Flow Computer Series ERZ 2000

OPERATING INSTRUCTIONS

Serving the Gas Industry Worldwide

RMG by Honeywell

STATUS MAY 2012 V 2.0

Note:

Unfortunately, paperwork does not automatically update itself but technical developments are constantly being made. Therefore, we reserve the right to change the descriptions and statements contained in our operating instructions without prior notice. However, you can conveniently download the most recent version of this manual (and those of other devices) from our website **www.rmg.com**.

RMG Messtechnik GmbH
Otto-Hahn-Str. 5
35510 Butzbach (Germany)
Fax: +49 (0)6033 897-130
E-mail: Messtechnik@Honeywell.com

Phone numbers:

Switchboard:	+49 (0)6033 897-0
Customer Service:	+49 (0)6033 897-127
Spare Parts:	+49 (0)6033 897-173

1 Introduction

1.1 Overview of functions

The ERZ 2000 is a further development of the proven ERZ 9000T concept. Just like the ERZ 9000, the ERZ 2000 consists of two functional groups. The base module provides data logging, all inputs and outputs, all interfaces and manual operation via the front panel. The actual calculations and corrector functions are managed by the second module, which is the arithmetic logic unit (ALU). It is an embedded PC with a high-performance CPU. Thus, the device is capable of making even more complex calculations with short computing cycles.

The base module is used for neutral measurements of all inputs similar to a multimeter, but no calculations or assignments to physical units are made. Therefore, the base module only deals with analog values, frequencies and meter contents without knowing the meaning of the individual values. The measured values are transmitted to the arithmetic logic unit where they are assigned to the appropriate physical quantities and converted into usable data. The base module also operates all outputs and the data interfaces. Another task is reading the keys and outputting texts and results on the display. For hardware extensions and future requirements, there are three spare slots.

The arithmetic logic unit, which represents the central functional module of the ERZ 2000, consists of a powerful microprocessor system based on an AMD 586 with an associated program memory (flash memory), random access memory and data memory.

The random access memory contains the variables, fields, buffers, etc. required for running the system software and the (changeable) device parameters of all functional modules. The device parameters are protected by means of a checksum which is automatically verified with each new start of the device.

The program memory contains the operating program of the device. A CRC checksum has been calculated via the source code and deposited as reference value. The correctness of the checksum can be verified under Software ID in the coordinates of column EJ.

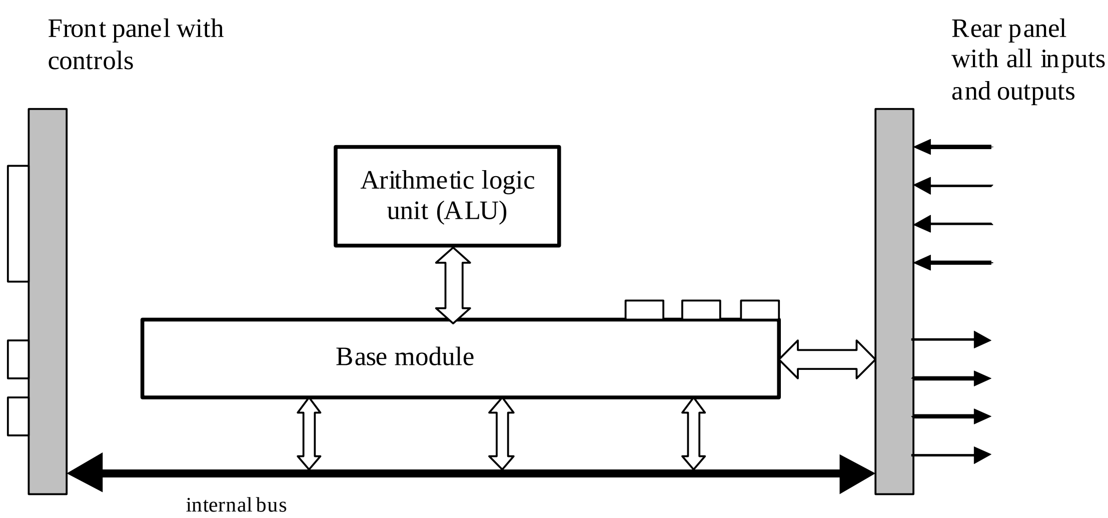


Figure 1: Overview of the system structure

1.2 Field of application

The general field of application includes the recording and metering of quantities in natural gas flow measurement technology for custody transfer applications. In special cases, there are also equation systems available for measuring pure industrial gases, for example.

Depending on the software installed, the device can be supplied as

- PTZ corrector for natural gases
  Calculation of the K coefficient in accordance with GERG 88 S, AGA NX 19 or AGA 8 92DC
- Superior calorific value corrector for natural gases
  Calculation of the K coefficient in accordance with GERG 88 S, AGA NX 19 or AGA 8 92DC
- Mass computer for pure gases
  Calculation of the K coefficient in accordance with the Beattie-Bridgeman equation for: hydrogen, nitrogen, oxygen, air, ammonia, carbon dioxide, helium, neon, argon, methane, krypton, xenon, ethane, ethylene, acetylene, propane and butane.

Other equation systems can optionally be used.

As a universal system, the device concept provides for the extension or integration of all individual devices of older type series from RMG Messtechnik GmbH.

Designations and device variants of the ERZ 2000 system family
The thousands place describes the system name.
The hundreds place defines the calculation of energy (superior calorific value correction).
The tens place defines the function of the orifice-plate computer.
The ones place defines the correction of state, temperature or density (1 = temperature, 2 = density, 3 = spare, 4 = pressure / temperature).

Examples:

PTZ corrector	ERZ 2004
Superior calorific value corrector	ERZ 2104
Density corrector	ERZ 2002
Density corrector – energy	ERZ 2102
PTZ corrector with ultrasonic controller	ERZ 2004 USC
Superior calorific value corrector with ultrasonic controller	ERZ 2104 USC
Density corrector with ultrasonic controller	ERZ 2002 USC
Density corrector – energy with ultrasonic controller	ERZ 2102 USC
PTZ corrector with mass calculation	ERZ 2004M
Superior calorific value corrector with mass calculation	ERZ 2104M
Density corrector with mass calculation	ERZ 2002M
Density corrector – energy with mass calculation	ERZ 2102M
Orifice-plate flowcomputer	ERZ 2114 / 2112

1.3 Performance features

- 19" design; plug-in unit with 42 depth units (half the width of 19")
- 4-line fluorescent display in blue colour
- Control keyboard with 19 keys of which the numbered keys from 0 to 9 have more than one function: they are function keys in normal display mode (here the marking below the relevant key applies) and in input mode, they are used to input digits or, in extended mode, letters for entering texts.
- System status, warning and alarm indications (LEDs) on the front panel
- Sealable calibration switch
- Serial data interfaces on the front and rear panels
- TCP/IP Ethernet interface on the rear side
- RS 485 bus interfaces for DSfG and MODBUS
- CAN bus on the rear side
- 2-channel volume input with pulse counting and frequency measurement
- Volume input for digitally operating Vo totalizers
- 8 analog inputs comprising one pressure-measuring input for analog signals and the HART protocol, one temperature-measuring input for resistance measurement, up to three signals for differential-pressure measuring cells, and spare inputs.
- 4 dispatcher pulse outputs
- 4 analog current outputs
- 4 frequency inputs
- Time system with automatic switching to daylight saving time and back and with an external synchronization input
- 4 signal inputs for switching H and L group gases, changing the direction and for external freeze
- Spare signal inputs
- Uploading operating programs is possible if the calibration switch has been opened
- Integrated DSfG remote data transmission (RDT) unit
- PTB's time service for time synchronization

1.4 Device structure

The ERZ 2000 system is characterized by a simple structure comprising only a few components. There is a distinct separation between the individual functions: data logging, volume correction, recording and basic tasks.

Hardware – Measurement – Accuracy
The base module is responsible for ensuring accuracy with volume calculation tasks. All parameters relevant to accuracy are assigned to this card and are also stored on this card. This card defines the base accuracy of the device with its accuracy and resolution of inputs and outputs and its temperature sensitivity.

The digital data interfaces are located on the base module. These interfaces can be used for:

- Service interface
- DSfG in accordance with the current specification for volume corrector and recording entities
- DSfG master
- CAN bus for internal communications between the modules or for external extension
- Printer connection (optional)
- Modbus for external data transmissions
- Ethernet TCP/IP network connections
- Connection of an external modem

The RS 485 COM 4 interface provides central access to the DSfG bus for all entities available in the device. If there is more than one entity, each entity has its own bus address, although there is only one physical access to the bus. An exception to this is the master which is assigned to the COM 3 interface.

Visualization is performed jointly for all functional modules. The function keys and the display are available to the various entities.

1.5 Commercial use

The ERZ 2000 system is available in different variants approved for commercial use (custody transfer application) in Germany as well as other countries.

The following domestic design approvals apply for Germany:

ERZ 2004:	State flow corrector (approval mark 7.741 /04.56)
ERZ 2104:	Fuel gas value flow corrector (approval mark 7.743 /04.16)
ERZ 2002:	Density flow corrector (approval mark 7.742 /04.08)
ERZ 2102:	Fuel gas value flow corrector with direct density measurement (approval mark 7.743 / 06.17)
ERZ 2114/2112:	Differential pressure gas meter (approval mark 7.543 /07.10)

An EC-type examination certificate is available for the European Union according to Directive 2004/22/EC (MID), Module B:

ERZ 2004:	pTZ-Volume Conversion Device acc. EN 12405-1 (certificate no. DE-11-MI002-PTB003)
ERZ 2104:	pTZ-Volume Conversion Device acc. EN 12405-1 with Additional Function Energy Conversion Device acc. EN 12405-2 (certificate no. DE-11-MI002-PTB003) *)

The relevant applicable approval (approval mark) is specified on the type plate. The related seal diagrams form either part of this manual or the approval documents.

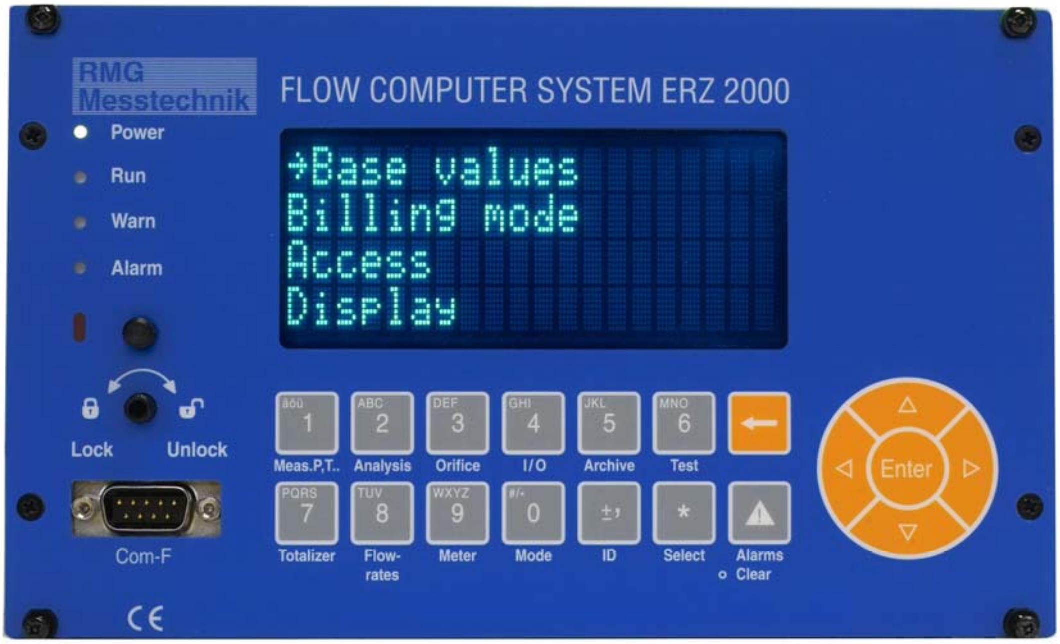
A temperature transmitter used for types ERZ 2004 or ERZ 2104 approved according to MID should be secured as follows:

- A security seal is affixed to the main plate.
- Security seals are used to connect the detachable cover on the electronics housing to fixed parts of the housing to prevent access to the calibration lock, which is set to "write protect" during normal operation.

*) In MID terms, fuel gas value correction in the ERZ 2104 (calculation of the energy and energy totalizers in each totalizer set) is an integrated function but is not subject to MID. However, the function has been certified as part of the national approval procedure for the ERZ 2104.

2 Getting started / operation

2.1 System overview



Keys 0 to 9 have more than one function. The current function depends on the operating condition. In normal display mode, the text below the key applies and allows measured values or chapter headings and functions to be directly or indirectly accessed. In input mode, the text on the key itself applies. You can enter numbers and, in extended mode, also letters. Entering letters is similar to the method used for mobile phones.

Function keys	Key legend
▪ Measured values P,T..	1
▪ Analysis	2
▪ Orifice	3
▪ I/O (inputs/outputs)	4
▪ Archive	5
▪ Test	6
▪ Totalizer	7
▪ Flow Rates	8
▪ Meter	9
▪ Mode	0
▪ ID	± ,
▪ Select (selects a chapter)	*
▪ Backspace function	🡐
▪ Alarms (displays or clears messages)	⚠

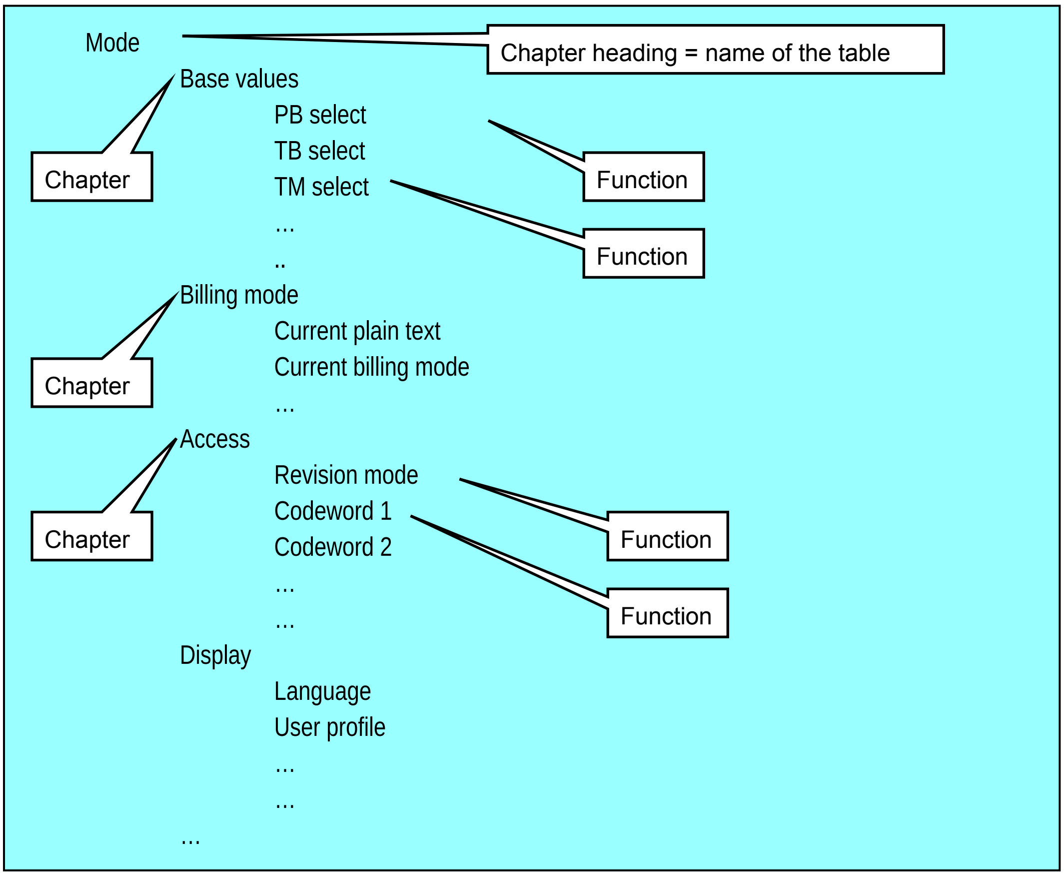
Use the keys 1, 2, 7 and 8 to directly display the most important measured values. Use the keys 3, 4, 5, 6, 9 and 0 to access the relevant headings and chapter overviews. The * key for "Select" will always show the current chapter. Use the 🡐 key to go back to the last 50 times you have pressed a key.

2.2 Coordinate system, levels and rights of access, visibility levels

2.2.1 Coordinate system

All variables and measured and calculated values are grouped into several tables in order to show associated functions. Each table represents a matrix with fields from AA 01 to AZ 99, or BA 01 to BZ 99, or CA 01 to CZ 99, etc. All tables together form the coordinate system.

Tabular structure:
Each table has a name which appears as chapter heading.
Each column has a chapter name, while the fields (coordinates) are the functions.
Example:



The <0> Mode key shown in the example above enables central access to the chapter headings. When you press the <0> key, the ERZ 2000 will jump to table E and display the first chapter Base values and the following chapters which can be browsed through using the Cursor Up or Down key. When you browse through the chapters, an arrow → appearing in front of the chapter selected is used for orientation. Press Enter to access the functions of the chapter to which the arrow points.

Starting from the central point (table E) which you access by pressing the Mode key, you can easily browse through all tables from the beginning (A) to the end (P) using the Cursor Right or Left key.

The <*> Select key fulfils an important function as it helps you orient yourself in the coordinate system and select the desired chapter. Using this key, you can switch back from any location in the coordinate system to the current chapter with heading, etc. If you press the <*> key once again, you are referred back to the function (coordinate) where you came from.

Whenever the device shows a view with a chapter heading, you can access all chapters of the entire system by pressing the Cursor Right or Left key. When you have reached the desired chapter heading, press the Cursor Up or Down key to access the chapter or press Enter to activate the function.

If you are inside a chapter (i.e. in a column of the table with the functions), you can also browse through all chapters of the complete coordinate system by pressing the Cursor Right or Left key. During the time you are browsing, the current coordinate is displayed for approx. 2 seconds in the fourth line.

Further guidance is provided by the option of permanently showing the coordinate of the current field together with each value displayed. To do this, press <0> Mode and browse downwards to Display. Then press Enter and the Cursor Up or Down key to access the Coordinates function and set the parameter to "Yes". Now all fields will be displayed together with their coordinates. Since the 4-character coordinates will then appear, long texts exceeding 20 characters per line will be truncated on the display.

2.2.2 Levels and rights of access

The ERZ 2000 system provides three access levels to change parameters or device settings.
The lowest level is the user level which is protected by code. It is marked B, C or P in the following documentation.
The second level is protected by the official calibration lock in the form of a sealable turn switch. It is marked E in the following documentation.
The third and highest level is the special-purpose level ("superuser level") which is reserved for type changes, etc. The special-purpose level can be reached by entering the code and by additionally opening the calibration lock. It is marked S in the following documentation.
A symbol (point, rhombus or blank) indicates whether a value displayed can be edited. The symbol is located between the line information and the text, e.g.

Any column, line 2:
02 Input value
↖ Blank: Value cannot be edited

Any column, line 9:
09 • Lower alarm limit
↖ Point: Value can be edited but is locked by means of the user code or the official calibration lock
09 ♦ Lower alarm limit
↖ Rhombus: Value has been enabled for editing.

2.2.3 Visibility levels

Dynamic hiding or showing of displays in the coordinate system depends on several factors. Firstly, the device type set (ERZ 2004, ERZ 2002, ERZ 2104, etc.) determines which parts of the coordinate system are relevant and only those are shown.

Secondly, there are visibility levels which can make further restrictions. These levels have been given names which correspond to the scope or range of displays shown.

The lowest level is the "Gas meter reader" who can access only a few useful displays or overviews via the keyboard while the rest cannot be accessed by him/her. This level can be selected by the user if outside access is to be prevented.

The next level up is the standard setting and is named "User". With this setting, all measured values, parameters, auxiliary quantities, etc. which are useful for the selected device type and the chosen operating modes are visible and can be edited. The device automatically shows only the coordinates or columns which are required.

Above this level there is another level which is called "Service". At the service level, there is no dynamic hiding or showing as with the "User" level and the service staff can view all values even those which are not needed in the current operating mode.

The topmost level is the "Developer". In this mode, additional auxiliary quantities and intermediate values are shown which may be useful for diagnostic purposes if a fault occurs.

From version 1.7, the "Data input" visibility level has been introduced as an extension or input assistance feature. Here only parameters are shown which can be adjusted; all the other values are hidden.

You can select the visibility level with the <0> Mode key in the Display chapter.

We would recommend setting the visibility level at "Service" before you start to parameterize the device.

2.2.4 Entering the user code

The lowest access level is protected by the user code. The code is divided into two 4-character parts and has to be entered in two subsequent coordinates. In the operating instructions, the relevant data are marked (for user lock). A special case is the marking C for the user code itself.
To enter the user code, press <0> Mode and enter the code in the Access chapter under the Codeword 1 and Codeword 2 functions.

Mode Base values Billing mode ➔Access

The arrow is already located on the third line on Access. In this example, pressing ***Enter*** will select the correct chapter. A new window will open with the **Access** heading. Use the ***Cursor Down*** key to select the first codeword.

Then the following text appears:

Access ♦Codeword 1 * * * *

The rhombus indicates that code entry has been enabled. The four asterisks stand for the first part of the 8-character code. After you have pressed ***Enter***, the display will turn a bit darker and the four asterisks will disappear. Now you have to enter the first four characters of the code correctly in the third line. Press ***Enter*** to terminate your inputs and use the ***Cursor Down*** key to browse to codeword 2. Now press ***Enter*** again to switch over the display to input mode (darker) and enter the second part of the codeword.

If the code has been entered correctly, the Power LED at the top left of the front panel will start to flash.

2.3 Setting the device type

If the device is not used for custody transfer applications (for this purpose, specific settings have to be made in the factory), the ERZ 2000, which exists in the following variants

- PTZ corrector ERZ 2004
- PTZ corrector with mass totalizer ERZ 2004M
- superior calorific value corrector ERZ 2104
- superior calorific value corrector with mass totalizer ERZ 2104M
- density corrector ERZ 2002
- density corrector with mass totalizer ERZ 2002M
- density corrector – energy ERZ 2102
- density corrector – energy with mass totalizer ERZ 2102M
- PTZ corrector ERZ 2004 USC
- superior calorific value corrector ERZ 2104 USC
- density corrector ERZ 2002 USC
- density corrector – energy ERZ 2102 USC
- Orifice-plate flowcomputer, P,T / energy ERZ 2014 / 2114
- Orifice-plate flowcomputer, density / energy ERZ 2012 / 2112

can be switched over by the customer from one version to another after the calibration lock has been opened.

To do this, you have to be on the topmost access level (superuser). Press <0> Mode, select the Base values chapter and then the Device type function to browse the variants. Press Enter to confirm your selection or change over to another variant.

If the device is used for custody transfer applications, this changeover option is disabled and you can only operate the version which has been set in the factory and corresponds to the type plate fixed to the front panel.
The device can only be changed over from a PTZ corrector to a superior calorific value corrector if the software is changed in the factory.

2.4 Software update

Required tools

- Null modem cable
- PC with serial interface (COM) and terminal emulation program e.g. Hyperterm
- HEXLoad.exe (renamed from EX_ to EXE) Windows program for loading the Flow Computer Bios (FCB).

Procedure

Measurement

Make sure the condition of your measuring station is safe. If possible, make sure the relevant flow computer is flow-free because correction does not take place during the software update and any accumulated quantities are ignored completely.

Updating the flow computer bios

- Connect COM-F on the flow computer (front side) to the serial interface on your PC using the null modem cable.
- Start the HEXLoad program.
- Under Options/Communication, set the baud rate to 115200 and select the serial interface you are using on your PC.
- Open the calibration switch on the flow computer.
- Cold start the flow computer (power off/on). The flow computer then registers itself in the target window on the HEXLoad program.
- Under File/Open..., load the flow computer bios program file. Bios files always have the file extension '.mot' (e.g. f1_009.mot).
- Then write the new program file to the flow computer using Target/Auto.
- Disconnect the null modem cable from the flow computer and/or close the HEXLoad program. IMPORTANT!
- Close the calibration switch
- The flow computer performs a cold start and then boots up with the new flow computer bios.

Updating the flow computer application

- Connect COM-F on the flow computer (front side) to the serial interface on your PC using the null modem cable.
- Start a terminal emulation program e.g. under Windows Start/All Programs/Accessories/Communication/Hyperterminal. When starting for the first time, establish a new connection with 115200, 8, none 1, no handshake and save these settings.
- Switch the flow computer to superuser mode. Enable ERZ superuser and user profile
  - Close the calibration switch
  - Key mode
  - Cursor down to Access
  - Enter code word 1
  - Enter code word 2
  - Open the calibration switch

  Observe the sequence specified. Set the user profile to Service or Developer.

- Now set the Software Update parameter to 'yes'. Mode key, cursor down to Software ID, ENTER, cursor up to Software Update. The flow computer finishes the correction process and immediately starts waiting for the software update to begin. Read the information on the flow computer display. Once initiated, the process can then be interrupted by pressing the 0 key on the keyboard of the flow computer. Pay attention to what the Hyperterminal program outputs on the display. The letter 'C' should appear at one second intervals to indicate that a data connection is still active.
- Now transfer the application to the flow computer. The application consists of several files packed into a ZIP archive. Select the ZIP archive (e.g. E1_7_0.ZIP) in Hyperterminal (Transfer/Send file...) and send using the 'Ymodem' transfer protocol. Monitor the progress bar in Hyperterminal and the equivalent indicator on the flow computer display.
- After the transfer is complete, the flow computer checks the ZIP file for validity and consistency and reports the result on the Hyperterminal display. If the result is negative, the ZIP file will be destroyed in the flow computer so that the previous application is preserved. If the result is positive, the unpacking process will be integrated into the booting-up procedure of the flow computer. The new application will be automatically unpacked and activated the next time the flow computer is restarted. The initial booting-up procedure of the flow computer will therefore take much longer than normal.
- The flow computer will perform this restart automatically. The null modem cable does not have to be disconnected immediately or the Hyperterminal program closed.

2.5 Activating the device again after a software update

Every software package contains an activation key which has to be communicated to the ERZ 2000 after a software update. The device verifies the key together with the new check number of the software and the ERZ 2000 will not be ready for normal operation until it has yielded a positive result. If the activation key is missing or is incorrect, the ERZ 2000 switches to permanent operation under fault conditions and thus signals that there is no activation. Corrector functions are performed normally, but only the disturbance totalizers are running.

Example:
Together with the new software, you also receive the new activation key which has to be entered as follows:

- Press <0> to select Mode and then press the Cursor Down key to browse to the Software-ID chapter.
- Select the chapter with the Enter key and press the Cursor Down key until you reach the Activation function. Here you can find the old activation key which is no longer valid for the new software.
- After you have opened the calibration lock, press Enter again (the display will turn darker and indicate input mode). The old activation key will disappear and the ERZ 2000 will be waiting for the new key to be entered.
- Enter the new activation key and terminate your inputs with Enter.
- Now the device should no longer be under fault conditions but operate without any trouble.

An important function of the activation key is the verification of the program code which represents the official functions for custody transfer metering. The activation key is used for verifying the check number cyclically. The program can immediately detect a change in the official kernel whether it is caused by an unacceptable program version or a defect of the program memory which results in a modified check number.
This function is important in order to separate the program into an official part for custody transfer metering and into an application part.

2.6 Description of checksums and the activation key

Programs responsible for the calculation and accuracy of custody transfer processes are known as official kernels . The programmer determines which program is official according to the following criteria:

formal = if an official variable is described in the program module ⇒ Program is official

intuitive = if executed functions (can) have an indirect effect on an official variable ⇒ Program is official. Example: unit correction.

The result of this definition is based on 5 criteria that must be answered YES/NO to lead to a decision.

1. formal, official display values are written
2. formal, official display values are read
3. formal, generally global variables are written
4. formal, generally global variables are read

The program makeich evaluates these 5 criteria and generates the identification list (part of the approval documentation).

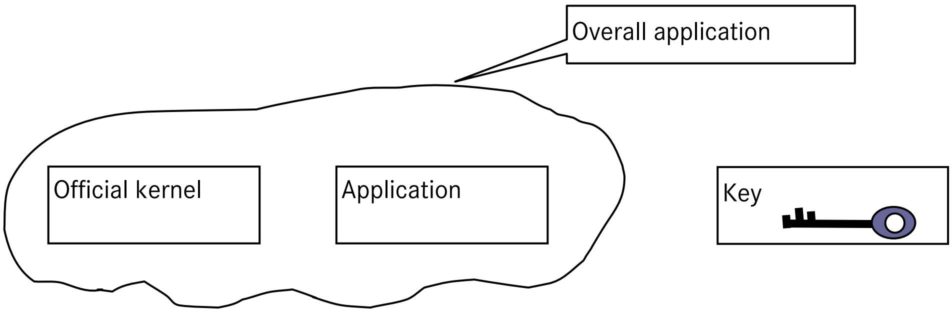
Each of these programs has a checksum (CRC) that is determined at the time of compilation. The list for the custody transfer kernel can be read in detail so that each of these individual programs can be tested on the device in case of doubt. A total checksum is formulated from the source of the official kernel and stored in a separate memory area.
This is the first checksum for the device

Programs that adopt customer-specific/system-specific functions are known as applications and are situated outside of the custody transfer framework. The official kernel and application combine to form the overall system, which is used to determine a separate checksum (CRC). The procedure for calculating a checksum is identical to the current procedure used on official devices without software separation.
This is the second checksum for the device

There is another checksum, which is calculated by multiplying the checksum of the official kernel by the checksum of the overall system.
This is the third checksum, also known as the activation key.

If customer-specific software adaptation takes place outside of the official kernel, the second checksum and the activation key change accordingly. After the new software has been imported, the inspector can check that the official kernel has remained unchanged during the software adaptation by entering (storing) the activation key. The flow corrector calculates the activation key for the new program and shows the value on the display. If the calculated key and the stored key do not correspond, an alarm is signaled and the disturbance totalizers are actuated. The program that calculates the key is a component of the custody transfer kernel.

Example:

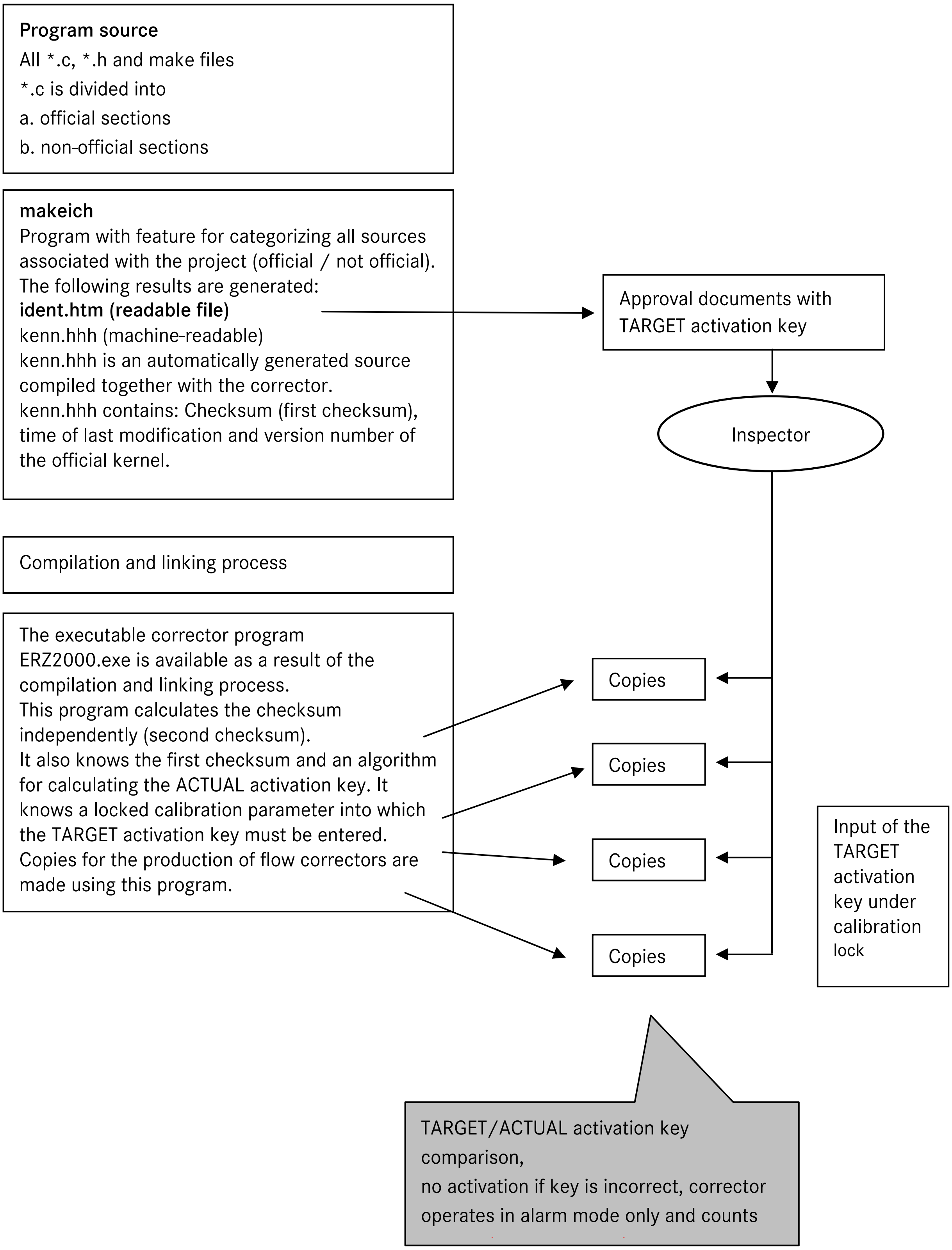


CRC: ECDA Hex * 16FD Hex = 356831090 Dec.

Source criteria include:

- Coding official
- **No** coding official
- Name
- Checksum
- Date, time
- Size
- History description

The program "makeich" inspects all files according to the above criteria and then generates the identification file (readable file).
"makeich" is an official source, but is not involved in the actual activities of the flow corrector in any way.
It is merely installed on the PC in the development environment and is not included in the executable code.
Another feature of „***makeich***" is the compilation of information about the official kernel in machine-readable format, which is then incorporated in the corrector program.


Program source
All *.c, *.h and make files
*.c is divided into
a. official sections
b. non-official sections
makeich
Program with feature for categorizing all sources associated with the project (official / not official).
The following results are generated:
ident.htm (readable file)
kenn.hhh (machine-readable)
kenn.hhh is an automatically generated source compiled together with the corrector.
kenn.hhh contains: Checksum (first checksum), time of last modification and version number of the official kernel.
Approval documents with TARGET activation key
Inspector
Compilation and linking process
The executable corrector program ERZ2000.exe is available as a result of the compilation and linking process.
This program calculates the checksum independently (second checksum).
It also knows the first checksum and an algorithm for calculating the ACTUAL activation key. It knows a locked calibration parameter into which the TARGET activation key must be entered.
Copies for the production of flow correctors are made using this program.
Copies
Copies
Copies
Copies
Input of the TARGET activation key under calibration lock
TARGET/ACTUAL activation key comparison,
no activation if key is incorrect, corrector operates in alarm mode only and counts

2.7 Adjusting the device to the transmitter data

2.7.1 Pressure sensor

The data of the pressure sensor used have to be communicated to the corrector as transmitter data. Apart from the parameters for measurement, the type, manufacturer, serial number, etc., have to be entered in the Absolute pressure chapter as well. Then these data appear automatically in the ID display.
Example for data entry:
Press <1> Meas. P,T.. The arrow (➔) is already located on Pabs. Press Enter and then the Cursor Down key to access the relevant values and enter the data.

There are the following operating modes for transmitting measured values:

OFF	No measurement, input is switched off.
Default	No measurement, fixed value.
from gauge pressure	The value is derived from the gauge pressure sensor connected.
Measured value=source value	HART on 4-20 mA loop in combination with a current input.
Polynomial 1st order	Coefficient 0 defines the polynomial.
Polynomial 2nd order	Coefficients 0 and 1 define the polynomial.
Polynomial 3rd order	Coefficients 0, 1 and 2 define the polynomial.
4-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range.
0-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range.
4-20mA limit	The min. and max. limits define the assignment of mA to pressure.
0-20mA limit	The min. and max. limits define the assignment of mA to pressure.
P-DZU	The pressure is measured by an ultrasonic measuring head (USE 09) and transmitted via the DZU protocol.

Use the cursor key to browse to the Operating mode function. Set the desired operating mode there after you have opened the calibration lock.
If the pressure sensor is to be operated using the HART protocol, make sure that the operating mode is set to "Measured value=source value" and a current input combined with the HART function is selected as source. If the pressure sensor is operated as a transmitter, make sure that its power supply is switched on in the associated menu of the current input.
The menu of the data sources comprises all metrological options of an input irrespective of whether or not these signals (e.g. current or frequency signal analogous to the measured quantity) exist for the selected transmitter.

2.7.2 Temperature sensor

The data of the temperature sensor used have to be communicated to the corrector as transmitter data. Apart from the parameters for measurement, the type, manufacturer, serial number, etc., have to be entered in the Gas Temperature chapter as well. Then these data appear automatically in the ID display.
Example for data entry:
Press <1> Meas. P,T.. and set the arrow (➔) to T. Press Enter and then the Cursor Down key to access the relevant values and enter the data.

For transmitting measured values, there are the following operating modes:

OFF	No measurement, input is switched off.
Default	Fixed value, no measurement.
PT100,500,1000	Polynomial according to Callendar van Dusen
Measured value=source value	HART on 4-20 mA loop in combination with a current input.
Polynomial 1st order	Coefficient 0 defines the polynomial.
Polynomial 2nd order	Coefficients 0 and 1 define the polynomial.
Polynomial 3rd order	Coefficients 0, 1 and 2 define the polynomial.
4-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range.
0-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range.
4-20mA limit	The min. and max. limits define the assignment of mA to temperature.
0-20mA limit	The min. and max. limits define the assignment of mA to temperature.
T-DZU	The temperature is measured by an ultrasonic measuring head (USE 09) and transmitted via the DZU protocol.

Use the cursor key to browse to the Operating mode function. Set the desired operating mode there after you have opened the calibration lock.
If the temperature sensor is to be operated using the HART protocol, make sure that the operating mode is set to "Measured value=source value" and a current input combined with the HART function is selected as source.
If the temperature sensor is operated as a transmitter, make sure that its power supply is switched on in the associated menu of the current input.

The menu of the data sources comprises all metrological options of an input irrespective of whether or not these signals (e.g. current or frequency signal analogous to the measured quantity) exist for the selected transmitter.

2.7.3 Gas meter / volume data logging / orifice plate

The data of the gas meter used have to be communicated to the corrector as transmitter data. Apart from the parameters for measurement, the type, manufacturer, serial number, etc., have to be entered in the Meter chapter as well. Then these data appear automatically in the ID display.
Example for data entry:
Press <9> Meter. The arrow (→) is located on Flow rate parameters. Press Enter and then the Cursor Down key to access the relevant values and enter the data.

The Volume transmitter mode function in the Flow rate parameters chapter defines the operating mode for calculating the volume at measurement conditions.
The following operating modes are available:

1. Vo	Vm is calculated from Vo, ENCO[1] totalizer provides data via protocol.
2. Vo, LF1-chan.	Vm is calculated from Vo, LF input is used for comparison.
3. Vo, HF1-chan.	Vm is calculated from Vo, HF input is used for comparison.
4. Vo, HF2-chan. 1/1	Vm is calculated from Vo, HF inputs are used for comparison.
5. Vo, HF2-chan. X/Y	Vm is calculated from Vo, HF inputs are used for comparison.
6. LF1-chan., Vo	Vm is calculated from the input signal, Vo is only used for comparison.
7. HF1-chan., Vo	Vm is calculated from the input signal, Vo is only used for comparison.
8. HF2-chan. 1/1, Vo	Vm is calculated from the input signal, Vo is only used for comparison.
9. HF2-chan. X/Y, Vo	Vm is calculated from the input signal, Vo is only used for comparison.
10. LF1-chan.	1-channel operation with LF input (only metering, no flow rate)
11. HF1-chan.	1-channel operation with HF input
12. HF2-chan. 1/1	2-channel operation with HF inputs of the same value
13. HF2-chan. X/Y	2-channel operation with HF inputs of different value
14. HF LF	2-channel operation with HF input (meas.) and LF input (comp.)
15. DZU	Vm is supplied via DZU protocol.
16. IGM	Activates the integrated ultrasonic controller (sensor data are supplied by the ultrasonic measuring head)
17. Orifice	An orifice plate is used to calculate the volume (for ERZ 2014, 2114, 2012, 2112).
18. 4-20 mA	Processing an analog signal which is proportional to the flow rate. A current I input has to be selected as source under **AQ Flow 4-20mA**.

[1] ENCO = ENCODER / Electronic totalizer with digital interface

2.7.4 Gas quality data

The data of the measuring device used (e.g. gas chromatograph) have to be communicated to the corrector as transmitter data. Apart from the parameters for measurement, the type, manufacturer, serial number, etc., have also to be entered in the relevant column of the measured value concerned, e.g. Superior calorific value. Then these data appear automatically in the ID display. This also applies to the other values such as Standard density and CO2, where the ID data have to be entered repeatedly. In the case of AGA 8 92 DC, this applies to all components as well.

Example for data entry:

Press <1> Meas. P,T.. and locate the arrow (➔) on Hs. Press Enter and then the Cursor Down key to access the functions (coordinates) and enter the relevant data.

There are different ways of measuring and transmitting the gas quality data (superior calorific value and standard density) and the individual components. In Germany, the standard is transmission via the DSfG interface.
There are the following operating modes for the superior calorific value, for example:

OFF	No measurement, input is switched off.
Default	Fixed value, no measurement.
DSfG	Data are supplied by one gas quality meter per interface. *
RMG bus	Data are supplied by one gas quality meter per interface *****
Linear frequency response	Frequency input
Polynomial 1st order	Coefficient 0 defines the polynomial. **
Polynomial 2nd order	Coefficients 0 and 1 define the polynomial. **
Polynomial 3rd order	Coefficients 0, 1 and 2 define the polynomial. **
0-20mA limit	The min. and max. limits define the assignment of mA to the superior calorific value. **
4-20 mA limit	The min. and max. limits define the assignment of mA to the superior calorific value. **
0-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range. **
4-20 mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range. **
Tabular value	The superior calorific value is taken from a table as a fixed value. ***
ISO 6976	The superior calorific value is calculated from the components.
Modbus	The superior calorific value is written in the ERZ 2000 by the Modbus master ****
GPA 2172-96	Another (US) calculation rule for Hs and rd at 60°F and under 14.696 psia.

To make your settings, use the cursor key to browse to the Operating mode function. Set the desired operating mode there after having opened the calibration lock.
Depending on the input quantities, there may be further operating modes, e.g. for the standard density:

from relative density	Calculation from relative density
Single frequency input	Frequency transmitter with one frequency
RMG standard density transmitter	Frequency transmitter with two frequencies

etc.

If the measuring device is to be operated using the HART protocol, make sure that the operating mode is set to "Measured value=Source value" and a current input combined with the HART function is selected as source. If the measuring device is operated as a transmitter, make sure that the power supply is enabled in the associated menu of the current input.

The menu of the data sources comprises all metrological options of an input irrespective of whether or not these signals (e.g. current or frequency signal analogous to the measured quantity) exist for the selected transmitter.

* DSfG
The gas quality data are read in accordance with DSfG rules in the rhythm of the analyses from the gas chromatograph or alternatively from the correlative gas measuring device.

** Option Current input
If the superior calorific value, standard density and CO2 quantities are sufficient for calculating the K coefficient (GERG 88S, AGA NX 19, AGA 8 Gross 1), then you can use the Current input operating mode. The current inputs measured by the base module are evaluated by the arithmetic logic unit.

*** Table
There are four tables with fixed values (for direction 1 or 2 or billing modes 1 to 4) which can be written either manually on the device or by remote control via DSfG.

**** Modbus
Modbus RTU via RS 232 serial interface or RS 485 bus. Alternatively, Modbus IP via Ethernet with a GQM gas quality manager (Siemens PCS 7 with special program).
To activate the Modbus IP, set the parameter

E * 52 use GQM

on "Yes". Please refer to *IJ Main gas quality imported via Modbus*.

***** RMG bus
RMG-specific protocol on the basis of MODBUS. The PGC is the master and the ERZ 2000 is a slave. Up to 32 slaves can receive gas quality data at the same time by broadcasting.

New normalization mode
Under BA Components mode, there are 2 modes:
Total balanced = 100% normalization
Methane-balanced = All components will be retained, only methane will be adjusted.
=> Methane = 100 – other components

2.7.5 Conversion factor comparison

Under CM Conversion factor comparison, it is possible to activate a comparison between two conversion factors (foreground/background).
Example:
C calculated via P, T and K is to be compared with C calculated via density and standard density. The corrector is used as a superior calorific value corrector and in addition to this, density and standard density transmitters are connected. The density transmitters can be activated under extra analog value 1 (2) (OF Extra analog value 1, OG Extra analog value 2).

Access	Line	Designation	Value	Unit
D	1	K coefficient	0,94988	
D	2	Compr.factor(M)	0,949876	
D	3	Compr.factor(B)	1,000000	
D	4	Conversion factor	27,4493	
D	5	Percentage error	-0,00001	%
D	10	Molar mass ideal	18,8368	kg/kmole
B	11	Src. stand. dens.	Extra analog 1	
B	12	Src. density	Extra analog 1	
B	13	VOS correction	No	
D	15	C factor deviation	0,00	%
B	16	C fact. perm.dev.	1,00	%
B	17	C factor monitoring	Yes	

Here reference is made to the extra analog value.

Here you can activate the comparison.

2.7.6 Other transmitter data

To input the data of other transmitters, proceed in the same way as described under 2.4.1 to 2.4.4. This basically applies to all gas components (see ***BA Components mode***).

3 Operating the gas volume corrector

3.1 Description of function keys

3.1.1 Coordinate structure

All measured and calculated values, parameters and functions are organized in a coordinate system. There are several tables with columns and lines as with a spreadsheet. There is a heading for each table where all chapters are combined which are logically connected to each other. The chapters correspond to the columns of a table, while the fields within a table (lines) are the functions or coordinates. Counting within a table is made using combinations of letters and digits starting with AA = first column, 01 = first line. Chapters which belong together are combined under the first letter: AA, AB, AC, AD... / BA, BB, BC, ... / CA, CB, CC, CD... In the present documentation, the function of a key is indicated in bold Italic typeface, e.g. Enter, Totalizer, Analysis, etc.
You can directly access an overview of measured values and results if you use the following four keys:

<1> Meas. P, T..
<2> Analysis
<7> Totalizer
<8> Flow rates

Since there are more columns used in the coordinate system than there are keys on the front panel, some data can only be accessed indirectly.
Indirect access is made by selecting the generic term e.g. by pressing the Meas. P,T.. key. The 4-line display shows the first four measured values and there is an arrow before the first value in the topmost line in front of the name of the value shown, e.g. ➔ Pabs. If you now press Enter, the display will jump to the Absolute pressure chapter. If you then press the Cursor Up or Down key, you can browse through the functions (coordinates). This applies to all values displayed which can be accessed by means of the arrow symbol (➔).

Another option for indirectly accessing data is to select the current chapter by pressing <*> Select and then the Cursor Right or Left key to browse through all chapters. As soon as you have reached the desired chapter heading, press the Cursor Up or Down key to access the chapter and press Enter to activate the function.

Depending on the device type and setting of operating modes, complete chapters (columns) or individual coordinates are hidden in the coordinate system. Only such values are displayed which are relevant to the device type selected. In addition, there are also functions or coordinates which are meant for service or verification purposes only. Depending on the visibility level and the device type chosen, it is not possible to see all parameters and data all the time.

The structure of the coordinate system has been designed in such a way that comparable displays and functions of all chapters (columns) always appear in the same line. If you are within a column, e.g. at the "Min. range" parameter, you can use the ◄► keys to jump to the neighbouring columns on the same line level where you will also reach the "Min. range" parameter.

For a description of the complete coordinate system, please see the annex to this documentation (Annex A).

3.1.2 Examples for accessing and showing parameters

Example: Measured values

Key

Cancel **1**

Meas. P,T..

If you press <1> Meas. P,T.., the display will jump to showing all available measured values. The number of measured values is calculated dynamically in accordance with the mode settings and the state of the device. There is an arrow ➔ displayed in front of the short designation of the first measured value which can be moved upwards or downwards using the cursor keys. If the arrow is located on the value displayed for the pressure at measurement conditions for example, you can now press Enter to directly jump to the functions through which you can browse using the cursor keys.

Example:
Press <1> Meas. PT.. to display the following overview.

➔P	16.257	bar
T		8.231
Hs	9.529	kWh/m3
Rhon	0.7786	kg/m3

The arrow is located on the first line and can be moved upwards or downwards using the cursor keys. In this example, pressing ***Enter*** will select the **Absolute Pressure** chapter. A new window will open with the **Absolute Pressure** heading. The contents of this chapter can be browsed using the cursor keys.

Example: Totalizers

Key

Take PCtime **7**

Totalizer

If you press <7> Totalizer, the display will jump to showing all available totalizers. The number of totalizers is determined dynamically in accordance with the mode settings and the state of the device. There is an arrow ➔ displayed in front of the short designation of the first totalizer which can be moved upwards or downwards using the cursor keys. If the arrow is located on the totalizer displayed for the volume at measurement conditions in billing mode 1 for example, you can now press Enter to directly jump to the Totalizer BM1 chapter. Here you can reach the functions (coordinates) of interest to you using the cursor keys.

Example: Analytical values

Key

Enter 2

Analysis

If you press <2> Analysis, the display will jump to showing all available values which are directly or indirectly connected to gas quality. The number of values is determined dynamically in accordance with the mode settings and the state of the device. There is an arrow ➔ displayed in front of the short designation of the first value which can be moved upwards or downwards using the cursor keys. If the arrow is located on AGA 8 92DC for example, you can now press Enter to directly jump to the K coefficient chapter. Here you can reach the functions (coordinates) of interest to you using the cursor keys.

Example: Flow rate values

Key

Cancel 8

Flow rates

If you press <8> Flow rates, the display will jump to showing all available flow rate results. The number of values is determined dynamically in accordance with the mode settings and the state of the device. There is an arrow ➔ displayed in front of the short designation of the first value which can be moved upwards or downwards using the cursor keys. If the arrow is located on Qe for example, you can now press Enter to directly jump to the Energy flow rate chapter. Here you can reach the functions (coordinates) of interest to you using the cursor keys.

Remaining keys:

<3> Orifice	Accesses an overview of the orifice plate (for ERZ 2014, 2114, 2012, 2112). If you press the Cursor Left key, you can access further data of the orifice plate.
<4> I/O	**Directly** accesses outputs and by pressing the Cursor Right key inputs.
<5> Archive	Directly accesses archives and by pressing the Cursor Left key maximum values.
<6> Test	Accesses test functions such as On-the-fly calibration, Freeze, Functional test, etc.
<9> Totalizer	Accesses the data of the flow meter.
<0> Mode	Accesses general settings.
<±,> ID	Displays ID data (electronic type plate).
<*> Select	Displays the currently selected chapter.

3.1.3 The special case of the <0> Mode key

If you press <0> Mode, the display will jump to the Mode heading in the centre of the coordinate system and the select arrow will point to Base values.

Mode ➔Base values Billing mode Access

From here, you have two options for proceding further on: You can press either the Cursor Down key to access all chapters under the Mode heading which have something to do with operating modes, device settings, base values, etc., or you can press the Cursor Right or Left key to scroll through the whole system on the heading level. As soon as you have reached the desired position, select the relevant chapter by moving the select arrow ➔. When the arrow is located on the desired chapter, press Enter to jump into this chapter onto the first active function (line).

3.2 General information

3.2.1 How to change over totalizers to another unit

Press <7> Totalizer to access the overview. The standard setting of Vm and Vb totalizers is m^3 with nine digits being displayed without fraction. To select the unit, there are texts and conversion functions available for each totalizer. For metering large quantities, you can change the representation mode of totalizers from 9 to 14 digits plus 3 decimal places. The 9- or 14-digit representation mode will be active for all totalizers at the same time and can be selected via the LK29 No. of digits parameter.

Note! As soon as the new unit is set, the totalizer increments are calculated with the new unit and added to the previous totalizer reading (thus, mixed values are formed).

In addition, it is also possible to shift the decimal separator and select "Totalizer reading" mode * 10 (100, 1000) m^3.

Example 1: You want to select another unit for the Vb totalizer.
Press <7> Totalizer and use the <*> Select key to switch to the chapter which is currently selected. In this case, the Totalizers chapter will be displayed as current chapter. Now use the Cursor Down key to browse to the Totalizer parameters chapter and press Enter. Browse until you reach the LK06 Vol. base unit parameter and set the desired unit there.

Example 2: You want all totalizers to run with 14 digits.
Press <7> Totalizer and use the <*> Select key to switch to the chapter which is currently selected. In this case, the Totalizers chapter will be displayed as current chapter. Now use the Cursor Down key to browse to the Totalizer parameters chapter and press Enter. Browse until you reach the LK29 No. of digits parameter and select the desired representation mode there.

From software version 1.7, there are CO2 totalizers for all the four billing modes.

Note! To make these settings, the topmost access level (superuser) has to be enabled, i.e. the user code has to be entered and the calibration lock has to be open.

3.2.2 How to change over measured values to another unit

Measured values, such as pressure, temperature, superior calorific value, etc., can be changed over to another unit without an automatic conversion being performed. In contrast to totalizers, the assignment of the minimum and maximum values determines the calculation of the physical quantity from the input value. Thus, changing the unit means merely changing the text.
For example, you want to change the pressure at measurement conditions displayed from bar to psi (activate the superuser access level, i.e. input the user code and open the calibration lock).
After you have pressed <1> Meas. P,T.., the following display appears:

➔P	13.068	bar
T	8.55	°C
Hs	11.972	kWh/m3
Rhon	0.969	kg/m3

The arrow is located on the first line and can be moved upwards or downwards using the cursor keys. In this example, pressing ***Enter*** will select the **Pressure** chapter. A new window will open with the **Absolute Pressure** heading. The contents of this chapter can be browsed using the cursor keys.

Use the Cursor Down key to browse to the Unit function. Then press Enter to change over to input mode and select the desired unit using the cursor keys. Press Enter to terminate your entries and close the calibration lock again. All the other functions and displays related to the pressure value will have been changed over to the new unit automatically.

If you want to change custody transfer parameters, you have to remove the official seal and set the calibration switch to the "Unlock" position. As soon as the first parameter has been changed, this is entered in the logbook together with the "Calibration lock open +" entry. The gas volume corrector will stop correcting immediately and will not supply current measured values until the calibration switch has been set to the "Lock" position again.

3.2.3 Activating inputs and/or outputs

In chapter EI Configuration under the <0> Mode key (superuser protection), you can activate the required inputs and/or outputs. The principle according to which this is to be done is explained by the example of the inputs:
The number of activated inputs decides on whether the corrector samples the relevant terminals in order to determine the measured value. If the input for the number of resistance measurements is at 0, no measurement will be taken. If you intend to connect a PT 100, you have to differentiate whether the explosion protection is external or internal, since this decides whether terminal X 4 or X 10 is to be used for connection. In the case of an Ex-d protected PT 100 at X 4, line 1 (resistance measurement number) is to be set at 1, while in the case of an Ex-i PT 100 at X 10, line 31 (Ex resistance number) is to be set at 1.
In the case of frequency inputs, you should note the following: frequencies F1, F2, F3 and F4 are dedicated for volume measurements. The standard assignments are as follows: F1 for the measuring channel and F2 for the reference channel. Frequencies F5, F6, F7 and F8 are reserved for the density, standard density and velocity of sound. This frequency measurement feature has another time base and is able to measure frequencies more accurately and with a higher resolution. When activating frequency inputs, make sure that frequencies 1 to 4 (volume) are always included in counting.
Example: Gas volume corrector with HF 2 and 3, density and standard density. Seven frequency inputs are to be activated (1 to 4 for the volume, 5 for the density, 6 and 7 for the standard density).

3.2.4 Information about parameters for the volume at measurement conditions

The following operating modes are possible:	Designation displayed
1. ENCO[2]	Vo
2. ENCO with LF transmitter	Vo, LF1-chan.
3. LF transmitter with ENCO	LF1-chan., Vo
4. ENCO with HF transmitter	Vo, HF1-chan.
5. HF transmitter with ENCO	HF1-chan., Vo
6. ENCO with 2-channel HF transmitter (1:1)	Vo, HF2-chan. 1/1
7. 2-channel HF transmitter (1:1) with ENCO	HF2-chan. 1/1, Vo
8. ENCO with 2-chan. HF transmitter (x:y)	Vo, HF2-chan. X/Y
9. 2-channel HF transmitter (x:y) with ENCO	HF2-chan. X/Y, Vo
10. 2-channel HF transmitter (1:1)	HF2-chan. 1/1
11. 2-channel HF transmitter (x:y)	HF2-chan. X/Y
12. 2-channel HF transmitter:LF transmitter	HF LF
13. 1-channel HF transmitter	HF1-chan.
14. 1-channel LF transmitter	LF1-chan.
15. US9000 ultrasonic flowmeter remote unit	DZU
16. Integrated ultrasonic controller	IGM
17. Orifice plate	Orifice
18. Flow 4-20 mA	4-20 mA

Volume transmitter mode:

As to the modes 1 to 9, the notation means: The first parameter applies to billing and the second parameter to comparison. If ENCO stands at the beginning, for example, Vm increments are calculated from the telegram contents of the digital totalizer, i.e. the Vm totalizer is calculated from ENCO information. However, if ENCO stands at the end, Vm is calculated normally from HF or LF signals and Vo is displayed and archived only additionally. Note also the following with regard to signalling alarms or warnings: If ENCO stands at the beginning of a 2-channel operating mode (operating mode 6 or 8), then as far as the HF measuring inputs stand at the end and if there is a missing pulse or a pulse comparison fault, no alarm will be outputted but a warning with a separate message number.
The operating modes 1 to 17 are described in more detail in the next section.
The Vo totalizers will become visible in the coordinates as soon as ENCO is activated in one of the operating modes (1 to 9). However, the pulse values (HFmeas., HFcomp. and LF) do not become visible until they are needed in the operating mode.

Some of the following functional descriptions are only visible if the service or developer access level has been activated. In order to provide a complete overview, they are listed here as well.

Missing pulses, reference pulses:
A differential connection alternately compares the counted pulses of the measuring and reference channels. Every deviation is accumulated by the internal missing pulse counter. An alarm is generated if the set limit (contents: missing pulses) is exceeded. If the limit is not exceeded within a settable period (contents: reference pulses), the missing pulse counter is set to zero.

[2] ENCO = ENCODER / Electronic totalizer with digital interface

Start-up pulses:
The start-up pulses parameter combines two functions:

- Suppression of fault messages of the volume input which can occur in the case of 2-channel volume measurement (1:1) when the gas meter is started up from standstill with signals which are not mechanically coupled with each other (e.g. vortex meter). Monitoring will not be activated until the start-up pulses have run out.
- Resetting fault messages of the volume input when the device has returned to untroubled operation after the start-up pulses have run out.

Starting up and shutting down a plant:
Start-up is troublefree if qm passes the range from the creeping quantity limit to the lower alarm limit during start-up and slow-down. An alarm is generated if qm is still below the alarm limit and above the creeping quantity limit after the start-up or slow-down time has been exceeded. The alarm is defined as going when the lower alarm limit is passed (when the plant is started up) or when the creeping quantity limit is passed (when the plant is shut down).

Start-up/slow-down time:
There is a separate "Start-up/Slow-down" chapter to be found under the <9> Meter key. Here you can see the momentary state, the current start-up and slow-down times and the parameters for the start-up and slow-down times.
Start-up and slow-down times are parameters for the time monitoring of the lower flow rate limit qmmin. The qmmin alarm is not triggered until one of these times has elapsed. These parameters are important for the start-up and slow-down phases. See also Starting up and shutting down a plant.

Creeping quantity limit:
The Vm and Vb totalizer readings are not increased as long as the flow rate at measurement conditions is below the creeping quantity limit.
The creeping quantity cut-off function prevents uncontrolled counting of pulses e.g. in the case of swinging movements when a turbine meter is at standstill or of pulses at zero drift in the case of other gas meters.

Creeping quantity mode:
There are the two following options:
Do not use the creeping quantities occurred ("discard").
Use the creeping quantities occurred and add them to normal quantities ("accumulate").

Volume frequency source:
Display of the connected or active input.

Channel Qm determination:
It is shown whether Qm (flow rate) is formed from the measuring channel or the reference channel.

Channel Vm determination:
It is shown from which channel Vm is calculated (measuring channel, reference channel, Vo).

Some functions and parameters described here are visible only at the "Service" or "Developer" level.

Hardware pulse comparison:
It is shown whether the hardware comparison is active.

Vo effect of fault:
It is shown whether Vo protocol errors are signalled as alarm or warning or whether they are not signalled. This depends on the selected operating mode.

Some functions and parameters described here are visible only at the "Service" or "Developer" level.

Reference quality:
It is shown how the corrector calculated the quality of the reference channel during software comparison. The result is calculated from the permanent monitoring of measuring and reference channels.

Maximum allowable deviation X:Y
Here you can set the maximum allowable deviation between the measuring and reference channels. The factory setting is 4%.

Main blades (X):
Display = integer ratio of Kv measuring channel to Kv reference channel, projected to approx. 200 pulses. The calculated values are automatically transferred to the hardware pulse comparison logic.

Reference blades (Y):
Display = integer ratio of Kv reference channel to Kv measuring channel, projected to approx. 200 pulses. The calculated values are automatically transferred to the hardware pulse comparison logic.

Better HF channel:
Display = comparison of the frequencies of the measuring and reference channels for the higher value.

Predictive reliability:
This parameter indicates how often the comparison from the Better HF channel function must provide the better value until a changeover is made.

Decision change:
It is shown how often the device has made a decision in favour of the other channel.

USZ effect of fault:
It is shown whether USZ protocol errors (DZU protocol) are signalled as alarm or warning or whether they are not signalled.
This depends on the selected operating mode.

Monitoring of synchronous run (coordinates JK...)
There is a chapter Synchronous run monitoring to be found under the <0> Mode key. Here you can find the parameters for monitoring synchronous run, such as the maximum deviation, termination short and termination quantity and information displayed about the current state of the ongoing comparison.

Monitoring of synchronous run deals with software comparisons between the possible inputs for volume formation. Comparisons are possible if two or three inputs are used. Comparisons are run automatically if there is more than one input.

Maximum deviation:
The permissible deviation in percent between the two comparative values is to be entered here. The termination quantity parameter defines the query limit.

Termination quantity:
Here a relative quantity is parameterized (in m³) for the comparison to which a totalizer deviation between the two channels to be compared is related. After this quantity has been reached, the verification is performed and then the volume meter is reset and a new comparative cycle started.

Termination short:
If the last comparison has resulted in an alarm, synchronous run can be tested with shorter cycles to observe the fault situation. This enables the alarm to be cleared more quickly. NOTE! Do not select too small a value, otherwise the quantity is too small to detect troublefree operation with the tolerance set (maximum deviation).

Logic of synchronous run
Monitoring of synchronous run is not only restricted to the comparison between Vo and HF input, but verifies all combinations with more than one input signal. The following table provides an overview of the functions in troublefree operation. In the case of a fault, the corrector uses the undisturbed signal or, if there are three input signals, it switches over to the relevant signal automatically.

Operating mode	Fault Vo	Fault DZU	HW comp.	SW comp.	Qm calculation	Vm calculation	kv use
Vo	Alarm	OFF	OFF	OFF	Metering	Vo	Vo
Vo, LF1-chan.	Alarm	OFF	OFF	Vo – LF1-chan.	Metering	Vo	Vo
LF1-chan., Vo	Warning	OFF	OFF	LF1-chan. – Vo	Metering	LF	Meas. channel
Vo, HF-1chan.	Alarm	OFF	OFF	Vo – HF-1chan.	HF signal	Vo	Vo
HF1-chan., Vo	Warning	OFF	OFF	HF1-chan. – Vo	HF signal	HF signal	Meas. channel
Vo, HF2-chan. 1/1	Alarm	OFF	1:1	Vo – HF meas.	HF meas. signal	Vo	Vo
HF2-chan. 1/1, Vo	Warning	OFF	1:1	HF meas. – Vo	HF meas. signal	HF meas. signal	Meas. channel
Vo, HF2-chan. X/Y	Alarm	OFF	X :Y	Vo – HF meas.	HF meas. signal	Vo	Vo
HF2-chan. X/Y, Vo	Warning	OFF	X :Y	HF meas. – Vo	HF meas. signal	HF meas. signal	Meas. channel
HF2-chan. 1/1	OFF	OFF	1 :1	Meas. — Comp.	HF meas. signal	HF meas. signal	Meas. channel
HF2-chan. X/Y	OFF	OFF	X:Y	Meas. — Comp.	HF meas. signal	HF meas. signal	Meas. channel
HF LF	OFF	OFF	OFF	HF – LF	HF signal	HF meas. signal	Meas. channel
HF1-chan.	OFF	OFF	OFF	OFF	HF signal	HF signal	Meas. channel
LF1-chan.	OFF	OFF	OFF	OFF	Metering	LF signal	Meas. channel
DZU	OFF	Alarm	OFF	OFF	DZU	DZU	DZU
IGM	OFF	OFF	OFF	OFF	IGM	IGM	IGM

Explanation of the operating modes

1. **Only ENCO, no NAMUR inputs:**
   Vm progress has to be calculated from Vo telegram contents. No calculation of the flow rate.

2. **ENCO with LF:**
   Vm progress is calculated from Vo telegram contents. The LF input is used only for checking synchronous run. An alarm is tripped if there is no synchronous run. A flow rate is determined with reduced accuracy from the LF signal.

3. **LF with ENCO:**
   Vm progress is calculated from the LF volume input. Vo is used only for checking synchronous run and is otherwise only displayed and recorded. An alarm is tripped if there is no synchronous run and the device will not switch to Vo. A flow rate is determined with reduced accuracy from the LF signal.

4. **ENCO with HF:**
   Vm progress is calculated from Vo telegram contents. The HF measuring input is used only for checking synchronous run and for calculating the flow rate. An alarm is tripped if there is no synchronous run.

5. **HF with ENCO:**
   Vm progress and flow rate are calculated from the HF measuring channel. Vo is used for checking synchronous run and is otherwise only displayed and recorded. An alarm is tripped if there is no synchronous run.

6. **ENCO with 2-channel HF (1:1):**
   Vm progress is calculated from Vo telegram contents. The HF inputs are used only for checking synchronous run and for calculating the flow rate (1-out-of-3 selection). An alarm is tripped if there is no synchronous run and the device switches to the plausible input. For function 1:1, see item 10 but with warnings instead of alarms.

7. **2-channel HF (1:1) with ENCO:**
   Vm progress and the flow rate are calculated from the HF inputs. Vo is used only for checking synchronous run (1-out-of-3 selection) and is otherwise only displayed and recorded. An alarm is tripped if there is no synchronous run and the device does not switch over to Vo. For function 1:1, see item 10.

8. **ENCO with 2-channel HF (x:y):**
   Vm progress is calculated from Vo telegram contents. The HF inputs are used only for checking synchronous run and for calculating the flow rate (1-out-of-3 selection). An alarm is tripped if there is no synchronous run and the device switches to the plausible input. For function x:y, see item 11, but with warnings instead of alarms.

9. **2-channel HF (x:y) with ENCO:**
   Vm progress and the flow rate are calculated from the HF inputs. Vo is used only for checking synchronous run (1-out-of-3 selection) and is otherwise only displayed and recorded. An alarm is tripped if there is no synchronous run and the device does not switch over to Vo. For function x:y, see item 11.

10. **2-channel HF (1:1):**
    The same number of pulses per time (or per rotation of the turbine wheel) on both channels. The input pulses must be out of phase (90° to 270°). The difference formation feature alternatively compares

measuring and reference pulses. Every deviation is accumulated by the missing pulse counter. An alarm is generated if the preset limit (missing pulses= e.g. 10 pulses) is exceeded. If the limit is not exceeded within a presettable period (reference pulses = e.g. 10,000 pulses), the missing pulse counter is set to zero. Vm progress and the flow rate are calculated from the "better" HF input.

11. **2-channel HF (x:y):**
    The number of pulses per time (or per rotation of the turbine wheel) is not the same on the two channels. The input pulses can have any phasing. The difference formation is only performed in the software. The quantities counted differently per time are corrected and then compared using the entered HFmeas. pulse value and HFref. pulse value parameters. An alarm is generated if there is a deviation exceeding the Comp. limit [%].Vm progress and the flow rate are calculated from the "better" HF input.

12. **2-channel HF/LF:**
    The number of pulses per time (or per rotation of the turbine wheel) is not the same on the two channels. The input pulses can have any phasing. The difference formation is only performed in the software. The specified deviation results from the ratio between the HFmeas. pulse value and LF pulse value parameters inputted. An alarm is generated if there is a deviation exceeding the Comp. limit [%]. If the device switches over to the reference channel (e.g. if a fault occurs), it is only possible to calculate a flow rate with reduced accuracy.

13. **1-channel HF:**
    Vm progress and the flow rate are calculated from the HF measuring channel. There is no reference channel and no monitoring for synchronous run.

14. **1-channel LF:**
    Vm progress is calculated from the measuring channel (in this case LF). A flow rate with reduced accuracy is determined from the signal. There is no reference channel and no monitoring for synchronous run. Each pulse received is counted and there is no lower cut-off limit (creeping quantity).

15. **DZU:**
    Connection of a US 9000 ultrasonic arithmetic processing unit with main totalizer function, transmission of totalizer readings and flow rates with the DZU protocol. For information about this protocol, see LO coordinate DZU protocol or Digital totalizer transmission. For further information, see FH Ultrasonic flowmeter diagnosis.

16. **IGM:**
    Direct connection to the sensors of the ultrasonic gas meter (IGM), integration of the US 9000 arithmetic processing unit, formation of totalizer readings from sensor data. This is only applicable in conjunction with the ERZ 2xxx USC variants.

17. **Orifice plate:**
    Connection to differential-pressure sensors; up to 3 cascaded sensors are possible. The overlapping areas are monitored when ramping up or down. To be used in conjunction with the ERZ 2014, ERZ 2012, ERZ 2114 and ERZ 2112 device types.

18. **4-20 mA:**
    Connection of an analog flow rate transmitter with proportional function. Contrary to the orifice plate, there is no root extraction and no grading; the 4-20 mA signal covers the complete range. The assignment is made as follows: 4 mA = 0 m^3/h, 20 mA = Qm,max (this is the value under GB Flow rate parameters).

3.2.5 Information about operating the device as an ERZ 2000 USC

In this operating mode, the sensor signals of the IGM measuring heads are directly connected to the volume corrector via a Modbus connection. The volume corrector interface to be used for this purpose is COM 1. By enabling the relevant software function, the ultrasonic controller is activated and no additional hardware is required. If one of the four possible device variants with an ultrasonic controller (ERZ 2004 USC, ERZ 2104 USC, ERZ 2002 USC or ERZ 2102 USC) has been selected, further functional units have to be observed.

FH Ultrasonic flowmeter diagnosis
This function has been intended to display diagnostic values not only when the US 9000 has been connected, but also for the ERZ 2xxx USC types (here only fields 3 to 32).
The display comprises:
averaged mean values, unit, gas velocities of paths 1 to 6, velocities of sound of paths 1 to 6, AGC level for upstream and downstream, the quality of measurement (= indication of valid measured values in percent), alarm states and indication of the messages of the US 9000.

GI Ultrasonic volume transmitter

GM Reynolds number correction, ultrasonic flowmeter

GN Base correction, ultrasonic flowmeter

GO Error curve linearization, ultrasonic flowmeter

GP Impact of the corrections

GQ IGM 1 ID display

GR IGM 2 ID display

GS IGM 3 ID display

GT IGM 4 ID display

HN Path 1

HO Path 2

HP Path 3

HQ Path 4

HR Path 5

HS Path 6

HT Path 7

HU Path 8

These functions provide detailed information about the ultrasonic transmitter, the sensors and their performance. For a detailed description of the individual field, see the separate ERZ_2000_USC_Details documentation.

3.2.6 Information about operating the device as an orifice-plate flowcomputer (ERZ 2014, 2114, 2012, 2112)

In this operating mode, the sensor signals of the differential-pressure measuring cells are connected to the flowcomputer via a 4 - 20 mA link. The signals can optionally be evaluated analogly or digitally (HART). The transmitter mode is the preferred operating mode of the measuring cells for which the ERZ 2000 supplies 24 VDC.
To activate volume calculation via the differential-pressure signals, set the Orifice operating mode in the Meter chapter under Flow rate parameters. In order to ensure that totalizers are calcuated through the differential-pressure signals, you have to select one of the following device types: ERZ 2014, 2114, 2012 or 2112.

<3> key Overview of Orifice

The following data are available in the overview of Orifice:
Display of the current flow rate at measurement conditions, the differential pressure, the cell selected, the diameter ratio beta, the expansion factor epsilon, the velocity of approach factor E and the flow coefficient C.

To access the Orifice chapter (coordinates GV 01...), press the Cursor Left key once in the overview (<3> key). Here the following information is shown:

GV 01 Current volumetric flow at measurement conditions
GV 02 Current differential pressure
GV 03 Current Reynolds number Re
GV 04 Current diameter ratio beta
GV 05 Current expansion factor epsilon
GV 06 Current velocity of approach factor E
GV 07 Current discharge coefficient C
GV 08 Current flow coefficient alpha
GV 09 Current pressure drop omega
GV 10 Pressure tapping mode (corner, flange, D-D/2)
GV 11 Calculation method (ISO 5167 / 2003, ISO 5167 / 1995, ISO 5167 / 1998, ISO 5167 / 2000)
GV 14 Number of iterations
GV 15 Cycle quantity
GV 16 Cycle time

> In the German version: DIN EN ISO 5167 (2004)

The dimensions of the orifice plate are summarized under Meter in chapter GA.

Under GA 01 to GA 12, you can find the following data:
GA 01 Diameter of the orifice plate at the temperature at measurement conditions
GA 02 Diameter of the pipe at the temperature at measurement conditions
GA 03 Temperature correction factor of the orifice plate
GA 04 Temperature correction factor of the pipe
GA 05 Linear expansion coefficient of the orifice plate
GA 06 Linear expansion coefficient of the pipe
GA 07 Diameter of the orifice plate at 20°C
GA 08 Diameter of the pipe at 20°C
GA 10 Material of the orifice plate
GA 11 Material of the pipe

Isentropic exponent
If the isentropic exponent is to be used as a running measured value in flow rate calculation, there a three calculation options:
Set the operating mode in the AN Isentropic exponent chapter (coordinate AN 03) at:

AGA 10	(Recommended for a complete analysis and AGA 8 92 DC.)
Polynomial (T, P)	Polynomial of the 9th order with default values (specified by e-on *Ruhrgas).*
Kobza	Formula

If the isentropic exponent is to be used as a fixed value in the calculation, select Default.

Joule-Thomson coefficient
If the Joule-Thomson coefficient is to be calculated and used as a running measured value in flow rate calculation, there are two calculation options:
Set the operating mode in the AO Joule-Thomson coefficient chapter (coordinate AO 03) at:

AGA 10	(Recommended for a complete analysis and AGA 8 92 DC.)
Polynomial (T, P)	Polynomial of the 9th order with default values (specified by e-on Ruhrgas).

To use the Joule-Thomson coefficient in the computational procedure, select ISO 5167 (2003) among the calculation methods under GV Orifice plate in line 11.

If the Joule-Thomson coefficient is to be used as a fixed value in the calculation, select ***Default***.

In the Differential pressure chapter (coordinates AP 01......), set the parameters for the differential-pressure sensors. Here you can find the following parameters for three measuring cells:

AP 01 to AP 07 show general information on selected measuring ranges and the interaction of the measuring cells in the transitional areas from a small to a large cell.

AP 10 Operating mode with the menu*:*

OFF	= Sensor switched off
Analog 1 range	= Measuring range measured analogly with 1 cell (4 to 20 mA)
Analog 2 ranges	= Measuring range measured analogly with 2 cells (4 to 20 mA)
Analog 3 ranges	= Measuring range measured analogly with 3 cells (4 to 20 mA)
Digital 1 range	= Measuring range measured digitally (HART) with 1 cell
Digital 2 ranges	= Measuring range measured digitally (HART) with 2 cells
Digital 3 ranges	= Measuring range measured digitally (HART) with 3 cells
Analog/digital 1 range	= Measuring range measured analogly and digitally with 1 cell *
Analog/digital 2 ranges	= Measuring range measured analogly and digitally with 2 cells *
Analog/digital 3 ranges	= Measuring range measured analogly and digitally with 3 cells *
Formalism check	= In this operating mode, a differential-pressure default value can be used instead of the measured value in order to check the flow rate equations.

* In this operating mode, the faster analog measured value is used for calculation and in parallel with this, the slower digital measured value is used to check and adjust the analog value. In this way, flow rate calculation is performed with the speed of the analog signal (7 cycles per second) on the basis of the accuracy of the digital signal. In this operating mode, the ERZ 2000 permanently adjusts the analog input automatically. The value in coordinate AP 51 defines the permissible range for this automatic adjustment.

AP 11 Formalism check
Here, enter a differential pressure value to check the flow rate equation (only possible in Formalism check mode). This function simulates the differential pressure and replaces the value measured.

AP 12 Zero-point noise
Differential pressure to be suppressed by the ERZ 2000 (its effect corresponds to that of the creeping quantity limit).

AP 13 Min. differential pressure
Lower limit of the permissible differential pressure of the orifice plate. It is used to calculate Qmmin (shown in coordinate GB 02). Note: dp min is a fixed value, while Qmmin is a running value (state quantities, etc.)

AP 14 Max. differential pressure
Upper limit of the permissible differential pressure of the orifice plate. It is used to calculate Qmmax (shown in coordinate GB 01). Note: dp max is a fixed value, while Qmmax is a running value (state quantities, etc.)

Measured values and parameters for cell 1:

AP 15 cell 1 differential pressure
AP 16 cell 1 input
AP 17 act. dp 1 offset
AP 18 cell 1 source with menu for assignment to the relevant current input
AP 19 dp 1 at 4 mA (lower mapping limit)
AP 20 dp 1 at 20 mA (upper mapping limit)
AP 21 dp 1 correction (offset correction)

Measured values and parameters for cell 2:

AP 22 cell 2 differential pressure
AP 23 cell 2 input
AP 24 act. dp 2 offset
AP 25 cell 2 source with menu for assignment to the relevant current input
AP 26 dp 2 at 4 mA (lower mapping limit)
AP 27 dp 2 at 20 mA (upper mapping limit)
AP 28 dp 2 correction (offset correction)

Measured values and parameters for cell 3:

AP 29 cell 3 differential pressure
AP 30 cell 3 input
AP 31 act. dp 3 offset
AP 32 cell 3 source with menu for assignment to the relevant current input
AP 33 dp 3 at 4 mA (lower mapping limit)
AP 34 dp 3 at 20 mA (upper mapping limit)
AP 35 dp 3 correction (offset correction)

AP 36 to AP 49 Information about mean values, DSfG values, etc. identical to other inputs such as pressure or temperature at measurement conditions.
AP 50 Display of the current differential pressure measured via the HART input (digital value).
AP 51 Display of the difference between the digital and analog measured values.

AP 52 Display of the calculated correction related to the HART measured value (online correction).
AP 53 Parameter for inputting the permissible correction related to the HART measured value.
AP 54 to AP 58 data plate information about the sensors.
AP 61 to AP 68 Freeze values.

Note:
In order to optimally operate the ERZ 2000 as an orifice-plate flowcomputer, the second A/D converter available in the device is to be activated to enable fast differential-pressure measurements to be taken in parallel with measurements of pressure and temperature. To do this, change over to the Current input chapter of the channel selected and set the Measuring strategy parameter at Differential pressure (Note: Access is only possible on the superuser level!).

Example:
Current input 4 is to measure the small cell => Chapter ND Current input 4 terminals X6-1, X6-2
In coordinate ND 09, there is the Measuring strategy parameter.
If the ERZ 2000 is operated as a volume corrector, the default parameter is Standard. If the ERZ 2000 is operated as an orifice-plate flowcomputer, you have to set this parameter at Differential pressure. Repeat this setting for all current inputs selected for differential-pressure measuring cells.
Please operate the inputs for pressure and temperature and all inputs which are not used for differential-pressure measuring cells with the Standard setting.

To activate the HART operating mode of the differential-pressure sensors, please see the relevant information for pressure transmitters.

3.2.6.1 Special case of the zero-point adjustment of all differential-pressure cells

In its orifice-plate flowcomputer mode, the ERZ 2000 has a function to correct the offset at zero flow. This enables the zero drift of the differential-pressure cells to be adjusted easily.

Preconditions:
The ERZ 2000 is informed via contact input or Modbus register that the meter run is closed and the flow rate should be zero.
The differential pressure caused by a zero drift has to be lower than the value defined by the creeping quantity limit (here: coordinate AP 12 Zero-point noise). If the differential pressure is higher, the alarm "Flow in closed pipe" is activated.
The calibration lock has to be open in order to perform the offset correction.
The correction can only be perfomed manually.

Example:
Under Meter in the GH Start-up/slow-down chapter next to the maximum valve time start-up/slow-down in coordinate GH 07, select the source which informs the ERZ when the flow rate has to be zero.

The menu shows the following options:

OFF	= No function
Contact inputs 1 to 8	= One of the 8 contact inputs supplies the information.
Modbus	= A Modbus register (register 9201) supplies the information.

In coordinate GH 06 Meter run, the current status (open / closed) is shown.

In coordinate GH 08 Modbus pipe state, the contents of the Modbus register 9201 (status: open/closed) is shown.

In coordinate GH 09 Definition (Pipe Wrk), you can select whether the status of the flow in closed pipe is to be signalized as an alarm or a warning.
In this example, contact input 5 is to supply the information.
If all the conditions for zero flow are fulfilled and there is a minor differential pressure left, select chapter AP Differential pressure to activate the zero-point adjustment. Coordinate AP 33 Actual dp1 offset shows the differential pressure caused by the zero drift.
Correction can only be made by pressing Enter on the front panel provided that the calibration lock is open and coordinate AP 33 is displayed at the same time.

3.2.6.2 Overview of the most important parameters when switching over the volume corrector to an orifice-plate flowcomputer

1. Under the Mode key ➔ EB base values
   Coordinate EB 19 Device type, select the correct ERZ type. The menu shows the following options:
   ERZ 2004
   ERZ 2104
   ERZ 2002
   ERZ 2102
   ERZ 2004M
   ERZ 2104M
   ERZ 2002M
   ERZ 2102M
   ERZ 2000 C
   ERZ 2004 USC
   ERZ 2104 USC
   ERZ 2002 USC
   ERZ 2102 USC
   ERZ 2004M USC
   ERZ 2104M USC
   ERZ 2002M USC
   ERZ 2102M USC
   ERZ 2014
   ERZ 2114
   ERZ 2012
   ERZ 2112
   ERZ 2014M
   ERZ 2114M
   ERZ 2012M
   ERZ 2112M
   } Select the desired type of orifice-plate flowcomputer from this group.

2. Under the Flow rates key ➔ Meter
   Coordinate GB 18 Volume transducer mode - Set the Orifice parameter in the menu.

3. Under the <1> Measured values key ➔ Overview of measured values ➔ Differential pressure Coordinate AP 10 Operating mode - Set the number of differential-pressure ranges and the appropriate operating mode.
4. Under coordinates AP 12 to AP 55 - Make further settings for differential-pressure cells.
5. The following example is for current input 4:
   If current input 4 is used for a differential-pressure cell, make sure that the measuring strategy in coordinate ND 09 is set at Differential pressure. This activates the second AD converter and shortens the measurement. If the cell is operated as a transmitter, set coordinate ND 13 Transducer supply at ON. If the cell is read digitally, set coordinate ND 16 at HART.
   If other current inputs are used, other coordinates have to be taken into account.
6. To see the data of the orifice plate, press the Flow rates key and select ➔ Meter ➔ GV Orifice ➔ Coordinate GV 10 and GV 11. For dimensions, see coordinates GA 05 to GA11.
   Further data of the orifice plate can be found under AM Viscosity, AN Isentropic exponent, AO Joule-Thomson coefficient.
7. Temperature correction
8.

Temperature correction of the orifice diameter GA07 Throat at 20°C and the internal pipe diameter GA08 Pipe diameter at 20°C is made in compliance with VDI/VDE 2040 Sheet 2 (Chapter 10) of April 1987. There are two methods of calculation: one method is based on the coefficient of linear thermal expansion and the other one on an approximation equation with coefficients selected in accordance with the materials used for the orifice plate and piping. The table below shows the various options for selection.

Temperature correction of orifice plate and piping ***GA10 Substance throat*** ***GA11 Substance pipe***		
Options for selection	**Coefficients**	
	A	**B**
OFF	-	-
Linear	-	-
Steel I	12.60	0.0043
Steel II3	12.42	0.0034
Steel III	12.05	0.0035
Steel IV	10.52	0.0031
Steel V	17.00	0.0038
Steel VI	16.30	0.0116
Bronze SnBz4	17.01	0.0040
Copper E-Cu	16.13	0.0038
Red brass Rg9	16.13	0.0038
Yellow brass Ms63	17.52	0.0089
Nickel	14.08	0.0028
Hastelloy C	10.87	0.0033

OFF
The appropriate temperature correction is switched off.

Linear
The correction factor GA03 T-crr.fact throat or GA04 T-crr.fact pipe is calculated with the coefficient of linear thermal expansion GA05 Lin. stretch throat or GA06 Lin. stretch pipe.

$$Tcrr.fact = 1 + lin.stretch * (temp - 20)$$

Selection of materials
The correction factor GA03 T-crr.fact throat or GA04 T-crr.fact pipe is calculated with an approximation equation and the coefficients A and B.

$$Tcrr.fact = 1 + (A * (temp - 20) + B * (temp - 20)^2 \ ) * 10^{-6}$$

The permissible temperature range for the materials listed extends from -200°C to 600°C, with the exception of copper, nickel and yellow brass which have 500°C as their upper limit.

3.2.6.3 Special case of a revision to be performed on an orifice-plate flowcomputer

If you press the Mode key ➔ chapter Access ➔ coordinate ED 01 to change the revision mode from Operation to Revision, you can follow the check of the individual differential-pressure cells by pressing the Orifice key (or selecting the GZ overview of the orifice when using the browser) without the changeover to the next cell being displayed. The display of the ERZ changes to:

➔ Revision	
dp1	xx,yy mbar
dp2	xx,yy mbar
dp3	xx,yy mbar

If you scroll forward, the relevant current inputs of the cells will be shown.

➔ I-dp1 x,yyy mA	
I-dp2	x,yyy mA
I-dp3	x,yyy mA

Thus, the whole range from 0 to the maximum value can be followed during the check of a differential-pressure cell.

There are two revision modes:
Revision = Standard function activated via the menu; to be used for tests in the case of series connection; totalizers are running and are marked in the archive; output pulses stop.
Revision via contact = Standard function activated via an external contact; to be used for tests in the case of series connection; totalizers are running and are marked in the archive; output pulses stop. The contact input to be used can be selected under ED Parameter access in line 12 Source revision contact.

Lines 13, 14 and 15 define the behaviour of the device during revision:

S	13	total. in revision	Running
S	14	Temp. at revision	Live value
S	15	Press. at revision	Live value

If you want the totalizers to stop during revision, select "At rest" here.

If you want to retain the last valid measured value for pressure or temperature during revision, select "Retained value" here.

(Extract from the browser)

3.2.6.4 Corrections according to GOST 8.586

Calculate temperature correction factors:	See GA dimensions
Take roughness of tube into consideration:	See GX Roughness of tube
Take abrasion of orifice into consideration:	See GY Abrasion of orifice

3.2.7 Information about pressure / parameters

The pressure input can be parameterized for 12 different operating modes:

OFF	No measurement, input is switched off.
Default	No measurement, fixed value.
from gauge pressure	The value is derived from the gauge pressure sensor connected.
Measured value=source value	HART on 4-20 mA loop in combination with a current input.
Polynomial 1st order	Coefficient 0 defines the polynomial.
Polynomial 2nd order	Coefficients 0 and 1 define the polynomial.
Polynomial 3rd order	Coefficients 0, 1 and 2 define the polynomial.
4-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range.
0-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range.
4-20mA limit	The min. and max. limits define the assignment of mA to pressure.
0-20mA limit	The min. and max. limits define the assignment of mA to pressure.
P-DZU	The pressure is measured by an ultrasonic measuring head (USE 09) and transmitted via the DZU protocol.

The incoming measured quantity (i.e. current input) is assigned to the operating mode, imposed with a correction value and shown with the correct unit.
If there is a fault, the default value is used for further calculations and is shown as an absolute value.

If the pressure sensor is to be operated using the HART protocol, make sure that the operating mode is set to "Measured value=source value" and a current input combined with the HART function is selected as source. If the pressure sensor is operated as a transmitter, make sure that its power supply is switched on in the associated menu of the current input.

The menu of the data sources comprises all metrological options of an input irrespective of whether or not these signals (e.g. current or frequency signal analogous to the measured quantity) exist for the selected transmitter.

In 0 or 4–20 mA limit mode, the alarm limit parameters include also an assignment (0 mA or 4 mA) to the lower adjusting value or an assignment (20 mA) to the upper adjusting value. If alarm limits and range limits are to be set separately from each other, use the 0 or 4-20mA coefficient operating mode.

3.2.7.1 Signal processing of the HART input – pressure at measurement conditions

Base functions of the HART input:

- Reading the measured value
- Reading the measured value in burst mode
- Searching the address
- Evaluating faults
- Evaluating "Config-Flag"
- Multimaster protocol
- Analog and digital communications are possible at the same time.

3.2.8 Information about temperature / parameters

The temperature input can be parameterized for 14 different operating modes:

OFF	No measurement, input is switched off.
Default	Fixed value, no measurement.
PT100,500,1000	Polynomial according to Callendar van Dusen
Measured value=source value	HART on 4-20 mA loop in combination with a current input.
Polynomial 1st order	Coefficient 0 defines the polynomial.
Polynomial 2nd order	Coefficients 0 and 1 define the polynomial.
Polynomial 3rd order	Coefficients 0, 1 and 2 define the polynomial.
4-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range.
0-20mA coefficient	Coefficient 0 defines the min. range, coefficient 1 defines the max. range.
4-20mA limit	The min. and max. limits define the assignment of mA to temperature.
0-20mA limit	The min. and max. limits define the assignment of mA to temperature.
T-DZU	The temperature is measured by an ultrasonic measuring head (USE 09) and transmitted via the DZU protocol.

Use the cursor key to browse to the Operating mode function. Set the desired operating mode there after you have opened the calibration lock.

The incoming measured quantity (i.e. current input) is assigned to the operating mode, imposed with a correction value and shown with the correct unit. There is a correction value for the Pt100 sensor and another one for the current transmitters. The definition of PT 100 or PT 500 or PT 1000 is to be made in the Operating mode function in the Gas temperature chapter.

If there is a fault, the default value is used for further calculations.

If the temperature sensor is to be operated using the HART protocol, make sure that the operating mode is set to "Measured value=source value" and a current input combined with the HART function is selected as source. If the temperature sensor is operated as a transmitter, make sure that its power supply is switched on in the associated menu of the current input.

The menu of the data sources comprises all metrological options of an input irrespective of whether or not these signals (e.g. current or frequency signal analogous to the measured quantity) exist for the selected transmitter.

In 0 or 4–20 mA limit mode, the alarm limit parameters include also an assignment (0 mA or 4 mA) to the lower adjusting value or an assignment (20 mA) to the upper adjusting value. If alarm limits and range limits are to be set separately from each other, use the 0 or 4-20mA coefficient operating mode.

3.2.8.1 Signal processing of the HART input – temperature

Base functions of the HART input:

- Reading the measured value
- Reading the measured value in burst mode
- Searching the address
- Evaluating faults
- Evaluating "Config-Flag"
- Multimaster protocol
- Analog and digital communications are possible at the same time.

3.2.8.2 Reference temperture/temperature at base conditions

If the K coefficient is calculated in accordance with GERG 88S or AGA NX 19 with H group gas, the temperature at base conditions can only be changed step by step according to the ISO table of countries (0, 15, 20, 25 degrees C)

.

From: ISO/DIS 12213-3, page 32

Reference pressure = 101.325 kPa = 1.01325 barabs

Country	Hs reference temperature °C combustion	Temperature at base conditions °C gas measurement
User-specific setting	0, 15, 20, 25	0, 15, 20, 25

If the K coefficient is calculated in accordance with GERG 88S or if K = constant is selected, the Hs reference temperature can be changed only step by step according to the ISO table of countries (0, 15, 20, 25 degrees C).

Example: ISO/DIS 12213-3, page 32

Reference pressure = 101.325 kPa = 1.01325 barabs

Country	Hs reference temperature °C combustion	Temperature at base conditions °C gas measurement
User-specific setting	0, 15, 20, 25	0, 15, 20, 25

3.2.8.3 Adjustable extra base conditions

Under the Calculated values heading (press the <0> Mode key and the Cursor left key once), there is the Extra base condition function. Here you can convert the flow rate Qb, the standard density and the ratio of two standard densities, rho n (extra base condition) / rho n (base condition) in relation to other base conditions. These values are available to the current outputs for allocation.

3.2.9 Information about the K coefficient / gas quality

There are different ways of calculating the K coefficient of a gas.

K constant, no calculation (the default value for the K coefficient is used).
K calculated for ideal gas.
K calculated via GERG 88S.
K calculated via AGA NX 19 L and H.
K calculated via AGA 8 1985.
K calculated via AGA 8 92 DC.
K calculated via the Beattie-Bridgeman equation for pure gases (mass computer).
K calculated via the Van der Waals equation.
K calculated for GC 1 in accordance with AGA 8 92 DC and for GC 2 in accordance with GERG 88 S with automatic changeover in the case of a fault (GC1 / GC2).
K calculated via AGA 8 Gross meth. 1.
K calculated via AGA 8 Gross meth. 2.
K calculated via GERG 88S set B.
K calculated via GERG 88S set C.

If the gas quality source (gas chromatograph or calorimeter) supplies the relative density (rd) instead of the standard density (rhon), you can parameterize the device in the Standard density chapter with the Operating mode function so that it calculates the standard density from the relative density.

NOTE!
For custody transfer metering with two gas quality measuring devices, calculations in accordance with AGA 8 92 DC are only permissible if both devices measure and transmit the individual components (e.g. two process gas chromatographs; if a combination of a process gas chromatograph and a correlative gas quality measuring device is used, mode GC1/GC2 has to be chosen).

Equation GPA 2172-96 can be used for calculating the superior calorific value and the relative density at 60°F and under 14.696 psia (US reference values). The relevant displays can be found under DL ***GPA*** 2172-96. Parameterization can be made in the menu under superior calorific value or relative density.

3.2.10 Information about the ID display

You can access the device data by pressing the <±> ID key. They can only be displayed here. There is no option for inputting data if the ID display is shown. If you want to enter values, you have to enter them together with the parameters of the associated transmitter device in the appropriate chapter (or column of the coordinate system). For example, the ID display data of the pressure sensor have to be entered in the Pressure chapter, while those of the temperature sensor have to be entered in the Temperature chapter, etc.

3.2.11 Information about test functions

Under the < 6> Test key, all chapters and functions for checking the device are combined. There are the following functions:
On-the-fly calibration, Freeze, Computing cycle, Calibration Rhon/Hs, Functional test, Hardware test, Ultrasonic diagnosis, and Test cabinet (internal).

3.2.11.1 On-the-fly calibration

If you have selected the On-the-fly calibration function, you can start this function by pressing Enter. All totalizers are displayed in high resolution together with a stopwatch. If you press Enter again, the totalizers and the stopwatch will be stopped. If you press Enter once again, all values will be reset to zero and the procedure will be restarted.

3.2.11.2 Freeze

If manual freeze has been set in Freeze mode, a freeze procedure is started every time the Test key is pressed. All values marked F.. are stored synchronously when the Test key is pressed. The measured values stored will be retained until the next freeze procedure is initiated. The following freeze modes are possible:
OFF / Manual / Contact / Cyclic / Gas day / Every day / Every hour / Every second / Every minute / DSfG.
For the "Cyclic" operating mode, it is possible to set the interval.

3.2.11.3 Calibration standard density / superior calorific value

Formation of correction values for the standard density and superior calorific value measuring inputs. It is possible to define or assign functions to buttons and set the maximum monitoring time. The measuring gas / test gas button initiates the formation of the holding value and the button for forming the correction value initiates the calculation of the correction value. The procedure is monitored for maximum limits and maximum time.

3.2.11.4 Functional test

Similar to the DSfG revision, there are four points of time which define the start, the interval and the end of a data recording procedure. When the first point of time is reached, the volume corrector automatically starts data recording, forms the mean values, etc. until the next point of time is reached and stops recording when the last point of time is reached. A direct start can be activated manually via the keyboard. To do this, press the <6> Test key and then the Cursor Down key until you reach the Functional test chapter. Select this chapter and start the procedure by pressing Enter in the Status function.
The results are to be found in archives 11, 12 and 13 and they carry the DSfG designations. A better option for reading these results in plain text is to use the browser of your laptop.

Setting times:
Test time defines the duration of testing
Time forerun/tracking defines the waiting time between the start time and the test time and between the end of the test time and the stop time.
Delay defines the delayed start.
Schedule enables time targets to be defined in advance by mouse click before loading them into the ERZ 2000 by pressing the "Enter" button. The time of the PC connected is used as a basis for the time forerun/tracking and the test time. In order to ensure that the times set correspond to reality, you have to synchronize the times of the PC and the ERZ beforehand. It is not necessary to take account of the daylight saving time or summer time shift of one hour, since this is done automatically.

Using the FF 09 Partner address and FF 10 Partner entity coordinates in the case of meters being connected in series, you can transmit the times defined for the functional test to a second ERZ 2000 (the one connected in series) and thus achieve a synchronous test sequence. Transmission is performed using the DSfG bus.

3.2.11.5 Hardware test

Option for testing all inputs and outputs of the device.
If the function is set to Inactive, the momentary status of the display, the LEDs and the signal inputs and/or outputs is shown while browsing.
If the function is set to Active, the input or output displayed is affected while browsing. E.g. the alarm contacts are operated and the current outputs are set to fixed values: current output 1 to 10mA, 2 to 11 mA, 3 to 12mA, 4 to 13mA and the pulse outputs are operated: pulse output 1 with 1 pulse per sec., 2 with 2 pulses per sec., 3 with 3 pulses per sec., 4 with 4 pulses per sec.

3.2.12 Information about inputs and outputs

3.2.12.1 Current outputs

Press <4> I/O to reach the Current input 1 to 4 chapters. There all important values for parameterization and display are combined. By using the relevant features, all appropriate data, calculated values, etc., can be selected and thus mapped on the current output.

Outputs
Overview
➔Current output 1
Current output 2

The arrow is located on the third line and can be moved upwards or downwards using the cursor keys. In this example, pressing ***Enter*** will select the **Current output 1** chapter. A new window will open with the **Current output 1** heading. The contents of this chapter can be browsed using the cursor keys.

There are two parameters for assigning a measured value to an output quantity:

1st assignment	optimizes the pressure, temperature and all flow rate values for control purposes
2nd assignment	extended selection of all the other values which can be mapped as a current output

If a parameter is selected under Assignment, it will be shown under Physical value together with its correct unit. Its output value is seized by a correction factor calculated from the lower and upper calibration values which is mapped on its limit ranges (upper and lower mapping) and the operating mode set. If the physical value exceeds the defined value, a warning is generated. There is an option to output a constant current (test

current) for test purposes which is independent of a measured value. Enter the desired value in the Test current parameter and activate it under Operating mode.
The same is valid for current outputs 2, 3 and 4.

3.2.12.2 Pulse outputs

Press <4> I/O and browse downwards until you reach the Pulse output 1 to 4 chapters. There all important values for parameterization and display are combined. By using the relevant features, all appropriate data, calculated values, etc. can be selected and thus mapped on the pulse output.


```
Outputs
➔Pulse output 1
  Pulse output 2
  Pulse output 3
```

The arrow is located on the second line and can be moved upwards or downwards using the cursor keys. In this example, pressing ***Enter*** will select the **Pulse output 1** chapter. A new window will open with the **Pulse output 1** heading. The contents of this chapter can be browsed using the cursor keys.

The same is valid for pulse outputs 2, 3 and 4.

There are the following Selection options:

- Volume at measurement conditions
- Corrected volume at measurement conditions
- Volume at base conditions
- Energy flow rate
- Mass totalizer
- Vo totalizer
- Cycle pulses
- Test pulses (duration)
- Test pulses (groups)
- OFF

Test pulses:
There are two options for outputting test pulses:
1. A specified number of pulses per second is permanently outputted (duration).
2. A specified number of pulses is outputted once with the set output frequency and is then stopped (group).

3.2.12.3 Other outputs

Similar to this are the Contact outputs 1 to 8 and Frequency output 1 chapters.

3.2.12.4 Inputs

Press <4> I/O and the Cursor Right key to reach the Current inputs 1 to 8, Resistance inputs 1 & 2, Frequency inputs 1 to 8 and Contact inputs chapters. There all important values for parameterization and display are combined. By using the relevant features, all appropriate data, calculated values, etc., can be selected.

3.2.12.5 Extra analog values

From software version 1.3, functions can be assigned to unassigned inputs and the measured values can be written in archives (DSfG archive 10). For each input, the function can be selected similarly to the standard inputs for pressure or temperature. It is also possible to define limits and values. For each measured value, there is an input field where a name can be entered. The extra analog values can be found under the Miscellaneous heading in section O from coordinate OF. See chapter 3.4.1.

3.2.13 Revision switch

Function of the revision switch:
If the revision switch is switched on, the pulse outputs of the corrector are switched off. In addition, the revision bit is activated in the data records from the DSfG interface. You can activate the revision switch by selecting an operating mode under the <0> Mode key in the Access chapter. Before you activate the revision switch, you have to enable entries at least with the user code. If you select the Access chapter, Revision mode will be the first function to appear. Press Enter to switch to input mode (the display will turn darker) and then use the Cursor Up or Down key to change from operation to revision. Press Enter again to terminate your inputs.

There are two revision modes which result in different operating modes in conjunction with the functions in coordinates ED 13 "Total. in revision" (Running/At rest), ED 14 "Temp. at revision“ (Live value/Retained value) and ED 15 "Press. at revision" (Live value/Retained value).

You can change coordinates ED 13, 14 and 15 only after you have opened the official seal on the Superuser access level.

ED 01** = **Revision
ED 13** = **Running => To be used for tests with meters connected in series; totalizers are running and are marked in the archive; output pulses stop.
ED 14** = **Live value => Temperature measurements continue to be taken for correction
ED 15** = **Live value => Pressure measurements continue to be taken for correction
or
ED 14** = **Retained value => ***Temperature*** measurements are being retained for correction. The measured value for revision can be seen in coordinate AC 24 (base value).
ED 15** = **Retained value => Pressure measurements are being retained for correction. The measured value for revision can be seen in coordinate AB 24 (base value).

ED 01** = **Revision
ED 13** = **At rest => To be used for tests in the case of simulation; all totalizers stop.
ED 14** = **Live value => Temperature measurements continue to be taken for correction
ED 15** = **Live value => Pressure measurements continue to be taken for correction
or
ED 14** = **Retained value => Temperature measurements are being retained for correction. The measured value for revision can be seen in coordinate AC 24 (base value).
ED 15** = **Retained value => Pressure measurements are being retained for correction. The measured value for revision can be seen in coordinate AB 24 (base value).

ED 01 = ***Revision via contact***
ED 13 = ***Running*** **=>** Activated by external contact; to be used for tests with meters connected in series; totalizers are running and are marked in the archive; output pulses stop.
ED 14 = ***Live value*** **=>** Temperature measurements continue to be taken for correction
ED 15 = ***Live value*** **=>** Pressure measurements continue to be taken for correction
or
ED 14 = ***Retained value*** **=>** Temperature measurements are being retained for correction. The measured value for revision can be seen in coordinate AC 24 (base value).
ED 15 = ***Retained value*** **=>** Pressure measurements are being retained for correction. The measured value for revision can be seen in coordinate AB 24 (base value).

ED 01 = ***Revision via contact***
ED 13 = ***At rest*** => Activated by external contact, to be used for tests in the case of simulation; all totalizers stop.
ED 14 = ***Live value*** **=>** Temperature measurements continue to be taken for correction
ED 15 = ***Live value*** **=>** Pressure measurements continue to be taken for correction
or
ED 14 = ***Retained value*** => Temperature measurements are being retained for correction. The measured value for revision can be seen in coordinate AC 24 (base value).
ED 15 = ***Retained value*** **=>** Pressure measurements are being retained for correction. The measured value for revision can be seen in coordinate AB 24 (base value).

NOTE: Limit monitoring is deactivated but all hardware monitoring features, such as open-circuit monitoring, etc., will remain active and will impact on the base value. The retained value will not be affected hereby.

3.2.14 Error curve linearization for volume measurement

Error curve linearization:
The error curve linearization of the gas meter can optionally be performed using two different methods.

a) Error curve linearization with polynomial related to the flow rate
Correction is made using a quartic polynomial which reproduces the error curve of the gas meter as a function of the flow rate.

Error equation: E = A-2*QVm-2+A-1*QVm-1+A0+A1*QVm+A2*QVm2

E	= Deviation of the error curve [%]
QVm	= Volumetric flow rate at measurement conditions [m3/h]
An	= Constants
KV	= Constant meter factor

The polynomial coefficients An (n = -2 to n = 2) are calculated from the measured value pairs error Ei and flow rate Qvmi . Instead of the constant meter factor KV , the corrected meter factor KVc is used for further calculation or correction.

$$K_{Vc} = K_V * (1 + \frac{E}{100})$$

The polynomial coefficients An are supplied by the manufacturer of the turbine gas meter.

b) Error curve linearization with polynomial related to the Reynolds number
Correction is made using a quartic polynomial which reproduces the error curve of the gas meter as a function of the Reynolds number.

Error equation	ERe = A-2*Re-2+A-1*Re-1+A0+A1*Re+A2*Re2
Reynolds number equation:	Re = 0.353677 * (Qm / DN) * (ρ/η)
	where ρ = ρb * ((P * Tb)/(Pb * T)) * (1/K)

ERe	= Deviation of the error curve [%]
Re	= Reynolds number
An	= Constants
KV	= Constant meter factor

The polynomial coefficients An (n = -2 to n = 2) are calculated from the measured value pairs error Ei and flow rate Rei . Instead of the constant meter factor KV , the corrected meter factor KVc is used for further calculation or correction.
Further entries are: $\eta = V * 10^{-6}\ m^2/s$ (V = constant, for natural gas V = 12)

$$K_{Vc} = K_V * (1 + \frac{E}{100})$$

The polynomial coefficients An are supplied by the manufacturer of the turbine gas meter.

c) Error curve linearization using the interpolation point method
This method uses 16 parameterizable interpolation points. The selected loads are to be entered on the X-axis (flow rate). For each interpolation point, the deviation from the zero line is to be entered. A linear interpolation is to be made between the individual points.
Instead of the constant meter factor KV , the corrected meter factor KVc is used for further calculation or correction.

$$K_{Vc} = K_V * (1 + \frac{E}{100})$$

The interpolation points (load points) and the deviation from the zero line are to be taken from the error curve of the turbine gas meter.

Thus, the corrected volumetric flow rate at measurement conditions is calculated using the following formula:

$$Q_{Vmc} = \frac{f_V}{K_{Vc}} * 3600$$

QVmc = Corrected volumetric flow rate at measurement conditions [m3/h]
KVc = Corrected meter factor of the gas meter [P/m3]
fv = Frequency of the volume transducer of the gas meter [Hz]
KV = Uncorrected meter factor of the gas meter [P/m3]

Entries can be made in any order since the volume corrector sorts them automatically.

3.2.14.1 NAMUR sensor adjustment (optional with built-in NAMUR isolating device)

The integrated isolating device can be adjusted manually or in a predefined way to the HF probes in the trigger threshold and the switching hysteresis. This simple method by pressing a button replaces the relatively inconvenient adjustment by using a potentiometer.
There are three options for performing the adjustment:

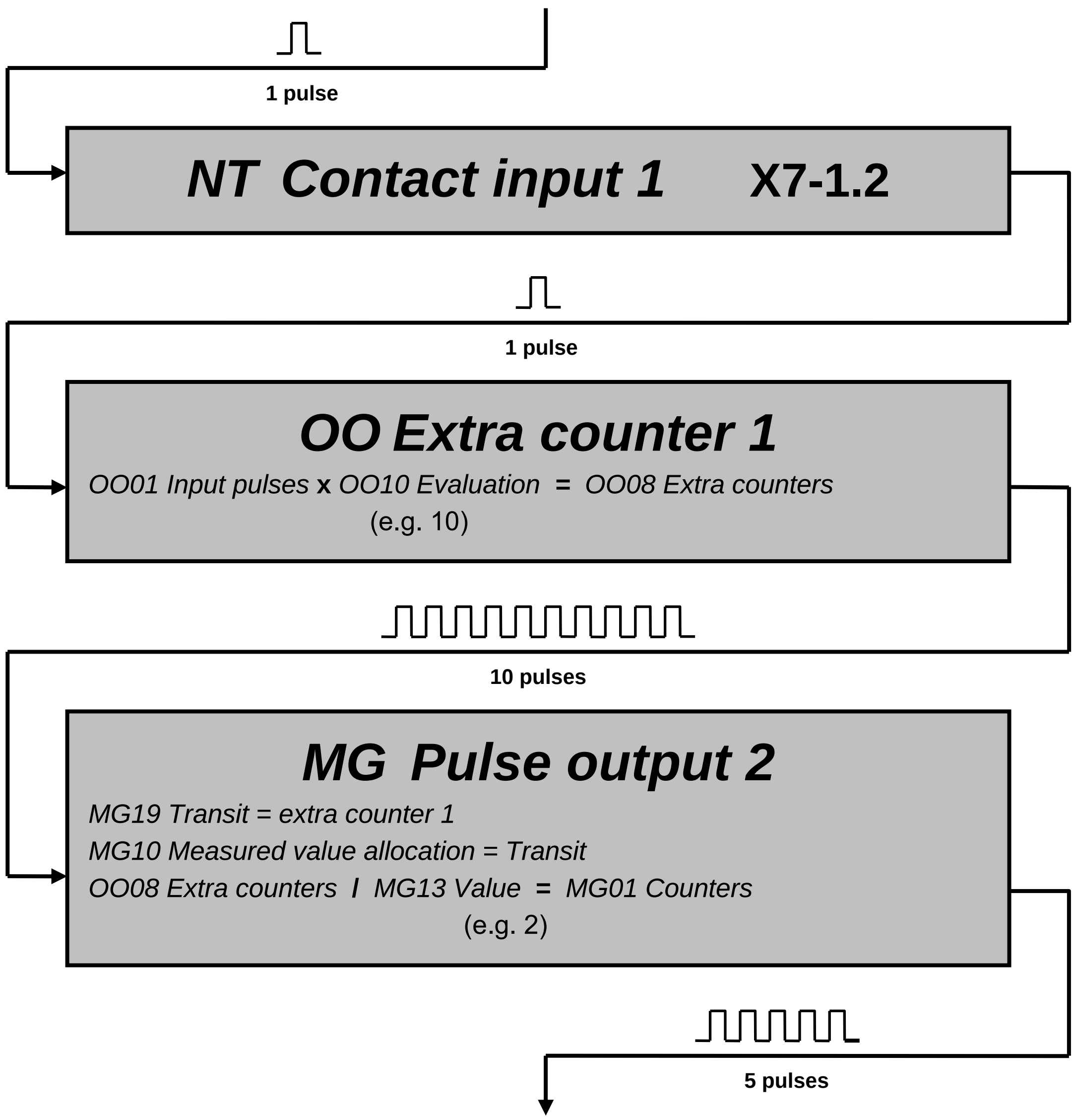
- **Standard NAMUR** (Standardized trigger threshold and hysteresis are loaded.)
- **RMG pick-off = factory settings** (Special trigger threshold and hysteresis are loaded.)
- **Manual adjustment** (Trigger value and hysteresis can be adjusted finely and roughly.)

This function can be accessed under Meter in chapter Namur sensor adjustment (coordinates GU, etc.) by simply pressing the <8> Flow rates key and the Cursor left key once.

3.3 Special instructions and operating procedures

3.3.1 Linking extra counters with pulse output

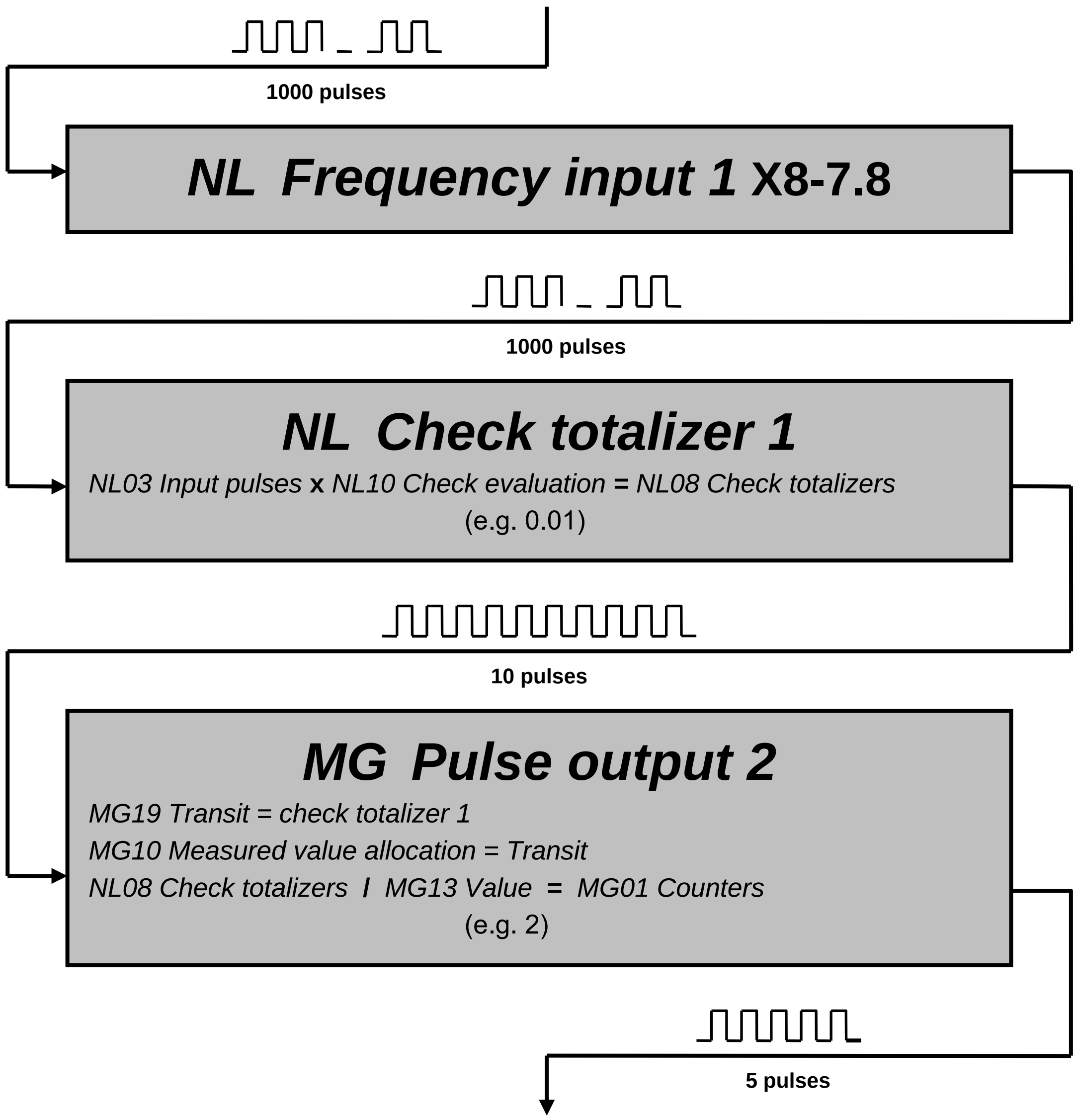
Example: Extra counter 1 with pulse output 2



There is no special operating mode for activating the extra counters.
They are supplied from the corresponding contact inputs and are active if an evaluation not equal to zero is parameterized and pulses arrive at the input.

3.3.2 Linking check totalizers with pulse output

Example: Check totalizer 1 (volume pulses) with pulse output 2



There is no special operating mode for activating the check totalizers.
They are supplied from the corresponding frequency inputs and are active if
a check evaluation not equal to zero is parameterized and pulses arrive at the input.

3.3.3 Implementing a "GERG 88S only computer"

If a ERZ 2000 must be parameterized in such a way that only the K coefficient calculation is to be used according to GERG 88S and the individual components are ignored, the components that are not required must be switched off (OFF mode). However, since the ERZ 2000 always calculates all equations including the AGA 8 92 DC, it requires at least one methane value to calculate a set of consistent data that the AGA 8 92 DC can then use. For this reason, the ERZ 2000 performs the following internal calculation automatically:
It adopts methane with 100% and calculates methane minus the defaults preset for the GERG or measured values.

Example:
An EMC 500 is connected that only delivers the fuel gas value, the standard density and CO_2. K coefficient mode is set to GERG 88S while the operating mode for the other components is set to OFF.
$100 - CO_2 = CH_4$
The ERZ 2000 uses the value for CH_4 and CO_2 to perform a normalization process and generate a data set of 21 components, which are then used for the AGA 8 92 DC.

3.3.4 Connecting an external modem

1. Modem type
   An industrial modem supplied by Phoenix, type PSI-DATA/FAX-Modem/RS232 is used as standard
2. Connection
   The ERZ2000 is connected to the external modem via a fully configured RS232 cable, i.e. all 9 pins are used 1:1. It does **not** function if a basic version of cable is used with only pins 2, 3 and 5 configured. The COM 5 interface is used.
3. Configuration
   The modem can retain the factory configuration (all DIL switches set to OFF). The Modem Init string and the dialing prefix on the ERZ 2000 must be set according to the local conditions.
4. Example of a setting
   In the function DSfG RDT

IE 06	Modem Init string	ate0s0=1
IE 07	Dialing prefix	atx3dt

Meaning:

at	Prefix for a command line
e0	Echo function deactivated
s0=1	Set register 0 to 1, i.e. number of ring tones before the modem answers and establishes a connection should be 1.
x3	Reply setting: Hayes Smartmodem 300 compatible answers/blind dialing (extension) plus all CONNECT answers plus detection of engaged tone
dt	Tone dialing method (dp = pulse dialing method)

If a different modem is used, different commands may be issued, in which case please consult the manual provided by the manufacturer.

3.3.5 Time synchronization via PTB time service

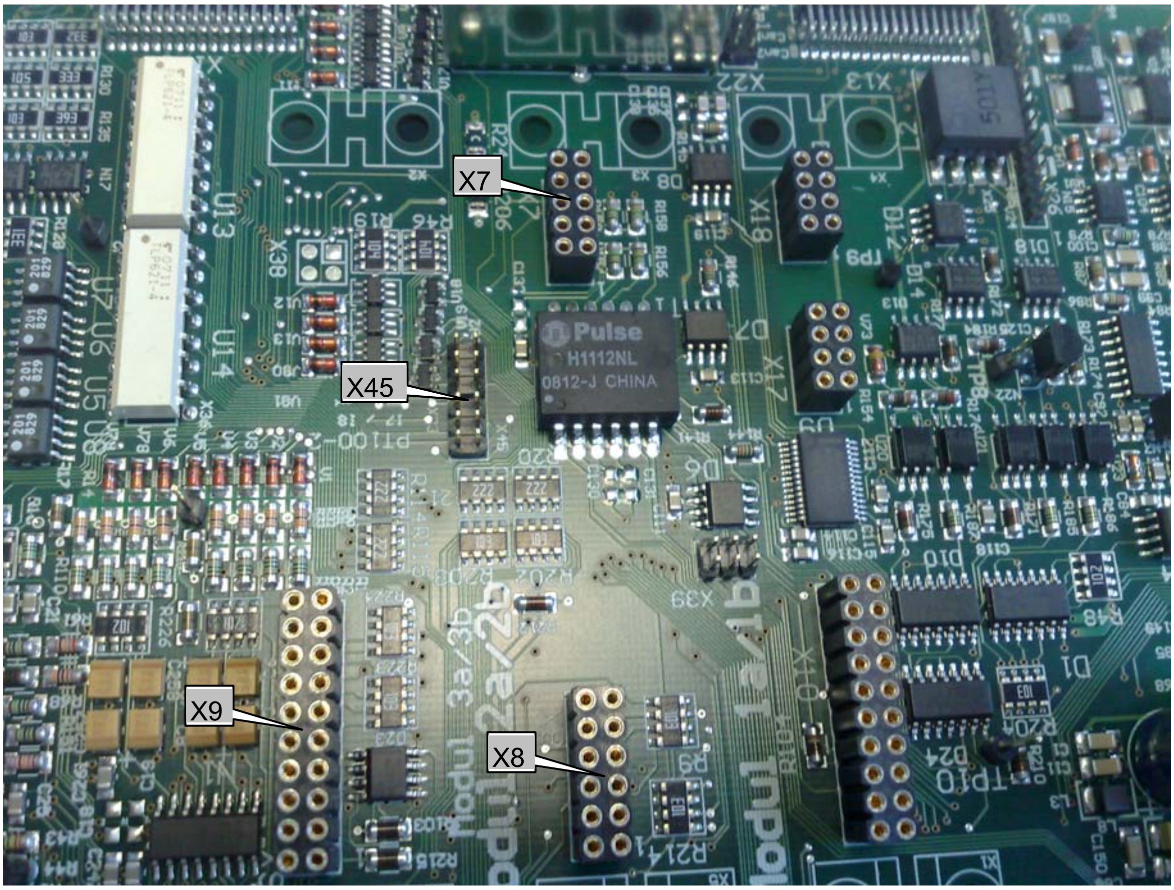
For times
KA 10 select "PTB service"

For DSfG RDT
IE 08 Enter the telephone number of the PTB, 00531512038
IE 09 PTB trigger
The remaining time in seconds until the ERZ2000 automatically calls the number specified above is displayed here.
IE 10 The time that the device waits if the number is engaged, for example, appears here. Another call attempt is made once this time has elapsed.

Example:
Manual triggering: Overwriting the displayed remaining time with the number 2 initiates a call after 2 seconds. If the call was successful and a plausible time was heard, the value in IE09 is set to 90000 seconds, i.e. the next attempted call takes place in 25 hours. If the line was engaged or the time was implausible, the value in IE10 (e.g. 300 seconds) is applied and the ERZ 2000 counts down to 0 before making another call attempt.

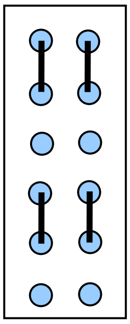
3.3.6 Second PT100

- Remove the housing cover.
- Configure the hardware using **socket strip X45** (inside the device at the back on the left between module slots 2 and 3).

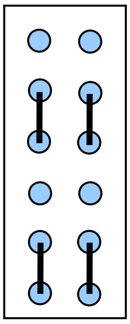


- Set the **solder bridges**.

PT100-1



PT100-1 **and -2**



- Connect PT100

PT100-1:	X5-7,8,9,10
PT100-2:	X6-7,8,9,10

- Parameterize **the measurement**

<u>EI Configuration</u>

S	1	No. resist.meas.ch.	2	rNumber

3.3.7 Deleting archives, logbooks, change memories, etc.

Under the heading ***Mode key <0>***, the section ***Erasing procedures*** is located. Here you have the option of selectively resetting saved values.
The following functions are available:

• Clear log	deletes the contents of the DSfG logbook.
• Clear changes	deletes the contents of the memory that documents all parameter changes.
• Clear archives	deletes the contents of the DSfG archives for the corrector and register entity.
• Clear maximum value archive	deletes the contents of the DSfG archives for the maximum values.
• Drag indic. reset	deletes the maximum and minimum values for all drag indicators and sets them to the current values.

Erasing is only possible in the **Superuser** access level.

3.4 Function inputs

3.4.1 Distribution of unassigned inputs and outputs (archive group 10)

From software version 1.3, functions can be assigned to unassigned inputs and events, statuses, additional totalizers, etc. can be recorded and stored in DSfG archives (DSfG archive 10).
Under the Miscellaneous heading (coordinates OA to OT), you can find chapters Extra analog values 1 to 8, Extra messages and Extra counters 1 to 6.

Measured values (extra analog values):
You can assign operating modes and sources via the menu to the extra analog values; this is also possible in the case of the inputs for pressure, temperature, etc. The user can enter a name for the measured value in a blank input field in line 53 (provided that the user code has been entered).

Binary inputs (extra messages):
Messages can be assigned to the eight contact inputs. A message can be either a hint, a warning or an alarm and provided with a user-definable text. The messages will be entered in the DSfG logbook.

Counting inputs (extra counters):
The extra counters have places before and after the decimal point just like the main totalizers for custody transfer metering. It is possible to assign a value and a unit to an extra counter.

Assignment to the archive:
In archive 10, four check totalizers, eight extra analog values and six extra counters can be stored.
The four extra counters are assigned to the frequency inputs 1 to 4 as additional totalizers. Independently from correction, a check totalizer can be activated here. This totalizer is permanently connected to the input concerned and does not differentiate between main or disturbance quantities. Neither error curve linearization nor suppression of creeping quantites are performed. A unit and a value can be added independently of correction. The fraction part (places after the decimal point) is stored by a fraction totalizer. The check totalizer will be activated if the Valuation parameter is set to a number greater than 0.
The eight extra analog values are assigned to the analog inputs.
It is possible to assign either six extra counters or eight binary inputs to the eight contact inputs. The extra counters have been designed for slow counting jobs and their maximum counting frequency is limited to 5 Hz.
It is possible to assign user-definable texts and a meaning to the eight binary inputs (hint, warning or alarm).
The relevant entries will be made in the logbook.

For the call-up software, archive group 10 can be shown or hidden under ID DSfG entity, recording in line 4 by toggling between Yes and No.

AG 10 visible Yes

3.4.2 Triggering a freeze procedure

A switch is connected to an unassigned pulse input. Then the freeze function is assigned to this input. To activate a freeze procedure, the switch must be closed.

From version 1.6 onwards, there is another alternative to activate a freeze procedure directly during accessing the freeze function via the browser by clicking the mouse button.

3.4.3 Changing the direction / billing mode

A maximum of four directions / billing modes per switch / contact can be selected. The switches / contacts are assigned to the terminals by means of the software. The following options are available for selection:
1 contact switches 2 directions
2 contacts switch 2 directions
2 contacts switch 4 directions
4 contacts switch 4 directions
plus other options for switching the mode via the measured value or forward/reverse information from a transmitter (e.g. ultrasonic flowmeter) or for selecting a fixed assignment.

If an illogical case occurs, the device switches automatically to the totalizers for the undefined direction.
All settings have to be made under EC Billing mode.

S 21 BM at revision	unchanged
B 22 BM0 suppression	No

In EC 21 BM at revision you can preset if the ERZ 2000 automatically changes the billing mode in the case of a revision (access is only possible on the Superuser level). Under the operating code, you can define in EC 22 whether, in the case of an unplausible contact assignment (see above), a changeover has to be made to the special set of totalizers for an undefined direction.

3.5 Programmable archive (archive group 9)

From software version 1.6 onwards, it is possible to customize a special archive. The contents and recording cycle can be chosen by the user. For storing data, the complete range of all useful measured values and results are available via a selection menu which is comparable to that of the current outputs.
The following time bases are selectable for the recording cycle:

Every minute
Every 3rd minute
Every 6th minute
Every 12th minute
Every 15th minute
Every hour
Every day
Gas day
Every month
Gas month
Freeze (Note the parameter set in the freeze cycle!)

The archive depth is 4,096 entries.
You can parameterize the contents of this archive under OU User-programmable archive. In coordinate OU 1 Record cycle you can set the desired time base (see above) in a menu. In coordinates OU 10 to OU 21 you can assign the 21 archive channels. To access these coordinates, it is sufficient to enter your user code.

3.6 Determining the correction factors for calibrating the current inputs

The current inputs for measuring the pressure, temperature, etc., are processed by an A/D converter with an upstream measuring-point selector. The adjustment on the mA side is performed in the factory. Any subsequent corrections are made by directly offsetting the input quantities of pressure, temperature, etc.

<u>Example:</u>
You want to determine the correction factor for the input of the pressure at measurement conditions which is to be measured in a range from 20 to 70 bar.

1st step	Parameterize the lower alarm limit at 20 bar (assigned to the metrological zero 0 or 4 mA).
2nd step	Parameterize the upper alarm limit at 70 bar (assigned to the metrological upper range value of 20 mA).
3rd step	Parameterize the offset correction at 0.
4th step	Apply the pressure signal or check the current input with a calibrated measuring instrument and read the measured quantity (display of the measured pressure input in bar).
5th step	Form the difference between the actually supplied measuring signal and the measured quantity displayed.
6th step	Enter this difference as offset in the offset correction parameter.
7th step	Check the display for pressure as measured quantity.

The same procedure applies to all analog inputs.

3.7 Interfaces

3.7.1 Front panel Com-F

Com-F interface: RS 232 reserved for program updates (flash) only. In normal operating mode, the interface is switched off and has no function whatsoever. Only if "Program update" mode is selected will the computer terminate the correction program and activate the interface.

3.7.2 Rear panel COM 1 to COM 5

COM 1 interface: Switchable from RS 232 to RS 422 or RS 485, different protocols can be used optionally; the MODBUS protocol and IGM (for connection to an ultrasonic flowmeter) are available. Optionally, MODBUS ASCII / RTU can be offered as standard Modbus drivers for RS 232 or RS 485 interfaces.

OFF
Test
Modbus RTU
Modbus ASCII
IGM
USE09
RMG bus master
DZU
Flowsick

If an ultrasonic FlowSick meter is connected, the COM 1 mode has to be set at Flowsick and the Modbus device address is to be set under IB 25.

E § 25 Address FLOWSIC 1

COM 2 interface: RS 232 is not switchable; the DZU protocol is used (connection to US 9000 = main totalizer for the ultrasonic flowmeter).

OFF
Test
DZU
Modbus RTU
Modbus ASCII
GPS 170
RMG View

COM 3 interface: Switchable from RS 232 with handshake to RS 485 conforming to the DSfG interface. A second Modbus protocol or the DSfG master can be assigned. The DSfG interface implemented in the ERZ 2000 complies with the current version of the DSfG technical specification for volume correctors. Within the scope of this documentation, we assume that the DSfG interface is known. Further documentation can be obtained from the DVGW. Second Modbus interface, parameters as with COM 1.

OFF
Test
DSfG master
Modbus RTU
Modbus ASCII
RMG bus master

COM 4 interface: Switchable from RS 232 without handshake to RS 485 conforming to the DSfG interface. The DSfG function for corrector and recording entities or the RMG bus function can be assigned. The DSfG interface implemented in the ERZ 2000 complies with the current version of the DSfG technical specification for volume correctors. Within the scope of this documentation, we assume that the DSfG interface is known. Further documentation can be obtained from the DVGW.
There is a separate description for the RMG bus. It is used in conjunction with RMG process gas chromatographs (GC 9000) instead of the DSfG interface.

OFF
Test
DSfG
RMG bus
RMG bus master

COM 5 interface: RS 232 with handshake plus carrier plus ring. Usable for MODEM (RDT). If a modem with TSC is connected, "Dedicated line" has to be selected in coordinate IB 21.

3.7.3 Rear panel CAN bus

A CAN bus connection is optionally available which can be used for customer-specific or plant-specific extensions. No function is stored at the moment.

3.7.4 Rear panel Ethernet

Network connection for various applications. Linking of devices, integration into customer networks (Intranet) or, as important issues, the remote operation and visualization of the ERZ 2000 with a laptop.
Here a separate description is available (see the operating instructions for the ERZ 2000_Remote_Operation).

MODBUS RTU on TCP/IP with the same parameters of COM 1 or COM 3 Modbus setting.

3.8 Remote control / parameterization

3.8.1 Connecting a notebook

Apart from operating the device via the front panel, there is another very convenient option for operating or parameterizing it either locally or remotely with a PC or notebook. Independently of a separate operating software, operation can be made using the PC's browser (e.g. Internet Explorer or Netscape). The ERZ 2000 operates as the server, while the PC operates as a client. For local connection without a hub, a crossover network cable is required. The ERZ 2000 can also be included in an existing network. For more information, see separate description.

3.8.2 Setting the addresses

To ensure that the network connection functions properly, you have to make the necessary settings in the TCP/IP Network chapter which you can find under the Communications heading.
Press <0> Mode and then four times the Cursor Right key.

For more information, see separate description.

3.9 Time system

3.9.1 Quartz clock

The time system consists of a battery-backed quartz-controlled real time clock (RTC) module which provides the time basis for the ERZ 2000.
The clock module can be synchronized by a higher-level timing element (external synchronization input). The internal time basis can be changed via the keyboard or the DSfG interface but only within the scope of the relevant access rights. If there is a telephone connection via MODEM available, the ERZ 2000 can use PTB's time service and synchronize its clock (and that of all users of the bus) with its integrated remote data transmission feature.
In PTB criterion operating mode conforming to PTB, the clock can be synchronized only once a day if the calibration lock is closed. The synchronization window is +/-20 seconds. If there are greater deviations, the clock will no longer be put back or forward! This applies to synchronization via the synchronization input and the synchronization telegrams (DSfG bus).
In coordinate KC3 Time sync. rule, there are the following three operating modes:

PTB criterion	The synchronization window is +/-20 seconds.
PTB crit. light	As above +/-20 seconds plus recovery of a missed changeover to summer time.
Always	Every time sync telegram will be evaluated and accepted.

Other operating modes are possible. See the relevant function, press <0> Mode and then six times the Cursor Right key to browse to the Times chapter.
In KA Times, there are the general displays and parameters.
In KB Time contact signal to external devices, there are all displays and parameters which are important for the time signal to external devices; i.e. if the ERZ 2000 itself is the source for the time signal.

In KC External time signal, there are all displays and parameters which are important for receiving the time signal.

The clock operates on the UTC (coordinated universal time) basis and the volume corrector converts the time into local time. For this reason, the correct time zone has to be set on the device. The selection menu comprises all time zones of the world. The time is changed automatically from normal time to daylight saving time and vice versa in accordance with the currently applicable official rules of the time zone set. If "Europe / Berlin" has been set for Germany, time is changed from CET to CEST on the last Sunday of March at 2 o'clock and thus the clock is put forward one hour. The time is changed from CEST to CET on the last Sunday of October at 3 o'clock and thus the clock is put back one hour.

3.9.2 Setting the time and date

The time and date are to be set in the Times chapter.
Press <0> Mode and then the Cursor Right key until the arrow points to the KA Times chapter. Then press Enter to access the Times chapter and make your settings directly at the Date and time function. If you want to change the settings manually, you will have to open the user lock in any case.
You can enter the date and time directly via the numerical keyboard. After you have pressed Enter, the time and/or date will be accepted. Non-permissible inputs will be disregarded.

3.9.3 Time synchronizations

Apart from the synchronization within a DSfG bus system which is common practice in Germany, it is possible to synchronize one or more ERZ 2000s to local time. If there is a time server in the network which supports the RFC 868 protocol, then you can use it. You can find the relevant settings for port 37 (server for time protocol as per RFC868) and the IP address and connection type for the time protocol server (UDP or TCP) under IA TCP/IP network in lines 22 and 23.

Another option is to connect GPS receiver modules of any manufacturer to the COM 5 (modem) interface. The ERZ 2000 knows the following protocols:
NMEA 0183, Meinberg Standard, SAT Standard, Uni Erlangen, ABB SPA, Computime and RACAL.

Another option is the synchronization to reference time which can be parameterized with the coordinates KC 51 Reference hour, KC 52 Reference minute and KC 53 Reference second. This procedure is triggered through a contact input which can be selected via KC 21 Source time contact.

3.9.4 Determining the ON time for the display

To allow the display to be read under optimum conditions, it has been permanently set to maximum brightness. In input mode, the line to be edited will turn darker to indicate that input mode is active. To increase the service life of the display, the ERZ 2000 switches its display dark as soon as a settable period of time has elapsed after the last key was pressed.
You can find the function where you can set this time under the <0> Mode key, Display chapter, Screen saver function.

3.10 ET 2000 integrated data logger for maximum values

The ERZ 2000 automatically forms maximum values from the measured values and writes them into its archive. The maximum-value display function is based on observing quantity units per hour and comparing them to a quantity from a previous time segment of the same observation period e.g. a day. If the new value is higher than the comparative value, the new value is entered into the archive. All the other data are derived from the maximum hourly values per day and are also written into the archive.

The maximum-value display has been integrated into the volume corrector and can be accessed any time by pressing the <5> Archive function key. To quit the maximum-value display, press any other function key.

If there is a type plate of the integrated data logger fixed to the front panel of the volume corrector, the data logger has been officially verified. If there is no type plate, this function is available but has not been officially verified.

The maximum values can be viewed by manually operating the ERZ 2000 in accordance with the following example:

Press <5> Archive and the Cursor Left key once to access the following view:

Maximum values
➔ Max. hourly value per day
Max. hourly value per month
Max. hourly value per year

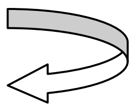
The arrow is located on the second line and can be moved upwards or downwards using the cursor keys. In this example, pressing ***Enter*** will select the archive with the maximum hourly values of a day. A new window will open with the **Maximum hourly value per day** heading and the first value shown will be the maximum value of the current day.

To access the current day, press Enter.

Max. hourly value per day
Uncorr. vol. (M)
3000 m3
02-07-2005 10h S

You can scroll to the right or left ...
(Vm <-> Vb <-> E <-> Vo <-> Vmc)

... and back to Vm.



If you press the Cursor Up key once, you will reach the oldest entry in the archive.
If you press the Cursor Up key once again, you will reach the second oldest entry in the archive.
etc.
If you continue to press the Cursor Up key you will reach the most recent entry, depending on the depth of the archive.
If you continue to press the Cursor Up key, you will return to the current entry.
If you press the Cursor Down key, the procedure will be the same in the other direction.

The depths of the individual archives are as follows:

Maximum hourly values per day	180 entries
Maximum hourly values per month	24 entries
Maximum hourly values per year	2 entries
Maximum daily values per month	24 entries
Maximum daily values per year	2 entries

3.10.1 Example for testing

Input frequency f = 230 Hz

Action: Reading out the archive on November 10, 2004, at 10:01 o'clock.

Date	Time	Vm	Time	Vb
08-11-04	14:00	498	14:00	2185
09-11-04	12:00	498	12:00	2185
10-11-04	09:00	498	09:00	2185

Three maximum values were stored: on Nov. 8, 2004, at 14:00 o'clock, on Nov. 9, 2004, at 12:00 o'clock and on Nov. 10, 2004, at 9:00 o'clock.

At 10:02 o'clock, raise the input frequency f from 230 Hz to 253 Hz.

Action: Reading out the archive on November 10, 2004, at 11:01 o'clock.

Date	Time	Vm	Time	Vb
08-11-04	14:00	498	14:00	2185
09-11-04	12:00	498	12:00	2185
10-11-04	11:00	548	11:00	5206

The hourly value of 9:00 o'clock was overwritten with the higher value of 11:00 o'clock.

At 11:02 o'clock, reduce the input frequency f from 253 Hz to 200 Hz.

Action: Reading out the archive on November 20, 2004, at 12:01 o'clock.

Date	Time	Vm	Time	Vb
08-11-04	14:00	498	14:00	2185
09-11-04	12:00	498	12:00	2185
10-11-04	11:00	548	11:00	5206

The hourly value of 11:00 o'clock has remained unchanged.

3.10.2 Option for checking the maximum-value storage function

To check the maximum-value storage function, see the Maximum values chapter (= Press <5> Archive and then the Cursor Left key once to reach the maximum values per day, month or year). Here you can find also an option for checking the operation of the maximum-value storage function at shorter intervals. For this purpose, use the maximum minute values within one hour displayed for the volumes at measurement and base conditions, energy and mass. No special test mode is used but the original procedure of valuation and storage of maximum values at one-minute intervals with the actual input values and quantities is shown. You can find this in the Checking maximum values chapter.

During the check you can see:

- the maximum value which is being stored at the moment
- the time stamp associated with this maximum value.

If you increase the flow rate, the maximum-value display will start to run as soon as the quantity is higher than the previously stored value. Also the time display (time stamp) will start to run. At the end of the minute, the value will be stored and will remain stable until a new higher value is detected. If you reduce the flow rate again, the value stored will remain unchanged. To view the storage procedure repeatedly, you can reset the memory contents manually. At the end of an hour, an automatic reset will be made.

3.11 Environment

DF Impact on the environment in the case of complete combustion
The water and CO2 produced during combustion as well as the emission factor are displayed.

DJ Exhaust summary
The contents of the constituents being combusted and their sum in the exhaust fumes are displayed.

DK Composition of exhaust fumes
Presentation of emission values.

All the four billing modes have been expanded (4 sets of totalizers) in connection with the calculation of emission values. There are CO2 totalizers in each of the four billing modes (directions). In the case of the parameters of the pulse outputs, it is also possible to select a CO2 totalizer as source for pulse outputs.

4 GC 6000

4.1 Overview

The ERZ 2000 can be fitted with an expansion module for connecting a gas analyzer. The module and the analyzer are spatially divided from each other but form a whole. Thus, the ERZ 2000 obtains a new functionality which is called GC 6000. The module is configured to slot 3A and occupies the connectors X9 and X10 on the rear panel. It converts the foundation fieldbus signals to the ERZ's internal modular bus and outputs the control signals for the sampling, calibration gas and reference gas valves.

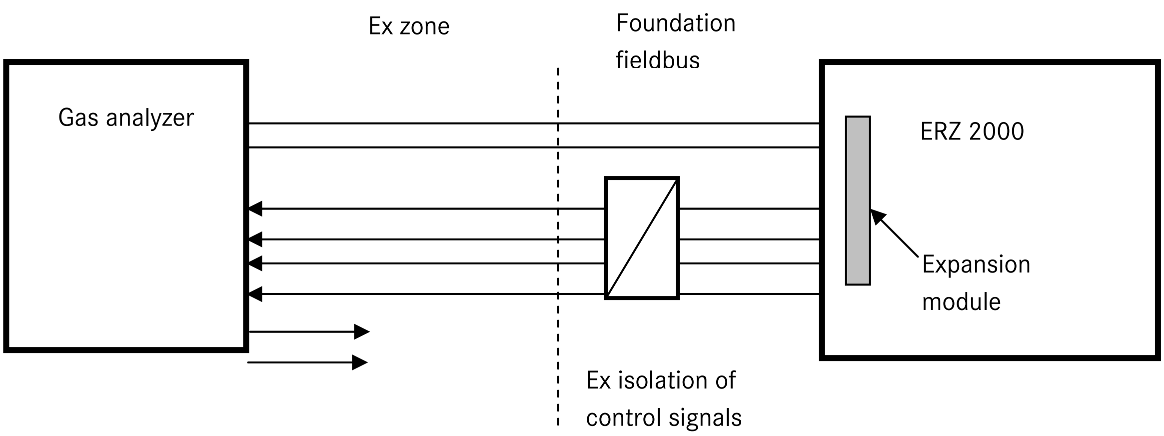
In this constellation, it is not possible to use an internal explosion protection card.

With the ERZ 2000, the gas quality data of the GC 6000 appear in column IH Gas quality imported via GC 6000 or RMG bus and can be routed from here to the desired measured-value inputs, e.g. superior calorific value or standard density.

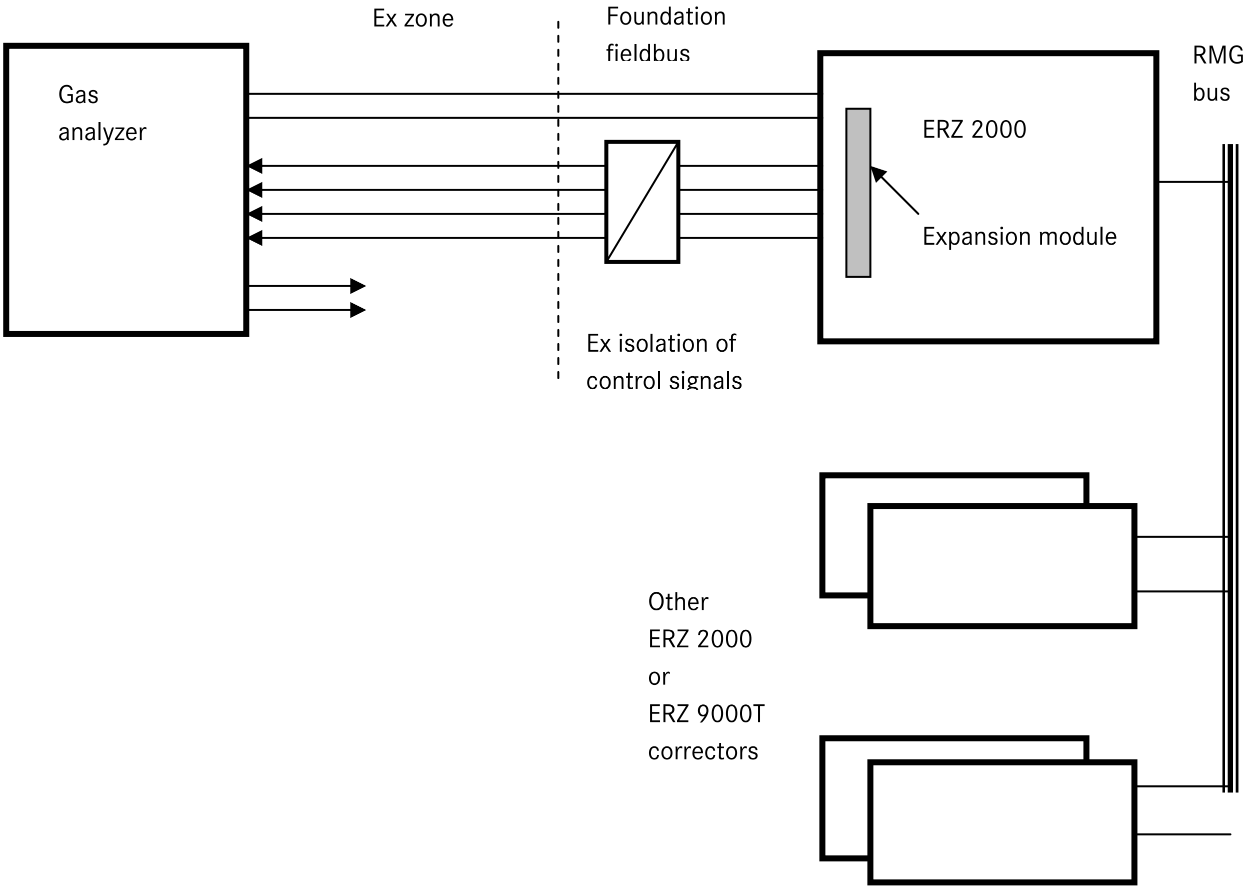
In addition, the gas quality data can be distributed via the RMG bus to other correctors, e.g. also to older ERZ 9000 T. For this purpose, set the interface mode RMG bus master at COM1, COM3 or COM4.

Inside the device, the gas quality data are archived in archive QH AG8 GC6000 GQ and in the Long-term archive GC6000.

ketch of a unidirectional measurement installation



Sketch of a multidirectional measurement installation



4.2 Coordinates

IH Gas quality imported via GC6000 or RMG bus

Access	Line	Designation	Value	Unit
D	1	protocol select	RMG bus	
A §	2	Interpretation	**default value**	
A §	3	Sup. calor. value	**12,092**	kWh/m3
A §	4	Standard density	**0,8326**	kg/m3
A §	5	Relative density	**0,6500**	
A §	6	Methane	**85,900**	mole%
A §	7	Ethane	**8,500**	mole%
A §	8	Propane	**2,300**	mole%
A §	9	I-Butane	**0,000**	mole%
A §	10	N-Butane	**0,000**	mole%
A §	11	I-Pentane	**0,000**	mole%
A §	12	N-Pentane	**0,000**	mole%
A §	13	Neo-Pentane	**0,000**	mole%
A §	14	Hexane+	**0,000**	mole%
A §	15	Carbon dioxide	**1,500**	mole%
A §	16	Nitrogen	**1,000**	mole%
A §	17	Current status	**Okay**	
A §	18	Time stamp	**DD-MM-YYYY hh:mm:ss**	
A §	19	Counter of analyses	0	
G §	20	Hs unit GC	**kWh/m3**	
G §	21	Rn unit GC	**kg/m3**	
G §	22	Amount of subst.GC	**mole%**	
E §	23	Stream selection	Without indication	
E §	24	Initial. RMGB GC	Start w/o fault	
B	25	RMG bus monitoring	60	s
I	26	Current stream	0	
I	27	Current state	Invalid	
I	28	Current status	Okay	
D	29	Interpretation	undefined	
I	30	GC tg: Hs	0,000	kWh/m3
I	31	GC tg: Rn	0,0000	kg/m3
I	32	GC tg: rd	0,0000	
I	33	GC tg: C1	0,000	mole%

The *GC 6000* mode will be active if an expansion module has been fitted and configured. Otherwise ***RMG bus*** will be assumed and displayed.

Interpretation options:
- default value (of the corrector)
- live value (of the GC)
- retained value (of the GC)

Fields *IH 03* to *IH 16* show the usable gas quality data. To use them for correction, select the ***RMG bus*** mode for the relevant measured-value inputs.

Assigning the corrector to a stream (**1 to 4**). Setting **Without indication** means that no stream is assigned. In GC6000 mode, only stream 1 can be used at the moment.

After MAINS ON with setting Start with fault, an alarm will be generated in the calibration phase. It will disappear as soon as there are valid gas quality data available.

Options for original values:
- analyzing run
- calibration gas
- control gas
- flushing
- retained value
- start-up value
- undefined
- RMG bus telegr.

I	34	GC tg: C2	0,000	mole%
I	35	GC tg: C3	0,000	mole%
I	36	GC tg: I-C4	0,000	mole%
I	37	GC tg: N-C4	0,000	mole%
I	38	GC tg: I-C5	0,000	mole%
I	39	GC tg: N-C5	0,000	mole%
I	40	GC tg: Neo-C5	0,000	mole%
I	41	GC tg: C6+	0,000	mole%
I	42	GC tg: CO2	0,000	mole%
I	43	GC tg: N2	0,000	mole%
D	44	Time stamp	0	s
D	45	Counter of telegr.	0	

Fields IH 30 to IH 43 show the gas quality data originating directly from the PGC. They relate to the stream selection and, if appropriate, are taken over into fields IH 03 to IH 16. Furthermore, original data can be forwarded to other correctors via a COM interface using the ***RMG bus master*** mode.

IL GC6000

Access	Line	Designation	Value	Unit	Variable
D	1	GC6000 state	waiting		btr6000
D	2	act. GC6000-msg.	no error		gc6Err
D	3	GC6000 cycle	0,0	%	gcpro
D	4	GC6000 Timeout	0	min	gc6To
D	5	open valves			gcValve
P	6	GC6000 maintenance	Normal run		gas6000
B	7	max. mainten.time	480	min	gas6CntMx
D	8	cur. maintenance	0	min	gas6C
B	9	max. flushing	3		mxspuel
D	10	flushing	0		spuelen
D	11	Man./auto calibr.	At rest		handkal
B	12	Calibration cycle	OFF		interkal
B	13	Calib. time base	01-01-1970 0		kalda
D	14	Next calibration	DD-MM-YYYY hh:mm:ss		kalnext
B	15	Calibr. duration	30	min	kalHtc
B	16	Ana. to Startupcal	3		rstKalCntS
D	17	Counter	0		rstKalCnt
D	18	Start up calibr.	pending		rstKal
E §	19	long term archive	Yes		lzd6000
S	20	FF-termination	ON		ffterm
I	35	total raw	0,000	mole%	gcTotRaw
I	36	Oven temperature	0,00	°C	gcOvenT
I	37	Carrier gas press	0,00	kPa	gcGasP
I	38	interface state	Restart		ymesstyp
I	39	GC6000 error map	00000000	hex	ystatus
I	40	GC6000 valve state	0000	hex	yventile
D	41	cumul. GC6000-msg.	no error		gc6Cum
D	46	DSfG status	Stop		gc6Estt

Communication with the analyzer must start within 5 minutes.

Counter for flushing procedures

From this value, the analyzer calculates the number of calibration runs and the number of flushing procedures to be carried out beforehand.

Max. number of analyses for delaying calibration after a restart.

Counter for analyses until calibration after a restart.

Status of calibration after a restart.

Yes will activate the recording of gas quality data in the long-term archive. The archive is located on the internal memory card. The status of the memory card can be checked via ***FJ File system***.

Status of the values in the DSfG archive ***QH AG8 GC6000 GQ.***

IM GC6000 response factors

Access	Line	Designation	Value	Unit
I	1	methane	0,00	
I	2	ethane	0,00	
I	3	propane	0,00	
I	4	i-butane	0,00	
I	5	n-butane	0,00	
I	6	i-pentane	0,00	
I	7	n-pentane	0,00	
I	8	neo-pentane	0,00	
I	9	hexane+	0,00	
I	10	carbondioxide	0,00	
I	11	nitrogen	0,00	
D	12	Quality	Doubtful	

Fields *IM 01* to *IM 11:*
The quality of calibration can be assessed by means of the response factors.

IN GC6000 cylinder rack and control panel

Access	Line	Designation	Value	Unit
B	1	Src.cyl.C1 temp.	OFF	
B	2	Src.cyl.C2 temp.	OFF	
B	3	Src.cyl.C1 press.	OFF	
B	4	Src.cyl.C2 press.	OFF	
B	5	Src.cyl.car. press.	OFF	
B	6	Src. GC amb. temp.	OFF	
B	7	Src. GC-cal.ctc.	OFF	
D	8	cyl.C1 temp.	OFF	
D	9	cyl.C2 temp.	OFF	
D	10	cyl.C1 press.	OFF	
D	11	cyl.C2 press.	OFF	
D	12	cyl.car. press.	OFF	
D	13	GC ambient temp.	OFF	
D	14	Extern.cal.start	OFF	
D	15	Analysis-LED	OFF	
D	16	Ref.gas-LED	OFF	
D	17	Calibr.-LED	OFF	
D	18	Error-LED	OFF	

Input fields *IN 01* to *IN 06*:
Assigning an input contact for monitoring the minimum limits for pressure and temperature of the calibration gas cylinders and the room temperature of the GC.

Defining an input contact as calibration contact.

Fields *IN 08* to *IN 14:*
Displaying the function linked to an input contact.

The external control panel has four LEDs visualizing the operation of the GC 6000. Fields *IN 15* to *IN 18* show the statuses of these LEDs.

FJ File system

Access	Line	Designation	Value	Unit
D	1	percent free memo	89,510	%
B	2	min. capacity warn	5,000	%
D	3	total memory	129,7	MByte
D	4	available memory	116,1	MByte

The long-term archive is located on the internal memory card. The status of the memory card can be checked by means of the ***FJ*** fields.

Generally, the following applies to the coordinate fields above:
Fields without specific comments are normally described in detail in the online documentation of the device. The specific information can be viewed via the network interface using the browser by clicking on the name of the variable concerned.

The CA Overview column for analyses will change its appearance as soon as the GC 6000 has been configured.

Archive *QH AG8 GC6000 GQ*

Archive group 8 is a DSfG archive which can be read remotely from a DSfG central station. It contains data of gas analyses imported via GC 6000 or RMG bus and several characteristic PGC values as well as time stamps and running numbers. This archive is located under Q Archives in coordinate QH. The fastest way to access it on the device is by pressing the Archive key.

Long-term archive GC6000

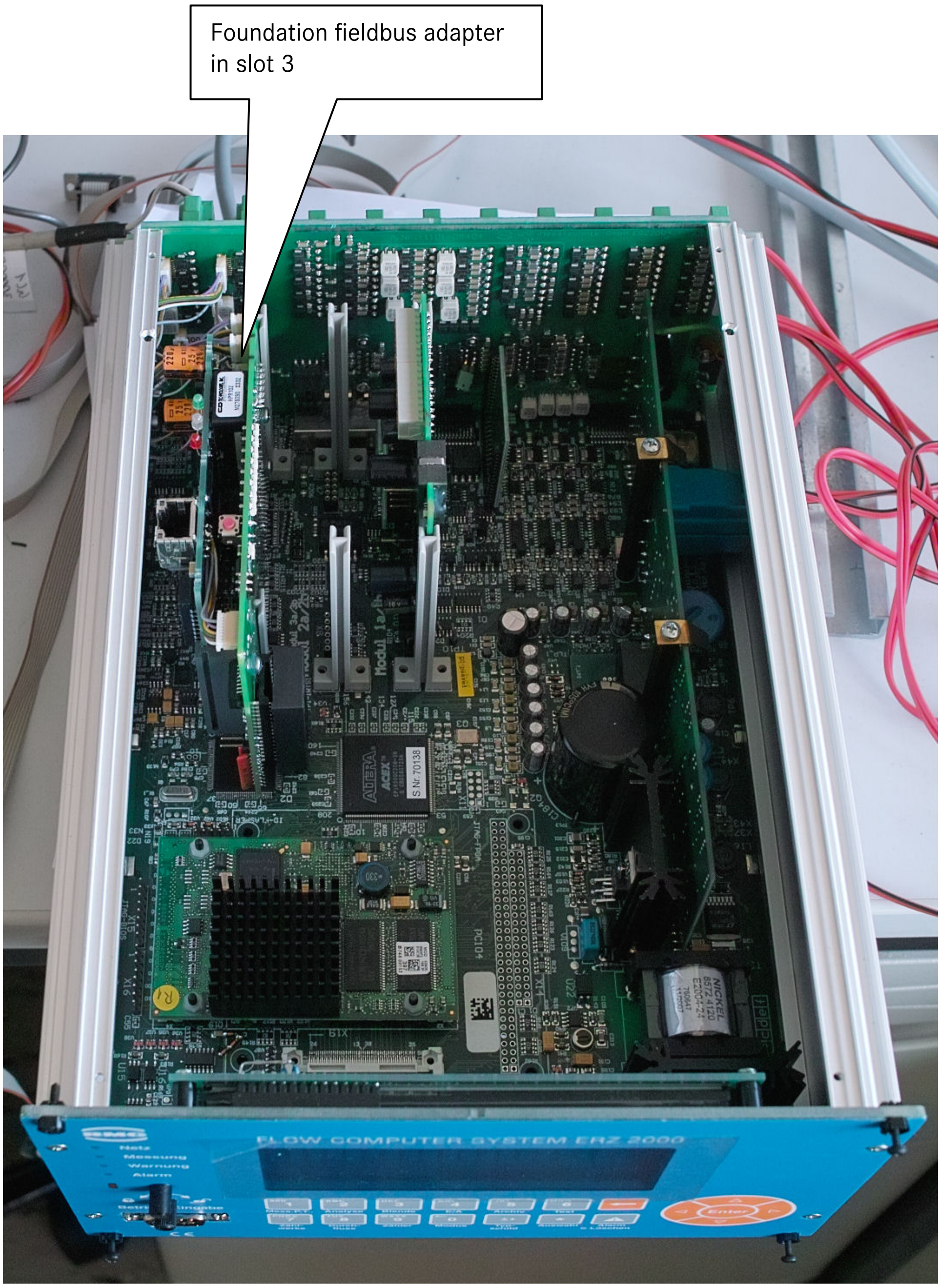
The long-term archive is located on the internal memory card. It replaces an external data memory which was previously assigned to the PGC. It contains the data from gas analyses, the most important characteristic values and statuses of the GC 6000 as well as time stamps and running numbers.

The long-term archive is located outside the regular coordinate system downstream of the Q Archives area and upstream of the Documentation area. It can be read out only via the network interface using the browser.
There are the following criteria for access:

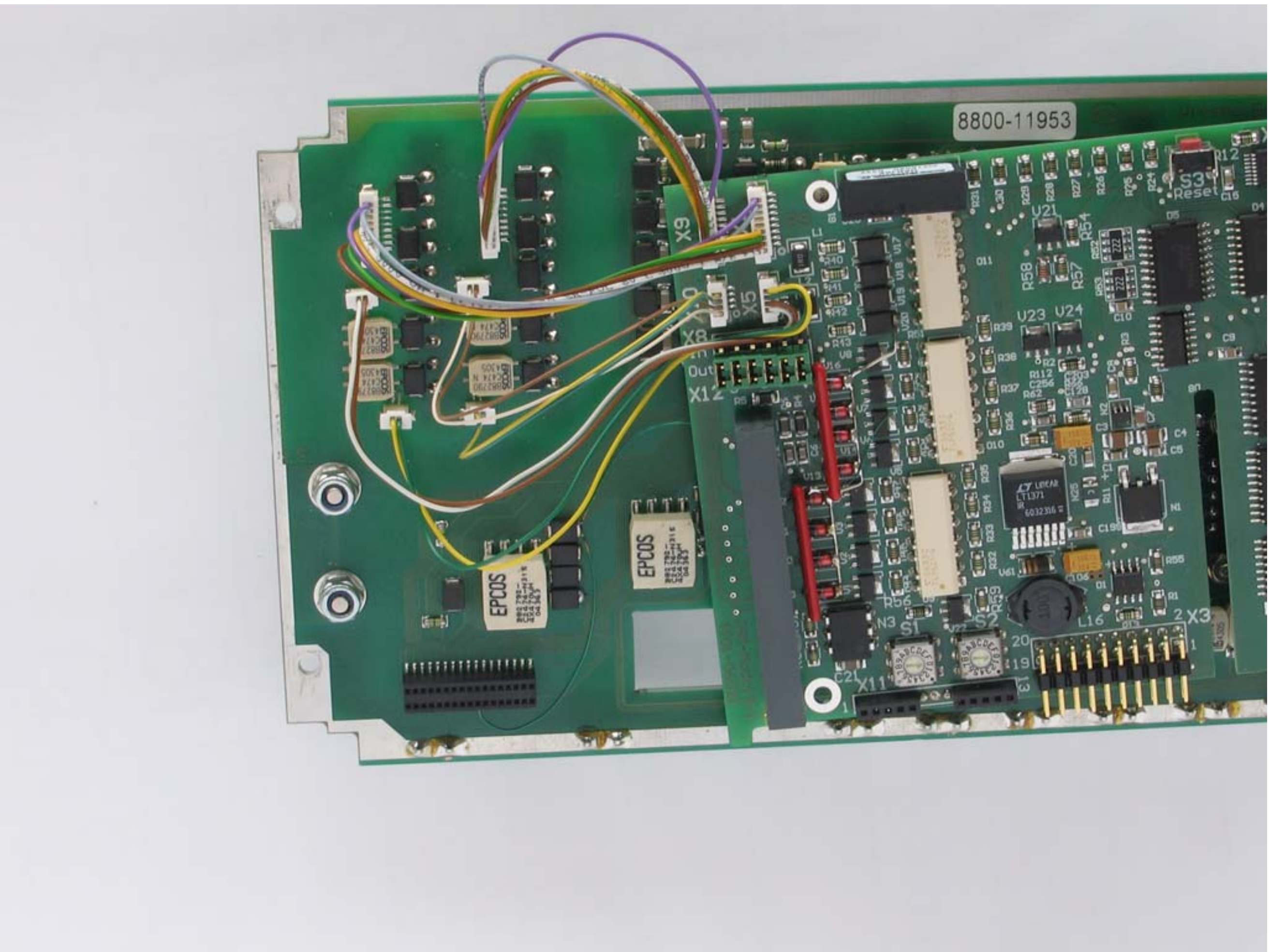
- Year
- Month
- Measured data: day, month, year or
- calibration data: month, year

4.3 Installation of the expansion module

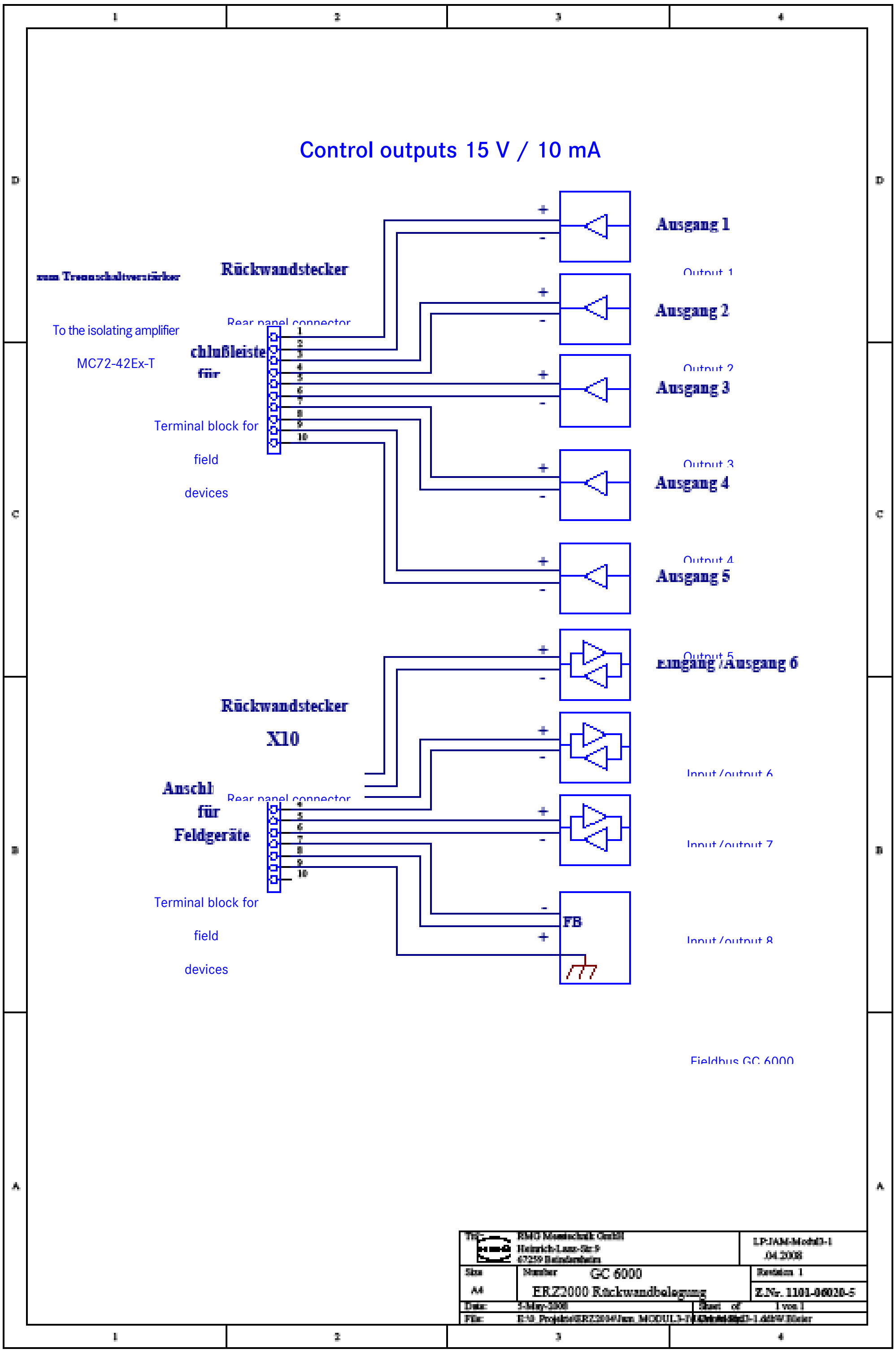
Position the module in slot 3 and plug the connecting cables onto the posts of X9 and X10.



Detailed view of the X9 and X10 connectors



Connector pin assignments of X9 and X10



4.4 Parameterization

To activate the GC 6000 functionality, make the following settings:

EH Module assembly

S	41	MOD 3A should be	GC6000

AD Superior calorific value

E §	3	Operating mode	RMG bus

AE Standard density

E §	3	Operating mode	RMG bus

BA Components mode

E §	1	CO2 oper. mode	0-20mA lim.
E §	2	H2 oper. mode	OFF
E §	3	N2 oper. mode	RMG bus
E §	4	Op.mode other comp.	RMG bus

IH Gas quality imported via GC6000 or RMG bus

E §	23	Stream selection	Stream 1
E §	24	Initial. RMGB GC	Start w /o fault

IL GC6000

P	6	GC6000 maintenance	Normal run	
B	7	max. mainten.time	480	min
B	9	max. flushing	3	
B	12	Calibration cycle	daily	
B	13	Calib. time base	01-01-2009 0	
B	15	Calibr. duration	30	min
B	16	Ana. to Startupcal	3	
E §	19	long term archive	Yes	

IN GC6000 cylinder rack and control panel

B	1	Src.cyl.C1 temp.	Contact input 1
B	2	Src.cyl.C2 temp.	Contact input 2
B	3	Src.cyl.C1 press.	Contact input 3
B	4	Src.cyl.C2 press.	Contact input 4
B	5	Src.cyl.car. press.	Contact input 5
B	6	Src. GC amb. temp.	Contact input 6
B	7	Src. GC-cal.ctc.	Contact input 7

The settings of the .IL and IN fields are only exemplary.

5 DSfG

5.1 DSfG in general

The *Digitale Schnittstelle für Gasmessgeräte* (i.e. digital interface for gas metering devices), DSfG in short, is described comprehensively in the documents (only available in German) below:

- G485 Technische Regeln, Arbeitsblatt, September 1997
- Gas-Information Nr.7, 3. Überarbeitung 04/2007,
  Technische Spezifikation für DSfG-Realisierungen
  - Teil 1: Grundlegende Spezifikationen
  - Teil 2: Abbildung der DSfG auf die IEC 60870-5-101/104
  - Teil 3: DSfG Datenelementelisten

These documents are issued by:

DVGW
Deutsche Vereinigung des Gas- und Wasserfaches e.V.
Postfach 140362
53058 Bonn (Germany)
Telephone: +49 (0)228 9188-5
Telefax: +49 (0)228 9188-990

They can be ordered in printed form at:

Wirtschafts- und Verlagsgesellschaft Gas und Wasser mbH
Postfach 140151
53056 Bonn (Germany)

And they can be downloaded as files at:

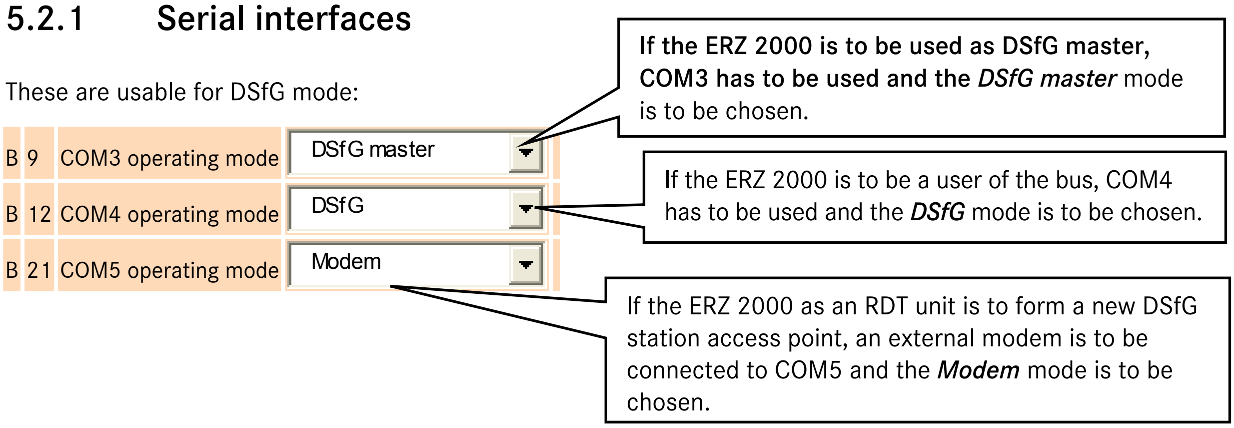
www.dvgw.de/gas/messtechnik-und-abrechnung/gasmessung/

In this user manual, it is assumed that these DSfG documents are known.
The following text briefly describes the DSfG functionality implemented in the ERZ 2000 in compliance with these regulations.

5.2 DSfG with the ERZ 2000

5.2.1 Serial interfaces

These are usable for DSfG mode:



5.2.2 Cross comparison via DSfG

Operating volumes, standard volumes, temperature and pressure of two correctors should be compared via DSfG.

A partner device (B and A) is assigned alternately to a converter pair, for example, with the addresses A and B. The parameters are configured via *IC 01 Corrector address* and *IO 10 Partner address.* Any corrector whose own address is smaller than the address of the partner adopts the role of master during data exchanges. The slave is passive in this situation.

The master generates a data transmission telegram with DFO=Y, i.e. reply expected, in line with a time event that can be adjusted with *IO 11 Test cycle* . The data section contains the values for Vb, Vn, T and P as well as the determination period. Vb and Vn are autonomous meters that operate independently of fault and billing mode. After a telegram is sent, the meters are reset to zero before they continue incrementing. Vb divided by time has the same meaning as a Qb flow.

The slave does not react to a time event, even if it is parameterized. It always replies when it receives a data transmission telegram with DFO=Y rather than a telegram with DFO=N, i.e. do not send a reply. The data section of this telegram then contains Vb, Vn, T and P of the slave. Data is exchanged in this way.

One *my* data and one *its* data set of mutual importance is then stored in each device. A serial number is sent together with the data for synchronization purposes.
If the data is valid, the percentage deviations are then calculated. The deviations of Vb and Vn are not actually determined using Vb and Vn, but are derived from *my* Vb divided by *my* time and *its* Vb divided by *its* time, i.e. based on the flows.

Example for Vb or Qb

My flow rate: Qb_*m* = dVb_*m* / dt_*m*

Its flow rate: Qb_*s* = dVb_*s* / dt_s

Percentage deviation when calculating the master, for example

Vb dev.: (Qb_*s* – Qb_*m*) / Qb_*m*

The formulas are implemented asymmetrically so that the master and slave have the same deviation value, i.e. *my* and *its* are interchanged.

The deviations are checked with reference to an adjustable maximum value.
If the value is exceeded, corresponding information messages are issued. (no alarm or warning)

The results and exchanged data are archived in archive group 7 and can be retrieved via DSfG

Extensive details of the general topic can be found in the coordination system of the ERZ 2000 under:
IO DSfG tandem meter comparison

See the table of contents for other points relevant to DSfG:
- ***Alarms and warnings / Special DSfG features***
- ***Electrical connections / DSfG bus / DSfG connector pin assignments***
- ***Electrical connections / DSfG bus / DSfG connector pin assignments***

5.2.3 Z data elements

Any ERZ coordinates that are not linked in the manufacturer-dependent data element lists from the DSfG specification can be addressed using Z data elements so that they can be read and written. If the calibration lock is open, custody transfer coordinates can be modified as well.

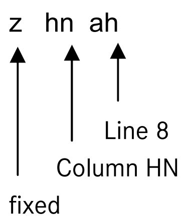
The ***data element address*** is comprised of:

1.	Address position:	z
2. and 3.	address position:	Column name
4. and 5.	Address position:	Line number

Address position 1 is defined with z, which means *manufacturer-specific data element.*
Address positions 2 and 3 are generated directly from the *column name* for the coordinates.
In address positions 4 and 5, the *line number* for the coordinates is displayed as follows:

Line number	Addr. positions 2 and 3
1	aa
2	ab
3	ac
...	...
26	az
27	ba
28	bb
29	bc
...	...

Example of coordinates *HN 08 Comparison VOS*



5.2.4 Archive groups

Archive assignment documentation

QA	Archive group 1	Traditional like in MRG2200 = main meter for AM 1 plus measured values
QB	Archive group 2	Traditional like in MRG2200 = disturbance counter for AM 1
QC	Archive group 3	Traditional like in MRG2200 = main meter for AM 2 plus measured values
QD	Archive group 4	Traditional like in MRG2200 = disturbance counter for AM 2
QI	Archive group 9	Freely programmable archive
QJ	Archive group 10 Data elements	Assigned with special inputs ("MRG functions" level 1) _z__
QK	Archive group 11	DSfG revision or official functional test
QL	Archive group 12	DSfG revision or official functional test
QM	Archive group 13	DSfG revision or official functional test
QN	Archive group 14	DSfG revision or official functional test
QU	Archive group 21	Logbook plus audit trail
QV	Archive group 22	Maximum values per day, hour value
QW	Archive group 23	Maximum values per month, hour and day value
QX	Archive group 24	Maximum values per year, hour/day value

A different setting must be selected for the corresponding measured value operating mode so that the average values for pressure, temperature etc. appear in the archives and archive groups.

If a measured input operates in ***Random*** mode, no entries are generated in the archives and logbook when alarms come and go.

5.2.5 Archive depth

DSfG archives

Archive group 1, 2, 3, 4, 8	2048 entries, then the oldest entry is overwritten.
Archive group 7	512 entries, then the oldest entry is overwritten.
Archive group 9	4096 entries, then the oldest entry is overwritten.
Archive group 10, 21	2048 entries, then the oldest entry is overwritten.
Archive group 11, 12, 13, 14	4 entries are rewritten each time
Archive group 22	180 entries, then the oldest entry is overwritten.
Archive group 23	36 entries, then the oldest entry is overwritten.
Archive group 24	10 entries, then the oldest entry is overwritten.

5.2.6 Archive identifiers

Text for identifying the corresponding archive group can be entered in coordinates ***ID05*** to ***ID12*** . The DSfG retrieval system reads these archive identifiers (archive names) when retrieving master data and uses them for visualization purposes.

6 MODBUS

6.1 Concept

In the ERZ 2000, there is a user-definable (configurable) range of 50 MODBUS registers preset in the factory with 25 values of 4 bytes each (defaults). The contents of these 50 registers can be changed by the user at any time.
This user-configurable range is called MODBUS superblock. All data of the superblock are stored under consecutive register addresses. This enables data to be transmitted quickly without a lot of individual queries. An offset can be assigned to the superblock.
In addition, there is a fixed range where the most important user data are stored. These registers cannot be changed by way of configuration. This fixed range is directly attached to the superblock and will be automatically shifted with the offset.

Changing data in the superblock:
When you edit items in the superblock, apart from the name of the variable, the coordinate of the variable is used as the most important selection assistant.
You can read the coordinate directly from the device. To do this, select the desired value, press the "*" key (Select) and the coordinate will appear in the second line in front of the name of the measured value shown. You can also look up the coordinate in the documentation (see Annex A of the manual) or read it via the Ethernet interface using a PC and the download method.
You always configure the superblock using a PC and you operate it via the Ethernet interface using html downloads.

If you want the volumetric flow rate at measurement conditions to rank first in the superblock, you have to proceed as follows:
Connect your PC via a crossover network cable. Establish a connection, call the MODBUS superblock (html download), enter your user code and then click the Edit function under the first item. In the menu offered, locate the previously selected coordinate and click on it. Upload the changed setting and click "Continue". Then lock the user code again and you're done! Now the newly entered measured value will be shown first in the MODBUS superblock.

See separate documentation for further details regarding remote control via PC.

Further parameters for the MODBUS interface:
The ERZ 2000 is a MODBUS slave.
Address adjustable from 1 to 247.

Set the interface parameters for COM 1, 2 and 3 under "Serial COMs" in coordinates IB 01 and 02.

The Modbus interface can be operated optionally in RTU or ASCII mode.
Depending on the model, Modbus is available on COM 1 (RS 232, 422 or 485 depending on the hardware settings), on COM 2 (only RS 232) and additionally on COM 3 (RS 232 or 485). There is another Modbus interface available as Modbus IP on the RJ45 connector, Ethernet TCP/IP.
The Modbus address and register offset parameters and the superblock definitions jointly apply to all 4 Modbus interfaces.

6.2 Combined fault messages

Register(s) 474 (and 9118) contain(s) combined faults messages in the form of a bit pattern.
Only alarms are relevant; warnings and hints are not taken into account.

Bit	Symbol	Meaning	
0	dP	Differential pressure	LSB
1	Gbh	Gas quality	
2	T	Temperature	
3	P	Pressure	
4	Vn	Volume at base cond.	
5	Vb	Volume at meas. cond.	
6	n.b.	Not used	
7	n.b.	Not used	
8	n.b.	Not used	
9	n.b.	Not used	
10	n.b.	Not used	
11	n.b.	Not used	
12	n.b.	Not used	
13	n.b.	Not used	
14	n.b.	Not used	
15	n.b.	Not used	MSB

In the ERZ 2000, all alarms are checked for logical relationship and are mapped in a specific bit as collective alarms in register 474.

Bit 0: Differential pressure alarms
Bit 1: Gas quality alarms
Bit 2: Temperature alarms
Bit 3: Pressure alarms
Bit 4: Alarms in connection with the volume at base conditions
Bit 5: Alarms in connection with the volume at measurement conditions

The same bit pattern can be found in the specific 9000 range in register 9118.

Examples
00000000 00000000 = There is no alarm pending.
00000000 00010000 = There is an alarm pending which affects only the volume at base conditions.
00000000 00010100 = There is an alarm pending which affects the temperature and the volume at base conditions.

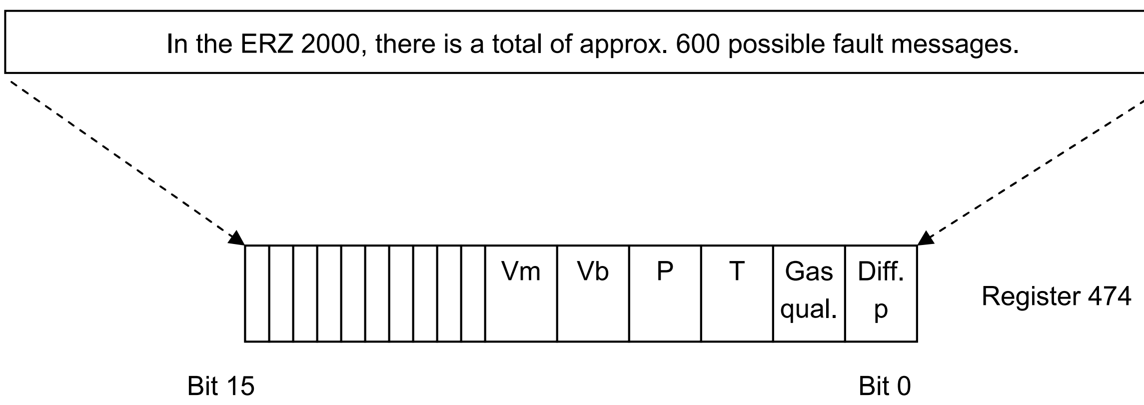


Table of faults affecting register 474

Running No.	Fault category	Fault number	Short text	Long text	Bit information flux control
0	A	00-0	T loss	Loss of temperature	Vn+T
1	A	00-1	T<l.alarm lim.	Temperature below lower alarm limit	Vn+T
2	A	00-2	T>up.alarm lim.	Temperature exceeds upper alarm limit	Vn+T
3	A	00-3	T jump	Temperature gradient exceeds maximum	Vn+T
7	A	01-0	TS loss	Loss of VOS temperature	Vn
8	A	01-1	TS<l.alarm lim.	VOS temperature below lower alarm limit	Vn
9	A	01-2	TS>up.alarm lim.	VOS temperature exceeds upper alarm limit	Vn
10	A	01-3	TS jump	VOS temperature gradient exceeds maximum	Vn
14	A	02-0	TD loss	Loss of density transmitter temperature	Vn
15	A	02-1	TD<l.alarm lim.	Density transmitter temperature below lower alarm limit	Vn
16	A	02-2	TD>up.alarm lim.	Density transmitter temperature exceeds upper alarm limit	Vn
17	A	02-3	TD jump	Density transmitter temperature gradient exceeds maximum	Vn
21	A	03-0	Pa loss	Loss of absolute pressure	Vn+P
22	A	03-1	Pa<l.alarm lim.	Absolute pressure below lower alarm limit	Vn+P
23	A	03-2	Pa>up.alarm lim.	Absolute pressure exceeds upper alarm limit	Vn+P
24	A	03-3	Pa jump	Absolute pressure gradient exceeds maximum	Vn+P
28	A	04-0	sd loss	Loss of standard density	Vn+Gbh
29	A	04-1	sd<l.alarm lim.	Standard density below lower alarm limit	Vn+Gbh
30	A	04-2	sd>up.alarm lim.	Standard density exceeds upper alarm limit	Vn+Gbh
31	A	04-3	sd jump	Standard density gradient exceeds maximum	Vn+Gbh
35	A	04-7	HW pulse comp.	Hardware pulse comparison has taken effect	Vb+Vn
38	A	05-0	R loss	Loss of density	Vn
39	A	05-1	R<l.alarm lim.	Density below lower alarm limit	Vn
40	A	05-2	R>up.alarm lim.	Density exceeds upper alarm limit	Vn
41	A	05-3	R jump	Density gradient exceeds maximum	Vn
44	A	05-6	R comp.error	Incorrect density calculation	Vn+Gbh
46	A	05-8	Vo alarm	Vo failure, effect of fault: alarm	Vb+Vn
48	A	06-0	Hs loss	Loss of superior calorific value	Vn+Gbh
49	A	06-1	Hs<l.alarm lim.	Superior calorific value below lower alarm limit	Vn+Gbh
50	A	06-2	Hs>up.alarm lim.	Superior calorific value exceeds upper alarm limit	Vn+Gbh
51	A	06-3	Hs jump	Superior calorific value gradient exceeds maximum	Vn+Gbh
55	A	07-0	CO2 loss	Loss of carbon dioxide	Vn+Gbh
56	A	07-1	CO2<l.alarm lim.	Carbon dioxide below lower alarm limit	Vn+Gbh
57	A	07-2	CO2>up.alarm lim.	Carbon dioxide exceeds upper alarm limit	Vn+Gbh
58	A	07-3	CO2 jump	Carbon dioxide gradient exceeds maximum	Vn+Gbh
62	A	08-0	VSM loss	Loss of VSM	Vn
63	A	08-1	VSM<l.alarm lim.	VSM below lower alarm limit	Vn
64	A	08-2	VSM>up.alarm lim.	VSM exceeds upper alarm limit	Vn
65	A	08-3	VSM jump	VSM gradient exceeds maximum	Vn
69	A	09-0	H2 loss	Loss of hydrogen	Vn+Gbh
70	A	09-1	H2<l.alarm lim.	Hydrogen below lower alarm limit	Vn+Gbh
71	A	09-2	H2>up.alarm lim.	Hydrogen exceeds upper alarm limit	Vn+Gbh
72	A	09-3	H2 jump	Hydrogen gradient exceeds maximum	Vn+Gbh
80	A	12-0	VSB loss	Loss of VSB	Vn

81 A	12-1	VSB<l.alarm lim.	VSB below lower alarm limit	Vn
82 A	12-2	VSB>up.alarm lim.	VSB exceeds upper alarm limit	Vn
83 A	12-3	VSB jump	VSB gradient exceeds maximum	Vn
87 A	13-0	Pg loss	Loss of gauge pressure	Vn+P
88 A	13-1	Pg<l.alarm lim.	Gauge pressure below lower alarm limit	Vn+P
89 A	13-2	Pg>up.alarm lim.	Gauge pressure exceeds upper alarm limit	Vn+P
90 A	13-3	Pg jump	Gauge pressure gradient exceeds maximum	Vn+P
94 A	19-0	N2 loss	Loss of nitrogen	Vn+Gbh
95 A	19-1	N2<l.alarm lim.	Nitrogen below lower alarm limit	Vn+Gbh
96 A	19-2	N2>up.alarm lim.	Nitrogen exceeds upper alarm limit	Vn+Gbh
97 A	19-3	N2 jump	Nitrogen gradient exceeds maximum	Vn+Gbh
105 A	32-2	CRC12 error	Official character of custody transfer GC data violated	Gbh
110 A	32-7	V.d.Waals alarm	Van der Waals iteration is running amok	Vn+Gbh
157 A	39-8	flow signal loss	Loss of flow proportional signal	Vb+Vn
164 A(R)	42-1	RTC defective	Real time clock is defective	Vb+Vn
165 A	43-2	Def.tot.	Totalizer is defective	Vb+Vn
195 A	48-0	CAN timeout	CAN bus timeout	Vb+Vn+P+T
200 A	48-5	C fact.failure	Primary value for conversion factor calculation is missing	Vn
203 A	50-0	T<>GERG lim.	Temperature exceeds GERG limits	Vn+T
204 A	50-1	P<>GERG lim.	Pressure exceeds GERG limits	Vn+P
205 A	50-2	rd<>GERG lim.	Relative density exceeds GERG limits	Vn+Gbh
206 A	50-3	CO2<>GERG lim.	Carbon dioxide exceeds GERG limits	Vn+Gbh
207 A	50-4	N2<>GERG lim.	Nitrogen exceeds GERG limits	Vn+Gbh
208 A	50-5	Hs<>GERG lim.	Superior calorific value exceeds GERG limits	Vn+Gbh
209 A	50-6	H2<>GERG lim.	Hydrogen exceeds GERG limits	Vn+Gbh
210 A	50-8	GERG iter.max	Maximum permissible GERG iterations exceeded	Vn
211 A	51-0	T<>AGA limit	Temperature exceeds AGA limits	Vn+T
212 A	51-1	P<>AGA limit	Pressure exceeds AGA limits	Vn+P
213 A	51-2	rd<>AGA limit	Relative density exceeds AGA limits	Vn+Gbh
214 A	51-3	CO2<>AGA limit	Carbon dioxide exceeds AGA limits	Vn+Gbh
215 A	51-4	N2<>AGA limit	Nitrogen exceeds AGA limits	Vn+Gbh
216 A	51-5	Hs<>AGA limit	Superior calorific value exceeds AGA limits	Vn+Gbh
217 A	51-6	H2<>AGA limit	Hydrogen exceeds AGA limits	Vn+Gbh
218 A	51-7	AGA oth.errors	Other AGA errors	Vn
219 A	51-8	AGA-pi,tau	AGA interim result, pi,tau exceed limits	Vn+P+T
220 A	51-9	Interp.pt.probl.	Error during calculation of interpolation point	Vn
227 A	52-6	illegal	Illegal operating mode	Vb+Vn
248 A(R)	56-0	Channel 1 fault	Pulse counting channel 1 implausible	Vb+Vn
249 A(R)	56-1	Channel 2 fault	Pulse counting channel 2 implausible	Vb+Vn
250 A	56-2	Tc/Tb comb.	Tc/Tb combination not permitted	Vn
255 A(R)	56-7	Power OFF	Supply voltage failure	
256 A(R)	56-8	Channel 3 fault	Pulse counting channel 3 implausible	Vb+Vn
257 A(R)	56-9	Channel 4 fault	Pulse counting channel 4 implausible	Vb+Vn
323 A	65-6	sd failure 2IV	Standard density, seconde input value failed	Vn+Gbh
365 A(R)	71-4	NMA ADC	Namur module A analog/digital-converter	Vn+P+T
366 A(R)	71-5	NMA overload	Namur module A overload	Vn+P+T
367 A(R)	71-6	NMA OC PT100	Namur module A open circuit PT100	Vn+T

368 A(R)	71-7	NMA OC mainch.	Namur module A open circuit main channel	Vb+Vn
369 A(R)	71-8	NMA OC ref.ch.	Namur module A open circuit reference channel	Vb+Vn
371 A(R)	72-0	NMB ADC	Namur module B analog/digital-converter	Vn+P+T
372 A(R)	72-1	NMB overload	Namur module B overload	Vn+P+T
373 A(R)	72-2	NMB OC PT100	Namur module B open circuit PT100	Vn+T
374 A(R)	72-3	NMB OC Messk.	Namur module B open circuit main channel	Vb+Vn
375 A(R)	72-4	NMB OC Vgl.k.	Namur module B open circuit reference channel	Vb+Vn
401 A	77-0	DP1 (I<3mA)	delta-P cell 1 current lower 3 mA	Vb+Vn+dP
402 A	77-1	DP2 (I<3mA)	delta-P cell 2 current lower 3 mA	Vb+Vn+dP
403 A	77-2	DP3 (I<3mA)	delta-P cell 3 current lower 3 mA	Vb+Vn+dP
404 A	77-3	Beta illegal	illegal diameter ratio throat/pipe	Vn+dP
405 A	77-4	DP1 failure	delta-P cell 1 failure	Vb+Vn+dP
406 A	77-5	DP2 failure	delta-P cell 2 failure	Vb+Vn+dP
407 A	77-6	DP3 failure	delta-P cell 3 failure	Vb+Vn+dP
408 A	77-7	DP>max.	delta-P bigger maximum	Vn+dP
413 A	78-2	GQM-list	GQM-list is fault	Gbh
414 A	78-3	Main GQ unknown	Main gas quality unknown identification	Gbh
415 A	78-4	Ref GQ unknown	Reference gas quality unknown identification	Gbh
416 A	78-5	Main GQ CRC12	Main gas quality CRC12 implausible	Gbh
417 A	78-6	Ref GQ CRC12	Reference Gas Quality CRC12 implausible	Gbh
430 A	80-0	dkvk>max.	Maximum deviation at operating point exceeded	Vn
431 A	80-1	IGM SV invalid	IGM invalid substitute value used	Vb+Vn
432 A	80-2	Path failure >max	Number of path failure's greater than allowed	Vb+Vn
434 A	80-4	Eta loss	Loss of viscosity	Vn+dP
435 A	80-5	Eta<l.alarm lim.	Viscosity below lower alarm limit	Vn+dP
436 A	80-6	Eta>up.alarm lim.	Viscosity exceeds upper alarm limit	Vn+dP
440 A	81-0	Eta jump	Viscosity gradient exceeds maximum	Vn+dP
466 A	83-6	HFX miss.pulses	Counter main channel (HFX) malfunction	Vb+Vn
467 A	83-7	HFY miss.pulses	Counter reference channel (HFY) malfunction	Vb+Vn
468 A	84-0	Kpp loss	Loss of isentropic coefficient	Vn+dP
469 A	84-1	Kpp<l.alarm lim.	Isentropic coefficient below lower alarm limit	Vn+dP
470 A	84-2	Kpp>up.alarm lim.	Isentropic coefficient exceeds upper alarm limit	Vn+dP
474 A	84-6	Kpp jump	Isentropic coefficient gradient exceeds maximum	Vn+dP
501 A	89-0	JTC loss	Loss of Joule-Thomson coefficient	Vn+T+dP
502 A	89-1	JTC<l.alarm lim.	Joule-Thomson coefficient below lower alarm limit	Vn+T+dP
503 A	89-2	JTC>up.alarm lim.	Joule-Thomson coefficient exceeds upper alarm limit	Vn+T+dP
507 A	89-6	JTC jump	Joule-Thomson coefficient gradient exceeds maximum	Vn+T+dP
527 A	91-8	GC components	GC components for complete analysis are bad	Vn+Gbh
543 A	93-5	USZ alarm	USZ transmitter signalizes an alarm	Vb+Vn
544 A	93-6	USZ timeout	No more signal from USZ transmitter	Vb+Vn
556 A(R)	95-0	Math.problem	Mathematical error	Vb+Vn
557 A	95-1	Corrupt code	corrupt code detected	Vb+Vn
558 A	95-2	Alarm volume	hard-wired contact of volume transmitter shows alarm	Vb+Vn
566 A	96-0	rd loss	Loss of relative density	Gbh
567 A	96-1	rd<l.alarm lim.	Relative density below lower alarm limit	Gbh
568 A	96-2	rd>up.alarm lim.	Relative density exceeds upper alarm limit	Gbh
569 A	96-3	rd jump	Relative density gradient exceeds maximum	Gbh

574 A	96-8	sd GC timeout	No more signal from standard density transmitter	Gbh
575 A	96-9	rd GC timeout	No more signal from relative density transmitter	Gbh
576 A	97-0	CO2 GC timeout	No more signal from CO2 transmitter	Gbh
577 A	97-1	N2 GC timeout	No more signal from N2 transmitter	Gbh
578 A	97-2	H2 GC timeout	No more signal from H2 transmitter	Gbh
579 A	97-3	Hs GC alarm	GC reports loss of superior calorific value	Vn+Gbh
580 A	97-4	sd GC alarm	GC reports loss of standard density	Vn+Gbh
581 A	97-5	rd GC alarm	GC reports loss of relative density	Vn+Gbh
582 A	97-6	CO2 GC alarm	GC reports loss of carbon dioxide	Vn+Gbh
583 A	97-7	N2 GC alarm	GC reports loss of nitrogen	Vn+Gbh
584 A	97-8	H2 GC alarm	GC reports loss of hydrogen	Vn+Gbh
585 A	97-9	Beattie alarm	Beattie&Bridgeman iteration is running amok	Vn
586 A	98-0	CH4 loss	Loss of methane	Gbh
587 A	98-1	CH4<l.alarm lim.	Methane below lower alarm limit	Gbh
588 A	98-2	CH4>up.alarm lim.	Methane exceeds upper alarm limit	Gbh
589 A	98-3	CH4 jump	Methane gradient exceeds maximum	Gbh
593 A	98-7	Comp.normaliz.	Error occurred during normalization of gas components	Vn+Gbh
596 A	99-2	CH4 GC timeout	No more signal from methane transmitter	Gbh
597 A	99-3	CH4 GC alarm	GC reports loss of methane	Gbh
599 A	99-5	VOS corr.error	Error during VOS correction calculation	Vn
601 A	99-7	AGA8 alarm	AGA 8 algorithmic error	Vn
602 A	99-8	AGA892DC alarm	AGA 8 92DC algorithmic error	Vn

6.3 Modbus EGO

This is a special interface which has been specifically created for Erdgas Ostschweiz.
There are the following EGO-specific Modbus registers:

Register	Bytes	Data type	Access	Col.	Line	Group	Designation	Value (display)	Value (Modbus)
2000	4	unsigned integer 32-bit	R	IP	1	EGO-Modbus	Counter Vb	997972 m3	00 0F 3A 54
2002	4	unsigned integer 32-bit	R	IP	2	EGO-Modbus	Counter Vm	20421 m3	00 00 4F C5
2004	4	unsigned integer 32-bit	R	IP	3	EGO-Modbus	Counter energy	9710 MWh	00 00 25 EE
2006	4	unsigned integer 32-bit	R	IP	4	EGO-Modbus	Disturbcnt. Vb	39597 m3	00 00 9A AD
2008	4	unsigned integer 32-bit	R	IP	5	EGO-Modbus	Disturbcnt. Vm	823 m3	00 00 03 37
2010	4	unsigned integer 32-bit	R	IP	6	EGO-Modbus	Disturbcnt. energy	389 MWh	00 00 01 85
2012	4	float IEEE 754	R	IP	7	EGO-Modbus	Flow Qb	12550.39 m3/h	46 44 19 8E
2014	4	float IEEE 754	R	IP	8	EGO-Modbus	Flow Qm	190.910 m3/h	43 3E E9 09
2016	4	float IEEE 754	R	IP	9	EGO-Modbus	Flow Qe	125503.9 kW	47 F5 1F F2
2018	4	float IEEE 754	R/W	IP	10	EGO-Modbus	Standard density	0.8000 kg/m3	3F 4C CC CD
2020	4	float IEEE 754	R/W	IP	11	EGO-Modbus	Gross cal.val.	10.000 kWh/m3	41 20 00 00
2022	4	float IEEE 754	R/W	IP	12	EGO-Modbus	Hydrogen	0.000 mole%	00 00 00 00
2024	4	float IEEE 754	R/W	IP	13	EGO-Modbus	Carbon dioxide	6.067 mole%	40 C2 21 10
2026	4	float IEEE 754	R	IP	14	EGO-Modbus	Oper. density	52.592 kg/m3	42 52 5D F9
2028	4	float IEEE 754	R	IP	15	EGO-Modbus	Abs. pressure	54.773 bar	42 5B 17 84
2030	4	float IEEE 754	R	IP	16	EGO-Modbus	Temperature	-10.00 °C	C1 20 00 00
2032	2	unsigned integer 16-bit	R	IP	17	EGO-Modbus	Alarm	0	00 00

Important issues

- The ERZ 2000 is a Modbus slave.
- Supported function codes:
  - 03 Read holding register To read data.
  - 16 Preset multiple registers To write data.
- The register addresses are referenced to 0 (zero).
  E.g. if register 2000 is queried on the interface, coordinate IB 17 Register offset = 0 is to be set.
- Totalizers and disturbance totalizers comply with billing mode 1.
- Standard density, superior calorific value, hydrogen and carbon dioxide can be described via Modbus.
  To use the values for correction, set the mode of the relevant measured value input at EGO-Modbus.
- There is no specific EGO interface mode.
- EGO mode only makes sense in conjunction with GERG 88.
- EGO mode does not function with billing modes 2,3 and 4.
- EGO mode does not function with 14-digit totalizers.
- EGO mode relies on fixed units (m3, kWh, m3/h, kW, kg/m3, mol%, bar, degree Celsius).
- Meaning of the alarm status in register 2032:
  - 0 No alarm
  - 1 Hardware fault(s) of the corrector
  - 2 Hardware fault(s) of pulse detection
  - 3 Limit fault(s) of volume measurements
  - 4 Hardware / limit fault(s) of other transmitters
  - 5 GERG limit violation
  - 6 Other alarms
  - 7 to 9 Spare
- An initialization value (float 999999) is agreed upon for the standard density, superior calorific value, hydrogen and carbon dioxide. This value will be sent by the Modbus master in such cases where there is no measured value available yet.

6.4 Modbus Transgas

The IB27 Modbus project coordinates enable the project-specific configuration of the modbus registers from 9000 upwards. The Transgas setting must be selected to exchange data with a bus coupler for Portugal, resulting in the following register configuration:

Register	Bytes	Data type	Access	Column	Line	Group	Name	Value (display)	Value (modbus)
9000	4	float IEEE 754	R	AB	1	Absolute pressure	Measurement variable	25,000 bar	41 C8 00 00
9002	4	float IEEE 754	R	AC	1	Gas temperature	Measurement variable	16.421568 °C	41 83 5F 5F
9004	4	float IEEE 754	R	HF	1	Corr. flow rate	Measurement variable	310.267 m3/h	43 9B 22 29
9006	4	float IEEE 754	R	HD	1	Volumetric flow rate	Measurement variable	7718.06 m3/h	45 F1 30 79
9008	4	float IEEE 754	R	AD	1	Fuel gas value	Measurement variable	12,000 kWh/m3	41 40 00 00

9010	4	float IEEE 754	R	AE	1	Standard density	Measurement variable	0.8880 kg/m3	3F 63 53 F8
9012	4	unsigned integer 32-bit	R	LB	4	Totalizer AM1	Energy	126843 MWh	00 01 EF 7B
9014	4	unsigned integer 32-bit	R	LB	7	Totalizer AM1	Corr.vol. meas.	447724 m3	00 06 D4 EC
9016	4	unsigned integer 32-bit	R	LB	1	Totalizer AM1	Volumetric flow	9803707 m3	00 95 97 BB
9018	4	unsigned integer 32-bit	R	LC	4	Disturbance totalizer AM1	Energy	21422 MWh	00 00 53 AE
9020	4	unsigned integer 32-bit	R	LC	7	Disturbance totalizer AM1	Corr.vol. meas.	92001 m3	00 01 67 61
9022	4	unsigned integer 32-bit	R	LC	1	Disturbance totalizer AM1	Volumetric flow	1869267 m3	00 1C 85 D3
9024	4	signed integer 32-bit	R	FG	10	Hardware test	Alarm LED	on	00 00 00 01
							Options:	off	= 0
								on	= 1
								flashes	= 2
9026	4	signed integer 32-bit	R	FG	9	Hardware test	Warning LED	off	00 00 00 00
							Options:	off	= 0
								on	= 1
								flashes	= 2
9028	2	unsigned integer 16-bit	R	YES	28	Error reports	Control bits	0000 hex	00 00
9029	2	unsigned integer 16-bit	R	KB	10	Time output	Modbus year	2010	07 DA
9030	2	unsigned integer 16-bit	R	KB	11	Time output	Modbus month	6	00 06
9031	2	unsigned integer 16-bit	R	KB	12	Time output	Modbus day	24	00 18
9032	2	unsigned integer 16-bit	R	KB	13	Time output	Modbus hour	13	00 0D
9033	2	unsigned integer 16-bit	R	KB	14	Time output	Modbus minute	30	00 1E
9034	2	unsigned integer 16-bit	R	KB	15	Time output	Modbus second	49	00 31
9500	4	float IEEE 754	R/W	IJ	3	Imp. GC Modbus, main	Fuel gas value	12,000 kWh/m3	41 40 00 00
9502	4	float IEEE 754	R/W	IJ	5	Imp. GC Modbus, main	Standard density	0.8880 kg/m3	3F 63 53 F8
9504	4	float IEEE 754	R/W	IJ	6	Imp. GC Modbus, main	CO2	1.00000 mol-%	3F 80 00 00
9506	2	unsigned integer 16-bit	R/W	KC	60	Time input	Modb.sync year	2010	07 DA
9507	2	unsigned integer 16-bit	R/W	KC	61	Time input	Modb.sync month	6	00 06

9508	2	unsigned integer 16-bit	R/W	KC	62	Time input	Modb.sync year	14	00 0E
9509	2	unsigned integer 16-bit	R/W	KC	63	Time input	Modb.sync hour	11	00 0B
9510	2	unsigned integer 16-bit	R/W	KC	64	Time input	Modb.sync minute	55	00 37
9511	2	unsigned integer 16-bit	R/W	KC	65	Time input	Modb.sync second	12	00 0C
9512	2	unsigned integer 16-bit	R/W	KC	66	Time input	Modb.sync trigger	0	00 00

Example of alternative configuration

IB Serial interfaces

B	7	COM3 baud rate	38400
B	8	COM3 B/P/S	8N1
B	9	COM3 operating mode	Modbus-RTU
B	17	Register offset	0
B	18	Modbus address	201
B	22	Modbus add. COM1	0
B	23	Modbus add. COM2	0
B	24	Modbus add. COM3	0
B	27	Modbus project	Transgas

AD Fuel gas value

E §	3	Operating mode	Modbus

AE Standard density

E §	3	Operating mode	Modbus

BA Components mode

E §	1	CO2 operating mode	Modbus

KC External time signal

T	1	Sync mode input	Modbus	
T	2	Time sync. tolerance	0	s
E §	3	Time sync. rule	immer	

Notes

- Bus coupler only synchronizes time and date of corrector in a 30-second time base
.
- In order to write Ho, Rhon and CO2 to the bus coupler, the factors D13, D14 and D15 must be considered.
- IB27 Modbus project parameterization = Transgas is only available from device software version 1.9.1.

6.5 Eon Gas Transport Modbus

With the setting IB27 Modbus project = EGT, the modbus registers are configured from 9000 upwards, as requested by Eon Gas Transport for the Werne project. A description of this standard register configuration extends beyond the scope of this device manual. However, the details are included in the internal device documentation and can be accessed under Documentation / III.MODBUS / 2. Werne Project registers from the network interface using the browser.

7 Alarms and warnings / acknowledging events

7.1 Functioning of alarms and warnings

Warnings and alarms are indicated by a yellow (warning) or red (alarm) LED on the front of the device. The warning relay or alarm relay closes parallel to this.
The active message is indicated by a flashing LED. If the message goes, the LED will turn to steady light. If there is more than one message at the same time, the flashing light prevails. For one-valued messages, there is only the state: "Message is active". No coming or going is indicated, and therefore, the active state of these messages is retained until they are acknowledged.
The warning or alarm relay picks up as soon as a message comes and releases again if all messages are gone. In the case of one-valued messages, the relays remain picked up until the messages are acknowledged.

7.2 Acknowledging events

Warnings and alarms have to be acknowledged by pressing the Alarms key. Symbol on the Alarms key: ⚠
All messages which have not been acknowledged will be displayed. If there are no more events, the following text will appear: "No fault".

7.3 Special DSfG features

It is possible to redundantly assign two gas quality measuring devices, e.g. two process gas chromatographs (PGCs), which are linked to the DSfG bus to the volume corrector. If the two PGCs run without trouble, the volume corrector always uses the main PGC in accordance with the DSfG rules. If the main PGC is disturbed (evaluation of the bit pattern), the volume corrector will use the measured values of the reference PGC until the main PGC returns to untroubled operation. When operation is switched over to the reference measuring device, the ERZ 2000 can also adjust the procedure for calculating the K coefficient.
Example: The main PGC supplies the complete analysis and the ERZ 2000 calculates with AGA 8 92 DC. The reference measuring device (e.g. correlative device) only supplies the superior calorific value, standard density and CO2 content. When operation is switched over to the reference device, the ERZ 2000 automatically switches its calculation mode from AGA 8 92 DC to GERG 88S. The relevant parameters can be found in the Import GC-DSfG chapter.

8 Characteristic data

8.1 Specifications of the corrector

8.1.1 Analog inputs

Current measurement

Range	0/4 to 25 mA
Resolution	20 bits
U max	2.5 V
Ri	250 Ω
Tc	20 ppm
Measuring period	50 ms
Overvoltage protection	6.8 V

Resistance measurement

Type	PT 100 4-conductor design
Range	-20°C to +60°C
Resolution	0.01°C
Accuracy	0.05°C
Measuring period	50 ms

8.1.2 Frequency inputs

HF input of the measuring channel, volume

The permissible measuring range of volume frequency is in the range from 0.1 Hz to 6 kHz. The accuracy is 0.01 Hz.
U hys = 1 V
U trg = 3 V
Overvoltage protection 6.8 V with external module, 18 V with internal module, electrically isolated.

HF input of reference channel, volume

The permissible measuring range of volume frequency is in the range from 0.1 Hz to 6 kHz. The accuracy is 0.01 Hz.
U hys = 1 V
U trg = 3 V
Overvoltage protection 6.8 V with external module, 18 V with internal module, electrically isolated.

8.1.3 Counting inputs

HF input, volume input

The permissible HF volume counting range starts at 0.1 Hz and extends to 6 kHz. The input has been designed with two channels.

LF volume input

The permissible LF volume counting range starts at 0 Hz and extends to 6 kHz. The input has been designed with two channels.

Input for the digital Vo totalizer
Data transmission between the gas meter and the volume corrector is made in one direction and in a non-reactive way from the gas meter to the volume corrector. The electrical characteristic data comply with DIN 19234 (NAMUR).

8.1.4 Other inputs

Digital status inputs
All inputs are electrically isolated from the computer but not from each other. The following signal generators can be used: Contact, Open collector / drain, Active push/pull
-U max = 5V
-I max = 13 mA
f max = 10 Hz
Overvoltage protection 6.8 V

8.1.5 HART protocol, connection of the SMART transmitter (optional)

2-conductor system
Simultaneous analog and digital communications
Multimaster protocol
3 inputs on the HART card, of these two are reserved for pressure and temperature, can be extended to 6 inputs. If the isolating card is used, another 2 HART inputs are available.

8.1.6 Analog outputs

Current outputs	Number	4
	Range	0-20 mA or 4-20 mA
	Resolution	12 bits
	Burden	700 Ω
	Overvoltage protection from 33 V, electrically isolated	

8.1.7 Other outputs

Signal outputs	Number	8
	U max	24 V DC
	P max	150 mW
	Ic	100 mA
	UCEsat	1.2V or Rhon = 50 Ω
	F max	400 Hz
	Overvoltage protection 33 V, electrically isolated	
Pulse outputs	Number	4
	tmin OFF	16 ms
	tmax OFF	230 ms
	tmin ON	16 ms
	tmax ON	230 ms

	Ic	400 mA
	UCEsat	1.2V or Rhon = 50 Ω
	F max	400 Hz
	Overvoltage protection 33 V, electrically isolated	
Status outputs, alarm and warning		
	U max	24 V DC
	I max	100 mA
	P max	100 mW
	RDSon	<= 50 Ω
	Photomos relay	
	Ic	100 mA
	UCEsat	1.2V or Rhon = 50 Ω
	F max	400 Hz
	Overvoltage protection 33 V, electrically isolated	
Power supply	Input voltage	24 V DC –10% / +15%
	Typical current input	0.7 A (depending on the components used)
	Max. power	24 W
DSfG interface		According to G485
Interference suppression		EN50081-1
Noise immunity		EN50082-2

8.1.8 Digital Vo totalizer

The data transfer between the gas meter and the volume corrector is made through a screened and twisted core pair. The electrical characteristic data comply with DIN 19234 (NAMUR). Data transmission is made in one direction and in a non-reactive way from the gas meter to the volume corrector.

Layer 1 (bit transfer layer)
The cable used must fulfil the requirements for intrinsically safe circuits. A screened and twisted 2-core cable has to be used and the screening is to be earthed on the side of the volume corrector. In order to ensure the intrinsic safety type of protection not only on the side of the primary device but also on the side of the end device, it is essential that the following limits are not exceeded:

Voltage Uo = 13.5 V Current intensity Is-c = 15 mA Power P = 210 mW

The electrical levels on the connecting line comply with DIN 19234 (NAMUR). Power is supplied with U0 = 8 V and Is-c = 8 mA. Data transmission is made asynchronously at a rate of 2400 bps. The level for log. 1 (MARK) must be greater than 2.1 mA, while the level for log. 0 (SPACE) must be less than 1.2 mA.

Layer 2 (data-link layer)
Data transmission is made character by character. Each character includes 1 start bit, 7 data bits, even parity and 1 stop bit. From these characters, data frames are formed which are structured as follows:

Start character	<US>	Data character, separated in part by <US>	<FS>	<BCC>	<CR>	<LF>

All lower case letters from a to z are used as start characters.

- <US> separates the start character from the following data characters.
- <FS> closes up the data frame as an end mark.
- <BCC> is the block check character. It is formed from incl. start character up to incl. <FS> as even horizontal parity over the data bits 0 to 6 and adds what is necessary for even character parity.
- <CR> and <LF> are used to clearly separate subsequent data frames.

The size of a data frame from incl. start character to incl. <LF> is a maximum of 64 characters.
Layers 3 to 6: n/a

Layer 7 (processing layer)
The following data frames have been specified up to now:
Data frame a "Totalizer reading" obligatory:

Contents	Meaning
a <US>	Start character lower case letter **a,** data frame identifier **"Totalizer reading"**
zzzzzzzz <US>	Totalizer reading max. 14 char. as ASCII decimal, ***no*** suppression of preceding zeros
ww <US>	Value of the totalizer reading, max. 2 characters, optional sign (+ or -) and decimal power as ASCII decimal[1]
eee<US>	Unit of the totalizer reading, max. 3 characters, as text field[2]
s<FS>	Totalizer status, exactly 1 byte, range of values 0x30 to 0x3F, 0x30 means no fault[3]

Comments:

1. The values of 0, +0 and –0 are equivalent and therefore also permissible.
2. Typically, the unit for the totalizer reading used is m3. Other volume or mass units are also permissible.
3. The totalizer status allows for four fault messages which are independent of each other. Faultless totalizer readings are to be expected for the end device only if status = 0x30.

Data frame b "ID display" optional:

Contents	**Meaning**
b <US>	Start character lower case letter **b,** data frame identifier **"ID display"**
HHH <US>	Manufacturer code, exactly 3 characters, upper case letters[1]
TTTTT <US>	Device type / meter size max. 6 characters[2]
SSSSSSSS <US>	Factory / serial number of the meter, max. 9 characters[2]
JJJJ <US>	Year of construction of the meter, exactly 4 characters, as ASCII decimal[3]
VVVV <FS>	Software version number of the electronics, max. 4 characters[2]

Comments:

- The manufacturer code consists of the first three letters of the company name listed in the Commercial Register.
- The fields are declared as free text fields which are for information only.
- The range of values extends from 19(50) to 20(49).

To maintain the connection between the primary device and the end device, the specification requires that at least one data frame per second is exchanged on layer 2. In each case, the "Totalizer reading" data frame a has priority.

8.1.9 Specifications of the embedded PC MOD520C

Microcontroller AMD Elan SC520 with 586 CPU
Integrated FPU (Floating Point Unit)

Power supply 2.5 V, 3.3 V and 5 V

CPU clock, 133 MHz

PCI controller, 32 bits

SDRAM controller for up to 256 Mbytes, max. 64 Mbytes on board

GP (general purpose) bus

ROM/flash controller for 16 Mbytes

32 I/O ports

256 bytes EEPROM for BIOS

DMA controller

2 x UARTs for serial interfaces

2 x CAN ports

Fast Ethernet controller for 10/100Mbps

RTC real time clock

9 Fault numbers / fault texts

Running No.	Fault category	Fault number	Short text	Long text	Valence	Input enabled
0	A	00-0	T loss	Loss of temperature	2	Yes
1	A	00-1	T<l.alarm lim.	Temperature below lower alarm limit	2	Yes
2	A	00-2	T>up.alarm lim.	Temperature exceeds upper alarm limit	2	Yes
3	A	00-3	T jump	Temperature gradient exceeds maximum	2	Yes
4	W	00-4	T<l.warn.lim.	Temperature below lower warning limit	2	Yes
5	W	00-5	T>up.warn.lim.	Temperature exceeds upper warning limit	2	Yes
6	H	00-9	T param.error	Inconsistent parameterization, temperature	1	No
7	A	01-0	TS loss	Loss of VOS temperature	2	Yes
8	A	01-1	TS<l.alarm lim.	VOS temperature below lower alarm limit	2	Yes
9	A	01-2	TS>up.alarm lim.	VOS temperature exceeds upper alarm limit	2	Yes
10	A	01-3	TS jump	VOS temperature gradient exceeds maximum	2	Yes
11	W	01-4	TS<l.warn.lim.	VOS temperature below lower warning limit	2	Yes
12	W	01-5	TS>up.warn.lim.	VOS temperature exceeds upper warning limit	2	Yes
13	H	01-9	TS param.error	Inconsistent parameterization, VOS temperature	1	No
14	A	02-0	TD loss	Loss of density transmitter temperature	2	Yes
15	A	02-1	TD<l.alarm lim.	Density transmitter temperature below lower alarm limit	2	Yes
16	A	02-2	TD>up.alarm lim.	Density transmitter temperature exceeds upper alarm limit	2	Yes
17	A	02-3	TD jump	Density transmitter temperature gradient exceeds maximum	2	Yes
18	W	02-4	TD<l.warn.lim.	Density transmitter temperature below lower warning limit	2	Yes
19	W	02-5	TD>up.warn.lim.	Density transmitter temperature exceeds upper warning limit	2	Yes
20	H	02-9	TD param.error	Inconsistent parameterization, density transmitter temperature	1	No
21	A	03-0	Pa loss	Loss of absolute pressure	2	Yes
22	A	03-1	Pa<l.alarm lim.	Absolute pressure below lower alarm limit	2	Yes
23	A	03-2	Pa>up.alarm lim.	Absolute pressure exceeds upper alarm limit	2	Yes
24	A	03-3	Pa jump	Absolute pressure gradient exceeds maximum	2	Yes
25	W	03-4	Pa<l.warn.lim.	Absolute pressure below lower warning limit	2	Yes
26	W	03-5	Pa>up.warn.lim.	Absolute pressure exceeds upper warning limit	2	Yes
27	H	03-9	Pa param.error	Inconsistent parameterization, absolute pressure	1	No
28	A	04-0	sd loss	Loss of standard density	2	Yes
29	A	04-1	sd<l.alarm lim.	Standard density below lower alarm limit	2	Yes
30	A	04-2	sd>up.alarm lim.	Standard density exceeds upper alarm limit	2	Yes
31	A	04-3	sd jump	Standard density gradient exceeds maximum	2	Yes
32	W	04-4	sd<l.warn.limit	Standard density below lower warning limit	2	Yes
33	W	04-5	sd>up.warn.lim.	Standard density exceeds upper warning limit	2	Yes
34	W	04-6	Vo warning	Vo failure, effect of fault: warning	2	Yes
35	A	04-7	HW pulse comp.	Hardware pulse comparison has taken effect	1	Yes
36	W	04-8	Run deviation	Quantitative comparison for synchronous run has taken effect	1	Yes

37	H	04-9	sd param.error	Inconsistent parameterization, standard density	1	No
38	A	05-0	R loss	Loss of density	2	Yes
39	A	05-1	R<l.alarm lim.	Density below lower alarm limit	2	Yes
40	A	05-2	R>up.alarm lim.	Density exceeds upper alarm limit	2	Yes
41	A	05-3	R jump	Density gradient exceeds maximum	2	Yes
42	W	05-4	R<l.warn.lim.	Density below lower warning limit	2	Yes
43	W	05-5	R>up.warn.lim.	Density exceeds upper warning limit	2	Yes
44	A	05-6	R comp.error	Incorrect density calculation	2	Yes
45	W	05-7	Acc.puls.>max.	Too many temporarily stored pulses with open calibration lock	2	No
46	A	05-8	Vo alarm	Vo failure, effect of fault: alarm	2	Yes
47	H	05-9	R param.error	Inconsistent parameterization, density	1	No
48	A	06-0	Hs loss	Loss of superior calorific value	2	Yes
49	A	06-1	Hs<l.alarm lim.	Superior calorific value below lower alarm limit	2	Yes
50	A	06-2	Hs>up.alarm lim.	Superior calorific value exceeds upper alarm limit	2	Yes
51	A	06-3	Hs jump	Superior calorific value gradient exceeds maximum	2	Yes
52	W	06-4	Hs<l.warn.lim.	Superior calorific value below lower warning limit	2	Yes
53	W	06-5	Hs>up.warn.lim.	Superior calorific value exceeds upper warning limit	2	Yes
54	H	06-9	Hs param.error	Inconsistent parameterization, superior calorific value	1	No
55	A	07-0	CO2 loss	Loss of carbon dioxide	2	Yes
56	A	07-1	CO2<l.alarm lim.	Carbon dioxide below lower alarm limit	2	Yes
57	A	07-2	CO2>up.alarm lim.	Carbon dioxide exceeds upper alarm limit	2	Yes
58	A	07-3	CO2 jump	Carbon dioxide gradient exceeds maximum	2	Yes
59	W	07-4	CO2<l.warn.lim.	Carbon dioxide below lower warning limit	2	Yes
60	W	07-5	CO2>up.warn.lim.	Carbon dioxide exceeds upper warning limit	2	Yes
61	H	07-9	CO2 param.error	Inconsistent parameterization, carbon dioxide	1	No
62	A	08-0	VSM loss	Loss of VSM	2	Yes
63	A	08-1	VSM<l.alarm lim.	VSM below lower alarm limit	2	Yes
64	A	08-2	VSM>up.alarm lim.	VSM exceeds upper alarm limit	2	Yes
65	A	08-3	VSM jump	VSM gradient exceeds maximum	2	Yes
66	W	08-4	VSM<l.warn.lim.	VSM below lower warning limit	2	Yes
67	W	08-5	VSM>up.warn.lim.	VSM exceeds upper warning limit	2	Yes
68	H	08-9	VSM param.error	Inconsistent parameterization, VSM	1	No
69	A	09-0	H2 loss	Loss of hydrogen	2	Yes
70	A	09-1	H2<l.alarm lim.	Hydrogen below lower alarm limit	2	Yes
71	A	09-2	H2>up.alarm lim.	Hydrogen exceeds upper alarm limit	2	Yes
72	A	09-3	H2 jump	Hydrogen gradient exceeds maximum	2	Yes
73	W	09-4	H2<l.warn.lim.	Hydrogen below lower warning limit	2	Yes
74	W	09-5	H2>up.warn.lim.	Hydrogen exceeds upper warning limit	2	Yes
75	H	09-9	H2 param.error	Inconsistent parameterization, hydrogen	1	No
76	W	10-8	Def. channel 1	Channel 1 failed	1	No
77	W	10-9	Def. channel 2	Channel 2 failed	1	No
78	W	11-0	Start-up>max.	Meter start-up time too long	2	Yes
79	W	11-1	Slow-down>max.	Meter slow-down time too long	2	Yes
80	A	12-0	VSB loss	Loss of VSB	2	Yes
81	A	12-1	VSB<l.alarm lim.	VSB below lower alarm limit	2	Yes
82	A	12-2	VSB>up.alarm lim.	VSB exceeds upper alarm limit	2	Yes

83	A	12-3	VSB jump	VSB gradient exceeds maximum	2	Yes
84	W	12-4	VSB<l.warn.lim.	VSB below lower warning limit	2	Yes
85	W	12-5	VSB>up.warn.lim.	VSB exceeds upper warning limit	2	Yes
86	H	12-9	VSB param.error	Inconsistent parameterization, VSB	1	No
87	A	13-0	Pg loss	Loss of gauge pressure	2	Yes
88	A	13-1	Pg<l.alarm lim.	Gauge pressure below lower alarm limit	2	Yes
89	A	13-2	Pg>up.alarm lim.	Gauge pressure exceeds upper alarm limit	2	Yes
90	A	13-3	Pg jump	Gauge pressure gradient exceeds maximum	2	Yes
91	W	13-4	Pg<l.warn.lim.	Gauge pressure below lower warning limit	2	Yes
92	W	13-5	Pg>up.warn.lim.	Gauge pressure exceeds upper warning limit	2	Yes
93	H	13-9	Pg param.error	Inconsistent parameterization, gauge pressure	1	No
94	A	19-0	N2 loss	Loss of nitrogen	2	Yes
95	A	19-1	N2<l.alarm lim.	Nitrogen below lower alarm limit	2	Yes
96	A	19-2	N2>up.alarm lim.	Nitrogen exceeds upper alarm limit	2	Yes
97	A	19-3	N2 jump	Nitrogen gradient exceeds maximum	2	Yes
98	W	19-4	N2<l.warn.lim.	Nitrogen below lower warning limit	2	Yes
99	W	19-5	N2>up.warn.lim.	Nitrogen exceeds upper warning limit	2	Yes
100	H	19-9	N2 param.error	Inconsistent parameterization, nitrogen	1	No
101	H	30-0	Malloc error	Dynamic memory allocation error	1	No
102	H	31-9	CAN fault	CAN bus malfunction	2	No
103	H	32-0	CAN overflow	CAN bus overflow	1	No
104	A	32-1	BM failure	Failure of the billing-mode signal	2	Yes
105	A	32-2	CRC12 error	Official character of custody transfer GC data violated	2	No
106	H	32-3	GC syntax	GC communications disturbed	1	No
107	H	32-4	GC comm.	GC communications disturbed	1	No
108	H	32-5	Overheating	Device is overheated	2	No
109	H	32-6	Undercooling	Device is undercooled	2	No
110	A	32-7	V.d.Waals alarm	Van der Waals iteration is running amok	2	Yes
111	M	33-0	Bill.Mod undef.	Undefinied billing mode	1	No
112	M	33-1	Billing mode 1	Billing mode 1	1	No
113	M	33-2	Billing mode 2	Billing mode 2	1	No
114	M	33-3	Billing mode 3	Billing mode 3	1	No
115	M	33-4	Billing mode 4	Billing mode 4	1	No
116	M	33-5	DSfG-freeze	archive entry because attention f (freeze) on DSfG	1	No
117	H	35-0	Oven-T >> high	Oven temperature extremely high	2	No
118	H	35-1	carrier gas	Carrier gas pressure error	2	No
119	H	35-2	response fakt.	Response Factor error	2	No
120	H	35-3	Chrom.base	Chromatogram baseline error	2	No
121	H	35-4	Oven temp.	Oven temperature error	2	No
122	H	35-5	carrier gas	Carrier gas pressure out of control	2	No
123	H	35-6	Chrom.peak	Chromatogram peak height over the measurement range	2	No
124	H	35-7	GC service	HGC overhaul time	2	No
125	H	36-0	raw sum	Total raw error	2	No
126	H	36-1	retention time	Retention time lock error	2	No
127	H	36-2	autocalibr.	Auto calibration	2	No
128	H	36-3	fieldwork	Fieldwork	2	No
129	H	36-4	GC6000 Hexane+	Hexane+(PV1) high / low alarm	2	No

130	H	36-5	GC6000 propane	Propane(PV2) high / low alarm	2	No
131	H	36-6	GC6000 i-butane	I-butane(PV3) high / low alarm	2	No
132	H	36-7	GC6000 N-butane	N-butane(PV4) high / low alarm	2	No
133	H	37-0	GC6000 Neo-P	neo-Pentane(PV5) high / low alarm	2	No
134	H	37-1	GC6000 i-pentane	I-pentane(PV6) high / low alarm	2	No
135	H	37-2	GC6000 N-pentane	N-pentane(PV7) high / low alarm	2	No
136	H	37-3	GC6000 N2	Nitrogen(PV8) high / low alarm	2	No
137	H	37-4	GC6000 methane	Methane(PV9) high / low alarm	2	No
138	H	37-5	GC6000 CO2	CO2(PV10) high / low alarm	2	No
139	H	37-6	GC6000 ethane	Ethane(PV11) high / low alarm	2	No
140	H	37-7	GC6000 heatval.	Heat value(PV12) high / low alarm	2	No
141	H	38-0	GC6000 density	Density(PV13) high / low alarm	2	No
142	H	38-1	GC6000 Wobbe	Wobbe index(PV14) high / low alarm	2	No
143	H	38-2	GC6000 compresf.	Compressibility factor(PV15) high / low alarm	2	No
144	H	38-3	GC6000 ICV	ICV(PV19) high / low alarm	2	No
145	H	38-4	GC6000 rel.dens.	Relative density(PV20) high / low alarm	2	No
146	H	38-5	GC6000 reserve 1	reserve 1	2	No
147	H	38-6	GC6000 reserve 2	reserve 2	2	No
148	H	38-7	GC6000 reserve 3	reserve 3	2	No
149	W	39-0	GC6000 comm.err.	GC6000 Kommunikationsfehler	2	No
150	W	39-1	cyl.C1 temp.	Cylinder temperature calibration gas 1	2	No
151	W	39-2	cyl.C2 temp.	Cylinder temperature calibration gas 2	2	No
152	W	39-3	cyl.C1 press.	Cylinder pressure calibration gas 1	2	No
153	W	39-4	cyl.C2 press.	Cylinder pressure calibration gas 2	2	No
154	W	39-5	cyl.car. press.	Cylinder pressure carrier gas	2	No
155	W	39-6	GC-room temp.	GC room temperature	2	No
156	W	39-7	filesys. full	filesystem no disc-space	2	No
157	A	39-8	flow signal loss	Loss of flow proportional signal	2	No
158	W	39-9	Calib.failure	Failure during GC6000-Calibration	1	No
159	W	40-0	GC6000 Timeout	GC6000 Timeout	2	No
160	H	40-1	old totalizer	Totalizer directly before setting of new value	1	No
161	H	40-2	new totalizer	Totalizer directly after setting of new value	1	No
162	W	40-3	GC6000 !Calibrf.	It is not possible to calibrate GC6000 without errors	2	No
163	A(R)	40-7	Rebooted	Restart performed	1	No
164	A(R)	42-1	RTC defective	Real time clock is defective	2	No
165	A	43-2	Def.tot.	Totalizer is defective	1	No
166	H	45-0	I1 inp.param.	Current input 1 parameterization error	2	No
167	H	45-1	I2 inp.param.	Current input 2 parameterization error	2	No
168	H	45-2	I3 inp.param.	Current input 3 parameterization error	2	No
169	H	45-3	I4 inp.param.	Current input 4 parameterization error	2	No
170	H	45-4	I5 inp.param.	Current input 5 parameterization error	2	No
171	H	45-5	I6 inp.param.	Current input 6 parameterization error	2	No
172	H	45-6	I7 inp.param.	Current input 7 parameterization error	2	No
173	H	45-7	I8 inp.param.	Current input 8 parameterization error	2	No
174	H	45-8	PT1 inp.param.	Resistance input 1 parameterization error	2	No
175	H	45-9	PT2 inp.param.	Resistance input 2 parameterization error	2	No
176	H	46-0	Cont.param.error	Parameterization of contact input, double seizing	1	No

177	H	46-1	Vo defective	Vo transmitter shows unexpected behaviour	2	No
178	H	46-2	Vo timeout	No more signal from Vo transmitter	2	No
179	H	46-3	Vo protocol	Vo protocol error	2	No
180	H	46-4	Deleted pulses	Stored pulses were deleted	1	No
181	H	46-5	I9 inp.param.	Current input 9 parameterization error	2	No
182	H	46-6	I10 inp.param.	Current input 10 parameterization error	2	No
183	H	46-7	I11 inp.param.	Current input 11 parameterization error	2	No
184	H	46-8	I12 inp.param.	Current input 12 parameterization error	2	No
185	W	47-0	Qm<l.warn.lim.	Flow rate at base conditions below lower warning limit	2	Yes
186	W	47-1	Qm>up.warn.lim.	Flow rate at meas. conditions exceeds upper warning limit	2	Yes
187	W	47-2	Qmc<l.warn.lim.	Corrected flow rate at meas. conditions below lower warning limit	2	Yes
188	W	47-3	Qmc>up.warn.lim.	Corrected flow rate at meas. conditions exceeds upper warning limit	2	Yes
189	W	47-4	Qb<l.warn.lim.	Volumetric flow rate at base conditions below lower warning limit	2	Yes
190	W	47-5	Qb>up.warn.lim.	Volumetric flow rate at base conditions exceeds upper warning limit	2	Yes
191	W	47-6	Qe<l.warn.lim.	Energy flow rate below lower warning limit	2	Yes
192	W	47-7	Qe>up.warn.lim.	Energy flow rate exceeds upper warning limit	2	Yes
193	W	47-8	Qms<l.warn.lim.	Mass flow rate below lower warning limit	2	Yes
194	W	47-9	Qms>up.warn.lim.	Mass flow rate exceeds upper warning limit	2	Yes
195	A	48-0	CAN timeout	CAN bus timeout	2	No
196	H	48-1	Def.modem	Modem is defective or switched off	1	No
197	M	48-2	Factory state	I am a device which has not been tested.	1	No
198	H	48-3	PT1 open circ.	Resistance measurement 1 shows open circuit	2	No
199	H	48-4	PT2 open circ.	Resistance measurement 2 shows open circuit	2	No
200	A	48-5	C fact.failure	Primary value for conversion factor calculation is missing	2	No
201	H	48-6	PT3 inp.param.	Resistance input 3 parameterization error	2	No
202	H	48-7	PT4 inp.param.	Resistance input 4 parameterization error	2	No
203	A	50-0	T<>GERG lim.	Temperature exceeds GERG limits	2	Yes
204	A	50-1	P<>GERG lim.	Pressure exceeds GERG limits	2	Yes
205	A	50-2	rd<>GERG lim.	Relative density exceeds GERG limits	2	Yes
206	A	50-3	CO2<>GERG lim.	Carbon dioxide exceeds GERG limits	2	Yes
207	A	50-4	N2<>GERG lim.	Nitrogen exceeds GERG limits	2	Yes
208	A	50-5	Hs<>GERG lim.	Superior calorific value exceeds GERG limits	2	Yes
209	A	50-6	H2<>GERG lim.	Hydrogen exceeds GERG limits	2	Yes
210	A	50-8	GERG iter.max	Maximum permissible GERG iterations exceeded	2	Yes
211	A	51-0	T<>AGA limit	Temperature exceeds AGA limits	2	Yes
212	A	51-1	P<>AGA limit	Pressure exceeds AGA limits	2	Yes
213	A	51-2	rd<>AGA limit	Relative density exceeds AGA limits	2	Yes
214	A	51-3	CO2<>AGA limit	Carbon dioxide exceeds AGA limits	2	Yes
215	A	51-4	N2<>AGA limit	Nitrogen exceeds AGA limits	2	Yes
216	A	51-5	Hs<>AGA limit	Superior calorific value exceeds AGA limits	2	Yes
217	A	51-6	H2<>AGA limit	Hydrogen exceeds AGA limits	2	Yes
218	A	51-7	AGA oth.errors	Other AGA errors	2	Yes
219	A	51-8	AGA-pi,tau	AGA interim result, pi,tau exceed limits	2	Yes

220	A	51-9	Interp.pt.probl.	Error during calculation of interpolation point	2	Yes
221	A	52-0	Q<Qmin	Flow rate at measurement conditions below minimum	2	Yes
222	A	52-1	Q>Qmax	Flow rate at measurement conditions exceeds maximum	2	Yes
223	M	52-2	Call	Carrier signal modem	1	No
224	M	52-3	PTB time	PTB's telephone time service time has been detected	1	No
225	W	52-4	Bus-ID<>12	Bus identification for remote data transmission has not exactly 12 characters	1	No
226	W	52-5	RDT ID<>16	Remote data transmission identification has not exactly 16 characters	1	No
227	A	52-6	illegal	Illegal operating mode	2	No
228	M	54-0	Calibr. lock	Calibration lock is open	1	No
229	M	54-1	User lock	User lock is open	1	No
230	M	54-2	Revision	Revision switch is open	1	No
231	M	54-3	Red.GQM active	Redundant gas quality measurement active	1	No
232	W	54-4	GQM1 failure	Gas quality measurement 1 failure	2	No
233	W	54-5	GQM2 failure	Gas quality measurement 2 failure	2	No
234	W	54-6	sd GQM1 failure	Loss of standard density (GQM1)	2	No
235	W	54-7	sd GQM2 failure	Loss of standard density (GQM2)	2	No
236	W	54-8	Hs GQM1 failure	Loss of superior calorific value (GQM1)	2	No
237	W	54-9	Hs GQM2 failure	Loss of superior calorific value (GQM2)	2	No
238	W	55-0	CO2 GQM1 failure	Loss of carbon dioxide (GQM1)	2	No
239	W	55-1	CO2 GQM2 failure	Loss of carbon dioxide (GQM2)	2	No
240	W	55-2	H2 GQM1 failure	Loss of hydrogen (GQM1)	2	No
241	W	55-3	H2 GQM2 failure	Loss of hydrogen (GQM2)	2	No
242	W	55-4	N2 GQM1 failure	Loss of mitrogen (GQM1)	2	No
243	W	55-5	N2 GQM2 failure	Loss of mitrogen (GQM2)	2	No
244	W	55-6	VOS<>theory	VOS deviation between measurement and theory	2	No
245	W	55-7	Master clock	Master clock shows unexpected behaviour	2	No
246	W	55-8	rd GQM1 failure	Loss of relative density (GQM1)	2	No
247	W	55-9	rd GQM2 failure	Loss of relative density (GQM2)	2	No
248	A(R)	56-0	Channel 1 fault	Pulse counting channel 1 implausible	1	No
249	A(R)	56-1	Channel 2 fault	Pulse counting channel 2 implausible	1	No
250	A	56-2	Tc/Tb comb.	Tc/Tb combination not permitted	1	No
251	H	56-3	CAN check	CAN bus plausibilization	1	No
252	H	56-4	Service request	Service staff urgently required	1	No
253	H	56-5	Old time	Time immediately before time adjustment	1	No
254	H	56-6	New time	Time immediately after time adjustment	1	No
255	A(R)	56-7	Power OFF	Supply voltage failure	2	No
256	A(R)	56-8	Channel 3 fault	Pulse counting channel 3 implausible	1	No
257	A(R)	56-9	Channel 4 fault	Pulse counting channel 4 implausible	1	No
258	H	57-0	HF param.error	Inconsistent parameterization, HF	1	No
259	W	58-0	Path 1 loss	Path 1 loss	1	No
260	W	58-1	Path 2 loss	Path 2 loss	1	No
261	W	58-2	Path 3 loss	Path 3 loss	1	No
262	W	58-3	Path 4 loss	Path 4 loss	1	No
263	W	58-4	Path 5 loss	Path 5 loss	1	No
264	W	58-5	Path 6 loss	Path 6 loss	1	No
265	W	58-6	Path 7 loss	Path 7 loss	1	No

266	W	58-7	Path 8 loss	Path 8 loss	1	No
267	W	60-0	Ethane<l.warn.lim.	Ethane below lower warning limit	2	Yes
268	W	60-1	Ethane>up.warn.lim.	Ethane exceeds upper warning limit	2	Yes
269	W	60-2	C3H8<l.warn.lim.	Propane below lower warning limit	2	Yes
270	W	60-3	C3H8>up.war.lim.	Propane exceeds upper warning limit	2	Yes
271	W	60-4	N-C4<l.warn.lim.	N-butane below lower warning limit	2	Yes
272	W	60-5	N-C4>up.warn.lim.	N-butane exceeds upper warning limit	2	Yes
273	W	60-6	I-C4<l.warn.lim.	I-butane below lower warning limit	2	Yes
274	W	60-7	I-C4>up.warn.lim.	I-butane exceeds upper warning limit	2	Yes
275	W	60-8	N-C5<l.warn.lim.	N-pentane below lower warning limit	2	Yes
276	W	60-9	N-C5>up.warn.lim.	N-pentane exceeds upper warning limit	2	Yes
277	W	61-0	I-C5<l.warn.lim.	I-pentane below lower warning limit	2	Yes
278	W	61-1	I-C5>up.warn.lim.	I-pentane exceeds upper warning limit	2	Yes
279	W	61-2	NeoC5<l.warn.lim.	Neo-pentane below lower warning limit	2	Yes
280	W	61-3	NeoC5>up.warn.lim.	Neo-pentane exceeds upper warning limit	2	Yes
281	W	61-4	Hexane<l.warn.lim.	Hexane below lower warning limit	2	Yes
282	W	61-5	Hexane>up.warn.lim.	Hexane exceeds upper warning limit	2	Yes
283	W	61-6	Heptane<l.warn.lim.	Heptane below lower warning limit	2	Yes
284	W	61-7	Heptane>up.war.lim.	Heptane exceeds upper warning limit	2	Yes
285	W	61-8	Octane<l.warn.lim.	Octane below lower warning limit	2	Yes
286	W	61-9	Octane>up.warn.lim.	Octane exceeds upper warning limit	2	Yes
287	W	62-0	Nonane<l.warn.lim.	Nonane below lower warning limit	2	Yes
288	W	62-1	Nonane>up.warn.lim.	Nonane exceeds upper warning limit	2	Yes
289	W	62-2	Decane<l.warn.lim.	Decane below lower warning limit	2	Yes
290	W	62-3	Decane>up.warn.lim.	Decane exceeds upper warning limit	2	Yes
291	W	62-4	H2S<l.warn.lim.	Hydrogen sulphide below lower warning limit	2	Yes
292	W	62-5	H2S>up.warn.lim.	Hydrogen sulphide exceeds upper warning limit	2	Yes
293	W	62-6	H2O<l.warn.lim.	Water below lower warning limit	2	Yes
294	W	62-7	H2O>up.warn.lim.	Water exceeds upper warning limit	2	Yes
295	W	62-8	He<l.warn.lim.	Helium below lower warning limit	2	Yes
296	W	62-9	He>up.warn.lim.	Helium exceeds upper warning limit	2	Yes
297	W	63-0	O2<l.warn.lim.	Oxygen below lower warning limit	2	Yes
298	W	63-1	O2>up.warn.lim.	Oxygen exceeds upper warning limit	2	Yes
299	W	63-2	CO<l.warn.lim.	Carbon monoxide below lower warning limit	2	Yes
300	W	63-3	CO>up.warn.lim.	Carbon monoxide exceeds upper warning limit	2	Yes
301	W	63-4	Ethene<l.warn.lim.	Ethene below lower warning limit	2	Yes
302	W	63-5	Ethene>up.warn.lim.	Ethene exceeds upper warning limit	2	Yes
303	W	63-6	C3H6<l.warn.lim.	Propene below lower warning limit	2	Yes
304	W	63-7	C3H6>up.war.lim.	Propene exceeds upper warning limit	2	Yes
305	W	63-8	Ar<l.warn.lim.	Argon below lower warning limit	2	Yes
306	W	63-9	Ar>up.warn.lim.	Argon exceeds upper warning limit	2	Yes
307	H	64-0	RMGB missing	connection lost, RMG-Bus	2	No
308	H	64-1	RMGB param.err.	Inconsistent parameterization, RMG-Bus	1	No
309	H	64-2	DSfG param.err.	Inconsistent parameterization, DSfG	1	No
310	H	64-3	TCPIP fault	can't initialize TCPIP sockets	2	No
311	H	64-4	buggy software	low grade software code detected	1	No
312	H	64-5	file system	file system unexpected behaviour	1	No

313	H	64-6	DSfG unex. char	DSfG: unexpected characters	2	No
314	H	64-7	DSfG overflow	DSfG: buffer overflow	2	No
315	H	64-8	DSfG checksum	DSfG: checksum incorrect	2	No
316	H	64-9	DSfG broadcast	DSfG: checksum incorrect broadcast telegram	2	No
317	H	65-0	DSfG broadc ign	DSfG: broadcast telegram ignored	2	No
318	H	65-1	DSfG busterm.	DSfG: missing bus termination	2	No
319	H	65-2	Restart archive	Restart archive after cleaning	2	No
320	W	65-3	EAV1 failed	Extra analog value 1 first input valuer failed	2	No
321	W	65-4	EAV1<l.warn.lim.	Extra analog value 1 below lower warning limit	2	No
322	W	65-5	EAV1>up.warn.lim.	Extra analog value 1 exceeds upper warning limit	2	No
323	A	65-6	sd failure 2IV	Standard density, seconde input value failed	2	Yes
324	W	65-7	EAV1 fail. 2IV	Extra analog value 1 second input value failed	2	No
325	W	65-8	EAV2 failed	Extra analog value 2 first input valuer failed	2	No
326	W	65-9	EAV2<l.warn.lim.	Extra analog value 2 below lower warning limit	2	No
327	W	66-0	EAV2>up.warn.lim.	Extra analog value 2 exceeds upper warning limit	2	No
328	W	66-1	EAV2 fail. 2IV	Extra analog value 2 second input value failed	2	No
329	W	66-2	EAV3 failed	Extra analog value 3 first input valuer failed	2	No
330	W	66-3	EAV3<l.warn.lim.	Extra analog value 3 below lower warning limit	2	No
331	W	66-4	EAV3>up.warn.lim.	Extra analog value 3 exceeds upper warning limit	2	No
332	W	66-5	EAV3 fail. 2IV	Extra analog value 3 second input value failed	2	No
333	W	66-6	EAV4 failed	Extra analog value 4 first input valuer failed	2	No
334	W	66-7	EAV4<l.warn.lim.	Extra analog value 4 below lower warning limit	2	No
335	W	66-8	EAV4>up.warn.lim.	Extra analog value 4 exceeds upper warning limit	2	No
336	W	66-9	EAV4 fail. 2IV	Extra analog value 4 second input value failed	2	No
337	W	67-0	EAV5 failed	Extra analog value 5 first input valuer failed	2	No
338	W	67-1	EAV5<l.warn.lim.	Extra analog value 5 below lower warning limit	2	No
339	W	67-2	EAV5>up.warn.lim.	Extra analog value 5 exceeds upper warning limit	2	No
340	W	67-3	EAV5 fail. 2IV	Extra analog value 5 second input value failed	2	No
341	W	67-4	EAV6 failed	Extra analog value 6 first input valuer failed	2	No
342	W	67-5	EAV6<l.warn.lim.	Extra analog value 6 below lower warning limit	2	No
343	W	67-6	EAV6>up.warn.lim.	Extra analog value 6 exceeds upper warning limit	2	No
344	W	67-7	EAV6 fail. 2IV	Extra analog value 6 second input value failed	2	No
345	W	67-8	EAV7 failed	Extra analog value 7 first input valuer failed	2	No
346	W	67-9	EAV7<l.warn.lim.	Extra analog value 7 below lower warning limit	2	No
347	W	68-0	EAV7>up.warn.lim.	Extra analog value 7 exceeds upper warning limit	2	No
348	W	68-1	EAV7 fail. 2IV	Extra analog value 7 second input value failed	2	No
349	W	68-2	EAV8 failed	Extra analog value 8 first input valuer failed	2	No
350	W	68-3	EAV8<l.warn.lim.	Extra analog value 8 below lower warning limit	2	No
351	W	68-4	EAV8>up.warn.lim.	Extra analog value 8 exceeds upper warning limit	2	No
352	W	68-5	EAV8 fail. 2IV	Extra analog value 8 second input value failed	2	No
353	W	70-0	Pulse 1 >max	Pulse output 1 overflow	2	Yes
354	W	70-1	Pulse 2 >max	Pulse output 2 overflow	2	Yes
355	W	70-2	Pulse 3 >max	Pulse output 3 overflow	2	Yes
356	W	70-3	Pulse 4 >max	Pulse output 4 overflow	2	Yes
357	W	70-6	I1 outp.<min	Current output 1 below minimum	2	Yes
358	W	70-7	I2 outp.<min	Current output 2 below minimum	2	Yes
359	W	70-8	I3 outp.<min	Current output 3 below minimum	2	Yes

360	W	70-9	I4 outp.<min	Current output 4 below minimum	2	Yes
361	W	71-0	I1 outp.>max	Current output 1 exceeds maximum	2	Yes
362	W	71-1	I2 outp.>max	Current output 2 exceeds maximum	2	Yes
363	W	71-2	I3 outp.>max	Current output 3 exceeds maximum	2	Yes
364	W	71-3	I4 outp.>max	Current output 4 exceeds maximum	2	Yes
365	A(R)	71-4	NMA ADC	Namur module A analog/digital-converter	1	No
366	A(R)	71-5	NMA overload	Namur module A overload	1	No
367	A(R)	71-6	NMA OC PT100	Namur module A open circuit PT100	1	No
368	A(R)	71-7	NMA OC mainch.	Namur module A open circuit main channel	1	No
369	A(R)	71-8	NMA OC ref.ch.	Namur module A open circuit reference channel	1	No
370	A(R)	71-9	NMA OC ENCO	Namur module A open circuit ENCO	1	No
371	A(R)	72-0	NMB ADC	Namur module B analog/digital-converter	1	No
372	A(R)	72-1	NMB overload	Namur module B overload	1	No
373	A(R)	72-2	NMB OC PT100	Namur module B open circuit PT100	1	No
374	A(R)	72-3	NMB OC Messk.	Namur module B open circuit main channel	1	No
375	A(R)	72-4	NMB OC Vgl.k.	Namur module B open circuit reference channel	1	No
376	A(R)	72-5	NMB OC ENCO	Namur module B open circuit ENCO	1	No
377	H	73-0	I1 outp.param.	Current output 1 parameterization error	1	No
378	H	73-1	I2 outp.param.	Current output 2 parameterization error	1	No
379	H	73-2	I3 outp.param.	Current output 3 parameterization error	1	No
380	H	73-3	I4 outp.param.	Current output 4 parameterization error	1	No
381	H	74-0	K1 outp.param.	Contact output 1 parameterization error	1	No
382	H	74-1	K2 outp.param.	Contact output 2 parameterization error	1	No
383	H	74-2	K3 outp.param.	Contact output 3 parameterization error	1	No
384	H	74-3	K4 outp.param.	Contact output 4 parameterization error	1	No
385	H	74-4	K5 outp.param.	Contact output 5 parameterization error	1	No
386	H	74-5	K6 outp.param.	Contact output 6 parameterization error	1	No
387	H	74-6	K7 outp.param.	Contact output 7 parameterization error	1	No
388	H	74-7	K8 outp.param.	Contact output 8 parameterization error	1	No
389	W	75-0	t>sd corr.time	Rn calibration time exceeded	2	Yes
390	W	75-1	Rncorr signal	Rn input signal fault, calibration unit	2	Yes
391	W	75-2	Rncorr>perm.(W)	Rn correction value out of permitted range	2	Yes
392	W	75-3	t>Hs corr.time	Hs calibration time exceeded	2	Yes
393	W	75-4	Hscorr signal	Hs input signal fault, calibration unit	2	Yes
394	W	75-5	Hscorr>perm.(W)	Hs correction value formation out of permitted range	2	Yes
395	H	76-0	Module 1A false	Module 1A assembly inplausible	2	No
396	H	76-1	Module 1B false	Module 1B assembly inplausible	2	No
397	H	76-2	Module 2A false	Module 2A assembly inplausible	2	No
398	H	76-3	Module 2B false	Module 2B assembly inplausible	2	No
399	H	76-4	Module 3A false	Module 3A assembly inplausible	2	No
400	H	76-5	Module 3B false	Module 3B assembly inplausible	2	No
401	A	77-0	DP1 (I<3mA)	delta-P cell 1 current lower 3 mA	2	No
402	A	77-1	DP2 (I<3mA)	delta-P cell 2 current lower 3 mA	2	No
403	A	77-2	DP3 (I<3mA)	delta-P cell 3 current lower 3 mA	2	No
404	A	77-3	Beta illegal	illegal diameter ratio throat/pipe	2	No
405	A	77-4	DP1 failure	delta-P cell 1 failure	2	No
406	A	77-5	DP2 failure	delta-P cell 2 failure	2	No

407	A	77-6	DP3 failure	delta-P cell 3 failure	2	No
408	A	77-7	DP>max.	delta-P bigger maximum	2	No
409	H	77-8	DP's incoherent	delta-P team play of cells is not harmonious	2	No
410	H	77-9	HART-Corr>max.	Maximum permitted HART-Correction out of range	2	No
411	H	78-0	DP1-Corr denied	Zero point correction for DP1 not accepted	1	No
412	H	78-1	G486 violated	DVGW G486 (1/3-rule) violated. Gas is incompatible with GERG	2	No
413	A	78-2	GQM-list	GQM-list is fault	2	No
414	A	78-3	Main GQ unknown	Main gas quality unknown identification	2	No
415	A	78-4	Ref GQ unknown	Reference gas quality unknown identification	2	No
416	A	78-5	Main GQ CRC12	Main gas quality CRC12 implausible	2	No
417	A	78-6	Ref GQ CRC12	Reference Gas Quality CRC12 implausible	2	No
418	W	78-7	flow in close	Flow in closed pipe	2	No
419	W	78-8	FC-BIOS old	Flowcomputer bios version is to old	1	No
420	H	78-9	HART1 status	HART 1 status reports trouble	1	No
421	H	79-0	HART2 status	HART 2 status reports trouble	1	No
422	H	79-1	HART3 status	HART 3 status reports trouble	1	No
423	H	79-2	HART4 status	HART 4 status reports trouble	1	No
424	H	79-3	HART5 status	HART 5 status reports trouble	1	No
425	H	79-4	HART6 status	HART 6 status reports trouble	1	No
426	H	79-5	HART9 status	HART 9 status reports trouble	1	No
427	H	79-6	HART10 status	HART 10 status reports trouble	1	No
428	H	79-7	HART11 status	HART 11 status reports trouble	1	No
429	H	79-8	HART12 status	HART 12 status reports trouble	1	No
430	A	80-0	dkvk>max.	Maximum deviation at operating point exceeded	2	Yes
431	A	80-1	IGM SV invalid	IGM invalid substitute value used	2	No
432	A	80-2	Path failure >max	Number of path failure's greater than allowed	2	No
433	H	80-3	AGA8<>range	AGA8 range violation	2	No
434	A	80-4	Eta loss	Loss of viscosity	2	Yes
435	A	80-5	Eta<l.alarm lim.	Viscosity below lower alarm limit	2	Yes
436	A	80-6	Eta>up.alarm lim.	Viscosity exceeds upper alarm limit	2	Yes
437	W	80-7	Eta<l.warn.lim.	Viscosity below lower warning limit	2	Yes
438	W	80-8	Eta>up.warn.lim.	Viscosity exceeds upper warning limit	2	Yes
439	H	80-9	Eta param.error	Inconsistent parameterization, viscosity	1	No
440	A	81-0	Eta jump	Viscosity gradient exceeds maximum	2	Yes
441	W	81-1	Path 1 measurem.	Path 1 measurement quality less as demanded	2	No
442	W	81-2	Path 2 measurem.	Path 2 measurement quality less as demanded	2	No
443	W	81-3	Path 3 measurem.	Path 3 measurement quality less as demanded	2	No
444	W	81-4	Path 4 measurem.	Path 4 measurement quality less as demanded	2	No
445	W	81-5	Path 5 measurem.	Path 5 measurement quality less as demanded	2	No
446	W	81-6	Path 6 measurem.	Path 6 measurement quality less as demanded	2	No
447	W	81-7	Path 7 measurem.	Path 7 measurement quality less as demanded	2	No
448	W	81-8	Path 8 measurem.	Path 8 measurement quality less as demanded	2	No
449	W	81-9	Path 1 communic	Path 1 communication quality less as demanded	2	No
450	W	82-0	Path 2 communic	Path 2 communication quality less as demanded	2	No
451	W	82-1	Path 3 communic	Path 3 communication quality less as demanded	2	No
452	W	82-2	Path 4 communic	Path 4 communication quality less as demanded	2	No

453	W	82-3	Path 5 communic	Path 5 communication quality less as demanded	2	No
454	W	82-4	Path 6 communic	Path 6 communication quality less as demanded	2	No
455	W	82-5	Path 7 communic	Path 7 communication quality less as demanded	2	No
456	W	82-6	Path 8 communic	Path 8 communication quality less as demanded	2	No
457	H	82-7	Path 1 VOS	Path 1 VOS implausible	2	No
458	H	82-8	Path 2 VOS	Path 2 VOS implausible	2	No
459	H	82-9	Path 3 VOS	Path 3 VOS implausible	2	No
460	H	83-0	Path 4 VOS	Path 4 VOS implausible	2	No
461	H	83-1	Path 5 VOS	Path 5 VOS implausible	2	No
462	H	83-2	Path 6 VOS	Path 6 VOS implausible	2	No
463	H	83-3	Path 7 VOS	Path 7 VOS implausible	2	No
464	H	83-4	Path 8 VOS	Path 8 VOS implausible	2	No
465	H	83-5	GQM uncomplete	Main/Reference-GQM via Modbus is uncomplete	2	No
466	A	83-6	HFX miss.pulses	Counter main channel (HFX) malfunction	2	No
467	A	83-7	HFY miss.pulses	Counter reference channel (HFY) malfunction	2	No
468	A	84-0	Kpp loss	Loss of isentropic coefficient	2	Yes
469	A	84-1	Kpp<l.alarm lim.	Isentropic coefficient below lower alarm limit	2	Yes
470	A	84-2	Kpp>up.alarm lim.	Isentropic coefficient exceeds upper alarm limit	2	Yes
471	W	84-3	Kpp<l.warn.lim.	Isentropic coefficient below lower warning limit	2	Yes
472	W	84-4	Kpp>up.warn.lim.	Isentropic coefficient exceeds upper warning limit	2	Yes
473	H	84-5	Kpp param.error	Inconsistent parameterization, isentropic coefficient	1	No
474	A	84-6	Kpp jump	Isentropic coefficient gradient exceeds maximum	2	Yes
475	H	85-0	msg1	Extra hint 1 with changeable short text	2	No
476	H	85-1	msg2	Extra hint 2 with changeable short text	2	No
477	H	85-2	msg3	Extra hint 3 with changeable short text	2	No
478	H	85-3	msg4	Extra hint 4 with changeable short text	2	No
479	H	85-4	msg5	Extra hint 5 with changeable short text	2	No
480	H	85-5	msg6	Extra hint 6 with changeable short text	2	No
481	H	85-6	msg7	Extra hint 7 with changeable short text	2	No
482	H	85-7	msg8	Extra hint 8 with changeable short text	2	No
483	W	86-0	msg1	Extra warning 1 with changeable short text	2	No
484	W	86-1	msg2	Extra warning 2 with changeable short text	2	No
485	W	86-2	msg3	Extra warning 3 with changeable short text	2	No
486	W	86-3	msg4	Extra warning 4 with changeable short text	2	No
487	W	86-4	msg5	Extra warning 5 with changeable short text	2	No
488	W	86-5	msg6	Extra warning 6 with changeable short text	2	No
489	W	86-6	msg7	Extra warning 7 with changeable short text	2	No
490	W	86-7	msg8	Extra warning 8 with changeable short text	2	No
491	A	87-0	msg1	Extra alarm 1 with changeable short text	2	No
492	A	87-1	msg2	Extra alarm 2 with changeable short text	2	No
493	A	87-2	msg3	Extra alarm 3 with changeable short text	2	No
494	A	87-3	msg4	Extra alarm 4 with changeable short text	2	No
495	A	87-4	msg5	Extra alarm 5 with changeable short text	2	No
496	A	87-5	msg6	Extra alarm 6 with changeable short text	2	No
497	A	87-6	msg7	Extra alarm 7 with changeable short text	2	No
498	A	87-7	msg8	Extra alarm 8 with changeable short text	2	No
499	H	88-0	param.ignored	Parameterization ignored	1	No

500	H	88-1	LCD-Type/Speech	Language setting not possible with this LCD-type	1	No
501	A	89-0	JTC loss	Loss of Joule-Thomson coefficient	2	Yes
502	A	89-1	JTC<l.alarm lim.	Joule-Thomson coefficient below lower alarm limit	2	Yes
503	A	89-2	JTC>up.alarm lim.	Joule-Thomson coefficient exceeds upper alarm limit	2	Yes
504	W	89-3	JTC<l.warn.lim.	Joule-Thomson coefficient below lower warning limit	2	Yes
505	W	89-4	JTC>up.warn.lim.	Joule-Thomson coefficient exceeds upper warning limit	2	Yes
506	H	89-5	JTC param.error	Inconsistent parameterization, Joule-Thomson coefficient	1	No
507	A	89-6	JTC jump	Joule-Thomson coefficient gradient exceeds maximum	2	Yes
508	A	89-7	flow in close	Flow in closed pipe	2	No
509	H	89-8	HART-Ver. old	Software version HART-card is to old	1	No
510	H	89-9	EXI-Ver. old	Software version EXI-card is to old	1	No
511	A(R)	90-0	F1 failure	Frequency measurement 1 failed	2	No
512	A(R)	90-1	F2 failure	Frequency measurement 2 failed	2	No
513	A(R)	90-2	F3 failure	Frequency measurement 3 failed	2	No
514	A(R)	90-3	F4 failure	Frequency measurement 4 failed	2	No
515	A(R)	90-4	F5 failure	Frequency measurement 5 failed	2	No
516	A(R)	90-5	F6 failure	Frequency measurement 6 failed	2	No
517	A(R)	90-6	F7 failure	Frequency measurement 7 failed	2	No
518	A(R)	90-7	F8 failure	Frequency measurement 8 failed	2	No
519	A(R)	91-0	I1 failure	Current measurement 1 failed	2	No
520	A(R)	91-1	I2 failure	Current measurement 2 failed	2	No
521	A(R)	91-2	I3 failure	Current measurement 3 failed	2	No
522	A(R)	91-3	I4 failure	Current measurement 4 failed	2	No
523	A(R)	91-4	I5 failure	Current measurement 5 failed	2	No
524	A(R)	91-5	I6 failure	Current measurement 6 failed	2	No
525	A(R)	91-6	I7 failure	Current measurement 7 failed	2	No
526	A(R)	91-7	I8 failure	Current measurement 8 failed	2	No
527	A	91-8	GC components	GC components for complete analysis are bad	2	No
528	H	91-9	Def.display	Display is defective	2	No
529	A(R)	92-0	PT1 failure	Resistance measurement 1 failed	2	No
530	A(R)	92-1	PT2 failure	Resistance measurement 2 failed	2	No
531	A(R)	92-2	HART1 failure	HART 1 input failed	2	No
532	A(R)	92-3	HART2 failure	HART 2 input failed	2	No
533	A(R)	92-4	HART3 failure	HART 3 input failed	2	No
534	A(R)	92-5	HART4 failure	HART 4 input failed	2	No
535	A(R)	92-6	HART5 failure	HART 5 input failed	2	No
536	A(R)	92-7	HART6 failure	HART 6 input failed	2	No
537	A(R)	92-8	Corrupt param.	corrupted parameter detected	1	No
538	A(R)	93-0	Def.cont.inp.	Contact input failed	2	No
539	H	93-1	Hscorr>perm.(N)	Ongoing Hs correction value formation out of permitted range	2	Yes
540	H	93-2	Rncorr>perm.(N)	Ongoing Rn correction value formation out of permitted range	2	Yes
541	H	93-3	Function test	A function test is running at the moment	2	No
542	H	93-4	USZ implaus.	USZ transmitter, implausible protocol data	2	No
543	A	93-5	USZ alarm	USZ transmitter signalizes an alarm	2	No
544	A	93-6	USZ timeout	No more signal from USZ transmitter	2	No
545	W	93-7	Vo1 implaus.	USZ totalizer for Vo1 shows implausible behaviour	1	No

546	W	93-8	Vo2 implaus.	USZ totalizer for Vo2 shows implausible behaviour	1	No
547	W	93-9	Vo1D implaus.	USZ totalizer for Vo1D shows implausible behaviour	1	No
548	W	94-0	Vo2D implaus.	USZ totalizer for Vo2D shows implausible behaviour	1	No
549	H	94-1	Time sync.para.	Parameterization of time synchronization implausible	2	No
550	A(R)	94-2	I9 failure	Current measurement 9 failed	2	No
551	A(R)	94-3	I10 failure	Current measurement 10 failed	2	No
552	A(R)	94-4	I11 failure	Current measurement 11 failed	2	No
553	A(R)	94-5	I12 failure	Current measurement 12 failed	2	No
554	A(R)	94-6	PT3 failure	Resistance measurement 3 failed	2	No
555	A(R)	94-7	PT4 failure	Resistance measurement 4 failed	2	No
556	A(R)	95-0	Math.problem	Mathematical error	1	Yes
557	A	95-1	Corrupt code	corrupt code detected	2	No
558	A	95-2	Alarm volume	hard-wired contact of volume transmitter shows alarm	2	No
559	W	95-3	Warning volume	hard-wired contact of volume transmitter shows warning	2	No
560	W	95-4	Time sync fail	Time synchronization failed	1	No
561	H	95-5	Nettime error	Nettime error	1	No
562	A(R)	95-6	HART9 failure	HART 9 input failed	2	No
563	A(R)	95-7	HART10 failure	HART 10 input failed	2	No
564	A(R)	95-8	HART11 failure	HART 11 input failed	2	No
565	A(R)	95-9	HART12 failure	HART 12 input failed	2	No
566	A	96-0	rd loss	Loss of relative density	2	Yes
567	A	96-1	rd<l.alarm lim.	Relative density below lower alarm limit	2	Yes
568	A	96-2	rd>up.alarm lim.	Relative density exceeds upper alarm limit	2	Yes
569	A	96-3	rd jump	Relative density gradient exceeds maximum	2	Yes
570	W	96-4	rd<l.warn.lim.	Relative density below lower warning limit	2	Yes
571	W	96-5	rd>up.warn.lim.	Relative density exceeds upper warning limit	2	Yes
572	H	96-6	rd param.error	Inconsistent parameterization, relative density	1	No
573	A	96-7	Hs GC timeout	No more signal from the superior calorific value transmitter	2	Yes
574	A	96-8	sd GC timeout	No more signal from standard density transmitter	2	Yes
575	A	96-9	rd GC timeout	No more signal from relative density transmitter	2	Yes
576	A	97-0	CO2 GC timeout	No more signal from CO2 transmitter	2	Yes
577	A	97-1	N2 GC timeout	No more signal from N2 transmitter	2	Yes
578	A	97-2	H2 GC timeout	No more signal from H2 transmitter	2	Yes
579	A	97-3	Hs GC alarm	GC reports loss of superior calorific value	2	Yes
580	A	97-4	sd GC alarm	GC reports loss of standard density	2	Yes
581	A	97-5	rd GC alarm	GC reports loss of relative density	2	Yes
582	A	97-6	CO2 GC alarm	GC reports loss of carbon dioxide	2	Yes
583	A	97-7	N2 GC alarm	GC reports loss of nitrogen	2	Yes
584	A	97-8	H2 GC alarm	GC reports loss of hydrogen	2	Yes
585	A	97-9	Beattie alarm	Beattie&Bridgeman iteration is running amok	2	Yes
586	A	98-0	CH4 loss	Loss of methane	2	Yes
587	A	98-1	CH4<l.alarm lim.	Methane below lower alarm limit	2	Yes
588	A	98-2	CH4>up.alarm lim.	Methane exceeds upper alarm limit	2	Yes
589	A	98-3	CH4 jump	Methane gradient exceeds maximum	2	Yes
590	W	98-4	CH4<l.warn.lim.	Methane below lower warning limit	2	Yes
591	W	98-5	CH4>up.warn.lim.	Methane exceeds upper warning limit	2	Yes

592	H	98-6	CH4 param.error	Inconsistent parameterization, methane	1	No
593	A	98-7	Comp.normaliz.	Error occurred during normalization of gas components	2	Yes
594	A	98-8	Inval.act.key	Invalid activation key	2	No
595	H	99-1	TCP after boot	Changed TCP configuration: restart is necessary	1	No
596	A	99-2	CH4 GC timeout	No more signal from methane transmitter	2	Yes
597	A	99-3	CH4 GC alarm	GC reports loss of methane	2	Yes
598	H	99-4	Adjusted float	Floating point parameter adjusted to floating-point notation	1	No
599	A	99-5	VOS corr.error	Error during VOS correction calculation	2	Yes
600	W	99-6	C fac.comp.	Conversion factor is not plausible	2	Yes
601	A	99-7	AGA8 alarm	AGA 8 algorithmic error	2	Yes
602	A	99-8	AGA892DC alarm	AGA 8 92DC algorithmic error	2	Yes
603	W	99-9	Comp.<>AGA 8	Components exceed AGA limits	2	Yes
604	H	59-0	T<>T-tandem	T maximum permitted deviation to tandem partner out of range	1	Yes
605	H	59-1	P<>P-tandem	P maximum permitted deviation to tandem partner out of range	1	Yes
606	H	59-2	Vb<>Vb-Tandem	Vb maximum permitted deviation to tandem partner out of range	1	Yes
607	H	59-3	Vm<>Vm-Tandem	Vm maximum permitted deviation to tandem partner out of range	1	Yes
608	H	59-4	DP2-Corr denied	Zero point correction for DP2 not accepted	1	No
609	H	59-5	DP3-Corr denied	Zero point correction for DP3 not accepted	1	No

Legend

A = Alarm
W = Warning
H = Hint
R = Internal computer error
M = Message

1 / 2 **1=One-valued message (only comes)**
2=Two-valued message (comes and goes)

In the case of a hint (H), a warning can be sent (this depends on the setting in coordinate JA-7); in the case of a message (M), this is not possible.

10 Optional explosion-protected input card

10.1 Operating instructions for the installer

Marking:
Type: EX1-NAMUR-2/V1 or V2

II(2)G [Ex ia] IIC

TÜV 06 ATEX 553139 X
Tamb = -20°C to +60°C
For technical data, see the EC prototype test certificate.

Use:
The module can only be used in conjunction with the ERZ 2000. It is used for electrically separating measuring and control signals such as 20 mA current loops, for example, or adjusting or standardizing signals. The different intrinsically safe circuits are used to operate intrinsically safe field devices in areas subject to explosion hazards. The relevant laws and guidelines which are applicable to the intended use shall be observed. Design version V1 is the standard design for a single-line gas volume corrector, while design version V2 has been designed for a two-line gas volume corrector (optional stage of extension).
Several transmitters or sensors can be connected to the EX1-NAMUR-2 card.
2 volume transmitters with pulse sensors similar to DIN 19234, 1 electronic totalizer (ENCO), 1 pressure sensor (4 to 20mA or HART), 1 temperature sensor (4 to 20mA or HART)
Option: 1 resistance thermometer (PT100 4-wire connection).

Installation and putting into service in areas subject to explosion hazards:
The device is to be installed and put into service by specially trained technical staff only. It is constructed according to the degree of protection IP20 in compliance with EN 60259 and, in the case of adverse environmental conditions exceeding the degree of soiling 2, appropriate precautions are to be taken. It is essential to avoid external heating due to exposure to sunlight or other sources of heat. The intrinsically safe circuits are to be installed in compliance with the installer's specifications. When interconnecting intrinsically safe field devices and intrinsically safe circuits of the relevant devices of the ERZ 2000, make sure that the appropriate maximum values of the field device and the relevant device concerned are observed with regard to explosion protection.
The EC certificate of conformity or prototype test certificate is to be observed. It is of particular importance to comply with the "Special conditions" possibly contained therein.

Putting the device into service
The plug is to be installed properly on the appropriate mating socket and secured mechanically. Operation is only permitted if the housing is completely closed.

Servicing / maintenance:
The fuses of the device may be replaced only if the device is completely disconnected and volt-free. This device may be repaired only by RMG Messtechnik GmbH.

Removal:
During removal, make sure that the sensor cable does not come into contact with other live parts. Make sure that you take appropriate precautions.

11 Electrical connections

11.1 Configuration variants

Due to the compact structure of the ERZ 2000, the assignment of terminals is mainly fixed. There is a zone for spare terminals which requires a different definition of terminal assignments depending on the expansion module used. For information about the locations of expansion cards and the assignment to multipoint connectors, please see the data sheet for the device.

The unassigned slots can optionally be used for the following expansion cards:

DSfG card for corrector and recording entities and DSfG master

Isolating card for volume (measuring and reference channels), Vo, P and T with 4 to 20mA or HART

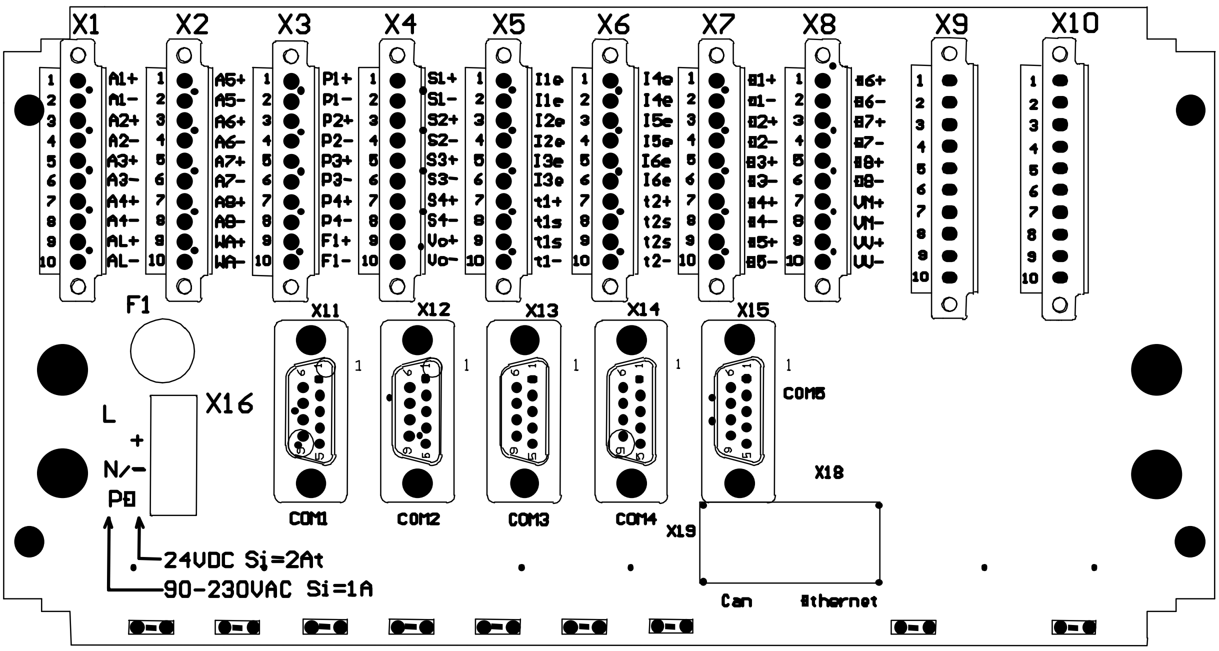
HART card, single for three transmitters or dual for up to 6 transmitters

Profibus (in preparation)

11.2 Terminal diagrams

11.2.1 Rear panel of the device

Since the device has been designed for universal use, there are more terminals than the individual device (e.g. a PTZ corrector) requires. There is a standard assignment of terminals which from the point of view of the numbering always uses the first pins; all the other pins are spare pins or can be assigned via the software. It is also possible to connect the pressure transmitter to one of the unassigned spare inputs and to select it via the software.



11.2.2 Assignment of terminals

X 16 Connection of the supply voltage
In accordance with the device design,
either alternating voltage 90 to 230 V to L, N and PE, with fuse 1 A
or direct voltage 24 V to +, - and PE, with fuse 2 At
is to be connected to X 16

The following assignment of terminals applies to the ERZ 2000 without an internal isolating device Ex1-NAMUR-2/V1 or V2

X 1	Terminal	1	Transistor output 1 +
	Terminal	2	Transistor output 1 -
	Terminal	3	Transistor output 2 +
	Terminal	4	Transistor output 2 -
	Terminal	5	Transistor output 3 +
	Terminal	6	Transistor output 3 -
	Terminal	7	Transistor output 4 +
	Terminal	8	Transistor output 4 -
	Terminal	9	Alarm contact + polarized solid-state relay, closed if de-energized
	Terminal	10	Alarm contact – polarized solid-state relay, closed if de-energized

X 2	Terminal	1	Transistor output 5 +
	Terminal	2	Transistor output 5 -
	Terminal	3	Transistor output 6 +
	Terminal	4	Transistor output 6 -
	Terminal	5	Transistor output 7 +
	Terminal	6	Transistor output 7 -
	Terminal	7	Frequency output + (higher priority) or transistor output 8 +
	Terminal	8	Frequency output - (higher priority) or transistor output 8 -
	Terminal	9	Transistor output warning +
	Terminal	10	Transistor output warning -

X 3	Terminal	1	Pulse output 1 + Dispatcher or totalizer pulses
	Terminal	2	Pulse output 1 - Dispatcher or totalizer pulses
	Terminal	3	Pulse output 2 + Dispatcher or totalizer pulses
	Terminal	4	Pulse output 2 - Dispatcher or totalizer pulses
	Terminal	5	Pulse output 3 + Dispatcher or totalizer pulses
	Terminal	6	Pulse output 3 - Dispatcher or totalizer pulses
	Terminal	7	Pulse output 4 + Dispatcher or totalizer pulses
	Terminal	8	Pulse output 4 – Dispatcher or totalizer pulses
	Terminal	9	Spare 2. Input for Vo with external isolating device +
	Terminal	10	Spare 2. Input for Vo with external isolating device -

X 4	Terminal 1	Current output 1 +
	Terminal 2	Current output 1 -
	Terminal 3	Current output 2 +
	Terminal 4	Current output 2 -
	Terminal 5	Current output 3 +
	Terminal 6	Current output 3 -
	Terminal 7	Current output 4 +
	Terminal 8	Current output 4 -
	Terminal 9	Input for Vo with external isolating device +
	Terminal 10	Input for Vo with external isolating device -

X 5	Terminal 1	Current input 1, active or passive, note the polarity (see examples of connection)	
	Terminal 2	Current input 1, active or passive, note the polarity (see examples of connection)	
	Terminal 3	Current input 2, active or passive, note the polarity (see examples of connection)	
	Terminal 4	Current input 2, active or passive, note the polarity (see examples of connection)	
	Terminal 5	Current input 3, active or passive, note the polarity (see examples of connection)	
	Terminal 6	Current input 3, active or passive, note the polarity (see examples of connection)	
	Terminal 7	PT 100/500/1000 # 1 supply ++	standard connection
	Terminal 8	PT 100/500/1000 # 1 sense +	standard connection
	Terminal 9	PT 100/500/1000 # 1 sense -	standard connection
	Terminal 10	PT 100/500/1000 # 1 supply –	standard connection

X 6	Terminal 1	Current input 4, active or passive, note the polarity (see examples of connection)
	Terminal 2	Current input 4, active or passive, note the polarity (see examples of connection)
	Terminal 3	Current input 5, active or passive, note the polarity (see examples of connection)
	Terminal 4	Current input 5, active or passive, note the polarity (see examples of connection)
	Terminal 5	Current input 6, active or passive, note the polarity (see examples of connection)
	Terminal 6	Current input 6, active or passive, note the polarity (see examples of connection)
	Terminal 7	Current input 7, Note: Polarity vs. 1 to 6 reversed, or spare PT 100*
	Terminal 8	Current input 7, Note: Polarity vs. 1 to 6 reversed, or spare PT 100*
	Terminal 9	Current input 8, Note: Polarity vs. 1 to 6 reversed, or spare PT 100*
	Terminal 10	Current input 8, Note: Polarity vs. 1 to 6 reversed, or spare PT 100*

* You can determine the setting, i.e. either spare PT 100 or current input 7 or 8, via hardware coding (jumper). The setting made in the factory is current input 7 or 8.

X 7	Terminal	1	Signal input 1 + , to be assigned via software
	Terminal	2	Signal input 1 - , to be assigned via software
	Terminal	3	Signal input 2 + , to be assigned via software
	Terminal	4	Signal input 2 - , to be assigned via software
	Terminal	5	Signal input 3 + , to be assigned via software
	Terminal	6	Signal input 3 - , to be assigned via software
	Terminal	7	Signal input 4 + , to be assigned via software
	Terminal	8	Signal input 4 - , to be assigned via software
	Terminal	9	Signal input 5 + , to be assigned via software
	Terminal	10	Signal input 5 - , to be assigned via software

X 8	Terminal	1	Signal input 6 + , to be assigned via software
	Terminal	2	Signal input 6 - , to be assigned via software
	Terminal	3	Signal input 7 + *(spare for second volume input measuring channel)*
	Terminal	4	Signal input 7 - *(spare for second volume input measuring channel)*
	Terminal	5	Signal input 8 + *(spare for second volume input reference channel)*
	Terminal	6	Signal input 8 - *(spare for second volume input reference channel)*
	Terminal	7	Volume input measuring channel (HFX) + (*external isolation*)
	Terminal	8	Volume input measuring channel (HFX) - (*external isolation*)
	Terminal	9	Volume input reference channel (HFY) + (*external isolation*)
	Terminal	10	Volume input reference channel (HFY) - (*external isolation*)

In the case of the ERZ 2002/2102 (density corrector), the frequency measuring card F 58 is used and X 9 is assigned:

X 9	Terminal	1	Frequency 5 + (density to be assigned via software)
	Terminal	2	Frequency 5 - (density to be assigned via software)
	Terminal	3	Frequency 6 + (standard density to be assigned via software)
	Terminal	4	Frequency 6 - (standard density to be assigned via software)
	Terminal	5	Frequency 7 + (standard density to be assigned via software)
	Terminal	6	Frequency 7 - (standard density to be assigned via software)
	Terminal	7	Frequency 8 + (velocity of sound to be assigned via software)
	Terminal	8	Frequency 8 - (velocity of sound to be assigned via software)
	Terminal	9	Spare / unassigned
	Terminal	10	Spare / unassigned

In the case of the ERZ 2004/2104, the frequency measuring card is not required; terminals X9 and X10 remain unassigned.

Internal isolating device of type Ex1-NAMUR-1/2V1 or V2
TÜV 06 ATEX 553139 X

The following examples refer to the design with an internal isolating device.

If the internal isolating device is used, terminal X 8 of the ERZ 2002/2102 is used for frequency measurements:

X 8	Terminal	1	Signal input 6 + , to be assigned via software
	Terminal	2	Signal input 6 - , to be assigned via software
	Terminal	3	Signal input 7 + , frequency input 5 (density to be assigned via software)
	Terminal	4	Signal input 7 - , frequency input 5 (density to be assigned via software)
	Terminal	5	Signal input 8 +, frequency input 6 (standard density to be assigned via software)
	Terminal	6	Signal input 8 - , frequency input 6 (standard density to be assigned via software)
	Terminal	7	Signal input 9 +, frequency input 7 (standard density to be assigned via software)
	Terminal	8	Signal input 9 -, frequency input 7 (standard density to be assigned via software)
	Terminal	9	Signal input 10 +, frequency input 8 (velocity of sound to be assigned via software)
	Terminal	10	Signal input 10 -, frequency input 8 (velocity of sound to be assigned via software)

If the internal isolating device is used, terminals X 9 and optionally X 10 (observe the polarity!) of the ERZ 2004/2104 are assigned:

X 9	Terminal	1	Explosion-protected option Enco + (Vo)
	Terminal	2	Explosion-protected option Enco – (Vo)
	Terminal	3	Explosion-protected option Vm measuring channel (HFX) +
	Terminal	4	Explosion-protected option Vm measuring channel (HFX) -
	Terminal	5	Explosion-protected option Vm reference channel (HFY) +
	Terminal	6	Explosion-protected option Vm reference channel (HFY) -
	Terminal	7	Explosion-protected option pressure measurements - transmitter (optionally HART)
	Terminal	8	Explosion-protected option pressure measurements + transmitter (optionally HART)
	Terminal	9	Expl.-prot. option temperature - transmitter (optionally HART) for PT100 see X10
	Terminal	10	Expl.-prot. option temperature + transmitter (optionally HART) for PT100 see X10

X 10	Terminal	1	Spare / unassigned (explosion-protected option for two-line design)
	Terminal	2	Spare / unassigned (explosion-protected option for two-line design)
	Terminal	3	Spare / unassigned (explosion-protected option for two-line design)
	Terminal	4	Spare / unassigned (explosion-protected option for two-line design)
	Terminal	5	Spare / unassigned (explosion-protected option for two-line design)
	Terminal	6	Spare / unassigned (explosion-protected option for two-line design)
	Terminal	7	Explosion-protected option PT 100 supply +
	Terminal	8	Explosion-protected option PT 100 sense +
	Terminal	9	Explosion-protected option PT 100 sense -
	Terminal	10	Explosion-protected option PT 100 supply -

Note when using the internal isolating device:
It is possible to mix inputs with regard to explosion protection, i.e. a single signal can also be used with an external isolating device or with the explosion-proof enclosure type of protection mixed with the intrinsically safe type of protection.
Example: The volume inputs for the measuring and reference channels and the original ENCO totalizer are assigned to X 9 and operated via the internal isolating card, while the pressure sensor as a 4 to 20 mA transmitter and the temperature sensor as a PT 100 (4-wire connection) are operated with the explosion-proof enclosure type of protection and connected to X 5.
Other possible mixtures are conceivable.

Data interfaces

X 11 COM 1 interface (first Modbus RTU or ASCII)

X 12 COM 2 interface (for ultrasonic flowmeter, DZU)

X 13 COM 3 interface (DSfG master or second Modbus)

X 14 COM 4 interface (DSfG or RMG bus)

X 15 COM 5 interface (for external modem)

X 18 Ethernet network connection (for remote operation or Modbus IP)

X 19 CAN bus for external expansions

11.2.3 Pin assignments for COM 1, COM 2, COM 3, COM 4 and COM 5:

COM 1

Pin	*RS 232 mode*	*RS422 mode*	*RS 485 mode*
1	+U (+5V DC)	+U (+5V DC)	+U (+5V DC)
2	RxD	TxD-A	..
3	TxD	..	R/TA A data
4	..	RxD-A	..
5	GND	GND	SGND Signal ground
6	..	TxD-B	..
7	..	..	..
8	..	RxD-B	R/TN B data
9	..	..	..

COM 2 (RS 232)

Pin	
1	..
2	RxD
3	TxD
4	..
5	GND
6	..
7	..
8	..
9	..

COM 3

Pin	*DSfG mode*		*RS 232 mode*
1	+U	Power supply (+5V DC)	..
2	GND	Reference potential (GND)	RxD
3	R/TA	A data	TxD
4	..	Unassigned	DTR
5	SGND	GND	GND
6	-U	GND	..
7	GND	GND	RTS
8	R/TN	B data	CTS
9	..	Unassigned	..

COM 4

Pin	*DSfG mode*		*RS 232 mode*
1	+U	Power supply (+5V DC)	..
2	GND	Reference potential (GND)	RxD
3	R/TA	A data	TxD
4	..	Unassigned	..
5	SGND	GND	GND
6	-U	GND	
7	GND	GND	
8	R/TN	B data	
9	..	Unassigned	

COM 5 (modem) RS 232

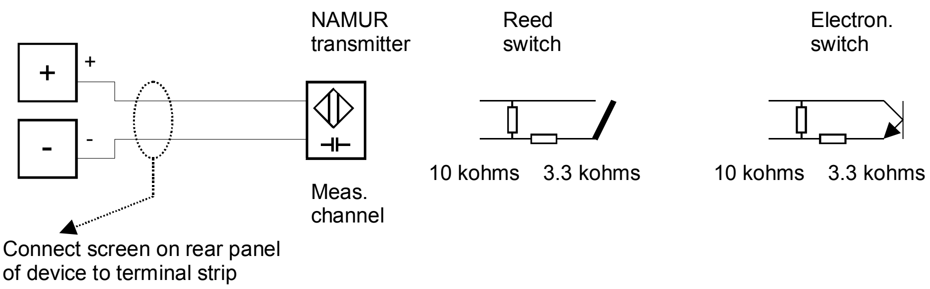
Pin	
1	DCD
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

11.2.4 EX input NAMUR signals: connection options of the measuring input as an example

Volume transmitter NAMUR sensor or switch with line monitoring

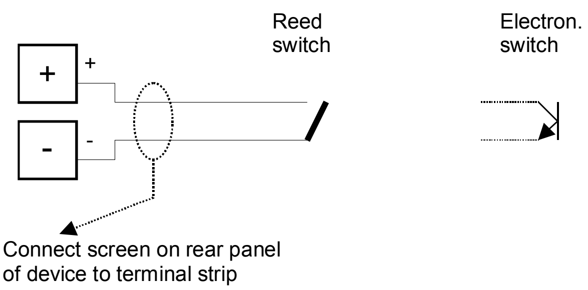
Selectable operating modes:

Standard NAMUR	=> The card adapts to the standardized NAMUR levels
RMG factory settings	=> The card adapts to the optimized levels for the TRZ 03
Manual adjustment	=> The levels set can be adjusted manually



Volume transmitter switch without line monitoring

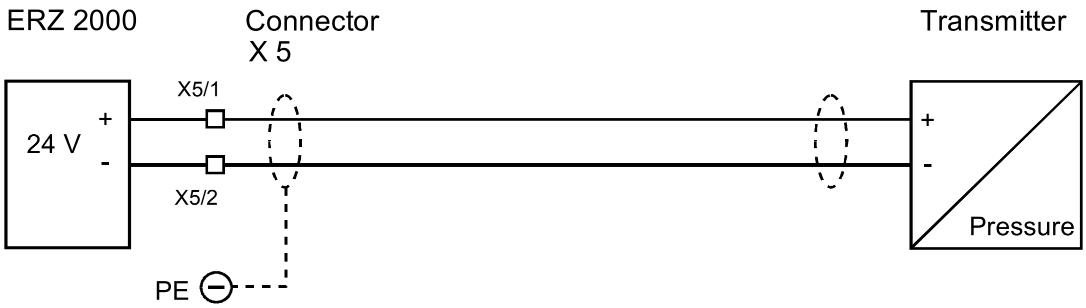
Reed switch or transistor / standard NAMUR setting



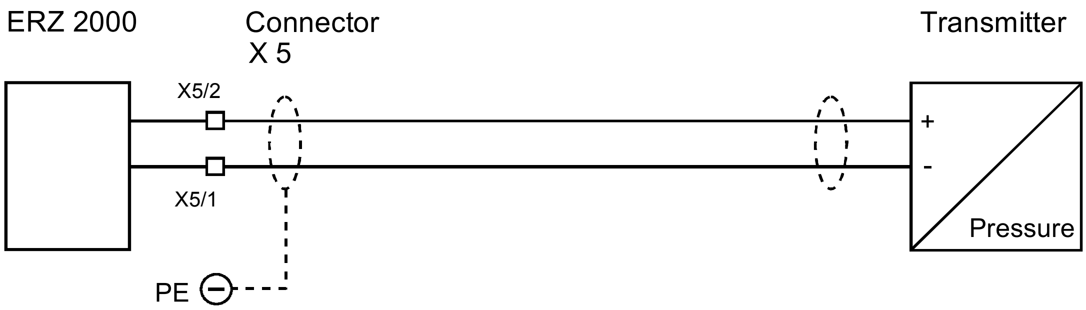
11.2.5 Wiring examples, standard assignments

11.2.5.1 Input of pressure transmitter

Current input, passive (transmitter)

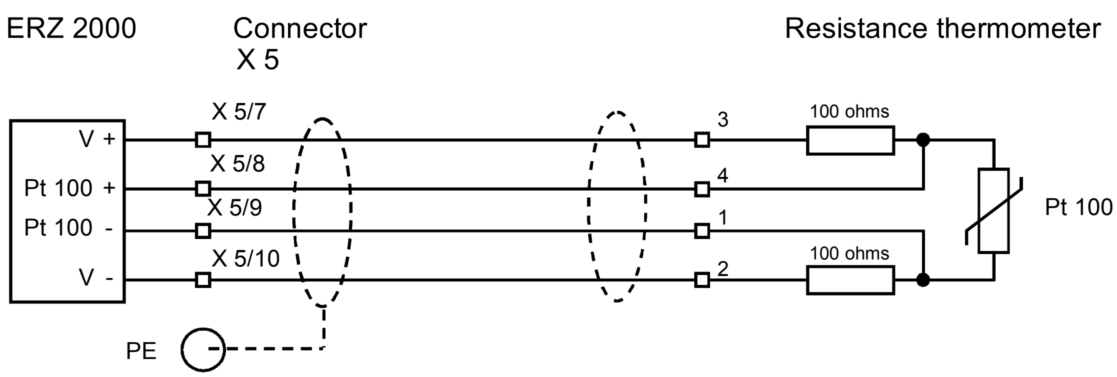


Current input, active e.g. 4 to 20mA

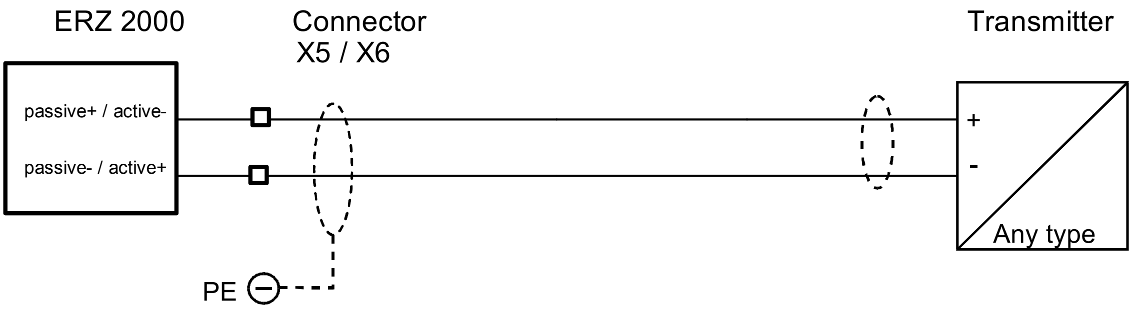


11.2.5.2 Input of resistance thermometer

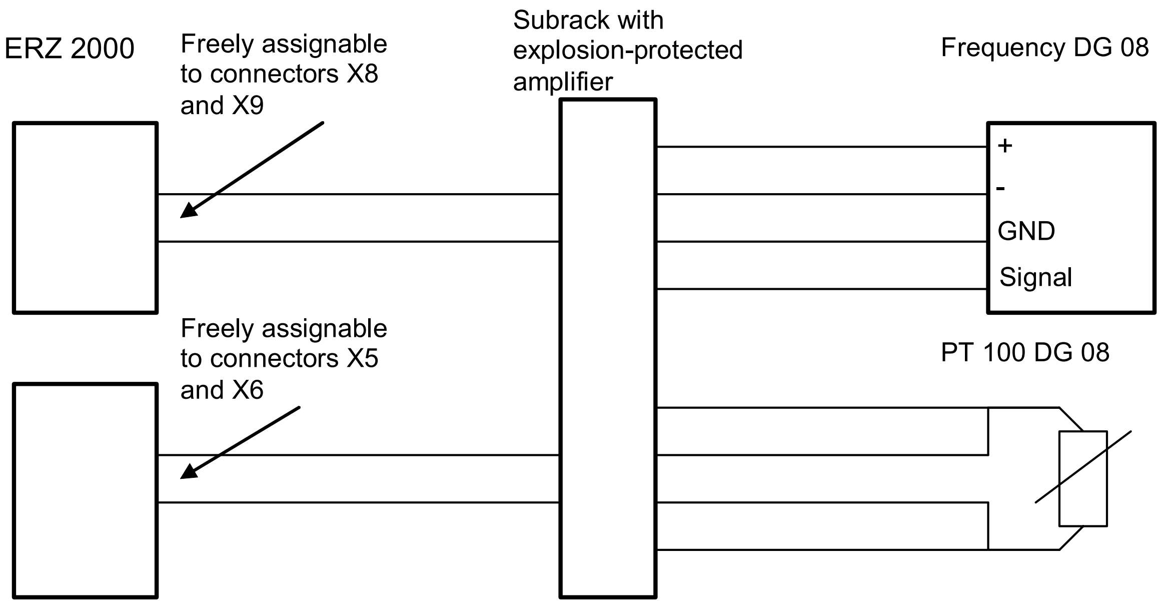
PT 100



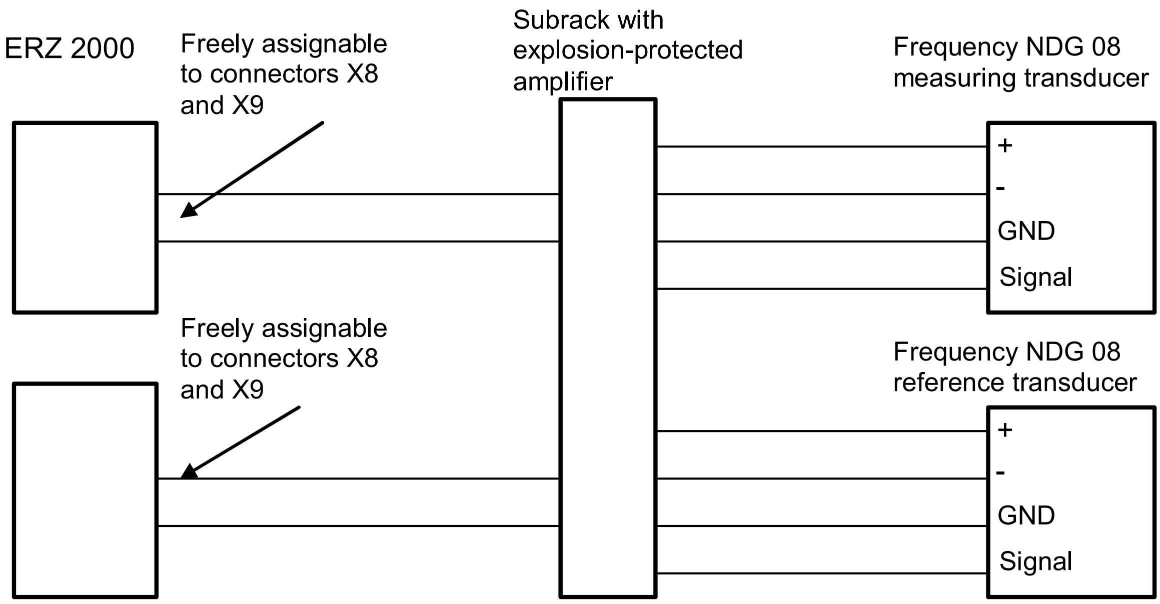
Spare inputs, active / passive e.g. differential-pressure sensor



11.2.5.3 Input of density transducer of type DG08

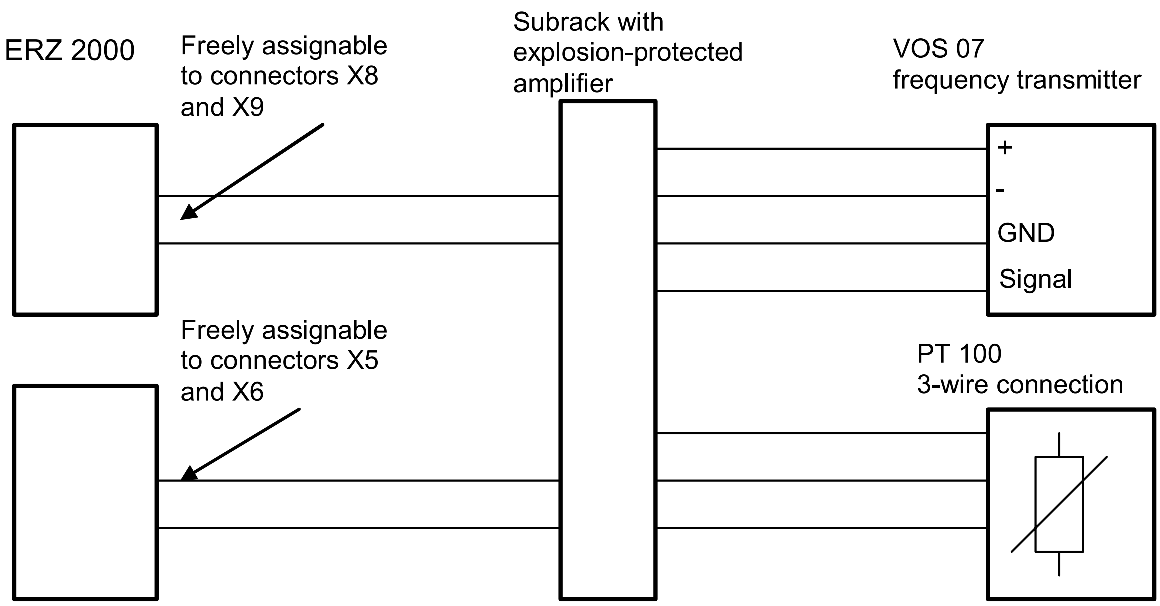


11.2.5.4 Input of standard density transducer of type NDG 08

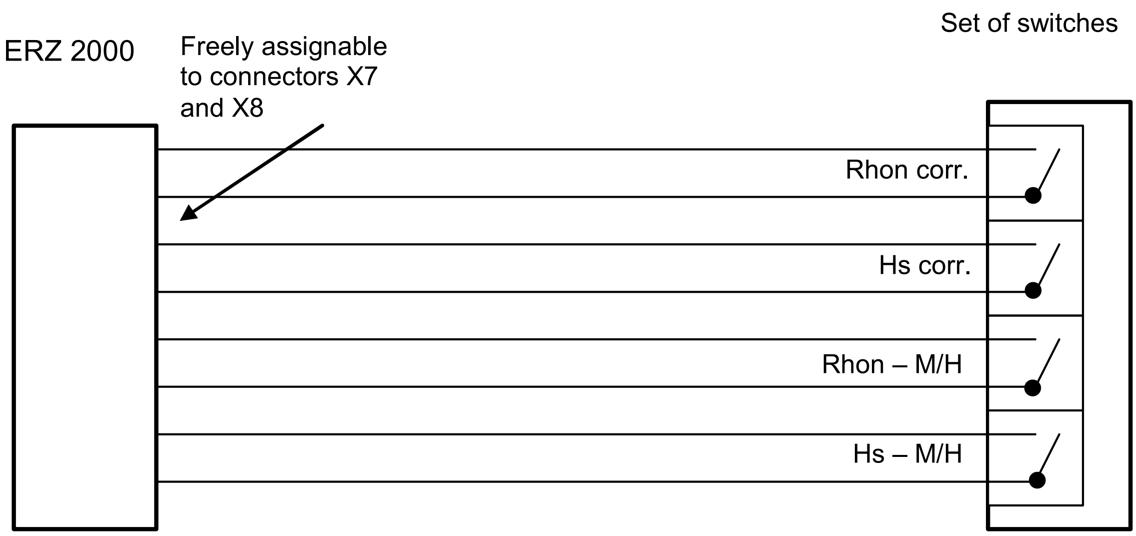


The frequency inputs 5, 6, 7 and 8 are multiplexed by the system. Therefore, make sure that the transducers are connected without interruption, i.e. in sequence.

11.2.5.5 Input of velocity-of-sound transducer of type VOS 07

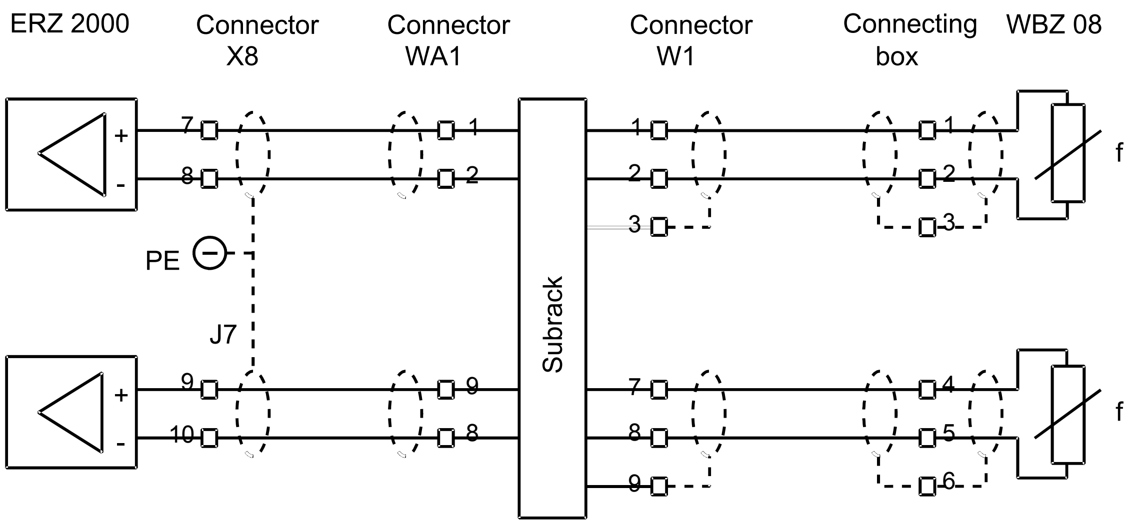


11.2.5.6 Input for standard density/superior calorific value correction

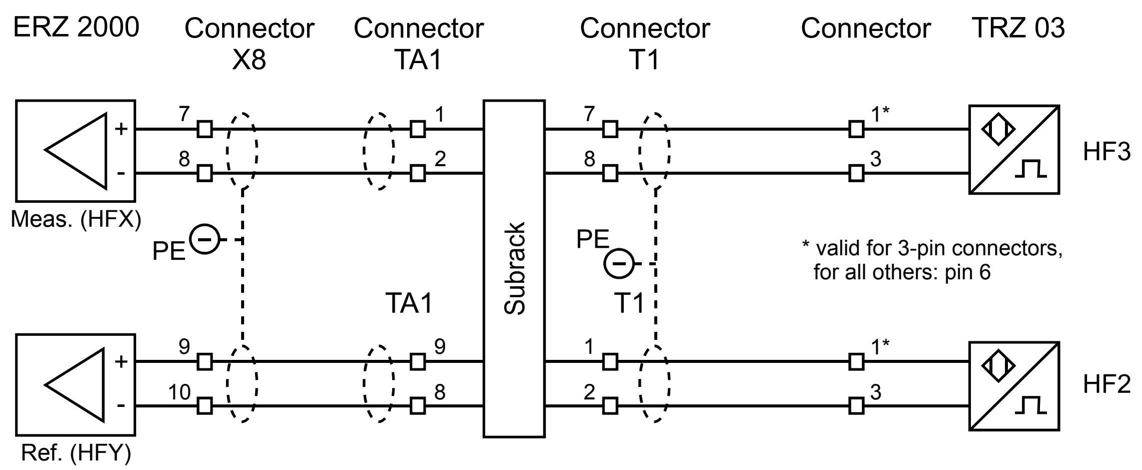


11.2.5.7 Input for volume measurements

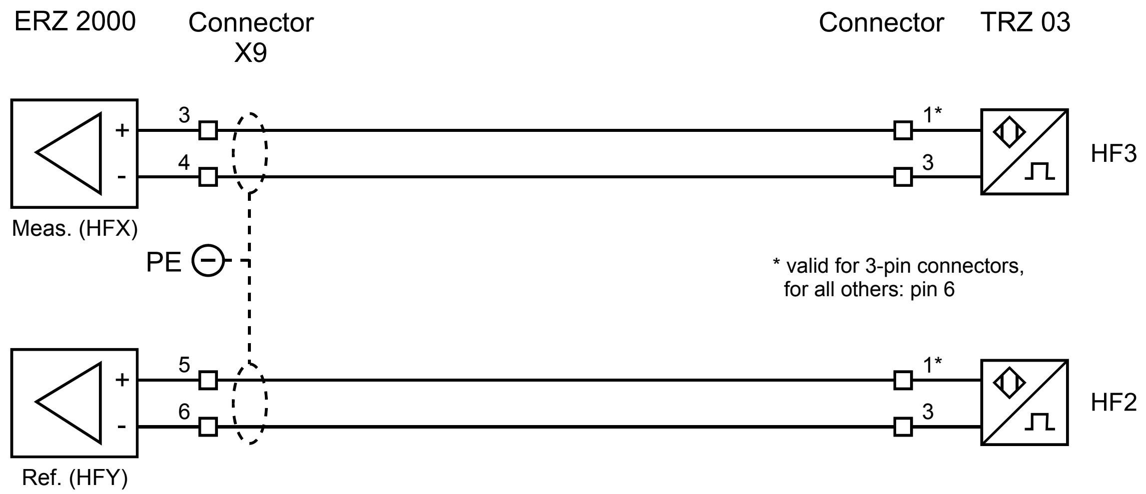
Vortex gas meter



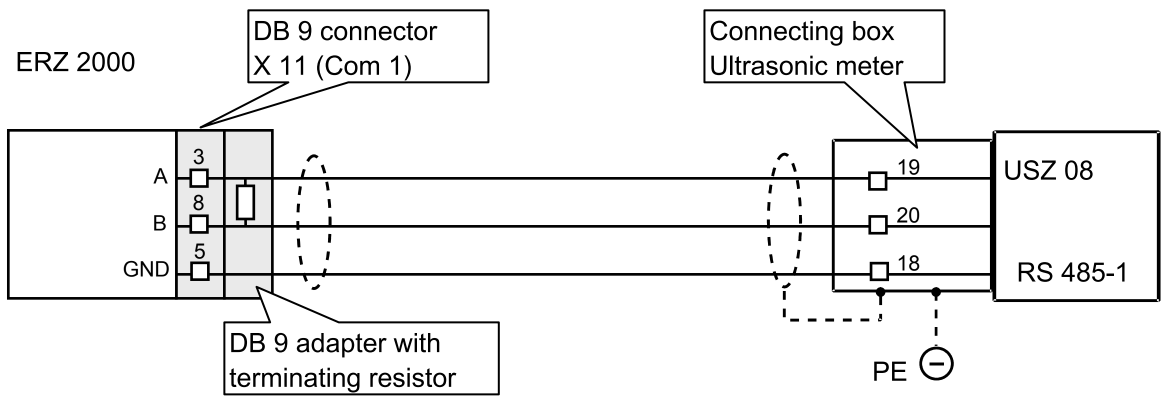
Turbine meter



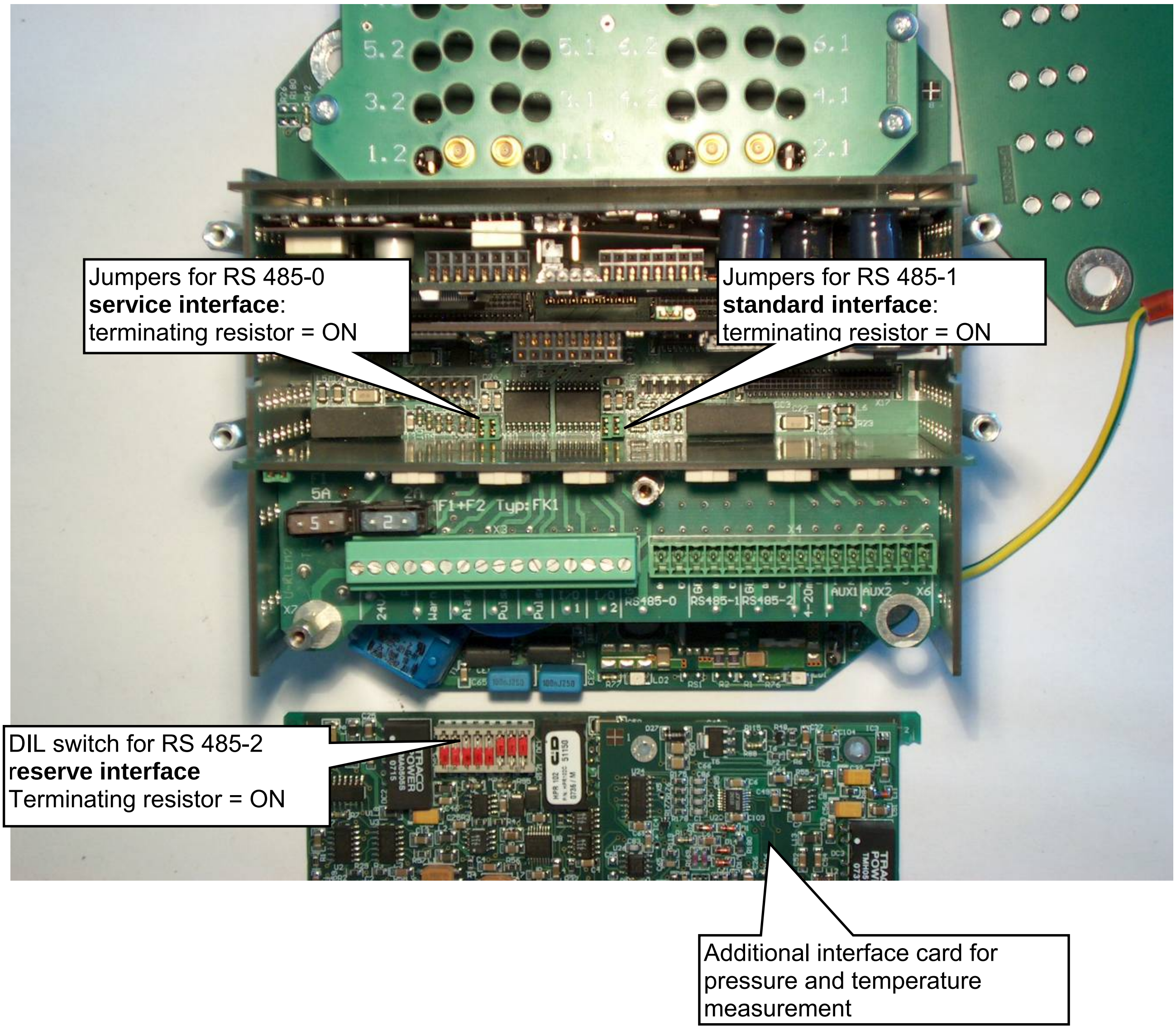
Turbine meter with built-in NAMUR isolating device (option)

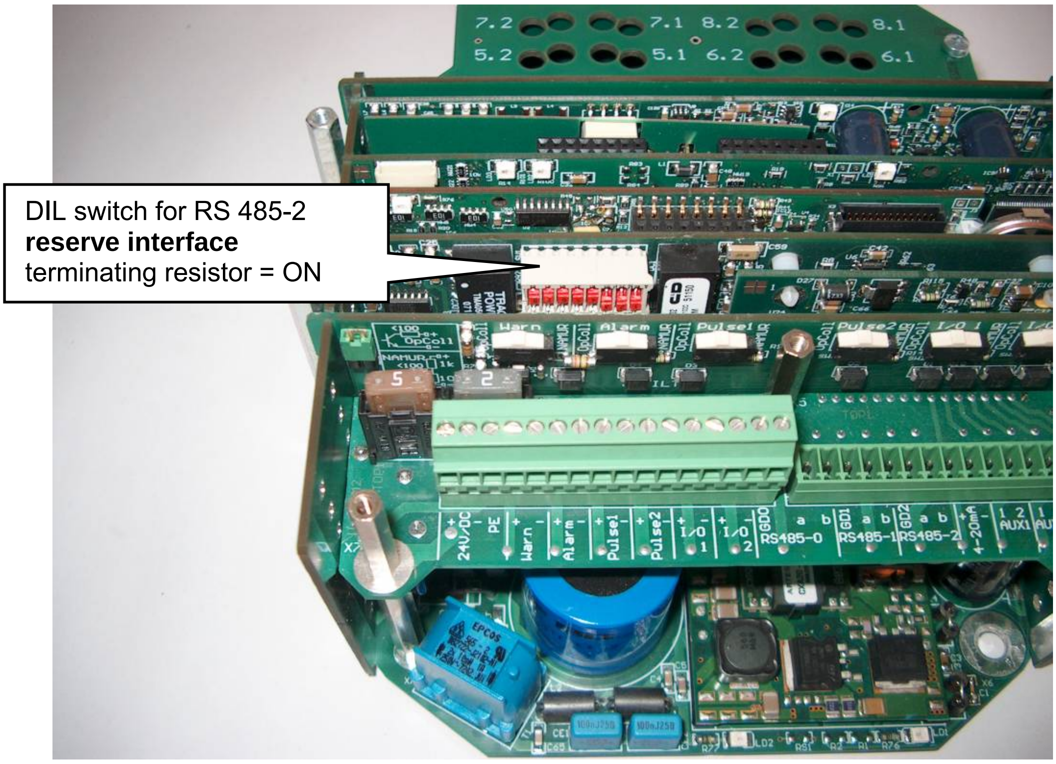


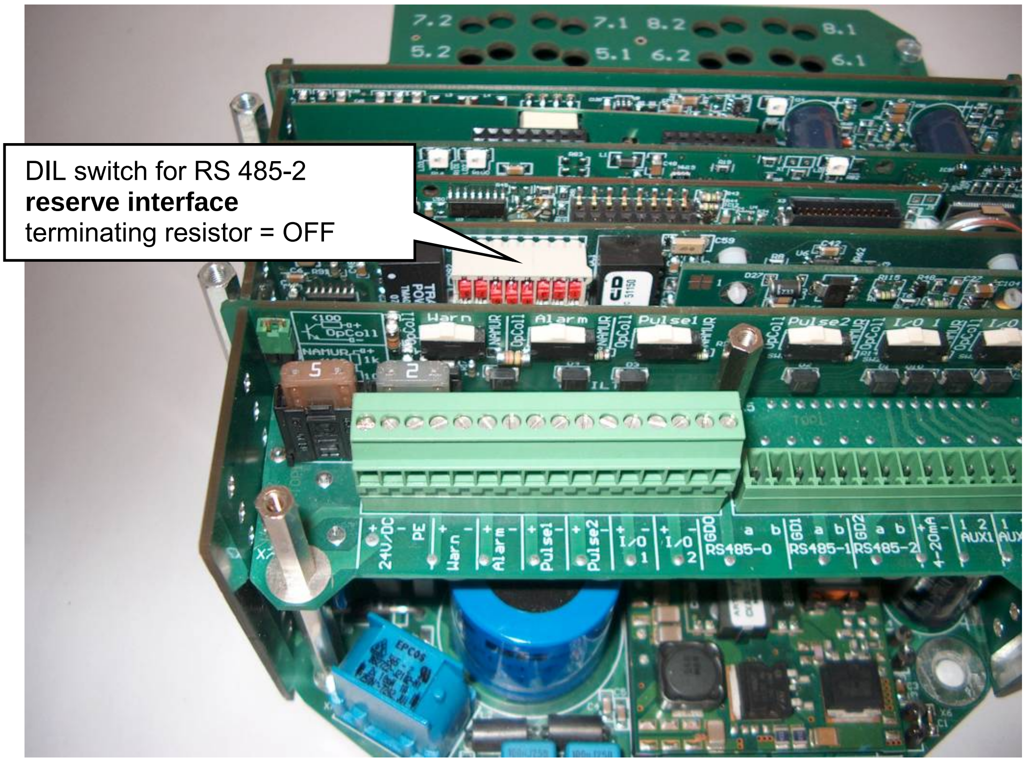
Ultrasonic flowmeter



The following pictures show the USE-09 electronics of the ultrasonic flowmeter

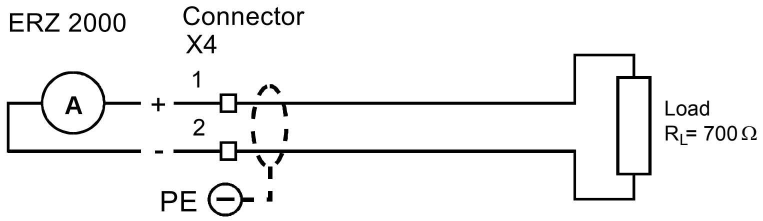



DIL switch for RS 485-2
reserve interface
terminating resistor = ON

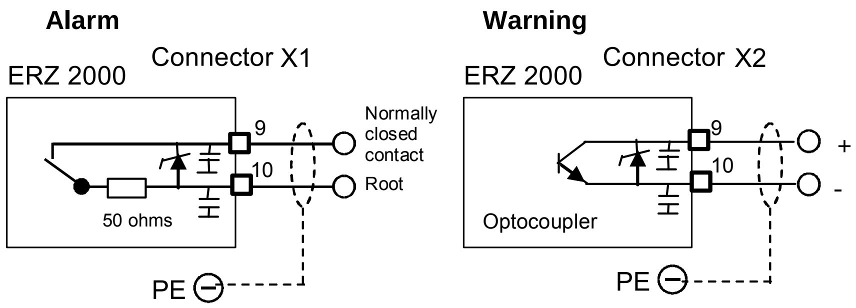

DIL switch for RS 485-2
reserve interface
terminating resistor = OFF

11.2.5.8 Analog output

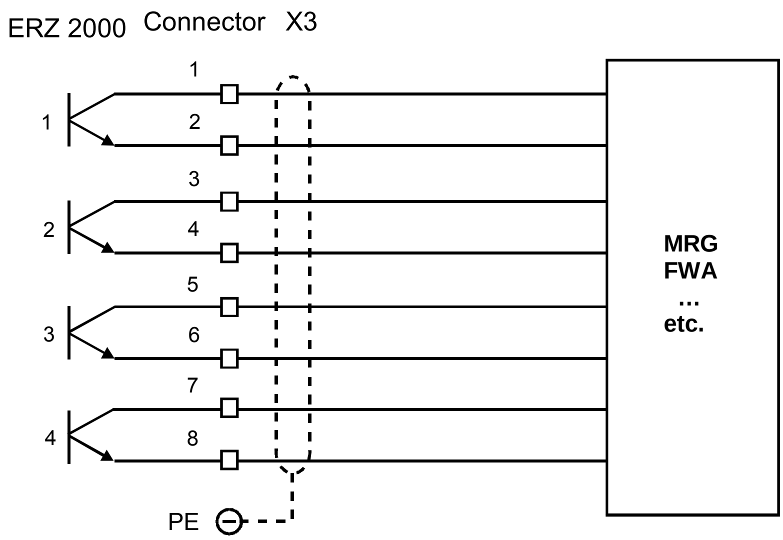
Example: analog output 1



11.2.5.9 Outputs (alarm, warning)



11.2.5.10 Pulse outputs (1 to 4) internal wiring as with warning



11.3 DSfG bus

11.3.1 DSfG connector pin assignments

To connect the device to the DSfG bus, there is a 9-pin male Cannon connector (COM 4) available on the rear panel of the device.

Pin assignments:

1. +5V, connectable via DIP switch
2. GND, connectable via DIP switch
3. RDA/TDA
4. unassigned
5. GND, connectable via DIP switch
6. unassigned
7. GND, connectable via DIP switch
8. TDB/RDB
9. unassigned

GND and +5V supply the RS 485 part with voltage but not the corrector.
The housing of the male Cannon connector is connected electrically to the device casing.

11.3.2 DSfG bus termination

Both ends of the DSfG bus have to be electrically closed (terminated). For this purpose, there are two 8-pin DIP switches on the DSfG interface card. They are used to connect the terminating resistors of the bus and the power supply to the connector. The switch on the left side of the card is dedicated to the corrector and recording entities, while the switch on the right side is dedicated to the master (if available).
In normal DSfG operation (typical German application), the COM 3 interface is used for the function of the master and the COM 4 interface is used for the function of the corrector and recording entities. The interfaces are electrically isolated and comply with the DSfG specification. In order to meet the specification with regard to the bus supply and the quiescent levels, it is possible to activate the resistors and the voltage via DIL switches. The terminating resistor has been deliberatively omitted on the card, since it has to be placed at one end of the trunk cable in compliance with the specification. Thus, it is to be placed externally on the cable or even better on the hub. If the function of the master is additionally activated in an ERZ 2000, a cable is to be taken to the hub not only from COM 4 but also from COM 3. The relevant DIL switches have to be switched on. The cut-out in the cover sheet of the corrector enables the DIL switch of the COM 4 interface to be accessed. Since the master is always a part of the corrector and it is therefore necessary to have two cables connected, there is no difference from a functional point of view whether DIL 1 or 2 is used for activation.

Meaning if switch is closed:

1 Device GND is at the connector housing.
2 GND is at pins 2 and 7 of the connector. Standard: always ON.
3 GND is at pin 5 of the connector. Standard: always ON.
4 Connects the 510 ohm resistor to pin 5 of the connector. Quiescent level GND.
5 Connects the 510 ohm resistor to pin 8 of the connector. Quiescent level GND.
6 Connects the 510 ohm resistor to pin 3 of the connector. Quiescent level 5 V.
7 Connects the 510 ohm resistor to pin 1 of the connector. Quiescent level 5 V.
8 Connects +5V to pin 1 of the connector.

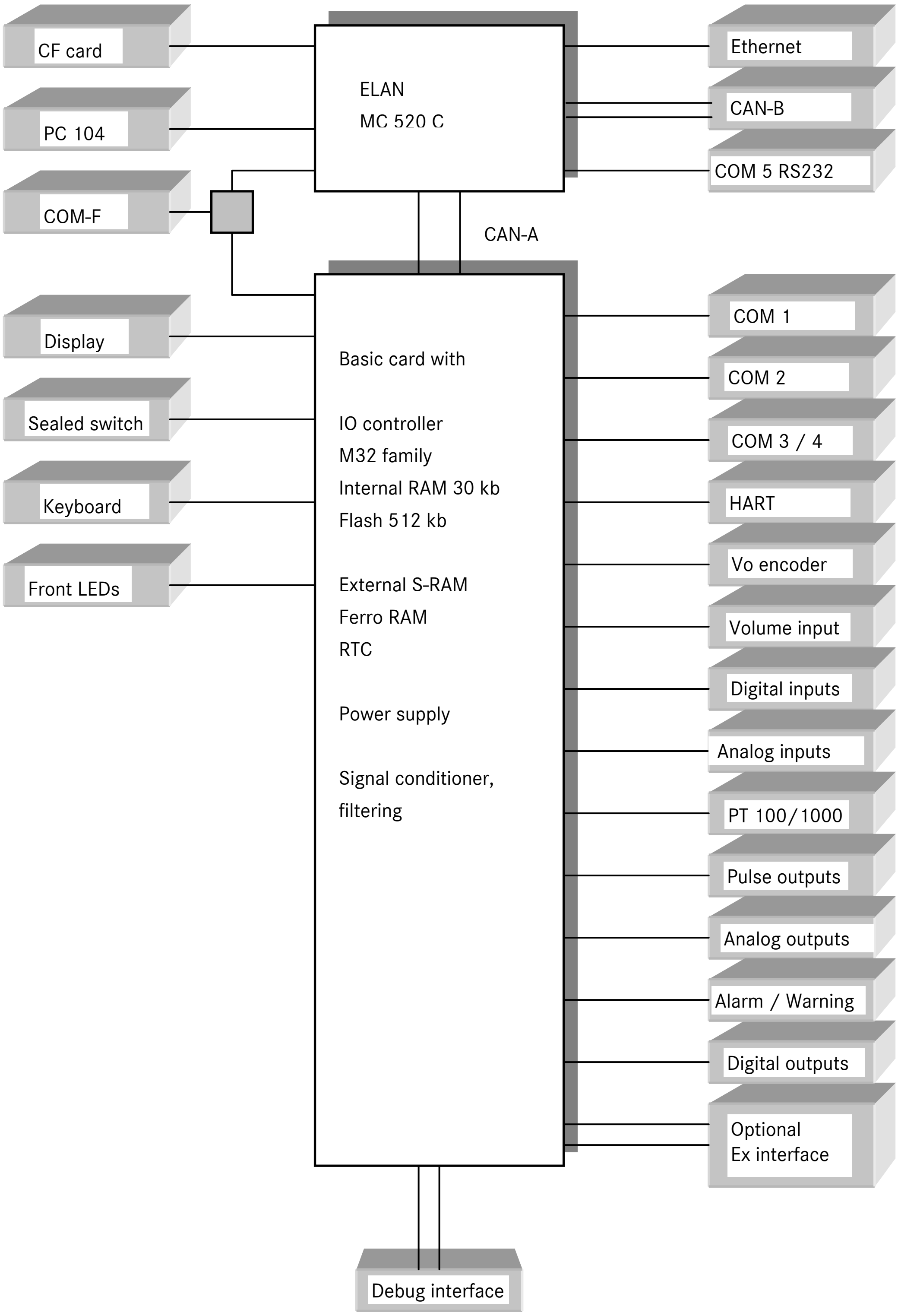
Closed means that the relevant switch is at "ON".

Examples of standard settings in practice:

Device fulfils the function of the master of the DSfG bus:	All switches at ON.
Device is not at one end of the DSfG bus:	Switches 2 and 3 at ON.

Note:
The terminating resistors of the bus have to be connected externally to the hubs or to both ends of the trunk cable.

Block diagram



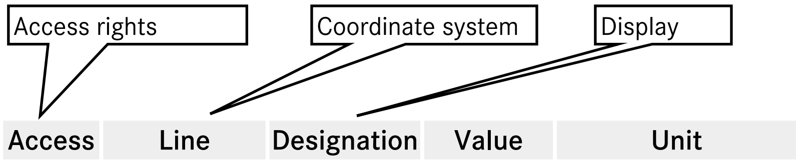
Annex

A) Coordinate system

This annex describes contains the most important parts of the coordinate system. Additional comments have been added for coordinates that are particularly important or require explanation.

The availability of coordinates and columns depends on the selected user profile.
Only with the developer setting are all coordinates visible.

Example presentation



Description of symbols in the Access column

- A Displayed value
- B Parameter locked by the user
- C Special case code number
- D General display values
- E Locked calibration parameter
- F Freeze value
- G Parameter for units and formats
- I Interface variable - measurement
- J Interface variable – type plates (e.g. USZ or HART sensor)
- K Constant or fixed parameter
- P Self-altering input value protected by the user e.g. time
- Q Self-altering input value without protection e.g. drag indicator maximum value
- S Parameter with special lock
- X Self-altering input value with official protection
- Z Totalizers

The coordinate system runs horizontally from AA to QX (columns) and vertically from 1 to 99 (lines).

AA	AB	AC	...	BA	BC	...	....	...	...	...	...	NA	NB
01													
02													
..													
..													
98													
99													

A.1 AB Absolute Pressure

Access	Line	Designation	Value	Unit
A §	1	Measured value	79,997	bar
A §	2	Input value -> AB05	79,997	bar
E §	3	Operating mode	off	
G §	4	Unit	bar	
B	5	Default	30,000	bar
B	6	Lower warning limit	1,000	bar
B	7	Upper warning limit	60,000	bar
E §	8	Lower alarm limit	1,000	bar
E §	9	Upper alarm limit	70,000	bar
E §	10	Coefficient 0	1	
E §	11	Coefficient 1	20	
E §	12	Coefficient 2	0	
E §	13	Coefficient 3	0	
E §	19	Source	Current 1	
E §	21	Correction value	0,000	Bar
E §	22	Max. gradient	10	bar
D	24	Base value	79,997	Bar
D	25	Mean for DSfG	79,997	Bar
D	27	Current status	Fixed value	
D	28	DSfG status	Fixed value	
D	29	Used range	0,000	Bar
G §	30	Format	%.3f	
D	31	Min. drag indicator	79,997	Bar
D	32	Max. drag indicator	79,997	Bar
D	33	Current gradient	0,000	bar/s
D	34	Second mean	79,997	Bar
D	35	Minute mean	79,997	Bar
D	36	Hourly mean	79,997	Bar
D	37	Ongoing mean	79,997	Bar
D	38	Standard deviation	0,000	Bar
D	47	Revision mean	79,997	Bar
D	48	retain value	79,997	bar
E §	50	Manufcturer	Rosemount	
E §	51	Device type	2088 A	

The 4-20mA coefficient setting does not cause the calibrated range to automatically define the alarm limits, but instead selects coefficient 0 for the 4 mA value and coefficient 1 for the 20 mA value. The alarm limits can then be adjusted freely and have no influence on the mapping of the current input.

The following pressure units are available:
bar, kp/cm2, psi, MPa, atm, kPa, torr, bara, Pa, hPa.

Selection field for assigning the source, i.e. where the signal is connected.
See next page for explanations.

The correction value causes an offset shift, which is calculated from:
Reference value minus display value entered directly in the unit of pressure.
Example: value read on reference device = 20.00 bar,
value displayed on ERZ = 20.02 bar
which produces -0.2 bar
Enter this value in field 17 with the correct prefix.

Format adjustments only possible in superuser mode

Type plate data for pressure sensors must always be entered at the end of a function block (column) in the sensor data. The ERZ 2000 automatically adopts the text in the type plate display.

E §	52	Serial number	631297	
F	61	Measured value	79,997	Bar
F	62	Input value	79,997	bar

Installing the ex card (possible from version 1.3) extends the selection options in the Source menu (line 16). An intrinsically safe connection is possible both for the PT 100 in 4-wire technology and temperature sensors with a 4..20mA signal or even HART configuration.
The pressure sensor can also be connected as a 4...20mA transmitter or HART sensor with an intrinsically safe degree of protection. Corresponding settings must be configured in the Source menu.

The connections are then situated at terminals X9 and X10 (see manual for more information).

A.2 AC Gas temperature

Access	Line	Designation	Value	Unit
A §	1	Measured value	60,02	°C
A §	2	Input value -> AC05	60,02	Ω
E §	3	Operating mode	PT100,500,1000	
G §	4	Unit	°C	
B	5	Default	12,00	°C
B	6	Lower warning limit	-15,00	°C
B	7	Upper warning limit	55,00	°C
E §	8	Lower alarm limit	-15,00	°C
E §	9	Upper alarm limit	60,00	°C
E §	10	Coefficient 0	0	
E §	11	Coefficient 1	0	
E §	12	Coefficient 2	0	
E §	13	Coefficient 3	0	
E §	19	Source	Resistance 1	
E §	21	Correction value	0,00	°C
E §	22	max. gradient	10	°C/s
D	24	Base value	60,02	°C
D	25	Mean for DSfG	60,02	°C
A §	26	Joule-Thomson-dT	**0,000000**	°K
D	27	Current status	Fixed value	
D	28	DSfG status	Fixed value	
D	29	Used range	0,00	°C

Automatic detection of three different temperature sensors.

Value for the offset correction calculated in the unit of the measured value

The basic value is derived from the uncorrected measured value (prior to offset correction using the value from field AC 17).

G §	30	Format	%.2f	
D	31	Min. drag indicator	60,02	°C
D	32	Max. drag indicator	60,02	°C
D	33	Current gradient	0,00	°C/s
D	34	Second mean	60,02	°C
D	35	Minute mean	60,02	°C
D	36	Hourly mean	60,02	°C
D	37	Ongoing mean	60,02	°C
D	38	Standard deviation	0,00	°C
D	47	Revision mean	60,02	°C
D	48	Retain value	60,02	°C
D	49	Daily mean	0,00	°C
E §	50	Manufacturer	Rosemount	
E §	51	Device type	PT100	
E §	52	Serial number	661297	
F	61	Measured value	60,02	°C
F	62	Input value	60,02	Ω

Special data that indicates the origin of average values

This value is used for the DSfG revision

Blue fields display the freeze values; note the triggering time.

A.3 AD Superior calorific value

Access	Line	Designation	Value	Unit
A §	1	Measured value	**11,9255**	kWh/m3
A §	2	Input value -> EF01	1	
E §	3	Operating mode	Default	
G §	4	Unit	**kWh/m3**	
B	5	Default	11,000	kWh/m3
B	6	Lower warning limit	7,000	kWh/m3
B	7	Upper warning limit	14,000	kWh/m3
E §	8	Lower alarm limit	7,000	kWh/m3
E §	9	Upper alarm limit	14,000	kWh/m3
E §	10	Coefficient 0	0	
E §	11	Coefficient 1	0	
E §	12	Coefficient 2	0	
E §	13	Coefficient 3	0	
E §	19	Source	OFF	

Indicates the origin of the value, in this case from the default. If a reference to a current input appears here, for example, direct access to the input can be gained via the link.

The source should be deactivated if the default value is used.

E §	21	Correction value	0,000		kWh/m3
E §	22	max. gradient	10		kWh/m3/s
D	23	Timeout		18000	S
D	24	Base value		11,9255	kWh/m3
D	25	Mean for DSfG		11,9255	kWh/m3
D	27	Current status		Fixed value	
D	28	DSfG status		Fixed value	
D	29	Used range		0,000	kWh/m3
G §	30	Format		%.4f	
D	31	Min. drag indicator		11,9255	kWh/m3
D	32	Max. drag indicator		11,9255	kWh/m3
D	33	Current gradient		0,000	kWh/m3/s
D	34	Second mean		11,9255	kWh/m3
D	35	Minute meam		11,9255	kWh/m3
D	36	Hourly mean		11.9255	kWh/m3
D	37	Ongoing mean		11,9255	kWh/m3
D	38	Std. deviation		0,000	kWh/m3
T	39	Table value 1	10,304		kWh/m3
T	40	Table value 2	10,000		kWh/m3
T	41	Table value 3	10,000		kWh/m3
T	42	Table value 4	10,000		kWh/m3
D	43	Running time out		0	S
D	44	Holding value		10,9949	kWh/m3
E §	45	Hs of test gas	11,061		kWh/m3
E §	46	Max.perm.corr.val.	0,300		kWh/m3
D	47	Revision mean		11,9255	kWh/m3
D	48	Retain value		11,9255	kWh/m3
E §	50	Manufacturer	RMG		
E §	51	Device type	GC		
E §	52	Serial number	0		
F	61	Measured value		11,9255	kWh/m3
F	62	Input value		1	kWh/m3

For online correction (old FE-06 function)

For online correction (old FE-06 function)

A.4 AE Standard density

Access	Line	Designation	Value	Unit
A §	1	Measured value	**0,8351**	kg/m3
A §	2	Input value -> EF01	1	
E §	3	Operating mode	Table value	
G §	4	Unit	**kg/m3**	
B	5	Default	0,8000	kg/m3
B	6	Lower warning limit	0,7000	kg/m3
B	7	Upper warning limit	1,0000	kg/m3
E §	8	Lower alarm limit	0,7000	kg/m3
E §	9	Upper alarm limit	1,3000	kg/m3
E §	10	Coefficient 0	0,8	
E §	11	Coefficient 1	-94	
E §	12	Coefficient 2	-97	
E §	13	Coefficient 3	0,01	
E §	19	Source	Current 3	
E §	20	2nd source ref.	Frequency 2	
E §	21	Correction value	0,0000	kg/m3
E §	22	max. gradient	10	kg/m3/s
D	23	Timeout	18000	S
D	24	Base value	0,8351	kg/m3
D	25	Mean for DSfg	0;8351	kg/m3
A §	26	2nd input value	(....)	
D	27	Current status	Fixed value	
D	28	DSfG status	Fixed value	
D	29	Used area	0,0000	kg/m3
G §	30	Format	%.4f	
D	31	Min. drag indicator	0,8351	kg/m3
D	32	Max. drag indicator	0,8351	kg/m3
D	33	Current gradient	0,0000	kg/m3/s
D	34	Second mean	0,8351	kg/m3
D	35	Minute mean	0,8351	kg/m3
D	36	Hourly mean	0,8351	kg/m3
D	37	Ongoing mean	0,8351	kg/m3
D	38	Standard deviation	0,0000	kg/m3

For standard density sensors with 2 frequencies, the second source is selected here.

Clear text display for DSfG status bits

T	39	Table value 1	0,8338	kg/m3
T	40	Table value 2	0,8000	kg/m3
T	41	Table value 3	0,8000	kg/m3
T	42	Table value 4	0,8000	kg/m3
D	43	Running timeout	0	s
D	44	Holding value	0,7420	kg/m3
E §	45	Sd of test gas	0,7175	kg/m3
E §	46	Max.perm.corr.val.	0,3000	kg/m3
D	47	Revision mean	0,8351	kg/m3
D	48	Retain value	0,8351	kg/m3
D	49	Daily mean	0,0000	Kg/m3
E §	50	Manufacturer	RMG	
E §	51	Device type	GC	
E §	52	Serial number	0	
F	61	Measured value	0,8351	kg/m3
F	62	Input value	1	

For online correction (old FE-06 function)

A.5 AF Relative desity

Access	Line	Designation	Value	Unit
A §	1	Measured value	**0,6459**	
A §	2	Input value -> AE01	**0,8351**	kg/m3
E §	3	Operating mode	From stand. dens.	
B	5	Default	0,5739	
B	6	Lower warning limit	0,5000	
B	7	Upper warning limit	1,0000	
E §	8	Lower alarm limit	0,5000	
E §	9	Upper alarm limit	1,0000	
E §	10	Coefficient 0	0	
E §	11	Coefficient 1	0	
E §	12	Coefficient 2	0	
E §	13	Coefficient 3	0	
E §	19	Source	OFF	

Important, dv is measured or must be calculated depending on the sensor.

E §	21	Correction value	0,0000	
E §	22	max. gradient	10	1/s
D	23	Timeout	18000	s
D	24	Base value	0,6459	
D	25	Mean for DSfG	0,6459	
D	27	Current status	okay	
D	28	DSfG status	okay	
D	29	Used range	0,0000	
G §	30	Format	%.4f	
D	31	Min. drag indicator	0,6459	
D	32	Max. drag indicator	0,6459	
D	33	Current gradient	0,0000	1/s
D	34	Second mean	0,6459	
D	35	Minute mean	0,6459	
D	36	Hourly mean	0,6459	
D	37	Ongoing mean	0,6459	
D	38	Standard deviation	0,0000	
T	39	Table value 1	0,6459	
T	40	Table value 2	0,5549	
T	41	Table value 3	0,5549	
T	42	Table value 4	0,5549	
D	43	Running timeout	0	S
D	47	Revision mean	0,6459	
D	48	Retain value	0,6459	
E §	50	Manufacturer	RMG	
E §	51	Device type	GC	
E §	52	Serial number	0	
F	61	Measured value	0,6459	
F	62	Input value	0,8351	kg/m3

Table values for the 4 billing modes, if no active measured value is available.

A.6 AG Density

Access	Line	Designation	Value	Unit
A §	1	Measured value	**35,000**	kg/m3
A §	2	Input value -> AG05	**35,000**	Kg/m3
E §	3	Operating mode	Calculation	
G §	4	Unit	**kg/m3**	
B	5	Default	35,000	kg/m3
B	6	Lower warning limit	0,100	kg/m3
B	7	Upper warning limit	60,000	kg/m3
E §	8	Lower alarm limit	0,100	kg/m3
E §	9	Upper alarm limit	60,000	kg/m3
E §	10	Coefficient 0	-340	
E §	11	Coefficient 1	-5	
E §	12	Coefficient 2	4	
E §	13	Coefficient 3	0	
E §	19	Source	OFF	
E §	21	VOS corr. active	no	
E §	22	max. gradient	10	kg/m3/s
D	24	Base value	35,000	kg/m3
D	25	Mean for DSfG	35,000	kg/m3
A §	26	Uncorrected	**35,000**	kg/m3
D	27	Current status	Stop	
D	28	DSfG status	Stop	
D	29	Used range	0,000	kg/m3
G §	30	Format	**%.3f**	
D	31	Min. drag indicator	35,000	kg/m3
D	32	Max. drag indicator	35,000	kg/m3
D	33	Current gradient	0,000	kg/m3/s
D	34	Second mean	35,000	kg/m3
D	35	Minute mean	35,000	kg/m3
D	36	Hourly mean	35,000	kg/m3
D	37	Ongoing mean	35,000	kg/m3
D	38	Standard deviation	0,000	kg/m3
D	47	Revision mean	35,000	kg/m3
D	48	Retain value	35,000	kg/m3

The typical setting here for ERZ 2002 or 2102
Select RMG density.

Select the correct frequency input here, e.g. from frequency 5 to 8 (frequencies 5, 6, 7, 8 are measurements with a higher resolution)

D	49	Daily mean	0,000	Kg/m3
E §	50	Manufacturer	RMG	
E §	51	Device type	DG08	
E §	52	Serial number	0	
F	61	Measured value	35,000	kg/m3
F	62	Input value	35	

The structure of the following menus is similar:

AH Density sensor temperature
AI VOS temperature
AJ Velocity of operating noise
AK Standard velocity of sound
AL Device temperature
AM Viscosity
AN Isentropic exponent
AO Joule Thomson coefficient
AP Effective pressure
AQ 4-20mA flow

A.7 AL Inside temperature of device

Access	Line	Designation	Value	Unit
D	1	Measured value	25,1	°C
D	2	Input value	1069	Ω
B	6	Max. oper. Temp.	60,0	°C
B	7	Min. oper. Temp	-20,0	°C
B	21	Correction	-8,5	°C
I	26	Converter value	00548000	hex

The internal device temperature is measured in the vicinity of the analog/digital converter. The value can be displayed as a current output for monitoring purposes

Component mode

It is important to know how the gas components are measured, depending on the method used to calculate the K coefficient. CO2, H2 and N2 can be recorded individually via a DSfG/RMG bus or current input and are only required for GERG 88S or AGA NX 19. All other values measured by the PGC and a selection of fixed values are recorded with AGA 8 92 DC (full version). Only a general setting can be selected for the operating mode of these components (other operating mode).

A.8 BA Components mode

Access	Line	Designation	Value	Unit
E §	1	CO2 oper. mode	Default	
E §	2	H2 oper. mode	OFF	
E §	3	N2 oper. mode	OFF	
E §	4	Op.mode other comp.	OFF	
G §	5	Unit	mol-%	
G §	6	Format	%.4f	
A §	7	Unnorm. Sum	100,00000	mol-%
D	8	Component error	00000000	Hex
D	9	Evaluation	okay	
T	10	Norm. Tolerance	0,01	%
E §	11	Balance method	Total balance	

In the case of AGA 8 92 DC, select the operating mode for all other components (table, DSfG, RMG bus, default).

A normalization process must be performed again to 100% after the data is received because formatting along the transfer routes can cause rounding errors. The permitted tolerance must be selected here.

With AGA 8 92 DC, there is a plausibility function to the min. and max. component limits. This function must be activated under the superuser protection in Configuration (EI 20). A violation of the limits only results in a warning (disturbance totalizers are not actuated).

The function for CO_2 is shown here as an example for all components

A.9 BB Carbon dioxide

Access	Line	Designation	Value	Unit
A §	1	Norm. Mol. Fraction	1,9100	mol-%
A §	2	Input value -> BB05	1,9100	mol-%
A §	3	Cur.meas.cond.	Default	
B	5	Default	2,00000	mol-%
B	6	Lower warning limit	0,00000	mol-%
B	7	Upper warning limit	20,00000	mol-%
E §	8	Lower alarm limit	0,00000	mol-%
E §	9	Upper alarm limit	20,00000	mol-%
E §	11	Coefficient 0	0	
E §	12	Coefficient 1	0	
E §	13	Coefficient 2	0	
E §	14	Coefficient 3	0	
E §	16	Source	OFF	

Link to input value (here: table)

The source is deactivated because table operating mode is used in this example.

E §	17	Correction value	0,00000	mol-%
E §	19	max. gradient	10	mol-%/s
D	20	Timeout	18000	s
D	21	Base value	1,9100	mol-%
D	22	Mean for DSfG	1,9100	mol-%
D	23	Mass fraction	4,5131	Gew-%
D	24	Volume fraction	1,9038	Vol-%
D	25	Standard fraction	1,9771	kg/m3
D	26	Root of B	0,083008	
D	27	Current status	Fixed value	
D	28	DSfG status	Fixed value	
D	29	Used range	0,00000	mol-%
D	31	Min. drag indicator	1,91[illegible]	
D	32	Max. drag indicaor	1,9100	mol-%
D	33	Current gradient	0,00000	mol-%/s
D	34	Second mean	1,9100	mol-%
D	35	Minute mean	1,9100	mol-%
D	36	Hourly mean	1,9100	mol-%
D	37	Ongoing mean	1,9100	mol-%
D	38	Std. deviation	0,00000	mol-%
T	39	Table value 1	1,01300	mol-%
T	40	Table value 2	1,00000	mol-%
T	41	Tabele value 3	1,00000	mol-%
T	42	Table value 4	1,00000	mol-%
D	43	Running timeout	0	s
D	44	Unnorm.mol.fraction	1,9100	mol-%
D	47	Revision mean	1,9100	mol-%
D	48	Retain value	1,9100	mol-%
E §	50	Manufacturer	RMG	
E §	51	Device type	GC	
E §	52	Serial number	0	
F	61	Norm.mol.fraction	1,9100	mol-%
F	62	Input value	1,91	mol-%

There is a drag indicator function for all measured values, which is separate for min. and max. peak values.
The contents of the drag indicator can be reset selectively (press the Enter key) or globally (in the display function).

A.10 CC Calculation of K coefficient

Access	Line	Designation	Value	Unit
A §	1	K coefficient	0,89416	
A §	2	Compr.factor (M)	0,891359	
A §	3	Compr.factor (B)	0,996868	
A §	4	R(K,Rn,T,P)	60,453	kg/
E §	5	Calc. method	GERG 88 S	
E §	6	Default	1	
G §	7	Format	%.5f	
E §	8	Kind of gas	Erdgas	
B	9	AGA control	boundless	
D	10	AGA range	PQGp<10Mpa	
D	11	CQ1/2 calculation	AGA 8 92DC	
D	12	Propane-Criterion	Complied	
D	13	Butan+-Criterion	Violated	
B	14	G486-Msg. aktive	no	
D	15	EOS-algorithm	3	
D	31	Min. drag indicator	0,89416	
D	32	Max. drag indicator	0,89416	
D	34	Second mean	0,89416	
D	35	Minute mean	0,89416	
D	36	Hourly mean	0,89416	
D	38	Std. deviation	0,00000	
D	47	Revision mean	0,89416	
F	61	K coefficient	0,89416	
F	62	Compr. Factor (M)	0,891359	
F	63	Compr.factor (B)	0,996868	

The K coefficient calculation method incorporated into the custody transfer results is selected here, i.e. the equation selected here is used for correction.
GC1 / GC2 means that the K coefficient method follows the relevant active measuring device if the gas quality connection is redundant.
Example:
Main measurement = GC with full analysis and K coefficient method according to AGA 8 92 DC.
Comparative measurement = correlative measuring device and K coefficient method according to GERG 88 S.
If the system switches from the main GC to the comparator device for whatever reason, the method for calculating the K coefficient switches automatically from AGA 8 92 DC to GERG 88 S.
If necessary, another billing mode (roadway) can be selected automatically for this particular case (see section EC Billing mode, line 4 Bill mode select for setting)

CC09 AGA check:
Controls checks of the quality ranges with regard to the AGA 8 92DC conversion factor calculation. The required quality range is selected here. See the table below.

	Pipeline Quality Gas (<10MPa)		Pipeline Quality Gas (<12MPa)		Wider Ranges of Application		
Value	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Unit**
Ho	30.	45.0	30.	45.0	20.	48.0	MJ/m3
T	263.	338.0	263.	338.0	225.	350.0	K
p	0.	10.0	0.	12.0	0.	65.0	Mpa
dv	0.55	80.0	0.55	80.0	0.55	90.0	-
Methan	70.	100.0	70.	100.0	50.	100.0	Mol-%
N2	0.	50.0	0.	20.0	0.	50.0	Mol-%
CO2	0.	23.0	0.	20.0	0.	30.0	Mol-%
Ethan	0.	13.0	0.	10.0	0.	20.0	Mol-%
Propan	0.	6.0	0.	3.5	0.	5.0	Mol-%
H2O	0.	0.015	0.	0.015	0.	0.015	Mol-%
H2S	0.	0.02	0.	0.02	0.	0.02	Mol-%
H2	0.	10.0	0.	10.0	0.	10.0	Mol-%
CO	0.	3.0	0.	3.0	0.	3.0	Mol-%
O2	0.	0.02	0.	0.02	0.	0.02	Mol-%
I-Butan	0.	1.5	0.	1.5	0.	1.5	Mol-%
N-Butan	0.	1.5	0.	1.5	0.	1.5	Mol-%
I-Pentan	0.	0.5	0.	0.5	0.	0.5	Mol-%
N-Pentan	0.	0.5	0.	0.5	0.	0.5	Mol-%
Hexan	0.	0.1	0.	0.1	0.	0.1	Mol-%
Heptan	0.	0.05	0.	0.05	0.	0.05	Mol-%
Oktan	0.	0.05	0.	0.05	0.	0.05	Mol-%
Nonan	0.	0.05	0.	0.05	0.	0.05	Mol-%
Dekan	0.	0.05	0.	0.05	0.	0.05	Mol-%
Helium	0.	0.5	0.	0.5	0.	0.5	Mol-%
Argon	0.	0.02	0.	0.02	0.	0.02	Mol-%

CC10 AGA range:
The value indicates which quality range of the AGA8DC92 equation of state is currently active. Three ranges are defined in ISO 12213.

1 Pipeline Quality Gas <10 MPa
2 Pipeline Quality Gas <12 MPa
3 Wider Ranges of Application

If the current operating conditions are not suitable for "Wider Ranges of Application", they are identified as inadequate here. A quality statement is then no longer possible. It is possible to set the message H80-3 AGA8<>range AGA8<>range for instances when a preselected quality range is breached. See also the parameter gasCtrl. Can only be used meaningfully when a full analysis is present.

CC11 GC1/2 calculation:
This value is only active in the operating mode ***CC05***= GERG 88 S, AGA 8 92DC and GC1/GC2. In the first two modes, it remains on GERG 88 S or AGA 8 92DC constantly. In GC1/GC2 operating mode (main and reference gas quality), the value is determined by whether a full analysis is available (AGA 8 92DC) or is not available (GERG 88 S) for the gas quality sensor currently selected. The value then selects the equation of state for the correction and suppresses the fault evaluation for the unselected equation of state. The value can also be used to control the billing mode. See also ***EC04***.

CC12 Propane criterion:
Checks the "rule of thirds" relating to propane. The rule of thirds determines whether the conversion factor calculation via GERG 88 S is permitted for a gas. See also ***CC13***. The message H78-1 G486 violated DVGW G486 (1/3 rule) violated. Gas is not GERG compatible. may be displayed to indicate that the rule has been violated. See also ***CC14.***

CC13 Butane + criterion:
Checks the "rule of thirds" relating to butane and higher. The rule of thirds determines whether the conversion factor calculation via GERG 88 S is permitted for a gas. See also ***CC12***. The message H78-1 G486 violated DVGW G486 (1/3 rule) violated. Gas is not GERG compatible. may be displayed to indicate that the rule has been violated. See also ***CC14.***

CC14 G486 mess. active:
Activates the message H78-1 G486 violated DVGW G486 (1/3 rule) violated. Gas is not GERG compatible. when the rule of thirds for propane ***CC12*** and butane or higher ***CC13*** is violated. Only meaningful when a full analysis is present.

CC31 min. drag indicator and ***CC32 max. drag indicator:***
The drag indicator records the smallest or largest measured value that was achieved since the drag indicator was last restarted or reset.
The drag indicator is reset either globally via the trigger ***EM14*** (reset all drag indicators) or individually (reset this drag indicator only). The drag indicator must be called onto the display and the enter key pressed to perform an individual reset.
Depending on the selected mode ***EI27***, the drag indicator is derived from the measured value used for correction or the original measured value. If the drag indicator does not need to be displayed, the setting can be configured accordingly under ***EI16***.

A.11 CD GERG equation of state

Access	Line	Designation	Value	Unit
A §	1	K coefficient	**0,89438**	
A §	2	Compr.factor(M)	**0,891587**	
A §	3	Compr.factor(B)	**0,996875**	
A §	4	R(k,Rn,T,p)	**60,438**	kg/m3
D	5	Percentage error	-0,02494	%
D	6	Consistency check	okay	
E §	7	Limit mode	Default if LV	
E §	8	Limits	narrow	
A §	9	Input values	**Hs, sd, CO2, H2**	
D	12	Rd for GERG	0,6459	
D	13	Hs for GERG	42,889	MJ/m3
D	14	Mod.gas iterations	5	
D	15	P(B) iterations	1	
D	16	P(M) iterations	5	
D	17	Molar mass	18,6595	kg/kMol
D	18	Hydrocarbon GERG	97,1384	mol-%
D	19	N2 GERG	0,9516	mol-%
D	20	CO2 GERG	1,9100	mol-%
D	21	H2 GERG	0,00000	mol-%
D	22	CO GERG	0,00000	mol-%
D	23	Hs Hydrocarbon	986,54	kJ/Mol

Indication of the deviation relating to the calculation method selected for the correction (AGA 8 92 DC in this case)

Default after limit value violation: Use the default value for the K coefficient if the limit value is exceeded.
Calculation after limit value violation: Continue calculation if the limit value is exceeded

Internal intermediate values from the GERG equation.

CD08 limits:

narrow: According to the German design = pipeline quality gas as per ISO 12213-3
T from -10 to 65°C
P from 0 to 120 bar
dv from 0.55 to 0.8
Ho from 30 to 45 MJ/m³
CO2 from 0 to 20 Mol%
H2 from 0 to 10 Mol%

wide: According to wider ranges of application as per ISO 12213-3
T from -10 to 65°C
P from 0 to 120 bar
dv from 0.55 to 0.9
Ho from 20 to 48 MJ/m³
CO2 from 0 to 30 Mol%
H2 from 0 to 10 Mol%

extremely wide: According to internal RMG specification
T from -15 to 70°C
P from 0 to 150 bar
dv from 0.38 to 1.16
Ho from 10 to 60 MJ/m³
CO2 from 0 to 30 Mol%
H2 from 0 to 30 Mol%

Sensor limits: without restriction, the normal sensor limits apply when these limits are violated.

A.12 CE Zustandsgleichung AGA NX 19

Access	Line	Designation	Value	Unit
A §	1	K coefficient	**0,92300**	
A §	2	Compr.factor(M)	**0,919537**	
A §	3	Compr.factor(B)	**0,996251**	
A §	4	R(K,Rn,T,P)	**23,768**	kg/m3
D	5	Percentage error	0,96660	%
D	6	Consistency check	okay	
E §	7	Tau-calculation	492 °R	
E §	8	N2 rich gas	No	
E §	9	with Rd factor	Yes	
E §	10	Rd source	From stand. dens.	

CE08 = Yes:
Calculation of the K coefficient acc. to AGANX19 is possible for natural gas with high nitrogen content with 70 mol-% of N2.

A.13 CH AGA 8 92DC equation of state

Access	Line	Designation	Value	Unit
A §	1	K coefficient	**0,89416**	
A §	2	Compr.factor(M)	**0,891359**	
A §	3	Compr.factor(B)	**0,996868**	
A §	4	R(k,Rn,T,p)	**60,453**	kg/m3
D	5	Percentage error	0,00000	%
D	6	Consistency check	okay	
A §	7	Calc.std.density	**0,8336**	kg/m3
A §	8	Calc. density	**60,343**	kg/m3
D	9	High temp. param.	0,000	
D	10	Quadrupol. Param.	0,013179	
D	11	Orientation param.	0,013792	
D	12	Energy parameter	171,2505	°K

Deviation in relation to itself equals one, of course.

Internal equation parameter, only relevant for the developer.

D	13	Size parameter	0,105010	m3/kmol
E §	14	Ethene assignment	Ethane	
E §	15	Propene assignm.	Propane	
E §	16	Neo-pentane assignm..	N-Pentane	

Define defaults for the distribution rule. What should happen to the values not measured by the GC? Which other values should these components be added to?

A.14 CK Industrial gas parameter

Access	Line	Designation	Value	Unit
E §	1	Sel.industr.gases	CH4	
E §	2	A0 other gases	2,2769	
E §	3	A other gases	0,01855	
E §	4	B0 other gases	0,05587	
E §	5	b other gases	-0,01587	
E §	6	c other gases	128300	
E §	7	Mol.mass other gas	16,043	kg/kMol
E §	8	Tc other gas	190,56	°K
E §	9	Pc other gas	45,98	Bar

Selection of technical gases (or gas parameter sets) for performing calculations using the Beattie-Bridgeman equation.

Coefficients for other gases = other gases that cannot be configured directly in the CK 01 coordinates (selection).

A.15 CN C6+-Distribution

Access	Line	Designation	Value	Unit
E §	1	C6+ distribution	ja	
D	2	Weight hexane	0,00	%
E §	3	Weight heptane	25,00	%
E §	4	Weight octane	25,00	%
E §	5	Weight nonane	25,00	%
E §	6	Weight decane	25,00	%
A §	17	N2	8,606	mole%
A §	18	CO2	5,336	mole%
A §	19	H2S	0,000	mole%
A §	20	H2O	0,000	mole%
A §	21	Helium	0,000	mole%
A §	22	Methane	86,058	mole%
A §	23	Ethane	0,000	mole%

The calculation of the K coefficient is performed with these components. These are the values after the 100% normalisation and after applying the the distribution rule. Important for the evaluation of the accuracy.

A §	24	Propane	**0,000**	mole%
A §	25	N-butane	**0,000**	mole%
A §	26	I-butane	**0,000**	mole%
A §	27	N-pentane	**0,000**	Mole%
A §	28	I-pentane	**0,000**	mole%
A §	29	Hexane	**0,000**	mole%
A §	30	Heptane	**0,000**	mole%
A §	31	Octane	**0,000**	mole%
A §	32	Nonane	**0,000**	mole%
A §	33	Decane	**0,000**	mole%
A §	34	O2	**0,000**	mole%
A §	35	CO	**0,000**	mole%
A §	36	H2	**0,000**	mole%
A §	37	Argon	**0,000**	mole%

A.16 DA Calculation in accordance with ISO 6976

Access	Line	Designation	Value	Unit
A §	1	Standard density	**0,8336**	kg/m3
A §	2	Relative density	**0,6448**	
A §	3	Sup.calorific.val	**11,9166**	kWh/m3
A §	4	Inf.calor.value	**10,7669**	kWh/m3
A §	5	Wobbe superior	**14,8407**	kWh/m3
A §	6	Wobbe inferior	**13,4088**	kWh/m3
D	7	Hs->Hs(TB25TN0)	0,9990	
D	8	Sd->Sd(Tb0)	1,0000	
D	9	Rd->Rd(Tb0)	1,0000	
D	10	Hi/Hs	0,9035	
D	11	Molar sup.cal.val.	958,51	kJ/Mol
D	12	Molar inf.cal.val.	866,03	kJ/Mol
D	13	Spec.gas constant	0,446402	kJ/kgK
D	14	Compressibility	0,996824	
D	15	Methane number	0,0000	
D	16	Methane no. Range	Invalid	

The ERZ 2000 can perform the ISO 6976 calculation because the components are known (if the components are only available as input variables, these can be used to calculate the fuel gas value, standard density, etc.).

Indication of the current conversion factors relating to country-specific settings

A.17 DB Calculation as per AGA 10 Helmholtz

Access	Line	Designation	Value	Unit
D	1	Internal energy	-130,329	kJ/kg
D	2	Fee energy	495,360	kJ/kg
D	3	Enthalpy	2,241	kJ/kg
D	4	Free enthalpy	627,930	kJ/kg
D	5	Entrophy	-1,878	kJ/kgK
D	6	Cv meas.cond.	1,7721	kJ/kgK
D	7	Cp meas.cond.	2,6241	kJ/kgK
D	8	Isentr.exp.(M)	1,34907	
D	9	Calc.VOS (M)	422,902	m/s
D	10	Joule Thomson(M)	3,36635	K/MPa
D	11	Cv base cond.	1,5430	kJ/kgK
D	12	Cp base cond.	1,9959	kJ/kgK
D	13	Isentr.exp.(B)	1,28947	
D	14	Calc.VOS(B)	395,903	m/s
D	15	Joule Thomson(B)	6,26736	K/MPa
D	16	Therm. Work	625,689	kJ/kg
D	17	Mech. Work	132,570	kJ/kg
D	18	G-U	758,259	kJ/kg

The AGA 10 allows the calculation of other variables required for the measurement of orifices, for example, that were previously available either as a fixed value or approximation equation.

For example, the velocity of sound can be calculated from the components

Difference between free enthalpy and internal energy

A.18 DC Transport phenomina

Access	Line	Designation	Value	Unit
D	1	dyn. Viskosity(M)	13,9600	μPas
D	2	dyn. Viskosity(B)	10,1943	μPas
D	3	kin.Viskosity(M)	0,0023	stokes
D	4	kin.Viskosity(B)	0,1221	stokes
D	5	Therm.conduct(M)	0,44247	W/m°K
D	6	Therm.conduct(B)	0,028134	W/m°K
D	7	Molar mass	18,6256	kg/kMol
B	8	Geometry factor	1,7886	
E §	9	Database	JSKV-Plus	

Kin.viscosity(B) = dyn. viscosity(B) divided by the density
Therm. conduct(B) = thermal conductivity
Geometry factor = calculated for methane
Thermal conductivity = geometry factor * viscosity * specific thermal capacity (at constant volumes)

A.19 DD critical values

Access	Line	Designation	Value	Unit
D	1	Temperature	-66,69	°C
D	2	Volumene	0,1052	L/Mol
D	3	Pressure	46,563	bar
D	4	Density	177,1153	kg/m3
D	5	Viscosity	13,0232	µPas
D	6	Compr.factor	0,28524	

Parameters of the actual gas (from the current measurement of the gas quality).
The equations for calculating the K coefficient only achieve a sufficient degree of accuracy if the actual conditions reach a much higher temperature and a much lower density than in this example.

A.20 DE Stoichiometry

Access	Line	Designation	Value	Unit
D	1	Stoichiom.frac. C	1,1288	
D	2	Stoichiom.frac. H	4,1626	
D	3	Stoichiom.frac. N	0,0186	
D	4	Stoichiom.frac. O	0,0382	
D	5	Stoichiom.frac. S	0,0000	
D	6	Stoichiom.frac. He	0,0000	
D	7	Stoichiom.frac. He	0,0000	
D	8	Molar mass	18,6256	kg/kMol
D	9	Reactive part C	1,1097	
D	10	Reactive part H	4,1626	
D	11	H/C-ratio	3,7511	
D	12	Approx octane no.	122,2	
D	13	Approx methane no.	79,3	

For pure methane CH_4, the ERZ 2000 would display:
D1 = 1
D2 = 4
Rest = 0
D8 = 16,043

Important for calculating the section DF Environment (environmental impact following complete combustion).

A.21 DF Impact of environment in the case of complete combustion

Access	Line	Designation	Value	Unit
D	1	H2O per kWh (Hs)	0,1408	kg/kWh
D	2	CO2 per kWh (Hs)	0,1866	kg/kWh
D	3	H2O per kWh (Hi)	0,1559	kg/kWh
D	4	CO2 per kWh (Hi)	0,2065	kg/kWh
D	5	CO2 emissionsfct.	57,36	t CO2/TJ
D	10	CO2 Emission	129157,23	kg/h
D	11	Combust air dry	851499,38	kg/h
D	12	Combust air hum.	853948,19	kg/h

Proportion of water calculated per kWh.
CO2 emission calculated per kWh.

A.22 DG Correction of velocity of sound

Access	Line	Designation	Value	Unit
A §	1	Rho corrected	35,3889	kg/m3
A §	2	Corr.factor	1,01111	
A §	3	Current L	59,3500	
E §	5	VOS source value	at base conditions	
E §	6	L with cn, meas.	53,3600	
E §	7	L with cn, base	59,3500	
E §	8	Cn calib. gas	341,1000	m/s
E §	9	Calib. Temp.	0,00	°C
A §	11	Rho for VOS corr.	35,0000	kg/m3
A §	12	VOS for corr.	431,1000	m/s

Parameter for the density correction

A.23 DH Assessed analysis

The assessed analysis calculates the correct gas composition from a few input variables provided by a correlative measuring device (EMC 500), for example. The calculation is consistent, however there may be one or several other compositions that also deliver the same fuel gas value, standard density, etc.

Access	Line	Designation	Value	Unit
D	1	N2	0,9439	mol-%
D	2	CO2	1,9100	mol-%
D	3	H2S	0,000	mol-%
D	4	H2O	0,000	mol-%
D	5	Helium	0,257	mol-%
D	6	Methane	88,9663	mol-%
D	7	Ethane	4,6348	mol-%
D	8	Propane	2,0162	mol-%
D	9	N-Butane	0,5669	mol-%
D	10	I-Butane	0,3678	mol-%

D	11	N-Pentane	0,1607	mol-%
D	12	I-Pentane	0,1607	mol-%
D	13	Hexane	0,2099	mol-%
D	14	Heptane	0,0296	mol-%
D	15	Oktane	0,0074	mol-%
D	16	Nonane	0,000	mol-%
D	17	Dekane	0,000	mol-%
D	18	O2	0,000	mol-%
D	19	CO	0,000	mol-%
D	20	H2	0,000	mol-%
D	21	Neo-Pentane	0,000	mol-%
D	22	Ethene	0,000	mol-%
D	23	Propene	0,000	mol-%
D	24	Argon	0,000	mol-%
B	26	Assessment base	Sd,Hs,CO2	
D	27	Rd for assessment	0,645772	
D	28	Hs for assessment	1092,26	BTU/ft3

The settings in the *Assessment base* menu enable the selection of input variables for the assessed analysis

A.24 DI Adjustable extra base condition

Access	Line	Designation	Value Unit	Unit
D	1	Qx(Tx,Px)	61313,129	m3/h
D	2	Rx(Tx,Px)	0,7912	kg/m3
D	3	Rx/Rn	0,947453	
B	11	Tx	288,15	°K
B	12	Px	0,101325	MPa

Unlike the base condition settings for the correction, other standard pressure and temperature values can be defined here and used to calculate a separate flow rate and density.

This menu is provided for subsequent upgrades and complete results under other standard conditions.

A.25 DJ Exhaust summary

Exhaust summary for the combustion of natural gas (fuel gas) with the supply of air.

Access	Line	Designation	Value	Unit
D	1	H2O per 1m3 gas	1,6782	kg/m3
D	2	CO2 per 1m3 gas	2,2235	kg/m3
D	3	N2 per 1m3 gas	0,0117	kg/m3
D	4	SO2 per 1m3 gas	0,0000	kg/m3
D	5	He fram nat gas	0,0000	kg/m3
D	6	Ar from nat gas	0,0000	kg/m3

Exhaust components originating from fuel gas. The inert gases He and Ar are not involved in the actual combustion process.

D	10	O2-consumption	3,0797	kg/m3
B	11	Air ratio	1,1015	
D	12	Saturation vapor P	23,3557	hPa
B	13	Ambient temp.	20,00	°C
B	14	Ambient pressure	1015,00	hPa
B	15	Rel. Air humidity	20,00	%
D	16	O2 from air	3,3922	kg/m3
D	17	N2 from air	11,0739	kg/m3
D	18	CO2 from air	0,0074	kg/m3
D	19	Ar from air	0,1852	kg/m3
D	20	H2O from air	,0,422	kg/m3
D	21	CO2 exhaust fume	2,2308	kg/m3
D	22	N2 exhaust fume	11,0855	kg/m3
D	23	Ar exhaust fume	0,1852	kg/m3
D	24	H2O exhaust fume	1,7203	kg/m3
D	25	SO2 exhaust fume	0,0000	kg/m3
D	26	He exhaust fume	0,0000	kg/m3
D	27	O2 exhaust fume	0,3126	kg/m3
D	28	Air consump. Dry	14,6587	kg/m3
D	29	Air consump. Hum.	14.7008	kg/m3

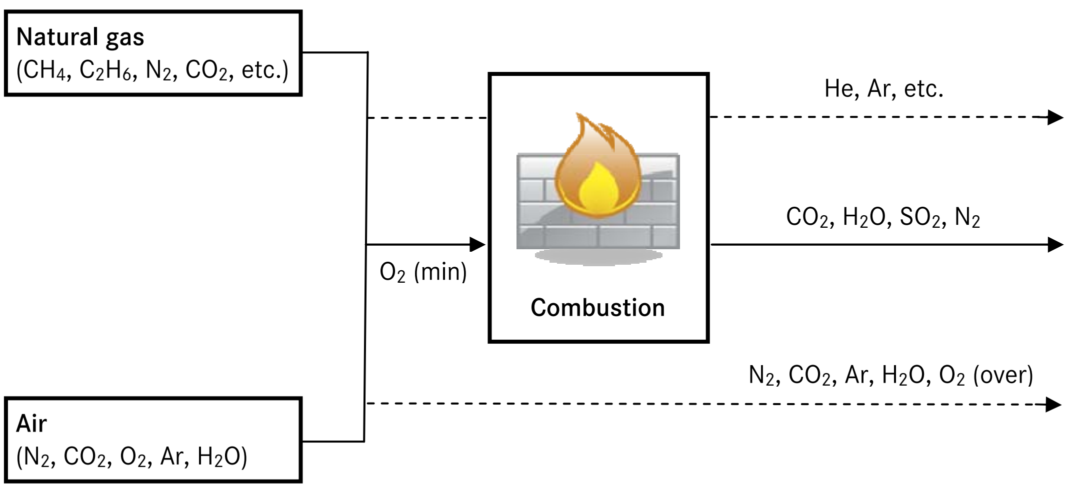
Ratio between the quantity of air actually supplied and the quantity of air theoretically supplied during complete combustion.

The H2O percentage in the quantity of supplied air is calculated using these constants.

Air oxygen involved in the combustion process.

Components of the supplied air that are not involved in the combustion process.

All exhaust components generated during combustion.



A.26 DK Composition of exhaust fumes

Access	Line	Designation	Value	Unit
D	1	CO2 humid	9,1116	mol-%
D	2	N2 humid	71,1336	mol-%
D	3	Ar humid	0,8334	mol-%
D	4	Vapor	17,1655	mol-%
D	5	SO2 humid	0,0000	mol-%
D	6	He humid	0,0000	mol-%
D	7	O2 humid	1,7560	mol-%
D	10	CO2 dry	10,9998	mol-%
D	11	N2 dry	85,8743	mol-%
D	12	Ar dry	1,0061	mol-%
D	13	SO2 dry	0,0000	mol-%
D	14	He dry	0,0000	mol-%
D	15	O2 dry	2,1199	mol-%

Composition of the wet exhaust gas, i.e. exhaust gas ***containing*** water (vapor).

Composition of the dry exhaust gas, i.e. exhaust gas ***that does not contain*** water (vapor).

A.27 EB Base values

Access	Line	Designation	Value	Unit
E §	1	Pbase selectionl	1.01325 bar	
E §	2	Tb selection	0 °C	
E §	3	Tm selection	25 °C	
A §	4	Press.at base cond.	**1,01325**	Bar
A §	5	Temp. Base Kelvin	**273,15**	°K
A §	6	Temp.base Celsius	**0,00**	°C
A §	8	Tm factor	**0,9999**	
A §	9	Rd factor	**1,0000**	
A §	10	Stand.density air	**1,292923**	kg/m3
S	11	CVD-Constant A	0,00390802	1/°C
S	12	CVD-Constant B	-5,80195e-07	°C-2
S	13	CVD-Constant C	-4,2735E-12	°C-4
W §	14	Gas constant	**8,3145100**	J/mol*K
W §	15	Mol.vol.ideal gas	**22,4140970**	L/Mol
W §	16	Avogadro Constant	**6,0221415**	10^23 /Mol
S	17	Device state	Function tested	
A §	18	Device family	**ERZ 2000**	
W §	19	Device type	ERZ 2104	

Typical national reference values for GERG 88 S

Constants for the linearization of PT 100, 500, 1000 temperature

Production and test state of the device. There are 4 states that can only be reversed in the factory.

Selection of device type in the testing laboratory only.

W §	20	CO2 emission	Yes	
W §	21	Enab.methane no.	GERG 88 S	
W §	22	2nd base condition	Yes	

EB22 = Yes:
Calculation of a complete standard volume totalizer set for a second base condition. This affects the main and disturbance totalizers for BM1,2,3,4. The calculation is connected with an operation using AGA892DC. The corresponding totalizers can be seen in the columns LB...LJ in the lines 25, 26 and 27. In the totalizer overview the totalizers for the second base condition are indicated as Vx1,2,3,4 or SVx1,2,3,4.
The second base condition is set in column DI (Extra base condition).

A.28 EC Billing mode

Access	Line	Designation	Value	Unit
D	1	Current text -> EC09	AM1	
A §	2	Current bill mode	1	
A §	3	Bill mode control	(....)	
E §	4	Bill mode select	Billing mode 1	
E §	5	Assignment	Edit	
E §	6	Threshold BM1->2	50	
E §	7	Threshold BM2->3	100	
E §	8	Threshold BM3->4	150	
B	9	Clear text BM1	from Werne	
B	10	Clear text BM2	from Vitzeroda	
B	11	Clear text BM3	AM3	
B	12	Clear text BM4	AM4	
A §	13	Contact 1 for BM	OFF	
A §	14	Contact 2 for BM	OFF	
A §	15	Contact 3 for BM	OFF	
A §	16	Contact 4 for BM	OFF	
E §	17	Source BM contact 1	Contact input 1	
E §	18	Source BM contact 2	OFF	
E §	19	Source BM contact 3	OFF	

Different billing modes are available. The first two correspond to classic roadways 1 and 2 and can be controlled via the usual contact inputs. Several options are available: A contact like on the ERZ 9000 or 2 contacts like on the ERZ 2200. Measuring limits can also be used as switches.

Edit opens another menu for selecting the measured value for the switching threshold.

If a measuring limit is used as a switch, the threshold must be configured here. The 3 threshold values can be cascaded.

Names can be assigned to the billing modes.

Indication of the active switch positions (contact input)

Selection of the contact input used to control the billing mode.

E §	20	Source BM contact 4	OFF	
S	21	BM at revision	Unchanged	
B	22	BM0 suppression	no	
D	23	No. bill.modes	1	

A.29 ED Parameter access

Access	Line	Designation	Value	Unit
B	1	Revision mode	Operation	
C	2	Codeword 1	9999	
C	3	Codeword 2	9999	
A §	4	Current access	**Calibration lock**	
D	7	Expired	0	s
B	8	Max. opering time	1800	s
D	10	act. Op./Rev.	Operation	
D	11	Revision contact	OFF	
B	12	Source revision ctc	OFF	
S	13	Totl in revision	Rnning	
S	14	Temp. At revision	Life value	
S	15	Press. At revision	Life value	

Function of the revision switch.
Sets the revision bit in the bit string for the corrector. Marks archive entries and standard queries. Pulse outputs are deactivated when revision is active.

Code words 1 and 2 divide the user code into two groups of 4 so that the supplier and purchaser can be separated, for example.

Indicates the current access protection.

- Closed
- Single (user) code
- Double (user) code
- Calibration lock
- Superuser

Adjustable time until ***Code*** or ***Superuser*** access protection is closed automatically.

A.30 EE Display

Access	Line	Designation	Value	Unit
B	1	Language	German	
B	2	User profil	Developer	
B	3	Screen saver	1800	s
B	4	Information line	no	
B	5	Display update	rarely	
E §	6	Decimal delimiter	Comma	
E §	7	Cust.transf.ID mark	Paragraph	
B	8	Buzzer mode	OFF	
B	9	Message line	no	
B	13	Coordinates	no	
D	15	Display state	10[illegible]	
S	17	Display type	CU2004[illegible]SCPB-W2J	
B	18	Qm/Vm-position	above m[illegible]ed	
B	19	Daily quantities	n[illegible]	

Available options include ***German, English*** and ***Russian.***

Selection of the visualization levels; influences the information content shown on the display and in HTML downloads.

Governs whether more detailed information (DSfG, modbus, access, etc.) on the current coordinates is shown in the fourth line of the display.

Display refresh speed

Available options include ***Comma*** and ***Period.***

Available options include ***None, Paragraph, Rhombus, Star*** or ***Cross.***

Operating mode of the Piezo beeper.

Governs whether a pending error report is shown in the fourth line of the display.

yes: coordinates are displayed permanently in the second line of the display.
no: coordinates are only displayed when navigating in the fourth line of the display.

Display type of last letter J = Japanese character,
last letter A = all european character (also includes Cyrillic font)
Note:
No automatic display recognition, i.e. if ***EE01 Language***=Russian is to be used, the display type W2A must be configured manually

A.31 EF Processing table values

Access	Line	Designation	Value	Unit
D	1	Selected table	1	
T	2	Table selection	Table value 1	

Displays the gas quality table currently in use.

Defines which gas quality table is used. The table contains default values for rhon, ho, co2, h2, meth and dv.

A.32 EH Module assembly

Access	Line	Designation	Value	Unit
S	1	MOD 1A Should be	COM3+4-card	
I	2	MOD 1A Assembly	Passive	
I	3	MOD 1A ID	0	
I	4	MOD 1A Version	0,00	
I	5	MOD 1A Status 1	0000	hex
I	6	MOD 1A Status 2	0000	hex
I	7	MOD 1A Status 3	0000	hex
I	8	MOD 1A Status 4	0000	hex
S	11	MOD 1B should be	Unknown	
I	12	MOD 1B assembly	Unknown	
I	13	MOD 1B ID	0	
I	14	MOD 1B Version	0,00	
I	15	MOD 1B Status 1	0000	hex
I	16	MOD 1B Status 2	0000	hex
I	17	MOD 1B Status 3	0000	hex
I	18	MOD 1B Status 4	0000	hex
S	21	MOD 2A should be	Unknown	
I	22	MOD 2A assembly	Unknown	
I	23	MOD 2A ID	0	
I	24	MOD 2A Version	1,03	
I	25	MOD 2A Status 1	0000	hex
I	26	MOD 2A Status 2	0000	hex
I	27	MOD 2A Status 3	0000	hex
I	28	MOD 2A Status 4	0000	hex
S	31	MOD 2B should be	Unknown	
I	32	MOD 2B assembly	Unknown	
I	33	MOD 2B ID	0	
I	34	MOD 2B Version	0,00	

Parameterization and display of inserted modules and modules detected by the system. Used as information for automatic detection and troubleshooting.
This information is important for the factory assembly of device combinations or the subsequent configuration of modules.
Note: from version 1.3, the modules must be registered in the system!!!!

I	35	MOD 2B Status 1	0000	hex
I	36	MOD 2B Status 2	0000	hex
I	37	MOD 2B Status 3	0000	hex
I	38	MOD 2B Status 4	0000	hex
S	41	MOD 3A should be	Unknown	
I	42	MOD 3A assembly	Unknown	
I	43	MOD 3A ID	0	
I	44	MOD 3A Version	0,00	
I	45	MOD 3A Status 1	0000	hex
I	46	MOD 3A Status 2	0000	hex
I	47	MOD 3A Status 3	0004	hex
I	48	MOD 3A Status 4	016D	hex
I	49	Namur stautus M3A	0000	hex
S	51	MOD 3B should be	Unknown	
I	52	MOD 3B assembly	Unknown	
I	53	MOD 3B ID	0	
I	54	MOD 3B Version	0,00	
I	55	MOD 3B Status 1	0000	hex
I	56	MOD 3B Status 2	0000	hex
I	57	MOD 3B Status 3	0000	hex
I	58	MOD 3B Status 4	0000	hex
I	59	Namur status M3B	0000	hex

A.33 EI Configuration

Access	Line	Designation	Value	Unit
S	1	No.resist.meas.ch.	1	
S	2	No. Nonex currents	6	
S	3	No. Freq. Meas.	2	
S	4	No. Of curr. outputs	4	
S	5	No. Cont. Outp.	8	
S	6	No. pulse outputs	4	
S	7	No. of freq. outputs	1	
S	8	FPGA-Quarz freq.	32000020	Hz
W §	9	Quartz meas. CPU	29491200	Hz
S	10	L calib.pt.current	4,0000	mA
S	11	U calib.pt. current	20,0000	mA
S	12	L calib.pt. ohm(T)	-10,0000	°C
S	13	L calib.pt. ohm(T)	60,0000	°C
S	14	Gradient active	no	
S	15	Meas.warn.lim.act	yes	
S	16	Drag indic. active	no	
S	17	Means active	no	
S	18	Show base values	no	
S	19	Flow warn.lim.act.	yes	
S	20	Comp.warn.lim.act.	yes	
W §	22	ADC ref. voltage	2500,00	mV
W §	23	Rref cur.measurem	43,00	Ω
W §	24	Rref PT100 meas.	274,00	Ω
W §	25	Rref PT1000 meas.	3000,00	Ω
W §	26	Rref KTY measurem	3240,00	Ω
B	27	Drag indicator mode	Base value	
S	28	Analyt. assessment	no	
S	29	Vol.freq. source	f1/f2	
B	30	VOS deviat. ctrl.	no	

Lines 1–7: Enter the number of connected inputs and outputs here. The device only connects and activates the inputs and outputs defined here.

Lines 8–9: Do not modify the default settings of the quartz frequencies.

Lines 10–13: Enter the actual minimum and maximum values for the reference sources. Important for calculating the linear equation.

Lines 14–20: Activate or deactivate this function.

Lines 22–26: Do not modify the references values for the temperature measurement.

Line 27 (✲): Is normally deactivated

Line 29: Select the source in use

Line 30: Comparison between measured and calculated sound velocity

S	31	No.resist.meas.exi	0	
S	32	No. exi currents	0	
S	33	Freq.1/5-source	F1-X8 / F5-X9	
S	34	Freq.2/6-source	F2-X8 / F6-X9	
S	35	Freq.3/7-source	F3-X8 / F7-X9	
S	36	Freq.4/8-source	F4-X8 / F8-X9	
S	37	ENCO-source		
B	38	Dead man button	10	S
B	39	use TIMER-ISR	no	

Select required number

Assignment of frequency inputs 1 and 5 (Ex card)

Assignment of frequency inputs 2 and 6 (Ex card)

Assignment of frequency inputs 3 and 7 (Ex card)

Assignment of frequency inputs 4 and 8 (Ex card)

Assignment of the input for encoder totalizers (Ex card)

✲ **Activate the drag indicator for source value or base value**

A.34 EJ Identification of Software

Access	Line	Designation	Value	Unit
A §	3	Vers.offic. kernel	**1.9**	
A §	4	Checks.offic.kernel	**814F**	hex
A §	5	Time offic. kernel	**07-07-2010 11:06:48**	
D	6	Version application	1.9.1	
D	7	Checks. application	ABF3	hex
D	8	Time stamp application	03-08-2010 09:07:32	
E §	9	Activation key	1679547770	
Y	10	Software update	no	
A §	11	Check sum. parameter	**00000000**	
D	12	CRC of binary code	4D00	hex
D	13	Code controls	41	
A §	14	MID permission	**PTBof**	

Activation key compatible with this software version.
See separate documentation at the end of this manual for a more detailed description.

In the event of a software update, select YES here in superuser mode.

If a data book is created when operating a browser in the user visualization level, the ERZ uses the parameters to generate a checksum.

The CRC binary code displayed in field 12 is used to periodically check the official kernel and the application. The code control meter in field 13 indicates the number of checks performed since the system was switched on.

A.35 EK Identification of hardware

Access	Line	Designation	Value	Unit
J	1	Version FC-Bios	1.010	
J	2	Checks. FC-Bios	565B	hex
J	3	FC bios time	07-10-2008 09:59:58	
S	6	Manufacturer	RMG Messtechnik	
S	7	Year of construction	2006	
S	8	Factory number	601297	
S	9	Hardware ID	39	
W §	10	Layout/parts list	3	
I	11	MAC Address	00-04-F3-00-2B-A7	
S	12	Remarks	None	
D	13	CAN module	Infineon	

A checksum monitors the program of a microcontroller also installed on the base board. This checksum forms part of the custody transfer approval. Control of the FPGA, basic measuring functions, etc.

A.36 EL Description site

Access	Line	Designation	Value	Unit
B	1	Measuring priority	Main measurement	
B	2	Line name	3.1H	
B	3	Measuring point	defect	
B	4	Postal address	Heinrich-Lanz	
B	5	Longitude	8,32600	°
B	6	Latitude	49,57700	°
B	7	Design. meas.pt.	Zählpunktbeze	
B	8	Owner	Besitzer	
B	9	Property number	Eigentumsnum	
B	11	Start-up	29-05-2006 1	
B	12	Responsible person	Verantwortlicl	
B	13	Phone No	Rufnummer	
B	14	Inspector	Eichbeamter	
E §	15	Last calibration	16-05-2006 1	
B	16	Line number	1	
B	17	Billing	standby meas.	

A.37 EM Erasing procedures

Access	Line	Designation	Value	Unit
Y	10	Clear log	No	
Y	11	Clear changes	No	
Y	12	Clear archive	no	
Y	13	Hour/day reset	no	
Y	14	Drag indic. reset	no	
Q	15	accuracy test init	no	
Y	16	Clear gasmodem	no	

Corresponding memories and archives can be deleted here in superuser mode.

A.38 FC Freeze

Access	Line	Designation	Value	Unit
D	1	Time last freezer	09-08-2010 10:53:10	
D	2	Freeze contact	OFF	
B	3	Freeze mode	manual	
B	4	Freeze interval	30	s
B	5	Source freeze cont.	OFF	

Setting for all freeze parameters. The freeze results then appear in the blue fields (browser).

Source can be:
Contact input 1 ... 8

A.39 FD Corrector cycle

Access	Line	Designation	Value	Unit
D	1	Cycle duration	0,1111	s
D	2	Program cycles	9	1/s
D	3	Cycle counter	111664	
S	4	Cycle brake	3	·10 ms

Indicates the number of corrector cycles per second (20 cycles per second here)

Significance of the cycle brake:
There is a pause of n x 10 ms after each corrector cycle. Here n=3, i.e. 30 ms pause after a 20 ms computing cycle, which produces the 50 ms shown in the sum.

A.40 FE Calibration unit standard density/gross calorific value

Access	Line	Designation	Value	Unit
A §	1	Sd connection	Process gas	
A §	2	Sd acceptance	OFF	
E §	3	Source sd conn.	OFF	
E §	4	Source sd accept	OFF	
A §	5	Hs connection	Process gas	
A §	6	Hs acceptance	OFF	
E §	7	Source Hs conn.	OFF	
E §	8	Sourde Hs accept.	OFF	
T	9	Max. calib. Time	180	min

This function corresponds to the "old" FE-06 or the switch set for online calibration of the fuel gas value and standard density, if these measurement variables are delivered by special sensors (calorie meter with frequency or current output, standard density from density sensor or scales). There is no longer an interface for connecting an FE-06.

A.41 FF Function test under running conditions

Access	Line	Designation	Value	Unit
D	1	Status	At rest	
Q	2	Time stamp 1	01-01-1970 0	
Q	3	Time stamp 2	01-01-1970 0	
Q	4	Time stamp 3	01-01-1970 0	
Q	5	Time stamp 4	01-01-1970 0	
Q	6	Revision run	30	s
Q	7	Pre/post run	1	s
Q	8	Delay	0	s
B	9	Partner address	OFF	
B	10	Partners entity	Flow . comp. entity	

Sufficient time must be allowed for the functional test to produce meaningful values with a corresponding resolution. Only a few minutes are required to measure the volume via the HF inputs because the test function is synchronized with the volume frequency measurement. The testing time for "slow" inputs such as interfaces with an Enco or ultrasound meter must be sufficiently long to minimize resolution errors (1000 seconds). This also applies for the "On-the-fly calibration" function !!

A function on the device simplifies testing procedures by identifying and documenting all the most important data involved in a testing procedure.
Information on the **functional test** function can be found in the section **Test** under key **<6>**.
The following parameters appear there:

Status	indicates the current status of the function (inactive / active
Time stamp 1	parameter for the start of the testing procedure (prestart stage)
Time stamp 2	parameter for the end of the prestart stage and the start of the actual test
Time stamp 3	parameter for the end of the test stage and the start of the follow-up stage
Time stamp 4	parameter for the end of the follow-up stage and the function

Testing time	parameter that gives a relative indication of the testing time, corresponds to the time between time stamp 3 and 4
Prestart/follow-up time	parameter that gives a relative indication of the prestart and follow-up time, corresponds to the time between time stamps 1 and 2 or 3 and 4
Delay	parameter for a waiting time before the start with time stamp 1

There are several ways of using the functional test function.
Use of the time stamps through manual input. Once the 4 time stamps are entered, the function is activated automatically when the respective times are reached and stops at the end of the 4th time stamp. The testing time, the prestart/follow-up time and the delay have no influence.
Use of the time stamps by making entries via the DSfG using the revision PC. Once the 4 time stamps are entered, the function is activated automatically when the respective times are reached and stops at the end of the 4th time stamp. The testing time, the prestart/follow-up time and the delay have no influence.
Parameterization of the time stamps by making remote entries using the browser. Click on the **Plan** button using the mouse. The 4 time stamps are then calculated from the time on the PC (not the corrector!) and the values for the testing, prestart/follow-up and delay times. The function is activated automatically when the respective times are reached and stops at the end of the 4th time stamp.

The previous function for the DSfG revision is merged with the custody transfer functional test. Although the user has the option of viewing the archives, the context cannot be included on the 4 lines of the display and the user is prompted to note down the values. The archive groups 11, 12 and 13 are described.
The data elements are hardly ever displayed either.
As a consequence, the results of a completed functional test can only really be accessed via a browser.

Time stamp 1 · Time stamp 2 · Time stamp 3 · Time stamp 4

	Prestart		Test			Follow-up			
Name	14-03-2006 16:01:26	-	14-03-2006 16:01:36	-	14-03-2006 16:02:36	-	14-03-2006 16:02:46	Unit	Trend
Time	6400.967663	10.000063	**6410.967726**	**59.999539**	**6470.967265**	9.999886	6480.967151	s	
Vb1	43044.898303	0.326637	**43045.224940**	**1.959824**	**43047.184764**	0.326637	43047.511401	m3	
Vk1	43044.898303	0.326637	**43045.224940**	**1.959824**	**43047.184764**	0.326637	43047.511401	m3	
Vn1	1354410.397590	12.228196	**1354422.625786**	**73.369174**	**1354495.994960**	12.228188	1354508.223148	m3	
E1	24540.539483	0.122184	**24540.661667**	**0.733105**	**24541.394771**	0.122184	24541.516955	MWh	
Vb2	0.000000	0.000000	**0.000000**	**0.000000**	**0.000000**	0.000000	0.000000	m3	
Vk2	0.000000	0.000000	**0.000000**	**0.000000**	**0.000000**	0.000000	0.000000	m3	
Vn2	0.000000	0.000000	**0.000000**	**0.000000**	**0.000000**	0.000000	0.000000	m3	
E2	0.000000	0.000000	**0.000000**	**0.000000**	**0.000000**	0.000000	0.000000	MWh	
Qb		117.589		**117.589**		117.589		m3/h	↑
Qbk		117.589		**117.589**		117.589		m3/h	↑
Qn		4402.15		**4402.15**		4402.15		m3/h	↑
Qe		43986.2		**43986.3**		43986.3		kW	↑
P		35.000		**35.000**		35.000		bar	
T		0.13		**0.13**		0.13		°C	↓
Ho		9.992		**9.992**		9.992		kWh/m3	
Rn		0.7768		**0.7768**		0.7768		kg/m3	
Rb		29.081		**29.081**		29.081		kg/m3	↑

Vsb		431.100		**431.100**		431.100		m/s	
Z		37.4366		**37.4366**		37.4366			↑
K		0.92223		**0.92223**		0.92223			↓
CO2		6.200		**6.200**		6.200		mol-%	
H2		0.000		**0.000**		0.000		mol-%	
N2		10.000		**10.000**		10.000		mol-%	
CH4		83.800		**83.800**		83.800		mol-%	
C2H6		0.000		**0.000**		0.000		mol-%	
C3H8		0.000		**0.000**		0.000		mol-%	
N-C4		0.000		**0.000**		0.000		mol-%	
I-C4		0.000		**0.000**		0.000		mol-%	
N-C5		0.000		**0.000**		0.000		mol-%	
I-C5		0.000		**0.000**		0.000		mol-%	
NeoC5		0.000		**0.000**		0.000		mol-%	
C6		0.000		**0.000**		0.000		mol-%	
C7		0.000		**0.000**		0.000		mol-%	
C8		0.000		**0.000**		0.000		mol-%	
C9		0.000		**0.000**		0.000		mol-%	
C10		0.000		**0.000**		0.000		mol-%	
H2S		0.000		**0.000**		0.000		mol-%	
H2O		0.000		**0.000**		0.000		mol-%	
He		0.000		**0.000**		0.000		mol-%	
O2		0.000		**0.000**		0.000		mol-%	
CO		0.000		**0.000**		0.000		mol-%	
C2H4		0.000		**0.000**		0.000		mol-%	
C3H6		0.000		**0.000**		0.000		mol-%	
Ar		0.000		**0.000**		0.000		mol-%	

The 3 columns in the center under the heading "Test" shown in bold contain the results of the functional test. The first column contains the start values, the central column contains the deviations and average values and the third column contains the end values.
The prestart and follow-up sections also contain meaningful test times and relevant data, depending on the preset time.

The functional test only delivers useful data if the flow corrector is operating smoothly and the totalizer status does not change (operational / inactive, etc.) during the test.
If this is not the case, the start and end values are not displayed and the lines containing the meter readings are hidden.
If only the disturbance totalizers are operating, for example, the stationary main totalizers are stored with a deviation = 0.

Make sure the test time is long enough!
Greater attention must be paid to the testing time of interface protocols that only send data at one-second intervals (ENCO, DZU). The same applies for LF inputs.

Display and stimulation of hardware states

A.42 FG Hardware test

Access	Line	Designation	Value	Unit
Y	1	Active	no	
I	2	Alarm contact	0	
I	3	Warning contact	0	
I	4	Contact output	0002	Hex
D	7	Power LED	Flashes	
D	8	Run LED	On	
D	9	Warning LED	OFF	
D	10	Alarm LED	On	
D	13	HFX test totalizer	593762	Pulse
D	14	HFY test totalizer	0	Pulse
D	15	HFX-HFY diff.	0	Pulse
I	16	Frequency input 1 -> NL01	80,2911	Hz
I	17	Frequency input 2 -> NM01	0,0000	Hz
I	18	Frequency input 3 -> NN01	0,0000	Hz
I	19	Frequency input 4 -> NO01	0,0000	Hz
I	20	Frequency input 5 -> NP01	0,0000	Hz
I	21	Frequency input 6 -> NQ01	0,0000	Hz
I	22	Frequency input 7 -> NR01	0,0000	Hz
I	23	Frequency input 8 -> NS01	0,0000	Hz
I	24	Current input 1 -> NA01	0,0002	mA
I	25	Current input 2 -> NB01	0,0001	mA
I	26	Current input 3 -> NC01	0,0000	mA
I	27	Current input 4 -> ND01	0,0000	mA
I	28	Current input 5 -> NE01	0,0001	mA
I	29	Current input 6 -> NF01	0,0001	mA
I	30	Current input 7 -> NG01	0,0000	mA
I	31	Current input 8 -> NH01	0,0000	mA
I	32	Current input 9 -> NU01	0,0000	mA
I	33	Current input 10 -> NV01	0,0000	mA
I	34	Current input 11 -> NW01	0,0000	mA
I	35	Current input 12 -> NX01	0,0000	mA
I	36	Inside temperature -> AL01	25,1	°C
I	37	Resistance 1 -> NI01	109,91	Ω
I	38	Resistance 2 -> NJ01	0,00	Ω

no: normal operation or measurement
yes: hardware test or stimulation

The display test is initiated using the coordinates 5 and 6 (not shown here).

173

Display (stimulation) of the state of the alarm, warning and contact outputs as well as the LEDs

Display of the pulses already counted on the measurement and comparison channel and the deviation, if applicable.

Display of the primary measured values for the frequency inputs.

Display of the primary measured values for the current inputs.

Display of the internal device temperature

Display of the primary measured values for the resistance inputs.

I	39	Resistance 3 -> NY01	0,00	Ω
I	40	Resistance 4 -> NZ01	0,00	Ω
I	41	Contact input	00FF	Hex
Y	43	Testing aid	OFF	

Binary pattern of the contact inputs

FG43 Testing aid

The testing aid is provided for tests in the factory.
Prerequisite is ***EB17 device status=brand new.*** (select ***EL03 Site=faulty***!
The testing aid is activated with the setting ***FG43 Testing aid=calibration aid.***
A PC can be connected to COM 5.
The interface parameters are fixed at 38400 baud and 8N1.
The interface mode ***IB21 COM5 operating mode*** is irrelevant.
All coordinates can be read and written using a terminal program (e.g. RMG terminal).
The variable name defined in the browser via the network interface is used for reference purposes.

Examples

- Read absolute pressure ***AB01 Measurement value***: ***drka*** [Return]
- Write absolute pressure ***AB05 Default=45***: ***drkaVg=45*** [Return]
- Export error memory: ***actErr*** [Return]

During write operations with a preceding '#', the described coordinates are immediately shown on the display for control purposes.

Example

- Write and display absolute pressure ***AB05 Default=45***: ***#drkaVg=45*** [Return]

If the power is OFF, the testing aid is shut down automatically or set to ***FG43 Testing aid=off***.

A.43 FH Ultrasonic flow meter diagnosis

Display of diagnostic values for a connected ultrasound gas meter.

Access	Line	Designation	Value	Unit
A §	1	VOS mean	0	m/s
D	11	VOS 1	0	m/s
D	12	VOS 2	0	m/s
D	13	VOS 3	0	m/s
D	14	VOS 4	0	m/s
D	15	VOS 5	0	m/s
D	16	VOS 6	0	m/s
D	17	VOS 7	0	m/s
D	18	VOS 8	0	m/s
D	19	AGC up 1	0	
D	20	AGC down 1	0	
D	21	AGC up 2	0	
D	22	AGC down 2	0	
D	23	AGC up 3	0	
D	24	AGC down 3	0	
D	25	AGC up 4	0	
D	26	AGC down 4	0	
D	27	AGC up 5	0	
D	28	AGC down 5	0	
D	29	AGC up 6	0	
D	30	AGC down 6	0	
D	31	AGC up 7	0	
D	32	AGC down 7	0	
D	33	AGC up 8	0	
D	34	AGC down 8	0	
D	35	Meas. Quality 1	0	%
D	36	Meas. Quality 2	0	%
D	37	Meas. Quality 3	0	%
D	38	Meas. Quality 4	0	%
D	39	Meas. Quality 5	0	%
D	40	Meas. Quality 6	0	%
D	41	Meas. Quality 7	0	%
D	42	Meas. Quality 8	0	%
A §	43	Alarm LED	Uncertain	
D	44	Warning LED	uncertain	

D	45	Message 0...15	0000	hex
D	46	Message 16...31	0000	hex
D	47	Message 32...47	0000	hex
D	48	Message 48...63	0000	hex
D	49	Message 64...79	0000	hex
D	50	Message 80...95	0000	hex
D	51	Message 96...111	0000	hex
D	52	Message 112...127	0000	hex
D	53	Message 128...143	0000	hex
D	54	Message 144...159	0000	hex
D	55	Message 160...175	0000	hex
D	56	Messung 176...191	0000	hex
D	57	Message 192...207	0000	hex
D	58	System staus	0000	hex
D	59	SNR 1 up	0,00	dB
D	60	SNR 2 up	0,00	dB
D	61	SNR 3 up	0,00	dB
D	62	SNR 4 up	0,00	dB
D	63	SNR 5 up	0,00	dB
D	64	SNR 6 up	0,00	dB
D	65	SNR 7 up	0,00	dB
D	66	SNR 8 up	0,00	dB
D	67	SNR 2 down	0,00	dB
D	68	SNR 3 down	0,00	dB
D	69	SNR 4 down	0,00	dB
D	70	SNR 5 down	0,00	dB
D	71	SNR 6 down	0,00	dB
D	72	SNR 7 down	0,00	dB
D	73	SNR 8 down	0,00	dB
D	74	SNR 9 down	0,00	dB

A.44 FI Test cabinet

Access	Line	Designation	Value	Unit
D	1	Test cabinet	At rest	
Q	2	Refreah time	2	s

Internal displays and parameters for testing devices in the Beindersheim factory. Periodically displays all measured values without having to press any buttons. The refresh time specifies the time it takes to switch the display to the next block of 4.

A.45 FJ File system

Access	Line	Designtion	Value	Unit
D	1	Percent free memo	86,963	%
B	2	Min. capacity warn	5,000	%
D	3	Total memory	127,9	MByte
D	4	Available memory	111,2	MByte

A.46 FL Ultrasonic profile of velocities

Access	Line	Designation	Value	Unit
D	1	V gas 1	0	m/s
D	2	V gas 2	0	m/s
D	3	V gas 3	0	m/s
D	4	V gas 4	0	m/s
D	5	V gas 5	0	m/s
D	6	V gas 6	0	
D	7	V gas 7	0	m/s
D	8	V gas 8	0	m/s
D	9	Swirl	0,000	%
D	10	Double swirl	0,000	%
D	11	Asymmetry	0,000	%
D	12	Cross flow	0,000	%
D	13	PFY1	0,000	
D	14	PFY2	0,000	
D	15	PFY	0,000	
D	16	PFY31	0,000	
D	17	PFY35	0,000	
D	18	PFY42	0,000	
D	19	PFY46	0,000	
D	20	PFX	0,000	

These are the profile factors of the ultrasound meter.

D	21	PFX12	0,000	
D	22	PFX56	0,000	
D	23	PF-Sym-X	0,000	
D	24	PF-Sym-Y	0,000	
D	25	PF-Sym	0,000	

A.47 GA Tube dimensions

Access	Line	Designation	Value	Unit
A §	1	Orifice diam. (T)	**100,0000**	mm
A §	2	Pipe diam. (T)	**150,0000**	mm
D	3	T-crr fact orifice	1,000000	
D	4	T-crr fact pipe	1,000000	
E §	5	Lin.expanse orifice	16,500	10^-6/°C
E §	6	Lin.expanse pipe	11,000	10^-6/°C
E §	7	Orifice diameter	36,0000	mm
E §	8	Pipe diameter	50,0000	mm
E §	10	Substance orifice	GOST 5.586	
E §	11	Substance pipe	GOST 5.586	
E §	12	Orifice a0-coeff.	15,600	
E §	13	Orifice a1-coeff.	8,300	
E §	14	Orifice a2-coeff.	-6,500	
E §	15	Tube a0-coeff.	11,100	
E §	16	Tube a1-coeff.	7,700	
E §	17	Tube a2-coeff.	-3,400	

Linear heat expansion coefficient of the orifice.

Linear heat expansion coefficient of the pipe.

Coefficients for the GOST correction.

The temperature correction of the orifice diameter *GA07 Orifice 20°C* and the internal pipe diameter *GA08 Pipe diameter 20°C* is calculated according to VDI/VDE 2040 sheet 2 (section 10) from April 1987. There are two methods of calculation: one is based on the linear heat expansion coefficients, while the other is based on the approximation equation with coefficients selected in line with the orifice and pipe materials. The following table shows the available options.

Temperature correction for orifice and pipe ***GA10 Substance orifice*** ***GA11 Substance pipe***		
Options	**Coefficients**	
	A	**B**
off	-	-
Linear	-	-
GOST	-	-
Steel I	12,60	0,0043
Steel II3	12,42	0,0034
Steel III	12,05	0,0035
Steel IV	10,52	0,0031
Steel V	17,00	0,0038
Steel VI	16,30	0,0116
Bronze SnBz4	17,01	0,0040
Copper E-Cu	16,13	0.0038
Gunmetal Rg9	16,13	0,0038
Brass Ms63	17,52	0,0089
Nickel	14,08	0,0028
Hastelloy C	10,87	0,0033

off
The relevant temperature correction is deactivated.

linear
The correction factors GA03 T-crr fact orifice and GA04 T-crr fact pipe are calculated using the linear heat expansion coefficients GA05 Lin.expanse orifice and GA06 Lin.expanse pipe.

$$T\,Ber.\,fakt = 1 + A.lin * (Temp - 20)$$

Material selection
The correction factors GA03 T-crr fact orifice and GA04 T-crr fact pipe are calculated using an approximation equation
and the coefficients A and B.

$$T\,Ber.\,fakt = 1 + (A * (Temp - 20) + B * (Temp - 20)^2\ ) * 10^{-6}$$

Coefficients are assigned automatically when a material is selected.
The permitted temperature range for the materials listed extends from -200°C to 600°C, with the exception of copper, nickel and brass, which have an upper limit of 500°C.

GOST

The correction is made according to the GOST 8.586 regulations for the measurement of liquids and gases flow rate and quantity by means of orifice instruments.

8.586.1 Part 1 Principle of the method of measurements and general requirements
8.586.2 Part 2 Orifice plates. Technical requirements
8.586.5 Part 5 Measurement procedure

The calculation uses three coefficients a0, a1 and a2 in line with the materials used for the orifice and pipe (coordinates GA12...GA17). The procedure is complex and the description would extend beyond the boundaries of this device manual. Therefore, refer to the documents listed above for further details.

A.48 GB Flow rate parameters

Access	Line	Designation	Value	Unit
A §	1	Qm max	11000,000	m3/h
A §	2	Qm min	50,000	m3/h
E §	3	High pressure ext.	no	
E §	4	Qm,min	50,000	m3/h
E §	5	Q,b,min (HP)	40,000	m3/h
E §	6	Qm max	11000,000	m3/h
E §	7	Pe,min	1,0	bar
E §	8	Pe,max	100,0	bar
E §	9	Rho,min	1,0	kg/m3
E §	10	Rho,max	100,0	kg/m3
E §	11	certified	for air	
E §	12	used	for natural gas	
E §	13	Creeping qty limit	12,500	m3/h
E §	14	Creeping qty mode	accumulate	
E §	15	LF measurable	yes	
E §	16	Vol.transd. mode	HF2-K 1/1	
E §	17	Start-up pulses	500	Pulse
E §	18	Missing pulses	10	Pulse
E §	19	Reference pulses	10000	Pulse
E §	20	mx.allow. Dev.X/Y	4,000	%
A §	21	act. Dev. X/Y	0,000	%
A §	23	Channel Qm det.	HFX	
A §	25	Channel Vm determ	HFX	

Creeping quantity limit:
Definition of the flow rate limit value below which a totalizer calculation should not take place.

This parameter is used to determine whether creeping quantity suppression is active or whether the accumulated quantities should be added together.

Function of these parameters same as ERZ 9000T.
See manual for more detailed description

Auxiliary displays for diagnosing problems with HF measurement and comparison sensor signals.
The actual device uses the K factors to calculate the ideal number of pulses for paddle wheel monitoring.

A §	27	Hardw.pulse comp.	OFF	
A §	29	Vo effect of fault	OFF	
A §	31	Main blades (X)	200	Pulse
A §	32	Ref. Blades	200	Pulse
A §	33	Better HF-channel	Uncertain	
B	34	Predict.reliability	5	
D	35	Decision change	0	
A §	36	USZ effect of fault	OFF	
A §	37	Vol alarm contact	OFF	
E §	38	Source vol alarm	OFF	
D	39	Vol.warn contact	OFF	
B	40	Sourve vol alarm	OFF	
E §	50	Manufacturer	RMG	
E §	51	Device type	TRZ03	
E §	52	Serial number	0	
E §	53	Meter type	TM	
E §	54	Meter size	G650	
Q	55	Freq. Turbinesim.	0	Hz

Number of tests for determining which is the better HF channel.

Indicates how many changes have already taken place.

The alarm output on external volume sensors can be connected. The contact input must be selected here.

The warning output on external volume sensors can be connected. The contact input must be selected here.

A.49 GC kv factor

Access	Line	Designation	Value	Unit
A §	1	Cur.kv factor	360,00000	l/m3
A §	2	Mean kv factor	360,00000	l/m3
A §	3	Mom.dev. at op.pt	0,000	%
D	4	Qm percentage	7,300	%
A §	5	Current direction	Forwards	
A §	6	Cur kv set	Kv=main	
E §	7	Kv main/forwards	6123,00000	l/m3
E §	8	kv ref./forwards	3123,00000	l/m3
E §	9	kv main/rev.	6125,00000	l/m3
E §	10	kv ref./rev.	6125,00000	l/m3
F	61	Current kv factor	360,00000	l/m3
F	62	Mom.dev. at opr.pt.	0,000	%
F	63	Qm percentage	0,000	%

Pulse values currently used (may deviate from line 2, e.g. after characteristic correction).

Setting of pulse values for measuring and comparison channels, and separately for meters that count forwards and backwards.

A.50 GD Determination of characteristic

Access	Line	Designation	Value	Unit
A §	1	Cur.kv factor main	360,00000	l/m3
A §	2	Cur.kv factor ref.	200,00000	l/m3
A §	3	Mean kv factor main	360,00000	l/m3
A §	4	Mean kv factor ref	200,00000	l/m3
D	5	Lower neighbout	0	
D	6	Upper neighbour	0	
E §	7	Kv mode	kv=constant	
E §	8	Max.dev.at op.pt.	2,00000	
E §	9	Op.pt.dev.mode	w ith correction	
G §	10	Unit	P/m3	
E §	11	Direction mode	alw ays forw ards	
E §	12	Direction BM1	forw ards	
E §	13	Direction BM2	reverse	
E §	14	Direction BM3	forw ards	
E §	15	Direction BM4	reverse	

Display of kv factors for forwards and backwards operation

Display of the number for the nearest support point below / above the current percentage flow. If the value -1 is displayed, the percentage flow is currently below / above the lowest support point.

Option for defining whether or not the correction procedure should be used for the calculation. Options include support point procedure, polynomial via flow and polynomial via Reynolds number.

Defines whether calculation should continue with or without the correction when the maximum deviation is exceeded.

Definition of the roadway, fixed assignment or independent of the billing mode.

A.51 GE Error curve linearization, forward flow

Access	Line	Designation	Value	Unit
E §	1	Interp.point 1	5	%
E §	2	Corr.point 1	1	%
E §	3	Interp.point 2	10	%
E §	4	Corr.point 2	0,5	%
E §	5	Interp.point 3	25	%
E §	6	Corr.point 3	0,2	%
E §	7	Interp.point 4	40	%
E §	8	Corr.point 4	0	%
E §	9	Interp.point 5	70	%
E §	10	Corr.point 5	0,1	%
E §	11	Interp.point 6	100	%

There are 16 pairs of support points for forward operation and polynomial coefficients (at the end of the table). The same function is also available for reverse operation under GF.

E §	12	Corr.point 6	0	%
E §	13	Interp.point 7	-1	%
E §	14	Corr.point 7	0	%
E §	15	Interp.point 8	-1	%
E §	16	Corr.point 8	0	%
E §	17	Interp.point 9	-1	%
E §	18	Corr.point 9	0	%
E §	19	Interp..point 10	-1	%
E §	20	Corr. point 10	0	%
E §	21	Interp.point 11	-1	%
E §	22	Corr.point 11	0	%
E §	23	Interp.point 12	-1	%
E §	24	Corr.point 12	0	%
E §	25	Interp. Point 13	-1	%
E §	26	Corr.point 13	0	%
E §	27	Interp.point 14	-1	%
E §	28	Corr. point 14	0	%
E §	29	Interp.point 15	-1	%
E §	30	Corr.point15	0	%
E §	31	Interp.point 16	-1	%
E §	32	Corr.point 16	0	%
E §	33	Coefficient A-2	-1503,953000	
E §	34	Coefficient A-1	97,168000	
E §	35	Coefficient A 0	-0,379000	
E §	36	Coefficient A 1	7,391000	·10^-4
E §	37	Coefficient A 2	-44,335000	·10^-8
E §	38	Straatsma A0	0,00000000	
E §	39	Straatsma A1	0,00000000	
E §	40	Straatsma A2	0,00000000	
E §	41	Straatsma A3	0,0000000	

A.52 GG Flow

Access	Line	Designation	Value	Unit
D	1	Reynolds number	9539539	
D	2	Flow velocity	12,624	m/s
D	3	Pressure loss	231,060	mbar
T	4	Press.loss coeff.	3000	
D	5	Dynamic pressure	48,171	mbar
D	6	Wind speed	6,1	bft
D	7	Wind type	Strong breeze	

Calculated values

From the data sheet for the meter e.g. TRZ (RMG Messtechnik specifications)

Wind data calculated from the gas flow velocity (only out of interest).

A.53 GH Start-up and slow-down monitoring

Access	Line	Designation	Value	Unit
D	1	Qm state	Flowing	
A §	2	Current start-up	0	s
A §	3	Current slow-down	0	s
E §	4	Max. time start-up	10000	s
E §	5	Max. time slow-down	10000	s
A §	6	Pipe start	Unrated	
E §	7	Source	OFF	
M	8	Modbus pipe state	0	
B	9	Action	as alarm	

Separately adjustable start-up and slow-down times for monitoring the operating time under Qmin.

A.54 GI Ultrasonic transmitter

Parameters for operation with an ultrasound gas meter

Access	Line	Designation	Value	Unit
B	1	No. Samples for SV	140	
E §	2	Number of plate	6	
E §	3	Zero point noise	0,000	m/s
E §	4	KV-factor	1,00000	
E §	5	Allowed brok. patha	2	
E §	7	Measurm. quality	70	%
E §	8	Communic. quality	95	%
B	9	VOS upper limit	500,00000	m/s

B	10	VOS upper limit	150,00000	m/s
A §	11	Velocity of sound	**0,00000**	m/s
A §	12	Direction	**Direction 1**	
D	13	IGM start-up	0	
A §	14	Broken path	**0**	
D	16	IGM cycle quantity	,000000	m3
I	17	Timeout IGM 1	0	
I	18	Timeout IGM 2	0	
I	19	Timeout IGM 3	0	
I	20	Timeout IGM 4	0	
Q	21	IGM Reset	0	
E §	22	Max. VOD deviation	3,000	%
D	23	Path status	00000000	
X	24	SV reset	no	
D	25	SV status	Invalid	
D	26	SV range	0	
D	27	SV valid	0	
D	28	SV set	0	
D	29	SV not valid	0	
D	30	VOS status	00000000	
D	31	Swirl	0,000	%
D	32	Double swirl	0,000	%
D	33	Asymmetry	0,000	%
D	34	Cross flow	0,000	%
B	35	Show VOS error	no	
S	36	IGM time out period	20	·10 ms
S	37	Def. C-Mode	yes	

A.55 GM Reynolds correction

Access	Line	Designation	Value	Unit
A §	1	Re corr. Factor	**0,00000**	
E §	10	Reynolds corr.	no	
E §	21	Coeff. A dir .1	1,00000	
E §	22	Coeff. B dir. 1	0,00000	

Correction procedure when using an ultrasound gas meter.

E §	23	Coeff. C dir. 1	1,00000	
E §	31	Coeff. A dir. 2	1,00000	
E §	32	Coeff. A dir. 2	0,00000	
E §	33	Coeff. C dir 2	1,00000	

A.56 GN Base correction

Access	Line	Designation	Value	Unit
A §	1	Base corr. Factor	0,00000	%
E §	10	Base correction	no	
E §	21	Coeff. A-2 dir 1	0,00000e+00	
E §	22	Coeff. A-1 dir. 1	0,00000e+00	
E §	23	Coeff. A0 dir. 1	0,00000e+00	
E §	24	Coeff. A1 dir. 1	0,00000e+00	
E §	25	Coeff. A2 dir. 1	0,00000e+00	
E §	31	Coeff. A-2 dir. 2	0,00000e+00	
E §	32	Coeff. A-1 dir. 2	0,00000e+00	
E §	33	Coeff. A0 dir. 2	0,00000e+00	
E §	34	Coeff. A1 dir. 2	0,00000e+00	
E §	35	Coeff. A2 dir. 2	0,00000e+00	

A.57 GO Err. Curve correction

Access	Line	Designation	Value	Unit
A §	1	Err.crv.corr.fact.	0,00000	%
E §	10	Error curve corr.	no	
E §	21	Coeff. A-2 dir. 1	0,00000e+00	
E §	22	Coeff. A-1 dir. 1	0,00000e+00	
E §	23	Coeff. A0 dir. 1	0,00000e+00	
E §	24	Coeff. A1 dir. 1	0,00000e+00	
E §	25	Coeff. A2 dir. 1	0,00000e+00	
E §	31	Coeff. A-2 dir. 2	0,00000e+00	
E §	32	Coeff. A-1 dir. 2	0,00000e+00	

E §	33	Coeff. A0 dir. 2	0,00000e+00	
E §	34	Coeff. A1 dir. 2	0,00000e+00	
E §	35	Coeff. A2 dir. 2	0,00000e+00	

A.58 GP Effects of correct.

Access	Line	Designation	Value	Unit
A §	1	Velo. Uncorr	0,000	m/s
A §	2	Velo, Re-corr.	0,000	m/s
A §	3	Velo, basecorr.	0,000	m/s
A §	4	Velo, errcrv.corr.	0,000	m/s
A §	5	Flow, uncorr.	0,00000	m3/h
A §	6	Flow, Re-corr.	0,00000	m3/h
A §	7	Flow, basecorr.	0,00000	m3/h
A §	8	Flow, errcrv.corr.	0,00000	m3/h
A §	9	Re, uncorr.	0	
A §	10	Re, Re-corr.	0	
A §	11	Re, basecorr.	0	
A §	12	Re, errcrv.corr.	0	

Indication of the effect of corrections under GM, GN and GO.

A.59 GU Namur Sensor adjustment

Access	Line	Designation	Value	Unit
E §	1	Sensor type A	standard Namur	
E §	2	Sensor type B	standard Namur	
S	3	Trig. RMG-tap	125	
S	4	Hyst. RMG-tap	100	
S	5	Trig. stnd. Namur	90	
S	6	Hyst. stnd. Namur	55	
E §	7	Trig. man. just.	125	
E §	8	. Hyst. man. just.	100	

New menu with introduction of Ex isolating device for NAMUR signals from HF / LF sensors or ENCO, and pressure and temperature sensors

A.60 GX Roughness of tube

Access	Line	Designation	Value	Unit
A §	1	Correct. Factor	**0,000000**	
D	2	Friction factor	0,000000	
D	3	Friction fict. Ref.	0,000000	
E §	4	Roughness-corr.	on	
E §	5	Equiv. Roughness	0,014	mm
D	6	Roughness	0,000000	mm
D	7	Lower margin	0,000000	mm
D	8	Upper margin	0,000000	mm
D	9	Correction	Switched off	

If the *on* setting is selected, the roughness of the internal pipe surface is taken into account according to GOST.

Roughness margin, below which correction takes place.

Roughness margin, above which correction takes place.

Current roughness correction status

A.61 GY Abrasion of orifice edge

Access	Line	Designation	Value	Unit
A §	1	Correct. Factor	**0,000000**	
D	2	Life time	0,000000	Years
D	3	Ongoing radius	0,000000	mm
E §	4	Miode	calculation	
E §	5	Point in time	07-06-2010 1	
E §	6	Beginning radius	0,040000	mm
E §	7	Default value	1,008230	

Time since the beginning radius was measured.

If the ***Calculation*** setting is selected, the abrasion of the orifice is taken into account according to GOST.

Point in time when the beginning radius was measured.

Default value for the correction factor.

The roughness and orifice abrasion are corrected according to GOST 8.586 regulations for the *measurement of liquids and gases flow rate and quantity by means of orifice instruments.*

8.586.1 Part 1 Principle of the method of measurements and general requirements

8.586.2 Part 2 Orifice plates. Technical requirements

8.586.5 Part 5 Measurement procedure

The calculation procedure is complex and the description would extend beyond the boundaries of this device manual. Therefore, refer to the documents listed above for further details.

A.62 HB Energy flow rate

Access	Line	Designation	Value	Unit
A §	1	Measured value	**2496,7**	kW
G §	4	Unit	**GJ/h**	
B	6	Lower warning limit	0,0	kW
B	7	Upper warning limit	3000000,0	kW
G §	30	Format	%.1f	
D	31	Min. drag indicator	0,0	kW
D	32	Max. drag indicator	3729,4	kW
D	34	Second mean	2496,6	kW
D	35	Minute mean	2489,4	kW
D	36	Hourly mean	3058,0	kW
D	38	Standard deviation	0,5	kW
D	41	Timestamp min.	09-08-2010 09:23:08	
D	42	Timestamp max.	09-08-2010 09:35:51	
D	47	Revision mean	2496,7	kW
F	61	Measured value	2574,9	kW

Format for all flows can be adjusted separately.

A.63 HG Mass flow rate broken down into components

Access	Line	Designation	Value	Unit
D	1	N2	679,366	kg/h
D	2	CO2	2191,99	kg/h
D	3	H2S	0	kg/h
D	4	H2O	0	kg/h
D	5	Helium	0	kg/h
D	6	Methane	36082,6	kg/h
D	7	Ethane	6712,14	kg/h
D	8	Propane	2173,32	kg/h
D	9	N-Butane	591,107	kg/h
D	10	I-Butane	0	kg/h
D	11	N-Pentane	94,0719	kg/h
D	12	I-Pentane	0	kg/h
D	13	Hexane	44,9443	kg/h
D	14	Heptane	0	kg/h
D	15	Octane	0	kg/h
D	16	Nonane	0	kg/h

The mass flow rate of each individual gas component can also be calculated because the components are known.

D	17	Decane	0	kg/h
D	18	O2	0	kg/h
D	19	CO	0	kg/h
D	20	H2	0	kg/h
D	21	Neo-Pentane	0	kg/h
D	22	Ethene	0	kg/h
D	23	Propene	0	kg/h
D	24	Argon	0	kg/h

A.64 HN Path 1

Access	Line	Name	Value	Unit
A §	1	Corrected velocity	**0,000**	m/s
D	2	Statur	Source value	
I	3	Genuine velocity	0,000	m/s
D	4	Substitute value	0,000	m/s
I	5	Measurem. Quality	0	%
D	6	Communic. Quality	0	%
I	7	VOS	0,00000	m/s
D	8	Comparison VOS	0,00000	m/s
D	9	VOS deviation	0,000	%
D	10	Path status	okay	
D	11	Path VOS status	okay	
I	15	AGC up 1	0	
I	16	AGC down 1	0	
E §	31	Weighting	1,00000	
E §	32	Corr. fact. dir. 1	1,00000	
E §	33	Corr. fact. dir.2	1,00000	
E §	34	Mapping	10	

Display and parameterization of details for paths 1 to 8 of an IGM ultrasound gas meter.

A.65 IA TCP/IP Net work

Important settings for networking devices and operation using the browser.

Access	Line	Designation	Value	Unit
B	1	Own IP4 address	192.168.20.12	
B	2	Port HTTP	80	
B	6	local@........	MR1	
B	7	....@domain.my	rmg.de	
B	13	Net mask	255.255.255.0	
B	14	Gateway	192.168.20.25	
B	15	DHCP	no	
B	16	Inactive timeout	30	s
B	17	Data timeout	120	s
B	19	max. block size	1024	Byte
B	21	Domain name service	194.25.0.70	
D	22	HTTPD-Sockets	3014	
D	23	Waterloo Timer	2212235916	

A.65.1 Setting the parameters

The necessary TCP/IP settings must be configured in the column **IA** so that the network connection functions correctly.

Access	Column	Line	Name	Minimum	Maximum	Unit	Remarks
B	IA	1	Separate IP4 address	unlimited	unlimited	none	
B	IA	2	HTTP port	0	65535	none	
B	IA	6	Host name	unlimited	unlimited	none	
B	IA	7	Domain suffix	unlimited	unlimited	none	
B	IA	13	Net mask	unlimited	unlimited	none	
B	IA	14	Gateway	unlimited	unlimited	none	
B	IA	15	DHCP	Menu		none	no, yes
B	IA	16	Inactive timeout	0 s	3600 s	s	
B	IA	17	Data timeout	0 s	3600 s	s	
B	IA	19	Max. block size	512 bytes	2048 bytes	byte	
B	IA	21	DNS	unlimited	unlimited	none	

A.65.2 Explanation of the settings

Important data is marked with Important! .

Important!

IA 1 coordinates Separate IP4 address
Configure the separate IP4 address for the ERZ 2000 here for the network e.g. 192.6.10.154. The ERZ 2000 operates as a HTTP server under this address and can be addressed by the PC using a standard browser (Internet Explorer, Netscape).

IA 2 coordinates http port Important!
This value is typically available at port 80

IA 6 coordinates Host name
Basic setting is MR1.

IA 7 coordinates Domain suffix
Basic setting is rmg.de.

IA 13 coordinates Net mask
Network mask basic setting ⇒ Administrator

IA 14 coordinates Gateway Important!
Gateway basic setting ⇒ Administrator

IA 15 coordinates DHCP Important
Automatic assignment of IP4 address, network mask and gateway (menu with "yes" and "no", normal setting = "no")

IA 16 coordinates Inactive timeout
Only for test

IA 17 coordinates Data timeout
Only for test

IA 19 coordinates Max. block size
Block size setting for data transfers to the Ethernet interface, lowest value = 512 bytes, highest value = 2048 bytes.

IA 21 coordinates DNS (Domain Name Service) IP address of the service for the name resolution
Setting associated with the time service function via the network

Refer to the separate manual for further important information:
ERZ2000 remote operation.

A.66 IB Serial interfaces

Access	Line	Designation	Value	Unit
B	1	Baud rate COM1	9600	
B	2	B/P/S COM1	8N1	
B	3	COM1 operating mode	Modbus-RTU	
B	4	Baud rate COM2	9600	
B	5	B/P/S COM2	8N1	
B	6	COM2 operating mode	OFF	
B	7	Baud rate COM3	9600	
B	8	B/P/S COM3	8E1	
B	9	COM3 operating mode	Modbus-RTU	
B	10	Baud rate COM4	9600	
B	11	B/P/S COM4	7E1	
B	12	COM4 operating mode	DSfG	
B	13	Baud rate Vo	2400	
B	14	B/P/S Vo	7E1	
B	15	Vo operating mode	Vo	
T	16	Timeout gas quality	45	min
B	17	Register offset	2000	
B	18	Modbus address	10	
B	19	Baud rate COM5	38400	
B	20	B/P/S COM5	8N1	
B	21	COM5 operating mode	Modem	
B	22	Modbus addr. COM1	0	
B	23	Modbus addr. COM2	0	
B	24	Modbus addr. COM3	0	
E §	25	Address FLOWSIC	1	
B	26	IP:Modbus Timeout	5	
B	27	Modbus project	Transgas	

COM 1 for RTU / ASCII modbus, IGM, USE09, RMG bus output, DZU, FLOWSIC600. Test mode for internal purposes only.

COM 2 for DZU, RTU / ASCII modbus, GPS 170, RMGView. Modbus test for internal purposes only.

COM 3 for DSfG master, RTU / ASCII modbus, RMG bus output. Test mode for internal purposes only.

COM 4 for DSfG, RMG bus, RMG bus output. Test mode for internal purposes only.

Internal COM for Vo (ENCO) totalizer

Shared timeout for gas quality

Register offset setting for the modbus registers.

Shared modbus address, valid for COM 1, COM 2, COM 3, TCP/IP

COM 5 with modem and permanent line settings for modem connection (external modem) e.g. RDT for DSfG-B

Modbus addresses that deviate from shared address *IB18*.

Modbus address of a FLOWSICK ultrasound meter.

The coordinates enable the project-specific configuration of the modbus registers from 9000 upwards.
Transgas: Register configuration for exchanging data with a bus coupler for Transgas Portugal.
EGT: Register configuration for Eon Gas Transport (Werne project).

The following applies for the operating mode of interfaces COM1, COM2, COM3 and COM4:
The sending and receiving of characters can be checked using the ***Test*** setting.
After activation, the interface name and parameters are sent to the interface periodically. An entered or received character is returned in the form of an echo.

Example for COM3
The interface is configured as RS232 and connected to a PC. A terminal program is used as a testing tool. The following is sent and displayed periodically:
C3,9600,8N1 (e.g.)

A.67 IC General DSfG

Access	Line	Designation	Value	Unit
E §	1	Corrector address	^	
E §	2	CRC12 start value	0	
D	3	Corrector entity	U2	
D	4	Time of last event	09-08-2011 09:23:22	
D	5	Last event	800	
D	14	Own bit string	0000	hex

IC 01 Corrector address:
DSfG address for the corrector entity. All 30 DSfG slave addresses and the setting ***off*** are permitted here. The corrector entity cannot be parameterized as a control station. The corrector entity uses interface COM4. A prerequisite is that the DSfG interface card is installed in the ERZ2004. For DSfG, the COM4 operating mode ***IB 12*** must then be set to DSfG. In addition, the bits/parity/stop bits ***IB 11*** must be set to 7E1 without fail. The only values permitted for the baud rate setting are 9600, 19200, 38400, 57600 and 115200. The following applies for DSfG: the lowest possible baud rate must be selected. The special design of the DSfG protocol means that only a minimal effective increase in velocity is expected from 19200 baud upwards, but the system load and susceptibility to failure increase drastically

IC 02 CRC12 start value:
CRC12 start value (also referred to as preset). This value generates a custody transfer ID mark for the archive data. The preset affects standard corrector queries as well as the archives of the internal recording function. If 0 is selected as a CRC12 start value, a custody transfer ID mark is not generated. The data on the DSfG bus is then sent without CRC12. If an external recording device is used to record standard corrector queries, the CRC12 start value entered here must be entered as the source CRC12

IC 05 Last event:
Last event in the corrector entity. The numerical code can be positive (message comes) or negative (message goes). The numerical value represents a message text. The registration numbers 1...999 are manufacturer-independent messages. Manufacturer-specific messages are assigned to all higher numbers. The range 5000...5999 was reserved for the ERZ2000 and is also used. See ***DSfG event documentation*** for the meaning. The time stamp for the last event can be viewed under ***IC 04***

IC 14 Own bit string:
Central status display for DSfG. Bit0=collective alarm, bit1=malfunction Vb, bit2=malfunction P or Rb, bit3=malfunction T or Rn, bit4= min. warning lim. Vb, P, T, Rb or Rn, bit5= min. alarm lim. Vb, P, T, Rb or Rn, bit6= max. warn. lim. Vb, P, T, Rb or Rn, bit7= max. alarm lim. Vb, P, T, Rb or Rn, bit8= direction lower-value bit, bit9= revision, bit10= parameter change, bit11= malfunction fuel gas value, bit12= malfunction carbon dioxide, bit13= malfunction original totalizer, bit14= replacement GQM, bit15= direction higher-value bit.

The internal device documentation contains a complete data element list for the corrector entity of the ERZ 2000, see: ***Documentation/II DSfG/1. Data elements/a Corrector***

A.68 ID DSfG entity recording

Access	Line	Designation	Value	Unit
E §	1	Rec.entity address	I	
D	2	Recording entity	R2	
B	3	Service request	999999999	
B	4	AG 10 visible	yes	
B	5	Identifier AG1	AG1	
B	6	Identifier AG2	AG2	
B	7	Identifier AG3	AG3	
B	8	Identifier AG4	AG4	
B	9	Identifier AG7	AG7	
B	10	Identifier AG8	AG8	
B	11	Identifier AG9	AG9	
B	12	Identifier AG10	AG10	
Q	13	Attention Freeze	no	

The setting ***yes*** initiates a DSfG freeze telegram, which may be necessary if the revision switch is missing from a station without MRG.

ID 01 Rec. entity address:
DSfG address of the recording unit. All 30 DSfG slave addresses and the setting ***off*** are permitted here. The recording unit cannot be parameterized as a control station. The recording entity uses interface COM4. See ***IC 01 Corrector address*** for more information.

ID 03 Service request:
The fill level indicators for the individual archive groups are checked to identify whether they exceed the numerical value entered here.
Message: H56-4 Service request, i.e.service personal urgently required

ID 04 AG 10 visible:
Governs whether the central exchange is able to view archive group 10 (extra measured values).

ID 05 to *ID 12:*
Text for identifying the corresponding archive group can be entered here.

The internal device documentation contains a complete data element list for the recording entity of the ERZ 2000, see: ***Documentation / II DSfG / 1. Data elements / b Recording.***

A.69 IE Remoted data transmission access

Access	Line	Designation	Value	Unit
E §	1	RDT address modem	OFF	
D	2	RDT entity	D2	
D	3	State of modem	Waiting for modem	
B	4	Bus identification	000000000000	
B	5	RDT ID	11111111111	
B	6	Modem init. String	at	
B	7	Dial prefix	atx3dt	
D	10	Time RDT param.	DD-MM-YYYY hh:mm:ss	
B	13	Carrier message	suppress	
B	14	PTB-Message	suppress	
D	15	DSfG-B-IP state	Listen	
B	16	DSfG-B-IP port	8000	
E §	17	RDT address IP	OFF	
B	18	Entity filter IP	ABC	

IE 01 RDT address modem:
DSfG address of the RDT unit. All 30 DSfG slave addresses and the setting ***off*** are permitted here. The RDT unit CANNOT be parameterized as a control station. The RDT unit uses interface COM4. See ***IC 01 Corrector address*** for more information.
Previously, the RDT unit was an autonomous device that simultaneously fulfilled the function of the control station. In the ERZ2000, the unit cannot assume this role because two different data protocols cannot run on a single interface at the same time. (the master algorithm is fundamentally different from a slave algorithm). Instead, an entity-free DSfG master was implemented on COM3 ***IB 09*** to avoid jeopardizing the stability of the DSfG bus. The master operates fully autonomously without a cross connection to other entities on the ERZ2000.

IE 03 State of modem:
Indicates the current state of the modem.
Stopped
Emergency state, if the modem state machine runs out of control. In such cases, it ensures that a potentially open telephone connection is terminated and blocks any further telephone activities until the ERZ2000 is restarted.
Initialization
The modem initialization string ***IE 06*** is sent. The system waits for a response from the modem.
Waiting for modem
The system waits for a response after the modem is initialized. If the response is positive, the modem is ready. If the response is negative or no response is received, the initialization process is repeated. If the modem still fails to respond, a message H48-1 Def. modem indicating that the modem is defect or off is issued if DSfG RDT is active (***IE 01*** not set to off).

IE 03 State of modem continued:
Acknowledgment
Intermediate step: syntactically correct acknowledgment of modem detected.
Modem ready
Initialization was successful. The modem now responds to incoming calls. Triggers for outgoing calls are processed.
PTB time service
The trigger for handling the PTB time service is processed. The following messages appear.
M52-2 Call Carrier signal modem comes
5 M52-3 PTB time PTB's telephone time service time has been detected comes (if PTB time service was detected)
6 Old time, new time (if time adjustment was necessary). The messages bear the time stamps before and after the time is adjusted.
M52-3 PTB time PTB's telephone time service time has been detected goes
M52-2 Call Carrier signal modem goes
Identification
The system waits for the bus identification query ***IE 04***, which forms phase 1 of the login procedure.
Identification
The system waits for the identification ***IE 05***, which forms phase 2 of the login procedure.
Commands
Identification ***IE 05*** is complete. The system waits for commands, which forms phase 3 of the login procedure.
The command for transparent switching has been detected. The connection between the remote central exchange and local DSfG bus is established, which forms phase 4 of the login procedure.
Hang up
The telephone connection is terminated.
Wiring of ERZ2000 to modem. All 9 wires must be connected one on one. All other variants are unsuitable.

IE 04 Bus identification:
Step 1 of the login procedure via modem (K command). According to DSfG specifications, the bus ID must be exactly 12 characters long. The bus ID can also be modified via the modem.

IE 05 RDT ID:
Step 2 of the login procedure via modem (I command). According to DSfG specifications, the ID must be exactly 16 characters long. The ID can also be modified via the modem.

IE 06 Modem init. string:
Initialization of the modem. Refer to the documentation accompanying the modem for information on the meaning of the commands. The default value "ate0s0=1" is the minimum requirement that must be fulfilled for the ERZ2000 to operate with the modem.
Meaning of the default value:
at: Hayes command prefix (precedes every command)
e0: ECHO OFF: the modem does not repeat the received characters.
s0=1: Automatic call acceptance after one ring

IE 07 Dial prefix:
Command for dialing a prefix. Refer to the documentation accompanying the modem for information on the meaning of the commands.
Minimum required information that must be obtained
Is pulse dialing required? ATDP command
Is tone dialing required? ATDT command
Is there a dialing tone immediately?
Are you at a private branch exchange? Dialing tone interpretation must be deactivated. See also ATX command.
- How do you access an outside line from a private branch exchange? (e.g. dial zero first).

Frequently used dialing commands

atx3dp: Pulse dialing command without identification of the dialing tone.
atx3dt: Tone dialing command without identification of the dialing tone.
atx3dt0: Tone dialing command without identification of the dialing tone. With access to an outside line by dialing zero.

IE 10 Time RDT param.:
If an RDT parameter is modified at the central exchange during the command phase (phase 3 of the login procedure), a time stamp is recorded here

IE 13 Carrier message:
Governs the activity of the message
M52-2 Call
Carrier signal modem
If the message is considered an unwanted interruption, it can be deactivated here.

IE 14 PTB message:
Governs the activity of the message
M52-3 PTB time
PTB's telephone time service time has been detected
If the message is considered an unwanted interruption, it can be deactivated here.

IE 15 DSfG-B-IP state:
Indication of the state of the DSfG-B-IP machine.

Open:	Opens a TCP-IP socket.
Listen:	State of the TCP-IP socket is LISTEN (waiting for a partner to dock).
Identification:	A partner has docked. Stage 1 of the login procedure.
Identification:	Stage 2 of the login procedure.
Commands:	Stage 3 of the login procedure.
Connected:	Transparent state.
Close:	TCP-IP connection is cut at the ERZ end.
Closed:	TCP-IP connection is cut at both ends.

IE 16 DSfG-B-IP port:
Port specification for DSfG-B-IP interface

The internal device documentation contains a complete data element list for the remote data transfer entity of the ERZ 2000, see: ***Documentation / II DSfG / 1. Data elements / c Remote data transfer.***

A.70 IF DSfG master

Access	Line	Designation	Value	Unit
D	1	DSfG device	f	
S	2	General polling	traditional	
S	3	Double EOT	yes	
S	4	Polling time	7,0	ms
S	5	Polling mode	fix	
D	6	DSfG fault	0000	hex
D	7	User pattern	000000	
D	8	Address pattern	00000020	hex
D	9	Baud rate gross	9748	bit/s
D	10	Baud rate net	0	bit/s
D	11	Working load	0,00	%

IF 01 DSfG device:
Addresses of all devices on the DSfG bus. Uppercase letters = external addresses. Lowercase letters = internal addresses.
Devices located on the bus are displayed here even if the control station is not active.

IF 02 General polling:
If the control station is active, the general polling strategy is defined here.

Traditional
: General polling across all available devices takes place once every minute.

Floating
: General polling does not occur. Instead, all the addresses that do not have a device allocated are systematically polled. New or lost devices arrive at the DSfG bus faster as a result.

Mixture
: Combination of both of the strategies described above.

The control station operates on COM3. Ensure that the settings for the baud rate, data bits, parity and stop bits for COM4 (DSfG slave entities) are the same

IF 03 Double EOT:
Traditional control stations send 2 EOTs. The second EOT is syntactical but not essential. Omission of the second EOT increases the polling speed by 20% without increasing the susceptibility to failure or the system load of the bus.
It is currently unclear whether all external devices as well as old devices function reliably when the second EOT is omitted.

IF 04 Polling time:
Traditional control stations wait 7 msec between two polling operations. Decreasing this time drastically increases the polling speed. However, the system load on the DSfG slaves increases just as drastically.
It is currently unclear whether all external devices as well as old devices function reliably when the waiting time is decreased.

IF 06 DSfG fault:
Auxiliary variable for transporting information from lower DSfG protocol layers for fault evaluation. If the parameter ***JD 01*** is set to 'YES', the following messages are activated.

- H64-6 DSfG unex. char. DSfG: unexpected characters in the telegram
- H64-7 DSfG overflow DSfG: buffer overflow
- H64-8 DSfG checksum DSfG: checksum incorrect
- H64-9 DSfG broadcast DSfG: checksum incorrect broadcast telegram
- H65-0 DSfG broadc. ign. DSfG: broadcast telegram ignored
- H65-1 DSfG bus term. DSfG: missing bus termination

The cause of the messages may originate from own device, but may also originate from another bus device. It should never be assumed that the device displaying the message is the exact cause of the problem.

IF 07 User pattern:
Bit pattern auxiliary variable, each bit corresponds to an external device. The lowest-value bit corresponds to the DSfG address 'A'. This bit and ***IF 07*** combine to produce ***IF 01***.

IF 08 Address pattern:
Bit pattern auxiliary variable, each bit corresponds to an internal device. The lowest-value bit corresponds to the DSfG address 'A'. This bit and ***IF 06*** combine to produce ***IF 01***.

A.71 IG Imported gas quality via DSfG

A §	1	Sup.calor.value	10,9949	kWh/m3
A §	3	Standard density	0,7420	kg/m3
A §	4	Relative density	0,5739	
A §	6	Carbon dioxide	1,9100	mol-%
A §	7	Nitrogen	0,9300	mol-%
A §	8	Hydrogen	0,00000	mol-%
A §	9	Methane	96,2500	mol-%
A §	10	Helium	0,00000	mol-%
A §	11	Hexane+	0,0200	mol-%
A §	12	Propane	1,8900	mol-%
A §	13	Propene	0,00000	mol-%
A §	14	I-butane	0,00000	mol-%
A §	15	N-butane	0,3900	mol-%
A §	16	I-pentane	0,00000	mol-%
A §	17	N-Pentane	0,0500	mol-%
A §	18	Ethene	0,00000	mol-%
A §	19	Ethane	8,5600	mol-%
A §	20	Oxygen	0,00000	mol-%
A §	21	Carbon monoxide	0,00000	mol-%
A §	22	Neo-pentane	0,00000	mol-%
A §	23	Argon	0,00000	mol-%
A §	24	Bit string	0000	Hex
A §	25	Time stamp	DD-MM-YYYY hh:mm:ss	
G §	26	Hs unit GQ	kWh/m3	
G §	27	sd unit GQ	kg/m3	
G §	28	Amount of subst.GQ	mol-%	
E §	29	Initial. DSfG GQ	start w/o fault	

IG 01 to ***IG 08:***
Measured value as received via DSfG. Make sure that the original input value appears here, e.g. if the PGC is being revised, the measured value for the test gas appears here. This value is only used for correction in the ERZ2004 following various plausibility checks and filters for the measured value. If the DSfG telegram does not contain the original measured value, it is replaced by the physically meaningless value "-1" and marked as unavailable.

IG 09 to ***IG 23:***
The complete gas analysis can only be obtained using the AGA8-compatible standard query 6c 'dlc'. See also ***IG 37***. If the component is not included in the reply to the standard query, the physically meaningless value -1 appears here.

After MAINS ON with setting ***Start with fault***, an alarm will be generated in the calibration phase. It will disappear as soon as there are valid gas quality data available.

E §	30	GQ1 address	OFF	
E §	31	DSfG preset CG 1	348	
E §	32	GC 1 type	autodetect	
E §	33	GQ 2 address	OFF	
E §	34	DSfG preset GC 2	0	
E §	35	GC2 type	autodetect	
E §	36	GC 1 rev. mode	no change	
E §	37	Query	GERG capable	
B	38	Max. waiting time	60	S
B	39	Max. repetitions	3	
D	40	Ord. No. Analysis	0	
D	41	Bit string GC	00000	Hex
D	43	Cur. Analysis of	0	
D	44	Next analysis	1	
D	45	GC 1 condition	Abse	
D	46	GC 2 condition	Inactive	
D	47	Waiting time	0	S
Q	48	GQM1 ignore time	0	min
Q	49	GQM2 ignore time	0	min
E §	50	Ignoring allowed	only for GQ1	
B	51	VNG mode	no	

DSfG address for the leading DSfG gas quality sensor.

Available settings: ***autodetect, G entity, Q entity.***

DSfG address for the redundant DSfG gas quality sensor.

In the event of a revision (calibration or ref. gas), either ***remain*** with the leading GQM device or ***change*** to the redundant GQM device.

Maximum waiting time for GQM replies

Maximum number of repeat requests

Specifies whether the leading or redundant gas quality sensor is used for the current correction. Switches replacement GQM bit in the bit string.

Specially for VNG applications:
If the setting ***yes*** is selected, PGC alarms have no effect in the corrector.

IG 37 Query:
Defines the data content in the DSfG request to the gas quality measuring device. The AGA8-compatible query retrieves the full analysis in addition to basic quality values.

- Standard query 6c 'dlc' for traditional gas quality
- Standard query (II)5 'qje' for gas quality II

The GERG-compatible query only retrieves basic quality values.

- Standard query 2 'dib' for traditional gas quality
- Standard query (I)2 'qib' for gas quality II

Warning
The AGA8-compatible query does not contain a relative density. The relative density must therefore be calculated in the actual corrector. Parameterize the operating mode for the relative density calculated from the standard density. The AGA8-compatible query allows all conversion factor calculations. The GERG-compatible query is only used when the gas quality measurement does not support the AGA8-compatible query (old devices) or when the measuring principle for the gas quality measurement does not deliver a full (or adequate) analysis (correlative procedure).

IG 50 Ignoring allowed:
Defines the response of the ERZ 2000 to analysis end messages from gas quality measuring devices. (GCs)

- *for no GC:* Take into account and process analysis end messages. (normal scenario)
- *only for GC1:* Ignore analysis end messages from GC1.
- *only for GC2:* Ignore analysis end messages from GC2.
- *for both GCs:* Ignore analysis end messages from GC1 and GC2.

IG 48 GQM1 ignore time and ***IG 49 GQM2 ignore time*** allow the user to parameterize the ignore time for each gas quality measuring device.

It is possible to assign 2 gas quality measuring devices (for example two PGCs) on the DSfG bus redundantly to the flow corrector. If both PGCs are operating without interruption, the flow corrector always uses the main PGC in line with DSfG regulations. In the event of a malfunction in the main PGC (evaluation of bit string), the flow corrector uses the measured values from the comparator PGC until the main PGC is operating correctly again. If the system switches to the comparator measuring device, the ERZ 2000 can also adapt the method for calculating the K coefficient.
Example: Main PGC delivers full analysis and the ERZ 2000 calculates with AGA 8 92 DC. The comparator measuring device (e.g. correlative) only delivers the fuel gas value, standard density and CO2. If the system switches to the comparator device, the ERZ 2000 automatically switches the calculation method from AGA 8 92 DC to GERG 88S.
The relevant parameters can be found on the ERZ 2000 under the coordinates **IG Import GC DSfG**.

A.72 IH Imported gas quality via RMG bus

Access	Line	Designation	Value	Unit
D	1	Protocol select	RmG bus	
A §	2	Interpretation	**Substitute value**	
A §	3	Sup. Calor. Value	**10,9949**	kWh/m3
A §	4	Standard density	**0,742[illegible]**	kg/m3
A §	5	Relative density	**0,5739**	
A §	6	Methane	**86,2500**	mol-%
A §	7	Ethane	**8,5600**	mol-%
A §	8	Propane	**1,8900**	mol-%
A §	9	I-butane	**0,00000**	mol-%
A §	10	N-butane	**0,0500**	mol-%
A §	11	I-pentane	**0,00000**	mol-%
A §	12	N-pentane	**0,0500**	mol-%
A §	13	Neo-Pentane	**0,00000**	mol-%
A §	14	Hexane+	**0,0200**	mol-%
A §	15	Carbon diozide	**1,9100**	mol-%
A §	16	Nitrogen	**0,9300**	mol-%

The ***GC 6000*** mode will be active if an expansion module has been fitted and configured. Otherwise, ***RMG bus*** will be assumed and displayed.

Interpretation options:
- default value (of the corrector)
- live value (of the GC)
- retained value (of the GC)

Fields ***IH 03*** to ***IH 16*** show the usable gas quality data. To use them for correction, select the ***RMG bus*** mode for the relevant measured value inputs.

A §	17	Current status	okay	
A §	18	Time stamp	DD-MM-YYYY hh:mm:ss	
A §	19	Counter of analysis	0	
G §	20	Hs unit GC	kWh/m3	
G §	21	sd unit GC	kg/m3	
G §	22	Amount of subst.GC	mol-%	
E §	23	Stream selection	Stream 1	
E §	24	Initial. RMGB GC	start w ith fault	
B	25	RMG bus monitoring	300	S
I	26	Current stream	0	
I	27	Current state	Invalid	
I	28	Current status	okay	
D	29	Interpretation	Undefined	
I	30	GC tg: Hs	0,000	kWh/m3
I	31	GC tg: sd	0,0000	kg/m3
I	32	GC tg: rd	0,0000	
I	33	GC tg: C1	0,00000	mol-%
I	34	GC tg: C2	0,00000	mol-%
I	35	GC tg: C3	0,00000	mol-%
I	36	GC tg: I-C4	0,00000	mol-%
I	37	GC tg: N-C4	0,00000	mol-%
I	38	GC tg: I-C5	0,00000	mol-%
I	39	GC tg: N-C5	0,00000	mol-%
I	40	GC tg: Neo-C5	0,00000	mol-%
I	41	GC tg: C6+	0,00000	mol-%
I	42	GC tg: CO2	0,00000	mol-%
I	43	GC tg: N2	0,00000	mol-%
D	44	Time stamp	0	S
D	45	Counter of telegr.	0	s

Assigning the corrector to a stream (**1 to 4**). Setting **Without indication** means that no stream is assigned. In GC6000 mode, only stream 1 can be used at the moment.

After MAINS ON with setting ***Start with fault***, an alarm will be generated in the calibration phase. It will disappear as soon as there are valid gas quality data available.

Options for original values:

- pipeline gas
- calibration gas
- reference gas
- flushing (mix)
- retained value
- start-up value

Fields *IH 30* to *IH 43* show the gas quality data originating directly from the PGC. They relate to the stream selection and, if appropriate, are taken over into fields *IH 03* to *IH 16*. Furthermore, original data can be forwarded to other correctors via a COM interface using the ***RMG bus output*** mode.

The displayed gas quality data may deviate slightly from the original PGC values due to the format definitions.

On the ERZ 2000 GC, a functional gas analyzer (Yamatake) must be connected so that archive group 8 is filled with data and can be accessed.
After the first analysis, coordinate *IH01 Protocol select* is set to *GC 6000* automatically, the archive is filled and can be accessed. If the analyzer is missing, however, *IH01* is set to RMG bus by default after MAINS ON, and the archive remains empty and cannot be accessed.
This only affects the ERZ application V1.8.1.

A.73 II Modbus superblock

Access	Line	Designation	Value	Unit
B	1	MB reg. 0 = KA01	Edit	
B	2	MB reg. 2 = NT01	Edit	bin
B	3	MB reg. 4 = AB01	Edit	bar
B	4	MB reg. 6 = AC01	Edit	°C
B	5	MB reg. 8 = LB19	Edit	m3
B	6	MB reg.10 = LB20	Edit	m3
B	7	MB reg.12 = LB10	Edit	m3
B	8	MB reg.14 = LB11	Edit	m3
B	9	MB reg.16 = LB01	Edit	m3
B	10	MB reg.18 = LB02	Edit	m3
B	11	MB reg.20 = CB01	Edit	
B	12	MB reg.22 = CH02	Edit	
B	13	MB reg.24 = CH01	Edit	
B	14	MB reg.26 = GC01	Edit	P/m3
B	15	MB reg.28 = CC01	Edit	
B	16	MB reg.30 = CB03	Edit	
B	17	MB reg.32 = LB13	Edit	kg
B	18	MB reg.34 = LB01	Edit	m3
B	19	MB reg.36 = LB04	Edit	GJ
B	20	MB reg.38 = LB10	Edit	m3
B	21	MB reg.40 = LD13	Edit	kg
B	22	MB reg.42 = LD01	Edit	m3
B	23	MB reg.44 = DF10	Edit	Kg/h
B	24	MB reg.46 = LB16	Edit	kg
B	25	MB reg.48 = LC16	Edit	kg

Definition of data in the modbus super block. Clicking Edit opens another menu that gives the option of selecting all data in the device (floating point variables and measured values) as modbus registers and assigning it to an address.

See the concise version of the manual for more details

A.74 IJ Imported main gas quality via modbus

Access	Line	Designation	Value	Unit
M	1	Trigger Werne	0	
M	2	Bit string	0	
M	3	Calorific value	10,9949	kWh/m3
M	4	Relative density	0,5739	
M	5	Standard density	0,7420	kg/m3
M	6	CO2	1,9100	mol-%
M	7	H2	0,00000	mol-%
M	8	N2	0,9300	mol-%
M	9	Methane	86,2500	mol-%
M	10	Ethane	8,5600	mol-%
M	11	Propane	1,8900	mol-%
M	12	N-butane	0,3900	mol-%
M	13	I-butane	0,00000	mol-%
M	14	N-pentane	0,0500	mol-%
M	15	I-pentane	0,00000	mol-%
M	16	Neo-Pentane	0,00000	mol-%
M	17	Hexane	0,0200	mol-%
M	18	Heptane	0,00000	mol-%
M	19	Octane	0,00000	mol-%
M	20	Nonane	0,00000	mol-%
M	21	Decane	0,00000	mol-%
M	22	H2S	0,00000	mol-%
M	23	H2O	0,00000	mol-%
M	24	Helium	0,00000	mol-%
M	25	O2	0,00000	mol-%
M	26	CO	0,00000	mol-%
M	27	Ethene	0,00000	mol-%
M	28	Propene	0,00000	mol-%
M	29	Argon	0,00000	mol-%
M	30	Id. GQ-source	0	
M	31	Main/Backup	0	
M	32	GQ type	0	
M	33	Ord. No. Analysis	0	
M	34	Time stamp	09-08-2010 09:22:58	
M	35	CRC12 protection	0	
M	36	Roadway	0	

The gas quality data is written to the device via MODBUS (MODBUS IP), special case WERNE system.
Two sets of data:
IJ for the main PGC
IK for the comparator PGC

M	37	Protected list	0	
G §	38	Hs unit GC	**kWh/m3**	
G §	39	Sd unit GC	**kg/m3**	
G §	40	Amount of subst. GC	**mol-%**	
E §	41	Initial MODB-GC	Start with fault	
A §	42	Better GQ	**Main GQ**	
A §	43	Actual value CRC12	**0**	
E §	44	1. allowed GQ-Id	1000	
E §	45	Preset for GQ-Id 1	1000	
E §	46	2. allowed GQ-Id	2000	
E §	47	Preset for GQ-Id 2	2000	
E §	48	3. allowed GQ-Id	3000	
E §	49	Preset for GQ-Id 3	3000	
E §	50	4. allowed GQ-Id	4000	
E §	51	Preset for GQ-Id 4	4000	
E §	52	use GQM	no	
E §	53	Nominal v. GQM list	247574400	
B	54	Mx.time revision	3600	S
D	55	Main-GQ rating	Uncertain	
D	56	time since entry	0	S
D	57	Debug value 1	0	
D	58	Time since Revis	0	S
B	59	GQM uncompl. Msg.	show	

A.75 IL GC6000

Access	Line	Designation	Value	Unit
D	1	GC 6000 state	Waiting	
D	2	act. GC 6000 msg.	No error	
D	3	GC 6000 cycle	0,0	%
D	4	GC 6000 Timeout	0	Min
D	5	Open valves		
P	6	GC 6000 maintenance	normal run	
B	7	max. mainten.time	480	Min
D	8	cur. maintenance	0	Min
B	9	max. flushing	3	
D	10	flushing	0	
D	11	Man/auto calibr.	At rest	
B	12	Calibration cycle	OFF	
B	13	Calib. Time base	01-01-1970 0	
D	14	Next calibration	DD-MM-YYYY hh:mm:ss	
B	15	Calibr. duration	30	Min
B	16	Ana. to startup cal	3	
D	17	Counter	0	
D	18	Start up calibr.	Pending	
E §	19	Long term archive	no	
S	20	FF-termination	an	
I	35	Total raw	0,00000	mol-%
I	36	Oven temperature	0,00	°C
I	37	Carrier gas press	0,00	kPa
I	38	Interface state	Restart	
I	39	GC6000-Error-Map	00000000	Hex
I	40	GC6000 valve state	0000	Hex
D	41	Cumul. GC6000-msg.	No error	
D	46	DSfG status	stop	

Communication with the analyzer must start within 5 minutes.

Counter for flushing procedures

From this value, the analyzer calculates the number of calibration runs and the number of flushing procedures to be carried out beforehand.

Max. number of analyses for delaying calibration after a restart.

Counter for analyses until calibration after a restart.

Status of calibration after a restart.

yes will activate the recording of gas quality data in the long-term archive. The archive is located on the internal memory card. The status of the memory card can be checked via ***FJ File system***.

Status of the values in the DSfG archive ***QH AG8 GC6000 GBH.***

A.76 IM GC6000 Response faktor

Access	Line	Designation	Value	Unit
I	1	Methane	0,00	
I	2	Ethane	0,00	
I	3	Propane	0,00	
I	4	I-butane	0,00	
I	5	N-butane	0,00	
I	6	I-pentane	0,00	
I	7	N-pentane	0,00	
I	8	Neo-Pentane	0,00	
I	9	Hexane+	0,00	
I	10	Carbon dioxide	0,00	
I	11	Nitrogen	0,00	
D	12	Quality	doubtful	

Fields *IM 01* to *IM 11:*
The quality of calibration can be assessed *by means of* the response factors.

A.77 IN GC6000 Gas cylinder and control panel

Access	Line	Designation	Value	Unit
B	1	Src.cyl.C1 temp.	OFF	
B	2	Src.cyl.C2 temp.	OFF	
B	3	Src.cyl.C1 press	OFF	
B	4	Src.cyl.C2 press	OFF	
B	5	Src.cyl.car. press	OFF	
B	6	Src. GC amb. temp.	OFF	
B	7	Src. GC-cal.ctc	OFF	
D	8	cyl.C1 temp	OFF	
D	9	cyl.C2 temp	OFF	
D	10	cyl.C1 press.	OFF	
D	11	cyl.C2 press	OFF	
D	12	cyl.car. press	OFF	
D	13	cyl.car. press	OFF	
D	14	Extern.cal.start	OFF	
D	15	Analysis-LED	OFF	
D	16	Ref.gas-LED	OFF	
D	17	Calibr.-LED	OFF	
D	18	Error-LED	OFF	

Input fields *IN 01* to *IN 06*:
Assigning an input contact for monitoring the minimum limits for pressure and temperature of the calibration gas cylinders and the room temperature of the GC.

Defining an input contact as calibration contact.

Fields *IN 08* to *IN 14:*
Displaying the function linked to an input contact.

The external control panel has four LEDs visualizing the operation of the GC6000. Fields *IN 15* to *IN 18* show the status of these LEDs.

A.78 JA Fault messages

Access	Line	Designation	Value	Unit
D	1	Current messages	M54-0 Calibr. Lock	
D	2	Accumulated msgs	M54-0 Calibr. Lock	
D	3	No. of alarms	0	
D	4	No. of warnings	0	
D	5	No. of notes	1	
E §	6	Computer fault	as alarms	
B	7	Notes	as notes	
Q	8	Fault ackn. Flag	0	
E §	11	Q=0fault suppress	suppress	
D	14	AG21 clear text	M54-0 calibr. Lock	
D	18	First alarm	09-08-2010 09:22:58	
D	19	Last alarm	09-08-2010 09:23:08	
D	20	First warning	DD-MM-YYYY hh:mm:ss	
D	21	Last warning	DD-MM-YYYY hh:mm:ss	
E §	22	Alarm contact mode	real time output	
B	23	Warn contact mode	real time output	
B	24	Elongation time	5	s
D	25	Collective msg.	00000000	hex
Q	26	Error simulation	-1	
D	27	Time confirmation	DD-MM-YYYY hh:mm:ss	
D	28	Bits flux control	0000	hex
A§	29	Vm-Alarm	0	

Displays current pending (active) messages at 2 second intervals.

Messages accumulated since last acknowledgment

Setting indicating whether computer faults are alarms or warnings.

Setting indicating whether notes are alarms or notes.

Activates the fault suppression function when flow = zero

These parameters can be used to modify the reaction of the relevant contact:
Realtime = as before
Extended = change the time in line 24
Retained = must be deleted manually

JA 28 Bits flux control:
All alarms in the ERZ 2000 are inspected for logical connections and displayed as collective alarms in register 474 (and 9118) in a special bit.

Bit 0: Delta P alarms
Bit 1: Gas quality alarms
Bit 2: Temperature alarms
Bit 3: Pressure alarms
Bit 4: Alarms associated with the standard volume
Bit 5: Alarms associated with the operating volume

A.79 JB Message register

B	51	Message event	passiv

Displays current pending (active) messages at 2 second intervals.

Passive = fault bits transferred via modbus remain on 1 until acknowledged manually.
Active = fault bits transferred via modbus remain on 1 while the fault is pending, corresponds to the LEDs flashing on the front of the device.
Lines 1 to 50 contain the assigned message numbers. See department documentation for the meaning.

A.80 KA Times

Access	Line	Designation	Value	Unit
P	1	Date and time	edit	
D	2	UTC	09-08-2010 09:01:57	
D	3	Difference to UTC	7200	s
D	4	Day of the week	Monday	
D	6	Time zone DSfG	S	
D	7	Time zone change	DD-MM-YYYY hh:mm:ss	
D	9	Name of time zone	CEST	
T	13	Time zone	edit	
B	14	Billing hour	9	h
T	15	Time event mode	local time	
D	27	Gas day start	19-08-2009 09:00:00	
D	28	Gas month start	01-08-2009 09:00:00	
D	29	Gas year start	01-01-2009 09:00:00	

Clicking Edit opens a menu for setting the date and time:

P	1	Date and time	EUROPE/BERLIN

Enter | Cancel | Take PC time

Only available with open access (code or calibration lock). If access is closed, the current time appears in line 1.

The standard international short form of the name for the currently active time zone is displayed, e.g.:
CET: **C**entral **E**uropean **T**ime
CEST: **C**entral **E**uropean **S**ummer **T**ime
PST: **P**acific **S**tandard **T**ime
PDT: **P**acific **D**aylight Savings **T**ime

KA13 Time zone:
The internal realtime clock (RTC chip) on the ERZ 2000 operates with UTC world time ***KA02 World time***.
The most current local time ***KA01 Date time*** is formed using the relevant offset for the preset time zone.
Clicking Edit opens a menu for selecting a time zone. All current valid time zones in the world are available.

T	13	Time zone	EUROPE/BERLIN

Enter | Cancel

The following syntax applies: Per cent sign (%) = plus
Minus sign (-) = minus

Examples: ***ETC/GMT%1*** signifies GMT+1 and is one hour more than UTC
ETC/GMT-1 signifies GMT-1 and is one hour less than UTC

Options according to the ETC/GMTx formula do not include daylight saving time, e.g. *ETC/GMT-1*.
With all other options, e.g. ***EUROPE/BERLIN,*** daylight saving time is activated automatically, provided a legal provision exists for the time zone.

Examples for setting time zones and deactivating daylight saving time.

Germany

- **With** daylight saving time
  KA13 Time zone = Europe/Berlin
  KA09 Time zone name = CET during normal time and *CEST* during the summer- time
  KA03 Difference to UTC = 3600 **s** (+1 hour, plus one hour during the summertime)
- **Without** daylight saving time
  KA13 Time zone = ETC/GMT-1
  KA09 Time zone name = GMT-1
  KA03 Difference to UTC = 3600 s (+1 hour)

Ireland

- **With** daylight saving time
  KA13 Time zone = EIRE
  KA09 Time zone name = GMT during normal time and ***IST*** during summer- time
  KA03 Difference to UTC = 0 s (plus one hour during the summertime)
- **Without** daylight saving time
  KA13 Time zone = ETC/GMT
  KA09 Time zone name = GMT
  KA03 Difference to UTC = 0 s

Israel

- **With** daylight saving time
  KA13 Time zone = ISRAEL
  KA09 Time zone nam**e* = ***IST during normal time and ***IDT*** during summer- time
  KA03 Difference to UTC = *7200* s (2 hours, plus one hour during the summertime)
- **Without** daylight saving time
  KA13 Time zone = ETC/GMT-2
  KA09 Time zone name = GMT-2
  KA03 Difference to UTC = 7200 s (2 hours)

Visit www.weltzeituhr.com for more information.

Procedure for setting the time

- I am in Butzbach, my watch shows the correct local time.
- The time zone ***KA13*** on the corrector shows "***EUROPE/BERLIN***" 3
- I enter the time in the corrector as described.
- The corrector now shows the correct local time in Germany.
- The default country is Afghanistan.
- I change the time zone ***KA13*** to "***ASIA/KABUL***".
- The corrector now shows the correct local time in Afghanistan.

A.81 KB Time contact signal to external devices

Access	Line	Designation	Value	Unit
D	1	Time contact	0	s
B	2	Time cont. duration	5	s
B	3	Time cont. mode	OFF	
D	10	Modbus year	2010	
D	11	Modbus month	8	
D	12	Modbus day	9	
D	13	Modbus hour	11	
D	14	Modbus minute	1	
D	15	Modbus second	57	
D	20	DSfG time	1281351717	s
E §	21	DSfG sync.source	OFF	
D	30	UTC FC BIOS	09-08-2010 09:01:57	
D	50	GC6000 timer	661	min

If the corrector generates a time signal, the following options are available:

- *off*
- *every minute*
- *every 30 seconds*
- *every hour*
- *every 30 minutes*
- *every day*
- *gas day*
- *every month*
- *every year*
- *gas month*
- *gas year*

The following must also be parameterized:

- Duration of time pulse *KB02*
- Assign contact output
- Adjust polarity if necessary

KB21 DSfG sync source:
If the setting ***on*** is selected, the corrector generates an attention telegram Z for DSfG time synchronization.

A.82 KC External time signal

Access	Line	Designation	Value	Unit
T	1	Sync.mode input	DSfG	
T	2	timesync.tolerance	1	s
E §	3	Time sync. rule	alw ays	
B	4	Retrigger success	3600	s
B	5	Time after failure	300	s
Q	6	PTB trigger	0	s
D	7	Clock free wheel	5928	s
B	10	Phone: PTB	0w 05315120:	
A §	20	Time sync.contact	**OFF**	
E §	21	Soure time contact	contact input 5	
I	30	GPS-time (UTC)	01-01-1970 00:00:00	
I	31	Time telegram	OFF	
B	40	Time server	ptbtime2ptb.de	
B	41	Time serv.protocol	UDP	
D	50	Reference time diff.	12926	s
B	51	Reference hour	14	
B	52	Reference minute	37	
B	53	Reference second	23	
M	60	Modb.sync year	0	
M	61	Modb.sync month	0	
M	62	Modb.sync day	0	
M	63	Modb.sync hour	0	
M	64	Modb.sync minute	0	
M	65	Modb.sync second	0	
M	66	Modb.sync trigger	0	

KC03 Time sync. rule:

Specifies criteria that define whether an external timer (e.g. DSfG radio clock, external contact) can be used to set the time on the corrector.

- *Always*
  Clock can always be set.
- *PTB criterion (strict)*
  The time can be adjusted automatically if:
  – the adjustment occurs within a time window of +/- 20 seconds, but at least once a day.
  – the calibration lock is open.
- *PTB crit. Soft*
  The time can be adjusted automatically according to the strict PTB criterion, but also if:
  – User access (password) is open.
  – After the corrector is restarted and if initial synchronization has not yet occurred.
  – The clock runs incorrectly for more than 59 minutes and 40 seconds. (daylight saving time missed)
  – After the clock is adjusted manually and subsequent synchronization has not yet occurred. (e.g. to test whether automatic synchronization works by deliberately setting the clock to the incorrect time.)

KC01 Sync mode input:

Defines the source and interpretation of a time synchronization originating from an external source.
The following options are available:

- *off*
- *DSfG*
  Time synchronization is only expected via DSfG and accepted.
- *Time contact to full minute*
- *Time contact to half minute*
- *Time contact to full hour*
- *Time contact to half hour*
  The following applies for the time contact options:
  Synchronization occurs on the rising edge.
  The polarity of the contact inputs can be modified with *NT04 Inverting mask*.
  The corrector time is adjusted to the nearest full/half minute or full/half hour, depending on the setting.
  A potential time synchronization via DSfG is ignored in these cases
- *PTB time service*
  If telephone access is available via a modem, the time can be synchronized by calling the PTB time service. The relevant telephone number must be entered in *KC10 Phone: PTB*.
- *Network time serv.*
  If a known time server is available, synchronization can take place via the network. However, this is only recommended if there is no possibility of using the telephone PTB time service. The following settings must be configured:
  KC40 port 37 server: IP address of the time server, e.g. 192.53.103.104, corresponding to the internet address ptbtime2.ptb.de of the PTB time server (determine IP address with: ping ptbtime2.ptb.de).
  KC41 port 37 protocol: Connection type for the time server, e.g. UDP for PTB time server
  IA14 gateway: IP address of the local gateway, e.g. 192.168.20.254 for the standard gateway from RMG Beindersheim. (determine gateway address with: ipconfig)
  If an internet address is specified in *KC40 port 37 server* , a domain name service must be activated to effect the change into an IP address.
  IA21 DNS: IP address for Domain Name Service, e.g. Telecom DNS.
  Important note:
  The power of the ERZ2000 must be switched off and on again after the network settings are changed so that the new settings take effect!
  PGS170
  Synchronization is initiated using a GPS receiver module on COM 5. The following protocols are available:
  Meinberg Std., NMEA, Computime, ABB SPA, Uni Erlangen, SAT, Racal.

A.83 LB Totalizer, billing mode 1

Access	Line	Designation	Value	Unit
Z §	1	Vol. at base cond.	**17632183**	m3
Z §	2	Vol.base fraction	**,760281**	m3
Z §	3	Vol.at.base ovfl	**0**	
Z §	4	Quantity of energy	4017893	kWh
Z §	5	QOE fraction	**,797976**	kWh
Z §	6	Energy Overflow	**0**	
Z §	7	Corr.vol.meas.	**358268**	m3
Z §	8	Corr.vol.meas.frac	**,913721**	m3
Z §	9	Cor.vol.meas ovfl	**0**	
Z §	10	Vol. at meas.cond.	**358268**	m3
Z §	11	Vol.meas.fraction	**,913721**	m3
Z §	12	Vol.at.meas ovfl	**0**	
Z §	13	Mass	**63813974**	kg
Z §	14	Mass fraction	**,242953**	kg
Z §	15	Mass Overflow	**0**	
Z §	16	CO2 emission	**81753878**	kg
Z §	17	CO2 emission frac	,384596	kg
Z §	18	CO2 emission ovfl	**0**	
Z §	19	Original totalizer	**0**	m3
Z §	20	Orig.tot.fraction	**,000000**	m3
D	21	DSfG status B	okay	
D	22	DSfG status M	Okay	
F	61	Vol. at base cond.	17623589	m3
F	62	Vol.base fraction	,078260	m3
F	63	Quantity of energy	4017524	kWh
F	64	QOE fraction	,812809	kWh
F	65	Corr.vol.meas.	358150	m3
F	66	Corr.vol.meas.frac.	,185943	m3
F	67	Orig. totalizer	0	m3
F	68	Orig.tot.frac.	,000000	m3
F	69	Mass	63806796	kg
F	70	Mass fraction	,823959	kg
F	71	Vol. at meas.cond	358150	m3
F	72	Vol.meas.fraction	,185943	m3

Represents all totalizers, display separated with preceding and following comma.

In *LK29 Overflow point=14* operating mode, the totalizer reading that appears on the device display consists of three components.

Example for energy totalizer E1:

LB04 Energy=16

LB05 QOE fraction=0.833023

LB06 Energy overflow=1

Quantity of carbon dioxide generated during the combustion of natural gas containing air.

A.84 LJ Totalizer, undefined billing mode

Access	Line	Designation	Value	Unit
Z §	1	Vol. at base cond	0	m3
Z §	2	Vol.base fraction	,000000	m3
Z §	3	Vol.at base ovfl.	0	
Z §	4	Quantity of energy	0	kWh
Z §	5	QOE fraction	,000000	kWh
Z §	6	Energy overflow	0	
Z §	7	Corr.vol.meas.	0	m3
Z §	8	Corr.vol.meas.frac.	,000000	m3
Z §	9	Corr.vol.meas.ovfl	0	
Z §	10	Vol.at meas.cond.	0	m3
Z §	11	Vol.meas.fraction	,000000	m3
Z §	12	Vol.at meas.ovfl.	0	
Z §	13	Mass	0	kg
Z §	14	Mass fraction	,000000	kg
Z §	15	Mass overflow	0	
Z §	16	CO2 emission	16776960	kg
Z §	17	CO2 emission frac.	,000000	kg
Z §	18	CO2 emission ovfl.	0	
Z §	19	Original toralizer	0	m3
Z §	20	Orig.tot.fraction	,000000	m3
D	21	DSfG status	okay	
D	22	DSfG status M		

This totalizer counts when the billing mode is invalid (e.g. incorrect switch position).

A.85 LK Counter parameter

Access	Line	Designation	Value	Unit
G §	3	Vol.meas. unit		m3
G §	6	Vol. base unit		m3
G §	9	QOE unit		GJ
G §	12	Mass unit		kg
D	13	Tot.formation	Running	
D	14	Cycle pulses	,000000	Pulse
D	15	Accumulated pulses	,000000	Pulse
E §	22	Totalizer mode	stops	
B	23	Max. accumulation	100000	Pulse
B	26	Chan. stat. mode	new definition	
G §	29	No. of digits	9	
G §	30	Totalizer format		%lu
E §	31	Vo Vol.meas.unit	m3	

In lines 3, 6, 9 and 12, the unit of the totalizers can be changed in superuser mode. **Warning**: not only the unit is changed, the historical counter readings are mixed with the new values and this cannot be reversed.

Operating mode of the main totalizers in the event of a fault
Stop = main totalizer stops after an alarm
Continue = main totalizer continues to operate after an alarm (in addition to the disturbance totalizers)

Checks the number of input pulses that have not yet been corrected and issues the message ***W05-7 Acc. puls.>max.*** if the maximum value is exceeded, i.e. too many pulses stored in the cache with the calibration lock open.

LK26 Chan. stat. mode:
Calculation method for channel status of totalizers (DSfG function).
There are two methods:
a.) *RMG traditional* and
b.) *New definition* according to Ruhrgas
with a:
the status of all stationary totalizers is ***stopped***, regardless of whether they are interrupted or another roadway is active. Only operating totalizers have the status ***okay***.

with b:
during normal operation, the status of all disturbance totalizers is ***stopped*** and the status of all main totalizers is ***okay***, regardless of whether they are operating or another roadway is active. In the event of a malfunction, the status of all disturbance totalizers is okay and the status of all main totalizers is stopped, regardless of whether they are operating or another roadway is active.

A.86 LL Monitoring of synchronous run

Access	Line	Designation	Value	Unit
D	1	Comparative error	0,0000	%
D	2	State of comparison	At rest	
D	3	Synchronous run	OFF	
D	4	Channel 1	0,0000	m3
D	5	Channel 2	0,0000	m3
T	6	Termination qty	10,00	m3
T	7	Termination short	5,00	m3
T	8	Max. deviation	100,00	%
T	9	Sync. Run active	yes	
D	10	Reference quality	inactive	

Termination quantity = reference variable for comparison

Termination short = reference variable used together with the termination quantity from line 6 after an error report to reduce the time until the system is activated again after rectification of the fault.

Activation of synchronous run monitoring

A.87 LN Original totalizer, encoder totalizer terminal X4 or X9

Access	Line	Designation	Value	Unit
I	2	Current tot.reading	,000000	m3
D	3	Last tot.reading	,000000	m3
I	4	Vo tot.status	-1	
D	5	Overflow	,000000	m3
D	6	Max.cycle quantity	,000000	m3
D	7	Vo direction	Uncertain	
D	8	Current time stamp	0	s
D	9	Last time stamp	0	s
J	10	Manufacturer		
J	11	Device type		
J	12	Serial number		
J	13	Vo year of constr.		
J	14	Software version		
J	15	Vo tot unit		
E §	16	Vo drection mode	Rev. permitted	
D	17	Running Vo timeout	0	s
B	18	Vo timeout	10	s
D	19	No. of telegrams	0	
D	20	Vo cycle quantity		m3
D	21	DSfG status	Default value	
E §	22	Encoder ID inout	automatical	

Automatic input of type plate data, provided the sensor delivers this data within the defined frame of the telegram.

Reaction to a Vo transmitter rotating in reverse. Two options are available: *Rev. forbidden* and *Rev. permitted*

E §	23	Manufacturer	RMG	
E §	24	Device type	ENCO-F/M	
E §	25	Serial number	0	
B	26	Safety margin	8	

A.88 LO Digital totalizer transmission, ultrasonic flow meter

Access	Line	Designation	Value	Unit
I	1	USZ Vm 1	,000000	m3
I	2	USZ VmD 1	,000000	m3
I	3	USZ Vm 2	,000000	m3
I	4	USZ VmD 2	,000000	m3
I	5	USZ flow	0	
I	6	USZ direction	0	m3/h
I	7	USZ status	0	
I	8	Sum direction 1	0	
I	9	Sum direction 2	0	
I	10	Total volume	,000000	
I	11	Temperature	-273	°C
I	12	Abs. pressure	0	Bar
I	13	Counter info	00000	
B	20	USZ time out	10	s
B	21	Eval of direction	immediately	
B	22	Eval of status	immediately	
B	23	Counter Vo archive	single counter	
G§	24	Unit of flow		m3/h
G§	25	Unit of counter		m3
D	30	USZ test status	0	
D	31	Overflow	,000000	
D	32	Running USZ timeout	0	
D	33	Max. cycle quantity	,000000	
D	34	USZ cycle quantity		
D	35	USZ direction	Direction 1	
D	36	Unit AGC		

Display of diagnostic information associated with a connected US 9000 computer with main totalizer function.

A.89 LP Setting totalizers

Access	Line	Designation	Value	Unit
Y	1	Task	Idle	
Q	2	Vb1	-1,000000	m
Q	3	Vc1	-1,000000	m3
Q	4	Vm1	-1,000000	m3
Q	5	E1	-1,000000	kWh
Q	6	M1	-1,000000	kg
Q	7	Vb2	-1,000000	m3
Q	8	Vc2	-1,000000	m3
Q	9	Vm2	-1,000000	m3
Q	10	E2	-1,000000	kWh
Q	11	M2	-1,000000	kg
Q	12	Vb3	-1,000000	m3
Q	13	Vc3	-1,000000	m3
Q	14	Vm3	-1,000000	m3
Q	15	E3	-1,000000	kWh
Q	16	M3	-1,000000	kg
Q	17	Vb4	-1,000000	m3
Q	18	Vo4	-1,000000	m3
Q	19	Vm4	-1,000000	m3
Q	20	E4	-1,000000	kWh
Q	21	M4	-1,000000	kg
Q	22	DVb1	-1,000000	m3
Q	23	DVc1	-1,000000	m3
Q	24	DVm1	-1,000000	m3
Q	25	DE1	-1,000000	kWh
Q	26	DM1	-1,000000	kg
Q	27	DVb2	-1,000000	m3
Q	28	DVc2	-1,000000	m3
Q	29	DVm2	-1,000000	m3

Idle

Nothing is happening!

All tot=0

All totalizers (main+disturbance) including fractions are set to 0. Totalizers for an undefined billing mode are also set to 0.

All dist tot=0

All disturbance totalizers including fractions are set to 0. Totalizers for an undefined billing mode are also set to 0. The main totalizers remain unchanged.

Vb=Vo

All Vb totalizers (uncorrected operating volume) are set to the current value of the assigned Vo totalizer (original totalizer). All other totalizers remain unchanged.

Vbk=Vb

All Vbk totalizers (corrected operating volume) are set to the current value of the assigned Vb totalizer (uncorrected operating volume). All other totalizers remain unchanged.

Individual

All totalizers that were not programmed in the totalizer set list with a negative value are set to this value. The decimal portion is written to the fraction totalizer. Then -1 is entered in the relevant input field in the set list. All totalizers in the totalizer set list with a negative value (explicitly -1) remain unchanged.

Q	30	DE2	-1,000000	kWh
Q	31	DM2	-1,000000	kg
Q	32	DVb3	-1,000000	m3
Q	33	DVc3	-1,000000	m3
Q	34	DVm3	-1,000000	m3
Q	35	DE3	-1,000000	kWh
Q	36	DM3	-1,000000	kg
Q	37	DVb4	-1,000000	m3
Q	38	DVc4	-1,000000	m3
Q	39	DVm4	-1,000000	m3
Q	40	DE4	-1,000000	kWh
Q	41	DM4	-1,000000	kg
Q	42	Controlcnt. 1	-1,000000	[]
Q	43	Controlcnt. 2	-1,000000	[]
Q	44	Controlcnt. 3	-1,000000	[]
Q	45	Controlcnt. 4	-1,000000	[]
Q	46	Extracnt. 1	-1,000000	m3
Q	47	Extracnt. 2	-1,000000	[]
Q	48	Extracnt. 3	-1,000000	[]
Q	49	Extracnt. 4	-1,000000	[]
Q	50	Extracnt. 5	-1,000000	[]
Q	51	Extracnt. 6	-1,000000	[]
Q	52	CO2-EM 1	-1,000000	kg
Q	53	CO2-EM 2	-1,000000	kg
Q	54	CO2-EM 3	-1,000000	kg
Q	55	CO2-EM 4	-1,000000	kg
Q	56	Dist. CO2-EM1	-1,000000	kg
Q	57	Dist. CO2-EM2	-1,000000	kg
Q	58	Dist. CO2-EM3	-1,000000	kg
Q	59	Dist. CO2-EM4	-1,000000	kg
...	...	...	...	...

A.90 LS Hourly quantities

Access	Line	Designation	Value	Unit
D	2	Last hour Vn	984	m3
D	3	Last hour Vb	71238	m3
D	4	Last hour E	3058	MWh
D	5	Last hour M	59491	kg
D	6	Last hour Vc	984	m3
D	12	Last hour Vm frac.	,91667	m3
D	13	Last hour Vb frac.	,214957	m3
D	14	Last hour E frac.	,384775	MWh
D	15	Last hour M frac.	0,33627	kg
D	16	Last hour Vc frac.	,91667	m3
D	22	Hour Vm	28	m3
D	23	Hour Vb	2048	m3
D	24	Hour E	87	MWh
D	25	Hour M	1710	kg
D	26	Hour Vc	28	m3
D	32	Hour Vm fraction	,294444	m3
D	33	Hour Vb fraction	,229635	m3
D	34	Hour E fraction	,934184	MWh
D	35	Hour M fraction	,476577	kg
D	36	Hour Vc fraction	,294444	m3

The quantities from the last hour LS02...LS16 are displayed on modbus registers 1400...1428.

1400	4	unsigned integer 32-bit	R	LS	2	Stundenmengen	Itz.Std. Vb	222 m3
1402	4	unsigned integer 32-bit	R	LS	3	Hourly quantities	Last hour Vn	2864 m3
1404	4	unsigned integer 32-bit	R	LS	4	Hourly quantities	Last hour E	34 MWh
1406	4	unsigned integer 32-bit	R	LS	5	Hourly quantities	Last hour M	7782 kg
1408	4	unsigned integer 32-bit	R	LS	6	Hourly quantities	Last hour Vbk	222 m3
1420	4	float IEEE 754	R	LS	12	Hourly quantities	Last hour Vb frac.	,345000 m3
1422	4	float IEEE 754	R	LS	13	Hourly quantities	Last hour Vn frac.	,842821 m3
1424	4	float IEEE 754	R	LS	14	Hourly quantities	Last hour E frac.	,378114 MWh
1426	4	float IEEE 754	R	LS	15	Hourly quantities	Last hour M frac.	,075000 kg
1428	4	float IEEE 754	R	LS	16	Hourly quantities	Last hour Vbk frac.	,345000 m3

A.91 LT Daily quantities

Access	Line	Designation	Value	Unit
D	2	Yesterday Vm	0	m3
D	3	Yesterday Vb	0	m3
D	4	Yesterday E	0	MWh
D	5	Yesterday M	0	kg
D	6	Yesterday Vc	0	m3
D	12	Yester. Vm frac	,000000	m3
D	13	Yester. Vb frac	,000000	m3
D	14	Yester. E frac	,000000	MWh
D	15	Yester. M frac	,000000	kg
D	16	Yester. Vc frac	,000000	m3
D	22	Today Vm	0	m3
D	23	Today Vb	0	m3
D	24	Today E	0	MWh
D	25	Today M	0	kg
D	26	Today Vc	0	m3
D	32	Today Vm fraction	,000000	m3
D	33	Today Vb fraction	,000000	m3
D	34	Today E fraction	,000000	MWh
D	35	Today M fraction	,000000	kg
D	36	Today Vc fraction	,000000	m3

A.92 LU Quantity weighted average values

Zugriff	Zeile	Name	Wert	Einheit
D	1	Hs run. hour	12,932	kWh/m3
D	2	sd run. hour	0,9444	kg/m3
D	3	den run. hour	35,000	kg/m3
D	4	Hs last hour	12,932	kWh/m3
D	5	sd last hour	0,9444	kg/m3
D	6	den last hour	35,000	kg/m3
D	7	Hs run. day	12,932	kWh/m3
D	8	sd run. day	0,9444	kg/m3
D	9	den run. day	35,000	kg/m3
D	10	Hs last day	0,000	kWh/m3
D	11	sd last day	0,0000	kg/m3
D	12	den last day	0,000	kg/m3

Quantity weighted average values are generated for superior calorific value, standard density and density. The average values are calculated by division of hourly or daily quantities.

- Superior calorific value : Division of energy quantity by volume at base conditions quantity
- Standard density : Division of mass quantity by volume at base conditions quantity
- Density : Division of mass quantity by volume at measurement conditions quantity

The quantity weighting depends on the method of quantity generation.

- from current hourly quantities
- from quantities of the last hour
- from current daily quantities
- from daily quantities of the last day

Example for a quantity weighted average value, Hs last hour:

Energy quantity last hour = *LS04+LS14* = 20 MWh + 0.264351 MWh = 20.264351 MWh
Volume at base conditions last hour = *LS03+LS13* = 1831 m3 + 0.534674 m3 = 1831.534674 m3

Hs last hour = Energy quantity last hour / Volume at base conditions last hour
= 20264.351 KWh / 1831.534674 m3
= 11.0642 KWh/m3

A.93 MB Current output 1 terminal X4-1, X4-2

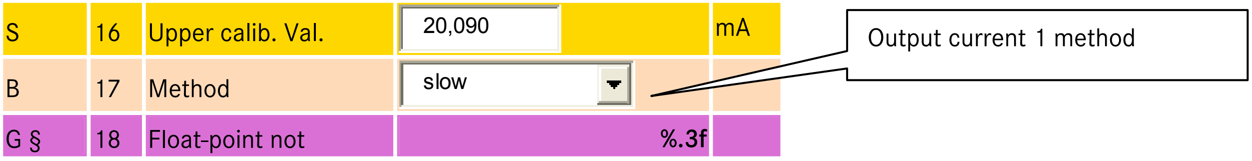
Represents all current outputs

Access	Line	Designation	Value	Unit
D	1	Current	6,575	mA
D	2	Physical value -> HE01	804,569	m3/h
D	3	Smoothed orig. value	804,569	m3/h
I	4	D/A converter value	4BE2	hex
B	5	Assignment	Vol.flow rate meas	
B	6	Extended assignm.	edit	
B	7	Lower mapping	0	m3/h
B	8	Upper mapping	1000	m3/h
B	9	Averaging factor	0	
B	10	Operating mode	warm up	
B	11	Operation if fault	Rise/decrease	
B	12	Rise/decr.w.fault	0	
B	13	Default current	4,000	mA
B	14	Test current	4,000	mA
S	15	Lower calib.val.	4,012	mA

Main selection for measured variable. The values most frequently used for the current output are listed here. If you wish to output a different measurement variable to the one listed here, program *Extended selection* and then set the measurement variable using the function in line 6.

Defines the operating mode in the event of a fault.

Preset fault operating mode = rise: If the output physical variable extends beyond the display range, the output current is increased or decreased by the value programmed here.



In line 6 *Extended assignm.*, you have the option of clicking Edit to access another menu and select a suitable variable for the current output from all the variables and measured values available.

Line 3 *Smoothed orig. value*
Active smoothing generates intermediate values, which are viewed as real measured values by a downstream device that digitalizes more quickly than the corrector. In order to control and monitor this effect and any adverse repercussions, the physical measured value is recalculated from the smooth output current and then displayed.

Line 9 *Averaging factor*
Determines the degree of current smoothing. 0 = Smoothing deactivated. 1 = Infinite smoothing.
Value range: Min = 0 Max = 0.99999

Line 17 *Method*

Slow Output method for plotters or displays. The output current is renewed after each complete second and then maintained for one second. Digital stages are assigned to the output current.

Fast Output method for regulation. The output current is calculated every time the physical output value is recalculated. The recalculation frequency can be viewed under Cycles. The output current follows the physical output value for the correction speed directly. The value is retained until a new output value is available. Digital stages are assigned to the output current.

Linear sweep Special output method that can be used if a downstream controller reacts over sensitively to digital stages, but can operate with a constant dead time of one second. A new current output value is calculated after each complete second. The current output is then set to the new value, not immediately (stage) but instead is increased gradually towards the new continuous value (slope) in 100 increments of 10 milliseconds, starting from the last value. The output current is then smooth but delayed by one second.

A.94 MF Pulse output 1 terminal X3-1, X3-2

Access	Line	Designation	Value	Unit
A §	1	Pulse totalizer	1658	Pulse
A §	2	Part exec.pulses	,9	Pulse
A §	3	Storage	,2	Pulse
A §	4	Frequency	0,95367	Hz
D	5	HW Storage	0	Pulse
E §	10	Assignm. meas.val.	cond.pulse test	
E §	11	Assignm. main/dist.	always	
E §	12	. Assignm. to BM	1	
E §	13	Pulse value	1	
E §	14	Max. pulse freq.	10	Hz
E §	15	Strategy	smooth	
E §	16	Overflow comes	100,0	Pulse
E §	17	Overflow goes	10,0	lse
G §	18	Float-point not	%.1f	
E §	19	Transit	OFF	
Q	20	Pulses for te	0,0	

Represents all pulse outputs

Display of the current situation regarding pulse output, fractions in the memory, output frequency, etc.

There are other options apart from assigning the output to a measured value: direct output of the HF input or for test purposes, the number of pulses entered in line 20 can be output as a one-off pulse group or periodically every second.

Pulses are output either always or in synchronization with the main totalizer or disturbance totalizer.

Output mode for billing mode. Pulse accumulation occurs when the current billing mode corresponds to one of the modes listed here.
Example:
'134' is set here. Pulse accumulation occurs in billing modes 1, 3 or 4. Accumulation does not occur in billing mode 2.

Overflow.
If the pulse output memory exceeds the value specified under "Overflow comes", the message W70-0 Pulse 1>max is set. If the pulse output memory falls below the value programmed under "Overflow comes", the message is canceled.

Strategy.
smooth: The output frequency is adapted to the current pulse quantity output in such a way that the pulses are distributed evenly. The maximum output frequency is not exceeded.
rough: The pulse quantity output with the constant output frequency.

A.95 MJ Contact output 1 terminal X1-1, X1-2

Represents all contact outputs

Access	Line	Designation	Value	Unit
D	1	Current position	0	
D	2	Physical value -> EC02	1	
B	3	Operating mode	alw ays 1	
B	4	Assignment	edit	
B	5	Inversion	no	
B	6	Min. threshold	0	
B	7	Max. threshold	70	

The operating mode of the contact determines the source that switches the contact. In pot, hat, value>max or value<min operating modes, a physical measurement variable must be assigned under Assignment *edit* . Furthermore, the min. and/or max. threshold values must be defined in these operating modes (lines 6 and 7).

Allows inversion of the contact function.

Determines the upper threshold value of the physical variable at which the contact switches. The value is entered in the unit displayed in line 2 (physical value). The upper threshold value is only effective in hat, pot and value<max operating mode

Determines the lower threshold value of the physical variable at which the contact switches. The value is entered in the unit displayed in line 2 (physical value). The lower threshold is only effective in hat, pot and value>min operating modes;

Example of a threshold switch that switches from high to low (pot) and is assigned to the pressure.

Access	Line	Designation	Value	Unit
D	1	Current position	0	
D	2	Physical value -> AB01	1	bar
B	3	Operating mode	Pot ~~|__|~~	
B	4	Assignment	edit	
B	5	Inversion	no	
B	6	min. threshold	0	bar
B	7	max. threshold	70	bar

A.96 MR Frequency output channel 1 terminal X2-7, X2-8

Access	Line	Designation	Value	Unit
A §	1	Curr. Frequency	**80,499**	Hz
A §	2	Physical value->OF01	**8,050**	%
A §	3	Rating of pulses	**0**	l/m3
E §	5	Assignment	percent.flow rate	
E §	6	Extended assignm.	edit	
E §	7	Lower mapping	0	
E §	8	Upper mapping	100	
B	9	Averging factor	0	
E §	10	Operating mode	OFF	
B	13	Default frequency	0,000	Hz
B	14	Test frequency	100,000	Hz
G §	18	Float.-point not.	**%.3f**	
I	19	Act. Frequency	80,499	Hz
D	20	Absolute error	0,000	Hz

Assignment of the frequency output to one of the measurement variables available for selection here or with extended options, to the variable that was selected in line 6.

Available operating modes include: off, 0-1000Hz, 0-2000Hz, 0-2500Hz, default and test frequency

The setpoint of the frequency is entered here in *Default* operating mode.

The setpoint of the frequency is entered here in *Test frequency* operating mode.

The actual value of the frequency output and the deviation from the setpoint are displayed here.

A deviation may occur if the setpoint cannot be displayed without the internal binary divider using a fraction.

The function of the frequency output is an auxiliary function for cases where the flow corrector is also the main totalizer for a connected ultrasound meter. The ultrasound gas meter requires a frequency signal for preliminary testing / calibration / bench testing. This signal is used for comparison with a reference device. An alternative (more modern) method would be to transfer the current values using the MODBUS.

A.97 NA Current input 1 terminal X5-1, X5-2

Access	Line	Designation	Vlaue	Unit
A §	1	Current 1	**0,0002**	mA
I	2	HART measure value	0	
D	3	Uncalib. Current	-0,0001	mA
D	4	Uncalib. Mean	-0,0001	mA
I	5	Converter value	FFFFFFDC	hex
D	6	Running timeout	0	s
S	9	Meas. Strategy	Standard	
S	10	Lower calib.val.	3,9985	mA
S	11	Upper calib.val.	19,9937	mA
S	13	Transd. Supply	OFF	
G §	14	Float.-point not.	**%4f**	
D	15	Beneficiary	Unknown	
S	16	HART oper. Mode	OFF	
J	17	HART unit code	0	
J	18	HART Manufact. Code	0	
J	19	HART Type code	0	
J	20	HART identification	0	
D	21	Timeout HART	0	s
D	22	HART status	0	

Represents all current outputs.

Displays which function uses this measured value, i.e. the beneficiary (the absolute pressure in this case).

A.98 NI Resistance measurement 1 terminal X5-7, X5-8, X5-9, X5-10

Access	Line	Designation	Value	Unit
A §	1	Resistance 1	**109,97**	Ω
D	2	Calibr. Temperature	25,4602	°C
D	3	Uncalib. Temperature	25,4647	°C
D	4	Uncalib. T mean	25,4652	°C
I	5	Converter value	0066B182	hex
D	6	Running timeout	1	s
S	10	Lower calib. Value	-9,9422	°C
S	10	Upper calib. Val.	59,9900	°C
B	12	Open.circ control	yes	
E §	13	Measuring range	PT100	
G §	14	Float.-point not.	**%.2f**	
D	15	Beneficiary	Unknown	
D	16	Spec.val.dev.AD0	0,38	%
D	17	Spec.val.dev.AD1	0,03	%
D	18	Spec.val.dev.AD2	1,00	%
D	19	Open-circ.fault	0000	
D	20	Special dev.AD0	0,12	%
D	23	Uncalibr. Resistance	109,91	Ω
D	24	Uncalibr. Mean	109,91	Ω
D	26	Open-circ.monit.AD0	3125	
D	27	Open-circ.monit.AD1	1906	
D	28	Open-circ.monit.AD2	1218	
D	29	R1 opencirc ready	3	

Displays which function uses this measured value, i.e. the beneficiary (the gas temperature in this case).

Diagnostic information for the monitoring of the 4-wire measurement for short circuits or breakages.

A.99 NL Frequency input 1 X8 oder X9

Represents all frequency inputs

Access	Line	Designation	Value	Unit
I	1	Frequency 1	80,5163	Hz
D	2	Smoothed	80,5062	Hz
I	3	Input pulses 1	48103	Pulse
D	4	Running timeout	1	s
G §	6	Float.-point not.	%.4f	
A §	7	Assignment	**Term. X8-7,X8-8**	
Z §	8	Integer part	**16776960**	[]
Z §	9	Fraction part	**,00000000**	[]

Display of the input frequency, in this case the operating volume measurement channel, see line 15 Beneficiary.

B	10	Weighting	0,01	
B	11	Unit	[]	
B	12	Symbol	Kontr.Zlw 1	
D	15	Beneficiary	Qm freq.main	

If the Ex card is used, this input becomes vacant and can be used for other counter inputs.
The relevant value and unit are entered here.

A.100 NT Contact inputs terminal X7, X8

Assignment for "MRG" functions, roadways, etc.

Access	Line	Designation	Value	Unit
D	1	Binary pattern	———	bin
I	2	Input pattern	0	
D	3	Used contact	0	
T	4	Inverting mask	0	
D	6	Target contact 1	(....)	
D	7	Target contact 2	(....)	
D	8	Target contact 3	(....)	
D	9	Target contact 4	(....)	
D	10	Target contact 5	(....)	
D	11	Target contact 6	(....)	
D	12	Target contact 7	(....)	
D	13	Target contact 8	(....)	
D	14	Running timeout	0	s

A.101 NU Current input 9 Exi

Current inputs 9 and 10 when using the Ex card (11 and 12 reserved for second Ex card).

Access	Line	Name	Value	Unit
A §	1	Current 9	0,0000	mA
I	2	HART measure value	0	
I	3	Uncalib. Current	0,0000	mA
D	4	Uncalib. Mean	0,0000	mA
D	6	Running timeout	31	s
S	8	EXI-Mod.calibr.	no	mA
S	10	Lower calib.val.	4,0000	mA
S	11	Upper calib.val.	20,0000	mA
G §	14	Float.-point not.	%.4f	
D	15	Beneficiary	Unknown	
S	16	HART operating mode	OFF	
J	17	HART unit code	0	

J	18	HART manufact.code	0	
J	19	HART type code	0	
J	20	HART identification	0	
D	21	Timeout HART	0	s
D	22	HART Status	0	

A.102 NY Resistance measurement 3

Resistance input 3 when using the Ex card (4 reserved for second Ex card).

Access	Line	Designation	Value	Unit
A §	1	Resistance 3	**0,00**	Ω
D	2	Calib. Temperature	-241,9039	°C
D	3	Uncalib. Temperature	-241,9039	°C
D	4	Uncalib. T-mean	-241,9039	°C
D	6	Running timeout	31	s
S	8	EXI-Mod. Calibr.	No	
S	10	Lower calib.val.	-10,0070	°C
S	11	Upper calib. Val.	60,0450	°C
B	12	Open.circ control	yes	
G §	14	Float.-point not.	**%.2f**	
D	15	Beneficiary	Unknown	
I	23	Uncalib. Resistance	0,00	Ω
D	24	Uncalib. Mean	0,00	Ω

A.103 OB Gauge pressure

OB Gauge pressure contains the same details as AB Absolute pressure. This function is required when a gauge pressure sensor is used instead of the absolute pressure sensor. The following operating mode must then be set in AB Absolute pressure: *from gauge pressure*

Access	Line	Designation	Value	Unit
A §	1	Measured value	**42,000**	bar
A §	2	Input value->OB05	**42,000**	bar
E §	3	Operating mode	OFF	
G §	4	Unit	**bar**	
B	5	Default	42,000	bar
B	6	Öower warning limit	14,000	bar
B	7	Upper warning limit	70,000	bar
E §	8	Lower alarm limit	14,000	bar
E §	9	Upper alarm limit	70,000	bar
E §	11	Coefficient 0	0	

E §	12	Coefficient 1	0	
E §	13	Coefficient 2	0	
E §	14	Coefficient 3	0	
B	15	Ambient pressure	1,01325	bar
E §	16	Source	Off	
E §	17	Correction value	0,000	bar
E §	19	Max. gradient	10	bar/s
D	21	Base value	42,000	bar
D	22	Mean for DSfG	42,000	bar
D	27	Current status	stop	
D	28	DSfG status	stop	
D	29	Used range	0,000	bar
G §	30	Format	%.3f	
D	31	Min. drag indicator	42,000	bar
D	32	Max. drag indicator	42,000	bar
D	33	Current gradient	0,000	bar/s
D	34	Second mean	42,000	bar
D	35	Minute mean	42,000	bar
D	36	Hourly mean	42,000	bar
D	37	Ongoing mean	42,000	bar
D	38	Standard deviation	0,000	bar
D	47	Revision mean	42,000	bar
D	48	Retain value	42,000	bar
E §	50	Manufacturer	Rosemount	
E §	51	Device type	3051CA	
E §	52	Serial number	0	
F	61	Measured value	42,000	bar
F	62	Input value	42	bar

The ambient pressure is set here.

A.104 OD Input values

Access	Line	Designation	Value	Unit
D	1	Debug value 4	005BFFFF	hex
D	2	Debug value 3	0	
D	3	Debug value 2	0	
I	4	FCBios-cycles	1773	Hz
I	13	Pulse comp.line 1	0	
I	14	Pulse comp.line 2	0	
I	15	Start-up line 1	Yes	
I	16	Start-up line 2	Yes	
I	18	Base time second	2719300091	
I	19	Base clock second	0,846671	s
I	24	Missing pulses	0	
I	25	Base clock HF 1/2	1,000	s
I	26	Base clock HF 3/4	1,000	s
I	27	Base time HF1/2	2736430353	
I	28	Base time HF 3/4	2736561425	
I	29	FPGA control	99	
I	30	IGM timer	0	
A §	31	IGM time slice	**0,000000**	s
D	32	Time slice	1,002	s
I	33	DP-timer raw value	2735170648	
I	35	Act. Dp-current	0	
I	36	Dp-current no.	0	
D	37	Dp qual. Timer	0	s
D	38	Qm-freq. rough	80,8714	Hz
D	39	QM-freq.precis.	80,5567	Hz
D	40	Qm trend rough	0	%
D	41	Pulse comp. Ignor.	No	
D	42	Qm rough	808,714	m3/h
D	43	Volume unit		
D	44	Flow unit		
D	45	VOS unit		

Diagnostic displays

A.105 OE Miscellaneous

Coordinates for analysis, diagnosis, troubleshooting, etc.

Access	Line	Designation	Value	Unit
D	1	Realtive density	0,6459	
D	7	Diverse 13	Region	
D	8	State	Offline	
D	9	User lock	0	
D	10	Diverse 1	Designation	
D	11	Diverse 2	Data type	
D	12	Diverse 3	Parameterization	
D	13	Diverse 4	Load defaults	
D	14	Diverse 5	Settable under	
D	15	Diverse 6	Modbus	
D	16	Diverse 7	Designation	
D	17	Diverse 8	Overview	
D	18	Diverse 9	Pictures	
A §	19	Counting check 1	**7945583**	
A §	20	Counting check 2	**7945583**	
D	21	Receipt MOD520	118729	
D	22	Send M32ok	118790	
D	23	Send M32 err	193	
D	24	Receipt difference	86	
D	25	Burst telegrams	0	
Q	26	CAN burst	0	
A §	27	Qm freq.main	**80,5606**	Hz
A §	28	Qm freq.ref	**0,00000**	Hz
D	29	Roughness	1,00000	
D	30	Current coordinate	3322	
D	31	Current key	16	
D	41	Status mom.values	okay	
D	42	State	At rest	
D	43	Group name A-M	Measured values	
D	44	Group name N-Z	Inputs	
D	45	Diverse 10	Components	
D	47	Current entity	D2	
D	48	Current address	OFF	
D	49	Aux. Value string	Leer	
D	50	Aux.value long	999999999	
D	51	Last event	800	

D	52	Time of last event	09-08-2010 09:23:22	
B	53	Orig.doc.printer	0	
B	54	Data memory	0	kByte
B	55	Battery change	01-01-1970 01	
D	56	Diverse 11	Frozen values	
D	57	Diverse 12	Parameter check	
K	62	Magic number	47110815	
Q	63	Save network conf.	0	
D	66	0	0	
D	67	Time of power fail	06-08-2010 15:41:07	
D	68	Power outage time	236521	s
D	69	unsigned short 0	0	
D	70	unsigned short 0	0	
D	71	unsigned short 0	0	
D	72	Billing	1	
D	73	No. Bill.modes	1	
D	74	EOS-algorithm	3	
D	75	Eval.subst.val.	0	
D	76	Eval.subst.val.	0	
D	77	Behaviour totaliz	0	
D	78	Behaviour totaliz	0	

Identification for ultrasound meter diagnostic software

A.106 OF Extra analog value 1

Access	Line	Designation	Value	Unit
D	1	Measured value	8,057	%
D	2	Input value	(....)	
B	3	Operating mode	OFF	
B	4	Unit	%	
B	5	Default	10,0000	bar
B	6	Lower warning limit	0,000	bar
B	7	Upper warning limit	100,000	bar
B	11	Coefficient 0	2	
B	12	Coefficient 1	1E-04	
B	13	Coefficient 2	0	
B	14	Coefficient 3	0	

Signals can be assigned to free inputs in a similar way to the calibration-relevant measurement inputs.

B	16	1st source	OFF	
B	18	2nd source	OFF	
B	19	Internal choice = AC01	edit	°C
D	21	Base value	8,057	%
D	22	Mean for DSfG	9,840	%
D	25	2nd input value	(....)	
D	27	Current status	Okay	
D	28	DSfG Status	Okay	
G §	30	Format	%.3f	
D	37	Ongoing mean	8,027	%
B	53	Symbol	P Eing.	

A.107 ON Extra messages

Access	Line	Designation	Value	Unit
D	1	Message 1 value	OFF	
B	2	Message 1 source	OFF	
B	3	Message 1 effect	as hint	
B	4	Message 1 text	msg1	
D	6	Message 2 value	OFF	
B	7	Message 2 source	OFF	
B	8	Message 2 effect	as hint	
B	9	Message 2 text	msg2	
D	11	Message 3 value	OFF	
B	12	Message 3 source	OFF	
B	13	Message 3 effect	as hint	
B	14	Message 3 text	msg3	
D	16	Massage 4 value	OFF	
B	17	Message 4 source	OFF	
B	18	Message 4 effect	as hint	
B	19	Message 4 text	msg4	
D	21	Message 5 value	OFF	
B	22	Message 5 source	OFF	
B	23	Message 5 effect	as hint	

Signals can be assigned to free inputs in a similar way to the calibration-relevant measurement inputs.

B	24	Message 5 text	msg5	
D	26	Message 6 value	OFF	
B	27	Message 6 source	OFF	
B	28	Message 6 effect	as hint	
B	29	Message 6 text	msg6	
D	31	Message 7 value	OFF	
B	32	Message 7 source	OFF	
B	33	Message 7 effect	as hint	
B	34	Message 7 text	msg7	
D	36	Message 8 value	OFF	
B	37	Message 8 source	OFF	
B	38	Message 8 effect	as hint	
B	39	Message 8 text	msg8	

A.108 OO Extra counter 1 X7-1,2

Access	Line	Designation	Value	Unit
I	1	Input pulses	0	Pulse
Z §	8	Integer part	**16776960**	m3
Z §	9	Fraction part	**,000000**	m3
B	10	Weighting	1	
B	11	Unit	m3	
B	12	Symbol	SonderZlw 1	

Signals can be assigned to free inputs in a similar way to the calibration-relevant measurement inputs.

A.109 OU Free programmable archive

Access	Line	Designation	Value	Unit
B	1	Record cycle	OFF	
B	10	Assign.Channel 1 = LB04	edit	bar
B	11	Assign.Channel 2 = LB01	edit	°C
B	12	Assign.Channel 3 = LB10	edit	kWh/m3
B	13	Assign.Channel 4 = LC04	edit	kWh
B	14	Assign.Channel 5 = LC01	edit	m3
B	15	Assign.Channel 6 = LC10	edit	m3
B	16	Assign.Channel 7 = LD04	edit	kWh
B	17	Assign.Channel 8 = LD01	edit	m3
B	18	Assign.Channel 9 = LD10	edit	m3
B	19	Assign.Channel 10 = LE04	edit	kWh
B	20	Assign.Channel 11 = LE01	edit	m3
B	21	Assign.Channel 12 = LE10	edit	m3
B	22	Assign.Channel 13 = HB01	edit	kW
B	23	Assign.Channel 14 = HD01	edit	m3/h
B	24	Assign.Channel 15 = HE01	edit	m3/h
B	25	Assign.Channel 16 = AB01	edit	bar
B	26	Assign.Channel 17 = AC01	edit	°C
B	27	Assign.Channel 18 = AD01	edit	kWh/m3
B	28	Assign.Channel 19 = AE01	edit	kg/m3
B	29	Assign.Channel 20 = AG01	edit	bar

A record cycle not equal to *off* must be selected so that the freely programmable archive is recognized as archive group 9 when the master data is imported.

A.110 PB Maximum load display, maximum hourly value of the day

Access	Line	Designation	Value	Unit
D	1	Max. hour/day	Maximum load	
D	10	Uncorr.vol.meas.	984	m3
D	11	Time unc.vol.meas.	09-08-2010 11:00:00	
D	12	Vol. at base cond.	71238	m3
D	13	Time vol base	09-08-2010 11:00:00	
D	14	Quantity of energy	3058	GJ
D	15	Time QOE	09-08-2010 11:00:00	
D	16	Mass	59491	kg
D	17	Time mass	09-08-2010 11:00:00	
D	18	Corr.vol.meas.	984	m3
D	19	Time corr.vol.meas.	09-08-2010 11:00:00	

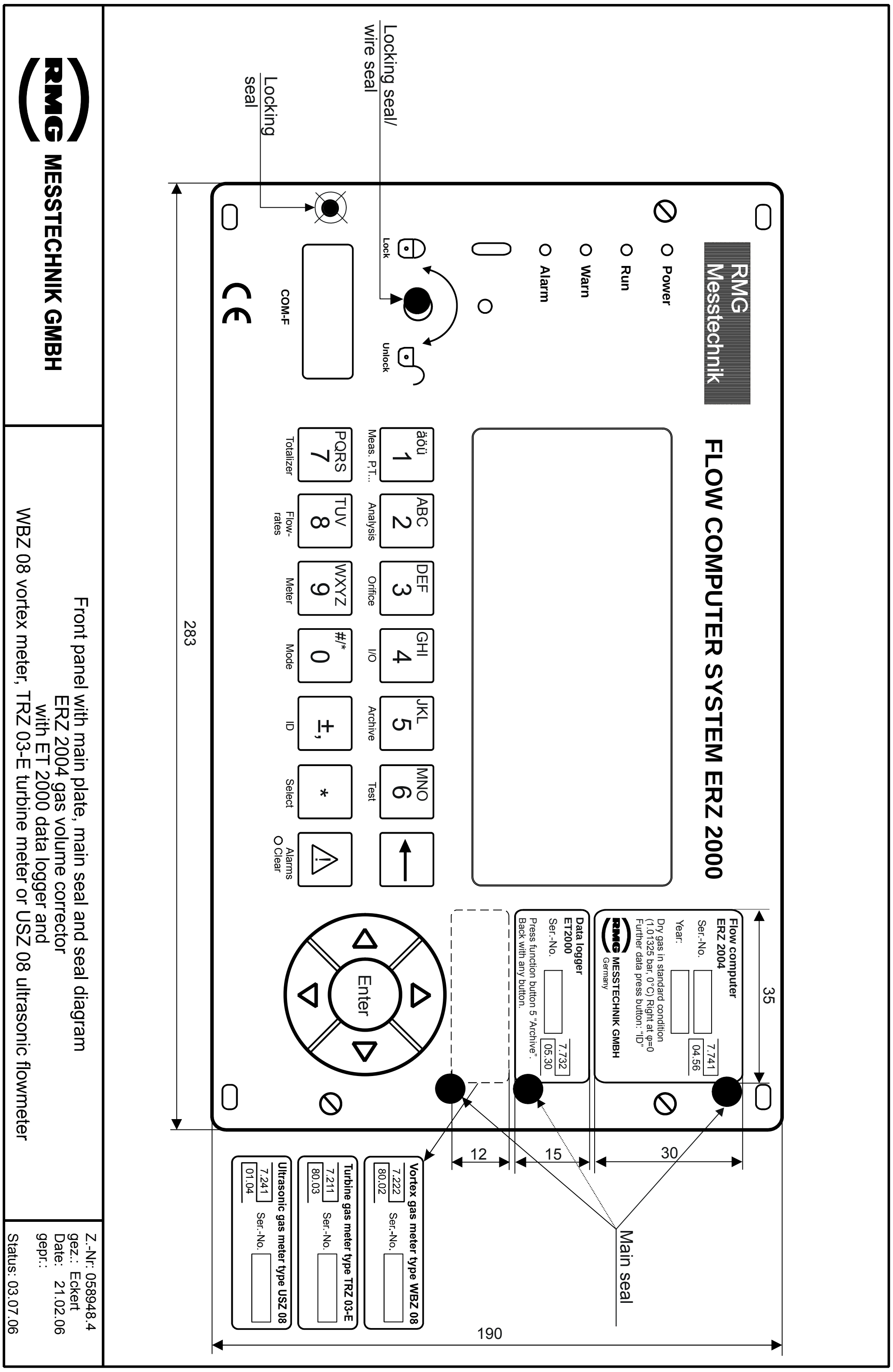
A.111 PG Maximum load display, maximum minute value of the hour

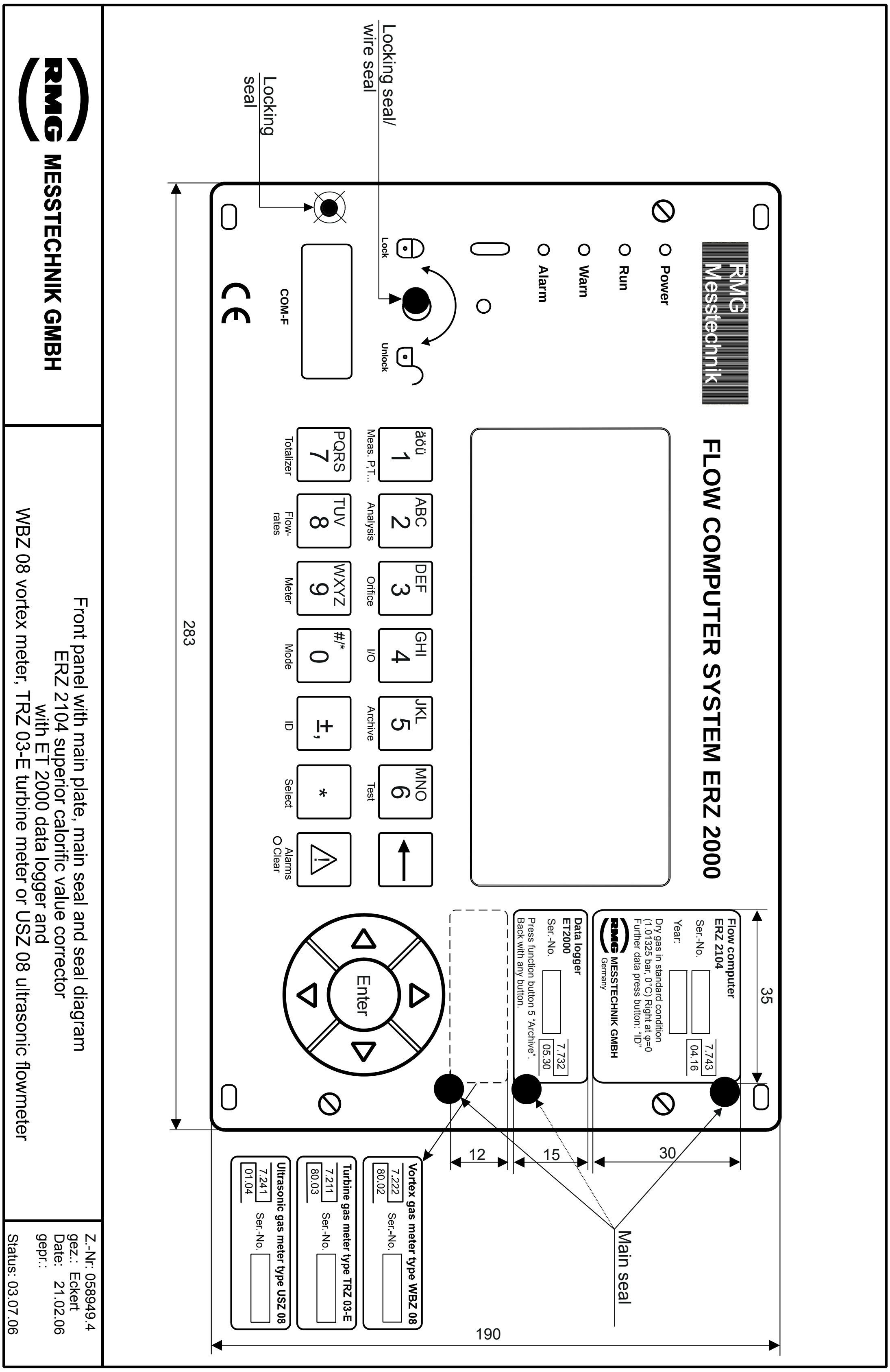
Access	Line	Designation	Value	Unit
D	1	Max minute/hour	Maximum load	
D	10	Uncorr.vol.base	13	m3
D	11	Fraction	,383333	m3
D	12	Time unc.vol.meas.	09-08-2010 11:02:00	
D	13	Vol.at base cond.	968	m3
D	14	Fraction	,8170041	m3
D	15	Time vol.base	09-08-2010 11:02:00	
D	16	Quantity of energy	41	GJ
D	17	Fraction	,593059	GJ
D	18	Time QOE	09-08-2010 11:02:00	
D	19	Mass	809	kg
D	20	Fraction	,59115	kg
D	21	Time mass	09-08-2010 11:02:00	
D	22	Corr.vol.meas.	13	m3
D	23	Fraction	,383333	m3
D	24	Time corr.vol.meas.	09-08-2010 11:02:00	

The smallest time unit for the maximum load is displayed to the nearest minute for easy verification. The maximum value for the hours, days and months is formulated on this basis.
It is possible to verify the maximum load using the original data without running separate memories in fast motion. A test cycle of one hour is reduced to one minute, etc.

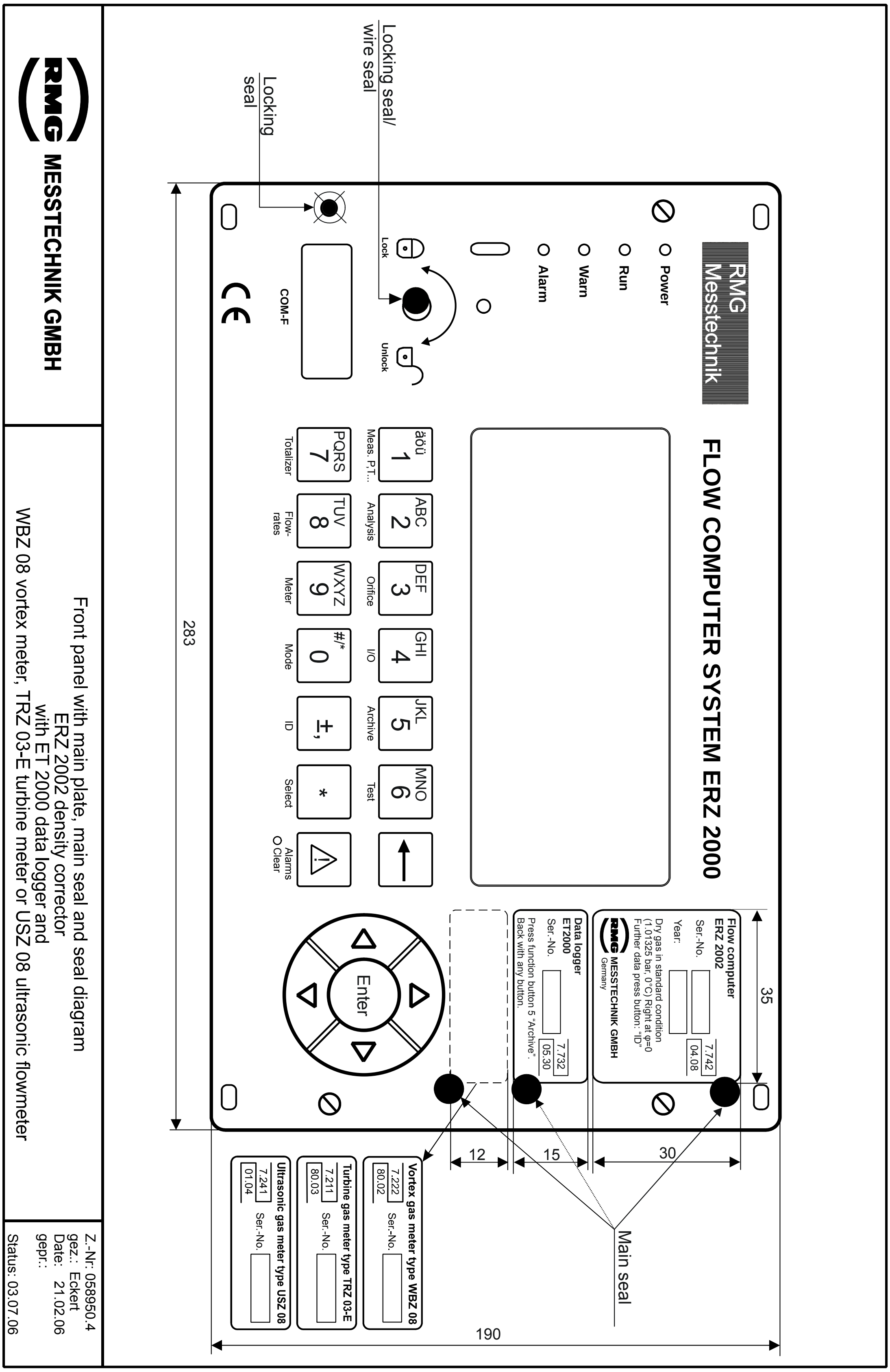
B) Seal diagrams

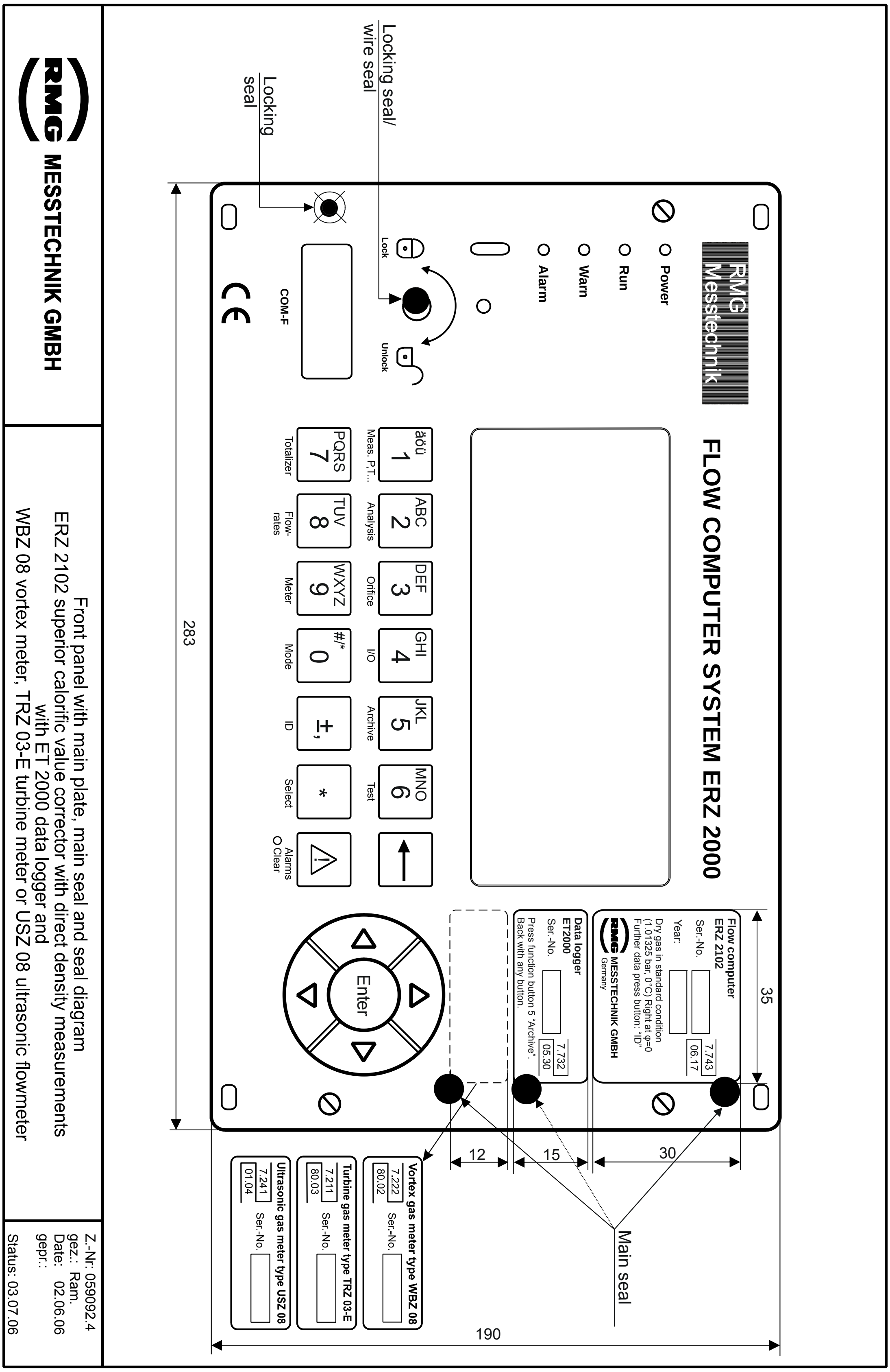
B.1 For devices with PTB approval



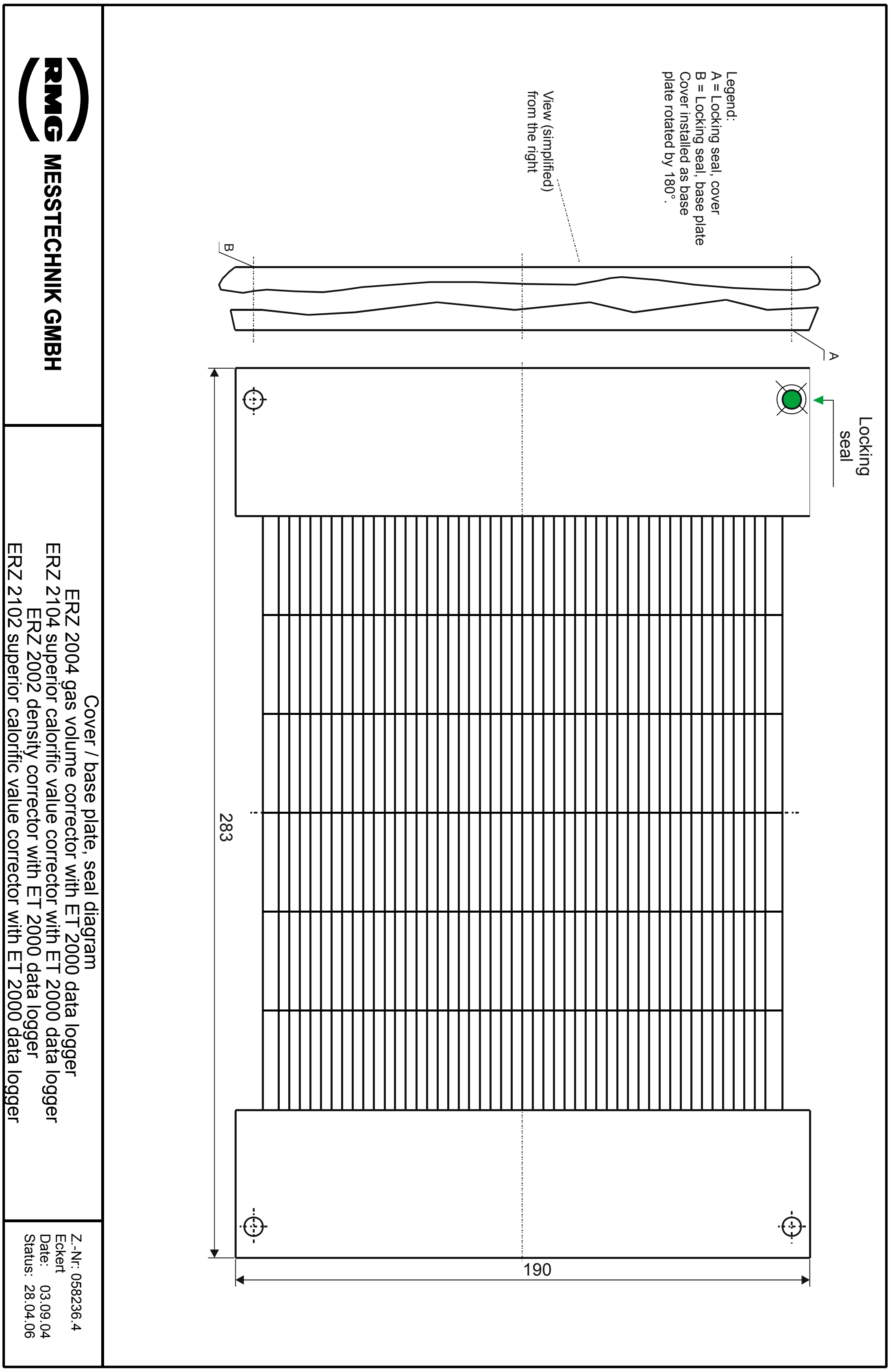


RMG MESSTECHNIK GMBH
Front panel with main plate, main seal and seal diagram
ERZ 2104 superior calorific value corrector
with ET 2000 data logger and
WBZ 08 vortex meter, TRZ 03-E turbine meter or USZ 08 ultrasonic flowmeter
Z.-Nr: 058949.4
gez.: Eckert
Date: 21.02.06
gepr.:
Status: 03.07.06
Locking seal/
wire seal
Locking
seal
RMG Messtechnik
FLOW COMPUTER SYSTEM ERZ 2000
Power
Run
Warn
Alarm
Lock
Unlock
COM-F
äöü 1 Meas. P,T...
ABC 2 Analysis
DEF 3 Orifice
GHI 4 I/O
JKL 5 Archive
MNO 6 Test
PQRS 7 Totalizer
TUV 8 Flow-rates
WXYZ 9 Meter
#/* 0 Mode
±, ID
* Select
Alarms O Clear
Enter
Flow computer ERZ 2104
Ser.-No.
Year:
Dry gas in standard condition (1.01325 bar, 0°C) Right at φ=0
Further data press button: "ID"
7.743
04.16
RMG MESSTECHNIK GMBH Germany
Data logger ET2000
Ser.-No.
Press function button 5 "Archive".
Back with any button.
7.732
05.30
Vortex gas meter type WBZ 08
Ser.-No.
7.222
80.02
Turbine gas meter type TRZ 03-E
Ser.-No.
7.211
80.03
Ultrasonic gas meter type USZ 08
Ser.-No.
7.241
01.04
Main seal
283
35
12
15
30
190

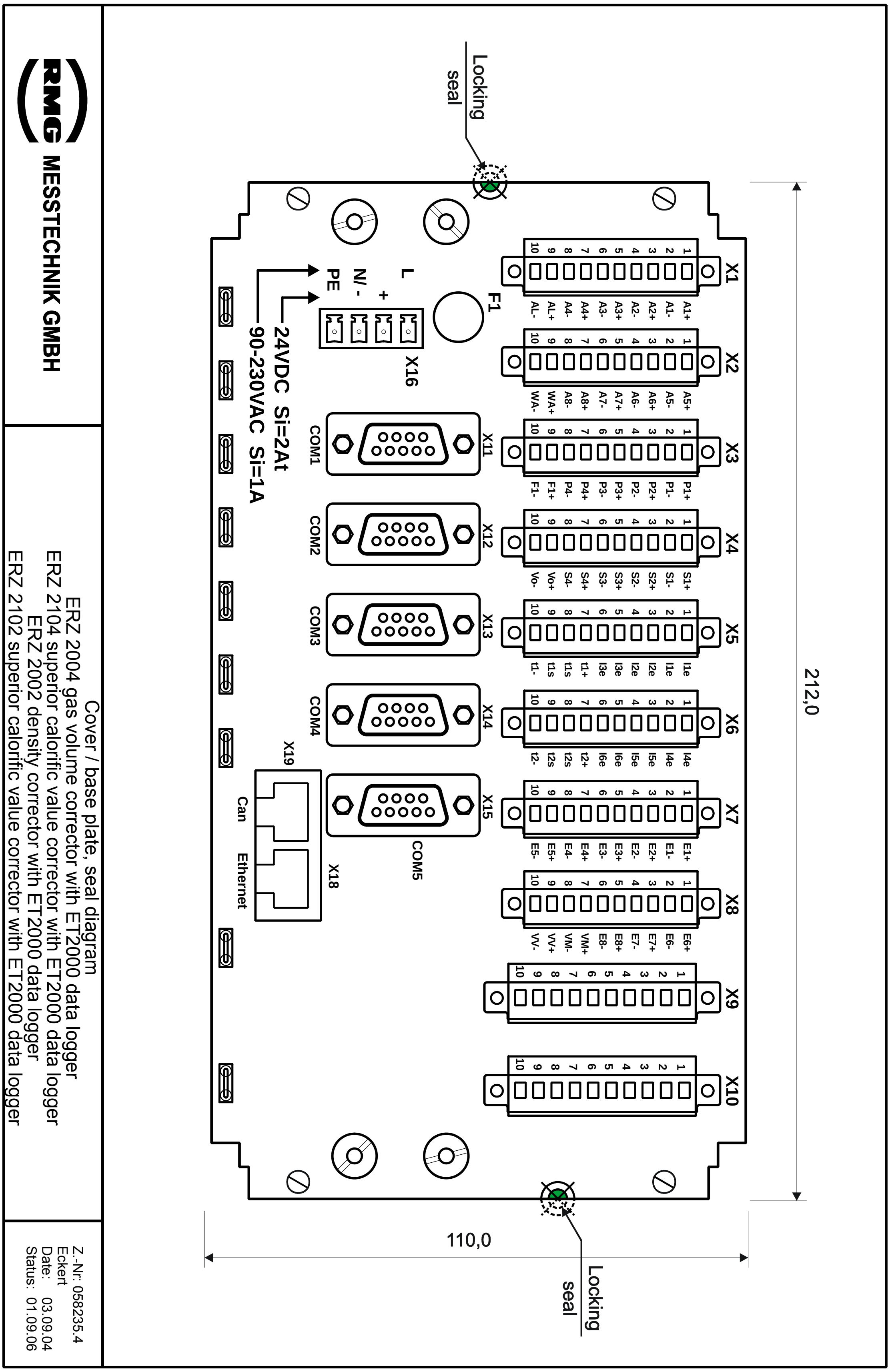

FLOW COMPUTER SYSTEM ERZ 2000
RMG Messtechnik
Power
Run
Warn
Alarm
Lock
Unlock
COM-F
Locking seal/ wire seal
Locking seal
1 äöü Meas. P,T...
2 ABC Analysis
3 DEF Orifice
4 GHI I/O
5 JKL Archive
6 MNO Test
7 PQRS Totalizer
8 TUV Flow-rates
9 WXYZ Meter
0 #/* Mode
±, ID
* Select
Alarms O Clear
Enter
Flow computer ERZ 2002
Ser.-No.
Year:
Dry gas in standard condition (1.01325 bar, 0°C) Right at φ=0
Further data press button: "ID"
7.742
04.08
MESSTECHNIK GMBH Germany
Data logger ET2000
Ser.-No.
Press function button 5 "Archive".
Back with any button.
7.732
05.30
Vortex gas meter type WBZ 08
Ser.-No.
7.222
80.02
Turbine gas meter type TRZ 03-E
Ser.-No.
7.211
80.03
Ultrasonic gas meter type USZ 08
Ser.-No.
7.241
01.04
Main seal
283
35
12
15
30
190
MESSTECHNIK GMBH
Front panel with main plate, main seal and seal diagram
ERZ 2002 density corrector
with ET 2000 data logger and
WBZ 08 vortex meter, TRZ 03-E turbine meter or USZ 08 ultrasonic flowmeter
Z.-Nr: 058950.4
gez.: Eckert
Date: 21.02.06
gepr.:
Status: 03.07.06



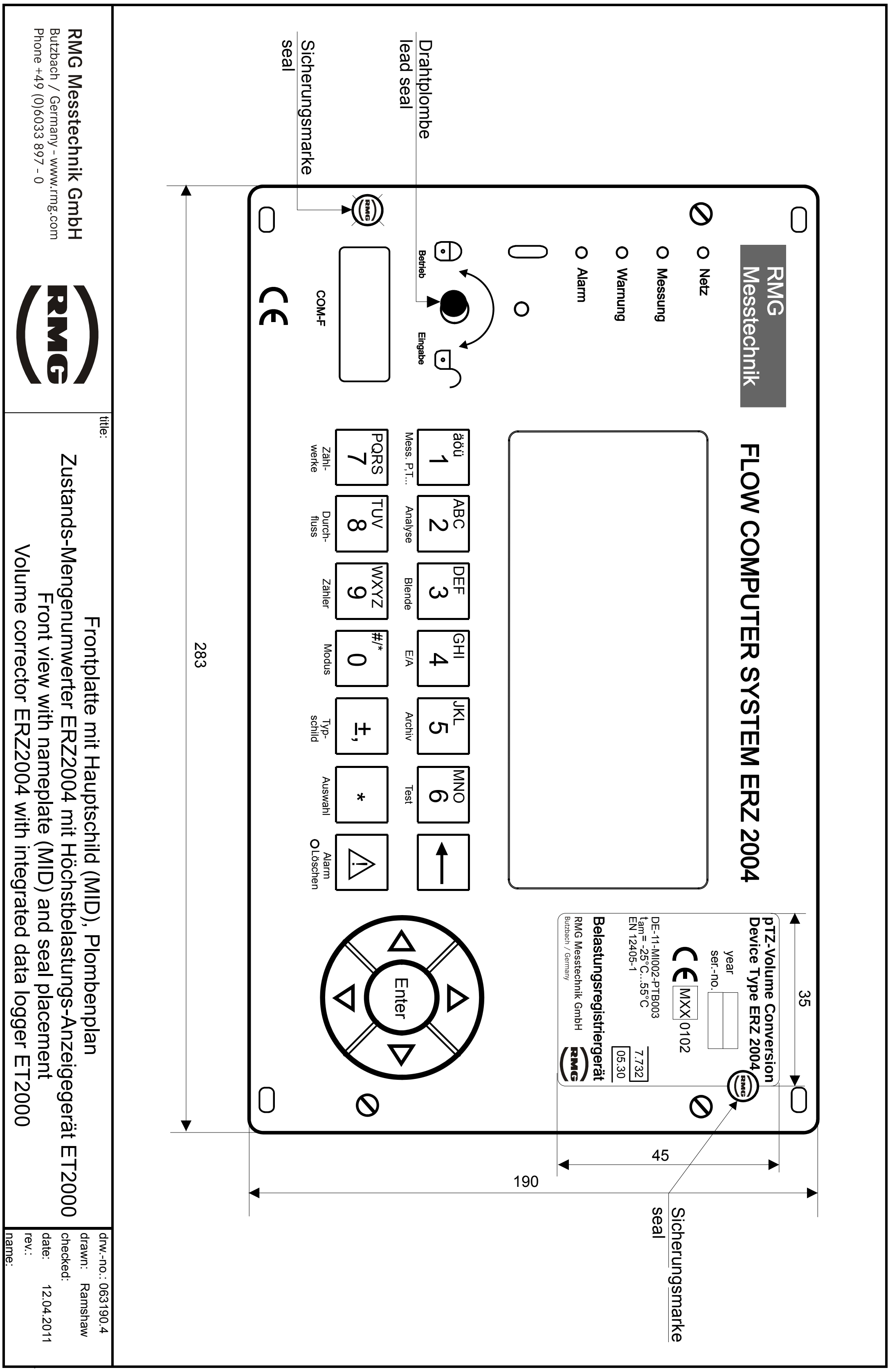
RMG MESSTECHNIK GMBH
Front panel with main plate, main seal and seal diagram
ERZ 2102 superior calorific value corrector with direct density measurements
with ET 2000 data logger and
WBZ 08 vortex meter, TRZ 03-E turbine meter or USZ 08 ultrasonic flowmeter
Z.-Nr: 059092.4
gez.: Ram.
Date: 02.06.06
gepr.:
Status: 03.07.06
Locking seal/
wire seal
Locking
seal
RMG
Messtechnik
FLOW COMPUTER SYSTEM ERZ 2000
Power
Run
Warn
Alarm
Lock
Unlock
COM-F
äöü 1
Meas. P,T...
ABC 2
Analysis
DEF 3
Orifice
GHI 4
I/O
JKL 5
Archive
MNO 6
Test
PQRS 7
Totalizer
TUV 8
Flow-rates
WXYZ 9
Meter
#/* 0
Mode
±,
ID
*
Select
Alarms
O Clear
Enter
Flow computer
ERZ 2102
Ser.-No.
Year:
7.743
06.17
Dry gas in standard condition
(1.01325 bar, 0°C) Right at φ=0
Further data press button: "ID"
RMG MESSTECHNIK GMBH
Germany
Data logger
ET2000
Ser.-No.
7.732
05.30
Press function button 5 "Archive".
Back with any button.
Vortex gas meter type WBZ 08
Ser.-No.
7.222
80.02
Turbine gas meter type TRZ 03-E
Ser.-No.
7.211
80.03
Ultrasonic gas meter type USZ 08
Ser.-No.
7.241
01.04
Main seal
283
35
12
15
30
190

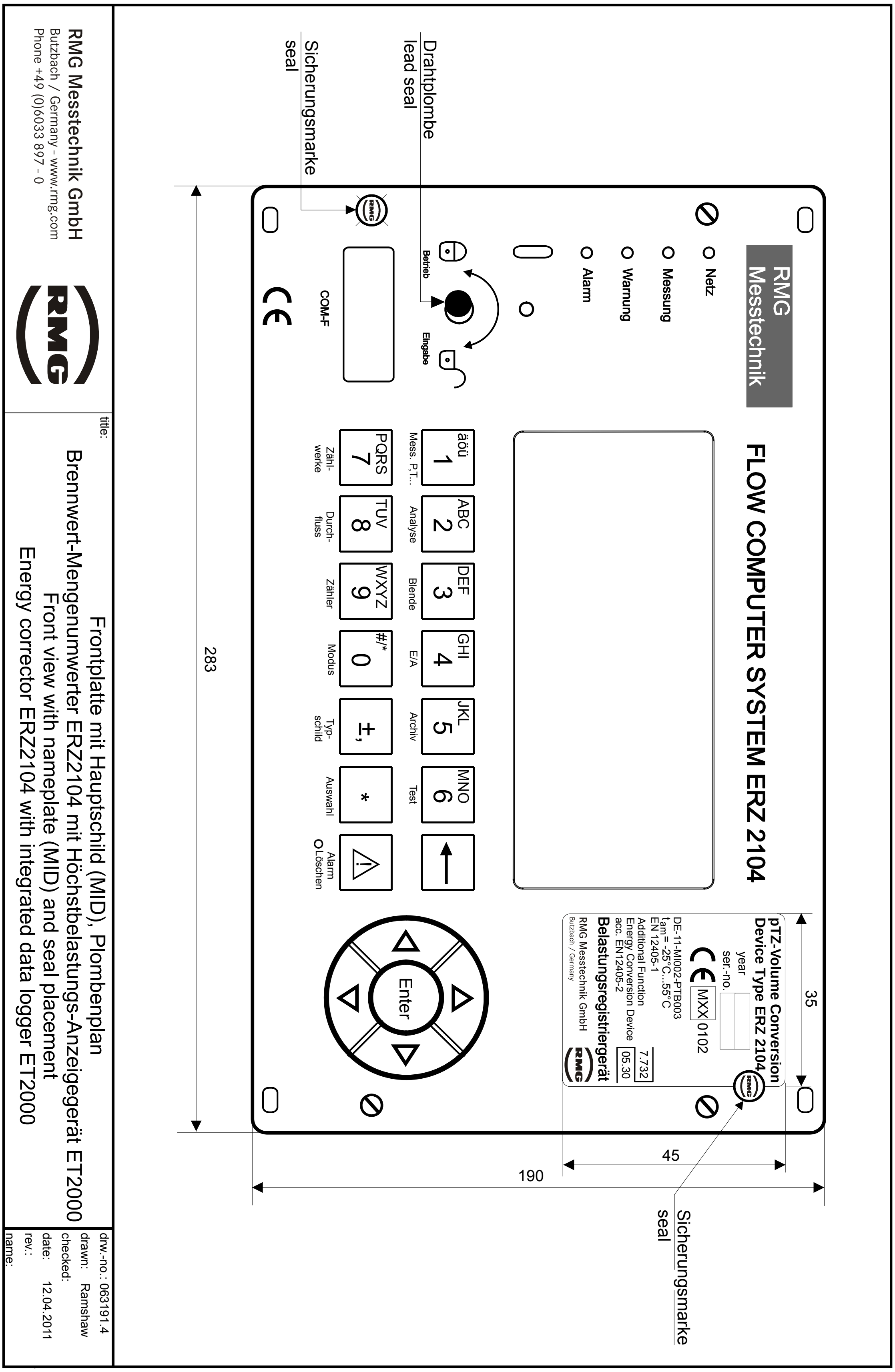


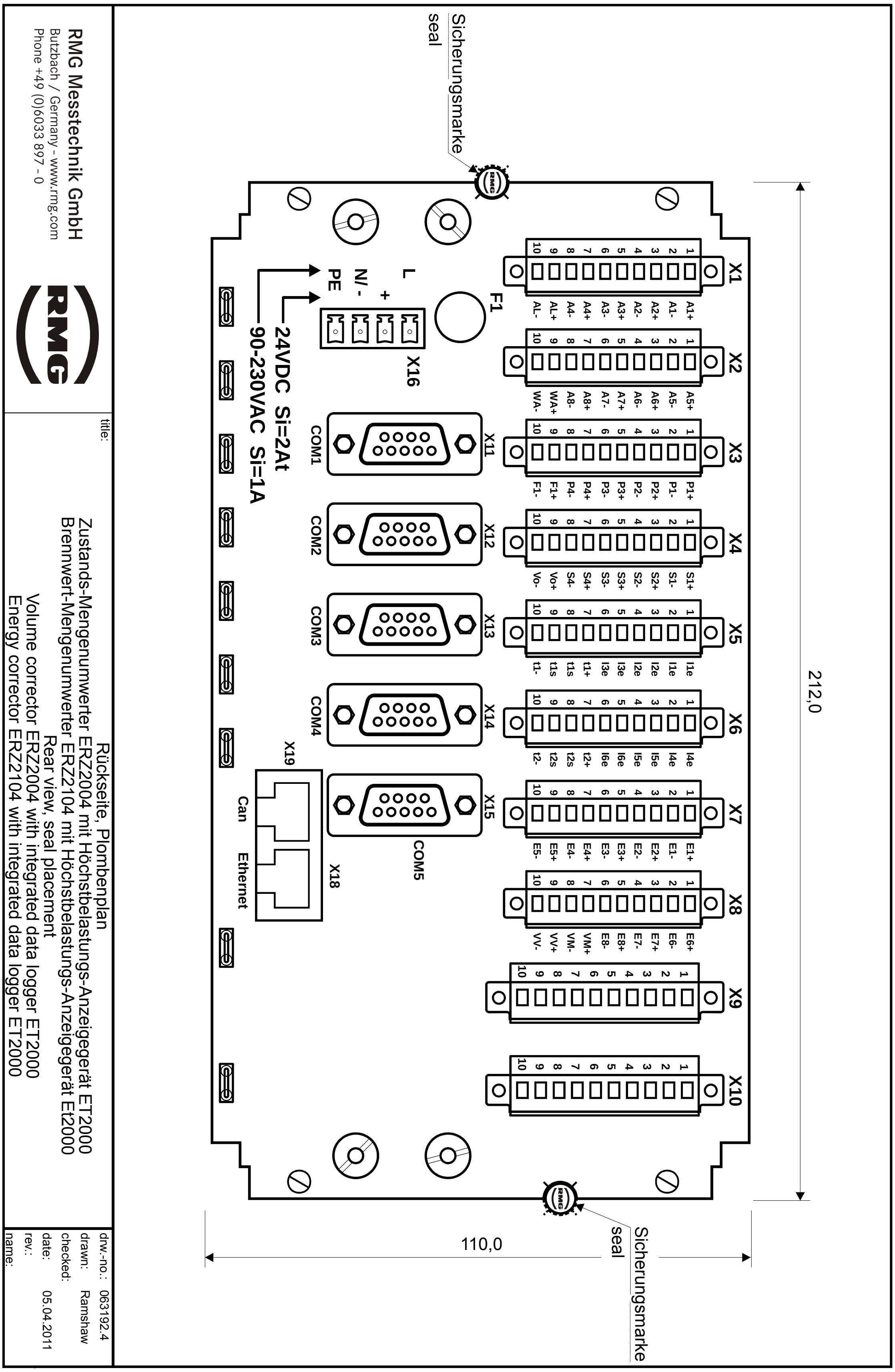
Legend:
A = Locking seal, cover
B = Locking seal, base plate
Cover installed as base plate rotated by 180°.
View (simplified) from the right
A
B
Locking seal
283
190
RMG MESSTECHNIK GMBH
Cover / base plate, seal diagram
ERZ 2004 gas volume corrector with ET 2000 data logger
ERZ 2104 superior calorific value corrector with ET 2000 data logger
ERZ 2002 density corrector with ET 2000 data logger
ERZ 2102 superior calorific value corrector with ET 2000 data logger
Z.-Nr: 058236.4
Eckert
Date: 03.09.04
Status: 28.04.06

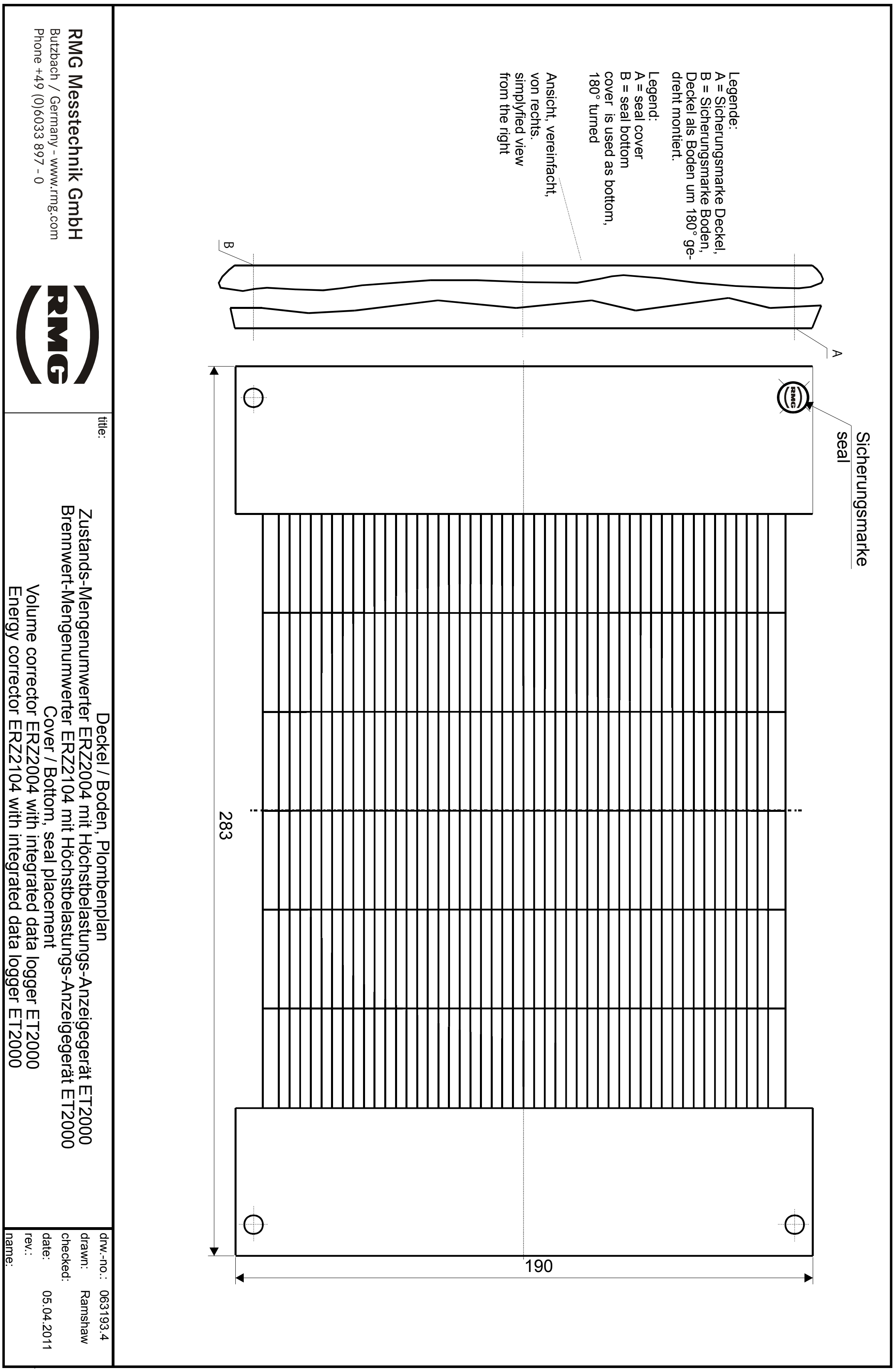

Locking seal
Locking seal
212,0
110,0
X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
X11
X12
X13
X14
X15
X16
X18
X19
COM1
COM2
COM3
COM4
COM5
Can
Ethernet
F1
L
N/ -
+
PE
24VDC Si=2At
90-230VAC Si=1A
MESSTECHNIK GMBH
Cover / base plate, seal diagram
ERZ 2004 gas volume corrector with ET2000 data logger
ERZ 2104 superior calorific value corrector with ET2000 data logger
ERZ 2002 density corrector with ET2000 data logger
ERZ 2102 superior calorific value corrector with ET2000 data logger
Z.-Nr. 058235.4
Eckert
Date: 03.09.04
Status: 01.09.06

B.2 For devices with MID approval

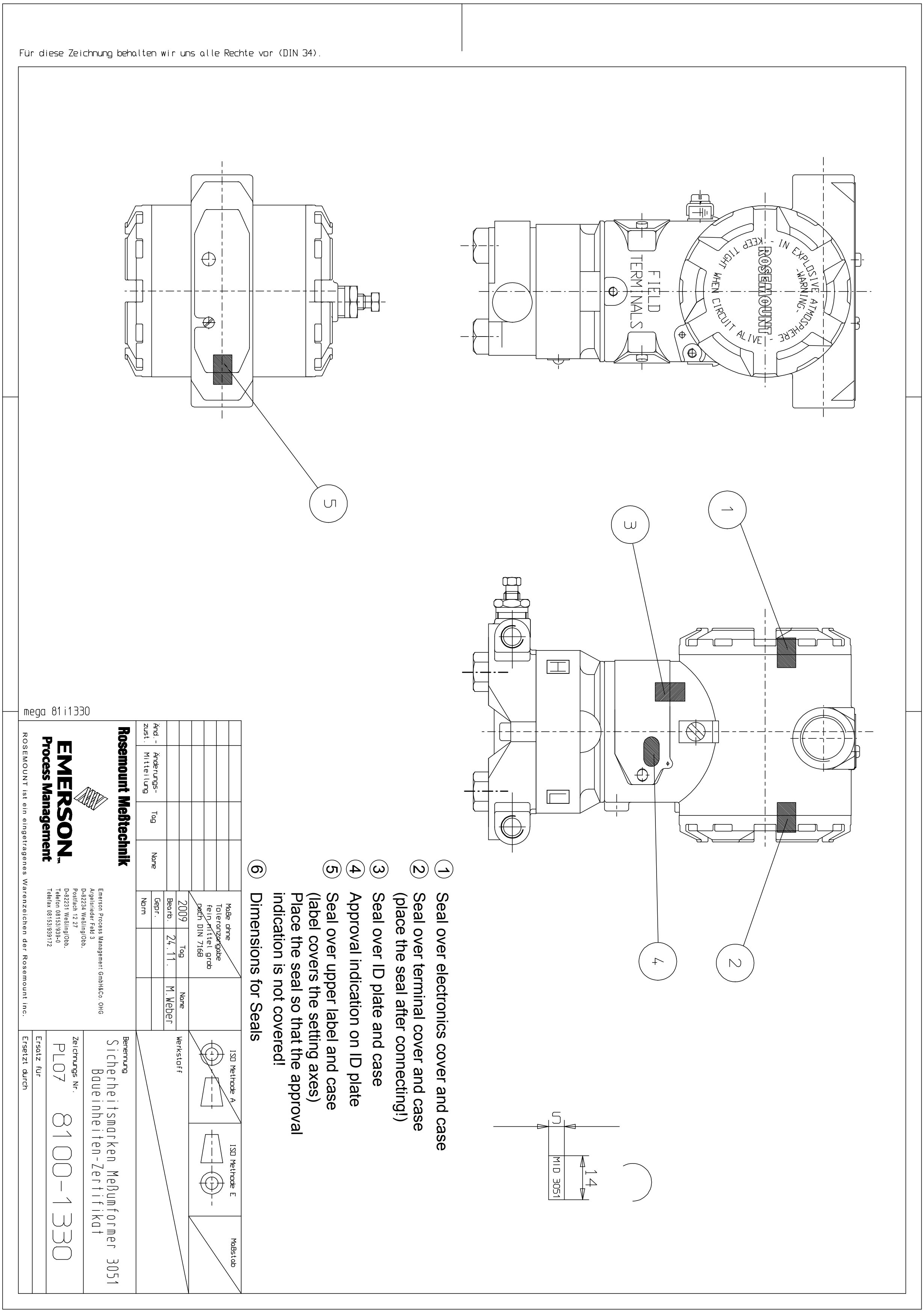



FLOW COMPUTER SYSTEM ERZ 2104
RMG Messtechnik
Netz
Messung
Warnung
Alarm
Betrieb
Eingabe
COM-F
Drahtplombe
lead seal
Sicherungsmarke
seal
äöü 1
ABC 2
DEF 3
GHI 4
JKL 5
MNO 6
PQRS 7
TUV 8
WXYZ 9
#/* 0
±,
*
Mess. P.T...
Analyse
Blende
E/A
Archiv
Test
Zähl-werke
Durch-fluss
Zähler
Modus
Typ-schild
Auswahl
Alarm Löschen
Enter
pTZ-Volume Conversion
Device Type ERZ 2104
year
ser.-no.
MXX 0102
DE-11-MI002-PTB003
EN 12405-1
Additional Function
Energy Conversion Device
acc. EN12405-2
Belastungsregistriergerät
RMG Messtechnik GmbH
Butzbach / Germany
7.732
05.30
35
45
190
283
Sicherungsmarke
seal
RMG Messtechnik GmbH
Butzbach / Germany - www.rmg.com
Phone +49 (0)6033 897 - 0
title:
Frontplatte mit Hauptschild (MID), Plombenplan
Brennwert-Mengenumwerter ERZ2104 mit Höchstbelastungs-Anzeigegerät ET2000
Front view with nameplate (MID) and seal placement
Energy corrector ERZ2104 with integrated data logger ET2000
drw-no.: 063191.4
drawn: Ramshaw
checked:
date: 12.04.2011
rev.:
name:


Sicherungsmarke
seal
X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
F1
X16
L
+
N/-
PE
24VDC Si=2At
90-230VAC Si=1A
COM1
COM2
COM3
COM4
COM5
X11
X12
X13
X14
X15
X18
X19
Can
Ethernet
212,0
110,0
RMG Messtechnik GmbH
Butzbach / Germany - www.rmg.com
Phone +49 (0)6033 897 - 0
title:
Rückseite, Plombenplan
Zustands-Mengenumwerter ERZ2004 mit Höchstbelastungs-Anzeigegerät ET2000
Brennwert-Mengenumwerter ERZ2104 mit Höchstbelastungs-Anzeigegerät Et2000
Rear view, seal placement
Volume corrector ERZ2004 with integrated data logger ET2000
Energy corrector ERZ2104 with integrated data logger ET2000
drw-no: 063192.4
drawn: Ramshaw
checked:
date: 05.04.2011
rev.:
name:



Legende:
A = Sicherungsmarke Deckel,
B = Sicherungsmarke Boden,
Deckel als Boden um 180° ge-
dreht montiert.
Legend:
A = seal cover
B = seal bottom
cover is used as bottom,
180° turned
Ansicht, vereinfacht,
von rechts.
simplyfied view
from the right
B
A
Sicherungsmarke
seal
283
190
RMG Messtechnik GmbH
Butzbach / Germany - www.rmg.com
Phone +49 (0)6033 897 - 0
title:
Deckel / Boden, Plombenplan
Zustands-Mengenumwerter ERZ2004 mit Höchstbelastungs-Anzeigegerät ET2000
Brennwert-Mengenumwerter ERZ2104 mit Höchstbelastungs-Anzeigegerät ET2000
Cover / Bottom, seal placement
Volume corrector ERZ2004 with integrated data logger ET2000
Energy corrector ERZ2104 with integrated data logger ET2000
drw-no.: 063193.4
drawn: Ramshaw
checked:
date: 05.04.2011
rev.:
name:


Für diese Zeichnung behalten wir uns alle Rechte vor (DIN 34).
FIELD TERMINALS
ROSEMOUNT
-WARNING- IN EXPLOSIVE ATMOSPHERE KEEP TIGHT WHEN CIRCUIT ALIVE
H
L
1
2
3
4
5
MID 3051
14
5
① Seal over electronics cover and case
② Seal over terminal cover and case (place the seal after connecting!)
③ Seal over ID plate and case
④ Approval indication on ID plate
⑤ Seal over upper label and case (label covers the setting axes) Place the seal so that the approval indication is not covered!
⑥ Dimensions for Seals
mega 81i1330
Rosemount Meßtechnik
EMERSON. Process Management
Emerson Process Management GmbH&Co. OHG
ROSEMOUNT ist ein eingetragenes Warenzeichen der Rosemount inc.
Änd.-zust.
Änderungs-Mitteilung
Tag
Name
Maße ohne Toleranzangabe fein mittel grob nach DIN 7168
2009
Tag
Name
Bearb.
24.11.
M.Weber
Gepr.
Norm
ISO Methode A
ISO Methode E
Werkstoff
Maßstab
Benennung
Sicherheitsmarken Meßumformer 3051
Baueinheiten-Zertifikat
Zeichnungs Nr.
PL07 8100-1330
Ersatz für
Ersetzt durch