LDB-C1
Impulse Counters and Ratemeters
The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.
1. LDC-C1 Series

Large format industrial meters with impulse counter, ratemeter and periodmeter functions

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

Instruments with 5 impulse counter modes (see section 1.13.3), 2 ratemeter modes (see section 1.13.9) and 1 periodmeter mode (see section 1.13.9).

Highly configurable, accepts all types of sensors (NPN, PNP, push-pull, Namur, inductive, pick-up, mechanical, TTL, CMOS, ...) including single and bidirectional encoder signals.

Reading from 999999 to -199999 (or 9999 to -1999 for 4 digit formats) with configurable decimal point, scalable reading with configurable multiplier (1 to 999999) and divider factors (1 to 999999). Includes internal pull-up and pull-down resistors, configurable trigger levels, detection by rising or falling edge, excitation voltage configurable from 5 Vdc to 18 Vdc.

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 RS232.

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.

- Configurable ‘Fast access’ to selected functions with key ‘UP’ (▲) (see section 1.13.17)
- ‘On power up’ for system protection on ‘cold’ start-up and control of alarm status (see section 1.13.18)
- ‘FAST’ mode for fast counter applications (see section 1.13.3)
- ‘SLOW’ mode for ratemeters applications at low frequencies (slow applications) (see section 1.13.9)
- Easy configuration for most usual sensors at the ‘SnSr/Auto’ menu (see section 1.13.14)
- alarms with 1 or 2 setpoints, independent activation and deactivation delays, hysteresis, manual unlocking, ...
  (see section 1.13.15)

Multiple display filters, memory of maximum and minimum reading, password protection, 5 brightness levels.

1.1 How to use this manual

If this is the first time you are configuring an LDB Series 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 1.17.

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 1.13)
   - select the main function, and the decimal point position (see section 1.13.2)
   - configure the main function selected (see section 1.13.2)
     - counter modes from section 1.13.3
     - ratemeter and periodmeter from section 1.13.9
   - configure the sensor (see section 1.13.13)

4. Advanced configuration (optional)
   - configure the instrument alarms (see section 1.13.15)
   - configure the fast access (see section 1.13.17), ‘on power up’ (1.13.18), key ‘LE’ (1.13.19) and password (1.13.26)

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 1.13.30)
   - see section 2 for information regarding the output and control options available

6. Install the instrument
   - mount on panel, wall or hanging (see section 1.16)
   - adjust the brightness level according to your environmental needs (see section 1.13.29)
1.2 How to order

<table>
<thead>
<tr>
<th>Format</th>
<th>Model</th>
<th>Power</th>
<th>Color</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3*</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDB-46</td>
<td>C1</td>
<td>H</td>
<td>-R</td>
<td>(1 relay)</td>
<td>(analog output)</td>
<td>(Modbus RTU)</td>
<td>(1 control SSR)</td>
</tr>
<tr>
<td>LDB-24</td>
<td></td>
<td>(60 mm, 4 digits)</td>
<td>(85-265 Vac and 120-370 Vdc)</td>
<td>(red led)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDB-26</td>
<td></td>
<td>(60 mm, 6 digits)</td>
<td>(11-36 Vdc isolated)</td>
<td>(green led)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDB-44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDB-46</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Option 3 available with formats LDB-26 and LDB-46

1.3 Index

1. LDB-C1 Series ............................................. 2
  1.1 How to use this manual ................................. 2
  1.2 How to order ........................................... 3
  1.3 Index ................................................... 3
  1.4 Sizes and formats ..................................... 4
     1.4.1 Format LDB-24 ...................................... 4
     1.4.2 Format LDB-44 ...................................... 4
     1.4.3 Format LDB-26 ...................................... 5
     1.4.4 Format LDB-46 ...................................... 5
  1.5 To access the instrument ................................ 6
  1.6 Modular system ......................................... 6
  1.7 Power connections and protective earth ............. 7
  1.8 Input signal connections .............................. 7
  1.9 Connections for remote keypad ....................... 7
  1.10 Technical specifications ............................. 8
  1.11 Functions included ................................... 9
  1.12 Messages and errors .................................. 9
  1.13 Configuration ........................................ 10
     1.13.1 How to operate the menus ....................... 10
     1.13.2 Initial set-up .................................... 11
     1.13.3 Counter modes description ....................... 12
     1.13.4 Standard counter ‘cn.1’ configuration menu .... 12
     1.13.5 Quadrature counter ‘cnq.2’ configuration menu 12
     1.13.6 Counter + inhibition ‘cn.3’ configuration menu 13
     1.13.7 Counter + control add / subtract ‘cn.4’ configuration menu 13
     1.13.8 Differential counter ‘cn.5’ configuration menu 13
     1.13.9 Ratemeter and periodmeter modes description 14
     1.13.10 Ratemeter ‘rt.6’ configuration menu ........... 14
     1.13.11 Quadrature ratemeter ‘rtq.7’ configuration menu 15
     1.13.12 Periodmeter ‘Prd.8’ configuration menu ....... 15
     1.13.13 Accepted sensors and signals .................. 16
     1.13.14 Sensor configuration menu ....................... 17
     1.13.15 Alarms ........................................... 18
     1.13.16 Alarms configuration menu ....................... 19
     1.13.17 Fast access ...................................... 20
     1.13.18 ‘On power up’ function ........................ 20
  1.14 Full configuration menu ............................... 24
  1.15 Factory configuration ................................ 27
  1.16 Mounting .............................................. 28
  1.17 Installation precautions ............................. 29
  1.18 Warranty .............................................. 29
  1.19 CE declaration of conformity ........................ 29

2. Output and control modules ................................ 30
  2.1 Module R1 .............................................. 30
  2.2 Module T1 .............................................. 30
  2.3 Module SSR ............................................. 31
  2.4 Module AO .............................................. 31
  2.5 Module RTU ............................................. 32
  2.6 Module S4 .............................................. 32
  2.7 Module S2 .............................................. 33
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 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.

1.6 Modular system

Large format meters from LDB Series 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 structure with the front metallic structure through an internal green-yellow cable. (dotted cable at Figure 3).
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.

![Figure 1 - Longer earth wire](image1)

![Figure 2 - Location of the internal 'PE' fixed screw and power cable gland](image2)

![Figure 3 - Power connections](image3)

1.8 Input signal connections

1. Unscrew the screws from the back cover and remove the back cover (see section 1.5).
2. Locate the input signal terminal (see section 1.4).
3. Pass the signal cable through the signal cable gland (see section 1.4).
4. Connect the input signal cables (see Figure 4).
5. 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.

![Figure 4 - Signal connections](image4)

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).

![Figure 4 - Signal connections](image4)
1.10 Technical specifications

**Digits**
- number of digits: 4 or 6 (see Table 9)
- digit: 7 segments
- view angle: 120°
- color: red or green
- digit height: (see Table 9)

**Reading**
- max., min.: (see Table 9)
- decimal point: configurable
- overrange / underrange: configurable (flash, reset or preset) (see section 1.13.23)
- display refresh: 15 refresh / second
- memory: yes, recovers the last counter value after power loss

**Input signal**
- signals accepted: NPN, PNP, Namur, pick-up, TTL, inductive, mechanical, quadrature, ...
- vdc max. at input: ±30 Vdc
- input impedance: 2.4 K with pull-up or pull-down
- frequency max./min.: 470 K without pull resistances

**Excitation voltage**
- output voltage: +18 Vdc, +15 Vdc, +9 Vdc, +5 Vdc
- maximum current: 70 mA
- protection: yes, current limited to 70 mA

**Power**
- power ‘H’
- power ‘L’
- consumption: (see Table 9)
- fuses: (see section 1.7)
- wire section: max. 2.5 mm²

**Configuration**
- front keypad with 3 keys
- remote keypad (see section 3.1)
- relay output, analog retransmission, Modbus RTU, ... (see section 2)

**Output and control options**
- relay output
- analog retransmission
- Modbus RTU

**Mechanical**
- IP protection:
- mounting connections:
- housing material:
- weight:
- front sizes:
- panel cut-out:
- depth:
- operation:
- storage:
- warm-up time:

**Temperature**
- operation: from 0 to +50 °C
- storage: from -20 to +70 °C
- warm-up time: 15 minutes

---

### Table 9 - Technical specifications associated to format

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

<table>
<thead>
<tr>
<th>Functions included</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast access menu</td>
<td>1.13.17</td>
</tr>
<tr>
<td>‘SLOW’ mode</td>
<td>1.13.9</td>
</tr>
<tr>
<td>‘FAST’ mode</td>
<td>1.13.3</td>
</tr>
<tr>
<td>Multiplier and divider</td>
<td>1.13.3</td>
</tr>
<tr>
<td></td>
<td>1.13.9</td>
</tr>
<tr>
<td>Reset</td>
<td>1.13.3</td>
</tr>
<tr>
<td></td>
<td>1.13.15</td>
</tr>
<tr>
<td></td>
<td>1.13.19</td>
</tr>
<tr>
<td>Preset</td>
<td>1.13.3</td>
</tr>
<tr>
<td>Trigger level</td>
<td>1.13.13</td>
</tr>
<tr>
<td>Sensor selection</td>
<td>1.13.13</td>
</tr>
<tr>
<td>Cycle counter</td>
<td>1.13.15</td>
</tr>
<tr>
<td>Retention memory</td>
<td>1.10</td>
</tr>
<tr>
<td>‘On Power Up’</td>
<td>1.13.18</td>
</tr>
<tr>
<td>Excitation voltage</td>
<td>1.13.13</td>
</tr>
<tr>
<td>Average filter</td>
<td>1.13.3</td>
</tr>
<tr>
<td></td>
<td>1.13.9</td>
</tr>
<tr>
<td>Memory</td>
<td>1.13.17</td>
</tr>
<tr>
<td>Password configuration</td>
<td>1.13.26</td>
</tr>
<tr>
<td>Alarms</td>
<td>1.13.15</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Brightness</td>
<td>1.13.29</td>
</tr>
</tbody>
</table>

1.12 Messages and errors

Error messages related to the local instrument are shown on display, in flash mode (see Table 11). Examples given are for instrument with 6 digit formats.

**Messages and errors on display**

- ‘Err.1’ incorrect password.
- ‘Err.W’ ‘Watchdog’ error
- ‘999999’ + flashing mode. Reading is in overrange.
- ‘-199999’ + flashing mode. Reading is in underrange.

Table 11 - Messages and error codes for local instrument
### 1.13 Configuration

#### 1.13.1 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 1.14.

**‘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 1.13.17 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.

---

**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 5 - Example of operation inside the ‘configuration menu’**

---

**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.
1.13.2 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 1.13.1. For a full vision of the ‘configuration menu’ structure see section 1.14.

To configure the initial set up, select the main function for the instrument, the decimal point position, configure the main function selected and configure the sensor.

Enter the ‘Main function’ (‘Func’) menu and select the desired function, from the 5 counting modes, 2 ratemeter modes and the periodmeter mode available.

- select ‘Counter’ (‘cn. 1’) for a standard impulse counter. Impulses are received at channel A. Channel B is disabled.
- select ‘Counter quadrature’ (‘cnq.2’) for a quadrature counter. Impulses are received at channel A and B, in quadrature format (typical for bidirectional encoders).
- select ‘Counter + inhibition’ (‘cnI.3’) for a counter with an external control to inhibit the counting. Impulses are received at channel A. The state of channel B controls the inhibition function.
- select ‘Counter + control add / subtract’ (‘cnc.4’) for a counter with an external control to add or subtract impulses received. Impulses are received at channel A. The state of channel B controls the add or subtract function.
- select ‘Counter differential’ (‘cnd.5’) for a counter where impulses received at channel A add and impulses received at channel B subtract.
- select ‘Ratemeter’ (‘rt.6’) for a standard ratemeter. Impulses are received at channel A. Channel B is disabled.
- select ‘Ratemeter quadrature’ (‘rtq.7’) for a quadrature ratemeter. Impulses are received at channel A and B, in quadrature format (typical for bidirectional encoders).
- select ‘Periodmeter’ (‘Prd.8’) for a standard periodmeter. Impulses are received at channel A. Channel B is disabled.

At the ‘Decimal point’ (‘dP’) parameter, select the decimal point position. Move the decimal point with the ‘LE’ ( ▼ ) key.

Configure the function mode selected (‘cnF.1’ to ‘cnF.7’) at the next menu entry (‘cnF.1’ to ‘cnF.8’). See sections 1.13.3 to 1.13.12.

Configure the sensor at the ‘SnSr’ menu. See section 1.13.13.
1.13.3 Counter modes description

The instrument offers 5 selectable impulse counter modes. Each mode has 2 independent input channels ‘A’ and ‘B’. Each impulse counter mode has a specific function assigned to channel ‘B’.

- **Standard counter** (‘cn.1’) *(see section 1.13.4)* counts impulses received at channel ‘A’. This counter has an optional ‘FAST’ mode to count high frequencies up to 250 KHz. The ‘FAST’ mode detects impulses on the rising edge of the impulse. The first edge received (rising or falling) after the instrument start up (after power loss or configuration change) will not be counted as a valid impulse, as it is needed for internal initialization.

- **Quadrature counter** (‘cnq.2’) *(see section 1.13.5)* counts quadrature impulses received at channels ‘A’ and ‘B’, *(for example from a bidirectional encoder)*. The counter increases or decreases depending on the sense of turn of the encoder.

- **Counter with inhibit** (‘cnI.3’) *(see section 1.13.6)* counts impulses received at channel ‘A’ if channel ‘B’ is inactive. Activate channel ‘B’ to inhibit the counting of impulses received at channel ‘A’.

- **Counter with add / subtract control** (‘cnc.4’) *(see section 1.13.7)* increases the counter with impulses received at channel ‘A’ if channel ‘B’ is active. Deactivate channel ‘B’ to decrease the counter with impulses received at channel ‘A’.

- **Differential counter** (‘cnd.5’) *(see section 1.13.8)* increases the counter with impulses received at channel ‘A’ and decreases the counter with impulses received at channel ‘B’.

All counter modes have scalable reading through multiplier (1 to 999999) and divider (1 to 999999) parameters, configurable preset value (preset value loads on display when ‘reset’ function activates), configurable reset function and accessible from external terminal, front keypad or at alarm activation. Alarms with independent activation and deactivation delays and functions to load ‘preset’ or ‘0’ to generate cycles of counting from ‘preset’ to ‘alarm setpoint’ and back. The number of cycles is accessible. In case of power loss, the instrument recovers the last configuration and last counted value.

### 1.13.4 Standard counter ‘cn.1’ configuration menu

Configuration menu for mode ‘counter’ (‘cn.1’). Total impulses received are multiplied by the value of the ‘multiplier’ (‘MuLt’) parameter and divided by the ‘divider’ (‘dIV’) parameter. Result is shown on the display.

- set the ‘multiplier’ (‘MuLt’) parameter from 1 to 999999.
- set the ‘divider’ (‘dIV’) parameter from 1 to 999999.
- set the ‘Preset’ (‘PrSt’) parameter from -199999 to 999999. Activate the reset to load the preset value on display.
- at the (‘Mode’) parameter select ‘up’ to count upwards (impulses received add) or select ‘down’ to count downwards (impulses received subtract).
- at the ‘FAST’ (‘FASt’) parameter select ‘on’ to activate the fast mode. See section 1.13.3 for more information.

### 1.13.5 Quadrature counter ‘cnq.2’ configuration menu

Configuration menu for mode ‘quadrature counter’ (‘cnq.2’). Total impulses received are multiplied by the value of the ‘multiplier’ (‘MuLt’) parameter and divided by the ‘divider’ (‘dIV’) parameter. Result is shown on the display.

- set the ‘multiplier’ (‘MuLt’) parameter from 1 to 999999.
- set the ‘divider’ (‘dIV’) parameter from 1 to 999999.
- set the ‘Preset’ (‘PrSt’) parameter from -199999 to 999999. Activate the reset to load the preset value on display.
- at the (‘Mode’) parameter select ‘up’ to count upwards (impulses received add) or select ‘down’ to count downwards (impulses received subtract).
- at the ‘Quadrature edges’ (‘q.124’) parameter select the number of edges to consider. Select ‘1--1’ for 1 impulse per quadrature cycle, ‘1--2’ for 2 impulses per quadrature cycle, ‘1--4’ for 4 impulses per quadrature cycle.
### 1.13.6 Counter + inhibition ‘cn.3’ configuration menu

Configuration menu for mode ‘counter + control inhibition’ (‘cnI.3’). Total impulses received are multiplied by the value of the ‘multiplier’ (‘MuLt’) parameter and divided by the ‘divider’ (‘dIV’) parameter. Result is shown on the display.

- set the ‘Multiplier’ (‘MuLt’) parameter from 1 to 999999.
- set the ‘Divider’ (‘dIV’) parameter from 1 to 999999.
- set the ‘Preset’ (‘PrSt’) parameter from -199999 to 999999.
- set the ‘Mode’ (‘ModE’) parameter select ‘uP’ to count upwards (impulses increase the counter) or select ‘doWn’ to count downwards (impulses decrease the counter).
- at the ‘inhibition’ (‘Inh’) parameter select ‘on_h’ to inhibit the counter when channel ‘B’ is active (logical state ‘1’) or select ‘on_0’ to inhibit the counter when channel ‘B’ is inactive (logical state ‘0’).

### 1.13.7 Counter + control add / subtract ‘cnc.4’ configuration menu

Configuration menu for mode ‘counter + control add/ subtract’ (‘cnc.4’). Total impulses received are multiplied by the value of the ‘multiplier’ (‘MuLt’) parameter and divided by the ‘divider’ (‘dIV’) parameter. Result is shown on the display.

- set the ‘Multiplier’ (‘MuLt’) parameter from 1 to 999999.
- set the ‘Divider’ (‘dIV’) parameter from 1 to 999999.
- set the ‘Preset’ (‘PrSt’) parameter from -199999 to 999999.
- set the ‘Control A/S’ (‘Add’) parameter select ‘on_h’ to increase (impulses increase the counter) or select ‘on_0’ to decrease (impulses decrease the counter).

### 1.13.8 Differential counter ‘cnd.5’ configuration menu

Configuration menu for mode ‘differential counter’ (‘cnd.5’). Total impulses received are multiplied by the value of the ‘multiplier’ (‘MuLt’) parameter and divided by the ‘divider’ (‘dIV’) parameter. Result is shown on the display.

- set the ‘Multiplier’ (‘MuLt’) parameter from 1 to 999999.
- set the ‘Divider’ (‘dIV’) parameter from 1 to 999999.
- set the ‘Preset’ (‘PrSt’) parameter from -199999 to 999999.
- set the ‘Mode’ (‘ModE’) parameter select ‘uP’ to count upwards (impulses increase the counter) or select ‘doWn’ to count downwards (impulses decrease the counter).
- at the ‘inhibition’ (‘Inh’) parameter select ‘on_h’ to inhibit the counter when channel ‘B’ is active (logical state ‘1’) or select ‘on_0’ to inhibit the counter when channel ‘B’ is inactive (logical state ‘0’).

Impulses received on channel ‘A’ add to the counter. Impulses received on channel ‘B’ subtract from the counter.
1.13.9 Ratemeter and periodmeter modes description

The instrument offers 2 selectable ratemeter modes and 1 periodmeter mode. Ratemeters provide a reading proportional to the frequency measured, while reading at periodmeters is proportional to the time between impulses.

- Standard ratemeter (‘rt.6’) (see section 1.13.10) to read speed values from impulse frequency signals.
- Quadrature ratemeter (‘rtq.7’) (see section 1.13.11) to read speed values and the turning sense of the axis, from two quadrature frequency signals, such as those provided by a bidirectional encoder. Speed is positive when the quadrature turns clockwise and negative when turns counterclockwise.
- Standard periodmeter (‘Prd.8’) (see section 1.13.12) to read time between impulses. For applications with long periods (long time between impulses) the ‘SLOW’ mode offers the best possible response time for each application.

All modes have scalable reading through multiplier (1 to 999999) and divider (1 to 999999) parameters, and a configurable time window (‘GAtE’) to adjust the measure refresh time.

1.13.10 Ratemeter ‘rt.6’ configuration menu

Configuration menu for mode ‘ratemeter’ (‘rt.6’). Measured frequency is multiplied by the value of the ‘multiplier’ (‘MuLt’) parameter and divided by the ‘divider’ (‘dIV’) parameter. Result is shown on the display. The measure is updated on display as configured on the ‘GAtE’ parameter.

- set the ‘Multiplier’ (‘MuLt’) parameter from 1 to 999999.
- set the ‘Divider’ (‘dIV’) parameter from 1 to 999999.
- select the ‘Time window’ (‘GAtE’) parameter at 0.5, 1.0, 2.0, 4.0, 8.0 or 16.0 seconds. This parameter defines how often the measure will be refreshed on display. This parameter has no effect if the ‘SLOW’ mode is active.
- for slow frequencies activate the ‘SLoW’ parameter configuring the ‘tIME’ parameter between 1 and 1000 seconds. See 1.13.9 for more information. Configure the ‘nuMb’ parameter between 1 and 32 impulses.
- if reading is unstable, set the ‘Average filter’ (‘AVr’) parameter to ‘on’ to activate a recursive filter on the display, and configure the filter strength from 0.0 to 99.9. The filter is stronger for higher values. Strong filters make readings more stable and changes slower to update. Set ‘0’ to disable the filter.
1.13.11 Quadrature ratemeter ‘rtq.7’ configuration menu

Configuration menu for mode ‘quadrature ratemeter’ (‘rtq.7’). Measured frequency is multiplied by the value of the ‘multiplier’ (‘MuLt’) parameter and divided by the ‘divider’ (‘dIV’) parameter. Result is shown on the display. The measure is updated on display as configured on the ‘GAtE’ parameter.

- set the ‘Multiplier’ (‘MuLt’) parameter from 1 to 999999.
- set the ‘Divider’ (‘dIV’) parameter from 1 to 999999.
- select the ‘Time window’ (‘GAtE’) parameter at 0.5, 1.0, 2.0, 4.0, 8.0 or 16.0 seconds. This parameter defines how often the measure will be refreshed on display. This parameter has no effect if ‘SLOW’ mode is active.
- at the ‘Quadrature edges’ (‘q.124’) parameter select the number of edges to consider. Select ‘1--1’ for 1 impulse per quadrature cycle, ‘1--2’ for 2 impulses per quadrature cycle, ‘1--4’ for 4 impulses per quadrature cycle.
- for slow frequencies activate the ‘SLoW’ parameter configuring the ‘tIME’ parameter between 1 and 1000 seconds. See 1.13.9 for more information. Configure the ‘nuMb’ parameter between 1 and 32 impulses.
- if reading is unstable, set the ‘Average filter’ (‘AVr’) parameter to ‘on’ to activate a recursive filter on the display, and configure the filter strength from 0.0 to 99.9. The filter is stronger for higher values. Strong filters make readings more stable and changes slower to update. Set ‘0’ to disable the filter.

1.13.12 Periodmeter ‘Prd.8’ configuration menu

Configuration menu for mode ‘periodmeter’ (‘Prd.8’). Measured period is multiplied by the value of the ‘multiplier’ (‘MuLt’) parameter and divided by the ‘divider’ (‘dIV’) parameter. Result is shown on the display. The measure is updated on display as configured on the ‘GAtE’ parameter.

- set the ‘Multiplier’ (‘MuLt’) parameter from 1 to 999999.
- set the ‘Divider’ (‘dIV’) parameter from 1 to 999999.
- select the ‘Time window’ (‘GAtE’) parameter at 0.5, 1.0, 2.0, 4.0, 8.0 or 16.0 seconds. This parameter defines how often the measure will be refreshed on display. This parameter has no effect if ‘SLOW’ mode is active.
- for slow frequencies activate the ‘SLoW’ parameter configuring the ‘tIME’ parameter between 1 and 1000 seconds. See 1.13.9 for more information. Configure the ‘nuMb’ parameter between 1 and 32 impulses.
- if reading is unstable, set the ‘Average filter’ (‘AVr’) parameter to ‘on’ to activate a recursive filter on the display, and configure the filter strength from 0.0 to 99.9. The filter is stronger for higher values. Strong filters make readings more stable and changes slower to update. Set ‘0’ to disable the filter.
1.13.13 Accepted sensors and signals

The instrument accepts the usual sensors and impulse signals, and provides a list for the operator to choose his sensor. It also allows to configure a wide range of parameters to adapt the reading to other non usual sensors and signals. The directly selectable sensors are:

- Mechanical contact (free potential contact)
- Namur
- NPN and PNP, 2 or 3 wires
- Push-pull
- TTL and CMOS
- Pickup
- AC voltage signals up to 30 Vp (inductive)

The configurable parameters are:

- Pull-up/pull-down resistors can be enabled or disabled independently for channel ‘A’, channel ‘B’ and the reset channel.
- The trigger level can be manually configured to any value between 0.0 V and 3.9 V. While modifying the trigger level parameter, the two segments to the left show the actual state ‘1’ or ‘0’ for channels ‘A’ and ‘B’. This information helps to easily identify the real trigger level. When the left segments switch from ‘high’ to ‘low’ means that the trigger level for channels ‘A’ and ‘B’ has been reached. The same trigger level applies to channels ‘A’, ‘B’ and reset.
- Activation by rising or falling edges can be configured. Channels ‘A’ and ‘B’ share the same configuration. Reset has its own independent configuration.
- Excitation voltage can be configured to 5 V, 9 V, 15 V or 18 V, or even power off the excitation voltage.
- An antirrebound filter is configurable, by setting a time between 0 and 1000 mSeconds. When an impulse is received, the instrument inhibits the counting of new impulses for the time configured.

See Table 15 below for a list of directly selectable sensors, the associated configuration parameters for each one and connections. Parameters can be later on modified through the configuration menu.

For signal connections and reset connections, see section 1.8.

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Connections (0 signal Vexc)</th>
<th>Pulls</th>
<th>Vexc.</th>
<th>Antirrebound filter</th>
<th>Trigger level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical contact</td>
<td>0 V ‘A’</td>
<td>pull-up</td>
<td>no</td>
<td>100 mSeg.</td>
<td>2.5 Vdc</td>
</tr>
<tr>
<td>Namur</td>
<td>‘A’ Vexc</td>
<td>pull-down</td>
<td>9 Vdc</td>
<td>no</td>
<td>3.0 Vdc</td>
</tr>
<tr>
<td>NPN 2 wires</td>
<td>0 V ‘A’</td>
<td>pull-up</td>
<td>18 Vdc</td>
<td>no</td>
<td>2.5 Vdc</td>
</tr>
<tr>
<td>NPN 3 wires</td>
<td>0 V ‘A’ Vexc</td>
<td>pull-up</td>
<td>18 Vdc</td>
<td>no</td>
<td>2.5 Vdc</td>
</tr>
<tr>
<td>PNP 2 wires</td>
<td>0 V ‘A’</td>
<td>pull-down</td>
<td>18 Vdc</td>
<td>no</td>
<td>2.5 Vdc</td>
</tr>
<tr>
<td>PNP 3 wires</td>
<td>0 V ‘A’ Vexc</td>
<td>pull-down</td>
<td>18 Vdc</td>
<td>no</td>
<td>2.5 Vdc</td>
</tr>
<tr>
<td>Push-pull</td>
<td>0 V ‘A’ Vexc</td>
<td>no</td>
<td>18 Vdc</td>
<td>no</td>
<td>2.5 Vdc</td>
</tr>
<tr>
<td>TTL CMOS</td>
<td>0 V ‘A’</td>
<td>no</td>
<td>5 Vdc</td>
<td>no</td>
<td>2.5 Vdc</td>
</tr>
<tr>
<td>Pickup</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC&lt;30 Vp Inductive</td>
<td>0 V ‘A’</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>0 Vdc</td>
</tr>
</tbody>
</table>

Table 15 - Parameters configured and connections for listed sensors. Channel ‘B’ applies the same connections as indicated for channel ‘A’.

Figure 6 - ‘Trigger sense’ for detection of trigger level
The 'Sensor' ('SnSr') configuration menu contains all parameters related to the detection of the input signal, excitation voltage and trigger levels.

- enter the ‘Automatic configuration’ ('Auto') menu to select a standard sensor from the list. The instrument will configure the appropriate parameters for the sensor selected, as indicated at Table 15. If the instrument does not detect the signal with this configuration, the following parameters can be manually reconfigured.

- at ‘Channel A pulls’ ('PuL.A') select 'PuP' to activate the internal pull-up resistors needed for NPN sensors, select 'P.dn' to activate the internal pull-down resistors needed for PNP sensors, or select 'no' to disable the pull resistors. Selecting pull-up or pull-down resistors sets the trigger level to 2.5 Vdc.

- at ‘Channel B pulls’ ('PuL.B') applies the same as previous entry but for channel B.

- 'Reset pulls' ('PuL.r') - applies the same as previous entry but for the reset channel.

- at ‘Trigger level’ ('trIG') configure the trigger level to detect the impulses. Signals levels above the trigger level are ‘1’ signals, and signal levels below trigger level are ‘0’ signals. Trigger level is selectable between 0.0 and 3.9 Vdc. Channels ‘A’ and ‘B’ share the same trigger level. Trigger level for reset channel is fixed at 2.5 Vdc. Vertical leds to the left are part of the 'trigger sense' utility to help locate the real trigger level for the actual signal. See section 1.13.13 for more information.

- at ‘Channel A activation’ ('Act.A') configure the activation of channel ‘A’ by rising edge ('on_h') or falling edge ('on_0')

- at ‘Reset activation’ ('Act.r') configure the activation of reset by rising edge ('on_h') or falling edge ('on_0')

- at ‘Excitation voltage’ ('V.EXc') configure the value for the excitation voltage to 5 Vdc, 9 Vdc, 15 Vdc or 18 Vdc. Select 'no' to disable the excitation voltage.

- at ‘Antirrebound’ ('rbnd') configure the filter that prevents mechanical rebounds to be accepted as real impulses. Configure a value between 0 and 1000 mSeconds. When an impulse is received, the instrument inhibits the counting of new impulses for the time configured. When time is over, the next impulse is accepted and the filter activates again. Recommended value is 100 mSeconds for a mechanical contact.
1.13.15 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.

- **Configurable parameters**
  Each alarm has several parameters for configuration, starting with the usual setpoint, 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).

- **Activation and deactivation delays**
  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.

- **Second setpoint**
  Configuring a second setpoint creates ‘windowed alarms’. The windowed alarm controls with a single relay output if the reading is inside or outside the values defined (see Figure 8).

- **Inverted relay**
  Activate the ‘inverted relay’ function to invert the activation logic of the associated relay.

- **Locked alarms**
  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, 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 1.13.17).

![Figure 7 - Example for alarm with 2 setpoint](image1)

![Figure 8 - Example for alarm with 2 setpoints](image2)
To configure the alarm, access the alarm menu ('ALr1', 'ALr2' or 'ALr3') and configure the following parameters:

- at the ‘Active’ (‘Act’) parameter select ‘on’
- 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 1.13.17).
- 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.
- to work with ‘windowed alarms’ (see Figure 8) activate ‘Setpoint 2’ (‘SET2’) to ‘on’ and then configure the desired second setpoint value. Second setpoint must always be higher in value than the first setpoint.
- 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 1.13.19).
- 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.
1.13.17 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 and minimum 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.

1.13.18 ‘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, and an automatic reset of the counter. 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.

1.13.19 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 1.13.15).

*Example: an impulse counter activates alarm 1 when reading reaches 153.000. Automatically the instrument activates a reset, reading goes to ‘0’, and relay 1 is activated to inform that the required level has been reached. Counter remains at 0 receives several additional impulses, related to the system not stopping immediately. When the operator arrives, reloads the system and presses key ‘LE’ to return the reading to ‘0’, unlocks the alarm and restarts the system.*
1.13.20 ‘Fast access’ configuration menu

At the ‘Key UP (‘fast access’)’ (%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 1.13.17.

- 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 cycles’ (%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.

1.13.21 ‘On power up’ 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 1.13.18.

- 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.

1.13.22 ‘Key LE’ configuration menu

The ‘LE’ (锔) key at the front of the instrument can be configured to activate several functions. For more information see section 1.13.19.

- the ‘No function’ (%nonE) value assigns no function.
- the ‘Front reset’ (%F.rSt) value assigns the reset function.
- the ‘Alarm unlock’ (%A.Lck) value assigns the manual alarm unlocking, when the ‘Locked alarms’ (%A.Lck) function is active.
- the ‘Reset and alarm unlock’ (%Fr.AL) value assigns both functions at the same key.
1.13.23 ‘Overrange / underrange’ function

The ‘Counter overrange’ (‘c.orG’) and ‘Counter underrange’ (‘c.urG’) parameters configure the behavior of the instrument when reading is higher than ‘999999’ (overrange) or lower than ‘-199999’ (underrange). Select ‘FLSH’ to enter reading into flash mode. Select ‘to_0’ to apply a reset to ‘0’. Select ‘to_P’ to apply a reset to preset value.

1.13.24 Left zeros function

The ‘Left zeros’ (‘L.ZEr’) parameter controls the left zeros on or off.

1.13.25 Excitation voltage function

At the ‘Vexc control’ (‘V.ctr’) parameter select ‘on’ to activate the ‘Err.8’ message, when consumption requested to the excitation voltage is higher than the current the instrument can provide.
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.
Press 'SQ' ( ■ ) for 1 second to access the 'Configuration menu'.

**1.14 Full configuration menu**

- **Main function**
  - Func
  - cn 1
  - cn 92
  - cn 1.3
  - cn 4
  - cn 5
  - rt 6
  - rt 97
  - Pr db

- **Counter**

- **Quadrature counter**

- **Counter + inhibition**

- **Counter + control add/subtract**

- **Differential counter**

- **Ratemeter**

- **Quadrature ratemeter**

- **Periodmeter**

- **Multiplier**

- **Divider**

- **Preset**

- **Preset value**

- **Mode**

- **Increasing**

- **Decreasing**

- **Inhibition**

- **Inhibits if channel 'B' to high**

- **Inhibits if channel 'B' to low**

- **Multiplier**

- **Divider**

- **Preset value**

- **Add/Subtract**

- **Seconds**

- **Ratemeter conf.**

- **Gate**

- **Time window**

- **Full configuration menu**

- **Press 'SQ' ( ■ ) for 1 second to access the 'Configuration menu'.
1.15 Factory configuration

Function counter (‘cn.1’)
Decimal point no
Counter configuration
Multiplier x1
Divider /1
Preset 0
Mode up
‘FAST’ off
Sensor
Pulls on channel A no pull resistor
Pulls on channel B no pull resistor
Pulls on reset pull-up
Trigger 2.5 Vdc
Activation for channel A on rising edge (‘on_h’)
Excitation voltage 5 Vdc
Antirrequency filter 0 mSeconds
Tools
Fast access (Key UP) off
‘On Power Up’
Delay 0 seconds
Key ‘LE’ reset function
Memory of maximum -199999
Memory of minimum 999999
Memory of cycles 0
Counter overrange flash
Counter underrange flash
Left zeros off
Vexc. control off
Password off
Brightness 3
Alarms 1,2 and 3
Active off (disabled)
Type maximum
Setpoint 1000
Hysteresis 0 counts
Activation delay 0.0 seconds
Deactivation delay 0.0 seconds
Setpoint 2 off
On Alarm continue
Inverted relay off
Locked alarms off

Factory configuration for Ratemeter (‘cnF.6) and periodmeter (‘cnF.8) modes.
Multiplier x1
Divider /1
Time windows 0.5
‘SLOW’ mode
’tIME 0 (off)
numB 1
Recursive filter 0 (off)
1.16 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 9). 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.

- Wall mount. Mount the side fixations against the wall, as shown (see Figure 11). 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.

- Hanging mount. Mount the side fixations as shown (see Figure 10). 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, .... see the position of the fixations at the images below.
1.17 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.

1.18 Warranty

Please see the last page for Omega’s warranty disclaimer

1.19 CE declaration of conformity

Supplier: Omega Engineering
Products: LDB-C1

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

<table>
<thead>
<tr>
<th>EN-61000-4-2</th>
<th>By contact ±4 kV</th>
<th>Criteria B</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN-61000-4-3</td>
<td>By air ±8 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td>EN-61000-4-4</td>
<td>On AC power lines: ±2 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td></td>
<td>On DC power lines: ±2 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td></td>
<td>On signal lines: ±1 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td>EN-61000-4-5</td>
<td>Between AC power lines ±1 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td></td>
<td>Between AC power lines and earth ±2 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td></td>
<td>Between DC power lines ±1 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td></td>
<td>Between DC power lines and earth ±2 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td></td>
<td>Between signal lines and earth ±1 kV</td>
<td>Criteria B</td>
</tr>
<tr>
<td>EN-61000-4-6</td>
<td>30 A/m at 50/60 Hz</td>
<td>Criteria A</td>
</tr>
<tr>
<td>EN-61000-4-8</td>
<td>0 % 1 cycle</td>
<td>Criteria A</td>
</tr>
<tr>
<td></td>
<td>40 % 10 cycles</td>
<td>Criteria A</td>
</tr>
<tr>
<td></td>
<td>70 % 25 cycles</td>
<td>Criteria B</td>
</tr>
<tr>
<td></td>
<td>0 % 250 cycles</td>
<td>Criteria B</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Type of relay</th>
<th>3 contacts (Com, NO, NC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. current</td>
<td>3 A (resistive load)</td>
</tr>
<tr>
<td>Voltage</td>
<td>250 Vac continuous</td>
</tr>
<tr>
<td>Isolation</td>
<td>3500 Veff</td>
</tr>
<tr>
<td>Terminal</td>
<td>plug-in screw clamp, pitch 5.08 mm</td>
</tr>
<tr>
<td>Installation allowed</td>
<td>slot 1, slot 2, slot 3</td>
</tr>
</tbody>
</table>

Figure 12 - Module ‘R1’ and internal schematic

Figure 13 - Connections for ‘R1’ relay output module

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.

<table>
<thead>
<tr>
<th>Type of output</th>
<th>transistor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. voltage</td>
<td>35 Vdc</td>
</tr>
<tr>
<td>Max. current</td>
<td>50 mA</td>
</tr>
<tr>
<td>Isolation</td>
<td>3500 Veff, optoisolated</td>
</tr>
<tr>
<td>Terminal</td>
<td>plug-in screw clamp, pitch 5.08 mm</td>
</tr>
<tr>
<td>Installation allowed</td>
<td>slot 1, slot 2, slot 3</td>
</tr>
</tbody>
</table>

Figure 14 - Module ‘T1’ and internal schematic

Figure 15 - Connections for ‘T1’ transistor output module
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.

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 - Module ‘SSR’ and internal schematic

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 from LDB series. 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.

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 - Module ‘AO’
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.

2.6 Module S4
The S4 module provides an isolated RS-485 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.
2.7 Module S2

The S2 module provides an isolated RS-232 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.

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

Figure 24 - Communications module Module ‘S2’

Figure 25 - Connections for RS-232 ‘S2’ communications module
Options and Accessories

Index

1.1 Read this first .............................................. 2
1.2 Modular architecture ...................................... 2
1.3 Installation and start-up ................................. 2
1.4 To access the instrument ................................. 3
1.5 Modular system ............................................. 3
1. Options R1, T1 and SSR .................................. 4
  1.1 Module R1 .................................................. 4
  1.2 Module T1 .................................................. 4
  1.3 Module SSR ................................................. 5
2. Option AO ..................................................... 6
  2.1 Connection examples .................................... 6
  2.2 Configuration menu ....................................... 7
  2.3 Error codes ............................................... 7
3. Option RTU .................................................. 8
  3.1 Registers accessible through Modbus RTU ............ 8
  3.2 Configuration menu ....................................... 9
  3.3 Exception codes .......................................... 9
  3.4 Compatible versions ..................................... 9
  3.5 Description and example of registers ................. 10
4. Option S4 .................................................... 11
  4.1 Accessible registers ..................................... 11
  4.2 Configuration menu ....................................... 12
  4.3 Compatible versions ..................................... 12
  4.4 Frame types .............................................. 13
  4.5 Frame structure .......................................... 13
  4.6 Error codes ............................................... 13
  4.7.1 Frames ‘PING’ (32) and ‘PONG’ (33) ............... 14
  4.8 Frame examples .......................................... 14
  4.8.1 Frames ‘RD’ (36) and ‘ANS’ (37) .................... 14
  4.8.2 Frames ‘ERR’ (38) .................................. 14
  4.7.1 Frames ‘PING’ (32) and ‘PONG’ (33) ............... 14
  4.7 CRC calculation ......................................... 14
5. Option S2 .................................................... 15

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:

<table>
<thead>
<tr>
<th>Format</th>
<th>Digits</th>
<th>Digit height</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDB-24</td>
<td>4</td>
<td>60 mm</td>
<td>2</td>
</tr>
<tr>
<td>LDB-44</td>
<td>4</td>
<td>100 mm</td>
<td>2</td>
</tr>
<tr>
<td>LDB-26</td>
<td>6</td>
<td>60 mm</td>
<td>3</td>
</tr>
<tr>
<td>LDB-46</td>
<td>6</td>
<td>100 mm</td>
<td>3</td>
</tr>
</tbody>
</table>

• 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 from menu entries ‘Opt.1’, ‘Opt.2’ or ‘Opt.3’, depending on the slot where the module has been installed.

11. configure the parameters at the ‘Configuration menu’.
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 an 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.

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’ or ‘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

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

![Figure 1 - Detail for the ‘R1’ module and internal schematic](image)

![Figure 2 - Connections for the ‘R1’ relay output module](image)

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

1.2 Module 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 at slot 1, slot 2, slot 3

![Figure 3 - Detail for the ‘T1’ module and internal schematic](image)

![Figure 4 - Connections for the ‘T1’ transistor output module](image)

<table>
<thead>
<tr>
<th>Option</th>
<th>T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of output</td>
<td>transistor</td>
</tr>
<tr>
<td>Max. voltage</td>
<td>35 Vdc</td>
</tr>
<tr>
<td>Max. current</td>
<td>50 mA</td>
</tr>
<tr>
<td>Isolation</td>
<td>3500 Veff, optoisolated</td>
</tr>
<tr>
<td>Type of terminal</td>
<td>plug-in screw clamp</td>
</tr>
<tr>
<td></td>
<td>pitch: 5.08 mm</td>
</tr>
<tr>
<td>Installation</td>
<td>allowed at slot 1, slot 2, slot 3</td>
</tr>
</tbody>
</table>

![Table](image)
1.3 Module SSR

**Option SSR**

<table>
<thead>
<tr>
<th>Type of output</th>
<th>to control SSR relay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>+15 Vdc</td>
</tr>
<tr>
<td>Max. current</td>
<td>45 mA</td>
</tr>
<tr>
<td>Isolation</td>
<td>1000 Vdc</td>
</tr>
<tr>
<td>Type of terminal</td>
<td>plug-in screw clamp</td>
</tr>
<tr>
<td>pitch</td>
<td>5.08 mm</td>
</tr>
</tbody>
</table>

Installation allowed at slot 1, slot 2, slot 3

---

**Figure 5 - Detail for the ‘SSR’ module and internal schematic**

---

**Figure 6 - Connections for the SSR control output module**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Not connected</td>
</tr>
<tr>
<td>B</td>
<td>Collector (-)</td>
</tr>
<tr>
<td>C</td>
<td>+15 Vdc (+)</td>
</tr>
</tbody>
</table>
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.

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

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.

2.1 Connection examples

Figure 7 - Detail for the ‘AO’ module

Figure 8 - Connections for ‘AO’ analog output module

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.hl') and ‘High Output’ (‘Ao.hl’)

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.

![Diagram of configuration menu]

Example - 4/20 mA, analog output associated to a reading of -50.0 to 100.0

- 'd.Lo' = '-50.0'
- 'd.hl' = '100.0'
- 'Ao.hl' = '20.00'
- 'Ao.Lo' = '4.00'

Reading

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.hl’ = ‘d.Lo’
- ‘Ao.hl’ = ‘Ao.Lo’
- (‘Ao.hl’ - ‘Ao.Lo’) > (‘d.hl’ - ‘d.Lo’)

<table>
<thead>
<tr>
<th>Jumper M</th>
<th>Jumper open</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jumper V</td>
<td>Jumper closed</td>
</tr>
</tbody>
</table>

Figure 11 - Connections for 0/10 Vdc.
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**

<table>
<thead>
<tr>
<th>Type of output</th>
<th>Modbus RTU communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function implemented</td>
<td>4 (Read_INPUT_Registers)</td>
</tr>
<tr>
<td>Addresses</td>
<td>01 to 247</td>
</tr>
<tr>
<td>Exception codes</td>
<td>see section 3.3</td>
</tr>
<tr>
<td>Registers*</td>
<td>see section 3.1</td>
</tr>
</tbody>
</table>

*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 ºC, storage from -20 to +70 ºC
- **Factory configuration**: ‘Address 1’, ‘Speed 19.2 Kbps’, ‘Format 8e1’, ‘Decimal point Auto’
- **Installation allowed at**: slot 1, slot 2, slot 3

### 3.1 Registers accessible through Modbus RTU

<table>
<thead>
<tr>
<th>Register</th>
<th>Name</th>
<th>Description</th>
<th>Size</th>
<th>Refresh</th>
<th>6 Digit Models (LDB-26 y LDB-46)</th>
<th>4 Digit Models (LDB-24 y LDB-44)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>DISPLAY1_L</td>
<td>Display value</td>
<td>16 bits</td>
<td>same as display</td>
<td>9999999 to -19999999</td>
<td>9999 to -19999</td>
</tr>
<tr>
<td>1</td>
<td>DISPLAY1_H</td>
<td></td>
<td>16 bits</td>
<td></td>
<td>0 to 6</td>
<td>0 to 4</td>
</tr>
<tr>
<td>2</td>
<td>DECIMALES1</td>
<td>Decimals on display</td>
<td>16 bits</td>
<td>every 30 seconds</td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>3</td>
<td>MAXMEM_L</td>
<td>Memory of maximum</td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>4</td>
<td>MAXMEM_H</td>
<td></td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>5</td>
<td>MINMEM_L</td>
<td>Memory of minimum</td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>6</td>
<td>MINMEM_H</td>
<td></td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>7</td>
<td>SETPOINT1_L</td>
<td>Setpoint 1 value</td>
<td>16 bits</td>
<td>every 2 seconds</td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>8</td>
<td>SETPOINT1_H</td>
<td></td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>9</td>
<td>SETPOINT2_L</td>
<td>Setpoint 2 value</td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>10</td>
<td>SETPOINT2_H</td>
<td></td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>11</td>
<td>SETPOINT3_L</td>
<td>Setpoint 3 value</td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>12</td>
<td>SETPOINT3_H</td>
<td></td>
<td>16 bits</td>
<td></td>
<td>9999999 to -19999999</td>
<td>999999 to -199999</td>
</tr>
<tr>
<td>13</td>
<td>STATUS</td>
<td>Alarm status Instrument status</td>
<td>16 bits</td>
<td>same as display</td>
<td>bit 0...7 alarm status bit 8...16 instrument status</td>
<td></td>
</tr>
<tr>
<td>14 to 16</td>
<td>Reserved</td>
<td>Reserved</td>
<td>16 x 3 bits</td>
<td>Not accessible</td>
<td>Not accessible</td>
<td></td>
</tr>
</tbody>
</table>

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’ (‘bItS’) 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’ device 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 cannot process the function or register requested.

The ‘EXCEPTION_CODES’ configured in the RTU module are:

<table>
<thead>
<tr>
<th>Exception code</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ILLEGAL_FUNCTION</td>
<td>Requested function is not supported</td>
</tr>
<tr>
<td>1</td>
<td>ILLEGAL_DATAADDRESS</td>
<td>Requested register is not supported</td>
</tr>
</tbody>
</table>

Table 2 - Exception codes

3.4 Compatible versions

<table>
<thead>
<tr>
<th>Formats</th>
<th>Firmware version</th>
<th>Formats</th>
<th>Firmware version</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDB-26, LDB-46</td>
<td>---</td>
<td>LDB24-P, LDB44-P</td>
<td>41.57</td>
</tr>
<tr>
<td>LDB26-P, LDB46-P</td>
<td>50.00</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>LDB26-C1, LDB46-C1</td>
<td>27.08</td>
<td>LDB24-C1, LDB44-C1</td>
<td>47.07</td>
</tr>
<tr>
<td>LDB26-CR, LDB46-CR</td>
<td>28.02</td>
<td>LDB24-C1, LDB44-C1</td>
<td>48.05</td>
</tr>
</tbody>
</table>

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
*available registers can vary for different instruments
Isolation 1000 Vdc
Temperature operation from 0 to 50 ºC
storage from -20 to +70 ºC
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.’

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.

<table>
<thead>
<tr>
<th>Register</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>DISPLAY1</td>
<td>Display1 value</td>
</tr>
<tr>
<td>1</td>
<td>MAXMEM</td>
<td>Memory of maximum</td>
</tr>
<tr>
<td>2</td>
<td>MINMEM</td>
<td>Memory of minimum</td>
</tr>
<tr>
<td>3</td>
<td>AL1</td>
<td>Setpoint 1 value</td>
</tr>
<tr>
<td>4</td>
<td>AL2</td>
<td>Setpoint 2 value</td>
</tr>
<tr>
<td>5</td>
<td>AL3</td>
<td>Setpoint 3 value</td>
</tr>
<tr>
<td>6</td>
<td>STATUS</td>
<td>Alarm status</td>
</tr>
</tbody>
</table>

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' '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).

<table>
<thead>
<tr>
<th>Bit 0</th>
<th>Alarm 1 status (0 = inactive, 1 = active)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 1</td>
<td>Alarm 2 status (0 = inactive, 1 = active)</td>
</tr>
<tr>
<td>Bit 2</td>
<td>Alarm 3 status (0 = inactive, 1 = active)</td>
</tr>
<tr>
<td>Bit 3 to 15</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
4.2 Configuration menu

At the ‘Configuration ASCII’ ('AAscI') 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’ ('bIts') 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

<table>
<thead>
<tr>
<th>Formats</th>
<th>Version firmware</th>
<th>Formats</th>
<th>Version firmware</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDB-26, LDB-46</td>
<td></td>
<td>LDB-24, LDB-44</td>
<td></td>
</tr>
<tr>
<td>LDB26-P, LDB46-P</td>
<td>50.00</td>
<td>LDB24-P, LDB44-P</td>
<td>41.57</td>
</tr>
<tr>
<td>LDB24-T, LDB44-T</td>
<td></td>
<td>LDB24-P, LDB44-P</td>
<td></td>
</tr>
<tr>
<td>LDB24-R, LDB44-R</td>
<td></td>
<td>LDB24-P, LDB44-P</td>
<td></td>
</tr>
<tr>
<td>LDB26-C1, LDB46-C1</td>
<td>27.08</td>
<td>LDB24-P, LDB44-P</td>
<td></td>
</tr>
<tr>
<td>LDB26-CR, LDB46-CR</td>
<td>28.02</td>
<td>LDB24-P, LDB44-P</td>
<td></td>
</tr>
</tbody>
</table>

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

<p>| | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>x</td>
<td>32</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>32</td>
<td>n+1</td>
<td>[data]</td>
<td>x</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

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’).

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

**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** display overrange
- **error 3** display underrange
- **error 4** CRC error
- **error 5** 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

<table>
<thead>
<tr>
<th>Header</th>
<th>Trail</th>
</tr>
</thead>
<tbody>
<tr>
<td>STX ID RSV FROM TO REG RSV LONG CRC ETX</td>
<td></td>
</tr>
<tr>
<td>2 36 32 32 60 32 32 32 58 3</td>
<td></td>
</tr>
<tr>
<td>Start RD --- 0 28 0 --- 0 CRC Stop</td>
<td></td>
</tr>
</tbody>
</table>

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

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.

<table>
<thead>
<tr>
<th>Header</th>
<th>Trail</th>
</tr>
</thead>
<tbody>
<tr>
<td>STX ID RSV FROM TO REG RSV LONG CRC ETX</td>
<td></td>
</tr>
<tr>
<td>2 38 32 43 32 33 32 32 46 3</td>
<td></td>
</tr>
<tr>
<td>Start ERR --- 11 0 1 --- 0 CRC Stop</td>
<td></td>
</tr>
</tbody>
</table>

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.
- if (CRC0<32) -> CRC=^CRC0 (one’s complement function)
- if (CRC0>31) -> CRC=CRC0

```c
//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.

<table>
<thead>
<tr>
<th>Option</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of output</td>
<td>RS-232 ASCII communication</td>
</tr>
<tr>
<td>Bus</td>
<td>RS-232</td>
</tr>
<tr>
<td>Speed</td>
<td>57.6 Kbps a 600 bps</td>
</tr>
<tr>
<td>Data format</td>
<td>8n1 (standard), 8o1, 8n2, 8e1</td>
</tr>
</tbody>
</table>

| 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 |

Figure 16 - Detail for the ‘S2’ module

Figure 17 - Connections for ‘S2’ module
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).
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.

OMEGA is a trademark of OMEGA ENGINEERING, INC.

© Copyright 2018 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without the prior written consent of OMEGA ENGINEERING, INC.
Where Do I Find Everything I Need for Process Measurement and Control?
OMEGA...Of Course!
Shop online at omega.com

TEMPERATURE
☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
☑ Wire: Thermocouple, RTD & Thermistor
☑ Calibrators & Ice Point References
☑ Recorders, Controllers & Process Monitors
☑ Infrared Pyrometers

PRESSURE, STRAIN AND FORCE
☑ Transducers & Strain Gages
☑ Load Cells & Pressure Gages
☑ Displacement Transducers
☑ Instrumentation & Accessories

FLOW/LEVEL
☑ Rotameters, Gas Mass Flowmeters & Flow Computers
☑ Air Velocity Indicators
☑ Turbine/Paddlewheel Systems
☑ Totalizers & Batch Controllers

pH/CONDUCTIVITY
☑ pH Electrodes, Testers & Accessories
☑ Benchtop/Laboratory Meters
☑ Controllers, Calibrators, Simulators & Pumps
☑ Industrial pH & Conductivity Equipment

DATA ACQUISITION
☑ Communications-Based Acquisition Systems
☑ Data Logging Systems
☑ Wireless Sensors, Transmitters, & Receivers
☑ Signal Conditioners
☑ Data Acquisition Software

HEATERS
☑ Heating Cable
☑ Cartridge & Strip Heaters
☑ Immersion & Band Heaters
☑ Flexible Heaters
☑ Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL
☑ Metering & Control Instrumentation
☑ Refractometers
☑ Pumps & Tubing
☑ Air, Soil & Water Monitors
☑ Industrial Water & Wastewater Treatment
☑ pH, Conductivity & Dissolved Oxygen Instruments