GAS CHROMATOGRAPH ENCAL 3000 PROCHAIN GC

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1. About this Document and Device delivery

1.1. Aim / Scope

The following document informs about the worldwide applicable Honeywell ® **EnCal 3000 proChain GC** hereinafter called short **proChain GC.** It is a compact gas chromatograph from the enCore instrument series and measures components in a gaseous sample in quantitative terms and is designed for operation in many potentially explosive atmospheres. To do so the instrument uses the configuration and analysis software **enSuite** with the corresponding application-related functionalities. (For further software details see chapter 3 Software).

The instrument covers a wide operating temperature range, this allows the fully automatic instrument to be placed close to the gas sample tap or sample conditioning system. One of its main applications is the analysis of natural gas and gas mixtures like natural gas to determine the heating value.

🔆	Please note that only the software and hardware versions mentioned on the cover page are described here.

This document is intended for trained personnel in the gas industry or process measuring sector. It explains the basic functions of this gas chromatograph and describes the installation, commissioning, operation, use and maintenance.

In addition to the general specialist knowledge, this document enables safe and efficient use of the **proChain GC**. Make sure that you have a good knowledge of the documentation language to understand all the information or use another translation of this document. The safety and warning instructions on the device are in English or French.

⚠	**Depending on the area of activity, trained personnel are assumed to have various basic skills; the pertinent details are contained in the relevant sections. The definitions used in this document are listed in section 1.1.2 Symbols abbreviations and definitions.**

Compliance with all the safety information and instructions set out in this information is a requirement for safe working practice and correct handling of the device and for correct measurement and calculation results.

Furthermore, the directives, standards, local accident prevention regulations and general safety regulations which apply to the field of application of the device, must be obeyed.

If you have any questions, any points in this information for general use are unclear or you require repair work, Honeywell's Technical Support will be delighted to help. Contact data can be found at the start of this document.

1.1.1. How to use this document

It is essential that you read through this information in full before starting work to ensure that you have a thorough understanding of the measuring system. Compliance with the information and rules given here will ensure the functions of the device, deliver reliable measurement results, extend the service life of the device and save you service and spare parts costs.

	Safety and warning information (generally shown as in this example) must be read and obeyed in all circumstances. A lack of warning signs or information does not release you from your personal responsibility for safety.

The document is divided into two main chapters:

The first chapter deals with the **hardware**. It contains the explosion-relevant information as well as a summary of relevant safety and warning notices. In addition to general expertise, it enables the **proChain GC** to be handled safely and efficiently.

The second chapter (**software**) is addressed to measurement operator's and explains the basic functions of the measuring instrument and how to operate the **proChain GC** in detail. In accordance with Honeywell's "**Safety first**" principle, it contains a summary of relevant safety and warning notices, too.

	Navigation information for experienced users and operators The modular, standard design of our devices means that some of the sections in this document can be skipped. To gain knowledge in the various fields, for example, operation, it is also enough simply to read the appropriate section. Select the topics based on the table of contents or the keyword index.

The illustrations and figures are designed to provide a visual depiction of the topics covered. They may differ slightly from the actual design.

If you wish to use the **proChain GC** together with devices from other manufacturers or third-party equipment, you must ensure that these are suitable components. These components will have their own operating manuals which also must be followed. Honeywell recommends that all technical documentation is always kept to hand in the system.

1.1.2. Symbols abbreviations and definitions

The safety and warning information in this document and on the device, is designed to help use the measurement device correctly. Essentially the same symbols are used both on the device and in the documents to ensure clarity.

A comparison with other Honeywell documentation will highlight the alternative symbol (if there is one). Texts which are preceded by a sign of this type must be followed to the letter.

The signs, symbols and terminology are defined in the following. To ensure greater differentiation between gas and electrical lines, the term **"cable"** is always used in this documentation for electrical lines.

General safety rules and expertise in conduct in plants and in dealing with gas are assumed to be known and are therefore not reproduced here in full.

Icons / symbols	Meaning
Attention ATTENTION NOTE	**Attention indicates information that is safety-relevant and important for the function. Failure to do so may result in damage to health, the environment, property, injury or death. The information given must be observed under all circumstances.**
CAUTION Explosion	**indicates that death and/or injury to persons can occur and additional significant damage to plant, equipment, and environment may arise if proper precautions are not taken.**
CAUTION Health impairment	**means that severe personal injury or damage to health can occur if proper precautions are not taken. Death is also possible**.
STOP *Prohibited action*	means that you may not perform or execute the following, unless the required terms and conditions are met, and you are qualified to carry out the relevant work.
Device symbol	Important information in the Operating Instructions: this symbol on the device reminds you to consider all matters that are mentioned in this document.

Icons / symbols	Meaning
Device symbol	In the interest of our environment, it is not permitted to dispose of the device with household waste within the EU! The symbol is a reminder. in accordance with the European WEEE directive.
$U = 24V$ Device symbol	Power supply of the device with 24 volts direct current.
Device symbol	This symbol on the device designates the equipotential bonding connection (PA) or the terminal for the electrical connection to the equipotential bonding system and earth.
Device symbol	This symbol on the device designates the connection for the functional earth (FE).
TIP / NOTE	Identifies useful information about a topic but does not apply to the safety.
	Message and signal identification (alarm / warning / note) in enSuite (see also the online help for more information).
	When the Security Switch (SSW) is closed, (official) parameters marked with this symbol in enSuite cannot be changed.
	Parameters marked with this symbol in enSuite can be changed even if the SSW is closed, if the change log is not full.

Short form	Description
°C	Temperature (Celsius) = $T_C = T_K - 273,15 = {}^5/_9 (T_F - 32)$
°F	Temperature (Fahrenheit) = $T_F = 1,8\,T_C + 32 = 1,8\,T_K - 459,67$
AFB	Application function block (enSuite)
AMR	Advanced meter reading
ATEX	Atmosphère explosible (French for explosive atmospheres)
AWG	American Wire Gauge
bar	Pressure (Europ. unit) 1 bar = 0.1 MPa = 14.504 psi
BTU	British thermal unit 1 BTU = 0.0010543503 MJ
C_2H_6	Ethane
C_3H_8	Propane
C_6H_{14}	Hexane
C_7H_{16}	Total heptane
C_8H_{18}	Total octane
CAL	Calibration gas inlet
CEC	Canadian Electrical Code
CH	Total of all hydrocarbons
CH_4	Methane
cm	Length 1 cm = 10 mm = 0.3937 in = 0.3937"
CO_2	Carbon dioxide
CPU	Central processing unit
CSA	(Canadian Standards Association) independent standards organization
d / rd	Relative density (density ratio of fuel and air)
DBB	Double block-and-bleed (valve block technology)
DC	Direct current
DHCP	Dynamic Host Configuration Protocol
DIN	Deutsches Institut für Normung e. V. (German Institute for Standardization)
DNS	Domain Name System
DST	daylight saving time
EMC	Electromagnetic compatibility
EN	European standard
EN/IEC 60079-14	Standard on explosive atmospheres
EPC	Electronic pressure control

Short form	Description
F	Farad = 1/ Daraf = S–1
FE	Functional earth / functional ground
ft · lb / ftlb	Pound-foot 1 ft · lb = 1 ftlb = 1.355817948 Nm
GC	Gas chromatograph
GCM	Gas chromatography module
GF	Gas family
gr	Grains 1gr = 64.79891 mg
Hi/HiM/HiV	Net heating value/Lower heating value/Inferior calorific value (molar/based on mass/based on volume)
Hs/HsM/HsV	Gross heating value/Higher heating value/Superior calorific value (molar/based on mass/based on volume)
Hz	Frequency
iC_4H_{10}	Isobutane (i-butane)
iC_5H_{12}	Isopentane (i-pentane)
ID	Identification number (enSuite), for example gas cylinder number
IECEx:	(IECEx SYSTEM) International explosion-protection (Ex) rating
in or ″	length in inch (1 ″) 1 in = 1 ″ = 0.0254 m = 25.4 mm
IP	Internet protocol / Protection class
ISO	International Organization for Standardization
K	Temperature (Kelvin) = T_K = 5/9 (T_F + 459.67) = T_C + 273.15 (Δ 1K = Δ 1°C)
kg	Kilogram 1kg = 2.204623lb.
l	Liter 1l = 0.001m³ = 0.0353 cft= 0.0353 cu ft
lb	Pound 1lb = 0.4535923kg
LED	Light emitting diode
log	Logbook
m	Mass
M (Mm)	Molar mass (of the mixture)
m or mm	Length in SI unit (meter) 1 m = 1000 mm = 3.280840 ft = 39.37008 in (or ″)
m³	Cubic meter 1m³= 1000 l = 35.3147 cft = 35.3147 cu ft
MEMS	Micro-electro-mechanical system
mg	Milligram 1 mg = 0.0154323584 gr
MJ	Megajoule 1MJ = 948.45138280892 BTU
MLC	Multi-level calibration (done by manufacturer)

Short form	Description
MMS	Manufacturing Messaging Specification
MPa	Megapascal (pressure) 1 MPa = 10 bar = 145.04 psi
MPag	Gauge pressure in megapascals
MZ (MN)	Methane number
N	Newton Force (SI unit) $1N=1kg \cdot m \cdot s^{-2}$ = 0.224809 lbf
N_2	Nitrogen (gas component)
NC	Switch/output which is closed when de-energized (NC contact)
nC_4H_{10}	n-butane
nC_5H_{12}	n-pentane
nC_6H_{14}	n-hexane (C_6+)
NEC	National Electrical Code (USA)
neo-C_5H_{12}	Neopentane (2,2-Dimethylpropane)
NIST	US National Institute of Standards and Technology
Nm	Torque 1 Nm = 0.7375621494575465 ft lb
NO	Switch/output which is open when de-energized (NO contact)
NPT	National Pipe Thread (self-sealing (pipe) thread)
NTP	Network Time Protocol (Standard for clock synchronization in computers)
O_2	Oxygen
P1-11K	Calibration gas mixture, see 1.3.1 About this Document and Device delivery
PA	Equipotential bonding connection
PC	Personal computer
PELV	Protective extra-low voltage
PG	Process gas/Measuring gas
PGC	Process gas chromatograph
PO	Product Owner = Prod. responsible person
ppm	Parts per million
Pressure (g)	Overpressure (g = gauge)
psi	Pressure (pound per square inch) 1psi = 0.068948 bar = 0.0068948 MPa
Rho	Density at base conditions
RS485	Interface standard for cable-based differential serial data transfer
S	Daraf = 1/ Farad = F−1
SAV	Safety shut-off valve

Short form	Description
SELV	Safety extra-low voltage
SFB	System function block (enSuite)
sft³/scft	Standard cubic foot 1cft = 0.028317 m³ = 28.317 l
SI	International unit system SI (Le Système International d'Unités)
SLC	Single level calibration (Calibration automatic or by user)
SSW	Security switch
TCD	Thermal conductivity detector
TCP	Transmission Control Protocol (Internet)
TLS	Transport Layer Security transmission protocol
VDE	German Association for Electrical, Electronic & Information Technologies
VPN	Virtual Private Network
WEEE	Waste of Electrical and Electronic Equipment (directive of the EU)
Wi	Inferior Wobbe index / Net Wobbe index
Ws	Superior Wobbe index (Wobbe index superior) / Gross Wobbe index
YOC	Year of construction
Z	Compressibility factor
ρ (Rho)	Density at base conditions

Term	Explanation/Definition
Administrator	Administrator is a person with unrestricted access to the device and responsible for setting and transferring user management to the device. The Administrator should therefore have the appropriate equipment knowledge e.g. by participating in a training course. The station operator usually takes on this task.
Alarm	Error which jeopardizes the correctness of the results. Generated, for example, if a measurement is outside the defined measuring range. The appearance and disappearance of an alarm are registered with time stamps in the associated logbook / error list.
Approval file	is an enSuite file which automatically defines which parameters should be especially protected. It contains approvals for specific countries or standardized settings and relates to all relevant AFBs. An approval file must be used for fiscal purposes, otherwise its use is optional.
Audit trail	is a two-part log archive (parameter audit trail) which enables the user to conduct changes relevant to billing without opening the SSW. These changes are monitored and documented in the fiscal section. If the SSW is opened, data are only included in the general section.
Authorizied metrology expert	or Fiscal verification officer ia a person who has the ability and is authorized, because of his or her technical training, knowledge and experience, to execute fiscally protected tasks in gas systems within the scope of legal metrology. A metrology expert is trained to work with fiscally protected devices and systems and is acquainted with the relevant standards and regulations that apply in specific countries.
Automation	The operating mode in which the device undertakes systematic analyses and is therefore the normal operating state.
Breathing device	The breathing device (short breather), also known as venting device or flame arrester, is designed to equalize the pressure on explosion-proof housings. This pressure equalization device is required during operation and must not be sealed.
Cable	To ensure greater differentiation between gas and electrical lines, electrical lines are always referred to as "cables" in the following.
Calibration gas	Also called operational calibration gas, is held in cylinder connected firmly to the device and is part of the measuring system. It is a mixture with fiscal established properties and is required for automatic and manual calibration.
Calibration officer	or representative is a person with country-specific authorization who may carry out officially protected work on gas systems which are to be used for fiscal measurements.
Carbon dioxide (CO_2)	An acidic, non-flammable, colorless and odorless gas comprising a chemical compound of carbon and oxygen. The gas is also known as carbonic anhydride or colloquially carbonic acid.

Term	Explanation/Definition
Carrier gas (mobile phase)	Kept in a cylinder permanently connected to the device. This gas, for example helium, carries the sample through the separation column of the gas chromatograph. The carrier gas (inert gas) carries the sample through the separation column. The most commonly used carrier gases are helium and argon. The selection depends on the measuring task.
Checksum	is a method to identify, display and check the software version. It is calculated by the device itself. Further information about this checking method used by enCore devices is provided in the manual entitled "enCore ZM1, MC1, FC1 – basic system with SFBs".
Chromatogram	Is the visual representation of the measurement results from a chromatograph. It shows the Retention time (time difference from injection to peak maximum) for each component and its proportional height/area to the injected amount of gas. The concentration becomes determined by a comparison with a known Height/Area from a reference/calibration gas.
Compressibility factor Z	The quotient from the actual (real) volume of a specified mass of gas at a specified pressure and temperature and its volume as calculated from the Ideal Gas Law (for the same pressure and temperature). The compressibility factor Z is generally dependent on the temperature, pressure and gas composition.
CSA mark	The mark shows that the product has been certified by an accredited third-party lab (independent standards organization) and have met applicable standards as required by American law.
DBB technology	is a valve technology to seal gas streams. The connection of 2 solenoid valves in series, between which there is a vent, ensures that the system is safe even if the valves leak
Density/Density at base conditions	Density or density at base conditions is a heat variable used to monitor the gas composition and energy content of fuel gases. It is the quotient of the mass of a gas sample and its volume in specified pressure and temperature conditions or at base conditions in kg/m^3.
Display	is the generic term for all depictions and views on the computer and the optional screen
enCore flow computer	(For short: enCore FC) A collection of various device types used as process computers. These include, for example, the volume conversion device enCore ZM1, the signaling and monitoring unit enCore MC1 and the flow computer enCore FC1. The proChain GC also uses this software package for data management.
enCore devices	Representatives of a highly-developed series of measuring instruments based on similar hardware components and software concepts. enCore is the name of the product platform. Both the hardware and software have a modular design; the configuration is variable.

Term	Explanation/Definition
enSuite	The configuration and analysis PC software for current Honeywell Elster devices in the field of flow computer, data storage, gas quality analyzer and ultrasonic gas meter. The software supports all activities that are required for commissioning and maintenance of these devices.
Export value (enSuite)	The function blocks in the software supply results which can be processed by other function blocks. These results are known as export values.
Fiscal parameters	are marked with this symbol 🔒📷. They provide information about whether items can be edited when the SSW is locked.
Fiscal verification officer	See Authorizied metrology expert.
Gas chromatograph / Process gas chromatograph	A measuring instrument which uses gas chromatography. In an industrial version, it is the low-maintenance and explosion-proof upgrade of the measuring instrument, known as a process gas chromatograph.
Gas chromatography	Process which allows the separation of a mixture of gaseous substances due to the differing distribution of its individual components using a carrier gas (mobile phase) and separation columns (stationary phase).
Gas family	Classification of fuel gas types into groups based on their physical and combustion properties (families, abbreviated to GF) A distinction is made between 4 gas families. Gas families are classified in Germany in DVGW Code of Practice G 260; natural gas and gas similar to natural gas are members of the second gas family in this system.
Gas saturation	Reflects the influence of water vapor on calorific value/heat value. Values for wet (saturated) gas or partly wet (partially saturated) gas are lower than those for dry (unsaturated) gas because the total volume consists of the components of hydrocarbons and water vapor. Gas chromatographs and thus also the proChain usually do not analyze water vapor. The determination of the actual water vapor content must, for example, be obtained from moisture or dew point measurements. The results are therefore calculated for three assumed standards (dry/wet /partly wet) of water vapor.
Ground loop	Grounding the devices may create ground loops since the cable screens create additional connections if they are connected to both sides. A ground loop is electric cabling closed to create a loop. In the event of low-frequency error currents, an undesirable voltage drop occurs in the signal path and an interference signal is added to the signal as a result of the impedance of the loop.

Term	Explanation/Definition
Grounding	Grounding is the general term used for the highly conductive connection to a reference potential, for example, to the earth which is also conductive. This device connection is used, among other things, to prevent incoming and outgoing interference as described in the EMC directives and allows various electrical devices and equipment to be operated with a joint reference potential.
Higher heating value Hs	A heat variable used to monitor the gas composition and energy content of fuel gases. The higher heating value can be specified in molar, mass or volume, for example in kWh/m³.
Inferior calorific value (net heating value)	(colloquially known as energy content or energy value) is a heat variable. All the combustion products are in gaseous which is why the inferior calorific value is lower than the superior calorific value.
Internal sampling system	A gas manifold which defines a gas route using valves. The gas channels in this metal block also enable DBB technology to be used.
Location of use	or of installation is the room or space where the device is placed. It must meet the specified requirements of the manufacturer, authorities, and operators.
Logbook	also known as the standard audit trail, is a log archive which can be used by all software parts and records every extraordinary situation, for example, errors in the measuring equipment.
Lower heating value Hi	(Colloquially energy content or energy value) is a heat variable. In contrast to the higher heating value, all the combustion products are in gaseous form. Therefore, the higher heating value is higher than the lower heating value. The lower heating value is quoted as a mass-related heating value, for example in kilojoules per kilogram in (kJ/kg) or as the heating value of the gas quantity over the measured volume, for example in building services engineering in kWh/m³.
Manufacturing Messaging Specification	MMS (pursuant to ISO 9506) allows communication between enSuite and enCore devices.
Message .	is an event which applies to multiple evaluation cycles of the device. It may be reset by a user with the appropriate user rights
Modbus protocol	Modbus TCP protocol for data exchange by user-defined registers between AMR and enCore devices using a standard TCP/IP network.
Network Time Protocol.	NTP for the high-precision time synchronization of enCore devices with an NTP time server.
Note	Generated if a measurement violates a state defined by the user. The start is logged in the logbook.
Operating mode	Different working states of the device during operation are known as operating modes.

Term	Explanation/Definition
Operational calibration gas	also known as just calibration gas, is kept in a cylinder permanently connected to the device and is an integral part of the measurement system.
Ordinal number	or sequence number is an automatically assigned identification number for archived data. This is formed so that the very first archive entry has the number 1. The number is incremented by one for each subsequent entry.
Peak	The maximum deflection of a signal. In a chromatogram, every peak represents a component.
PELV	PELV protective extra-low voltage systems which comply with DIN EN 60079-14: the power supply to generate PELVs must ensure that no short-circuit is possible between the primary voltage and the extra-low voltage and its connections. It has a safe electrical isolation point (safety isolation transformer) and complies with IEC 61558-2-6. The circuits are grounded. All bodies of electrical equipment must be connected to a common grounding (and equipotential bonding) system.
Pipeline	Pipeline is the 0.5 to >2 m diameter steel pipe. The proChain GC use 'sample tubing', 'sample transport tubing', or short 'tubing' with much smaller diameter. The production and installation of tubing is entirely different from pipelines.
Place of use	or installation site is the room or position at which the measurement device is located. It must satisfy the requirements defined by the manufacturers, authorities and operators.
Power-limited circuit	A power-limited circuit is a circuit separated from other circuits by at least BASIC INSULATION in which the direct voltage (U) is no greater than 60 V. The current which can occur in the circuit is limited by certain measures to a value of less than 200/U. These measures must interrupt the circuit within 120 seconds if this value is exceeded.
Process gas.	is the gas which is to be analyzed or measured. It is supplied to the measuring equipment in normal operation and is also known as the operating sample gas
Reference potential	is a potential to which all other voltages are referred. The potential of a grounded point (ground potential) is used for this purpose and gives it a value of zero volts. Since ground connections, like all connections, have different resistances, voltage differences or potential differences may occur between grounded points and system parts. A correctly designed low resistance equipotential bonding cable between the system parts or devices can eliminate these ground potential differences.
Security switch (SSW)	(also known as the CAL switch) is a possible hardware isolator and part of the concept to limit user rights. Since a change requires the housing to be opened, this may only be done by trained personnel with the authorization of the manufacturer.

Term	Explanation/Definition
SELV	SELV safety extra-low voltage systems which comply with DIN EN 60079-14: The power supply to generate SELVs must ensure that no short-circuit is possible between the primary voltage and the extra-low voltage and its connections. It has a safe electrical isolation point (safety isolation transformer) and complies with IEC 61558-2-6. Live parts of circuits must not be grounded or connected to live parts or PE wires of other circuits. All bodies of electrical equipment cannot be grounded (for example, for electromagnetic compatibility). (**the proChain GC must be grounded even in a SELV system**)
Separation column (stationary phase)	A capillary with a defined internal diameter and a defined length. It is clad internally with a material which separates the gas components over time. Traditionally, this component is known as a "column". Current technology uses thin tubes on a coil or chips manufactured using MEMS technology.
Signal	is an event which is only output for a short time. Acceptance by the user is not required or possible and signals are also entered into the logbook
Specialist	or professional is the designation for a trained person who, as a result of their technical training, possesses skills and experience and who is familiar with the relevant standards and regulations. Trained personnel can assess their work and identify potential dangers. Hardware work on the GasLab Q2 requires, among others, the expertise described in EN/IEC 60079-14, Annex A.
Stream ahead flushing	A method to prevent unnecessary flushing waiting times, when a stream is changed.
Super user	shortened (su...) is one of five users who can create or delete further users in the own profile, all five are included in every parameterization and cannot be deleted. The administrator determines the rights of the su and its profile.
Superior calorific value	This is a heat variable which, for example, is used to monitor the energy content of fuel gases. The superior calorific value is higher than the inferior calorific value. Not all the combustion products are in gaseous form.
System time	is the combination of time and date shown on the device. Changing the system time is the generic term for both synchronizing and adjusting these values. Further information on synchronization and the Network Time Protocol is provided in the manual entitled "enCore ZM1, MC1, FC1 – basic system with SFBs".
Test gas	A gas mixture with known properties which can be supplied to the measuring instrument through a sample inlet instead of the process gas for verification purposes.
Time stamp	are time details which relate to an event. They contain the time in seconds since 1 January 1970, the local time zone and the local time difference (additional deviation in minutes). The format for displaying time stamps depends on the language selected on the device, for example, YYYY-MM-DD hh:mm:ss or DD.MM.YYYY hh:mm:ss.
Time zone	can only be set using enSuite offline parameterization and enables the geographic location of the device to be identified.

Term	Explanation/Definition
Trained personnel	The designation for a person who, as a result of their technical training, possesses skills and experience and who is familiar with the relevant standards and regulations. Trained personnel can assess their work and identify possible dangers. Hardware work on the device requires, among others, the expertise described in EN/IEC 60079-14, Annex A.
Upper Calorific value	A thermodynamic parameter that is used, for example, to monitor the energy content of fuel gases. The upper calorific value is greater than the inferior calorific value (net heating value). Not all combustion products are gaseous.
User	is a person who belongs to a defined user profile (including super user) and operates or parameterizes the device. The user is identified by a user name and password.
User management	Subject to changes by the administrator. If used correctly, it guarantees, by means of passwords and access rights, that unauthorized changes are suppressed and authorized changes are permitted.
User profile	is a list of access rights for a group. A super user, for example, SU3, manages the profile with up to 9 other users.
Valve block	is a gas manifold which defines a gas route using valves. The gas channels in this metal block also enable DBB technology to be used.
Vent gas	Also called waste or exhaust gas, is the gas flowing out of the measuring device after the measurement.
Verification gas	A test gas mixture with known properties which is supplied to the measurement device instead of the process gas for verification purposes.
Virtual private network	A virtual private network (VPN for short) is a closed logical network in which the participants are physically separated from one another and connected via an IP tunnel.
Warning (message or signal)	Error messages which do not falsify the results but are important for monitoring the measurement. The calculation is continued without falsification.
WEEE Directive	The Waste Electrical and Electronic Equipment Directive dated 14 August 2018 is designed to prevent and reduce waste from electrical and electronic equipment, particularly in household waste. It defines minimum standards for handling end-of-life electrical and electronic devices in the EU and relates to all electrical and electronic devices used for private and commercial purposes. To achieve this aim, end-of-life electrical and electronic devices are collected separately and recycled to obtain raw materials.
Wobbe index Ws	Used to characterize the quality of fuel gases and is a calculated variable for monitoring and regulating the heat output. A distinction is made between a superior Wobbe index (Ws) and an inferior Wobbe index (Wi). The unit is J/m³ or kWh/m³, depending on the unit used for the superior and lower heating value.

1.2. Safety information and warning

The safety and warning notices in this introduction to the document, together with the information on the device and the notices in the main sections Hardware and Software, enable correct use of the device. They prevent personal injury and property damage. The **proChain GC** complies with the relevant safety standards. If it is handled correctly, it does not pose any danger which may adversely affect health or cause property damage.

To avoid risks, no changes or modifications may be made that have not been expressly approved by the manufacturer. Avoidable damage, e.g. due to insufficient knowledge of these instructions, will result in the loss of all liability claims.

	When working on the gas tubings, always ensure there is adequate ventilation and protect yourself from gases which contain aggressive or toxic components. **When carrying out mechanical work (transport, assembly, etc.), use your personal protective equipment (safety footwear, gloves, etc.) to avoid injury. Direct contact with hot or cold surfaces can cause heat and ice burns. Never lift weights which may jeopardize your health.**

	Safety information and warnings must always be read and adhered to for the safe and proper operation! Necessary language skills are assumed.

	In addition to the instructions in the document, always observe the safety instructions on the proChain GC and the relevant technical data from the respective sections. Do not violate any basic rules of safety. Please contact Honeywell if you have any questions or doubts.

	Missing warning symbols do not relief individuals from their personal responsibility for safety!

	It is forbidden to operate devices with damage, modified housing or inappropriate connections as the protection against explosions is no longer provided.

	If it is determined that the proChain GC or parts of the measurement system, such as safety valves or inlet tubes, are damaged or no longer operate safely, the measuring device must be taken out of operation, disconnected from the gas and electricity supply and secured from being placed into operation inadvertently.

1.2.1. Intended use

The **proChain GC** is designed and built exclusively for its intended use, which is the analysis of natural gas or gas similar to natural gas (details explained in **2. Hardware**). Intended use also includes compliance with all the information in this document and on the measuring instrument.

⚠️	**The proChain GC may only be installed and used in the potentially dangerous zones specified on it.**

Any additional use or use other than that intended will be deemed to be misuse. Claims of any kind due to damage as a result of misuse will be void.

⚠️	**The proChain GC is to be used only for its intended purpose as described in these Operating Instructions. Use of the device for other tasks or purposes may impair the protection in place. This can lead to dangerous situations.**

1.2.2. Responsibility of the device or system operator

The operator of the **proChain GC** or system is subject to legal duties relating to industrial safety. In addition to the safety information in this document, compliance with the safety, accident prevention and environmental protection regulations valid for the field of application of the device is mandatory. Furthermore, the operator is responsible for keeping the device always in technically perfect condition.

⚠️	**The proChain GC should only be installed in the measuring plant where access control is guaranteed, i.e. where protective measures are taken to prevent unauthorized persons from gaining physical access to the device.** **The system operator must ensure that no hazards to persons or components exist or can arise from the electrical installation. It must ensure (e.g. by means of an equipotential bonding cable) that there is no earth potential displacement.**

⚠️	**The operator must use high-pressure reduction systems and safety devices to ensure that the maximum inlet pressure of the respective gas does not exceed the maximum permitted value.** **Carrier gas: 0.35 MPa(g) ≙ 50.76 psi(g) ≙ 3.5 bar(g).** **Sample gas/Calibration gas/ Verification gas** **for ATEX / IECEx: 0.3 MPa(g) ≙ 43.51 psi(g) ≙ 3bar(g).** **for cCSAus: 0.15 MPa(g) ≙ 21.75 psi(g) ≙ 1.5bar(g).**

⚠	The operator is responsible for ensuring that the proChain GC remains in a technically perfect and safe state during its operating period. If a ventilation line is connected to the device, it is the duty of the device user to ensure permanent atmospheric ventilation, e.g. by means of a stainless-steel insect screen. The operator must ensure that the installation and maintenance work described in this document is carried out correctly.

1.2.3. Conditions of Acceptability for the cCSAus certification

The operator of the **proChain GC** or system is obliged to observe the following conditions to operate the device in accordance with the cCSAus certification. The enclosure is non-conducting and may generate an ignition capable level of electrostatic charge under certain extreme conditions.

⚠	The user / operator should ensure that the equipment is not installed in a location where it could be exposed to external conditions that could result in electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment should be done only with a damp cloth.

⚠	This equipment has flame paths which differ from those in CAN/CSA-C22.2 No. 60079-1, ANSI/UL 60079-1 and are not intended for repair.

⚠	The equipment shall not be used with process gases which contain oxygen or any other oxidizer in concentrations greater than found in normal air. Also, note the general restriction from section 2.1.3 Safety information about gases.

⚠	The internal heaters shall be set to operate within the temperature range of ≥0°C≙32°F and ≤40°C ≙104°F Use enSuite to do the settings.

⚠	The equipment shall be supplied by a Limited Energy Circuit (LEC) as defined in CSA C22.2 No. 61010-1-12, a Class 2 power as defined in article 725.121 of NFPA70. Please refer to documentation of power supply and change the device if necessary. Primary Battery is intended for replacement only by a trained service technician.

Equipment has only been tested for all aspects of Hazard in the safety standard. No evaluation of functional safety and performance characteristics has been conducted.

1.3. Technical data (General)

The main technical data are noted on various type plates and labels on the **proChain GC**. They are also listed thematically below and can be found in total on the data sheet.

1.3.1. Tables and information about the proChain GC

proChain GC	Values and/or comments
Gas group	Only gases set out in the list of suitable gases below
Calculations to	ISO 6976, GPA 2172, or ASTM D3588
Ex rating	
ATEX	II 2(1) G Ex db [ia Ga] IIC T6 Gb
IECEx	Ex db [ia Ga] IIC T6 Gb
cCSAus	Class I Division 1 Groups B, C, D T6 Associated Equipment for Class I, Division 1, Groups A, B, C and D Ex db [ia Ga] IIC T6 Gb, Class I Zone 1 AEx db [ia Ga] IIC T6 Gb
Pursuant to the standards:	
IECEx:	IEC 60079-0 2011 6th edition IEC 60079-1 2014-06 7th edition
ATEX:	EN 60079-0 2012 EN 60079-1 2014
cCSAus	2258 02 2258 82

1.3.2. Explanation of explosion protection markings

Icons / symbols	Meaning
Device Ex symbol	Designations around these symbols (on the nameplate) indicate the area of application taking explosion protection into account. Notified body, device group, device category, Ex zone, Ex class, type of protection, explosion group, temperature class and device protection level are indicated among other things.

Used Shorthand	Description / Explanation
0044	Ex marking for Notified Body
	Notified Bodies are state notified and supervised testing bodies. On behalf of the manufacturer, they inspect the conformity or compliance with corresponding standards and regulations for his products and/or his production.
II 2(1) G	Ex marking complete device suitable for ex- zone 1 and 2 (gases/vapors)
	Ex zones Potentially explosive areas are divided into zones according to the frequency and duration of occurrence of hazardous explosive atmospheres. The following applies to flammable gas-air mixtures: **Zone 0 / Division 1** is an area in which a hazardous explosive atmosphere is present continuously, for long periods or frequently. **Zone 1 / Division 1** is an area in which a hazardous explosive atmosphere may occasionally occur during normal operation. *(Division 1 comprises the combination of Zone 0 and Zone 1 areas)* **Zone 2 / Division 2** is an area in which a hazardous explosive atmosphere normally does not occur during normal operation, and if it does, it does occur only rarely and for a short period of time.
Ex db / AEx db	Principle and type of ex-protection (in this case flameproof enclosure)
	Flameproof enclosure By using this **protection principle and type of protection** parts that can ignite an explosive atmosphere are enclosed in a housing. The enclosure will withstand an internal explosion and prevent transmission to the atmosphere surrounding the enclosure.
[ia Ga]	Shorthand of **Intrinsic safety,** another protection principle. This is only used of some device parts. The protection principle works by limiting the energy.
IIC	Ex marking of explosion group
	Explosion group Group I contains equipment for mine workings endangered by firedamp. **Group II** for all other potentially explosive atmospheres. The classification is based on the equipment design and the hazardousness of the gases. It increases from explosion group II A to II C.
T6	Ex marking of temperature class (in this case 85°C)
	Temperature class The maximum surface temperature of the device must always be lower than the ignition temperature of the explosive mixture. The following temperature classes are specified: T1=450 °C (842 °F) T2=300 °C (572 °F) T3=200 °C (292 °F) T4=135 °C (275 °F) T5=100 °C (212 °F) T6= 85 °C (185 °F)

Used Shorthand	Description / Explanation
Gb	Ex marking of equipment protection level (in this case "high")
	Equipment Protection Level (EPL) Equipment for potentially explosive atmospheres where there is no risk of ignition during normal operation is classified in three levels of protection. These apply to gas (G) and dust (D) „Very high" protection level (**Ga or Da)** no danger of ignition in case of foreseeable or rare malfunctions „high" protection level (**Gb or Db)** no danger of ignition in the event of foreseeable faults or malfunctions „increased" protection level (**Gc or Dc)** Additional protective measures are taken to ensure that there is no danger of ignition in the event of foreseeable malfunctions of the device.

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1.3.3. Technical range of suitable gases (gas like natural gas)

The gases must be technically free of dust, particles and liquids.

Gas temperature between –25°C≙–13°F and +75°C≙167°F.

Concentrations outside these ranges and other components on request. In the following table the composition of the standard calibration gas P1–11K is also described.

Component name	formula		Min. measuring range [mol%]	Max. measuring range [mol%]	Calibration Gas P1–11K [mol%]	Output
Nitrogen (N)	N_2	0.0	20	8.0	Yes
Methane	CH_4	60	100	79.25	Yes
Carbon dioxide	CO_2	0.0	12	3	Yes
Ethane	C_2H_6	0.0	14	6.5	Yes
Propane	C_3H_8	0.0	6	2	Yes
i-Butane	$i\text{-}C_4H_{10}$	0.0	3	0.5	Yes
n-Butane	$n\text{-}C_4H_{10}$	0.0	3	0.5	Yes
neo-Pentane	$neo\text{-}C_5H_{12}$	0.0	0.1	0.025	Yes
i-Pentane	$i\text{-}C_5H_{12}$	0.0	0.3	0.1	Yes
n-Pentane	$n\text{-}C_5H_{12}$	0.0	0.3	0.1	Yes
Hexane plus	C_6+	0.0	0.3	0.025	Yes

Carrier gas	Ranges/Variables
Helium: Quality: 5.0 or better	Supply pressure: = 0.325 MPa(g)± 0.025 MPa(g) ≙ 47 psi(g) ± 3.6 psi(g) ≙ 3.250 bar(g) ± 0.250 bar (g) Flow rate: approx. 0.12 l/h ≙ 0.0042 cft/h per module (depending on application)
50 l gas cylinder (not always supplied from Honeywell) Option: 2 cylinders with autom. changeover syst.	Ensure that only suitable standard-compliant types are used if you do not source them from Honeywell. Cylinder pressure greater than 1.0 MPa(g) ≙ 10 bar(g) ≙ 145 psi(g) required. At a pressure below 2 MPa ≙ 20 bar ≙ 290 psi keep a replacement cylinder available. Other accessories required: Connection lines and Pressure regulator with a safety relief (Set at 0.4 MPa(g) ≙ 4 bar(g) ≙ 58 psi(g))

Calibration gas (P1–11K)	Ranges/Variables
Reference gas with a Quality of 2.0 or better for all components and **(max. 1% measurement uncertainty)** The composition for this gas is mentioned in the table at the previous page and at the NMI nameplate. Other Compositions are possible depending on the expected sample gas and application	Rated supply pressure (Protection against pressure peaks needed) 0.1 to 0.3 MPa(g) ≙ 14.5 to 43.5 psi(g) ≙ 1.0 to 3.0 bar(g) for ATEX / IECEx 0.1 to 0.15 MPa(g) ≙ 14.5 to 21.7 psi(g) ≙ 1.0 to 1.5 bar(g) for cCSAus Flow rate / Consumption (at atm. pressure). ± 600 ml/ Calibration (1 Calibration /day) ≙ ± 0.0212 cft/ Calibration (1 Calibration /day)
10 l gas cylinder (not always included in Honeywell package)	Ensure that only suitable standard-compliant types are used if you do not source them from Honeywell. Cylinder pressure greater than 1.0 MPa(g) ≙ 10 bar(g) ≙ 145 psi(g) required. At a pressure below 2 MPa ≙ 20 bar ≙ 290 psi keep a replacement cylinder available. Other accessories required: Pressure regulators and connection lines

1.3.4. Declarations of conformity, certificates and approvals

The EU declaration of conformity lists all the certificates and approvals. The following provides an extract from the declaration. The complete declaration of conformity and associated documents can be downloaded in PDF format from our Docuthek (www.docuthek.com).

Type, model	EnCal3000 proChain GC
Manufacturer	Elster GmbH, Steinern Strasse 19-21, 55252 MAINZ-KASTEL, GERMANY
Product	Gas chromatograph

This declaration of conformity applies to the following Directives:

2014/30/EU (EMC)	2014/34/EU (ATEX)	2011/65/EU (RoHS)

The object of the declaration described above is in conformity with the relevant harmonization legislation from the European Union:

OIML-R140: 2007	EN 60079-0:2012/A11:2013 EN 60079-1:2014	EN 50581: 2012

Certificates and interventions by notified bodies:

Test report NMi-1901745-01	Sira 18ATEX1025X	Not applicable
	EU-type examination	
NMi Certin BV 2600 AL Delft The Netherlands	CSA Group Netherlands B.V. Utrechtseweg 310, 6812 AR, Arnhem, Netherlands	

This declaration of conformity is valid for products labelled accordingly:

CE	CE 0044 Ⓔⓧ II 2(1)G Ex db [ia Ga] IIC T6 Gb	CE

The production is subject to the following surveillance procedures:

Directive Annex II	Directive Annex IV+VII	Directive Article 7
	Notified Body 0044 TÜV NORD CERT GmbH D-30519 Hannover	

cCSAus Certification, Master Contract 268277, Certificate number 70184020

2258 82 – PROCESS CONTROL EQUIPMENT for Hazardous Locations Certified to US Standards Class I Division 1 Groups B, C, D T6 Associated Equipment for Class I, Division 1, Groups A, B, C and D Class I Zone 1 AEx db [ia Ga] IIC T6 Gb	2258 02 – PROCESS CONTROL EQUIPMENT for Hazardous Locations Certified to CSA Standards Class I Division 1 Groups B, C, D T6 Associated Equipment for Class I, Division 1, Groups A, B, C and D Ex db [ia Ga] IIC T6 Gb
T_{amb} = –40 °C (–40 °F) to +60 °C (+140 °F)	

1.4. Version History Updates and File Integrity

The printed documentation enclosed with the device on delivery corresponds to the technical status and is considered correct until updates are carried out.

We reserve the right to make changes to the device series and the documentation during further development. The following table gives an overview of the latest changes in the version and device history.

Revision	Date	Description
F	2019-09-03	Extension optional display and USB connection, updates and new document format
G	2019-11-21	Extension explanation of explosion protection / Additional Software security hints
H	2020-07-30	Software / Hardware statuses included in documentation / Update control and data security introduced / Remote control panel for basic functions / Updates for connection to device, parameterization and software configuration

This document (revision H) is also available online in PDF format for the duration of its validity and can be downloaded from our Docuthek under the following link:

https://docuthek.kromschroeder.com/documents/index.php?menuid=29&topmenu=29&lang=de&selclass=&sellang=&folder=401318

The current enSuite version is available on the Elster-Instromet website. The firmware can be found in the Gas Analysis subdirectory. A modification history, which is also available there, provides information about development steps in the instrument series. You can access the page with the following link:

https://www.elster-instromet.com/en/ensuite

Make sure to keep the device up to date and use the appropriate version of the documentation. From time to time you should therefore check the above web pages to see if the hardware and software used is still up to date.

	If you have obtained this documentation in PDF format, e.g. after an update, you can use the SHA-1 checksum information to test the file integrity. The SHA-1 information can be found in the comment field of the Docuthek or in brackets on the elster-Instromet page.

1.5. EnCal 3000 proChain GC delivery

1.5.1. Checking the delivery (list of supplied and required parts)

Unpack all components and check them for signs of damage and missing or incorrect parts. Use your order documents and the information in this document as a guide for this purpose. The **proChain GC** is supplied ready-assembled with all interior components and includes the required connections and potential connections for gas, electricity and signals in standard operation unless otherwise ordered. You should therefore check the following points:

- Every gas connection must be fitted with a Swagelok pipe fitting with a suitable thread or a blind plug.
- Every electrical connection must be fitted with a cable gland of a suitable size or a blind plug.
- There are no openings on the device that do not have plugs or fittings/glands.
- Fastening materials, for example wall mounting bracket with screws, are included if ordered.

1.5.2. Transporting and storing the proChain GC

Prevent transport damage, incorrect storage. Please also refer to the liability information at the start of this document.

⚠	**Store the proChain GC in a clean and dry place. Prevent dirt from entering the interior of it. Prevent material damage caused by the formation of condensation and corrosion.**

The following regulations apply for storage:
- environmental specifications listed in 2.11 Technical data (Hardware) must be adhered to.
- Packaging must only be stored under indoor conditions.
- Mechanical vibrations must be avoided during storage.
- The storage time with battery up to one year; 2 years with subsequent battery substitution. (Please store important data on a PC before storage the device, as data will be lost if the battery goes empty during storage time)

🛑 STOP	Do not expose the proChain GC to temperatures below -25°C (-13°F) or above +55°C (130°F) for fiscal metering (according metrological approvals). For non-fiscal metering the allowed temperature range according to safety approvals is -40 °C (-40 °F) to +60 °C (+140 °F).

If the **proChain GC** is transported in cold weather or extreme temperature fluctuations have occurred, the proChain GC must be returned to room temperature (temperature at the place of use) slowly to prevent damage caused by the formation of condensation.

🛑 STOP	Do not remove transport guards and other safety devices, for example for gas connections, before the device has been installed at its destination and if dirt can still ingress into it.

2. Hardware

The **Hardware chapter** is aimed at trained personnel in the gas industry or process measuring sector and contains the explosion-relevant information as well as a summary of relevant safety and warning notices. This section additional explains the basic functions of the measuring instrument and how to handle the EnCal 3000 proChain GC. In addition to general expertise, it enables the **proChain GC** to be used safely and efficiently.

According to the definition, trained personnel can assess the work assigned to them and identify possible dangers. Based on this requirement, trained personnel are assumed to be familiar with general safety rules and these are therefore not reproduced in full in this document.

⚠	**Any individual appointed to perform work on or with the proChain GC must read and be familiar with the content of this Operating Instructions prior to the work.** **Any unclear points and questions must be clarified before starting work!**

2.1. Hardware safety information and warning

The safety and warning information in this document (and on the **proChain GC** in English) is designed to enable the device to be used correctly and prevent personal injury and property damage. The device is designed for installation in potentially explosive atmospheres and certified to:

⬡ Ex	**ATEX: II 2(1) G Ex-db [ia Ga] IIC T6 Gb / IECEx: Ex db [ia Ga] IIC T6 Gb**
	cCSAus: Class I Division 1 Groups B, C, D T6 /
	        Associated Equipment for Class I, Division 1, Groups A, B, C and D
	        Class I Zone 1 AEx db [ia Ga] IIC T6 Gb
	$T_{amb.}$: –40 °C (–40 °F) to +60 °C (+140 °F).

In compliance with:

IECEx:	IEC 60079-0:2011, Sixth edition / IEC 60079-1:2014, Seventh edition
ATEX:	EN 60079-0:2012 / EN 60079-1:2014
cCSAus:	2258 02 PROCESS CONTROL EQUIPMENT for Hazardous Locations 2258 82 PROCESS CONTROL EQUIPMENT for Hazardous Locations – Certified to US Standards

To avoid risks, no changes or modifications may be made unless they have been expressly approved by the manufacturer.

	The proChain GC may only be installed and used in non-corrosive atmospheres and hazardous areas per the listed approval on it. *
	The device should not be installed in a location where it might be subjected to external conditions which might cause electrostatic charges on non-conducting surfaces.

* Deviations from this provision may only be made with Honeywell's agreement and consent.

	The ambient conditions must comply with the specifications in section 2.11 Technical data (Hardware). It must be ensured (for example by an additional air-conditioned housing) that the proChain GC is not exposed to any excessive temperatures during storage or operation. The temperature range is indicated on the instrument, for storage, the advised temperature range is 0 °C (+32 °F) to +60 °C (+140 °F).

2.1.1.   Authorized (hardware) personnel

The manufacturer accepts no liability for damage and consequential damage caused using untrained personnel. The operator of the system should carefully select suitable persons and have the level of training, knowledge of this documentation and the instruction of the persons confirmed in writing.

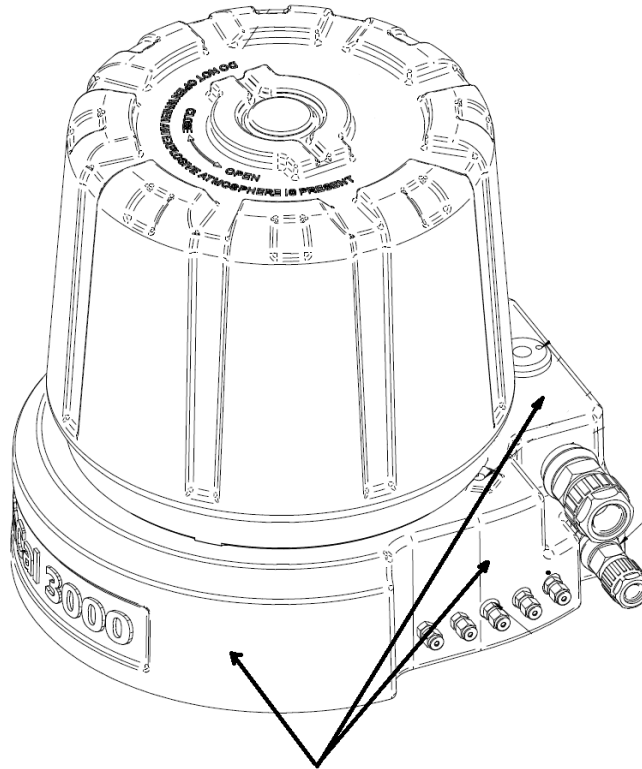|	Assembly, electrical installation, commissioning, inspection and maintenance work (e.g. opening the housing) must only be carried out by qualified personnel. The station operator is responsible for compliance with this safety measure if the specialists are not authorized by Honeywell.

The qualified specialists must have expertise according to EN-IEC 60079-14 Annex A or have comparable knowledge thereof:

- General safety rules
- Care and use of appropriate safety equipment
- Regulations for electrical safety technology and explosion protection
- Work on electrical circuits for hazardous (explosive) areas
- Working with high pressures and aggressive and dangerous media
- Safety instructions and Warnings in this document

	The ability to recognize hazards and risks, to assess one's own work and avoid potential hazards, must absolutely exist.

2.1.2. Information and warnings on the housing of proChain GC

There are warnings in English and/or French on the device. This information is also repeated at the appropriate point in the documentation in the documentation language. Additional warning signs are on the housing. The figure below shows the possible locations on the device and an example of a warning in English and French on an additional label.

Information and warnings on the housing

Figure 2.1: Warning and information labels on the device

EnCal 3000 proChain GC   Type:
Elster GmbH
Steinern Str.19-21
55252 Mainz-Kastel | Germany
Serial No.: 7 ELS96 1234 5678 Year: 2017
Power rating: 24 V === 5 A 120 W
U_m = 250 V
IS O/P rating: U_0 = 12.6V, I_0 = 496 mA, P_0 = 1.413W,
C_0 = 1.15µF, L_0 = 141µH
Max. sample gas pressure: 3 barg
ELECTRICAL ENTRIES M25x1.5 & M20x1.5

-40°C ≤ T_{amb} ≤ +60°C

II 2(1)G Ex db [ia Ga] IIC T6 Gb

CE 0044 ⟨Ex⟩

SIRA No: 18ATEX1025X   IECEx SIR 18.0006X

WARNING: DISCONNECT POWER BEFORE OPENING. DO NOT OPEN WHEN AN
EXPLOSIVE GAS ATMOSPHERE IS PRESENT. POTENTIAL ELECTROSTATIC CHARGING
HAZARD, SEE INSTRUCTIONS. IF CONDUITS ARE USED, SEAL THEM WITHIN 2 INCHES.

Use cables or wires and cable entries suitable for 80°C (176°F) and 70°C (158°F) ambient temperatures, respectively.

Utilisez des câbles ou des fils et des entrées de câbles adaptés pour 80°C (176°F) et 70°C (158°F) température ambiante, respectivement.

⚠	The information on the proChain GC must be always observed and followed! The user (YOU) must have enough language skills to understand their meaning!

2.1.3. Safety information about gases

The measuring instrument requires various gases for operation and measurement with different hazard potentials. Supply all gases to the **proChain GC** and remove them from it through tubes which comply with the listed switching, connection and pipework plans in the relevant sections.

	Gases may form an explosive mixture with air, may be toxic, harmful, or dangerous to the environment.

	When working with gas, always ensure adequate ventilation and protect yourself from gases containing aggressive or toxic components.

	Only natural gas and gas that is like natural gas (all components are gaseous) and gases from the 2nd gas family pursuant to DIN DVGW 460 or approved calibration gases may be used. For other gas types, please contact Honeywell before use. For gas specifications, refer to 1.3.3 Technical range of suitable gases (gas like natural gas)

	It is not allowed to connect gas containing more that 3.0 percent of oxygen (volume-based).

	Even in the event of a fault, no inlet pressure above the maximum permitted value may be applied to the device connections. The following limits apply: Carrier gas: 0.325 MPa(g) ± 0.025 MPa(g) ≙ 47.1 psi(g) ± 3.6 psi(g) ≙ 3.250 bar(g) ± 0.250 bar (g) Sample gas/Calibration gas/ Verification gas for ATEX / IECEx: 0.30 MPa(g) ≙ 43.5 psi(g) ≙ 3.0 bar(g). for cCSAus: 0.15 MPa(g) ≙ 21.7 psi(g) ≙ 1.5 bar(g).

⚠	**The breathing element outlet does not have to be connected, since during normal operation, no gas escapes. If a line is connected in buildings, to reach a safe area, this ventilation line must be protected from dirt, insects and rain by the system operator and ensure permanent atmospheric ventilation.**

The following specifications apply to vent tubing (If in doubt, please contact Honeywell):

- The additional pressure drop that may occur through the pipe depends on installations, curves and the material used. It must not allow the internal pressure of the housing to rise above 10 kPa ≙ 1.45psi ≙ 100 mbar. When using a straight, smooth pipe with a minimum inside diameter of 8 mm ≙ 0.31496 inch, lengths of 40m ≙ 131ft are possible at admissible inlet pressure. If you wish to use other diameters and lengths over 40m ≙ 131ft, please contact Honeywell Technical Support.

- The breathing element venting line connected to the internal thread of the breathing element must remain separated from all other vent lines.

The breather (main breathing element) is not part of the vent gas / exhaust system and is in direct contact with the ambient atmosphere. Gas will only escape from the breather in the event of a fault. Take suitable precautions to discharge it. For example, for installations in a building, this may take the form of a vent line into a safe ventilation area or appropriate ventilation of the installation site.

⚠	**The breathing element must not be closed or blocked! If it must be replaced, this may only be carried out by authorized personnel.**

🛑	DO NOT CONNECT THE BREATHING ELEMENT VENT LINE TO ANY OTHER EXISTING VENT LINE! Loosening or unscrew of the breathing element by unauthorized persons is prohibited!

2.1.4. Electrical safety information connecting with earth & emergency stop

Reference is made to the appropriate technical regulations regarding the installation, commissioning, decommissioning and maintenance work in general. All national, local or company standards and regulations which apply at the installation site of the **proChain GC** must always be given due consideration and applied. For example, Directive 99/92/EC (ATEX 137) governs the installation and operation of electrical systems in potentially explosive atmospheres. Do not fail to comply with this Directive in territories in which it applies.

Honeywell cannot accept any responsibility for compliance with provisions and regulations unless the work was carried out by Honeywell. We recommend that you read through the appropriate regulations again before installation.

Compliance with standards and directives on the following topics is mandatory:

- Electrical apparatus / devices for explosive gas atmospheres areas

- Operation of electrical installations

- Inspection and maintenance of electrical installations in hazardous areas

- Installation of power installations with nominal voltages up to 1000V - tests - initial tests

- Ordinance on Industrial Safety

⚠	**To protect personnel and equipment, the place of use and installation must have a functioning effective lightning protection.**

⚠	**The proChain GC must be connected in accordance with the hardware data.** **See section 2.11 Technical data (Hardware)**

⚠	**The device housing and mounting base must be included in the earth system or equipotential bonding system. The earth connection on the device (together with other connections if necessary) must be used for this purpose.**

🛑 STOP	Operation of the device without potential equalization / potential equalization cable or willful interruption of this connection is prohibited. **There must be no earth / ground potential shift.**

⚠️	The power supply 24 V DC (including mains fluctuations ± 15%) must have a safe reliable electrical isolation / separation. Generated e.g. with Quint-PS-100-240AC / Quint-PS-24DC / 24DC / 10 / Siemens PSU / Siemens logo or equivalent power supplies. Each device must be operated with its own voltage supply. This must be protected externally by a fuse or an automatic circuit breaker.

⚠️	The supply and communication equipment (cables not supplied) must be shielded /screened and comply with local installation regulations. Use cables or wires and cable entries suitable at least up to +70 °C (+158 °F) ambient temperature.

⚠️	The installer must ensure that the wiring is protected against overload and short circuit. Its power supply must be fused externally.

⚠️	Replacement of fuses and batteries may only be carried out by qualified personnel authorized by Honeywell.

⚠️	The installation must conform to the local standards applying for electrical and explosion safety. (e.g. DIN, EN, VDE, UL etc.)

⚠️	In addition to the SELV system, a PELV system may also be used. The housing must be earthed using the equipotential bonding connection (PA) on the underside of the housing.

⚠️	Any electrical equipment connected to the appliance must be insulated in a reinforced manner from the mains (electrical distribution).

Cable glands and connections

In the housing of the **proChain GC** are four holes for electrical inlets and outlets. The threaded holes can be fitted as required with blind plugs, adapters or cable glands. These screw-in parts must be suitable for the IIC Zone and need an explosion-protection certification.

⚠	**The proChain GC may only be connected using certified parts (e.g. cable glands). These must comply with local explosion-protection regulations and be installed or replaced by authorized trained personnel. To comply with explosion-protection regulations, they must be installed and sealed as specified by the manufacturer of the part. The relevant regulations must be observed during this process.**

⚠	**The cable inlets must satisfy or exceed the IP rating of the device. NEC-compliant cable inlet equipment must be used in the USA. CEC-compliant equipment must be used in Canada.**

Required properties:

- Cable and cable gland (with sealing ring) suitable for temperatures of at least 70 °C

- Cable gland in castable design according to EX certification (refer to 1.3.4 Declaration of conformity).

- Conduit system
  conduit stop boxes as long as they are potted / sealed within 5 cm (2")

⚠	**The proChain GC does not have its own off switch. It must be operated using an isolating device (switch or circuit breaker) and current limiting device (or a combination of the two) to comply with ISO/IEC 60079-14 and ISO/IEC 61010-1. (Operating voltage of the isolating device at least 48 V DC.)**

This isolating device (not supplied) must be located close to the device to comply with explosion protection and electrical safety regulations, thus contributing to the formation of the power-limited circuit. The isolating device must also isolate all the power supply cables leading into the potentially explosive atmosphere. It must comply with the requirements for the installation site as mentioned in the standard. One example of such an isolating device is a C-5A circuit breaker.

⚠	**Warning: this device is a Class A device (according to EN 55016-2-3). It may cause radio interference in residential areas. In this case, the operator may be requested to take suitable action at their cost.**

2.1.5. Explosion protection

⚠	**The regulations in the relevant national and international standards (for example IEC/EN 60079-14, installation of explosion-protection equipment) must be followed to the letter.**

Handling explosion-proof devices

Installation and connection must be carried out per the wiring, connection and piping diagrams listed in this document. Follow the instructions below carefully and make sure that you have carried out all necessary safety steps before working on the movement or switching it on! Work in hazardous areas is dangerous and subject to strict rules, therefore you need a written permit (fire brigade permit) e.g. for:

- Transport and / or use of PC or laptop through / in an Ex-zone.

- Opening the device in hazardous areas with the voltage switched on.

- Connection of the operating and parameterization device or laptop in hazardous areas.

🛑 STOP	The explosion-proof housing must not be opened in the presence of an explosive gas atmosphere. The cable inlets must not be disconnected in any circumstances in this case.

If you are working on the **proChain GC**, switch it off, before opening! Note the following sequence:

- Switch off the supply voltage.
  (**Mark! / secure against being switched on again!)**
- Turn off all gases.
- Protect all open lines and connections from dirt.

⚠	**ATTENTION! ELECTROSTATIC HAZARD!** **The housing of painted /coated devices may only be cleaned with a damp cloth, to prevent sparks, which are hazard.**

⚠	**Operation and maintenance of explosion-protected devices may only be carried out by qualified personnel with explosion-protected, approved work equipment and measuring instruments.**

🛑 STOP	The recommissioning procedure must not be carried out in an explosive gas atmosphere. The flame paths for this device are not intended for repair. * *Caution must be taken to prevent damages to it.

Maintaining explosion protection

⚠	**The test certificate for this device specifies all requirements and regulations which are prescribed for the installation and operation of the device for maintaining explosion protection.**

⚠	**All removable parts (e.g. covers) for opening the housing must be protected against accidental opening by safety screws.**

Danger of explosion

⚠	**Danger of explosion due to improper installation and connection!** **The proChain GC may only be installed in a hazardous area per the listed approval on it.**

STOP	Do not operate or use damaged devices or devices with modified housings or with an incorrect connection. Using such a device will void the explosion-proof protection certifications. Safety would no longer be guaranteed.

⚠	**Safety information on the proChain GC.** **DISCONNECT POWER BEFORE OPENING.** **DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.**

Additional you should not open the device if you not have the permission of the manufacturer and the station operator and not meet the conditions according to ISO / IEC61010-1. These conditions (temperature +5 °C (+41 °F) to +40 °C (+104 °F); humidity up to 80% at +31 °C (+88 °F) decreasing linearly to 50% at +40 °C (+104 °F)) are typically found in residential and office environments. In case of doubt, please contact Honeywell. In addition, always pay attention:

⚠	**Before the device is switched on or switched back on, ensure that all the gas connections are sealed, and the earth or PE wire is correctly installed.**

⚠	**If the proChain GC is not serviced or maintained correctly, there is a danger that it will explode. Contact the manufacturer for repair work which affects the explosion protection and the flameproof properties of the device.**

2.2. EnCal 3000 proChain GC design

The **proChain GC** is a process gas chromatograph (PGC) which has been developed to analyze the composition of natural gas in fully autonomous operation. Gas chromatography is a very efficient separation method for substances in gaseous state. Based on the composition the device determines the calorific value, absolute density, Wobbe index and other properties of the sample gas.

This modern analyzer uses the latest micro-electro-mechanical system components (MEMS) to determine very accurate analysis results and makes the laboratory method of gas chromatography available on an industrial scale. In its basic configuration, the measuring system consists of the measuring unit in an explosion-proof housing and a freely selectable data processing unit, for example a PC or laptop, to read and evaluate the measurements (e.g. in a control room).

The measuring unit is the actual process gas chromatograph and conducts the analysis autonomously from a metrological point of view. It can analyze up to 5 gas streams sequentially. The data processing unit, which also serves as a data logger within the system, displays the operating stages of the measuring unit. The measuring unit and data processing unit use the **"enSuite" PC software**. The following sections explain the metrological concept in detail.

2.2.1. Housing with analytical modules

The **proChain GC** is supplied in an Ex-d housing with several special features offering space for up to two analytical modules. The explosion-proof aluminum housing essentially consists of a low base on to which a relatively high cover is screwed using an M270 thread. The mounting holes in the base at the rear (M8) and on the underside (M5) enable it to be secured.

The housing design allows it to be used in the most extreme conditions which are conceivable for natural gas applications. Only the cover must be removed for inspections, maintenance work and the electrical installation. Turn the locking/ safety screws (see marking left in the following figure) as far as possible downwards to allow the cover to be removed. As soon as the cover has been unscrewed and removed, almost all the internal components are directly accessible:

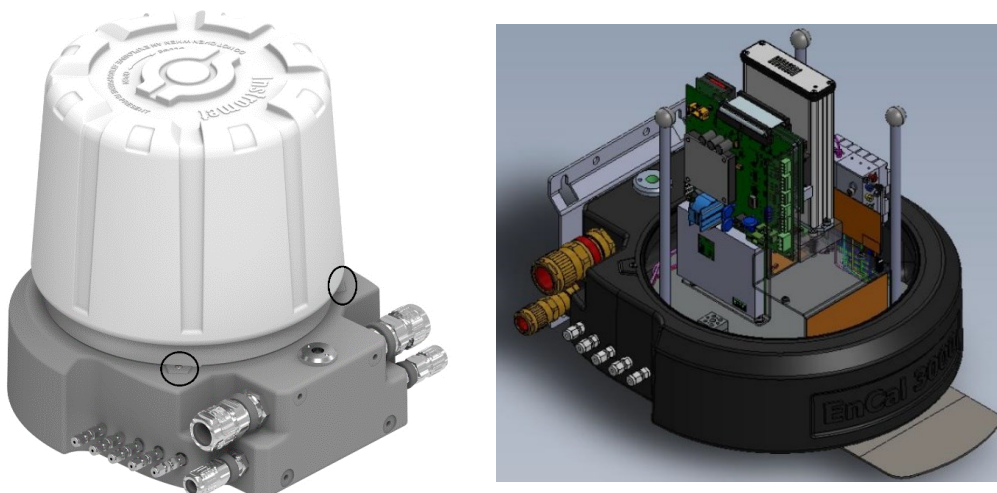**For safety reasons, this may only be done by trained personnel.**

Figure 2.2: Housing with and without the cover

The open housing provides a view of the layout of the main components and internal parts. The frame is used to fasten the individual components. It enables all components on the mounting plate located on the base to be removed directly and individually. The housing contains all the electrical and electronic equipment such as:

- Printed circuit boards for processors, Ethernet, Modbus and digital I/O
- Fuses, switches and jumpers
- DC-DC converter for multiple circuits
- Optional regulation of housing temperature and required heater foils
- GCM1000 analytical modules
- Internal sample conditioning system
- Electronic pressure controllers

The components can be removed directly and individually by unscrewing/undoing screws. This layout allows the service technician to inspect and replace the components easily in the event of a malfunction.

	For more information about the internal structure have a look to section 2.3 The general measurement concept.

2.2.2.   Main features

The **proChain GC** is a compact gas chromatograph designed to determine components in a gaseous sample in quantitative terms. One of its main applications is the analysis of natural gas and gas mixtures like natural gas to determine the heating value.

The device is fully automatic and is enclosed in an explosion-proof housing. It can be positioned close to the gas sample tap or sample conditioning system.

The **enSuite** PC software connected to the device can be used for operating the device, if necessary. Measurements and operating conditions can also be displayed in this way. Both the hardware and the software of the device are modular, which means that the proChain configuration and programming may vary.

Communication is possible using a TCP/IP connection and two Modbus ports. The enSuite software is also used for configuration and data management.

The **proChain GC** includes the analytical components, the stream selection and all the electronic components required for autonomous automated operation. The hardware design and the compilation of the software blocks depends on the measuring task. Changes in ambient temperature have no significant influence on the peak retention times. Under normal conditions the device does not need a temperature-controlled environment.

Honeywell's used device technology (more info in the next section) provides superior performance, the system delivers high accuracy for a wide range of gases. Maintenance work is only required once per year.

The analysis result is delivered in less than three minutes and includes the complete composition of any natural gas up to C_6+ (standard), lower heating value, density and Wobbe index. Up to five streams can be processed sequentially in the integrated sample selection system. Routine calibration could take place automatically. Date and time of calibration can be programmed by the user.

Compared to conventional gas chromatographs only approx. 2.9 l ≙ 0,102 cft carrier gas a day and 600 ml ≙ 0.0212 cft per calibration (1 Calibration /day) are needed. (Standard values per module and depending on application.)

The measurements are archived and can be transferred by the measuring unit via the outputs to the data processing system using the Modbus protocol. Archives such as the log are managed internally. Signals and messages can be generated. Furthermore, it is possible to connect external signals and monitor contact closures in a control room, for example the low-pressure limit value of the calibration gas cylinder.

💡	Further information ⇨ see technical data and the labels on the proChain GC.

Key features of the **proChain GC**:

- Explosion protection to ATEX and IECEx (compact Ex-d version)

- IP 66 protection against dust and precipitation (suitable for offshore applications)

- Fully autonomous operation and featuring analytical MEMS components

- Integrated sampling system, automatic calibration and verification

- Maintenance work only required once a year

- High-speed analysis (C_6+ in less than three minutes), up to five streams possible

- Repeatability (with SLC) < 0.025%
  for all calculated properties at steady temperature (can be increased with MLC).

- Internal data logger, log and audit trail

- Standard temperature range:
  0 °C (+32 °F) to +60 °C (+140 °F)
  optional expansion with internal heating up to -20 °C (-4 °F)
  with internal heating and external insulation up to -40 °C (-40 °F)

- EMC certification to EN 61000-6-2/4 (technical equipment)

- Vibration and impact test in accordance with OIML D11

2.3. The general measurement concept

The measurement concept is based on gas chromatography, an analytical method for analyzing gas mixtures, in other words, for measuring the concentration of the various components of a gas mixture.

For this purpose, a very small quantity of the sample gas to be analyzed is heated and inserted into a carrier gas stream by an injector. This carrier gas transports the sample through a very thin tube known as a "**column**". Because of its internal structure, this tube acts as a separating medium and is therefore also known as a "**separation column**".

The different properties of the individual components of the sample gas mean that they have different transit times through the column. As result the mixture is separated into its individual components.

At the outlet of the column, each component is measured by a detector. Based on the mole percentage of each individual component, every gas property can be calculated and displayed in a chromatogram. The following diagram shows this relationship.
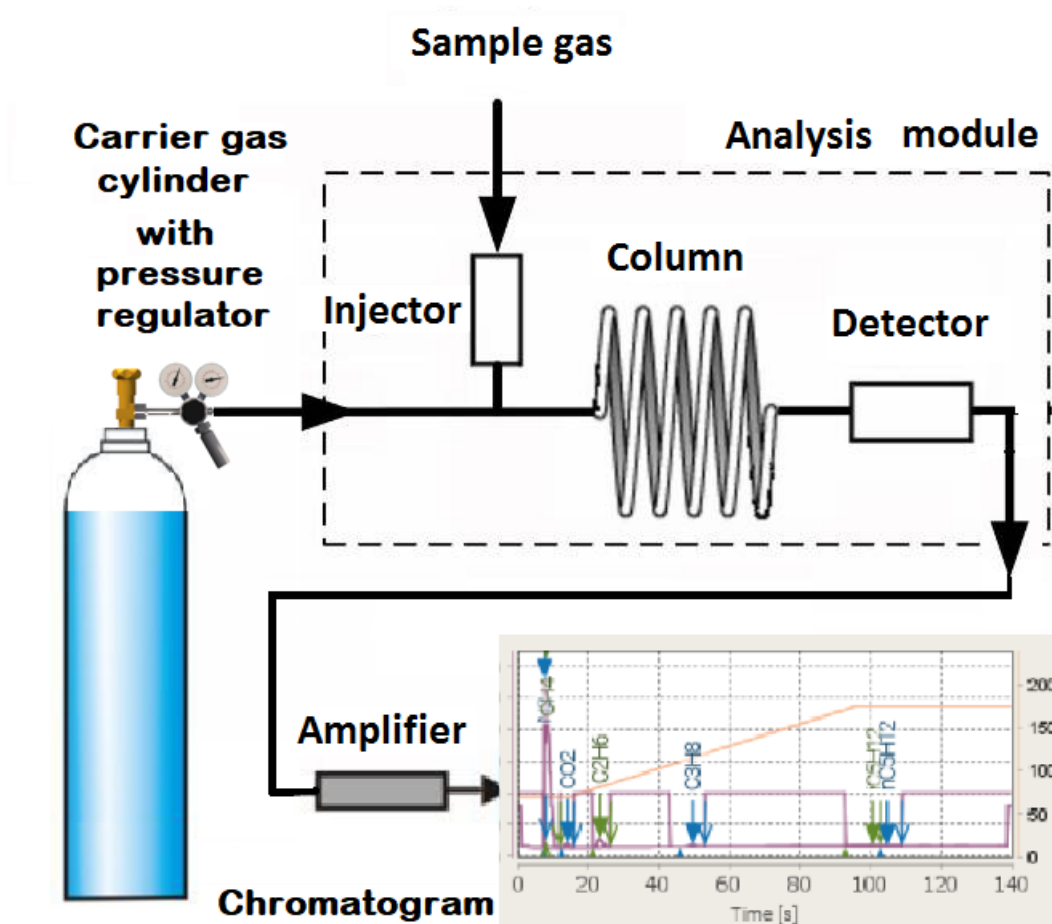
Figure 2.3: The analytical principle

The individual parts of the analysis module and the design of the **proChain GC** is described in the following.

2.3.1. Internal parts of the analysis process and the design of the device

The first items which are visible is the analytical module. It is in a separate module housing, together with the required electronics and cooling fans. This is called **GCM1000** which is the heart of the **proChain GC**. The amount and characteristic of modules will differ depending on the measuring task.
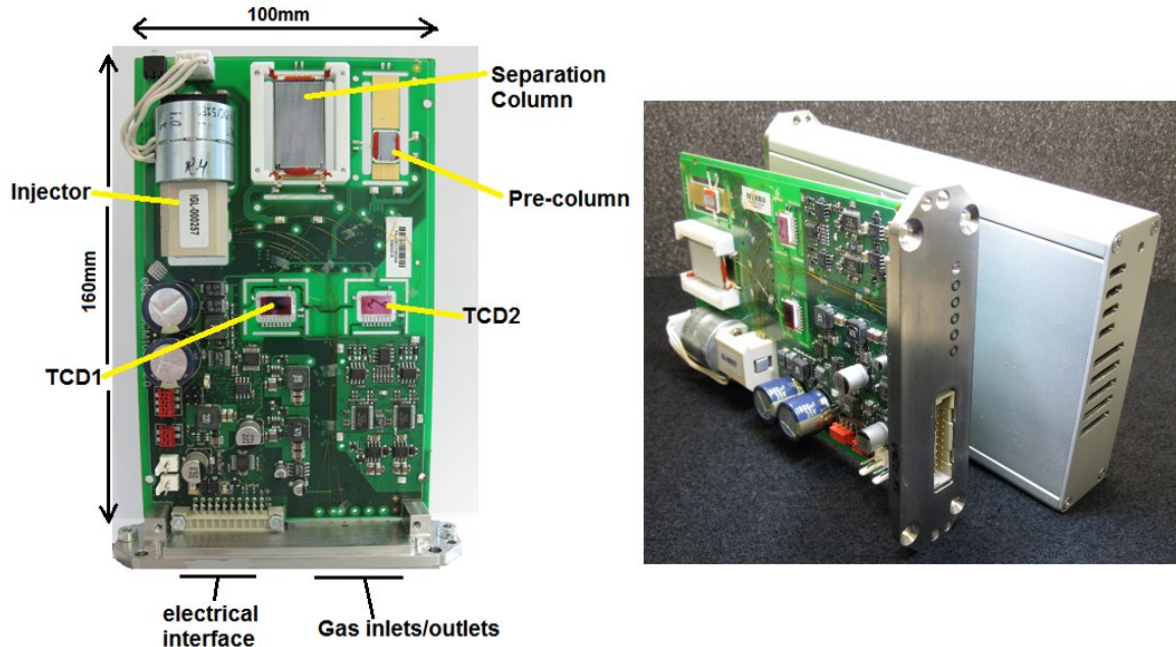
Figure 2.4: GCM1000

If two GCM1000 are used (future option), they can work in parallel and each module is responsible for one part of the overall analysis. Following components are the main parts of the GCM1000:

The sample injector, simply the injector, injects a fix volume of sample gas into the carrier gas stream. The injection must precisely deliver the sample gas at a consistent volume, pressure, temperature, and flow rate. This is important to the repeatability of the analyses.

The MEMS technology used in the proChain GC with channels etched in silicon and diaphragm valves to control the flow direction comes very close to this ideal. In comparison with traditional fine mechanical technology, this injector achieves high-precision control of the injection volume and temperature.
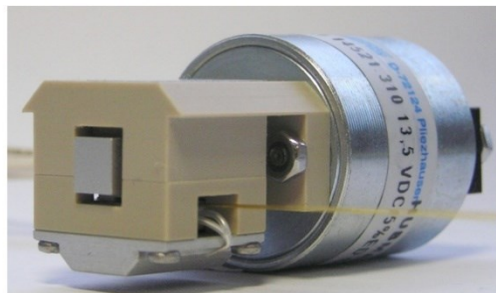
Figure 2.5: MEMS injector in the proChain GC

The **separation columns**, or **columns**, used in the **proChain GC** are fabricated in MEMS technology. See the figure below.
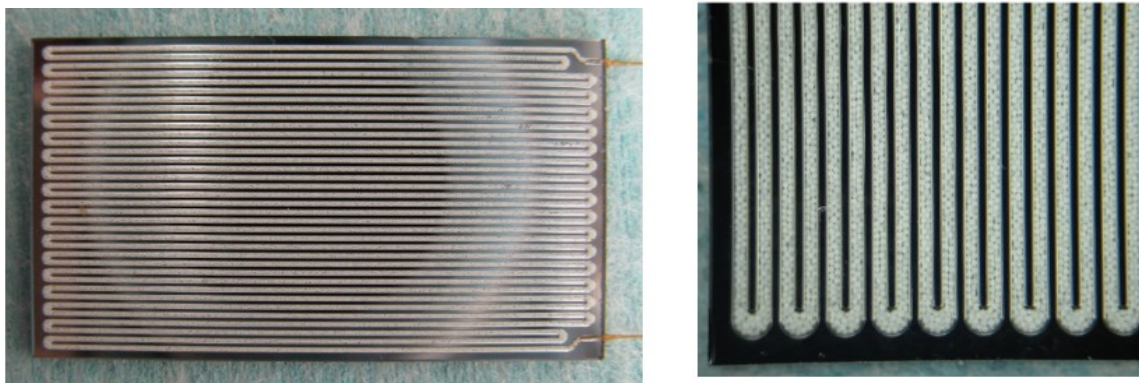
Figure 2.6: MEMS column, complete and enlarged section

The inner coating or filler materials are known as the "stationary phase". They are used as an adsorption layer for the gas molecules flowing through the column and ensure the actual separation of the components. There are various types of columns:

- **Wall–coated open tubular column:** the medium of the stationary phase consists of a thin liquid coating on the interior wall of the column.

- **Packed capillary column:** the medium of the stationary phase is applied to a filler which is evenly distributed in the column.

- **Support–coated open tubular column** (SCOT column): the medium of the stationary phase consists of a coated filler which itself is applied to the interior wall of the column.

- **Porous layer open tubular column:** the medium of the stationary phase consists of a porous coating on the interior wall of the column.

The **thermal conductivity detector (TCD),** the detector, is a universal, very efficient, robust detector which is very widely used in the natural gas industry.

Since process gas chromatographs are mainly used to measure the lower heating value, relative density and Wobbe index and the calculation of these parameters is based on the concentrations of the main gas components, its low sensitivity and lower linearity compared to flame ionization detectors (FIDs) are negligible.

TCDs of a more recent design as used in the proChain GC are manufactured using MEMS technology and have a much lower volume than their predecessors.

In addition, the components can be integrated with a great deal more precision so that the analytical precision of the TCDs is very close to that of the FIDs in their area of application, without requiring the complexity of an FID application.

The circuit of four freely suspended platinum filaments using MEMS technology on a Silicon/Pyrex chip is designed as a so-called Wheatstone bridge.
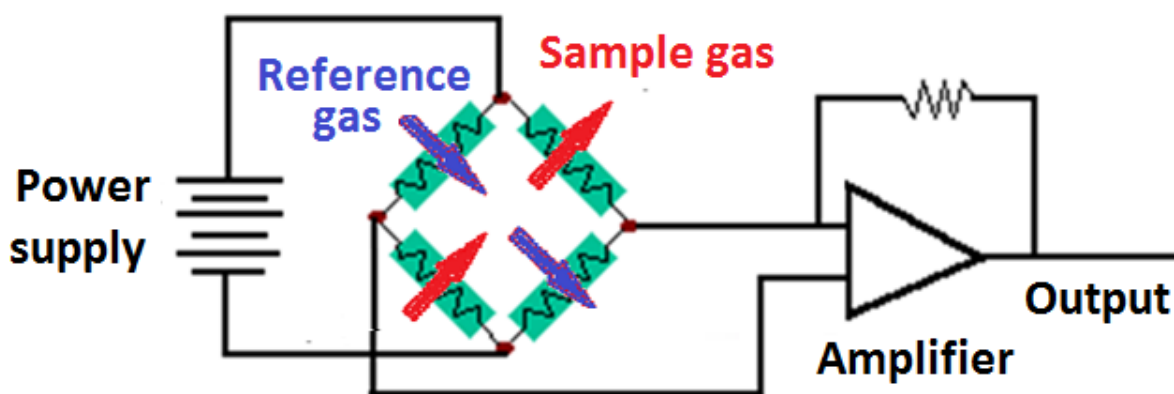
Figure 2.7: Detector

Two fluidically independent cells for reference gas and sample gas are used. Temperature differences occur between the chip (approximate temperature +100 °C (+212 °F)) and the filament (temperature up to approx. +350 °C (+662 °F)), depending on the thermal conductivity of the gas, which result in the bridge losing its tuning and thus a change in the electrical circuit.

The **internal sample conditioning system** is another main component of the device.

After passing through the inlet coupling (inlet filters), which are no substitute for a proper sample conditioning system and only filter out small particles to protect the device, the gas flows into the manifold. Please remember to provide only samples free of solids and liquids. Several valves are installed on the manifold, see following figure.
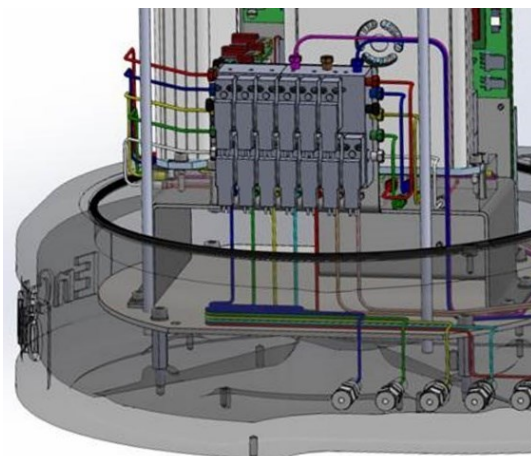
Figure 2.8: Internal sampling system in the device

The internal sampling system has the following functions:

- Stream selection with "double-block-and-bleed function"
  (up to five sample gas streams/one calibration gas stream)

- Supply of carrier gas (helium) and sample gas / calibration gas to GCM1000 module(s)

- Connection of the vents or outlets (gas lines) of the GCM1000 module(s)

- Integrated bypass function (purge valve)
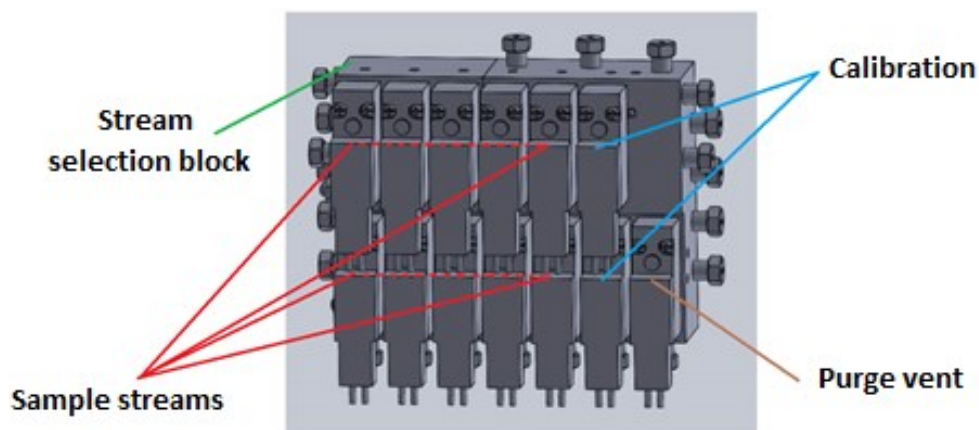
Figure 2.9: Internal sampling system for five streams (standard version)

The sample bypass valve is a purge valve. The valves which are installed above each other directly to the left of the purge valve are used for calibration and are activated in pairs at the same time.

To the left of the valves for the calibration gas stream, there are one to five pairs which are used for the process gas streams. Depending on the configuration, the manifold may connect between two and six streams (maximum five sample gas streams plus one calibration gas stream). Not used positions on the manifold are blocked.

In the operating state, gas enters the lower valve and flows to the second, upper valve. The second valve guides the stream to a manifold line. When it is deactivated, the supply is blocked by the lower valve and the discharge is forwarded to the vent which discharges the gas into the opening (SBV).

The supply through the upper valve is also blocked and no pressure can build up between the valves. If one or both valves have a leak, the pressure will not rise above the line pressure since the gas is forwarded to the vent (SBV). It is not possible for it to mix with the stream. This circuit realizes the double-block-and-bleed function (DBB).

The discharge from all upper valves is combined via a manifold line. Depending on which stream is active, the deactivated valves and part of the line form a dead volume.

The discharge from the deactivated valves is released to a second vent which is blocked by the sample bypass valve. The internal sample bypass is therefore realized as follows:

The activation (opening) of the valve causes a flow from the activated stream through the upper, deactivated valves for the other streams and through the sample bypass valve into the vent gas. This means that all the second (upper) valves and the tubes and therefore also the dead volume are refreshed or purged. The flow, details in next section, which then becomes established is around 15 times higher than in normal operation due to the lower flow resistance of this stream.

At the same time, the flow through the analytical modules is reduced but not stopped. When the purge valve is closed (default condition), the flow through the analytical modules returns to normal and the purge time is over.

If a new stream is selected, the sample bypass valve is activated automatically. To adjust the opening time, the lengths of the tubing between the sampling points and the device and the pressure between the sampling points must be given. See also next section.

If the stream is changed during a measurement, flushing will start immediately after the injection while the analysis is running to prevent unnecessary waiting times. Remember that flushing and flush time also apply to the calibration gas. Lengthy, frequent flushing will empty the cylinder more quickly.

The first following figure represents the normal operating case: stream 1 is measured. The DBB function is demonstrated using the example of the calibration gas (CAL). If the upper or lower valve is leaking, the gas (shown in pink) is always routed to the vent gas duct and to the SBV.

The second following figure shows the stream selection system in which calibration gas is now supplied to the GCM

After the carrier gas, sample gas and, if applicable, the calibration gas has entered the inlet filter flame arrester and selection system, they pass the electronic pressure control (EPC) where the gas pressure is adjusted before they reach the GCM, the core of the proChain GC.
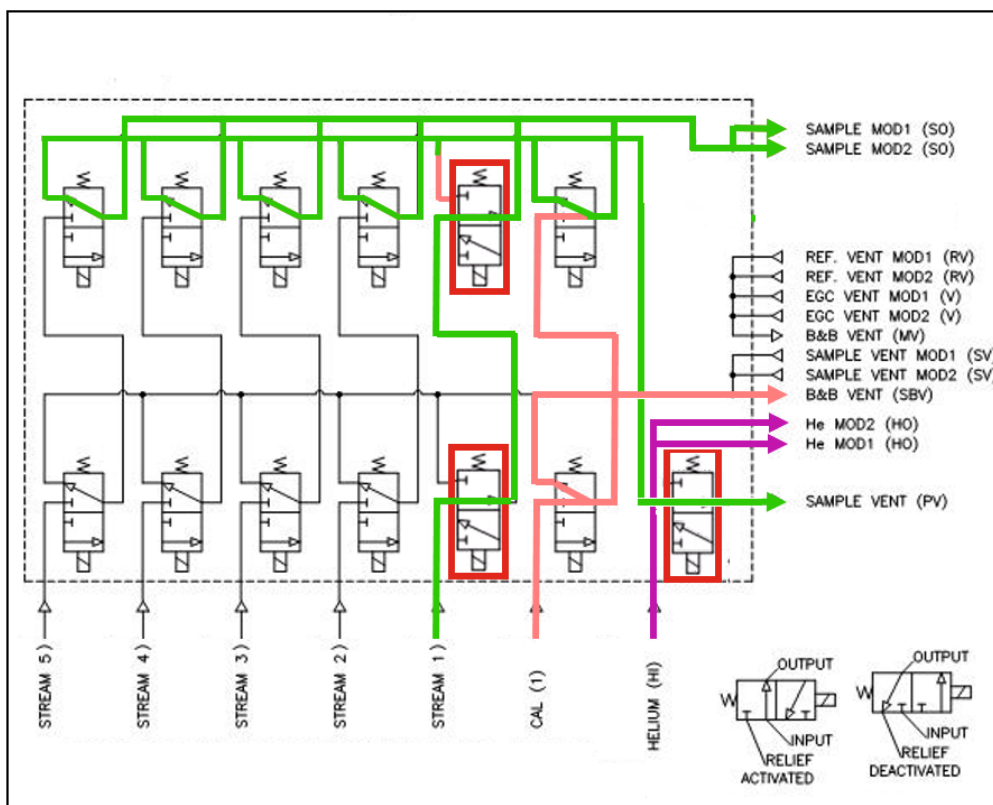
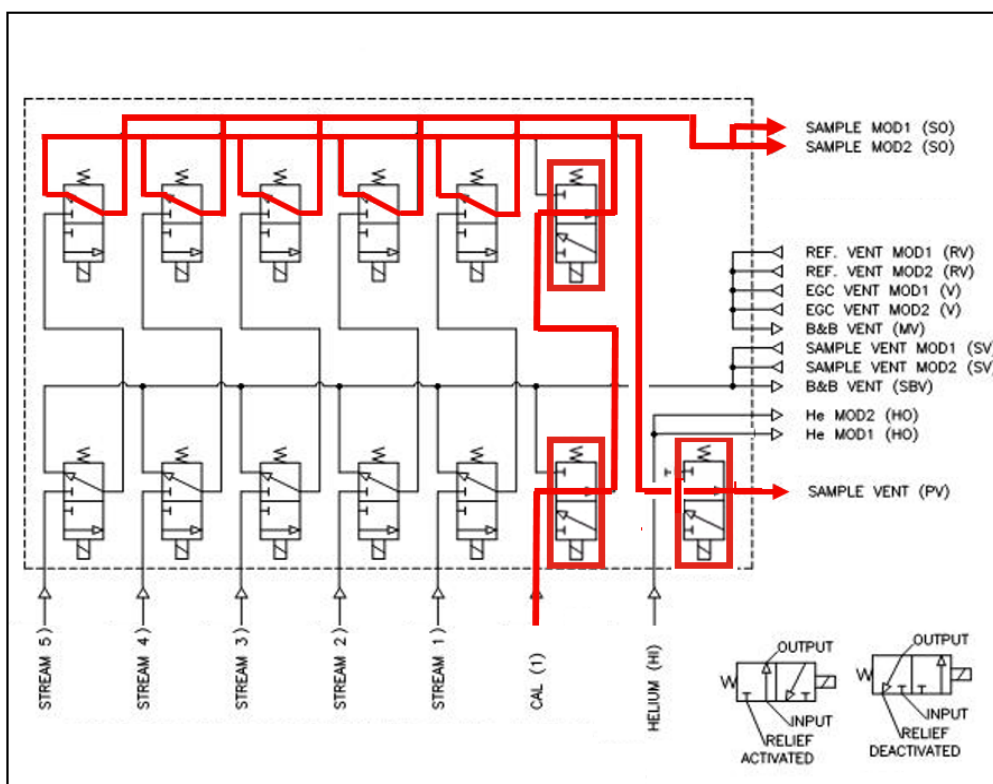Figure 2.10: Gas flow diagram, normal operation

Figure 2.11: Calibration gas flow diagram

The EnCal 3000 proChain GC contains following **electronic boards** to manage the measurement results and the communication. There is a Terminal Board, a Base Board, a CPU3Core Board and electronic (back) pressure regulation board(s). The intrinsically safe IS Display Board is an optional additional PCB. The overview shows the main PCBs.
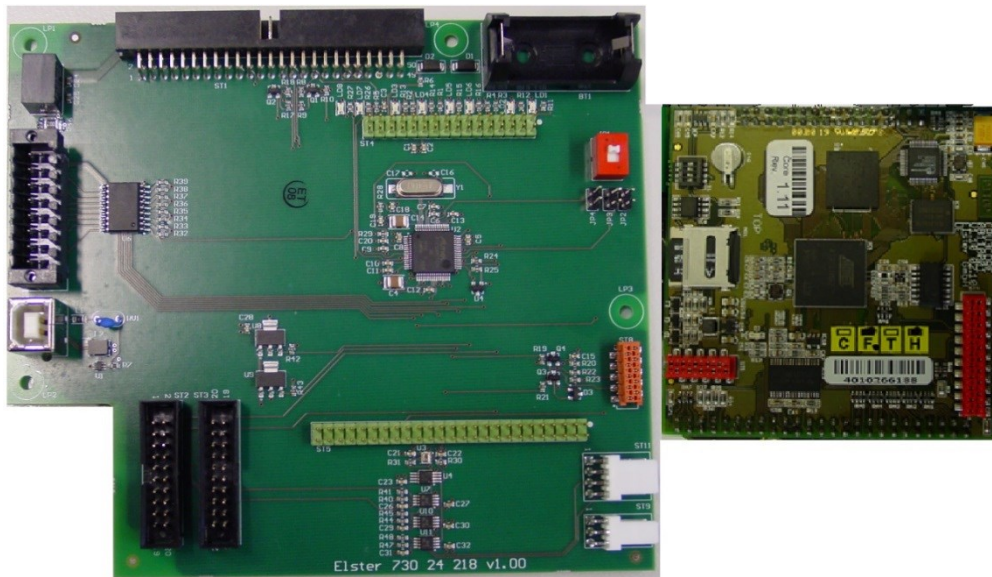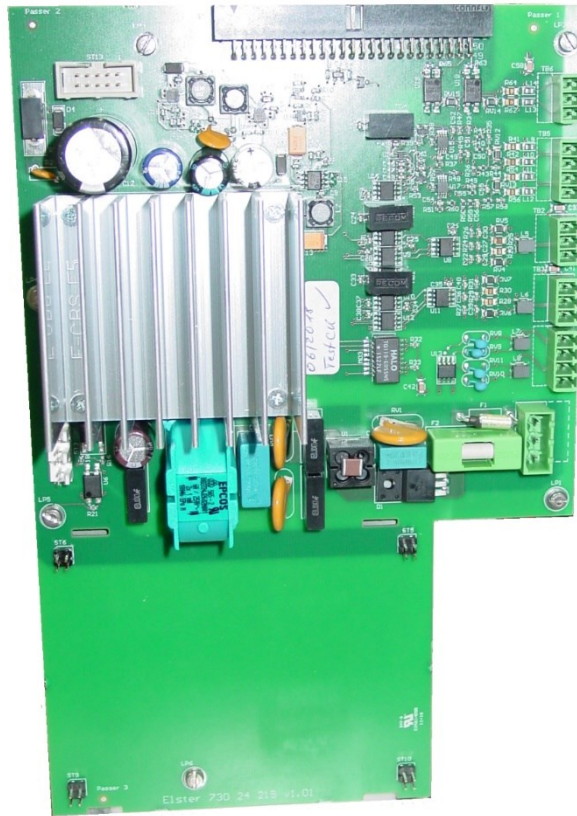
(Top Terminal Board / left Base Board / right CPU 3 Board)

Figure 2.12: Overview of the functional device boards

2.3.2.   Procedure and results of the measurement

After passing the inlet coupling, even small particles have been filtered out and the gas flows into the manifold to which multiple valves are connected. These components build the internal sampling system with the following functions:

- Stream selection with "double-block-and-bleed" function (up to five sample gas streams/one calibration gas stream)

- Supply of the carrier gas and the sample gas into up to two GCM1000 modules

- Connection of the vent gas lines of the two modules

- Integrated bypass function (purge valve) for around 15 times higher flow than in normal operation (flow 20 – 30 Nl/h software selectable)

Depending on the configuration, the manifold may connect between two and six streams (including the calibration gas stream) for measurement. If a new stream is selected, the sample bypass valve is activated automatically for an adjustable time. The lengths of the tubing between the sampling points and the device and the pressure between the sampling points must be given due consideration in the adjustment.

If the stream is changed for the next measurement the flushing will start during the current measurement. This procedure is called "stream ahead flushing". The flushing will automatically start immediately after the injection while the analysis is running to prevent unnecessary waiting times. The flushing time for the calibration gas can be adjusted separately. It is typically set to 60s to have a enough flushing and avoid too much calibration gas consumption.

After passing the manifold, the gas is forwarded (in parallel) to the downstream components. The last job of the manifold is then to transfer the gas to the vent, after it has passed through the analytical modules.

After the carrier gas, sample gas and, if applicable, the calibration gas has passed through the sample conditioning and selection system, they must pass the electronic pressure controllers where the gas pressure is adjusted before they reach the GCM module, the core of the proChain GC.

Different processes are used for the carrier gas on the one hand and for the sample or calibration gas on the other hand

- The carrier gas pressure is actively regulated by an electronic pressure controller (EPC)

- The sample, or calibration, gas flow and pressure are controlled via a Backpressure EPC (BEPC).

The injector injects a fix volume of sample gas into the carrier gas stream. This package reaches the first separation column (pre-column). The light components pass the pre-column and flow into the second column (analytical column).

The light components are separated by the analytical column and measured by the first detector. In most cases, the analytical column is temperature programmed.

The heavier components are still in the pre-column. The flow direction of the carrier gas is reversed and the component are flushed back to the former inlet of the pre-column and measured by the second detector.

After this analytical run is completed, the columns are cooled to their starting temperatures by an active fan.

The differences of the thermal conductivity are detected in the TCD. It results in the peaks in the chromatogram. The chromatogram is now evaluated and analyzed. The figure below shows examples of a chromatogram. All the main gas components can therefore be directly recorded and processed.
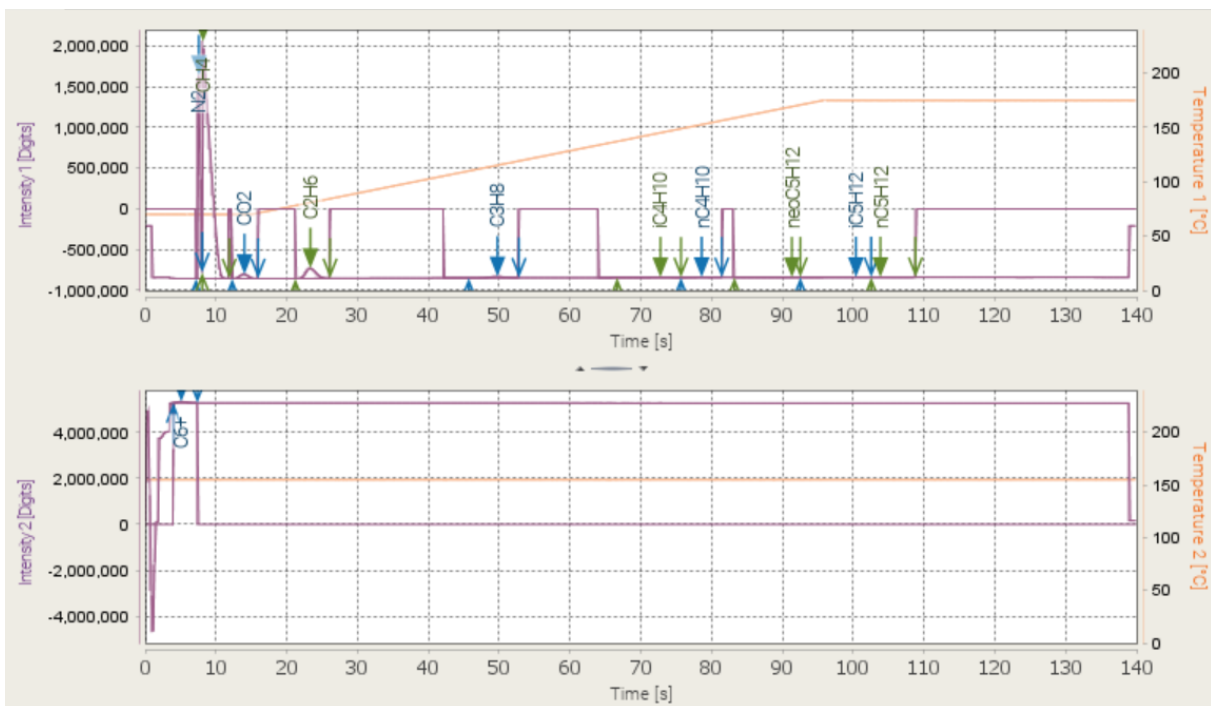
Figure 2.13: Chromatograms

2.3.3. Design of the measurement point (system overview)

A typical measurement point consists of up to five sampling lines from the gas pipeline(s) to the measuring instrument. If necessary, a "**sample conditioning system**" must be installed and adjusted upstream of the sample gas inlet. If the pipeline pressure is higher than the maximum inlet pressure, the sample conditioning system must include a safety pressure relief valve to prevent sample pressure to the proChain from exceeding the maximum allowable limit (hint under 2.1.3 Safety information about gases). The system must maintain sample integrity by lowering sample pressure without causing condensation in the sample. It must also remove any solids or liquids before sending the low-pressure sample gas to the proChain GC.

It is recommended that sample transport lines to the proChain be heat-traced to maintain sample integrity and avoid condensation of water vapor or heavy HCs during low ambient temperatures. The streams of gas are measured in sequence. Gases which have passed through the device are fed into the vent gas.

The carrier gas and calibration gas are generally supplied from gas cylinders with pressure reducers installed near the device, see section 2.1.3 Safety information about gases for pressure settings. These auxiliary gases are used to maintain operation and measurement accuracy. The gas supply will generally last for several years of operation. By using an optional changeover valve, the exchange of gas bottles is possible without interruption of operation. This option is shown on the helium cylinders in the figure below.

All components and sample tubing (made of stainless steel) should be installed permanently. An additional heating is required for the use below the freezing point. The gases leaving the device must not cause any backpressure in the exhaust system and must not interfere with each other. To enable this, the gas from the module vent (MV) must always be discharged separately. The power supply and the communication cables must be connected and installed as usual in industrial environments. The following figure shows a typical system layout in simplified form:
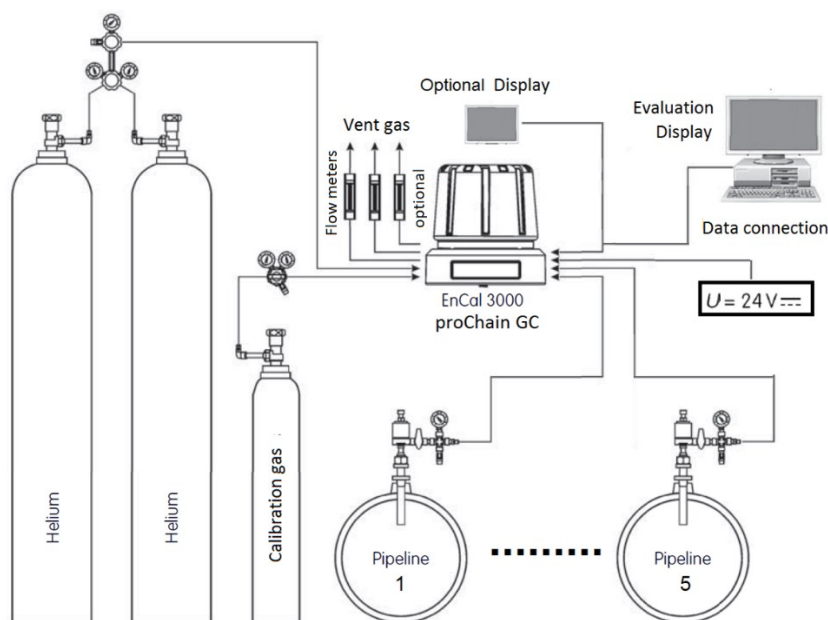
Figure 2.14: System overview

Flowmeters can optionally be installed in the exhaust gas streams to obtain further status information of the device.

2.4. Optional add-ons

The **proChain GC** offers several options which you can be installed. In addition to the pure extension of functions by a second analysis module, it is also possible to extend communication through a USB service interface or a local display. Furthermore, the operating temperature range can be extended to below freezing point by an additional heating system.

💡	After concluding the extension work, you should conduct a test to rule out the possibility of errors and leaks and check the new function.

2.4.1. Housing heater

The device has an optional additional heating system for use in temperatures from 0 °C (+32 °F) down to -25 °C (-13 °F). To protect the proChain against overheating, this function does not operate whenever the temperature inside the housing reaches of + 40 °C (+104 °F).

The heating function is adjusted and modified via the PC software **enSuite.** Please refer to chapter 3 Software of this document or the online help for this software for further information.

⚠️	**If this option is required, the proChain GC is generally fitted with the required parts at the factory. If the heaters must be retrofitted, this must be done by personnel authorized by the manufacturer for safety reasons.**

2.4.2. USB connection

Most systems only require connections for data transmission and power supply. The remaining threaded holes can be equipped with add-on screw-in parts, e.g. a USB port or the optional display port, otherwise they are sealed with blind plugs.

The **screw-in USB port** enables the access to the device via USB. It has the correct IP rating and the suitable explosion-protection certification.

💡	The use of this option extends access to the device and is beneficial for communication.

⚠️	**DO NOT REMOVE THE CAP AND DO NOT CONNECT THE USB WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.** **FOR SAFE USE ONLY.**

Figure 2.15: USB connection

⚠	If the USB Connection should be installed, this must be done by personnel authorized by the manufacturer for safety reasons.

Use of the USB service interface

⚠	DO NOT REMOVE THE CAP AND DO NOT CONNECT THE USB WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT. FOR SAFE USE ONLY.

Before using, the cap of the USB interface must first be removed and the USB adapter (compare left image) plugged in, see figures below.
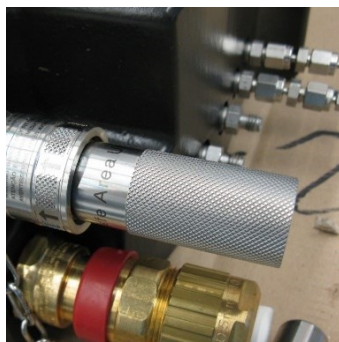
An USB cable can now be plugged into the adapter. The other side of the connecting cable can then be connected to the PC. With the proChain switched on, you can connect to the **proChain GC** via USB using the configuration and analysis PC software enSuite.

2.4.3. Local display

The proChain GC is designed to operate with its primary interface, the enSuite software, running on your computer. All functions of the proChain GC are accessible through enSuite. Consequently, the basic proChain is not provided with a local display and it is not possible to read the measurements and target values on the **proChain GC** itself.

	This method and the software are explained in further detail in chapter 3 Software. Detailed information about the display can also be found there.

There is also an option to view the main data using a **local display**.

The **Honeywell Local Display** is intrinsically safe and suitable for use in potentially explosive atmospheres. It is connected to the measuring instrument using a cable and does not require a separate power supply.

The Honeywell Local Display can simply be mounted on a wall or on rails. The highly visible display has backlighting and five keys for scroll through the results. This simple, intuitive navigation makes the device very easy to use and saves time by avoiding unnecessary referrals to the control room.

The figure below shows the local display.

Figure 2.16: Local display

	The display is available from Honeywell. The installation must be done by personnel authorized by the manufacturer for safety reasons.

2.5. Mechanical installation (assembly)

Professional installation is the only way to ensure that the **proChain GC** operates safely and without problems. Always observe the general safety rules, particularly in a potentially explosive atmosphere. Always use a gas detector for your own protection to check your respiratory air for toxic or explosive gases when you are working on the device in areas where such hazards exist. Do not carry out any unauthorized modifications or technical changes.

⚠	**If unauthorized alterations are made to the product or when it is modified, the CE declaration becomes void with immediate effect. There may be a security risk!**

Many components are assembled with screws. Ensure that these screws are securely tightened. The technical specifications and proper operation will only be guaranteed if the device is installed in the correct position (left/right/top/bottom). Ensure this, when fitting the device and the parts. Prevent dirt and/or moisture getting into the device or its openings as it could possibly falsify the measurements or cause damage.

2.5.1. External dimensions of proChain GC

Please note that all dimensions in the following drawing are shown in mm. The relevant dimensions (raw dimensions) are highlighted in bold. Some of them will change depending on the types of fluidic and electrical couplings used.
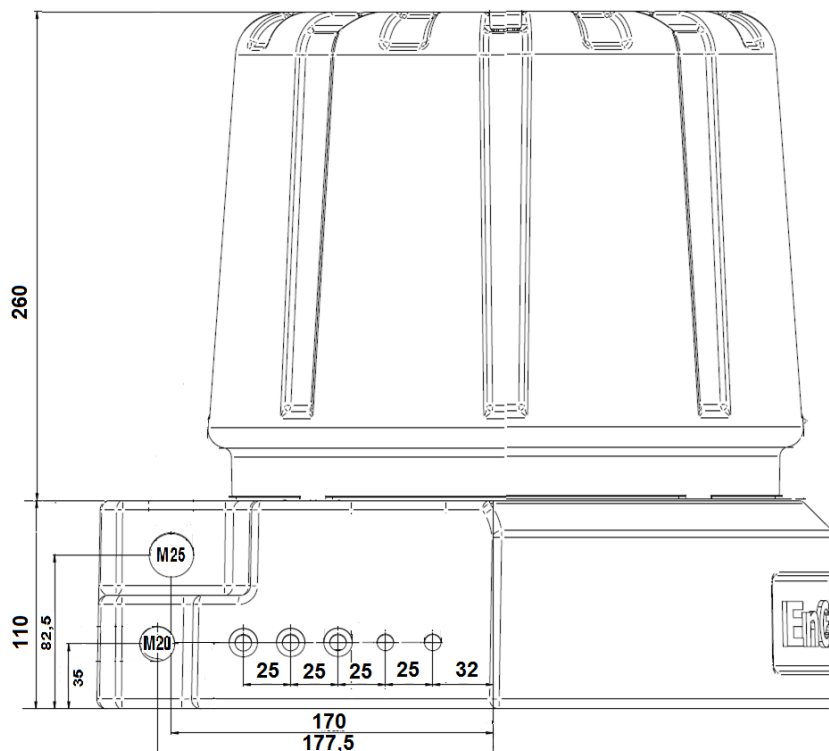
Figure 2.17: Side view with dimensions (without couplings and connections)
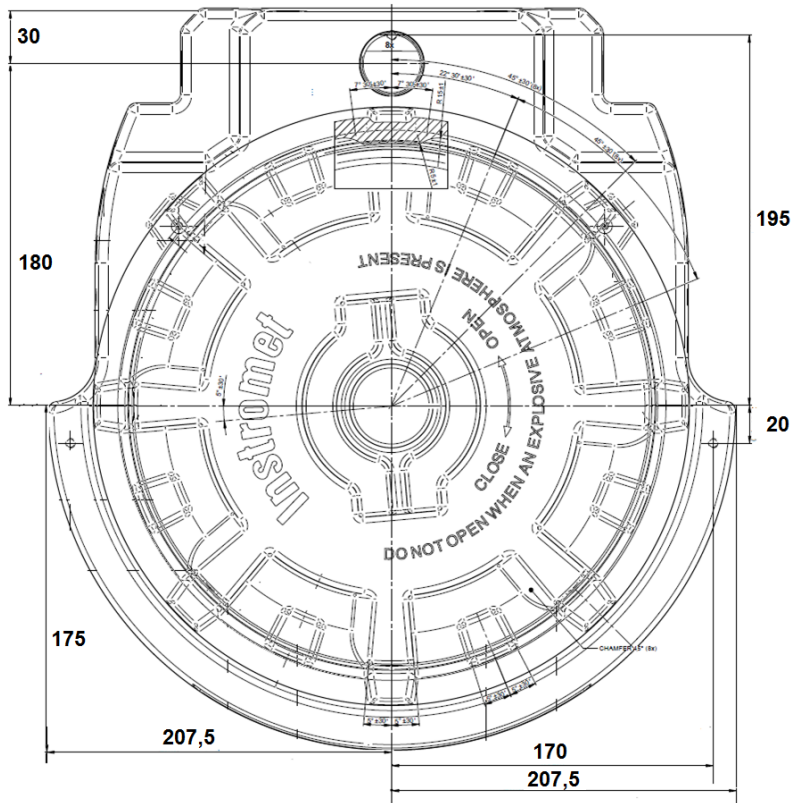
Figure 2.18: Plan view with dimensions (without couplings and connections)

	Please note all dimensions are given metric and in mm. 1 mm = 0.03937" NPT adapters are available for the threads.

2.5.2. Place / location of use and installation site

	Always obey the explosion-protection rules when working with tools or on items in hazardous zones.

	The **proChain GC** should be installed as close as possible to the process gas sampling point to avoid having long supply lines and to ensure that you obtain representative samples.

	The installation site must satisfy the required ambient conditions (see section 2.11 Technical data (Hardware)). If this is not the case, for example outside buildings, the device must be protected from direct sunlight and rain, for example by a metal roof or an additional air-conditioned housing. Make sure that the device cannot be hit by a water jet (e.g. during cleaning the plant).

	If possible, install the **proChain GC** close to the process gas tapping to avoid long lines and to get current measurement values. The **weight** is about **29 kg (64 lb.)**. Make sure that the installation area has sufficient stability. The **proChain GC** must always be **operated in a horizontal position**, with the analytical modules and hood at the top, the electrical entries are left and right. It can be installed on a flat vertical surface (wall/measuring board) or on a horizontal surface. Select an **installation height between 1.0 m (3.28 ft.)** and **1.5 m (4.92 ft.)** above the floor which is suitable for maintenance work.

There must be a minimum gap of 700 mm (2.30 ft.) above the base of the device and 100 mm (0.33 ft.) in front of the gas connections or a radius of 225 mm (0.74 ft.) around the center of the cover. We recommend that you use larger gaps to make installation and maintenance work easier. The following figure shows these requirements.
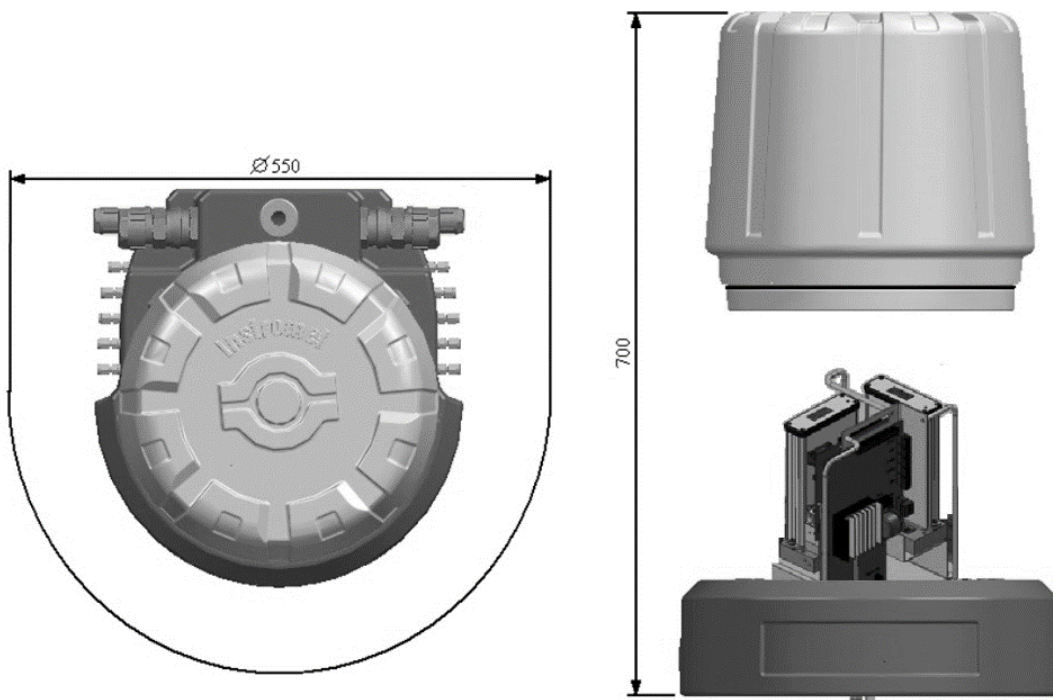
Figure 2.19: Minimum installation gaps

	Please note all dimensions in the figures are given in mm. **1 mm = 0.03937"**

Use the fastening holes provided in the housing and, if necessary, additional mounting plates (as shown) for this purpose.

The drawings below and to the side show the various installation options:

For example, the measuring unit can be secured to a horizontal surface with four screws using the four threaded blind holes in the housing base plate (*not* when with stainless steel type plate delivered).

See drawing to the side (**dimensions in mm**).

It can be installed vertically (wall/board mounting) using a wall mounting bracket secured as shown in the figures below (**dimensions in mm).**
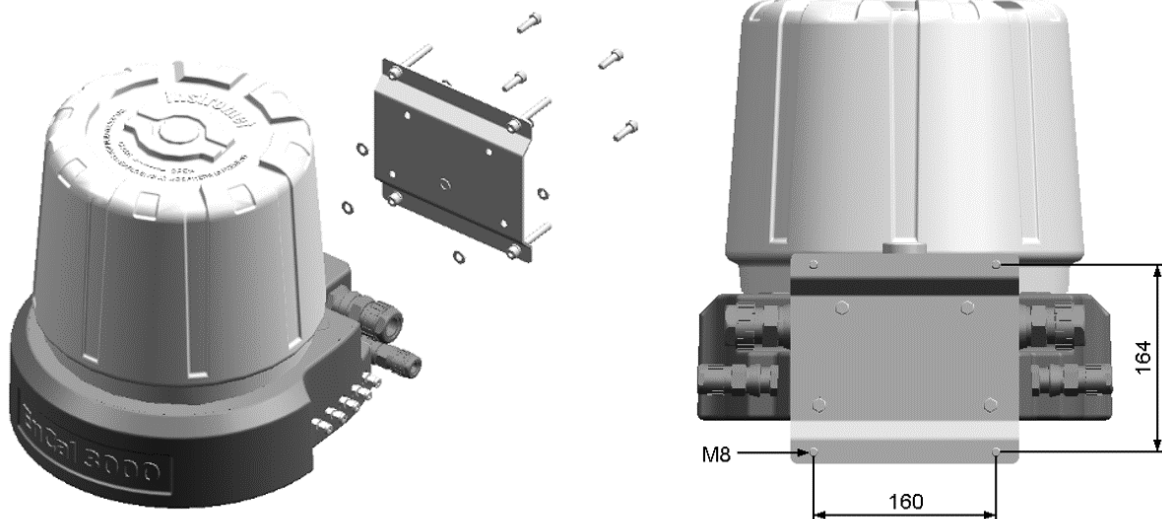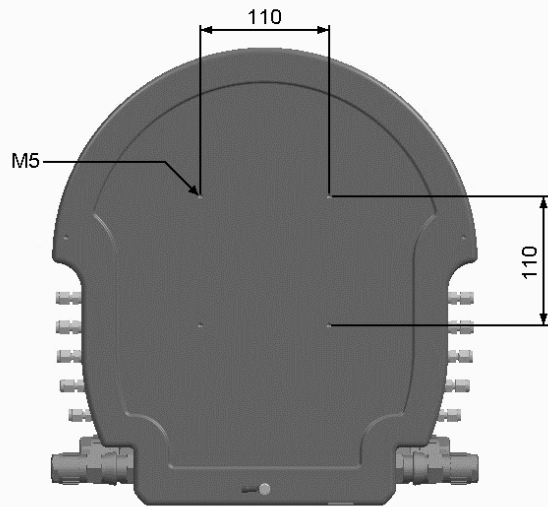
Figure 2.20: Installation options

Use suitable fastenings and mating parts in each fastening hole (i.e. nuts and bolts or anchoring which fill the holes as much as possible). Select them based on the material and the type of installation surface.

> **Ensure that your fastenings will withstand a combined vertical load of at least 1000 N (this is equal to a weight force from a mass of about 100 kg).**

2.6.   Electrical installation

	A functioning, effective lightning protection system must exist at the place of use to protect personnel, equipment and the proChain GC. The device does not have its own off switch. An external off switch (not supplied) must be installed near the device by the system operator (see section 2.1.4 Electrical safety information connecting with earth & emergency stop).

	Always observe general safety rules, particularly in potentially hazardous atmospheres. Always use a personal gas monitor when working on the device. **Always switch off the entire power supply (supply and sensors) before making or disconnecting electrical connections.**

	The electrical connection plan of the device specified hereinafter must be strictly adhered.

	The proChain GC is protected against reverse polarity. The device does not work if the connections are interchanged.

	The device may only be opened in a controlled environment according ISO/IEC60079-14* **When the proChain GC is open, there is a risk of damaging the internal components and thus generating safety problems or malfunctions.**

* These conditions (temperature +5 °C (+41 °F) to +40 °C (+104 °F); humidity up to 80% at +31 °C (+88 °F) decreasing linearly to 50% at +40 °C (+104 °F)) usually prevail in residential and office spaces. In case of doubt, please read the standard or contact Honeywell Technical Support.

	DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT DISCONNECT POWER BEFORE OPENING

	The local / national installation standards (e.g. EN 60079-14 for Europe) must be considered.

2.6.1. Power supply / Electric protection / Grounding

The power supply must comply with section **2.1.4 Electrical safety information connecting with earth & emergency stop**. Please note the following in this context:

⚠️	• **The 24 V (DC) power supply must be reinforced isolated from mains. Fluctuations, including mains fluctuations: ± 15%. It must be possible to supply a rating of up to 120 W.** • **Only one device may be operated at a voltage supply.** • **The overvoltage/current protection and electrical line protection must be ensured by the power supply. Suitable external safety devices must shut down a current of 8.3 A or over within 120 seconds, thus limiting the power supply.**

💡	The proChain GC has no user replaceable guards. The device will not work if the internal protective equipment has tripped. This protective equipment (thermal trips and electrical fuses) must be changed by Honeywell. Please get in contact if the internal guards have tripped.

Check the input voltage, at the location of use, for accuracy and usability according to the following data:

Power supply	Voltage range: 24 V DC. Including mains fluctuations ± 15%, e.g. Quint-PS-100-240AC / Quint-PS-24DC/24DC/10 / Siemens SITOP / Siemens Logo or equivalent power supply units with safe electrical isolation
	An external safety device which shuts down within 120 seconds* is installed
	Rating of up to 5 A/120 W can be supplied.

* Note: The shut-down current is 200/Supply voltage. The tripping properties depend on the ambient temperature. This must be taken into account if the temperature is significantly higher than room temperature.

> ⚠️ **The housing must be connected to the equipotential bonding system (earthed / grounded), the potential equalization connection point (PA) on the bottom side of the housing is provided for this purpose.**

The **proChain GC** must be connected to the equipotential bonding system at the place of use and earthed, see section **2.1.4 Electrical safety information connecting with earth & emergency stop**. Use a suitable connection on the base (see next figure) to connect the device to the local earth and the equipotential bonding system.

If other metal parts are connected to the device during the installation work, they must be expertly included in the earthing and the equipotential bonding system. Use the appropriate connections or install such connections.

The device will only operate correctly if all the system parts have the same earthing potential. Ensure that the same earthing potentials are always connected to each other.

The permissible conductor cross-section for grounding is at least 6 mm² ≙ 10 AWG (maximum 10 mm² ≙ 8 AWG) of the copper cable. The earthing cable can be connected at various points on the base, depending on the installation configuration. Generally, the bottom side is used with M5 threaded bolts, but the rear with M8 threaded bolts may also be used, see following figure.
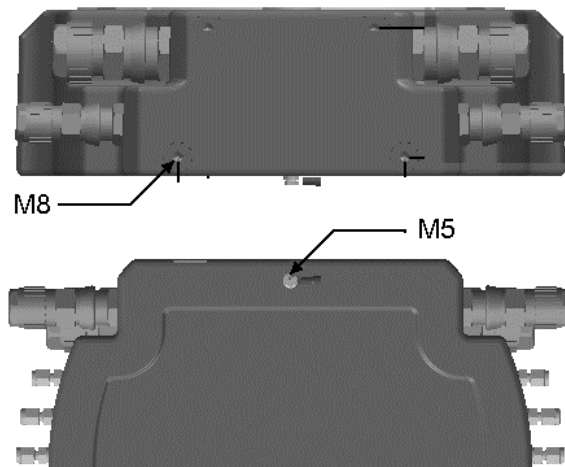
Figure 2.21: Example of earthing points on the device

> ⚠️ **When connecting the earthing cable, ensure that it has a permanent, stable electrical contact. When making the contact and selecting the fastening materials, comply with the appropriate regulations, for example IEC/EN 60079-14.**

2.6.2. Cables and electrical entries (power supply and communication)

	Cables, wires, cable glands, adapters and blind plugs which are required for operating the proChain GC are standard products and not manufactured by Honeywell. The basic equipment can be extended or adapted by using other parts or buying additional ones.

In general, the connection cables can be routed to two separate locations without additional Ex-rated junction boxes. Various control and signal cables are suitable for the connection between the proChain GC and other devices. They should be selected based on the requirements at the place of use. The insulation must have at least flammability class 1.

The cables must be screened /shielded. The shields of the supply and communication cables are connected in accordance with the Ex regulations (e.g. EN 60079-0; EN 60079-14) and the local conditions. We recommend that the data cables are separated from the power supply cable. The relevant installation guidelines must be observed when routing the cables.

Wire cross-sections of up to 2.5 mm^2 ≙ 14 AWG can be used for the power supply terminals, wire cross-sections of 0.14 mm^2 ≙ 25 AWG to 1.5 mm^2 ≙ 16 AWG are suitable for signal terminals. When making your selection, also note that the wire cross-section must satisfy the electrical and mechanical requirements. For example, signal cables generally require wire cross-sections of >0.25 mm^2.

A maximum rated operating current of 5 A should be considered for the power supply. Remember to take the cable voltage drop into account. Ensure that the power supply can trip the external circuit breakers or the internal 5 A fuse in the event of a short-circuit.

Honeywell generally recommends a signal cable with a conductor-to-conductor capacitance of less than 120pF/m ≙ 36.58 p S–1/ft. and an inductance < 0.7 µH/m ≙ 0.213 µΩs /ft.

The number of cores varies depending on the application, whereby the cores should be twisted in pairs and screened jointly. The maximum cable length depends on the type of signal and must not be exceeded.

A cable type of at least category 5 (Cat. 5) is recommended for data communication links via Ethernet. See also the following section.

There are four threaded holes which pass completely through the device base (2x M20x1.5 and 2x M25x1.5) (see next figures). The threaded holes can be fitted with blind plugs, adapters or cable glands as required.

These screw-in parts must have the correct IP rating (at least IP 66) and suitable explosion-protection certification. To comply with the specified explosion-protection regulations, they must be installed and sealed in their function as securing parts as specified by the manufacturer of the cable glands.

Unused openings must be fitted with suitable certified blind plugs.

⚠	The temperature on the proChain GC surface may rise to a temperature 10 °C / 18 °F above the ambient temperature (+70 °C / +158 °F). Make sure cable entries and cables are suitable for this increase under ambient conditions on site.

Most systems only require two cable glands, one for the data transfer cable and one for the power supply (24 V DC). Other cable inlets may be used for additional signal cables, the optional local display or the optional USB port.

The device can also be fitted with bespoke cable glands, for example with ½" NPT threads, using adapters. Please contact Honeywell for further details if you wish to change the standard equipment.
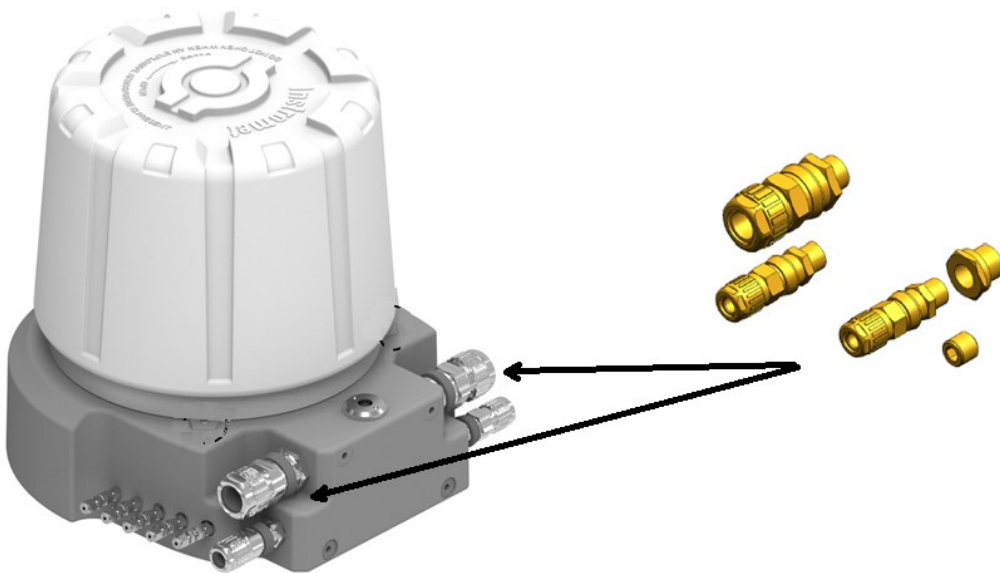
Figure 2.22: Position of the cable end glands on the housing base

The next figure shows the number and position of cable glands (looking from the wall towards the device). The relevant installation guidelines must be obeyed for routing the cables.

Figure 2.23: Position of the cable glands (back view)

All the electrical connections can be directly connected to the device using cable glands. When selecting, <u>you must comply with the manufacturer's instructions</u>.

⚠	**The electrical inputs are sealed for reasons of explosion protection. In the event of a replacement, the complete gland must be replaced. The residual cable in the device must then be cut and can no longer be used. The replacement and extension of the electrical connections involve similar work to a new installation.** **Sealing rings and washers supplied must also be installed. Treat the thread of the cable gland and blind plugs with a screw locking device! Loctite 243 is applied to the thread flanks in the last third of the internal thread.**

The M25 cable glands used as standard are suitable for reinforced cable with a diameter of 17 – 26 mm, while the M20 cable end glands can be used for reinforced cable with a diameter of 5,5 – 12 mm (small) or 12,5 – 20,5 mm (medium).

The following cable properties are required in order to comply with the explosion-protection regulations:

- Not sensitive to cold flow, impermeable to air and at least three meters long.

- The cable and cable gland are suitable for temperatures of +70 °C (+158 °F) and higher.

⚠	**Use only suitable and approved cable inlet equipment. The cable inlets must satisfy or exceed the IP rating. NEC-compliant cable inlet equipment must be used in the USA. CEC-compliant cable inlet equipment must be used in Canada.**

Other examples of suitable electrical inputs are cable junction boxes when sealed within 2" (~5 cm).

💡	The manufacturer is only responsible for compliance with the listed regulations if the cable glands were made by him or on his behalf.

2.6.3. Electrical connection plan and electrical interfaces (outputs and inputs)

All the electrical interfaces, except the options (USB/local display), are located on the Terminal Board using plug connectors and are electrically isolated. The connection terminals in the interior are different for the voltage supply and signals. The shielded / screened cables must be connected and installed in compliance with the local/national installation guidelines (e.g. EN 60079-14) and regulations.

Connector	Interface
TB1	Power supply (see also figure 2.26)
TB2 /TB3	RS485 port 1/2 (electrical isolation), range: 500m ≙ 1640ft
TB4	Ethernet connection 10/100 Mbit/s; electrically isolated, range: 100m ≙ 328.084ft
TB5	Digital inputs 1 and 2 supplied by the device, max. 9 V (electrical isolation)
TB6	2 digital outputs (electrically isolated), common supply (semi-conductor circuit operates as a floating contact), max. 120 mA at 28.8 V (DC)

The electrical connection options are also shown in the following overview:
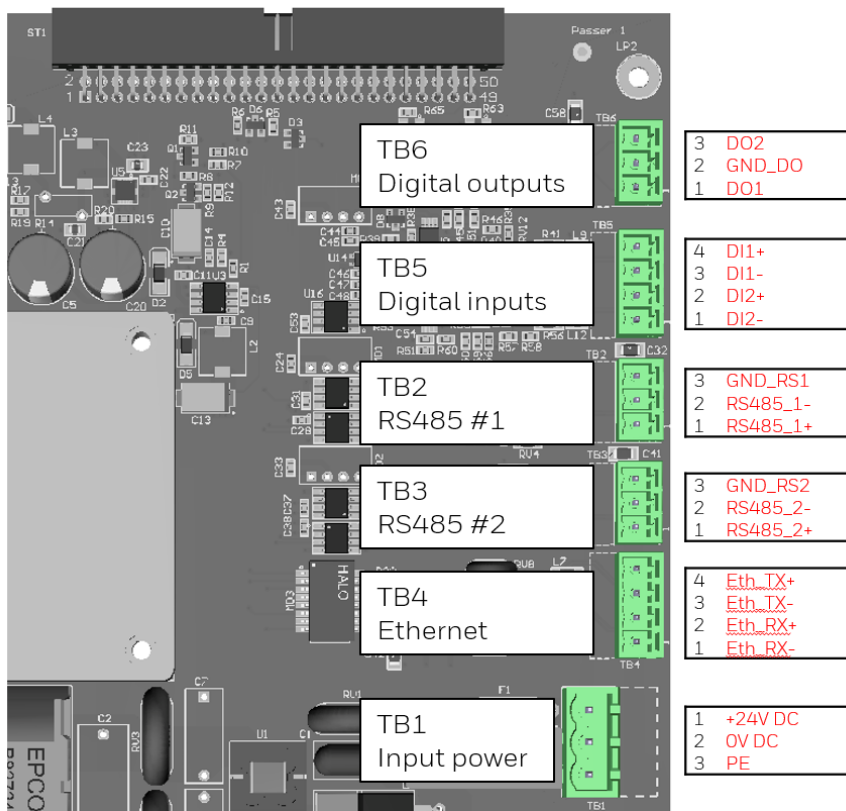
Figure 2.24: Overview of Terminal Board inputs and outputs (connection diagram)

	Please note that the connection for the supply voltage (TB1) has been preassigned with an EMC adapter cable at the factory for EMC reasons.

The EMC adapter cable ends at a **connection terminal** on the base plate in front of the Terminal Board, see following figure.

Figure 2.25: Power connection position and details

The two wires of the power supply are screwed to this grey connection terminal. Figure 2.27 shows the already made connection with the EMC adapter cable.

Use the opposite clamps and pay attention to the correct polarity.
Connect + 24V DC opposite the brown wire. Connect 0V DC opposite the blue wire

	Check for tightness of connectors! Screws of unused terminals must be tightened!

	Connect the cables and shields/screens in accordance with the explosion protection regulations! In practice, the shields are not connected in the explosion area, but only outside.
	If you make a connection via the terminals of the Ex-i socket for the optional local display, the shields must also not be connected there. The installation up to the device has already been carried out and does not have to be changed.

2.6.4. Connection to other devices and parts of the plant

Connection diagram examples for sensors and devices with which proChain GC can be connected are shown below. This can require special parameterization in enSuite.

	For detailed information on parameterization, see section 3.4 Changing existing device settings (Parameterization) and online help. Here, only the minimum required settings are displayed in keywords.

Regarding wiring, shielding/screening and grounding, the general industrial rules as well as the local conditions and regulations, e.g. EN 60079-0 and EN 60079-14, apply taking explosion protection into account.

The shielding of the cable serves to create a space free of external fields. Cable shields can best be imagined as a continuation of the housing. In order to better dissipate any interference that may occur, it is recommended that the shield be contacted as frequently and extensively as possible.

The following options for attaching the screen to the connection cable are possible as long as they do not breach explosion protection regulations		
1.	**Two-sided attachment (preferred if possible)**	
	Benefit	EMC-compliant connection is also effective against inductive coupling components
	Drawback	Compensating currents (ground loop formation), which flow through the screens should be prevented where possible and require appropriate action.
2.	**One-sided attachment**	
	Benefit	Lower voltage with potential isolation in conjunction with low frequency signals No compensating currents and ground loop formation
	Drawback	Is only effective against capacitive couplings and only produces significant success if the screened circuit has no connection to the ground, at least on the cable side.

	In order to comply with the specified explosion protection level, the cable connection in the gland must always obey the gland manufacturer's specifications. **The isolation or surge (lightning) protection on the cables of the device data connections must be installed by the user, depending on the situation of use.**

Ethernet

A cable type of category 5 (Cat 5) is recommended for data communication links via Ethernet. As already mentioned, the maximum cable length is 100m ≙ 328ft. The screen on the connection cable must be connected in compliance with local regulations. The following drawing is only designed to illustrate the screening using an example.

🔆	In addition to the wiring, various settings are required, before this interface can be used. These can be made using enSuite, information given in chapter 3 Software.

Ethernet (TCP/IP) connection is made using terminals TB4-1 to TB4-4 on the proChain GC Terminal Board shown in the following figure. The required wire colors can be determined from the table data.
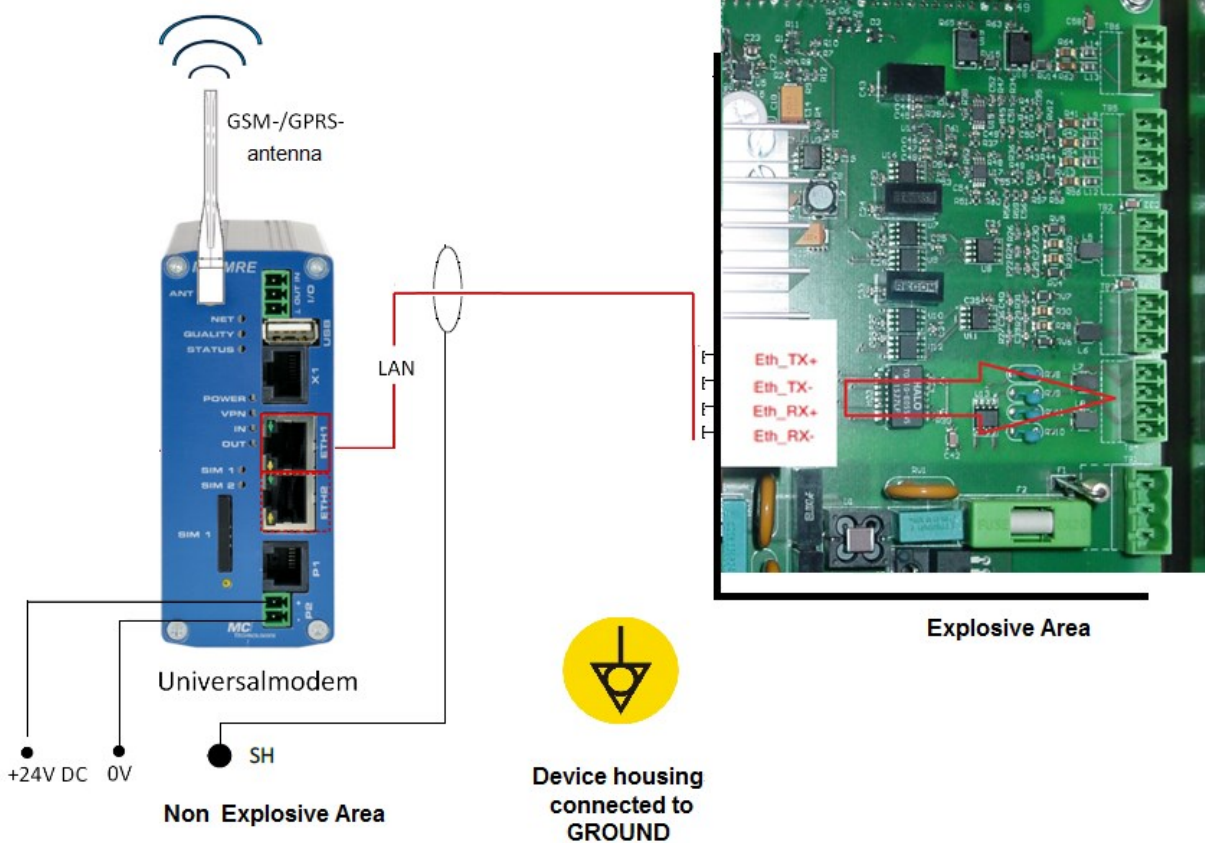
Figure 2.26: Example LAN / Ethernet connection (overview)

Pair of wires	Plug outside (Pins)	Color depending on standard					Comment	inside device
		EIA/TIA 568 B	EIA/TIA 568 B	IEC	REA	DIN 47.100		
1	4 / 5	blue+ white/blue	blue+ white	white +blue	white+ blue	white+ brown		
2	3 / 6	white/green + green	white + orange	red+ orange	turquoise+ violet	green+ yellow	Only wire pair 2 and 3 are needed	TB4-4
								TB4-3
3	1 / 2	white/orange + orange	white + green	black+ green	white+ orange	green + pink		TB4-2
								TB4-1
4	7 / 8	white/brown + brown	white + brown	yellow+ brown	turquoise+ violet	blue+ red		

- The wire colors depend on the underlying standard, EIA/TIA 568B is usual.

- The twisted pairs of wires must not be taken apart and regrouped.

- The polarity of the wires within the wire pair is unimportant the wire pairs can even be reversed.

	For grounding and shielding see hints at the beginning of the section. Here are only examples.

Serial interface RS485

Connections include, for example, other measurement devices, devices for final processing and evaluation, PLC systems, and so on. The connection varies depending on the device (see dotted cable in the following example). The ground (0 V) is either connected directly to the device/system or connected to GND. There are two interfaces with electrical isolation (TB2-terminals and TB3–terminals details see figure 2.24) The following requirements also apply to the wiring:

The screen on the connection cable must be connected in compliance with local conditions and regulations. The following drawing is only designed to illustrate the screening using an example.

	In addition to the wiring, various settings are required, before this interface can be used. These can be made using enSuite, information given in chapter 3 Software.

Pull-up / pull-down resistors should be installed at the cable end near the data evaluation unit to generate the neutral potential. A 470 Ω resistor must be connected between RSA and the positive supply voltage of the connected data evaluation unit. A further 470 Ω resistor must be connected between RSB and GND.

For cable lengths over 200 m ≙ 656ft, additional bus connection resistors of 120 Ω each between RSA and RSB at the cable end at the data evaluation unit are recommended.
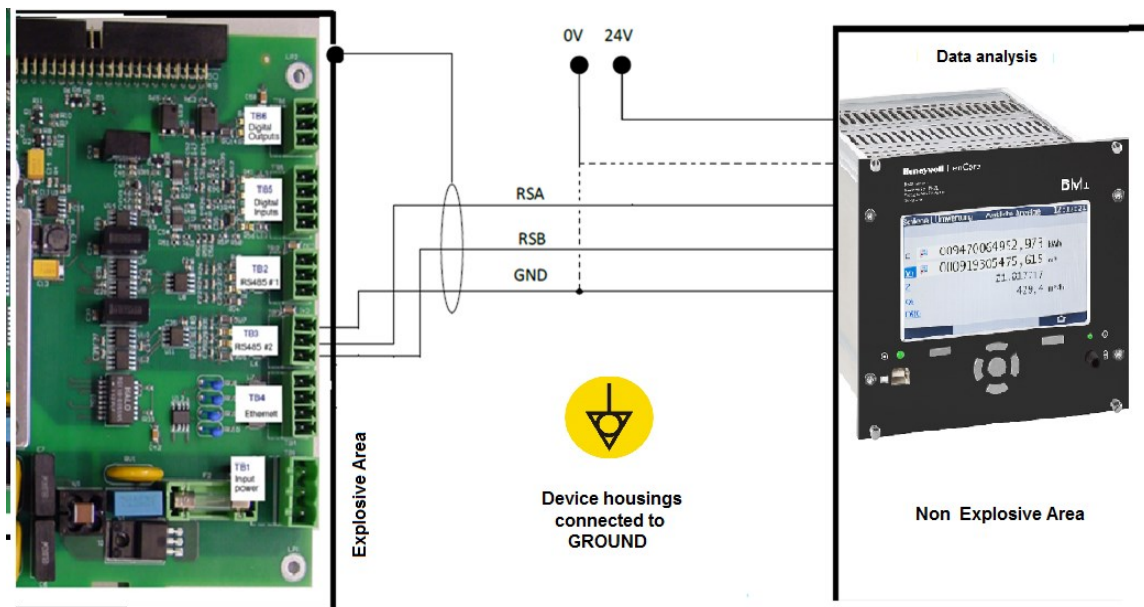
Figure 2.27: Example RS485 connection (overview)

Digital inputs

There are two electrically isolated inputs supplied by the device. The maximum supply voltage is approx. 9 V.

The screen on the connection cable must be connected in compliance with local conditions and regulations. The following drawing is only designed to illustrate the screening using an example.

	In addition to the wiring, various settings are required, before this interface can be used. These can be made using enSuite, information given in chapter 3 Software.

The figure also shows the corresponding terminals in the connection box.
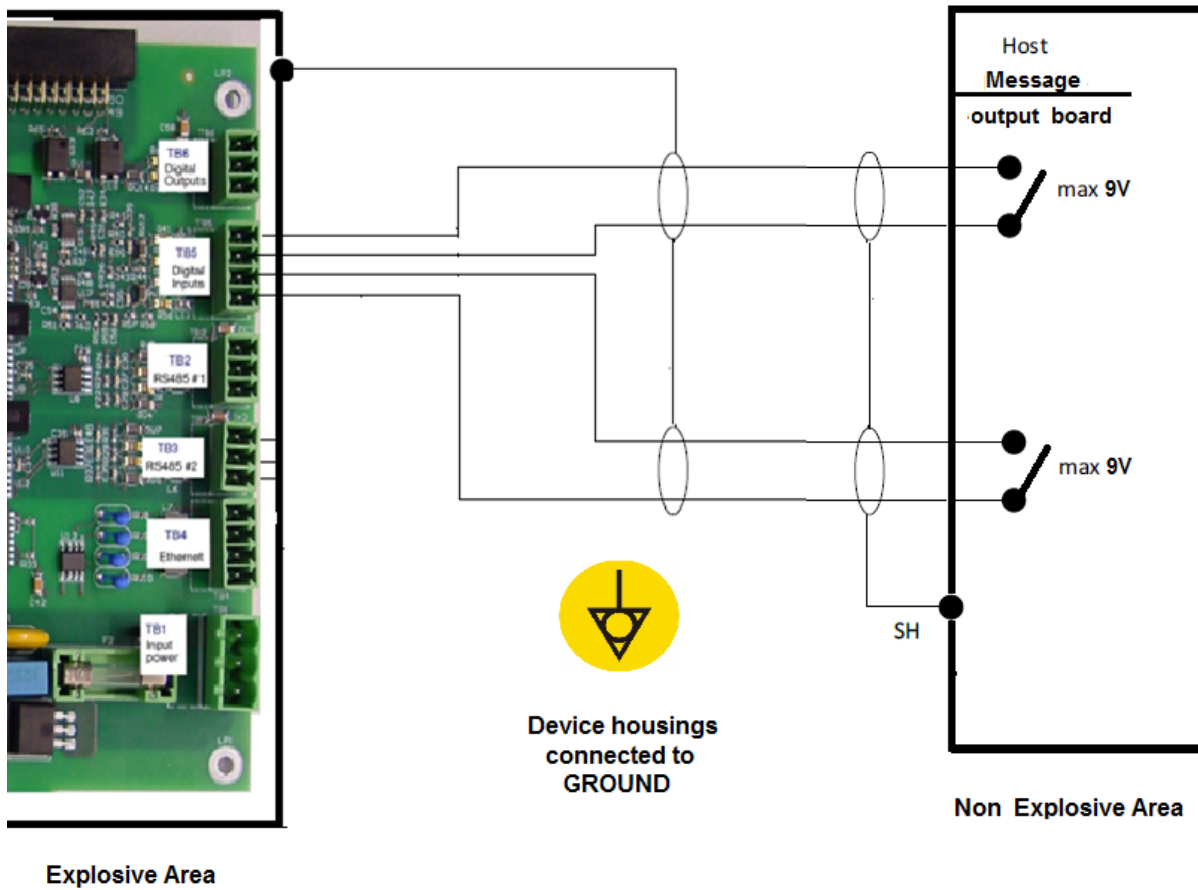
Figure 2.28: Example connection of the digital inputs (overview)

	For grounding and shielding see hints at the beginning of the section. Here are only examples.

Digital outputs

There are two outputs (electrically isolated passive output circuits). Output DO1 is an NC contact (terminal TB6-1) and output D02 is a NO contact (terminal TB6-3). The maximum cable length is 250 m (820 ft). The screen is connected to precisely one point (ideally on the device) using the cable inlet. The maximum load per channel is 28.8 V DC/120 mA. The maximum pulse rate is 25 Hz. The following figure shows the terminal assignment on the Terminal Board.

💡	In addition to the wiring, various settings are required, before this interface can be used. These can be made using enSuite, information given in chapter 3 Software.

Figure 2.29: Example connection of the digital outputs (overview)

💡	For grounding and shielding see hints at the beginning of the section. Here are only examples.

Optional USB connection and Honeywell Local Display

A cable gland can also be used to move the internal USB connection to the outside or connect a local display. See examples next figure.

Figure 2.30: Example optional connections via cable gland

⚠	The display and the USB connection are available from Honeywell for installation. For safety reasons this must be done by the manufacturer.

Optional additional heating system

If the device has an optional additional heating system, it is completely installed in the factory only the heating function must be adjusted and modified via the software **enSuite.** The heating system is required for the use of the device if an ambient temperature below 0 °C (+32 °F) is expected. Please refer to chapter 3 Software of this instructions or to the enSuite online help.

⚠	If the proChain GC is not prepared for additional heating, Honeywell is able to install it. For safety reasons this must be done by the manufacturer.

2.6.5. Electrical device test to verify correct installation

After completion of the electrical work, you should conduct a test to eliminate the possibility of errors, e.g. insulation faults in the supply voltage and communication.

⚠	**Do not conduct the tests in a potentially explosive atmosphere.** **You will require the permission of the system operator to conduct the test.**

The use of a multimeter is required to conduct the test. You should check the following points:

Test point	Procedure
1.	Conduct a visual inspection of the interior of the device. There must be no loose wires. All wires are connected as shown in the circuit diagram. Spare wires have been dealt with correctly and routed safely.
2.	The supply voltage is 24 V DC. ± 15% is available after switching on the terminals on the Terminal Board.
3.	A rating of up to 120 W can be supplied. Connect a load resistor in parallel if necessary.
4.	Cause a short-circuit and the supply voltage must be switched off within 120 seconds.
5.	Check all switches and fuses outside the device. Is everything accessible and can everything be switched off and on?
6.	Conduct resistance measurements to ensure that all the electrical connections have low resistance. Check the earthing as well.
7.	Conduct resistance measurements to ensure that all the cables are adequately isolated from each other and to earth.

If you find any discrepancies or errors during the test, repeat the appropriate items in the installation procedure until all the points are error-free and OK. This finalizes the installation work. Seal the device correctly afterwards.

⚠	**Close the proChain GC.** **Position the cover with the sealing ring and fully tighten the thread.** **Then turn the countersunk security screws upwards to the edge of the cover to prevent the cover being removed accidentally or through ignorance.**

2.7. Fluidic installation gas supply connections and breather

The **proChain GC** has multiple **gas connections** for various functions. They are always fitted by the manufacturer. In the standard version, they take the form shown in the figure below.
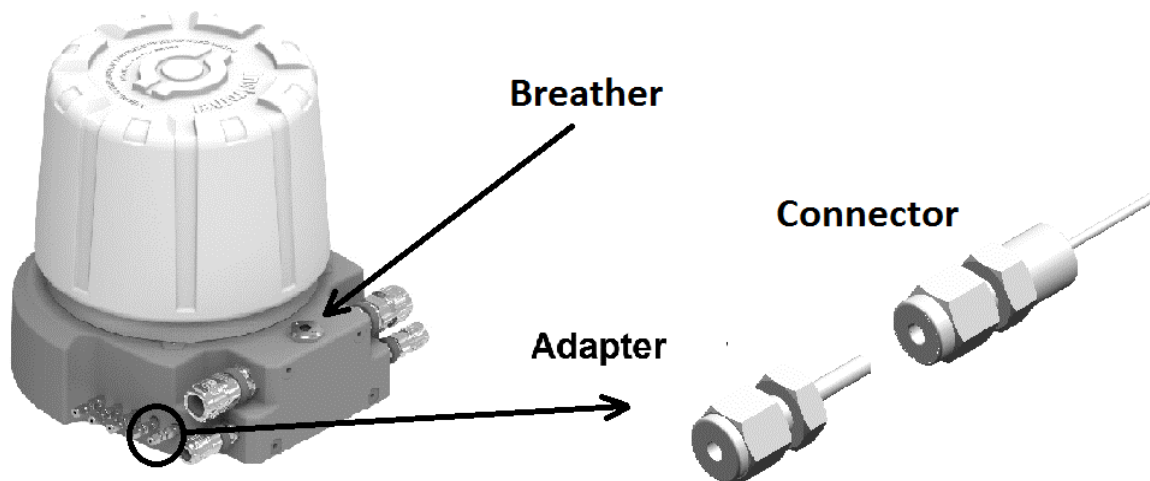
Figure 2.31: Layout of the gas connections of the proChain GC

Each gas inlet / outlet consists of:

- Coupling/Connector (1/8" Swagelok fitting factory sealed that enters the housing) Attention: **Be careful not to loosen this connection, it will be damaged!**

- Adapter with 2µfilter (field replaceable tube only for inputs)

The adapter can be replaced without removing the hood from the gas chromatograph and is suitable for connecting a Swagelok pipe fitting (3 mm or 1/8"). It contains an interchangeable internal 2 µ filter for each gas inlet.

Inside the **proChain GC**, the gas connections are each soldered to a pipe which is used as a flame arrester. Sample and vent tubing outside the device should be made of seamless stainless steel tubing that is permanently connected. Supplied sample gases must comply with the inlet specification and be fully free of solids and liquids. The particle filters in the adapters are only designed to protect the device. Always respect the following:

⚠️	The specified maximum pressure on the gas inlets must not be exceeded to prevent damage to the device and dangerous situations. This must be guaranteed by an external protection, which is not an integral part of the proChain GC.
	Refer to the information in section 2.1.3 Safety information about gases when setting the maximum pressure.
	The required tubes and protection devices must be provided according to the general guidelines as well as the requirements in these Operating Instructions.

The breather

An explosion proof element (also **vent**) on the rear of the housing is used to allow an atmospheric pressure equalization process between the interior of the device and the ambient area to comply with the Ex-regulations.

These state that the gauge pressure inside the housing must not exceed 100 mbar in the event of a complete gas rupture. In other words, if all the gas supply lines inside the housing were to be detached at the same time.

STOP	**DO NOT UNSCREW THE BREATHER.** **DO NOT CONNECT THE BREATHER'S TUBE TO OTHER TUBES.**

The **breather** in the **proChain GC** is made of sintered metal. It must not be sealed or blocked, for example by water, condensation, ice, insects, dirt or the like, as otherwise the pressure equalization process will be adversely affected. In the case of outdoor installation, it may be protected, for example by connecting a gooseneck pipe or a vent line.

	PROTECT THE BREATHING ELEMENT FROM ANY KIND OF OBSTRUCTION.

If this optional tube is connected using the ¼ "NPT thread, it must have a minimum internal diameter of 8 mm (0.3149").

With the tube connected (comply with the length details in section 2.1.3 Safety information about gases, IP 66 protection is achieved and a vent line flow rate of around 10.5 l/min is possible.

Always keep in mind

!	**Complete all Work around the fluidic installation (this section) in accordance with all national / local safety regulations as well as the following instructions. Failure to do so may result in significant damage to the proChain GC or the system, which is not covered by warranty.**

2.7.1. Overview gas and vent connections (Fluidic interfaces)

The figure below provides an overview of all the gas connections and the breather. The gas inlets and outlets are marked on the device.
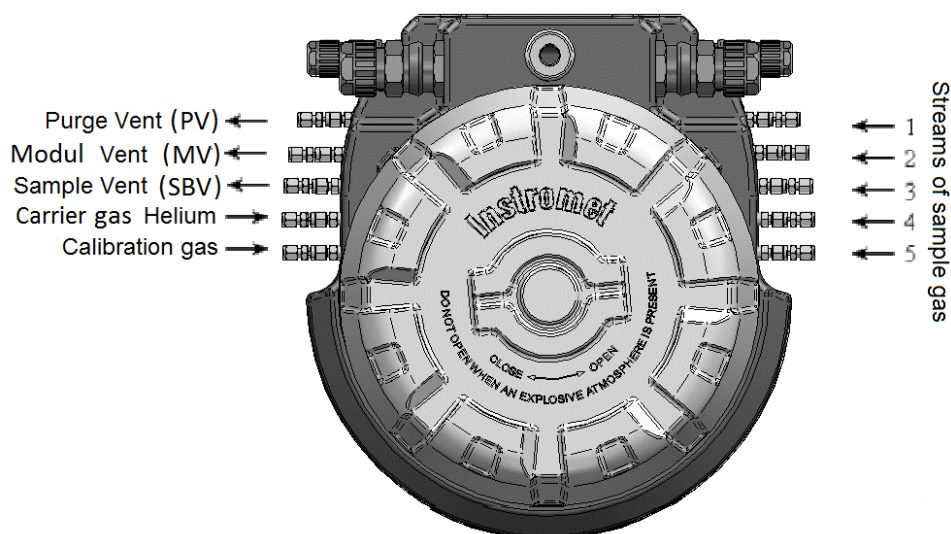
Figure 2.32: Overview of gas connections (fluidic connections)

Connection	Position on the proChain GC / Note
Breather with ¼" NPT connection thread for tube into save area	**Rear of the device:** If a tubing is connected, it must be **completely separated from all other gas lines** and meet the specifications set out in section 2.1.3 Safety information about gases
Calibration gas cylinder with certificated gas (P1-11K) Maximum inlet pressure: **ATEX/IECEx: 0.3MPa(g) ≙ 43.5psi(g) ≙ 3bar(g). cCSAus: 0.15 MPa(g) ≙ 21.75 psi(g) ≙ 1.5bar(g).**	**Left-hand side, first connection** Used to maintain measurement accuracy.
Carrier gas cylinder with helium Maximum inlet pressure **0.35 MPa(g) ≙ 50.7 psi(g) ≙ 3.5 bar(g).**	**Left-hand side, second connection** Carrier gas is a required utility gas for transporting the measurement gas inside the device and performing chromatography.
Module vent (MV) Approximate flow rate is 0.12 l/h ≙ 0.0042 cft/h.	**Left-hand side, penultimate connection** The vent of measured sample and carrier gas, nearly pure helium is released at ambient pressure.
Purge vent (PV) Flow rate during purge is between 20 l/h ≙ 0.706 cft/h. and 30 l/h ≙ 01.059 cft/h.	**Left-hand side last connection** Purge of sample gas used to flush (bypass)
Sample and blocking vent (SBV) Approximate flow rate is 2 l/h ≙ 0.071 cft/h	**Left-hand side, third connection** The unmeasured sample gas is released at ambient pressure.
Sample gas streams 1 – 5 Maximum inlet pressure **ATEX/IECEx: 0.3MPa(g) ≙ 43.5psi(g) ≙ 3bar(g). cCSAus: 0.15 MPa(g) ≙ 21.7 psi(g) ≙ 1.5bar(g).**	**Right-hand side** It is possible to measure up to five different gases in sequence. One inlet is standard.

The generally accepted rules of engineering for handling gases must be followed when carrying out the work described below. This means sample integrity and operational integrity. All gas tubing must be free of grease, oil, solvents and other impurities.

2.7.2. Connecting gas lines (general)

The recognized rules of technology for dealing with pure gases must be observed during all works as described. Surfaces that get in touch with gas must be free of grease, oil, solvents, and other contaminants.

🔆	The user must ensure the integrity of all gases being transported from the source (pipeline or cylinder) to the measuring instrument. The gases must be extracted, conditioned, and transported to the proChain GC in a manner that ensures there are no phase changes, solids or liquids in the inlet lines. Refer to the appropriate ISO and API guidelines regarding sample integrity.

Install the gas tubes up to the **proChain GC**. Follow the piping plan drawn up and specified by the plant operator. Ensure that each gas line contains the <u>necessary safety and shut-off devices</u>. All tubes must be kept as short as possible to minimize sample transport times and the need for bypass / flushing. Use only tight, clean stainless-steel gas lines.

🔆	The user is responsible for selecting and maintaining the **external sample conditioning equipment** require to extract a sample from the pipeline and deliver it to the proChain GC free of solids and liquids, at the required inlet pressure. For this purpose, the installation of additional shut-off valves, an additional pressure reducing systems, filters, gas dryers, etc. in the tubing could be required. Stainless steel fulfills these properties. Fittings and pipe joints with small dead volumes are preferred.

🛑 STOP	Never mix the tube fitting components from different manufacturers.

⚠️	**Before connecting the gas lines to the GC, flushing the lines with clean gas for at least 30 seconds to ensure that the tubing is clean and free of air. The flushed gas from the unconnected lines must be discharged correctly and safely.**

The process gas is taken from the process pipeline. The tapping equipment should have a temperature equalization system and pressure regulator and be as close as possible to the device.

	The integrated inlet filters are a last line of defense in the event of a failure of the external, user-supplied and maintained, sample conditioning system. The inlet filters are not a substitute for a well-designed and maintained sample conditioning system. The sample conditioning system is always required if the gas specifications in section 1.3.3 Technical range of suitable gases (gas like natural gas) cannot be satisfied.

	The volume and pressure of the sampling line determine how current the measurement result is in addition to the dead time of the measuring instrument itself.
	Gas consumption under normal flow and during purge could be found in section 2.7.1 Overview gas and vent connections (Fluidic interfaces) and section 2.11 Technical data (Hardware).

2.7.3. Steps to prepare the process gas sampling line

Repeat following steps for each used sample line being connected to the proChain GC.

Step	Work
1.	Ensure that the sample conditioning and transport system contains a shut-off valve*. Ensure that the shut-off valve is closed. If the sample conditioning system contains a pressure regulator*, turn the regulator to its lowest outlet pressure setting.
2.	Ensure that the sample probe and sample conditioning and transport systems are properly installed per their manufacturers' instructions. Do not connect the sample transport line to the proChain GC.
3.	Check that the outlet pressure and other parameters of the sample probe and sample conditioning and transport systems are correct before you carefully open the shut-off valve to create a permitted gas flow above the operating conditions. Ensure that any gas flowing toward the disconnected proChain is safely vented.
4.	Then flush for 30 to 45 seconds** to clean the tubing system. Discharge the gas at the end of the sample transport line correctly into a vent gas system e.g. via using a temporary hose.
5.	Set the gas outlet pressure of the sample transport line below the maximum permissible pressure defined in section 2.1.3 Safety information about gases. Then close the shut-off valves. The precise pressure is set later after the proChain GC has been connected.
6.	The sample transport tubing to the proChain GC is now ready for connection ⇨ see steps below. Prevent the ingress of dirt and moisture if the connection is not made immediately.

*   not part of device and delivery; make sure to use a type that meet the specifications and standards

**   If long lines are used extend this time

During normal measurement, all the gas flows through the **proChain GC** then discharged as vent gas at atmospheric pressure. As these gases are flammable, they must be taken, via tubing, into a safe area outside buildings.

For proper operation, these vent lines must be discharged without any backpressure to the **proChain GC**. Therefore, the diameter of the tube must never be reduced. Outlet connections for tubing on the proChain GC (3 mm or 1/8") are sufficient in most cases. It is recommended that each vent connection use a separate tube.

If an installation will use the high-volume bypass (PV outlet) and / or wish to combine the vent lines into a common vent line, then a much larger internal diameter vent line is required: ideally a 6mm (1/4") diameter exhaust line should be installed to avoid backpressure.

	When using, flow meters the combination of vent lines must be done after the gas has passed the flowmeters. The use of 6 mm (1/4") pipe is also recommended because of its better mechanical strength.

The vent gas lines' outlets must be protected from wind-caused backpressures and the ingress of contaminants such as dirt, moisture, bugs, etc.

	Unused gas inlets and outlets must be sealed using stainless steel plugs compatible with the proChain's tube fittings.

	Never connect the breather tube (if connected) to other gas lines. Doing so is a violation of the proChain's safety design and certification.

2.7.4. Connect the proChain GC to the process gas

Step	Work: Connect measurement device with the process gas line:
1.	Ensure that the required work described in the previous sections has been completed. The tubes must have been flushed.
2.	Ensure that the process gas is connected to the sample sensor and that the shut-off valve in the process gas line is closed. (If there is a pressure regulator, turn the regulator to its lowest setting.)
3.	Ensure that a process gas inlet pressure range according to section 2.1.3 Safety information about gases can be set. Do not use settings below 0.1 MPa(g) ≙ 14.5 psi(g) ≙ 1.0 bar(g).
4.	Remove the protection (sealing plugs or screw plugs) from the relevant inlets on the device ensuring that the connection on the housing is not released because otherwise the pipes soldered to it will be damaged. You should therefore use a second wrench to limit the rotary movement on the connection coupling.
5.	Connect the tube properly. NEVER OPEN THE GAS SUPPLY IF THE COUPLING HAS BEEN DETACHED. In this case, you should always contact Honeywell.
6.	Carefully open all the shut-off controls, valves and regulators in the process gas route to slowly increase the pressure up to operating conditions.

A leak test must be conducted once the installation work has been completed in full and when all the gas lines have been connected and pressurized.

Since the test cannot be carried out on all parts when the device is switched off, the leak test for these parts must be carried out first when the device is running.

2.7.5.   Connecting the vent gas tubings

In regular measuring mode, the entire gas flows through the device and is discharged via the exhaust tubing to secure ventilation areas outside buildings. The gases from measurement and (if used) bypass must be drained **without back pressure** through this exhaust tubing.

Never decrease diameters of exhaust lines!

.

⚠	The gas drain connections of the unit must ventilate atmospherically and be protected against dirt or liquids. These venting lines shall be routed to a safe area away from the device.

Step	Work: Connect the vent tubes
1.	Connect the vent gas to the relevant outlets. Always discharge the gas from (MV) separate. Avoid back pressure formation and mutual interference in the exhaust system.
2.	Connect the tubing immediately after you have removed the sealing elements (blind plugs or screw plugs) from the gas outlets on the device.
3.*	It is not possible to conduct a leak test when the device is switched off. The vent gas line must be checked for leaks with a gas detector during the flushing cycle. This test must be carried out immediately after the **proChain GC** is fully installed and starting operating.

*Usually step 3 cannot be performed at this stage of installation it is done during commissioning

🛑	The breathing element line (if connected) is not part of the exhaust system and may never be connected to other lines.

2.7.6. Connecting and replacing gas cylinders (calibration gas, carrier gas and test gas)

To operate correctly, the **proChain GC** needs a regular automatic calibration/adjustment with a calibration gas. A gas cylinder containing the calibration gas mixture with a recommended +/- 1% per component certification is required for this purpose. Components of this mixture, called P1-11K, listed in section 1.3.3 Technical range of suitable gases (gas like natural gas).

A gas cylinder containing helium to act as the carrier gas is also required for operation. These gas cylinders should be replaced as soon as the outlet pressure can no longer be held at a stable level. Depending on the regulator, this will usually occur around 0.5MPa ≙ 72.5psi ≙ 5bar.

The cylinder pressure should be monitored, for example with a pressure gauge or contact pressure gauge. Further options and details about the calibration gas mixture and carrier gas can be found in section 1.3 Technical data (General) in this document.

⚠	**After replacing the calibration gas cylinder, the current components of the calibration gas must be re-entered in the GC AFB. See chapter 3 Software.**

Some situations, e.g. a verification (test gas measurement), make it necessary to connect further gas cylinders temporary. These connections must follow the same steps for setting pressure, flushing tubing, and connection to the **proChain GC**.

💡	As mentioned before suitable pressure reduction is required to connect the gas cylinder to the proChain GC. Honeywell can supply prefabricated boards with high-pressure reduction systems for this purpose.

Precondition:
An appropriate high-pressure reducing regulator with high- and low-pressure gauges, pressure relief safety valve (setting at maximum pressure per section 2.1.3 Safety information about gases), an inlet fitting suitable for connection to the cylinder, and an outlet shut-off valve exist.

Stainless steel tubing (3mm or 1/8") to transport the gas to the proChain GC as described in 2.7.1 is already installed.

Apart from the connection to the gas cylinder, all other parts are already connected. (Flushing through the device).

Complete the following steps in accordance with national / local regulations. Failure to do so may result in significant destruction of the device or the system.

Step	Work: Connect a gas cylinder
1.	Ensure that the cylinder is safely secured from tipping and movement.
2.	Unscrew the safety cap covering the cylinder's valve.
3.	⚠ Make sure that the main valve on the cylinder is closed. ⚠ If this is the case, remove the screw cap (plug) from the valve connection. Ensure that the outlet shut-off valve* on the pressure regulator* to be connected is closed.
4.	Connect the pressure regulator to the gas cylinder. ⚠ Never apply any type of oil or grease to the thread as that will contaminate the certified gas in the cylinder.
5.	⚠ Make sure that the regulator* is set to the lowest setting.
6.	Close the cylinder connection of the high-pressure reducer or cylinder pressure regulator* to the valve connection of the gas cylinder.
7.	Flushing of the pressure reduction is recommended at this point for accuracy reasons. You can do this by triggering several purge processes in the proChain GC (see chapter 3 Software) or by manual flushing of a pressure regulator (see description below).
8.	⚠ Open the main valve of the gas cylinder. (all parts in the line are connected) Adapt the output pressure of the pressure regulator* to the required pressures: Carrier gas: 0.325 MPa(g) ± 0.025 MPa(g) ≙ 47.1 psi(g) ± 3.6psi(g) ≙ 3.250 bar(g) ± 0.250 bar (g) Calibration gas/ Verification gas for ATEX / IECEx: 0.30 MPa(g) ≙ 43.5 psi(g) ≙ 3.0 bar(g). for cCSAus: 0.15 MPa(g) ≙ 21.7 psi(g) ≙ 1.5 bar(g).
9.	⚠ Perform leakage test for all connections. ⚠

* Steps to connect the gas cylinder (parts marked with an asterisk (*) are not necessarily included in the delivery and must be obtained before starting the work; use suitable standard-compliant types only)

Step	Work: Manual flushing of a pressure regulator*
1.	⚠ Make sure that the following requirements are met: To flush the pressure regulator and connected transport tubing, disconnect the tubing at the proChain while the gas cylinder is closed.) Ensure that the flushing gas that will be exiting the disconnected tubing is safely vented in a professional, safe manner.
2.	Slowly open the main valve of the gas cylinder.
3.	Establish the gas flow and observe it with the high and low pressure gauges on the regulator. Do not exceed the maximum permissible pressures.
4.	Now close the main valve of the gas cylinder.
5.	If the output pressure of the pressure regulator* has almost fallen to zero, due to the discharge of gas, open the gas cylinder briefly and close it again.
6.	Repeat step 5 to ensure that there is no more air or other contamination left in the dead volume of the regulator. After a total of five cycles (filling / draining), everything will be flushed out.
7.	After the flushing process connect the end of the tubing to the proChain or seal the end of the tubing if immediate connection is not performed. Continue with step 8 of the gas cylinder connection procedure (see above)

* not part of proChain GC, make sure to use a type that meets the specifications and standards if not from Honeywell.

Step	Work: Removing the gas cylinder
1.	Close the gas cylinder main valve.
2.	Depressurize the connected gas line
3.	Remove connections from the gas cylinder
4.	Protect the connection thread of the cylinder valve with the associated screw cap.
5.	Put the protection cap on the gas cylinder.
6.	Loosen the protection against falling and remove the gas cylinder
7.	Protect the connection thread of the unused cylinder connection with a suitable protective cap if a new gas cylinder is not installed immediately.

2.8. Leakage test of the System

	Leaks in the gas supply lines of sample, carrier, or calibration gas increase the risk of explosion and may lead to inadequate measurement results!

Steps of the leakage test

Step	Work: Leakage test
1.	Close the internal valves of the proChain GC e.g. by interrupting the power supply or place it in idle mode via the enSuite software (see section 3.8 Operate the device with enSuite for instructions).
2.	Supply all inlet gas lines for the measuring equipment with gases at the maximum pressure values so that the tubes / lines contain a gas volume.
3.	Check the whole installation (all the parts of the system) for leakages with a gas detector.
4.	If leakage is detected it must be fixed (sealed) immediately. Stop the gas supply! Seal the leak! Repeat the leakage test!
5.	Do not perform any other actions or work before everything is free of leaks!

Tips to seal the leak

If you identify a leak, it must be sealed. You have some options to do this.

- Replace the seals. Switch off the gas supply for this purpose, always observe the rules of explosion protection. You need the corresponding replacement seal. Apply a very thin coating of Molykote 55 to all new O-rings/seals.

- Tighten the connections. In the course of time, connections may have come loose easily and can be sealed again by retightening. Take care not to block the flow of the line, this can happen if you tighten the line connections too much.

2.9. Commissioning and decommissioning

This section describes the main points for commissioning and decommissioning the proChain GC. The steps required for commissioning are listed in order below. All new devices are supplied with default parameter set also called parameterization, including operational temperatures and peak identification parameters.

These parameters should not need modification and are typically left at their factory-set values. But it may occur, that in different ambient conditions, additional adjustments are required. To understand these parameters and modify their values, if necessary, further information can be found in chapter 3 Software in this document and the **online help of enSuite**.

Furthermore, only the streams of gas and the carrier and calibration gas properties must be adjusted. The information required for the standard commissioning procedure is listed below in chronological order.

If, in addition, (integration) parameters must be adjusted, the information required for this purpose can be found in chapter 3 Software and in the **enSuite online help**.

STOP	Do not carry out any of the work described in this section if you do not have permission and have not received the required training from the manufacturer or its agents.

The commissioning procedure may only be carried out by qualified technician or field service personnel. Honeywell can provide training and commissioning services.

💡	Within the scope of fiscal metering, the final commissioning of the instrument may require the presence of a verification officer or his deputy, depending on your country's regulations.

In case of fiscal use, the conditions set out in the relevant approval must also be satisfied. This is assured by a file in the device which adjusts the settings. Details are provided in chapter 3 Software.

For official (fiscal) operation, make sure that you also comply with the current regulations relating to sealing and closing off the housing, see section 2.9.6 Special features in fiscal operation (security switch / sealing).

Finally, this section contains information which you should consider if you no longer wish to use the device or if you wish to use it at a different location.

2.9.1. Preparation and requirements for commissioning and operation

Prior to commissioning, ensure that you comply with the safety and warning information in sections 1.2 Safety information and warning and 2.1 Hardware safety information and warning and that the **proChain GC** has been installed and connected per this document. If you are unfamiliar with the proChain's software, read chapter 3 Software of this document before proceeding.

The following also applies:

- The upstream sample handling and conditioning system must be operating properly, providing the correct pressure to the proChain GC, and at its operating temperature.

- A process calibration gas cylinder is correctly connected. The composition of the calibration gas mixture is programmed into the proChain

- A carrier gas cylinder is connected and providing 0.325 MPa(g) ± 0.025 MPa(g) ≙ 47.1 psi(g) ± 3.6 psi(g) ≙ 3.250 bar(g) ± 0.250 bar (g) pressure to the proChain GC.

- Delivery is less than 1 year ago, (battery charge above 20%). If you are unsure check according to hints in section 3.6.4 Info (System) display Device monitor or have the battery replaced as a precaution.

- The cover of the proChain GC is installed and fully closed.

- There is no moisture condensation inside the proChain GC. If you are in any doubt, leave the cover removed and the proChain GC in a warm, dry location for at least 12 hours; or contact Honeywell.

- Power supply and communications are carried out properly.

	Regulations for explosion protection and safety must be observed, especially during commissioning in an area with a potentially explosive atmosphere

2.9.2. Opening and closing the hardware parameter guard (SSW)

You can (and must for fiscal use) protect settings which affect the measuring properties. This is done with the Security Switch (short: SSW) also called calibration switch. This ensures that fiscally relevant changes can only be made with the SSW opened or are logged in the audit trail. To open or close the SSW, the device must be opened.

⚠	**Never open the device without the permission of the manufacturer and consent of the system operator.** **Observe the explosion protection and safety regulations, particularly in potentially explosive atmospheres**

Additionally, the removal of the housing is only permitted under controlled conditions according to ISO / IEC60079-14. These conditions (temperature +5 °C (+41 °F) to +40 °C (+104 °F); humidity up to 80% at +31 °C (+88 °F) decreasing linearly to 50% at +40 °C (+104 °F)) are typically found in residential and office environments. In case of doubts, please contact Honeywell.

The SSW is the red switch on the Base Board near the battery next to the CPU3 board, see figure.
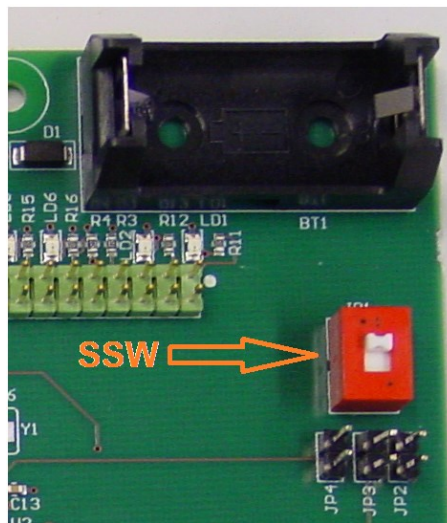
Figure 2.33: Overview of SSW position (without battery and CPU board)

On delivery, the switch is in the open (position as shown in the figure). Change the status by moving the switch to its other position. Be careful, the interior of the device contains sensitive parts. You can view the setting by using online parameterization. (Information later in this document and in the online help of enSuite).

💡	You can fit a seal direct to the SSW (jumper) or seal the entire housing to prevent or detect unauthorized access.

2.9.3. Set password for admin 1

Assign password at first login to the enCore device! In the delivery state, user passwords for standard users are empty for all enCore devices, including admin1. Even if you create a new user in enSuite, enSuite creates these users without a password.

**We strongly recommend that each user changes his or her password
at the first loginto the device.**

💡	Further details in sections⇨ 3.1Data security information, 3.3 User management and login and 3.6.11System display (device) Users (Login/Logout/change password)

2.9.4. Standard commissioning (application "C$_6$+")

Complete all the commissioning work in the specified sequence to avoid possible damage and fault situations affecting the device.

Step	Action: Commissioning
1.	Open the carrier gas cylinder setting: 0.35 MPa(g) ≙ 50.7 psi(g) ≙ 3.5 bar(g).
2.	Open the calibration gas cylinder setting: for ATEX / IECEx: 0.3 MPa(g) ≙ 43.5 psi(g) ≙ 3bar(g). for cCSAus: 0.15 MPa(g) ≙ 21.7 psi(g) ≙ 1.5bar(g).
3.	Open the process gas setting: for ATEX / IECEx: 0.3 MPa(g) ≙ 43.5 psi(g) ≙ 3bar(g). for cCSAus: 0.15 MPa(g) ≙ 21.7 psi(g) ≙ 1.5bar(g).
4.	Switch on the power supply.
5.	After the proChain GC completes its boot sequence, you may connect to the unit with the enSuite software. Chapter 3 Software describes this software including instructions on how to connect with the proChain GC.
6.	Using the enSuite PC software, select "**Chromatograph**" and the "**Auto**" function. Follow the instructions in chapter 3 Software.
7.	The software performs the steps defined by the parameterization. (see chapter 3 Software). If parameterized, the continuous measuring operation "**Automation**" is started directly. While reasonable analysis results may occur quickly, stable results can be expected after approximately one hour of operation.
8.	Check for fault-free operation, e.g. with a measurement of a known gas
(9).	Change parameter "**Start on power up**" to **YES**, if wanted. (proChain GC performs an auto start e.g. in the case of power supply interruption)
10.	This concludes the standard commissioning procedure.

The device will now operate with the default parameter set which enables it without any further changes to operate with low accuracy deviations.

The default parameter set defines the starting behavior, calibrations, process gas sampling and the communications properties.

The measured values are processed, and messaging, monitoring and logging tasks are also completed with the default settings.

For change requests, see chapter 3 Software, or get in contact with the Honeywell.

The measuring system is used for various natural gases and measures samples of these gases at intervals of about three minutes. If the gas is not measured, it is discharged from the proChain GC via a vent gas line to create a continuous flow and the sample is taken from the current gas.

The device can be fitted with an optional additional heating system for use in temperatures below freezing. Further details of this option are provided in section 2.4.1 Housing heater and in the software section 3.4.8 Changing the settings of the GC AFB (Device sub-node / Device control limits).

2.9.5. Checking the device settings and signals

If you have completed the commissioning steps listed above and there are still errors or uncertainly measurement results. It may be necessary to adjust the flow of some gases or adjust some other settings. Since the default settings cannot know the site conditions, which may differ from the standard ones, it may be necessary to re-adjust the settings, for example the flush times, in some cases. This is also the case if the gas chromatograph was not supplied with the calibration gas in which case the calibration settings must be adjusted again.

	During commissioning, flush times and the settings of the gas compositions from calibration gas must be checked and, if necessary, adjusted. Further information ⇨ see section 3.4.11 Adjusting gas mixtures and limit values select calculation standard.

Adjust the settings and parameters using the procedure described in software section.

If errors are still active after you have made these changes, an extended (complete) check of the current device parameter set is required. This can be done using the enSuite software. The procedure is described in chapter 3 Software. For example, you must check and adjust the bespoke alarm limits and settings for the sequence of sample gases and the calibration and protocol settings.

Parameterized output signals can be measured using suitable measuring equipment. The digital communication (Modbus, etc.) can be checked using suitable tools (for example a protocol analyzer).

2.9.6. Special features in fiscal operation (security switch / sealing)

In addition to the possible necessary presence of a calibration officer or its representative and the corresponding approval files in the device, the security switch (SSW) must be closed for the final commissioning if the device is to be used for fiscal measurements.Details of SSW see section 2.9.2 Opening and closing the hardware parameter guard (SSW). For approval file see 3.4.13 Fiscal parameters and optional using approval file (Select approval). After closing the security switch, make sure you also comply with the current regulations relating to sealing and closing off the housing.

2.9.7. Decommissioning / Dismantling / Disposal

⚠	Without external power supply nor from the backup battery, data will be lost (e.g. archived data, device time settings). The device will not start correctly without Honeywell support.

Please proceed in the following sequence to decommission the measuring instrument if you want to use it again later e.g. at another location. Pay attention to the following:

Step	Action: Decommissioning (temporary)
1.	Switch off the voltages (supply and communication) and secure them against being switched on again. (The battery buffers data for approx. one year and may need to be replaced afterwards.)
2.	Shut down all gas streams and depressurize all gas inlets. Ensure that you prevent the shut-off valves being reopened unintentionally by taking suitable precautions.
Step	For long time decommissioning add following steps
3.	Allow the proChain GC to cool down to ambient temperature and disconnect all the gas tubing at the couplings. Immediately seal all outlets and inlets.
4.	Cut all the cables near the cable glands in an area which does not contain a potentially explosive atmosphere and remove the device mechanically.
5.	Comply with the storage and disposal instructions, regardless of whether you have completed all the above steps.

💡	Removed devices should generally be stored in the same way as new devices. We recommend replacing the battery with a new one (for safety reasons done by Honeywell) if the device has not been supplied with power for more than one year.
	After two years without a power supply, the battery charge will be less than 20% and it must be replaced by Honeywell service personnel.
	After three years, the battery will be completely discharged. Please contact Honeywell if you wish to store the device for a longer period.

Dismantling: Please observe the following notes before removal of the device to prevent any risk of sparks, release of flammable gas, and explosions (in the hazardous area).

⚠️	**If the device contains hazardous media e, g. toxic gases, they must be removed before its dismantling. Prevent the release of potentially pollutant substances.** **It must be guaranteed that the power, communications, and gas cannot be accidentally turned back on, so that there is no danger of disassembly.**

🛑 STOP	Dismantling is prohibited without switching off all supplies, such as pressure and electricity (power and communication) before.

💡	If you wish to continue using the device later or if you want to send it back, you must return it to the state in which it was delivered. (transportation protections, dummy plugs, covers, etc.)

Disposal: The proChain GC falls under the WEEE directive like all enCore devices and is marked with the WEE 🗑 symbol.

It is important to note that disused enCore devices must be sent to an individual or collective take-back and disposal system. As the EU member states have transposed the WEEE directive into national legislation in different ways, the regulations for the return of disused equipment vary. Please ask your local Honeywell sales partner how the take-back of your equipment is regulated

💡	Environmentally friendly disposal according to WEEE directive The WEEE directive 2012/19/EU was issued by the European Commission. WEEE stands for "Waste of Electrical and Electronic Equipment". It aims to create a legal framework for sustainable production and consumption of electrical and electronic equipment through reuse, recycling and other forms of recovery of used electrical and electronic equipment. The proportion of such devices in household waste should be reduced, raw materials should be are collected and sent for recycling.

⚠️	**Remove the battery before shipping or disposing of the enCore device. Please note that batteries are subject to hazardous waste treatment and hand them in at a collection point or have them disposed of by a specialist company.** **(The Battery is located near the SSW see figure 2.33 in section** **2.9.2 Opening and closing the hardware parameter guard (SSW))**

2.10. Maintenance and repair

As the operator, you are responsible for ensuring that the installation and maintenance work described in this document is carried out correctly. Honeywell will be happy to assist you with this work. To ensure long-term use, the instrument must be serviced, cleaned, and repaired annually in addition to the regular automatic calibrations described in chapter 3 Software. We recommend that this work be carried out only by trained personnel instructed by the manufacturer or by him in order to rule out malfunctions and program the software accordingly.

⚠	**The operator is responsible for ensuring that the device remains in technically perfect, safe condition throughout its period of operation.**

2.10.1. Troubleshooting

This section contains guidelines to help with repairing faults. The causes of these faults can be localized and rectified by checking the input and sensor values.

Step	Action: Troubleshooting
1.	Check that the process gas or sample gas is available at the correct pressure.
2.	Check that the carrier gas is available at the correct pressure.
3.	Check that the calibration gas is available at the correct pressure.
4.	Check that the vent gas line is not blocked.
5.	Check that the supply voltage (24 VDC) is available with the correct values.
6.	Check the communication between the device via the network and USB.
7.	Check the housing earth / ground for excessive resistance.
8.	If there are no more faults in items 1 – 7 and if the problem still exists, a defect has occurred which can only be rectified by replacing modules. Please contact Honeywell for a service operation.

💡	If you assume that the internal hardware is causing the error, check this with the help of displays, the Error List or "Live data and trending " (see section 3.6 The remote operation panel displays and actions and 3.7 Using enSuite program functions when the device is operating). With this function, you can monitor changes to sensor data. If there are no valid values, it is likely that a hardware error has occurred that cannot be corrected without spare parts. Contact Honeywell.

The following describes action to prevent some faults. It is essential to comply with all the safety regulations when troubleshooting, particularly the following:

<table>
<tr>
<td rowspan="7"></td>
<td><strong style="color:red">The housing may only be opened by authorized/trained personnel with written operating permission and in compliance with all safety measures!</td>
</tr>
<tr>
<td><strong style="color:red">Do not attempt any repairs or maintenance e.g. disconnect cable inlets in a potentially explosive atmosphere.</td>
</tr>
<tr>
<td><strong style="color:red">Loosening or unscrewing the breather is prohibited!</td>
</tr>
<tr>
<td><strong style="color:red">Only explosion-protected, approved work equipment may be used!
(a standard PC can be used in the area is deemed 'safe' during the maintenance / repair)</td>
</tr>
<tr>
<td><strong style="color:red">No explosive gas atmosphere may be present during work!</td>
</tr>
<tr>
<td><strong style="color:red">Protect all open lines and connections from dirt!</td>
</tr>
<tr>
<td><strong style="color:red">Before the device is switched on again, ensure that all the gas connections are tightened, and the earthing or PE wire is correctly installed.</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>If you are not successful with the following methods, please contact Honeywell.

Contact data can be found at the beginning of this document.</td>
</tr>
</table>

Rectification of the faults under steps 1 – 4 (gas supply fault)

The following action can be taken if a fault occurs in the gas supply, for example abnormal loss of calibration gas or carrier gas.

Step	Work: Gas supply fault rectification
1.	Perform a leak check of each complete gas path from its start, at a sample probe or gas cylinder, to the proChain GC's inlet fitting.
2.	Seal any leaks properly.
3.	Set the regulators and valves to the required values.
4.	If a line contains a blockage or restriction, you may disconnect the line from the proChain GC and attempt to clear the blockage and flush out any solids or liquids using a non-flammable. It is highly recommended that the inlet filter adaptor fitting on the proChain GC be replaced at this time.
5.	Discharge the flushing gas properly.

<table>
<tr>
<td></td>
<td>Use suitable gas detectors for the leakage test. These must reliably display even very small quantities of the possibly leaking process, calibration and carrier gases.</td>
</tr>
</table>

Rectification of the faults under steps 5 and 7 (electrical supply and insulation faults)

The following action can be taken if an error occurs in the electrical power supply. Use a voltmeter to localize the error. If the device is not supplied with electricity or the supply voltage/current is too low, you cannot establish a connection with enSuite or the optional local display.

	The housing and mounting base must be included in the local earthing system **and must not be opened or disconnect from earth in a potentially explosive atmosphere.** Only carry out activities in compliance with explosion-protection procedures.

Step	Work: Testing the electrical supply
1.	Check all switchgear and fuses outside the device and replace any defective parts.
2.	Check that the cable connection between the device and the electrical supply is OK (no interruptions in the wiring). Ensure that a low-resistance electrical contact is established. Reconnect the cores if necessary.
3.	Check that voltage is being supplied to the inlet point and that the voltage is not impaired or reduced by overload, insulation errors or defective components. Remove or replace these components if necessary.
4.	Measure the idling voltage (without connections). Replace the 24 VDC power supply if you suspect a problem with it.
5.	Check that the connection between the device and the grounding system is OK (no interruptions in the wiring). Ensure that a low-resistance electrical contact is established. Reconnect the earthing cable if necessary.
(6.)	Only with authorization and in compliance with explosion-protection procedures! Measure the incoming idling voltage on the supply cable at the device. To do so, switch off the electrical supply and disconnect the supply cable plug from the PCB. Switch on the electrical supply again and measure the voltage in the plug. If there is no voltage or if it is significantly lower than the idling voltage, replace the cable after disconnecting it from the power supply.
7.	If the problem has not been rectified after completing steps 1 – 5 (6), the error is inside the proChain GC. Please contact Honeywell to check the internal fuse.
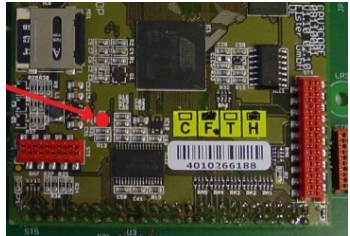
	If the electronic overheating guard or the internal fuse has tripped, it will not be possible to establish a connection to the device. Please notify Honeywell.

Rectification of the fault under step 6 (communication fault)

The following action can be taken if an error occurs in the data communication. It is possible to act to rectify both hardware errors and software errors. You should therefore first check the following:

- Was the fault preceded by changes to the parameter set? If so, reverse the changes or use the default parameter set ⇨ see chapter 3 Software.

- Are there multiple devices connected to the bus? You must take the slowest station into account when selecting the operating mode. If the bus communication is not working, it may be the case that the proChain GC has been parameterized to too high operating mode. Check and change if necessary.
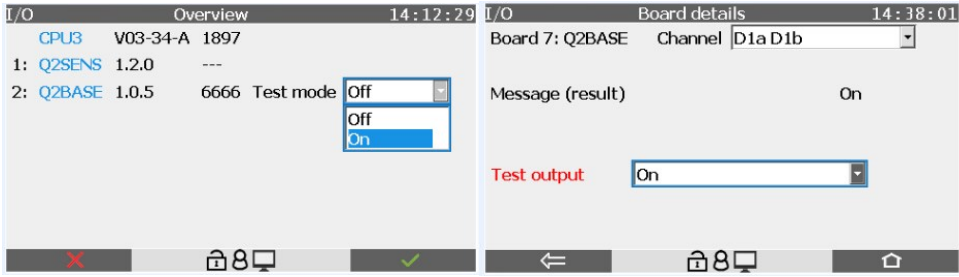
⚠	The following hardware check should only be carried out in compliance with explosion-protection procedures. Any housing opening may only take place if there is no potentially explosive atmosphere. The authorization to open the housing is needed.

Step	Action: Checking the communication
1.	Check the communication cables for signs of damage. Check the "terminal to terminal" connection for each core.
2.	Test the function of the digital outputs after switching off the device. Use a measuring instrument to test whether there is a connection between the switch signal cable and the return cable. A connection may only ever be established at the NC contact at the output. (see figure 2.29)
3.	Check the bootloader LED on CPU board. If the LED flashes regularly, the Bootloader is OK, if not please inform Honeywell

⚠	If there are several devices on the bus, focus on the slowest participant when selecting the operating mode! If the bus communication is not working, it might be so that the device is set at wrong operating mode.

A complete check of the current device configuration can be made using the enSuite software with an online connection to the device. Parameterized output signals can be measured and thus checked using the appropriate measuring instruments. The digital communication (Modbus, etc.) can be checked (e.g. as a protocol analyzer). Use suitable tools.

Further tests to step 6

I

Step	Action: Checking the communication links
1.	If changes have been made to the parameter set, you can reverse them
2.	Test the function of the digital outputs after switching off the device. **The communication cables have been disconnected** Use a measurement device to test whether there is a connection between the switch signal terminals and the return cable. **Except for output DO_1, the normally closed contact, no connections are permitted to be made.**
3.	Navigate to the **I/O overview display**. Select "**On**" for the test mode of the appropriate hyperlink (Q2Base in the example). Click on the hyperlink to go to the **Board details sub-display**. **Requirement: The inputs and outputs being tested are parameterized, the device is installed, sealed and ready for operation.** **You are logged in with the required rights.** Figure 2.34: I/O overview and Board details displays
4.	Select the output you wish to test under "Channel" in **Board details**. The desired state of the output is shown next to "Message (result)". In the example, it is "**On**". You can change the states of the output, regardless of the actual conditions, using "**Test output**". **Measure each output in both states (On/Off)** to obtain a complete overview of the error situation. Use a measurement device to test whether a **connection exists, will be created or has been interrupted** between the switch signal cable and the return cable. **Do not forget to switch off test mode again.**

Always use the latest version of enSuite for your work.

2.10.2. Overview of maintenance and maintenance intervals

Maintenance consists of an inspection of the entire system and preventive controls. The regular maintenance interval is one year. However, this monitoring can also be carried out more often independently in order to detect deviations at an early stage. Use the following sections to check the possible ranges of consumables and the presence of unusual damage that may have occurred since installation and commissioning.

	The provisions for explosion protection (e.g. per IEC EN 60079-14) must be observed. **In addition, the operator must regularly check all safety devices for operability, if necessary, also outside the maintenance interval.** **Not all maintenance work, e.g. battery replacement, can be carried out by the user. The following overview lists all possible maintenance work and intervals.** **If necessary, please arrange a service appointment.**

- Visual inspection. Fill in the "**First inspection**" form one month after commissioning.
- Close-up inspection(s) every twelve months' use "**Service report template**"

Main topics of the inspection:

- Check gas connections by leakage test (test with gas detector per section 2.8)
- Check the battery charge (if it is determined that an exchange is necessary, this must be done via a service visit, please inform Honeywell)
- Check housing parts (and optional display)
- Control of the outer elements with tools (everything is tightly screwed)
- Monitor the ventilation / breathing system.
- Visual check of connections (electrical/mechanical)
- Check the inside of the device
- Visual inspection of the cylinder pressure
- Visual inspection of inlet pressures
- Control flow rates / pressure settings (with enSuite)
- Visual inspection / replace (if necessary) filter gas inlet in the gas lines,
- Check electrical grounding for mechanical strength and low resistance.

	If you wish to operate the device with an approval, the corresponding instructions in this document must be observed. If you have any questions, please contact Honeywell Technical Support.

2.10.3. First inspection (Report)

To ensure that the operating conditions created during installation and commissioning are retained for a long time, check the following points after one month. Use this template:

First inspection	Date of inspection ___. ___. 20____	
Device	Serial number: _____ Software: _____	
Inspector/Company: _____		Result yes / no
Gas connections, gas pipes and (if installed) flow meters have been checked with a suitable detector e.g. methane detector for sample gas or helium detector for carrier gas and are tight.		
Housing parts and paintwork are undamaged and firmly sealed.		
The breather (and the line) is free of dirt and blockages.		
Gas and electrical connections are undamaged and free of corrosion.		
No corrosion inside the device, all cores are securely connected, all housing openings sealed.		
All the gas lines and cables which belong to the measurement point are undamaged and free of corrosion.		
The ground connection is mechanically secure. There is a low resistance connection to the ground.		
The terminals on unused electrical connections are closed, there are no loose, unconnected wires in the device.		
The cylinder pressure of the calibration gas mixture is: _____		
The cylinder pressure of the carrier gas is: _____		
The inlet pressures are in the valid range: Process gas pressure: _____ Calibration gas pressure: _____ Carrier gas pressure: _____		
The battery charge is: _____ and is adequate.		
The device functions perfectly.		

2.10.4. Inspection (Work)

Step	Work: Battery check
1.	Connect to the device via enSuite as written in section3.2.5 Establish a connection to the enCore device
2.	Activate the remote operation panel as written in section3.5.1 Activate remote operation panel
3.	Navigate to System (Info) and select "Device monitor".
4.	Read the battery charge • > 50 % battery can be used for another year. • < 50 % Check battery more frequently. • < 20% inform Honeywell for battery replacement.
5.	Write down the charge in the service report.

Step	Work: Check housing parts (and optional display)
1.	Inspect the housing parts (and, if applicable, the display) visually for signs of damage and leaks (ensure all parts are secure).
2.	Tighten loose parts. Set existing unscrewing protections in operation, to fix the cover.
(3.)	Please inform Honeywell if parts are damaged. or missing In this case, disconnect the gas and voltage supply.
4.	Do not execute any other actions or work before damaged parts are replaced.
5.	Write down the result in the service report.

STOP	The housing may only be repaired by Honeywell. Explosion-proof equipment not repaired by the manufacture may be not used again.

Step	Work: Monitoring the breather
1.	Check if the breather, openings are pollution- and blockage-free
2.	If the breather is dirty or blocked, clean the component. Do not pour or spray water or cleansers in the breather!
(3.)	Please notify Honeywell if the breather cannot be cleaned without removing, service work is needed. In this case, disconnect the gas and voltage supply.
4.	Do not execute any other acts or work before breather function is given or part is replaced
5.	Write down the result / condition in the service report.

Step	Work: Check connections visual
1.	Check connections (fluidic / electrical) and tubes / cables, to see if they are undamaged, complete and free of corrosion.
2.	If damages or corrosion has occurred, replace damaged and / or corroded components and close the unused openings!
3.	If step 2 is not possible or spare parts are required, please contact Honeywell for service.
4.	Stop the gas supply and electricity. Do not execute any other actions or work before the functions function are given or parts are replaced.
5.	Write down the result / condition in the service report.

Step	Work: Inspection of internal device
1.	Disconnect the gas and voltage supply. Only in an atmosphere which is not potentially explosive! Remove the housing cover to ensure that there is no damage/corrosion, unused open connections or loose wires.
2.	The inside is undamaged, there are no loose wires, no parts are corroded. All unused openings are closed.
3.	If step 2 is not met, please contact Honeywell for a service call. In this case do not complete any further action or work until the damaged parts have been replaced and the cover has been closed again.
4.	Only power the proChain GC if step 2 is fulfilled and all covers have been screwed. Observe the explosion regulations!
5.	Write down the result / condition in the service report.

Step	Work: Reading the gauges of cylinders
1.	Read the calibration gas cylinder pressure on the pressure gauge.
2.	If there is still a minimum pressure of over 1.0 MPa, the cylinder can remain in use. Note: if the pressure is close to the minimum, the cylinder must be replaced independently of the maintenance work if necessary.
3.	Read the carrier gas cylinder pressure on the pressure gauge.
4.	If there is still a minimum pressure of over 1.0 MPa, the cylinder can remain in use. Note: if the pressure is close to the minimum, the cylinder must be replaced independently of the maintenance work if necessary.
5.	Please notify Honeywell if you require a new gas cylinder. You may use the device without calibration gas but not without carrier gas. In this case, the results are less accurate.
6.	Write down the status in the service report.
Step	**Work: Reading the gauges of supplied gases**
1.	Read the process gas inlet pressure of the sample gas streams (1 – 5) on the pressure gauges.
2.	If the inlet pressure (PG) is not between 0.1 MPa(g) and 0.3 MPa(g) for ATEX / IECEx: use or between 0.1 MPa(g) and 0.15 MPa(g) for cCSAus use, adjust the pressure within this range
3.	If you cannot complete step 2, disconnect the gas and voltage supply. Do not proceed with any further action or work unless step 2 is correct.
4.	Attempt repair work. If necessary, notify Honeywell. Write down the status in the service report.

Step	Work: Reading the gauges
1.	The flow rates are correct, the ranges are as described in chapter 2 About this Document and Device delivery of this document.
2.	The flow rates are incorrect, a process gas pressure alarm is active, the inlet pressures are already at maximum.
3.	If the case described in step 2 applies, the gas and voltage supply must be disconnected. Filters or flame barriers must be replaced (flame barriers by Honeywell). Do not complete any further measurements unless step 2 is correct.
4.	Attempt repair work. If necessary, notify Honeywell. Write down the status in the service report.

	In some systems, there are also variable area flow meters installed in the gas streams. These are not essential since the flow rate is generally controlled via the pressure, but they provide an option for additional checks.

Step	Work: Replace an inlet filter
1.	Close the main valve on the gas supply line and relieve the pressure in the supply line to the device.
2.	When the residual gas has flowed through the device, switch off the electrical supply to the device.
3.	**Only carry out the following work when the device is depressurized, and the ambient conditions are similar to the interior.** Disconnect the gas pipe from the device. **Ensure that no gas escapes.**
4.	Disconnect the Swagelok pipe fittings from the filter and replace it with a new filter (see figure). **Spare part: Filter Gas inlet, SAP No. 801.06.712 (3 mm) / 801.06.713 (1/8")** Gas line Device
5.	Refit the fittings and lines to the device.
6.	Open the gas supply to the supply line.
7.	**It is essential that you conduct a leakage test. Ensure that no gas escapes.**
8.	If everything is tight, switch on the device or restart operations.

2.10.5. Repair work and Honeywell service work

The device has hardly any consumables and wearing parts. Honeywell recommends an annual inspection and offers to carry it out. Please make an appointment in good time; this is also a good time to rectify any deviations that may have occurred during maintenance.

If used in legal metrology, the presence of a calibration officer or his representative may also be required when the instrumentation area is opened.

The device may only be opened by personnel authorized by Honeywell. In any case, the following always applies:

	DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT **DISCONNECT POWER BEFORE OPENING**

	Please contact Honeywell in the event of damage to make an appointment for a service visit. Contact details can be found at the beginning of this document. Spare and replacement parts for work you can carry out yourself can also be obtained from this contact.

The gas inlets are equipped with filters to protect the inside of the unit from contamination. These can become blocked if gas that does not conform to the specifications is supplied or if the upstream filter system fails and must then be replaced.

A possible blockage is indicated, for example, by a valid inlet pressure and a too low pressure in the unit. In this case, please contact Honeywell for further testing or to rule out other causes.

After several years of operation, wear and tear and aging may result in additional maintenance and repair. Examples are battery replacement (approx. ten years) and the replacement of seals.

Factory maintenance must also be carried out if irreparable defects occur during the annual maintenance or if the housing is damaged. Depending on the circumstances, this work may require the unit to be completely dismantled or returned to the manufacturer.

For example, the housing can only be repaired by the manufacturer, since the dimensions of the Ex column are not part of the general knowledge and are only specified in the manufacturer's design documentation. Please contact Technical Support if necessary.

	Explosion-protected equipment that has not been repaired by the manufacturer may not be reused until it has been inspected by a recognized expert and again complies with the design documents.

Do not take any safety risks from incorrect spare and replacement parts. Only original Honeywell spare parts may be used.

	No liability is accepted for damage resulting from the use of unauthorized spare and replacement parts from third parties.

2.10.6. Cleaning of equipment and documentation of service work / maintenance

For cleaning, only use tools that will not accumulate static charge and generate sparks. As a rule, a mild cleaning solution or a mild glass cleaner as used in the household can be used. Always note the following

STOP	• **Do not use any equipment for cleaning which charges statically and may generate sparks.** • **Do not pour or spray water or cleaning products directly into the breather or vent line.** • **Do not use high-pressure cleaners or similar equipment for cleaning.**

Honeywell recommends that the completed maintenance work and general operations are documented. This documentation is in fact mandatory in some countries and at some institutions.

Below you will find a template that helps you to document the work carried out. You can copy this template and include it in your documents.

	Naturally, you will also receive detailed documentation of the work if you have it completed by Honeywell service technicians. In this case, these documents need to be archived.

Service Report	Number: _____	
Device	Serial number: _____ Software: _____	
Date of service work: ___. ___. 20____	Inspector/Company: _____	Result Yes/No
Gas connections, gas pipes and (if installed) flow meters have been checked with a suitable detector e.g. methane detector for sample gas or helium detector for carrier gas and are tight.		
Housing parts and paintwork are undamaged and firmly sealed.		
The breather (and the line) is free of dirt and blockages.		
Gas and electrical connections are undamaged and free of corrosion.		
No corrosion inside the device, all cores are securely connected, all housing openings sealed.		
All the gas lines and cables which belong to the measurement point are undamaged and free of corrosion.		
The ground connection is mechanically secure. There is a low resistance connection to the ground.		
The terminals on unused electrical connections are closed, there are no loose, unconnected wires in the device.		
The cylinder pressure of the calibration gas mixture is higher than 1.0 MPa. ≙ 145 psi ≙ 10 bars. The pressure is: _____		
The calibration gas cylinder was replaced. ***		
The cylinder pressure of the carrier gas is higher than 1.0 MPa. ≙ 145 psi ≙ 10 bars. The pressure is: _____		
The carrier gas cylinder was replaced. ***		
The inlet pressures are in the valid range: Process gas pressure: _____ Calibration gas pressure: _____ Carrier gas pressure: _____		
The particulate filters are OK, the flow rates are in the valid range. *		
Analytical components were replaced. **		
The battery charge is above 20% and is: _____		
The battery (Li/SOCl2 ½ AA 3.6 V) was replaced. ***		

*   If not, a pressure error will occur with valid inlet pressures and the filter must be replaced.

** Only required if measurement errors occur. Replacement part: _____

*** Must be carried out after 10 years or if the battery charge/pressure is low.

2.11. Technical data (Hardware)

The main technical data are noted on various type plates and labels on the actual device and are also listed below. Additional tables and the data for the CE declaration supplement this list.

2.11.1. Tables and information about the device

EnCal 3000 proChain GC system	Values and/or comments
Place of use	Installation close to the sampling point up to Ex Zone 1 If installed outdoors, the device may have to be placed in an air-conditioned housing.
Installation	Wall mounting using a bracket or installation on a bench or platform
Breather line	Connection at breather: 1/4" NPT
Gas connections	Inlets (up to 5 x process gas, 1 x carrier gas, 1 x calibration gas) Outlets (2 x process gas & gas measured) 1/8" Swagelok pipe fitting (standard equipment, others on request)
Sample gas consumption	approx. 2 l/h ≙ 0.071 cft/h per module
Gas management	Integrated double-block-and-bleed device
Dimensions	Base Ø 37 mm x height 37 cm (Ø 14" x height 14")
Weight:	29 kg ≙ 64 lb.
Enclosure	IP 66
Electrical connections (Only by certified parts)	e.g. following cable glands: Power supply and data transfer per M25 cable end gland for reinforced cable Ø 17 to 26 mm / M20 cable end gland (2) for reinforced cable Ø 5,5 to 12 mm or 12,5 – 20,5 mm Ext. sensor (optional) or adapters from M20 thread to ½" NPT, for using imperial threads.
Power supply (single supply)	24 V DC Fluctuations, including mains fluctuations ± 15%, for example with Quint-PS-100-240AC / Quint-PS-24DC/24DC/10 / Siemens SITOP / Siemens Logo or equivalent power supply units with safe electrical isolation
Maximum current/rating	(± 15% mains fluctuations) 5 A / 120 W (start-up peak and heated) (Heating time approx. 1 to 2 hours at -25°C (-13°F))

EnCal 3000 proChain GC system	Values and/or comments
	16 W typical, 30 W max, 60 W peak (not heated)
Analysis time	4 min. for C_6+ analysis.
Detection limit	for C_5: 50 ppm

Ambient conditions	Value and note
Ambient pressure	Atmospheric pressure
Ambient temperature range	-40 °C (-40 °F) to +60 °C (+140 °F) (according safety approvals)
Ambient temperature range (metrological)	-25 °C (-13 °F) to +55 °C (+130 °F) (with additional housing heaters) 0 °C (+32 °F) to +55 °C (+130 °F) (unheated)
Humidity	RH 0-95% (non-condensing)
EMC strength	to EN 61000-6-2 and EN 61000-6-4
Mechanical strength	Vibration and shock test to IEC 60068-2-31 and -64

Inputs/Outputs	Values and/or comments
Communication:	Velocity: 345,600 Baud: Interfaces: TCP/IP (serial) (for connection box only)
Digital outputs:	2 for 24 V DC (common earth, electrically isolated) 1 NC contact (closed when de-energized, suitable for general alarms) 1 NO contact
Digital inputs:	2 (2 cores each, 9 V, electrically isolated) Separate power supply, for example process and calibration gas pressure monitoring
Ethernet communication	1 x Ethernet (TCP/IP; Modbus; ftp; http)
Serial communication	2 x RS485 (Modbus serial)

2.11.2. Labels and information on the device

The layout and content or meaning of the labels and signs on the device can be seen in the following. This information must be noted and obeyed in all circumstances.

Metrological type plate (measuring ranges)

The details relating to the approved measuring range are given on a special label, the metrological type plate on the device base. All the listed measurements can be output. The information refers to the standard state which is also defined.

NMi				Metering ranges TC11244					
Ambient temp.		**Gas temp.**		**Nature of gases**	**Cal Gas**		**Gas flow (l/h)**		
Tmin	**Tmax**	**Tmin**	**Tmax**	burnable natural and natural-like gases			**Qmin**	**Qmax**	
-25 °C	+55 °C	-25 °C	+75 °C		P1-11K		2	40	
Accuracy (Class A to OIML R 140 Hs: ≤0.5 %, p: ≤0.5 %) with following component measurement ranges and cal.gas composition in [mol%]									
Cal gas	**Component Formula**	**Min.**	**Max.**	**Cal gas**	**Component Formula**		**Min.**	**Max.**	
8	N_2	0	20	0.5	i-C_4H_{10}		0	1	
balance	CH_4	65	100	0.5	n-C_4H_{10}		0	2	
3	CO_2	0	12.5	0.025	neo-C_5H_{12}		0	0.1	
6.5	C_2H_6	0	11	0.1	i- / n-C_5H_{12}		0	0.3	
2	C_3H_8	0	4.5	0.025	n-C_6H_{14}		0	0.3	
Heating value: 28.0 to 46.5 MJ/m³, Wobbe index: 31.7 to 54.7 MJ/m³, Densitiy: 0.74 to 1.01 kg/m³ According to ISO 6976 at T_1=25 °C, T_2=0 °C and base pressure p_0=101.325 kPa Determination of the compressibility factor according to the selected standard ISO 6976									

Figure 2.35: Measuring ranges

Furthermore, there is an uncertainty ≤0.25% and a repeatability ≤0.025% (relative standard deviation) for Hs and ρ. The drift of this values is ≤0.1 %.

Type labels

The main (adhesive) type label, containing the most important details, is located above the sample gas inlets on the right at the base.

In order to meet various approval conditions, the device can also be equipped with a stainless steel plate on the bottom side.

The contained information must be noted and obeyed in all circumstances.

If the main type label cannot provide sufficient space for all the details, the additional details can be read off an additional type label which is also affixed to the housing base.

The figure on the right shows the positions of the type labels.

Possible positions of type plates
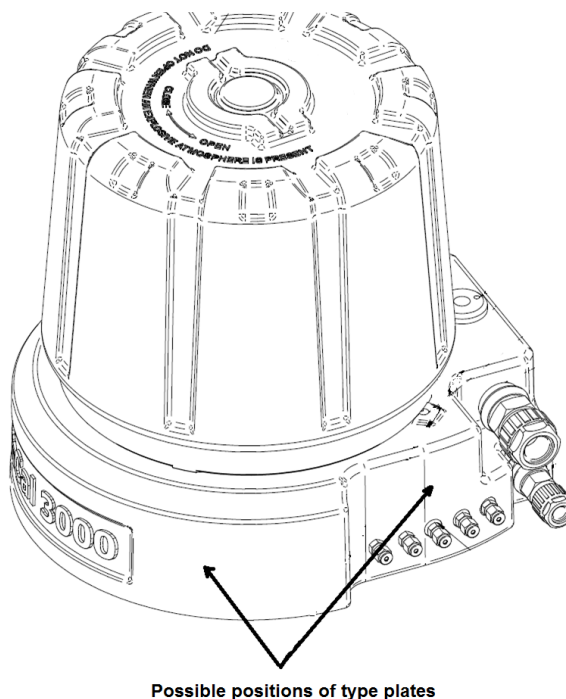
Figure 2.36: Example positions of the labels

The type label will vary depending on the application and country of use for the device. The language and specified standards or regulations will be adjusted accordingly. The details on the placed label or labels always apply and are exclusively to the device. These labels always contain the following data, possibly spread over multiple labels:

Data on the type label and additional type label
Manufacturer and manufacturer's address with the address of the production site
Device type, type designation, serial number and year of manufacture MM/YYYY
2D matrix code and warning note to read the documentation
Gas inlet pressure range, ambient temperature range and enclosure
Voltage and power consumption
Approvals issued, approval number, CE mark with auditor number
Complied with or to be complied with environmental regulations such as WEEE or RoHS
Ex rating
Warning and connection instructions, in several languages, if necessary
Maximum sample gas pressure

The following shows some examples:
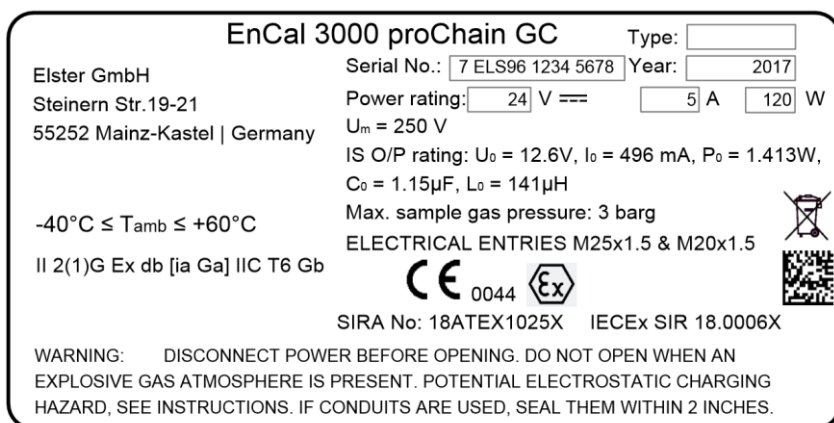
Figure 2.37: Example type plate EU
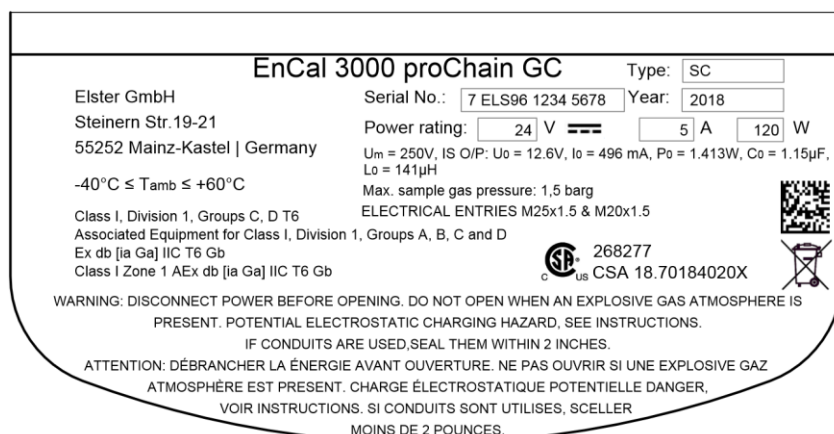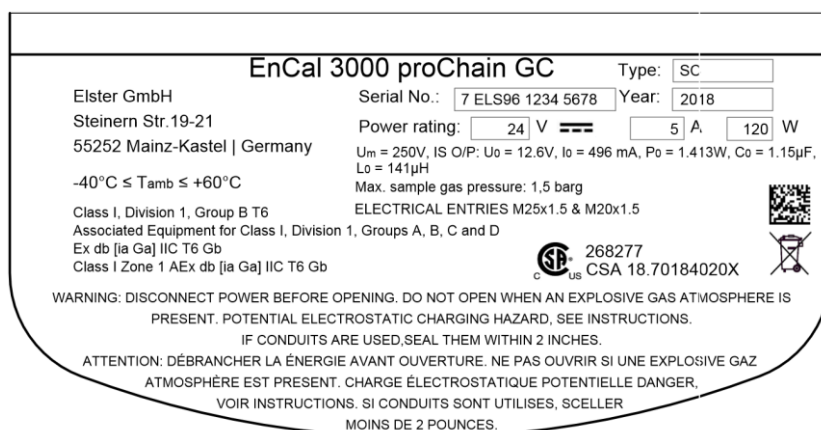
Figure 2.38: Example type plate US /CA with different groups

Description of the numeric key: Serial No.: 7 ELS96 1234 5678

7 = Gas (division)
ELS = Elster GmbH Mainz (manufacturer's code)
96 = Production site MZ-Kastel
123... = 8 digits long individual serial number

Hints about the type labels:

💡	Please note, the device is used by default with 24 V DC voltage at 5A.

💡	U_m = 250V IS O/P rating: U_0 = 12.6V, I_0 = 496mA, P_0 = 1.413W, C_0 = 1.15μF, L_0 = 141μH is the characteristic to the optional intrinsically safe display: This is only for information, if the display is used it is connected internal. No external power supply is needed.

Additional markings and safety instructions

The safety instructions for opening the device can be found on the top of the cover. The gas inlets and outlets are also labelled.
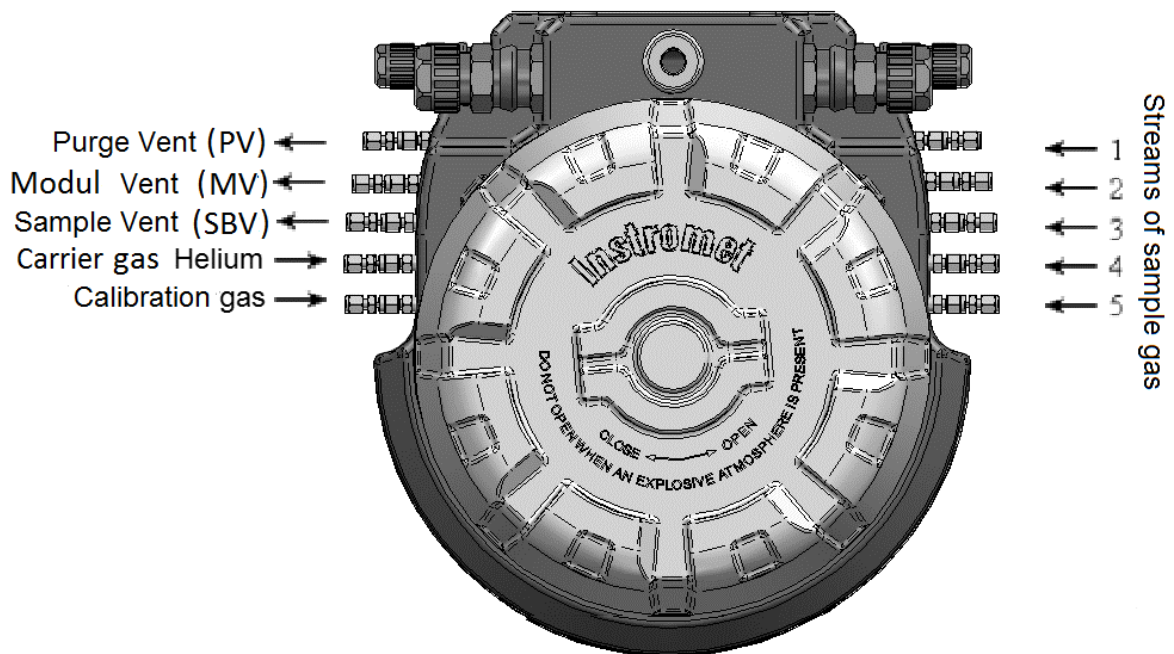
Figure 2.39: Additional markings on the device

3. Software

Welcome to enSuite

enSuite is the configuration and analysis software for Honeywell Elster® devices in the field of flow computers, data loggers, gas analyzers and ultrasonic flow meters. enSuite offers tools for configuration, parameterization, diagnosis, software download as well as other service purposes, and supports all activities required for the commissioning and maintenance of these devices.
Please visit our homepage at **www.elster-instromet.com**

Online help

For help on a specific topic either choose this topic in the content tree (Help – Show online help) or select the item and press the [F1] key during parameterization of the desired branch or tab to get context sensitive help. Note that the context-sensitive help for a tab or an area of a tab is only displayed if you first set the focus to a control element.
Context-sensitive help is available for device series enCore and Q.Sonic Series VI only.

Tip: Searching parameterizations

Using the key combination [Ctrl + F] you can search parameterizations by parameter names, export values (on tabs), and parameterized values.

The software chapter is aimed at measurement operator's and explains the operation and parameterization of the measuring instrument. In accordance with the Honeywell "**Safety first**" principle, this section starts with a summary of all relevant safety and warning information.

An overview of the software is given and the first connection after switching on the power supply is explained. Finally, the details of the software for operating and parameterizing the device follow. The chapter is closed with options, the technical data and notices of the software.

	Training and courses
☀	Honeywell can provide classes and training to make the measuring equipment easier for you to use and for using all the individual options offered by the device. If you are interested, please contact Honeywell. Contact data can be found at the beginning of this document.

3.1. Data security information

Honeywell gas analyses devices are used in modern infrastructures and network control systems with the aim of transferring process information such as meter readings, measurements and messages to a central billing or control point. A connection of this type constitutes a significant security risk which must be given careful consideration when designing the network.

3.1.1. General guidelines Software versions and actuality

	Only use the device with the latest released software according to the approvals of your device. N'utilisez l'appareil qu'avec les logiciels les plus récents, conformément aux homologations de votre appareil.
	Please note that only the software versions mentioned on the cover page are considered in this manual. Veuillez noter que seules les versions de logiciels mentionnées sur la page de couverture sont prises en compte dans ce manuel.

To increase data security, you may need to install the latest available software version before using the device. You should also check from time to time whether the software used is still up to date.

Check on the website www.elster-instromet.com/en/software-downloads whether your enSuite version is still up-to-date, download the latest version if necessary and install it. To do this you will find information on this website and under "Installing and starting enSuite" in this document.

A modification history, which is also available, provides information on the development of the device series.

	With the help of the latest enSuite version, the status of the other software parts can also be checked. The section 3.4.15 Changing the software configuration (software update) contains the necessary information. If the software is out of date, update all parts.

The device may also be upgraded now by Honeywell upon request. Honeywell shall not be liable for loss of data, provision of incorrect information or other potential problems associated with failure to upgrade the software to the latest release in the manner required.

	You can use the methods described in section 1.4 Version History Updates and File Integrity to verify the integrity of the file. Additional information on how to check the software's up-to-dateness can also be found there.

3.1.2. Password guidelines and role-based access control

Each user has his own access data consisting of **<u>user name</u>** and **<u>password</u>**. The device checks the access data, i.e. the user must be known to the device.

⚠	**The device is supplied with standard users without password protection or password. Honeywell recommends that you first set an administrator password and set up passwords for all super users before operating.** **L'appareil est fourni avec des utilisateurs standard sans protection par mot de passe ou mot de passe. Honeywell vous recommande de définir d'abord un mot de passe administrateur avant d'utiliser et configurer des mots de passe pour tous les principaux utilisateurs.**

Use the best practices for managing your passwords with the device. Special characters like the equal sign "=" are allowed in passwords. Here are some best practices to make password attacks more difficult:

- Always change default passwords
  e.g. your preset by the administrator or super user access data

- Always use strong passwords (at least eight characters)
  Always use a combination of higher and lower case letters, numbers and special characters. Furthermore, protection increases with the length of the password.

The role-based authorization concept of the enCore device series is another tool for increasing data security. Six different roles with six user profiles help to ensure correct operation with correspondingly restricted access.

An administrator profile and five super user profiles (su1-su5) are always available.

⚠	**The device is delivered without preset rights and access management.** **Honeywell recommends the administrator to adjust the authorization concept before operation. The table at the end of the section gives appropriate recommendations to ensure safe use of the device.** **L'appareil est livré sans droits prédéfinis ni gestion d'accès.** **Honeywell recommande à l'administrateur d'ajuster le concept d'autorisation avant l'opération. Le tableau à la fin de la section donne des recommandations appropriées pour garantir une utilisation sûre de l'appareil.**

The administrator profile or the administrator has unrestricted access to the device and manages the other user profiles. The administrator is responsible for setting and transferring user management to the device. Passwords and access rights must be assigned by her or him. The Administrator should therefore have the appropriate equipment knowledge e.g. by participating in a training course. The station operator usually takes on this task.

Section <u>3.3 User management and login</u> describes the necessary steps.

The access rights are assigned per super user profile and determine which user profile, which parameters **(rights at parameter level)** or system settings **(rights at system level)** may change on the device. A user of this profile therefore only has access to the corresponding part of the device. This provides you with a powerful tool with which you can implement exactly **the role concept** that fits your applications. In the delivery state, all super user profiles are set the same.

The following figure gives you a first overview:
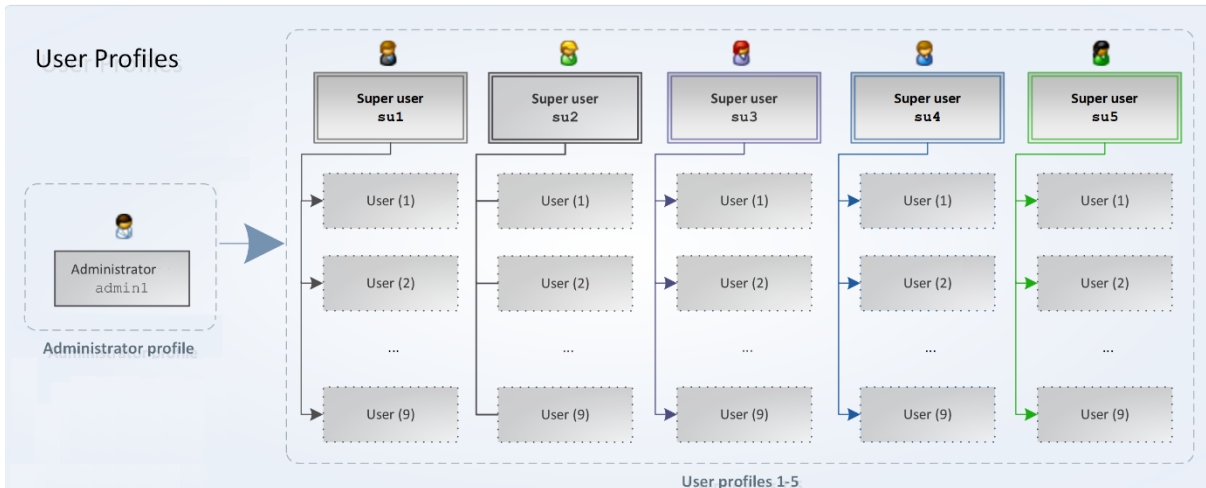
Figure 3.1: Roles and user profiles

All user profiles (exception administrator) are groups of up to nine standard users and one super User (su), who manages his group, i.e. he can add or delete users and change user names.

Users inherit the permissions of their profile.

Groups of people working with the device should only be provided with the required user profile by the administrator after password creation. An example is shown in the table at the end of the section.

By default, users of profiles 1–5 have read-only access to the enCore device after login.

To ensure data consistency, only one user can be exclusively logged on to the device at a time and changes can only be made after successful login.

Apart from password protection and access rights, changes can also be prevented by the calibration switch (SSW) 🔒 or logged in the fiscal audit trail 🖳. The administrator must also make the necessary settings for this protection, which was not installed on delivery. See also section 3.3.4 Viewing position of the security switch .

🔆	Further information and application about user management, logging in, logging out and changing the password, see section 3.3 User management and login or additional **enSuite online help**.

In order to ensure the security of your enCore device, you should always give user profiles 1–5 only the minimum rights required to perform a task. The following table gives an example overview of a few roles and use cases of the permissions proposed by Honeywell:

Administratorprofil **enSuite**	**Main actor(s):** Device owner / Station Operator
	Goals: System- / Device-Management
	all rights at system level and at parameter level exists **(no adaption necessary)**
	Use case: Creating and deleting users / assigning rights / assigning passwords
one of the **User profiles 1–5** **enSuite**	**Main actor(s):** Honeywell Service Technician / Technical Support Service technician with additional qualification (authorized in legal metrology)
	Goals: Mount device / configure device functions / change software (legally relevant, operational) / adapt parameterization to measuring point / open and close security switch / ensure correctness of the official measurement / seal device
	required rights (administrator rights without user management) **All rights at system level / All rights at parameter level** **(Rights must be adjusted)**
	Use case: Service technician commissions the device in legal metrology or operationally or carries out essential changes to the operating mode or repair measures. Honeywell Technical Support supports service technicians, technical personnel and controllers in their activities
another one of **User profiles 1–5** **enSuite**	**Main actor(s):** Honeywell Service partner / Metrologie-Expert with HONEYWELL Training
	Goals: Open and close security switch / erase fiscal audit trail/fiscal archives / change legally relevant parameters according to the approval file / change legally relevant software on the device / ensure correctness of the official measurement / seal device
	Minimum required rights (Rights must be adjusted) **rights at system level:** Change device system time / Reset battery status / Change AFB configuration / Change legally relevant and operational software / Change general system settings / Erase fiscal audit trail/fiscal archives / Change approval file.
	rights at parameter level: Right to change all parameters that are protected by security switch 🔒 according to the approval file. / Change rights around operational AFBs
	Use case: Authorized metrology expert carries out legally relevant maintenance.
a third profile of the User profiles 1–5 **enSuite**	**Main actor(s):** Qualified personnel with HONEYWELL training e.g. electrician / gas specialist
	Goals: Goals: Regularly change a defined set of parameters, e.g. adjust values of the gas component table / change operational software / delete operational archives / perform calibrations / perform maintenance
	Minimum required rights (Rights must be adjusted) **rights at system level:** Change displays / Change device system time / Reset battery status / Change AFB configuration / Change operational software / Change general system settings
	rights at parameter level: rights to change the required set of parameters, z. e.g. gas quality values / gas composition
	Use case: Technical staff carries out operational maintenance work
Rest of the **User profiles 1–5** **enSuite**	**Main actor(s):** User without HONEYWELL training e.g. Controller.
	Goals: readout archives / readout parametrization / view and accept error list
	no adjustment of rights necessary (default setting allows read-only access)
	Use case: Employee reads out non-sensitive data from the measuring device

Figure 3.2: Overview of user profiles and proposed authorizations

3.1.3. Networks and security for data at rest and data in transit

All enCore device data is written and stored on the SD card in the device. This data is also called **data at rest.** To prevent unauthorized access, the configuration data is encrypted starting with basic system version 03-39-A. Write access is only possible after authentication with **user name** and **password**. The security switch (SSW) also prevents manipulation of the device.

Data-in-transit is the data that is transferred between an enCore device and e.g. a control station in a public or trusted network or between enCore device and enSuite e.g. when transferring data during parameterization of the device. The communication between the enCore device and enSuite is carried out via **MMS (Manufacturing Messaging Specification)**, which is encrypted since Basic System 03-39-A to prevent data from being read by other network users.

The encryption is carried out using the **TLS (Transport Layer Security)** transmission protocol. The enCore device uses a **self-signed certificate** to authenticate itself to enSuite each time an MMS connection is established. The devices are always delivered without a certificate, which is automatically created when the enCore device is put into operation and announced to enSuite during the first MMS connection. This certificate is retained until it is changed / deleted manualy.

To increase security, we recommend changing this certificate on the enCore device or on the remote operation panel before regular operation and having the device create an up-to-date certificate **with administrator and user passwords set up**. The certificate information can also be viewed on the enCore device or the remote operation panel. Details on the **use of certificates** will follow later in this document.

Other protocols that are also used in the enCore devices - e.g. Modbus - transmit data partly in plain text. If possible, use the secure variant of a protocol. **To increase security, also use a firewall as described in the next section.** Supported data protocols are shown in the following table. Not all options are included in every enCore device.

Communication	Supported data protocols
Ethernet	• DSfG (class B) • HTTP (*only up to version 03-38*) • MMS (secured via TLS) • Modbus TCP • NTP • SMTP (unencrypted, SSL/TLS, STARTTLS)
Serial communication (RS232, RS485)	• DSfG (class A) • Modbus (ASCII, RTU) • UNIFORM

⚠	**We recommend using a VPN connection whenever you need a secure data connection, but no secure protocol is supported for data transmission.**

	In a VPN, data is transferred between two or more participants in encrypted form. For this reason, a VPN connection is recommended, for example, for mobile access to a flow computer, access to the private network or for data communication via different systems is of great importance.

3.1.4. Preventing unauthorized external access using a firewall

To reduce the risk to your network, we highly recommend including a firewall or some other mechanism to limit the network traffic between the (external) central accounting center resp. control station and the (internal) network of the gas measuring plant in a target manner. Furthermore, we recommend allowing protocols and ports only that are actually used for data exchange with the external network, e.g. by adding these to the white list of the firewall and allow data exchange with trusted participants only. Supported data protocols for GQ devices are shown in the following table.

Protocol	Standard port	Description
MMS	102	Manufacturing Messaging Specification (pursuant to ISO standard 9506) allows communication between enSuite and enCore devices, for example, access to an enCore device via the remote operation panel.
Modbus TCP	502	Protocol for data exchange by user-defined registers between AMR and enCore devices using a standard TCP/IP network.
NTP	123	Network Time Protocol for the high precision time synchronization of enCore devices with an NTP time server.

Following Example shows a router and a firewall between the metering device and the control room during data exchange via Modbus TCP in a trustworthy network.
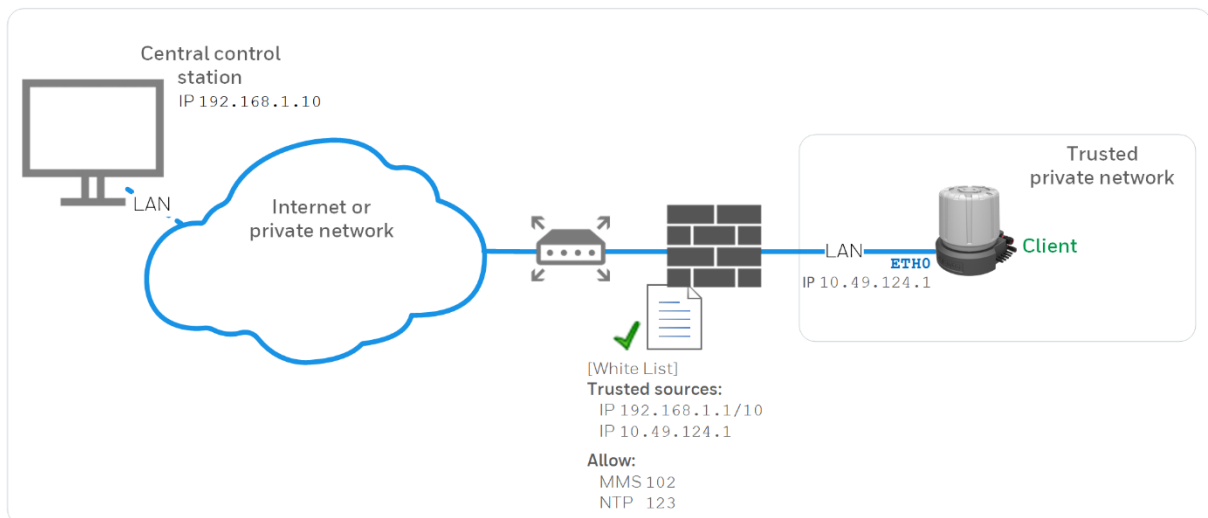
Figure 3.3: Example of a router and firewall

3.1.5. Logging of device events with logbooks

	Log files can provide useful information to help troubleshooting on site, but also provide valuable data on the use of the device and any violations. Please note therefore the contents of these files. **Les fichiers journaux peuvent fournir des informations utiles pour aider au dépannage sur place, mais ils peuvent également fournir des données précieuses sur l'utilisation de l'équipement et sur les éventuelles violations. Veuillez donc noter que le contenu de ces dossiers**

In enCore devices, a distinction is made between the general audit trail and the fiscal audit trail. Both are log archives:

General audit trail: The audit trail is a fixed component of the Basic System and exists in every enCore device. All parameter changes and the following system events are logged here:

– System messages
– All parameter changes
– User login and logout
– Setting counters
– All entries in the fiscal audit trail

The audit trail has a depth of 1000 entries. As soon as the logbook is full and another event occurs, the oldest entry is overwritten by the latest entry using the FIFO (first-in-first-out) principle.

Fiscal audit trail: enCore devices which are used for legal metrology purposes also have a fiscal audit trail. All changes of parameters made while the security switch is closed, which are labeled with the ⊞ symbol in the device parameterization, are logged here.

The fiscal audit trail has a *maximum* storage capacity of 1000 entries. As soon as the fiscal audit trail is full, parameters with the relevant symbol can *no longer* be changed while the security switch is closed – the fiscal audit trail must first be cleared. This action can only be performed by an authenticated user with the opened security switch.

	The sections on operation and parameterization contain further information on handling the logbooks

3.1.6. Reporting security vulnerability to Honeywell

A security vulnerability is defined as an error or weakness in the software that can be exploited to impair the operation or security of the parameterization or device software or to access sensitive data.

Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services. For details on Honeywell security policy, visit

https://www.honeywell.com/product-security.

To report a potential security vulnerability against any Honeywell product, please follow the instructions at:

https://www.honeywell.com/product-security (under the "Vulnerability Reporting" section)

To view information on current malware threats please visit:

https://www.honeywellprocess.com/en-US/support/Pages/security-updates.aspx

OR contact your local Honeywell Process Solutions Customer Contact Center (CCC) or our technical support of Elster Gas ©

Contact data (at the beginning of this document)

3.1.7. Uninstalling programs and data

Uninstall enSuite in the usual way in Windows, but only if you do not want to access any enCore device permanently, as the uninstallation removes all enCore devices and data from your parameterization device (PC) at the same time.

In the **navigation window**, remove data by selecting a line and activating **Delete** in the context menu. After confirmation, the line and all subordinate entries are deleted.

If the device is disposed of, the stored data can be easily and safely removed by removing the SD card. Without SD card the device is unusable.

⚠	**If the SD card is removed improperly, additional hardware damage is possible! Disposal of the memory card and device are subject to environmental protection regulations.**
	Si la carte SD est retirée de manière incorrecte, des dommages matériels supplémentaires sont possibles ! La mise au rebut des cartes et des appareils à mémoire est soumise à la réglementation sur la protection de l'environnement.

All data of the device is stored on the SD card. This card is located on a separate board, called CPU3 CORE.

Unscrew the mechanically and electrically uninstalled device. The circuit boards (in the housing or on the HMI module) become visible.

You will then see the CPU3 CORE board with the SD card as shown. The SD card is located in a holder and has a red border in the figure.

Open the holder by first sliding the cover to the edge and then folding it forward. Now remove the SD card and with it all data of the device.
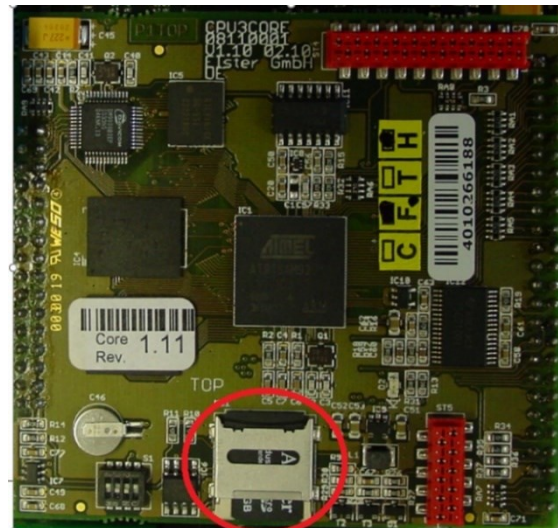
3.2. The PC software enSuite

Since it is not possible to complete operating procedures and read the measurements directly on the **proChain GC**, these tasks can be completed using the enSuite PC software and the IP address of the device or the optional USB adapter.

The combination of computer and device enables you to control the device from flexible distances.

💡	The IP address is part of the existing default parameter set.

This PC software supports the **proChain GC** and other Honeywell devices. It is also being used for starting /stopping of measurements and provides many ways to configure the device and managing its data and results.

Access to the chromatograms, described in following sections, is also provided via this software.

The parameter set and device settings can be checked, changed or archived using **enSuite**. This will provide you with an extensive overview of the device and its operating situation. Your PC can therefore also be used as a parameterization device.

The following provides a brief presentation of the software concept and enSuite and describes the installation process.

Further details of the software are available in the enSuite online help. Please refer to the other information in this section before you access the device using enSuite.

💡	Always use the latest version of enSuite from the download section (see next pages) for your work. This will enable you to access all device versions.

The following sections require the assembly and installation of the enCore device. The basic working steps, which are always necessary when dealing with enCore devices and the associated enSuite PC software, will be described.

It is therefore recommended that you read through this section in full before handling the device for the first time. Starting with an overview and the installation of enSuite software on the computer.

3.2.1. Application and System function blocks (AFBs/SFBs)

The **proChain GC** is based on a Honeywell product platform called enCore. All more recent measuring instrument series are based on the same hardware components and software concepts. Both the hardware and software have a modular design.

Figure 3.4: enSuite blocks (basic system with SFBs and AFBs)

The software blocks consist on the one hand of the basic functions such as the I/O coupling or the connection of digital protocol interfaces provided by the basic system with its SFBs (system function blocks).

On the other hand, the software blocks consist of user-related functions provided by the various AFBs (application function blocks).

This modular principle enables every device to be tailored perfectly to individual requirements. The illustration above shows this principle.

The device software in every device consists of the following parts:

- the basic system which contains various basic functions (SFBs) and

- several user-related functions (AFBs). One AFB for the device-specific properties which is always included bears the name **GC** from **EnCal 3000 proChain GC**.

3.2.2. Installing enSuite

If you do not wish to use the default parameter set, you should change the parameter set before or during the start-up procedure. The software package will help you do this. One example of these discrepancies is the use of gas properties not stored in the device for the verification or calibration.

You can download the installation program from the Software Downloads section of the website:

www.elster-instromet.com/de/software-downloads.

	This site also contains a file describing the installation procedure and the minimum system requirements.

Complete the installation as specified on the website. Ensure that there are no special characters in the file path, otherwise it will not be possible to transfer files to a device.

	If enSuite is already installed on your computer (parameterization device), ensure that you have the latest version. Also ensure that no data are overwritten by a new installation (backup copy/changing the storage location).

	No restart is required after completing the installation and the shortcut symbol shown here will appear on your desktop.

	For non-fiscal operation, the enSuite configuration and analysis software also allows communication via a network interface using the Modbus TCP protocol.

3.2.3. Starting enSuite; the first steps

Start enSuite either via the enSuite program symbol ◣ on the desktop or via the Start menu (Elster group of programs).

The software's user interface will appear once it has been opened. At the top, there is the menu bar and below it is the button bar. If necessary, you can change the language via the options dialog (**Tools – Options**, tab **General**) as shown in the following figure.
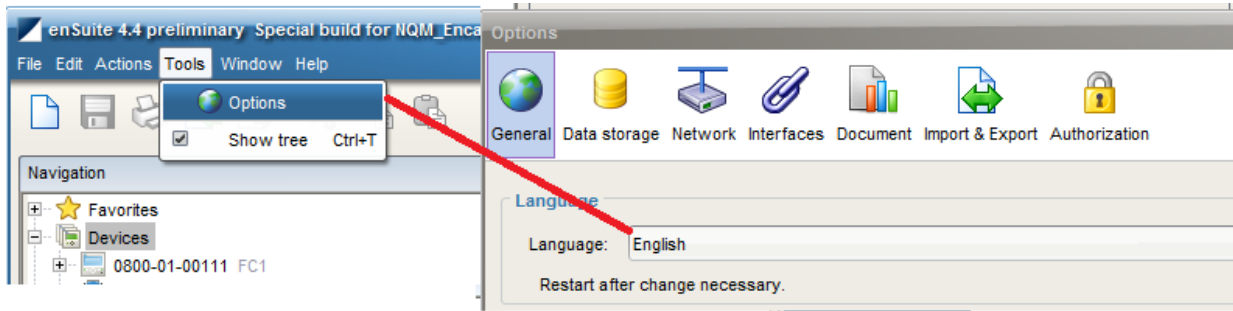
Figure 3.5: Change language in enSuite

Set the language you require using the drop-down menu. enSuite then has to be restarted. A note and / or a link will be displayed the bottom right of the window. The symbol 🌐 reminds of the pending restart.

The rest of the interface is split into window areas. The communication is established using these input and output windows. enSuite will remember the position of the windows from previous sessions.

The rest of the interface is divided into window areas. Communication is established via these input and output windows. It is possible to detach some windows or window areas from enSuite and display them separately.

Open the context menu in the header or tab of the area you want to detach and select "**Float**" or "**Float Group**" or drag the item line to a free area of your desktop using "Drug and Drop".

The individual windows can then be resized to a desired size. To do this, hold down the mouse button and drag the window edges or use the corresponding functions from the context menu. Use "**Dock**" or "**Dock Group**" to reintegrate the window. Closing the window with **X** also removes the detachment.

EnSuite remembers the position of the windows from previous applications.

🔅	The "Reset windows" function ⊞ (see menu bar under the window) enables you to restore the default state.
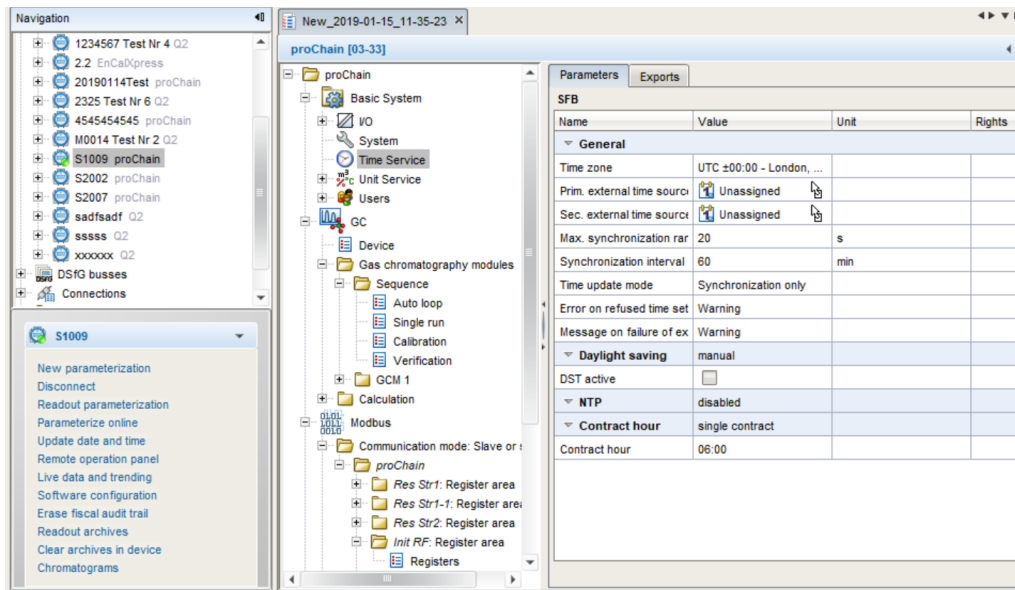
Figure 3.6: Example of navigation window and parameterization window

One of these windows is the Navigation window. The upper half of the navigation window is designed with a fixed data structure, just like an application-oriented file manager. The top hierarchy levels include the aforementioned levels **Devices** and **Connections**.

The view of the data structure in the navigation window can be changed; by default, you only see the currently selected branch. You can navigate to a lower level by double clicking, or a higher level by pressing the 🔼 button.

The navigation window is normally located on the left-hand edge of the screen. It can be hidden so that a greater working area is available. The navigation window is then displayed once again after clicking on the 🔸 Navigation button on the left-hand edge of the enSuite window. If you simply move over the button using the cursor, the navigation window is temporarily displayed.

The lower half of the navigation window shows which actions are executable in the current context. If, for example, an unconnected device is highlighted, then only the actions **New parameterization** and **Connect** are executable. If a currently connected device is highlighted, then the entries **Disconnect** and **Read out parameterization**, along with a number of other actions which are only possible in the event of an active data connection, are possible here instead of Connect. All possible actions are also provided in the context menu (right mouse click). By clicking on one of the actions, it is then started and opened in a new editing window.

More information about the interface is provided in the **online help**.
You can activate the general online help via the menu item **Help – ❓ Show online help**. Open the context-sensitive help directly from the desired branch in the parameterization window with **[F1].**

By using the "**Info**" line or (About) in the help menu, you can view license and other software information about enSuite, as shown in the next figure.
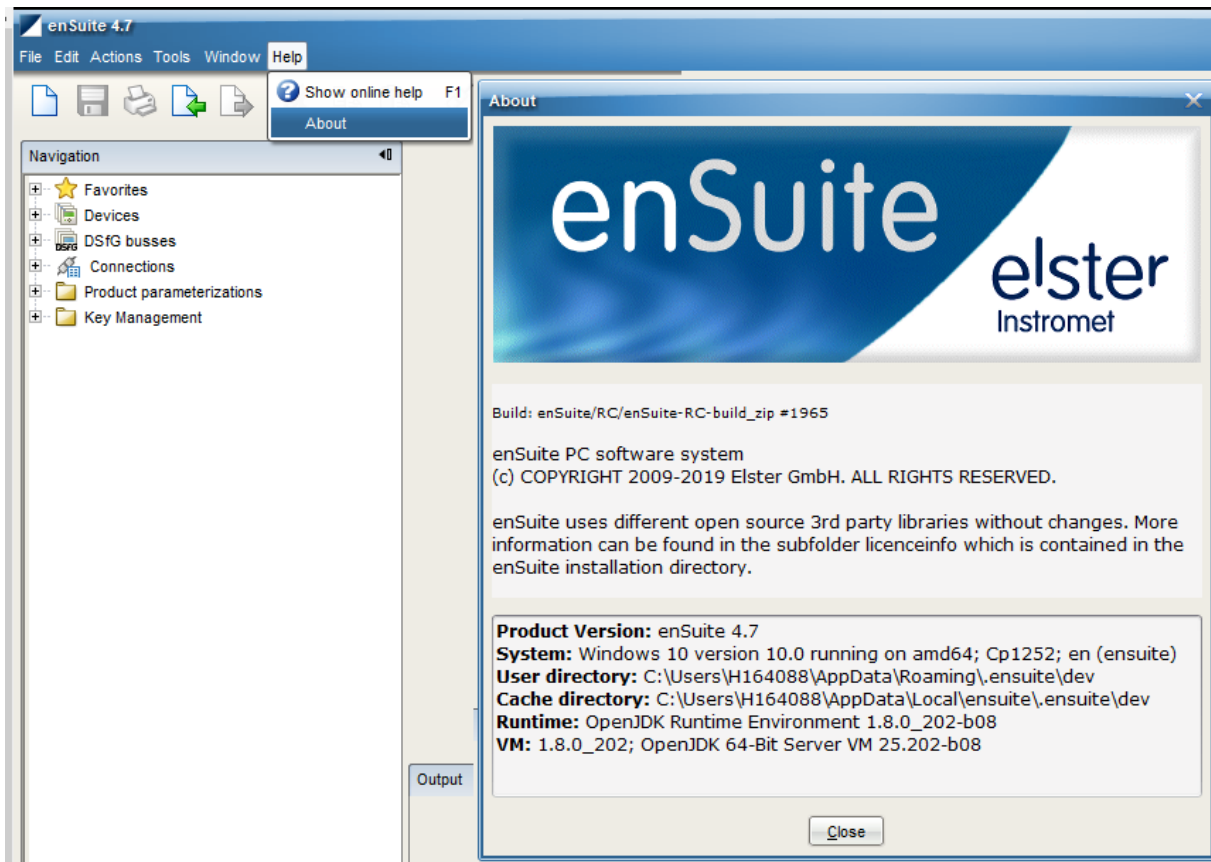
Figure 3.7: enSuite license and software information window.

	Use the online help to obtain an overview of the basic enSuite functions.
	It includes information for setting the inactivity timeout and the automatic logout.
	The sub-sections below provide more details of this information and are easier to understand with this background knowledge.

3.2.4. General connection options to the enCore device

A data connection between computer and device be established either directly via a USB cable or via TCP/IP computer network.

The communication between enCore device and enSuite is carried out via MMS and is secured via TLS since Basic System 03-39-A. The enCore device uses a self-signed certificate to authenticate itself to enSuite every time an MMS connection is established. The certificate is normally created once when the enCore device is put into operation and is announced to enSuite during the first MMS connection.

- **Connect enCore device locally via USB**
  Connect service PC and enCore device using a USB cable. Since Windows 10, enSuite can communicate with the enCore device via USB without driver installation.

	Since in particular mobile devices are designed to use as little energy as possible, communication problems can occur. We recommend to deactivating the USB energy saving settings for battery and mains operation under Windows.

Open the Windows **Control Panel**.

- ► Make sure that for **View** either option **Small icons** or **Large icons** is selected.
- ► Open the **Power Options**.
- ► Click on the actions **Change when the computer sleeps** – **Change advances power settings**.
- ► In dialog **Power Options** open node **USB settings** – **USB selective suspend setting** and deactivate the following settings:
- **On battery**
- **Plugged in**

	You can only use the USB connection when the housing is open or in combination with an optional adapter, see section 2.4.2 USB connection.

- **Connecting the enCore device via TCP/IP**
  The Device is mounted in an accessible computer network. Cable type according to Category 5 (Cat 5) Connect the service PC and enCore device with a cable.

	Use mainly the TCP/IP data connection. Both the PC and the device must be connected to the same network and the IP addresses may have to be adjusted to ensure a perfect TCP/IP connection.

3.2.5. Establish a connection to the enCore device

The connection to one or more devices can be made in various ways, for example select one of the following symbols on the button bar shown in the table.

	Actions – **Search device** (alternatively press the [F3] key)	Searches for all accessible devices and establishes the connection. All devices which were unknown up until now are entered in the enSuite database. This option is recommended for all initial connections established with one or more devices.
	Actions – **Connect**	Establishes the connection to a specific device. The device must be contained already in the enSuite database and selected in the navigation window under the **Devices** branch (identification via serial number).

The first icon contains a search function, e.g. for connecting devices (new devices) that are not yet available in the database. After a first connection the individual devices are identified and stored in the enSuite database by their serial number; for such devices, the second symbol can be used.

In both cases, a dialog to select the connection path then appears once the option is activated
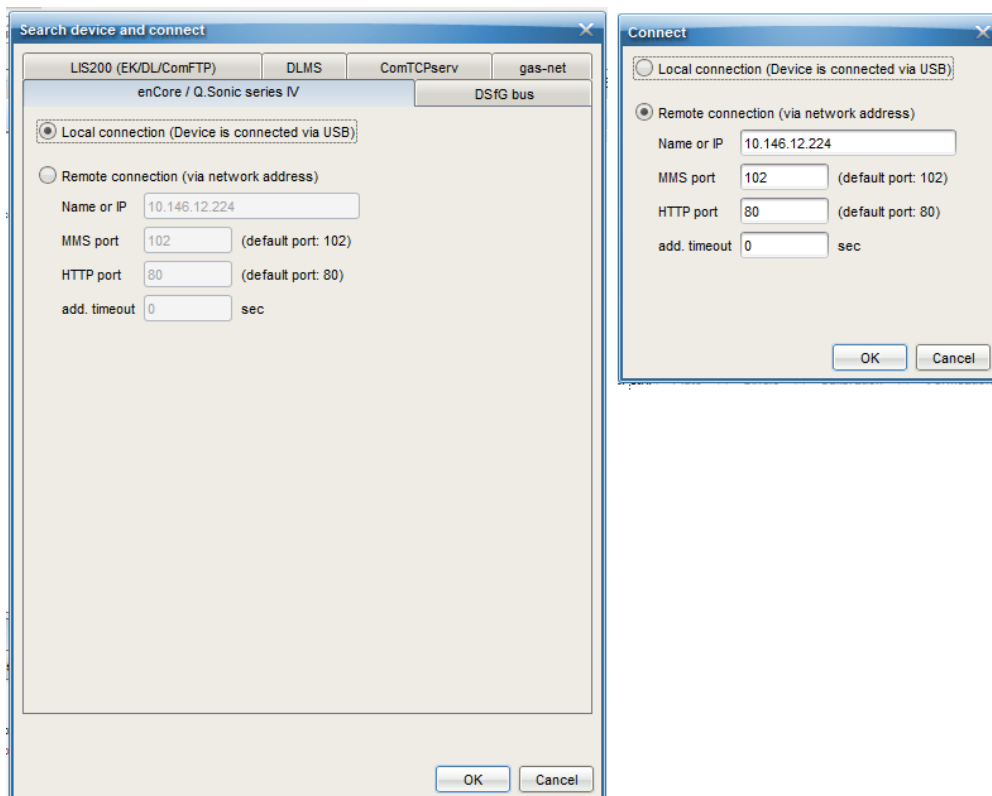
Figure 3.8: Dialogs **Search device and connect** and **Connect** (examples)

> The dialog "**Search device and connect**" also allows the selection
> of other device types. For proChain GC select the type as shown in the figure above

To establish a USB connection, select **Local connection**; this can only be used when the housing is open or in combination with an optional adapter, see section 2.4.2 USB connection.

For a TCP-IP connection, select **Remote connection** – in this case, you need **the basic network settings** of the device. These can be **found on the device** or (if installed) on the optional local display and is part of the existing default parameter set.

Steps to establish the **first connection with a device not registered in the database**

1. select the corresponding function e.g. in the **navigation window** or on the button bar

2. enter the connection data in the dialog, see next figure
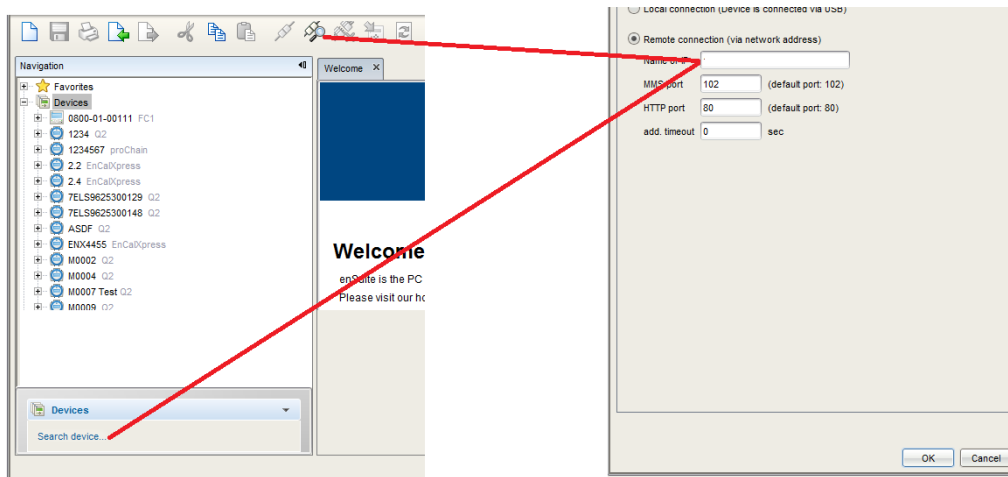
3. confirm with **[OK]**

If it was not possible to establish the connection, an error message will be displayed.

There may be several causes of this error, for example the device is switched off or is still starting up.

The entered address was incorrect, or hardware errors have occurred. See also section 2.10.1 Troubleshooting**.**
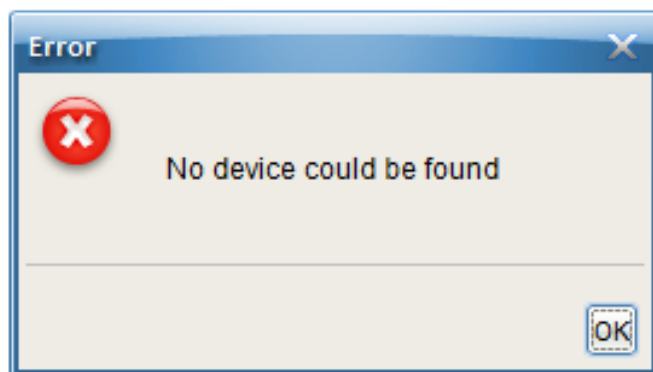
Figure 3.9: Connection not established

	Since Basic System 03-39-A the **enCore device** tries to authenticate itself with its self-signed TLS certificate. Depending on the pre-set device system time and the time zones used, the certificate will only become valid or unrestrictedly usable after a certain time has elapsed. In this case a note is displayed.

Only in case the certificate is unknown to enSuite or don't match with the stored one, enSuite makes no connection and will display the certificate for validation.

This is always the case at the first time the device is connected, or if the device authenticates itself with a new certificate.

First check the information about the device in the section Subject of the dialog.

If the information is correct, the next step is to establish a **temporary** device connection by selecting the button in the middle of the display. If not select **[Abort]** the MMS connection is not made.

Figure 3.10: Certificate is unknown – example first connection establishment
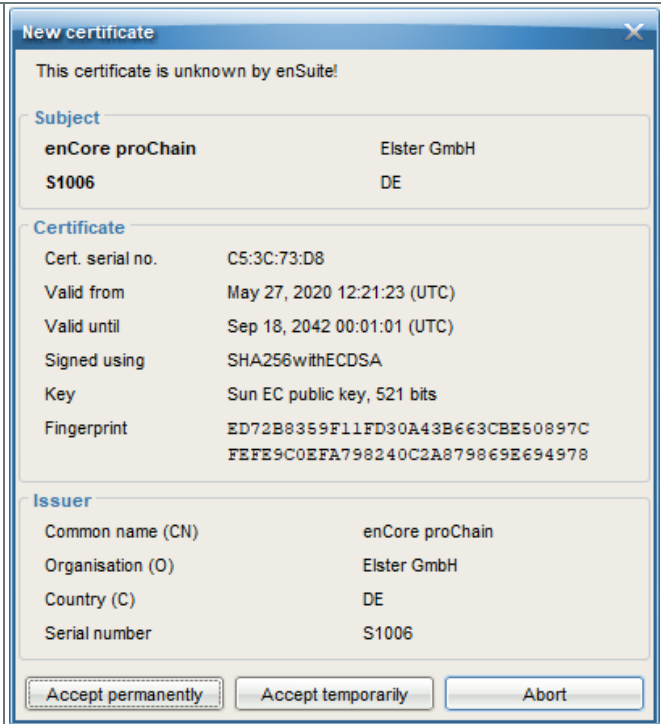
With **[Accept temporarily]** the current MMS connection will remain, but enSuite will not save the certificate in the database. The next time a connection is established, a security query will appear again. Now check certificate in detail. Since a temporary connection exists, call the **Remote operation panel** action, see section 3.5 Remote operation panel functions of enSuite.

– Open the certificate information via the 🏠 -- ℹ️ **Info – <device serial no.>**, **Certificate**
– In enSuite, open the output window via **Window – Output**
  (Here all transferred certificates are linked with the time stamp of the transfer)
– Open the corresponding certificate with **Show certificate.**
– Compare fingerprint and subject information from enSuite and **Remote operation panel**.

If both matches, you can permanently save the certificate in enSuite by reconnecting to the device and Select **[Accept permanently]** In this case, enSuite saves the certificate in the database. Each time a connection is established, enSuite compares the received certificate (in the background) with the saved one.

As long as both certificates match, enSuite trusts this connection and establishes the connection. Only if the device's certificate changes, e.g. because a user has newly created the certificate, will enSuite display the new certificate information.

After this first connection, has been established, enSuite will enter the device and the connection details in the parameter tree. In the enSuite **navigation window**, all devices with serial numbers which are contained in the database are listed under the **Devices** branch.

Connected devices can be identified by

the green dot ⬤ during the data connection in the symbol in front

of the serial number. (navigation window)
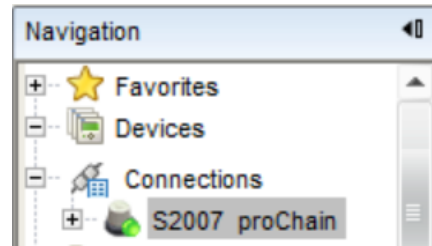
With respect to devices for which a connection has currently been requested but has not yet been established, the device symbol is marked under the Devices branch with a yellow dot 🟡.

In addition, all devices for which a connection has been established during the current enSuite session are listed under the **Connections** branch. These entries are retained until enSuite is closed, even if the respective connection is disconnected.

	If you make any changes to the network settings on a device to which a connection has already been established via enSuite, when you attempt to make the new connection, you will be asked whether you wish to save these changed settings. **Click on "Yes" in this case.** The individual devices are identified in the enSuite database via their serial number (ID). In addition, an individual name can be added to the serial number.

To add an individual name to this **device ID**, highlight device and select **Properties** in the context menu. Then enter the name in the dialog. Example: Adding an individual device name.
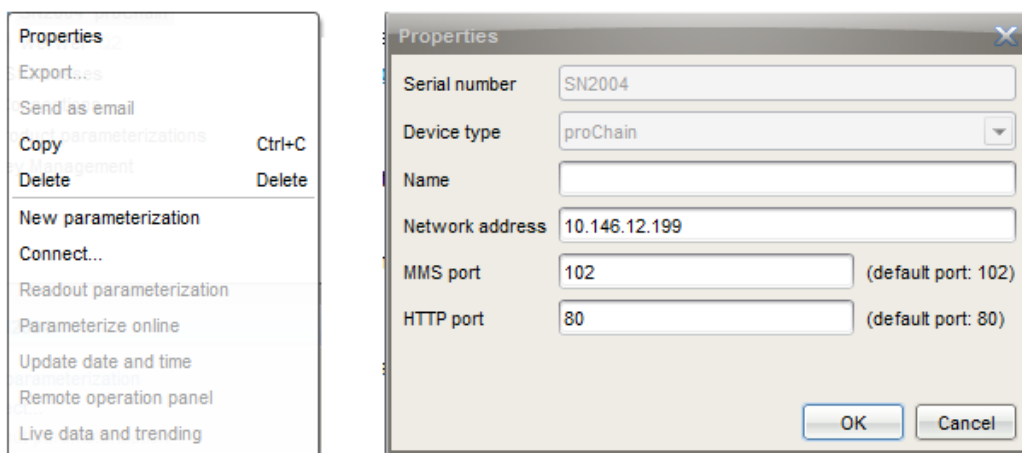
Figure 3.11: Context menu and properties (enSuite window)

💡	As soon as the connection is established, you can and should read out the parameterize of the device, more information in the next sections. All the steps to make device connection are explained in detail in the "**enSuite online help**". Follow these instructions.

3.2.6. Disconnecting the device and Connection errors

The disconnection of one or more devices can be done in different ways, e.g. with the adjacent icons of the button bar.

icon	**Actions – Disconnect from all devices** (or press the [F4] key)	Terminates all active connections.
icon	**Actions - Disconnect**	Terminates the connection to the selected device in the navigation window

The **context menu** or the lower part of the **navigation window**, also offer the disconnection.
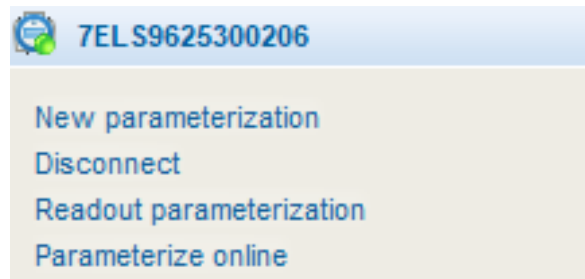
The connection can also be disconnected by suddenly appearing events, for example a power failure in the device or a wire break. In these cases, the disconnection will be displayed in a dialog window.
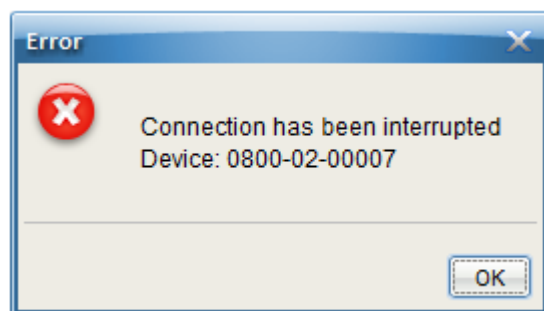
Figure 3.12:
Connection has been interrupted

💡	In addition, an A planned automatic disconnection takes place when a new parameter set is uploaded. See section [3.4 Changing existing device settings (Parameterization)](#) for more details

The disconnection of all devices is always done if enSuite is closed!

3.2.7. Read-out parameterization

There must be an active data connection to the device (⇨ section 3.2.4 General connection options to the enCore device and 3.2.5 Establish a connection to the enCore device) before the parametrization can be read-out from the device.

	Read the parameter set after making any changes. Save every changed parameter set as a backup separately for emergencies and, if necessary, export it to an external PC/external data medium. **enSuite will not automatically back up the parameter set!**

If a connection exists, proceed as follows:

1. Highlight the device in question in the navigation window either under the **Devices** branch or under the **Connections** branch.

2. Select the action **Read out parameterization** in the lower section of the navigation window or open the context menu and select "**Readout parameterization**".

A dialog "**Save as**" will appear.
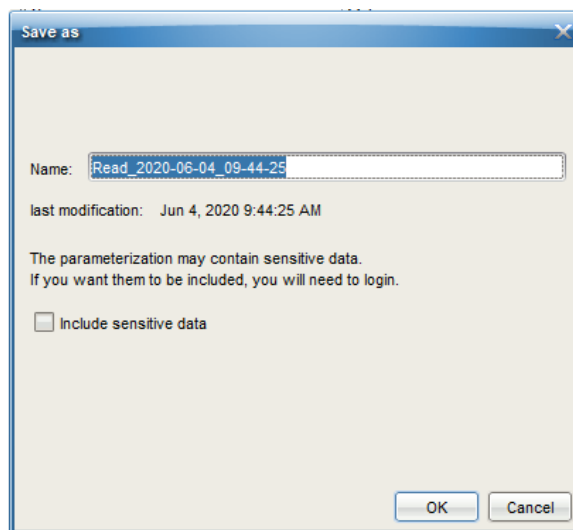
Figure 3.13: Save as dialog

If necessary, you can now change the displayed name by overwriting it. Then press **[OK].**

	Some devices transfer sensitive data, for the proChain it is not nessesary to mark the checkbox. You can confirm with [OK]. If the checkbox is selected a login dialog will appear after pressing [OK] button. See section 3.3 User management and login for more details about login.

3.2.8. Saving, and exporting the parameter set

Enter a name for the file in the "**Save as**" dialog. The read parameterization is then stored under this name under the **Devices – <Serial Number/Name> – Parameterizations branch.**

Change the suggested name, for example to "Default_parameters_YYYY-MM-DD" (always include the date so that you can identify the backup copy).

Check that the parameter set has been saved correctly in the navigation window. A file must now exist with the selected name. See the following example:
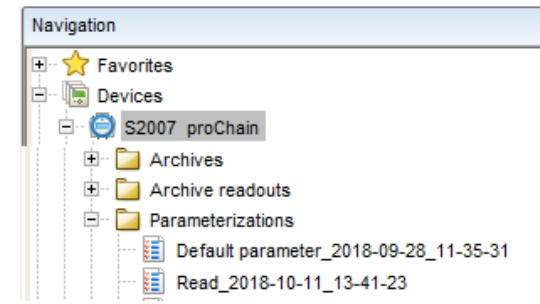
Figure 3.14:
Example of saved parameter set

Certain parameters are set to defined values as default. You have now backed up these values. Do not make any more changes to this file which can be used as a restore and backup file in an emergency.

You can also export selected files using the symbol in the enSuite window or the export function in the context menu to make yourself independent of your current enSuite installation.

Click on the marked symbol as in the example shown here and follow the dialog boxes.

As soon as the file(s) has/have been exported, it/they should be saved with a defined name as backup copies on the PC hard drive or externally.
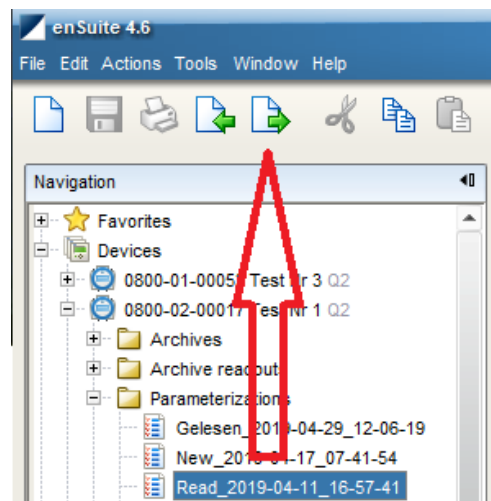
💡	Always read the current parameters from the device after making any changes, changes to parameter sets which have already been saved in enSuite will be saved using the old name, in other words, **the original file will be overwritten**.

🛑 STOP	Do not change any parameter sets filed for documentation of backup purposes as you will lose the original content.

After double-clicking on the file, enSuite will open the parameterization window and show the parameter set. See the online help for more information about this window.

3.2.9. Viewing the parameterization of SFBs and AFBs (AFB configuration)

You can see the current parameter structure tree in the **Parameter** tab in the left-hand part of the parameterization window. The root is for the device itself and the top level consists of software modules that are currently included. The Basic System is always included in the device software here; however AFBs may be added or deleted.

To establish which SFBs, AFBs and settings the device uses or with which ones it was delivered, read the unchanged parameter set as described above and display the tree structure in the parameterization window.

This view shows the components of the "**enSuite modular system**" used in the device in the delivery state on the left-hand side. These folders and sub-folders contain the default parameters unless you have made some changes. The various parameters will be displayed on the right-hand side of the window when you select the corresponding block.
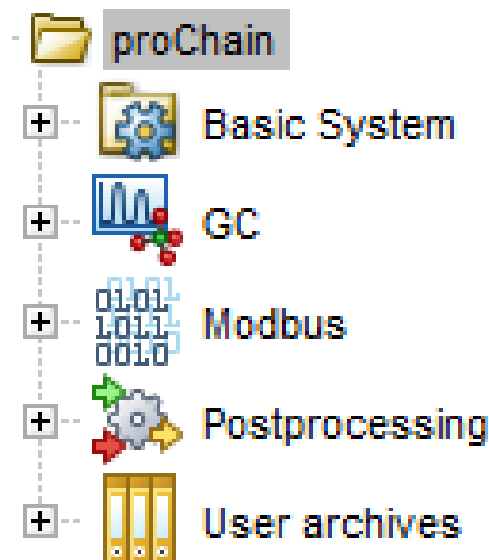
Figure 3.15: Example of a device tree structure
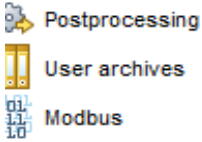
	The rule of thumb is that: The default parameter set is visible in the parameterization window the first time the parameters are read. The meaning of the various software parts and parameters is described in detail in the online help. If some of the elements in the tree (see figure above) are colored orange, there is a conflict with the approval file, see section 3.4.13 Fiscal parameters and optional using approval file (Select approval)

☀	Tip to transfer parameter or Modbus tables into other programs: For parameter tables select the whole table with (Ctrl-A), copy it (Ctrl-C) and then paste into a different program like EXCEL. For the Modbus-Table select the whole table (Ctrl-A) on the overview page to get a list of all register numbers grouped by area, or open the register array of an area, open all registers to see all the details and then copy it (Ctrl-C) and paste into a different program like EXCEL.

The following is a brief description of the SFBs and AFBs:

Basic System	**Basic system (SFBs)** **contains the basic functions such as time service for date and time purpose or NTP synchronization, user management as well as I/O functions for IP address and network settings. Also, refer to the software concept at the start of this section and the online help, which explains the various settings in more details**
⚠	**Do not change the configuration settings. (Only relevant for service personnel.)** **Always make a note of the current / changed network settings on the device. Without this information, you will be unable to establish any connections.**

GC	**The GC AFB contains the pre-set parameters for this specific device such as calculation (standard), correction factors, automatic calibration, verification and limit values. The flush times and composition of the calibration and test gases are also stored and set there. These parameters are explained in the online help and in the remainder of this document.**

Postprocessing User archives Modbus	**The Modbus, Postprocessing and User archives AFBs are used for calculations, archiving, create messages and data communication. Their configuration has not been finalized on delivery. They must be adjusted retrospectively and can essentially be freely selected. The online help contains all the information required for this software which is also used in other enCore devices.**

The Modbus AFB enables communication, for example, if TCP/IP has not been configured for data transmission or data exchange. It has its own operating instructions which can be downloaded from the Docuthek (www.docuthek.com). The online help contains all other necessary information.

Displays	**Displays** **This folder contains the remote displays. Displays protected as default can be identified by "padlocks". You can adjust the other displays and create new ones. Further details are described later in this document.**

> If you want to start or stop the device, or do some other work with it,
> click on the last entry in the lower part of the navigation window and then switch to
> the "**Status and Control**" page.
> Under the displayed table you will find, among other things,
> **the Start and Stop buttons**.
> For further information on chromatograms and this page, see section
> 3.8 Operate the device with enSuite and the following.

If the tree root (i.e. the device name) is highlighted on the left-hand side, then you will see all available AFBs for the device in the **Configuration** tab. Of each AFB, both the version and the number of instances already used by the device are stated for this purpose.

The AFB composition can be freely configured. Restrictions base on the resources already in use. Most AFBs can be used several times.

Here's how to edit the AFB composition:

- In order to add an AFB, highlight it in the right-hand part of the window in the **Configuration** tab and click on **Add AFB**.

> If a newly added AFB is labeled in bold orange in the parameter window,
> you then need to click on the **Make compliant** button
> again in the Configuration window ⇨
> 3.4.13 Fiscal parameters and optional using approval file (Select approval)
>
> Any blue labeling means
> therefore that the changes have not yet been saved.

- In order to delete an AFB, highlight it in the left-hand part of the window and select **Delete AFB**.

Attention: It is possible that the parameterization is no longer valid when an AFB has been deleted. In such cases all parameter branches and parameters which contain references to the deleted AFB that are no longer valid are labeled in **red**.

3.3. User management and login

Like all enCore devices, the proChain GC has a user management system. In principle, a parameter can only be changed and used in the device if the user is entitled to do this and the position of the security switch (SSW) allows it.

⚠️	**In the delivery state, the preset standard login works for all users without password. The administrator should therefore first determine the authorizations and passwords. See also section 3.3.2 Assigning or changing a password using online parameterization**

EnCore devices differentiate between rights at parameter level and at system level. Rights at parameter level can be assigned in a differentiated way for individual parameters or parameter areas of an application. Rights at system level determine which system settings of the device may be changed. This includes, for example, changing the device time.

💡	Details of the user management system are available in the Docuthek (www.docuthek.com) under "**enCore ZM1, BM1, MC1, FC1 – basic system with SFBs**" and in the online help.

Various situations are explained in the following use cases.

For working on protected settings, a login prompt will automatically appear when you start the action.

To log in, you will require a **user name** and **password** which the system operator, acting as the administrator, or the super user of the profile will have prepared for you.

Please request these data.
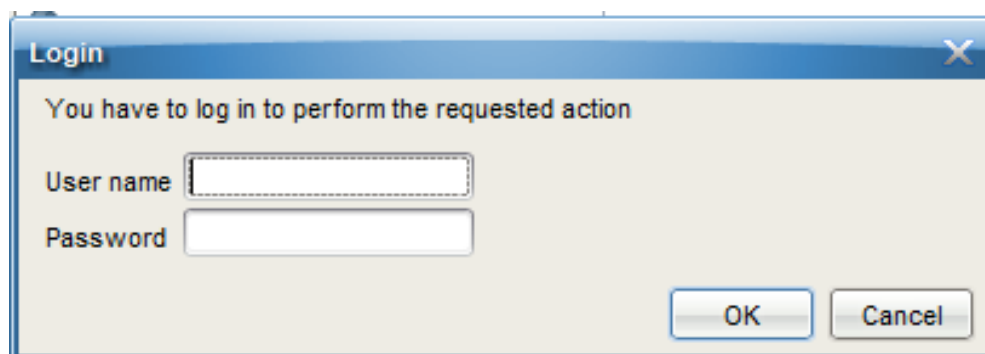
Figure 3.16: Login dialog window

3.3.1. User profile management (log in/out)

	The **administrator** and **super user** of a profile have the right to manage the other users in that profile, in other words, they can add new users, delete existing ones or change user names. The relevant parameter set must be opened offline for this purpose. See section 3.4 Changing existing device settings (Parameterization).

Example: To change the name of a user, mark the required name in the list (**Basic system >> Users >> User profile**, **User list** tab) and then click on the Edit symbol ⬚. The "Edit user" dialog will appear.
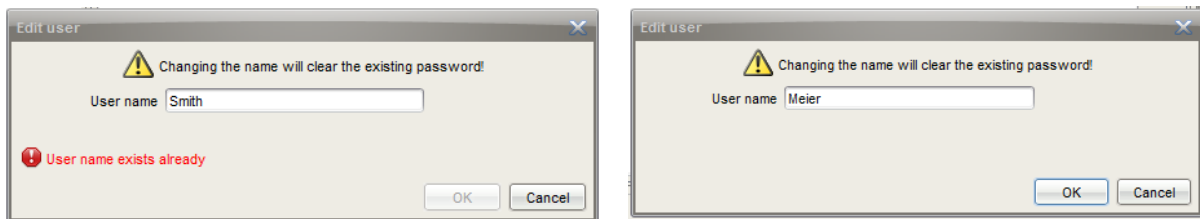
Figure 3.17: Edit user dialog (example)

Enter an admissible change in the dialog, obeying the instructions in it. If your entry is valid, the **[OK] button** will be enabled and you can conclude your change by clicking on it.

	The old password will be deleted as stated in the warning. **The changed user will be saved in the parameter set with a blank password.**

Save your changes in the parameter set and **transfer the changed parameter set to the device**. The user can then log in and carry out actions with these rights. You should then assign a (starting) password either using online parameterization (see the following information) or the remote operation panel described later in this information.

	If you are logged in as an administrator, you have all rights for the device. **All factory default settings can be changed, even accidentally.** **Please proceed with appropriate caution to your work**!

3.3.2. Assigning or changing a password using online parameterization

Connect to the device and select "**Parameterize online**" (see next section for further information). A login prompt will appear in which you must **log in as the administrator or super user** (for example, SU3). Click on "**OK**".

<center>**You can only log in if no other login is active on the device.**</center>

The parameter set will be read after the login. Open the user management in the basic system and select the appropriate user.

Double-clicking on the user will open the following dialog box (see figure).
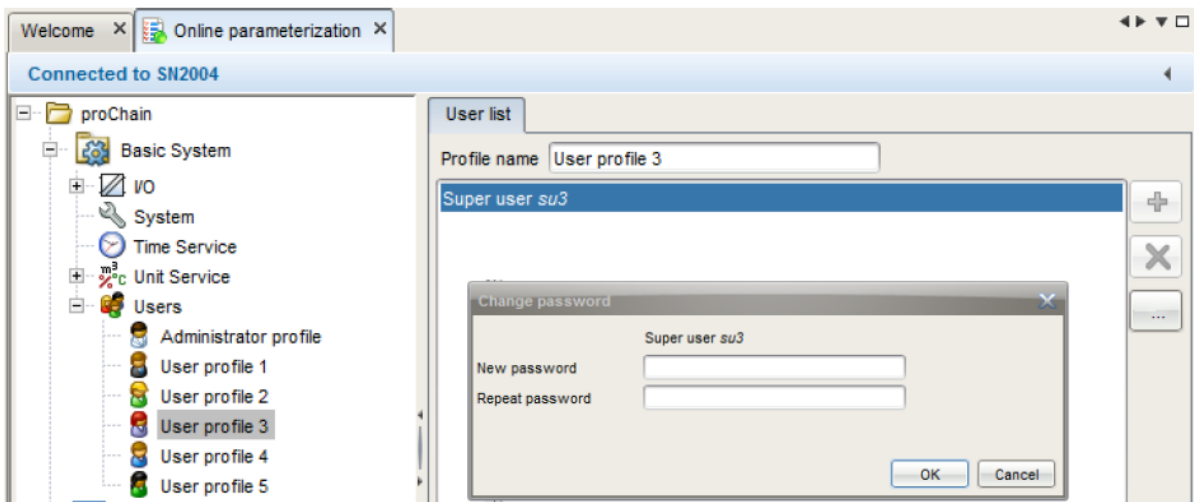
Figure 3.18: Change password dialog (online parameterization)

Enter a legal password in both boxes in the dialog, obeying the instructions in the dialog. If your entry is valid, the **[OK] button** can be selected, and you can conclude your change by clicking on it. The new password is now active. After you have selected **OK**, you can break the connection.

🔆	Assigning or changing own password could also be done with the help of the remote operation panel. See section 3.6.11 System display (device) Users (Login/Logout/change password).

When carrying out any online work on the device, please note that an automatic logout will take place after a defined period of inactivity. (Further information about this inactivity timeout can be found in section 3.2.3 Starting enSuite; the first steps.)

You will also be logged out when the connection to the device is disconnected e.g. by reboot.

3.3.3. Viewing setting and change access rights

Requirement: The parameter set is displayed in the parameterization window in enSuite. "**Edit user rights**" has been selected in the "**Configuration**" tab. On the right-hand side of the parameterization window, you can see the appropriate parameters in the "**Parameters**" tab. see following example.

The symbol bar is divided into two and consists of the following:

Buttons 1 to 5: rights for user profiles 1 to 5 . Each button has a unique symbol assigned to it. The sequence corresponds to the position of the profiles in the user management. As soon as a symbol has been enabled, the associated profile has the corresponding right.

There is no symbol for the administrator profile, as it must always have access rights.

Buttons 6 and 7: fiscal security settings . Button 6 is the symbol for protection by the security switch (SSW) and button 7 is the symbol for the fiscal audit trail. Button 7 is only displayed at parameter level. As soon as a symbol has been enabled, this security setting will be valid.

	Rights are managed using symbols, and where rights or security settings have been allocated, a symbol will be displayed. Only the administrator has access rights if no symbol is displayed in the buttons 1 to 5.

The administrator can change the setting by clicking the icons or empty fields and then commit his changes to the device. This authorization is missing for all other users. The parameter cannot be selected or permanently changed by these users, for them the lines only serve as information display.

The administrator can define further user rights on the following page

3.3.4. Viewing position of the security switch

Some settings must be protected as mentioned above for fiscal measurements. This is done using a physical switch inside the device, known as the security switch (SSW), compare section 2.9.2 Opening and closing the hardware parameter guard (SSW). Independent of the use in fiscal measurements, the administrator has the possibility to place further device settings under this protection.

You can view the setting using **online parameterization**. (Information in this document and in the online help of enSuite). After opening the online parameterization, select the elements as shown in the figure.
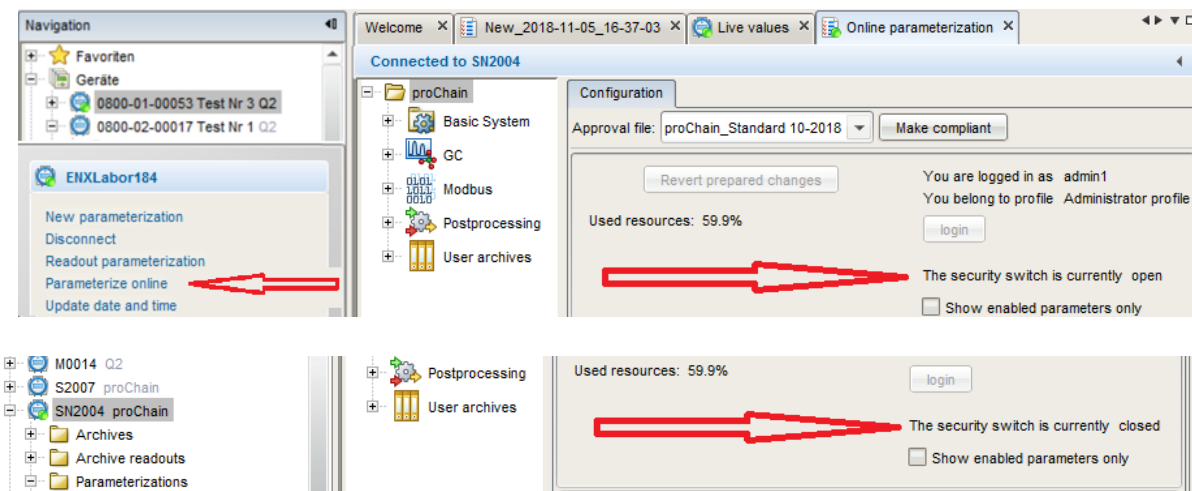
Figure 3.19: View the SSW position (open and closed)

💡	**On delivery and in "non-fiscal operation"**, this connection is open. When the switch is closed, the text "**The security switch is currently closed**" is displayed.

3.3.5. Access rights dependent restricted editing options (virtual login)

In addition to the official access rights, a user authorization is also required to change parameters. The user must log in as a member of a user group by entering a password.

An administrator can in principle make any changes, however the conditions of the applicable approval must be considered, e.g. it may be necessary to open the security switch. (⇨ section 2.9.2 Opening and closing the hardware parameter guard (SSW)).

	The parameters that a user can change depend on the user group that he/she belongs to and, potentially, whether it is allowed to open the security switch or not. For offline parameterization, enSuite offers the option to restrict the editing possibilities so that only changes can be made that an individual user is permitted to make. This is referred to as a **virtual login**.

Example: A parameter set may be transferred to the device and refused at the end of the transfer. The device checks the requirements and rights before saving the parameter set. It is therefore also possible to change parameters in advance without the appropriate rights.

To prevent this, you can filter the parameter lists using the "**Use virtual login**" function.

Requirement: You have selected **offline parameterization** (see section 3.4.3 Changing the device parameter set in the connected device (online parameterization)), the parameter set is open, and the topmost folder is marked. You will then see the possible selections shown below in the "**Configuration**" tab in the right-hand section of the window.
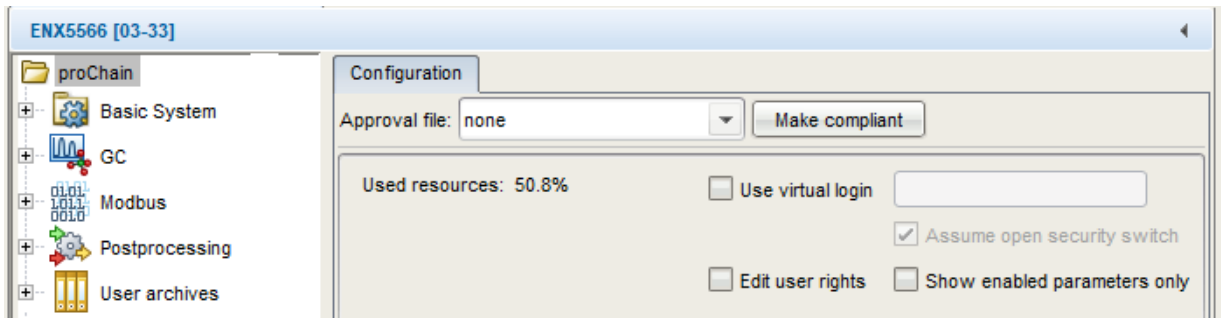
Figure 3.20: Use virtual login

- If you deactivate the option **Assume open security switch**, then all parameters under security switch protection can no longer be edited either.

Non-editable parameters are listed in gray in the parameter lists and are labeled with the symbol ⊘. By using the option **Show enabled parameters only**, you can achieve that any such parameters are not displayed at all.

	Activate the online help in enSuite to find out more about the required settings. The figures below in this document generally assume that this function is used with the name "**SU3**".

Example: If you use the virtual login as described above as user **SU3** and check the box "**Show enabled parameters only**" and then select "**Time Service**", you will only see a gray box under Parameters.
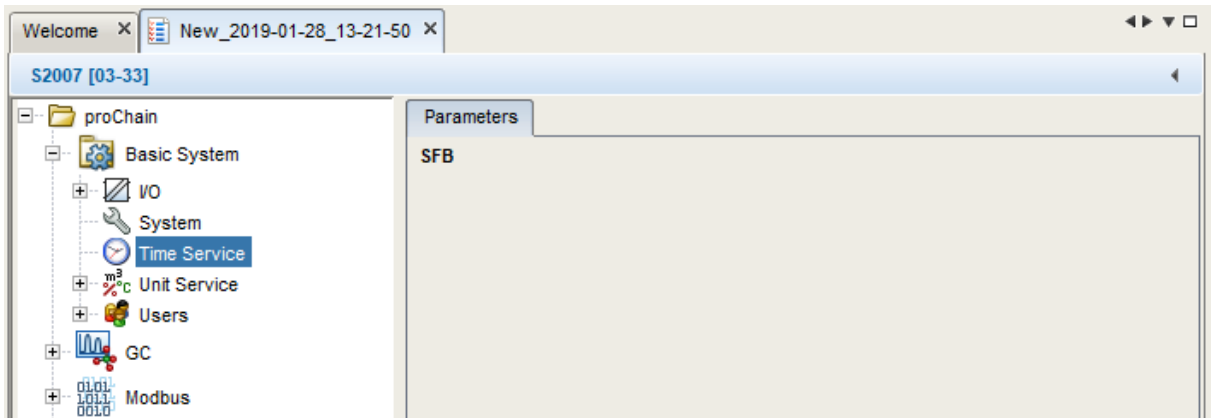
To display all the parameters again regardless of their access rights, disable the checkbox "**Use virtual login**". You will now see the existing setting options under Parameters.
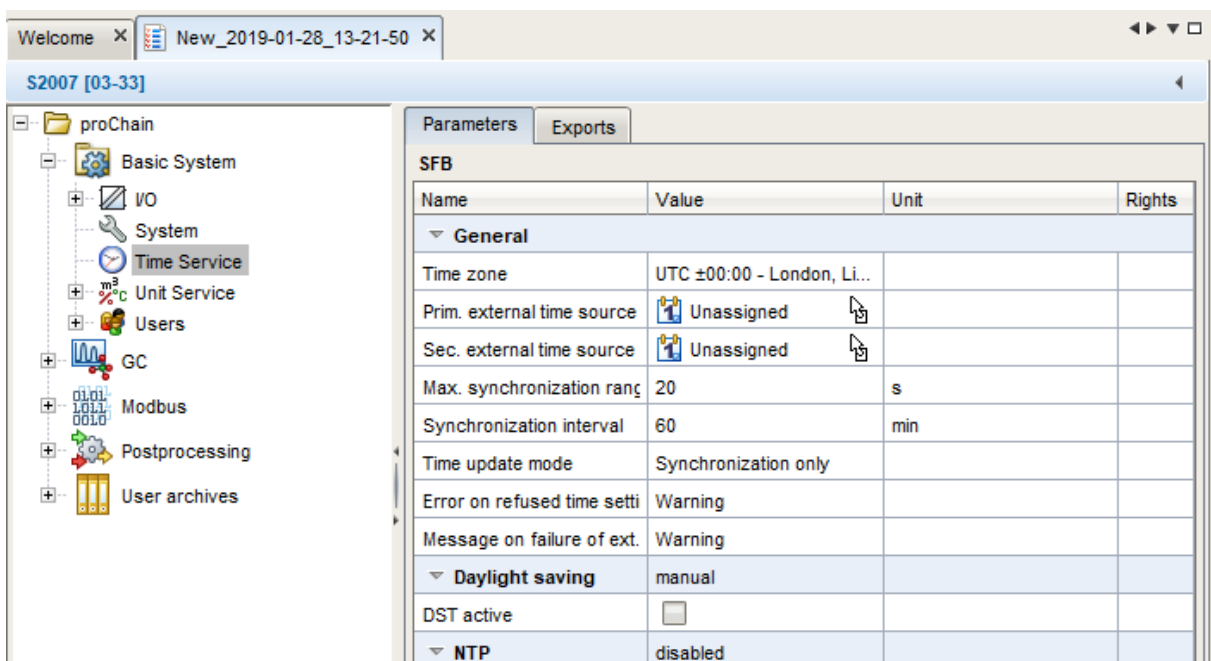
If you were to make changes as user SU3, the device would reject the parameter set after the transfer.

3.4. Changing existing device settings (Parameterization)

There are various types of parameter sets in the enSuite database (**see online help for more information**). This information for general use only refers mainly to editing the default parameter set.

🔆	On delivery, the device will always have a default parameter set (called device parameter set or device parmererization). This only must be adjusted if necessary.

The following table outlines the differences between offline and online parameterization the most two kinds of changing parameterization you can use:

Offline parameterization	Online parameterization
Editing the device parameterization without being connected to the device. The parameterization is transferred to the device in a second step.	Changing of parameter contents during an existing data connection to the device.
The options available for editing the parameterization are in principle available. Whether a parameterization can be accepted or not after installation is decided by the device whilst taking into account the access rights of the logged in user and the condition of the security switch.	It is necessary to log in to the device in order to start editing. Only changes that the logged in user is allowed to make are possible. In addition, the condition of the security switch is also taken into account.
The edited device parameterization must be saved in the enSuite database prior to being transferred.	The saving of the edited parameterization as a device parameterization in enSuite is optional.
Changes of the AFB configuration possible.	No changes of the AFB configuration possible.
In addition to changing parameter *content*, changes of the parameter *structure* are also possible (e.g. by activating functionalities or adding process boards).	Only the content of parameters which already exist may be changed.
Restarting the device after installing the parameterization.	No restarting the device.

If you change the factory settings, please note that you must always be logged in when making or transferring the changes and you are bound by the user management restrictions.

Only parameter changes which the logged in user is permitted to make are possible. Parameters which cannot be edited are displayed in the parameter lists in grey and marked with the ⊘ symbol, or in some cases will not be displayed depending on who is logged in.

	Displays (see bottom left section of the parameterization window) The structure of the displays on delivery is described in this documentation. If you have the required rights, you can use the display editor to modify the device displays. See the enCore manuals for further information.

Furthermore, a distinction is made between **offline** and **online parameterization**. These terms and the differences are explained in the **online help** and further details are also given below.

	Any change runs the potential risk of the device being set incorrectly.

The **user and rights management** of enCore devices makes it possible to define in detail which changes users may make. This is the responsibility of the administrator, who in turn has unrestricted access to the device.

To reduce the risk of incorrect changes which may render the device useless, the administrator should block actions which are not required by other users during normal operation. For example, these include editing the **approval file, Configuration AFB and both non-fiscal and fiscal software**.

These actions are listed in the basic system under "**User SFB**" in the "**Special user rights**" tab. The rights can be set there.

3.4.1. Changing device parameters offline (Offline parameterization)

Requirement offline parameterization: the parameter file you wish to open has been read and saved as described in sections 3.2.7 Read-out parameterization and 3.2.8 Saving, and exporting the parameter set is opened in the navigation window by double-clicking.

The parameterization window is displayed. See the online help for more information about this window.

💡	Several parameterization windows may also be opened in different tabs. You can distinguish them by way of the tab label – the parameterization name is stated here (saved name or identification of the device for new parameterizations and parameterizations which have not yet been saved).

⚠️	**Do not use any parameter sets stored in the archive or as a backup to make changes since the original content will be lost. Instead, always read a new parameter set as described in 3.2.7 Read-out parameterization and 3.2.8 Saving, and exporting the parameter set**

This type "**edit existing device parameterization**" takes place in the following steps*:

Step	Content/Action
1.*	Edit the device parameterization, save the device parameterization 💾. Attention: The device parameterization is saved under the old name, i.e. the original file is overwritten.
2.	Transfer the changed parameter set to the device with the matching serial number.

* If you are using a new parameter set or a product parameter set from other devices for step 1, please consider that this is only a template and that all the relevant parameters must be adjusted on the device before the parameter set is transferred to the device in step 2. If you fail to do this, the device may react in an undesirable manner.

💡	All the parameters for editing are subject to the user management restrictions and can only be changed or transferred to the device with the appropriate rights and with the SSW in the appropriate position.

The parameter set also called parameterization is changed or edited in the parameterization window of enSuite (see the figures below). The online help describes this window and the parameters in detail.

The software blocks will be displayed on the left-hand side of the window. After selecting and opening a block, the appropriate parameters will be displayed on the right-hand side.

Depending on the situation, the parameter values can be changed freely or a drop-down list will appear with the appropriate possible settings.

Some functions can also be switched on and off using checkboxes. See the following examples:
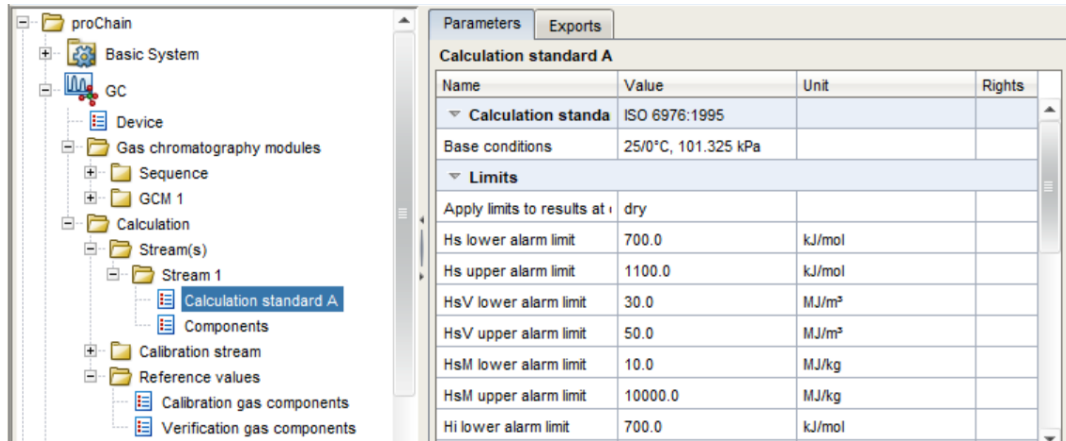
Figure 3.21: Example of left- and right-hand sections of the parameterization window

The Parameter tab in the left-hand part of the parameterization window contains the parameter tree. The top level shows the device name; in the subordinate level you can see the Basic System and the AFBs. The tree levels can be opened by clicking on the prefix +. If the selected level contains parameters, then you can view and edit these parameters on the right-hand side of the window.

In the **parameters tab**, the parameters of the individual parameter branches are listed in table format and offered for editing. For more complex functionalities, there is sometimes a more convenient editing dialog in a separate tab.

Figure 3.22: Example of reactions in the param. window after using a drop-down box

	New functions or changed methods require additional parameters, which are then provided in a new sub-path for editing. Such structural changes in the parameter set are only possible in offline editing.

There are different types of parameters. Some of them can be switched. Some are displayed in separate windows, for example under Export values.These are required partly because the function groups of the device share their values via the parameter set. It must be ensured in every edited parameter set that the cross-references are correct.

Figure 3.23: Example of switchable parameters

Figure 3.24: Example of export values in the Export values window

	Whether the parameter type can be switched, depends on the actual parameter. More details of the parameter types, units and windows are given in the online help.

During editing, the program makes use of color-based signs in order to identify the status. If the parameter label is **blue**, this means that the parameter was edited but the change has not yet been saved. Any superordinate branches are also blue at the same time. A **red** parameter label indicates that changes have been made and the **parameterization is not yet valid**. The parameterization can be saved, but it cannot be transferred to a device.
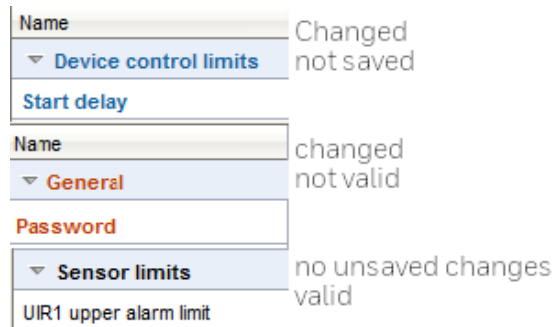
Figure 3.25:
Example of parameters during editing

	If you delete or make a major change to a value in a parameter set and the value is used in a different context, all the links to this value will be invalidated and will be automatically deleted. You will receive a message about this process so that it is obvious which links must be recreated.

3.4.2. Create a new device parameter set (Offline parameterization)

:.

Step	Create new / default device parameterization
1.	Highlight the device
2.	Select the action **New parameterization**.
3.	Select a "**Copy from product parameterization**" or a default "**From scratch**" as a template for this purpose. enSuite opens the parameterization window in order to edit the device parameterization
4.	Edit the device parameterization according the following hints in this text or use the online help to get additional information.
5.	Save the device parameterization using a suitable name.

	You can sometimes select operating modes or add or delete functions in the **All Parameter** tab as well. Example: Converting the operating mode of a board channel, e.g. for changing from "not used" to "message input". New functions or changed operating modes require additional parameters which are then made available for editing in a new subordinate branch. Any such structural changes to a parameterization are only possible using offline parameterization.

The tabular listing of parameters in the parameter window has several columns. The name of the parameter (**Parameter name** column) depends on the selected language. You can see the current value of the parameter in the **Value** column; here, changes can be made.

You can distinguish between different types of parameters:

1. **Selection of one of several options**
   Example: Selection of one of several calculation methods

2. **Name**: Entry of character string for identification purposes
   Example: Name of a temperature sensor, e.g. serial number

3. **Constant**: Entry of numerical constant
   Example: "Housing heater target temperature" as a limit value for the monitoring of temperature

4. **Import value**: Assignment of an export value (result of another functionality)
   Example: **Elapsed running time** to monitor processes at based on GC AFB

The function blocks of the enCore software provide results which can be further processed by other function blocks. These results are called **Export values**.

	Value window – Export values
	There is a window with a tab for export values in the parameterization interface of enSuite. All export values are sorted here according to function blocks and made available in a tree. The structure here is identical to the parameter tree structure in the parameterization window. The window is normally located on the right-hand corner of the screen. It can be hidden so that a greater working area is available. The window is then displayed once again after clicking on the Values button on the right-hand corner of the enSuite window. If you simply move over the button using the cursor, the value window is temporarily displayed.

The **export value name** is derived from the tree structure. The **export values** in the value window are identified by a symbol. This symbol shows at a glance to which physical quantity the value belongs. Examples:

Symbol	Physical quantity
	temperature
	pressure (absolute or gauge)
	volume (volume at base conditions, volume at measurement conditions)
	energy
	heating value

> If a parameter is an import value, i.e. the assignment of an export value is expected, then, within the corresponding **Value** field, the symbol for the physical quantity is shown on the left-hand side and the drag-and-drop sign on the right-hand side.

> The assignment of an export value to an import parameter only works
> if the physical quantity is matching.
> You can assign a value by dragging onto the parameter from the value window using drag-and-drop. A stop sign Ø appears if any such assignment is not possible (e.g. because the physical quantity is not matching).
> Alternatively, you can also open the selection list directly at the parameter value and select the desired value. However, this list contains all export values that match the physical quantity. As a result, the drag-and-drop method is clearer for more complex parameterizations.

There are parameters for which either the use of a constant or an import value is possible. For certain parameters, it is also possible to select the option **Not used**, e.g. for unavailable input values or in order to disable a monitoring routine (by choosing **Not used** for a limit value).

> The possibility of **switching the parameter type**
> (import value or constant or not used) depends on the respective parameter.
> If several options are possible, you can open a context menu by right clicking on the parameter name. You can select the desired option here.

Alongside the **Name** and **Value** of a parameter, the associated physical unit is displayed in the **Unit** column for values that correspond to a particular physical quantity. Under normal circumstances, the default unit is used for the physical quantity in question. This is highlighted in the display with an asterisk *.

> **Change units** If you click on the unit of a parameter in the Unit column,
> a list then opens in which you can select another unit if required.
> The default units for specific physical quantities can also be edited.
> This is carried out centrally under **Basic System – Unit service – Default units**.
> You can find out more information on the Unit service SFB in the Online Help and in section 3.4.7Changing units and adjusting display formats in the Unit Service SFB

Further practical tips for editing parameterization:

- **Parameterization of input channels**
  Parameterize the measurement devices that are connected to the digital channels. The operating mode typically needs to be selected initially for the respective channel under Basic System – I/O – <Board name> – <Channel name>). The associated parameters can then be edited.

- **Define protocol channels**
  The CPU and or certain process boards provide digital protocol channels. These are intended for the connection of measurement devices via digital protocol or for communication via Modbus (in conjunction with the Modbus AFB). Only the basic communication parameters are specified when defining a protocol channel. You can then edit the associated parameters.

- **define Pre-processing operations**
  in the Postprocessing AFB. Create messages or implement a strategy e.g.in the event of errors and/or for fixed substitute values.

- **Assign the desired export value**
  to each required input value of the AFB or SFB. This export value is typically provided by another SFB or AFB. You must take care to ensure that the source of the value is correct.

- **Check or edit all options and constants.** For certain constants, such usage can also be switched off via the context menu by choosing **Not used**.

	You can activate the associated Context-specific online help in order to find out information regarding the importance/meaning of individual functionalities and parameters. Simply highlight the parameter or parameter tree and press F1.

When all the required changes have been made, save the parameterization 💾.

Only saved device parameterizations can be transferred, and only to the device with the matching serial number

After it has been saved, the symbol 💾 will turn gray and the lines will be displayed in black.

The saved valid device parameter set can now be transferred to the device with the appropriate serial number.

Step	Action: Transfer parameterization to the device
1.	Establish the data connection to the appropriate device (⇨ see section 3.2.5 Establish a connection to the enCore device).
2.	Highlight the desired device parameterization in the data structure of the navigation window
3.	Select the **Transfer parameterization to device** action (for example in the context menu).
4.	Log in using the login dialog with your **user name** and **password** which appears.

The parameter set will be transferred.
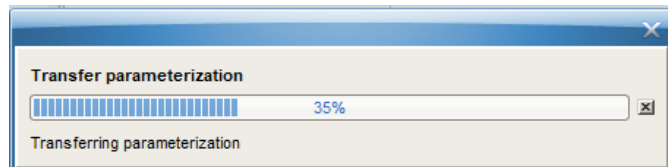
There are typically a number of parameters which are protected by the security switch (SSW) (e.g. in order to meet the requirements of an approval).

If the new device parameterization is likely to bring about changes to such parameters, but the security switch is closed, then the message **Device could not be parameterized** appears following the transfer.

The device does not restart however; the old parameterization is still used.

If the parameters are not protected by the SSW or if this is open, the changes will be transferred, and the device will restart.
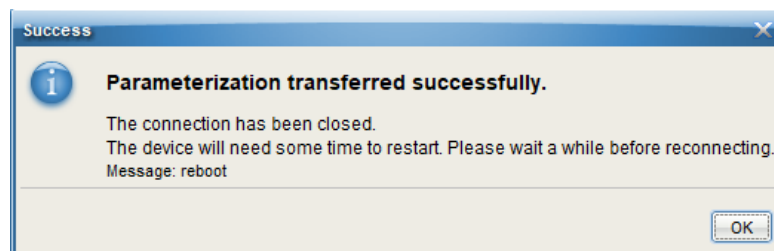
The restart will disconnect the device and the user will be logged out automatically.

The device will now operate using the transferred settings after you have re-enabled the required operating mode. These new settings will remain in use even after the device is switched off and on again.

3.4.3. Changing the device parameter set in the connected device (online parameterization)

Online parameterization means that the content of certain parameters is changed directly during an existing data connection to the device. **(data connection⇨ see section** [3.2.4 General connection options to the enCore device](#) **)** This method, also described in the online help, is suitable for minor changes.**.**

Step	Action: Changing device parameters in the connected device online
1.	Establish the data connection to the device and Highlight the device in question in the navigation window either under the **Devices** branch or under the **Connections** branch.
2.	Select the entry **Online parameterization** in the lower section of the navigation window.
3.	Log in with your **user name** and password using the login dialog that appears.
4.	The parameterization is read; the parameterization window then opens up for editing purposes. (The elements of the parameter tree will be displayed in black.)
5.	Make the change. Editing methods are in principle the same as for the offline editing (see hints under 3.4.2) but no changes may be made to the AFB composition or the parameter structure. Only parameter changes that the logged in user is permitted to carry out may be made. The following applies additionally in the event the security switch is closed: Parameters labeled as 🔒 cannot be changed, parameters labeled as 📷 may only be changed provided the fiscal audit trail is not full. Non-editable parameters are listed in gray in the parameter lists and are labeled with the symbol 🚫. After entering the edited value, the edited parts of the parameter tree will be highlighted in green. This indicates that the parameter was edited but the change has not yet been transferred to the device. Any superordinate branches are also green at the same time.
6.	Activate the **Transfer parameterization to device** button 🖥. Once the transfer is completed, the parameter label is then blue. This indicates that the transfer was completed but the edited parameterization has not yet been saved in enSuite.
7.	You can and should save the changed parameter set in enSuite. Use the diskette symbol 💾 to save the current status. (Once they have been saved, the values will again be displayed in black.)

Then click on the topmost folder in the parameter tree, select the tab as shown and check your login status. **Log out** by closing the online parameterization window.

If you have been logged out by other users, you can complete additional tasks in the online parameterization by using "**Login**".
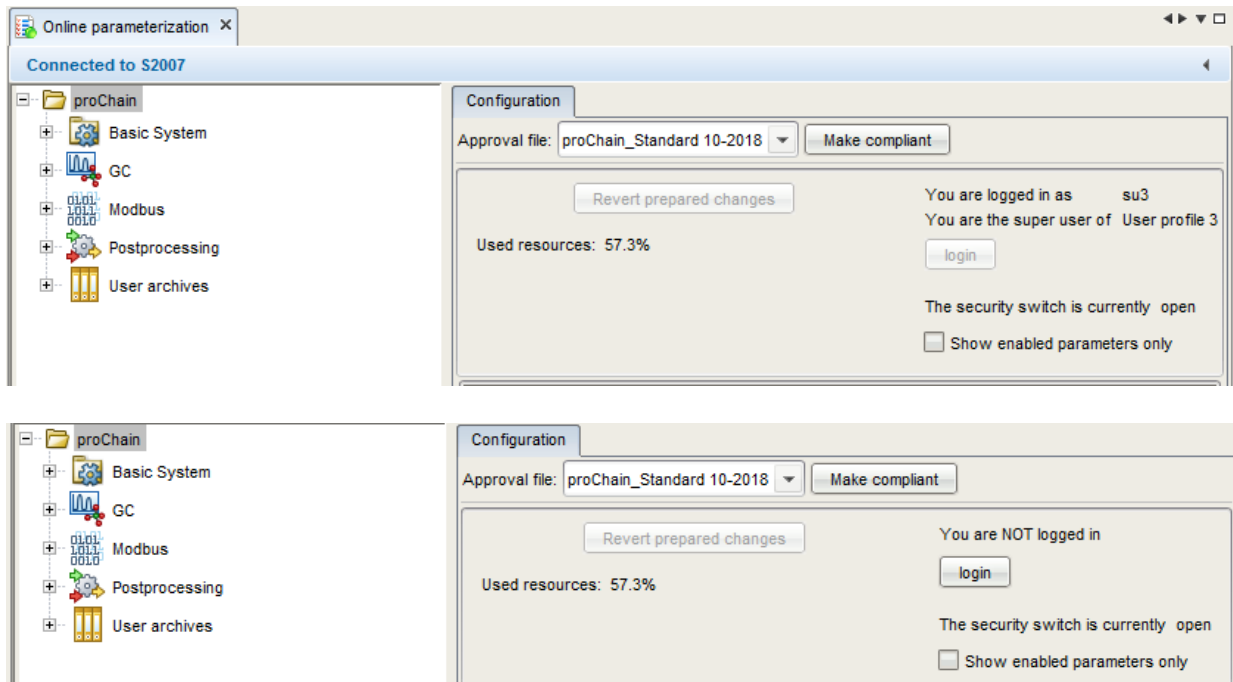
Figure 3.26: Online parameterization login and logout

3.4.4. Product and device parameterizations

Two different types of stored parameterizations are provided in the enSuite database:

A **Product parameterization** belongs to an enCore product class (e.g. enCore FC1, GasLab Q2, proChain GC) and may be used as a template when creating a parameterization for a specific device. By using **File – New** 🗋, you can then create a new product parameterization.

A **Device parameterization** belongs to a specific device with a fixed serial number. A device parameterization can only be transferred to the device with the matching serial number.
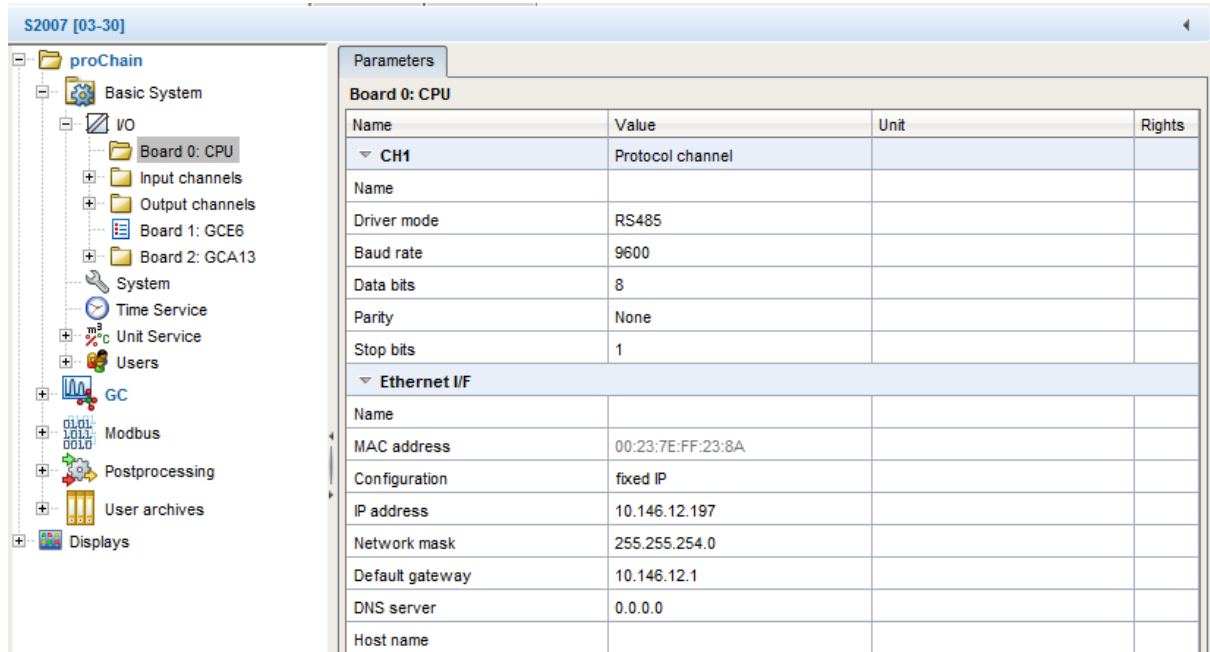
A device parameterization may be obtained, for example, when reading an existing parameterization from a device (⇨ section 3.2.7 Read-out parameterization). Alternatively, you can create a completely new device parameterization (either based on a product parameterization or without a template) for a specific device in the enSuite database after selecting the action **New parameterization**.

You can save a device parameterization as a product parameterization so that it is available as a template for parameterizations for other devices.

3.4.5. Changing the IP address basic network and I/O settings

As mentioned, the connection is usually established via the IP address of the device. The IP address is part of the existing parameter set. This information used to establish the first connection is given on the device and in attached documents.

After this first connection, has been established, enSuite creates the device and the connection data in the parameter tree (shown in navigation window). After "**readout parameterization"** you can change the settings (offline) on the following page:

Name	Value	Unit	Rights
▽ CH1	Protocol channel		
Name			
Driver mode	RS485		
Baud rate	9600		
Data bits	8		
Parity	None		
Stop bits	1		
▽ Ethernet I/F			
Name			
MAC address	00:23:7E:FF:23:8A		
Configuration	fixed IP		
IP address	10.146.12.197		
Network mask	255.255.254.0		
Default gateway	10.146.12.1		
DNS server	0.0.0.0		
Host name			

Figure 3.27: I/O Settings in enSuite

> **Do not change the network settings without consulting the IT administration.**
>
> **Note all changes and show them on the device or its documents!**

Change or activate the following I/O interfaces for communication and data exchange with other devices.

Ethernet settings

For data communication, connections via Ethernet are mainly used. Go to parameter branch: **proChain GC – Basic system – I/O – Board 0: CPU.** Fill in your changes, proceed like explained in the online help.

Serial interface RS485

These connections include, for example, other measuring instruments, devices for final processing and evaluation, PLC systems, etc. Go to parameter branch **proChain GC – Basic system – I/O – Board 0: CPU.** On the "Parameters" tab: Set the type of CH1 or CH2 from "Unused" to "Protocol channel". Refer to the information in the online help which contains the details required to define the other parameters.

Digital inputs

There are two electrically isolated inputs supplied by the device. Go to parameter branch **proChain GC – Basic system – I/O – Input channels** and set the type from "Unused" to "Message input" or "LF pulse input". Refer to the information in the online help which contains the details required to define the other parameters.

Digital outputs

There are two outputs (electrically isolated passive output circuits). Go to parameter branch **proChain GC – Basic system – I/O – Output channels** set the type from "Unused" to "Message output" or "Pulse output" in the tab. Refer to the information in the online help which contains the details required to define the other parameters.

3.4.6. Setting time-related values and actions in the Time service SFB

Apart from date and time, which are independent of the parameterization, you set all other time-related values and time-controlled actions in the **Time service SFB** of the device parameterization. The online help provides information on the parameters required for adjustment.

	The system time can be compared via the device's network using the Network Time Protocol (abbreviation: NTP) to (high) precision time servers. Activate this parameter and proceed as described in the online help to use this function.

In the Export values window, the SFB provides time-related events of type ⚡ signal in **Basic system – Time service – Timer events**. The proChain GC generates these events based on the system time and the (parameterized) start of the day.

They can be used as input signals for time-controlled actions in other SFBs or AFBs. More information about the options and settings for time-controlled actions or timer events is provided in the **online help**.

Further settings:

Daylight saving: The time can be switched from standard time (≙ "winter time") to daylight saving time and vice versa in accordance with the regional rules of the European Union, the USA or Mexico (central zone), or on a user-defined basis in accordance with the POSIX standard for time zone information. Alternatively, you can change the time manually on the enCore device or via an external time source (**Prim. external time source**/**Sec. external time source**).

Parameterizing daylight saving in enSuite

▶ Open the branch 🕐 **Time Service**. On the **Parameter** tab, use the drop-down menu **Daylight saving** to determine the rules the switch should follow. Select the relevant entry:

- **manual** The time can be changed manually in the operation panel of the enCore device, via the online parameterization, via an event message or via the daylight saving time information from an external time source.
- **by region** The time is changed automatically based on the predefined rules for the region.
- **user defined** The time is changed automatically based on a user-defined **Posix TZ string**.

Depending on the settings selected, the associated parameters will be displayed.

Time-controlled actions: The enCore device provides following time-related events of a 🖈 signal type in the export branch 🖼 **Basic System –** or standard time 🕐 **Time Service –** 🗀 **Timer events**:

- 🖈 **Every second** / 🖈 **Every <2, 3, 5, 10, 15, 20, 30> seconds**
- 🖈 **Every minute** / 🖈 **Every <2, 3, 5, 10, 15, 20, 30> minutes**
- 🖈 **Every hour** / 🖈 **Every <2, 3, 4, 6, 12> hours**
- 🖈 **Every day (at midnight)**
- 🖈 **Every Sunday (at midnight)**
- 🖈 **Every Monday (at midnight)**
- 🖈 **Every month (midnight on 1st)**

🗲	Special case: Trigger for a longer cycle duration is activated first Event signals in a second rhythm are formed relative to a full minute and event signals in a minute rhythm are formed relative to a full hour. **For example:** 🖈 **Every other minute** e.g., 12:02:00 … 12:04:00 … 12:06:00 …, etc. 🖈 **Every 3 minutes** e.g., 12:03:00 … 12:06:00 … 12:09:00 …, etc. This means that immediately after the device is restarted and until a cyclic event signal is first triggered the time depends on the boot time and may be shorter than the associated cycle. This special case can only occur once immediately after the device is restarted. **Example:** If the enCore device is switched on at 12:02:30 and the signals 🖈 **Every other minute** and 🖈 **Every 3 minutes** are used as triggers, at system time 12:03.00, the signal 🖈 **Every 3 minutes** is formed and only subsequently at 12:04.00 is the signal 🖈 **Every other minute** formed.

Export values based on the system time in the export branch 🖼 **Basic System –** 🕐 **Time Service –** 🗀 **Contract hour: <single contract/two contracts>**:

(initial contract or single contract)

- ✱ **Contract hour (numeric)**
- 🖈 **Every day (at contract hour)**
- 🖈 **Every Sunday (at contract hour)**
- 🖈 **Every Monday (at contract hour)**
- 🖈 **Every month (at contract hour on 1st)**

(second contract – optional)

- ✱ Contract **hour 2 (numeric)**
- 🖈 **Every day (at 2nd contract hour)**
- 🖈 **Every Sunday (at 2nd contract hour)**
- 🖈 **Every Monday (at 2nd contract hour)**
- 🖈 **Every month (at 2nd contract hour on 1st)**

Parameterizing contract hour in enSuite: A gas day lasts 24 hours and by default begins at 06:00. If another contract hour is contractually agreed to, you can adjust the default. Optionally, the enCore device can manage a further contract with another contract hour.

To change the default open the branch ⏰ **Time Service**.

> ▶ On the **Parameter** tab, select one of the following entries from the drop-down menu in the **Contract hour** area:

- **single contract –** *default*
- **two contracts**

✓ If you have selected **two contracts**, the parameter **Contract hour 2** will also be displayed.
> ▶ Select the time for the contract hour for the first or single contract from the drop-down menu **Contract hour** – *default* is **06:00**.

> ▶ Where applicable, select the time for the start of day for the second contract from the drop-down menu **Contract hour 2** – *default* is **08:00**.

- The enCore device provides various contract hour specific events in the export branch 🖼 **Basic System** – ⏰ **Time Service** – 🗂 **Contract hour: <single contract/two contracts>**.

3.4.7. Changing units and adjusting display formats in the Unit Service SFB

The Unit Service SFB manages physical quantities and their respective units in the enCore devices. It contains all physical quantities that are typically required. The pre-defined units are based on the SI-System and the conventions and rules of the NIST. Features of default units are:

- The default units are identified in enSuite with an asterisk (*).
- The associated default unit is used as a pre-assigned value if you, for example, allocate a physical quantity to an input or output channel first.
  Alternatively, you can select another unit from the set of units for a physical quantity in a targeted manner for parameters or export values You can change units of parameters on the **Parameter** tabs and units of export values on the **Export value** tabs.
- If you change a default unit, the new default unit will automatically be updated in all of the parameterization for all of the values which use this default unit.
- A unit which is defined as a default unit is displayed twice in the set of units for the physical quantity to which it is allocated: once as a default unit and once as a "normal" unit. It is therefore possible to use the "normal" unit for individual parameters or export values and therefore avoid the unit being automatically adapted due to a change in default unit.

Every physical quantity is allocated a precise unit or set of units in enSuite. Of these, one unit is defined as a default unit. A display format is preset for each combination of physical quantities and physical units. Default units and display formats can be parameterized.

In each parameterization, there are values for which you can select the desired physical unit in enSuite. There are also values for which the physical quantity must be indicated first. For example, in the case of a measurement via the input channel, the physical quantity depends on the type of measurement device connected. In other cases, the physical quantity is fixed but the unit may need to be adapted for the display or the further processing of the value.

As soon as you change the unit for a value, this measurement will be displayed in the amended unit. A measurement will automatically be calculated in the new unit.

Changing default units in enSuite

▶ Open the branch 🖼 **Basic System – 🧩 Unit Service**.
    ✓ The tab **Parameter** lists all physical quantities in the area **Default units** which are typically used by enCore devices.
      The column **Value** displays the default unit currently allocated to each physical quantity.

To allocate a default unit to a physical quantity, mark the corresponding row.
    ✓ The drop-down menu in the **Value** column contains all pre-defined and user-defined units for this physical quantity.

Select the desired unit.
    ✓ As soon as you save your change, the unit selected is set as the default unit across the entire parameterization for this physical quantity. Parameters which use this default unit automatically use this new default unit.

There are two entries for this unit in the drop-down menus: there is one entry as the default unit **<Unit> *** and one as a "normal" unit **<Unit>**.

Example:

The default unit for the physical quantity **temperature** is degrees Celsius (**°C**). To allocate the unit Fahrenheit as the default for temperature (°**F**) mark the **temperature** row.

In the **Value** column, in the drop-down menu select the entry °**F**.

As soon as you save the change, Fahrenheit (°**F**) is the default unit for temperature values.

If you need an additional unit not provided as a standard for a physical quantity, you can easily define this based on a pre-defined unit. A user-defined unit is useful for example if you…

- … need various display formats or unit symbols for a unit. In this case, the value itself is not converted, just displayed in a different way.
- … want to use a unit based on a decadic factor – a single, ten, hundred times the value etc. – for counter values and for example want to derive the unit centimeters from the unit millimeters.

A user-defined unit is defined from a pre-defined unit by indicating a gradient and an optional offset. To do this, the gradient and offset for the linear conversion of a value in the pre-defined unit to the value in the user-defined unit must be determined.

The formula is as follows:
Value in user defined unit= gradient × value in predefined unit+Offset

Creating a new unit in enSuite

▶   Open the branch 🔳 **Basic System –** 🔳 **Unit Service –** 🔳 **User-defined units**.
Click the Add symbol ➕ on the **Parameter** tab.
The area **Unit <x>** is added to the table.

To define a new unit, in the parameter…

▶   … **Name** enter a unique identifier – *default* is **Unit <x>**.
    ✓   In the area name, the name entered is displayed instead of the **<x>**: **Unit <Name>**
… **Symbol** enter a unique symbol.
    ✓   After saving this, identify the user-defined unit with a **Name** and **Symbol**. They are displayed together in the drop-down menu in the format **<Name> (<Symbol>)** – in contrast to this, in the case of pre-defined units only the symbol is displayed.
… **Physical quantity** enter the physical quantity for which you want to add a new unit.
… **Derived from** enter the pre-defined unit from which the new unit is to be derived.

💡	User-defined units cannot be derived from the default unit Please note that you can only derive a user-defined unit from a "normal" pre-defined unit (<Unit>) but not from the default unit (<Unit *>). Since a default unit is always also available as a "normal" unit for a physical quantity, select this entry in this case

… **Gradient m** enter the factor by which the value in the pre-defined unit is to be multiplied to convert to the new unit.
… **Offset n** enter the offset which is added during the conversion (optional).
… **Format string** enter the representation format for the user-defined unit on the device

In this parameterization, the new unit is available in the set of units for the physical quantity indicated.

Example

The units meter (**m**) and millimeter (**mm**) are pre-defined for the physical quantity **Length** as a standard.

▶ To define the unit centimeter (**cm**), parameterize the following values:

Name	Centimeter
Symbol	cm
Derived from	m
Gradient m	100
Offset n	0

The new unit **Centimeter (cm)** is available in the set of units for the physical quantity.

💡	Deleting a user-defined unit you can delete user-defined units by marking the row Area <Name> and clicking the Remove symbol ❌. Please note that the user-defined unit will also be deleted even if it is being used in the parameterization. This will render the parameterization invalid; invalid references will be indicated in red font as usual so you can correct the references manually.

Adjusting display formats of physical quantities

Display formats determine how values of a physical quantity are displayed in the device in the associated unit. Display formats are defined for each combination of physical quantity/physical unit by means of so-called format strings. They enable decimal and exponential representation. The format for a decimal representation determines, for example, the number of places before and after the decimal point.

💡	**Notation on the exponential representation**: In the exponential representation, each numerical value x is represented with two values, with the mantissa m and the exponent e: $x = m \times 10^e$ The mantissa m is a rational number. In the normal representation, the mantissa only has one significant figure before the decimal point. The exponent is a whole number. A number is displayed in the exponential representation on the device in the normal representation and in the format: <m>E<e> The exponent is displayed with at least two digits in the device. Where necessary a leading zero (0) is added. **Example**: In a standardized exponential representation, the value 0.0000123456789 is $1.23456789 \times 10^{-5}$ and is represented in the device as **1.23456789E-05**.

Display formats for pre-defined and user-defined units can be parameterized. You can easily determine the format string using graphical operation elements. Alternatively, you can also manually adjust the format string. You call the format string depending on whether you change a pre-defined or a user defined unit:

To change the display format for a *pre-defined* unit open in branch ⊞ **Basic System – ⚙ Unit Service** the tab **Display formats**.

▶   Select the physical quantity from the drop-down menu for which you want to change the display format of a unit.
       ✓   The table lists all associated (pre-defined) units with format strings.
Mark the row showing the desired unit.

To change the display format for a *user defined* unit open the branch ⊞ **Basic System – ⚙ Unit Service – User defined Units**.

On tab **Parameter** select the user defined unit or add a new unit.
Mark the **Format string**.

Continue with further steps (the same for pre-defined and user defined units)

The control elements will be displayed in the lower area of the tab so you can change the display format. The live values of the format strings are preset.

To display the value in *decimal notation* on the device select the checkbox **Decimal notation**.

Adjust the representation of the figures before the decimal point:
- To only show the significant figures before the decimal point, select **All significant digits**. This setting is typically used for measurements.
- To limit the number of figures before the decimal point, select the maximum number **<1 to 12> digits before the decimal point**.
  - To add leading zeros, select the checkbox **Show leading zeros**. This setting is typically used for counters.

▶   Adjust the representation of decimal places:
- To only show whole numbers, select the checkbox **No digits**.
- To display a fixed number of figures after the decimal point, select the relevant checkbox and the desired number **<1 to 6> digits**. Filling zeros will be added where applicable.

To display the value in *exponential notation* on the device select the checkbox **Exponential notation (normalized)**.

To display a fixed number of figures after the decimal point, select the desired number **<0 to 9> digit after decimal point**. Filling zeros will be added where applicable.

Regardless of the representation selected your changes will be implemented in the **Format string** column immediately as a format string.

If necessary, you can restore the pre-defined display format at a later point using **[Restore default]**.

3.4.8. Changing the settings of the GC AFB

💡	Using the default parameter set and the commissioning settings, automation, calibration and verification will run without any additional intervention in the parameters.

The default parameter set covers most applications. Nevertheless, it may be necessary to adjust some parameters. This is done in the **GC AFB** and its underlying nodes, see example of parameter tree in the figure below.
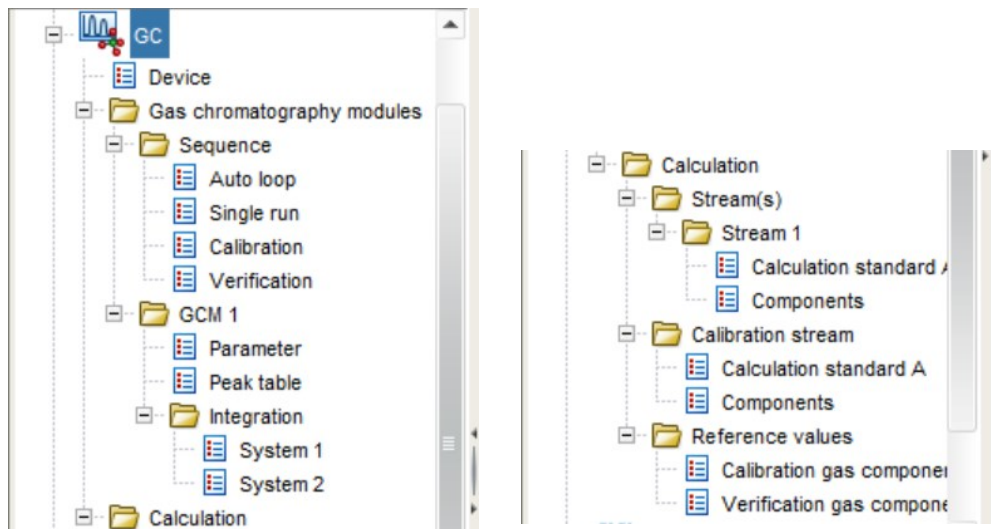
Figure 3.28: Overview of GC AFB sub-nodes
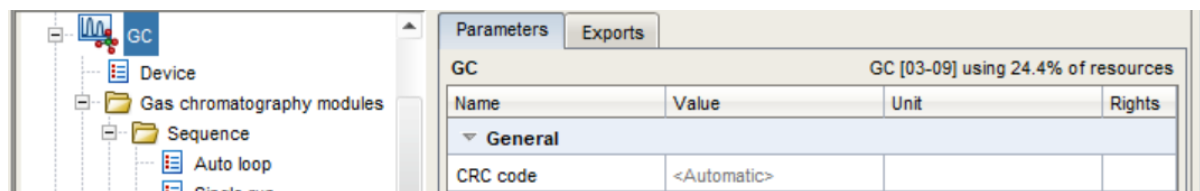
On the right-hand side (on the parameterization window), you can see the settings used for the **Code checksum** (software check). The **Export values** tab contains possible links for the AFB which can be used in other software parts. In general, it is not necessary to make any changes here.
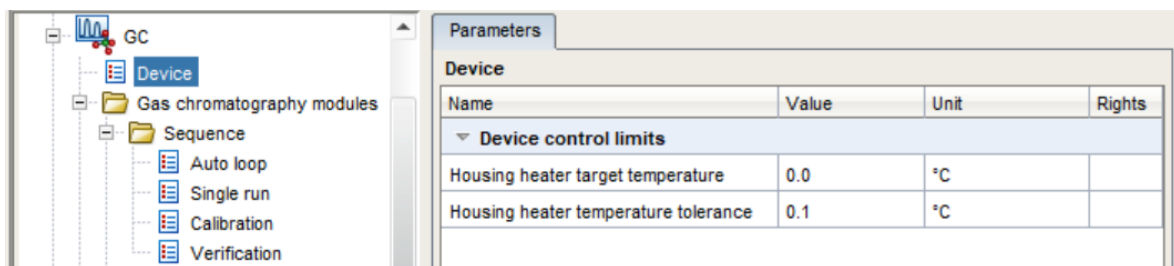
Figure 3.29: GC AFB – Device sub-node

Under this node, the target temperature and the sensitivity for the optional housing heating are defined. When this temperature is reached, the heating switches off within the selected tolerance range. Detailed information is available in the **enSuite online help**.

The **Gas chromatography modules** node contains two groups of module parameters **Sequence** and **GCM 1.** The node "**Sequence**" should be adjusted near the end of commissioning. Under the node "**GCM 1**" the user generally does not have to make changes.
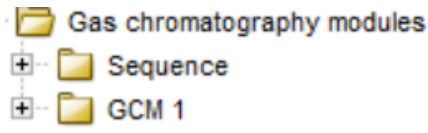
Figure 3.30: GC AFB – Gas chromatography modules node and sub-nodes

3.4.9. Defining and changing sequence settings

This section describes adjustments made by users, if changes must be made to the automatic process after order placement and commissioning. This is carried out in the "**Sequence**" node and its sub-nodes.
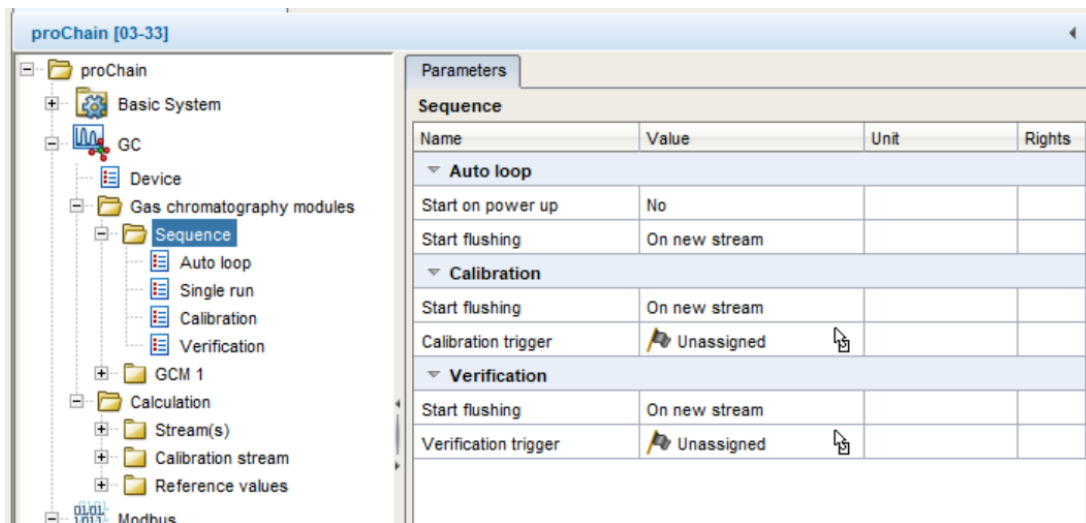
Figure 3.31: Sequence node

"**Start on power up**" enables you to define what happens after the device is connected to the power supply. "**Yes**" enables the device to start immediately in automation mode, "**No"** means that the device will not start until it is activated by a user.

"**Start flushing**" enables you to flush the device **before every measurement** or only if you change the stream ("**On new stream**"). The additional parameters **Calibration trigger** under **Calibration** and **Verification trigger** under **Verification** starts this function on an event basis, if the device runs in automation.

A range of options can be selected in the **Value column** using a dropdown menu. There is no entry in the **Unit column**. Instead of using the dropdown menu you can also drag and drop values from the **Export window** directly into the **Value column**.

If you want to start a **Calibration** or **Verification** depending on date and time, (**system time**) a corresponding setting in the Time service SFB must be done before. In addition, it is also possible to extend the events with corresponding settings in the **Postprocessing AFB**.

[lightbulb icon]	Changing the time-controlled trigger (interval, day, time) of factory settings e.g. if the measurement is done using two redundant devices. Otherwise both devices perform its calibration at the same time and do not get new measurement results. It may be useful to start an automatic operational calibration at certain events e.g. after a reboot or when an input signal is triggered.
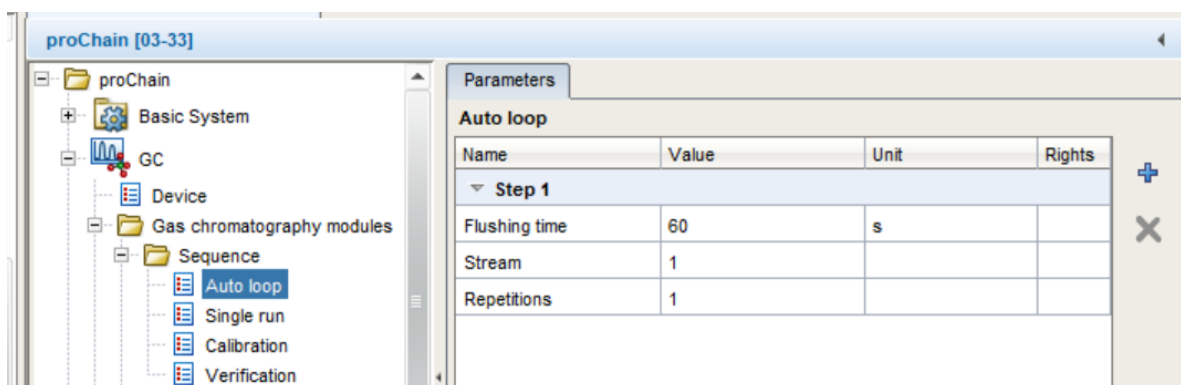
Figure 3.32: Auto loop

The "**Auto loop**" essentially decides the automation sequence. It runs in an infinite loop. The user can permanently interrupt this loop manually with the "**Stop**" button see section 3.8 Operate the device with enSuite. The device can also interrupt the loop on an event basis using the calibration or verification trigger. After the **Calibration** or **Verification**, the loop will be continued at the interrupted step.

You must define for **each stream** how often this stream (**stream number**) is measured consecutively (**Repetitions**) and how long it is flushed (**Flushing time**). The frequency is depending on the settings in the sequence main node. The **+ symbol** on the right-hand edge enables you to add additional **steps** for running other streams and the **X** enables you to remove marked steps/streams from the loop.

Figure 3.33: Single run table

On the **Single run** parameter tab page, you can define the **stream** on which you wish to conduct this single run. **Flush time** enables you to define the time for which the stream is flushed first. For more details use the **online help**.

The **Flush time** ensures that the tubing and the Stream selection block are filled with the correct gas (fresh sample). If the device is analyzing one stream continuously, it is recommended to flush 10s before every measurement. After changing the stream, it is recommended to flush 60s.

Figure 3.34: Calibration (cycle)

The **Calibration tab** contains the steps and type of runs used for calibration purposes at **Calibration stream**. For each step, you must determine how often the device measures it one after the other (**Repetitions)** before switching to the next **step** and how long it flushes (**Flushing time**). (Frequency is depending on the settings under the sequence main node)

Two **Calibration types** could be selected. Based on this selection, the instrument calculates the new calibration factors.

- An **Ignore cycle**, although the system is flushed with calibration gas, the analysis data are not considered when calculating the new factors.

- A **Replace cycle** means that the calibration factor is recalculated after every new calibration cycle. For this type, <u>always 1 should filled into Repetitions</u>

The **+ symbol** on the right-hand edge enables you to add additional steps, if the stream is being subjected to a different **Calibration type**. The **X** enables you to remove marked steps from the list. The procedure is the normal one in **enSuite**. In general, two steps like in the example are sufficient.

🔆	If the calibration fails, an entry is generated in the log. The table process is repeated on the next planned event. The parameters from the last successful calibration remain in use. If this error occurs frequently and you cannot rectify it, contact Honeywell.
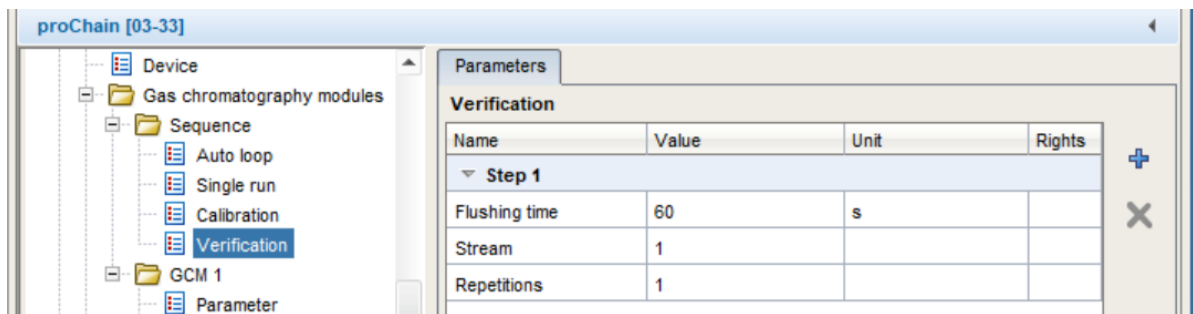
Figure 3.35: Verification (cycle)

With "**Verification**" the measurement accuracy of the device can be checked. For this control purpose, a test gas with a known composition is measured and the results of the measurement compared to the original analysis. You must set for each (verification gas) **stream** the stream number and how often this stream is measured consecutively (**Repetitions**) and how long it is flushed (**Flushing time**). (Frequency is depending on the settings under the sequence main node).

The **+ symbol** on the right-hand edge enables you to add additional streams if the device runs with multiple test gases. The **X** enables you to remove marked streams from the list.

🔆	The easiest way to use this function is the use of calibration gas as verification gas. Then the stream could be the calibration gas inlet.

3.4.10. GCM/Parameter/Peak table/Integration settings

This section describes settings which are normally completed when the proChain GC is ordered and during its commissioning. However, the user should check the settings, particularly if incorrect measurements are made, to ensure that this part is not contributing to the error.

As the figure below shows, the settings are stored under node **GCM 1.**
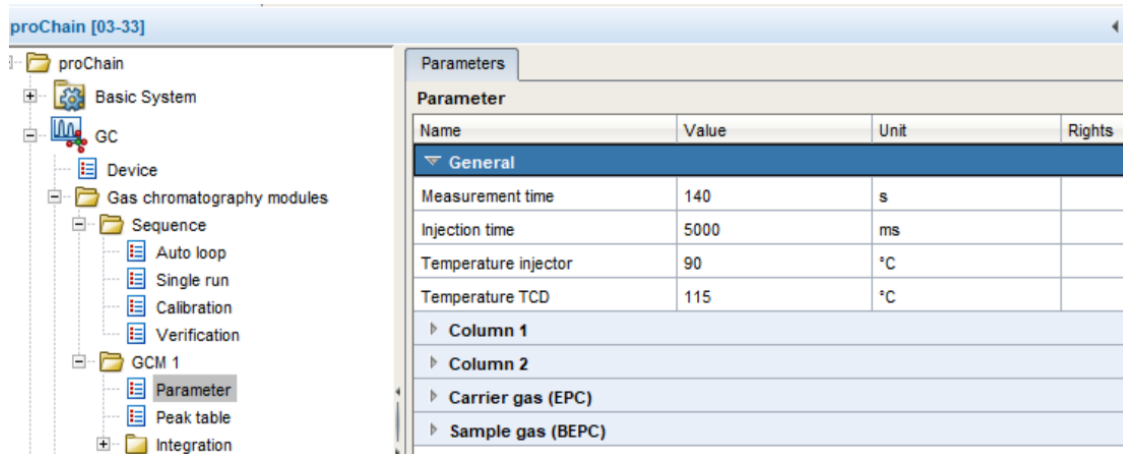
Figure 3.36: GCM (1) Parameter

The Parameters tab contains system settings such as measuring method, amplification, sensor and injector temperature. More details are given in the online help

	Since normally no changes must be made here, these items are not described in this document. The online help contains further details. The instructions required for checking or changing the settings are available from Honeywell, if necessary.

The next tab contains the parameters included in the "**Peak table**". The peak number stands for the relevant gas component. The **+ symbol** on the right–hand edge enables you to add additional components. The **X** enables you to remove marked **peaks** from the list.

The procedure is the normal one used in enSuite and should only be carried out by trained personnel. A change of this parameters (not necessary in normal operation) has influence on the analysis results.

Figure 3.37: GCM (1) Peak table

Each Peak (CH$_4$ in the example above) contains a list of peak parameters, including the name of the component, retention time and tolerances, the system and various coefficients.

🔆	The template setting of the parameters in the Peak table and the integration node are the starting point for each individual optimization. More information about the parameters are given in the online help.

Like the Peak table, the "**Integration**" node contains grouped parameters which are used for internal calculations.

Section is the name of a section of the measurement in which these calculations are used for the peaks contained within it.

The **+ symbol** on the right-hand edge enables you to add additional "**Sections**" to make the calculations even more accurate. **Sections** with an **X** can be removed from the list, the remaining **sections** then must be adjusted.

An adjustment of this parameters is not necessary in normal operation. In exceptional cases only, trained personnel should do this.
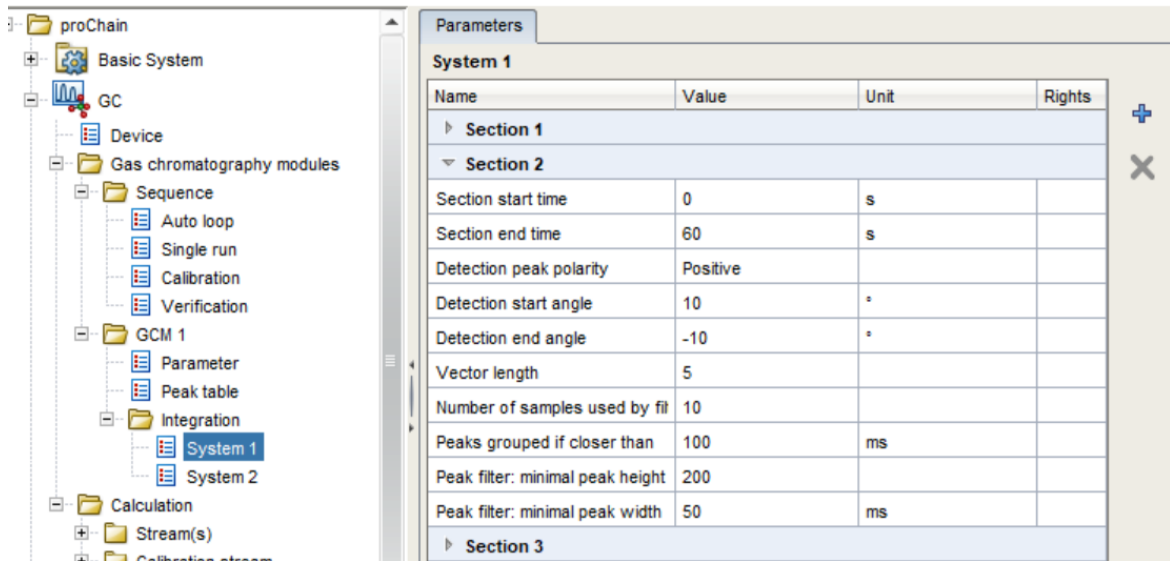
Figure 3.38: Integration (Sections)

3.4.11. Adjusting gas mixtures and limit values select calculation standard

This sub-node contains settings for the device which should be defined during the commissioning and ordering processes, and which generally do not need to be changed.

C6+ splitting shows how the device is modeling the sum peak of C6+ (splitting the sum peak into higher hydrocarbons) for further calculations.
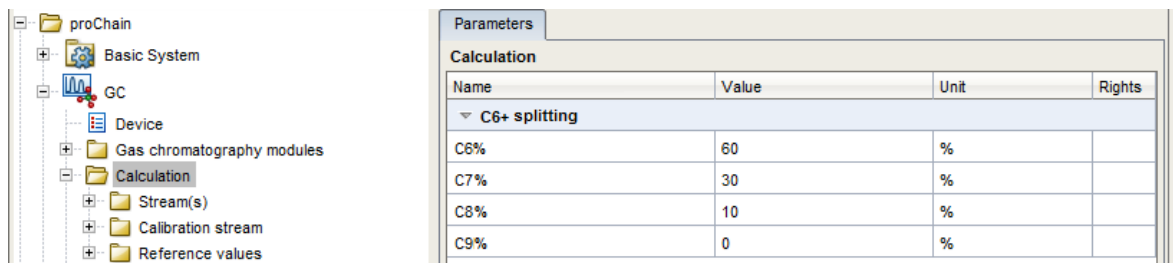
Figure 3.39: Calculation

The node **Stream(s)** allows the parameterization to be adapted to the existing streams in the device. This should already have been done during commissioning. Subsequently, the **+ symbol** on the right-hand edge enables you to add additional "**Streams**". With the **X,** streams can be removed from the list. Every listed stream produces a new node in the parameter tree.
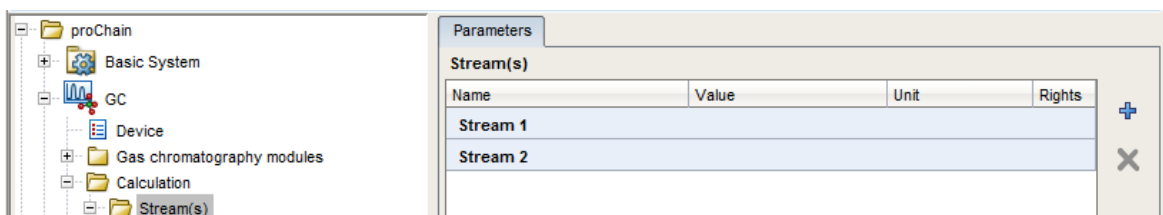
Figure 3.40: Calculation Stream(s)

In addition to the measurement accuracy of the device, the result of the analysis is heavily dependent on the calculation standard used. You can choose between five calculation standards to ensure that the device complies with local requirements.
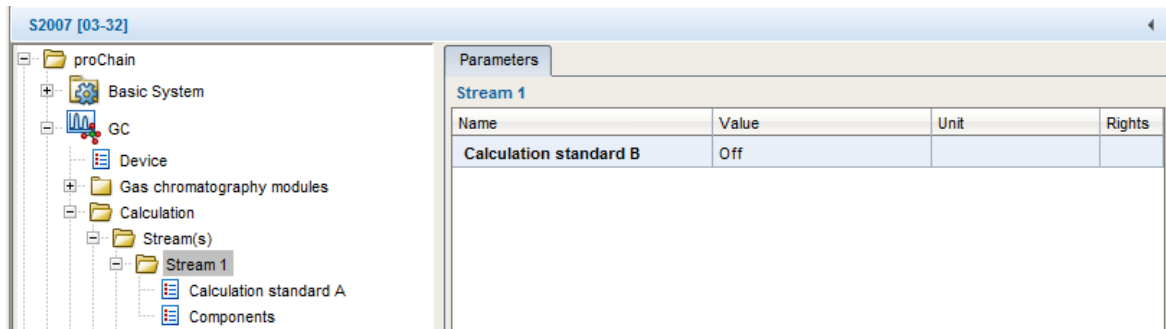
Figure 3.41: Calculation Stream calculation standard

You can adjust the calculation standard individually for each generated stream and the **Calibration Stream**. Up to 2 standards can be used simultaneously for each stream. If you set **Calculation standard B** to **On** (dropdown in the **Value column**, see above), a new table (identical to Calibration standard A) appears in the parameter tree.
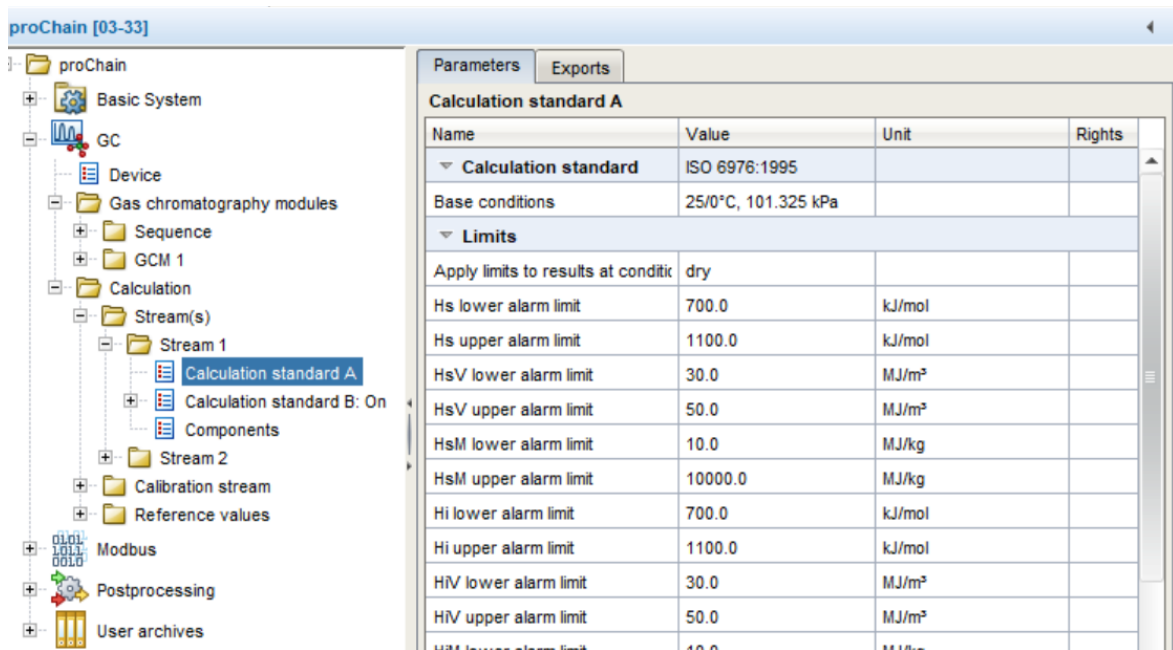
Figure 3.42: Calculation standard settings / calculation limits

In the above figure, you can change standard A (standard A is always active) for the stream by a dropdown menu in column **Value**. After it has been selected, the **Base conditions** of the standard can be viewed and if necessary, also adjusted by a dropdown menu in this cell.

Use the parameters below **Limits** to define the alarm limits for the corresponding values. If these values are exceeded or not reached, the device issues an error message.
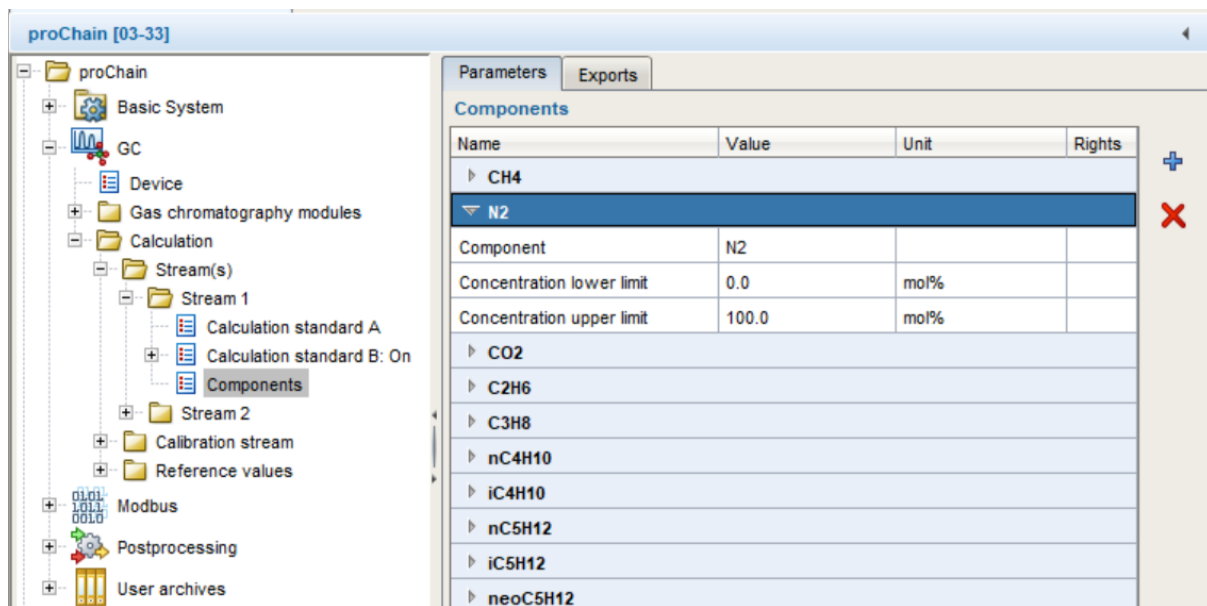
Please check the default settings.

Further information on the individual parameters can be found in the online help.

💡	Adjust the entries on and select the unit required for your application only by agreement with the system operator or after consulting Honeywell. Ensure that all physically identical values also have the same units.

You use the **Components tab** to define the limits for each expected gas component. These components first must be generated with the **+ symbol** on the right-hand edge.

Then the **limits** can be set. See example in next figure. With the **X**, components can be removed from the list. Further information can be found in the online help.

Figure 3.43: Stream components limits

Like in the examples above you must adjust all existing streams. In normal cases this was already done during factory setup and commissioning.

To ensure the measurement correctness of the device, it is calibrated at the factory before delivery and is also checked and corrected during operation.

This is achieved using an automatic calibration system.

The requirement for this is the permanent connection and availability with adequate pressure of the calibration gas (P1-11K, see section 1.3.3 Technical range of suitable gases (gas like natural gas)) to the device (stream 6 / **Calibration stream**). In addition, the components of the gas used must be entered precisely as shown in the manufacturer's certificate of analysis.

These values must be adjusted during the commissioning procedure and after changing the cylinder. Go to the following place of parameter tree for this purpose.
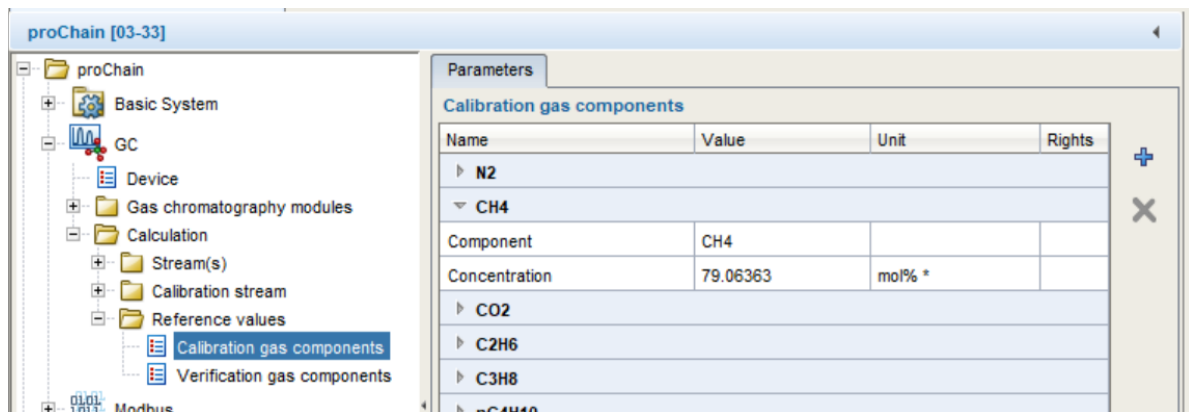
Figure 3.44: Reference values (Calibration / Verification gas properties)

In the tables, **Calibration gas components** and **Verification gas components** you first create the components of the corresponding gas with **+ symbol** on the right-hand edge. Create an entry for all components specified in the manufacturer certificate of analysis.

🔅	The parameter Component contains the name of the gas component and is selectable by a dropdown list, which opens after a click into the column Value.

Then open each entry with a click on the arrow and enter the concentration of the component according to the analysis certificate as shown in the example.

If calibration gas or verification gas is changed use the **X** to remove not used components from the list. Further information can be found in the online help.

3.4.12. Editing displays (Basic display editor)

Normally the displays do not have to be edited. However, if you have the appropriate rights, you can do the following (navigate in enSuite to the point indicated):
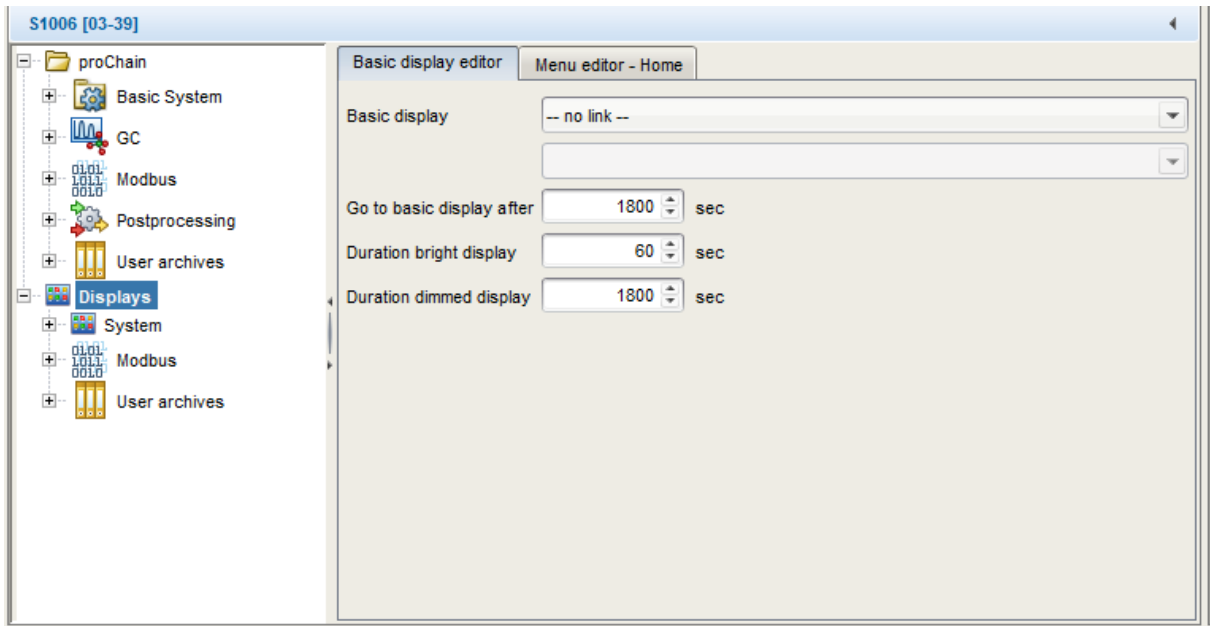
Figure 3.45: Editing the display

On the right-hand side of the parameterization window, there are various settings and options available in the Basic display editor tab.

- **Basic display**
  Using the 2 selection menus you can define which display or sub-display the device shows first when it is switched on or restarted. You can define the AFB in the first selection menu. The second menu is to select any sub-displays.

- **Go to basic display after**
  Here you can define after what time the system quits the current display and returns to the basic display. Do not make this time too short since after a break in editing above this time, you will have to reopen the previous display, making your work more difficult.

- **Duration bright display**
  If a bright display is not used for a lengthy period, it will dim. You can define the time after which it will dim here.

- **Duration dimmed display**
  If a dimmed display is not used for a lengthy period, the screen will be shut down. You can define the time after which it will shut down here.

The device displays are also listed on the right-hand side of the parameterization window in the Menu editor – Home tab. If you have the appropriate rights, you can use the context menu and the symbols on the right-hand edge to make various changes to settings.

3.4.13. Fiscal parameters and optional using approval file (Select approval)

For devices, which are intended to be used in legal metrology, the approval specifies which parameters are legally relevant. The editing of such parameters must be specifically protected or logged.

	There are two different types of access rights for legally relevant parameters: 🔒 Can only be changed if the sealable security switch is open 📖 Can also be changed if the security switch is closed, provided the fiscal audit trail is not yet full. The change is logged in the fiscal audit trail.

If the device is operated in accordance with a valid approval, then the following conditions need to be met in the parameterization:

- The access rights for legally relevant parameters must be set in line with the approval.

- The software versions of the fiscal software components must comply with the approval.

In order to ensure compliance with these conditions, please proceed as follows:
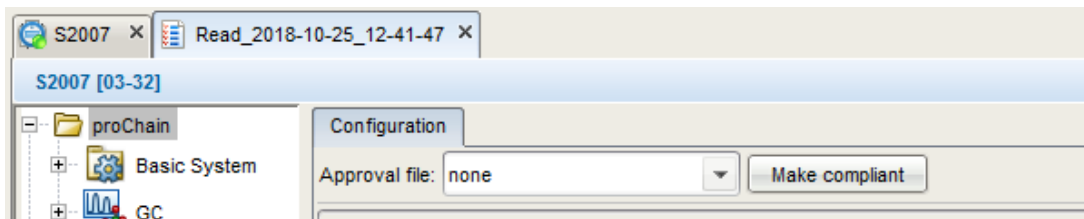
Figure 3.46: Configuration – selecting the approval file

1. Select the approval to be applied in the **Configuration** tab, **using the drop-down list**. All parameters and parameter branches whose official access rights (i.e. 🔒 or 📖) deviate from the selected approval are now labeled in bold **orange**. A **blue** label indicates that official access rights have been newly added.

2. Now click on **Make compliant**. By doing this, the access rights for legally relevant parameters are set in line with the selected approval. The orange labeling is replaced by a **blue** one as the changes have not yet been saved.

3. Check the listing of AFBs in the **Configuration** tab. If an AFB is still labeled in bold **orange** here, then this means that a software version was selected here which does not comply with the approval.

   Select the correct version which is in line with the approval. (Versions in line with the approval are listed in black, and versions which are not in line with the approval are listed in orange. Versions that are not compatible with the current Basic System appear in red.)

   Then click on the **Make compliant** button.

4. Save the parameterization 🖫. The blue labeling of parameters and parameter paths then disappears.

This action does not make any changes to the values of parameters. After the changes are saved, all the colored markings will disappear. Transfer this compliant parameter set to your device to use it for fiscal measurements.

	Approval file within enSuite / the device
🔆	There are various national approval files which define the fiscal parameters which must be monitored and the corresponding values in enSuite. There are also files which allow this protection mechanism to be used for non-fiscal operation as well.
	A special official approval file transferred and contained in the device's software determines which approval should apply for the device. It is possible to replace the approval file in the device via software configuration (⇨ section 3.4.15 Changing the software configuration (software update)).

During operation, the device checks whether the official access rights and the fiscal software component versions match the requirements of the approval file in the device. The selection in enSuite is used solely for support purposes during parameterization.

On the remote operation panel, you can see an identifying string for the approval file in the Info (system) display. If both the official access rights of the parameterization as well as the fiscal software component versions are in line with the approval file, then this text is black; the text is red in the event of any deviations.

Security switch and fiscal audit trail may also be used for devices that are not to be operated in accordance with an official approval. In such cases there are prepared unofficial "approval" files, including a file without any official access rights whatsoever.

All the AFBs available for the device will be listed in a table in the bottom section of the tab. They can be used with the appropriate rights to expand the Configuration AFB. See the **online help** for further information.

🔆	If this protection is disabled, "**none**" (see figure) will be displayed. after "**Approval file**".

3.4.14. Restoring the parameter set to factory settings (importing data)

If the device no longer produces acceptable results due to several incorrect settings, it may be necessary to restore an older parameter set or the factory settings.

⚠️	This process should only be used in an emergency when all other options have been exhausted, as the current settings in the device will be deleted. If you are in any doubt, contact Honeywell. It is essential that you first save all the data you require to an independent external data medium or computer. A backup as described in must be available (see section 3.2.8 Saving, and exporting the parameter set).

Step	Work: Restore default setting in the device
1.	Start the enSuite configuration and analysis software.
2.	Back up all the relevant device data to an external data medium or computer.
3.	Upload the backup parameter set created as described in section **Fehler! Verweisquelle konnte nicht gefunden werden.** to your PC*.
4.	Connect to the device.
5.	Transfer the backed up (default) parameter set to the device.
6.	The device will restart and then continue to operate with the settings from the backup file.

* If the backup is still in your enSuite installation, this point may be skipped.

Otherwise, you can also import selected files (backups) using the symbol in the enSuite window.

Click on the marked symbol as in the example shown here and follow the dialog boxes.

As soon as the file has been imported, it will appear in the **navigation window** under the device's parameter tree.
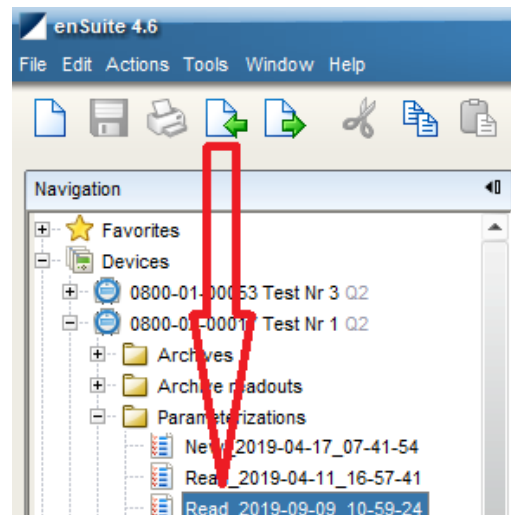
⚠️	Do not forget to adjust the calibration gas properties if you are no longer using the same calibration gas cylinder as when the device was delivered.

3.4.15. Changing the software configuration (software update)

As with all products, changes and additions are made from time to time for the proChain GC. This section describes an example of how to update the software and firmware from the basic system version 03-33-A to 03-37-A.

The device software contains different software components (software modules) that can be individually replaced with other software versions. These software modules include the Basic System, all available AFBs and the optional approval file that defines the official or protected access rights.

	The version number for software modules consists first of a major version number, then a minor version number and at least a version letter (e.g.: 03-33-A).
	The major version number must match for all software modules within a device. The minor version number is incremented if the parameter structure is different, but the module version is still compatible with other software modules with the same major version. A differing version letter indicates that the software changes are minor, and the parameter structure has not changed.

For all following steps, you always need all current software versions. The SSW of the device must be open and you must log on as administrator.

	Attention!
	All security settings will be lost if you work as the administrator with the SSW open!
	If a software update is completed incorrectly, it may render the device useless. **Refer also to the information on the specified websites and contact Honeywell if you are in any doubt.**

Requirements:

- The software versions could be independent from each other. Please observe the notes under https://www.elster-instromet.com/en/ensuite

- The current software version of the basic system requires version 3-08-A or newer.

Compare the requirements with the current situation in your device only if all the above requirements are satisfied you should continue with the other points in this section. In the update, various software components are replaced by others. These include the basic system, all available AFBs and the approval file. This procedure is generally identical for all enCore devices. Proceed as described below.

- Download the firmware you require from https://www.elster-instromet.com/en/gas-analyzers in the Software Downloads section and save the files on your parameterization device. **Caution when saving the file.** It is not possible to use files if there are special characters in the file path.

- Check whether your enSuite version is still up to date and download the latest version if necessary from www.elster-instromet.com/en/software-downloads in the **Software Downloads** section and install it as described in section 3.2.2 Installing enSuite .

- Establish the data connection to the device (in this case, S1007 is connected).

- Highlight the device in question in the navigation window either under the Devices branch or under the Connections branch.

- Read out the current parameter set, the archive data and the Chromatograms stored on device. **Save these data, see section** 3.2.8 Saving, and exporting the parameter set**, they will be lost if not.** (Devices delivered after summer 2019 will keep the chromatograms).

- Read the parameter set again for changes during the remainder of the work.

- Check carefully using the read parameter set whether the update can be used (**see requirements**).

- Select action **Software configuration** in the bottom section of the navigation window. (see next figure)

Figure 3.47: Activate software configuration

The **Configure software** window shows a tabulator for all software modules that are currently included in the device (along with version number in the column **Current**).

It is also indicated whether a module is **fiscal** or **not.** In the following example, **none (Elster)** is displayed for a nonofficial approval file. Legally relevant (fiscal) modules are intended for official measurements in accordance with a valid approval. The replacement of fiscal and non-fiscal software modules can be separately restricted by way of special access rights.
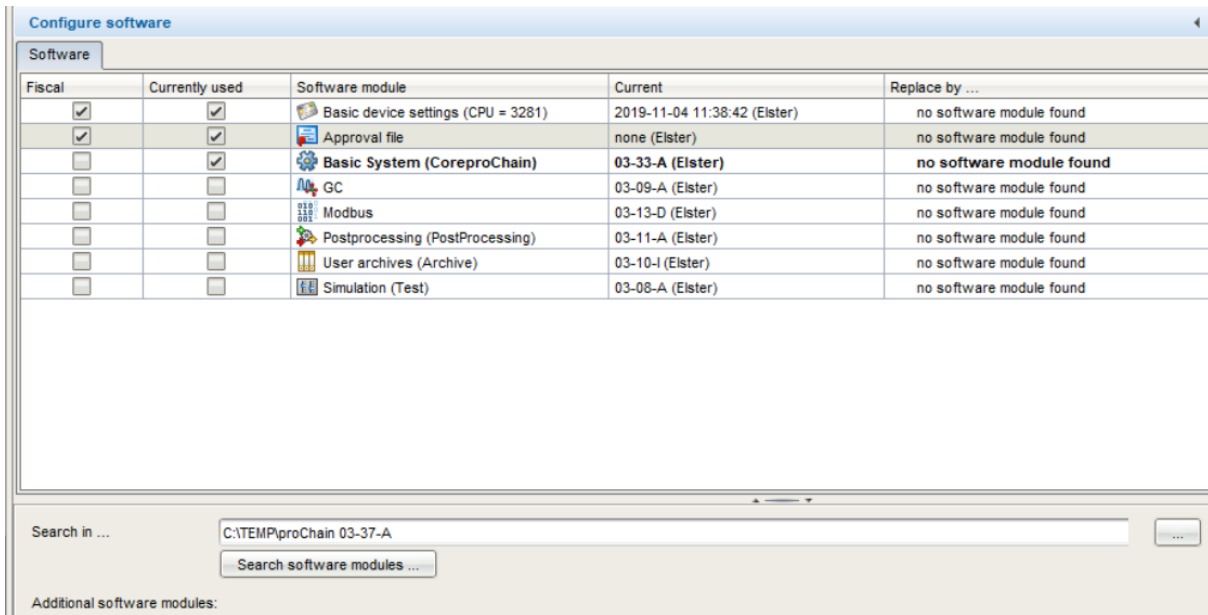
- In order to search for other versions and software modules which may be installed as well, select the directory in which the new software versions are located under **Search in….**Click on [...] to select and define the path to the stored software package. (Attention! If there are German umlauts in the Search file path, it is not possible to transfer update files (including parameter sets) to a device).

- Now click on the "**Search software modules**" button. A search is now conducted in the specified directory for other software versions.

If newer versions of the searched software modules are found, then these are displayed in the **Replace by…** column and highlighted in bold **green**, see above. If not the text "**Don't change**" then appears.

Depending on the situation, you can select **additional software modules** via a dropdown menu that opens by clicking in these fields. You can exclude individual software modules from the update by explicitly selecting **do not replace**.

	In general, all the modules highlighted in green must be changed. We recomend to follow the automatic suggestion from the system for changing modules. Provided the old and new software modules only differ in terms of their version letters, then the original parameterization can continue to be used, even after the software download. If the version numbers differ as well, this means that the old parameterization is no longer compatible, although it can be easily converted.

Attention: Approval files do not have any particular versions, but rather they are identified by their name instead, none (Elster) in the example above. For a replacement of the current approval with a new approval file, it must be taken into consideration, to explicitly select the appropriate file. A click in column **Replace by ...** will open a dropdown menu.

- Once you have selected all desired replacement actions, click on the [Perform software changes] button at the bottom of the window.
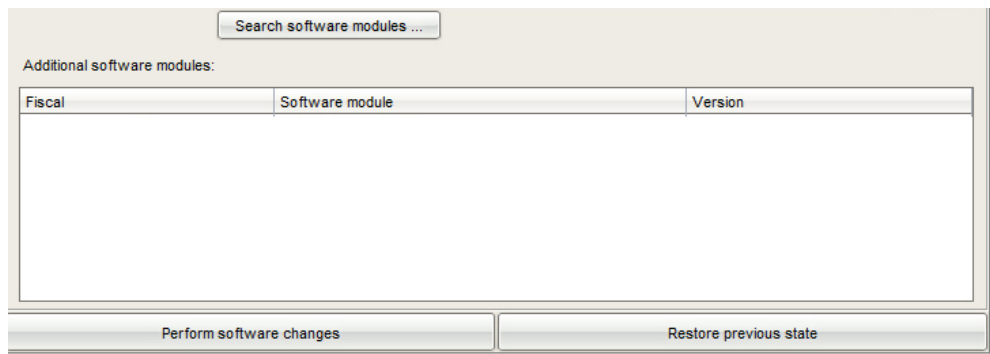
If you have not yet registered, you must fill in the login form with your **user name** and **password** and log in. (The login form is displayed automatically if needed) Checks are then made as to whether you belong to a user group that allows the chosen software changes to be made. If this is not the case, then the procedure is terminated.
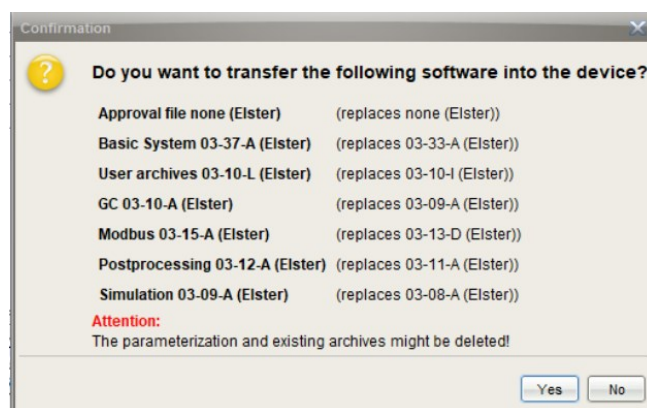
- If everything has been considered, confirm the security dialog. (see above)

The software updates are now transferred to the device. The condition of the security switch is then examined.

If this is closed, and if changes to the software configuration are prohibited in that case, then the procedure is terminated. Otherwise the device restarts. (see below)

	The replacement of fiscal and non-fiscal software modules may be protected by the security switch. These settings can be found in the parameterization in the branch **Basic system – Users**, on tab **Special user rights**.

After the restart, there are only basic settings in the device. Archives and parameter settings are deleted! If you look to the remote operation panel (see next section) you can only see the following line in the display.
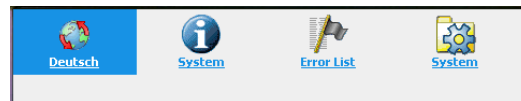
The device must now be provided with a parameterization again. This maid requires the conversion of the original parameterization, to do so.

- Open the parameterization saved for changings that you have read from the device and highlight the root of the parameter tree (labeled by the device name) in the parameter window

- The various software modules which can be parameterized can then be seen in the **Configuration window,** i.e. the Basic System as well as all included AFBs along with their version number. (see figure)

- Select the newest version for all modules to be replaced under **Version** per the example

- Click on **Commit changes** and confirm the security dialog.

- Then Check the parameterization for changes that have occurred unintentionally because of the update. Edit the parameterization if necessary.

The updated modules can eliminate functions or prevent them from being taken over automatically. Invalid parameters / paths are displayed in orange in this case, the message "**Conversion error"** may appear.

If necessary, revise, improve or supplement the corresponding parts using your saved templates. To do this, copy the values from the original parameterization into the identical positions of the new structure. **Please always check all entries**.

- Save the updated device parameterization and close the parameterization window (The updated parameter set is now ready to be transferred to the device)

To provide the device with the original or converted parameterization again. Reconnect to the device and transfer it. After a restart the software update is finished.

If errors occur after the software update which have no physical cause, the update was not carried out correctly or the software of the device was unsuitable for this update.

	With "**Restore previous state**" (in window Configure software) you can try to undo the change. Then transfer the old unchanged parameterization back.

Some software and firmware parts cannot be replaced using the method described above. If a replacement is necessary, Honeywell will contact you and provide necessary special files for the work described in the following.

These software and firmware parts can only be replaced by using the SD card. For this purpose, the card must be taken out of the device and the required data transferred to it in a PC.

Proceed using the following instructions:

⚠	**Disconnect the power supply and open the device in compliance with the explosion protection regulations.**

Remove the flash memory card (on the center-left in the figure).

You can open the holder by first pulling the cover to the left and then flipping it forwards.

Do not remove the complete CPU board since otherwise the boot-loader will be lost.
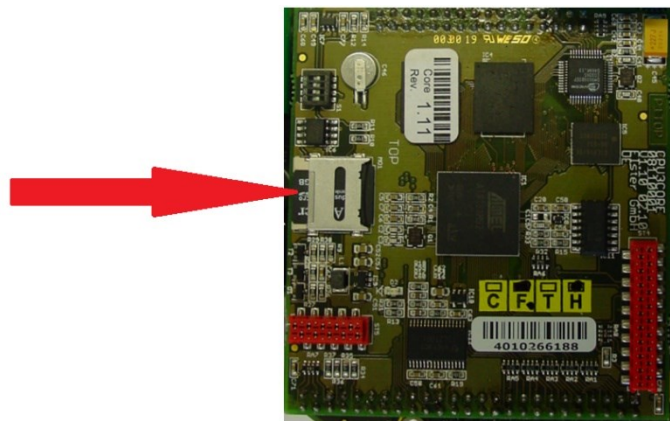
Figure 3.48: SD card at CPU Board

⚠	**Ensure that you do not lose the card, since it can fall into inaccessible device areas.**

You need a method of connecting the SD card to your PC/laptop to complete the update.

To update the firmware, copy the file(s) given from Honeywell e.g. GCM1000.bin or GCBase.bin, into the "IOBoards" directory on the SD card.

If this directory does not exist, you can simply create it (use suitable tools such as "Total Commander").

Then reinsert the card into the device and assemble it fully before you reconnect the **proChain GC** to the power supply.

3.5. Remote operation panel functions of enSuite

Since Basic System 03-39-A you can access a remote operation panel with enCore device basic functions in enSuite using the action of the same name. In this case, the connection is established via MMS and secured via TLS.

3.5.1. Activate remote operation panel

As soon as you are connected to a device, the entries in the lower left corner of the enSuite interface will be activated. If you select the "**Remote operation panel**" entry there, a graphic image of the operation panel will appear in the middle of the enSuite interface. At the same time, the physical display and local inputs (if existing) are deactivated.
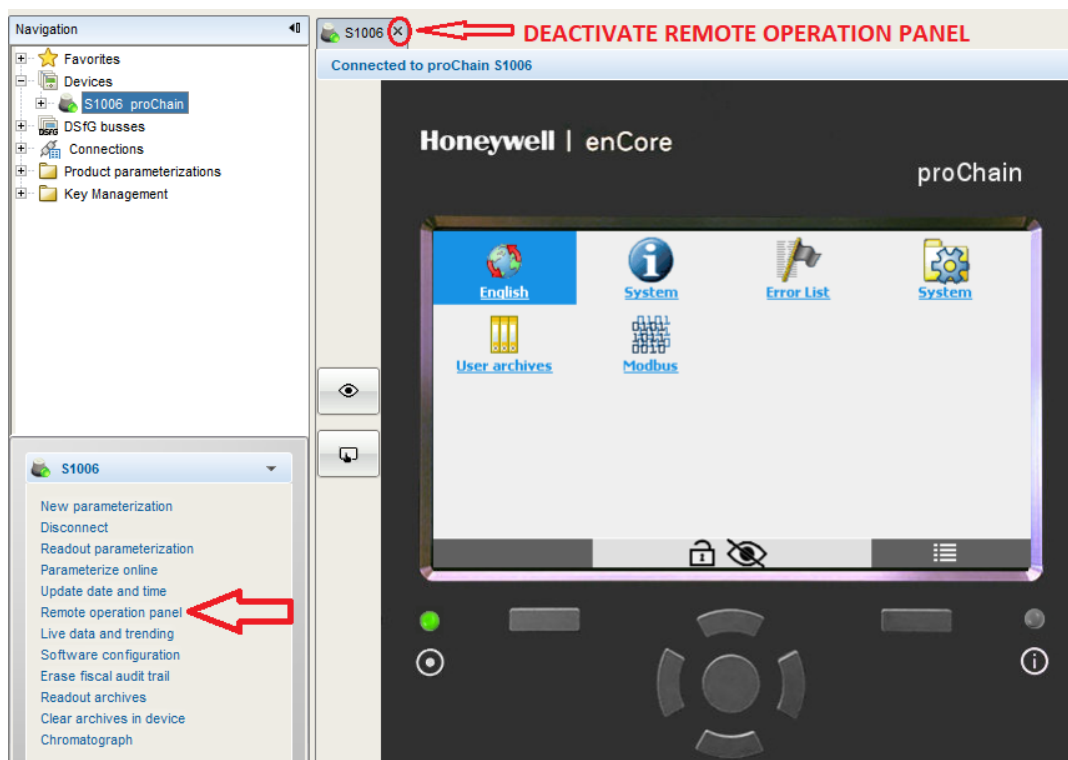
Figure 3.49: View of the remote operation panel via enSuite

After **deactivating** the function **by closing** the window using the **X** in the first line (shown in the figure above), disconnecting the device (see section 3.2.6 Disconnecting the device and Connection errors) **or automatic** after a time without activity physical displays and local inputs are activated again.

If a user uses the remote operation panel function, it can't be opened by another one. If the remote operation panel function is not used it can be used in another enSuite connection.

Since the remote operation panel behaves like a real display on the device, opening, closing or connecting / disconnecting the device does not change the login status.

Two toggle buttons **[Grant/Revoke local view]** and **[Grant/Revoke local control]** for changing the local conditions during remote access are displayed to the left of the figure. As the proChain does not have an operation panel, these buttons are not relevant and can remain in the default setting.

The image is a reproduction of the local operation panels used on most enCore devices and allows the same operating procedures as on these devices. Two also indicated status LEDs below the display area additionally represent the device status. See the following figure.

Remote accesses from flexible distances of the proChain GC is now possible in the same way as local operation known from other enCore devices. This means that all basic functions can be displayed, and various operating modes can be controlled, for example setting date and time. Only parameters which influence the result (fiscal parameters) cannot be edited on this place.

3.5.2. LED indicators below the display area

In addition to the screen and the keys, the remote operation panel also shows a visualizes of two multi-colored LEDs, which are normally used on other enCore devices. The Power LED is shown on the left side and the Status LED is shown on the right. Their color and behavior (permanently on or flashing) indicate whether the measuring device is operating flawlessly or whether an error is or has been active.

Power LED - State	Explanation
Green	Power supply on; no USB connection
Orange	Power supply on; USB connection active (only during service work and when using the optional USB connection)
Status LED	**Explanation**
Green, permanently on	The device is working and no faults are active, in other words, there are no active or non-accepted alarms or warnings in the error list.
A red or yellow status LED indicates that there are pending errors or errors which have not been accepted. (The LED status will be retained even after a restart and will be redisplayed.) The status LED shows the error state as follows (in sequence of priority):	
Red flashing	The error list contains at least one active alarm which has not been accepted.
Yellow flashing	The error list contains at least one active warning which has not been accepted.
Red, permanently on	The error list contains at least one alarm which, depending on the acceptance action, has either already ended but has not yet been accepted or is still active but has already been accepted.
Yellow, permanently on	The error list contains at least one warning which has either already ended but has not yet been accepted or is still active but has already been accepted.

3.5.3. Navigation in the operation panels and displays

> Actions that are normally made by touching the screen of enCore devices
> or the keys below it can now be done with the help of a mouse.
> Click on the corresponding areas in the illustration of the remote operation panel
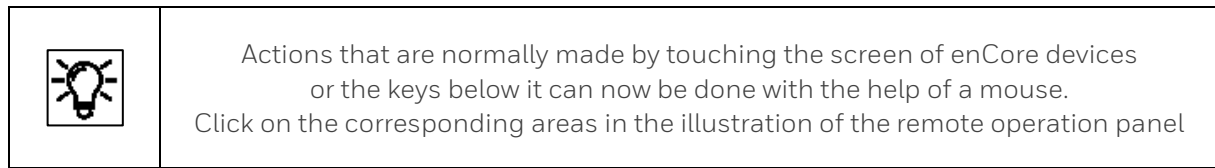
The following section describes the menu control and operation using the remote operation panel in general form based on examples. The figures below provide an initial overview of the structure. The details are described later in this document.

① Navigation keys
② Function keys
③ Display area
④ Power-LED
⑤ Status-LED
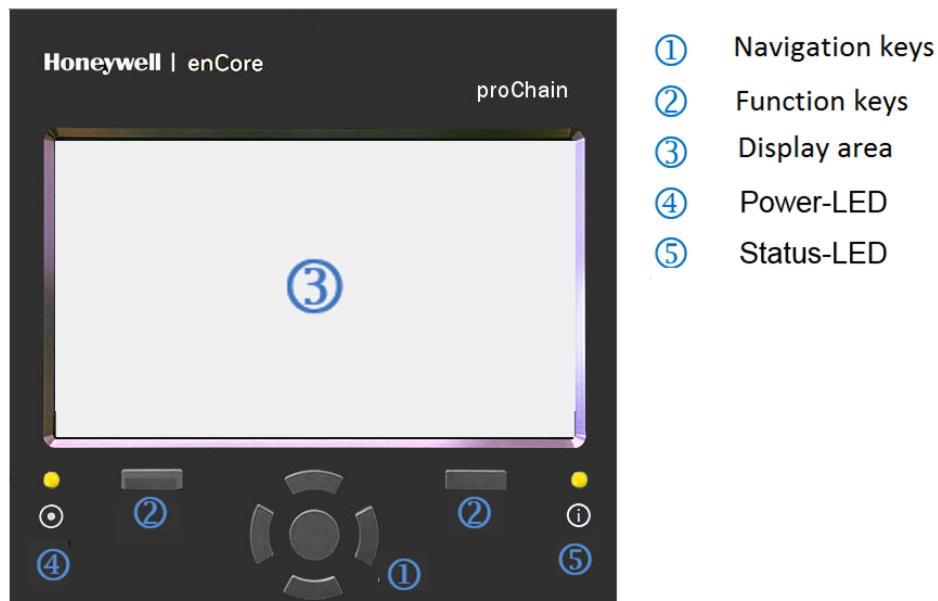
Figure 3.50: Overview of the remote operation panel

The following contains further information on the screen area, also known as the display.

① Software part
② Display name
③ Time
④ Display data area
⑤ Home
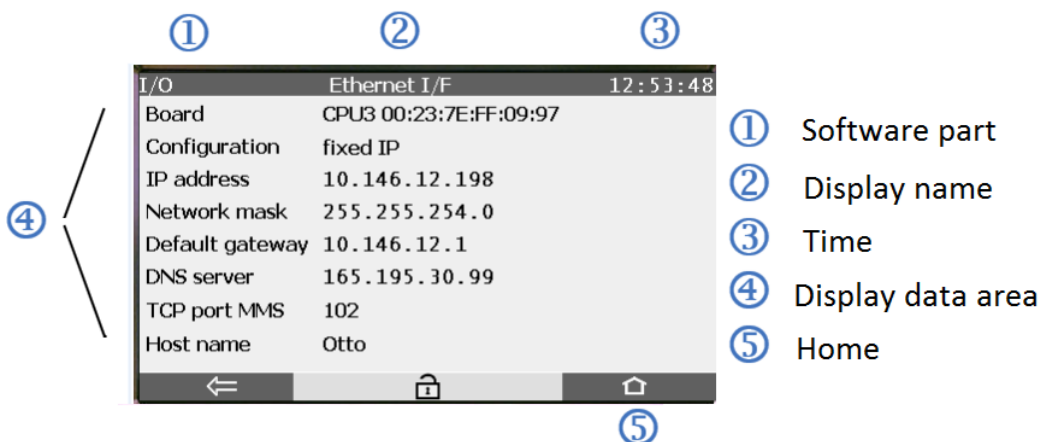
Figure 3.51: Remote operation panel display

There are two function keys below the display (screen area). Clicking on one of these keys activates the function of the display button on the display shown above it. This can also be selected directly.

This keys therefore only standardize the control of the device and are redundant with the buttons.

The displayed navigation keys (Up, Down, Left, Right, Enter) are designed for navigating in the menus and displays. They are alternative and supplementary controls to clicking with the mouse in the screen area.

① Up
② Down
③ Left
④ Right
⑤ Enter

Figure 3.52: Navigation keys and Enter

Since some displays are too long to be shown completely, a small yellow diamond on the right-hand edge indicates where you are in the list. You can scroll through the list of displayed values using the **Up** and **Down** keys.
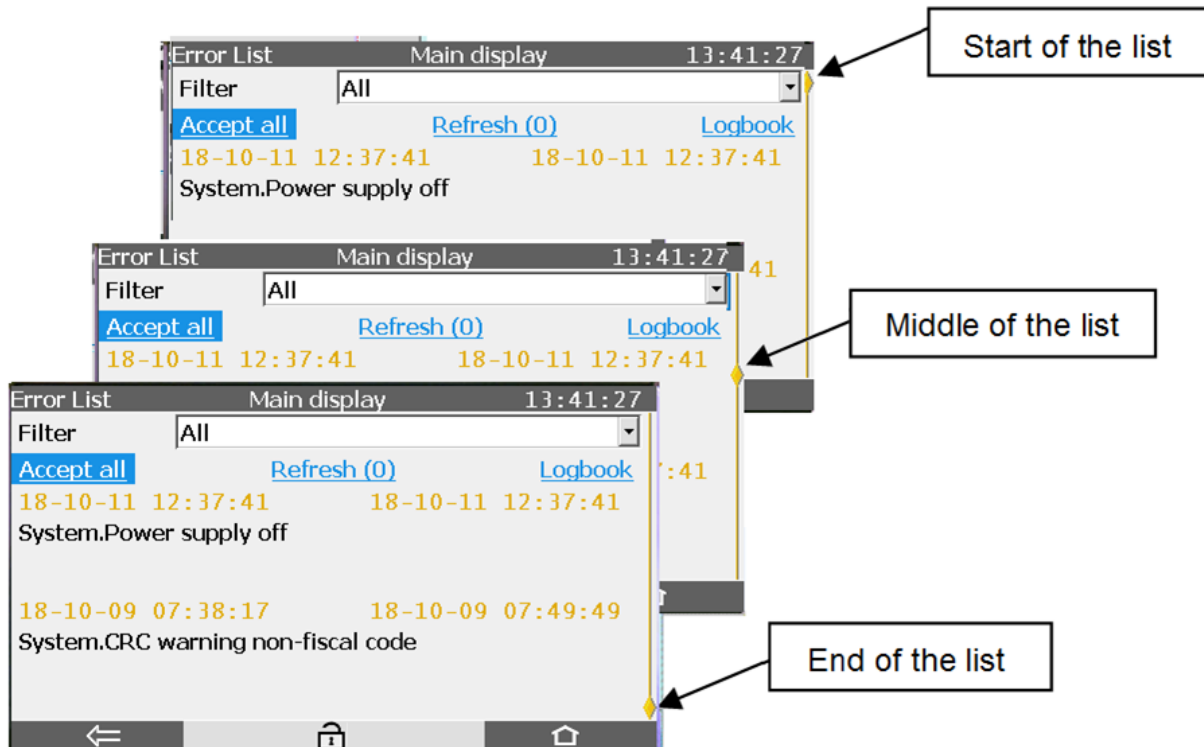
Figure 3.53: Navigation in long lists

Other menu control properties include items which can be selected on the display such as **hyperlinks, actions, drop-down lists** and **input boxes**.

You can select all the entries in question using the navigation keys or by clicking on them.

This selection then has a background or is highlighted, such "**Device monitor**", "**Date**" and "**Time**" in the following examples. Not all displays have this option.

Hyperlinks and actions are shown in the displays in blue.

Figure 3.54: Hyperlinks and actions

	Hyperlinks
	enable you to navigate through the displays by opening the appropriate display automatically when they are activated.
	Actions
	enable you to perform a specific function. Dialogs appear for editing values.

A **drop-down list** can be identified by the triangle on the small grey box next to the value with everything being framed in blue when selected.

Input boxes show their values in white boxes. When a value has been selected, it will be displayed with a blue background and there will be a blue border around the box. See the following examples:
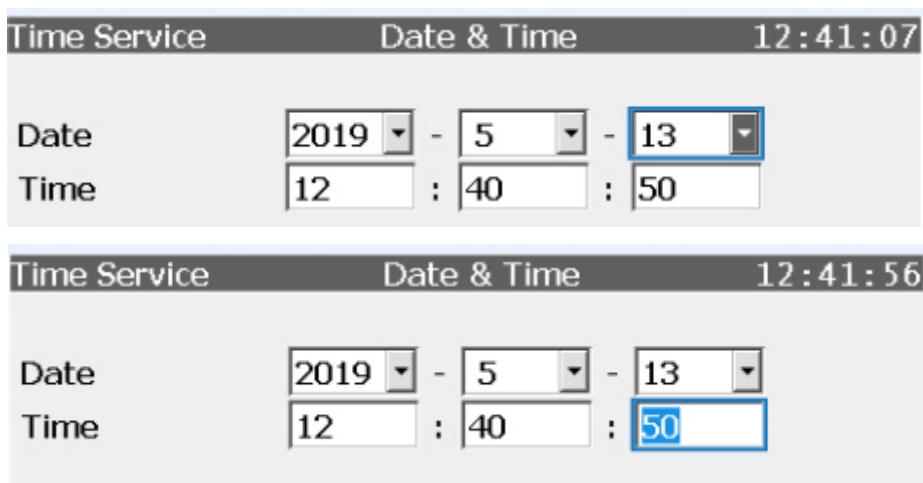
Figure 3.55: Drop-down list and input boxes

	A drop-down list
	enables you to choose between predefined values. Input boxes enable you to edit values freely within specified limits.
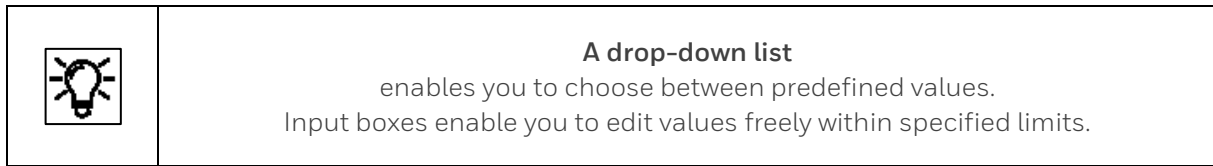
Selectable points are underlined in blue, for example, "**Device monitor**" and "**Software status**" in Figure 3.53.

**If the text is not underlined, as is the case with
"Reset battery status to 100%" (in the next figure), the item cannot be selected**

The **Up** and **Down** keys enable you to jump to the next selectable item, even if it is not in the visible section of the display. In this case, look for the small yellow diamond on the right-hand edge. To confirm or execute the **selection with a blue background** (in Figure 3.51, for example, device monitor), you must click on **Enter** in the navigation keypad. Alternatively, you can click direct on the required item which is then executed immediately.
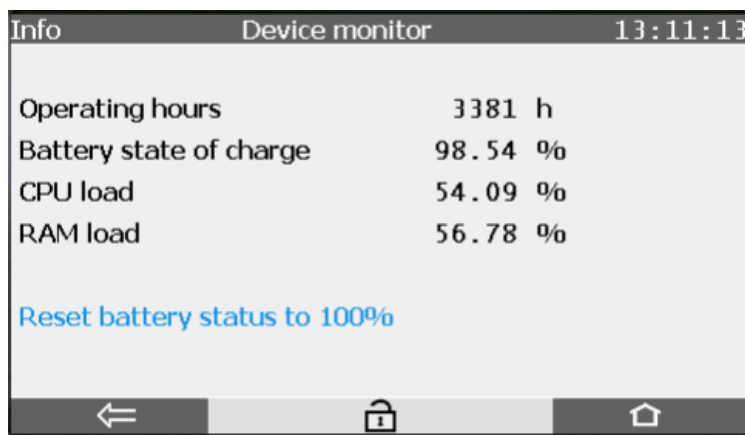
Figure 3.56: Selecting and executing hyperlinks and actions

There are two other navigation areas at the bottom edge of the display on enCore devices. These are also shown in the operation panel and change appearance depending on context. The figure below shows the possible combinations (without the possible symbols in the center).
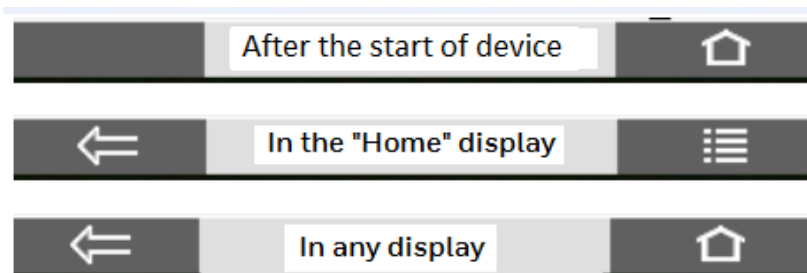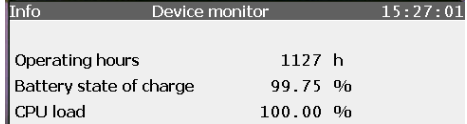
Figure 3.57: Buttons on the bottom edge of the display

Generally, these enable you to jump to a different display. Select a navigation area next to the symbols, or use the keys displayed beneath, by clicking it.

Clicking on the ⌂ area returns you to the "**Home**" display. The ▤ area shows the display of the serial number with "**Device type**", "**CPU Serial number"** and **certificate options**. Clicking on ⇐ returns you to the previous display.

Navigation example:

If you are in a display, there are the following navigation destinations:

1. To subordinate displays or dialogs (for example, from (i)System proChain to Device monitor) Click on the navigation keys (Up, Down, Left, Right) until the required destination has a blue background. Then click on Enter. Alternatively, simply click on the destination	Info proChain 13:53:00 proChain-Testdevice-00 (DEMO) Device monitor Software status
2. Back to the previous display (e.g. from the Device monitor to (i)System proChain) Click on ⇐ or the key shown beneath it.	Info Device monitor 15:27:01 Operating hours 1127 h Battery state of charge 99.75 % CPU load 100.00 %
3. Back from any point to the Home display (for example from Device monitor) Click on ⌂ or the key beneath it to go to the Home display (display (i)System Q2 is skipped in this example, the symbol changes to ▤). If a basic display has been parameterized, click on ▤ again to get to this display.	

💡	Regardless of the current device display, you can always return to the start screen using the buttons on the bottom right of the screen (symbols ⌂ or ▤) with a maximum of 2 taps.

3.5.4. Middle of the bottom line (security switch/ users/ visibility/aktivities)

Additional information symbols are shown at times in the center of the bottom line:
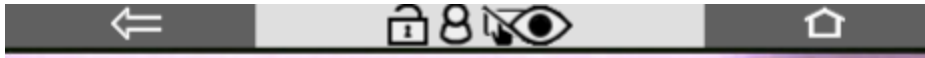
	These symbols are only displayed in context. It is possible that not all or none are displayed

Safety settings which comply with the approval must be protected for fiscal measurements. This is done using the security switch (SSW). This is a physical switch inside the device.

If this security feature is missing, this is shown by this symbol which appears in every display.

In "**non-fiscal operation**", this connection may be open and the symbol is displayed. Since the housing must be opened to close the security switch (SSW), special rules apply, see section 2.9.2 Opening and closing the hardware parameter guard (SSW)).

You can also have a seal affixed to the switch itself to verify unauthorized access. Please contact Honeywell if necessary.

If the symbol is shown, somebody has logged in and is working with the device. Normally you are the logged in user, if not you should not carry out any further activities, so as not to disturb the work of the user who is logged in. If several people access the device, mutual agreement is always required since the remote operation panel can affect other functions. (Further information on this is provided in section 3.6 The remote operation panel displays and actions)

These symbols provide information about the visualization settings and input conditions on device displays. (not relevant for the proChain GC.)

The following table gives an overview:

	means that the security switch (SSW) is open.
	means that the user is logged in.
	means the toggle buttons **[Grant/Revoke local view]** and **[Grant/Revoke local control]** have been used and the visualization and input conditions deviate from the standard settings. (not relevant for the proChain GC.)

3.5.5. Entries and changes in the remote operation panel displays

	Changes are usually made in the following steps: • Log into the device • Complete and confirm the changes • Log out of the device

Use the **Users main display** to log in, confirm and log out ⇨ see section 3.6.11System display (device) Users (Login/Logout/change password). The procedure for changing parameters is also described there.

Values which can be changed are displayed in white boxes. These are editable boxes. These editable boxes appear depending on the login status and user rights. Changes are not finally entered and saved to the device until the user has explicitly confirmed them. If the user has logged out beforehand or is logged out due to another event without confirming the changes, any changes that have been made will be discarded.

Entries and changes can be made either using a **drop-down list** or the displayed **keypad**.

Changes using a drop-down list

are shown in the following example.

A drop-down list can be identified by the small gray box with a triangle next to the value to be changed, in this example after month and day.

The view will change when you click on it, in the example the year.
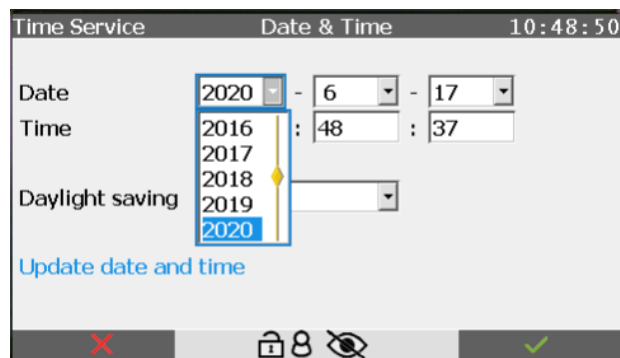
Figure 3.58: Drop-down list open

The drop-down list is opened and displays the available values. The superimposition keys enable you to select a value from the drop-down box. Your selection then has a blue background (in the example 2020). After this user action, a confirmation of the selection is requested, which is why the buttons at the bottom of the display area are marked with a check or an X symbol. See figure.
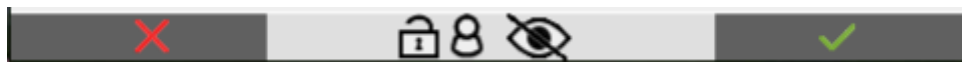
Figure 3.59: Selection confirmation

You can now accept your selection by clicking on ✓ or discard it by clicking on ✗.

	The confirmation described above simply confirms your entry. If you wish to use your entry, you also have to execute your change. In the above example, this is the action **Update date and time**.

Changes using a displayed keypad for entering letters and numbers. You can identify an entry box by its white background. When the box has been selected, it will have a blue border and the content (if there is any) will have a blue background. In the following examples, the entry boxes for **Password** and **Time** can be seen. The view will change after you click on a box as shown below and the keypad will be displayed.
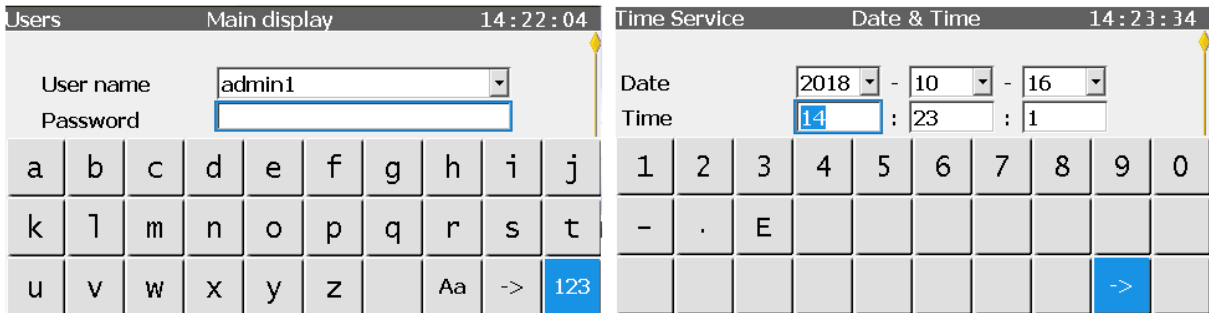
Figure 3.60: Keypad displayed

Depending on the expected entry, a keypad which can be switched between letters and numbers (on the left in the example) or just a number pad (on the right in the example) will be displayed.

You can switch between upper and lower case letters using the "Aa" key. You can switch between letters and numbers using the "123" or "ABC" key. If a special symbol must be entered, the "Aa" key will also appear on the number pad. When this is pressed, the special characters will be displayed and can be selected.

To select a key (button) in the box click on it or use the navigation keys. Your selection then has a blue background. The keypad will remain open and you can select and add another value in the box. If all the values are already filled in, you can close the keypad using ✔ and keep all the entries in the box. You can discard the entries using ✖. The keypad will also close.

When you leave entry mode, a consistency check is made to find whether a value has been entered which in this context is nonsensical or not allowed. If this is the case, the value is not saved and the previous one is retained or replaced by a substitute value.

	If only individual characters are to be replaced, it is possible to jump to the end of the existing entry using the `->` key and then supplement the entry. At the same time, the key changes and shows the following symbol `<-` which allows individual characters to be deleted starting from the right.

If the entry requires a restart, this is indicated in the display with a link. The restart is then carried out immediately after you click on the link.

If you log out without completing the restart, the changes will not be saved. An example of this is changing the IP address.

3.6. The remote operation panel displays and actions

In contrast to other enCore devices, the proChain GC uses the operation panel displays mainly for status purposes. The measurement results are output via other enSuite functions and via chromatograms (see sections 3.7 or 3.8 and 3.9).

You can get to any display using the navigation methods explained in the previous section. In addition, device dialogs and confirmation prompts guide you through the displays. Progress displays provide information about the success and progress of actions.

> The current time is shown in the top right-hand corner of most device displays.
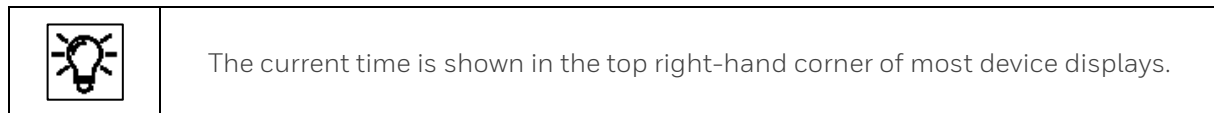
Changing display is generally done using a special display known as "**Home**". This is the main node for the device. This display is explained first of all as it provides a better understanding and a good overview. Starting from the "**Home**" display, various other displays are then presented and the details described.

3.6.1. Home (display overview/device language/start-up error)

> If not already shown the "**Home" display** can be accessed using 🏠 . This is a special display; it shows the software structure of the device.
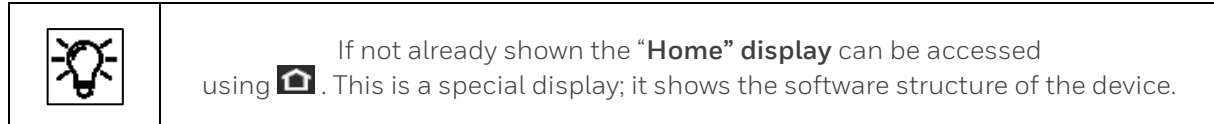
Individual software parts and selected other functions which should be easy to access (for example, changing the language) are displayed here in the form of small symbols. These symbols are marked with the name of the relevant function and may contain additional branching. Figure 3.55 shows the main node, the "**Home**" display.

The menu structure is like a tree, in other words, a subordinate menu option of a module may, in turn, include subordinate menu options and branch off to the side.

Only the contents of the "**Home**" display on delivery are described below. If you have the required rights, you can change and supplement this structure using the enSuite configuration and analysis software.
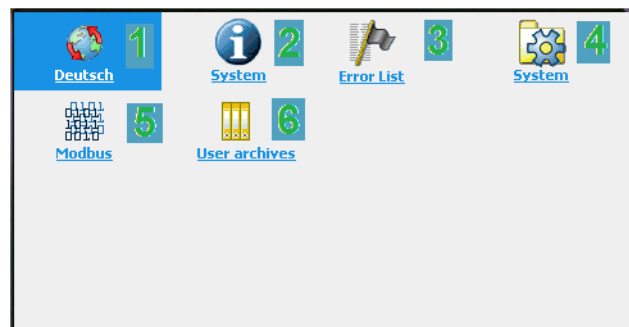
(⇨ note also further hints in this document)

Figure 3.61: "Home" display nodes

Navigation options in the Home display

Selecting a symbol (clicking on it or using the navigation keys and Enter) in the Home display will open it to display the functions grouped in this folder. If only one function is assigned to this symbol, selecting it will immediately take you to the main display of this function.

Symbol	Explanation
1	The "**Globe**" enables you to **change the language** to the language stated below the symbol.
2	The displays behind "**Info (System)**" provide an overview of "**Serial number**", "**Ceritificate**," "**Device monitor**", "**Software status**", "**Display test**" and "**License info**". The state of the **security switch** is also specified.
3	The "**Error List – Main display**" display contains a complete list of **all active errors** and those which are no longer active (but have not been accepted).
4	The gear wheel symbol opens the **System display**, another node to the displays for the **Time Service**, **User Management**, **Logbooks** and **I/O functions**
5	The "**Modbus**" display enables you to select various tabs and view them. For further information
6	The "**User archives**" display enables you to select various archives and view them.

Changing the device language (optional)

Up to two languages are possible. English is always the second language. The devices will always start in the first language. Please notify Honeywell if you wish to change the first language installed in the device.

If English is selected as the first language, the device can only be operated in English.

The design of displays and menus, for example, date and time format, depends on the current parameter set and language. If the language is changed, all the data in the device will be renamed or reformatted and displayed in the current language. Carry out the following steps in the "**Home**" display to change the device language:

Step	Action	
1	Select the "Globe". The alternative language is shown below the symbol Confirm your selection.	Deutsch
2	The language has changed. The text beneath the "Globe" shows the previous language as the new alternative.	English

Error display after start-up or for system errors

A system error may occur in very rare cases. If this happens, a prohibition sign will be visible in the remote operation panel. The device has switched to emergency mode.
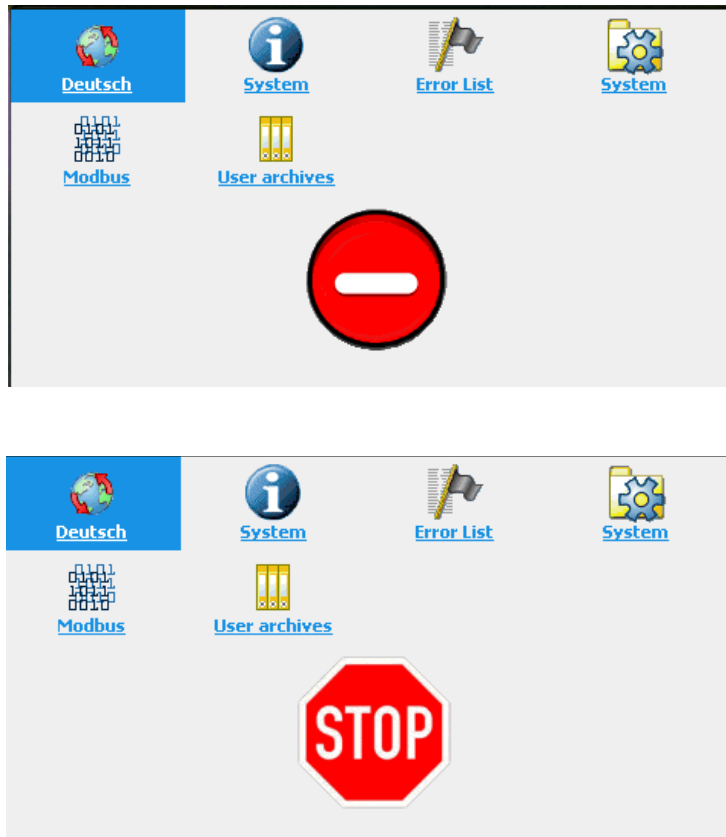
Figure 3.62: Device not ready

Examples of these errors include uploading an incorrect parameter set or internal connection errors. This means that after or during the start-up process, for example, a one-way street sign will be displayed, and only the basic functions for troubleshooting will be active; all other functions are disabled.

	Was the error caused by the parameter set? Rectify it by transferring a correct parameter set to the device, for example, the default parameter set. ⇨ 3.4.14 Restoring the parameter set to factory settings (importing data) If the error cannot be rectified by the parameter set, please contact Honeywell.

3.6.2. Info (System) display overview

	This symbol opens the following display:

The display shows the device's **serial number (first line)** and the status of the **security switch (SSW).** This is a switch which can be sealed, also known as the calibration switch.

This protection prevents changes to the fiscal settings or main device settings and software downloads (see section 3.4.15 Changing the software configuration (software update))
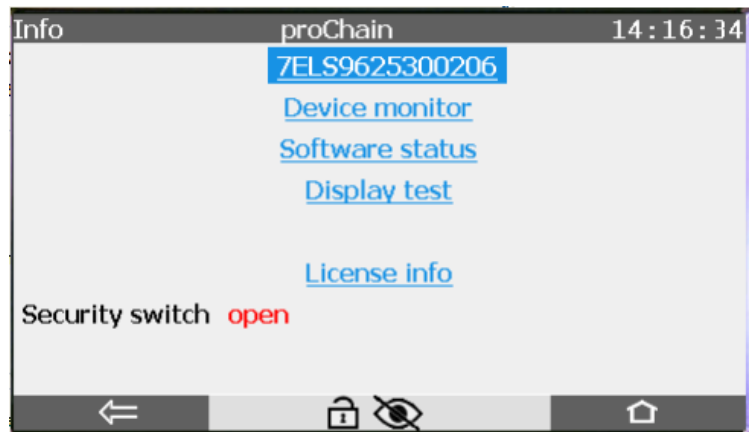
Figure 3.63: Info (System) display

Furthermore, the display provides access to the following functions:

3.6.3. Info (System) display Serial number and TLS certificate

The serial number shows after a klick on it as second display information of the device type and the used CPU.

The link **Certificate** enables to view the MMS certificate for secure data transmission. The action **Delete certificate** allows the authorized user to delete the existing certificate and create a new one.

Figure 3.64: Display serial number (example)

The certificate display shows the details of the used certificate for secure data transmission. Since the display is too long to be shown completely, use the small yellow diamond on the right-hand edge or scroll using the **Up** and **Down** keys.
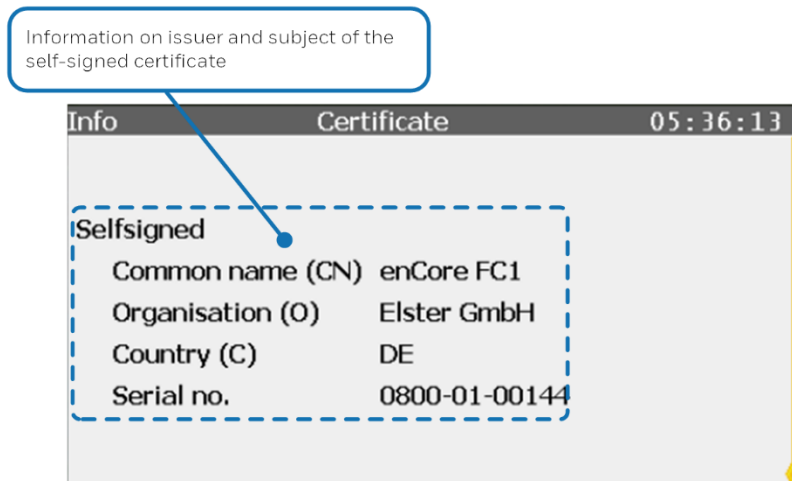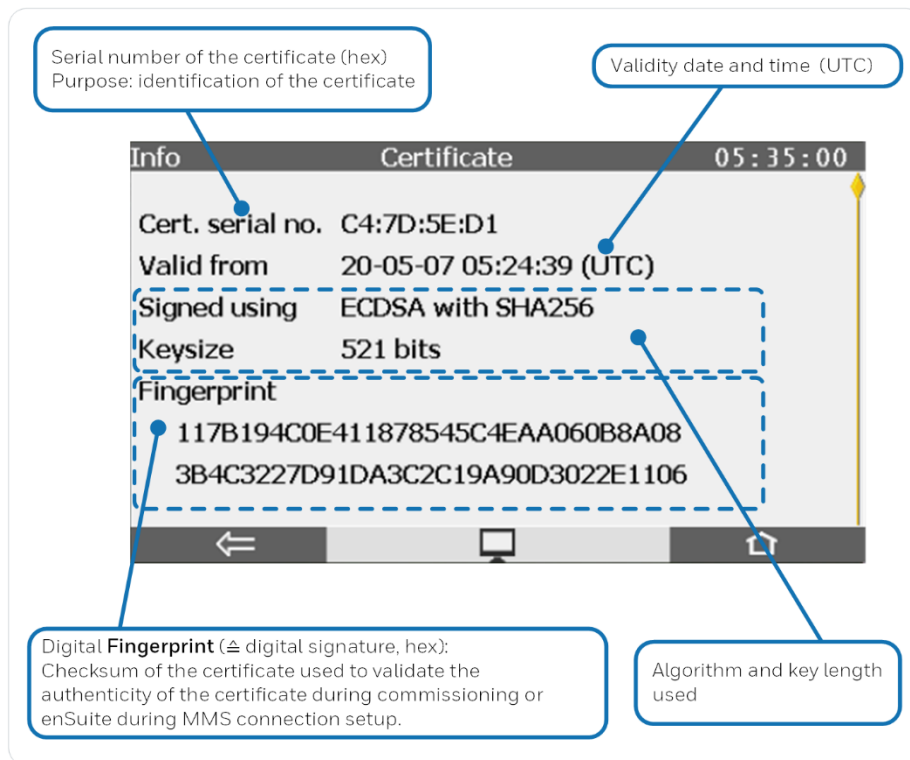
Figure 3.65: Display certificate page one and two (example)

	To increase security, we recommend that a new TLS certificate always be created if the existing one was made under unknown conditions, e.g. on the transport route or in trial operation.

Step	Change a TLS certificate and publish it to enSuite
1.	**Prerequisite:** The enCore device is preferably connected to enSuite via USB, or alternatively via TCP/IP
2.	Log in on the "**Users main display**" on device or on the remote operation panel (Home >> System >> Users).
3.	Switch via basic display to device display Info – <device serial no.>. Info 0800-01-00144 08:56:13 Certificate Delete certificate Device type **proChain GC**
4.	Delete the existing certificate with the action **<u>Delete certificate</u>** the text of the action will change see figure (The certificate will only be permanently deleted on shutdown) Info 0800-01-00144 08:56:13 Certificate Reboot and create certificate Device type **proChain GC**
5.	Restart the device with the action **<u>Reboot and create certificate</u>**. On restart, the device generates a new certificate for MMS communication.

3.6.4. Info (System) display Device monitor

The device monitor shows information about the operating hours and battery charge and about the CPU and RAM load.

Info   Device monitor   15:17:38

Operating hours   430 h
Battery state of charge   100.00 %
CPU load   54.32 %
RAM load   46.02 %

Reset battery status to 100%

Figure 3.66: System info – Device monitor display

The battery is mainly used when the device is switched off. After service or repair work (including battery replacement), a user with the appropriate rights can reset the battery status to 100%.

	The battery must be replaced when the charge falls to below 20%. A discharged battery may, in certain circumstances, result in the loss of calculated and saved measurement data. The device will no longer start correctly. DANGER OF EXPLOSION IF THE BATTERY IS NOT REPLACED CORRECTLY. The battery replacement must be carried out by Honeywell service personnel.

3.6.5. Info (System) display Software Status

Software status shows the identification data of all software parts in the device. The data consist of the name of the software parts, the version number and the checksum. In addition to the "**Last check**", the topmost line contains the date of the readout for the following information.

The first column lists the names of the software parts. These names are selectable hyperlinks and take you to subordinate displays (component displays) containing information on the corresponding software part. The second column contains the software version number of the components and the third column contains the relevant checksum. During operation, the actual checksums are calculated and compared to the reference values.

If an entry (checksum) is marked red, the last test failed, in other words, a discrepancy was identified.

In this case, an error is generated, see also section 1.1.2 Symbols abbreviations and definitions.

Figure 3.67:System info – Software status display

The following shows some examples of component displays. You will find the following there: Last check/Software part/Name/Version/Software/All parameters

Figure 3.68: System info – Software info display

	The above figure only shows examples. If, for example, the device is not used without an approval file, the "**Secured parameters**" display will not be available. Furthermore, some links can only be selected if there are no red entries. As the example shows, the component displays do not have a uniform structure.

The "**Software status**" display shows the short name of an **approval file** in second place on the list. This file contains the definition of which parameters are backed up before being changed so that the device can be operated in compliance with customer specifications or approvals.

In the example above non approval file is used, this operation is also possible and "**NonFiscal**" is as the abbreviation displayed in this case.

	If an approval file is used and both the official access rights of the parameterization as well as the fiscal software component versions are in line with the approval file, then this text is black; the text is red in the event of any deviations. If you activate the hyperlink of the Approval, a display is then evoked which contains detailed information on the approval.

If the device is operated with an **approval file** and a closed SSW, the appropriate parameters are protected to prevent them being changed.

3.6.6. Info (System) Display test

This function is mainly used for devices with local display. **Display test** shows a display in which all the pixels in the display area are switched on and off alternately. This enables you to check whether the screen is working correctly. Since the **proChain GC** does not have an enCore display, this test is not relevant here

You will see the remote operation panel flashing and can end the test using ⬅ or ⌂.
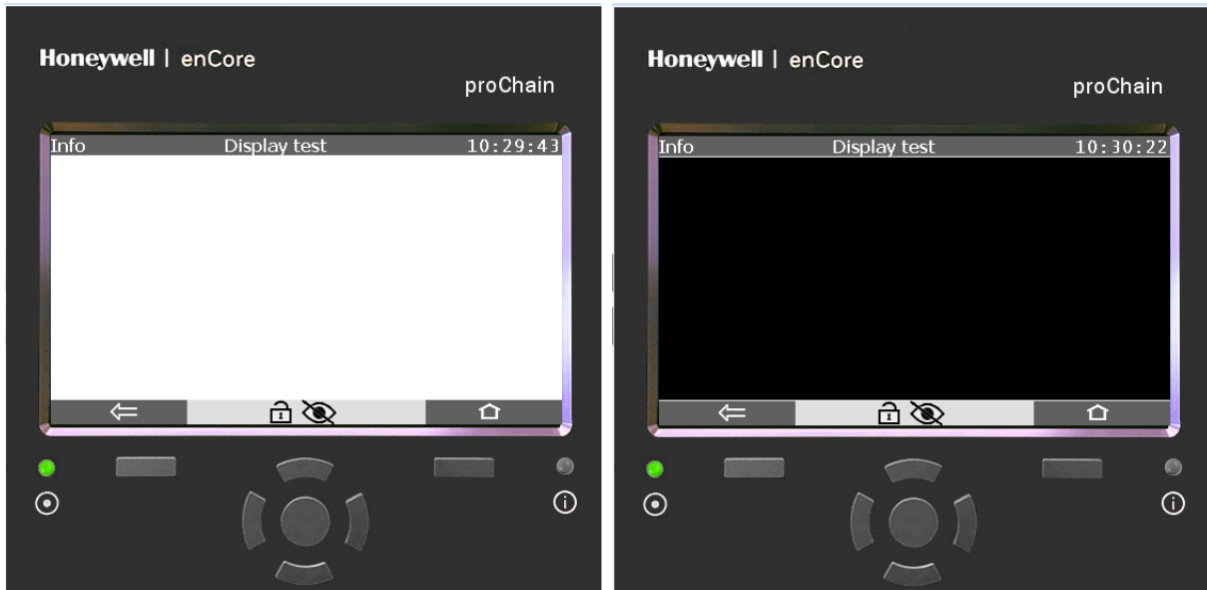
Figure 3.69: System info – Display test display

3.6.7. Info (System) display License info
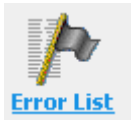
The hyperlink leads to a display with details of licenses, copyright and rights.

Figure 3.70: System info – License info display

3.6.8. Error List – Main display (accepting / quit error messages)

Background: If the status LED is lit or flashing in red or yellow, there are entries in the error list.

Error List	**The device manages warning and alarm messages in this list and records them in the logbook. Which messages appear, depends on the parameterization of the device. The list can be opened by clicking on this symbol.**

The error list shows all the alarms and warnings which are either currently active or have already ended but have not yet been accepted. These alarms and warnings also affect the reaction of the status LED. After it has been opened, the list is "**frozen**" to avoid having to re-sort the entries. The list is arranged in ascending order by date and time. The last event before the display was opened is at the top.

Time stamps (date and time of the start of the error and, if applicable, the end of the error) are shown above each message. These time stamps for all alarms are displayed in red text and for all warnings in yellow text.

A current error can be identified by the fact that the *Ends* time stamp (right) has not yet been entered and instead empty boxes are displayed. The figure below shows an example of the error list and explains the display in detail.
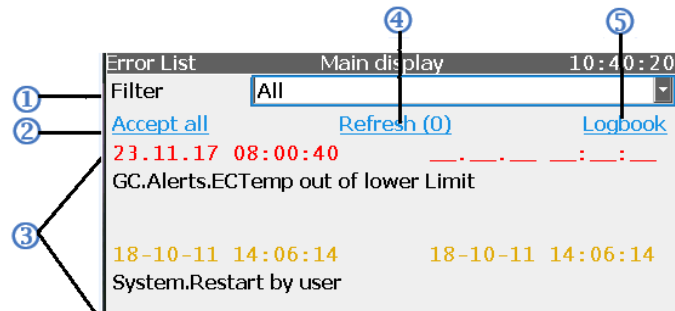
Figure 3.71: Error List – Main display

Item	Error List details
①	**Filter selection box**: In the first line, you can use the drop-down list to restrict the display to the selected range.
②	Action **Accept all**: All displayed errors which are no longer current can be accepted at the same time so that they are no longer displayed. They must comply with the defined acceptance action for this purpose. Messages which are still active or have been filtered out will be retained.
③	Section of the **error display**: The date and time of the start of the error are displayed on the left and the end of the error on the right (if applicable), with the relevant message beneath. If the list contains more than 2 events, you can scroll through it (yellow diamond on the right-hand edge).
④	Action **Refresh:** the error list which was "frozen" when it was opened, will be updated.
⑤	Link to go to the **logbook:** you can go to the "**Logbook error list**" ⇨ See next section

The error list is sorted in chronological order with the latest message being displayed first. If there are only a few errors in the list, you can scroll to specific messages. If the list is long, you can filter the contents based on the origin of the message.

To do this, select the software part, for example "**Time Service**", from the **Filter drop-down list**. Only the messages which apply to this software part will be displayed.

The error list shows all the alarms and warnings which are either currently active or have already ended but have not yet been accepted. If it contains more messages than can be shown on one screen, the scroll bar appears in the right margin.

🔆	**Entries in the error list must be accepted** (see the following steps). On delivery of the device, this is only possible using the defined acceptance action if the cause of the entry has been rectified. You may also require the appropriate rights. You can change the acceptance action using enSuite. Details are available in **enSuite online help**

Step	Action: Clearing (accepting) the error list
1.	Navigate to the Error List main display and open it. (Click on **Home >> Error List**).
(2.)	To accept only messages for a specific software part from the list, open the filter and select the appropriate entry.
3.	Select "**Refresh**" to update the list which had been frozen upon opening (number in brackets = number of new messages).
4.	Start the **Accept all** action. The selected list will be accepted and refreshed according to the parameterized acceptance action.
(5.)	Repeat these steps for other display texts from other software parts if necessary.

After all the entries have been accepted, the system will be returned to error-free status. The status LED will be lit in green. You can go straight to the logbook display from the error list display using the **Logbook** hyperlink. The logbook will also log the start and end of all messages (alarms and warnings). It is similar to an archive; each entry is assigned an ordinal number. The entries which have been removed from the error list can be found here.

🔆	Honeywell provides assistance with troubleshooting work. Contact data are provided at the start of this document.

3.6.9. System display (device) overview

	The system display, a node to additional displays, is opened by selecting this symbol.
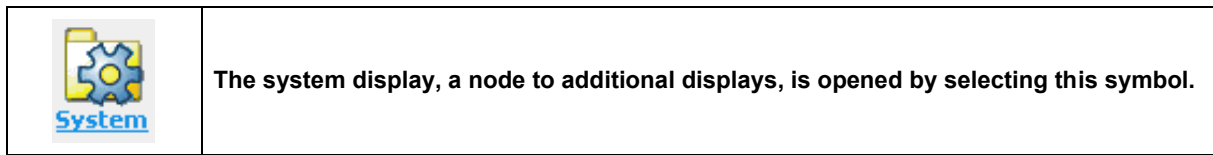
You can go to the following sub-displays using this node:

**Time Service,
Users,
Logbook,
Audit trail,
I/O.**
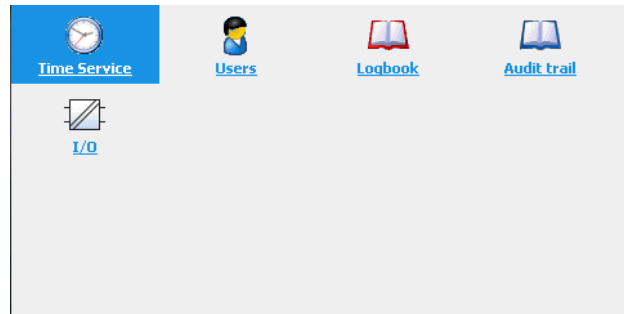
Figure 3.72: System display

3.6.10. System display (device) Time Service

The system time (permanent device-internal calendar with date and time) is saved on a battery-buffered clock block. The time or system time is therefore available even after the device has been switched off and on again.

Changing the system time is the generic term for both *synchronization* and for ***adjusting the date and time***.

	The <u>time service</u> to output and change the device's internal time has up to four standard displays. These displays will change depending on the parameterization and the user's login.
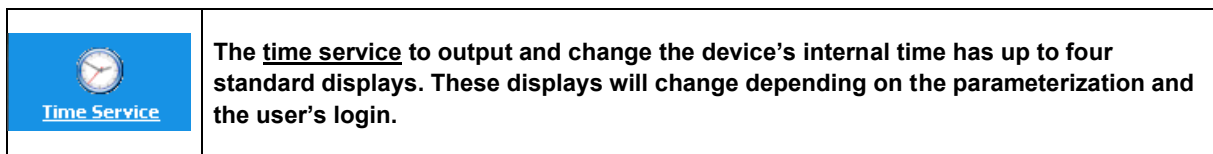
The following figure shows the hierarchical structure and the navigation through the displays
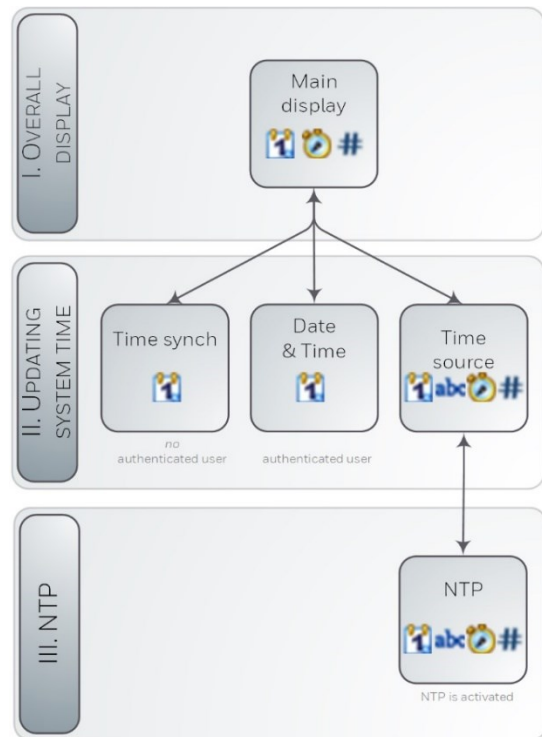
Figure   3.73:
Time Service display overview

Depending on the user's authentication, the main display branches to the corresponding display to change the system time. The hyperlink **NTP overview** is only displayed when time polling via NTP is enabled in the enCore device.

The initial display of the T i m e S e r v i c e is the **Main display**. Access: 🖥 **System –** 🕐 **Time Service**

Figure 3.74: Time Service main display without/with NTP synchronization

The **Time Service main display** shows the date and time (also known as the **system time**). The abbreviation (DST) means daylight saving time and is only shown if the current time is in daylight saving time.

The Network Time Protocol (NTP) is a standard for clock synchronization in computer systems. The NTP overview link is only displayed if NTP synchronization has been enabled in this device.

Furthermore, the following is also displayed:

Time zone: Geographical location
Latest update: Time stamp of the last time change.
Latest deviation: Deviation (in seconds) at the last time change
Ext. source: Number of the external source for the last time synchronization

For a user who is not logged in or a user who is logged in but is not entitled to change the device time,

"**Time Service – Time Synchronization**" will open as the second display after "Date & Time" has been activated.

Figure 3.75: Time Service – Time Synchronization display
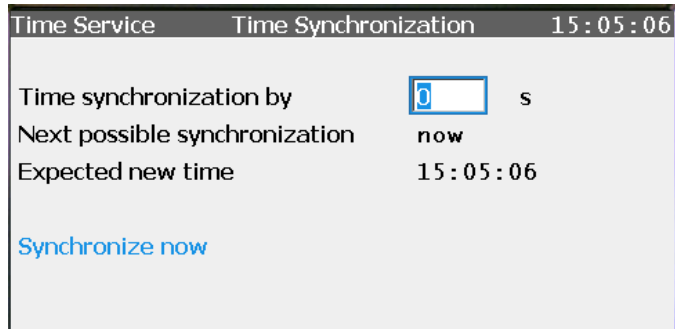
The display shows following information:

Time synchronization by: Enter the seconds in the box by which the system time is to be changed. The entry depends on the limits defined in enSuite.

Next possible synchronization: Next possible time for another synchronization. The calculation is made after a synchronization based on the synchronization interval parameter which is also set in enSuite.

Expected new time: The time service continuously calculates the new system time in this line.

Synchronize now: This action (if available) specifically saves the new time as the system time.

Step	Action: Time synchronization (can be performed by all users)
1.	Open the **Time Synchronization** display without logging in (System > Time Service > Date & Time).
2.	Enter the seconds (box after **Time synchronization by**) by which the system time is to be changed. Both positive and negative values may be entered. The box will only accept values within the parameterized synchronization window.
3.	Check the information after "**Next possible synchronization**". If the entry is **Now**, you can synchronize the system time (step 4); otherwise, you must wait until the next specified time.
4.	Click on the action "**Synchronize now**" and the expected new time will be saved as the system time.

For a **user who is logged in** and entitled to change the device time, after "**Date & Time**" has been activated, the display with the same name will open as the second display. The type and sequence

of the display (this can be parameterized) is dependent on the language and the time stamp format, for instance. The following shows an example:
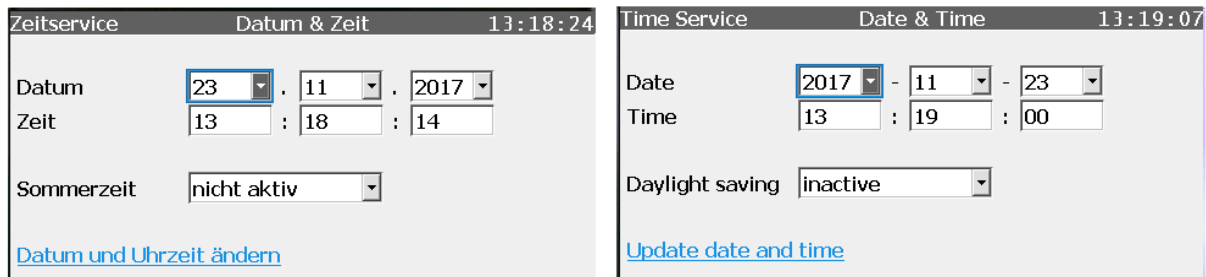
Figure 3.76: Time Service display "Date & Time" (various time stamp formats)

The system time can be adjusted in this display. You require the appropriate rights for this purpose and the security switch (SSW) must be in the setting specified in the parameter set. The display provides a selection for using daylight saving time.

Step	Action: Setting the time and date
1.	Log in and open the **Date & Time** (System > Time Service > Date & Time).
2.	Enter the current date and time using the drop-down lists and keypads.
3.	If applicable, click on the Daylight saving box. This is only possible if the appropriate setting has been made in enSuite. Then choose between the following: **Active** The device's system time is in daylight saving time. **Inactive** The device's system time is in standard time. Automatic switchover between daylight saving time and standard time is not provided for in the default parameter set. Information about setting the time using enSuite is provided in section 3.7.1 Update date and time (system time action).
4.	When the entries have been made and are correct, select or click "**Update date and time**". A status message is displayed briefly at the bottom of the screen for confirmation and the new time setting is used. If the synchronization fails, this is indicated by red text.

The final optional display entitled **NTP overview** is only displayed if NTP synchronization has been enabled in the device (by using enSuite).

It will open after NTP overview has been selected in the main display.

Figure 3.77:
Time Service – NTP overview display (optional)

This display provides the action Update now with NTP server synchronization. In addition, the following entries are displayed:

Latest update: time stamp of the last time synchronization using NTP. If a synchronization has already been completed, the precise time of the synchronization can be read in the display (date, time and time zone).

Latest deviation: The deviation (in seconds) at the last time synchronization using NTP shows by how many seconds the internal time deviated from the standard time at the last synchronization.

Server used: name or IP address of the NTP server used for the last time synchronization, for example, ptbtime1.ptb.de or de.pool.ntp.org or company servers as in the figure.
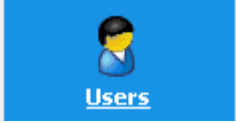
Server stratum: stratum value of the NTP server used for the last time synchronization (number of computers up to the time reference in the NTP hierarchy).

Select "**Update now**" to view the current time information values from the parameterized NTP servers, regardless of the specified query interval.

[icon]	Further details are available in the Docuthek (www.docuthek.com) under "enCore ZM1, BM1, MC1, FC1 – basic system with SFBs" and in the online help.

3.6.11. System display (device) Users (Login/Logout/change password)

Users	**The <u>User management</u> only provides a <u>main display</u>. Users can log in and out using this display whose appearance changes accordingly.** **It can be accessed via Home >> System >> Users**
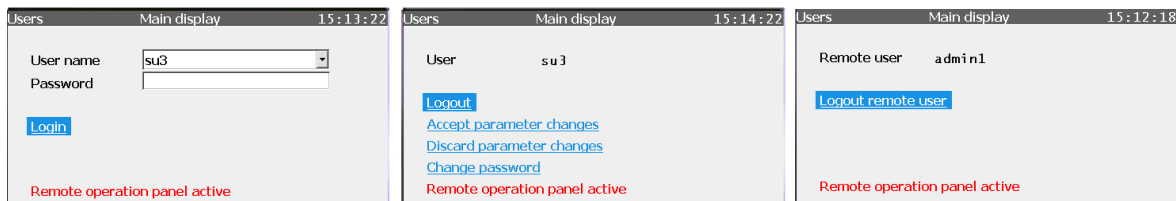
Figure 3.78: Users main display in different appearances

⚠️	In addition to enSuite, a user can also log in and out in at the remote operation panel. If a user has logged in at the remote operation panel and is not using the remote operation panel function, it can be used in another enSuite connection, because closing the remote operation panel or disconnecting the device does not change the login status. Before you close the function, you must log out to prevent changes being made by others using your user data.

The main display either shows the action **<u>Login</u>** or the user name (in the example above in the middle and right) of the user who is already logged on to the device.

This case occurs, for example, when a user is logged in due to other actions and the remote operation panel function is out of use or the connection to the device was interrupted without logging out.

After successfully logging in, the actions to save or discard changed parameters and the **<u>Logout</u>** are displayed. In addition, the user who is logged in can change the own password. See the picture in the middle of the example above.

The user is identified and checked based on a user name and password in the device, in other words, the user must have been created in the parameter set in the device (see section 3.3 User management and login).

The created users in addition with the super users and the administrator, which always exist, can be viewed and selected using the "**User name**" drop-down box. Only one user can be logged in at any one time. If a user is already using the remote operation panel the function, it can't be opened by other connections to the device.

If the remote operration panel is not used and a log in has happened by other users or other own activities "**Users main display**" will appear in the following appearance:

No "**Login**" is possible.

You can "**Logout**" the shown user

If you are the shown user, you can leave the display because you are already logged in or use it to log out.
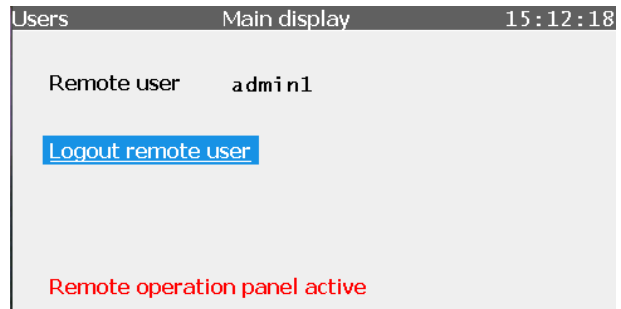
Figure 3.79: Users main display with remote (enSuite) user

If there is no login on the device the **User name** box shows the name of the last person to log in. "Login" is possible if your user name appears on the list and you select it.
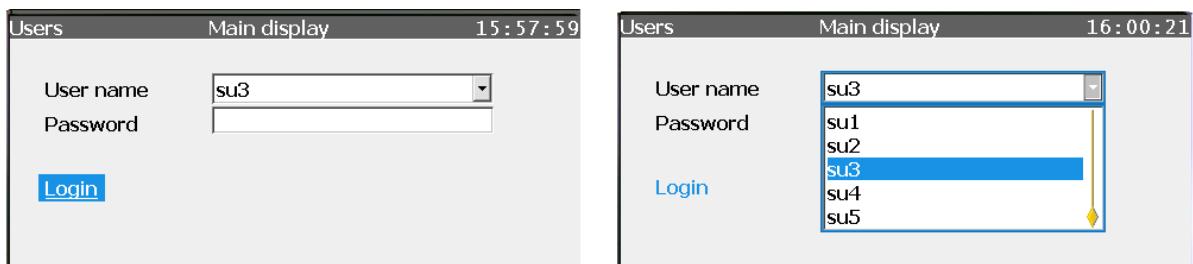
Figure 3.80: Users main display with the possibility to login

	Remote operation panel active
	This warning is always show, because the proChain has no local display like other enCore devices.

After selecting your **user name**, you have to enter your "**Password**".

	Attention – data security!
	The device is delivered without default passwords. Passwords should be assigned to all users by the administrator or super users at first. If no passwords have been set up, the login could be done with an empty "Password" box by everyone.

You normally have to carry out the following steps:

Step	Action
1.	Select the "**Password**" entry box.
2.	Enter the password using the keypad which appears. Each character in the password is replaced with an * on the screen. When all characters have been entered, click on ✅.
3.	Navigate to the "<u>Login</u>" line and click on this action

You are now logged in and have the rights assigned to you until you log out. The display appearance is as shown in Figure 3.78 in the middle.

> ⚠️ **If you are logged in as an administrator, you will have all device rights. All the factory settings can be changed, even inadvertently. <u>Take the appropriate care with your work.</u>**

If no action is carried out, you will be logged out automatically after a preset/adjustable time.

(Further information about this inactivity timeout can be found in section <u>3.2.3 Starting enSuite; the first steps</u>.)

After logging in, you can make changes to the parameters. You can then save or discard them. You can also change your own password or create a new one. The scope of access depends on the assigned rights of the user group under which you are logged on.

> 💡 Please do not forget that changes do not take effect until they have been confirmed.
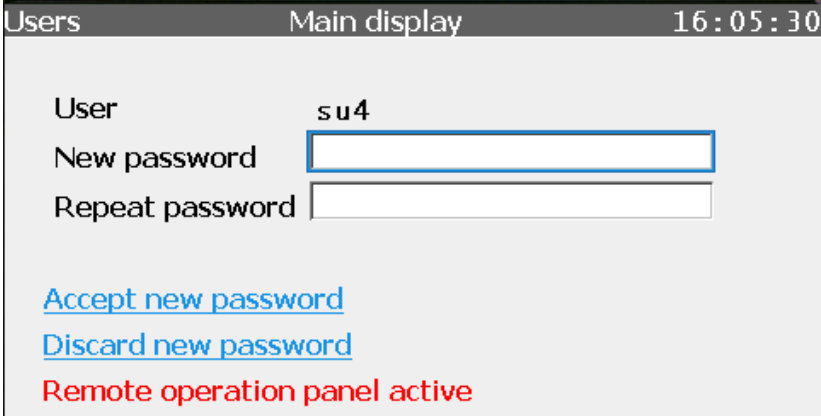
You can carry out the listed tasks by following the steps below.

Step	"Accept parameter changes" action
1.	Do the required changes in the appropriate displays and return to **Users main display**.
2.	Navigate to the "**Accept parameter changes**" line and click on this action.
3.	The changes completed earlier on the device will be saved.

Step	"Discard parameter changes" action
1.	If changes in the appropriate displays are not for saving, return to **Users main display**.
2.	Navigate to the "**Discard parameter changes**" line and click on this action.
3.	The changes you previously made on the device will be discarded and not saved.

Step	"Changing (own) password" action
1.	Navigate to the "**Change password**" line (see Figure 3.91). Click on this link and the display will change to the one shown below
2.	Navigate to the entry box at the top and click on it. Enter the new password as if you were logging in. **(Attention – data security! If you do not enter a password, the current password will be deleted and login is possible without password)** Please refer to the information in section 3.1.2Password guidelines and role-based access control for the structure of the password.
3.	Navigate to the second entry box and repeat step 2.
4.	After completing the entries, click on Accept new password. After the new password has been checked, it will be valid immediately and the display will change to the logout screen. Please ensure that you remember your password. If you decide you do not wish to activate the new password, click on Discard new password. The entry will be discarded and the original password will still be valid. The display still changes to the logout screen.

A status message is displayed briefly to notify you that the change has been made or, if applicable, the reason why the change has not been made.

Red text indicates that the password has not been saved.
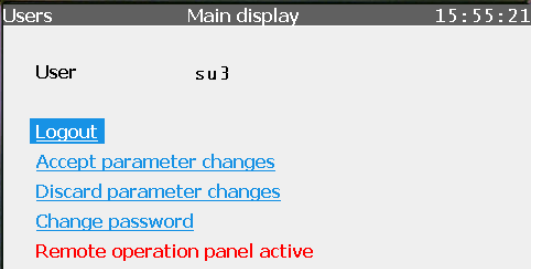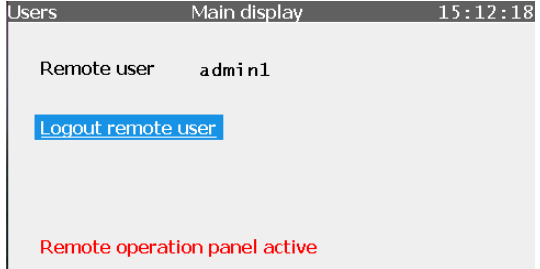
Figure 3.81: Users main display for changing the password

With the appropriate parameterization, you can additional / alternative protect the device against unauthorized access by operating with closed SSW.

Step	"Logout" action (from the device/on the operation panel)
1.	Navigate via "**Home**" to the **System >> Users** display (see Figure 7.59). This always contains an action to **log out** if a user is logged in. If you are not logged in yourself, you can agree with the user who is logged in to log them out. Please note that parameter changes by the user you log out will be discarded unless they have been saved.
2.	Select Logout or Logout remote user and confirm your selection.
3.	The display changes to the login screen. No users are currently logged in.

When you have finished your work,
you should log out to make the device available to other users.
On the one hand, this will prevent the device being blocked unnecessarily
for service work and on the other, it will prevent changes
being made by others using your user data.
Further details of the user management which applies to all enCore devices are
available in the Docuthek (www.docuthek.com) under
"**enCore ZM1, BM1, MC1, FC1 – basic system with SFBs**".

3.6.12. System display (device) >Logbook

The device has 2 logbooks: the "**Logbook**" and the "**Audit trail**" in which events are saved as a history during operation.

	The logbook (<u>Logbook error list, see the figure below</u>) documents / saves events and protocol the device operation in this way. Whenever an event begins or ends, the change of status is recorded in the logbook. The logbook cannot be deleted and contains up to 1,000 data records. When the logbook is full, the next entry will overwrite the oldest data record.
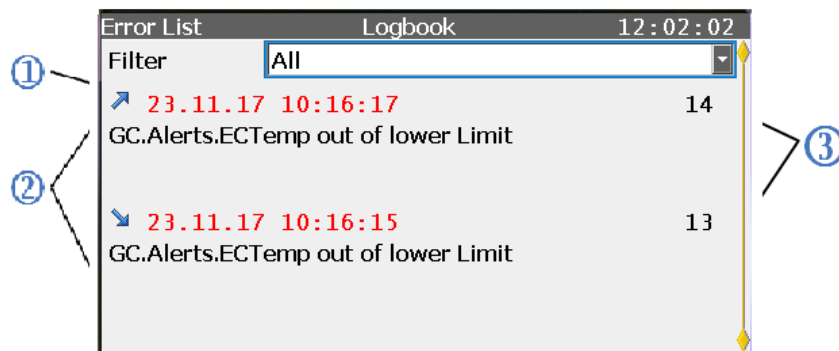
Figure 3.82: Error List – Logbook display
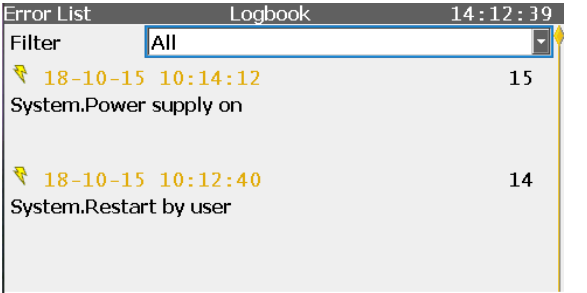
Item	Error Logbook details
①	**Filter selection** (as in the Error List main display)
②	**Section of the error display**: The small arrow before the date shows when the event began (tip downwards) or ended (tip upwards). The list is scrollable if the logbook contains more than 2 entries.
③	**Logbook entry's serial number**: Every event is displayed separately and numbered on the right-hand side.

See also the following table:

Identification	Meaning
↗	Event begins
↘	Event ends
⚡ <Black text>	Event of type Information
⚡ <Yellow text>	Event of type Warning
⚡ <Red text>	Event of type Alarm

Whenever changes occur or an event is included in or removed from the Error List main display, this information is recorded in the logbook.

	To analyze large archive sections, it is more practical to read the archives from the device using enSuite and save them to a PC. The data can then be viewed in a table and, possibly, in the form of a diagram.

Step	Action: Viewing the logbook error list on remote operation panel
1.	Navigate via **System** to **Logbook** and click on the symbol **Logbook**
2.	(The entries are displayed in the same way as in the error list in the main display)

The archive takes the form of a ring memory with 1000 data records. When the memory is full, the newest data record overwrites the oldest one. The archive content remains available in the event of a power failure or software update.

The header contains a time stamp with the precise calendar time at which the entry was generated and a serial (sequence) number. The main body contains the text with information as to why the entry was created and starts with the name of the software part which caused the entry.

3.6.13. System display (device) Audit trail

	The <u>audit trail</u> is another protocol archive for documentation. **It is part of the basic system and therefore available in all enCore device types.** **The contents are displayed in the current device language.** **As a result of the different types of archive data, a distinction is made between "<u>General</u>" and "<u>Fiscal</u>"** (Entries in the fiscal audit trail are only generated when the SSW is closed.)

It is possible to choose between "**General**" and "**Fiscal**" in the left drop-down list.

The events recorded in the general audit trail can be displayed more clearly using a filter from the right-hand drop-down list.

Figure 3.83:
General audit trail display

Audit trail	Overview	12:08:05
General	Filter	All

18-10-15 10:14:12	System
18-10-15 10:12:40	System
18-10-15 10:12:37	User login
18-10-15 10:12:36	System
18-10-15 10:12:36	System
18-10-15 10:10:55	User login
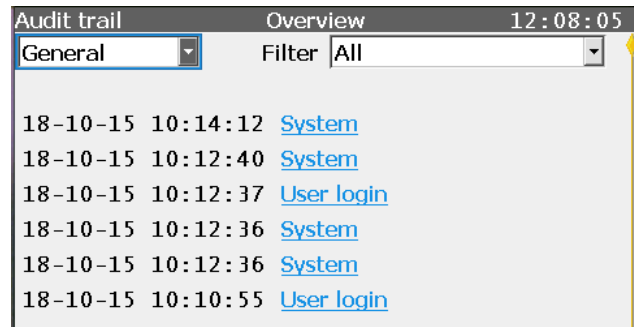
You can choose between "**All**" (filter not used), "**System**", "**Parameter change**" and "**User login**".

In the fiscal audit trail, parameters can be recorded which can also be changed when the security switch (SSW) is closed. Only if this switch is closed, will the actions be recorded; in all other cases, the archive will be empty. This archive is primarily relevant for billing purposes.

Figure 3.84:
Fiscal audit trail display

Audit trail	Overview	12:09:33
Fiscal	Filter	All

Erase fiscal audit trail

| 18-10-12 11:29:50 | Parameter changed |
| 18-10-12 11:29:50 | Parameter changed |
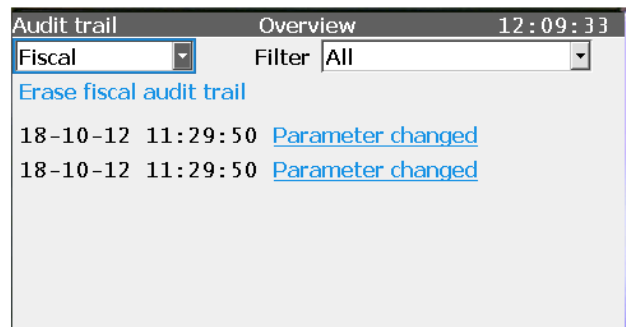
Activating the hyperlink next to the entry enables the user to view details of the entry in a new display. See example.
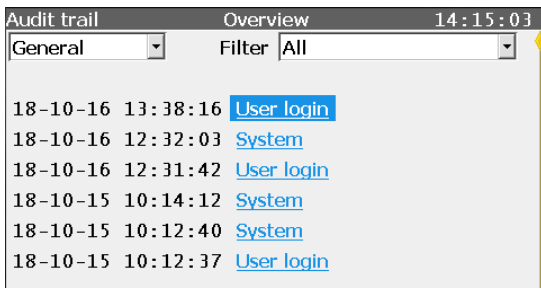
Details of the change include the date and time, old/new value or the user who made the change.

Figure 3.85:
Example of audit trail details

Audit trail	System	13:32:43

Time   2018-10-16 12:32:03
Origin   Time Service

Date and time updated
old time: 2018-10-16 12:32:03
new time: 2018-10-16 13:32:14
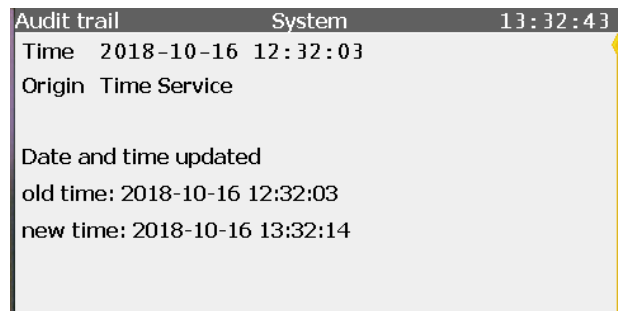
	The type and scope of the displayed data depends on the situation and the settings in enSuite. For further information ⇨ see enSuite online help.

	All the data in the audit trail is also saved in the logbook, which means that the entire recorded history is visible in it. The user cannot delete the entries.

Step	Action: Viewing the "General" audit trail	
1.	Navigate via **System** to **Audit trail** and click on the symbol	
2.	Audit trail　　Overview　　14:15:03 General　　Filter All 18-10-16 13:38:16 User login 18-10-16 12:32:03 System 18-10-16 12:31:42 User login 18-10-15 10:14:12 System 18-10-15 10:12:40 System 18-10-15 10:12:37 User login	The overview shown above will be displayed. You can scroll through the list. Two selection lists enable you to restrict the overview or choose between "General" and "Fiscal".
3.	Click on the hyperlink after the entry whose details you wish to view. Audit trail　　User login　　14:16:38 Time　2018-10-16 13:38:16 Origin　Users User "admin1" logged out	The detailed view for the entry will appear. The displayed details depend on the type of entry and the settings in enSuite and are displayed in the selected language (see enSuite online help > Basic system > System > Audit trail).

The audit trail has space for 1000 entries. In the general section, the oldest entry will be overwritten after 1000 entries have been created. If this space is occupied in the fiscal section (entries are only possible if the SSW is closed), no changes can made to the legally relevant parameters without opening the security switch (SSW). If the SSW is opened, the entries can be deleted using the displayed action to create space for new changes.

	A completely new set of parameters (if the SSW is open) is also entered in the audit trail. Each software part is listed with an appropriate note.

3.6.14. System display (device) I/O – Overview / IP address / basic network

	The <u>I/O – Overview display</u> lists all the device parts available on inputs or outputs and enables the user to go to other sub-displays using hyperlinks.

The hyperlinks and test mode function appear depending on the parameter set.

A login is required to use the functions. (Section **3.6.11 System display (device) Users (Login/Logout/change password)**).
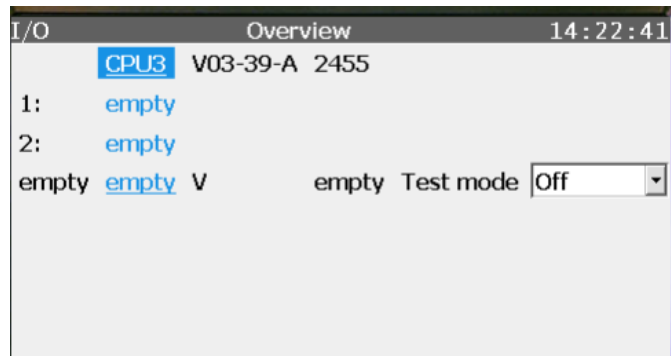
Figure 3.86: I/O – Overview display

Using test mode, you can apply test values to individual output channels, which are used instead of the original values. Hyperlink CPU3 is always available and enables the user to go to the Ethernet I/F display with the basic network settings. See figure.

Figure 3.87: I/O – Ethernet I/F display

As the example above shows, this display lists the internal board (CPU3) with its MAC address (00:23:7E:FE:04:17). If a user with the appropriate authorization is logged in, the configuration (DHCP mode), IP address, network mask, default gateway, DNS server, TCP ports and host name can be changed. The number of entries which can be changed is also affected by the selected/pre-set settings.

	If the user is not logged in or does not have the appropriate authorization, data can only be read in this display.

If a user is logged in with the appropriate rights, the basic network settings can be changed in the **Ethernet I/F** (Ethernet interface) display, see the figure below.
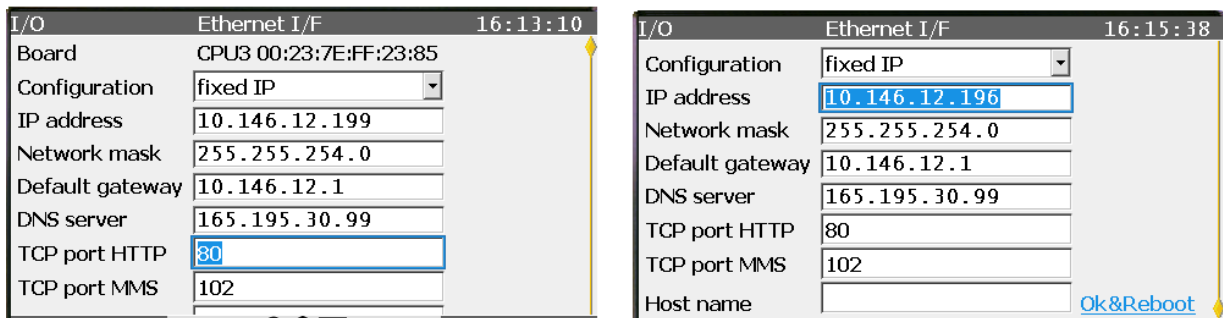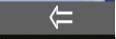
Figure 3.88: I/O displays with options to make an entry and restart

💡	The IP address and the basic network settings can be defined from the remote operation panel or through enSuite. Information about this is also available in the enSuite online help, which also explains the various settings in more details.

⚠️	**Do not change the configuration settings (DHCP mode).** **(Only relevant for service personnel.)**

Step	Action: Viewing/Editing basic network settings
1.	**Log in** (⇨ see section 3.6.11System display (device) Users (Login/Logout/change password)) and navigate to "**System**" **I/O Overview** display and click on **CPU3**.
2.	Make a note of the settings and select the entry you wish to edit. If necessary, ask your system administrator which parameters must be edited. (When an entry is selected, the keypad will be displayed.)
3.	Enter the values specified (by the system administrator) box by box using the displayed keypad.
4.	When you have made all the changes, you must restart the device using the displayed action **Ok&Reboot** (see figure). The edited data will then be used after the restart. If you exit the display using [⇐], your changes will not be saved.

3.6.15. User archives displays

This symbol takes you to the main display of the User Archives AFB, which can be used by multiple devices, in other words, also by the proChain GC.

The following figures and explanations are only examples, further information and the actual set-up takes place using the enSuite configuration and analysis software, see the next sections.

The main display contains two drop-down list boxes. Using these, you can select

the **archive group** and then select the **archive channel**.

All the parameterized user archives in the enCore device are available.

After making your selection, you can go to a detailed display "**Values**" using the **Show values** link.
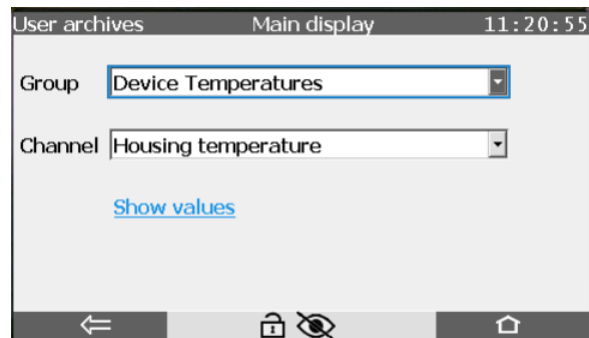
Figure 3.89: User archives main display
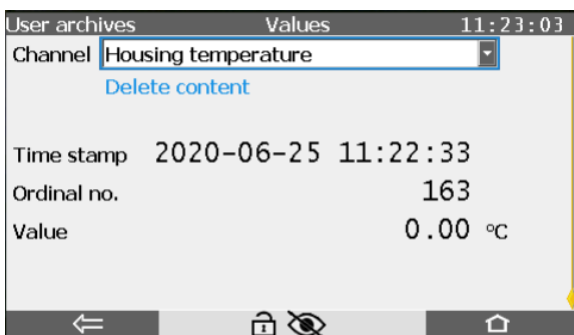
Figure 3.90: Values sub-display

The following functions and information are available in the displays:

Channel (switch to other group channels)

Delete content (not possible)

Time stamp (date of archive entry)

Ordinal no. (automatic identification number)

Value (archived measurement or calculation result)
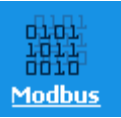
It is also possible to delete the content of the archive. A login with the appropriate rights is required for this.

The archive can be cleared if the **Delete content** link is underlined, see the two examples
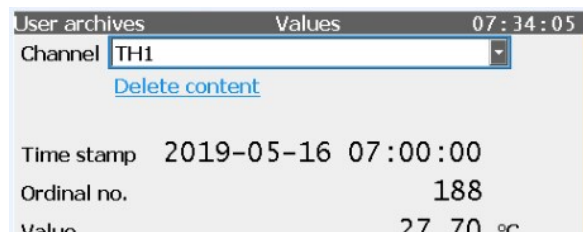
Documents for the enCore flow computer under www.docuthek.com also contain information about this general data management.

3.6.16. Modbus displays

	This symbol takes you to the main display of the Modbus AFB which can be used by multiple devices, in other words, also by the proChain GC

The following figures and explanations are only examples, further information and the actual set-up takes place using the enSuite configuration and analysis software, see the next sections.

The **main display** provides an overview of all the parameterized Modbus areas of the enCore device in the first line. If there are no different areas parameterized (as in this example), the list will be empty. All the registers (for the selected area) will be listed in ascending order. As an option, you can open a detailed display for any register using the number displayed as a link (first column).

Figure 3.91: Example of Modbus displays

The second column on the main display shows the register content. The telegram counter **TC** at the top right of the screen counts the number of telegrams transferred. A symbol – **|** (vertical line) in the example – indicates for each import or export tab that the data in this register have been transferred successfully. Using the symbols **–** (dash), **** (backslash), **|** (vertical line) and **/** (slash), a sort of rotary hub is simulated which changes by one step each time when the individual register has been transferred successfully.

The following information is provided in the detailed **Modbus register** display:

Test on/off:	Test function of the selected export register enabled/disabled
Area name:	Name of the register section (parameter n the
Register name:	Name of the register (parameter name)
Register number:	Register number of the import or export register
Register content:	Transferred value (hexadecimal)
Data object:	Transferred value, formatted with unit
Last refresh:	Date and time

	You need the required rights and/or a login to view or run all the functions. The documents for the enCore flow computer, refer to www.docuthek.com contain additional information.

3.7. Using enSuite program functions when the device is operating

In normal operation, the device will operate autonomously in Automation mode. The user does not generally have to intervene. Nevertheless, there are situations which require contact to be established with the device. This may be the case, for example, if you wish to view or check the results live or export and archive data from the device memory before they are overwritten. In addition to the operation panel, enSuite generally provides the more convenient and comprehensive options for this purpose. The following describes how to use the device with enSuite.

3.7.1. Update date and time (system time action)

The system time is the combination of the device time and date. You can update it within the device in enSuite using the enSuite action. As part of this, the updated time and date will be transferred directly to the enCore device without changing the parameterization. (You can only update the time zone, however, in the device parameterization).

You can either synchronize the system time with the local PC time or set this manually. You can also switch the daylight saving time settings in the associated enSuite dialog.

Prerequisites

- The user has the right to **Update device time**.
  (⇨see section 3.3.3 Viewing setting and change access rights)
- enSuite is connected to the enCore device via an active data connection.
  (⇨See section 3.2.5 Establish a connection to the enCore device).
- The security switch (SSW) is in the right position (specified the parameter set)

▶ Click the **Update date and time** action in the lower area of the navigation window.
  ✓
  ✓ The login dialog will open.

Log in with the necessary user rights.

Once you have logged in successfully, the **Update device's date and time** tab will open

Figure 3.92: Update date and time navigation window
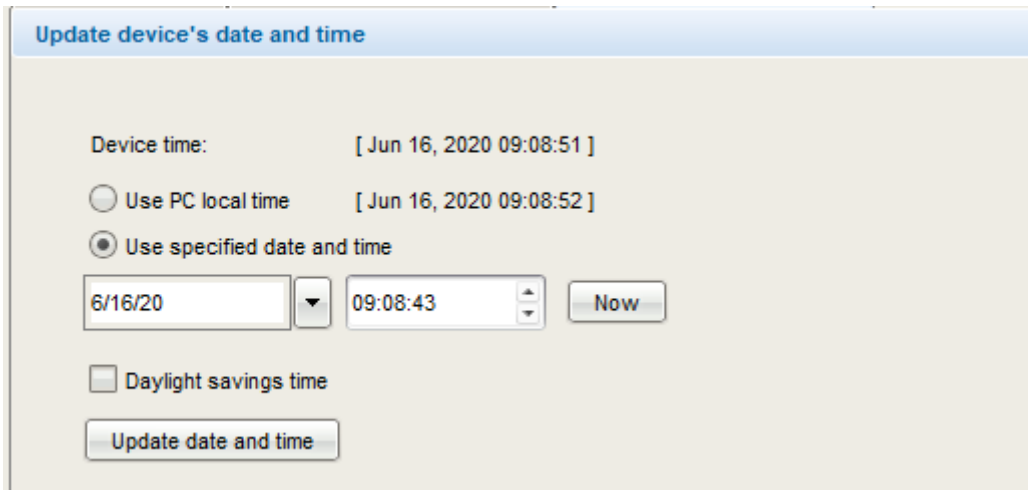
Figure 3.93: Update device's date and time tab

To synchronize the system time of the device to the PC time enable the option **Use PC local time** – the current PC time will be shown in square brackets.

OR to set the system time of the device yourself enable the option **Use specified date and time** – default.

💡	The date and time selection fields are pre-assigned using the system time of the enCore device at the point at which the user logged in; the date and time are not updated

To assign the date and time selection fields again with the updated local PC time, click **[Now]**. Change the date in the date field and the time in the time field manually if necessary.

If the local PC time or the time you have selected is in daylight saving time select the checkbox **Daylight savings time**.

Clicking **[Update date and time]** transfers your settings to the enCore device. The settings are immediately saved by the device and then in the main display of the `Time Service` this update time will be displayed as the 🔲 **Latest update** value.

If the date and time could *not* be set successfully, enSuite will display a warning and the cause of the error in the **Output** window. The cause of the error may be, for example, that the user has been automatically logged out due to the **Inactivity timeout**

💡	Tip: If the output window is not displayed in enSuite, you can open it using the path Window – Output or the <Ctrl + 4> keyboard shortcut.

3.7.2. Displaying and reading analysis results

The analysis results can be displayed and read in different ways.

The **Modbus AFB** can be used to export and process the data. You can also use the **User archives AFB** to save the results in the device. These data can be read out and viewed or saved later to a PC.

The enSuite function "**Live data and trending**" can be used to analyze individual results in more detail and display them in graphic form.

Another way of displaying and reading the results is to use the enSuite functions in "**Chromatograph**", see sections 3.8 and 3.9. In addition to graphic displays, number values are also displayed in this case.

3.7.3. Working with the Modbus AFB

The Modbus AFB allows the Modbus parameters to be configured. It is used if TCP/IP has not been configured for data transfer or data exchange. The settings can be freely selected within wide ranges.

This enables you to adjust the proChain GC perfectly to the environment of your measuring equipment using standard parameter sets or to use the device as a replacement without changing the existing structure.

	Consider country-specific regulations! **Please note that Modbus communication is not encrypted. This does not prevent an attacker from intercepting or modifying the communication. Consider the country-specific regulations. These may require manual verification of the data.**

	The Modbus AFB has its own operating instructions which can be downloaded from the Docuthek www.docuthek.com.

3.7.4.   Working with archives and logs

Whenever changes occur or events come and go, this information is also written into the log. The instrument has two logs called "**Logbook**" and **"Audit trail"** in which events during operation are stored as a history. The archive takes the form of a ring buffer with 1000 data records.

- **The header contains a timestamp with the precise calendar time at which the entry was generated and an ascending ordinal (sequence) number for the log entry.**

- **The text body contains the text with information about the reason the entry was generated. This text depends on the cause and the settings in enSuite. It starts with the name of the SFB/AFB which caused the entry.**

	All the data in the audit trail is also saved in the log which means that the entire recorded history is visible in the latter. The user cannot delete the entries.

The **Logbook**

documents / saves events and protocol the device operation in this way. All the relevant data, like logins, logouts and password changes, new set of parameters, can be viewed in these archives. The archive content remains available in the event of a power failure or software update. When the logbook is full, after 1000 entries, the next entry will overwrite the oldest data record.

The **Audit trail**
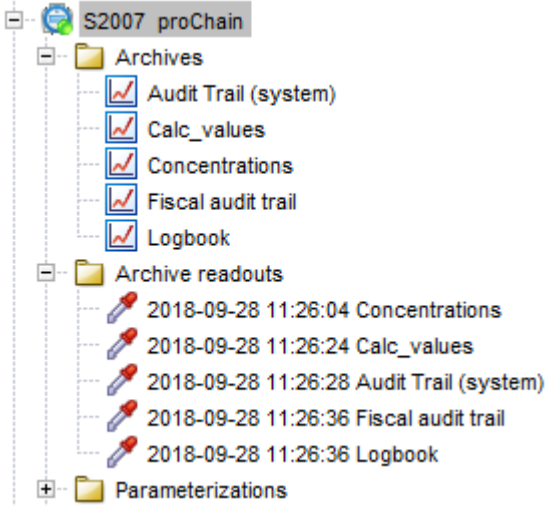
is another protocol archive for documentation. It is part of the basic system and exists in all enCore device types. A distinction is made between "**System /General**" and "**Fiscal**". In the **General section**, the oldest entry will be overwritten after 1000 entries have been created. In the **Fiscal audit trail**, parameters can be recorded which can also be changed when the security switch (SSW) is closed. Only if this switch is closed, will the actions be recorded; in all other cases, the archive will be empty. This archive is primarily relevant for billing purposes. After 1000 entries, no changes can be made to the legally relevant parameters unless the security switch (SSW) is open.

	The fiscal audit trail is only filled if the SSW is closed and an approval file is used, which provides. **The terms "official", "fiscal" and "legal metrology" are used synonymously.** The archives can only be cleared/deleted if the user has the appropriate rights and the SSW is open.

The three archives that are always available, "**Audit trail (system)**", "**Audit trail (fiscal)**" and "**Logbook**", document / store the corresponding events and thus protocol the device operation.

Further **individual archives** can be created via the parameterization in the AFB **User archive**. The data can be read out, viewed, saved, backed up and exported using enSuite.

The data can be read out, viewed, saved and exported via enSuite.

Step	Work: Reading archives
1.	Establish a connection to the device (⇨ see section 3.2.4 General connection options to the enCore device) and select the "Readout archives" action in the bottom section of the navigation window. A dialog window will appear in which the archive query can be configured.
2.	Select the required archives and settings in this dialog. If necessary, change the suggested names for the reading process. (Always include the date so that you know exactly when something happened.) After making your selection, click on "**Start readout**".
3.	Under the selected name, the read archives will be saved in the path Devices − <Serial number/Name> − Archives or Archive reading cycles. See example: Each time enSuite reads data, a reading cycle is generated − displaying exactly what was read − sorted by ordinal number.
4.	Disconnect the connection to the device (⇨see section 3.2.6 Disconnecting the device and Connection errors)) and view the data in a table. To do this, select the archive, for example Logbook, and click on Display archive in the bottom section of the navigation window.

	The operator must read the data using enSuite and save it to external data media at suitable intervals. Only if this is done, will it be possible to access the information in the logbooks if the data have been deleted or overwritten on the device. The archive can only be cleared/deleted if the user has the appropriate rights and the SSW is open.

After step four, the archive window appears and shows the content of the selected archive in tabular and, possibly, graphic form. The **ordinal number** and the **archive time** are displayed on the left. The archived data is shown in the remainder of the line.
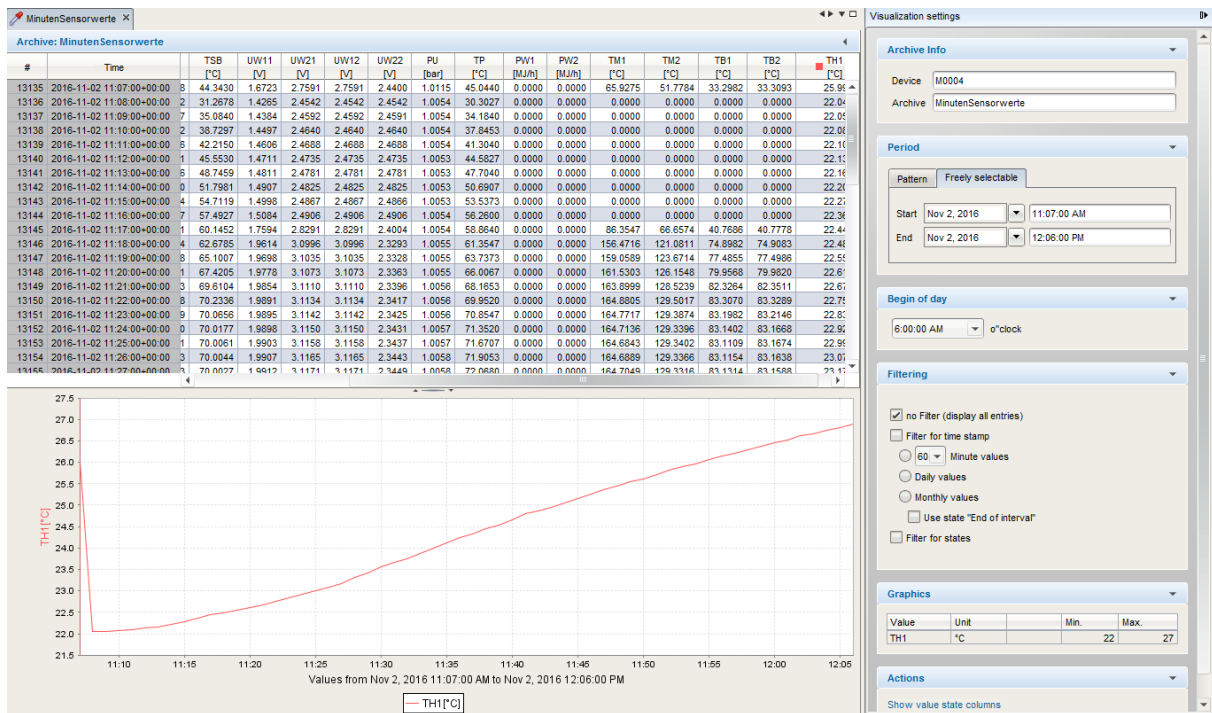
Figure 3.94: enSuite Archive Window

Use the "scroll bar" (if displayed) to view more archive entries. Depending on the type of data, a visualization window may also appear under the table. You can view selected data in graphic form in this window. The selection is made in the context menu by clicking on the header.

There is a clear link between the date and ordinal number; each entry has a time stamp. A window with settings for the visualization appears on the right-hand side. You can filter the display here and decide how the archive channels should be displayed. Once again, you can use the "scroll bar" (if displayed) to view all the options.

Using the same process as for parameterization, you can also export selected files using the **symbols** or the export function in the context menu to make yourself independent of your current enSuite installation.

Figure 3.95: EnSuite export functions

	Further information about logs ⇨ see enSuite online help. Information on viewing archived chromatograms is provided in [3.9.1 Opening stored chromatograms.](#)

3.7.5. Live data and trending function in enSuite

It is possible to view the device's "Live data and trending" using enSuite. First of all, you must establish a connection to the device (⇨ see section 3.2.5 Establish a connection to the enCore device). Once you are connected to the proChain, you can right-click on the "**Live data and trending**" entry in the bottom section of the navigation window. The parameters are then read from the instrument and a new window opens in the center of the screen (see figure).
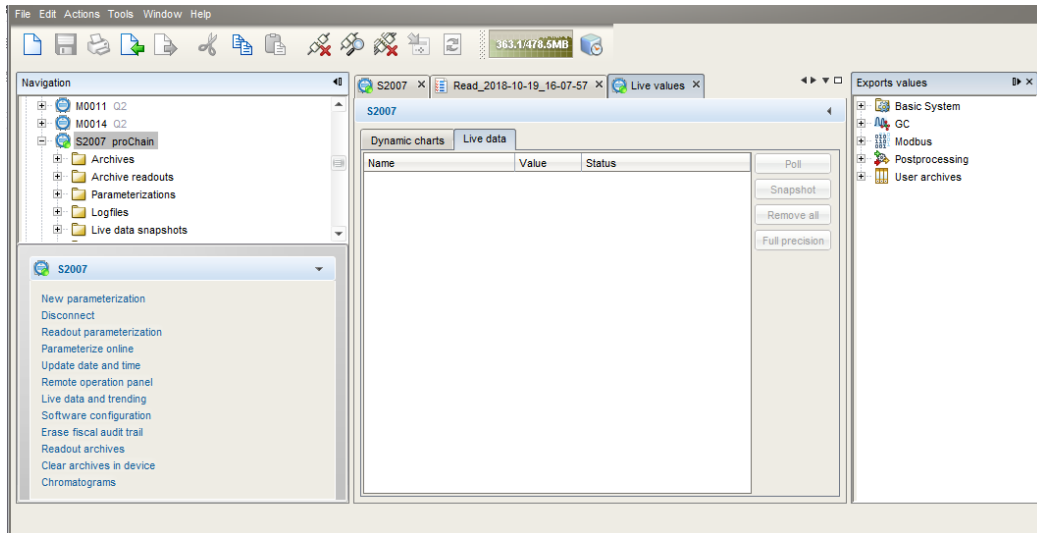
Figure 3.96: Windows and tabs for "Live data and trending" function

There are 2 tabs in the window, "**Dynamic charts**" and "**Live data**". In the "**Live data**" tab, you can monitor lots of data simultaneously in number form. In the "**Dynamic charts**" tab, you can monitor the data in graphic form. There are only 2 physically different data items to observe since there is a maximum of 2 vertical axes. Several data items of the same type can be compared on each vertical axis, for example two temperatures (in °C).

Examples of the "Live data" tab application

There is a window with all the available values in the device (parameter tree) on the right-hand side. Simply navigate to the required value, hold it and drag it into the center window (see the following screen section)
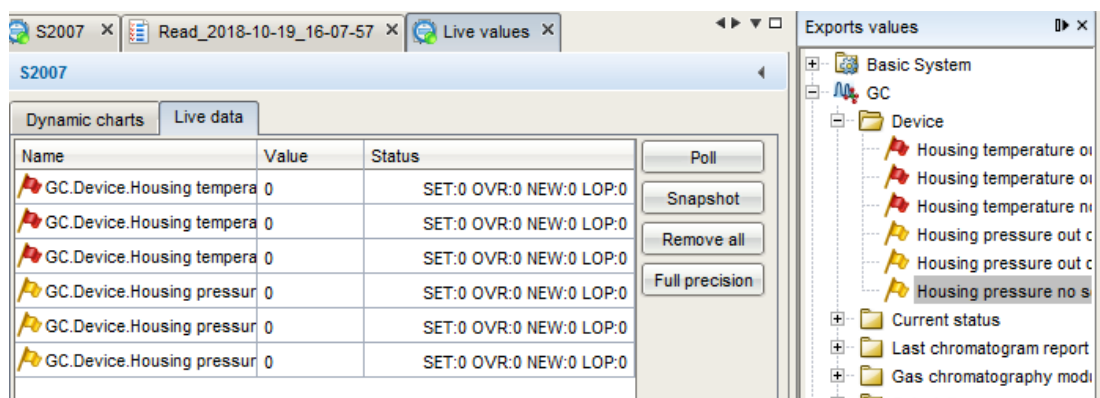
Figure 3.97: Live data tab

If you wish to view a calculated value, for example the inferior calorific value, you can display all three different states of the gas (completely dry/completely wet/partly wet).

When you have dragged the required values from the right-hand window into the center, simply click on "**Poll**" and you will see values updated every second while the button changes to "**Suspend**". If you click on "**Snapshot**", the current value will be frozen and can be viewed in a new table sheet created at the same time.

Figure 3.98: Snapshot tab

If you click on "**Full precision**", the display of the values will be extended to all the existing decimals. If you click on "**Remove all**", the display window in the center will be cleared. Other examples include the following:

- Use as "**Device monitor**" to obtain information about the operating hours and battery charge and the CPU and RAM load. These data can be opened if the export values from "**Device status**" are used in the tab.

- Use as "**Time Service display**" to provide information about the time setting and events and data linked to it. This information can be opened if the export values from "**Time service**" are used.

	Details are given in the next sections.

Examples of application tab "Dynamic charts"

Here you can select values which you wish to see in graphic form. To do so, drag the values from the right-hand window into the central area.

Please remember that these must be "**Groups**" (see above) if you want to display more than 2 values.

Once the required values have been positioned in the center window, click again on "**Poll**". The values will then be displayed in a line diagram.

The button will change to "**Suspend**" (as shown below) and "freezes" the graphs when it is clicked until fresh values are displayed by clicking on "**Poll**".
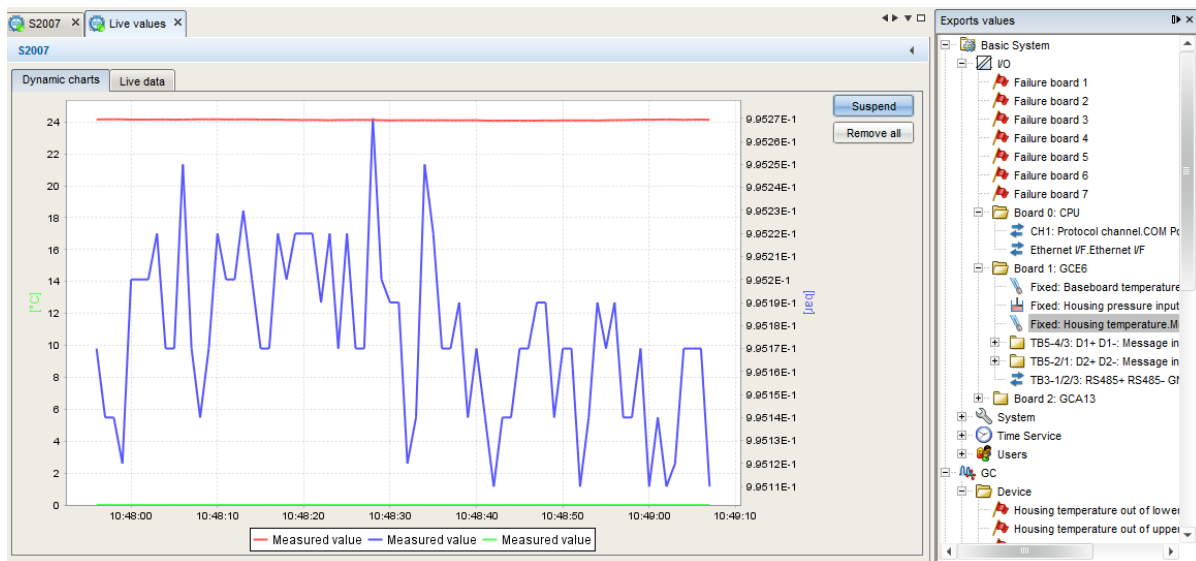
Figure 3.99: Tab "Dynamic chart"

You can clear the central section again by clicking on "**Remove all**" and display other values in graphic form.

The number values form the Y-axis, while the recording time is shown as the X-axis.

3.7.6. Use "Live data tab" as Device monitor

The information about

- Operating hours

- Battery state of charge

- CPU load

- Ram load

can be obtained if the **system export values** are used in the tab "**Live data**" as shown below.
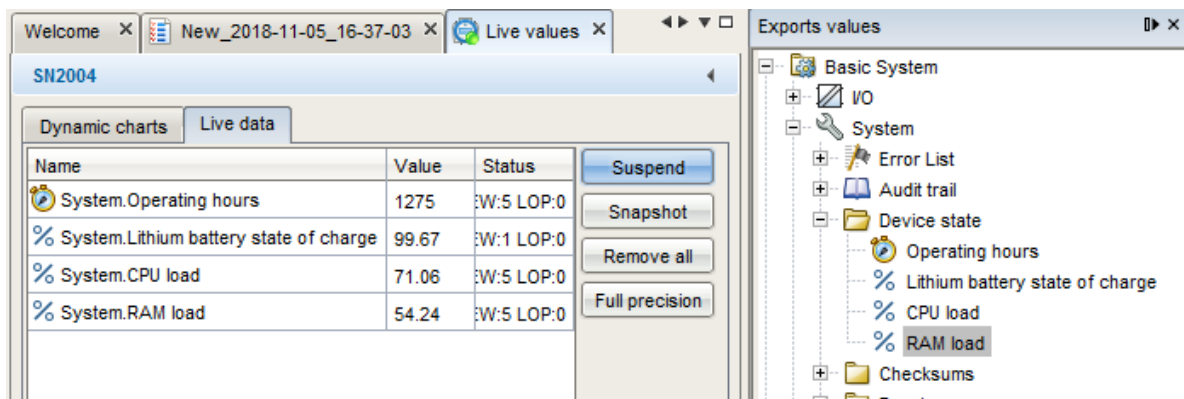
Figure 3.100: System– Device monitor values

The battery is mainly used when the device is off, it must be replaced when the charge drops to less than 20%.

A discharged battery may, in certain circumstances, result in the loss of calculated and saved measurement data. The device will no longer start correctly.

	CAUTION — DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED.
	The replacement of battery must be carried out by Honeywell service personnel additional a permit from the plant operator is needed.

3.7.7. Use "Live data tab" to view Time Service data

Information around time setting, related events and data can be obtained, if the time service export values are used in the tab **"Live data**" as shown below.

Value	Meaning
Current time	System time
Latest update	Time stamp of the last time change.
Latest deviation	Deviation (in seconds) at the last time change
Latest external time source	Number of the external source for the last time synchronization
Daylight saving time:	(DST) is the practice of advancing clocks during warmer months

Figure 3.101: Time service main data

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The **Time zone** (geographical location)
and the setting of DST could be viewed in the parameter settings of Basic system

The Network Time Protocol (NTP) is a standard for clock synchronization in computer systems. If NTP synchronization has been activated in the device. Information about enabling and function ⇨ see sections 3.2 and 3.4. Following data can be viewed (information also in the online help available).

Time stamp: Latest update of the last time synchronization using NTP. If a synchronization has already been completed, the precise time of the synchronization can be read in the display (date, time and time zone).

Duration since latest polling: the deviation (in seconds) at the last time synchronization using NTP shows by how many seconds the internal time deviated from the standard time at the last synchronization.

NTP Server: name or IP address of the NTP server used for the last time synchronization, for example ptbtime1.ptb.de or de.pool.ntp.org or company servers as in the figure.

Stratum: stratum value of the NTP server used for the last time synchronization (number of computers up to the time reference in the NTP hierarchy).

3.7.8. Use "Live data tab" to view the Software status

In most enCore devices, a display called "**Software status**" shows information about the identification data of all the software parts in the device. The data comprise the name of the software parts, the version number and the checksum. These data can also be displayed using enSuite functions "**Software configuration**" and "**Live data**".

Use the "**Software configuration**" tab to display the software status.

Figure 3.102: Software configuration info

The software configuration lists the names of the main software parts in the column headed Software module. The next column **Current** contains the software version numbers of the components.

The second line of the tab shows the short name of an **approval file**. This file contains the definition of which parameters should be protected from changes so that the device can be operated to the customer's specification or approval (further information about the approval file is provided in section 3.4.13 Fiscal parameters and optional using approval file (Select approval)).

Operation without an approval file is also possible. In this case, "**none (Elster)**" is displayed. If the device is operated with an approval file and a closed SSW, the appropriate parameters are protected to prevent them being changed.

Use the "**Live data**" tab to obtain information about the software **checksum,** third column of missing "**Software status**" display. To do so, drag the export values out of the checksum folder under "**System**" into the tab's table.

Figure 3.103: Software checksum info

The above figure only shows examples.
If, for example, the device is not used for fiscal measurements, the "**Secured parameters**" display will not be supported.

The **Value** column contains the appropriate checksum (after clicking on Poll). During operation, the actual checksums are calculated and compared to the reference values.

If a checksum discrepancy is identified an error is generated. To check this, add the relevant points listed under **Event** additional in the live data tab.

3.7.9. Creating reports using enSuite

In addition to displaying the analysis results, the **Postprocessing AFB** and the **User archives AFB** can also be used to compile reports which can then be displayed, saved or transferred in the normal way on the device. enSuite once again provides users with a great deal of scope for designing the report to meet their requirements.

For example, an integration report which contains detailed information about the component analysis, for example shape, location, calculation and name of the various peaks, is conceivable. Details such as retention times can also be included in these reports. Since the scope depends on the application, the number of components and entries in the report can be adjusted accordingly.

Another example report, as used by many users, is an application report with the complete analysis data, the calculated data and stream information.

3.8. Operate the device with enSuite

The aim of this following sections is to familiarize you with the operation and modes of operation of the device. First, normal operation is presented, which delivers continuous results in the form of chromatograms and associated values in automated operation. Then operating instructions for the more complex operating modes and functions, e.g. calibration, are explained.

The operation and operating modes of the device are controlled via the chromatogram functions of enSuite.

There must be a connection to the device.

By activating "**Chromatograph**" in the lower part of the navigation window you get the following view:
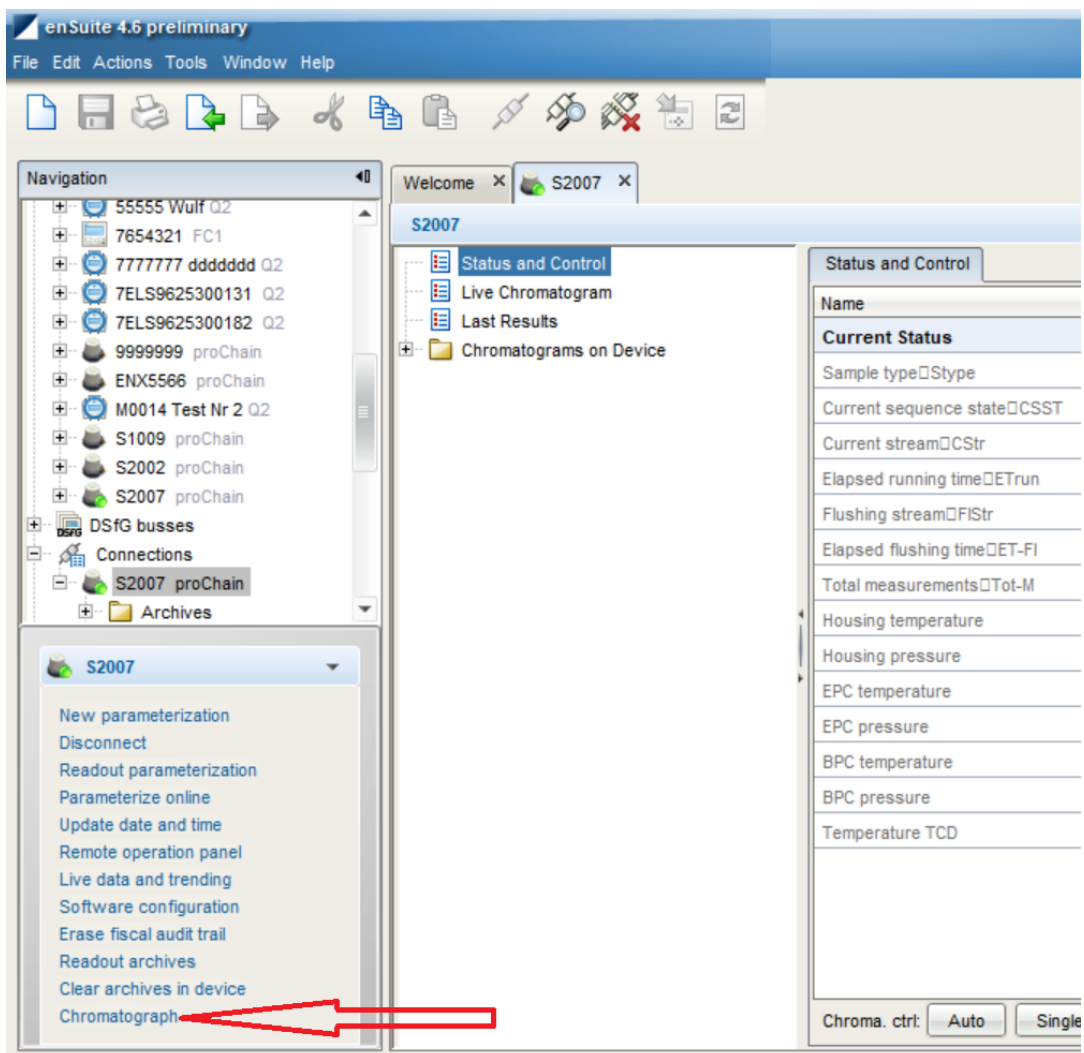
Figure 3.104: Calling the control and chromatogram functions

The left part of the window opened by the activation contains the following elements, as shown in the figure above:

>"**Status and Control** " for operating the device and displaying the device status

>"**Live Chromatograms**" for graphic observation of the current measurement

>"**Last Results**" gives a list with analyzing results of the last measurement

>"**Chromatograms on Device**" node with saved chromatograms and results.

A chromatogram is the graphic representation of the measurement result of a chromatograph, in this case, the **proChain GC**.

Chromatograms stored on the device can be reopened, saved and viewed later. You can export the chromatograms in different ways to other computers. Detailed information about chromatograms can be found in the next sections.

3.8.1. The control functions

After activating "**Chromatograph**" in the lower part of the navigation window, select **"Status and Control"**. To do this, if not already displayed automatically, click on the entry of the same name in the parameterization window.
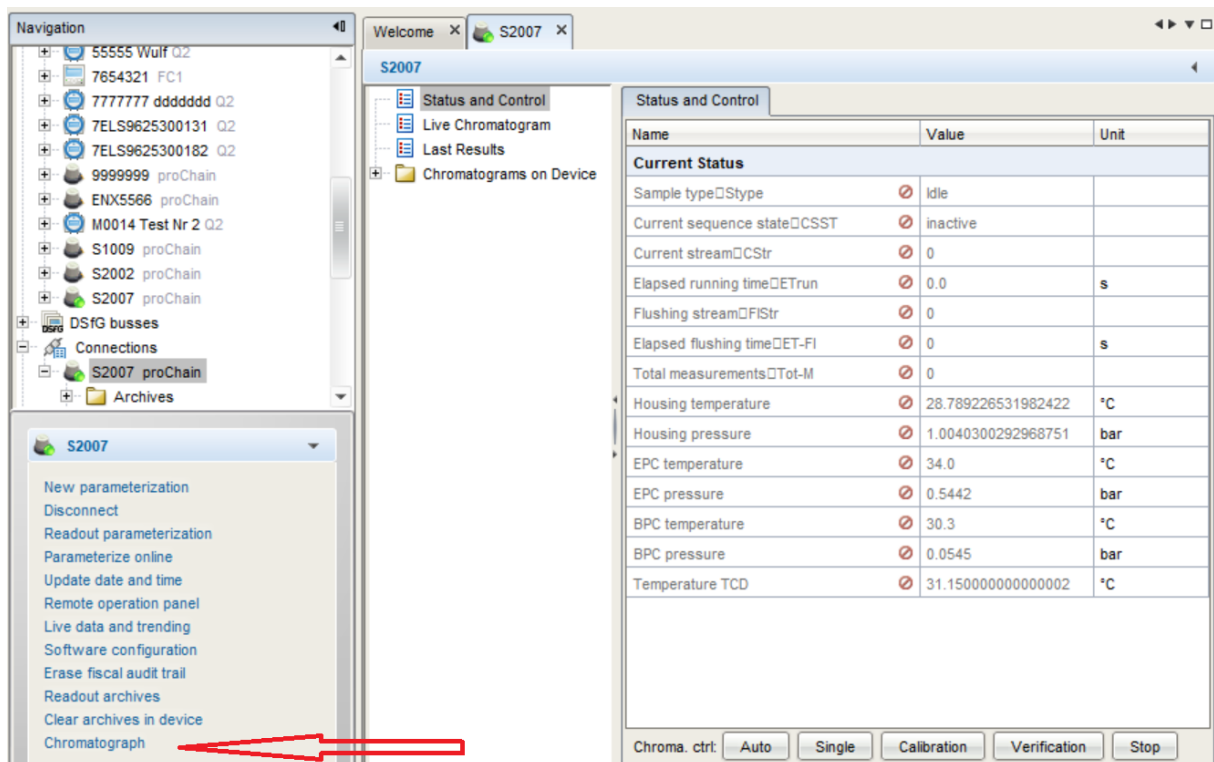
Figure 3.105: Calling up the control functions

After activation, you will see a table in the right part of the window showing the **current status** of the device, the next section contains the details of the entries. In addition, a **control / command line** appears at the bottom with which the device is operated.
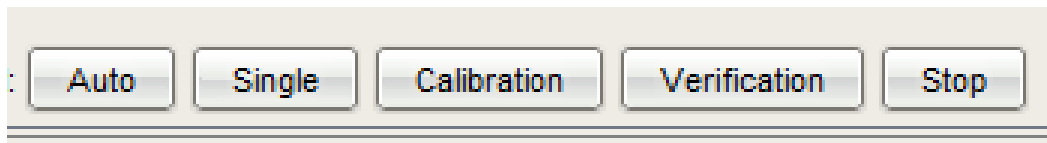
Figure 3.106: Control and operating line

Use the table entries to check whether the device is already performing a measurement.

If the device is not yet in operation, you can start automated measurements with "**Auto"** or a single measurement with "**Single"**. "**Calibration**" allows you to perform a calibration manually. With **"Verification"** you can check the performance of the gas chromatograph manually. You must be logged in for all these actions and the device must be in **Idle**.

A corresponding dialog gives you the opportunity to login. Further details in the following subsections. The "**Stop"** button makes it possibility set the device to **Idle** if necessary. The currently state e.g. measurement, will be completed before the device enters the **Idle state**. This may take up to 140s or the time defined for measurement time in the **GC parameter** section.

3.8.2. Automation (normal operation mode)

After switching on the device, click on "**Auto**" (if you are not already logged in, a dialog box appears prompting you to do so).

The measurements now run autonomously and continuously using the settings/parameters defined during the commissioning procedure on a recurring basis using a "**Sequence table**" in an infinite loop. This table (see section 3.4.8 Changing the settings of the GC AFB) also governs the automatic calibration process, for instance. A logged-in user can end the automation by clicking on "**Stop**".

3.8.3. Single run (manual)

In addition to fully automatic measurements, it is also possible to complete just a single measurement, for example for test purposes. This operating mode is called "**Single run**". Short "**Single".**

If the device is already working in the automated system, activate "**Stop**" first; if the device is idle, you can immediately activate "**Single**" action when logged in, otherwise the login prompt appears. If you activate "**Stop**" during the single run, the current run will be finished.

If the **single run** is completed without interruption and without errors, the device will return to **Idle mode**. The measured values are now saved as "**Last results**" and are available for further evaluation. You can now start further **single runs** or use "**Auto**" to put the device back into continuous operation.

3.8.4. Calibration (manual)

The device calibration, which must be repeated at regular intervals to maintain its measurement accuracy, generally runs fully automatically according to the settings in section 3.4.8 Changing the settings of the GC AFB.

⚠	**The calibration gas inlet must be connected to the calibration gas either for automatically or manually calibration. The calibration takes a few minutes and the calibration gas data must be valid. see section 3.4.8 Changing the settings of the GC AFB.** **During the entire calibration time, the last valid gas quality values are maintained via measured value outputs.**

Additionally, you can start a calibration cycle at any time by hand, for example after you have replaced the calibration gas cylinder.

💡	With the factory settings and the settings in place during commissioning, the calibration runs without additional intervention automatically. A manual calibration only makes sense if there are no physical errors in the device.

After activating "**Chromatograph**" in the lower part of the enSuite **navigation window**.

The device status must be **Idle** this means no other functions are running in the moment. Check this on the table in the right part of the window (**Current Status**). If necessary, activating "**Stop**" and wait until the current run is finished.

Click the "**Calibration**" button at the bottom of the **Status and Control window**, when you are logged in. If you are not logged in, the logon prompt appears.

The instrument switches to calibration mode at the end of the current measurement (at idle immediately). It carries out the calibration procedure set in the parameterization and returns to the previous operating mode after operation. If you activate "**Stop**" during this operation, no changes are made, and the old calibration values remain in use.

After a successful run, the instrument now uses the newly found calibration values. Only a new successful calibration changes this setting again.

💡	If the calibration fails, the parameters of the last successful calibration remain in use. In this case, contact Honeywell for further actions, for example to organize repair work.

3.8.5. Verification (manual)

During a verification run, the operating properties of the gas chromatograph are normally assessed by analyzing a test gas with a known composition with the results then being compared to the data on the manufacturer's certificate of analysis.

The most practical method is to use the calibration gas as the test gas. If the results are not inside the Verfication deviation limits (defined for each peak in the peak table) a message for each fault peak is created in the "**Logbook**". Read out the logbook according to section 3.7.4 Working with archives and logs and check the result of the verification.

🔆	In this special operating mode, a test gas or the calibration gas replaces the sample gas. This may require modifications or additions to the gas line. The analysis data of the used gas must be stored precisely in order to detect deviations reliably. For details, see section 3.4.8 Changing the settings of the GC AFB

For the next steps the device status must be **Idle**, this means the instrument does not perform any measurements. If necessary, activating "**Stop**", please note the following before proceeding:

⚠️	**Replace the gas at the sample gas inlet.** **Connect the cylinder containing the test gas as described in section** **2.7.6 Connecting and replacing gas cylinders (calibration gas, carrier gas and test gas)** **using a cylinder pressure reducer.** **Open the test gas cylinder and set the pressure to the same level as the sample gas pressure. Obey all the safety instructions for working on gas connections.**

Once the gas line connection has been established, you can activate "**Verification**" in the control line. If you click on "**Stop**" during this operation, the measurement will be cancelled, and the device will return to **Idle mode**. After the uninterrupted flow of the test gas measurement, the instrument also goes into idle mode. The measured values are now saved as "**Last results**" and are available for further evaluation.

⚠️	**Restore the original gas connections correctly. Conduct a leakage test in any case.**

When the operating conditions and settings have been returned to those before the verification, you can **restart Automation** by a click on "**Auto**".

3.8.6. Viewing the device status

After activating "**Status and Control**" you will see a table in the right part of the window showing the current status of the device and the values of the internal sensors.

You can view these entries e.g. alternately with "**Live Chromatograms**" to better evaluate the graphs of the chromatogram and to get additional information.

Status and Control		
Name	**Value**	**Unit**
Current Status		
Sample type ⊘	sequence automatic	
Current sequence state ⊘	measurement	
Current stream ⊘	6	
Elapsed running time ⊘	51.0	s
Flushing stream ⊘	0	
Elapsed flushing time ⊘	0	s
Total measurements ⊘	2	
Housing temperature ⊘	29.376266479492188	°C
Housing pressure ⊘	1.0151900024414062	bar
EPC temperature ⊘	28.6	°C
EPC pressure ⊘	1.2902	bar
BPC temperature ⊘	31.700000000000003	°C
BPC pressure ⊘	0.597	bar
Temperature TCD ⊘	115.66	°C

Figure 3.107: Part of status table (working details and sensor values)

💡	The abbreviations after some entries are used in the optional display and thus facilitate the assignment

In addition to the measured values of sensors, the table especially contains the operating mode which are called **Sample Type** and the current **sequence state / step**.

Six operating modes are available, four of them are set by the user. These are the actions **Automation / Single Run / Calibration** and **Verification** which can be selected in the control line.

The remaining operating modes **Idle** and **Error** are automatically assumed by the device depending on the situation.

The device can perform up to nine work steps, depending on the operating mode. A possible combination of these states could be the following:

Sample Type: **Calibration** /Current sequence state: **Flushing**.

When using Modbus only numbers represent the operation and steps.

Modbus number	Sample Type	Current sequence state
0	Idle	Inactive
1	Parameter Update	Flushing
2	Auto	Switching stream
3	Calibration	Waiting for module ready
4	Verification	Start Measurement
5	Single run	Measurement
6	Initialization	Abort measurement
7		Parameterization
8		Initialization
9		Measurement& Flush next stream

3.8.7. Viewing live chromatograms

To view "**Live Chromatograms**", click on the node of the same name. On the right side of the window two chromatogram areas are displayed. If the instrument is already performing a measurement, the areas up to the "live point" are quickly filled with graphs, after which the result graphs are plotted in real time.
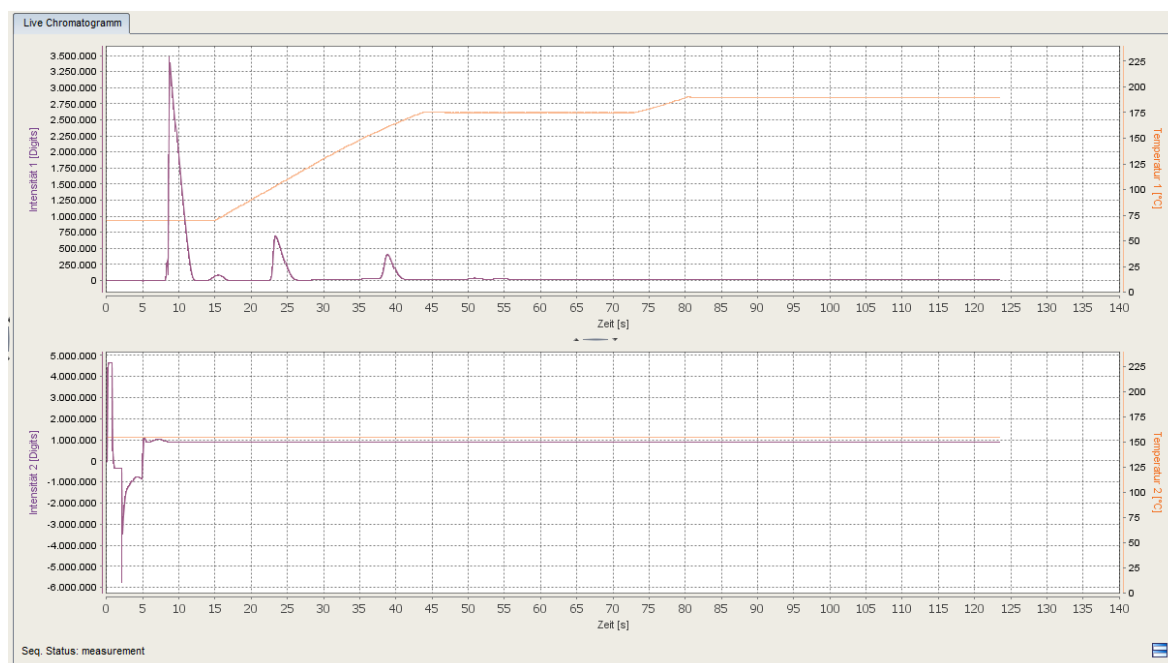
Figure 3.108: Live data tab chromatograms

Values are displayed in graphic form as chromatograms in two drawing sections. Since each GCM1000 module consists of two systems (pre-column and main column with detectors), a measurement always consists of both chromatograms.

The blue graph shows the deflection of the detector (Y value). When combined with the time (X axis), we obtain the lines in the chromatogram known as "peaks". The area under such a peak corresponds to the proportion of the gas component in the sample. The temperature at which the blue measurements were found is shown by the orange line to make the values easier to assess.

The current sequence sate is shown at the bottom left of the picture, see also previous section3.8.6. After the measurement is finished, the result is saved in a file. This file can be displayed again as a chromatogram. For further information in section 3.9 Handling with chromatograms.

The evaluation (numerical values) of the chromatogram can also be viewed under "**Last results**" if no new measurement has been completed. If you have used the ZOOM function described in section 3.9.2, you can reset the view of the chromatograms to the normal size with the button ▭ at the bottom right.

Please note that regardless of the connected measuring paths (streams) and built-in modules, the current measurement is always displayed here, which must be assigned accordingly if necessary.

3.8.8. View the analysis in numerical values

The "**Last results**" list contains the last current measurement result, regardless of when the chromatogram function window was opened via enSuite. With the settings selected in section 3.4 , the corresponding physical meaning can be assigned to each deflection.

Name		Value	Unit
Head Data			
Last measurement ti...	⊘	2019-02-01T16:17:25+02:00	
Total measurements	⊘	31	
Sample type	⊘	sequence automatic	
Stream	⊘	3	
Not normalized sum	⊘	11.22464569883847	
Peak 1 - N2			
Measured by system	⊘	1	
Retention time	⊘	7.1	s
Retention time tolera...	⊘	1.0	s
Retention time tolera...	⊘	1.0	s
Intercept coefficient	⊘	0.0	
Linear coefficient	⊘	7.74522449298924E-8	
Quadratic coefficient	⊘	0.0	
Cubic coefficient	⊘	0.0	
Calibration factor	⊘	1.0	
Base calibration devi...	⊘	10.0	%
Auto calibration devi...	⊘	5.0	%
Verification deviatio...	⊘	5.0	mol%
Measured retention t	⊘	0.0	s

Figure 3.109: Section of last results table

After this additional buffering, these values are stored in a file under the node "**Chromatograms on Device**".

3.9. Handling with chromatograms

3.9.1. Opening stored chromatograms

As soon as a run has been started, chromatograms can be displayed for the current measurement (one per channel) (see the previous pages).

Regardless of visualization, this information is also automatically written to a file in binary format. You can generate (redraw) chromatograms as often as you require using these files in enSuite and then open them offline for further processing.

To do this, call up the enSuite chromatogram functions by clicking on "**Chromatograph**" in the lower part of the navigation window. To view the stored chromatograms, select the **"Chromatograms on Device**" node in the parameterization window that appears on the right.
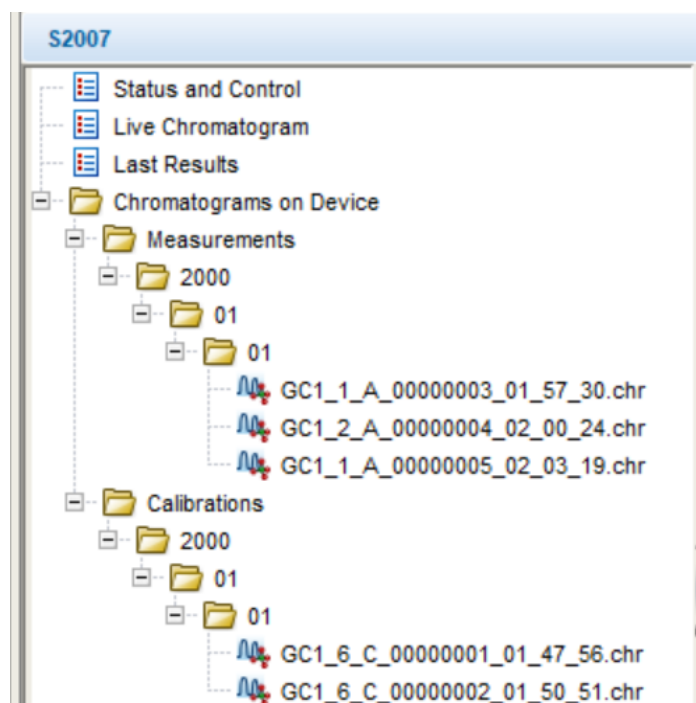
Figure 3.110: Stored chromatograms in the device

Nodes with dates, months and days appear, see the figure above. Chromatograms of measurement and calibration are separated. The status (nodes and files) at the time of function activation is displayed. If the searched data is newer use the **Refresh** function in the context menu or the shortcut key **F5**.

The files are still on the device, so it is necessary to have a connection to it. If you want to view the chromatograms in enSuite without connection to the device, you have the possibility to save the data (like the parameter settings).

To do this, select a node from the **Chromatograms on Device node** and choose **Save** in the context menu. New sub nodes are created under "**Chromatograms**" in the enSuite navigation window. The files stored there can be used in the same way as those stored in the device.
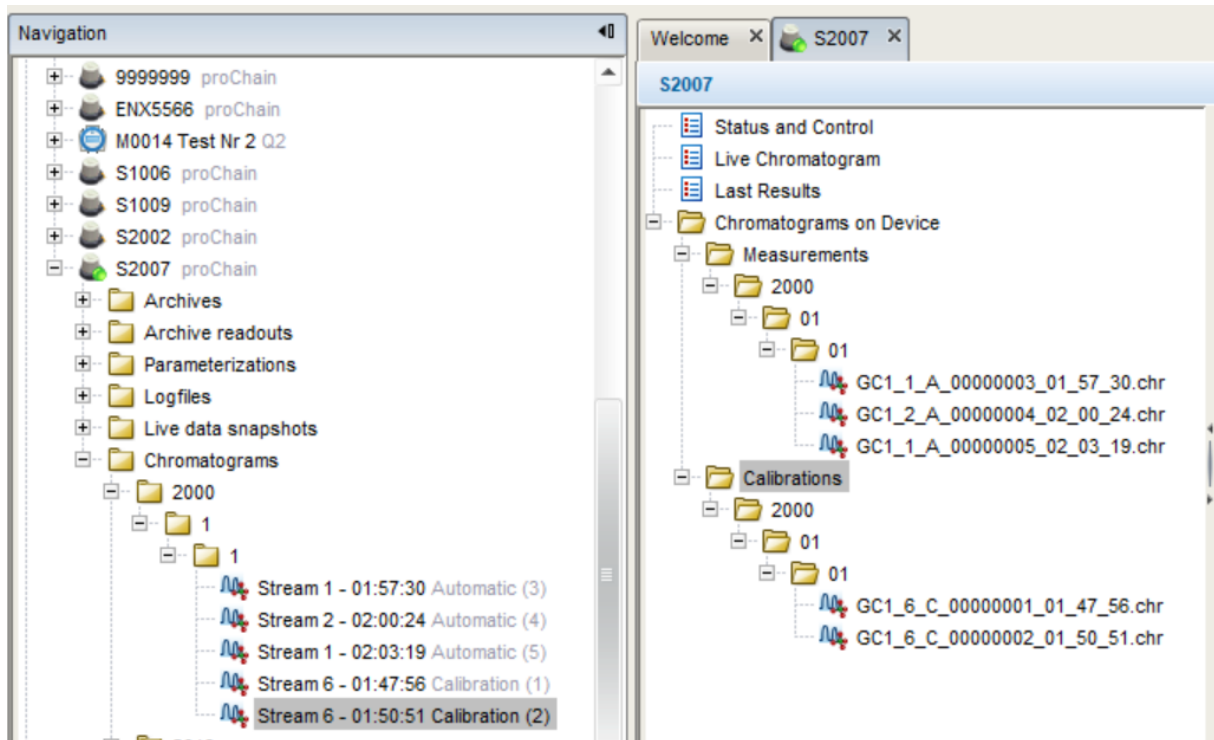
Figure 3.111: Stored chromatograms in enSuite

In the day nodes (in the example shown this is 2000/01/01) you will find the files with the results. On the device, these files have an identifier (e.g. **GC1_6_C_**) and consecutive number (e.g. **00000003_**) followed by the time of the measurement start (e.g. **09_23_24**). This means that each measurement can be clearly identified.

(lightbulb icon)	**GC1_1_A =**this is a chromatogram of an automated measurement **GC1_2_S=** this is a chromatogram of a single measurement **GC1_3_V=** this is a chromatogram of a verification **GC1_6_C=** this is a chromatogram of a calibration

The chromatograms stored in enSuite show the stream of measuring gas, measuring time and type of measurement followed by the measurement number in brackets, instead of the identifier.

When you click on the desired measurement, the context menu offers you additional options. **Export** exports the chromatogram as a file to a computer. **Add to Overlay View** opens the chromatogram for a comparative analysis and offers the possibility to optimize settings with the function Recalculation (see below in this document).

If the chromatogram is stored in enSuite additional functions are offered by the context menu. **Open Chromatogram** opens the chromatogram in a new window, alternatively you can double click on it. **Delete** enables you to remove no longer used chromatograms from enSuite storage.

The **Copy** function is linked to the drag & drop function in the **Overlay view.** It can only use in this context, more details later in this document.

At the same time as clicked on (or double clicked if saved in enSuite) the desired measurement, on the right side of the window, as with the live chromatograms, two areas are displayed again, which are now quickly filled with the stored / saved data. In addition, the graphs are evaluated, and results are displayed graphically, see example.
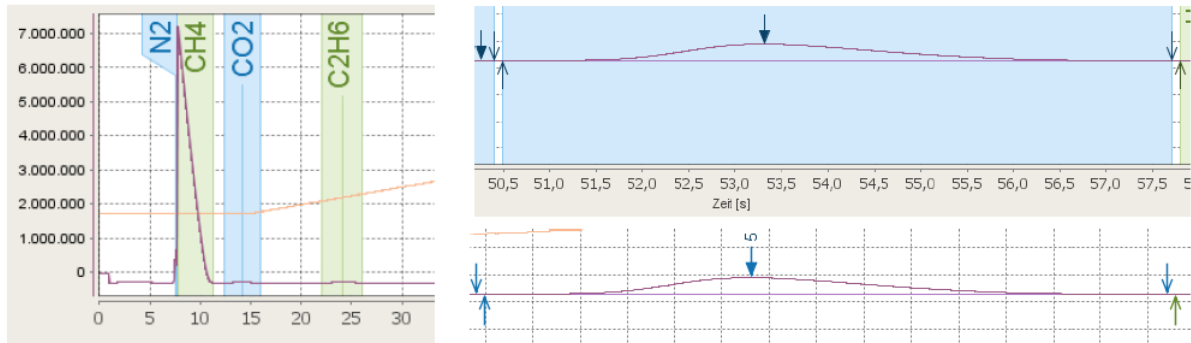
Figure 3.112: Various peak views

There is no difference between the displays under "**Live Chromatograms**" and calling up from the "**Device**" node or **enSuite navigation window** except for the labeling of the chromatogram area.

If you open the context menu in the chromatogram area, you can change the views under **Next Peak View Mode**. (Alternatively press the letter **M**)

Zoom to next peak	Right
Zoom to previous peak	Left
Reset Zoom	Up
Adjust Y-Axis	
Copy Chart	
Next Peak View Mode	M

Figure 3.113: Peak views and change of representation

Two further registers (Peaks / Raw Data) are also created. Peaks contains all peak related calculated values. Raw Data includes the chromatogram data in text form.

| Chromatogram | Peaks | Raw Data |
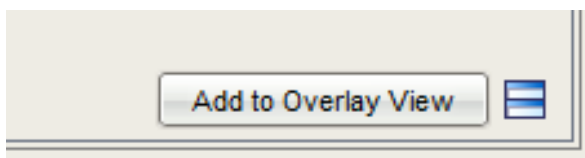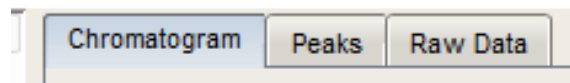
In the lower right corner of the window next to button ▤ (**reset to normal size)** the option **Add to Overlay View** appears again. (Information about see below)

Further information about online and offline chromatograms is also provided below and in the **online help**.

3.9.2. Adjusting the view (zoom)

Besides the peak views there are further options to change the view of the chromatograms. There are various procedures to choose from.

The view of a chromatogram can be enlarged **(ZOOM IN)**. You can enlarge any part by left clicking in the chromatogram section and drawing a rectangle over the desired area while holding the left mouse button. This will then be highlighted in color. To do this, start at the left corner above the section that you wish to enlarge. The figure below shows the change:
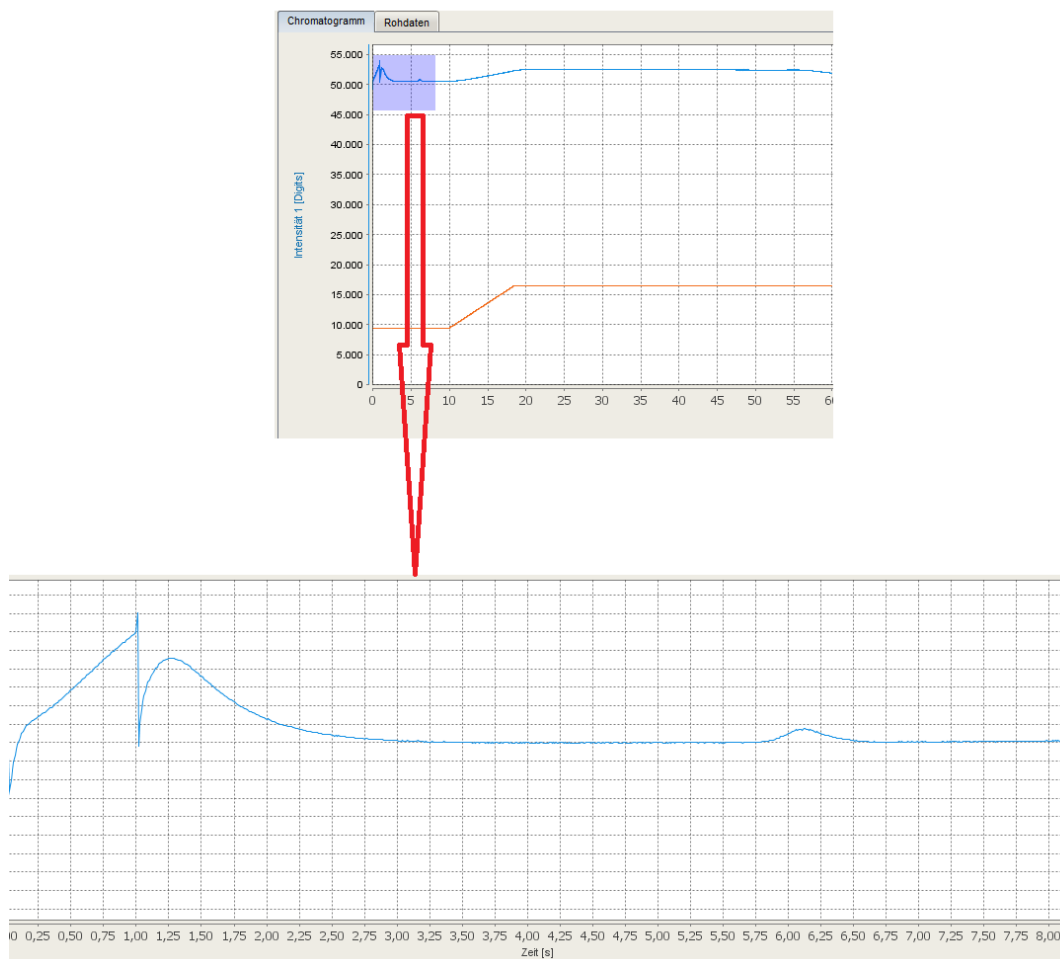
The selected rectangle is then spread over the available area, adjusting the X and Y axes in the process.

You can also use the context menu above. With the selection "**Zoom to next peak**" the first peak is optimally enlarged. If you select it again, the second peak will be enlarged, etc. If you select "**Zoom to previous peak**", you will return to the previous peaks step by step.

Use the context menu opened with the right mouse button in the chromatogram area and the "**Reset zoom**" entry to return to the reduced previous general view.

You can also restore the original view by clicking on the symbol (at the bottom right in the chromatogram window).
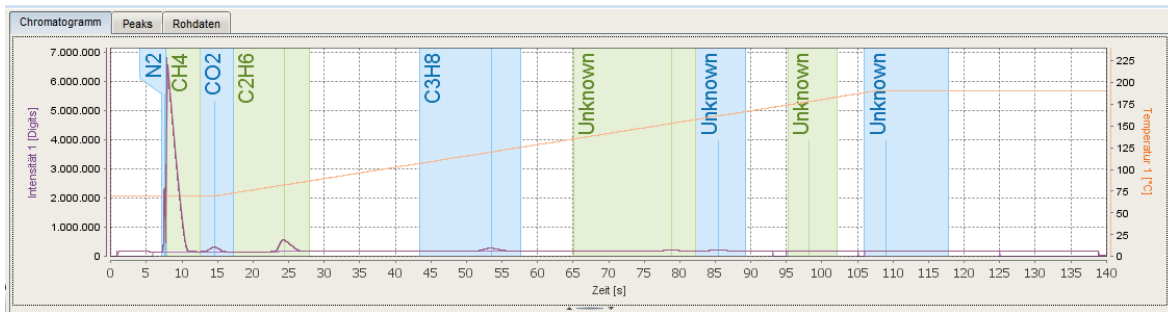
If you press e.g. the cursor key **<right>** the first peak (in the example N_2) is enlarged. See the following figure.
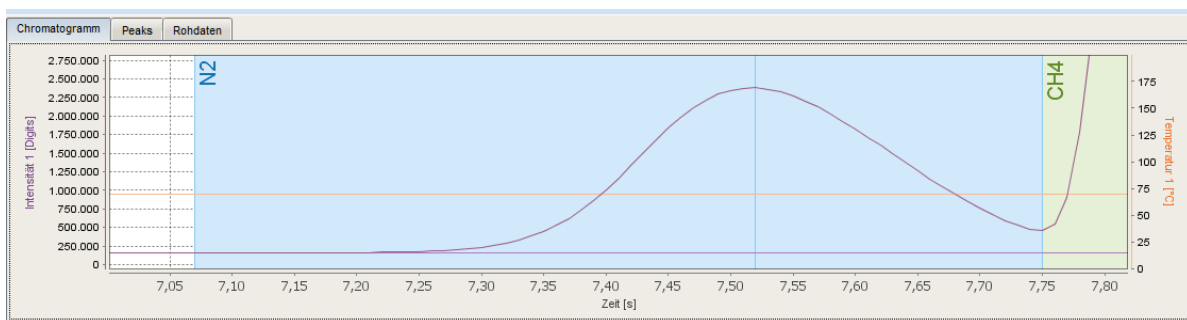
Press this key again to display the next peak (same as when using the context menu), in the example CH_4.
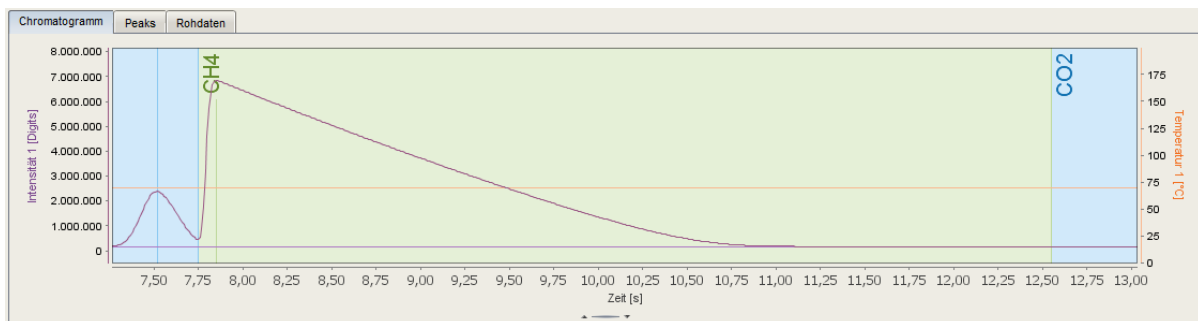
With the cursor key **<right>** you continue to run through the chromatogram each time you press. Press the cursor key **<left>** the direction is changed, and you return to the previous peaks until you reach the first one again.

Use the cursor key **<up>** to cancel the magnification and return to the overall view in the same way as in the context menu Use.

The course key **<down>** and the **<Shift>** key extend the display options compared to the context menu.

If you want to use the zoom functions again after completion, you can return to the last zoomed view with **<down>.**

If you press the **<Shift>** key in combination with a cursor key, you can increase or decrease the number of peaks displayed with each press. See examples:
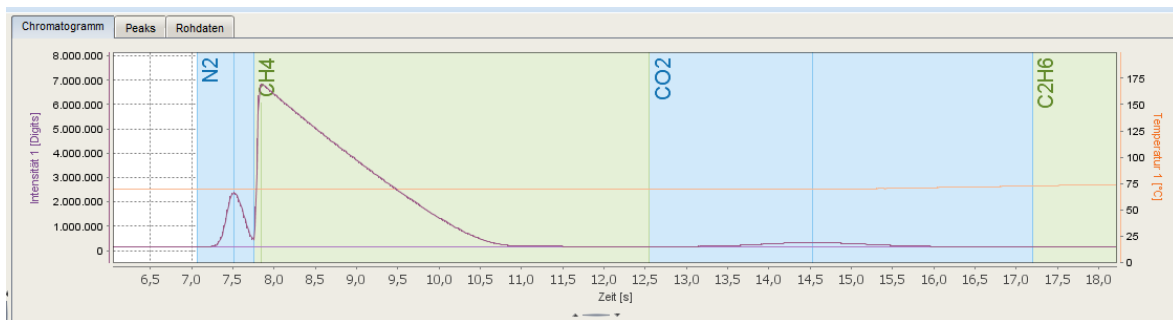
(<Shift>+<right>) Number of peaks displayed increases.
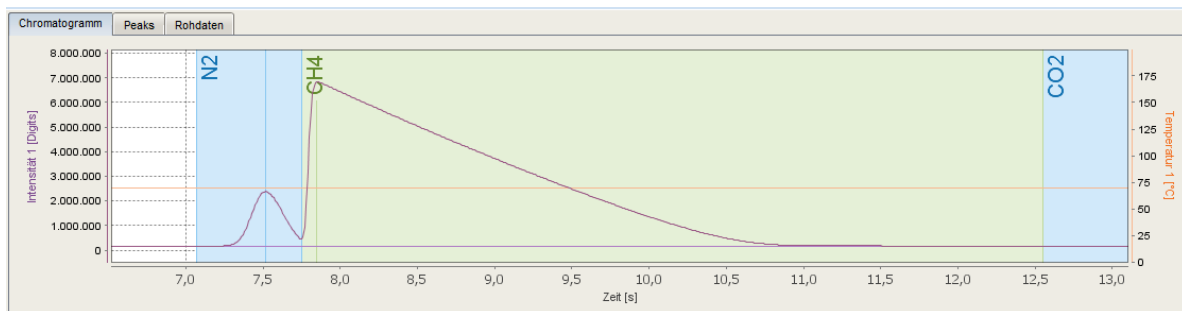
 (<Shift> +<left>) Number of peaks displayed decreases.

Another possibility for ZOOM IN and ZOOM OUT is the mouse wheel. When the wheel is turned, the contents are displayed up to extreme magnifications and reductions.

This method is not as comfortable as the previous ones and should only be used for minor changes or by experienced users.

3.9.3. Overlaying chromatograms (maintenance)

With this function, up to 20 stored chromatograms can be simultaneously loaded. This makes it easy to compare chromatograms and detect differences. Chromatograms can be selected (as mentioned before) by the context menu (right mouse button). Only the graphs (without integrated peaks and results) are displayed.
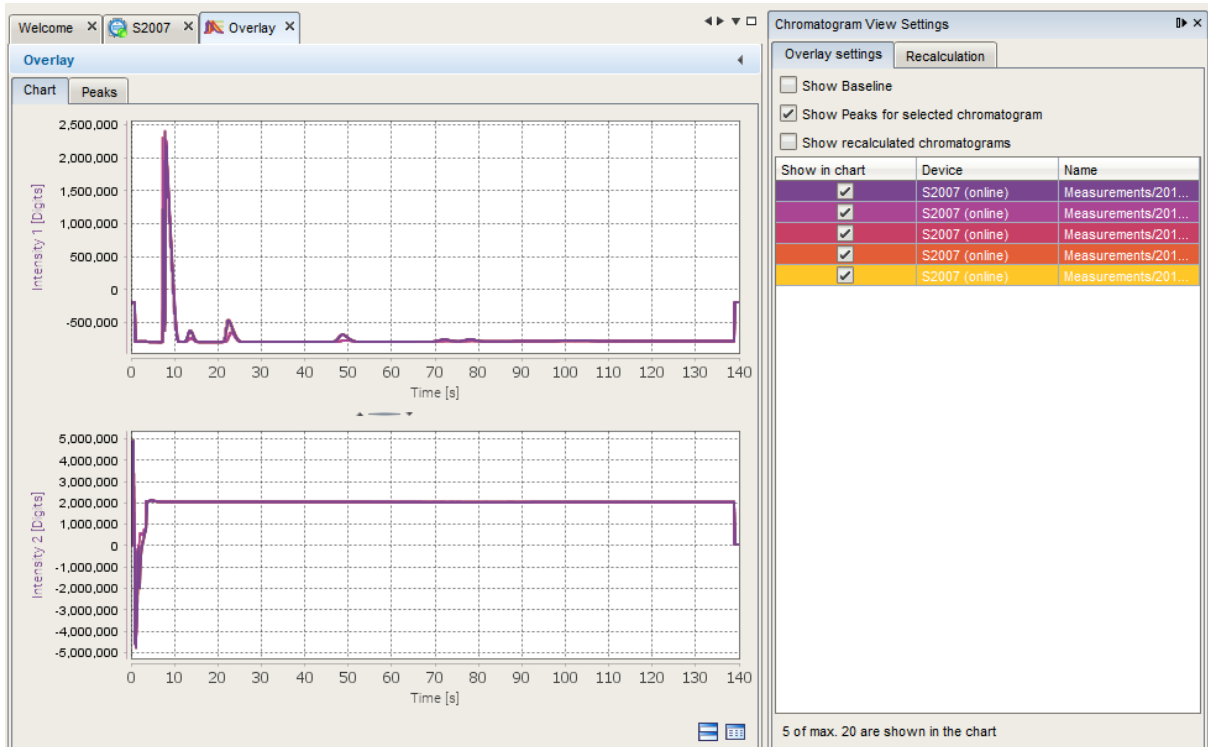
Figure 3.114: Overlay View (Chart)

By setting check marks on tap "**Overlay settings**" on the right-hand side of the window, you can select desired view properties and define which chromatograms are to be displayed. If the window does not appear automatically after opening, you can open it with the symbol at the bottom right of the chromatogram display. To compare numeric values and results use the **tab Peaks**. (See next figure)

Figure 3.115: Overlay View (Peaks)

You are able to open an overlay settings window with the symbol at the bottom right, if it is not already displayed. In this window, you can use radio buttons and check boxes to adjust and filter the displayed values of the list for evaluation.

The second tab of the window called **Recalculation** can be used to adjust and optimize the settings (peaks, integration…) of the device.

In this table, you will find all relevant parameters that you can change.

A click on **Recalculate** accepts your changes in the selected chromatogram(s) as a trial.
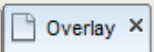
You can now check your changes by switching back to the **Overlay settings** table and selecting the **Show recalculated chromatograms.**

If your changes are ok, then go back to tab **Recalculation** and press **Copy.**

Then you can open a parameterization (use a new read out for this purpose) and insert the changed parameters with **Paste** into the **GC AFB**.

After saving and sending the parameterization to the device, the new settings are used.

Figure 3.116: Overlay View tab. Recalculation

Leave this function by closing the window [Overlay X] on its register.

The procedure described above is usually done during commissioning more information is given in the enSuite online help.

3.9.4. Exchanging chromatograms between device and PC

In addition to the export function in the context menu, symbols at the top left of the enSuite window also allow the user to export selected data, e.g. chromatograms (via intermediate storage with "Save") to the hard disk of a computer.
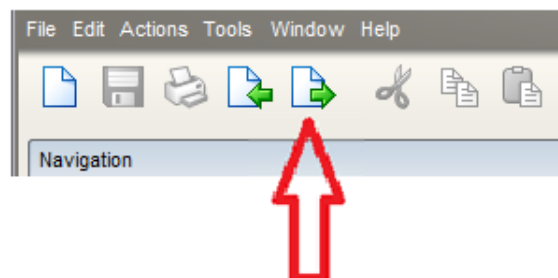
As soon as files have been exported, they should be saved on the hard disk under a defined name as a backup copy. If you have chromatograms from such an export, you can also import them back into the enSuite software and view them there again for further evaluation.
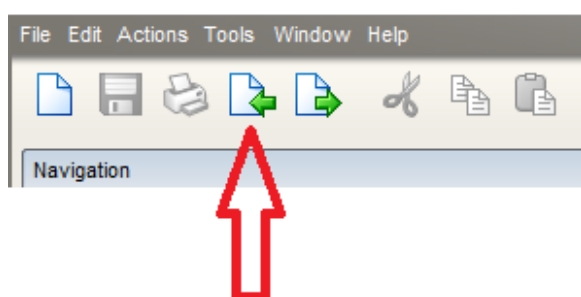
To do this, select the left button, the chromatogram opens after the import and is now displayed in the software.

You now also have the option of saving or printing the chromatogram as an image via the clipboard. See next section.
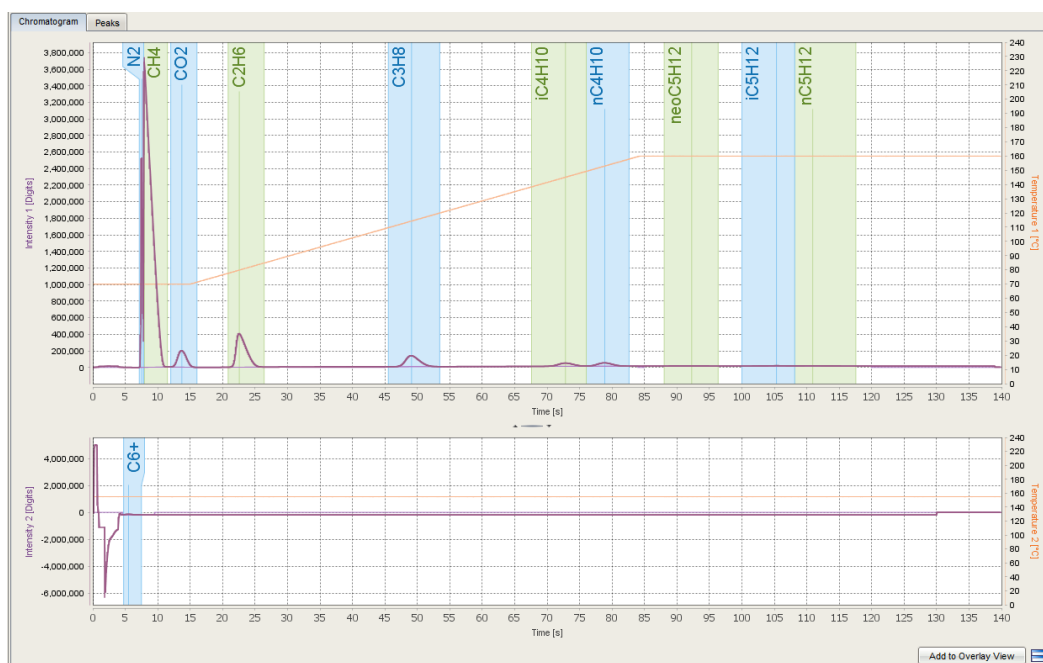
> More information about saving / exporting data and files
> can be found in the **online help of enSuite**.

3.9.5. Printing a chromatogram

If you have activated a **chromatogram view** in enSuite and you open the context menu in the chromatogram, the "**Copy Chart**" option will always be available (see figure).
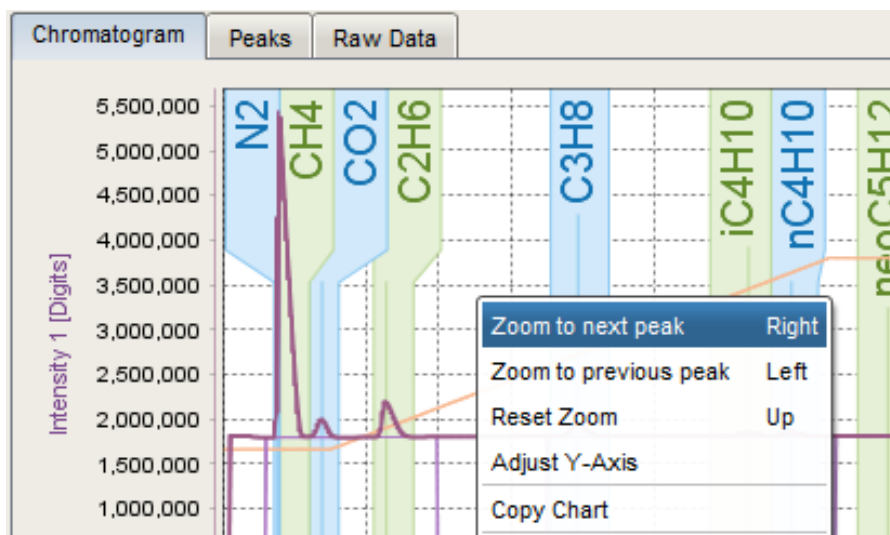
By selecting this option, you can copy the chromatogram to the computer's clipboard. This means that you can use it for all available processing options. For this purpose, go to the required application and use the standard Windows functions to insert contents from the clipboard. For example, using a right-click menu or the Ctrl + V keyboard shortcut.

You can now save the chromatogram in various formats and reopen or print it later. It can also be inserted into a report as in the following example.
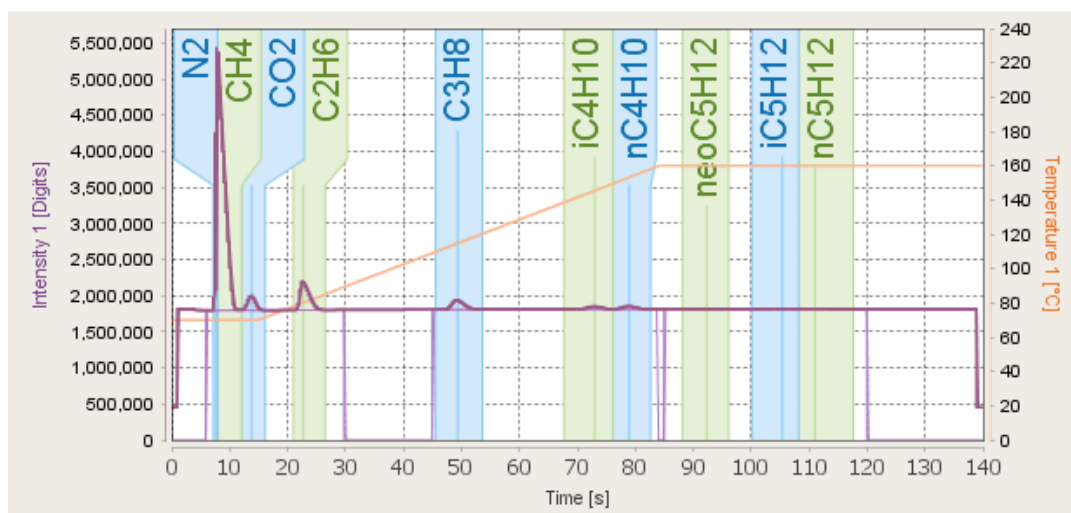
	Remember that **both** chromatograms on the page belong to a complete measurement and only the chromatogram is copied. Neither the analysis table nor the trends section will be copied.

3.10. Optional local display observation of device

Some device functions can be monitored locally by a Honeywell Local Display as an option to view the main data as an overview, see section 2.4.3 Local display. This optional local display is not affected by connection or disconnection of enSuite, it will be refreshed constantly.

3.10.1. Navigation in the display

The following sections describe the menu using the Honeywell Local Display in general form based on examples. The figures below provide an initial overview of the structure. The figure below shows the standard version.
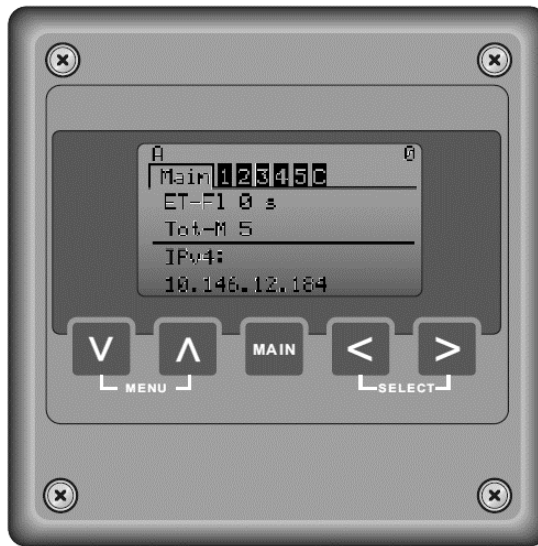
Figure 3.117: Optional local display

There are five keys below the display (screen area). Pressing one of these keys activates the display, which switches itself off after a longer period of non-use. The display will appear in the position, that was last used. The following two characteristics provide information about this position.

- The second line gives an overview of all menus. The current (selected) menu is displayed highlighted a wider line, see examples for "Main", STR1" and Calibration"

Figure 3.118: Current (selected) menu

- The black triangle shows the current (selected) point of the menu in the following examples IPv4 in menu Main and C3H8 in menu STR 1

Figure 3.119: Current (selected) point of the menu

The keys to change this position and view the desired values are located under the display area and have following functions:
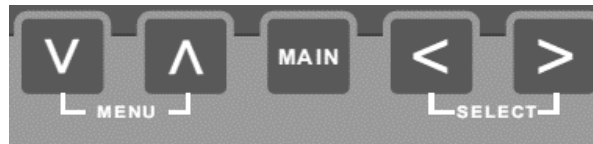
Figure 3.120: Navigation keys and Main

With the **MENU keys,**
you scroll up and down in a menu. If the DOWN key is pressed again after the last entry, the list jumps back to the beginning. The last entry is also jumped to if the UP key is pressed in the topmost position.

With the **SELECT keys**,
additional information for the current line can be displayed or the full information is shown because the line was too short for it. (use > for this function, < will return to the list)

Figure 3.121: Details of a menu point

If you are in the topmost position of a menu, as shown in the examples figure 3.70, you can use these keys to switch into another menu.

	With a click on the **MAIN key** at the bottom center you return to the start of the display, no matter which position is displayed now.

3.10.2. Display status line (first line)

The first line gives a rough overview of the device status. Alarms (A) or warnings (W) or both (if present) are displayed on the left, they are independent from the measured stream. If they do not exist or no longer guilty the place is empty. On the right the current measured stream is shown (0 for idle or no measurement, 6 for calibration running), see examples

Figure 3.122: Display status line (Alarms / Warnings)

The appearance of the display depends on the parameterization.
The values displayed are only valid if the system is in analysis mode and has not suffered a fault. This means that no alarm or error messages are active (view log)

3.10.3. Data / content of Main display

The main display is the start display of the device. This position can be reached by pressing the MAIN key. As the display only offers space for a few characters, abbreviations are used.

Figure 3.123: Main display (Start display)

The following table explains the abbreviations and lists all values contained in the menu. Use the DOWN and UP button of MENU to scroll through the display.

Display text	Meaning
Main	Name of the menu
AL-S	Alarm (Alarms exist = On / No Alarms exist = off)
Stype	Sample Type (only numbers are displayed) 0 = Idle 4 = Verification 1 = Parameter Update 5 = Single run 2 = Auto 6 = Initialization 3 = Calibration
CSST	Sequence State (only numbers are displayed) 0 = Inactive 6 = Abort measurement 1 = Flushing 7 = Parameterization 2 = Switching stream 8 = Initialization 3 = Waiting for module ready 9 = Measurement & Flush next stream 4 = Start Measurement 5 = Measurement
CStr	Current stream (Gas of the input which is connected / measured in the module)
ETrun	Running Time (Time elapsed since the beginning of the measurement)
FlStr	Flushing stream (Gas path which is flushed for the next measurement 0 = no flushing in the moment)
ET-Fl	Elapsed flushing time
Tot-M	Total measurements (Number of all measurements independent of the stream)
IPv4	IP-Address of the device
SerNo	Serial number of the device

3.10.4. Data / content of display STR1–5 and Calibration

The displays for Stream 1–5 and calibration are build identical. The last measurement results for dry gas for the set reference state are displayed as standard. As the display only offers space for a few characters, abbreviations are used.

```
A                          0
M▶STR1 2 3 4 5 C
    Std.    ISO 6976:2016…
    Base    25/0°C, 101.3…
    Hs      371.25468 kJ/…
    HsV     16.59692 MJ/m³
```

Figure 3.124: Display of streams and calibration

The following table explains the abbreviations and lists all values contained in the menu. Use the DOWN and UP button of MENU to scroll through the display.

Display text	Meaning
STRx	Name of the menu (x= 1 to 5 and C = Calibration)
Std.	Calculation standard
Base	Base conditions selected for the calculation standard
Hs	Gross heating value / Higher heating value (molar)
HsV	Gross heating value / Higher heating value (based on volume)
HsM	Gross heating value / Higher heating value (based on mass)
Hi	Net heating value / Lower heating value (molar)
HiV	Net heating value / Lower heating value (based on volume)
HiM	Net heating value / Lower heating value (based on mass)
Z	Compressibility factor
Ws	Superior Wobbe index (Wobbe index superior) Gross Wobbe index
Wi	Inferior Wobbe index / Net Wobbe index
rd	(d) Relative density (of fuel and air)
ρ	(Rho) Density at base conditions
M	Molar mass
CH_4	Methane
N_2	Nitrogen

Display text	Meaning
CO_2	Carbon dioxide
C_2H_6	Ethane
C_3H_8	Propane
nC_4H_{10}	n-Butane
iC_4H_{10}	Isobutane (i-butane)
nC_5H_{12}	n-Pentane
iC_5H_{12}	Isopentane (i-pentane)
$neoC_5H_{12}$	Neopentane (2,2-Dimethylpropane)
nC_6H_{14}	n-Hexane (C6+)
C_7H_{16}	Heptane
C_8H_{18}	Octane
C_9H_{20}	Nonene
$C_{10}H_{22}$	Decane

3.11. Technical data (Software)

The main technical data are noted on various type plates and labels on the actual device and are also listed below. Additional tables and the data for the CE declaration supplement this list.

3.11.1. Tables and information about the device

EnCal 3000 proChain GC system	Values and/or comments
Interval setting	1 x daily calibration
Data logger (non-volatile):	Archives/Calibration data/Parameterization/Logbooks
Operating system	Service PC: see download section
Software	enSuite
File format	enSuite.csv / enSuite.par
Data logger	Integrated (interval adjustable)

Inputs/Outputs	Values and/or comments
Analysis output	Complete composition of natural gas up to C_6+ Heating value, density, Wobbe index
Data logging (Exceeds API 21.1)	local storage of last 100 days of all analytical data (analysis, events, alarms, averages, calibration data) in accordance with API Report 21.1. Last 2000 chromatograms are stored (ca. 4 days).
Data output	All data can be supplied in XML format.

3.11.2. Copyright notice for the pressure sensor used

(License for EnCal 3000 proChain GC Baseboard Bosch Pressure sensor Lib)

****

* Copyright (C) 2015 – 2016 Bosch Sensortec GmbH

* File: bmp280.c

* Date: 2016/07/01

* Revision: 2.0.5 (pressure and temperature compensation code revision 1.1)

* Usage: Sensor Driver for BMP280 sensor

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4. Keywords and list of figures

4.1.   Keyword register

4.2. List of Figures

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