elster
Instromet

EnCal 3000 / EnCal 3000 Quad Controller

Technical Documentation

Function, Operation, Commissioning and Maintenance

FCEncal-BA-EN a 18.09.2013

2008 / Sep.2013

Kontaktinformationen / Contact Information

Hersteller / Manufacturer:

Elster GmbH
Steinern Straße 19-21
55252 Mainz-Kastel
Deutschland / Germany
Tel. ++49 (0) 61 34 / 605-0
www.elster.com

Kundenbetreuung / Aftersales/ Service Germany & International:

Elster GmbH
Schlossstrasse 95a
44357 Dortmund
Deutschland / Germany
Tel. ++49 (0) 231 93 71 10-88
e-mail: system.Support-DO@elster.com

Internationaler Service / Aftersales /Service International:

Elster-Instromet N.V.
Rijkmakerlaan 9
2910 Essen
Belgien / Belgium
Tel. ++32 (0) 3 6 700 700
e-mail: aftersales@elster-instromet.com?

Vorort Vertretung / Or your local agent: www.elster-instromet.com

Elster GmbH
Schloßstraße 95a
D - 44357 Dortmund / Germany
Tel.:   +49 (0) 2 31 - 93 71 10 0
Fax: +49 (0) 2 31 - 93 71 10 99
E-mail: systems@elster-instromet.com

Contents

General Notes on the Structure of this Manual

This documentation describes the function, operation, commissioning and maintenance of the EnCal 3000 Controller. This controller is part of the EnCal 3000 Gas Quality Measurement System, which also consists of the EnCal 3000 Gas Chromatograph (GC). When mentioned within this documentation, "EnCal 3000" or "controller" always refers to the EnCal 3000 Controller.

ς **Tip:** Chapter 4 provides brief instructions on how to accomplish regular tasks during routine tests in the station. It is intended for the impatient reader who does not want to read the entire manual first just to accept an error. It is, however, necessary to read the entire manual to comprehend the device's mode of operation.

Three manuals describe the EnCal 3000 gas quality measuring system:
The manual on hand deals with the controller. The other two manuals deal with the hardware and the PC parameterization software of the gas chromatograph.

The entire Technical Documentation must always be at hand in the station.

Safety and Warning Notes

⚠ **Attention! The following safety and warning notes must be observed at any rate:**

- **The EnCal 3000 Controller must neither be stored at temperatures below -20°C nor above +50°C.**
- **A temperature between 0°C und +40°C must be guaranteed during operation.**
- **The EnCal 3000 Controller must be installed outside hazardous area 2 as it is not an explosion-proof device. The EnCal 3000 Gas Chromatograph, however, is explosion-proof.**
- **The EnCal 3000 Controller can be equipped with hardware modules that are approved as *associated electrical apparatus* of category *ib* according to DIN EN 50020 with intrinsically safe circuits (EXMFE5 / EXDE6 input boards). It is therefore suitable for being connected to sensors, signal transmitters and pulsers located in hazardous areas (e.g. zone 1). It is <u>not</u> permitted to connect intrinsically safe and non-intrinsically safe circuits to these modules together.**
- **The power supply of the EnCal 3000 Controller is 24 V DC and must be secured externally by 1 A.**
- **Connect the earthing to PE of the power supply socket for equipotential bonding.**
- **Observe the regulations of the relevant standards, in particular the regulations of DIN EN 50014, DIN EN 50020 and DIN EN 50029.**
- **Observe the limit values stated in the respective certificates of conformity of the boards to be connected. (Please refer to the annex for the certificates of conformity.)**
- **Warning: This is a Class A device that may cause interferences in living areas; you may be asked for appropriate measures at your expense if the device is installed in such areas.**

1 Introduction

1.1 The EnCal 3000 Gas Quality Measuring System

The basic configuration of the EnCal 3000 gas quality measuring system consists of the EnCal 3000 Gas Chromatograph and the EnCal 3000 Controller (see Figure 1 below).

When running EnCal 3000 Quad is the meter is in two cases and can contain up to four analytical channels. (see Figure 2 below).

The gas chromatograph's measuring technology performs the analysis independently.

You can install further controllers as an option. The subsystems communicate via Modbus with each other, with one controller being the active unit (Modbus master) that controls the gas chromatograph (Modbus slave). The two optional controllers act as passive units (Modbus listeners), i.e. they also read the communication at the Modbus and extract the data relevant to them, but they do not send and process any commands.

The controllers serve as displays and data logging devices within the EnCal 3000 measuring system. As active unit the controller also serves as control element for the gas chromatograph. It is therefore used to perform manual calibrations or test gas runs.

As an option the EnCal 3000 Controller provides a hydrocarbon dew point calculation derived from the ISO 23874 standard and based on a C9+ analysis of the EnCal 3000 Gas Chromatograph.

The gas quality measurement system EnCal 3000 is described in 3 manuals

This manual deals with the controller.

Two other manuals are devoted to the hardware and the PC configuration software of the measuring element.

Gas Chromatograph

Controller active unit
e.g. stream 1, 2

PC for parameterization

parameterization:
gas chromatograph:
RGC 3000
controller:
Gasworks

V.24 serial

Modbus ASCII/RTU (RS232/485)

Modbus TCP (ethernet 10Base-T)

Controller (optional) passive unit
e.g. stream 3, 4

V.24 serial

Controller (optional) passive unit
e.g. stream 5

V.24 serial

ethernet 10Base-T

Figure 1

Measuring unit, Modbus-Slave

(optional) EnCal 3000 Controler

Parameterization-PC

RGC 3000

Modbus seriell

Modbus-Master

V.24 seriell

(optional)

Modbus-Listener

V.24 seriell

(optional)

Modbus-Listener

V.24 seriell

Ethernet 10Base-T
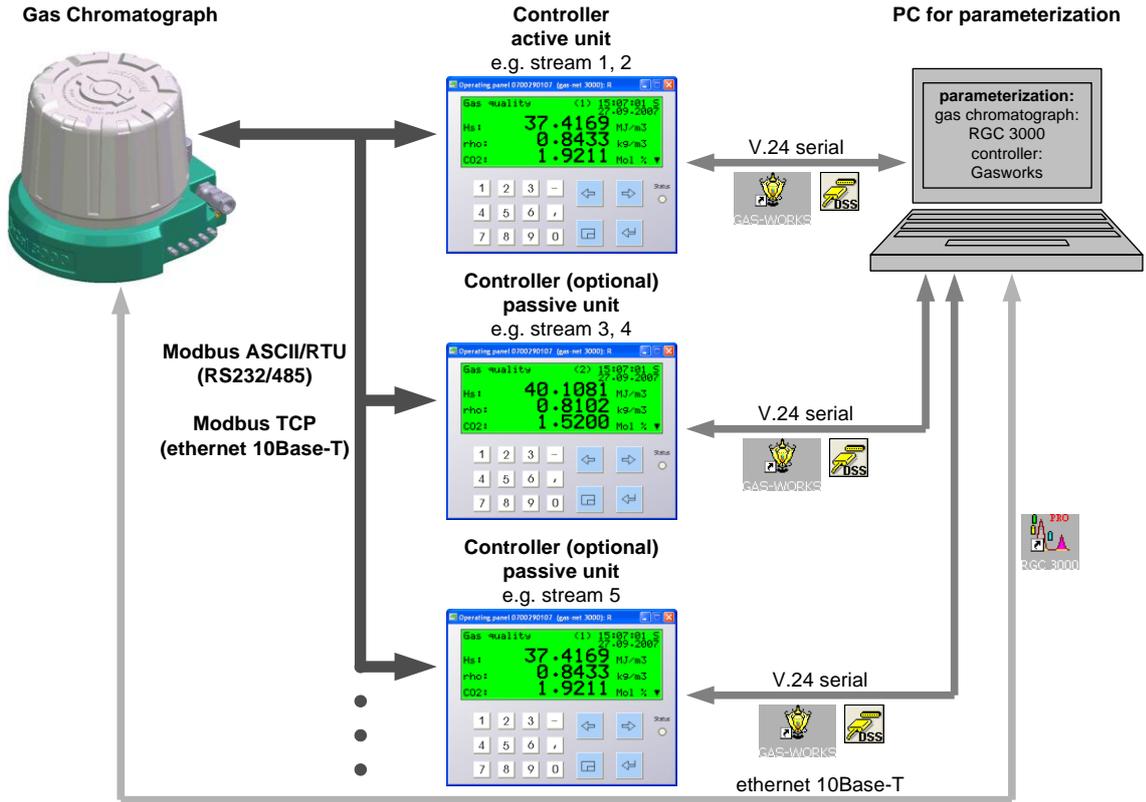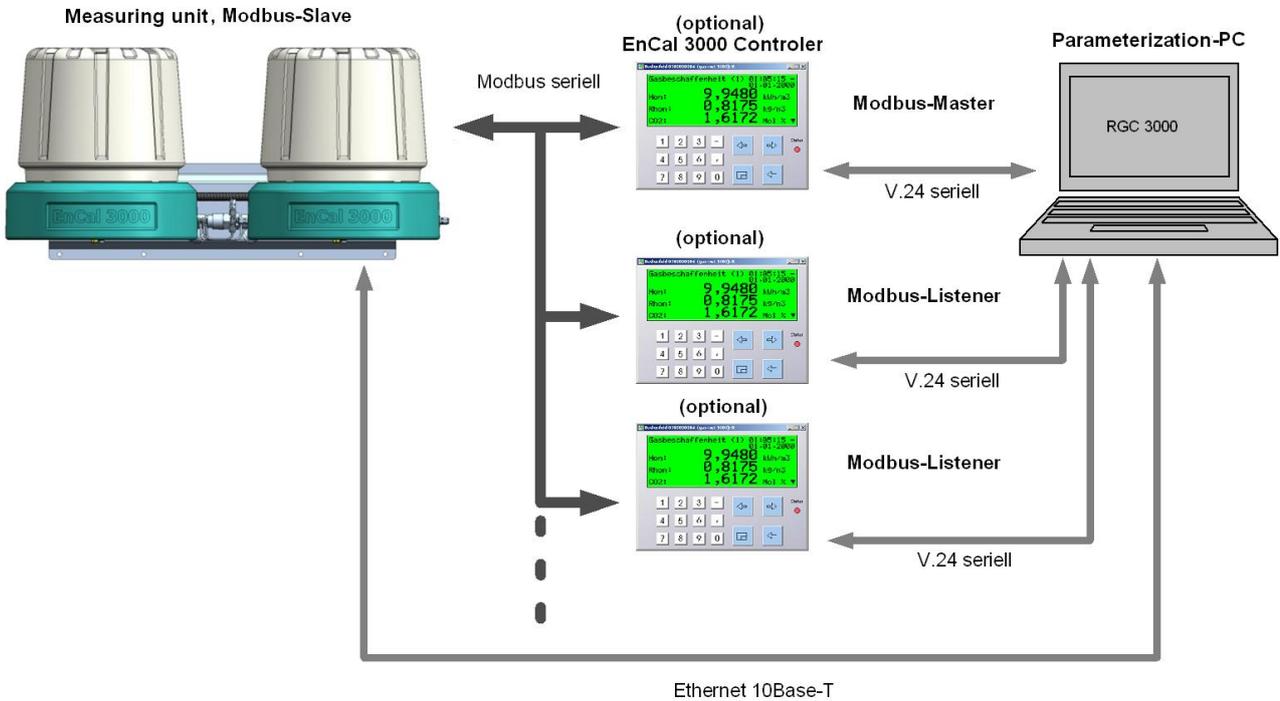
Figure 2

1.2   The EnCal 3000 Controller

The EnCal 3000 Controller is part of the gas quality measuring system. Each controller can process one or two gas streams, while it is also possible to assign one gas stream to several controllers. This makes it possible, for instance, to distribute the data of one gas stream to several DSfG buses.

The EnCal 3000 Controller indicates the calibratable measurements superior heating value Hs, standard density rho and the mole fraction of the gas components in the basic display of the operator panel. The font size of these measurements is twice as large due to their significance. The EnCal 3000 Controller automatically invokes this basic display again 30 minutes after the last device operation.

The basic display shows the measurements of the first assigned gas stream in dual-stream operation. You can switch to the corresponding display of the second assigned stream with a menu command.

The EnCal 3000 Controller is also equipped with a data logging function that logs important measurement variables. A *Long-term* archive is available as a certifiable archive type, which logs the calibratable measurement variables cyclically every 15 minutes. There is one separate certifiable *Long-term* archive available for each gas stream.

The data logging function logs the measurements provided by the gas chromatograph. It is also able to log further measurement variables provided by operational supplementary functions. The measurement variables to be logged are provided with a time mark of the data logging time and a classification criterion, the ordinal number. They are saved in a storage area that is organized as ring storage. If the ring storage is full, each new data record overwrites the oldest one.

If the controller is the one taking on the active function within the Modbus communication with the gas chromatograph, it can also be used to perform manual calibrations or test gas runs.

In addition to the displaying and data logging function the EnCal 3000 Controller offers a variety of operational supplementary functions; for instance, for monitoring tasks and data communications. The certifiable functions are isolated from each other and from the operational functions.

The controller monitors itself and all incoming measurements. If it detects an internal error or an error in the communication with the gas chromatograph and if this error affects the accuracy of the measurement variables, this error will be indicated by a red flashing status LED and additional clear text. During such an error the last two measurements measured before the error will be maintained. After the error has been eliminated, the EnCal 3000 Controller switches automatically back to the current online values.

The EnCal 3000 Controller is equipped with up to two digital data interfaces of the DSfG type (DSfG stands for Digital Interface for Gas Metering Device), which is used by all devices in the Elster gas-net device family as described below. The controller uses the interface labeled *DSfG* to provide other measuring instruments connected to the DSfG multidrop connection and typically calibrated (e.g. flow computers) with the calibrated target variables Hs, rho and the entire analysis.

For this, the EnCal 3000 Controller operates exactly according to the method specified by the DSfG regulations. If new measurements are available, the EnCal 3000 Controller sends a *New measurements* attention telegram. Data sinks being interested in the values due to this signal have to get hold of these values by themselves by means of query telegrams. In the EnCal 3000 Controller the transferred calibrated data is provided with an additional signature, which is checked for integrity in the receiver. This procedure ensures the accuracy of the transferred data.

1.3   The *gas-net* System Idea

gas-net   is the generic term for an Elster device family. All *gas-net* devices, including future device types, are characterized by uniformity in appearance, operation and parameterization.

Each *gas-net* device always covers a multitude of measurement and control functionalities.

EnCal 3000 Controllers also provide this functional variety. To keep the operation and parameterization of the devices well-structured and user-friendly, the *gas-net* series is based on a modular concept. A module corresponds to a special functionality. Each module has its own main display within the device's menu assistance, and each module has its own group of settings within the parameter data record.

A particular module can be employed in different device types. This yields a modular system that is advantageous to the user as a particular module can always be operated and parameterized in the same way, no matter in which device type it has been installed.

2 Device View and Design

The housing of the EnCal 3000 Controller is designed as plug-in unit for a 19" frame and is usually available in two housing sizes, i.e. with a mounting width of 1/3 for up to four process boards or a mounting width of 1/2 for up to seven process boards.

The version number and check sum for identifying the software update are directly invokable via the main display of the *System* module.

The device front includes one 8x32 character-LCD, one keypad with 16 keys, one status LED and the calibration switch.

The DSS data interface is also located on the device front. It serves the connection of a PC for servicing purposes.

The following illustration shows, as an example, the front view of the EnCal 3000 Controller in the narrow design with a mounting width of 1/3:
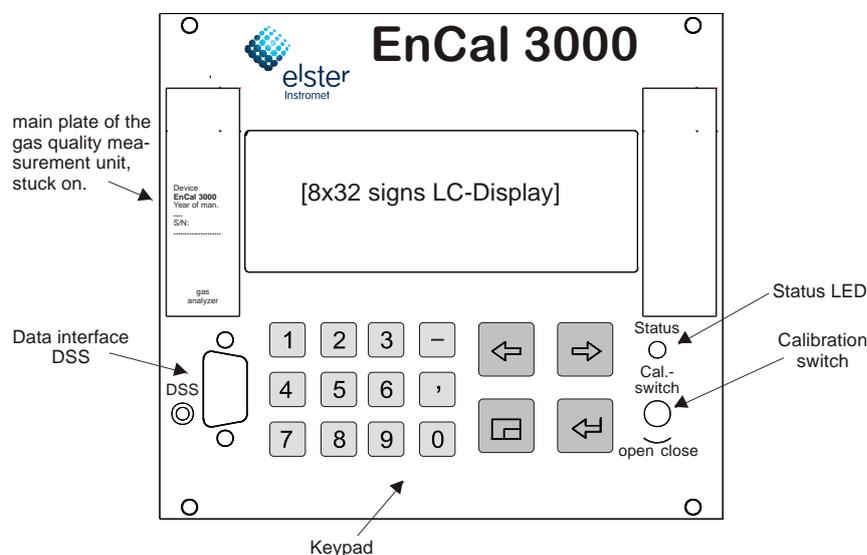
In addition to the 24 VDC mains connection up to two of the following interfaces are located on the back of the device:

- DSfG interface
- COM2 interface: Intended for connecting the modem for the integrated RDT. Alternatively suitable for connecting proprietary protocols (Modbus RTU, Modbus ASCII, RK512 or 3964R)
- TCP/IP for integration in a standard network installation (for data exchange via Modbus TCP or time synchronization via NTP)

All process connections are implemented via process boards installed in the housing. The exact composition of the I/O boards depends on the tasks of each individual device (single- or multi-stream gas quality measurement, number of required output signals, etc.).

Gas quality measurement is the main functionality of the EnCal 3000 Controller. For connecting the EnCal 3000 Gas Chromatograph via Modbus TCP the device has to be equipped with a TCP/IP module.

The following process board is only necessary for connecting the EnCal 3000 Gas Chromatograph via Modbus serial (RTU or ASCII):

- A multi-functional serial MSER2 interface board. Even if more than one stream is measured, the device is only connected via one protocol channel of the board.

The overview below shows the typical board assignments for different operating modes.

Operating modes (OM):

1   Modbus TCP, connection of gas chromatograph (GC) via TCP/IP interface for single- or dual-stream operation

2   Modbus RTU/ASCII, connection of gas chromatograph (GC) via serial interface for single- or dual-stream operation

Unassigned board locations (BL) may contain any *gas-net* process boards for operational purposes. A description of the currently available boards is provided in Chapter 7.2.2 or in Chapter 10 Technical Data.

Board locations 5 to 7 are only available in case of a 1/2 mounting width.

BL OM	1	2	3	4	5	6-7	
1							TCP/IP interface module required
2	MSER2 (RS232/485)						

The illustration below shows a typical rear view of a device in the narrow design for operating mode 2 as described in the table above.

Process card (board) MSER2 in slot 1 as standard.
Further board configuration and overview of connections to be secured officially,
refer to document no. 07 00 29 040.
Document no. 07 00 29 090 shows how the connections have to be secured officially.

Card slots not used, are covered by dummy plates.
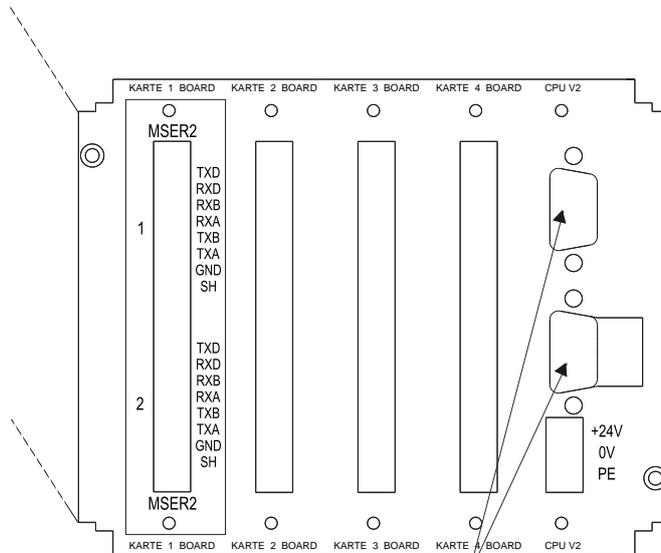
Optional digital interfaces,
top: with the choice of DSfG or COM2
bottom: with the choice of TCP, DSfG or COM2
with caption (label) each.

EnCal 3000 Controller rear view (example)

3 Operating the Device

This chapter's objective is to give you an understanding of the basic operating and menu structures of *gas-net* devices. As already mentioned, all devices of the *gas-net* family have a uniform appearance and a comparable menu structure. This means: If you have operated a *gas-net* device once, you will also be able to ea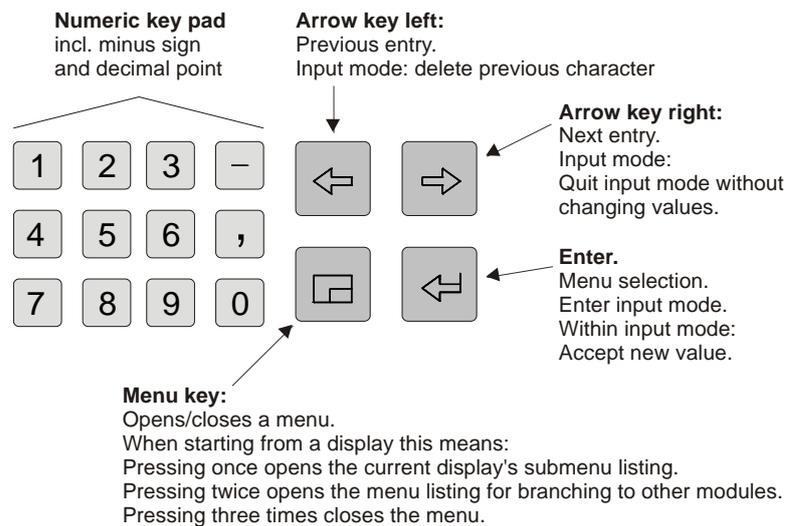sily operate all other device types. According to our philosophy of how to parameterize *gas-net* devices, they are parameterized by means of a PC and not via the operator panel. The device operation via the operator panel mainly serves the indication of the most important information on the display. The content of the operator interface on the display depends on the individual *gas-net* device type.

3.1.1 Keypad

The keypad of *gas-net* devices consists of a numeric keypad for entering numbers, the minus sign and decimal point keys, and a group of four navigation keys. With these keys, you can move within the menu structure and invoke menus and displays. In some cases you can also trigger actions or change values via the navigation keys.

The illustration below shows an overview of the keys' meanings. The exact context-related meaning of each navigation key will be explained together with the menu structure in Chapter 3.1.4.

Numeric key pad
incl. minus sign
and decimal point

Arrow key left:
Previous entry.
Input mode: delete previous character

Arrow key right:
Next entry.
Input mode:
Quit input mode without
changing values.

Enter.
Menu selection.
Enter input mode.
Within input mode:
Accept new value.

Menu key:
Opens/closes a menu.
When starting from a display this means:
Pressing once opens the current display's submenu listing.
Pressing twice opens the menu listing for branching to other modules.
Pressing three times closes the menu.

3.1.2 Other Operating Elements: Status LED, Calibration Switch

The status LED on the device front is a three-color light emitting diode. The status of this LED indicates whether a gas quality measurement error is pending or has been pending.

Please refer to the table below for the meaning of the colors:

LED status	Meaning
red, flashing	An alarm is pending, i.e. an error has occurred that affects the correction.
yellow, flashing	A warning is pending, i.e. an event has occurred without affecting the correction.
green, flashing	A green flashing light appears during the start-up phase after a mains failure.
red, permanently illuminated	An alarm has been pending but is no longer relevant. It can be removed from the error listing by accepting it.
yellow, permanently illuminated	A warning has been pending but is no longer relevant. It can be removed from the error listing by accepting it.
green, permanently illuminated	The device runs error-free.

The sequence of the LED status lights in the above table corresponds to the sequence the error management keeps to: The system always indicates the error with the highest priority. A pending error always takes precedence over an error that is no longer relevant.

The exact meaning of the terms *alarm*, *warning* and *hint* is explained in Chapter 5.3.1.

The calibration switch is on the lower right side of the front panel.

The EnCal 3000 Controller is furnished with a two-level safety concept: All parameters being protected by the calibration switch can only be changed if the calibration switch is open. Such parameters are always modified with a PC and the GW-GNET+ parameterization software.

Open the calibration switch by turning it anticlockwise as far as it will go. This first safety level is important for devices used for legal metrology and custody transfer. In this case, seals may officially secure the calibration switch and must possibly be removed before.

The basic device display will automatically be invoked when you close the calibration switch.

Note: The *User lock* as the safety concept's second level consists of one numerical lock for each of the two contract parties. The user lock is, in contrast to the calibration switch, implemented via the device software. This means that the locks are defined via the device parameterization and opened or closed via the operator panel. Open locks allow the user to access certain parameters or actions. All parameters being subject to the user locks can be changed when both locks are or the calibration switch is open.

3.1.3   Display

The display is an illuminated LCD consisting of 8 lines with 32 characters each. After approximately 30 minutes without a keystroke, the display's background illumination switches off automatically.

3.1.4   Displays / Menus / Dialogs

This chapter describes the menu assistance and operation of all *gas-net* devices in general. Individual subjects have been illustrated with examples, where appropriate. These examples refer to currently available device types; it can therefore happen that a special menu illustrated in an example does not exist in your *gas-net* device type. The operating mechanisms generally described here function in all devices in the same way.

Each module has a main display that indicates all important current values.

> For example: The EnCal 3000 Controller contains, among others, the modules *Gas Quality* and *Monitoring.* The main display of the *Gas Quality* module shows the current analysis data, whereas the main display of the *Monitoring* module indicates the error listing.

The main display of the first module is also the basic display of the device, i.e. the display that is invoked automatically if there has not been any keystroke for about 30 minutes.

> For example: The EnCal 3000 Controller is capable of dual-stream operation, so it contains one *Gas Quality* module per gas stream. The basic display of the device is the main display of the *Gas Quality* module of stream 1.

A display serves to indicate values. If there are more entries than can be made visible at once, little scroll arrows on the right side indicate whether or not you can scroll upwards or downwards. The scrolling is either implemented line by line or, if the display contains many entries, also page by page or by coherent blocks.

"Down" scroll arrow pointing downwards: Scroll downwards with the rightward arrow key.

"Up" scroll arrow pointing upwards: Scroll upwards with the leftward arrow key.

Each invokable display belongs to a module within the device software and thus to an enclosed functionality. In the display of a module, no matter which one, there are principally two different navigation targets within the menu of the device. One target can be a subordinate display/dialog[1] of the indicated module, another one the basic display of any module.

To be able to navigate within the menu structure as easily and quickly as possible, the Menu key has been provided with the following functions:

Pressing the Menu key once opens the submenu listing offered by the currently opened module display. Pressing the Menu key again opens the menu listing containing all branching possibilities to other modules. Pressing the Menu key again closes the menu.

The structure of a module's submenu listing depends on the current parameterization: Menu items referring to functionalities that have not been parameterized will not be offered for selection.

For example: If the EnCal 3000 Gas Chromatograph is connected to only one stream, the gas quality module will not include the *Other stream* menu item.

Submenus of a module either invoke further displays or dialogs in which the user can adjust values via the operator panel.

The menu structure is tree-like: A subordinate menu item of a module can also have its own subordinate menu items.

At lower hierarchy levels of the menu tree the following menu items exist for returning to the next higher level, depending on the context:

- In a display: menu item *Back*
- In a dialog: menu items *OK / Cancel* (*OK* also means accepting the modified values; *Cancel* means rejecting the modifications)

No matter on which menu level you currently are: You can move back and forth within a menu listing and select a menu item by using the arrow keys. The selected target is presented in an inverted way, i.e. green writing highlighted in black. Activate the menu item belonging to the selected entry by pressing the Enter key.

An example for the EnCal 3000 Controller:
Let's assume you want to check the user locks. There is an own display in the *System* module for this; we therefore have to invoke the *System* module and branch to the module-specific submenus from there.
Let's also assume the basic display of the *Gas Quality* module is currently invoked. If you press the Menu key, you will see the submenus offered by the *Gas Quality* module.

---

[1] A dialog is a special kind of display indicating values you can edit via the operator panel.

Gas quality   (1) 15:31:31 S
                   10.09.2007
Hs: 37.4200 MJ/m3
rho: 0.8435 kg/m3
CO2:   1.9216 Mol % ▼

Start:
Basic display of Gas Quality

↓ ▣

Gas quality   (1) 15:32:01 S
                   10.09.2007
Hs: 37.4200
       0.8 - Other stream
rho: - Measurements
       1.9 - Calibration
CO2:   - Test gas

Invoke the menu:
Menu listing of the *Gas Quality* module
The dashes in front of the menu names indicate that the listing refers to subordinate menus.

As we do not want to activate a gas quality menu in our example but branch to a different module, please press the Menu key again.

↓ ▣

Gas quality   (1) 15:32:13 S
                   10.09.2007
       37.4
Hs: Gas quality
       0.8 Data logging
rho: Monitoring
       1.9 Integrated RDT
CO2:   System

Module listing
(without listing dashes in front of the menu name)

Now the menu shows the listing of all modules included in the device software. Press the rightward arrow key a couple of times until the module you want to invoke is selected. It's the *System* module in our example.

↓ 4x ⇨

Gas quality   (1) 15:32:28 S
                   10.09.2007
       37.4
Hs: Gas quality
       0.8 Data logging
rho: Monitoring
       1.9 Integrated RDT
CO2:   System

Module listing:
The *System* module has been selected.

Press the Enter key and the display of the module you have just selected will be invoked.

↓ ⇦

System   15:32:52 S
                   10.09.2007

Device ID: gas-net 3000
Software version: 1.03e
Serial no.:   0700290107
Checksum: DC77FE8E
Operation hours: 777   ▼

Basic display of the *System* module

Now you can probably guess how to proceed: Please press the Menu key to open the subordinate menu listing.


```
System                    15:33:17 S
                          10.09.2007

Device ID: -Device configuration
Software v -DSfG
Serial no. -Locks
Checksum:  -Synchronize clock
Operation  -Display test
```

The menu listing of the *System* module has been invoked. The dashes in front of the menu names indicate that the listing refers to <u>subordinate</u> menus.

Our destination, the *Locks* menu, is the third entry in the menu listing. Therefore, press the rightward arrow key twice to select the *Locks* line.

2x ⇨

```
System                    15:33:27 S
                          10.09.2007

Device ID: -Device configuration
Software v -DSfG
Serial no. -Locks
Checksum:  -Synchronize clock
Operation  -Display test
```

The *Locks* menu has been selected.

Press the Enter key afterwards to confirm your selection and invoke the related display.


```
Locks                     15:33:37 S
                          10.09.2007


    No locks defined
```

Further tips on navigating within the displays:

∗ If you have pressed the rightward arrow key too often and went too far down in the menu selection list, move upwards again by pressing the leftward arrow key.

∗ If you want to quit an invoked menu selection window <u>without</u> having made a selection, just press the Menu key again as often as necessary to close the menu window (twice in case of a menu listing within a certain module; once in case of the module listing).

The selection of some menu items invokes a dialog. These dialogs are displays in which values can be modified. However, only a few values can be modified via the operator panel.

In such input dialogs you move from one parameter to another by using the arrow keys. If a parameter must not be changed, it is crossed out on the display; for instance, because it is a parameter being subject to the calibration lock, which is closed at that moment.

If you have selected an editable parameter, you can get into the edit mode by pressing the Enter key.

To render the operation more convenient, there are different methods of defining a new value available, depending on the type of the value to be changed:

Directly Entering a New Numerical Value

If you want to replace individual characters only, delete the characters step by step from the right using the leftward arrow key. Then enter the new characters via the numerical keys including decimal point and minus sign.

If it is easier to replace the entire value by a new one, just start with your entry right away: As soon as you press any numerical key the preset value will be deleted and overwritten by the new entry.

Quit the edit mode via the Enter key. This initiates a consistency check: If you have entered a value that does not make sense in the present context or is not permissible, you will not be able to quit the edit mode. This way, you will be forced to correct the value you have entered.

Just press the rightward arrow key to quit the edit mode without accepting the change, for instance after a false entry.

Invoke the menu and select either *OK* (the new values will be accepted) or *Cancel* (the values will be rejected) to quit the entire dialog.

New Value by Selecting a Value from a Listing

The device software lists possible values in case of editable values the range of which is restricted to a fixed selection. Choose a suitable value from the listing via the arrow keys and accept it by pressing the Enter key.

For example: Opening the revision switch of an EnCal 3000 Controller. (Note: This is only possible if the locks are open!). You can change the status of the revision switches in the *Switches* menu of the *Monitoring* module. Therefore, go to the corresponding dialog via the *Monitoring - Switches* menu item.

The revision switch is marked as being closed in the above figure (Revision switch = off). Let's assume you would like to activate the revision switch. This switch is already selected when you invoked this display, which means you can immediately press the Enter key to get into the edit mode. A selection list opens, offering useful values (in this case: *off* and *on).*

```
Switches                    15:34:31 S
                            10.09.2007

        Revision switch: Off
             Switch 1: on
             Switch 2:
             Switch 3: off
             Switch 4: off
```

Select the desired value via the arrow keys, i.e. *on*. The display looks like this:

```
Switches                    15:34:38 S
                            10.09.2007

        Revision switch: on
             Switch 1: off
             Switch 2:
             Switch 3: off
             Switch 4: off
```

Press the Enter key to quit the edit mode and invoke the menu:

```
Switches                    15:34:56 S
                            10.09.2007

        Revision switch: on
             Switch 1: Off
             Switch 2: of
             Switch 3: of -Ok
             Switch 4: of -Cancel
```

Confirm the new setting with *OK* or reject it with *Cancel*.

Modifying Several Values at once

Most of the dialogs do not offer individual values but whole groups of values for being modified. In such a case, edit the first selected value first. Switch to the edit mode by pressing the Enter key.

Move to the next value by pressing the Enter key.

∗ **Tip:** If you don't want to modify an offered value, skip it by pressing the rightward arrow key.

Change the value either by directly entering the new value via the numerical keypad or by selecting a new value from a listing.

After having edited all values, press the Menu key. The invoked menu contains the menu items *OK* and *Cancel*. Selecting *OK* means accepting the modified values[2]. Selecting *Cancel* means rejecting the changes. In both cases you will return to the display you had invoked last.

---

[2] In this case, too, a consistency check is performed: If you have entered a value that does not make sense in the present context or is not permissible, you will not be able to quit the edit mode. You will have to correct your entry first.

4 Primer for Impatient Operators: What do I have to do to ...

Note: The EnCal 3000 Controller can be operated with one or two streams, i.e. it can indicate the analysis values of up to two gas streams of an EnCal 3000 Gas Chromatograph (GC). As the GC can be equipped with up to five streams, the streams to be indicated on the display must be selected. Select the streams in the parameterization of the controller (cf. Chapter 0, page 17). The two streams indicated by the controller are called gas stream A and B in the parameterization. You can assign a number from 1 to 5 to each of the two gas streams according to the up to five streams of the GC. The controller's display then indicates the gas streams with either A or B or with the numbers you assigned in the parameterization.

The following examples assume that the controller has been parameterized with two streams, with gas stream A corresponding to GC stream 1 and gas stream B corresponding to GC stream 2.

The basic display of the controller is always the main display of the *Gas Quality* module for gas stream A. The following instructions are based on the assumption that you are in the basic device menu, i.e. in the main display of the *Gas Quality (1)* module.

4.1 ... view the process values of the second stream in case of a dual-stream EnCal 3000 Controller?

The EnCal 3000 Controller is capable of dual-stream operation. The basic display of the device is always the main display of the *Gas Quality* module for stream A. It shows the most important analysis values of this stream. To switch to the display of stream B (e.g. *Gas Quality (2)* module), please proceed as follows:

1) Invoke the submenu listing by pressing the Menu key once. The *Other stream* menu item is pre-selected.

2) Press the Enter key to confirm your selection and invoke the main display of the desired module.
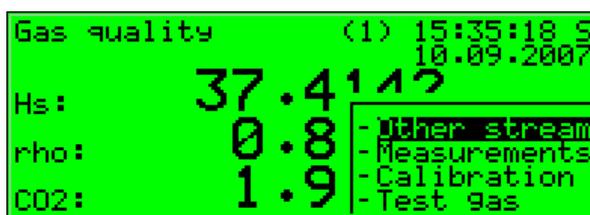
Tip: To switch back to the first stream, repeat the procedure described above and activate the *Other stream* menu item again.

It is possible to discern at a glance to which stream the indicated analysis values belong by looking at the first line of the *Gas Quality* display – the display states either *Gas quality (1)* or *Gas quality (2).*

4.2 ... view the error listing of the *Gas Quality* module?

If the status LED is flashing red or yellow or is permanently illuminated, the error listing contains alarm or warning entries. View the error listing by proceeding as follows:

1) Invoke the module listing by pressing the Menu key twice.

2) Press the rightward arrow key until the *Monitoring* menu item is selected.

3) Press the Enter key. The main display of the *Monitoring* module is invoked. The error with the highest priority level is indicated. Scroll through the error listing by means of the arrow keys.
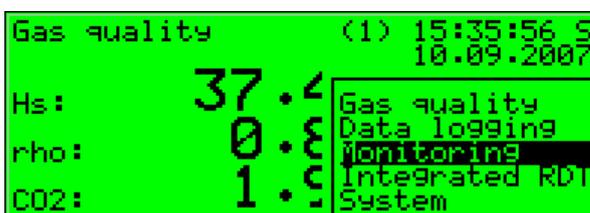
4) Proceed to Chapter 5.3.2, page 50, should you need more detailed information. If you want to accept an error, proceed to read the very next chapter.

Note: If the EnCal 3000 Controller is operated with two streams, each gas stream has its own error listing. There is, however, only *one* status LED at the device. Consequently, it is not possible to distinguish by the LED to which stream a message refers. The status LED will also flash red, for instance, when an alarm is pending for stream B, while stream A is operating error-free.

To be able to clearly classify an error condition indicated by the status LED, it is necessary to check the error listings.

After the *Monitoring* menu has been invoked, the error listing of stream A is displayed first. This is indicated by the text *Gas Quality A* in the third line.

To view the error listing of stream B, proceed as follows:

1) Press the Menu key to invoke the listing of the subordinate menu items.

2) Press the rightward arrow key until the *Next listing* menu item is selected.

3) Press the Enter key. The error listing of stream B is shown indicated by the phrase *Gas quality B* in the third line.

There may be up to three error listings. In addition to one or two gas quality error listings, an error listing of the *Monitoring* module's message processing is also available. Always switch to the display of the next error listing via the *Next listing* menu item.
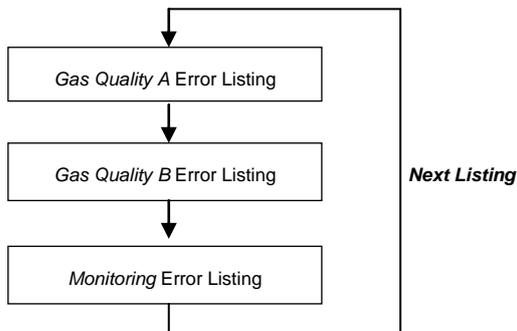

Please refer to Chapter 5.2, page 40 for further information on the error listing of the message processing.

4.3 ... accept gas quality errors?

Errors can only be accepted and thus removed from the gas quality error listings if they are no longer pending.

To accept such an error, proceed as follows:

1) Open the error listing via the Menu key as described above in Chapter 4.2. If the EnCal 3000 Controller is operated with more than one stream, please ensure that the error listing of the desired stream is indicated. The third line of the display indicates the stream to which the currently invoked error listing refers.

2) Select the error you want to accept via the rightward or leftward arrow key.

3) Press the Menu key. If the error indicated on the display cannot be accepted, the first menu item appears as being crossed out: ~~Accept~~. If the error can be accepted, just select **Accept** and press the Enter key. The error
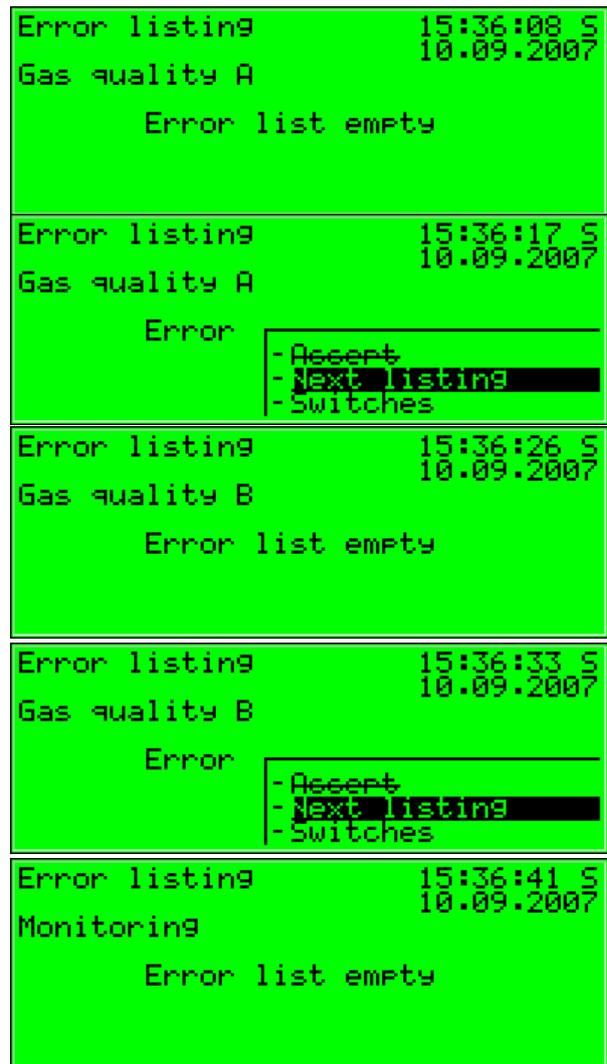
disappears from the error listing, and the error with the next lower priority level will be indicated on the display.[3]

4) Repeat the steps explained above to accept further errors.

Note: Accepting errors as described above only applies to errors in connection with the device's gas quality functions. How to accept messages of the general message processing (*Monitoring* error listing) is explained in Chapter 5.2.

4.4 ...to view the software versions?

1) Invoke the module listing by pressing the Menu key twice.
2) Press the rightward arrow key until the *System* entry is selected.
3) Press the Enter key. The main display of the *System* module is invoked, which shows the data for identifying the device (software version, check sum, etc.).

Note: The software version and check sum shown here refer to the EnCal 3000 Controller. Please refer to the software manual of the EnCal 3000 Gas Chromatograph for the steps required for having the software version of the EnCal 3000 Gas Chromatograph indicated.

4.5 ... to view the device configuration ?

1) Invoke the module listing by pressing the Menu key twice.
2) Press the rightward arrow key until the *System* entry is selected.
3) Press the Enter key. The main display of the *System* module is invoked.
4) Press the Menu key again and select the *Device configuration* submenu. The safeguarded parameters are sorted on the modules they belong to for a better overview. Choose the desired module in the *Device configuration* display: Press the Enter key, select a module via the arrow keys and press the Enter key again. Activate the *View* submenu.

---

[3] The following special feature applies to an EnCal 3000 operated with two streams: An error referring to both streams disappears from both gas quality error listings as soon as it has been accepted in one of the listings. An example of such an error is alarm A409: Power failure.

4.6 checking all parameter settings?

The parameterization of a *gas-net* device contains too many settings for them to be conveniently displayed via the operator panel. It is much easier to get a general idea of the device settings by means of the GW-GNET+ parameterization program and a PC.

1. Connect the COM interface at the PC to the DSS interface at the *gas-net* device using a parameterization cable. In case of PCs without COM interface, you can connect the parameterization cable by means of a USB-to-serial converter cable.
2. Start GAS-WORKS on your PC. Activate the communication program by clicking the **Import – Data interface** tool in the GW-BASE toolbar.
3. After having successfully started the communication program, you are linked with the connected device data technology-wise. The window appearing on your screen shows some important basic device information.
4. Select the **Tools** tab now. Double-click the **Change parameters** or the **Edit parameterization** entry. The GW-GNET+ interface will appear on the screen. This is where you can invoke and check the parameter listings of the individual modules.

Please note: The **Change parameters** or **Edit parameterization** service programs also offer the option of changing device settings. The current status of the protection mechanisms (calibration switch / user lock) is of course taken into consideration. Please refer to the comprehensive online help of GW-GNET+ for further information.

4.7 .. view archives?

1) Change to the display of the *Data Logging* module: Press the Menu key twice, move to the *Data logging* entry using the rightward arrow key and press the Enter key.

2) Select exactly the archive information you want to view in the appearing dialog. Please refer to Chapter 5.2.2 starting on page 41 for a detailed description of the filter function.

5 Functional Description

5.1 *Gas Quality Module(s)*

5.1.1 Function

The EnCal 3000 Controller is a device for indicating and controlling the measurement of the gas quality (GQ) of natural gases by the gas chromatograph (GC) of the same name (EnCal 3000 Gas Chromatograph). The GC uses the different adsorptions rates of the individual components contained in the sample gas, which are separated from each other on their way through the integrated GC column. Each component's concentration is measured at the end of the column by a detector. Each piece of gas quality data (e.g. superior heating value or relative density) can then be calculated based on the mole fraction of each individual component. The gas quality data is determined in the GC according to ISO 6976[4] and transferred to the EnCal 3000 Controller at the end of each analysis together with the values of the component fractions. Another variable is derived from these direct variables in the EnCal 3000 Controller: the methane number (Mn).

A variable that can also be derived is the hydrocarbon dew point. It indicates the temperature at which the first hydrocarbons condensate. The gas will partly become fluid below this temperature. All components are completely gaseous above this temperature. The hydrocarbon dew point is indicated in Kelvin and can be determined for a parameterized pressure or the current online pressure. In case the current online pressure is used, an upper pressure limit can be parameterized. If the current value is above this limit, the dew point is determined for the parameterizable substitute pressure value.

The dew point calculation is an additional option that must be purchased and activated with a license key in the parameterization. The following basic requirements also apply to the use of this option:

- The chromatograph must be able to measure all higher components up to n-nonan (C9). This is why the dew point calculation can only be performed in combination with the C9+ version of the EnCal 3000 Gas Chromatograph.
- The chromatograph must be parameterized accordingly for the application. A corresponding Modbus table[5] and a corresponding application[6] are necessary in particular. Furthermore, the GC should be able to identify the benzol (C6H6, benzene), cyclohexane (C6H12), methylcyclohexane (C7H14) and toluene (C7H8) components separately from the other components so that the dew point calculation is as accurate as possible.

After the EnCal 3000 Controller has been switched on, it establishes the communication to the EnCal 3000 Gas Chromatograph and starts to permanently poll new analysis results. As soon as new analysis results are available they are indicated. Therefore, make sure to switch on the gas chromatograph about 30 s **before** the controller.

You can restart the controller during the operation of the gas chromatograph as the gas chromatograph continues the parameterized measurement series independently. After a restart the controller indicates the last valid analysis results from before the restart until the first valid analysis after the restart has been completed and the results have been transferred. It may happen, however, that an analysis is being completed during the restart period of the controller. In this case the corresponding results are not transferred.

A prerequisite for starting the measuring operation is that the helium carrier gas is applied with sufficient pressure. The gas chromatograph contains an electronic pressure regulator that determines whether the inlet pressure is sufficient.

Another prerequisite for the operation to start is that the two modules of the gas chromatograph must have reached the respective parameterized operating temperature. The warm-up time of a cold device can take up to 30 minutes. The gas chromatograph waits until the operating temperature has been reached before starting to measure. Not until then can the controller indicate valid measurements.

Observe the temperature of the gas chromatograph in the *Instrument status* display of the RGC 3000 (PC) software of the EnCal 3000 Gas Chromatograph (cf. Chapter 3.2 in the EnCal 3000 Gas Chromatograph Software Manual).

---

[4] T1 = 25°C (combustion reference temperature), T2 = 0°C (volume reference temperature)

[5] See Chapter 4.8 in the EnCal 3000 Software Manual

[6] See Chapter 3.7 in the EnCal 3000 Software Manual

Important: Operate the EnCal 3000 Controller after commissioning only while the calibration switch is closed! The calibration switch (rotary switch at the device front) can be sealed for safety reasons. A closed calibration switch ensures that actions to be performed by trained and qualified staff only, such as calibrating actions, cannot be started at the device by anybody else.

5.1.1.1 Gas Streams

The EnCal 3000 Controller can indicate the analysis results of one or two gas streams of the EnCal 3000 Gas Chromatograph. In this case it contains one or two *Gas Quality* modules. The analysis results of either the first or the second gas quality module are updated in the controller, depending on the assignment of the current analysis result of the gas chromatograph to the respective gas stream.

As it is physically the same gas chromatograph only one communication line is necessary even for dual-stream operation.

5.1.1.2 Strategy when Input Measurements Are Disturbed

If the input values are disturbed, the last valid gas quality analysis performed before the occurrence of the error still applies. The device falls back to the *entire* last valid analysis even if only one component is disturbed.

5.1.2 Display and Operation

5.1.2.1 *Gas Quality Main Display*

While in the *Gas Quality* module's main display, you can quickly invoke all important current data of the gas quality measurement. The first line shows (in case of a dual-stream parameterization) to which gas stream the display refers; the second line shows the pending error with the highest priority level in clear text. The right section of the first two lines is reserved for displaying the calendar time with the corresponding time zone.

The last three lines of the basic display show the current values of Hs, rho and CO_2 indicated in a font that is twice as large as usual. If you scroll downwards, the display shows the mole fractions of the gas components and the analysis time of this measurement.

The values shown in the basic display are only current and valid if the system is running error-free. This means that the measurement is not in an alarm condition and a calibration does not take place.

Error with highest priority level — Assigned gas stream — Time and date

Measurements for:
Heating value superior
Standard density
Carbon dioxide
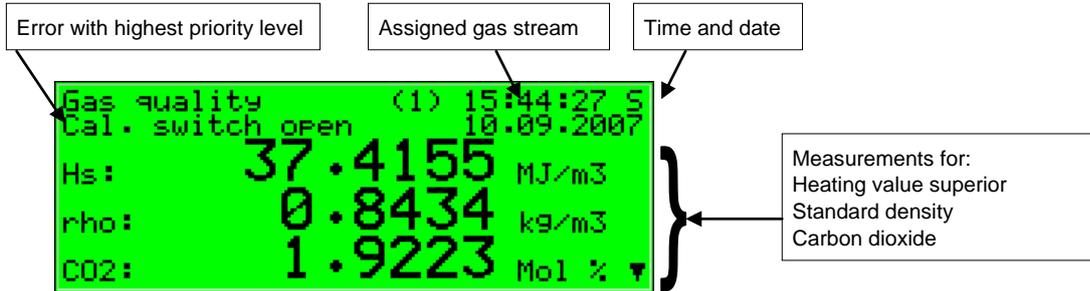
The following figure shows an example for the basic display during an error-free operation:

"Down" scroll arrow pointing downwards: Scroll downwards with the rightward arrow key.

Measurements for:

Nitrogen

Methane

Ethane

Propane

I-butane

N-butane

Neopentane

I-pentane

N-pentane

Hexane and higher hydrocarbons

End of analysis
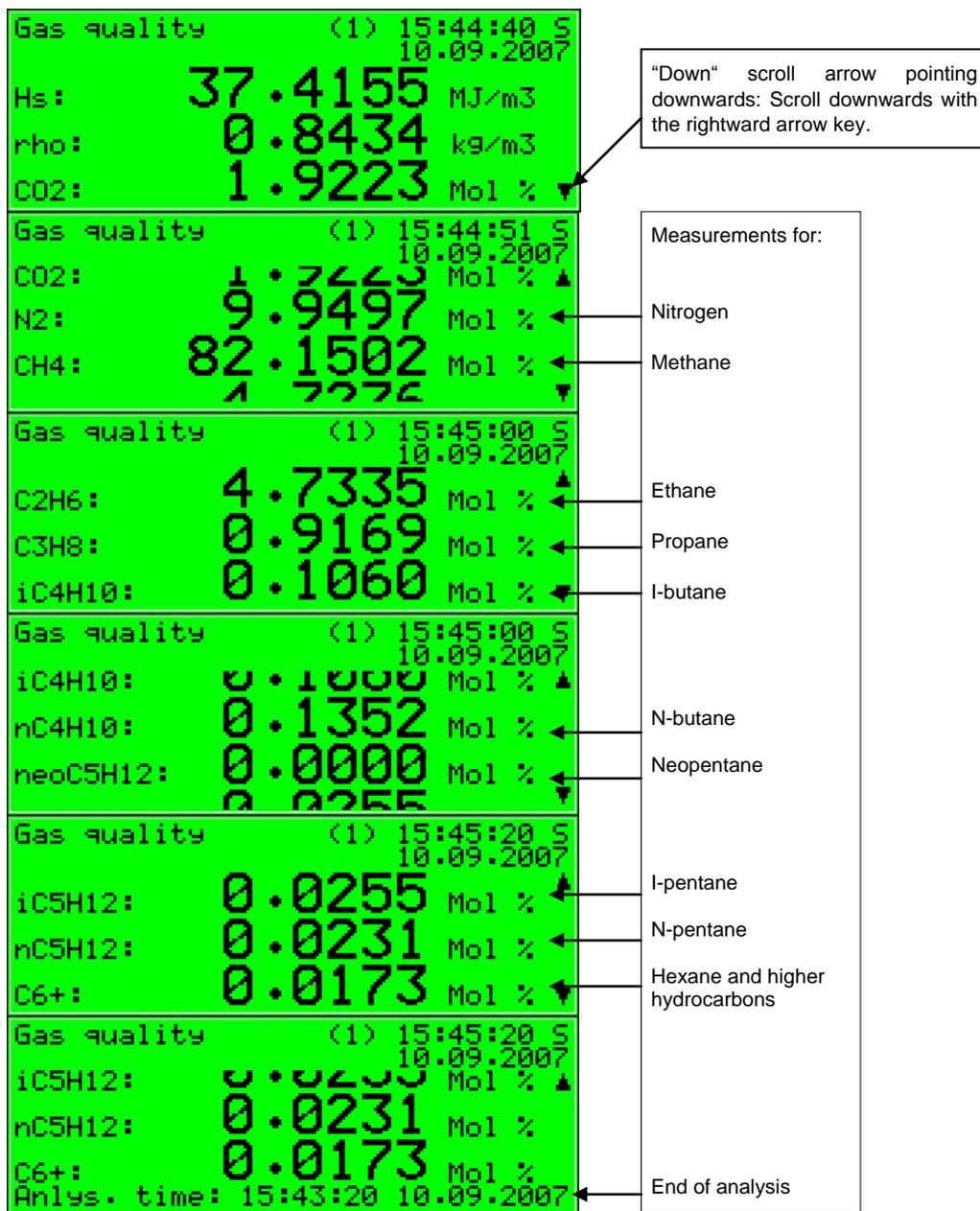
If the controller indicates the measurements of two streams, there is one main display for each gas quality module. In this case you switch to the display of the other module via the subordinate menu item *Other stream* to view the other gas stream.

Switch to the indication of *all* gas quality data (for the current gas stream in case of two streams) via the subordinate menu item *Measurements*.

Other stream menu item for indicating the gas quality of the second gas stream

Measurements menu item for indicating all measurements and derived values of the current gas quality
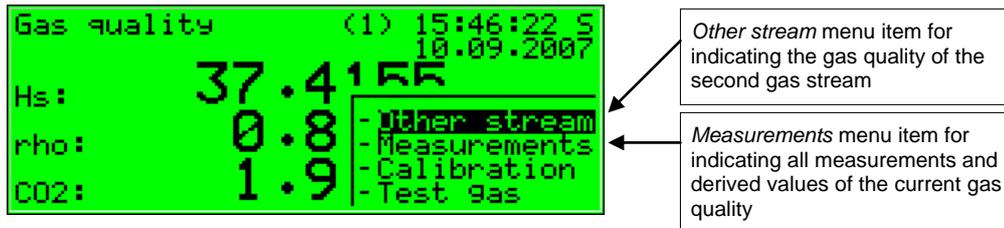
5.1.2.2 *Other Stream*

If you use the controller for the indication of two streams, one main display is available for each gas quality module. Switch to the display of the other module via the subordinate menu item *Other stream* to view the other gas stream.

5.1.2.3 *Measurements* Display

The EnCal 3000 Controller has an own display for indicating *all* gas quality data belonging to the current gas stream. This data comprises direct measurements as supplied by the main display and further derived measurement variables. Invoke this display as follows:

1) Invoke the menu in the basic display.

2) Press the rightward arrow key until the *Measurements* entry is selected. Press the Enter key.

The *Measurements* display contains too many values for them to be displayed all on one display.
Scroll downwards with the rightward arrow key to view all values.

The number of components listed here depends on the version of the connected EnCal 3000 Gas Chromatograph (e.g. C6+ or C9+).

Sum estd.: corresponds to the addition of all detected component concentrations

Inferior heating value (Hi): corresponds to the superior heating value minus the heat of condensation of the water formed during the combustion

Wobbe index (WIs): refers to the superior heating value

Wobbe index (WIi): refers to the inferior heating value

Density ratio or relative density (d)

Compressibility ratio (k)

Methane number (MN)

Hydrocarbon dew point in Kelvin referring to the stated pressure in bar (optional)

The EnCal 3000 Controller always indicates new measurements here after the EnCal 3000 Gas Chromatograph has finished a measurement within its sequence. This measuring sequence is the automatic iterative measurement of the preset gas streams. It continues independently after you have started it once. You can start it either via the PC software (RGC 3000) of the EnCal 3000 Gas Chromatograph or from the EnCal 3000 Controller as follows:

Invoke the menu and confirm the selected *Start sequence* entry by pressing the Enter key.

5.1.3 *Calibration* Display

There are two different calibration types: the basic and the automatic calibration.

Both are technically identical, except for the fact that in case of a basic calibration the currently determined response factors are saved as reference values in the EnCal 3000 Controller and serve as benchmarks for future calibrations.

The currently determined response factors are then compared with the stored reference values during the automatic calibration. The resulting deviations are entered in the controller's *Calibration* archive.

You can start the basic calibration only manually. Usually, you perform it when commissioning the device for the first time, whereas the automatic calibration is performed automatically and daily during operation at a parameterizable time. However, you can also start it manually at the EnCal 3000 Controller or remotely via a remote operating panel or the DSfG bus.

You have to connect the calibration gas[7] properly to the gas chromatograph (*Cal.* channel) to ensure that the calibration is carried out successfully (cf. Chapter 5.1.5, page 36 and Chapter 2.9 or 5.1.5 in the EnCal 3000 Gas Chromatograph Hardware Manual). For this, set the high-pressure regulator to an outlet pressure of 1 to 4 bars and open the corresponding shut-off valve, if available. If the calibration gas cylinder has not been opened yet, open it now and perform a purge first (cf. Chapter 5.1.5, page 36).

5.1.3.1 Automatic Calibration

The **calibration switch** at the EnCal 3000 Controller **does not have to be open** for this calibration type. If **user locks** have been parameterized, however, they must be **open**.

An automatic calibration is carried out in a fixed cycle daily at xx o'clock (parameterizable) in normal measuring conditions. You can also start this calibration type manually.

The following reactions of the controller indicate the calibration status:

- The last valid gas quality data is maintained via measurement outputs and in the basic display of the controller, provided any data is available at all.

- The second line shows *GQM calibrates*.

- A **revision status is not signaled** to the corrector.

To start the calibration manually, proceed as follows:

While in the gas quality main menu, press the Menu key and activate the *Calibration* command in the invoked menu.
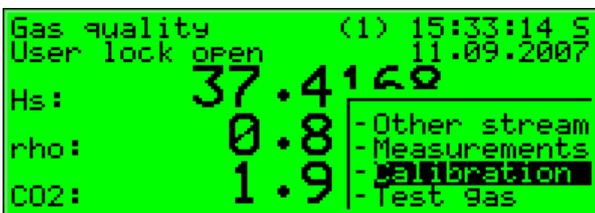
A display with the actual and target values of the calibration gas to be measured appears. The actual values are still the ones of the last calibration (see analysis time). The target values are read out of the gas chromatograph and must be

---

[7] The composition of the calibration gas should correspond to the process gas, and the quality of the components must be. 2.0 or better in order to obtain a sufficient accuracy of the instrument. Please contact Elster in advance to select the optimum calibration gas for your application.

entered via the PC software (RGC 3000) of the EnCal 3000 Gas Chromatograph (cf. Chapter 5.4 in the EnCal 3000 Gas Chromatograph Software Manual).

```
Actual/Target values   15:33:26 S
User lock open         11.09.2007
              Meas.       Target
Hs:          0.0000      40.1090
rho:         0.0000       0.0000
CO2:         0.0000       1.5200
N2:          0.0000       4.0100
CH4:         0.0000      88.8088  ▼
```

```
Actual/Target values   15:33:38 S
User lock open         11.09.2007
              Meas.       Target
C2H6:        0.0000       0.0000  ▲
C3H8:        0.0000       1.0000
iC4H10:      0.0000       0.2020
nC4H10:      0.0000       0.1990
neoC5H12:    0.0000       0.0500  ▼
```

```
Actual/Target values   15:33:48 S
User lock open         11.09.2007
              Meas.       Target
iC5H12:      0.0000       0.0500  ▲
nC5H12:      0.0000       0.0500
C6+:         0.0000       0.0500
Sum estd.:     0.00
Anlys. time: 10:20:30 11.09.2007
```

If you press the Menu key again, the following submenu appears:

```
Actual/Target values   15:34:01 S
User lock open         11.09.2007
                  M
iC5H12:      0 |-Back
nC5H12:      0 |-Differences
C6+:         0 |-Cal. start
Sum estd.:     |-Basic cal. start
Anlys. time: 1 |-Cal. cancel
```

Select the *Cal. start* entry.

```
Actual/Target values   15:34:15 S
User lock open         11.09.2007
                  M
iC5H12:      0 |-Back
nC5H12:      0 |-Differences
C6+:         0 |-Cal. start
Sum estd.:     |-Basic cal. start
Anlys. time: 1 |-Cal. cancel
```

The calibration starts after you have confirmed this selection as soon as the currently running analysis has been finished. The calibration always takes 14 minutes and is composed of the following periods:

- 150 s purging time before the first analysis within the calibration sequence
- 180 s per analysis within the calibration sequence. A calibration sequence always consists of three measurements, the first of which is dismissed. The other two measurements are averaged.
- 150 s purging time before the first analysis within the process gas measuring sequence that has started again.

The *GQM calibrates* message disappears from the display at the end of the calibration:

After the calibration has been finished the gas chromatograph automatically injects the process gas again and starts measuring. The analysis results determined during the calibration are entered in the *Calibration* archive.

If you want to abort the calibration prematurely, do so as described below:

While in the main display, invoke the menu via the Menu key and select *Calibration*.

Confirm your selection and open the menu again. Select *Cal. Cancel* and confirm your selection.

The EnCal 3000 Gas Chromatograph interrupts the calibration now (at the end of the current analysis) and returns to the normal operating conditions. The gas chromatograph then carries on working with the old calibration data.

The process is only aborted automatically if the inlet pressure of the carrier gas drops during the calibration. In this case, the EnCal 3000 Gas Chromatograph also returns to the normal operating conditions as soon as the carrier gas is injected again and carries on working with the old calibration data.

5.1.3.2 Basic Calibration

This calibration type can only be started manually. The **calibration switch** at the EnCal 3000 Controller must be **open**. If user locks have been parameterized, they are ignored due to the open calibration switch.

The following reactions of the controller indicate the basic calibration status:

- The last valid gas quality data is maintained via measurement outputs and in the basic display of the controller, provided any data is available at all.

- The second line shows *GQM calibrates*.

- A **revision status is not signaled** to the corrector.

```
Gas quality      (1) 15:36:20 S
GQM calibrates       11.09.2007
Hs:      37·4141    MJ/m3
rho:      0·8434    kg/m3
CO2:      1·9232    Mol %  ▼
```

To start the basic calibration, proceed as follows:

While in the gas quality main menu, press the Menu key and activate the *Calibration* command in the invoked menu.

```
Gas quality      (1) 15:33:14 S
Cal. switch open     11.09.2007
      37·4160
Hs:    0·8  ─────────────
rho:          -Other stream
              -Measurements
CO2:   1·9   -Calibration
              -Test gas
```

A display with the actual and target values of the calibration gas to be measured appears. The actual values are still the ones of the last calibration (see analysis time). The target values are read out of the gas chromatograph and must be entered via the PC software (RGC 3000) of the EnCal 3000 Gas Chromatograph (c.f. Chapter 5.4 in the EnCal 3000 Gas Chromatograph Software Manual).

```
Actual/Target values  15:33:26 S
Cal. switch open      11.09.2007
             Meas.      Target
Hs:         0.0000     40.1090
rho:        0.0000      0.0000
CO2:        0.0000      1.5200
N2:         0.0000      4.0100
CH4:        0.0000     88.8088  ▼
```

```
Actual/Target values  15:33:38 S
Cal. switch open      11.09.2007
             Meas.      Target
C2H6:       0.0000      0.0000  ▲
C3H8:       0.0000      1.0000
iC4H10:     0.0000      0.2020
nC4H10:     0.0000      0.1990
neoC5H12:   0.0000      0.0500  ▼
```

```
Actual/Target values  15:33:48 S
Cal. switch open      11.09.2007
             Meas.      Target
iC5H12:     0.0000      0.0500  ▲
nC5H12:     0.0000      0.0500
C6+:        0.0000      0.0500
Sum estd.:     0.00
Anlys. time: 10:20:30 11.09.2007
```

If you press the Menu key again, the following submenu appears:

```
Actual/Target values  15:34:01 S
Cal. switch open      11.09.2007
             M
iC5H12:     0 -Back
nC5H12:     0 -Differences
C6+:        0 -Cal. start
Sum estd.:    -Basic cal. start
Anlys. time: 1 -Cal. cancel
```

Select the *Basic cal. start* entry.

```
Actual/Target values   15:34:01 S
Cal. switch open       11.09.2007
                 M
iC5H12:          0 -Back
nC5H12:          0 -Differences
C6+:             0 -Cal. start
Sum estd.:         -Basic cal. start
Anlys. time: 1   -Cal. cancel
```

The calibration starts after you have confirmed this selection as soon as the currently running analysis has been finished.
The calibration always takes 14 minutes and is composed of the following periods:

- 150 s purging time before the first analysis within the calibration sequence
- 180 s per analysis within the calibration sequence. A calibration sequence always consists of three measurements, the first of which is dismissed. The other two measurements are averaged.
- 150 s purging time before the first analysis within the process gas measuring sequence that has started again.

The *GQM calibrates* message disappears from the display at the end of the calibration:

```
Actual/Target values   15:39:47 S
GQM calibrates         11.09.2007
              Meas.      Target
Hs:           0.0000     40.1090
rho:          0.0000      0.0000
CO2:          0.0000      1.5200
N2:           0.0000      4.0100
CH4:          0.0000     88.8088 ▼
```
→
```
Actual/Target Values   10:27:28 S
Cal. switch open       12.09.2007
              Meas.      Target
Hs:          40.1081     40.1090
rho:          0.8102      0.8102
CO2:          1.5200      1.5200
N2:           4.0100      4.0100
CH4:         88.8090     88.8088 ▼
```

After the calibration has been finished the gas chromatograph automatically injects the process gas again and starts measuring. The analysis results determined during the calibration are entered in the *Calibration* archive.

If you want to abort the calibration prematurely, do so as described below:

While in the main display, invoke the menu via the Menu key and select *Calibration*.

```
Gas quality       (1) 15:36:44 S
GQM calibrates        11.09.2007
         37.4141
Hs:
              -Other stream
rho:     0.8  -Measurements
              -Calibration
CO2:     1.9  -Test gas
```

Confirm your selection and open the menu again. Select *Cal. Cancel* and confirm your selection.

The EnCal 3000 Gas Chromatograph interrupts the calibration now (at the end of the current analysis) and returns to the normal operating conditions. The gas chromatograph then carries on working with the old calibration data.

The process is only aborted automatically if the inlet pressure of the carrier gas drops during the calibration. In this case, the EnCal 3000 Gas Chromatograph also returns to the normal operating conditions as soon as the carrier gas is injected again and carries on working with the old calibration data.

5.1.4 *Test Gas* Injection

The injection of test gases serves to check the gas chromatograph with a known gas or to measure unknown gases on a non-routine basis. It can only be started manually.

The **calibration switch** at the EnCal 3000 Controller **does not need to be open** for this. If **user locks** have been parameterized, however, they must be **open**.

The following reactions of the controller indicate the status of the test gas injection:

- The last valid gas quality data is maintained via measurement outputs and in the basic display of the controller, provided any data is available at all.

- The second line shows *Revision/Test Gas*.

- The **revision status** is signaled to the corrector.

Inject the test gas as described below:
While in the gas quality main menu, press the Menu key and activate the *Test gas* command in the invoked menu.

A display with the actual and target values of the test gas to be measured appears. The actual values are still the ones of the last test gas measurement (see analysis time). The target values are read out of the controller and must also be entered here in this case (cf. Chapter 5.1.4.1, page 33).

If you press the Menu key again, the following submenu appears:

Select the *Test gas start* menu item.

The test gas run starts after you have confirmed this selection as soon as the currently running analysis has been finished.

A test gas measurement always takes 5 ½ minutes. It will be repeated until you interrupt it manually. A single test gas sequence is composed of the following periods:

- 150 s purging time before the first analysis within the test gas sequence
- 180 s per analysis within the test gas sequence. A test gas sequence always consists of one measurement.

If you want to abort the process, proceed as described below:

While in the main display, invoke the menu via the Menu key and select *Test gas*.

Confirm your selection and open the menu again. Select *Test gas cancel* and confirm your selection.

The EnCal 3000 Gas Chromatograph interrupts the test gas run now (at the end of the current analysis) and returns to the normal operating conditions.

The process is only aborted automatically if the inlet pressure of the carrier gas drops during the test gas run. In this case, the EnCal 3000 Gas Chromatograph also returns to the normal operating conditions as soon as the carrier gas is injected again.

The *Revision/Test Gas* message disappears at the end of the test gas run:

The analysis results determined during the test gas measurement are entered in the *Test gas* archive.

5.1.4.1 Entering *Target Values*

You can enter the reference values of the test gas (e.g. stated on the analysis certificate of the test gas cylinder) via the *Target values* submenu. Afterwards, they can be compared with the current measurements during a test gas injection. You can also have the absolute deviations calculated and indicated on the *Differences* display.

To enter the target values, proceed as follows:
While in the basic display, press the Menu key and activate the Test gas menu item.

A display with the actual and target values of the test gas to be measured appears.

```
Test gas            16:01:41 S
                    10.09.2007
              Meas.    Target
Hs:          0.0000    0.0000
rho:         0.0000    0.0000
CO2:         0.0000    0.0000
N2:          0.0000    0.0000
CH4:         0.0000    0.0000  ▼
```

If you press the Menu key again, the following submenu appears:

```
Test gas            16:01:47 S
                    10.09.2007

Hs:      │-Back▐▐▐▐▐▐▐▐▐▐▐▐▐
rho:     │-Differences
CO2:     │-Enter target values
N2:      │-Test gas start
CH4:     │-Test gas cancel
```

Select the *Enter target values* entry and confirm your selection.

```
Test gas            16:01:53 S
                    10.09.2007

Hs:      │-Back
rho:     │-Differences
CO2:     │-Enter target values
N2:      │-Test gas start
CH4:     │-Test gas cancel
```

A listing with the gas quality data of the test gas to be used appears. You can enter all values via the display:

```
Enter target values 16:06:20 S
                    10.09.2007

Hs:          0.0000   MJ/m3
rho:         0.0000   kg/m3
CO2:         0.0000   Mol %
N2:          0.0000   Mol %
CH4:         0.0000   Mol %  ▼
```

```
Enter target values 16:02:44 S
                    10.09.2007

C2H6:        0.0000   Mol %   ▲
C3H8:        0.0000   Mol %
iC4H10:      0.0000   Mol %
nC4H10:      0.0000   Mol %
neoC5H12:    0.0000   Mol %   ▼
```

```
Enter target values 16:03:10 S
                    10.09.2007

nC4H10:      0.0000   Mol %   ▲
neoC5H12:    0.0000   Mol %
iC5H12:      0.0000   Mol %
nC5H12:      0.0000   Mol %
C6+:         0.0000   Mol %
```

To edit a value, get into the edit mode by pressing the Enter key.

You can enter a new value now, e.g.:

If you exit the input field by pressing the rightward arrow key, the value you have entered will not be accepted. If you exit the input field by pressing the Enter key, however, the old value will be replaced by the new one.

Note: When leaving the menu, you have to decide again whether you want to accept the new gas quality data or return to the previous ones.

New value has been accepted:

Old value will still be used:

To quit the *Enter target values* submenu, press the Menu key and choose one of these two options:

Accept all pieces of new gas quality data:

Continue to use all pieces of old gas quality data:

If you select *OK*, all values are used as new target values of the test gas. By selecting *Cancel* you return to the *Test gas* menu without accepting values you have possibly edited before. In this case, the target values that were valid before you have opened the *Enter target values* submenu are still valid.

5.1.5 Cylinder Change / Purging

Different gases must be available in the station for calibration and measurement tasks. From time to time, it is therefore necessary to connect a new gas cylinder to a gas supply connection of the EnCal 3000 Gas Chromatograph; for instance, if the pressure of the calibration gas cylinder is insufficient.

To remove the old cylinder, proceed as follows:

1. Close the old cylinder at the main valve on top of the cylinder and unpressurize the connected gas line. You possibly have to wait until the remaining gas has been used up or use an available venting possibility (low pressure side).
2. Screw the cylinder connection off the cylinder and close the cylinder with the corresponding nut.
3. Place the protective cap on the cylinder and fasten it.
4. Detach the possibly attached safety chain or clamp and remove the cylinder.

To connect a new cylinder, proceed as follows:

5. Secure the new cylinder with a chain or clamp against falling down first.
6. Remove the protective cap from the cylinder by unscrewing it.
7. Make sure that the main valve on top of the cylinder is closed.
8. Remove the nut from the valve connection now.
9. Make sure that the pressure reducing and the shut-off valve of the high-pressure or cylinder pressure regulator to be connected are closed. Close the pressure reducing valve by unscrewing its setting screw.
10. Connect the cylinder connection of the high-pressure or cylinder pressure regulator to the valve connection of the gas cylinder.
11. Open the main valve of the gas cylinder and adjust the outlet pressure of the high-pressure or cylinder pressure regulator to the operating pressure needed by the gas chromatograph for the gas stream you are preparing just now.

To purge the high-pressure or cylinder pressure regulator, proceed as follows:

12. Close the main valve of the gas cylinder and wait until the high-pressure or cylinder pressure regulator has almost drained, i.e. until the outlet pressure has almost sunk to 0 bar. Now open the gas cylinder again.
13. Repeat this draining and filling of the high-pressure or cylinder pressure regulator twice to ensure that the regulator's dead volume does not contain any gas from the previous use or any air.
14. Pay attention to the fact that the gas cylinder must be open at last to make a calibration or measurement possible.

5.1.6 Revision

The EnCal 3000 Controller sets the revision status when test gas is injected. A set revision status means that the gas quality is not measured under normal, proper operating conditions.

All entries in the *Hourly mean bill* archive are therefore marked with the *Revision* status note. Furthermore, the *Revision/Test Gas* hint is generated and entered in the error listing and logbook. A termination of the test gas measurement results in the end of the *Revision/Test Gas* hint with an entry in the logbook and a last entry marked *Revision* in the *Hourly mean bill* archive. The gas quality measurement runs normally again.

You can also set the revision status manually to mark an incorrect gas quality measurement.
For this, open the menu by pressing the Menu key while in the main display:

```
Gas quality      (1) 16:07:19 S
                     10.09.2007
         37.4117
Hs:                ┌─────────────
          0.8      │- Other stream
rho:               │- Measurements
                   │- Calibration
CO2:      1.9      │- Test gas
```
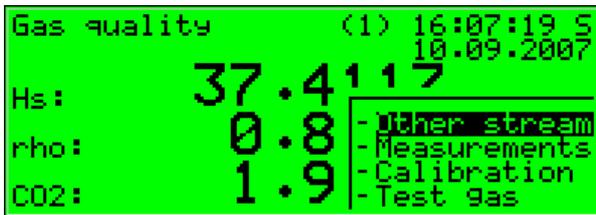
If you press the Menu key again, the module listing appears.

```
Gas quality      (1) 16:07:25 S
                     10.09.2007
         37.4     ┌──────────────
Hs:               │Gas quality
          0.8     │Data logging
rho:              │Monitoring
                  │Integrated RDT
CO2:      1.9     │System
```
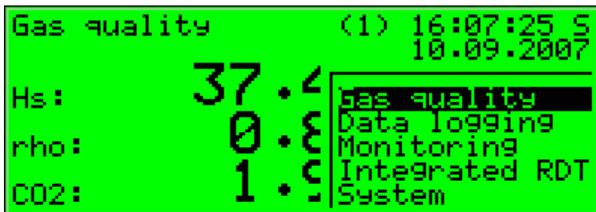
Choose the *Monitoring* module via the rightward arrow key and confirm your selection by pressing the Enter key.

```
Gas quality      (1) 16:07:31 S
                     10.09.2007
         37.4     ┌──────────────
Hs:               │Gas quality
          0.8     │Data logging
rho:              │Monitoring
                  │Integrated RDT
CO2:      1.9     │System
```
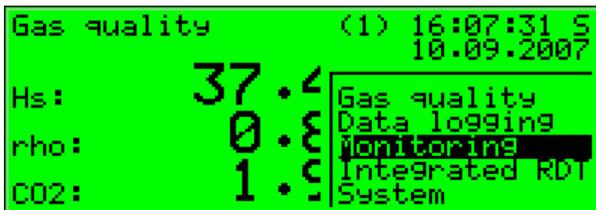
Open the submenu overview in the appearing display of the *Monitoring* module by pressing the Menu key.

```
Error listing       16:07:59 S
                     10.09.2007
Gas quality A

       Error      ┌──────────────
                  │- Accept
                  │- Next listing
                  │- Switches
```
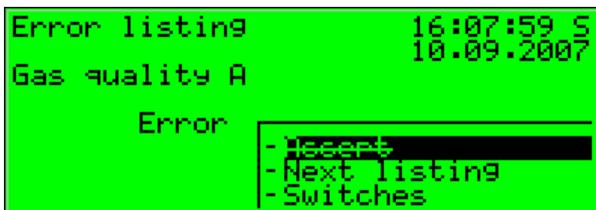
Select the *Switches* submenu with the rightward arrow key and confirm your selection by pressing the Enter key.

The revision switch has already been selected in the appearing display.

Get into the selection mode by pressing the Enter key:

Switch the revision switch *on* by pressing the rightward arrow key:

Press the Enter key again to quit the selection mode.

Only by quitting the *Switches* menu you finally confirm whether you want to accept the new switch settings or reject them. For this, open the menu by pressing the Menu key:

If you confirm the *OK* option by pressing the Enter key, you accept all switch settings as indicated now. By pressing the rightward arrow key and confirming the *Cancel* option with the Enter key afterwards, you reject all changes you have made and carry on working with the old switch settings as they were before you have opened the *Switches* menu.

If you have set the revision status by means of the revision switch, it will be indicated on the display just like during a test gas run and signaled to the corrector.

5.2 *Data Logging* Module

5.2.1 Function

EnCal 3000 Controllers are always equipped with an integrated data logging function. The responsible *Data Logging* module, however, provides only the data logging *service*. The actual data to be logged is generated by other modules of the module group.

When parameterizing the *Data Logging* module, you only have to define *which* of the available archive groups shall actually be logged and which storage depth shall be applicable. All archives defined in that way are designed as ring storages. The data logging depth determines how many entries an archive is able to write at most. If an archive is full, the respective oldest entry will be overwritten by each new entry.

The following sections describe the types of archive groups the individual software modules provide:

Gas Quality Module:

If two gas streams are measured, all archives of the *Gas Quality* module are available once for each stream.

Among others, the *Hourly mean bill.* archive type is available for each gas stream. The related data (superior heating value, density, carbon dioxide and nitrogen concentrations) are cyclically logged with a time mark every hour and upon each occurrence of an error. This archive is supplemented by the *Hourly mean ext.* and *Hourly mean comp.* archives, which log further gas quality data every hour.

The *Daily mean comp.* archive logs the gas quality data daily at a defined time (when the daily archives start, i.e. at the hour of the gas day beginning).

The *Monthly mean comp.* archive logs analogously the gas quality data monthly on the first day of a month at a defined time (when the daily archives start, i.e. at the hour of the gas day beginning).

Furthermore, there are the *Calibration* and *Test Gas* archives that only log data during the corresponding actions. In case of a calibration this is exactly one archive entry at the end of the calibration sequence; in case of a test gas run entries are created after each analysis at regular intervals for the time the test gas injection lasts (one hour max.).

The *Single analyses* archive can be compared with the latter. The results of each analysis are saved in this archive during normal operation.

Finally, a special *Long-term* archive is available for the gas quality measurement. This archive exclusively logs billing-relevant data cyclically together with a time mark. Another channel of the *Long-term* archive contains the number of the alarm with the highest priority level that has been pending once during the last billing interval.

Monitoring Module:

The *Monitoring* module facilitates the compilation of process value archives (archives with any measurements). Moreover, it runs one *logbook* for each stream of the gas quality measurement, where the beginning and end of all error types (alarm, warning, hint – cf. Chapter 5.3.1) are entered in clear text and together with a time mark. The internal message processing is also provided with an additional, separate error listing (*Monitoring Logbook*), which can be logged.

System Module:

The *System* module keeps a parameter change archive (*Changed Settings archive)*, in which changes of the parameterization are logged. If the device is operated with two streams, the changed settings archive logs the parameter changes of both streams.

If individual parameters are modified, the old and new values will be logged in addition to the time mark. A completely new parameterization will be entered in the changed settings archive as *New parameterization* via the data interface when the calibration switch is open. A change of the parameterization's operational part is marked as *New parameterization (op.)*.

Note: You can configure the archive depth, exact composition and order of archives largely by yourself via the parameterization. However, when changing the archive structure, you have to delete the old archives already existing in the device.

Before delivery, the devices have already been provided with a pre-defined archive structure corresponding to common requirements.

5.2.2 Display and Operation

Main Display (Data Logging Module)

All existing archive entries can be made visible at the operator panel.

The main display of the *Data Logging* module consists of a mask in which you can choose the data you want to view more closely. The following illustration shows an example:

Current calendar time

```
Data logging        15:20:28 S
                     13.09.2007

Archive: Hourly mean bill A
Channel: Hs0
Time:    13.09.2007 06:00:00
Ord.no.:       1398
```

Input mask for selecting <u>the archive information</u> that shall be indicated in the next step.
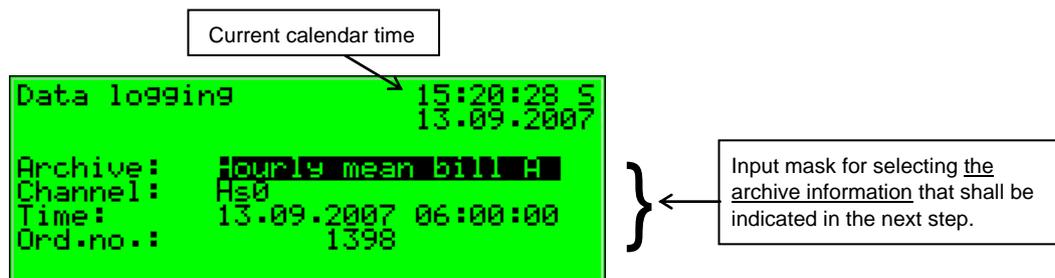
After the main display of the *Data Logging* module has been invoked, the most recent entry of the first channel of the first archive group is always indicated first.

<u>Choose the archive information you want to view:</u>

- The archive group type is selected at the beginning, i.e. it is highlighted in black. Press the Enter key to get into the edit mode. A listing opens up from which you can choose the desired archive type via the arrow keys. Afterwards, confirm your choice by pressing the Enter key.

- Specify the archive channel you want to view in detail in the next selection field. Several possibilities are offered, depending on the archive group type you have selected in the first step. For instance, you can choose between *Hs, rho, d, CO2, N2* and *Z* (status [8]) in case of the *Hourly mean bill A* archive type.

- You can now specify the point of time to be filtered by changing day, month, year, and time one after the other. You get into the edit mode for each respective field by pressing the Enter key and are thus able to specify date and time step by step. Confirm your entry by pressing the Enter key.

- The next field is selected. Select the entry you want to view via the ordinal number[9] in this field. As there is an unambiguous relation between date and ordinal number, the related ordinal number is indicated automatically after the date has been entered (see above). If you enter a different ordinal number, the date in the second line of the selection mask will be adjusted automatically.

Invoke the selected archive via the menu (see next section).

---

[8] Status stands for a bit string that provides an overview of the EnCal 3000 Controller's status.

[9] Each individual measurement variable of an archive group logged by a device additionally has an ordinal number for reasons of unambiguity. The order of the ordinal numbers is arranged in such a way that the very first archive entry receives the number 1. The ordinal number for each further entry is increased by one.

Ordinal numbers are needed, for instance, for polling archive data via DSfG.

□ *Subordinate Menu Items (Data Logging Module)*

View

Activating the *View* menu item invokes the display of the archive channel you have selected in the main display.
The archive type, archive channel and current calendar time are shown in the first two lines. Each entry is always indicated with a time mark, value and unit. The density ratio d has no unit and is logged accordingly.
Furthermore, a change compared to the previous archive entry is indicated.

For example (*Hourly mean bill A*, *Hs* channel):

Archive type and archive channel		Current calendar time

```
Hourly mean bill A    15:20:40 S
Hs0                   13.09.2007
                               ▲
13.09.2007 06:00:00         1398
37.411 MJ/m3

Change:    0.002 MJ/m3         ▼
```

Time mark, value and unit

Difference between last entry and currently displayed entry

Archive entry with ordinal no. 9

The "up" and "down" scroll arrows indicate that you can view even more archive entries (scroll with leftward and rightward arrow keys)

Next Channel
Previous Channel
The *next/previous channel* menu items serve to quickly switch over to another channel of the same archive group.

Back
Return to the main display, i.e. to the selection mask for viewing archives, via the subordinate menu item *back*.

∗ **Tip:** The archive representation on the display is limited due to a lack of space. To analyze larger archive areas it is much more practical to read the archives out of the device and into a PC before; for example via the data interface by means of the GAS-WORKS module GW-REMOTE+. You can view the data afterwards in a table or as a diagram with the GW-DATA+ program.

5.3 *Monitoring* Module

5.3.1 Function

The *Monitoring* module basically performs the signaling and monitoring tasks of the device:

- Monitoring the gas quality (-ies) for errors.
  Together with the *Logbook* functionality (*Data Logging* module, cf. Chapter 5.2) the gas quality error listings serve to analyze and remove gas quality-related errors and to be able to understand the history of the course of the error.
- Monitoring of any logged measurements
- Signaling of operating states
- Measurements
- Log-on of process value archives (archives for measurements that can be used to replace a recording instrument)
- Switching functionality

5.3.1.1 Monitoring of Gas Quality (-ies), Error Listing(s)

There are three different kinds of gas quality errors, which are also treated differently by the error management:

- An *Alarm* is generated if a gas quality-relevant error has occurred. Beginning and end of an alarm are entered in the related error listing together with a time mark (*<Alarm> begins/ends*).
  If an alarm is no longer pending, i.e. it is no longer relevant, you can accept it at the device and thus remove it from the error listing.

- A *Warning* is generated if a system-relevant variable is affected by an error that does not influence the result of the gas quality measurement (e.g. changing the time). If a warning is no longer pending, i.e. it is no longer relevant, you can accept it at the operator panel and thus remove it from the error listing.

- A *Hint* is generated if a measurement violates a hint limit specified by the user (e.g. upper/lower hint limits for gas quality data, pressure, temperature).
  In addition, a hysteresis can be defined to avoid fluttering messages when a measurement fluctuates around a limit value. The message *<Hint limit begins>* will then only be generated or removed if the measurement is not within the hysteresis range.
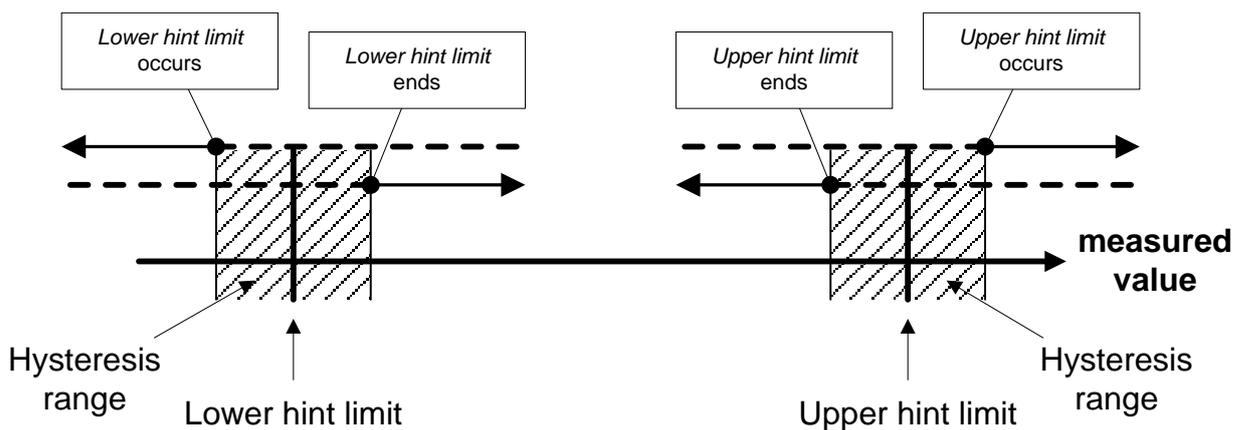
A hint is also generated if an event occurs that has no influence on the gas quality measurement (e.g. *Calibration switch open*).
The beginning of a hint is entered in the error listing together with a time mark. Hints cannot be accepted and automatically disappear from the error listing after they have ended.

A complete listing of all errors together with their classification is included in the annex to this documentation.

Note: If the EnCal 3000 Controller is operated as dual-stream device, the error management is performed separately for each stream. Consequently, there are also two gas quality error listings. There are alarms that are restricted to one stream; for example, a violation of the specified range of stream A will only trigger an alarm for stream A, whereas the error status of stream B is not affected. In addition, there are errors affecting both streams equally. Such an error, for example the *Power failure* alarm, is entered in the error listings of both streams.

The status LED of the device indicates the message with the highest priority level (pending alarm, pending warning, unaccepted alarm, unaccepted warning) according to the table shown in Chapter 3.1.2, page 8.

During multiple-stream operation it does not matter to which stream the error with the highest priority level belongs; the status LED does not show which stream is affected. You can always obtain detailed information via the error listings.

The software of the EnCal 3000 Controller includes a revision switch to facilitate a system check by revision. You can activate this revision switch via the operator panel at the device if the user locks are open.

If the revision switch is set, the *Revision/Test Gas* hint is generated and entered in the error listing and logbook of all streams. From then on, all entries in the *Long-term* archive are marked with the *Revision* status note.

A closing of the revision switch results in the ending of the *Revision/Test Gas* hint with an entry in the logbook and induces a last entry in the *Long-term* archive marked with the *Revision* note. All streams operate normally again.

5.3.1.2   Measurements

An EnCal 3000 Controller supplies a whole lot of measurements from the gas quality measurement. It can also capture measurements via analog inputs and partly also creates derived measurements. An example for such an analogously collected measurement is a temperature value supplied by a thermostat.

In addition to monitoring measurements for hint limits and gradients, the device can also file up to 32 measurements. For each defined measurement the minimum and maximum values measured since the last reset are indicated. You can view these values together with the associated time marks on the display.

5.3.1.3   Measurement Monitoring; Messages and Groups

Note: The message and signal processing of the *Monitoring* module runs completely independent of the monitoring of the device's gas quality functions. This functionality of the *Monitoring* module is therefore provided with a separate error listing and an own logbook.

Please take into consideration that the rules of this message processing considerably differ from those of monitoring the gas quality functions (see above); the acceptance mechanism is totally different, for instance. If you know the DIN 19 235 standard (*Signalling of operating conditions*), you may be familiar with many terms mentioned in the description below. The message processing of the EnCal 3000 Controller is oriented towards this standard wherever it has proved to be useful and possible with regard to the monitoring function.

The message processing in the EnCal 3000 Controller can manage up to 64 messages defined by parameterization. In principle, there are different types of conditions to be signaled that can be mapped on such a message. You define yourself the events that shall result in messages within the message processing when parameterizing the device.

First, the status of a digital message input (set/not set) can be evaluated as message. Messages generated by the device itself during operation can also be included in the message processing, such as a gas quality alarm.

Second, measurements can be monitored for limit violations. This applies to measurements supplied via analog inputs or measurements created internally, such as the superior heating value. In addition to monitoring upper and lower hint limits as well as boundaries, you can also *monitor gradients*. The gradient monitoring observes measurement changes within defined time ranges: If the difference between the largest and smallest values of a measured quantity exceeds the defined maximum value within a parameterized time range, the condition for generating the *Hint limit gradient* message has been met.

Note: All single messages referring to measurements are also pending if the corresponding input value is regarded as being disturbed.

There are two different methods of avoiding fluttering messages:

1. Hysteresis monitoring (only in case of measurement monitoring)
    You can additionally define a hysteresis to avoid fluttering messages when a measurement fluctuates around a limit value. The message *<Hint limit begins>* will then only be generated or removed if the measurement is not within the hysteresis range.
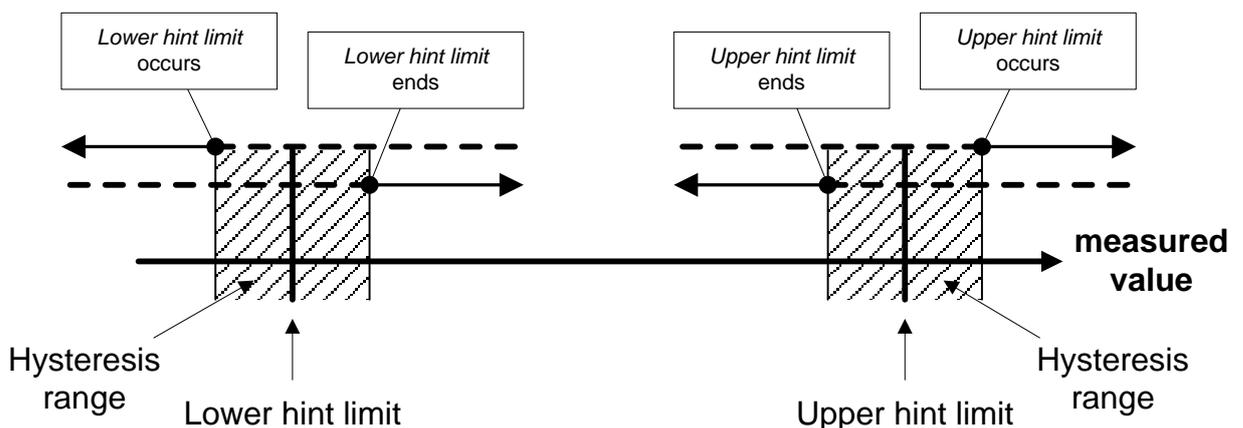
2. Considering a minimum pending time
    If a minimum pending time is evaluated, a message is only considered pending if the condition to be signaled (set digital input, hint limit violation, etc.) is pending longer than the minimum pending time lasts.

The target of the message-processing concept is to combine messages in groups. Owing to group monitoring and evaluation the monitoring itself remains clearly understandable even if the amount of signals is rather large.
You can define the scope of the related error listing by yourself, namely by determining in the parameterization for each message whether a *single* message shall be entered in the error listing and logbook of the *Monitoring* module. Only if this is the case, the message will be entered in the error listing as soon as it begins. There is no acceptance required for single messages; they are automatically removed from the error listing when they end. If a message is entered in the error listing, beginning and end of this message are also entered in the logbook. The *Data Logging* module can log the logbook of the *Monitoring* module.

You can *disable* individual messages during operation, which is, for instance, rather helpful during a plant inspection. The message processing completely disregards disabled messages, which are always considered not pending. You can change the disable note of a message via the operator panel of the device, via the parameterization and with a DSfG setting telegram.
Single message data (characteristics, current values) can be enquired via DSfG. Some properties are also adjustable via DSfG, such as hint limits and gradients.[10]

In order to simplify the monitoring of up to 64 messages, single messages can be combined by parameterization in up to 32 groups in any composition whatever. Each group generates 3 different messages that are created by linking the single messages contained in that group. This way, you can monitor the status of content-related messages without getting lost in the observation of single messages.

The different message types of a group are called *Group message*, *Held group message* and *Centralized message.*

---

[10] The DSfG data elements for message processing are included in the DSfG data element tree of the *Control* entity. Please ask Elster for a precise list of the supported or used DSfG data elements, when required.

Group message

A group's group message results from the OR operation of the single messages belonging to the group. Thus, a group message is pending if at least one of the group's messages is pending.

A group message is not linked with an acceptance.

Held group message

The held group message only differs from the normal group message by always keeping to a holding time; for instance, for taking the telecontrol response times into consideration. A held group message is pending at least as long as the holding time lasts even if the normal group message ends during the holding time.

Group

Single message M1

Single message M2

Group message

Held group message

= holding time
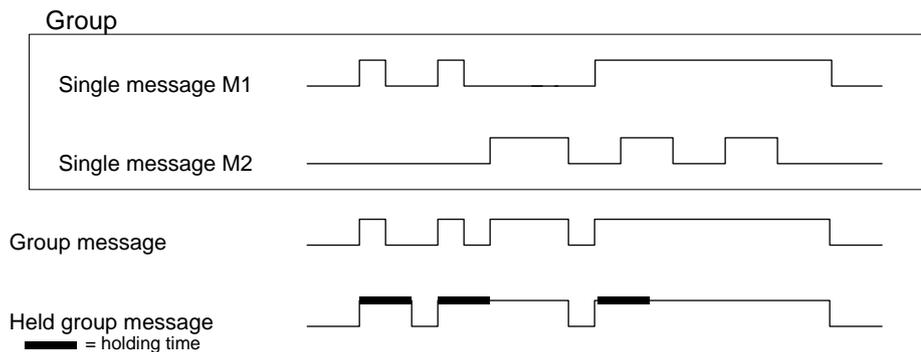
Centralized message

A special feature of the centralized message is that it can link the states of single messages with an acceptance signal. The *Acceptance required* or *No acceptance required* property is defined as group characteristic in the parameterization.

All centralized messages are entered in the logbook and error listing.

If a group is marked with *No acceptance required*, the result of the centralized message is always the same as the result of the group message.

There are two different procedures for the acceptance technique and the status of the centralized message of a group marked *Acceptance required*. These two procedures are described below.

Acceptance technique of centralized messages, procedure to DIN 19 235

According to this procedure, the centralized message of a group characterized *Acceptance required* links the states of the single messages contained in that group with an acceptance signal.

The acceptance can either be implemented via an assigned digital input or via the *Accept all* menu item, i.e. via the operator panel. An acceptance accepts all groups at once. The source of the acceptance does not matter.

The centralized message of a group classified as *Acceptance required* is pending if at least one single message of the group is pending. It will only end with the end of the last single message if all pending messages have been accepted. A currently pending single message is also considered accepted if it had been accepted before it ended.

The fact that a centralized message is still pending after the last single message has ended indicates that at least one of the single messages has begun again after the last message was accepted. In such a case the single message or single messages just has/have to be accepted!

The following illustration shows how, according to procedure 1, the centralized message of a group classified as *No acceptance required* differs from the one of a group classified as *Acceptance required*.

Group

Single message M1

Single message M2

Centralized message
group marked *no acceptance required*
(= group message)

Centralized message
group marked *acceptance required*

Acceptance   Acceptance   Acceptance   Acceptance
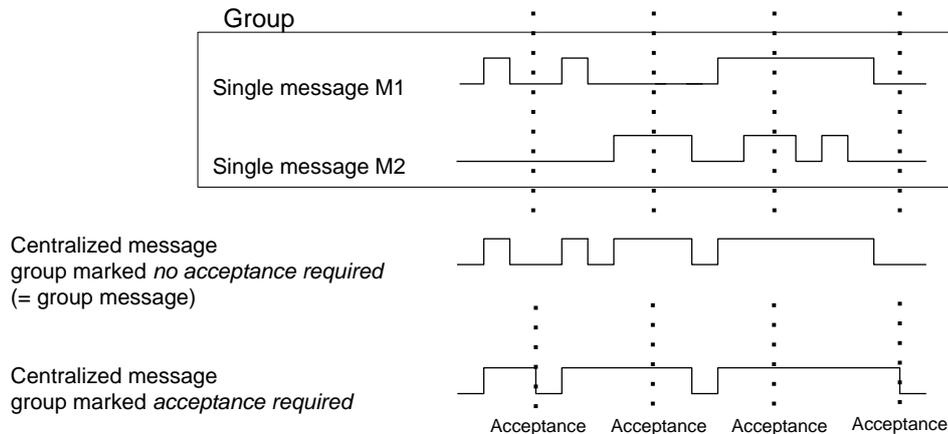
Acceptance technique of centralized messages, standard procedure

According to this procedure the result of the centralized message of a group classified *Acceptance required* ensues from the OR operation of the single messages. It does therefore not differ from the result of the group message and the no-acceptance-requiring centralized message.

This means in particular that the centralized message also ends when the last contained single message ends. In this case, however, it remains in the error listing and waits for being accepted. The centralized message disappears from the error listing after acceptance.

These groups with their centralized and group messages are intended to provide an overview of the plant conditions. This is why the output of these message types is supported in different ways:

- In contrast to single messages, centralized and group messages can be output via digital outputs.
- The events *Group message begins / Group message ends / Any message of the group begins / Any message of the group ends* can be routed to the DSfG bus with an attention telegram. It can be determined separately for each group upon which events such attention telegrams shall be generated and of which type they shall be (*Alarm*, *Hint* or *Warning*).
- The status of centralized, group and held group messages can be enquired via DSfG.
- Only the centralized message of the messages linked within a group is entered in the error listing and logbook of the message processing to keep them well-structured.

A *Maintenance switch (M-switch)* is used to suppress group and/or centralized messages if maintenance work has to be performed.
The setting of this M-switch can affect each group differently:

- No influence
    A set M-switch does not have any effect on the signaling reactions of this group.
- Suppression "towards telecontrol"
    This means that, if the M-switch is set, the group does no longer trigger any DSfG attention telegrams and the *Held group message* is always considered *not pending*.
- Suppression of all signaling reactions without exception
    In this case all messages generated by a group are suppressed if the M-switch is set.
    This means that the group neither generates held group nor group nor centralized messages. Nevertheless, the centralized message is still entered in the logbook and error listing.
    If the M-switch is set, the main signaller no longer takes the group into account.

The M-switch is activated via an assigned digital input. It cannot be set via the operator panel for safety reasons.
Status and signaling reactions of *single* messages remain unaffected by the M-switch. Single messages are suppressed via the disabling mechanism explained above.

In addition to the above-mentioned messages a message named *Main signaller* is also available. It usually triggers a hooter if being routed to an output. An additional acceptance input is assigned to the main signaller.

The main signaller can include any number of groups.

It begins when a message arrives that belongs to one of the involved groups, and it ends upon acceptance, no matter whether or not messages are still pending. You can accept it via the digital input assigned to the main signaller. Besides, if all groups are accepted via the operator panel, the main signaller is also accepted. It begins again as soon as the next involved message arrives.

The following illustration shows the behavior of the main signaller in connection with the acceptance (in case of one involved group):
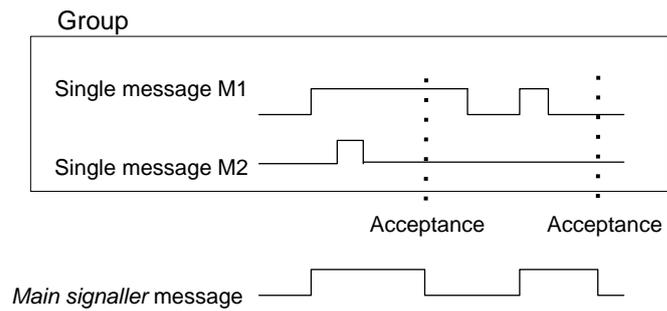
5.3.1.4 Logging on Measurement or Counter Archives

The EnCal 3000 Controller is able to keep archives for process values, i.e. archives for measurements and count values. Up to four archive groups with up to 8 channels each are available. You can determine for each archive group individually in which conditions the contained archive channels shall be logged.

The standard procedure used is cyclic data logging (with parameterizable data logging cycles from one second up to one hour).

Additionally or alternatively, the data logging can be made conditional on certain events detected during the monitoring of the process values:

- It is possible to link the data logging with one or more group(s) of single messages. In this case the logging takes place upon the beginning and end of each message contained in one of the involved groups.
- If the trend of a particular process value shall be logged in detail, a maximum change rate can be defined for an archive channel. Then the entire archive group is logged each time the difference between the current measurement and the value measured during the last data logging exceeds the maximum change rate. This way, the data is logged more often in case of quickly changing values.

  This option is also available for counter archives, which means you can define that the data logging starts each time a count value has increased by a defined difference.

Measurements and count values are always logged additionally if the input value has been identified as being disturbed.

It is possible to "freeze" process value archives. If an assigned message begins, the corresponding archive continues to log data and stops after a set number of entries has been reached. The point of time of the last entry will be marked with hint *PVA <no.> freeze begins* (PVA stands for **P**rocess**V**alue**A**rchive) in the error listing and logbook of the *Monitoring* module. The data logging will only be continued when the assigned message ends. Simultaneously, hint *PVA <no.> frozen* also ends.

The freezing of measurement archives is useful if you are interested in how a measurement behaves if a certain event occurs. It is possible, for instance, to link the freezing with a centralized message. Then, the freezing will be activated upon the first beginning of any message of the group. Normal data logging will not be continued after the end of the last message until the group has been accepted explicitly, for the centralized message only ends in this case.

In addition, you can make the logging in a process value archive conditional on a message. In this case, data is only logged in the archive if the allocated message has been set, independent of all other conditions.

5.3.2 Display and Operation

Main Display (Monitoring Module)

The display indicates the error listing of stream A when you invoke the *Monitoring* module. The error message with the highest priority level[11] is visible, provided the error listing is not empty.

If the error listing contains further errors, you can scroll through the error listing with the arrow keys. The little black scroll arrows on the right side of the display indicate whether or not there is more than one entry in the listing.

The following information is provided for each error:

Error type
(*Alarm*, *Warning* or *Hint*)

Current time

DSfG error number

Error description (clear text)

"Up" and "down" scroll arrows:
There are at least two more errors in the listing.

Date and time of *Beginning* and *End*
(The latter is only indicated if the error is no longer pending.)
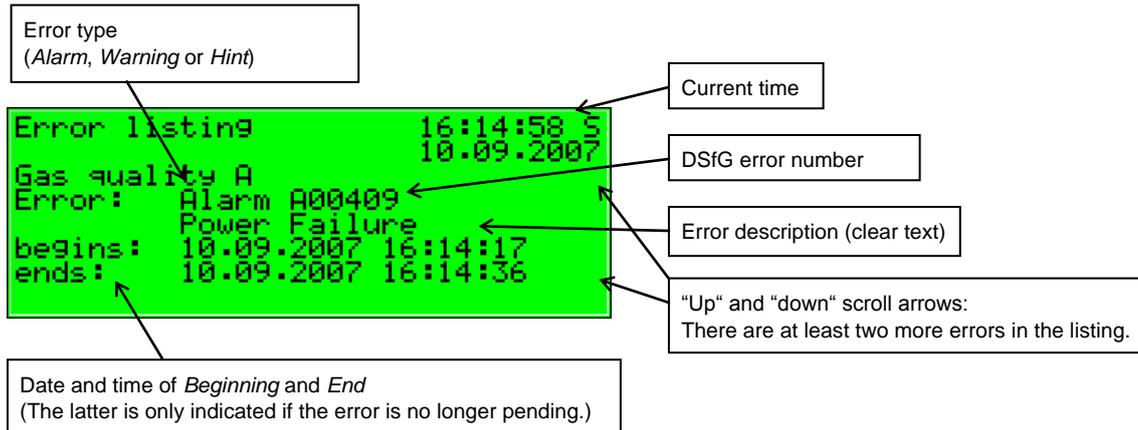
Subordinate Menu Items (Monitoring Module)

Accept

The *Accept* menu item only exists for gas quality error listings.

If this menu item is crossed out, you cannot accept the indicated message because it is still pending. If *Accept* is not crossed out, however, you can accept the currently indicated error message and thus remove it from the error listing. After you have accepted the message, the menu is cleared and the next error is displayed. Just repeat the procedure if you want to accept this error, too: Invoke the menu and confirm *Accept*.

Accept all (only available for the *Monitoring* error listing)

The *Accept all* menu item is only available if you are in the error listing display of the *Monitoring* module; you accept all groups requiring an acceptance together with the main signaller (hooter) via this menu item.

Accept all is crossed out if there is no need to accept any messages.

---

[11] An alarm has the highest priority level, i.e. it is of greatest importance. A warning has a higher priority level than a hint.

Cf. Chapter 5.3.1 for an explanation of the terms *Alarm*, *Warning* and *Hint*.

Next listing

You can switch to the respective following error listing via *Next listing*. There are up to three error listings: the *Gas Quality A,* the *Gas Quality B* and the *Monitoring* error listing.

The following messages are entered in the error listing of the *Monitoring* module:

- Messages named *System messages*[12] have top priority.
- The next position shows an *M-switch* message if the maintenance switch has been activated.
- All pending centralized messages of groups 1 to 32 are indicated below.
- Pending single messages follow according to their priority level.
  In order to keep the error listing clearly understandable only such single messages that have been parameterized accordingly are entered in the error listing.

In principle, all single messages of the message processing including the *M-switch* message do not require an acceptance. Only centralized messages of groups requiring an acceptance must be accepted. This means that all single, group and centralized messages of groups that do not require an acceptance automatically disappear from the error listing when they stop pending.

Centralized messages of groups requiring an acceptance will only end after they have been accepted and if none of the single messages of the group is pending any longer. The messages can be accepted even before the last single message has ended.

Measurements

An EnCal 3000 Controller can have up to 32 parameterized measurements for maximum/minimum indication on file. If you invoke the related display, the first measurement is indicated. You can switch to the display of another measurement via the name.

The display contains the following information in detail:

Name of the shown measurement: Pressing the Enter key opens up a selection list containing all measurement names. You can switch to the indication of another measurement via this listing.
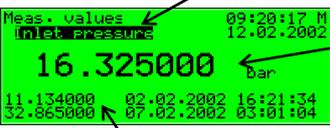
Current value incl. unit:
Flashes if the data source is disturbed.

Line before last: Minimum value since last resetting, with time mark.
Last line: Maximum value since last resetting, with time mark.

If the associated measurement is indicated as being disturbed, the display keeps showing the last valid value. The value is flashing in this case.

---

[12] System messages are generated for instance for the events *Re-start performed, Power failure, New parameterization* and *Parameter changed.* These messages are usually not visible in the error listing as they are pending for only one second. Other messages that are important for the entire system, such as *Interface monitoring* in case of a board location error or *Calibration/User switch open* are more like hints and disappear automatically from the error listing after they have ended.

The measurement display contains the following subordinate menu items:

Resetting

> The *Resetting* menu item sets the minimum and maximum values of the indicated measurement to the current measurement.

Reset all

> The *Reset all* menu item resets all filed measurements.

Groups

> The *Groups* menu refers to the message processing of the *Monitoring* module. You can invoke the related display only if message groups have been created. The display facilitates an overview of the event status of the messages linked in a group. If you invoke the related display, you will see information on the first group. To switch to the display of another group, get into the edit mode (by pressing the Enter key) and select the name of the group you want to view from the appearing listing. Confirm your choice by pressing the Enter key again.

Name of the indicated group

First message, i.e. the message of the group that has begun first.
The text is flashing if the message has not been accepted via the group yet.

New message, i.e. the message of the group that has begun last. The text is flashing if the message has not been accepted via the group yet.
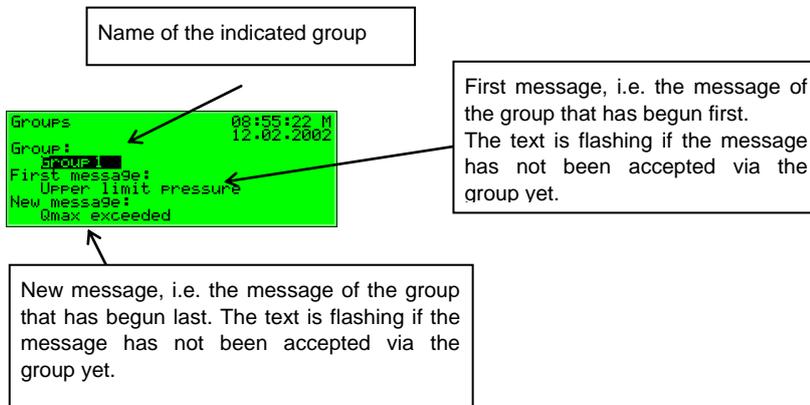
> If the centralized message of the invoked group is currently pending, the single message of the group that has begun first is indicated below *First message.* As this is always the message that has initially caused the beginning of the centralized message, this information helps to analyze the error condition. The message text is flashing if no message has been accepted yet after the beginning of the centralized message.

> You can read off the single message of the group that has begun last below *New message.* As long as the centralized message itself is pending, the *New message* indication is updated upon each beginning of a new message of the group. A *New message,* too, is flashing on the display until an acceptance has been performed after its beginning.

> Only if neither first nor new messages are indicated, a centralized message is not pending at that point of time.

> Activate the *View* submenu to check the status of all single messages contained in the group*:*

> View

>> This display provides information on the single messages contained in the group invoked before. Besides, it provides information on the status of each contained single message. Due to the mass of information only one single message is indicated on the display at a time.

>> As the *Name* selection list contains all single messages of the corresponding group you can switch to the indication of any other single message of the currently selected group.

Name of selected group

Currently indicated single message of the group. A listing with all messages existing in this group opens up if you press the Enter key. You can also switch to the indication of another single message of the group via this selection list.

The following information is indicated for each individual message:

Name

You can identify each message by its parameterized name. Switch to the indication of any other single message of the group via the *Name* selection list.

Type

A single message can be derived from a *Message*, the monitoring of an *Upper* or *Lower limit value* or *Gradient monitoring*.

Status

The status of a single message is characterized by several specifications:
On or *Off* indicates whether the message is pending. Here, a possibly parameterized minimum pending time is taken into consideration: Even if the status to be signaled is already pending, the related single message will only be set if this status is pending longer than the minimum pending time lasts.
To be able to make out whether a single message would be pending if no minimum pending time were assigned to it, the display includes a seconds counter:

Seconds counter for minimum pending time

If the seconds counter starts counting backwards, the status to be signaled is already pending. A minimum pending time has been assigned to the single message, so the message itself will only be generated if its status is still pending after the minimum pending time has elapsed. The counter therefore constantly shows how many seconds of the minimum pending time are remaining. Only after the counter has reached 0, the status indication of the message will change from *Off* to *On*.
If the status to be signaled ends before the minimum pending time has elapsed, the counter will be set to 0, but the message will not begin.
The counter always shows 0 if a minimum pending time has not been assigned to a single message. In this case the message begins immediately after the status to be signaled has been detected.
Whether a single message is being routed at all depends on the fact whether the message is disabled or enabled: If a single message has been disabled, the entire subsequent message processing considers it as not pending.

Tip: The main advantage of the *Groups – View* menu described here is the possibility of analyzing the status of a group and of the single messages contained therein. This menu only provides information but does not allow changing the properties of a single message, for instance to disable or enable a single message. For this purpose the *Single messages* menu must be invoked, the display of which is structured similar to the one described above.

Single messages

The *Single messages* menu refers to the message processing of the *Monitoring* module. It does not only serve to indicate basic information relating to single messages but also provides the possibility of disabling such messages via the operator panel of the device and editing limit values for single messages of the measurement monitoring.

In order to switch to the display of another single message you have to get into the edit mode (by pressing the Enter key) and select the name of the message you want to view from the appearing listing. Confirm your choice by pressing the Enter key again.

The *Single messages* display is basically identical with the display of the *Groups – View* menu described above.

The parameterized limit value is indicated as additional information in case of a message derived from measurement monitoring:

Limit

The *Limit* menu item indicates the currently set limit value of the limit monitoring or the maximum permissible change of a measurement within a parameterized monitoring period when monitoring gradients.

Limit, here: upper limit value.
Note: An additional hysteresis may have been parameterized with the parameterization program via a PC to avoid fluttering messages.

This dialog allows disabling single messages via the operator panel. You can also edit the limit value to be monitored in case of messages of the measurement monitoring directly at the device. The user locks, however, must be open for such actions to be carried out.

Disabled messages

The *Disabled messages* menu refers to the message processing of the *Monitoring* module. The corresponding display lists all currently disabled single messages. Additional information indicated on the display comprises the type of the message, the actual message status before the disabling, and possibly the counter for a monitored minimum pending time.

Pressing the Enter key opens the selection list containing all currently disabled messages.

The *Disabled messages* menu described here merely provides information. Please switch to the *Single messages* menu (see above) if you want to disable or enable a single message.

This is the last submenu of the *Monitoring* module:

Switches (for changing switch outputs and the revision status)

The *Switches* menu has two functions:

First, you can monitor and change the status of the revision switch in the corresponding display.

Off means that the gas quality measurement is not in the revision status. *On* means that the revision status is set (at the same time, hint H802 *Revision/Test Gas* is pending).

A revision status can only be changed if the locks are open.

The second function of the *Switches* menu is to display the states of the so-called *Switches*.

A switch is a message with a preset status (*on* or *off*). You can change the status of the switch manually, i.e. via the operator panel of the device. Messages of the *Switch* type can be routed to digital outputs (cf. Chapter 5.5.1) to trigger switching operations of any kind from the EnCal 3000 Controller.

Four switches are available (*Switch 1* to *Switch 4).* To change the status of a switch you need to invoke the *Switches* menu of the *Monitoring* module. It indicates the current switching status of each switch. Select the switch the status of which you want to edit and get into the edit mode. Select a different switch status and confirm via **OK**. Changing switch states is subject to the user locks.

Note: Message outputs can be parameterized in such a way that they invert the output signal during operation. Please consider that this setting also applies to the output of switches.

5.4 *Integrated RDT* Module

5.4.1 Function

The *Integrated RDT*) module implements the data connection between the EnCal 3000 Controller and a remote center. The center accesses the data traffic as a logical equal-access station via the integrated RDT during an established data connection. The data transmission is implemented according to the DSfG specification by means of a Class B DSfG interface.

If the device is equipped with a DSfG interface, further devices can be connected via this interface. If such a local DSfG bus exists, the connection to the center not only refers to the communication with the entities of the EnCal 3000 Controller but with the entire local DSfG bus traffic. With respect to data communications, the RDT integrated in the EnCal 3000 Controller thus completely replaces an independent DSfG RDT as other devices connected via DSfG can also use it.

The parameterization assigns an own bus address (EADR) to the internal *Center via RDT* entity.[13]

The data connection can use one of the following transmission media:

1) Public switched telephone network or GSM wireless network (hardware requirements: modem, COM2 interface)

2) serial direct connection (hardware requirements: null-modem cable, COM2 interface)

3) TCP (hardware requirements: computer network, TCP/IP interface)

Independent of the data transmission type, the data connection established by the integrated RDT offers multiple diagnostic and information gathering possibilities. For example, it is possible to poll archive data from a remote location.

The RDT, however, can also be parameterized in such a way that a special event (e.g. a gas quality measurement alarm) will trigger a call at the center. This works as follows: According to the DSfG specification, the entities generate *attention telegrams* in case of special events that are forwarded to all other stations in form of multi-address messages. You can define for each station separately that the center will be informed in case of particular generated telegram types[14].

Re 1) Data connection via modem and telephone line or GSM wireless network

The data connection usually uses either the public or the company telephone network. If a system is not connected to a public switched telephone network, a connection can be implemented via the GSM wireless network. An external modem is connected to the COM2 interface of the EnCal 3000 Controller for connection to the respective telephone network.

In order to check the access authorization of the center, the integrated RDT manages the bus identifier and password of the center (*Center identifier*). A login procedure is carried out during a call connection. If errors occur during this procedure, each side is authorized to interrupt the connection by 'hanging up' for in this case a faulty connection or an unauthorized access can be assumed.

The remote center is only linked via the integrated RDT during an established telephone connection. If the transmission of attention telegrams has been parameterized, the center will spontaneously be called and informed. For this, the integrated RDT has to know the center's telephone number.

It is also possible to synchronize the internal device time via the integrated RDT if a server reachable by telephone that provides the time via telephone in accordance with a defined protocol. Should you be interested, please consult Elster to clarify the usability of this functionality in your case.

---

[13] See Footnote 19, page 55.

[14] Please refer to Footnote 21, page 56 for the attention telegram types.

Re 2) Serial direct connection (null-modem cable)

In case of a serial direct connection the RDT assumes a continuous connection, i.e. a leased-line operation. The interface hardware is connected by a three-core null-modem cable; control lines are therefore not supported. The RDT is always online, so there is no connection set-up, no login procedure, and no connection tear-down. Telegrams to DSfG Class B can arrive at the RDT at any time and are processed there accordingly, i.e. they are answered by internal bus stations or routed to the local DSfG bus. Attention telegrams from local entities are spontaneously sent by the RDT via the leased line to the center directly after their creation.

This operating mode is thus intended for applications for which a continuously established serial direct connection is guaranteed.

Re 3) TCP (computer network)

The TCP connection type is intended for applications which use a TCP/IP network for the transmission of DSfG data. The easiest way is to imagine this operating mode without the modems and telephone network and with an IP network instead. Only the hardware is exchanged and telephone numbers are replaced by IP addresses. The connection is still a dial-up network (between any IP address of the network and the IP address of the RDT). Like in case of the telephone dial-up network the connection set-up can be initiated by the center or the local RDT.

In addition to the IP addresses of RDT and center, the values for the subnet mask and gateway usually used in the IP world and the port to be used for the transmission are special parameters of the TCP connection.

In case of this operating mode the preferred service for time synchronization would be NTP, which is a common network service.

A center that also supports DSfG queries via TCP/IP network is required for this operating mode; e.g. GW-Remote+.

The use of the TCP/IP network is advantageous for applications provided with a nearby IP network. The modem and telephone network can then be saved.

5.4.2 Display and Operation

Main Display (Integrated RDT Module)

The main display of the *Integrated RDT* module indicates the current status of the RDT.

```
Integrated RDT        16:17:54 S
                      10.09.2007

Mode:    TCP/IP connection
Status:  Transparency mode
since 00:01:13 TCP/IP connection
to 10.90.21.99 Port 1470
```

The *Mode* menu item indicates the current operating mode of the RDT (TCP/IP connection, dial modem analog, dial modem GSM, null modem). *Status* indicates the current RDT status:

Status	Explanation
RDT not in operation	The *RDT not in operation* status may have the following causes: 1. During start up it turned out that the TCP/IP interface is either not available or electrically defective. Additional message: *TCP/IP socket/module fault.* 2. Hardware error: wrong interface module. Additional message: *Module W3150 not recognized*.
TCP error (TCP/IP operation only)	During operation it turned out that the TCP/IP interface is electrically defective. Additional message: *TCP/IP socket/module fault.*
No modem (modem operation only)	The *No modem* status can have two causes: 1. No modem has been connected. 2. The modem initialization has failed. After some time the system will try to initialize the modem again, i.e. it changes to the *Modem initialization* status again (see below).
Modem initialization (modem operation only)	The RDT tries to initialize the modem directly after start-up. The RDT status changes to *Basic status* after successful initialization.
Basic status not connected	The integrated RDT is ready for operation but is currently not connected to the center.
Calling (modem operation only)	The integrated RDT calls the center. Additional information is provided on the number of call attempts and the phone number being called.
Call attempt (TCP/IP only)	The integrated RDT tries to establish a connection to the center.
Call connection	An external call comes in. The telephone connection is established. The modems are setting up the connecting protocol.
Identification phase (not in case of a null modem)	During the *Identification phase* the center and bus identifiers are exchanged and checked. The data connection via the modems has already been established. The operator is informed about when the telephone connection was established. Moreover, the telephone number of the station to which the connection has been established is indicated, provided the number is known. In case of a TCP/IP connection the display shows the host IP and the dynamically allocated port number instead.

Status	Explanation
Transparency mode	Connection set-up and login procedure have been completed successfully. Exchanging data is possible. The operator is informed about when the telephone connection was established. Moreover, the telephone number of the station to which the connection has been established is indicated, provided the number is known. In case of a TCP/IP connection the display shows the host IP and the dynamically allocated port number instead.
Call delay time (modem operation only)	The RDT has attempted to call the center, but the connection could not be established. Now the dialing is interrupted by a parameterized *Call delay time* before a new call will be initiated. The display also indicates which call delay time is currently pending and how long it will last.
Long-term block (modem operation only)	The maximum number of call attempts can be parameterized. If the connection has not been established yet after this number of call attempts was performed, the RDT is put into a *long-term block*. All attention telegrams are rejected as long as the long-term block lasts.
Time query calling (modem operation and telephone time query only)	The integrated RDT calls the phone number for the telephone retrieval of the time standard. Additional information is provided on the number of call attempts and the telephone number of the time server. This status only occurs if time synchronization by time query calling has been set in the parameterization of the RDT.
Time query synch. (modem operation and telephone time query only)	The connection to the parameterized phone number for the telephone time query has been established. The time is now being enquired. This status only occurs if time synchronization by time query calling has been set in the parameterization of the RDT.

Subordinate Menu Items (Integrated RDT Module)

History

The *History* display lists the last three completed center connections together with start time and duration.

RDT Statistics

The *RDT statistics* submenu is a tool for trouble shooting in case of recurring connection errors. The display provides an overview of the reason for and the number of failed connections, sorted following incoming and outgoing calls.
Scroll through the listing by means of the arrow keys.

Number of failed calls (here: incoming calls with login error)

The meaning of the display texts and counters is described below:

Text	Meaning
Incoming / outgoing calls without login start	Those calls are counted during which the following error has occurred: Both stations have established the connection logging. The login procedure, i.e. the checking of the access authorization by center and bus identifiers, has not started at all.
Incoming / outgoing calls with login error	Indicates the number of calls to which the following applies: The connection has been established via the stations, but the login procedure, i.e. the checking of the access authorization by center and bus identifiers, has failed.
Failed after redialing (only relevant in case of modem operation)	Counter for the occurred long-term blocks.
Incoming / outgoing calls without transparency mode	Those calls are counted during which the following event has occurred: The stations have established the connection logging and the login procedure has been completed successfully. However, no data was exchanged as the center did not switch into the transparency mode.

GSM (only if a wireless modem is connected)

The *GSM* display indicates whether a connection to the wireless network is currently established and, if so, it also indicates the measured data signal quality. The data signal quality is indicated as integer on a scale of 0 to 31 according to the convention of the modem manufacturers. The corresponding value is additionally indicated in dBm (see table below):

0	-113 dBm or less
1	-111 dBm
2-30	-109...-53 dBm
31	-51 dBm or more
99	unknown

The minimum data signal quality level depends on the type of the connected wireless modem. Please refer to the corresponding modem manual for further information.

Synchronization   (only if time synchronization is carried out via telephone time query)

A synchronization of the internal device time can also be carried out via the integrated RDT if a server is reachable by telephone that provides the time via telephone in accordance with a defined protocol. If this functionality is used, the *Synchronization* display contains additional information on the status of the time query.

The subordinate menu contains the following item: (only if time synchronization is carried out via telephone time query)

Synchronize now

With the menu item *synchronize now* the internal device time can be synchronized immediately. This is only possible if the synchronization status is *waiting for end of interval* or *dialing pause*. If the calibration switch is closed, it is impossible to start *synchronize now*.

5.5 *System* Module

5.5.1 Functions

The *System* module comprises all basic functionalities of the EnCal 3000 Controller.

Inputs (optional)

One such basic functionality of the *System* module is the processing of the input information and transfer of this information to other modules. The availability of input channels depends on the process board equipment of each individual device. Please refer to Chapter 7.2.2 for further information to the different input boards.

The *System* module's display offers a special menu for viewing the source as well as the raw and final values of an input signal (cf. Chapter 5.5.2). There is also an own diagnosis display for protocol input channels.

Outputs (optional)

The EnCal 3000 Controller normally does not contain any output boards.

However, there are several process boards that provide output channels available (cf. Chapter 7.2.2).

The EnCal 3000 Controller provides a special menu for viewing and checking outputs (cf. Chapter 5.5.2). Checking the outputs is only possible if the locks are open.

DSfG (optional)

DSfG is a digital interface especially developed for data communications between gas meters (such as *gas-net* devices). The EnCal 3000 Controller can be equipped with a DSfG interface as an option. The DSfG bus is connected via the connector labeled DSfG on the back of the device.

TCP/IP (optional)

The TCP/IP interface is used for integrating the device into a standard network installation (for data exchange via Modbus TCP or time synchronization via NTP).

Locks

The parameter listing of the EnCal 3000 Controller contains various parameters that are not subject to the calibration lock but protected against willful changes by an operational safety mechanism. This protection mechanism is called user or numerical lock. One lock of up to 6 digits can be defined for each of the two contract parties. These locks are opened and closed via the keypad (cf. Chapter 5.5.2). The device parameterization specifies the locks that shall be valid.

Set Clock / Synchronize Clock

If the calibration switch is open, a given time supplied by any source will always be accepted.

If the calibration switch is closed, the clock can only be set once within 24 hours and only within a fixed time frame. This time frame is ± 20 seconds. This restriction applies to all time sources, especially to the manual setting of the clock via the operator panel of the device.

The following external synchronization sources are available:

1) synchronization by telephone time query[15] (hardware requirements: COM2 interface and a connected modem)
2) synchronization via NTP (hardware requirements: TCP/IP interface, NTP server within the network)
3) synchronization via GPS (hardware requirements: free MSER2 interface and a GPS receiver in the station)
4) synchronization via DSfG protocol (hardware requirements: DSfG interface and a device in the DSfG bus system that is synchronized via one of the sources 1), 2) or 3))

If the time is adjusted by more than ± 20 seconds while the calibration switch is open, two warnings[16] will be generated.

If the time is synchronized outside the permissible time frame and the calibration switch is closed, the warning *W812 Clock synch. failed* will be generated.

5.5.2 Display and Operation

Main Display (System Module)

The main display of the *System* module shows basic device information.

The following details are indicated:

- device name with software version
- product version of the device software
- serial number of the relevant device
- check sum for software authentication (will be calculated after the display has been invoked)
- number of operating hours of the device
- supply voltage
- operating temperature
- IP address of the device (only if you use the TCP/IP module)

Subordinate Menu Items (System Module)

Device configuration

The *Device configuration* menu item offers the possibility of checking the assignments of all parameters protected by the calibration lock by module (cf. Chapter 4.4, page 17).

Inputs

The *Inputs* display makes it possible to view detailed information of message, pulse, current or resistance inputs.

After you have activated the *Inputs* menu item, the first channel of the input board will always be indicated at board location 1. The display indicates the following information:

---

[15] The usability of these procedures in dependence on local conditions has to be clarified in advance with Elster.

[16] According to the DSfG specification:

W810: Clock set old; W811: Clock set new

Name	Name of the input channel: serves to identify the channel and is parameterized
Board	Board location, board type, version number of board software
Channel	Channel number with operating mode
Phys. Value	The final value of the respective physical variable with physical unit
Input Value	In case of current inputs: current value in mA In case of resistance inputs: resistance in ohms In case of message inputs: contact closed / open In case of pulse inputs: frequency in Hz

To switch to the display of another channel get into the edit mode (by pressing the Enter key) and select the name of the desired input value from the appearing listing. After you have confirmed your choice by pressing the Enter key, the display of the selected board will be invoked.

Outputs

The *Outputs* system menu enables you to view the assignment and current status of the output channels, similar to the input channels' display. After you have activated the corresponding menu item, details of the first defined output channel will be presented:

Name	Name of the output channel: serves to identify the channel and is parameterized
Board	Board location, board type, version number of board software
Channel	Channel number with operating mode
Phys. Value	The final value of the respective physical variable with physical unit
Output Value	In case of analog values: value for the current output (in mA) calculated on the basis of the final value In case of messages: output contact closed / open In case of pulse outputs: frequency in Hz, number of pulses retained in the pulse buffer
Test Value	Only for output testing (see below)

Get into the edit mode by pressing the Enter key to switch to the display of another channel. A listing with the names of all parameterized output channels appears. After you have chosen the desired output channel and pressed the Enter key, the display of the selected channel will be invoked.

<u>Output testing</u>

In addition to just viewing the current process values you can also test the output channels. This means that you can output any current value between 0 and 20 mA via an analog output for testing purposes. You can set a message output to *Contact closed* or *open*, and you can have pulses being output via a pulse output for testing reasons. However, only one output can be switched into the test mode at the same time.

Proceed as described below:

1) Select the desired output channel, and press the Menu key afterwards.

2) Select the *Test on* submenu.

The *Test value* line is selected automatically. Press the Enter key to get into the edit mode. If you enter a new value now and confirm it by pressing the Enter key, this value will be output via the selected output.

In the activated test mode the *Test value* indicated in the last line is no longer crossed out. The *Output value* menu item indicates the output test value additionally.

3) To quit the test mode, press the Menu key again and confirm the *Test off* menu item.

Note: You can also quit the test mode by quitting the current display, for instance via *Back* or by selecting a different channel.

<u>Protocols</u>

When measurement and signal transmitters are connected via digital protocols, the *Protocols* display offers an overview of the most important protocol data, for example data on pressure and temperature sensors connected via HART protocol, on gas meters with encoder totalizer, and on ultrasonic gas meters via Q.Sonic or SICK protocol. The *Protocols* display also supplies the most important information on the synchronization of the internal time via GPS or NTP for diagnostic purposes.

Note: The *Protocols* display is not intended for host protocols being processed by the *Data Exchange* module; please refer to the corresponding module display for information on these protocols.

The following table shows the display structure in case of HART/encoder/Q.Sonic or SICK protocols:

Line	Legend	Content
3	Name:	Name of protocol channel
4	I/O:	Board / channel indication
		In case of HART protocol:
		Board / channel / HART address indication
		In brackets: Number of successful communication operations; counts continuously upwards when the communication is working.
		If an asterisk * appears between the board/channel indication and the number of successful communication operations, the data transmission is disturbed (this indication possibly considers a maximum number of admissible communication errors).
		For example: - Name of protocol channel - Protocol input via board 2 / channel 1; already 236 successful communication operations - Input value: flow rate When an asterisk appears here, the communication is disturbed. At the same time the counter for successful communication operations (in brackets) stops.
5	Depending on the protocol type:	
	Value:	measurement (in case of HART protocol)
	ENC:	encoder digit string and priority in digits/m3
	Q:	flow rate supplied via Q.Sonic protocol
	Vf / Vr / Vfs / Vrs:	SICK gas meter; transmitted totalizers: measuring volume undisturbed forwards (Vf), measuring volume undisturbed backwards (Vr), measuring volume disturbed forwards (Vfs), measuring volume disturbed backwards (Vrs)
		The shown value is only a valid current value if the data communication is not disturbed, i.e. there is no asterisk in the fourth line between the board/channel indication and the number of successful communication operations (see above).

All pieces of data shown in further lines are intended for diagnosis by experts; please refer to the documentations and specifications of the respective measuring instrument manufacturers or contact Elster.

The *Protocols* display is structured as shown below in case of time synchronization via GPS or NTP: :

Legend	Content
Current UTC:	Universal Time, Coordinated: derived from the latest synchronization via GPS and counted upwards based on the device time
Name / I/O or Socket	Name of the input channel to which the GPS receiver has been connected as well as board/channel indication
	Name of the TCP/IP socket used for time synchronization
Telegrams	Counter for incoming telegrams
Sync. Data	Status indication, *valid* in undisturbed conditions
Syncr.	Counter for successful synchronizations transferred to the *System* module
Last:	Device time of the last successful synchronization (considers time zone and daylight savings time adjustment)
Lat./Long./Decl.	Position specification (only in case of GPS)
Stratum	The stratum value is a measure for the number of computers to the time reference in the NTP hierarchy
Clk. Ident. Clk. Offset Rndtr. Delay	Only in case of time synchronization via NTP: Protocol-internal diagnostic information

DSfG (only in case of DSfG interface)

Activating the DSfG submenu invokes a display listing important DSfG settings as well as information on the status of the DSfG interface and on the bus activity.

Operating mode:

The *operating mode*[17] determines the transmission speed on the DSfG bus. Caution: If several devices are connected to the bus, you have to select the operating mode depending on the slowest station. If the bus communication does not work, the EnCal 3000 Controller may have been parameterized with a baud rate that is too high.

---

[17] All DSfG-capable *gas-net* devices support the following operating modes:

0	9600 baud
1	19200 baud
2	38400 baud
3	57600 baud
7	115200 baud

Own stations:

Own stations lists the bus addresses (EADRs[18]) of the EnCal 3000 Controller's internal entities[19].

Known stations:

Known stations indicates the EADRs of all bus stations currently known to the EnCal 3000 Controller. If a general polling[20] has not yet taken place or there is no local DSfG bus available, only the stations within the EnCal 3000 Controller can be known as being connected to the bus.

Bus activity: :

This line indicates the last activities on the bus. The last 32 activities can be shown, with the very last one always being indicated on the far right.

The abbreviations have the following meanings:

Upper case letters and special characters:

A,...,Z,Ä,Ö,Ü,∧,_

The EnCal 3000 Controller has received a telegram from this DSfG address.

Lower case letters and special characters:

a,...,z,ö,ö,ü,ß,■

The EnCal 3000 Controller has sent a telegram to this DSfG address.

Upper case letters highlighted in black:

B,F,H,I,L,M,P,W,Y,Z

The EnCal 3000 Controller has received an attention telegram of this type[21].

Lower case letters highlighted in black:

b,f,h,i,l,m,p,w,x,z

The EnCal 3000 Controller has sent an attention telegram of this type[21].

---

[18] *EADR* is the address by which a station identifies itself in the DSfG bus traffic. The upper case letters A to Z and some special characters are used as bus addresses. An unambiguous address assignment is required for a faultless data communication.

[19] According to DSfG terminology an *Entity* is an enclosed functionality within a device. One single entity is not necessarily identical with an enclosed device, as a device may contain different entities with their own DSfG bus addresses. A *gas-net* F1 flow computer for instance contains one or two *Correction* entity (-ies) (one per stream), one *Data logging* entity and additionally one *Center via RDT* entity if the integrated RDT is used.

[20] Each DSfG bus system must contain one station that controls the data communication. This station is called *Bus master* and has the EADR "_". *General polling* means addressing all permissible bus addresses to update the station list.

[21] Each DSfG telegram contains a character for the telegram type (TTY). The telegram type identifiers of the currently valid attention telegram types are the following:

Telegram type	TTY
Bus alarm	B
Freeze request	F
Hint	H
End of billing period	I
Alarm	L
New measurement	M
Parameter change	P
Warning	W
Make-specific meaning	Y
Timesynch telegram	Z

The DSfG menu contains the following subordinate menu item in master operation:

General polling

If one of the entities within the EnCal 3000 Controller is the bus master (the station with the EADR "_"), you can trigger a general polling via this menu item. If there is no master operation, the menu cannot be activated.

Locks

After you have activated the *Locks* menu item, a display is invoked indicating the current status of the user locks. The display is empty if no lock has been defined. New lock digits must always be defined by parameterization. .

The submenu contains the following items:

Open locks

This menu item is crossed out if all locks are open. If at least one lock is closed, you can activate the *Open locks* menu item by pressing the Enter key. A dialog will be invoked in which you can enter the numerical lock(s):
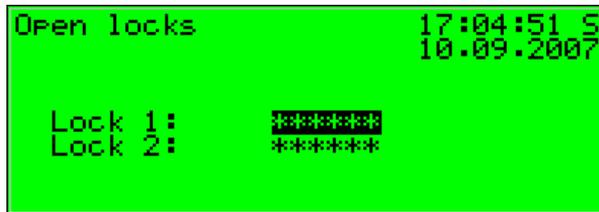
If only one lock has been defined, only one line appears here.

Select the lock you want to open in the first step. Get into the edit mode via the Enter key as usual and enter the lock's string of digits.

Confirm the code by pressing the Enter key. If the entered string of digits is incorrect, you cannot quit the edit mode via the Enter key. You have to correct the code first (or quit the menu via the rightward arrow key).

It is also possible to change the status of just one of two locks. Press the Menu key after you have successfully entered the numerical lock(s). Open the locks via *OK* or leave them closed by confirming *Cancel*.

Close locks

All defined locks are closed.

This menu item appears being crossed out and is thus not selectable if all locks are closed. If the calibration switch is open, all locks are automatically open, too, and cannot be closed.

Set clock

A free setting of the device time is only possible if the calibration switch is open. The *Set clock* menu item is therefore invisible if the calibration switch is closed.
The display of the *Set clock* menu looks as follows:

```
Set clock          16:21:22 S
                   10.09.2007

Time:      16:21:17
Date:      10.09.2007
Time zone: Summer time
```

You can re-enter time and date step by step via the numerical keypad in the edit mode, i.e. after you have pressed the Enter key.
The time zone menu item offers a selection list (*summer/winter time*) for you to choose the seasonal time zone as soon as you are in the edit mode.

It is also possible, however, to operate the device throughout the year without a seasonal time change. The seasonal time change can be prevented by parameterization. In such a case, the phrase ~~not used~~ appears next to *Time zone*, and you cannot get into the edit mode here.

After having set the time correctly, invoke the menu. Return to the main display without accepting the new time via *Cancel*. Accept the new time by confirming *OK*.

Synchronize clock

The *Synchronize clock* menu item is visible even if the calibration switch is closed. It is, however, protected by the user lock (numerical code). You can adjust the time once within 24 hours by up to ± 20 seconds via *Synchronize clock*. Enter the desired time adjustment in seconds (with a positive sign for setting the clock forwards and with a negative sign for setting the clock backwards). Afterwards, invoke the menu and confirm *OK*.
You cannot enter a synchronization time that is outside the permissible range in the *Synchronize clock* dialog. This way it is ensured that with the *Synchronize clock* menu item no *Clock synch. failed* alarm or warning can be triggered.
In principle, re-synchronizations are only allowed once within 24 hours if the calibration switch is closed, even when the adjustment is within the permissible range of ± 20 seconds. This regulation is independent of the synchronizing source (entry via operator panel, DSfG, telephone time query, NTP or GPS). Therefore, if synchronization has already been performed once within the ongoing 24-hour interval by any source, each further manual synchronization attempt will be rejected. The phrase *Clock synch. rejected* is then indicated in the bottom line of the display for about 10 seconds.
Even if the entered adjustment is permissible, it will not be accepted immediately. Setting the clock forwards will only be performed at the 2nd second of a minute whereas setting the clock backwards at the 57th second of a minute. That is why the setting will possibly not be carried out before the following minute starts. This prevents the generation of a minute change caused by *Synchronize clock*, which possibly triggers an archive entry. As long as the time adjustment has not been carried out yet, the bottom line of the display shows the phrase *Clock synch. delayed.* This message will be replaced by *Clock synch. executed* at the moment the adjustment starts.

Display test

You can check whether or not the display and the status LED function correctly by performing the display test After you have activated the *Display test* menu item, the pixels of the display are alternately switched on and off. At the same time the status LED shows all three colors after each other.
Finish the display test via *Back*.

5.6 *DSfG* Module, *Data Exchange* Module

The DSfG protocol is a digital data protocol that has been particularly developed for communication between gas meters in gas measuring and regulating stations. If the EnCal 3000 Controller is equipped with a DSfG interface, all important measurements and characteristics are provided via DSfG protocol. The contents of DSfG data elements can be internally queried and provided without a physical DSfG interface, too.

A PLC (programmable logic controller) is installed in many gas measuring and regulating stations. Its tasks are the closed- and open-loop control of the station and the telecontrol connection to a remote center.
A PLC usually uses digital communication protocols such as *3964R/RK512* (e.g. in case of Siemens S5/S7) or *Modbus-RTU* (e.g. in case of Cegelec Modicon).

In addition, there are non-DSfG-capable external meters that can be connected to the EnCal 3000 Controller and provide their measurements via MODBUS protocol, for example.

An interfacing of proprietary protocols or a conversion between DSfG and proprietary protocols is therefore often necessary in practice (gateway functionality).

These tasks are accomplished by the *DSfG* and *Data Exchange* modules of the EnCal 3000 Controller software.

As this rather complex functionality exists in several Elster device types, it is described by a separate documentation.

6 GW-GNET+

The parameterization of the EnCal 3000 Controller is performed with a PC and the GAS-WORKS software system like in case of all our devices.

All devices are parameterized with the same GAS-WORKS module called GW-GNET+[22].

The next two chapters explain in general terms how to create or edit a complete device parameterization using GW-GNET+ and how to export it to the device. It is rather easy to learn how to work with the parameterization program. As soon as you have mastered the techniques, you only need to know the meaning and effect of each adjustable parameter – no matter which device type is actually concerned. We therefore have enclosed a complete parameter list with additional information in the annex to this documentation.

For a detailed description of the parameterization program, please refer to the context-sensitive online help of GW-GNET+ which is activated by the F1 key. It describes other editing methods the parameterization program offers as well.[23]

Important Note: Parameters protected by the calibration lock can <u>only</u> be edited via a PC and <u>not</u> at the operator panel, even if the calibration switch is open.

The following brief description particularly refers to a parameterization changing parameters protected by the calibration lock.

6.1 Creating and Exporting a Parameter Data Record: Brief Description

To create a completely new device parameterization, proceed as follows:

1. Start GW-BASE from the Windows environment by double-clicking the lantern icon.

2. Invoke the GW-GNET+ module by clicking the **New – Create gas-net parameterization** tool in the toolbar. Alternatively, select the **Tools – New – Create gas-net parameterization** menu item from the main menu.

3. Answer the question regarding the standard parameterization with "No" (selected) first. Select the device type you want to parameterize in the appearing dialog and the version number of the device software in the next step. Choose the existing standard parameterization (e.g. "one stream" or "two streams") on which the new parameter data record shall be based in the following dialog.

   After you have confirmed your selection by clicking **OK,** the GW-GNET+ interface is activated.

4. The **Modules and Linkages** window contains each module included in the device software with its name and icon. Double-clicking the corresponding line activates a dialog listing all parameters that belong to the module concerned.

   Adjust the settings according to your requirements.

---

[22] Please refer to the GAS-WORKS CD-ROM, which is part of the delivery scope of each device of Elster, for further information on the GAS-WORKS program system with all the possibilities it provides. All GAS-WORKS components can be installed from this CD.

[23] It is possible to change the device parameterization or single parameters <u>via an established data connection</u> between the computer and the device. This is advantageous with respect to different situations: For instance, you can exchange operational parts of the parameterization in the GW-GNET+ **Edit parameterization** mode, even if the calibration switch is closed. In the **Change parameters** mode, parameters characterized as *online-changeable* can be edited without restarting the device.

Important Note:

When completing the parameterization, you have to pay attention to the consistency of the data record. Our devices are equipped with functional groups, or modules, that are largely independent of one another. In some cases modules provide other modules with the values to be processed. For this reason you have to ensure that the respective cross-references are correct each time you edit a parameter.

An example for such a linkage is the cross-reference in the *Integrated RDT* module to the channel to be used for the modem operation. This input channel is defined in the *System* module.

The type of an integrated RDT is first of all a characteristic of an input channel via which the remote data transmission shall be performed. It is thus parameterized in the *System* module under *Board assignment*. It is the serial interface in our example. The data of the serial interface must be transferred to the *Integrated RDT* module, however, for the module to be able to implement the remote data transmission. The *Integrated RDT* module must therefore know which interface it has to evaluate for the modem connection type. This is why we choose COM2 for the *use serial port* parameter in our example.

When creating a new parameterization with GW-GNET+, you are offered several standard parameterization options. These standard parameterizations are consistent and contain all necessary references. This, of course, also applies to the parameterization preset by the manufacturer before delivery.

If you delete or fundamentally change a parameterized input value being used in a different context, all linkages to this value become invalid and are automatically deleted by the parameterization program. You will receive a corresponding message indicating which linkages you have to set up again afterwards to render the parameterization consistent again.

For example: You want to change the connection type of the integrated RDT from *Modem* to *TCP* in the parameterization. For this, change the presence of the serial interface in the *System* module from *Yes* to *No* and the presence of the TCP/IP connection from *No* to *Yes*. The parameterization program tells you the following: *Module: Integrated RDT. Following linkage has been deleted: General parameters. Use serial port*. If you go to the *Integrated RDT* module now, you will see that the *use serial port* parameter is set to unassigned in the *General parameters* branch. Change the *Connection type* from *Modem* to *TCP* and choose the input channel of the TCP/IP connection under *use serial port*. The linkage to the RDT input channel is now assigned correctly.

The online help provides more detailed information.

5. Go through all modules in this way until all adjustments meet your requirements.

6. Select **File – Save as** and enter the file name under which the parameter data record shall be saved in GAS-WORKS. Close GW-GNET+; for instance via **File – Exit.**

7. The parameter data record is now in the worksheet of GW-BASE. Before exporting it to the device, you have to drag it into a suitable hierarchy of the GAS-WORKS data management[24].

8. Connect the DSS data interface at the device to a COM interface of the PC using a parameterization cable. Alternatively, you can also use a USB-to-serial converter cable to connect the parameterization cable.

9. Turn the calibration switch at the device to "open".

10. Mark the parameter data record and select the **Data – Export** menu item from the main or context menu of GAS-WORKS.

11. The communication program starts.
The window appearing on your screen shows the information **Data transfer into *gas-net* device**.
As soon as the transmission has been completed, the device will be re-started. The message **Data transfer into *gas-net* device** vanishes from the communication window, and the type plate of the connected *gas-net* device is indicated instead, stating the most important device data.
Close the communication program now.

---

[24] To drag a data record from the worksheet into a hierarchy, proceed as described below:

1. Mark the target hierarchy (which must possibly be created before).

2. Drag the data record with the mouse from the worksheet into the right half of the configuration window.

Alternatively, drag the data record directly to a folder in the hierarchy (on the left side of the configuration window).

Refer to the online help for more detailed information.

6.2   Importing and Editing a Parameterization: Brief Description

You can read out the current parameterization of an EnCal 3000 Controller via the data interface and edit it afterwards.

Import the parameterization as follows:

1. Connect the DSS data interface of the EnCal 3000 Controller and the COM interface of the PC using a parameterization cable. Alternatively, you can also use a USB-to-serial converter cable to connect the parameterization cable.

2. Start GAS-WORKS on your PC if you haven't done so before. Activate the communication program by clicking the **Import – Data interface** tool in the GW-BASE toolbar.

After having successfully started the communication program, you are connected to the device as regards data technology. The window appearing on your screen contains some important basic device information.

3. Switch to the **Content** tab.

4. Mark the **Parameterization** data record and click the lantern icon.
   A **Save as** dialog box appears asking for the file name under which the data record shall be saved in GAS-WORKS. After you have entered the name and confirmed your entry by clicking OK, the reading in of the data starts.

5. As soon as the reading in has been finished, close the communication program via the **File – Exit** main menu item.

The parameter data record is filed in the GAS-WORKS worksheet under the specified file name. Before starting GW-GNET+, you have to file this data record away in the hierarchy, as worksheet data records cannot be processed further.[25]

This is how to edit an existing parameter data record:

1. Mark the parameter data record in the configuration window of GW-BASE.

2. Select **Data – Edit** from the main or context menu.
   GW-GNET+ starts.

3. Edit the parameterization according to your requirements. Please observe the notes in Chapter 6.1, page 72.

4. Save your adjustments: By clicking **Save** you save the data record under its old name.
   If you select **Save As**, you can enter a new file name. The created data record is saved in the GW-BASE worksheet in this case and must be filed away in a suitable hierarchy.

5. Close GW-GNET+ and export the modified parameterization as described in Chapter 6.1, steps 8-11.

---

[25] For brief instructions cf. Footnote 24, page 60.

6.3 Extras: GW-GNET+ Service Programs

The GW-GNET+ program includes some additional service programs fulfilling different tasks relating to the devices. The range of available service programs depends on the device type.

	Change parameters	For changing individual parameters via the data interface during an established data connection to the device. **Note**: For instructions, please refer to the GW-GNET+ online help.
	Edit parameterization	For changing the parameterization during an established data connection to the device. Purely operational parts of the parameterization can be changed this way even if the calibration switch is closed. **Note:** Please refer to the GW-GNET+ online help for instructions.
	Totalizer setting	As this device type does not contain any totalizers, this help program has no function.
	Snapshot function	As this device type does not contain any totalizers, this help program has no function.
	Delete archives	Facilitates the deletion of archives of the *gas-net* device when the calibration switch is open.
	DSfG bus access	Starts GW-REMOTE+ via the data interface, if installed. Facilitates data access to all devices connected via DSfG; for instance, for reading out archive data and viewing current data.

These programs can only be activated if a data connection is established via the DSS data interface.
Proceed as usual:

1. Start GW-BASE on your PC.
2. Connect the DSS interface of the *gas-net* device to a COM interface of the PC using a parameterization cable. Alternatively, you can use a USB-to-serial converter cable to connect the parameterization cable.
3. Start the communication program by clicking the **Import – Data interface** tool in the GW-BASE toolbar. After the data connection to the device has been established, the type plate of the connected device appears on the screen.
4. Select the **Tools** tab. The appearing tab lists all available service programs.
5. Start the desired program by double-clicking.

The functional range of the service programs is manageable and practical. The operation is thus rather easy. A comprehensive online help is also available for each program. It can be activated via the **Help – Content** menu item or by pressing the **F1** key.

7 Installation

7.1 Mounting the EnCal 3000 Controller

The EnCal 3000 Controller device is designed for mounting in a 19"-cabinet and is available with mounting widths of 1/3 or 1/2. Please pay attention to a mounting depth of 170 mm (with connectors: approximately 220 mm) to guarantee the accessibility of the terminals on the back. We recommend mounting the device in a swing frame.

The EnCal 3000 Controller must be installed in an explosion-free installation area (electrical operating area) according to protection class IP 20.

7.2 Connecting the Lines

Ensure that the device is in de-energized conditions before connecting the transmitter, supply, signal and data lines.

Any modification of the wiring is only permitted if the supply is disconnected!

Connect the transmitter and signal lines to the EnCal 3000 Controller using plug-in screw terminals, each of which is located in a cable terminal box. Connect the power supply via fixed screw terminals. Data lines have to be connected to the corresponding SUB-DB9 connector housings.

Please pay special attention to intrinsically safe circuits. Before switching on the supply, make sure the connectors for the *Pressure* and *Temperature* inputs are plugged in as only then a thread measure of 50 mm can be guaranteed, which is required by the relevant guidelines. The connector for the connection of these sensor lines can be secured by official stickers or, alternatively, by a seal wire and a seal for the billing-relevant transfer.

Consider the relevant installation regulations when arranging the wiring. The lines must be tensile stress-free and must be provided with a bend protection if the device is mounted in a swing frame. Dimension the cable length in such a way that there is no tensile stress on the cable during the swinging of the swing frame.

We recommend conducting the lines coming from the transmitters on transfer terminals into a control cabinet and connecting them from there to the EnCal 3000 Controller. However, these terminals have to comply in part with the explosion protection regulations and must possibly also be sealable.

7.2.1 Power Supply and Earthing

Operate the EnCal 3000 Controller with a nominal voltage of 24 V DC.

The connection of 24 V is implemented via the terminals **+** and **−** on the back of the device and must be protected externally against short circuits with 1 A. The internal device protection is guaranteed by a self-resetting overcurrent protector.

Connect the protective earth to **PE** of the power supply socket for equipotential bonding.

7.2.2 Process Boards

The process board equipment of an EnCal 3000 Controller depends on the tasks the device is supposed to accomplish. Generally, the maximum number of boards depends on the mounting width of the device housing: Housings with a mounting width of 1/3 accommodate up to four process boards whereas housings with a mounting width of 1/2 mounting accommodate up to seven process boards.

Altogether, only up to four boards of the EXMFE5, EXDE6 and MSER2 types can be employed in the same device.

7.2.2.1 EXMFE5 Input Board

EXMFE5

Z1+
Z1-
Z2+
Z2-
Z3+
Z3-
I+
U+
U-
I-

P+
P-
SH

EXMFE5

CE 0158
BVS 05ATEX E019
II (2) G [EEx ib] II C
II /2) G

Important Note: The EXMFE5 input board is approved as an *associated electrical apparatus* of category *ib* according to DIN EN 50020 with intrinsically safe circuits. This is why sensors and signal transmitters located in hazardous areas (e.g. zone 1) can be connected to this board. A mixed operation of intrinsically safe and non-intrinsically safe circuits is <u>not</u> permissible for such an input board!

Intrinsically safe pulsers in NAMUR technique can be connected to the first three channels of an explosion-proof EXMFE5 input board. These channels can also be used as message input channels. You can also connect an encoder totalizer to the first input channel for digital transmission of original meter readings.
Connect the signals for channels 1 to 3 to terminals **Z1+, Z1-, Z2+, Z2-,** and **Z3+, Z3-**.

The inputs are intrinsically safe. Use shielded cables for a better interference suppression. The maximum cable length is 100 m at a cross section of 1.5 square mm. If the cables are longer, you have to ensure that the lines are installed separately from other conducting lines to avoid interferences.

Each EXMFE5 board also has one intrinsically safe temperature sensor input in 4-wire technique to be connected to terminals **I+, U+, U-** and **I-** according to the Pt100 specification.

The board is also equipped with an intrinsically safe input for measuring sensors (e.g. a pressure sensor) in 4 to 20 mA-two wire-technique (terminals **P+** and **P-**).

This fifth channel of the EXMFE4 input board can also be used for the parallel connection of up to 4 measuring sensors using a HART interface (multi-drop procedure)[26]. For the sensors, only the HART polling addresses from 1 to 4 are allowed; make sure that the address assignment is unambiguous and corresponds to the assignment in the parameterization of the *gas-net* device.

Important Note: In general, each modification of the wiring is only permitted after the supply has been disconnected. This means in particular in case of HART sensors that the HART polling addresses must be adjusted individually in the sensors *before* connecting them together to the corresponding input channel at the *gas-net* device in de-energized conditions. When the device starts up again afterwards, all connected HART sensors are polled once for the device to find out the current polling addresses.
If you changed the polling addresses later, the *gas-net* device could not identify the individual sensors correctly.

The device supplies the measuring sensors with power. For this, shielded cables must be used with the shielding being fitted only at the device but not at the sensor. If the cross section is 1.5 square mm, the cable should not be longer than 100 m; otherwise, it must be guaranteed that it is installed separately from other conducting lines to avoid interferences.
The cable shielding for all transmitter lines is placed on the **SH** terminal at the EXMFE5 input board.

---
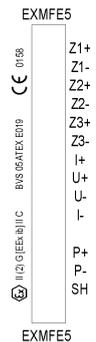
[26] Please consult Elster if you want to connect sensors via HART protocol and the cable is longer than 50 m.

7.2.2.2 MSER2 Serial Process Board

The MSER2 serial process board provides two interfaces supporting V24 (RS232) as well as RS422 and RS485. The table below shows the assignment of the individual pins:

Signal	Assignment
TXD	RS232: Transmitted data
RXD	RS232: Received data
RXB	RS422/RS485: Received data (B)
RXA	RS422/RS485: Received data (A)
TXB	RS422/RS485: Transmitted data (B)
TXA	RS422/RS485: Transmitted data (A)
SGD	Signal ground
SCH	Shield
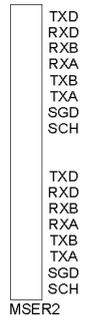
If the communication with the EnCal 3000 Gas Chromatograph is realized via Modbus serial (RTU or ASCII) over RS232 or RS485 the device contains a MSER2 board.

Other applications of a serial MSER2 channel are the connection of a host computer via RK512/3964R or MODBUS protocol or the connection of a GPS receiver for time synchronization.

Notes:
- When RS422 or RS485 is used, a terminating resistor of 120 ohms may be required in the receiver between RXB and RXA, depending on the cable length.
- In case of RS485, you have to externally connect RXB to TXB and RXA to TXA.
- Pay attention to the individual protocol specifications. For instance, there are protocols that render a connection via RS485 impossible (e.g. in case of RK512).

7.2.2.3   EXDE6 Input Board

Important note: The EXDE6 input board is approved as an *associated electrical apparatus* of category *ib* according to DIN EN 50020 with intrinsically safe circuits. This is why signal transmitters located in hazardous areas (e.g. zone 1) can be connected to this board. A mixed operation of intrinsically safe and non-intrinsically safe circuits is <u>not</u> permissible for such an input board!

The channels of an explosion-proof EXDE6 input board can be connected to intrinsically safe pulsers in NAMUR technique. They can also be used as message input channels, and it is possible to connect a transmitter for totalizers to the first one of these input channels for the digital transmission of original meter readings.

Connect the signals for channels 1 to 6 to terminals **Z1+, Z1-** to **Z6+, Z6-**.

The inputs are intrinsically safe. Use shielded cables for a better interference suppression. The maximum cable length is 100 m at a cross section of 1.5 square mm. If the cables are longer, you have to ensure that the lines are installed separately from other conducting lines to avoid interferences.

The cable shielding for all transmitter lines is placed on the **SH** terminal at the EXDE6 input board.
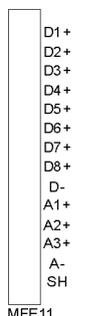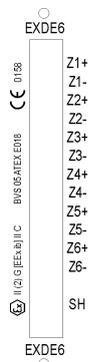
7.2.2.4 MFE11 Input Board

A multi-functional MFE11 input board is equipped with 8 digital message inputs 0/24 V DC; however, it is also possible to use these channels as pulse inputs with a maximum input frequency of 25 Hz. Connect the inputs at terminals **D1+** to **D8+** with the common ground **D-**.

In addition, the MFE11 input board provides 3 analog inputs for the connection of measuring sensors with 0/4 to 20 mA output signals. Connect the inputs via terminals **A1+** / **A2+** / **A3+** with the common ground **A-**.

The analog inputs of the MFE11 board are electrically isolated from the digital inputs. Besides, all channels are electrically isolated from the rest of the system. Connect the cable shielding for the inputs to the **SH** terminal.

7.2.2.5 AE12 Input Board

The AE12 input board offers 12 analog inputs for the connection of measuring sensors with 0/4 to 20 mA output signals. Connect the inputs via terminals **I1+** to **I12+** with the common ground **I-**. Connect the cable shielding to the **SH** terminal.

7.2.2.6 MFA8 Output Board

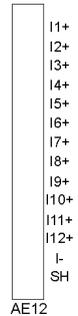A multi-functional MFA8 output board contains one PhotoMos output for the output of a message as break contact (**D1a**/**D1b**). In addition, there are three PhotoMos outputs for the output of additional messages or volume pulses (**D2+/D2-**, **D3+/D3-**, **D4+/D4-**). The output assignment can be parameterized as desired within a certain range.

The MFA8 output board also provides four analog outputs for the output of measurements. Current limits can be parameterized in a range of 0 to 20 mA. The corresponding terminals are marked **I1 to I4** with the common ground **I-**.

The message and pulse outputs are electrically isolated from each other and from the rest of the system; the analog outputs are electrically isolated from the rest of the system but not from each other.

Connect the cable shielding for the outputs to the **SH** terminal of the board.

The analog output assignment can be parameterized as desired.
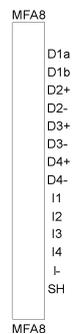
7.2.2.7 DA12 Output Board

The digital DA12 output board has 12 transistor outputs for the output of messages or volume pulses (to be connected to terminals **D1,…,D12** with the common reference point **COM**). Connect the cable shielding for the outputs to the **SH** terminal.

7.2.2.8 LMFA7 Output Board

The LMFA7 output board offers 3 digital outputs: one relay output (active break contact) for the output of a message and two transistor outputs for the output of messages or pulses. Connect the outputs via terminals **D1, D2, D3** with the common ground **DC**.

Furthermore, the LMFA7 board is equipped with four 0/4 to 20 mA analog outputs (terminals **I1, I2, I3, I4** with the common ground **I-**).

The terminals named **LA** and **LE** on top of the board are reserved for later expansions (LA = fiber-optics output, LE = fiber-optics input).

Connect the cable shielding to the **SH** terminal of the board.
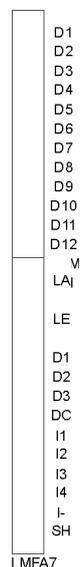
7.2.3 Further Connection Possibilities

7.2.3.1 DSS Serial Interface

The DSS serial interface in form of a SUB-DB 9 female connector on the front panel serves the connection of the EnCal 3000 to other devices, such as a PC. The technical data is stated in the annex. An interconnecting cable to the PC can be delivered as accessory. A standard COM connection (one-to-one connection) is not permissible.

7.2.3.2 DSfG Interface (optional)

The DSfG interface at the EnCal 3000 Controller is a SUB-DB 9 male connector located on the back of the device. Secure the connector with screws.

7.2.3.3 TCP/IP Interface (optional)

The TCP/IP interface is an RJ45 socket on the back of the device. It facilitates the communication via Ethernet with 10/100 MBit/s and thereby integrates the device in a standard network installation. In addition to time synchronization based on the NTP protocol, remote inquiries and the Modbus-TCP protocol for exchanging data with external devices are also possible via the TCP/IP interface.

The IP address, subnet mask and gateway address must be parameterized for an adequate integration in the existing network infrastructure. Pay attention to the fact that the IP address must be unambiguous in the subnet. Ask the network administrator for the subnet mask and gateway address.

The use of an STP CAT5 network cable (not transposed) is mandatory.

The pin assignment of the RJ45 socket corresponds to the general Ethernet standard.

The TCP/IP interface adjusts itself automatically to the network transmission rate.

7.2.3.4 COM2 Interface (optional)

The COM2 interface is a serial interface to RS232 and can be used as protocol interface for the connection of a host computer.

The corresponding pin assignment is as follows:

Pin No.	Signal	Signal Name	9-pin rectangular connector
1	DCD	Data Carrier Detect	--
2	RXD	Receive Data	for RK512/3964R and MODBUS
3	TXD	Transmit Data	for RK512/3964R and MODBUS
4	DTR	Data Terminal Ready	--
5	GND	Signal Ground	for RK512/3964R and MODBUS
6	DSR	Data Set Ready	--
7	RTS	Request to Send	--
8	CTS	Clear to Send	--
9	RI	Ring indicator	--
Shield	--	Chassis	Same potential as protective earth (ground)

If the functionality of the integrated RDT via modem or serial direct connection is used, connect the modem or the null-modem cable to the COM2 interface.

The connection of a <u>wireless modem</u> requires special attention and thus some preparations that must be accomplished before you can actually commission the device:

Provider Selection / Preparation for Antenna Selection

The first step is the selection of a suitable provider for the use of the wireless network, considering the area coverage and service rates. The provider's data service must use the RLP protocol for data backup. The converter (gateway) of the provider must offer an error protocol conversion according to MNP4 and V42, respectively.

In order to be able to select the correct antenna, check the data signal quality on site; for instance, check the field strength by means of a normal mobile phone.

Also check the installation possibilities for the antenna. Especially consider the characteristics of the building. An external installation is always preferable. Attention is to be paid to the station's environment. In case of stations located within built-up areas an antenna that can be protected against vandalism might be useful.

It is also important to measure the distance between the antenna and modem to be able to order an antenna cable with the required length.

Component Composition

As soon as you have finalized the contract with the provider you have to apply for the data service. Furthermore, make sure that the data service will be released by the scheduled commissioning date and that the chip card is available, too.

Select the antenna depending on the determined data signal quality and preferably after consultation with Elster.

The following specifications are guidelines:

Field Strength	Suitable Antenna
High	Omnidirectional dipole antenna with mounting base
Medium to low	Flat omnidirectional antenna, also for external mounting and for mounting on metal surfaces
Low	Directional antenna for pole mounting

The length of the antenna cable to be ordered depends on the distance between modem and antenna.

Commissioning the Wireless Modem

Have the PIN number at hand, if required.

After having installed the antenna, connect it to the modem using the antenna cable. The antenna must be aligned to the maximum receive level, except for the case that the antenna is an omnidirectional one.

Note: The further commissioning of the integrated RDT with wireless modem is described in Chapter 8.3 from page 84.

It is especially important for the further proceeding to enter the correct PIN number of the SIM card in the parameterization data record of the *gas-net* device.

Also observe the following notes on the correct power supply connection of a Siemens M20 or TC35 wireless modem:

Connection of the Siemens M20 / TC35 Wireless Modem to 24 V

Unfortunately, no generally valid color-coding details can be given for the connection of the M20 or TC35 wireless modem to 24 V DC. Due to the variety of different cables supplied, it is not possible to guarantee a uniform color coding.

Therefore, please proceed as follows: Position the Western plug of the connecting cable in such a way that the locking catch is at the front pointing upwards. Look at the clamped cable: There are 6 wires. The assignment of the wires from left to right can be seen from the illustration on the right. [27]

In this way it is also possible to assign the color coding correctly at the open end of the cable and to connect the power supply correctly.

Note: Wires 3 and 6 must <u>both</u> be connected to +24 V! These are monitoring and supply signals.

From left to right:
1: earth (ground)
2: unassigned
3: +24 V
4: unassigned
5: unassigned
6: +24 V

---
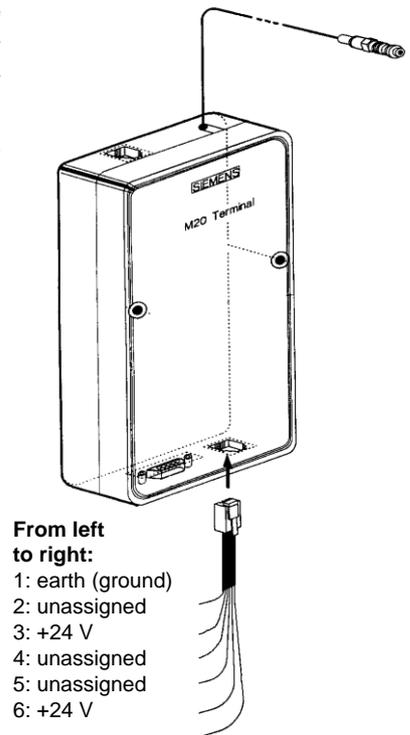
[27] The illustration shows a Siemens M20 wireless modem, but holds by analogy for the Siemens modem type TC35.

8 Commissioning

This chapter briefly describes the most important aspects of commissioning an EnCal 3000.

8.1 Parameter Protection against Unauthorized Access

The functionality of the EnCal 3000 Controller can be completely configured via a parameter data record. Unauthorized persons must therefore be prevented from changing these parameters. In order to guarantee this protection, the EnCal 3000 Controller is provided with a two-level security system consisting of the *Calibration lock* (official safeguarding) and the *Locks* (user locks, password protection).

8.1.1 Calibration Lock

The calibration lock physically consists of a sealable rotary switch on the front of the device. Open the calibration switch by turning it anticlockwise as far as it will go. For additional safeguarding, the device generates hint *H800: Calibration lock open* when the calibration switch is open.
Opening the calibration lock enables the operator to access all device parameters.

8.1.2 User Lock

The user lock consists of one (numerical) lock for each of the two contract parties and is implemented via the software. This means that the locks are defined by the device parameterization and opened or closed via the operator panel. Open locks allow the user to access specific parameters or actions that are editable directly at the device. All parameters being subject to the user locks can be modified when both locks are or the calibration switch is open.

8.2 Parameterization

Use a PC to create a complete parameterization or edit existing parameters (except for a few). Create the parameter data record using the GW-GNET+ parameterization software. The calibration switch has to be open during the import of a complete parameterization via the DSS data interface.

Note: Please refer to Chapter 6 for brief instructions on the parameterization by means of GW-GNET+. Please refer to the GW-NET+ online help for a comprehensive description of the parameterization program.

Operational parameters can also be changed by means of GW-GNET+ via the data interface, even if the calibration switch is closed. In case of password-protected parameters, however, the user locks must be open.

Checking the Settings

It is possible to check the complete set of parameter settings of *gas-net* devices by means of the GW-GNET+ parameterization program (cf. Chapter 4.4 for brief instructions). The billing-relevant parameters of the EnCal 3000 Controller are very important. They can be invoked at the operator panel to facilitate an effective supervision of the device configuration (cf. Chapter 4.4 for brief instructions on how to view the device configuration).

8.3 Commissioning the Integrated RDT

Parameterize the settings for the integrated RDT (together with all other parameters of the *gas-net* device) using the GAS-WORKS module GW-GNET+. Please pay attention to the consistency of the parameter data record.

Different procedures are necessary for commissioning the integrated RDT, depending on the operating mode (dial-up line, GSM wireless modem or TCP/IP network).

 Dial-up line   GSM wireless modem   TCP/IP network

Dial-up line:

1) Remove the DSfG connector on the back of the *gas-net* device if a local DSfG bus exists.

2) Connect the modem and COM2 interface at the *gas-net* device using the supplied V24 cable. Pull the telephone plug out of the TAE socket outlet.

3) Switch the supply voltage of the *gas-net* device off and on again.
   Switch to the basic display of the *Integrated RDT* module.
   The current status of the RDT is visible here. The device will try to initialize the modem directly after start-up.
   If the initialization fails, you will regularly receive *No modem* status messages between the individual initialization attempts. Check the modem settings of your parameterization in this case.
   Once the initialization has been successful, the status indication will change from *Modem initialization* to *Basic status.*

4) If there is a local DSfG bus, plug in the connector marked **DSfG** on the back of the *gas-net* device.
   Perform a general polling at the device representing the bus master, i.e. which contains the entity with the EADR "_".[28]
   Invoke the *DSfG* menu (*System* module) at the *gas-net* device, if this hasn't happened yet. You can view the station list here and compare it with the planned bus configuration.

5) Call your center and verbally announce the connection test. Switch the device off and immediately on again; this way you avoid the call delay times that may have been activated already and thus a waiting period. Then plug the cable into the TAE socket outlet.
   If a routing job has already been pending, the RDT establishes the connection to the center. If this is not the case, you have to trigger an event that induces the RDT to call first; for instance, an alarm in the *gas-net* device.
   The main menu of the *Integrated RDT* module indicates the RDT's status change. Once a data connection has been established and data has been exchanged, the **RX** and **TX** LEDs keep flashing irregularly on the back of the device.

6) After the connection to the center has been terminated successfully, check the telephone connection in the other direction. This means that the call has to originate in the center. The connection is implemented as described above. Afterwards, the center staff should release the telephone connection.

GSM Wireless Modem:

Important note: Before starting with the commissioning of the integrated RDT, make sure the accurate PIN number of the SIM card has been set in the parameterization of the *gas-net* device (*Integrated RDT* module) as you can only enter a wrong PIN twice. If you enter the wrong number a third time, the SIM card will be deactivated.

---

[28] If an entity of the *gas-net* device is the bus master, initiate the general polling via the operator panel at the device:

- Switch to the main display of the *System* module*.*
- Invoke the menu and select the subordinate menu item *DSfG*.
- Press the Menu key again and confirm the subordinate menu item *General polling.*

1) Remove the DSfG connector on the back of the *gas-net* device if a local DSfG bus exists.

2) Disconnect the wireless modem from the supply and pull the V24 cable off the EnCal 3000.
Check whether the V24 cable is plugged in the modem. Test the antenna installation (has the antenna been connected?).
Insert the chip card in the modem if you haven't done so yet.

3) Switch off the *gas-net* device and plug in the V24 cable at the **COM2** interface. Switch the GSM modem and *gas-net* device on again.

4) Change to the basic display of the *Integrated RDT* module. The current status of the RDT is visible here. The device will try to initialize the modem directly after start-up.
If the initialization fails, you will regularly receive *No modem* status messages between the individual initialization attempts. Check the modem settings of your parameterization in this case.
Once the initialization has been successful, the status indication will change from *Modem initialization* to *Basic status*.
If the status indication shows the text *RDT not in operation*, the SIM card could not be recognized (for instance, because the card is defective or the PIN has not been parameterized correctly). In such a case, the integrated RDT remains deactivated until the next start-up of the device will take place.

5) Check the modem's data signal quality via the *Integrated RDT – GSM* menu (cf. Chapter 5.4.2, page 58).

6) If there is a local DSfG bus, plug in the connector marked **DSfG** on the back of the *gas-net* device. Perform a general polling at the device representing the bus master, i.e. which contains the entity with the EADR "_".[29]
Invoke the *DSfG* menu[30] (*System* module) at the *gas-net* device. You can view the station list here and compare it with the planned bus configuration.

7) Call your center now and announce the connection test.

8) If a routing job has already been pending, the RDT establishes the connection to the center. If this is not the case, you have to trigger an event that induces the RDT to call first; for instance, an alarm in the *gas-net* device.
The main menu of the *Integrated RDT* module indicates the RDT's status change. Once a data connection has been established and data has been exchanged, the **RX** and **TX** LEDs keep flashing irregularly on the back of the device.

9) After the connection to the center has been terminated successfully, check the telephone connection in the other direction. This means that the call has to originate in the center. The connection is implemented as described above. Afterwards, the center staff should release the telephone connection.

---

[29] See Footnote 28, page 70

[30] Cf. Chapter 5.5.2

TCP/IP Network:

1) Remove the DSfG connector on the back of the *gas-net* device if a local DSfG bus exists.

2) Remove the network connector from the respective socket at the *gas-net* device.

   Switch to the main display of the *Integrated RDT* module.

   It shows the current status of the RDT. The device will try to initialize the integrated network module directly after start-up.

   If the initialization fails, you will regularly receive *Module error* status messages between the individual initialization attempts. Check whether your *gas-net* device is actually equipped with a network module.

   Once the initialization has been successful, the status indication will change from *Initialization* to *Basic status*.

3) If there is a local DSfG bus, plug in the connector labeled **DSfG** on the back of the *gas-net* device. Perform a general polling at the device representing the bus master, i.e. which contains the entity with the EADR "_".[31]

   Invoke the *DSfG* menu (*System* module) at the *gas-net* device if this has not happened yet. It is possible to view the station list here and compare it with the planned bus configuration.

4) Now plug the network connector in the corresponding socket at the *gas-net* device. Call your center and ask for the connection test. The center staff then has to establish a connection to the IP address of your RDT with their data polling tools (which must support DSfG connections via network) and check the data polling. Once the connection has been successful, the main menu of the *Integrated RDT* module indicates the status change of the RDT. Afterwards, the center staff should release the telephone connection.

5) After the connection has been successfully established by the center, the network connection has possibly to be checked in the other direction afterwards. This step has only to be taken if DSfG-related events shall spontaneously be signaled to another center via the network. This center must be able to receive DSfG calls via network. In this case the RDT wants to establish the connection. To initiate such a connection request, you have to trigger an event first that induces the RDT to call; e.g. an alarm in the *gas-net* device. The connection will then be established as described above.

---

[31] See Footnote 28, page 70

9 Maintenance

The EnCal 3000 Controller does not require much maintenance.

9.1 Battery Replacement

The device battery mainly runs down when the device is switched off. The battery consumption can be neglected as long as the device is switched on.

The battery should therefore be replaced after 5 years when in the meantime the device has been switched off for a longer period of time. Otherwise it is sufficient to replace the battery after 10 years at the latest.

If the battery must be replaced, it should only be replaced by a service engineer or trained expert for safety reasons.

For a replacement, it is necesarry to open the housing of the gas-net device.

Proceed as described below:

- A battery of the following type is required: lithium 3V CR ½ AA.

- Save the device parameterization by reading it out with GAS-WORKS, to be on the safe side. Read out the archives, too.

- Disconnect the supply voltage.

- Loosen the 4 fixing screws on the back of the device.

- Slightly withdraw the mounting rail.

  Attention: The boards are sensitive! Avoid any contact with other components!

- The battery compartment is (seen from behind) on the board located back at the top on the far right side. Detach the cover strap of the battery compartment with a screwdriver. Remove the old battery. Now you have 15 minutes for replacing the battery. During these 15 minutes a capacitor guarantees a data backup. Insert the new battery.
  Note: When inserting the battery, pay attention to the correct polarity: The positive pole (+) must point downwards! A wrong polarity will not be noticed at first, but during the next power failure lasting more than 15 minutes the device data will be lost!

- Re-assemble the device and connect the supply voltage.

10 Technical Data: EnCal 3000 Controller

Device Type

Electronic gas quality measurement device as display for the EnCal 3000 Gas Chromatograph with integrated data logging function. Each EnCal 3000 Controller can process one or two gas streams. If the EnCal 3000 Controller takes on the active role within the Modbus communication with the EnCal 3000 Gas Chromatograph, you can also use it to perform manual calibrations or test gas runs. As an option the EnCal 3000 Controller provides a hydrocarbon dew point calculation derived from the ISO 23874 standard and based on a C9+ analysis of the EnCal 3000 Gas Chromatograph.

Housing

Plug-in unit in 19" design, 3 height units, 1/3 or 1/2 mounting width for swing frame mounting
The mounting depth is about 170 mm without connectors and about 220 mm with connectors.
The process interfacing is on the back; the operator panel is on the front.

Power Supply

24 V DC +/- 20 %; power input: up to 12 W. As an option: 230 V AC via external power supply

Operation

16 input keys (12 for numerical entry and 4 for navigation) and one calibration switch. Easy-to-learn operation via invokable menus. The GAS-WORKS program system provides a remote control function via the DSS data interface or possibly via modem and COM2 or TCP/IP computer network.

Display

Illuminated LCD; 8 lines with 32 characters each; status LED for the indication of mains/alarm/warning.

Board Array

The board array depends on the tasks of the device and type of the input signals. The maximum number of boards depends on the housing size: Housings with a 1/3 mounting width accommodate up to four process boards whereas housings with a 1/2 mounting width accommodate up to seven process boards.
The following board types are currently available:

EXMFE5 input board:

- Three pulse or message inputs [EEx ib] IIC. When being used as pulse inputs, the board is suitable for the connection of LF and HF pulsers similar to DIN 19234 for gas meters, with max. 5 kHz; automatic level adaptation by channel. The first channel is also suitable for connecting an encoder totalizer.

- Temperature sensor input for a PT100 in 4-wire technique; [EEx ib] IIC; the maximum measuring error is ± 0.05 % of the measurement in a range of -10 to +60°C and at an ambient temperature of 0 to 40°C.

- Measuring sensor input 4 to 20 mA; [EEx ib] IIC; the maximum measuring error is ± 0.05 % of the measurement in a range of 4 to 20 mA and at an ambient temperature of 0 to 40°C.
  This channel can alternatively be used for the connection of up to 4 measuring sensors with HART interfaces (multi-drop).

EXDE6 input board:

- Six pulse or message inputs [EEx ib] IIC. When being used as pulse inputs, the board is suitable for connecting NF and HF pulsers similar to DIN 19234 for gas meters, with max. 5 kHz; automatic level adaptation per channel. The first channel is also suitable for connecting an encoder totalizer.

MSER2 process board:

- Two serial interfaces for one protocol channel each.

- Each interface can be configured to RS232, RS485 or RS422 by a suitable assignment of the interface terminals.

- Implemented protocols: Modbus RTU, Modbus ASCII, Siemens 3964R, Q.Sonic ultrasonic gas meter protocol of Elster. Furthermore, it is possible to connect a FLOWSIC ultrasonic gas meter of SICK/MAIHAK or a GPS receiver for time synchronization.

MFE11 input board:

- Eight digital inputs that can be used as message inputs 0/24V DC or pulse inputs with a maximum input frequency of 20 Hz.

- Three measurement inputs 0/4 to 20 mA; the maximum measuring error is ± 0.1 % of the measurement in a range of 0 to 20 mA and at an ambient temperature of 0 to 40°C.

AE12 input board:

- Twelve analog inputs (0/4 to 20 mA).

MFA8 output board:

- One PhotoMos output (break contact, max. 28.8 V 120 mA).

- Three PhotoMos outputs (max. 28.8 V DC 120 mA) for messages or pulses of max. 25 Hz.

- Four analog outputs 0/4 to 20 mA for measurements; max. load impedance: 300 ohms. The error is ± 0.1 % of the output value in a range of 4 to 20 mA and at an ambient temperature of 0 to 40°C.

DA12 output board:

- Twelve transistor outputs (max. 28.8 V DC 150 mA) for messages or pulses of max. 25 Hz.

LMFA7 output board:

- One relay output (break contact, max. 28.8 V 120 mA).

- Two transistor outputs (max. 28.8 V DC 90 mA) for messages or pulses of max. 25 Hz.

- Four analog outputs 0/4 to 20mA.

Other Interfaces

DSS data interface for the connection to the COM interface of a PC (for parameterization when commissioning and for archive polling).

Optional COM2 interface (serial interface to RS232C): Intended for connecting a modem with a maximum transmission rate to V.34 bis (33600 baud) and data compression to V.42 or NMP5 when the integrated RDT is used. An integrated RDT is also possible via a serial direct connection (null-modem cable at COM2).
Alternatively, the COM2 interface can be used as protocol channel for connecting a host computer.

Optional TCP/IP interface in form of an RJ45 socket; facilitates data communication via Ethernet with 10/100 MBit/s and thereby integrates the device in a standard network installation. In addition to time synchronization based on the NTP protocol, remote inquiries and the Modbus-TCP protocol for exchanging data with external devices are also possible via the TCP/IP interface.

Optional DSfG interface for data transmission between *gas-net* devices. Correction and data logging archives pollable via DSfG.

11 Annex

11.1 Error Listing of the Gas Quality Module

The following listing describes all error messages that can appear on the error listing(s) of the gas quality measurement(s). The reaction of the device to gas quality-relevant errors is also explained.

The error classification follows the *DVGW-Arbeitsblatt G485* (DVGW G485 technical rule) and thus complies with the DSfG specification. The letter in front of the error number classifies the priority level of the error: **A** stands for alarm, **H** for hint, and **W** for warning.

A407 Re-start performed

The *Re-start performed* alarm is always generated during the first start-up of the EnCal 3000 Controller after a software update.
If this alarm occurs during normal operation, however, a software problem has occurred in the device. A faultless operation of the device is no longer guaranteed in this case.

A409 Power failure

The EnCal 3000 Controller generates the *Power failure* alarm in case of a mains failure. It is pending until the device starts up again after the mains has returned. During this time the incoming analysis information (from the GC) is not evaluated.

A423 Interface monitoring

If the *Interface monitoring* alarm is pending, the device software is not able to recognize an interface or board. This happens, for example, if a board is defective. A faultless operation of the device is no longer guaranteed.

A604 Timeout

The A604 alarm is generated if the data communication between the EnCal 3000 Controller and the gas chromatograph is disturbed for more than 10 seconds. This can be caused, among others, by a power failure or failure of the gas chromatograph.

A647 GQM disturbed

The *GQM disturbed* alarm signals a general gas quality measurement problem. It is generated if the parameterized alarm limits for
- a component
- the superior heating value
- the density
- or the estimated sum   have been violated.
(See EnCal 3000 Gas Chromatograph - Software Manual, Chapter 4.7 Definition of Alarms).

H760 GQM calibrates

The *GQM calibrates* hint is generated if the calibration of the EnCal 3000 Gas Chromatograph starts (automatically or manually). The hint ends as soon as the calibration is finished.

H800 Calibration lock open

An opening of the calibration switch is marked by hint H800.
Only if the calibration switch is open, it is possible to

- change all parameters, i.e. also the billing-relevant parameters, online with a PC and the GAS-WORKS software or to export them to the EnCal 3000 Controller as new parameterization
- access the parameters or actions disabled by the user locks
- perform a basic calibration

This is why the calibration switch should always be closed during normal operation.

H801 User lock open

The *User lock* consists of one numerical lock for each of the two contract parties. The locks are optional and defined via the device parameterization. They are opened and closed via a special operator panel menu. The *User lock open* hint is generated if all defined locks are open.

Open locks facilitate an access to special parameters or actions (e.g. starting a calibration or a test gas run), either via the operator panel of the device or by means of GAS-WORKS via the data interface.

H802 Revision/Test Gas

If a revision switch is set at the device, the device reacts as follows:

The *Revision/Test Gas* hint is generated. From this moment, all archive entries in the *Hourly mean* archive receive a *Revision* mark.

The revision switch is a software tool and is opened either automatically when starting a test gas run or manually via the operator panel of the device.

H810 Clock set old

H811 Clock set new

Each time the internal device time is adjusted by more than 20 seconds two hints are generated. These two hints show together with the corresponding time marks by how much time the clock has been adjusted.

W812 Clock Synch. failed

The setting of the internal device time is only possible within a range of $\pm$ 20 seconds if the calibration switch is closed – and only once within 24 hours.

In case of a synchronization attempt outside the permissible time range with the calibration switch being closed, warning W812 will be generated.

H2000 Modbus error

Hint H2000 is generated directly after the start-up of the EnCal 3000 Controller if an error has occurred in the parameterization of the Modbus communication. For instance, the selected Modbus version (RTU or ASCII) must be the same in the parameterization of the controller and in the Modbus set-up of the gas chromatograph (cf. EnCal 3000 Gas Chromatograph - Software Manual, Chapter 4.8 Configuration of Modbus Table).
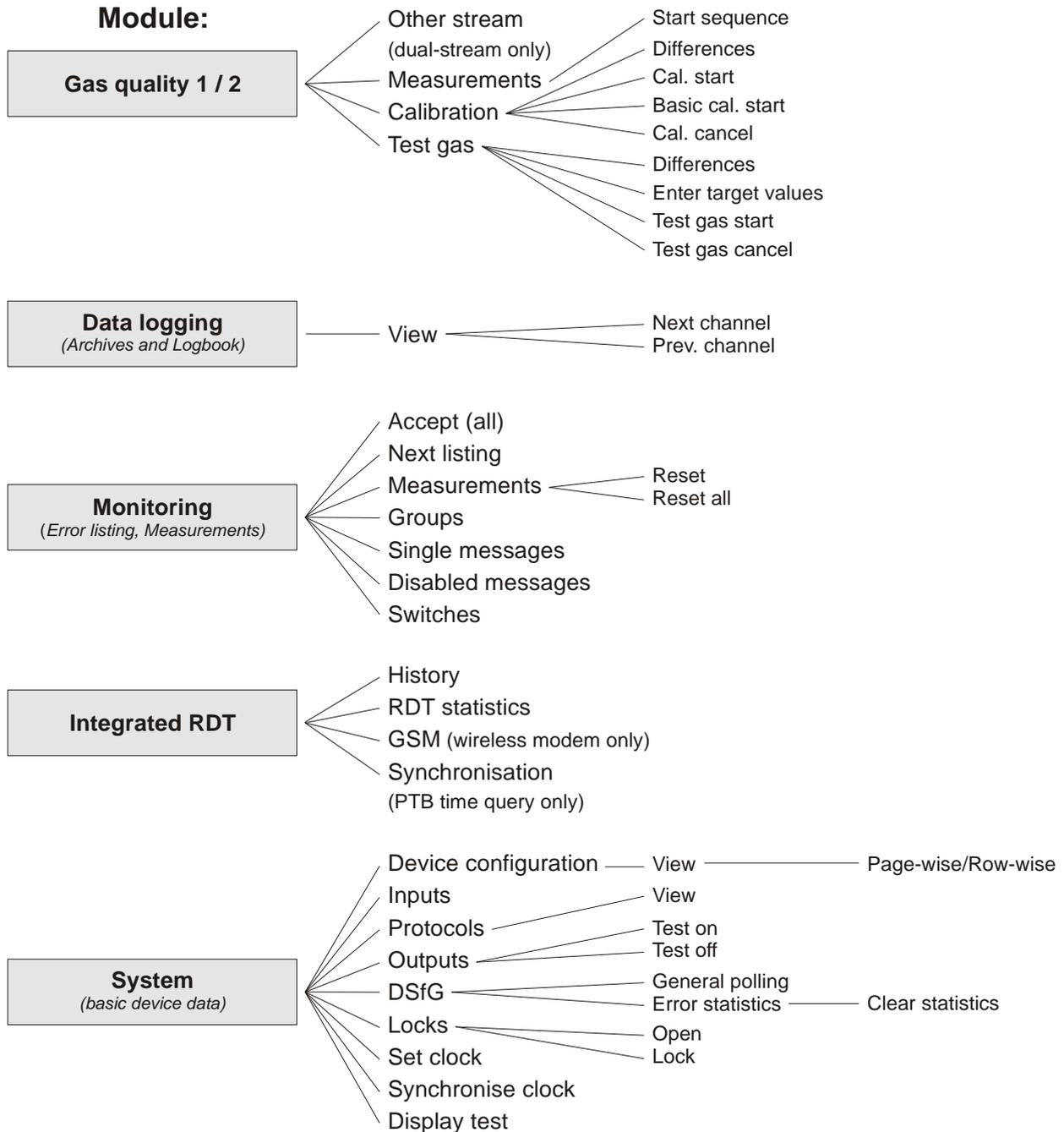
H2001 Modbus extent error

Hint H2001 is generated directly after the start-up of the EnCal 3000 Controller if an error has occurred in the parameterization of the Modbus registers in the Modbus set-up of the gas chromatograph (cf. EnCal 3000 Gas Chromatograph - Software Manual, Chapter 4.8 Configuration of Modbus Table).

11.2 Menu Structure of the EnCal 3000 Controller

Within the main display of a module, you may open the listing of the subordinate menu items by pressing the menu button ▣. By pressing the button ▣ again, the menu with the listing of all available modules is opened.

Module:

Gas quality 1 / 2	— Other stream (dual-stream only)
	— Measurements
	— Calibration — Start sequence
	— Differences
	— Cal. start
	— Basic cal. start
	— Cal. cancel
	— Test gas — Differences
	— Enter target values
	— Test gas start
	— Test gas cancel

| Data logging (*Archives and Logbook*) | — View — Next channel |
| | — Prev. channel |

Monitoring (*Error listing, Measurements*)	— Accept (all)
	— Next listing
	— Measurements — Reset
	— Reset all
	— Groups
	— Single messages
	— Disabled messages
	— Switches

Integrated RDT	— History
	— RDT statistics
	— GSM (wireless modem only)
	— Synchronisation (PTB time query only)

System (*basic device data*)	— Device configuration — View — Page-wise/Row-wise
	— Inputs — View
	— Protocols — Test on
	— Outputs — Test off
	— DSfG — General polling
	— Error statistics — Clear statistics
	— Locks — Open
	— Set clock — Lock
	— Synchronise clock
	— Display test

Menu items for functionalities that are not parameterised are not displayed.

Following modules are not listed in the menu overview shown above:
- **DSfG**(**-Requester**) and **Data exchange** (**Host communication**) for the gateway functionality
  (this display is meant for diagnosis by experts only)

EC Declaration of Conformity

Manufacturer: Elster-Instromet Systems GmbH

Address: Schlossstraße 95a, D-44357 Dortmund

Product family: *gas-net Series II, device names Z0, Z1, M1, F1, C1, C2, D1, EnCal3000*

The described product is in conformity with the provisions of the following European directive:

Council Directive 89/336/EC of 3 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility

The conformity of the described product for usage in domestic and industrial environment to the provisions of above directive is proven by complete conformity to the following harmonised European standards:

- **EN 61000-6-3:2005** (interference emmission)
- **EN 61000-6-2:2001** (interference immunity)

If the product provides process-cards for connecting electrical equipment residing in potentially explosive atmospheres, the product additionally is in conformity with the provisions of the European directive

Council Directive 94/9/EC Equipment and protective systems intended for use in potentially explosive atmospheres.

This is proven by complete conformity to the following harmonised European standards:

- **EN 50014:1997 +A1+A2** (general requirements)
- **EN 50020:2002** (intrinsic safety)

This declaration certifies the conformity of the product to the mentioned directives. However, it does not imply any assurance of properties. The safety and installation instructions given in the attached product documentation must be observed.

Dortmund, 20.08.2006

Dr.-Ing. Dieter Stirnberg
(Geschäftsführung)
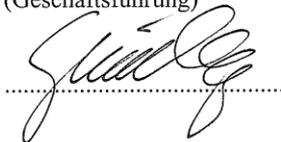
Dipl.-Ing. Ulrich Ewerlin
(Hardware-Entwicklung)

konferkl_gasnet_2e.doc   09.2006   EIS / UE
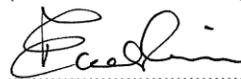
11.4 ATEX Certificate EXMFE5

EX

EXAM
BBG Prüf- und Zertifizier GmbH

(1)

EC Type Examination Certificate

(2)

- Council Directive 94/9/EC -
Protective devices and systems intended for use
in potentially explosive atmospheres

(3)

BVS 05 ATEX E 019

(4) **Device:** **Process Board Type EXMFE5**

(5) **Manufacturer:** **FLOW COMP Systemtechnik GmbH**

(6) **Address:** **D – 44357 Dortmund**

(7) This device type and its various permissible versions are specified in the appendix to this Type Examination Certificate.

(8) The EXAM BBG Prüf- und Zertifizier GmbH certification body, notified body no. 0158 in accordance with Article 9 of the European Parliament and Council Directive 94/9/EC of 23 March 1994, certifies that this device has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of protective devices and systems intended for use in potentially explosive atmospheres according to Annex II to the Directive.
The test results are recorded in the test report BVS PP 05.2005 EC.

(9) The compliance of the device with the Essential Health and Safety Requirements has been assured by compliance with

EN 50014:1997 + A1 – A2   General Requirements
EN 50020:2002   Intrinsic Safety 'i'

(10) If the character "X" is placed after the certificate number, it indicates that the device is subject to special requirements for safe use as referenced in the appendix to this certificate.

(11) This EC type examination certificate refers only to the design and construction of the specified device in accordance with Council Directive 94/9/EC.
Further requirements of this Directive, which are not covered by this certificate, apply to the manufacture and supply of this device.

(12) The marking of the device shall include the following details:

Ex II (2)G [EEx ib] IIC

EXAM BBG Prüf- und Zertifizier GmbH
Bochum, 31 January 2005

_____   _____
Certification Body   Head of Unit

Page 1 of 3 of BVS 05 ATEX E 019
This certificate may only be circulated without alteration.
Dinnendahlstrasse 9 44809 Bochum   Tel. +49 (201) 172 3947   Fax +49 (201) 172 3948

EXAM
BBG Prüf- und Zertifizier GmbH

(13)   Appendix to

(14)   # EC Type Examination Certificate

                              ## BVS 05 ATEX E 019

(15)   15.1 Object and Type

              Process Board Type EXMFE5

              15.2 Description
              The process board that will be installed outside potentially explosive atmospheres serves as power supply and for processing the signals of up to five sensors being installed in potentially explosive atmospheres.

              15.3 Characteristics

              15.3.1   Non-intrinsically safe supply and signal circuits (connector ST1)

Nominal voltage		DC	24	V
Maximum voltage	U_m	AC	250	V

              15.3.2   Intrinsically safe output circuits (terminal strip connections)
              15.3.2.1 Channel 1 (terminals Z1+, Z1-)
                       Channel 2 (terminals Z2+, Z2-)
                       Channel 3 (terminals Z3+, Z3-)
                       Values per circuit

Voltage	U_o	DC	8.6	V
Current	I_o		14.9	mA
Power	P_o		32	mW
Linear output characteristic				
Max. external inductivity	L_o		10	mH
Max. external capacitance	C_o		0.5	μF

              15.3.2.2 Channel 4 (terminals I+, I-, U+, U-)

Voltage	U_o	DC	5.9	V
Current	I_o		14.4	mA
Power	P_o		21	mW
Linear output characteristic				
Max. external inductivity	L_o		10	mH
Max. external capacitance	C_o		0.5	μF

              15.3.2.3 Channel 5 (terminals P+, P-)

Voltage	U_o	DC	21	V
Current	I_o		73.9	mA
Power	P_o		388	mW
Linear output characteristic				
Max. external inductivity	L_o		5	mH
Max. external capacitance	C_o		0.18	μF

              15.3.3   Ambient temperature range T_a -20°C to +70°C

Page 2 of 3 of BVS 05 ATEX E 019
This certificate may only be circulated without alteration.
Dinnendahlstrasse 9   44809 Bochum   Tel. +49 (201) 172 3947   Fax +49 (201) 172 3948

EXAM
BBG Prüf- und Zertifizier GmbH

(16) <u>Test report</u>
BVS PP 05.2005 EC, as of 31 January 2005

(17) <u>Special conditions for safe use</u>
None

Page 3 of 3 of BVS 05 ATEX E 019
This certificate may only be circulated without alteration.
Dinnendahlstrasse 9   44809 Bochum   Tel. +49 (201) 172 3947   Fax +49 (201) 172 3948

(1) # EG-Baumusterprüfbescheinigung

(2) ## - Richtlinie 94/9/EG -
Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung
in explosionsgefährdeten Bereichen

(3) ## BVS 05 ATEX E 019

(4) **Gerät:** Prozesskarte Typ EXMFE5

(5) **Hersteller:** FLOW COMP Systemtechnik GmbH

(6) **Anschrift:** D 44357 Dortmund

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Baumusterprüfbescheinigung festgelegt.

(8) Die Zertifizierungsstelle der EXAM BBG Prüf- und Zertifizier GmbH, benannte Stelle Nr. 0158 gemäß Artikel 9 der Richtlinie 94/9/EG des Europäischen Parlaments und des Rates vom 23. März 1994, bescheinigt, dass das Gerät die grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie erfüllt.
Die Ergebnisse der Prüfung sind in dem Prüfprotokoll BVS PP 05.2005 EG niedergelegt.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

EN 50014:1997 + A1 – A2 Allgemeine Bestimmungen
EN 50020:2002   Eigensicherheit 'i'

(10) Falls das Zeichen „X" hinter der Bescheinigungsnummer steht, wird in der Anlage zu dieser Bescheinigung auf besondere Bedingungen für die sichere Anwendung des Gerätes hingewiesen.

(11) Diese EG-Baumusterprüfbescheinigung bezieht sich nur auf die Konzeption und die Baumusterprüfung des beschriebenen Gerätes in Übereinstimmung mit der Richtlinie 94/9/EG.
Für Herstellung und in Verkehr bringen des Gerätes sind weitere Anforderungen der Richtlinie zu erfüllen, die nicht durch diese Bescheinigung abgedeckt sind.

(12) Die Kennzeichnung des Gerätes muss die folgenden Angaben enthalten:

⟨Ex⟩ II (2)G [EEx ib] IIC

EXAM BBG Prüf- und Zertifizier GmbH
Bochum, den 31. Januar 2005

_____   _____
Zertifizierungsstelle   Fachbereich

Seite 1 von 3 zu BVS 05 ATEX E 019
Dieses Zertifikat darf nur unverändert weiterverbreitet werden.
Dinnendahlstraße 9   44809 Bochum   Telefon 0201/172-3947   Telefax 0201/172-3948

EXAM

BBG Prüf- und Zertifizier GmbH

(13)   Anlage zur

(14)   **EG-Baumusterprüfbescheinigung**

BVS 05 ATEX E 019

(15)   15.1 Gegenstand und Typ

Prozesskarte Typ EXMFE5

15.2 Beschreibung
Die Prozesskarte, die außerhalb des explosionsgefährdeten Bereiches errichtet wird, dient zur Energieversorgung
und Verarbeitung der Signale von bis zu fünf Sensoren, die im explosionsgefährdeten Bereich installiert sind.

15.3 Kenngrößen

15.3.1	nicht-eigensichere Versorgungs- und Signalstromkreise (Stecker ST1)				
	Nennspannung		DC	24	V
	max. Spannung	Um	AC	250	V

15.3.2   eigensichere Ausgangsstromkreise (Anschl. Stiftleiste)

15.3.2.1	Kanal 1 (Anschl. Z1+ , Z1-)				
	Kanal 2 (Anschl. Z2+ , Z2-)				
	Kanal 3 (Anschl. Z3+ , Z3-)				
	Werte je Kreis				
	Spannung	U_o	DC	8,6	V
	Stromstärke	I_o		14,9	mA
	Leistung	P_o		32	mW
	linearere Ausgangskennlinie				
	max. äußere Induktivität	L_o		10	mH
	max. äußere Kapazität	C_o		0,5	µF

15.3.2.2	Kanal 4 (Anschl. I+ , I- , U+ , U-)				
	Spannung	U_o	DC	5,9	V
	Stromstärke	I_o		14,4	mA
	Leistung	P_o		21	mW
	linearere Ausgangskennlinie				
	max. äußere Induktivität	L_o		10	mH
	max. äußere Kapazität	C_o		0,5	µF

15.3.2.3	Kanal 5 (Anschl. P+ , P-)				
	Spannung	U_o	DC	21	V
	Stromstärke	I_o		73,9	mA
	Leistung	P_o		388	mW
	linearere Ausgangskennlinie				
	max. äußere Induktivität	L_o		5	mH
	max. äußere Kapazität	C_o		0,18	µF

15.3.3	Umgebungstemperaturbereich	T_a	-20 °C bis +70 °C	

Seite 2 von 3 zu BVS 05 ATEX E 019
Dieses Zertifikat darf nur unverändert weiterverbreitet werden.
Dinnendahlstraße 9   44809 Bochum   Telefon 0201/172-3947   Telefax 0201/172-3948

EXAM
BBG Prüf- und Zertifizier GmbH

(16) Prüfprotokoll
      BVS PP 05.2005 EG, Stand 31.01.2005

(17) Besondere Bedingungen für die sichere Anwendung
      Entfällt

Seite 3 von 3 zu BVS 05 ATEX E 019
Dieses Zertifikat darf nur unverändert weiterverbreitet werden.
Dinnendahlstraße 9   44809 Bochum   Telefon 0201/172-3947   Telefax 0201/172-3948

11.5 ATEX Certificate EXDE6

EX

EXAM
BBG Prüf- und Zertifizier GmbH

(1) # EC Type Examination Certificate

(2) **- Council Directive 94/9/EC -**
Protective devices and systems intended for use
in potentially explosive atmospheres

(3) ## BVS 05 ATEX E 018

(4) **Device:** **Process Board Type EXDE6**

(5) **Manufacturer:** **FLOW COMP Systemtechnik GmbH**

(6) **Address:** **D – 44357 Dortmund**

(7) This device type and its various permissible versions are specified in the appendix to this Type Examination Certificate.

(8) The EXAM BBG Prüf- und Zertifizier GmbH certification body, notified body no. 0158 in accordance with Article 9 of the European Parliament and Council Directive 94/9/EC of 23 March 1994, certifies that this device has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of protective devices and systems intended for use in potentially explosive atmospheres according to Annex II to the Directive.
The test results are recorded in the test report BVS PP 05.2004 EC.

(9) The compliance of the device with the Essential Health and Safety Requirements has been assured by compliance with

EN 50014:1997 + A1 – A2   General Requirements
EN 50020:2002   Intrinsic Safety 'i'

(10) If the character "X" is placed after the certificate number, it indicates that the device is subject to special requirements for safe use as referenced in the appendix to this certificate.

(11) This EC type examination certificate refers only to the design and construction of the specified device in accordance with Council Directive 94/9/EC.
Further requirements of this Directive, which are not covered by this certificate, apply to the manufacture and supply of this device.

(12) The marking of the device shall include the following details:

Ex II (2)G [EEx ib] IIC

EXAM BBG Prüf- und Zertifizier GmbH
Bochum, 31 January 2005

_____   _____
Certification Body   Head of Unit

Page 1 of 2 of BVS 05 ATEX E 018
This certificate may only be circulated without alteration.
Dinnendahlstrasse 9   44809 Bochum   Tel. +49 (201) 172 3947   Fax +49 (201) 172 3948

EXAM
BBG Prüf- und Zertifizier GmbH

(13)   Appendix to

(14)   **EC Type Examination Certificate**

BVS 05 ATEX E 018

(15)   15.1 Object and Type

Process Board Type EXDE6

15.2 Description

The process board that will be installed outside potentially explosive atmospheres serves as power supply and for processing the signals of up to six sensors being installed in potentially explosive atmospheres.

15.3 Characteristics

15.3.1   Non-intrinsically safe supply and signal circuits (connector ST1)

Nominal voltage			DC	24	V
Maximum voltage	Um		AC	250	V

15.3.2   Intrinsically safe output circuits (terminal strip connections)
Channel 1 (terminals Z1+, Z1-)
Channel 2 (terminals Z2+, Z2-)
Channel 3 (terminals Z3+, Z3-)
Channel 4 (terminals Z4+, Z4-)
Channel 5 (terminals Z5+, Z5-)
Channel 6 (terminals Z6+, Z6-)
Values per circuit

Voltage	U_o	DC	9.6	V
Current	I_o		9.8	mA
Power	P_o		24	mW

Linear output characteristic

Max. external inductivity	L_o	10	mH
Max. external capacitance	C_o	0.5	µF

15.3.3   Ambient temperature range T_a -20°C to +70°C

(16)   Test report
BVS PP 05.2004 EC, as of 31 January 2005

(17)   Special conditions for safe use
None

Page 2 of 2 of BVS 05 ATEX E 018
This certificate may only be circulated without alteration.
Dinnendahlstrasse 9   44809 Bochum   Tel. +49 (201) 172 3947   Fax +49 (201) 172 3948

EXAM
BBG Prüf- und Zertifizier GmbH

(1) # EG-Baumusterprüfbescheinigung

(2) ### - Richtlinie 94/9/EG -
Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung
in explosionsgefährdeten Bereichen

(3) ## BVS 05 ATEX E 018

(4) **Gerät:** Prozesskarte Typ EXDE6

(5) **Hersteller:** FLOW COMP Systemtechnik GmbH

(6) **Anschrift:** D - 44357 Dortmund

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Baumusterprüfbescheinigung festgelegt.

(8) Die Zertifizierungsstelle der EXAM BBG Prüf- und Zertifizier GmbH, benannte Stelle Nr. 0158 gemäß Artikel 9 der Richtlinie 94/9/EG des Europäischen Parlaments und des Rates vom 23. März 1994, bescheinigt, dass das Gerät die grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie erfüllt.
Die Ergebnisse der Prüfung sind in dem Prüfprotokoll BVS PP 05.2004 EG niedergelegt.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

EN 50014:1997 + A1 – A2 Allgemeine Bestimmungen
EN 50020:2002 Eigensicherheit 'i'

(10) Falls das Zeichen „X" hinter der Bescheinigungsnummer steht, wird in der Anlage zu dieser Bescheinigung auf besondere Bedingungen für die sichere Anwendung des Gerätes hingewiesen.

(11) Diese EG-Baumusterprüfbescheinigung bezieht sich nur auf die Konzeption und die Baumusterprüfung des beschriebenen Gerätes in Übereinstimmung mit der Richtlinie 94/9/EG.
Für Herstellung und in Verkehr bringen des Gerätes sind weitere Anforderungen der Richtlinie zu erfüllen, die nicht durch diese Bescheinigung abgedeckt sind.

(12) Die Kennzeichnung des Gerätes muss die folgenden Angaben enthalten:

II (2)G [EEx ib] IIC

EXAM BBG Prüf- und Zertifizier GmbH
Bochum, den 31. Januar 2005

_____
Zertifizierungsstelle

_____
Fachbereich

Seite 1 von 2 zu BVS 05 ATEX E 018
Dieses Zertifikat darf nur unverändert weiterverbreitet werden.
Dinnendahlstraße 9   44809 Bochum   Telefon 0201/172-3947   Telefax 0201/172-3948

EXAM
BBG Prüf- und Zertifizier GmbH

(13)   Anlage zur

(14)   **EG-Baumusterprüfbescheinigung**

BVS 05 ATEX E 018

(15)   15.1 Gegenstand und Typ

Prozesskarte Typ EXDE6

15.2 Beschreibung
Die Prozesskarte, die außerhalb des explosionsgefährdeten Bereiches errichtet wird, dient zur Energieversorgung und Verarbeitung der Signale von bis zu sechs Sensoren, die im explosionsgefährdeten Bereich installiert sind.

15.3 Kenngrößen
15.3.1   nicht-eigensichere Versorgungs- und Signalstromkreise (Stecker ST1)

Nennspannung			DC 24	V
max. Spannung	U_m		AC 250	V

15.3.2   eigensichere Ausgangsstromkreise (Anschl. Stiftleiste)
Kanal 1 (Anschl. Z1+ , Z1-)
Kanal 2 (Anschl. Z2+ , Z2-)
Kanal 3 (Anschl. Z3+ , Z3-)
Kanal 4 (Anschl. Z4+ , Z4-)
Kanal 5 (Anschl. Z5+ , Z5-)
Kanal 6 (Anschl. Z6+ , Z6-)
Werte je Kreis

Spannung	U_o		DC 9,6	V
Stromstärke	I_o		9,8	mA
Leistung	P_o		24	mW
linearere Ausgangskennlinie				
max. äußere Induktivität	L_o		10	mH
max. äußere Kapazität	C_o		0,5	µF

15.3.3   Umgebungstemperaturbereich T_a -20 °C bis +70 °C

(16)   Prüfprotokoll
BVS PP 05.2004 EG, Stand 31.01.2005

(17)   Besondere Bedingungen für die sichere Anwendung
Entfällt

Seite 2 von 2 zu BVS 05 ATEX E 018
Dieses Zertifikat darf nur unverändert weiterverbreitet werden.
Dinnendahlstraße 9   44809 Bochum   Telefon 0201/172-3947   Telefax 0201/172-3948

12 Bibliography

- ISO 12213-3 / ISO 12213-3: Natural gas – Calculation of compression factor

- DIN EN 50014, DIN EN 50020 and DIN EN 50029

- DIN 19 235: Measurement and control; signalling of operating conditions

13 Index

Locks 8, 83

Closing 68

Function 61

Opening 68

View status 68

M

Main display

Data logging 41

Gas quality 22

general 8

Integrated RDT 58

Monitoring 50

Main signaller 48

Maintenance 87

Measurement archives 49

Measurement failures

Fall-back strategy 22

Measurements 24, 44, 51

Resetting 52

Menu structure 95

Message processing 44

MFA8 78

MFE11 78

Minimum pending time 45

seconds counter 53

Modem 56

Module 4

Monitoring 43

Monitoring module

Display and operation 50

Function 43

MSER2 77

M-switch 47

N

Nachrichtentyp 67

New message 52

No acceptance required 46, 47

Null modem 57

O

Operating 7

Operation

Dual-stream 15, 22

Ordinal number 41

Other stream 24

Switch display 15, 24

Output board

DA12 78

LMFA7 78

MFA8 78

Outputs 61

Testing 64

View 63

P

Parameterization *See also* GW-GNET+ Online Help

Parameterization

Check settings 18

Parameterization 71

Parameterization

Short description 71

Parameterization

Creating 71

Parameterization

Exporting 72

Parameterization

Importing 73

Parameterization

Editing 73

Parameterization 83

Pin assignment

COM2 79

Power supply 75

Pressure sensor input

Connection 76

Primer 15

Process value archives 49

Freezing 49

Protocols

Display 64

Purging 36

R

RDT

Null modem 57

via modem or GSM 56