

Portable data recorder HMG 3000

User manual

(Translation of the original instruction)



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1 Tasks and Functions of the HMG 3000

1.1 Standard functions of the HMG 3000

The HMG 3000 portable data recorder is a hand-held unit for measurement and data acquisition tasks on hydraulic and pneumatic systems. Applications are mainly in maintenance and servicing, troubleshooting and test rigs.

The HMG 3000 can monitor signals from up to ten sensors simultaneously. The unit features input jacks for connecting the sensors; if necessary this number can be doubled using an adapter for measurement operations involving more than 5 sensors. HYDAC offers HSI sensors (HYDAC Sensor Interface) for pressure, temperature and flow rate with automatic sensor recognition. The measuring range and unit can be set according to the customer's requirements.

You also have the option of connecting SMART sensors to the HMG 3000. These represent a sensor generation from HYDAC which can output several different measured variables. These sensors are also automatically recognized by the HMG 3000 via HSI, and the measured values including the measurement unit are shown in the display.

The HMG 3000 can render up to 32 measurement channels in total.

Depending on the sensor type, the sensor has an internal memory for the storage of recorded measured value on a long-term basis. In addition, depending on the sensor type, preset parameters can be changed and stored in the internal memory as a sensor configuration.

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 operator can access all of the unit's functions and settings by means of clearly presented selection menus. The HMG 3000 has a combination keypad for entering numeric values and text, similar to a mobile phone.

The HMG 3000 is designed in particular for recording typical measurements (pressure, temperature, flow rate) in hydraulic and pneumatic systems. A variety of other measurement tasks can be performed using additional inputs for voltage measurement. For example, checking the actuation of a switching valve or plotting the characteristic curve of a valve setpoint. In addition, it is also possible to determine differential values between the measured values of individual sensors. One example of this is taking a flow rate measurement using a differential pressure orifice.

In addition to the analogue measurement inputs, the HMG 3000 features two digital inputs (e.g. for measuring frequency or speed), thus expanding the unit's range of potential applications.

When taking measurements of rapid, dynamic machine processes, all 8 analogue input signals can be recorded simultaneously at a rate of 0.5 ms.

One special feature of the HMG 3000 is its ability to also monitor highly dynamic processes in a machine. To achieve this, two input channels can record measured values 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 3000 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 3000 is equipped with specially developed software providing for fast data collection and processing. A measurement curve can consist of up to 500,000 measured values. The HMG 3000 memory is capable of storing at least 100 of such measurement curves.

In addition to enabling simple measurement curves to be recorded, the HMG 3000 also has other functions enabling event-driven measurements to be taken and event logs to be recorded. Various trigger options are available for triggering events.

Apart from measurement curves, the HMG 3000 can store user-specific settings (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 3000's memory.

The HMG 3000 has a 3.5" colour display with graphics capabilities, which can show the measured values either as text or as measurement curve. Individual measured values can be displayed in a large format (7-segment format), enabling them to be read from far away.

The HMG 3000 also provides a variety of user-friendly features for displaying, evaluating and processing measured values:

- Table
- Graph
- Scaling
- Ruler
- Tracker
- Zoom

The HMG 3000 communicates with a computer via a USB or serial port. HYDAC software **HMGWIN** which is specific to the HMG 3000, is supplied for convenient post-processing, rendering and evaluation of measurements on your computer. It also enables the HMG 3000 to be operated directly from your computer.

The HYDAC software **CMWIN** is also supplied as standard with the unit. This software enables you to communicate directly from your computer with SMART sensors connected to the HMG 3000.

2 About Your HMG 3000

2.1 Items supplied

- HMG 3000
- Power supply for 90 ... 230 V
- User Manual
- CD-ROM containing USB drivers and HMGWIN and CMWIN software (software for analyzing measurement data and sensor communication) in addition to other product information
- USB connector cable

2.2 Power supply

The HMG 3000 has an internal NiMH battery. To charge the battery, simply connect the power supply with the HMG 3000 (see HMG 3000 connections). The battery is fully charged after approx. 2 hours.

A direct current supply (12 – 30 V DC) can be connected to the power input socket for operating the HMG or charging the battery.

When connecting the power supply to the input socket make sure that $+U_B$ is applied to the inner contact of the plug and 0 V to the outer contact. A JEITA RC 5320-5 plug, for example, is suitable for this purpose and is available in most electrical/electronics shops.

3 Technical Safety

The individual components of the HMG 3000 portable data recorder and the assembled unit are subject to strict quality assurance inspection and testing. Each HMG 3000 undergoes a final test. This ensures that upon delivery, the unit is free from defects and complies with the designated specifications.

The series HMG 3000 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 3000 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 complies with the provisions of the following European directives: EN 61000-6-1 / 2 / 3 / 4.

We reserve the right to make technical modifications.

3.1 Safety information

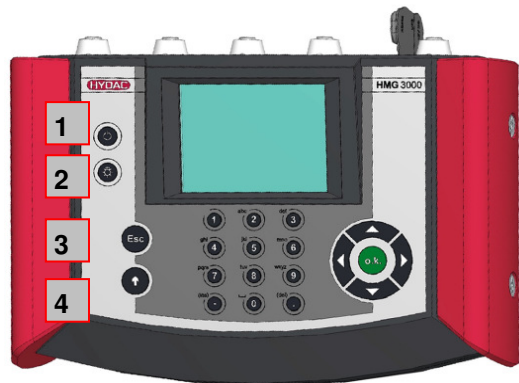
The HMG 3000 series Portable Data Recorder can be operated safely provided it is used in accordance with its proper, designated use. However, in order to avoid any risk to the operator or any damage due to incorrect handling of the unit, please adhere strictly to the following safety instructions:

- The HMG 3000 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 6.1.3 "Zeroing of Measurement Channels".
- If sensors and interfaces are used simultaneously (online measurement), please ensure equipotential (see chapter 6.1.4 "PC Connection").
- The information on the type code label must be noted.
- Troubleshooting and repair work may only be carried out by the HYDAC Service Department.
- All relevant and generally recognised safety requirements must be adhered to.

4 Commissioning

4.1 Operating Elements

- 1** On/Off button
- 2** Brightness setting of the display
- 3** ESC key
To cancel an entry or go **Back** step by step
- 4** Shift key (↑)
Switches the number-pad to a text pad when pressed; the text pad is active only as long as the Shift key is pressed.
- 5** Text/number keypad
Numbers and letters can be entered via the combination keypad similar to that of mobile phones.



Numerals: 0 to 9; "." (decimal separator) and "-" (minus)

Text entry: a, b, c, ... x, y, z and A, B, C, ... X, Y, Z; ins = insert; del = delete;

To insert special characters: shift (↑) + "1" (if necessary, several times for /, %, \$...)

To insert spaces: shift (↑) + ins (simultaneously)

To delete characters: shift (↑) + del (simultaneously)

Line break: shift (↑) + OK (simultaneously)

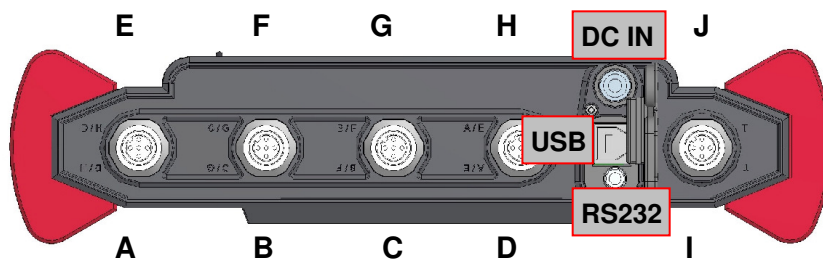
Tip:

- To accept characters:
release the Shift key (↑) or press the right arrow (►) of the 5-way navigation key.
- To jump directly to the function line:
simultaneously press the Shift key (↑) and the down arrow (▼) of the 5-way navigation key.

- 6** **Graphic display**
Display of the menu and operating functions, measured values and curves

- 7** **5-way navigation key**
To navigate step by step in the display: **OK** key for inputting, finishing, accepting or storing an entry

4.2 Ports



Y adapter

A - E 4 sensor input sockets* each with two measurement channels (**channel A – D or E – H**) to connect up to 8 analogue sensors or up to 4 SMART sensors, e.g. for pressure, temperature or flow rate.

B - F The four input sockets can be doubled, if required, by plugging in Y adapters (ZBE 38).

C - G

D - H

I / J 1 input socket for
-2 digital signals, e.g. for frequency or speed measurements (channel I, J)

DC IN Female jack for power supply

USB 1 USB connector for PC communication

RS232 1 serial interface for PC communication

* For overview table of measuring inputs / input signals, see Point 6.5 Technical Specifications

4.3 Switching on the instrument

When starting the unit up for the first time the **Welcome** start-up screen appears. Select your language using the 5-way navigation key (select or checkmark your option by pressing **OK**) and set the date and time. Select the desired format, and then enter the current date and time via the **keypad**. Save your entries by pressing **OK**, followed by **Next**.

The following appears in the display when starting the unit up in normal operation:

- Manufacturer
- Designation of the unit
- HMG version
- Date and time
- Battery charge status

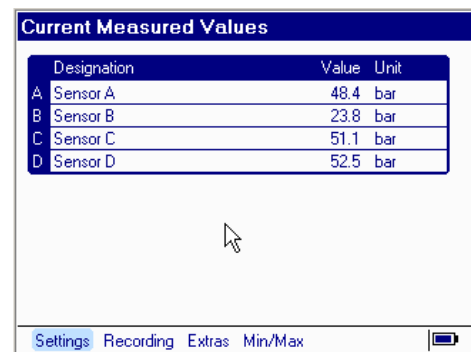
The screen switches to measured value display mode in a few seconds. If sensors are already connected, the current measured values are shown in the **Current Measured Values** menu (see title bar at top of display). To skip through the start-up screen more quickly and proceed directly to the measured values menu, press **Esc** or **OK**.

The following is listed in the measured values screen (see screenshot): Input channel – Designation – Value – Unit (of measurement)

The menu bar at the bottom of the screen (function bar) displays the main menu and next to that, on the right, the battery charge status. The main menu contains the following functions which you can access using the 5-way navigation key (arrow key) plus the **OK** key.

Settings — for entering or retrieving setting data used for performing measurements

Recording — for recording a measurement and graphically rendering measurement data, e.g. as a curve



Note:

As a rule, functions which can be selected and executed are in **blue**.

Functions which can't be selected or altered are in **black**.

Warnings appear in **red** when input data is incorrect.

Extras — for other functions, plus a function for displaying the **Min/Max** values.

Measuring the **Min/Max** values has a special significance and is explained in detail below.

Apart from the current measured values, the HMG records the minimum and maximum values (Min/Max values) too, except when plotting a measurement curve. The minimum value is the lowest value to which a measured variable has dropped during the time period under consideration, the maximum value being the highest value achieved by a measured variable during this period. Resetting causes the Min/Max values to be set to the actual measured value at the time. This will reset all sensors.

The time period always begins when the Min/Max values are reset. The values are reset in the following situations:

- Switching the unit on
- Selecting and activating **Reset** function in the menu bar (only if **Min/Max** is active)
- Connecting or removing an HSI sensor
- Altering the sensor settings
- While recording an event log
- When finishing recording

Before resetting the Min/Max values it is frequently necessary to determine when the Min/Max values were last reset. To do this, go to **Extras** in the function bar and then **About HMG 3000**.

Current Measured Values			
Designation	Value	Unit	
A Sensor A	26.7	bar	
B Sensor B	14.8	bar	
C Sensor C	86.8	bar	
D Sensor D	93.8	bar	
E Sensor E	26.8	bar	

Settings Recording Extras **Min/Max**



Note:

Even when the Min/Max values are not shown in the display, the HMG is nevertheless recording them in the background.

Current Measured Values				
Designation	Value	Unit	Min	Max
A Sensor A	53.7	bar	0.0	100.0
B Sensor B	27.0	bar	4.5	49.5
C Sensor C	1.1	bar	0.0	99.9
D Sensor D	0.6	bar	0.0	100.0
E Sensor E	89.7	bar	0.6	100.0

Settings Recording Extras Min/Max **Reset**

About HMG 3000	
0 Stored recordings: 0 stored configurations 0% Total usage: 0 KB / 31996 KB	
Min/max Values since 11.04.12 14:23:12 6 min., 46 sec.	
Address HYDAC ELECTRONIC GmbH	
Back	

5 Getting Started Guide

This Getting Started Guide outlines the basic steps for conducting a simple measurement (measured values shown in display) and plotting a measurement curve (graph of measured values). The examples involve pressure measurement using 2 pressure transmitters with sensor detection (HSI sensors). For a detailed description of all the settings, see **Detailed Operating Instructions**.

The examples are based on the factory settings of the HMG 3000. Simply follow the steps described here. If you don't know the status of your HMG 3000 because there might be more than one user in your company using the HMG, you can simply restore the unit to its "as supplied" condition (see Manage Settings — Restore Factory Settings).

Preparation for Performing a Measurement

First charge the batteries or connect the power supply as described in **Power Supply**. Two HYDAC HDA 4748-H-0400-000 pressure transmitters with automatic sensor detection are used in the following example.

Example of a Simple Measurement Using Two Pressure Transmitters

Connect the two pressure transmitters hydraulically to your machine and connect the two pressure transmitters using the sensor connector cables, e.g. to sockets A and B of the HMG 3000.

After the HMG 3000 is switched on it jumps to the **Current Measured Values** menu. The function bar contains various functions providing quick access to the three main menus:

- **Settings**
- **Recording**
- **Extras**

and to the display of the

- **Min/Max values.**

gelangen.

Title bar

Current Measured Values		
Designation	Value	Unit
A Sensor A	71.4	bar
B Sensor B	34.7	bar
<div>Settings Recording Extras Min/Max</div>		

Function bar

When HSI sensors with automatic sensor detection are used, the HMG automatically detects the measurement range and the unit of measurement of the two connected pressure transmitters and shows them in the display with the actual measured values. You can also display the minimum and maximum values for the sensors.

To hide or show the Min/Max display, press the right arrow of the 5-way navigation key until **Min/Max** is highlighted in blue and then press the **OK** key. The Min/Max values of the sensors are now also displayed. Press the **OK** key again to hide the Min/Max display.

When the Min/Max values are shown, **Reset** appears in the function bar, enabling you to reset the Min/Max values as required. Select **Reset** using the arrow keys (blue highlight) and then press the **OK** key to reset the Min/Max values.

The measured values can also be displayed in a **7-segment pane**. To do this, go to Settings in the function bar and then press **OK**. In the **Settings** menu, navigate to **Change display settings** using the 5-way navigation key, and then confirm with **OK** (see screenshot of two-pane display on the next page).

Now select the second item, **Measured value rendering**. **Measured value table** is the default setting here. Press **OK**. A **drop-down list** appears in which you navigate to **2 display panels** using the arrow keys, followed by confirming with **OK**. To return to the measured value display press **Esc** twice.

Current Measured Values				
Designation	Value	Unit	Min	Max
A Sensor A	49.7	bar	0.0	100.0
B Sensor B	25.1	bar	4.5	49.5

Settings Recording Extras **Min/Max** Reset

Settings

- Change settings of measurement channels
- Change display settings**
- Zero measurement channels
- Change initial setup
- Administer settings (save, load, ...)

Back

Display Settings

Measured value display Medium

Measured value rendering 2 display panels

Show bar

- Measured value table
- 1 display panel
- 2 display panels**
- 2x2 display panels
- 3x2 display panels
- Set automatically

Back

The HMG now shows the measured values in the 7-segment display panes. Depending on the setting, the Min/Max values are shown in addition to the current measured values.

The **Recording menu** is used for recording measurement curves. During recording, the measured values are recorded for a certain period of time, stored and then shown as a graph.

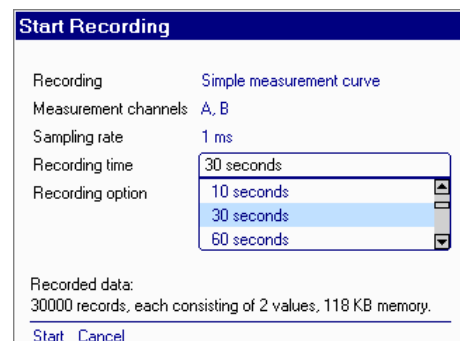
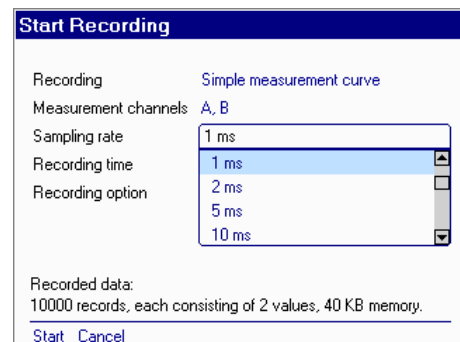
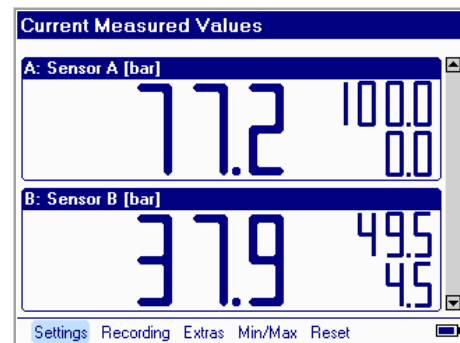
Example of Recording a Measurement Curve:

The function bar of the **Current Measured Values** menu contains the item **Recording**. Select it using the 5-way navigation key, followed by **OK**. In the **Recording** menu that follows, select **Start recording** and confirm with **OK**.

In the menu that follows, **Start Recording**, you are shown the default settings for recording a measurement curve. In our example, we want to generate a **Simple measurement curve** with **two sensors** at channels A and B with a **sampling rate** of **1 ms** and a **Recording time** of 30 s. Then **measurement** must be **finished**.

Simple measurement curve is already set in the menu. For the other settings, proceed as follows:

Using the arrow keys of the 5-way navigation key, select the third item, **Sampling rate**. **OK** opens up a **drop-down list** where you select a sampling rate of **1 ms**, confirm with **OK**. This takes you automatically to the **Recording time** line. Press **OK**. Scroll down the list using the arrow keys to **30 seconds**, and confirm with **OK**.



In the **Recording option** line, select **End when time has elapsed** in the same manner.


Start Recording	
Recording	Simple measurement curve
Measurement channels	A, B
Sampling rate	1 ms
Recording time	30 seconds
Recording option	End when time has elapsed
Recorded data: 30000 records, each consisting of 2 values, 118 KB memory.	
Start Cancel	

In the **Automatic operation** line, select the **Deactivated** option and in the **Magnified section** the **5 second** option.

Your display now shows the settings you made for recording measured values (see screenshot). To double-check your settings, refer to the recorded data selected by you above the function bar.

Start Recording	
Recording	Simple measurement curve
Measurement channels	A, B, C, D
Sampling rate	10 ms
Recording time	10 seconds
Recording option	Record continuously until terminated
Automatic measurement	Deactivated
Magnifier range	5 seconds
Recorded data: 1000 records, each consisting of 4 values, 10 KB memory.	
Start Cancel	

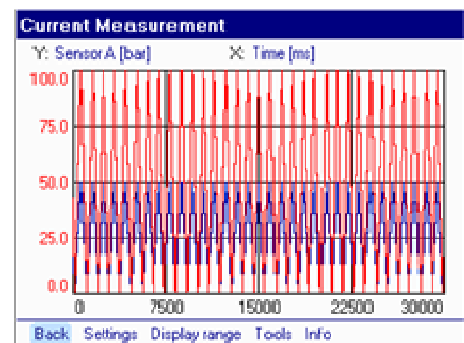
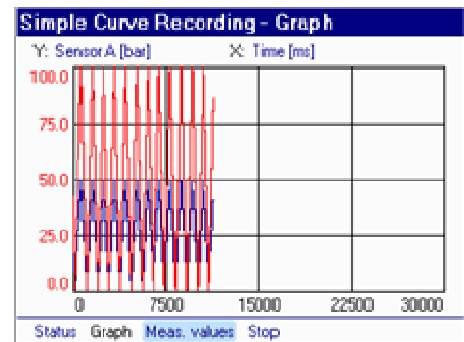
Now you can start recording by pressing **Start** in the function bar + **OK**. A **progress bar** shows you the status of your measurement. The function bar offers you the option of having the measurement curve plotted or the current value shown while recording.

Simple Curve Recording - Status	
Started at	18.09.06 08:30:53
Running since	19 sec.
Saved	19 sec. of 30 sec.
Records	19280 of 30000 (76 KByte)
	
Recording status: Wait for time to elapse.	
Status Graph Meas. values Stop	

Graphic rendering provides a faster visual impression of the changes in the measured values. To have the measurement curve displayed while recording, select **Graph** + **OK**. The screenshot on the right shows you the curve plotted for our example.

When recording is finished, you have the option of saving or discarding the measurement. To save the recording, select **Save** and confirm with **OK**. The HMG automatically assigns a name and a consecutive number, which can also be renamed by you. In our example, accept the name suggested by the HMG and save with **OK**.

You can view any stored recording again or delete it as you like. For more information on this, refer to Detailed Operating Instructions.

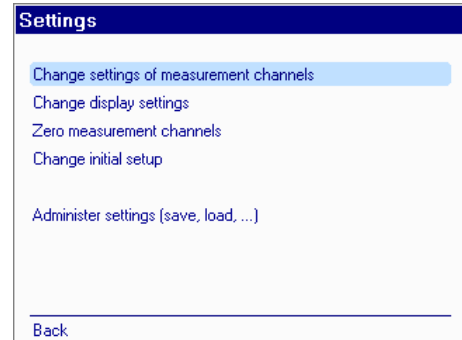


6 Detailed Operating Instructions

6.1 Settings Menu

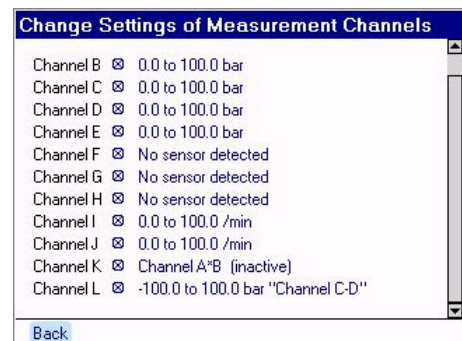
Submenus of the Settings menu:

- Change settings of measurement channels
- Change display settings
- Zero measurement channels
- Change initial setup
- Administer settings (save, load, ...)
- Administer sensor configuration
(not visible unless the configuration of a SMART sensor has been read out, see section 6.4.2.5)



6.1.1 Change settings of measurement channels

Select **Change settings of measurement channels** to obtain a list of all the channels available in the HMG (see screenshot). There is a checkbox next to each of the channels enabling you to switch the input on or off (+ **OK** key). **Activated channels** are marked by an "X". To the right of the checkbox is the **measurement range setting**, the **unit** of measurement, and, as applicable, a **designation** for the sensor, e.g. "System pressure".



The various options available for channels A to H are demonstrated here using channel A as an example. Select the **measurement range entry** on the right of the channel using the navigation keys and press **OK**. This takes you to the menu window for the selected channel.

To enter a **designation**, press **OK** again and then enter it in the box using the combination keypad, followed by **OK**.

In the **Mode** menu you now have the option of **Automatic detection (HSI)** and **Manual**. The **Automatic detection (HSI)** option is used for HYDAC sensors which have automatic sensor detection. The **Manual** setting is used for adapting sensors with standard analogue signals (e.g. 4 - 20 mA) to the HMG.

However, there are applications for which it is useful to enter settings manually, also in the case of HSI sensors with sensor recognition. For example, by entering settings manually for a pressure measurement, you can have physical variables displayed which are proportional to the pressure, e.g. force.

Manual mode also provides the following further settings:

- **Input signal**
- **Upper and lower measurement range**
- **Unit (of measurement)**
- **Decimal format**

As soon as you select one of these items, a drop-down list appears or a box appears for entering your settings.

Channel A

Designation: system pressure

Mode: Automatic detection (HSI)

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Channel A

Designation: system pressure

Mode: Manual

Back

Channel A

Designation: system pressure

Mode: Manual

Input signal: HSI (HydacSensorInterface)

Lower measurement range: 0

Upper measurement range: 100

Unit: bar

Decimal format: 1 decimal place

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Channel A

Designation: system pressure

Mode: Manual

Input signal: HSI (HydacSensorInterface)

Lower measurement range: 0 to 20 mA

Upper measurement range: 4 to 20 mA

Unit: 0 to 5 V

Decimal format: 0 to 10 V

0.5 to 4.5 V

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For **Input signal** you can choose between HSI (HYDAC Sensor Interface) and various standard analogue signals in the drop-down list (using the arrow keys). To set the **Lower** and **Upper** measurement range, enter the relevant limits via the combination keypad.

A drop-down list is also provided for selecting the **Unit** (of measurement). You also have the option of defining your own unit with **other** (top line of the drop-down list). The cursor then jumps to the **input box** and a small **triangular arrow** appears as the **insertion point**. Enter the new unit using the combination keypad, e.g. "kPa" for kilopascal.

To enter additional characters, move the triangle insertion point to the desired position and enter the characters. Confirm your entry with **OK** so that your unit of measurement is stored.

Decimal format: Here you can specify how many decimal places are to be used when recording and displaying the measured values.

In addition to the settings described above, Channel B has two further measurement options. In the **Mode** drop-down menu you now also have the menu options **Pressure difference dP** and **Orifice measurement $Q=f(dP)$** . With **Pressure difference dP** the HMG 3000 gives you the opportunity to display the difference in pressure between channel A – channel B with a very high degree of accuracy. This can be used, for example, to determine if a filter is clogged, by measuring the pressure differential.

Channel A

Designation	system pressure
Mode	Manual
Input signal	HSI (HydacSensorInterface)
Lower measurement range	20
Upper measurement range	100
Unit	bar
Decimal format	1 decimal place

Back

Channel A

Designation	system pressure
Mode	Manual
Input signal	HSI (HydacSensorInterface)
Lower measurement range	20
Upper measurement range	100
Unit	kPa
Decimal format	other

Back

Channel A

Designation	system pressure
Mode	Manual
Input signal	HSI (HydacSensorInterface)
Lower measurement range	20
Upper measurement range	100
Unit	kPa
Decimal format	2 decimal places

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Channel B

Designation	
Mode	Pressure difference dP

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The function **Orifice measurement** **$Q=f(dP)$** enables you to carry out a flow rate measurement by measuring the differential pressure at a flow rate measurement orifice (e.g. HYDAC EVS 1000).

For both these modes HYDAC HSI pressure transmitters with the same measurement range must be connected to channel A and channel B. The differential measurement range is produced automatically, being $\pm 10\%$ of the measurement range of the pressure transmitters connected. The accuracy of the HSI pressure transmitters is $\leq \pm 0.5\%$ FS.

This means that one 100 bar pressure transmitter might measure 50 bar pressure as being 49.5 bar, and another might measure it as 50.5 bar. These pressure transmitter errors can be compensated for by recording a correction curve.

After correctly recording a curve, the accuracy for differential measurement is $\leq \pm 0.1\%$ of the differential measurement range.

Example:

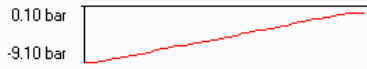
For both 100 bar pressure transmitters there is a differential measurement range of -10 – +10 bar, in other words a measurement margin of 20 bar. The accuracy of $\leq \pm 0.1\%$ refers to this measurement margin. The pressure differential can therefore be measured with an accuracy of $\leq \pm 0.02$ bar.

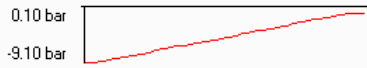
To measure a **pressure difference**, select the item **Pressure differential dP**. Then you find a menu point **Organise curves**. Here you can plot up to 3 curves for 3 pressure transmitter pairs. If a curve for a pressure transmitter combination already exists, you can quit the menu again by selecting **Back** or the **Esc** key. The HMG 3000 automatically selects the appropriate curve. If you quit the menu and the HMG 3000 detects that no curve exists for this combination, you will get the message shown on the right. You can now, with less accuracy, measure the differential or you call the menu item again to record a new curve under **Organise curves**.

Once **Organise curves** is selected, a screen appears which allows you to record a new curve, or you see information on curves which already exist. At this point you can also delete existing curves if they are no longer required. If curve 1 already exists, navigate to this field and press the **OK** key. You can now, for example, select **Characteristic curve 2, Not available** and then record a curve. To record the curve you must connect both pressure transmitters to the HMG 3010 at channel A and channel B.

Channel B	
Designation	Sensor B
Mode	Pressure difference dP
Organise curves	
Back	

Channel B	
Designation	Sensor B
Mode	Pressure difference dP
Organise curves	
No suitable curve was found. Measurements from Channel B might possibly be inaccurate	

Organise curves	
Characteristic curve 1, 0.0..100.0 bar	
Recorded on:	18.09.06 13:06:50
Range:	0.0..100.0 bar
Sensor A:	(Part no./Ser.): 123456 / 1
Sensor B:	(Part no./Ser.): 123456 / 2
	
Back Delete characteristic curve	

Organise curves	
<div> <div>Characteristic curve 1, 0.0..100.0 bar</div> <div> <div>Characteristic curve 1, 0.0..100.0 bar</div> <div>Characteristic curve 2, Not available</div> <div>Characteristic curve 3, Not available</div> </div> </div>	
Sensor A:	(Part no./Ser.): 123456 / 1
Sensor B:	(Part no./Ser.): 123456 / 2
	
Back Delete characteristic curve	

When doing this, identify which pressure transmitter has been connected to channel A and which to channel B, since the pressure transmitters must be re-connected in the same way later when taking measurements.

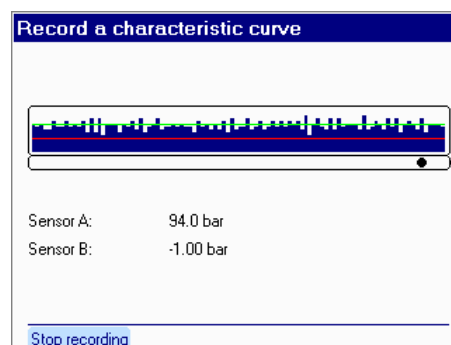
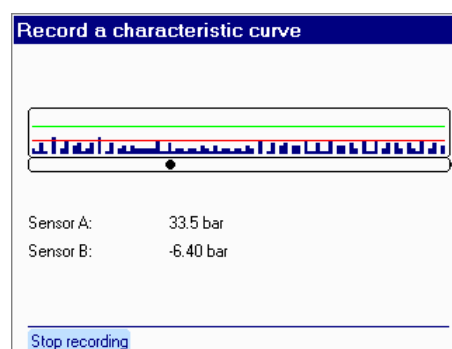
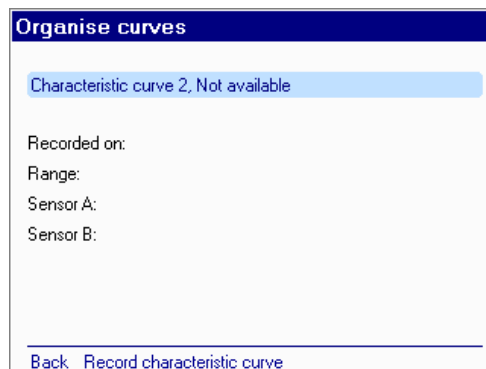
Connect the pressure transmitter hydraulically so that the two instruments are subjected to the same pressure. The ideal for recording curves is connecting to a test rig on which you can increase the pressure slowly from 0 bar to the full measurement range of the pressure transmitter and back again.

However, the minimum requirement is to record the curves/measured values in the pressure range in which the differential measurement is to take place later.

In the example above (to measure the filter contamination level) both pressure transmitters might be fitted to the inlet side of the filter, e.g. using T-fittings and then, with the machine running, the curve could be recorded.

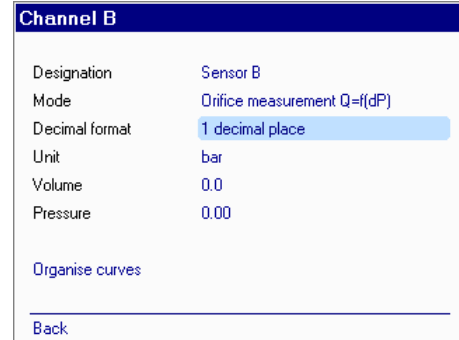
When these pre-conditions are in place, select **Record characteristic curve**. This brings up a display showing 0 to 100% of the whole measurement range. If you increase the pressure you will see from the blue bar that measured values are being recorded in this pressure range.

If the measured values remain under the red line, this means that not enough values have been recorded in this range. To achieve maximum accuracy for differential measurement, the recorded measured values should at least be in the area between the red and the green line. After this, select **Stop recording** and you can quit the menu. The curve is now automatically taken into account for the differential measurement using these two pressure transmitters.



In order to measure the flow rate using a differential pressure measurement at a flow rate orifice, select the item **Orifice measurement $Q=f(dP)$** . Then select the number of decimal places and the unit (of measurement).

A flow rate orifice is supplied with information showing the correlation between pressure differential and flow rate. For example, on a HYDAC EVS 1000 it says: calibration factor 4.87 bar at 350 l/min. Enter these values under the flow rate and pressure.



The screenshot shows a configuration menu for 'Channel B'. It contains the following settings:

Channel B	
Designation	Sensor B
Mode	Orifice measurement $Q=f(dP)$
Decimal format	1 decimal place
Unit	bar
Volume	0.0
Pressure	0.00
Organise curves	
Back	

Here again the menu **Organise curves** appears, (for a function description and handling, see **Pressure differential dP** above). Curve recording can be carried out exactly as described above.

If you are using a HYDAC EVS 1000 flow rate measurement orifice, you can also use this to record curves. On the EVS 1000 there are 2 pressure ports before the orifice (ports 1 and 2) and one after (port 3).

To make a recording, connect the pressure transmitter from channel A to port 1, and the one from channel B to port 2. To start measurement all you need is to change the pressure transmitter from port 2 to port 3.

Input channels I and J are for digital (not analogue) signals. As the input signal you can choose between **Count pulses** and **Frequency signal**. There are many possibilities for this, e.g. speed sensors, proximity switches, pulse generators, flow rate measuring instruments with a frequency signal, HYDAC HDS 1000, to name only a few. As in the case of the analogue sensor inputs, settings can be manually entered for the input signal, unit of measurement and decimal format.

In addition to these settings, a **factor** has to be entered which is required for conversion to the desired unit of measurement.

Another special feature is that the **Upper measurem. range** must be input. Frequencies of up to 30000 Hz can be measured on channels I and J, consequently a scale from 0 to 30000 is possible in the graphical display. If, for example, you record a speed of up to 1450 rpm, an awkward Y-axis scale will result in the graph. If you enter "1500" as the **Upper measurement range** for this speed measurement, for example, the Y-axis in the graph will be scaled from 0 to 1500 rpm.

Channel J	
Designation	
Input signal	Frequency signal
Unit	Count pulses
Factor	Frequency signal
Upper measurem. range	100
Decimal format	1 decimal place
Back	

Channel J	
Designation	
Input signal	Frequency signal
Unit	/min
Factor	Hz
Upper measurem. range	kHz
Decimal format	/min
Back	

Channel J	
Designation	
Input signal	Frequency signal
Unit	Hz
Factor	1
Upper measurem. range	1500
Decimal format	1 decimal place
Back	

In this case the reason for inputting the upper measurement range is just a means of limiting the scale of the Y-axis in the graphical display. You should set this value as close as possible to that of the expected measured value in order to get the best possible graphical display.

If there are measured values higher than the upper measurement range, these are not lost. The scale of the Y-axis can be changed again in the graph at any time later on.

Caution!

The measurement range of the frequency entries is 1 Hz to 30000 Hz. If, for example, the rpm of a motor is recorded and this motor stops abruptly, the last rpm can still show in the display for up to 2 seconds, depending on the measurement system, before 0 is displayed.



Examples of frequency measurements:

1) You would like to measure a frequency up to 1000 Hz. Frequencies are recorded by the HMG per minute. Enter "60" as the **Factor** to display the frequency in **Hz**, enter "1000" for the **Upper measurem. range** to scale the Y-axis from 0 to 1000 in the graphical display.

2) You would like to measure the speed of a machine from 0 to 2900 rpm, the speed sensor supplies 2 pulses per revolution. Enter "2" as the **Factor** and "3000" as the **Upper measurem. range**. The display is then in revolutions per minute; for the graphical display, the Y-axis is scaled from 0 to 3000.

3) A flow rate measurement transmitter in a measurement range up to 450 l/min with a frequency output supplies 8 pulses per litre. Enter "8" as the **Factor** and "500" as the **Upper measurem. range**. The display is then in l/min; for the graphical display, the Y-axis is scaled from 0 to 500.

Examples of count pulses:

1) The switching output of a proximity switch on a conveyor belt is connected to the frequency input of the HMG 3000. Enter "1" as the **Factor** and the expected maximum quantity to be counted (maximum 30000) as the **Upper measurem. range**.

2) A gear flow meter supplies 250 pulses per liter. Enter "250" as the **Factor** and as the **Upper measurement range**, the maximum no. of litres expected (maximum 30000).

Channel J	
Designation	Frequency
Input signal	Frequency signal
Unit	Hz
Factor	60
Upper measurem. range	1000
Decimal format	No decimal places
Back	

Channel J	
Designation	r.p.m.
Input signal	Frequency signal
Unit	/min
Factor	2
Upper measurem. range	3000
Decimal format	No decimal places
Back	

Channel J	
Designation	Flow rate
Input signal	Frequency signal
Unit	/min
Factor	8
Upper measurem. range	500
Decimal format	No decimal places
Back	

Channel J	
Designation	Count pulses
Input signal	Count pulses
Unit	pieces
Factor	1
Upper measurem. range	30000
Decimal format	No decimal places
Back	

Channel J	
Designation	Count pulses
Input signal	Count pulses
Unit	liter
Factor	250
Upper measurem. range	30000
Decimal format	No decimal places
Back	

If you have selected counter pulses as the input signal, and have returned to the normal measurement value display, you will find on the far right of the function bar a **symbol**, as shown in the screenshot. The counter is currently stopped. If you select the **symbol** using the arrow key and confirm with **OK**, the counter is reset and will start again. To stop it, select the **symbol** again using the arrow keys and confirm again with **OK**.

In addition to the input channels (channels A to channel J) there are also the virtual channels **Channel K** and **Channel L** available. These two channels can be used to display a differential between 2 input channels, or to calculate a power.

When setting to **Differential** the HMG 3000 calculates for channel K the difference between channel A/channel B and for channel L the difference between channel C/channel D. To measure the differential, sensors with the same measurement range, unit (of measurement) and number of decimal places must be used on the input channels. These parameters are then automatically adapted to channel K or L, i.e. no further settings are necessary.

If you would like to measure **Power (P*Q)**, via channel K, the pressure must be measured at channel A and the flow rate must be measured at channel B. To measure the power via channel L you have to measure the pressure at channel C and the flow rate at channel D. You can then select kW, PS or hp as the **unit (of measurement)**.

Entering the **upper measurement range** merely limits the scale of the Y-axis in the graphical display.

Current Measured Values		
Designation	Value	Unit
A Sensor A	13.2	bar
B Sensor B	9.0	bar
C Sensor C	29.9	bar
D Sensor D	17.3	bar
E Sensor E	98.6	bar
J Count pulses	0	liter

Settings Recording Extras Min/Max

Channel K

Designation

Mode

Power p*Q

Differential

Power p*Q

Back

Channel K

Designation

Mode

Differential

Back

Channel K

Designation

Mode

Unit

Upper measurem. range

Decimal format

Power p*Q

kW

100

1 decimal place

Back

You should set this value as close as possible to that of the expected power value in order to get the best possible graphical display. If there are measured values which are higher than the upper measurement range, these are not lost. The scale of the Y-axis can be changed again in the graph at any time later on.

This brings you back again to the display shown on the right. In the example, a power is shown at channel K, and the difference at channel L.

If you have made an invalid setting, or you have connected 2 sensors with different measurement ranges for the differential, for example, the relevant calculated channel is deactivated. In the example, a pressure transmitter with measurement range of 0-100 bar has been connected to channel C and a pressure transmitter with a measurement range of 0-250 bar has been connected to channel D. Therefore channel L would be automatically deactivated.

Change Settings of Measurement Channels	
Channel B	<input checked="" type="checkbox"/> 0.00 to 300.00 l/min
Channel C	<input checked="" type="checkbox"/> 0.0 to 100.0 bar
Channel D	<input checked="" type="checkbox"/> 0.0 to 100.0 bar
Channel E	<input type="checkbox"/> Switched off
Channel F	<input checked="" type="checkbox"/> No sensor detected
Channel G	<input checked="" type="checkbox"/> No sensor detected
Channel H	<input checked="" type="checkbox"/> No sensor detected
Channel I	<input type="checkbox"/> Switched off
Channel J	<input type="checkbox"/> Switched off
Channel K	<input checked="" type="checkbox"/> 0.0 to 100.0 kW "Channel A*B"
Channel L	<input checked="" type="checkbox"/> -100.0 to 100.0 bar "Channel C-D"

Back

Change Settings of Measurement Channels	
Channel B	<input checked="" type="checkbox"/> 0.00 to 300.00 l/min
Channel C	<input checked="" type="checkbox"/> 0.0 to 100.0 bar
Channel D	<input checked="" type="checkbox"/> 0.00 to 250.00 bar
Channel E	<input type="checkbox"/> Switched off
Channel F	<input checked="" type="checkbox"/> No sensor detected
Channel G	<input checked="" type="checkbox"/> No sensor detected
Channel H	<input checked="" type="checkbox"/> No sensor detected
Channel I	<input type="checkbox"/> Switched off
Channel J	<input type="checkbox"/> Switched off
Channel K	<input checked="" type="checkbox"/> 0.0 to 100.0 kW "Channel A*B"
Channel L	<input checked="" type="checkbox"/> Channel C-D (inactive)

Back

6.1.2 Change display settings

The next submenu of the **Change Display Settings** item enables you to make settings affecting the display and rendering of measured values and the display size in keeping with your measurement task. Select the item using the arrow keys, followed by **OK**.

When selecting **Measured value display**, a drop-down list appears enabling you to choose the rendering speed:

- Fast
- Medium
- Slow
- Delayed

Make your selection, followed by **OK**.

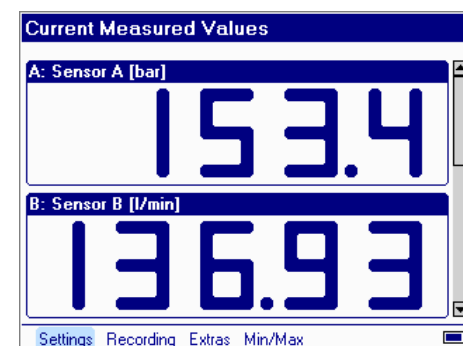
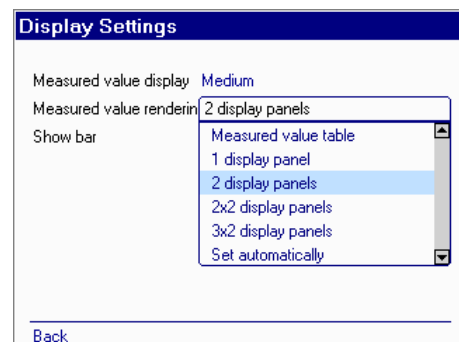
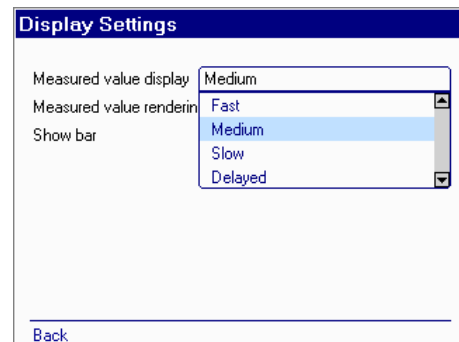
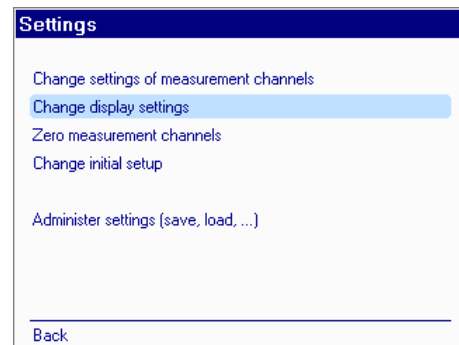


Note!

The settings for displaying the measured value has no impact on the measurement itself. It is just to make the display easier to read, e.g. during pulsations.

For **Measured value rendering** you can choose between the measured value table and various 7-segment display formats (*1 display panel, 2 display panels, ..., Set automatically*).

When selecting **Set automatically**, the HMG automatically searches for the optimal rendering. When two sensors are connected and activated, the display looks like this screenshot.



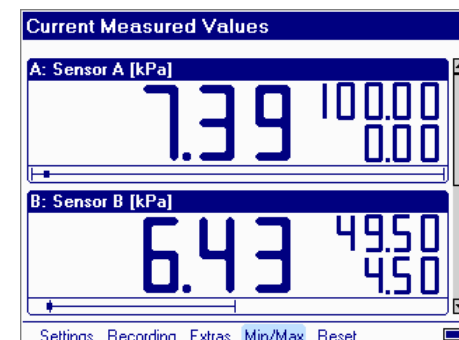
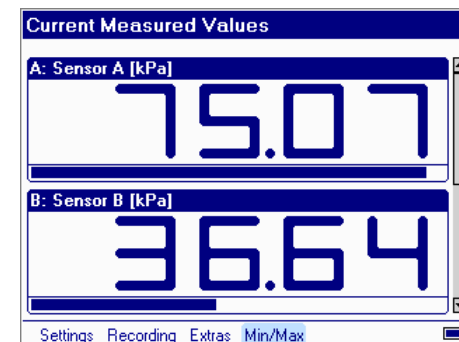
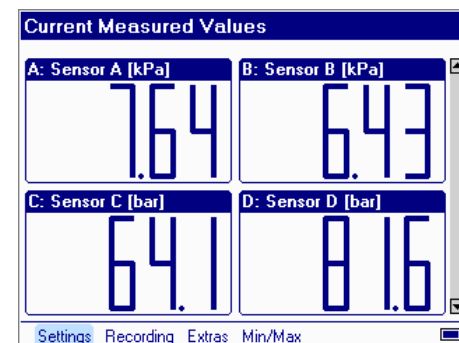
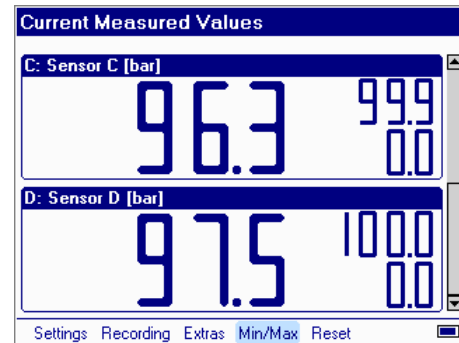
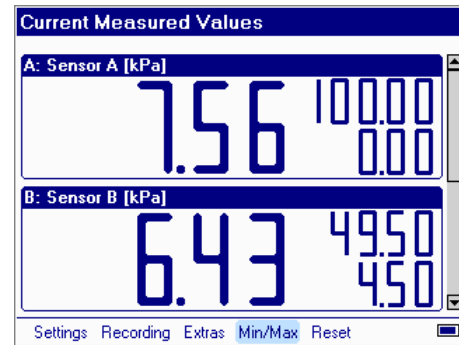
The screenshots on the right show the measured values of **four sensors** when the **2 display panels** option is selected and the Min/Max display is activated. Consequently, the display only shows the measured values of two sensors at a time. Use the arrow keys (▲) and (▼) to see the measured values of the other two sensors.

In order to display the measured values of **4 sensors** simultaneously, you need to select the **2x2 display panels** option (cf. screenshot).

In the third line of the **Display Settings** menu there is a **Yes/No** option next to **Show progress bar**. Yes causes the progress bar to be shown in the measured value display. The appearance of the display may vary according to what settings have been made for rendering the measured values.

The overall width of the respective progress bar corresponds to 0% – 100% of the measurement range. The progress bar shows the position of the current measured value in the overall measurement range. Showing the Min/Max values causes the display to be altered. The current measured value is now shown by a dot and the length of the progress bar shows the range from Min to Max. No causes the progress bar to be switched off.

Back takes you back to the **Settings** menu.



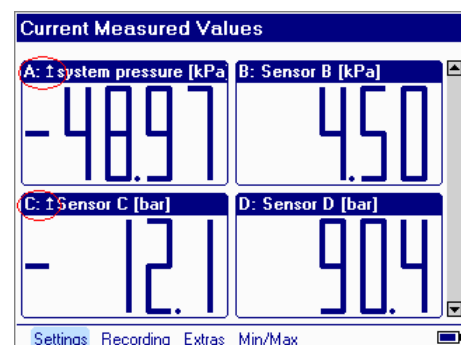
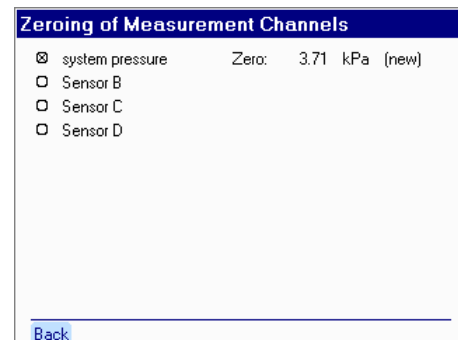
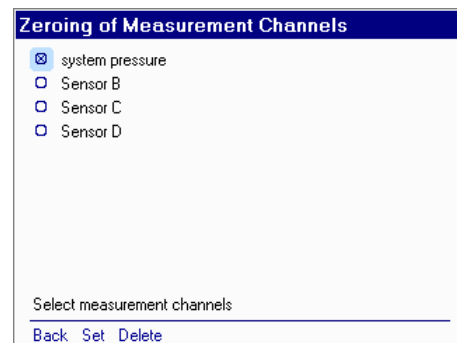
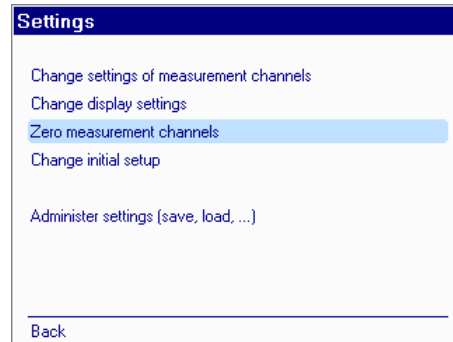
6.1.3 Zeroing Measurement Channels

You can re-zero the measurement channels in the Settings menu. This function is used to mask out backpressure buildups present in the system. For example, if a pressure of 3 bar is present at a pressure transmitter despite the fact that the system has been switched off, this value can be used as the new zero point for display purposes.

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

In the **Settings** menu, select **Zero measurement channels**, and then confirm with **OK**. The screen on the right appears. You are now prompted to select a measurement channel. Select the channel (checkbox) which you would like to zero using the arrow keys, and then confirm with **OK**. Then select **Set** followed by **OK** — you have zeroed the channel. You can delete the changed zero point by pressing **Delete**.

All measurement channels which have been re-zeroed are indicated by an arrow in front of their designation for safety reasons (see screenshot).



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 so may result in serious injury or death!

Switching the HMG unit or measurement channels OFF/ON doesn't automatically delete the newly set zero point. The following message is shown when switching the HMG off and then back on:

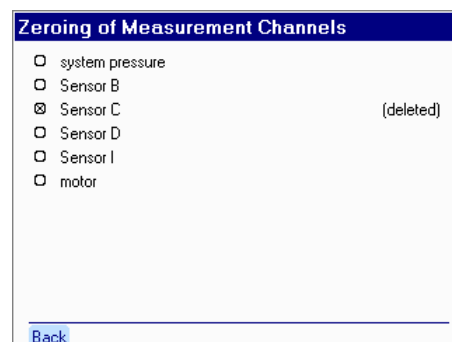
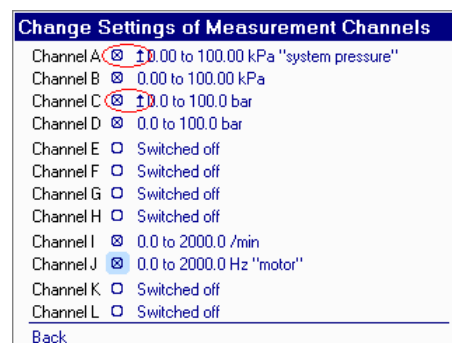
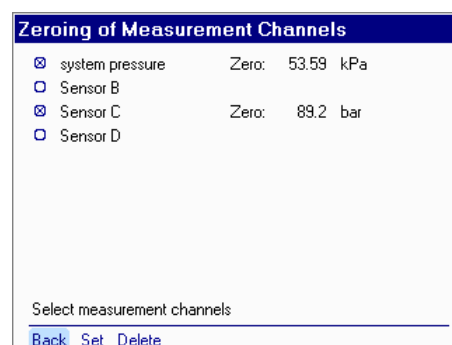
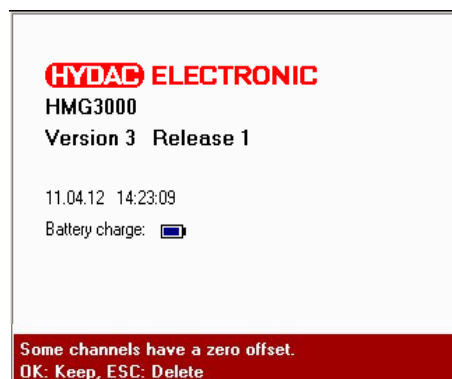
**"Some channels have a zero offset."
Press OK to retain the zero offset or
"Esc" to delete it.**

To determine the extent of a zero offset which has been set, go to the **Settings** menu (**OK**) and select **Zero measurement channels** (**OK**). This brings up a list of all the channels which are active. Channels with a zero point adjustment are **checkmarked**. The value of the **zero offset** is shown on the right.

Any zero offset is also shown in the measurement channel list by way of a small arrow in front of the measurement range. To find it, go to the **Settings** menu, then **Change Settings of Measurement Channel** (**OK**).

There is one exception where the zero offset 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 zero offset was set. This means that the zero offset 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.

When the zero offset is automatically deleted, a message to this effect appears in the display for two seconds.



6.1.4 Change initial setup

Change initial setup is a submenu of the **Settings** menu.

To make changes to the initial setup, press **OK**. You can now change the following items:

Language

You can choose between German, English and French.

- Select your language using the arrow keys, followed by **OK**.

Setting/Correcting the Date and Time Various format options are offered depending on the language selected by you and the associated regional formatting applicable to the date and time. Make your selection, followed by pressing **OK**. Then enter the current date and time via the **numerical keypad** and save your entries via **OK**.

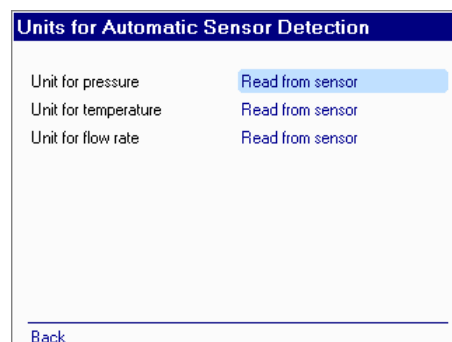
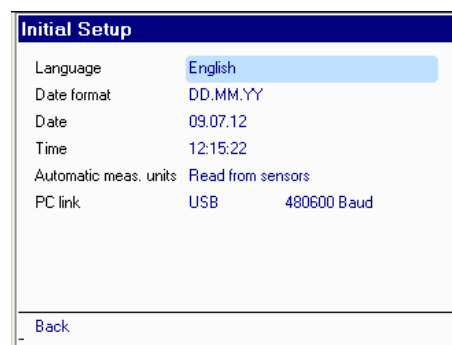
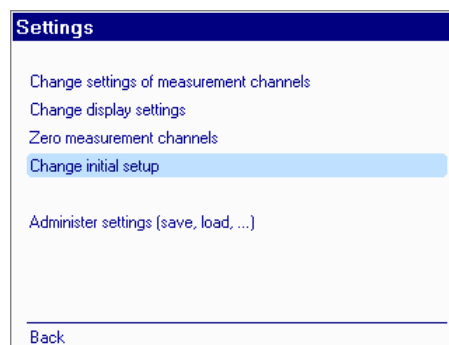
- Save by pressing **OK**.

Automatic Measurement Units

This subitem refers only to HSI sensors with automatic sensor detection. When the sensors are connected, the unit of measurement of the sensor is read out and automatically adopted.

If, for example, you want all pressure transmitters with automatic sensor detection to show psi readings, you can make this setting here.

For a connected 0 ... 100 bar pressure transmitter, the HMG then shows the measured values in a measurement range of 0 ... 1450 psi, i.e. the measurement range and the unit of measurement are automatically converted.



**Note!**

Automatic conversion of measured values to the selected unit of measurement will not work unless **Automatic detection (HSI)** mode is selected under **Settings – Measurement Channel Settings**.

Select the unit of measurement to be changed, followed by **OK**. Select the new unit of measurement desired from the drop-down list by pressing **OK**.

In the list of measurement channels, the measurement range for this channel is now shown in 0 ... 1450 psi instead of in 0 ... 100 bar, for instance.

In the **current measured values display** the measured values show psi readings (listed after the channel or sensor designation).

Units for Automatic Sensor Detection

Unit for pressure psi
 Unit for temperature Read from sensor
 Unit for flow rate bar
 psi
 MPa

Back

Change Settings of Measurement Channels

Channel A ☒ 0 to 1450 psi "system pressure"
 Channel B ☒ 0 to 1450 psi
 Channel C ☒ 0 to 1450 psi
 Channel D ☒ 0 to 1450 psi
 Channel E ☐ Switched off
 Channel F ☐ Switched off
 Channel G ☐ Switched off
 Channel H ☐ Switched off
 Channel I ☒ 0.0 to 2000.0 /min
 Channel J ☒ 0.0 to 2000.0 Hz "motor"
 Channel K ☐ Switched off
 Channel L ☐ Switched off

Back

Current Measured Values

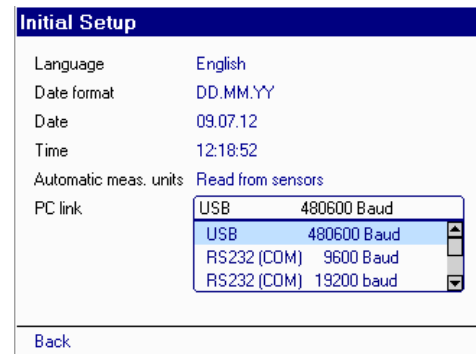
A: system pressure [psi] 967	B: Sensor B [psi] 484
C: Sensor C [psi] 1073	D: Sensor D [psi] 1201
I: Sensor I [/min] 0.0	J: motor [Hz] 0.0

Settings Recording Extras Min/Max

PC Link

The **HMGWIN 3000** and **CMWIN** software enables you to make online measurements and settings in the HMG 3000, in addition to further processing, archiving, documenting and updating etc. Data transfer generally takes place via the USB port.

You can also transfer data to the PC via the HMG's serial port. To do this, select the **RS232(COM)** setting along with the requisite baud rate.



The screenshot shows the 'Initial Setup' window with the following settings:

Initial Setup	
Language	English
Date format	DD.MM.YY
Date	09.07.12
Time	12:18:52
Automatic meas. units	Read from sensors
PC link	<div>USB 480600 Baud</div> <div>USB 480600 Baud</div> <div>RS232 (COM) 9600 Baud</div> <div>RS232 (COM) 19200 baud</div>
Back	



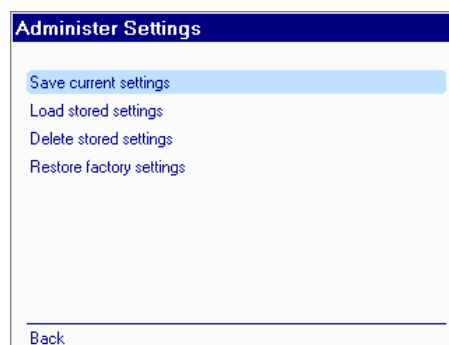
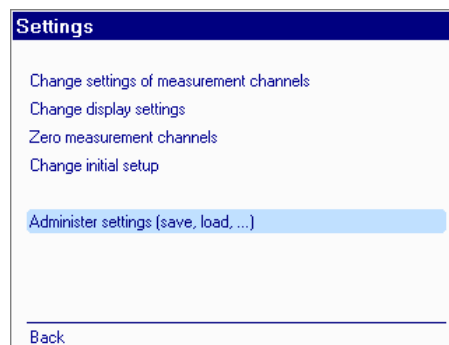
Ground potential of the sensor ports and interfaces (USB/serial) are connected galvanically. If sensors and interfaces are used simultaneously (online measurement), please ensure equipotential bonding to avoid transient currents between the electricity grids with different ground potential via HMG, as the device could be destroyed.

6.1.5 Administer settings (save, load, ...)

All of the measurement channel settings made by you in the HMG for the last measurement can be saved and then reloaded later in order to be able to repeat the same measurement periodically, for example.

You can also delete individual stored settings or restore the factory settings.

Select **Settings (save, load, ...)**, press **OK**, and now proceed to the **Settings** menu with its four submenus (see screenshot).

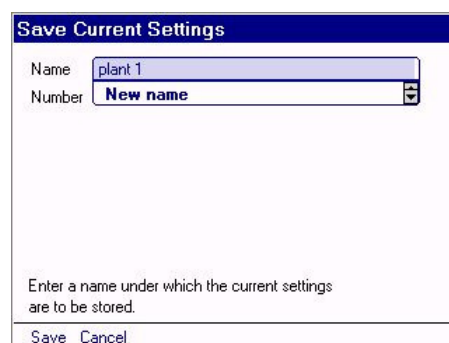
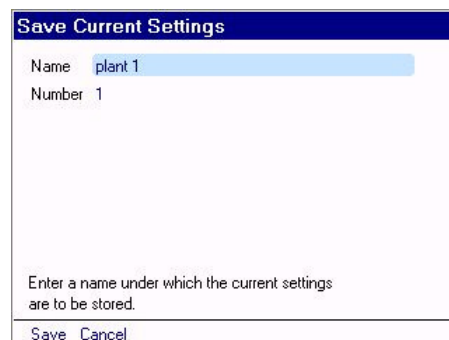


When you confirm **Save current settings** with **OK**, you see the name of the setting saved last, or **No Name** if nothing was saved. Confirm with **OK**, and you are shown a list of all the saved settings and/or the option of entering a new name. Select **New Name** and enter a name using the combination keypad.

Press **OK** x 2 to save the new name and to return to the **Settings** menu.

The HMG automatically assigns a consecutive number, which can also be changed by you.

The HMG automatically assigns the next highest unused consecutive number, which is always unique. Any gaps in the list of numbers are not filled.



In the submenus **Load stored settings** or **Delete stored settings**, you are shown a list of all the saved settings from which you can **Load** or **Delete** individual settings.

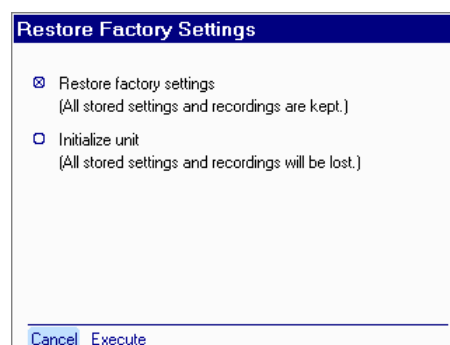
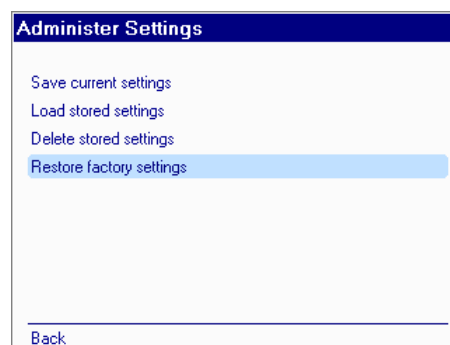
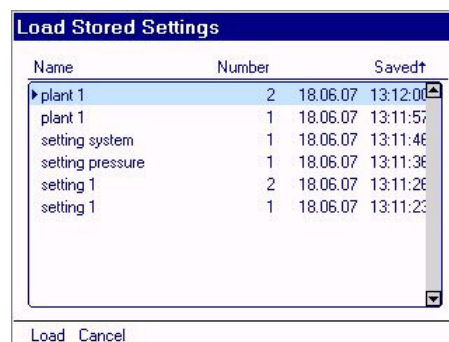
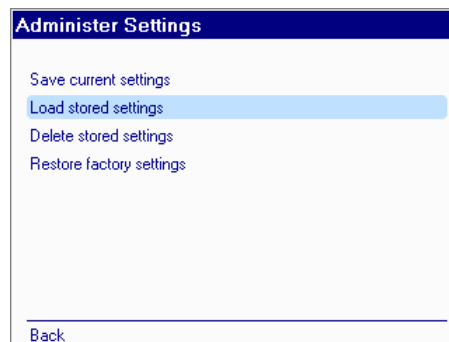
Navigate to a setting using the arrow keys and highlight using **OK**. The item "activated" jumps into the function bar, enabling you to accordingly **Load** or **Delete** the setting.

You can restore your HMG to the original factory settings by selecting **Restore factory settings** (see right).

Confirm **Restore factory settings** with **OK** and the menu following offers you two options. Select the required function (checkbox) followed by **OK** and execute the option via the **Execute** command in the function bar.

Caution

Initialise unit will delete all of the stored settings and recordings; the **Welcome** startup screen appears, similar to when turning the unit on for the first time.



6.2 Recording Menu

Here the HMG enables you to perform a measurement for a specific period of time and save it. This recording can be rendered as a graph or a table. To do this, proceed as follows: To access the recording menu, go to the **Current Measured Values** menu, then select **Recording** in the function bar at the bottom. In the **Recording** menu that follows, select **Start recording**, **View recording** or **Delete recordings**, using navigation keys and confirm with **OK**.

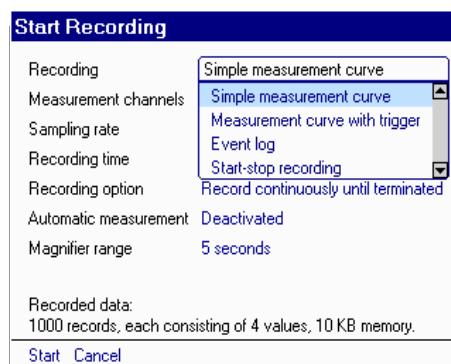
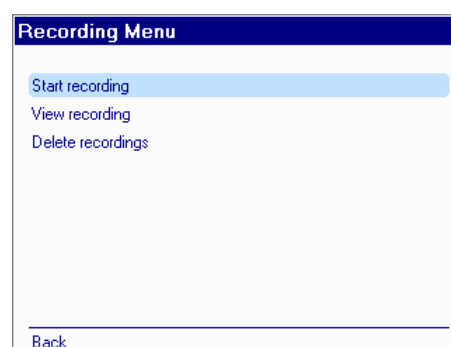
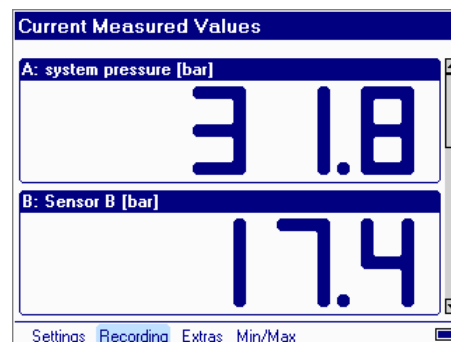
6.2.1 Aufnahme starten

The **Start recording** option takes you to a menu which lists the individual measurement parameters which can be set for making a recording. When selecting the first item, **Recording**, a drop-down list appears in which you can choose between **Simple measurement curve**, **Measurement curve with trigger** or **Event log**. Select appropriate recording option followed by **OK**.

Select **Simple measurement curve** to make additional parameter settings:

Measurement channels

The active measurement channels are shown here. Confirm with **OK**. You now proceed to the **Change Settings of Measurement Channels** menu. All of the settings you can make here are described in detail in the **Changing the Settings of the Measurement Channels** section of **Settings Menu**. Before starting your recording you can now also decide whether you want to switch off individual channels (X = "off").



Caution!

Don't forget to reactivate the measurement channels after completing your measurement, assuming they are still needed.

Sampling rate

This item enables you to set the rate at which the HMG reads a measured value from the sensors and saves it in the internal memory. A measurement curve may comprise up to 500,000 measured values. Selecting 1 ms, for example, means that 1000 measured values per second are taken and saved for each connected measurement channel.

Use the arrow keys (▲) and (▼) to scroll through the various settings for the sampling rate. At the bottom of the display you see information on the resulting recorded data (number of data records and memory usage). If you select an invalid setting, meaning that the sampling rate selected by you would exceed the 500,000 maximum, you are shown a message in lieu of the recorded data describing the invalid setting made by you.

The sampling rate selected depends primarily on the measurement task at hand. A sampling rate of 1 s is probably sufficient for monitoring the temperature in a hydraulic tank, as temperature changes generally progress slowly. If, however, you want to track extremely rapid system-induced pressure surges, which generally occur in the milli-second range, you have to work with a sampling rate of 1 ms or less. HYDAC HSI pressure transmitters with automatic sensor detection are capable of tracking rectangular pressure pulses (theoretically occurring in a time of 0 s) less than 0.5 ms apart.

This means that simply setting a sampling rate of 0.1 ms is not sufficient to capture pressure surges occurring faster than 0.5 ms apart. A suitable dynamic pressure transmitter also has to be used.

Start Recording	
Recording	Simple measurement curve
Measurement channels	A, B
Sampling rate	1 ms
Recording time	1 ms
Recording option	2 ms
	5 ms
	10 ms
Recorded data: 10000 records, each consisting of 2 values, 40 KB memory.	
Start Cancel	

Start Recording	
Recording	Simple measurement curve
Measurement channels	A, B, C
Sampling rate	0.1 ms
Recording time	0.1 ms
Recording option	0.2 ms
	0.5 ms
	1 ms
Sampling rate too small for no. of measurement channels. Max. 2 meas. channels possible for 0.1 ms, 4 for 0.2 ms.	
Start Cancel	

Start Recording	
Recording	Simple measurement curve
Measurement channels	A, B
Sampling rate	1 ms
Recording time	10 seconds
Recording option	End when time has elapsed
Recorded data: 10000 records, each consisting of 2 values, 40 KB memory.	
Start Cancel	

The sampling rate which can be set is also dependent on the active measurement channels:

- 0.1 ms max. 2 analogue input channels
- 0.2 ms max. 4 analogue input channels
- 0.5 ms all 10 input channels
- 1.0 ms for SMART sensors

Recording time

A drop-down list appears when this item is selected. Using the arrow keys (▲) and (▼) you can select a recording time of between 1 second and 24 hours, followed by **OK**.

Similar to when changing the Sampling rate, information is shown at the bottom of the display pertaining to the recorded data showing you the result of your setting.

The screenshot shows the 'Start Recording' menu with the following settings:

- Recording: Simple measurement curve
- Measurement channels: A, B, C, D
- Sampling rate: 10 ms
- Recording time: 10 seconds (selected in a dropdown list)
- Recording option: 2 seconds
- Automatic measurement: 5 seconds
- Magnifier range: 10 seconds

Recorded data: 1000 records, each consisting of 4 values, 10 KB memory.

Start Cancel

Recording option

The options available here are **End when time has elapsed** and **Record continuously until terminated**.

End when time has elapsed means that recording is discontinued when the time entered in **Recording time** has elapsed.

Record continuously until terminated causes the oldest measured values to be deleted when new measured values are added upon the time entered in Recording time elapsing. The time entered in Recording time remains as the "past" in relation to the current time in the measured value memory until the Stop command is given (**Stop** + **OK** or actuate the **Esc** key).

The screenshot shows the 'Start Recording' menu with the following settings:

- Recording: Simple measurement curve
- Measurement channels: A, B, C
- Sampling rate: 1 ms
- Recording time: 30 seconds
- Recording option: End when time has elapsed (selected in a dropdown list)

Recorded data: 30000 records, each consisting of 3 values, 176 KB memory.

Start Cancel

Automatic mode

In this menu point, you define whether the recording (using the settings previously set) is to be started just once or at regular intervals.

Deactivated means that the recording is started as predefined, and is ended once the stop condition occurs and is saved.

Activated means that once the stop condition occurs, the current recording is ended and saved, and a new recording is started immediately with the same conditions. When the stop condition occurs again, it is saved under a consecutive number.

This continues until the (automatic) recording is ended with **Autostop** and subsequent stop condition or the memory is full.

The automatic operation reverts automatically to "deactivated" each time a recording is stopped, and must be "activated" again as required.


Zoomed 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).

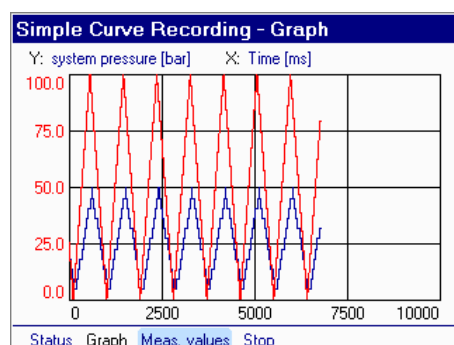
(The setting options for the zoomed area are dependent on the preset sampling rate and the specified recording time.)

Start Recording	
Recording	Simple measurement curve
Measurement channels	A, B, C, D
Sampling rate	10 ms
Recording time	10 seconds
Recording option	Record continuously until terminated
Automatic measurement	Deactivated
Magnifier range	Deactivated Activated
Recorded data: 1000 records, each consisting of 4 values, 10 KB memory.	
Start Cancel	

Simple Curve Recording - Status	
Started at	18.09.06 09:27:32
Ended at	18.09.06 09:27:42
Saved	10 sec. of 10 sec.
Records	10000 of 10000 (40 KByte)
	
Recording finished successfully.	
Graph Table Save Discard	

View Stored Recording		
Name	Number	Recording started†
hydraulic press	49	18.09.06 10:33:46
hydraulic press	48	18.09.06 10:29:51
hydraulic press	47	18.09.06 10:29:37
hydraulic press	46	18.09.06 10:29:28
hydraulic press	45	18.09.06 10:29:19
hydraulic press	44	18.09.06 10:29:10
hydraulic press	43	18.09.06 10:29:01
hydraulic press	42	18.09.06 10:28:52
Measurement curve with trigger (6 sec.) 3 Measurement channels, 1 ms Sampling rate, 40 KB memory.		
Graph Table Cancel		

Start Recording	
Recording	Simple measurement curve
Measurement channels	A, B, C, D
Sampling rate	10 ms
Recording time	10 seconds
Recording option	Record continuously until terminated
Automatic measurement	Deactivated
Magnifier range	5 seconds 5 seconds 10 seconds
Recorded data: 1000 records, each consisting of 4 values, 10 KB memory.	
Start Cancel	



Example of recording a *Simple Measurement Curve*

The settings made for the example shown on the right mean that the measured values of channels A and B are recorded with a sampling rate of 1 ms (i.e. 1000 measured values per second, referred to as **data records** under **recorded data**), and that recording is automatically discontinued after 10 seconds. You see the following brief summary under **Recorded data**:

10,000 records each consisting of 2 values (1 x channel A, 1 x channel B), memory usage: 41 kB.

Now you can either start or cancel (or Esc) the recording from the function bar. The following appears in the display (see right) after starting a recording. You see a list showing the start time, date & time, the time elapsed, and the number of data records recorded. A progress bar shows you the status of your recording.


The function bar offers you the option of having the measurement curve plotted (graph) or the current measured values displayed. Graphic rendering provides a faster visual impression of the changes in the measured values. To have the measurement curve plotted while recording, select **Graph** + **OK**. The screenshot at the right shows you what the plotted measurement curve might look like.

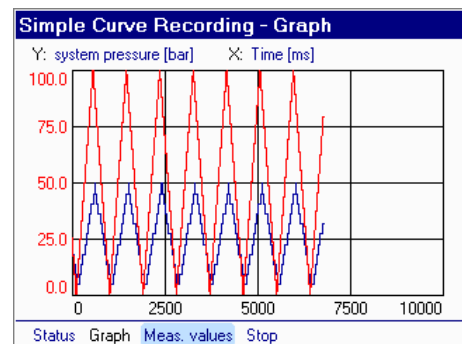
Note


When plotting a measurement curve, recording of the Min/Max values is switched off as all the measured values are rendered in the curve for the period under consideration.

Recording can be discontinued at any time by selecting **Stop** or pressing the **Esc** key. When recording is concluded, the measurement must be **saved** or **discarded**.

Start Recording	
Recording	Simple measurement curve
Measurement channels	A, B, C, D
Sampling rate	10 ms
Recording time	10 seconds
Recording option	Record continuously until terminated
Automatic measurement	Deactivated
Magnifier range	5 seconds
Recorded data: 1000 records, each consisting of 4 values, 10 KB memory.	
Start Cancel	

Simple Curve Recording - Status	
Started at	18.09.06 09:25:02
Running since	8 sec.
Saved	8 sec. of 10 sec.
Records	8470 of 10000 (34 KByte)
	
Recording status: Wait for time to elapse.	
Status Graph Meas. values Stop	



Simple Curve Recording - Status	
Started at	18.09.06 09:27:32
Ended at	18.09.06 09:27:42
Saved	10 sec. of 10 sec.
Records	10000 of 10000 (40 KByte)
	
Recording finished successfully.	
Graph Table Save Discard	

Before doing this, you can have the measurement shown again as a curve (**Graph + OK**) or as a measured value table (**Table + OK**).

When doing this, other tools are offered for analyzing the chart or table. For more information on how you can retrieve recordings and view them as a curve or table, please refer to **Viewing Recordings**.

Back/Esc enables you to return to the

Simple Curve Recording – Status screen.

To save the recording, select **Save** and confirm with **OK**. The HMG automatically assigns a name and a consecutive number, both of which can be subsequently changed by you. Select the appropriate item + **OK** and make your entries using the combination keypad.

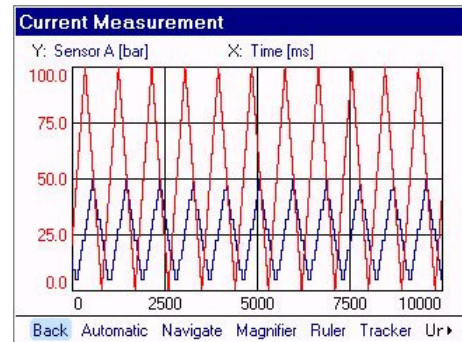
The **Comment** item enables you to enter text, e.g. a description indicating the operational status of the unit or facility while the recording was being made.

To save the recording, select **Save** and confirm with **OK**. The HMG saves the measurement settings together with each recording so that a detailed measurement log is created.

Generally speaking, the following applies:

Each measurement is given a number.

The HMG automatically assigns the next highest unused consecutive number, which is always unique. Any gaps in the list of numbers are not filled.



The table displays sensor data over time. The title is 'Current Measurement'. The columns are 'system pre', 'Sensor B', and 'Sensor A'. The rows show data from 0ms to 7ms. The Y-axis ranges from 0.0 to 100.0, and the X-axis ranges from 0 to 10000. The table is titled 'Current Measurement' and includes a navigation bar at the bottom with options: Back, Settings, and Info.

	system pre	Sensor B	Sensor A
	[bar]	[bar]	[bar]
0ms	25.3	18.0	
1ms	25.1	18.0	
2ms	24.8	18.0	
3ms	24.6	18.0	
4ms	24.4	18.0	
5ms	24.2	18.0	
6ms	24.0	18.0	
7ms	23.7	18.0	

The form is titled 'Save Current Recording'. It contains three fields: 'Name' (plant pressure), 'Number' (7), and 'Comment' (pressure peaks in the range of). The 'Comment' field is a text area. Below the fields is a note: 'Note: The next number was assigned automatically.' and two buttons: 'Save' and 'Back'.

The form is titled 'Save Current Recording'. It contains three fields: 'Name' (plant pressure), 'Number' (8), and 'Comment' (empty). Below the fields is a note: 'Note: The next number was assigned automatically.' and two buttons: 'Save' and 'Back'.

Measurement Curve with Trigger

Measurement curve with trigger is another recording option. "**Trigger**" means that a measurement curve can be started automatically when one or more specific events occur. Events can be a limit being exceeded or fallen short of or a measurement window being departed from.

When selecting **Measurement curve with trigger**, you see other parameters which can be set in addition to the setting parameters available for **Simple measurement curve** (Measurement channels, Sampling rate, and Recording time, Automatic operation and Zoomed area). The additional settings are **Trigger settings** and **Pre/Post trigger**.

Select **Trigger setting** + **OK**. In the menu which follows you can specify up to 4 different trigger events (event 1 to 4). To activate an event, select the relevant box by pressing **OK** so that a checkmark appears. The event used last is shown next to the checkbox. (What appears in the display varies according to the event used last.) Use the arrow keys to navigate to the right to the event box, and confirm with **OK**.

In **Trigger event** ..., confirm with **OK**. The following list of trigger events is displayed:

- Actuation of button/key
- External signal change
- Specific value
- Leaving measurement window
- Timed

Select the appropriate option for your measurement task.

Event: Actuation of button/key

This setting is designed to trigger a measurement when a button is specifically actuated. After starting the recording, you can trigger measurement by selecting **Trigger** in the function bar (+ **OK**).

Event: External signal change

An external signal change means that you apply a direct current signal to one of the **frequency inputs (I or J)**, e.g. via a button (**NC or NO contact**). A measurement can then be started when the voltage is switched on via an **NO contact (rising signal edge)** or **NC contact (falling signal edge)**.

In the settings menu (see screenshot), you specify the **trigger input** under **Input**. **Only** the two digital inputs **I** and **J** are available here. Next you set the **Slope** to **rising** or **falling** and confirm with **OK**.

Event: Specific value

Use the trigger event **Specific value** to locate pressure peaks or pressure troughs in a machine. Pressure peaks always occur in a rising direction (measured value increases), whereas pressure troughs occur in a falling direction (measured value drops). First determine the measurement channel and sub-channel for which you wish to set the trigger, then enter the measured value (via the numerical keypad) at which you want to trigger a recording. Finally, select the direction (**From below** or **From above**).

Note:

Sub-channel setting only required for SMART sensors (see Section 6.4)

Curve Recording with Trigger - Status	
Started at	18.09.06 09:39:37
Running since	27 sec.
Pre trigger	0 sec. of 0 sec.
Post trigger	0 sec. of 10 sec.
Records	0 of 10000 (1 KByte)
<div style="border: 1px solid black; height: 15px; width: 100%;"></div>	
Recording status: Wait for trigger event.	
Status Graph Meas. values Stop Trigger	

Trigger event 1	
Event	External signal change
Input	Trigger input J
Slope	<div> <div>Trigger input I</div> <div>Trigger input J</div> </div>
<div>Back</div>	

Trigger event 1	
Event	External signal change
Input	Trigger input J
Slope	<div> <div>Falling</div> <div>Falling</div> <div>Rising</div> </div>
<div>Back</div>	

Trigger event 2	
Event	Specific value
Measurement channel	Channel A
Measured value	5.00
Direction	<div> <div>From below</div> <div>From below</div> <div>From above</div> </div>
<div>Back</div>	

Event: Leaving measurement window

This trigger event is very similar to **Specific value**. You can specify a **Lower Limit** and an **Upper Limit**. The trigger is activated when the measured value enters the measurement window. However, recording is not started until the measured value leaves the measurement window in a rising or falling direction.

Note:

Sub-channel setting only required for SMART sensors (see Section 6.4)

Event: Timed

The event setting using a time function (*Timed*) is useful for measurements which must be repeated at specific intervals. In the Settings menu you can specify the number of **Repetitions** (max. 30,000), the **Interval** and the **Starting time**. In the **Start** item you can specify whether this event must be activated immediately (**Start immediately**) or not until after a certain **Start date** and **Start time**.

In the example shown on the right

– Event: Timed –

a measurement is started 10 times every 30 minutes. The trigger becomes active for the first time on 21 October 2006 at 14:20.

Up to 4 events can be specified for recording triggered measurements. After making each of the settings, return to the **Trigger Settings** menu via **Back**. The menu now provides an overview of all the events and settings for you to check.

Trigger event 1	
Event	Leaving measurement window
Measurement channel	Channel A
Lower limit	4.00
Upper limit	6.00
Back	

Trigger event 1	
Event	Timed
Repetitions	10
Interval	2 min.
Start	Start immediately
Back	

Trigger event 1	
Event	Timed
Repetitions	10
Interval	30 min.
Start	Enter start time
Start date	21.10.06
Start time	14:20:00
Back	

Trigger Settings	
Event 1	<input checked="" type="checkbox"/> Actuation of button/key
Event 2	<input checked="" type="checkbox"/> Channel A falls to 5.00bar
Event 3	<input checked="" type="checkbox"/> Channel A leaves window 4.00 up to 6.00bar
Event 4	<input checked="" type="checkbox"/> Trigger input J triggers on falling slope
Joint events	None
Back	

Linking Events

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.

In the line **Joint events** (options shown to the right) a drop-down list opens containing the linked event options. In the example, the linking of **Events 1 and 2** (shown on the left by a circuit diagram symbol) means that recording is EITHER triggered by the simultaneous occurrence of events 1 and 2 (the measured value in channel A drops to 5.00 bar, with the measured value in channel B leaving the window of 4.00 to 6.00 bar at the same time) OR a voltage signal (falling signal edge) is detected at trigger input J, OR a key or button is actuated.

Other event linking options are shown in the drop-down list. It should be borne in mind that events are always listed in descending order, otherwise you have to re-sort the events.

In the **1 and 2 and 3 and 4** option, all events have to occur simultaneously in order for a recording to be triggered. By contrast the last option

– **1 and 2 & 3 and 4** – provides three variants:

A triggered recording is initiated when

- 1 and 2 coincide or
- 3 and 4 coincide or
- all, i.e. 1 and 2 and 3 and 4, occur simultaneously.

Trigger Settings

Event 1 ☒ Actuation of button/key
 Event 2 ☒ Channel A falls to 5.00bar
 Event 3 ☒ Channel A leaves window 4.00 up to 6.00bar
 Event 4 ☒ Trigger input J triggers on falling slope

Joint events None

Back

Trigger Settings

Event 1 ☒ Actuation of button/key
 Event 2 ☒ Channel A falls to 5.00bar
 Event 3 ☒ Channel A leaves window 4.00 up to 6.00bar
 Event 4 ☒ Trigger input J triggers on falling slope

Joint events 1 and 2

Back

Trigger Settings

Event 1 ☒ Actuation of button/key
 Event 2 ☒ Channel A falls to 5.00bar
 Event 3 ☒ Channel A leaves window 4.00 up to 6.00bar
 Event 4 ☒ Trigger input J triggers on falling slope

Joint events 1 and 2 and 3 and 4

Back

Trigger Settings

Event 1 ☒ Actuation of button/key
 Event 2 ☒ Channel A falls to 5.00bar
 Event 3 ☒ Channel A leaves window 4.00 up to 6.00bar
 Event 4 ☒ Trigger input J triggers on falling slope

Joint events (1 & 2) or (3 & 4)

Back

The next setting parameter for recording a triggered measurement curve is **Pre/post trigger**. After starting a triggered measurement curve the HMG begins to record the measured values for the recording time set (e.g. 30 seconds). 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.

The **Pre/post trigger** option enables you to specify how much of this "past" is to remain in memory when the event occurs and how much "future" you would like to record after the event.

A **Pre/post trigger** setting of 50 / 50% means that for a recording time of 30 s the "oldest 15 s" are discarded, 15 s remain before the occurrence of the event, and recording is done for another 15 s after the trigger event occurs.

With **Automatic mode** you define whether you wish to make just one recording (**Deactivated**) or whether, after recording one measurement curve, another curve is to be recorded using the same settings (**Activated**). For a **Simple triggered measurement**, select the **Deactivated** automatic measurement option.

Zoomed 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).

(The setting options for the zoomed area are dependent on the preset sampling rate and the specified recording time.)

Start Recording	
Recording	Measurement curve with trigger
Measurement channels	A, B, C
Sampling rate	10 ms
Recording time	10 seconds
Trigger settings	T1
Pre / post trigger	50 / 50%
Automatic measurement	20 / 80%
Recorded data:	30 / 70%
1000 records, each consisting of 3 values, 7 KB memory.	40 / 60%
	50 / 50%
Start Cancel	

Start Recording	
Recording	Measurement curve with trigger
Measurement channels	A, B, C
Sampling rate	10 ms
Recording time	10 seconds
Trigger settings	T1
Pre / post trigger	50 / 50%
Automatic measurement	Deactivated
Recorded data:	Deactivated
1000 records, each consisting of 3 values, 7 KB memory.	Activated
Start Cancel	

Start Recording	
Recording	Measurement curve with trigger
Measurement channels	A, B, C
Sampling rate	10 ms
Recording time	10 seconds
Trigger settings	T1
Pre / post trigger	50 / 50%
Automatic measurement	Deactivated
Recorded data:	1000 records, each consisting of 3 values, 7 KB memory.
Start Cancel	

Example of an Automatically Triggered Measurement

The following occur in a hydraulic press from time to time: defective components, ruptured hoses or cracked cylinders. You suspect there may be extremely high pressure peaking in three hydraulic circuits and want to monitor the press for pressure surges for an extended period of time.

To do this, you make the following settings:

- Recording: Measurement curve with trigger
- Channels: A, B, C
- Sampling rate: 1 ms
- Recording time: 30 seconds

Trigger settings:

- Event 1: channel A increases to 180 bar
- Event 2: channel B increases to 230 bar
- Event 3: channel C increases to 280 bar
(Each of these pressures is 50 bar higher than is normally allowed.)
- Pre/post trigger: 80 / 20%
(You select this option because you are interested in knowing what happened in the other pressure circuits before the trigger was actuated and you want to record the pressure curve somewhat longer after the trigger event.)
- Automatic measurement: **Activated**

When actuating **Start** (+ **OK**) in the function bar, in the next screen you are prompted for a name and number for the measurement. The measurement is then stored under this name with a consecutive number after every trigger event. You also have the option of entering a comment, e.g. the operating condition of the machine.

Trigger event 1	
Event	Specific value
Measurement channel	Channel A
Measured value	180
Direction	From above
Back	

Trigger Settings	
Event 1	<input checked="" type="checkbox"/> Channel A rises to 180.00bar
Event 2	<input checked="" type="checkbox"/> Channel B rises to 230.00bar
Event 3	<input checked="" type="checkbox"/> Channel C rises to 280.00bar
Event 4	<input type="checkbox"/> Switched off
Joint events	None
Back	

Start Recording	
Recording	Measurement curve with trigger
Measurement channels	A, B, C
Sampling rate	1 ms
Recording time	30 seconds
Trigger settings	T1, T2, T3
Pre / post trigger	80 / 20%
Automatic measurement	Activated
Recorded data: 30000 records, each consisting of 3 values, 176 KB memory.	
Start Cancel	

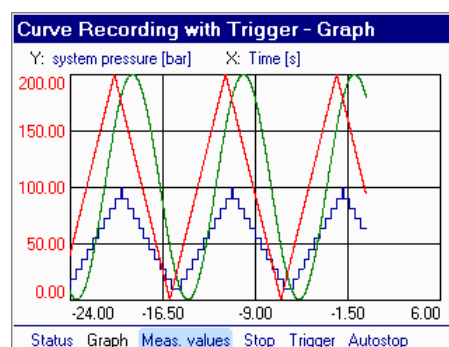
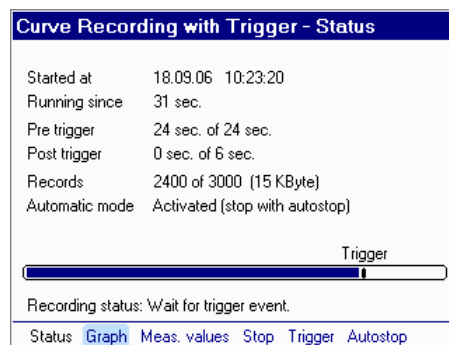
Enter File Name for Automatic Measurement	
Name	hydraulic press
Number	12
Comment	Controlling of 3 hydraulic circuits on pressure peaking
Note: The next number was assigned automatically.	
Save Back	

As soon as you confirm this with **OK**, measurement is activated, resulting in the screen shown on the left. Selecting **Graph** means a measurement curve is plotted and displayed (cf. top screenshot), selecting **Measured values** takes you to the normal measured values screen (cf. bottom screenshot). If you like, you can switch back and forth between the **Status**, **Graph** and **Measured values** screens.

You can manually end the recording currently in progress at any time by selecting **Stop**. This cancels the current measurement and activates a new measurement automatically. To end automatic measurement, select **Autostop** followed by **OK**.

After ending automatic measurement the result obtained is a series of measurements, which can be viewed as a list via **View recording**. To do this, select **View recording** in the **Recording menu**; you are now shown all of the measurement curves just recorded. Select one of the recordings using the arrow keys. A short overview of the recorded data appears above the function bar for the recording selected.

The recording can be displayed as a graph or a table via the relevant options in the function bar. For more detailed information, please see chap. **Viewing Recordings**.



View Stored Recording

Name	Number	Recording started
hydraulic press	49	18.09.06 10:33:46
hydraulic press	48	18.09.06 10:29:51
hydraulic press	47	18.09.06 10:29:37
hydraulic press	46	18.09.06 10:29:28
hydraulic press	45	18.09.06 10:29:19
hydraulic press	44	18.09.06 10:29:10
hydraulic press	43	18.09.06 10:29:01
hydraulic press	42	18.09.06 10:28:52

Measurement curve with trigger (6 sec.)
 3 Measurement channels, 1 ms Sampling rate, 40 KB memory.

Graph Table Cancel

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 to the Min and Max value of each active channel. The trigger settings enable you to specify which event is to create a new line in the event log once the measurement has been started (e.g. Actuation of button/key, Specific value). As soon as a new measured value line is saved, the Min and Max values are always automatically reset. Similar to the recording option **Measurement curve with trigger**, in automatic measurement you can also choose whether you would like to make just one recording or whether an event log is to be recorded again afterwards using the same settings.

Example of an Event Log

In order to gauge the quality of a stamping operation, the stamping machine is to be monitored for two hours. Proper stamping requires a die closing pressure of between 127 bar and 132 bar. In this case, only the maximum pressure value in each cycle is of interest. Measurement is done using a pressure transmitter at channel A.

To make the recording, proceed as follows:

- From **Start recording** menu, **Recording** item: select **Event log**.
- For our example, **activate** only **channel A**.
- For **Trigger settings**: select **Specific value** for event 1, channel A, measured value: **5 bar**, and **Measured value falling**.

Start Recording

Recording: Event log
 Measurement channels: Simple measurement curve
 Sampling rate: Measurement curve with trigger
 Recording time: Event log
 Recording option: Start-stop recording
 Automatic measurement: Record continuously until terminated
 Magnifier range: Deactivated
 5 seconds

Recorded data:
 1000 records, each consisting of 4 values, 10 KB memory.

Start Cancel

Trigger event 1

Event: Specific value
 Measurement channel: Channel A
 Measured value: 5.00
 Direction: From below

Back

Trigger Settings

Event 1 ☒ Channel A falls to 5.00bar
 Event 2 ☒ Actuation of button/key
 Event 3 ☐ Switched off
 Event 4 ☐ Switched off

Joint events: None

Back

Start Recording

Recording: Event log
 Measurement channels: A
 Trigger settings: T1, T2
 Automatic measurement: Deactivated

Start Cancel

- In order to also manually generate a measured value line, set a second event to **Actuation of button/key**.

- Automatic measurement: **Deactivated**

When measurement starts, a new menu window **Event Log Recording — Status** opens, enabling you to track the measurement on the basis of the settings. Data is recorded only when an event occurs.

The sampling rate for the event log is automatically determined by the HMG in keeping with the number of active measurement channels:

- 0.1 ms max. 2 analogue input channels
- 0.2 ms max. 4 analogue input channels
- 0.5 ms all 10 input channels
- 1.0 ms for SMART sensors

For the above example this means that the stamping press is switched on, the pressure reaches 131 bar and drops back to 0 bar. When reaching 5 bar in the falling direction, a measured value line is generated and the Min/Max values are reset. The last Max value is retained in the measured value line. A die closing pressure of 129 bar is reached in the next cycle. This value is also written to a new line as the pressure drops to 5 bar.

The function bar offers you the option of having the current measured values displayed (**Measured Values**) or a **Table** shown.

The **Table** option will list the **data records of each individual event** line by line. Apart from the date and time of the respective recording, the trigger event and the Min and Max values for the active sensors are shown. The **most recent data record** is shown in the **bottom line** of the table.

Event Log Recording - Status			
Started at	18.09.06	10:37:14	
Running since	1 min., 55 sec.		
Triggered at	18.09.06	10:39:08	
Records	155	(1 KByte)	
Recording status: Wait for trigger event.			
Status	Table	Meas. values	Stop Trigger

Event Log Recording - Meas. values			
A: system pressure [bar]			
86.23			
0.00 20.40			
Status	Table	Meas. values	Stop Trigger

Event Log Recording - Table				
	Trigger	system pr [bar]	Min [bar]	Max [bar]
10:40:26	1	4.80	4.80	200.00
10:40:27	1	4.80	0.00	200.00
10:40:28	1	4.80	0.00	200.00
10:40:29	1	4.80	0.00	200.00
10:40:29	2	147.00	0.00	200.00
10:40:30	1	4.80	4.80	147.00
10:40:30	2	3.40	0.00	4.80
10:40:30	2	88.00	3.40	88.00
Status	Table	Meas. values	Stop	Trigger

Event Log Recording - Status			
Started at	18.09.06	10:40:25	
Triggered at	18.09.06	10:42:44	
Ended at	18.09.06	10:42:44	
Records	181	(1 KByte)	
Recording finished successfully.			
Graph	Table	Save	Discard

By means of the arrow keys of the 5-way navkey, you can select the arrows next to the scroll bar. After confirming with OK, you can scroll up/down and left/right in the table. A single arrow means ▲ scrolling line by line, a double arrow means ▲ screen by screen, and means "jump to the beginning or end of the table".

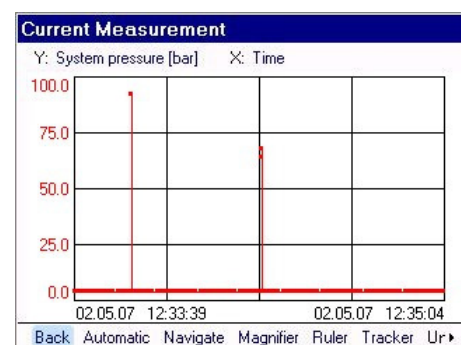
You can end the **event log** recording with **Stop** in the function bar. In the next menu you are shown an overview of the event log and are prompted to **Save** your recording or **Discard** it (function bar).

Before doing this, the measurement can be shown again as a curve (**Graph + OK**) or table (**Table + OK**). Other tools are also available. For more information, please refer to the next section **Viewing Recordings**. It provides a detailed description of the options available and how to use the tools and other features for analyzing each saved recording, whether as a table or a graph.

To save the recording, select **Save** and confirm with **OK**. The HMG automatically assigns a name and a consecutive number, both of which can be subsequently changed by you. Select the appropriate item + **OK** and make your entries using the combination keypad.

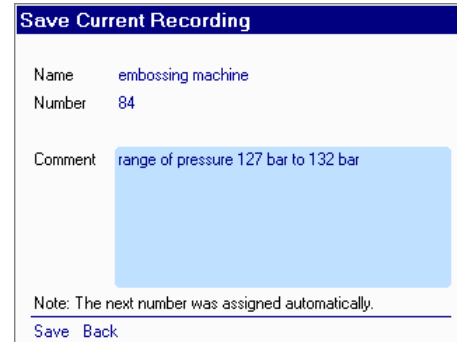
Current Measurement				
	Trigger	Sensor A	Min	
		[bar]	[bar]	
18.09.06	15:37:23	2	38.8	38.8
18.09.06	15:37:24	2	60.4	0.0
18.09.06	15:37:24	2	38.8	38.8
18.09.06	15:37:24	2	60.4	0.0
18.09.06	15:37:25	2	38.8	38.8
18.09.06	15:37:25	2	60.4	0.0
18.09.06	15:37:26	2	38.8	38.8
18.09.06	15:37:26	2	60.4	0.0

Back Settings Info Min/Max Date



Event Log Recording - Status	
Started at	18.09.06 10:40:25
Triggered at	18.09.06 10:42:44
Ended at	18.09.06 10:42:44
Records	181 (1 KByte)
Recording finished successfully.	
Graph Table Save Discard	

The **Comment** item enables you to enter a text, e.g. a description indicating the operational status of the unit or system while the recording was being made. The HMG saves the measurement settings together with each recording so that a detailed measurement log is created.



Save Current Recording

Name embossing machine

Number 84

Comment range of pressure 127 bar to 132 bar

Note: The next number was assigned automatically.

Save Back

Note:

For the same example, if you select automatic measurement **Activated** and start the measurement with **Start**, you are asked to allocate a **Name** and a **Number** to the measurement. The measurement is then stored under this name with the next consecutive number. In the function bar on the screen you also see the **Autostop** function. The measurement currently running can be ended by selecting **Stop**. This measurement will then be saved and a new measurement will start automatically. To end automatic measurement, select **Autostop** followed by **OK**. The measurement that was just running is resumed and can be ended again by selecting **Stop**.

Start-Stop Measurement

The **Start-Stop Measurement** option allows you to start a recording when triggered by a defined condition and to stop it again when triggered by a second defined condition. If the stop condition does not occur within the pre-set recording time, then the recording will stop after the specified time has elapsed.

Example of a Start-Stop Measurement:

Under **Trigger 1 (Start)** and **Trigger 2 (Stop)** select the relevant start and stop condition and confirm with **OK**.

Under **Recording time**, define the time at which the measurement must stop automatically if the Trigger-Condition 2 (Stop) has not occurred by then.

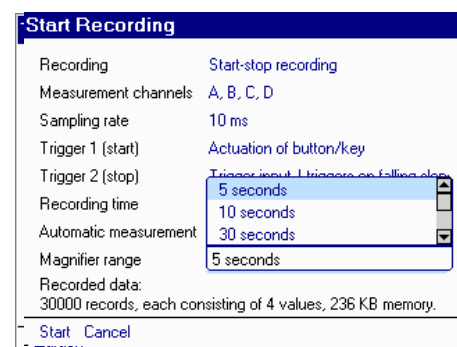
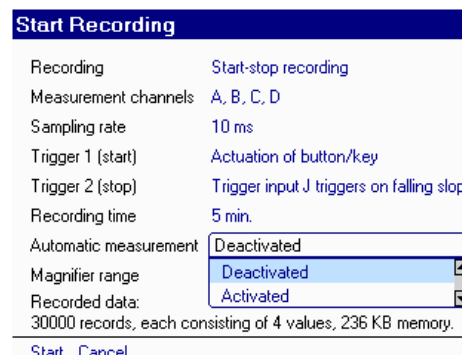
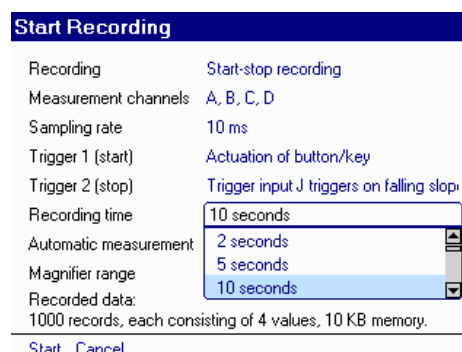
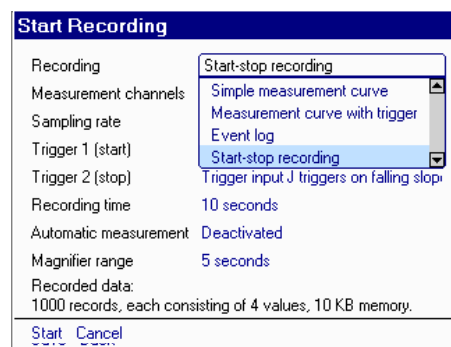
With **Automatic mode** you define whether you wish to make just one measurement (**Deactivated**) or whether, after recording one measurement curve, another curve is to be recorded using the same settings (**Activated**).

Zoomed 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 / ...).

(The setting options for the zoomed area are dependent on the preset sampling rate and the specified recording time.)



6.2.2 Viewing Recordings

The **View recording** item in the **Recording** menu will display a list of the recordings stored in the HMG. Use the arrow keys to select the measurement you wish to view. The selected recording is indicated by an arrowhead and is blue-highlighted. The associated recorded data appears above the function bar.

Before selecting a measurement, this list can be sorted according to

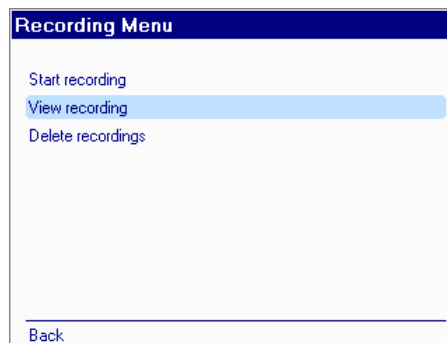
- **Name**
- **Number**
- **Recording started**

and in ascending (▲) or descending order (▼) in each case.

Hit **Esc** to change from the selection list to the menu in the next level up. The arrow key (▲) enables you to access the header row. The list can be sorted accordingly by pressing **OK**. To do this, select Name, Number or Recording started in the header row. To sort in ascending or descending order, click in the relevant **column header** with **OK** (pressing OK more than once will reverse the sorting order). An arrow next to the column header indicates whether sorting is in ascending (▲) or descending (▼) order. To return to the selection list, press (▼) + **OK**.

In the list of the stored recordings, select a measurement followed by **OK**. You are now in the **function bar** and can now decide whether you want to view the measurement as a **Graph** or a **Table**. This applies to measurement curves and event logs.

Event Log



View Stored Recording			
Name	Number	Recording started	
► embossing machine	84	18.09.06 10:40:25	▲
hydraulic press	49	18.09.06 10:33:46	
hydraulic press	48	18.09.06 10:29:51	
hydraulic press	47	18.09.06 10:29:37	
hydraulic press	46	18.09.06 10:29:28	
hydraulic press	45	18.09.06 10:29:19	
hydraulic press	44	18.09.06 10:29:10	
hydraulic press	43	18.09.06 10:29:01	▼

Event log (139 sec.)
1 Measurement channels, 181 Events, 4 KB memory.

Graph Table Cancel

View Stored Recording			
Name▲	Number	Recording started	
hydraulic press	18	18.09.06 10:25:02	
hydraulic press	17	18.09.06 10:23:20	
hydraulic press	16	18.09.06 10:22:46	
hydraulic press	15	18.09.06 10:22:18	
hydraulic press	14	18.09.06 10:22:12	
hydraulic press	13	18.09.06 10:22:06	
hydraulic press	12	18.09.06 10:21:59	
► embossing machine	84	18.09.06 10:40:25	

Event log (139 sec.)
1 Measurement channels, 181 Events, 4 KB memory.

Graph Table Cancel

View Stored Recording			
Name	Number	Recording started▲	
► embossing machine	84	18.09.06 10:40:25	
hydraulic press	49	18.09.06 10:33:46	
hydraulic press	48	18.09.06 10:29:51	
hydraulic press	47	18.09.06 10:29:37	
hydraulic press	46	18.09.06 10:29:28	
hydraulic press	45	18.09.06 10:29:19	
hydraulic press	44	18.09.06 10:29:10	
hydraulic press	43	18.09.06 10:29:01	

Event log (139 sec.)
1 Measurement channels, 181 Events, 4 KB memory.

Graph Table Cancel

Graph

A measurement can also be rendered as a measurement curve. To do this, select **Graph + OK** in the function bar. The screenshot on the right shows what appears next in your display. The measurement is scaled throughout the entire **time range** (x-axis) and **measurement range** (y-axis). Above the y-axis you can see which channel is currently scaled along the y-axis.

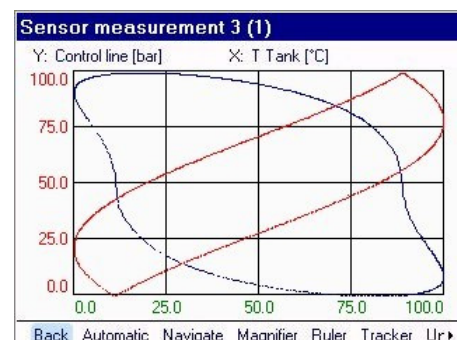
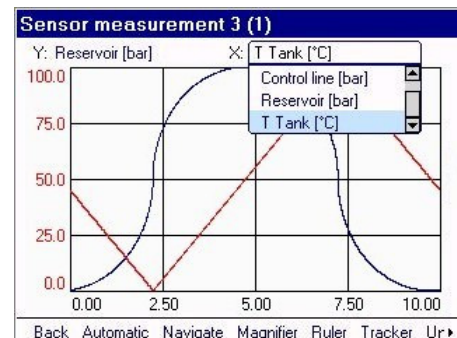
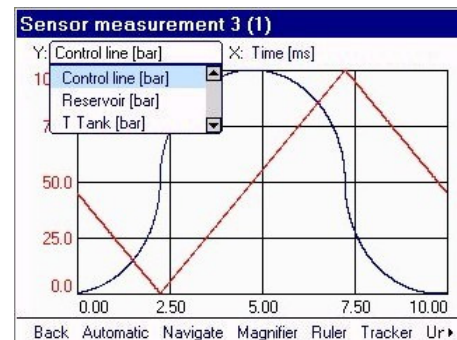
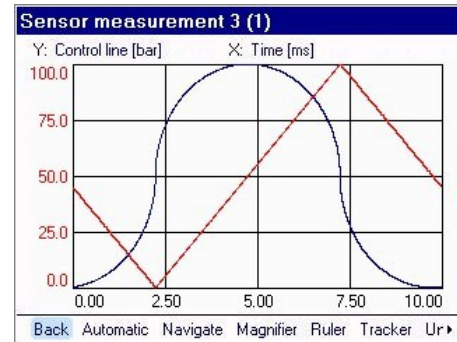
If you have recorded the measurement using more than one channel, you can select the channel or sensor to be rendered in the y-axis. Press **Arrow Up** „(▲)“ followed by **OK** to change the **scaling** of the **y-axis** to another channel activated for display. This causes a drop-down box to open, in which all channels are listed. Select one channel followed by **OK** to specify y-axis display. (The axis is now displayed in the same colour as its measured values curve - see below).

Press (►) to go to the setting field for the x-axis. Here you can change the **Scaling** for the **x-axis** in the same way.

As a general rule, the **x-axis** is the **time axis**. A measurement channel can be assigned to the x-axis, for example, to render the performance curve of a pump (**P-Q graph**). In the example shown at the right, rendering as a **P-T graph** has been selected for the control line and reservoir curves.

The following options are available to you in the function bar of the Graph menu:

Back, Automatic, Navigate, Magnifier, Ruler, Tracker, Undo, Display all, Settings and Info.



Back:

Back/Esc enables you to return to the previous menu.

Automatic:

Automatic renders all individual curves optimally "automatically". When selecting **Automatic** (+ OK) the y-scaling is automatically adapted for each active channel separately, i.e. the y-scaling is zoomed to its maximum size.

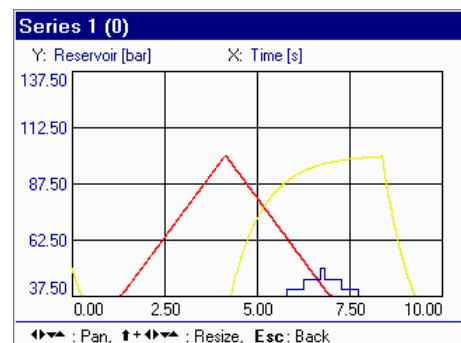
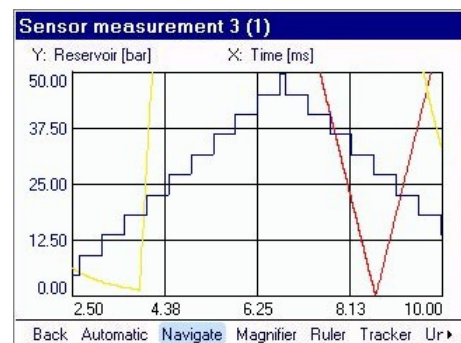
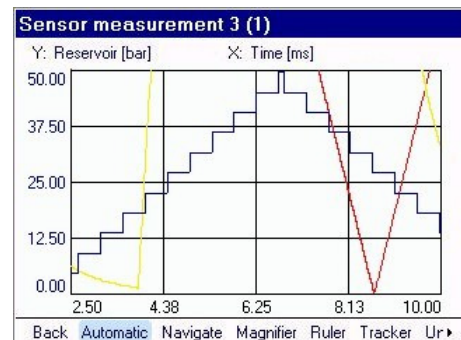
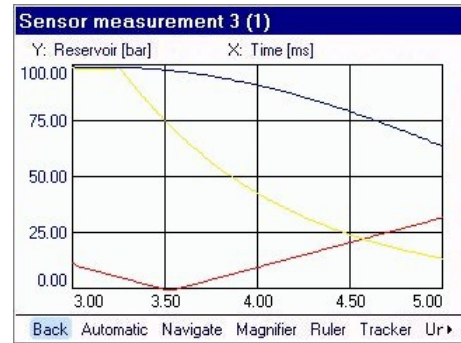
Navigate:

Navigate is used to evaluate a measurement curve quickly and accurately or to render parts of it. It enables the **size** of the **curve** to be **changed** or the **measurement curve** to be **shifted**, so that details can be rendered more accurately and analyzed more easily.

When selecting **Navigate** you are shown information in the function bar about the activities possible here, including graphical tips for using them.

Use the **arrow keys** of the 5-way navkey to **shift** the curve or the section of the curve in the direction of the arrow.

If you also press and hold the Shift key (↑), you can change the size of the rendering.



Use the ► and ▲ arrow keys while holding the Shift key (↑) down to enlarge a portion of the measurement in the x- or y-axis.

Conversely use the ◀ and ▼ arrow keys while holding the Shift key down to **decrease** or "squash" the curve in the x- or y-axis. (cf. screenshot)

Zoom:

To explore a specific section of the curve and zoom into it, use the **Magnifier** (+ **OK**). The function bar contains similar functions for shifting and resizing as the Navigate feature (see previous page).

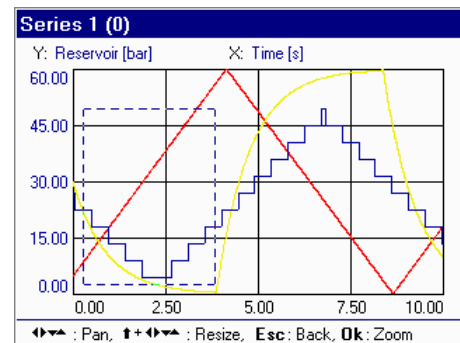
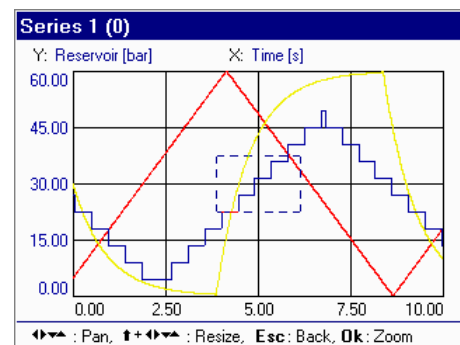
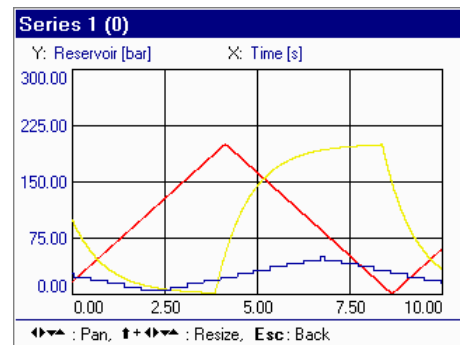
A frame, or zoom window, appears in the middle of the graph. The position and size of the zoom can be changed using the 5-way navkey and the Shift key (↑), similar to Navigate.

Use the arrow keys ◀ & ► and ▼ & ▲ to shift the zoom window to any place in the graph.

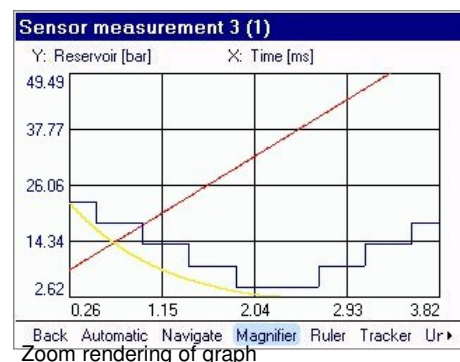
To resize the zoom window, in addition to shifting it using the arrow keys, hold the Shift key (↑) down.

When the zoom is set and positioned in the zooming section, **OK** activates the **zoom** and the selected area is enlarged.

You also have the option of zooming several times in several steps, with the rendering being further enlarged each time.



Shift: use arrow keys
Decrease/Increase:
 Shift key + arrow keys



Ruler:

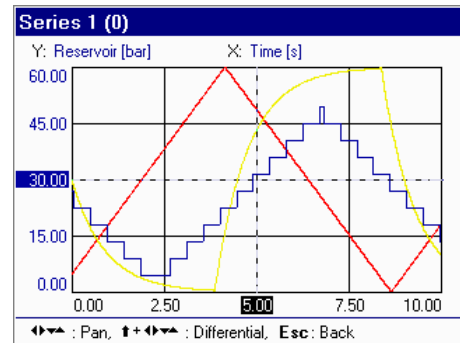
When the **Ruler** is activated, the screen appears as shown in the screenshot. The function bar contains the commands which can be accessed for the ruler.

Using the arrow keys by themselves enables you to determine the pressure at a particular point in time. If you move the ruler using the arrow keys parallel to the x- and y-axis to a specific measurement point in the curve, the associated x- and y-values are shown along the axis, colour-highlighted with the colour of the measurement curve.

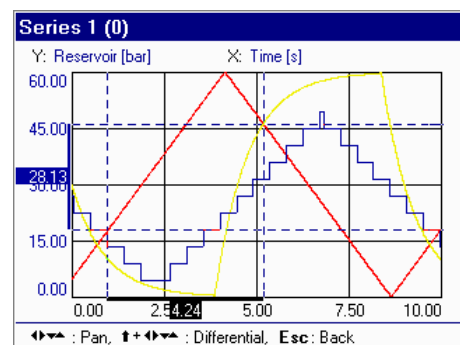
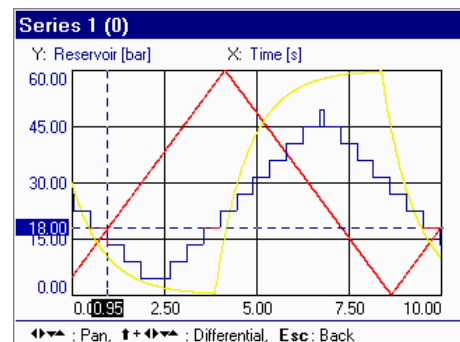
To measure a **pressure pulse in time and amplitude**, for example, use the **Differential** function. Proceed as follows:

First shift the x- and y-ruler to the starting point of the pressure pulse using the arrow keys. Then press the **Shift** key in addition to the arrow keys and hold it down. As soon as you actuate one of the arrow keys, a second x- and y-ruler appears, which you can move to the end point of the pressure pulse using the arrow keys (continue to press the **Shift** key).

Now you can release the **Shift** key. The value of the pressure differential is shown relative to the starting value along the y-axis; the duration of the pressure pulse (now colour-highlighted) is shown along the x-axis. To exit the Ruler, press **Esc**.



Determining measurement values



Determining differential values

Tracker:

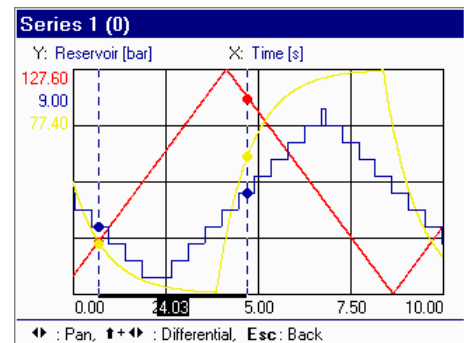
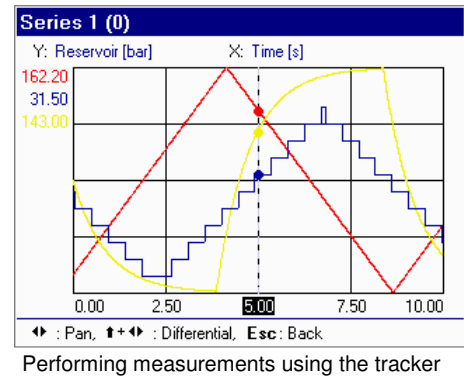
Using the **Tracker** is similar to using the ruler. The difference is that each **value** actually measured is **rendered by a point**. A ruler only appears for the purpose of "tracking" the curve in time. The tracker "jumps" from one measurement point to the next, with the respective measured value of each measurement channel shown along the y-axis to this point x in time (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.

To exit the **Tracker**, press **Esc**.

Undo:

Undo enables you to undo any changes (e.g. **Automatic**, **Navigate**, **Zoom**) you have made, step by step.



Display all:

Display all renders the recording throughout the entire recording period with all the measured values. This option is used, for example, to restore the original condition of a recording. **Display All + OK** restores the measurement throughout the entire time period along with the complete measurement range scaling if the ranges had been previously limited.

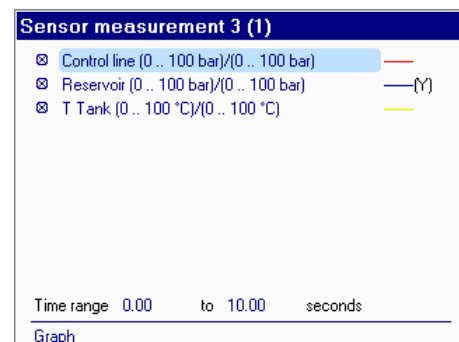
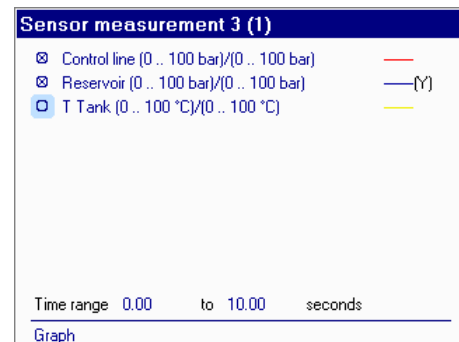
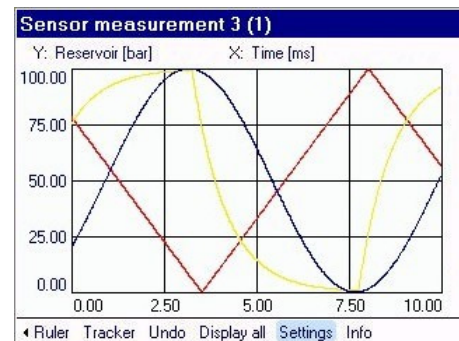
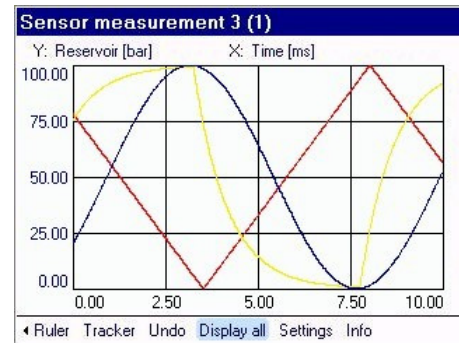
Settings:

Settings will display the measurement channels which have been used to make the recording. The channel rendered along the y-axis in the measurement curve is additionally labelled with "(Y)".

For rendering as a graph you can activate or deactivate a channel by checking or unchecking the box in front of it using the **arrow keys + OK** (checkmarked means that the channel will be shown). This enables you to specify whether all measurement channels are to be shown, or only one or two at a time. This feature enables you to keep track when several measurement channels are used (cf. example on left: "Tank" is deactivated).

For **curve rendering**, there are additional settings apart from which **channels or sensors** are to be shown (on/off), e.g.

- **Upper and lower limit**
- **Colouring and rendering** of curves and values
- **Time range**



In the list of channels, select a channel to the right next to the box, and confirm with **OK**. In the next menu you see an overview of the **measurement range**, current **scaling** (upper and lower limit) of the y-axis, **line style** and **colour** in which the measured values of this sensor is shown. You can re-set all the parameter settings except for the measurement range.

The default **scaling** (upper and lower limit) can be manually changed here via the keypad. This is one of the various options offered by the HMG 3010 to enlarge interesting parts of graphs. After confirming the **Lower limit** line with **OK**, you can change the value.

Conclude your entry via **OK**. You are now in the next line in the menu. Follow the same steps here to specify another upper limit, if necessary.

For **Line style** a drop-down list appears offering you a choice of **Solid line**, **Dotted line**, and **Dash-dotted line**. Make your selection, confirming with **OK**.

Colour: use the arrow keys to select various colours from a list (confirming with **OK**). This enables the rendering of every channel to be adapted according to your preferences.

Back takes you back to the list containing the measurement channels. The **Time range** is shown above the function bar; it can also be adapted manually as needed. Select a value and enter another time period of interest to you via the keypad (+ OK).

After selecting **Graph** in the function bar, press **OK** to return to the graph.

Control line - Sensor measurement 3 (1)

Measurement range	0 .. 100	bar
Lower limit	80	bar
Upper limit	100	bar
Line style	Solid line	
Colour	Red	

Example:

Back

Control line - Sensor measurement 3 (1)

Measurement range	0 .. 100	bar
Lower limit	0	bar
Upper limit	100	bar
Line style	Dotted line	
Colour	Red	

Example:

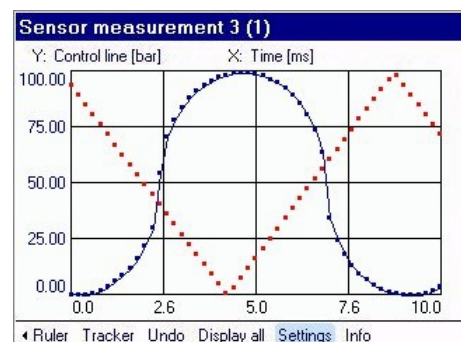
Back

Sensor measurement 3 (1)

- ☒ Control line (0 .. 100 bar)/(0 .. 100 bar) — (Y)
- ☒ Reservoir (0 .. 100 bar)/(0 .. 100 bar) — (Y)
- ☒ T Tank (0 .. 100 °C)/(0 .. 100 °C) — (Y)

Time range 3.00 to 5.00 seconds

Graph



Entering the following new settings for "**Sensor measurement 3(1)**" would result in the curve shown right:

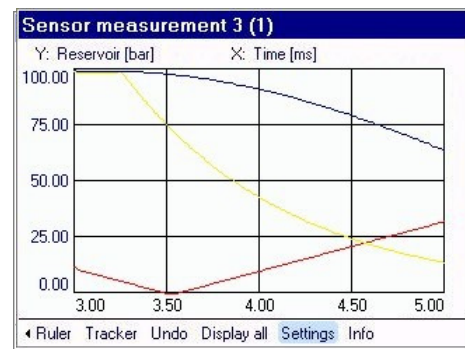
Scaling (lower and upper limit) of y-axis:

0 - 50 bar - Control line

Time range of x-axis:

4.00 - 6.00 s - Time

results in the curve shown in the picture.



Curve: control line and tank

Info:

The last item **Info** in the graph screen is used to view and modify comments entered by you (comments are entered using the combination keypad). You can also have the recording data for a measurement displayed.

To exit the **Info** menu, use **Back**.

To exit the graph, use **Back** or **Esc**.

Table

Tables are useful for displaying individual measured values. Select **Table** (+ **OK**) in the function bar to select a stored recording and have its values displayed.

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. No Min/Max values are shown here as they are not captured while recording the measurement curve.

If, however, you select the measurement of an event log, the measured values table looks like this:

A complete data record is shown per row for each event. Each individual data record consists of the date, time, trigger event and the associated measured values of the individual channels including the Min and Max values. The data record of **the event recorded last** is contained in the **bottom line** of the table.

When more than one channel are used, the tables of measurements in general, and event logs in particular, feature a series of columns and rows which don't become visible until the respective scroll bar is moved. Use the arrow keys of the 5-way navkey to select the arrows next to the scroll bar. After confirming via OK, you can scroll in the table up/down and left/right.

A single arrow ▲► means scrolling line by line or column by column, a double arrow ▲▼ means screen by screen, and ► means "jump to the beginning or end of the table".

View Stored Recording			
Name	Number	Recording started†	
embossing machine	84	18.09.06	10:40:25
► hydraulic press	49	18.09.06	10:33:46
hydraulic press	48	18.09.06	10:29:51
hydraulic press	47	18.09.06	10:29:37
hydraulic press	46	18.09.06	10:29:28
hydraulic press	45	18.09.06	10:29:19
hydraulic press	44	18.09.06	10:29:10
hydraulic press	43	18.09.06	10:29:01

Measurement curve with trigger (6 sec.)
3 Measurement channels, 1 ms Sampling rate, 40 KB memory.

Graph Table Cancel

Sensor measurement 3 (1)			
	Control line [bar]	Reservoir [bar]	T Tank [°C]
0.00s	78.20	20.40	75.30
0.01s	78.00	20.40	75.60
0.02s	77.70	20.80	75.80
0.03s	77.50	21.20	76.10
0.04s	77.30	21.20	76.40
0.05s	77.10	21.60	76.60
0.06s	76.80	22.00	76.90
0.07s	76.60	22.00	77.10

Back Settings Info

embossing machine (84)				
	Trigger	system pre	Min	
		[bar]	[bar]	
18.09.06 10:40:26	1	4.80	4.80	
18.09.06 10:40:27	1	4.80	0.00	
18.09.06 10:40:28	1	4.80	0.00	
18.09.06 10:40:29	1	4.80	0.00	
18.09.06 10:40:29	2	147.00	0.00	
18.09.06 10:40:30	1	4.80	4.80	
18.09.06 10:40:30	2	3.40	0.00	
18.09.06 10:40:30	2	88.00	3.40	

Back Settings Info Min/Max Date

The date and Min/Max values can be hidden so as to make tables easier to read. You can **hide** or **display Min/Max** and the **Date** directly in the function bar with **OK**.

You can also hide or display individual channels for display in the table using the **Settings** function (a checkmark means that the channel is displayed; activate/deactivate with **OK**). You can also jump to a specific place in the table via the date and time setting in the column next to the beginning of the table. Select with **OK**, enter the desired time using the combination keypad, and finish with **OK**. Select **Table** to take you back to table display.

embossing machine (84)

	Trigger	system pr. [bar]	Min [bar]	Max [bar]
10:40:26	1	4.80	4.80	200.00
10:40:27	1	4.80	0.00	200.00
10:40:28	1	4.80	0.00	200.00
10:40:29	1	4.80	0.00	200.00
10:40:29	2	147.00	0.00	200.00
10:40:30	1	4.80	4.80	147.00
10:40:30	2	3.40	0.00	4.80
10:40:30	2	88.00	3.40	88.00

Back Settings Info Min/Max Date

Series 1 (1)

☐ Sensor A (0.00 .. 100.00 bar)
☒ Sensor B (0.00 .. 100.00 bar)
☒ Sensor C (0.00 .. 100.00 bar)

Beginning of table 0.00 seconds

Table

Info is used to view and modify comments you have previously entered (make your entries using the combination keypad). It also enables you to display the recorded data for a measurement. To exit the **Info** menu, use **Back**.

To exit the table view of a recording, use **Back** or **Esc**. You are now back in the selection list of stored recordings. To exit it, press **OK** or **Esc**.

To exit the **View Recording** menu, use **Cancel** or **Esc**.

Series 1 (1)

Recording Measurement curve with trigger

Measurement channels 3

Records 1000

Memory used 8 KB

Started at 18.09.06 11:58:47

Ended at 18.09.06 11:58:59

Triggered at 18.09.06 11:58:49

Trigger activated 1

PreTriggerCount 0

Back

6.2.3 Deleting Recording

Any recording can be deleted when no longer needed. To do this, select **Delete recording** in the **Recording** menu + **OK**. You are now shown a list of all the stored recordings. Now select the recording to be deleted. A small arrowhead to the left of the file name shows you what you have selected.

Before selecting a recording, you can sort the list by:

- **Name**
- **Number**
- **Recording started**

and in ascending (↑) or descending order (↓) in each case.

Hit **Esc** to change from the recording list to the menu in the next level up. The arrow key (▲) enables you to access the **header row**. Press **OK** to sort the list according to Name, Number or Recording started. To do this, select Name, Number or Recording started in the header row using the **arrow keys**. To sort in ascending or descending order, click in the relevant **column header** with **OK** (pressing OK more than once will reverse the sorting order). An arrow next to the column header indicates whether sorting is in ascending (↑) or descending (↓) order. To return to the selection list, press (▼) + **OK**. Select the measurement to be deleted and confirm with **OK**. Several recordings can be selected in one go by simultaneously pressing the **Shift** key. Confirm with **OK**, you now have access to the **Delete** function. Hit **OK** again and the selected recordings are deleted.



Caution!

At this stage, there is no "last chance" dialogue to check if you really want to delete the recording.

Delete Stored Recordings			
Name	Number	Recording started†	
Sensor measurement 3	3	18.09.06	12:04:13
▶ Sensor measurement 3	2	18.09.06	12:03:46
Sensor measurement 3	1	18.09.06	12:03:17
Series 1	0	18.09.06	12:02:19

Simple measurement curve (10 sec.)
5 Measurement channels, 10 ms Sampling rate, 11 KB memory.

Delete Cancel

Delete Stored Recordings			
Name†	Number	Recording started	
▶ Series 1	0	18.09.06	12:02:19
Sensor measurement 3	3	18.09.06	12:04:13
Sensor measurement 3	2	18.09.06	12:03:46
Sensor measurement 3	1	18.09.06	12:03:17

Measurement curve with trigger (10 sec.)
3 Measurement channels, 10 ms Sampling rate, 8 KB memory.

Delete Cancel

Delete Stored Recordings			
Name	Number	Recording started†	
▶ hydraulic press	50	18.09.06	12:16:29
hydraulic press	49	18.09.06	12:15:28
hydraulic press	48	18.09.06	12:10:37
hydraulic press	47	18.09.06	12:08:59
hydraulic press	46	18.09.06	12:07:50
hydraulic press	45	18.09.06	12:07:32
hydraulic press	44	18.09.06	12:07:14
hydraulic press	43	18.09.06	12:07:04

Event log (52 sec.)
1 Measurement channels, 184 Events, 4 KB memory.

Delete Cancel

Delete Stored Recordings			
Name	Number	Recording started†	
hydraulic press	50	18.09.06	12:16:29
hydraulic press	49	18.09.06	12:15:28
▶ hydraulic press	48	18.09.06	12:10:37
hydraulic press	47	18.09.06	12:08:59
hydraulic press	46	18.09.06	12:07:50
hydraulic press	45	18.09.06	12:07:32
hydraulic press	44	18.09.06	12:07:14
hydraulic press	43	18.09.06	12:07:04

Event log (286 sec.)
1 Measurement channels, 953 Events, 13 KB memory.

Delete Cancel

6.3 Extras Menu

The following options are available to you in the function bar of the **Extras** menu:

- **Stopwatch**
- **About HMG 3000.**
The stopwatch offers you the following functions: **Start**, **Stop**, **Interim reading** and **Reset**.
- **SMART sensors**
- **Update Instrument Software.**
(only after downloading new firmware)

Stopwatch

To record the time you needed to trouble-shoot an error (locate it), you can start the stopwatch. Use **Back** or **Esc** to switch back to normal measurement mode. The stopwatch continues to run in the background. As soon as you have completed troubleshooting, call up the **Stopwatch** menu again and stop the clock using the **Stop** command.

Use **Reset** to set the stopwatch back to zero.

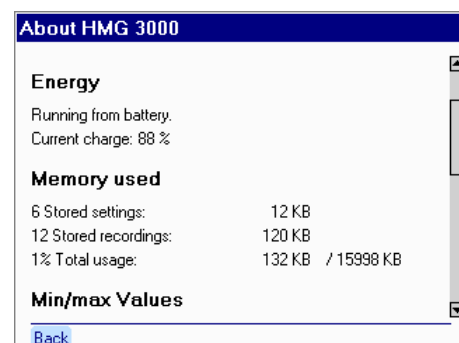
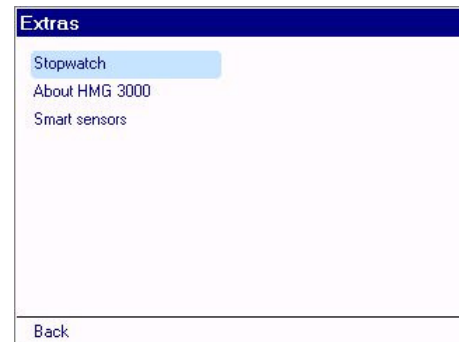
About HMG 3000

The About HMG 3000 menu provides an overview of available **power supply**, **how much memory** is still free, when the **Min and Max** values were reset last, and the **address** of **HYDAC ELECTRONIC**.

SMART sensors

Measured values (SMART sensors)

The menu points **SMART sensors** and **Measured values (SMART sensors)** are described in more detail in the next section (6.4).



Update Instrument Software

If a firmware update has been transferred to your HMG 3000 via the HMGWIN 3000 software, you will still see the **Update Instrument Software** item in the **Extras** menu. This means that an update is present which you can now activate in the HMG 3000.

CAUTION:

All data stored in the HMG 3000 (measurements, settings, ...) is deleted when the update is imported. Back up this data to a PC using HMGWIN 3000 before starting the update. Connect the power supply to the HMG 3000 to ensure a secure voltage supply during the update.

To activate the update, select **Update Instrument Software** and then **Start + OK**. Once the update has been carried out, the HMG 3000 switches off automatically. After the unit is restarted again you can continue working.

6.4 SMART sensors

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.

CAUTION: To connect SMART sensors to HMG 3010 see "Connection requirements" and "Wiring diagrams" in each sensor user manual.

The following details refer to the SMART sensor HYDACLAB® HLB 1300, 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 1300).

The display settings and measured value renderings can be changed as described in section 6.1.2 above.

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.

6.4.1 Connecting SMART Sensors

To connect SMART sensors with the HMG 3000, select the **SMART Sensors** option in the **Extras** menu.

Then enter the **connector** to which the SMART sensor is connected.

You also have the option of entering a **sensor bus address**. 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).*

After selecting **Connect** you see some information about the connected SMART sensor above the function bar. Click **Continue** to access the options menu of the SMART sensor.

Disconnect enables you to break the connection to the SMART sensor.

Current Measured Values		
Designation	Value	Unit
A Temp	27.32	°C
A ReVisco	0.00	%
A ReIdk	0.00	%
A ReHum	35.66	%

Settings Recording Extras Min/Max

Extras	
Stopwatch	
About HMG 3000	
Smart sensors	

Back

Smart sensors	
Port	Sensor port A
Sensor bus address	No address

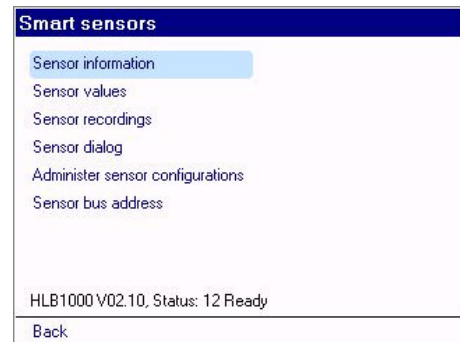
Back Connect

Smart sensors	
Port	Sensor port A
Sensor bus address	No address
HLB1000 V02.10, Status: 12 Ready	
Back	Disconnect Continue

6.4.2 SMART Sensors Menu

You are now in the SMART Sensors menu and can enter settings to adapt the sensor to your requirements.

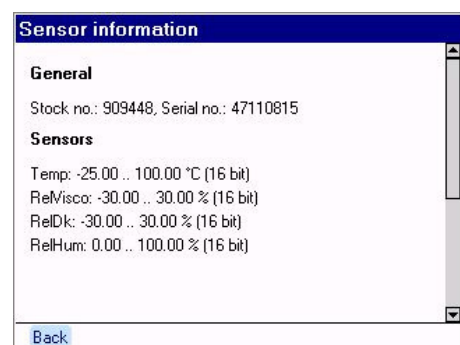
The items contained in the menu vary in accordance with the sensor type connected, i.e. not all of the menu items described below may be available.



6.4.2.1 Sensor Information

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

- Part number
- Serial number
- Information about the various measurement channels with regard to their type and measurement range.



6.4.2.2 Sensor Values

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

If the SMART sensor records Min/Max values internally, they are also shown; if not, a dotted line is shown.

Name	Value	Unit	Min	Max
Temp	29.51	°C
RelVisco	-1.63	%
RelDk	0.81	%
RelHum	40.24	%

6.4.2.3 Sensor Recordings

In this menu you can transfer long-term recordings created by the SMART sensor to the HMG 3000, or delete them from the SMART sensor's memory.

Refresh enables you to check whether new recordings are present.

Name	Number	Recording start
▶ HLB1000-ACTUAL LOG	1	
HLB1000-COMPLETE LI	2	
HLB1000-COMPENSATI	3	

Transfer Delete Cancel Refresh

After selecting a recording and the **Transfer** option, you see the following screen:
Now you can determine whether the selected recording is to be stored in the HMG 3000 under the combination of name+number, or whether you would like to assign a new designation.

6.4.2.4 Sensor Dialogue

This menu enables you to modify the configuration of the SMART sensor.

Note that what is shown in this menu depends on the SMART sensor connected. For detailed information on the possible settings, please refer to the particular sensor documentation.

6.4.2.5 Administer Sensor Configuration

Here you have the possibility of reading the current configuration of the SMART sensor, or transferring saved settings into the SMART sensor.

You can also have a saved configuration displayed or deleted.

Read configuration from sensor

This menu item enables you to read the configuration of the SMART sensor and transfer it to the HMG 3000. You can accept the suggested name+number combination, or enter a new one.

Transfer configuration to sensor

This menu enables you to transfer existing SMART sensor configurations to the SMART sensor. This is particularly useful when you want to put new SMART sensors into operation and want to reuse settings previously entered for other SMART sensors.

Display stored sensor configuration

This enables you to display a configuration which is stored in the HMG 3000.

You are then shown detailed information on the sensor configuration.

Delete stored sensor configuration

This menu enables you to delete a sensor configuration. Select the configuration concerned and select **Delete** on the function bar.

6.4.2.6 Set sensor bus address

This menu enables you to assign a bus address to a sensor. To do this, select a value from the list and click on **Apply** on the function bar.

Bus addresses must be assigned when the SMART sensor is operated in a bus system.

(This function is not described further here).

Transfer configuration to sensor			
Configuration record Ov. Configuration			
Name	Number	Savedt	
► Ov. Configuration	0	19.06.07	13:39:11

Transfer Back

Display stored sensor configuration			
Name	Number	Savedt	
► Ov. Configuration	0	19.06.07	13:39:11

Back Show

HSI Configuration File	
HLB1000 V02.1, Ov. Configuration	
19.06.07	
Analog output 1	
Indication	Dielectricity
Mode	Current
Switch output 1	
Indication	Viscosity

Back

Delete stored sensor configuration			
Name	Number	Savedt	
► Ov. Configuration	0	19.06.07	13:39:11

Delete Cancel

Set sensor bus address	
Bus address	<div style="border: 1px solid black; padding: 2px;"> a a b c d e </div>

Accept Back

6.5 Technical Details

Sensor inputs

The HMG features:

- 4 sensor input jacks (channel A – H) for up to 8 analogue sensors, or up to 4 SMART sensors and
- 1 input jack with 2 digital inputs (channel I - J) and a voltage input of -10 V to + 10 V (shown at channel H)

The sensors are connected using an standard M12x1 male connector (5 pole).

Channel A to H:

- Automatic detection for HSI sensors (pressure, temperature, flow rate transmitters and SMART sensors)
- Connection of commonly-available sensors with current or voltage signals
- Differential channels for channel A - B; channel C - D; Differential channel for flow rate measurement orifice (shown at channel B)

Channel I and J:

- Frequency channels (speed (rpm) measurement, counting function)
Frequency range: 1 30,000 Hz ($\leq \pm 0.1\%$ FS max.)
Switching threshold / switch-back threshold: 2V/1V
Max. input voltage: 50 V; display delay **max. 2 s.**

Overview of signals / measurement inputs

Measurement range (accuracy)	Chann A	Chann B	Chann C	Chann D	Chann E	Chann F	Chann G	Chann H
HSI	X	X	X	X	X	X	X	X
4 .. 20 mA ($\leq \pm 0.1\%$ FS max.)	X	X	X	X	X	X	X	X
0 .. 20 mA ($\leq \pm 0.1\%$ FS max.)	X	X	X	X	X	X	X	X
0 .. 4,5 V ($\leq \pm 0.1\%$ FS max.)	X	X	X	X	X	X	X	X
0 .. 5 V ($\leq \pm 0.2\%$ FS max.)	X	X						
($\leq \pm 1.0\%$ FS max.)			X	X				
0 .. 10 V ($\leq \pm 0.1\%$ FS max.)	X	X						
($\leq \pm 0.5\%$ FS max.)			X	X				
0 .. 50 V ($\leq \pm 0.1\%$ FS max.)			X	X				
0.5 .. 4.5 V ($\leq \pm 0.1\%$ FS max.)	X	X	X	X	x	x	x	x
0.5 .. 5.5 V ($\leq \pm 0.1\%$ FS max.)	X	X						
($\leq \pm 1.0\%$ FS max.)			X	X				
1 .. 5 V ($\leq \pm 0.2\%$ FS max.)	X	X						
($\leq \pm 1.0\%$ FS max.)			X	X				
1 .. 6 V ($\leq \pm 0.2\%$ FS max.)	X	X						
($\leq \pm 0.5\%$ FS max.)			X	X				
-10 .. +10 V ($\leq \pm 0.5\%$ FS max.)								X

Battery life (from fully charged)

- HMG 3000 without sensors approx. 11 hours
- HMG 3000 with 2 sensors approx. 9 hours
- HMG 3000 with 4 sensors approx. 7 hours
- HMG 3000 with 8 sensors approx. 4 hours

Sampling rates

- Sampling rate: 0.1 ms .. 1 min
- Sampling rate: 0.1 ms for a maximum of two sensors (other sensor inputs inactive); e.g. for pressure peak measurements

The sampling rate which can be set is dependent on the active measurement channels. The following applies:

- 0.1 ms max. 2 analogue input channels
- 0.2 ms max. 4 analogue input channels
- 0.5 ms all 10 input channels
- 1.0 ms for SMART sensors

Measured value memory

- Single recording: up to 500,000 measured values
- Archive memory: 128 MB
(for min. 100 individual recordings)

PC link interfaces

- USB port
- Serial interface (RS 232)

For communication and evaluation using the HYDAC **HMGWIN 3000** or **CMWIN** software and using HSP log

Dimensions and weight

- Dimensions: 246 x 174 x 58 mm
- Weight: 1100 g

Operating and ambient conditions

- Operating temperature: 0 ... 50 °C
- Storage temperature: -20 ... 60 °C
- Relative humidity: 0 ... 70 %

Technical standards

- EMC: EN 61000-6-1/2/3/4
- Safety: EN 61010
- Protection class: IP 40

Supply voltage

- 12 ... 30V DC

7 Cleaning

The HMG 3000 must not be cleaned with aggressive agents (e.g. alcohol, screen cleaner,...). For cleaning we recommend using a slightly damp cloth.

8 Accessories

- **Pressure Transmitter** (with HSI-interface) of the measuring ranges:
- 1 ... 9 bar, 0 ... 16 bar, 0 ... 100 bar, 0 ... 250 bar, 0 ... 400 bar, 0 ... 600 bar

Part no. 909429	Part descr.	HDA 4748-H-0009-000 (- 1 ... 9 bar)
Part no. 909425	Part descr.	HDA 4748-H-0016-000
Part no. 909554	Part descr.	HDA 4748-H-0060-000
Part no. 909426	Part descr.	HDA 4748-H-0100-000
Part no. 909337	Part descr.	HDA 4748-H-0250-000
Part no. 909427	Part descr.	HDA 4748-H-0400-000
Part no. 909428	Part descr.	HDA 4748-H-0600-000
- **Temperature Transmitter** (with HSI-interface)

Part no. 909298	Part descr.	ETS 4548-H-000 (-25 to +100 °C)
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- **Flow Rate Transmitter** (with HSI-interface)

Part no. 909293	Part descr.	EVS 3100-H-1 (006 - 060 l/min)
Part no. 909403	Part descr.	EVS 3100-H-2 (040 - 600 l/min)
Part no. 909404	Part descr.	EVS 3100-H-3 (015 - 300 l/min)
Part no. 909405	Part descr.	EVS 3100-H-5 (1.2 - 020 l/min)
Part no. 909406	Part descr.	EVS 3110-H-1 (006 - 060 l/min)
Part no. 909407	Part descr.	EVS 3110-H-2 (040 - 600 l/min)
Part no. 909408	Part descr.	EVS 3110-H-3 (015 - 300 l/min)
Part no. 909409	Part descr.	EVS 3110-H-5 (1.2 - 020 l/min)
- **Rpm Probe**

Part no. 909436	Part descr.	HDS 1000-002 (male M12x1)
Part no. 904812	Part descr.	HDS 1000 reflective foil set (quantity 25)
- **Sensor Simulator for 2 HSI Transmitters**

Part no. 909414	Part descr.	SSH 1000-H-3 (simulator for HMG 3000) ideal for training purposes
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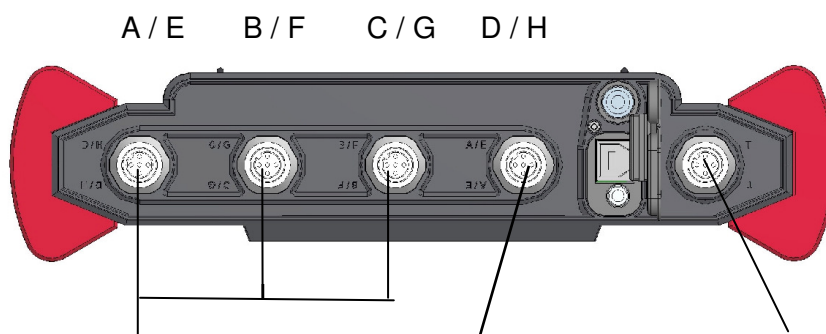
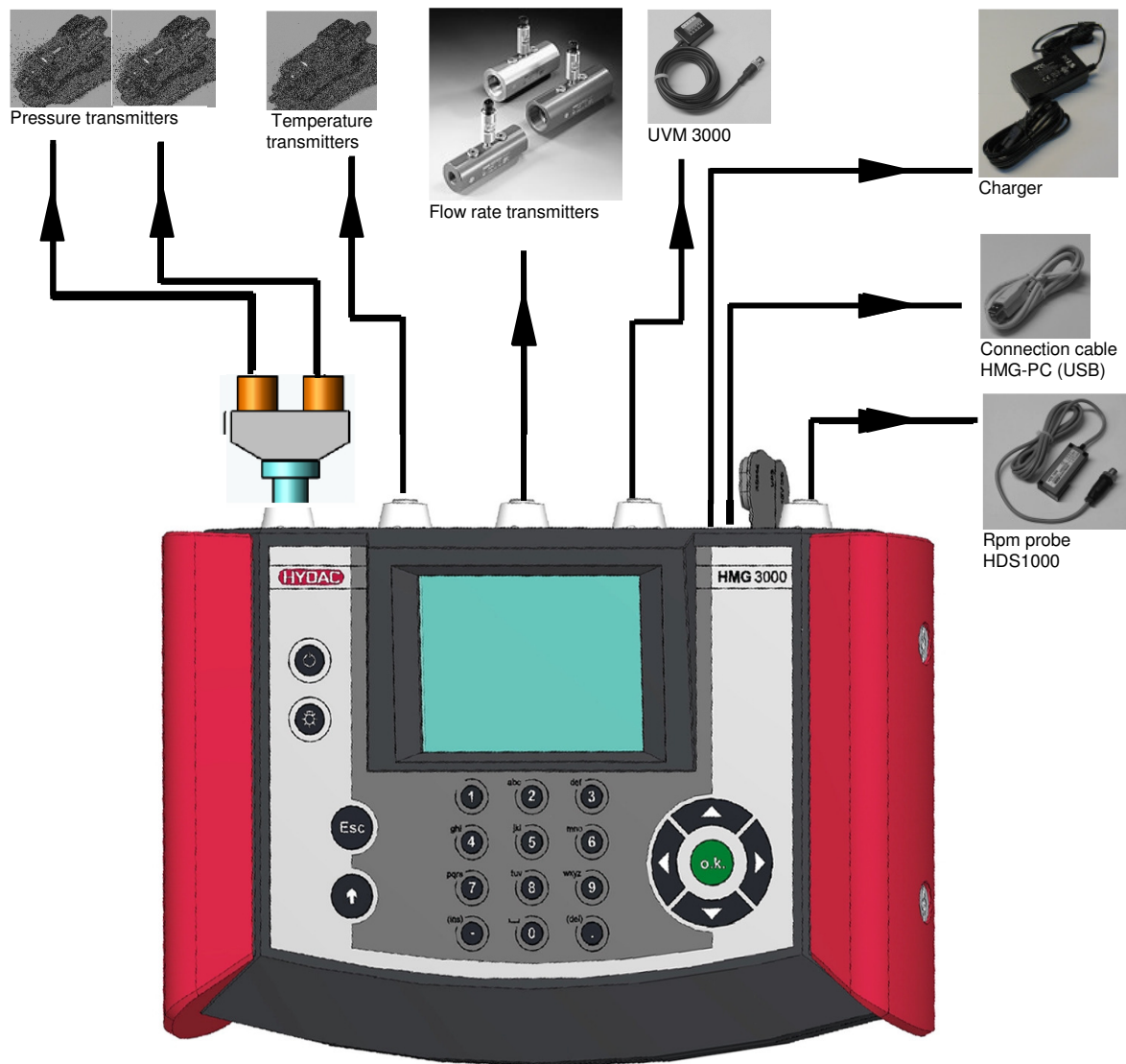
- **Other accessories**

Part no.	6042959	Part descr.	Case for HMG 3000 & accessories
Part no.	909795	Part descr.	Bag with carrying strap for HMG 3000
Part no.	909739	Part descr.	ZBE 31 (car charger for HMG 3000)
Part no.	3236597	Part descr.	ZBE 34 (adapter M12/Binder; 4 .. 20 mA, 2-conductor)
Part no.	3236601	Part descr.	ZBE 35 (adapter M12/Hirschmann; 4..20 mA, 2-conductor)
Part no.	3224436	Part descr.	ZBE 38 (Y adapter)
Part no.	3304374	Part descr.	ZBE 26 (Y adapter blue for HLB 1000)
Part no.	909737	Part descr.	ZBE 36 (connection adapter for AS 1000)
Part no.	910000	Part descr.	ZBE 41 (Y adapter yellow for CS 1000)
Part no.	6040851	Part descr.	ZBE 30-02 (sensor cable M12x1, 5-pole) 2m
Part no.	6040852	Part descr.	ZBE 30-05 (sensor cable M12x1, 5-pole) 5m
Part no.	909752	Part descr.	UVM 3000 Adapter (for non-HYDAC sensors)
Part no.	903083	Part descr.	Hydraulic adapter kit for the HMG
		Contents:	
		2 adapter hoses DN 2 / 400 mm	1620 / 1620
		2 adapter hoses DN 2 / 1000 mm	1620 / 1620
		2 pressure gauge direct connection adapters	1620 / G 1/4
		2 adapters	1615 / 1620
		2 bulkhead couplings	1620 / 1620

- **Spare parts**

Part no.	6054296	Part descr.	Power supply for HMG 3000
Part no.	6040585	Part descr.	Connection cable HMG 3000 – PC (USB)

9 Examples of Connections

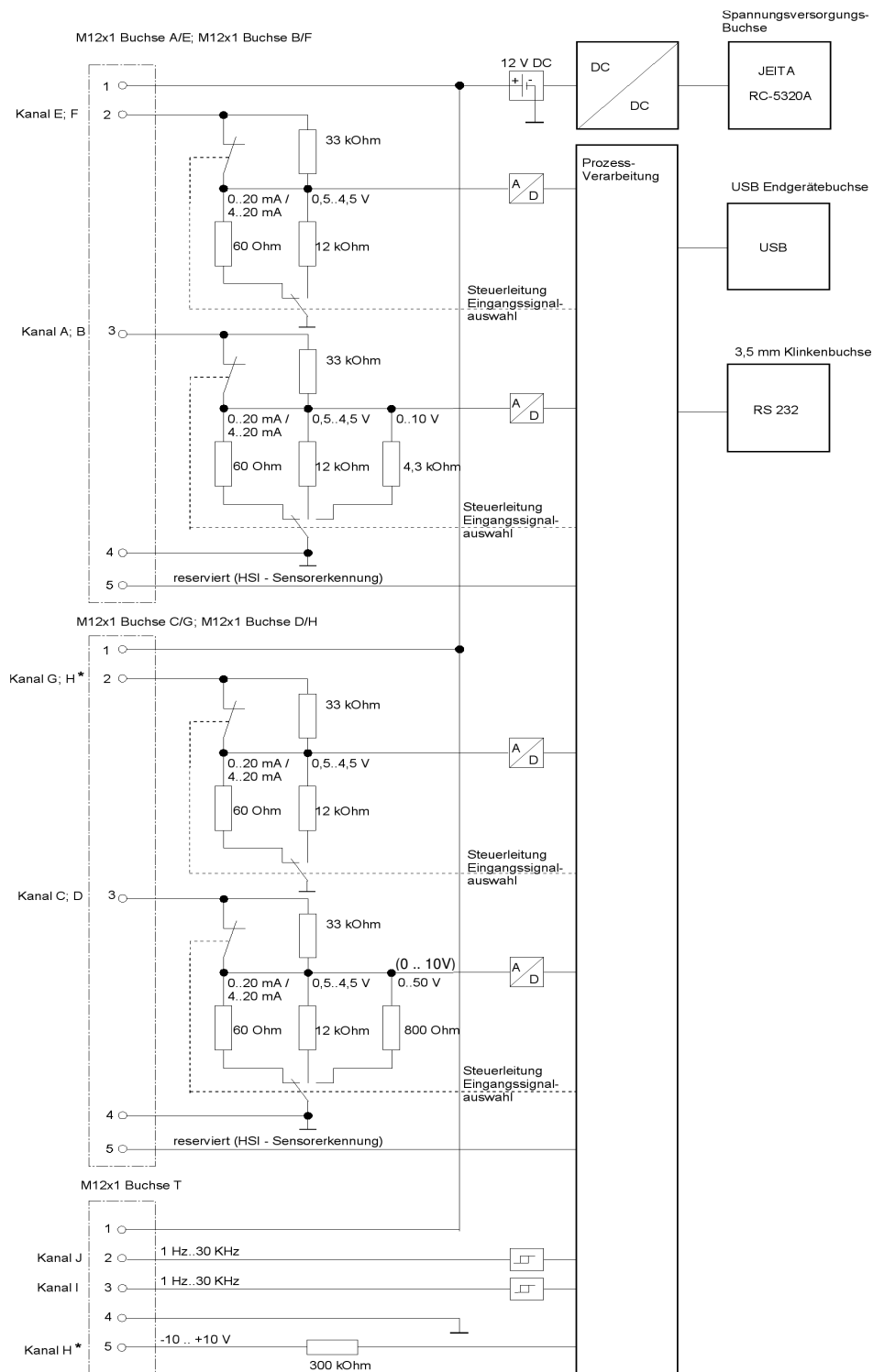


Pin 1: 12 V; 50 mA
 2: Channel E / F / G
 3: Channel A / B / C
 4: GND
 5: HSI

Pin 1: 12 V; 50 mA
 2: Channel H
 3: Channel D
 4: GND
 5: HSI

Pin 1: 12 V; 50 mA
 2: Channel J
 3: Channel I
 4: GND
 5: Analog. input +/-10 V (channel H)

9.1 Pin assignment



Note on H*:

Channel H can be used for sensors with an analogue signal (connection to jack D/H) or for voltage measurements of -10 V to +10 V (connection to jack T).

The input signal is selected when setting the measurement range for channel H.

Power supply connector:

JEITA RC-5320 A

Pin 1 (outer contact): 0V (GND)

Pin 2 (inner contact): +12 .. 30 V DC

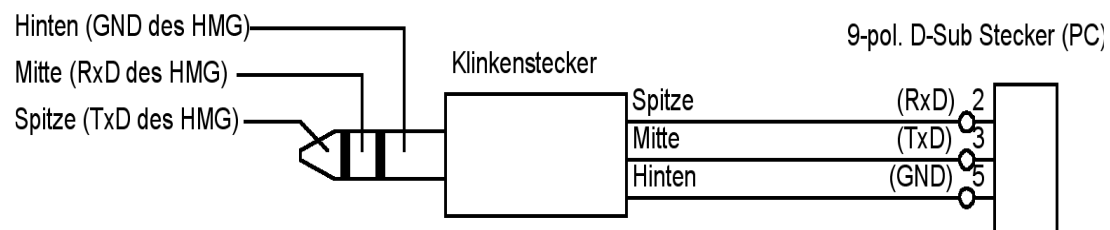
USB end device connector:

Standard USB end device connector for standard USB end device connector cable.

Jack socket 3.5 mm (RS 232):

For connecting the HMG to the serial port (RS 232) of PC.

Connecting diagram/pin assignment:



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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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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.