

Portable Data Recorder HMG 4000

Operating Manual

(Translation of original instructions)



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Preface

This manual provides you, as user of our product, with key information on the operation and maintenance of the equipment.

It will acquaint you with the product and assist you in obtaining maximum benefit in the applications for which it is designed.

Keep the manual in the vicinity of the instrument for immediate reference.

Please note: the specifications given in this documentation regarding the instrument technology were correct at the time of publishing.

Modifications to technical specifications, illustrations and dimensions are therefore possible.

If you discover errors while reading the documentation or have additional suggestions or tips, please contact us at:

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We look forward to receiving your input.

“Putting experience into practice”

1 General

This manual is a constituent part of the device. It contains texts and graphics concerning the correct handling of the product and must be read before operation of the device.

The manual offers information concerning the safe operation of the portable data recorder HMG 4000.

By using this manual as recommended, you will ensure that the HMG 4000 is put into effective and safe operation as quickly as possible.

1.1 Standard functions

The HMG 4000 portable data recorder is a mobile measurement and data gathering device for measuring tasks for hydraulic and pneumatic systems and machines as well as in industrial and mobile areas.

The applications are primarily to be found in the areas Service, Maintenance, Fault-finding or in the test bench area.

The HMI 4000 can record the signals of up to 38 sensors at once.

For this purpose, HYDAC ELECTRONIC offer special sensors, which are automatically detected by the HMG 4000 and whose parameters such as measurement values, measuring ranges and measuring units can be set.

On the one hand, there are the HYDAC HSI-Sensors (HYDAC Sensor Interface) for the measurement of pressure, temperature and flow rate, for the connection of which there are 8 analogue input channels.

Furthermore, there is the option of connecting HYDAC SMART sensors to these inputs. SMART sensors can display several different measured variables at a time.

Up to 28 special HYDAC HCSI-Sensors (HYDAC CAN Sensor Interface) can be connected additionally via the CANbus port, also supporting automatic sensor detection.

HMG 4000 can optionally be connected to an existing CAN network. This enables the recording of measured data transmitted via CAN bus (e.g. motor speed, motor pressure) in combination with the measured data from the hydraulic system.

Older model HYDAC sensors or commonly available sensors made by other manufacturers can also be used. However, these sensors do not have any automatic sensor detection, consequently the initial set-up has to be entered manually.

The device also offers measurement inputs for standard sensors with current and voltage signals.

The HMG 4000 rounds off the application, providing two additional digital inputs (e.g. for frequency or rpm measurements).

The HMG 4000 can render up to 100 measurement channels in total.

Depending on the type of sensor, there is an internal memory in the sensor for the storage of recorded measurement data on a long-term basis. In addition, depending on the sensor type, pre-set parameters can be changed and stored in the internal memory as a sensor configuration.

The operator can intuitively access all of the unit's functions and settings by means of clearly presented selection menus. The HMG 4000 has a touchscreen similar to that of a mobile phone or tablet computer for the purpose of entering number values and text.

When taking measurements of rapid, dynamic machine processes, all 8 analogue input signals can be recorded simultaneously at a rate of 0.1 ms.

This function of course requires suitable fast sensors to be used.

The most impressive feature of the HMG 4000 is its ability to record the dynamic processes of a machine in the form of a measurement curve and render them as a graph — and, moreover, online and in real time.

The HMG 4000 is equipped with specially developed software providing for fast data collection and processing. A measurement curve can comprise up to 8 million measured values. The measured value memory for archiving this data can record more than 500 measurement curves of this type.

Alongside simple measurement curves for single and endless recordings, the HMG 4000 has additional functions for recording event-controlled measurements and event logs. There are various trigger options available for triggering events.

Alongside measurement curve recording, it is possible to create and save user-specific settings, so-called user profiles. The main advantage of this is to enable identical measurements of various equipment items to be repeated for the purpose of preventive maintenance. All the user has to do is retrieve the relevant user profile from the HMG 4000's memory.

For visualisation purposes, the HMG 4000 has a fully graphic-enabled 5.7" touchscreen for displaying the shown measured values clearly as text or as a measurement curve. A very large format display of individual measured values is also possible in order to be able to read them from greater distances.

The HMG 4000 is equipped with numerous user-friendly functions for displaying, evaluating and processing measured values:

- Table
- Graphics
- Scaling
- Tracker
- Zoom

The HMG 4000 communicates with a PC via the integrated USB device interface. For the subsequent easy editing, display and evaluation of the measurements on a PC, you can use the HMG 4000's "*HMGWIN*" software which is included in the scope of delivery. This also permits the (remote) control of the HMG 4000 directly from the computer.

The HYDAC software **CMWIN** is also supplied as standard with the unit. This software enables you to communicate directly from your PC with SMART sensors connected to the HMG 4000.

1.2 CAN functions

- Port option to CAN bus
- Read-out and evaluation of up to 28 measured values from up to 28 CAN messages
- Configuration of CAN sensor measured values
- Connection of up to 28 HYDAC HCSI sensors
- For further functions, see "*CAN Tools*" menu

1.3 Programming function for electronic switches

Programmable electronic print, temperature and level switches with IO link (EDS 8xx / ExS 3xxx) as well as the HPG P1-000 can be easily programmed and parametrised via the programming function of the HMG 4000.

1.4 Scope of delivery

- HMG 4000
- Power supply for 90 ... 230 V connection
- Instruction manual
- Data carrier with USB drivers, the software "HMGWIN" and "CMWIN" (software for evaluating measured data or sensor communication) as well as other product information
- USB connection cable
- Harness

1.5 Technical Safety

The individual components of the HMG 4000 portable data recorder and the assembled unit are subject to strict quality assurance inspection and testing. Each HMG 4000 undergoes a final test. This ensures that upon delivery, the unit is free from defects and complies with the designated specifications.

The series HMG 4000 portable data recorders are maintenance-free and work perfectly when used under the conditions specified. If, however, you do encounter problems, please contact your HYDAC representative.

Any tampering with the switch will cause all warranty claims to become null and void.

Compliance with European Standards

The HMG 4000 series portable data recorders have the CE mark and thus comply with all current German regulatory requirements and European standards relating to the operation of these units. This ensures compliance with the applicable directives relating to electromagnetic compatibility and the safety provisions according to the low-voltage directive.

This product is in compliance with the regulations contained in the following European guidelines:

EN 61000-1 / 2 / 3 / 4.

We reserve the right to make technical modifications.

1.6 Safety information

The HMG 4000 series Portable Data Recorder can be operated safely provided it is used in accordance with its proper, designated use. Please maintain strict adherence to the following safety guidelines in order to preclude hazards to the user and damage to property and surroundings as the result of improper use:

- The HMG 4000 may not be used unless it is in perfect condition/working order.
- The instructions for use must be strictly adhered to. Functions which involve adjusting the zero point in particular can lead to hazardous situations. For more information, please refer to Point 7.1.5 "Zeroing of Measurement Channels".
- If sensors and interfaces are used simultaneously (online measurement), please ensure equipotential.
- The information on the name plate must be noted.
- Troubleshooting and repair work may only be carried out at the HYDAC Service Department.
- All relevant and generally recognised safety requirements must be adhered to.

1.7 Copyright protection

The dissemination and/or reproduction of this document, as well as the exploitation and communication of its content, is not permitted unless specifically authorized. Any violations hereof will be prosecuted to the maximum extent possible under the law. All rights reserved.

1.8 Note on Warranty

This manual was compiled with the greatest possible care. Nevertheless, errors or deviations cannot be excluded, and for this reason we assume no responsibility for the complete accuracy of the content.

In view of the fact that, despite intensive endeavours, errors can never be completely avoided, we welcome tips and suggestions for improvement at any time.

2 The HMG 4000 at a glance

2.1 Touchscreen and operating keys



1 Touchscreen



Only use your fingers to touch the touchscreen!

Make sure the touchscreen does not come into contact with electrical devices as electrostatic discharges can cause malfunctions on the touchscreen.

Make sure the touchscreen does not come into contact with liquids. Dampness or contact with liquids can cause malfunctions on the touchscreen.

To prevent damage to the touchscreen, do not use sharp or pointy objects on it and do not apply heavy pressure.

A few simple gestures (tap, stroke and drag movements as well as expanding and shrinking) are all you need to operate the touchscreen. Notes can be found in Chapter 4.1 "Touchscreen operation".

2 ESC key

To cancel an entry or go **Back** step by step

3 On/off button

4 Brightness setting Touchscreen

Quick press: Switch display on/off; Long press: Set brightness

5 5-way navigation key

Step-by-step navigation inside the display: "o.k." key for entering, completing, transferring or saving input



Alternatively to the touchscreen, the HMG 4000 can be operated using the ESC key and the navigation and directional pad.

2.2 Connection jacks



A Analogue inputs (black)

8 input jacks (*Channels A-H*) for connecting normal analogue sensors (0-10 V, 4-20 mA, ...), as well as HYDAC HSI sensors or SMART sensors, for example for measuring print, temperature, flow rate or oil condition.

I/J Digital inputs (blue)

1 input jack for 2 digital signals (*Channel I, J*), e.g. for frequency or speed measurements

K CAN bus/HCSI (red)

1 connection jack for CAN bus and HYDAC HCSI sensors (*channel K*)

P Programming connection (yellow)

1 connection jack for programmable, electronic HYDAC pressure, temperature and level switches

USB A **USB host** for connecting slaves (e.g. USB memory stick)

USB B **USB Device** for PC connection

DCin **Female jack for power supply**

LED **LED display for battery charge**

3 first steps with the HMG 4000

3.1 Unpacking

The HMG 4000 is supplied in a cardboard box. When accepting and unpacking, make sure the item has been delivered in full and look out for any possible transport damage. If present, show it to the shipper.

3.2 Charging battery

Charge the battery with the help of the power supply unit provided before using the HMG 4000 for the first time.

The battery built into the HMG 4000 starts charging as soon as the measuring device is supplied with power by the power adapter provided.



Only use the batteries, power adapters and cables supplied or authorised for use by HYDAC.

Not permitted batteries, chargers and cables can lead to overheating or explosion of the battery or to damage to the HMG 4000.



If the battery charge is low, a corresponding warning message appears on the display.

If the battery is completely empty, the HMG 4000 cannot be switched on directly after connecting the power adapter. Charge the empty battery for a few minutes first before switching the HMG on again.



Incorrectly connecting the power adapter can lead to damage to the device.

Damage through improper use is not covered by the warranty.

The device can heat up when charging. This is normal and does not affect the function, performance or service life of the HMG 4000.

If the battery gets hotter than normal, unplug the power adapter.

The charge of the battery is shown by the integrated LED beside the connection jack:



Green = Battery fully charged



Orange = Battery charging



Red = Error

The current charge is also shown in the display to the top right if the device is switched on.



3.3 Switching device on and off

After switching on the HMG 4000 for the first time, follow the instructions on the display and adjust the necessary basic settings on the "Welcome screen".

3.4 Updating firmware

To have the latest version of the HMG 4000 the firmware of the device needs to be updated provided an update file is available.



Under certain circumstances, the settings saved in the HMG 4000 may no longer be legible after installing an update.

Corresponding notices appear on the display before the update is executed.

If necessary, back up this data on a PC before starting the update.

Connect the power adapter to the HMG 4000 in order to guarantee a safe and interruption-free power supply during the update process.

Detailed information on the firmware update can be found in chapter 16.4 "Software update"

4 Managing the HMG 4000

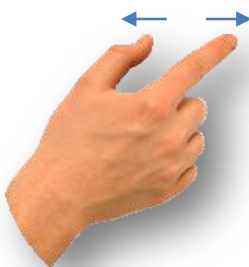
4.1 Touchscreen operation

The use and operation of the touchscreen is done with a few simple gestures (tap, swipe and drag movements as well as expanding and shrinking):

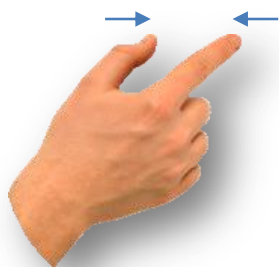
Tap / Drag



Expand



Shrink

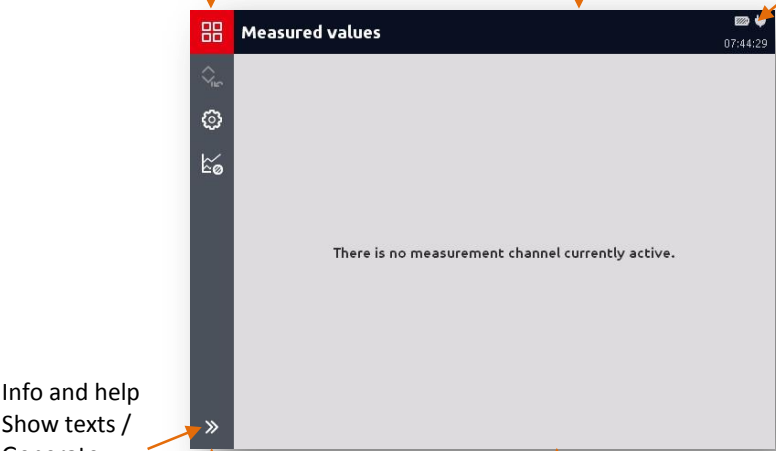


4.2 Display graphics setup

Start button (start menu) / Back button

Display bar

Battery charge status



Info and help
Show texts /
Generate
screenshot

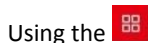
Menu/Command bar (toolbar)


Display/Selection field

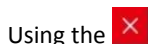
4.3 Navigating in the menu/command bar (toolbar)




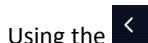
All settings and input options in the different applications and function menus of the HMG 4000 are largely self-explanatory and can be used intuitively.




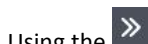
Using the  button, you can directly access every display and from every menu point you can access the "Start menu".




Using the  button, you can access the most recently started application / menu page / display directly from the start menu.




Using the  button at the top of the display bar, you can always go back to the previous page in all of the menus and displays.



Using the  button to the bottom of the menu/command bar you can show or hide the information texts on the individual command buttons (icons) and/or the current application.



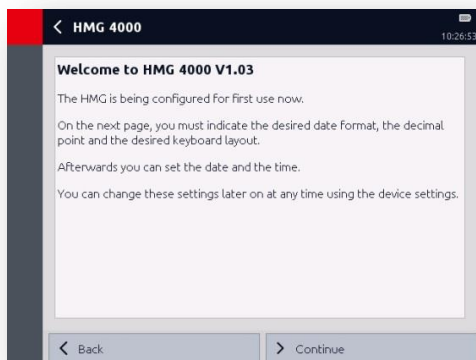
Additionally, the  button appears, which you can use to directly generate a screenshot of the current screen content.

5 Quickstart

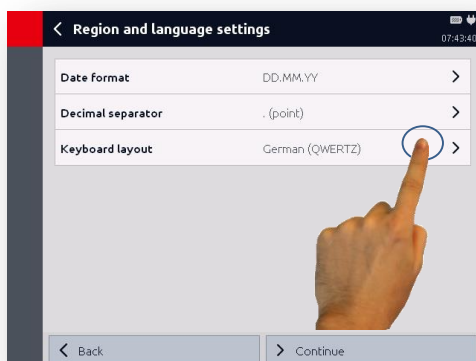
5.1 Basic settings

When starting the unit up for the first time the Welcome start-up screen appears.

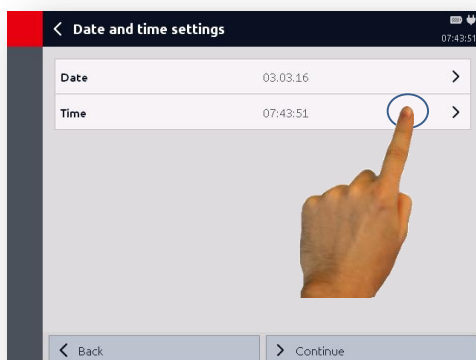
You now have to adjust the "*Basic settings*" required for the device to work.



Select the desired date format, decimal point and keyboard layout. Complete the operation with "*Continue*" or go back to the previous screen by pressing "*Back*".

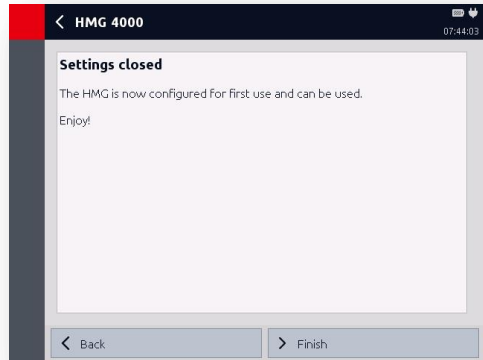


Enter the date and time. Complete the operation with "*Continue*" or go back to the previous screen by pressing "*Back*".

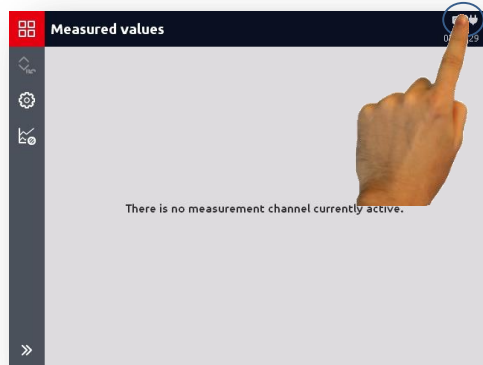


The entry of basic settings is now finished and you can use the HMG 4000.

Complete the operation with "*Finish*" or go back to the previous screen by pressing "*Back*".

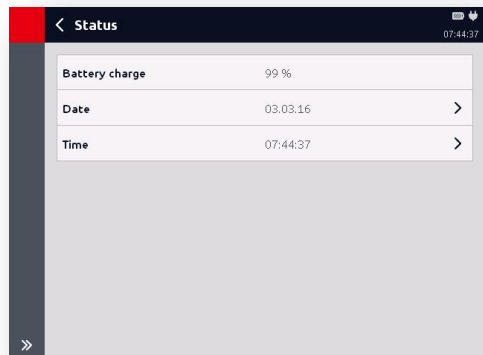


The display then jumps to the measured value display. If there is no sensor connected, the following message will appear on the display
"No measurement channel currently active".



By tapping the battery/time field in the display bar, the adjacent "Status window" will open.

This provides information on the current charge status as well as on the currently set date and time. Date and time can be changed here.



5.2 Measured values

If there is no sensor connected, the following message will appear on the display

"No measurement channel currently active".



In delivery status, all eight analogue inputs are preset to *"Automatic sensor detection"* mode.

If a HYDAC HSI or SMART sensor is now connected to one of the channels A-H, this is automatically detected and displayed accordingly.

In the measured value display (see right), you will find the following listed:

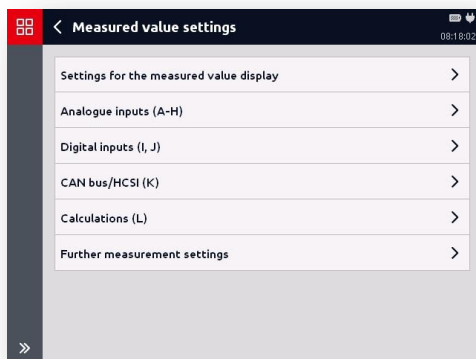
Input channel - Designation - Unit - Measured value




To be able to make changes to the measured value settings or measured channels, you can access the *"Measured value settings"* menu

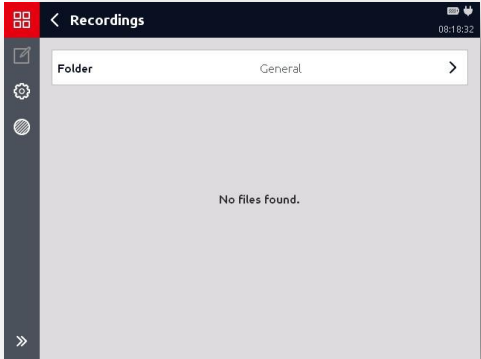
via the  button.


(For extensive information on this, see chapter 7 "Measured value application")



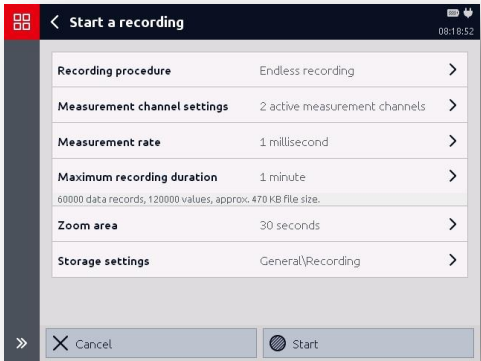
5.3 Starting simple recording

To record measured value curves, you can access the "Recordings" menu from the measured value display using the  Recordings button.




Using the  Start button you can access the "Start a recording" menu.

You can adjust the corresponding settings for the recording here.
(For extensive information on this, see chapter 8 "Recordings")




6 Start menu

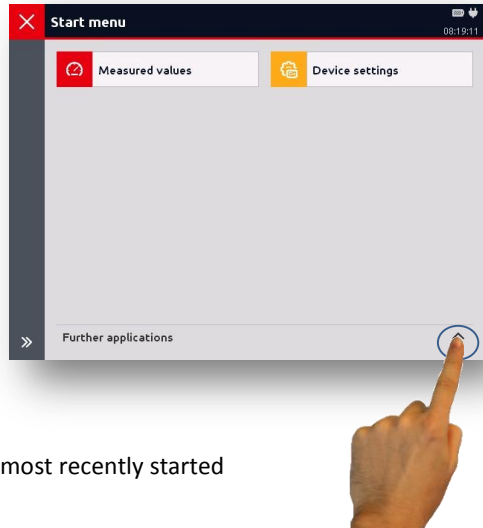
After switching on the HMG 4000, the screen will automatically switch to the measured value display.


Using the  button you can access the "Start menu".

In the basic setting, only the following two applications are shown:

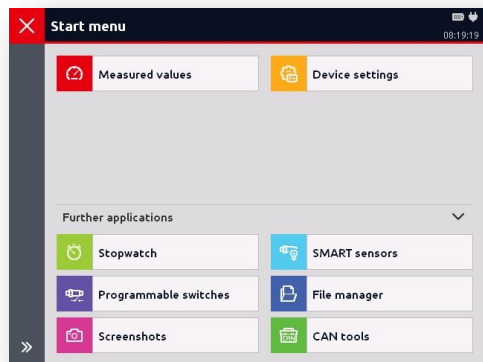
- Measured values
- Device settings



Using the  button, you can access the most recently started application.



Using the  button in the "Further applications" field, additional functions or applications of the device will be shown for selection:

- Stopwatch
- SMART sensors
- Programmable switches
- File manager
- Screenshots
- CAN tools



 If "Further applications" is selected, this setting will remain. This means that when you open the start menu, all of the applications and functions will always be shown. You can reset this using the  button.

7 "Measured values" application

If sensors are connected and the channels set accordingly, their current measured values will be shown to you immediately. The following details will be shown to you by default in the measured value display:

- Input channel (e.g. subchannel)
- Designation (sensor type)
- Unit
- Measured value
- History

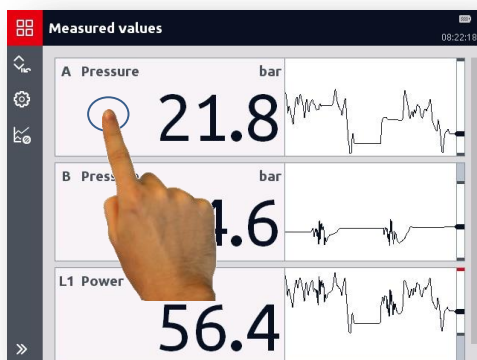



7.1 Displaying measured channel information

When you tap a measured value field, a new window with detailed information on the respective measured channel will appear.

In this window, you will receive the following information on the measurement channel and the connected sensor:

- Measurement range
- Min./Max. values reset
- Last measured value
- Last min. value
- Last max. value
- Settings:
 - Mode
 - Name
 - Sensor detection
- Progression

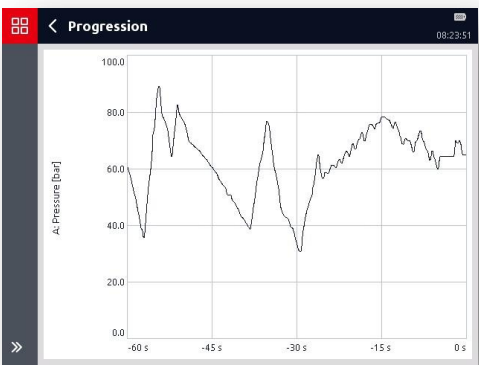


Using the  button you can access the measured value display again.


Using the "Progression" opens a new window.

Here, the current history of the measured values is shown as an ongoing graphic.


(Also see chapter 7.2.5 "Display progression")




7.1.5 Resetting measured value zero point

You can re-specify the zero point via the  button.

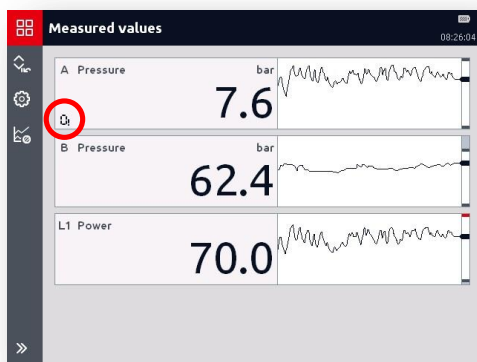
This function can be used, for example, in order to hide any pressure heads in a system. In case a pressure transducer still has, for example, 3 bar of pressure even when the system is switched off, this value can be used as the new zero point for the display.

Using the  button, you can delete the zero shift.



 Re-zeroing can be done at any point throughout the measurement range of a measurement channel.

For safety reasons, all measurement channels for which the zero point was reset will be highlighted in the measured value display with a corresponding symbol.



Caution!

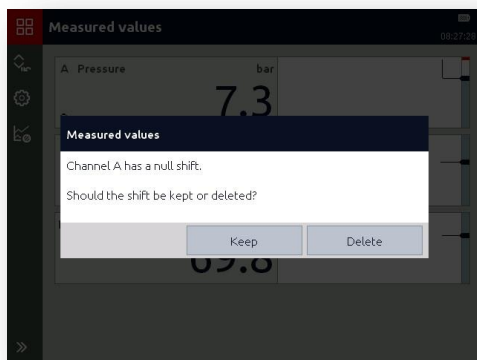
A high pressure may still be present in a measurement channel marked by an arrow even though the display shows 0 bar.

When removing a sensor or other system components make sure the system has been depressurized first.

Failure to do this may pose a hazard to life and limb.


Switching ON/OFF the HMG 4000 or one or more measured channels does not lead to the automatic deletion of the newly set zero point.

If you switch the HMG off and on again, you will receive a corresponding message.



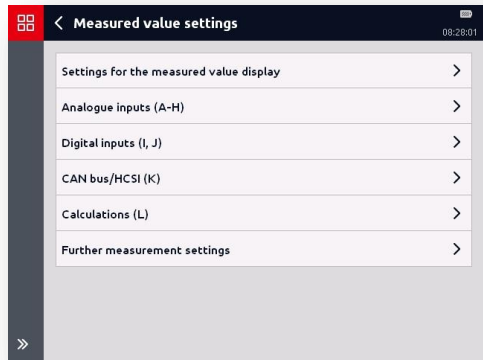
There is one exception where the null shift is automatically deleted. This happens when a sensor is connected to the channel and this sensor has a different measurement range to the one for which the null shift was set.

This means that the null shift is not retained unless the lower and upper measurement limit, the number of decimal places, and the unit of measurement of the newly connected sensor are identical.

To make changes to the measured value settings or the measured channels, access the measured value display in the "*Measured value settings*" menu via the  button.

You can adjust the settings and changes in the following menu points via this window:

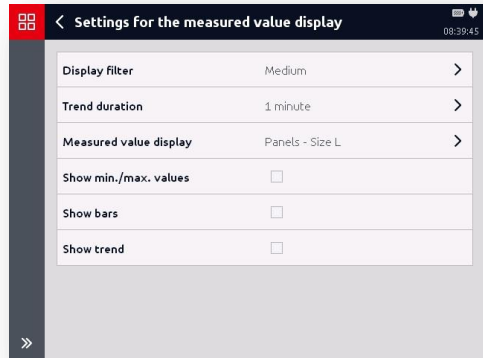
- Settings for the measured value display
- Analogue inputs (A-H)
- Digital inputs (I, J)
- CAN-Bus/HCSI (K)
- Calculations (L)
- Further measurement settings



7.2 Settings for the measured value display

You have the following setup options under this menu point:

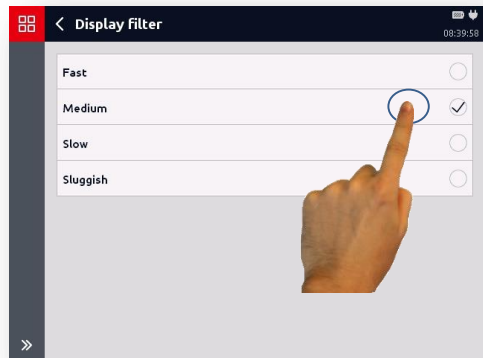
- Display filter
- Trend duration
- Measured values display
- Show min./max values
- Show bars
- Show trend



7.2.1 Display filter

With the selection of "*Display filter*", a selection list for the display dynamics will appear:

- Fast
- Medium
- Slow
- Sluggish

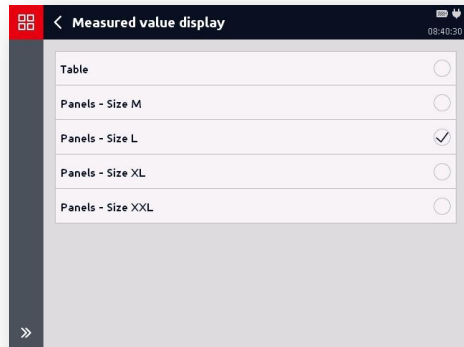


The settings for the display filter in the measured value display do not influence the measurement itself! They solely serve to settle down the display, for example, with pulsations.

7.2.2 Measured value display

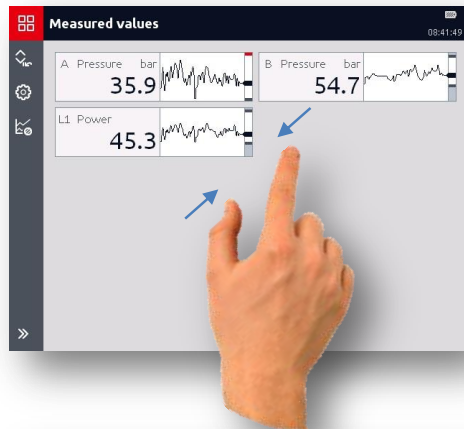
Upon selecting "*Measured value display*", a selection list for displaying the individual measured values appears:

- Table
- Panels - Size M
- Panels - Size L
- Panels - Size XL
- Panels - Size XXL



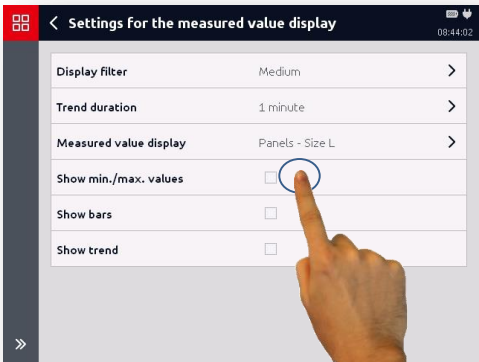
In this menu point, you can select between measured value table and different numerical display fields for display size of the individual measured values.


Alternatively, you can increase or decrease the size of the display fields directly via the touchscreen by using your fingers to enlarge and shrink.

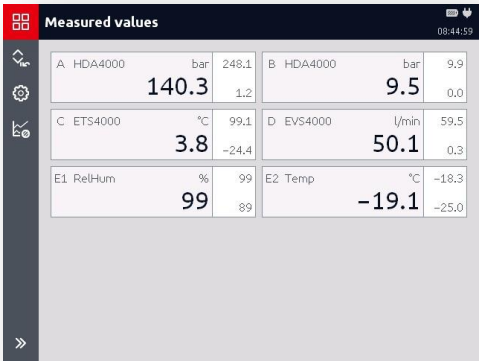


7.2.3 Displaying min./max. values

After selecting "Show min./max. values", the min. and max. values will be shown together with the measured value.



The min./max. values will continue to be displayed until either the display is switched off or the min./max. values are reset in the meantime by the  button.



7.2.4 Displaying bars

With the "Show bars" selection, you also switch on a bar display in the measured value display.

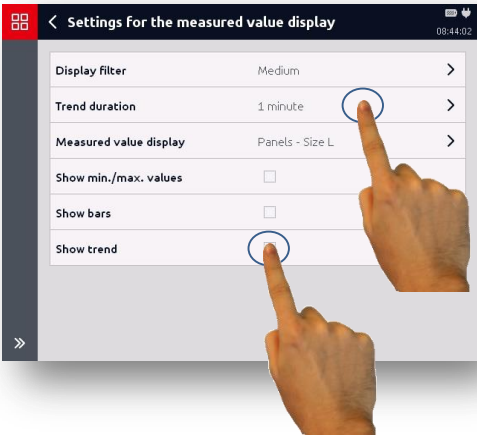
The appearance of the display may vary according to what settings have been made for rendering the measured values.



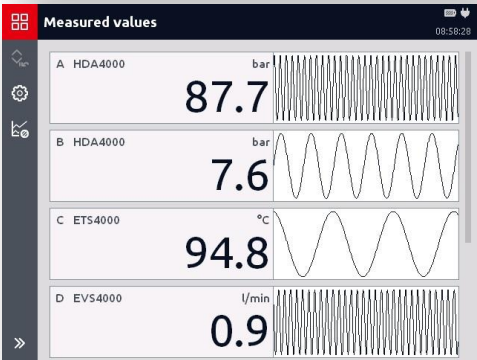
7.2.5 Displaying trend

With the "Show trend" selection, you can also switch the trend display on and off in the measured value display.

You can select for which period the history should be shown. You can choose from different time periods from 10 seconds to 60 minutes.



Different display images appear in the measured value display depending on the trend display settings.



7.3 Analogue inputs (A-H)

Under this menu point you have a list of all of the analogue measurement channels available in the HMG.

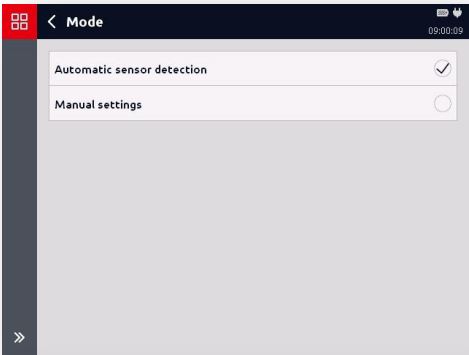
To the left beside the corresponding channel you will find a box which you can use to switch the input on and off. Active channels are marked with a tick.

Depending on the settings, to the right beside the box you will find the sensor type (e.g. "HDA 4000"), the sensor type (e.g. "analogue sensor") and possibly a designation (e.g. "system pressure").



7.3.1 Mode

In field "Mode" you can set whether a HYDAC HSI or SMART sensor with automatic sensor detection or a standard analogue sensor is connected.



With automatic sensor detection, the HMG 4000 applies all of the information and values directly from the connected HYDAC HSI or SMART sensor.

With manual settings, you need to manually enter the corresponding information and values of the connected sensor as described in the following.



7.3.2 Name

You can enter an optional designation for each measurement channel in the "Name" field.

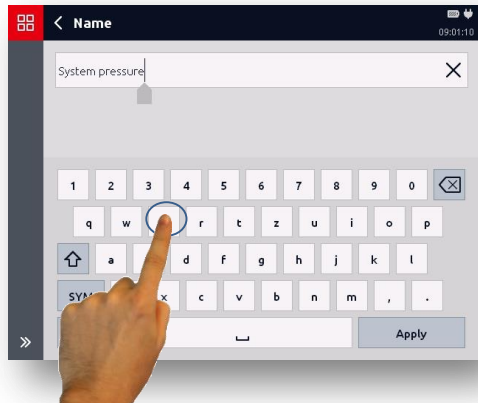


In this regard, a new window with a keyboard layout opens.

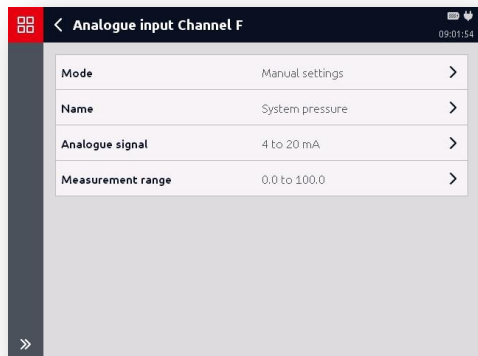
Enter the desired name and save the input with "Apply".



German umlauts will show if you press and hold the corresponding letter.




The designation entered is now shown in the "Name" field and correspondingly in the measured value display.

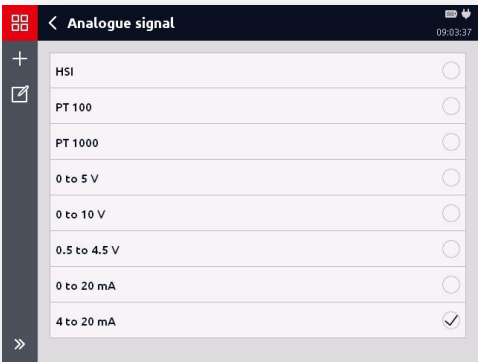



7.3.3 Analogue signal


A selection list with different analogue signals is stored in the "Analogue signal" field.

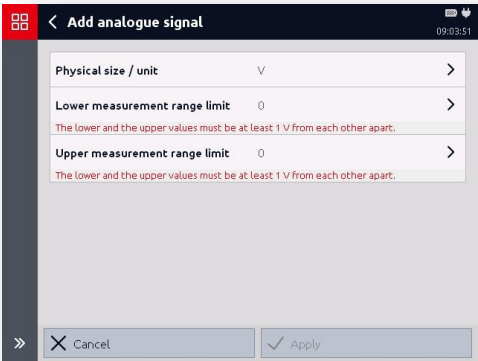
Here you can select an analogue signal from the existing entries.

 In delivery status, you will only find *HSI*, *0 to 10 V* and *4 to 20 mA* as well as *PT 100* and *PT 1000* at channel "H" in the list.




You can add an additional analogue signal via the  button.


With the  button you can delete an analogue signal from the list.



7.3.4 Measurement range

To define the measurement range, enter the corresponding values for "Decimal format", "Lower / Upper measurement area" and "Unit".

In the "Unit" field, you can add an additional unit to the list using the  button.

With the  button you can delete units from the list.

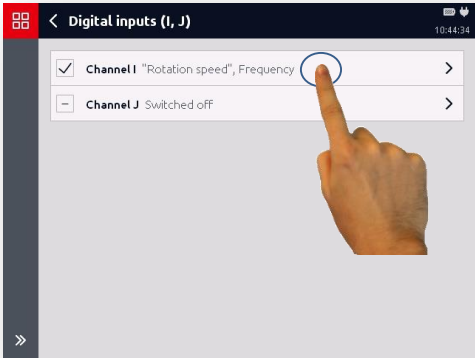


7.4 Digital inputs (I, J)

Under this menu point you have a list of all of the digital measurement channels available in the HMG.

To the left beside the corresponding channel you will find a box which you can use to switch the input on and off. Active channels are marked with a tick.

Depending on the settings, to the right beside the box you will find the mode and possibly a designation (e.g. "speed").



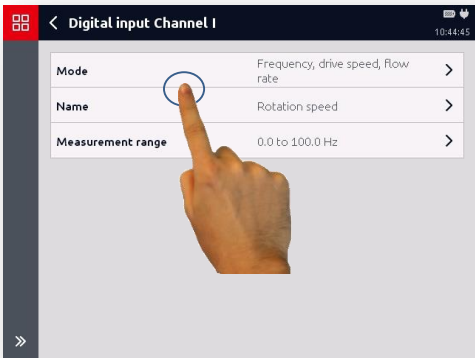
7.4.1 Mode

Here you can specify separately for each input in which form the digital input signal should be processed.

The following modes are available:

- Digital status
- Frequency, speed, flow rate
- Pulse count
- Intervals
- PWM duty cycle
- Extended measurement

Depending on the selection, corresponding submenus will open in which you can adjust the settings required for the corresponding function.



7.4.2 Digital state

The measured value corresponds to the digital state at the input. It is updated every 0.1 ms.

The measurement range goes from 0 to 1 and does not have any unit or decimal points.



7.4.3 Frequency, drive speed, flow rate

The frequency is measured in "Hz" and, depending on the setting, can be converted to speed or flow rate (1 Hz to 30 kHz).

With "l/min" and "USG/min" the "K Factor" must also be entered. This indicates the connection between pulses and volume ("Pulse/l" or "Pulse/USG")

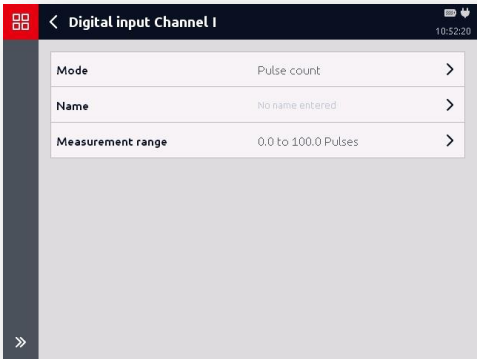
Frequencies under 1 Hz can be measured with "Advanced measurement".



7.4.4 Pulse count

The pulses are counted here. The measured value corresponds to the counter reading.

The measured value is updated every ms. Up to 2 billion pulses can be counted.

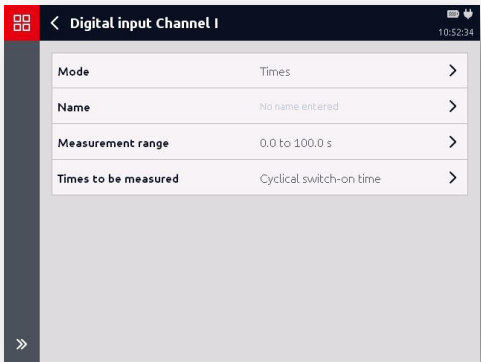


7.4.5 Times

Times are measured here. The following can be measured:

- Cycle time (periodic time)
- Cyclical switch-on time
- Cyclical switch-off time
- Sum of switch-on times
- Sum of switch-off times

Using the totalled up times, you can measure, for example, the switch-on times for units.
The times are measured with a resolution of 1 ms.
Times up to 500 hours can be totalled up. The total can be reset at all times.

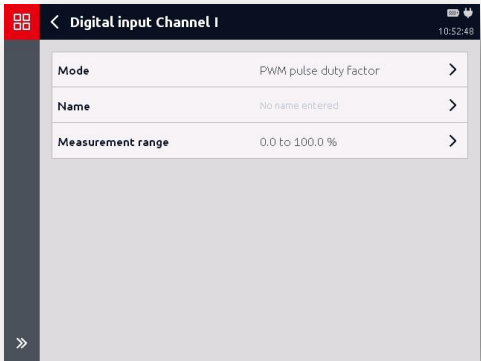


7.4.6 PWM pulse duty factor

Here, the ratio between the switch-on and switch-off times is measured.

The HMG records the pulse duty factor for frequencies of 1 Hz to 1 kHz.
The value is updated with the current periodic time.

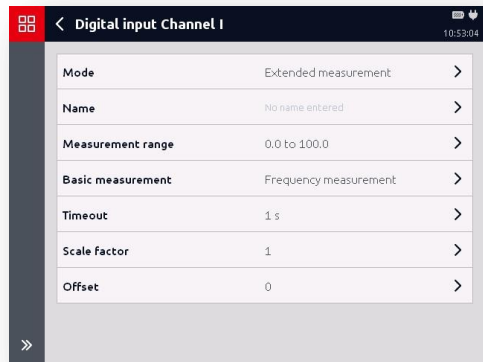
The pulse duty factor with frequencies under 1 Hz can be measured with "*Advanced measurement*".
The lower measurement area range is always "0 %", while the upper range is always "100 %".



7.4.7 Extended measurement

A measurement can be freely configured here.

- Measurement used as a basis (Frequency / Pulse / Times / PWM)
- Timeout (with Frequency / PWM only)
- Times to be measured (with Times only)
- Scale factor
- Offset value



The measured value is calculated by multiplying a basic measured value with a scaling factor and then adding the offset value to this.

$$\text{Measured value} = (\text{basic measured value} \times \text{scaling factor}) + \text{offset}$$

With a basic frequency measurement, the resolution is always set in the selected measurement unit by Hz, with pulses by pulse, with a pulse duty factor by percent and with times always by the second.

The offset value is always set up in the selected measurement unit. Both values can be entered with up to 9 positions in front of and 6 positions after the decimal point.

The update rate, measurement ranges and accuracies are dependent on the basic measured procedures used.

One particularity is with the measurement procedure "Measure frequency" or "Measure PWN pulse duty factor". Here you can set a timeout value.

While the measured value jumps to 0 when measuring the simple frequency, the speed, the volume flow and the pulse duty factor whose values are lower than 1 Hz, that is, after 1 second, this limit can be set with the advanced measurement. Here frequencies up to 0.01 H can be measured. This corresponds to a periodic time of 100 seconds.

Example of advanced measurements:

If a rotation is to be recorded with the help of a gear with 50 teeth, then 1 rotation/minute represents a measurement frequency of 50 pulses/60 seconds = 0.83333 Hz. Select Frequency as the measurement procedure, RPM as the unit, 0.83333 (RPM)/Hz as the scaling factor and 0 RPM as the offset value.

7.5 CAN bus/HCSI (K)

When connecting up the HMG 4000 to an existing external CAN bus system or setting up an internal CAN bus system with HCSI sensors, the following basic safety steps need to be taken into consideration:



The CAN bus can be connected to the HMG 4000 via the red jack "CAN" (K) only!

The HMG 4000 may only ever be connected to one CAN bus system according to the selected mode.

The connection "K" (CAN bus/HCSI) at the HMG 4000 can be operated in two different modes:

- **HCSI sensors**

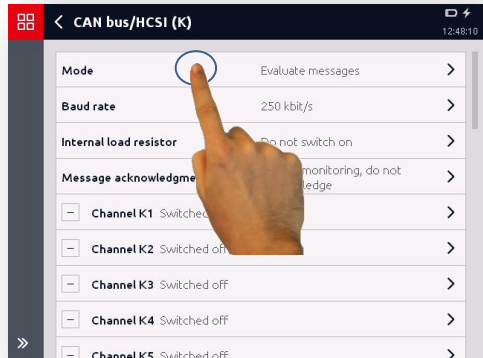
In this mode, up to 28 HCSI sensors with a total of up to 28 measurement channels can be connected to the device in order to establish an internal CAN bus system.



- **Evaluating messages**

This mode describes connecting up an existing CAN bus system (e.g. in agricultural/construction machinery, etc.).

Up to 28 different measurement channels can be defined which read out the defined data from the received messages and calculates corresponding measured values from this.



7.5.1 HCSI sensors

These sensors are termed "*HCSI sensors*" (HYDAC CAN Sensor Interface) according to the analogue HSI sensors (HYDAC Sensor Interface) for the analogue input.

If connection "K" is run in this mode, HCSI sensors connected to this, including all features, will be automatically detected by the HMG 4000 and the "internal" CAN sensor bus operated with 500 kB/s.

A HCSI sensor can have one or more channels. In the sensor, a channel number is stored for every channel. A maximum of 28 channels can be allocated in the HMG 4000. Each channel number may only appear in the bus configuration just once and can be changed or reassigned at the HMG 4000.

In the delivery state, all sensors have the channel number "1", number "2" for sensors with multiple channels, etc. This means that when setting up the bus connection one or more channel numbers must be set for each sensor in order to establish a direct reference between the physical sensor and the corresponding display in the HMG.

The allocated channel number remains saved permanently in the sensor.

The individual sensors are connected via a 5-pin M12x1 connection cable (ZBE 30) and "*HCSI Y splitter*".

Like with every CAN bus system, the bus line in HCSI mode needs to terminate at every end.

In this respect, the HMG-internal load resistor in HCSI mode connects automatically and a "*HCSI bus termination*" must be screwed onto the last sensor of the Y splitter at the other end.



Signal update time:

The following rule of thumb can be used to calculate the signal update time of the connected HCSI sensors:

$$T \approx 1 + \frac{n}{4} \text{ [ms]}$$

n = Number of connected sensors

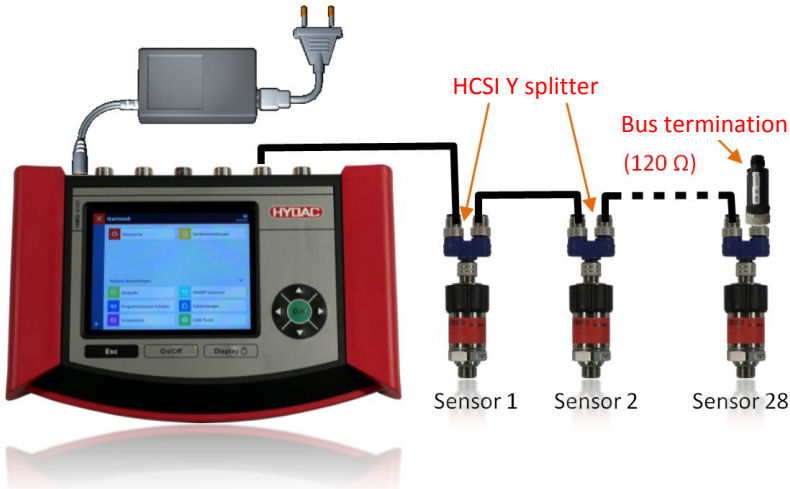
T = Update time, rounded up to full ms



The HMG 4000 can supply power to up to 28 HCSI sensors internally when a power supply is connected.

No separate power supply is required to set up the bus.

HCSI bus setup connection diagram:



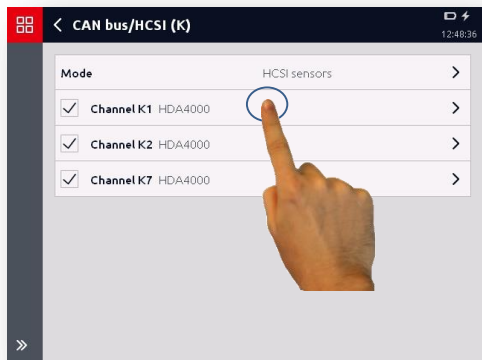
*Starting from HMG 4000, the bus setup may only be in one direction.
The HMG 4000 must always be the first participant in the bus.
Branching the HMG 4000 in two directions is not permitted!*

HCSI sensors

Under this menu point you have a list of all of the HCSI measurement channels which are active in the HMG, that is, a list with all connected HCSI sensors.

To the left beside the corresponding channel you will find a box which you can use to switch the input on and off. Active channels are marked with a tick.

To change the settings of the corresponding channel, tap on the corresponding field.



In the window which opens, you can provide a name for the channel and change or reassign the sensor (1-28).

In addition, the designation, the item & serial number as well as the measurement range and the unit of the connected sensors are shown.



Handling conflicts

If two or more sensors with the same channel number are connected, only the first sensor is activated and a corresponding message appears.

You must trigger the conflict by changing and reallocating duplicate channel numbers.



Handling measured values

The HMG 4000 sends a measured value query via the bus. After this, all connected HCSI sensors send their measured value. Once the HMG has received all measured values, it will send the next query. The refresh time of the measured values is specified automatically via the number of connected sensors.

The baud rate for the HCSI bus system is 500 kBit/s and cannot be changed. A possible maximum cable length of ≤ 100 m results from this.

7.5.2 Evaluating CAN bus messages

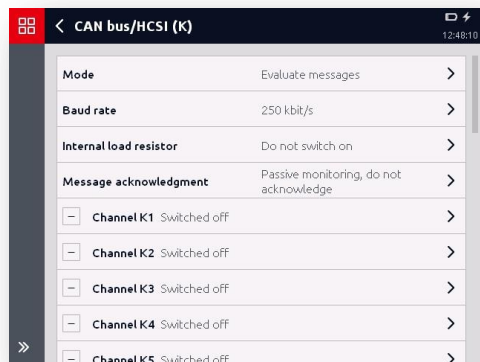


This chapter is aimed at engineers, programmers, commissioning engineers as well as service and maintenance staff with the corresponding knowledge of automation technology, CAN bus systems in particular.

Before the HMG 4000 is set up in a running CAN bus system, corresponding presets and parameter specifications need to be adjusted for the HMG 4000 according to the type and model of the CAN bus system and the way it is connected.

If the HMG 4000 is connected to a running CAN bus system with incorrect presets, this can lead to bus malfunctions, bus crashes and error functions and as a result can also lead to damage to the machine, to the system and to individuals.

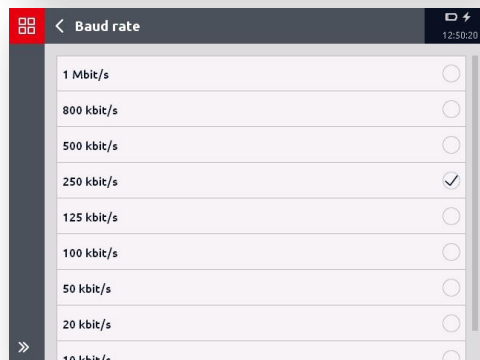
In "Evaluating messages" mode, you can access the main menu of this CAN functionality, where you have the option of adjusting the settings according to your requirements. It is more important that the following settings be made first:



Baud rate

To evaluate the messages, the HMG must be set to the baud rate of the external bus system.

Baud rates of 10 kBit/s to 1 MBit/s are possible.



- **Internal load resistor**

The internal load resistor needs to be connected if the HMG 4000 is hooked up to the CAN bus system at the end of the bus line as the "last participant", rather than using a branch line.

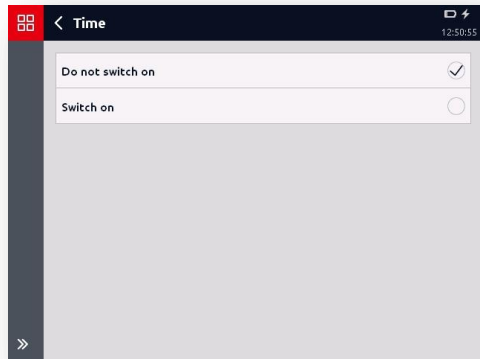
If the HMG 4000 is connected using a branch line, the internal load resistor may not be connected.



"Do not switch on"

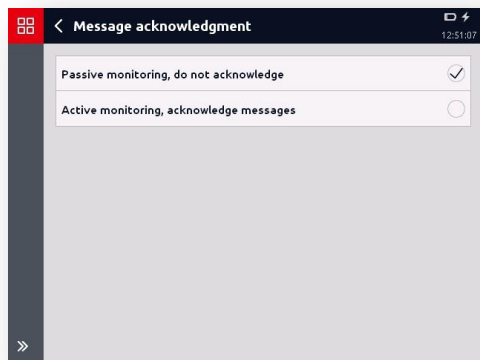


"Switch on"



- **Message acknowledgement**

Message acknowledgement needs to be switched off or on depending on the application.



Passive monitoring, do not acknowledge

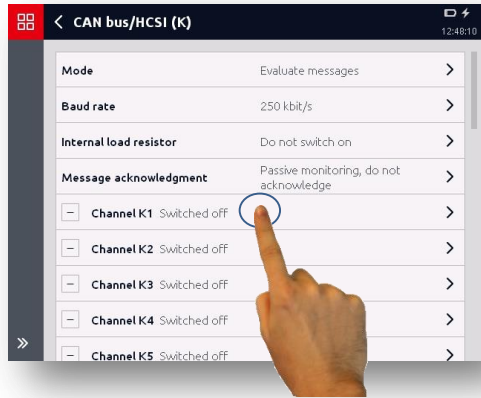
This setting must always be selected when the HMG 4000 is connected up to a CAN bus system so as to evaluate pre-defined messages passively.

Active monitoring, acknowledging messages

To test or to commission individual bus participants, for example, it is often necessary to acknowledge the receipt of messages. In cases like this, this setting must be selected.

Configuring CAN message

In the following you can activate and then configure up to 28 CAN messages (sub-channels) individually. These messages are then evaluated by the HMG like "normal" measurement channels (measured values).



If you selected and activated a (CAN bus channel Kn), the adjacent configuration window will open.

Adjust all of the necessary settings, one after the other according to the bus messages, which need to be evaluated and displayed as a measured value.

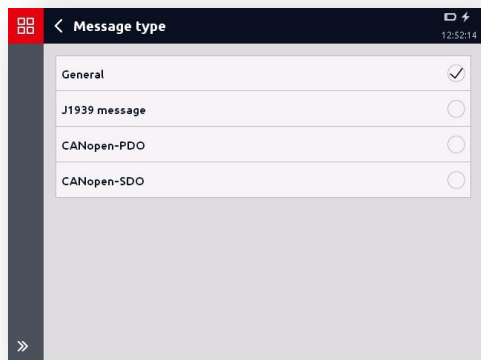


Message type

The HMG 4000 can evaluate the following message types:

- General
- J1939 Message
- CANopen PDO
- CANopen SDO

Depending on the selected message type, the required settings/configurations vary as described in the following.



"General" message type

In this mode, you can evaluate general CAN messages.

For the message type "General" the following listed parameter settings are required.

CAN bus Channel K1	
Message type	General
Name	No name entered
Measurement range	0.0 to 100.0
Resolution	1
Offset	0
Frame type	Standard frame
Messages ID	0 hex
Message format	Normal messages
Number display	Unsigned whole number

- **Name**

The entered name is used as the name of the measurement channel. If no name is entered here, "CAN channel x" will be shown as the channel name.

- **Measurement range**

Enter the lower and upper measurement range limit, unit and decimal format.

- **Resolution**

Enter the value for the unit / bit.

- **Offset**

Enter any offset there may be.

- **Frame type**

Select the used frame type (standard / extended).

- **Message ID**

Enter the message ID (hex) (0 - 1FFFFFFF).

- **Message format**

Select the used message format (normal / multiplex).

With Multiplex, enter the *bit position and bit length of the selector* as well as the *value of the selector*.

- **Number display**

Select the used number representation (whole number / floating point number).

- **Byte series**

Select the byte order used (Little / Big Endian).

- **Bit position**

Enter the corresponding bit position of the data (0 - 63).

- **Bit length**

Enter the corresponding bit length of the data (1 - 64).

J1939 message

In this mode, the data at a J1939 bus is taken from a transferred parameter group.

The parameter groups here need to be transferred directly.

(BAM and CMT cannot be evaluated!)

In J1939 PGN mode, the following settings are required:

CAN bus Channel K1	
Message type	J1939 message
Name	No name entered
Measurement range	0.0 to 100.0
Resolution	1
Offset	0
Priority	0
Data page	EDP=0, DP=0
PDU format	0
PDU specific	0

- **Name**

The entered name is used as the name of the measurement channel. If no name is entered here, "CAN channel x" will be shown as the channel name.

- **Measurement range**

Enter the lower and upper measurement range limit, unit and decimal format.

- **Resolution**

Enter the value for the unit / bit.

- **Offset**

Enter any offset there may be.

- **Priority**

Enter the priority of the message (0 - 7).

- **Datapage**

Enter the values for EDP and DP of the PGN (EDP=0 / DP=0 - EDP=1 / DP=1)

- **PDU format**

Enter the value for the PDU format (0 - 255).

- **PDU specific**

Enter the value for PDU Specific (0 - 255).

- **Source address**

Enter the value for the source address (0 - 255).

- **Bit position**

The bit position is entered as a decimal figure with one decimal point. With J1939, counting starts at 1 (not 0). For this reason only those numbers are allowed which have figures between 1 and 8 in front of and after the decimal point. (e.g. 2.1 = 2nd byte / 1st bit)

- **Bit length**

Enter the corresponding bit length of the data (1 - 64).

CANopen PDO

When transferring process data the mechanism of the Process Data Object (PDO) is available

In this mode, the data is taken from a PDO.

The following settings are required:

Setting	Value
Message type	CANopen-PDO
Name	No name entered
Measurement range	0.0 to 100.0
Resolution	1
Offset	0
COB ID	0 hex
Number display	Unsigned whole number
Bit position	0
Bit length	8

- Name**
 The entered name is used as the name of the measurement channel. If no name is entered here, "CAN channel x" will be shown as the channel name.
- Measurement range**
 Enter the lower and upper measurement range limit, unit and decimal format.
- Resolution**
 Enter the value for the unit / bit.
- Offset**
 Enter any offset there may be.
- COB ID**
 Enter the COB ID (hex) (0 - 3FFFFFFF).
- Number display**
 Select the used number representation (whole number / floating point number).
- Bit position**
 Enter the corresponding bit position of the data (0 - 63).
- Bit length**
 Enter the corresponding bit length of the data (1 - 64).

CANopen SDO

Service Data Objects (SDOs) are used for changes in the object folder and for status queries.

Data can be written to an OD or read from one.

The following settings are required for this:

The screenshot shows a configuration window titled "CAN bus Channel K1" with a timestamp of 12:53:02. It contains a list of settings for a CANopen SDO:

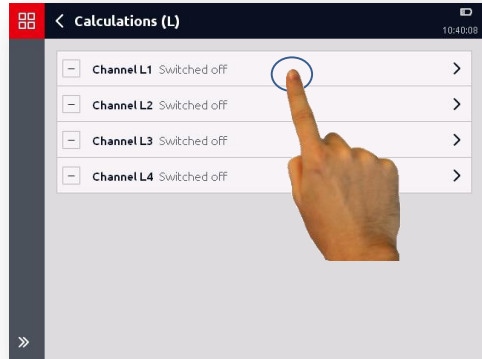
Message type	CANopen-SDO	>
Name	No name entered	>
Measurement range	0.0 to 100.0	>
Resolution	1	>
Offset	0	>
COB ID	0 hex	>
Index	0000 hex	>
Subindex	00 hex	>
Transfer direction	Download (describe OD)	>

- **Name**
The entered name is used as the name of the measurement channel. If no name is entered here, "CAN channel x" will be shown as the channel name.
- **Measurement range**
Enter the lower and upper measurement range limit, unit and decimal format.
- **Resolution**
Enter the value for the unit / bit.
- **Offset**
Enter any offset there may be.
- **COB ID**
Enter the COB ID (hex) (0 - 3FFFFFFF).
- **Index**
Enter the index (hex) (0 - FFFF).
- **Subindex**
Enter the subindex (hex) (0 - FF).
- **Transfer direction**
Select the transfer direction (download / upload)
- **Number display**
Select the used number representation (whole number / floating point number).
- **Bit length**
Enter the corresponding bit length of the data (1 - 64).

7.6 Calculations (L)

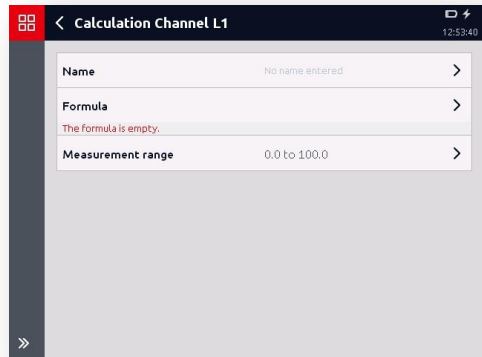
Here you have the option of defining and configuring up to four "virtual" measurement channels.

The virtual measurement channels are always updated at 1 ms.



The following settings are required for calculated channels:

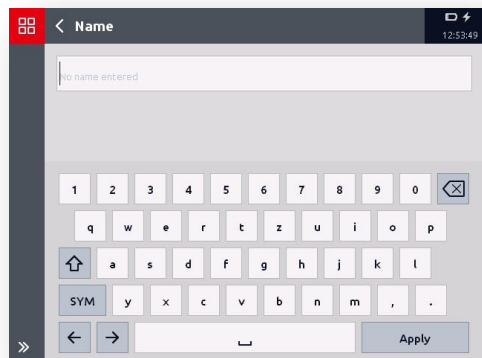
- Name
- Formula
- Measurement range



Name

The entered name is used as the name of the measurement channel.

If no name is entered, "Formula channel X" is used as the channel name, with "X" standing for a number between 1 and 4.



Formula

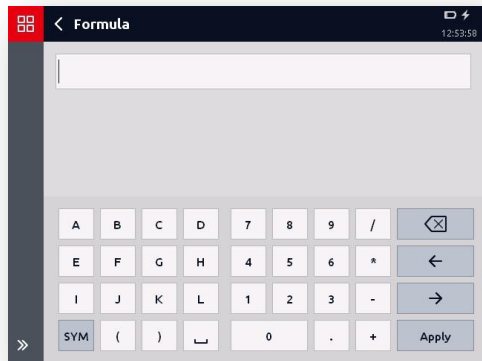
You can enter a formula here with which the other measurement channels can be offset.

*Example: "(A + B) * C2 + K4"*

The channels are addressed via their port letters and channel number. If a port has just one channel, the channel number can be omitted.

The following operations are possible:

- +, -, *, /
- abs, sqr, sqrt (absolute value, square, square root)
- ln, log, e, x^y
- Setting the evaluation order with brackets



If there is "division by 0" in the calculation or if one of the outlet channels has left the measurement range, the measured value will be identified as "invalid".

Unlike the mathematical rules, the root of a negative number does not result in an error. Instead, the result corresponds to the negated root from the sum of the radians. As such, the result of "*sqrt* (-4)" is "-2". The same applies for the logarithm (log, ln).

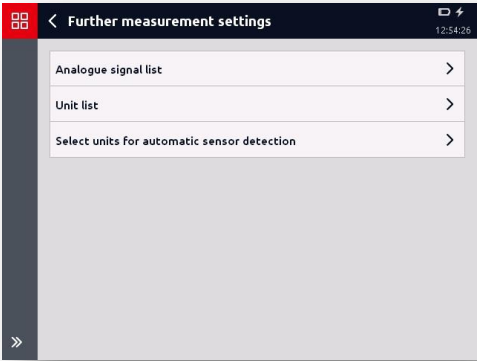
This usually corresponds to the technical ratio.

e.g. a flow rate can be measured via the fall in pressure at an orifice. Here, the root is taken from the pressure differential. If the pressure differential is negative, this means that the flow direction is reversed. In this case, the HMG provides the correct results.

7.7 Further measurement settings


Here you have a summary of the following information on the used analogue signals and units:


- Analogue signal list
- Unit list
- Units with automatic sensor detection



7.7.1 Analogue signal list

In the "Analogue signal list" you can currently see the input signals stored in the HMG 4000 and at which input channels these are used.


You can add an additional analogue signal via the  button.


With the  button you can delete an analogue signal from the list.



7.7.2 Unit list

In the "Unit list", you can see the physical units currently stored in the HMG 4000 and at which input channels these are used.

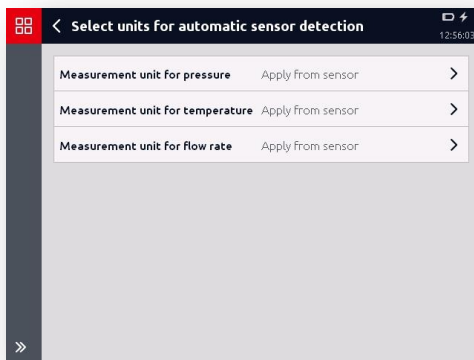
With the  button, you can add another unit.

With the  button you can delete a unit from the list.



7.7.3 Units with automatic sensor detection

Here you can set which unit should be displayed for the measured values of HSI and HCSI sensors with automatic sensor detection in the measured value display.

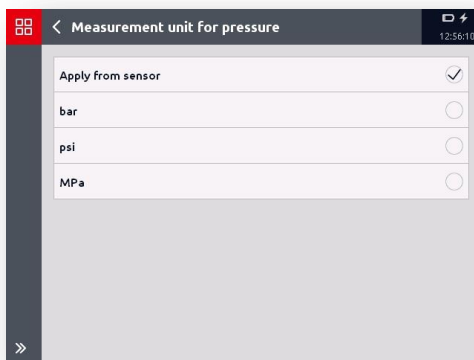


7.7.4 Measurement unit for pressure

- Apply from sensor
- bar
- psi
- MPa

If "*Apply from sensor*" is selected, the corresponding unit of the sensor will be displayed.

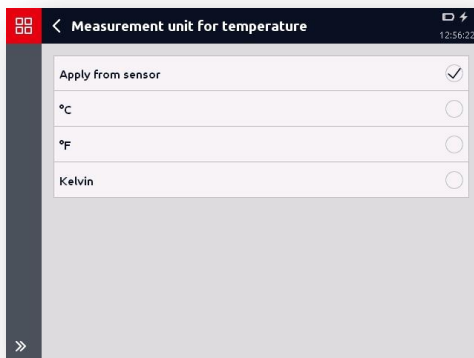
If "*bar*", "*psi*" or "*MPa*" is active, the measured value will be converted to the corresponding unit.



7.7.5 Measurement unit for temperature

- Apply from sensor
- °C
- °F
- Kelvin

If "*Apply from sensor*" is selected, the corresponding unit of the sensor will be displayed. If "*°C*", "*°F*" or "*Kelvin*" is active, the measured value will be converted into the corresponding unit

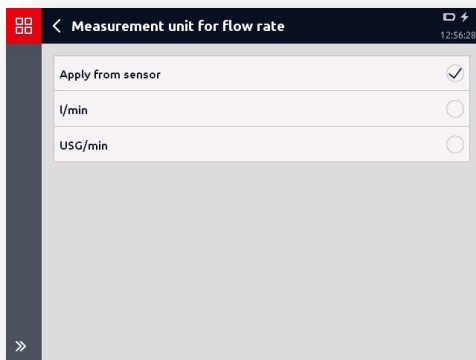


7.7.6 Measurement unit for flow rate

- Apply from sensor
- l/min
- USG/min

If "*Apply from sensor*" is selected, the corresponding unit of the sensor will be displayed.

If "l/min" or "USG/min" is active, the measured value will be converted into the corresponding unit



The settings in this menu always apply to all analogue measurement channels and all connected HSI sensors with automatic sensor detection!

This means, for example, that when "*psi*" is selected as the unit for the pressure sensors, the measured values of all of the HSI pressure sensors connected to the HMG will be shown in psi.


The HSI temperature and flow rate sensors behave accordingly.

The same also applies to the HCSI sensors connected to the device.

8 Recordings

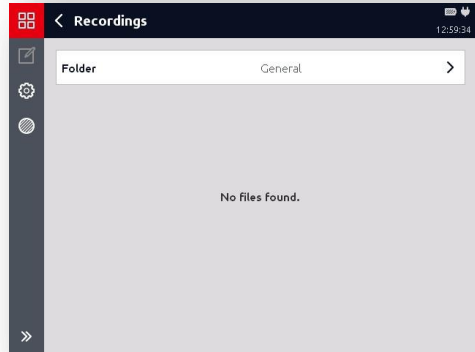
The HMG 4000 provides very comprehensive and easy-to-use options in regard to recording and saving a measuring over a certain period of time.

You can access the "Measured values" view via the Recording menu.


In the measured value view, tap the  button in the menu/command bar (toolbar).




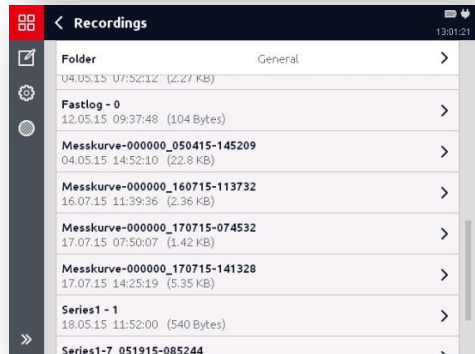
If there are no recordings saved in the HMG 4000 yet, the adjacent screen will open.




If there are recordings in the HMG 4000 already, these will be shown in the display correspondingly.

Using the  button, you can delete the individual saved recordings.

You can access the "Folder settings" window using the  button. Here you can change the defaults for sorting the files.

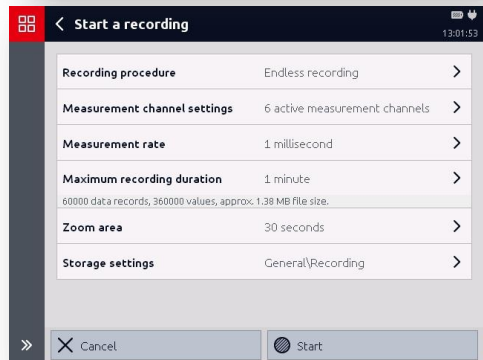


8.1 Starting a recording

To start a recording, tap the  button in the toolbar.

Then the "Start a recording" window will open.

In this menu and all other submenus, all of the measurement parameters are listed for each recording type which can be selected.



The following basics need to be taken into account in relation to the settings for the measurement rate:

With all recording procedures, the smallest possible measurement rate which can be set depends, among other things, on the number of active measurement channels and is scaled as follows:


- up to 10 active channels 100 μ s
- 11 to 20 active channels 200 μ s
- 21 to 50 active measurement channels 500 μ s
- 51 to 100 active measurement channels 1 ms
- with calculated channels in general 1 ms

The measured values according to the set measurement rate are saved independent from the signal update time of the connected sensors.





If there is no power adapter hooked up to the HMG 4000, the maximum recording length for all recording procedures is also restricted by the capacity and the charge status of the battery.



An ongoing recording can be stopped manually at any moment by tapping the  button in the menu/ commands bar (tool bar).

The recording will be stopped immediately!

Then, please exit the recording menu by tapping the  button in the display list or by pressing the "Esc" key. You will be asked whether you want to discard or save the stopped recording.

If you touch the  button during an ongoing recording or if you press the "Esc" key, your measurement will still continue.

In this event, you will first be asked whether you intend to discard or save the recording after having finished your recording.

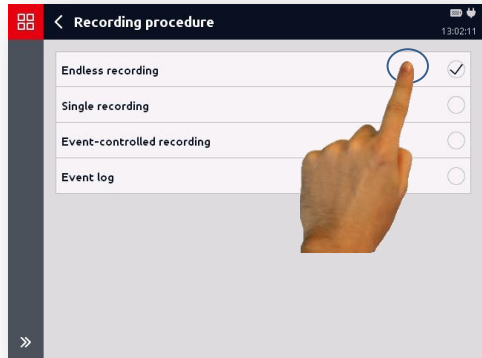


All recording settings (including graphic settings) are "noted" in the HMG 4000. This means that if there are no changes made to the input channels, all of the adjusted settings will remain intact.

As soon as there are changes to an input channel (different sensor with different unit and/or measurement range), all of the recording settings will be reset to the default settings for the corresponding channel.

8.2 Recording procedure

Select one of the following options by tapping on the corresponding field:



- **Endless recording**

This means that after starting the recording, the device permanently records measured values according to the presets. This happens until such a time as the recording is manually ended. Here, all that remains in the recording memory is the set max. recording length.

- **Single recording**

This means that the recording is started manually and is ended once the set recording length has been reached. The recordings are automatically saved according to the preset.

- **Event-controlled recording**

This means that a measurement curve is automatically started and/or ended if one or more of the predefined events occur. These are, for example, exceeding or not reaching a set limit value or exiting a measurement window, external digital signals, etc.

- **Event log**

The event log provides the opportunity to save measured values in the form of a table. A measurement line in the table includes a timestamp and the current measured value. Optionally it also contains the min. and max. values of each active channel.

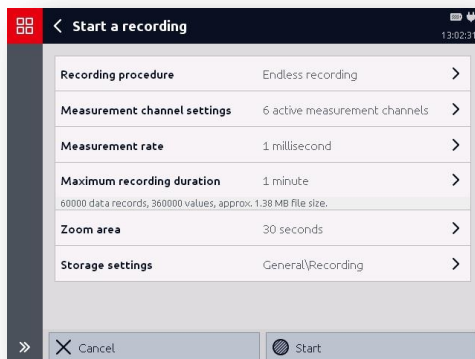
Using the trigger settings, you can set for which event a new measurement line should be stored in the event log (e.g. specific key activation, achieving a measured value limit, etc.).



In the display you can see the corresponding information on the resulting recording data (number of sentences and storage allocation). If you select an invalid setting, e.g. the maximum of 8 million measured values with these settings is exceeded, instead of the recording data you will receive a message describing the invalid setting.

8.2.1 Endless recording

For an endless recording you must specify the following settings:



- **Measurement channel settings**

Under this menu point you can set which measurement channels should be added to the recording and which channels are to be "*switched off*" for it.

- **Measurement rate**

Under this menu point you can set the time interval that the HMG 4000 reads in a measured value from the "*active*" sensors and stores it in the internal memory. One recording can comprise a maximum of 8 million measured values.

Selecting 1 ms, for example, means that 1000 measured values per second are taken and saved for each connected measurement channel.



The measured values according to the set measurement rate are saved independent from the signal update time of the connected sensors.

This means that, for example, with a preset measurement rate of 1 ms and a signal update time of 10 ms, the measured value will be saved 10 times before the signal at the input changes.

- **Maximum recording duration**

Under this menu point, you can select a recording length of 10 seconds, staggered for up to 28 days.

- **Zoom area**

With the "*zoomed area*", an additional display area can be created during the recording in the graphic mode.

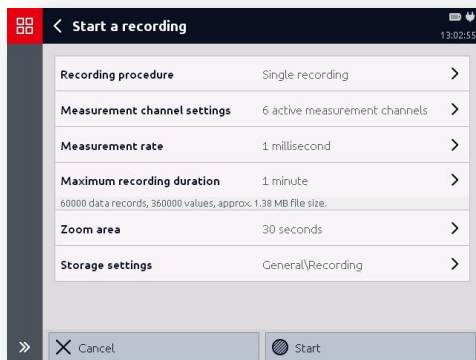
This means that the X axis in the "**Zoomed**" setting is scaled to the time range set in this menu point (switched off / 5 seconds / 10 seconds / ...).

- **Storage settings**

Under this menu point you can specify the storage type, folder and file name for the corresponding recording.

8.2.2 Single recording

For a single recording you must specify the following settings:



- **Measurement channel settings**

Under this menu point you can set which measurement channels should be added to the recording and which channels are to be "*switched off*" for it.

- **Measurement rate**

Under this menu point you can set the time interval that the HMG 4000 reads in a measured value from the "*active*" sensors and stores it in the internal memory. One recording can comprise a maximum of 8 million measured values. Selecting 1 ms, for example, means that 1000 measured values per second are taken and saved for each connected measurement channel.



The measured values according to the set measurement rate are saved independent from the signal update time of the connected sensors.

This means that, for example, with a preset measurement rate of 1 ms and a signal update time of 10 ms, the measured value will be saved 10 times before the signal at the input changes.

- **Maximum recording duration**

Under this menu point, you can select a recording length of 10 seconds, staggered for up to 28 days.

- **Zoom area**

With the "zoomed area", an additional display area can be created during the recording in the graphic mode.

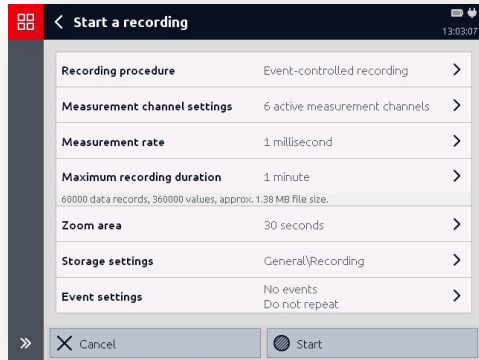
This means that the X axis in the "**Zoomed**" setting is scaled to the time range set in this menu point (switched off / 5 seconds / 10 seconds / ...).

- **Storage settings**

Under this menu point you can specify the storage type, folder and file name for the corresponding recording.

8.2.3 Event-controlled recording

For an event-controlled recording you must specify the following settings:



- **Measurement channel settings**

Under this menu point you can set which measurement channels should be added to the recording and which channels are to be "*switched off*" for it.

- **Measurement rate**

Under this menu point you can set the time interval that the HMG 4000 reads in a measured value from the "*active*" sensors and stores it in the internal memory..



The measured values according to the set measurement rate are saved independent from the signal update time of the connected sensors.

This means that, for example, with a preset measurement rate of 1 ms and a signal update time of 10 ms, the measured value will be saved 10 times before the signal at the input changes.

- **Maximum recording duration**

Under this menu point, you can select a recording length of 10 seconds, staggered for up to 28 days.

- **Zoom area**

With the "zoomed area", an additional display area can be created during the recording in the graphic mode. In other words, with the **Magnifier** setting, the x-axis is scaled to the time span preset in this menu point (5 seconds / 10 seconds / ...).

- **Storage settings**

Under this menu point you can specify the storage type, folder and file name for the corresponding recording.

- **Event settings**

Under this menu point, you can specify the settings for the event control. (start condition / end condition / trigger events / distribution of measured values / action after end of the recording)

Event settings

Start condition

If there is a "Start condition" for the measurement, you can activate it by tapping on the corresponding check box (☒ Start condition). The following conditions are available for this:

- **Digital input**
Select the corresponding digital input and enter the required switching status.
- **Measured value limit**
Select the corresponding measurement channel and enter the position of the measured value and the limit value.
- **Measured value window**
Select the corresponding measurement channel and enter the position of the measured value as well as the lower and upper measured value limit.
- **Time**
Enter the desired date and time.

The starting condition must be fulfilled in order for the recording to start.

End condition

If there is an "End condition" for the measurement, you can activate it by tapping on the corresponding check box (☒ End condition). The following conditions are available for this:

- **Digital input**
Select the corresponding digital input and enter the required switching status.
- **Measured value limit**
Select the corresponding measurement channel and enter the position of the measured value and the limit value.
- **Measured value window**
Select the corresponding measurement channel and enter the position of the measured value as well as the lower and upper measured value limit.
- **Time**
Enter the desired date and time.

The end condition must be fulfilled in order for the recording to end.

Trigger events

You can define up to 4 different trigger events (event 1 to 4) and activate them by tapping on the corresponding check box (☒ **Trigger event**). The following events are available for this:

- **Digital input**
Select the corresponding digital input and enter the desired switching direction.
- **Measured value limit**
Select the corresponding measurement channel and enter the history of the measured value and the limit value.
- **Measured value window**
Select the corresponding measurement channel and enter the history of the measured value as well as the lower and upper measured value limit.

- **Event connection**
You also have the option of linking events. Without linking, each of the four events acts alone and independently as a trigger for a measurement recording.

It should be borne in mind that events are always listed in descending order, otherwise you have to re-sort the events.



- **Manual trigger**
Another option to start the recording is the manual trigger.

If this option is selected, you can manually trigger-start the recording via the button in the menu/command bar (toolbar).



Distribution of the measured values

After starting the event-controlled recording, the HMG 4000 will begin to record the measured values for the set recording length. If the trigger event does not occur during this time, the oldest measured values are replaced with new measured values in the measured value memory. This means that you always have the set recording time as the "past" in the measured value memory.

You can use the "*Distribution of measured values*" menu point to set how much of this "History" should remain in the memory, when the event happens and how much into the "future" you wish to record this event.



The 50/50 % setting, for example, means that with a recording length of 30 seconds, the 15 seconds before the event happens should be recorded, as should the 15 seconds after it.

The 10/90% setting, for example, means that with a recording length of 30 seconds, the 3 seconds before the event happens should be recorded, as should the 27 seconds after it.

After the end of a recording

Under this menu point you can set how you wish to proceed after the automatic ending of the recording. Here you have the following options at your disposal:

- **Stop recording**

The recording is stopped automatically and saves. No other recording starts automatically.

- **Save and repeat without limit**

The recording is stopped and saved, while at the same time another recording with the same settings starts and is saved with a serial number. This operation repeats until the recording is stopped manually.

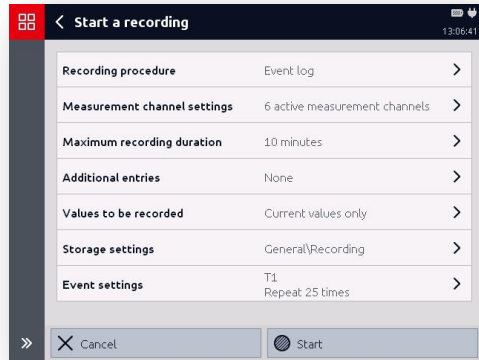
- **Save and repeat with limit and repeat**

The recording is stopped and saved, while at the same time another recording with the same settings starts and is saved with a serial number. This operation repeats for the specified number of repetitions or until the memory is full and is then stopped automatically.

8.2.4 Event log

The Event Log option enables you to store measured values as a table. A line in the table contains the current measured value, in addition, optionally, to the Min and Max value of each active channel.

Using the trigger settings you can set which event after starting a measurement should store a new line in the event log.



- **Measurement channel settings**

Under this menu point you can set which measurement channels should be added to the recording and which channels are to be "switched off" for it.

- **Maximum recording duration**

Under this menu point, you can select a recording length of 10 seconds, staggered for up to 28 days.

- **Additional entries**

Under this menu point you can set if additional, time-controlled entries (staggered from 1 second to 24 hours) should be saved in the table alongside the triggered entries.

- **Values to be recorded**

Under this menu point you can set if the current min. and max. values should be saved in the table in addition to the current measured values. As soon as a new measured value line is saved, the Min and Max values are always automatically reset.

- **Storage settings**

Under this menu point you can specify the storage type, folder and file name for the corresponding recording.

- **Event settings**

Under this menu point, you can specify the settings for the event control. (start condition / end condition / trigger events / action after end of the recording)



Only table view is possible during the recording. However, a saved event log can also be shown as a graphic.

Event settings

Start condition

If there is a "Start condition" for the measurement, you can activate it by tapping on the corresponding check box (☒ Start condition). The following conditions are available for this:

- **Digital input**
Select the corresponding digital input and enter the required switching status.
- **Measured value limit**
Select the corresponding measurement channel and enter the position of the measured value and the limit value.
- **Measured value window**
Select the corresponding measurement channel and enter the position of the measured value as well as the lower and upper measured value limit.
- **Time**
Enter the desired date and time.

The starting condition must be fulfilled in order for the recording to start.

End condition

If there is an "End condition" for the measurement, you can activate it by tapping on the corresponding check box (☒ End condition). The following conditions are available for this:

- **Digital input**
Select the corresponding digital input and enter the required switching status.
- **Measured value limit**
Select the corresponding measurement channel and enter the position of the measured value and the limit value.
- **Measured value window**
Select the corresponding measurement channel and enter the position of the measured value as well as the lower and upper measured value limit.
- **Time**
Enter the desired date and time.

The end condition must be fulfilled in order for the recording to end.

Trigger events

You can define up to 4 different trigger events (event 1 to 4) and activate them by ticking the corresponding check box (☒ **Trigger event**). The following events are available for this:

- **Digital input**
Select the corresponding digital input and enter the desired switching direction.
- **Measured value limit**
Select the corresponding measurement channel and enter the history of the measured value and the limit value.
- **Measured value window**
Select the corresponding measurement channel and enter the history of the measured value as well as the lower and upper measured value limit.

- **Event connection**


You also have the option of linking events. Without linking, each of the four events acts alone and independently as a trigger for a measurement recording.

It should be borne in mind that events are always listed in descending order, otherwise you have to re-sort the events.



- **Manual trigger**

Another option to start the recording is the manual trigger.

If this option is selected, you can manually trigger-start the recording via the  button in the menu/command bar (toolbar).

After the end of a recording

Under this menu point you can set how you wish to proceed after the automatic ending of the recording. Here you have the following options at your disposal:

- **Stop recording**

The recording is stopped automatically and saves. No other recording starts automatically.

- **Save and repeat without limit**

The recording is stopped and saved, while at the same time another recording with the same settings starts and is saved with a serial number. This operation repeats until the recording is stopped manually.

- **Save and repeat with limit**

The recording is stopped and saved, while at the same time another recording with the same settings starts and is saved with a serial number. This operation repeats for the specified number of repetitions and is then stopped automatically.

8.3 Operation during recording

After starting the recording, the measurement in the entire time period (X axis) and measurement range (Y axis) will be displayed in scale.

To the left of the Y axis, you can see which measurement channel is currently scaled to the Y axis.



If multiple channels are being recorded simultaneously, you can choose the channel or the sensor which should be displayed on the Y axis.

To do so, click on the corresponding measurement channel over the graphic.

The axis is now displayed in the same colour as its measured values curve - see below.



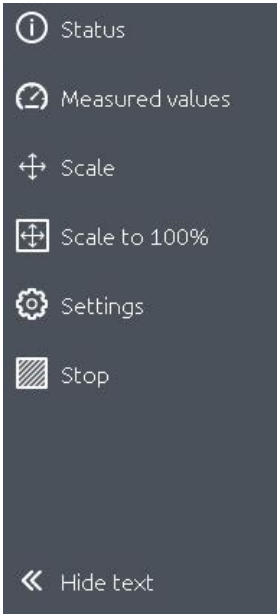
By ticking the corresponding selection box, you can show or hide each measurement channel separately in the graphic.




The measurement channel is recorded for the entire time range, even if it is hidden in the graphical display.

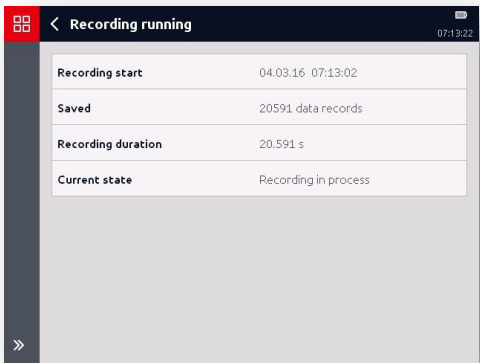


In the menu/command list (toolbar), you have the following options for the graphical display of the recording while it is running:




8.3.1 Status

You can view the current information on the running recording by pressing the  button.




8.3.2 Measured values


The current measured values, as shown in the measured value display are represented in corresponding panels by pressing the  button.

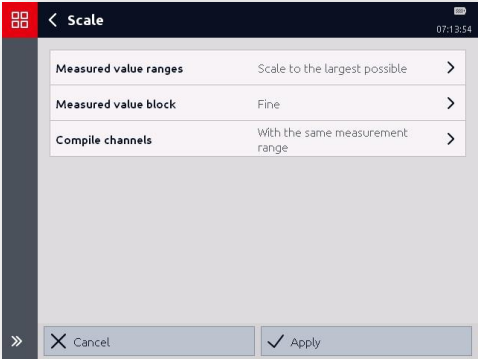


8.3.3 Scale


You can access the "Scale" submenu using the  button.

Here you can adjust the detail settings for the graphical display.

Press the  button to go from the graphical display back to the overall view, that is, in the overall time range (X axis) and measurement range (Y axis).




8.3.4 Settings

You can access the "View settings" submenu using the  button.

Here you can adjust the detail settings for the graphical display of the individual measurement channels.



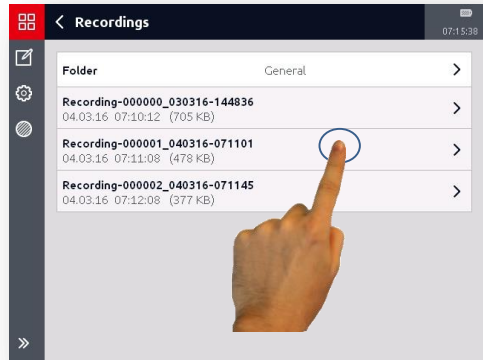
8.3.5 Stop

Use the  button to end and save the recording.

8.4 Recordings

Under the "Recordings" menu point, you can view a list of the recordings saved in the HMG 4000.

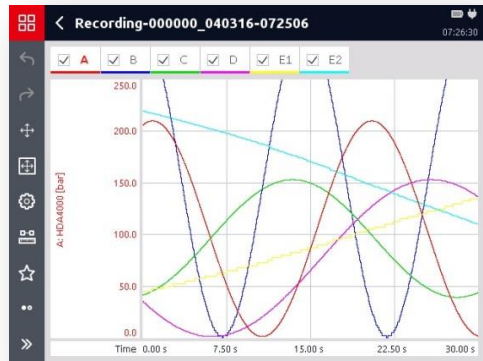
By tapping on the corresponding field, you can open the desired recording and edit it.



In the display, there is an adjacent display picture which shows the measurement for the entire time period (X axis) and measurement range (Y axis) in scale.

To the left of the Y axis, you can see which measurement channel is currently scaled to the Y axis.

If you have recorded the measurement using more than one channel, you can select the channel or sensor to be rendered in the y-axis.



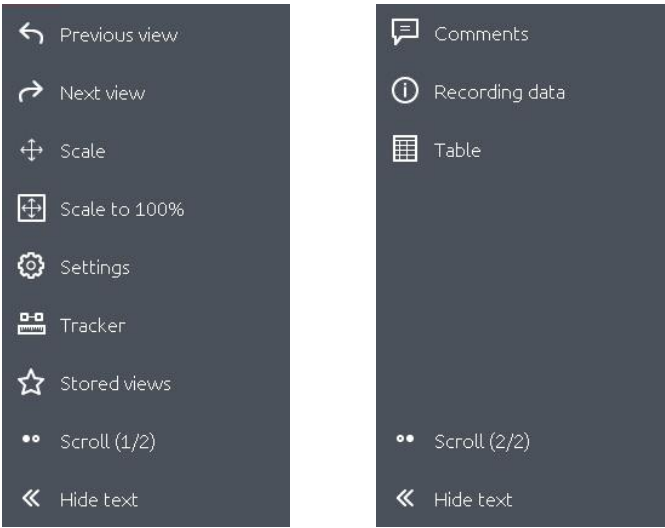
To do so, click on the corresponding measurement channel over the graphic.

The axis is now displayed in the same colour as its measured values curve - see below.



By tapping the corresponding selection box, you can show or hide each recorded measurement channel in the graphic.




In the menu/command list (toolbar), you have the following options for displaying and processing the recording:



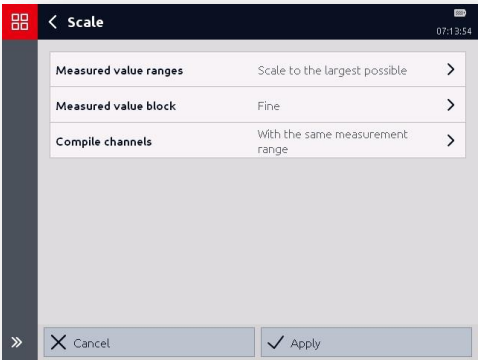
8.4.1 Previous / Next view

You can switch back and forth between the different edited views step by step using the  and  buttons.


8.4.2 Scale

You can access the "Scale" submenu using the  button.


Here you can adjust the detail settings for the graphical display.



8.4.3 Scale to 100%

With the  function, the Y axis is scaled to the entire measurement range of the measurement channel (sensor) set for the scaling.

8.4.4 Settings

You can open the "View settings" window with the  function. Here, all possible options for the graphical display of the recording are summarised once again. You can adjust the following settings:

X axis

Scaling over time / scaling across recorded measurement channels

Y axis

Setting the measurement channel for scaling the Y axis

Time Settings

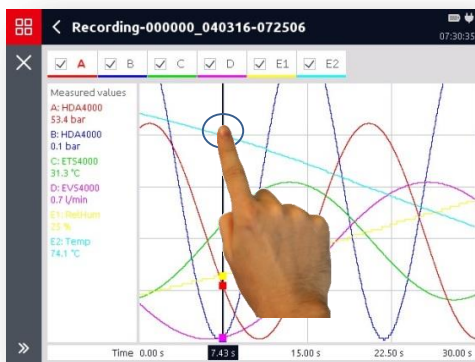
Time display / Time format / Lower recording limit / Upper recording limit / Lower display limit / Upper display limit

Measurement channel settings


Colour (in the display) / Current upper display limit / Current lower display limit

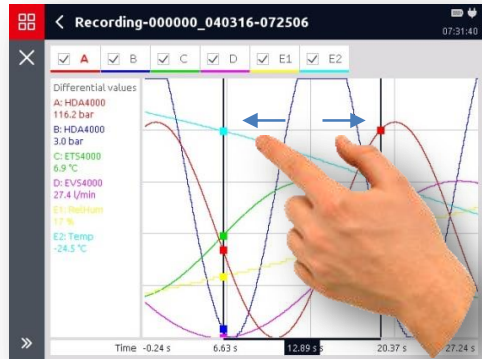
8.4.5 Tracker

The tracker always "jumps" from the actual recorded measurement point to measurement point and at the Y axis the corresponding measurement value for each active channel at this time is X (X axis).





Here, too, the differential between a selected starting and end point of a particular curve section (e.g. of a pressure pulse) can be rendered and measured.


 If you tap the "Tracker" function on the X axis, you can zoom into the measurement curve in the background and move it.



8.4.6 Stored views


With the  function, you can save individually generated graphic views and open them whenever you want.

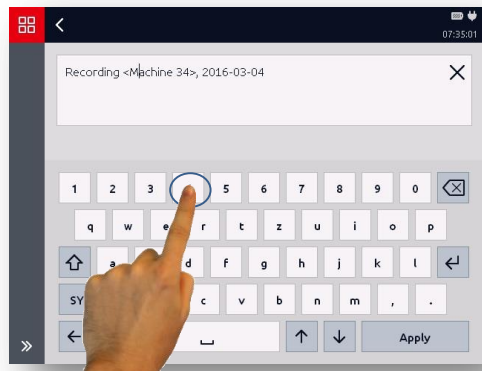
With the  button, you can add a view.

Using the  button, you can delete the individual saved views.




8.4.7 Comments

With the  function, you can enter a comment text for recording, e.g. a description of the operating status of the machine or system when recording the measurement.




8.4.8 Recording data

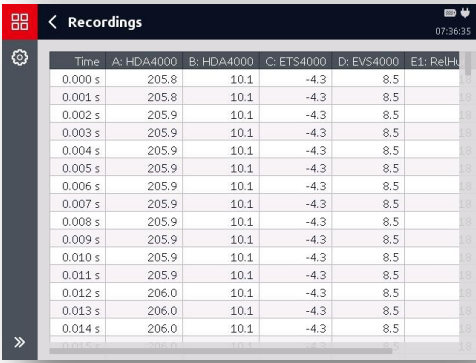
With the  function, you can view a summary of all the relevant data for the current recording.



8.4.9 Table

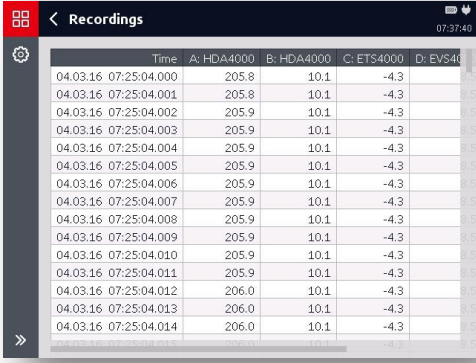
With the  function all of the recorded measured values are shown in a table. Tables are useful for displaying individual measured values.

For a simple measurement curve recording you are shown a measured values table listing the measured values of the active channels in columns and the associated recording time in rows.




Time	A: HDA4000	B: HDA4000	C: ETS4000	D: EVS4000	E1: RelH
0.000 s	205.8	10.1	-4.3	8.5	
0.001 s	205.8	10.1	-4.3	8.5	
0.002 s	205.9	10.1	-4.3	8.5	
0.003 s	205.9	10.1	-4.3	8.5	
0.004 s	205.9	10.1	-4.3	8.5	
0.005 s	205.9	10.1	-4.3	8.5	
0.006 s	205.9	10.1	-4.3	8.5	
0.007 s	205.9	10.1	-4.3	8.5	
0.008 s	205.9	10.1	-4.3	8.5	
0.009 s	205.9	10.1	-4.3	8.5	
0.010 s	205.9	10.1	-4.3	8.5	
0.011 s	205.9	10.1	-4.3	8.5	
0.012 s	206.0	10.1	-4.3	8.5	
0.013 s	206.0	10.1	-4.3	8.5	
0.014 s	206.0	10.1	-4.3	8.5	

Depending on the display settings, like in the graphical display, either the timestamp or the date and time will be shown for each entry.

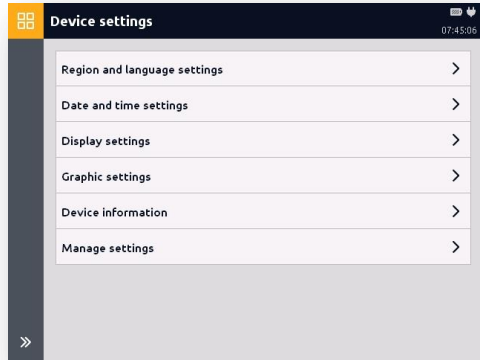


Time	A: HDA4000	B: HDA4000	C: ETS4000	D: EVS4000
04.03.16 07:25:04.000	205.8	10.1	-4.3	8.5
04.03.16 07:25:04.001	205.8	10.1	-4.3	8.5
04.03.16 07:25:04.002	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.003	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.004	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.005	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.006	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.007	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.008	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.009	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.010	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.011	205.9	10.1	-4.3	8.5
04.03.16 07:25:04.012	206.0	10.1	-4.3	8.5
04.03.16 07:25:04.013	206.0	10.1	-4.3	8.5
04.03.16 07:25:04.014	206.0	10.1	-4.3	8.5

 In the Recording menu you can switch between the graphical view and table view at any time, also with event logs.

9 "Device settings" application

In the "Devices settings" menu, you can adjust the different basic settings for the HMG 4000 and manage the different device settings.



9.1 Region and language settings

Under this menu point, you can adjust the following settings for the display and input of texts, figures and values:

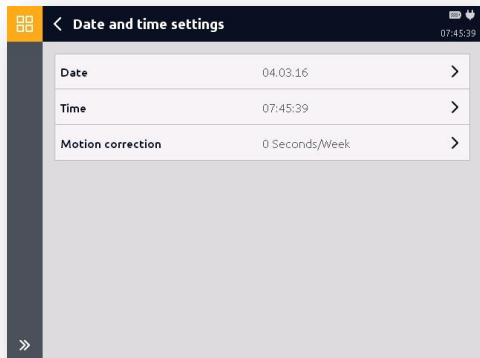
- Language
- Date format
- Decimal separators
- Keyboard layout



9.2 Date and time settings

Under this menu point, you can enter the current values for the date and time.

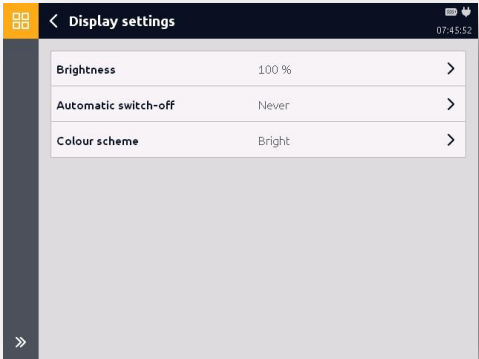
In the "Motion correction" field, you can correct any inaccuracies in the HMG's time measurement in the range -60 to +60 seconds.



9.3 Display settings

Under this menu point, you can adjust settings of the following display properties:

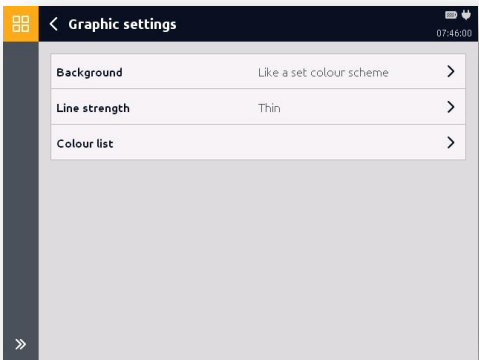
- Brightness
(10% - 100%)
- Automatic switch-off
(switch-off time up to 8 hours)
- Colour scheme
(bright, dark)



9.4 Graphic settings

Under this menu point, you can adjust the following settings for the graphical display of recordings:

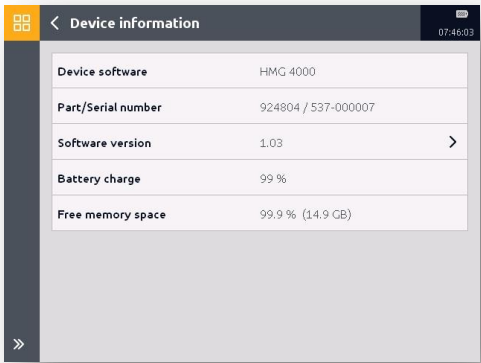
- Background
(like set colour scheme, always bright, always dark)
- Line strength
(thin, thick)
- Colour list
(for the display of the individual measurement channels)



9.5 Device information

Under this menu point, the following device information will be shown to you:

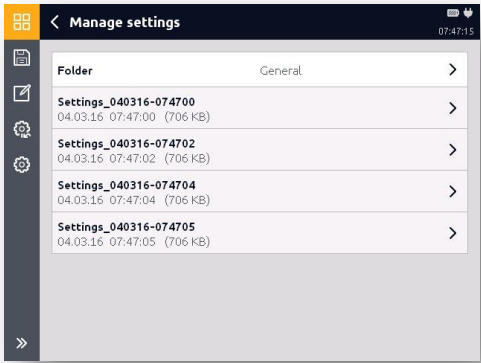
- Device software
- Part / serial number
- Software version
(update files possibly on the internal data carrier, see Chapter 16.4 "Software update")
- Battery charge status
- Memory allocation




9.6 Manage settings

All measurement channels and device settings you adjusted in the HMG 4000 for the last measurement can be saved and the reloaded at a later time, for example, when the same measurement needs to be repeated multiple times.

Furthermore, you can delete specific settings or restore the factory settings.

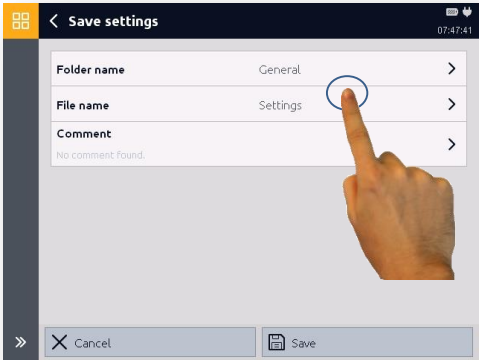



9.6.1 Save

You can save the current settings with the  button.

Here, select or create the desired target folder and enter a file name.


Then complete the operation with "Save" or discard your input with "Cancel".



 The preset standard folder for saved settings is the "General" folder. However, you can add as many folders as you like to this folder, like a reference to halls or machines for example.

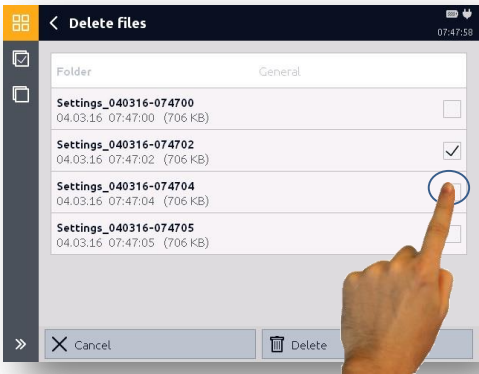
To load saved device settings, select the desired file and finish the operation with "Apply".

9.6.2 Delete


Using the  button, you can delete the individual saved settings.

Select the settings you wish to delete (a corresponding check mark will appear to the edge on the right of the screen).

Then complete the operation with "Delete" or discard the process with "Cancel".



9.6.3 Resetting

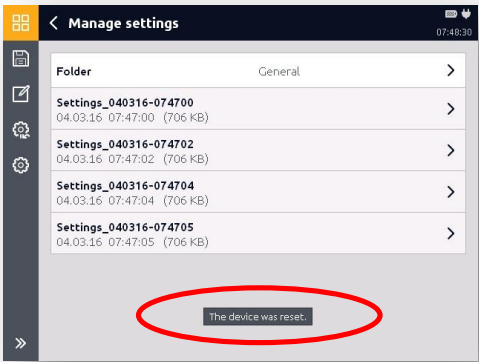
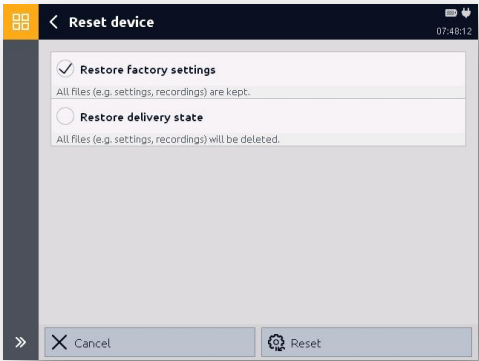
Use the  button to reset the HMG 4000.

There are two selection options for this:


- Restore default settings
(All saved files, settings and recordings remain intact)
- Restore delivery status
(All saved files, settings and recordings will be deleted)

Select the desired function and then finish the operation with "Reset" or discard the operation with "Cancel".

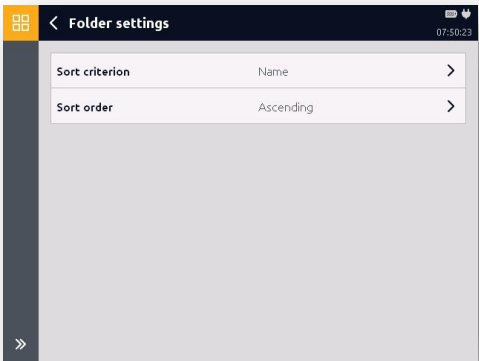
After resetting, a corresponding message will appear for a short time or the welcome screen if you are in delivery status.



9.6.4 Settings

You can access the "Folder settings" window using the  button.


Here you can change the defaults for sorting the files.





10 "Stopwatch" application


This stopwatch permits the measuring of the elapsed time, interim times and the times between two or more events.

The following functions are integrated into the menu/command bar (toolbar):

 **Start**
Starts measuring

 **Stop**
Ends measuring

 **Reset**
Zero points of the display

 **Lap time**
Recording of interim times (addition stop)



11 "Programmable switches" application

In this application, programmable electronic pressure, temperature and level switches with IO link (EDS 8xx / ExS 3xxx) as well as the HPG P1-000 can be easily programmed and parametrised.

Connect the sensor or the HPG to the yellow jack "P" on the HMG 4000 using an M12x1 connection cable (type: ZBE 40 or ZBE 30) and select "Establish connection" from the display.

After establishing the connection successfully, the following menu will open.



The content of this menu can vary depending on the device connected.

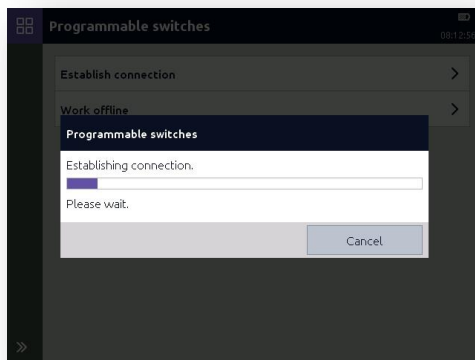
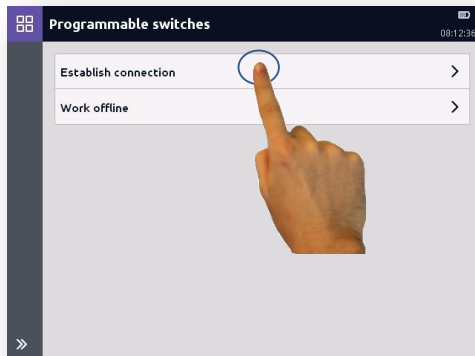
The following displays and functions are available in the window which opens:

- Part / serial number
- Measured values
- Switch point settings
- Advanced settings
- Manage settings



Working offline

Using this button you can manage and edit the settings read out from a switch and saved to the HMG 4000.



11.1 Article / Serial number

Article and serial numbers are read out from the connected sensor and shown in the display.

11.2 Measured values

In the menu point, the current measured value and the switch status of the switch outputs for the connected devices will be shown.

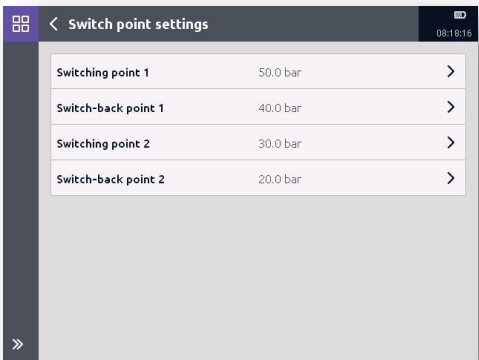


11.3 Switch point settings

Under this menu point, you can enter and change the values for the switch and switch-back points of the available switch outputs.



The content of this menu can vary depending on the device connected.

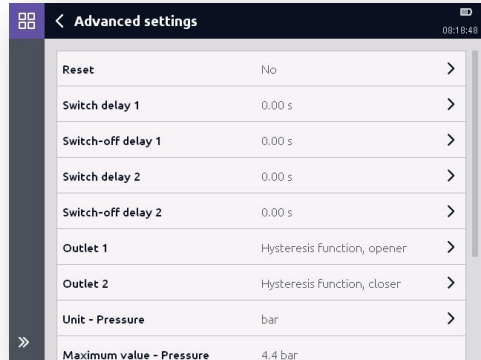


11.4 Advanced settings

Under this menu point, you can adjust the advanced settings for the switch outputs and for the device.



The content of this menu can vary depending on the device connected.




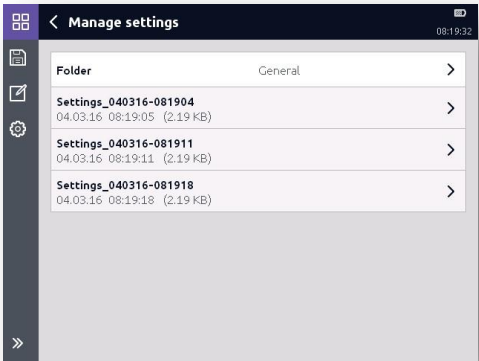
- Reset**
Reset sensor to default settings (delivery status) (Yes/No)
- Switch delay** (1; 2; 4 depending on the number of switch outputs)
Enter the switch delay (0.00 - 99.99 sec).
- Switch-off delay** (1; 2; 4 depending on the switch outputs)
Enter the reset delay (0.00 - 99.99 sec at pressure / 0.00 - 9999 sec for temperature and level).
- Outlet** (1; 2; 4 depending on the number of switch outlets)
Select the switch function for the respective switch output. (hysteresis function - closer / opener; window function closer / opener)
- Unit pressure / temperature / level**
Select the unit in which the measured value of the connected sensor should be output and shown. (Pressure: bar / psi / MPa; Temperature: °C / °F; Level: cm / inch)
- Maximum value - pressure / temperature / level**
The last max. value will be shown here.
- Reset min./max.**
Reset currently saved min./max. values (yes / no)
- Adjust zero point**
The currently pending pressure is saved as the new zero point. This is usually possible in the range of $\pm 3\%$ of the device measuring range (device-dependent).
- Version**
Firmware version of the connected sensor

11.5 Managing settings


All device settings can be saved and then reloaded at a later time, for example, if the same settings are to be installed onto multiple devices.

Furthermore, you can also delete specific settings here.

You can access the "Folder settings" window using the  button. Here you can change the defaults for sorting the files.

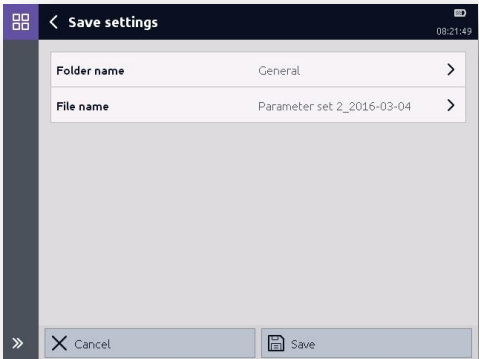



11.5.1 Save

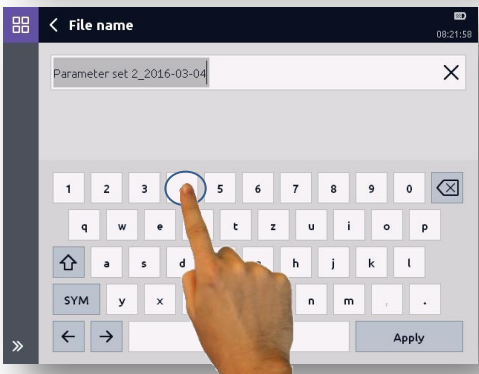
You can save the current settings with the  button.

Here, select or create the desired target folder and enter a file name.

Then complete the operation with "Save" or discard your input with "Cancel".

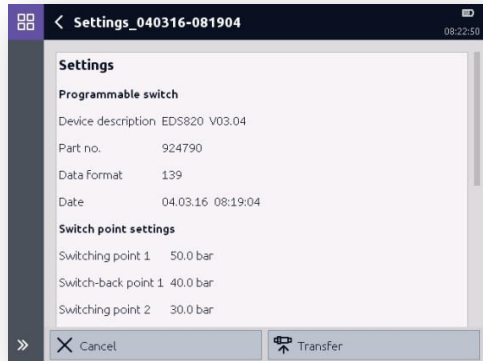


 The preset standard folder for saved settings is the "General" folder. However, you can add as many folders as you like to this folder, like a reference to different device types, machines or similar, for example.

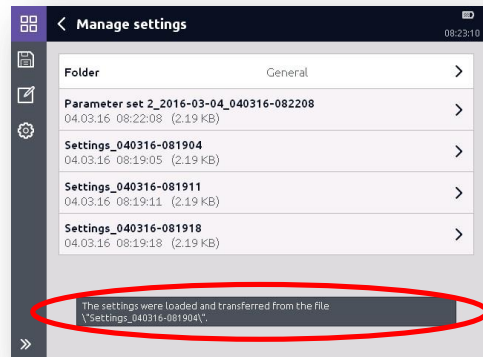


11.5.2. Applying settings


To load saved device settings, select the desired file and finish the operation with "Apply" or discard the operation with "Cancel".



After applying the settings, a corresponding message appears.

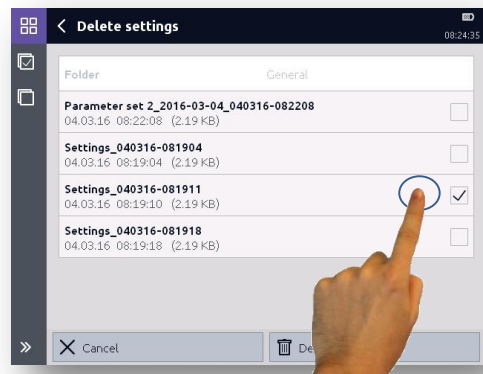


11.5.3 Delete

Using the  button, you can delete the individual saved settings.

Select the settings you wish to delete (a corresponding check mark will appear to the edge on the right of the screen).

Then complete the operation with "Delete" or discard the process with "Cancel".



12 "SMART sensor" application

SMART sensors are HYDAC sensors, capable of outputting several different measured variables which are displayed as sub-channels of one measurement channel on the HMG. Depending on the sensor type, these variables are stored for an extended period in the unit's internal memory. Regardless of the sensor used, its parameters can be set.



You can find the connection conditions and porting patterns in the respective SMART sensor's operating instructions.

The following details refer to the SMART sensor HYDACLab® HLB 1400, however they can apply equally to other sensors.

The measured value display of SMART sensors is shown in the screenshot on the right (example: HLB 1400).
The number and content of the outlet signals, and thus of the showed measured values can vary depending on the connected SMART sensor.

The display settings and measured value views can be adjusted as described in chapter 7.2. "Measured value display settings".

Measured values			09:34:44
A1 Conductivity	nS/m	0.6	
A2 relative change in Conductivity	%	0	
A3 DC		1.00	
A4 relative change in DC	%	0	
A5 Saturation	%	23	
A6 Temperature	°C		

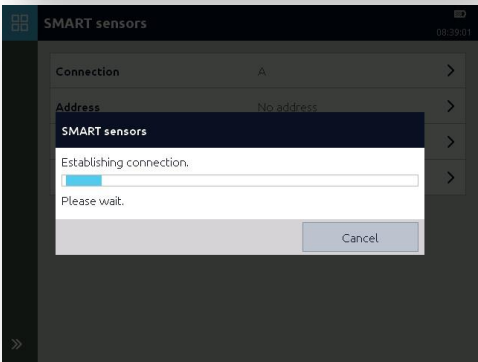
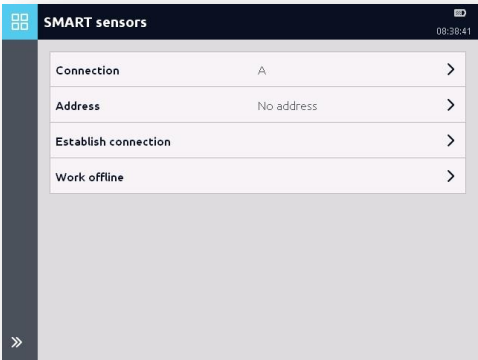


Since every SMART sensor goes through an initialization phase until the actual measured values are displayed, we recommend resetting the Min and Max values after this phase has completed.

12.1 Connecting SMART sensors

In this menu point, you can specify and change the connection settings for every SMART sensor connected to the HMG 4000.

- **Connection**
Measurement channel to which the SMART sensor is connected (A - H)
- **Address**
Optionally, you can specify a "sensor bus address" (a-z). The default setting is *No address*. Bus addresses must be assigned when the SMART sensor is operated in a bus system. (*This function is not described further here*).
- **Establishing connection**
Use this button to connect the HMG 4000 with the connected SMART sensor.
- **Working offline**
Use this button to manage the recordings and settings read out from the SMART sensor and saved to the HMG.



12.2 SMART sensor menu

Once the connection has been made to the connected SMART sensor, the adjacent screen will open.



The content of this and of all of the following menus can vary depending on the connected SMART sensor.



12.2.1 Information


This menu provides the following information about the connected SMART sensor:

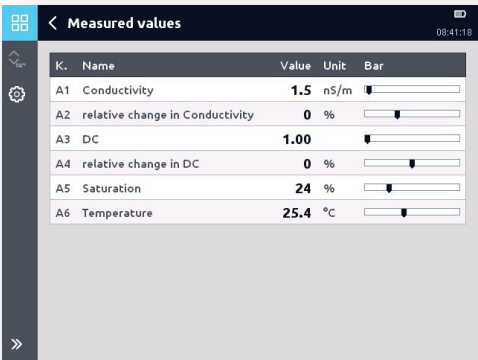
- Designation of the unit
- Part / serial number
- Status
- Information about the various measurement channels with regard to their type and measurement range.



12.2.2 Measured values

The actual measured values along with the associated units of measurement of the connected SMART sensor are shown here.


Using the  button you can access the "Measured value display settings" window. You can change the defaults for the display of the measured values cp. "Measured values" application.

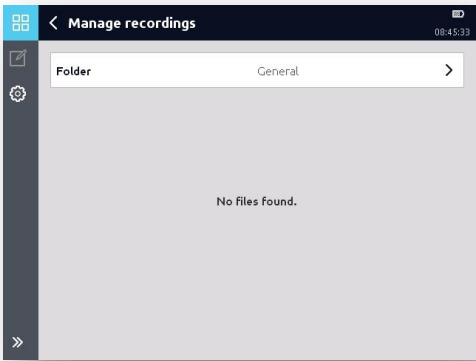


12.2.3 Manage recordings

In this menu item, you can manage the recordings saved in the SMART sensor.

The recordings can be imported to the HMG 4000, displayed and edited (see chapter 8. "Recordings").

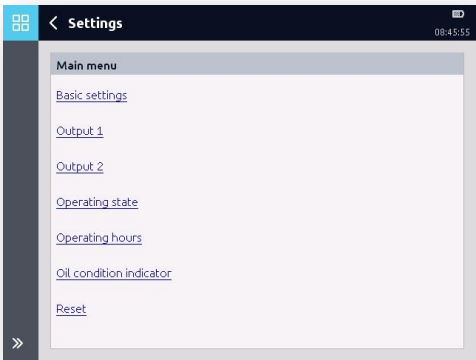
You can access the "Settings" window using the  button. Here you can change the defaults for the importing of recordings.



12.2.4 Settings


This menu varies depending on the connected SMART sensor.


The possible settings, presets, etc. can be found in the respective instruction manual of the SMART sensor being used.




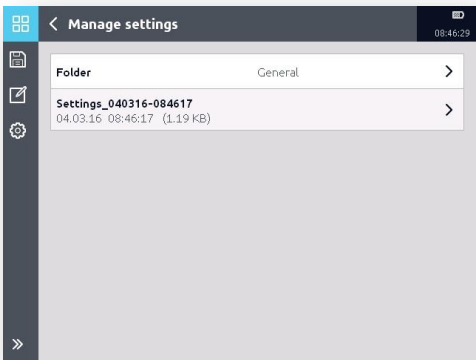
12.2.5 Managing settings

All device settings can be saved and loaded again at a later time.

You can save the current settings with the  button.

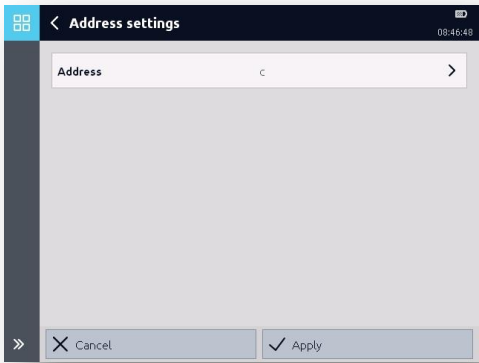
You can delete the individual saved settings with the  button.


You can access the "Folder settings" window using the  button. Here you can change the defaults for sorting the files.



12.2.6 Address settings

This menu enables you to assign a bus address to a sensor. Here, select a value from the list.
Complete the operation with "Apply" or discard the process with "Cancel".



 Bus addresses must be assigned when the SMART sensor is operated in a bus system. (This function is not described further here).

13 "CAN Tools" application

When connecting up the HMG 4000 to an existing external CAN bus system, the following basic safety steps need to be taken into consideration:



The CAN bus can be connected to the HMG 4000 via the red jack "CAN" (K) only!

The HMG 4000 may only ever be connected to one CAN bus system according to the selected mode.



This chapter is aimed at engineers, programmers, commissioning engineers as well as service and maintenance staff with the corresponding knowledge in automation technology, CAN bus systems in particular.

Before the HMG 4000 is set up in a running CAN bus system, corresponding presets and parameter specifications need to be adjusted for the HMG 4000 according to the type and model of the CAN bus system and the way it is connected.

If the HMG 4000 is connected to a running CAN bus system with incorrect presets, this can lead to bus malfunctions, bus crashes and error functions and as a result can also lead to damage to the machine, to the system and to individuals.

The "CAN tools" application is mainly meant for the following two tasks:

- **Configuring and parametrising individual CAN bus participants**

You can connect individual bus participants to the HMG 4000 and configure them for bus operation.

- **Logging message traffic in the bus system**

You can switch the HMG 4000 to a CAN bus system and log the entire message traffic.

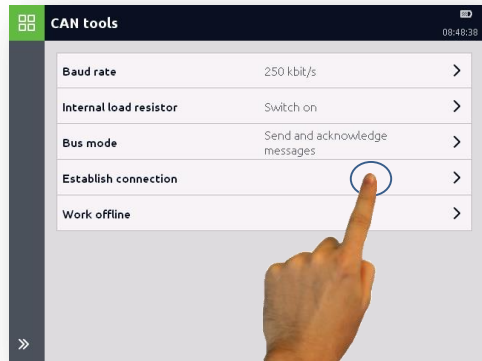


In the "CAN Tools" application, no measured values or similar information from individual messages can be shown.

This is only possible in the "Measured values" application.

13.1 Basic settings

Before connecting a bus participant or hooking up an external CAN bus system, the following presets must be applied in the HMG 4000:



- **Baud rate**

To configure participants or log messages, the HMG 4000 must be set to the baud rate of the participant or the external bus system. Baud rates of 10kBit/s to 1 MBit/s are possible.

- **Internal load resistor**

The internal load resistor needs to be connected if the HMG 4000 is hooked up to the CAN bus system at the end of the bus line as the "last participant", rather than using a branch line.

If the HMG 4000 is connected using a branch line, the internal load resistor may not be connected.



- **Message acknowledgement**

Message acknowledgement needs to be switched off or on depending on the application.

Passive monitoring, do not acknowledge

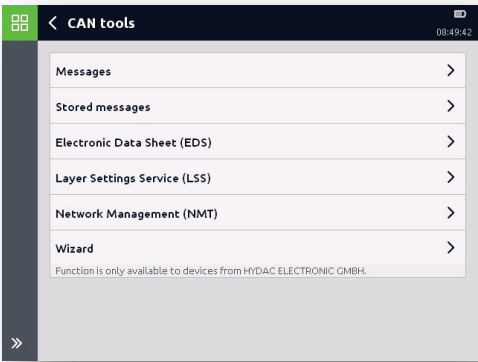
This setting should always be selected when the HMG 4000 is connected up to a CAN bus system so as to log messages passively (unnoticed).

Active monitoring, acknowledge messages

To test or to commission individual bus participants, for example, it is often necessary to acknowledge the receipt of messages. In cases like this, this setting must be selected.

13.2 Establishing connection

In this menu, you have the following options of establishing a connection to the connected participant or bus system:





13.2.1. Messages


In this window, you can keep up to date with current message traffic. According to the presets, you can view all or just individual messages.


- „T“ = Sent messages
- „R“ = Received messages
- „S“ = Status values
- „Warning“ = CAN messages (Bus errors)
- „Passive“ = Status messages



Use the  button to reset the messages list.

Using the  button, you can delete the settings for displaying mode or sorting order.


Use the  button to store the current messages list as a file. After storing, a new messages list will be opened immediately.

Using the  button, you can configure and send messages.

If the setting “Cyclical Transmission” is selected, you can switch on or switch off the cyclical transmission process by tapping on the corresponding message line.

If the setting “Cyclical Transmission” is not selected, you can send the message manually by tapping on the corresponding message line.





Using the  button, you can display a summary of the current messages list information.



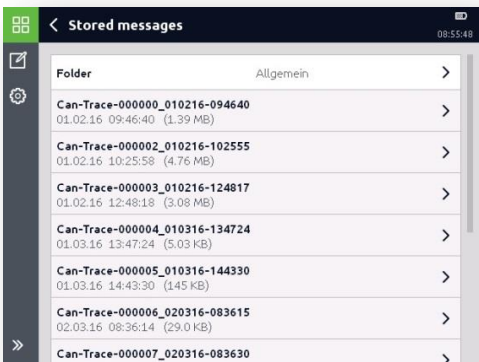
13.2.2 Stored messages

In this menu point, you can manage the messages lists stored in the HMG 4000.

Using the  button, you can mark and delete the saved lists.


You can access the "Folder settings" window using the  button.

Here you can change the defaults for sorting the files.



13.2.3 Electronic Data Sheet

With the "*Electronic Data Sheet (EDS)*", you can specifically access individual bus participants in order to make changes to the configuration.

 There are no EDS files saved in the HMG 4000.


All of the required EDS files first need to be transferred from a USB stick or PC to the HMG into the "*CAN Tools / EDS / ...*" folder. (see Chapter 15 "File Manager")

First select the corresponding communication log and enter the node ID of the participant.

Open

Using this function, you can specifically select the EDS file of the participant.

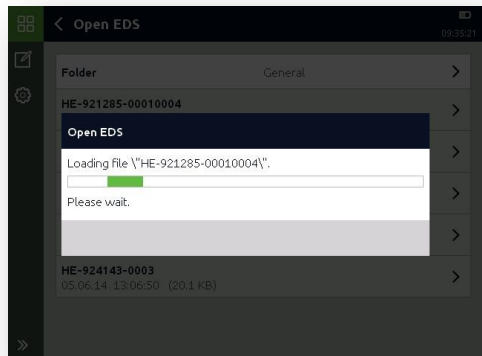
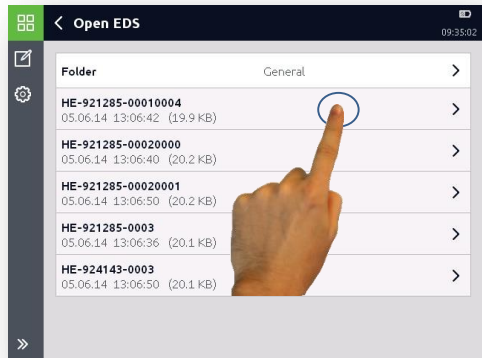
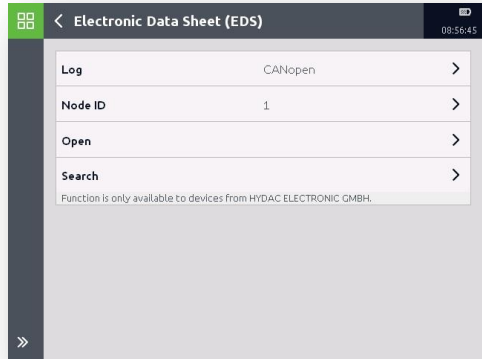
Tap to open the corresponding field.

 It may be the case under certain circumstances that individual EDS files from different manufacturers cannot be processed!

Search

This function is only available to HYDAC ELECTRONIC GmbH devices.

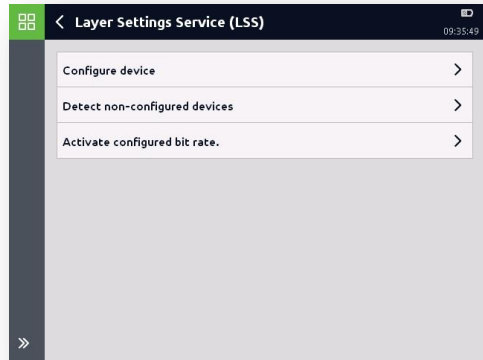
The HMG 4000 automatically searches for the EDS file which corresponds to the participant and opens it. The corresponding data is generated from the "*1018, IdentityObject*" parameter.



13.2.4 Layer Settings Service

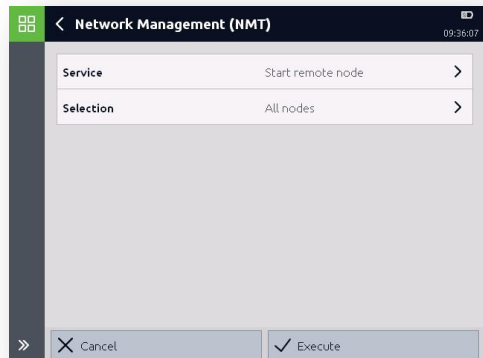
With the "*Layer Settings Service (LSS)*" function, you can use the CAN bus to change the baud rate and node ID of one or more participants for which no EDS file is yet saved to the HMG 4000.

The data can be entered manually and correspond to the data from parameter 1018.



13.2.5 Network Management

With the "*Network Management (NMT)*" function, you can specify the global services of the network management. Included in this is the starting and stopping of individual participants during operation and the management of emergency situations.



You can assign the following statuses to one of the participants or all of them:

- **Start Remote Node**
- **Stop remote node**
- **Reset node**
- **Reset communication**
- **Enter pre-operational**



13.2.6 Wizard

This function is only available to HYDAC ELECTRONIC GmbH devices.

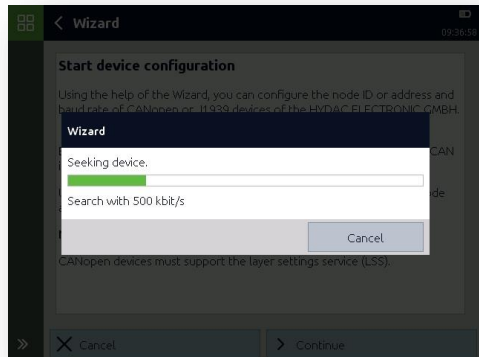
Using the help of the Wizard, you can quickly and easily configure or change the node ID or address and baud rate of CANopen or J1939 devices of the HYDAC ELECTRONIC GMBH.

In this respect, only one device without an active load resistor may be connected to the HMG 4000.

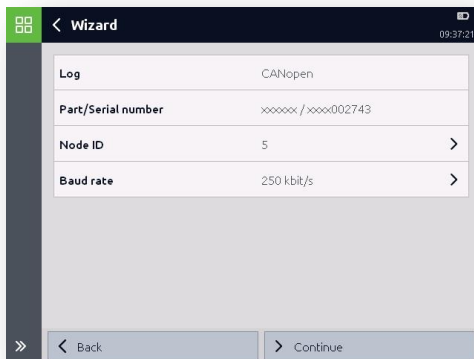


The values currently set in the device for node ID and baud rate as well as the device status and configuration do not have to be known for the search to function! All information is read out using the search function of the HMG 4000.

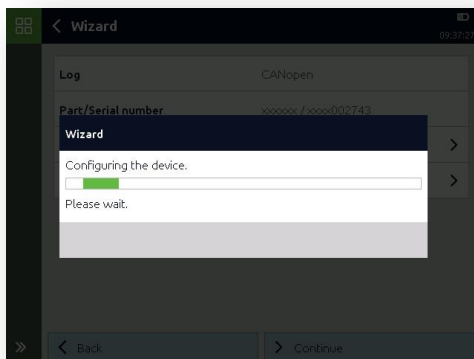
After tapping "Continue", the HMG begins to search for connected participants.



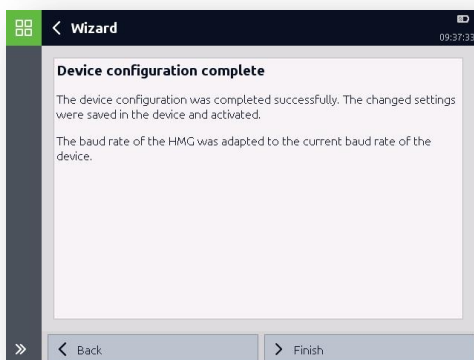
If the connected device is "found" (detected), you can change the node ID and baud rate according to the requirements.



After tapping "Continue", the connected device is configured with the changed settings.





Then finish the operation with "Finish" or tap on "Back" to make further changes to the connected device.

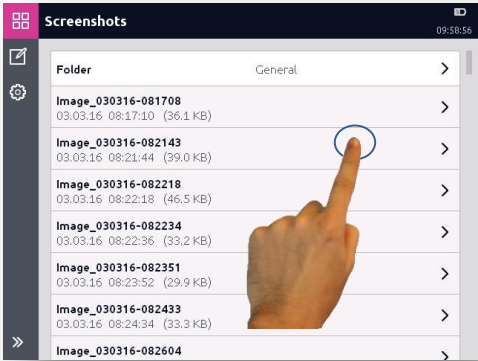



14 "Screenshots" application

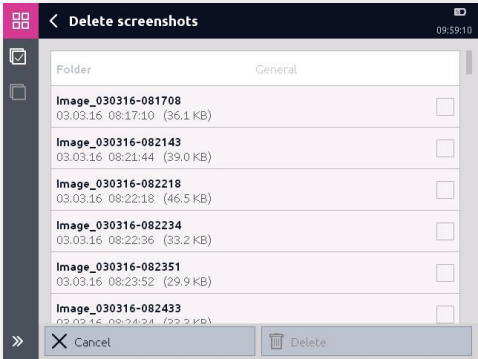
In this menu you can manage the screenshots created in the HMG 4000.


To show a screenshot on the display, quickly tap the corresponding file.

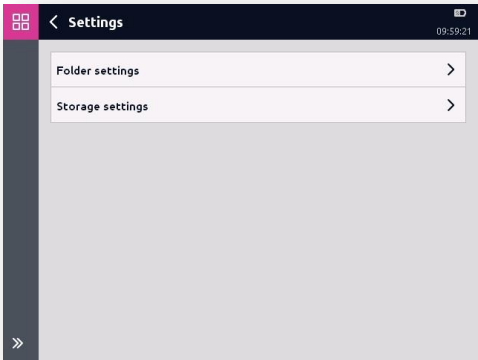
In display mode, you can use the  and  buttons to swipe back and forth between saved screenshots.



You can select and delete saved screenshots using the  button.



You can access the "Settings" window using the  button. Here you can change the defaults for sorting the files as well as the storage location and file names.



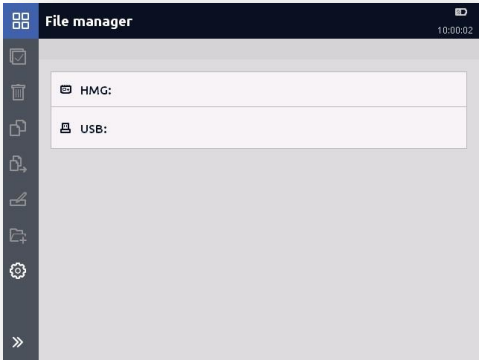
15 "File Manager" application

In this application, you can easily manage all of the user files stored on the HMG 4000, like recordings, settings, parameter sets, etc.

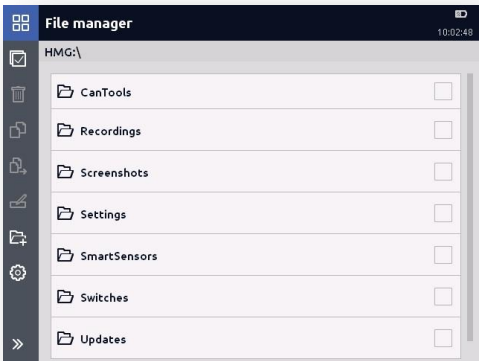
15.1 Working with the file manager

The device has an internal data carrier and a USB host interface for an external data carrier (USB memory stick).

After starting the file manager, the selection of internal memory "HMG" or of external memory "USB" will appear (provided an external device was detected).










If there is no USB memory stick inserted, the "HMG" folder will show up straight away.

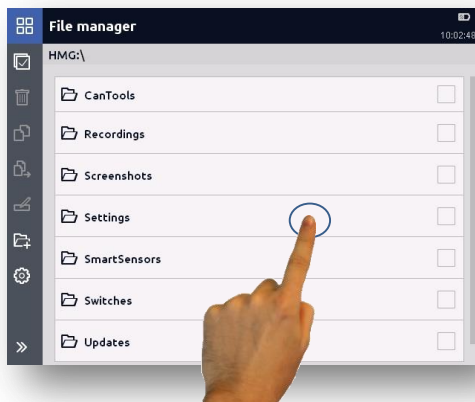


With the file manager, you work at "*File level*", that is, all folders and files are shown and you can work with them like in Explorer.

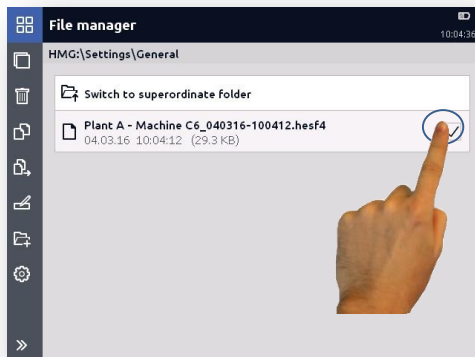
In this regard, you can avail of the following tools from the menu/command list:

-  Select all
-  Remove all selections
-  Delete
-  Copy
-  Move
-  Rename
-  New folder

To open a folder, tap on the corresponding field.



To edit a folder or file, select the corresponding line by tapping the box to the right (a tick will appear). To remove the selection, tap on the box again (the tick disappears).





Generally in the HMG 4000, the levels of embedding of the file manager are restricted to two or three levels with CanTools, SmartSensors and switches. That means that in all "superordinate" folders (CanTools, recordings, screenshots, ...) there are just one or two levels in which other subfolders can be created

The "General" folder is the default folder (subfolder 1) and preset storage location for user files in all superordinate folders.

Exception: Updates - Here the files are saved directly to the folder.

📁 **CanTools** (folder)

📁 **EDS**

📁 **General** (subfolder 1)

📁 Subfolder 2

:

📁 Subfolder n

📁 **Traces**

📁 **General** (subfolder 1)

📁 Subfolder 2

:

📁 Subfolder n

📁 **Recordings** (folder)

📁 **General** (subfolder 1)

📁 Subfolder 2

:

📁 Subfolder n

:

📁 **Updates** (folder)

Update file 1

:

Update file n

In each folder you can create up to 1000 subfolders each with up to 10000 files in order to, for example, create references to halls or machines, etc.

(Exception: Updates)

The loading time of a folder depends on the number of subfolders and files contained. (Files > 2 GB will not be shown!).

All saved files can be transferred via the USB device interface from the HMG 4000 to a PC or back to the HMG 4000.

15.2 Restrictions to the file manager

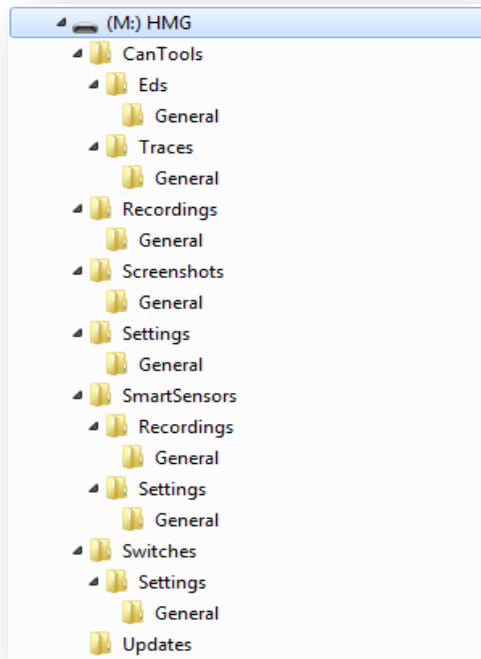
The file manager evaluates just the first 55 characters of folder and file names. Longer names will be shortened. Files, which are larger than 2 GB, will also not be shown.

In normal applications, just 31 characters are allowed for folder and file names. Here, a timestamp or serial number is attached as a postfix to the entered name

15.3 PC Link

If you connect the HMG 4000 to a PC using the supplied USB cable, the device will be detected and displayed automatically like with a standard USB drive.

Now, using the Explorer programme on your PC, you can create folders and copy, insert, rename and delete files, among other things.



During an active connection to the PC, the HMG 4000 will switch to "PC mode".

In this mode, only the current measured values and, depending on the setting, the history and min./max. values will be displayed consecutively.



It is not possible to operate the HMG 4000 in "PC mode".

- In this status, the touchscreen and operating keys are non-functioning!
- If the HMG is connected to a PC during a running recording, the recording will be stopped automatically and saved!

16 Cleaning / Maintenance / Update

16.1 Cleaning

Before cleaning, switch off the HMG 4000 and disconnect the device from the power supply.

Do not use any aggressive substances when cleaning, e.g. solvents, alcohol, screen cleaners, petroleum ether or similar chemicals.

The use of these substances can damage the housing and the display!

For minor contamination, wipe the device down with a soft, slightly dampened cloth.

With stubborn contamination, you can also use a mild household cleaner.

Make sure no dampness gets into the device.

16.2 Maintenance / Calibration

The series HMG 4000 portable data recorders are maintenance-free and work perfectly when used under the conditions specified (see technical data).

However, we recommend having the device calibrated at regular intervals.

Depending on usage and area of operation, cyclical calibration of the HMG 4000 must be done or is even the regulation (e.g. at test benches).

16.3 Repair

If you have any questions concerning repair work, please do not hesitate to contact HYDAC Service:

HYDAC SERVICE GMBH

Hauptstr. 27

D-66128 Saarbrücken

Germany

Phone: +49 (0) 6897-509-1936

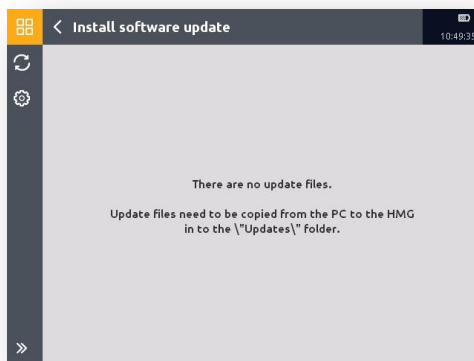
Fax: +49 (0) 6897-509-1933


16.4 Software update

To get to the "Software update"
go to the
Start menu

- └ Device settings
- └ Device information
- └ Software version

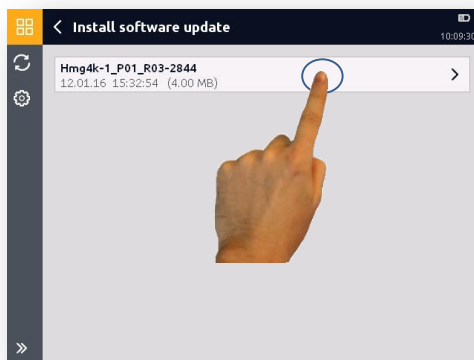
If no update files are available, the
adjacent message will appear.



 Update files for the device always have to be transferred manually from the PC to the HMG 4000 and into the folder "HMG / Updates". Multiple update files can be saved to the device at the same time.

If one or more update
files are saved to the HMG 4000,
the adjacent window
will open.

Select the desired update
file

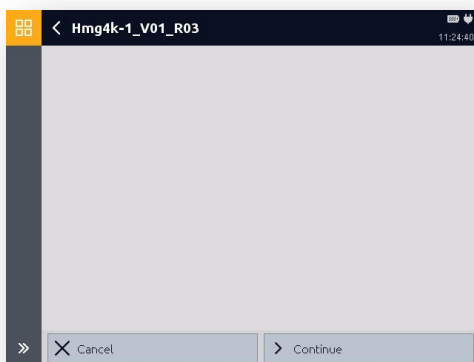


It is possible to save multiple update files (and thus different software versions) to the HMG 4000.

Under certain circumstances it may be necessary to install an older version than the currently installed software version.

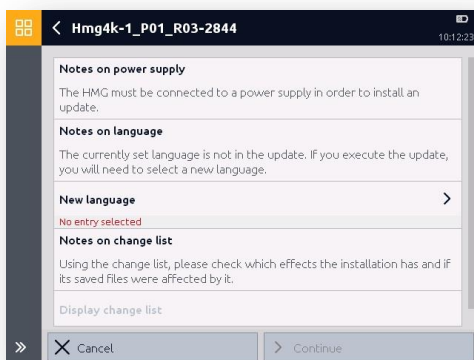
In this case, please take the corresponding notices into consideration!
It is possible that you may no longer be able to subsequently access saved, newer files like recordings, settings, etc.

A "Changes list" for the selected update file will then appear. This describes the effects the installation has on the HMG 4000 and if its saved files were affected by it.



If the HMG 4000 is not connected to the power and the battery charge is too low, the adjacent message will appear.

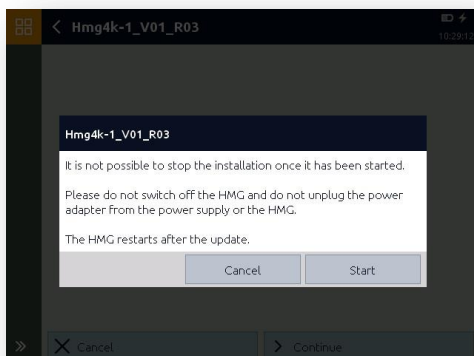
In this case, the software update may only be started if the HMG 4000 is connected to the power.



After confirmation with "Continue", the software update will begin. Here the adjacent message will first appear.

Then complete the operation with "Start" or discard the process with "Cancel".

The HMG 4000 will restart automatically once the software update completes successfully.



16.5 Changing battery

Loosen and remove the fixing screw in the battery compartment cover.



Move the battery compartment cover downward, over and past the block.



Loosen the connection plug of the battery pack.

Connect up the new battery pack, slide the battery compartment cover into the guide (until it snaps into place) and reattach the cover with the fixing screw.



*The battery cannot be disposed of in the residual waste.
Send the battery pack for recycling of old batteries..*

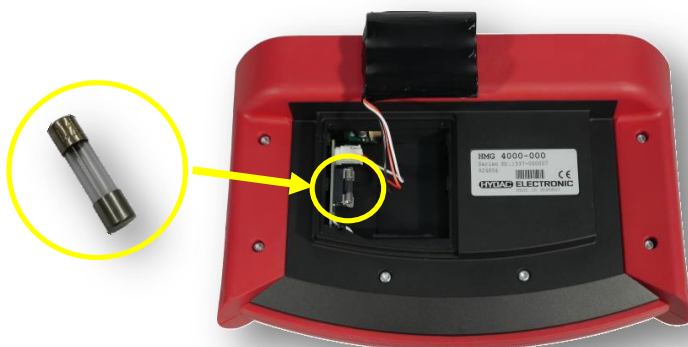
16.6 DC-DC ground bond

The HMG 4000 performs galvanic separation of the DC power supply provided by the power adapter internally.

In rare and exceptional circumstances, it may happen with unfavourable network setups that "ripple voltages" are recorded (e.g. 50 Hz "mains hums") when measuring with connected power supply units.

In this case, you have the opportunity to bridge the galvanic separation by inserting a "speedy" 100 mA micro-fuse (included in the scope of delivery!) into the intended holder in the battery compartment of the HMG 4000.

This creates a ground connection between the power supply of the power supply unit and the internal power supply for the sensors, eliminating the ripple voltage.



After taking the measurements with bridged galvanic separation, remove the fuse to avoid damage or measurement errors during normal operation.

17 Accessories

17.1 Sensors

- Pressure measuring transducer with HSI interface:**

-1 ... 9 bar	HDA 4748-H-0009-000(-1...+9bar)	Mat. no.	909429
0 ... 16 bar	HDA 4748-H-0016-000	Mat. no.	909425
0 ... 60 bar	HDA 4748-H-0060-000	Mat. no.	909554
0 ... 100 bar	HDA 4748-H-0100-000	Mat. no.	909426
0 ... 160 bar	HDA 4748-H-0160-000	Mat. no.	922944
0 ... 250 bar	HDA 4748-H-0250-000	Mat. no.	909337
0 ... 400 bar	HDA 4748-H-0400-000	Mat. no.	909427
0 ... 600 bar	HDA 4748-H-0600-000	Mat. no.	909428
0...1000 bar	HDA 4748-H-1000-000	Mat. no.	924580
- HCSI pressure measuring transducer:**

-1 ... 9 bar	HDA 4748-HC-0009-000(-1...+9bar)	Mat. no.	925287
0 ... 16 bar	HDA 4748-HC-0016-000	Mat. no.	925298
0 ... 60 bar	HDA 4748-HC-0060-000	Mat. no.	925305
0 ... 100 bar	HDA 4748-HC-0100-000	Mat. no.	925299
0 ... 160 bar	HDA 4748-HC-0160-000	Mat. no.	925286
0 ... 250 bar	HDA 4748-HC-0250-000	Mat. no.	925304
0 ... 400 bar	HDA 4748-HC-0400-000	Mat. no.	925303
0 ... 600 bar	HDA 4748-HC-0600-000	Mat. no.	925301
0...1000 bar	HDA 4748-HC-1000-000	Mat. no.	925300
- Temperature measuring transducer with HSI interface**

-25 to +100 °C	ETS 4148-H-006-000	Mat. no.	923398
----------------	--------------------	----------	--------
- HCSitemperature measuring transducer:**

-25 to +100 °C	ETS 4148-HC-006-000	Mat. no.	925302
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- Flow rate measuring transducer with HSI interface:**

Aluminium

1.2 - 20 l/min	EVS 3108-H-0020-000	Mat. no.	909405
6.0 - 60 l/min	EVS 3108-H-0060-000	Mat. no.	909293
15 - 300 l/min	EVS 3108-H-0300-000	Mat. no.	909404
40 - 600 l/min	EVS 3108-H-0600-000	Mat. no.	909403

Stainless steel

1.2 - 20 l/min	EVS 3118-H-0020-000	Mat. no.	909409
6.0 - 60 l/min	EVS 3118-H-0060-000	Mat. no.	909406
15 - 300 l/min	EVS 3118-H-0300-000	Mat. no.	909408
40 - 600 l/min	EVS 3118-H-0600-000	Mat. no.	909407

- **Speed sensors**

HDS 1000-002 (Plug M12x1 for HMG 3x/4x)	Mat. no.	909436
HDS 1000 Reflection slides	Mat. no.	904812
HSS 210-3-050-000 (in connection with ZBE 46)	Mat. no.	923193
HSS 220-3-046-000 (in connection with ZBE 46)	Mat. no.	923195

17.2 Sensor cables

Push-pull connection (plug-side):

2 m length ZBE 40-02(CABLE M12X1/5P, PUSH-PULL) 2M	Mat. no.	6177158
5 m length ZBE 40-05(CABLE M12X1/5P, PUSH-PULL) 5M	Mat. no.	6177159
10 m length ZBE 40-10(CABLE M12X1/5P, PUSH-PULL)10M	Mat. no.	6177160

Screw connection:

2 m length ZBE 30-02(Sensor cable M12x1, 5-pin) 2m	Mat. no.	6040851
5 m length ZBE 30-05(Sensor cable M12x1, 5-pin) 2m	Mat. no.	6040852

17.3 Other accessories

Case for HMG 4000 and accessories	Mat. no.	6179836
ZBE 31 (car battery charger for HMG 2x/3x/4x)	Mat. no.	909739
HCSI Y splitter	Mat. no.	6178196
HCSI bus termination	Mat. no.	6178198
ZBE 46 Pin adapter HMG (for three-wire signals, AS, ...)	Mat. no.	925725
ZBE 100 adapter for TFP 100	Mat. no.	925726
ZBE 38 (Y adapter, black for jack I/J)	Mat. no.	3224436
ZBE 26 (Y adapter, blue for HLB 1000)	Mat. no.	3304374
ZBE 41 (Y adapter, yellow for CS 1000)	Mat. no.	910000
UVM 3000 adapter (for external sensors)	Mat. no.	909752
Hydraulic adapter set for HMG	Mat. no.	903083
SSH 1000-H-3 (Sensor simulator for HMG 2x/3x/4x)	Mat. no.	909414
Ideal for training and learning purposes		

17.4 Spare parts

Power supply for HMG 2x/3x/4x	Mat. no.	6054296
USB cable (1x plug A – 1x plug B)	Mat. no.	6040585
Harness for HMG 4000	Mat. no.:	4070365
Battery pack for HMG 4000	Mat. no.	3956715

18 Technical data

18.1 Input channels

18.1.1 Analogue inputs

Quantity	8 channels via eight M12x1 Ultra Lock flanged jacks (5-pin)
Description	Channel A - Channel H
Input signals	HYDAC HSI analogue sensors HYDAC HSI SMART sensors Voltage ranges: 0 - 50 V, 0 - 10 V, 0 - 4.5 V, -10 - +10 V Current ranges: 0 - 20 mA PT 100 / PT 1000 (channel H only)
Resolution	12 bit
Accuracy	$\leq \pm 0.1$ % of respective input range end value (Examples: Sensor signal = 0 - 5 V → Input range 0 - 10 V Sensor signal = 0 - 15 V → Input range 0 - 50 V) $\leq \pm 1$ % with PT 100 / PT 1000

18.1.2 Digital inputs

Quantity	2 channels via one M12x1 Ultra Lock flanged jack (5-pin)
Description	Channel I, J
Input signals	Digital status (high / low) Frequency (0.01... 30,000 Hz) PWM duty cycle
Level	Switching threshold / switch-back threshold: 2 V / 1 V Max input voltage: 50 V
Accuracy	$\leq \pm 0.1$ %

18.1.3 CAN

Quantity	28 channels via one M12x1 Ultra Lock flanged jack (5-pin)
Description	Channel K1 - K28
Input signals	HYDAC HCSI sensors CAN J1939 CANopen PDO CANopen SDO
Baud rate	10 kbit/s ... 1 Mbit/s
Accuracy	$\leq \pm 0.1$ %

18.1.4 Calculated channels

Quantity	4 channels via virtual port L
Description	Channel L1 - Channel L4
Possible operations	+, -, *, / sqr, sqrt, ln, log abs, π , e, x^y ()
Refresh rate	1 ms

18.2 Programming interface

Quantity	1 channel via M12x1 Ultra-Lock Flange socket (5 pole)
Description	P
Parametrizable devices	EDS 8xx-F31- ExS 3000-F31 / AS 3xxx-F31- HPG-P1-000

18.3 Supply voltage

Power supply	9 ... 36 V DC via standard round plug 2.1 mm
Battery	Lithium-Nickel-Cobalt-Aluminium-Oxide 3.6 V; 9300 mAh
Charging status	System-monitored, LED display Green: Battery charged Orange: Charging Red: Error status
Battery charging time	approx. 5 hours
Service Life	without sensors: approx. 11 hours with 2 sensors: approx. 9 hours with 4 sensors: approx. 7 hours with 8 sensors: approx. 4 hours

18.4 Display

Type	TFT-LCD Touchscreen
Size	5.7 "
Resolution	VGA 640 x 480 Pixel
Backlight	10 ... 100 % adjustable

18.5 Interfaces

18.5.1 USB Host

Plug connection	USB socket, Type A, screened
USB Standard	2.0 (USB Full speed)
Transmission rate	12 Mbit/s
Voltage supply	5 V DC
Power supply	100 mA max.
Protection	Short circuit protection against GND (0 V)

18.5.2 USB Device

Plug connection	USB socket, Type B, screened
USB Standard	2.0 (USB High speed)
Transmission rate	480 Mbit/s
Voltage supply	5 V DC
Power supply	100 mA max.
Protection	Short circuit protection against GND (0 V)

18.6 Memory

Main processor	2 MB Flash on board / 260 kB internal RAM
External memory	64 MB SDRAM
Measured value memory	16 GB for min. 500 measurements, each containing 8 Million measured values

18.7 Technical standards


EMC	IEC 61000-4-2 / -3 / -4 / -5 / -6 / -8
Safety	EN 61010
Protection class	IP 40

18.8 Ambient conditions

Operating temperature	0 ... 50°C
Storage temperature	-20 ... 60°C
Relative humidity	0 ... 70 %
Max. operating altitude	2000 m

18.9 Port allocations

18.9.1 Measurement channels:

Socket		Colour	Channel	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
A ... G		black	A ... G	+UB	n.c.	Signal	GND	HSI
H		black	H	+UB	n.c.	Signal	GND	HSI
I/J		black	H	n.c.	PT 100 Force +	PT 100 Sense +	PT 100 GND	n.c.
I/J		Blue	I/J	+UB	Digital-IN I	Digital-IN J	GND	n.c.
CAN/HCSI		red	K	n.c.	+UB	GND	CANH	CANL
P		yellow	---	+UB	n.c.	GND	Q/C	n.c.

Socket "A"... "G"

1	+UB (12 V DC)
2	n.c.
3	Channel A, B, C, D, E, F, G,
4	GND (0 V)
5	HSI Sensor recognition

Socket "H" analog / PT 100 (PT 1000)

1	+UB (12 V DC) / n.c.
2	n.c. / PT 100 (Force +)
3	Channel H / PT 100 (Sense +)
4	GND (0 V) / PT 100 (GND)
5	HSI Sensor rec. / n.c.

Socket "I/J"

1	+UB (12 V DC)
2	Channel I
3	Channel J
4	GND (0 V)
5	n.c.



Socket "CAN/HCSI"

1	n.c.
2	+UB
3	GND
4	CAN HIGH
5	CAN LOW


Socket "P"

1	+UB
2	n.c.
3	GND
4	Q/C (Progr.)
5	n.c.

18.9.2 Interfaces:

Socket		Transmission rate	Function
USB Master	 Type A	Max. 12 Mbit / s (USB Full speed)	Connection of slaves (USB memory stick)
USB Slave	 Type B	Max. 480 Mbit / s (USB High speed)	PC interface

18.9.3 Power supply

Socket		Connection	Function
DC IN	 +U _B -0 V	Round plug 2.1 mm JEITA RC-5320 A	Supply voltage (9 ... 36 V)

18.10 Dimensions and weight

Dimensions	approx. 285 x 189 x 87 mm (B x H x T)
Weight	approx. 1,850 g
Housing material	Plastic (Elastollan® R 3000 – TPU-GF)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

HYDAC ELECTRONIC GMBH

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HYDAC Service

If you have any questions concerning repair work, please do not hesitate to contact HYDAC Service:

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Hauptstr. 27

D-66128 Saarbrücken

Germany

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Fax: +49 (0) 6897-509-1933

NOTE

The information and particulars provided in this manual apply to the operating conditions and applications described herein. For applications and operating conditions not described, please contact the relevant technical department.

If you have any questions, suggestions, or encounter any problems of a technical nature, please contact your HYDAC representative.

Subject to technical modifications.