Symbols Used

STOP

This symbol warns of possible danger.
Failure to heed this warning may result in personal injury or death, or property damage, including destruction.

Warning

This symbol warns the user of a possible fault.
Failure to heed this warning can lead to total failure of the device and any other connected equipment.

Attention

This symbol draws attention to important information.

Note
Safety Notes

The Transmitter Supply Converter must only be operated by trained personnel in accordance with this handbook.

The protection of operating personnel and of the system is only ensured if the devices are used in accordance with their intended purpose. Any other type of operation than that described in this manual places the safety and functionality of the devices and systems connected to them in question.

The devices may only be installed, connected, and adjusted by electrical professionals outside the hazardous area.

If faults cannot be eliminated, the devices must be taken out of operation and protected from being placed in service again inadvertently. Tampering with or making changes to the devices is dangerous and therefore not permitted. They render the warranty void.

The responsibility for the adherence to local safety standards lies with the operator.
Installation and Connection

Application Information

Bulletin 937 Intrinsically Safe Barriers transmit signals between field devices and a process control system/control system.

They are suitable for the connection of field devices used in potentially explosive atmospheres. Safe field circuits for these devices are intrinsically safe and are galvanically isolated from non-intrinsically safe circuits. establish an electromagnetic separation between the potentially explosive atmospheres and the safe areas in a system.

The transmitter supply converters are measuring units that provide an output signal consisting of a unit current signal (4 mA ... 20 mA). A transmitter power supply provides a transmitter with power and processes the current signal.

The transmitter supply converter translates a fully parameterizable partition of input signal into a proportional output current (4mA...20mA).

This output signal will be transferred to indicators or to analog inputs on the process control system/control system, for example. Both relay outputs of the transmitter supply converter can monitor two fully parameterizable trip values of the input signal.
Installation

The Transmitter Supply Converter can be mounted on a 35 mm standard rail corresponding to DIN EN 60175. The devices must be snapped onto the rail vertically, and never slanted or tipped to the side.

CORRECT: Device snapped on vertically.

INCORRECT: Device snapped on from the side. Can damage the contacts and cause the device to fail.
**Connection**

The removable terminals of the Bulletin 937 Converters simplify the connection and the switch cabinet assembly. They make it possible to replace devices quickly and without error if a customer service becomes necessary.

Terminals are equipped with screws, are self-opening, have a large connection area for a wire cross-section up to 2.5 mm²/14 AWG and coded plugs, making it impossible to mix them up.

**Connection terminals (Input) IS Side**

The intrinsically safe field circuit is connected to the **blue** terminals 1 and 3. These may be guided into the potentially explosive areas with connector cables in accordance with DIN EN 60079-14. Terminal 2 is always left unconnected.

The non-intrinsically safe field circuit is connected to the **black** terminals 1 through 3.

You can connect:
- a 3-wire transmitter
- a 2-wire transmitter with HART
- an active current source
Connection (Output) Safe Side

The functions of the other black terminals are as follows:

The control circuit and the power supply are connected to the black terminals 7 to 24.

The terminals have the following functions:

- Terminals 7/8: current output (terminal 9 not used)
- Terminals 10 ... 12: relay 1
- Terminals 16 ... 18: relay 2
- Terminals 23/24: (terminal 22 not used)

24 V DC power supply

Terminals 4 ... 6, 13 ... 15 and 19 ... 21 do not exist
Front

The following indicating and operating elements are located on the front of the Transmitter Supply Converter:

- LED CHK (red) to indicate a device fault
- LED PWR (green) to indicate the presence of the supply voltage
- LED OUT 1 (yellow) to indicate that relay 1 is active
- LED OUT 2 (yellow) to indicate that relay 2 is active
- RS 232 serial interface for a connection to a PC for setting parameters and diagnosis of the transmitter supply converter using FDT.
- Display for indication of the measured values, fault messages and parameterization modi
- Four keys for setting the parameters of the transmitter supply converter:
  ▲ (Up) ▼ (Down) ESC (Escape) OK
**Display modes and error messages**

In normal operation, the current measured value is indicated in the selected unit.

If the Alarm freeze is triggered but the device continues operating normally, a corresponding message appears in the second line of the display.

If a fault occurs, one of the following messages is displayed until the fault is rectified (when parameterized):

- *Err Mem* for device fault,
- *Err LB* for lead breakage,
- *Err SC* for short circuit,

The relays de-energizes when a fault occurs.

> The display of the device is updated at regular intervals. This can causes a short flickering of the display. This flickering isn’t a defect of the display.

**Editing Device Data**

**WARNING**: A change in device data will change the operation of the device!

**WARNING**: Before entering new data into the device, you should therefore as certain that no danger to the installation will result.

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**FDT Interface**

This manual describes Parameterization mode of the universal frequency converter using the control panel. Parameterization mode for the universal frequency converter is more convenient with a PC using Field Device Tool (FDT) software.

Some specialized functions can only be selected using the FDT, for instance, pulse suppression as an alternative to the start-up override.

The FDT interface is the specification describing the standardized data exchange between devices and control system or engineering or asset management tools. Examples include: PACTware™, FieldCare, FactoryTalk AssetCentre, and Process Device Configuration. FDT frame software can be downloaded from the web: www.pactware.com www.fdtgroup.org.

PACTware™ is trademark of PACTware Consortium
Parameterization mode control panel

Programming

Main menu parameterization mode

Display mode OK + ESC (simultaneously, 1 sec) → Unit ()
← ESC

Input ()

Output

Service

You can return to display mode from any point in the menu in parameterization mode by pressing the ESC key (possibly multiple times). If you do not press any key for 10 minutes in parameterization mode, the device automatically switches back into display mode.
Password

You can protect the current configuration from unauthorized changes by using a password (See Service; inactive when universal frequency converter is delivered).

If password protection is active, the various settings in parameterization mode are visible before entry of the password, but may not be changed. The first time an attempt is made to change a setting, the device automatically displays a window for entering the password.

- You must enter the password once each time after switching from display mode to parameterization mode.
- The password cannot be changed and is 1234.

How to enter the password:

*If the ▲ or ▼ keys are pressed, the value changes stepwise. If you hold the ▲ or ▼ key, the setting "rolls" to higher or lower values.
Navigation Method

The following illustration shows the navigation method in parameterization mode using the ▲, ▼, OK, and ESC keys:
Lowest menu level

*Choose Values, Enter Numbers*

At the lowest level of the menus, you can either choose between particular possible values for individual parameters, or enter a numeric value.

When entering numeric values, please note:

- If you press the ▲ or ▼ key, the value changes stepwise.
- If you hold the ▲ or ▼ key for a longer time, the value "rolls" to higher or lower values.
- The algebraic sign switches automatically.
- The decimal point is moved automatically.
Units

The following illustration shows the units menu. Menu items on the lowest level are outlined in bold.

The Universal Transmitter Power Supply measures in mA. Using the parameters zero point and conversion factor it converts the measured value into the selected units. These units are used for the display of the measured values and for all corresponding settings in the parameterization mode.

<table>
<thead>
<tr>
<th>Unit</th>
<th>°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>bar</td>
<td></td>
</tr>
<tr>
<td>Pa</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
</tr>
<tr>
<td>t</td>
<td></td>
</tr>
<tr>
<td>kg</td>
<td></td>
</tr>
<tr>
<td>km/h</td>
<td></td>
</tr>
<tr>
<td>m/s</td>
<td></td>
</tr>
</tbody>
</table>

Continued from the left

<table>
<thead>
<tr>
<th></th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>m³/h</td>
<td></td>
</tr>
<tr>
<td>l/h</td>
<td></td>
</tr>
<tr>
<td>l/min</td>
<td></td>
</tr>
<tr>
<td>m³</td>
<td></td>
</tr>
<tr>
<td>l</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td></td>
</tr>
<tr>
<td>mA</td>
<td></td>
</tr>
</tbody>
</table>
Input

The following diagram shows the input parameters menu. Items from the lowest menu level are outlined in bold. The menu items *Zero point* and *Conversion factor* will **not** be shown if the unit mA is selected.
Line monitor

- If you select On for LB, an input current <0.2 mA will be registered as a lead break.
- If you select On for SC, an input current >0.22 mA will be registered as a short circuit.
- If you wish to process the ≤0.2 mA input values as measured values, you must deselect the lead breakage detection (Off LB). If not, an error will be signalled within the measuring range.

Zero point and Conversion factor

The device measures in mA. If you have selected different units, the device calculates the measured value in the selected units using the parameters Zero point and Conversion factor.

The parameters for your application must be determined according to the following formula:

\[
\text{Measured value in the selected units} = (\text{Original measured value [mA]} - \text{Zero point}) \times \text{Conversion factor}
\]

An arbitrary value between -15 mA and +15 mA can be set as the Zero point, and values between 0.100 and 5000 as the Conversion factor.

The following includes examples where the formulas are applied.
Example 1: selected unit °C, 0 °C ... 200 °C is to correspond to 4 mA ... 20 mA

- Linearization
  \[ y = m \times x + n \]

- Conversion factor = rise in the graph
  \[ m = \frac{(y_2 - y_1)}{(x_2 - x_1)} \]
  \[ m = \frac{(200 - 0)}{(20 - 4)} = 12.5 \]

- Zero point = intersection point with the x-axis on the graph, providing that the physical measuring range starts from 0 (y = 0 °C). The zero point corresponds to the lower measuring range limit (x = 4 mA) from which the measuring range starts.

The zero point can be calculated as follows:

\[ n = y - m \times x \]
\[ n = 200 - 12.5 \times 20 = -50 \]
\[ y = m \times x + n \]
\[ x = \frac{(y - n)}{m} \]
\[ x = \frac{(0 - 50)}{12.5} = 4 \]
Example 2: selected unit °C, 0 °C ... -100 °C is to correspond to 20 mA ... 0 mA

- Linearization
  \[ y = m \cdot x + n \]

- Conversion factor = rise in the graph
  \[ m = \frac{(y_2 - y_1)}{(x_2 - x_1)} \]
  \[ m = \frac{(100 - 0)}{(20 - 0)} = 5 \]

- Zero point = intersection point with the x-axis on the graph, with the condition that the physical
  
  The zero point can be calculated as follows: 
  \[ n = y - m \cdot x \]
  \[ n = -100 - 5 \cdot 0 = -100 \]
  \[ y = m \cdot x + n \]
  \[ y = 5 \cdot 0 - 100 \]
  \[ x = \frac{(y - n)}{m} \]
  \[ x = \frac{(0 + 100)}{5} = 20 \]
Example 3: selected unit bar, -4 bar ... 4 bar is to correspond to 4 mA ... 20 mA

- Linearization
  \[ y = m x + n \]
- Conversion factor = rise in the graph
  \[ m = \frac{(y2 - y1)}{(x2 - x1)} \]
  \[ m = \frac{(4 - 0)}{(20 - 12)} = 0.5 \]
- Zero point = intersection point with the x-axis on the graph (bar value at y = 0)
  \[ n = y - m x \]
  \[ n = 4 - 0.5 \times 20 = -6 \]
  \[ y = m x + n \]
  \[ x = \frac{(y - n)}{m} \]
  \[ x = \frac{(0 + 6)}{0.5} = 1 \]
Linearization

Using the FDT parameterization software, a linearization table can be saved in the Transmitter Supply Converter; for details of this function see On-line help. Via the operator panel you can merely switch the use of the table for the calculation of the output value on and off (On/Off).

Smoothing

For extremely variable measurement values, you can use *Smoothing* to influence how quickly an output reacts to a change in input value: 0 s = no smoothing, 255 s = maximum smoothing.
Relays

The following diagram shows the relay outputs menu. Items from the lowest menu level are outlined in bold.

From the Rel1 and Rel2 menu options, you can use the OK key to get to a menu in which you can enter individual parameters for the selected relay. Both menus are structured in the same way and are thus only described once. Information about current output.

Continued on next page
Operating behaviour

The switching direction can be set as Max or Min and the direction of action as Active or Passive.

Application ranges:

- Switching direction Max, mode of operation Active:
  alarm on trip value overrange, e.g. audible alarm on

- Switching direction Max, mode of operation Passive:
  switch off on trip value overrange, e.g. pump, heating, ... off; with large hysteresis Min/Max operation (pump, heating, ... on/off)

- Switching direction Min, mode of operation Active:
  alarm on trip value underrange, e.g. audible alarm on

- Switching direction Min, mode of operation Passive:
  switch off on trip value underrange, e.g. pump, heating, ... off; with large hysteresis Min/Max operation (pump, heating, ... off/on)
The exact operating behaviour of the Transmitter Supply Converter is shown in the following diagram:

Switching direction **Max**, mode of operation **Active**: energized, de-energized

Switching direction **Max**, mode of operation **Passive**: energized, de-energized

Switching direction **Min**, mode of operation **Active**: energized, de-energized

Switching direction **Min**, mode of operation **Passive**: energized, de-energized
Trip and Hysteresis

When entering the values for Trip and Hysteresis please note:
- Both values are to be entered in the units, which were selected under Units.
- You can enter values
  – between 0 mA and 24 mA and
  - between the converted values of these limits in the selected units; for conversion using the parameters Zero point and Conversion factor.
- The hysteresis must be selected as > 1 % of the trip point to prevent the relay from vibrating.
- As the representation of the operating behaviour, the following must apply: for the switching direction Max: Trip point - Hysteresis > 0
  - for the switching direction Min: Trip point + Hysteresis ≤ upper limit trip point

These input limits are automatically preset by the transmitter supply converter.

Alarm freeze

The Alarm freeze helps you to avoid that short-term trip value overranges are not noticed by the operating staff.

If Alarm freeze On has been selected, the new state is maintained after the relay switching until the ESC key is pressed or the device is restarted. These actions reset the relay, except for a limit violation.

Delay

If you set a time > 0 sec, you prevent short-time violations of the trip value from triggering an alarm.
- The relay only switches if the trip point is exceeded/fallen short of for a period that is longer than the delay time.
- The relay only switches back if the trip point -/+ hysteresis is fallen short of/exceeded for a period that is longer than the delay time.
- If the trip point is exceeded/fallen short of for a short time, this does not have any effects.
The following diagram shows the operating behaviour for the trip mode Max, operating mode Active.
Current output

The following illustrations show the current output menus. Items from the lowest menu level are outlined in bold. Review the information about relay outputs.
Characteristic

With the parameters Start value and End value establish a sub-range of the input signal as the measuring range of the application. This measuring range is formed linearly on the output signal.

The following table shows, for the various characteristics, the conversion of the Start value and End value and the behaviour during measuring overrange.

- The statements apply for the setting Inverted to Normal.
- If you select Inverted to Inverted, the conversion of Start value and End value are reversed. The start value is thus converted to 20 mA and the end value to 0 mA or 4 mA.
- Measuring overrange, which extend over the described linear range, cannot be evaluated. In the case of such overrange, the specified value is constantly output.
Example of a diagram of a mA measurement range on the output signal

Characteristic 4 mA ... 20 mA NE43, start value 2 mA, end value 10 mA

Example diagram displaying the input signal in °C to the output signal

Characteristic 4 mA ... 20 mA NE43, start value 0 °C, end value 200 °C.
Fault current

The following table shows the current output in the event of a fault, depending on the characteristic.

<table>
<thead>
<tr>
<th>Setting</th>
<th>0 mA ... 20 mA</th>
<th>4 mA ... 20 mA NE43</th>
<th>4 mA ... 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up/Down</td>
<td>21.5 mA with short-circuit</td>
<td>21.5 mA with short-circuit</td>
<td>22 mA with short-circuit (not distinguishable from End value overrange)</td>
</tr>
<tr>
<td></td>
<td>0 mA with lead breakage (not distinguishable from Start value measurement)</td>
<td>2.0 mA with lead breakage</td>
<td>0 mA with lead breakage (not distinguishable from Start value underrange)</td>
</tr>
<tr>
<td>Hold</td>
<td>Last measured value before the fault</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>21.5 mA</td>
<td>21.5 mA</td>
<td>22 mA (not distinguishable from End value overrange)</td>
</tr>
<tr>
<td>Min</td>
<td>0 mA (not distinguishable from Start value measurement)</td>
<td>2.0 mA</td>
<td>0 mA (not distinguishable from Start value underrange)</td>
</tr>
</tbody>
</table>

Start value and End value

Please note when entering Start value and End value:

- Both values are to be entered in the units, which were selected under Units.
- Values between 0 mA and 20 mA can be entered, or between the values of these limits converted into the selected units, using the parameters Zero point and Conversion factor.

The difference between End value and Start value must be at least 1 % of the End value (preset automatically by the transmitter supply converter).
Service

The following diagram shows the service parameter menus. Items from the lowest menu level are out-lined in bold.

**Reset:** Pressing the OK key when *On Reset* is flashing resets all settings on the transmitter supply converter to default. Any entries that you have made in parameterization mode are lost.
### Default settings

<table>
<thead>
<tr>
<th>Menu</th>
<th>Parameter</th>
<th>Default setting</th>
<th>Separate value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main menu</strong></td>
<td><strong>Unit</strong></td>
<td><strong>mA</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td><strong>Line monitor</strong></td>
<td><strong>On LB/On SC</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Zero point</strong></td>
<td></td>
<td><strong>4.000 mA</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Conversion factor</strong></td>
<td></td>
<td><strong>0.100</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Linearization</strong></td>
<td></td>
<td><strong>Off</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Smoothing</strong></td>
<td></td>
<td><strong>3 s</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Output Rel1</strong></td>
<td><strong>Min/Max (= switching direction)</strong></td>
<td><strong>Min</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Trip</strong></td>
<td></td>
<td><strong>16.00 mA</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
<td></td>
<td><strong>2.000 mA</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td></td>
<td><strong>Passive</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Alarm freeze</strong></td>
<td></td>
<td><strong>Off</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Delay</strong></td>
<td></td>
<td><strong>0 s</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Output Rel2</strong></td>
<td><strong>Min/Max (= switching direction)</strong></td>
<td><strong>Min</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Trip</strong></td>
<td></td>
<td><strong>2.000 mA</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
<td></td>
<td><strong>2.000 mA</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Mode</strong></td>
<td></td>
<td><strong>Active</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Alarm freeze</strong></td>
<td></td>
<td><strong>Off</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Delay</strong></td>
<td></td>
<td><strong>0 s</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Output Iout</strong></td>
<td><strong>Characteristics</strong></td>
<td><strong>4 mA ... 20 mA NE43</strong></td>
<td></td>
</tr>
</tbody>
</table>
### Bul. 937C Transmitter Supply Converter Installation Instructions

<table>
<thead>
<tr>
<th>Menu</th>
<th>Parameter</th>
<th>Default setting</th>
<th>Separate value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fault current</td>
<td>Min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Start value</td>
<td>0.000 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>End value</td>
<td>20.00 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inverted</td>
<td>Normal</td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>Password</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Language</td>
<td>ENG</td>
<td></td>
</tr>
</tbody>
</table>