Battery-powered signal converter for magnetic-inductive flow meters
model FLC-406
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1. Introduction

1.1 Conventions
In order to draw the attention of all personnel working with the equipment supplied by Euromisure, the points of particular importance described in this manual are highlighted with graphic signs that will make them easily identifiable.

CAUTION / WARNING!
...indicates vital information and points to be observed. Please refer to the related documents.

NOTE
...indicates information and points of particular importance to be observed.

1.2 General information

WARNING!
It is very important that all personnel working with the equipment have read and understood the instructions and indications provided in this manual, and that they follow them prior to using the equipment itself. The manufacturer assumes no responsibility for the consequences resulting from improper use by the operators.

The operator shall bear responsibility for the suitability of the device for the specific purpose. The warranty will be considered void in cases of improper installation and use of the devices (systems).

- The manufacturer will not be liable for any kind of damage resulting from the use of its products, including, but not limited to those deemed direct, indirect, incidental, punitive and consequential. The installation, connection, commissioning and maintenance must be performed by staff specifically qualified and authorized for that purpose.
- The personnel in charge of the installation must make sure that the measurement system is properly connected as per the wiring diagram indicated in this document.
- The manufacturer shall bear responsibility for any damages or injuries resulting from any misunderstanding of this manual. In order to avoid possible accidents to persons or things caused by incorrect interpretation of the instructions, the user must not proceed with operations and/or interventions on the converter if there are uncertainties or doubts regarding the operation(s) to be performed. We recommend contacting Assistance Service for clarifications in this regard for more precise instructions.

For applications that require high working pressures or substances that may be hazardous to people, environment, equipment or anything else if a pipe breakage occurs, Euromisure recommends to take necessary precautions, such as adequate positioning and protection or installation of a guard or safety valve, before installing the converter. The device contains live electrical components, thus the installation, monitoring and maintenance must be carried out by qualified and experienced staff fully aware of all the necessary precautions. Before opening any inner part, disconnect the power supply. The flow meter consists of metal and plastic parts, all of which must be in compliance with local rules and requirements concerning waste disposal.

1.3 Manufacturer’s statement
- Stresses and loads possibly caused by earthquakes, traffic, strong winds, fire damages, vibrations and natural disasters were not taken into account in the phase of designing.
- Do not install the device so that it acts as a focus for pipeline stresses. Take into account any external loads in the device configuration.
- Do not exceed the pressure and/or temperature ratings indicated on the product lable or in this Operating Manual during operation.

1.4 Packing check
At the moment of purchase and/or upon the receipt of the product, the buyer is strongly advised to check the quality of the packaging, which must be intact without visible dents, and completely and correctly closed.
When opening the packaging, also check that the product complies with the information on the packing list in terms of completeness of components/accessories.

1.5 Preliminary notes
The main parts that make up the magnetic-inductive flow meter are:
- The sensor - installed in the pipes with the use of flanges or threaded connections.
- The converter - installed on the sensor (in the Compact version) or in its proximity (in the Remote version) connected by two cables.
See the following paragraphs for more detailed indications on correct use and installation.

1.6 Product identification
Each FLC-406 converter supplied by Euromisure has an adhesive product lable, on which the following information are reported.
- Model: sensor and converter model;
- CE conformity mark;
- S/N: serial number that identifies the converter and the sensor;
- Y: year of construction;
- Size: nominal diameter, standard and nominal pressure flanges;
- Q3: nominal flow rate and ratio R (Qnom / Qmin);
- Power Supply: supply voltage and/or battery;
- MAP: instrument nominal pressure;
1. Introduction / 2. Product description

- Press. loss class: max pressure drop class in the sensor;
- Env. class: environmental class;
- EMC class: Electromagnetic Compatibility class;
- T: totalizer that cannot be reset;
- P: resettable partial totalizer.

WARNING!
The product label must not be removed, damaged or impaired. It must also be kept clean from dirt and miscellaneous adhesions. The information reported represent the only safe and unambiguous way to recognize the type of converter in your possession.

2. Product description

2.1 General description
FLC-406 is an electronic converter that, paired with an Euromisure magnetic-inductive sensor, is able to display measured flow rate on the LCD screen together with one of the 4 totalizers available; other information and some basic settings are directly accessible using the 4-button interface. Two independent positive and negative pulse outputs allow connection with any external meter (max 30 V AC or DC / 100 mA). The required power supply is between 12 and 24 V DC and a battery pack can be connected to attain uninterrupted service even in the event of power failure. A GSM module can also be installed to allow remote transmission of measurements.

NOTE
The data transmitted remotely are not considered legally relevant and have the sole purpose of providing a remote viewing. The integrity and correctness of the data transmitted are not covered by MID certification.

2.2 Coupling
The maximum diameter of the sensor that can be paired with the FLC-406 is 600 mm. Backup battery life is affected by the size of the sensor. The flow meter can be ordered both in a compact and separate version, with a maximum length of 30 mt cable.

2.3 Measurement characteristics
- Flow speed range: from 0.015 m/s to 10 m/s.
- Liquid conductivity: \( \geq 20 \, \text{uS/cm} \).
- Sampling: 3.125 Hz nominal powered unit (depends on the diameter); battery mode (low power): from 1/5 Hz at 1/60 Hz (default 1/15 Hz).

2.4 Data storage
All parameters, totalizers and the register are stored in a non-volatile memory.

2.5 Display
The LCD screen can display an 8 and a 6-digit number plus different information icons, allowing the user to view different information and set many parameters. The details of what can be shown are:
- Instant flow
- Positive totalizer (T+)
- Negative totalizer (T−)
- Partial Positive (P+)
- Partial negative (N−)
- Date and time
- Converter temperature
- Code and value of the corresponding parameter.

2.6 Battery
Lithium batteries are primary energy sources with high energy content, and are designed to satisfy the highest possible safety standards. However, they can represent a potential hazard if subject to improper electrical or mechanical use. In many cases, this is associated with a production of excessive heat, in which the increased internal pressure could damage the cells. The following precautions should therefore be observed when handling and using lithium batteries:
- Do not short circuit, charge, overcharge or connect to incorrect polarity.
- Do not expose the battery to temperatures higher than those specified.
- Do not crush, puncture or open cells or disassemble.
2. Product description / 3. Converter

battery packs.
- Do not weld or braze on the battery body or battery packs.
- Do not expose the contents to water.

The UN document n. 3091 class 9 covers lithium batteries packed with equipment or within it. The UN document no. 3090 class 9 covers the transport of stand-alone batteries. The following basic precautions should therefore be followed when transporting lithium batteries:
- Transport only in special packages with special shipping labels and documents.
- Use caution when handling, transporting and packing.
- The gross mass of the package must be limited according to the type of transport. In general, a gross mass of less than 5 kg is acceptable for all forms of transport.
- The batteries comply with the requirements stated in "UN Manual of tests and criteria, Part III, subsection 38.3" for transport by air and in accordance with ADR regulations for transport by truck / ship.

![Diagram of FLC-406 converter]

**WARNING!**
Remove the battery from the transmitter before sending the flow meter to Euromisure in case of maintenance work in warranty.

3. Converter

- Infrared port
- Push buttons 1-4
- Status LED
- Cable glands for pulse and other I/O
- Sensor signal
- Sensor coils
- Positive pulse output
- Negative pulse output
- SIM gate
- Grounding connection
- Battery pack connection
- LED Power indicator
- 12/24 V input
3. Converter

3.1 System start
Once the physical installation of the instrument is complete, the electronic converter can be switched on by connecting the 12/24 V power supply and/or by connecting the battery pack to the connector. Different information is displayed to the user and a basic configuration is required.

3.1.1 Bootloader version and checksum
The bootloader is a separate software required to download new firmware to the converter.

3.1.2 Firmware version and checksum
It refers to the main firmware.

3.1.3 Battery replacement notification
If the unit is powered by a new battery pack, it is necessary to select «YES» by pressing P4 to reset the battery energy meter. If the unit has just been disconnected and turned back on with the same battery pack, the correct selection is "NO" (P1).

3.1.4 Date and time setting
Check and, if necessary, adjust the date and time.
The flashing values can be setted using P3 / P4.
P2 selects the next value in the sequence: year-> month-> day-> hour-> minute.
After selecting the last value, a further press of P2 confirms the value and go to the next screen.
P1 confirms the current settings and exits.

3.1.5 Main display screen
The converter is now ready.
The positive totalizer appears on the first line and the instantaneous flow rate on the second.
The current technical unit is shown on the right side.

3.2 User interface
Starting from the main display screen (flow rate and total positive total), the 4 buttons can be used to perform various operations. In detail:
- Scroll through the display options of the first and second lines.
- P3: scrolls the instantaneous flow rate, T+ in maximum resolution, T- in maximum resolution, the time and the board temperature. See the following sequence.
3. Converter

- **P4**: scrolls the totalizers (reduced resolution) and the date in this order: T ↔ T→ P ↔ P→ date.

- **P2**: scrolls the number of active alarms (first row) / total alarms (second row) In a normal working condition no alarms will be signaled.

If one (or more) alarm condition is registered, it will be scrolled.

- **P1**: entering the password to access the function selection (the preset value is 000000).

Use **P4/P3** to increase/decrease the current value of the digit. Go to the next digit with **P2**. When the last digit is entered, a further press of **P2** will unlock access to the function selection if the entered password is correct, otherwise the figure will return to the first one.

- Function selection code: each value corresponds to a menu or a parameter set function (see Par. 3.7 ‘Functions’).
For selecting the function code use **P4/P3**; use **P2** to enter the selected code. Pressing **P1** returns to the main screen.
Within a specific function, the functionality of the buttons may be different; in this example, P4/P3 increases and decreases the value of the parameter shown on the first line, P2 confirms the value and returns when the function is selected. P1 stops the operation and returns to the main screen.

3.3 Display of the totalizer overflow counter

If the totalizers reach the display saturation value, they perform the rollover and continue to count; while one of the four totalizers is displayed, pressing P2 and P3 together will show its overflow counter.

3.4 Cellular communication

NOTE

This function is available only if optional cellular hardware is installed.

Some basic information on cellular activity is shown directly on the FLC-406 display. See the following details:

Cellular signal level

- None / Insufficient
- Low
- Ok
- Optimal

- new parameter/command received. Press P2 to confirm.
3. Converter

3.5 First activation
Depending on the instrument configuration, the converter can be shipped with the battery pack disconnected or already connected.

- If disconnected: the unit is automatically operational once connected (see page 11).
- If already connected: the unit is hibernated and must be activated.

To activate a hibernated unit, the P2 and P3 keys must be kept pressed for 5 seconds.

3.6 Display test
The integrity of the LCD display can be checked by pressing P1 and P4 together from the current measurement screen; all segments of the display will be activated and deleted in sequence. In addition the version and revision, bootloader revision (VV.RR b) / firmware version and revision (VV.RR f) and the corresponding checksum are displayed.

The previous measurement screen will be restored at the end of this operation.
3.7 Functions
A list of all the functions available by the user interface is shown below.

<table>
<thead>
<tr>
<th>FUNC</th>
<th>DESCRIPTION</th>
<th>ACTION P1</th>
<th>ACTION P2</th>
<th>ACTION P3</th>
<th>ACTION P4</th>
<th>MIN VALUE</th>
<th>MAX VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Instant flowrate unit</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>1</td>
<td>6</td>
<td>1=m; 2=m³; 3=L; 4=ML; 5=m³; 6=gal; 7=BBL. Setting 1 (meters) the time base is automatically set to 1 s.</td>
</tr>
<tr>
<td>02</td>
<td>Time base unit</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>1</td>
<td>4</td>
<td>1=s; 2=m; 3=h; 4=d</td>
</tr>
<tr>
<td>03</td>
<td>Counter unit</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>1</td>
<td>4</td>
<td>1=m³; 2=L; 3=ML; 4=gal; 5=BBL; 6=ft³; 7=Alin</td>
</tr>
<tr>
<td>04</td>
<td>Zero calibration</td>
<td>Back to main screen</td>
<td>Cancel operation + return to function selection</td>
<td>No action</td>
<td>Start calibration</td>
<td>-</td>
<td>-</td>
<td>The display shows the time left to complete the operation. At the end of the operation, the main screen is displayed.</td>
</tr>
<tr>
<td>05</td>
<td>Ka factor</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Back to main screen</td>
<td>Back to main screen</td>
<td>-10.0</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>Sensor diameter</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Back to main screen</td>
<td>Back to main screen</td>
<td>1</td>
<td>4000</td>
<td>The parameter is electrically blocked; read only.</td>
</tr>
<tr>
<td>07</td>
<td>Pulse volume</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Back to main screen</td>
<td>Back to main screen</td>
<td>1</td>
<td>10000</td>
<td>The parameter is electrically blocked; read only.</td>
</tr>
<tr>
<td>08</td>
<td>Pulse technical unit</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Back to main screen</td>
<td>Back to main screen</td>
<td>1</td>
<td>4</td>
<td>1=mL; 2=L; 3=ML; 4=gal</td>
</tr>
<tr>
<td>09</td>
<td>Pulse duration</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>5</td>
<td>500</td>
<td>Expressed in ms (seconds/1000).</td>
</tr>
<tr>
<td>10</td>
<td>Measurement frequency</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection.</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>5</td>
<td>60</td>
<td>Interval between two measurements [s].</td>
</tr>
<tr>
<td>11</td>
<td>Date and time</td>
<td>Back to the previous field; if in years setting field, back to main screen.</td>
<td>Forward to the next field; if in minutes setting field, back to main screen.</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>2015/01/01 00:00</td>
<td>2099/12/31 23:59</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Damping</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>2</td>
<td>100</td>
<td>Number of samples averaged.</td>
</tr>
<tr>
<td>13</td>
<td>Bypass</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>2</td>
<td>95</td>
<td>Bypass filter threshold, % of full scale.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>FUNC</th>
<th>DESCRIPTION</th>
<th>ACTION P1</th>
<th>ACTION P2</th>
<th>ACTION P3</th>
<th>ACTION P4</th>
<th>MIN VALUE</th>
<th>MAX VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Peak cut</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>1</td>
<td>90</td>
<td>Pulse suppression filter threshold, % of full scale.</td>
</tr>
<tr>
<td>15</td>
<td>Cut off</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Back to main screen</td>
<td>Back to main screen</td>
<td>0.00</td>
<td>10.00</td>
<td>[m/s] - the parameter is electrically locked.</td>
</tr>
<tr>
<td>16</td>
<td>Flowrate display digits</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>4</td>
<td>Number of decimal digits of the instant flow shown on the display.</td>
</tr>
<tr>
<td>17</td>
<td>Totalizers display digits</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>4</td>
<td>Number of decimal places of the totalizers</td>
</tr>
<tr>
<td>18</td>
<td>Empty pipe threshold</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>200</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Full scale</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>1.0</td>
<td>10.0</td>
<td>Full scale expressed in m/s (not connected to the diameter value).</td>
</tr>
<tr>
<td>20</td>
<td>Partial positive totalizer reset</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>No action</td>
<td>Partial positive tot. reset (must be hold pressed for 5 s).</td>
<td>No action</td>
<td>No action</td>
<td>The display shows the positive partial totalizer.</td>
</tr>
<tr>
<td>21</td>
<td>Partial negative totalizer reset</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>No action</td>
<td>Partial negative tot. reset (Must be hold pressed for 5 s)</td>
<td>No action</td>
<td>No action</td>
<td>The display shows the negative partial totalizer.</td>
</tr>
<tr>
<td>22</td>
<td>Firmware version</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>No action</td>
<td>No action</td>
<td>-</td>
<td>-</td>
<td>Show the current version. Firmware revision.</td>
</tr>
<tr>
<td>23</td>
<td>Firmware checksum</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>No action</td>
<td>No action</td>
<td>-</td>
<td>-</td>
<td>Shows the installed firmware CRC32.</td>
</tr>
<tr>
<td>24</td>
<td>Empty pipe detection mode</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>3</td>
<td>0: Disabled; 1: Enabled on the fourth electrode; 2: Enabled on the measuring electrodes; 3: Enabled on both</td>
</tr>
<tr>
<td>25</td>
<td>Password setup</td>
<td>Back to main screen</td>
<td>Forward to the next digit, confirm and return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>000000</td>
<td>999999</td>
<td>- - Replaces the parameters of the instrument with those saved as user copy.</td>
</tr>
<tr>
<td>26</td>
<td>Bootloader version</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>No action</td>
<td>No action</td>
<td>-</td>
<td>-</td>
<td>Shows the current version. Revision of the bootloader.</td>
</tr>
<tr>
<td>27</td>
<td>Bootloader checksum</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>No action</td>
<td>No action</td>
<td>-</td>
<td>-</td>
<td>Show the current bootloader CRC32</td>
</tr>
<tr>
<td>28</td>
<td>Line frequency</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>1</td>
<td>Set the frequency of the power supply</td>
</tr>
<tr>
<td>29</td>
<td>Load user parameters</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>(Long press) load user parameters</td>
<td>-</td>
<td>-</td>
<td>Replaces the parameters of the instrument with those saved as user copy.</td>
</tr>
<tr>
<td>30</td>
<td>Save user parameters</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>(Long press) save user parameters</td>
<td>-</td>
<td>-</td>
<td>Save the instrument parameters as a user copy.</td>
</tr>
</tbody>
</table>
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<th>MAX VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Load factory parameters</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>(Long press) load factory parameters</td>
<td></td>
<td></td>
<td>It replaces the parameters of the instrument with the factory ones.</td>
</tr>
<tr>
<td>32</td>
<td>Damping in low power mode</td>
<td>Back to main screen</td>
<td>Confirm + return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>1</td>
<td>100</td>
<td>Number of samples to be averaged over.</td>
</tr>
</tbody>
</table>
| 33   | Auto power off | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 7 | Shutdown time: 
  0=20 s; 
  1=1 min; 
  2=3. |
| 34   | Sensor offset | Back to main screen | Return to function selection | No action | No action | -999999999 | 999999999 | It shows the offset of the paired sensor. |
| 35   | Log of firmware download attempts | Back to main screen | Return to function selection | Show previous record | Show next record | Oldest registry (0) | Last registry available | It shows log of firmware download attempts. |
| 36   | Service code | Not accessible | Not accessible | Not accessible | Not accessible | Not accessible | Function not accessible; attempt to access will show “denied” on the screen. |
| 37   | Negative pulse output configuration | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 3 | |
| 38   | Selection of the measurement to map on 4-20 mA output | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 4 | 0: Flow; 
  1: Full scale percent; 
  2: Pressure; 
  3: Temperature T1 
  4: Temperature T2 |
| 39   | Measurement value to be mapped on 4 mA output | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 1000 | Measurement value to be mapped on 4 mA output (enabled only with 4-20 mA card). |
| 40   | Measurement value to be mapped on 20mA output | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 1 | 0: signals error in case of reverse flow |
| 41   | Flow send | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 1 | 0: flow simulation disabled 
  1: flow simulation enabled (enabled only with 4-20 mA card). |
| 42   | Flow simulation value | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 1000 | Value of the flow to be simulated (enabled only with 4-20 mA card). |
| 43   | Flow simulation value | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 9 | 0: Always off; 
  1: On every 30 s; 
  2: On every 60 s; 
  3: On every 2 min; 
  4: On every 5 min; 
  5: On every 10 min; 
  6: On every 15 min; 
  7: On every 30 min; 
  8: On every 60 min; 
  9: Always on (Enabled only with Bluetooth-Modbus card). |
| 44   | Bluetooth access interval | Back to main screen | Return to function selection | Decrease value | Increase value | 0 | 9 | |
### 3. Converter

<table>
<thead>
<tr>
<th>FUNC</th>
<th>DESCRIPTION</th>
<th>ACTION P1</th>
<th>ACTION P2</th>
<th>ACTION P3</th>
<th>ACTION P4</th>
<th>MIN VALUE</th>
<th>MAX VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>Bluetooth access duration</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>3</td>
<td>30</td>
<td>Duration in seconds of the Bluetooth access (enabled only with Bluetooth-Modbus card installed).</td>
</tr>
<tr>
<td>46</td>
<td>MODBUS access duration</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>12</td>
<td>0: Always off; 1: On every 5 s; 2: On every 10 s; 3: On every 15 s; 4: On every 30 s; 5: On every 1 min; 6: On every 2 min; 7: On every 5 min; 8: On every 10 min; 9: On every 15 min; 10: On every 30 min; 11: On every 60 min; 12: Always on (enabled only with Bluetooth-Modbus card installed).</td>
</tr>
<tr>
<td>47</td>
<td>MODBUS baud rate</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>6</td>
<td>Baud rate Modbus 0: 2400; 1: 4800; 2: 9600; 3: 19200; 4: 38400; 5: 57600; 6: 115200 (default) (enabled only with Bluetooth-Modbus card installed).</td>
</tr>
<tr>
<td>48</td>
<td>MODBUS access duration</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>12</td>
<td>0: Always off; 1: On every 5 s; 2: On every 10 s; 3: On every 15 s; 4: On every 30 s; 5: On every 1 min; 6: On every 2 min; 7: On every 5 min; 8: On every 10 min; 9: On every 15 min; 10: On every 30 min; 11: On every 60 min; 12: Always on (enabled only with Bluetooth-Modbus card installed).</td>
</tr>
<tr>
<td>49</td>
<td>Number of MODBUS bits</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>1</td>
<td>Number of modbus bits 0: 8 data bits 1: 7 data bits</td>
</tr>
<tr>
<td>50</td>
<td>MODBUS parity</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>2</td>
<td>MODBUS parity 0: None 1: Odd</td>
</tr>
<tr>
<td>51</td>
<td>MODBUS stop bit</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>1</td>
<td>MODBUS stopbit 0: 1 bit stop 1: 2 bit stop (enabled only with Bluetooth-Modbus card installed).</td>
</tr>
<tr>
<td>52</td>
<td>MODBUS address</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>0</td>
<td>255</td>
<td>MODBUS address (enabled only with Bluetooth-Modbus card installed).</td>
</tr>
<tr>
<td>53</td>
<td>MODBUS byte-order</td>
<td>Back to main screen</td>
<td>Return to function selection</td>
<td>Decrease value</td>
<td>Increase value</td>
<td>1</td>
<td>5</td>
<td>MODBUS byte order 0: little endian 1: big endian 2: little endian byte swap.</td>
</tr>
</tbody>
</table>

■ = editable
■ = read only
4. Battery life

The converter is supported by an optional lithium battery pack and can operate for over 10 years in battery mode (depending on the configuration and working conditions). The residual life comes estimated by calculating the use of energy for the duration of the tool, so when the battery is replaced it is necessary to reset the battery usage counter. When switched on, the unit automatically takes the user to a screen selection (see SYSTEM START). Frequent unit waking up or entering very long shutdown times (feature 33 in the previous table) can shorten the expected battery life.

**Battery levels**

<table>
<thead>
<tr>
<th>Battery charged</th>
<th>25% or less</th>
<th>10% or less</th>
</tr>
</thead>
</table>

**Expected battery life (years) according to sensor diameter and sampling rate**
## 5. Auto diagnostics

During the measurement process, the FLC-406 detects automatically if error condition occurs and possibly stops the operation by reporting an alarm indication on the display. The following table describes the various conditions of alarm and converter behavior.

<table>
<thead>
<tr>
<th>Detected anomaly</th>
<th>Possible cause</th>
<th>Converter behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excitation failure.</td>
<td>■ Damaged sensor cables;</td>
<td>The measurement is forced to 0 and the error condition is displayed and recorded.</td>
</tr>
<tr>
<td></td>
<td>■ Sensor disconnected;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Damaged sensor coils.</td>
<td></td>
</tr>
<tr>
<td>Empty pipe detected on the fourth electrode.</td>
<td>■ The sensor is not completely full of liquid;</td>
<td>The measurement is forced to 0 and the error condition is displayed and recorded.</td>
</tr>
<tr>
<td></td>
<td>■ An air intake causes turbulence;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Sensor disconnected;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Damaged sensor cables;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Low liquid conductivity.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The measurement is forced to 0 and the error condition is displayed and recorded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To save battery, the excitation of the coils is stopped until the error condition is overcome.</td>
<td></td>
</tr>
<tr>
<td>Empty pipe detected / invalid measurement on the measuring electrodes.</td>
<td>■ The sensor is at least half empty;</td>
<td>The measurement is forced to 0 and the error condition is displayed and recorded.</td>
</tr>
<tr>
<td></td>
<td>■ Air drawn in due to turbulence;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Sensor disconnected;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Damaged sensor cables;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Low liquid conductivity;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ An electrical leak on the process influences the measurement;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ A high source of electromagnetic interference influences the measurement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The measurement is forced to 0 and the error condition is displayed and recorded.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To save battery, the excitation of the coils is stopped until the error condition is overcome.</td>
<td></td>
</tr>
<tr>
<td>The temperature exceeds the converter nominal operating range.</td>
<td>■ The surrounding temperature is above the working range;</td>
<td>The error condition is displayed.</td>
</tr>
<tr>
<td></td>
<td>■ The converter is installed with direct sunlight exposure</td>
<td></td>
</tr>
<tr>
<td>Wet electronic board.</td>
<td>The cap or a cable gland has not been closed properly causing water or moisture condensation in the converter housing</td>
<td>The error condition is displayed.</td>
</tr>
<tr>
<td>Supply voltage out of limit.</td>
<td>■ The battery is damaged or discharged;</td>
<td>The error condition is displayed.</td>
</tr>
<tr>
<td></td>
<td>■ An incorrect power source is connected to the converter.</td>
<td></td>
</tr>
<tr>
<td>Pulse overlap</td>
<td>Pulse settings are not compatible with the measured process.</td>
<td>The error condition is displayed.</td>
</tr>
<tr>
<td>Communication error with 4-20 mA board</td>
<td>■ Current loop interrupted;</td>
<td>The error condition is displayed.</td>
</tr>
<tr>
<td></td>
<td>■ Problems on connection cable between 4-20 mA board and measurement board;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ 4-20 mA board malfunction</td>
<td></td>
</tr>
<tr>
<td>Incorrect Bluetooth parameters warning.</td>
<td>Bluetooth power-on interval too short, battery life will be reduced</td>
<td>The error condition is displayed.</td>
</tr>
<tr>
<td></td>
<td>considerably.</td>
<td></td>
</tr>
<tr>
<td>The firmware checksum differs from the expected value.</td>
<td>The memory of the internal program has changed.</td>
<td>The error condition is displayed and the program execution stopped.</td>
</tr>
</tbody>
</table>
### 5. Auto diagnostics / 6. PC interface software

<table>
<thead>
<tr>
<th>Detected anomaly</th>
<th>Possible cause</th>
<th>Converter behavior</th>
<th>Icon displayed and corresponding error code</th>
</tr>
</thead>
<tbody>
<tr>
<td>The parameters checksum differs from the expected value.</td>
<td>Parameter data is corrupt.</td>
<td>The error condition is displayed and the program execution stopped.</td>
<td>![Attention Icon] 802</td>
</tr>
<tr>
<td>A watchdog reset has been performed</td>
<td>A disturbance has resulted in unmanaged behavior in the regular execution of the software.</td>
<td>The error condition is displayed and the program execution stopped.</td>
<td>![Attention Icon] 901</td>
</tr>
</tbody>
</table>

### 6. PC interface software

The supplied PC communication software is based on a proprietary protocol; its use is possible with the interface IrCOMM (USB to infrared adapter) and allows to:
- View live measurements in real time;
- View all parameters;
- Modify the editable parameters;
- Download the internal data logger;
- Update the firmware.

#### Main Dashboard - real live values and basic information

#### Data LOG - Internal process log download and CSV file export

#### Graphic - Recording of live measurements/Visualization

#### Configuration - Parameters setting & configuration
6. PC interface software

6.1 Firmware update
To update a newer firmware release, select the firmware ".hex" file and press "Download new firmware to converter". The progress of the firmware download is displayed while the instrument shows the sequence of internal operations. The previously installed firmware is saved in backup on a dedicated memory area, therefore in case of error during unloading, the converter will automatically restore the normal functionality. During the operation the red LED turns on lights up when the FLASH memory is cleared or written. At the end of the process, the unit will restart automatically.

Firmware updating steps

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Firmware check installed</td>
</tr>
<tr>
<td>1</td>
<td>Awaiting download request</td>
</tr>
<tr>
<td>2</td>
<td>Download request received</td>
</tr>
<tr>
<td>3</td>
<td>Clear download memory</td>
</tr>
<tr>
<td>4</td>
<td>Firmware download</td>
</tr>
<tr>
<td>5</td>
<td>Checking the downloaded firmware</td>
</tr>
<tr>
<td>6</td>
<td>Checking the downloaded firmware</td>
</tr>
<tr>
<td>7</td>
<td>Firmware update installed</td>
</tr>
<tr>
<td>8</td>
<td>Backup of the new firmware</td>
</tr>
<tr>
<td>9</td>
<td>Updating OK</td>
</tr>
<tr>
<td>10</td>
<td>Firmware reset installed (only during startup)</td>
</tr>
<tr>
<td>11</td>
<td>Firmware reset installed (after error during update)</td>
</tr>
</tbody>
</table>

6.2 Download attempt log
Any attempt to download the firmware is recorded in the internal memory. The log can store over 500 records: once completed, further downloads are not allowed. The download attempt log can be viewed on the converter display function 35 or by pressing P1 and P3 together on the main display screen. Each log information scrolls automatically in 4 screens. P3 and P4 can be pressed at any time to go to the previous or next saved recording.
6. PC interface software / 7. GSM

6.2.1 Additional information displayed

«Safe EEPROM secured»: the calibration and measurement parameters saved in the EEPROM memory are protected from writing attempts.

The checksum of the firmware or EEPROM data (parameters and/or totalizers)

7. GSM

The GSM module is an expansion of the FLC-406 electronic converter, which makes possible:
- Remote transmission of information available in the measuring instrument;
- Data reception for remote management of the instrument itself;
- Modification of some parameters;
- Converter FW update.

7.1 Main features

7.1.1 Fully autonomous operation
The module works as a completely autonomous unit, similar to an external GSM data logger: at regular intervals (minimum 60 s) it acquires the measurement data from the FLC-406 and saves them in its internal Flash memory.

7.1.2 Battery powered
Power is supplied via a battery pack with 2 batteries. Nominal battery life 5 years, with guaranteed minimum of 1 year regardless of module configuration.

7.1.3 Worldwide compatibility
The internal modem (Telit HE910-GL) was chosen to guarantee worldwide operation at least for bands B5, B8, B2, B1, B4; Frequencies [MHz] 800/850, 900, AWS 1700.1900.2100. Europe, Australia, New Zealand, Brazil, North America.

7.1.4 Data sending mode
Sending measurement data includes the following modes; SMS, E-mail; Email with attachment (containing the latest log lines).

7.1.5 Data transmission interval
The programmable data transmission interval is independent for each mode. The minimum interval is every hour. In case of error, the management of sending and attempts is completely delegated to the module.

7.1.6 Parameter configuration
The operating parameters are configured via the FLC-406 optical interface and via the MC User Interface software.

7.2 GSM connection
The software starts communication with the GSM module and downloads all its parameters by pressing the button.
7. GSM

7.3 Device settings
All communication parameters are set up by pressing the button.

Press the button to save the data on the form.

NOTE
Without this operation, no data on the form will change.

7.4 Phone number and email settings
Up to 5 mobile numbers / email addresses can be set.
7.5 Scheduling
The user can program the 4 independent programmers of the module: SMS, e-mail, e-mail with attachment.
For each scheduler it is possible to choose one of the four predefined types:
- Hourly interval (Send data/sms every hour).
- Daily per hour (Send data every day at a specified time).
- Day of the week (sends data every week at the selected day and time).
- Day of the month (Send data every month at the selected day and time).
You can also build a flexible schedule by choosing Day of the week, Day of the month and Time.

7.6 Data saving
To save the data on the module it is necessary to save the configuration file (including telephone / e-mail number and all the scheduler data) by pressing the button, then upload the file to the module by pressing the button.

![Image]

NOTE
Without this operation, no data on the settings will change.

7.7 Test
Press the button to test all the functions of the GSM module.
8. 4-20 mA output module

The 4-20 mA output module is an expansion of the FLC-406 electronic converter, which makes it possible to transmit one of the quantities measured on the 4-20 mA line LOOP POWERED [Loop voltage 24Vdc; maximum impedance 800 ohms].

It is possible to map on this output:
- Instant flow rate;
- Instantaneous flow rate as a percentage of the full scale;
- Pressure;
- Temperature T1;
- Temperature T2.

1. Sensor signal
2. Sensor coils
3. Positive pulse output
4. Negative pulse output
5. Pressure sensor input
6. 4-20 mA output
7. SIM gate
8. Grounding connection
9. Battery pack connection
10. LED Power indicator
11. 12/24 V input

It is possible:
- To select the flow rate value to be associated with 4 mA and that to associate with 20 mA.
- To select the current values to be generated in case of Overload / Underload according to the standard NAMUR N43 (es. AO-LL = 3.8mA, AO-UL = 21.6 mA).
- To manage error reporting via 4-20 mA by selecting the current values to be generated in the event of:
  - Reverse flow
  - Empty pipe
  - Coil error
  - Generic error

It is also possible to activate the simulation mode, setting the flow rate value that the instrument detects and verifying the correctness of the 4-20mA signal generated by the module. This simulation has a maximum duration of 20 minutes, after which the meter returns to normal operation. During the simulation mode, the total counters are not increased. In case of malfunction of the module, the error code 501 will be displayed on the instrument display.
9. Bluetooth® – Modbus module

The Bluetooth® - Modbus module is an expansion of the FLC-406 electronic converter, which makes it possible to communicate the instrument with a PC via Bluetooth and Modbus.

For communication on the PC side, a USB dongle will be provided to be connected to a USB socket on a computer with Windows operating system.

9.1 Bluetooth communication

Bluetooth is a device that consumes a lot of current so, to guarantee battery life, it will be activated periodically by the FLC-406 in order to search for a possible connection request from a PC. The periodicity of the ignition can be set from menu item 44. The following values are available:

- 0 = Off
- 1 = Power on every 30 seconds
- 2 = Power on every 60 seconds
- 3 = Power on every 2 minutes
- 4 = Power on every 5 minutes
- 5 = Power on every 10 minutes
- 6 = Power on every 15 minutes
- 7 = Power on every 30 minutes
- 8 = Power on every 60 minutes
- 9 = Always powered.

The switch-on duration is set by menu item 45, in a range between 3 and 30 sec.

- For distances between FLC-406 and PC shorter than 1 meter, a switch-on duration of 3 s is recommended (default).
- For distances between 2 and 4 meters, a switch-on time of 4 s is recommended.
- For distances over 5 meters we recommend an ignition duration of 5 s or more.

The module activates the Bluetooth connection with the selected periodicity and for the set duration, in search of the PC. Once the connection with the PC is established, the Bluetooth module will remain on for a maximum of 15 minutes allowing configuration and/or data download operations using the User Interface software.

By simultaneously pressing the P1 and P4 keys (device reset) you can immediately activate the search for Bluetooth communication. This activation will last for a maximum of 30 seconds and then the device will re-search for the connection with the periodicity set in parameters 44 and 45. The instruments are shipped by Euromisure with Bluetooth disabled. It is therefore necessary to activate the Bluetooth connection at the start by going to menu item 44 and selecting a value other than 0. For a first function test and for the initial configuration of the device, it is recommended to set parameter 44 to 1 (switch on every 30 seconds). At the end of this phase it is necessary to set the Bluetooth to turn on every 10 minutes.

NOTE

It is important to remember that the Bluetooth device has a high current consumption therefore, in order to preserve battery life, it is recommended to select a power-on interval of not less than 10 minutes. In case of selection of lower intervals, the instrument signals error 601.

9.2 PC connection through software interface

Communication between FLC-406 and PC (Windows) via Bluetooth is managed with the User Interface software, selecting Bluetooth instead of IrCOMM according to the following procedure:

- Insert the USB dongle into a free USB slot; a COM communication port will be generated.
- Open the User Interface software and select the menu item Options-> Settings-> Connection.
  - Select the COM port corresponding to the USB dongle.
  - Select Mode-> Bluetooth.
  - Click on Search.

The software will start searching for visible devices nearby. If the flag on “FLC-406 only” is selected, only FLC-406 devices will be filtered, otherwise all visible Bluetooth devices will be displayed.
9. Bluetooth – Modbus module

Once a device is found, click on the corresponding line. This will stop the search and connect to the device.

With the device connected, click on "Disconnect" to terminate the connection.

The next time you start, you can connect directly to the last paired device.

If multiple devices are paired, you can select which one to use at startup. From the settings menu, select the device in the list of Paired Devices.

- Click on Connect to connect the device.
- Click on Imp. Default to set the device to connect at startup.
- Click on Remove to remove it from the list.
10. Converter installation

Once the meter has been installed, the pulse outputs can be wired; the maximum voltage allowed is 30 V AC or DC (no polarity attention is required). The clean electronic contacts can handle a current up to 100 mA.

The battery pack must also be connected to the motherboard (if it is not shipped already connected). You must remove the battery pack, insert the connector and put it back in place.

Observe the orientation of the package as shown (see the image below). At this point the allowed parameters can be viewed and adjusted.

10.1 Grounding recommendation

The purpose of the ground connection is to protect the system from external electromagnetic interference and set the reference of meter measurement. A clean ground connection with the lowest possible resistance is required. We recommend using at least a 4mm² / AWG11 cable to make the ground connections. In the event that the liquid is not electrically connected to the pipes (plastic or internal coating), grounding rings are required. Missing or incorrect grounding will result in unpredictable behavior.
10. Converter installation

10.2 Separate configuration
All the grounding recommendations described on the previous page are also valid for this configuration. Please note that both the sensor and the converter must be grounded using two separate wires. Avoid placing the signal and power cables close together to minimize interference.

10.3 Remote configuration
Battery and pulse connection not shown, please consult the compact version.
11. Dismounting, return and disposal

11.1 Dismounting

**WARNING!**
Residual media in the dismounted instrument can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

11.2 Return

**WARNING!**
Do not disconnect while under voltage.

If you decide to put the converter out of service because it is definitely no longer in use, disconnect it from the electrical power source (FLC-406) and from the connection cables to the sensor before proceeding to its removal and its disposal.

**To avoid damage:**
1. Wrap the instrument in an antistatic plastic film.
2. Place the instrument, along with the shock-absorbent material, in the packaging. Place shock-absorbent material evenly on all sides of the transport packaging.
3. If possible, place a bag, containing a desiccant, inside the packaging.
4. Label the shipment as transport of a highly sensitive measuring instrument.

11.3 Disposal

Incorrect disposal can put the environment at risk. Dispose of instrument components and packaging materials in an environmentally compatible way and in accordance with the country-specific waste disposal regulations. The manufacturer declares that the design, development and construction of the CONVERTER have been carried out in compliance with the directive on the reduction of the use of dangerous substances with particular attention to waste electrical and electronic equipment (WEEE) supporting, from an environmental point of view and the protection of the health of the worker, the intervention of the subjects who participate in the installation, use and disposal of their products (manufacturer, distributors, consumers, operators involved in WEEE treatment).

Strictly observe the following when shipping the instrument. All instruments delivered to WIKA must be free from any kind of hazardous substances (acids, bases, solutions etc.).