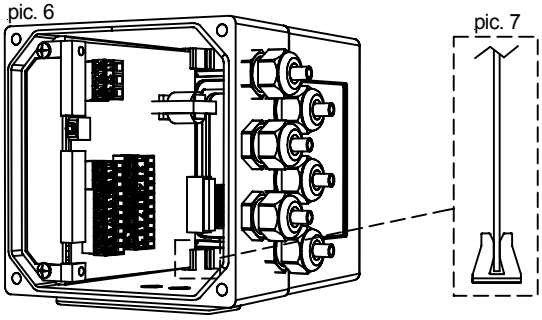
Pic. 4

Pic. 5

- Rotate the display in the desired location, verify the correct set of the seal, the cleaning of the contact surfaces of and set the display in the lodging.

- Shift the angular in the suitable direction (pic. 5) and screw down the scew, till to the support perception of the angular on the display

- Shut definitely the screw in the order 1-2-3-4 suitable in represents pic. 4



- Reinstall the flat cable to the display

- Verify the correct seat of the board into the fixing clip (Pic.7)

- Reinstall the mounting screws that attach the board to the enclosure.