Digital limit switch, model EGS80

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With regard to the supply of products, the current issue of the following document is applicable:
The general terms of delivery for products and services of the electrical industry, as published by the central association of the "Elektrotechnik und Elektronikindustrie (ZVEI) e.V.", including the supplementary clause "Extended reservation of title".
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1 Symbols Used

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
2 Overview

2.1 Range of Application

The devices are used for transmitting signals between field devices and a process control system/control system. Transmitters are measuring units that provide an output signal consisting of a unit current signal (4 mA to 20 mA). A transmitter power supply provides a transmitter with power and processes the current signal.

The devices convert a fully parameterizable partition of input signal in a proportional output current (4 mA to 20 mA). This output signal will be transferred to indicators or to analogue inputs on the process control system/control system, for example.

Both relay outputs of the device can monitor two fully parameterizable trip values of the input signal.

More information can be found on certificates and datasheets.
3 Safety Instructions

The device may only be operated by trained professionals in a manner corresponding to
this operating manual.

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. Devices must only be repaired directly
by the manufacturer. 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.
4 Installation and Connection

4.1 Installation

The device is constructed in protection degree IP20 and must therefore be protected from undesirable ambient conditions (water, small foreign objects).

Attention

The devices can be mounted on a 35 mm DIN mounting rail according to DIN EN 60715. The devices must be snapped onto the rail vertically, and never slanted or tipped to the side.
4.2 Connection

The removable terminals of the KF-series considerably simplify the connection and the switch cabinet assembly. They make it possible to replace devices quickly and without fault 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 and coded plugs, making it impossible to mix them up.
4.2.1 Connection Input (Field Circuit)
The non-intrinsically safe field circuit is connected to the terminals 1 to 3.
In both cases you can connect the following field devices:
1. a 2-wire transmitter
2. an active current source
4.2.2 Connection Output

The control circuit and the power supply are connected to terminals 7 to 24 on the device. The terminals have the following functions:

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

Terminals 4 to 6, 13 to 15 and 19 to 21 do not exist.
4.3 Field Device Communication via HART

In order to set the parameters of the connected HART field device, you will require a HART communicator which you can connect to the field cables. Transmitting the HART signal via the current output of the device is not possible.

4.4 Front Side

The following indicating and operating elements are located on the front of the device:
- 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
- Display for indication of the measured values, fault messages and parameterization modi
- Four keys for setting the parameters of the device: ▲ (Up) ▼ (Down) ESC (Escape) OK
- Interface for connecting a computer for parameterization and diagnostics of the device with the parameterization software, using a adapter
5 Display Modes and Fault Messages

In normal operation, the current measured value is indicated in the selected unit. For information on selecting the unit, see section 6.2.

If the Alarm freeze (see section 6.4.3) 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

For the selection of fault messages see section 6.3.1.

If switching the device on/off and checking the cables does not rectify the fault, please contact Pepperl+Fuchs or the field device manufacturer.

The relays de-energizes when a fault occurs.

For information on the behaviour of the current output in the event of fault, see section 6.5.2.

Note

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.
6 Editing Device Data

A change in device data will change the operation of the device!
Before entering new data into the device, you should ascertain that no danger to the installation will result.

In this manual, the parameterization of the device via the control panel is described. Parameterization by means of a PC is more convenient.

6.1 Parameterization Mode

6.1.1 Invocation

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.
6.1.2 Password

You can protect the parameterization from unauthorized changes by means of a password (see section 6.6; at the delivery of the device, the password is inactive).

If the password protection is active, you can view the different settings in the parameterization mode, but not change them before entering the password. On the first attempt to make a change, the device immediately prompts for a password.

The password must be entered for each transition from display mode to parameterization mode, once each time.

The password cannot be changed. It is 1234.

The password is entered as follows:

<table>
<thead>
<tr>
<th>Change attempt</th>
<th>value 0, flashing</th>
</tr>
</thead>
<tbody>
<tr>
<td>automatic switch to password entry →</td>
<td>▲, ▼, ESC</td>
</tr>
<tr>
<td>parameters still protected ← ESC</td>
<td>OK, value 1234</td>
</tr>
<tr>
<td>parameters released ← OK</td>
<td>value, flashing</td>
</tr>
</tbody>
</table>

* If you press the ▲ or ▼ key, the value changes step by step. If you hold the ▲ or ▼ key, the setting "rolls" to higher or lower values.
6.1.3 Navigation Method

The following diagram shows the navigation method in parameterization mode using the ▲, ▼, OK and ESC keys:

- Rel1 OK → Min/Max ▼ ▲
- ← ESC → Trip ▼ ▲
- ← ESC → Hysteresis ▼ ▲
- ← ESC → Mode OK → Active ▼ ▲
- ← ESC → Alarm freeze ▼ ▲
- ← ESC → Delay ▼ ▲
6.1.4 Lowest Menu Level: Select Values, Enter Numeric Values

On the lowest level of the menu, you can either select one of several possible values, or enter a number for the individual parameters.

Proceed as follows:

- When entering numeric values, please note:
  - If you press the ▲ or ▼ keys, the value changes step by step.
  - If you hold the ▲ or ▼ keys, the value "rolls" to higher or lower values.
  - The algebraic sign changes automatically.
  - The decimal point is moved automatically.
6.2 Unit

The following diagram shows the unit menu. Items from the lowest menu level are outlined in bold. The device measures in mA. Using the parameters zero point and conversion factor (section 6.3.2) 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.

```
Unit ---------- °F
              °C
              bar
              Pa
              N
              t
              kg
              km/h
              m/s

Continued from the left
              m
              m³/h

Continued right
              l
              l/min
              l/min
              m³
              %
              mA
```
6.3 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 (section 6.2).

[Diagram showing menu structure with parameters]

- Input
  - Line monitor (6.3.1)
  - LB
    - LB On
    - LB Off
  - SC
    - SC On
    - SC Off
  - Zero point (6.3.2) -15 mA to 15 mA
  - Conversion factor (6.3.2) 0.100 to 5000
  - Linearization (6.3.3) Linearization On
    - Linearization Off
  - Smoothing (6.3.4) 0 s to 255 s
6.3.1 Line Monitor

- If you select On for LB, an input current < 0.2 mA will be registered as a lead break (section 5).
- If you select On for SC, an input current > 22 mA will be registered as a short circuit (section 5).

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 fault will be signalled within the measuring range.

6.3.2 Zero Point and Conversion Factor

The device measures in mA. If you have selected different units (section 6.2), 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 to 200 °C is to correspond to 4 mA to 20 mA

- Linearization
  \[ y = mx + n \]

- 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:

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

- **Linearization**
  \[ y = mx + n \]

- **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 measuring range starts from 0 (y = 0 °C). The zero point corresponds to the upper measuring range limit (x = 20 mA) at which the measuring range ends.

The zero point can be calculated as follows:

\[ n = y - m x \]
\[ n = -100 - 5 \times 0 = -100 \]
\[ y = mx + n \]
\[ x = \frac{(y - n)}{m} \]
\[ x = \frac{(0 + 100)}{5} = 20 \]
Example 3: selected unit bar, -4 bar to 4 bar is to correspond to 4 mA to 20 mA

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

- 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)
  \[ n = y - m \times x \]
  \[ n = 4 - 0.5 \times 20 = -6 \]
  \[ y = m \times x + n \]
  \[ x = \frac{(y - n)}{m} \]
  \[ x = \frac{(0 + 6)}{0.5} = 1 \]
6.3.3 Linerization
Using the parameterization software a linearization table can be saved in the device; 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).

6.3.4 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.
6.4 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 see section 6.5.

Continued on next page
6.4.1 Operating Behaviour
The switching direction can be set as Max or Min and the direction of action as Active or Passive (section 6.4).

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 device is shown in the following diagram:

<table>
<thead>
<tr>
<th>Value</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td></td>
</tr>
<tr>
<td>Max - hysteresis</td>
<td></td>
</tr>
<tr>
<td>Min + hysteresis</td>
<td></td>
</tr>
<tr>
<td>Min</td>
<td></td>
</tr>
</tbody>
</table>

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
6.4.2 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 (section 6.2).
- You can enter values within the limits selected under Units.
- The hysteresis must be selected as > 1 % of the trip point to prevent the relay from vibrating.
- As the representation of the operating behaviour in section 6.4.1 shows, 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 device.

6.4.3 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 trip value overrange.

6.4.4 Delay
If you set a time > 0 sec, you prevent short-time trip value overranges 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.
- You can adjust the delay time from 0 s to 250 s.
The following diagram shows the operating behaviour for the trip mode Max, operating mode Active.
6.5 Current Output

The following illustrations show the current output menus. Items from the lowest menu level are outlined in bold. Information about relay outputs see section 6.4.

Output — Rel1 — Rel2

Iout

Characteristics (6.5.1)
- 0 mA to 20 mA
- 4 mA to 20 mA NE43
- 4 mA to 20 mA

Fault current (6.5.2)
- Up/Down
- Hold
- Max
- Min

Continued on next page
### 6.5.1 Characteristic

With the parameters Start value and End value establish a sub-range of the input signal as the measuring range of the application (section 6.5.3). This measuring range is formed linearly on the output signal.

The following table shows, for the various characteristics (section 6.5), the conversion of the Start value and End value and the behaviour during measuring overrange.

- The statements apply for the setting Inverted → Normal.
- If you select Inverted → 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.

<table>
<thead>
<tr>
<th>Start value</th>
<th>6.5.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>End value</td>
<td>6.5.3</td>
</tr>
<tr>
<td>Inverted (6.5.1)</td>
<td>Inverted</td>
</tr>
<tr>
<td></td>
<td>Normal</td>
</tr>
</tbody>
</table>
### Table: mA Measurement Range on Output Signal

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Start Value Converted into</th>
<th>End Value Converted into</th>
<th>Linear underrange up to</th>
<th>Linear overrange up to</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 mA to 20 mA</td>
<td>0 mA</td>
<td>20 mA</td>
<td>0 mA</td>
<td>20.5 mA</td>
</tr>
<tr>
<td>4 mA to 20 mA NE43</td>
<td>4 mA</td>
<td>20 mA</td>
<td>3.8 mA</td>
<td>20.5 mA</td>
</tr>
<tr>
<td>4 mA to 20 mA</td>
<td>4 mA</td>
<td>20 mA</td>
<td>0 mA</td>
<td>approx. 22 mA</td>
</tr>
</tbody>
</table>

### Example Diagram of a mA Measurement Range on the Output Signal

Characteristic 4 mA to 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 to 20 mA NE43, start value 0 °C, end value 200 °C (see example 1 in section 6.3.2)
6.5.2 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 to 20 mA</th>
<th>4 mA to 20 mA NE43</th>
<th>4 mA to 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>Hold</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>Max</td>
<td>21.5 mA</td>
<td>21.5 mA</td>
<td>22 mA</td>
</tr>
<tr>
<td></td>
<td>(not distinguishable from End value overrange)</td>
<td></td>
<td>(not distinguishable from Start value underrange)</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>

6.5.3 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 (section 6.2).
- 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 (see section 6.3.2).

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

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

- **Service**
  - **Password (6.1.2)**: On, Off
  - **Language**: DE (German), ENG (English)
  - **Reset (see below)**: On, Off

**Reset**: Pressing the OK key when On Reset is flashing resets all settings on the device to default (see section 6.7). Any entries that you have made in parameterization mode are lost.
### 6.7 Default Settings

<table>
<thead>
<tr>
<th>Menu</th>
<th>Parameter</th>
<th>Default setting</th>
<th>Separate value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main menu</td>
<td>Unit</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td>Line monitor</td>
<td>On LB/On SC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zero point</td>
<td>4.000 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conversion factor</td>
<td>0.100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Linearization</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smoothing</td>
<td>3 s</td>
<td></td>
</tr>
<tr>
<td>Output Rel1</td>
<td>Min/Max (= switching direction)</td>
<td>Min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trip</td>
<td>16.00 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hysteresis</td>
<td>2.000 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mode</td>
<td>Passive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm freeze</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delay</td>
<td>0 s</td>
<td></td>
</tr>
<tr>
<td>Output Rel2</td>
<td>Min/Max (= switching direction)</td>
<td>Min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trip</td>
<td>2.000 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hysteresis</td>
<td>2.000 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mode</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alarm freeze</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delay</td>
<td>0 s</td>
<td></td>
</tr>
<tr>
<td>Output Iout</td>
<td>Characteristics</td>
<td>4 mA to 20 mA</td>
<td>NE43</td>
</tr>
</tbody>
</table>
### Trip Amplifier EGS80X002001
#### Editing Device Data: Default Settings

<table>
<thead>
<tr>
<th>Menu</th>
<th>Parameter</th>
<th>Default setting</th>
<th>Separate value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault current</td>
<td>Min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start value</td>
<td>0.000 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End value</td>
<td>20.00 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inverted</td>
<td>Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>Password</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>ENG</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Trip Amplifier EGS80X002001
Notes
tecsis subsidiaries worldwide can be found online at www.tecsis.com.
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