hotset

Operating instructions

D-System

Data logger - Hydraulic and thermal process visualization

Table of contents

Foreword

hotset's mobile D-System is a highly flexible and easy-to-use measuring device for in-situ analysis of the energy balance of process water cycles. Wherever water circulates as a functional medium, this enables rapid checking and visualization of flow rate, temperature progression and pressure differences. Some of the applications of the D-System are troubleshooting, fine-tuning of fluid power processes, or monitoring in the context of quality assurance. "Water is utilized for industrial purposes as a coolant and heating medium, as a transport and hydraulic fluid, as an operating and drive medium, and even as a fuel component. As a process optimization tool or mobile service tool, our D-System can therefore provide valuable services in many industries.

Safety information

General instructions

Intended use

These operating instructions are intended to make it easier for the operator to understand and operate the D-system.

They must be read prior to connecting the D-system, as they contain important information for connection and operation.

The D-System includes at least one visualization and works only with one measuring module.

All electrical connections of the D-system are made by means of plug-in devices.

Symbols

Symbols – Display


USB port


Network connection (RJ45)


Measuring module connection (D-SUB15)


Power supply (3 pole, 5V DC)

I/O interface inputs/outputs (D-SUB9)

Symbols – Measuring module


Display connector (D-SUB15)


Medium connection inlet/flow (G3/4" inside)


Medium connection outlet/return (G3/4" inside)


Flow direction Medium

Component overview

Visualization with power supply

Dimensions (H x W x D) [mm]	240 x 190 x 85
Weight [kg]	2.7
Interface	USB, WLAN, LAN
Display	7" LED TFT, 800 x 480 pixel
Operation	Touch, max.10 fingers
Power supply	230 V / 5 V 50 Hz CE, power supply unit with 3 m connection cable
Power consumption	max. 15 W
Battery	Lithium-Polymer, 12000 mA integrated.

The visualization includes a 7" touch screen with integrated rechargeable battery. The battery is charged with the included power supply as soon as it is connected to the mains. The initial charging time is about 2.5 hours. Once charged, the display can be used mobile for up to 4 hours, depending on the application, before it has to be charged again at the mains connection.

The supplied power supply has a power of 15 W at a voltage of 5 V. The use is exclusively intended for 230 V/50 Hz networks.

Visualization

There are 5 ports with the following functions on the bottom of the visualization:

Mains connection for charging the battery and simultaneous voltage supply.

Symbol: 

This plug-in connection is designed with 3 poles.

Only the supplied mains cable may be used to charge the battery.

The use of any other charging source may result in a fire hazard!

Connection of the connecting cable to the measuring module:

This is the communication connection to the measuring module. It transmits the measurement data for visualization. This connection is 15-pole (D-SUB15).

Symbol: 

USB port:

This port is suitable for USB storage media (USB stick), and can be written to with the log function.

Symbol: 

Network/LAN connection:

For integration into the local network, the connection can be established here with an RJ45 connector.

Symbol: 

Digital inputs and outputs:

This connector is 9pin (D-SUB9) and serves as alarm output and synchronization/input.

Symbol: I/O

Pin assignment of the D-SUB9

DI (digital inputs)		DO (digital outputs)	
D-SUB9		D-SUB9	
Uintern5V	3	Uext	1
DI1	8	DO1	6
DI2	4	DO2	2
DI3	9	DO3	7
		GNDext	5

Connection cable visualization <-> measuring module

This connection cable is 15-pole and 3m long in the stand wheel.

Connection points: Display  <-> Measuring module 

Measuring module

The sensors for measurement data acquisition are integrated in the measuring module.

Dimensions (H x W x D) [mm]	225 x 190 x 85
Weight [kg]	5.5
Medium connection	4 x G 3/4" internal thread

Use of compressed air for emptying

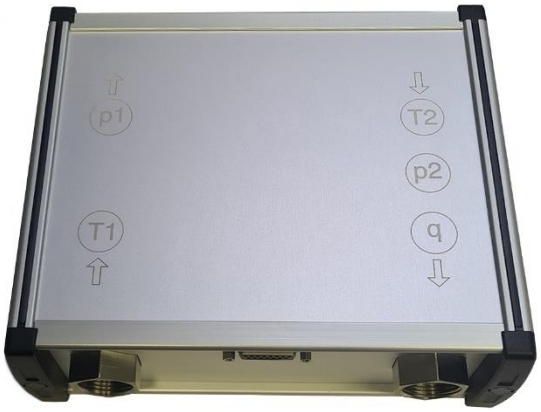
ATTENTION! When using compressed air, the measuring components can be destroyed!

Measuring ranges of the components in the measuring box:

Measuring medium	Water
Max. medium temperature	85 °C (short-term 95 °C)
Max. operating pressure at medium temperature	over the service life 12 bar at +40 °C over the service life 8 bar at +70 °C
Pressure measurement	
Measuring range	0 – 12 bar
Resolution	0.1 % of measuring range end
Measuring accuracy	0.5 % of measuring range end
Flow rate	
Measuring range	1.8 – 32 l/min
Measuring principle	Piezoceramic sensor element
Measuring accuracy at < 50 % FS* (water)	< 1 % FS*
Measuring accuracy at > 50 % FS* (water)	< 2 % measured value
Temperature measurement	
Measuring principle	Resistance Pt1000
Measuring accuracy	± 0.3 K

* Full scale (final value)

Connection of the measuring module



There is a number or a flow symbol at each connection of the measuring module.

It is important that the flow direction is observed, otherwise incorrect measurements or misinterpretation of the process may occur. The supply should always be on the side that is shown (**see connection 1**). Observe the connection direction as follows:

Connection 1 or the arrow points into the circle 

Here, the medium must flow into the measuring module. The inlet temperature T1 and the inlet pressure p1 are measured in the measuring module.

Connection 2 or the arrow points out of the circle

The medium comes out of the measuring module at this connection point and can be connected from here to a measurement object, such as an injection molding tool, heat exchanger, etc.

It is also possible to make a direct connection from **port 2** to **port 3**. This allows, for example, pump capacities to be determined, or temperature control units to be calibrated.

Tip: Maximum pressure and flow values of the supply (observe maximum measuring range!) can be tested if it is possible to integrate a valve for flow regulation in the hose connection from **port 2** to **port 3**.

Connection 3 or the arrow points into the circle

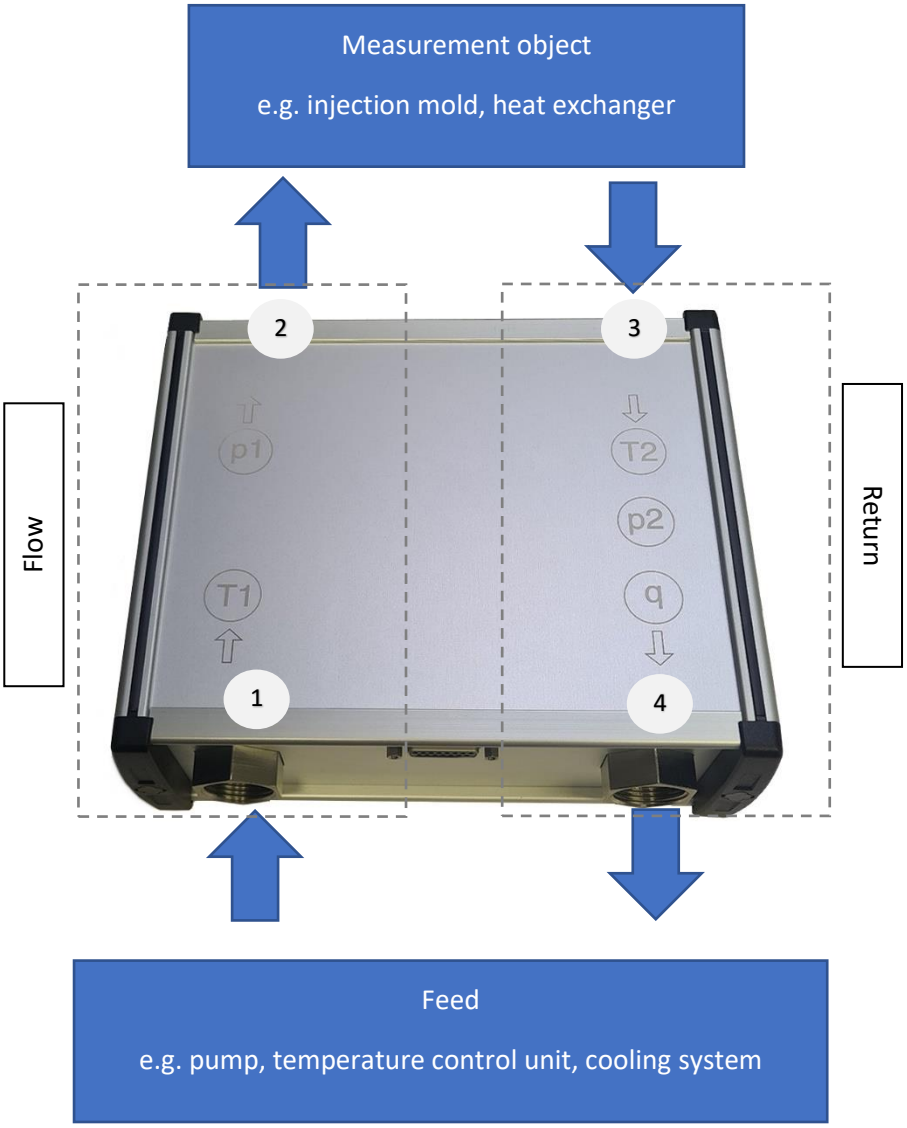
If the medium has flowed through the consumer/measurement object, it is connected to **port 3**. The output temperature T2, output pressure p2 and flow rate q are measured in the measuring module.

Connection 4 or the arrow points out of the circle 

The medium has now flowed through all measuring points and, if applicable, the consumer/measurement object and is now returned to the supply via **port 4**.

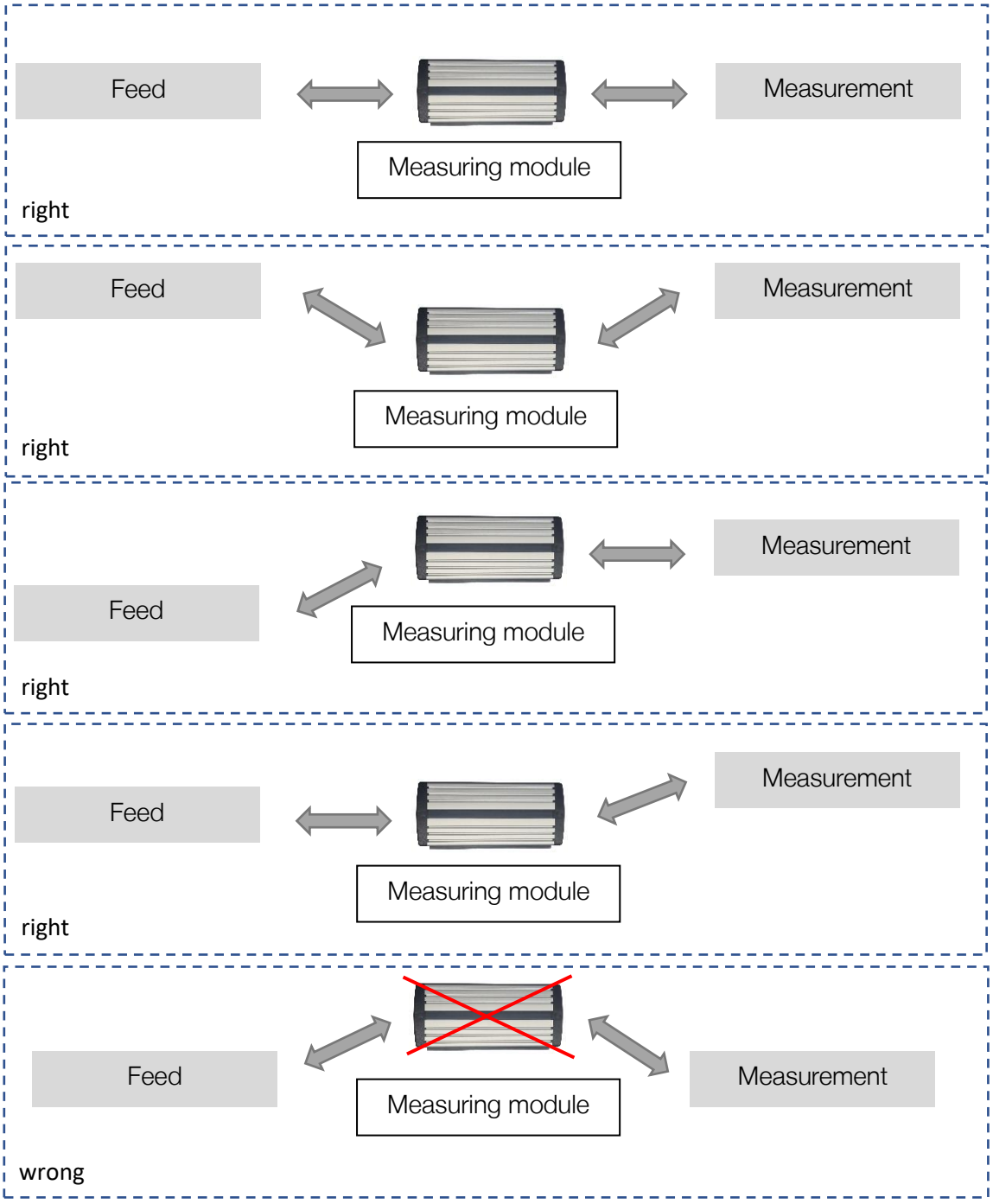
Connection diagram measuring module

In injection molding processes, we often use the terms flow and return. However, from the observer perspective, this definition can be understood the other way around. Here, we show the view from the measuring module's perspective. The side with the D-SUB15 or connection point 1+4 is the **supply side**, i.e. the connection point where e.g. a temperature control unit, cooling unit or similar conveying devices are connected. At the connection points 2+3 a **measurement object**, e.g. a mold circuit, heat exchanger or other test objects is connected. If, for instance, only a temperature control unit is connected to the supply side for testing, a direct connection (hose bridge) can be used at connection point 2+3.



Operation of the measuring module

The position should always be selected below or at the same level as the measurement object so that any air bubbles do not accumulate in the measuring module and lead to incorrect measurements. Make sure that the system is well vented.



Maintenance and water quality

Make sure that the medium is clean in order to avoid deposits such as lime, rust and dirt in the measuring module. The water flowing through should be free of suspended particles and meet the following requirements:

	Min. – Max.	Unit
pH value	6.5 – 9.5	-
Solid substances	free	mg/l
Electrical conductivity (20°C)	200 - 2000	µS/cm
Fe / Cu	0 - 1	mg/l
Total hardness	5 - 12	°dH

Using compressed air to clean or empty the measuring module can damage the measuring components. Cleaning brushes or similar objects should also not be used to remove any deposits. The individual components can only be cleaned carefully with a cloth once the measuring module has been disassembled.

We recommend that you return the device to Hotset GmbH for maintenance and servicing.

Please contact us for this purpose:

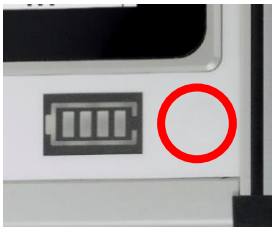
Hotset GmbH
Hueckstraße 16
58511 Lüdenscheid / Germany

Office: +49 2351 4302-0
vertrieb@hotset.com

Battery display

The visualization can be charged and used at the same time. The capacity of the battery can be checked by pressing the battery check button, or it is displayed in the program at the top right.

The battery level indicator can only be pressed when the display is already switched on.



Battery full

Battery medium

Battery low

Battery critical

The respective usage time depends on the power in the measuring box. During normal use, the following operating times can be expected:

Operating time still approx. 4 hours

Battery operation still approx. 2 hours

Battery operation still approx. 0.5 hours

Charge immediately!

Safety instructions battery

Read and observe all safety notes and instructions. Failure to comply with safety information and instructions may result in electric shock, fire and/or serious injury.

The contents of lithium polymer battery cells are generally flammable under certain conditions.

- Do not open the battery
- Never remove the battery from the display case
- Protect the battery from heat, fire, and immersion in water
- Do not store or operate the battery near hot or flammable objects
- Do not place the power plug or display near flammable materials
- Only charge the battery when it is dry and in a fire-safe location.
- Only charge the battery with the supplied hotset power plug
- The battery must not be charged unattended
- The rechargeable battery must not be subjected to mechanical stress
- Vapors may escape if the rechargeable battery is damaged or used improperly. Supply fresh air and consult a doctor if you experience any discomfort

Technical data:

Type:	Lithium polymer
Rated voltage:	3.7 V
Rated capacity:	12,000 mA
Energy:	45 Wh
Operating temperature:	+5…+40 °C
Storage temperature:	+2…+50 °C
Permissible charging temperature range:	+2…+40 °C

Maintenance and service

If the battery is no longer functional, please contact hotset.

The battery is subject to the requirements of dangerous goods legislation. When transported by commercial users or third parties (e.g. forwarding agents), special requirements for packaging and marking must be observed. Only ship the display with battery if the battery is undamaged.

Disposal

Do not dispose of the battery in household waste! When disposing of the battery, have the battery disconnected by a qualified electrician. Before disposing of the battery, tape the contacts with adhesive tape. Avoid touching severely damaged batteries with bare hands, as electrolyte may leak out and cause skin irritation. Store the battery in a safe place outdoors. Please contact hotset if necessary, we will assist you in disposing of it properly.

Switch on the display

First connect the measuring module with the supplied connection cable (D-SUB15) and the display.

Press the hotset logo briefly (approx. 0.5 seconds) to switch on the display.

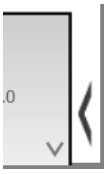
A membrane button is located under this logo to start the display.

The display starts and needs about 30 seconds until the start page is displayed.

Operation

The hotset logo always takes you back to the start screen.

Pressing the burger menu ☰ takes you to the menu pages.



Pressing the arrow key in the lower right area of the display takes you to the previous page.

Burger menu

☰

System setting	Configuration of the system
Process setting	Limit settings
Process overview	Display of the measurement data
Analysis	Configuration of the graph and start of logging
Information	Contact, system information and error history
Shutdown	Switching off the display

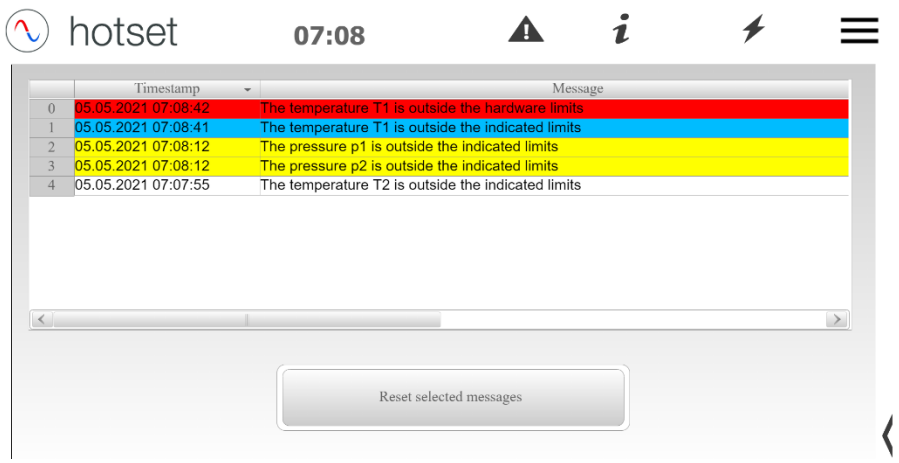
Switching off the display

Press "Shutdown" in the menu to switch off the system.

The system can also be forced to shut down in the event of an unexpected crash, such as a touchscreen malfunction. To do this, press the hotset logo membrane button for 20 seconds.

Error message

The warning symbol ⚠ takes you to the error message display, which shows process error messages and hardware errors.



Blue marked line = selected line

White marked line = resettable hint

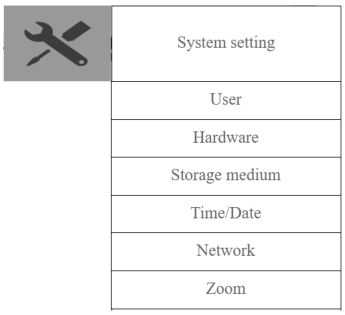
Yellow marked line = pending non-resettable indication of process monitoring.

Line marked red = pending non-resettable hardware limit reached.

To reset, activate the corresponding white line and press "Reset selected reports".

System settings

When pressing the system settings, a submenu opens, which contains the following items:

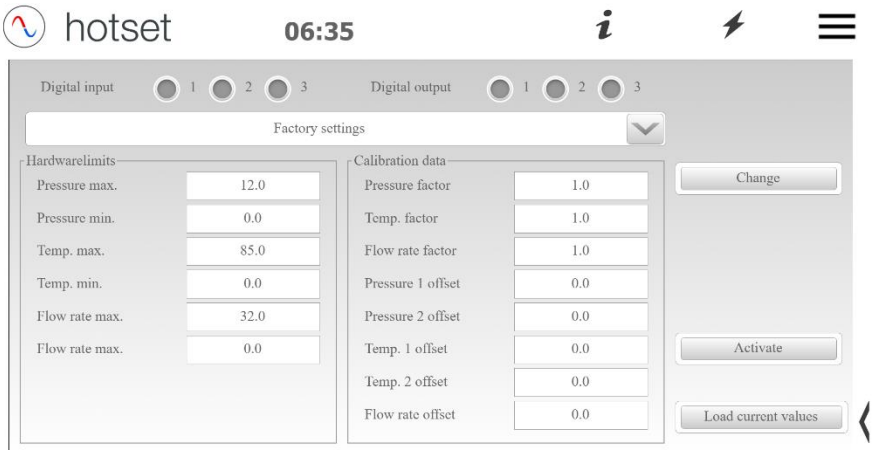


User system settings

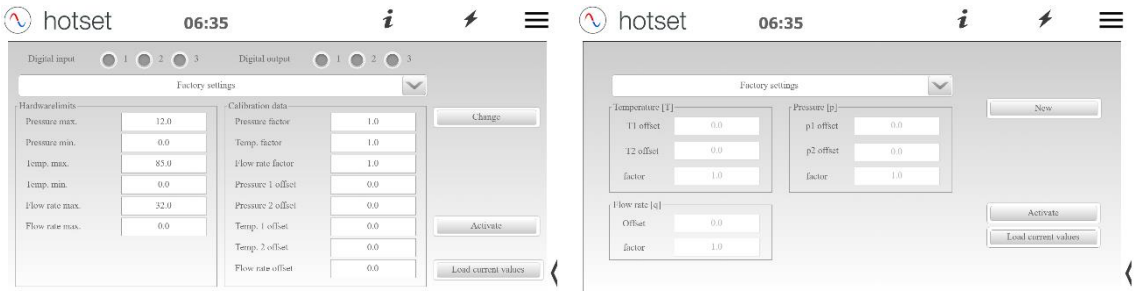
Setting of the language, selectable in German and English.

Setting of the measuring interval for the graphs. This setting has no influence on the data logging. It only changes the speed of the curves in the graphical view.

System setting hardware



Each measuring module is assigned a dedicated hardware configuration when it is delivered from the factory, in which the measuring range data is stored. The minimum and maximum measuring ranges are defined by hotset under the hardware limits. The calibration data contains factors for the measurement data acquisition and offset values. The use is able to configure these values.



To do this, select a previously saved data set from the drop-down menu, or click "Modify". Under "Change" you have the possibility to adjust the offset values and factors.

This change has a direct influence on the measured values and can lead to incorrect measurements if entered incorrectly.

Following the change or if a selection has been made via the drop-down menu, the values must be accepted by pressing "Activate". If not, the set values do not yet have any influence on the measurement.

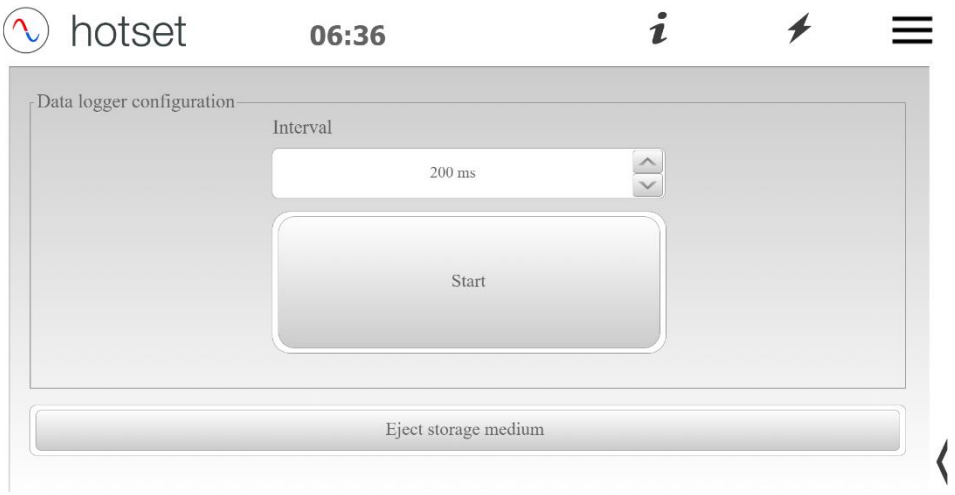
You can read out the active values that are already used for the measurement via "Load current values".

Already created data sets can also be unburned or deleted.

System setting storage medium

Data logger – configuration

In order to perform a comprehensive analysis of the measurement data, the data logging function can be used to write the measurement data to a USB storage medium at a selectable interval.



The interval defines the number of measured values per time unit. The setting range here is between 200 ms and 60000 ms.

The smaller the interval is set, the more precisely the measurement process can be analyzed. This results in approximately the following data rates:

Interval = 200 ms approx. 1 MB/h

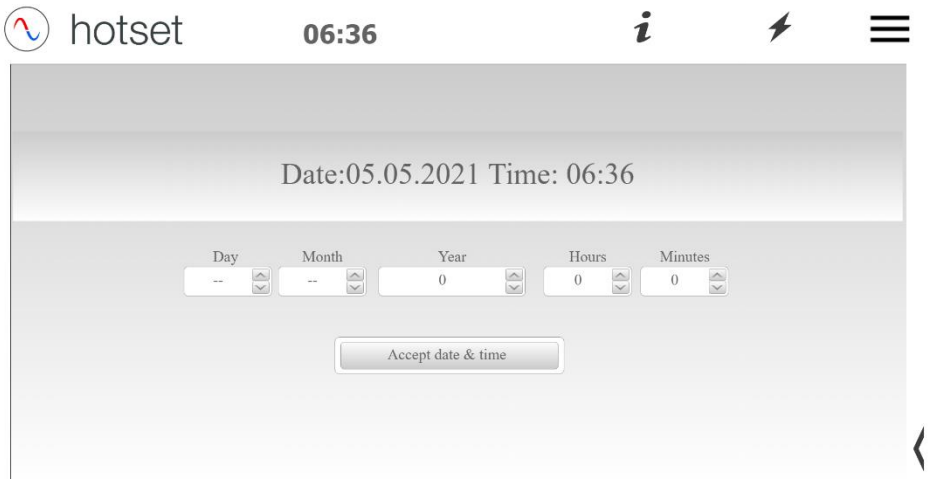
Interval = 1000 ms approx. 0.2 MB/h

The following data is saved in a .csv file:

Date, time, input temperature T1, input pressure p1, output temperature T2, output pressure p2, flow rate q, digital input signal, limit and hardware error.

System setting time/date

To set the system time, change the corresponding drop-down menu and press the "Write date & time" button. The settings are then applied.



System setting network

The D-System can be integrated into a local network, e.g. to enable access via webview or a mobile end device such as a smartphone. Make sure that you are in the same network.

The following connections are possible:

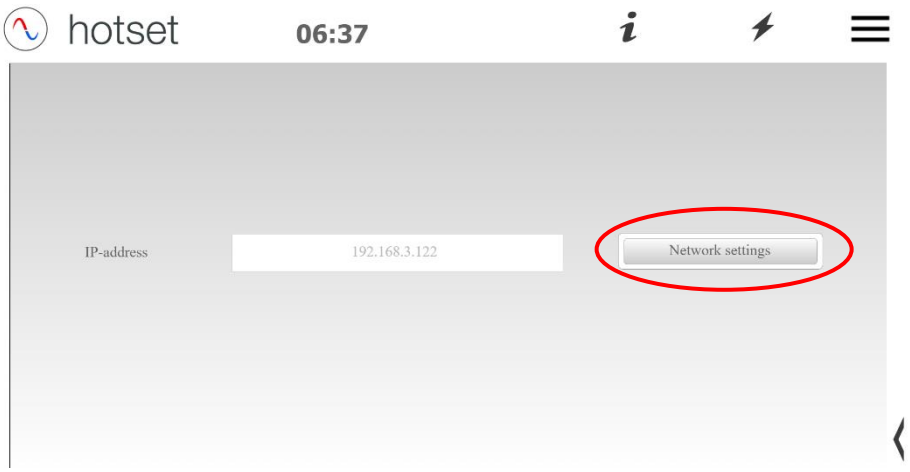
- WLAN
- LAN with automatic IP address
- LAN with fixed IP address

If the D-system is connected to a local network via the network connection, it automatically obtains an IP address and can also be accessed under this, e.g. via a browser.

The IP address assigned by the network is displayed in the window.

To connect via WLAN and LAN with a fixed IP address, proceed as follows.

Select the menu item System settings "Network".

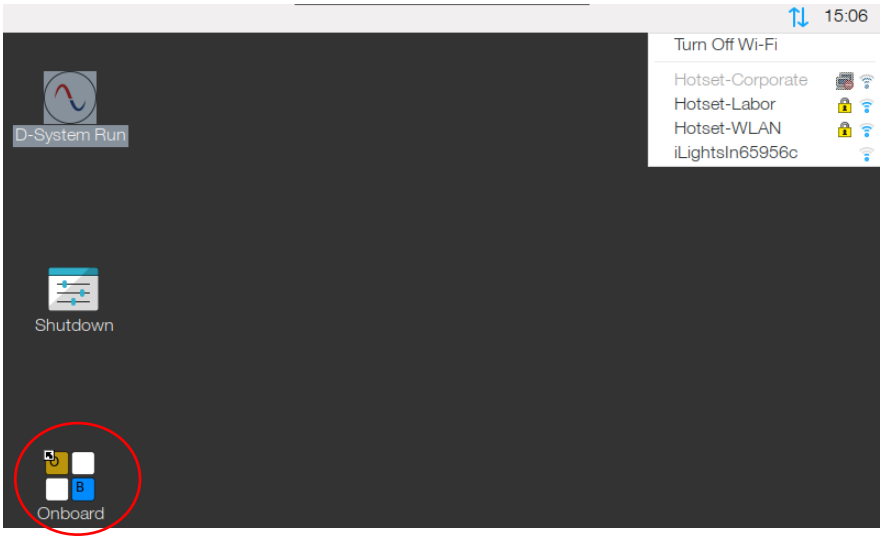


A new view appears under the "Network settings" and the D-System program is closed.

We recommend connecting a USB adapter for connecting a mouse and keyboard to the USB port as an operating aid.

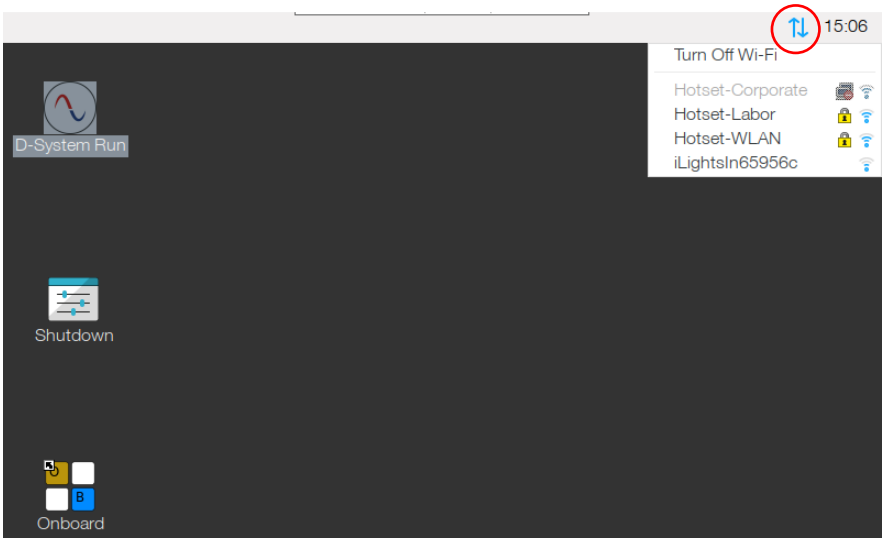
You can also use the display keyboard if this is not available.

Click or tap once on the desktop icon "Onboard" and the keyboard will open.

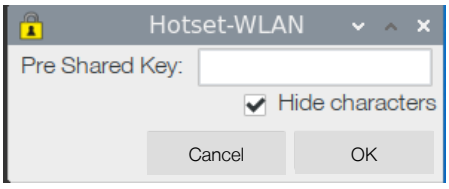


WLAN connection

Click on the connection icon ⇅ and switch on the WLAN. The available networks are listed.



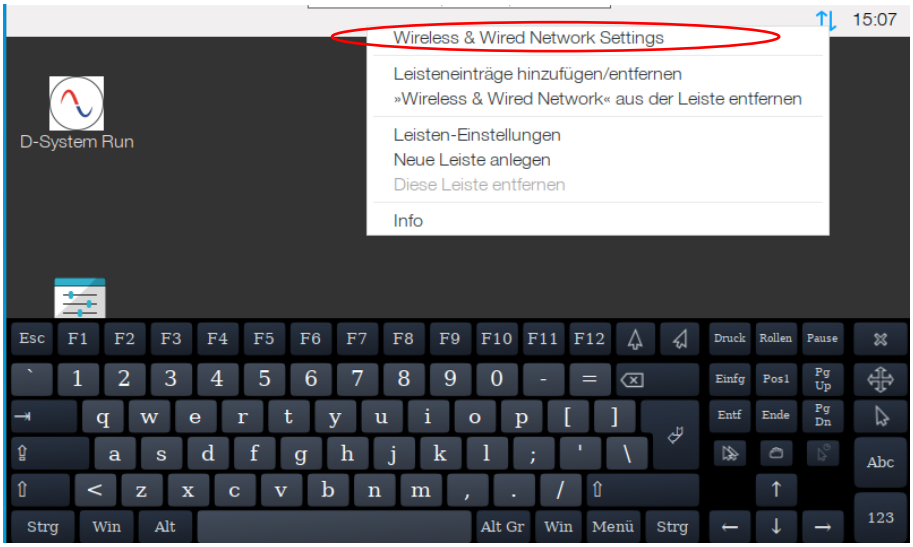
Enter the password and confirm with "OK". Once the connection has been established successfully, the color of the connection icon changes from gray to blue.



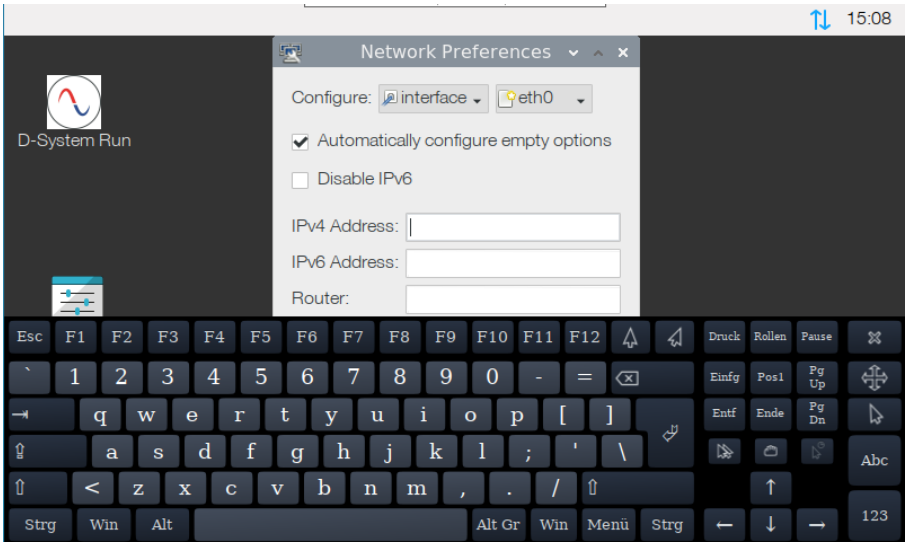
Connection with fixed IP address

At least one mouse connected via the USB port is required to assign a fixed IP address. Use a connected keyboard or the display keyboard as described above.

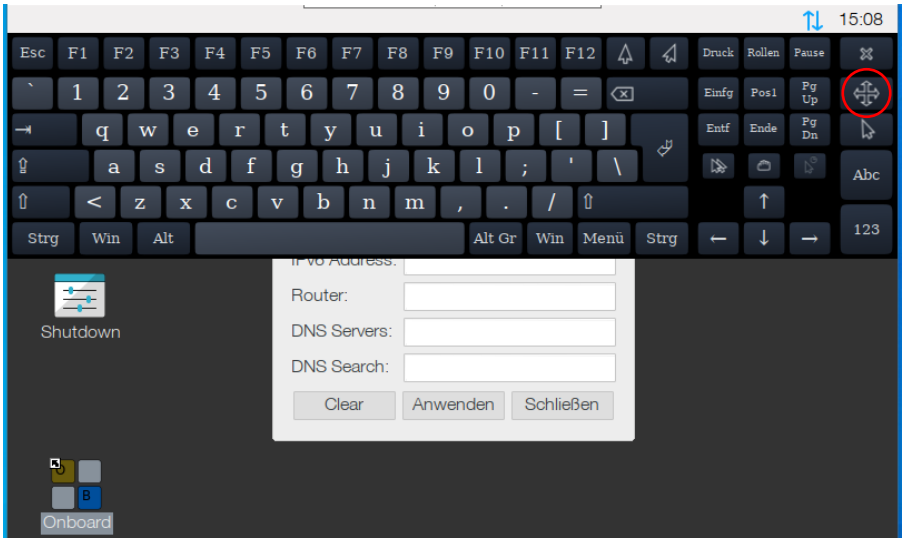
A submenu appears when you right-click on the connection icon. Select "Wireless & Wired Network Settings".



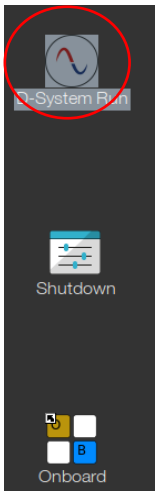
Under "Configure" select "interface" and "eth0".



Enter the required network parameters and move the keyboard using the position key. Press the "Apply" button to confirm the entry and the connection to the network will be established.



To return to the D-System program click or tap only once on the desktop icon "D-System Run".

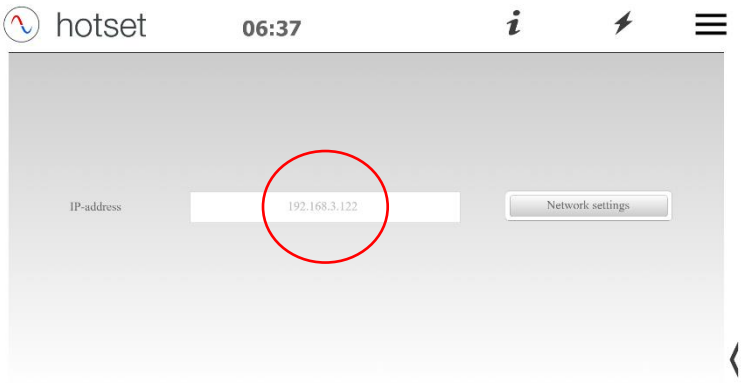


Browser and mobile view

Mobile view

To connect the D-System to, for example, a smartphone, connect to the shared network and enter the displayed IP address of the D-System into the smartphone's browser as follows:

IP address D-System



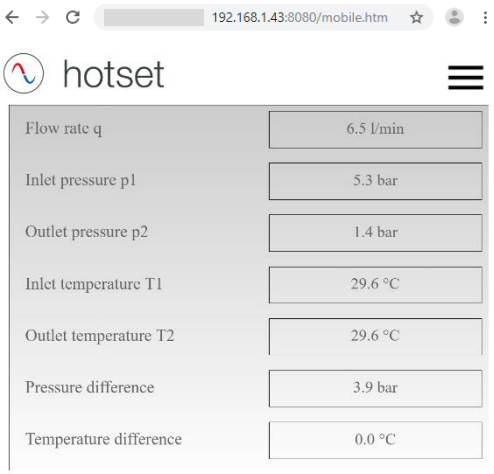
Enter in the browser:

Please use your displayed IP address, instead of the address given in the example.

Example: 192.168.1.43:8080/Mobile.htm

Pay attention to the suffix after the IP address.

The mobile view of the D-System opens. Use the burger menu to toggle between the values and the error message.



Desktop view

The D-System can be connected to e.g. a desktop PC for visualization and operation. Connect both systems to the same network and enter the following in your browser.

Enter in the browser:

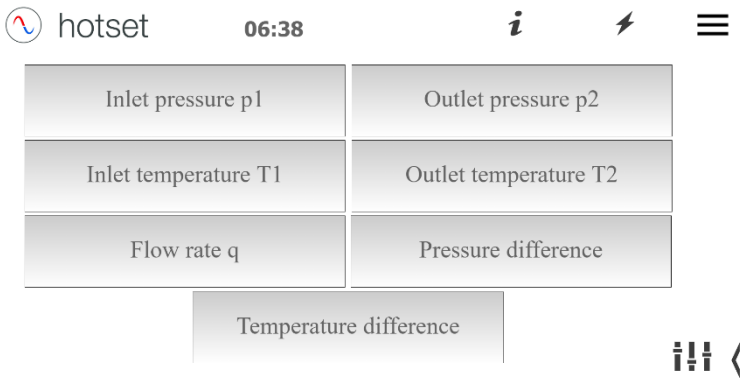
Please use your displayed IP address, instead of the address given in the example.

Example: 192.168.1.43:8080/webvisu.htm
Pay attention to the suffix after the IP address.

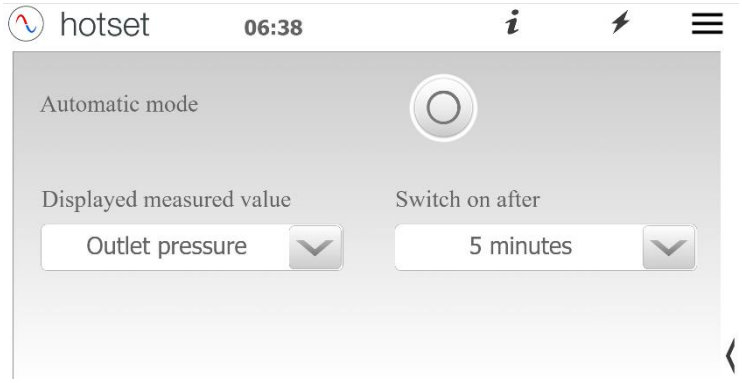
The web visualization of the D-System opens.

System setting Zoom

This function enables the user to display a selectable measured value graphically in a larger size.



The user can directly select one of the displayed values or activate/deactivate an automatic appearance via the settings .



An automatic switch-on can be activated/deactivated in the Settings menu item.

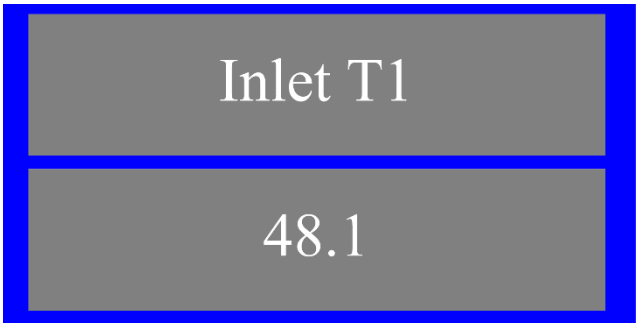
Select the desired measured value in the drop-down menu and the corresponding switch-on time.

The selected value is now always displayed in full screen after the set time.

To stop the automatic switch on, deactivate the function via the

"Switch on automatically" button.

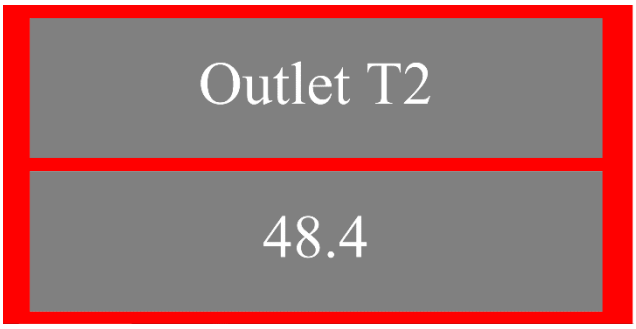
Display example: Output temperature T2



Blue background:

The measured value "Input temperature T1" is smaller than "Output temperature T2".

This type of energy flow can also be called cooling mode, because energy is absorbed by the measurement object.



Red background:

The measured value "Input temperature T1" is greater than "Output temperature T2".

This type of energy flow can also be called heating mode, since energy is released to the measurement object.

Click on the displayed actual value to return to the setting.

Process settings

The limit values for temperature, pressure and flow rate are assigned in the Process settings menu item. This setting is used for monitoring and can be activated and deactivated. Monitoring is activated in the default setting.

The button is highlighted in gray if process monitoring is **activated**. 

If process monitoring is **deactivated**, the button  is highlighted (blue).

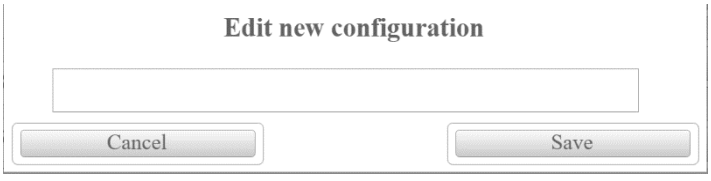
An additional symbol appears in the information bar  and points out a deactivated monitoring.

If monitoring is activated  and the values exceed or fall below the limit values, the system issues a report ⚠ . If logging is activated at the same time, this limit value violation is written to the file and marked with a "1" in the "Limit" line.

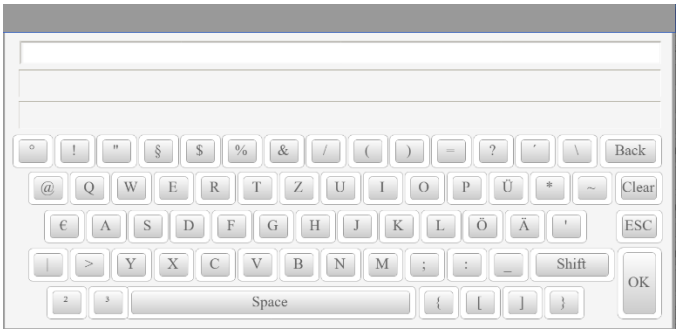
The corresponding limit value violations can be read out in the error message by pressing the message symbol ⚠ .

Creation of various process settings

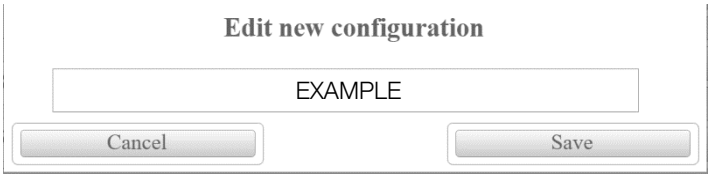
Overview of the stored data sets in the drop-down menu. For example, a measurement object can be named here and saved with specific limit values. To create a new data set, press "New" and an input field appears.



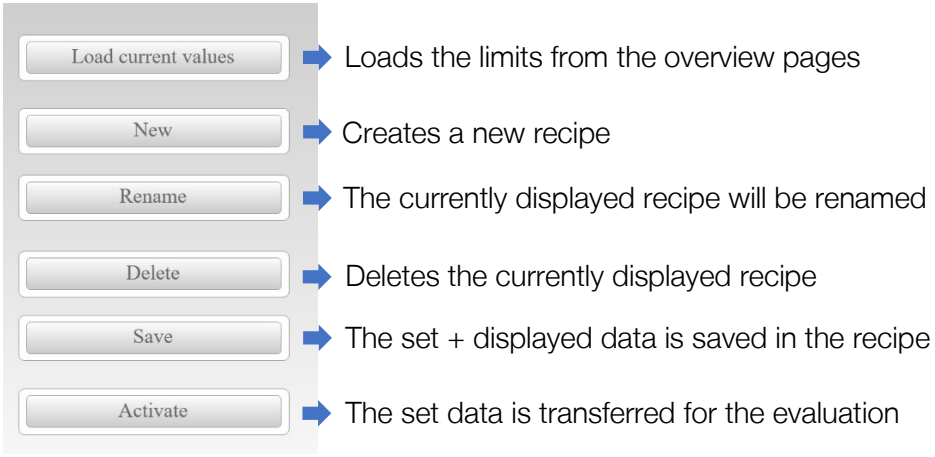
Tap on the free box and a display keyboard will appear.



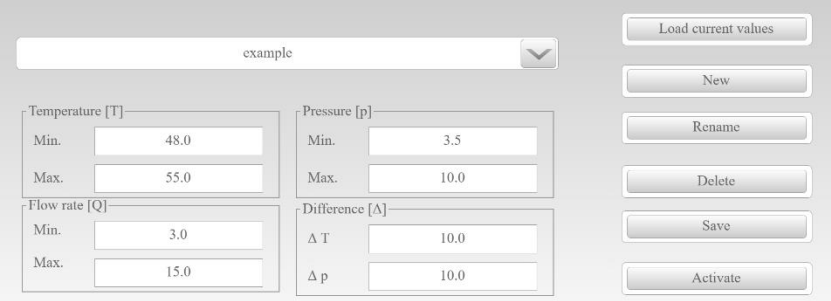
Enter your designation for the data record and confirm with the "OK" button.



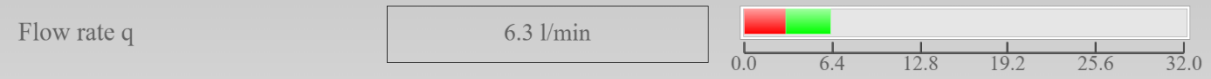
To change the entry, press the input box again. To save the designation, press "Save".



Assign the desired process windows (min/max) for temperature, pressure and flow. "Save" them in the selected data set and press "Activate" to transfer these values to the current process monitoring.

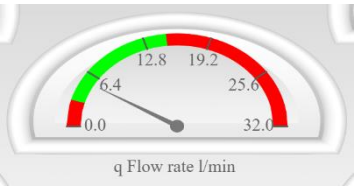


The process windows that are now active are displayed to you as red/green bars in the Process overview -> List, for example. However, these are only visible in color if the actual value is in the corresponding limit range.



If the end of the bar is in the red range, there is a limit value violation. If it is in the green area, the measured values are within the tolerance of the process window.

In the Process overview -> The process windows are also displayed in red/green. However, here the pointer moves along the scale and points to the corresponding

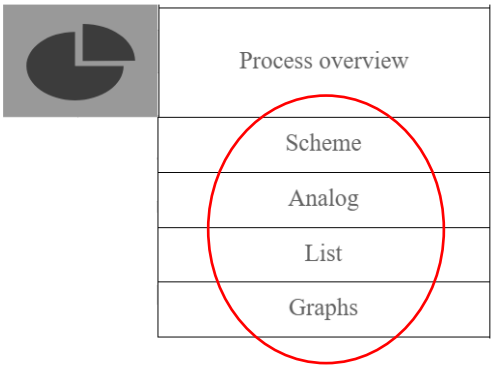


Limit value violations are displayed in the error message if process monitoring is activated or if the monitoring symbol  is not  visible in the info bar.

Process overview

The measured values of the measuring module can be viewed in four different views:

- Scheme
- Analog
- List
- Graphs



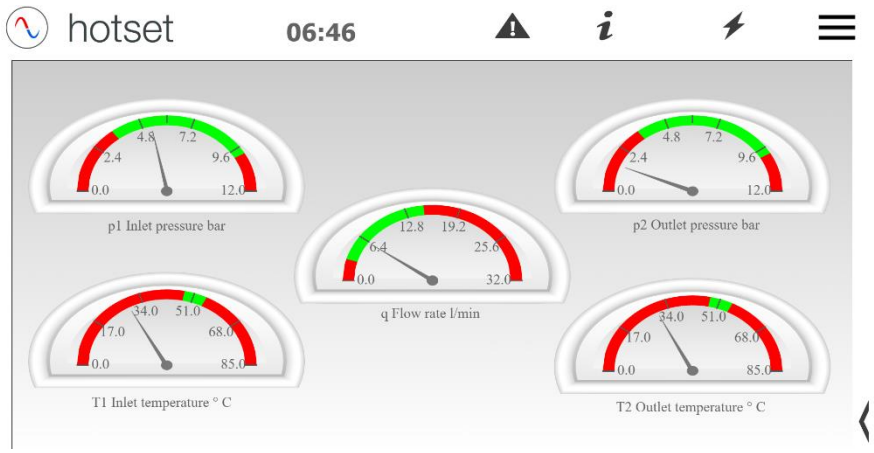
Process overview scheme

This overview variant shows the sensors as they can be found at the corresponding position in the measuring module. In addition, the energy that is added or removed via the measurement object is displayed.

Analog process overview

In the "Analog" view, the measurement data is displayed via a pointer. The limit values entered in the process settings are highlighted here in two colors.

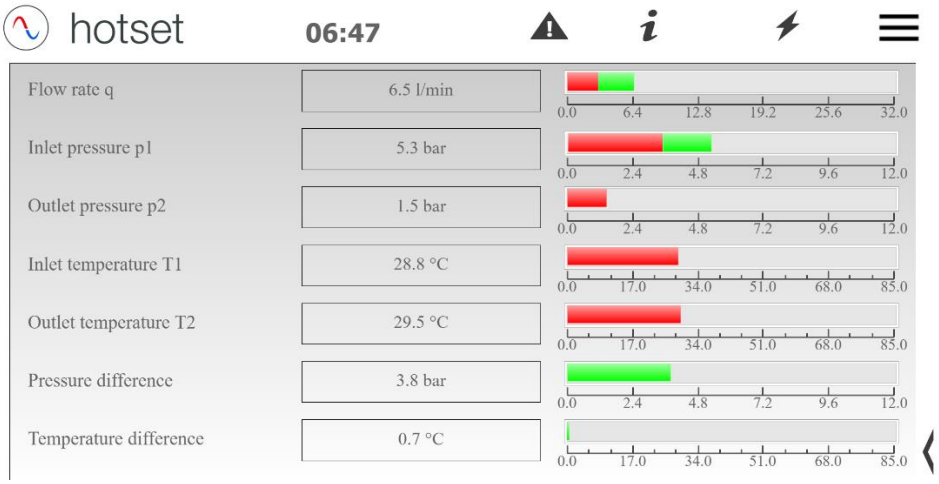
The green area is within the limit values and the red area is outside. This makes it possible to determine whether a limit value violation is imminent or already present without having to read off each individual value.



List process overview

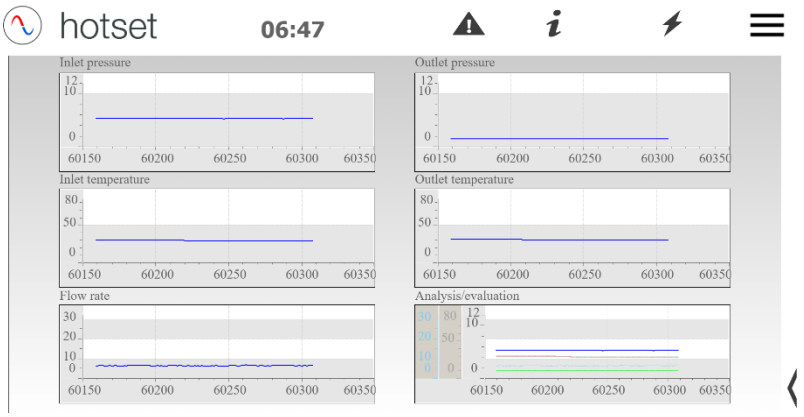
In the list view, all measurement data is displayed one below the other, with additional display of the pressure and temperature difference. In the bar chart to the right, a limit value violation can be read and is defined in two colors.

The blue area is within the limit values and the red area is outside. This makes it possible to determine whether a limit value violation is imminent or already present without having to read off each individual value.

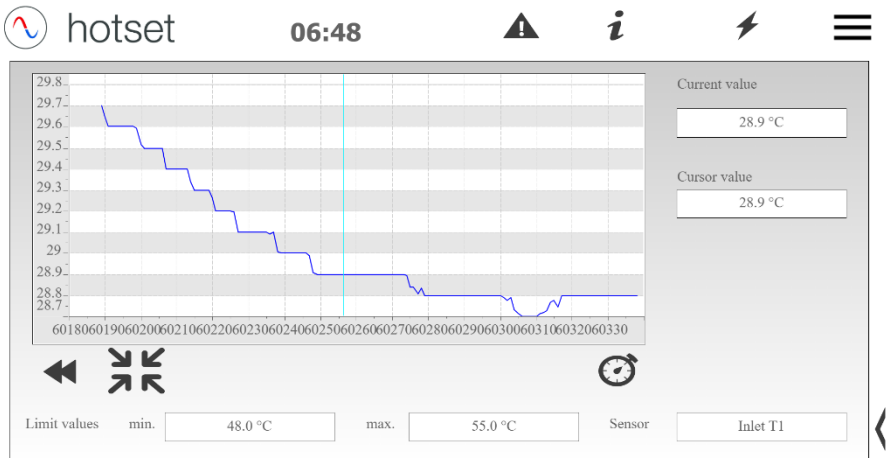


Graphs process overview

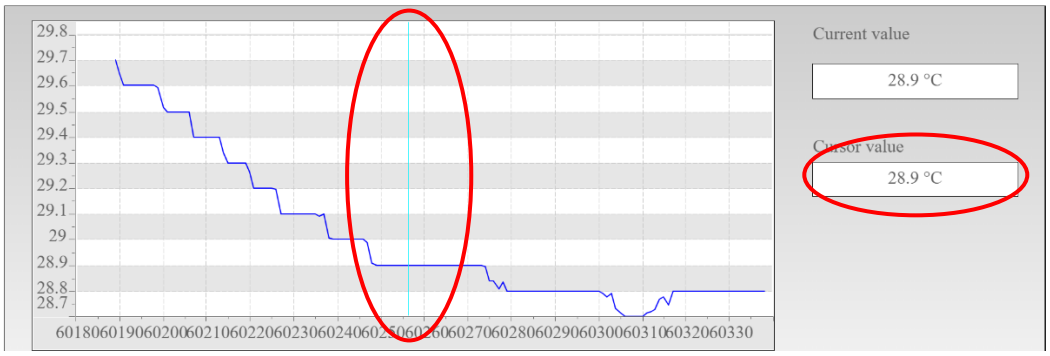
In the graph overview, the measurement data is visualized in a small preview. Each individual graph can be selected to view it in more detail. To do so, press on the desired graph and you will get to the detailed view. The graph labeled "Analysis/Evaluation" takes you to the visual and adjustable analysis and data logger.



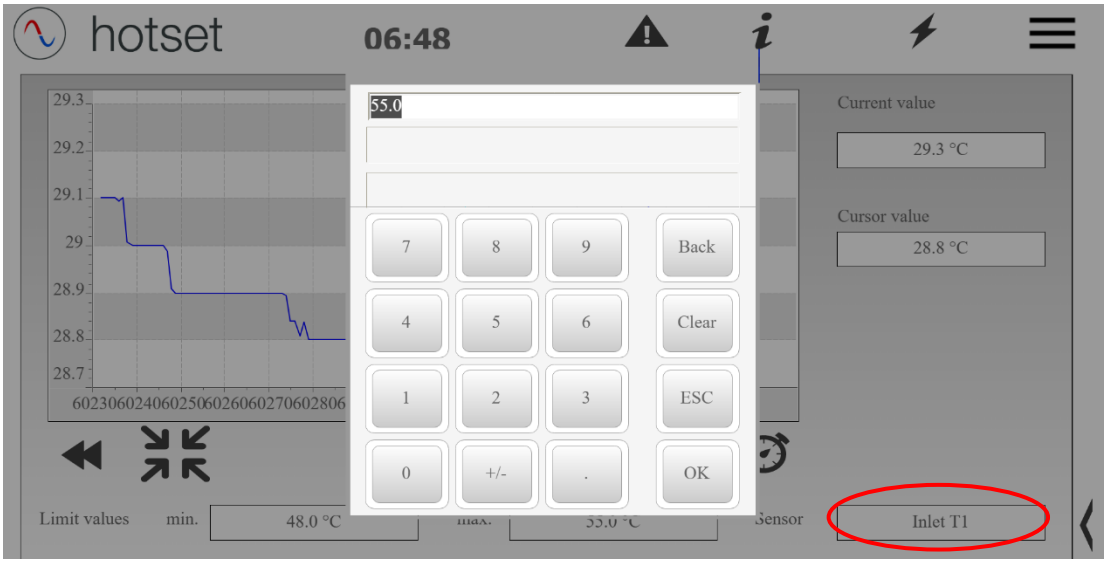
In the detailed view of each graph, you can zoom in on a specific area. You can zoom directly with two fingers, in the graph. Zoom by moving two fingers apart over the desired time period on the measurement line. This process can be repeated several times, note here the left scale area, which adjusts accordingly. For example, a pressure, temperature or flow fluctuation can be viewed more closely, or analyzed. The left symbol can be used to undo the last zoom operation. The arrow symbol deletes all views and brings you back to the starting position.



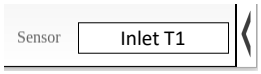
The current measured value at the sensor is displayed to the right of the graph. The display of the cursor position is the vertically running line in the graph and can be moved to show the desired position in the graph.



The corresponding limit values of the selected sensor are displayed below the graph. These can be changed directly with the value ranges. Press the selection box for this purpose.



The Sensor field indicates which graph is currently being viewed.



Analysis

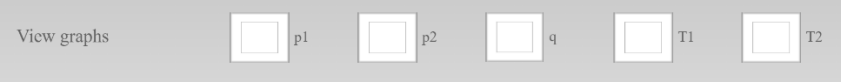
In the Analysis view, the user has the option to evaluate the measurement data in three different ways. As an adjustable graph, where several graphs can be visualized at the same time, an analysis from a subsection of the visualized graphs and the evaluation of the data logger on an external device.

Analysis: Activating the graphs

When you select the analysis for the first time, the graph is still empty.

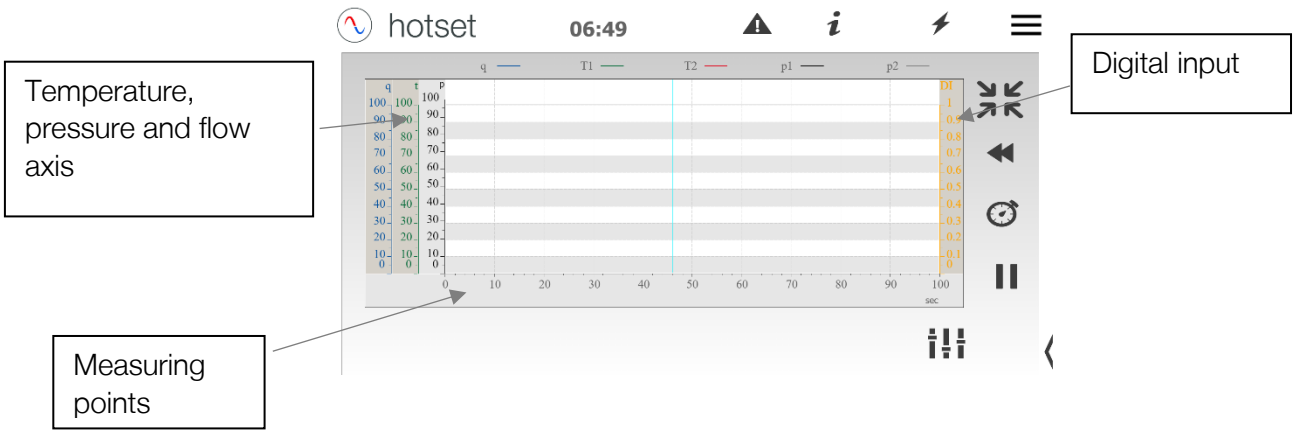
Select the setting  to activate the desired measurement lines in the graph.

Select the corresponding graphs using the selection fields.



Use the arrow key  to go back and view the selected graphs.

The display speed of the graphs can be set via the User system settings. This setting has no influence on the analysis/data logging. Here all measurement data is always written with the set interval.

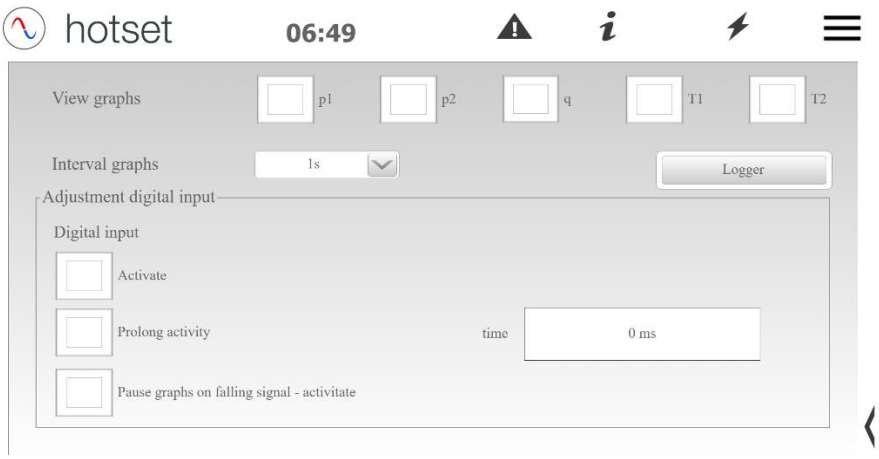


For a synchronization of the measurement data with an e.g. injection molding cycle, the digital input can be activated.

The digital input is displayed in the right Y-axis. The value is "0" when the contact is open and changes to "1" as soon as the contact is closed. This is displayed as long as the contact is closed.

The state of the digital input is also recorded when data logging is activated and can be evaluated at a later time.

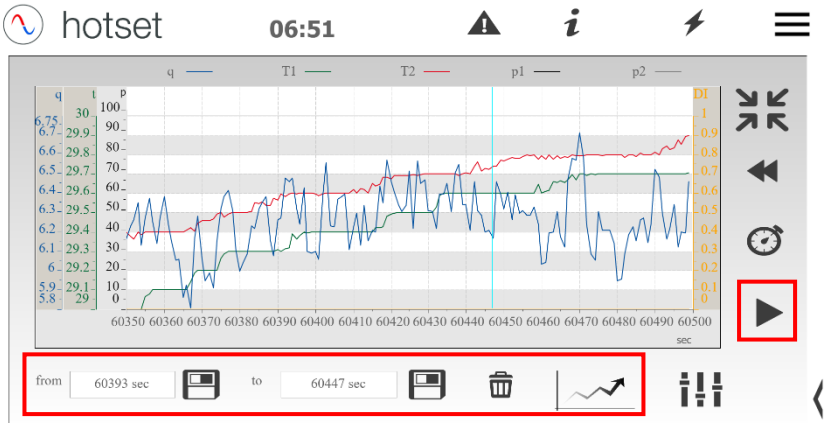
If for technical process reasons the contact can only be closed for a minimum time, this can be artificially extended. To do this, activate "Extend activity" and select the "Time specification".



In addition, the graph can be stopped when the signal drops or the contact is opened. To do this, activate the "Pause graph on falling signal" function.

Analysis of the activated graphs

The D-System analyzes the graphs selected under the settings , for a certain range. This range can only be set when at least one graph has been activated.



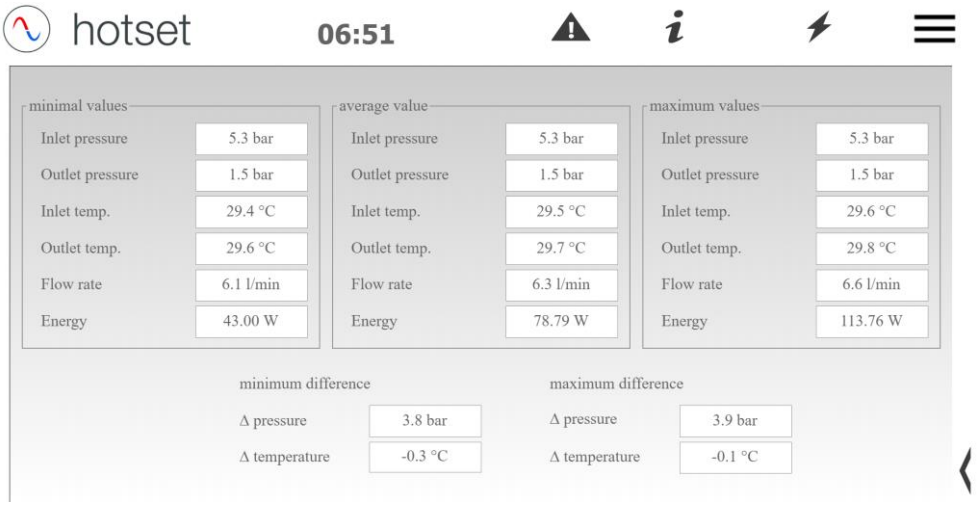
Press the Play button to show the range analysis.

Selection of the analysis range:

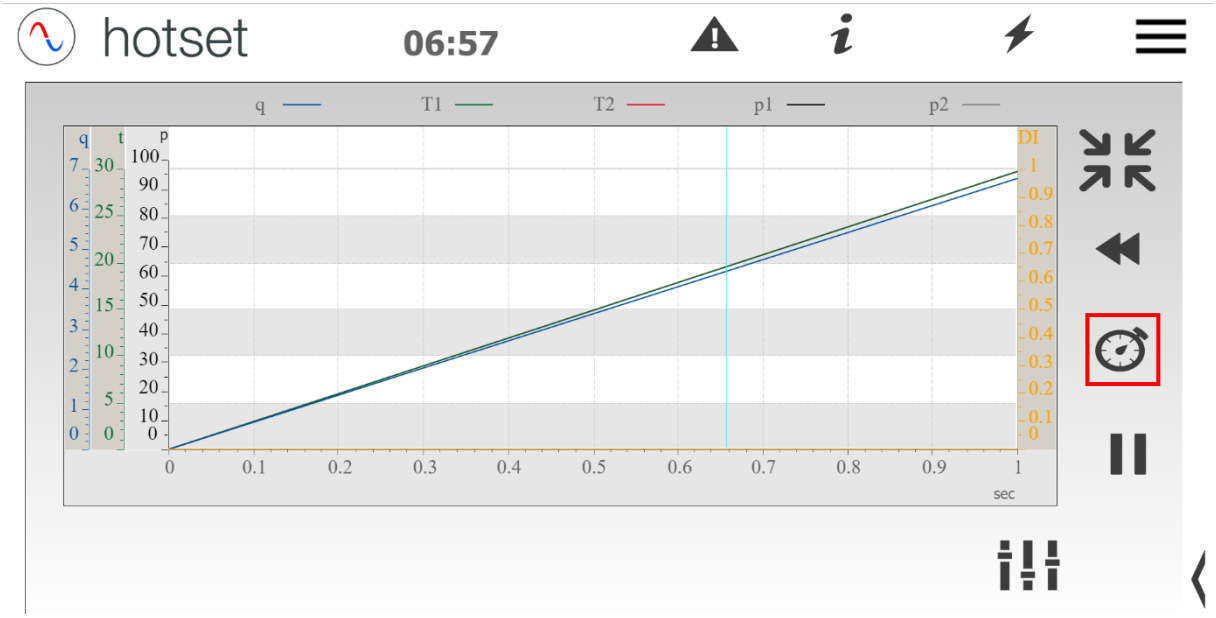
Use your finger to move the vertical line to the start point of the analysis area. Then press the save button below the actual value display "from". The selected value is now saved. Now move the line as far to the right as you want the analysis range to end. Now press the save symbol of the actual value display "to".

Press the trash can symbol to delete the analysis ranges.

Press the analysis symbol to get to the analysis.



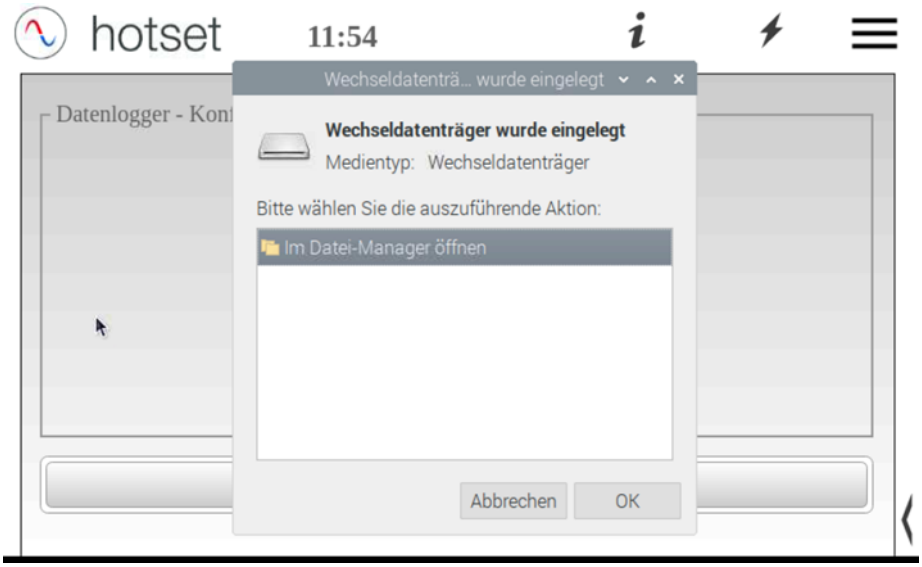
This brief analysis displays minimum, maximum and average values from the selected analysis range.



Pressing the timer button  sets the measuring point counter to zero. This has no influence on the time code in a log file and is only for graphical display.

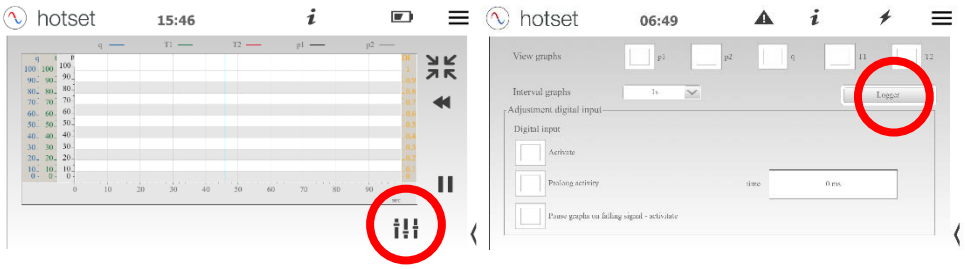
Data logging

The data log function can only be executed if the USB port has detected a storage medium. Connect a USB stick here, for example, and a window appears giving access to the contents of the medium.

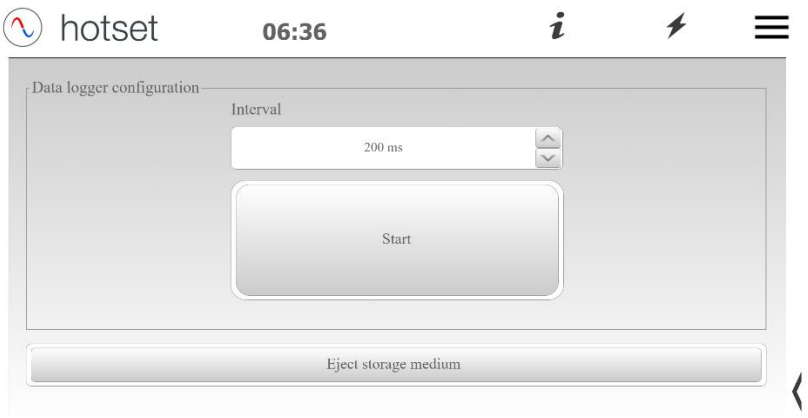


You can close the window with "Cancel" and start the log function. There are two methods to start logging.

Method 1:

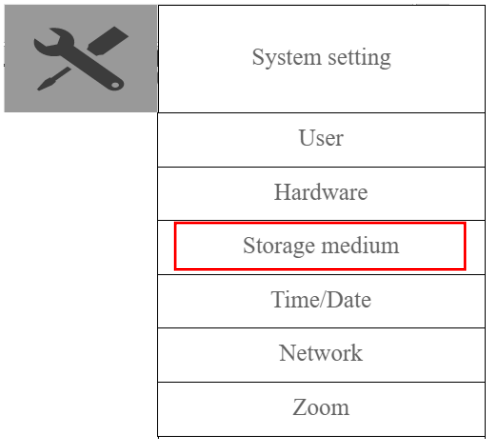


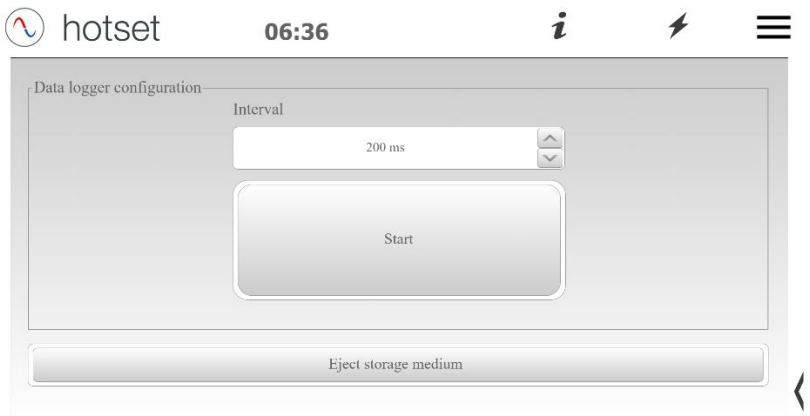
You can access the log function from the "Analysis" menu item and the Settings icon.



Method 2:

You can also access the log function in the menu item "System settings" and "Storage medium".

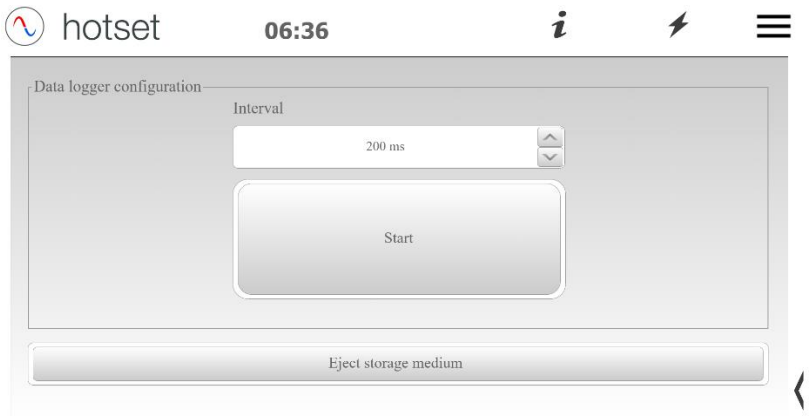




Select the desired interval between 200 ms and 60000 ms. The smaller the value, the more detailed the measurement data can be viewed. To make the selection, use the drop-down menu or the input function by clicking on the value.

The save symbol appears in the info line after pressing the "Start" button and remains visible until logging is "stopped" again by pressing the same button. If the save symbol is not visible, no data is recorded.

Before the storage medium is removed, press the "Eject storage medium" button. This function prevents a possible data loss.



There is a file with the following naming on the medium after finishing the data logging: "Date"_"Time".csv such as 2021_02_01_11_50_09.csv.

It describes the date and time when the data logging was started. This file can be opened e.g. by MS Excel and analyzed as desired.

Example Excel import

If the USB stick is connected to the PC, the log file described above appears in csv format.

This file can be opened directly with, for example, MS Excel.

	A	B	C	D	E	F	G	H	I	J
1	Date	Time	T1	T2	p1	p2	q	DI1	Warning	Limit
2	14.04.2021	09:57:59	70	69,7	6,8	2	7,6	0	0	0
3	14.04.2021	09:58:00	70	69,7	6,8	2	7,7	0	0	0
4	14.04.2021	09:58:00	70	69,7	6,8	2	7,7	0	0	0
5	14.04.2021	09:58:01	70	69,7	6,9	2	7,3	0	0	0
6	14.04.2021	09:58:02	70	69,7	6,9	2	7,3	0	0	0
7	14.04.2021	09:58:02	70	69,7	6,9	2	7,3	0	0	0
8	14.04.2021	09:58:03	70	69,7	6,9	2	7,3	0	0	0
9	14.04.2021	09:58:04	70	69,7	7	1,9	7,4	0	0	0
10	14.04.2021	09:58:04	70	69,7	7	1,9	7,4	0	0	0
11	14.04.2021	09:58:05	70	69,7	7	1,9	7,5	0	0	0
12	14.04.2021	09:58:05	70	69,7	7	1,9	7,5	0	0	0
13	14.04.2021	09:58:06	70	69,7	6,9	2	7,6	0	0	0
14	14.04.2021	09:58:07	70	69,7	7	1,9	7,5	0	0	0
15	14.04.2021	09:58:07	70	69,7	7	1,9	7,5	0	0	0

Information

The menu item Information contains the following details:

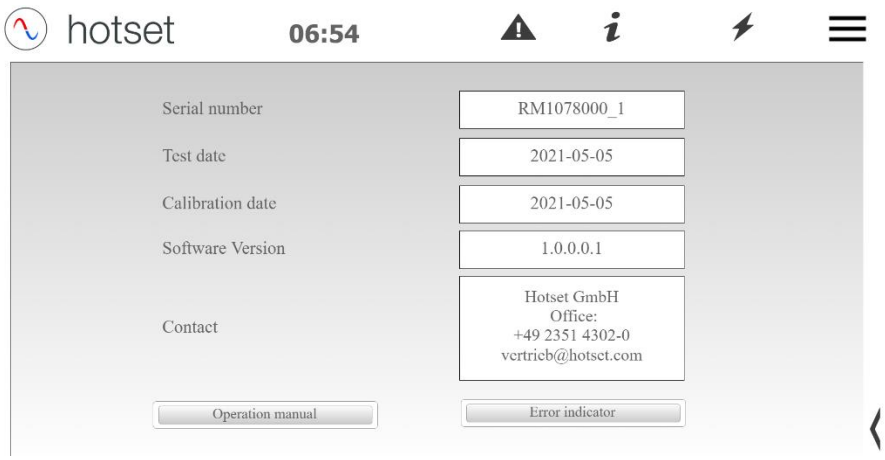
Serial number

Year of construction

Calibration date

Software version

Contact



From the information page, you can directly access the stored operating instructions or view error messages.