EK230

This product is discontinued!

Volume Conversion Device EK230

Operating Instructions and Installation Information

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

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

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

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

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

Mainz-Kastel, March 2008

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I Safety information

F *The connections of the EK230 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 EK230 into operation.*

The EK230 Volume Conversion Device (= Electronic Volume Corrector) fulfils the requirements of Category 2 of the directive 94/9/EC (ATEX) and can be used according to EN 1127-1 in Ex Zone 1 for gases of Group IIC and Temperature Class T4 (ignition temperature < 135°C, e.g. natural gas). See Appendix A-2 for EC prototype test certificate.

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

F *The Ex-approval only applies to the EK230 versions with the interfaces "RS485" and "RS232-EEx", not to "RS232"!*

F *Follow the relevant applicable national regulations and appropriate standards, e.g. EN 60079-14 and EN 50014.*

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

F *The housing of the EK230 must be earthed directly to a potential equalisation strip. A terminal screw is provided for this on the left housing wall.*

II Items supplied and accessories

Items supplied:

The items supplied with the EK230 include:

a) EK230 Volume Conversion Device
b) Dispatch list
c) Configuration data sheet
d) Operating Manual
e) 3 blind insertion seals for PG11 gland-type cable entries
f) Lead sleeves for sealing the pressure connection.

Ordering information and accessories	Order no.
EK230 Volume Conversion Device, complete	83 462 340
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	73 017 527
Operating manual, English	73 017 526
Plug-in terminal, 2-pole black	04 130 407
Calibration covering cap	73 017 456
Battery module, 13 Ah	73 015 774
Bag of accessories, EK2xx	73 017 991

1 Brief description

The EK230 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 and in the appropriate energy.

The momentary values of pressure and temperature are measured for the determination of the operating state. The inverted compressibility factor ratio (K-value) can be computed alternatively according to S-GERG-88, AGA 8 GC, AGA-NX19 or it can be entered as a constant. The volume is converted into energy using the adjustable calorific value.

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

Power supply:

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

Operator interface:

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

Counter / signal inputs:

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

Pulse / signal outputs:

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

Data interface:

- Optical interface according to IEC 62056-21 (replaces IEC 61107 and EN61107).
- Permanently wired serial interface, RS485 or RS232 available (RS232 versions with and without Ex-approval).
- MODBUS protocol via permanently wired serial interface.
- IDOM protocol via the permanently wired serial interface.
- Automatic setting of the clock by remote data transmission with a modem connected.

Pressure sensor:

- Pressure sensor type CT30 integrated in device, or external mounted.
- Alternatively absolute or gauge pressure measurement.

Temperature sensor:

- Pt500 temperature sensor, variable length

Mechanical details / housing:

- Suitable for wall mounting and meter 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:

- Approval by calibration authorities as Volume Conversion Device acc. MID-Directive 2004/22/EG
- Ex approval for use in Ex Zone 1 according to EEx ia IIC T4.

Monitoring functions

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

Archives

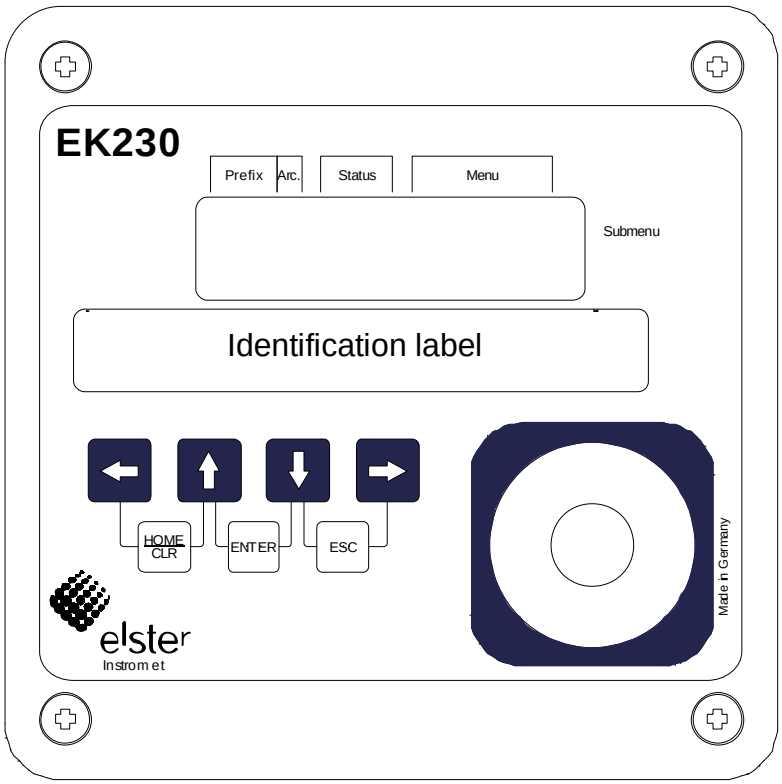
- Measurement period values (consumption profile) from the last 2 months for Vb, Vm, p, T, K and C for a measurement period of 60 minutes. The measurement period can be set in the range from 1 to 60 minutes.
- Automatic summer time selection can be set.
- Event logbook with 250 entries for events such as for example status changes, signalling inputs, limit violations.
- Changes logbook ("audit trail") with entry of the last 200 changes to settings (parameterising steps).

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.
- Four keys for the display and entry of values.



2.2 Display

Basic display structure (with an example):

Prefix		Archive		Device status					M e n u						
	Æ		á		A	W	B		A	c	t.	V.			à
V	m	A		1	2	3	4	5	6	7	8	9		m	3

Submenu

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

2.2.1 Line 1 = Labels

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

1. Prefix (Type of computation)

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

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

2. Archive

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

3. Device status

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

A flashing character signifies that the corresponding state is still present and the corresponding message is present in the momentary status.
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 with numbers "1" or "2" represent alarms (e.g. "Alarm limits for pressure or temperature violated" → 3.8).
  Alarm messages are copied into the status register and are retained here, even after rectification of the cause of the error, until they are manually cleared.
- W "Warning"
  At least one status message has occurred which is valid as a warning.
  Basically, all messages with numbers in the range "3" to "8" represent warnings (e.g. "Warning limits for pressure or temperature violated" or "Error on output" → 3.8).
  Warning messages are copied into the status register and are retained here, even after rectification of the cause of the error, until they are manually cleared.
- B "Batteries discharged"
  The remaining battery service life is less than 3 months.
  This display corresponds to Status Message "Batt. low" (→ page 43).
- P "Programming mode"
  The programming lock (calibration lock) is open.
  This display corresponds to Status Message "Calibration lock" (→ page 40).
- 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.
  This display corresponds to Status Message "online" (→ page 43).

4. Menu

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

5. Submenu

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

2.2.2 Line 2 = Value with name and unit

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

Example:

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

2.3 Keypad

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

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

2.3.1 Changing values

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

The following data classes (DC) are present in the EK230:

DC	Type	Entry, change using "ENTER"
1	Display test	No change possible.
2	Function	Triggers the function by entering "1".
3	Constant	No change possible.
4	Measurement	The value is updated by pressing <ENTER> twice.
5	Status	By pressing <ENTER> short texts for statusmessages are available.
6	Initialisable value	After <ENTER> value initialisation (standard setting) by pressing the key combination <CLR> = [←] + [↑].
7	Discrete value	After <ENTER> value change by selection from a list of possible values with the keys [↑] and [↓]. Value initialisation is possible with [←] + [↑].
8	Permanent value	After <ENTER>, setting to any value within the valid range is possible. Selection of each individual character to be changed with [←] and [→] and changing with [↑] und [↓]. Value initialisation is possible with [←] + [↑] .
9	Archive heading	Branching to the appropriate archive.
11	Combination	Similar to "Permanent value" (see above) but masked entry, i.e. only the character currently being edited is visible, all others are masked out by a minus sign. With a 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, sometimes branching to a submenu.
17	Archive value	No change possible.
19	Status register	By pressing <ENTER> short texts for statusmessages are available. Initialisation (standard setting) by using menu-function <CLR>
21	Permanent value with 0	Similar to “permanent value” (data class “8”, see above). In addition, the value “0” can always be entered independently from its defined limits.

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

2.3.2 Entering "sources"

At a number of points the entry of a "source" is required for parameterisation (e.g. SC.Qb in the standard volume list, SC.A1 in the output list).
The address of the desired value is entered as the source. It can be found in the tables at the beginning of each list (Chapter 3.1 ff.). In comparison to the addresses shown there however, the following supplements must be given:

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

Example 1:

Source:	2:300	(Address of the standard volume Vb, see table in 3.1)
Enter:	**000**2:300_**0**	(Supplements printed in bold)

Example 2:

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

2.3.3 Entry errors

Entry error messages are displayed if incorrect entries are made via the keypad.
Representation: **----x---** with x = Error code according to the following table.

Code	Description
1	The archive is empty, no values are available yet.
2	The archive value cannot be read. The archive has possibly just been opened by the interface for reading out.
4	Parameter cannot be changed (constant).
5	No authorisation for changing the value. To change the value the appropriate lock must be opened.
6	Invalid value. Entered value is outside the permissible limits.
7	Incorrect combination. The entered combination (numerical code) is incorrect and the lock is not opened.
8	Entry not possible due to special setting or configuration.
11 *	The entry of the calorific value Ho.b in the energy list is not permitted. Please change Ho.b in the Volume corrector list (→ 3.6, page 32).
12	The entry of this source (address) is not permitted.
13	The function can only be executed after the clock (**à** 3.9, Time*) has been set (initialised) to its starting value with the key combination* ← + ↑.
14	Gas analysis parameters for AGA-NX-19 do not match. Example: For "H gas" (calorific value *Ho.b* over 11.055) the density ratio dr must not exceed the maximum value of 0.691. (**à** 3.6)
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 EK230 differentiates between four access parties. Each access party has a lock and a corresponding code. The locks have the order of priority

Calibration lock – Manufacturer's lock[1] – Supplier's lock – Customer lock.

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

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

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

Each party with write access for a value can also change the access rights (write and read access for each 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 EK230 housing below the circuit board cover panel. It can be secured with an adhesive seal.

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

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

The calibration lock is opened by pressing the pushbutton (the symbol "P" flashes in the display) and is closed again when it is pressed again (symbol "P" goes out). Closure is also possible by deleting the value "St.PL" ($\rightarrow$ 3.10) via the keypad or interface.

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

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

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 not 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"). (→ 3.10: *St.SL, Cod.S, St.PL, Cod.C*)

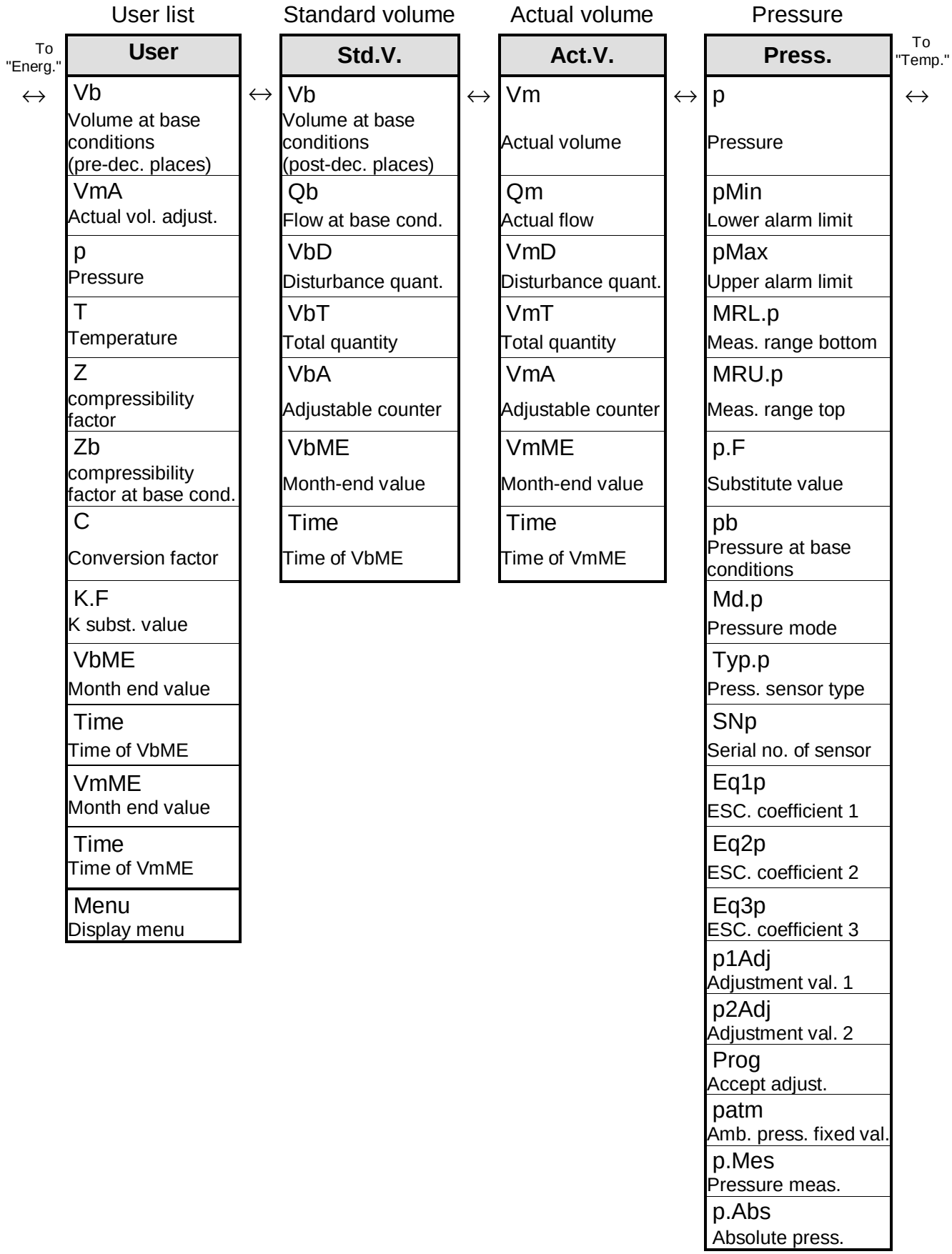
2.5 Formation of the list structure

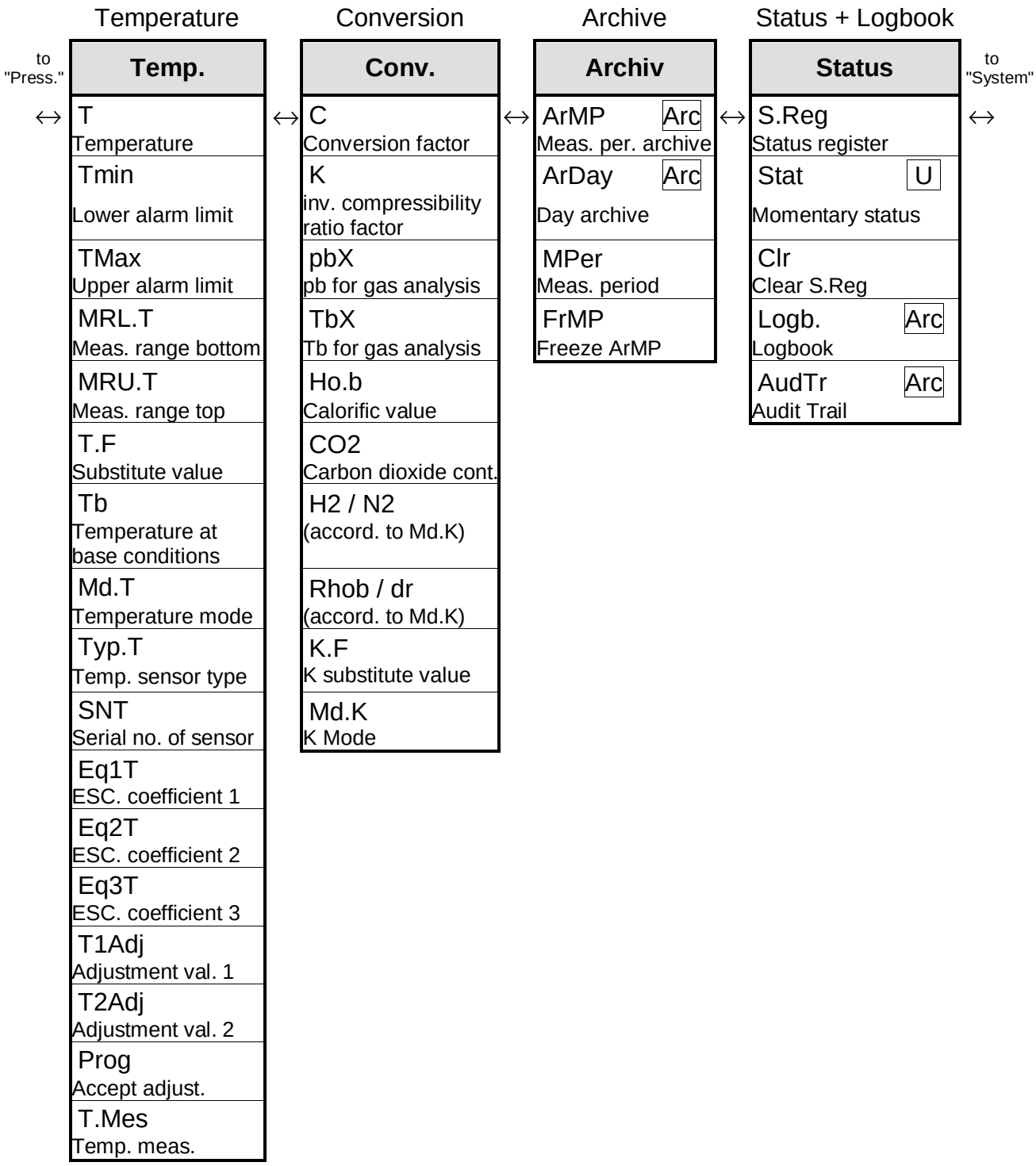
The data display in the EK230 is structured in a tabular form. The individual columns in the table each contain associated values.

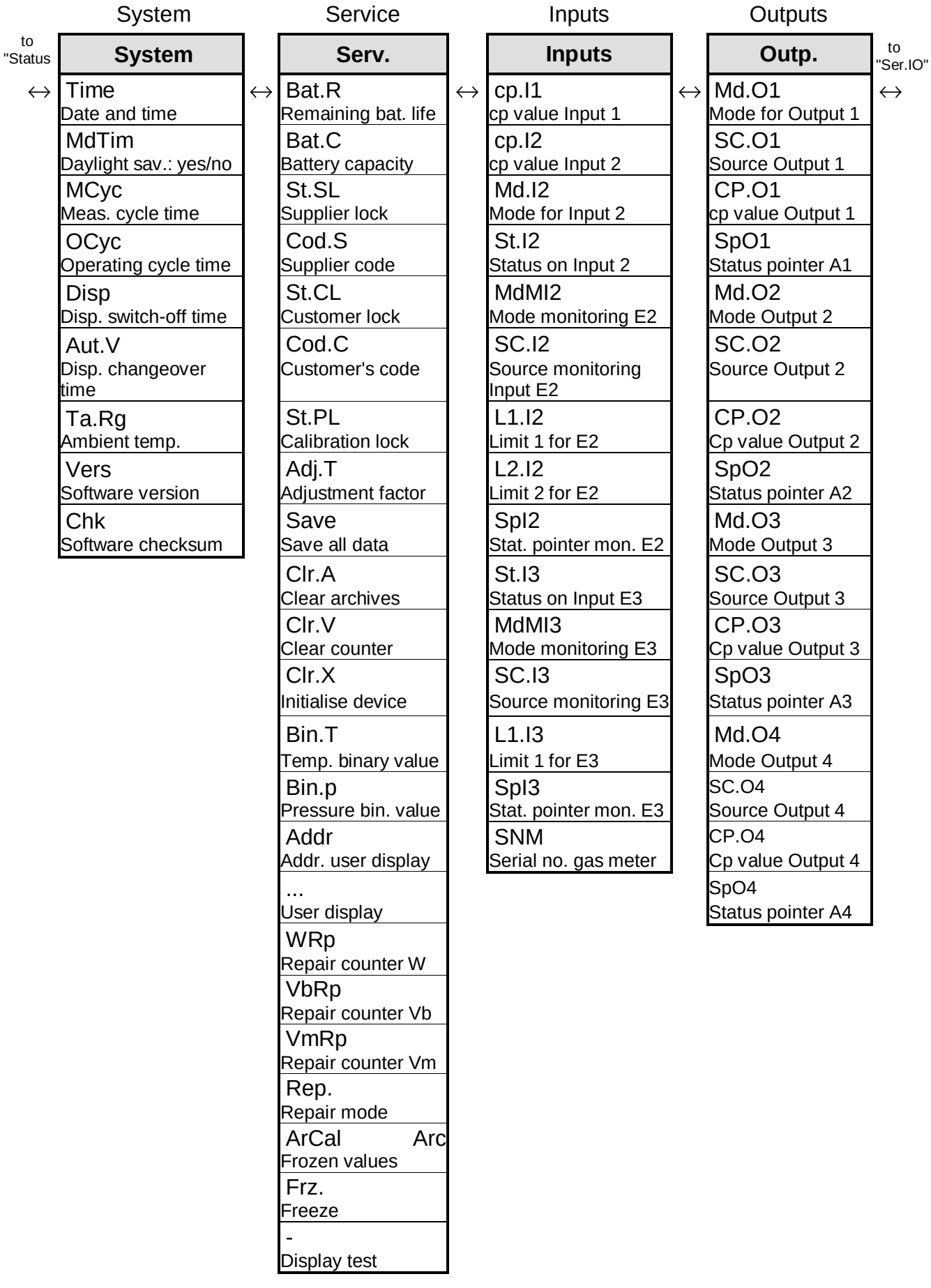
Values identified with [U] and [Arc] are submenus or archives which you can view by entering <ENTER> and leaving again with <ESC>. They each have, subordinate to the main menu, a dedicated list structure, which is written in the corresponding list (→ **3**).

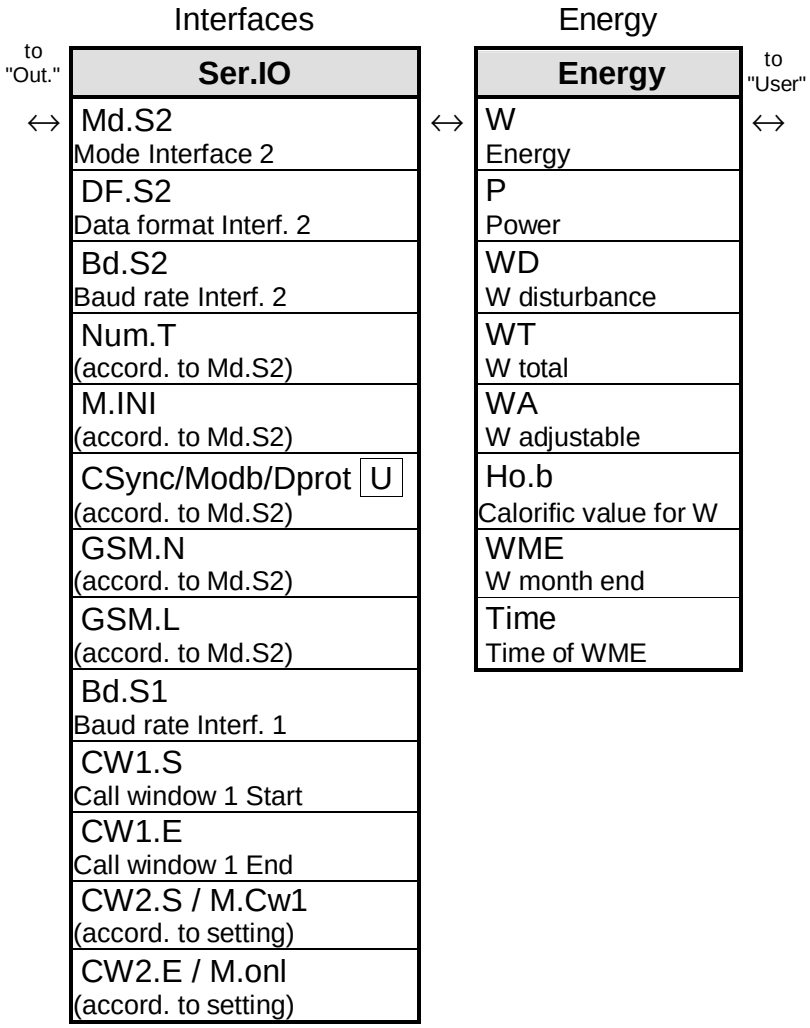
The archives are subdivided into a number of data rows (also termed "data records"). All values in the same data row are saved ("archived") at the same point in time.
The maximum number of data rows and the number of values in a data row depends on the relevant archive. Within an archive the number of values and their meaning are the same for each data row.
Switching to another archive data row occurs with the keys [↑] (for "younger" data rows) and [↓] (for "older" data rows). After the last data row, the first follows again and vice versa.
Switching to another value within a data row occurs with the keys [→] and [←]. After the last value, the first follows again and vice versa.

Overview of main menu (list structure): See next page.


User list
Standard volume
Actual volume
Pressure
To "Energ."
To "Temp."
User
Vb
Volume at base conditions (pre-dec. places)
VmA
Actual vol. adjust.
p
Pressure
T
Temperature
Z
compressibility factor
Zb
compressibility factor at base cond.
C
Conversion factor
K.F
K subst. value
VbME
Month end value
Time
Time of VbME
VmME
Month end value
Time
Time of VmME
Menu
Display menu
Std.V.
Vb
Volume at base conditions (post-dec. places)
Qb
Flow at base cond.
VbD
Disturbance quant.
VbT
Total quantity
VbA
Adjustable counter
VbME
Month-end value
Time
Time of VbME
Act.V.
Vm
Actual volume
Qm
Actual flow
VmD
Disturbance quant.
VmT
Total quantity
VmA
Adjustable counter
VmME
Month-end value
Time
Time of VmME
Press.
p
Pressure
pMin
Lower alarm limit
pMax
Upper alarm limit
MRL.p
Meas. range bottom
MRU.p
Meas. range top
p.F
Substitute value
pb
Pressure at base conditions
Md.p
Pressure mode
Typ.p
Press. sensor type
SNp
Serial no. of sensor
Eq1p
ESC. coefficient 1
Eq2p
ESC. coefficient 2
Eq3p
ESC. coefficient 3
p1Adj
Adjustment val. 1
p2Adj
Adjustment val. 2
Prog
Accept adjust.
patm
Amb. press. fixed val.
p.Mes
Pressure meas.
p.Abs
Absolute press.


Temperature
Conversion
Archive
Status + Logbook
to "Press."
to "System"
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
Eq1T
ESC. coefficient 1
Eq2T
ESC. coefficient 2
Eq3T
ESC. coefficient 3
T1Adj
Adjustment val. 1
T2Adj
Adjustment val. 2
Prog
Accept adjust.
T.Mes
Temp. meas.
Conv.
C
Conversion factor
K
inv. compressibility ratio factor
pbX
pb for gas analysis
TbX
Tb for gas analysis
Ho.b
Calorific value
CO2
Carbon dioxide cont.
H2 / N2
(accord. to Md.K)
Rhob / dr
(accord. to Md.K)
K.F
K substitute value
Md.K
K Mode
Archiv
ArMP
Arc
Meas. per. archive
ArDay
Arc
Day archive
MPer
Meas. period
FrMP
Freeze ArMP
Status
S.Reg
Status register
Stat
U
Momentary status
Clr
Clear S.Reg
Logb.
Arc
Logbook
AudTr
Arc
Audit Trail


System
Service
Inputs
Outputs
to "Status
to "Ser.IO"
System
Time
Date and time
MdTim
Daylight sav.: yes/no
MCyc
Meas. cycle time
OCyc
Operating cycle time
Disp
Disp. switch-off time
Aut.V
Disp. changeover time
Ta.Rg
Ambient temp.
Vers
Software version
Chk
Software checksum
Serv.
Bat.R
Remaining bat. life
Bat.C
Battery capacity
St.SL
Supplier lock
Cod.S
Supplier code
St.CL
Customer lock
Cod.C
Customer's code
St.PL
Calibration lock
Adj.T
Adjustment factor
Save
Save all data
Clr.A
Clear archives
Clr.V
Clear counter
Clr.X
Initialise device
Bin.T
Temp. binary value
Bin.p
Pressure bin. value
Addr
Addr. user display
...
User display
WRp
Repair counter W
VbRp
Repair counter Vb
VmRp
Repair counter Vm
Rep.
Repair mode
ArCal Arc
Frozen values
Frz.
Freeze
-
Display test
Inputs
cp.I1
cp value Input 1
cp.I2
cp value Input 2
Md.I2
Mode for Input 2
St.I2
Status on Input 2
MdMI2
Mode monitoring E2
SC.I2
Source monitoring Input E2
L1.I2
Limit 1 for E2
L2.I2
Limit 2 for E2
SpI2
Stat. pointer mon. E2
St.I3
Status on Input E3
MdMI3
Mode monitoring E3
SC.I3
Source monitoring E3
L1.I3
Limit 1 for E3
SpI3
Stat. pointer mon. E3
SNM
Serial no. gas meter
Outp.
Md.O1
Mode for Output 1
SC.O1
Source Output 1
CP.O1
cp value Output 1
SpO1
Status pointer A1
Md.O2
Mode Output 2
SC.O2
Source Output 2
CP.O2
Cp value Output 2
SpO2
Status pointer A2
Md.O3
Mode Output 3
SC.O3
Source Output 3
CP.O3
Cp value Output 3
SpO3
Status pointer A3
Md.O4
Mode Output 4
SC.O4
Source Output 4
CP.O4
Cp value Output 4
SpO4
Status pointer A4


Interfaces
Energy
to "Out."
Ser.IO
Md.S2
Mode Interface 2
DF.S2
Data format Interf. 2
Bd.S2
Baud rate Interf. 2
Num.T
(accord. to Md.S2)
M.INI
(accord. to Md.S2)
CSync/Modb/Dprot U
(accord. to Md.S2)
GSM.N
(accord. to Md.S2)
GSM.L
(accord. to Md.S2)
Bd.S1
Baud rate Interf. 1
CW1.S
Call window 1 Start
CW1.E
Call window 1 End
CW2.S / M.Cw1
(accord. to setting)
CW2.E / M.onl
(accord. to setting)
Energy
W
Energy
P
Power
WD
W disturbance
WT
W total
WA
W adjustable
Ho.b
Calorific value for W
WME
W month end
Time
Time of WME
to "User"

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:

- AD — Abbreviated designation
  Designation of the value in the display
- Access — Write access
  Indicates which lock must be opened to change the value (→ 2.4.1, 2.4.2):
  - C = Calibration lock
  - M = Manufacturer's lock
  - S = Supplier's lock
  - K = Customer's lock
  - C / S = Calibration lock or supplier's lock, depending on national regulations

  If the letter is located in brackets, the value can only be changed via the interface and not via the keypad. In case of verification of device under calibration regulations (e.g. acc. MID) the write access C must be used.
- Address — Address of the value.
  This is required especially for data transmission via the serial interface. The address can be displayed by pressing the keys ← + → simultaneously.
- 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

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

(Legends: see page 22)

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

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

With *Menu* the complete display structure of the EK230 can be switched between "complete" and "simple".

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

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

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

Vb Volume at base conditions (pre-decimal places)

The volume at base conditions computed from the measured "actual volume" is summed here provided no alarm is present.

An alarm is present when any message with the number "1" or "2" is urgent (→ 3.8).

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 standard volume list (→ 3.2).

Vm Actual volume

p Pressure

T Temperature
Values which are also displayed in another list and described in the corresponding chapters.

Z Compressibility factor

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

C Conversion factor

K.F Inverted compressibility factor ratio , substitute value

VbME Vb month end value

Time Date and time of Vb month end value

VmME V month end value

Time Date and time of Vm month end value
These values are also displayed in other lists and are described in the appropriate chapters.

3.2 Standard volume (volume at base conditions) list

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

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.
"Alarm" means any message with the number "1" or "2" (→ 3.8).
An alarm is present when any message "1" or "2" is urgent (→ 3.8).
Vb = *V* ĭ C where *V* = Actual volume (→ 3.3)
C = Conversion factor (→ 3.6)
The pre-decimal places of *Vb* are displayed in the user list (→ 3.1).

Qb Flow at base conditions

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

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

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

3.3 Actual volume (volume at measurement conditions) list

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

(Legends: see page 22)

Vm Actual volume
The volume *V1* (→ 3.8) measured on the input is summed here provided no alarm is present.
"Alarm" means any message with the number "1" or "2" (→ 3.8).

Qm Actual flow rate

Momentary actual flow (actual flow rate).
If the EK230 receives fewer than four pulses per hour on the counter input (terminal "DE1"), the flow rate is set to "0".
The maximum inaccuracy of the indicated value corresponds to four pulses.
Example: The cp value of the pulse transmitter (→ cp.I1, page 52) is 0.1 pulses/m3 and the momentary flow rate is 3600 m3/h.

⇒ Pulse frequency = 3600 m3/h • 0.1 pulses/m3 = 360 pulses/h
⇒ max. inaccuracy = 4 pulses/h / 360 pulses/h = 1.11 %

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

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

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

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

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

3.4 Pressure list

AD	Designation / value	Unit	Access	Address	DC
p	Pressure	bar	-	7:310_1	4
pMin	Lower alarm limit pressure	bar	C	7:3A8_1	8
pMax	Upper alarm limit pressure	bar	C	7:3A0_1	8
MRL.p	Pressure meas. range lower limit	bar	C	6:224_1	8
MRU.p	Pressure meas. range upper limit	bar	C	6:225_1	8
p.F	Pressure substitute value	bar	S	7:311_1	8
pb	Pressure at base conditions	bar	C	7:312_1	8
Md.p	Pressure mode	-	C	7:317	7
Typ.p	Pressure sensor type	-	C	6:223	8
SNp	Serial no. of pressure sensor	-	C	6:222	8
Eq1p	Coefficient 1 of pressure equation	-	C / S	6:280	8
Eq2p	Coefficient 2 of pressure equation	-	C / S	6:281	8
Eq3p	Coefficient 3 of pressure equation	-	C / S	6:282	8
p1Adj	Adjustment value 1 for pressure	bar	C / S	6:260_1	8
p2Adj	Adjustment value 2 for pressure	bar	C / S	6:261_1	8
Prog	Accept pressure adjustment	-	C / S	6:259	2
patm	Ambient pressure fixed value	bar	C	6:212_1	8
p.Mes	Pressure measurement	bar	-	6:211_1	4
p.Abs	Absolute pressure measurement	bar	-	6:210_1	4

(Legends: see page 22)

p Pressure

pMin Lower alarm limit pressure

pMax Upper alarm limit pressure

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

If the measured pressure *p.Abs* (see below) is within the alarm limits *pMin* and *pMax*, it is used as *p*: *p* = *p.Abs.*.

If *p.Abs* is located outside the alarm limits, the substitute value *p.F* (see below) is used: p = p.F. In addition, disturbance quantities are then counted (→ 3.2, 3.3) and the message "p Alarm Lim." displayed (→ page 41).

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.Abs* is outside the alarm limits *pMin* and *pMax* (see below), *p.F* is used as pressure *p* for correction. *p* = *p.F*.

pb Pressure at base conditions

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

Md.p Pressure mode
With *Md.p* = "1" the measured pressure *p.Abs* (see below) is used for correction, provided it does not violate the alarm limits.
With *Md.p* = "0" the fixed value (substitute value) *p.F* is always used for correction. No disturbance quantities are counted.

Typ.p Pressure sensor type

SNp Serial no. of pressure sensor
Identification of the pressure sensor associated with the EK230.

Eq1p Coefficient 1 of pressure equation

Eq2p Coefficient 2 of pressure equation

Eq3p Coefficient 3 of pressure equation
The coefficients of the quadratic equation for calculating the pressure *p.Mes* from the raw pressure value *Bin.p* (→ 3.10):

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

To adjust the pressure measurement, the 3 coefficients of the quadratic equation can either be found by the EK230 itself or calculated and entered by the user.
External to the EK230, the three coefficients can be calculated based on three values for *Bin.p* and the corresponding reference values.
When the EK230 determines the coefficients, it uses the value for *Eq3p* available at the time of entering *Prog* (see below) and it calculates the corresponding *Eq1p* and *Eq2p* for this. The standard value for *Eq3p* is "0".

p1Adj Adjustment value 1 for pressure

p2Adj Adjustment value 2 for pressure

Prog Accept pressure adjustment
These values are used for the adjustment of the pressure measurement, i.e. for the internal computation of the equation coefficients for the pressure (see above).
The adjustment takes place in three steps:

1. Apply measurement pressure 1 (= reference value 1) to the pressure sensor and enter as *p1Adj*.
2. Apply measurement pressure 2 (= reference value 2) to the pressure sensor and enter as *p2Adj*.
3. Enter *Prog* = "1" so that the EK230 calculates the equation coefficients.

After applying the measurement pressure, you should either wait about one minute each time before entering the adjustment or press the key combination ENTER a number of times during the display of the pressure measurement *p.Mes* (see below) until the displayed value is stable.
Approx. 0.4 · *pMax* and approx. 0.9 · *pMax* should be selected as adjustment values.

patm Ambient pressure fixed value

p.Mes Pressure measurement

p.Abs Absolute pressure measurement
p.Abs is the sum of *patm* and *p.Mes*: *p.Abs = patm + p.Mes*

For *patm*, when an absolute sensor is used, "0" is entered and the ambient pressure is entered when a gauge pressure sensor is used.
p.Mes is absolute or gauge depending on the pressure sensor.
If the absolute pressure *p.Abs* is within the alarm limits *pMin* and *pMax* (see above), then it is used as the pressure *p* for correction: *p = p.Abs.*

3.5 Temperature list

AD	Designation / value	Unit	Access	Address	DC
T	Temperature	°C	-	6:310_1	4
TMin	Lower alarm limit temperature	°C	C	6:3A8_1	8
TMax	Upper alarm limit temperature	°C	C	6:3A0_1	8
MRL.T	Temperature meas. range lower limit	°C	C	5:224_1	8
MRU.T	Temperature meas. range upper limit	°C	C	5:225_1	8
T.F	Temperature substitute value	°C	S	6:311_1	8
Tb	Temperature at base conditions	K	C	6:312	8
Md.T	Temperature mode	-	C	6:317	7
Typ.T	Temp. sensor type	-	C	5:223	8
SNT	Serial number of temperature sensor	-	C	5:222	8
Eq1T	Coefficient 1 of temperature equation	-	C / S	5:280	8
Eq2T	Coefficient 2 of temperature equation	-	C / S	5:281	8
Eq3T	Coefficient 3 of temperature equation	-	C / S	5:282	8
T1Adj	Adjustment value 1 for temperature	°C	C / S	5:260_1	8
T2Adj	Adjustment value 2 for temperature	°C	C / S	5:261_1	8
Prog	Accepts temperature adjustment	-	C / S	5:259	2
T.Mes	Temperature measurement	°C	-	5:210_1	4

(Legends: see page 22)

T Temperature

TMin Lower alarm limit temperature

TMax Upper alarm limit temperature
T is the temperature which is used for computing the conversion factor (→ 3.6) and hence the volume at base conditions (→ 3.1).
If the measured temperature *T.Mes* (see below) is within the alarm limits TMin and TMax (see below), it is used as *T*: T = *T.Mes*.
If *T.Mes* is located outside the alarm limits, the substitute value *T.F* (see below) is used: T = *T.F*. In addition, disturbance quantities are then counted (→ 3.2, 3.3) and the message "T Alarm Lim." displayed (→ page 41).

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.

T.F Temperature substitute value

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

Tb Temperature at base conditions

The temperature at base conditions is used for computing the conversion factor (→ **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 EK230.

Eq1T Coefficient 1 of temperature equation

Eq2T Coefficient 2 of temperature equation

Eq3T Coefficient 3 of temperature equation
The coefficients of the quadratic equation for calculating the temperature *T.Mes* from the raw temperature value *Bin.T* (→ 3.10):

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

To adjust the temperature measurement circuit, the three coefficients of the quadratic equation can either be found by the EK230 itself or calculated and entered by the user.
External to the EK230, the three coefficients can be calculated based on three values for *Bin.T* and the corresponding reference values.
When the EK230 determines the coefficients, it uses the value for *Eq3T* set at the time of entering *Prog* (see below) and it calculates the corresponding *Eq1T* and *Eq2T* for this.

T1Adj Adjustment value 1 for temperature

T2Adj Adjustment value 2 for temperature

Prog Accept temperature adjustment
These values are used for the adjustment of the temperature measurement circuit, i.e. for the internal computation of the equation coefficients for the temperature (see above).
The adjustment takes place in three steps:

1. Apply measurement temperature 1 (= reference value 1) on the temperature sensor and enter as *T1Adj*.
2. Apply measurement temperature 2 (= reference value 2) on the temperature sensor and enter as *T2Adj*.
3. Enter *Prog* = "1" so that the EK230 calculates the equation coefficients.

After applying the measurement temperature, you should either wait about one minute each time before entering the adjustment or press ENTER number of times during the display of the temperature measurement *T.Mes* (see below) until the displayed value is stable.
To optimise the accuracy, the adjustment values should be located as close as possible to the measurement range limits *MRL.T* and *MRU.T* (e.g. -10°C and +60°C).

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

3.6 Volume corrector list

The values shown in this list depend on the set computation method *Md.*K (see below) for the inverted compressibility factor ratio:

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

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

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

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

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

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

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

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

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

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

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

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

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

(Legends: see page 22)

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 z_b = compressibility factor at base conditions.

The computation of z and zb takes place according to S-Gerg-88 or AGA-NX19, depending on the setting of *Md.K*. The gas analysis values *Ho.b*, *CO2*, *H2* and *Rhob* (*Md.*K = 1), resp. *N2* and *dr* (*Md.K* = 2, 3 and 4) need to be included in the entries for this (→ 3.6).

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

pbX Pressure at base conditions for gas analysis input

TbX Temperature at base conditions for gas analysis input

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

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

Ho.b	Calorific value	
CO2	Carbon dioxide content	
H2	Hydrogen content	(only for *Md.K* = 1)
Rhob	Density gas at base conditions	(only for *Md.K* = 1)

N2 **Nitrogen content** (only for *Md.K* = 2 and 4)
dr **Density ratio** (only for *Md.K* = 2, 3 and 4)

Depending on the set K-value mode these four gas analysis values must be entered so that the inverted compressibility factor ratio *K* can be computed.

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

Ho.b	6,0	...	13,0	kWh/m^3	
CO2	0,0	...	30,0	Mol-%	
H2	0,0	...	10,0	Mol-%	(only for Md.K = 1)
Rhob	0,71	...	1,16	kg/m^3	(only for Md.K = 1)
N2	0,0	...	30,0	mol-%	(only for Md.K = 2)
dr	0,554	...	0,900		(only for Md.K = 2)

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 *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* (→ 3.1) are determined with the calculated K-value or with the constant K-value, *K.F*:
Md.K = "0": The fixed value (substitute value) *K.F* is used.
Md.K = "1": The K-value is calculated according to S-Gerg-88.
Md.K = "2": The K-value is calculated according to AGA-NX19.
Md.K = "3": The K-value is calculated according to AGA 8 gross char. method 1.
Md.K = "4": The K-value is calculated according to AGA 8 gross char. method 2.
Md.K = "5": The K-value is calc. acc. to AGA-NX19 following Herning & Wolowsky

3.7 Archive list

AD	Designation / value	Unit	Access	Address	DC
ArMP	Measurement period archive	-	(S)	3:A30	8
ArDay	Day archive	-	(S)	7:A30	8
MPer	Measurement period	Minutes	S	4:150	8
FrMP	Measurement period archive, freeze	-	S	3:A50	2

(Legends: see page 22)

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

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

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

ArMP Measurement period archive

Entry point for the measurement period archive where counter readings and measurements are archived in the cycle of the measurement period *MPer*. The archive has approx. 1500 data rows, corresponding to a memory depth of about 2 months for a measurement period of 60 minutes.

Each archive data row has the following entries:

↔ to "Check"								↔
	ABNo Block no.	Time Saving time	Vb Volume at base cond.	Δ Vb Counter progress	VbT Totaliser Vb	Δ VbT Counter progress	Vm Actual volume	
↔	Δ Vm Counter progress	VmT Totaliser Vm	Δ VmT Counter progress	p.MP Ø Pressure mean	T.MP Ø Temperature mean	K.MP Ø Inv. compr. ratio factor mean	C.MP Ø Conversion factor mean	↔
↔	St.2 Status 2 (incl. Vb)	St.4 Status 4 (incl. Vm)	St.7 Status 7 (incl. p)	St.6 Status 6 (incl. T)	St.Sy System status	Er Triggering event	Check Checksum	↔ to "ABNo."

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

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

With the aid of the "WinPADS" parameterization software and with the calibration lock open, the setting can be made at which counter and associated counter progress values are saved in this archive.

		Standard setting	
Meaning	Address	Value	Meaning
1st counter in the archive	3:0C00	2:0300	Vb
2nd counter in the archive	3:0C01	2:0302	VbT
3rd counter in the archive	3:0C02	4:0300	Vm
4th counter in the archive	3:0C03	4:0302	VmT

ArDay Day archive

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

The structure and content correspond to the measurement period archive ArMP (see above).

In some special versions of the EK230 an archive status ("ASR7") is saved additionally after the system status StSy.

MPer Measurement period

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

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

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

FrMP Measurement period archive, freeze

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

3.7.1 Find function for checking the archive entries

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

- Block number
- Date and time
- Counter reading

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

3.8 Status list

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

(Legends: see page 22)

S.Reg Status register, total

Stat Momentary register, total

The EK230 supplies two types of status information: Momentary status (also known as "status") and the status register.

Messages in the momentary status point to current statuses such as for example, errors that are present. When the state is no longer present, the corresponding message in the momentary status disappears. Manual deletion is not possible. Alarms, warnings and reports (i.e. messages with numbers in the range from "1" to "16") are displayed in the momentary statuses.

In the status register all messages since the last manual clearing are collected. Here, you can also see what has happened, for example, since the last station inspection. The messages can be cleared in this list with the command "Clr".

Only alarms and warnings (i.e. messages with numbers in the range from "1" to "8") are displayed in status registers. Reports are not entered because they identify states which are not problematical or may even be intended (e.g. "Daylight saving", "Calibration lock open" or "Data transfer running").

S.Reg and Stat initially show all existing messages as numbers. With the entry of <ENTER> they can be recalled individually as short texts: First the most important message (with the lowest number) is displayed. With the keys [→] and [←] you can change to the next, respectively the previous message.

In addition to the short text the display also shows

- in the upper row to the right the associated status register name and
- in the lower row to the left the message number (prefixed with "#").

You need the status register name and the message number, for example, for entering a "status pointer" for the outputs (SpO1, SpO2, etc., , page 59).

All status messages are listed in Chapter 3.8.1(from page 40).

Deleting messages:

After entering <ENTER> the messages in *SReg* (not in *Stat*) can be cleared (acknowledged) singly by pressing the key combination [←] + [↑] . With the command *Clr* (see below) all messages in "*SReg*" can be cleared simultaneously.

Clr Clear status register

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

Logb. Logbook (event logbook)

Entry addresses for the logbook in which the last 250 status changes are archi ved.

Each archive data row has the following entries:

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

AudTr Audit trail (changes logbook)

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

Each archive data row has the following entries:

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

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

3.8.1 List of status messages

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

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

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

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

Restart Restart of the device Message 1 in
The device was started without usable data. Counter readings and archives are empty, the clock has not been set.

C-fact. err. Conversion factor cannot be computed Message 1 in St.5
The conversion factor *C* (→ 3.6) cannot be computed because the temperature *T* (→ 3.5) is outside the range or no usable inverted compressibility factor ratio *K* (→ 3.6) is available (cf. message "*K-val. error.*").
Possibly the temperature sensor is not connected correctly or the substitute value for the inverted compressibility factor ratio *K.F* (→ 3.6) has the value "0".
The conversion factor is set to "0" and disturbance quantities for *Vb* are counted in *VbD* (→ 3.2).
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.

T Alarm Lim. Alarm limits for temperature violated Message 1 in St.6
The measured gas temperature *T.Mes* is located outside of the set alarm limits TMin, TMax (→ 3.5).
While ever this message is present in St.6, the substitute temperature *T.F* (→ 3.5) is used for volume correction and disturbance quantities are counted for Vb and Vm (→ 3.2, 3.3).
The alarm limits can be changed with the calibration lock open. If they are set to the same value, they are ignored, i.e. they cannot give rise to any alarm messages nor disturbance quantities.

p Alarm Lim. Alarm limits for pressure violated Message 1 in St.7
The measured gas pressure p.Abs is located outside of the set alarm limits *pMin*, *pMax* (→ 3.4).
While ever this message is present in St.7, the substitute pressure *p.F* (→ 3.4) is used for volume correction and disturbance quantities are counted for Vb and Vm (→ 3.2, 3.3).
The alarm limits can be changed with the calibration lock open. If they are set to the same value, they are ignored, i.e. they cannot give rise to any alarm messages nor disturbance quantities.

K-val. error Inv. compr. ratio factor cannot be computed Message 1 in St.8
The inverted compressibility factor ratio *K* (→ 3.6) cannot be computed because no valid compressibility factor could be determined. (cf. message "*C-fact. err.*")
While ever this problem exists, the substitute value K.F is used for the inverted compressibility factor ratio and disturbance quantities are counted for Vb and Vm (→ 3.2, 3.3).

Z-fact. err. Compressibility factor cannot be computed Message 1 in St.9
At least one of the gas analysis values Ho.b, 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* (→ 3.2, 3.3). If a valid value has not yet been able to be calculated (because the gas analysis has not till now been correct), the compressibility factor is set to "0". Consequently therefore, also no inverted compressibility factor ratio can be computed. (See above: message "*K-val. error*").

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

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

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

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

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

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

Dat. restore Data has been restored Message 3 in StSy

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

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

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

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

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

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

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

Outp.4 error Error on Output 4 Message 4 in St.4

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

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

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

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

Input 2 (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. With a deviation which is too large, this message is displayed.

Settings for the pulse comparison can be made with *MdMI2*, *SC.I2*, *L1.I2*, *G3.I2* und *SpI2*. Further explanation for this: → 3.11.

Settings e. Setting error Message 8 in StSy

On account of the programming that has been carried out, an unusable combination of settings arose, e.g. a value which cannot be processed in a certain mode.

Detailed information can be called up with special read-out programs via the serial interface under the address 1:1FA. However, they are coded and can only be

interpreted by Elster GmbH.

I2 Warn.sig. Warning signal on Input E2 Message 8 in St.2

Input 2 can be parameterised for monitoring as a pulse or signal input. When set as signalling input, here this message is displayed while ever an active signal is present, i.e. the terminals are connected through a low resistance. For connection of a contact for tamper detection, the warning input can also be set such that message "8" is displayed here while ever an inactive signal is present, i.e. the terminals are open.

Settings for the message input can be made with MdMI2, SC.I2, L1.I2, G3.I2 und *SpI2*. Further explanation for this: → 3.11.

I3 Warn.sig. Warning signal on Input E3 Message 8 in St.3

This message is displayed, for example, while ever an active signal is present, i.e. the terminals are connected through a low resistance. For connection of a contact for tamper detection, the warning input can also be set such that this message is displayed while ever an inactive signal is present, i.e. the terminals are open.

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

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

The calculated remaining battery service life *Bat.R* (**à** Service list, Chapter 3.10) has fallen below the set limit.

The limit can be changed via the serial interface under the address 2:4A1. The standard setting is 3 months. So long as this message is displayed, the "B" in the display field "Status" flashes (**à** 2.2.1).

Repair mode Repair mode switched on Message 10 in StSy

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

Clock n. set Clock not set Message 11

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

online Data transmission running Message 13 in StSy

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

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

I2 Rep.sig. Report signal on Input E2 Message 13 in St.2

Input 2 (E2) can, for example, be used as a time-synchronous input. As long as the input receives an active signal (i.e. the terminals are connected through low resistance), this message is displayed.

Settings for the message input can be made with MdMI2, SC.I2, L1.I2, G3.I2 und *SpI2*. Further explanation for this: → 3.11.

I3 Rep.sig. Report signal on Input 3 Message 13

Input 3 (E3) can, for example, be used as a time-synchronous input. As long as the input receives an active signal (i.e. the terminals are connected through low resistance), this message is displayed.

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

With special parameterization for the connection an FE230 Function Expansion, this

message means "Data transmission running via FE230".

Remote clock Remote clock setting starter Message 14 in StSy

This message is entered when the EK230 starts to set its clock by remote transmission. It is deleted again when it has been successfully concluded.

If this message remains entered longer than a few minutes, the function "Automatic setting of clock by remote transmission" is activated, but could not be executed. Possible causes of this may be, for example:

- A modem which is ready for operation is not connected.
- An interface mode *Md.S2* (**à** 3.13) is set, with which the function is not possible. *Md.S2* must be set to "3" or "6".
- The telephone number *TNoCS* (**à** 3.13.1) for the time service is not correct.
- On calling the time service, it was engaged for a long period.
- The deviation of the device clock from the clock of the time service is greater than *DevCS* (**à** 3.13.1).

Further details on the function "Automatic setting of the clock by remote transmission" **à** 3.13.1.

Calibration lock Calibration lock open Message 14 in St.1

For protection against unauthorised parameterization or reading out via a serial interface, the EK230 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 (→ 5.9). Closure is also possible by deleting the value "*St.PL*" (→ 3.10) via the keypad or interface. While ever this message is displayed in St.1, the "P" in the display field "Status" flashes (→ 2.2.1).

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

For protection against unauthorised parameterization or reading out via a serial interface, the EK230 has a total of four locks: Calibration, manufacturer's, supplier's and customer's locks.

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

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

For protection against unauthorised parameterization or reading out via a serial interface, the EK230 has a total of four locks: Calibration, manufacturer's, supplier's and customer's locks.

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

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

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

For protection against unauthorised parameterization or reading out via a serial interface, the EK230 has a total of four locks: Calibration, manufacturer's, supplier's and customer's locks.

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

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

Batt. operat. Battery operation Message 15 in StSy

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

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

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

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

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

In the system list (→ 3.9) you can set under *MdTim* whether the EK230 carries out automatic daylight saving switchover or not.

Call Win.1 Call acceptance time window 1 is active Message 16 in St.1

Call Win.2 Call acceptance time window 2 is active Message 16 in St.2

The EK230 provides two time windows within which a modem connected to the serial interface accepts calls for data interrogation. Outside of these time windows calls are ignored, so that, for example, a person located in the station can be called via a telephone connected to the same telephone line.

The message indicates that the time window 1 (→ 3.13 Interface list) programmed with *CW1.S* and *CW1.E* (*Call Win.1*) resp. with *CW2.S* and *CW2.E* (*Call Win.2*) is active, i.e. the EK230 accepts calls.

3.8.2 Status register addresses

To read out the status information via the interface or to accept it into the user list (→ page 23), its addresses are needed (cf. table on page 40):

AD *	Description	Address
Stat	Total momentary status	1:100
StSy	System momentary status	2:100
St.1	Momentary status 1	1:110
St.2	Momentary status 2	2:110
St.3	Momentary status 3	3:110
St.4	Momentary status 4	4:110
St.5	Momentary status 5	5:110
St.6	Momentary status 6	6:110
St.7	Momentary status 7	7:110
St.8	Momentary status 8	8:110
St.9	Momentary status 9	9:110

AD *	Description	Address
SReg	Total status register	1:101
SRSy	System status register	2:101
SR.1	Status register 1	1:111
SR.2	Status register 2	2:111
SR.3	Status register 3	3:111
SR.4	Status register 4	4:111
SR.5	Status register 5	5:111
SR.6	Status register 6	6:111
SR.7	Status register 7	7:111
SR.8	Status register 8	8:111
SR.9	Status register 9	9:111

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

3.9 System list

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

(Legends: see page 22)

Time Date and time

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

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

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

MdTim Daylight saving

"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 EK230 does not find any suitable value during the correction attempt, it rejects the entry with error message "6". (→ **2.3.3**)

In applications subject to official calibration EN 12405 *MCyc* must be less than or equal to 2030 seconds.

The standard setting is 2030 seconds.

With settings less than 2030 seconds the battery service life is reduced. (→ B-2 Batteries)

OCyc Operating cycle time

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

OCyc must only be set to values which are integer factors or multiples of 60 seconds and which are also integer multiples of *MCyc* (see above). Entries of other values are, where possible, corrected automatically. If the EK230 does not find any suitable value during the correction attempt, it rejects the entry with error message "6". (→ **2.3.3**)

In addition, *OCyc* must be an integer factor of the measurement period *MPer* (→ 3.7) so that the measurement period values can be concluded at the correct points in time.

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

With settings less than 300 seconds the battery service life is reduced. (→ B-2 Batteries)

Disp Time before display switches off

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

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

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

Ta.Rg Ambient temperature range

The permissible ambient temperature for the EK230 in operation subject to calibration regulations.

Aut.V Time to changeover to standard display

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

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

The standard setting is 1 minute.

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

Vers Software version number

Chk Software checksum

Version number and checksum provide clear identification of the software implemented in the EK230.

By pressing the key combination <ENTER> (- + ¯) during the display of *Vers*, the size (number of entries) of the measurement period archive *ArMP* (**à** 3.7) can be called. Return to *Vers* is with the key combination <ESC> (- + **à**).

3.10 Service list

AD	Designation / value	Unit	Access	Address	DC
Bat.R	Remaining battery service life	Months	-	2:404	15
Bat.C	Battery capacity	Ah	S	1:1F3	8
St.SL	Supplier's lock: Status / close	-	K	3:170	7
Cod.S	Supplier's combination, enter / change	-	S	3:171	11
St.CL	Customer's lock: Status / close	-	K	4:170	7
Cod.C	Customer's combination, enter / change - or	-	K	4:171	11
St.PL	Calibration lock: Status / close	-	C	1:170	7
Adj.T	Clock adjustment factor	-	C	1:452	8
Save	Save all data	-	S	1:131	2
Clr.A	Clear measurement archives	-	C	1:8FD	8
Clr.V	Clear counters (incl. archive)	-	C	2:130	2
Clr.X	Initialise device	-	C	1:130	2
Bin.T	Temperature binary value	-	-	5:227	4
Bin.p	Pressure binary value	-	-	6:227	4
Addr	Address for user display	-	S	14:1C2	21
...	User display (value under address "Addr")	...	...	...	...
WRp	Repair counter W	kWh	S	1:305	12
VbRp	Repair counter Vb	m3	S	2:305	12
VmRp	Repair counter Vm	m3	S	4:305	12
Rep.	Repair mode on / off	-	C	1:173	7
ArCal	Frozen values	-	(S)	6:A30	8
Frz.	Freeze	-	S	6:A50	2
-	Display test	-	-	1:1F7	1

(Legends: see page 22)

Bat.R Remaining battery service life

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

If *Bat.R* is less than 3 months, "Batt. low" (→ page 43) is displayed in the system status 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 the measurement cycle MCyc (→ 3.9), operating cycle OCyc (→ 3.9), input mode Md.I1 (→ 3.11) and display switch-off Disp (→ 3.9) are taken into account during the computation of the remaining battery service life. Future operating conditions, e.g. changing the settings, duration of readouts or frequency of key operations cannot be foreseen however and therefore lead to a

corresponding uncertainty for the displayed remaining battery service life. For data readouts, a mean future duration of 15 minutes per month is estimate.
To increase the service life two batteries instead of one can be used. In this case double the value (e.g. 26.0 Ah) must be entered for Bat.C (see below) after inserting the batteries.

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

St.SL Supplier's lock(status / close)

Cod.S Supplier's combination (enter / change)

St.CL Customer's lock (status / close)

Cod.C Customer's combination (enter / change)

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

Open lock: Enter the correct combination (numerical code)

Close lock: Clear *St.SL* resp. *St.CL*.
(← + ↑ in the entry mode, → 2.3.1, Data Class 6).

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 "F" is followed again by "0", i.e. the key ↑ changes "9" to "A" and "F" to "0".

St.PL Calibration lock (status / close)

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

Opening the calibration lock: Only with the sealed pushbutton (→ 5.9).

Closing the calibration lock: Either by pressing the pushbutton again or by clearing *St.PL* via the interface or keypad (← + ↑ in the entry mode, → 2.3.1, Data Class 6).

Adj.T Clock adjustment factor
Adj.T is the deviation of the running accuracy of the clock at room temperature in per mil ($\check{z}10^{-3}$). The EK230 uses *Adj.T* to optimise the running accuracy of the clock.
The adjustment of the clock is carried out in the factory.
Provided no value has been entered for *Adj.T*, the EK230 displays the message "Batt. low" in the status *Stat*.

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

Clr.A Clear measurement archives
All measurement archives (not log book and changes log book "audit trail") are cleared. This function is particularly practicable after the measuring point of the EK230 is changed.
In order that the archives are not unintentionally deleted, the following safety mechanism is integrated: To clear the archives the EK230 serial number (found on the name-plate of the device) must be entered.

Clr.V Clear counters (incl. archive)
All the counter readings and archives are cleared.

Clr.X Initialise device
All data (counter readings, archives and settings) are cleared.
To ensure that this function cannot be executed with the calibration lock open, the following safety mechanism is included: *Clr.X* can only be executed after the clock (**à** 3.9, Time) has been set (initialised) to its starting value with the key combination ¬ + - . Otherwise, an attempt to execute *Clr.X* results in the error message "13" appearing in the display.

Bin.T Temperature binary value

Bin.p Pressure binary value
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).

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

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

ArCal Frozen values

Frz. Freeze

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

The calibration archive is especially intended for operating points checks.

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

↔ to "Check"	ABNo Block number	Time Saving time	Vb Volume at base cond.	Δ Vb Counter progress	Vm Actual volume	Δ Vm Counter progress	↔
↔	VbRp Repair counter	Δ VbRp Counter progress	VmRp Repair counter	Δ VmRp Counter progress	p Pressure	T Temperature	↔
↔	K Inv. compr. ratio factor	C Conversion factor	Qb Flow at base cond.	Qm Actual flow	Check Checksum	↔ to "ABNo"	

\- Display test

The display flashes to test all segments.

3.11 Input list

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

(Legends: see page 22)

cp.I1 cp value Input 1

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

cp.I2 cp value Input 2

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

Md.I2 Mode for Input 2

The application of Input 2 (I2) can be defined here.

0: Switched off (input is not used).
1: Counting input.
2: Status input.

When the input is used as a counting input, the EK230 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 EK230 can, for example, signal attempts at tampering on a pulse generator of the gas meter, provided the meter also supports this.
After setting *Md.I2* the function on Input 2 is particularly defined with *MdMI2* (see below).

St.I2 Status on Input 2
If *Md.I2* = "2" (see above), the status of Input 2 is displayed here:
St.I2 = 0: Input signal is inactive (no signalling).
St.I2 = 1: Input signal is active (signalling).

MdMI2 Mode for monitoring E2

SC.I2 Source for monitoring E2

L1.I2 Limit 1 E2

L2.I2 Limit 2 E2

SpI2 Status pointer for monitoring E2

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

Depending on the application of Input 2 as counting or status input (see above: *Md.I2*), the following functions can be realised by setting these values:
If Input 2 is a counting input, the function "pulse comparison" can be set.
If Input 2 is a status input, the functions "active warning input", "inactive warning input", "active reporting input", "inactive reporting input" and "time-synchronous input" can be set.
"Warning input" signifies that the status message "*I2 Warn.sig.*" is affected. This is entered in the momentary status *St.2* and in the status register *SR.2*.
"Reporting input" signifies that the status message "*I2 Rep.sig.*" is affected. This is only entered in the momentary status *St.2* and not in the status register.
"Active": A signal arises when the input terminals are short-circuited (switch to switching point "on", → B-4 Pulse and status inputs).
"Inactive": A signal arises when the input terminals are parted (switch to switching point "off", → B-4 Pulse and status inputs).

Programming takes place according to the following table:

a) E2 is a <u>counting input</u> (*Md.I2* = "1")

- Pulse comparison on Inputs 1 and 2

Value	Setting	Comment
Md.I2	1	Input mode "counting input"
MdMI2	17	Monitoring mode "pulse comparison"
SC.I2	01:226_0 = "*PulE1*"	Address of pulse counter for Input 1
L1.I2	4	Maximum number of disturbance pulses
L2.I2	1000	Pulse windows per disturbance pulse
SpI2	0.05_02:1.1 = *I2 Pulse cmp*↑	Pointer to message "5" in status 2

With this setting the pulses counted on Inputs 1 and 2 are compared:
If the pulse counters on Input 1 and Input 2 differ by more than 4 pulses (= *L2.I2*) in 4000 pulses (= *L1.I2 ž L2.I2*), the message "*I2 Pulse cmp*" is displayed in the status *Stat*.

b) E2 is a <u>status input</u> (*Md.I2* = "2")

- Input 2 is an <u>active</u> warning input (input for warning signal):

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

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

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

- Input 2 is an active <u>reporting</u> input (input for report signal):

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

- Input 2 is an inactive <u>reporting</u> input (input for report signal):

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

- Input 2 is time-synchronised input:

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

Time synchronisation can occur under the following conditions:

- There must be a pulse on the input within one minute before or after a full hour. The deciding factor is the time in the EK230.
- Only one synchronisation per hour can occur.

St.I3 Status on Input 3

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

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

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

MdMI3 Mode for monitoring E3

Qu.I3 Source for monitoring E3

L1.I3 Limit 1 E3

SpI3 Status pointer for monitoring E3

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

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

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

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

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

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

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

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

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

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

- Input 3 is time-synchronised input:

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

Time synchronisation: See "Input 2 is time-synchronised input" (page 54).

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

3.12 Output list

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

(Legends: see page 22)

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

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

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

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

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

The four signal outputs of the EK230 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 (*SpO...*, 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 *SpO...* must be parameterised.

Md.A..	Meaning	To program:		
		SC.A...	*cp.A...*	*SpO...*
0	Output switched off (transistor blocking, "switch open")	-	-	-
1	Volume pulse output, logic active	Yes	Yes	-
2	Status output, logic active (signalling active => output switched on)	-	-	Yes
3	Time-synchronised output, logic active	Yes	-	-
4	Output switched on (transistor conducting, "switch closed")	-	-	-
5	Volume pulse output, logic inactive	Yes	Yes	-
6	Status output, logic inactive (signalling active => output switched off)	-	-	Yes
7	Time-synchronised output, logic inactive	Yes	-	-
9	Event output, logic active (message active => output switched on)	-	-	Yes
10	Event output, logic inactive (message active => output switched off)	-	-	Yes
99	Continuous pulse (for test purposes)	-	-	-

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

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

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

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

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

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

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

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

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

cp.O1 ... cp.O4 cp value for Outputs 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 = V ž *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. messages "Outp.1 Error" to "Outp.4 Error, page 42).

*SpO*1 ... *SpO*4 Status pointer for Outputs 1...4

The status pointers SpO1 ... Sp04 determine which status messages an output represents which is parameterised as a status or event output.

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

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

If the output is programmed as status or event output "with active logic" (*Md.A...*= 2 or 9), then *Sz.A...* sets with which status messages of the momentary status → (3.8) the output is to be switched on. If none of the selected messages is present, the output remains switched off.

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

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

There are two basic ways of selecting status messages with *SpO...*:

- Selection of a single message.
- Selection of a message group.

Example of a "message group":

"Messages 1 to 8" signify that the output is switched while ever one or more of the messages with the number "1" to "8" is present in the momentary status.

"Message groups" always start with the message "1" ("any of the messages 1 to ..."). It is not possible, for example, to select the messages "3 to 5".

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

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

SpO... = „mm_0s:1.1“
where s = 1 to 9 for *St.1* to *St.9*
Example:
"0.08_03:1.1“ signifies message 8 in Status St.3 ("I3 Warn.sig.“ → page 43).

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

SpO... = "mm_02:2.1"
Example:
"0.03_02:2.1" signifies: Message 3 in the system status *St.Sy* ("Data restore" → page 42)

c) A message in the system status *Stat*

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

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

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

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

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

f) Message group in the total status *Stat*

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

3.12.1 Brief summary of output parameterisation

s Output switched off ..... *Md.A...* = 0

s Volume pulse output, logic active (1) or inactive (5) ..... *Md.A...* = 1 or 5

Selection of the volume counter: .....

- Vb Volume at base conditions, undisturbed ..... *SC.A...* = 02:300_0
- VbD Volume at base cond., disturbance quantity .. *SC.A...* = 02:301_0
- VbT Volume at base conditions, total quantity..... *SC.A...* = 02:302_0
- Vm Actual volume, undisturbed ..... *SC.A...* = 04:300_0
- VmD Actual volume, disturbed..... *SC.A...* = 04:301_0
- VmT Actual volume, total quantity..... *SC.A...* = 04:302_0

Setting of the cp value ..... *cp.A...* = **...**

s Status output, logic active or inactive ..... *Md.A...* = 2 or 6

s or **event output, logic active or inactive** ..... *Md.A*... = 9 or 10

¢ Selection of the status message(s):

- A message in a status *St.1* to *St.9* ..... *SpO...* = 0.mm_0s:1.1 *
- A message in the system status *St.Sy*..... *SpO...* = 0.mm_02:2.1 *
- A message in the total status *Stat*..... *SpO...* = 0.mm_01:2.1 *
- Message group in a status *St.1* to *St.9*..... *SpO...* = 1.mm_0s:1.1 *
- Message group in the system status *St.Sy* ..... *SpO...* = 1.mm_02:2.1 *
- Message group in the total status *Stat*..... *SpO...* = 1.mm_01:2.1 *

s Time-synchronised output, logic active (3) or inactive (7) .... *Md.A...* = 3 or 7

¢ Time-point setting:

- At the start of each month at 0 hrs. ..... *SC.A...* = 01:143_0
- At the start of each month at 6 hrs. ..... *SC.A...* = 02:143_0
- At the start of each day at 0 hrs. ..... *SC.A...* = 01:142_0
- At the start of each day at 6 hrs. ..... *SC.A...* = 02:142_0
- At the start of each hour ..... *SC.A...* = 01:403_0
- At the start of each minute ..... *SC.A...* = 01:402_0
- At the start of each measuring period ..... *SC.A...* = 04:156_0

s Continuous pulse (for test) ..... *Md.A...* = 99

s Output switched on ..... *Md.A...* = 4

s Output switched off ..... *Md.A...* = 0

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

3.13 Interface list

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

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

AD	Designation / value	Unit	Access	Address	DC
Md.S2	Mode, Interface 2	-	S	2:705	7
DF.S2	Data format, Interface 2	-	S	2:707	7
Bd.S2	Baud rate, Interface 2	Bd	S	2:708	7
Num.T	Number of ringing tones before accepting call.	-	S	2:720	8
M.INI	Initialise modem	-	S	2:728	2
CSync	Automatic setting of clock by rem. data trans.	-	(C)	2:7D4	8
GSM.N	GSM network	-	-	2:775	4
GSM.L	Reception level	%	-	2:777	4
Bd.S1	Baud rate, Interface 1	Bd	S	1:709	7
CW1.S	Call acceptance window 1, start	-	S	5:150	8
CW1.E	Call acceptance window 1, end	-	S	5:158	8
CW2.S M.Cw1	Call acceptance window 2, start or: Status message "Call Acceptance Window 1"	-	S	6:150	8
CW2.E M.onl	Call acceptance window 2, end or: Status message "FE230 online"	-	S	6:158	8

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

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

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

AD	Designation / value	Unit	Access	Address	DC
Md.S2	Mode, Interface 2	-	S	2:705	7
DF.S2	Data format, Interface 2	-	S	2:707	7
Bd.S2	Baud rate, Interface 2	Bd	S	2:708	7
Modb	MODBUS	-	(E)	1:1C1	8
Bd.S1	Baud rate, Interface 1	Bd	S	1:709	7
CW1.S	Call acceptance window 1, start	-	S	5:150	8
CW1.E	Call acceptance window 1, end	-	S	5:158	8
CW2.S	Call acceptance window 2, start	-	S	6:150	8
CW2.E	Call acceptance window 2, end	-	S	6:158	8

(Legends: see page 22)

Md.S2 Mode, Interface 2

This value informs the EK230 of which device is connected to the internal (permanently wired) interface and how it is to be controlled.

All modes that can be set are described here. You can quickly find the setting suitable for your application in Chapter 4.1.

Md.S2 =

1 "With control line"

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

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

Connection diagram **à** Chapter 5.7.3

3 " Modem with return messages"

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

Suitable for the connection of an FE260 Function Expansion or a modem and an external power supply.

The EK230 controls the modem via the data lines using "return messages". The activation of the return messages occurs with the modem command "ATQ0V1".

Num.T (see below) is activated.

Md.S2 =

5 "Without control lines"

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

The baud rate selection changeover can be bypassed in this mode by setting the values under the addresses 02:708 (Bd.S2) and 02:709 to the same value. Ex-works the setting is: 02:708 = 02:709 = 19200 Bd. For this mode the EK230 needs an external power supply.

Suitable for the connection of the following devices:

- Modem with automatic call acceptance modem
- Modem with automatic call acceptance in or onat an FE260.
- Another device (no modem) with RS232 or RS485 interface connected to an FE260 for data interrogation
- Another device with RS232 or RS485 interface (e.g. PC, PLC) directly connected to the EK230.

Num.T *(see below) is not activated.*

In most cases the current requirement of the device in this mode is not just increased during the actual communication, but during the complete call acceptance time window. If it is set in battery operation, the time window should therefore be restricted as far as possible.

6 "Modem with return messages, battery mode" (e.g. for FE230)

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

In the mode *Md.S2* = 6 the EK230 handles, as with *Md.S2* = 3 (see above), the control of the modem via the data lines using "return messages". The modem is not parameterised for automatic call acceptance.

Suitable for the connection of an FE230 (pure battery operated application "Volume Conversion Device + modem", **à**).

Num.T (see below) is activated.

9 "Without control lines, battery operation"

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

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

The current requirement of the device in this mode is increased during the complete call acceptance time window. The time window should therefore be restricted as far as possible.

Suitable for the connection of an FE230 (pure battery operated application "Volume Conversion Device + modem", **à** 4.3.2).

For the special application "FE230" (**à** 4.3.2, 5.6.1) the setting can however be carried out using existing parameter files such that the power requirement is also only increased during the actual communication.

Md.S2 =

11 "IDOM protocol"

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

In the mode Md.S2 = 11 the IDOM protocol is available via the permanently wired interface. Further details **à** 3.13.2, page 70.

13 "MODBUS"

Modem control	RS232 control lines	Battery operation	Baud rate changeover
no	yes [1]	yes [1]	no

In the mode Md.S2 = 13 MODBUS protocol is available over the permanently wired serial interface. Refer to chapter 3.13.2 for more information.

DF.S2 Data format, Interface 2

Here the number of data bits, parity bit usage and number of stop bits are set for the data interchange between the EK230 and a device connected to the interface terminals.

For this there are three possible settings:

- "0" = 7e1 = 7 data bits, even parity, 1 stop bit
- "1" = 7o1 = 7 data bits, odd parity, 1 stop bit
- „2“ = 8n1 = 8 data bits, no parity, 1 stop bit

"0" (7e1) is the basic setting which is described in the applicable IEC 62056-21 interface standard.

Bd.S2 Baud rate, Interface 2

Here, the baud rate (speed) for the data transmission between the EK230 and a device connected to the interface terminals can be set.

Possible settings: 300, 600, 1200, 2400, 4800, 9600, 19200

With the application of baud rate selection changeover the baud rate is generally set according to IEC 62056-21 to "300". It is then only used briefly for initiating and terminating the data interchange. The actual baud rate for transferring the useful data is automatically increased.

With a modem connected (also within an FE260 Function Expansion) normally no automatic baud rate selection changeover occurs. Bd.S2 should then be set to "19200".

Num.T Number of ringing tones before answering

With some settings for *Md.S2* (see above) the setting can be made here of how many ringing tones the EK230 awaits until it accepts the call ("lifts receiver"). For entries, values in the range from 1 to 12 are accepted. Depending on the type of modem, the function is however only ensured with additional restrictions. (Refer to the instruction manual for the connected modem and to Chaps. 5.6 and 5.7).

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

Possible values are 1 to 12.

[1] Version RS232 only

M.INI Initialise modem

With this command you can initialise a connected modem when you, for example, are connecting an unparameterised modem or when the modem has lost its settings.

In particular when connecting a new modem, it must be ensured that a suitable initialization string is available under the address "2:0721" of the EK230. This can then be loaded using the "WinPADS" parameterization software.

Modb MODBUS parameters

Entry point in the submenu for setting the modbus parameters **à** 3.13.2.

CSync Automatic remote clock setting

Entry point in the submenu for setting the function "Automatic remote clock setting" **à** 3.13.2.

GSM.N GSM network operator

GSM.L Reception level

When using a mobile radio modem and with a suitable setting of *Md.S2* (see above), information regarding the mobile radio network can be recalled here once the EK230 has logged in.

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

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

The values of the reception level GSM.L have the following meaning:

0	at least -113 dBm	Poor reception
1	-111 dBm	...
2 to 30	-109 to -53 dBm	...
31	max. –51 dBm	good reception
99	(unknown)	

Bd.S1 Baud rate, Interface 1

Here, the baud rate (speed) for the data transmission between the EK230 and a device connected to the optical interface can be set.

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

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

CW1.S Call acceptance window 1, start

CW1.E Call acceptance window 1, end

CW2.S Call acceptance window 2, start - or:

M.Cw1 Status message "Call acceptance window 1"

CW2.E Call acceptance window 2, end - or:

M.onl Status message "Data transmission running via FE230"

With these values two different time windows can be set within which a data transmission is possible each day via the internal permanently wired interface . The EK230 does not respond outside of this time window.

It the value "0" is written to the two so-called "Pointers to the time windows" (addresses 2:722 and 2:723) using the parameterization software ("WinPADS"), communication is always possible independent of the time windows.

The EK230 compares the two time windows with the running time of day on a rhythm with the operating cycle, OCyc, (→ 3.9). If, for example, with a standard operating cycle of 5 minutes, the start of a time window is at 6:53 hrs., then it is first activated at 6:55 hrs.

For the connection of an FE230 Function Expansion special parameter files are available which are installed with the "WinPADS" parameterising program and which can also be loaded with it into the device. In this case the two display points *CW2.S* and *CW2.E* are changed into *M.Cw1* and *M.onl*:

M.Cw1 is the number of the message "Call Win.1" (→ page 27). *M.onl* is the number of the message "online" (→ page 43). The EK230 needs this information for the control of the FE230. M.Cw1 and M.onl must not be changed!

3.13.1 Submenu “Automatic remote clock setting”

AD	Designation / value	Unit	Access	Address	DC
MdCSy	Automatic setting of the clock on/off	-	S	14:157	7
TimCS	Time for setting the clock by remote data transmission	-	S	14:150	8
ScCSy	Cycle for setting the clock by remote data transmission	-	S	14:154	8
TNoCS	Tel. no. for setting the clock by remote data transmission	-	S	2:7D0	8
DevCS	Max. deviation for setting the clock	Minutes	S	2:7D1	8
DF.CS	Data format for setting clock by rem. data trans.	-	S	2:7D5	7
Sync	Command: Set clock by remote data transmission	-	S	2:7D3	2

(Legends: see page 22)

The EK230 can be set using these values such that it regularly calls a telephone time service via a connected modem and sets its clock.

If the function is active, the EK230 sets the message "Remote clock" in the system status StSy (→ page 44) with each call and then clears it again afterwards. If the setting of the clock does not function (e.g. because the telephone number is not correct or a modem ready for operation is not connected), the message "Remote clock" is retained until the start of the cycle in which the next time for setting the clock is located.

Example: The clock should be set monthly on the 2nd day at 23:00. If the setting of the clock on 2.5.2003 at 23:00 does not work, the message "Remote clock" is set at 2.5.2003 at 23:00 and cleared again on 1.6.2003 at 0:00 hrs.

Requirements for this function:

A modem ready for operation must be connected to the EK230.

The EK230 must be set to an interface mode *Md.S2* (**à** 3.13) in which it controls the modem, i.e. Md.S2 = 3 or 6. In all other modes the function is not possible, even if a modem is connected.

Dev.T (see below) must be set ≠ "0" and MdCSy = "6" to activate the function.

F *If you use the function "Automatic remote clock setting", take note of the following points:*

In the battery mode every data transmission costs additional battery capacity. If you use the function in the battery mode, you should therefore use larger cycles (*ScCSy,* see below).

With every setting of the clock an entry is made in the measurement period archive (**à** 3.7). The memory duration is reduced by this and the data transmission time extended. With daily setting of the clock you lose, for example, about 4% of the memory duration and the data transmission lasts about 4% longer. Therefore you should prefer to use longer cycles (**à** *ScCSy*, see below) where possible for this reason.

If you use this function with a number of devices, they should, if possible, be set to different times, so that they do not all try to call the time service at the same time.

MdCSy Switch automatic setting of clock on/off

To activate (switch on) the function " Automatic setting of the clock by remote data transmission" *MdCSy* = "6" must be set and *MdCSy* = "0" must be set to switch off.

TimCS Time of remote clock setting

ScCSy Cycle for remote clock setting

These two values are used for setting the recurring time points at which the cyclical setting of the clock occurs.

First, set the cycle (monthly, weekly or daily) with *ScCSy* and then the recurring time point with *TimCS*:

ScCSy =	⇒ Cycle	⇒ Format for *TimCS* *
0001:140_3	Daily	hh:mm
0001:140_4	Weekly	WW,hh:mm:ss
0001:140_5	Monthly	DD,hh:mm:ss

* WW = Week-day (So, Mo, Tu, ...); DD = Day in month (01, 02, ... 31); hh = Hour; mm = Minute; ss = Second

TNoCS Telephone no. for remote clock setting

Telephone number of the telephone time service. As standard, the telephone number of the time service of the German standards organisation (PTB) is entered.

DevCS Max. deviation for setting the clock

Maximum deviation between the device clock and the clock of the telephone time service. With larger deviations the clock is not set. If this value is set to "0", the function "Automatic remote clock setting" is switched off, but the message "*Remote clock*" in the system status is however generated as set with *TimeCS* and *ScCSy* (see above).

DF.CS Data format for setting the clock by remote data transmission

Setting of data bits, parity and stop bits specially and exclusively for the data transmissions for the setting of the clock by remote data transmission.

Possible settings:

- "0" = 7e1 = 7 data bits, even parity, 1 stop bit
- "1" = 7o1 = 7 data bits, odd parity, 1 stop bit
- "2" = 8n1 = 8 data bits, no parity, 1 stop bit

The setting must conform to that used by the time service which is called up with TNoCS (see above). The standard setting is "2" (8 data bits, no parity, 1 stop bit).

Sync Command: Set clock remotely

Entering "1" causes immediate setting of the clock remotely.

3.13.2 Submenu "IDOM protocol"

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

(Legends: see page 22)

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

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

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

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

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

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

The disturbance signal "@" is sent if a status message with a code 12 or lower is entered in the momentary status. (→ Chap. 3.8.1, page 40)

Examples of the IDOM protocol data block:

Va:00000006↵Vr:00000005↵P1.230↵T26.05↵

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

3.13.3 Submenu “MODBUS parameters”

AD	Designation / value	Unit	Access	Address	DC
MBDir	Data direction	-	S	2:7B0	7
MBTrM	Transmission mode	-	S	2:7B1	7
MBAdr	Device address (slave address)	-	S	2:7B2	8
MAd1	MODBUS address of register 1	-	S	1:8C0	8
LAd1	LIS-200 address for register 1	-	S	1:8C1	21
Fmt1	MODBUS data format for register 1	-	S	1:8C2	8
MAd2	MODBUS address register 2	-	S	2:8C0	8
LAd2	LIS-200 address register 2	-	S	2:8C1	21
Fmt2	MODBUS data format register 2	-	S	2:8C2	8
…	…	…	…	…	…
MAd40	MODBUS address register 40	-	S	40:8C0	8
LAd40	LIS-200 address register 40	-	S	40:8C1	21
Fmt40	MODBUS data format register 40	-	S	40:8C2	8

(Legends: see page 22)

In the mode Md.S2 = 13 MODBUS protocol is available over the permanently wired serial interface, only. You can read and write values and read out the measuring period archive.

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

For the MODBUS communication external power-supply to the EK230 is necessary and at least one “call acceptance window” has to be open. In addition, in the Interface list “Ser.IO” ($\rightarrow$ 3.13) Md.S2 must be set to “13” and DF.S2 to ”0” or “2”, depending on the transmission mode MBTrM (see below).

MBDir Data direction

0 = most significant word in the first register

1 = least significant word in the first register (affects only values with binary formats Fmt1 … Fmt40, see below).

MBTrM Transmission mode

0 = ASCII-Mode – the contents of each register are transmitted as four ASCII coded hexadecimal digits. DF.S2 must be set to “0”

1 = RTU-Mode – the contents of each register are transmitted as two bytes. DF.S2 must be set to “2”.

MBAdr Device address (slave address)

Address of the EK230 in a MODBUS environment.

Range from 1 to 247 (0 = broadcast).

MAd1 … MAd40 Address of MODBUS registers 1 to 40

There are 40 MODBUS registers available in order to read and write values. To describe each MODBUS register, three values have to be programmed: the MODBUS register address MAd…, the corresponding LIS-200 address LAd… (EK230 value address) and the MODBUS data format code Fmt…

MODBUS register address range is from 1 to 65536

Fmt1 … Fmt40 Data format for MODBUS registers 1 to 40

The data format code of each register, see table below. For further details refer to separate documents, available from Elster GmbH.

code	format	no. of registers				
binary formats:						
3	number	1	value			
4	number	2	MS word high part	LS word low part		
32	exponential	2	MS word Bit 31 sign	 Bit 30…23 exponent	 Bit 22…16 mantissa high part	LS word Bit 15...0 mantissa low part
9	counter	3	MS word pre-decimal high part	... pre-decimal low part	LS word post-decimal	
decimal formats:						
17	BCD counter *	4	MS word pre-decimal digits	... 	... 	LS word post-decimal digits
	BCD timestamp *	4	MS word CCYY **	... MMDD **	... hhmm **	LS word ss00 **
16	BCD number	3	MS word 12 digits	...	LS word	
12	BCD time	1	hhmm **			

* counter or timestamp depending on assigned LIS-200 address (see below)

** CC = century, YY = year, MM = month, DD = day, hh = hour, mm = minutes, ss = seconds

LAd1 … LAd40 LIS-200 address for MODBUS registers 1 to 40

You cannot read all device information via MODBUS but only important values like counter readings and current measuring values. The lists below gives the standard adjustment. (“Reg.” = MODBUS register, „AD“ = Abbreviation designation)

Reg.	AD	Designation / value	Format code	Unit	Lis-200 address
1	Bat.R	Remaining battery service life	3	months	2:404
2	Stat	Actual status, total	3		1:100
3	VT	Total actual volume (post-decimal places)	3	10^{-4} m^3	4:302_2
4	VbT	Total volume at base conditions (post-decimal places)	3	10^{-4} m^3	2:302_2
5	W.T	Total Energy (post-decimal places)	3	10^{-4} kWh	1:302_2
101	VT	Total actual volume (pre-decimal places)	4	m^3	4:302_1
103	VbT	Total volume at base conditions (pre-decimal places)	4	m^3	2:302_1
105	W.T	Total Energy (pre-decimal places)	4	kWh	1:302_1
301	pb	Base pressure	32	bar	7:312_1
303	Tb	Base temperature	32	°C	6:312_1
305	p.Abs	Absolute pressure measurement	32	bar	6:210_1
307	p.Mes	Pressure measurement	32	bar	6:211_1
309	T.Mes	Temperature measurement	32	°C	5:210_1
311	C	Conversion factor	32		5:310
313	K	Inverted compressibility factor ratio	32		8:310
315	p.F	Substitude pressure	32	bar	7:311_1
317	T.F	Substitude temperature	32	°C	6:311_1
319	N2	Nitrogen content	32	%	14:314
321	H2	Hydrogen content	32	%	12:314
323	CO2	Carbon dioxide content	32	%	11:314
325	Rhob	Density gas at base conditions	32	kg/m^3	13:314_1
327	Q	Flow rate	32	m^3/h	4:310
329	Qb	Flow rate at base conditions	32	m^3/h	2:310
331	P	Power	32	kW	1:310
333	Ho.b	Calorific value	32	kWh/m^3	10:314_1
335	dr	Density ratio	32		15:314
337	p	Pressure	32	bar	7:310_1
339	T	Temperature	32	°C	6:310_1
501	VT	Total actual volume	9	m^3	4:302
504	VbT	Total volume at base conditions	9	m^3	2:302
507	W.T	W, total	9	kWh	1:302
801	VT	Total actual volume	17	10^{-4} m^3	4:302
805	VbT	Total volume at base conditions	17	10^{-4} m^3	2:302
809	W.T	Total Energy	17	10^{-4} kWh	1:302
813	Time	Date and time	17		1:400
817	SNo	Serial number	16		1:180
820	DayB	Day boundary	12		2:141_1

Example for parameterising MODBUS:

To read the 9 pre-decrement places of the total actual volume under MODBUS address “101” and the current measured temperature in °C under MODBUS address “309”, the following LIS200 parameters have to be set as described:

a) either enter values via keypad in the Modbus submenu of the Interface list:

input	comment
MAd1 = 101	MODBUS address “101”
LAd1 = 0004:302_1	LIS-200 address of the volume (see list above)
Fmt1 = 4	Format code of “number”, two registers (see list above)
MAd2 = 309	MODBUS address “309”
LAd2 = 0005:210_1	LIS-200 address of the temperature (see list above)
Fmt2 = 32	Format code of “exponential” (see list above)

b) or send a parameter file with the “WinPADS” software via the optical interface:

```
W1  01:08C0.0  (101)
W1  01:08C1.0  (0004:0302_1)
W1  01:08C2.0  (4)
W1  02:08C0.0  (309)
W1  02:08C1.0  (0005:0210_1)
W1  02:08C2.0  (32)
```

3.14 Energy list

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

(Legends: see page 22)

W Energy

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

W = Vb ž Ho.b where Vb = volume at base conditions (→ 3.2)
Ho.b = calorific value (→ 3.6)

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

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

P Power

Momentary power (energy per hour). P = Qb ž Ho.b

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

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

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

Ho.b Calorific value
This calorific value is used to compute the energy. Please note that it may differ from the calorific value of the gas analysis (→ 3.6, page 32) if pnX differs from pn (→ 3.4) or TnX differs from Tn (→ 3.5).

F The entry of the calorific value Ho.b in the energy list is not permitted (entry error code “6” will occur). Please change Ho.b only in the volume corrector list (→ 3.6, page 32).

WME W month end value

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

4 Applications

4.1 Rated operating conditions for the various conversion methods

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

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

The following correction methods are available for certain applications:

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

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

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

- +5 °C for gases with $H_{o,b} < 11.5$ kWh/m³
- +12 °C for gases with $H_{o,b} \geq 11.5$ kWh/m³

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

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

Fixed values for K, which differ from 1, may be suitable for measuring points, the absolute pressure of which always lies below 11 bar and for which the gas pressure and the gas temperature only vary within known limits. The fixed value must be calculated using one of the following methods:

- S-Gerg 88 after testing the reliability of the method (see below)
- AGA8-DC92 according to ISO 12213 Part 2 /1/

Through a calculation using the same method, it must be proven that the K-values only deviate by at the most 0.25% from this fixed value in the permissible measurement range (i.e. with compliance to the pressure and temperature limits). The principles of the calculation and the calculated results at the limits of the measurement range must be recorded in the operational and rating data book, page "Proof of measures implemented". The alarm limits p_{min}, p_{max}, T_{min} and T_{max} must be set according to the measurement range (see above).

S-Gerg 88 (Md.K = 1, see Chapter 3.6)

This method is suitable for natural gases and their mixtures

1.) at temperatures between -10°C and +60°C and for absolute pressures up to 26 bar

2.) at temperatures between -10°C and +60°C, also at absolute pressures above 26 bar, when the following conditions are fulfilled

- The amount of substance of the propane x_{C3} [in mol%] must lie within the limits given by the following equation in relationship to the amount of substance of the ethane x_{C2} [in mol%].

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

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

AGA8 Gross characterisation method 1 und 2 (Md.K = 3 and 4, see Chapter 3.6)

This method is suitable for temperatures between 0°C and 55°C for gas mixtures, whose relative density lies between 0.554 and 0.87, whose calorific value is between 5.2 kWh/m³ and 12.5 kWh/m³ and whose components comprise the following amounts of substances [in mol-%]:

CH_4	N_2	CO_2	C_2H_6	C_3H_8	C_4H_{10}	C_5H_{12}	C_{6+}	He	H_2	CO	H_2O	H_2S
≥ 45	≤ 50	≤ 30	≤ 10	≤ 4	≤ 1	≤ 0.3	≤ 0.2	≤ 0.2	≤ 10	≤ 3	≤ 0.05	≤ 0.02

C_4H_{10}: Sum of n-butane and i-butane;

C_5H_{12}: Sum of n-pentane and i-pentane;

C_{6+}: Sum of all hydrocarbons with at least 6 carbon atoms

AGA-NX19 and AGA-NX19 according to Herning and Wolowsky (Md.K = 2 and 5, see Chapter 3.6)

This method is suitable for applications for which it has been shown by a comparative calculation with the reference method AGA8-DC92 or (in its application range) S-Gerg 88 that no deviations of more than 0.1% occur.

4.2 Connection of a counter with LF pulse transmitter

Ex-works the maximum counting frequency of the EK230 Volume Conversion Device is parameterised to 2 Hz. Reparameterising to a maximum of 10 Hz is possible by trained specialist personnel with the calibration lock open. Changes to the input frequency must be noted in the operational and rating data book on the page "Proof of measures carried out".

4.3 Applications for Interface 2 (Version RS485)

4.3.1 FE260 Function Expansion

F *Connection see Chap. 5.6.1*

The FE260 is a mains-powered function expansion incl. Ex isolation and supply for the EK230. It has may have alternatively an integral modem or a connection for a commercially available modem.

For the connection of an FE260 with integral or separately connected modem, the following settings should be made under the interface list (→ 3.13):

- Md.S2 = **3** **With modem control by "return messages"** via data lines, without baud rate selection changeover. Num.T is activated.
  or = **5** * **Without modem control**. Either the modem accepts the call automatically or another device is connected to the FE260 (no modem). Num.T is not activated.
- Bd.S2 = 19200 * Baud rate 19200 Bd (or lower, depending on the device connected to the FE260)
- Num.T = ... Num.T is only activated with Md.S2 = 3.
  Possible values are dependent on the modem used, e.g.:
  - Standard modem (Insys) integrated in FE260..... 2 to 9
  - ISDN modem (Insys) integrated in FE260..... 2 to 9
  - GSM modem (Wavecom) integrated in FE260 ..... 1 to 9
  - Separate GSM modem Siemens M20T or TC35T 1
  - Separate analogue modem EM200 or Insys Onbit ..... 2 to 9

* Normally, modems do not execute any baud rate selection changeover so that with Md.S2 = "5" the values under the addresses 02:708 (Bd.S2) and 02:709 must be equal. For the connection of a device with baud rate selection changeover, the starting baud rate (normally 300 Bd) must be set under the Bd.S2 (address 02:708) and the baud rate identification under address 02:709.

4.3.2 FE230 Function Expansion with modem

F *Connection see Chap. 5.6.1*

The FE230 is a battery-powered function expansion with integral modem.

For this application extended parameterization of the device via the optical interface is required. Special parameter files are available for this which are installed with the "WinPADS" program and which can also be loaded into the device using the program.

After the parameterising process with "Md.S2 = 69", the settings for the read-out time window should be made under the interface list (→ 3.13).

- Md.S2 = 69 Without modem control. The modem accepts the call automatically. Battery operation is possible. The EK230 controls the modem and the call acceptance. Num.T is activated.
- Bd.S2 = 19200 Baud rate 19200 Bd
- Num.T = ... Num.T is not activated. 1 to 9 ("1" recommended)

! The power consumption of the device in this mode is increased during the complete call acceptance time window, which should therefore be restricted as far as possible !

4.3.3 Devices with RS485 interface (no modem)

F *For this applications the EK230 should be operated with needs an external power supply.*

F *Connection see Chap. 5.6.1, page 87.*

4.3.3.1 Device with standard protocol (according to IEC 62056-21)

For the connection of a device with RS485 interface without a modem, the following settings must be made under the interface list (→ 3.13):

- Md.S2 = 5 — No modem control by the EK230, without control signals, baud rate selection changeover possible
- Bd.S2 = 300 — With application of baud rate selection changeover according to IEC 62056-21 (procedure as for the optical interface) [1]
  - or = 19200 — Baud rate selection changeover bypassed

4.3.3.2 Device with MODBUS protocol

For the connection of a device with RS485 interface and MODBUS protocol, the following settings must be made under the interface list (→ 3.13):

- Md.S2 = 13 — MODBUS protocol, without baud rate changeover possible
- Bd.S2 = 9600 — Standard baud rate for MODBUS
- DF.S2 = 0 or 2 — Data format depending on transmission mode MBTrM (→ 3.133.13.3)

[1] The set baud rate is only used briefly for initiating the data interchange. The actual baud rate for transmitting the useful data is increased automatically to 9600 Bd.

4.4 Applications for Interface 2 (Version RS232)

4.4.1 Modem with control signals

F *For this applications the EK230 needs an external power supply.*

F *Connection see Chap. 5.75.7.1*

A commercially available modem with RS232 interface is connected to the internal serial interface of the EK230. For this application the EK230 needs an external power supply.

For the connection of a modem it must be parameterised for automatic call acceptance and the following settings must be made under the interface list (→ 3.13):

- Md.S2 = 1 No modem control by the EK230, with RS232 control lines, baud rate selection changeover possible
- Bd.S2 = 19200 19200 Bd - without application of baud rate selection changeover

Also, the values under the addresses 02:708 (Bd.S2) and 02:709 must be the same. The ex-works setting is: 02:708 = 19200 Bd and 02:709 = 19200 Bd.

4.4.2 Modem without control signals

F *For this applications the EK230 should be operated with needs an external power supply.*

F *Connection see Chap. 5.75.7.2*

A commercially available modem with RS232 / V.24 interface is connected to the internal serial interface of the EK230. For this application the EK230 needs an external power supply.

The following settings should be made under the interface list (→ 3.13):

- Md.S2 = **3** **The EK230 controls the modem by "return messages"** via data lines; without baud rate selection changeover; *Num.T* is activated.
  - or = **5** * **Without modem control** by the EK230, without baud rate selection changeover. *Num.T* is not activated. The modem accepts the call automatically
- Bd.S2 = 19200 * 19200 Bd
- Num.T = ... Only activated with Md.S2 = 3. Possible values depend on modem used, e.g.:
  - GSM modem Siemens M20T or TC35T..... 1
  - Analogue modem EM200 or Insys Onbit..... 2 to 9

* Normally, modems do not execute any baud rate selection changeover so that with Md.S2 = "5" the values under the addresses 02:708 (Bd.S2) and 02:709 must be equal.

  For the special case of a modem with baud rate selection changeover, the starting baud rate (e.g. 300 Bd) must be set under the Bd.S2 (address 02:708) and the baud rate identification (e.g. 19200 Bd) under address 02:709.

  The ex-works setting is: 02:708 = 19200 Bd and 02:709 = 19200 Bd.

4.4.3 Other devices with RS232 interface (no modem)

F *For all this applications the EK230 needs an external power supply.*

F *Connection see Chap. 5.75.7.3.*

4.4.3.1 Device with standard protocol (according to IEC 62056-21)

a) With baud rate changeover

The following settings must be made under the interface list (→ 3.13):

- Md.S2 = 1 No modem control by the EK230; with RS232 control line; baud rate selection changeover possible
- Bd.S2 = 300 300 Bd - with the use of baud rate selection changeover (procedure as for the optical interface) [1]

b) Without baud rate changeover

The following settings must be made under the interface list (→ 3.13):

- Md.S2 = 5 No modem control by the EK230; without RS232 control lines; without baud rate selection changeover
- Bd.S2 = 19200 19200 Bd - without the use of baud rate selection changeover

4.4.3.2 Device with MODBUS protocol

For the connection of a device with RS232 interface and MODBUS protocol, the following settings must be made under the interface list (→ 3.13):

- Md.S2 = 13 MODBUS protocol, without baud rate changeover possible
- Bd.S2 = 9600 Standard baud rate for MODBUS
- DF.S2 = 0 or 2 Data format depending on transmission mode MBTrM (→ 3.133.13.3)

[1] The set baud rate is only used briefly for initiating the data interchange. The actual baud rate for transmitting the useful data is increased automatically within the framework of the protocol e.g. to 19200 Bd.

4.3 Applications for interface 2 (RS232-EEx version)

4.3.1 Interface isolator MTL5051

F *For connection see Chap. 0.55.8.1, page 91).*

For this application it is necessary to send the wake-up call (NULL character string) according to IEC 62056-21.
The following settings should be made:

a) Using the baud rate changeover (recommended), maximum 19200 Bd:
- Md.S2 = 1
- Bd.S2 = 300 (Starting baud rate)
- 2:0709 = 19200 (Changeover baud rate)

b) Without using the baud rate changeover (recommended), maximum 9600 Bd:
- Md.S2 = 1
- Bd.S2 = 9600 (Start baud rate)
- 2:0709 = 9600 (Changeover baud rate)

When using the baud rate changeover, Bd.S2 is used only briefly to initiate the data traffic. Then, the actual baud rate for transferring the useful data is automatically selected. This can be set using the WinPADS parameterisation software under address 2:0709. The standard setting is 19200 Bd.
Without using the baud rate changeover reliable data transmission is possible up to a maximum of 9600 Bd.

If a PC with the WinPADS parameterisation software is connected to the MTL5051, the following settings are to be carried out under WinPADS:

a) With the use of the baud rate selection:

Settings > Interface > Link formation > .....Local connection
Settings > Interface > Local connection options
> Local connection baud rate > 300
Settings > Interface > Local connection options
> Baud rate changeover >..... with

b) Without use of the baud rate selection:

Settings > Interface > Link formation > .....Local connection
Settings > Interface > Local connection options
> Local connection baud rate > 9600
Settings > Interface > Local connection options
> Baud rate changeover >..... None

5 Installation and maintenance

The EK230 is suitable for wall mounting and for installation on a gas meter. The holes for wall mounting become accessible after opening the housing cover. For installation on a meter a mounting bracket is required.

The 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 EK230 on the gas meter, on a bracket 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 the following equipment to the power supply input, serial interface or pulse/signal outputs.

F *If the EK230 is used in zones of hazardous atmospheres (Zone 1), then only intrinsically safe electrical circuits of certificated "associated operating equipment" must be connected.*
The regulations for connecting intrinsically safe circuits must be followed. The electrical data of the EK230 can be taken from the EC prototype test certificate (see Appendix A-2). These figures should not be exceeded.
Devices with the intrinsically safe type of protection lose their approval when they are operated with circuits which do not conform to the EC prototype test certificate.
The approval for Ex Zone 1 is only valid for EK230-option with RS485-interface (not for RS232)

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 EK230 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 EK230 has special EMC cable glands for this purpose.

With correct connection of the cable screens and correct laying of the cables effects due to circulation should not be expected. If, however, interference due to earthing points with potential differences occur, potential equalisation lines can be laid in parallel to the cables. These should then be connected as close as possible to the cable screen connection points.

Additional requirements are placed on the earthing of conducting screens between Ex areas and non-Ex areas. The relevant installation requirements, e.g. EN 60079-14, must be followed.

5.3 Checking the pressure sensor

The pressure sensor must be checked for leaks during the recurring pressure tests of the system.

5.4 Terminal layout

Connection of the individual cables is made to the corresponding terminals on the circuit board in the housing cover. When positioning the cables, make sure that no cables are pinched as the cover is closed.

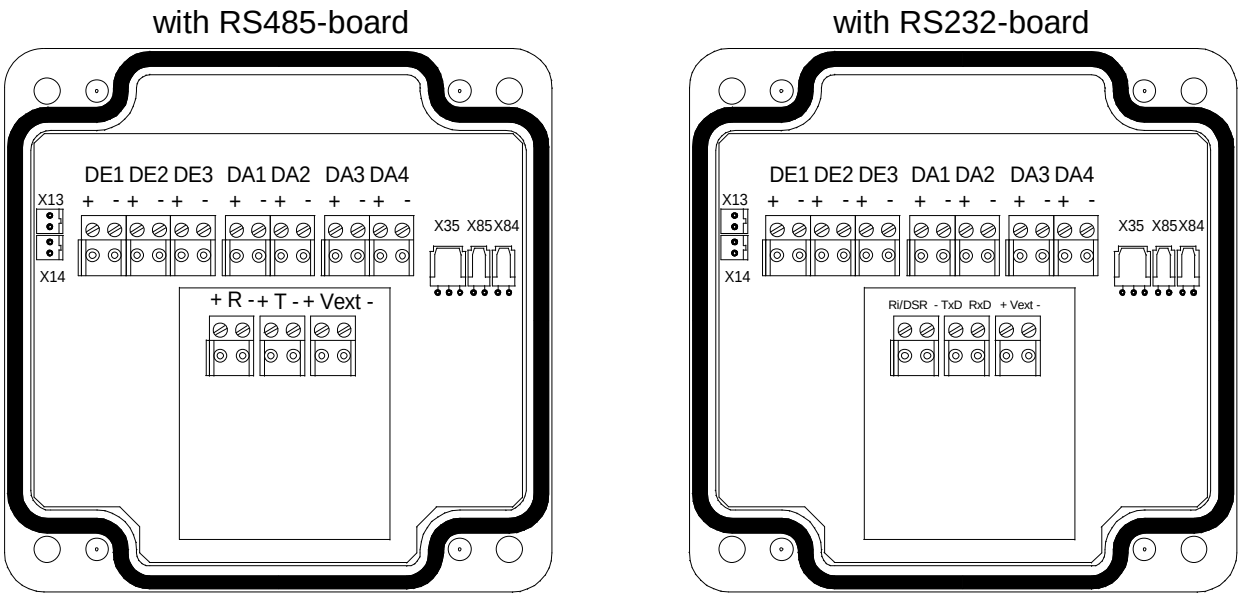


Fig. 2: Terminal layout

Inputs:

DE1	Digital Input 1
DE2	Digital Input 2
DE3	Digital Input 3

Outputs:

DA1	Digital Output 1
DA2	Digital Output 2
DA3	Digital Output 3 (cannot be sealed)
DA4	Digital Output 4 (cannot be sealed)

Serial interface, Version RS485:

Vext-	External power supply -
Vext+	External power supply +
R-	Received data -
R+	Received data +
T-	Transmitted data -
T+	Transmitted data +

Serial interface, Version RS232

Vext-	External power supply -
Vext+	External power supply +
RxD	Received data
TxD	Transmitted data
-	Ground
Ri/DSR	Controlsignal

Pressure and temperature sensors:

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

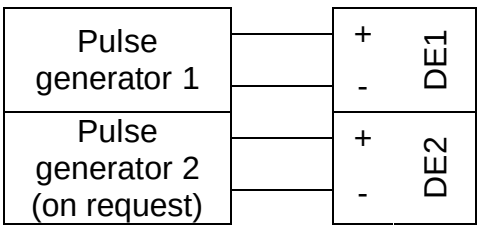
Batteries:

X13	Battery 1
X14	Battery 2

5.5 Connection of a low-frequency pulse generator (reed contacts)

A pulse generator must always be connected to the terminal "DE1". In addition, a second pulse generator can be connected to terminal "DE2", e.g. for a pulse comparison (→ page 53). Any polarity can be chosen. Connection scheme:

When using the lead available from Elster GmbH with the order no. 73017093 (about 70 cm long), the following wires should be connected:
Terminal DE1: Brown and white
Terminal DE2: Yellow and green



5.6 Connection of the serial interface RS485

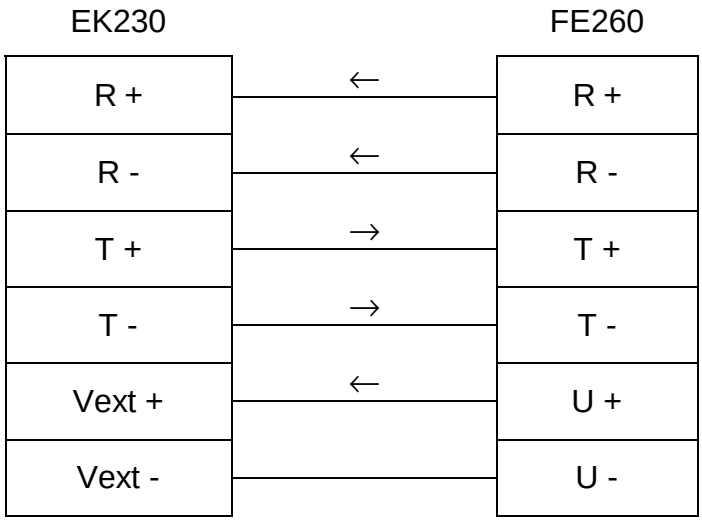
Before connecting serial interface the display should be inactive.
! Please connect external power supply first. After that the serial interface can be connected.

5.6.1 FE260 Function Expansion (with or without modem)

For this application the EK230 also needs the external power supply through
! the FE260, i.e. the terminals Vext + and – must be connected (see below).
During mains failure no data transmission can take place.

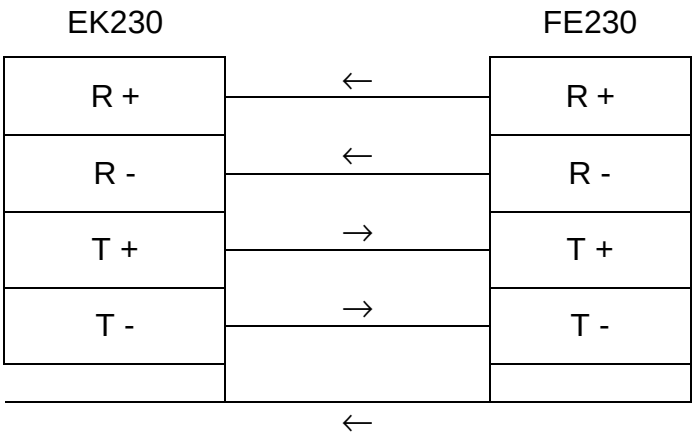
A four-wire connection (one core each for T+, T-, R+, R-, full duplex) should be made.

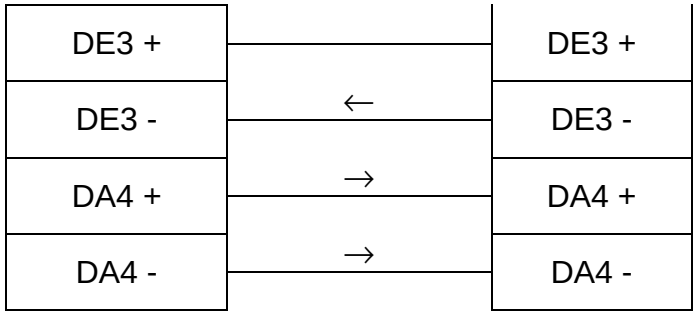
Connection diagram:



5.6.2 FE230 Function Expansion

Connection diagram:



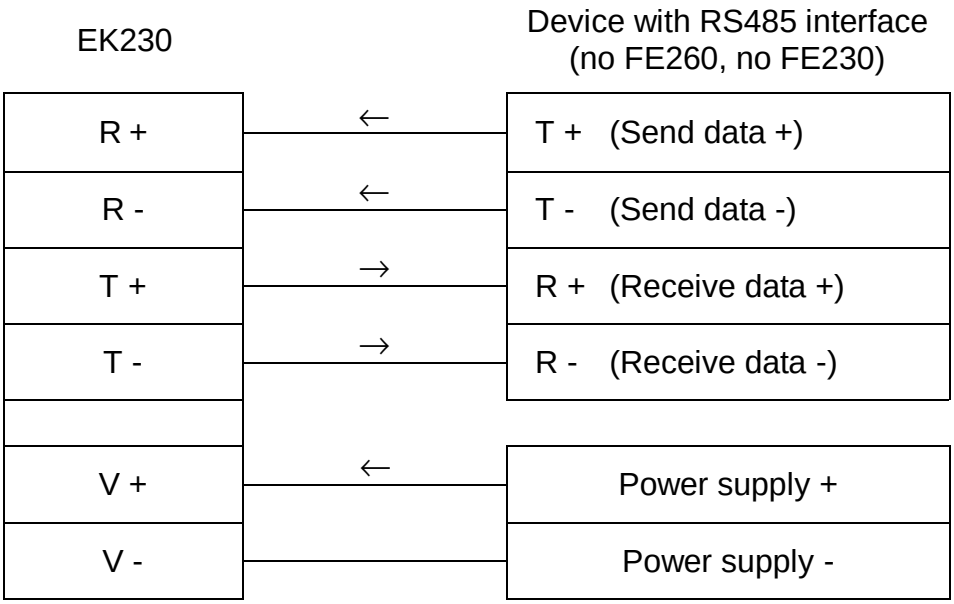


5.6.3 Other devices with RS485 interface (no modem)

F *For this application the EK230 should be operated with needs an external power supply.*

A four-wire connection (one core each for T+, T-, R+, R-) should be made, two-wire connection (half duplex) is not possible.

Connection diagram:



5.7 Connection of the serial interface RS232

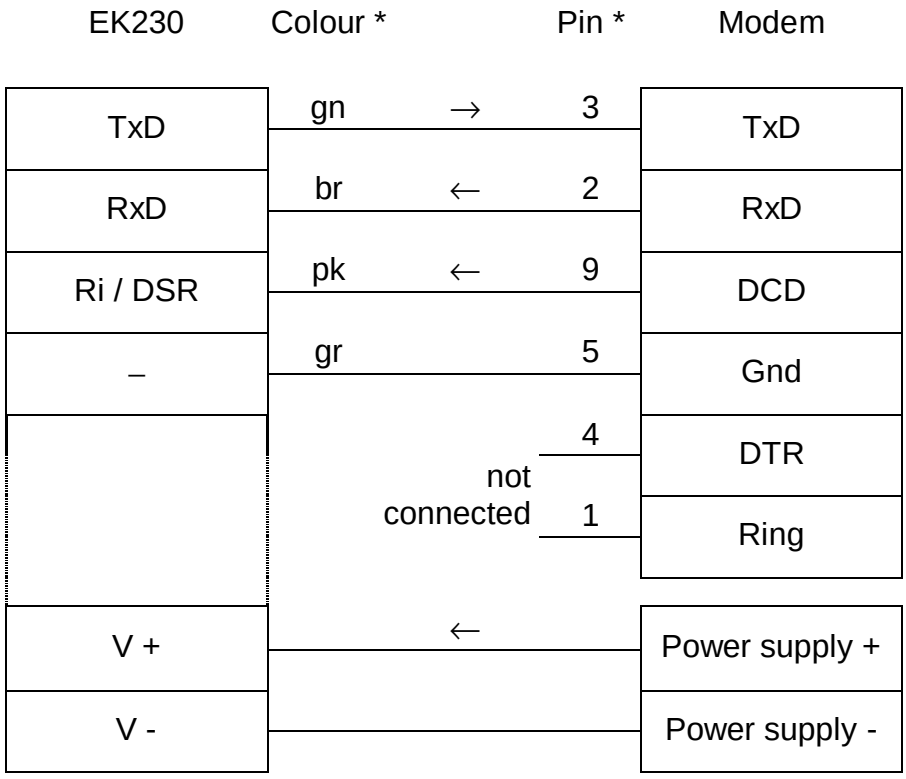
! **The EX approval does <u>not</u> apply to operation with the standard RS232 interface, but only to the versions "RS485" and "RS232-EEx" !**

! **Before connecting serial interface the display should be inactive.**
Please connect external power supply first. After that the serial interface can be connected.

5.7.1 Modem with control signals

F *For this application the EK230 needs an external power supply.*

Connection diagram:

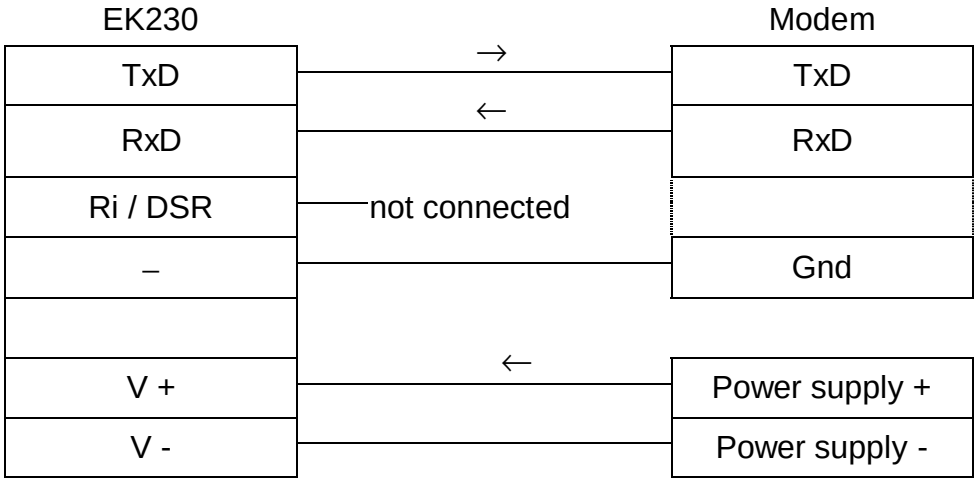


* Pin numbers of the DSUB-9 plug and core colours when using a ready-made cable available from Elster GmbH, e.g. Order No. 73016923 (2 m) or 73017268 (10 m).

5.7.2 Modem without control signals

F *For this application the EK230 needs an external power supply.*

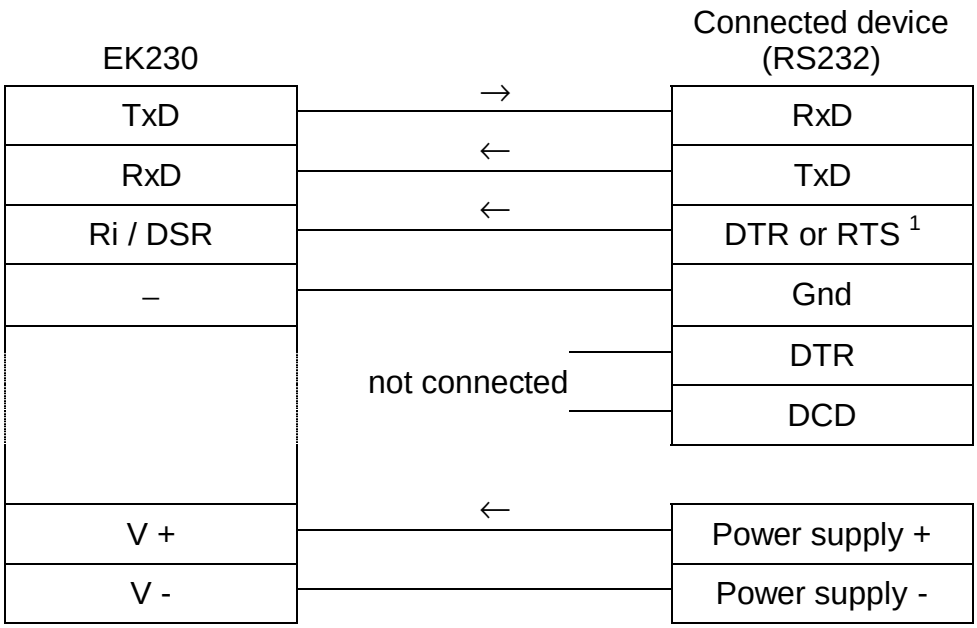
Connection diagram:



5.7.3 Other devices with RS232 interface (no modem)

F *For this applications the EK230 needs an external power supply.*

Connection diagram:

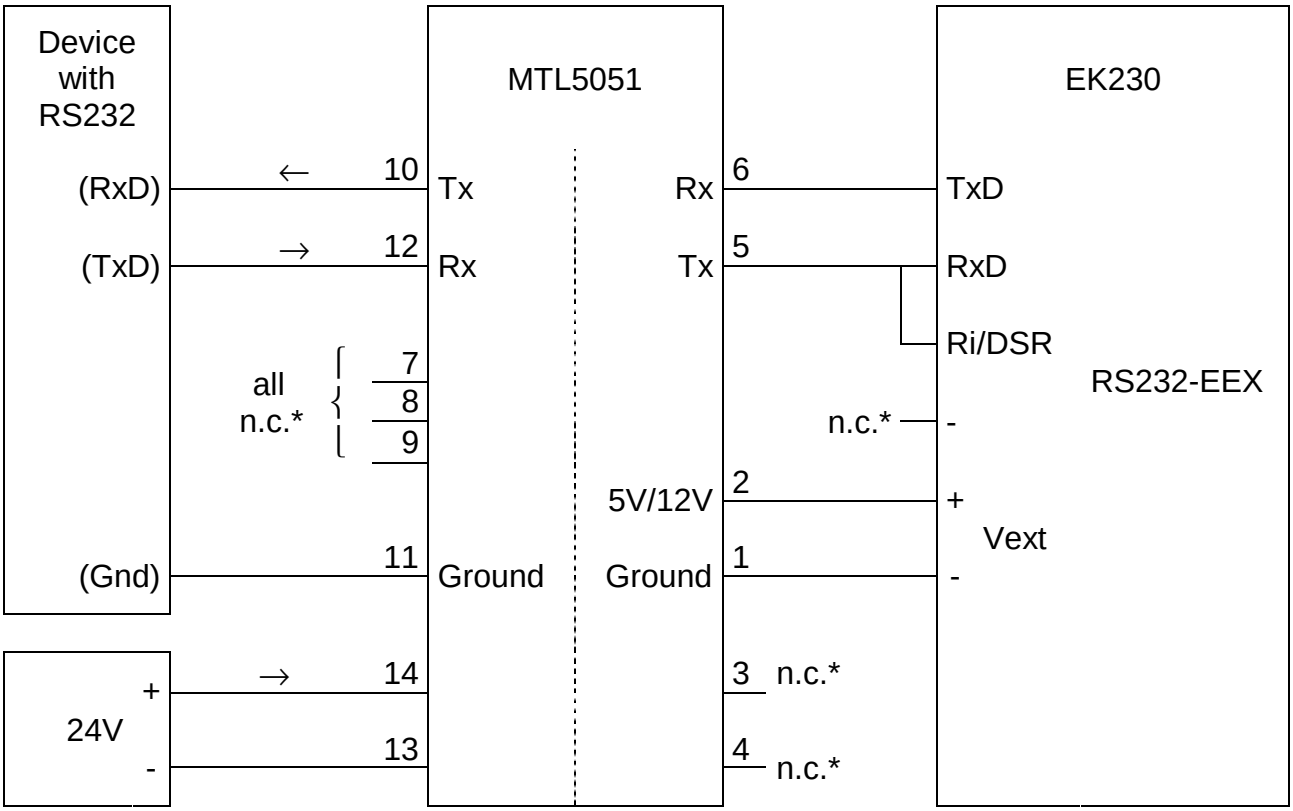


[1] The connected device must switch the used signal active before the start of communications and inactive again after the end of communications.

5.8 Connection of the serial interface RS232-EEx

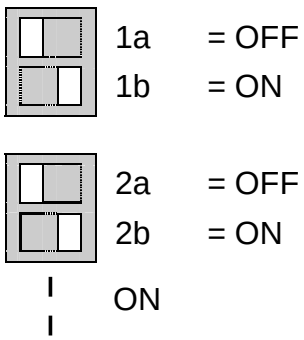
5.8.1 Interface isolator MTL5051

Connection diagram:



* n.c. = not connected

Settings of MTL5051:



5.9 Seals

1. Setting the parameters

To change values subject to calibration regulations (e.g. cp value), the adhesive labels on the calibration lock in the device must be opened up and the button pressed (status "P" flashes in the display).

2. Closing and securing the calibration lock

Once all values subject to calibration regulations have been changed, the calibration lock is closed by pressing the button (status "P" goes out) and the access opening is sealed with an adhesive label.

3. Securing the circuit board

The circuit board is provided with a plastic cover to protect it from tampering. 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. 1530528.95.9.1 for seal layout.

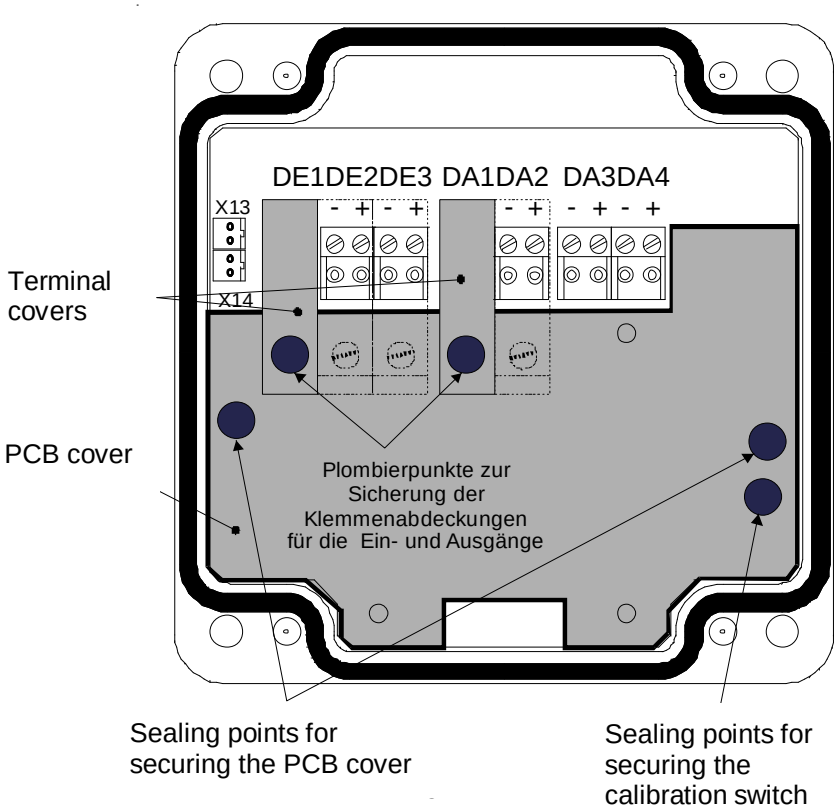
5. Securing the housing

The two screws on the top of the front are designed as sealing screws.

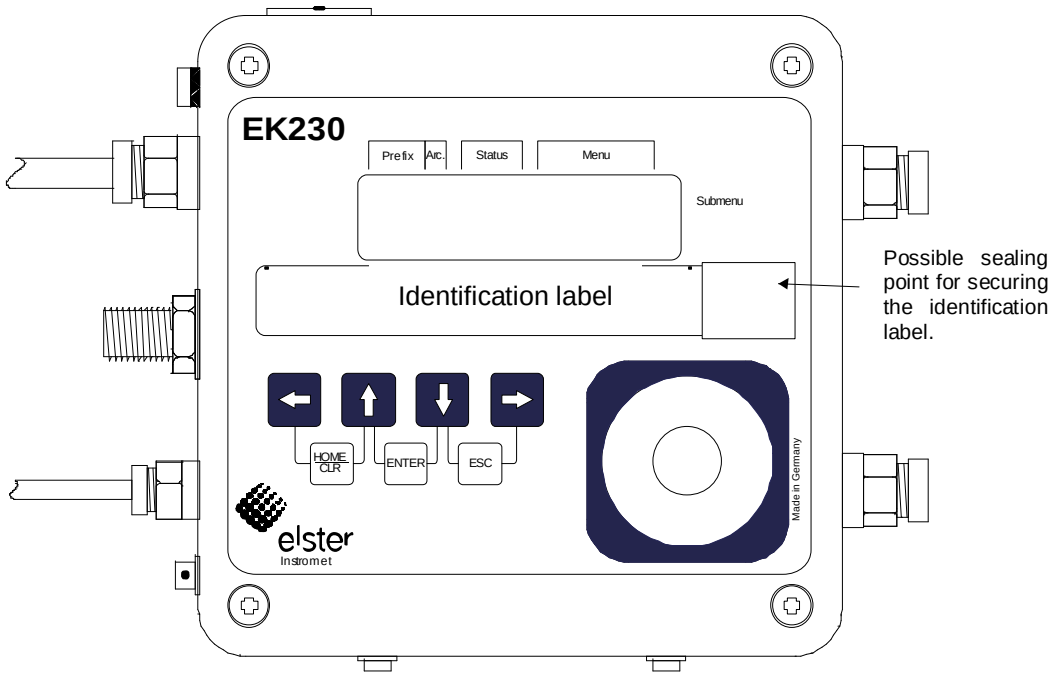
If necessary customer can protect the housing against opening by sealing wire and a suitable customer seal.

5.9.1 Seal layout of basic device

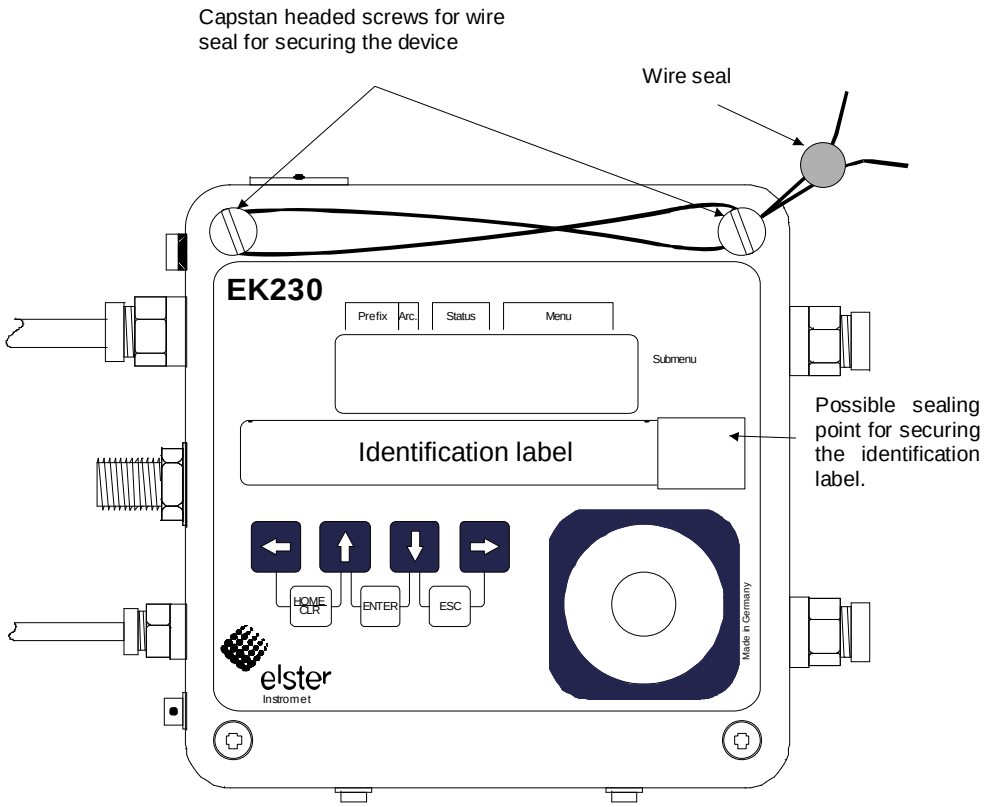
a) Housing cover (internal view)



b) Housing cover (front view), standard seals



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

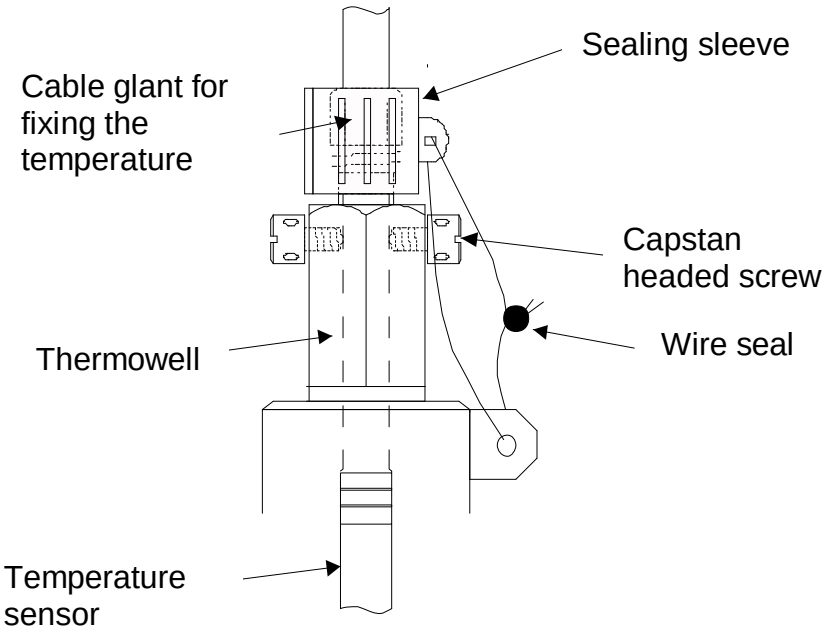


5.9.2 Seal layout of temperature sensor

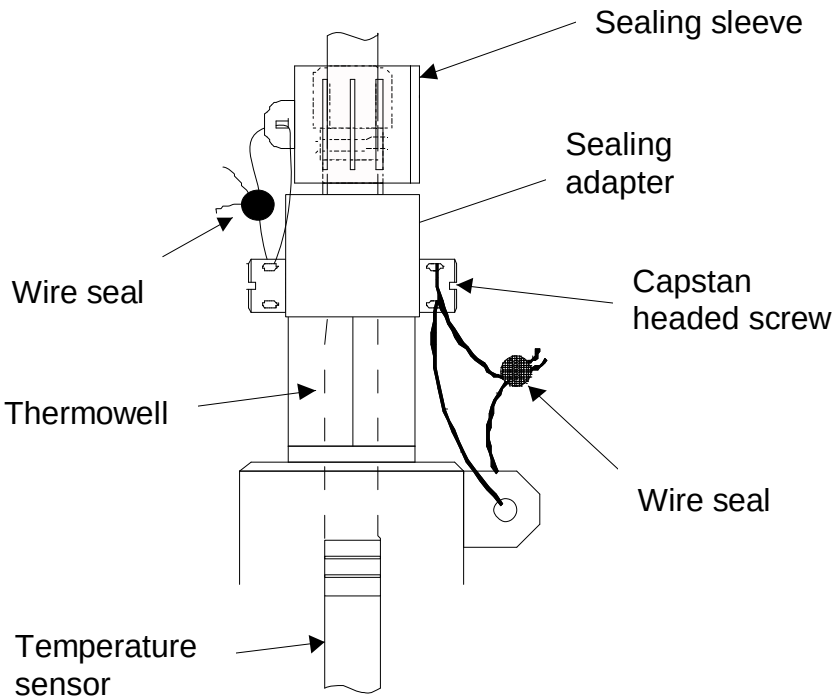
The sealing of the temperature sensor is generally carried with wire seals.

In this section the sealing methods used by Elster GmbH for the standard temperature sensors are illustrated as examples. Other variants of seals are possible depending on the combination of temperature sensor and thermowell.

a) Temperature sensor of variable length + standard thermowell



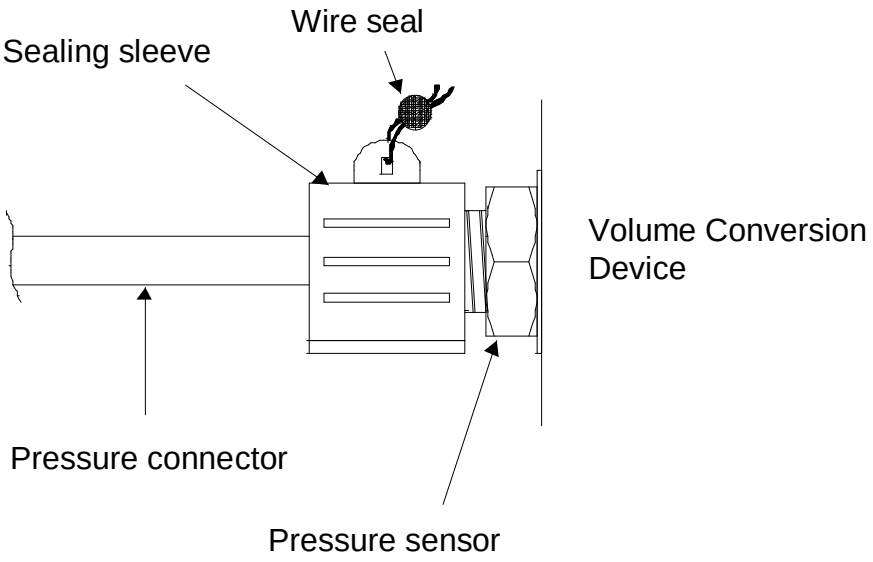
b) Temperature sensor of variable length + older Elster thermowells



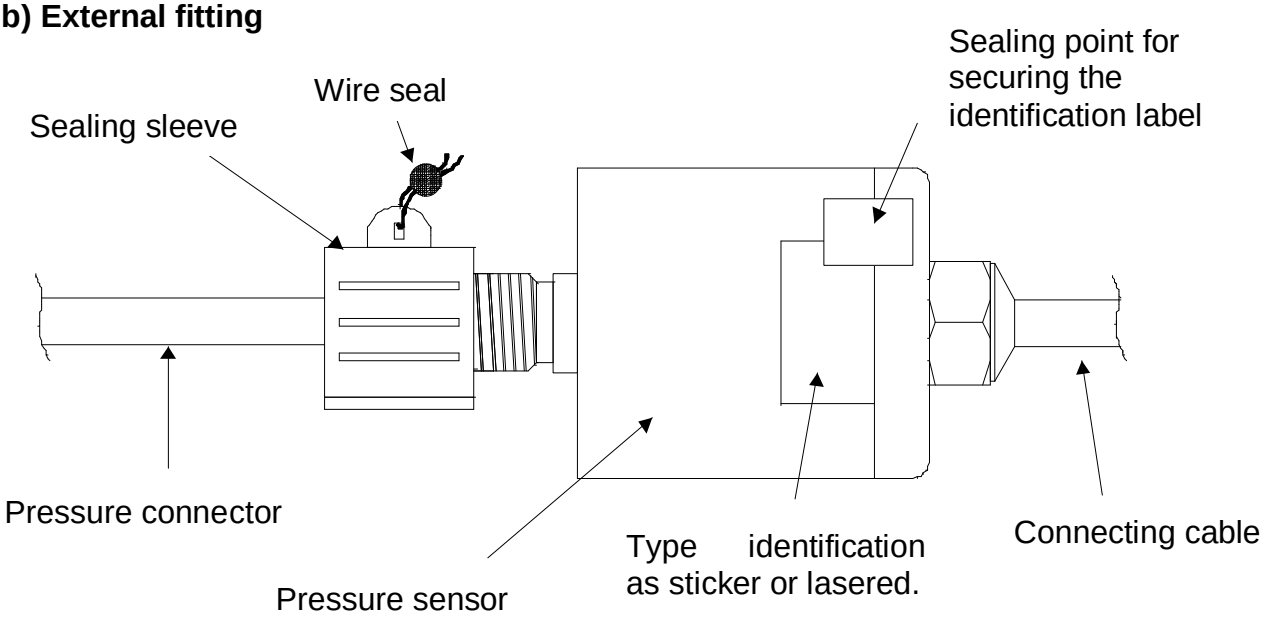
5.9.3 Sealing layout of pressure sensor

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

a) Internal fitting



b) External fitting



5.10 Battery replacement

During operation a check must be made from time to time of whether the batteries need to be replaced. The battery warning "B" in the "Status" field of the display (→ **2.2.1**) is used for this as well as the remaining battery life in the service list (→ 3.10: *Bat.R*).

F *The displayed remaining battery service life applies to the specified standard operating application (® B-2 Batteries). The remaining service life is reduced correspondingly quicker due to changes of the measurement cycle, reading of the values or continuous active display.*

The battery life with one battery in the standard operating mode (® B-2 Batteries) is at least 5 years. The battery life may be reduced in other operating modes. Further details are given in ® 3.10:

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

F *During battery replacement one battery should always remain connected. Before the old battery is removed, the new battery must be connected. Two plugs are provided for this.*

F *EK230 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 (® 3.10, "Save"). If, due to an operating fault during battery replacement, data is lost, the EK230 automatically recalls the data from the time it was previously saved.*

F *Therefore, replacement should only be carried out by Elster Service or by specially trained personnel.*

Carrying out the battery replacement:

1. Save the data as a precautionary measure (→ 3.10: Save).
2. Open up the housing cover and swivel downwards. The battery is then accessible in the bottom part of the housing.
3. Check the type and order number of the new battery.

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, archives may be deleted, volume pulses may be lost during the battery replacement and the clock may be slow after battery replacement.
5. Insert the new battery and connect to the free plug in parallel to the old battery (both are electrically isolated). The plugs are polarised against incorrect connection.
6. Pull off the old battery from the plug and remove.
7. Fix the new battery in the holder on the floor of the housing.
8. Reclose the housing (make sure that the cable is not pinched).
9. Under "Service" - "Battery capacity" (→ 3.10: *BAT.C)* the initial capacity must be entered (essential even with the same capacity value)!
   With the use of the size "D" battery obtainable from Elster GmbH, the value 13.0 Ah should be entered for *Bat.C*.
10. Check the operating life calculated by the EK230: At least 60 months should be displayed for *Bat.R* (→ 3.10). If this is not the case, carry out the step again.
11. End of the battery replacement.

A Approvals

A.1 EC Declaration of Conformance

CE

Declaration of Conformance

Manufacturer:	Elster GmbH Steinern Straße 19-21 55252 Mainz-Kastel Germany
Product designation:	Volume Conversion Device
Type designation:	**EK230**

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 02 ATEX 1827
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 - Version with RS485 and RS232-Eex

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 02 ATEX 1827

(4) Equipment: Electronic volume corrector type EK230

(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 NORD CERT GmbH & Co. KG, 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° 02 YEX 158780.

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

Hanover, 2002-04-25

TÜV NORD

TÜV NORD CERT

Head of the Certification Body

TÜV CERT A4 07.01 10.000 L6

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(13) **SCHEDULE**

(14) **EC-TYPE EXAMINATION CERTIFICATE N° TÜV 02 ATEX 1827**

(15) Description of equipment

The electronic volume corrector type EK230 is an explosion-proof electronic device that meets the requirements of category 2. The device determines and displays the basic volume of a gas volume, which is measured by an external gas meter under service conditions, using the state variables pressure and temperature.
For the 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. An external voltage supply of the device and the use of a second battery are possible.

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

Electrical data

Supply (internal battery) ..... 1 resp. 2 pc. lithium batteries type LS 33600, company Saft
U = 3,6 V, modified accumulator pack of the manufacturer

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

The digital outputs are also intended for the connection to certified intrinsically safe circuits:
U_i = 6,6 V
I_i and P_i see below

The effective internal inductance and capacitance is negligibly small.

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 05 02

Schedule EC-Type Examination Certificate N° TÜV 02 ATEX 1827

RS485 board

Supply circuit ..... (terminals Vext +, -)	in type of protection „Intrinsic Safety" EEx ia IIC/IIB resp. EEx ib IIC/IIB only for the connection to certified intrinsically safe circuits with the following maximum values: U_i = 10 V I_i and P_i see below The effective internal inductance and capacitance is negligibly small.
RS485 interface ..... (terminals T+, T-; R+, R-)	type of protection „Intrinsic Safety" EEx ia IIC/IIB resp. EEx ib IIC/IIB only for the connection to certified intrinsically safe circuits with the following maximum values: U_i = 6,6 V I_i and P_i see below For the interconnection the following maximum values have to be taken into consideration as well: U_o = 6,6 V I_o = 132 mA P_o = 217 mW Characteristic line: linear effective internal capacitance C_i = 5,8 µF The effective internal inductance is negligibly small.
Supply circuit, RS485 interface and digital outputs	maximum values (sum values) of these intrinsically safe circuits: I_i = 100 mA P_i = 0,5 W

(16) Test documents are listed in the test report No.: 02 YEX 158780.

(17) Special conditions for safe use

none

(18) Essential Health and Safety Requirements

no additional ones

BA 02 03.02

page 3/3

TÜV NORD

Translation

2. SUPPLEMENT to

EC-TYPE EXAMINATION CERTIFICATE No. TÜV 02 ATEX 1827

Equipment:	Electronic Volume Corrector type EK230
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 EK230 may also be manufactured and operated according to the documents listed in the test report.

The amendments concern the internal design, the extension of an optional RS 232 interface and of an optional RS 485 interface suitable for multipoint connection and the electrical data, as well.

For the RS 485 interface suitable for multipoint connection the same electrical data apply as for the standard RS 485 interface.

Electrical data

Supply (internal battery) ..... 1 resp. 2 pc. lithium batteries type LS 33600, company Saft
U = 3,6 V, modified accumulator pack of the manufacturer

Digital outputs (terminals DA1 ... DA4) ..... 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 = 380 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

The digital outputs are also intended for the connection to certified intrinsically safe circuits:
U_i = 6,6 V

I_i and P_i in dependence on the used interface and of the gas group, see below.

The effective internal inductance and capacitance is negligibly small.

2. Supplement to EC-Type Examination Certificate No. TÜV 02 ATEX 1827

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	

RS485 board optional (standard and suitable multipoint connection)

Supply circuit (terminals Vext +, -)	in type of protection „Intrinsic Safety"	EEx ia IIC/IIB resp. EEx ib IIC/IIB
	only for the connection to certified intrinsically safe circuits with the following maximum values: U_i = 10 V I_i and P_i see below The effective internal inductance and capacitance is negligibly small.	
RS485 interface (terminals T+, T-; R+, R-)	in type of protection „Intrinsic Safety"	EEx ia IIC/IIB resp. EEx ib IIC/IIB
	only for the connection to certified intrinsically safe circuits with the following maximum values: U_i = 6,6 V I_i and P_i see below For the interconnection the following maximum values have to be taken into consideration as well: U_o = 6,6 V I_o = 132 mA P_o = 217 mW R_i = 50 Ω Characteristic line: linear effective internal capacitance C_i = 5,8 µF The effective internal inductance is negligibly small.	
Supply circuit, RS485 interface and digital outputs	maximum values (sum values) of these intrinsically safe circuits: I_i = 100 mA P_i = 0,5 W	

2. Supplement to EC-Type Examination Certificate No. TÜV 02 ATEX 1827

RS232 EEx board (optional)

Supply and signal circuits ..... in type of protection „Intrinsic Safety EEx ia IIC/IIB
(terminals Vext +, - resp. EEx ib IIC/IIB
Ri/DSR, TxD, and RxD) only fort he connection to certified intrinsically safe circuits with the following maximum values:

U_i = 20 V
I_i = 200 mA
P_i = 0,83 W
C_i = 14 nF

The effective internal inductance is negligibly small.

U_o = U_i of the digital outputs but at least 6,6 V (due to the internal battery or external circuits)
I_o, P_o negligibly small

Digital outputs ..... Maximum values (sum value) of these intrinsically safe circuits

U_i = 6,6 V
I_i = 10 mA
P_i = 20 mW

only for application of the gas groups IIB reps. IIA
(applies for the use with the RS232-EEx-board and the RS485 board)

In case of interconnection of the digital outs 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 (Sum values) for all outputs:

U_i = 10 V
I_i = 10 mA
P_i = 20 mW

U_o = U_i but at least 6,6 V
I_o = 106 mA, static (sum current of all digital outputs)
I_o =1,28 A, dynamic (shot-time discharge current per digital output)
P_o =380 mW
Characteristic line: linear

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

2. Supplement to EC-Type Examination Certificate No. TÜV 02 ATEX 1827

RS485 board optional (standard and suitable multipoint connection)

RS485 interface ..... in type of protection „Intrinsic Safety" EEx ia IIB/IIA
(terminals T+, T-; R+, R-) resp. EEx ib IIB/IIA
only for the connection to certified intrinsically safe circuits with the following maximum values:
U_i = 6,6 V
I_i and P_i see below

For the interconnection the following maximum values have to be taken into consideration as well:

U_o = Ui of the digital outputs but at least 6,6 V
I_o = 200 mA
P_o = 380 mW
R_i = 50 Ω
Characteristic line: linear

effective internal capacitance C_i = 5,8 µF
The effective internal inductance is negligibly small.

The different intrinsically circuits are galvanic connected with each other.

All further data apply unchanged for this 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-a.

TÜV NORD CERT GmbH & Co. KG
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Fax: +49 (0) 511 986-1590

Hannover, 2006-01-18

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. 126 x 126 x 90 mm (with cable glands)
Weight	Approx. 1.6 kg
Cable connection	Clamp terminals; 0.5 ... 1.5 mm² with flexible cable fit core-end sleeves
Screen	Connect cable screen to the cable gland
Protection	IP 66 according to EN60529
Ambient conditions accord. to	MID Directive:
Ambient temperature	-25°C ... +55 °C
Humidity conditions	condensation
Point of use	open

Mechanical ambient conditions accord. to MID Directive:

Class	M2

Electromagnetic ambient conditions accord. to MID Directive:

Class	E2

B-2 Batteries

Batteries	1 lithium battery; 3.6V; size D normal rated capacity: 16.5 Ah Usable capacity for EK230: 13.0 Ah Order no.: 73015774
	1 additional lithium battery optional for double battery service life Order no.: 73015774

The min. service life of five years is guaranteed for the following ***standard operating mode****:*

Ambient temperature	T_a = -10...+50 °C
Measurement cycle (*MCyc*)	2030 s
Operating cycle (*OCyc*)	300 s (5 minutes)
Mode Input	1 (pulse input)
Display active	1 hour per month
Optical interface active	15 minutes per month
Internal interface (terminals)	Not used

B-3 External power supply

F *For impulse-counting at the digital inputs an internal battery is required, although the external power supply is connected !*

Designation	Uext
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.

Nominal data:

Supply voltage:	U = 5.0 V ... 10.0 V
Supply current:	I ≤ 30 mA

B-4 Pulse and status inputs

Three digital inputs with common ground (minus pole) for reed contacts or transistor switches (only Input "DE1").

Designation	DE1... DE3
Cable connection	Plug-in terminals; 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 EK230 in Ex Zone 1.*

Open-circuit voltage	$U_0 \approx 2$ V
Internal resistance	$R_i \approx 500$ kΩ
Short-circuit current	$I_k \approx 4$ µA
Switching point "on"	$R_e \leq 100$ kΩ or $U_e < 0.8$ V
Switching point "off"	$R_a \geq 2$ MΩ
Pulse duration	$t_e \geq 50$ ms
Space duration	$t_a \geq 50$ ms
Counting frequency	f ≤ 2 Hz (see chapter 4.2)

B-5 Signal and pulse outputs

Four transistor outputs with common ground (minus pole).

The volume pulses acquired for one measurement cycle are output as pulse packets. They are therefore not suitable for open and closed-loop control purposes.

Designation	DA1... DA4
Cable connection	Plug-in terminals; 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 output can be parameterised and sealed separately.

Nominal data:

F *The limits in the certificate of conformance must be observed when using the EK230 in Ex Zone 1, also for data which is not mentioned here.*

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-6 Optical serial interface

Optical interface according to IEC 62056-21; bit-serial, asynchronous data transmission according to ISO 1177, half duplex.

Support of **Data transmission mode "C"** (= Data read-out, programming and manufacturer-specific applications with automatic change of the baud rate).

Baud rate	300 Bd (initial baud rate); automatic up to 9600 Bd.
Format	1 start, 7 data, 1 parity (even) and 1 stop bit.
Connection	Optical read-out head on device front panel (automatic positioning / fixing by magnet).

B-7 Electrical serial interface (internal)

- Version with RS485 interface, intrinsically safe, e.g. for connection of an FE260 function expansion unit with modem (order no. 83 480 540) .
- Version with RS232 interface, not intrinsically safe, e.g. for connection of an external Modem or direct to a PC (without approval for use in Ex zone 1)
- Version with RS232 interface, intrinsically safe, e.g. for connection to an MTL5051 interface isolator.

B-8 Pressure sensor

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

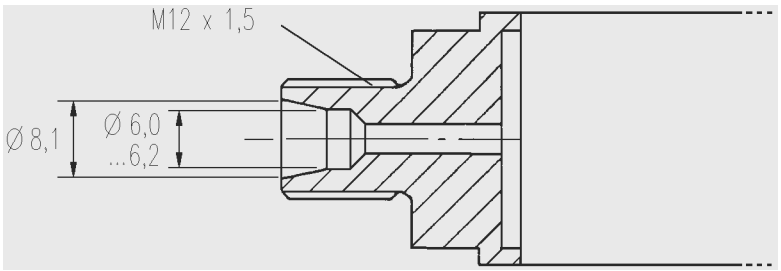
Connection:

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

Installation information:

When connecting the pressure line to the installed pressure sensor, attention must be paid to the pipe diameter to avoid damage and leaks on the gland connection. In particular the parting point on the pipe should be checked for burrs or flaring, which cause an increase in the outside diameter of the pipe (see following drawing of the Ermeto connection on the pressure sensor).

Cross-section of pressure sensor connection



Measurement ranges:

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-9 Temperature sensor

Type: Pt500 according to EN 60751
Measurement range: -30°C ... +60°C
Measurement uncertainty: ≤ ± 0.1% of measurement
Mounting: Insertion into sensor receptacle with variable length

B-10 Measurement uncertainty

The error limits quoted in the MID and in (DIN) EN 12405 are maintained.

Depending on the ambient temperature and the pressure measurement range, detailed data is available on request.

C Language Reference List

German **Deutsch** **Allemand**	**English** **Englisch** **Anglais**	French **Französisch** **Français**	
User Liste	User List	Liste Utilisateur	
z	Z	Z	
zn	Zb	Zb	
Menü	Menu	Menu	
Normvolumen	**Standard volume**	**Volume de base**	
Vn	Vb	Vb	
Qn	Qb	Qb	
VnSt	VbD	VbDp	
VnG	VbT	VbTo	
VnP	VbA	VbR	
VnME	VbME	VbFM	
Zeit	Time	Heure	
Betriebsvolumen	**Actual volume**	**Volume service**	
Vb	Vm	Vm	
Qn	Qm	Qm	
VbSt	VmD	VmDp	
VbG	VmT	VmTo	
VbP	VmA	VmR	
VbME	VmME	VmFM	
Zeit	Time	Heure	
Druck	**Pressure**	**Pression**	
p	p	p	
pMin	pMin	pMin	
pMax	pMax	pMax	
Mbu.p	MRL.p	PMi.p	
Mbo.p	MRU.p	PMs.p	
p.F	p.F	p.VR	
pn	pb	pb	
Md.p	Md.p	Md.p	
Typ.p	Typ.p	Typ.p	
SNp	SNp	NSp	
G1.p	Eq1p	C1.p	
G2.p	Eq2p	C2.p	
G3.p	Eq3p	C3.p	
p1Jus	p1Adj	p1Reg	
p2jus	p2Adj	p2Reg	
Prog	Prog	Prog	
pLuft	patm	patm	
p.Mes	p.Mes	p.Mes	
p.Abs	p.Abs	p.abs	
Temperatur	**Temperature**	**Température**	
T	T	T	

German **Deutsch** **Allemand**	**English** **Englisch** **Anglais**	French **Französisch** **Français**	
TMin	Tmin	Tmin	
TMax	Tmax	Tmax	
Mbu.T	MRL.T	PMi.T	
Mbo.T	MRU.T	PMs.T	
T.F	T.F	T.VR	
Tn	Tb	Tb	
Md.T	Md.T	Md.T	
Typ.T	Typ.T	Typ.T	
SNT	SNT	NST	
G1.T	Eq1T	C1.T	
G2.T	Eq2T	C2.T	
G3.T	Eq3T	C3.T	
T1Jus	T1Adj	T1Reg	
T2Jus	T2Adj	T2Reg	
Prog	Prog	Prog	
T.Mes	T.Mes	T.Mes	
Umwertung	**Conversion**	**Conversion**	
Z	C	C	
K	K	K	
Ho.n	Ho.b	Ho.b	
CO2	CO2	CO2	
H2	H2	H2	
N2	N2	N2	
Rhon	Rhob	Rhob	
dv	dr	d	
K.F	K.F	K.VR	
Md.K	Md.K	Md.K	
Archiv	**Archive**	**Archive**	
ArMP	ArMP	ArPC	
ArTag	ArDay	ArJ	
Mper	MPer	Pcom	
FrMP	FrMP	GelPC	
Status	Status	Etat	
S.Reg	S.Reg	S.Reg	
Stat	Stat	Stat	
Clr	Clr	Clr	
Logb.	Logb.	Journ.	
ArAen	AudTr	ArMod	
System	**System**	**Système**	
Zeit	Time	Heure	
Mod.Z	MdTim	Mod.H	
MZyk	MCyc	CycT	
AZyk	OCyc	CycTR	
Disp	Disp	Disp	
Aut.V	Aut.V	Aut.V	
TuBer	Ta.Rg	Tamb	

German **Deutsch** **Allemand**	**English** **Englisch** **Anglais**	French **Französisch** **Français**	
Vers	Vers	Vers	
Chk	Chk	Chk	
Service	**Service**	**Service**	
Bat.R	Bat.R	Bat.R	
Bat.K	Bat.C	Bat.C	
St.LS	St.SL	St.VD	
Cod.L	Cod.S	Cod.D	
St.KS	St.CL	St.VC	
Cod.K	Cod.C	Cod.C	
R.Pas	R.Pas	R.Pas	
St.ES	St.PL	St.VE	
Jus.Z	Adj.T	Aju.H	
Sich	Save	Sauv	
Clr.A	Clr.A	Clr.A	
Clr.V	Clr.V	Clr.C	
Clr.X	Clr.X	Clr.X	
Bin.T	Bin.T	Bin.T	
Bin.p	Bin.p	Bin.p	
Adr	Addr	Adr	
WRv	WRp	WRv	
VnRv	VbRp	VbRv	
VbRv	VmRp	VmRp	
Rev.	Rep.	Rev.	
Arkal	ArCal	Arcal	
Einfr	Frz.	Gel	
Eingänge	**Inputs**	**Entrées**	
CP.E1	cp.I1	PI.E1	
CP.E2	cp.I2	PI.E2	
Md.E2	Md.I2	Md.E2	
St.E2	St.I2	St.E2	
MdÜE2	MdMI2	MdCE2	
Qu.E2	SC.I2	So.E2	
G1.E2	L1.I2	VL1E2	
G2.E2	L2.I2	VL2E2	
SzE2	SpI2	IndE2	
St.E3	St.I3	St.E3	
MdÜE3	MdMI3	MdCE3	
Qu.E3	SC.I3	So.E3	
G1.E3	L1.I3	VL1E3	
SzE3	SpI3	IndE3	
SNZ	SNM	NSC	
Ausgänge	**Outputs**	**Sorties**	
Md.A1	Md.O1	Md.S1	
Qu.A1	SC.O1	So.S1	
CP.A1	CP.O1	PI.S1	
SzA1	SpO1	IndS1	

German **Deutsch** **Allemand**	**English** **Englisch** **Anglais**	French **Französisch** **Français**	
Md.A2	Md.O2	Md.S2	
Qu.A2	SC.O2	So.S2	
CP.A2	CP.O2	PI.S2	
SzA2	SpO2	IndS2	
Md.A3	Md.O3	Md.S3	
Qu.A3	SC.O3	So.S3	
CP.A3	CP.O3	PI.S3	
SzA3	SpO3	IndS3	
Md.A4	Md.O4	Md.S4	
Qu.A4	SC.O4	So.S4	
CP.A4	CP.O4	PI.S4	
SzA4	SpO4	IndS4	
Schnittstellen	**Interfaces**	**Interfaces**	
Md.S2	Md.S2	Md.I2	
DF.S2	DF.S2	FD.I2	
Bd.S2	Bd.S2	Bd.I2	
Anz.T	Num.T	Nbr.T	
M.INI	M.INI	M.INI	
Zsync	CSync	Hsync	
GSM.N	GSM.N	GSM.O	
GSM.P	GSM.L	GSM.P	
Bd.S1	Bd.S1	Bd.I1	
An1.B	CW1.S	Fn1.D	
An1.E	CW1.E	Fn1.F	
An2.B	CW2.S	Fn2.D	
M.An1	M.Cw1	M.Fn1	
An2.E	CW2.E	Fn2.F	
M.onl	M.onl	M.onl	
Energie	**Energy**	**Énergie**	
W	W	W	
P	P	P	
WSt	W.D	WDp	
W.G	W.T	WTo	
W.P	W.A	W.R	
WME	WME	WFM	
Zeit	Time	Heure	

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