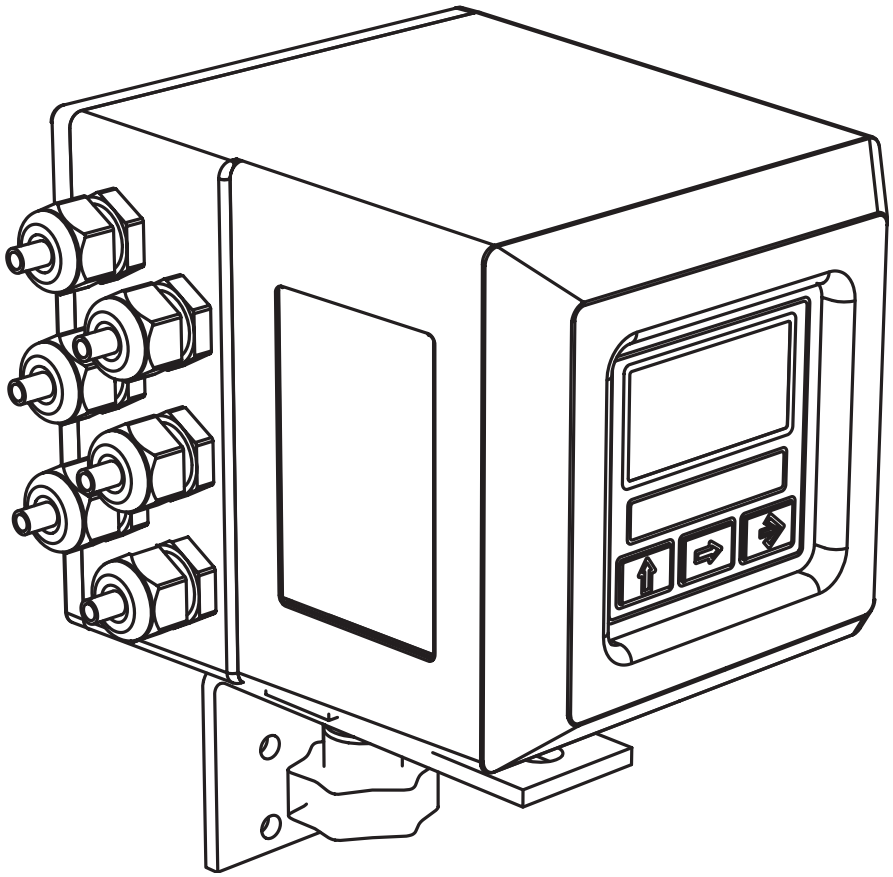
Installation & Operation Manual

HML210 Converter

LCMag Electromagnetic Flowmeters

LIQUID CONTROLS
A Unit of IDEX Corporation

IDEX CORPORATION



Installation

www.lcmeter.com

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Publication Updates and Translations

The most current English versions of all Liquid Controls publications are available on our website, **www.lcmeter.com**. It is the responsibility of the Local Distributor to provide the most current version of LC Manuals, Instructions, and Specification Sheets in the required language of the country, or the language of the end user to which the products are shipping . If there are questions about the language of any LC Manuals, Instructions, or Specification Sheets, please contact your Local Distributor.

⚠ WARNING

- Before using this product, read and understand the instructions.
- Save these instructions for future reference.
- All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of equipment and/or systems in accordance with all applicable codes and ordinances.
- Failure to follow the instructions set forth in this publication could result in property damage, personal injury, or death from fire and/or explosion, or other hazards that may be associated with this type of equipment.

Liquid Controls offers a broad selection of electromagnetic (Mag) flow meters for industrial, water, and waste water flow measurement applications, worldwide. The LCMag family consists of seven sensor models for specific applications. The models include micro-flow, wafer, sanitary, flanged, pipe clamp, and insertion meters. The units are offered in a wide variety of sizes, materials, and flow ranges for many industrial and OEM applications.

The LCMag family of electromagnetic flow meters offers the best solution for measuring the flow of electrically conductive liquids (5µS/cm minimum), for the following reasons:

- Accuracy is not affected by fluid characteristics such as viscosity, density, temperature, or suspended solids.
- No moving parts.
- Virtually no pressure drop.
- Clean-in-place construction (HMS501 and HMS2410 with remote converter only).
- Minimal maintenance.
- Easy to install and operate.
- Wide range of nominal diameters from 1/8" to 72".
- Wide range of flow rates from as low as 0.1 GPM to as high as 400,000 GPM.
- Automatic, dual flow range capability.
- Broad selection of liners, electrode materials, and process connections.
- High, full-scale accuracy, ±0.2% over a 10:1 range (for liquid velocity greater than 4 ft/second) with some sensor/converter combinations.

LCMag meters are available in a full selection of configurations and sizes. Models are available in flow ranges from 0.10 GPM to 400,000 GPM and in process fittings from 1/8" NPT to 72" flanged meters and up to 80" for insertion meters. Connections include flanged, threaded, wafer, pipe clamp, and sanitary. A scaled, digital pulse output is standard. A wide range of additional outputs are available. These include: analog (0–20mA or 4–20mA) serial (RS-232 or RS-485), relays, Profibus DP, additional inputs, and data logger.

The **HML210 Converter** is for use with all HMS series flow sensors (except HMS600 and HMS5000). The converter is a programmable, microprocessor-driven unit providing automatic zeroing, EEPROM data protection on loss of power, empty pipe detection, and self diagnostics. The optional display matrix is 128 x 64, 8-line (16 characters per line) with three external membrane programming keys.

Features

- Available with three external membrane programming keys
- IP67 rating
- Available with an LCD display; 8 lines, 16 characters, backlit
- Two digital outputs
- Four internal totalizers
- Panel mount configuration available

Accuracy

Capable of ±0.2% for liquid velocity > 4 ft/sec (with full bore sensors)

Repeatability

Capable of 0.01% or better

HML210 mounted on an HMS2500 Flange Sensor

Safety

Before applying power to the instrument please, verify the following:

- Power supply voltage must correspond to that specified on the name plate of the instrument.
- Electrical connections must be made as described on pages 8-9.
- Ground connections must be correctly installed.

Periodically Verify:

- The integrity of the power supply cables, wiring, and other connected electrical equipment.
- The integrity of the instrument's housing. The housing must not have any damage that could compromise the environmental sealing.
- The torque setting of elements such as cable glands, covers, etc. (Use supplied fittings if using hard conduit).
- The integrity of the front panel, display, and keyboard. Damage may compromise the environmental sealing.
- The mechanical attachment of the sensor to the pipe and the converter mounted to a wall (for remote converter mounting).

Grounding Instruction


For correct operation of the instrument, it is essential that the sensor and the liquid are at the same electrical potential. Always connect the sensor and converter to a dedicated earth ground.

Legend


Dangerous voltage. Terminals identified by this symbol are subject to variable voltages that may exceed 60VDC and cause electric shock. Terminals 12 and 13 (page 7) have a 60VDC max with 250V spikes during magnetic field switching.


Dangerous voltage. May cause severe electric shock.


General warning.


Caution.



Always establish a reliable electrical connection to ground before using the instrument.


Verify that the supply voltage is the same as written on the nameplate of the converter.


Ensure that the power supply voltage is not connected to the outputs or to any terminals of terminal blocks M1 or M2.


Carefully close the rear cover of the converter when the electrical connections are completed.


Do not open the converter's rear cover when the power is on.



Avoid any attempt to repair the converter or sensor. If the system is not functioning properly, please call the nearest authorized service center.

Electrical Specifications

Classification of the instrument:

- Class I Division 2, IP 67.

Power Supply Versions	Power Supply voltage	Power Supply Frequency	PMax	Current Max
HV	90 to 265 VAC	44 to 66Hz	20W/25VA	0.25A
LV	18 to 45 VAC/DC	0-44 to 66Hz	20W/25VA	1.6A
LLV	10 to 35 VDC		20W	1.5A

Environmental Specifications

- This instrument can be installed inside or outside of buildings subject to the specifications indicated.
- Altitude: -650 to 19,680 feet (-200 to 6,000 m).
- Humidity range: 0 to 100% (IP 67, NEMA 6/6P).

Temperature Specifications

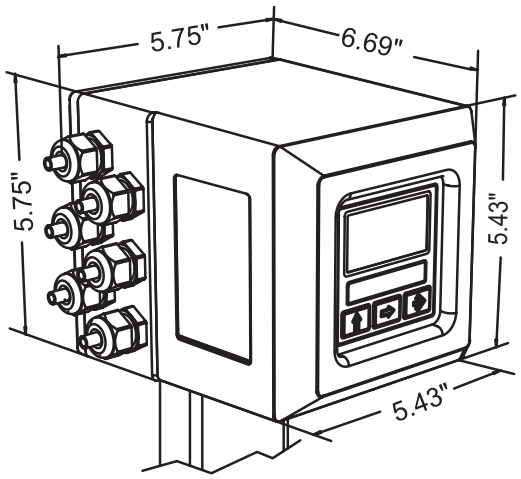
Ambient Temperature: -4º to 122ºF (-20º to 50ºC)

Input / Output Isolation

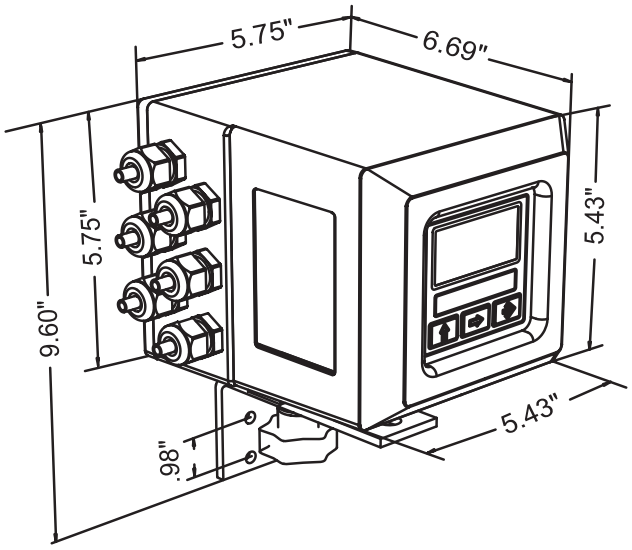
- Inputs and outputs are isolated up to 500V.
- The 4- 20mA analog output and the 24VDC output are electrically connected.

Converter Dimensions

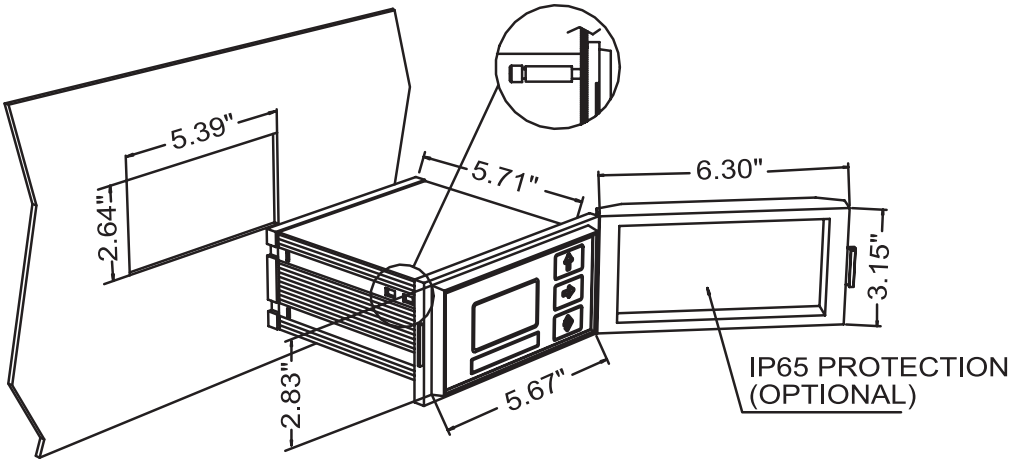
Integral (Compact) Mount Version.



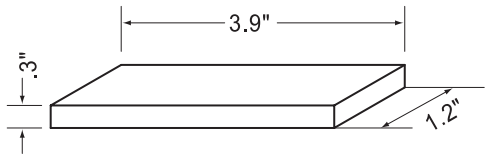
Remote Wall Mount Version.



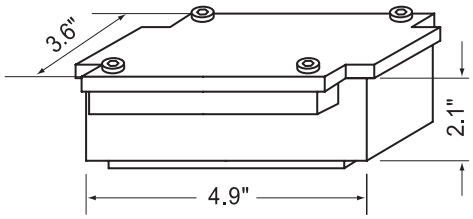
Panel Mount Version



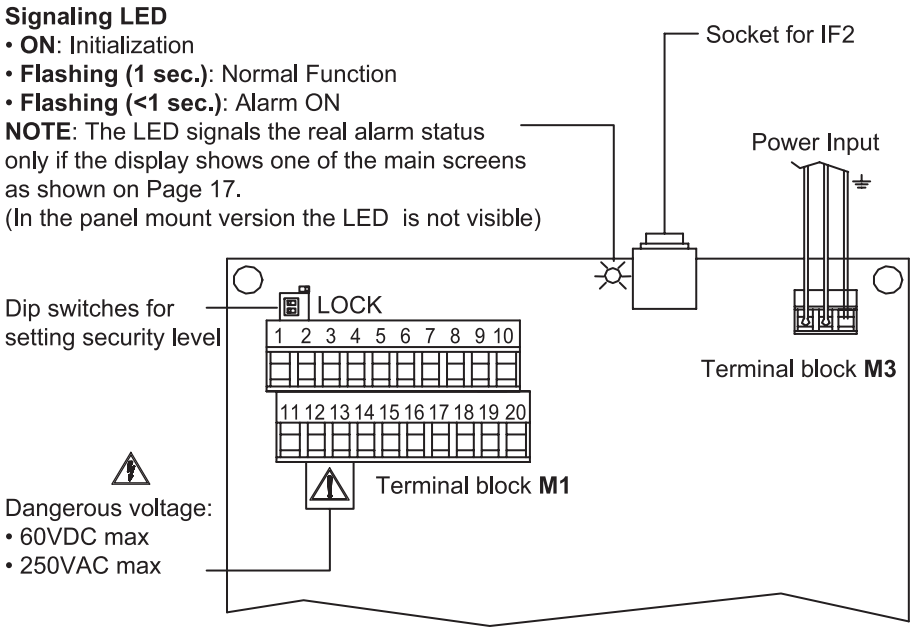
Sensor Cover



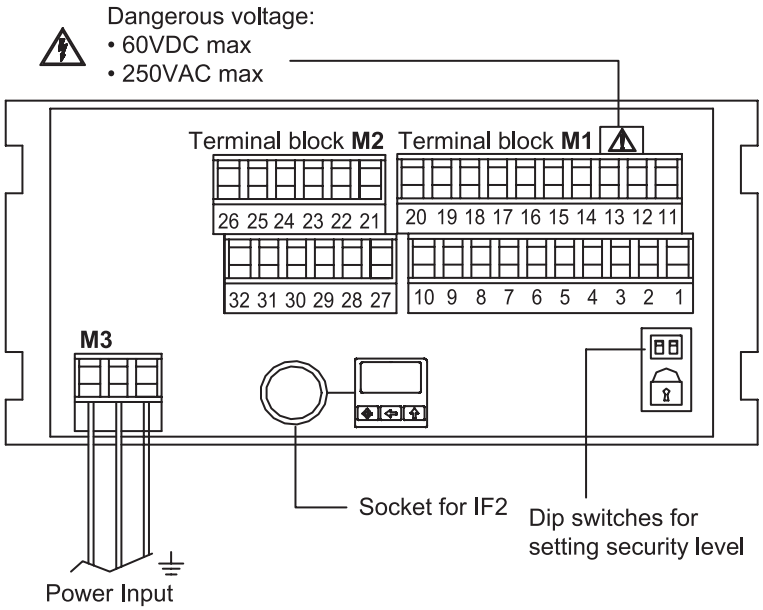
Pre-Amplifier



Terminal Block M1 For Integral and Remote Mount Versions



Terminal Block M1 For Panel Mount Versions



Wiring Instructions

⚠ IMPORTANT

For North American Installations, the installation must be fully in accordance with the National Electrical Code (US) or the Canadian Electrical Code respectively to maintain the hazardous location ratings on the product.

For European installations, the installation must be fully in accordance with EN60079-14 to maintain the hazardous location ratings on the product. This may involve using special cable glands for all connections.

Sensor to Converter Connection

There are several options for the Sensor to Converter interface.

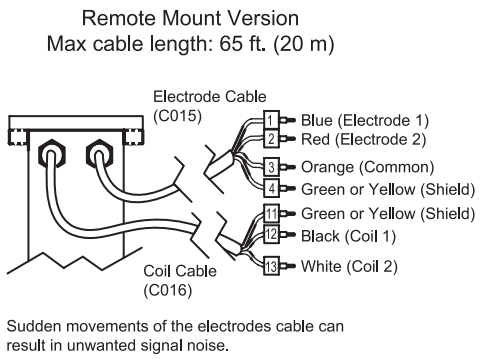
- HML210 Converter mounted integrally on the sensor (compact).
- HML210 Converter mounted remotely from the sensor (remote). This requires cable assemblies C015 and C016.
- HML210 Converter mounted remotely from the sensor in a panel (remote).

If the HML210 is mounted remotely from the sensor, the following guidelines must be adhered to:

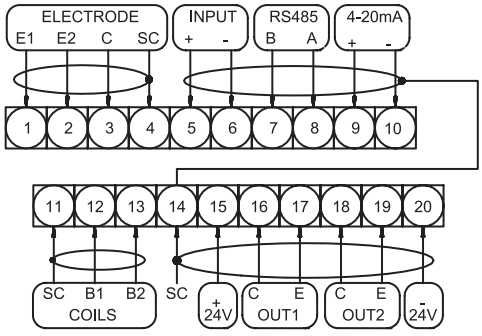
- Maximum distance from the HML210 to the sensor is 30 ft for fluids with a conductivity less than 200µS (micro siemens).
- Maximum distance from the HML210 to the sensor is 65 ft for fluids with a conductivity greater than 200µS.

For applications where these conditions are not met, a preamplifier is required. This mounts directly on top of the sensor. With a preamplifier installed, the maximum distance from the sensor to the HML210 is 1,640 ft (500m).

NOTE: For proper installation, the cables must be ordered with the unit. User supplied cables may void warranty coverage and could affect the functioning of the meter.



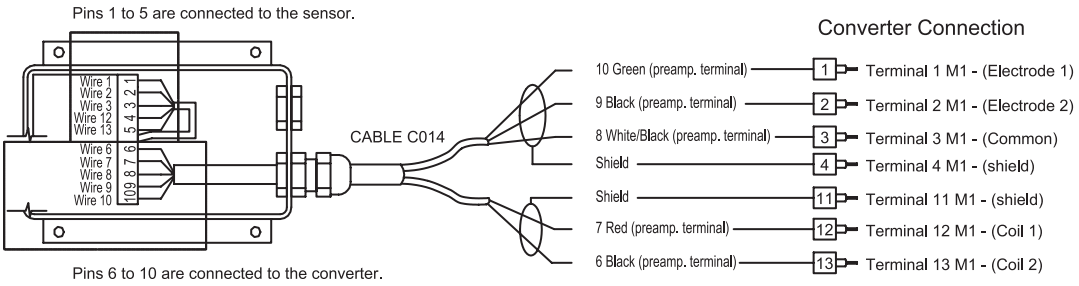
Sensor



*Converter Terminal Block **M1***

Preamplifier Version

NOTE: Maximum length of cable C014 is 1,640 ft (500m).



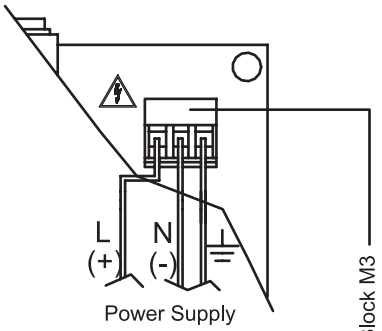
Connecting Power to the Converter

As described in the Technical Specifications on page 5, there are three different configurations for converter input voltage. Before connecting the power source to the converter, verify that the supply voltage falls within the limits indicated on the converter nameplate.

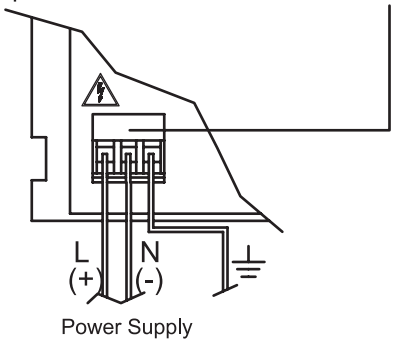
- The power supply line must be equipped with an external device for overload protection (10A maximum fuse or circuit breaker).
- Ensure that a circuit breaker is installed in proximity to the converter and is clearly identified and easily accessible by the operator.
- Use only approved (fireproof) conductors for all field wiring.

NOTE: The converter for DC power supply (10-35VDC) is not protected against reverse polarity. Do not apply reverse polarity voltage.

Rear view of converter,
remote mount and compact version.



Rear view of converter,
panel mount version.



Optional Modules

Optional Modules without Relays

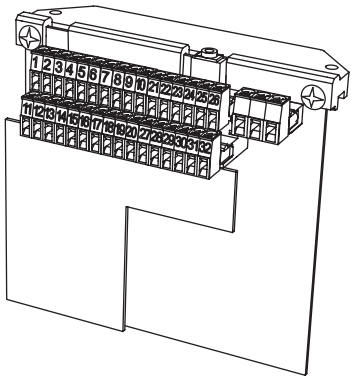
The module name is viewable when powering on the converter.

- **ME200:** two programmable ON/OFF digital outputs. (Option C)
- **ME201:** one programmable ON/OFF digital output and one high frequency output. (Option D)
- **ME202:** one 0/4 to 20mA analog output and two programmable ON/OFF digital outputs. (Option E)
- **ME203:** one RS-232 port and two programmable ON/OFF digital outputs. (Option F)
- **ME204:** one RS-232 port, two programmable ON/OFF digital outputs, and one 0/4 to 20mA analog output. (Option G)
- **ME220:** Data logging module. (Option M)

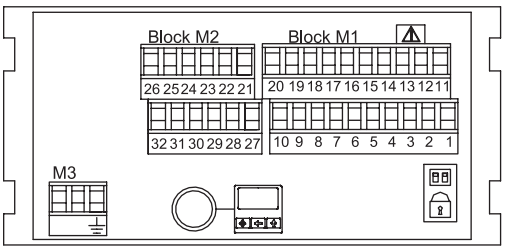
Legend for RS-232 Communication

- **SC:** Cable shield, electrically connected to ground and to the chassis.
- **CTS:** RS-232 Input "**CLEAR TO SEND**".
- **RD:** RS-232 Input "**RECEIVE DATA**".
- **TD:** RS-232 Output "**TRANSMIT DATA**".
- **SG:** "**SIGNAL GROUND**" common to all signals of the RS-232 port.
- **C:** "**COLLECTOR**" of the transistor + output.
- **E:** "**EMITTER**" of the transistor - output.

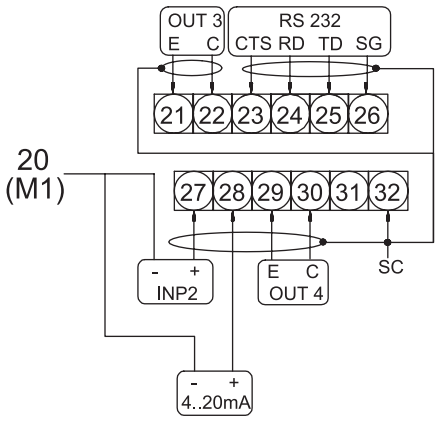
INTEGRAL AND REMOUNT-MOUNT VERSIONS



PANEL-MOUNT VERSION



Terminal Block
ME203, ME204



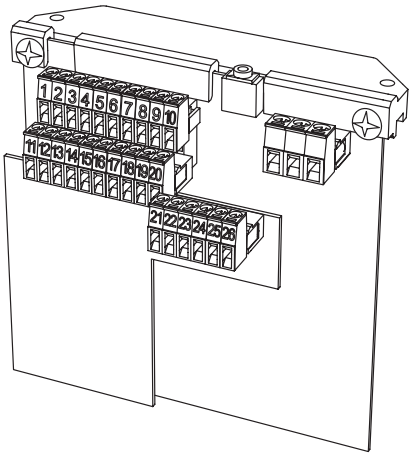
Optional Modules with Relays

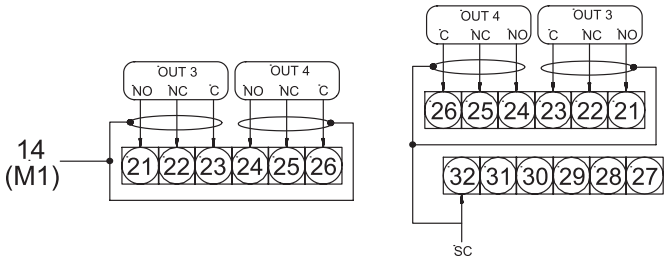
- **ME207:** two relay outputs with one NO contact and one NC contact each, 2A 250VAC, 60W/125Va. (Option T).

Legend

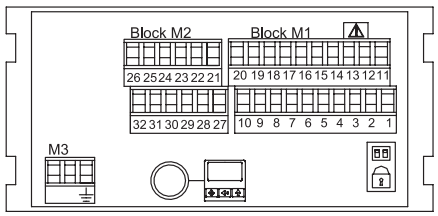
- **SC:** Cable shield, electrically connected to ground and to the chassis.
- **C:** Relay - common.
- **NC:** Normally closed contact.
- **NO:** Normally open contact.

INTEGRAL AND REMOTE-MOUNT VERSION





PANEL-MOUNT VERSION



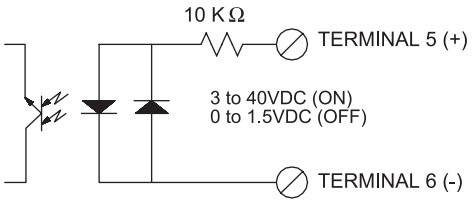
Digital Input

There are three types of digital input:

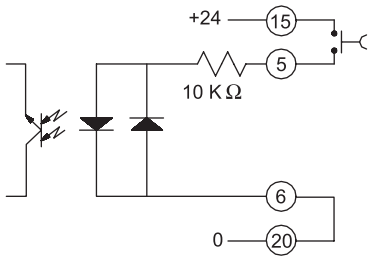
1. Functions assignable to digital input 1 only (page 12).
2. Functions that act directly on the inputs and independently from the selected input (page 13).
3. Functions assignable to input 1 only and functions assignable to input 2 only, which can affect each other based on their current state.

NOTE: Activation of any **Batch** function automatically disables other functions. A table describing the relationships between these outputs is on page 34.

INPUT WIRING
external power supply



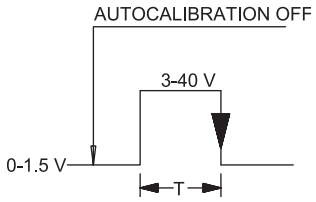
INPUT WIRING
internal power supply



Digital Input

Input Operation (Generic Functions)

Activate Auto-Calibration from a Remote Input

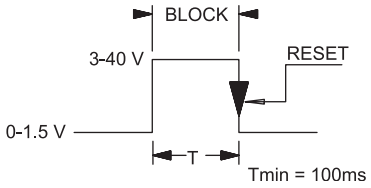


T_{MIN} < T < 1 second = Autocalibration
T > 1 second = Autozero

Necessary conditions for this function to be enabled:
- **Calibration** enabled (**10-DIAGNOSTIC** menu).
- **Batch** on digital input 1 disabled (**5-INPUTS** menu).
- **Batch** on digital input 2 disabled (**5-INPUTS** menu).

NOTE: This feature should not be used for applications with large viscosity variations.

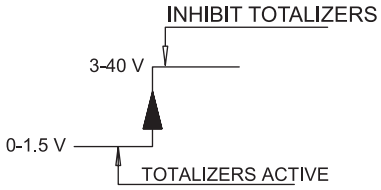
Reset Totalizer from a Remote Input



Necessary conditions for this function to be enabled:
- One of the following must be enabled:
  - **T+ RESET** (**5-INPUTS** menu).
  - **T- RESET** (**5-INPUTS** menu).
  - **P+ RESET** (**5-INPUTS** menu).
  - **P- RESET** (**5-INPUTS** menu).

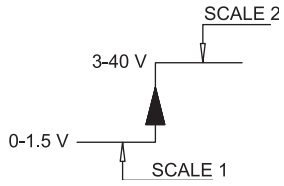
(It is recommended that only the partial totalizers P+/P- be enabled to avoid losing continuous totalizer data.)

Disable Totalizer from a Remote Input



Necessary conditions for this function to be enabled:
- **Count lock** enabled (**5-INPUTS** menu).
- **Auto batch** disabled (**12-BATCH** menu).
- **Cons. mode** disabled (**12-BATCH** menu).

Activate Range Change from a Remote Input



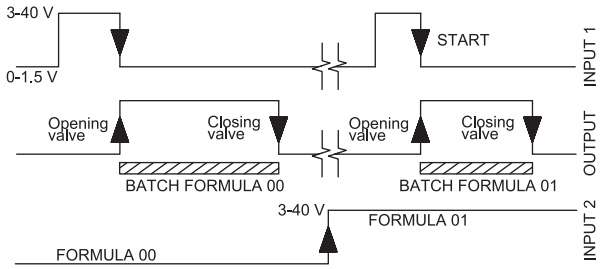
Necessary conditions for this function to be enabled:
- **Range change** enabled (**5-INPUTS** menu).
- **Batch** on digital input 2 disabled (**5-INPUTS** menu).
- **Batch** functions assigned to digital input 2 disabled.
- **Out1**, **Out2**, **Out3**, or **Out4** batch end functions assigned to digital output 2 and digital output 1 or 2 is disabled (**6-OUTPUTS** menu).

Sampling Frequency	T_{MIN}	HMS2500
10Hz	220ms	
20Hz	110ms	12"
50Hz	45ms	1" to 10"
80Hz	30ms	
150Hz	15ms	

NOTE: Time T must be ≥ to T_{MIN}

Input Operation on Inputs 1 and 2 (Batch Function)

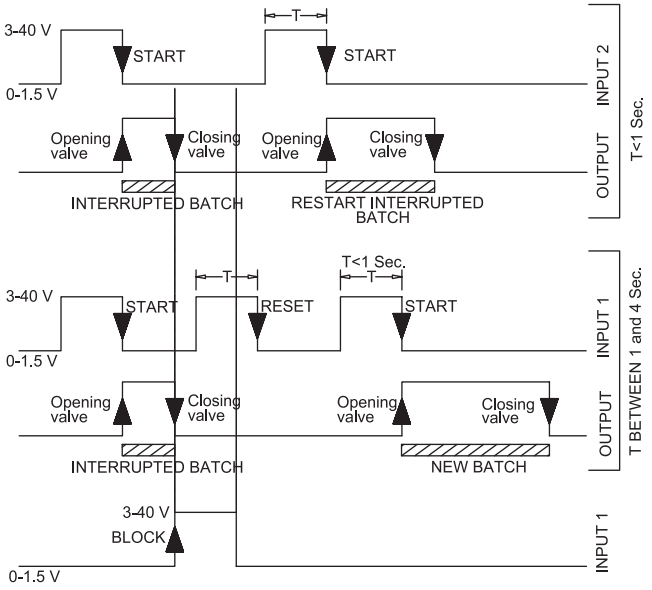
Start Batch on Remote Input 1, END BATCH on Out1 or Out4, Formula 00 or 01 on Remote Input 2



Necessary conditions for this function to be enabled:

- **INP.2** enabled (optional module required).
- **Out1** or **Out4** set to "**END BATCH**".
- Batch function with formula selection 00/01 assigned to input 2 (optional) enabled (**5-INPUTS** menu).

Inhibit Totalizer on Remote Input 1 Start, Resume, or Reset Batch on Remote Input 2



Inhibit Totalizer always interrupts the batch. Pulsing Input 2 again:

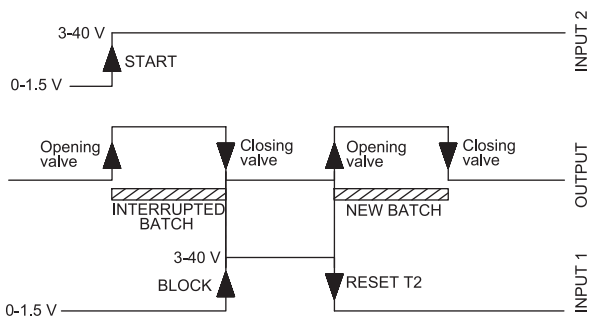
- T < 1 sec = resumes interrupted batch.
- 1 sec < T < 4 sec = starts a new batch.

NOTE: It is necessary to generate a new start pulse to input 2 (T < 1 sec) to begin a new batch.

Necessary conditions for this function to be enabled:

- **Count lock** enabled (**5-INPUTS** menu).
- **Out1** or **Out4** on "**END BATCH**".
- **Batch** function assigned to input 2 (option) enabled (**5-INPUTS** menu).
- **P+ RESET** enabled (**5-INPUTS** menu).

Inhibit Totalizer or Reset Totalizer on Remote Input 1 Start Batch on Remote Input 2 and Consent Mode to Enable Batch



Activation of the totalizer reset inhibit always interrupts a batch. When reset T2 inhibit on input 1 completes, input 1 resets the totalizer of the current batch. The presence of an input signal on input 2, or a new pulse signal on input 2 will start a new batch.

Necessary conditions for this function to be enabled:

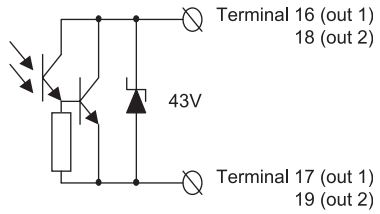
- **Count lock** enabled (**5-INPUTS** menu).
- **Batch** function assigned to input 2 (option) enabled (**5-INPUTS** menu).
- **Cons.mode** enabled (**12-BATCH** menu).
- **P+ RESET** enabled (**5-INPUTS** menu).

On/Off Digital Output Wiring

Out 1/Out 2 Standard - Out 3/Out 4 with optional modules

- Opto-isolated output with isolated collector and emitter terminals.
- Maximum switching voltage: 40VDC.
- Maximum switching current: 100mA.
- Maximum saturation voltage between collector and emitter @ 100mA: 1.2V.
- Maximum switching frequency (load on the collector or emitter, R_{LMIN}=470Ω, V_{OUT} = 24VDC): 1,250Hz.
- Maximum reverse current on the input during an accidental polarity reversal (VEC): 100mA.
- Isolation from other secondary circuits: 500VDC.

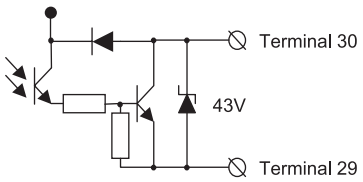
On/off outputs wiring (Up to 1,250 HZ)



On/Off output wiring (Up to 10,000 Hz) (high frequency): only with optional ME201 module

- Opto-isolated output with isolated collector and emitter terminals. In order to get the maximum performance, it is necessary to connect the emitter to the common terminal of the outputs (0V), while the load is 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 switching frequency, load on the collector and internal power supply: (R_{LMIN}=470Ω, V_{OUT} = 24VDC): 1,250Hz.
- Maximum switching frequency, load on the emitter or external power supply: (R_{LMIN}=470Ω, V_{OUT} = 24VDC): 10,000Hz.
- Isolation from other secondary circuits (except 24V and 4 to 20mA outputs): 500VDC.

On/off outputs wiring (Up to 10,000 Hz)

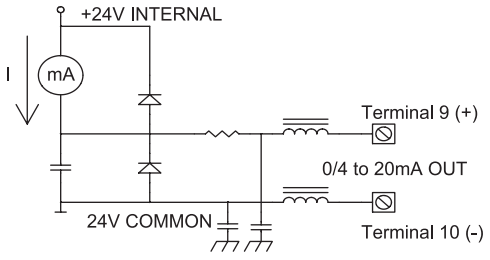


Technical Characteristics Analog Output (0-4/20 mA)

- Opto-isolated output.
- Maximum load 1,000Ω.
- Maximum voltage without load 27VDC.
- Refresh frequency is the same as the sample frequency of the connected sensor.
- Protected against constant over voltage up to 30VDC.

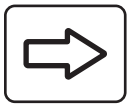
The converter CHECK checks the load on the 4-20mA output; to disable this function set the value **mA Val. Fault** to "**0**" (**4-ALARMS** menu).

Circuit Characteristics:
Analog Output (0-4/20 mA)



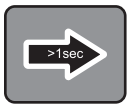
Access to the Instrument Key Board

The three keys of the converter programming keyboard have the following functionality:



Short Press (< 1 Second):

- Increases the numeric value or the parameter selected by the cursor.
- Goes to the previous item in the menu.
- Batch start/stop (when enabled).



Long Press (> 1 Second):

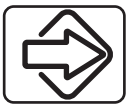
- Decreases the numeric value or the parameter selected by the cursor.
- Goes to the next item in the menu.

Short Press (< 1 Second):

- Moves the cursor to the right in an input field.
- Goes to the next item in the menu.
- Change the display of the process data.

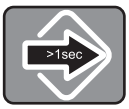
Long Press (> 1 Second):

- Moves the cursor to the left in an input field.
- Goes to the previous item in the menu.



Short Press (< 1 Second):

- Enters or exits the selected function.
- Enables the main menu for instrument configuration.
- Cancels the selected function in progress.

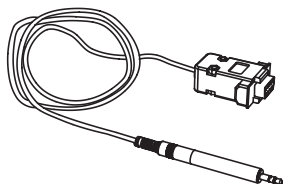


Long Press (> 1 Second):

- Exits the current menu.
- Enables the totalizer reset request (when enabled).
- Confirms/enables the selected function.

Blind Converter Programming

For converters without a keyboard or display (blind version), programming is accomplished using this interface cable connected to a desktop or laptop computer and running the interface software.



IF2, PC Interface

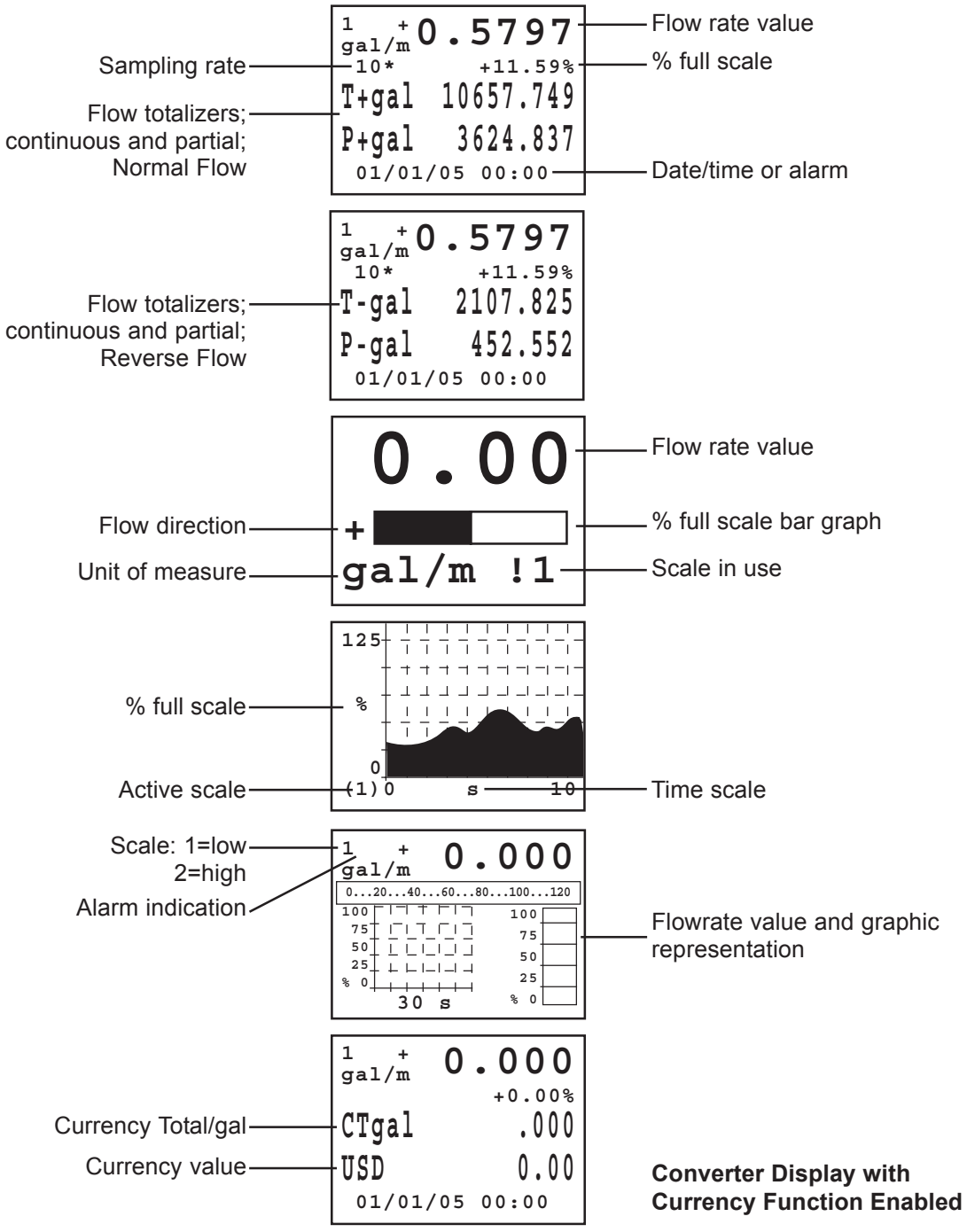
Converter Display Screens

⚠ IMPORTANT

- Direct exposure of the converter display to sunlight could damage the liquid crystal display.
- To adjust the display Contrast setting, refer to page 29.

Press ⇨ to change the display.

NOTE: The maximum number of digits shown on the display is 9, independent of the number of decimal places selected. Once this value is exceeded, totalizer count resets to **0**.

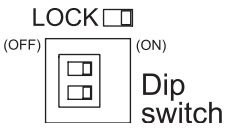


Converter Display with Currency Function Enabled

Factory Settings

The converter is factory programmed and delivered with the following standard configuration:

- **Dip switches**: ON (Switch position as shown below).
- **Lock level**: 3
- **Keycode L2** = 11111



When powered up with the above preset values, the instrument will show one of the display screens described on page 16. Press the ⇨ key to access the **0-QUICK START** menu.

0-QUICK START

0-QUICK START		Descriptions appear on:
Fs1=gal/m	100.00	*page 20*
Tot.MU=gal	1.000	*page 20*
Impl=gal	1.00000	*page 20*
Tpul1=ms	0050.00	*page 20*
Contrast=	13	*page 29*
Language=	EN	*page 29*
Main menu		

The **0-QUICK STAR**T menu shown above may display different parameters from those shown after programming the converter.

Access Codes

The information in this manual is related to all functions available with the **Keycode L2** access code. Functions available at higher security levels are protected. These are critical to operation and should only be adjusted with proper guidance from factory personnel.

Access code description: **Keycode L2** (**11-INTERNAL DATA** menu).

A. With **Keycode L2** set to **11111** the **0-QUICK START** menu may be accessed by pressing the ⇨ key. **Main menu** may then be accessed by entering the **Keycode L2** code of **11111**.

B. With **Keycode L2** set to **22222** (**11-INTERNAL DATA** menu) the access code is not required. Pressing the ⇨ key advances the display to the **MAIN MENU**.

   CAUTION: This allows anyone access.

NOTE: The availability of any function is related to the selected security level (see page 18).

C. With **Keycode L2** set to a custom value (set by the user) pressing the ⇨ key prompts for the access code to the **MAIN MENU**. The **0-QUICK START** menu will not appear.

NOTE: Remember to record the new code entered. There is no way for the user to retrieve the code if it is forgotten.

To enter the **MAIN MENU** from the **0-QUICK START** menu, position the cursor on the word **Main menu** and press the ⇨ key for less than one second. Enter the **Keycode L2** access code **11111** and press the ⇨ key for less than one second.

All the functions of the converter are now available, except those reserved for factory personnel, which can only be accessed with a different access code.

NOTE: All meters must have the Autozero Calibration function performed once installed in line. Refer to page 19 for details.

Security Levels

Setting Security Levels

To set the security level, follow the steps listed below:

- Set the dip switches in the **OFF** position (see picture on page 17).
- Access the **MAIN MENU**.
- Press the ⇨ key until the selection bar is on "**11-Internal data**".
- Press the ⇳ key and then the ⇨ key to scroll to the function **Lock level=**.
- Press the ⇳ key to access **Lock level=** and choose the desired security level by pressing the ⇧ key. Confirm the choice by pressing the ⇳ key.
- To enable the level of security selected, place the DIP switches back to the original **ON** position (see picture on page 17).

Security Level Options

Lock level 0: Completely disables access to the functions. The following procedures may be accessed through the keyboard:

- Changing the display mode.
- Batch Start/Stop (when the batch function is enabled).
- Printing data (when an RS-232 module is installed and the function is enabled).

Lock level 1: Enables access to the following functions:

- Totalizer resetting.
- Batch function modifications.

NOTE: Lock level must be set to 1 for custody transfer applications.

Lock level 2: Enables access to the following functions:

- **0-QUICK START** menu (**Keycode L2** = **11111**).
- **2-SCALES** menu with full access.
- **8-DISPLAY** menu with partial access.
- **10-DIAGNOSTIC** menu with partial access.

Lock level 3: Enables access to all the functions of **Lock level 2**. When the Dip-switches are in the **OFF** position, all the functions are accessible. Functions requiring an access code higher than **Lock level 2** are reserved for factory personnel.

NOTE: By setting the **Lock level** to **1** and changing **L2** to "**22222**", the operator is locked out of programming. However, simply turning off the lock switch allows easy access to programming without the need to remember a keycode.

Main Menu Access

Accessing the **MAIN MENU** from the main display screen is done by entering the **Keycode L2** access code from the **0-QUICK START** menu. Follow the steps below to gain access to the twelve sub-menus.

Main Display Screen

```
1   +
gal/m          0.00
 10*            +0.00%
T+gal      10657.749
P+gal       3624.837
CURR.LOOP OPEN
```

Press ⇳ to access the **0-Quick Start** menu.

0-Quick Start Menu

```
 0-QUICK START
Fs1=gal/m  100.00
Tot.MU=gal   1.000
Impl=gal   1.00000
Tpul1=ms   0050.00
Contrast=        13
Language=        EN
Main menu
```

Press ⇧ or ⇨ to scroll through the fields, stopping on **Main menu**.

```
 0-QUICK START
Fs1=gal/m  100.00
Tot.MU=gal   1.000
Impl=gal   1.00000
Tpul1=ms   0050.00
Contrast=        13
Language=        EN
Keycode L2: 00000
```

Press ⇳ to access **Keycode L2**.

```
 0-QUICK START
Fs1=gal/m  100.00
Tot.MU=gal   1.000
Impl=gal   1.00000
Tpul1=ms   0050.00
Contrast=        13
Language=        EN
Keycode L2: 11111
```

Enter the keycode using the ⇧ and ⇨ keys and then press ⇳. This advances the display to the **MAIN MENU**.

MAIN MENU

```
MAIN MENU
 1-Sensor
 2-Scales
 3-Measure
 4-Alarms
 5-Inputs
 6-Outputs
 7-Communication
```

The **MAIN MENU** contains twelve sub-menus. Access these sub menus by scrolling with the ⇧ and the ⇨ keys and then pressing the ⇳ key.

```
 8-Display
 9-Data logger
10-Diagnostic
11-Internal data
12-Batching
```

As there are twelve sub-menus accessible from the **MAIN MENU**, and the display contains eight lines maximum, the screen will wrap around when the bar reaches the bottom or the top of the display.

1-SENSOR

```
 1-SENSOR
ND=mm          00050
KA=         -01.8377
KL=+[0]     +00.0000
KL=-[0]     +00.0000
Cable len.=m    000
E.P.detect=     OFF
Autozero cal.
```

```
E.P.calibr.
```

ND=mm is the Nominal Diameter (in millimeters) for the sensor. This value can be found on the sensor nameplate. Enter this value using the keypad. Enter a value between 3 and 2000 (1/8" to 80").

NOTE: If **ND=** is set to "**0**", the display will show the velocity of the liquid through the sensor, but the totalizers will not be valid.

KA= represents the signal amplification value. It is calculated during sensor calibration. This value is on the sensor nameplate. Verify that this value matches the one on the nameplate. If it doesn't, enter the correct value (between ±0.5000 to ±9.9999) using the keypad.

KL=+, KL=- are coefficients used for improving low end accuracy of the sensor. These values are factory set and should not be adjusted. The default value for both of these fields is "**0**".

Cable len.= is the length of the cable (in meters) used to connect the converter to the sensor. The converter accepts values in multiples of 10 meters. Enter a value that represents this cable length. If the converter is mounted directly to the sensor (compact), set this value to "**000**".

E.P.detect= is a function that enables the empty pipe detection feature. To determine the empty/full pipe condition, the signal is analyzed within a one second window. This setting toggles between **ON** and **OFF**. Select the desired option with the keypad.

NOTE: E.P. detect should remain off until a calibration of this function is performed on site ad sidrected in E.P.calibr.

When the converter detects an empty pipe condition, the following occurs:

- "**EMPTY PIPE**" will display on the screen.
- An empty pipe alarm output will occur if assigned to one of the outputs (**Out1** or **Out2**).
- Flow rate indicator will show "**0**".
- Flow totalizers will stop incrementing.

When the pipe fills again, **EMPTY PIPE** will disappear from the screen, the alarm output will reset, flow rate will display a flow rate, and the totalizers will continue counting from where they left off.

Autozero cal. is used to initiate the automatic zero calibration function.

NOTE: It is necessary to perform this function at start-up or if the sensor has been empty for a long period of time.

To perform automatic zero calibration, it is absolutely necessary that the sensor be full of liquid and that the liquid is not moving. Even minute movements of liquid will affect autozero calibration and the accuracy of this calibration. Once these conditions are obtained, proceed with autozero calibration.

With the selection bar on **Autozero cal.** press  . Check to ensure that the percentage flow rate value stabilizes around zero. If it does not, repeat the operation again. When the value stabilizes around zero, press  .

NOTE: If the unit does not stabilize around zero, check to ensure the converter and sensor are properly connected to a dedicated earth ground.

E.P.calibr. is used to calibrate the converter for the empty pipe detection function.

Before performing empty pipe calibration, the sensor must be completely filled with liquid so that the lining and electrodes are wetted. The sensor then must be emptied. When this is accomplished, press the  key. The display will replace **E.P.calibr.** with "**EXECUTE?**". Press the  key to confirm the operation or  to cancel the operation. The display will flash "**DONE**" when it is complete.

To enable this function after calibration, select **E.P.detect** and change to "**ON**".

2-SCALES

```
 2-SCALES
Fs1=gal/m  099.99
Tot.MU=gal  1.000
Imp1=gal  1.00000
Imp2=gal  1.00000
Tpul1=ms  0050.00
Tpul2=ms  0050.00
Sg=kg/dm³ 01.0000
```

Fs1= is the full scale value for the sensor connected to the converter. There are four fields to select to set this parameter. From left to right these are:
1. Volume Unit of Measure (**gal**)
2. Type of Unit (**/**)
3. Time Unit of Measure (**m**)
4. Numeric Value of Full Scale Measure (**099.99**)

STEP 1: With the selection bar on **Fs1**, press ⇳ to gain access to the four fields. Move the cursor to "/" using the ⇨ key and press the ⇧ key to change the type of unit of measure. The options are metric, British or American, mass, or volume units.

When scrolling through the four options, the following will be displayed:
oz/ :select for non-metric mass units
l/ :select for metric volume units
kg/ :select for metric mass units
in³/ :select for non-metric volume units

Scroll to the desired option and press ⇳ to accept the value, ⇨ to move to the next field, or ENTER to move to the previous field.

STEP 2: Selection of the "/" field changes the options for the unit of measure field. Selecting the time base field changes the available options of the unit of measure field as well. Therefore, after selection of the "/" field, set the time base field by pressing ⇨ once.

The options for time base are:
s :per second
m :per minute
h :per hour
d :per day

Make the selection and press ENTER twice to move to the first field to set the unit of measure. The options available are determined by the rate base and type of unit already selected. The following tables contain the available units of mass and volume.

"oz/" Selection Options	
oz	ounces
lb	pounds
ton	short tons

"l/" Selection Options	
l	litres
dm³	cubic decimeters
dal	decaliters
hl	hectoliters
m³	cubic meters
cm³	cubic centimeters
ml	milliliters

"kg/" Selection Options	
g	grams
kg	kilograms
t	tonnes

"in³/" Selection Options	
in³	cubic inches
gal	American gallons
GAL	British gallons
ft³	cubic feet
bbl	standard barrel
BBL	oil barrel
yd³	cubic yards
kgl	1000 American gallons
KGL	1000 British gallons

STEP 3: With the three fields selected, proceed to program the full scale value. Press ⇨ to move to the first digit of the numeric value representing full scale for the sensor connected. Use ⇧ to scroll through 0-9 for each position. When the full scale value has been entered, press ⇳ to exit the field.

NOTE: The converter accepts any kind of combination of units of measure satisfying both the following conditions:
- Numeric field value i s ≤ 99999.
- $^1/_{25}$ fs_{max} ≤ numeric field value ≤ fs_{max}.

Where fs_{max} is the maximum full scale value corresponding to the sensor, equal to a 10m/sec liquid velocity.

NOTE: It is recommended that this value be set approximately 10% above the desired maximum flow rate. If the Fs1 value is reached, an alarm appears on the display: "**FLOW RATE>FS**".

2-SCALES (continued)

Tot.MU= is the totalizer for the selected Unit of Measure. There are three fields to set.

1. Unit of Measure
2. Type of unit (see table on page 20)
3. Decimal position

Press ⇳ to access these fields. Press ⇨ to move the cursor to the blank space between the unit of measure and the numeric values. Press ⇧ to scroll through the options:

oz :select for non-metric mass units
l :select for metric volume units
g :select for metric mass units
in³ :select for non-metric volume units

Press ESC to move one position to the left and select the totalizer unit of measure. Refer to the tables on the previous page for available options. Once the unit is selected, press ⇨ twice to set the decimal location. Press ⇧ to scroll through the decimal location options of:

00001
001.0
01.00
1.000

These options represent the decimal location of the totalizer as it will display on the main screen.

Imp1= represents the volume corresponding to each pulse of digital output 1 from the controller and is only displayed if **Out1** is set to one of the three "**#1 IMP**" options. There are three fields to set for **Imp1=**:

1. Unit of Measure
2. Type of Unit
3. Numeric Value

Press ⇳ to access these fields. Press ⇨ to move the cursor to the blank space between the unit of measure and the numeric values. Press ⇧ to scroll through the options:

oz :select for non-metric mass units
l :select for metric volume units
g :select for metric mass units
in³ :select for non-metric volume units

Press ESC to move one position to the left and select the unit of measure. Refer to the tables on the previous page for available options. Once the unit is selected, press ⇨ twice to set the numeric value corresponding to the volume per number of pulses.

Press ⇧ to scroll each location through 0-9. To move the decimal point, move the cursor to the decimal point and press ⇧ to move the decimal point to the right. To move the decimal point to the left, place the cursor on the decimal point and press ⇧.

Tpul1= is the duration of the output pulse for output 1 from the controller. This is only displayed when **Out1** is set to one of the three "**#1 IMP**" options. This setting is measured in milliseconds (ms) and must be between 0.40 and 9999.99 ms.

Press ⇳ to access the field for pulse duration. Use the ⇧ and ⇨ keys to scroll through each location to set the pulse duration. The decimal location cannot be changed in this field.

NOTE: Since the instrument can't detect which type of device it is connect to, it is up to the user to verify that the pulse duration is compatible with the external device processing the pulses. If, for example, an electro-mechanical pulse counter is connected, two kinds of problems may occur:

- If the pulse is too long the totalizer coils may burn out.
- If the pulse is too short, the counter may not read the input pulse and damage to the converter output may result.

Imp2=, and **Tpul2=** are programmed in exactly the same way as **Imp1=** and **Tpul1=**. These two options will only appear on the display when **Out2** is set to one of the "**#2 IMP**" options.

NOTE: If **Imp1** and **Tpul1** are set too high, the converter will attempt to output more pulse signals than is possible in the available time. The result is that the signal output will continue after after the registers stops to allow the pulses to "catch up".

2-SCALES (continued)

```
 2-SCALES
Fs1=gal/m  099.99
Tot.MU=gal  1.000
Frq1=Hz  01000.00
Frq2=Hz  01000.00
Sg=kg/dm³ 01.0000
```

Frq1=Hz is the full scale frequency set for output 1 from the controller. This is only displayed when **Out1** is set to one of the three "**#1 FREQ**" options. Its value is expressed in Hertz and is between **1.0** and **1,250.0**. When the high frequency output option is present, the maximum value may go up to **10,000.0**.

With the selection bar on **Frq1=Hz**, press the ⇳ key. Set the value of the first digit using the ⇧ key and then move to the next digit using the ⇨ key. When programming of this value is complete, press the ⇳ key.

NOTE: It is recommended that this value be set approximately 10% above the desired maximum flow rate. If the Frq1 value is reached, an alarm appears on the display: "**PULSE/FREQ/>FS**".

Frq2=Hz is programmed in the exact same way as **Frq1=Hz**. It is only displayed when **Out2** is set to one of the three "**#2 FREQ**" options.

```
 2-SCALES
Fs1=oz/m   099.99
Tot.MU=lb   1.000
Imp1=lb   1.00000
Tpul1=ms  0050.00
Sg=kg/dm³ 01.0000
```

(This line only appears when a mass unit of measure is selected.)

Sg= is the specific gravity of the liquid being measured. It is a value expressed in kilograms per cubic decimeter (kg/dm³) and must be within a range of **00.0001** to **99.9999**.

Press ⇳ to access the field for specific gravity. Use the ⇧ and ⇨ keys to scroll through each location to set the specific gravity. The decimal location cannot be changed in this field.

SCALES Display

The **SCALES** display will change depending on the **OUTPUT** options selected. If all **OUTPUTS** are in the **OFF** position, the only two items displayed in **SCALES** will be **Fs1** and **Tot.MU**. The following table indicates which options become active in **SCALES** for options selected in **OUTPUT**.

OUTPUTS	SCALES Display
#1 IMP+	Imp1, Tpul1
#1 IMP-	Imp1, Tpul1
#1 IMP±	Imp1, Tpul1
#2 IMP+	Imp2, Tpul2
#2 IMP-	Imp2, Tpul2
#2 IMP±	Imp2, Tpul2
#1 FREQ+	Frq1
#1 FREQ-	Frq1
#1 FREQ±	Frq1
#2 FREQ+	Frq2
#2 FREQ-	Frq2
#2 FREQ±	Frq2
RANGE	Fs2

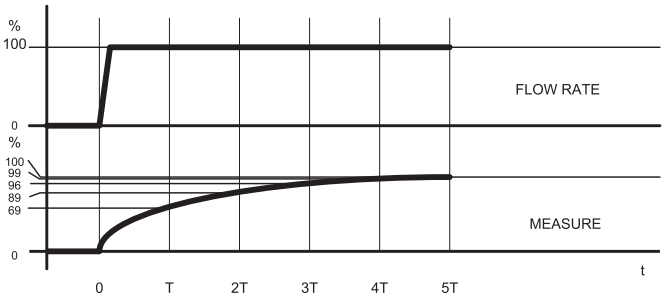
3-MEASURE

3-MEASURE	
Tconst=s	0001.0
Filter=s	0.1
Skip thr=%	050
Peak thr=%	125
Cut-off=%	01.5
Autocal.=	OFF
Autorange=	OFF

E.saving=	OFF

Tconst =s is a time constant for the instrument response rate. It is represented in seconds. This field setting affects the integrating filter which increases or decreases the instrument response rate to changes in flow rate. A higher value corresponds to a more stable but slower measurement. The most common values are from **1** to **5** seconds.

The acceptable range is **0** to **6,000.0** seconds. The diagram below shows the response of the instrument for a flow rate variation from 0 to 100% within the **T** time constant period.



Effect of the Time Constant

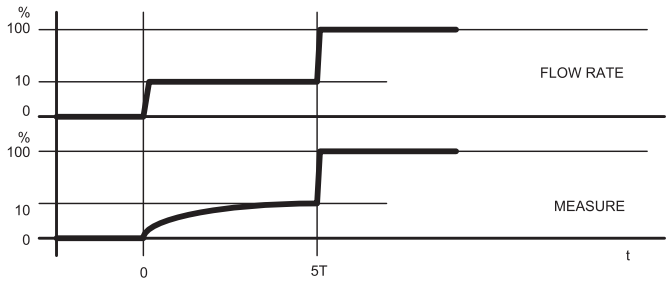
For applications such as dosing or short runs, this value should be set to "**0**". For applications where regulation of valves or pumps is controlled by the converter, this value is typically set in the lower range (**0.5** to **5**). A higher value results in a more stable display of flowrate due to a slower response to fluctuations.

Filter=s represents the amount of filtering of noise of the power supply frequency of 60 Hz. There are four options for this field: **0.1**, **0.2**, **0.5**, or **OFF**. The higher the value, the more filtering of the signal.

Skip thr=% represents the acceleration threshold. This is the limit beyond which a flow rate variation determines an immediate response at the output, without being filtered by the **Tconst=s**. The system allows the instrument to have an immediate response for big variations in the flow rate while filtering the response to small variations.

The result is a more stable measurement. The value is set as a percentage of the full scale value and may be set from **0** to **125%**. If the value is set to **0%**, any flow rate variation greater than **0.5%** of the full scale value will immediately affect the outputs.

The diagram below 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 immediately sent to the output. There is always a minimum time between flow measurement and outputs.



Effect of Time Constant acceleration threshold

For applications such as dosing or short runs, this value should be set to "**0**". For applications where regulation of valves or pumps is controlled by the converter, this value is typically set in the lower range (**~20%**). A higher value results in a more stable display of flowrate due to a slower response to fluctuations.

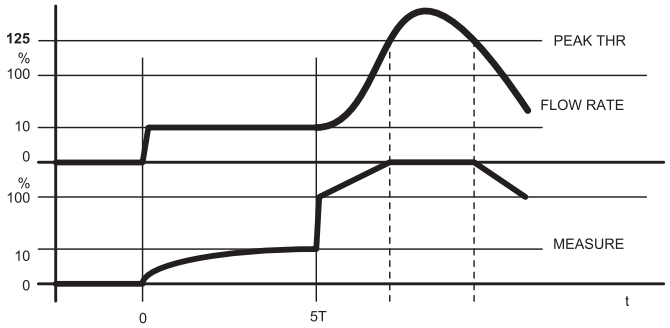
Peak thr=% is the peak cutoff threshold. This parameter is used to set the maximum value of deviation of the actual measure sample by comparison with an average one. If the new value is higher than the set limit, then the value is "cut" to the limit value. This function is used to make the meter less sensitive to big disturbances of the flow rate measurement. This can happen if there are solids in suspension in the liquid and they hit against the electrodes and cause spikes in the signal.

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 **0**, the peak detection function is disabled and any new measure sample will be accepted and processed as it is by the converter.

For applications such as dosing or short runs, this value should be set to "**0**". For applications where regulation of valves or pumps is controlled by the converter, this value is typically set in the upper range (**115%** to **125%**).

An example of this setting appears on the following page.

3-MEASURE (continued)



Effect of Peak threshold

Cut-off=% is the low flow zero threshold. When the flow rate falls below this parameter, the flow rate is assumed to be **0** and set to such a value by the converter. This parameter can be set from **0** to **25.0%** of the full scale value. This function is the compliment to **Peak thr** as it sets the lower limit of measurable flow rate.

Autocal.= is the auto-calibration function. When enabled the converter performs a calibration cycle once every hour. During such a cycle, the flow rate is "frozen" at the last measured value. The calibration lasts from 8 to 15 seconds and allows removal of temperature induced errors. This function is recommended to be enabled if the instrument undergoes large temperature variations while operating. This can be set to **ON** or **OFF**.

Autorange= is a function used to automatically change from the **Fs1** to **Fs2** range. The meter may have two different working ranges in order to address variable process conditions. In order to get the best results out of this function, it is important to set the range of **Fs2** greater than range setting of **Fs1**.

When the flow rate increases and reaches the 100% of **Fs1**, the converter automatically switches to **Fs2**. When the flow rate decreases, reaching a value on **Fs2** equal to 90% of **Fs1**, then the active scale is changes back to **Fs1**. This may be set to **ON** or **OFF**.

NOTE: The autorange feature disables the manual change of the range from an external source (**Range change, 5-INPUTS** menu).

E.saving= is the Energy saving function. This function is particularly useful when the instrument is powered by a battery or solar cells, providing a 60-80% energy saving, or when many flow sensors are in use. 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" cycles (lower frequency), so the average consumption is greatly reduced. If the flow rate suddenly changes, the meter switches to a higher sampling frequency in order to respond faster to fluctuations in flow rate. It returns to a lower sampling frequency as soon as the flow rate stabilizes.

If the flow rate falls below the acceleration threshold (**Skip thr**) percentage value, the meter goes on with "off" cycles. As soon as the flow rate value exceeds this threshold, the meter switches back to a higher sampling frequency. The speed at which the meter switches on and off the excitation cycles is different: changing from a constant flow rate to a variable one the converter responds very quickly. Switching from a variable rate to stable one the converter responds much slower. This field may be set to **ON** or **OFF**.

NOTE: To optimize this function it is recommended that a value of **5** to **10** be set for the acceleration threshold (**Skip thr**).

4-ALARMS

```
 4-ALARMS
Max thr+=%     000
Max thr-%      000
Min thr+=%     000
Min thr-=%     000
Hyst.=%         03
E.p.thr.=      189
mA v.fault=%   010
```

```
Hz v.fault=%   125
Timeout=s    01.0
```

Max thr+=% is the alarm setting for maximum **positive** flow rate (+). When the flow rate value exceeds this threshold, 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 **0** disables the alarm.

Max thr-=% is the alarm setting for maximum **reverse** flow rate (-). When the flow rate value exceeds this threshold, 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 **0** disables the alarm.

Min thr+=% is the alarm setting for minimum **positive** flow rate (+). When the flow rate value falls below this threshold, 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 **0** disables the alarm.

Min thr-=% is the alarm setting for minimum **reverse** flow rate (-). When the flow rate value falls below this threshold, 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 **0** disables the alarm.

Hyst.=% is the Hysteresis threshold set for the **Max/Min thr** alarms. Hysteresis is the lagging of an effect behind its cause. For example, if this is set to 5%, then the flow rate must exceed or drop below the **Max/Min thr** settings by 5% before an alarm output will be generated. This is to prevent the alarm output from toggling on and off repeatedly if the flowrate is hovering around any of the **Max/Min thr** settings. This may be set from **0** to **25%**.

E.p.thr.= is the empty pipe detection threshold. The value of this parameter is automatically set by the function **E.P.calibr.** in the **1-SENSOR** menu. This may be set from **0** to **250**, but should not be set without first consulting the factory for details.

mA v.fault=% is the setting of the output current value in case of failure. This output will activate in one of the following cases:

- Empty pipe is detected
- Coils are interrupted
- A DC voltage error

The may be set from **0** to **125%** and represents a value along the 0 to 20mA scale. **125%** corresponds to 25mA and does not depend on the selected range (0-20 or 4-20 mA). The NAMUR NE43 recommendations ask for an alarm signaling value for the current output lower than 3.6 mA (<18%) or greater than 21 mA (>105%). It would then be preferable to set the value of this function at "**10%**", so that the current value would be 2 mA, allowing the following diagnostics:

- Current < 2mA - 5%: line interrupted, power supply failure or faulty converter.
- 2mA -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% of full scale.

NOTE: Setting this parameter to **0** disables the alarm.

Hz v.fault=% is the frequency output setting. This only displays when either **Out1** or **Out2** is set to one of the "**#1 Freq**" or "**#2 Freq**" options. This output will activate in one of the following cases:

- Empty pipe is detected
- Coils are interrupted
- A DC voltage error

The may be set from **0** to **125%** of the full scale frequency value. Although there are no specific rules, it is recommended to use the frequency information as follows:

- 0% Hz ≤ frequency ≤ 100% of full scale: normal working range.
- 100% full scale < frequency ≤ 110% of full scale: overflow, measure above the 100% of the full scale.
- 115% of full scale ≤ frequency ≤125% of full scale: hardware alarm condition.

Timeout=s is the batch safety timer. This is only

4-ALARMS (continued)

displayed when **Batch** is enabled in the **5-INPUTS** menu.

This function is used to set a maximum time for a batch to start, end, or to stall. If the batch takes too long to start (flow remains at zero after start) and it exceeds this value, it will activate an alarm. If the batch is interrupted for a time that exceeds this value, it will activate an alarm. If the batch is complete, but the converter senses flow for a time that exceeds this value, it will activate an alarm.

This function is useful for controlling one or both of the following conditions:

- Batch valve is open and flow rate is **0**.
- Batch valve is closed and flow rate different than **0**.

When this alarm is activated, the batch operation is canceled and the power supply to the valve is removed, allowing it to close. This may be set from **0** to **6,000** seconds.

5-INPUTS

```
 5-INPUTS
T+ RESET=      OFF
P+ RESET=       ON
T- RESET=      OFF
P- RESET=       ON
Pulse.reset=   OFF
Count lock=     ON
Calibration=   OFF
```

```
Range change= OFF
Batch=        OFF
```

T+RESET= is the reset enable for the total **direct** (positive) flow totalizer. When this function is active, the totalizer may be reset by applying a voltage to the on/off input or via the keyboard. This may be set to **ON** or **OFF**. If set to off, this totalizer can not be reset. T+ and T- Reset are continuous totalizers and are most often not reset.

P+RESET= is the reset enable for the partial **direct** (positive) flow totalizer. See the previous function. P+ and P- Reset are typically reset after a process or batch.

T-RESET= is the reset enable for the total **reverse** (negative) flow totalizer. See the previous function.

NOTE: This function is disabled when **Batch** is set to **ON**.

P-RESET= is the reset enable for the partial **reverse** (negative) flow totalizer. See the previous function.

NOTE: To reset the totalizers from the keypad, follow these instructions:

1. From any display screen press the  key.
2. Enter the proper **Keycode L2** and then push the  key. The display will prompt the operator with the questions:
    - **T+gal:RESET TOT?**
    - **P+gal:RESET TOT?**
    - **CTgal:RESET TOT?**
3. Push the  key to proceed with resetting these totalizer values. Push any other key to cancel this operation. The questions appearing on the display during this operation depend on which reset options are enabled.

Pulse.reset= is a function which enables resetting of the totalizer from a digital input. This may be set to **ON** or **OFF**.

Count lock= is used to lock or freeze the totalizers. When this function is enabled, applying a voltage to the on/off input terminals pauses the totalizers regardless of the flow rate. This allows the operator to view the current flow total. When the input signal is removed, the totalizers update to the actual current total as the converter was keeping internal track of the totalizer. This may be set to **ON** or **OFF**.

Calibration= is used to enable the autozero calibration from an external command. When this function is enabled and active, applying a voltage to the on/off input terminals causes the system to perform an autozero calibration cycle. This may be set to **ON** or **OFF**.

NOTE: This function is disabled when Batch is set to **ON.**

NOTE: If the voltage pulse is applied for less than one second, the meter performs a temperature calibration cycle. If the voltage pulse is applied for more than one second, the meter performs a zero calibration of measure. This function enables/disables the automatic zero calibration system.

Refer to the **Autozero cal.** description in the **1-SENSOR** menu.

Range change= is the external command used to initiate a range change. When this function is enabled and a voltage is applied to the on/off input terminals, the meter switches to the second measuring range (**Fs2**). When the voltage is removed, it reverts back to the **Fs1** measuring range. This may be set to **ON** or **OFF**.

NOTE: This function is disabled when Batch is set to **ON.**

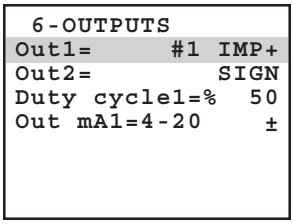
NOTE: If range change is activated, it overrides the **Autorange** function located in the **3-MEASURE** menu.

Batch= enables batching functions. This may be set to **ON** or **OFF**. When set to "**ON**", the **12-BATCH** menu is activated.

INP.2= is the function associated with input 2. This will only appear when an optional module is in use. The available functions are listed in the table below.

Functions for Input 2	
OFF	Disabled
T+Reset	Reset totalizer for direct flow rate (+)
P+Reset	Reset partial direct totalizer for direct flow rate (+)
T-Reset	Reset totalizer for direct flow rate (+)
P-Reset	Reset partial direct totalizer for direct flow rate (+)
Batch	Start or Stop batch
BM Selection	Static selection of formula

6-OUTPUTS



Out1= Is the function corresponding to digital output 1. The functions available for output 1 are listed in the table on the next page. Press the ⇳ key to access **Out1** options. Use the ⇧ and ⇨ keys to scroll though the options. Press the ⇳ key to accept the option.

Out2= Is the function corresponding to digital output 2. The functions are listed in the table below.

Out3= Is the function corresponding to digital output 3. The functions are listed in the table on the next page. This output only appears when an optional module is installed.

Out4= Is the function corresponding to digital output 4. The functions are listed in the table on the next page. This output only appears when an optional module is installed.

NOTE: Out4 is the only output which can reach a frequency of 12.5 kHz.

OFF	Disabled.
# 1 IMP+	Pulse on Channel 1 for positive flowrate.
# 1 IMP-	Pulse on Channel 1 for negative flowrate.
# 1 IMP±	Pulse on Channel 1 for positive and negative flowrate.
# 2 IMP+	Pulse on Channel 2 for positive flowrate.
# 2 IMP-	Pulse on Channel 2 for negative flowrate.
# 2 IMP±	Pulse on Channel 2 for positive and negative flowrate.
# 1 FREQ+	Frequency channel 1 for positive flowrate.
# 1 FREQ-	Frequency channel 1 for negative flowrate.
# 1 FREQ±	Frequency channel 1 for positive and negative flowrate.
# 2 FREQ+	Frequency channel 2 for positive flowrate.
# 2 FREQ-	Frequency channel 2 for negative flowrate.
# 2 FREQ±	Frequency channel 2 for positive and negative flowrate.
SIGN	Flow direction output (Energized = -).
RANGE	Range indication output (Energized = Scale 2).
MAX AL+	MAX direct flowrate output (Energized = Alarm OFF).
MAX AL-	MAX reverse flowrate output (Energized = Alarm OFF).
MAX AL±	MAX direct/reverse flowrate output (Energized = Alarm OFF).
MIN AL+	MIN direct flowrate output (Energized = Alarm OFF).
MIN AL-	MIN reverse flowrate output (Energized = Alarm OFF).
MIN AL±	MIN direct/reverse flowrate output (Energized = Alarm OFF).
MAX+MIN±	MAX and MIN flowrate alarm output (Energized = Alarm OFF).
P. EMPTY	Empty pipe alarm output (Energized = Full pipe).
OVERFLOW	Out of range alarm output (Energized = Flow rate OK).
HARDW AL.	Cumulative alarm output: interrupt coils, empty pipe, measure error (Energized = NO ALARMS **AL.** BATCH AL :BATCH ALARM).
EXT. COMM.	Only available with data-logger module.
BATCH AL.	Batch alarm output.
BATCH SYN	At the end of a batch, the status output changes.
END BATCH	End batch output (Energized = Batch in progress).
PREBATCH	Pre-batch output (Energized = Prebatch in progress).

6-OUTPUTS (continued)

Duty cycle1=% is the duty cycle for **Out1**. This defines the ratio between the **ON** and **OFF** states. When **Out1** is set to one of the three "**#1 FREQ**" options, a value of 50% indicates the **ON** phase will be the same as the **OFF** phase; 60% indicates the phase **ON** will be 60% and phase **OFF** will be 40% of the total cycle time.

When **Out1** is set to one of the three "**#1 IMP**" options, the duty cycle indicates the **OFF** phase because the **ON** phase it's already set with the function **Tpul1** set in the **2-SCALES** menu. Set the duty cycle by calculating the minimum time of the **OFF** phase and the time of total cycle using the following formulas:

T.total cycle = 100 x (pulse duration in ms)÷(duty cycle)

T.OFF phase = T. total cycle - pulse duration.

NOTE: If **Duty cycle1=%** is set to "**0**", the pulses are synchronized with the flow rate, therefore, when frequency is selected, do not set to "**0**". This is the recommended setting for short run applications such as dosing.

Duty cycle2=% is the duty cycle for **Out2**. It is defined and set the same as **Duty cycle1=%**.

Out mA1= is the setting for the current output range for **Fs1**. The current output setting for **Fs1** is optional. There are three fields to modify for this function:

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

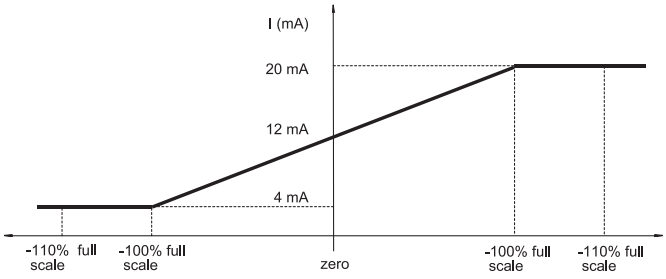
  -0+ =central zero scale

The values corresponding to the scale points are shown in the chart to the right.

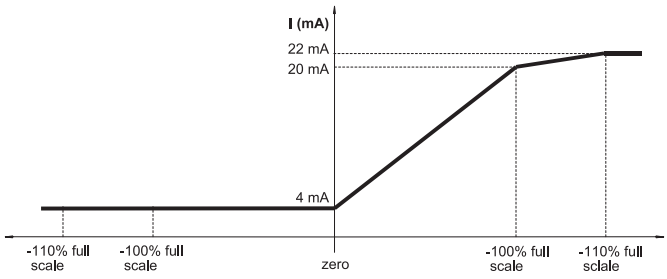
In hardware alarm conditions (**HARDW AL.**) the current value is programmed by the function **mA v.fault** in the **4-ALARMS** menu and it is expressed as percentage of a fixed current range, where: 0% = 0mA and 110% = 22mA.

Out mA2= is set up the same way as **Out mA1=**. It is only available with optional modules ME202 or ME204.

Current values in mA associate to the % value of full scale					
	Reverse Flow Value		Zero	Direct Flow Value	
Possible Field	<-100%	-100%	0%	+100%	>+100%
OutmA1= 0-20+	0	0	0	20	20
OutmA1= 0-22+	0	0	0	20	22
OutmA1= 4-20+	4	4	4	20	20
OutmA1= 4-22+	4	4	4	20	22
OutmA1= 0-20-	20	20	0	0	0
OutmA1= 0-22-	22	20	0	0	0
OutmA1= 4-20-	20	20	4	4	4
OutmA1= 4-22-	22	20	4	4	4
OutmA1= 0-20±	20	20	0	20	20
OutmA1= 0-22±	22	20	0	20	22
OutmA1= 4-20±	20	20	4	20	20
OutmA1= 4-22±	22	20	4	20	22
OutmA1= 0-20-0+	0	0	10	20	20
OutmA1= 0-22-0+	0	1	11	21	22
OutmA1= 4-20-0+	4	4	12	20	20
OutmA1= 4-22-0+	4	4.8	12.8	20.8	22



Graph of 4-20-0+



Graph of 4-22+

7-COMMUNICATION

```
 7-COMMUNICATION
Address=       000
Speed1=      19200
Speed2=      19200
Print=          ON
Printer=        ON
Print data=     ON
Print events=   ON
```

Address= is the Network address setting. The address is used to identify the instrument when connected via the RS-485 interface. This may be set from **0** to **255**.

Speed1= is the interface communication speed (baud rate) for RS-485 communication. This parameter may be set to one of the following values: **2400**, **9600**, **19200**, and **38400** bps.

The HML210 converter has RS-485 communication as an optional feature. RS-232 communication is only available with optional modules ME203 and ME204.

RS-232 interface is used to exchange data over short distances with a single source, usually a PC, printer, or external modem.

The following five items only appear when the converter is equipped with an optional RS-232 module.

Speed2= is the Serial interface communication speed (baud rate) for the RS-232 output. This parameter may be set at one of the following values: **2400**, **9600**, **19200**, and **38400** bps. Select a value with the same baud rate as the printer connected.

Print= enables print function. This may be set to **ON** or **OFF**. Set this to **ON** to enable printing.

Printer= enables printer format. This may be set to **ON** or **OFF**. Set this to **ON** to enable the RS-232 port to send formatted data compatible with a serial printer.

Print data= enables data printing. This may be set to **ON** or **OFF**. Set this to **ON** to print data at regular intervals.

Print events= enables alarm status printing. This may be set to **ON** or **OFF**. Set this to **ON** to print alarm status.

8-DISPLAY

```
 8-DISPLAY
Language=       EN
D.Rate=Hz        2
Contr.range=     1
Contrast=        7
Currency=       ON
Curr.decim.=     2
USD/gal+  1.00000
USD/gal-  1.00000
```

These only display when** Currency= **is set to "ON".

Language= is the Choice of the layout language. There are four languages available: **EN**= English, **IT** = Italian, **FR** = French, **SP** = Spanish.

D.rate=Hz is the display refresh rate. This parameter affects only the display and not the response time of the meter itself. The possible choices are: **1**, **2**, **5**, or **10** Hz.

Contr.range= is factory set and not editable.

Contrast= is the display contrast setting. The contrast can change with ambient temperature. This may be set from **0** to **15**. The contrast will be set when the field is exited.

Contrast also can be set from any main display screen by pushing  for 8 seconds or more. Hold this key and the display will toggle though contrast settings. Release the button when the display is most visible. The contrast will be set when the key is released.

Currency= is used to activate the currency functions listed below. When activated, a currency value appears on the display. Currency is tied to the partial totalizers (**P+gal** and **P-gal**). When these are reset, the currency total resets.

Curr.decim.= is the number of decimal places used for currency. This may be set from **0** to **3**. The function is only active when **Currency** is enabled.

USD/gal+ Set the value of conversions/currency for direct totalizer (positive). There are three fields to set for this parameter, from left to right:

1. Currency denomination
2. Default/personalized currency denomination
3. Price per unit

8-DISPLAY (continued)

There are seven preset currency denominations (standard: ISO 4217-REV81) and one custom currency denomination. The preset currency denominations are:

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

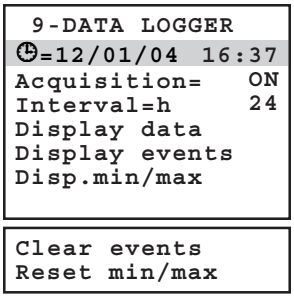
There is also a custom setting for currency denomination. To change to a custom setting, move the cursor to the "*/*" character and press the ⇧ key once. Then press the ⇨ key to move to the first position. Enter a 3 character, alpha-numeric code for custom currency.

When the currency denomination has been set, move the cursor to the right of the display and enter the price per unit. This is a six digit number. Move the cursor to the decimal point to change its position. It may be adjusted from the second position (1.00000) to the sixth position (10000.0). When the decimal place has been set, proceed with setting the price per unit volume by setting each of the six digits individually.

NOTE: Even though the currency value may be set to five decimal places, the display has a maximum of three decimal places.

USD/gal- Set the value of conversion/currency for reverse totalizer (negative). Refer to the previous function.

9-DATA LOGGER



= is the date and time setting. If the real time clock optional module is present (ME220), then the time setting is retained even when the power supply is off. If this module is not present, the time will not update. For example, if the power supply to the converter has been off for one hour, when the converter is switched on again, the display will be one hour behind.

NOTE: Date and time only appear on the display when the data logger is enabled (**Acquisition=ON**) and the optional module (ME220) is installed.

Acquisition= activates automatic data logging. This may be set to **ON** or **OFF**. Data is sampled at a time interval set in **Interval=h**. Optional module ME220 must be installed in order to log data.

Interval=h is the time interval for the data logging function and printing. This may be set to: **1**, **2**, **3**, **6**, **8**, **12**, **24**, **48** hours.

Display data is a link to the logged data display. When accessed, a new window opens and data stored in the data logger can be viewed.

Display events brings up the events display. When accessed, up to 64 stored events can be viewed. Events are stored in chronological order.

Disp.min/max brings up the minimum and maximum flow rate displays. The numeric values stored refer to the units of measure set during configuration.

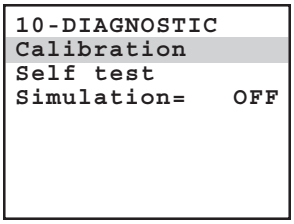
Clear data is used to clear stored data. Activating this function completely clears stored information.

Clear events is used to clear all alarm events.

Reset min/max is used to reset the minimum and maximum flow rate stored.

NOTE: This feature, along with RS-232, should be selected if printing directly to a printer.

10-DIAGNOSTIC



Calibration is used to calibrate the sensor. Press the key with the cursor on **Calibration**. The display will change to "**EXECUTE?**". Press the key to verify or any other key to cancel.

Self test is the sensor auto-test function. This function stops the normal functions of the meter and performs a complete test cycle on the measure input circuits and on the excitation generator. To activate this function, press the key. The display will change to "**EXECUTE?**". Press the key to verify or any other key to cancel.

The result of the test is shown on the display. At the end of operation, the display will return to the start-up screen. This function is automatically performed when switching on the device.

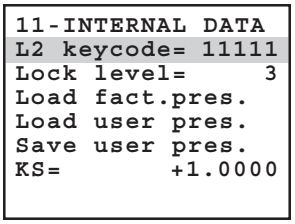
Simulation is used to simulate a flow rate. This will allow testing of the outputs and all the instruments connected. This may be set to **ON** or **OFF**.

After simulation has been activated, a flow rate may be:

- **Set**: By pushing the key from one of four main display screens for more than 1 second ;
- **Started**: By pushing the key after setting it;
- **Finished**: By pushing the key from one of the four main display screens for more than 1 second and then pushing the key for more than 1 second.

NOTE: If the flow rate simulation is active, the contrast control key is disabled.

11-INTERNAL DATA



L2 keycode= is the Level 2 access keycode. This code is programmable and may be in the range from **00000** to **65535**. Setting this value to "**22222**" disables the need to enter an access code for levels lower than 3.

Lock level= is the security level setting. This may be set from **0** to **3**. Every level enables and disables the use of specific functions.

NOTE: Lock level only appears when the dip-switches on the back of converter are on. Refer to page 17.

Load fact.pres. is used to load the preset programming from the factory. This resets all parameters to the factory default.

Load user pres. is used to load the parameters saved in the **Save user pres.** fields.

Save user pres. is used to save the current settings to a file to be recalled by **Load user pres.**.

NOTE: After the unit is set up, LC recommends that user presets be saved. This will allow an operator to recall the user settings if the settings were tampered with.

Hours= is the total amount of time that the converter has been in operation. This is not editable.

KS= is a sensor calibration coefficient. A new value may be entered to change the sensor calibration.

NOTE: Do not change this setting without first consulting the factory.

12 - BATCH

```
12-BATCH
Nsamples=
Diff. thr=%
V.com=
V.pre=
Auto batch=
BM auto sel=
Cons.mode=
```

The **12-BATCH** menu is only displayed when **Batch** is set to **ON** in the **5-INPUTS** menu.

Nsamples= is the number of batch cycles required to define the value of compensation for valve closure. This function is used to automatically determine the average value for automatic compensation of system delay (**Interval=h, 9-DATA LOGGER** menu). Set this function to "**0**" for manual entry of the compensation value.

Diff. thr=% is the value which defines the percentage of maximum difference between the value of compensation set (**V.com=, 12-BATCH menu**) and the value of compensation set with the function **Interval=h** (**9-DATA LOGGER** menu). Beyond this threshold the new value of compensation will be automatically set (if Number of batch samples is not zero).

V.com= is the value expressed in the same units of measure of the selected volume and is the result of the difference between the batch value setting and the quantity of product dispensed due to delays in the system: valve closing times, pump stop times, etc.

NOTE: If the value of compensation needs to be set manually, set the number of batch samples to "**0**" (**Nsamples=, 12-BATCH** menu).

V.pre= is the volume of liquid at which the pre-batch is enabled. At this pre-batch volume, the output (if enabled) is de-energized. This value is a constant for all batch quantities and is based on the units of measure of volume. The pre-batch function is useful for fast and accurate fillings.

Auto batch= Applying a voltage to the on/off input terminals for more than 5 seconds, the valve driven from the meter will open until the voltage is applied on the input. When the product has reached the desired volume/ level removing voltage from the input: the meter closes the valve and memorizes the volume of product dispensed in the current memory batch (see "BATCH FUNCTIONS"); the value obtained with this procedure will be the volume of each consecutive batch. To modify this value, repeat the operations above. This procedure sets the safety timer to 1.25 times the time employed for reaching the batch quantity. It will also reset the count of the number of batches.

BM auto sel= is the automatic selection of the first 4 formulas act as the duration of the pulse of start of the batch (see page 12 "Input operation stage"). This function is active only if it has not enabled the function **Cons.mode** (**12-BATCH** menu). Activating this function also excludes the automatic compensation of the batch volume (the value of **Nsamples=, 12-BATCH** menu will be automatically set to zero). However, manual compensation is possible introducing parameter **V.com=, 12-BATCH** menu.

Cons.mode= is the consent mode. This function enables the start and stop of batching using a constant signal applied to the input instead of a pulse (see diagram on page 12). This signal stays **ON** through the entire batch. This function automatically disables the functions **BM auto sel=** and **Auto batch** (**12-BATCH** menu).

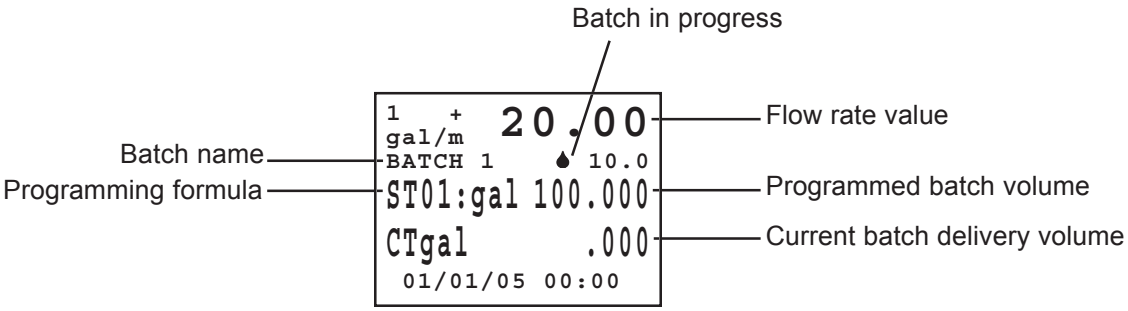
Batch Function Enable

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

- **START/STOP** batch from input (**5-INPUTS** menu).
- **Out1**, **Out2** (**6-OUTPUTS** menu): assign one of these output functions to one of the two inputs.

Batch Programming

Display Screen with Batch Function Enabled



Batch Programming

For each formula you can associate:

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

Programming Batch Example

Push ⇧ for two seconds.

Keycode L2:00000	Input the correct code.
ST 00	Choose the formula number for the batch (between 00 and 15).
⇨	
000.000	Input the volume to be delivered for the batch.
Push ENTER for two seconds.	
ABCDEFG	Input a name for the batch (maximum of 8 alpha-numeric characters). Use the ⇧ key to choose the character and the ⇨ key to advance.
⇨	
S 0000.0	Input the maximum time for the batch. If the timer is set to 0, the safety timer is disabled. The maximum time allowed is 6,000 seconds. (6,000 seconds = 100 minutes = 1 hour and 40 minutes).

NOTE: If one output is assigned to "**BATCH AL.**", and the maximum programmed time is reached before the batch is complete, the alarm output will be activated.

Start / Stop Batch Operation

BATCH START: A batch may be started in two ways:

1. **From a remote input:** by assigning the function of batch start/stop to input 1 (**5-INPUTS** menu), or input 2 (**5-INPUTS** menu) and use the inputs as indicated on page 13.
2. **From the keyboard:** by pressing the ⇧ key.

NOTE:

- A batch is started from keyboard by pressing the ⇧ key. When the key is released, the batch begins.
- This function is not active when **Cons.mode** (**12-BATCH** menu) is enabled.

BATCH STOP: A batch may be stopped in three ways:

1. **From keyboard or remote input** (manual stop): by pressing the ⇧ key.
2. **End batch:** Stop of batch will be activated by an output signal upon reaching the batch quantity.
3. **Maximum time of batch:** If maximum time for batch is exceeded, the batch is stopped independent of the batch quantity.

NOTE:

- With the IF2 during the batch, the symbol of the active batch and the name of the formula may be viewed.
- When the output of batch is enabled, pushing the ⇧ for more than 5 seconds will cause the output to remain energized until the key is released. On the display, the CT and ST totalizers appear as follows:

  !! VALVE !!

  !! OPENED !!

Important Notes

Starting a batch disables the functions listed below:

*** If used on Input 1** **** Value to 0**		Display Data	Display Events	T-Reset	Date Time	Count Lock	Autorange Puls.Reset	E. Saving	P-Reset
		Auto Batch	**BM Auto Sel**	**Block Totalizer**	**N. Samples**	**Input 1 ON Start/Stop Batch**	**Auto Range Change From Input**	**Energy Saving**	**Calibration**
Display Data	**Auto Batch**			*Disable					
Display Events	**BM Auto Sel**				**Disable				
Disp Min/Max	**Cons. Mode**	Disable	Disable	*Disable					
Count Lock	**Input 2 on Start/Stop Batch**						Disable	Disable	Disable
Calibration	**Input 1 on Start/Stop Batch**					Disable	Disable	Disable	Disable
Calibration	**BM Select**		Disable		**Disable				
Out1, Out2	**Output on End Batch**						Disable		

Acts On

To optimize the performance of the meter when used as a batch controller, it is recommended to set them as close as possible in the application, choosing the appropriate values of **Tconst** and **Skip thr** (**3-MEASURE** menu).

Programming Menu Map

```
1   +          0.00
gal/m
 10*            +0.00%
T+gal    10657.749
P+gal     3624.837
CURR.LOOP OPEN
```

The Main Display after start-up of the converter is complete.

```
 0-QUICK START
Fs1=gal/m  100.00
Tot.MU=gal   1.000
Impl=gal  1.00000
Tpul1=ms  0050.00
Contrast=        5
Language=       EN
Main menu
```

0-Quick Start Menu
Full scale value.
Total

Current Contrast setting.
Interface language.
Main Menu access.

```
MAIN MENU
1-Sensor
2-Scales
3-Measure
4-Alarms
5-Inputs
6-Outputs
7-Communication
```

```
8-Display
9-Data logger
10-Diagnostic
11-Internal data
12-Batch
```

Main Menu
All submenus are accessed from the Main Menu.

```
 1-SENSOR
ND=mm
KA=
KL=+[0]
KL=-[0]
Cable len.=m
E.P.detect=
Autozero cal.
```

1-SENSOR MENU
Nominal diameters (meters)
KA Coefficient
Positive KL Coefficient
Negative KL Coefficient
Cable length:sensor to converter
Empty pipe detection
Autozero calibration

```
E.P.calibr.
```

Empty pipe calibration

```
 2-SCALES
Fs1=
Tot.MU=
Imp1=
Imp2=
Tpul1=
Tpul2=
Sg=
```

2 - SCALES MENU
Full scale value channel 1
Totalizer value
Volume per pulse channel 1
Volume per pulse channel 2
Pulse output duration channel 1
Pulse output duration channel 2
Specific gravity value

```
Frq1=
Frq2=
```

Full scale frequency channel 1
Full scale frequency channel 2

```
 3-MEASURE
Tconst=s
Filter=s
Skip thr=%
Peak thr=%
Cut-off=%
Autocal.=
Autorange=
```

3-MEASURE MENU
Time constant
Noise filtering value
Acceleration threshold
Peak cutoff threshold
Low flow zero threshold
Autocalibration function enable
Automatic scale change enable

```
E.saving=
```

Energy saving enable

```
 4-ALARMS
Max thr+=%
Max thr-=%
Min thr+=%
Min thr-=%
Hyst.=%
E.p.thr.=
mA v.fault=%
```

4 - ALARMS
Max forward value alarm
Max reverse value alarm
Min forward value alarm
Min reverse value alarm
Hysteresis for min/max flow rate
Empty pipe detection threshold
Current output setting on failure

```
Hz v.fault=
Timeout=
```

Frequency output value
Batch safety timer value

5-INPUTS	***5-INPUTS MENU***
T+ RESET=	*Positive total flow reset enable*
P+ RESET=	*Positive partial flow reset enable*
T- RESET=	*Negative total flow reset enable*
P- RESET=	*Negative partial flow reset enable*
Pulse.reset=	*Digital input pulse reset enable*
Count lock=	*Totalizer count lock enable*
Calibration=	*Autocalibration digital input*
Range change=	*Range change digital input enable*
Batch=	*Batch enable*

6-OUTPUTS	***6-OUTPUTS MENU***
Out1=	*Output 1 function*
Out2=	*Output 2 function*
Duty cycle1=%	*Duty cycle for output 1*
Duty cycle1=%	*Duty cycle for output 2*
Out mA1=	*Range of current output 1*

7-COMMUNICATION	***7- COMMUNICATION MENU***
Address=	*Network address setting*
Speed1=	*Serial interface baud rate RS-485*
Speed2=	*Serial interface baud rate RS-232*
Print=	*Print enable*
Printer=	*Printer enable*
Print data=	
Print events=	

8-DISPLAY	***8-DISPLAY MENU***
Language=	*Choice of layout language*
D.Rate=Hz	*Display refresh rate*
Contr.range=	*Contrast range*
Contrast=	*Contrast adjustment*
Currency=	*Enables display of currency*
Curr.decim.=	*The currency decimal place*
EUR/gal+	*Currency conversion factor + flow*
EUR/gal-	*Currency conversion factor - flow*

9-DATA LOGGER	***9-DATA LOGGER MENU***
◷=12/01/04	*Data and time set*
Acquisition=	*Automatic data logging enable*
Interval=h	*Time interval for data logging*
Display data	*Display data enable*
Display events	*Display events enable*
Disp.min.max	*Display min/max data enable*
Clear data	*Clear the logged data*
Clear events	*Reset all alarm events*
Reset min/max	*Reset all min/max data stored*

10-DIAGNOSTIC	***10-DIAGNOSTIC MENU***
Calibration	*Meter calibration enable*
Self test	*Meter auto-test function*
Simulation=	*Flow rate simulation enable*
Electrodes test	*Test electrodes*
Signals	
Display data	
Aux in=	

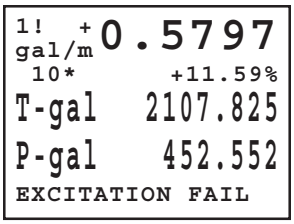
11-INTERNAL DATA	***11-INTERNAL DATA MENU***
L2 keycode=	*Level 2 access code*
Lock level=	*Security level setting*
Load fact.pres.	*Load factory preset settings*
Load user pres.	*Load user preset settings*
Save user pres.	*Save user preset settings*
KS=	*Instrument calibration value*

12-BATCH	***12-BATCH MENU***
Nsamples=	*No. of cycles for comp. calculation*
Diff. thr=%	*Differential threshold for comp.*
V.com=	*Volume compensation value*
V.pre=	*Volume pre-batch value*
Auto batch=	*Automatic batching value*
BM auto sel=	*Batch mode automatic selection*
Cons.mode=	*Consent mode*

Troubleshooting

Error messages and corrective actions to be taken

Message:	Error:	Action to take:
NO ALARMS	Instrument working properly	None
MAX ALARM	The flow rate is higher than the maximum threshold setting.	Check the maximum flow rate threshold set and the process conditions.
MIN ALARM	The flowrate is lower than the minimum threshold setting.	Check the minimum flowrate threshold setting and the process conditions.
FLOW RATE>FS	The flowrate is higher that the full scale value set on the instrument.	Check the full scale setting on the instrument and the process conditions.
PULSE/FREQ/>FS	The pulse generation output of the device is saturated and cannot generate additional pulses.	Set a larger 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 repeat the empty pipe calibration procedure.
BATCH ALARM	Batch interrupted for the following reasons: • Batch timer expired before the end of batch. • Batch valve open and flowrate at zero for a time longer than the safety timer setting. • Batch valve closed and flowrate more than zero for a timer longer than the safety timer setting.	Verify: • Presetting. • System condition.
INPUT NOISY	The measurement is affected by external noise in the cable connecting the converter to the sensor or the cable is broken.	Check the status of the cables connecting the converter to the sensor, the ground connections of the devices or the possible presence of large and erratic noise sources.
EXCITATION FAIL	The coils or the cable connecting the sensor to the converter are broken or intermittent.	Check the status of the cables connecting the sensor to the converter.
CURR. LOOP OPEN	The output (0/4-20mA) on the board or optional module are not connected correctly on the milliampere circuit.	Verify that the load is connected to the output (max 1000 ohm.) To disable the alarm, preset the “mA Val.fault” value to 0.
P.SUPPLY FAIL	Power supply different from that specified on the name plate.	Verify that the power supply conforms to the specification the name plate.



Display with “Excitation Fail” displayed.

Error messages when the converter is turned on.

Codes	Descriptions	Recommendation
0001	Problem with watch-dog circuit.	Contact service.
0002	Wrong configuration work data in EEPROM.	Contact service.
0004	Wrong configuration safety data in EEPROM.	Contact service.
0008	Defective EEPROM.	Contact service.
0010	Defective keyboard (one or more keys are pushed during the test).	Contact service.
0020	Power supply voltage (+3.3) is out of range.	Contact service.
0040	Power supply voltage (+13) is too low (<10V).	Contact service.
0080	Power supply voltage (+13) is too high (>14V).	Contact service.
0200	Timeout calibration input (input circuit broken).	Contact service.
0400	Gain input stage is out of range.	Check the status of the cables connecting the sensor to the converter, the ground connections of the devices or the possible presence of large, erratic noise sources.
0800	Interruption of the coils circuit.	Check the status of the cables connecting the sensor to the converter.

Display flag description

Flag	Description
M	Max alarm activated.
m	Min alarm activated.
!	• Interruption of the coils circuit. • Signal error. • Empty Pipe.
C	Calibration running.
S	Simulation.
⎍	Pulse output saturation (reduce Time Pulse).

Troubleshooting

Problems can be separated between those that occur during start-up of the converter and those that occur during normal operation.

At start-up, the converter performs internal diagnostic tests. A few common alarm signals that the converter may display are "**INPUT NOISY**" and "**EXCITATION FAIL**".

INPUT NOISY

This type of alarm is generated when noise is strong enough to be detected during while measuring flow, when the sensor signal is distorted, or when the converter can not perform a correct calibration function. Common causes of INPUT NOISY alarms include:

- The integrity of the cable connection between the converter and the sensor. Refer to page 41 for instruction on how to test for cable integrity.
- The cable connection are not securely fastened in the converter. Check to ensure that the wires are securely connected.
- The terminal block connections are not seated properly.
- A pin into which a terminal block plugs into may be bent or broken.
- The sensor pipe must be completely full.
- The integrity of the grounding connections be between the sensor, converter, and the liquid.
- Electromagnetic interference from the environment. Ensure that the cables connecting the sensor to the converter (remote mount) are not located near any other cables or sources of EMI.

EXCITATION FAIL

This type of alarm is generated when a problem exists between the cable connecting the coils or wiring issues.

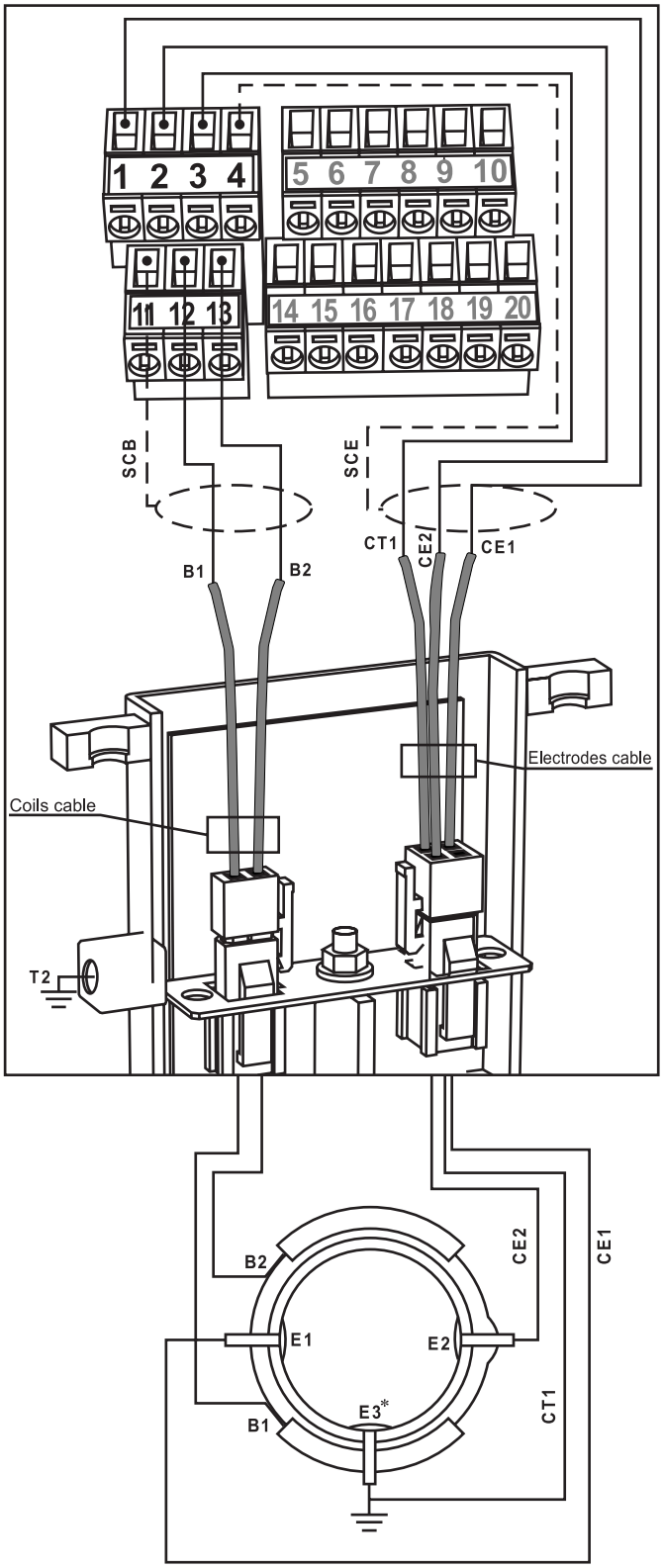
- The integrity of the cable connection between the converter and the sensor. Refer to page 41 for instruction on how to test for cable integrity.
- The cable connection are not securely fastened in the converter. Check to ensure that the wires are securely connected.
- The terminal block connections are not seated properly.
- A pin into which a terminal block plugs into may be bent or broken.

Continuity Test

This test checks for the integrity of the sensors inside the the sensor. An Ohm meter is required for this test.

TEST	MEASURE BETWEEN	READING
Coils:	B1 and B2	50 to 300Ω
Electrodes:	E1 and CE1	<0.5Ω
	E2 and CE2	<0.5Ω
	*E3 and CT1	<0.5Ω
Common:	CT1 and T2	<0.5Ω

**E3 is an optional electrode and may not be present.*



Insulation Test

This test checks for proper insulation of the electrode circuits. An Ohm meter is required for this test.

TEST	MEASURE BETWEEN	READING
Coils:	B1 and CT1	>1,999MΩ
	B2 and CT1	>1,999MΩ
Electrodes:	CE1 and CT1	>1,999MΩ
	CE2 and CT1	>1,999MΩ
Electrodes	CE1 and B1	>1,999MΩ
& Coils:	CE1 and B2	>1,999MΩ
	CE2 and B1	>1,999MΩ
	CE2 and B2	>1,999MΩ
Insulation	SCB and B1	>1,999MΩ
& Coils:	SCB and B2	>1,999MΩ
	SCB and T2	>1,999MΩ
Insulation	SCE and CE1	>1,999MΩ
& Electrodes:	SCE and CE2	>1,999MΩ
	SCE and CT1	>1,999MΩ
	SCE and T2	>1,999MΩ

Appendix

Display Rotation

Remove the two screws which fasten the board in place as indicated in Figure 1.

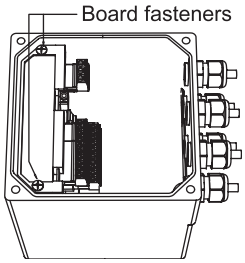


Figure 1

Lift the board and remove the flat cable from the display as indicated in Figure 2. Remove the board from the enclosure.

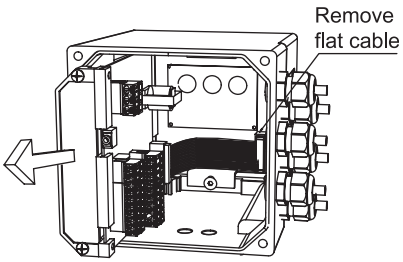


Figure 2

Remove the screw in the display to allow the board to be tilted to extract the display as indicated in Figure 3.

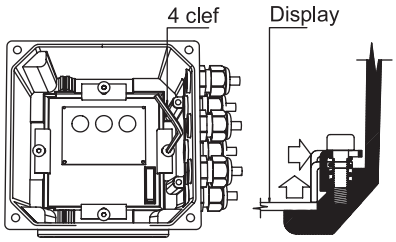


Figure 3

Rotate the display to the desired location, verify the correct location of the seal, clean the contact surfaces, and set the display in the housing.

Tilt the display is a suitable orientation and fasten with the screw.

Tighten the screws in the order as indicated in Figure 4.

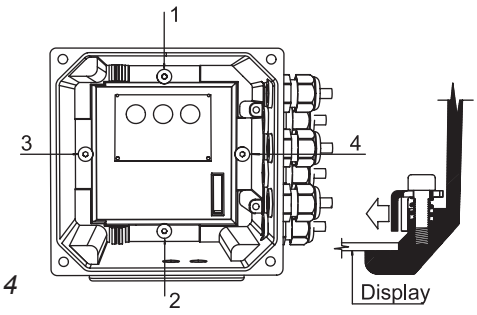


Figure 4

Reconnect the flat cable to the display. Verify the correct location of the board in the retaining clip and finish the assembly by fixing the board to the box.

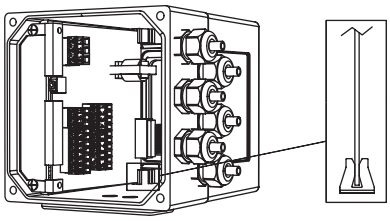


Figure 5

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