EK220

**Volume and Temperature Conversion Device
EK220
Operating Instructions and Installation Information**

Operating Manual:	73020052	SW Version:	from V1.36
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All the figures and descriptions in this operating and instruction manual have been compiled only after careful checking. Despite this however, the possibility of errors cannot be completely eliminated. Therefore, no guarantee can be given for completeness or for the content. Also, the manual cannot be taken as giving assurance with regard to product characteristics. Furthermore, characteristics are also described in it that are only available as options.

The right is reserved to make changes in the course of technical development. We would be very grateful for suggestions for improvement and notification of any errors, etc.

With regard to extended product liability the data and material characteristics given should only be taken as guide values and must always be individually checked and corrected where applicable. This particularly applies where safety aspects must be taken into account.

Further support is available from your local branch office / agent. The addresses are available on the internet or from Elster GmbH.

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The guarantee becomes invalid if the product described here is not handled properly, repaired or modified by unauthorised persons or if replacement parts which are not genuine parts from Elster GmbH are used.

Mainz-Kastel, December 2022

Contents

I   Safety information

☞   *The connections of the EK220 are freely accessible during setting up. Therefore, make sure that no electrostatic discharge (ESD) can occur in order to avoid damage to the components. The person carrying out the installation can, for example, discharge himself/herself by touching the potential equalisation line.*

☞   *To avoid erroneous operation and problems, the operating manual must be read before putting the EK220 into operation.*

The EK220 Volume and Temperature Conversion Device (= Electronic Volume Corrector) can be used in Ex Zone 1 according VDE 0170 for gases of Temperature Class T4 (ignition temperature > 135°C, e.g. natural gas). See Appendix A-2 for EC prototype test certificate.

In this application it is essential to take note of the following information:

☞   *Follow the relevant applicable national regulations and appropriate standards, e.g. EN 60079-14 and EN 60079-11.*

☞   *Make sure that the limits quoted in the EC prototype test certificate (see Appendix A-2) for the devices to be connected are not exceeded.*

☞   *The housing of the EK220 must be earthed directly to a potential equalisation strip. A terminal screw is provided for this on the left housing wall.*

☞   *Repairs on the EK220 may only by carried out by Elster GmbH.*

II   Items supplied and accessories

Items supplied:

The items supplied with the EK220 include:

a) EK220 Volume or Temperature Conversion Device
b) Dispatch list
c) Configuration data sheet
d) Operating Manual
e) Bag of accessories, EK220

Ordering information and accessories	Order no.
EK220 Volume Conversion Device, complete	83 462 540
EK220 Temperature Conversion Device, complete	83 452 250
EBL 50 Temperature Sensor Receptacle, complete with M10 x 1 weld-in sleeve	73 012 634
EBL 67 Temperature Sensor Receptacle, complete with M10 x 1 weld-in sleeve	73 014 456
EBL 160 Temperature Sensor Receptacle, complete with G 3/4" weld-in sleeve and seal	73 012 100
EBL 250 Temperature Sensor Receptacle, complete with G 3/4" weld-in sleeve and seal	73 015 695
Three-way test tap	73 008 403
Shut-off ball valve with Ermeto 6L test connection	73 016 166
Minimess test connection	73 016 167
Operating manual, German	73 020 054
Operating manual, English	73 020 052
Plug-in terminal, 2-pole black	04 130 407
Calibration covering cap	73 017 456
Battery module, 13 Ah	73 015 774
Bag of accessories, EK220	73 020 169

1 Brief description

The EK220 Volume Conversion Device and the Temperature Conversion Device are used for the conversion of the gas volume measured in the operating state by a gas meter to the standard state and in the appropriate energy.

The momentary values of pressure and temperature are measured for the determination of the operating state of Volume Conversion Device EK220. When using the EK220 as a Temperature Conversion Device, the momentary values of temperature are measured and the pressure is set as a constant.

The gas law deviation factor (K-value) can be computed alternatively according to S-GERG-88, AGA 8 GC method 1 or 2, AGA-NX19, AGA-NX19 according Herning and Wolowsky or compatible with AGA-8 DC92 or it can be entered as a constant. The volume is converted into energy using the adjustable calorific value.

The integral recording device includes the consumption profile of a number of months for a measurement period of 60 minutes.

Power supply:

- Battery operation with a service life depending on operating mode $\geq$ 5 years.
- Optional double battery life by connection of an additional battery possible.
- Battery replacement possible without loss of data and without violation of calibration seals.
- Data retention without battery supply due to internal non-volatile memory.
- Connection for external power supply unit.

Operator interface:

- Alphanumeric display with two lines of 16 characters.
- A display list freely assignable by the user.
- Programming via keypad possible.
- Calibration switch (separately sealed in the device).
- Two user locks (supplier's and customer's locks) with numerical codes.
- Access rights for each individual value can be set separately via interface (with appropriate rights).

Data interface:

- Optical interface according to IEC 62056-21 (replaces IEC 61107 and EN61107).
- Permanently wired serial interface, as RS485 or RS232 usable
- MODBUS protocol via permanently wired serial interface.
- IDOM protocol via the permanently wired serial interface.
- Short message via SMS
- Programmable standard output data records for process data ("three-minute values").

Counter / signal inputs:

- 3 inputs for reed contacts or transistor switches, programmable as pulse or signal inputs. Input 2 may be used as a comparison input for input 1.
- Maximum counting frequency 2 Hz (adjustable).
- Pulse value for each input separately adjustable, also non-decade.
- Various counters for Vb and Vm as well as for each input (main and original counter, disturbance volumes, totalizer, adjustable counter, measurement period counter).
- Each input can be separately sealed and secured under official calibration.

Pulse / signal outputs:

- 4 programmable transistor outputs, each freely programmable as alarm / warning output, pulse output, signal output for limit monitoring.
- Each output can be separately sealed and secured under official calibration.

Pressure sensor [1]:

- Pressure sensor integrated in device, or externally mounted.
- Connection of second pressure sensor possible (option, for non-calibrated recording).
- Alternatively absolute or gauge pressure measurement.

Temperature sensor:

- Pt500 (option Pt100 or Pt1000) temperature sensor, different length

Mechanical details / housing:

- Suitable for wall mounting and meter installation (with mounting bracket).
- Mounting and device installation without violating the calibration seals.
- Ambient temperature range: -25°C...+55°C
  Extended temperature with restricted functions possible.

Approvals:

- Approval by calibration authorities acc. MID-Directive 2004/22/EG
- Ex approval for use in Ex Zone 1 according to II 2 G EEx ia [ia] IIC T4.

Monitoring functions

- Monitoring of signalling inputs.
- Monitoring of any values against programmable limits.
- All monitoring can trigger appropriate reactions such as for example, entries in the status register, log book, archive or signalling via outputs.

Archives

- Counter readings and maxima from the last 24 months for Vb and Vm.
- Mean values, maxima and minima from the last 24 months for pressure and temperature as well as partially for the K-value and conversion factor.
- Flexible archive for measurement period values (consumption profile) from the last 5 months for Vb, Vm, p, T, K and C (standard structure of archive) for a measurement period of 60 minutes. The measurement period can be set in the range from one minute up to one month.
- Archive for meas. period values for saving redundant measurement period archive data from the last approx. 40 days for Vb, V, p, T, K and C for a meas. period of 60 minutes.
- Day archive with 600 entries. Measurement period values from the last 20 month for Vb, Vm, p, T, K and C. Archiving once a day.
- Event logbook with 500 entries for events such as for example status changes, signalling inputs, limit violations.
- Changes logbook ("audit trail") with entry of the last 200 changes to settings (parameterising steps).
- Certification data log (as option) with 50 entries for changing of some parameters relevant to calibration regulations. A data row for the value is entered before and after the change for each change to such a parameter.
- Four freely configurable archives.
- Automatic summer time selection can be set.

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[1] Not applicable when used as a Temperature Conversion Device.

2 Operation

2.1 Front panel[2]

The following are positioned on the front panel for operation:

- Two-line alphanumeric display with 16 characters per line.
- Four keys for the display and entry of values.
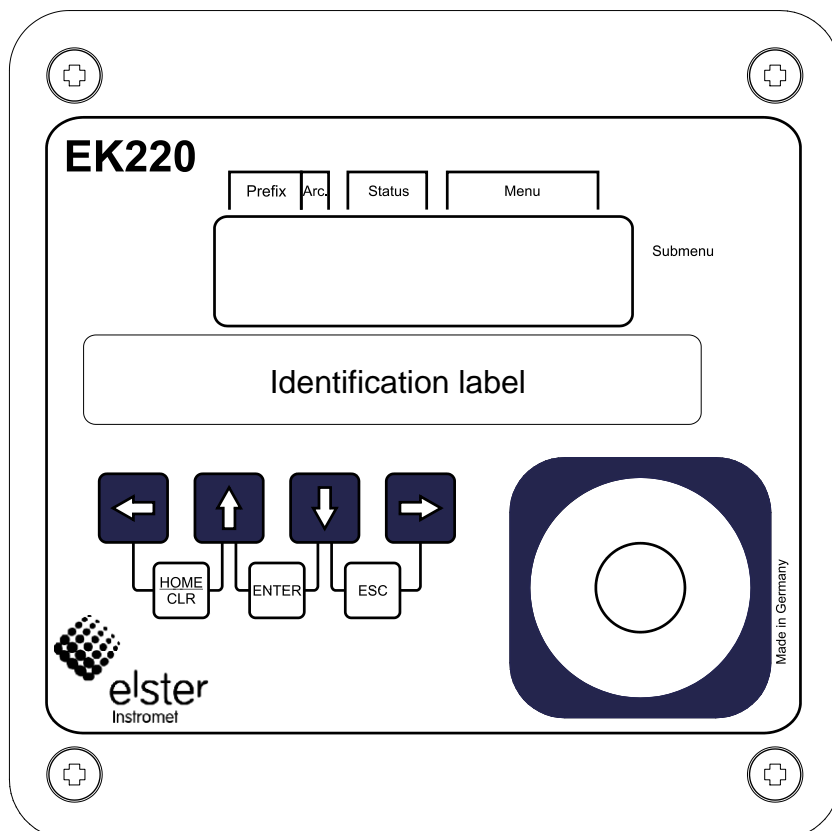
2.2   Display

Basic display structure (with an example):

Prefix	Archive	Device status	Menu	
∅	↑	A W B	A c t. V.	→ Submenu
V m A	1 2 3 4 5 6 7 8 9			m 3

Both lines in the display are subdivided into fields which are described below.

2.2.1   Line 1 = Labels

The first line is subdivided into five fields of which four are labelled on the front panel.

1.   Prefix (Type of computation)

The type of computation identifies so-called "initial values" (also termed "capture values"). These are values which have been formed over a time period (e.g. the adjustable measurement period or one month). Labels:

- max   Maximum   –   highest value within the time range
- min   Minimum   –   lowest value within the time range
- ∆   Change   –   volume within the time range
- ∅   Mean   –   mean within the time range

2.   Archive

If an arrow points upwards to the label "Archive", then the displayed value is an archived value. This was frozen at a defined point in time and cannot be changed.

3. Device status

Here a maximum of three of the most important items of status information are continually shown.

A <u>flashing character</u> signifies that the corresponding state is still present and the corresponding message is present in the momentary status.

A <u>non-flashing character</u> signifies that the corresponding state is past, but the message in the status register has not yet been cleared.

Meaning of the letters:

- A "Alarm"
   At least one status message has occurred which has resulted in disturbance volumes being counted. Basically, all messages with numbers "1" or "2" represent alarms (e.g. "Alarm limits for temperature violated" $\rightarrow$ 3.8).
   Alarm messages are copied into the status register and are retained here, even after rectification of the cause of the error, until they are manually cleared.
- W "Warning"
   At least one status message has occurred which is valid as a warning.
   Basically, all messages with numbers in the range "3" to "8" represent warnings (e.g. "Warning limits for temperature violated" or "Error on output" $\rightarrow$ 3.8).
   Warning messages are copied into the status register and are retained here, even after rectification of the cause of the error, until they are manually cleared.
- B "Batteries discharged"
   The remaining battery service life is less than 3 months.
   This display corresponds to Status Message "Batt. low" ($\rightarrow$ page 51).
- L[3] "Certification data log full"
   The certification data log is full; some parameters can now only be changed with the calibration lock open. ($\rightarrow$CDL, page 15)
   This display corresponds to the status message "CDL full", ($\rightarrow$ page 51).
   ☞ - *If the calibration lock is opened with the calibration logbook full, it can only be closed again after clearing the calibration logbook.*
- P "Programming mode"
   The programming lock (calibration lock) is open.
   This display corresponds to Status Message "Calibration lock" ($\rightarrow$ page 52).
- o "online"
   A data transfer via the optical or permanently wired interface is running. In each case the other interface cannot then be used.
   This display corresponds to Status Message "online" ($\rightarrow$ page 52).

4. Menu

Here is displayed to which list according to Chapter 3 the currently displayed value belongs. In submenus (indicated by an arrow to the left, see below) its name is displayed which is identical with the abbreviated designation of the entry point.

5. Submenu

- 〉 Arrow to the right
   indicates that the displayed value is the entry point of a submenu. This can be called with the key combination <ENTER>.
- 〈 Arrow to the left
   indicates that you are located in a submenu which can be quit with the key combination <ESC>. On pressing <ESC> you are returned to the entry point of the submenu.

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[3] If certification data log is available.
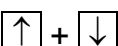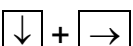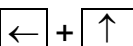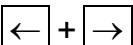
2.2.2 Line 2 = Value with name and unit

In the second line the name, value and (when available) the unit of the data are always shown.

Example:

V	m	A		1	2	3	4	5	6	7	8	9		m	3

2.3 Keypad

Key(s)	Designation	Effect
↓	Down cursor key	**Downwards movement** within the list: From the first value in the list movement is in the direction of the last value or from the last value <u>directly</u> to the first one.
↑	Up cursor key	**Upwards movement** within the list: From the last value in the list movement is in the direction of the first value or from the first value <u>directly</u> to the last one.
→	Right cursor key	**Movement to the right** to a different list: From the first list movement is in the direction of the last list or from the **last** list <u>directly</u> to the first one. With similar lists (e.g.: Vb and Vm skipping occurs to the appropriate value, otherwise to the first value. **Switchover to the second part of the value** for values displayed on two lines: - Counter readings **divided** into pre- and post-decimal places. - Date and time (together one value) divided.
←	Left cursor key	**Movement to the left** to a different list: From the last list movement is in the direction of the first list or from the first list <u>directly</u> to the last one. With similar **lists** (e.g.: Vb and Vm skipping occurs to the appropriate value, otherwise to the first value in the adjacent list.
↑ + ↓	Enter	Depends on the value displayed (Data class, → 2.3.1) **Activate the entry mode.** **Open the submenu.** **Update measurement** (by pressing twice).
↓ + →	Escape	**Return from a submenu** to the entry point in the higher level main menu. **Cancel entry** (the value remains unchanged).
← + ↑	Home / Clear	**Skips to first value in the list** **Updates a value** in the entry mode
← + →	Help	**Displays the address** (value number) of the value

In the entry mode the keys change their functions, see Chapter 2.3.1.

2.3.1 Changing values

The methods of entering and changing values differ depending on the value. These are therefore subdivided into so-called "data classes" (abbreviation: "DC"). Values in the same data class are treated identically during entry. A prerequisite for an entry is that the lock assigned to the value is open.

The following data classes (DC) are present in the EK220:

DC	Type	Entry, change using "ENTER"
1	Display test	No change possible.
2	Function	Triggers the function by entering "1".
3	Constant	No change possible.
4	Measurement	The value is updated by pressing <ENTER> <u>twice</u>.
5	Status	By pressing <ENTER> short texts for status messages are available.
6	Setable value	After <ENTER> value initialisation (standard setting) by pressing the key combination <CLR> = $\boxed{\leftarrow}$ + $\boxed{\uparrow}$.
7	Discrete value	After <ENTER> value change by selection from a list of possible values with the keys $\boxed{\uparrow}$ and $\boxed{\downarrow}$. Value initialisation is possible with $\boxed{\leftarrow}$ + $\boxed{\uparrow}$.
8	Permanent value	After <ENTER>, setting to any value within the valid range is possible. Selection of each individual character to be changed with $\boxed{\leftarrow}$ and $\boxed{\rightarrow}$ and changing with $\boxed{\uparrow}$ und $\boxed{\downarrow}$. Value initialisation is possible with $\boxed{\leftarrow}$ + $\boxed{\uparrow}$.
9	Archive heading	Branching to the appropriate archive.
11	Combination	Similar to "Permanent value" (see above) but masked entry, i.e. only the character currently being edited is visible, all others are masked out by a minus sign. With a <u>closed lock</u> it is opened on entering the correct combination. With an <u>open</u> lock, the combination is changed by the entry.
12	Counters	As "Permanent value" (see above.).
15	Computation counter	No change possible.
16	Initial value	No change possible, sometimes branching to a submenu.
17	Archive value	No change possible.
19	Status register	By pressing <ENTER> short texts for status messages are available. Initialisation (standard setting) by using menu-function <CLR>

If a value is accommodated in a submenu, it <u>cannot</u> be changed independent of its data class by the keypad, since the key <ENTER> is then used for branching into the submenu.

2.3.2 Entering "sources"

At a number of points the entry of a "source" is required for parameterisation (e.g. SC.Qb in the standard volume list, SC.O1 in the output list).

The address of the desired value is entered as the source. It can be found in the tables at the beginning of each list (Chapter 3.1 ff.). In comparison to the addresses shown there however, the following supplements must be given:

- Completion of leading zeroes so that a total of four numbers exist in front of the colon.
- If the address includes no underscore "_", then "_0" should be appended.

Example 1:
Source: 2:300   (Address of the standard volume Vb, see table in 3.1)
Enter: **000**2:300**_0**   (Supplements printed in bold)

Example 2:
Source: 6:310_1   (Address of the temperature T, see table in 3.5)
Enter: **000**6:310_1   (Supplements printed in bold)

2.3.3 Entry errors

Entry error messages are displayed if incorrect entries are made via the keypad.

Representation: **----x---**   with x = Error code according to the following table.

Code	Description
1	The archive is empty, no values are available yet.
2	The archive value cannot be read. The archive has possibly just been opened by the interface for reading out.
4	Parameter cannot be changed (constant).
5	No authorisation for changing the value. To change the value the appropriate lock must be opened.
6	Invalid value. Entered value is outside the permissible limits.
7	Incorrect combination. The entered combination (numerical code) is incorrect and the lock is not opened.
8	Entry not possible due to special setting or configuration.
11	The entry of the calorific value Ho.b in the energy list is not permitted. Please change Ho.b in the Volume corrector list ($\rightarrow$ 3.6, page 36).
12	The entry of this source (address) is not permitted.
13	The function can only be executed after the clock ($\rightarrow$ 3.9, Time*) has been set (initialised) to its starting value with the key combination* $\boxed{\leftarrow}$ + $\boxed{\uparrow}$.
14	Gas analysis parameters do not match.
20	Value for the application-specific display is not defined. The value to be displayed can be defined by the user by entering the address. No value is displayed because this has not yet occurred.
21	Because the certification data log is full the calibration lock must be opened for changing the parameter.

2.4 Access rights

The EK220 differentiates between four access parties. Each access party has a lock and a corresponding code. The locks have the order of priority

Calibration lock – Manufacturer's lock[4] – Supplier's lock – Customer lock.

The access rights apply both for keypad inputs as well as for accesses via the optical or electrical (permanently wired) interface. If the lock is locked, all attempts to set values are answered with an appropriate error message (see Chap. **2.3.2**).

Also the reading of values via the interfaces is only possible, for reasons of data protection, when at least one of the locks is open.

Normally, in addition to the access rights assigned to each individual value, values can also be changed by the access parties with higher priority. A value, which for example has "S" ("Supplier") as access rights, can also be changed by calibration officials and a value subject to the customer's lock can also be changed by suppliers.

Each party with write access for a value can also change the access rights (write and read access for each "lower" party) for this value via interface. Therefore, it is possible for the specifications to deviate from the access rights specified in the lists in the operating instructions.

2.4.1 Calibration lock

The calibration lock is used for securing parameters subject to calibration regulations. This includes all values which affect the volume counting.

The calibration lock is implemented as a pushbutton located within the EK220 housing below the circuit board cover panel. It can be secured with an adhesive seal.

The parameters protected under calibration regulations are each identified with "C" in the lists in the functional description.

Depending on the applications, values, which are not included as inputs subject to calibration regulations, can be placed under the user lock via the WinPADS parameterising software, for example to be able to use them as signalling inputs.

The calibration lock is opened by pressing the pushbutton (the symbol "P" flashes in the display) and is closed again when it is pressed again (symbol "P" goes out). Closure is also possible by deleting the value "St.PL" ($\rightarrow$ 3.10) via the keypad or interface. In addition to this, a time period given in minutes can be set using the "WinPADS" parameterisation software, after which the calibration lock automatically closes.

On request (during order procedure) parameters which are normally protected under calibration lock can be protected under a different lock, e.g. supplier's lock or certification data log.

2.4.2 Certification data log

With the aid of the "certification data log" according to PTB-A 50.7 ($\rightarrow$ *CDL,* chapter 3.8) a selection of parameters relevant to calibration regulations can be changed also with the calibration lock closed. Prerequisites for this are:
- The supplier's lock (see below) must be open.
- At least three entries must be available in the certification data log.

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[4] The manufacturer's lock is reserved for Elster GmbH and is not described here.

The according to factory setting affected parameters (e.g. cp value, measurement period, meter readings) are identified in the lists in chapter 3 with the access right "CDL". By changing the access rights as described in 2.4 further parameters may be affected or the affected parameters may only be subject to the calibration lock.

A data row for the value is entered inside the certification data log before and after the change of the value for each change to such a parameter with the calibration lock closed.

If the certification data log has been written full, it can be cleared with the calibration lock open using the command *ClrPL* ($\rightarrow$ chapter 3.8).

☞ If the calibration lock is opened with the certification data log full, it can only be closed again after clearing the certification data log.

The certification data log is activated by default, but can also be deactivated optionally (see chapter 3.10; parameter "*Addr*"). The affected parameters are then subject to the calibration lock.

2.4.3 Supplier's lock and customer's lock

The supplier's and customer's locks are used for securing all data which is <u>not</u> subject to calibration regulations, but which should also not be changed without authorisation.

The parameters which are according to factory setting write-protected under the supplier or customer locks are each identified with "S" or "K" in the lists in the functional description ($\rightarrow$ 3). All values which are shown with a minus symbol "-" cannot be changed, because they represent, for example, measurements or constants.

The locks can be opened by entering a code (the "combination"). ($\rightarrow$ 3.10: *St.SL, Cod.S, St.PL, Cod.C*)

2.5 Formation of the list structure

The data display in the EK220 is structured in a tabular form. The individual columns in the table each contain associated values.

Values identified with $\boxed{S}$ and $\boxed{Arc}$ are submenus or archives which you can view by entering <ENTER> and leaving again with <ESC>. They each have, subordinate to the main menu, a dedicated list structure, which is written in the corresponding list ($\rightarrow$ 3).

The archives are subdivided into a number of data rows (also termed "data records"). All values in the same data row are saved ("archived") at the same point in time.

The maximum number of data rows and the number of values in a data row depends on the relevant archive. Within an archive the number of values and their meaning are the same for each data row.

Switching to another archive data row occurs with the keys $\boxed{\uparrow}$ (for "younger" data rows) and $\boxed{\downarrow}$ (for "older" data rows). After the last data row, the first follows again and vice versa.

Switching to another value within a data row occurs with the keys $\boxed{\rightarrow}$ and $\boxed{\leftarrow}$. After the last value, the first follows again and vice versa.

A summary of the standard main menu (list structure) is shown on the following pages. By changing the value *Menu* (see chapter 3.1), a minimum main menu can be selected.

	User list		Standard volume		Actual volume		Pressure	
to "Energ." ↔	**User**	↔	**Std.V.**	↔	**Act.V.**	↔	**Press**	↔ to "Temp."

User list

User
Vb Vol. at base cond. (pre-dec. places)
VmA Actual vol. adjust.
p Pressure
T Temperature
z Compressibility factor
zb Compressibility factor at base cond.
C Conversion factor
K.F K subst. value
VbME Month end value
Time Time of VbME
VmME Month end value
Time Time of VmME
Menu Dislpay menu

Standard volume

Std.V.
Vb Vol. at base cond. (post-dec. places)
Qb Flow at base cond.
VbD Disturbance quant.
VbT Total quantity
VbA Adjustable counter
VbME Month end value
Time Time of VbME

Actual volume

Act.V.
Vm Actual volume
Qm Actual flow
VmD Disturbance quant.
VmT Total quantity
VmA Adjustable counter
VmME Month end value
Time Time of VmME

Pressure

Press
p Pressure
pMin Lower alarm limit
pMax Upper alarm limit
MRL.p Meas. range bottom
MRU.p Meas. range top
p.F Substitute value
pb Press. at base cond.
Md.p Pressure mode
Typ.p Press. sensor type
SNp Serial no. of sensor
SMenu p coeff. [S] Submenu p coeff.
pAdj1 Adjustment val. 1
pAdj2 Adjustment val. 2
Prog Accept adjust.
p.atm Amb. press. fixed value
p.Mes Pressure meas
p.Abs Absolute press.
SMenu Press.2 [S] Submenu p-sens. 2 (acc. to Selp2)
p2Mes Pres. meas p-sens.2 (acc. to Selp2)

Temperature	Conversion	Archive	Status + Logbook

to "Press" ↔

Temp.	**Conv.**	**Archiv**	**Status**	to "System" ↔
↔ T — Temperature	↔ C — Conversion factor	↔ ArMo1 [Arc] — Month archive 1	↔ S.Reg [S] — Status register	↔

Temp.

- T — Temperature
- TMin — Lower alarm limit
- TMax — Upper alarm limit
- MRL.T — Meas. range bottom
- MRU.T — Meas. range top
- T.F — Substitute value
- Tb — T at base cond.
- Md.T — Temperature Mode
- Typ.T — Temp. sensor type
- SNT — Serial no. of sensor
- SMenu T coeff. [S] — Submenu T coeff.
- TAdj1 — Adjustment val. 1
- TAdj2 — Adjustment val. 2
- Prog — Accept adjust.
- T.Mes — Temp. meas.

Conv.

- C — Conversion factor
- K — Compressibility ratio factor
- pbX — pb for gas analysis (acc. to Md.K)
- TbX — Tb for gas analysis
- Ho.b — Calorific value (acc. to Md.K)
- CO2 — Carbon diox. cont.
- H2 — Hydrogen content (acc. to Md.K)
- Rhob — Gas density at base cond. (acc. to Md.K)
- N2 — Nitrogen content (acc. to Md.K)
- dr — Density ratio (acc. to Md.K)
- SMenu Gas data [S] — Submenu Gas data (acc. to Md.K)
- K.F — Substitute value
- Md.K — K mode

K mode changeover
Md.K = 0

Conv.

- C — Conversion factor
- Ho.n — Calorific value
- K.F — Substitute value
- Md.K — K mode

Archiv

- ArMo1 [Arc] — Month archive 1
- ArMo2 [Arc] — Month archive 2
- ArDay [Arc] — Day archive
- ArMP [Arc] — Meas. per. archive
- MPer — Meas. period
- MP.Re — Rem. time mea. p.
- FrMP — Freeze ArMP

Status

- S.Reg [S] — Status register
- Stat [S] — Momentary status
- Clr — Clear S.Reg
- Logb. [Arc] — Logbook
- AudTr [Arc] — Audit Trail
- CDL [Arc] — Certification data log (acc. to *CDL* → p. 59)
- ClCDL — Clear cert. data log (acc. to *CDL* → p. 59)

Volume and Temperature Conversion Device EK220

	System		Service					Inputs	
	System	↔	**Serv.**	↔		↔		**Inputs**	

System	Serv.		Inputs
↔ Time Date and time	↔ Bat.R Remaining bat. life		↔ cp.I1 cp-value Input 1
MdTim Daylight sav.: yes/no	Bat.C Battery capacity		cp.I2 cp-value Input 2
MCyc Measurement cycle time	St.SL Supplier lock		Md.I2 Mode for Input 2
MCPul Measurement cycle triggered by input pulse	Cod.S Supplier code		St.I2 Status on Input 2
OCyc Operating cycle time	St.CL Customer lock		MdMI2 Mode monitoring I2
Disp Disp. switch-off time	Cod.C Customer code		SC.I2 Source monitoring I2
Aut.V Disp. changover time	St.PL Calibration lock		L1.I2 Limit 1 for I2
SNo Serial no. device	Contr Display contrast		L2.I2 Limit 2 for I2
Ta.Rg Ambient temp.	Adj.T Clock adjust. factor		SpI2 Stat. pointer mon. I2
Vers Software version	Save Savbe all data		St.I3 Status on Input 3
Chk Software checksum	Clr.A Clear achives	Selp2 Select p sensor 2	MdMI3 Mode monitoring I3
	Clr.V Clear counter	SMenu Amb. temp. [S] Submenu ambient temp.	SC.I3 Source monitoring I3
	Clr.X Initialise device	Addr Addr. user display	L1.I3 Limit 1 for I3
	Bin.T Temp. binary value	... User display	SpI3 Stat. pointer mon. I3
	Bin.p Pressure binary value	SMenu Revisal [S] Submenu Revisal	SNM Serial no. gas meter
	Binp2 Press. 2 binary value	ArCal [Arc] Frozen data	
	Sel.T Select T sensor	Frz Freeze	
	Sel.p Select p sensor	- Display test	

Outputs	Interfaces	Energy

to "Inputs"		to "User"

Outp.	**Ser.IO**	**Energy**
↔	↔	↔

Outp.	Ser.IO	Energy
Md.O1 — Mode for output 1	Md.S2 — Mode interface 2	W — Energy
SC.O1 — Source for output 1	DF.S2 — Data format interface 2	P — Power
cp.O1 — cp value output 1	Bd.S2 — Baud rate interface 2	WD — W disturbance
SpO1 — Status pointer for output 1	TypS2 — Type interface 2 (acc. to Md.S2)	W.T — W total
Md.O2 — Mode for output 2	BusS2 — Bus mode RS485 on / off (acc. to Md.S2)	W.A — W adjustable
SC.O2 — Source for output 2	Num.T — No. of ringing tones before accept. call (acc. to Md.S2)	Ho.b — Calorific value for W
cp.O2 — cp value output 2	M.INI — Initialise modem (acc. to Md.S2)	WME — Month end value
SpO2 — Status pointer for output 2	SMenu GSM&SMS [S] — Submenu GSM and SMS parameter (acc. to Md.S2)	Time — Time of WME
Md.O3 — Mode for output 3	DProt IDOM Prot [S] — Submenu IDOM protocol (acc. to Md.S2)	
SC.O3 — Source for output 3	SMenu Modbus Par [S] — Submenu Modbus parameter (acc. to Md.S2)	
cp.O3 — cp value output 3	Bd.S1 — Baud rate interface 1	
SpO3 — Status pointer for output 3	CW1.S — Call window 1 start	
Md.O4 — Mode for output 4	CW1.E — Call window 1 end	
SC.O4 — Source for output 4	CW2.S — Call window 2 start	
cp.O4 — cp value output 4	CW2.E — Call window 2 end	
SpO4 — Status pointer for output 4	CW3.S — Call window 3 start	
	CW3.E — Call window 3 end	
	CW4.S — Call window 4 start	
	CW4.E — Call window 4 end	
	CWTst — Test call window (acc. to Md.S2)	

3 Functional description

The data display is structured in tabular form (list structure) ($\rightarrow$ 2.5). The individual columns in the table each contain associated values. The following functional description is orientated to this list structure.

Here, the following abbreviations are used:

- AD   Abbreviated designation
           Designation of the value in the display
- Access Write access
           Indicates which lock must be opened to change the value ($\rightarrow$ 2.4.1, 15):
    - C   = Calibration lock
    - CDL[5] = Certification data log
    - M   = Manufacturer's lock
    - S   = Supplier's lock
    - Cu   = Customer's lock
    - C / S = Calibration lock or supplier's lock, depending on national regulations
           In case of verification of device under calibration regulations (e.g. acc. MID) the write access C must be used.
    If the letter is located in brackets, the value can only be changed via the interface and not via the keypad.
- Address Address of the value.
           This is required especially for data transmission via the serial interface. The address can be displayed by pressing the keys $\leftarrow$ + $\rightarrow$ simultaneously.

- DC   Data class
           The data class shows, amongst other properties, whether and how the value can be changed. ($\rightarrow$ 2.3.1)

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[5] If the device does not have a calibration logbook, then the affected values are subject to the calibration lock.

3.1   User list

AD	Designation / value	Unit	Access	Address	DC
Vb	Volume at base conditions (pre-decimal places)	m3	CDL	2:300_1	12
VmA	Vm adjustable	m3	S	4:303	12
p	Pressure	bar	-	7:310_1	4
T	Temperature	°C	-	6:310_1	4
z	Compressibility factor		-	9:310	4
zb	Compressibility factor at base conditions		C	9:312	8
C	Conversion factor	-	-	5:310	4
K.F	K-value, substitute value		S	8:311	8
VbME	Vb month end value	m3	-	7:161	16
Time	Date and time of Vb month end value	-	-	7:165	16
VmME	V month end value	m3	-	14:161	16
Time	Date and time of Vm month end value	-	-	14:165	16
Menu	Selection display menu	-	S	1:1A1	7

With the exception of the first and last value (*Vb* and *Menu*), this list is user-specific, i.e. the user can himself set which values in this list are displayed. Ex-works, these are the above-mentioned values some of which are also displayed in another list and described in the corresponding chapters.

The setting of the values to be displayed occurs by using the parameterisation software WinPADS.

Vb   Volume at base conditions (pre-decimal places)
The volume at base conditions computed from the measured "actual volume" is summed here provided no alarm is present. An alarm is present when any message with the number "1" or "2" is urgent ($\rightarrow$ 3.8).

$Vb = Vm \cdot C$ where Vm = Actual volume ($\rightarrow$ 3.3)
                                 C   = Conversion factor ($\rightarrow$ 3.6)

The post-decimal places of *Vb* are displayed in the standard volume list ($\rightarrow$ 3.2).

Vm   Actual Volume (Volume at measurement conditions)
p   Pressure
T   Temperature
Values which are also displayed in another list and described in the corresponding chapters.

z   Compressibility factor
zb   Compressibility factor at base conditions
The computation of z and zb occurs according to S-Gerg-88, AGA-8 GC method 1 or 2, AGA-NX19, AGA-NX19 acc. Herning and Wolowsky or compatible with the AGA-8 DC92, depending on the setting of Md.K. The gas analysis values *Ho.b*, *CO2*, *H2* and *N2* and *Rhob* (*Md.K* = 1) need to be included in the entries for this ($\rightarrow$ 3.6).

C   **Conversion factor**

K.F   **K-value, substitute value**

VbME **Vb month end value**

Time **Date and time of Vb month end value**

VmME **Vm month end value**

Time **Date and time of Vm month end value**

These values are also displayed in other lists and are described in the appropriate chapters.

Menu **Selection display menu**

With Menu the complete display structure of the EK220 can be switched between "complete" and "simple".

Menu =	Meaning
1	Complete display structure
2	Only "User" column
3	Complete display structure without "Energy" column

Menu = 1 corresponds to the standard setting which is described in this manual.

With the setting Menu = 2, the display is limited to the column "User" described here. All other columns cannot be called.

3.2 Standard volume (volume at base conditions) list

AD	Designation / value	Unit	Access	Address	DC
Vb	Volume at base conditions (post-decimal places)	m3	CDL	2:300_2	12
Qb	Flow at base conditions	m3/h	-	2:310	4
VbD	Vb disturbed	m3	S	2:301	12
VbT	Vb total	m3	-	2:302	15
VbA	Vb adjustable	m3	S	2:303	12
VbME	Month-end value	m3	-	7:161	16
Time	Time of VbME	-	-	7:165	16

(Legends: see page 21)

Vb   Volume at base conditions (post-decimal places)
The volume at base conditions computed from the measured "actual volume" is summed here provided no alarm is present.

An alarm is present when any message "1" or "2" is urgent ($\rightarrow$ 3.8).

$Vb = Vm \cdot C$ where Vm = Actual volume ($\rightarrow$ 3.3)
C = Conversion factor ($\rightarrow$ 3.6)

The pre-decimal places of Vb are displayed in the user list ($\rightarrow$ 3.1).

Qb   Flow at base conditions
Momentary flow at base conditions (Volume at base conditions). In the alarm state Qb is computed with the substitute values of the disturbed measurements.

VbD   Vb disturbed
Here the volume at base conditions is summed while ever an alarm is present, i.e. a message with the number "1" or "2" is located in any momentary status ($\rightarrow$ 3.8).

In the alarm state the volume at base conditions is computed with the substitute values of the disturbed quantities. ($\rightarrow$ 3.4: *p.F*, 3.5: *T.F*)

VbT   Vb total
Here the sum of $Vb + VbD$ is always displayed. Entries for Vb or VbD therefore also have an effect here. No entry for VbT itself can be carried out.

VbA   Vb adjustable
Here, as with VbT, the total quantity, i.e. disturbed and undisturbed volumes are counted. In contrast to VbT, VbA can however be changed manually.

The counter is typically used for tests.

VnME   Vn month-end value
VnME saves the current month-end value at the change of month at the day boundary.

Time   Time of VnME
Date and time of the saved *VnME*.

3.3   Actual volume (volume at measurement conditions) list

AD	Designation / value	Unit	Access	Address	DC
Vm	Actual volume	m3	CDL	4:300	12
Qm	Actual flow rate	m3/h	-	4:310	4
VmD	Vm disturbed	m3	S	4:301	12
VmT	Vm total	m3	-	4:302	15
VmA	Vm adjustable	m3	S	4:303	12
VmME	Month-end value	m3	-	14:161	16
Time	Time of VmME	-	-	14:165	16

Vm   **Actual volume (Volume at measurement conditions)**
The volume $V1$ ($\rightarrow$ 3.8) measured on the input is summed here provided no alarm is present. An alarm is present when a message "1" or "2" is located in any momentary status ($\rightarrow$ 3.8).

Qm   **Actual flow rate**
Momentary actual flow (actual flow rate).
If the EK220 receives fewer than four pulses per hour on the counter input (terminal "DE1"), the flow rate is set to "0".
The maximum inaccuracy of the indicated value corresponds to four pulses.

Example: The cp value of the pulse transmitter ($\rightarrow$ (Legends: see page 21) cp.I1, page 61) is 0.1 pulses/m3 and the momentary flow rate is 3600 m3/h.
$\Rightarrow$ Pulse frequency   = 3600 m3/h   • 0.1 pulses/m3 = 360 pulses/h
$\Rightarrow$ max. inaccuracy   = 4 pulses/h   / 360 pulses/h =   1.11 %

VmD   **Vm disturbed**
Here the actual volume is summed while ever an alarm is present, i.e. a message with the number "1" or "2" is located in any momentary status ($\rightarrow$ 3.8).

VmT   **Vm total**
Here the sum of $Vm + VmD$ is always displayed. Entries for Vm or VmD therefore also have an effect here. No entry for VmT itself can be carried out.

VmA   **Vm adjustable**
Here, as with VmT, the total quantity, i.e. disturbed and undisturbed volumes are counted. In contrast to VmT, VmA can however be changed manually.
This counter is typically set to the same reading as the gas meter in order to be able to easily detect deviations by comparison of the two counter readings.

VmME **Vm month-end value**
$VmME$ saves the current month-end value at the change of month at the day boundary.

Time   **Time of VmME**
Date and time of the saved $VmME$.

3.4   Pressure list

☞   *The values displayed in this list depend on whether a second pressure sensor is connected to the EK220 and is activated via Sel.p2 (see Chapter 3.10).*

☞   *If designed as Temperature Conversion Device only the list as described in chapter "a" (see below) is displayed. Any other lists are not considered!*

a)   One or none[6] pressure sensor connected to the EK220, *Sel.p2 = 0 ("off")*:

AD	Designation / value	Unit	Access	Address	DC
p	Pressure	bar	-	7:310_1	4
pMin	Lower alarm limit pressure	bar	C	7:3A8_1	8
pMax	Upper alarm limit pressure	bar	C	7:3A0_1	8
MRL.p	Pressure meas. range lower limit	bar	C	6:224_1	8
MRU.p	Pressure meas. range upper limit	bar	C	6:225_1	8
p.F	Pressure substitute value	bar	S	7:311_1	8
pb	Pressure at base conditions	bar	C	7:312_1	8
Md.p	Pressure mode	-	C	7:317	7
Typ.p	Pressure sensor type	-	C	6:223	8
SNp	Serial no. of pressure sensor	-	C	6:222	8
SMenu p coeff.	Submenu pressure coefficients	-	(C)	12:1C1	8
pAdj1	Adjustment value 1 for pressure	bar	C / S	6:260_1	8
pAdj2	Adjustment value 2 for pressure	bar	C / S	6:261_1	8
Prog	Accept pressure adjustment	-	C / S	6:259	2
p.atm	Ambient pressure fixed value	bar	C	6:212_1	8
p.Mes	Pressure measurement	bar	-	6:211_1	4
p.Abs	Absolute pressure measurement	bar	-	6:210_1	4

(Legends: see page 21)

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[6] EK220 as Temperature Conversion Device.

b) Two pressure sensors[7] connected to the EK220, *Sel.p2 = 1 ("CT30")*:

AD	Designation / value	Unit	Access	Address	DC
p	Pressure	bar	-	7:310_1	4
pMin	Lower alarm limit pressure	bar	C	7:3A8_1	8
pMax	Upper alarm limit pressure	bar	C	7:3A0_1	8
MRL.p	Pressure meas. range lower limit	bar	C	6:224_1	8
MRU.p	Pressure meas. range upper limit	bar	C	6:225_1	8
p.F	Pressure substitute value	bar	S	7:311_1	8
pb	Pressure at base conditions	bar	C	7:312_1	8
Md.p	Pressure mode	-	C	7:317	7
Typ.p	Pressure sensor type	-	C	6:223	8
SNp	Serial no. of pressure sensor	-	C	6:222	8
SMenu p coeff.	Submenu pressure coefficients	-	(C)	12:1C1	8
pAdj1	Adjustment value 1 for pressure	bar	C / S	6:260_1	8
pAdj2	Adjustment value 2 for pressure	bar	C / S	6:261_1	8
Prog	Accept pressure adjustment	-	C / S	6:259	2
p.atm	Ambient pressure fixed value	bar	C	6:212_1	8
p.Mes	Pressure measurement	bar	-	6:211_1	4
p.Abs	Absolute pressure measurement	bar	-	6:210_1	4
SMenu Press. 2	Submenu pressure sensor 2	-	(C)	13:1C1	8
p2Mes	Pressure 2 measurement	bar	-	7:211_1	4

(Legends: see page 21)

The unit of the various pressure displays can vary depending on the device setting. The setting of the unit takes place via the WinPADS parameterisation software with the aid of parameter files. To do this the appropriate lock must be open. Possible units are: bar, kPa, psi and MPa.

Furthermore, representation as overpressure or absolute pressure is possible. Exceptions here are the adjustment values for the pressure (pAdj1, pAdj2, p2Ad1 and p2Ad2) and the atmospheric pressure (p.atm) which are always displayed as absolute pressure.

p   Pressure
pMin   Lower alarm limit pressure[8]
pMax   Upper alarm limit pressure[8]

> *p* is the pressure which is used for computing the conversion factor ($\rightarrow$ 3.6) and hence the volume at base conditions ($\rightarrow$ 3.2).
>
> If the measured pressure *p.Abs* (see below) is within the alarm limits *pMin* and *pMax*, it is used as *p*: *p = p.Abs.*.
>
> − If p.Abs is located outside the alarm limits, the substitute value p.F (see below) is used: p = p.F. In addition, disturbance quantities are then counted ($\rightarrow$ 3.2, 3.3) and the message "p Alarm Lim." displayed ($\rightarrow$ page 49).

---

[7] For EK220 as Volume Conversion Device is only possible to connect two pressure sensors of type CT30!
[8] These values are not required when designed as a temperature conversion device!

- No disturbance quantities are counted when designed as a temperature conversion device, but the substitute value is used: $p = p.F$

MRL.p **Pressure meas. range lower limit** [9]
MRU.p **Pressure meas. range upper limit** [9]

These details of the measurement range are used to identify the pressure sensor. They have no effect on the measurements.

p.F **Pressure substitute value**

If the measured pressure p.Abs is outside the alarm limits pMin and pMax (see below) or the EK220 is operated as a temperature conversion device, p.*F* is used as pressure p for correction. $p = p.F$.

pb **Pressure at base conditions**

The pressure at base conditions is used for computing the conversion factor ($\rightarrow$ 3.6) and hence the volume at base conditions

Md.p **Pressure mode**

With *Md.p* = "1" the measured pressure *p.Abs* (see below) is used for correction, provided it does not violate the alarm limits.

With *Md.p* = "0" the fixed value (substitute value) p.F is always used for correction. No disturbance quantities are counted.

Typ.p **Pressure sensor type** [9]
SNp **Serial no. of pressure sensor** [9]

Identification of the pressure sensor associated with the EK220.

SMenu **Submenu pressure coefficients** [9]

Here, <ENTER> is used to recall the submenu with the coefficients for the pressure calculation (*p.Mes*) ($\rightarrow$ 3.4).

pAdj1 **Adjustment value 1 for pressure** [9]
pAdj2 **Adjustment value 2 for pressure** [9]
Prog **Accept pressure adjustment** [9]

These values are used for the adjustment of the pressure measurement, i.e. for the internal computation of the equation coefficients for the pressure (see above).

The adjustment takes place in three steps:

1. Apply measurement pressure 1 (= reference value 1) to the pressure sensor and enter as *pAdj1*.
2. Apply measurement pressure 2 (= reference value 2) to the pressure sensor and enter as *pAdj2*.
3. Enter *Prog* = "1" so that the EK220 calculates the equation coefficients.

After applying the measurement pressure, you should either wait about one minute each time before entering the adjustment or press the key combination ENTER a number of times during the display of the pressure measurement *p.Mes* (see below) until the displayed value is stable.

Approx. $0.4 \cdot pMax$ and approx. $0.9 \cdot pMax$ should be selected as adjustment values.

---

[9] These values are not required when designed as a Temperature Conversion Device!

p.atm **Ambient pressure fixed value** [9]

p.Mes **Pressure measurement** [9]

p.Abs **Absolute pressure measurement** [9]

p.Abs is the sum of *p.atm* and *p.Mes*: *p.Abs = p.atm + p.Mes*

For *p.atm*, when an absolute sensor is used, "0" is entered and the ambient pressure is entered when a gauge pressure sensor is used.

p.Mes is absolute or gauge depending on the pressure sensor.

If the absolute pressure *p.Abs* is within the alarm limits *pMin* and *pMax* (see above), then it is used as the pressure *p* for correction: *p = p.Abs.*

SMenu Press2 [10]

Here, <ENTER> is used to recall the submenu for the parameters of the second pressure sensor ($\rightarrow$ 3.4.1).

p2Mes **Pressure measurement** [9]

p2Mes is the pressure measured by the second pressure sensor. Depending on the pressure sensor, p2Mes is displayed as the absolute pressure or overpressure.

3.4.1 Submenu pressure sensor 2 "SMenu Press. 2"

☞ *Only two pressure sensors of type CT30 can be connected!*

☞ *This submenu is not applicable when designed as a temperature conversion device.*

AD	Designation / value	Unit	Access	Address	DC
p2.LW	Lower warning limit pressure 2	bar	S	15:150	8
p2.UW	Upper warning limit pressure 2	bar	S	15:158	8
MdM.W	Mode for monitoring pressure 2	-	S	15:157	7
MRLp2	Pressure 2 meas. range lower limit	bar	C	7:224_1	8
MRUp2	Pressure 2 meas. range upper limit	bar	C	7:225_1	8
Typp2	Pressure sensor 2 type	-	C	7:223	8
SNp2	Serial no. of pressure sensor 2	-	C	7:222	8
E1p2	Coefficient 1 of pressure equation 2	-	S	7:280	8
E2p2	Coefficient 2 of pressure equation 2	-	S	7:281	8
E3p2	Coefficient 3 of pressure equation 2	-	S	7:282	8
p2Ad1	Adjustment value 1 for pressure 2	bar	S	7:260_1	8
p2Ad2	Adjustment value 2 for pressure 2	bar	S	7:261_1	8
Prog	Accept pressure adjustment 2	-	S	7:259	2
p2Mes	Pressure 2 measurement	bar	-	7:211_1	4
p2Abs	Absolute pressure 2 measurement	bar	-	7:210_1	4

(Legends: see page 21)

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[10] These values are not required in the performance as temperature conversion device!

p2.LW Lower warning limit pressure 2
p2.UW Upper warning limit pressure 2

These values are used to monitor the gas pressure *p2Mes* that is present at the second pressure sensor. The message "p2-warning limit" is entered in *St.7* as soon as *p2Mes* exceeds the upper limit value *p2.LW* or falls below the lower limit value *p2.UW*. ($\rightarrow$ Page 3.4)

Several different results can in turn be programmed for this message, e.g. entry of the status change in the logbook ($\rightarrow$ 3.8) or activation of a signal output ($\rightarrow$ 3.12)

MdM.W Mode for monitoring pressure 2

Mode *MdM.W* facilitates the activation or deactivation of the monitoring of the gas pressure *p2Mes* at the second pressure sensor, taking the entered warning limits *p2.LW and p2.UW* into account (see above)

MdM.W = "0":   The gas pressure *p2Mes* is not monitored.
MdM.W = "12": The monitoring of gas pressure *p2Mes* is performed within pro-grammed warning limits.

☞ *For reasons that are inherent in the system, further values are offered after entry of the key combination ENTER, but which are not sensibly applicable here.*

MRLp2 Pressure meas. range lower limit
MRUp2 Pressure meas. range upper limit

These details of the measurement range are used to identify the pressure sensor. They have no effect on the measurements.

Typp2 Pressure sensor type
SNp2   Serial no. of pressure sensor

Identification of the second pressure sensor associated with the EK220.

E1p2   Coefficient 1 of pressure equation 2
E2p2   Coefficient 2 of pressure equation 2
E3p2   Coefficient 3 of pressure equation 2

The coefficients of the quadratic equation for calculating the pressure *p2Mes* from the raw pressure value *Binp2* ($\rightarrow$ 3.10):

$$p2Mes = E1p2 + E2p2 \cdot Binp2 + E3p2 \cdot Binp2^2$$

To adjust the pressure measurement, the 3 coefficients of the quadratic equation can either be found by the EK220 itself or calculated and entered by the user.

External to the EK220, the three coefficients can be calculated based on three values for *Binp2* and the corresponding reference values.

When the EK220 determines the coefficients, it uses the value for *E3p2* available at the time of entering Prog (see below) and it calculates the corresponding *E1p2* and *E2p2* for this. The standard value for *E3p2* is "0".

p2Ad1 Adjustment value 1 for pressure 2
p2Ad2 Adjustment value 2 for pressure 2
Prog   Accept pressure adjustment

These values are used for the adjustment of the pressure measurement, i.e. for the internal computation of the equation coefficients for the pressure (see above).

The adjustment takes place in three steps:

1. Apply measurement pressure 1 (= reference value 1) to the pressure sensor and enter as *p2Ad1*.
2. Apply measurement pressure 2 (= reference value 2) to the pressure sensor and enter as *p2Ad2*.
3. Enter *Prog* = "1" so that the EK220 calculates the equation coefficients.

After applying the measurement pressure, you should either wait about one minute each time before entering the adjustment or press the key combination ENTER a number of times during the display of the pressure measurement *p2Mes* (see below) until the displayed value is stable.

Approx. $0.4 \cdot$ *pMax* and approx. $0.9 \cdot$ *pMax* should be selected as adjustment values.

p2Mes Pressure 2 measurement
p2Abs Absolute pressure 2 measurement

p2Abs is the sum of *p.atm* and *p2Mes*: *p2Abs = p.atm + p2Mes*

For *p.atm*, when an absolute sensor is used, "0" is entered and the ambient pressure is entered when a gauge pressure sensor is used.

p2Mes is absolute or gauge depending on the pressure sensor.

3.4.2 Submenu pressure coefficients

☞ *The values shown in this list depend on the set the type of pressure sensor* Sel.p *($\rightarrow$ 3.10):*

☞ ***This submenu is not applicable when designed as a temperature conversion device.***

   a) **Pressure sensor type CT30, *Sel.p = 1 ("CT30")*:**

AD	Designation / value	Unit	Access	Address	DC
Eq1p	Coefficient 1 of pressure equation	-	C / S	6:280	8
Eq2p	Coefficient 2 of pressure equation	-	C / S	6:281	8
Eq3p	Coefficient 3 of pressure equation	-	C / S	6:282	8

(Legends: see page 21)

Eq1p   Coefficient 1 of pressure equation
Eq2p   Coefficient 2 of pressure equation
Eq3p   Coefficient 3 of pressure equation

The coefficients of the quadratic equation for calculating the pressure *p.Mes* from the raw pressure value *Bin.p* ($\rightarrow$ 3.10):

$$p.Mes = Eq1p + Eq2p \cdot Bin.p + Eq3p \cdot Bin.p^2$$

To adjust the pressure measurement, the 3 coefficients of the quadratic equation can either be found by the EK220 itself or calculated and entered by the user.

External to the EK220, the three coefficients can be calculated based on three values for *Bin.p* and the corresponding reference values.

When the EK220 determines the coefficients, it uses the value for *Eq3p* available at the time of entering Prog (see below) and it calculates the corresponding *Eq1p* and *Eq2p* for this. The standard value for *Eq3p* is "0".

b) Pressure sensor type 17002, *Sel.p = 4 ("17002")*:

AD	Designation / value	Unit	Access	Address	DC
a0p1	Coefficient a0 of pressure equation	-	C / S	6:290_1	8
a1p1	Coefficient a1 of pressure equation	-	C	6:290_2	8
a2p1	Coefficient a2 of pressure equation	-	C	6:290_3	8
a3p1	Coefficient a3 of pressure equation	-	C	6:290_4	8
b0p1	Coefficient b0 of pressure equation	-	C / S	6:291_1	8
b1p1	Coefficient b1 of pressure equation	-	C	6:291_2	8
b2p1	Coefficient b2 of pressure equation	-	C	6:291_3	8
b3p1	Coefficient b3 of pressure equation	-	C	6:291_4	8
c0p1	Coefficient c0 of pressure equation	-	C	6:292_1	8
c1p1	Coefficient c1 of pressure equation	-	C	6:292_2	8
c2p1	Coefficient c2 of pressure equation	-	C	6:292_3	8
c3p1	Coefficient c3 of pressure equation	-	C	6:292_4	8
d0p1	Coefficient d0 of pressure equation	-	C	6:293_1	8
d1p1	Coefficient d1 of pressure equation	-	C	6:293_2	8
d2p1	Coefficient d2 of pressure equation	-	C	6:293_3	8
d3p1	Coefficient d3 of pressure equation	-	C	6:293_4	8
a.Up	Coefficient a for pressure main value	-	C / S	6:272	8
b.Up	Coefficient b for pressure main value	-	C / S	6:273	8
a.RB	Coefficient a for pressure auxiliary value	-	C / S	6:27A	8
b.RB	Coefficient b for pressure auxiliary value	-	C / S	6:27B	8

(Legends: see page 21)

a0p1 to a3p1   **Coefficients a0 to a3 of pressure equation**
b0p1 to b3p1   **Coefficients b0 to b3 of pressure equation**
c0p1 to c3p1   **Coefficients c0 to c3 of pressure equation**
d0p1 to d3p1   **Coefficients d0 to d3 of pressure equation**
a.Up   **Coefficient a for pressure main value**
b.Up   **Coefficient b for pressure main value**
a.RB   **Coefficient a for pressure auxiliary value**
b.RB   **Coefficient b for pressure auxiliary value**

The coefficients are used to calculate the pressure *pMes* from the pressure raw value *Bin.p* ($\rightarrow$ 3.10).

3.5   Temperature list

AD	Designation / value	Unit	Access	Address	DC
T	Temperature	°C	-	6:310_1	4
TMin	Lower alarm limit temperature	°C	C	6:3A8_1	8
TMax	Upper alarm limit temperature	°C	C	6:3A0_1	8
MRL.T	Temperature meas. range lower limit	°C	C	5:224_1	8
MRU.T	Temperature meas. range upper limit	°C	C	5:225_1	8
T.F	Temperature substitute value	°C	S	6:311_1	8
Tb	Temperature at base conditions	K	C	6:312	8
Md.T	Temperature mode	-	C	6:317	7
Typ.T	Temp. sensor type	-	C	5:223	8
SNT	Serial number of temperature sensor	-	C	5:222	8
SMenu T coeff.	Submenu temperature coefficients	-	(C)	11:1C1	8
TAdj1	Adjustment value 1 for temperature	°C	C / S	5:260_1	8
TAdj2	Adjustment value 2 for temperature	°C	C / S	5:261_1	8
Prog	Accepts temperature adjustment	-	C / S	5:259	2
T.Mes	Temperature measurement	°C	-	5:210_1	4

(Legends: see page 21)

The unit of the various temperature displays, except for the standard temperature, can vary depending on the device setting. The setting of the unit takes place via the WinPADS parameterisation software with the aid of parameter files. To do this the appropriate lock must be open. Possible units are:°C, K and °F

T **Temperature**
TMin **Lower alarm limit temperature**
TMax **Upper alarm limit temperature**

> T is the temperature which is used for computing the conversion factor ($\rightarrow$ 3.6) and hence the volume at base conditions ($\rightarrow$ 3.1).
> If the measured temperature $T.Mes$ (see below) is within the alarm limits TMin and TMax (see below), it is used as T: T = $T.Mes$.
> If $T.Mes$ is located outside the alarm limits, the substitute value $T.F$ (see below) is used: T = $T.F$. In addition, disturbance quantities are then counted ($\rightarrow$ 3.2, 3.3) and the message "T Alarm Lim." displayed ($\rightarrow$ page 49).

MRL.T **Temperature meas. range lower limit**
MRU.T **Temperature meas. range upper limit**

> These details of the measurement range are used to identify the temp. sensor.

T.F **Temperature substitute value**

> If the measured temperature $T.Mes$ is outside the alarm limits $TMin$ and $TMax$ (see below), $T.F$ is used as temperature T for correction. $T = T.F$.

Tb **Temperature at base conditions**

> The temperature at base conditions is used for computing the conversion factor ($\rightarrow$ 3.6) and hence the volume at base conditions.

Md.T   Temperature mode

With *Md.T* = "1" the measured temperature *T.Mes* (see below) is used for correction, provided it does not violate the alarm limits.

With *Md.T* = "0" the fixed value (substitute value) *T.F* is always used for correction. No disturbance quantities are counted.

Typ.T   Temperature sensor type
SNT   Serial number of temperature sensor

Identification of the temperature sensor associated with the EK220.

SMenu Submenu temperature coefficients

Here, <ENTER> is used to recall the submenu with the coefficients for the temperature calculation (T*.Mes)* ($\rightarrow$ 3.5).

TAdj1   Adjustment value 1 for temperature
TAdj2   Adjustment value 2 for temperature

Prog   Accept temperature adjustment

These values are used for the adjustment of the temperature measurement circuit, i.e. for the internal computation of the equation coefficients for the temperature (see above).

The adjustment takes place in three steps:

1. Apply measurement temperature 1 (= reference value 1) on the temperature sensor and enter as *TAdj1*.
2. Apply measurement temperature 2 (= reference value 2) on the temperature sensor and enter as *TAdj2*.
3. Enter *Prog* = "1" so that the EK220 calculates the equation coefficients.

After applying the measurement temperature, you should either wait about one minute each time before entering the adjustment or press ENTER number of times during the display of the temperature measurement *T.Mes* (see below) until the displayed value is stable.

To optimise the accuracy, the adjustment values should be located as close as possible to the measurement range limits *MRL.T* and *MRU.T* (e.g. -10°C and +60°C).

T.Mes   Temperature measurement

If the measured temperature *T.Mes* is within the alarm limits *TMin* and *TMax* (see below), then it is used as the temperature *T* (see above) for correction. *T = T.Mes*.

3.5.1   Submenu temperature coefficients

AD	Designation / value	Unit	Access	Address	DC
Eq1T	Coefficient 1 of temperature equation	-	C / S	5:280	8
Eq2T	Coefficient 2 of temperature equation	-	C / S	5:281	8
Eq3T	Coefficient 3 of temperature equation	-	C / S	5:282	8

(Legends: see page 21)

Eq1T   Coefficient 1 of temperature equation
Eq2T   Coefficient 2 of temperature equation
Eq3T   Coefficient 3 of temperature equation

The coefficients of the quadratic equation for calculating the temperature *T.Mes* from the raw temperature value *Bin.T* ($\rightarrow$ 3.10):

$$T.Mes = Eq1T + Eq2T \cdot Bin.T + Eq3T \cdot Bin.T^2$$

To adjust the temperature measurement circuit, the three coefficients of the quadratic equation can either be found by the EK220 itself or calculated and entered by the user.

External to the EK220, the three coefficients can be calculated based on three values for *Bin.T* and the corresponding reference values.

When the EK220 determines the coefficients, it uses the value for *Eq3T* set at the time of entering *Prog* (see below) and it calculates the corresponding *Eq1T* and *Eq2T* for this.

3.6   Volume corrector list

The values shown in this list depend on the set computation method *Md.*K (see below) for the K-value (gas law deviation factor):

a)   Computation according to S-Gerg-88 (Md.K = 1)

AD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310_1	4
K	K-value	-	-	8:310_1	4
pbX	Pressure at base conditions for gas analysis input	bar	S	7:314_1	8
TbX	Temperature at base conditions for gas analysis input	°C	S	6:314_1	8
Ho.b	Calorific value	kWh/m3	S	10:314_1	8
CO2	Carbon dioxide content	%	S	11:314	8
H2	Hydrogen content	%	S	12:314	8
Rhob	Density gas at base conditions	kg/m3	S	13:314_1	8
K.F	K-value substitute value	-	S	8:311_1	8
Md.K	K-value mode	-	CDL	8:317	7

b)   Computation according to AGA-NX19 (Md.K = 2)

AD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310_1	4
K	K-value	-	-	8:310_1	4
pbX	Pressure at base conditions for gas analysis input	bar	S	7:314_1	8
TbX	Temp. at base conditions for gas analysis input	°C	S	6:314_1	8
Ho.b	Calorific value	kWh/m3	S	10:314_1	8
CO2	Carbon dioxide content	%	S	11:314	8
N2	Nitrogen content	%	S	14:314	8
dr	Density ratio	-	S	15:314	8
K.F	K-value substitute value	-	S	8:311_1	8
Md.K	K-value mode	-	CDL	8:317	7

c)   Computation according to AGA 8 Gross characterization method 1 (Md.K = 3)

AD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310_1	4
K	K-value	-	-	8:310_1	4
pbX	Pressure at base conditions for gas analysis input	bar	S	7:314_1	8
TbX	Temperature at base cond. for gas analysis input	°C	S	6:314_1	8
Ho.b	Calorific value	kWh/m3	S	10:314_1	8
CO2	Carbon dioxide content	%	S	11:314	8
dr	Density ratio	-	S	15:314	8
K.F	K-value substitute value	-	S	8:311_1	8
Md.K	K-value mode	-	CDL	8:317	7

d)   Computation according to AGA 8 Gross characterization method 2 (Md.K = 4)

AD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310_1	4
K	K-value	-	-	8:310_1	4
CO2	Carbon dioxide content	%	S	11:314	8
N2	Nitrogen content	%	S	14:314	8
dr	Density ratio	-	S	15:314	8
K.F	K-value substitute value	-	S	8:311_1	8
Md.K	K-value mode	-	CDL	8:317	7

e) Computation according to AGA-NX19 following Herning & Wolowsky (Md.K = 5)

AD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310_1	4
K	K-value	-	-	8:310_1	4
CO2	Carbon dioxide content	%	S	11:314	8
N2	Nitrogen content	%	S	14:314	8
dr	Density ratio	-	S	15:314	8
K.F	K-value substitute value	-	S	8:311	8
Md.K	K-value mode	-	CDL	8:317	7

f) Computation acc. Detailed Characterization, equivalent to AGA-8 DC92 (Md.K= 6)

AD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310_1	4
K	K-value	-	-	8:310_1	4
SMenu	Submenu gas data	-	(S)	16:1C1	8
K.F	K-value substitute value	-	S	8:311_1	8
Md.K	K-value mode	-	CDL	8:317	7

g) Constant K value (Md.K =0)

AD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310_1	4
Ho.b	Calorific value	kWh/m3	S	10:311_1	8
K.F	K-value substitute value	-	S	8:311_1	8
Md.K	K-value mode	-	CDL	8:317	7

The rated operating conditions applying to the various conversion methods are described in Chapter 4.1.

C   Conversion factor

The conversion factor is calculated according to the following formula:

$$C = \frac{1}{K} \cdot \frac{p}{pb} \cdot \frac{Tb}{T}$$ (p, pn: $\rightarrow$ 3.4, T, $Tn \rightarrow$ 3.5, K: see below)

K   **Compressibility factor ratio (K-value)**
The K-value is used for computing the conversion factor (see above). It is calculated according to the following formula:

$$K = \frac{z}{z_b}$$

where z = compressibility factor (address 09:310) and
z_b = compressibility factor at base conditions (address 09:312)

The computation of z and zb takes place according to the set computation method, depending on the setting of *Md.K*. The gas analysis values *Ho.b*, *CO2*, *H2* and *Rhob* (*Md*.K = 1), resp. *N2* and *dr* (*Md.K* = 2, 3 and 4) need to be included in the entries for this ($\rightarrow$ 3.6).

If the K-value mode *Md.K* (see below) is set to "fixed value" (= "0"), *K* is not computed, but the substitute value *K.F* (see below) is used instead.

pbX   **Pressure at base conditions for gas analysis input**
TbX   **Temperature at base conditions for gas analysis input**
The base condition described by pbX and TbX is valid for the gas analysis input (Ho.b, CO2, … dr, see below) only. By contrast, the conversion factor C ($\rightarrow$ 3.6) and the volume at base conditions Vb ($\rightarrow$ 3.2) will be computed using the base condition described by pb and Tb ($\rightarrow$ 3.4 resp. 3.5).

Any change of pb or Tb will change pbX resp. TbX to the same value. To get different values, change pbX or TbX after pb or Tb.

Ho.b   **Calorific value**
CO2   **Carbon dioxide content**
H2   **Hydrogen content**   **(only for Md.K = 1)**
Rhob   **Density gas at base conditions**   **(only for Md.K = 1)**
N2   **Nitrogen content**   **(only for Md.K = 2 and 4)**
dr   **Density ratio**   **(only for Md.K = 2, 3 and 4)**
Depending on the set K-value mode these four gas analysis values must be entered so that the K-value *K* can be computed.

For computations according to S-Gerg-88 (Md.K = 1) and AGA-NX19 (Md.K = 2 and 5) only, the range of validity is:

Ho.b 6.0	...13.0	kWh/m^3	
CO2 0.0	...30.0	mol %	
H2 0.0	...10.0	mol %	(only for Md.K = 1)
Rhob 0.71	...1.16	kg/m^3	(only for Md.K = 1)
N2 0.0	...30.0	mol %	(only for Md.K = 2)
dr 0.554	... 0.900		(only for Md.K = 2)

☞   *Furthermore, the following limits must be ensured by the gas supplier:*
Methane CH_4 50 – 100%   Propane C_3H_8 0 – 5% Ethane C_2H_6 0 - 20%
Nitrogen N_2 0 – 50%   Butane C_4H_{10} 0 – 1% Pentane C_5H_{12} 0 – 0,5%

☞   *The respective new value is determined from the value entered during entry of the density gas at base conditions Rhob or of the density ratio dr!*

K.F   **K-value substitute value**
If the K-value mode *Md.K* (see below) is set to "fixed value" (= "0"), the constant *K.F* is used instead of the calculated K-value *K* for the computation of the conversion factor *C* (see above).

Md.K   K-value mode

With *Md.K* you can set whether the conversion factor *C* ($\rightarrow$ 3.6) and hence the volume at base conditions *Vb* ($\rightarrow$ 3.1) are determined with the calculated K-value or with the constant K-value, *K.F*:

Md.K = 0: The fixed value (substitute value) *K.F* is used.

Md.K = 1: K-value calculated according to S-Gerg-88.

Md.K = 2: K-value calculated according to AGA-NX19.

Md.K = 3: K-value calculated according to AGA 8 gross char. method 1.

Md.K = 4: K-value calculated according to AGA 8 gross char. method 2.

Md.K = 5: K-value calc. acc. to AGA-NX19 following Herning & Wolowsky

Md.K = 6: K-value calc. acc. Detailed Characterization, equivalent to AGA-8 DC 92

3.6.1 Submenu gas data for Detailed Characterization

AD	Designation / value	Unit	Access	Address	DC
CH4	Methane content	%	S	1:330	8
N2	Nitrogen content	%	S	14:314	8
CO2	Carbon Dioxide content	%	S	11:314	8
C2H6	Ethane content	%	S	2:330	8
C3H8	Propane content	%	S	3:330	8
H2O	Water content	%	S	4:330	8
H2S	Hydrogen Sulfide content	%	S	5:330	8
H2	Hydrogen content	%	S	12:314	8
CO	Carbon Monoxide content	%	S	6:330	8
O2	Oxygen content	%	S	7:330	8
iC4Hx	i-Butane content	%	S	8:330	8
nC4Hx	n-Butane content	%	S	9:330	8
iC5Hx	i-Pentane content	%	S	10:330	8
nC5Hx	n-Pentane content	%	S	11:330	8
C6H14	Hexane content	%	S	12:330	8
C7H16	Heptane content	%	S	13:330	8
C8H18	Octane content	%	S	14:330	8
C9H20	Nonane content	%	S	15:330	8
C10Hx	Decane content	%	S	16:330	8
He	Helium content	%	S	17:330	8
Ar	Argon content	%	S	18:330	8
SumGC	Total amount of gas analysis values	%	-	9:35F	4

(Legends: see page 21)

CH4	**Methane content**		**nC4Hx**	**n-Butane content**
N2	**Nitrogen content**		**iC5Hx**	**i-Pentane content**
CO2	**Carbon Dioxide content**		**nC5Hx**	**n-Pentane content**
C2H6	**Ethane content**		**C6H14**	**Hexane content**
C3H8	**Propane content**		**C7H16**	**Heptane content**
H2O	**Water content**		**C8H18**	**Octane content**
H2S	**Hydrogen Sulfide content**		**C9H20**	**Nonane content**
H2	**Hydrogen content**		**C10Hx**	**Decane content**
CO	**Carbon Monoxide content**		**He**	**Helium content**
O2	**Oxygen content**		**Ar**	**Argon content**
iC4Hx	**i-Butane content**			

If the K-value mode is set to *Md.K* = 6 (Detailed Characterization), these gas analysis values are to be entered, so that the compressibility *K* is calculated correctly.

For calculations in accordance with Detailed Characterization (Md.K = 6), the following validity ranges apply:

CH4	*45.0 … 100.0*	*%*
N2	*0.0 ... 30.0*	*%*
CO2	*0.0 ... 30.0*	*%*
C2H6	*0.0 … 10.0*	*%*
C3H8	*0.0 … 4.0*	*%*
H2O	*0.0 … 0.05*	*%*
H2S	*0.0 … 0.02*	*%*
H2	*0.0 ... 10.0*	*%*
CO	*0.0 … 1.0*	*%*
O2	*0.0 … 21.0*	*%*
iC4Hx	*0.0 … 1.0*	*%*
nC4Hx	*0.0 … 1.0*	*%*
iC5Hx	*0.0 … 0.3*	*%*
nC5Hx	*0.0 … 0.3*	*%*
C6H14	*0.0 … 0.2*	*%*
C7H16	*0.0 … 0.2*	*%*
C8H18	*0.0 … 0.2*	*%*
C9H20	*0.0 … 0.2*	*%*
C10Hx	*0.0 … 0.2*	*%*
He	*0.0 … 0.2*	*%*
Ar	*0.0 … 1.0*	*%*

SumGC   Total amount of gas analysis values

SumGC gives the sum of all the entered gas analysis values (see above). To calculate the compressibility *K* correctly, the sum must be 100%. Otherwise a warning message will be generated ($\rightarrow$ 3.8.1).

3.7 Archive list

AD	Designation / value	Unit	Access	Address	DC
ArMo1	Monthly archive 1	-	(S)	1:A30	8
ArMo2	Monthly archive 2	-	(S)	2:A30	8
ArDay	Day archive	-	(S)	7:A30	8
ArMP	Measurement period archive	-	(S)	3:A30	8
MPer	Measurement period	Minutes	CDL	4:150	8
MP.Re	Remaining time of measurement period	Minutes	-	4:15A	15
FrMP	Measurement period archive, freeze	-	S	3:A50	2

(Legends: see page 21)

The contents of the archives described here are suitable for processing with the "WinLIS" evaluation program. The data is allocated there to so-called "device numbers". Within each "device number" the so-called "channel number", indicating the type of data, is located at the fifth position from the right (ten thousands position).

Channel number	Value	
1	Vb	Volume at base conditions (undisturbed)
2	VbT	Total volume at base conditions
3	VmT	Actual volume (undisturbed)
4	Vm	Actual volume (total)
5	C	Conversion factor
6	T	Gas temperature
7	p	Gas pressure
8	K	K-value

Examples:

- Device number: 1438004 $\Rightarrow$ Channel number = 3 $\Rightarrow$ VmT (Actual volume, total)
- Device number: 1479321 $\Rightarrow$ Channel number = 7 $\Rightarrow$ p (Gas pressure)

ArMo1 Monthly archive 1

Entry point for the first monthly archive in which counter readings and consumption maxima from the last 24 months are saved.

The day boundary (= month boundary) "06:00 hrs." can be changed via the serial interfaces under the address 2:141.

Each archive data row has the following entries:

↔ To "Check"	ABNo Block number	Time Storage time	Vb Volume at base cond.	VbT Totaliser Vb	VbMP max Month's maximum	Time Time-point VbMP max	Stat Status for VbMP max	↔

↔	VbDy max Month's maximum	Time Time-point VbDy max	Stat Status for VbDy max	Vm Actual volume	VmT Totaliser Vm	VmMP max Month's maximum	Time Time-point VmMP max	↔

↔	Stat Status for VmMP max	VmDy max Month's maximum	Time Time-point VmDy max	Stat Status for VmDy max	St.2 Status 2 (incl. Vb)	St.4 Status 4 (incl. Vm)	Check Checksum	↔ To "ABNo"

ArMo2 Monthly archive 2

Entry point for the second monthly archive in which maxima, minima and some mean values for Qn, Qb, p, T from the last 24 months are saved.

The day boundary (= month boundary) "06:00 hrs." can be changed via the serial interfaces under the address "2:141".

Each archive data row has the following entries:

	ABNo	Time	
To "Check"	Block number	Storage time	↔

	Qb max	Time	Stat	Qb min	Time	Stat	
↔	Month's maximum	Time-point Qb max	Status for Qb max	Month's minimum	Time-point Qb min	Status for Qb min	↔

	Qm max	Time	Stat	Qm min	Time	Stat	
↔	Month's maximum	Time-point Qm max	Status for Qm max	Month's minimum	Time-point Qm min	Status for Qm min	↔

	p.Mon Ø	p.Mon max	Time	Stat	p.Mon min	Time	Stat
↔	Pressure mean	Month's maximum	Time-point p max	Status for p max	Month's minimum	Time-point p min	Status for p min

	T.Mon Ø	T.Mon max	Time	Stat	T.Mon min	Time	Stat
↔	Temperature mean	Month's maximum	Time-point T max	Status for T max	Month's minimum	Time-point T min	Status for T min

	K.Mon Ø	C.Mon Ø	St.7	St.6	St.8	St.5	Check	
↔	K-value mean	C factor mean	Status 7 (incl. p)	Status 6 (incl. T)	Status 8 (incl. K)	Status 5 (incl. C)	Checksum	↔ To "ABNo"

ArMP Measurement period archive

Entry point for the measurement period archive where counter readings and measurements are archived in the cycle of the measurement period *MPer*.

The archive structure of the measurement period archive is flexible and can be parameterised with the aid of the "WinPADS" parameterisation software with the supplier's lock open.

☞ *With deviations of the archive structure from standard the read-out data cannot be used by the software from Elster GmbH for processing.*

☞ *Processing of the read-out data by the appropriate software from Elster GmbH is possible if the archive structure is retained. This means that the settings of which counters and associated counter increments are saved in this archive are possible with the aid of the "WinPADS" parameterisation software with the supplier's lock open and the read-out data can be processed.*

The archive has approx. 3600 data rows with standard parameterisation, corresponding to a memory depth of about 5 months for a measurement period of 60 minutes.

Each archive data row has the following entries for standard parameterisation:

↔ to "Check"	ABNo Block no.	Time Saving time	Vb Volume at base cond.	Δ Vb Counter progress	VbT Totaliser Vb	Δ VbT Counter progress	Vm Actual volume	↔

↔	Δ Vm Counter progress	VmT Totaliser Vm	Δ VmT Counter progress	p.MP Ø Pressure mean	T.MP Ø Temperature mean	K.MP Ø Inv. compr. ratio factor mean	C.MP Ø Conversion factor mean	↔

↔	St.2 Status 2 (incl. Vb)	St.4 Status 4 (incl. Vm)	St.7 Status 7 (incl. p)	St.6 Status 6 (incl. T)	St.Sy System status	Er Triggering event	Check Checksum	↔ to "ABNo."

The progress of the counters in comparison to the corresponding previous entries are identified with a "Δ". They are only shown in the display and are not read out via the interface.

Normally, a flow (consumption) within a measurement period is involved. This only becomes relevant when an archive line has been entered due to a special event (e.g. setting of the clock or a counter, appearance of an important status message). Then the segment "Δ" and the abbreviated designation flash at the displayed counter progress to indicate this special occurrence to the user.

ArDay   Day archive

Entry point for the day archive in which counter readings and measurements are daily archived. The archive has approx. 600 data rows, corresponding to a memory depth of approx. 1.5 years.

The structure and content correspond to the measurement period archive ArMP for standard parameterisation (see above), whereby the means of p, T, K and C now relate to the day.

MPer   Measurement period

With the measurement period that can be set here, all values related to the measurement period are formed. These are: *VbMP Δ* (→ 3.2), *VmMP Δ* (→ 3.3), *p.MP Ø* (→ 3.4) , *T.MP Ø* (→ 3.5) as well as values present in the measurement period archive *ArMP* (see above).

MPer must be an integer multiple of the operating cycle *OCyc* (→ 3.9) so that the measurement period values (e.g. VbMP Δ, VbDy ∅, p.MP ∅, T.MP) can be concluded at the correct points in time.

With the default setting for *OCyc* the following values for *MPer* are practicable and usual: 5, 10, 15, 20, 30 or 60 minutes.

FrMP   Measurement period archive, freeze

A data row can be saved in the measurement period archive *ArMP* (see above) with this function. Based on the "trigger event" *EvTr* which is also saved, it can be seen in the data row whether it was saved automatically due to the expired measurement period or by triggering of *FrMP*.

3.7.1 Find function for checking the archive entries

The measurement period has more than a thousand and a few hundred entries respectively. In order to be able to display individual values from this amount of data for checking purposes, the device has a find function for archive entries. Values can be sought in the following columns:

- Block number
- Date and time
- Counter reading

First, the search occurs by choosing the desired column (block number, date/time or counter reading) in any archive line. Then pressing the "ENTER" key-combination enables the input of the desired value in this column. After terminating the input with "ENTER" the display skips to the archive line containing the entered value. If the entered value does not exist, it skips to the entry most closely resembling the sought value.

3.7.2 Measurement period archive 2

Measurement period archive 2 is used for saving redundant measurement period archive data. These are archived at intervals of the measurement period *MPer*. The structure and content correspond to the measurement period archive *ArMP* for standard parameterisation (see above). The archive structure cannot be changed. The archive has approx. 1000 data rows which corresponds to a memory depth of approx. 40 days for a measurement period of 60 minutes.

Measurement period archive 2 is not displayed on the device and can be read out with the aid of the "WinPADS" parameterisation software.

3.7.3 Flexible archives 1 to 4

The archive structures of these archives are flexible and can be parameterised with the aid of the "WinPADS" parameterisation software with the supplier's lock open.

☞ *Processing of the read-out data by software from Elster GmbH is not possible!*

The flexible archives 1 to 4 are not displayed on the device and can be read out with the aid of the "WinPADS" parameterisation software.

3.8 Status list

The values shown in this list depend on the set the functionality of certification data log *CDL* (see page 59):

a) Functionality of certification data log active, *CDL = 1 ("on")*:

AD	Designation / value	Unit	Access	Address	DC
S.Reg	Status register, total	-	(S)	1:101	19
Stat	Momentary register, total	-	-	1:100	5
Clr	Clear status register	-	S	4:130	2
Logb.	Logbook	-	(S)	4:A30	8
AudTr	Audit trail	-	(S)	5:A30	8
CDL	Certification data log	-	-	9:A30	8
ClCDL	Clear certification data log	-	C	9:A52	2

b) Functionality of certification data log inactive, *CDL = 0 ("off")*:

AD	Designation / value	Unit	Access	Address	DC
S.Reg	Status register, total	-	(S)	1:101	19
Stat	Momentary register, total	-	-	1:100	5
Clr	Clear status register	-	S	4:130	2
Logb.	Logbook	-	(S)	4:A30	8
AudTr	Audit trail	-	(S)	5:A30	8

(Legends: see page 21)

S.Reg   Status register, total
Stat   Momentary register, total

> The EK220 supplies two types of status information: Momentary status (also known as "status") and the status register.
>
> Messages in the momentary status point to current statuses such as for example, errors that are present. When the state is no longer present, the corresponding message in the momentary status disappears. Manual deletion is not possible. Alarms, warnings and reports (i.e. messages with numbers in the range from "1" to "16") are displayed in the momentary statuses.
>
> - In the status register all messages since the last manual clearing are collected. Here, you can also see what has happened, for example, since the last station inspection. The messages can be cleared in this list with the command "Clr".
>
> Only alarms and warnings (i.e. messages with numbers in the range from "1" to "8") are displayed in status registers. Reports are not entered because they identify states which are not problematical or may even be intended (e.g. "Daylight saving", "Calibration lock open" or "Data transfer running").

- S.Reg and Stat initially show all existing messages as numbers. With the entry of <ENTER> they can be recalled individually as short texts: First the most important message (with the lowest number) is displayed. With the keys $\boxed{\rightarrow}$ and $\boxed{\leftarrow}$ you can change to the next, respectively the previous message.

In addition to the short text the display also shows
- in the upper row to the right the associated status register name and
- in the lower row to the left the message number (prefixed with "#").

You need the status register name and the message number, for example, for entering a "status pointer" for the outputs (SpO1 ... SpO4, page 68).

All status messages are listed in Chapter 3.8.1 (from page 48).

Deleting messages:

After entering <ENTER> the messages in *SReg* (not in *Stat*) can be cleared (acknowledged) singly by pressing the key combination $\boxed{\leftarrow}$ + $\boxed{\uparrow}$. With the command *Clr* (see below) all messages in "*SReg*" can be cleared simultaneously.

Clr   Clear status register

This enables you to clear all the status register contents, i.e. "*S.Reg*" and its complete submenu: By pressing <ENTER> a "0" appears right justified on the display. By switching to "1" and finish with <ENTER> all status registers were cleared. If the alarm or warning states are however still present, they are again directly entered as messages. The messages in *SReg* can also be cleared singly: see *SReg*.

Logb. Logbook (event logbook)

Entry addresses for the logbook in which the last 500 status changes are archived.

Each archive data row has the following entries:

	ABNo	Time	Er	Check	
↔ to "Check"	Block number	Saving time	Trigger event	Checksum	↔ to "ABNo"

AudTr Audit trail (changes logbook)

Entry addresses for the changes logbook (audit trail) in which the last 200 settings changes (parameterisations) are archived.

Each archive data row has the following entries:

	ABNo	Time	Addr	o	n	
↔ to "Check"	Block number	Saving time	Address changed val.	Old value	New value	↔

	St.PL	St.ML	St.SL	St.CL	Check	
↔	Calibration lock	Manuf. lock	Supplier lock	Customer lock	Checksum	↔ to "ABNo"

CDL Certification data log (Calibration logbook)

With the aid of the "Certification data log" according to PTB-A 50.7 some parameters relevant to calibration regulations can be changed also with the calibration lock closed (for more information – see chapter 2.4.2 on page 15).

For each change of such a parameter with the calibration lock closed a data row is entered with the value before and after the change. Additionally, an entry is always made on opening and closing the calibration lock.

The calibration logbook has 50 data rows. Since the first data row always logs the closure of the calibration lock and the last data row is always kept free for opening the calibration lock, a maximum of 48 parameter changes can be entered.

With a logbook which is fully written up the status message "CDL full" is displayed in the system status ($\rightarrow$ page 51) and "L" ($\rightarrow$ page 11) flashes in the display field "Status". The certification data log can be cleared with the calibration lock open using the command *ClCDL* (see below).

☞ *The affected values are subjected to the calibration lock when the calibration logbook is deactivated. (see Addr, Page 59)*

The data rows of the certification data log have the following entries:

	ABNo	Time	Addr	o	n	
$\leftrightarrow$ to "Check"	Block number	Saving time	Address changed val.	Old value	New value	$\leftrightarrow$

	St.PL	St.ML	St.SL	St.CL	Check	
$\leftrightarrow$	Calibration lock	Manuf. lock	Supplier lock	Customer lock	Checksum	$\leftrightarrow$ to "ABNo"

CICDL Clear certification data log

This means that all entries in the calibration logbook *CDL* (see above) can be deleted:

After calling by ENTER, an "0" is positioned right-justified in the display. The function is triggered, i.e. all records are cleared, after switching to "1" (with $\uparrow$) and terminating with <ENTER>.

3.8.1 List of status messages

	Code	in status		Short text	Meaning
Alarm [11]	1	StSy	SRSy	Restart	Restart of the device
	1	St.5	SR.5	C-fact.err.	Conversion factor cannot be computed
	1	St.6	SR.6	T Alarm Lim.	Alarm limits for temperature violated
	1	St.7	SR.7	p Alarm Lim.	Alarm limits for pressure violated
	1	St.8	SR.8	K-val. error	Inv. compr. ratio factor cannot be computed
	1	St.9	SR.9	z-fact. err.	Compressibility factor cannot be computed
	2	St.5	SR.5	T Inp. Error	No usable input values for temperature
	2	St.6	SR.6	p Inp. error	No usable input values for pressure
Warning [12]	3	StSy	SRSy	Dat.restore	Data has been restored
	4	St.1	SR.1	Outp.1 error	Error on Output 1
	4	St.2	SR.2	Outp.2 error	Error on Output 2
	4	St.3	SR.3	Outp.3 error	Error on Output 3
	4	St.4	SR.4	Outp.4 error	Error on Output 4
	5	St.2	SR.2	I2 Pulse cmp	Error during pulse comparison on Input 2
	6	St.6	SR.6	T Warn Lim.	Warning limits for temperature violated
	6	St.7	SR.7	p Warn Lim.	Warning limits for pressure violated
	6	St.9	SR.9	z Warning	Total amount of gas analysis values $\neq 100\%$
	7	StSy	SRSy	Soft. error	Software error
	8	StSy	SRSy	Settings e.	Setting error
	8	St.2	SR.2	I2 Warn.sig.	Warning signal on Input I2
	8	St.3	SR.3	I3 Warn.sig.	Warning signal on Input I3
	8	St.7	SR.7	p2 Warn Lim.	Warning limits for pressure 2 violated
Report [13]	9	StSy		Batt. low	Battery service life below limit
	10	StSy		Repair mode	Repair mode switched on
	11	StSy		Clock n. set	Clock not set
	12	StSy		CDL full	Certification data log full
	13	StSy		online	Data transmission running
	13	St.2		I2 Rep.sig.	Report signal on Input I2
	13	St.3		I3 Rep.sig.	Report signal on Input I3
	14	St.1		Calibration lock	Calibration lock open
	14	St.2		Man.lock o.	Manufacturer's lock is open
	14	St.3		Supp.lock o.	Supplier's lock is open
	14	St.4		Cust.lock o.	Customer's lock is open
	15	StSy		Batt.operat.	Battery operation
	15	St.1		Call Win.1+	Extended call acceptance time window 1
	16	StSy		Dayl.Sav.Tim	The displayed time is summer time
	16	St.1		Call Win.1	Call acceptance time window 1 is active
	16	St.2		Call Win.2	Call acceptance time window 2 is active
	16	St.3		Call Win.3	Call acceptance time window 3 is active
	16	St.4		Call Win.4	Call acceptance time window 4 is active

---

[11] Alarm: Instead of the relevant measurement the substitute value is used; quantities are counted in disturbance quantity counters.

[12] Warning: The message is retained in the status register until it is manually deleted.

[13] Report: The message is not retained in the status register.

Restart   **Restart of the device**   **Message 1 in StSy**

The device was started without usable data. Counter readings and archives are empty, the clock has not been set.

C-fact. err.   **Conversion factor cannot be computed**   **Message 1 in St.5**

The conversion factor C ($\rightarrow$ 3.6) cannot be computed because the temperature T ($\rightarrow$ 3.5) is outside the range or no usable K-value K ($\rightarrow$ 3.6) is available (cf. message "K-val. error."). Possibly the temperature sensor is not connected correctly or the substitute value for the K-value K.F ($\rightarrow$ 3.6) has the value "0". The conversion factor is set to "0" and disturbance quantities for Vb are counted in VbD ($\rightarrow$ 3.2).

With the correct device setting, this message does not occur, because, for example, when an alarm limit, TMin or TMax ($\rightarrow$ 3.5), is exceeded, the temperature substitute value T.F is used.

T Alarm Lim.   **Alarm limits for temperature violated**   **Message 1 in St.6**

The measured gas temperature T.Mes is located outside of the set alarm limits TMin, TMax ($\rightarrow$ 3.5).

While ever this message is present in St.6, the substitute temperature T.F ($\rightarrow$ 3.5) is used for volume correction and disturbance quantities are counted for Vb and Vm ($\rightarrow$ 3.2, 3.3).

The alarm limits can be changed with the calibration lock open. If they are set to the same value, they are ignored, i.e. they cannot give rise to any alarm messages nor disturbance quantities.

p Alarm Lim.   **Alarm limits for pressure violated**   **Message 1 in St.7**

The measured gas pressure p.Abs is located outside of the set alarm limits *pMin*, *pMax* ($\rightarrow$ 3.4).

While ever this message is present in St.7, the substitute pressure p.F ($\rightarrow$ 3.4) is used for volume correction and disturbance quantities are counted for Vb and Vm ($\rightarrow$ 3.2, 3.3).

The alarm limits can be changed with the calibration lock open. If they are set to the same value, they are ignored, i.e. they cannot give rise to any alarm messages nor disturbance quantities.

K-val. error   **Inv. compr. ratio factor cannot be computed**   **Message 1 in St.8**

The K-value K ($\rightarrow$ 3.6) cannot be computed because no valid compressibility factor could be determined. (cf. message "C-fact. err.")

While ever this problem exists, the substitute value K.F is used for the K-value and disturbance quantities are counted for Vb and Vm ($\rightarrow$ 3.2, 3.3).

z-fact. err.   **Compressibility factor cannot be computed**   **Message 1 in St.9**

At least one of the gas analysis values Ho.b, CO_2, H_2, Rhob ($\rightarrow$ 3.6) is located outside of the permissible range.

While ever this problem exists, the last valid value for each of the affected gas analysis values is used and disturbance quantities are counted for Vb and Vm ($\rightarrow$ 3.2, 3.3). If a valid value has not yet been able to be calculated (because the gas analysis has not till now been correct), the compressibility factor is set to "0". Consequently therefore, also no K-value can be computed. (See above: message "K-val. error").

T Inp. Error   **No usable input values for temperature**   **Message 2 in St.5**

The signal, Bin.T ($\rightarrow$ 3.10), measured on the temperature input is outside the valid range. Perhaps the sensor is not correctly connected.

In this case the substitute temperature T.F ($\rightarrow$ 3.5) is used for volume correction and disturbance quantities are counted for Vb and Vm ($\rightarrow$ 3.2, 3.3).

p Inp. error   No usable input values for pressure   Message 2 in St.6

The signal, Bin.p ($\rightarrow$ 3.10 Service list), measured on the pressure input is outside the valid range. Perhaps the sensor is not correctly connected.

In this case the substitute pressure p.F ($\rightarrow$ 3.4) is used for volume correction and disturbance quantities are counted for Vb and Vm ($\rightarrow$ 3.2, 3.3).

Dat. restore   Data has been restored   Message 3 in StSy

The device was temporarily without any power supply. Possibly during battery replacement, the battery was removed before the new one was connected. Data has been retrieved from the non-volatile memory (EEPROM).

The retrieved counter readings and the clock values are possibly out of date:

If a manual data backup was carried out with the command "Save" before the voltage failure ($\rightarrow$ 3.10), the counter readings and clock values correspond to the state at the time of the data backup.

Without manual data backup, the counter readings and clock values are retrieved with the state at the end of the last day before the voltage failure.

Outp.1 error   Error on Output 1   Message 4 in St.1
Outp.2 error   Error on Output 2   Message 4 in St.2
Outp.3 error   Error on Output 3   Message 4 in St.3
Outp.4 error   Error on Output 4   Message 4 in St.4

The volume pulses to be passed through an output are temporarily saved in a pulse buffer. The buffer can accommodate 65535 pulses. If the volume to be output is continuously greater than that which can be output in the form of pulses, the pulse buffer continually fills and will eventually reach its maximum state. If then further pulses arrive, these can no longer be temporarily saved and are lost. The pulse buffer remains at its maximum state in this case.

If the pulse buffer drops below the level of 65000 pulses, the message is cleared again. To rectify the cause of this problem, the cp value of the output ($\rightarrow$ 3.12, Output list) can be reduced or the output frequency (address 1:617) increased with an AS-200 Read-out Device or the WinPADS Parameterization Software.

With a change of the output cp value, the corresponding input buffer is cleared.

I2 Pulse cmp   Error during pulse comparison on Input 2   Message 5 in St.2

Input 2 (I2) can be parameterised for monitoring as a pulse or signal input. When used as a pulse input, the pulses arriving on I2 can, for example, be compared with those on Input 1. With a deviation which is too large, this message is displayed.

Settings for the pulse comparison can be made with *MdMI2*, *SC.I2*, *L1.I2*, *G3.I2* and *SpI2*. Further explanation for this: $\rightarrow$ 3.11.

T Warn Lim.   Warning limits for temperature violated   Message 6 in St.6

The measured temperature T.Mes is located outside of the set warning limits. The limits can be set with WinPADS. Supplier's lock must be open.

p Warn Lim.   Warning limits for pressure violated   Message 6 in St.7

The measured gas pressure p.Mes is located outside of the set warning limits. The limits can be set with WinPADS. Supplier's lock must be open.

z Warn Lim. Total amount of gas analysis values ≠ 100%   Message 6 in St.9

The sum over the gas data (SumGC) in K. Mod = 6 ($\rightarrow$ 3.6.1) is greater or less than 100%. Thus, no calculation of the K-value is possible.

Soft. error   Software error   **Message 7 in StSy**

> This message is used for diagnosis at the factory. If it occurs during operation, contact Elster GmbH or your local representative.

Settings e.   Setting error   **Message 8 in StSy**

> On account of the programming that has been carried out, an unusable combination of settings arose, e.g. a value which cannot be processed in a certain mode.
>
> Detailed information can be called up with special read-out programs via the serial interface under the address 1:1FA. However, they are coded and can only be interpreted by Elster GmbH.

I2 Warn.sig.   Warning signal on Input I2   **Message 8 in St.2**

> Input 2 can be parameterised for monitoring as a pulse or signal input. When set as signalling input, here this message is displayed while ever an active signal is present, i.e. the terminals are connected through a low resistance. For connection of a contact for tamper detection, the warning input can also be set such that message "8" is displayed here while ever an inactive signal is present, i.e. the terminals are open.
>
> Settings for the message input can be made with MdMI2, SC.I2, L1.I2, G3.I2 and *SpI2*. Further explanation for this: → 3.11.

I3 Warn.sig.   Warning signal on Input I3   **Message 8 in St.3**

> This message is displayed, for example, while ever an active signal is present, i.e. the terminals are connected through a low resistance. For connection of a contact for tamper detection, the warning input can also be set such that this message is displayed while ever an inactive signal is present, i.e. the terminals are open.
>
> Settings for the message input can be made with MdMI3, SC.I3, L1.I3, G3.I3 and *SpI3*. Further explanation for this: → 3.11.

p2 Warn Lim.   Warning limits for pressure 2 violated   **Message 6 in St.7**

> The measured gas pressure p2Mes is located outside of the set warning limits p2.LW, p2.UW (→ 3.4.1).

Batt. low   Battery service life below limit   **Message 9 in StSy**

> The calculated remaining battery service life Bat.R (→ Service list, Chapter 3.10) has fallen below the set limit.
>
> The limit can be changed via the serial interface under the address 2:4A1. The standard setting is 3 months. So long as this message is displayed, the "B" in the display field "Status" flashes (→ 2.2.1).

Repair mode   Repair mode switched on   **Message 10 in StSy**

> The device is in the repair mode. This is switched on and off with Rep. (→ 3.10).

Clock n. set Clock not set   **Message 11 in StSy**

> The running accuracy of the internal clock has been optimised in the factory by frequency measurement and a corresponding setting of the adjustment factor Adj.T (→ 3.10 Service list). The error message indicates that this has not yet been carried out.

CDL full   Certification data log full   **Message 12 in StSy**

> The certification data log is full. Without the calibration lock a change of the parameters identified with the access "CDL" is only possible again when the content of the certification data log is cleared (→ ClCDL, page 47). The calibration lock can only be closed again after clearing the certification data log.

online   **Data transmission running**   **Message 13 in StSy**

Data is currently being transmitted via one of the two serial interfaces (optical or permanently wired).

The data transmission cannot take place over both interfaces simultaneously. While ever this message is displayed, the "o" in the display field "Status" flashes ($\rightarrow$ 2.2.1).

I2 Rep.sig.   **Report signal on Input I2**   **Message 13 in St.2**

Input 2 (I2) can, for example, be used as a time-synchronous input. As long as the input receives an active signal (i.e. the terminals are connected through low resistance), this message is displayed.

Settings for the message input can be made with MdMI2, SC.I2, L1.I2, G3.I2 and *SpI2*. Further explanation for this: $\rightarrow$ 3.11.

I3 Rep.sig.   **Report signal on Input 3**   **Message 13 in St.3**

Input 3 (I3) can, for example, be used as a time-synchronous input. As long as the input receives an active signal (i.e. the terminals are connected through low resistance), this message is displayed.

Settings for the message input can be made with MdMI3, SC.I3, L1.I3, G3.I3 and *SpI3*. Further explanation for this: $\rightarrow$ 3.11.

With special parameterization for the connection an FE230 Function Expansion, this message means "Data transmission running via FE230".

Calibration lock   **Calibration lock open**   **Message 14 in St.1**

For protection against unauthorised parameterization or reading out via a serial interface, the EK220 has a total of four locks in the following order of priority: Calibration, manufacturer's, supplier's and customer's locks.

The calibration lock can be opened and closed using a sealable pushbutton which is located inside the device ($\rightarrow$ 5.9.1). Closure is also possible by deleting the value "St.PL" ($\rightarrow$ 3.10) via the keypad or interface. While ever this message is displayed in St.1, the "P" in the display field "Status" flashes ($\rightarrow$ 2.2.1).

Man.lock o.   **Manufacturer's lock is open**   **Message 14 in St.2**

For protection against unauthorised parameterization or reading out via a serial interface, the EK220 has a total of four locks: Calibration, manufacturer's, supplier's and customer's locks.

The manufacturer's lock is normally only opened for special applications by Elster GmbH staff and includes access for changing all values not subject to official calibration. It can only be opened and closed via a serial interface with an AS-200 Read-out Device or the WinPADS Parameterization Software.

Supp.lock o.   **Supplier's lock is open**   **Message 14 in St.3**

For protection against unauthorised parameterization or reading out via a serial interface, the EK220 has a total of four locks: Calibration, manufacturer's, supplier's and customer's locks.

The supplier's lock is normally used by gas suppliers. It gives access for changing various values which are not subject to official calibration. The relevant values are identified in the lists ($\rightarrow$ 3) with an "S".

The supplier's lock can be opened and closed with "Cod.S" and "St.SL" ($\rightarrow$ 3.10).

Cust.lock o. **Customer's lock is open** **Message 14 in St.4**

For protection against unauthorised parameterization or reading out via a serial interface, the EK220 has a total of four locks: Calibration, manufacturer's, supplier's and customer's locks.

The customer's lock is normally used by gas customers. It gives access for changing some values which are not subject to official calibration. The relevant values are identified in the lists ($\rightarrow$ 3) with a "Cu".

The customer's lock can be opened and closed with "Cod.C" and "St.CL" ($\rightarrow$ 3.10).

Batt. operat. **Battery operation** **Message 15 in StSy**

This message is always displayed when the device is being supplied by its internal batteries, i.e. not by an external power supply.

Call Win.1+ **Extended call acceptance time window 1** **Message 15 in St.1**

This message is needed for the operation of an FE230 Function Expansion to switch on the FE230 power supply via an output terminal set as a status output.

The message largely corresponds to the message Call Win.1 (see below). If a data transmission is still running at the end of Call acceptance window 1, the message Call Win.1+ remains however entered until the data transmission has finished.

Dayl.Sav.Tim **The displayed time is summer time** **Message 16 in StSy**

In the system list ($\rightarrow$ 3.9) you can set under MdTim whether the EK220 carries out automatic daylight saving switchover or not.

Call Win.1 **Call acceptance time window 1 is active** **Message 16 in St.1**
Call Win.2 **Call acceptance time window 2 is active** **Message 16 in St.2**
Call Win.3 **Call acceptance time window 3 is active** **Message 16 in St.3**
Call Win.4 **Call acceptance time window 4 is active** **Message 16 in St.4**

The EK220 provides four time windows within which a modem connected to the serial interface accepts calls for data interrogation. Outside of these time windows calls are ignored, so that, for example, a person located in the station can be called via a telephone connected to the same telephone line.

The messages indicates that the responsible time window ($\rightarrow$ 3.13, Interface list) is.

3.8.2 Status register addresses

To read out the status information via the interface or to accept it into the user list ($\rightarrow$ page 22), its addresses are needed (cf. table on page 48):

AD *	Description	Address		AD *	Description	Address
Stat	Total momentary status	1:100		SReg	Total status register	1:101
StSy	System momentary status	2:100		SRSy	System status register	2:101
St.1	Momentary status 1	1:110		SR.1	Status register 1	1:111
St.2	Momentary status 2	2:110		SR.2	Status register 2	2:111
St.3	Momentary status 3	3:110		SR.3	Status register 3	3:111
St.4	Momentary status 4	4:110		SR.4	Status register 4	4:111
St.5	Momentary status 5	5:110		SR.5	Status register 5	5:111
St.6	Momentary status 6	6:110		SR.6	Status register 6	6:111
St.7	Momentary status 7	7:110		SR.7	Status register 7	7:111
St.8	Momentary status 8	8:110		SR.8	Status register 8	8:111
St.9	Momentary status 9	9:110		SR.9	Status register 9	9:111

* "AD" = Abbreviated designation (value designation on the display)

3.9 System list

AD	Designation / value	Unit	Access	Address	DC
Time	Date and time	-	S	1:400	12
MdTim	Daylight saving: yes / no	-	S	1:407	7
MCyc	Measurement cycle time	Seconds	C	1:1F0	8
MCPul	Measurement cycle triggered by input pulse	-	C	1:1FB_2	7
OCyc	Operating cycle time	Seconds	S	1:1F1	8
Disp	Time before display switches off	Minutes	S	2:1A0	8
Aut.V	Time to changeover to standard display	Minutes	C	1:1A0	8
SNo	Serial number of device	-	C	1:180	8
Ta.Rg	Ambient temperature range	-	C	3:424	8
Vers	Software version number	-	-	2:190	3
Chk	Software checksum	-	-	2:191	4

(Legends: see page 21)

Time   Date and time

The date and time are displayed separately. When moving to the right within the list structure, the date is displayed after the time. When moving to the left, only the time is displayed.

After pressing the key combination ENTER for entry (set clock), the date and time are displayed together (initially without seconds). The input mark (cursor) is located on the right-hand display position, then after pressing $\rightarrow$ again, the complete value is moved to the left so that the seconds can also be changed.

The time is updated in synchronism with the operating cycle *OCyc* (see below) or after key operation.

MdTim Daylight saving

"off"   = Automatic changeover between summer and winter time OFF.

"auto"   = Automatic changeover between summer and winter time:
                     Summer time begins on the last Sunday in March at 2:00 hrs. and ends on the last Sunday in October at 2:00 hrs.

"manually" = Switchover at set times
                     The start and finish of daylight saving is set manually under the addresses 1:4A0 and 1:4A8. The times must be set each year.

MCyc   Measurement cycle time

Measurements (e.g. pressure, temperature), computed values (e.g. K-value, conversion factor) and counter readings are updated on this cycle.

To ensure all functions, *MCyc* must only be set to integer factors of 60 seconds, e.g. 5, 10, 15, 20, 30 or 60 seconds. In addition *MCyc* must be an integer factor of *OCyc* (see below). Entries of values not satisfying these conditions are, where possible, corrected automatically. If the EK220 does not find any suitable value during the correction attempt, it rejects the entry with error message "6". ($\rightarrow$ **2.3.2**)

In applications subject to official calibration EN 12405 *MCyc* must be less than or equal to 30 seconds.

The standard setting is 30 seconds.

With settings less than 30 seconds the battery service life is reduced. ($\rightarrow$ B-2)

MCPul **Measurement cycle triggered by input pulse**

MCPul defines whether measurements and counter readings are acquired on the same interval as the measurement cycle time (see above) or with each counter impulse on Input 1:

"0" = Measurement at the intervals of the measurement cycle time MCyc

"1" = Measurement only for a counting pulse on Input 1 (DE1):
If more than one input pulse is counted on Input 1 (DE1) during a measurement cycle *MCyc* (see above), then the next measurement occurs after the current measurement cycle has expired.

OCyc **Operating cycle time**

The time and all values which relate to a time interval (e.g. measurement period, 1 day, 1 month) are updated on this cycle. The latter includes in particular all values for which a type of computation is displayed ($\rightarrow$ 2.2.1).

OCyc must only be set to values which are integer factors or multiples of 60 seconds and which are also integer multiples of *MCyc* (see above). Entries of other values are, where possible, corrected automatically. If the EK220 does not find any suitable value during the correction attempt, it rejects the entry with error message "6". ($\rightarrow$ **2.3.2**) In addition, *OCyc* must be an integer factor of the measurement period *MPer* ($\rightarrow$ 3.7) so that the measurement period values can be concluded at the correct points in time. The standard setting is 300 seconds (= 5 minutes).

With settings less than 300 seconds the battery service life is reduced. ($\rightarrow$ B-2)

Disp **Time before display switches off**

In order to conserve the batteries the display switches off after key operation once the set time has expired.

The setting "0" signifies that the display is always switched on.

With settings of "0" or greater than 10 minutes, the battery service life is reduced.

Ta.Rg **Ambient temperature range**

The permissible ambient temperature for the EK220 in operation subject to calibration regulations.

Aut.V **Time to changeover to standard display**

The display automatically changes over to the standard display once the time set here has expired without any key operation.

The setting "0" signifies that the display is not switched over. In applications subject to official calibration this setting is not however permissible.

The standard setting is 1 minute.

The number of the display column, to the first value of which switching takes place, can be set via the interface under address "1:01F2". The standard setting is "1", i.e. switching takes place to the standard volume column ($\rightarrow$ 3.2) with the first value Vn.

SNo **Serial number**

The serial number of the Volume Conversion Device (same number as on the identification label).

Vers **Software version number**

Chk **Software checksum**

Version number and checksum provide clear identification of the software implemented in the EK220.

By pressing the key combination <ENTER> ($\uparrow$ + $\downarrow$) during the display of Vers, the size (number of entries) of the measurement period archive ArMP ($\rightarrow$ 3.7) can be called. Return to Vers is with the key combination <ESC> ($\uparrow$ + $\rightarrow$).

3.10 Service list

AD	Designation / value	Unit	Access	Address	DC
Bat.R	Remaining battery service life	Months	-	2:404	15
Bat.C	Battery capacity	Ah	S	1:1F3	8
St.SL	Supplier's lock: Status / close	-	S	3:170	7
Cod.S	Supplier's combination, enter / change	-	S	3:171	11
St.CL	Customer's lock: Status / close	-	Cu	4:170	7
Cod.C	Customer's combination, enter / change - or	-	Cu	4:171	11
St.PL	Calibration lock: Status / close	-	C	1:170	7
Contr	Display contrast	-	S	1:1F6	8
Adj.T	Clock adjustment factor	-	C	1:452	8
Save	Save all data	-	S	1:131	2
Clr.A	Clear measurement archives	-	CDL	1:8FD	8
Clr.V	Clear counters (incl. archive)	-	C	2:130	2
Clr.X	Initialise device	-	C	1:130	2
Bin.T	Temperature binary value	-	-	5:227	4
Bin.p	Pressure binary value	-	-	6:227	4
Bin2p	Pressure 2 binary value	-	-	7:227	4
Sel.T	Temperature sensor selection	-	C	5:239	7
Sel.p	Pressure sensor selection	-	C	6:239	7
Selp2	Pressure sensor 2 selection	-	C	7:239	7
SMenu Amb.temp.	Submenu ambiant temperature	-	(C)	14:1C1	8
Addr	Address for user display	-	S	14:1C2	21
...	User display (value under address "Addr")	...	...	...	...
SMenu Revisal	Submenu Revisal	-	(C)	15:1C1	8
ArCal	Frozen values	-	(S)	6:A30	8
Frz.	Freeze	-	S	6:A50	2
-	Display test	-	-	1:1F7	1

Bat.R   Remaining battery service life

The calculation of the remaining battery service life occurs in dependence of the consumed capacity (which is measured) and a consumption expected for the future. Therefore, for applications with high current consumption the remaining battery service life may reduce quicker than stated by the figure for the remaining service life!

If *Bat.R* is less than 3 months, "Batt. low" ($\rightarrow$ page 51) is displayed in the system status and "B" flashes in the display status field ($\rightarrow$ 2.2.1).

Recalculation of the remaining battery service life is carried out automatically after the entry of a new battery capacity *Bat.C* (see below).

The settings of the measurement cycle MCyc ($\rightarrow$ 3.9), operating cycle OCyc ($\rightarrow$ 3.9), input mode Md.I1 ($\rightarrow$ 3.11) and display switch-off Disp ($\rightarrow$ 3.9) are taken into account during the computation of the remaining battery service life. Future operating conditions, e.g. changing the settings, duration of readouts or frequency of key operations cannot be foreseen however. For data readouts, a mean future duration of 15 minutes per month is estimate.

To increase the service life two batteries instead of one can be used. In this case double the value (e.g. 26.0 Ah) must be entered for Bat.C (see below) after inserting the batteries.

Bat.C Battery capacity

Here, the original capacity and <u>not</u> the residual capacity of the batteries last used is displayed. After a battery replacement the capacity of the battery used must be entered here so that recalculation of the remaining battery service life is initiated.

The capacity to be entered don't correspond to the capacity quoted by the battery manufacturer because the capacity depends on the application conditions such as ambient temperature and the device current consumption.

With the use of the size "D" battery obtainable from Elster GmbH, the value 13.0 Ah should be entered for *Bat.C* and 26.0 Ah when two cells are used.

Contr Display contrast

Setting the contrast of the display. Changes only become effective after confirmation of entry with <ENTER>. Valid range: 0 bis 255.

☞   *For changes to the contrast "Contr" greater than the standard value of 100, the device display does not display any more digits!*
        In this case, the value must be reset using the WinPADS software.

St.SL Supplier's lock   (status / close)
Cod.S Supplier's combination   (enter / change)
St.CL Customer's lock   (status / close)
Cod.C Customer's combination (enter / change)

Basic principle of operation of lock and combination: $\rightarrow$ 2.4.3.

<u>Open</u> lock: Enter the correct combination (numerical code)
<u>Close</u> lock: Clear *St.SL* resp. *St.CL*. ($\leftarrow$ + $\uparrow$ in the entry mode,
                              $\rightarrow$ 2.3.1, Data Class 6).
<u>Change</u> combination: Entry of a new combination (code) <u>with lock open</u>.
                              (irrespective of the above mentioned access rights)

The individual characters of the combination code in hexadecimal notation, i.e. they take on values from 0 to 9 and from A to F. "A" follows "9" and "F" is followed again by "0", i.e. the key $\uparrow$ changes "9" to "A" and "F" to "0".

St.PL Calibration lock   (status / close)

Basic principle of operation of the calibration lock: $\rightarrow$ 2.4.1.

<u>Opening</u> the calibration lock: Only with the sealed pushbutton ($\rightarrow$ 5.9.1).

<u>Closing</u> the calibration lock: Either by pressing the pushbutton again or by clearing *St.PL* via the interface or keypad ($\boxed{\leftarrow}$ + $\boxed{\uparrow}$ in the entry mode, $\rightarrow$ 2.3.1).

Adj.T Clock adjustment factor

Adj.T is the deviation of the running accuracy of the clock at room temperature in per mil ($\cdot 10^{-3}$). The EK220 uses *Adj.T* to optimise the running accuracy of the clock. The adjustment of the clock is carried out in the factory.

Save   **Save all data**

This function should be executed before any battery replacement in order to save the counter readings, date and time in the non-volatile memory (EEPROM).

Clr.A   **Clear measurement archives**

All measurement archives (not log book and changes log book "audit trail") are cleared. This function is particularly practicable after the measuring point of the EK220 is changed.

In order that the archives are not unintentionally deleted, the following safety mechanism is integrated: To clear the archives the EK220 serial number (found on the name-plate of the device) must be entered.

Clr.V   **Clear counters (incl. archive)**

All the counter readings and archives are cleared.

Clr.X   **Initialise device**

All data (counter readings, archives and settings) are cleared.

☞   ***This action restarts the device, including deleting the calibration values and the serial number. The device can no longer be operated without re-adjustment! That's why this function may only be carried out by a suitably trained service personnel!***

To ensure that this function cannot be executed with the calibration lock open, the following safety mechanism is included: *Clr.X* can only be executed after the clock (→ 3.9, Time) has been set (initialised) to its starting value with the key combination $\boxed{\leftarrow}$ + $\boxed{\uparrow}$. Otherwise, an attempt to execute *Clr.X* results in the error message "13" appearing in the display.

Bin.T   **Temperature binary value**

Bin.p   **Pressure binary value**

Bin2p   **Pressure 2 binary value**

These are the raw values measured directly on the respective input and which are converted to the corresponding measurement quantities with the adjustments made (→ 3.4, 3.5).

Sel.T   **Temperature sensor selection**

With this value the EK220 is informed of which temperature sensor is installed:

      0:     No temperature sensor
      1:     Pt500
      2:     Pt100
      3:     Pt1000
      4 to 6: No function.

On changing this value the designation of the temperature sensor *Typ.T* (→ 3.5) is appropriately changed automatically.

Sel.p   **Pressure sensor selection**

With this value the EK220 is informed of which pressure sensor is installed:

      0: No pressure sensor
      1: CT30
      4: 17002   2, 3, 5 and 6: no function

On changing this value the designation of the pressure sensor type (→ 3.4) is appropriately changed automatically.

Sel2p   Pressure sensor 2 selection

With this value the EK220 is informed of which second pressure sensor is installed:

- 0:   No pressure sensor
- 1:   CT30
- 2 to 6: no function

On changing this value the designation of the pressure sensor type ($\rightarrow$ 3.4) is appropriately changed automatically.

SMenu Amb. temp.

With <ENTER> the submenu for the parameters for the determination and display of the ambient temperature is called here.

Addr   Address for user display

...   User display (value under the address "Addr")

The address of any value can be entered under *Addr* to read it in the display point below it (shown here with "...").

The address 9:A51 is programmed to the default value *CDL* for the activation or deactivation of the calibration logbook function.

CDL = "0"   = "off"   :   The certification data log function is deactivated.
CDL = "1"   = "on"   :   The certification data log function is activated.

The affected parameters are subjected to the calibration lock and the display list is reduced ($\rightarrow$ 3.10) when the calibration logbook is deactivated

SMenu   Revisal

With <ENTER> the submenu for the parameters for the checking measurement are called here.

ArCal Frozen values

Frz.   Freeze

ArCal is the entry address for the calibration archive which contains the two last manually frozen data rows with measurements. Freezing is carried out with *Frz.* (see below).

The calibration archive is especially intended for operating points checks.

Each archive data row has the following entries, whereby the abbreviated designations for the counter progress values ("Δ...") normally flash:

	ABNo	Time	Vb	Δ Vb	Vm	Δ Vm	
$\leftrightarrow$ to "Check"	Block number	Saving time	Volume at base cond.	Counter progress	Actual volume	Counter progress	$\leftrightarrow$

	VbRp	Δ VbRp	VmRp	Δ VmRp	p	T	
$\leftrightarrow$	Repair counter	Counter progress	Repair counter	Counter progress	Pressure	Temperature	$\leftrightarrow$

	K	C	Qb	Qm	Check	
$\leftrightarrow$	Inv. compr. ratio factor	Conversion factor	Flow at base cond.	Actual flow	Checksum	$\leftrightarrow$ to "ABNo"

-   Display test

The display flashes to test all segments.

3.10.1 Submenu ambient temperature "SMenu Amb. temp."

AD	Designation / value	Unit	Access	Address	DC
Ta	Ambient temperature	°C	-	3:410_1	4
BinTa	Ambient temperature binary value	-	-	3:427	4
Eq1Ta	Coefficient 1 of temperature equation	-	C	3:480	8
Eq2Ta	Coefficient 2 of temperature equation	-	C	3:481	8
Eq3Ta	Coefficient 3 of temperature equation	-	C	3:482	8
PrgTa	Accepts ambient temperature adjustment	-	C	3:459	2
TaAdj	Adjustment value for ambient temperature	°C	C	3:460_1	8

(Legends: see page 21)

Ta **Ambient temperature**
Ta is the ambient temperature in the immediate vicinity of the circuit board.

BinTa **Ambient temperature binary value**
This is the directly measured raw value which is converted by means of the adjustments made (see below) for the measurement quantity.

Eq1Ta **Coefficient 1 of temperature equation**
Eq2Ta **Coefficient 2 of temperature equation**
Eq3Ta **Coefficient 3 of temperature equation**
The coefficients of the quadratic equation for calculating the ambient temperature *Ta* from the raw temperature value *Bin.Ta.*

PrgTa **Accepts ambient temperature adjustment**
TaAdj **Adjustment value for ambient temperature**
These values are used for the adjustment of the ambient temperature measurement circuit.

3.10.2 Submenu revisal "SMenu Revisal"

AD	Designation / value	Unit	Access	Address	DC
WRp	Repair counter W	kWh	S	1:305	12
VbRp	Repair counter Vb	m3	S	2:305	12
VmRp	Repair counter Vm	m3	S	4:305	12
Rep.	Repair mode on / off	-	C	1:173	7

(Legends: see page 21)

WRp **Repair counter W**
VbRp **Repair counter Vb**
VmRp **Repair counter Vm**
Rep. **Repair mode on / off**
The repair mode is switched by entering "1" for *Rep*. In the repair mode all the counters located in the actual volume, standard volume and energy lists are stopped and all the measured quantities are counted in *WRp, VbRp* and *VmRp*.
The repair mode is switched off again, thereby returning to the normal operating mode, by entering "0" for *Rep*.

3.11 Input list

AD	Designation / value		Unit	Access	Address	DC
cp.I1	cp value	for Input 1	1/m3	CDL	1:253	8
cp.I2	cp value	for Input 2	1/m3	S	2:253	8
Md.I2	Mode	for Input 2	-	S	2:207	7
St.I2	Status	on Input 2	-	-	2:228	4
MdMI2	Mode	for monitoring Input 2.	-	S	11:157	7
SC.I2	Source	for monitoring Input 2.	-	S	11:154	8
L1.I2	Limit 1	for monitoring Input 2.	-	S	11:150	8
L2.I2	Limit 2	for monitoring Input 2.	-	S	11:158	8
SpI2	Status pointer for monitoring Input 2.		-	S	11:153	8
St.I3	Status	on Input 3	-	-	3:228	4
MdMI3	Mode	for monitoring Input 3.	-	S	12:157	7
SC.I3	Source	for monitoring Input 3.	-	S	12:154	8
L1.I3	Limit 1	for monitoring Input 3.	-	S	12:150	8
SpI3	Status pointer for monitoring Input 3.		-	S	12:153	8
SNM	Serial number of gas meter		-	S	1:222	8

cp.I1   cp value Input 1
Pulse constant (parameter of the connected gas meter) for conversion of the pulses counted on Input 1 into the volume counter $V1$ (see below); the increase in volume is directly accepted into the total actual volume VmT ($\rightarrow$ 3.3).
$cp.I1$ indicates how many pulses correspond to the volume 1 m^3.

cp.I2   cp value Input 2
If Input 2 is set as a counting input ($Md.I2$ = 1, see below), the pulse constant must be entered here which is used for the conversion of the pulses to the volume $V2$ (see below).
$cp.I2$ is not subject to the calibration lock because it has no influence on Vm or Vb.
Input 2 can only be used for pulse comparison with Input 1 ($\rightarrow$ $MdMI2$, see below).
If Input 2 is set as a status input ($Md.I2$ = 2, see below), $cp.I2$ has no significance.

Md.I2   Mode for Input 2
The application of Input 2 (I2) can be defined here.
> 0: Switched off (input is not used).
> 1: Counting input.
> 2: Status input.

When the input is used as a counting input, the EK220 can, for example, be parameterised such that it carries out a pulse comparison of Inputs 1 and 2 and signals impermissibly large deviations.
With the setting "status input" the EK220 can, for example, signal attempts at tampering on a pulse generator of the gas meter, provided the meter also supports this.
After setting $Md.I2$ the function on Input 2 is particularly defined with $MdMI2$ (see below).

St.I2   Status on Input 2

If *Md.I2* = "2" (see above), the status of Input 2 is displayed here:

St.I2 = 0: Input signal is inactive (no signalling).

St.I2 = 1: Input signal is active (signalling).

MdMI2 Mode for monitoring I2

SC.I2   Source for monitoring I2

L1.I2   Limit 1 I2

L2.I2   Limit 2 I2

SpI2   Status pointer for monitoring I2

☞   *For MdMI2 only enter one of the values described here: "2", "3", "5" or "17". Depending on the system and after entering the key combination ENTER, other values are offered which are however not meaningfully applicable here.*

Depending on the application of Input 2 as counting or status input (see above: *Md.I2*), the following functions can be realised by setting these values:

If Input 2 is a counting input, the function "pulse comparison" can be set.

If Input 2 is a status input, the functions "active warning input", "inactive warning input", "active reporting input", "inactive reporting input" and "time-synchronous input" can be set.

"Warning input" signifies that the status message "*I2 Warn.sig.*" is affected. This is entered in the momentary status *St.2* and in the status register *SR.2*.

"Reporting input" signifies that the status message "*I2 Rep.sig.*" is affected. This is only entered in the momentary status *St.2* and not in the status register.

"Active": A signal arises when the input terminals are short-circuited (switch to switching point "on", → B-4).

"Inactive": A signal arises when the input terminals are parted (switch to switching point "off", → B-4).

Programming takes place according to the following table:

I2 is a <u>counting input</u> (*Md.I2* = "1")

- Pulse comparison on Inputs 1 and 2

Value	Setting	Comment
Md.I2	1	Input mode "counting input"
MdMI2	17	Monitoring mode "pulse comparison"
SC.I2	01:226_0 = "*PuI1*"	Address of pulse counter for Input 1
L1.I2	4	Maximum number of disturbance pulses
L2.I2	1000	Pulse windows per disturbance pulse
SpI2	0.05_02:1.1 = *I2 Pulse cmp*↑	Pointer to message "5" in status 2

With this setting the pulses counted on Inputs 1 and 2 are compared:

If the pulse counters on Input 1 and Input 2 differ by more than 4 pulses (= *L2.I2*) in 4000 pulses (= *L1.I2 · L2.I2*), the message "*I2 Pulse cmp*" is displayed in the status *Stat*.

I2 is a status input (*Md.I2* = "2")

- Input 2 is an active warning input (input for warning signal):

Value	Setting	Comment
Md.I2	2	Input mode "status input"
MdMI2	2	Monitoring mode: "Signal when SC.I2 $\geq$ L1.I2"
SC.I2	02:228_0 = "*St.I2*"	Status on Input 2
L1.I2	1	Comparative value
L2.I2	-	(Not used here)
SpI2	0.08_02:1.1 = *I2 Warn.sig.*↑	Pointer to message "8" in status 2 (warning)

- Input 2 is an inactive warning input (e.g. tamper detection):

Value	Setting	Comment
Md.I2	2	Input mode "status input"
MdMI2	3	Monitoring mode: "Signal when SC.I2 < L1.I2"
SC.I2	02:228_0 = "*St.I2*"	Status on Input 2
L1.I2	1	Comparative value
L2.I2	-	(Not used here)
SpI2	0.08_02:1.1 = *I2 Warn.sig.*↑	Pointer to message "8" in status 2 (warning)

- Input 2 is an active reporting input (input for report signal):

Value	Setting	Comment
Md.I2	2	Input mode "status input"
MdMI2	2	Monitoring mode: "Signal when SC.I2 $\geq$ L1.I2"
SC.I2	02:228_0 = "*St.I2*"	Status on Input 2
L1.I2	1	Comparative value
L2.I2	-	(Not used here)
SpI2	0.13_02:1.1 = *I2 Rep.sig.*↑	Pointer to message "13" in status 2 (report)

- Input 2 is an inactive reporting input (input for report signal):

Value	Setting	Comment
Md.I2	2	Input mode "status input"
MdMI2	3	Monitoring mode: "Signal when SC.I2 < L1.I2"
SC.I2	02:228_0 = "*St.I2*"	Status on Input 2
L1.I2	1	Comparative value
L2.I2	-	(Not used here)
SpI2	0.13_02:1.1 = *I2 Rep.sig.*↑	Pointer to message "13" in status 2 (report)

- Input 2 is time-synchronised input:

Value	Setting	Comment
Md.I2	2	Input mode "status input"
MdMI2	5	Monitoring mode: "Time-synchronised input"
SC.I2	02:228_0 = "*St.I2*"	Status on Input 2
L1.I2	1	Comparative value
L2.I2	-	(Not used here)
SpI2	0.13_02:1.1 = *I2 Rep.sig.*↑	Pointer to message "13" in status 2 (report)

Time synchronisation can occur under the following conditions:
- There must be a pulse on the input within one minute before or after a full hour. The deciding factor is the time in the EK220.
- Only one synchronisation per hour can occur.

St.I3   Status on Input 3

Here the status of Input 3 is displayed which is used as status input:

St.I3 = 0:   Input signal is inactive
(terminals open or voltage > 3V)

St.I3 = 1:   Input signal is active
(terminals connected through low resistance or voltage < 0.8V)

MdMI3 Mode for monitoring I3
Qu.I3   Source for monitoring I3
L1.I3   Limit 1 I3
SpI3   Status pointer for monitoring I3

By setting these values the following functions can be realised for Input 3 (Input 3 is only used as status input):

- Input 3 is an active warning input (input for warning signal):

Value	Setting	Comment
MdMI3	2	Monitoring mode: "Signal when SC.I3 $\geq$ L1.I3"
SC.I3	03:228_0 = "*St.I3*"	Status on Input 3
L1.I3	1	Comparative value
SpI3	0.08_03:1.1 = *I3 Warn.sig.*↑	Pointer to message "8" in status 3

- Input 3 is an inactive warning input (e.g. tamper detection):

Value	Setting	Comment
MdMI3	3	Monitoring mode: "Signal when SC.I3 < L1.I3"
SC.I3	03:228_0 = "*St.I3*"	Status on Input 3
L1.I3	1	Comparative value
SpI3	0.08_03:1.1 = *I3 Warn.sig.*↑	Pointer to message "8" in status 3

- Input 3 is an active reporting input (input for report signal):

Value	Setting	Comment
MdMI3	2	Monitoring mode: "Signal when SC.I3 $\geq$ L1.I3"
SC.I3	03:228_0 = "*St.I3*"	Status on Input 3
L1.I3	1	Comparative value
SpI3	0.13_03:1.1 = *I3 Warn.sig.*↑	Pointer to message "13" in status 3 (report)

This setting is also established by loading a special parameter file for the connection of an FE230 Function Expansion.

- Input 3 is an inactive reporting input (input for report signal):

Value	Setting	Comment
MdMI3	3	Monitoring mode: "Signal when SC.I3 < L1.I3"
SC.I3	03:228_0 = "*St.I3*"	Status on Input 3
L1.I3	1	Comparative value
SpI3	0.13_03:1.1 = *I3 Warn.sig.*↑	Pointer to message "13" in status 3 (report)

- Input 3 is time-synchronised input:

Value	Setting	Comment
MdMI3	5	Monitoring mode: "Time-synchronised input"
SC.I3	03:228_0 = "*St.I3*"	Status on Input 3
L1.I3	1	Comparative value
SpI3	0.13_03:1.1 = *I3 Rep.sig.*↑	Pointer to message "13" in status 3

Time synchronisation: See "Input 2 is time-synchronised input" (page 63).

SNM   Serial number of gas meter
The serial number of the gas meter connected to the counting input I1.

3.12 Output list

AD	Designation / value		Unit	Access	Address	DC
Md.O1	Mode	for Output 1	-	S	1:605	7
SC.O1	Source	for Output 1	-	S	1:606	21
cp.O1	Cp value	for Output 1	1/m3	S	1:611	8
SpO1	Status pointer	for Output 1	-	S	1:607	8
Md.O2	Mode	for Output 2	-	S	2:605	7
SC.O2	Source	for Output 2	-	S	2:606	21
cp.O2	Cp value	for Output 2	1/m3	S	2:611	8
SpO2	Status pointer	for Output 2	-	S	2:607	8
Md.O3	Mode	for Output 3	-	S	3:605	7
SC.O3	Source	for Output 3	-	S	3:606	21
cp.O3	Cp value	for Output 3	1/m3	S	3:611	8
SpO3	Status pointer	for Output 3	-	S	3:607	8
Md.O4	Mode	for Output 4	-	S	4:605	7
SC.O4	Source	for Output 4	-	S	4:606	21
cp.O4	Cp value	for Output 4	1/m3	S	4:611	8
SpO4	Status pointer	for Output 4	-	S	4:607	8

(Legends: see page 21)

The function of the outputs can be set with the values described here. The ex-works standard setting is:

- Output 1: Pulse output *VbT* (total volume at base conditions), 1 pulse per m^3; changes to the settings only possible with open supplier's lock.
- Output 2: Pulse output *VmT* (total actual volume), 1 pulse per m^3; changes to the settings only possible with open supplier's lock.
- Output 3: Status output alarm or warning, logic active; Changes to the settings only possible with open supplier's lock.
- Output 4: Pulse output *VbT* (total volume at base conditions), 1 pulse per m^3; changes to the settings only possible with open supplier's lock.

With the aid of the WinPADS Parameterisation Software the access rights ($\rightarrow$ 2.4) mentioned here can be changed for each output with an appropriately open lock. In this respect there are the following alternatives:

- Changes to the settings only possible subject to the calibration lock.
- Changes to the settings possible subject to the supplier's and calibration locks.
- Changes to the settings possible subject to the customer's, supplier's and calibration locks.

Md.O1 ... Md.O4   Mode for Outputs 1...4

The four signal outputs of the EK220 can be set for various functions. The basic function is defined with the mode *Md.O...* Depending on this, the source (*SC.O...,* see below), the cp value (*cp.O...,* see below) or the status pointer (*SpO...,* see below) must also be parameterised, where necessary, for the relevant output.

In the following table, apart from the setting possibilities for *Md.O...* it is shown for each setting whether *SC.O...*, *cp.O...* or *SpO...* must be parameterised.

Md.O..	Meaning	To program:		
		SC.O...	*cp.O...*	*SpO...*
off	Output switched off (transistor blocking, "switch open")	-	-	-
pulse+	Volume pulse output, logic active	Yes	Yes	-
status+	Status output, logic active (signalling active => output switched on)	-	-	Yes
time sync+	Time-synchronised output, logic active	Yes	-	-
on	Output switched on (transistor conducting, "switch closed")	-	-	-
pulse-	Volume pulse output, logic inactive	Yes	Yes	-
status-	Status output, logic inactive (signalling active => output switched off)	-	-	Yes
time sync.-	Time-synchronised output, logic inactive	Yes	-	-
event+	Event output, logic active, time limited (message active => output switched on)	-	-	Yes
event-	Event output, logic inactive, time limited (message active => output switched off)	-	-	Yes
cont.pulse	Continuous pulse (for test purposes)	-	-	-

SC.O1 ... SC.O4   Source for Outputs 1...4

These values are only of significance if the mode *Md.O...* of the same output is set to "1", "5" (volume pulse output), "3" or "7" (time-synchronised output). Depending on this, the following settings for *SC.O* are practicable:

- for modes "1" and "5" (volume pulse output)

SC.O...	Meaning		
02:300_0	Vb	Volume at base conditions, undisturbed	
02:301_0	VbD	Volume at base conditions, disturbance quantity	
02:302_0	VbT	Volume at base cond., total quantity (undisturbed + disturbed)	
04:300_0	Vm	Actual volume, undisturbed	
04:301_0	VmD	Actual volume, disturbed	
04:302_0	VmT	Actual volume, total quantity (undisturbed + disturbed)	

The period duration and pulse duration can be set individually for each output via the serial interface under the addresses "1:617" to "4:617" (period duration) or "1:618" to "4:618" (pulse duration) as a multiple of 125 ms. The period duration must always be greater than the pulse duration.

- for modes "3" and "7" (time-synchronised output)

By programming *SC.O...* according to the following table, you can set at which time points the time-synchronised output issues a pulse:

SC.O...	Pulse is output
01:143_0	At the beginning of each month at 0 hrs.
02:143_0	At the beginning of each month at 6 hrs. The day boundary (= month boundary) "06:00 hrs." can be changed via the serial interfaces under the address "2:141".
01:142_0	At the beginning of each day at 0 hrs.
02:142_0	At the beginning of each day at 6 hrs. The day boundary "06:00 hrs." can be changed via the serial interfaces under the address 2:141.
01:403_0	At the beginning of each hour.
01:402_0	At the beginning of each minute.
04:156_0	At the beginning of each measurement period *MPer* ($\rightarrow$ 3.7)

The pulse duration can be set individually for each output via the serial interfaces under the addresses "1:618" to "4:618" as a multiple of 125 ms.

If a mode other than "1" or "3", "3", "5" or "7" is set, *SC.O...* has no significance.

cp.O1 ... cp.O4   cp value for Outputs 1...4

If the output is programmed as a volume pulse output (*Md.O...= 1*), the increase in volume is converted with *cp.O...* into the number of pulses to be output. The conversion takes place according to the formula: $i = V \cdot cp.O...$

where   i: Number of output pulses and

V: Volume increase which is to be output as a pulse.

cp.O... therefore states how many pulses are to be output for 1 m^3.

If a mode other than "1" is set, *cp.O...* has no significance. This also applies to the setting "time-synchronised output" (see above), although then *cp.O...* is displayed dependent on *SC.O...* with a time unit.

With a change of the output cp value, the corresponding input buffer is cleared . (cf. messages "Outp.1 Error" to "Outp.4 Error, page 50).

SpO1 ... SpO4   Status pointer for Outputs 1...4

The status pointers SpO1 ... SpO4 determine which status messages an output represents which is parameterised as a status or event output.

The <u>display</u> of the status pointer occurs as a short text according to Chapter 3.8 with a following arrow pointing upwards "↑" (e.g. "I3 Warn.sig."). Here, the symbol "↑" indicates that the "signal arrives".

For <u>entry</u> a special numerical display is implemented (e.g. "*08_03:1.1*"), because a text entry on the device would only be possible with a great deal of effort.

If the output is programmed as status or event output "with <u>active</u> logic" (*Md.O...= 2* or 9), then *Sp.O...* sets with which status messages of the momentary status $\rightarrow$ (3.8) the output is to be switched <u>on</u>. If none of the selected messages is present, the output remains switched off.

If the output is programmed as status or event output "with <u>inactive</u> logic" (*Md.O...= 6* or 10), then *Sp.O...* sets with which status messages of the momentary status the output is to be switched <u>off</u>. If none of the selected messages is present, the output remains switched on (!).

In contrast to the status output, an event output is reset automatically after an adjustable time to its basic state. This time can be set with WinPADS.

There are two basic ways of selecting status messages with *SpO...*:
 - Selection of a single message.
 - Selection of a message group.
Example of a "message group":
 "Messages 1 to 8" signify that the output is switched while ever one or more of the messages with the number "1" to "8" is present in the momentary status.
"Message groups" always start with the message "1" ("any of the messages 1 to ..."). It is not possible, for example, to select the messages "3 to 5".

All the possible settings for *SpO...* are described in the following. Here, "mm" signifies the message, i.e. one of the messages "1" to "16" can be selected with "mm" and "s" the status numbers, i.e. one of the number "1" to "9" can be selected with "s".

a) A message in a status St.1 to St.9

SpO... = „mm_0s:1.1"   where   s = 1 to 9 for *St.1* to *St.9*
<u>Example:</u>
"0.08_03:1.1" signifies message 8 in Status St.3 ("I3 Warn.sig." → page 51).

b) A message in the system status *St.Sy*

SpO... = "mm_02:2.1"
<u>Example:</u>
"0.03_02:2.1" signifies: Message 3 in the system status *St.Sy* ("Data restore" → page 50)

c) A message in the system status *Stat*

Since *Stat* combines the messages of all statues, this setting means that the output is switched while ever the message "mm" is present in any of the statuses *St.Sy or St.1* to *St.9*. *SpO...* = "mm_01:2.1"
<u>Example:</u>
"0.08_01:2.1" signifies: Message 8 in any status *St.Sy or St.1* to *St.9*. (After the entry "*Message 8*↑ " is displayed.)

d) Message group in a status *St.1* to *St.9*

SpO... = "1.mm_0s:1.1"   where   s = 1 to 9 for *St.1* to *St.9*
<u>Example:</u>
"1.06_04:1.1" means: Any of the messages 1 to 6 in the status *St.4*. (After the entry "*St.4:M1-6*↑ " is displayed.)

e) Message group in the system status *St.Sy*

SpO... = "1.mm_02:2.1"
<u>Example:</u>
"1.03_02:2.1" signifies: Any of the messages 1 to 3 in the system status *St.Sy*. (After the entry "*StSy:M1-3*↑ " is displayed.)

f) Message group in the total status *Stat*

The output is switched while ever one of the messages 1 to mm is present in any of the statuses *St.Sy or St.1* to *St.9*.
SpO... = "1.mm_01:2.1"
<u>Example:</u>
"1.08_01:2.1" signifies: Any of the messages 1 to 2 in any status *St.Sy or St.1* to *St.9*, i.e. any alarm or any warning. (After the entry "*Stat:M1-8*↑ " is displayed.)

3.12.1 Brief summary of output parameterisation

◆ **Volume pulse output** .... *Md.O..* = 1 or 5
  ➜ Selection of the volume counter:
      - Vb   Volume at base conditions, undisturbed ...... *SC.O...* = 0002:300_0
      - VbD   Volume at base conditions, disturbance quantity *SC.O...* = 0002:301_0
      - VbT   Volume at base conditions, total quantity .... *SC.O...* = 0002:302_0
      - Vm   Actual volume, undisturbed .... *SC.O...* = 0004:300_0
      - VmD   Actual volume, disturbed .... *SC.O...* = 0004:301_0
      - VmT   Actual volume, total quantity .... *SC.O...* = 0004:302_0
  Setting of the cp value .... *cp.O...* = **...**

◆ **Status output, logic active or inactive** .... *Md.O..* = 2 or 6
◆ or **event output, logic active or inactive** .... Md.O = 9 or 10
  ' Selection of status message(s):
  - A message in a status *St.1* to *St.9* .... *SpO...* = 0.mm_0s:1.1 *
  - A message in the system status *StSy* .... *SpO...* = 0.mm_02:2.1 *
  - A message in the total status *Stat* .... *SpO...* = 0.mm_01:2.1 *
  - Message group in a status *St.1* to *St.9* .... *SpO...* = 1.mm_0s:1.1 *
  - Message group in the system status *StSy* .... *SpO...* = 1.mm_02:2.1 *
  - Message group in the total status *Stat* .... *SpO...* = 1.mm_01:2.1 *

◆ **Time-synchronised output, logic active or inactive** .... *Md.O..* = 3 or 7
  'Setting of the time-point:
  - At the start of each month at 0 hrs .... *SC.O...* = 0001:143_0
  - At the start of each month at 6 hrs .... *SC.O...* = 0002:143_0
  - At the start of each day at 0 hrs .... *SC.O...* = 0001:142_0
  - At the start of each day at 6 hrs .... *SC.O...* = 0002:142_0
  - At the beginning of each hour .... *SC.O...* = 0001:403_0
  - At the beginning of each minute .... *SC.O...* = 0001:402_0
  - At the beginning of each measurement period .... *SC.O...* = 0004:156_0

◆ **Continuous pulse (for test)** .... *Md.O..* = 99

◆ **Output switched on** .... *Md.O..* = 4

◆ **Output switched off** .... *Md.O..* = 0

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* *mm* = *Message (1...16),* **s** = *Status number (1...9 for St.1 ... St.9)*

3.13 Interface list

The values shown in this list depend on the set interface mode Md.S2 (see below):

a) All modes except "IDOM protocol" and "MODBUS" (Md.S2 ≠ 11, Md.S2 ≠ 13):

AD	Designation / value	Unit	Access	Address	DC
Md.S2	Mode Interface 2	-	S	2:705	7
DF.S2	Data format, Interface 2	-	S	2:707	7
Bd.S2	Baud rate, Interface 2	Bd	S	2:708	7
TypS2	Type Interface 2	-	S	2:70A	7
BusS2	Bus mode RS485 on / off	-	S	2:704	7
Num.T	Number of ringing tones before accepting call.	-	S	2:720	8
M.INI	Initialise modem	-	S	2:728	2
SMenu GSM & SMS	Submenu GSM & SMS	-	(C)	5:1C1	8
Bd.S1	Baud rate, Interface 1	Bd	S	1:709	7
CW1.S	Call acceptance window 1, start	-	S	5:150	8
CW1.E	Call acceptance window 1, end	-	S	5:158	8
CW2.S	Call acceptance window 2, start	-	S	6:150	8
CW2.E	Call acceptance window 2, end	-	S	6:158	8
CW3.S	Call acceptance window 3, start	-	S	16:150	8
CW3.E	Call acceptance window 3, end	-	S	16:158	8
CW4.S	Call acceptance window 4, start	-	S	17:150	8
CW4.E	Call acceptance window 4, end	-	S	17:158	8
CWTst	Test acceptance window	-	S	2:727	3

b) Mode "IDOM protocol" (Md.S2 = 11):

AD	Designation / value	Unit	Access	Address	DC
Md.S2	Mode, Interface 2	-	S	2:705	7
DF.S2	Data format, Interface 2	-	S	2:707	7
Bd.S2	Baud rate, Interface 2	Bd	S	2:708	7
DProt	IDOM protocol	-	(C)	2:7E6	8
Bd.S1	Baud rate, Interface 1	Bd	S	1:709	7
CW1.S	Call acceptance window 1, start	-	S	5:150	8
CW1.E	Call acceptance window 1, end	-	S	5:158	8
CW2.S	Call acceptance window 2, start	-	S	6:150	8
CW2.E	Call acceptance window 2, end	-	S	6:158	8
CW3.S	Call acceptance window 3, start	-	S	16:150	8
CW3.E	Call acceptance window 3, end	-	S	16:158	8
CW4.S	Call acceptance window 4, start	-	S	17:150	8
CW4.E	Call acceptance window 4, end	-	S	17:158	8

c) Mode "MODBUS" (Md.S2 = 13 or Md.S2 = 14)

AD	Designation / value	Unit	Access	Address	DC
Md.S2	Mode, Interface 2	-	S	2:705	7
DF.S2	Data format, Interface 2	-	S	2:707	7
Bd.S2	Baud rate, Interface 2	Bd	S	2:708	7
TypS2	Type,Interface 2	-	S	2:70A	7
BusS2	Bus mode RS485 on / off	-	S	2:704	7
SMenu	Modbus parameter	-	(C)	1:1C1	8
Bd.S1	Baud rate, Interface 1	Bd	S	1:709	7
CW1.S	Call acceptance window 1, start	-	S	5:150	8
CW1.E	Call acceptance window 1, end	-	S	5:158	8
CW2.S	Call acceptance window 2, start	-	S	6:150	8
CW2.E	Call acceptance window 2, end	-	S	6:158	8
CW3.S	Call acceptance window 3, start	-	S	16:150	8
CW3.E	Call acceptance window 3, end	-	S	16:158	8
CW4.S	Call acceptance window 4, start	-	S	17:150	8
CW4.E	Call acceptance window 4, end	-	S	17:158	8

(Legends: see page 21)

Md.S2 Mode, Interface 2

This value informs the EK220 of which device is connected to the internal (permanently wired) interface and how it is to be controlled.

All modes that can be set are described here. You can quickly find the setting suitable for your application in Chapter 4.4. Some examples of possible wiring are shown in Chapters 5.7 and 5.8.

Md.S2 =

1 "With control line"

Modem control	RS232 control lines	Battery operation	Baud rate selection
no	yes	yes	yes

Suitable for the connection of a device with RS232 interface which does not need modem control, e.g. PC, PLC or also a modem with automatic call acceptance.

2 „Modem" (no GSM modem)

Modem control	RS232 control lines	Battery operation	Baud rate selection
yes	yes	yes	no

Suitable for the connection of a commercially available modem.

For GSM modems Mode 2 can also be used, but Mode 7 is more suitable (see below), because then monitoring of the link to the GSM network also occurs. Num.T (see below) is effective.

Md.S2 =

3 " Modem with return messages"

Modem control	RS232 control lines	Battery operation	Baud rate selection
yes	no	no	no

Suitable for the connection of an FE260 Function Expansion, an industrial modem EM260[14] or a modem and an external power supply.

The EK220 controls the modem via the data lines using "return messages". The activation of the return messages occurs with the modem command "ATQ0V1". Num.T (see below) is activated.

5 "Without control lines"

Modem control	RS232 control lines	Battery operation	Baud rate selection
no	no	no	yes

Suitable for the connection of an external modem with integral call acceptance. The start and switching baud rates of the two devices must be identically adjusted. Num.T (see below) is not effective; communication is only established when the call window is open.

6 "Modem with return messages, battery mode"

Modem control	RS232 control lines	Battery operation	Baud rate selection
yes	no	yes	no

In the mode $Md.S2 = 6$ the EK220 handles, as with $Md.S2 = 3$ (see above), the control of the modem via the data lines using "return messages". The modem is <u>not</u> parameterised for automatic call acceptance. Num.T (see below) is activated.

Important: Higher power requirement of the EK220. To be used only after consultation.

7 "GSM modem"

Modem control	RS-232 control lines	Battery operation	Baud rate selection
yes	yes	yes	no

Suitable for the connection of an external commercially available GSM modem.

This mode largely corresponds to Mode 2 (see above), but checks the EK220 daily shortly after midnight for whether the modem is still ("logged in") with the GSM network and, if required, establishes the connection. Num.T (see below) is effective.

Important: higher power requirement of the EK220 during the call acceptance time window!
The time windows should therefore be limited as much as possible.

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[14] Delivery from mid of 2008!

Md.S2 =

9 **"Without control lines, battery operation"**

Modem control	RS-232 control lines	Battery operation	Baud rate selection
no	no	yes	yes

Md.S2 = 9 works like Md.S2 = 5 but can also be used in battery operation.

Important: higher power requirement of the EK220 during the call acceptance time window!
The time windows should therefore be limited as much as possible.

11 **"IDOM protocol"**

Modem control	RS-232 control lines	Battery operation	Baud rate selection
no	no	yes	no

In the mode Md.S2 = 11 the IDOM protocol is available via the permanently wired interface. Further details → 3.13.2, page 79.

Important: higher power requirement of the EK220 during the call acceptance time window!
The time windows should therefore be limited as much as possible.

13 **"MODBUS"**

Modem control	RS-232 control lines	Battery operation	Baud rate selection
no	no	no	no

In the mode Md.S2 = 13 MODBUS protocol is available over the permanently wired serial interface. Further details → 3.13.3, page 80

14 **„Modbus in battery mode"**

Modem control	RS-232 control lines	Battery operation	Baud rate selection
no	no	yes	no

In the mode Md.S2 = 13 MODBUS protocol is available over the permanently wired serial interface also in battery operating mode.
Further details → 3.13.3, page 80
Important: higher power requirement of the EK220 during the call acceptance time window!

15 **"GSM modem without control lines with call acceptance"**

Modem control	RS-232 control lines	Battery operation	Baud rate selection
no	no	no	yes

Md.S2 = 15 corresponds to Md.S2 = 5 (see above), but also makes available the GSM parameters such as Reception Level and Network Operator.
Suitable for connection of following devices:
 - GSM modem with automatic call acceptance without control lines.
However, Mode 3 (see above) is recommended for a GSM modem in or on an FE260.

Md.S2 =
17 "GSM modem with control lines with call acceptance"

Modem control	RS-232 control lines	Battery operation	Baud rate selection
no	yes	yes	yes

Md.S2 = 17 corresponds to Md.S2 = 1 (see above), but also makes available the GSM network parameters such as Reception Level and Network Operator. With this setting the battery lifetime will be greatly reduced in some applications as e.g. for FE230 operation. But it is possible to set Md.S2=17 for several minutes during the installation of the FE230 to check the GSM-level.

Important: higher power requirement of the EK220 during the call acceptance time window!
The time windows should therefore be limited as much as possible.

19 "GSM modem without control lines, call acceptance, battery mode"

Modem control	RS-232 control lines	Battery operation	Baud rate selection
no	no	yes	yes

Md.S2 = 19 corresponds to Md.S2 = 9 (see above), but also makes available the GSM parameters such as Reception Level and Network Operator.

Important: higher power requirement of the EK220 during the call acceptance time window!
The time windows should therefore be limited as much as possible.

DF.S2 Data format, Interface 2
Here, the number of data bits, parity bit usage and number of stop bits are set for the data interchange between the EK220 and a device connected to the interface terminals.
For this, there are three possible settings:
- "0" = 7e1 = 7 data bits, even parity, 1 stop bit
- "1" = 7o1 = 7 data bits, odd parity, 1 stop bit
- „2" = 8n1 = 8 data bits, no parity, 1 stop bit
"0" (7e1) is the basic setting which is described in the applicable IEC 62056-21 interface standard.

Bd.S2 Baud rate, Interface 2
Here, the baud rate (speed) for the data transmission between the EK220 and a device connected to the interface terminals can be set.
Possible settings: 300, 600, 1200, 2400, 4800, 9600, 19200
With the application of baud rate selection the baud rate is generally set according to IEC 62056-21 to "300". It is then only used briefly for initiating and terminating the data interchange. The actual baud rate for transferring the useful data is automatically increased.
With a modem connected (also within an FE260 Function Expansion) normally no automatic baud rate selection occurs. Bd.S2 should then be set to "19200".

TypS2 Type, Interface 2

The interface type can be set here:

"1" = RS-232   (e.g. for connecting a commercially available modem)

"2" = RS-485   (e.g. for connecting an "FE260" function expansion)

In the setting "2" (RS485) BusS2 (see below) sets whether the RS485 interface is operated in the two-wire (bus) mode or four-wire mode.

BusS2 Bus mode RS485 on / off

When TypS2 (see above) is set to "2" (RS485), the RS485 interface can be set with BusS2 to two-wire (bus) mode or four-wire mode:

"0" = Bus mode off (four-wire mode $\rightarrow$)

for the connection of an FE260 or FE230 or an RS232 device.

"1" = Bus mode on (two-wire mode)

e.g. for the connection of several EK220s to an RS485 bus.

When TypS2 is on "1" (RS232), BusS2 must always be set to "0".

Num.T Number of ringing tones before answering

With some settings for *Md.S2* (see above) the setting can be made here of how many ringing tones the EK220 awaits until it accepts the call ("lifts receiver"). For entries, values in the range from 1 to 12 are accepted. Depending on the type of modem, the function is however only ensured with additional restrictions. (Refer to the instruction manual for the connected modem and to Chaps. 5.7 and 5.8).

When using a GSM modem, *Num.T* must be set to 1 ringing tone.

Possible values are 1 to 12.

M.INI Initialize modem

With this command you can initialise a connected modem when you, for example, are connecting a not parameterised modem or when the modem has lost its settings.

In particular when connecting a new modem, it must be ensured that a suitable initialization string is available under the address "2:0721" of the EK220. This can then be loaded using the "WinPADS" parameterisation software.

SMenu Submenu GSM & SMS

Here, the submenu for the GSM and SMS parameters is called with <ENTER>.

DProt IDOM protocol

Here, the submenu for the IDOM protocol parameters is called with <ENTER>.

SMenu Submenu Modbus parameter

Here, the submenu for the Modbus parameters is called with <ENTER>.

Bd.S1 Baud rate, Interface 1

Here, the baud rate (speed) for the data transmission between the EK220 and a device connected to the optical interface can be set.

The standard setting is 9600 Bd. If problems occur with the data transmission, then this is probably due to the readout lead. Then set Bd.S1 to 4800 Bd to give a slower data transmission or use a different readout lead.

Depending on the system, Bd.S1 can also be set to 19200 Bd. With this setting, the data transmission does not function correctly. Therefore, avoid using this setting.

CW1.S Call acceptance window 1, battery powered - start
CW1.E Call acceptance window 1, battery powered - end
CW2.S Call acceptance window 2, battery powered - start
CW2.E Call acceptance window 2, battery powered - end
CW3.S Call acceptance window 3, with external power supply - start
CW3.E Call acceptance window 3, with external power supply - end
CW4.S Call acceptance window 4, with external power supply - start
CW4.E Call acceptance window 4, with external power supply - end

With these values four different time windows can be set within which a data transmission is possible each day via the internal permanently wired interface. The EK220 does not respond outside of this time window.

The EK220 compares the four time windows with the running time of day on a rhythm with the operating cycle, OCyc, ($\rightarrow$ 3.9). If, for example, with a standard operating cycle of 5 minutes, the start of a time window is at 6:53 hrs., then it is first activated at 6:55 hrs.

For the connection of an FE230 Function Expansion special parameter files are available which are installed with the "WinPADS" parameterising program and which can also be loaded with it into the device.

CWTst Call acceptance window

The Test call window enables the GSM modem to be switched on for a parameterised time (e.g. 30 minutes) to make, for example, test calls. The smallest possible entry is two minutes. After initiating the function the display is refreshed every minute and indicates the remaining open time of the call window.

This call window is also opened for two minutes if the GSM parameters in the display are to be updated and in this period no Call window 1 to 4 (see above) is open.

3.13.1 Submenu „GSM & SMS"

AD	Designation / value	Unit	Access	Address	DC
GSM.N	GSM network operator	-	-	2:775	4
GSM.L	Reception level	%	-	2:777	4
StM	Status of modem (GSM)	-	-	2:77C_1	4
P.Sta	Reply to PIN-Code	-	-	2:77A	20
PIN	PIN-Code	-	S	2:772	11
Resp1	Reply to short message 1	-	-	2:742	20
Resp2	Reply to short message 2	-	-	2:74A	20
Send	Send short message (SMS)	-	S	2:734	2

(Legends: see page 21)

GSM.N GSM network operator
GSM.L Reception level

When using a mobile radio modem and with a suitable setting of *Md.S2* (see above), information regarding the mobile radio network can be recalled here once the EK220 has logged in.

The information is automatically updated each night at 0:00 and after a failure of the external power supply. If required, an update can be carried out by pressing the key combination <ENTER> during the display of GSM.N or *GSM.L*.

Under GSM.N the GSM network operator is displayed in text.

StM   Status of modem (GSM)

☞   *This value is only valid when using a GSM modem.*

This value indicates in which network the GSM modem is registered:

not registered   The GSM modem is currently not registered.
Possible causes: Call window off, no SIM card inserted, SIM-PIN not entered.

own network   The GSM modem is registered in its own network.

network search...   The GSM modem is currently registering in a network.

rejected external   The registration of the GSM modem was rejected.

network   The modem is registered in an external network ("roaming").

no command   The modem command for reading out the modem status is not parameterised. If this text is displayed with the GSM modem connected, the EK220 is not correctly parameterised.

P.Sta   Reply to PIN-Code
PIN   PIN-Code

☞   *These values are only valid when using a GSM modem.*

Under PIN the "Personal Identification Number" of the SIM card is entered in order to be able to use it. The status with regard to the PIN can be seen under P.Sta:

Message	Meaning
PIN NEW	The PIN has not yet been entered.
PIN READY	The SIM card is being used without a PIN.
PIN OK	The PIN has been entered correctly, the SIM card is ready for operation.
PIN ERROR	The PIN has been entered incorrectly.

☞   *When the message "PIN ERROR" occurs, a new or identical PIN MUST **be entered** again, **even if the PIN on the SIM card has been deactivated**.*

Resp1 Reply to short message 1
Resp2 Reply to short message 2
SEND Send short message (SMS)

☞   *These values are only valid when using a GSM modem*

With the occurrence of definable events, the EK220 is able to send a short message by SMS, e.g. to a mobile phone. In this respect the message content, recipient and triggering events can be set using the WinPADS software. By entering "1" for SEND, the defined short message can be immediately sent.

3.13.2 Submenu "IDOM protocol"

AD	Designation / value	Unit	Access	Address	DC
cycl.	Cyclical output	Minutes	S	13:150	8
daily	Daily output	-	S	3:141_1	8
Print	Immediate output	-	S	2:7E5	2

(Legends: see page 21)

In the mode Md.S2 = 11 a data block can be sent cyclically via interface 2 according to the IDOM protocol. The data block contains the momentary values of the standard volumes, actual volumes, pressure and temperature as well as a disturbance signal.

cycl.   Cyclical output

Here you can set the cycle for outputting the IDOM protocol data block in the range from 1 to 60 minutes. Entering "0" signifies: No cyclical output.

The cyclical output must be activated at the address 13:0157 by changing "0" (de-activated) to "21", i.e. every "xx minutes".

daily   Daily output

Here you set a time at which a daily output of the IDOM protocol data block occurs in addition or alternatively to the cyclical output.

The daily output must be activated at the address 14:0157 by changing "0" (deac-tivated) to "21", i.e. at "xx:xx hrs.".

print   Immediate output

With the entry of "1" you can initiate the immediate output of an IDOM protocol data block.

All values are ASCII coded with a terminating "Return" character (0D hexadecimal). They are sent in the following order:

Value	Name	Format	Unit
Actual volume (*VmT*)	Va:	8 places without decimal places	m3
Standard volume (*VbT*)	Vr:	8 places without decimal places	m3
Gas pressure (*p*)	P	1 or 2 places before, 3 after decimal point	bar
Gas temperature (*T*)	T	1 or 2 places before, 2 after decimal point Negative values with minus symbol "-"	°C
Disturbance signal	@	-	-

The disturbance signal "@" is sent if a status message with a code 12 or lower is entered in the momentary status. ($\rightarrow$ Chap. 3.8.1, page 48)

Examples of IDOM protocol data block: Va:00000006↵Vr:00000005↵P1.230↵T26.05↵

Va:00000036↵Vr:00000024↵P12.000↵T-6.20↵@↵

3.13.3   Submenu "MODBUS parameters"

AD	Designation / value	Unit	Access	Address	DC
MBDir	Data direction	-	S	2:7B0	7
MBTrM	Transmission mode	-	S	2:7B1	7
MBAdr	Device address (slave address)	-	S	2:7B2	8
MBRSz	Size of register	-	S	2:7B8	7
MBAMd	Addressing mode	-	S	2:7B9	7

(Legends: see page 21)

In the mode Md.S2 = 13 MODBUS protocol is available over the permanently wired serial interface, only. You can read and, from firmware V1.21, write values. All archives can read out.

The Modbus functions "Read holding registers" (3), "Read Input Registers" (4), "Preset Single Register" (6) and "Preset Multiple Registers" (16) of the protocol are implemented. To read out the values and the archives please refer to separate document, available from Elster GmbH.

For the MODBUS communication in mode MD.S2= "13" an external power-supply to the EK220 is necessary and at least one "call acceptance window" has to be open. From software version V1.32 on with mode *Md.S2* = 14 also Modbus protocol is available in battery mode and at least one "call acceptance window" has to be open ($\rightarrow$ page 77).
higher power requirement of the EK220 during the call acceptance time window!

☞   *The time windows should therefore be limited as much as possible.*

In addition, in the Interface list "Ser.IO" ($\rightarrow$ 3.13) Md.S2 must be set to "13", *Bd.S2* to 9600 and DF.S2 to "0" or "2", depending on the transmission mode MBTrM (see below).

Additional settings:

MBDir   Data direction
>   0 = „H word first". most significant word is in the first register
>   1 = „L word first". least significant word is in the first register

MBTrM   Transmission mode
>   0 = ASCII-Mode – the contents of each register are transmitted as four ASCII
>   coded hexadecimal digits. DF.S2 must be set to "0"
>   1 = RTU-Mode – the contents of each register are transmitted as two bytes.
>   DF.S2 must be set to "2".
>   2 = RTU-TCP-Mode – Transmission like RTU-Mode with additional information of
>   Modbus –TCP-Protocol.

MBAdr   Device address (slave address)
>   Address of the EK220 in a MODBUS environment.
>   Range from 1 to 247 (0 = broadcast).

MBRSz   Size of register
>   2 = Size of register 2 byte
>   4 = Size of register 4 byte

MBAMd   Addressing mode

The Modbus addresses parameterised in the device are assigned based on the logical addressing. Depending on the recall software employed, it may be necessary to change the addressing in the protocol to the physical addressing.

0 = Logical addressing of the Modbus registers with addresses starting at 1.

1 = Physical addressing of the Modbus registers with addresses starting at 0.

Depending on the addressing mode, when scanning the registers the following must be taken into account:

Value according to following table	Addressing mode MdAMd	Value to be recalled (Register)
301	"0" (logical)	"300"
	"1" (physical)	"301"

Modbus standard settings:

Reg.	AD	Designation / value	Format	Unit	Address
1	Bat.R	Remaining battery service life	3	months	2:404
2	Stat	Actual status, total	3		1:100
3	VT	Total actual volume (post-decimal places)	3	10^{-4} m^3	4:302_2
4	VbT	Total vol. at base conditions (post-dec. places)	3	10^{-4} m^3	2:302_2
5	W.T	Total Energy (post-decimal places)	3	10^{-4} kWh	1:302_2
101	VT	Total actual volume (pre-decimal places)	4	m^3	4:302_1
103	VbT	Total vol. at base conditions (pre-dec. places)	4	m^3	2:302_1
105	W.T	Total Energy (pre-decimal places)	4	kWh	1:302_1
301	pb	Base pressure	32	bar	7:312_1
303	Tb	Base temperature	32	°C	6:312_1
305	p.Abs	Absolute pressure measurement	32	bar	6:210_1
307	p.Mes	Pressure measurement	32	bar	6:211_1
309	T.Mes	Temperature measurement	32	°C	5:210_1
311	C	Conversion factor	32		5:310
313	K	K-value	32		8:310
315	p.F	Substitute pressure	32	bar	7:311_1
317	T.F	Substitute temperature	32	°C	6:311_1
319	N2	Nitrogen content	32	%	14:314
321	H2	Hydrogen content	32	%	12:314
323	CO2	Carbon dioxide content	32	%	11:314
325	Rhob	Density gas at base conditions	32	kg/m^3	13:314_1
327	Q	Flow rate	32	m^3/h	4:310
329	Qb	Flow rate at base conditions	32	m^3/h	2:310
331	P	Power	32	kW	1:310
333	Ho.b	Calorific value	32	kWh/m^3	10:314_1
335	dr	Density ratio	32		15:314
337	p	Pressure	32	bar	7:310_1
339	T	Temperature	32	°C	6:310_1
501	VT	Total actual volume	9	m^3	4:302
504	VbT	Total volume at base conditions	9	m^3	2:302
507	W.T	W, total	9	kWh	1:302
801	VT	Total actual volume	17	10^{-4} m^3	4:302

Reg.	AD	Designation / value	Format	Unit	Address
805	VbT	Total volume at base conditions	17	10^{-4} m^3	2:302
809	W.T	Total Energy	17	10^{-4} kWh	1:302
813	Time	Date and time	17		1:400
817	SNo	Serial number	16		1:180
820	DayB	Day boundary	12		2:141_1

Changes can be made to the Modbus register assignment via the optical interface using the "WinPADS" parameterisation software.

Definition of formats:

Format	Definition
3	Ushort, 16 Bit
4	Ulong, 32 Bit
9	Zaehler6
12	Array2, BCD, 4 Bit

Format	Definition
16	Array6, BCD, 12 Bit
17	Array8, BCD, 16 Bit
32	IEEEfloat, 32 Bit

Code	Format	Number of Registers

a) Binary formats:

3	Digit	1

Value

4	Digit	2

MS word	LS word
top part	Bottom part

32	Exponential	2

	MS word		LS word
Bit 31	Bit 30…23	Bit 22…16	Bit 15...0
Prefix	Exponent	Mantissa top part	Mantissa bottom part

9	Counter	3

MS word	...	LS word
Integer places top part	Integer places bottom part	Decimal places

b) Decimal formats:

17	BCD counter*	4

MS word	...	...	LS word
Integer places			Decimal places

	BCD timestamp *	4

MS word	...	...	LS word
CCYY **	MMDD **	hhmm **	ss00 **

16	BCD digit	3

MS word	...	LS word
12 digits		

12	BCD time	1

hhmm **

* Counter or timestamp, depending on the assigned LIS-200 address (see below)

** CC = century, YY = year, MM = month, DD = day, hh = hour, mm = minute, ss = second

3.14 Energy list

AD	Designation / value	Unit	Access	Address	DC
W	Energy	kWh	S	1:300	12
P	Power	kW	-	1:310	4
WD	W disturbance	kWh	S	1:301	12
W.T	W total	kWh	-	1:302	15
W.A	W adjustable	kWh	S	1:303	12
Ho.b	Calorific value	kWh/m3	S	10:312_1	8
WME	W month end value	kWh	-	33:161	16
Time	Time of W.ME	-	-	33:165	16

(Legends: see page 21)

W   Energy

The energy is calculated from the measured volume at base conditions and the entered calorific value according to the following equation :

$W = Vn \cdot Ho.n$ where Vn = volume at base conditions ($\rightarrow$ 3.2)

$Ho.n$ = calorific value ($\rightarrow$ 3.6)

The energy is summed in the counter W provided no alarm is present.

An alarm is present when any message "1" or "2" is urgent ($\rightarrow$ 3.8).

P   Power

Momentary power (energy per hour). $P = Qn \cdot Ho.n$

WD   W disturbance

Here the energy is summed so long as an alarm is present, i.e. a message "1" or "2" is present in any momentary status ($\rightarrow$ 3.8).

WT   W total

Here the sum W + WD is displayed. Entries for W or WD therefore arrive here. No entries can be made for WT itself.

WA   W adjustable counter

As with WT, here the total quantity, i.e. disturbed and undisturbed quantities, are counted. In contrast to WT, WA can however be changed manually. This counter is typically used for tests.

Ho.b   Calorific value

This calorific value is used to compute the energy. Please note that it may differ from the calorific value of the gas analysis ($\rightarrow$3.6, page 36) if pnX differs from pn ($\rightarrow$ 3.4) or TnX differs from Tn ($\rightarrow$ 3.5).

The entry of the calorific value Ho.b in the energy list is not permitted (entry error code "6" will occur). Please change Ho.b only in the volume corrector list ($\rightarrow$ 3.6, page 36).

WME   W month end value
Time   Time of WME

Here, the counter reading is saved with associated time stamp at the first day boundary of each month.

4 Applications

4.1 Application in areas subject to explosion hazards

☞ *If the EK220 is operated outside of Ex Zone 1, application again in Ex Zone 1 is only admissible after prior checking of the volume corrector at Elster GmbH.*

4.1.1 Applications in Zone 1

The EK220 is suitable for applications in Ex Zone 1 for gases in the temperature class T4 (ignition temperature > 135°C, e.g. natural gas). (Certificate of conformance: → Appendix A-2). With applications in Zone 1 connected devices must not exceed the conditions and limits quoted in the certificate of conformance (→ A-2). Furthermore, all safety information (→ Chapter I) must be followed.

4.1.2 Applications in Zone 2

The device may also be used in Zone 2 under all conditions which enable application in Zone 1.

Furthermore, the device may be used according to DIN EN 60079-14 (VDE 0165 Part 1), Section 5.2.3 c) in Zone 2 for gases of temperature class T1 (e.g. natural gas) if the installation is implemented according to DIN EN 60079-14 (VDE 0165 Part 1) and the operating conditions quoted in these instructions are fulfilled.

In particular they are:

- Ambient temperature according to Chapter B-1.
- Batteries according to Chapter B-2.
- Correct wiring, in particular no active outputs switching one against the other.
- Voltage of an external power supply according to Chapter B-3 has a maximum of 9.9 V (manufacturer's rating of the connected device).
- Switching of the digital inputs DE1...DE3 according to Chapter B-3 only with reed contacts, transistor switches or encoder interface.
- Switching voltage of the device connected to the outputs DA1..DA4 with a maximum of 30 V according to Chapter B-5 (manufacturer's rating of the connected devices).
- Only connect devices which conform to the RS-232 or RS-485 standard to the electrical serial interface according to Chapter B-7.
- Unused cable glands must be closed off according to DIN EN 60079-14 (VDE 0165 Part 1), Section 14.3.2 with plugs or suitable screw caps.
- Installation, cables and lines according to DIN EN 60079-14 (VDE 0165 Part 1), in particular Sections 9, 12.1, 12.2 and 14.3.

4.1.3 Ex identification label

CE 0044

Elster GmbH
55252 Mainz-Kastel

⟨Ex⟩

Typ EK220   II 2 G Ex ia [ia] IIC T4
TÜV 08 ATEX 554344   -30 °C ≤ Tₐ ≤ +60 °C

Elektr. Daten: siehe EG - Baumuster-Prüfbescheinigung
73020153
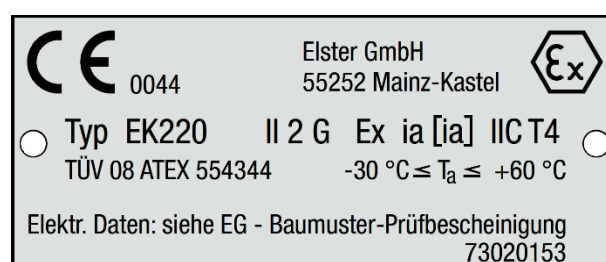
4.2   Rated operating conditions for the various conversion methods

In determining the actual permissible measurement range for the pressure and temperature of the gas, apart from the technical possibilities offered by the connected measurement sensor, the conversion method must also to be considered. The alarm limits Tmin, Tmax, pmin and pmax can lie outside of the measurement range and differ by up to 5% (for pressure) or 1°C (for temperature) from the measurement range limits. In this way testing of the device at the measurement range limits for temperature and pressure is simplified.

On reaching or exceeding the alarm limits, an alarm is triggered and counting takes place in the disturbance quantity counters.

The following correction methods are available for certain applications:

Fixed value K=1 (Md.K = 0, see Chapter 3.6)

This fixed value can be used when the gas shows only slight deviations (up to 0.25%) from the ideal gas behaviour. For natural gases and their mixtures, i.e. gas mixtures, which have a high methane content, this applies at temperatures above -10°C up to an absolute pressure of 1.5 bar or an overpressure of 0.5 bar.

The pressure range can be extended to 2.0 bar absolute pressure or 1.0 bar overpressure if the temperature is always higher than

-          +5°C for gases with $H_{o,b}$ < 11.5 kWh/m³

-          +12°C for gases with $H_{o,b} \geq$ 11.5 kWh/m³

Wider pressure and temperature ranges can be set for the gas composition present at a measuring point if compliance with the error limit is proven by calculations. This also applies to other fuel gases (e.g. town gas). For the calculations the conditions given in the following section apply.

Fixed value K≠1 (Md.K = 0, see Chapter 3.6)

Fixed values for K, which differ from 1, may be suitable for measuring points, the absolute pressure of which always lies below 11 bar and for which the gas pressure and the gas temperature only vary within known limits. The fixed value must be calculated using one of the following methods:

- S-Gerg 88 after testing the reliability of the method (see below)

- AGA8-DC92 according to ISO 12213 Part 2 /1/

Through a calculation using the same method, it must be proven that the K-values only deviate by at the most 0.25% from this fixed value in the permissible measurement range (i.e. with compliance to the pressure and temperature limits). The principles of the calculation and the calculated results at the limits of the measurement range must be recorded in the operational and rating data book, page "Proof of measures implemented". The alarm limits p_{min}, p_{max}, T_{min} and T_{max} must be set according to the measurement range (see above).

S-Gerg 88 (Md.K = 1, see Chapter 3.6)

This method is suitable for natural gases and their mixtures

1.) at temperatures between -10°C and +60°C and for absolute pressures up to 26 bar

2.) at temperatures between -10°C and +60°C, also at absolute pressures above 26 bar, when the following conditions are fulfilled

- The amount of substance of the propane x_{C3} [in mol%] must lie within the limits given by the following equation in relationship to the amount of substance of the ethane x_{C2} [in mol%].

$$0.3 \cdot x_{C2} - 1.0 \quad < \quad x_{C3} \quad < \quad 0.3 \cdot x_{C2} + 1.0 \tag{1}$$

- The sum of the amounts of substance of n-butane, isobutane and higher hydrocarbons x_{C4} [in mol%] must lie within the limits given by the following equation in relationship to the amount of substance of the ethane x_{C2} [in mol%].

$$0.1 \cdot x_{C2} - 0.3 \quad < \quad x_{C4+} \quad < \quad 0.1 \cdot x_{C2} + 0.3 \tag{2}$$

3.) For other gas compositions (e.g. processed biogas), temperature ranges and pressure ranges, when it is proven through comparative calculations using the method AGA8-DC92 for the expected pressure and temperature ranges, which are safeguarded by alarms, as well as the present gas composition, that no deviations of more than 0.1% occur.

The principles of the calculation and the calculation results at the limits of the measurement range must be recorded in the operational and rating data book, page "Proof of measures implemented", unless the calculation method S-Gerg 88 is generally accepted for the present application due to a national regulation.

AGA8 Gross characterisation method 1 und 2 (Md.K = 3 and 4, see Chapter 3.6)

This method is suitable for temperatures between 0°C and 55°C for gas mixtures, whose relative density lies between 0.554 and 0.87, whose calorific value is between 5.2 kWh/m³ and 12.5 kWh/m³ and whose components comprise the following amounts of substances [in mol-%]:

CH_4	N_2	CO_2	C_2H_6	C_3H_8	C_4H_{10}	C_5H_{12}	C_{6+}	He	H_2	CO	H_2O	H_2S
≥ 45	≤ 50	≤ 30	≤ 10	≤ 4	≤ 1	≤ 0.3	≤ 0.2	≤ 0.2	≤ 10	≤ 3	≤ 0.05	≤ 0.02

C_4H_{10}: Sum of n-butane and i-butane;

C_5H_{12}: Sum of n-pentane and i-pentane;

C_{6+}: Sum of all hydrocarbons with at least 6 carbon atoms

AGA-NX19 and AGA-NX19 according to Herning and Wolowsky (Md.K = 2 and 5, see Chapter 3.6)

This methods are compatible and suitable for applications for which it has been shown by a comparative calculation with the reference method AGA8-DC92 or (in its application range) S-Gerg 88 that no deviations of more than 0.1% occur.

Detailed Characterization (Md.K = 6, see Chapter 3.6)

This method is equivalent to AGA8-DC92 and is suitable for natural gases and mixtures thereof

1.) for temperatures between -25°C and +60°C and for absolute pressures up to 12 bar
2.) for temperatures between -20°C and +60°C and for absolute pressures up to 16 bar
3.) for temperatures between -10°C and +60°C and for absolute pressures up to 26 bar
4.) for temperatures between -10°C and +60°C and for absolute pressures up to 40 bar, when the following conditions are fulfilled

- The amount of substance of the propane x_{C3} [in mol%] must lie within the limits given by the following equation in relationship to the amount of substance of the ethane x_{C2} [in mol%].

$$0.3 \cdot x_{C2} - 1.0 \quad < \quad x_{C3} \quad < \quad 0.3 \cdot x_{C2} + 1.0$$

- The sum of the amounts of substance of n-butane, isobutane and higher hydrocarbons x_{C4} [in mol%] must lie within the limits given by the following equation in relationship to the amount of substance of the ethane x_{C2} [in mol%].

$$0.1 \cdot x_{C2} - 0.3 \quad < \quad x_{C4+} \quad < \quad 0.1 \cdot x_{C2} + 0.3$$

5.) For other gas compositions (e.g. processed biogas), temperature ranges and pressure ranges, when it is proven through comparative calculations using the AGA8-DC92 method for the expected pressure and temperature ranges, which are safeguarded by alarms, as well as the present gas composition, that no deviations of more than 0.1% occur.

4.3 Connection of a counter with LF pulse transmitter

Ex-works the maximum counting frequency of the EK220 Volume Conversion Device is parameterised to 2 Hz. Re-parameterizing to a maximum of 10 Hz is possible by trained specialist personnel with the calibration lock open. Changes to the input frequency must be noted in the operational and rating data book on the page "Proof of measures carried out".

4.4   Applications for Interface 2 as RS485

4.4.1 FE260 Function Expansion

☞   *Connection see Chap. 5.7.1, page 98*

The FE260 is a mains-powered function expansion incl. Ex isolation and supply for the EK220. It has may have alternatively an integral modem or a connection for a commercially available modem.

For the connection of an FE260 with integral or separately connected modem, the following settings should be made under the interface list ($\rightarrow$ 3.13):

- Md.S2 = **3**   **With modem control by "return messages"** via data lines, without baud rate selection. Num.T is activated.
    or   = **5** *   **Without modem control**. Either the modem accepts the call automatically or another device is connected to the FE260 (no modem). Num.T is not activated.
- Bd.S2   = 19200 *   Baud rate 19200 Bd (or lower, depending on the device connected to the FE260)
- TypS2 = RS485   Type of interface 2: RS485
- BusS2 = 0   No bus mode.
- Num.T = ...   Num.T is only activated with Md.S2 = 3.
                       Possible values are dependent on the modem used, e.g.:
                       - Standard modem (Insys) integrated in FE260 .... 2 to 9
                       - ISDN modem (Insys) integrated in FE260 .... 2 to 9
                       - GSM modem (Wavecom) integrated in FE260 .... 1 to 9
                       - Separate GSM modem Siemens M20T or TC35T...... 1
                       - Separate analogue modem EM200 or Insys Onbit..... 2 to 9

* Normally, modems do not execute any baud rate selection so that with Md.S2 = "5" the values under the addresses 02:708 (Bd.S2) and 02:709 must be equal.

For the connection of a device with baud rate selection, the starting baud rate (normally 300 Bd) must be set under the Bd.S2 (address 02:708) and the baud rate identification under address 02:709.

4.4.2 Devices with RS485 interface (also FE260), without modem

☞   *For this applications the EK220 needs an external power supply.*

☞   *Connection see Chap. 5.7.1, page 98.*

For the connection of a device with RS485 interface without a modem, the following settings must be made under the interface list ($\rightarrow$ 3.13):

- Md.S2 = 5   No modem control by the EK220, without control signals, baud rate selection possible
- Bd.S2   = 300   With application of baud rate selection according to IEC 62056-21 (procedure as for the optical interface) [15]
    or   = 19200   Baud rate selection bypassed
- TypS2 = RS485   Type of interface 2: RS485
- BusS2 = 0   No bus mode.

---

[15] The set baud rate is only used briefly for initiating the data interchange. The actual baud rate for transmitting the useful data is increased automatically to 9600 Bd.

4.4.3 FE230 Function Expansion with modem

☞ *Connection see Chap. 5.7.2*

The FE230 is a battery-powered function expansion with integral modem.

For this application extended parameterization of the device via the optical interface is required. Special parameter files are available for this which are installed with the "WinPADS" program and which can also be loaded into the device using the program.

After the parameterising process with "Md.S2 = 1", the settings for the read-out time window should be made under the interface list ($\rightarrow$ 3.13).

- Md.S2   = 1   **No modem control** by the EK220. The modem accepts the call. Battery operation is possible.
- Bd.S2   = 19200   Baud rate 19200 Bd
- TypS2   = RS485   Type of interface 2: RS485
- BusS2   = 0   No bus mode.
- Num.T   = ...   Num.T is not activated.

☞ ***The internal interface mode (Md.S2) must be temporarily (!) set to "6", so that the reception level can be checked during installation.***

   Important: EK220 power requirement increased in mode "6"!

! After the parameterisation process particularly the settings for the readout time window must be adjusted under the interface list ($\rightarrow$ 3.13), because the battery service life of the FE230 crucially depends on them.

4.4.4 EK220 connected to RS485-Bus (real RS485)

☞ *For this applications the EK220 needs an external power supply.*

☞ *Connection see Chap. 5.7.4, page 100.*

To connect the EK220 to an RS485 bus as a slave, the following settings must be carried out under the interface list ($\rightarrow$ 3.13):

- Md.S2 = 5   No modem control through the EK220, without control signals
- Bd.S2 = 19200   Baud rate 19200 Bd
- TypS2 = RS485   Type of interface RS485
- BusS2 = 1   Bus mode

In addition the bus device address 2:070E of the EK220 must be set to a value $\neq 0$ with the aid of the "WinPADS" parameterisation software. The serial number, for example, of the EK220 as shown on the nameplate can be used as the device address.

4.5   Applications for Interface 2 as RS232

4.5.1 Modem without control signals

☞ *For this applications the EK220 needs an external power supply.*

☞ *Connection see Chap. 5.8.1, page 101*

The following settings should be made under the interface list ($\rightarrow$ 3.13):

- Md.S2 = **3**   **The EK220 controls the modem by "return messages"** via data lines; without baud rate selection; *Num.T* is activated.

     or   = **5[16]**   **Without modem control** by the EK220, without baud rate selection. *Num.T* is not activated.
The modem accepts the call automatically.

- Bd.S2   = 19200 * 19200 Bd
- Num.T   = ...   Only activated with Md.S2 = 3.
Possible values depend on modem used, e.g.:
  - GSM modem Siemens M20T or TC35T 1
  - Analogue modem EM200 or Insys Onbit .... 2 to 9

4.5.2 Interface isolator MTL5051

☞ *For connection see Chap. 5.8.2, page 101).*

For this application it is necessary to send the wake-up call (NULL character string) according to IEC 62056-21.

The following settings should be made:

- Md.S2   = 5
- Bd.S2   = 19200   (Starting baud rate)
- 2:0709 = 19200   (Changeover baud rate)

If a PC with the WinPADS parameterisation software is connected to the MTL5051, the following settings are to be carried out under WinPADS:

Settings > Interface   > <u>Start connection via</u> > .... | Local connection |

Settings > Interface > Options local connection
                 > <u>Baud rate local connection</u> >............... | 19200 |

Settings > Interface > Options local connection > Extended
                 > <u>Baud rate switching</u> > .... | without |

---

[16] Normally, modems do not execute any baud rate selection so that with Md.S2 = "5" the values under the addresses 02:708 (Bd.S2) and 02:709 must be equal. For the special case of a modem with baud rate selection, the starting baud rate (e.g. 300 Bd) must be set under the Bd.S2 (address 02:708) and the baud rate identification (e.g. 19200 Bd) under address 02:709. The ex-works setting is: 02:708 = 19200 Bd and 02:709 = 19200 Bd.

4.5.3 Other devices with RS232 interface (no modem)

a) EK220 with external power supply

☞ *Connection see Chap. 5.8.4, page 102.*

The following settings must be made under the interface list ($\rightarrow$ 3.13):
- Md.S2 = 5   No modem control by the EK220; without RS232 control lines; without baud rate selection
- Bd.S2   = 19200   19200 Bd - without the use of baud rate selection

4.5.4 Sending short messages by SMS.

☞ *It is not possible to send short messages with an FE230*.

If a modem (except FE230) is connected to Interface 2, then with definable events the EK220 can send a brief message by a short message (Short Message Service in the GSM mobile radio network). To do this, a large number of settings are needed which cannot be made by means of the keypad on the device, but instead with the aid of the "WinPADS" parameterisation software.

The settings which can be made include the event which triggers the message, one or two recipients and any eight volume corrector values as the message content.

With *SEND* ($\rightarrow$ page 78) you can send the defined message also with the keypad.

4.5.5 Standard output data records for process data

Process data can be synchronously temporarily stored in short cycles (e.g. 3 minutes) and interrogated over the interface. To output these data records the mode "Data readout"" in "Mode C" according to IEC 62056-21[17] is used.

In order to obtain practicable values, buffer storage of the process data has to be activated. In this respect
- the value "21" is written to the address "13:0157.0" via the interface and
- the operating cycle OCyc ($\rightarrow$ *55*) is set to an integer divisor of 3 minutes.

Through these measures the battery service life of the EK220 is slightly reduced. The expected remaining service life is displayed under Bat.R ($\rightarrow$ page *56*).

---

[17] IEC 62056-21: formerly IEC 1107 or EN 61107

Output of the data records

The data records are labelled on recalling with the addresses 1:01CD ... 15:01CD. (Other addresses are used to set the content, see above.)

In the factory setting the following data are output:

No.	Address	Assign-ment	Meaning	Example
1.	1:01CD	1:0180	EK220 serial number	1:1CD.10(4102758)
2.	2:01CD	1:0400	Time stamp	2:1CD.12(2007-02-26,13:24:35)
3.	3:01CD	2:0300	Volume at base conditions	3:1CD.12(12340*m3)
4.	4:01CD	2:0301	Volume at base conditions, disturbed	4:1CD.12(0*m3)
5.	5:01CD	4:0300	Actual volume	5:1CD.12(134560*m3)
6.	6:01CD	4:0301	Actual volume, disturbed	6:1CD.12(0*m3)
7.	7:01CD	5:0310	Conversion factor	7:1CD.11(0.89531)
8.	8:01CD	7:0310_1	Gas pressure	8:1CD.11(0.98862* bar)
9.	9:01CD	6:0310_1	Gas temperature	9:1CD.11(24.32*°C)
10.	10:01CD	8:0310	Inverted compressibility factor ratio	10:1CD.11(1.00068)
11.	11:01CD	2:0310	Flow at base conditions	11:1CD.11(32.23*m3|h)
12.	12:01CD	4:0310	Actual flow	12:1CD.11(36*m3|h)
13.	13:01CD	2:0110	Status 2 (incl. Vb)	13:1CD.13(0)
14.	14:01CD	4:0110	Status 4 (incl. Vm)	14:1CD.13(0)
15.	15:01CD	2:0100	System status	15:1CD.13(13)(15)

Setting the data record content

You can freely set the content of the process data with the aid of the "WinPADS" Parameterising Software". The addresses 1:01CF ... 15:01CF are used for setting values.

Archiving the data records

For tracing (e.g. after a mains failure) the last 200 process data records can be saved in Archive 10. Archiving starts once the buffer storage of the process data has been activated (see above).

4.6   Interface protocols

Apart from the standard protocol according to DIN IEC 62056-21, the following protocols can also be set:

4.6.1 Modbus

4.6.2 Idom protocol

5 Installation and maintenance

The EK220 is suitable for wall mounting and for installation on a gas meter. The holes for wall mounting become accessible after opening the housing cover. For installation on a meter a mounting bracket is required.

The underlined installation and first test can occur without the presence of a calibration official, because all relevant areas are secured by adhesive labels.

5.1 Installation procedure

The following steps must be carried out to install the device:

1. Mounting of the EK220 on the gas meter, on a bracket or on the wall.

2. Connection of the pulse transmitter, pressure line[18] (perform leak test) and insertion of the temperature sensor in the thermowell.

3. If required, connection of the following equipment to the power supply input, serial interface or pulse/signal outputs.

☞ *If the EK220 is used in a hazardous area (Zone 1), then only intrinsically safe electrical circuits of certificated "associated operating equipment" must be connected. Their certificated electrical data must conform to the requirements stated in the certificate of conformance for the EK220.*

4. With unused union screw joints the insertion seal must be replaced by one the enclosed blind insertion seals.

5. The pressure screws of the cable glands must be tightened with a torque of at least 6 Nm to prevent damages or malfunction due to penetrating moisture.

6. Sealing of the device by the weights and measures office or test station according to the seal layout.

7. Close the housing.

☞ *When closing the housing, make sure that no cables are pinched.*

8. Open the shut-off valve[24] (two-way or three-way valve) between the gas meter pressure sensor port and the pressure sensor of the volume conversion device.

☞ *Open the shut-off valve slowly to avoid pressure surges.*

☞ *Insofar as the volume conversion device has not been commissioned by a calibration authority, we recommend comparing the displayed pressure in the Pressure menu p.Mes (Chapter 3.4) with the value of a pressure gauge (may be present) directly upstream or downstream of the gas meter in the system. If applicable, note that the pressure gauge displays relative pressure, that is, atmospheric pressure (approx. 1 bar) must be added. This check allows you to ensure that the shut-off valve is open and that the volume conversion device is using the operating pressure for conversion.*

---

[18] Not applicable when using EK220 as a temperature conversion device.

5.2 Three-way valve[19]

A three-way valve is normally installed when the pressure sensor is fitted in order to be able to test the pressure sensor while it is installed or to replace defective sensors without having to shut off the entire gas line every time. The three-way valve available from ELSTER is configured as follows:

to EK220

Shut-off in 45° position

from meter
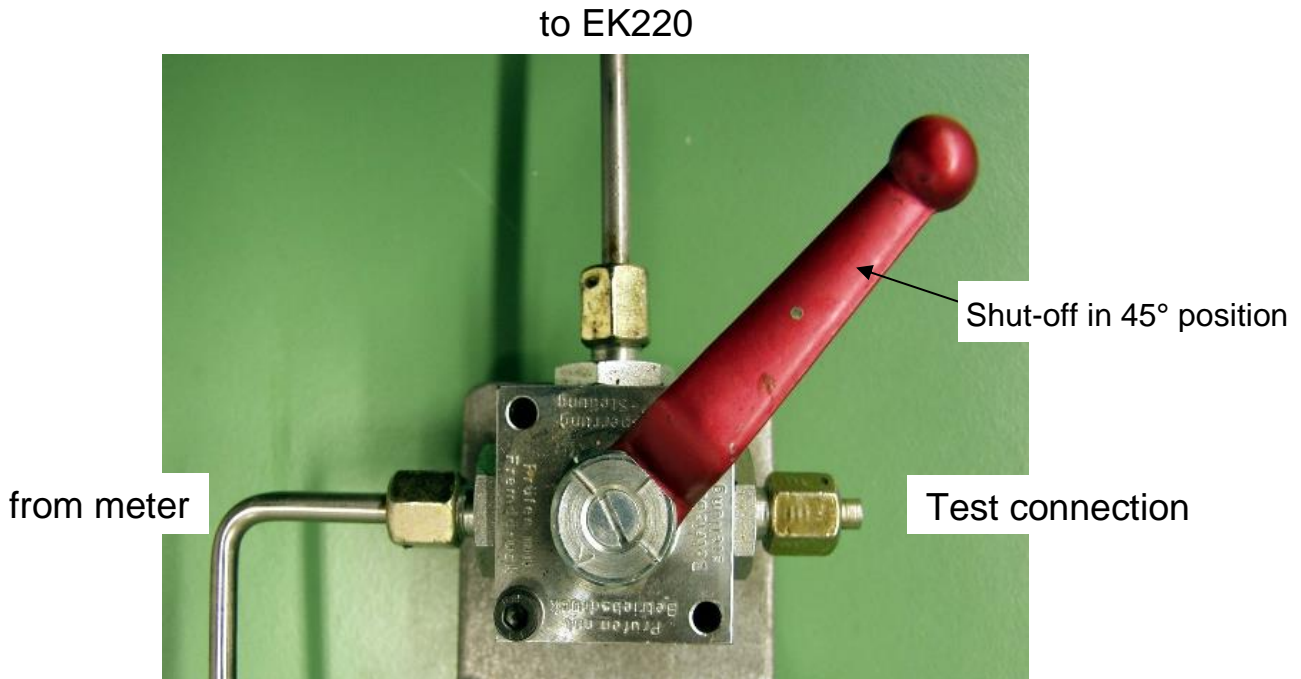
Test connection

Explanation:

"from meter"	from gas meter "p-connection"; on the meter inlet side for diaphragm gas meters;
"to VCD"	to the connector on the pressure sensor of the volume conversion device;
"Test connection"	point for reading the test pressure or for applying external pressure to the volume conversion device.

When installing the three-way valve, make sure that the position of the control lever is checked with the corresponding flows, since the lever can be removed and may be installed in the wrong position!

The pipe from the pressure sensor to the meter has to be laid sloping, to prevent water damaging the pressure sensor or influencing the accuracy of the measurement.

---

[19] Not applicable when using EK220 as a temperature conversion device.

5.3   Cable connection and earthing

The EK220 housing must always be earthed in order to divert high energy and high voltage electromagnetic interference. An M6 screw is provided for this on the left-hand side of the housing.

The earthing must be low resistance. The best conditions are obtained when a direct connection is provided to the local potential equalisation strip through a cable which is as short and as thick (at least 4mm²) as possible.

All permanently connected cables must have a screen which must be earthed <u>at both ends</u> to prevent interference due to high frequency electromagnetic fields. The screen must be connected <u>all round, complete and flat</u>. The EK220 has special EMC cable glands for this purpose.

With correct connection of the cable screens and correct laying of the cables effects due to circulation should not be expected. If, however, interference due to earthing points with potential differences occur, potential equalisation lines can be laid in parallel to the cables. These should then be connected as close as possible to the cable screen connection points.

Additional requirements are placed on the earthing of conducting screens between Ex areas and non-Ex areas. The relevant installation requirements, e.g. EN 60079-14, must be followed.

5.4   Checking the pressure sensor[20]

The pressure sensor must be checked for leaks during the recurring pressure tests of the system.

---

[20] Not applicable when using EK220 as a temperature conversion device.

5.5   Terminal layout

Connection of the individual cables is made to the corresponding terminals on the circuit board in the housing cover. When positioning the cables, make sure that no cables are pinched as the cover is closed.
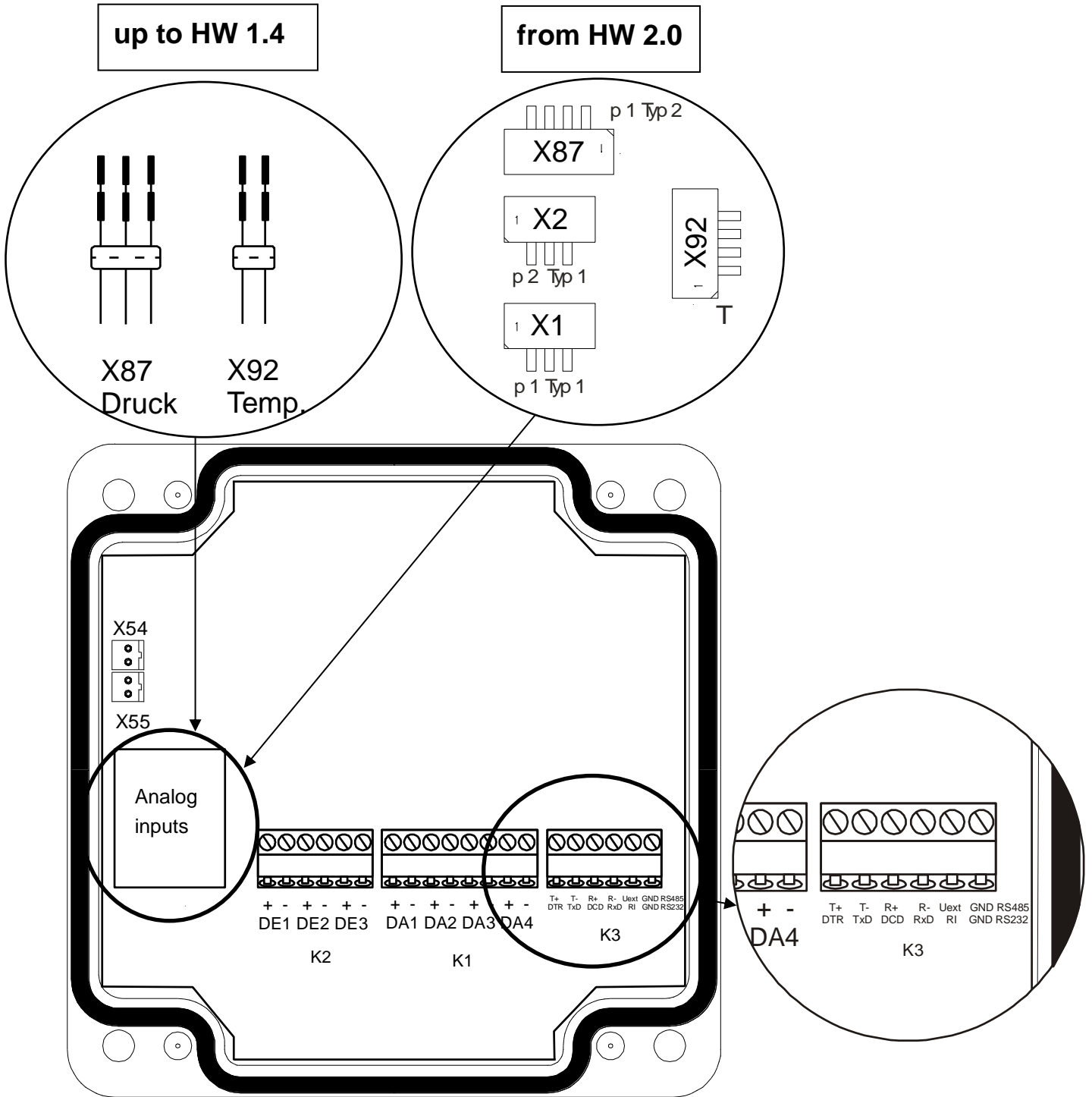
Fig. 2: Terminal layout

Inputs:

DE1	Digital Input 1
DE2	Digital Input 2
DE3	Digital Input 3

Outputs:

DA1	Digital Output 1
DA2	Digital Output 2
DA3	Digital Output 3
DA4	Digital Output 4

Serial interface, Version RS485:

GND	Signal ground (Ground)
Uext	External power supply +
R-	Received data -
R+	Received data +
T-	Transmitted data -
T+	Transmitted data +

Serial interface, Version RS232:

GND	Signal ground (Ground)
RI	Control signal / External power supply +
RxD	Received data
DCD	Control signal
TxD	Transmitted data
DTR	Control signal

Pressure and temperature sensors (up to circuit board V1.4):

X92	Temperature sensor, four-wire
X87	Pressure sensor (Option: two pressure sensors[21])

Pressure and temperature sensors (from circuit board V2.0):

X92	Temperature sensor, four-wire
X87	Pressure sensor type 17002
X1	Pressure sensor type CT30
X2	Option for second pressure sensor type CT30[22]

Batteries:

X54	Battery 1
X55	Battery 2

Others:

X100	*If the EK220 is __not__ employed in Ex Zone 1, the jumper X100 should be plugged onto both pins of the male connector when connecting an external power supply or an external Modem.* *In this way any interference introduced by the connected device, which may otherwise cause erroneous measurements, can be led away.*

---

[21] Only using pressure sensor type CT-30.

[22] Only possible in connection with a CT30 on X1. Not possible in connection with a 17002 on X87.

5.6 Connection of a low-frequency pulse generator (reed contacts)

A pulse generator must always be connected to the terminal "DE1". In addition, a second pulse generator can be connected to terminal "DE2", e.g. for a pulse comparison (→ page 62). Any polarity can be chosen. Connection scheme:

When using the lead available from Elster GmbH with the order no. 73017093 (about 70 cm long), the following wires should be connected:
Terminal DE1: Brown and white
Terminal DE2: Yellow and green

Pulse genera-tor 1		+	DE1
		-	
Pulse genera-tor 2 (on request)		+	DE2
		-	
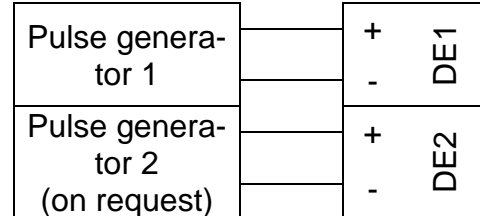
5.7 Connection of the serial interface RS485

☞ *If the EK220 is not employed in Ex Zone 1, the supplied jumpers should be plugged onto both pins of the X100 male connector (position: in front of the terminals) when connecting a following device (e.g. modem or power supply unit).*
In this way any interference introduced by the connected device, which may otherwise cause erroneous measurements, can be led away.

5.7.1 FE260 Function Expansion (with or without modem)

☞ *Before connection the display should no longer be active. When connecting, it must be ensured that first the external power supply and then the communication lines are connected.*
A four-wire connection (one core each for T+, T-, R+, R-, full duplex) should be made.

Connection diagram:

EK220		FE260
R +	←	R +
R -	←	R -
T +	→	T +
T -	→	T -
Uext		U +
GND		U -
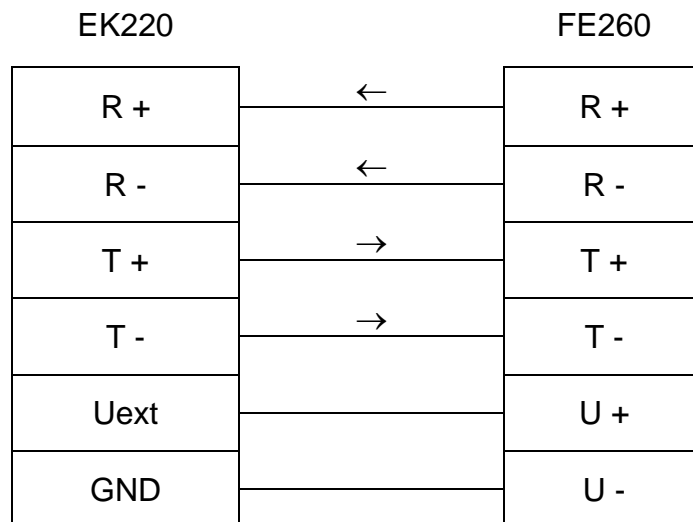
5.7.2 FE230 Function Expansion

☞ *For this application the connection of the external power supply is not possible.*

Connection diagram:

EK220		FE230
R +	←	R +
R -	←	R -
T +	→	T +
T -	→	T -
Ri	←	Ri
GND		GND
DA4 +	←	DA4 +
DA4 -	→	DA4 -
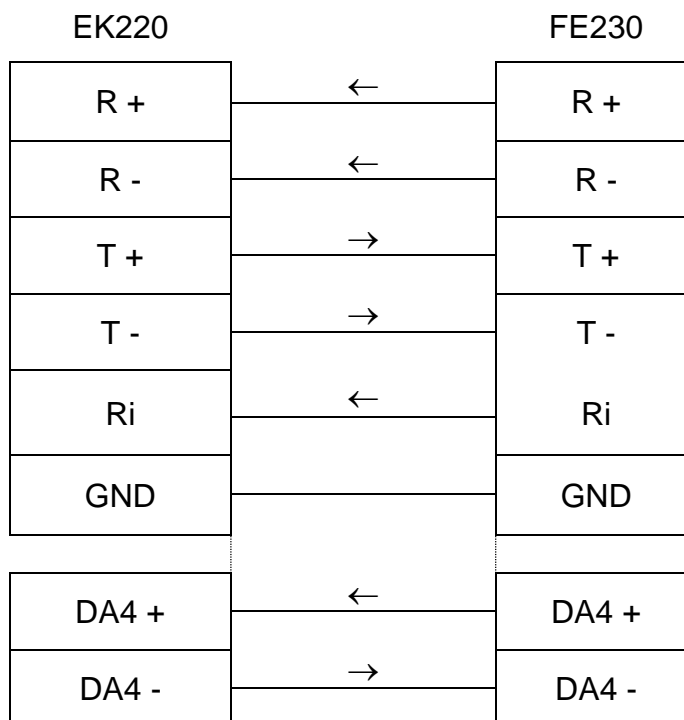
5.7.3 Other devices with RS485 interface (no modem)

☞ *Before connection the display should no longer be active. When connecting, it must be ensured that first the external power supply and then the communication lines are connected.*

☞ *For this applications the EK220 needs an external power supply.*

A four-wire connection (one core each for T+, T-, R+, R-) should be made, two-wire connection (half duplex) is not possible.

Connection diagram:

EK220		Device with RS485 interface (no FE260, no FE230)
R +	←	T + (Send data +)
R -	←	T - (Send data -)
T +	→	R + (Receive data +)
T -	→	R - (Receive data -)
Uext		Power supply +
GND		Power supply -
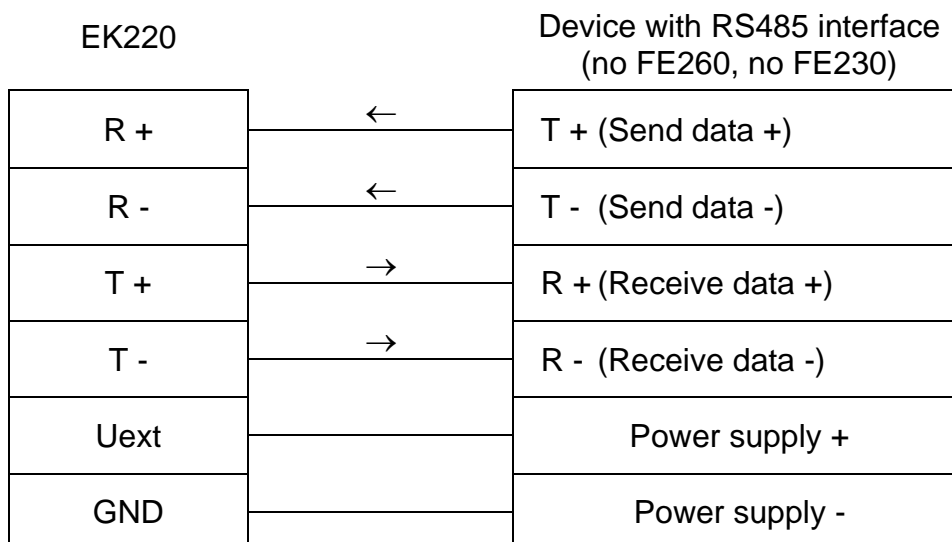
5.7.4 EK220 connected to RS485-Bus (real RS485)

☞ *Before connection the display should no longer be active. When connecting, it must be ensured that first the external power supply and then the communication lines are connected.*

☞ *For this applications the EK220 needs an external power supply.*

☞ *No termination resistance should be connected to the RS485 bus.*

☞ *The Bus mode must be activated (s. Chapter 4.4.4).*

Connection diagram:
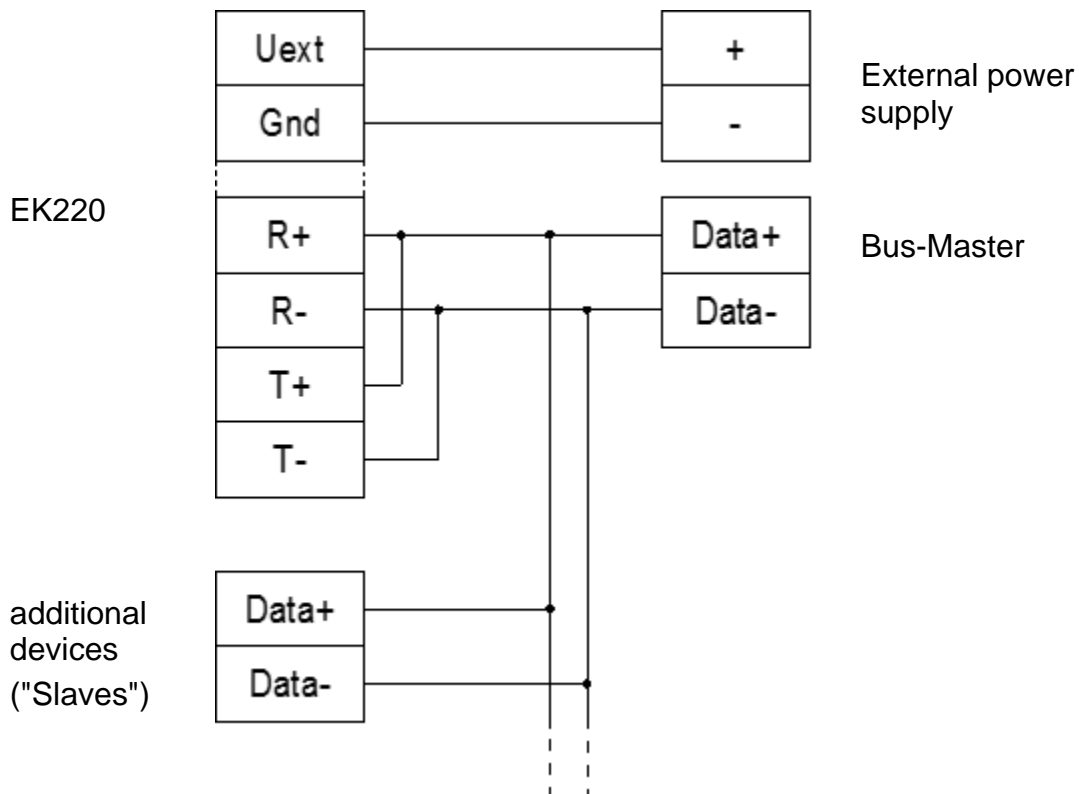
5.8 Connection of the serial interface RS232

☞ *If the EK220 is **not** employed in Ex Zone 1, the X100 jumpers (position: in front of the terminals, see chapter 5.5) should be plugged onto both pins of the male connector when connecting a device to the serial interface (e.g. mode, not EM260 or power supply unit). In this way any interference introduced by the connected device, which may otherwise cause erroneous measurements, can be led away.*

5.8.1 Industrial modem EM260 or Modem without control signals

☞ *For this application the EK220 needs an external power supply.*

☞ *EK220 on EM260 only functions with an EM260 shipped from mid-2008 onwards.*

Connection diagram:

EK220		EM260
TxD	→	TxD
RxD	←	RxD
Uext		+9V
GND		GND
DTR		
DCD	not connected	
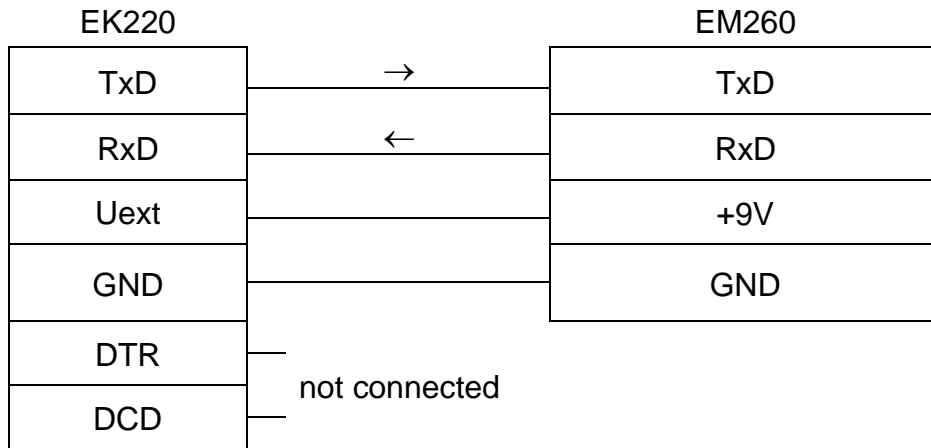
5.8.2 Interface isolator MTL5051

Connection diagram:

Device with RS232			MTL5051			EK220
(RxD)	←	10	Tx	Rx	6	TxD
(TxD)	→	12	Rx	Tx	5	RxD
				n.c.*		DTR
all n.c.*		7 8 9		n.c.*		DCD
				5V/12V	2	Ri / Uext
(Gnd)		11	Ground	Ground	1	GND
24V +	→	14			3	n.c.*
24V -		13			4	n.c.*

RS232

* n.c. = not connected

	1a	= OFF
	1b	= ON
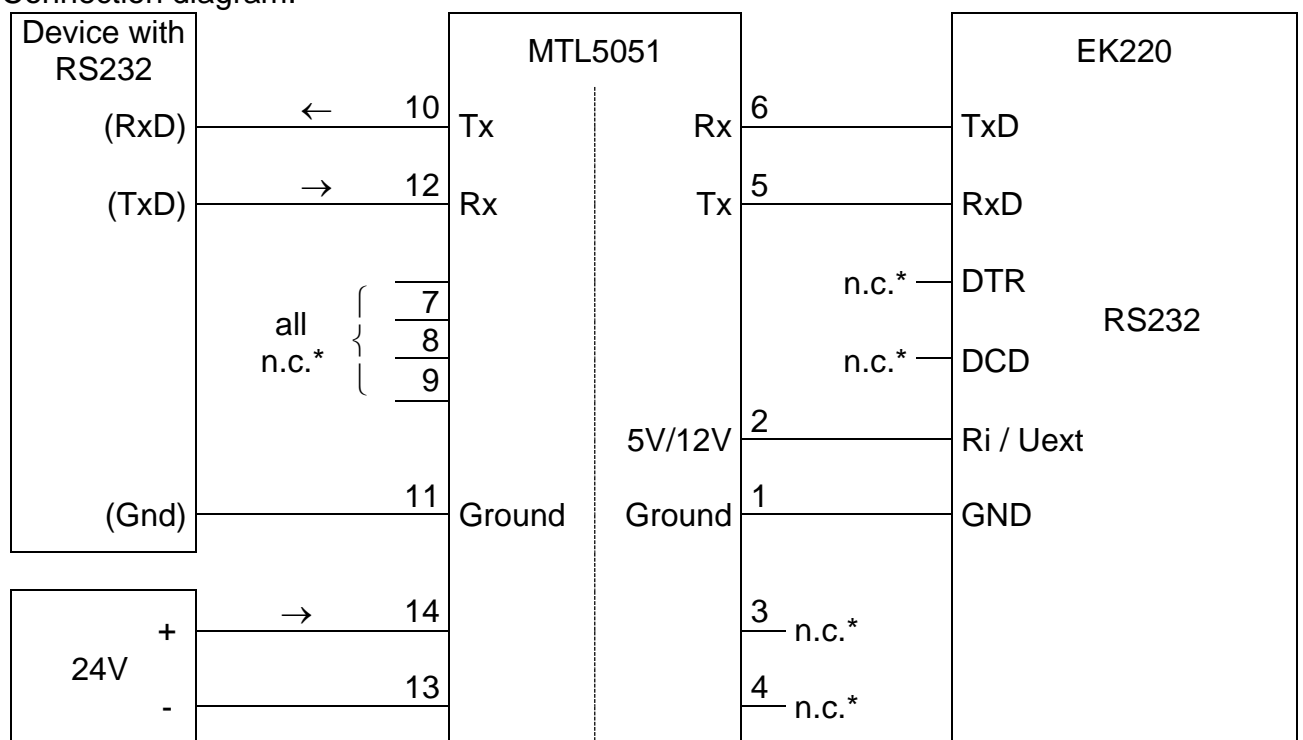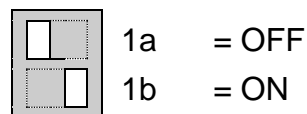
Settings of MTL5051:

	2a	= OFF
	2b	= ON
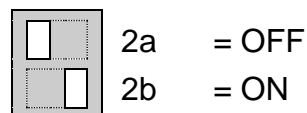
→ ON

5.8.3 Other devices with RS232 interface, EK220 battery powered

Connection diagram:
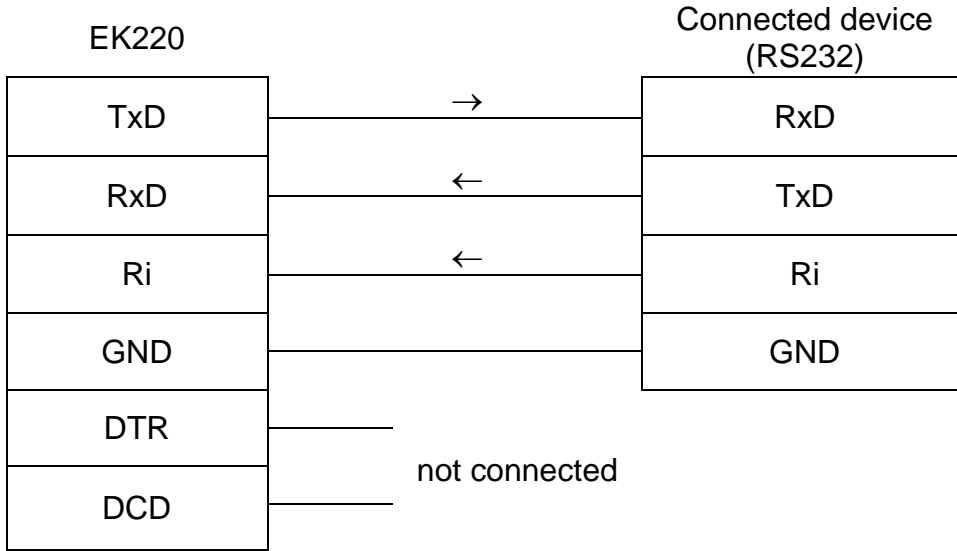
EK220		Connected device (RS232)
TxD	→	RxD
RxD	←	TxD
Ri	←	Ri
GND		GND
DTR		
DCD	not connected	

☞ *If the EK220 is **not** employed in Ex Zone 1, the X100 jumpers (position: in front of the terminals, see chapter 5.5) should be plugged onto both pins of the male connector when connecting a device to the serial interface (e.g. mode, not EM260 or power supply unit). In this way any interference introduced by the connected device, which may otherwise cause erroneous measurements, can be led away.*

☞ ***Important:** Higher power requirement of EK220. To be used only after consultation.*

5.8.4 Other devices with RS232 interface, EK220 with ext. power supply

Connection diagram:
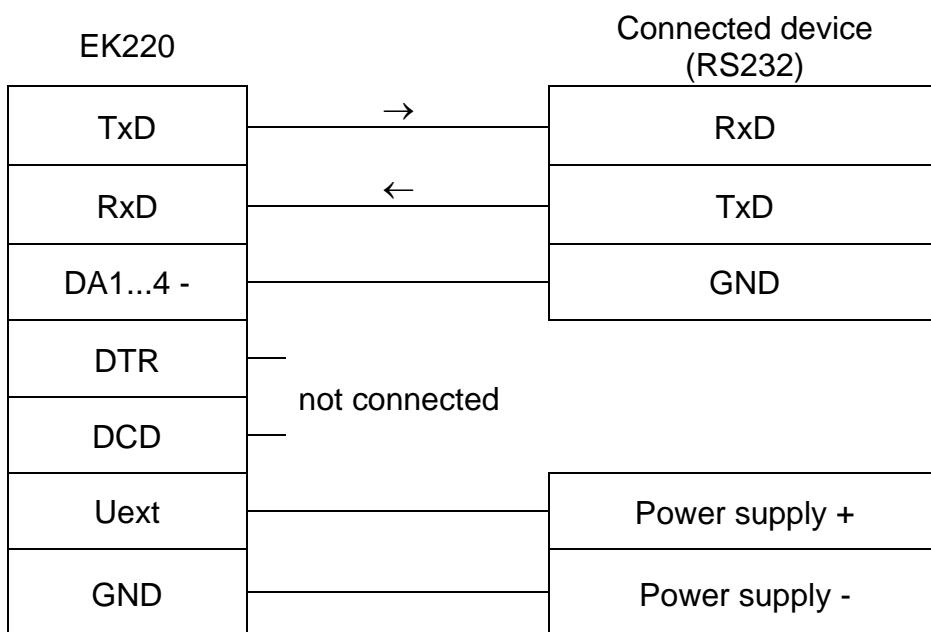
EK220		Connected device (RS232)
TxD	→	RxD
RxD	←	TxD
DA1...4 -		GND
DTR		
DCD	not connected	
Uext		Power supply +
GND		Power supply -

☞ *If the EK220 is **not** employed in Ex Zone 1, the X100 jumpers (position: in front of the terminals, see chapter 5.5) should be plugged onto both pins of the male connector when connecting a device to the serial interface (e.g. mode, not EM260 or power supply unit). In this way any interference introduced by the connected device, which may otherwise cause erroneous measurements, can be led away.*

☞ *Since the external power supply is usually separate from the interface, both GND lines (from the interface and from the power supply) must be connected. However, since only one GND terminal is available in the EK220, the terminals DA1 - ... DA4 - can be used as an alternative.*

5.9 Seals

1. Setting the parameters

To change values subject to calibration regulations (e.g. cp value), the adhesive labels on the calibration lock in the device must be opened up and the button pressed (status "P" flashes in the display).

2. Closing and securing the calibration lock

Once all values subject to calibration regulations have been changed, the calibration lock is closed by pressing the button (status "P" goes out) and the access opening is sealed with an adhesive label.

3. Securing the circuit board

The circuit board is provided with a plastic cover to protect it from tampering. The fixing screws of this cover must be provided with an adhesive label.

4. Securing the inputs and outputs

When used in applications subject to official calibration, the terminals relevant to official regulations (e.g. counting inputs) must be secured against tampering by calibration covering caps. Sealing is provided by an adhesive label on the screw of the covering cap.

See Chap. 5.9.1 for seal layout.

5. Securing the housing (option)

The two screws on the top of the front are designed as sealing screws.

If necessary customer can protect the housing against opening by sealing wire and a suitable customer seal.

5.9.1 Seal layout of basic device

a) Housing cover (internal view)

PCB cover

Sealing points for securing the calibration switch

Sealing points for securing the PCB cover

Sealing points for securing in- and outputs

Terminal covers
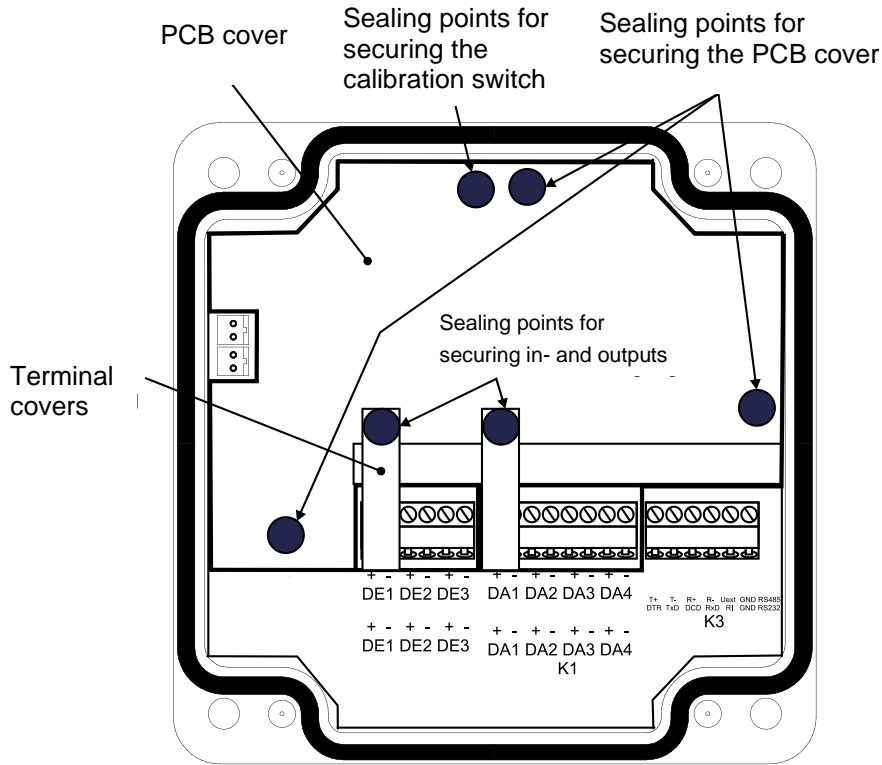
b) Housing cover (front view), standard seals

EK220

Prefix | Arc. | Status | Menu

Submenu

Identification label

Possible sealing point for securing the identification label.

HOME CLR   ENTER   ESC

Made in Germany

elster
Instromet
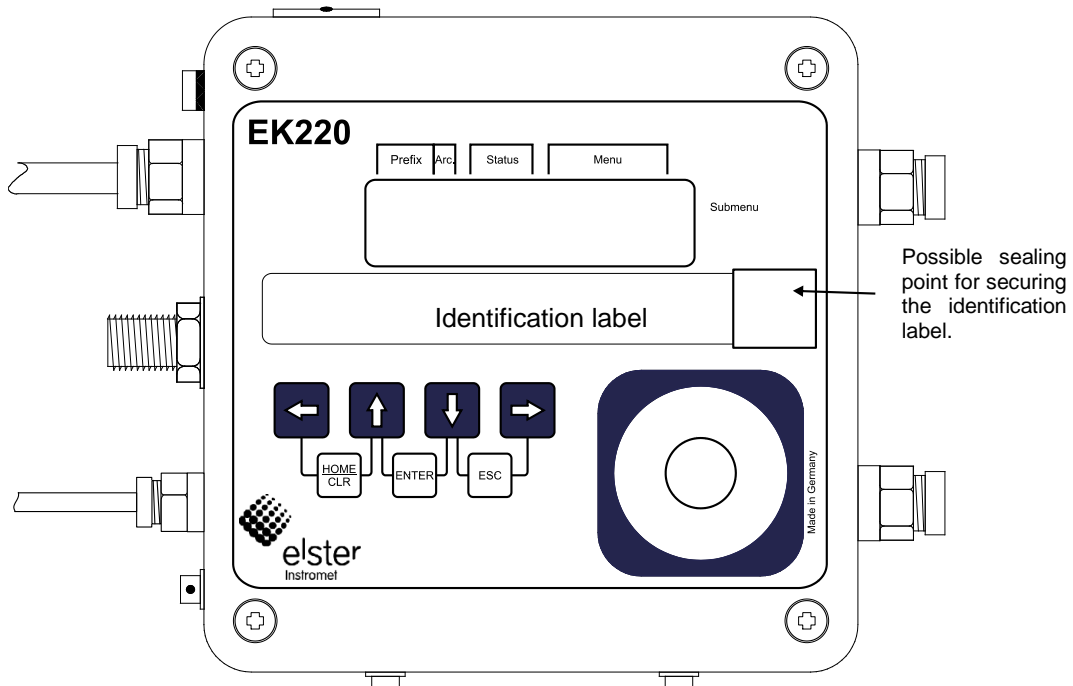
c) Housing cover (front view), cover sealing using wire seal (optional user sealing)

Capstan headed screws for wire
seal for securing the device

Wire seal

EK220

Prefix | Arc. | Status | Menu

Submenu

Identification label

Possible sealing point for securing the identification label.

HOME CLR | ENTER | ESC

Made in Germany

elster
Instromet

.
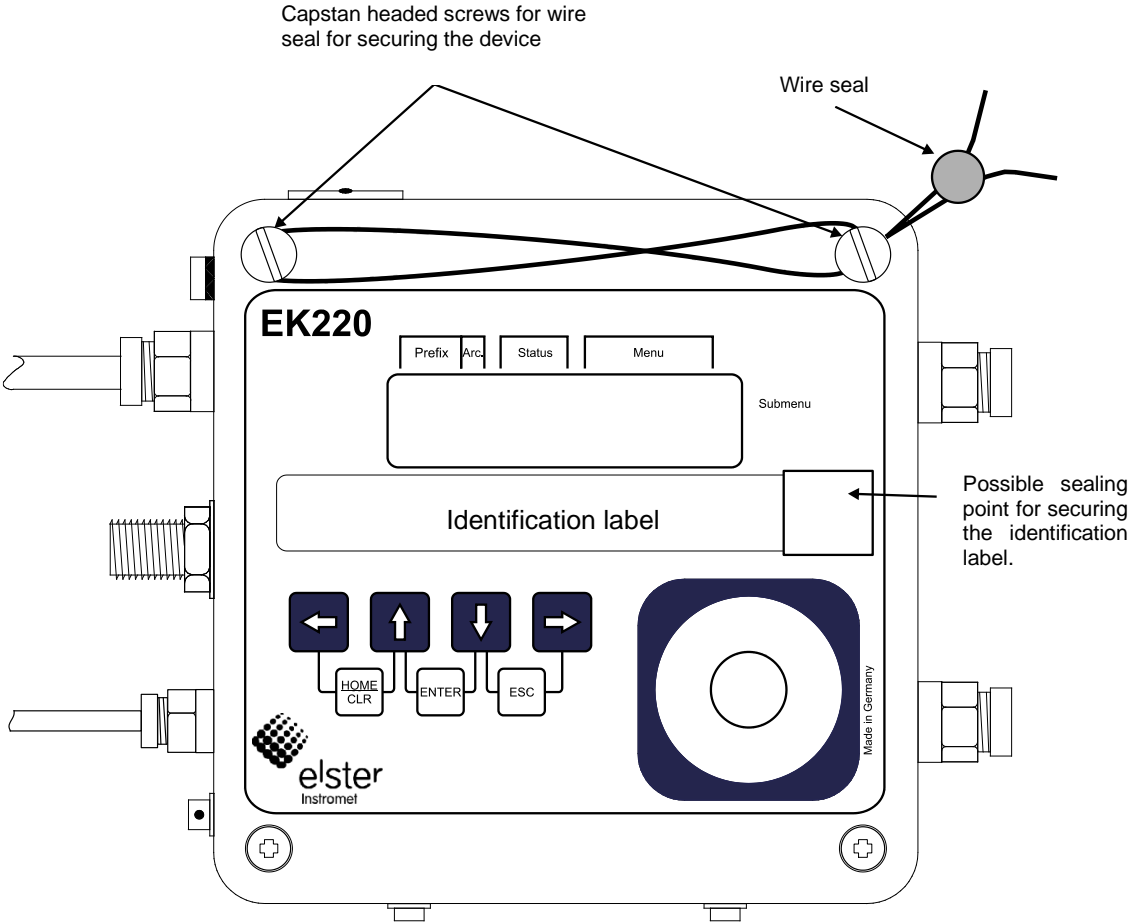
5.9.2 Seal layout of temperature sensor

The sealing of the temperature sensor is generally carried with wire seals.

In this section the sealing methods used by Elster GmbH for the standard temperature sensors are illustrated as examples. Other variants of seals are possible depending on the combination of temperature sensor and thermowell.

a) Temperature sensor of variable length + standard thermowell
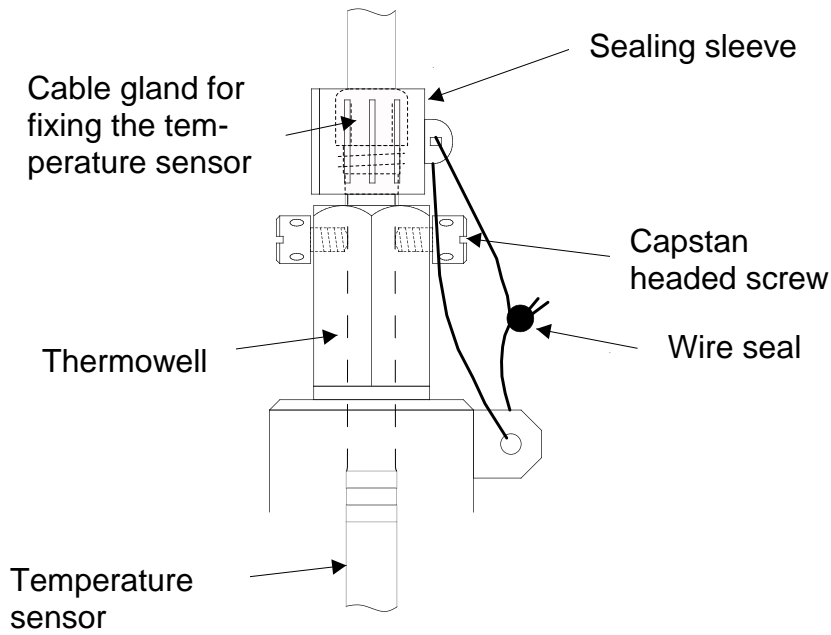
b) Temperature sensor of variable length + older Elster thermowells
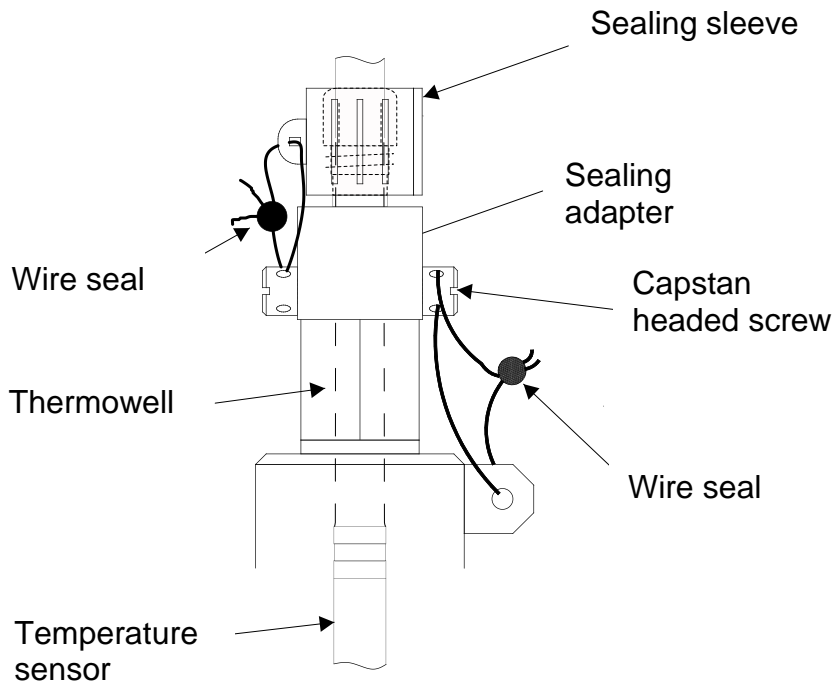
5.9.3 Sealing layout of pressure sensor -Type CT30[23]

The sealing points shown in the sealing layouts are to be secured with sealing labels

a) Internal fitting

Sealing sleeve

Wire seal

Volume Conversion Device

Pressure connector

Pressure sensor

b) External fitting

Wire seal

Sealing sleeve

Sealing point for securing the identification label

Pressure connector

Type identification as sticker or lasered.

Pressure sensor

Connecting cable

---
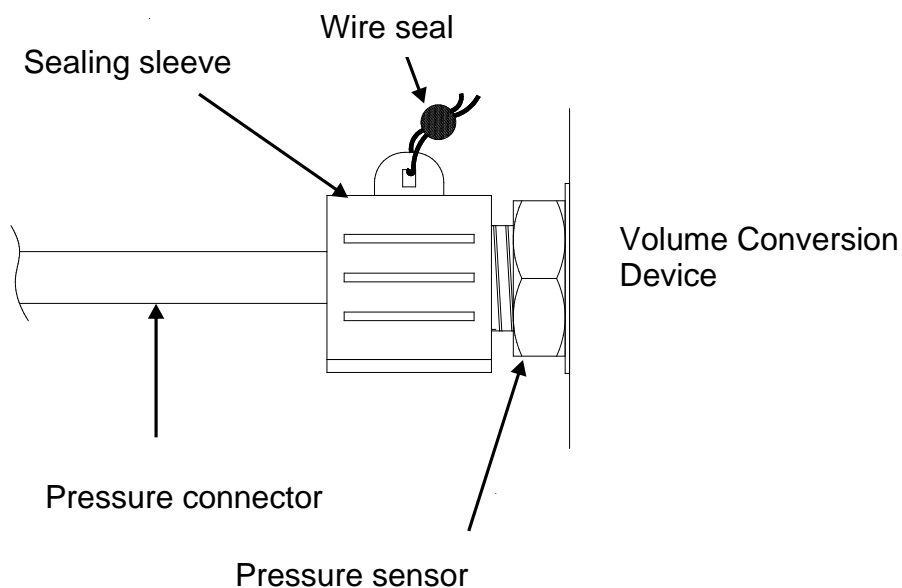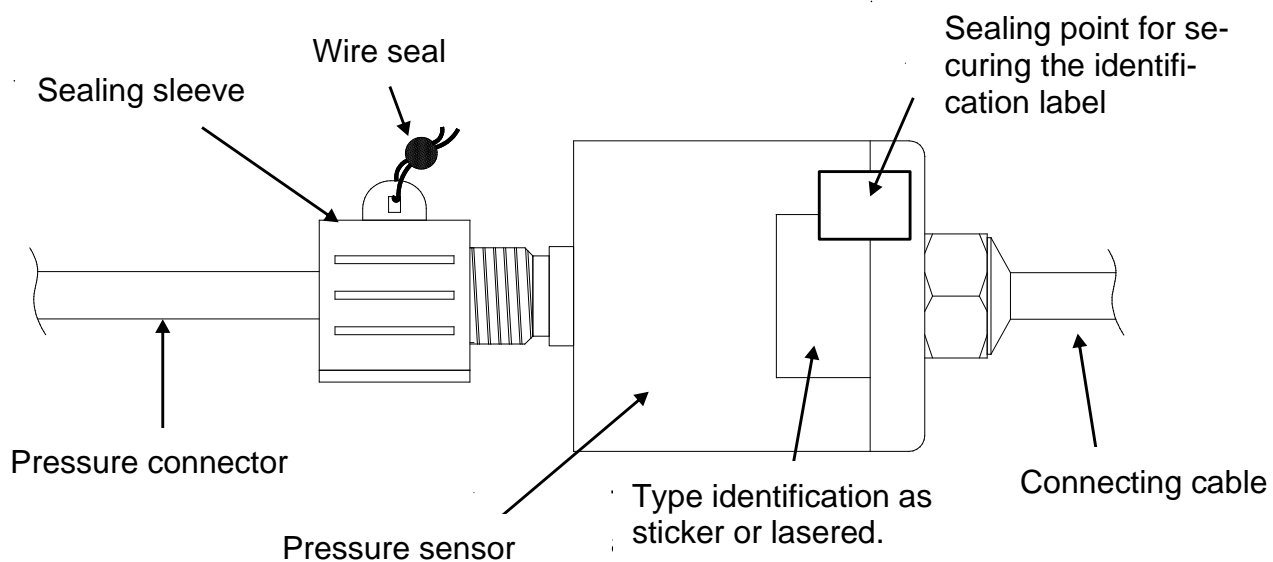
[23] Not applicable when using EK220 as a temperature conversion device.

5.9.4 Sealing layout of pressure sensor type 17002[24]

a) Internal fitting

An internal fitting of this sensor type is not planed at the moment.

b) External fitting

Wire seal

Type identification as sticker or la-sered.

Union nut

Pressure connector

Sealing point for se-curing the identifi-cation label

Pressure sensor

---
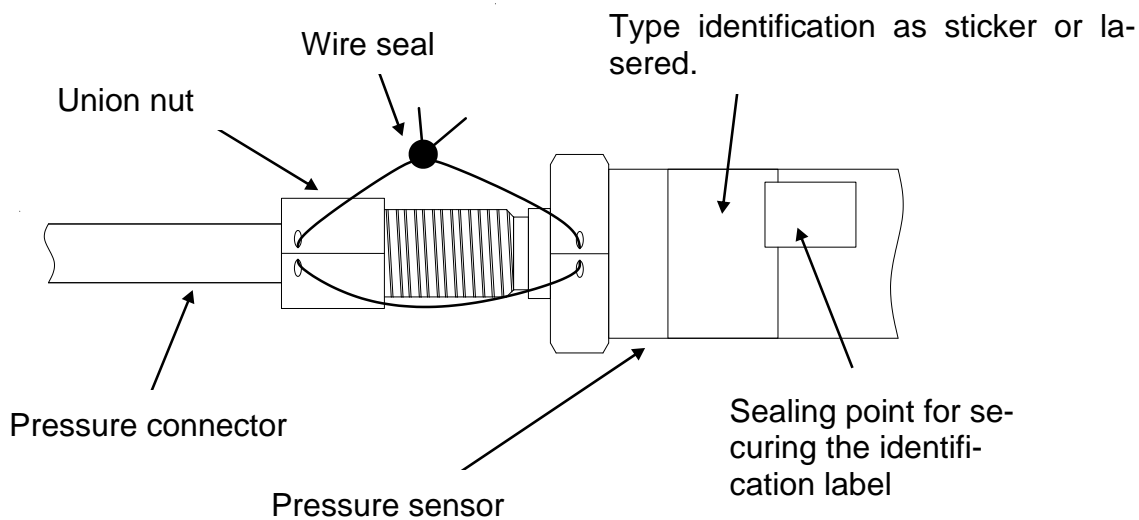
[24] Not applicable when using EK220 as a temperature conversion device.

5.10 Battery replacement

During operation a check must be made from time to time of whether the batteries need to be replaced. The battery warning "B" in the "Status" field of the display ($\rightarrow$ 2.2.1) is used for this as well as the remaining battery life in the service list ($\rightarrow$ 3.10: *Bat.R*).

☞ *The displayed remaining battery service life applies to the specified standard operating application ($\rightarrow$ B-2). The remaining service life is reduced correspondingly quicker due to changes of the measurement cycle, reading of the values or continuous active display.*

☞ *The battery life with one battery in the standard operating mode ($\rightarrow$ B-2) is at least 5 years. The battery life may be reduced in other operating modes. Further details are given in $\rightarrow$ 3.10: Bat.R and Bat.K*

☞ *Battery replacement can be carried out without the presence of a calibration official, because the housing itself is not officially sealed.*

☞ *During battery replacement one battery should always remain connected. Before the old battery is removed, the new battery must be connected. Two plugs are provided for this.*

☞ *EK220 measurements may be lost due to careless procedures. All the set parameters, along with the once-daily date, time and counter readings are saved in a non-volatile memory (EEPROM) and automatically recalled when required.*

☞ *As an additional backup, all data should be saved in the non-volatile memory (EEPROM) directly before battery replacement ($\rightarrow$ 3.10, "Save"). If, due to an operating fault during battery replacement, data is lost, the EK220 automatically recalls the data from the time it was previously saved.*

☞ *Therefore, replacement should only be carried out by Elster Service or by specially trained personnel.*

Carrying out the battery replacement:

1. Save the data as a precautionary measure ($\rightarrow$ 3.10: Save).
2. Open up the housing cover and swivel downwards. The battery is then accessible in the bottom part of the housing.
3. Check the type and order number of the new battery.

   ☞   Tip: Mark the <u>old</u> battery, e.g. with a felt-tip pen or sticker <u>before</u> you start the battery replacement. This avoids any later confusion.

4. At least one battery must always be connected to one of the two plugs. If this is not the case, archives may be deleted, volume pulses may be lost during the battery replacement and the clock may be slow after battery replacement.
5. Insert the new battery and connect to the free plug in parallel to the old battery (both are electrically isolated). The plugs are polarised against incorrect connection.
6. Pull off the old battery from the plug and remove.
7. Fix the new battery in the holder on the floor of the housing.
8. Reclose the housing (make sure that the cable is not pinched).
9. Under "Service" - "Battery capacity" ($\rightarrow$ 3.10: *BAT.C)* the initial capacity must be entered (essential even with the same capacity value)!
   With the use of the size "D" battery obtainable from Elster GmbH, the value 13.0 Ah should be entered for *Bat.C*.
10. Check the operating life calculated by the EK220: At least 60 months should be displayed for *Bat.R* ($\rightarrow$ 3.10). If this is not the case, carry out the step again.
11. End of the battery replacement.

A   Approvals

A-1   EC Declaration of Conformance

CE

EU Declaration of Conformity No. **DEMZE2204**
EU-Konformitätserklärung Nr.

Honeywell

Type, Model *Typ, Ausführung*	**EK220**
Manufacturer *Hersteller*	Elster GmbH, Postfach 1880, D - 55252 Mainz-Kastel; Steinern Straße 19-21
Product *Produkt*	Volume conversion device *Zustands-Mengenumwerter*

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:
Der oben beschriebene Gegenstand der Erklärung erfüllt die einschlägigen Harmonisierungsrechtsvorschriften der Union:

2014/32/EU (MID)	**2014/30/EU** (EMC)	**2014/34/EU** (ATEX)	**2011/65/EU** (RoHS)

Relevant harmonised standards used:
Einschlägige harmonisierte Normen, die zugrunde gelegt wurden:

EN 12405-1:2011-04, OIML D11 Edition 2004 (E)	EN 61326-1:2013	EN IEC 60079-0:2018 EN 60079-11:2012	EN 50581:2012

Certificates and interventions by notified bodies:
Bescheinigungen und Maßnahmen durch notifizierte Stellen:

DE-17-MI002-PTB002 (for EK220) DE-17-MI002-PTB003 (for EK220-T)	Not applicable *Entfällt*	TÜV 08 ATEX 554344	-
EU-type examination *EU-Baumusterprüfung*		EU-type examination *EU-Baumusterprüfung*	
Notified Body 0102 Physikalisch Technische Bundesanstalt (PTB) D-38116 Braunschweig		Notified Body 0032 and 0044 (legal succession) TÜV NORD CERT GmbH D-30519 Hannover	

This declaration of conformity is valid for products labelled accordingly:
Diese Konformitätserklärung gilt für entsprechend gekennzeichnete Produkte:

CE M.... 102 DE-17-MI002-PTB002 (for EK220) DE-17-MI002-PTB003 (for EK220-T)	**CE**	**CE** 0044 ⟨Ex⟩ II 2 G EEx ia [ia] IIC T4	**CE**

The production is subject to the following surveillance procedures:
Die Herstellung unterliegt folgenden Überwachungsverfahren:

Directive Module D *Richtlinie Modul D*	Directive Module C *Richtlinie Modul C*	Directive Annex IV+VII *Richtlinie Anhang IV+VII*	Directive Article 7 *Richtlinie Artikel 7*
Notified Body 0102 Physikalisch Technische Bundesanstalt (PTB) D-38116 Braunschweig		Notified Body 0044 TÜV NORD CERT GmbH D-30519 Hannover	

This declaration of conformity is issued under the sole responsibility of the manufacturer. If alterations are made to the product or it is modified, this declaration becomes void with immediate effect.
Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller. Bei Umbau des Produkts oder Änderungen am Produkt verliert diese Erklärung mit sofortiger Wirkung ihre Gültigkeit.

Elster GmbH	**Mainz-Kastel, 02.11.2022**	*Dr. Martin Schröder*	*Christian Neugebauer*
Signed for and on behalf of *Unterzeichnet für und im Namen von*	Place and date of issue *Ort und Datum der Ausstellung*	Dr. Martin Schröder, Managing Director	Christian Neugebauer, R&D Manager Gas Electronics

A-2   Approval for Ex Zone

Translation

(1) # EC-Type Examination Certificate

TÜV NORD

(2) Equipment and protective systems
intended for use in potentially
explosive atmospheres, **Directive 94/9/EC**

(3) **Certificate Number**   TÜV 08 ATEX 554344

(4) for the equipment: Electronic Volume Corrector EK220

(5) of the manufacturer: **Elster GmbH**

(6) Address: Steinern Straße 19-21
55252 Mainz-Kastel
Germany

Order number: 8000554344

Date of issue: 2008-04-31

(7) This equipment or protective system and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV NORD CERT GmbH, notified body No. 0044 in accordance with Article 9 of the Council Directive of the EC of March 23, 1994 (94/9/EC), certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive. The examination and test results are recorded in the confidential report No. 08 203 554344.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 60079-0:2006   **EN 60079-11:2007**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment or protective system must include the following:

⟨Ex⟩   II 2 G Ex ia [ia] IIC T4

TÜV NORD CERT GmbH, Langemarckstraße 20, 45141 Essen, accredited by the central office of the countries for safety engineering (ZLS), Ident. Nr. 0044, legal successor of the TÜV NORD CERT GmbH & Co. KG Ident. Nr. 0032

The head of the certification body

Schwedt

Hanover office, Am TÜV 1, 30519 Hanover, Fon +49 (0)511 986 1455, Fax +49 (0)511 986 1590

This certificate may only be reproduced without any change, schedule included.
Excerpts or changes shall be allowed by the TÜV NORD CERT GmbH

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TÜV NORD

(13) **S C H E D U L E**

(14) **EC-Type Examination Certificate No. TÜV 08 ATEX 554344**

(15)   Description of equipment

The electronic volume corrector type EK220 is an explosion-proof electronic device that meets the requirements of category 2. The device determines and displays the basic volume of a gas volume, which is measured by an external gas meter under service conditions, using the state variables pressure and temperature.
For the different applications the EK220 may be assembled with two, one, or none pressure sensors (0...2 p-sensors) and with one or none temperature.
For the supply a battery is used. A change of the batteries does not impair the Intrinsic Safety. It is possible to supply the device by an external supply and two batteries.

The maximum permissible ambient and gas temperature range is	- 20 °C to + 50 °C

Electrical data

Supply
(Internal battery)

1 resp. 2 pc. Lithium batteries type LS 33600, company Saft
$U = 3.6$ V, modified accumulator pack of the manufacturer

Supply circuit
(External supply)

in type of protection „Intrinsic Safety"   Ex ia IIC/IIB
only for connection to certified intrinsically safe circuits with the following maximum values:
$U_i =$ 20 V
I_i and P_i see supply circuit, interface and digital outputs

$C_i =$ 12 nF
The effective internal inductance is negligibly small.

Digital outputs
(terminals DA1 ... DA4)

in type of protection „Intrinsic Safety"   Ex ia IIC/IIB
maximum values:

$U_o =$ 6.6   V
I_o =   0.3   mA,   static (sum current of all digital outputs)
I_o = 1.41   A,   dynamic (short-time discharge current per digital output)
$P_o =$ 2   mW

Characteristic line: linear

Ex ia	IIC	IIB
Max. permissible external inductance per digital output	29,8 µH	150 µH
Max. permissible external capacitance per digital output	1.45 µF	5.75 µF

TÜV NORD

Schedule EC-Type Examination Certificate No. TÜV 08 ATEX 554344

The digital outputs are also intended for the connection to certified intrinsically safe circuits:
U_i = 10 V
I_i and P_i see supply circuit, interface and digital outputs

The effective internal inductance and capacitance is negligibly small.

Digital inputs
(terminals DE1 ... DE3)

in type of protection „Intrinsic Safety" Ex ia IIC/IIB
maximum values:

U_o = 6.6 V
I_o = 0.07 mA, static (sum current of all digital outputs)
I_o = 0.93 A, dynamic (short-time discharge current per digital output)
P_o = 0.4 mW

The effective internal inductance Li = 2.3 µH for each output
The effective internal capacitance is negligibly small.

Characteristic line: linear

Ex ia	IIC	IIB
Max. permissible external inductance per digital output	87.8 µH	380 µH
Max. permissible external capacitance per digital output	2.35 µF	9.15 µF

Only for the connection to reed contacts with a cable length up to 35 m or to Wiegandsensor (TÜV 01 ATEX 1776).

Interface
(terminals T+, DTR / T-,TxD / R+, DCD / R-, RxD / Uext, RI / GND)

in type of protection „Intrinsic Safety"   Ex ia IIC/IIB
only for connection to certified intrinsically safe circuits with the following maximum values:

U_i = 20 V
I_i and P_i see supply circuit, Interface and Digital outputs

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Schedule EC-Type Examination Certificate No. TÜV 08 ATEX 554344

For the interconnection the following maximum values have to be taken into consideration as well:

$U_o = 6.6$ V
$I_o = 35$ mA
$P_o = 231$ mW

Characteristic line: linear

The effective internal capacitance is negligibly small.
The effective internal inductance is negligibly small.

<u>or</u> for connection to MTL5051 Intrinsically Safe Serial Data Communications Isolator by the manufacturer MEASUREMENT TECHNOLOGY LIMITED with the EC-Type Examination Certificate No. BAS01ATEX7158 option CON 1 pin 2; CON 2 pins 5, 6 w.r.t CON 1 pin 1 (for connecting to the terminals 1, 2, 5, 6 (see datasheet)).

Supply circuit
Interface and
Digital outputs

maximum values (sum values) of these intrinsically safe circuits:

$\sum I_i = 139$ mA
$\sum P_i = 0.50$ W

(16) Test documents are listed in the test report No. 08 203 554344.

(17) Special conditions for safe use

(18) Essential Health and Safety Requirements

no additional ones

TÜV NORD

Translation
1. S U P P L E M E N T

to Certificate No.	**TÜV 08 ATEX 554344**
Equipment:	Electronic Volume Corrector EK220
Manufacturer:	**Elster GmbH**
Address:	Steinern Straße 19-21
	55252 Mainz-Kastel
	Germany
Order number:	8000554724
Date of issue:	2008-07-04

Amendments:

The electronic volume corrector type EK220 is an explosion-proof electronic device that meets the requirements of category 2. The device determines and displays the basic volume of a gas volume, which is measured by an external gas meter under service conditions, using the state variables pressure and temperature. In the future the electronic volume corrector may be operated with the pressure sensor type 17002. In the future the circuit board may be produced according to the documents listed in the test documents.

The maximum permissible ambient and gas temperature range is –30 °C bis +60 °C.

The electrical data and all other data apply unchanged for this supplement.

The equipment incl. of this supplement meets the requirements of these standards:

EN 60079-0:2006   **EN 60079-11:2007**

(16)   The test documents are listed in the test report No. 08 203 554724.

(17)   Special conditions for safe use

no additional ones

(18)   Essential Health and Safety Requirements

no additional ones

TÜV NORD CERT GmbH, Langemarckstraße 20, 45141 Essen, accredited by the central office of the countries for safety engineering (ZLS), Ident. Nr. 0044, legal successor of the TÜV NORD CERT GmbH & Co. KG Ident. Nr. 0032

The head of the certification body

Schwedt
Hanover office, Am TÜV 1, 30519 Hanover, Tel.: +49 (0) 511 986-1455, Fax: +49 (0) 511 986-1590

B   Technical data

B-1   General data (mechanical)

Housing/construction	Wall-mounted housing (horizontally); aluminium cast alloy G AI SI 12 / DIN 1775; with cable glands
Dimensions (W x H x T)	Approx. 126 x 126 x 90 mm (with cable glands)
Weight	Approx. 1.7 kg
Cable connection	Clamp terminals; d = 0.3 ... 1.4 mm with flexible cable fit core-end sleeves Cable diameter: 7,0 … 9,5 mm
Screen	Connect cable screen to the cable gland
Protection	IP 66 according to EN60529
Ambient conditions accord. to	MID Directive:
Ambient temperature	-25°C ... +55°C
Humidity conditions	condensation
Point of use	open

Mechanical ambient conditions accord. to MID Directive:	Class	M2
Electromagnetic ambient conditions accord. to MID Directive:	Class	E2

B-2 Batteries

Batteries	1 lithium battery; 3.6V; size D normal rated capacity: 16.5 Ah Usable capacity for EK220: 13.0 Ah Order no.: 73015774
	1 additional lithium battery optional for double battery service life Order no.: 73015774

*The min. service life of five years is guaranteed for the following **standard operating mode**:*

Ambient temperature	T_a = -10...+50°C
Measurement cycle (*MCyc*)	30 s
Operating cycle (*OCyc*)	300 s (5 minutes)
K-value mode (Md.K)	1 (acc. S-Gerg-88)
Mode Input	1 (pulse input)
Display active	1 hour per month
Optical interface active	15 minutes per month
Internal interface (terminals)	Not used

B-3 External power supply

Designation	Uext
Cable connection	Plug-in terminals; d = 0.3 ... 1.4 mm
	With flexible cable use wire-end sleeves.
Screening	Connect cable screen to the cable gland.

Nominal data:

Supply voltage:	$U = 5.0\ V\ ...\ 9.5\ V$
Supply current:	$I \leq 30\ mA$ (Typ.S2 = RS-485)
	$I \leq 50\ mA$ (Typ.S2 = RS-232)

☞ *For impulse-counting at the digital inputs an internal battery is required, although the external power supply is connected!*

☞ *It`s only allowed to use an external power supply, which is approved by Elster GmbH.*

☞ *If the EK220 is not employed in Ex Zone 1, the X100 jumper (position: in front of the terminals, see Chapter 5.5) should be plugged onto both pins of the male connector when connecting an external power supply.*
In this way any interference introduced by the connected device, which may otherwise cause erroneous measurements, can be led away.

B-4 Pulse and status inputs

Three digital inputs with common ground (minus pole) for reed contacts or transistor switches (only Input "DE1").

Designation	DE1... DE3
Cable connection	Plug-in terminals; d = 0.3 ... 1.4 mm
	With flexible cable use wire-end sleeves.
Screening	Connect cable screen to the cable gland over the full area.
Special features	Each input can be parameterised and sealed separately.

Nominal data

☞ *For data which is not mentioned here, the limits in the certificate of conformance must be observed when using the EK220 in Ex Zone 1.*

Open-circuit voltage	$U_0 \approx 2\ V$
Internal resistance	$R_i \approx 500\ k\Omega$
Short-circuit current	$I_k \approx 4\ \mu A$
Switching point "on"	$R_e \leq 100\ k\Omega$ or $U_e < 0.8\ V$
Switching point "off"	$R_a \geq 2\ M\Omega$
Pulse duration	$t_e \geq 50\ ms$
Space duration	$t_a \geq 50\ ms$
Counting frequency	$f \leq 2\ Hz$ (see chapter 0)

B-5 Signal and pulse outputs

Four transistor outputs with common ground (minus pole).

The volume pulses acquired for one measurement cycle are output as pulse packets. They are therefore not suitable for open and closed-loop control purposes.

Designation	DA1... DA4
Cable connection	Plug-in terminals; d = 0.3 ... 1.4 mm
	With flexible cable use wire-end sleeves.
Screening	Connect cable screen to the cable gland over the full area.
Special features	Each output can be parameterised and sealed separately.

Nominal data:

☞ *The limits in the certificate of conformance must be observed when using the EK220 in Ex Zone 1, also for data which is not mentioned here.*

Maximum switching voltage	30 V DC (Ex Zone 1: max 10V DC)
Maximum switching current	100 mA DC
Maximum voltage drop	1V
Maximum residual current	0.001 mA
Pulse duration	Min. 125 ms, adjustable on a pitch of 125 ms
Space duration	Min. 125 ms, adjustable on a pitch of 125 ms
Output frequency	Max. 4 Hz, adjustable

☞ **When the EK220 is used in Ex Zone 1, it is essential that the applied switching voltage on the outputs A1 – A4 does not exceed 10 V, even in the event of a fault (single fail-safe) – see chapter A-2; U_i = 10V!**
In this case, it is recommended that an ex-proof isolating amplifier is used.

Output sheet:
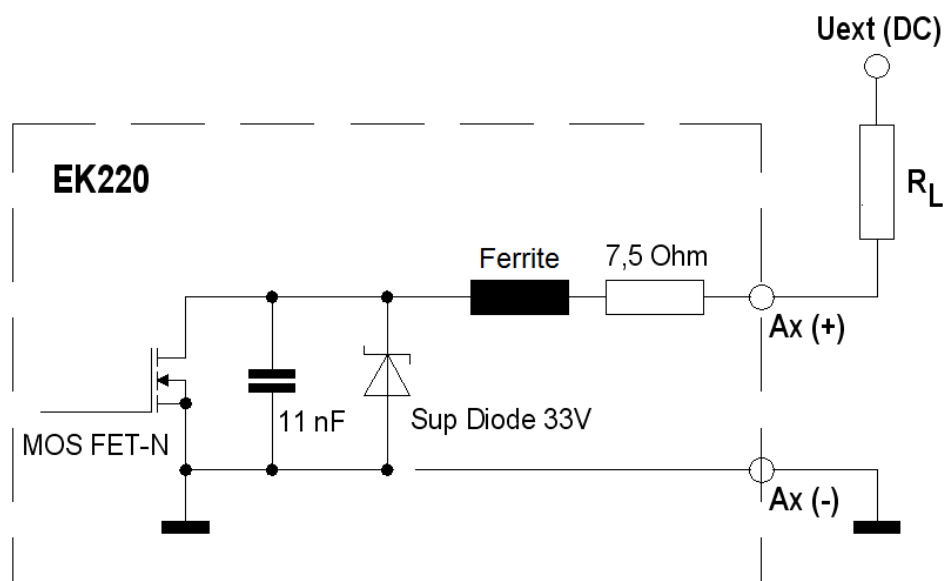
B-5.1   Connection of an EK220 to a PLC or external switching amplifier

☞   *When connecting the outputs to a customer installation (e.g. PLC), an isolating amplifier is usually required, since the EK220 works with common ground and the PLC usually with a common plus. The isolating amplifier is also recommended, so that both systems are galvanic isolated (EMC influences).*

☞   *Generally, a switching amplifier is strictly recommended to separate the two systems isolated (e.g. against EMC effects)!*

Wrong wiring of the outputs to a PLC or an external switching amplifier by use of more than one outputs of the EK220:
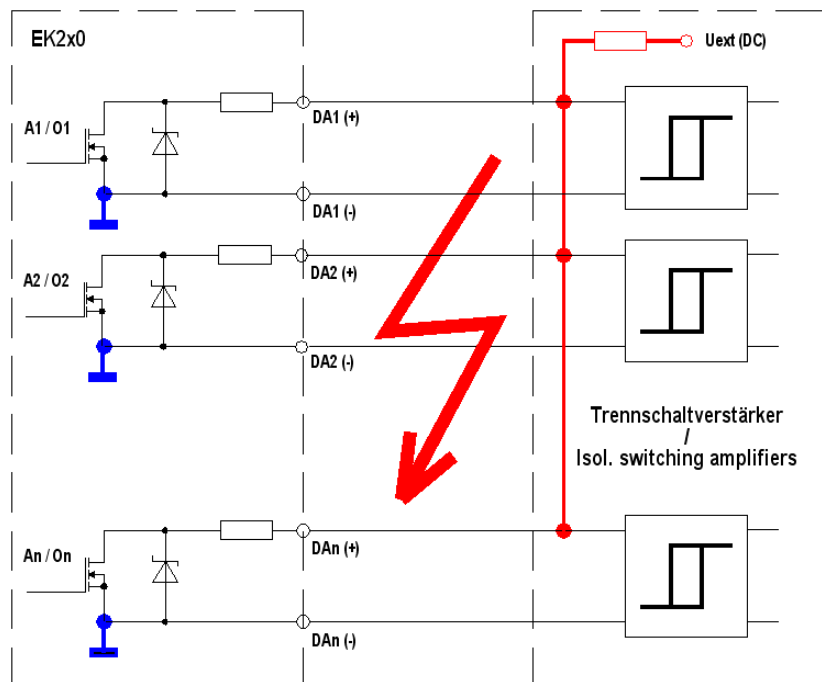
Correct wiring:

Switching amplifier with common ground:
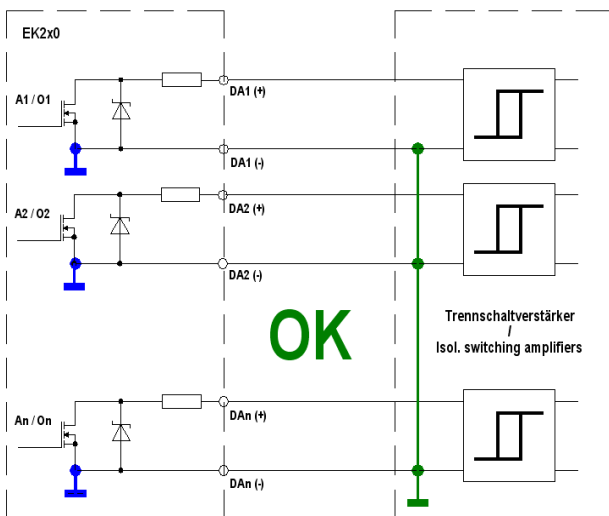
Separate Switching amplifier for each output (recommended):
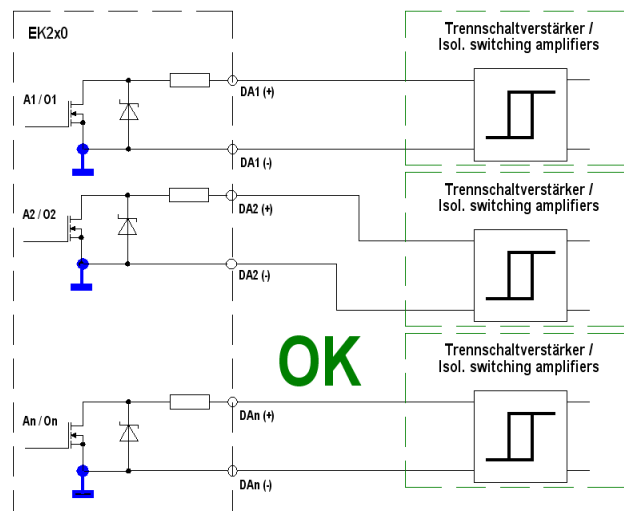
B-6   Optical serial interface

Optical interface according to IEC 62056-21; bit-serial, asynchronous data transmission according to ISO 1177, half duplex.

Support of **Data transmission mode "C"** (= Data read-out, programming and manufacturer-specific applications with automatic change of the baud rate).

Baud rate	300 Bd (initial baud rate); automatic up to 9600 Bd.
Format	1 start, 7 data, 1 parity (even) and 1 stop bit.
Connection	Optical read-out head on device front panel (automatic positioning / fixing by magnet).

B-7   Electrical serial interface (internal)

Interface RS232 or RS485 (via software selectable), e.g. for the connection of an FE260 Function Expansion Unit, a modem or other interfaces with RS-485, RS-232 or RS-422 interface. The RS485 interface can be operated in 4-wire (RS422) or 2-wire (RS485) mode.

☞   *Since the interface of the EK220 has been designed for use in the hazardous area and for a battery device, the correct function when connecting an external device with RS232 / RS485 interface cannot always be guaranteed and must be checked in individual cases!*

☞   *In most cases an external power supply is required when the internal interface is operated (see chapter: 4.4 and 4.5).*

B-8 Pressure sensor [25]

B-8.1 Type CT30

From these pressure sensor type two sensors can be connected to the EK220.

The first pressure sensor can be implemented either as internal or as external version and is available only as an absolute-pressure sensor.
The second pressure sensor is connectable only as external version (cable length 2.5m or 10m) and can be implemented as an absolute or relative pressure sensor.

Pressure connection: Ermeto M12 x 1.5 male thread, usable length approx. 10 mm

Absolute pressure ranges [26]**:**

Measurement range	Max. admissible overload	Measurement range	Max. admissible overload
0.7 ... 2 bar abs.	18 bar abs.	4 ... 20 bar abs.	40 bar abs.
0.8 ... 5 bar abs.	25 bar abs.	6 ... 30 bar abs.	60 bar abs.
0,8 ... 6 bar abs.	25 bar abs.	8 ... 40 bar abs.	60 bar abs.
1.4 ... 7 bar abs.	25 bar abs.	14 ... 70 bar abs.	105 bar abs.
2 ... 10 bar abs.	40 bar abs.	16 ... 80 bar abs.	105 bar abs.
2.4 ... 12 bar abs.	40 bar abs.		

Gauge pressure ranges [27]**:**

Measurement range	Max. admissible overload
1.4 ... 7 barG	40 barG
4 ... 20 barG	40 barG
16 ... 80 barG	105 barG

Cross section of the pressure connection:
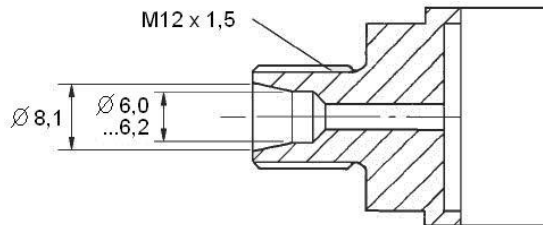
B-8.2 Type 17002

Only one of these pressure sensor types can be connected to the EK220.

The pressure sensor is currently implemented only as an external version (cable length 2.5m).

Pressure connection: ¼" – NPT – male thread

Absolute pressure ranges:

Measurement range	Max. admissible overload
0.9 ... 7 bar abs.	10 bar abs.
0.9 ... 10 bar abs.	10 bar abs.

---

[25] Not applicable when using EK220 as a temperature conversion device.

[26] For first and/or second pressure sensor.

[27] Only for second pressure sensor.

B-8.3 Installation information

When connecting the pressure line to the installed pressure sensor, attention must be paid to the pipe diameter to avoid damage and leaks on the gland connection. In particular the parting point on the pipe should be checked for burrs or flaring, which cause an increase in the outside diameter of the pipe.

B-9 Temperature sensor

Type:	Pt100, Pt500 or Pt1000 according to EN 60751
Measurement range:	-30°C ... +60°C
Measurement uncertainty:	$\leq \pm 0.1\%$ of measurement
Mounting:	Insertion into sensor receptacle with variable length
Sensor dimensions:	Diameter: 6,0 mm / length: 50 mm
Cable length:	standard: 2 m / optional: 10 m

B-10 Measurement uncertainty

The error limits quoted in the MID and in (DIN) EN 12405 are maintained.

Depending on the ambient temperature and the pressure measurement range, detailed data is available on request.

C   Index