Electronic Transmitter

ES

Instructions on Operating and Configuring the ES Transmitter

This operating manual is a supplement to the instructions for the flow meters

BGN, BGF, BA, TSK, DWF.

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1 Identification

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Product

Electric transmitter model "ES" for converting the pointer position to a proportional
4-20 mA signal.

Issue date

Date: 19 January 2021

Version no. / File

Version: 21.01
File: ES_BA_20.01_ENG.DOC

2 Applications

The ES transmitter is used in combination with the BGN, BGF and TSK series of flowmeters, as well as in BA level meters. As a result, the areas of both volume and mass flow rate as well as level measurement according to the displacer principle are covered. For the installation in potentially explosive gas atmospheres, the ES transmitter is intended for use in an enclosure providing a degree of protection of at least IP 20.

3 Mode of Operation and System Design

3.1 Measuring principle

The position of the float is transmitted to the pointer axle by means of a magnetic system. The ES transmitter measures the field of a magnet mounted on the pointer axle (sensor signals A, B) and generates an output current of 4 to 20 mA from it. The scale is generally non-linear and is linearized in the process with a maximum of 16 interpolation points.
The earth's magnetic field and moderate homogeneous external magnetic fields are largely compensated by the applied differential measurement.

3.2 System design

An indication unit prepared for mounting an ES transmitter consisting of a base plate, a special bearing unit with a pointer with the magnets mounted on it, as well as a stud bolt for mounting the ES.

4 Input

4.1 Measured variables

Variable area flowmeter of the
series BGN and BGF:

- Volume flow rate
- Mass flow rate

Level meter of the series BA:

- Liquid level

5 Output

5.1 Analog output

Signal output 4-20 mA with HART® protocol.
For ES transmitters with a software version > 2.0 the output current will be limited to 20.5mA when the calibrated range is exceeded (according NE43).

5.2 Binary outputs (option)

Two switching outputs N1 and N2 as per EN60947-5-6:2000 integrated in the ES as limit transducers or pulse outputs are available as an option. The standard version is not equipped with these binary outputs
(see also Chapter 6.9, page 6).

6 Characteristic Values

6.1 Technical characteristics

Power supply

14 V to 30 V DC
Influence of power supply: < 0.1% of URV

Load

The load impedance RB results from the supply voltage:

$$R_B = \frac{U_B - 14V}{22mA}$$

When the HART® protocol is used, the load must be greater than 250 ohms.

Load influence:
0.2 to 680 ohms: < 0.1% of measured value

Accuracy

< +/-0.2% of URV in the interpolation points

Repeatability

Typically < 0.1% of URV

Resolution

Typically 0.05% of URV

6.2 Environmental conditions

External magnetic fields (e.g. from adjacent fittings) must be avoided.

Degree of protection

For use in potentially explosive gas atmospheres of the ATEX Group II, The ES transmitter must be installed in an enclosure that offers a degree of protection of at least IP 20.

Ambient temperature limits

Approved for safe operation at temperatures from -40°C to +70°C. In the range from -20 °C to -40°C there is an increase in measuring error. It must be ensured that the temperature in the indication unit does not exceed a value of +70°C due to process or environmental influences such as hot medium, sunlight or heating of the meter tube. If necessary, the indicating unit with extended, available as an order option, arm must be used at high fluid temperatures. Please also observe the tables of the section "Fluid temperature limit" of the device description for the mechanical sensor.

Storage temperature

-40°C to +80°C

Influence of ambient temperature

< +/-0.5% of URV/10°K

6.3 Binary outputs (option)

The binary outputs are optional and comply with the standard EN60947-5-6:2000 (NAMUR switch). The current for the "open" state is typically 0.4 mA; the current for the "closed" state is typically 4 mA (see also Chapter 5.2, page 5).

6.4 Electromagnetic compatibility (EMC)

- EN61000-6-2
  Immunity industrial environment
- EN61000-6-3
  Emitted interference residential environment
- EN55011 Group 1, Class B (limiting values and methods of measurement)
- NAMUR NE21 Version 2012-05-09
- All measurements were performed with an unshielded twisted-pair cable.

Refer to Declaration of Conformity in section 15

6.5 Safety data

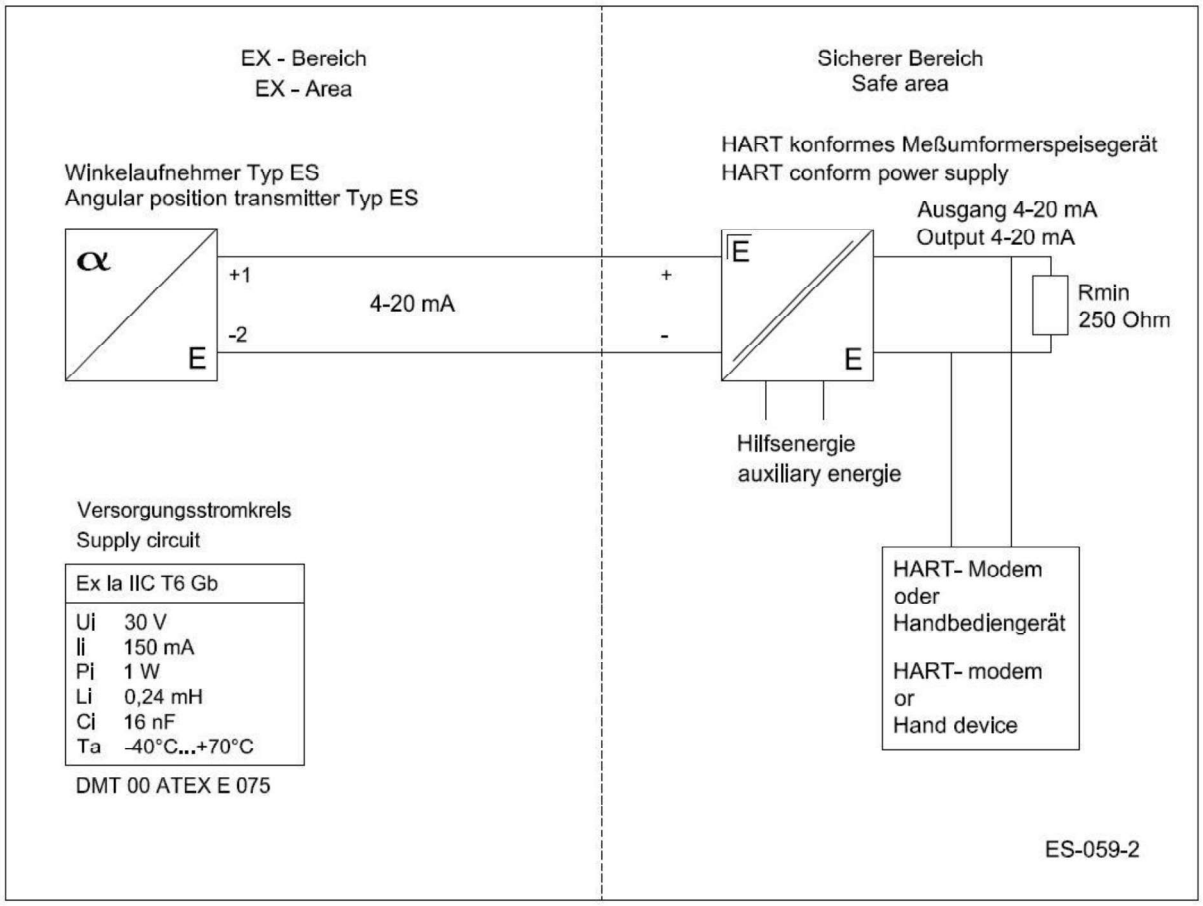
EU-Type Examination Certificate

DMT 00 ATEX E 075 / IECEx BVS 16.0072
II 2G Ex ia IIC T6 Gb
-40°C to +70°C

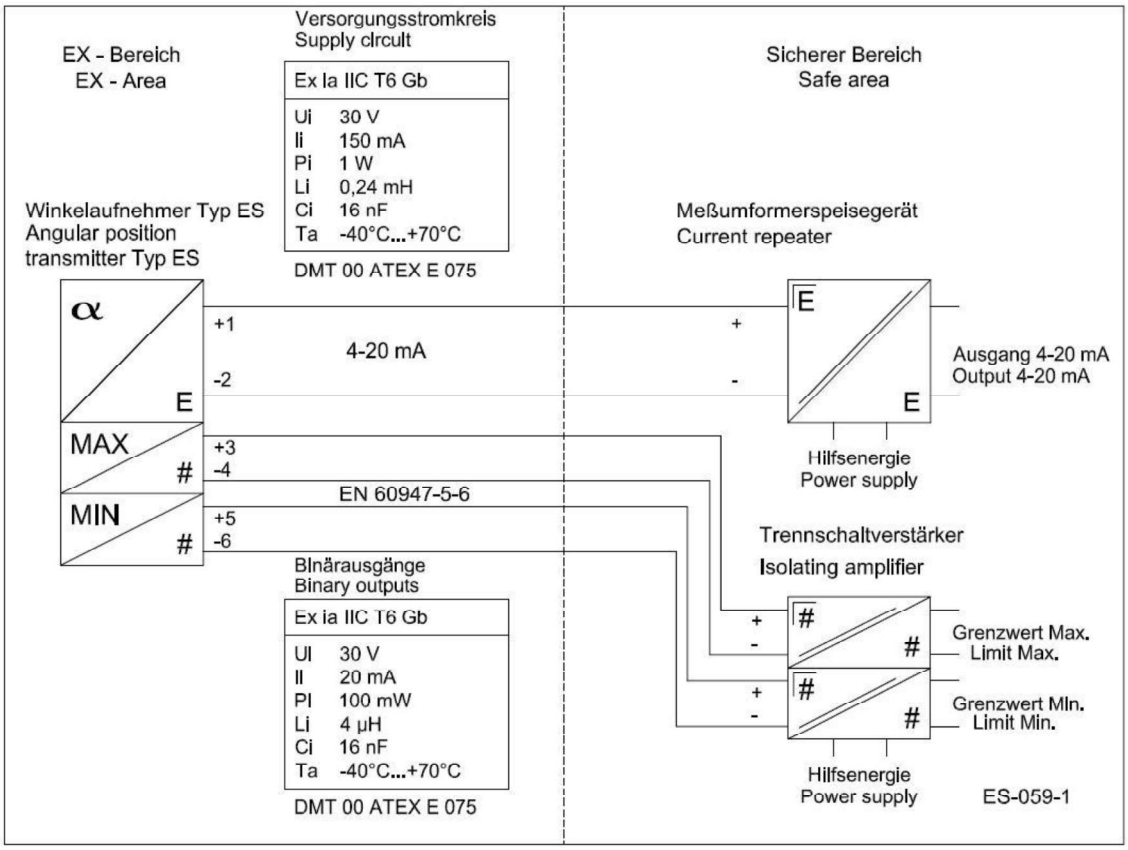
Supply circuit	Binary outputs N1 and N2
Ui DC 30V Ii 150mA Pi 1W Li 0,24mH Ci 16nF	Ui DC 30V Ii 20mA Pi 100mW Li 4µH Ci 16nF

7 Electrical Connection

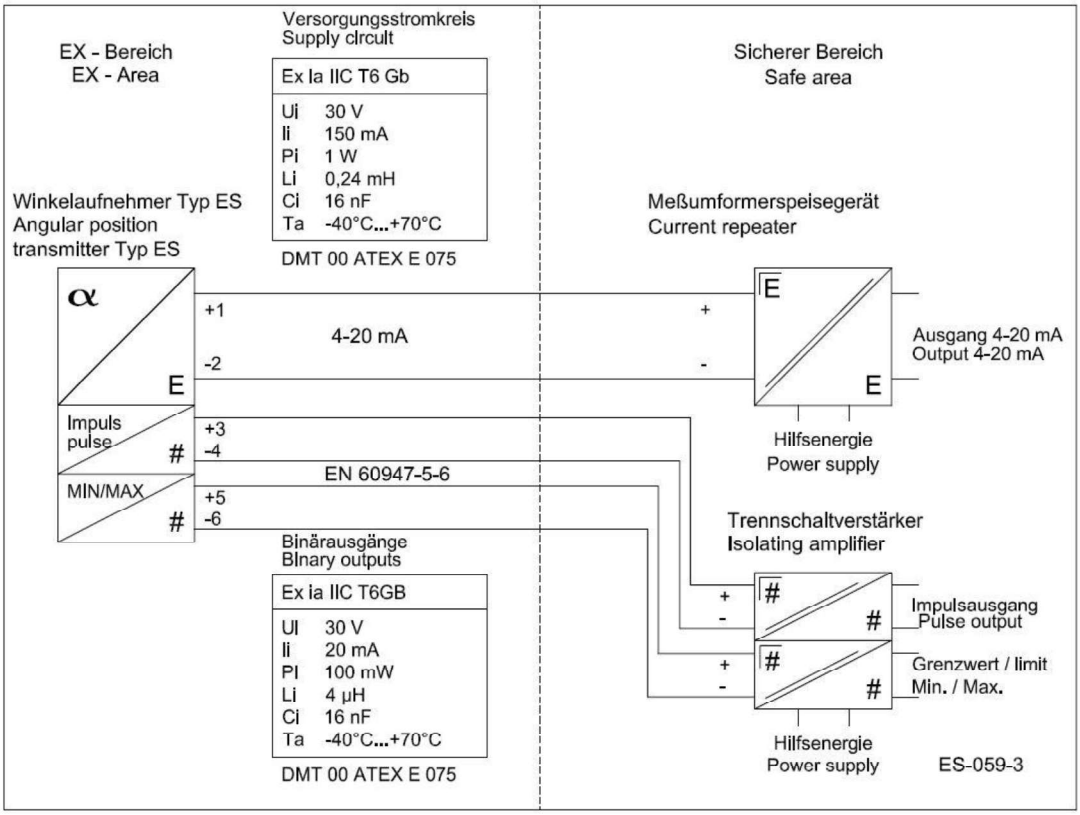
7.1 Wiring diagram for ES transmitter (signal output 4-20 mA) with HART®



7.2 Wiring diagram for ES transmitter with 4-20 mA output and 2 limit contacts



7.3 Wiring diagram with 4-20 mA output, pulse output and limit contact



7.4 Installation procedure

Remove hood.
Guide the signal wires from the cable gland underneath the ES to the terminal block and connect them as described in the wiring diagrams of the preceding paragraphs 7.1, 7.2 and 7.3. **The polarity must be observed during connection.**
Remount hood.

7.5 Commissioning

After the power supply is applied, a current of less than 3.6 mA (LO-Alarm) is set to the output to indicate that the ES has been switched on. Following this, a current proportional to the pointer deflection flows. Due to the influence of the float magnet, the ES transmitter will only provide the correct current when the pointer movement is evoked by the moving float. Turning the pointer by hand will lead to deviating values, but enables a verification of the tendency.

8 Retrofitting ES

An ES can only be retrofit on a previously installed instrument under certain circumstances. If the mechanical instrument has been calibrated with a pointer axle that does not carry a measuring magnet, then the scale must be recalibrated. The reason for this is the retroactive effect of the additional measuring magnet on the float magnet.

9 Certificates and Approvals

EU/IECEx Type Examination Certificate:
DMT 00 ATEX E075 / IECEx BVS 16.0072

The ES Transmitter complies with the EU Directives:

2014/34/EU (ATEX Explosion Protection) and
2014/30/EU (EMC)

including all changes and/or supplements published up-to-date (08.12.2020). Conformity with the tested prototype is confirmed by applying the CE Mark.
Refer also to the declaration of Conformity in section 15

10 Order Information

The ES is only supplied in conjunction with a mechanical instrument or as a spare part. When ordering the device as a spare part, please specify the mechanical instruments serial number.

11 ES functions

11.1 Upper range value, units

The **"Upper range value" parameter** (called "URV" with HART®) is used to adjust the current output to the measuring range (20 mA = 100 %). The lower range value (called "LRV" with HART®) is not supported by the ES and is set to zero.

The **"Unit" parameter**:
The following units are available:

- m3/h, min, s
- l/h, min, s
- USgal/h, min, s
- IMPgal/h, min, s
- kg/h, t/h, g/h
- cm (When used with a level meter)

The measured value and upper range value are not converted when the unit is changed.

11.2 Time constant

The time constant can be selected within a range from 0 to 60 seconds. After the time constant expires, the measured value reaches 63.7 % of its final state after a sudden step of the input signal.

11.3 Low-flow cutoff

If the flow drops below the low-flow cutoff, the indicated value will be set to zero.

11.4 Totalizer, pulse output

The totalizer and the pulse output count the volume and mass units. The unit follows that of the flow rate (e.g. if the unit of the flow rate is l/h, then the totalizer counts liters).
Pulses are output at the binary output N1 as an option. Here it must be noted that the maximum pulse rate is approx. 10 Hz. The pulse width is approx. 50 ms. The totalizer can be switched on and off: **"Totalizer on/off" parameter**. The totalizer count is saved in the EEPROM when the device is switched off. The totalizer can be reset via a HART® command.

11.5 Binary outputs N1 and N2

The binary outputs N1 and N2 are configured as optocouplers with a downstream transistor and in accordance with the standard EN60947-6-6. Operation is controlled by the microprocessor. The binary outputs can be assigned the following functions:

"NAMUR switch function" parameter

N1	N2
MAX	MIN
Pulse output	MIN
Pulse output	MAX
Pulse output	MIN/MAX

The **"MAX" parameter** is the upper limiting value for the relative flow rate and the **"MIN" parameter** is the lower limiting value. Exceeding/dropping below MAX/MIN can also be output as an alarm at the current output (see the description of the self-test).
The **"Active state" parameter**: The active state of N1 and N2 can be selected between "closed" and "open" (also applies to N1 as a pulse output).
As an Alarm, the operator has the following choice:
Parameter „activated self-test":

- Totalizer overflow?
- MAX or MIN exceeded or dropped below?

(Refer also to section 11.7 "Selftest")

Note: When parameterizing via HART®, the ALARM selection is not displayed. Instead, use the Pulse output setting MIN/MAX.

11.6 Simulation

The outputs can be simulated for commissioning and testing **("Simulation on/off" parameter)**. The values for the output current (**"Preset value current" parameter**) and the state of the binary outputs **("Preset value N1 on/off" parameter, "Preset value N2 on/off" parameter)** can be directly specified (**"Qrel/direct preset value" parameter)**. It is also possible to specify the relative flow rate (**"Preset value Qrel" parameter)**. The entire system will follow this value, including the totalizers and the pulse output.

11.7 Selftest, alarm

The following self-tests may be selected which are then continuously conducted:
"Activated self-tests" parameter:

- Relative flow rate > 103 %?
- Relative flow rate outside sensor limits?
- Float movement too large/too small?
- Totalizer overflow?
- Temperature in device too high/too low?
- Sensor signals implausible?
- MAX or MIN exceeded or dropped below?

Each test can be activated and deactivated individually. The presence of a self-test error is signaled under HART® in the status and output at the current output as an alarm state if necessary.
"Current for alarm" parameter
One of the following can be chosen for the alarm state of the current output:

- ≥ 21 mA (HI-Alarm)
- ≤ 3.6 mA (LO-Alarm)
- not in use

12 Maintenance

The ES is maintenance-free. In the event of a malfunction the ES can be replaced. A malfunction has, for example, occurred when the output current supplied by the device differs considerably from the expected value (e.g. difference cannot be explained with a temperature drift). If there is a justified doubt as to the operation of the device, the ES must be returned to the manufacturer. The ES cannot be repaired by the customer.

12.1 Replacing ES

If an ES transmitter is to be replaced, then the new transmitter adopts all parameters of the old transmitter by importing the archived data record with the HART® protocol. An ES supplied as a spare part is generally parameterized with the characteristic curve of the device to be replaced by the manufacturer prior to shipping. The order /serial number of the fitting must be specified for this purpose.

Replacement procedure:

- Switch off device
- Remove hood and disconnect current loop
- Remove scale (remove screw at the top right-hand corner of the scale)
- Remove ES
  (two M4 countersunk screws)
- Mount new ES and reconnect current loop
- Remount scale and hood

13 HART® Protocol

The ES transmitter disposes of the HART® **Protocol 5**. Parameterisation can be carried out using the company's own parameterisation software tool SensorPort. The device description (DD) is already integrated into the device catalogue of numerous parametrising tools.
A hand-held interface may also be used for the parametrisation. Multidrop and burst-mode applications are not possible.

The integration of HART® **Protocol 7** into the ES is forecasted for the first half of 2021.

WARNING!
The parameters for the configuration and evaluation of the measuring signal can be amended using the communications interface. Incorrect programming may result in complete functional failure and may even disable the device entirely when using the hand-held terminal. The user must accept full responsibility for any amendments made to the parameters. Heinrichs Messtechnik shall warrant no reclamations for errors caused by incorrect programming. The same applies to consequential damage caused by, for example, a change to the measuring range or the characteristic curve of the sensor.

13.1 PDM parameterisation software (Siemens)

PDM drivers are available. When using the PDM software, it must be observed that the self-test parameters will not be transferred when replacing the ES transmitter, but rather must be entered manually.

13.2 SensorPort Parameterisation Software

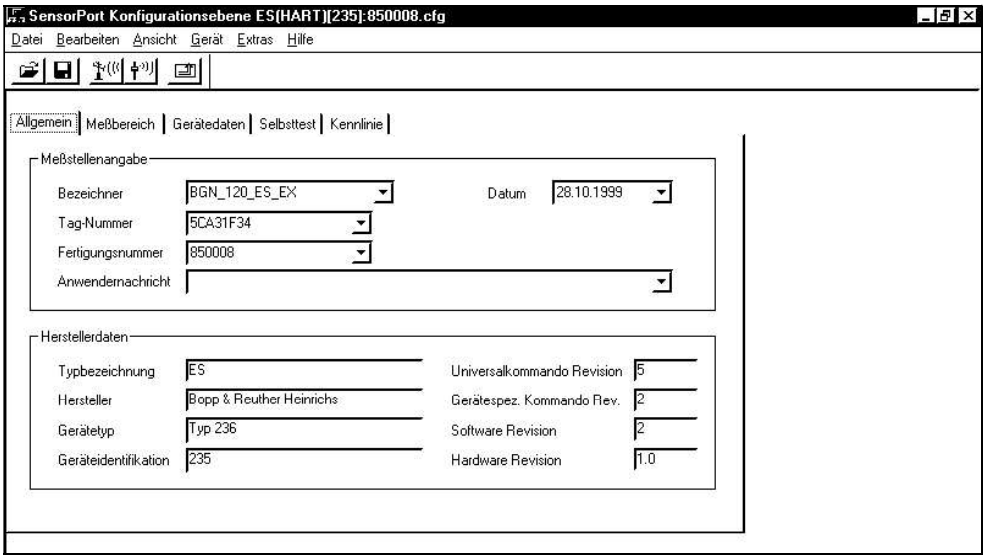
The SensorPort software is used for parameterisation and displaying the measured-values via the HART® protocol 5. To run the software, you need a computer with an unassigned COM port. The program works on Windows versions from XP upwards. The field device is connected via a HART® modem and is to be plugged into the COM port. Different SensorPort versions differ slightly in their design. The following Instructions describe version 2.30b. For details, see the SensorPort User's Manual.

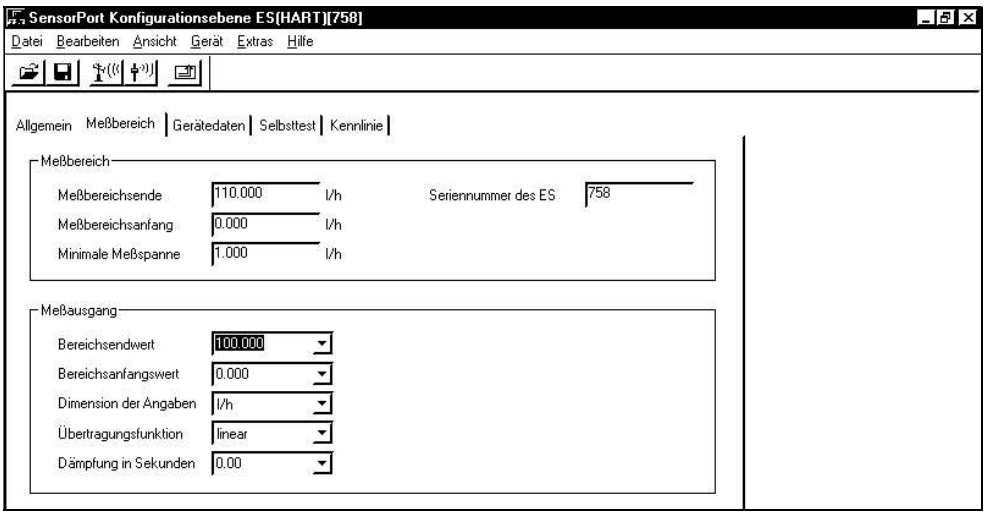
You can work offline and prepare data records independently of a field device if a data record of an ES has already been filed on the computer. The following description refers to online operation.
First, a connection to the field device must be established (see SensorPort User's Manual).
Under "Data Acquisition," you can then display the measured values issued by the HART® protocol (as a bar chart or diagram). The measured values of the diagram can be saved in a file.
Under "Display" > "Maintenance" you are granted read-write access to a selection of parameters. You cannot access the calibration function of the device.
Under "Display" > "Specialist" you can access the calibration function. Therefore, this function is secured by a password. The factory-set password is **"SensorPort"** (case-sensitive).

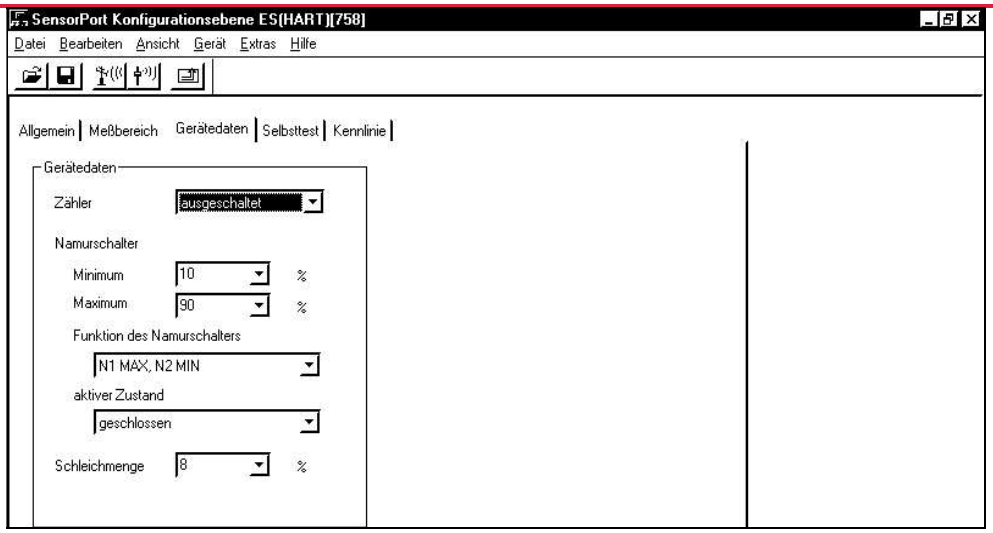
WARNING!
The Specialist status enables you to change all device data and even disable the device entirely. The user must accept full responsibility for such actions.

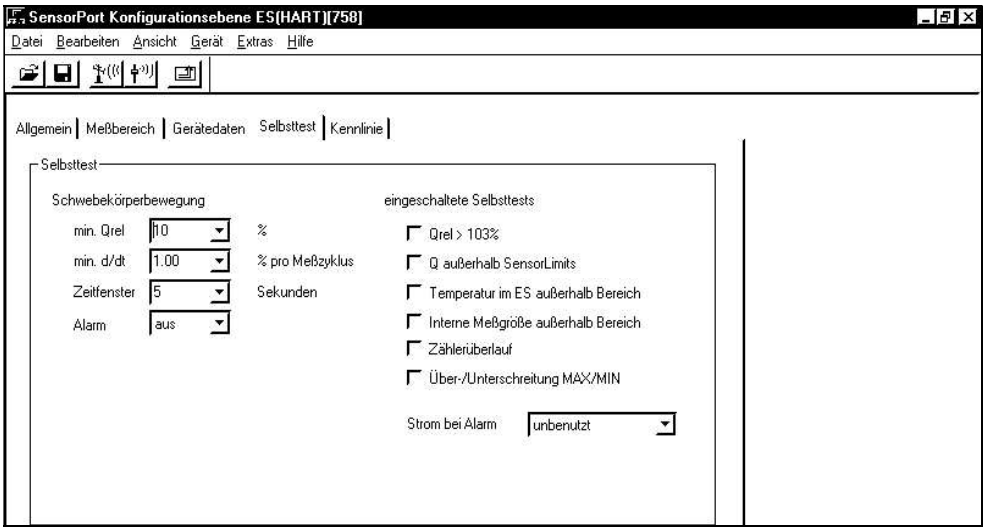
13.3 Configuration level

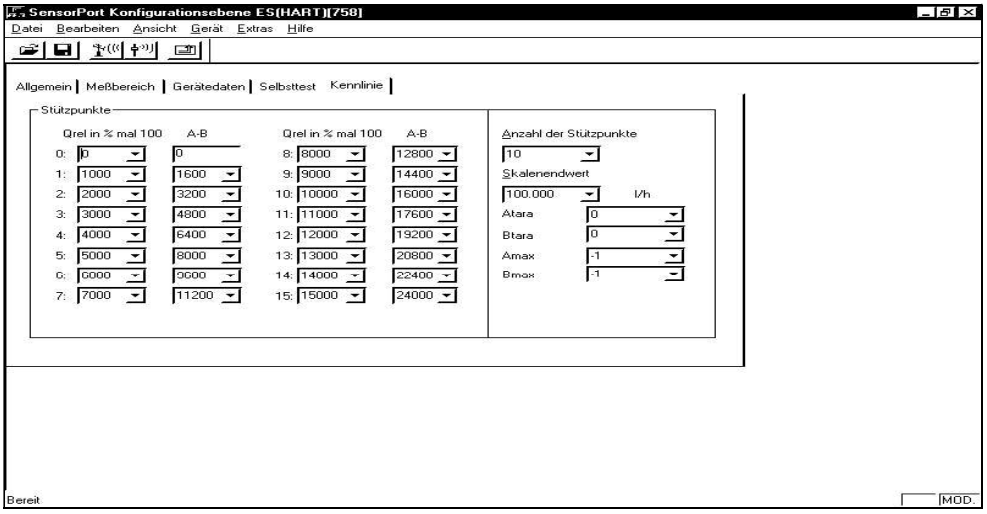
Five tabs appear.
The parameters on these tabs can now be edited. With “Device” > “Write data” (right-hand transmission tower) the parameters are sent to the device and saved there in the EEPROM. With “Device” > “Read data” (left-hand receiving antenna) the parameters are read from the device.











The parameters of the "Characteristic curve" page are used for the device replacement. Only the parameters "Number of interpolation points" and "Upper limit of scale" may be changed.

13.4 Dialog boxes

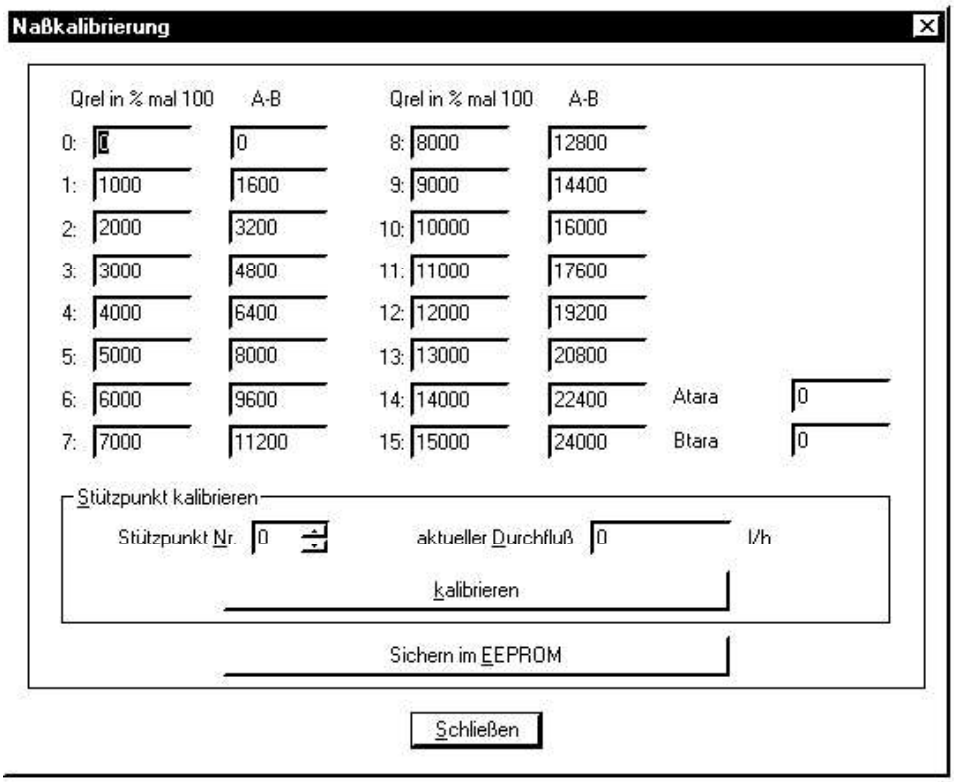
13.4.1 Calibrating the characteristic curve

The calibration functions can be run in the "Device" column. The characteristic curve of the ES in conjunction with the fitting is linearized with a maximum of 16 interpolation points.
"Number of interpolation points" parameter, 2 to 16
Linearization is performed with linear interpolation between the interpolation points. The interpolation points can be transferred or calibrated with the HART®- protocol. The algorithm used by the ES requires the "Upper limit of scale" parameter. This value is independent of the upper range value under **"Upper range value, units"** in section **11.1** on page **10** and must be set prior to calibration.

Procedure:
Establishing connection

- Read device data from sensor as Specialist.
- Under "Measuring range": enter time constant 1s, flow-rate upper range value and flow-rate unit.
- Under "Characteristic curve": enter scale upper range value, select number of interpolation points.
- Write device data
- Under "Device" open the "Calibrate zero point" dialog box.
- Set flow rate to zero point. Wait for time constant!!!
- Calibrate zero point.
- Close window.
- Under "Device" open the "Wet calibration" dialog box.
    - Allow pointer to stop at zero point.
    - Interpolation point with index 0, flow rate = zero calibration.
    - Then calibrate the other interpolation points:
        - Set flow rate, select index of interpolation point to be calibrated, enter current flow rate.
        - Wait for time constant, calibrate interpolation point.
- Run "Save to EEPROM". The calibration is not valid until this has been done.
- Close window.

The calibrations can be carried out in any order. The relative flow rate based on the scale upper range value, multiplied by 100, appears in the column Qrel (A-B). In the column A-B the internal measured value of the ES appears. The values Qrel (A-B) and A-B must be present in ascending order ("ascending monotonously"), i.e. the values with a higher index must be greater than those with a lower index. This only applies to the specified number of interpolation points; the interpolation points that follow can remain uncalibrated. Individual interpolation points can be calibrated at a later point.



13.4.2 Calibrating zero point

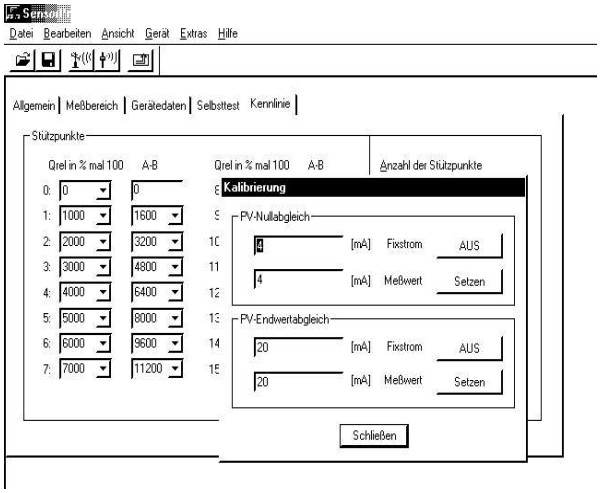
The calibration of the zero point leads to a parallel shifting of the entire characteristic curve. The zero point should not be recalibrated if possible, but instead the cause for any zero point shift should first be determined. Zero point calibration can be undone once. However, it cannot be undone after it has been saved into the EEPROM. It is also no longer possible to undo the calibration after the device is switched off and then on again.

Procedure:

Establishing connection

- Read device data from the sensor as a Specialist.
- Set flow rate to zero, pointer is positioned at the lower stop.
- Calibrate zero point.
- Save in EEPROM.

13.4.3 Calibrate current output



Procedure:

Establishing connection

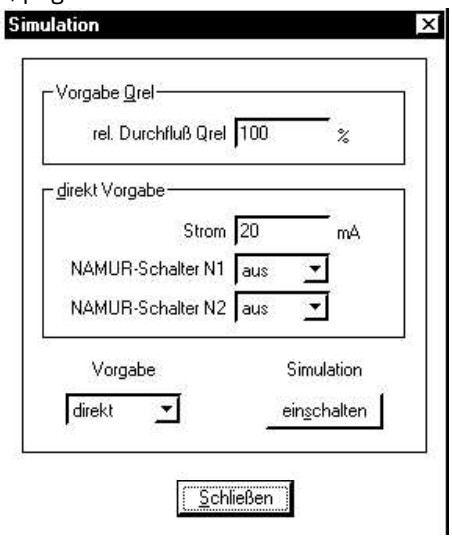
- Read device data from the sensor as a Specialist.
- Under “Device” open the “Calibrate current output” dialog box.
- Switch on 4.0 mA fixed current, measure and enter the actual value, “set!”
- Switch on 20.0 mA fixed current, measure and enter the value, “set!”

13.4.4 Saving the data record

Under “File” > “Save as...”
A file *.cfg is created in the selected path.
It is advisable to archive the data record following each change in the parameter settings.

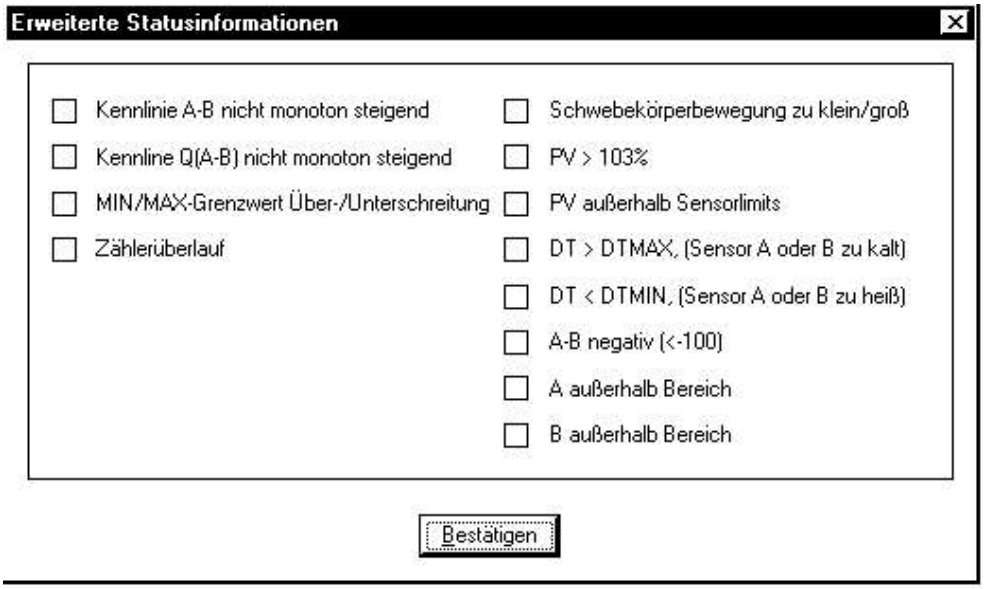
13.4.5 Simulation

See also "Simulation ", page 8



13.4.6 Self-test

The error messages of the device are displayed here. The first menu level shows general error messages, e.g. the overloading of the output. The special error messages of the ES are output in the submenu “Extended status messages” (see also “Self-test alarm” from Page 8).



13.5 Additional submenus in the “Device” column

13.5.1 Resetting the totalizer

Under “Reset device” > “Reset totalizer.”
The "Reset device" function forces a warm start of the device.

13.5.2 Setting the device address

Under “Communication status.”
The HART® protocol enables setting of a device address from 0 to 15. Changes to the device address is only intended for Multidrop applications. For each address not equal to zero it causes a current of 4 mA to be output, regardless of the measured value, and the measured value
.

can then only be read out via HART®. The ES is not suitable for this application.

13.5.3 Setting the number of response preambles

Under “Communication status”.
The number of preambles sent back by the ES can be changed. Caution: not all parameter setting software functions with a value > 5.

13.5.4 Direct access to intermal parameters

Under “Direct access.” These functions are used by the service and enable, for example, reading out of the AD converter. Write accesses may only be carried out after consulting the manufacturer.

14 Operating the ES with the Hand-Held Terminal

After connecting the terminal, you can switch it on. If the terminal does not identify the field device or if you switch it on before connecting it, the following menu will appear:

1. Offline
2. Online
3. Frequency device (not in use)
4. Utility (information about the terminal itself)

When you select "Online," the terminal will try to establish a connection for a second time.
If the terminal identifies the ES, the main menu will appear. From here, the submenus can be accessed. The entire menu has a tree structure. Pressing the left-arrow key moves you to the previous menu. You can access all parameters of the ES without entering a password.

WARNING
When using the hand-terminal, the user can amend all device data and even disable the device entirely. The user must take full responsibility for any amendments made to the parameters. Heinrichs Messtechnik shall warrant no reclamations for errors caused by incorrect programming.

In the following, several typical submenus will be explained.

Display menu-type

totalizer 0.00 L
Flow 5.35 L/h
Exit

This submenu can only display values. You cannot edit them. Press Exit to exit from this menu.

Menu type "Entering values"

Vol flo URV	
12.00 L/h	current value
[11.00]	edited value
Help Del ESC Enter	

In the top-line, the current value of the parameter will be displayed. The second line shows a copy of this value. This line can be edited. You enter the value using the numeric keys. With the "Del" function, you can delete individual digits. You can exit the submenu without saving your entry by pressing ESC. With Enter you can save the new value and exit from the submenu. If the value has been saved with Enter in the submenu, the following command will appear at the bottom of the next higher menu level:
SEND HOME
Before the parameter can be used by the device, you have to submit it with "SEND." Pressing Home returns you to the main menu.

Menu type "Release function"

Reset totl
Press OK to reset totl
ABORT OK

By pressing Abort, you exit from the submenu without releasing the function; pressing OK will release the function.

Selection menu-type

PV unit
L/h

L/h
L/min
L/s
gal/h
gal/min
gal/s
ESC ENTER

You can select a unit with the cursor keys and save it with ENTER. Pressing ESC will discard the entry. If the value has been saved with Enter in the submenu, the following command will appear at the bottom of the next-higher menu level:
SEND HOME

Before the parameter can be used by the device, you have to submit it with "SEND." Pressing Home returns you to the main menu.

14.1.1 Main menu (Home)

1) Device setup
2) PV 5.35 L/hmeasured value
3) PV AO 11.43 mA corresponding current
4) LRV 0.00 L/hlower range value
5) URV 12.00 L/h upper range value

14.1.2 Displaying measured value and totalizer

1) Device setup
    1) Process variables
        1) Flow rate flow rate (or liquid level)
        2) Totalizer totalizer

14.1.3 Basic settings

14.1.3.1 Setting the TAG

1) Device setup
    3) Basic setup
        1) TAG measuring point

14.1.3.2 Unit of measured value

1) Device setup
    3) Basic setup
        2) PV unit unit of the measured value L/h,min,s; gal/h,min,s; Imgal/h,min,s; Cum/h,min,s; kg/h; MetTon/h; g/h, cm

14.1.3.3 Setting the measuring range

1) Device setup
    3) Basic setup
        3) Range values
        1) PV LRV always 0, not writable
        2) PV URV upper range value
        3) PV unit see above
        4) PV LSL lower limit for the measuring range, only readable
        5) PV USL upper limit for the measuring range, only readable

14.1.3.4 Information about the device

1) Device setup
3) Basic setup
4) Device information

1) Model	ES
2) Device ID	our order number
3) TAG	measuring point
4) Date	e.g. installation date
5) Write protect NO	the device is not write-protected
6) Descriptor	description of the measuring point
7) Message	brief message
8) Revision #'s	
1) Universal rev	
2) Fld device rev	
3) Software rev	
5) Xfer function	always linear

14.1.3.5 Setting the time constant

1) Device setup
3) Basic setup
6) PV damp time constant

14.1.4 Special settings

14.1.4.1 Totalizer

1) Device setup
4) Detailed setup

1) Totalizer	totalizer function on/off
4) Reset totalizer	set totalizer to zero

14.1.4.2 Low-flow volume

1) Device setup
4) Detailed setup

2) Low flow cutoff	low-flow volume in %

14.1.4.3 Binary outputs

1) Device setup
4) Detailed setup
3) Namur

1) MAX		uppper range value in %
2) MIN		lower range value in %
3) N1	N2	switch functions
MIN	MAX	incorrect text in the DD, correct: N1 MAX N2 MIN
IMP	MIN	
IMP	MAX	
IMP	MIN/MAX	
4) Switch	open/closed	active state open or closed

14.1.5 Self-test

1) Device setup
2) Diag/Service
1) Test device see Self-test alarm
1) Self test
1) Min Qrel Self-test paramenter "Float movement"
2) Min Delta function "Float movement"
3) Test period
4) Self test maskTest on/off
1) Float mvment off/ too small/ too large
Self-test "Float movement"
2) Self test mask
Q>103% OFF
Q <> Sensorlimits OFF
Sensor too hot/cold OFF
A-B not plausible OFF
Totalizer overflow OFF
MIN/MAX limit OFF
2) Status errors are being displayed
1) Status group 1
Totalizer overflow OFF totalizer overflow
MIN/MAX range error OFF measured value not within MIN/MAX
A-B not monotonous ascending OFF A-B not ascending monotonously
Q(A-B) not monotonous ascending OFF Q(A-B) not ascending monotonously
2) Status group 2
Float movement too . OFF float movement too close/far
PV>103% OFF
PV out of limits OFF
DT>DTMAX , too hot OFF ***NOTE**! incorrect text in DD,* correct: too cold
DT<DTMIN , too cold OFF ***NOTE**! incorrect text in DD,* correct: too hot

14.1.6 Simulation

1) Device setup
2) Diag/Service
2) Simulation see Simulation
1) Default values
1) Simulate direct output/Qrel
2) Qrel preset value Qrel
3) Current preset value current
4) Switch N1 preset value for NAMUR switch 1
5) Switch N2 for N2
2) Start simulation
Accessing the submenu will start the simulation.
Flow rate and totalizer value will be displayed.
Pressing OK exits the menu and deactivates the simulation.

14.1.7 Calibration

14.1.7.1 Editing the characteristic curve, preparing the calibration

1) Device setup
2) Diag/Service
3) Calibration
1) Characteristic curve Editing the characteristic curve
1) Qrel
1) Qrel table relative flow rate in the interpolation points
1) Qrel 4...15 >> index 4 to 15; left arrow >> previous page
2) 00 0 interpol. point index 0, e.g. Qrel(0) = 0 %
3) 01 1250 interpol. point index 1, e.g. Qrel(0) = 12.50 %
4) 02 2500 interpol. point index 2 e.g. Qrel(0) = 25.00 %
5) 03 3000 interpol. point index 3 e.g. Qrel(0) = 30.00 %
2) A-B table
1) A-B table-based measured value A-B in the interpolation points
1) A-B 4...15 >> index 4 to 15; left arrow >> previous page
2) 00 0 interpolation point index 0
3) 01 567 interpolation point index 1
4) 02 1247 interpolation point index 2
5) 03 1966 interpolation point index 3
2) Atara internal representation of zero point
3) Btara
4) REF below internal value, only for the service
5) REF above
3) Curve point count number of interpolation points
4) Flow unit L/h,min,s; gal/h,min,s; Impgal/h,min,s; Cum/h,min,s; kg/h; MetTon/h; g/h
measured value is not converted from old into new unit
5) Calibrated URV calibrated upper limit of scale

14.1.7.2 Wet calibration (see also 13.4.1)

1) Device setup
2) Diag/Service
3) Calibration
   2) Wet calibration — wet calibration
      1) curve index — index of the calibration point to be calibrated
      2) Value — current flow rate
      3) Wet calibrate — perform calibration
         set index and calibration first, then perform calibration
      4) Zero trim — calibrate zero point
         1) Zero trim — calibrate
         2) Undo Zero trim — undo last zero-point calibration
      5) Init&save — The calibrations become effective and are saved in the EEPROM. Perform this function not until you have terminated the calibration process!!!

14.1.7.3 Calibrate current output

1) Device setup
2) Diag/Service
   4) DA trim — 4 and 20 mA are subsequently output at the current output and measured with an amperemeter. The read value will be sent back to the device.
   The order is preset by the terminal.

14.1.8 Direct access (only for the service of the manufacturer)

1) Device setup
2) Diag/Service
3) Calibration
   3) Direct access — direct access to internal parameters
      1) Index index of the parameter
      2) Value value of the parameter
      3) Read data — read paramenter >> value
      4) Write data — value >> write parameter

14.1.9 Performing a warm start

1) Device setup
2) Diag/Service
   5) Reset device — warm start