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LDB-CR **Chronometers and Time Counters**



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1. LDB-CR Series

Large format industrial meters with chronometer and time counter functions

Large format meters for long distance reading, for industrial applications. Different formats available with 4 and 6 digits, with 60 mm and 100 mm digit height. Front keypad to access the configuration menu, and optional remote keypad.

Multiple reading time formats in hours, minutes, seconds, cents of seconds and days. Configurable for decimal or sexagesimal reading (time format). Functions for up and down counting, with preset value configurable.

Controls

Independent controls for 'start', 'stop' and 'reset' through free potential contacts. Configurable for activation with other control signals (NPN, PNP, inductive, ...).

Reset

External reset control, with activation configurable by edge or by level, front reset and automatic reset configurable when reaching an alarm setpoint.

Special functions

Special functions with activation by external connection: counting direction, total accumulated times, total exceeded time, display hold, and memory of events, maximum and minimum (see section 1.14.6).

Alarms

Independent alarms configurable as maximum or minimum, with configurable activation and deactivation delays and optional inverted relay activation and relay manual unlocking. Alarms with 'repeat' mode with activation at multiples of configured time (see section 1.14.12).

'On_alarm' parameter to link functions to alarm activation;

continue, reset to '0', load 'preset' value or stop counting (see section 1.14.12).

Flash

Configurable display flashing in case of 'stop' counting, 'start' counting, or alarm activation.

Security on start-up

'On power-up' function to define inactivity times after power-up, configure the counter status ('start' or 'stop') after power-up, and the option to apply a reset after power-up.

Memory

The instrument saves and recovers the last reading value in case of power-loss.

Configurable 'fast-access' menu

The front key 'UP' () gives access to a user configurable menu with direct access to several useful functions such as alarm setpoints and/or preset value (see section 1.14.14).

Configurable 'Fast access' to selected functions with key 'UP' (▲) (see section 1.14.14), typically alarm setpoints and preset values.

Control and retransmission options

Output and control options with 1, 2 and 3 relays, transistor outputs, controls for SSR relays, isolated analog outputs, communications in Modbus RTU, RS-485 ASCII and RS-232.

Mechanical and mounting

Sturdy metal housing with full IP65 protection. Internal connections by plug-in screw clamp terminals, and output through cable glands. Housing prepared for panel, wall and hanging mount.

1.1 How to use this manual

If this is the first time you are configuring a large format meter, below are the steps to follow to install and configure the instrument. Read all the manual sections in

order to have a full and clear view of the characteristics of the instrument. Do not forget to read the installation precautions at section 1.20.

1. Identify the instrument format (see section 1.4)
2. Power and signal connections
 - open the instrument (see section 1.5)
 - connect the power (see section 1.7)
 - connect the signal (see section 1.8)
 - close the instrument (see section 1.5)
3. Configure the instrument (see section 1.14)
 - select the reading format, counting direction and preset value (see section 1.14.2)
4. Advanced configuration (optional)
 - functions 'on power up', external reset and 'B' function (see section 1.14.7)
 - control configurations (see section 1.14.10)
 - configure the alarms (see section 1.14.12)

- configure the fast access (see section 1.14.14), and key 'LE' (1.14.15)
 - configure other functions (see section 1.14.16)
5. If the instrument includes analog output (AO) or serial communications (RTU, S4, S2)
 - to include an option to an instrument see section 1.6
 - to configure an installed option, access the option configuration menu (see section 1.14.23)
 - see section 2 for information regarding the output and control options available
6. Install the instrument
 - mount on panel, wall or hanging (see section 1.19)
 - adjust the brightness level according to your environmental needs (see section 1.14.22)
7. Check application examples at sections 1.15 and 1.16

1.2 How to order

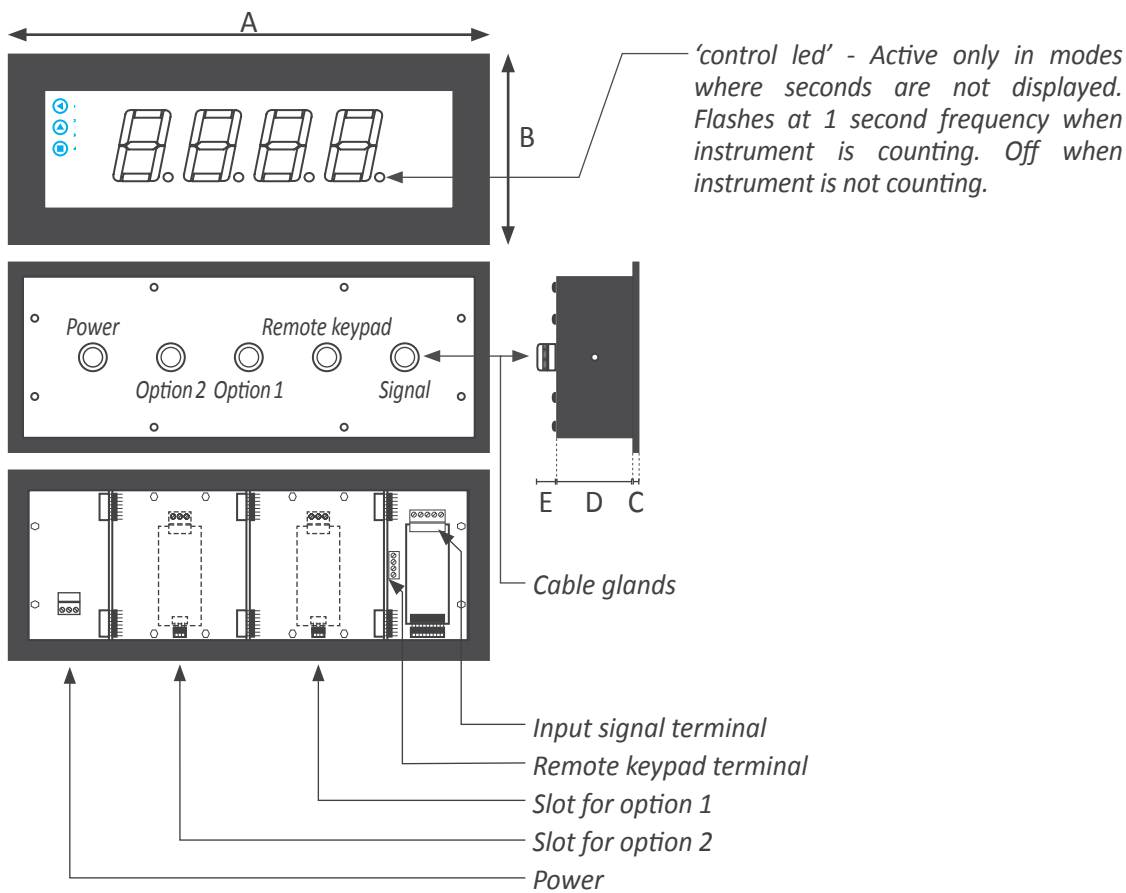
Format	Model	Power	Color	Option 1	Option 2	Option 3*	Others
LDB-26	CR	H					
LDB-24 (60 mm, 4 digits) LDB-26 (60 mm, 6 digits) LDB-44 (100 mm, 4 digits) LDB-46 (100 mm, 6 digits)		-H (85-265 Vac and 120-370 Vdc) -L (11-36 Vdc isolated)	-R (red led) -G (green led)	-R1 (1 relay) -AO (analog output) -RTU (Modbus RTU) -S4 (RS-485) -S2 (RS-232) -T1 (1 transistor) -SSR (1 control SSR) -0 (empty)		*Option 3 available with formats LDB-26 and LDB-46	

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1.4 Sizes and formats

1.4.1 Format LDB-24

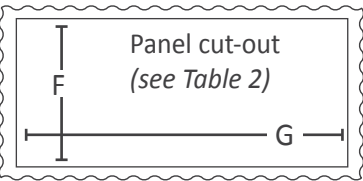


Size A	340 mm
Size B	135 mm
Size C	3 mm
Size D	55 mm
Size E	25 mm

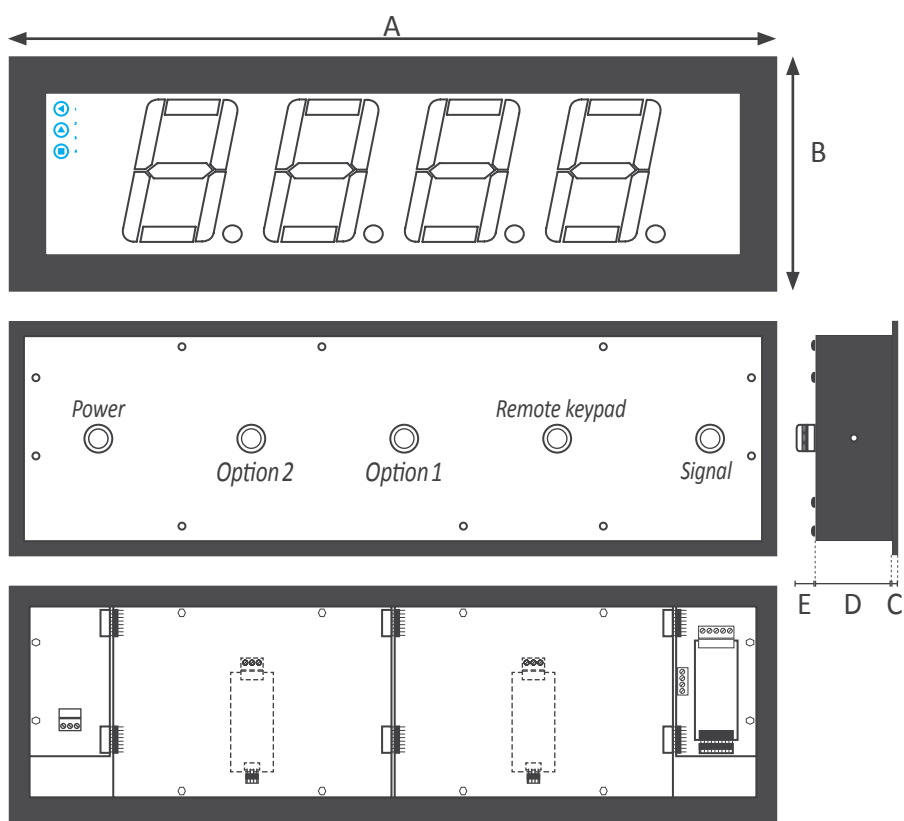
Table 1 - Sizes LDB-24

Cut-out G	322 mm (±1)
Cut-out F	117 mm (±1)

Table 2 - Panel cut-out LDB-24



1.4.2 Format LDB-44

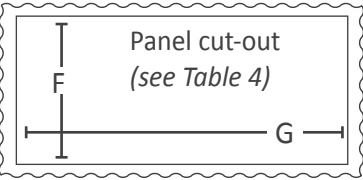


Size A	542 mm
Size B	166 mm
Size C	3 mm
Size D	55 mm
Size E	25 mm

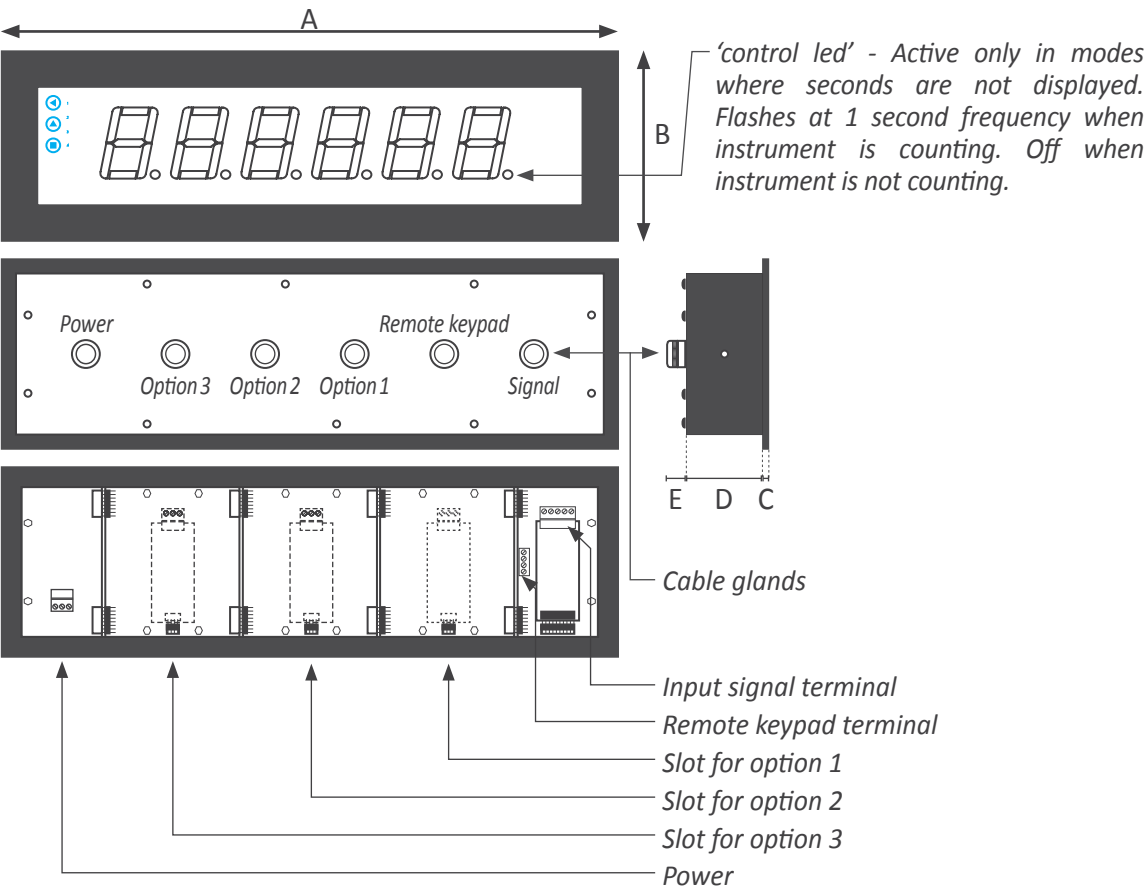
Table 3 - Sizes LDB-44

Cut-out G	524 mm (±1)
Cut-out F	148 mm (±1)

Table 4 - Panel cut-out LDB-44



1.4.3 Format LDB-26

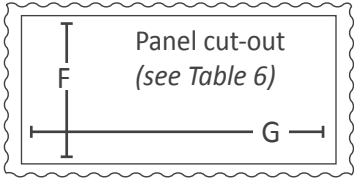


Size A	436 mm
Size B	135 mm
Size C	3 mm
Size D	55 mm
Size E	25 mm

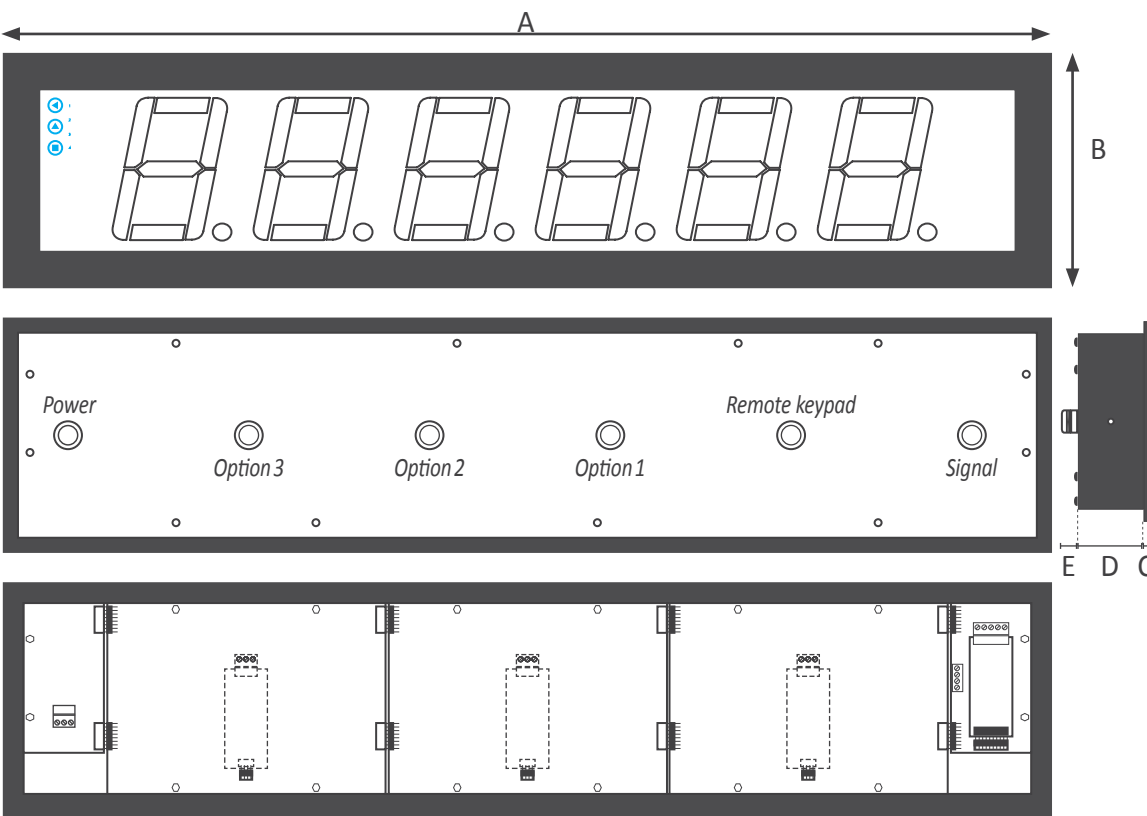
Table 5 - Sizes LDB-26

Cut-out G	418 mm (±1)
Cut-out F	117 mm (±1)

Table 6 - Panel cut-out LDB-26



1.4.4 Format LDB-46

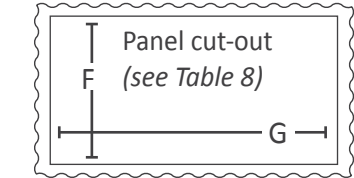


Size A	740 mm
Size B	166 mm
Size C	3 mm
Size D	55 mm
Size E	25 mm

Table 7 - Sizes LDB-46

Cut-out G	722 mm (±1)
Cut-out F	148 mm (±1)

Table 8 - Panel cut-out LDB-46



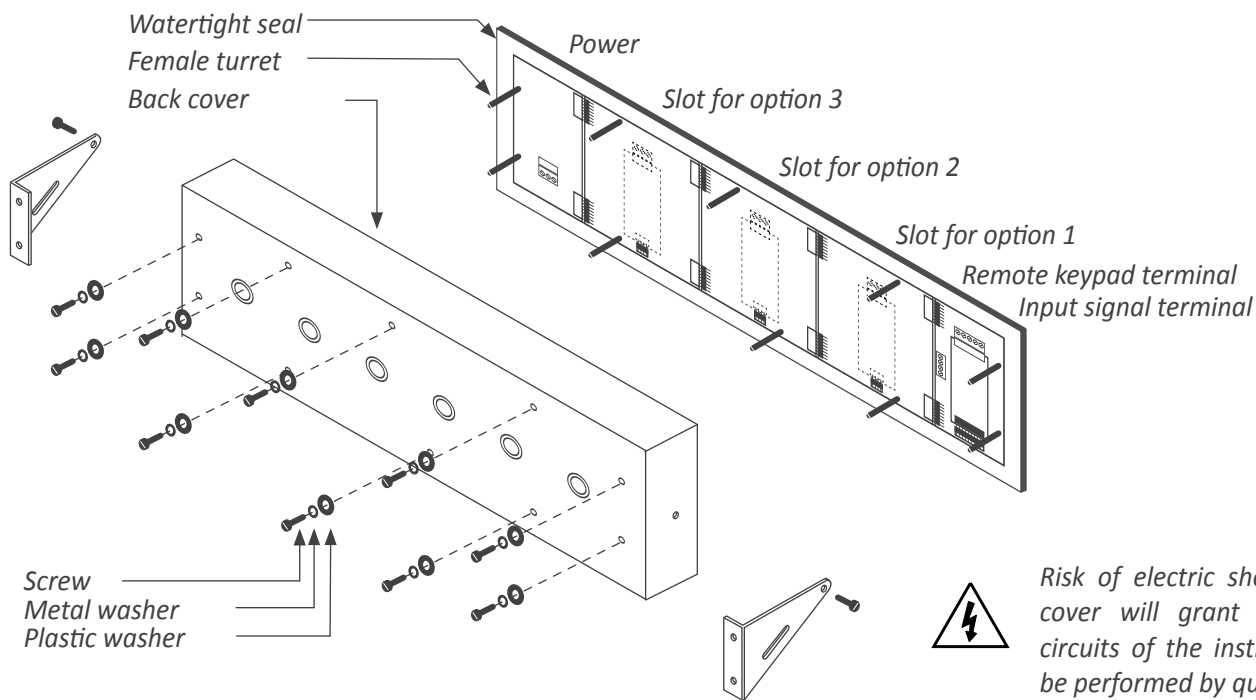
1.5 To access the instrument

To open the housing, remove the screws from the back cover. With each screw there is a metal washer and a plastic washer. Once the screws are out, remove the back cover.

The figure below shows the instrument internal structure for a B26 format. It shows the location of the 3 slots for optional output and control modules, the power terminal and the input signal terminal.

To close the instrument, place the back cover, the screws, the metal washer and the plastic washer. The plastic washer is in contact with the back cover. Confirm that the screws are correctly turning inside the internal female screws.

To ensure a correct IP65 protection tighten the back cover screws with a strength between 30 and 40 Ncm, with the help of a dynamometer screwdriver.



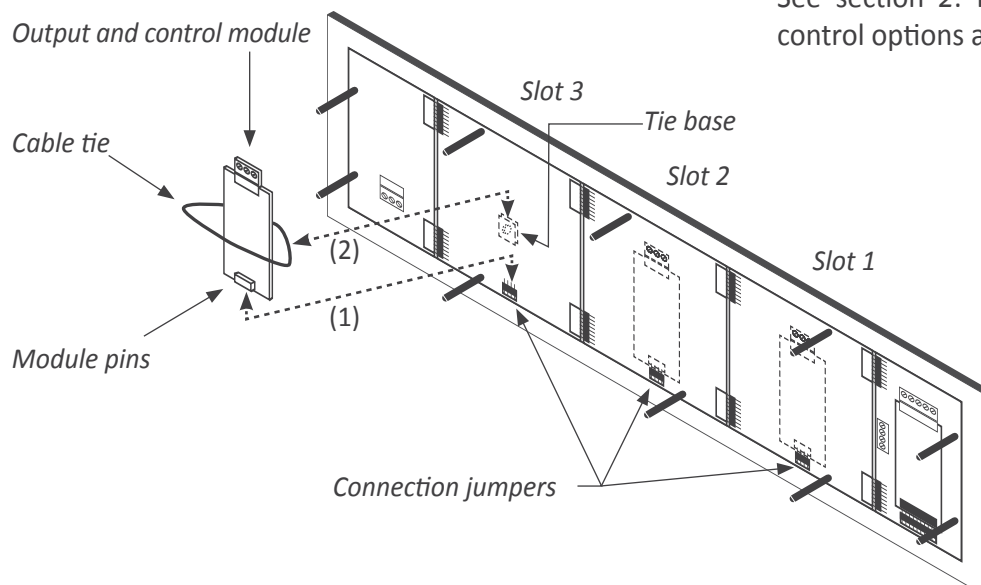
Risk of electric shock. Removing the back cover will grant access to the internal circuits of the instrument. Operation must be performed by qualified personnel only.

1.6 Modular system

Large format meters are designed with an internal modular architecture. The output and control modules are independent and can be installed by accessing the internal circuits of the instrument, and connecting the module to the connection jumpers of the selected slot.

Each module is provided with a cable tie to fix the module to the tie base. The input signal modules defines the instrument function and are exchangeable, switching a temperature meter to an impulse counter only by replacing the input signal module.

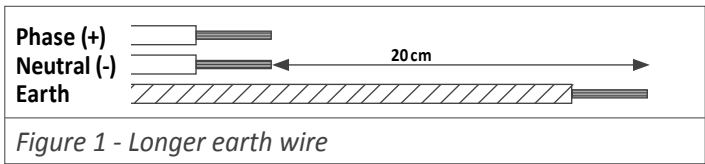
See section 2. for information regarding the output and control options available



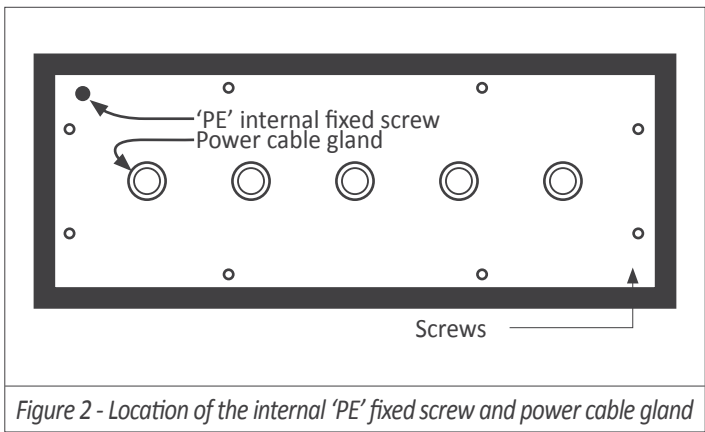
- To install an output and control module
- (1) insert the 'module pins' into the 'connection jumpers' in one of the free slots
 - (2) place the 'cable tie' into the 'tie base' and embrace the 'module' firmly, until it is fixed

1.7 Power connections and protective earth

1. Unscrew the screws from the back cover and remove the back cover (see section 1.5).
2. Pass the power cable through the power cable gland (see section 1.4).
3. Prepare the power cables so that the earth wire is 20 cm longer than the other cables (see Figure 1).

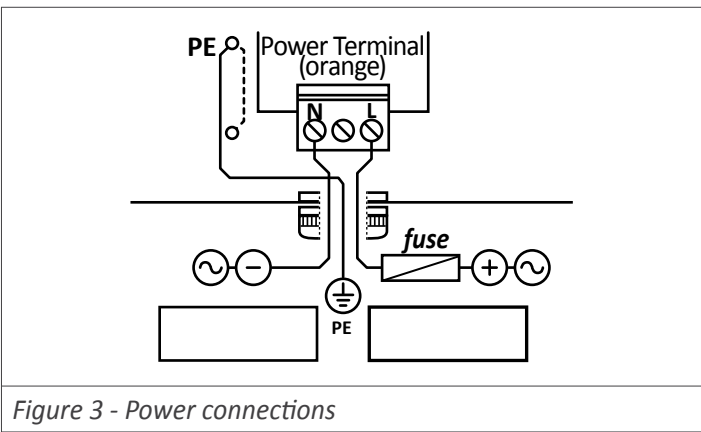


4. Connect the earth wire to the internal fixed screw 'PE' (see Figure 2) located at the inside of the back cover. The instrument internally connects the back cover metallic



5. Connect phase and neutral (in AC power) or positive and negative (in DC power) to the internal power terminal.
6. The connections label attached to the outside of the instrument has some free space left to write the color or local code for each cable.
7. To comply with security regulation 61010-1, add to the power line a protection fuse acting as a disconnection element, easily accessible to the operator and identified as a protection device.

Power 'H'	500 mA time-lag fuse
Power 'L'	1000 mA time-lag fuse

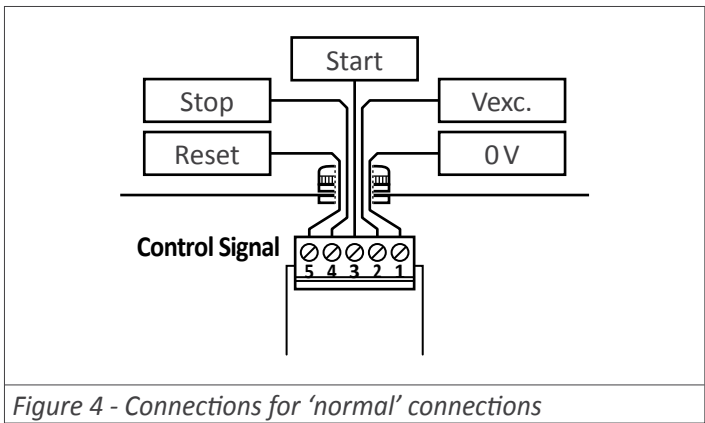


1.8 Control signal connections

The connections terminal is located in the instrument (see section 1.5). All control signals activate by falling edge, by short-circuit to 0V. To activate controls with other signals or activation, see section (see section 1.14.10).

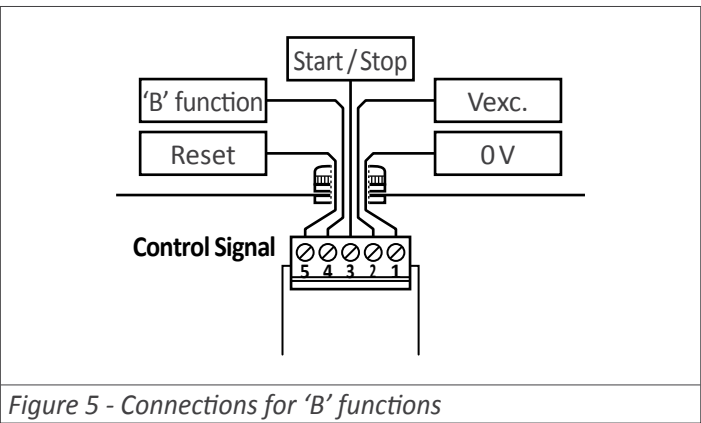
1.8.1 'Normal' connections

At normal connections, the 'start', 'stop' and 'reset' controls are independent.



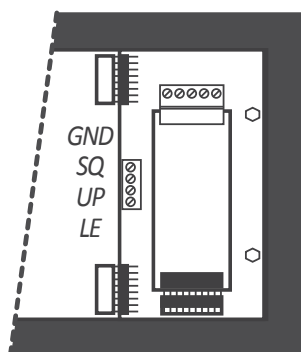
1.8.2 'B' connections

The 'B' connections activates automatically when one of the special 'B' functions (see section 1.14.6) is configured. The 'start' and 'stop' controls share the same terminal 3. Signal at 'high' level activates the 'start', and at 'low' level activates the 'stop'. The remaining terminal is dedicated to control the 'B' function selected.



1.9 Connections for remote keypad

The 4 pin terminal located beside the input signal module allows to replicate a remote version of the front keypad. Connect 4 cables for front keys 'SQ' (■), 'UP' (▲) and 'LE' (◀) and for the common. Pass these cables through the 'remote keypad' cable gland (see section 1.4).



1.10 Functions included

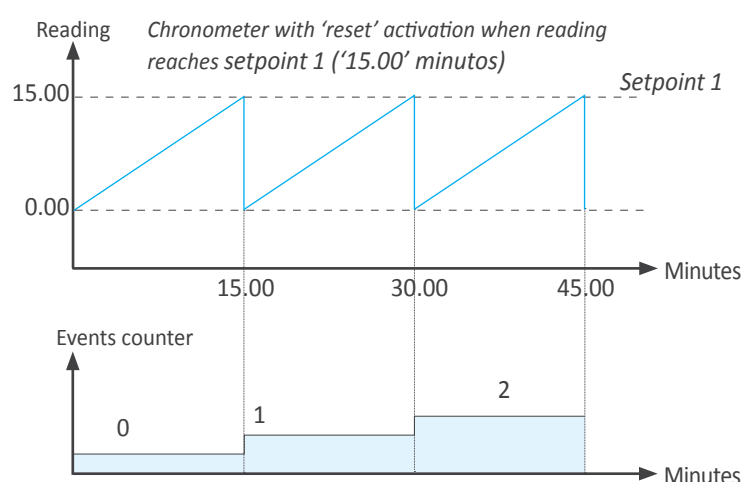
Functions included		Section
Reading	15 different formats	1.14.2
Counting direction	up or down counting	1.14.2
Preset	yes	1.14.2
'On Power Up'	yes	1.14.3
Reset	configurable : external, front and linked to alarm activation	1.11
Special functions	control up / down event counter total time exceeded time reading 'hold' longest and shortest cycle	1.14.6
Controls	configurable	1.14.10
Alarms	simple or double setpoint 'on alarm' events activation delays deactivation delays inverted relays locked alarms	1.14.12
Fast access menu	yes, configurable	1.14.14
Front 'LE' key	yes, configurable	1.14.15
Retention memory	yes, recovers with power	1.13
Password	configuration locked	1.14.19
Brightness	configurable, 5 levels	1.14.22

Table 9 - Functions included

1.11 Reset types

The reset function can be activated from three independent and configurable sources:

- Front reset - associated to the front key 'LE' (◀). This reset can be configured by menu (see section 1.14.15). The front reset is activated by levels (pressed / not pressed).
- External reset - connected to pin 5 at the internal signal terminal (see section 1.8). It activates by falling edge, by connection to the 0 Vdc terminal. To configure a different activation see section 1.14.10. Configurable trigger level between 0 and 3.9 Vdc, configurable pull-up / pull-down resistors, can be configured to work with other type of signals (NPN, PNP, push-pull, inductive, TTL, ...).
- Alarm reset - the 'on alarm' parameter at alarms 1, 2 and 3 (see section 1.14.12) can be configured to activate a certain function when alarm activates: stop, load '0', load 'preset'.



1.12 Messages and errors

Error messages related to the local instrument are shown on display, in flash mode (see Table 10). Examples given are for instrument with 6 digit formats.

Messages and errors on display	
'Err.1'	incorrect password.
'Err.2'	at 'oPt.X' menu entry. Installed module is not recognized.
'Err.8'	excitation voltage overload
'999999'	+ flashing mode. Reading is in overrange.
'-199999'	+ flashing mode. Reading is in underrange.

Table 10 - Messages and error codes for local instrument

1.13 Technical specifications

Digits	
number of digits	4 or 6 (see Table 12)
digit	7 segments
view angle	120°
color	red or green
digit height	(see Table 12)
Reading	
max., min.	(see Table 12)
reading formats	(see Table 11) for 6 digits (see Table 13) for 4 digits
display refresh	15 refresh / second
memory	yes, recovers the last counter value after power loss
quartz accuracy	±0.01 %
thermal drift	20 ppm / °C

Reading formats (6 digits)

Sexagesimal modes	mm.ss.cc	mmmm.ss	
	hh.mm.ss	hhhh.mm	
	dd.hh.mm	dddd.hh	
Decimal modes	ssssss	mmmmmm	hhhhhh
	sssss.s	mmmmm.m	hhhhh.h
	ssss.ss	mmmm.mm	hhhh.hh

Table 11 - Reading formats (d=days, h=hours, m=minutes, s=seconds, c=cents of second)

Reading formats (4 digits)

Sexagesimal	mm.ss	hh.mm.ss	dd.hh
Decimal modes	ssss	mmmm	hhhh
	sss.s	mmm.m	hhh.h
	ss.ss	mm.mm	hh.hh

Table 13 - Reading formats (d=days, h=hours, m=minutes, s=seconds)

Controls	
default control signal	start, stop, reset
configurable for ...	free potential contact NPN, PNP, Namur, pick-up, TTL, inductive, mechanical, ...
max. Vdc on terminals	±30 Vdc
excitation voltage	+18 Vdc, +15 Vdc, +9 Vdc, +5 Vdc
max. current	70 mA
protection	yes, current limited to 70 mA
control wires section	max. 0.5 mm ²
Power	
power 'H'	85 to 265 Vac and 120 to 370 Vdc isolated (isolation 2500 Vac)
power 'L'	11 to 36 Vdc isolated (isolation 1500 Vdc)
consumption	(see Table 12)
fuses	(see section 1.7)
wire section	max. 2.5 mm ²
Configuration	
Output and control options	
Mechanical	
IP protection	full IP65 housing
mounting	panel, wall, hanging (see section 1.19)
connections	cable gland outputs internal plug-in screw terminals
housing material	textured iron, black painted methacrylate front filter
weight	(see Table 12)
front sizes	(see section 1.4)
panel cut-out depth	(see section 1.4)
Temperature	
operation	from 0 to +50 °C
storage	from -20 to +70 °C
warm-up time	15 minutes

	Format LDB-24	Format LDB-44	Format LDB-26	Format LDB-46
Number of digits	4	4	6	6
Digit height	60 mm	100 mm	60 mm	100 mm
Reading distance	25 meters	50 meters	25 meters	50 meters
Slots for output and control options	2	2	3	3
Maximum reading	9999		999999	
Minimum reading	-1999		-199999	
Consumption (without options installed)	3 W	5.25 W	3.5 W	5.5 W
Consumption (with options installed)	5 W	6.75 W	5.5 W	7 W
Weight	2200 gr.	2500 gr.	3500 gr.	4500 gr.

Table 12 - Technical specifications associated to format

1.14 Configuration

1.14.1 How to operate the menus

The instrument has two menus accessible to the user :

'Configuration menu' (key 'SQ') (■)

'Fast access' menu (key 'UP') (▲)

Configuration menu

The '*configuration menu*' modifies the configuration parameters to adapt the instrument to the application needs. To access the '*configuration menu*' press for 1 second the 'SQ' (■) key. This access can be blocked by activating the '**Password**' ('**PASS**') function. While operating the '*configuration menu*', the alarm status is 'hold' to the status it had before accessing the menu, and the output and control modules remain in '*error*' state. When leaving the '*configuration menu*', the instrument applies a system reset, followed by a brief disconnection of the alarms and the output and control modules. Functionality is then recovered.

For a detailed explanation on the '*configuration menu*' see the following sections, and for a full view of the '*configuration menu*' see section 1.17.

'Fast access' menu

The *'fast access'* menu is an operator configurable menu, providing fast and direct access to the most usual functions of the instrument with a single key pad stroke. Press key 'UP' (▲) to access this menu.

See section 1.14.14 for a list of selectable functions for the ‘fast access’ menu in this instrument. The ‘Password’ (‘PASS’) function does not block access to this menu. Accessing and modifying parameters in the ‘fast access’ menu does not interfere with the normal functionality of the instrument, and it does not generate any system reset when validating the changes.

Operating with the front keypad inside the menus

Key 'SQ' (■) - press the 'SQ' (■) key for 1 second to access the *'configuration menu'*. Inside the menu, the 'SQ' (■) key acts as an *'ENTER'*. It enters into the menu option selected, and when entering a numerical value, it validates the number.

Key 'UP' (▲) - press the 'UP' (▲) key to access the '*fast access*' menu. Inside the menu, the 'UP' (▲) key sequentially moves through the available parameters and menu entries. When entering a numerical value, it modifies the digit selected by increasing its value to 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

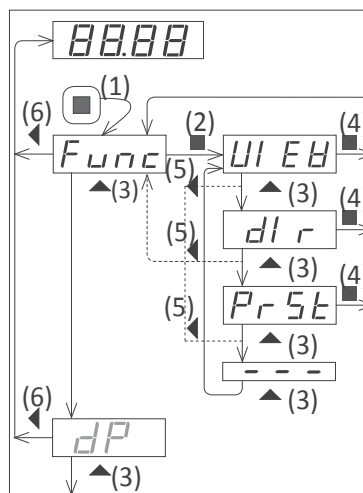
Key 'LE' (◀) - press the 'LE' (◀) key to activate the configured special functions associated to this key. Inside the menu, the 'LE' (▶) acts as an 'ESCAPE'. It leaves the selected menu level and eventually, by leaving all menu levels, it leaves from the configuration menu. Then changes are applied and the instrument is back to normal function. When entering a numerical value, it selects the active digit, and the value is then modified by key 'UP' (▶).

'Rollback'

After 30 seconds without interaction from the operator, the instrument will rollback and leave the '*configuration menu*' or the '*fast access*' menu. All changes will be discarded.

Instruments with 4 and 6 digits

The configuration menus included in this document show values for a 6 digit instrument. In case of 4 digit instruments, note that maximum reading values should be 9999 instead of 999999 to 9999 and minimum reading values should be -1999 instead of -199999.



Example of operation inside the '*configuration menu*'.







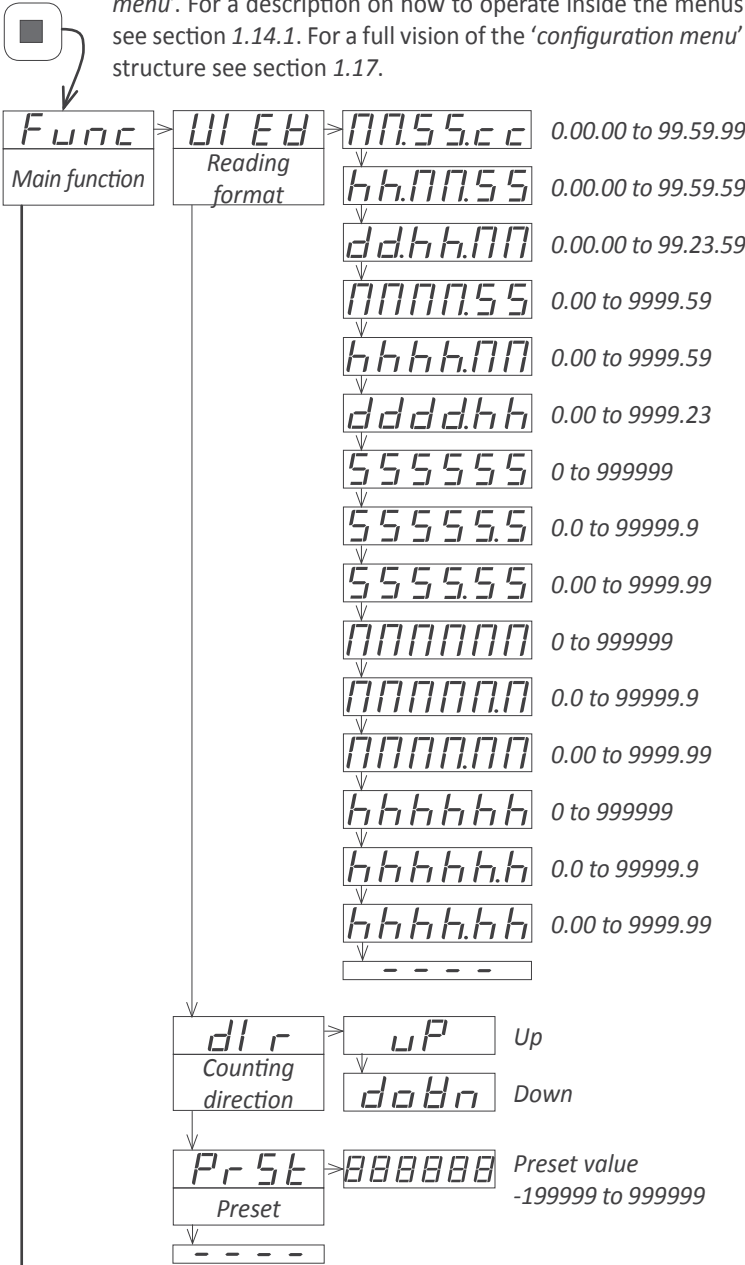
1. The () key enters into the 'configuration menu'.
2. The () key enters into the 'InP' menu.
3. The () key moves through the menu options.
4. The () key selects the desired range and returns to the 'InP' menu.
5. The () key leaves the actual menu level and moves to the previous menu level.
6. The () key leaves the 'configuration menu'. Changes are applied and saved at this moment.

Figure 6 - Example of operation inside the 'configuration menu'

1.14.2 Initial set-up

Press 'SQ' (■) for 1 second to access the 'configuration menu'. For a description on how to operate inside the menus see section 1.14.1. For a full vision of the 'configuration menu' structure see section 1.17.



To configure the initial set up, enter the 'Main function' ('Func') menu and select the reading format, the counting direction and the preset value.

At the 'Reading format' ('VIEW') menu select one of the available formats.

- 'MM.SS.cc' - clock format, minutes, seconds and cents.
- 'hh.MM.SS' - clock format, hours, minutes and seconds.
- 'dd.hh.MM' - clock format, days, hours and minutes.
- 'MMMM.SS' - counter of minutes and seconds.
- 'hhhh.MM' - counter of hours and minutes.
- 'dddd.hh' - counter of days and hours.
- 'SSSSSS' - counter of seconds.
- 'SSSS.S' - counter of seconds with one decimal.
- 'SSSS.SS' - counter of seconds with two decimals.
- 'MMMMMM' - counter of minutes.
- 'MMMMM.M' - counter of minutes with one decimal.
- 'MMMM.MM' - counter of minutes with two decimal.
- 'hhhhh' - counter of hours.
- 'hhhhh.h' - counter of hours with one decimal.
- 'hhhh.hh' - counter of hours with two decimal.

At the 'Counting direction' ('dlr') parameter, select 'uP' for up counting or 'doWn' for down counting.

At the 'Preset' ('PrSt') parameter, configure the value that will load on display when the 'reset' function activates. See section 1.11 for the different types of reset activation.

1.14.3 'On power up' function

The '**On Power Up**' ('**on.Pu**') functions allows to define a series of actions to activate when the instrument restarts after a power loss. Functions available are a delay so the instrument waits a defined time before starting to measure and control, an automatic reset of the time counter and the definition of the status of the counter (counting or stopped). The functions will apply only after a restart due to power-loss, they will not apply after a restart due to changes in configuration.

Delaying the measure and control functions gives additional time to elements of the system who are slower, so they can

start completely before the instrument begins to acquire signal and control the outputs.

While on delay mode, the instrument shows all decimal points lightened and flashing, all alarms are deactivated, and there is no signal acquisition or communications control. When the delay time is over, the instrument starts its normal functioning.

El full start-up process of the instrument is as follows: waits the time configured at '**Delay**', resets the time counter (as configured at '**Reset**'), starts counting or stopped, and reads the status of the external controls 'start', 'stop' and 'reset'.

1.14.4 Flash function

The '**Flash**' ('**FLSh**') configures flashing display when the instrument is stopped ('**StP.F**') and/or when the instrument is counting ('**StP.F**').

1.14.5 External reset configuration

The external reset can be activated by edge or by level. Edge activation means that the reset will activate when there is a transition from '0' to '1' or from '1' to '0'. Level activation means that the reset activates at level '0' or level '1'.

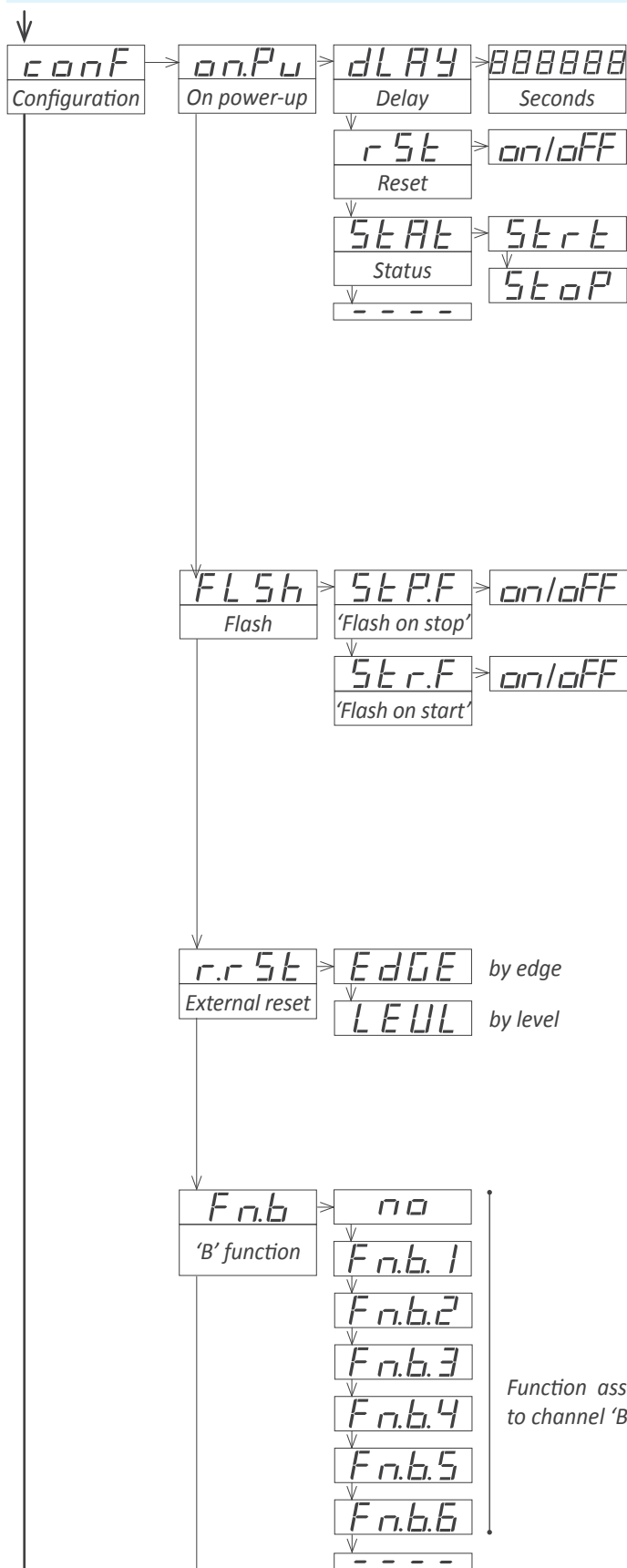
To invert the logic of the activation see section 1.14.10.

1.14.6 'B' function

The operator can select a special function (called 'B' function) to be controlled from external control terminal 3 (see section 1.8.2). Selecting a 'B' function modifies the standard connection of the instrument, and activates the 'B' connections in order to free one of the terminals to control the 'B' function. Available functions are listed below. See also section 1.14.8 :

- function B1 ('**Fnb.1**') to control counting direction (up or down)
- function B2 ('**Fnb.2**') to count events
- function B3 ('**Fnb.3**') to view total accumulated working times
- function B4 ('**Fnb.4**') to view exceeded times
- function B5 ('**Fnb.5**') to 'hold' the reading
- function B6 ('**Fnb.6**') to control maximum an minimum values (memories of longer and shorter times)

1.14.7 'Configuration' menu



The 'On Power Up' ('on.Pu') menu assigns functions to be applied when the instrument starts after a power loss. For more information see section 1.14.3.

- at the 'Delay' ('dLay') parameter configure the time the instrument will wait before starting normal functionality. Time between 0 and 200 seconds.
- at the 'Reset' ('rSt') parameter set to 'on' to activate a reset when restarting after a power loss
- at the 'Status' ('StAt') parameter configure the state of the counter after power-up. Select 'Strt' to count after power-up or 'StoP' to remain stopped after power-up.

At the 'Flash' ('FLSH') menu configure:

- **Flash on stop** ('StP.F') set to 'on' to activate flashing reading when the chronometer is stopped.
- **Flash on start** ('Str.F') set to 'on' to activate flashing reading when the chronometer is counting.

At the 'External reset' ('r.rSt') select the activation of the external reset by edges or by levels.

At the 'B' function' ('Fn.b') select the the function associated to channel 'B'. By default there is no selected 'B' function. For more information see section 1.14.6.

Next menu entry gives access to the configuration parameters for the "B' function' selected. Following are explanations for possible menus 'Fn.b.1' to 'Fn.b.6' (or message 'Fn.b.n' if no 'B' function' has been selected).

1.14.8 Functions 'B1' to 'B6'

The 'B' function is a special function disabled by default. To activate one of the 'B' functions, see section 1.14.6. When activating a 'B' function, the 'B' connection also activates (see section 1.8.2). The 'B' function control signal (terminal 3) activates by short-circuit to 0V. For other activation signals see section 1.14.10 and take into account that the 'start' signal is now 'start-stop', and the 'stop' signal is now the 'channel 'B'' control signal.

- with the '**B.1 control up / down**' ('Fn.b.1') function the up or down counting is controlled through the channel 'B' control signal.

- the '**B.2 events**' ('Fn.b.2') function enables an internal events counter (0 to 999999) visible on display activating the channel 'B' control signal. Events that add '+1' to the internal event counter are :

- at '**on alarm 1**' ('o.AL1') select '**on**' to add '+1' each time alarm 1 activates.

- at '**on alarm 2**' ('o.AL2') select '**on**' to add '+1' each time alarm 2 activates.

- at '**on alarm 3**' ('o.AL3') select '**on**' to add '+1' each time alarm 3 activates.

- at '**on reset**' ('o.rSt') select '**on**' to add '+1' each time the reset function activates.

Application - a production process repeats every 15 minutes. Each time the chronometer reaches '15.00' minutes, it activates alarm 1 to inform the operator that the material can be packed. Once the material is packed, the operator manually unlocks the alarms and they cycle restarts. At the end of the day, the operator can activate the 'B' function and see the total number of cycles done during the day.

- the '**B.3 total**' ('Fn.b.3') function enables an internal time counter visible on display activating the channel 'B' control signal. To reset the internal counter visualize the value and activate the reset (front or external). The internal time counter can be configured to count the total time the instrument has been powered, or counting, or stopped.

- at the '**Format**' ('ForM') parameter configure the visualization format for the internal time counter. Select '**ch.A**' to visualize with the same format as the main instrument.

- at the '**Count**' ('cnt') parameter select '**ALWS**' to count the time the instrument has been powered, select '**Strt**' to count the time the instrument has been counting or select '**StoP**' to count the time the instrument has been stopped.

Application - a manufacturing process repeats every 120 minutes. Any change in the production process, model or series implies a stop in the manufacturing process. The operator can activate the 'B' function to visualize the total accumulated time the system has been stopped.

- the '**B.4 exceeded**' ('Fn.b.4') function enables an internal exceeded time counter visible on display activating the channel 'B' control signal. To reset the internal counter visualize the value and activate the reset (front or external). The reset leaves the exceeded counter at '0' and stopped. The exceeded time counter can be configured to count the total elapsed from a configured event.

- at the '**Start**' ('Strt') parameter select '**o.AL1**' to start the exceeded counter when alarm 1 activates. Select '**o.AL2**' or '**o.AL3**' to start counting with the activation of alarm 2 or alarm 3.

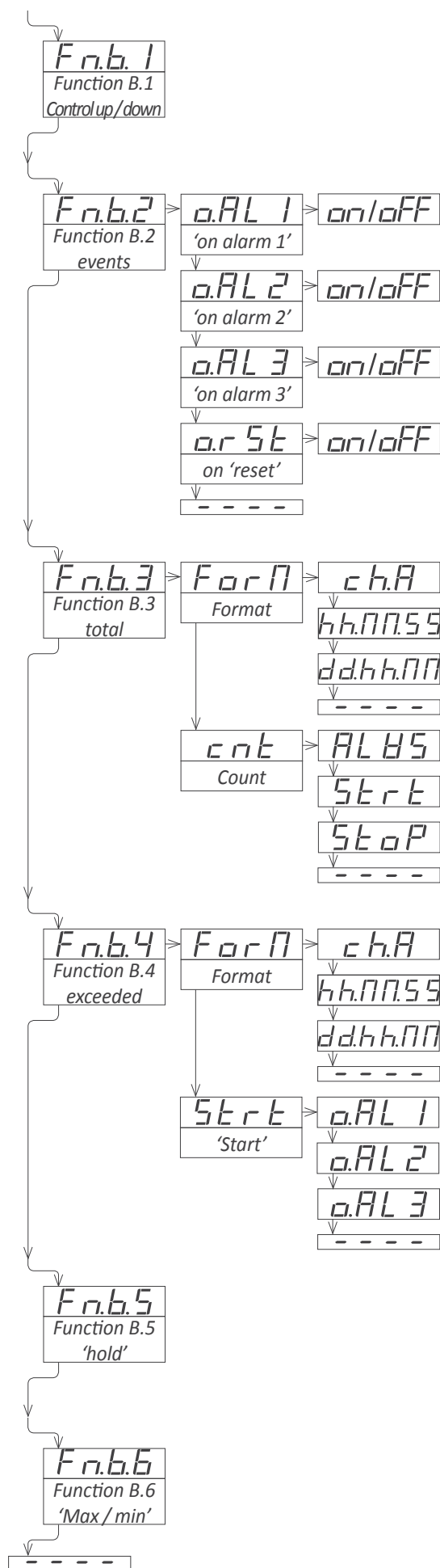
- at the '**Format**' ('ForM') parameter configure the visualization format for the exceeded time counter. Select '**ch.A**' to visualize with the same format as the main instrument

Application - a long duration manufacturing process repeats every 72 hours continuously without stop. At the end of each cycle the operator must refill the consumed material in less than 60 minutes. When a cycle is finished the instrument activates and locks alarm 1, starting the exceeded counter 'B'. The alarm activates a signal to the operator and at the same time activates the visualization of the exceeded time counter. The operator now can see the elapsed since the alarm activated.

- the '**B.5 hold**' ('Fn.b.5') function allows to hold the reading. The chronometer continues counting on the background.
- the '**B.6 max / min**' ('Fn.b.6') function allows to access the memory of maximum and minimum time. Each time a reset is applied, the instrument compares the reading value with the maximum and minimum value and updates the memory values if needed. Values can be displayed with front (or remote) key UP (▲) (see section 1.14.14). Activate channel 'B' to reset the maximum and minimum values.

Application - a production process executes a reset signal each time a cycle ends. At the end of the day the operator can access the maximum and minimum memory values, related to the longer and shorter production cycles of the day.

1.14.9 'B' function configuration menu



Only the configuration menu for the 'B' function selected is visible. See section 1.14.8 for more information on each function.

- special function 'B1' has no associated configuration.
- at the special function 'B2' select '**on**' at the events that add '+1' to the event counter.
- at the special function 'B3' configure at the '**Format**' ('**ForM**') parameter the visualization format for the internal totalizer. At the '**Count**' ('**cnt**') parameter select '**ALWS**' to count continuously, '**Strt**' to totalize only counting times and '**StoP**' to totalize the time the chronometer has been stopped.
- at the special function 'B4' configure at the '**Format**' ('**ForM**') parameter the visualization format for the internal totalizer. At the '**Start**' ('**Strt**') parameter select the event that triggers the start of the internal totalizer.

• the special function 'B5' has no associated configuration.

• the special function 'B6' has no associated configuration.

1.14.10 External controls configuration

The instrument allows to configure the 'start', 'stop' and 'reset' external controls to accept different types of signals and different activation signals

The default configuration is activation by free potential contacts, with activation by falling edge (direct connection to terminal 0 Vdc). The following parameters allow to configure the external controls to work with other type of signals:

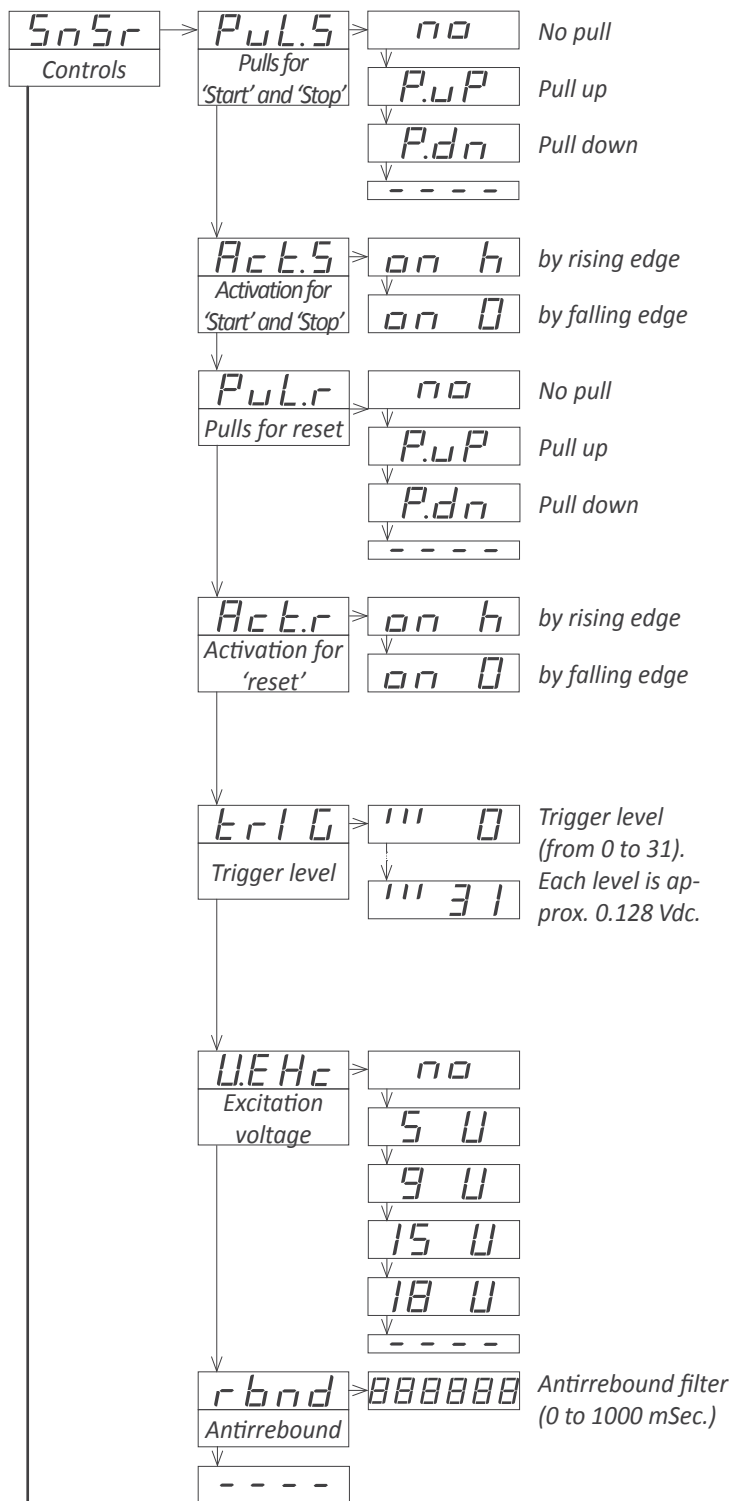
- **'Pulls for 'Start' and 'Stop' ('PuL.S')** - select **'P.uP'** to activate pull-up resistors (needed for NPN sensors). Select **'P.dn'** to activate pull-down resistors (needed for PNP sensors). Select **'no'** to deactivate pulls. Selecting a pull resistors configures the trigger level to 2,5 Vdc.
- **'Activation for 'Start' and 'Stop' ('Act.S')** - select **('on_h')** to activate the 'Start' and 'Stop' controls by rising edge. Select **('on_0')** to activate by falling edge. (With 'B' connections active, the affected signals are the 'start/stop' and the 'B' function signals)
- **'Pulls for reset' ('PuL.r')** - select **'P.uP'** to activate pull-up resistors (needed for NPN sensors). Select **'P.dn'** to activate pull-down resistors (needed for PNP sensors). Select **'no'** to deactivate pulls. The trigger level for the reset is fixed to 2,5 Vdc.
- **'Activation for 'Reset' ('Act.r')** - select **('on_h')** to activate the 'Reset' control by rising edge. Select **('on_0')** to activate by falling edge. Additionally, reset signal can be configured to activate by levels instead of edges (*see section 1.14.5*). In case of activation by levels, value **'on_h'** activates the reset on high signal value, and value **'on_0'** activates reset on low signal. Front reset activates always by state (pressed activates the reset).

- **'Trigger level' ('trIG')** - select the signal voltage level at which the instrument will consider that the signal has reached the activation level. Selectable from 0 to 31 levels, where each level is approximately 0.128 Vdc. Trigger level is the same for channels 'start' and 'stop'. Reset channel has a fixed trigger to 2,5 Vdc. The three leds to the left of the value reflect the state ('0' or '1') of control channels 'Start', 'Stop' and 'Reset'.

- **'Excitation voltage' ('V.Exc')** - power provided by the instrument to power-up the sensors (if needed) used to control the signals 'start', 'stop' and / or 'reset', or to be used as an active signal ('1') for special connections. Select the for the excitation voltage at 5 Vdc, 9 Vdc, 15 Vdc or 18 Vdc. Select **'no'** to disable the excitation voltage.

- **'Excitation voltage' ('V.Exc')** - power provided by the instrument to power-up the sensors (if needed) used to control the signals 'start', 'stop' and / or 'reset', or to be used as an active signal ('1') for special connections. Select the for the excitation voltage at 5 Vdc, 9 Vdc, 15 Vdc or 18 Vdc. Select **'no'** to disable the excitation voltage.

1.14.11 External control configuration menu



The **'Controls' ('SnSr')** menu contains all the configuration parameters related to the detection of the control signals 'start', 'stop' and 'reset'. For more information see section 1.14.10.

- at the **'Pulls for 'Start' and 'Stop' ('PuL.S')** parameter select pull-up, pull-down or without pull resistors, for the 'start' and 'stop' control signals.
- at the **'Activation for 'Start' and 'Stop' ('PuL.S')** parameter select activation by rising edge or falling edge for the 'start' and 'stop' control signals.
- at the **'Pulls for reset' ('PuL.r')** parameter select pull-up, pull-down or without pull resistors, for the 'reset' external control signal
- at the **'Activation for reset' ('Act.r')** parameter select activation by rising edge or falling edge, for the 'reset' external control signal.
- at the **'Trigger level' ('trIG')** parameter empirically select the trigger level from 0 to 31. The 3 leds to the left inform about the actual state '0' or '1' for the external controls 'start', 'stop' and 'reset'.
- at the **'Excitation voltage' ('V.Exc')** parameter select the voltage value for the excitation voltage, in case it is needed to power the sensors for the 'start', 'stop' and 'reset' external signals.
- at the **'Antirrebound' ('rbnd')** parameter configure the time in milliseconds for the antirrebound filter.

1.14.12 Alarms

The instrument manages 3 independent internal alarms, each one controlling the activation of an optional relay, transistor or control SSR output.

Optional modules (see section 2) are installed at the free slots inside the instrument (see section 1.4). LDB-24 and LDB-44 formats have 2 free slots for output and control modules, while LDB-26 and LDB-46 formats have 3 free slots for output and control modules.

The instrument has 3 front leds that reflect the state of the 3 internal alarms. These leds are only for local help during installation, as they are not appropriate for long distance reading.

Each alarm controls the activation of the relay, transistor or control SSR installed on its associated slot, and the front led.

• Alarms in 'repeat' mode

With 'repeat' ('rEPt') mode the alarm activates each time that the chronometer reaches a multiple of the setpoint. Alarm remains active during the time indicated at parameter 'deactivation delay' ('dEL.1'). Other parameters on the 'Alarm' menu have no effect in this mode. This mode is not functional in viewing modes with tenths of second or cents of second.

Application: chronometer in 'mm.ss' mode with a 'repeat' alarm and setpoint 1 at '15.00'. Alarm activates at '15.00', '30.00', '45.00', etc.

• Alarms in 'normal' mode

In 'normal' mode ('norM') the alarm activates when the reading reached the setpoint value. Each alarm has several parameters for configuration, starting with the usual etpoint, hysteresis and maximum (alarm active when reading is higher than setpoint) or minimum (alarm active when reading is lower than minimum) alarm types (see Figure 7).

Each alarm can configure independent activation and deactivation delays. These delays affect the alarm as a whole, and the delay will affect the front led and the associated relay.

Activate the 'inverted relay' function to invert the activation logic of the associated relay.

Activate the 'locked alarms' function will force the operator to interact with the instrument when an alarm has been activated. Once activated, the alarm will remain locked at active state, even is the reading returns to a value below setpoint, until the operator manually unlocks the alarms pressing the front key 'LE' (or the remote key 'LE', see section 3.1).

• 'On alarm' functions

The 'on alarm' functions allow to associate a function to the alarm activation event. Functions available are reset to '0', load the preset value, stop counting, or do nothing. Functions reset and preset create counting cycles (from 0, then to setpoint, then to 0 again, ...). The number of cycles performed can be accessed through the fast access menu (see section 1.14.14).

• Alarm flash

The 'Alarm flash' ('AL.FL') set to 'on' activate the flash on display when the alarm activates To stop the flashing mode press any of the front (or remote) keys pr change the state of any of the external controls 'start', 'stop' or 'reset'.

• Configurable parameters

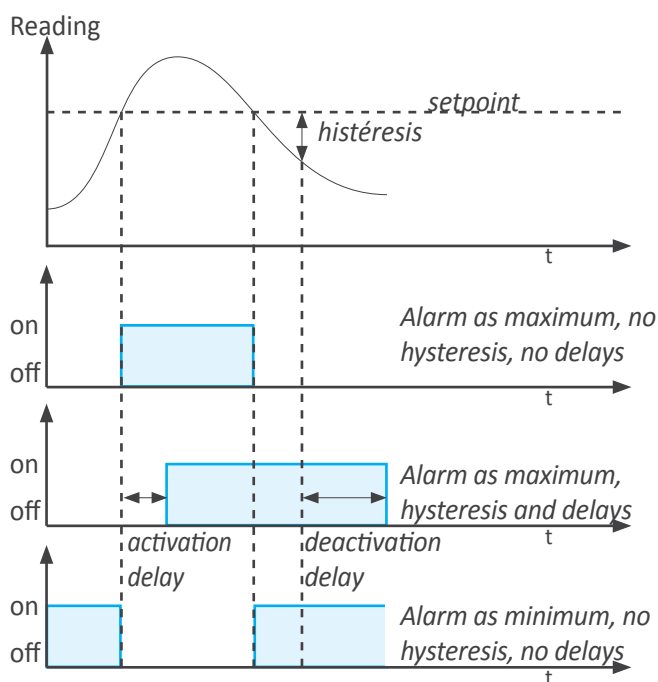
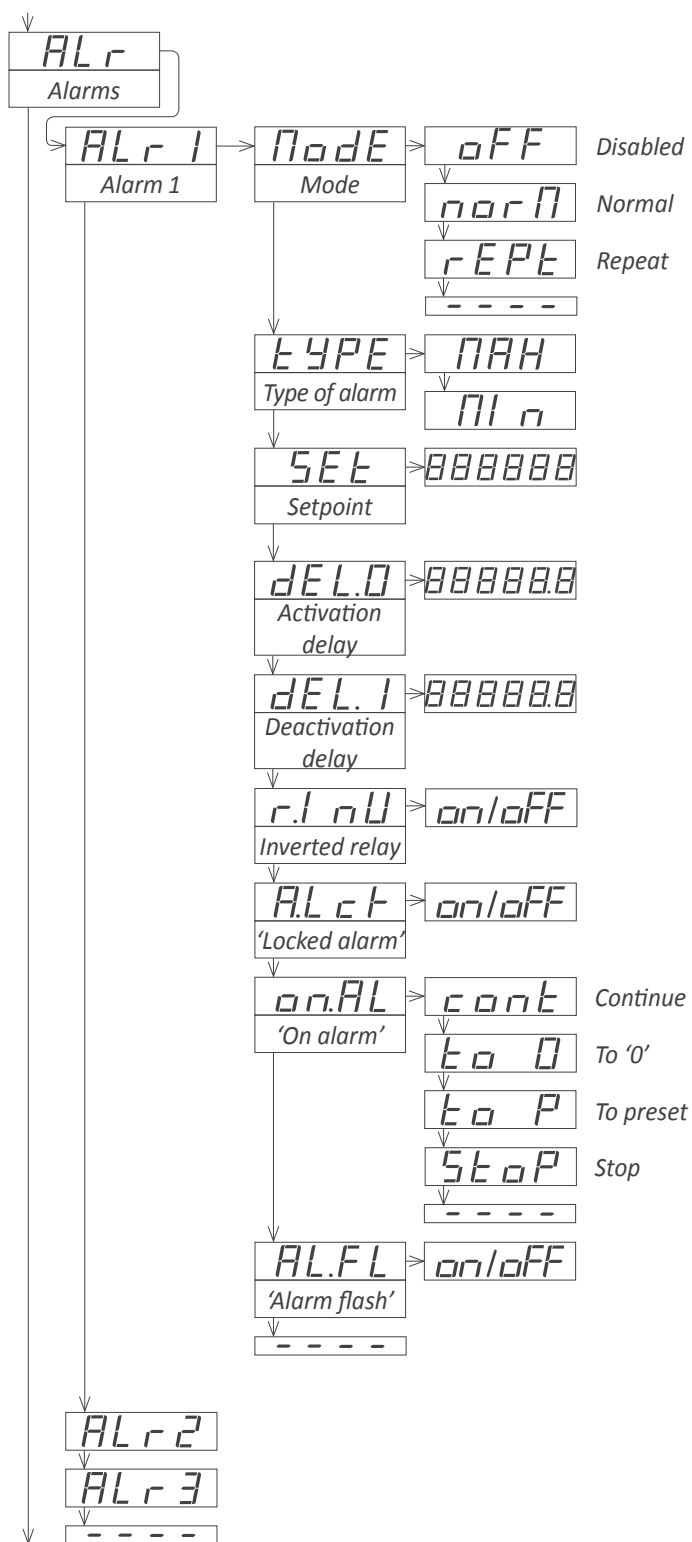


Figure 7 - Example for alarm with 2 setpoint

1.14.13 Alarms configuration menu



To configure the alarm, access the alarm menu ('ALr1', 'ALr2' or 'ALr3') and configure the following parameters :

- at the '**Mode**' ('**Mode**') select '**off**' to disable the alarm, select '**normal**' ('**norM**') to enable the normal mode, or select '**repeat**' ('**rEPt**') to enable the repeat mode. The 'repeat' mode only needs the '**deactivation delay**' ('**dEL.1**') parameter and other parameters have no effect on this mode. The 'repeat' mode is not functional if cents or tenths of seconds are visualized.
- at the '**Type of alarm**' ('**Type**') parameter select '**MAX**' for maximum alarm (activates when reading is higher than setpoint), or '**Min**' for minimum alarm (activates when reading is lower than setpoint).
- at the '**Setpoint**' ('**SEt**') parameter configure the alarm activation point. Parameter value is accessible through 'fast access' (see section 1.14.14).
- at the '**Hysteresis**' ('**hySt**') parameter select the hysteresis value. Hysteresis applies to the alarm deactivation. Alarm deactivates once the reading is beyond the setpoint plus the hysteresis value. Hysteresis prevents relay switching in case of signal fluctuations close to the setpoint value.
- at the '**Activation delay**' ('**dEL.0**') parameter configure the delay to apply before the alarm is activated. Delay starts to count once the setpoint is reached. Value from 0.0 to 99.9 seconds.
- at the '**Deactivation delay**' ('**dEL.1**') parameter configure the delay to apply before the alarm is deactivated. Delay starts to count once the setpoint is reached plus the hysteresis value. Value from 0.0 to 99.9 seconds.
- at the '**Inverted relay**' ('**r.Inv**') parameter select '**on**' to invert the activation logic of the relay. Relay is inactive when alarm is active, and relay is active when alarm is inactive.
- at the '**Locked alarm**' ('**A.Lck**') parameter select '**on**' to block the automatic alarm deactivation. Alarm deactivation must be performed manually, by pressing the 'LE' front button (see section 1.14.15).
- at the '**On alarm**' ('**on.AL**') parameter configure the action to activate when the alarm activates. Select '**cont**' to do nothing and continue counting, select '**to_0**' to load a '0' on display, or select '**to_p**' to load the preset value on display. Selecting '**to_0**' or '**to_p**' configures '**dEL.1**' to 1 second. Select '**stop**' to stop counting.
- at the '**Alarm flash**' ('**AL.FL**') select '**on**' to activate the flash in display when the alarm is active.

1.14.14 Fast access

The 'fast access' is an operator configurable menu. The operator can access this menu with a single press of the front key 'UP' (▲). The configured menu entries will be accessible. Eligible parameters to be accessed by this menu are:

- access to the alarm setpoints through the 'UP' (▲) key allows to read and modify the values.
- access to the maximum, minimum and events alarms through the 'UP' (▲) key allows to read and reset the values. To reset the memory values: visualize the value on display, press the 'UP' (▲) key, when the 'rSt' message appears, press 'SQ' (■). The instrument will return to the memory visualization. Press the 'LE' (◀) key to exit his menu.
- access to the preset value to read and modify the value.

The 'fast access' menu is not affected by the password function. This means that the configuration menu can be password blocked, while some configured functions or parameters can still be accessible to the operator through the 'fast access' menu.

- **Super fast access**

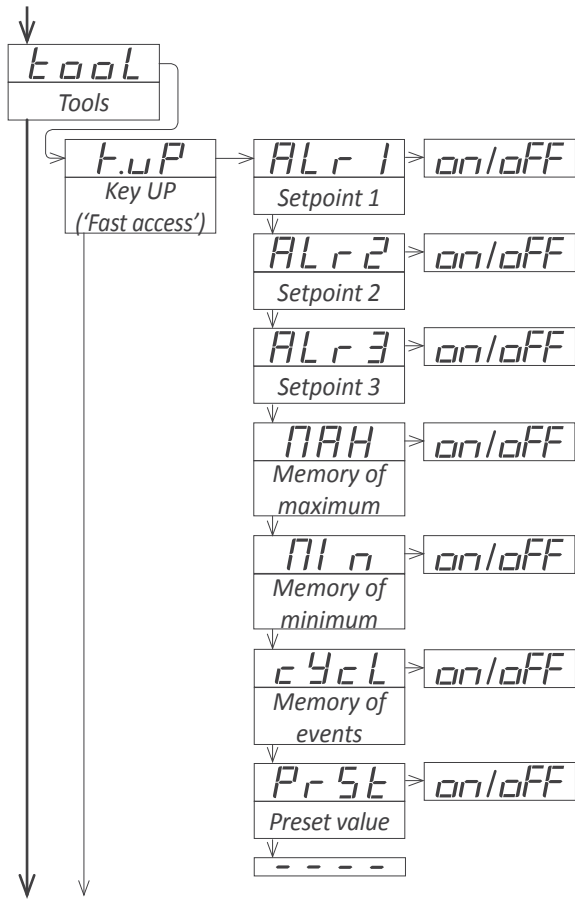
If only a single function is selected for the 'fast access' menu, pressing the the 'UP' (▲) key will shortly display the function name and then automatically jump to the function value.

1.14.15 Key 'LE'

The 'LE' (◀) key at the front of the instrument can be configured to activate several functions. Only one function can be assigned to the 'LE' (◀) key. Eligible functions are reset of the counter and the alarm unlock function (see section 1.14.12).

Example: the chronometer activates alarm 1 when reaching value '15.00' hours. Automatically the instrument resets to '0' and activates the relay to inform the time has been reached. To prevent the automatic alarm deactivation when loading the '0', the 'locked alarms' function is activated. Once at '0', the chronometer is configured to continue counting. When the operator arrives, it applies the routine functions on the system, and it frees the locked alarms by pressing the front (or external) key 'LE', resets the instrument to '0' again, and starts a new cycle.

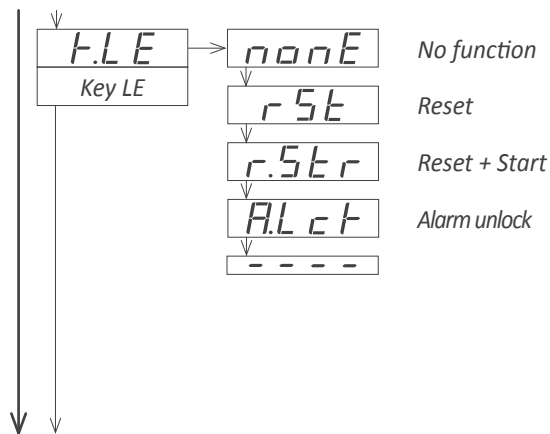
1.14.16 'Fast access' configuration menu



At the **'Key UP ('fast access')' ('K.uP')** menu configure which functions and parameters will be accessible through the 'fast access' menu. Select **'on'** to activate each function. For more information see section 1.14.14.

- the **'Setpoint 1' ('ALr1')** function allows to visualize and modify the alarm 1 setpoint through the 'fast access' menu.
- the **'Setpoint 2' ('ALr2')** function allows to visualize and modify the alarm 2 setpoint through the 'fast access' menu.
- the **'Setpoint 3' ('ALr3')** function allows to visualize and modify the alarm 3 setpoint through the 'fast access' menu.
- the **'Memory of maximum' ('MAX')** or **'Memory of minimum' ('Min')** functions allow to visualize the maximum or minimum reading value stored in memory.
- the **'Memory of events' ('cYcL')** function allows to visualize the number of cycles value stored in memory. The cycles value increases '+1' with each reset or preset associated to the alarm activation or resets associated to 'overrange' / 'underrange'.
- the **'Preset value' ('PrSt')** function allows to visualize and modify the preset value through the 'fast access' menu.

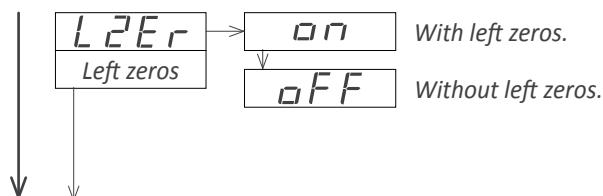
1.14.17 'Key LE' configuration menu



The **'LE' (◀)** key at the front of the instrument can be configured to activate several functions. For more information see section 1.14.15.

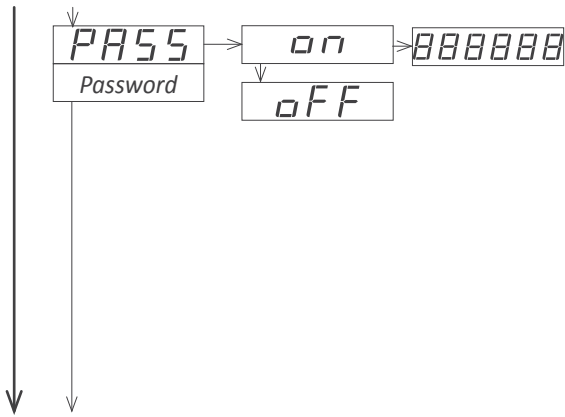
- the **'No function' ('none')** value assigns no function.
- the **'Reset' ('rSt')** value assigns the reset function.
- the **'Reset + start' ('r.Str')** value assigns the reset and start function with the same key.
- the **'Alarm unlock' ('A.Lck')** value assigns the manual alarm unlocking, when the **'Locked alarms' ('A.Lck')** function is active (see section 1.14.12).

1.14.18 Left zeros configuration menu



The **'Left zeros' ('L.ZEr')** parameter controls the left zeros on or off.

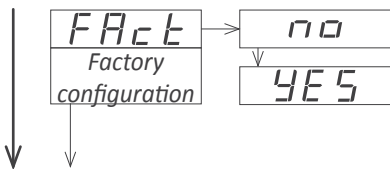
1.14.19 'Password' function



The password function blocks access to the configuration menu. The 'fast access' menu is not affected by the password function. This means that the configuration menu can be password blocked, while some configured functions or parameters (setpoint values, preset value, ...) can still be accessible to the operator through the 'fast access' menu.

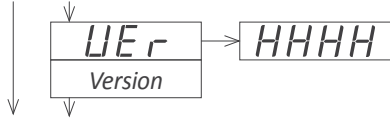
To active the 'Password' function select 'on' and introduce the 6 digits code. The code will be requested when trying to access the 'configuration menu' (front key 'SQ' (■)).

1.14.20 Default factory configuration



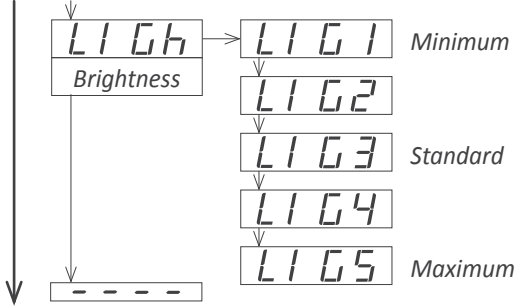
At the 'Factory configuration' ('FAct') menu select 'yes' to activate the default factory configuration. See section 1.18 for a list of default parameters.

1.14.21 Firmware version



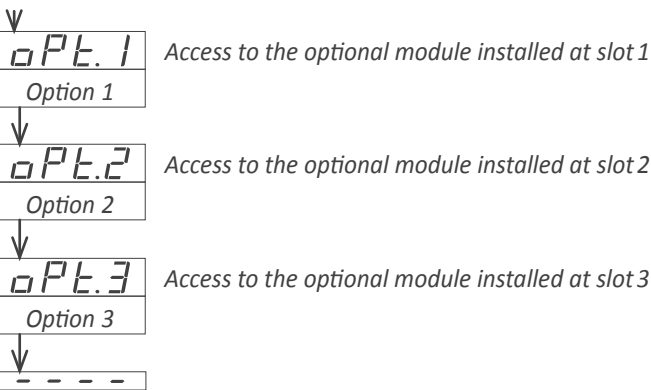
The 'Version' ('VEr') menu informs about the firmware version installed on the instrument.

1.14.22 Brightness configuration



At the 'Brightness' ('LIGh') menu select the intensity level for the display . Use this function to adapt the brightness to match other instruments in the vicinity or to the darkness or clarity of your environment.

1.14.23 Access to the options configuration menu



The output and control options are optional modules that can be installed at the instrument. Formats LDB-24 and LDB-44 have 2 free slots for output and control options, while formats LDB-26 and LDB-46 have 3 free slots (see section 1.4).

Several of these optional modules have their own configuration menu embedded.

The 'oPt.1', 'oPt.2' and 'oPt.3' menu entries give access to the configuration menu of the option installed.

See section 2 for a list of available output and control modules

1.15 Example for application 1

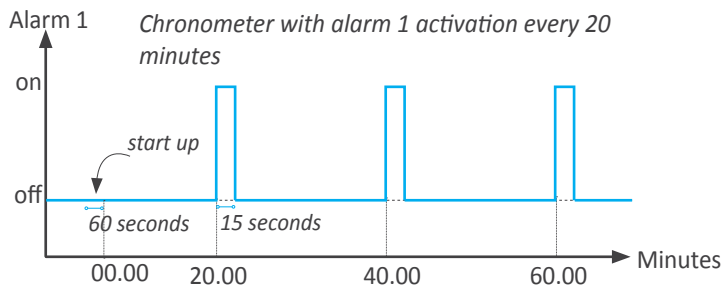
An industrial process with electrolytic bath needs to remove the pieces and submerge new ones every 20 minutes. The process of removing and adding new pieces needs 15 seconds. During these 15 seconds the bath system must be powered off. Power should reactivate after the 15 seconds, when the new elements are inside the bath-

The objective is to configure the instrument to activate a relay output every 20 minutes, and this output should be active for 15 seconds and then disabled.

Additionally, the instrument should start to count automatically at power up, although it is necessary to wait 1 minute before count starts to give time to the first power activation of the whole system. The counter must not be restarted at power up, but it must continue counting from the last value it had before the power off.

Configuration should be as shown below:

- Reading
'Func' / 'View' 'hh.mm.ss'
- Counting direction
'Func' / 'dIr' 'uP'
- Preset value
'Func' / 'PrSt' '0.00'
- Start up delay
'conF' / 'on_Pu' / 'dLAY' 60 seconds
- Initial reset disabled
'conF' / 'on_Pu' / 'rSt' 'oFF'
- Start counting
'conF' / 'on_Pu' / 'StAt' start ('Strt')
- Alarm mode
'ALr' / 'ALr1' / 'Mode' repeat ('rEPt')
- Alarm every 20 minutes
'ALr' / 'ALr1' / 'SEt' 20.00
- Deactivation delay
'ALr' / 'ALr1' / 'dEL.1' 15.0 seconds
- When alarm activates
'ALr' / 'ALr1' / 'on_AL' continue ('cont')

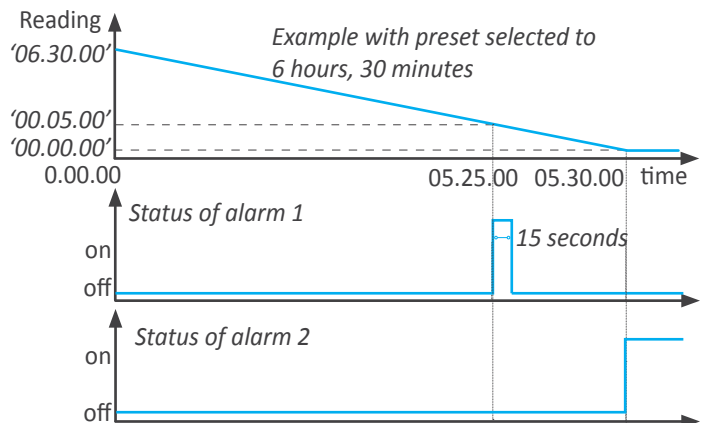


1.16 Example for application 2

An industrial process has an oven to dry different elements. The dry time for each element is variable and the operator an easy way to needs to enter the time each time. All other parameters must be not accessible to the operator. During the process, the operator needs two signals. The first one controls a buzzer which must be on for 15 seconds and start 5 minutes before the end of the dry time. The second signal must activate when the time is over and will be active until the operator resets manually the signal.

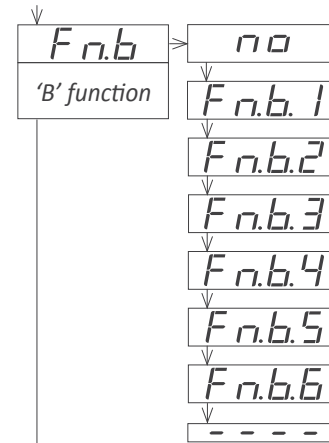
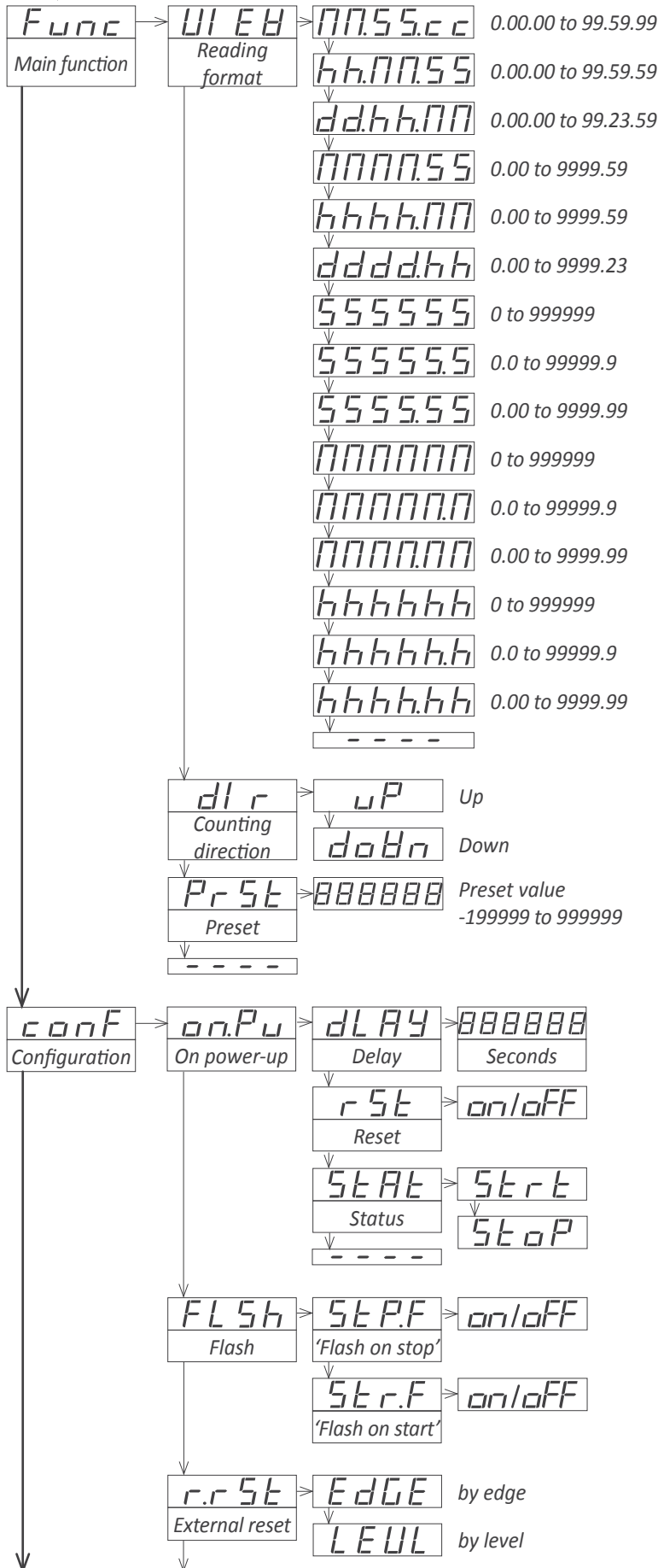
The objective is to configure a down counter, starting at preset value, and this preset value will be directly accessible to be modified through the key UP ('▲') front or remote. The configuration (except the preset value) will be locked with a password. Alarm 1 will activate during 15 seconds when there are 5 minutes to end the process. Alarm 2 will activate when the process finishes and will remain active until the operator forces a manual reset.

- Reading
'Func' / 'View' 'hh.mm.ss'
- Counting direction
'Func' / 'dIr' down ('doWn')
- Alarm 1 : alarm mode
'ALr' / 'ALr1' / 'Mode' normal ('norM')
- Alarm 1 : alarm type
'ALr' / 'ALr1' / 'tYPE' minimum ('MIIn')
- Alarm 1 : activation point
'ALr' / 'ALr1' / 'SEt' '00.05.00'
- Alarm 1 : deactivation delay
'ALr' / 'ALr1' / 'dEL.1' 15.0 seconds
- Alarm 1 : when alarm activates, continue
'ALr' / 'ALr1' / 'on_AL' continue ('cont')
- Alarm 2 : alarm mode
'ALr' / 'ALr1' / 'Mode' normal ('norM')
- Alarm 2 : alarm type
'ALr' / 'ALr1' / 'tYPE' minimum ('MIIn')
- Alarm 2 : activation point
'ALr' / 'ALr1' / 'SEt' '00.00.00'
- Alarm 1 : when alarm activates, stop
'ALr' / 'ALr1' / 'on_AL' stop ('stop')
- Assign the preset to the 'UP' key
'Tool' / 'K.uP' / 'PrSt' 'on'
- Lock the configuration with a password
'Tool' / 'PASS' / 'on' assign the code

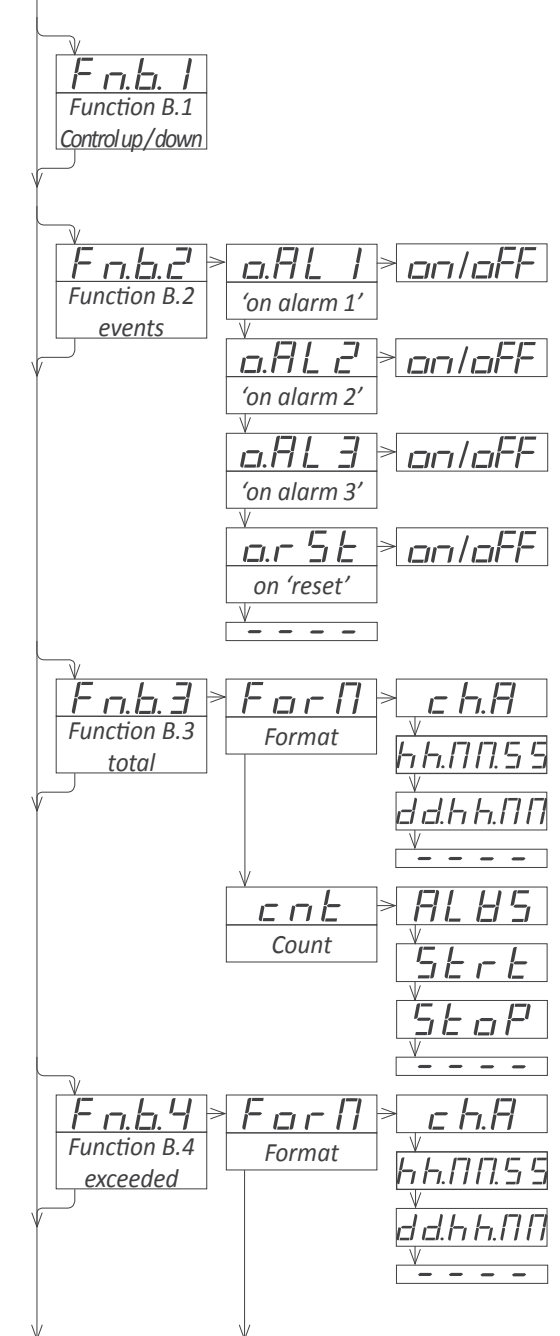


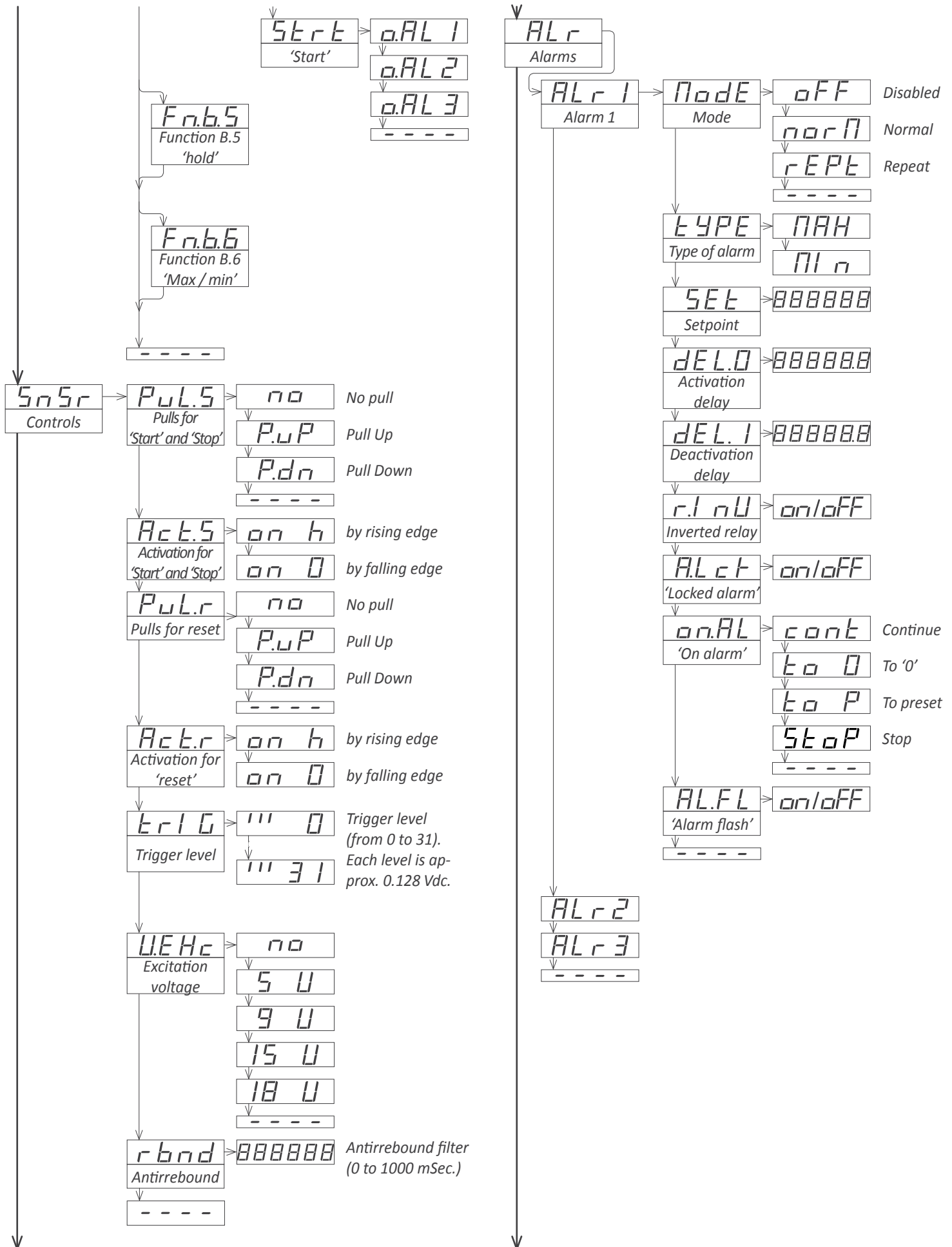
1.17 Full configuration menu

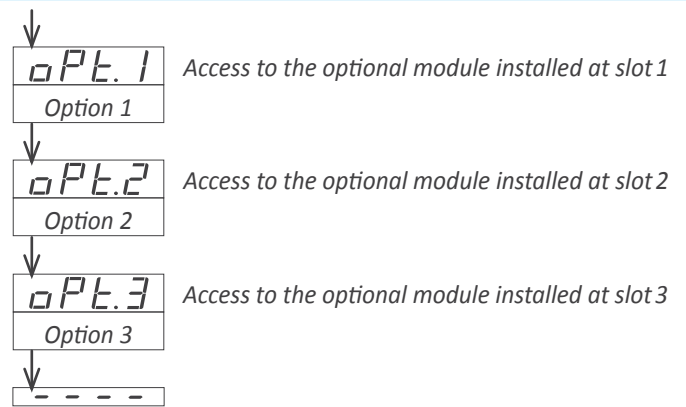
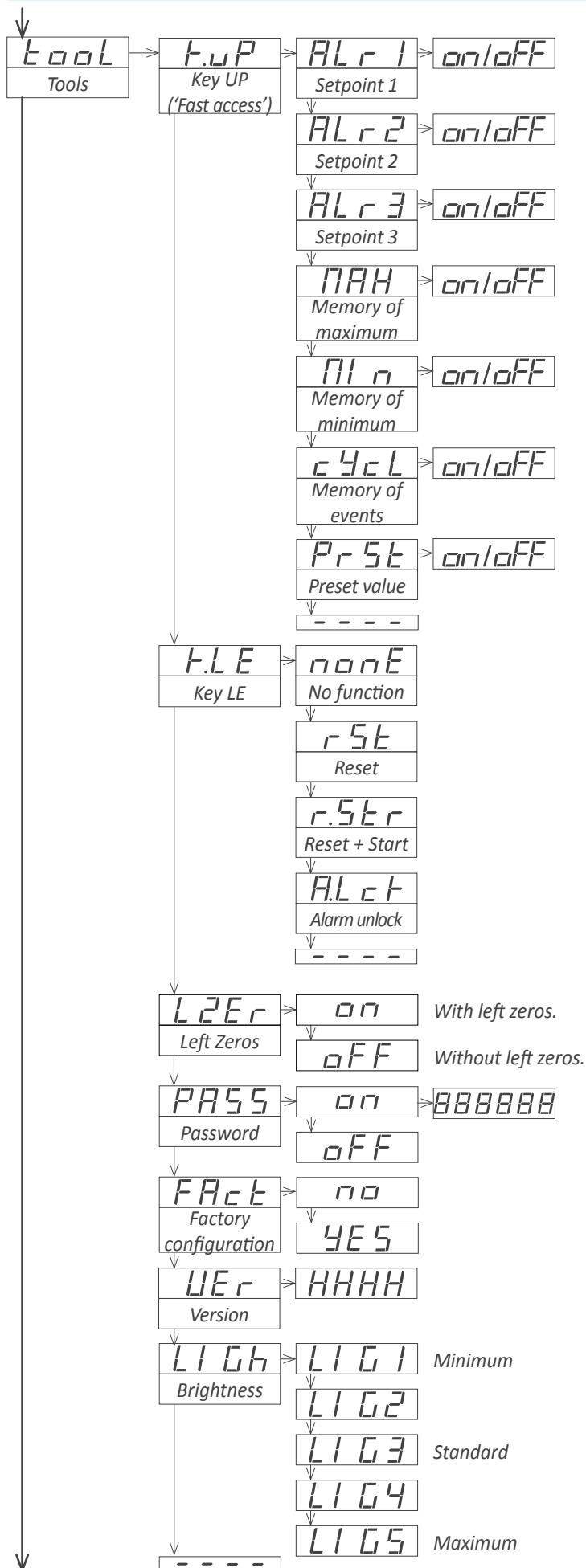
Press 'SQ' (■) for 1 second to access the 'Configuration menu'.



Next menu entry gives access to the configuration parameters for the "B' function' selected. Following are explanations for possible menus 'Fn.b.1' to 'Fn.b.6' (or message 'Fn.b.n' if no 'B function' has been selected).







1.18 Factory configuration

Function mode	
View format	hh.MM.SS
Counting direction	up
Preset	00.00.00
Configuration	
'On power-up'	
Delay	0 seconds
Reset	off
State	stopped ('StoP')
Flash	
'Flash on stop'	off
'Flash on start'	off
External reset	activates by edges ('EdGE')
Function on channel 'B'	no
Controls	
Pulls for 'start' and 'stop'	pull-up ('P.uP')
Activation for 'start' and 'stop' by falling edge ('on_0')	
Pulls for reset	pull-up ('P.uP')
Activation for reset	by falling edge ('on_0')
Trigger level	2.56 Vdc (level 20)
Excitation voltage	15 Vdc
Antirrebound filter	disabled (0 mSeconds)
Alarms 1,2 and 3	
Mode	off (disabled)
Type of alarm	of maximum
Setpoint	0
Activation delay	0.0 seconds
Deactivation delay	0.0 seconds
Inverted relay	off
'Locked alarms'	off
'On alarm'	continue
'Alarm flash'	off
Tools ('Tool')	
'Fast access' (key UP)	off
Setpoint 1	off
Setpoint 2	off
Setpoint 3	off
Memory of maximum	off
Memory of minimum	off
Cycles	off
Preset	off
Ley 'LE'	reset function
Left zeros	off
Password	off
Brightness	3

1.19 Mounting

The instrument fixations are designed to allow panel mount, wall mount, or hanging mount. For each type of mounting,

- Panel mount. Apply the cut-out to the panel as seen on section 1.4. Remove the side fixations. Introduce the instrument into the panel cut-out. Mount the side fixations as shown (see Figure 8). Slightly loosen the fixation screw of one side and press the instrument against the panel. Tighten the fixation screw so it presses the panel and maintains the fixation. Repeat with the opposite side fixation. For IP65 protection at the panel junction, see the IPB accessories at section 3.

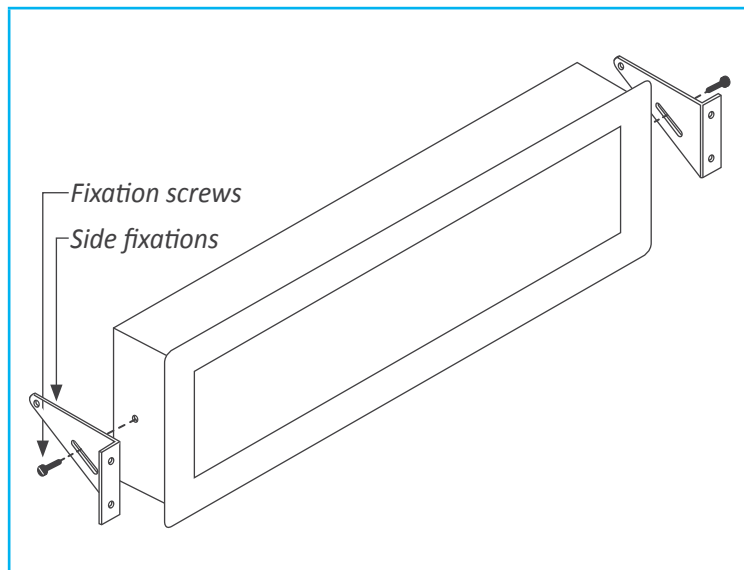


Figure 8 - Panel mount

see the position of the fixations at the images below.

- Wall mount. Mount the side fixations against the wall, as shown (see Figure 10). Each fixation has 2 holes with 4,5 mm diameter and a separation between hole centers of 30 mm. Once the side fixations are secured against the wall, place the instrument and press the fixation screws slightly. Tilt the instrument to the desired viewing angle and firmly screw the fixation screws.

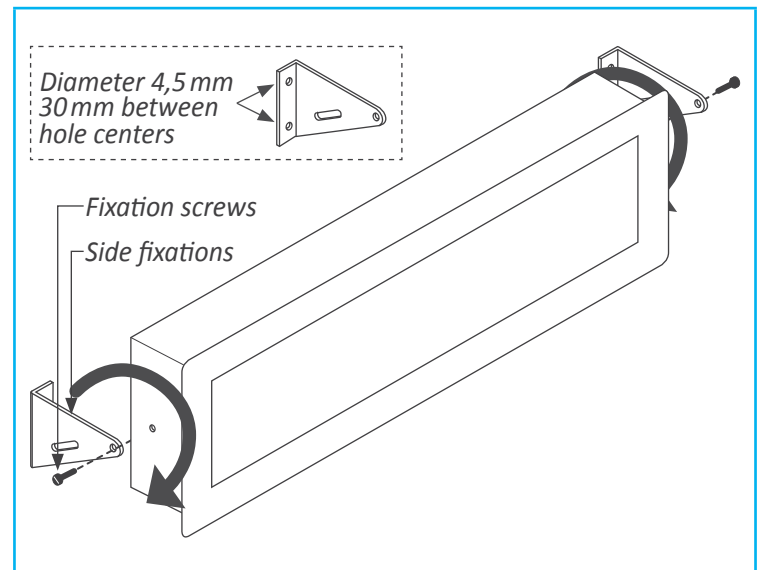


Figure 10 - Wall mount

- Hanging mount. Mount the side fixations as shown (see Figure 9). Each fixation has 2 holes with 4,5 mm diameter and a separation between hole centers of 30 mm. Instrument can be hanged using cable, threaded rod,

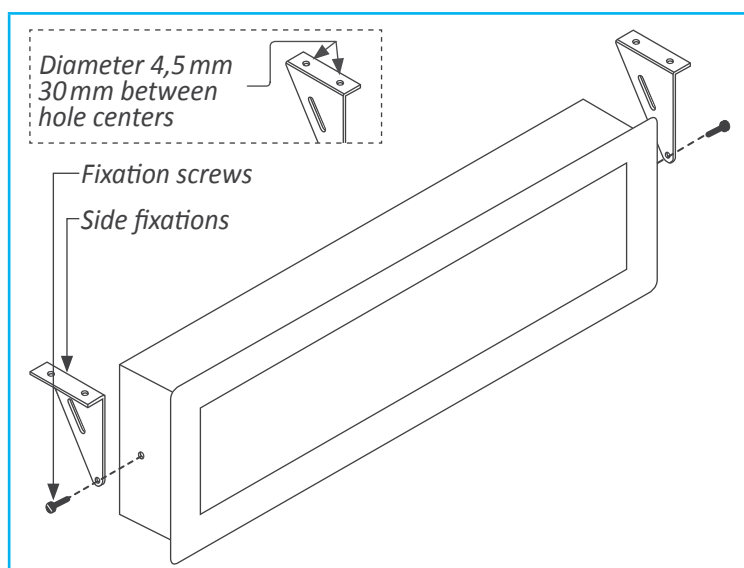


Figure 9 - Hanging mount

1.20 Installation precautions



Risk of electrical shock. Instrument terminals can be connected to dangerous voltage.



Instrument conforms to CE rules and regulations.

This instrument has been designed and verified conforming to the 61010-1 CE security regulation, for industrial applications. Installation of this instrument must be performed by qualified personnel only. This manual contains the appropriate information for the installation. Using the instrument in ways not specified by the manufacturer may lead to a reduction of the specified protection level. Disconnect the instrument from power before starting any maintenance and / or installation action.

The instrument does not have a general switch and will start operation as soon as power is connected. The instrument does not have protection fuse, the fuse must be added during installation.

An appropriate ventilation of the instrument must be assured. Do not expose the instrument to excess of humidity. Maintain clean by using a humid rag and do NOT use abrasive products such as alcohols, solvents, etc.

General recommendations for electrical installations apply, and for proper functionality we recommend : if possible, install the instrument far from electrical noise or magnetic field generators such as power relays, electrical motors, speed variators, ... If possible, do not install along the same conduits power cables (power, motor controllers, electrovalves, ...) together with signal and/or control cables.

Before proceeding to the power connection, verify that the voltage level available matches the power levels indicated in the label on the instrument.

In case of fire, disconnect the instrument from the power line, fire alarm according to local rules, disconnect the air conditioning, attack fire with carbonic snow, never with water.

1.21 Warranty

Please see the last page for Omega’s warrently disclaimer

1.22 CE declaration of conformity

Supplier Omega Engineering
Products LDB-CR

The manufacturer declares that the instruments indicated comply with the directives and rules indicated below.

Electromagnetic compatibility directive 2014/30/EU
Low voltage directive 2014/65/EU
Directive ROHS 2011/65/EU
Directive WEEE 2012/19/EU

Security rules EN-61010-1

Instrument Fixed, Permanently connected
Pollution degree 1 and 2 (without condensation)
Isolation Basic + Protective union
Category CAT-II

Electromagnetic compatibility rules EN-61326-1

EM environment Industrial

Immunity levels

EN-61000-4-2	By contact ±4 KV	Criteria B
	By air ±8 KV	Criteria B
EN-61000-4-3		Criteria A
EN-61000-4-4	On AC power lines: ±2 KV	Criteria B
	On DC power lines: ±2 KV	Criteria B
	On signal lines : ±1 KV	Criteria B
EN-61000-4-5	Between AC power lines ±1 KV	Criteria B
	Between AC power lines and earth ±2 KV	Criteria B
	Between DC power lines ±1 KV	Criteria B
	Between DC power lines and earth ±2 KV	Criteria B
	Between signal lines and earth ±1 KV	Criteria B
EN-61000-4-6		Criteria A
EN-61000-4-8	30 A/m at 50/60 Hz	Criteria A
EN-61000-4-11	0 % 1 cycle	Criteria A
	40 % 10 cycles	Criteria A
	70 % 25 cycles	Criteria B
	0 % 250 cycles	Criteria B

Emission levels

CISPR 11 Instrument Class A, Group 1 Criteria A



According to directive 2012/19/EU, electronic equipment must be recycled in a selective and controlled way at the end of its useful life.

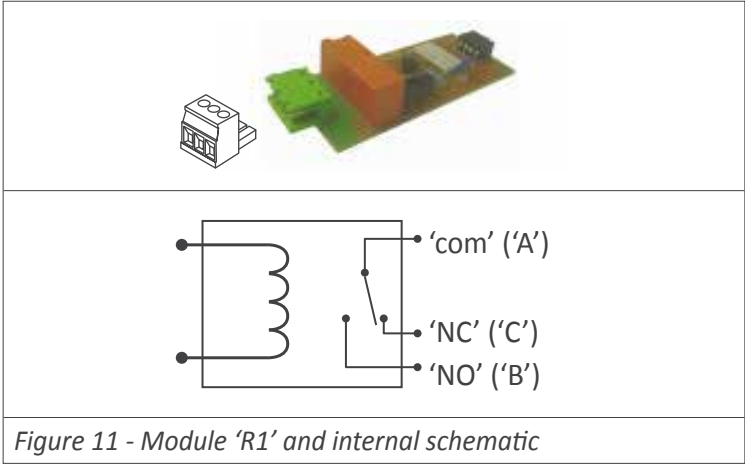
2. Output and control modules

2.1 Module R1

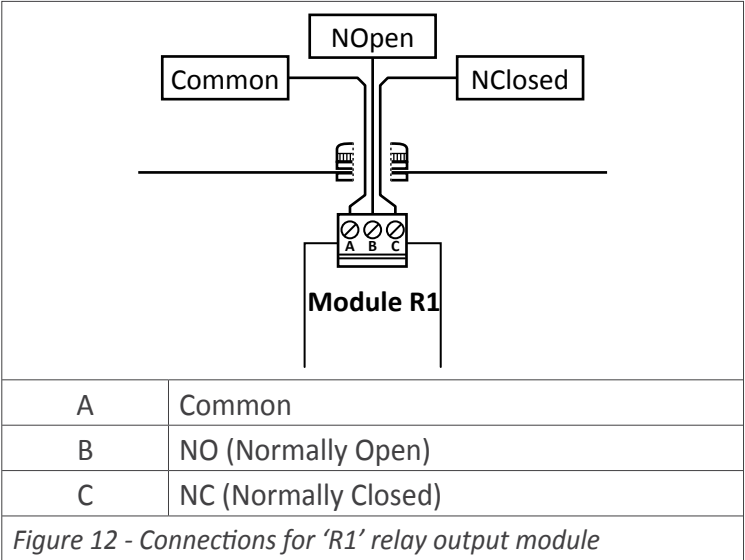
The R1 module provides 1 relay output to install in large format industrial meters from LDB series. Formats LDB-26 and LDB-46 accept up to 3 relays, and formats LDB-24 and LDB-44 accept up to 2 relays.

Configuration is performed from the front keypad of the instrument, by setting the alarm parameters. Check the alarm menu parameters at the instrument user's manual for full information.

Modules R1 can be provided factory installed into a LDB series, or standalone for delayed installation. No soldering or special configuration is required. See section 1.6 on how to install output and control modules.



Type of relay	3 contacts (Com, NO, NC)
Max. current	3 A (resistive load)
Voltage	250 Vac continuous
Isolation	3500 Veff
Terminal	plug-in screw clamp, pitch 5.08 mm
Installation allowed at	slot 1, slot 2, slot 3

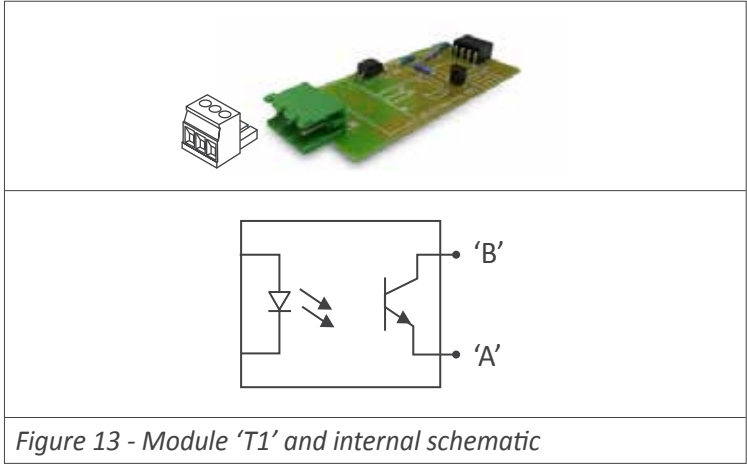


2.2 Module T1

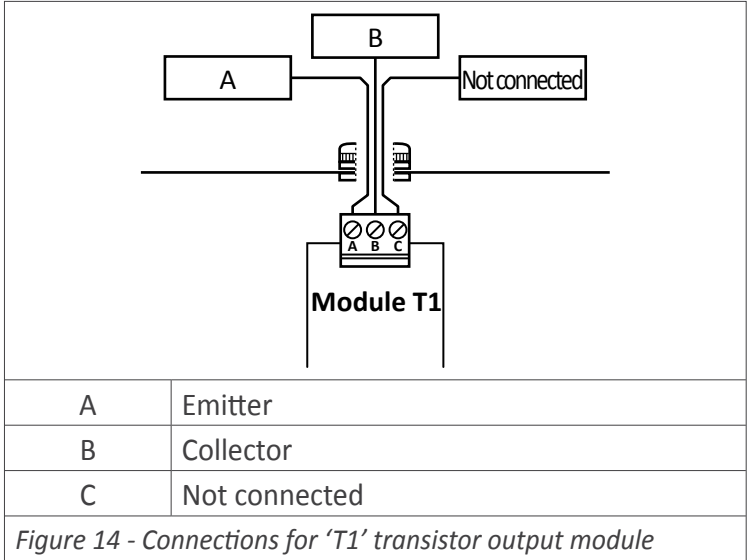
The T1 module provides 1 transistor output to install in large format industrial meters from LDB series. Formats LDB-26 and LDB-46 accept up to 3 transistor outputs, and formats LDB-24 and LDB-44 accept up to 2 transistor outputs.

Configuration is performed from the front keypad of the instrument, by setting the alarm parameters. Check the alarm menu parameters at the instrument user's manual for full information.

Modules T1 can be provided factory installed into a LDB series, or standalone for delayed installation. No soldering or special configuration is required. See section 1.6 on how to install output and control modules.



Type of output	transistor
Max. voltage	35 Vdc
Max. current	50 mA
Isolation	3500 Veff, optoisolated
Terminal	plug-in screw clamp, pitch 5.08 mm
Installation allowed at	slot 1, slot 2, slot 3



2.3 Module SSR

The SSR module provides 1 output for SSR relay control, to install in large format industrial meters from LDB series. Formats LDB-26 and LDB-46 accept up to 3 SSR control outputs, and formats LDB-24 and LDB-44 accept up to 2 SSR control outputs.

Configuration is performed from the front keypad of the instrument, by setting the alarm parameters. Check the alarm menu parameters at the instrument user's manual for full information.

Modules SSR can be provided factory installed into a LDB series, or standalone for delayed installation. No soldering or special configuration is required. See section 1.6 on how to install output and control modules.

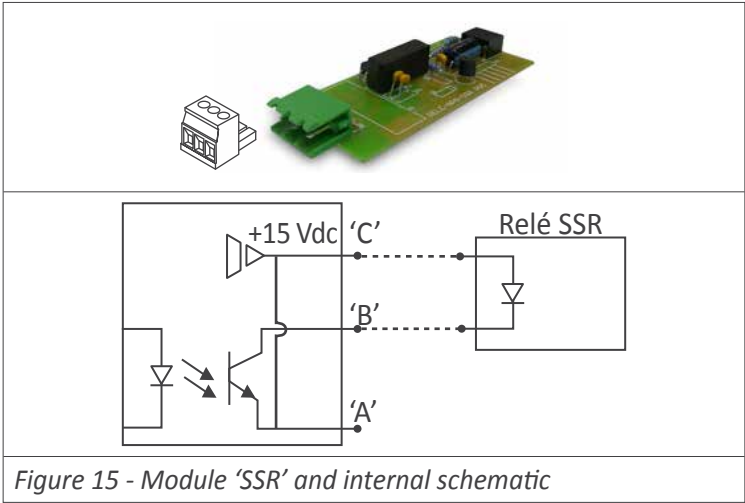


Figure 15 - Module 'SSR' and internal schematic

Type of output	for SSR relay control
Output voltage	+15 Vdc
Max. current	45 mA
Isolation	1000 Vdc
Terminal	plug-in screw clamp, pitch 5.08 mm
Installation allowed at	slot 1, slot 2, slot 3

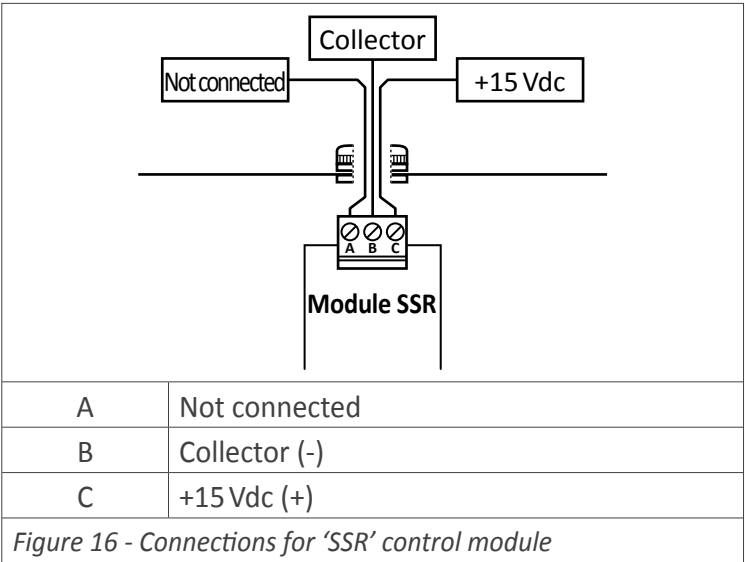


Figure 16 - Connections for 'SSR' control module

2.4 Module AO

The AO module provides 1 analog output, configurable for 4/20 mA or 0/10 Vdc signal, to install in large format industrial meters. Formats LDB-26 and LDB-46 accept up to 3 analog outputs, and formats LDB-24 and LDB-44 accept up to 2 analog outputs.

Output signal is fully scalable, both with positive and negative slopes, and is proportional to the reading. The mA output can be configured for active loops (the instrument provides the power to the mA loop) or passive loops (the loop power is external to the instrument).

Configuration is performed from the front keypad of the instrument, by accessing the menu entries 'Opt.1', 'Opt.2' or 'Opt.3', according to the slot where the module is installed.

AO modules can be provided factory installed into a LDB series, or standalone for delayed installation. No soldering or special configuration is required. See section 1.6 on how to install output and control modules.

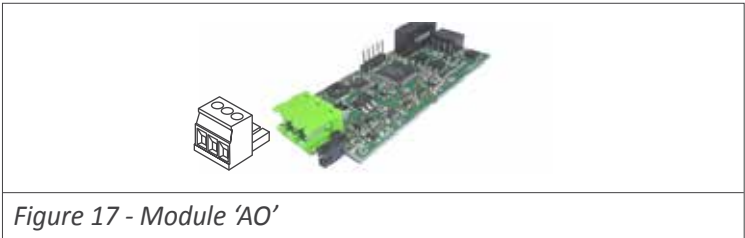


Figure 17 - Module 'AO'

Signal output	4/20mA, 0/10Vdc (active and passive)
Accuracy	0.1% FS
Isolation	1000 Vdc
Terminal	plug-in screw clamp, pitch 5.08 mm
Installation allowed at	slot 1, slot 2, slot 3

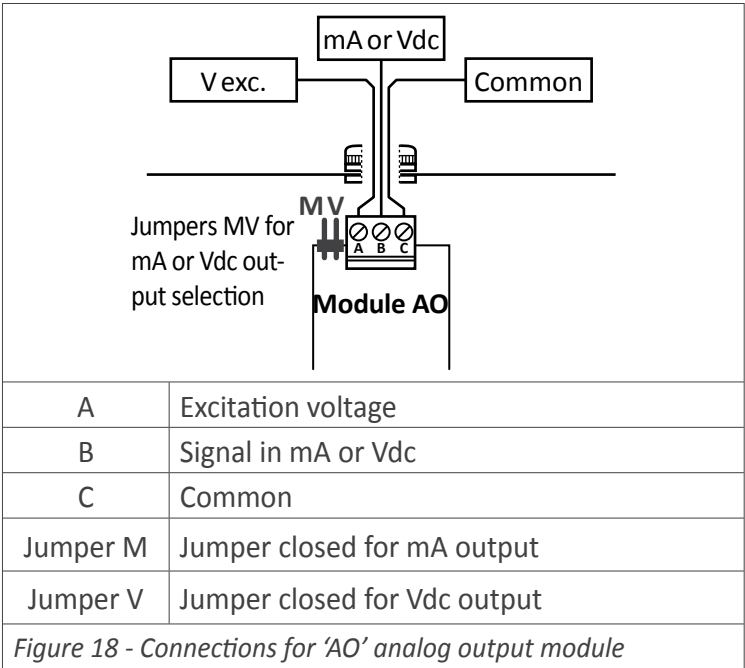


Figure 18 - Connections for 'AO' analog output module

2.5 Module RTU

The RTU module provides an isolated Modbus RTU communications port, to install in large format industrial meters from LDB series.

The RTU module implements function ‘4’ (‘Read Input Registers’) of the Modbus RTU protocol, to access the instrument registers (reading value, alarm status, memory of maximum and minimum, ...).

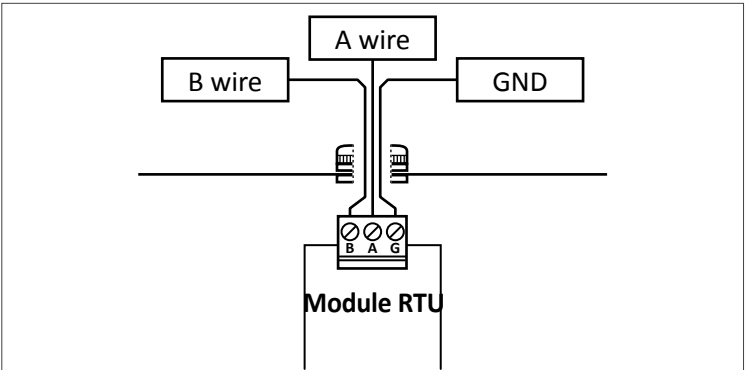
Configuration is performed from the front keypad of the instrument, by accessing the menu entries ‘Opt.1’, ‘Opt.2’ or ‘Opt.3’, according to the slot where the module is installed.

Modules RTU can be provided factory installed into a LDB series, or standalone for delayed installation. No soldering or special configuration is required. See section 1.6 on how to install output and control modules.



Figure 19 - Communications module ‘RTU’

Protocol	Modbus RTU
Bus	RS-485, up to 57.6 Kbps
Isolation	1000 Vdc
Terminal	plug-in screw clamp, pitch 5.08 mm
Installation allowed at	slot 1, slot 2, slot 3



A	Bus signal A
B	Bus signal B
G	GND

Figure 20 - Connections for Modbus ‘RTU’ communications module

2.6 Module S4

The S4 module provides an isolated RS485 ASCII communications port, to install in large format industrial meters from LDB series.

The S4 module implements a MASTER / SLAVE protocol, with up to 31 addressable slaves. In SLAVE mode allows access to reading values, alarm status, memory of maximum and minimum, ...

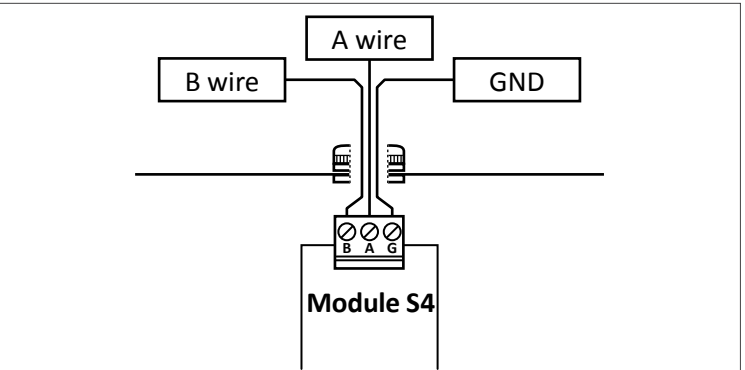
Configuration is performed from the front keypad of the instrument, by accessing the menu entries ‘Opt.1’, ‘Opt.2’ or ‘Opt.3’, according to the slot where the module is installed.

Modules S4 can be provided factory installed into a LDB series, or standalone for delayed installation. No soldering or special configuration is required. See section 1.6 on how to install output and control modules.



Figure 21 - Communications module ‘S4’

Protocol	ASCII
Bus	RS-485, up to 57.6 Kbps
Isolation	1000 Vdc
Terminal	plug-in screw clamp, pitch 5.08 mm
Installation allowed at	slot 1, slot 2, slot 3



A	Bus signal A
B	Bus signal B
G	GND

Figure 22 - Connections for RS-485 ‘S4’ communications module

2.7 Module S2

The S2 module provides an isolated RS232 ASCII communications port, to install in large format industrial meters from LDB series.

The S2 module implements a MASTER / SLAVE protocol, with up to 31 addressable slaves, with 'daisy-chain' connection. In SLAVE mode allows access to reading values, alarm status, memory of maximum and minimum, ...

Configuration is performed from the front keypad of the instrument, by accessing the menu entries 'Opt.1', 'Opt.2' or 'Opt.3', according to the slot where the module is installed.

Modules S2 can be provided factory installed into a LDB series, or standalone for delayed installation. No soldering or special configuration is required. See section 1.6 on how to install output and control modules.

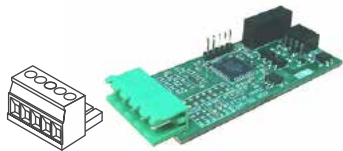
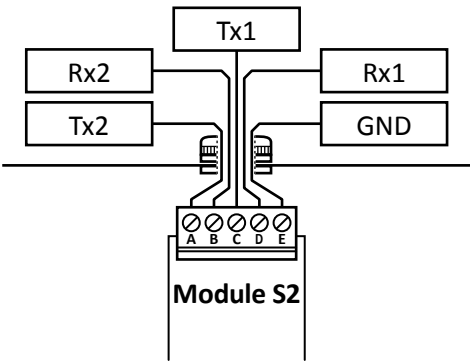


Figure 23 - Communications module Module 'S2'

Protocol	ASCII
Bus	RS-232, up to 57.6 Kbps
Isolation	1000 Vdc
Terminal	plug-in screw clamp, pitch 5.08 mm
Installation allowed at	slot 1, slot 2, slot 3



A	'Daisy chain' Tx data transmission
B	'Daisy chain' Rx data reception
C	Tx data transmission
D	Rx data reception
E	GND

Figure 24 - Connections for RS-232 'S2' communications module



Options and Accessories

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3.1 Registers accessible through Modbus RTU	8	4.7 CRC calculation	14
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1.1 Read this first

All modules mentioned in this document are compatible with large format meters from LDB series has 4 formats, and each format differ in the number of digits, the digit height and the number of output and control options they can accept. This document assumes the following :

Format	Digits	Digit height	Options
LDB-24	4	60 mm	2
LDB-44	4	100 mm	2
LDB-26	6	60 mm	3
LDB-46	6	100 mm	3

- inside the programming menus, when a 6 digits value is shown, it is assumed that only 4 digits apply to formats LDB-24 and LDB-44
- when this document explains that a maximum of 3 output and control modules are installable, it is assumed that the maximum is 2 modules for formats LDB-24 and LDB-44

The output and control modules mentioned in this document, are covered by the warranty of the instrument where they are installed. Check the user's manual of the instrument for more information related to warranty.

The user's manual of the instrument where the module is installed, has important information related to installation that applies also to the output and control modules mentioned in this document. Check the user's manual of the instrument for more information related to installation precautions.

The output and control modules mentioned in this document are covered by the 'CE declaration of conformity' of the instrument where they are installed. Check the user's manual of the instrument for more information related to the CE declaration of conformity.

1.2 Modular architecture

Large displays from the LDB series are designed following a modular architecture that allows the operator to install any of the output and control modules mentioned in this document. Each module is supplied with 1 cable tie, 1 square self adhesive tie base and 1 female connector.

1.3 Installation and start-up

To install an optional output and control module into a large display:

1. remove the rear cover of the instrument (*see section 1.4*)
2. install the module at one of the free slots (*see section 1.5*)
3. place the squared tie base at the free slot selected. Location to place the tie base is clearly indicated on the PCB (*see section 1.5*).
4. pass the cable tie through the tie base (*see section 1.5*)
5. place the output and control module at the slot connection jumpers (*see section 1.5*)
6. use the cable tie to firmly fix the module (*see section 1.5*)
7. if needed, configure the appropriate jumpers at the output and control module
8. pass the connection wires through the housing cable gland
9. connect the signal wires to the terminals of the output and control module
10. place and close the rear cover of the instrument (*see section 1.4*)
11. configure the parameters at the 'Configuration menu'.
 - modules R1, T1 and SSR are configured from the alarms menu of the instrument
 - other modules are configured from menu entries 'Opt.1', 'Opt.2' or 'Opt.3', depending on the slot where the module has been installed.

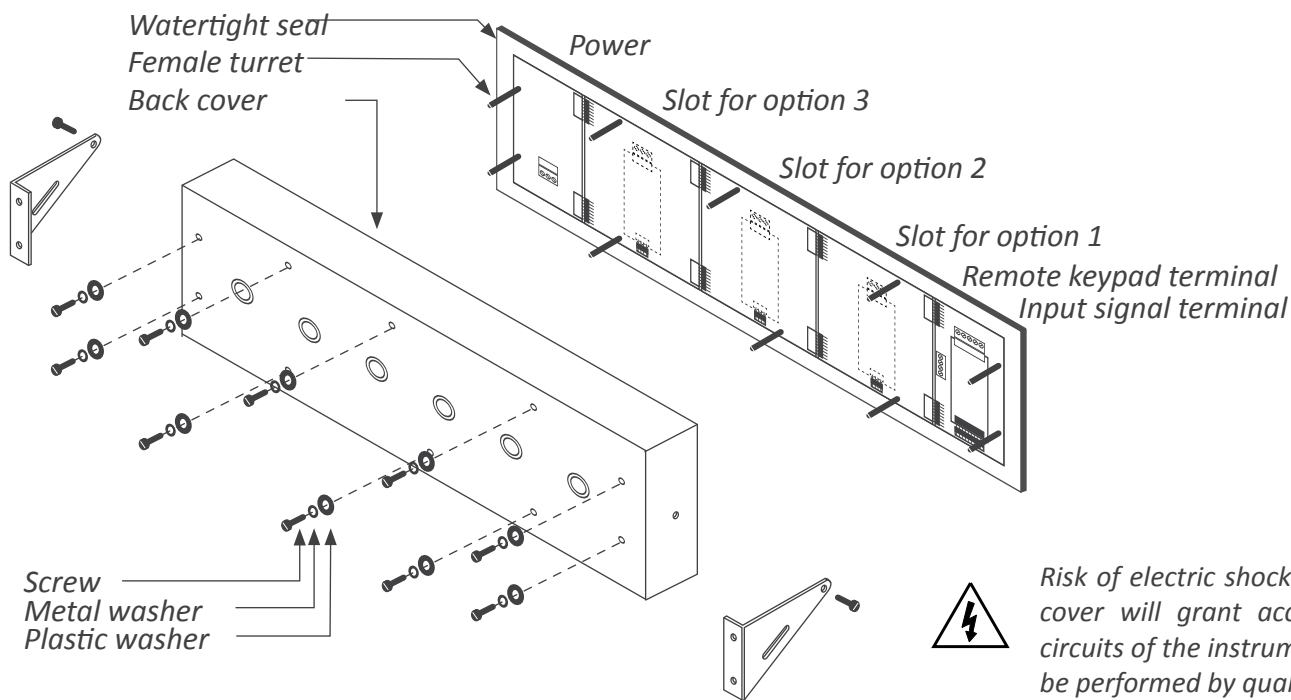
1.4 To access the instrument

To open the housing, remove the screws from the back cover. With each screw there is a metal washer and a plastic washer. Once the screws are out, remove the back cover.

The figure below shows the instrument internal structure for a LDB-26 format. It shows the location of the 3 slots for optional output and control modules, the power terminal and the input signal terminal.

To close the instrument, place the back cover, the screws, the metal washer and the plastic washer. The plastic washer is in contact with the back cover. Confirm that the screws are correctly turning inside the internal female screws.

To ensure a correct IP65 protection tighten the back cover screws with a strength between 30 and 40 Ncm, with the help of a dynamometer screwdriver.

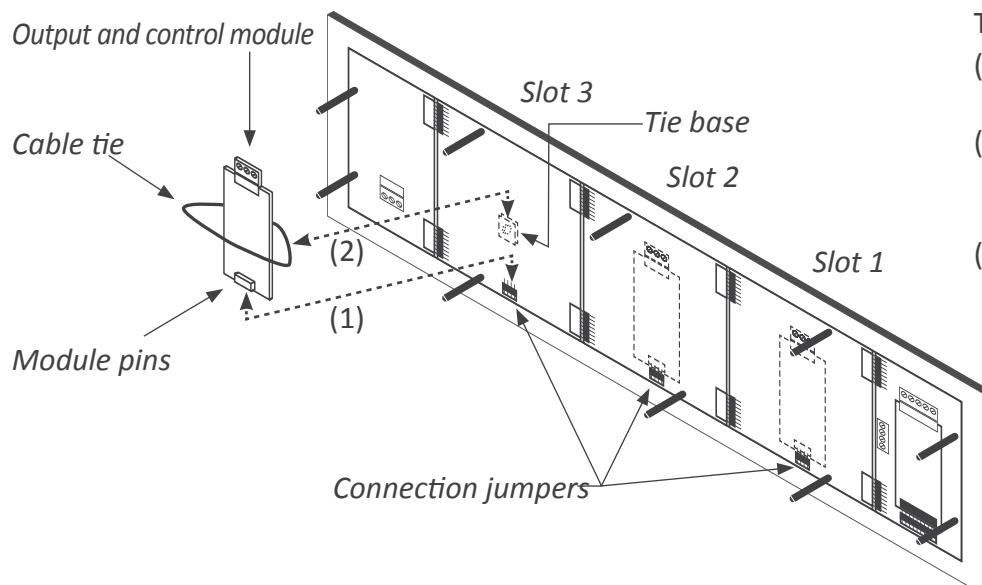


Risk of electric shock. Removing the back cover will grant access to the internal circuits of the instrument. Operation must be performed by qualified personnel only.

1.5 Modular system

Large format meters are designed with an internal modular architecture. The output and control modules are independent and can be installed by accessing the internal circuits of the instrument, and connecting

the module to the connection jumpers of the selected slot. Each module is provided with a cable tie to fix the module to the tie base. A cable gland to install at the back cover is also provided, in order to enable an output for the connection wires.



- To install an output and control module
- (1) insert the 'module pins' into the 'connection jumpers' in one of the free slots
 - (2) place the 'cable tie' into the 'tie base' and embrace the 'module' firmly, until it is fixed
 - (3) an additional white cable tie is provided to fix as indicated below. Only needed in case of vibrations or heavy transportation.



1. Options R1, T1 and SSR

The R1, T1 and SSR modules provide 1 digital ‘on/off’ output. The output is configured from the instrument alarms menu (‘ALr.1’, ‘ALr.2’ o ‘ALr.3’). The menu allows to configure the setpoint, hysteresis,

independent activation and deactivation delays, and a second setpoint to create windowed alarms. The R1, T1 and SSR output modules are isolated between them and between all other circuits of the instrument.

1.1 Module R1

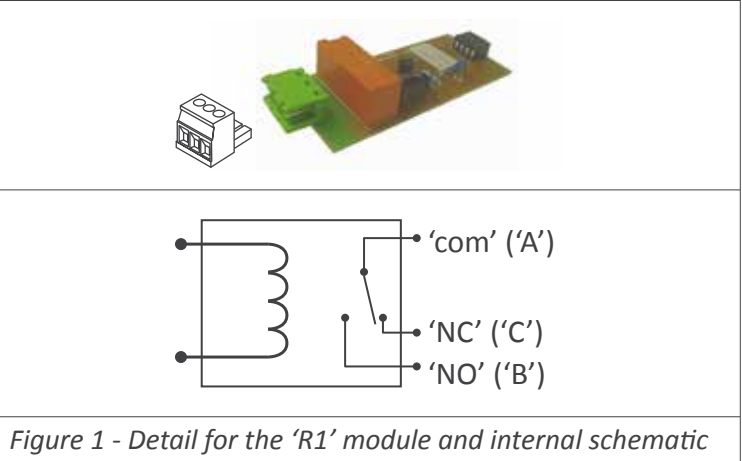


Figure 1 - Detail for the ‘R1’ module and internal schematic

Option	R1
Type of output	relay
Type of relay	3 contacts (Com, NO, NC)
Max. current	3 A (resistive load)
Voltage	250 Vac continuous <i>(max. 150 Vac if switching power network with Overvoltage category III)</i>
Isolation	3500 Veff
Type of terminal	plug-in screw clamp pitch 5.08 mm
Installation allowed atslot 1, slot 2, slot 3	

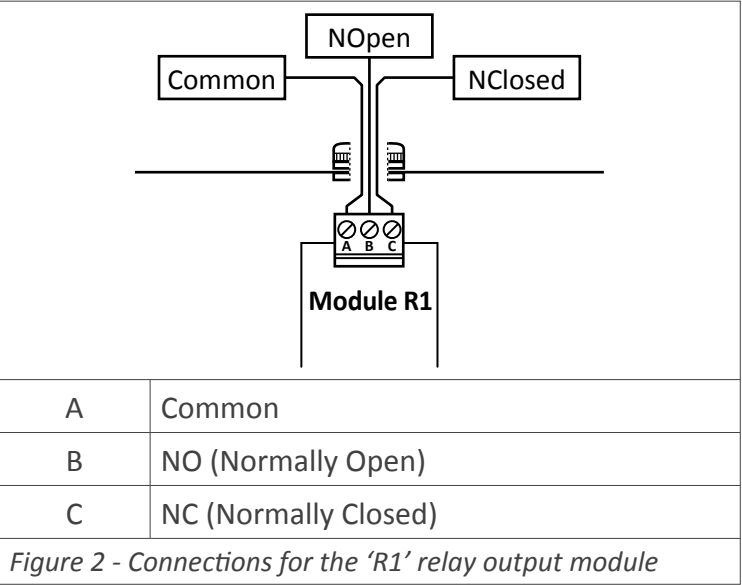


Figure 2 - Connections for the ‘R1’ relay output module

1.2 Module T1

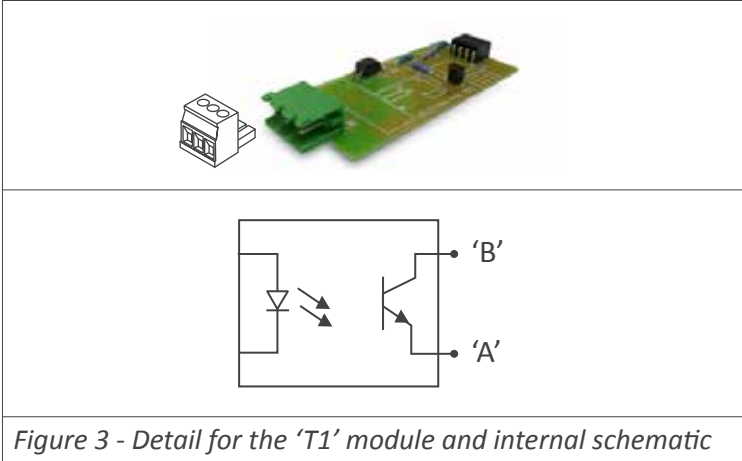


Figure 3 - Detail for the ‘T1’ module and internal schematic

Option	T1
Type of output	transistor
Max voltage	35 Vdc
Max. current	50 mA
Isolation	3500 Veff, optoisolated
Type of terminal	plug-in screw clamp pitch 5.08 mm
Installation allowed atslot 1, slot 2, slot 3	

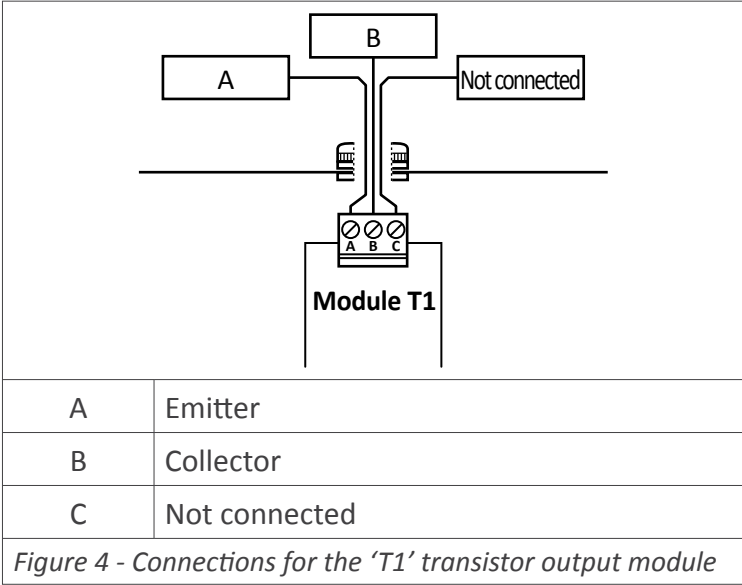


Figure 4 - Connections for the ‘T1’ transistor output module

1.3 Module SSR

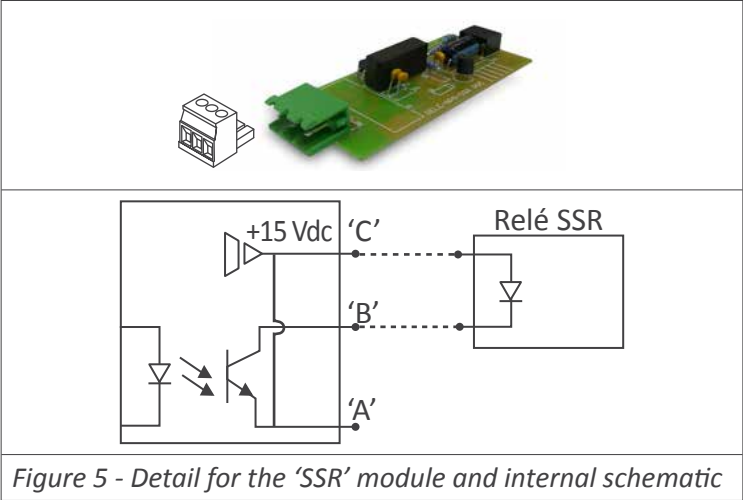


Figure 5 - Detail for the 'SSR' module and internal schematic

Option	SSR
Type of output	to control SSR relay
Output voltage	+15 Vdc
Max. current	45 mA
Isolation	1000 Vdc
Type of terminal	plug-in screw clamp pitch 5.08 mm
Installation allowed atslot 1, slot 2, slot 3	

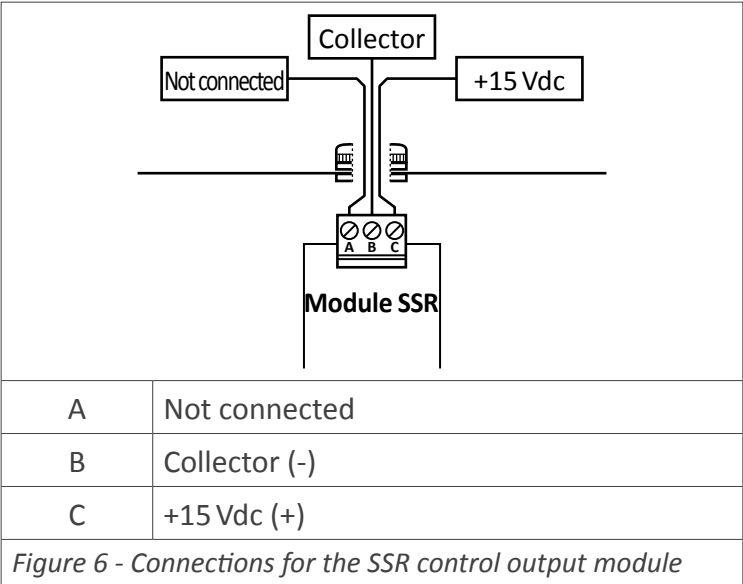


Figure 6 - Connections for the SSR control output module

2. Option AO

The AO modules provide 1 analog output, configurable for 4/20 mA or 0/10 Vdc signal. The analog output is configured from the options menu entry ('Opt.1', 'Opt.2' or 'Opt.3') of the instrument.

Option	AO
Type of output	analog output
Signal output	4/20 mA active 4/20 mA passive 0/10 Vdc
Max. signal	22 mA, 10.5 Vdc
Min. signal	0 mA, -50 mVdc
Scaling	proportional to the reading positive or negative slopes
Vexc (terminal A)	+13.8 Vdc \pm 0.4 Vdc (max. 25 mA) protection against shortcircuit
Load impedances	\leq 350 Ohm (for 4/20 mA active) \leq 800 Ohm (for 4/20 mA passive) (for 24 Vdc external Vexc) (maximum voltage 27 Vdc between 'B' and 'C') \geq 10 KOhm (en 0/10 Vdc)
Accuracy (at 25 °C)	<0.1 % FS
Thermal stability	60 ppm/°C in mA 50 ppm/°C in Vdc
Step response (0% to 99% of the signal)	<75 mSeconds + step response of the reading
Isolation	1000 Vdc
Warm up	15 minutes
Type of terminal	plug-in screw clamp pitch 5.08 mm
Factory configuration	'Mode mA' 'Scaling 0/9999 = 4/20 mA' 'On error 'to_h'
Installation allowed at	slot 1, slot 2, slot 3

The output signal is proportional to the reading, and it is scalable both in positive or negative slopes. The mA output can be configured for active loops (the instrument provides the power to the mA loop) or passive loops (the loop power is external to the instrument).

The AO analog output modules are isolated between them and between all other circuits of the instrument.



Figure 7 - Detail for the 'AO' module

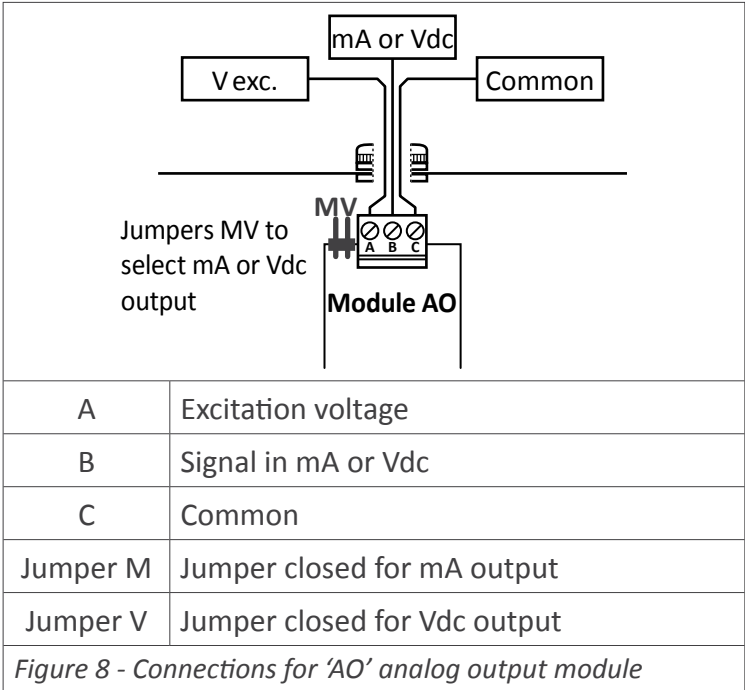


Figure 8 - Connections for 'AO' analog output module

2.1 Connection examples

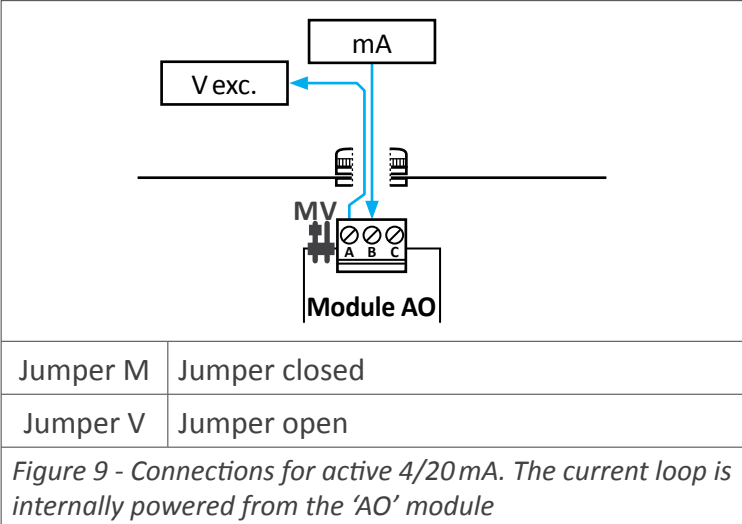


Figure 9 - Connections for active 4/20 mA. The current loop is internally powered from the 'AO' module

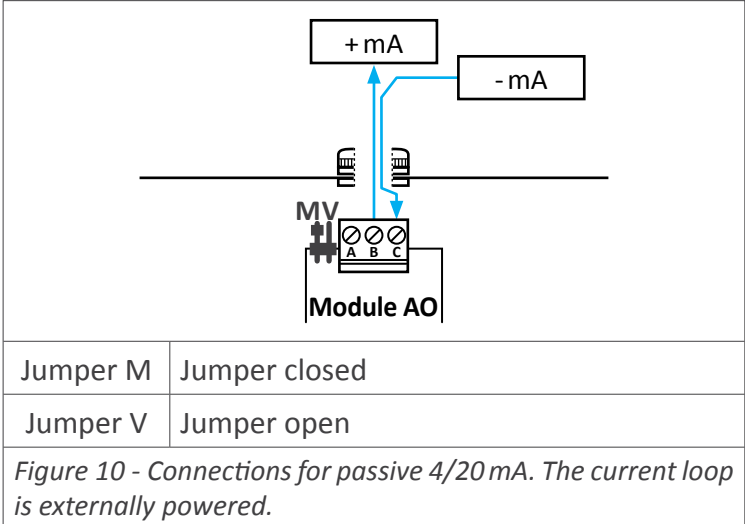


Figure 10 - Connections for passive 4/20 mA. The current loop is externally powered.

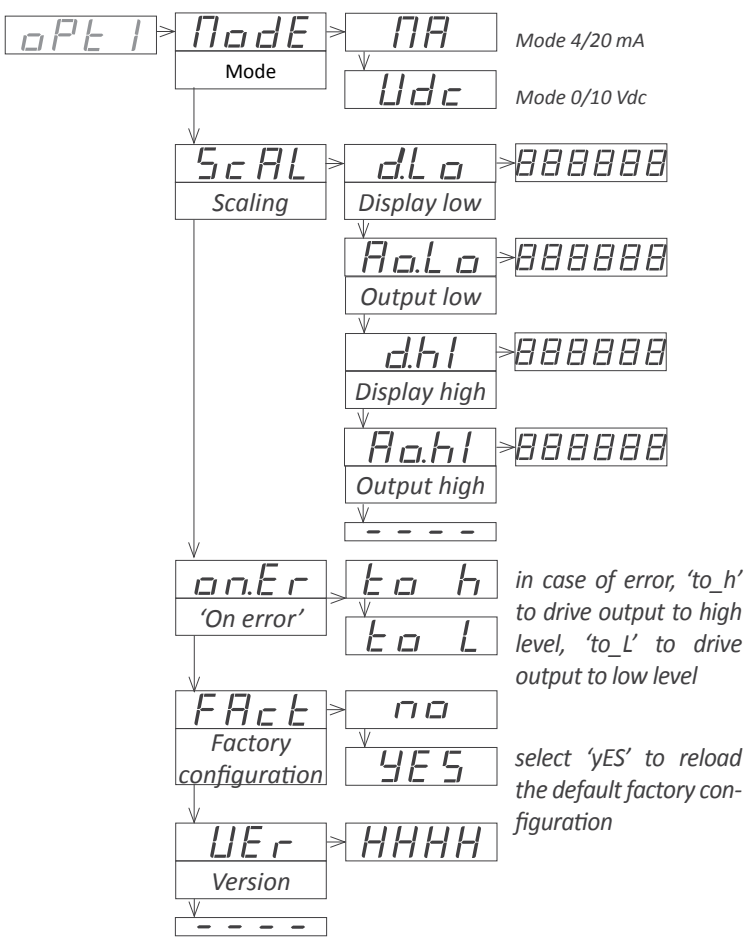
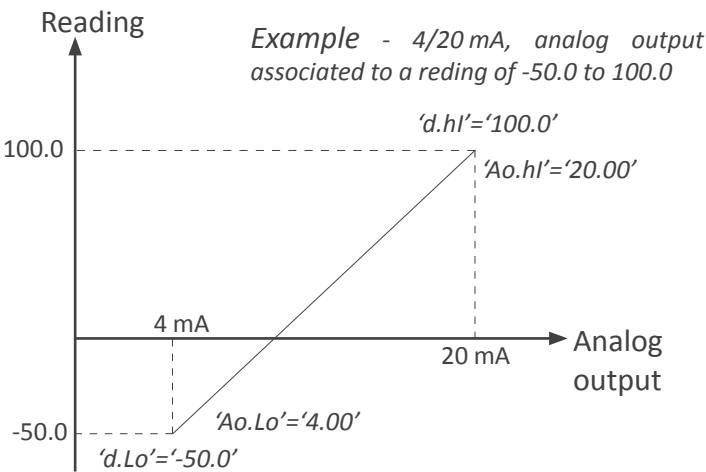
2.2 Configuration menu

At the **'Mode' ('ModE')** menu configure the type of output **'4/20 mA' ('mA')** or **'0/10 Vdc' ('Vdc')**. Position for jumpers **'V'** and **'M'** must be according to the range selected.

At the **'Scaling' ('ScAL')** menu enter the values that define the two points of the slope:

- the lower point, defined by the **'Low Display' ('d.Lo')** and **'Low Output' ('Ao.Lo')**
- the upper point, defined by the **'High Display' ('d.hi')** and **'High Output' ('Ao.hi')**

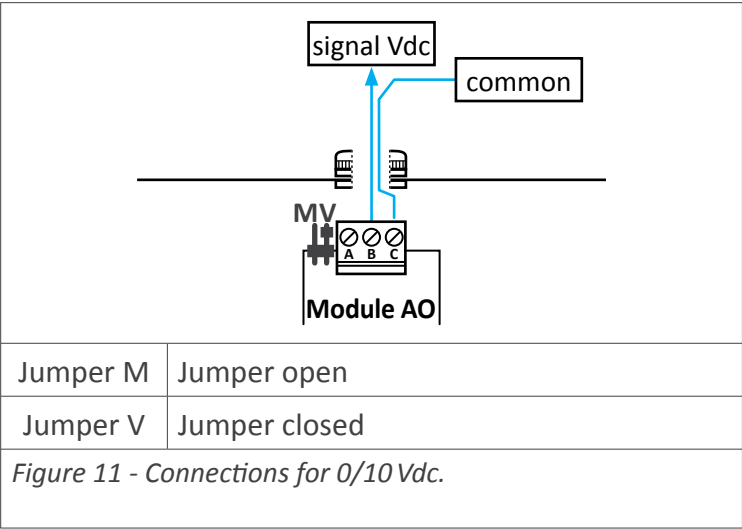
Analog output values are shown with **'XX.XX'** format. acceptable values are **'0.00'** to **'10.00'** Vdc for voltage, and **'0.00'** to **'20.00'** mA for current.



2.3 Error codes

'Er.34' output signal configured to value lower than 0 Vdc or 0 mA
'Er.35' output signal configured to a value higher than 10 Vdc or 20 mA

'Er.36' configured slope points are not acceptable, such as :
'd.Hi'='d.Lo'
'Ao.Hi'='Ao.Lo'
('Ao.Hi'-'Ao.Lo') > ('d.Hi'-'d.Lo')



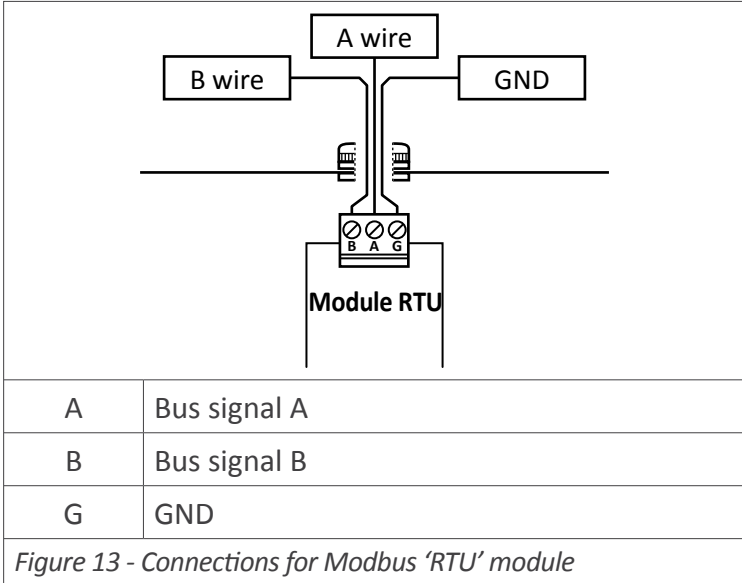
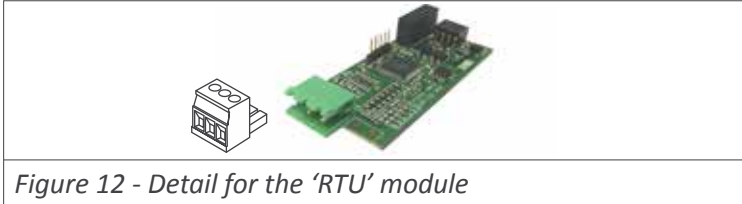
3. Option RTU

The RTU modules provide 1 port for communications in Modbus RTU protocol. Use function '4' ('Read Input Registers') of the Modbus RTU protocol, to access the instrument registers (reading value, alarm status, memory of maximum and minimum, setpoint values, ...).

Option	RTU
Type of output	Modbus RTU communication
Function implemented	4 (Read_Input_Registers)
Addresses	01 to 247
Exception codes	see section 3.3
Registers*	see section 3.1
*available registers can vary for different instruments	
Bus	RS-485
Speed	57.6 Kbps to 600 bps
Data format	8e1 (standard), 8o1, 8n2
Bus terminator	not included
Isolation	1000 Vdc
Temperature	operation from 0 to 50 °C storage from -20 to +70 °C
Factory configuration	'Address 1'
	'Speed 19.2 Kbps'
	'Format 8e1'
	'Decimal point Auto'
Installation allowed at slot 1, slot 2, slot 3	

The communication parameters are configured from the options menu entry ('Opt.1', 'Opt.2' or 'Opt.3') of the instrument.

The RTU modules are isolated between them and between all other circuits of the instrument.

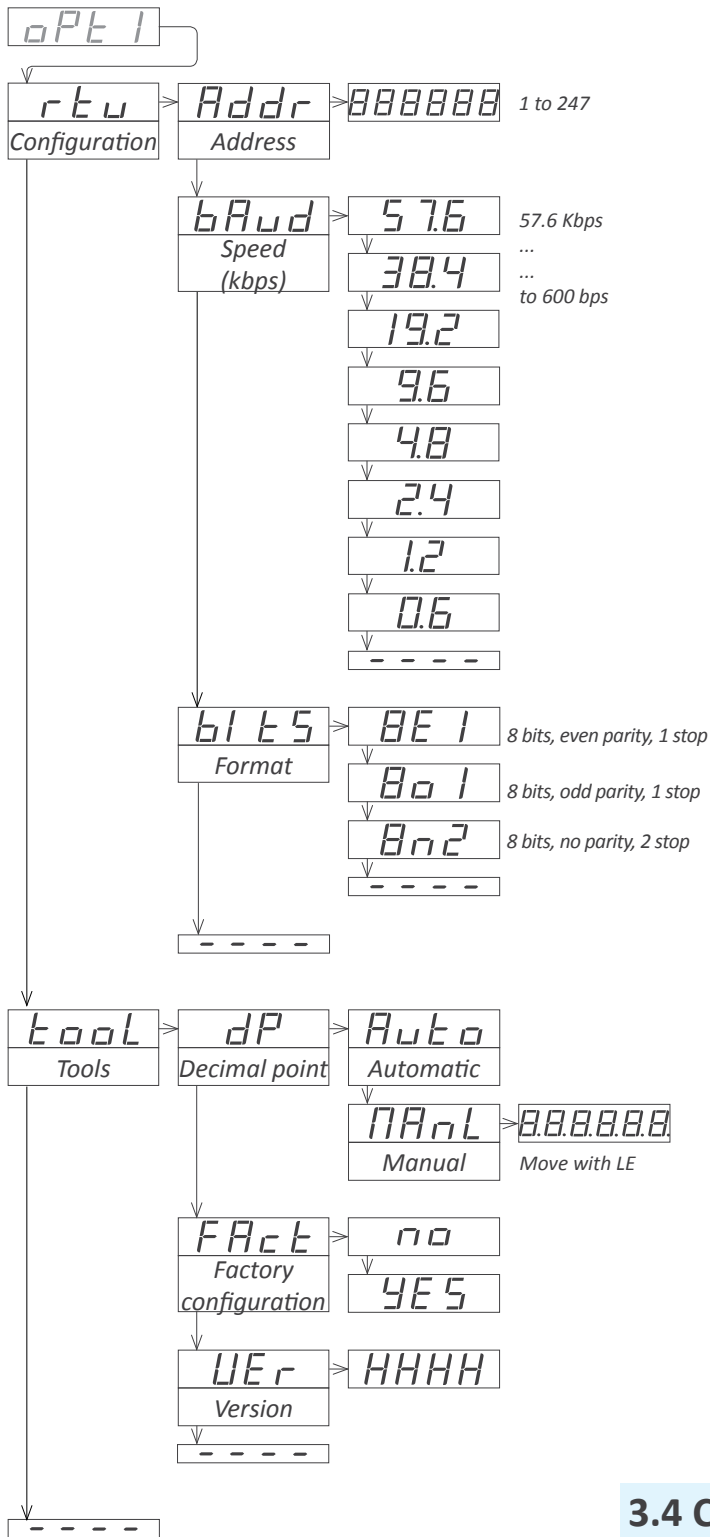


3.1 Registers accessible through Modbus RTU

Register	Name	Description	Size	Refresh	6 Digit Models (LDB-26 y LDB-46)	4 Digit Models (LDB-24 y LDB-44)
0	DISPLAY1_L	Display value	16 bits	same as display	999999 to -199999	9999 to -1999
1	DISPLAY1_H		16 bits		0 to 6	0 to 4
2	DECIMALES1	Decimals on display	16 bits		every 30 seconds	999999 to -199999
3	MAXMEM_L	Memory of maximum	16 bits	999999 to -199999		9999 to -1999
4	MAXMEM_H		16 bits			
5	MINMEM_L	Memory of minimum	16 bits	999999 to -199999		9999 to -1999
6	MINMEM_H		16 bits			
7	SETPOINT1_L	Setpoint 1 value	16 bits	every 2 seconds	999999 to -199999	9999 to -1999
8	SETPOINT1_H		16 bits			
9	SETPOINT2_L	Setpoint 2 value	16 bits		999999 to -199999	9999 to -1999
10	SETPOINT2_H		16 bits			
11	SETPOINT3_L	Setpoint 3 value	16 bits		999999 to -199999	9999 to -1999*
12	SETPOINT3_H		16 bits			
13	STATUS	Alarm status Instrument status	16 bits	same as display	bit 0...7 alarm status bit 8...16 instrument status	
14 a 16	Reserved	Reserved	16 x 3 bits		Not accessible	Not accessible

Table 1 - Registers accessible through MODBUS-RTU. Registers codified as binary numbers. Negative values codified in two's complement. Available registers can vary for different instruments. Register 11 is not accessible for instruments with formats LDB-24 and LDB-44 (slot 3 is not available).

3.2 Configuration menu



At the 'Configuration' ('rtu') menu, configure the 'Address' ('Addr') parameter with the address value between '1' and '247', at the 'Speed' ('bAud') parameter select the bus speed (in Kbps) and at the 'Format' ('bltS') parameters select the data format.

Inside the 'Tools' ('Tool') menu, special tools and functions are grouped.

- the 'Decimal point' ('dP') menu is provided for compatibility with ancient hardware that does not support decimal point retransmission. By default, select 'Automatic' ('Auto'). If your instrument does not transmit the decimal point position, select 'Manual' ('MANL') and fix the position of the decimal point manually.
- at the 'Factory reset' ('FAct') menu, select 'yes' to load the default factory configuration for the instrument.

the 'Version' ('VEr') menu informs of the current firmware version installed in the module.

3.3 Exception codes

The Modbus RTU protocol defines the following scenarios when a 'Master' is sending a frame to a 'Slave':

- the 'Slave' device receives the frame correctly and replies with the requested data
- the 'Slave' devices detects a CRC error, parity error, or other. and discards the frame without generating a reply frame. The 'Master' will detect a 'TIMEOUT' condition due to the absence of reply.
- the 'Slave' device receives the frame correctly, but replies with an 'EXCEPTION_CODE' as it can not process the function or register requested.

The 'EXCEPTION_CODES' configured in the RTU module are :

Excep- tion code	Name	Description
0	ILLEGAL_FUNCTION	Requested function is not supported
1	ILLEGAL_DATA_AD- DRESS	Requested register is not supported

Table 2 - Exception codes

3.4 Compatible versions

Formats LDB-26, LDB-46	Firmware version	Formats LDB-24, LDB-44	Firmware version
---	---	LDB24-P, LDB44-P	41.57
LDB26-P, LDB46-P	50.00	---	---
---	---	LDB24-T, LDB44-T	44.05
---	---	LDB24-R, LDB44-R	45.05
LDB26-C1, LDB46-C1	27.08	LDB24-C1, LDB44-C1	47.07
LDB26-CR, LDB46-CR	28.02	LDB24-C1, LDB44-C1	48.05

Table 3 - Firmware versions compatible with the indicated registers

3.5 Description and example of registers

Registers R0 and R1 (DISPLAY1_L y DISPLAY1_H)

Contains the display value of the instrument, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified at register R2.

Example R0=FBF1 (hex) and R1=0009 (hex)

Register value = 0009 FBF1 (hex)

Reading value = 654321

Register R2 (DECIMALS1)

Contains the number of decimals of the display, codified in a single register of 16 bits. Possible values are from 0 to 6.

Example R2=0002 (hex)

Number of decimals = 2 = 6543.21

Register R3 and R4 (MAXMEM_L and MAXMEM_H)

Contains the memory of maximum reading of the instrument, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

Example - same example as in R0 and R1 but accessing to R3 and R4.

Registers R5 and R6 (MINMEM_L and MINMEM_H)

Contains the memory of minimum reading of the instrument, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

Example - same example as in R0 and R1 but accessing to R5 and R6.

Registers R7 and R8 (SETPOINT1_L and SETPOINT1_H)

Contains the setpoint value of alarm 1, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

Example - same example as in R0 and R1 but accessing to R7 and R8.

Registers R9 and R10 (SETPOINT2_L and SETPOINT2_H)

Contains the setpoint value of alarm 2, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

Example - same example as in R0 and R1 but accessing to R9 and R10.

Registers R11 and R12 (SETPOINT3_L and SETPOINT3_H)

Contains the setpoint value of alarm 3, codified in two registers of 16 bits each. Possible values are from 999999 to -199999. Decimal point position is codified on register R2.

Example - same example as in R0 and R1 but accessing to R11 and R12.

Register R13 (STATUS)

Information bit-by-bit, for the alarm status (on / off) and instrument status. See below for a description.

- Bit 0 Alarm 1 status (0 = inactive, 1 = active)
- Bit 1 Alarm 2 status (0 = inactive, 1 = active)
- Bit 2 Alarm 3 status (0 = inactive, 1 = active)
- Bit 3 to 7 Reserved
- Bit 8 Display overrange
- Bit 9 Display underrange
- Bit 10 Lost communication with the main processor
- Bit 11 to 15 Reserved

Registers R14, R15 and R16

Reserved

4. Option S4

The S4 modules provide 1 port for communications RS485 ASCII protocol. Protocol with 'master' - 'slave' architecture, addressable up to 31 modules. Frames codified in representable ASCII characters (codes 32 to 255), which are visible using 'hyperterminal' or similar programs. Instrument

Option	S4
Type of output	RS-485 ASCII communication
Bus	RS-485
Speed	57.6 Kbps to 600 bps
Data format	8n1 (standard), 8o1, 8n2, 8e1
Bus terminator	not included
Protocol	ASCII
Architecture	'master - slave'
Addresses	01 to 31
'Broadcast' address	128
Registers*	see section 4.1
<i>*available registers can vary for different instruments</i>	
Isolation	1000 Vdc
Temperature	operation from 0 to 50 °C storage from -20 to +70 °C
Factory configuration	'Mode Slave' 'Address 1' 'Speed 19.2 Kbps' 'Format 8n1' 'Decimal point Auto'
Configuration 'Master'	'Destination address 31' 'Frequency 0.5 sec.'
Tools	'Decimal point Auto' 'Legacy Off' 'Answer delay 0 mSec.'
Installation allowed at	'Opt.1', 'Opt.2', 'Opt.3'

registers are accessible through the RS-485 ASCII port (reading value, alarm status, memory of maximum and minimum, setpoint values, ...). The communication parameters are configured from the options menu entry ('Opt.1', 'Opt.2' or 'Opt.3') of the instrument. The S4 modules are isolated between them and between all other circuits of the instrument.

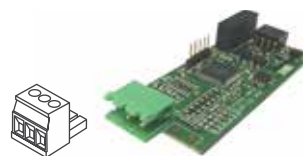


Figure 14 - Detail for the 'S4' module

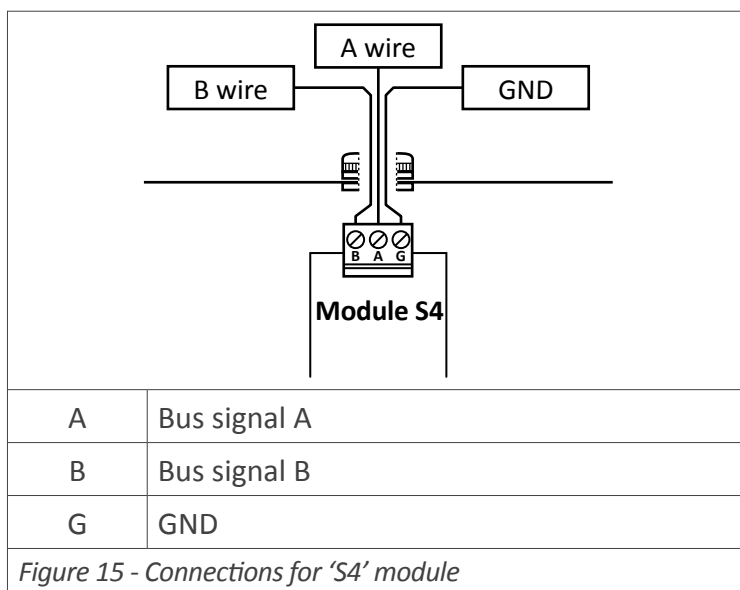


Figure 15 - Connections for 'S4' module

4.1 Accessible registers

Display values (DISPLAY1, MAXMEM, MINMEM, AL1, AL2, AL3) are codified with a minimum of 6 digits (left zeros are added if necessary), polarity and decimal point.

Register	Name	Description
0	DISPLAY1	Display1 value
1	MAXMEM	Memory of maximum
2	MINMEM	Memory of minimum
3	AL1	Setpoint 1 value
4	AL2	Setpoint 2 value
5	AL3	Setpoint 3 value
6	STATUS	Alarm status

Table 4 - Accessible registers for ASCII protocol.

Register 0 - DISPLAY1

Contains the display value of the instrument, in ASCII code, including polarity (positive / negative) and decimal point.

Example 1 - R0='+' '0' '6' '5' '4' '3' '.' '2' Display value = 6543.2

Example 2 - R0='-' '0' '0' '0' '4' '.' '5' '2' Display value = -4.52

Register 1 - MAXMEM

Contains the value for memory of maximum, in ASCII code,

including polarity (positive / negative) and decimal point.

Register 2 - MINMEM

Contains the value for memory of minimum, in ASCII code, including polarity (positive / negative) and decimal point.

Register 3 - AL1

Contains the value for alarm 1 setpoint, in ASCII code, including polarity (positive / negative) and decimal point.

Register 4 - AL2

Contains the value for alarm 2 setpoint, in ASCII code, including polarity (positive / negative) and decimal point.

Register 5 - AL3

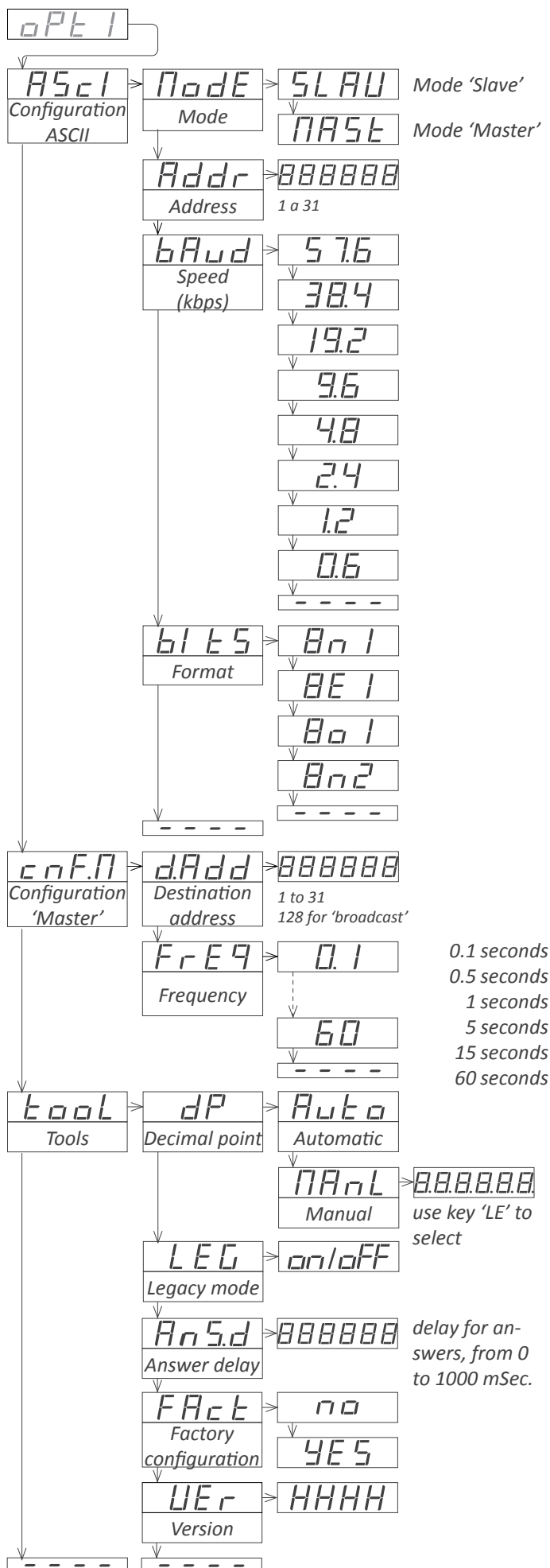
Contains the value for alarm 3 setpoint, in ASCII code, including polarity (positive / negative) and decimal point.

Register 6 - STATUS

Contains the alarm status (on/off).

Bit 0	Alarm 1 status (0 = inactive, 1 = active)
Bit 1	Alarm 2 status (0 = inactive, 1 = active)
Bit 2	Alarm 3 status (0 = inactive, 1 = active)
Bit 3 to 15	Reserved

4.2 Configuration menu



At the 'Configuration ASCII' ('AScl') menu, configure the 'Mode' ('ModE') parameter to select the 'slave' or the 'master' mode, at the 'Address' ('Addr') parameter configure the local port address between '1' and '31', at the 'Speed' ('bAud') parameter select the bus speed (in Kbps) and at the 'Format' ('bltS') parameter select the data format.

When working as 'master', the instrument continuously transmits the display value data frame. The local module address is '0'. Configure at menu 'Configuration Master' ('cnF.M') the 'Destination address' ('d.Add') parameter from '1' to '31' or use value '128' for a broadcast message. At parameter 'Frequency' ('FrEq') select the how often the frame with the reading value will be transmitted.

Special tools are grouped inside the 'Tools' ('Tool') menu.

- the 'Decimal point' ('dP') menu is provided for compatibility with ancient hardware that does not support decimal point retransmission. By default, select 'Automatic' ('Auto'). If your instrument does not transmit the decimal point position, select 'Manual' ('MANL') and fix the position of the decimal point manually.
- the 'Legacy mode' ('LEG') parameter is provided to maintain compatibility with instruments with older communication protocols. Select 'on' to activate this mode.
- the 'Answer delay' ('Ans.d') parameter applies only to 'Slave' mode. The local module delays the answer frame. Configure for applications where the 'Master' needs additional time to switch between 'transmit' and 'receive' modes. Enter a numeric value between '0' and '1000' mSeconds.
- at the 'Factory reset' ('FAct') menu, select 'yes' to load the default factory configuration for the instrument.

the 'Version' ('VEr') menu informs of the current firmware version installed in the module.

4.3 Compatible versions

Formats LDB-26, LDB-46	Version firmware	Formats LDB-24, LDB-44	Version firmware
Instruments with access to registers 0, 1, 2, 6			
		LDB24-P, LDB44-P	41.57
LDB26-P, LDB46-P	50.00	---	---
		LDB24-T, LDB44-T	44.05
		LDB24-R, LDB44-R	45.05
LDB26-C1, LDB46-C1	27.08	LDB24-C1, LDB44-C1	47.07
LDB26-CR, LDB46-CR	28.02	LDB24-CR, LDB44-CR	48.05

Table 5 - Firmware versions compatible with the indicated registers

4.4 Frame types

The ASCII protocol defines the following frames:

- Frame ‘read’ (**‘RD’**). Id code 36. Request data frame. The requested register is indicated into the ‘REG’ byte (‘Header’ section).
- Frame ‘answer’ (**‘ANS’**). Id code 37. Response frame to a request data frame. The requested register is indicated into the ‘REG’ byte (‘Header’ section). Data of the requested register is indicated into data bytes ‘D0’ to ‘Dn’ (‘Data’ section).
- Frame ‘error’ (**‘ERR’**). Id code 38. Response frame to a request data frame. Indicates that an error has occurred. Error code is codified into the ‘REG’ byte (‘Header’ section).
- Frame ‘ping’ (**‘PING’**). Id code 32. Used to confirm the existence of the remote instrument.
- Frame ‘pong’ (**‘PONG’**). Id code 33. Response to a ‘ping’ frame. It confirms the existence of the remote instrument.

4.5 Frame structure

Header								Data				Trail	
STX	ID	RSV	FROM	TO	REG	RSV	LONG	D0	D1	...	Dn	CRC	ETX
2	x	32	x	x	x	32	n+1	[data]				x	3
0	1	2	3	4	5	6	7	8	9	...	n+7	n+8	n+9

Protocol frames have a structure made of ‘Header’, ‘Data’ and ‘Trail’.

Section ‘Header’

Contains the start byte (‘STX’), the frame identifier (‘ID’), the origin address (‘FROM’) and the destination address (‘TO’), the register id (‘REG’) and the length (‘LONG’) of the ‘Data’ section.

Section ‘Data’

Contains data for the requested register (‘REG’).

Section ‘Trail’

Contains the ‘CRC’ code and the end of frame byte (‘ETX’).

‘Real value’ and ‘Frame value’

To use representable ASCII values, the real values are codified before being sent into the frame. The following definitions apply :

- ‘real value’ is the value of the field without codification
- ‘frame value’ is the value of the field, codified

Field	Description	Size	Position	Real value	Frame value
STX	Start of frame	1 byte	0	does not apply	2
ID	Frame type	1 byte	1	(see section 4.4)	real_value
RSV	Reserved	1 byte	2	0	32
FROM	Origin address	1 byte	3	0 (‘Master’) / 1 to 31 (‘Slave’)	32 + real_value
TO	Destination address	1 byte	4	0 (‘Master’) / 1 to 31 (‘Slave’) 128 (‘broadcast’)	32 + real_value
REG	Register identification	1 byte	5	(see section 4.1)	32 + real_value
RSV	Reserved	1 byte	6	0	32
LONG	Length of ‘Data’ section	1 byte	7	n (between 0 and 32)	32 + real_value
D0 ... Dn	Data	n bytes	8 to n+7	number 0 to 9 decimal point polarity (+/-)	ASCII code of the number (48 to 57) ASCII code of decimal point (46) ASCII code of ‘+’ (43) ASCII code of ‘-’ (45)
CRC	CRC calculation	1 byte	n+8	does not apply	(see section 4.7)
ETX	End of frame	1 byte	n+9	does not apply	3

Table 6 - Description of the bytes for the ASCII frame

4.6 Error codes

Frames ‘ERR’ contain within the ‘REG’ field, the error code.

Available error codes are :

error 1 unknown register

error 2

error 3

error 4

error 5

display overrange

display underrange

CRC error

internal error

4.8 Frame examples

4.8.1 Frames ‘RD’ (36) and ‘ANS’ (37)

Example - ‘Master’ (address ‘0’) requests the value of register ‘0’ (display value) to the ‘Slave’ at address ‘28’ (‘RD’ frame) and the ‘Slave’ replies to the ‘Master’ with a reply frame (‘ANS’ frame) containing the requested data (765.43).
*Instruments with 4 digits also send reading values formatted with 6 digits : value -321.5 is transmitted as -00321.5

Header								Trail	
STX	ID	RSV	FROM	TO	REG	RSV	LONG	CRC	ETX
2	36	32	32	60	32	32	32	58	3
Start	RD	---	0	28	0	---	0	CRC	Stop

Header								Data								Trail	
STX	ID	RSV	FROM	TO	REG	RSV	LONG	D0	D1	D2	D3	D4	D5	D6	D7	CRC	ETX
2	37	32	60	32	32	32	40	43	48	55	54	53	46	52	51	15	3
Start	ANS	---	28	0	0	---	8	+0765.43								CRC	Stop

4.8.2 Frames ‘ERR’ (38)

Example - ‘Slave’ at address ‘11’ replies to the ‘Master’ (address ‘0’) with an error frame (‘ERR’ frame) indicating that the requested register number is unknown (‘UNKNOWN_REGISTER’, error code ‘1’). The error code is codified into the ‘REG’ byte. For a list of error code see section 4.6.

Header								Trail	
STX	ID	RSV	FROM	TO	REG	RSV	LONG	CRC	ETX
2	38	32	43	32	33	32	32	46	3
Start	ERR	---	11	0	1	---	0	CRC	Stop

4.7.1 Frames ‘PING’ (32) and ‘PONG’ (33)

Example - ‘Master’ (address ‘0’) requests confirmation of existence to the ‘Slave’ at address ‘22’ (‘PING’ frame) and the ‘Slave’ replies to the ‘Master’ with a ‘PONG’ frame.

Header								Trail	
STX	ID	RSV	FROM	TO	REG	RSV	LONG	CRC	ETX
2	32	32	32	54	32	32	32	52	3
Start	Ping	---	0	22	0	---	0	CRC	Stop

Header								Trail	
STX	ID	RSV	FROM	TO	REG	RSV	LONG	CRC	ETX
2	33	32	54	32	32	32	32	53	3
Start	Pong	---	22	0	0	---	0	CRC	Stop

4.7 CRC calculation

The ‘frame value’ for the CRC byte is calculated applying a XOR function to the ‘frame value’ (see section 4.5) of all bytes in sections ‘Header’ and ‘Data’, from byte ‘0’ (‘STX’) to the last data byte (‘Dn’).

- if the calculated CRC value is lower than ‘32’, it is normalized by applying the ‘one’s complement’ function .

$CRC0 = STX \wedge ID \wedge RSV \wedge FROM \wedge TO \wedge REG \wedge RSV \wedge LONG \wedge D0 \wedge \dots \wedge Dn$

- if $(CRC0 < 32) \rightarrow CRC = !CRC0$ (one’s complement function)
- if $(CRC0 > 31) \rightarrow CRC = CRC0$

```
//example of CRC calculation in C language
int8 Calculate_CRC(int8 CRC_Position)
{
    int8 i,CRC=0;
    for(i=0;i<CRC_Position;i++)
    {
        CRC=CRC ^ frame[i];
    }
    if(CRC<32) CRC=~CRC;
    return(CRC);
}
```

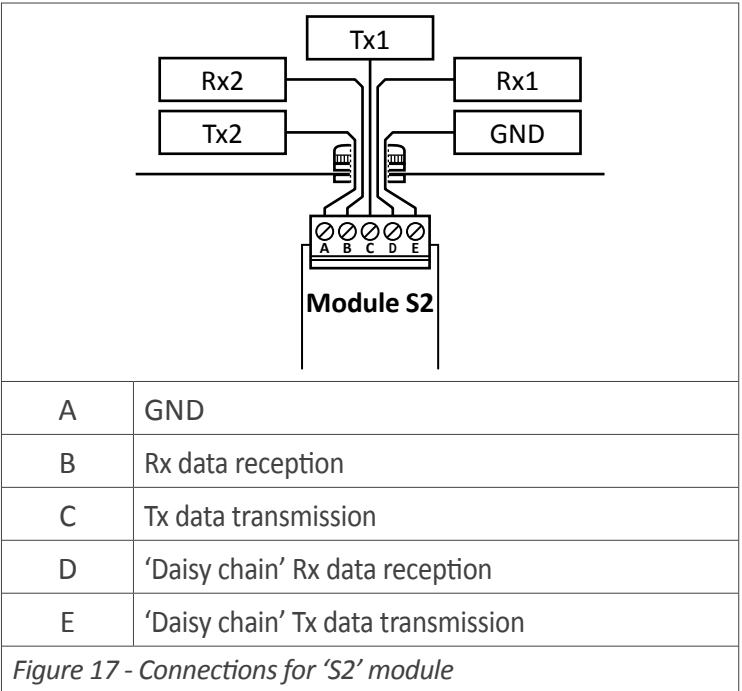
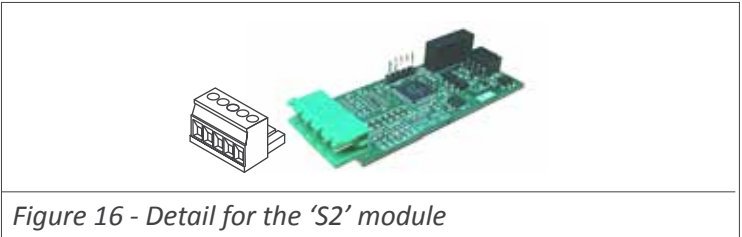

5. Option S2

The S2 modules provide 1 port for communications RS232 ASCII protocol. The S2 modules use the same protocol as the S4 modules (see section 4), the only difference is the physical layer of the bus, that is RS232 for the S2.

S2 modules allow for point-to-point communication over RS232 and also allow for multinode communication over

RS232 using a ‘Daisy-Chain’ type of connection. Terminals RX1 and TX1 are for the main communication with the RS232 bus. Terminals RX2 and TX2 are for the multinode connection, so all frames received at RX1 with destination address different from the local address, will be retransmitted through TX2. On the same way, frames received at RX2 with destination address different from the local address, will be retransmitted through TX1.

Option	S2
Type of output	RS-232 ASCII communication
Bus	RS-232
Speed	57.6 Kbps a 600 bps
Data format	8n1 (standard), 8o1, 8n2, 8e1
Protocol	ASCII
Architecture	‘master - slave’
Address	01 to 31
‘Broadcast’ address	128
Registers*	see section for S4 module
*available registers can vary for different instruments	
Isolation	1000 Vdc
Temperature	operation from 0 to 50 °C storage from -20 to +70 °C
Installation allowed at	‘Opt.1’, ‘Opt.2’, ‘Opt.3’



1. Remote keypad LDB-RKB

Industrial keypad with 3 push buttons to connect to large format meters from LDB series. It allows to replicate the front keypad of the instrument to a remote location.

A RKB remote keypad allows the operator to access the advanced control functions from the large format meters, such as fast access to alarm setpoints, preset value modification, access to maximum and minimum reading values, signal tare for load applications, front reset, manual alarm unlock, ...

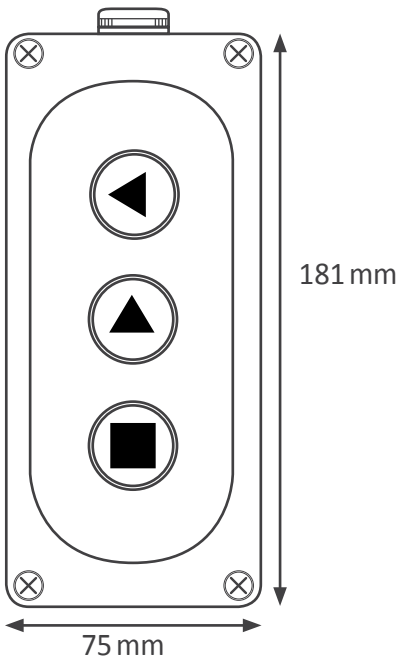
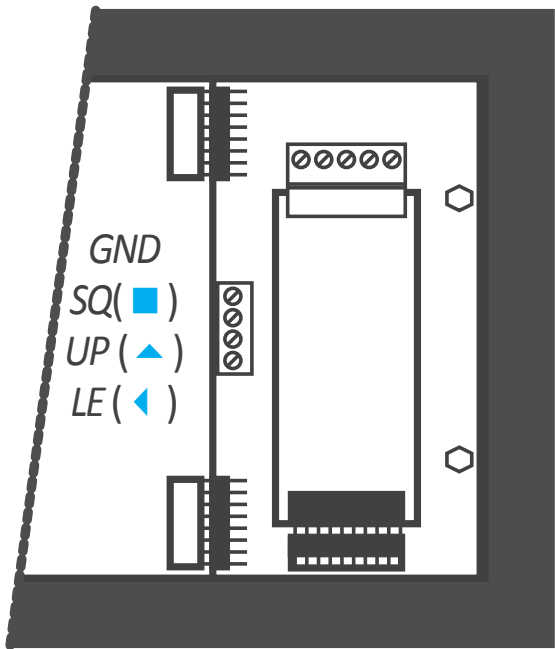
All these features are accessible while maintaining the main feature of these instruments, which is the installation in heights for long distance reading.

The RKB remote keypad is provided with an industrial IP65 protected housing, with cable gland output, aligned with the technical specifications of the LDB series. The RKB remote keypad can be easily installed against wall. The push buttons are 25 mm size for easy use even with protection gloves.

The RKB remote keypad is provided with labeled push buttons and does not included cable.



Normal button state	open
Recommended wire	0.25 mm2
Protection	IP65
Output	by cable gland
Mounting	accepts wall mount
Color	grey
Material	plastic
Weight	200 gr



Connect the wire to the 4 pole terminal located close to the input signal module. Connect 4 wires for keys 'SQ' (■), 'UP' (▲), 'LE' (◀) and common. Pass the wires through the cable gland identified as 'remote keypad' (see Figure 2) and connect the other end to the internal RKB push buttons.

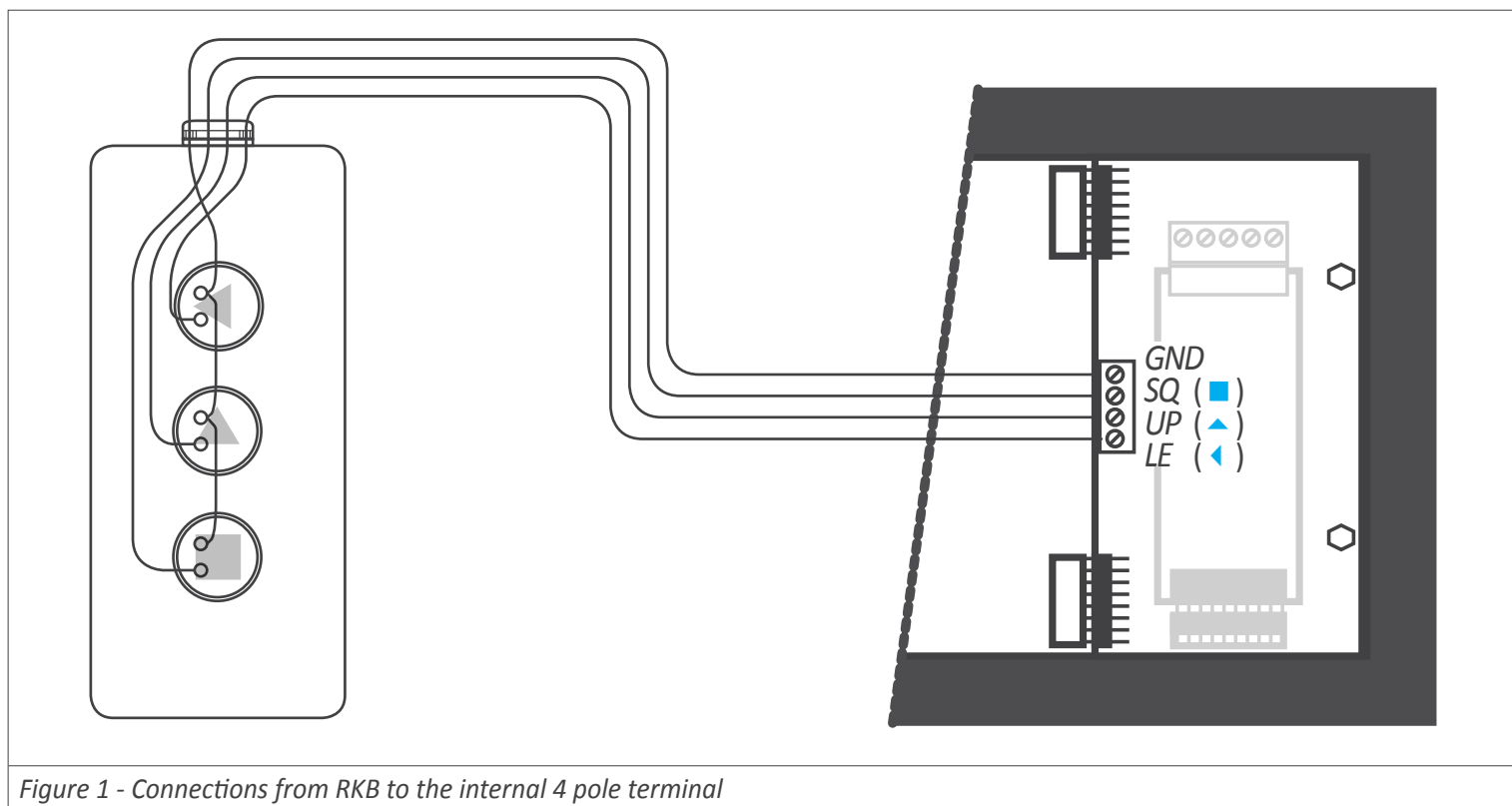


Figure 1 - Connections from RKB to the internal 4 pole terminal

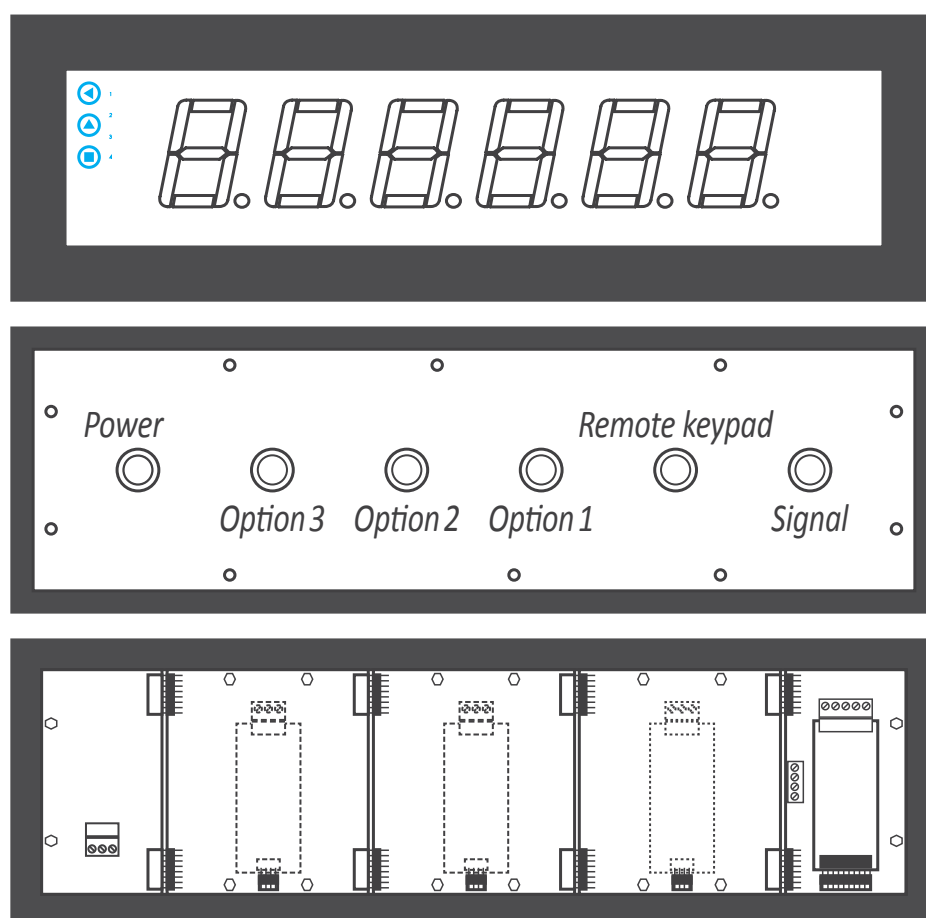


Figure 2 - LDB-26 instrument front view (top), rear view (middle) and internal view (bottom).

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **61 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **five (5) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

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2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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