TC210

This product is discontinued!

Temperature-Volume Corrector TC210

Operating Manual and Installation Instructions

Operating Manual:	73018728	SW version:	from V1.00
Issued:	20.09.2006 (c)	Circulation:	

All details and descriptions in this operating manual and installation instructions have been given 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-Instromet GmbH.

Mainz-Kastel, September 2006

Contents

I Safety information

☞ *The connections of the TC210 are freely accessible during setting up. In order to avoid damage to the components, make sure that no electrostatic discharge (ESD) can occur.*
The person carrying out the installation can, for example, discharge himself/herself by touching the potential equalisation line.

☞ *To avoid erroneous operation and problems, the operating manual must be read before putting the TC210 into operation.*

The TC210 Temperature-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 IIB and Temperature Class T4 (ignition temperature > 135°C, e.g. natural gas). EC prototype test certificate, refer to Appendix A-2)

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

☞ *Follow the regulations and standards applicable in the respective country, e.g. in Germany DIN EN 60079-14 (VDE 0165 Part 1) and DIN EN 50014.*

☞ *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.*

II Items supplied and accessories

II-1 Supplied items

The following items are included with the TC210:

a) Temperature-Volume Corrector TC210
b) Dispatch list
c) Design data sheet
d) Operating Manual
e) Bag of accessories

II-2 Ordering information and accessories

Designation	Order no.
• TC210 Temperature-Volume Corrector in various versions (refer to Chapter 5)	834 52 240
• Mounting plate for fixing directly to the thermowell or to the thermowell via a bendable arm	730 18477
• Connection piece for pluggable fixing directly to the thermowell or to the thermowell via a bendable arm	730 13 853
• Connecting piece R ½" for fixing directly to the thermowell	730 13 854
• Bendable arm for thermowell M10*1	730 14 250
• Bendable arm for thermowell ¾"	730 14 251
• Battery module 3.6 V/16.5 Ah (also usable: 13 Ah)	730 15 774
• Calibration covering cap for digital inputs or outputs	730 18 474
• TC210 accessory bag	730 18 488

Part 1

Device description for applications subject to calibration

1 Brief description

1.1 Functions and performance features

General remarks:

The TC210 Temperature-Volume Corrector is used for the conversion of the gas volume measured in the operating state by a gas meter to the standard state.

To determine the measurement conditions, the momentary value of the temperature is measured. The pressure and inverted compressibility ratio factor (K-value) are entered as constants.

Power supply:

- Battery operation with a service life of up to eight years.
- Battery replacement possible without loss of data and without violation of calibration seals.
- Data retention without battery supply due to internal EEPROM.

Operator interface:

- 12-character LCD display, description of values with short designations.
- Operation via a key; special functions by pressing the key for at least two seconds.
- Restricted programming via keypad possible.
- Display values can be freely assigned by user.
- Calibration switch (separately sealed on 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).

Pulse / signal inputs:

- 2 intrinsically safe pulse inputs for reed contacts or transistor switches, programmable as pulse or signal inputs.
- Maximum counting frequency 2 Hz.
- Pulse value decade can be set for each input.
- Various counters for Vb and V (main counter, disturbance quantities, totaliser, adjustable counter).
- Inputs can be sealed together with one covering cap for security under calibration regulations.

Pulse / signal outputs:

- Two transistor outputs, each freely programmable as alarm/warning output.
- Pulse duration adjustable on pitch of 125 ms (max. output frequency: 4 Hz).
- Each output can be separately sealed and secured under official calibration.

Data interface:

- Optical interface according to IEC 1107.

Temperature sensor:

- Pt500 temperature sensor.

Mechanical details / housing:

- Suitable for wall mounting and meter installation (with mounting plates).
- Mounting + device installation without breaking the calibration seals.
- Ambient temperature range: -30°C...+60°C
  (At T < -20°C it is not possible to read the display and so convenient operation is only possible using the WinPADS parameterisation software.)
- Class of protection: IP 65, non-condensing atmosphere.

Approvals:

- PTB approval.
- Ex approval for use in Ex Zone 1 according to EEx ib IIB T4.

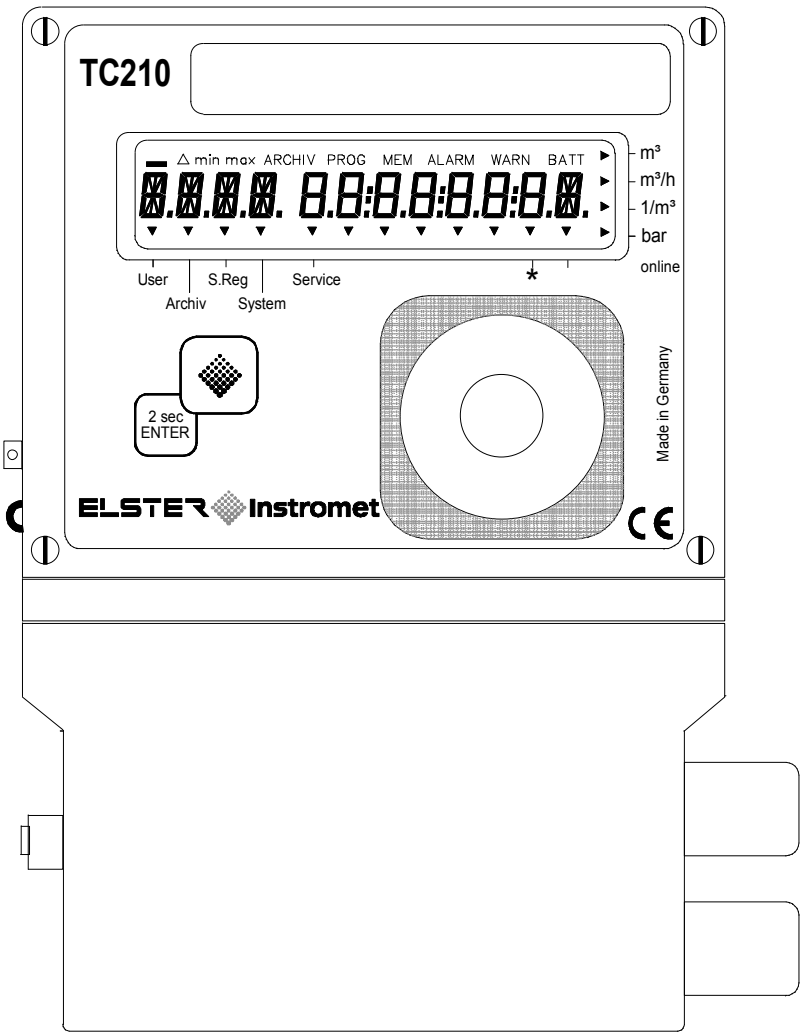
Archive

- Month-end readings of Vb, V and means of p, T, K and C.
- Automatic changeover to daylight saving time can be set.

2 Operation

2.1 Front plate

A single-line display (LCD) with 12 characters, various special symbols and a key are provided on the front plate for operation.



The display has the following display features:

- Single-line text display with 12 characters.
- Ten special symbols in the top margin.
- Four indicating arrows in the right margin.
- A total of twelve indicating arrows in the bottom margin

2.2 Display

2.2.1 Values

Identification of the values on the 12-character display occurs using abbreviated designations. Generally, an abbreviated designation consists of up to four letters which appear at the left end of the display. The right-hand eight places are normally used for displaying numerical values.

2.2.2 Special characters

The special characters are arranged in the top margin of the display. The TC210 does not use all of the special characters. In the following the special characters that are used are described.

_	The value located in the display is a mean value.
Δ	Flashes briefly at the end of a measurement cycle.
PROG	"PROG" flashes when the calibration lock is open.
ALARM	At least one status message has occurred which is valid as an alarm. 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. A flashing character signifies that the relevant state is still present and the relevant message is present in the momentary status. A non-flashing character signifies that the relevant state is past, but the message in the status register has not yet been cleared.
WARN	At least one status message has occurred which is valid as a warning. 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. A flashing character signifies that the relevant state is still present and the relevant message is present in the momentary status. A non-flashing character signifies that the relevant state is past, but the message in the status register has not yet been cleared.
BATT	"BATT" flashes when the remaining battery service life is less than the set warning limit (factory setting: 3 months).

2.2.3 Indicating arrows

1. Units
The arrows located in the right margin of the display point to the relevant physical unit for the displayed value.

2. Communication
If the arrow in the bottom right margin of the display points to "online" (→ 2.1), then a data transmission is running via the optical interface.

3. Uncalibrated values
If the arrow in the bottom right margin points to "✱" (→ 2.1), then the displayed value is an uncalibrated value.

4. Menus
The five left arrows in the bottom margin on the display are used for orientation and for better identification of the relevant displayed value. A "menu heading" of the display list (→ 2.3) is assigned to each arrow. For each value the relevant associated arrow is switched on (e.g. display *TIME* -> Arrow "User").

5. Submenu
All the right-hand arrows flash except the arrow which, if applicable, indicates a unit for indicating a possible branch to a submenu (e.g. "Service").

When you are in a submenu, the arrows in the bottom margin of the display flash. Exceptions are the arrows for the reference to the current display list and indications of an existing communication or an uncalibrated value.

2.2.4 Keypad

Key	Action
	• **Downwards movement** within the current list: From the end of the list movement is then to the first value. • **Changing values in the entry mode**
 Hold pressed for 2 seconds (ENTER)	• **Initiate functions**, e.g. Clear all volumes => CLR.V • **Activate entry mode**, e.g. cp value of Input 1 => CP.I1 • **Update measurement** • **Open the submenu.** • **Return from a submenu** to the entry address in the higher level main menu. • **Display of second part of paired values**, e.g. volume at base conditions => Vb (predecimal and post-decimal places)

2.3 User interface structure

The user interface in the TC210 is structured as a list (main menu). From here at the appropriate entry points it is possible to skip into the submenus Archive, Total status register, System or Service.

2.3.1 Main menu (User list)

User		
Vb	Volume at base conditions [1]	
VbT	Volume at base conditions, total quantity [1]	
V	Actual volume [1]	
VT	Actual volume, total quantity [1]	
T	Temperature	
TIME	Time and date [1]	
P.F	Pressure fixed value	
K.F	Inverted compressibility ratio factor, fixed value	
C	Conversion factor	
TMIN [2]	Lower temperature alarm limit	
TMAX [2]	Upper temperature alarm limit	
EQIT [2]	Coefficient 1 of temperature equation	
EQ2T [2]	Coefficient 2 of temperature equation	
EQ3T [2]	Coefficient 3 of temperature equation	
ARCH	Archive	**ARC1** [3]
S.REG	Overall status register	**U1** [4]
SYS	System	**U2** [4]
SERV	Service	**U3** [4]

[1] Values subdivided into two (e.g. pre- and post-decimal places). To display the second part of the value keep the key pressed for at least two seconds. Press the key again to skip back to the display list.

[2] User-specific values, i.e. the user can set which values are displayed using the WinPADS parameterisation software (for explanation: see Chapter 3.1.

[3] The archive is assigned under "ARC1" (Explanation: see Chapter: 3.2).

[4] Submenus are assigned under "U1" – "U3" (Explanation: see Chapter: 3.3).

2.3.2 Structure of the archive "ARC1" and the submenus "U1" – "U3"

ARCH (ARC1) [1]	
AONo	Block number
TIME	Storage time-point
Vb	Volume at base conditions
VbT	Totaliser volume at base conditions
V	Actual volume
VT	Totaliser actual volume
T.MP	Temperature mean
P.MP	Pressure mean
C.MP	Conversion factor mean
ST.5	Status 5
ST.6	Status 6
ST.SY	System status
Ev	Trigger event
ER.Ch	Checksum

S.REG (U1)	
SR.SY	System status register
SR.1	Status Register 1
SR.2	Status Register 2
SR.5	Status Register 5
SR.6	Status Register 6

SYS (U2)	
BAT.R	Remaining bat. life
MRL.T	Meas. range lower temperature
MRU.T	Meas. range upper temperature
T.F	Temperature substitute value
TARG	Ambient temperature range
Tb	Temperature at base conditions
TYP.T	Type of temperature sensor
SN.T	Serial no. temperature sensor
Pb	Pressure at base conditions
ST.CL	Status customer lock[2]
Cod.C	Customer's code[2]
VERS	Software version
CHK	Software checksum[2]
MCYC[3]	Measurement cycle time
DAYb[3]	Day boundary
ADJ.T[3]	Clock adjustment factor

SERV (U3)	
CLR	Clear status register[2]
-	Display test
CP.I1	cp value Input 1
CP.I2	cp value Input 2[2]
CP.O1	cp value Output 1
CP.O2	cp value Output 2
SAVE	Save all data[2]
BAT.C	Battery capacity[2]
ST.SL	Status supplier's lock[2]
Cod.S	Supplier's code[2]
CLR.V	Clear counters
FRZ	Freeze[2]
CLR.X	Initialise device[2]
Md.O1[3]	Mode for Output 1
SC.O1[3]	Source Output 1
SP.O1[3]	Status pointer, Output 1
STAT[3]	Momentary status

[1] Basic structure of an archive data record.

[2] Quitting the submenu at this point is **not** possible (value can be changed via the keypad).

[3] User-specific values, i.e. the user can set which values are to be displayed (see 3.1).

2.4 Changing values

2.4.1 Differentiating between values (data classes)

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 TC210:

DC	Type	Entry, change using "ENTER"
1	Display test	No change possible.
2	Function	Function is initiated by pressing the key for at least two seconds.
3	Constant	No change possible.
4	Measurement	The value is updated by pressing the key for at least two seconds.
5	Status	No change possible.
7	Discrete value	When the key is pressed for at least two seconds, the value can be changed by using the key to select from a list of possible values.
8	Permanent value	No change is possible using the keypad on the device.
11	Combination	Changes possible on the device, but with 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.
19	Status register	No change possible.

If a value is accommodated in a submenu, it cannot be changed independent of its data class by the keypad, since pressing the key for at least two minutes then results in branching into the submenu.

2.4.2 Entry errors

Entry errors are output to the display if incorrect entries are made via the keypad by the operator.

The display is structured as follows:

--xx-- x = Error code according to the following table.

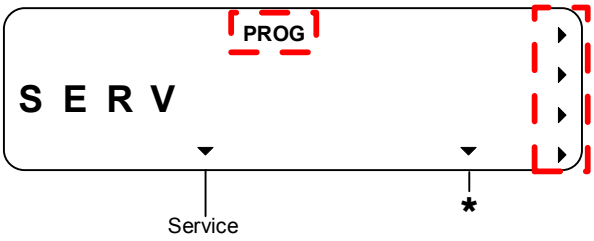
Code	Description
01	The archive is empty, no values are available yet.
02	The archive value cannot be read. The archive has possibly just been opened by the interface for reading out.
04	Parameter cannot be changed via the keypad or is a constant.
05	No authorisation for changing the value. To change the value the appropriate lock must be opened.
07	Incorrect combination: The entered combination (numerical code) is incorrect and the lock is not opened or the entered value is outside the limits.
11	Entry not possible due to special setting or configuration.

2.4.3 Examples of changing values

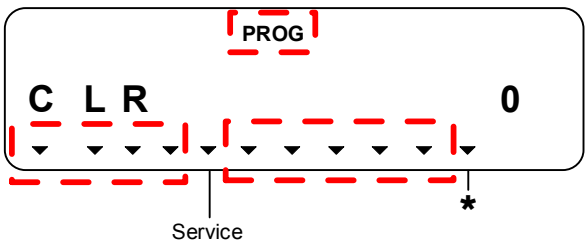
Adjustable values can be conveniently changed via the optical interface using the "WinPADS" parameterisation software. With the key on the device this is only possible with restrictions. The adjustable values are identified in the lists of the functional description.

Example 1: "cp value of Input 1" is to be changed (short designation: **CP.I1**). The calibration lock must be open for this.

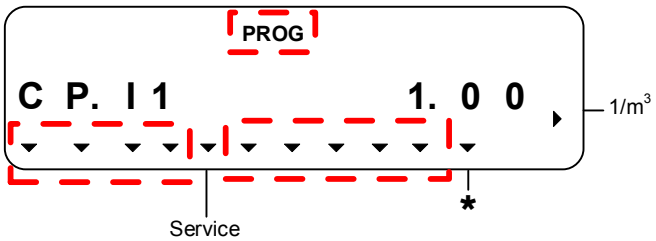
Open calibration switch. (**PROG** flashes). Use key to access **SERVICE** submenu (Right indicating arrows flash)



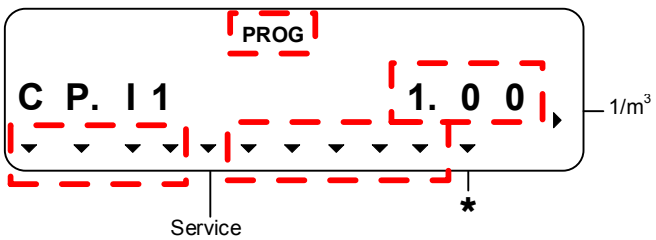
Press the key for at least 2 s. The value CLR (Clear status register) is displayed. (Lower indicating arrows flash)



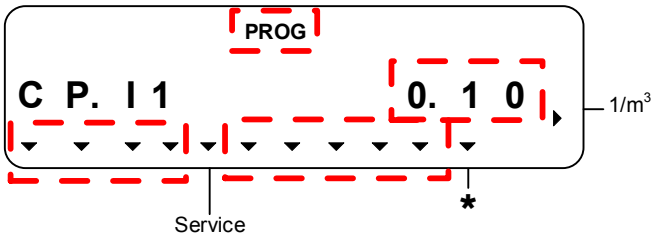
Keep pressing the key until the value **CP.I1** is displayed.

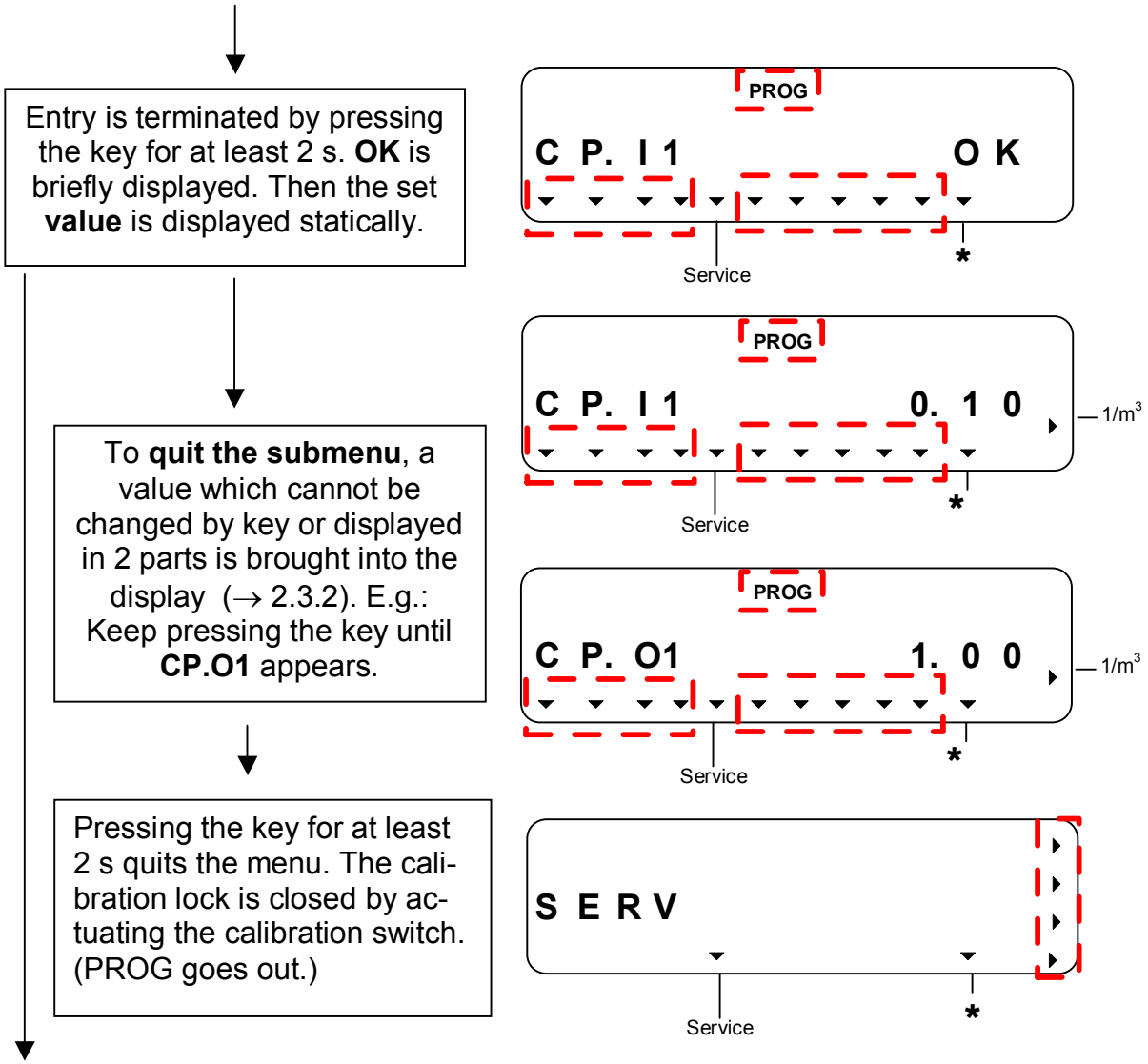


Press the key for at least 2 s. Displayed value flashes.



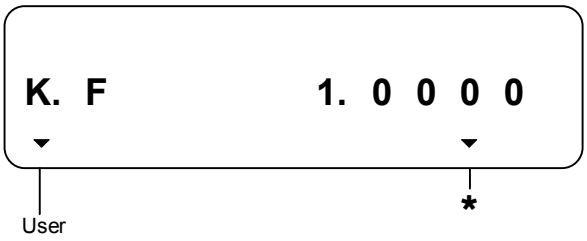
A decade value (1; 10; 100; 0.01; 0.10) can be set with the key e.g. 0.01.



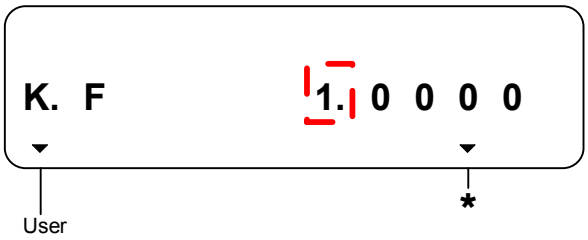

Entry is terminated by pressing the key for at least 2 s. **OK** is briefly displayed. Then the set **value** is displayed statically.
PROG
C P. I 1
O K
Service
To **quit the submenu**, a value which cannot be changed by key or displayed in 2 parts is brought into the display (→ 2.3.2). E.g.: Keep pressing the key until **CP.O1** appears.
PROG
C P. I 1
0. 1 0
1/m3
Service
PROG
C P. O1
1. 0 0
1/m3
Service
Pressing the key for at least 2 s quits the menu. The calibration lock is closed by actuating the calibration switch. (PROG goes out.)
S E R V
Service
The submenu is also left when the display switches off (after two minutes). The calibration lock must be closed again by actuating the calibration switch. (PROG goes out.)

Example 2: The "**Fixed value of the inverted compressibility ratio factor**" is to be changed (short designation: **K.F**). To achieve this, for operating the first time or in applications not subject to calibration, the supplier's lock is to be opened and then the calibration lock after putting into operation under official calibration.
In this example the first time of putting into operation is described.

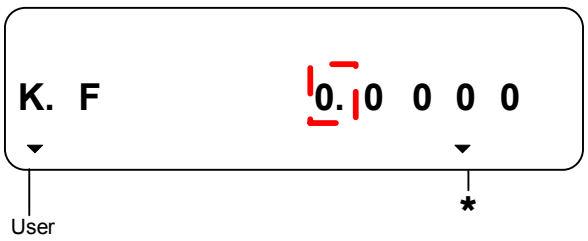
Open supplier's lock (see 2.5.3). Keep pressing the key until the value **K.F** is displayed.



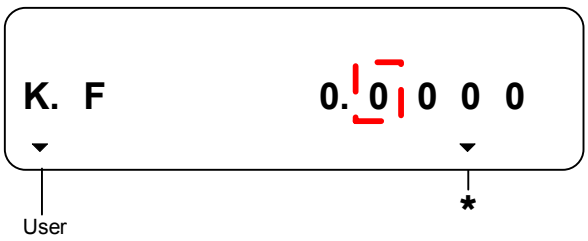
Press the key for a minimum of 2 s. The most significant figure flashes.



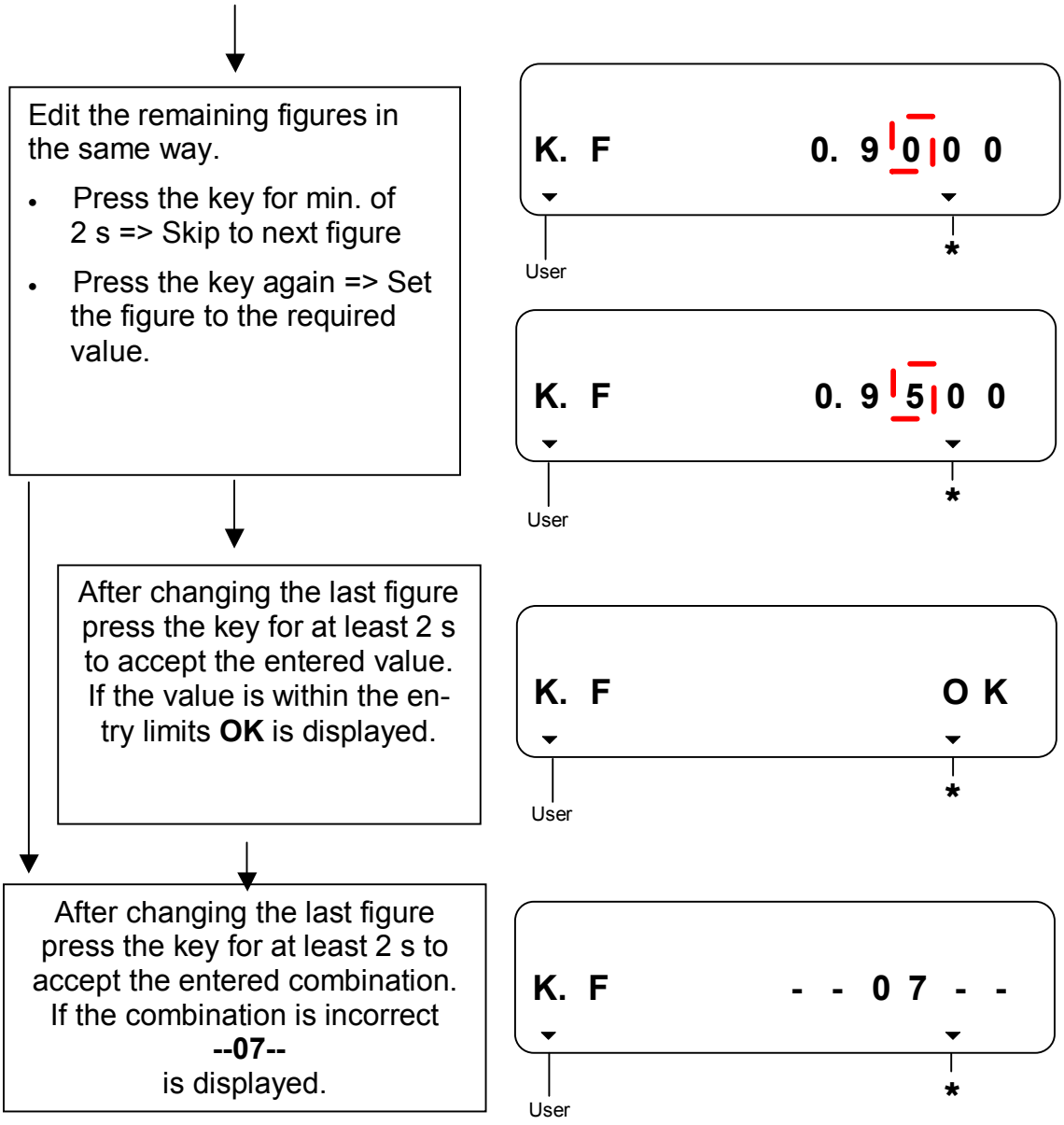
This figure can be set to the desired value with the key.



By pressing the key for a min. of 2 s the figure to the right can be selected (which then flashes).



This figure can be set to the desired value with the key.

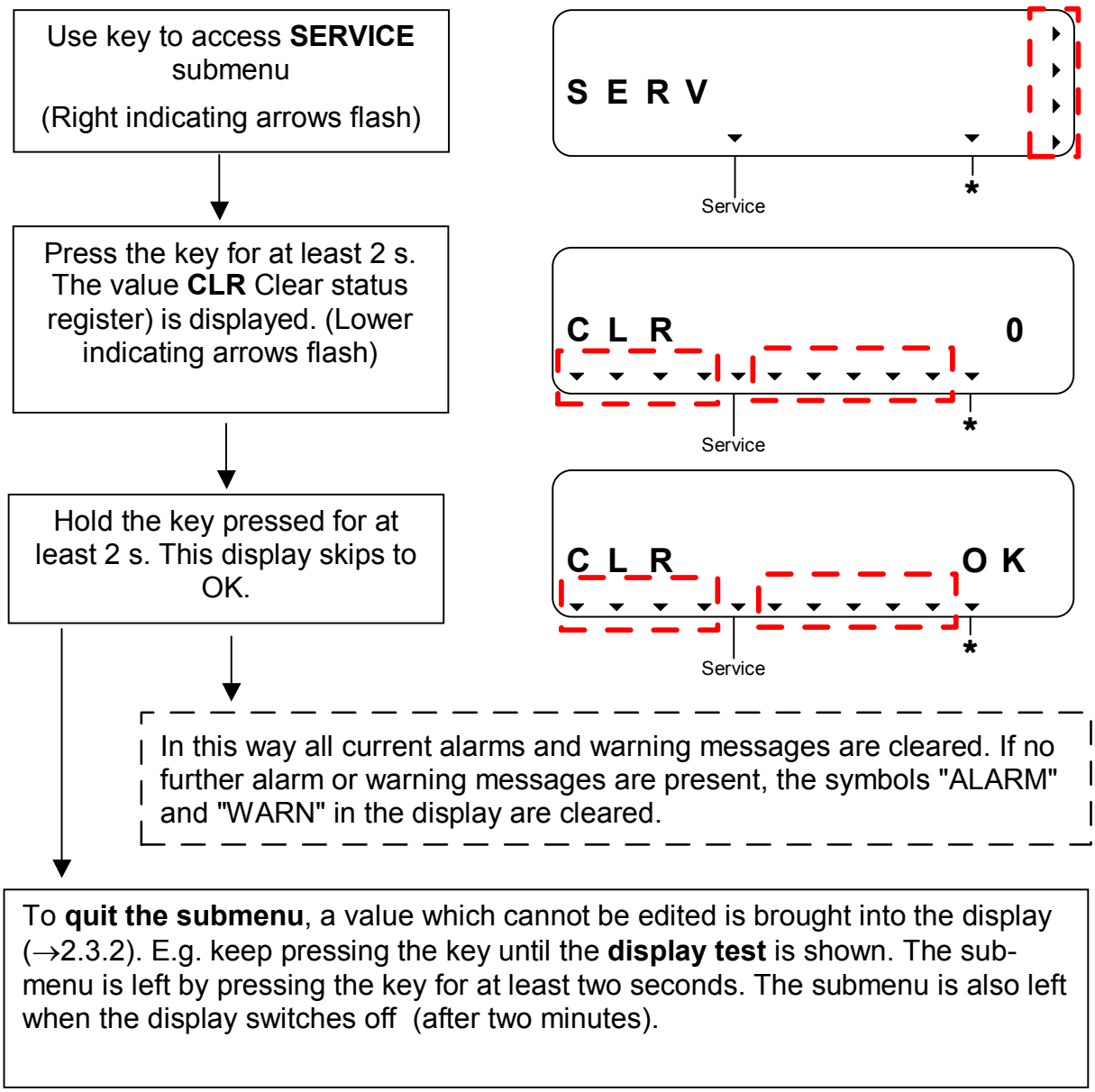

Edit the remaining figures in the same way.
• Press the key for min. of 2 s => Skip to next figure
• Press the key again => Set the figure to the required value.
K. F 0. 9 0 0 0
User
*
K. F 0. 9 5 0 0
User
*
After changing the last figure press the key for at least 2 s to accept the entered value. If the value is within the entry limits OK is displayed.
K. F O K
User
*
After changing the last figure press the key for at least 2 s to accept the entered combination. If the combination is incorrect --07-- is displayed.
K. F - - 0 7 - -
User
*

2.4.4 Quitting a submenu or the archive

- To **quit the archive** press the key for at least two seconds.
- To **quit a submenu** a value, which cannot be changed by key nor displayed in two parts, is brought into the display (see 2.3.2, e.g.: *CP.O1* in the submenu "*Service*"). The submenu is left by pressing the key for at least two seconds.
  The submenu is also left when the display switches off (after two minutes).

2.4.5 Example of initiating functions

The "**Status register**" is to be deleted (short designation: **CLR**).



2.5 Securing the values (access rights)

The TC210 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 to entries via the keypad as well as for access via the optical interface. If the lock is locked, all attempts to set values are answered with an appropriate error message (see Chapter **2.4.2**).

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

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

Each party with write access for a value can also change the access rights (write and read access for each party) for this value via the interface. This means that also the rights of parties with higher priority can be changed.

2.5.1 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 realised as a pushbutton which is located within the part of the TC210 housing which is secured under calibration regulations. It can be secured under calibration regulations with a sealing screw (→ **4.6**).

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

The calibration lock is opened by pressing the pushbutton (the symbol "PROG" flashes in the display) and is closed again when it is pressed again (symbol "PROG" goes out). Closure is also possible via the interface.

2.5.2 Supplier's and customer's locks

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"). (→ **2.5.3**, **2.5.4**). The code consists in each case of an eight-character code number.

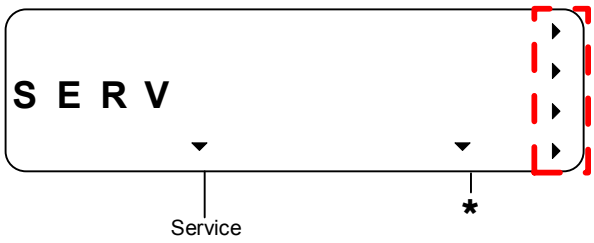
[1] The manufacturer's lock is reserved for Elster-Instromet GmbH and is not described here.

2.5.3 Supplier's lock: Status, closure, opening, changing the combination

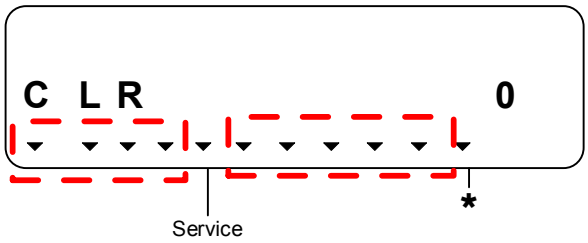
Displaying the current status of the supplier's lock

The supplier's lock is located in the submenu *Service*.

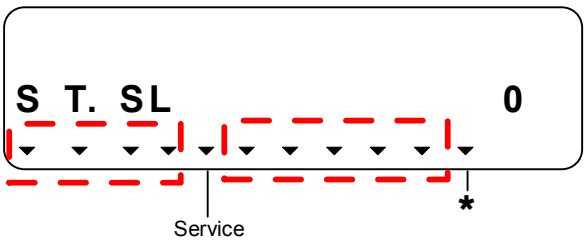
Move to the submenu **SERV** with the key (Right indicating arrows flash)



Press the key for at least 2 s. The value **CLR** (Clear status register) is displayed. (Lower indicating arrows flash)



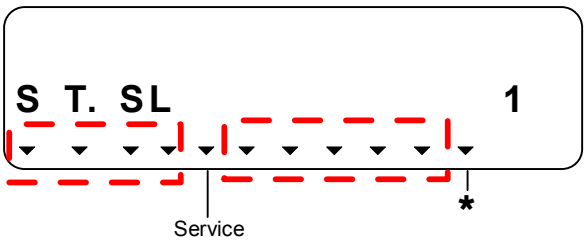
Keep pressing the key until the value **ST.SL** is displayed. The display "0" indicates a closed supplier's lock.



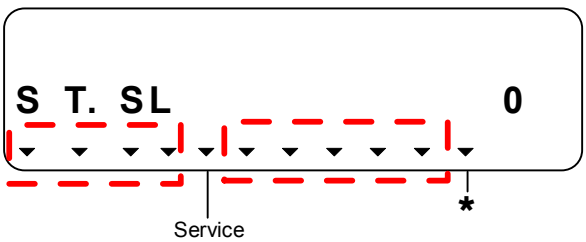
Closing the supplier's lock

To close the supplier's lock the status of the supplier's lock must be recalled in the submenu *Service* (see above), so that the following display appears:

This display of "1" indicates an open supplier's lock.

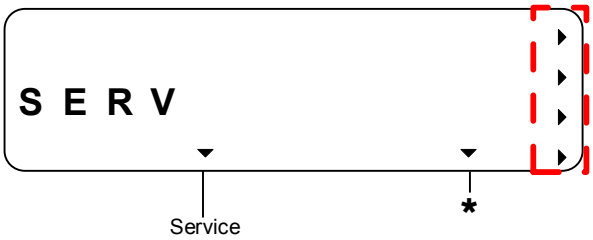


Press the key for at least 2 s. The display skips from "1" to "0". This concludes the entry and the supplier's lock is closed.

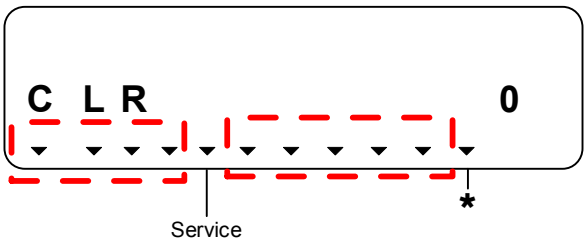


Opening the supplier's lock
Example customer combination: 13579Ad

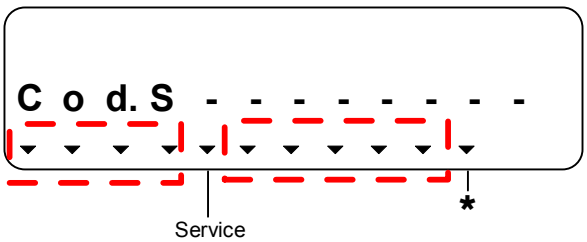
Move to the submenu **SERV** with the key (Right indicating arrows flash)



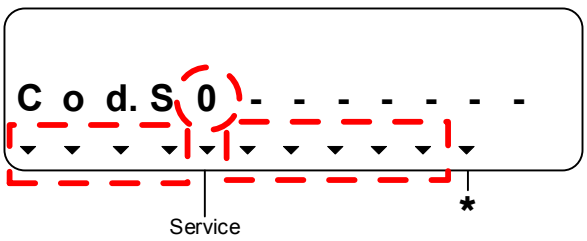
Press the key for at least 2 s. The value **CLR** (Clear status register) is displayed. (Lower indicating arrows flash)



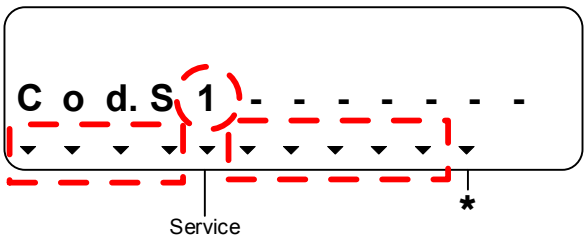
Keep pressing the key until the value **Cod.S** is displayed.



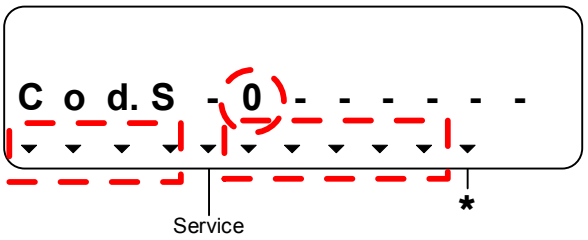
Press the key for at least 2 s. The most significant figure flashes.



With the key this figure can be set to the desired value.



By pressing the key for at least 2 s the figure to the right can be selected (it then flashes).



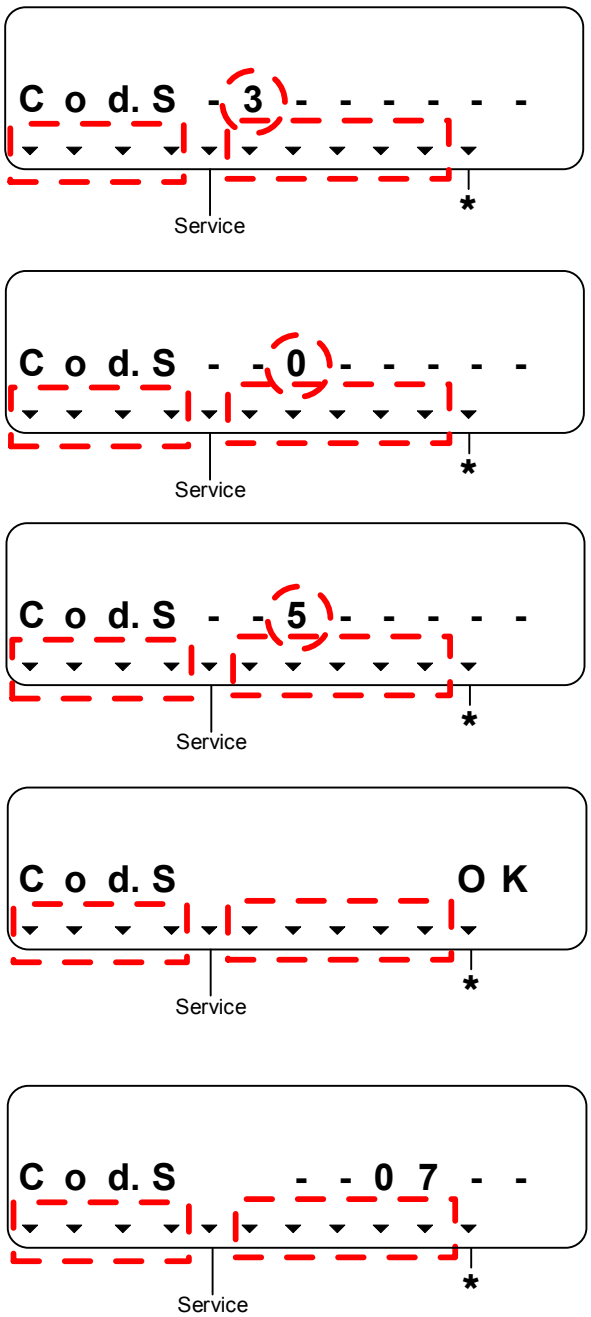
With the key this figure can be set to the desired value.

You can edit the remaining figures in the same manner.

- Press the key for at least 2 s => skip to next figure.
- Press the key again => Sets the figure to the desired value.

After changing the last figure, press the key for at least 2 s to accept the entered code. If the code is correct, **OK** is displayed.

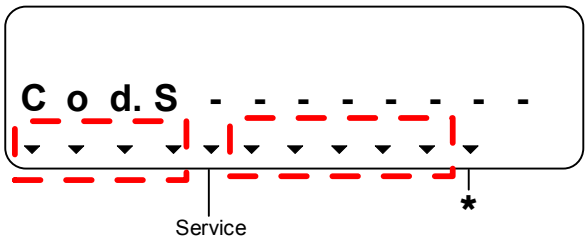
After changing the last figure, press the key for at least 2 s to accept the entered code. If the code is incorrect, **--07--** is displayed.



Changing the supplier's combination

Changing the supplier's combination is only possible with an open supplier's lock **(ST.SL = 1**, see above).

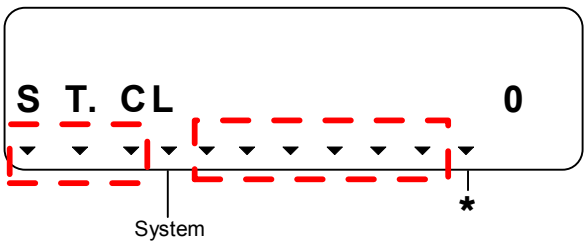
The change is made in the same way as for opening the supplier's lock (see above) using the value **Cod.S**. Once the entry is complete, the supplier's code is changed.



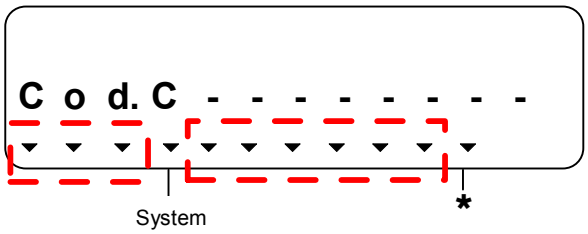
2.5.4 Customer's lock : Status, closure, opening, changing the combination

The customer's lock is located in the submenu *System*. The procedure for opening, changing and closing corresponds to that of the supplier's lock. Here, the following displays are recalled:

Display of the status and closing of the customer's lock:



Opening the customer's lock and changing the combination:



3 Functional description

The user interface in the TC210 is structured as a list (main menu) (see Chapter 2.3). From here at the appropriate entry points it is possible to skip into the submenus Archive, Total status register, System or Service.

The following functional description is orientated to this menu structure.

Here, the following abbreviations are used:

- AD Abbreviated designation
  Designation of the value in the display
- Address Address of the value.
  This is required especially for data transmission via the serial interface.
- Access Write access
  Indicates which lock must be opened to change the value (→ **2.5**):
  - C = Calibration lock
  - M = Manufacturer's lock
  - S = Supplier's lock
  - K = Customer's lock
- DC Data class
  The data class shows, amongst other properties, whether and how the value can be changed. (→ **2.4**)

3.1 Main menu (User list)

AD	Address	Designation / value	Unit	Access	DC
Vb	2:300	Volume at base conditions	m^3	C*	12
VbT	2:302	Total volume at base conditions	m^3	-	15
V	4:300	Actual volume	m^3	C*	12
VT	4:302	Actual volume (total)	m^3	-	15
T	6:310_1	Temperature	°C	-	4
TIME	1:400	Date and time	-	S*	12
P.F	7:311	Pressure fixed value	bar	S / C**	8
K.F	8:311	Inverted compressibility ratio factor, fixed value	-	S / C**	8
C	5:310	Conversion factor	-	-	4
TMIN	6:3A8_1	Lower alarm limit temperature	°C	C*	8
TMAX	6:3A0_1	Upper alarm limit temperature	°C	C*	8
EQ1T	5:280	Coefficient 1 of temperature equation	-	C*	8
EQ2T	5:281	Coefficient 2 of temperature equation	-	C*	8
EQ3T	5:282	Coefficient 3 of temperature equation	-	C*	8
ARCH	-	Skip to Archive 1 for display of the archive content.	-	-	-
S.REG	1:101	• Status register overall • Skip to Submenu 1 for display of the single statuses.	-	-	19
SYS	-	Skip to Submenu 2 for display of the system list.	-	-	-
SERV	-	Skip to Submenu 3 for display of the service list.	-	-	-

***** = The displayed value can only be changed via the interface.

****** = The displayed value is subject to the calibration lock after commissioning according to calibration regulations (for explanation see P.F and K.F).

(For legend see page 30)

The four values marked in grey are user-specific, i.e. the user can himself set which values are displayed in this list. The factory settings are the above values. The values which can be set at this point can be taken from the data list (Appendix C:).

The setting of the values to be displayed occurs by entering the addresses of the values to be displayed with the parameterisation software "WinPADS" under the addresses "1:1C2" to "5:1C2".

Vb **Volume at base conditions**

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" (→ 3.3.1.2).

VbT **Vb total**

Here the sum of *Vb* + *VbD* (volume at base conditions and disturbance quantity) is always displayed. Entries for *Vb* or *VbD* therefore also have an effect here. No entry for *VbT* itself can be carried out.

V **Actual volume**

The volume measured on Input 1 is summed here provided no alarm is present.

"Alarm" means any message with the number "1" or "2" (→ 3.3.1.2).

VT **V total**

Here the sum of *V* + *VD* (actual volume and disturbance quantity) is always displayed. Entries for *V* or *VD* therefore also have an effect here. No entry for *VT* itself can be carried out.

T **Temperature**

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

In disturbance-free operation the measurement T.MES (→ **3.3.3**) is used: *T = T.MES*.

With a relevant disturbance (alarm), the substitute value *T.F* (→ see below) is used: *T = T.F*. In addition, disturbance quantities are then counted (→ see below) and the message 6 displayed in the status register (→ 3.3.1.2). Relevant disturbances are:

- *T.MES* is located outside of the alarm limits *TMIN (6:3A8_1)*, *TMAX (6:3A0_1).* The alarm limits are read out and set with the calibration lock open using the WinPADS parameterisation software.

TIME **Date and time**

The date and time are displayed separately. First, the time is displayed. The date is displayed by pressing the key for at least two seconds. Briefly pressing the key again recalls the time into the display.

P.F **Pressure fixed value**

Here the fixed value of the absolute gas pressure needed for forming the C-factor (see below) is displayed. Changing via the keypad is possible taking the access rights into account (for the procedure see 2.4.3).

Entry range: 0.5 - 6 bar.

After putting into operation under calibration regulations, with calibrated devices the access right of this value must be changed with the aid of the parameterisation software from supplier's lock to calibration lock. To achieve this, the parameter file saved in WinPADS can be used or the command line *W1 7:1311.0 (175)* can be sent to the TC210 via the function "Set single values".

K.F **K-value, fixed value**

Here the fixed value of the inverted compressibility ratio factor needed for forming the C-factor (see below) is displayed. Changing via the keypad is possible taking the access rights into account (for the procedure see 2.4.3).

Entry range 0.5 - 1.5.

After putting into operation under calibration regulations, with calibrated devices the access right of this value must be changed with the aid of the parameterisation software from supplier's lock to calibration lock. To achieve this, the parameter file saved in WinPADS can be used or the command line *W1 8:1311.0 (175)* can be sent to the TC210 via the function "Set single values".

C **Conversion factor**

The conversion factor is calculated according to the following formula:

$$C = \frac{1}{K} \cdot \frac{p}{pb} \cdot \frac{Tb}{T}$$

(Pressure at base conditions ***Pb,*** pressure ***p = P.F*** *(for TC210)*, temperature ***T***, gas law deviation factor ***K= K.F*** *(for TC210)*: see above, Temperature at base conditions ***Tb*** → **3.3.2**)

TMIN **Lower temperature alarm limit**

TMAX **Upper temperature alarm limit**

The validity of the measured temperature is checked, based on these alarm limits. This monitoring does not occur when TMIN = TMAX.

If the measured temperature is located within the alarm limits, it is used as T (see below) for conversion:

If the measured temperature is located outside the alarm limits, the substitute value *T.F* (→ 3.3.2) is used: *T* = *T.F*. In addition, disturbance quantities are counted in this case and the message "1" is displayed in SR.1 (→ 3.3.1.2).

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 measured temperature *T.MES* from the raw temperature value *BIN.T* (→ Appendix C:):

$T.MES = EQ1T + EQ2T \cdot BIN.T + EQ3T \cdot BIN.T^2$

To adjust the temperature measurement circuit, the three coefficients of the quadratic equation can either be found by the TC210 itself or calculated by the user and entered using the WinPADS parameterisation software.

External to the TC210, the three coefficients can be calculated based on three values for *BIN.T* and the corresponding reference values.

When the TC210 determines the coefficients, it uses the value for *EQ3T* available at the time of entry and it calculates the corresponding *EQ1T* and *EQ2T* for this. The standard value for *EQ3T* is 6.4110E-7.

ARC **Archive**

Entry address for the archive which archives counter readings and measurements on a monthly cycle. Furthermore, archive rows are entered due to a special event (e.g. setting of the clock or of a counter, appearance of an important status message). The total depth of the archive is > 500 data rows.

S.REG Status register overall

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 the submenu *Service* 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 is an entry address for a submenu and initially indicates all available messages as numbers.

Skipping into the submenu is by pressing the key for at least two seconds. Pressing the key again switches from value to value in turn.

The submenu is left, returning to the entry address, by pressing the key for at least two seconds.

The meanings of the messages displayed in this submenu are described in the Chapters 3.3.1.1 and 3.3.1.2.

SYS System

Entry address for the submenu *System*.

SERV Service

Entry address for the submenu *Service*.

3.2 Archive

Counter readings and measurements are archived in the archive on a monthly cycle.
The day boundary (= month boundary) "6 hrs" can be changed using the WinPADS parameterisation software.

Skipping into the archive is by pressing the key for at least two seconds. Browsing through the data records can be carried out by pressing the key again, whereby switching always occurs to the next older data record. The content of the respective data record runs automatically through the display.

The archive is left, returning to the entry address, by pressing the key for at least two seconds.

Each archive data row has the following entries:

→	AONo	TIME	Vb	VbT	V	VT	T.MP	→
	Block number	Storage time	Volume at base conditions	Totaliser Vb	Actual volume	Totaliser V	Tempera-ture mean	

→	P.MP	C.MP	ST.5	ST.6	ST.SY	Ev	ER.Ch	→
	Pressure mean	C-factor mean	Status 5	Status 6	System status	Trigger event	Check-sum	To "AONo"

Normally, the flow (consumption) within a month is involved with the entries. This does not occur when an archive row has been entered due to a special event (e.g. setting of the clock or of a counter, appearance of an important status message).
The total depth of the archive is > 500 data rows.

3.2.1 Reading out the archive

There are a number of ways of reading out the archive in the TC210:

- AS-200/S2 (from version **V8.4**) on site (with entry of mech. meter reading possible).
- WinPADS parameterisation software for EK200 Series with optical readout head.

☞ **Since the TC210 does not support any readout notes, readout of the archive is only possible with certain settings, e.g. in conjunction with the AS200, *complete readout* or *previous month till now*. When reading out with WinPADS for the EK Series all readout settings which are <u>not</u> possible are masked out in grey in the appropriate window.**

3.3 Submenus

Skipping into the submenu occurs by pressing the key for at least two seconds.

3.3.1 Status register

AD	Address	Designation / value	Unit	Access	DC
SR.SY	2:101	System status register	-	-	19
SR.1	1:111	Status Register 1	-	-	19
SR.2	2:111	Status Register 2	-	-	19
SR.5	5:111	Status Register 5	-	-	19
SR.6	6:111	Status Register 6	-	-	19

(For legend see page 30)

The messages displayed in the status register *S.REG* can be found in the system status register SR.SY and in the status registers *SR.1*, *SR.2*, *SR.5* and *SR.6*. Their meanings are described in Chapters 3.3.1.1 and 3.3.1.2.

SR.SY System status
Here, messages can be found which generally relate to the TC210 system (→ 3.3.1.1).

SR.1 Status Register 1
SR.2 Status Register 2
SR.5 Status Register 5
SR.6 Status Register 6
Here, messages can be found which affect the inputs, outputs, temperature measurement and conversion factor (→ 3.3.1.2).

3.3.1.1 Messages in the system status (SR.SY)

1 Restart (Alarm)
The device was started without usable data. Counter readings and archive are empty, the clock has not yet been set.

3 Data restored (Warning)
The device was temporarily without any power supply. Possibly during battery replacement, the old 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 (→ 3.3.3), the counter readings and clock values correspond to the state at the time of the data backup.
Without manual data backup, the counter readings and clock values are retrieved with the state at the end of the last day before the voltage failure.

4 Voltage too low (Warning)
The voltage of the internal battery is too low in order to ensure trouble-free device operation.

8 Setting error (Warning)
On account of the parameterisation that has been carried out, an unusable combination of settings arose, e.g. a value which cannot be processed in a certain mode.

9 Remaining battery service life lower limit (Report)
The calculated remaining battery service life *BAT.R* (→ 3.3.2) has fallen below the set limit.
The limit can be changed via the serial interface under the address 2:4A1 using the WinPADS parameterisation software. The factory setting is 3 months.
While ever this message is present in *ST.SY*, the "BATT" symbol in the display flashes (→ 2.1).

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

13 Data transmission (Report)
Data is being transferred over the optical interface.
While ever this message is present in *ST.SY*, the "online" arrow in the display is active (→ 2.1).

15 Battery operation (Report)
This message indicates that the TC210 is a battery-powered device.

16 Daylight saving (Report)
The *TIME* (→ 3.1) in the TC210 is summer time (CEST).
The daylight saving selection (manual or automatic) can be changed via the serial interface using the WinPADS parameterisation software. The factory setting is manual.

3.3.1.2 Messages in the status registers 1, 2, 5 and 6

In *SR.1, SR.2, SR.5* and *SR.6* all messages are qualitatively equivalent.

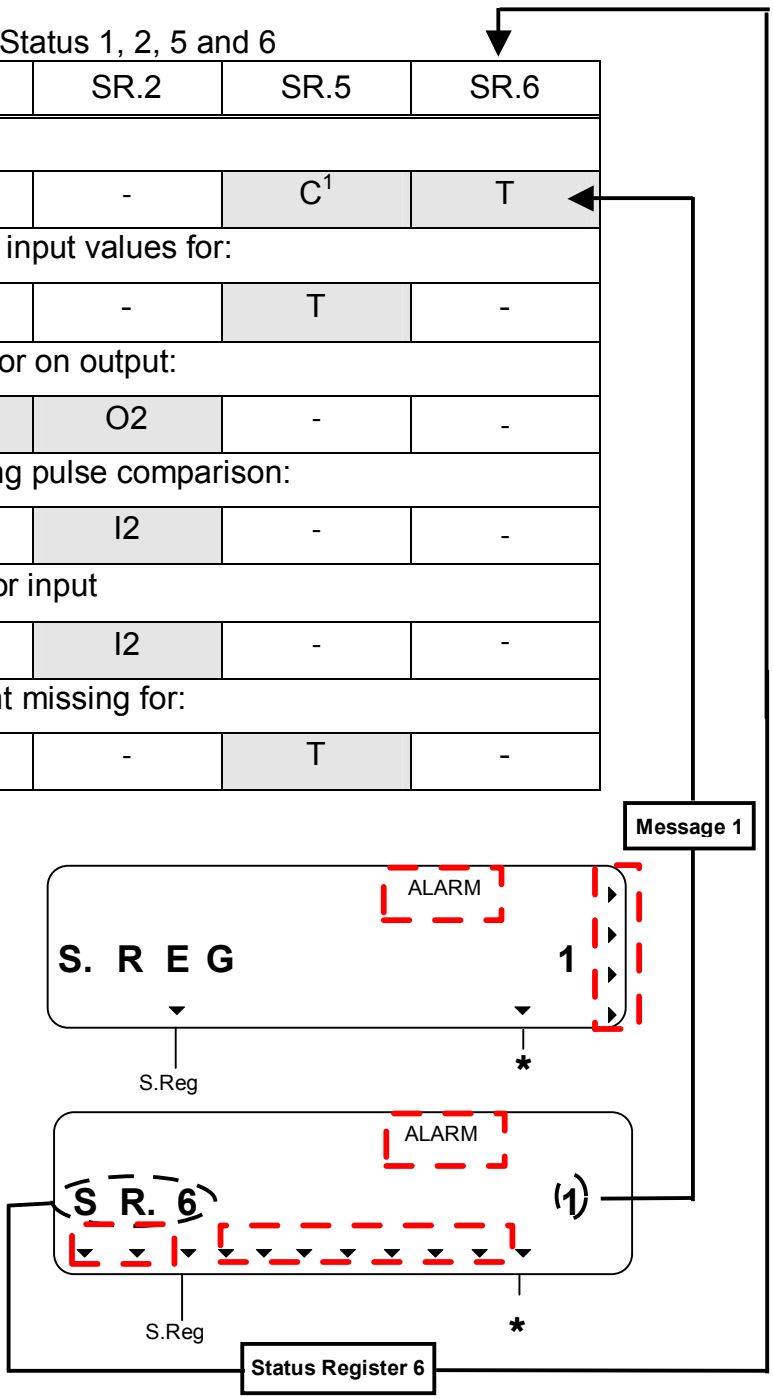
Table 1: Overview of the messages in Status 1, 2, 5 and 6

Message	SR.1	SR.2	SR.5	SR.6
1	Alarm for:			
	-	-	C[1]	T
2	No usable input values for:			
	-	-	T	-
4	Output error on output:			
	O1	O2	-	-
5	Error during pulse comparison:			
	-	I2	-	-
8	Warning for input			
	-	I2	-	-
10	Adjustment missing for:			
	-	-	T	-

Example:

In the main menu (User list) under the overall status register S.REG die Message 1 is shown and *ALARM* flashes. The arrows on the right side flash indicating a submenu.

Skipping into the submenu occurs by pressing the key for at least 2 s. Press the key until the Message 1 appears in the display (see right).



Meaning of the Message "1" in status register *SR.6*: The gas temperature is outside of the alarm limits .

[1] Conversion factor

SR.1 Status Register 1

4 Error on Output 1 (Warning)

The volume pulses to be passed through an output are temporarily saved in a pulse buffer. The buffer can accommodate 65535 pulses. If the volume to be output is continuously greater than that which can be output in the form of pulses, the pulse buffer continually fills and will eventually reach its maximum state. If then further pulses arrive, these can no longer be temporarily saved and are lost. The pulse buffer remains at its maximum state in this case. Message "4" indicates that pulses have been lost in this way.

If the pulse buffer drops below the level of 65000 pulses, the message is cleared again.

To rectify the cause of this problem, the cp value of the output (→ **3.3.3**) can be reduced or the output frequency (address 1:617) increased with an AS-200 Readout Device or with the WinPADS Parameterisation Software.

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

SR.2 Status Register 2

4 Error on Output 2 (Warning)

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

5 Error during pulse comparison on Input 2 (Warning)

Input 2 (E2) can be parameterised for monitoring purposes as a pulse input . With this parameterisation the pulses arriving on E2 are compared with those on Input 1. If the deviation is too great, Message "5" is displayed in *SR.2*.

Settings for the pulse comparison can be carried out with the WinPADS parameterisation software.

8 Warning signal on Input E2 (Warning)

Input 2 (E2) can be parameterised for monitoring as a pulse or signal input . When set as signalling input, here, for example, message "8" is displayed while ever an active signal is present, i.e. the terminals are connected through a low resistance.

SR.5 Status Register 5

1 Conversion factor cannot be computed (Alarm)

The conversion factor *C* (→ 3.1) cannot be computed because the temperature *T* (→ 3.1) is outside the range -100°C to +100°C or no usable fixed value for the gas law deviation value *K.F* (→ 3.1) is available.

Possibly the temperature sensor is not connected correctly or the fixed value for the gas law deviation value *K.F* has the value "0".

The conversion factor is set to "0" and disturbance quantities for V are counted in *VD* (→ 3.1).

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

2 No usable input value for temperature (Alarm)

The signal, *BIN.T* (→ 3.3.3), measured on the temperature input is outside the valid range. The sensor may not be correctly connected.

In this case the substitute temperature *T.F* (→ 3.1) is used for volume correction and disturbance quantities are counted for Vb and V (→ 3.1).

10 Temperature input not adjusted (Report)

The temperature input of the TC210 is precisely adjusted in the factory to the connected temperature sensor.

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

SR.6 Status Register 6

1 Alarm limits for temperature violated (Alarm)

The measured gas temperature *T.MES* is located outside of the set alarm limits (*TMIN*, *TMAX* → Appendix C:).

While ever this message is present in *SR.6*, the substitute temperature *T.F* (→ 3.1) is used for volume conversion and disturbance quantities are counted for *Vb* and *V* (→ 3.1). The alarm limits can be changed with the calibration lock open using the WinPADS parameterisation software. If they are set to the same value, they are ignored, i.e. they cannot cause any alarm messages nor disturbance quantities.

3.3.2 System

AD	Address	Designation / value	Unit	Access	DC
BAT.R	2:404	Remaining bat. life	M	-	15
MRL.T	5:224_1	Measurement range lower temperature limit	°C	C*	8
MRU.T	5:225_1	Measurement range upper temperature limit	°C	C*	8
T.F	6:311_1	Temperature substitute value	°C	S*	8
TARG	3:424	Ambient temperature range	°C	C*	8
Tb	6:312	Temperature at base conditions	K	C*	8
TYP.T	5:223	Type of temperature sensor	-	C*	8
SN.T	5:222	Serial number of temperature sensor	-	C*	8
Pb	7:312	Pressure at base conditions	bar	C*	8
ST.CL	4:170	Status of customer's lock: Status / close	-	K	7
Cod.C	4:171	Customer's combination, enter / change	-	K	11
VERS	2:190	Software version	-	-	3
CHK	2:191	Software checksum	-	-	4
MCYC	1:1F0	Measurement cycle time	s	C*	8
DAYb	2:141	Day boundary	h	C*	8
ADJ.T	1:452	Clock adjustment factor	-	C*	8

***** = The displayed value can only be changed via the interface.

(For legend see page 30)

The two values marked in grey are user-specific, i.e. the user can himself set which values are displayed in this list. The factory settings are the above values. The values which can be set at this point can be taken from the data list (→ Appendix C:).

The setting of the values to be displayed occurs by entering the addresses of the values to be displayed with the parameterisation software "WinPADS" under the addresses "6:1C2" and "8:1C2".

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). If *BAT.R* is less than 3 months, the message "9" (→ 3.3.1.1) is displayed in the system status and "BATT" (→ 2.1) flashes in the display.

Recalculation of the remaining battery service life is carried out automatically after the entry of a new battery capacity *BAT.C* (→ 3.3.3).

The settings of the measurement cycle MCYC (→ 3.3.2), operating cycle OCYC (→ Appendix C:), input mode and display switch-off (→ Appendix C:) 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 estimated.

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* (→ 3.3.3) is outside of the alarm limits, *T.F* is used as the temperature T for the conversion. *T = T.F*.

TARG Ambient temperature range

Identifies the ambient temperature for the TC210 in operation subject to calibration regulations.

Tb Temperature at base conditions

The Temperature at base conditions is used for computing the conversion factor (→ 3.1) and hence the volume at base conditions.

TYP.T Temperature sensor type

Identifies the type of temperature sensor used in the TC210.

SN.T Serial number of temperature sensor

Identifies the temperature sensor associated with the TC210.

Pb Pressure at base conditions

The Pressure at base conditions is used for computing the conversion factor (→ 3.1) and hence the volume at base conditions.

ST.CL Customer's lock status and lock closed

Depending on the status of the customer's lock a "0" (= closed) or "1" (= open) appears. Here, it is only possible **to close** the customer's lock.

Closing the customer's lock is comprehensively described in Chapter 2.5.4.

Cod.C Enter customer's combination and change combination

Here, the customer's lock can **only be opened** or **changed**, but not closed.
The customer's combination must be entered with 8 places. The individual characters of the combination code are 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".
The lock is opened after the correctness of the combination has been checked. An incorrect combination produces the error message --07--.
With the lock opened a new customer's combination can be entered here.
The procedure for opening and changing the customer's lock is comprehensively described in Chapter 2.5.4.
All places not changed are automatically written with "0" due to the default combination 00000000 and the entry procedure. This must also be taken into account when entering the combination via the interface.
For the case where a user has forgotten his combination Cod.C, it can be read out via the interfaces with the calibration lock open.

VERS Version number of software

CHK Software checksum

Version number and checksum provide clear identification of the software implemented in the TC210.

MCYC Measurement cycle time

Measurements (e.g. temperature), computed values (e.g. 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).

Changing this value is only possible with the WinPADS parameterisation software. Entering values which do not fulfil these conditions is rejected with the error message "6".

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

The factory setting is 20 seconds.

With settings less than 20 seconds the battery service life is reduced.

(→ B-2)

DAYb Day boundary

The day boundary indicates how many hours after 0:00 a change of day is to be carried out.

ADJ.T Clock adjustment factor

ADJ.T is the deviation of the running accuracy of the clock at room temperature in per mil ($\cdot 10^{-3}$). The TC210 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 TC210 displays the message 11 in the system status in the status *Stat*. (→ 3.3.1.1)

3.3.3 Service

AD	Address	Designation / value	Unit	Access	DC
CLR	4:130	Clear status register	-	S	2
-	1:1F7	Display test	-	-	1
CP.I1	1:253	cp value Input 1	1/m³	C	7
CP.I2	2:253	cp value Input 2	1/m³	S	7
CP.O1	1:611	cp value Output 1	1/m³	C*	8
CP.O2	2:611	cp value Output 2	1/m³	S*	8
SAVE	1:131	Save all data	-	S	2
BAT.C	1:1F3	Battery capacity	Ah	S	8
ST.SL	3:170	Status of supplier's lock: Status / close	-	S	7
Cod.S	3:171	Supplier's combination, enter / change	-	S	11
CLR.V	2:130	Clear counters	-	C	2
FRZ	1:1FE	Freeze	-	S	2
CLR.X	1:130	Initialise device	-	C	2
Md.O1	1:605	Mode for Output 1	-	C*	8
SC.O1	1:606	Source Output 1	-	C*	8
SP.O1	1:607	Status pointer, Output 1	-	C*	8
STAT	1:100	Momentary overall status	-	-	5

***** = The displayed value can only be changed via the interface.

(For legend see page 30)

The four values marked in grey are user-specific, i.e. the user can himself set which values are displayed in this list. The factory settings are the above values. The values which can be set at this point can be taken from the data list (Appendix C:).

The setting of the values to be displayed occurs by entering the addresses of the values to be displayed with the parameterisation software "WinPADS" under the addresses "9:1C2" to "12:1C2".

CLR **Clear status register**
With this function all the status register content (alarms and warnings) can be cleared (see Chapter 2.4.5 for procedure). If the alarm or warning states are still present, they are again directly entered as messages.

- **Display test**
The display flashes to test all segments.

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 *V* (→ 3.1); the increase in volume is directly accepted into the total actual volume *VT* (→ 3.1). (See Chapter 2.4.3 for the principal procedure for the change on the device.)
CP.I1 indicates how many pulses correspond to the volume of 1 m^3.

CP.I2 cp value Input 2

If Input 2 is set as a counting input (pulse comparison with Input 1) (*Md.I2* = 1, *address: 2:207*), the pulse constant must be entered here which is used for the conversion of the pulses to the volume *V2* (→ Appendix C:).
(See Chapter 2.4.3 for the principal procedure for the change on the device.)

The volume *V2* can only be read out using the WinPADS parameterisation software.

Input 2 can be used for the pulse comparison with Input 1 or as active status input. The setting of the mode on Input 2 (→ Appendix C:) is only possible using the WinPADS parameterisation software.

- *Md.I2 = 0* signifies: Input 2 is switched off.
- *Md.I2 = 1* signifies: Pulse comparison between Inputs 1 and 2
- *Md.I2 = 2* signifies: Input 2 is an active status / warning input.

If Input 2 is set as a status input (see above), *CP.I2* has no significance.
CP.I2 is not subject to the calibration lock because it has no influence on *V* or *Vb*.

CP.O1, CP.O2 cp value for Outputs 1 and 2

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

$i = V \cdot CP.O...$

where i: Number of output pulses
V: Volume increase which is to be output as a pulse.

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

If a mode other than "1" is set (→ Appendix C:), CP*.O...* has no significance. With a change of the output cp value, the corresponding input buffer is cleared. (→ 3.3.1.2)

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).
(See Chap. 2.4.5 for the principal procedure).

BAT.C Battery capacity

Here, the original capacity (not the residual capacity) of the battery last used is displayed.

After a battery replacement the capacity of the battery used must be re-entered so that calculation of the new 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-Instromet GmbH, the value 13.0 Ah should be entered accordingly for *BAT.C*.

ST.SL Supplier's lock status and close

Depending on the status of the supplier's lock a "0" (= closed) or "1" (= open) appears. Here, it is only possible **to close** the supplier's lock.

Closing the supplier's lock is comprehensively described in Chapter **2.5.3**.

Cod.S Enter supplier's combination and change combination

Here, the supplier's lock can **only be opened** or **changed**, but not closed.
The supplier's combination must be entered with 8 places. The individual characters of the combination code are 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".
The lock is opened after the correctness of the combination has been checked. An incorrect combination produces the error message --07--.
With the lock opened a new supplier's combination can be entered here.
The procedure for opening and changing the supplier's lock is comprehensively described in Chapter **2.5.3**.
All places not changed are automatically written with "0" due to the default combination 00000000 and the entry procedure. This must also be taken into account when entering the combination via the interface.
For the case where a user has forgotten his combination *Cod.S*, it can be read out via the interfaces with the calibration lock open.

CLR.V Clear counters (incl. archive)

All counter readings and the archive can be cleared with this function. (See Chap. 2.4.5 for the principal procedure).

FRZ Freeze

Measurements (see below) can be frozen with this function.
(See Chap. 2.4.5 for the principal procedure).
Freezing is used especially for checking the operating point
Frozen values which can be read out with the WinPADS parameterisation software:

AD	Address	Designation / value
Vb.FR	2:3E0	Frozen value of Vb
V.FR	4:3E0	Frozen value of V
T.FR	6:3F0_1	Frozen value for T
P.FR	7:3F0	Frozen value of p
C.FR	5:3F0	Frozen value of C
K.FR	8:3F0	Frozen value of K

CLR.X Initialise device

With this function the TC210 can be reset to a defined initial status. All data (counter readings, archive and settings) are cleared. (See Chap. 2.4.5 for the principal procedure).

☞ **The function should only be executed by trained persons with appropriate operating equipment, because a complete parameterisation with, where applicable, calibration must then be carried out.**

☞ **This function may only be executed when there is no link via the optical interface to the TC210, because it would be uncontrollably interrupted and not then reset.**

Md.O1 Mode for Output 1

The two signal outputs of the TC210 can be set for various functions. The settings can only be carried out via the optical interface with the aid of the WinPADS parameterisation software.

The basic function of the output is defined with the mode *Md.O...* Depending on this, the source (*SC.O...,* see below), the cp value (CP*.O...,* see above) or the status pointer (*SP.O...*, see below) must also be parameterised, where necessary, for the relevant output.

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

Md.O...	Meaning	To program:		
		SC.O...	*CP.O...*	*SP.O...*
0	Output switched off (transistor blocking, "switch open")	-	-	-
1	Volume pulse output	Yes	Yes	-
2	Status output, logic active (signalling active => output switched on)	-	-	Yes
4	Output switched on (transistor conducting, "switch closed")	-	-	-
6	Status output, logic inactive (signalling active => output switched off)	-	-	Yes

The ex-works standard setting is:

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

With the aid of the WinPADS Parameterisation Software the access rights (→ 2.5) 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.

SC.O1 Source for Output 1

The setting of the sources for the outputs can only be carried out via the optical interface with the aid of the WinPADS parameterisation software.
This value is only of significance if the mode *Md.O...* of the same output is set to "1" (volume pulse output) (the same also applies to *SC.O2*, → Appendix C:). Depending on this, the following settings for *SC.O…* are practicable:

- for mode "1" (volume pulse output)

SC.O...	Meaning
00002:300_0	Vb Volume at base conditions, undisturbed
00002:301_0	VbD Volume at base conditions, disturbance quantity
00002:302_0	VbT Volume at base conditions, total quantity (undisturbed + disturbed)
00004:300_0	V Actual volume, undisturbed
00004:301_0	VD Actual volume, disturbed
00004:302_0	VT Volume at base conditions, total quantity (undisturbed + disturbed)

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

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

SP.O1 Status pointer for Output 1

The setting of the status pointers for the outputs can only be carried out via the optical interface with the aid of the WinPADS parameterisation software.

If the output is programmed as "status output with active logic" (*Md.O...*= 2), then *SP.O...* sets with which status messages (→ 3.3.1) the output is to be switched on. If none of the selected messages is prevailing, the output remains switched off (the same also applies to *SC.O2*, → Appendix C:).

If the output is programmed as "status output with inactive logic" (*Md.O...*= 6), then *SP.O...* sets with which status messages the output is to be switched off. If none of the selected messages is prevailing, the output remains switched on (!) (the same also applies to *SC.O2*, → Appendix C:).

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

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

STAT Momentary overall status

The momentary status is also designated briefly as "Status".
Messages in the momentary status point to current statuses such as for example, errors that are present. When the condition is no longer present, the corresponding message in the momentary status disappears. Manual deletion is not possible. Alarms, warnings and reports are displayed.

4 Putting into operation subject to calibration

4.1 Setting the parameters on site

The modes (counting or signal input) and the c_p values of the inputs, the day boundary and, where applicable, the reading of the main or adjustable counter must be set.

☞ ***Before changing values subject to calibration, the calibration lock must be opened by pressing the calibration button in the device (symbol "PROG" flashes in the display).***

The setting of the access rights for the fixed values for pressure (P.F) and inverted compressibility ratio factor (K.F) is described in Chapter 3.1 under the respective description of the value (K.F and P.F).

4.2 Checking the set values

Checking the set parameters can take place directly on the unit by means of the keypad, (see Chap. 2.3) or conveniently via the WinPADS parameterisation software.

The software can be obtained free of charge as a download via www.elster-instromet.com in the section "Download", "Software Download"; the product code can be requested via the Electronics hot-line (Tel.: +49 (0) 6134 / 605-123 or at support@elster-instromet.com).

In the rating data book the associated parameters are clearly described by quoting the address. Values not directly available in the TC210 display can be recalled under "Application-specific values" (see Chap. 3.1, 3.3.2 or 3.3.3).

The correctness of the set parameters is ensured by comparison of the details in the rating data book with the called values in the operator list, (see Chapter 2.3) or with the WinPADS parameterisation software.

4.3 Calibration check

If a calibration test is required, it is carried out based on the **PTB-Prüfregel, Band 20** (Standards Board Test Rules, Volume 20), Chapter 4.

4.4 Sealing

1. **Secure the housing cover**
   The housing cover is screwed on with four screws. Sealing occurs using adhesive labels (**seal layout - see Chapter** 4.6).

2. **Closing and securing the calibration switch**
   Once all values subject to calibration regulations have been modified, the calibration lock is closed by pressing the button (*"PROG" symbol goes out)* and the opening is closed off with a capstan-headed screw. The calibration lock is sealed by a sealing wire which joins the capstan-headed screw to the housing.
   (See Chapter 4.6 for seal layout).

3. **Securing the inputs**
   When used in applications subject to calibration for billing purposes, the required inputs must be secured against tampering by calibration covering caps. Sealing is provided by an adhesive label on the relevant covering cap.
   (for seal layout see Chapter 4.6).

4. **Closing the housing**
   Completely close the housing (battery compartment) and secure with four screws.

   ☞ ***Make sure that no cables are pinched.***

   ☞ ***Ensure that the screws are securely tightened so that no moisture can penetrate the TC210.***

4.5 Recalibration

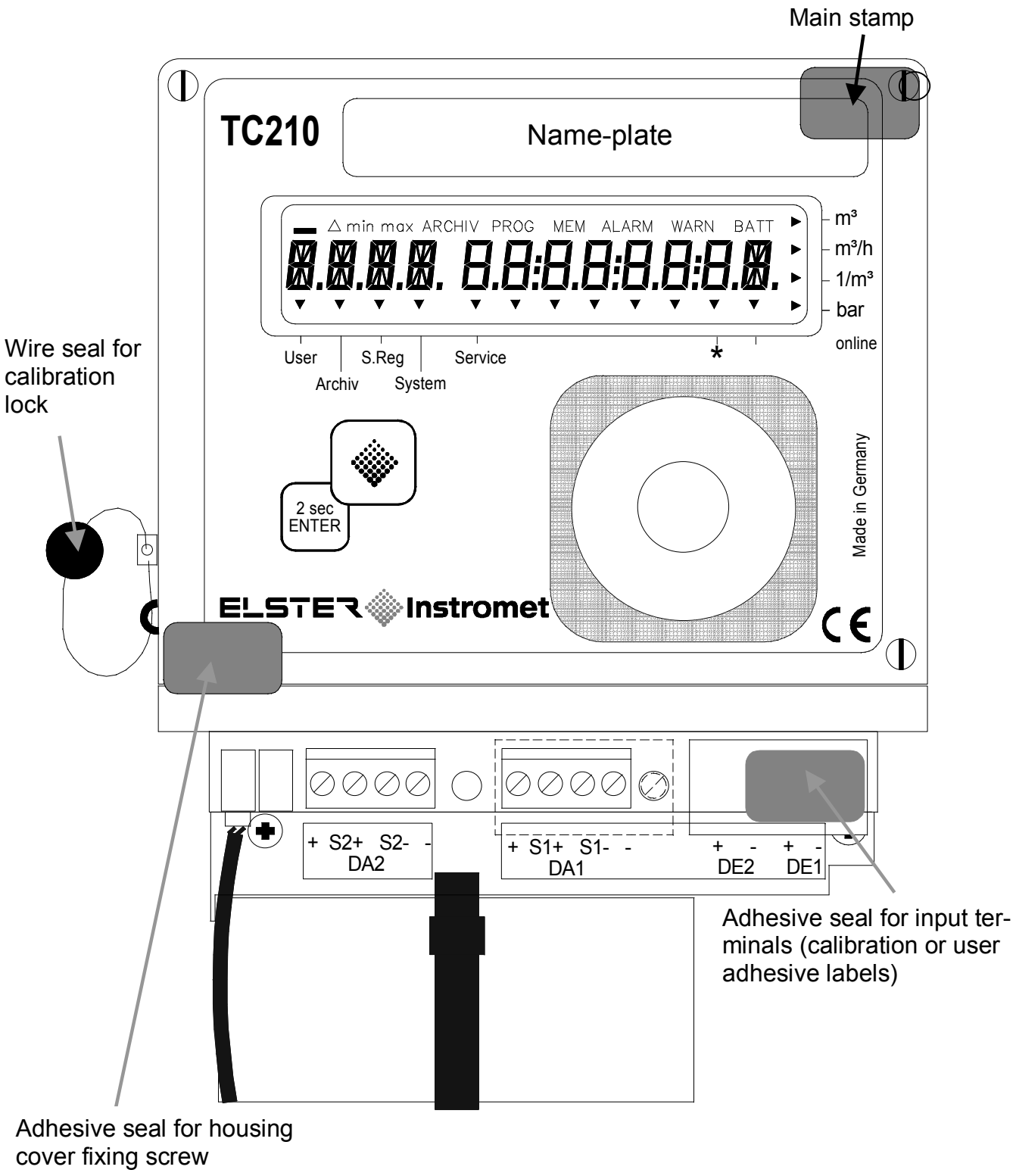
When using the TC210 in applications subject to official calibration, the recalibration periods should be observed.

According to the **Calibration directive – General regulations**, issued in 2000, these recalibration periods are given in Appendix B under item number 7.10.

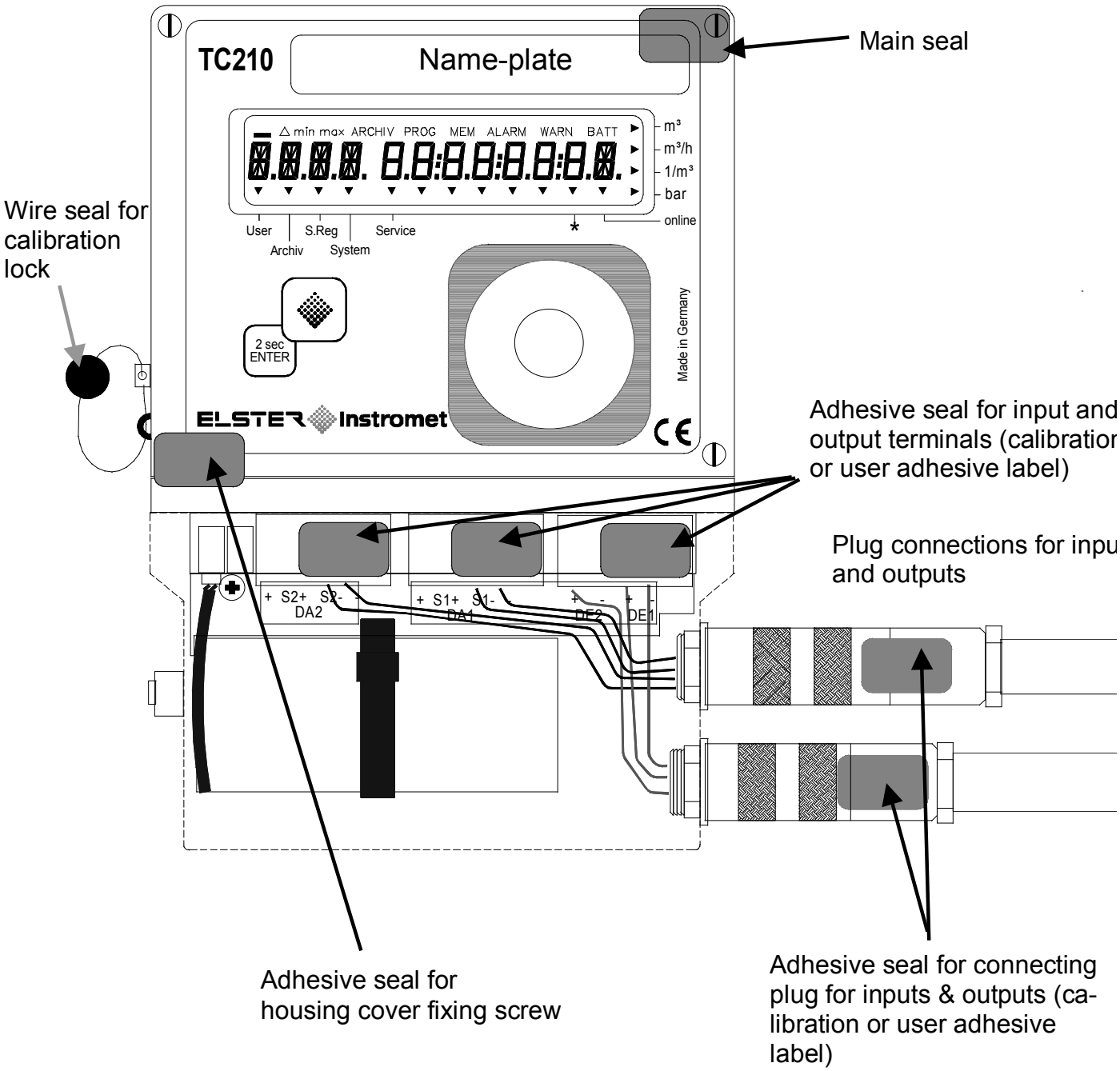
In the **PTB-Prüfregel, Band 20** (Standards Board Test Rules, Volume 20), the procedures for testing electronic volume correctors for gas are described.

4.6 Seal layout

4.6.1 Cable connection by cable glands



4.6.2 Cable connection using plugs



Part 2

Description of the Initial Operation

5 Installation

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 Fitting to a diaphragm gas meter ≤ G25

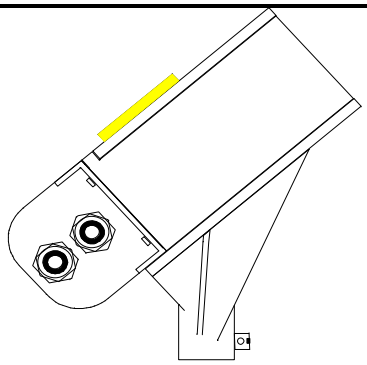
According to the PTB directive TRG3, the TC210 can be put into operation together with the commercial diaphragm gas meters BK-G10 to BK-G25 in the factory as a measurement unit.

5.2 Installations made directly onto thermowells

In various versions the TC210 is set up directly on a thermowell.
If no thermowell is available, then with turbine-wheel and diaphragm gas meters the installation must be made up to 3 D (D = pipe diameter), but at most 600 mm after the meter.
With rotary piston meters the installation must be made up to 2 D in front of the meter.

☞ ***A second thermowell for the comparison measurement is generally required for acceptance of the system.***

Version I	Mounting directly on the thermowell using a plug system.
Version II	Mounting on the thermowell using a plug system via a bendable arm.
Version III	Mounting directly on the thermowell using a screw thread.
Version IV	Mounting on the thermowell using a screw thread via a bendable arm.

TC210 with installation plate								
Order no.	Installation plate: 73018477							
Connecting piece								
Order no.	73013853						73013854	73013853
Bendable arm								
Order no.				73014250				73014251
Thermowells								
Order no..	73014456	73012634	73018428	73014456	73012634	73018428	73012100	73012100
Version	I			II			III	IV

5.2.1 Installation procedure for the device versions I to IV

The following steps must be carried out to install the device:

1. Mounting the TC210 directly onto a thermowell.
   If no thermowell is available, then with turbine-wheel and diaphragm gas meters the installation must be made up to 3 D, but at most 600 mm after the meter. With rotary piston meters the distance should be 2 D in front of the meter (D = pipe diameter).
2. Connect the pulse transmitter.
3. If required, connect further equipment to the pulse/signal outputs.
   ☞ *If the TC210 is used in a hazardous area (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 TC210 can be taken from the EC prototype test certificate (see Appendix A-2). These must be followed. The approval is only valid when electrical circuits are connected which conform to the EC prototype test certificate.*
4. With any unused union glands replace the insertion seal by 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 (battery compartment).
   ☞ When closing the housing, make sure that no cables are pinched.

5.3 Other mounting versions

In addition to the mounting versions described under 5.2, it is possible with the aid of additional mounting brackets to mount the TC210 on the wall (Id. No. 73018475) or on the Elster-Instromet S1 Meter Head (Id. No. 73018478).

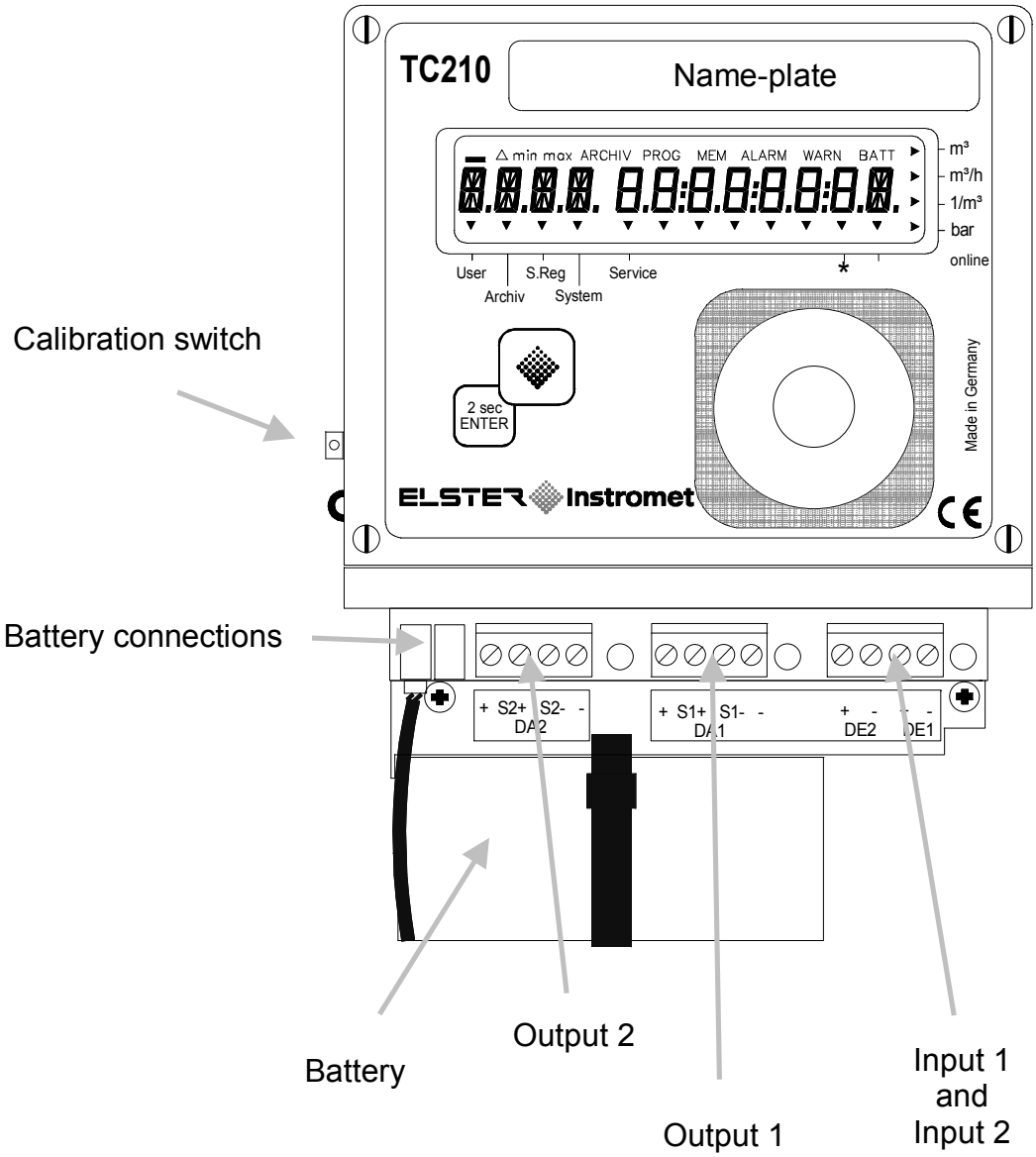
5.4 Cable connection and earthing

The TC210 must not be earthed. The connection is only used by the manufacturer for test purposes.

All permanently connected cables have a screen. The screen must be connected all round, complete and flat. The TC210 has special EMC cable glands for this purpose.

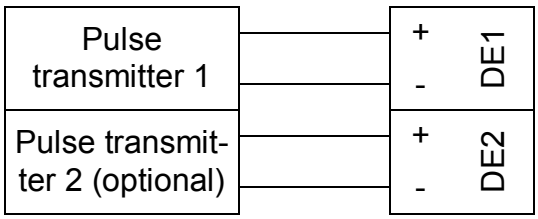
A single-ended connection to earth is sufficient to prevent interference from high frequency electromagnetic fields.

5.5 Terminal layout



5.6 Connection of a low-frequency pulse transmitter (reed contacts)

A pulse transmitter must always be connected to the terminal "DE1". In addition, a second pulse transmitter can be connected to terminal "DE2", e.g. for a pulse comparison. Any polarity can be chosen. Connection diagram:



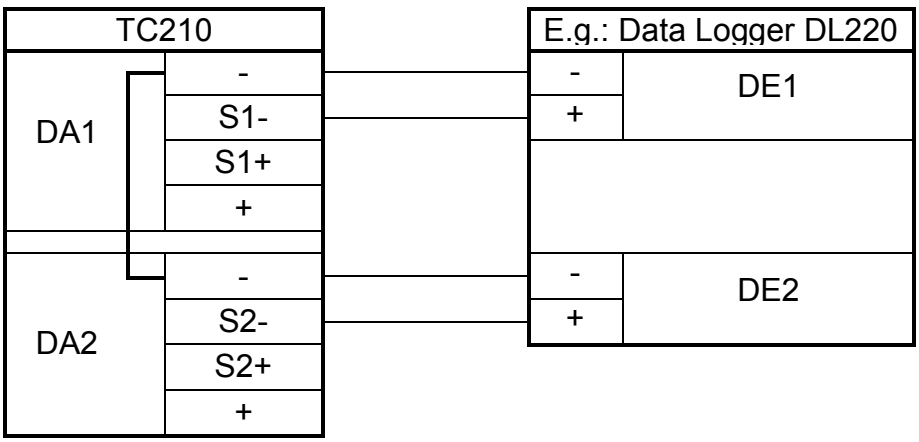
5.7 Output connections

The TC210 outputs can be connected in two ways.

☞ **The TC210 outputs have a common negative potential.**

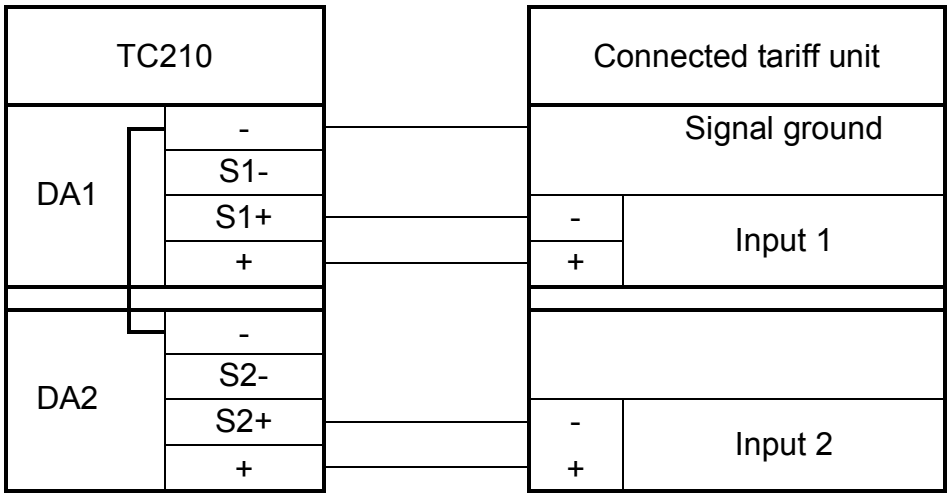
5.7.1 Connecting the negative pole

Connection diagram:



5.7.2 Connecting the positive pole

Connection diagram:



5.8 Setting parameters specific to the measuring point

1. **Putting into operation**
   All parameters can be set conveniently via the WinPADS parameterisation software. The most important values can however also be adjusted via the keypad.

   ☞ Values subject to calibration regulations can only be changed with the calibration lock open.

5.9 Functional testing

1. **Functional tests**
   The display is switched on by key depression and the inputs and outputs can be checked (see Chapter **2**).
2. **Setting the time**
   The device time can be set with the WinPADS parameterisation software.
3. **Test of pulse counting**
   The pulse transfer from the meter to the TC210 must be checked for proper functioning.

5.10 Maintenance

If the TC210 is used in the field subject to calibration regulations, the recalibration periods must be observed.

When cleaning the housing becomes necessary, no aggressive cleanser (e.g. acetone, petroleum spirit, etc.) should be used, because this may attack the housing. A damp cloth with a soapy solution or similar is quite sufficient.

5.10.1 Battery replacement

During operation a check must be made from time to time of whether the battery needs to be replaced. A display of the remaining battery service life is provided for this in the TC210 under "System" submenu.

☞ *With the specified standard operating mode (see Chapter: B-2), operation is still possible until as shown in the display. The remaining battery service life reduces more quickly through more frequent measurement, reading out of the values and an active display.*

☞ *Battery replacement can be carried out without the presence of a calibration official, because the battery compartment itself is not sealed.*

☞ *TC210 measurements (e.g. counter readings) may be lost due to careless procedures. All the set parameters and, once daily, the date, time and counter readings are also saved in an EEPROM. This means that these values are also not completely lost even in the event of a voltage failure.*

☞ *Generally, replacement should only be carried out by Elster-Instromet Service or by specially trained personnel.*

5.10.1.1 Carrying out battery replacement

(1) Save the data as a precautionary measure (see Chapter 3.3.3).

(2) Open up the battery compartment and pull it downwards. The battery is then accessible.

☞ *Do not pull the battery compartment downwards too vigorously, because connected cables may be broken.*

☞ *Check the type and order number of the new battery.*

Tip: Mark the old batteries, e.g. with a felt-tip pen or sticker before you start the battery replacement. This avoids any later confusion.

(3) At least one battery must always be connected to one of the two plugs. If this is not the case, volume pulses may be lost during the battery replacement and the clock may be slow after battery replacement.

(4) Release the cable tie to enable the battery to be removed.

(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 with the cable tie and insert its end into the opening in the housing.

(8) Close the device again.

☞ *Make sure that the connected cables are not pinched.*

(9) Check in the display that no message "3" is entered under "Status"!

(10) The initial capacity must be re-entered under "Service" - "Battery capacity" (→ 3.3.3: *BAT.C*) (this is essential even with the same capacity value)! With the use of the size "D" battery obtainable from Elster-Instromet GmbH, the value 13.0 Ah should be entered accordingly for *BAT.C*.

(11) Check the operating life calculated by the TC210: For *BAT.R* (→ 3.3.2) at least 96 months must be displayed. Apart from that, carry out step (10) again.

This successfully concludes the battery replacement.

Appendix

Appendix A Approvals

A-1 EC Declaration of Conformance

Konformitätserklärung

Nr. KCE115

gemäß: EMV-Richtlinie 89/336/EWG des Rates in der aktuellen Fassung
bzw. "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)"
in der aktuellen Fassung

Anbieter: ELSTER GmbH

Anschrift: Steinernstrasse 19-21
55252 Mainz-Kastel

Produkt: Temperatur-Mengenumwerter TC210

Das oben beschriebene Produkt ist konform mit:

Dokument-Nr.	Titel	Ausgabe / Ausgabedatum
DIN EN 61326	Elektrische Betriebsmittel für Leittechnik und Laboreinsatz - EMV-Anforderungen	Mai 2004
DIN EN 61000-6-1	Störfestigkeit für Wohnbereich, Geschäfts- und Gewerbebereiche sowie Kleinbetriebe	Aug. 2002
DIN EN 61000-6-3	Störaussendung für Wohnbereich, Geschäfts- und Gewerbebereiche sowie Kleinbetriebe	Aug. 2002

Zusätzliche Angaben

Zu „Störaussendung": Es wird „Klasse B" erfüllt.

Mainz-Kastel, 28. Oktober 2004
(Ort und Datum der Ausstellung)

O. Pfaff, Leiter Elektronik Entwicklung
(Name, Funktion)

O. Pfaff
(Unterschrift)

Declaration of Conformance (Translation of original document)

No. KCE115

According to: EMC Directive 89/336/EEC of the Council in the current version or "Law on the electromagnetic compatibility of equipment (EMCL)" in the current version.

Supplier: ELSTER GmbH

Address: Steinernstrasse 19-21
55252 Mainz-Kastel

Product: Temperature-Volume Corrector TC210

The product described above conforms to:

Document No.	Title	Issued / publication date
DIN EN 61326	Electrical equipment for measurement, control and laboratory use - EMC requirements	May 2004
DIN EN 61000-6-1	Electromagnetic compatibility - Generic standards - Immunity for residential, commercial and light-industrial environments	Aug. 2002
DIN EN 61000-6-3	Electromagnetic compatibility - Interference emission for residential, commercial and light industrial areas	Aug. 2002

Additional details

Interference emission: "Class B" is satisfied.

Mainz-Kastel, 28th October 2004
(Place and date of issue)

O. Pfaff, Manager of Electronics Development Department
(Name, job title) Signed

A-2 Certificate for Ex Zone 1

Translation

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

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

(3) EC-Type Examination Certificate Number

TÜV 04 ATEX 2574

(4) Equipment: Electronic temperature volume corrector type TC210

(5) Manufacturer: ELSTER GmbH

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

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

(8) The TÜV NORD CERT GmbH & 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° 04 YEX 551620.

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

EN 50014:1997 **EN 50020:2002** **BGR 104:2000**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

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

II 2 G EEx ib IIB 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

Head of the
Certification Body

Hanover, 2004-12-09

TÜV NORD CERT

TÜV CERT A4 02.04 5.000 L6

This certificate may only be reproduced without any change, schedule included.
Excerpts or changes shall be allowed by the TÜV NORD CERT GmbH & Co. KG

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(13) **SCHEDULE**

(14) **EC-TYPE EXAMINATION CERTIFICATE N° TÜV 04 ATEX 2574**

(15) Description of equipment

The electronic temperature volume corrector TC210 is an intrinsically safe accessory device that determines and displays the basic volume (= standard volume) of a gas volume which is measured by an external gas meter under service conditions, using the state variable temperature and the fixed values for pressure and K factor.
The device is connected with a temperature sensor.

The supply of the device is realised with a battery. The battery replacement may be carried out inside of the hazardous explosive area. In order to avoid data loss, it is permissible to plug in the new battery first before the old one is unplugged.

In addition to the electrical interfaces the electronic temperature volume corrector is also equipped with an optical interface.

The permissible ambient temperature range is -40°C to 60°C.

Electrical data

Supply (internal battery)	1 pc lithium battery type LS 33600, manufacturer Saft U = 3,6 V, modified battery of the manufacturer
Digital inputs 1: terminal X1, connection 1 and 2 2: terminal X5, connection 1 and 2	in type of protection Intrinsic Safety EE ib IIB Maximum values per digital input: U_o = 6,6 V I_o, P_o negligibly small C_o = 500 µF L_o = 1 H
Digital outputs 1: terminal X29, connection 1 and 2 terminal X30, connection 1 and 2 2: terminal X31, connection 1 and 2 terminal X32, connection 1 and 2	in type of protection Intrinsic Safety EE ib IIB only for the connection of certified intrinsically safe circuits with the following maximum values per output U_i = 6,6 V I_i = 100 mA P_i = 500 mW Due to the internal battery: U_o = 3,7 V I_o, P_o negligibly small

The intrinsically safe circuits are galvanically connected with each other.

Schedule EC-Type Examination Certificate N° TÜV 04 ATEX 2574

(16) Test documents are listed in the test report No.: 04 YEX 551620.

(17) Special conditions for safe use

none

(18) Essential Health and Safety Requirements

no additional ones

TÜV NORD

Translation

1. SUPPLEMENT to

EC-TYPE EXAMINATION CERTIFICATE No. TÜV 04 ATEX 2574

Equipment:	**Electronic temperature volume corrector TC210**
Manufacturer:	Elster-Instromet Production GmbH
Address:	Steinernstraße 19-21
	D – 55252 Mainz-Kastel
formerly:	ELSTER GmbH

In the future, the Electronic temperature volume corrector TC210 may also be manufactured and operated according to the documents listed in the test report.

The changes concern the internal design and the electrical data.

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

Digital inputs ..... in type of protection Intrinsic Safety EE ib IIB
I1 (input 1): terminal X1, connection 1 and 2
I2 (input 2): terminal X5, connection 1 and 2
Maximum values per digital input:
$U_o = U_i \leq 10$ V
I_o, P_o negligibly small
C_o = 20,0 µF
L_o = 1 H

Digital outputs ..... in type of protection Intrinsic Safety EE ib IIB
O1 (output 1): terminal X29, connection 1 and 2
terminal X30, connection1 and 2
only for the connection of certified intrinsically safe circuits with the following maximum values per output
O2 (output 2): terminal X31, connection 1 and 2
terminal X32, connection 1 and 2
U_i = 10 V
I_i = 100 mA
P_i = 500 mW

Due to the internal battery:
U_o = 3,7 V
I_o, P_o negligibly small

The intrinsically safe circuits are galvanically connected with each other.

TÜV NORD

1. Supplement to EC-Type Examination Certificate No. TÜV 04 ATEX 2574

All further data apply unchanged for this supplement.

The test documents are listed in the test report N° 05 YEX 552358.

TÜV NORD CERT GmbH & Co. KG
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Hannover, 2005-08-04

Head of the
Certification Body

Appendix B: Technical data

B-1 General data (mechanical)

Housing/construction	Plastic housing, With cable glands
Dimensions (W x H x T)	Approx. 157 x 117 x 57 mm
Weight	Approx. 600 g
Cable connection	Screw terminals; 0.14 ... 1.5 mm² (solid wire); use core ferrules for flexible cable.
Screening	Connect cable screen to the cable gland.
Protection	IP 65
Ambient temperature	-30 °C ... +60 °C
Mounting	Using corrosion-protected screws where possible
Climatic conditions	Suitable for outside installation

B-2 Power supply

Device battery	Lithium battery module, 3.6V, 16.5 Ah; Order no.: 73015774, 13.0 Ah usable

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

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

B-3 Pulse and signal inputs

Two digital inputs with common ground (negative pole) for reed contacts, transistor switches.

Each input can be parameterised and sealed separately.

Designation DE1, DE2

Nominal data

☞ ***When connecting the TC210 in Ex Zone 1, the limits quoted in the certificate of conformance must also be followed (see Chap. A-2).***

Open-circuit voltage	U_0	≈	1.85 V
Internal resistance	R_i	≈	300 kΩ
Short-circuit current	I_s	≈	4.5 µA
Switching level "on":	R_e	≤	100 kΩ or U_e < 0.8 V
Switching level "off"	R_a	≥	2 MΩ
Pulse duration	t_e	≥	25 ms
Space duration	t_a	≥	25 ms
Counting frequency	f	≤	2 Hz

B-4 Pulse and signal outputs

2 transistor outputs with common ground (negative pole) with which the negative pole or the positive pole can be switched. (→ 5.7)
If the output is parameterised as a "pulse input", the quantity pulses occurring in a measurement cycle are output as pulse packets.

Each output can be parameterised and sealed separately.

Designation DA1, DA2

Nominal data:

☞ ***When connecting the TC210 in Ex Zone 1, the limits quoted in the certificate of conformance must also be followed (see Chap. A-2).***

Maximum switching voltage	30 V DC
Maximum switching current	100 mA DC
Maximum voltage drop	1 V
Maximum residual current	0.001 mA
Pulse duration	Min. 125 ms, adjustable on a pitch of 125 ms
Space duration	Min. 125 ms, adjustable on a pitch of 125 ms
Output frequency	Max. 4 Hz, adjustable

B-5 Optical interface

Optical interface according to IEC 62056, Electricity metering - Data exchange for meter reading, tariff and load control - Part 21: Data exchange for fixed and mobile connections (IEC 62056-21:2002), bit serial, asynchronous data transfer 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 and fixing by magnet).

B-6 Measurement uncertainty

The error limits quoted in the calibration directive are maintained for the measurement ranges quoted here.

Appendix C: Data list

Below all values are listed which as standard cannot be called via the keypad, but instead only via interface and can also be changed depending on the status of the locks.

Via the interface all values must be accessed by means of the "address". The "address" of the values which can be recalled in the display can be found in Chapter 3.

In the column "Access" it is apparent who may change the value:
"C" = Calibration lock, "S" = Supplier's lock, "K" = Customer's lock, "-" = read only.

Address Entity : Object	AD[1]	Meaning	Access
1:0100	STAT	Momentary status	-
2:0100	STSY	System - momentary status	-
1,2,5,6:0110	ST.1, ST.2, ST.5, ST.6	Momentary status 1, 2, 3,5, 6	-
2:0141	DAYb	Day boundary	C
4:0150	M.PER	Event: Limit 1 (measurement period)	-
11:0150		Event: Limit 1 (pulse comparison)	C
11:0158		Event: Limit 2 (pulse comparison)	C
1:0170		Calibration lock: Status / close	K
1:01F0	MCYC	Measurement cycle time	C
1:01F1	OCYC	Operating cycle time	S
1:01F5		Time of day: Switch test mode on/off	S
1:0202	VT.1	Totaliser Input 1	-
2:0202	VT.2	Totaliser Input 2	-
1:0203	V1	Adjustable counter input 1	S
2:0203	V2	Adjustable counter input 2	S
2:0207	Md.I2	Mode for input 2	S
1:0210	Q1	Flow on input 1	-
2:0210	Q2	Flow on input 2	-
5:0210_1	T.MES	Temperature measurement	-
1:021A		Customer number Input 1	S
1:021B		Customer name Input 1	S
1:021C		Measuring point number Input 1	S
1:021D		Measuring point name Input 1	S
1:0222		Serial number of the meter on Input 1	S
5:0224		Temperature meas. range lower limit	C
5:0225		Temperature meas. range upper limit	C
5:0227	BIN.T	Temperature binary value	-
5:0280	EQ1T	Temperature Equation Coefficient 1	C
5:0281	EQ2T	Temperature Equation Coefficient 2	C
5:0282	EQ3T	Temperature Equation Coefficient 3	C
2:0301	VbD	Volume at base conditions, disturbance quantity	S
4:0301	VD	Actual volume, disturbed	S
2:0303	VbA	Adjustable counter Vb	S
4:0303	VA	Adjustable counter V	S
2, 4...7:032D		DS-100 device number for totaliser	S

[1] Values with AD (abbreviated designation) can be displayed via the user-specific values (→ 3.1, 3.2, 3.3.2, 3.3.3) In the TC210 display.

Address Entity : Object	AD[1]	Meaning	Access
2, 4...7 : 032E		DS-100 device number for undist. counter	S
1 : 0407	MdTI	Daylight saving: yes / no	S
1 : 0452	ADJ.T	Clock adjustment factor	C
1 : 04A0	CET.b	Summer time, beginning	S
2 : 04A1		Battery warning limit (months)	S
1 : 04A8	CET.E	Summer time, end	S
1 : 0600		Status of output 1 (active / inactive)	-
2 : 0600		Status of output 2 (active / inactive)	-
1 : 0605	Md.O1	Mode for Output 1	C
2 : 0605	Md.O2	Mode for Output 2	S
1 : 0606		Source Output 1	C
2 : 0606		Source Output 2	S
1 : 0607		Status pointer, Output 1	C
2 : 0607		Status pointer, Output 2	S
1...2 : 0616		Time pitch for Output 1...2	-
1 : 0617	Pd.O1	Period, Output 1 (No. of time pitches)	C
2 0617	Pd.O2	Period, Output 2 (No. of time pitches)	S
1 : 0618	Pl.O1	Pulse duration of Output 1 (spec. figure multiplied by time pitch for output)	S
2 : 0618	Pl.O2	Pulse duration of Output 2 (spec. figure multiplied by time pitch for output)	E
3 : 0A01	ASIZ	Archive memory depth (no. of data records)	-

Explanations:

MdTI Daylight saving: yes / no

"0" = 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.

Md.I2 Mode for input 2

The application of Input 2 (E2) can be defined here.

"0" = Switched off (input is not used).

"1" = Pulse comparison on Inputs 1 and 2
If the pulse counters of Input 1 and Input 2 deviate from one another by more than a maximum of four pulses (11:150 = 4) within an adjustable number of pulses (e.g. 11:158 = 4000), the message "5" is entered in Status 2 (→ 3.3.1.2).

"2" = Active status input, e.g. to report attempts at tampering on a pulse transmitter of the gas meter, provided the meter also supports this.

Md.O2 Mode for output 2

Md.O2 see Md.O1 (→ 3.3.3)

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