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71590322
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Valid as of version
Software: 1.09.xx

Operating Instructions
Bunker Metering Computer SBC600

Providing accuracy and efficiency in bunkering

Endress+Hauser
People for Process Automation

Revision history

Product version	Operating Instructions	Changes	Comments
1.01.xx	BA01353S/04/EN/01.14	Initial version	-
1.04.xx	BA01474S/04/EN/01.15	New Content Management System Changes added in relation to the new program version	-
1.05.xx	BA01474S/04/EN/03.16	The valve can also be used for version 1.04.02. The system can use up to two lines again.	-
1.05.xx	BA01474S/04/EN/04.17	New Appendix: Interface specification Section 7.1.2 "Shutting down": valid from version 1.04.04, screen updated	-
1.05.xx	BA01474S/04/EN/05.17	New section 15.4.3 "Microsoft(R) Windows(R) Embedded Standard 7"	-
1.06.xx	BA01474S/04/EN/06.18	Custody transfer measurement results also in volume based on std density at 15 °C	-
1.07.xx	BA01474S/04/EN/07.18	Support for Promass 300	-
1.08.xx	BA01474S/04/EN/08.22	Section 15.3.2 Modbus data register specification expanded	-
1.09.xx	BA01474S/04/EN/09.22	Section 15.1 List of messages expanded Section 15.3.2 Modbus data register specification expanded	- -

Table of contents

List of figures

1 Document information

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols used

1.2.1 Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Symbols for certain types of information

Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.
	**Preferred** Procedures, processes or actions that are preferred.
	**Forbidden** Procedures, processes or actions that are forbidden.
	**Tip** Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.3 Electrical symbols

Symbol	Meaning	Symbol	Meaning
⎓	Direct current	~	Alternating current
⎓ ~	Direct current and alternating current	⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.	⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.4 Software symbols

Symbol	Meaning
	Error message
	Warning
	New message, not acknowledged
	Acknowledged message, but message is still active
	Acknowledged message, no longer active (cause has been rectified)
	Acknowledged message: Press this button to acknowledge the selected message.
	Print: Press this button to print out the list of messages (only if a printer is connected).
	Refresh: Press this button to update the list of messages.

1.3 Text emphasis

Emphasis	Meaning	Example
Bold	Keys, buttons, program icons, tabs, menus, commands	**Start → Programs → Endress+Hauser** In the **File** menu, select the **Print** option.
Angle brackets	Variables	<DVD drive>

1.4 Acronyms used

Acronyms	Meaning
API	American Petroleum Institute
BTN	Bunker Ticket Number
EMC	Electromagnetic compatibility
GEP	Good Engineering Practices
GMP	Good Manufacturing Practices
GMT/UTC	Greenwich Mean Time/Coordinated Universal Time
HMI	Human Machine Interface - software visualization application

Acronyms	Meaning
IPA	Isopropyl alcohol
NIST	US National Institute of Standards and Technology
PLC	Programmable logic controller (PLC)
RTD	Resistance temperature detector
SBC600	Bunker Metering Computer
TCP	Transmission Control Protocol
UPS	Uninterruptible power supply
ZV	Zero Verification

1.5 Valid versions

This user manual applies to the following versions:

Component	Version
PLC program [1)]	From V1.07.xx
HMI program [1)]	From V1.07.xx
Hardware platform [1)]	From V1.02.xx

1) It applies for all types of cabinet installation (systems with just one cabinet or two cabinets)

1.6 Registered trademarks

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2 Basic safety instructions

When installing, commissioning, diagnosing and maintaining the Bunker Metering Computer or other individual devices in the Bunker Metering System, it is absolutely essential to observe the safety instructions provided in the Operating Instructions for the specific devices and in the associated device documentation.

2.1 Requirements for personnel

The staff responsible for installation, commissioning, diagnosis and maintenance must meet the following requirements:
- They must be suitably qualified experts who have been trained by Endress+Hauser, or they must be experts from the Endress+Hauser service organization.
- The staff must be authorized by the ship owner/operator.
- The staff must be familiar with regional/national requirements and regulations.
- Prior to commencing work, the staff must have read and understood the instructions in these Operating Instructions and in the supplementary documentation and certificates (depending on the application).
- The staff must follow the instructions and comply with the basic requirements.

Operating personnel must meet the following requirements:
- The operating staff must be instructed and authorized according to the requirements of the task by the facility's owner/operator.
- The operating staff must follow the instructions contained in this manual.

2.2 Designated use

This user manual is aimed at **operators** and **supervisors** working with the Bunker Metering Computer. The functionality described in this manual applies to users at **supervisor** level. Access for **operator** level users is slightly restricted.

The SBC600 has been designed for use with Endress+Hauser Promass F84 Coriolis flowmeters, sizes DN80 to DN350. Any other use is considered to be non-designated use. The manufacturer is not liable for damage resulting from non-designated use; in such instances the user bears full responsibility. Designated use entails compliance with the operating and maintenance requirements specified by the manufacturer.

The SBC600 must be installed in a safe environment (not in hazardous areas or Ex zones).

It is advisable to install the SBC600 in a dry, air-conditioned room.

2.3 Occupational safety

When working on or with components of the Bunker Metering Computer:
Always use personal protective equipment in accordance with regional/national requirements and specifications.

When working with wet hands on or with devices:
The wearing of gloves is recommended, as otherwise there is an increased risk of electric shock

2.4 Operational safety

- Operate the SBC600 and the complete Bunker Metering System in proper technical condition and fail-safe condition only
- The operator is responsible for the trouble-free operation of the complete Bunker Metering System including the SBC600 and the devices
- Repairs must only be performed by certified Endress+Hauser specialists
- Unauthorized modifications to the Bunker Metering Computer or the use of devices that are not permitted can lead to unforeseeable dangers:
  If modifications are nevertheless required, please contact the manufacturer
- To ensure continued operational safety and reliability:
  - Only carry out repairs if they are expressly permitted by the manufacturer
  - Observe all regional/national regulations regarding the repair of electrical devices.
  - Use only original spare parts and accessories from Endress+Hauser

2.5 Product safety

Endress+Hauser components

The Bunker Metering Computer has been developed and certified in accordance with the company's product development standard. This includes the mechanical and electrical design, performance testing and impact assessment of environmental sustainability (e.g. climate, vibration, EMC) in accordance with the requirements of the OIML R117 standard.

Program (software)

The application software was written by Endress+Hauser using the specified tools. We have adhered to the GMP and GEP as described in an Endress+Hauser standard for writing application software.

The software has been developed following a V-model based standardized process and has been certified to WELMEC 7.2.

2.6 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

The operator is responsible for data backup.

3 Product description

The principle functions of the Bunker Metering Computer are:

The main functions of the Bunker Metering Computer are to record and visualize the bunkering data of all the devices involved. The Computer then creates bunker metering tickets and metering profiles from these data.

In conjunction with the complete metering system for bunkering operations, the SBC600 provides the following functionalities:
- Continuous, bidirectional mass flow measurement using Coriolis flowmeters
- Compensation of entrained air
- Totalization of the quantity of transferred fuel
- Batch data storage
- Bunker metering ticket printout
- Metering profiles
- Density display
- Volume display
- Fluid temperature measurement
- Line packing optimization using control valve (loading only)

3.1 Product design

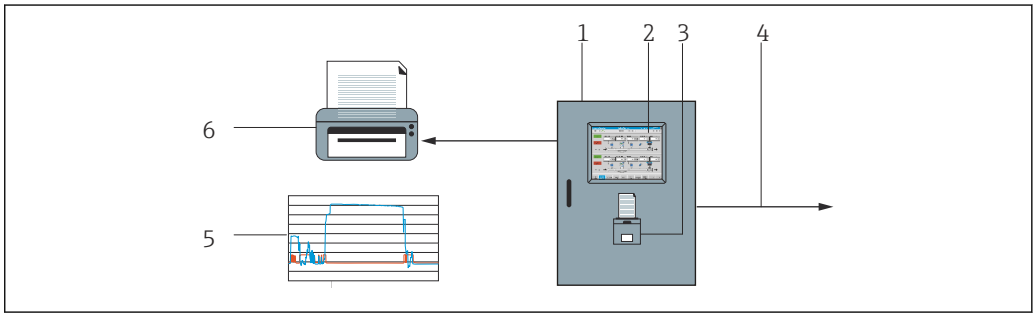
The Bunker Metering Computer SBC600 is designed to create and issue bunker metering tickets and metering profiles when connected to the relevant system components (devices). The system provides user-friendly, step-by-step procedures for measuring, monitoring and tracking bunkering operations.

Optionally, these data can be forwarded to the customer via a Modbus connection.

The SBC600 can be supplied with a choice of three cabinet configurations:
- Single cabinet with the PLC and HMI in the same cabinet (control unit) for wall mounting
- Two cabinets with the PLC (control unit) and HMI (operator terminal) in separate cabinets for wall mounting
- Two cabinets with the PLC (control unit) in one cabinet for wall mounting and the HMI (operator terminal) in a desk panel

This user manual applies for all the versions listed above.

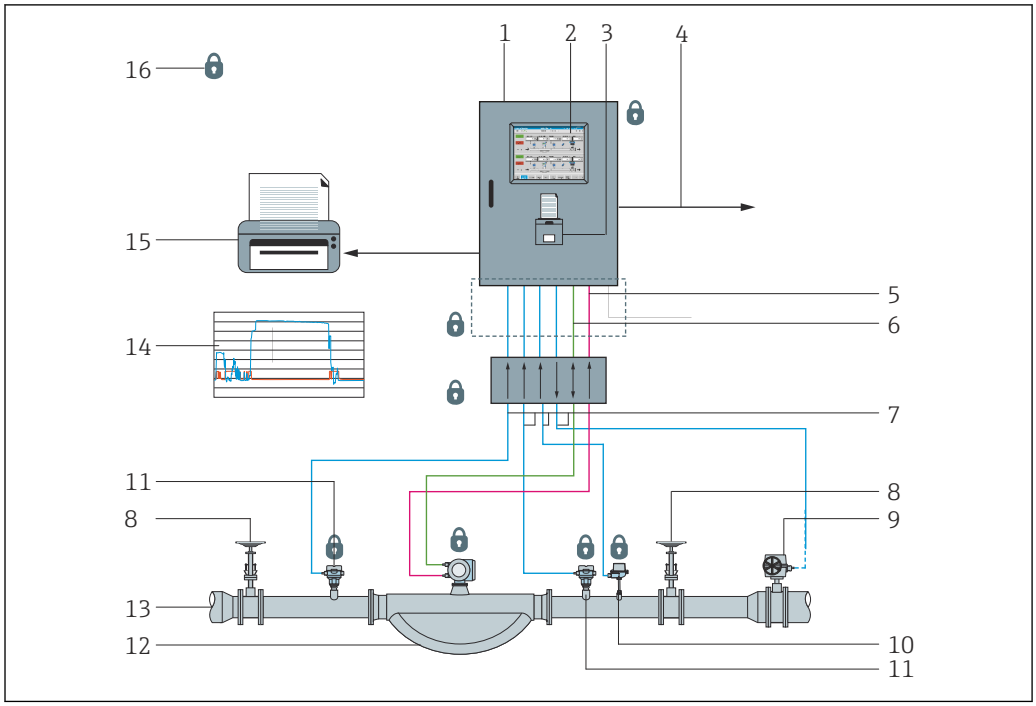
3.1.1 System Overview



1 *Overview of the Bunker Metering Computer*

1 *Control unit and operator terminal of the Bunker Metering Computer SBC600*
2 *Integrated human-machine interface (HMI)*
3 *Integrated printer for Bunker Metering Tickets (BMT)*
4 *Modbus TCP (optional)*
5 *Metering profile*
6 *External printer to print out metering profiles (optional)*

A complete Bunker Metering System is depicted in the picture below to provide a better understanding of the functionality of the SBC600.



2 *System design of the Bunker Metering System*

1 *Bunker Metering Computer SBC600*
2 *Integrated human-machine interface (HMI)*
3 *Integrated printer for Bunker Metering Tickets (BMT)*
4 *Modbus TCP (optional)*
5 *DC 24 V pulse*
6 *Modbus RTU*
7 *4 to 20 mA*
8 *Shutoff valve*
9 *Control valve*
10 *Temperature*
11 *Pressure*
12 *Flow*
13 *Metering line*
14 *Metering profile*
15 *External printer to print out metering profiles (optional)*
16 *Sealed system components*

3.2 Using the Bunker Metering Computer

The Bunker Metering Computer may only be used if it has no technical defects and only in accordance with its designated use and in accordance with the instructions specified in this user manual. The SBC600 may be operated only by safety-conscious and suitably trained personnel who are fully aware of the risks involved.

3.3 Modifications to the Bunker Metering Computer

As it is a modular, high-precision measuring system, only suitably trained and qualified personnel may modify the system. Modifications to the design of the hardware or software may be undertaken only by Endress+Hauser Process Solutions prior to the implementation of updates or upgrades.

All modifications must comply with the applicable certificate of the calibration authority. Otherwise, the certificate will lose its validity.

Contact your local Endress+Hauser Sales Center for more support.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Upon receipt of goods, check the following:
- Examine the packaging and contents for damage
- Check the delivery to ensure it is complete and matches the order

The documentation is included in the scope of delivery of the Bunker Metering Computer and comprises:
- These Operating Instructions for the Bunker Metering Computer SBC600
- The wiring diagram for the Bunker Metering Computer SBC600

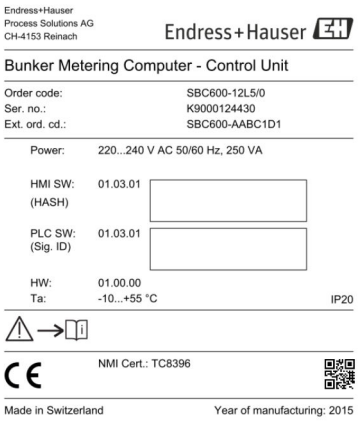
4.2 Product identification

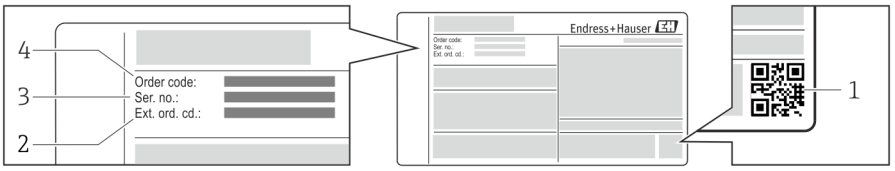
4.2.1 Control unit and operator terminal

The control unit and the operator terminal can be identified using the nameplate which is located on every cabinet. The operator terminal can be accommodated in a separate cabinet or integrated in the cabinet of the control unit. The control unit nameplate is always attached. The operator terminal nameplate is only attached if an optional operator terminal is provided.

4.2.2 Endress+Hauser system

You can identify the components in the following ways:
- Nameplate specifications on the cabinet.
- Enter the serial number indicated on the nameplate in W@M Device Viewer (www.endress.com → About us → W@M Life Cycle Management → Operations → The right device information always at hand (find spare part) → Access device-specific information → Enter serial number): all the information relating to the system/device is then displayed.
- Enter the serial number indicated on the nameplate into the Endress+Hauser Operations App or scan the 2-D matrix code (QR code) on the nameplate with the Endress+Hauser Operations App: all the information relating to the system/device is then displayed.





1 2-D matrix code (QR code)
2 Extended order code (Ext. ord. cd.)
3 Serial number (ser. no.)
4 Order code

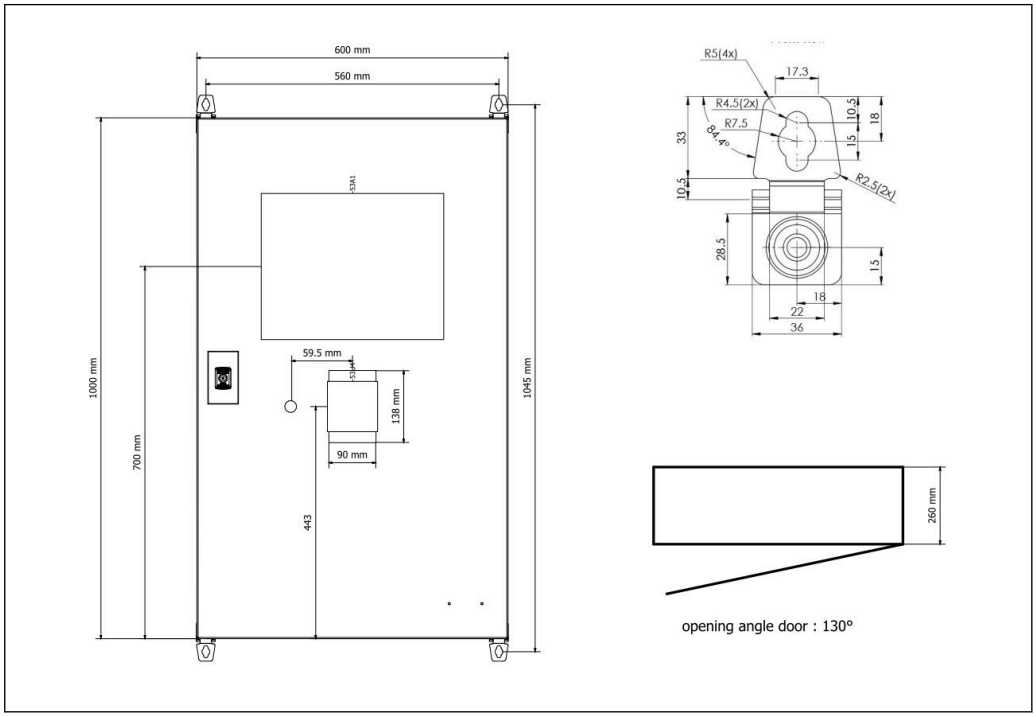
4.3 Storage and transport

- The cabinet is packed in such a way that it is fully protected against shock when in storage and during transportation. The original packaging offers the best protection
- The permitted storage temperature is −20 to +60 °C (−4 to 140 °F), preferably +20 °C (68 °F).
- When transporting the cabinet protect it from direct sunshine to avoid excessively high surface temperatures
- Store the cabinet packaged in a dry place
- Transport the cabinet to its final destination in the transportation box in which it was delivered

5 Installation

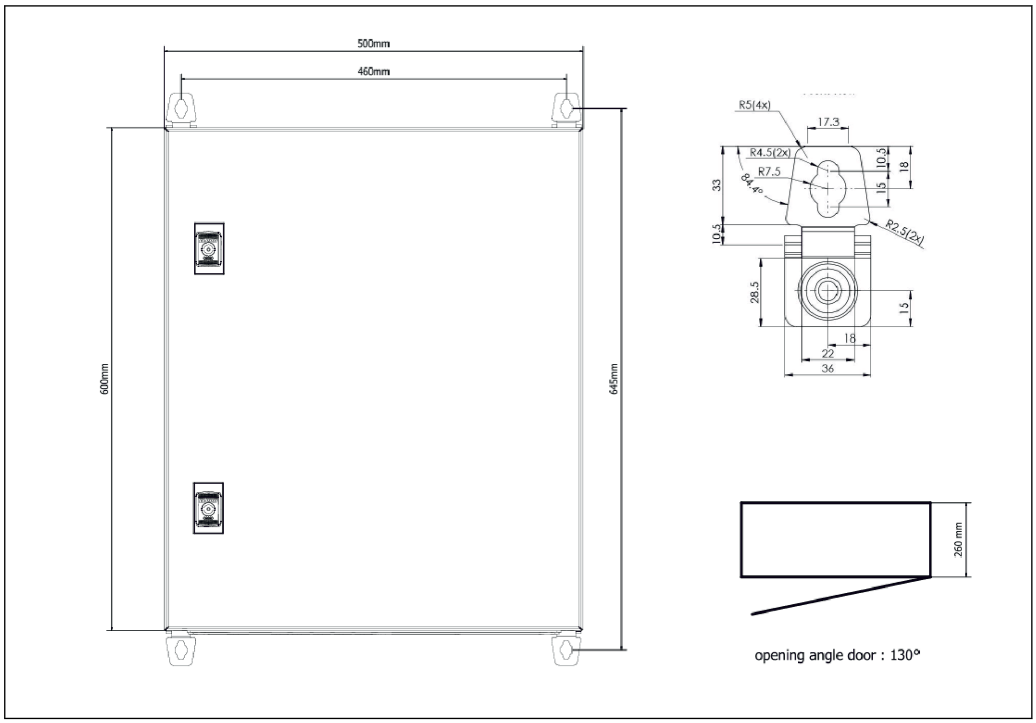
The SBC600 is supplied with brackets for wall mounting and must be mounted on a stable wall using suitable mounting equipment.

See below for an example of a system with an individual cabinet with installed mounting brackets and details of the mounting brackets.

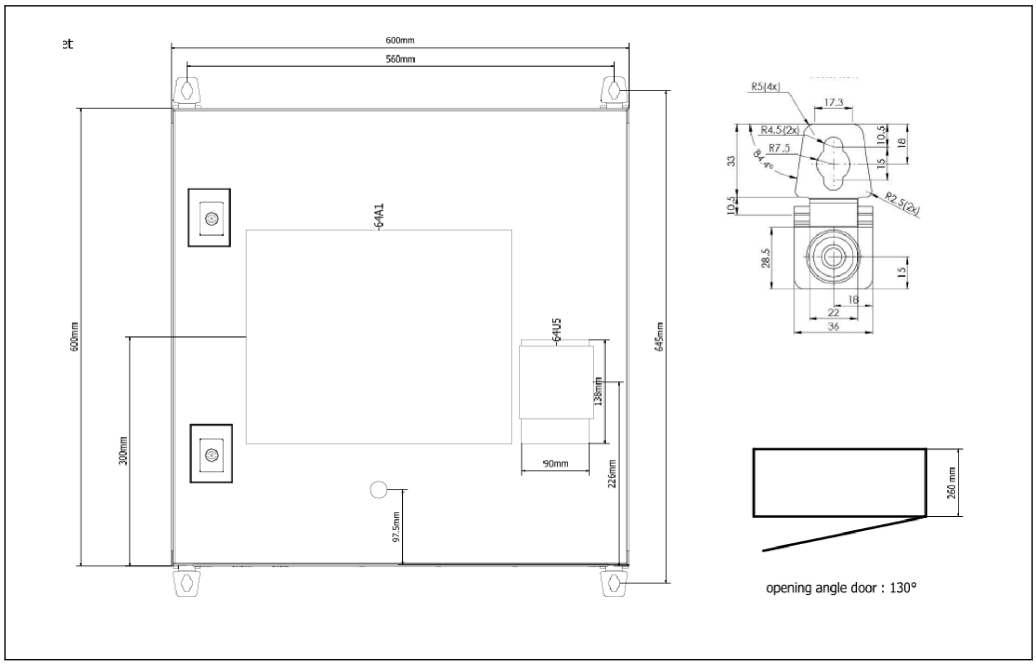


3 *Single cabinet with the PLC and HMI in the same cabinet (control unit) for wall mounting.*

Two cabinets with the PLC (control unit) and HMI (operator terminal) in separate cabinets for wall mounting:

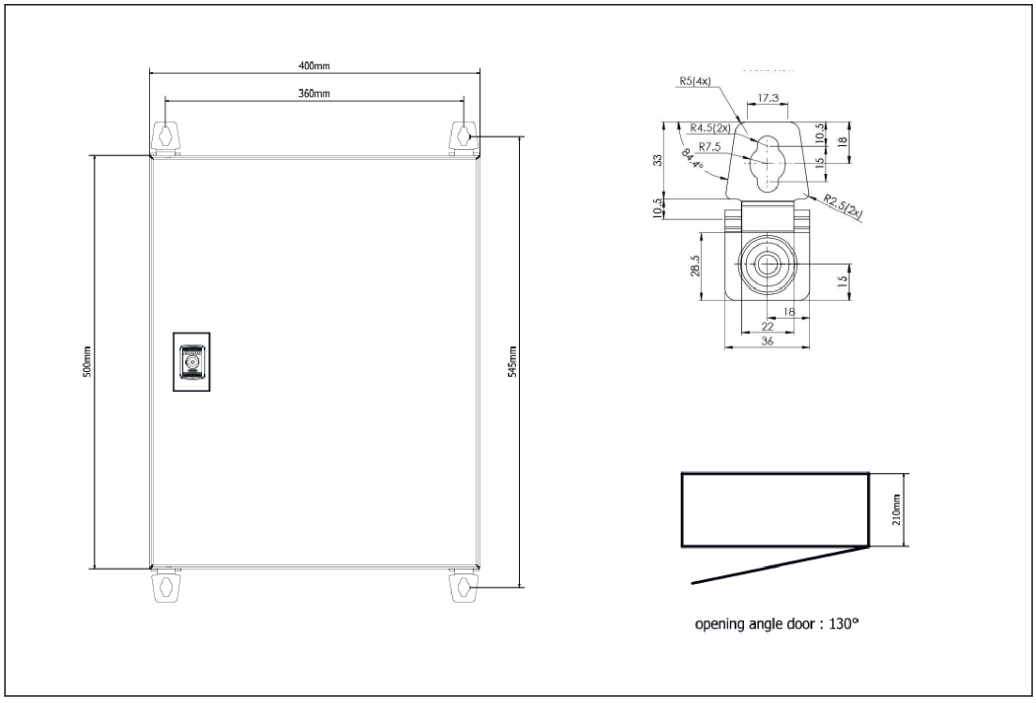


4 *PLC (control unit) in a cabinet*

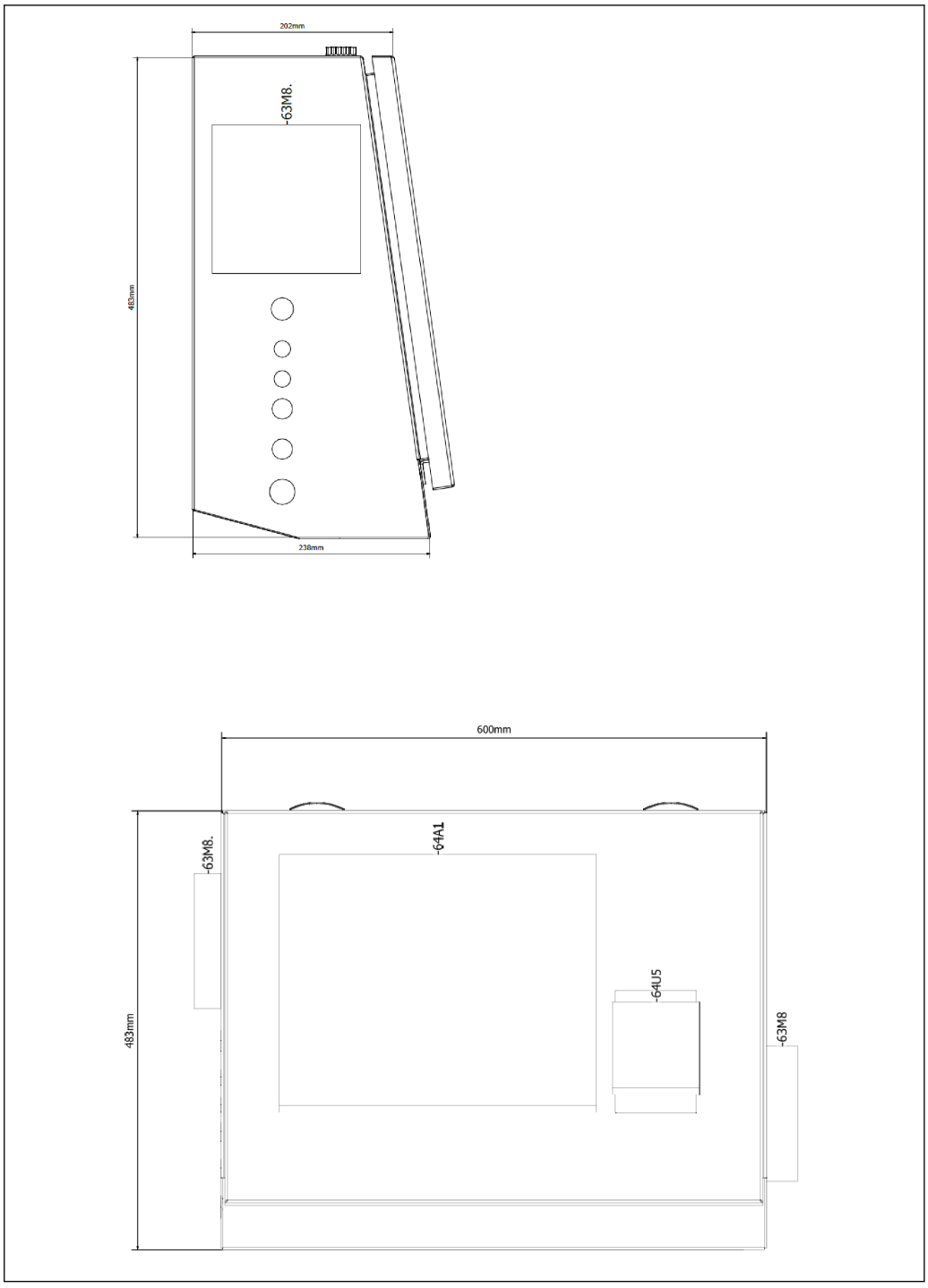


5 HMI (operator terminal) separately in one cabinet for wall mounting

Two cabinets with the PLC (control unit) in one cabinet for wall mounting and the HMI (operator terminal) in a desk panel:



6 PLC (control unit) in a cabinet for wall mounting



7 *HMI (operator terminal) in a desk panel*

6 Electrical connection

6.1 Connection conditions

6.1.1 Required tools

- For cable entries: use suitable tools
- For securing clamp (stainless steel housing): 8 mm wrench
- Wire stripper
- When using standard cables: use a crimper for wire end ferrules
- Crimper for keystone jack and plug cat. 6A
- Universal measuring device for cable testing

6.1.2 Connecting cable

WARNING

As the cabinet is installed in a maritime environment,
the connecting cables and cable entries must meet special requirements.
► The requirements in these Operating Instructions must be met.

All power and signal cables used must be approved for use in the maritime industry in accordance with the latest technology and generally recognized rules of technology:
- All cables laid must be specifically designed for use in the maritime industry. In addition, they must meet requirements relating to ship class and have other necessary approvals.
- The use of armored cables is recommended, and these should be laid in fixed or flexible conduits to protect them from mechanical damage.
- All signal cables must be grounded. If multi-core cables are used, the individual signal cables must be grounded individually.
- All Ethernet connection cables must be Cable Type S/FTP Category 7 (individual pairs with braided shield and overall cable with foil screen).
- Required wire cross-sections:
  - Signal cable: 0.75 mm^2
  - Power cable for AC: 1.5 mm^2

6.1.3 Ethernet socket

The RJ-45 Ethernet connections on the Ethernet cables must meet the following specifications: Keystone jack cat. 6A

6.1.4 Cable entries and distribution box

The cable entries must meet all safety requirements applicable at the place of installation. These may include:
- Protection against climatic conditions
- Protection against corrosion
- Sealing off of any unused cable entries using dummy plugs.

Additional use of a sealing compound to seal off connection seams or joints is common practice and has proven to be effective.

6.2 Special connection instructions

Wiring the cabinet

The pressure sensors and the RTD assembly are powered directly via the Bunker Metering Computer (SBC600). The Coriolis mass flowmeter and the control valve are powered separately. Suitable circuit breakers must be provided for these devices.

NOTICE

If the circuit breakers were installed in this cabinet, it would only be possible to access them by breaking the seal.

- The circuit breakers may not be installed in the cabinets of the Bunker Metering Computer (SBC600) as these cabinets are sealed.

For the SBC600 and associated devices, the use of an uninterruptible power supply (UPS) is recommended. For the required power ratings, see **Section 14**. → 53

7 Operation options

7.1 Starting up and shutting down

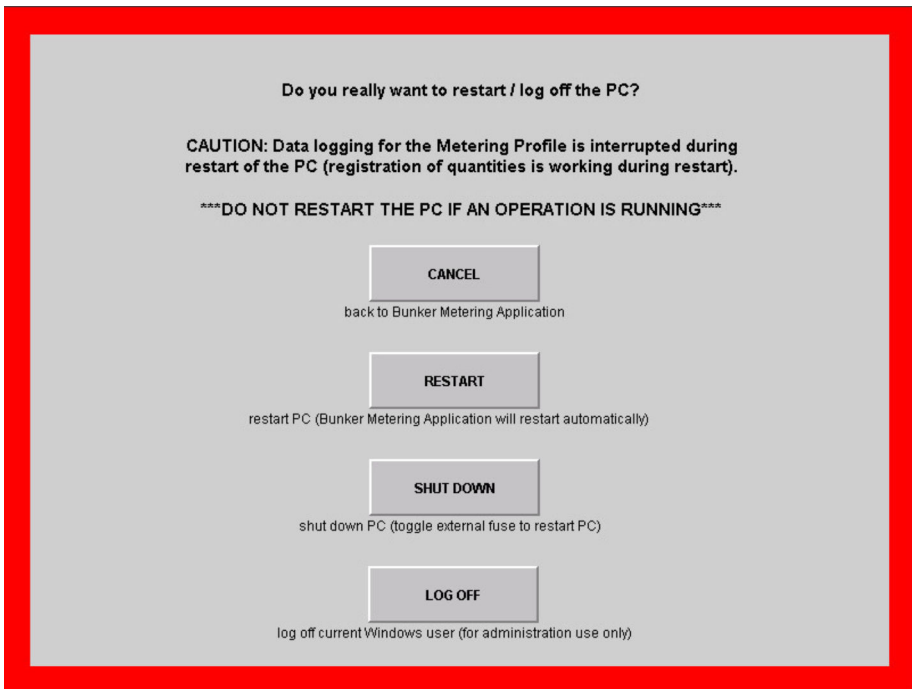
7.1.1 Starting up

The Bunker Metering Computer application is started automatically as soon as power is supplied to the system. It can take up to 5 minutes for the operating panel to start up. The **operator** user is automatically logged onto the Bunker Metering Computer after startup.

7.1.2 Shutting down

The Bunker Metering Computer application can be shut down using the **Shutdown** button:

In the pop-up window that follows, select **CANCEL** to return to the previous screen, **RESTART** to restart the Bunker Metering Computer application, **SHUT DOWN** to shut down the PC or **LOG OFF** to log off the current **user** (for administration use only).



NOTICE

If the application is shut down during a bunkering operation/batch,
this will result in inconsistent data in the metering profile.

- ▶ Do not restart during a bunkering operation/batch.

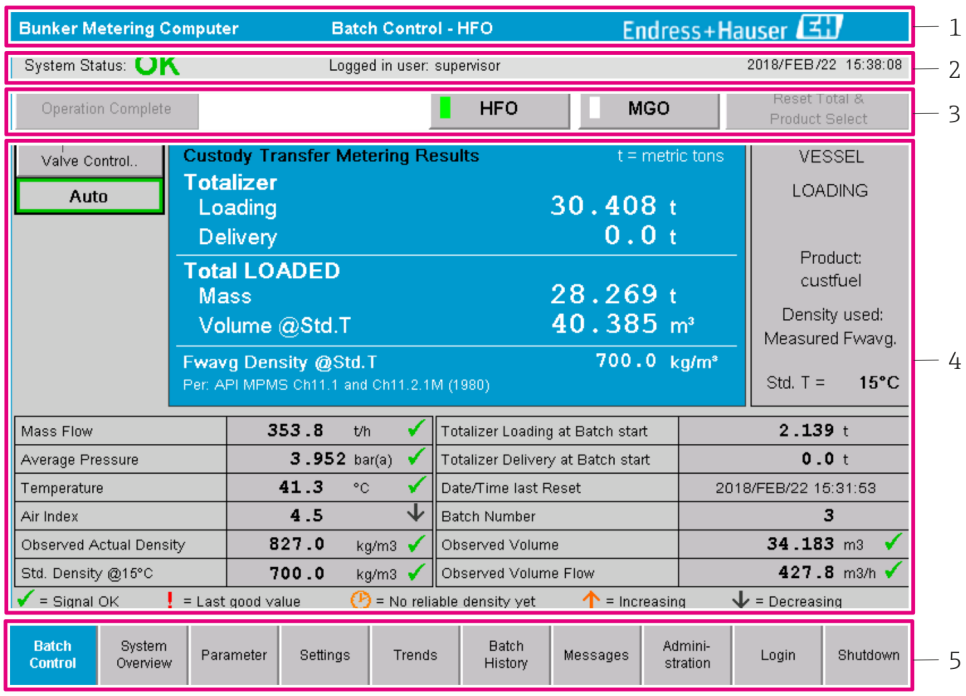
The Bunker Metering Computer stops all data logging if the application is shut down.

If the PC is shut down, it can only be restarted by switching the main fuse.

7.2 Navigation

Some of the following functionalities are only visible for the **supervisor**.

7.2.1 General screen layout



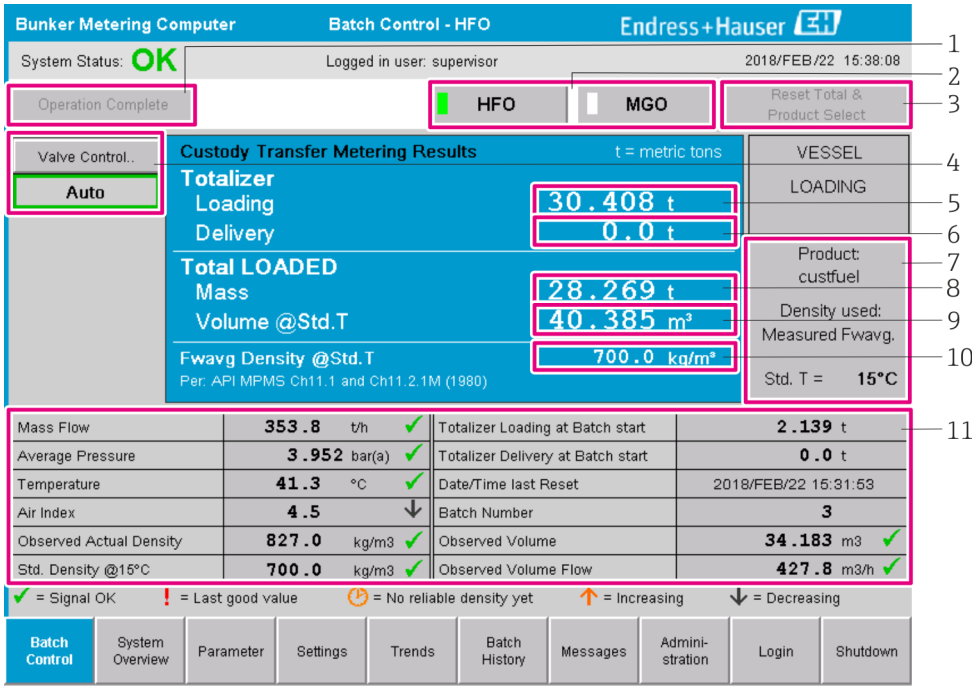
8 *Main page*

1 *Header: Contains the system description (Bunker Metering Computer), the identification of the current screen and the Endress+Hauser logo. Clicking the logo opens the Diagnostic Information screen.*
2 *System Status bar: Displays the system status, the user currently logged in and the current date and time.*
3 *Function bar: Comprises function buttons or options for navigating within the display screen (depending on the user that is currently logged in).*
4 *Screen body: The content depends on the particular screen.*
5 *Navigation bar: For navigating between screens (depending on the user that is currently logged in). The screen that is currently selected is indicated by a blue button background.*

7.3 Display screens and buttons

7.3.1 Batch Control screen

A bunkering operation is handled in the **Batch Control** screen:



9 *Batch Control screen*

1 *Operation Complete button, see Section 10.3 → 44*
2 *Line selection: only visible on two-line systems*
3 *Reset Total button, preparation for a bunkering operation (reset totalizer to 0) or Reset Total & Product Select if volume measurement is enabled (reset totalizer to 0 and select product), see Section 10.2 → 42*
4 *Valve Control button with status indicator, see Section 7.5 → 31*
5 *Totalizer Loading, non-resettable*
6 *Totalizer Delivery, non-resettable*
7 *Product currently selected, density and std. temperature, only visible if volume measurement is enabled*
8 *Resettable totalizer*
9 *Resettable totalizer in volume based on std. density at std. temperature, only visible if volume measurement is enabled*
10 *Current density at std. temperature, only visible if volume measurement is enabled*
11 *Parameter section: Overview of the parameters related to bunkering operations*

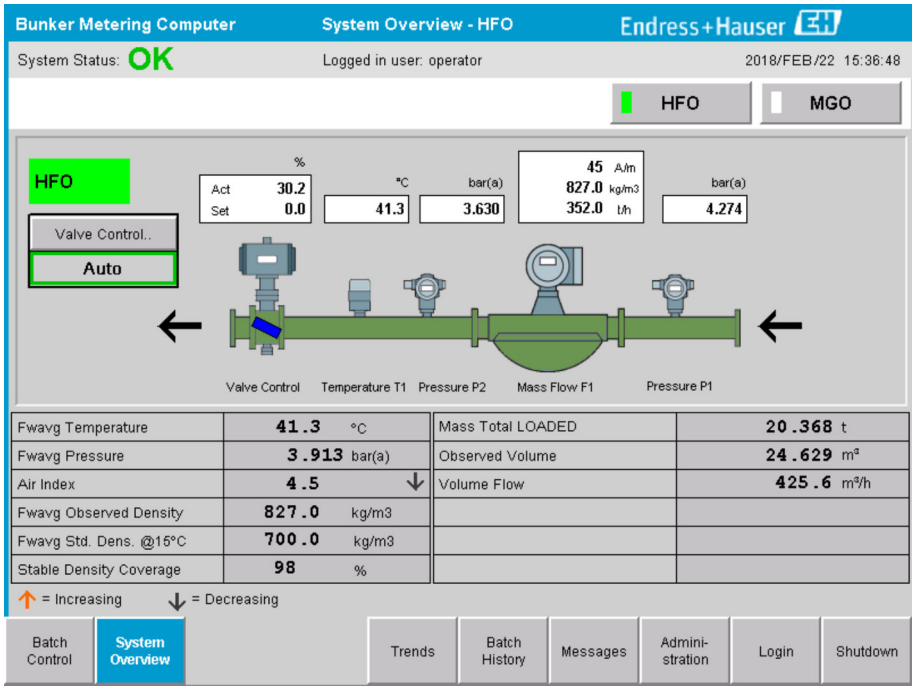
NOTICE

If too much data is recorded under one batch,
it might not be possible to create a metering profile (time-out error message).

- The **Reset Totalizer** function must be executed before the start of a bunkering operation even if the resettable totalizer already shows **0**. This ensures that the correct bunkering operation start time is recorded and that the metering profile does not contain unnecessary data.

7.3.2 System Overview screen

The **System Overview** screen provides an overview of the system:



10 *System Overview screen*

- If a sensor is in a fault state, the corresponding value field flashes red
- Clicking the **Valve Control** value field opens the pop-up window for the control valve
- The color of the pipe changes to green as soon as flow is detected

7.3.3 Parameter screen

The **Parameter** screen (supervisor) contains additional data that are not displayed in the **Batch Control** or **System Overview** screens:

11 *Parameters screen (supervisor)*

- Different parameter tables can be displayed with the buttons in the **Function bar**
- The current state of the parameter value is displayed in the column on the far right

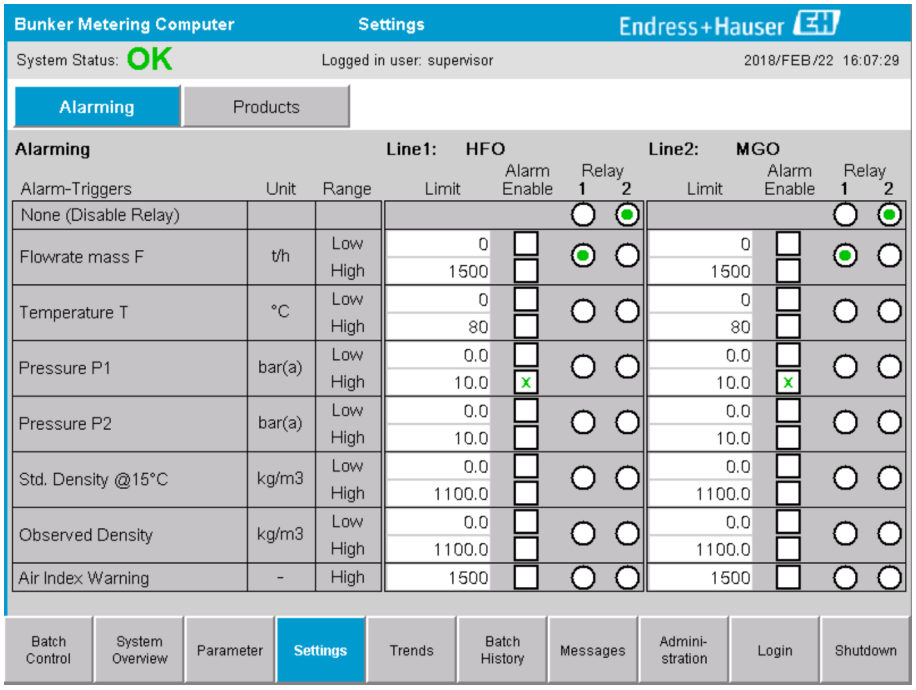
7.3.4 Settings screens

The **Settings – Alarming** (supervisor) screen is used to set the alarm settings for process values. The **Settings – Products** (supervisor) screen is only displayed if volume measurement is enabled. This screen is used to define and assign the products and the associated fluid groups.

Settings – Alarming screen

The **Settings – Alarming** (supervisor) screen is used to set the alarm settings for process values. Alarms can be enabled and disabled. All alarms are disabled by default. The enabled alarms are displayed. See also **Section 11.2** → 🖹 46. The two customer-specific relay outputs can be configured with the process value required for alarm output. See also **Section 9.4**→ 🖹 40.

The screen is displayed in the graphic below:

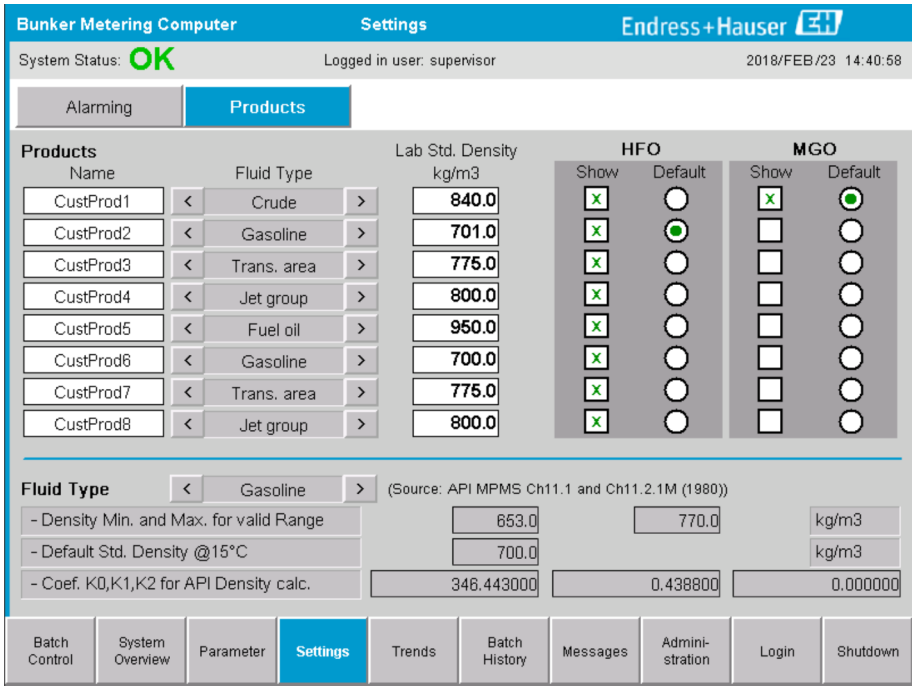


12 Settings – Alarming (supervisor) screen

Settings – Products screen

The **Settings – Products** (supervisor) screen is only displayed if volume measurement is enabled. On this screen, the products are assigned to a fluid group and can be given a customized name. The visibility of the products and a default product can be selected per line. The values for the selected fluid group are displayed in the lower part of the screen.

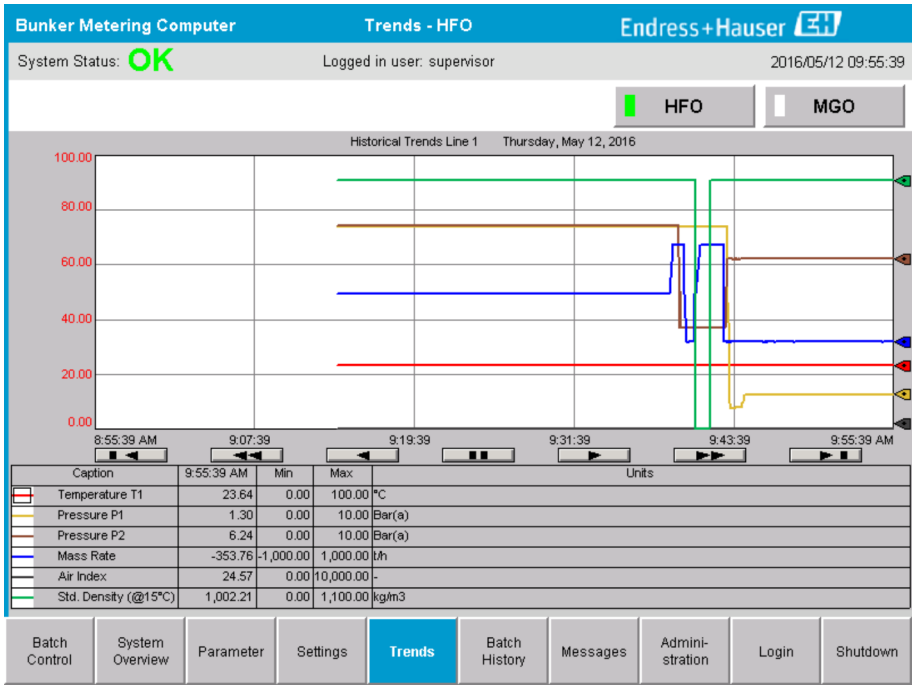
The screen is displayed in the graphic below:



13 *Settings – Products (supervisor) screen*

7.3.5 Trends screen

The **Trends** screen displays values in graphical form:



14 *Trends screen*

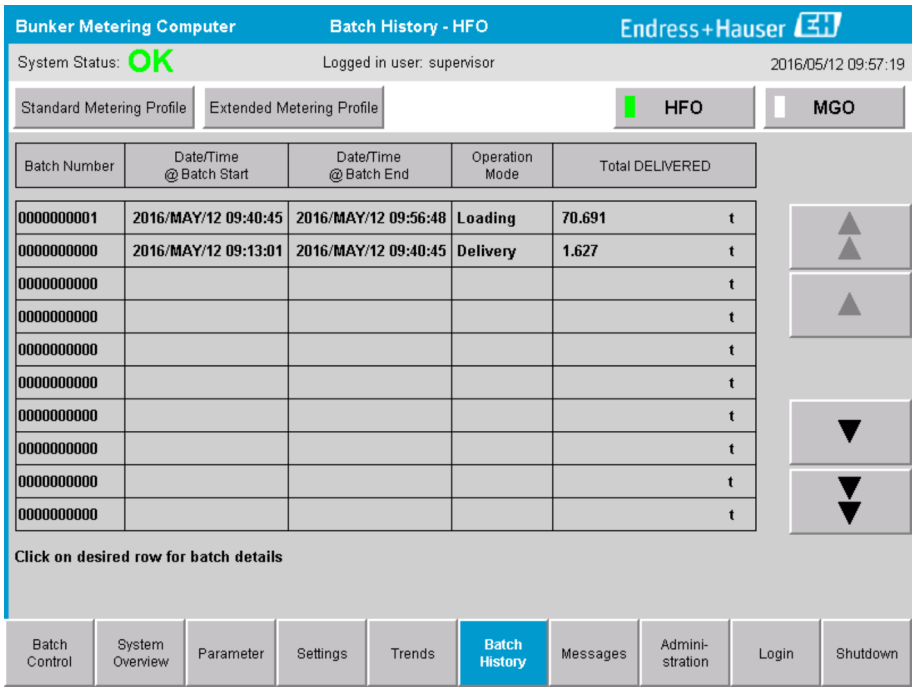
- If a separate **external data logger** is used, only the real-time trends are displayed on the **Trends** screen. This means that the **Trends** screen is empty when it is invoked and data logging only starts when the **Trends** screen is active.
- The following values are displayed: Temperature T1, Pressure P1, Pressure P2, Mass Rate, Air Index and Standard Density (@ 15 °C15 °C).

The data of the last hour are shown by default. This time frame can be adjusted using the buttons:

	Show oldest data
	Go back 60 minutes
	Go back 30 minutes
	Pause/resume data refresh (if data refresh is not interrupted, the data are updated every 2 seconds)
	Go forward 30 minutes
	Go forward 60 minutes
	Show latest data

7.3.6 Batch History screen

The **Batch History** screen shows the data of the last 50 bunkering operations (including in-transit operations which do not show a totalized quantity of 0.0 T):

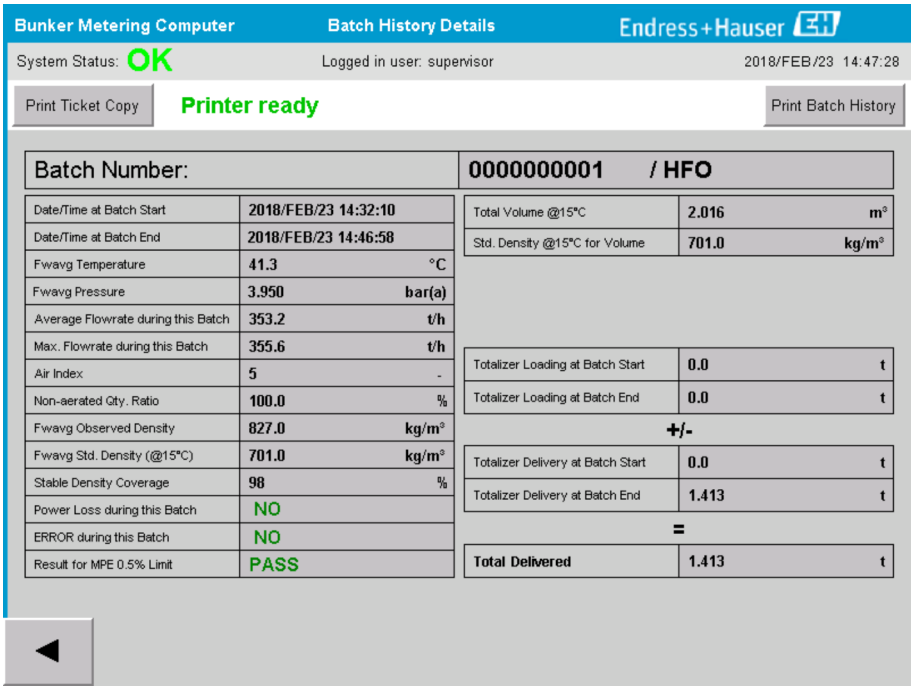


15 Batch History screen

- Clicking a data row opens the corresponding **Batch History Details** window
- Navigate up and down with the arrow buttons to the right side of the batch history table
- **Metering profiles** for the batches can be opened using the button in the function bar, see **Section 7.6**. → 32

7.3.7 Batch History Details screen

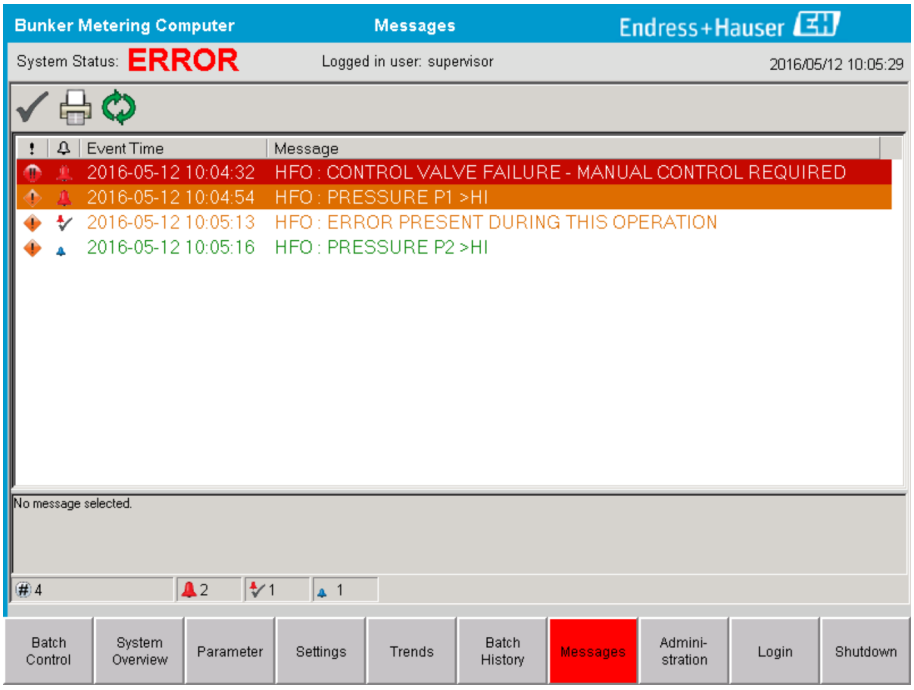
The **Batch History Details** screen shows the detailed data of the selected bunkering operation:



16 *Batch History Details screen*

7.3.8 Messages screen

The **Messages** screen shows all the messages that are currently active:



17 *Messages screen*

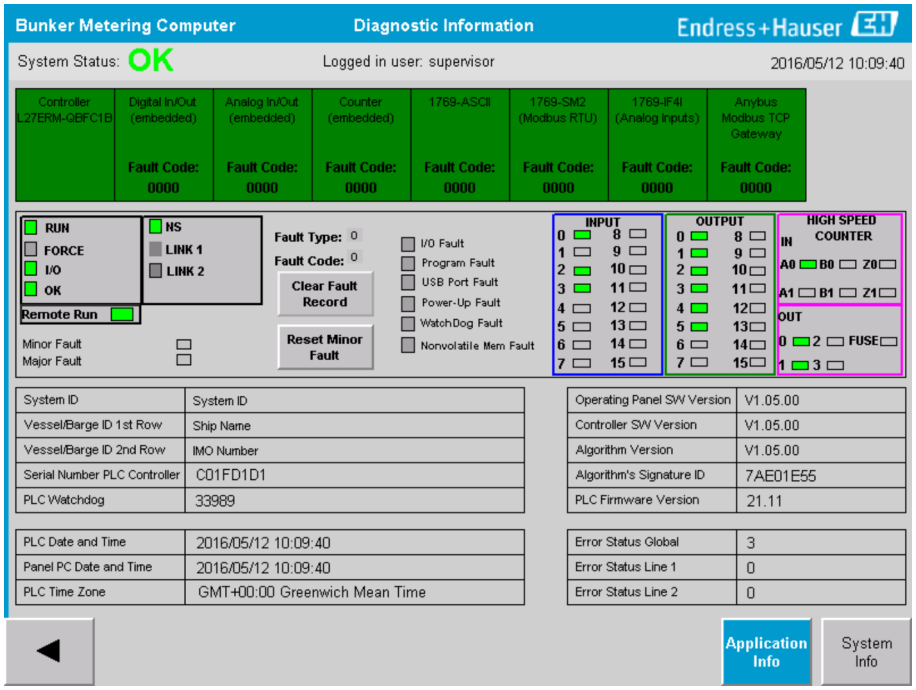
More detailed information on the messages is provided in **Section 11.2**. → 46

7.3.9 Administration screen

The functions of the **Administration** screen are described in **Section 9**. → 37

7.3.10 Diagnostic Information screen

The **Diagnostic Information** screen contains diagnostics-related information. This information is helpful when troubleshooting and should be sent to Endress+Hauser for all kinds of service requests. For more information on the **Diagnostic Information** screen, see **Section 9** → 37

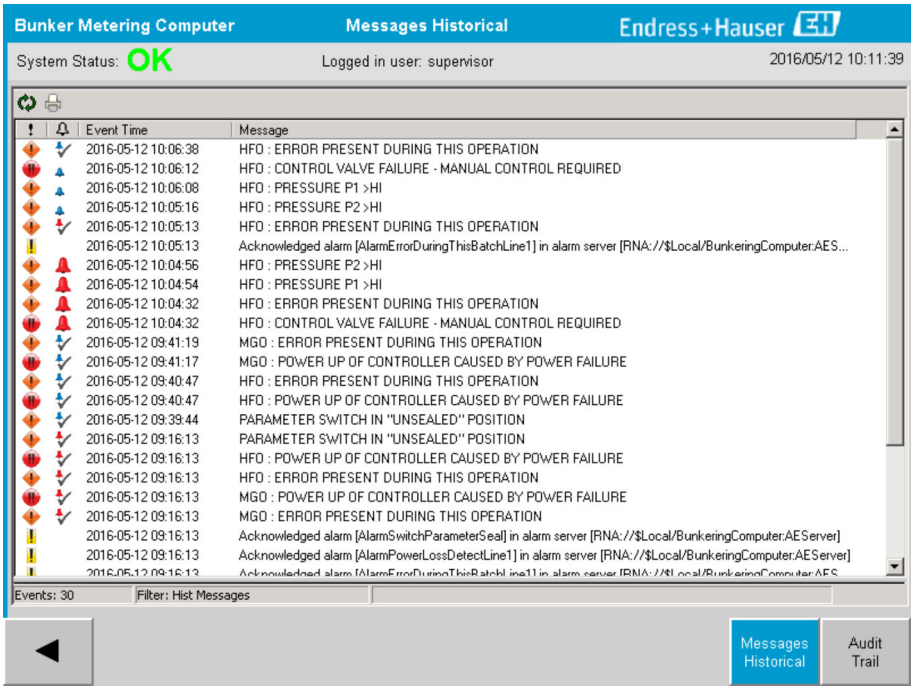


18 *Diagnostic Information screen*

7.3.11 Messages Historical screen

The **Messages Historical** screen (supervisor) can be opened from the **Administration** screen by clicking the **Messages Historical** button. For more information on the **Messages Historical** screen, see **Section 9** → 37

All the messages that are no longer active (past messages) are displayed here:

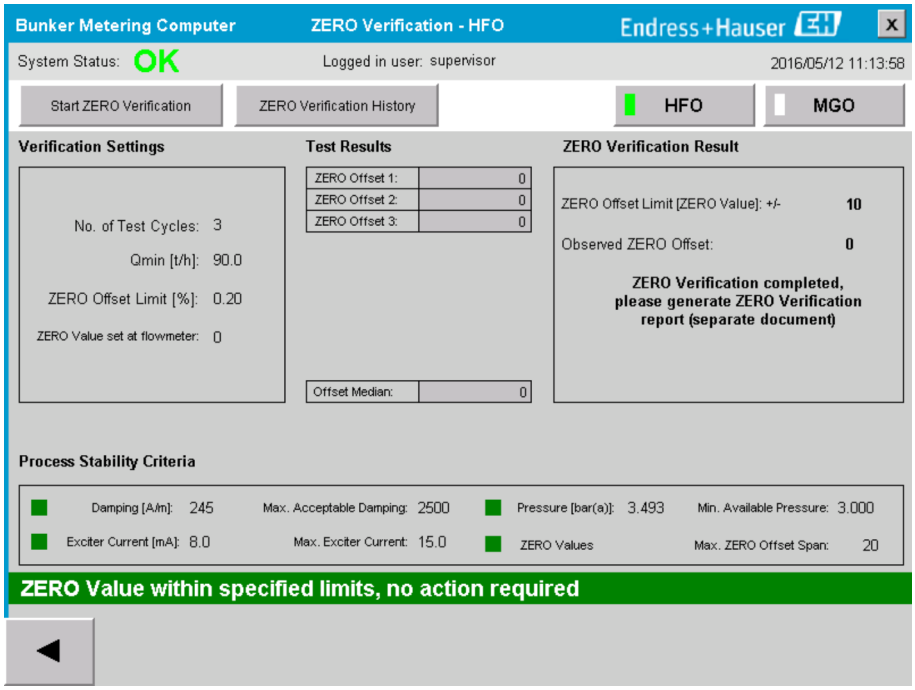


19 *Messages Historical screen (supervisor)*

7.3.12 ZERO Verification screen

Zero Verification (supervisor) is an important part of the subsequent verification which a metering installation undergoes and is used to verify that the zero value stored in the flowmeter meets the requirements during periodical inspections/recalibrations. The Zero Verification process is described in a separate document for the given installation and must be followed closely.

The Bunker Metering Computer functionality described below supports this process. The deviation between the stored zero value and the observed zero point shift is calculated and must be within an acceptable range. The **ZERO Verification** function can be accessed via the **Administration** page. For more information on the **ZERO Verification** screen, see **Section 9** → 🖹 37



20 ZERO Verification screen (supervisor)

- Process Stability Criteria: A zero verification process can only be started if process conditions are within the limits (marked green). These limits are set during commissioning and can only be modified by Endress+Hauser.

  Click the **Start ZERO Verification** button.

  ↳ The verification process starts with the values specified under **Verification Settings**.
  Measurement: Intermediate result of the zero point shift for every measuring cycle. Once the specified number of cycles has been performed, the median value is determined.
  If the zero verification process is concluded successfully, the result is displayed under **ZERO Verification Result**. The following results are possible:

Status	Color	Text on the HMI	Limit values
Good	Green	ZERO Value within specified limits, no action required	The zero point deviation is within the range of ± the maximum value
Adjustment	Yellow	ZERO Value shall be adjusted. Please contact the supervisor for further steps	The zero point deviation is within the range of ± the maximum value and 2 * ± the max. value
Inspection	Red	ZERO Value needs inspection. Please contact Endress+Hauser service for further steps	The zero deviation is greater than 2 * ± the maximum value

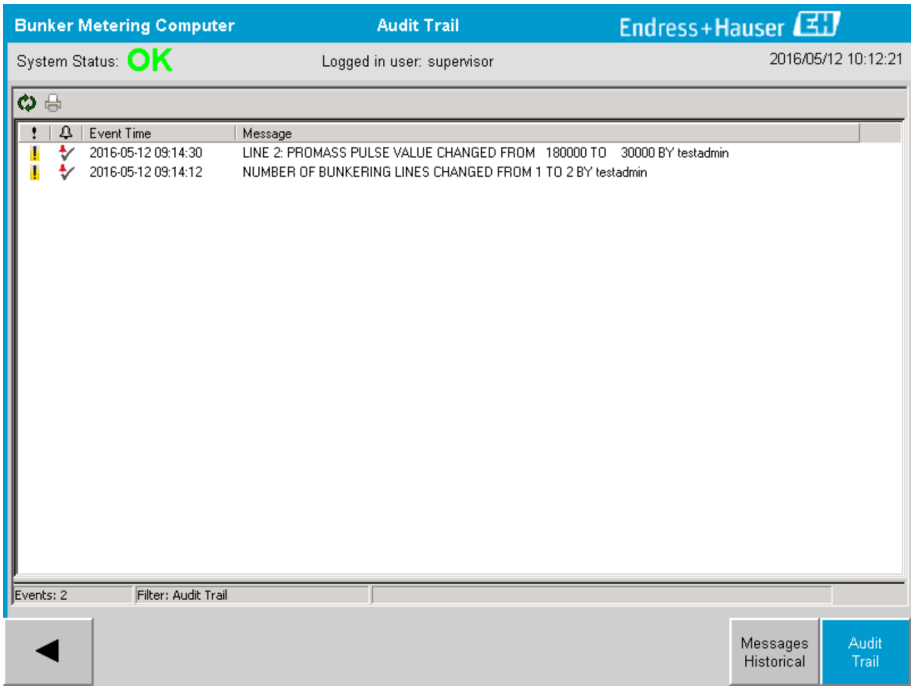
The last 10 zero verification processes can be viewed:

- Click the **ZERO Verification History** button.

  ↳ The **Zero Verification History** screen opens.

7.3.13 Audit Trail screen

The **Audit Trail** screen (supervisor) shows all the process-related changes made in the system. For more information on the **Audit Trail** screen, see **Section 9** → 37



21 Audit Trail screen (supervisor)

To switch to the **Audit Trail** screen:

▶ Click the **Audit Trail** button in the **Administration** screen.

Each time a parameter value is changed (and it is part of the audit trail), the old and the new value are displayed along with a date/time stamp and the name of the user who performed the parameter change.

7.3.14 Show Keyboard button

Pressing the **Show Keyboard** button (supervisor) will cause a virtual keyboard to be displayed. This keyboard can be used if the touch screen functionality is not sufficient.

7.3.15 Display Off button

The **Display Off** button (supervisor) only switches off the screen (system/measurements continue running in the background). For more information on the **Display Off** button, see **Section 9** → 37

7.4 Valve control

A control valve is installed in many applications to ensure that the pipe is filled quickly and remains filled during the bunkering operation. This is achieved by maintaining a certain pressure at the outlet side of the measuring device. There are three possible operation modes for the control valve:

- **Automatic control:** The Bunker Metering Computer controls the valve automatically using the set point
- **Manual control:** The control valve can be operated manually by selecting the desired open/closed position from 0 – 100% in the **Valve Control** window on the Bunker Metering Computer. This window opens when **Valve Control** is touched
- **Manual operation:** The control valve is normally equipped with a hand-wheel for emergency manual override or manual operation in the event of a malfunction. Please refer to the control valve manual for more detailed information.

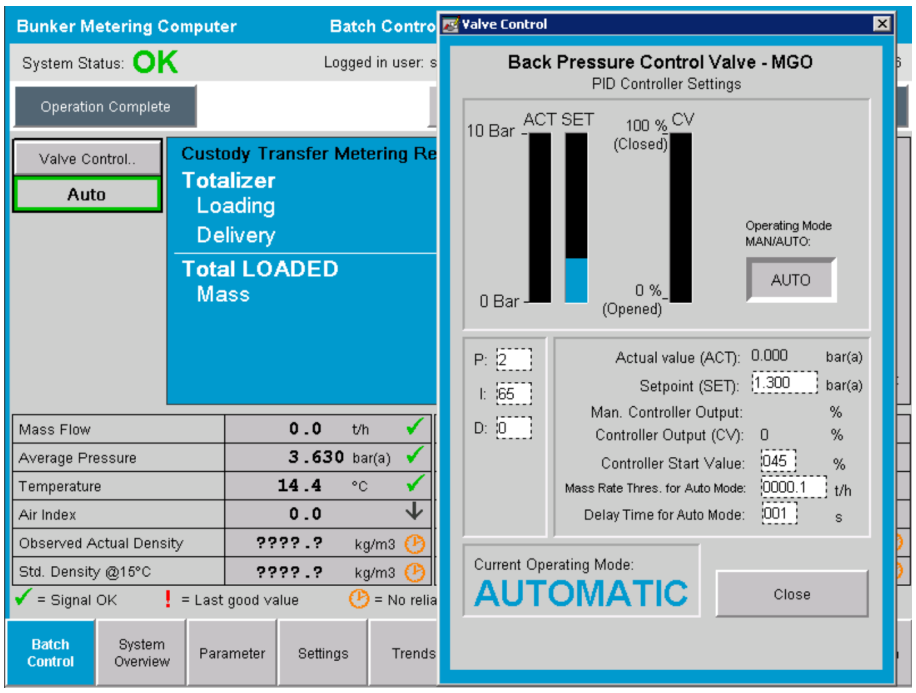
The control valve is normally in the **Automatic Control** mode for operations like **loading** and **delivery**. During **loading operations** the control valve actively controls the pressure while it remains completely open during **delivery operations**. The control valve can be switched to Manual Control at any time.

DANGER

Incorrect valve operation can result in high pressure ratings,
which can cause serious damage and/or serious injury during loading and delivery.

- ▶ Only operate the control valve in the **Manual Control** mode if this is absolutely essential; proceed with extreme care here.

If a valve error or valve failure occurs, the control valve automatically switches to the **Manual Control** mode. Manual operation might be necessary depending on the cause of the problem. The **Valve Control** button and the **Valve Control** window are orange in the manual control mode, and blue in the **Automatic Control** mode.



7.5 Metering profiles

The Bunker Metering Computer has the functionality to create a metering profile for each bunkering operation performed.

Two different configurations are possible:

- **Standard option:** Use the database of the Bunker Metering Computer and create the metering profiles directly from the operating panel.
- **Alternative:** Use an external data logger. The data are then stored on this separate external unit and can be downloaded from there.

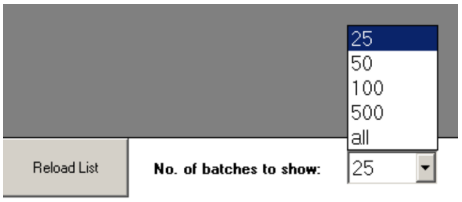
One of the two options is set up by Endress+Hauser during system commissioning.

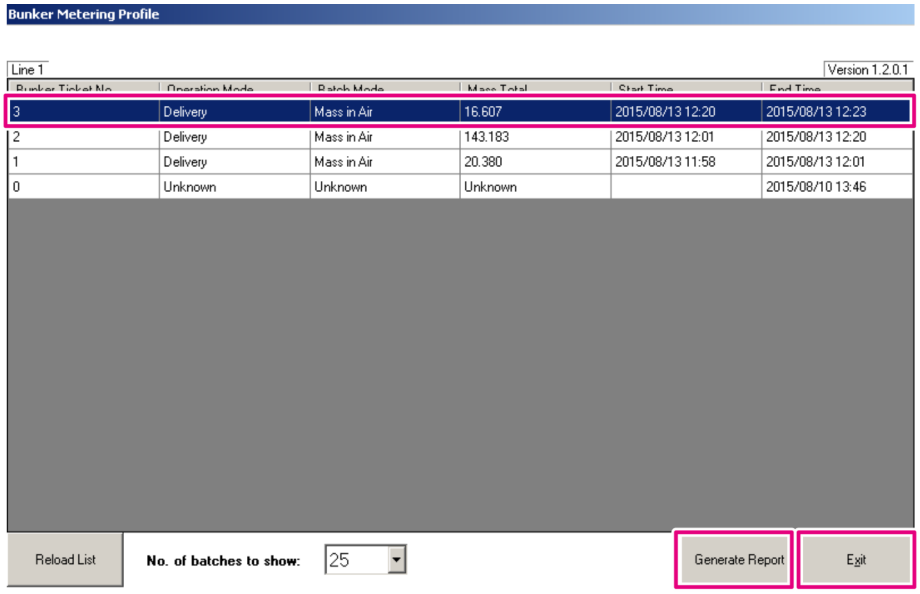
7.5.1 Metering profiles from the HMI operator panel

If the **Metering Profile** function is enabled on the operating panel (only if no external data logger is used), both **operator** and **supervisor** users can create metering profiles for the bunkering operations performed. The function can be accessed via the **Function bar** in the **Batch History** screen:

The **operator** user can access the **Standard Metering Profile** function. The **supervisor** user can also use the **Extended Metering Profile** function. The **Standard Metering Profile** contains the information on **Mass Flow**, **Air Index**, **Damping** and **Standard Density**. The **Extended Metering Profile Expert** contains additional information about the temperature and pressure during bunkering.

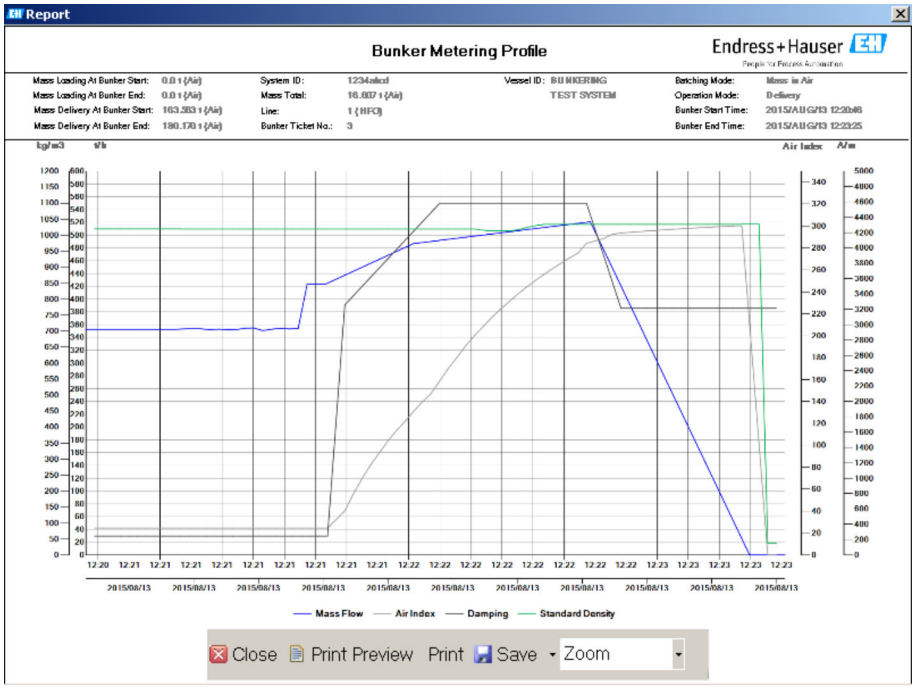
Both buttons open the **Bunker Metering Profile** window that contains a list of all the bunkering operations recorded. By default, only the last 25 metering profiles are displayed. If necessary, older metering profiles can be loaded from the drop-down list at the bottom of the metering profile application:





1. Select a batch from the list.
2. Click the **Generate Report** button.
   ↳ The metering profile report is generated.
3. Click the **Exit** button.

The generated metering profile report appears in a separate window.



- Click the **Save** button to save the metering profile report as a PDF or Excel file on a connected data storage drive. Once the desired file format has been selected, the user can enter a file name for the file to be saved.
- If a more in-depth analysis of the bunkering operation data is required, the data can be exported to a CSV file using the CSV function. This file can then be exported and sent to an Endress+Hauser specialist.

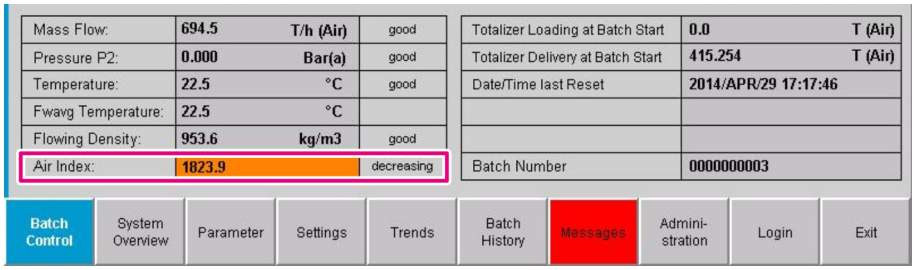
7.6 Special functions

7.6.1 Air Index warning

The Air Index (AI) is a parameter which is normally used for ascertaining whether a batch is within the specified accuracy limits. In addition, it can also give the operator(s) information at any time as to whether the bunkering operation is within the acceptable limits. The aim of the air index warning function is to improve the overall conditions during the bunkering operation.

The bunkering operation normally starts with an empty piping system and a correspondingly high air index. This period is bridged with a delay time before a warning that the air index is too high is issued. The warning is deactivated as soon as the air index value drops below the limit value for a reduced standard delay time and is reactivated as soon as it exceeds this limit for the same period.

The value and status are indicated on the **Batch Control** screen:



The air index warning is listed on the **Messages** screen:

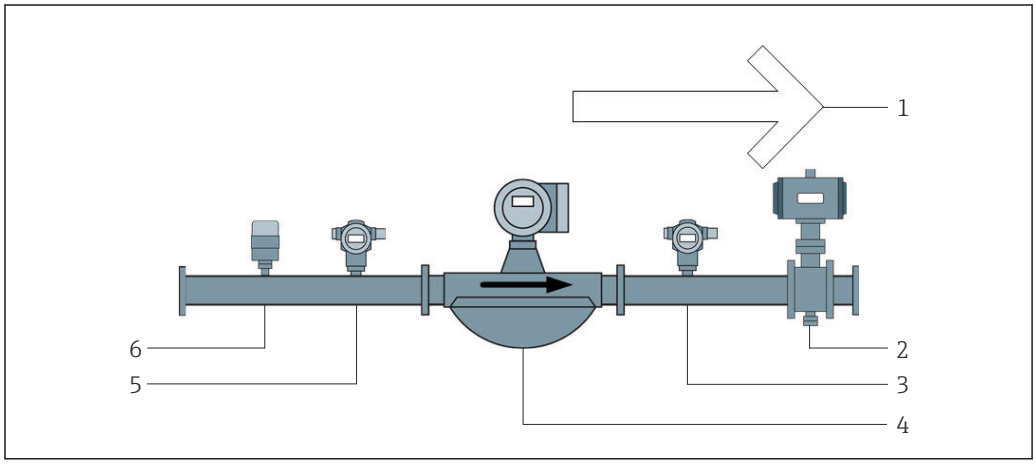

Bunkering Computer
Messages
Endress+Hauser
System Status: WARNING
Logged in user: BUNKER\TESTADMIN
2014/04/29 17:40:05
Event Time
Message
2014/04/29 17:39:29
Line 1 : AIR INDEX IS ABOVE CRITICAL VALUE

8 System integration

The system can be used for different bunker metering applications that each require slightly different functionalities. For this reason, the appearance of the screens can vary depending on the operating mode selected.

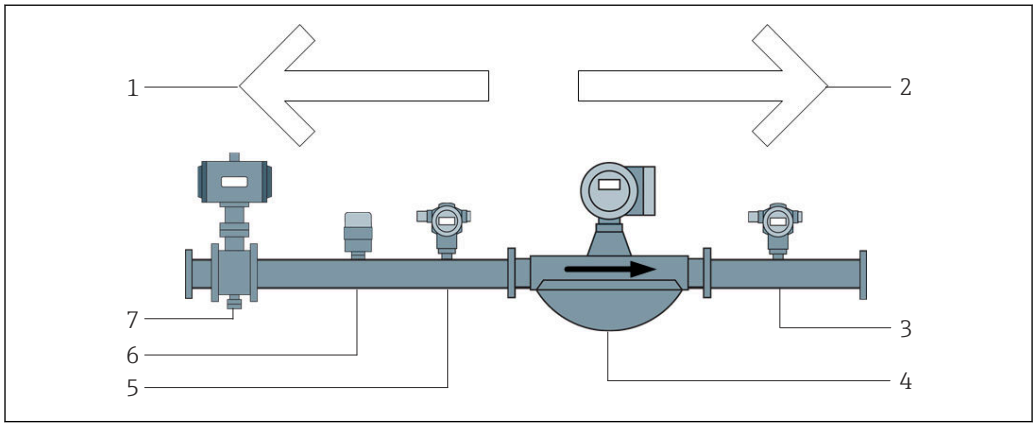
Main operating modes:
- Vessel installation
- Barge installation

The Bunker Metering Computer is always in the measuring mode and therefore continuously totalizes the quantity of fuel flowing through the measurement section.



22 *Vessel installation*

1 *Loading = towards vessel; positive flow rate*
2 *Control valve*
3 *Pressure P2*
4 *Coriolis flowmeter*
5 *Pressure P1*
6 *Temperature T1*



23 *Barge installation*

1 *Loading = towards barge; negative flow rate - the Loading Totalizer is incremented*
2 *Delivery = from barge; positive flow rate - the Delivery Totalizer is incremented*
3 *Pressure P2*
4 *Coriolis flowmeter*
5 *Pressure P1*
6 *Temperature T1*
7 *Control valve (optional)*

9 Commissioning

9.1 Changing the date and time

The system time can be changed via the function to **edit the date and time** by clicking the **Change Date and Time** button.

NOTICE

If the date and time settings are changed during a running bunkering operation,
this can cause inconsistencies in the batch data and in the database.

- ▶ Do not change the date and time settings during a running bunkering operation.

NOTICE

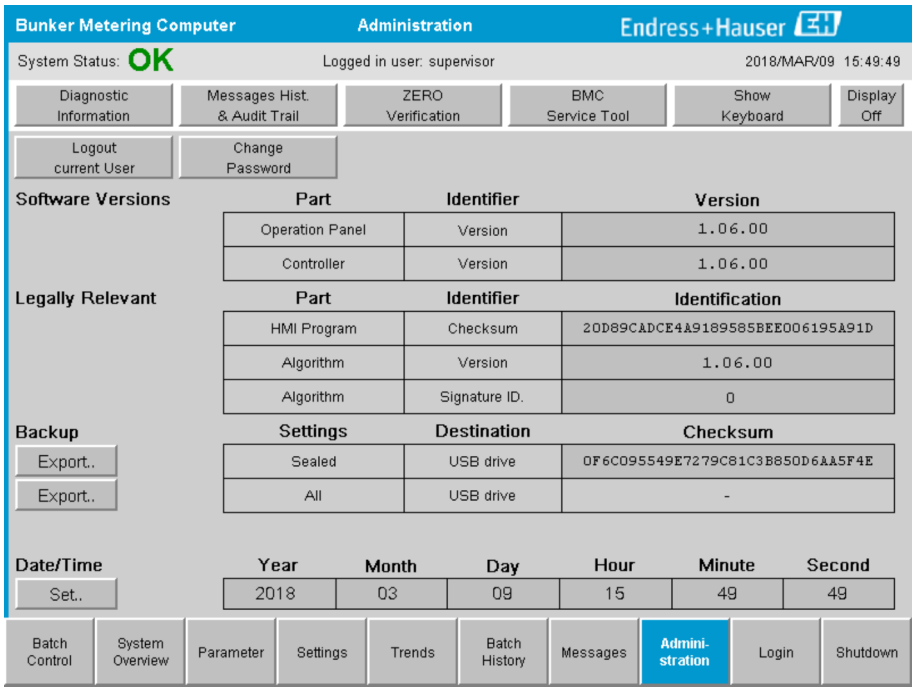
If the date, time or time zone settings are changed
the database might no longer be synchronized.

- ▶ Restart the Bunker Metering Computer panel after changing the date, time or time zone settings in order to synchronize the database with the correct date and time settings.

NOTICE

If the application is shut down during a running bunkering operation or batch,
this can result in inconsistent data in the metering profile.

- ▶ Do not restart during a bunkering operation or a batch.



24 *Administration screen (supervisor)*

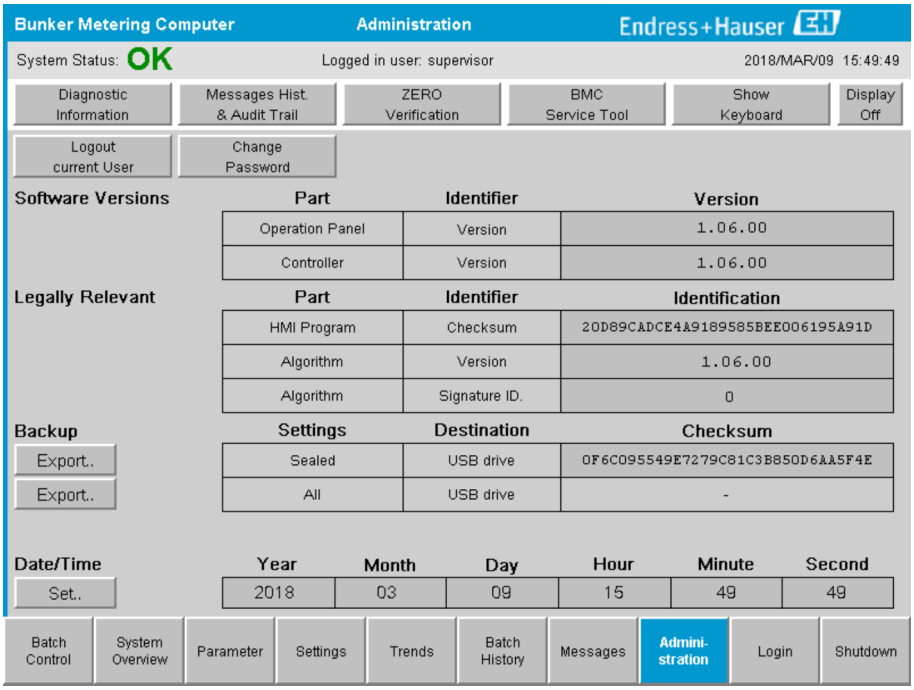
Only the date and time can be changed on the **Administration** screen. If the time zone settings need to be changed, this must be done using the Windows functions for setting the date and time. The default setting for the time zone is UTC. The time zone is set to the local time zone during commissioning.

9.2 Exporting the settings

The current system settings can be exported onto a USB stick. It is possible to export either all the settings or only the settings that are relevant for custody transfer (sealed).

Exporting the settings

1. Select the **Administration** view.
   ↳ The **Administration** view is displayed.



2. Connect the USB stick to the system.
3. Wait until the system recognizes the USB stick. This takes approx. 1 minute.
4. Click the corresponding **Export** button to export the desired **Settings**.
   ↳ A window appears.
5. Click the **OK** button.
   ↳ The settings are exported to the USB stick.

9.3 BMC Service Tool

For details on the **BMC Service Tool** screen (**supervisor**), see the separate **BMC Service Tool** document.

9.4 User administration

A user administration system is available which is used to set up access authorization for the Bunker Metering Computer. Specific functions described in this user manual for setting up access authorization are available only to higher-level users (**supervisor**).

9.4.1 User levels

The following user levels are available:

User name	Password
operator	operator (default)
supervisor	supervisor

The **operator** user is logged in automatically when the system starts up. When the **supervisor** user logs out, the **operator** user is automatically logged in.

The password for the **supervisor** user can be changed by clicking the **Change Password** button.

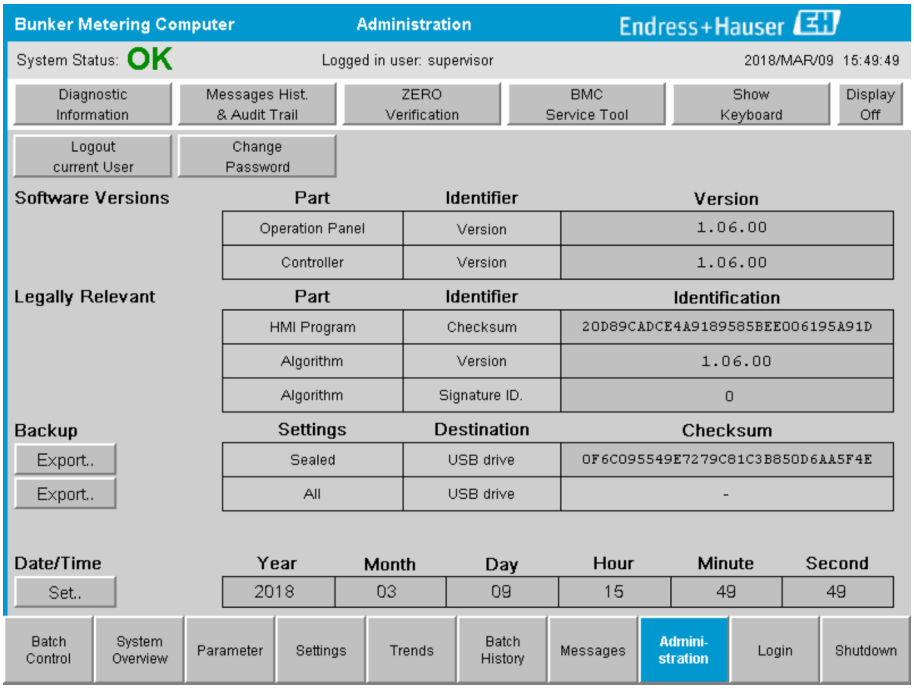
NOTICE

If the password for the supervisor has been forgotten,
it cannot be reset by the user.

- Only Endress+Hauser service staff can reset a password (this can be done onsite only, a manual reset of the password is not possible).

9.4.2 Log in / log out

Users can only log in via the **Login** screen. The current user can only be logged out and the password changed in the **Administration** screen.



25 *Administration screen (supervisor)*

9.4.3 Access authorization

User-specific access authorizations are listed in the following table:

Display screens	operator	supervisor
Batch Control	☑	☑
System Overview	☑	☑
Parameter	☒	☑

Display screens	operator	supervisor
Settings	☒	☑
Trends screen	☑	☑
Batch History	☑	☑
Messages	☑	☑
Administration	☑	☑
Messages Historical	☒	☑
Audit Trail	☒	☑
ZERO Verification	☒	☑
Custom Relay Output Config.	☒	☑
Diagnostic Information	☑	☑

Operation	operator	supervisor
Run the **Operation Complete** function	☑	☑
Run the **Reset Total** function	☑	☑
Manual valve control	☑	☑
Show and print out metering profiles	☑	☑
Show and print out **Extended Metering Profiles**	☒	☑
Display and acknowledge messages	☑	☑

Administration	operator	supervisor
Change the password for the **supervisor** user	☒	☑
End the application	☒	☑
Change settings for date and time	☒	☑
Show Windows keyboard	☒	☑

Settings	operator	supervisor
Change settings for control valve	☒	☑
Change PID settings for control valve	☒	☑
Change alarm limits	☒	☑

9.5 Relay outputs

Floating relay output contacts are available that allow easy access to overall system status information and other warnings. More information on the wiring scheme can be found in the wiring diagram.

9.5.1 System status

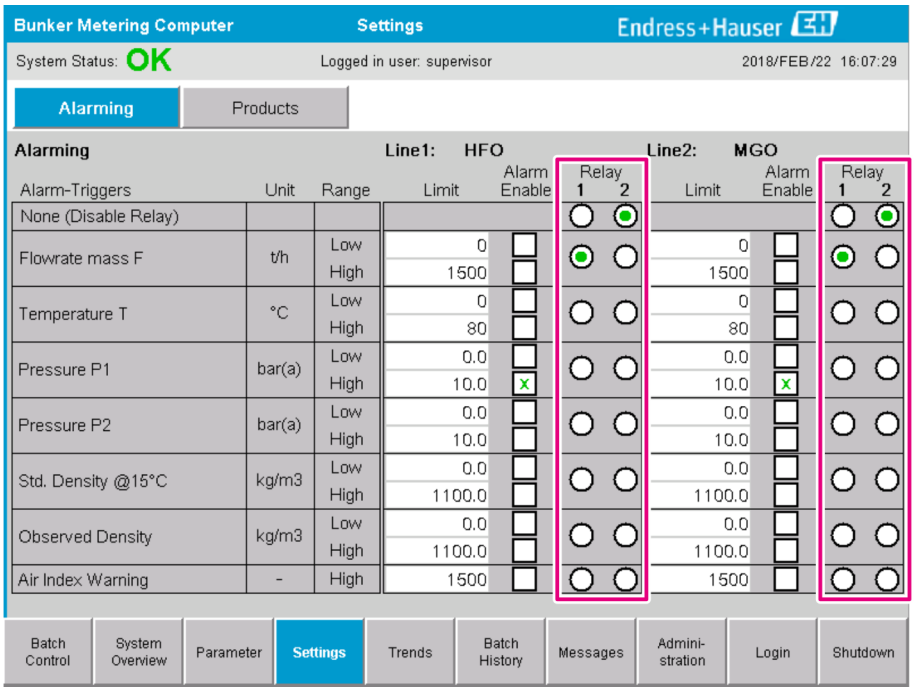
Two floating contacts are available for outputting the system status (for more information on the system status, see **Section 11.1** → 🖹 46):

Function	Relay contact open	Relay contact closed
System status WARNING	System status WARNING - active	System status WARNING - not active
System status ERROR	System status ERROR - active	System status ERROR - not active

If both floating contacts are closed, then the system status is **OK** (fail safe operation).

9.5.2 Custom warnings

Two floating contacts are available for user-configurable warnings. These warnings are configured via the **Settings** screen.



The following warnings are available:

Function	Relay contact open	Relay contact closed
Flowrate mass F	At least one message relating to **Flowrate mass F** is active	No message relating to **Flowrate mass F** is active
Temperature T	At least one message relating to **Temperature T** is active	No message relating to **Temperature T** is active
Pressure P1	At least one message relating to **Pressure P1** is active	No message relating to **Pressure P1** is active
Pressure P2	At least one message relating to **Pressure P2** is active	No message relating to **Pressure P2** is active
Std. Density @ 15 °C	At least one message relating to **15 °CStd. Density @** is active	No message relating to **15 °CStd. Density @** is active
Observed Density	At least one message relating to **Observed Density** is active	No message relating to **Observed Density** is active
Air Index Warning	At least one message relating to **Air Index Warning** is active	No message relating to **Air Index Warning** is active

9.6 Modbus TCP Gateway (optional)

This gateway is optional and is used to connect the Bunker Metering Computer to other information systems. It is necessary to check whether it is permitted to connect to other systems under the custody transfer regulations.

For more information, please refer to: → 66

10 Operation

10.1 Totalizing the transferred quantity

The transferred quantity is calculated using the two non-resettable totalizers: the **Totalizer Loading** and the **Totalizer Delivery**. Depending on the operating mode of the Bunker Metering Computer, only one of the two totalizers is displayed. The transferred quantity **Total Loading** or **Total Delivery** is calculated from the value that these two totalizers display at the start and at the end of a bunkering operation. This totalizer can be set to zero.

10.2 Preparing for a bunkering operation

Because of the application, an unread quantity can be totalized during transit (in-transit quantity). To start a new bunkering operation, the resettable totalizer must be set to zero; the correct start time for the bunkering operation is saved at the same time.

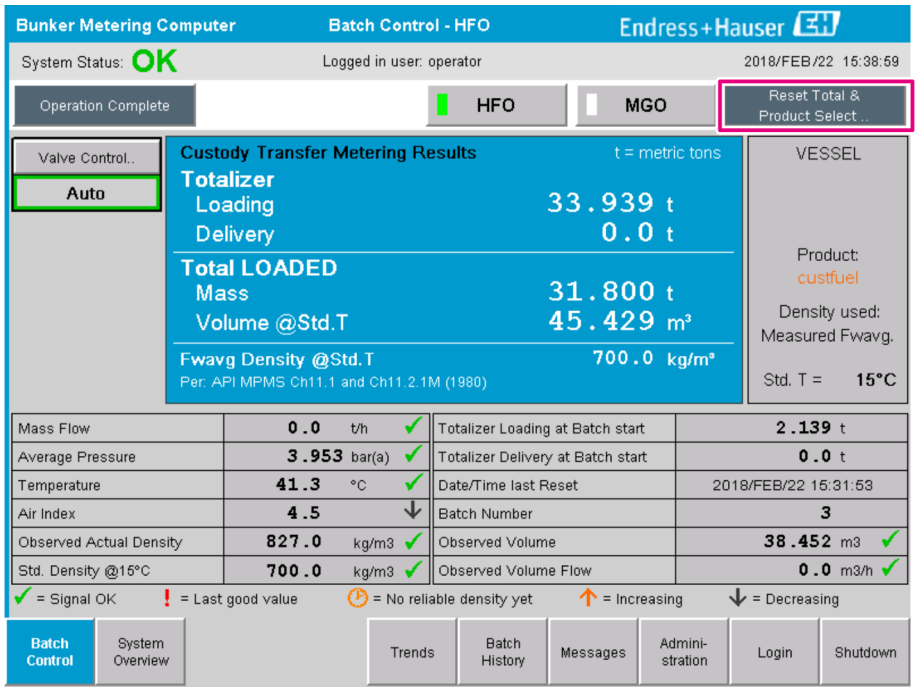
NOTICE

If too much data is recorded under one batch,
it might not be possible to create a metering profile (time-out error message).

- The **Reset Totalizer** function must be executed before the start of a bunkering operation even if the resettable totalizer already shows 0. This ensures that the correct bunkering operation start time is recorded and that the metering profile does not contain unnecessary data.

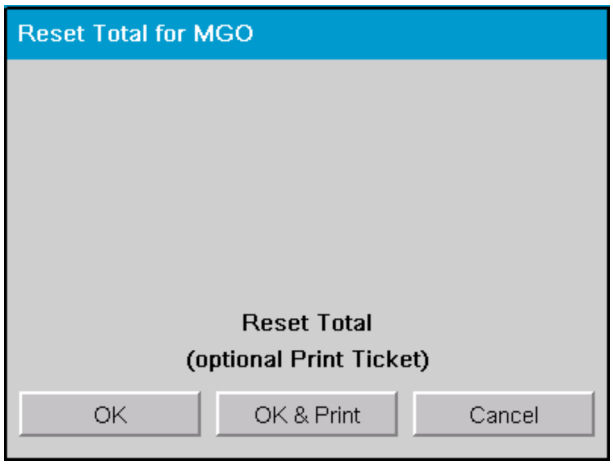
Proceed as follows to start a new bunkering operation:

1. Make sure the system is ready for the operation. To do so, check the system status, see **Section 11.1**→ 46.
2. Select the **Batch Control** view.
   ↳ The **Batch Control** view is displayed.



Further course of action if volume measurement has not been enabled.

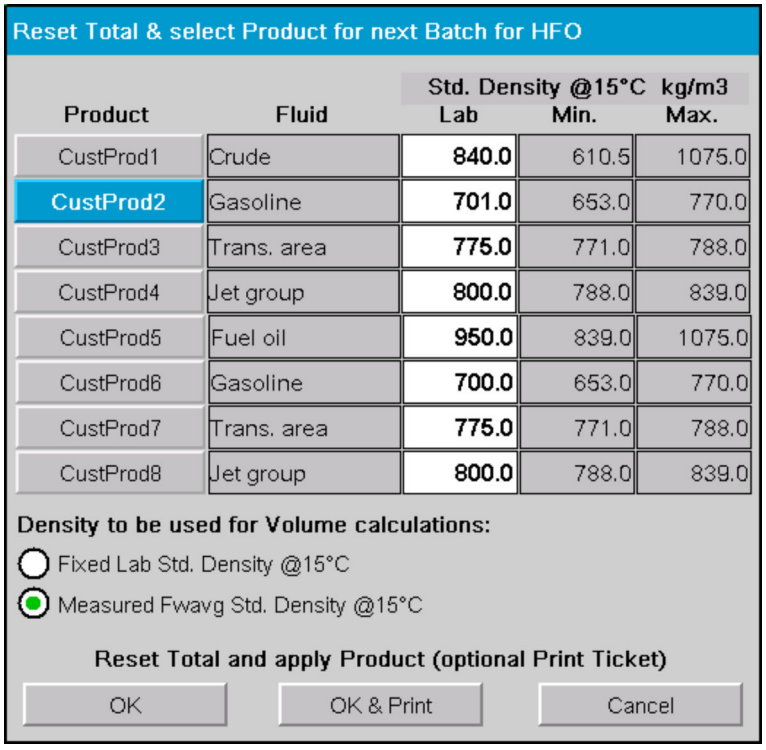
3. Click the **Reset Total** button in the **Batch Control** view.
   ↳ The following window appears:



4. Click the **OK & Print**, **OK** or **Cancel** button as required.
   ↳ OK & Print: an in-transit metering ticket is printed and the totalizer is reset to "0".
   OK: no in-transit metering ticket is printed but the totalizer is reset to "0".
   Cancel: the window is closed. The totalizer is **not** reset to "0".

Further course of action if volume measurement has been enabled.

3. Click the **Reset Total** button in the **Batch Control** view.
   ↳ The following window appears:



4. Select the product for the impending bunkering operation.
5. Check the std. density at std. temperature to be used for the selected product and change it if necessary.
6. If the laboratory value is to be used for the entire bunkering operation, select the "Fixed Lab Std. Density" option.

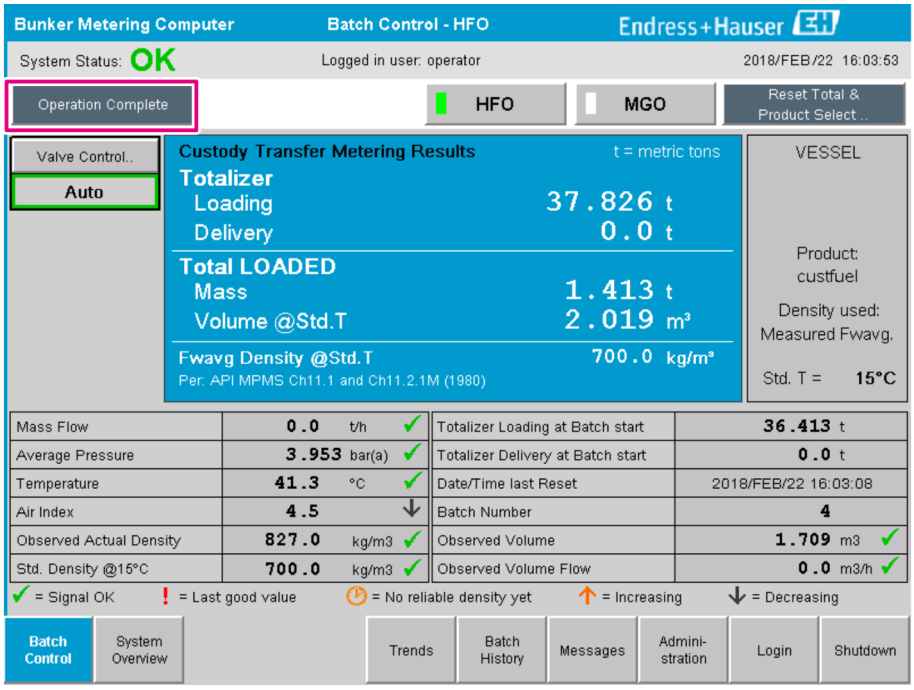
7. Click the **OK & Print**, **OK** or **Cancel** button as required.
   ↳ OK & Print: an in-transit metering ticket is printed and the totalizer is reset to "0".
   OK: no in-transit metering ticket is printed but the totalizer is reset to "0".
   Cancel: the window is closed. The totalizer is **not** reset to "0".

If the "Measured Fwavg Std. Density @Std. Temperature" option is selected, the laboratory density entered is used at the start of the bunkering operation. This laboratory density is used until the system can determine a reliable density. Until this is the case, the "No reliable density yet" status is displayed for the values concerned in the **Batch Control** view.

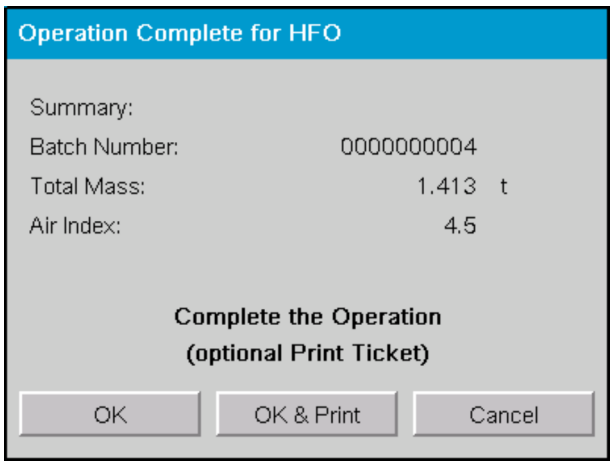
- The **Total loaded/delivered** totalizer is now reset to 0. The Bunker Metering Computer is now ready for a new bunkering operation.
- If an error occurs during printing, the error can be rectified and printing can be started again or canceled, see **Section 12.1** → 🖹 49
- Only one original copy of the in-transit metering ticket can be printed per batch even if the printout was incomplete (e.g. not enough paper in the printer). Once the original in-transit metering ticket has been printed, only duplicate tickets can be printed out. The tickets are marked accordingly.
- Make sure that sufficient printer paper of the right paper quality is always available, see **Section 12.1.4** → 🖹 51

10.3 Ending a bunkering operation

1. Select the **Batch Control** view.
   ↳ The **Batch Control** view is displayed.



2. If a bunkering operation is finished, click the **Operation Complete** button.
   ↳ The following window appears. A summary of the batch is displayed.



3. Click the **OK & Print**, **OK** or **Cancel** button, as required, to confirm the current bunkering operation is finished.
   ↳ OK & Print: a bunker metering ticket is printed and the totalizer is reset to "0".
   OK: no bunker metering ticket is printed but the totalizer is reset to "0".
   Cancel: the window is closed. The totalizer is **not** reset to "0".

- If an error occurs during printing, the error can be rectified and printing can be started again or canceled, see **Section 12.1** → 📄 49
- Only one original copy of the bunker metering ticket can be printed per batch even if the printout was incomplete (e.g. not enough paper in the printer). Once the original bunker metering ticket has been printed, only duplicate tickets can be printed. The tickets are marked accordingly.
- Make sure that sufficient printer paper of the right paper quality is always available, see **Section 12.1.4** → 📄 51

The Bunker Metering Computer measures, saves and calculates the volumes delivered with utmost accuracy. All the values indicated on the bunker metering ticket are also calculated with utmost accuracy but are rounded off to just three decimal places. If the volume delivered is calculated manually on the basis of these rounded off values, the result can deviate from the result calculated by the Bunker Metering Computer.

11 Diagnostics and troubleshooting

11.1 System status

The overall system status can be one of three categories:

OK	Green	No active error message
WARNING	Yellow	At least one error message in the WARNING category is active but NO error messages in the ERROR category are active
ERROR	Red	At least one error message in the ERROR category is active

11.2 Messages

11.2.1 Message categories

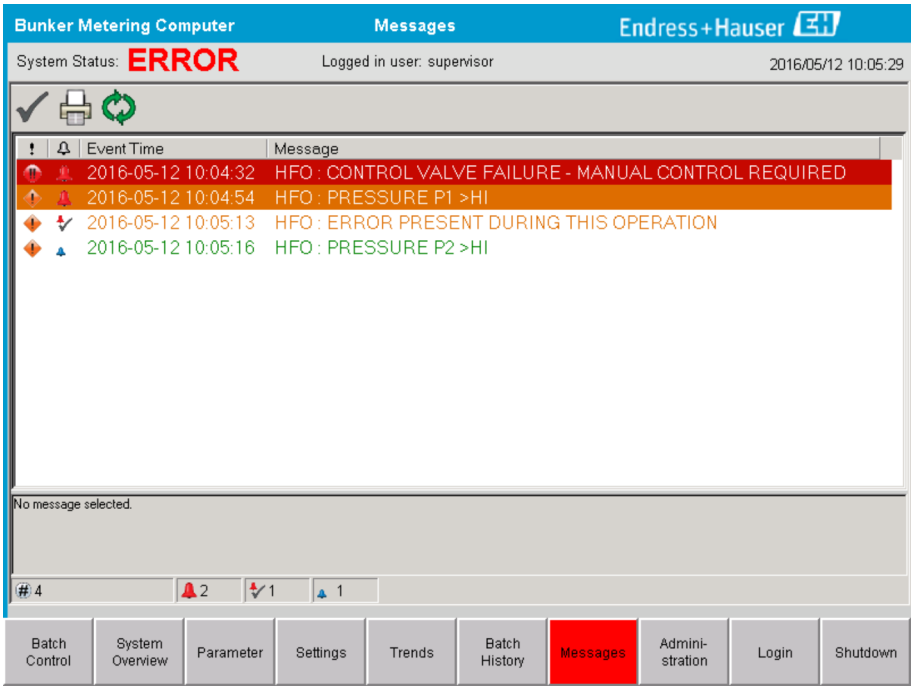
Messages are divided into two categories:

WARNING	Yellow	An abnormal condition which is not process-critical has been detected.
ERROR	Red	An abnormal condition which is process-critical has been detected. Every message in the **Error** (alarm) category causes the information **Alarms: Yes** to appear on the bunker metering ticket

11.2.2 Displaying currently active messages

The error messages that are currently active are listed in the **Messages** screen. Each error contains the time the event occurred and a message text. The following messages are possible:

Warning, not acknowledged		New warning
Warning, not acknowledged, resolved		Warning which is not active anymore but has not yet been acknowledged
Warning, acknowledged		Warning which is still active but has already been acknowledged
Error message, not acknowledged		New error message
Error message, not acknowledged, resolved		Error message which is not active anymore but has not yet been acknowledged
Error message, acknowledged		Error message which is still active but has already been acknowledged



11.2.3 Acknowledging messages

Each message must be acknowledged, even if the condition which led to the message is no longer present and the message is therefore no longer active.

- Select the message in question from the list and click the **Acknowledge** button. Alternatively, double-click the message.

11.2.4 List of messages

An overview of all the possible messages is provided in **Appendix A** . → 54

11.3 Ticket printer

If an error occurs during printing, the ticket printer displays the word "Error" and an error message. If the printer has run out of paper, the message "Error: Out of Paper" is displayed. New printer paper has to be inserted if this message appears, see **Section 12.1.1**. → 49

If an error occurs during printing, the error can be rectified and printing can be started again or canceled.

The paper roll must be replaced if the markings (red stripes) indicating the end of the paper roll are visible. **Section 12.1.1** → 49

11.4 Broken wire signal

If messages indicating a wire break are displayed, an authorized electrician must check the wiring of the device using the wiring diagram supplied with the system.

11.5 Power failure

If a power failure has occurred, the system displays the following messages after restart:
- LINE 1: POWER UP OF CONTROLLER
- LINE 2: POWER UP OF CONTROLLER (optional)
- CONNECTION BETWEEN HMI AND PLC INTERRUPTED

These messages must be acknowledged before you can continue with the next batch. A **Reset Total** (see **Section 10.2** → 🖹 42) must be performed before the next bunkering operation to ensure that the new measurement is not added to the previous measurement.

11.6 Batch result too high

If the result displayed by the Bunker Metering Computer after a bunkering operation is higher than other reference measurements, it is necessary to check whether the resettable totalizer (batch totalizer) was reset to zero via the **Reset Total** button before the start of the bunkering operation (see **Section 10.2** → 🖹 42).

12 Maintenance

12.1 Ticket printer

12.1.1 Replacing the paper roll

The printer is designed for a paper width of 57.5 ± 0.5 mm, and with a paper weight of 60 g/m². Other types of paper might not be suitable. See **Section 12.1.4** → 🖹 51. for ordering information.

12.1.2 Inserting the paper roll

Use paper rolls which are coated on the outside with a width of 57.5 mm ±0.5 mm and a maximum winding diameter of 60 mm for GPT-4344. Standard paper: paper type: GPR-T01-057-031-007-060A (available from Endress+Hauser – order number: 71293016)

1.

Unwind 10 cm of paper from the roll, making sure that the rest of the roll remains wound tightly.

2.

Press the lever inside the lid slightly upwards. The print roll is lifted out of the printer mechanism along with the lid.

↳ The printer cover can now be opened.

3. 

Insert the new paper roll into the paper compartment, ensuring that the outside faces toward the printer mechanism. This is the only printable side.

4. 

Apply some pressure to close the lid.

↳ The cover snaps into place with an audible click. The paper can be torn off at the tear-off edge without having to reopen the cover or without the paper sliding through the print head.

12.1.3 Cleaning

After larger print jobs, it may be necessary to clean the print head, the sensor and platen roller depending on the paper quality and unfavorable environmental conditions. This is particularly true if some areas are no longer printed correctly.

Never use sharp objects to clean the printer, as this could damage the print head.

1. Open the cover of the paper feed and remove the paper roll.
2. Using a small brush (e.g. cotton bud) remove any dirt particles on the paper sensor and the tear-off edge.
3. Blow forcefully into the paper feed compartment in order to remove larger dust particles.
4. Soak a cleaning swab in isopropanol (IPA) and clean the print head. A cleaning pen or cleaning card can also be used.
5. Clean stubborn dirt with a soaked cleaning swab also.

12.1.4 Service and replacement

Printer paper or a new printer can be ordered from Endress+Hauser. For more information on spare parts, please contact your Endress+Hauser Sales Center.

Standard paper: paper type: GPR-T01-057-031-007-060A (available from Endress+Hauser – order number: 71293016)

Printer: special version (available from Endress+Hauser - order number: 71293014

12.2 Display on operating panel

Cleaning the display:

1. Disconnect the power supply to the computer directly at the power source.
2. Clean the display using a mild soap or a mild cleaning agent and a clean sponge or a soft cloth.
3. To avoid water marks, dry the display with a leather cloth or a moist cellulose sponge.

- If the computer has a touch display and the computer is switched on during cleaning, objects on the display may be activated while the devices are being cleaned.
- The use of abrasive cleaners or solutions can damage the display window. Do not scrub the display or use brushes to clean it.

12.3 Cabinet fan

The filter mat of the cabinet fan must be checked periodically. Where necessary, the filter mat must be cleaned or replaced with the following type of mat: Rittal filter mats SK 3322.700.

12.4 System maintenance

It is advisable to have the Bunker Metering System regularly serviced by the system supplier.

For more information, please contact your Endress+Hauser Sales Center at www.address.endress.com

13 Repairs

13.1 General notes

- Replace the following entirely in the event of an error:
  All inexpensive components
- Use only original spare parts
- Observe all the applicable standards, regional/national laws, certificates and the sealing of the SBC600
- Document all repairs and enter them in the W@M Lifecycle Management database
- Repairs may be carried out only by Endress+Hauser service employees or by suitably trained customer staff

13.2 Spare parts and services

Please contact your Endress+Hauser Sales Center at: www.addresses.endress.com

14 Technical data

The SBC600 can be supplied with a choice of three cabinet configurations:
- Single cabinet with the PLC and HMI in the same cabinet (control unit) for wall mounting
- Two cabinets with the PLC (control unit) and HMI (operator terminal) in separate cabinets for wall mounting
- Two cabinets with the PLC (control unit) in one cabinet for wall mounting and the HMI (operator terminal) in a desk panel

Unless otherwise specified, the following technical data apply for all cabinet configurations.

14.1 Power supply

Control unit:	220 to 240 VAC, 50 to 60 Hz, 250 VA
Operator terminal:	220 to 240 VAC, 50 to 60 Hz, 120 VA

14.2 Input/output

Flowmeter:	Pulse 24 VDC, Modbus RTU
Temperature:	Current signal 4 to 20 mA
Pressure:	2x current signal 4 to 20 mA
Control valve:	1x control signal 4 to 20 mA, 1x feedback signal 4 to 20 mA

14.3 Environment

Operating environment for Bunker Metering Computer cabinets:

Ambient temperature range:	–10 to 55 °C
Relative humidity:	25 to 75 %

15 Appendix

15.1 List of messages

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
1	COMMUNICATION BETWEEN HMI AND PLC INTERRUPTED	10s	Alarm	Communication error with PLC	Message	-	Global	Check Ethernet communication cable between operating panel and control unit (only possible if housing open).
2	PARAMETER SWITCH IN UNSEALED POSITION	0s	Warning	Custody transfer switch has been set to unsealed position	Message	Custody transfer switch can be changed	Global	Set custody transfer parameter switch to **Sealed** position.
3	CONTROL CABINET DOOR OPENED	0s	Warning	Cabinet door has been opened	Message	-	Global	Close cabinet door.
4	POWER SUPPLY 1 POWER FAILURE	5s	Warning	Power unit 1 power failure	Message	-	Global	Check power supply.
5	POWER SUPPLY 2 POWER FAILURE	5s	Warning	Power unit 2 power failure	Message	-	Global	Check power supply.
6	COMMUNICATION ERROR WITH EXTERNAL DATA LOGGER	10s	Warning	Communication error with external data logger	Message	-	Global	Check serial communication cable between control unit and external data logger (only possible if housing open).
7	I/O MODULE FAULT - SEE DIAGNOSTIC INFORMATION FOR DETAILS	0s	Alarm	Hardware error	Message	-	Global	Check connection between the PLC and the I/O modules.
8	MODBUS GATEWAY I/O FAULT	10s	Warning	Hardware error Module is missing	Message	-	Global	Check connection between PLC and Anybus Modbus gateway.
9	CONTROLLER MAJOR FAULT - SEE DIAGNOSTIC INFO	0s	Alarm	Software error	Message	-	Global	See Diagnostic Information screen: contact Endress+Hauser
101	LINE 1: MASS FLOW F1 <LO	5s	Warning	Mass flow lower than LO limit	Message	-	Line 1	Check process conditions.

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
102	LINE 1: MASS FLOW F1 >HI	5s	Warning	Mass flow higher than HI limit	Message	-	Line 1	Check process conditions.
103	LINE 1: TEMPERATURE T1 <LO	5s	Warning	Temperature lower than LO limit	Message	-	Line 1	Check process conditions.
104	LINE 1: TEMPERATURE T1 >HI	5s	Warning	Temperature higher than HI limit	Message	-	Line 1	Check process conditions.
105	LINE 1: TEMPERATURE T1 - BROKEN WIRE	5s	Alarm	Temperature T1 signal cable wire break	▪ Message ▪ System shows the last valid value	Continuous measurement	Line 1	Check sensor signal cable.
106	LINE 1: PRESSURE P1 <LO	5s	Warning	Pressure P1 lower than LO limit	Message	-	Line 1	Check process conditions.
107	LINE 1: PRESSURE P1 >HI	5s	Warning	Pressure P1 higher than HI limit	Message	-	Line 1	Check process conditions.
108	LINE 1: PRESSURE P1 -BROKEN WIRE	5s	Alarm	Pressure P1 signal cable wire break	▪ Message ▪ System shows the last valid value	▪ Continuous measurement ▪ VFR operating mode not available ▪ Barge installation: Control valve operating mode changes if a switch is made from automatic to manual in the loading mode	Line 1	Check sensor signal cable.
109	LINE 1: PRESSURE P2 <LO	5s	Warning	Pressure P2 lower than LO limit	Message	-	Line 1	Check process conditions.
110	LINE 1: PRESSURE P2 >HI	5s	Warning	Pressure P2 higher than HI limit	Message	-	Line 1	Check process conditions.

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
111	LINE 1: PRESSURE P2 -BROKEN WIRE	5s	Alarm	Pressure P2 signal cable wire break	▪ Message ▪ System shows the last valid value	▪ Continuous measurement ▪ VFR operating mode not available ▪ Barge installation: Control valve operating mode changes if a switch is made from automatic to manual in the loading mode	Line 1	Check sensor signal cable.
112	LINE 1: CONTROL VALVE FEEDBACK – BROKEN WIRE	5s	Warning	Valve message: wire break/ short-circuit	▪ Message ▪ System shows the last valid value	-	Line 1	Check control valve wiring of feedback signal.
113	LINE 1: CONTROL VALVE FAILURE - MANUAL CONTROL REQUIRED	5s	Alarm	Difference detected in valve control and feedback signal	Message	▪ Continuous measurement ▪ Control valve operating mode changes from automatic to manual	Line 1	Check the wiring and proper operation of the control valve. If the valve does not respond, manual control using the hand-wheel is necessary!
114	LINE 1: MODBUS – COMMUNICATION FAILURE TO FLOWMETER	10s	Alarm	Modbus connection to flowmeter interrupted	▪ Message ▪ System shows the last valid value	▪ Continuous measurement ▪ System switches to the VFR measuring mode (if available)	Line 1	Check Modbus signal cable of flowmeter. Primary measuring mode inaccurate. Auxiliary measurement takes over.

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
115	LINE 1: FLOWMETER PULSE LINE FAILURE	5s	Alarm	Broken wire of pulse signal (deviation compared with the flow value transmitted via Modbus for more than 5 seconds, loading or delivery active, Promass Status =1. The deviation can be configured.)	Message	▪ Continuous measurement ▪ System totalizes with Modbus flow value	Line 1	Check pulse line cable of flowmeter. Modbus process values are taken into account.
116	LINE 1: FLOWMETER FAILURE	5s	Alarm	Modbus connection of flowmeter and pulse signal failed	▪ Message ▪ System shows the last valid value (Modbus)	▪ Continuous measurement ▪ System switches to the VFR measuring mode (if available)	Line 1	Check Modbus and pulse line cable of flowmeter. Auxiliary measurement takes over.
117	LINE 1: POWER UP OF CONTROLLER CAUSED BY POWER FAILURE	0s	Alarm		Controller power failure	Alarm, power failure indicated on BMT	Line 1	Message is automatically hidden when next batch starts. After startup, the system automatically continues with the measurements.
118	LINE 1: VFR MEASURING MODE NOT AVAILABLE	5s	Alarm	Broken wire detected at P1 and/or P2	Message	System does not switch to the VFR measuring mode	Line 1	Check signal cable of sensors P1 and P2. Not possible to switch to auxiliary measuring mode.
119	LINE 1: FLOWMETER MEASURING MODE NOT AVAILABLE	5s	Alarm	Modbus communication error to flowmeter or flowmeter status not OK	Message	System does not switch flowmeter to measuring mode	Line 1	Check Modbus and pulse line cable, or status of flowmeter. Auxiliary measurement takes over.
120	LINE 1: NO MEASURING MODE AVAILABLE	5s	Alarm	VFR measuring mode and flowmeter measuring mode cannot be accessed	Message	System shows the last valid value. Totalization can be stopped manually.	Line 1	See additional detailed messages.

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
121	LINE 1: AIR INDEX IS ABOVE CRITICAL VALUE	See settings	Warning	**Air Index** is higher than EU 0.5% limit	Message	None	Line 1	Too much air in bunker pipe.
122	LINE 1: WARNING: AIR INDEX HIGH, TAKE STEPS FOR REDUCTION OF ENTRAINED AIR	0s	Warning	**Air Index** is higher than Air Index limit (adjustable)	Message	None	Line 1	Too much air in bunker pipe.
123	LINE 1: STANDARD DENSITY OUT OF RANGE (LOW LIMIT)	10s	Warning	**Standard Density** lower than lower limit (adjustable)	Message	None	Line 1	Check process conditions.
124	LINE 1: STANDARD DENSITY OUT OF RANGE (HIGH LIMIT)	10s	Warning	**Standard Density** higher than upper limit (adjustable)	Message	None	Line 1	Check process conditions.
125	LINE 1: OBSERVED DENSITY OUT OF RANGE (LOW LIMIT)	10s	Warning	**Observed Density** lower than lower limit (adjustable)	Message	None	Line 1	Check process conditions.
126	LINE 1: OBSERVED DENSITY OUT OF RANGE (HIGH LIMIT)	10s	Warning	**Observed Density** higher than upper limit (adjustable)	Message	None	Line 1	Check process conditions.
127	LINE 1: PRESSURE P1 >HIHI (ACKNOWLEDGMENT REQUIRED!)	1s	Alarm	Pressure P1 higher than HIHI limit	Message	Control valve fully opened in manual mode	Line 1	Reduce the pressure immediately (reduce pump speed, open valve). The valve only returns to the automatic control mode if this message has been acknowledged.

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
128	LINE 1: PRESSURE P2 >HIHI (ACKNOWLEDGMENT REQUIRED!)	1s	Alarm	Pressure P2 higher than HIHI limit	Message	Control valve fully opened in manual mode	Line 1	Reduce the pressure immediately (reduce pump speed, open valve). The valve only returns to the automatic control mode if this message has been acknowledged.
129	LINE 1: ERROR PRESENT DURING THIS OPERATION	0s	Warning	At least 1 message with Level Alarm active during this operation	Message	None	Line 1	The message is hidden automatically when the next **Reset Total** or **Operation Complete** is performed.
131	LINE 1: PROMASS CUSTODY TRANSFER LOGBOOK FULL	0s	Alarm	Custody transfer logbook of the Promass 300 is full	Message	▪ Continuous measurement ▪ System switches to the VFR measuring mode (if available)	Line 1	1. Deactivate custody transfer mode 2. Delete custody transfer logbook (all 30 entries) 3. Activate custody transfer mode
132	LINE1: PROMASS STATUS WARNING	0s	Warning	Promass status not ok	Message	▪ Continuous measurement ▪ System switches to the VFR measuring mode (if available)	Line1	Check Modbus and pulse line cable, or status of flowmeter. Auxiliary measurement takes over.
201	LINE 2: MASS FLOW F1 <LO	5s	Warning	Mass flow lower than LO limit	Message	-	Line 2	Check process conditions.
202	LINE 2: MASS FLOW F1 >HI	5s	Warning	Mass flow higher than HI limit	Message	-	Line 2	Check process conditions.
203	LINE 2: TEMPERATURE T1 <LO	5s	Warning	Temperature lower than LO limit	Message	-	Line 2	Check process conditions.
204	LINE 2: TEMPERATURE T1 >HI	5s	Warning	Temperature higher than HI limit	Message	-	Line 2	Check process conditions.
205	LINE 2: TEMPERATURE T1 - BROKEN WIRE	5s	Alarm	Temperature T1 signal cable wire break	▪ Message ▪ System shows the last valid value	Continuous measurement	Line 2	Check sensor signal cable.
206	LINE 2: PRESSURE P1 <LO	5s	Warning	Pressure P1 lower than LO limit	Message	-	Line 2	Check process conditions.

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
207	LINE 2: PRESSURE P1 >HI	5s	Warning	Pressure P1 lower than HI limit	Message	-	Line 2	Check process conditions.
208	LINE 2: PRESSURE P1 -BROKEN WIRE	5s	Alarm	Pressure P1 signal cable wire break	▪ Message ▪ System shows the last valid value	▪ Continuous measurement ▪ VFR operating mode not available ▪ Barge installation: Control valve operating mode changes if a switch is made from automatic to manual in the loading mode	Line 2	Check sensor signal cable.
209	LINE 2: PRESSURE P2 <LO	5s	Warning	Pressure P2 lower than LO limit	Message	-	Line 2	Check process conditions.
210	LINE 2: PRESSURE P2 >HI	5s	Warning	Pressure P2 higher than HI limit	Message	-	Line 2	Check process conditions.
211	LINE 2: PRESSURE P2 -BROKEN WIRE	5s	Alarm	Pressure P2 signal cable wire break	▪ Message ▪ System shows the last valid value	▪ Continuous measurement ▪ VFR operating mode not available ▪ Vessel installation: Control valve operating mode changes if a switch is made from automatic to manual in the loading mode	Line 2	Check sensor signal cable.
212	LINE 2: CONTROL VALVE FEEDBACK – BROKEN WIRE	5s	Warning	Valve message: wire break/ short-circuit	▪ Message ▪ System shows the last valid value	--	Line 2	Check control valve wiring of feedback signal.
213	LINE 2: CONTROL VALVE FAILURE - MANUAL CONTROL REQUIRED	5s	Alarm	Difference detected in valve control and feedback signal	Message	▪ Continuous measurement ▪ Control valve operating mode changes from automatic to manual	Line 2	Check the wiring and proper operation of the control valve. If the valve does not respond, manual control using the hand-wheel is necessary!

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
214	LINE 2: MODBUS – COMMUNICATION FAILURE TO FLOWMETER	10s	Alarm	Modbus connection to flowmeter interrupted	▪ Message ▪ System shows the last valid value	▪ Continuous measurement ▪ System switches to the VFR measuring mode (if available)	Line 2	Check Modbus signal cable of flowmeter. Primary measuring mode inaccurate. Auxiliary measurement takes over.
215	LINE 2: FLOWMETER PULSE LINE FAILURE	5s	Alarm	Broken wire of pulse signal (deviation compared with the flow value transmitted via Modbus for more than 5 seconds, loading or delivery active, Promass Status =1. The deviation can be configured.)	Message	▪ Continuous measurement ▪ System totalizes with Modbus flow value	Line 2	Check pulse line cable of flowmeter. Modbus process values are taken into account.
216	LINE 2: FLOWMETER FAILURE	5s	Alarm	Modbus connection of flowmeter and pulse signal failed	▪ Message ▪ System shows the last valid value (Modbus)	▪ Continuous measurement ▪ System switches to the VFR measuring mode (if available)	Line 2	Check Modbus and pulse line cable of flowmeter. Auxiliary measurement takes over.
217	LINE 2: POWER UP OF CONTROLLER CAUSED BY POWER FAILURE	0s	Alarm		Controller power failure	Alarm, power failure indicated on BMT	Line 2	Message is automatically hidden when next batch starts. After startup, the system automatically continues with the measurements.
218	LINE 2: VFR MEASURING MODE NOT AVAILABLE	5s	Alarm	Broken wire detected at P1 and/or P2	Message	System does not switch to the VFR measuring mode	Line 2	Check signal cable of sensors P1 and P2. Not possible to switch to auxiliary measuring mode.

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
219	LINE 2: FLOWMETER MEASURING MODE NOT AVAILABLE	5s	Alarm	Modbus communication error to flowmeter or flowmeter status not OK	Message	System does not switch flowmeter to measuring mode	Line 2	Check Modbus and pulse line cable, or status of flowmeter. Auxiliary measurement takes over.
220	LINE 2: NO MEASURING MODE AVAILABLE	5s	Alarm	VFR measuring mode and flowmeter measuring mode cannot be accessed	Message	System shows the last valid value. Totalization can be stopped manually.	Line 2	See additional detailed messages.
221	LINE 2: AIR INDEX IS ABOVE CRITICAL VALUE	See settings	Warning	**Air Index** is higher than EU 0.5% limit	Message	None	Line 2	Too much air in bunker pipe.
222	LINE 2: WARNING: AIR INDEX HIGH, TAKE STEPS FOR REDUCTION OF ENTRAINED AIR	0s	Warning	**Air Index** is higher than Air Index limit (adjustable)	Message	None	Line 2	Too much air in bunker pipe.
223	LINE 2: STANDARD DENSITY OUT OF RANGE (LOW LIMIT)	10s	Warning	**Standard Density** lower than lower limit (adjustable)	Message	None	Line 2	Check process conditions.
224	LINE 2: STANDARD DENSITY OUT OF RANGE (HIGH LIMIT)	10s	Warning	**Standard Density** higher than upper limit (adjustable)	Message	None	Line 2	Check process conditions.
225	LINE 2: OBSERVED DENSITY OUT OF RANGE (LOW LIMIT)	10s	Warning	**Observed Density** lower than lower limit (adjustable)	Message	None	Line 2	Check process conditions.
226	LINE 2: OBSERVED DENSITY OUT OF RANGE (HIGH LIMIT)	10s	Warning	**Observed Density** higher than upper limit (adjustable)	Message	None	Line 2	Check process conditions.

Message number	Message text	Time delay	Message category	Cause	Visual system reaction	Function system reaction	Application	Recommended action
227	LINE 2: PRESSURE P1 >HIHI (ACKNOWLEDGMENT REQUIRED!)	1s	Alarm	Pressure P1 higher than HIHI limit	Message	Control valve fully opened in manual mode	Line 2	Reduce the pressure immediately (reduce pump speed, open valve). The valve only returns to the automatic control mode if this message has been acknowledged.
228	LINE 2: PRESSURE P2 >HIHI (ACKNOWLEDGMENT REQUIRED!)	1s	Alarm	Pressure P2 higher than HIHI limit	Message	Control valve fully opened in manual mode	Line 2	Reduce the pressure immediately (reduce pump speed, open valve). The valve only returns to the automatic control mode if this message has been acknowledged.
229	LINE 2: ERROR PRESENT DURING THIS OPERATION	0s	Warning	At least 1 message with Level Alarm active during this operation	Message	None	Line 2	The message is hidden automatically when the next **Reset Total** or **Operation Complete** is performed.
231	LINE 2: PROMASS CUSTODY TRANSFER LOGBOOK FULL	0s	Alarm	Custody transfer logbook of the Promass 300 is full	Message	▪ Continuous measurement ▪ System switches to the VFR measuring mode (if available)	Line 2	1. Deactivate custody transfer mode 2. Delete custody transfer logbook (all 30 entries) 3. Activate custody transfer mode
232	LINE 2: PROMASS STATUS WARNING	0s	Warning	Promass status not ok	Message	▪ Continuous measurement ▪ System switches to the VFR measuring mode (if available)	Line 2	Check the Promass status and rectify the problem according to the Operating Instructions of the Promass.

15.2 Sealing/locking

15.2.1 Sealing program settings

The settings of the SBC600 are sealed by a hardware switch inside the control cabinet. If this switch is set to **Sealed**, it is not possible to modify any settings that are relevant for custody transfer. If the switch is set to **Unsealed**, an error message appears on the HMI.

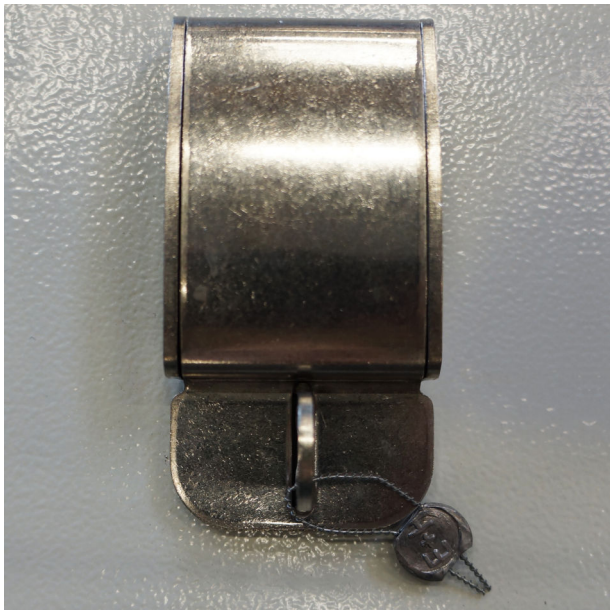
15.2.2 Sealing cabinets

The cable entries of the system cabinets must be protected against unauthorized access. The plates with the cable entries are secured with sealing screws. These screws must be sealed as shown in the figure below:

26 Location of the cable entries

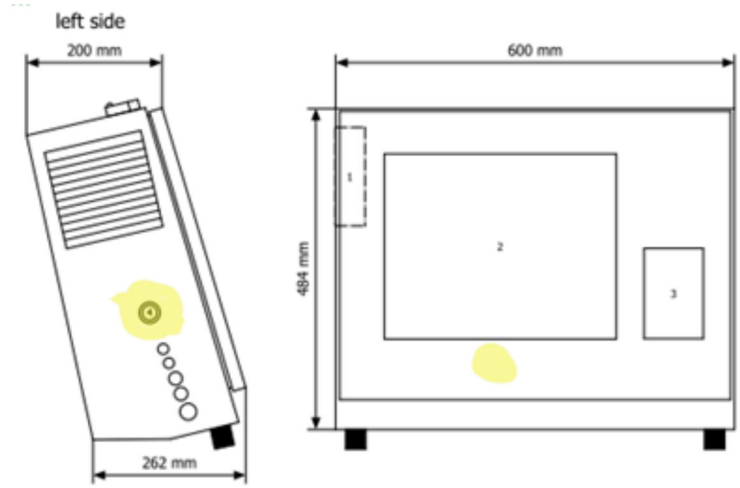
27 Screws sealed with sealing wire

After commissioning the system, the door locks can be sealed as shown in the figure below:



15.2.3 USB ports

If all access to the system is prohibited, the USB ports on the operating panel must be sealed as shown in the figures below.



28 *Location of the USB port*

29 *USB port sealed with sealing wire*

15.3 Interface specification

This section describes the Modbus TCP interface between the SBC600 and the external system. Modbus is compatible with all versions of the SBC600 software that have installed an Anybus Modbus TCP Gateway. Not all SBC600 software versions have all the values. The SBC600 application version must be known before the TCP interface is implemented.

15.3.1 Modbus TCP

IP default settings

IP address:	10.126.97.48
Subnet mask:	255.255.255.0
Port:	502

The IP configuration of the Anybus Modbus TCP network interface can be edited using the IPconfig tool. The IPconfig tool can be downloaded from www.anybus.com.

Definitions

The SBC600 acts as a Modbus server/slave, while the third-party system is the Modbus client/master. The register addresses indicated in this document are 1-based in accordance with the Modbus data model.

Modbus function codes

The following Modbus function codes are supported:

Function code	Function name	Meaning
04	Read Input Registers (3xxxx)	Read interrelated registers 1-125
06	Write Single Register (4xxxx)	Write 1 register

Floating-point number

Floating point number as per IEEE 754:

Byte 3	Byte 2	Byte 1	Byte 0
SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM

S = sign

E = exponent

M = mantissa

Byte transmission sequence (little endian):

1.	2.	3.	4.
Byte 0	Byte 1	Byte 2	Byte 3

Byte transmission sequence (big endian):

1.	2.	3.	4.
Byte 1	Byte 0	Byte 3	Byte 2

String values

Examples of string values (system ID, register 30215, max. 20 characters) with the value "abcd 1234":

Register 30224			Register 30219		Register 30218		Register 30217		Register 30216		Register 30215	
Byte 19	Byte 18	...	Byte 9	Byte 8	Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
“NUL” [1]	“NUL”	...	“NUL”	"4"	"3"	"2"	"1"	" "	"d"	"c"	"b"	"a"
0x00	0x00	...	0x00	0x34	0x33	0x32	0x31	0x20	0x64	0x63	0x62	0x61

1) Bytes that are not used are populated with "NUL" and ignored by the target system.

Byte transmission sequence (little endian):

1.	2.	...	19.	20.
Byte 0	Byte 1	...	Byte 18	Byte 19

Byte transmission sequence (big endian):

1.	2.	...	19.	20.
Byte 1	Byte 0	...	Byte 19	Byte 18

Integer values (16-bit)

Byte transmission sequence (little endian):

1.	2.
Byte 0	Byte 1

Byte transmission sequence (big endian):

1.	2.
Byte 1	Byte 0

Integer values (32-bit)

Byte transmission sequence (little endian):

1.	2.	3.	4.
Byte 0	Byte 1	Byte 2	Byte 3

Byte transmission sequence (big endian):

1.	2.	3.	4.
Byte 1	Byte 0	Byte 3	Byte 2

15.3.2 Modbus data register specification

The following data do not refer to a specific SBC600 line.

Global data

Modbus watchdog

Modbus register:	40001	Watchdog signal received from the master.
Register count value:	1	
Data type:	Integer (16-bit signed)	
Access:	Write	
SBC600 software version:	All	

Modbus watchdog

Modbus register:	30001	The watchdog signal received from the master is sent back to the client (copied from the Write tag to the Read tag). The client should check the watchdog signal for uninterrupted communication.
Register count value:	1	
Data type:	Integer (16-bit signed)	
Access:	Read	
SBC600 software version:	All	

Vessel ID 1st line

Modbus register:	30002	User-configurable vessel ID (1st text line). Can be used for IMO number.
Register count value:	10	
Data type:	String (20)	
Access:	Read	
SBC600 software version:	All	

Vessel ID 2nd line

Modbus register:	30205	User-configurable vessel ID (2nd text line).
Register count value:	10	
Data type:	String (20)	
Access:	Read	
SBC600 software version:	All	

System ID

Modbus register:	30215	SBC600 system ID (not customizable).
Register count value:	10	
Data type:	String (20)	
Access:	Read	
SBC600 software version:	All	

SBC600 error status - global

Modbus register:	30012	Bitwise SBC600 error status as per the following table (for message numbers, see the Operating Instructions).		
Register count value:	1			
Data type:	Integer			
Access:	Read			
Bit 0:	-	No active error message	(1=no error)	All software versions
Bit 1:	-	No warning active	(1=no warning)	All software versions
Bit 2:	001	COMMUNICATION BETWEEN HMI AND PLC INTERRUPTED	(1=active)	All software versions
Bit 3:	002	PARAMETER SWITCH IN **UNSEALED** POSITION	(1=active)	All software versions
Bit 4:	003	CONTROL CABINET DOOR OPENED	(1=active)	All software versions
Bit 5:	004	POWER SUPPLY 1 POWER FAILURE	(1=active)	All software versions
Bit 6:	005	POWER SUPPLY 2 POWER FAILURE	(1=active)	All software versions
Bit 7:	006	COMMUNICATION ERROR WITH EXTERNAL DATA LOGGER	(1=active)	All software versions
Bit 8:	007	I/O MODULE FAULT - SEE DIAGNOSTIC INFORMATION FOR DETAILS	(1=active)	V1.04.00 and higher
Bit 9:	008	MODBUS GATEWAY I/O FAULT	(1=active)	V1.04.00 and higher
Bit 10:	009	CONTROLLER MAJOR FAULT - SEE DIAGNOSTIC INFO	(1=active)	V1.05.00 and higher

Line-specific SBC600 data

The following data apply specifically to the SBC600 line.

SBC600 error status - line-specific

Modbus register:	Line 1: 30014, 30015 Line 2: 30069, 30070	Bitwise SBC600 error status as per the following table (for message numbers, see the Operating Instructions).		
Register count value:	2			
Data type:	Integer			
Access:	Read			
Register 1:				
Bit 0:	101/201	MASS FLOW F1 < LO	(1=active)	All software versions
Bit 1:	102/202	MASS FLOW F1 > HI	(1=active)	All software versions
Bit 2:	103/203	TEMPERATURE T1 < LO	(1=active)	All software versions
Bit 3:	104/204	TEMPERATURE T1 > HI	(1=active)	All software versions
Bit 4:	105/205	TEMPERATURE T1 - BROKEN WIRE	(1=active)	All software versions
Bit 5:	106/206	PRESSURE P1 < LO	(1=active)	All software versions
Bit 6:	107/207	PRESSURE P1 > HI	(1=active)	All software versions
Bit 7:	108/208	PRESSURE P1 - BROKEN WIRE	(1=active)	All software versions
Bit 8:	109/209	PRESSURE P2 < LO	(1=active)	All software versions
Bit 9:	110/210	PRESSURE P2 > HI	(1=active)	All software versions
Bit 10:	111/211	PRESSURE P2 - BROKEN WIRE	(1=active)	All software versions
Bit 11:	112/212	CONTROL VALVE FEEDBACK - BROKEN WIRE	(1=active)	All software versions
Bit 12:	113/213	CONTROL VALVE FAILURE - MANUAL CONTROL REQUIRED	(1=active)	All software versions
Bit 13:	114/214	MODBUS - COMMUNICATION FAILURE TO FLOWMETER	(1=active)	All software versions
Bit 14:	115/215	FLOWMETER PULSE LINE FAILURE	(1=active)	All software versions
Bit 15:	116/216	FLOWMETER FAILURE	(1=active)	All software versions
Register 2:				
Bit 0:	117/217	POWER UP OF CONTROLLER CAUSED BY POWER FAILURE	(1=active)	All software versions
Bit 1:	118/218	VFR MEASURING MODE NOT AVAILABLE	(1=active)	All software versions
Bit 2:	119/219	FLOWMETER MEASURING MODE NOT AVAILABLE	(1=active)	All software versions
Bit 3:	120/220	NO MEASURING MODE AVAILABLE	(1=active)	All software versions
Bit 4:	121/221	AIR INDEX IS ABOVE CRITICAL VALUE	(1=active)	All software versions
Bit 5:	127/227	PRESSURE P1 > HIHI (ACKNOWLEDGMENT REQUIRED!)	(1=active)	V1.04.00 and higher
Bit 6:	128/228	PRESSURE P2 > HIHI (ACKNOWLEDGMENT REQUIRED!)	(1=active)	V1.04.00 and higher
Bit 7:	122/222	WARNING: AIR INDEX HIGH, TAKE STEPS FOR REDUCTION OF ENTRAINED AIR	(1=active)	V1.04.00 and higher

Bit 8:	123/223	STANDARD DENSITY OUT OF RANGE (LOW LIMIT)	(1=active)	V1.04.00 and higher
Bit 9:	124/224	STANDARD DENSITY OUT OF RANGE (HIGH LIMIT)	(1=active)	V1.04.00 and higher
Bit 10:	125/225	OBSERVED DENSITY OUT OF RANGE (LOW LIMIT)	(1=active)	V1.04.00 and higher
Bit 11:	126/226	OBSERVED DENSITY OUT OF RANGE (HIGH LIMIT)	(1=active)	V1.04.00 and higher
Bit 12:	129/229	ERROR PRESENT DURING THIS OPERATION	(1=active)	V1.04.00 and higher
Bit 13:	131/231	PROMASS CUSTODY TRANSFER LOGBOOK FULL	(1=active)	V1.09.00 and higher
Bit 14:	132/232	PROMASS STATUS WARNING	(1=active)	V1.09.00 and higher

Mass Flow

Modbus register:	Line 1: 30016 Line 2: 30071	Current mass flow in [t/h]
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Air Index

Modbus register:	Line 1: 30018 Line 2: 30073	Air index for current operation
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Tube Damping

Modbus register:	Line 1: 30020 Line 2: 30075	Tube damping of the Promass in [A/m]. If invalid, the value is displayed as **-9999**.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Temperature T1

Modbus register:	Line 1: 30022 Line 2: 30077	Temperature T1 in [°C]. If invalid, the value is displayed as **-9999**.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Pressure P1

Modbus register:	Line 1: 30024 Line 2: 30079	Pressure P1 in [bar (a)]. If invalid, the value is displayed as **-9999**.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Pressure P2

Modbus register:	Line 1: 30026 Line 2: 30081	Pressure P2 in [bar (a)]. If invalid, the value is displayed as **-9999**.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Flowing Density

Modbus register:	Line 1: 30028 Line 2: 30083	Flow density of the Promass in [kg/m3]. If invalid, the value is displayed as **-9999**.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Exciter Current

Modbus register:	Line 1: 30030 Line 2: 30085	Exciter current of the Promass in [mA]. If invalid, the value is displayed as **-9999**.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Total Quantity (Delivered − Loaded)

Modbus register:	Line 1: 30032 Line 2: 30087	Total quantity in [t] for the current operation. The value is displayed with 3 decimal places.
Register count value:	10	
Data type:	String (20)	
Access:	Read	
SBC600 software version:	All	

Total Quantity (Delivered − Loaded) [FLOAT]

Modbus register:	Line 1: 30132 Line 2: 30134	Total quantity in [t] for the current operation. The accuracy of this value is limited. The number of decimal places displayed depends on the totalizer value. For maximum accuracy, use the string value (register 30032/30087).
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	V1.05.00 and higher	

Total Volume (Delivered − Loaded)

Modbus register:	Line 1: 30042 Line 2: 30097	Total volume in [m3] for the current operation. The value is displayed with 3 decimal places.
Register count value:	10	
Data type:	String (20)	
Access:	Read	
SBC600 software version:	All	

Total Volume (Delivered − Loaded) at Std. T

Modbus register:	Line 1: 30136 Line 2: 30146	Total volume in [m3] at standard temperature for the current operation. The value is displayed with 3 decimal places.
Register count value:	10	
Data type:	String (20)	
Access:	Read	
SBC600 software version:	V1.06 and higher	

Date − Time last Reset

Modbus register:	Line 1: 30052 Line 2: 30107	Date and time the operator clicked one of the buttons **Operation Complete** or **Reset Total**. Format: YYYY/MMM/DD hh:mm:ss
Register count value:	10	
Data type:	String (20)	
Access:	Read	
SBC600 software version:	All	

Promass Error Status

Modbus register:	Line 1: 30062 Line 2: 30117	Promass error code. For error codes, see the Promass manual 1 = no error
Register count value:	1	
Data type:	Integer (16-bit signed)	
Access:	Read	
SBC600 software version:	All	

Control Valve Feedback

Modbus register:	Line 1: 30063 Line 2: 30118	Feedback from the back-pressure control valve in [%]. If invalid, the value is displayed as **-9999**.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	All	

Batch Number

Modbus register:	Line 1: 30065 Line 2: 30120	Current batch number.
Register count value:	2	
Data type:	Double integer (32-bit signed)	
Access:	Read	
SBC600 software version:	All	

Operating Mode

Modbus register:	Line 1: 30067 Line 2: 30122	Current SBC600 operating mode (flow direction). 1 = DELIVERY (from vessel to barge) 2 = LOADING (from barge to vessel)
Register count value:	1	
Data type:	Integer (16-bit signed)	
Access:	Read	
SBC600 software version:	All	

Batch Mode

Modbus register:	Line 1: 30068 Line 2: 30123	Current batch mode (mass unit). 1 = MASS (VACUUM) 2 = MASS (IN AIR)
Register count value:	1	
Data type:	Integer (16-bit signed)	
Access:	Read	
SBC600 software version:	V1.00.00 – V1.05.xx	

Batch Mode

Modbus register:	Line 1: 30068 Line 2: 30123	Current batch mode. 4 digits (digit 4 | digit 3 | digit 2 | digit 1) Digit 1: Batch mode ▪ 1 = MASS (VACUUM) ▪ 2 = MASS (IN AIR) Digit 2: Std. temp. 0 = V15 Digit 3: Std. density ▪ 0 = Fwavg. ▪ 1 = Fixed lab ▪ 2 = Default (lab) Digit 4: Fluid group ▪ 1 = Crude ▪ 2 = Gasoline ▪ 3 = Trans. area ▪ 4 = Jet group ▪ 5 = Fuel oil ▪ 6 to 8 = Free fill 1 to 3
Register count value:	1	
Data type:	Integer (16-bit signed)	
Access:	Read	
SBC600 software version:	V1.06.00 and higher	

Operating Status

Modbus register:	Line 1: 30226 Line 2: 30227	Current operating status. The operating status is defined by the two buttons **Operation Complete** or **Reset Total** in the **Batch Control** view. 0 = NO OPERATION (**Operation Complete** button was last clicked) 1 = OPERATION RUNNING (**Reset Total** button was last clicked)
Register count value:	1	
Data type:	Integer (16-bit signed)	
Access:	Read	
SBC600 software version:	V1.00.00 - V1.04.02	

Operating Status

Modbus register:	Line 1: 30226 Line 2: 30225	Current operating status. The operating status is defined by the two buttons **Operation Complete** or **Reset Total** in the **Batch Control** view. 0 = NO OPERATION (**Operation Complete** button was last clicked) 1 = OPERATION RUNNING (**Reset Total** button was last clicked)
Register count value:	1	
Data type:	Integer (16-bit signed)	
Access:	Read	
SBC600 software version:	V1.05.00 and higher	

Standard Density at Std. T

Modbus register:	Line 1: 30227 Line 2: 30231	Standard density for the current operation.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	V1.04.00 and higher	

Observed Density

Modbus register:	Line 1: 30229 Line 2: 30233	Observed density for the current operation.
Register count value:	2	

Data type:	Float	
Access:	Read	
SBC600 software version:	V1.04.00 and higher	

Fwavg. Standard Density at Std. T

Modbus register:	Line 1: 30124 Line 2: 30128	Average flow-weighted standard density for the current operation.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	V1.05.00 and higher	

Fwavg. Observed Density

Modbus register:	Line 1: 30126 Line 2: 30130	Average flow-weighted observed density for the current operation.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	V1.05.00 and higher	

Fixed Lab Standard Density

Modbus register:	Line 1: 30156 Line 2: 30158	Fixed laboratory standard density for the current operation.
Register count value:	2	
Data type:	Float	
Access:	Read	
SBC600 software version:	V1.06.00 and higher	

Non-resettable Mass Totalizer Loading

Modbus register:	Line 1: 30160 Line 2: 30170	Non-resettable mass totalizer loading in |t| or |t(air)| depending on the configured system settings. The value is displayed with 3 decimal places.
Register count value:	10	
Data type:	String (20)	
Access:	Read	
SBC600 software version:	V1.08.04 and higher	

Non-resettable Mass Totalizer Delivery

Modbus register:	Line 1: 30180 Line 2: 30190	Non-resettable mass totalizer delivery in |t| or |t(air)| depending on the configured system settings. The value is displayed with 3 decimal places.
Register count value:	10	
Data type:	String (20)	

Access:	Read	
SBC600 software version:	V1.08.04 and higher	

15.4 Information on the third-party software used

15.4.1 Rockwell Factory Talk View - Site Edition and RSLinx

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15.4.2 Microsoft(R) Windows(R) XP Professional

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15.4.3 Microsoft(R) Windows(R) Embedded Standard 7

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15.4.4 MICROSOFT SQL SERVER 2008 R2 EXPRESS

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15.4.5 Comfort on-screen keyboard

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