EK210

This product is discontinued!

Volume Conversion Device EK210

Operating Manual and Installation Instructions

Operating Manual	73017449	SW version:	from V 1.21
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Mainz-Kastel, April 2008

Contents

I Safety information

F *The connections of the EK210 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.*

F *To avoid erroneous operation and problems, the operating manual must be read before putting the EK210 into operation.*

The EK210 Volume Conversion Device (= Electronic Volume Corrector) is suitable for applications in Ex Zone 1 for gases in the temperature class T4 (ignition temperature > 135°C, e.g. natural gas) according to VDE 0170 (see Appendix A-2).

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

F *Follow the regulations in the relevant standards, in particular DIN EN 60079-14 (VDE 0165 Part 1) and DIN EN 50014.*

F *Make sure that the limits quoted in the certificate of conformance (see Appendix A-2) for the devices to be connected are not exceeded.*

F *The housing of the EK210 must be earthed directly to a potential equalisation strip. A connection screw is located on the left wall of the housing for this purpose.*

II Items supplied and accessories

Items supplied:

The items supplied with the EK210 include:

a) EK210 Volume Conversion Device

b) Dispatch list

c) Configuration data sheet

d) Operating Manual

e) Bag of accessories

Ordering information and accessories	Order no.
• EK210 Volume Conversion Device, complete	83 462 240
• 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	73 017 271
• Operating manual, English	73 017 449
• Operating manual, French	73 017 923
• Plug-in terminal, 2-pole black	04 130 407
• Calibration covering cap	73 016 879
• Battery module, 13 Ah	73 015 774
• Bag of accessories, EK2xx	73 017 991

1 Brief description

The EK210 Volume Conversion Device is used for the conversion of the gas volume measured in the operating state by a gas meter to the standard state. The momentary values of pressure and temperature are measured for the determination of the operating state. The inverted compressibility factor ratio (K-value) can alternatively be calculated according to S-GERG-88 or entered as a constant.

Power supply:

- Battery operation with a service life depending on operating mode ≥ 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 EEPROM.

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).

Counting / signal inputs:

- 3 inputs for reed contacts or transistor switches, programmable as pulse or signal inputs.
- Maximum counting frequency 10 Hz.
- Pulse value for each input separately adjustable by decade.
- Various counters for Vb and Vm as well as for each input (main counter, disturbance volumes, totaliser, adjustable 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.
- Outputs A1 and A2 can be separately sealed and secured under official calibration.

Data interface:

- Optical interface according to IEC 62056-21
  (Replacement for IEC 1107 respectively EN 61107)

Pressure sensor:

- Type CT30 pressure sensor mounted in device or as extern version.

Temperature sensor:

- Pt500 temperature sensor, variable length.

Mechanical details / housing:

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

Approvals:

- Metrological approval acc. MID-Directive 2004/22/EG
- Ex approval for use in Ex Zone 1 according to EEx ia IIC/IIB/IIA 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 or signalling via outputs.

Archive

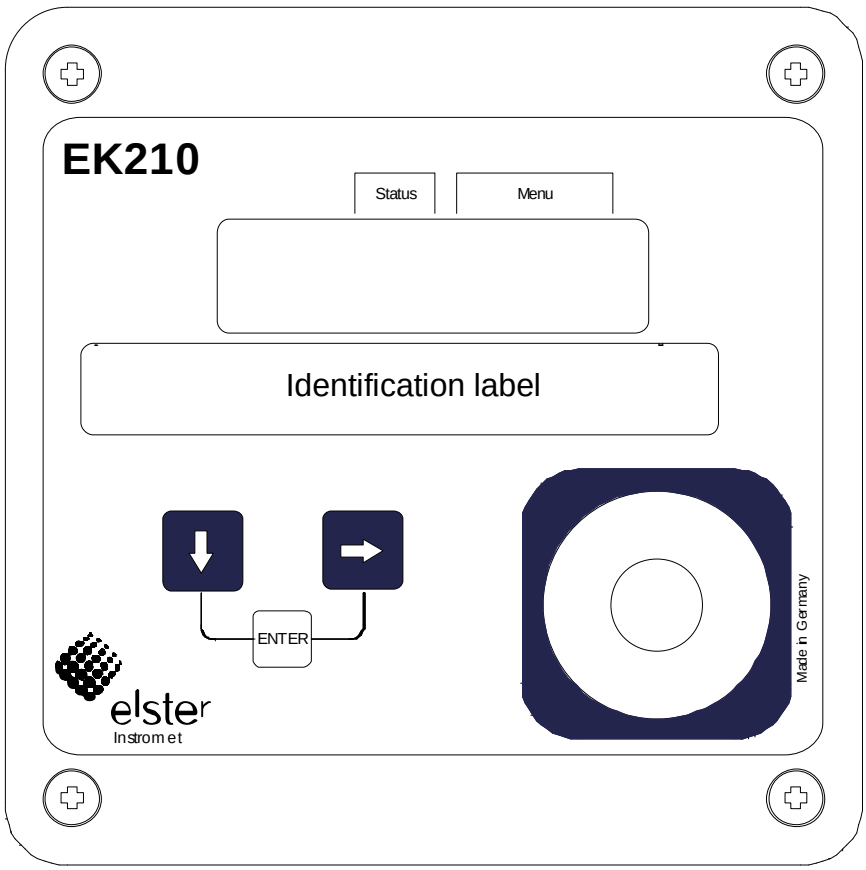
- Counter readings and maxima from the last 15 months for Vb and Vm
- Last month's end value for volumes at base conditions and actual volumes
- Event logbook with 250 entries for events such as for example status changes, signalling inputs, limit violations.
- Changes logbook ("audit trail") with entry of the last 200 changes to settings (parameterising steps).
- Automatic summer time changeover can be set.

2 Operation

2.1 Front panel

The following are positioned on the front panel for operation:

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



2.2 Display

Basic display structure (with an example):

					Status				Menu						
					A	W	B		S	t	d	.	V	.	
V	b	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 two fields, both of which are labelled on the front panel.

1. Device status

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

A flashing label indicates that the corresponding state is still present.
A non-flashing character 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 "1" and "2" represent alarms (e.g. "Alarm limits for pressure or temperature violated" → 3.7).
  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 ""3" to "8" represent warnings (e.g. "Error on output" → 3.7).
  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 "Battery discharged"
  The remaining battery service life is less than 3 months.

- P "Programming mode"
  The programming lock (calibration lock) is open.

- o "On-line"
  A data transfer via the optical or permanently wired interface is running. In each case the other interface cannot then be used.

2. Menu

Here is displayed to which list according to Chapter 3. The currently displayed value belongs.

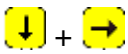
2.2.2 Line 2 = Value with name and unit

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

Example:

V	**b**	**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 directly to the first 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 directly to the first one. • **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.
	Enter	Depends on the value displayed (Data class, → 2.3.1) • **Activate the entry mode.** • **Terminate entry mode.** • **Update measurement** (by pressing twice).

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 EK210:

DC	Type	Entry, change via <ENTER>
1	Display test	No change possible.
2	Function	Triggers the function by entering "1".
3	Constant	No change possible.
4	Measure-ment	The value is updated by pressing <ENTER> (↓ + →) twice.
5	Status	The value is updated by pressing <ENTER> (↓ + →) twice.
7	Discrete value	After <ENTER> (↓ + →) change value by selection from a list of possible values with the key ↓.
8	Permanent value	After <ENTER> (↓ + →), setting to any value within the valid range is possible. Selection of the character to be changed with → and changing with ↓ only possible with restriction.
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 closed lock it is opened on entering the correct combination. With an open 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.
17	Archive value	No change possible.
19	Status regis-ter	No change possible.
20	Flag	No change possible.

2.3.2 Entering "sources"

At a number of points the entry of a "source" is required for parameterisation (e.g. *SC.A1* in the output list).

The address of the desired value is entered as the source. This can be found in the tables of the relevant list. 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 volume at base conditions *Vb*, see table in 3.2)
Enter: **000**2:300_**0** (Supplements printed in bold)

2.3.3 Entry errors

Entry errors are displayed if incorrect entries are made by the operator via the keypad.

Main representation:

with x = Error code according to the following table.

Code	Description
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.
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.

2.4 Access rights

The EK210 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 lock[1] – Supplier lock – Customer lock.

The access rights apply both for keypad inputs as well as for accesses via the optical interface. If the lock is locked, all attempts to set values are answered with an appropriate error message (see Chap. 2.3.3).

Also the reading of values via the interface 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 party) for this value via interface. This means that also the rights of parties with higher priority can be changed.

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 EK210 housing below the circuit board cover panel. It can be secured with an adhesive seal (→ 5.4.1)

The parameters protected under calibration regulations are each identified with "C" in the lists in the functional description (→ 3).

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.CL" (→ 3.9) via the keypad or interface.

2.4.2 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.

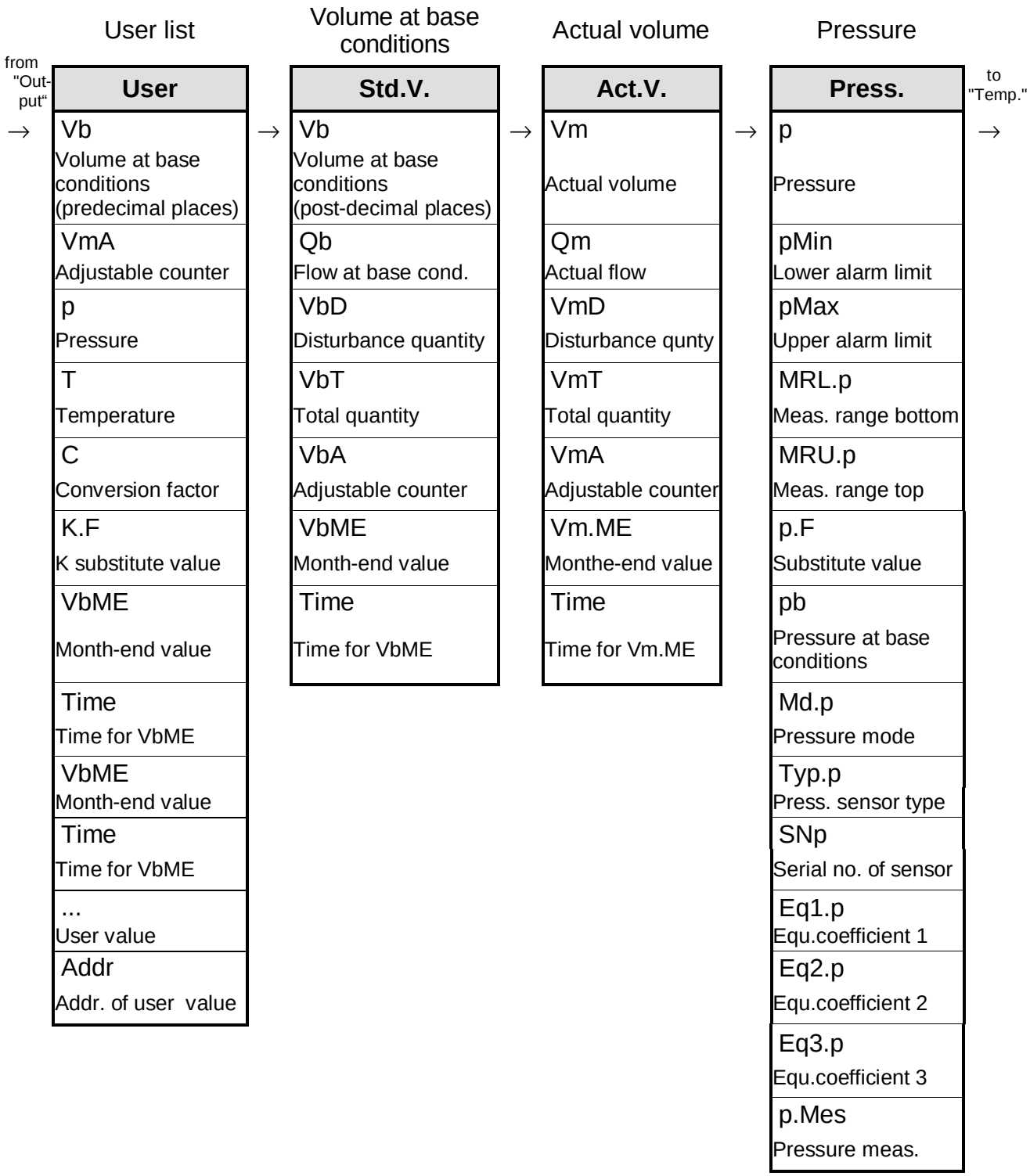
The parameters which are write-protected under the supplier or customer locks are each identified with "S" or "K" in the lists in the functional description (→ 3). All values which are shown with a minus symbol "-" cannot be changed, because they represent, for example, measurements or constants.

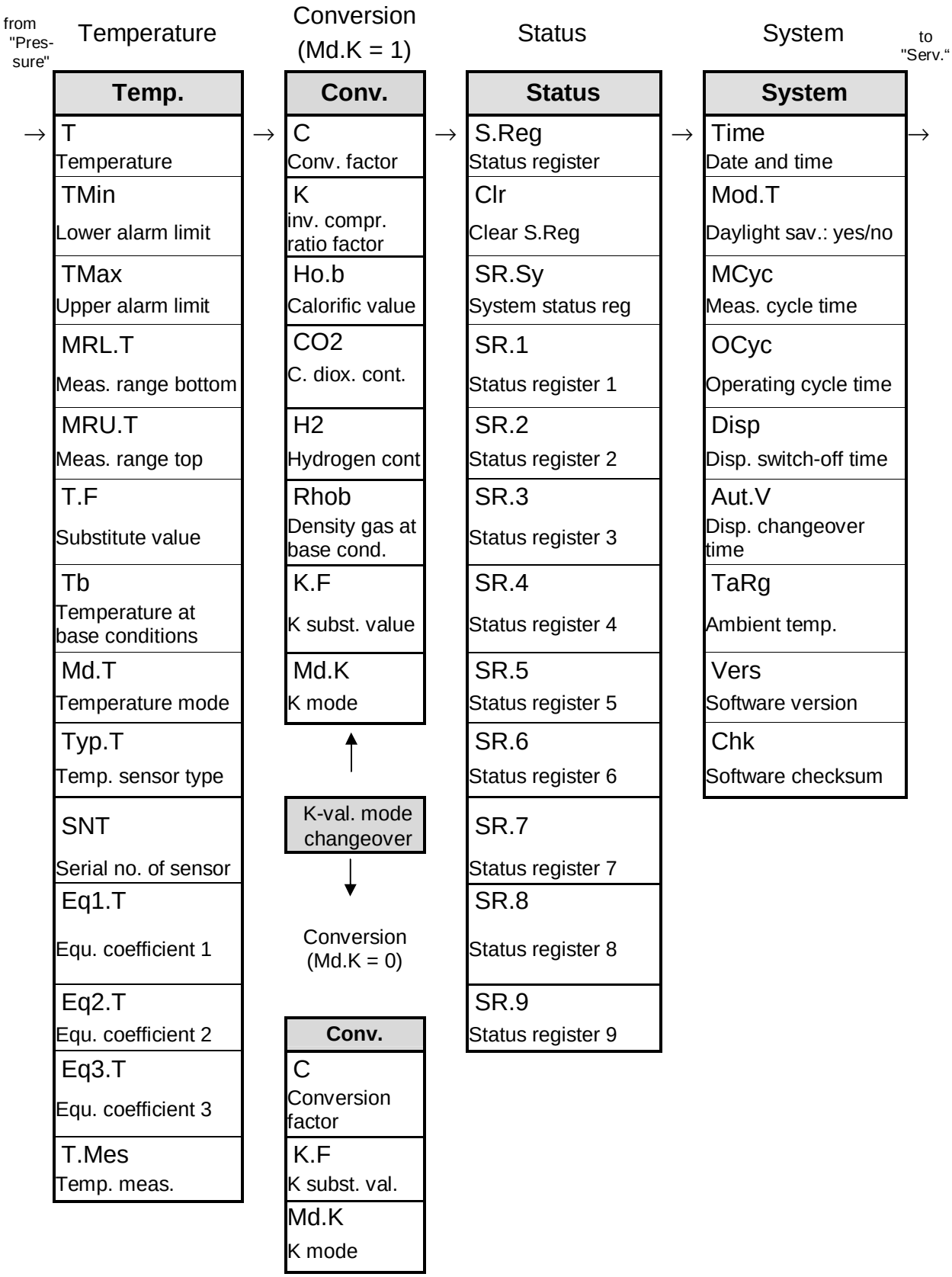
The locks can be opened by entering a code (the "combination"). (→ 3.9: *St.SL, Cod.S, St.KL, Cod.K*)

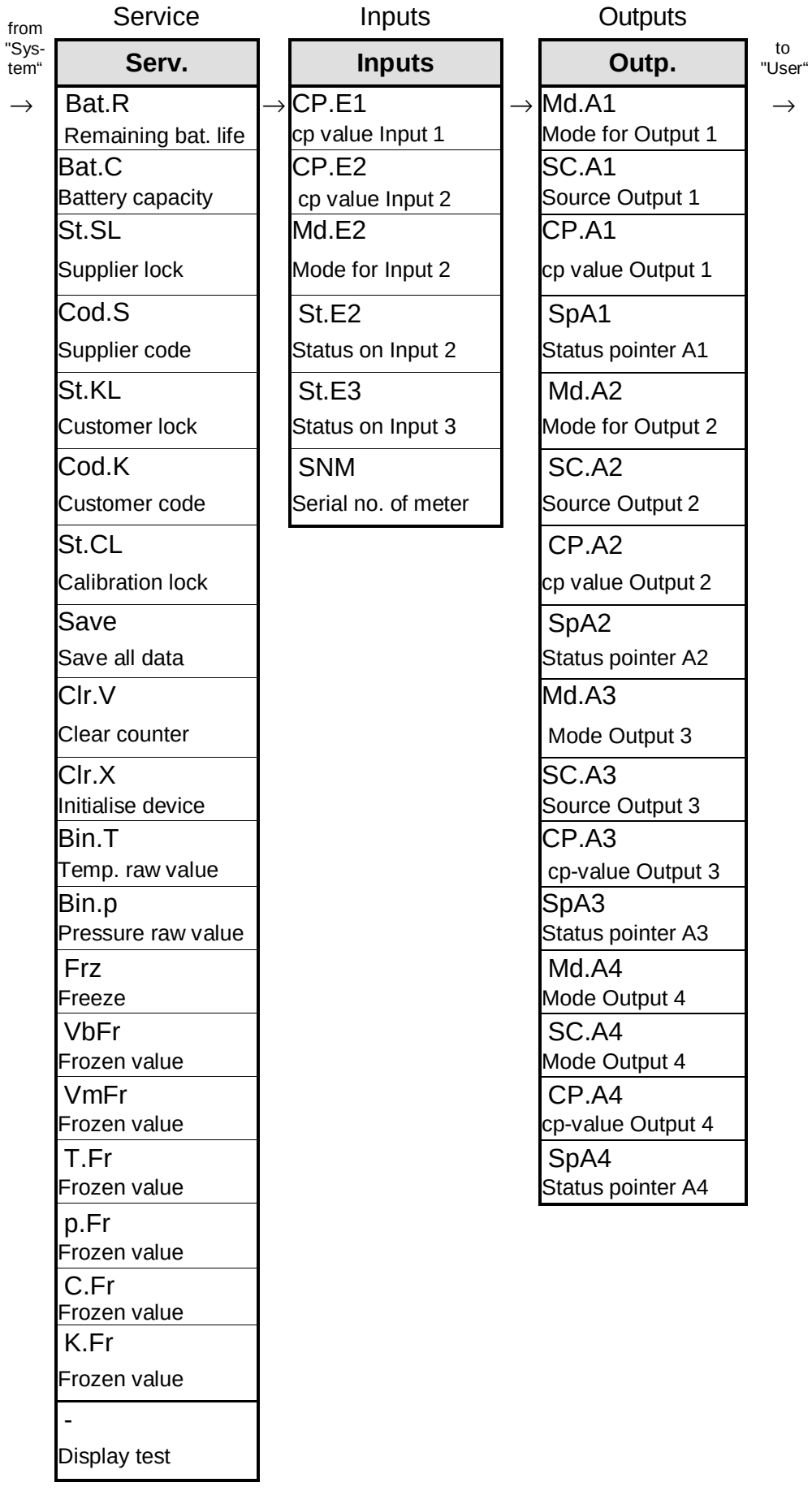
[1] The manufacturer lock is reserved for Elster-Instromet GmbH and is not described here.

2.5 Formation of the list structure

The data display in the EK210 is structured in a tabular form. The individual columns in the table each contain associated values.




from "Pressure"
Temperature
Conversion (Md.K = 1)
Status
System
to "Serv."
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
Temperature at base conditions
Md.T
Temperature mode
Typ.T
Temp. sensor type
SNT
Serial no. of sensor
Eq1.T
Equ. coefficient 1
Eq2.T
Equ. coefficient 2
Eq3.T
Equ. coefficient 3
T.Mes
Temp. meas.
Conv.
C
Conv. factor
K
inv. compr. ratio factor
Ho.b
Calorific value
CO2
C. diox. cont.
H2
Hydrogen cont
Rhob
Density gas at base cond.
K.F
K subst. value
Md.K
K mode
K-val. mode changeover
Conversion (Md.K = 0)
Conv.
C
Conversion factor
K.F
K subst. val.
Md.K
K mode
Status
S.Reg
Status register
Clr
Clear S.Reg
SR.Sy
System status reg
SR.1
Status register 1
SR.2
Status register 2
SR.3
Status register 3
SR.4
Status register 4
SR.5
Status register 5
SR.6
Status register 6
SR.7
Status register 7
SR.8
Status register 8
SR.9
Status register 9
System
Time
Date and time
Mod.T
Daylight sav.: yes/no
MCyc
Meas. cycle time
OCyc
Operating cycle time
Disp
Disp. switch-off time
Aut.V
Disp. changeover time
TaRg
Ambient temp.
Vers
Software version
Chk
Software checksum


from "System"
Service
Inputs
Outputs
to "User"
Serv.
Bat.R
Remaining bat. life
Bat.C
Battery capacity
St.SL
Supplier lock
Cod.S
Supplier code
St.KL
Customer lock
Cod.K
Customer code
St.CL
Calibration lock
Save
Save all data
Clr.V
Clear counter
Clr.X
Initialise device
Bin.T
Temp. raw value
Bin.p
Pressure raw value
Frz
Freeze
VbFr
Frozen value
VmFr
Frozen value
T.Fr
Frozen value
p.Fr
Frozen value
C.Fr
Frozen value
K.Fr
Frozen value
-
Display test
Inputs
CP.E1
cp value Input 1
CP.E2
cp value Input 2
Md.E2
Mode for Input 2
St.E2
Status on Input 2
St.E3
Status on Input 3
SNM
Serial no. of meter
Outp.
Md.A1
Mode for Output 1
SC.A1
Source Output 1
CP.A1
cp value Output 1
SpA1
Status pointer A1
Md.A2
Mode for Output 2
SC.A2
Source Output 2
CP.A2
cp value Output 2
SpA2
Status pointer A2
Md.A3
Mode Output 3
SC.A3
Source Output 3
CP.A3
cp-value Output 3
SpA3
Status pointer A3
Md.A4
Mode Output 4
SC.A4
Mode Output 4
CP.A4
cp-value Output 4
SpA4
Status pointer A4

3 Functional description

The data display is structured in tabular form (list structure) (→ 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:

- SD Abbreviated designation
  Designation of the value in the display
- Access Write access
  Indicates which lock must be opened to change the value (→ 2.4.12.4.2):
  - C = Calibration lock
  - M = Manufacturer's lock
  - S = Supplier's lock
  - K = Customer's lock

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

3.1 User list

SD	Designation / value	Unit	Acc.	Addr.	DC
Vb	Vb (predecimal places)	m3	C	2:300_1	12
VmA	Vm adjustable	m3	-	4:303	15
p	Pressure	bar	-	7:310	4
T	Temperature	°C	-	6:310_1	4
C	Conversion factor	-	-	5:310	4
K.F	inv. compressibility factor ratio, substitute value	-	-	8:311	4
VbME	Month-end value Vb	m3	-	7:161	16
Time	Time for VbME	-	-	7:165	16
Vm.ME	Month-end value	m3	-	14:161	16
Time	Time for Vm.ME	-	-	14:165	16
...	Anwender-Anzeige (Wert unter Adresse „Adr“)	...	...	...	...
Addr	Address for user display	-	S	11:1C2	8

(Legend: see page 18)

This list is user-specific, i.e. the user can, apart from *Vb (predecimal places)* himself set which values from the twelve positions in this list are displayed. Ex-works, these are the above-mentioned values which are also all 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 (predecimal 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 severe (→ 3.7).

Vb = *Vm* ž C where *Vm* = Actual volume (→ 3.3)

C = Conversion factor (→ 3.6)

The post-decimal places of *Vb* are displayed in the list of volume at base conditions (→ 3.1).

Addr **Address for user display**

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

Under *Addr* the address of any value can be entered in order to read it in the display item situated there (here respresented by "..."). As set at the factory, this is assigned to the internal error register (addr. 1:01FA_1).

Bd.S1 **Baud rate, Interface 1**

Here, the baud rate (speed) for the data transmission between the EK210 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).

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.

3.2 Standard volume (volume at base conditions) list

SD	Designation / value	Unit	Access	Address	DC
Vb	volume at base conditions (post-decimal places)	m3	C	2:300_2	12
Qb	Flow (flowrate) 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 VbME	-	-	7:165	16

(Legend: see page 18)

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 severe (→ 3.7).

Vb = *Vm* ž C where *Vm* = Actual volume (→ 3.3)
C = Conversion factor (→ 3.6)

The predecimal places of *Vb* are displayed in the user list (→ 3.1).

Qb **Flow (flowrate) at base conditions**

Momentary flowrate 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 "1" or "2" is present (→ 3.7).

In the alarm state the volume at base conditions is computed with the substitute values of the disturbed quantities. (→ 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.

VbME **Vb month-end value**

VbME saves the current month-end value at each change of month at the day boundary.

Time **Time for VbME**

Date and time for the saved *VbME*.

3.3 Actual volume (volume at measurement conditions) list

SD	Designation / value	Unit	Access	Address	DC
Vm	Actual volume	m3	C	4:300	12
Qm	Actual flowrate	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
Vm.ME	Month-end value	m3	-	14:161	16
Time	Time for Vm.ME	-	-	14:165	16

(Legend: see page 18)

Vm **Actual volume**
The volume measured on Input 1 is summed here provided no alarm is present.
An alarm is present when any message "1" or "2" is severe (→ 3.7).

Qm **Actual flowrate**
Momentary actual flow (actual flowrate).

VmD **Vm disturbed**
Here the actual volume is summed while ever an alarm is present, i.e. a message "1" or "2" is present (→ 3.7).

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.

Vm.ME **Vm month-end value**
Vm.ME saves the current month-end value at each change of month at the day boundary.

Time **Time for Vm.ME**
Date and time for the saved *Vm.ME*.

3.4 Pressure list

SD	Designation / value	Unit	Access	Address	DC
p	Pressure	bar	-	7:310	4
pMin	Lower alarm limit pressure	bar	C	7:3A8	8
pMax	Upper alarm limit pressure	bar	C	7:3A0	8
MRL.p	Pressure meas. range lower limit	bar	C	6:224	8
MRU.p	Pressure meas. range upper limit	bar	C	6:225	8
p.F	Pressure substitute value	bar	S	7:311	8
pb	Pressure at base conditions	bar	C	7:312	8
Md.p	Pressure mode	-	C	7:317	7
Typ.p	Type of pressure sensor	-	(C)	6:223	8
SNp	Serial number of pressure sensor	-	C	6:222	8
Eq1.p	Coefficient 1 for pressure equation	-	C	6:280	8
Eq2.p	Coefficient 2 for pressure equation	-	C	6:281	8
Eq3.p	Coefficient 3 for pressure equation	-	C	6:282	8
p.Mes	Pressure measurement	bar	-	6:210	4

(Legend: see page 18)

p **Pressure**

p is the pressure which is used for computing the conversion factor (→ 3.6) and therefore the volume at base conditions (→ 3.2).
In disturbance-free operation the measurement *p.Mes* (see below) is used: *p* = *p.Mes*. With a relevant disturbance (alarm), the substitute value *p.F* (see below) is used: *p* = *p.F*. In addition disturbance quantities are counted (→ 3.2, 3.3) and the message "1" is displayed in *SR.7* (→ 3.7.2). Relevant disturbances are:

– *p.Mes* is located outside of the alarm limits *pMin* and *pMax* (see below).

pMin **Lower alarm limit pressure**
pMax **Upper alarm limit pressure**

The validity of the measured pressure *p.Mes* (see below) is checked based on these alarm limits. This monitoring does not take place when *pMin* = *pMax*
If *p.Mes* is located within the alarm limits, it is used as *p* (see above) for correction: *p* = *p.Mes*.
If *p.Mes* is located outside the alarm limits, the substitute value *p.F* (see below) is used: *p* = *p.F*. In addition, disturbance quantities are counted in this case (→ 3.2, 3.3) and the message "1" is displayed in *SR.7* (→ 3.7.2).

MRL.p **Pressure meas. range lower limit**
MRU.p **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.

p.F **Pressure substitute value**

If the measured pressure *p.Mes* is outside the alarm limits *pMin* and *pMax* (see below), *pF* 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 (→ 3.6) and hence the volume at base conditions.

Md.p **Pressure mode**

With *Md.p* = "1" the measured pressure *p.Mes* (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**

SNp **Serial no. of pressure sensor**

Identification of the pressure sensor associated with the EK210.

Eq1.p **Coefficient 1 of pressure equation**

Eq2.p **Coefficient 2 of pressure equation**

Eq3.p **Coefficient 3 of pressure equation**

The coefficients of the quadratic equation for calculating the pressure *p.Mes* from the raw pressure value *Bin.p* (→ 3.9):

$$p.Mes = Eq1.p + Eq2.p \cdot Bin.p + Eq3.p \cdot Bin.p^2$$

To adjust the pressure measurement circuit, the three coefficients of the quadratic equation can either be found by the EK210 itself or calculated and entered by the user and can be set via WinPADS.

External to the EK210, the three coefficients can be calculated based on three values for *Bin.p* and the corresponding reference values.

When the EK210 determines the coefficients, it uses the value for *Eq3.p* available at the time of entering and it calculates the corresponding *Eq1.p* and *Eq2.p* for this. Standard for *Eq3.p* is “0”.

p.Mes **Pressure measurement**

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

3.5 Temperature list

SD	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
Eq1.T	Coefficient 1 of temperature equation	-	C	5:280	8
Eq2.T	Coefficient 2 of temperature equation	-	C	5:281	8
Eq3.T	Coefficient 3 of temperature equation	-	C	5:282	8
T.Mes	Temperature measurement	°C	-	5:210_1	4

(Legend: see page 18)

T Temperature

T is the temperature which is used for computing the conversion factor (→ 3.6) and hence the volume at base conditions (→ 3.2).

In disturbance-free operation the measurement *T.Mes* (see below) is used: *T* = *T.Mes*.

With a relevant disturbance (alarm), the substitute value *T.F* (see below) is used: *T* = *T.F*. In addition, disturbance quantities are then counted (→ 3.2, 3.3) and the message "1" displayed in *SR.6* (→ 3.7.2). Relevant disturbances are:

– *T.Mes* is located outside of the alarm limits *TMin* and *TMax* (see below).

TMin Lower alarm limit temperature

TMax Upper alarm limit temperature

The validity of the measured temperature *T.Mes* (see below) is checked, based on these alarm limits. This monitoring does not take place when *TMin* = *TMax*.

If *T.Mes* is located within the alarm limits, it is used as *T* (see above) for correction: *T* = *T.Mes*.

If *T.Mes* is located outside the alarm limits, the substitute value *T.F* (see below) is used: *T* = *p.F*. In addition, disturbance quantities are counted in this case (→ 3.2, 3.3) and the message "1" is displayed in *SR.6* (→ 3.7.2).

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 temperature sensor. They have no effect on the measurements.

T.F Temperature substitute value

If the measured temperature *T.Mes* is outside the alarm limits *TMin* and *TMax* (see above), *TF* 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 (→ 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 EK210.

Eq1.T Coefficient 1 of temperature equation

Eq2.T Coefficient 2 of temperature equation

Eq3.T Coefficient 3 of temperature equation

The coefficients of the quadratic equation for calculating the temperature *T.Mes* from the raw temperature value *Bin.T* (→ 3.9):

$$T.Mes = Eq1.T + Eq2.T \cdot Bin.T + Eq3.T \cdot Bin.T^2$$

To adjust the pressure measurement circuit, the three coefficients of the quadratic equation can either be found by the EK210 itself or calculated and entered by the user.

External to the EK210, the three coefficients can be calculated based on three values for *Bin.T* and the corresponding reference values.

When the EK210 determines the coefficients, it uses the value for *Eq3.T* set at the time of entry and it calculates the corresponding *Eq1.T* and *Eq2.T* for this. The standard value for *Eq3.T* is $2.6975 \cdot 10^{-7}$.

T.Mes Temperature measurement

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

3.6 Volume corrector list

The values displayed in this list depend on the set K-value computation method *Md.K* (see below:

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

SD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310	4
K	Inverted compressibility factor ratio	-	-	8:310	4
Ho.b	Calorific value	kWh/m3	S	10:311	8
CO2	Carbon dioxide content	%	S	11:311	8
H2	Hydrogen content	%	S	12:311	8
Rhob	Density gas at base conditions	kg/m3	S	13:311	8
K.F	K-value, substitute value	-	S	8:311	8
Md.K	K-value mode	-	C	8:317	7

b) Constant K-value (Md.K = 0)

SD	Designation / value	Unit	Access	Address	DC
C	Conversion factor	-	-	5:310	4
K.F	K-value, fixed value	-	S	8:311	8
Md.K	K-value mode	-	C	8:317	7

(Legend: see page 18)

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*, *pb*: → 3.4, *T*, *Tb* → 3.5, *K*: see below)

K Inverted compressibility factor ratio (K-value)

The Inverted compressibility factor ratio 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 and zb = compressibility factor at base conditions. The computation of z and z_n takes place according to S-Gerg-88 following the setting of *Md.K*. The gas analysis values *Ho.b*, *CO2*, *H2* and *Rhob* (*Md.K* = 1) need to be included in the entries for this (see below).

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.

Ho.b Calorific value
CO2 Carbon dioxide content
H2 Hydrogen content
Rhob Density gas at base conditions

These gas analysis values must be entered so that the inverted compressibility factor ratio *K* can be correctly computed.

Range of validity:				
	Ho.b	6,0	... 13,0	kWh/m^3
	CO2	0,0	... 30,0	Mol-%
	H2	0,0	... 10,0	Mol-%
	Rhob	0,71	... 1,16	kg/m^3

F *For Ho.b and Rhob the values converted to the German standard must be entered.*

F *Furthermore, the following limits must be ensured by the gas supplier:*

Methane	*CH_4*	*50 - 100 %*	*Propane*	*C_3H_8*	*0 - 5 %*
Nitrogen	*N_2*	*0 - 50 %*	*Butane*	*C_4H_{10}*	*0 - 1 %*
Ethane	*C_2H_6*	*0 - 20 %*	*Pentane*	*C_5H_{12}*	*0 – 0.5 %*

K.F K-value, substitute value

If the K-value mode *Md.K* (see below) is set to "fixed value" (= "0"), the constant substitute value *K.F* is used instead of the calculated inverted compressibility factor ratio *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* (→ 3.6) and hence the volume at base conditions *Vb* (→ 3.2) 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": The K-value is calculated according to S-Gerg-88.

3.7 Status list

SD	Designation / value	Unit	Access	Address	DC
S.Reg	Status register, total	-	-	1:101	19
Clr	Clear status register	-	S	4:130	2
SR.Sy	System status register	-	-	2:101	19
SR.1	Status register 1	-	-	1:111	19
SR.2	Status register 2	-	-	2:111	19
SR.3	Status register 3	-	-	3:111	19
SR.4	Status register 4	-	-	4:111	19
SR.5	Status register 5	-	-	5:111	19
SR.6	Status register 6	-	-	6:111	19
SR.7	Status register 7	-	-	7:111	19
SR.8	Status register 8	-	-	8:111	19
SR.9	Status register 9			9:111	19

(Legends: see page 18)

S.Reg Status register, total

In the status register messages since the last manual clear are collected. Here, it can therefore be seen what, for example, has occurred since the last station inspection. The messages can be cleared in this list with the command "Clr".

The momentary status (1:100) can only be read out by means of WinPADS. Messages in the momentary status indicate current statuses, such as, for example, prevailing errors. When the status is no longer present, the corresponding message is removed from the momentary status. Manual deletion is not possible.

S.Reg combines the messages of all status registers.
Message "8" in *S.Reg* signifies, for example, that message "8" has been entered in at least one of the status registers.

The meaning of the messages displayed is described in the Chapters 3.7.1 and 3.7.2.

Clr Clear status register

Here, the content of all status registers, i.e. "*S.Reg*" and all subordinate status registers (*SR.Sy and SR.1 to SR.9*), can be cleared.

Clear status register via keypad: 1.)  +  2.)  (⇒ „1“) 3.)  + 
If the alarm or warning states are however still present, they are again directly entered as messages.

SR.Sy System status

Display of the system status messages → 3.7.1

SR.1, SR.2, SR.3, SR,4, SR.5, SR.6, SR.7, SR.8, SR.9

Possible messages → 3.7.2

3.7.1 Messages in system status (*SR.Sy*)

a) The following messages can be displayed:

1 Restart (Alarm)

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

3 Data restored (Warning)

The device was temporarily without any power supply. Possibly during battery replacement, both batteries were removed simultaneously before the new ones were 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(→ 3.9), 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.

4 Voltage too low (Warning)

The voltage of the internal batteries is too low in order to ensure trouble-free device operation.

8 Setting error (Warning)

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.

b) The following messages can only be read out using WinPADS and are not displayed in the system status SR.Sy:

Procedure for reading out using WinPADS:

- Establish the connection EK210 **ó** WinPADS ("o" flashes in the EK210 display).
- "Action" menu; Set/read single values... (Window "Edit single values" is opened).
- Enter *R1 2:0100.0* into the field "Commands".
- "Execute" button (read-out messages shown under Values).

9 Remaining battery service life lower limit (Report)

The calculated remaining battery service life *Bat.R* (**à** Service list, Chapter 3.9) 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.

While ever this message is present in *St.Sy*, the "B" in the display field "Status" flashes (**à** Chapter 2.2.1).

11 Clock not set (Report)

The running accuracy of the internal clock has been optimised in the factory by frequency measurement and a corresponding setting of the adjustment factor. The error message indicates that this has not yet been carried out.

13 Data transmission (Report)

Data is transferred over the serial interfaces (optical).

While ever this message is present in *St.Sy*, the "o" in the display field "Status" flashes (**à** Chapter 2.2.1).

15 Battery operation **(Report)**

This message indicates that the EK210 is a battery-powered device.

16 Daylight saving **(Report)**

The *Time* (→ 3.8) in the EK210 is summer time (CEST).

In the system list (→ 3.8) you can set under *Mod.T* whether the EK210 carries out automatic daylight saving switchover or not.

3.7.2 Messages in Status Registers 1 to 9 (*SR.1 to SR.9*)

In *SR.1 to SR.9* all messages are qualitatively equivalent, e.g. message "1" always means that a quantity is located outside of the alarm limits. *SR.6* indicates this, for example, for the gas temperature and *SR.7* for the gas pressure. In *SR.1 to SR.9* only the messages 1 to 8 are written. The messages 10 to 14 can be called up in the relevant momentary individual statuses (*St.1; 1:110 to St.9; 9:110*) using WinPADS (→ 3.7.1, b).

Table 1: Overview of the messages in Status 1 to 8

Meldung	St.1, SR.1	St.2, SR.2	St.3, SR.3	St.4, SR.4	St.5, SR.5	St.6, SR.6	St.7, SR.7	St.8, SR.8	St.9, SR.9
1	Alarm for:								
	-	-	-	-	C*	T	p	K	z*
2	No useful input values for:								
	-	-	-	-	T	p			
4	Output error on output:								
	A1	A2	A3	A4	-	-	-	-	-
5	Error during pulse comparison on input:								
	-	E2	-	-	-	-	-	-	-
8	Warning for input:								
	-	E2	E3	-	-	-	-	-	-
10	Adjustment missing for:								
	-	-	-	-	T	p	-	-	-
13	Report for input:								
	-	E2	E3	-	-	-	-	-	-
14	Lock is open:								
	Cal.	Man.	Suppl.	Cust.	-	-	-	-	-

* "C" (uppercase) = Conversion factor, "z" (lowercase) = compressibility factor

SR.1 Status Register 1

a) The following messages can be displayed:

4 Error on Output 1 (Warning)

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. Message "4" indicates that pulses have been lost in this way.

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 (→ 3.11 Output list) can be reduced or the output frequency (address 1:617) increased with an AS-200 Read-out Device or the WinPADS Parameterisation Software.

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

b) The following messages can only be read out using WinPADS and are not displayed in SR.1:

14 Calibration lock open (Report)

For protection against unauthorised parameterisation or reading out via a serial interface, the EK210 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 (→ 5.4.1). Closure is also possible by deleting the value "St.PL" (→ 3.9) via the keypad or interface.

While ever this message can be read out in *St.1 (1:110)*, the "P" in the display field "Status" flashes (→ Chapter 2.2.1).

SR.2 Status Register 2

a) The following messages can be displayed:

4 Error on Output 2 (Warning)

The pulse buffer for Output 2 has overflowed (for further explanation: See message 4 for *SR.1*).

5 Error during pulse comparison on Input 2 (Warning)

Input 2 (E2) can be parameterised for monitoring as a pulse or signal input. When used as a pulse input, the pulses arriving on E2 can, for example, be compared with those on Input 1. If the deviation is too great, message "5" is displayed in *SR.3*.

Settings for comparing pulses can be loaded into the EK210 via parameter files using WinPADS. Further explanation for this: → 3.10.

8 Warning signal on Input E2 (Warning)

Input 2 (E2) can be parameterised for monitoring as a pulse or signal input . When set as signalling input, here, for example, message "8" 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 signalling input can be loaded into the EK210 via parameter files using WinPADS. Further explanation for this: → 3.10.

b) The following messages can only be read out using WinPADS and are not displayed in SR.2:

13 Report signal on Input E2 (Report)

Input 2 (E2) can, for example, be used as a time-synchronous input. While ever the input is receiving an active signal (i.e. terminals connected through low resistance), message "13" can be read out of *St.2 (2:110)*.

14 Manufacturer's lock is open (Report)

For protection against unauthorised parameterisation or reading out via a serial interface, the EK210 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 Parameterisation Software.

SR.3 Status Register 3

a) The following messages can be displayed:

4 Error on Output 3 (Warning)

The pulse buffer for Output 3 has overflowed (further details: see Message 4 for *SR.1*).

8 Warning signal on Input E3 (Warning)

Message "8" 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 message "8" is displayed while ever an inactive signal is present, i.e. the terminals are open.

Settings for the signalling input can be loaded into the EK210 via parameter files using WinPADS. Further explanation for this: → 3.10.

b) The following messages can only be read out using WinPADS and are not displayed in SR.3:

13 Report signal on Input 3 (Report)

Input 3 (E3) can, for example, be used as a time-synchronous input. While ever the input is receiving an active signal (i.e. terminals connected through low resistance), message "13" can be read out of *St.3 (3:110)*.

14 Supplier's lock is open (Report)

For protection against unauthorised parameterisation or reading out via a serial interface, the EK210 has a total of four locks: Calibration, manufacturer's, supplier's and customer's locks.

The supplier's lock is normally used by the gas supplier. It permits changing various values which are not subject to calibration regulations. The relevant values are identified with an "S" in the lists (→ 3 EK210).

The supplier's lock can be opened and closed with "*Cod.S*" and "*St.SL*" (→ 3.9).

SR.4 Status Register 4

a) The following messages can be displayed:

4 Error on Output 4 (Warning)

The pulse buffer for Output 4 has overflowed (further details: see Message 4 for *SR.1*).

b) The following messages can only be read out using WinPADS and are not displayed in SR.4:

14 Customer's lock is open (Report)

For protection against unauthorised parameterisation or reading out via a serial interface, the EK210 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 permits changing various values which are not subject to calibration regulations. The relevant values are identified with a "K" in the lists (→ 3).

The customer's lock can be opened and closed with "*Cod.K*" and "*St.SL*" (→ 3.9).

SR.5 Status Register 5

a) The following messages can be displayed:

1 Conversion factor cannot be computed (Alarm)

The conversion factor *C* (→ 3.6) cannot be computed because the temperature *T* (→ 3.5) is outside the range -100°C to +100°C or no usable inverted compressibility factor ratio *K* (→ 3.6) is available.

Possibly the temperature sensor is not connected correctly or the substitute value for the substitute value of inverted compressibility factor ratio *K.F* (→ 3.6) has the value "0".

The conversion factor is set to "0" and disturbance quantities for Vm are counted in *VmD* (→ 3.3).

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

2 No usable input value for temperature (Alarm)

The signal, *Bin.T* (→ 3.9), 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* (→ 3.5) is used for volume correction and disturbance quantities are counted for Vb and Vm (→ 3.1, 3.3).

b) The following messages can only be read out using WinPADS and are not displayed in SR.5:

10 Temperature input not adjusted (Report)

The temperature input of the EK210 has been precisely balanced at the factory to the connected temperature sensor.

The error message indicates that this has not yet been carried out.

SR.6 Status Register 6

a) The following messages can be displayed:

1 Alarm limits for temperature violated (Alarm)

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

While ever this message is present in *SR.6*, the substitute temperature *T.F* (→ 3.5) is used for volume correction and disturbance quantities are counted for Vb and Vm (→ 3.1, 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.

2 No usable input value for pressure (Alarm)

The signal, *Bin.p* (→ 3.9 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* (→ 3.4) is used for volume correction and disturbance quantities are counted for Vb and Vm (→ 3.1, 3.3).

b) The following messages can only be read out using WinPADS and are not displayed in SR.6:

10 Pressure input not adjusted (Report)

The pressure input of the EK210 has been precisely balanced at the factory to the connected pressure sensor.

The error message indicates that this has not yet been carried out.

SR.7 Status Register 7

a) The following messages can be displayed:

1 Alarm limits for pressure violated (Alarm)

The measured gas pressure *p.Mes* is located outside of the set alarm limits *pMin*, *pMax* (→ 3.4).

While ever this message is present in *SR.7*, the substitute pressure *p.F* (→ 3.4) is used for volume correction and disturbance quantities are counted for Vb and Vm (→ 3.1, 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.

b) The following messages can only be read out using WinPADS and are not displayed in SR.7:

For the EK210 no further messages are currently applicable here.

SR.8 Status Register 8

a) The following messages can be displayed:

1 Inverted compressibility factor ratio (K-value) cannot be computed (Alarm)

The inverted compressibility factor ratio *K* (→ 3.6) cannot be computed because no valid compressibility factor could be determined. (cf. message "1" in *St.9*).

While ever this problem exists, the substitute value *K.F* is used for the inverted compressibility factor ratio and disturbance quantities are counted for Vb and Vm (→ 3.1, 3.3).

b) The following messages can only be read out using WinPADS and are not displayed in the system status SR.8:

There are currently no further messages applicable here for the EK210.

SR.9 Status Register 9

a) The following messages can be displayed:

1 Compressibility factor cannot be computed (Alarm)

At least one of the gas analysis values *Ho.b*, *CO2*, *H2*, *Rhob* (→ 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 (→ 3.1, 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 inverted compressibility factor ratio can be computed. (See above: message "1" in *St.8*).

b) The following messages can only be read out using WinPADS and are not displayed in the system status SR.9:

There are currently no further messages applicable here for the EK210.

3.8 System list

SD	Designation / value	Unit	Access	Address	DC
Time	Date and time	-	S	1:400	12
Mod.T	Daylight saving: yes / no	-	S	1:407	7
MCyc	Measurement cycle time	Seconds	C	1:1F0	8
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
TaRg	Ambient temperature range	-	(C)	3:424	8
Vers	Software version number	-	-	2:190	3
Chk	Software checksum	-	-	2:191	4

(Legends: see page 18)

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.

After pressing the key combination  +  for entry, the date and time are displayed together (initially without seconds). If the input mark (cursor) is located on the right-hand display position, then after pressing  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.

Mod.T Daylight saving: yes / no

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

"1" = 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.

"2" = Switchover at set times
The start and finish of daylight saving is set 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 EK210 does not find any suitable value during the correction attempt, it rejects the entry with error message "6" and quits the editing. (→ 2.3.3)

In applications subject to official calibration *MCyc* must be less than or equal to 20 seconds.

The standard setting is 20 seconds.

With settings less than 20 seconds the battery service life is reduced. (→ B-2)

OCyc Operating cycle time

The time and all values which relate to a time interval (e.g. 1 month) are updated on this cycle.

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 EK210 does not find any suitable value during the correction attempt, it rejects the entry with error message "6" and quits the editing. (→ 2.3.3)

The standard setting is 300 seconds (= 5 minutes).

With settings less than 300 seconds the battery service life is reduced. (→ 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.

TaRg Ambient temperature range

The permissible ambient temperature for the EK210 in operation subject to calibration regulations.

Aut.V Time to changeover to standard display

After key operation the display automatically changes over to the standard display *Vb* (→ 3.1) once the time set here has expired.

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.

Vers Software version number

Chk Software checksum

Version number and checksum provide clear identification of the software implemented in the EK210.

3.9 Service list

SD	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	6
Cod.S	Supplier's combination, enter / change	-	S	3:171	11
St.KL	Customer's lock: Status / close	-	K	4:170	6
Cod.K	Customer's combination, enter / change	-	K	4:171	11
St.CL	Calibration lock: Status / close	-	K	1:170	6
Save	Save all data	-	S	1:131	2
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
Frz	Freeze	-	S	1:1FE	2
VbFr	Frozen value Vb	-	-	2:3E0	20
VmFr	Frozen value Vm	-	-	4:3E0	20
T.Fr	Frozen value T	-	-	6:3F0_1	20
p.Fr	Frozen value p	-	-	7:3F0	20
C.Fr	Frozen value C	-	-	5:3F0	20
K.Fr	Frozen value K	-	-	8:3F0	20
-	Display test	-	-	1:1F7	1

(Legends: see page 18)

Bat.R Remaining battery service life

The calculation of the remaining battery service life occurs in dependence of the consumed capacity (which is calculated) and the consumption expected in the future (which gives the remaining battery service life).

If *Bat.R* is less than 3 months, the message "9" is displayed in the system status (→ 3.7.1) and "B" flashes in the display status field (→ 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 measurement cycle *MCyc* (→ 3.8), operating cycle *OCyc* (→ 3.8), input mode *Md.E1* (→ 3.10) and display switch off *Disp* (→ 3.8) are taken into account during the computation of the remaining battery service life. Future operating conditions such as for example, changes to settings, duration of readouts or frequency of key operations can however not be foreseen and consequently lead to a corresponding uncertainty in the displayed remaining battery service life. For data readouts an average future duration of 15 minutes per month is used.

Two batteries instead of one can be used to increase the battery service life. In this case after inserting the batteries the doubled figure for *Bat.C* (see below) must be entered.

Bat.C Battery capacity

Here, the original capacity and not 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 need not necessarily correspond to the typical capacity quoted by the battery manufacturer. Apart from these details, the capacity depends on the application conditions such as ambient temperature and the device current consumption. In view of this and as a precaution, the minimum and not the typical value should be used. When used in ambient temperatures between –10°C and +50°C, the value to be entered is normally about 80% of the capacity quoted by the manufacturer.

With the use of the battery obtainable from Elster-Instromet of size "D", the value 13 Ah should be entered for *Bat.C* and 26.0 Ah when 2 cells are used.

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

Basic principle of operation of lock and combination: → 2.4.2.

Open lock: Enter the correct combination (numerical code)

Close lock: Clear *St.SL* resp. *St.KL*.
Clearing using the keypad
1.) ↓ + → 2.) ↓ (⇒ "0") 3.) ↓ + →

Change combination: Entry of a new combination (code) with lock open.
(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 "0" follows "F" again.

St.CL Calibration lock (status / close)

Basic principle of operation of the calibration lock: → 2.4.1.

Opening the calibration lock: Only with the sealed pushbutton (→ 5.4.1).

Closing the calibration lock: Either by pressing the button again or by clearing *St.CL* via interface or keypad.

Clearing via keypad: 1.) ↓ + → 2.) ↓ (⇒ „0“) 3.) ↓ + →

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.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.

Bin.T Temperature binary value
Bin.p Pressure 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).

Frz **Freeze**

Measurements (see below) can be frozen with this function. Freezing occurs by entering "1". It is particularly used for testing operating points.

VbFr **Frozen value Vb**
VmFr **Frozen value Vm**
T.Fr **Frozen value T**
p.Fr **Frozen value p**
C.Fr **Frozen value C**
K.Fr **Frozen value K**

These the the measurements last frozen by *Frz* (see above).

- **Display test**

The display flashes to test all segments

3.10 Input list

SD	Designation / value		Unit	Access	Address	DC
CP.E1	cp value	for Input 1	1/m3	C	1:253	7
CP.E2	cp value	for Input 2	1/m3	C	2:253	7
Md.E2	Mode	for Input 2	-	S	2:207	7
St.E2	Status	an Input 2	-	-	2:228	4
St.E3	Status	an Input 3	-	-	3:228	4
SNM	Serial number of gas meter		-	S	1:222	8

(Legends: see page 18)

CP.E1 **cp value Input 1**

Pulse constant (parameter of the connected gas meter) for conversion of the pulses counted on Input 1; the increase in volume is directly accepted into the total actual volume *VmT* (→ 3.3).

CP.E1 indicates how many pulses correspond to the volume 1 m^3.

CP.E2 **cp value Input 2**

If Input 2 is set as a counting input (*Md.E2* = 1, see below), the pulse constant must be entered here which is used for the conversion of the pulses to the volume *V2* (*2:203*, can only be called using the parameterising software WinPADS).

CP.E2 is not subject to the calibration lock because it has no influence on *V* or *Vb*. Input 2 can only be used for pulse comparison with Input 1.

If Input 2 is set as a status input (*Md.E2* = 2, see below), *CP.E2* has no significance.

Md.E2 Mode for Input 2

The application of Input 2 (E2) 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 EK210 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 EK210 can, for example, signal attempts at tampering on a pulse generator of the gas meter, provided the meter also supports this.

The following parameterisations are possible with the WinPADS parameterisation software and a suitable parameterisation file obtainable from Elster GmbH:

a) When E2 is a <u>counting input</u> (*Md.E2* = "1")

- Pulse comparison on Inputs 1 and 2

With the 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, for example, 4 pulses from one another in an adjustable number of pulses (e.g. 4000), the message "5" is displayed in Status 2 ($\rightarrow$ 3.7.2).

b) When E2 is a <u>status input</u> (*Md.E2* = "2")

- E2 is an <u>active</u> warning input (input for warning signal)
- E2 is an <u>inactive</u> warning input (e.g. tamper detection)
- E2 is an active <u>reporting</u> input (input for reporting signal)
- E2 is an inactive <u>reporting</u> input (input for reporting signal)
- E2 is a time-synchronous input

St.E2 Status on Input 2

If *Md.E2* = "2" (see above), the status of Input 2 is displayed here:
St.E2 = 0: Input signal is inactive (terminal open or voltage > 3V)
St.E2 = 1: Input signal is active (terminal low resistance or voltage < 0.8V)

St.E3 Status on Input 3

Here the status of Input 3 is displayed which is used as status input:
St.E3 = 0: Input signal is inactive (terminal open or voltage > 3V)
St.E3 = 1: Input signal is active (terminal low resistance or voltage < 0.8V)
Input 3 can be assigned with the WinPADS parameterising software and a suitable parameterisation file just like Input 2 as a status input various functions, see *Md.E2*, b).

SNM Serial number of gas meter

The serial number of the gas meter connected to the counting input E1.

3.11 Output list

SD	Designation / value		Unit	Access	Address	DC
Md.A1	Mode	for Output 1	-	C	1:605	7
SC.A1	Source	for Output 1	-	C	1:606	8
CP.A1	cp-Wert	for Output 1	1/m3	C	1:611	7
SpA1	Status pointer	for Output 1	-	C	1:607	8
Md.A2	Mode	for Output 2	-	C	2:605	7
SC.A2	Source	for Output 2	-	C	2:606	8
CP.A2	cp value	for Output 2	1/m3	C	2:611	7
SpA2	Status pointer	for Output 2	-	C	2:607	8
Md.A3	Mode	for Output 3	-	S	3:605	7
SC.A3	Source	for Output 3	-	S	3:606	8
CP.A3	cp value	for Output 3	1/m3	S	3:611	7
SpA3	Status pointer	for Output 3	-	S	3:607	8
Md.A4	Mode	for Output 4	-	S	4:605	7
SC.A4	Source	for Output 4	-	S	4:606	8
CP.A4	cp value	for Output 4	1/m3	S	4:611	7
SpA4	Status pointer	for Output 4	-	S	4:607	8

(Legends: see page 18)

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

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

- Modification of the settings only possible under calibration lock.
- Modification of the settings possible under supplier and calibration locks.
- Modification of the settings possible under customer, supplier and calibration locks

Md.A1 ... Md.A4 Mode for Output 1 ... 4

The four signal outputs of the EK210 can be set for various functions. The basic function is defined with the mode *Md.A...* Depending on this, the source (*SC.A...,* see below), the cp value (*cp.A...,* see below) or the status pointer (*SzA...*, see below) must also be parameterised, where necessary, for the relevant output.
In the following table, apart from the setting possibilities for *Md.A*... it is shown for each setting whether *SC.A...*, *cp.A...* or *SzA...* must be parameterised.

Md.A...	Meaning	To program:		
		SC.A...	*cp.A...*	*SpA...*
0	Output switched off (transistor blocking, "switch open")	-	-	-
1	Volume pulse output	yes	yes	-
2	Status output, logic active (signal active => output switched on)	-	-	yes
3	Time-synchronised output	yes	-	-
4	Output switched on (transistor conducts, "switch closed")	-	-	-
5	(Not assigned)	-	-	-
6	Status output, logic inactive (signal active => output switched off)	-	-	yes

SC.A1 ... SC.A4 Source for Output 1 ... 4

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

- for mode "1" (volume pulse output)

SC.A...	Meaning	
00002:300_0	Vb	Volume at base conditions undisturbed
00002:301_0	VbD	Volume at base conditions disturbed
00002:302_0	VbT	Volume at base conditions total quantity (undisturbed + disturbed)
00004:300_0	Vm	Actual volume undisturbed
00004:301_0	VmD	Actual volume disturbed quantity
00004:302_0	VmT	Actual volume total quantity (undisturbed + disturbed)

The period duration and pulse duration can be set individually for each output via the optical serial interface under the addresses "1:617", "2:617", "3:617" and "4:617" (period duration) or "1:618", "2:618", "3:618" and "4:618" (pulse duration) as a multiple of 125 ms. The period duration must always be greater than the pulse duration.

- for mode "3" (time-synchronised output)

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

SC.A...	Pulse is output
00001:143_0	At the beginning of each month at 0 hrs.
00002:143_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".
00001:142_0	At the beginning of each day at 0 hrs.
00002:142_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.
00001:403_0	At the beginning of each hour.
00001:402_0	At the beginning of each minute.

The pulse duration can be set individually for each output via the serial interfaces under the addresses "1:618", "2:618", "3:618" and "4: 618" as a multiple of 125 ms.

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

cp.A1 ... cp.A4 cp value for Output 1 ... 4

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

$i = Vm \cdot cp.A...$

where i: Number of output pulses

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

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

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

With a change of the output cp value, the corresponding input buffer is cleared . (cf. Chap. 3.7.2, message "4").

***SpA*1 ... *SpA4* Status pointers for Output 1 ... 4**

If the output is programmed as "status output with active logic" (*Md.A...*= 2), then *SpA...* sets with which status messages (→ 3.7) the output is to be switched on. If none of the selected messages is severe, the output remains switched off.

If the output is programmed as "status output with inactive logic" (*Md.A...*= 6), then *SpA...* sets with which status messages the output is to be switched off. If none of the selected messages is severe, the output remains switched on (!).

There are two basic ways of selecting status messages with *SpA...* Status messages to be selected:
- Selection of a single message.
- Selection of a message group.

Example of a "message group":
"Messages 1 to 8" mean that the output is switched provided one or more of the messages "1" to "8" are severe.

"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 *SzA...* are described in the following. Here, "mm" signifies the message, i.e. one of the messages "1" to "16" can be selected with "mm" (→ 3.7.1, 3.7.2).

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

SpA... = "mm_0s:1.1"
where s = 1 to 9 for *SR.1* to *SR.9* (→ 3.7.2)
Example:
"01_06:1.1" means: Message 1 in Status *SR.6*
(= "Alarm limits for temperature violated", cf. Table 1: Overview 8 on page 30)

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

SpA... = "mm_02:2.1"
Example:
"03_02:2.1" means: Message 3 in the system status *SR.Sy* ("Data restored", → 3.7.1).

c) A message in the total status *S.Reg*

Since *S.Reg* combines the messages of all statuses, this setting means that the output is switched while ever the message "mm" is severe in any of the statuses *SR.Sy or SR.1* to *SR.9*.
SpA... = "mm_01:2.1"
Example:
"08_01:2.1" means: Message 8 in any status *SR.Sy* or *SR.1* to *SR.9*.

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

SpA... = "1.mm_0s:1.1"
where s = 1 to 8 for *SR.1* to *SR.9* (→ 3.7.2)
Example:
"1.05_02:1.1" means: Any of the messages 1 to 5 in status *SR.2*.

e) Message group in system status *SR.Sy*

SpA... = "1.mm_02:2.1"

Example:

"1.03_02:2.1" means: Any of the messages 1 to 3 in the system status *SR.Sy*.

f)* Message group in the total status *S.Reg

The output is switched while ever one of the messages 1 to mm is severe in any of the statuses *SR.Sy or SR.1* to *SR.9*.

SpA... = "1.mm_01:2.1"

Example:

"1.02_01:2.1" means: Any of the messages 1 to 2 in any status *SR.Sy or SR.1* to *SR.9*, i.e. any alarm or any warning.

3.11.1 Brief summary of output parameterisation

s Output switched off	*Md.A...*	=	0	
s Volume pulse output	*Md.A...*	=	1	
Selection of volume counter:				
- Vb Volume at base conditions disturbed	*SC.A...*	=	00002:300_0	
- VbD Volume at base conditions disturbed	*SC.A...*	=	00002:301_0	
- VbT Volume at base conditions total quantity	*SC.A...*	=	00002:302_0	
- Vm Actual volume undisturbed	*SC.A...*	=	00004:300_0	
- VmD Actual volume disturbed	*SC.A...*	=	00004:301_0	
- VmT Actual volume total quantity	*SC.A...*	=	00004:302_0	
Setting of cp value	*cp.A...*	=	**...**	
s Status output, logic active	*Md.A...*	=	2	
- An active message in a status *SR.1* to *SR.9*	*SpA...*	=	mm_0s:1.1	*
- An active message in sysetm status *SR.Sy*	*SpA...*	=	mm_02:2.1	*
- An active message in total status *S.Reg*	*SpA...*	=	mm_01:2.1	*
An active message in a...				
- Message group in einem Status *SR.1* bis *SR.9*	*SpA...*	=	1.mm_0s:1.1	*
- Message group in system status *SR.Sy*	*SpA...*	=	1.mm_02:2.1	*
- Message group in total status *S.Reg*	*SpA...*	=	1.mm_01:2.1	*
s Time synchronous output	*Md.A...*	=	3	
- at the start of each month at 0 hrs.	*SC.A...*	=	00001:143_0	
- at the start of each month at 6 hrs.	*SC.A...*	=	00002:143_0	
- at the start of each day at 0 hrs.	*SC.A...*	=	00001:142_0	
- at the start of each day at 6 hrs.	*SC.A...*	=	00002:142_0	
- at the start of each hour	*SC.A...*	=	00001:403_0	
- at the start of each minute	*SC.A...*	=	00001:402_0	
s Outut switched on	*Md.A...*	=	4	
s Status output, logic inactive	*Md.A...*	=	6	
- An active message in a status *SR.1* to *SR.9*	*SpA...*	=	mm_0s:1.1	*
- An active message in the system status *SR.Sy*	*SpA...*	=	mm_02:2.1	*
- An active message in any status	*SpA...*	=	mm_01:2.1	*
Active messages...				
- 1 to (mm) in a status *SR.1* to *SR.9*	*SpA...*	=	1.mm_0s:1.1	*
- 1 to (mm) in the system status *SR.Sy*	*SpA...*	=	1.mm_02:2.1	*
- 1 to (mm) in any status	*SpA...*	=	1.mm_01:2.1	*

** mm = Message (01...08), s = Status number (1...9 for SR.1 ... SR.9)*

3.12 Archives

The EK210 has three archives
- Month Archive 1 (counter readings and maxima)
- Logbook (event logbook)
- Changes logbook (audit trail)

All archives cannot be displayed on the device. They can be read out with the AS-200 Readout Device or the WinPADS parameterisation software.

3.12.1 Month Archive (counter readings and maxima)

The counter readings and consumption maxima of the last 15 months are saved in Month Archive.
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:

- AONo Block number
- Time Storage time-point
- Vb Volume at base conditions
- VbT Totaliser Vb
- VbMP max Month maximum VbMP
- Time Time-point VbMP max
- Stat Status for VbMP max
- VbDy max Month maximum VbDy
- Time Time-point VbDy max
- Stat Status for VbDy max
- Vm Actual volume
- VT1 Totaliser Input 1
- VMP max Month maximum VMP
- Time Time-point VMP max
- Stat Status for VMP max
- VDy max Month maximum VDy
- Time Time-point VDy max
- Stat Status for VDy max
- St.2 Status 2 (incl. Vb)
- St.4 Status 4 (incl. Vm)
- Er.Ch Checksum

3.12.2 Logbook (event logbook)

Here, the last 250 status changes are archived.

Each archive data row has the following entries:

- AONo Block number
- Time Storage time-point
- St.Ae Trigger event
- Er.Ch Checksum

3.12.3 Changes logbook (audit trail)

Here, the last 200 settings changes (parameterisations) are archived.

Each archive data row has the following entries:

- AONo Block number
- Time Storage time-point
- Adr Address of the changed value
- Old Old value
- New New value
- St.CL Calibration lock
- St.ML Manufacturer's lock
- St.SL Supplier's lock
- St.KL Customer's lock
- Er.Ch Checksum

4 Applications

4.1 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 configuration data sheet, 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%].

$$\mathbf{0.3 \cdot x_{C2} - 1.0 \quad < \quad x_{C3} \quad < \quad 0.3 \cdot x_{C2} + 1.0} \qquad (1)$$

- 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%].

$$\mathbf{0.1 \cdot x_{C2} - 0.3 \quad < \quad x_{C4+} \quad < \quad 0.1 \cdot x_{C2} + 0.3} \qquad (2)$$

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 configuration data sheet, page "Proof of measures implemented", unless the calculation method S-Gerg 88 is generally accepted for the present application due to a national regulation.

4.2 Application in areas subject to explosion hazards

4.2.1 Applications in Zone 1

The EK210 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: **à** Appendix A-2).

With applications in Zone 1 connected devices must not exceed the conditions and limits quoted in the certificate of conformance (**à** A-2). Furthermore, all safety information (**à** Chapter I) must be followed.

4.2.2 Applications in Zone 2

The device may also be used in Zone 2 under all conditions which enable application in Zone 1 (**à** 4.2.1).

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.
- Switching of the digital inputs DE1...DE3 according to Chapter B-3 only with reed contacts or transistor switches.
- Switching voltage of the device connected to the outputs DA1..DA4 with a maximum of 30 V according to Chapter B-4 (manufacturer's rating of the connected devices).
- 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.

5 Installation and maintenance

The EK210 is suitable for wall or pipe 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 and for a pipe installation a mounting bracket with a pipe clamp is needed.

The 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 EK210 on the gas meter, a bracket, a pipe or on the wall.
2. Connection of the pulse generator, pressure line and insertion of the temperature sensor in the temperature sensor receptacle.
3. If required, connection of following devices to, for example, pulse/signal outputs.

F *If the EK210 is used in an* (zones of) explosion-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 EK210.*

4. With unused union screw joints the insertion seal must be replaced by one the enclosed blind insertion seals.
5. Sealing of the device by the weights and measures office or test station according to the seal layout.
6. Close the housing.

F *When closing the housing, make sure that no cables are pinched.*

5.2 Cable connection and earthing

The EK210 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 have a screen which must be earthed at both ends to prevent interference due to high frequency electromagnetic fields. The screen must be connected all round, complete and flat. The EK210 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 occurs, 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.

5.3 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.

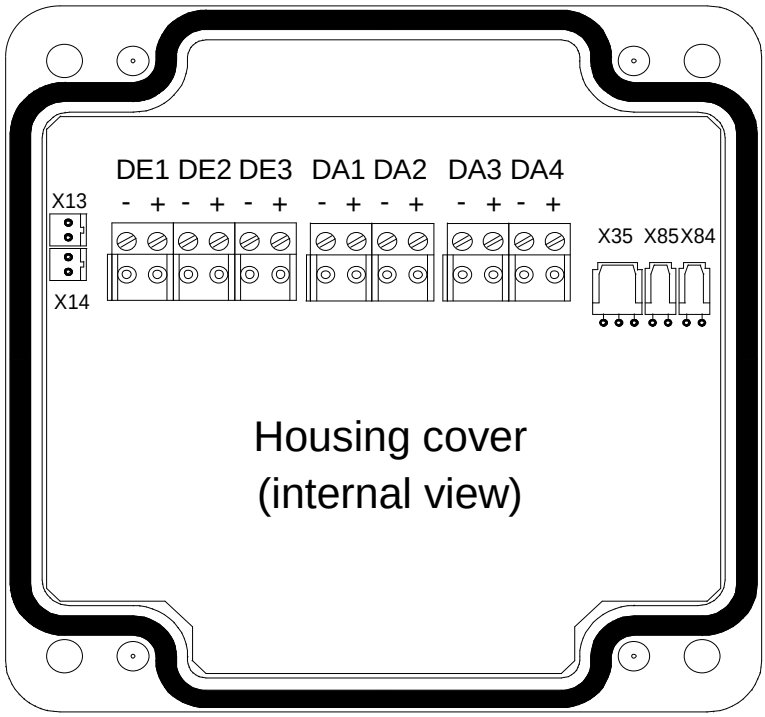


Fig. 1: Terminal layout

Inputs:	
DE1	Digital input 1 for pulse generator
DE2	Digital input 2
DE3	Digital input 3

Outputs:

DA1	Digital output 1 (can be sealed)
DA2	Digital output 2 (can be sealed)
DA3	Digital output 3
DA4	Digital output 4

Pressure and temperature sensors:

X84	Temperature sensor Pt500, two-wire
X84 + X85	Temperature sensor Pt500, four-wire
X35	Pressure sensor CT30 (three-wire)

Batteries:

X13	Battery 1
X14	Battery 2

5.4 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

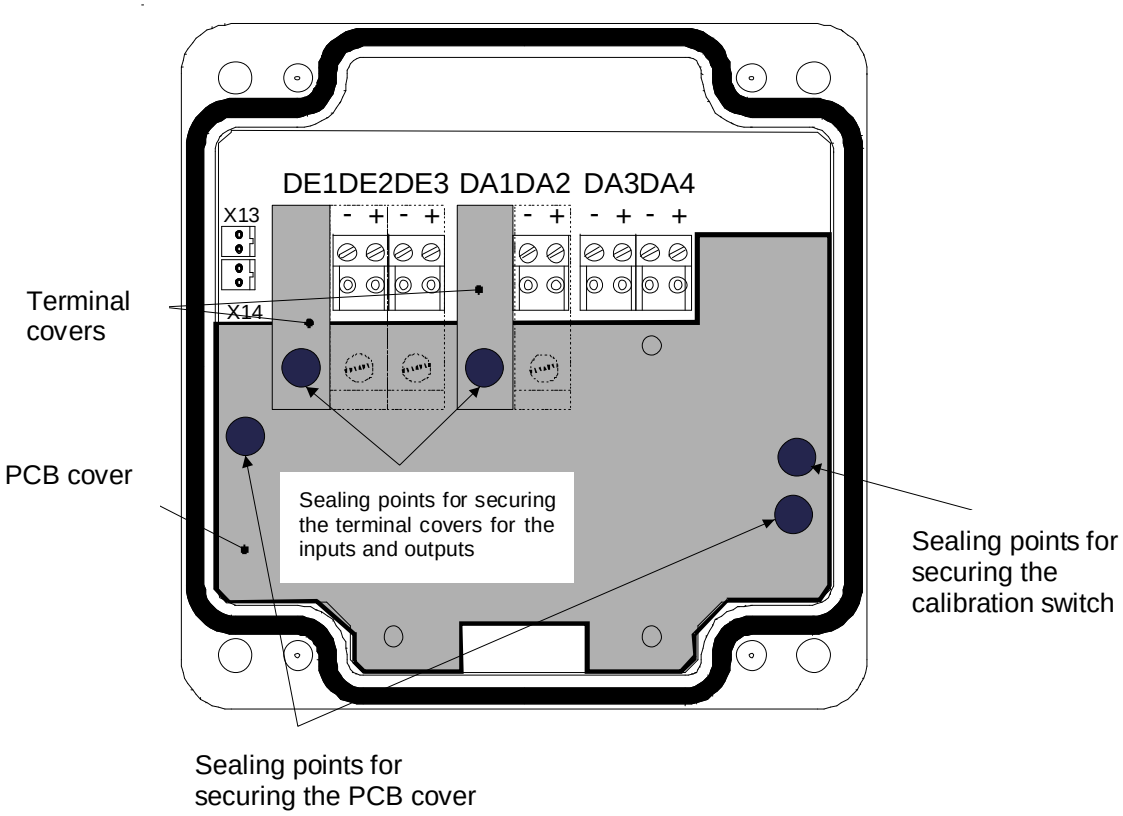
- The circuit board is provided with a plastic cover to protect it from tampering. One of the two fixing screws of this cover must be provided with an adhesive label.

4. Securing the inputs/outputs

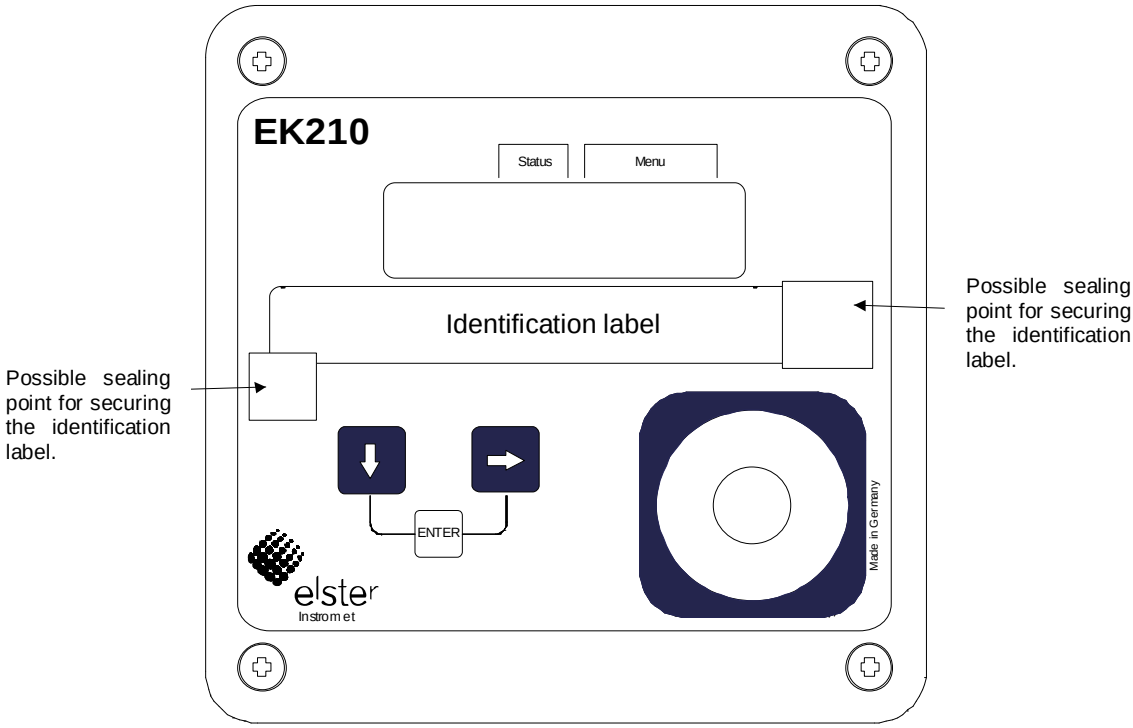
- When used in applications subject to official calibration, the terminals relevant to official regulations (e.g. counting inputs) must be secured against tampering by calibration covering caps. Sealing is provided by an adhesive label on the screw of the covering cap.
- See Chap. 5.4.1 for seal layout.

5.4.1 Seal layout

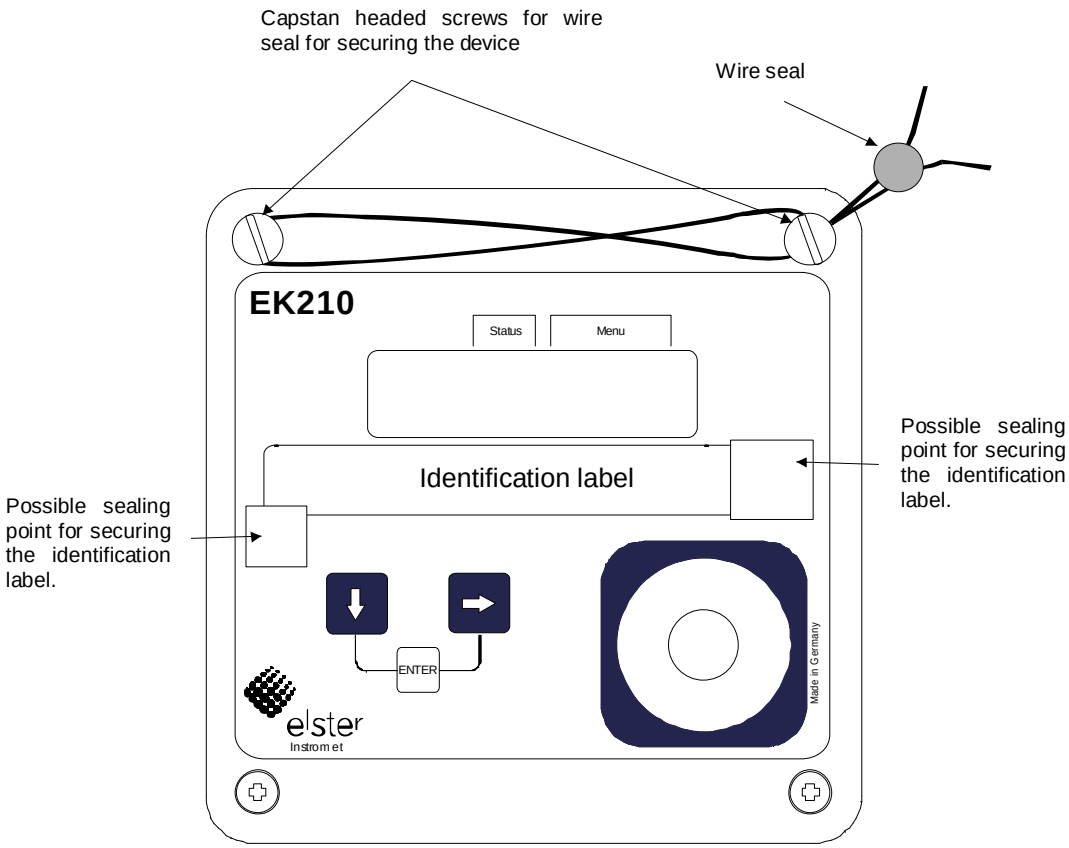
a) Housing cover (internal view)



b) Housing cover (front view), standard seals



c) Housing cover (front view), cover sealing using wire seal (optional user sealing)

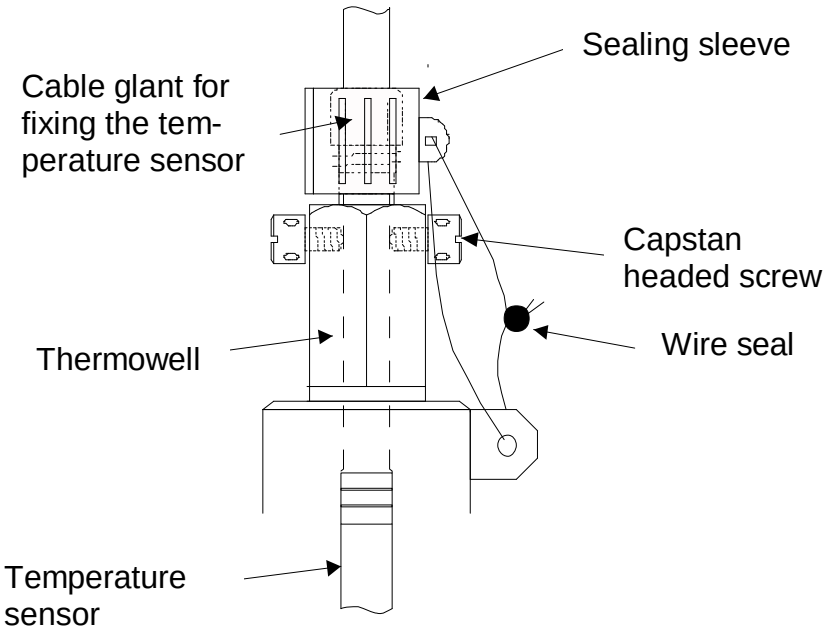


5.4.2 Seal layout of temperature sensor

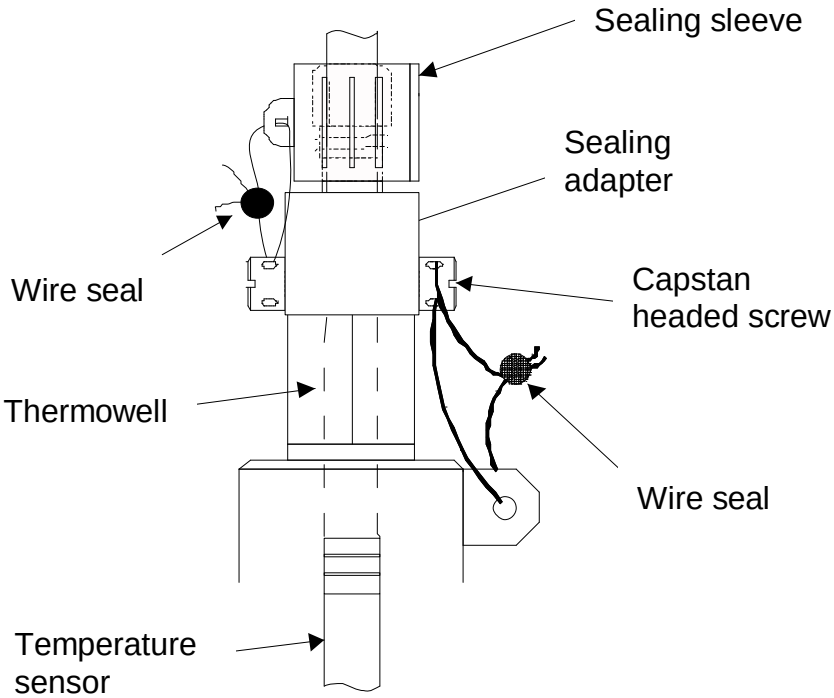
The sealing of the temperature sensor is generally carried with wire seals.

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



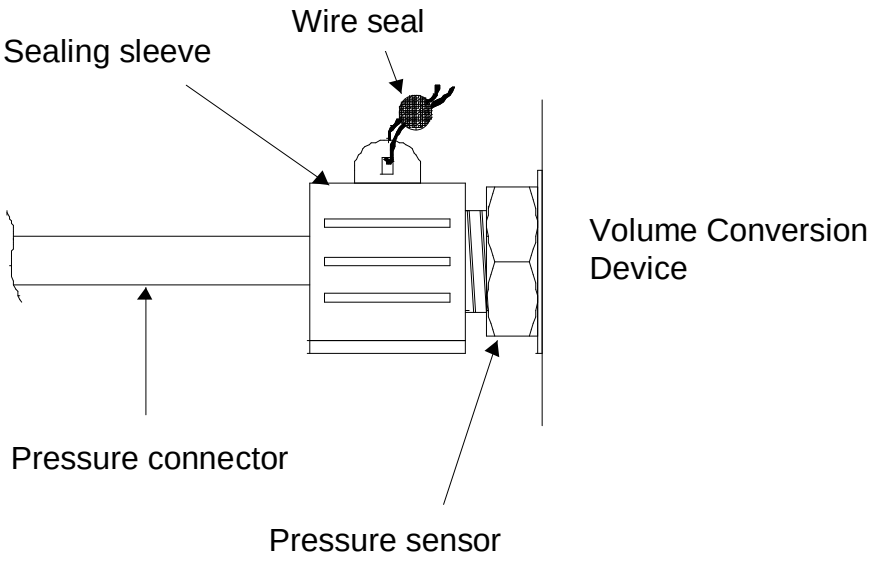
b) Temperature sensor of variable length + older Elster thermowells



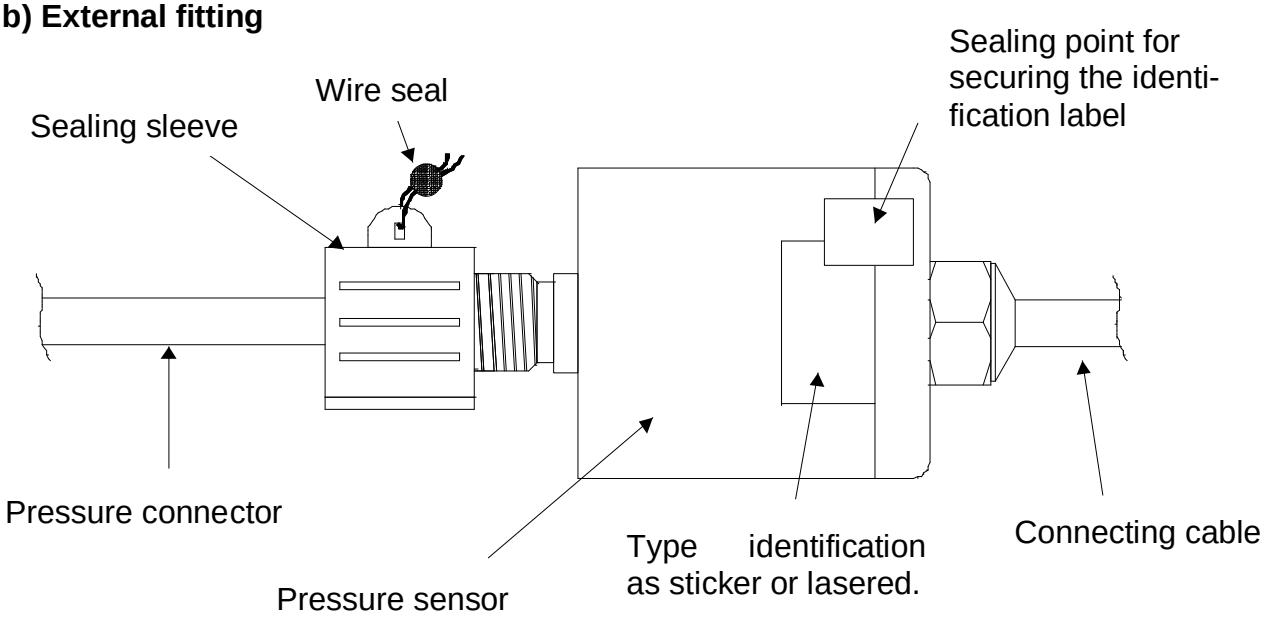
5.4.3 Sealing layout of pressure sensor

The sealing points shown in the sealing layouts are to be secured with sealing labels

a) Internal fitting



b) External fitting



5.5 Battery replacement

During operation a check must be made from time to time of whether the battery needs to be replaced. For this, the battery warning "B" in the "Status" field of the display is used (→ 2.2.1) as well as the remaining battery life in the service list (→ 3.9: Bat.R).

F *In the standard operating case (® B-2 Battery) the operating period with one battery is at least 5 years. The operating period may reduce due to different modes of operation. For further details ® 3.9: Bat.R and Bat.C*

F *Battery replacement can be carried out without the present of a calibration official, because the housing itself is not sealed.*

F *During battery replacement at least one battery should always remain connected. Before the old battery is removed, the new battery must be connected. A total of two plugs are provided for this.*

F *EK210 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.*

F *As an additional backup, all data should be saved in the non-volatile memory (EEPROM) directly before battery replacement (® 3.9, "Save"). If, due to an operating fault during battery replacement, data is lost, the EK210 automatically recalls the data from the time it was previously saved.*

F *Replacement should only be carried out by Elster-Instromet Service or by specially trained personnel.*

5.5.1 Carrying out battery replacement

1. Carry out a data backup as a precautionary measure (→ 3.9: *Save*).
2. Open up the housing cover and swivel downwards. The battery in the bottom part of the housing is then accessible.
3. Check the type and order number of the new batteries.

C Tip: Mark the old battery, e.g. with a felt-tip pen or sticker before 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, volume pulses may be lost during the battery replacement and the clock may be slow after battery replacement.
5. Remove the retaining clip on the battery holder.
6. 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.
7. Pull off the old battery from the plug and remove.
8. Fit the retaining clip on the battery holder.
9. Reclose the housing (make sure that the cable is not pinched).
10. Under "Service" - "Battery capacity" (→ 3.9: *BAT.K)* the initial capacity must be entered (essential even with the same capacity value)!
    With the use of the battery obtainable from Elster GmbH of size "D", the value 13 Ah should be entered for *Bat.C* and 26.0 Ah when 2 cells are used.
11. Check the operating life calculated by the EK210: *Bat.R* (→ 3.9).
12. End of the battery replacement.

A Approvals

A.1 EC Declaration of Conformance

CE

Declaration of Conformance

Manufacturer:	Elster GmbH Steinern Straße 19-21 55252 Mainz-Kastel Germany
Product designation:	Volume Conversion Device
Type designation:	**EK210**

Based on its design, construction and type, in the version brought by us into circulation, the above product conforms to the basic safety requirements of the following directives and harmonised standards including the changes applicable at the time of the declaration.

Relevant EC directives:	Directive 94/9/EC (ATEX) Directive 2004/22/EC (MID) Directive 89/336/EEC (EMC Directive)
Applied harmonised standards:	a) Electrical apparatus for potentially explosive atmospheres: EN50014:1997+A1+A2; General requirements EN50020:2002; Intrinsic safety "i" b) Volume conversion and electromagnetic compatibility: EN12405-1:2005 + A1:2006-04; Volume conversion, electromagnetic compatibility (interference immunity) EN61326:1997 + A1:1998; Electromagnetic compatibility (interference immunity – impulse voltages, interference emission) OIML D 11 Edition 2004 (E); General requirements for electronic measuring instruments (interference immunity – magnetic fields)
EC prototype test certificate	TÜV 01 ATEX 1760
Designated station:	No. 0032 and No. 0044 (legal succession) TÜV Hannover/Sachsen-Anhalt e.V. TÜV CERT-Zertifizierungsstelle Am TÜV 1 30519 Hannover Germany

If alterations are made to the product or it is modified, this declaration becomes void with immediate effect.

Mainz-Kastel, 17.12.07 Ortwin Pfaff, Development Manager, Electronic Systems

A.2 Approval for Ex Zone 1

TÜV CERT

Translation

(1) **EC TYPE-EXAMINATION CERTIFICATE**

(2) Equipment or protective system intended for use in potentially explosive atmospheres - **Directive 94/9/EC**

(3) EC-Type Examination Certificate Number

TÜV 01 ATEX 1760

(4) Equipment: Electronic volume corrector type EK210

(5) Manufacturer: Elster GmbH

(6) Address: Steinernstraße 19-21
D – 55252 Mainz-Kastel

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV Hannover/Sachsen-Anhalt e.V., TÜV CERT-Certification Body, notified body number N° 0032 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 N° 01 YEX 132683.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014: 1997 **EN 50 020: 1994**

(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 and construction of the specified equipment or protective system according to Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and placing on the market of this equipment or protective system.

(12) The marking of the equipment or protective system must include the following:

Ex II 2 G EEx ia IIC T4

TÜV Hannover/Sachsen-Anhalt e.V.
TÜV CERT-Zertifizierungsstelle
Am TÜV 1
D-30519 Hannover

Hanover, 2001-10-18

Head of the Certification Body

TÜV NORD

This certificate may only be reproduced without any change, schedule included.
Excerpts or changes shall be allowed by the TÜV Hannover/Sachsen-Anhalt e.V.

(13) **SCHEDULE**

(14) **EC-TYPE EXAMINATION CERTIFICATE N° TÜV 01 ATEX 1760**

(15) Description of equipment

The electronic volume corrector type EK210 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, that is measured by an external gas meter under service conditions, using the state variables pressure and temperature.
For the measurement of the pressure an internal sensor is used. The temperature sensor is permanently fixed with the device.
For the supply a battery is used. Prior the unplugging of the old battery it is permissible to plug in the new one in order to avoid data leakage.

The permissible ambient and gas temperature range is –30°C to 60°C.

Electrical data

Supply (internal battery) .....1 pc. lithium battery type LS 33600, company Saft
U = 3,6 V, modified accumulator pack of the manufacturer

Digital outputs (terminals DA1 ... DA2) .....in type of protection „Intrinsic Safety" EEx ia IIC/IIB resp. EEx ib IIC/IIB

Maximum values:
U_o = 6,6 V
I_o = 106 mA, static (sum current of all digital outputs)
I_o = 847 mA, dynamic (short-time discharge current per digital output)
P_o = 358 mW
Characteristic line: linear

EEx ia	IIC	IIB
max. permissible external inductance per digital output	110 µH	460 µH
max. permissible external capacitance per digital output	2,2 µF	8,8 µF

Digital inputs (terminals DE1 to DE3) .....in type of protection "Intrinsic Safety" EEx ia IIC/IIB resp. EEx ib IIC/IIB
only for the connection to reed contacts with a cable length up to 35 m

BA 02 04.00

page 2/3

Schedule EC-Type Examination Certificate N° TÜV 01 ATEX 1760

(16) Test documents are listed in the test report No.: 01 YEX 132683.

(17) Special conditions for safe use

none

(18) Essential Health and Safety Requirements

no additional ones

BA 02 04.00

page 3/3

Translation

1. SUPPLEMENT to

EC TYPE-EXAMINATION CERTIFICATE No. TÜV 01 ATEX 1760

of the company: Elster GmbH
Steinernstraße 19-21
D – 55252 Mainz-Kastel

In future, the electronic volume corrector type EK210 may also be manufactured according to the test documents listed in the test report.
The amendments concern the internal design. The number of the digital outputs was extended to 4.

Electrical Data

Digital outputs..... in type of protection „Intrinsic Safety" EEx ia IIC/IIB
(terminals DA1 ... DA4) resp. EEx ib IIC/IIB

Maximum values per circuit:
U_o = 6,6 V
I_o = 106mA, static (sum current of all digital outputs)
I_o = 847mA, dynamic (short-time discharge current per digital output)
P_o = 358mW
Characteristic line: linear

EEx ia	IIC	IIB
max. permissible external inductance per digital output	110 µH	460 µH
max. permissible external capacitance per digital output	2,2 µF	8,8 µF

All other data apply unchanged for this supplement.

Test documents are listed in the test report N° 03 YEX 550617.

TÜV NORD CERT GmbH & Co. KG
TÜV CERT-Certification Body
Am TÜV 1
D-30519 Hannover
Tel.: 0511 986-1470
Fax: 0511 986-2555

Hanover, 2003-05-20

TÜV NORD CERT GmbH & Co. KG legal successor of the notified body of TÜV Hannover/Sachsen-Anhalt e.V.

i.V.

Head of the Certification Body

page 1/1

TÜV NORD

Translation

2. SUPPLEMENT to

EC-TYPE EXAMINATION CERTIFICATE No. TÜV 01 ATEX 1760

Equipment: **Electronic volume corrector type EK210**

Manufacturer: Elster GmbH

Address: Steinernstraße 19-21
D – 55252 Mainz-Kastel

In the future, the electronic volume corrector type EK210 may also be operated with modified electrical values for applications of the gas group IIB resp. IIA

The amendments concern the optional active interconnection of the intrinsically safe digital outputs. No technical changes were carried out at the devices.

Digital outputs ..... in type of protection Intrinsic Safety EEx ia IIC/IIB/IIA
(terminals DA1 ... DA4) resp. EEx ib IIC/IIB/IIA

Maximum values per circuit:

U_o = 6,6 V
I_o = 106 mA, static (sum circuit for all digital output circuits)
I_o = 847 mA, dynamic (short-time discharge current per digital output)
P_o = 358 mW
Characteristic line: linear

EEx ia/ib	IIC	IIB
max. permissible external inductance per digital output	110 µH	460 µH
max. permissible external capacitance per digital output	2,2 µF	8,8 µF

BA 02 04.03 1.000.000

TÜV NORD

2. Supplement to EC-Type Examination Certificate No. TÜV 01 ATEX 1760

Only for applications of gas groups IIB resp. IIA

In case of interconnection of the digital outputs with another active apparatus the following maximum values apply:

Digital outputs ..... in type of protection Intrinsic Safety EEx ia IIB/IIA
(terminals DA1 ... DA4) resp. EEx ib IIB/IIA

Maximum values per output:
U_i = 10 V
I_i = 25 mA
P_i = 20 mW

or the maximum sum values for all outputs of
I_i = 100 mA
P_i = 80 mW
must not be exceeded.

$U_o = U_i$ but at least 6,6 V
I_o = 106 mA, static (sum current for all digital outputs)
I_o = 1,28 A, dynamic (short-time discharge current per digital output)
P_o = 358 mW
Characteristic line: linear

The rules for the interconnection of intrinsically safe circuits have to be observed.

All further data apply unchanged for this supplement.

The test documents are listed in the test report N° 05 YEX 552041.

TÜV NORD CERT GmbH & Co. KG
Am TÜV 1
D-30519 Hannover
Tel.: +49 511 986-1470
Fax: +49 511 986-1590

Hannover, 2005-03-15

Head of the Certification Body

DA 02 04 05 1 000 000

Translation

3. SUPPLEMENT to

EC-TYPE EXAMINATION CERTIFICATE No. TÜV 01 ATEX 1760

Equipment:	**Electronic Volume Corrector type EK210**
Manufacturer:	Elster-Instromet Production GmbH
Address:	Steinern Straße 19-21 D-55252 Mainz Kastel
Formerly	ELSTER GmbH

In the future, the Electronic Volume Corrector type EK210 may also be manufactured and operated according to the documents listed in the test report.

The amendments concern the internal design.

The electrical data and all further information apply unchanged fort his supplement.

The equipment inclusive these amendments meet I the requirements of the following standards:

EN 50014:1997+ A1+A2 **EN 50020:2002**

The test documents are listed in the test report N° 06 YEX 552672-c.

TÜV NORD CERT GmbH & Co. KG
Am TÜV 1
D-30519 Hannover
Tel.: +49 (0) 511 986-1455
Fax: +49 (0) 511 986-1590

Hannover, 2005-01-18

Head of the
Certification Bo

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. 160 x 120 x 90 mm (with cable glands)
Weight	approx. 1.7 kg
Cable connection	clamp terminals; 0.5 ... 1.5 mm² with flexible cable fit core-end sleeves
Screen	connect cable screen to union joint
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 Battery

Battery	1 lithium battery; 3.6V; size D normal rated capacity: 16.5 Ah Usable capacity for EK210: 13.0 Ah Order no.: 73015774
	1 additional lithium batteries optional for double service life Order no.: 73015774

The minimum operating life of 5 years with two batteries is guaranteed for the following ***standard operating case****:*

Measurement cycle	20 s
Operating cycle	300 s (5 minutes)
Mode for Input 1	1 (pulse input)
Display active	1 hour per month
Interface active	15 minutes per month
Ambient temperature	T_A = -10...+50 °C

B-3 Pulse and status inputs

Three digital inputs with common ground (minus pole) for reed contacts or transistor switches.

Designation	DE1... DE3
Cable connection	Plug-in terminals; 0.5 ... 1.5 mm² 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

F *For data which is not mentioned here, the limits in the certificate of conformance must be observed when using the EK210 in Ex Zone 1.*

Open-circuit voltage	U_0	≈ 2 V		
Internal resistance	R_i	≈ 500 kΩ		
Short circuit current	I_k	≈ 4 µA		
Switching level "on"	R_e	≤ 100 kΩ	or	U_e < 0,8 V
Switching level "off"	R_a	≥ 2 MΩ		
Pulse duration	t_e	≥ 50 ms		
Space duration	t_a	≥ 50 ms		
Counting frequency	f	≤ 10 Hz		

B-4 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; 0.5 ... 1.5 mm² With flexible cable use wire-end sleeves.
Screening	Connect cable screen to the cable gland over the full area.
Special features	All outputs can be parameterised separately and Outputs A1 and A2 can be sealed using calibration labels.

Nominal data:

F *For data which is not mentioned here, the limits in the certificate of conformance must be observed when using the EK210 in Ex Zone 1.*

Maximum switching voltage	30 V 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

B-5 Optical serial interface

Optical interface according to (DIN) 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-6 Pressure sensor

The pressure sensor can be implemented either as an internal or external variant.

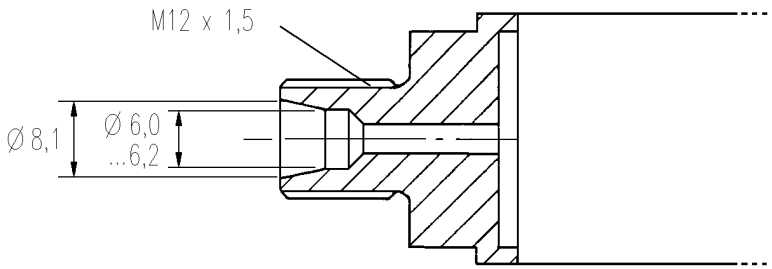
Connection:

Pressure connection: Ermeto M12 x 1.5 male thread
Usable length approx. 10 mm

Installation information:

When connecting the pressure line to the 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 (see following drawing of the Ermeto connection on the pressure sensor).

Cross-section of pressure sensor connection



Measurement range	Max. admissible overload
0,7 ... 2 bar abs.	18 bar abs.
0,8 ... 5 bar abs.	25 bar abs.
1,4 ... 7 bar abs.	25 bar abs.
2 ... 10 bar abs.	40 bar abs.
2,4 ... 12 bar abs.	40 bar abs.
4 ... 20 bar abs.	40 bar abs.
6 ... 30 bar abs.	60 bar abs.
8 ... 40 bar abs.	60 bar abs.
14 ... 70 bar abs.	105 bar abs.
16 ... 80 bar abs.	105 bar abs.

B-7 Temperature sensor

Type:	Pt500 according to DIN EN 60751
Measurement range:	-10°C ... +60°C
Measurement uncertainty:	≤ ± 0.1% of measurement
Mounting:	Insertion into sensor receptacle with variable length

B-8 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