PRECISION IN
TEMPERATURE & DENSITY

LUDWIG
SCHNEIDER

OPERATING INSTRUCTIONS

DIGITAL MEASURING DEVICE PHYSICS 1000

58532

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1. OPERATING CONTROLS

Front of Device

(1) **Measuring Inputs M0 to M1**
M0 and **M1** Pt100-Sensors (RTD)
M2 Difference

(2) **Sleep-LED**

(3) **Output Socket A2**
MMC – Connector (57733)

(4) **Output Socket A1**
Serial V24 Interface (55855)
USB (57091)
Ethernet (57512)

(5) **Socket DC 12V**
Mains adapter (57090)

(6) **LCD graphics display**
7 lines for functions
1 line for softkeys, e.g. **MEM**, **FCT**, **MENU**
Corresponding Softkeys beneath
F1, **◄**, **▲** / **▼**, **►**, **F2**

(7) **Operating Keys**

ON/PROG	Switch Device on. Press and hold down to switch off
F1, **F2**	Function Keys (Softkeys)
▲ / **▼**	**M**: Select measuring point
▼, **▲**	**F**: Select menu
ON/PROG, **M◄◄**	**F**: Select functions Jump to measuring menu
▲, **▼**, **►**	Input data

Rear of device

(8) **Battery Compartment**
3 AA Alkaline-manganese batteries

2. CONTENT

3. GENERAL

Congratulations on your purchase of this new and innovative Ludwig Schneider GmbH & Co. KG data logger.

3.1. Warranty

Each and every device, before leaving our factory, undergoes numerous quality tests. We provide a guarantee, lasting two years from delivery date, that your device will function trouble-free. Before you send your device to us, please observe the advisory notes in. Trouble-shooting in the unlikely event that the device proves defective and you need to return it please wherever possible use the original packaging material for dispatch and enclose a clear and informative description of the fault and of the conditions in which it occurs.
This guarantee will not apply in the following cases:

- The customer attempts any form of unauthorized tampering and alliteration inside the device.
- The device is used in environments and conditions for which is not suited.
- The device is uses with unsuitable power supply equipment and peripherals.
- The device is uses for any purpose other than that for which it is intended.
- The device is damaged by electrostatic discharge or lightning.
- The user fails to observe and comply with the operating instructions.

The manufacturer reserves the right to change the product´s characteristics in the light of technical progress or to benefit from the introduction of new components.

3.2. Scope of delivery

While unpacking the device check carefully for any signs of transport damage and ensure that delivery is complete:

- Measuring instrument PHYSICS 1000 with 3 AA alkaline batteries
- This operating instruction

In the event of transport damage please retain the packaging material and inform your supplier immediately.

3.3. Handling batteries / rechargeable batteries correctly

When inserting batteries / rechargeable batteries ensure that these are correctly polarized

If the device will probably not be needed for a relatively long period of time or if the batteries are empty remove the batteries; this will prevent battery acid spilling out and damaging the device. Rechargeable batteries should be recharged as and when necessary.

You should never attempt to recharge an ordinary (non-rechargeable) battery; it may explode!

Batteries / rechargeable batteries must never be short-circuited or thrown on the fire.

Batteries / rechargeable batteries are special waste and must not be discarded together with normal domestic waste!

3.4. Special notes on use

- If the device is brought into the work-room from a cold environment there is a risk that condensation might form on the electronics. Wait unit the device has reached the conditions of the environment.
- Before using the mains adapter make sure that the mains voltage is suitable.
- Before you touch any sensor lines, ensure that all static electricity has been discharged.
- Do not run sensor lines in the neighborhood of high-voltage power cables.

4. INTRODUCTION

The PHYSICS 1000 series have two galvanic separated sockets for Pt100-sensors (RTD). For simple operation the device provides a LCD graphics display combined with softkeys including a cursor control. The displayed content is adapted to the connected sensor and shows sensor specific menus and all suitable applications. There are further sockets for power supply and several interfaces (e.g. USB, Ethernet, MMC-Adapter).

4.1. Sensor programming

The measuring channels are programmed, completely and automatically, by the connectors.

Measuring ranges

The Physics 1000 is especially designed for the use of Pt100-sensor.

Units

The dimensions can be switched between centigrade (°C) degree, Fahrenheit (°F) and Kelvin (K).

Sensor identification

For the identification of the sensors a 10-character ID is designated. It can be created by the keypad or through on of the interfaces and is shown on the display, printouts or on the connected PC screen.

Correction of measured values

The measured value of every channel can be set to zero. Further all sensors can be calibrated in several points; the correction graph is stored in the EEPROM of the connector. A calibrated sensor can be used with any PHYSICS-device without any adjustment.

4.2. Measuring

The measured value of every channel can be set to zero. Further all sensors can be calibrated in several points; the correction graph is stored in the EEPROM of the connector.

Averaging over measuring points

In case of fluctuating values they can be averaged. Between 2 and 99 scanned values will be taken and the arithmetic mean will be calculated and displayed continuously.

Maximum and minimum values

For each measuring operation the maximum value and minimum value are acquired and saved to memory. These values can then be displayed, printed out, or deleted from memory.

Single value memory
Up to 100 measured values can be saved manually. This data can then be shown on the display. If you need more measuring values and transfer them to a PC a MMC-Interface is available for output socket A2.

Operation
All measuring and function values can be displayed in different menus on the LCD screen. Six keys (four of them softkeys) can be used to operate the device. This system also allows you to fully program the sensors and the device.

Output
All data logs, menu functions, and stored program parameters can be output to any peripheral equipment. RS232, USB, and Ethernet interfaces are available using the appropriate interface cables. Measured data can be output in list, column, or table format. The print header can be programmed to refer specifically to you company or to your application.

Measured value memory – data logger
The device can, by fitting an external MMC-connector (accessory) with a multimedia card, be upgraded to a high-capacity data logger. The stored files can be transferred to the PC by any standard card reader.
After insert of the MMC-connector, there will be two additional menus with all required parameters such as time, date, cycles, start- and end-time, file-name and more available.

5. INITIAL COMMISSIONING

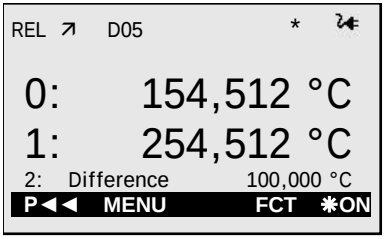
Sensor connection: Connect the sensor to any socket M0 to M1
Power supply: via batteries or mains adapter to DC socket
To switch on: Press key **ON/PROG**

The measuring menu will be displayed automatically.

Measuring menu:

The measured values will be shown. If 2 sensors are connected – channel 2 – the difference between channel 0 and channel 1 will be shown additionally.

Call up main menu **MENU** or ◄
Call up function menu **FCT** or ►
Display illumination on/off **✱ON** rather **F2**

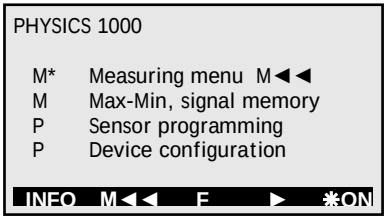


Main menu:

Sub menus will be selected with **F** or ▲ / ▼ and called up with **ON/PROG** or ►.

M◄◄ or ◄ provides a jump to the measuring menu immediately.

Selection of Max-Min, single memory will lead to the functions menu.

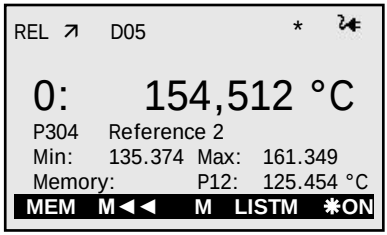


Functions menu:

One measuring point and its minimum, maximum and the last stored value (independent from the above shown measuring point) will be shown.

P304 indicates the measuring range of the sensor.

Reference 2 is the sensor identification, which can be set for each sensor separately.



Measuring point can be selected by **M** rather ▲ / ▼.
Pressing **MEM** rather **F1** will store the value of the current measuring point in the single value memory. Are there values in the memory, they can be shown with in a list by pressing **LISTM**.
After pressing **ON/PROG** you can choose with ▲ / ▼ between measuring point, minimum/maximum and the last stored value. Your selection will be shown inverted and context sensitive keys will appear in the softkey-line, e.g. **154.512**.

6. POWER SUPPLY

Power can be supplied to the measuring instrument in any of the following ways:

- 3 AA alkaline batteries (included in delivery)
- Mains adapter 12V, 0.2A with Physics connector 507090

Our product spectrum includes all the appropriate accessories.

6.1. Battery operation and supply voltage monitoring

Power is supplied to the measuring instrument as delivered by 3 Alkaline-Mignon batteries. At a power consumption of approx. 20 mA the operating time will be approx. 100 hours. If the illumination is constantly switched on, the power consumption doubles and the operating period reduces to approx. 50 hours. The charge of battery is visible in the upper right corner of the display:

- ´´´´´´´´´¶ Full charged batteries
- ´´´´´µµµµµ¶ Semi charged batteries
- ´µµµµµµµµµ¶ Batteries nearly empty, voltage <3,8V
- As soon as the remaining battery capacity drops below 10%, the symbol ´µµµµµµµµµ¶ starts flashing. Additionally the symbol will flash in the softkey-line instead of the illumination symbol. The illumination will then be disabled. The flashing symbol can appear in other areas of the display, too.

The currently supplied voltage can be observed in the info menu, reachable from the main menu by hitting **INFO** rather **F1**. You should then be able to evaluate the remaining running time. If the voltage drops below 3V, the device will switch off itself. All stored values and other data will remain in the memory. For substitution of the batteries, you have to unscrew the cover of the battery compartment. Keep an eye on the right polarity while inserting the batteries.

6.2. Mains operation

To power the device from an external source preferably use the mains adapter with the PHYSICS connector 57090 (12V/12 mA) on the DC socket. Please ensure that the mains voltage is correct (220V/50~). If the device is supplied with external voltage the ↯-symbol will appear in the status of the display.

6.3. Switch ON / OFF, Re-initialisation

To switch ON press key **ON/PROG** (6) located in the middle of the cursor block. The display will show the measuring menu immediately after a status message.
To switch OFF press and hold down the same key **ON/PROG**. After the device is switched off the real-time clock continues to run and all saved values data and settings are retained intact.

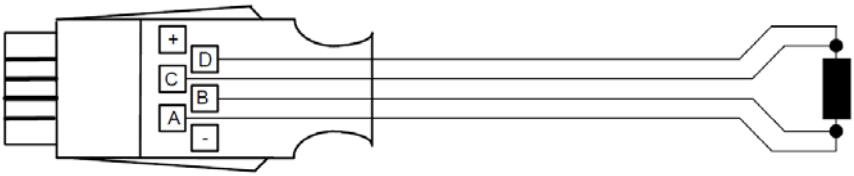
If interface (e.g. electrostatic) or a malfunction (e.g. battery failure) causes the device to behave abnormally, the device can be reinitialized. To activate reste press **F1** while switching on with **ON/PROG**. However, the date and time-of-day settings will be lost.
To restore the device to the factory default settings press **F2** when switching on. In so doing many parameters will be lost or be restored to their defaults: Language = German, illumination = off. Only the programming of the sensors in the PHYSICS connectors remains unaffected.

6.4. Data buffering

The sensors programming is stored in the EEPROM on the sensor connector, the internal data memory and the devices calibration and programmed parameters are stored in the EEPROM on the instrument itself, all on a fail-safe basis. Date and time-of-day settings and the individual values memory are retained intact if the device is just switched off but are lost when the device is reset or the batteries are replaced.

7. CONNECTING THE SENSORS

Any Pt100-sensor with PHYSICS-connector can be connected to one of the input sockets M0 to M1. If you want to connect your own Pt100-sensor you need a PHYSICS-connector. For multipoint-calibrations please contact us.



Pt100-Sensor

7.1. Sensors

All Pt100-Sensors with PHYSICS-Connector are programmed with measuring range and resolution and hence applicable to any PHYSICS device. A mechanical encoding system ensures that sensors, interfaces and power modules can only be connected to the correct sockets. All PHYSICS connectors incorporate two snap-lock levers these snap into position as soon as the connector is inserted into the socket, thus preventing unintended disconnection if the cable is accidentally pulled. To withdraw the connector, both these levers must be pressed in at the sides.
Splash-proof variants of are also available as options. For this purpose a number of new sensors are now available with spray-coated PHYSICS connectors incorporating a double sealing lip, specially designed to protect the socket unit against the effects of penetration by splashing water. For any unused sockets protection caps are available.

7.2. Measuring inputs and additional channels

All PHYSICS 1000 devices incorporate 2 input sockets appropriate two the channels M0 and M1.

Device internal channels

A further innovation on devices in this series is additional device-internal channel M2. It is only visible, when two sensors are connected to socket M0 and M2.

$$M2 = M1 - M0$$

7.3. Potential separation

When organizing a properly functioning measuring setup it is very important to ensure that no equalizing current can flow between sensors, power supply, and peripherals. All points must therefore lie at the same potential and / or any unequal potentials must be electrically isolated.

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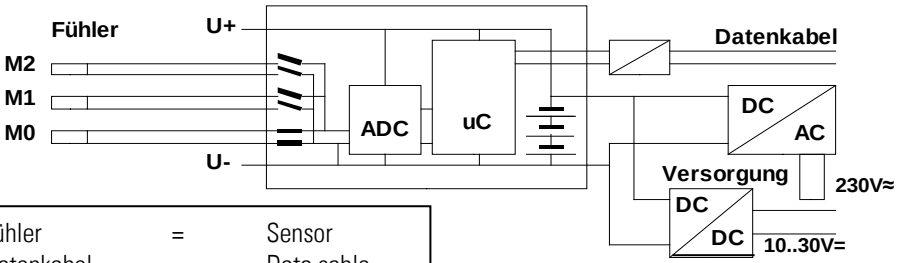


Fühler	=	Sensor
Datenkabel	=	Data cable
Versorgung	=	Power supply

The analogue inputs are electrically isolated by means of photovoltaic relays; the maximum potential difference permitted between them is 50 VDC or 60 VAC.

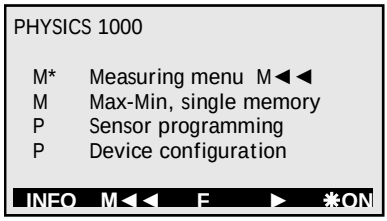
8. DISPLAY AND KEYPAD

The display (5) incorporated in the ALMEMO 2590 series consists of a dot matrix LCD display with 128x64 pixels, or 8 rows of 8 pixels each. There are 7 keys for operation available.

8.1. Display and menu selection

The main menu provides the following submenus:

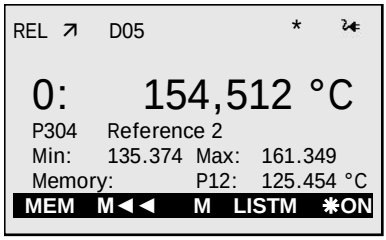
Measuring menu for acquiring measured values
Functions menu, also accessible from the measuring menu by pressing key **FCT**
2 programming menus for programming sensors and device parameters
Info menu for device and sensor information



To call up main menu depending on menu:	◄ or **MENU**
To switch on display illumination:	**✱ON** or **F2**
To switch device off:	**ON/PROG** press and hold down
To select menu press key:	▲ and ▼
To call up the selected menu press key:	**ON/PROG** or ►
To view the most important device information:	**INFO** or **F1**

8.2. Measured value and status symbols

The measuring menu shows the measured value of the activated measuring point. On the left of the measured value is the measuring point number on the right the unit.



Symbols of the status line:

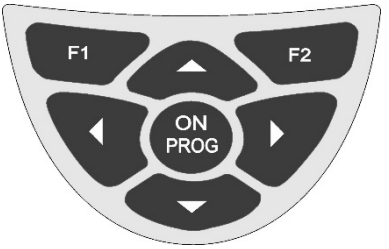
Relative measuring with respect to a reference value (one measuring point has been set to (**ZERO**):	REL	
Measured value modified with multi point calibration:	↗	
Measuring value attenuation activated:	D05	
Interface to a PC activated:	COM	
Display illumination on:	*	
Charge of batteries:	´´´´´´´´´¶	Batteries full charged
	´´´´´µµµµµ¶	Batteries semi charged
	´µµµµµµµµµ¶	Batteries nearly empty

Control symbols of the measured value:

No sensor connected, measuring point disabled:	----	
Measuring range exceeded:	O	flashes
Measuring range undershot:	U	flashes
Sensor breakage:	B	flashes
Sensor voltage Lo:	L	flashes

8.3. Function keys

The way in which the function keys **F1** , **F2** and the cursor keys ◄ , ▲ , ▼ , ► operate may differ in each menu, according to the symbols shown in the bottom line of the display (softkey). These softkey-abbreviations are shown in white letters on black background, e.g. **MEM**.



Measuring menu

Call up device configuration:	**P◄◄**	**F1**
Call up main menu:	**MENU**	◄
Call up functions menu:	**FCT**	►
Illumination:	***ON**	**F2**

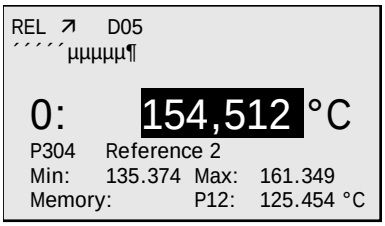
Functions menu

Store measured value to single value memory:	**MEM**	**F1**
Call up measuring menu:	**M◄◄**	◄
Select measuring point with cursor keys:	**M**	▲ or ▼
Show content of single value memory:	**LISTM**	►
Activate illumination:	***ON**	**F2**

8.4. Function selection

Each menu compromises a number of functions; these may have to be activated or programmed during operation.

Functions are activated by pressing **ON/PROG** . The first changeable parameter will be highlighted in inverse front. The example on the shown functions menu on the right the selected parameter measuring point is shown inverted: **154.512**



The softkey symbols appear context sensitive in the softkey-line

With the softkeys for **F** you can swith between the parameters. ▼ and ►

To leave the programming mode press **ESC**. ◄

8.5. Data input

When a programmable parameter is selected (see 8.4) you can clear or reprogram the current value directly.

Activate programming mode by pressing:	**ON/PROG**
In the middle of the softkey line will appear:	**P**
The changeable value will appear in a small box, the cursor flashes under the first changeable decimal place:	05
Erase the values and save is achieved by pressing:	**CLR**

Attention! The former values will be erased without inquiry.

Changing values	
Choose the decimal unit with:	◄ and ►
Change incrementally with:	▲ and ▼
Save your changes with:	**P** or **ON/PROG**
Chancel changes and leave programming mode:	**ESC**

When entering **alphanumeric characters** select the group with **F2**

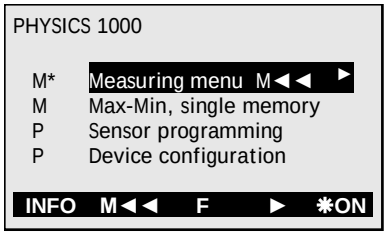
Upper case characters:	**ABC**
Lower case characters:	**ABC**
Numbers only:	**123**
Arithmetic signs:	**+ – /**

By changing some parameters such as unit or language you cannot enter characters. Instead you can switch between possible values by pressing softkey **F2**, in the softkey-line will appear , **SET** e.g. the unit will switch between °C ↔ °F ↔ K, is also achieved by pressing ▲ and ▼. While changing the contrast of the screen you can do this by pressing **–** and **+** in steps of 10%.

9. MAIN MENU

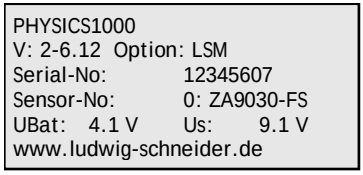
In the main menu you can call up the following submenus:

- M* Measuring menu
- M Functions menu
- P Sensor programming
- P Device configuration



To obtain the most important device data press: **INFO** or **F1**

Here, if you have any questions, you can find the exact device type together with its firmware version, options, and serial number. Here, you can select any sensor by pressing key(s) ▲ / ▼ and identify if on the basic of its order number (if available).



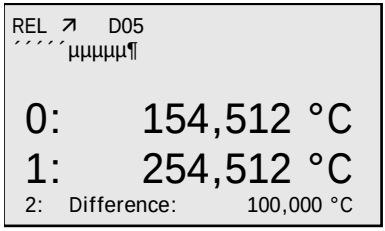
To determine the power supply requirements both the battery voltage and the sensor voltage can be called up. You can also obtain help at our WEB address.

10. MEASURING MENU

When the device is switched on, after a short status message the measuring will appear automatically.

In the first line you will find some status symbols. The second and the third line show the measured values of the attached sensor, in the fourth line you´ll find channel 2, the difference (only when two sensors are connected).

Additional functions can be called up with key **FCT**.



10.1. Differential measurement

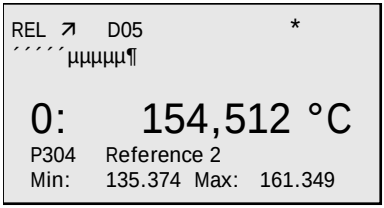
If two sensors are connected to the PHYSICS device, the internal channel 2 will automatically display the difference:

$$M2 = M1 - M0$$

11. FUNCTION MENU

The function menu provides the possibility to observe minimum and maximum values over a period of time. Further you can set any measuring point to zero.

Call up function menu in the main menu
with the keys: ▲ and ▼ and
confirm with **ON/PROG** or ►
or in the measuring menu with key: **FCT**
go back to measuring menu: **M◄◄**



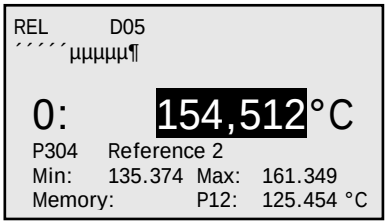
11.1. Select measuring point

The symbol **M** in the middle of the softkey line signals that you can select the measuring point.

Increase measuring point number: ▲
Decrease measuring point number: ▼

11.2. Set measured value to zero

One very useful function is to zero the measured value at certain locations or at certain times as a reference value in order then to observe only the subsequent deviations.



Activate functions
Measuring point will be shown inverted, in the softkey-line will appear: **ZERO**, **ESC** and **F** — **ON/PROG**
Select measuring point: ▲ and ▼
Set the measuring point in zero: **ZERO** or **F1**

The measured value shows 0.000 °C and the symbol REL appears in the status line of the

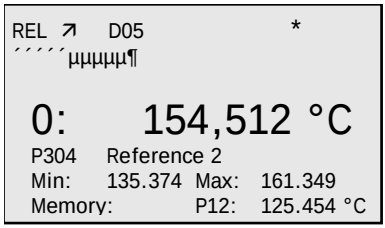
- Function menu when the zeroed value is selected

Always in the measuring menu.
Return to absolute value by press and hold **ZERO** rather **F1**

- The offset is only stored in the RAM of the device. By switching OFF the device the offset will be eliminated.
- Keep attention when setting the internal difference channel to zero, the REL symbol will not be shown in the status line of the measuring menu.

11.3. Maximum minimum memory

The function menu shows beside the measured value the stored minimum and maximum oft he selected

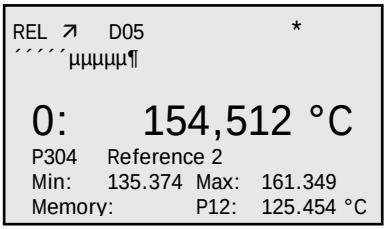


To clear the extreme values activate the functions:	**ON/PROG**
Select the line with the extreme values	▲ and ▼
In the softkey-line will appear:	**CLR** and **CLRA**
To clear the extreme values of all channels press:	**CLRA** or **F2**
To clear the extreme values of the selected measuring point:	**CLR** or **F1**

As soon as you clear the extreme values, the current measured value will appear in case of continuously running measurements:

- By setting a value to zero the extreme values of the measuring point will be cleared, too.
- Switching device OFF will also clear all extreme value memory.

11.4. Single value memory



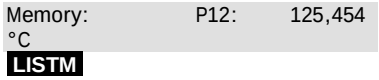
Up to 100 measured values can be saved by the touch of a button. They will be saved including unit, measuring point and a running number – starting with 00 up to 99 – in the memory.

Saving measured values:

To save the value of the selected measuring point press: **MEM** or **F1**

The last saved value is shown in the display:

As soon as one value is saved the softkey will appear: **LISTM**



Delete measured values:

Activate functions: **ON/PROG**

Select the memory line: ▲ or ▼

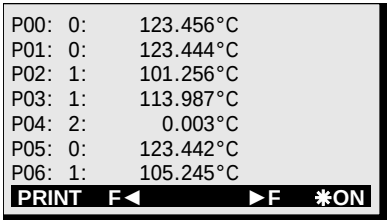
The following softkeys will appear: **CLRP** and **CLRM**

To delete the last saved value press: **CLRP**

To delete all saved value press: **CLRM**

Display all saved values:

By pressing the softkey **LISTM** a list of all values in the memory will be shown:



Are there more pages with values, you´ll find in the softkey-line: **►F**

By pressing it you scroll to the next page: **►F**

To scroll back to the precious page press: **F◄**

By pressing this key from the first page of the memory you return to function menu: **F◄**

With softkey **PRINT** you can output all saved data to a printer.

This printer is a special accessory. If required, please don´t hesitate to contact us.

12. DATA LOGGER

You can upgrade your PHYSICS 1000 to a multifunctional data logger by connecting a multimedia-card connector, available as accessory. (57733)

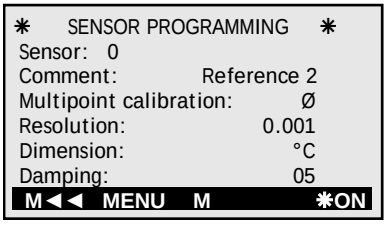
- Define start and end time.
- Collect data in user-defined intervals.
- Send the device to sleep mode (saves energy when driven by batteries).
- Transfer data to any spread sheet software.

13. SENSOR PROGRAMMING

The sensors for the PHYSICS 1000 device incorporate an EEPROM in the connector, which takes care that the sensor will be identified by the PHYSICS device. It also contains the factory-provided multi point calibration. Further you have the possibility to save some individual parameters, e.g. Measuring point designation, units or attenuation.

Choose the entry sensor programming in the main menu.

Is more than one sensor connected you can switch between both with ▲ and ▼.



13.1. Measuring point desingation

Each measuring point can be assigned a 10-character alphanumerical designation denoting as clearly as possible the type of sensor, measuring location, and / or purpose. This designation is included in all standard measured value displays. In an output via the interface the measuring point designation appears in the program header as “Designation” and also in the measured value list. Activate the function by pressing **ON/PROG**, comment with ▲ and ▼ press again **ON/PROG**.

13.2. Multi point calibration

In order to increase the accuracy of sensors, a factory-provided correction can be saved in the EEPROM of the connector. It contains the deviations of several temperatures, which are determined in our calibration laboratory. When you measure temperatures between these calibration points the display value is achieved by linear interpolation.

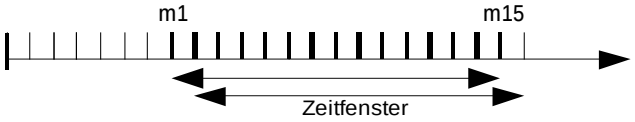
13.3. Resolution and unit

By default the device is supplied with a resolution of 0.001 K and degree centigrade (°C). You have the possibility to reduce the resolution to 0.01 K and switch the unit to Kelvin (K) or degree Fahrenheit (°F).

Changes made for resolution and unit will influence all channels.

13.4. Attenuation by means of a sliding average

All measured and values are taken with a frequency of 2.5 values per second, i.e. every 0.4 seconds. Measurements with a resolution of 0.001 K can lead to restless values particularly when the sensors are in air. For this case you have the possibility to attenuate the shown value by building the mean average of a user defined number measurements. You can choose this number between 0 and 99 with the parameter damping.

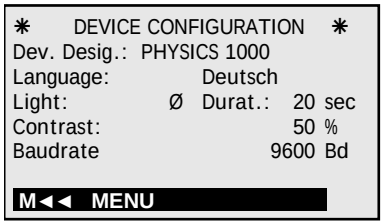


$$\overline{M} = \frac{1}{N} \sum_{i=1}^{N} M_i$$

Attenuation over 15 values is done by setting damping to 15
Time constant (s) = Damping / $2.5s^{-1}$ = 6s

14. DEVICE CONFIGURATION

The menu device configuration provides some changeable generally parameters, e.g. language, illumination, data transfer rate. The device designation serves as header while transferring data by any connected interface.



14.1. Device designation

The parameter device configuration allows you to input a user-defined string with a maximum of 40 characters (s. 8.5).

14.2. Language

The menu-language and the language of the data transfers can be switched between Deutsch, English and French (additional languages on request). The softkeys are international and have no need to be changed.

14.3. Illumination and contrast

Illumination

Display illumination can be enabled / disabled in the menus by pressing ***ON** or **F2** . When switched on the softkey changes to ***OFF** and the additional symbol ***** will appear in the status line as long as the light is on. With the parameter Durat. In the device configuration you can set the period of time until the light switches off automatically. The possible settings are 20sec, 40sec, 1min, 2min, 5min, 10min and –min (equal to always on). As long as you do not explicit switch the illumination off, the symbol ***** remains in the status line and every time you press any key, the device illuminates for the chosen period of time.

- The automatic switch off works only when the device is driven by batteries.
- When supplied with the mains adapter on the DC socket the illumination is either always on or always off.

By setting the checkmark Ø in the device configuration for the parameter Light you can switch the illumination to always on.

- The current drain will double while illumination is on, so the operation time will drop from about 100h to 50h.

Cntrast

With the parameter Contrast the contrast can be set in steps of 10% from 0% to 100%.

14.4. Interface, data cable, baud rate

Via interface you can output measuring data online to a PC with installed PHYSICS view software. For the connection are several interface cable available.
The baud rate is factory-provided set to 9600 baud at all interfaces. You can change it with the parameter baud rate, possible settings are 150, 300, 600, 12000, 2400, 4800, 9600bd or 57.6, 11.2 kbd (keep the baud rate of the opponent device in mind). The baud rate is saved in the EEPROM of the interface connector, i.e. you´ll see and change it only when an interface is connected.
Data format: fixed 8 data bit, no parity, 1 stop bit

15. TROUBLE SHOOTING

The PHYSICS measuring instrument can be configured and programmed in many versatile ways. It is suitable for connecting a wide variety of different sensors and peripheral equipment. Given these numerous possibilities the device may in certain circumstances not behave quite as expected. The cause of such unexpected behavior is only very rarely a device defect; more usually it is incorrect operation by the user, an invalid setting, or unsuitable cabling. In such an event, try to pinpoint and clear the problem with the aid of the following tests.

Error:	No display, display malfunction, keys do not react.
Remedy:	Check the power supply; replace the batteries; switch off and then on again; if necessary re-initialize.

Error:	Measured values are incorrect.
Remedy:	Check all the channel programming very carefully, especially zero-point (sensor programming and special functions menu).

Error:	Fluctuating measured values or the system hangs in mid-operation.
Remedy:	Check the cabling for any inadmissible electrical connections. Unplug any suspicious sensors. Connect hand-held sensors in air or phantoms (use a 100 Ohms resistance) and check the output. Then connect the sensors again one at a time and check successively; if a fault persists for any one connection check the wiring; if necessary, insulate the sensor and eliminate interference by using shielded or twisted wiring.

Error:	Data transmission via the interface does not function.
Remedy:	Check interface module, connections and settings. Are both devices set to the same baud rate and transmission mode? Is the correct COM interface on the computer being addressed?

If, after performing the above-listed checks and remedial steps, the device still fails to behave as described in the operating instructions, it must be returned to our factory in Wertheim, accompanied by an explanatory note, error description and if available test printouts.

16. ELECTROMAGNETIC COMPATIBILITY

The PHYSICS 1000 device complies in full with the safety requirements specified in the EU directive relating to electromagnetic compatibility (EMC) (89/336/EWG).

The following standards have been applied in evaluating the product:

- IEC 61326:1997+A1:1998+A2:2000
- IEC 61000-6-1:1997
- IEC 61000-6-3:1996
- IEC 61000-4-2: 1995+A1:1998+A2:2000 8kV
- IEC 61000-4-4: 1995+A1:2000 2kV
- IEC 61000-4-3: 1995+A1:1998+A2:2000 3V/m

The following advisory notes must be observed when operating the device:

- If the standard sensor is extended (1.5 meters) care must be taken to ensure that the measuring lines are not laid together with high-voltage power cables and that, if necessary, they are properly shielded so as to prevent spurious interference being induced in the system.
- Using the device in strong electromagnetic fields may aggravate measuring errors (<50 mV at 3V/m and 1.5 meters thermocouple sensor). After exposure to such irradiation ceases, the device will again operate within its technical specifications.

17. APPENDIX

17.1. Technical data

Messeingänge
2 primary channels with PHYSICS sockets for Pt100
1 internal channel or difference

AD-Converter
Delta-Sigma 24bit, 2.5, Amplification: 5

Outpus
2 PHYSICS-sockets for MMC-interface and several data interfaces

Standard equipment

Measuring range:	from -200°C to 400°C
Resolution:	0,001K / 0,01K
Accuracy:	0,01% of measured value
Display:	graphics 128x64 pixels, 8 rows, 4mm each
Illumination:	2 LED, white
Operation:	7 keys (including 4 softkeys)
Memory:	100 measured values in RAM
	MMC-memory connector (accessory)
Date and time of day:	real time clock buffered with device battery

Power supply

Batteries:	3 AA Alkaline batteries
Mains adapter:	230V AC or 115V AC to 12V DC, 0.2 A
Power consumption:	approx. 20 mA (at 4.5V)
Illumination ON:	approx. 40 mA (at 4.5V)

Housing

Dimensions:	L127 x B83 x H42 mm,
Material:	ABS, light grey
Weight:	approx. 290g
Degree of protection:	IP54

Suitable conditions

Operating temperature:	–10°C . . . +50°C (storage temperatur: –20°C . . . +60°C)
Ambient relative humidity:	10% . . . 90% rH (non condensing)

17.2. Product overview

Digital measuring device PHYSICS 1000	Order-No.
2 inputs for Pt100, Resolution 0.001K, ,	
7 keys, LCD graphic display, socket for external power supply	57089
Accessoires:	
Mains adapter 230V, 200 mA	57090
Mains adapter 115V, 200 mA	58802
MMC interface (RS) min. 128MB	57733
USB data cable, galvanic separated max. 115.2kB	57091
Serial (V24) data cable, galvanic separated max. 115.2kB	55855
Ethernet data cable, galvanic separated max. 115.2kB	57512
Bluetooth adapter plug	58321
Software PHYSICS VIEW	58306
Operating instructions	58532
Suitcase for the PHYSICS device and accessories	57844
Holster (rubber) with bail	58804
Sensors	
Temperature sensor Pt100: 250mm, 2m cable	57527
Laboratory Resistance Thermometer Pt 100: Type WT-GL-303-3/6 (Glass)	
250mm, Ø6, 2m cable, -50°C to 310°C	59270
Laboratory Resistance Thermoemter Pt100: Type WT-MI-303-D-30E (Metal)	
400mm, Ø3, 2m cable, -90°C to 410°C	59265
Sets	
Temperature sensor Pt100 (57527) with PHYSICS 1000, USB data cable,	
Mains adapter 230V and software PHYSICS view in the suitcase	58330
Set of WT-GL-303-3/6 and PHYSICS 1000	59302
Set of WT-MI-303-D-30E and PHYSICS 1000	59303

For sensors and sets the following additional specifications are available:

……/01 Officially calibrated without certificate
……/02 Officially calibrated with certificate
……/03 Works certificate
……/04 DKD-certificate (Deutscher Kalibrierdienst, German Calibration Service)

If you are interested further temperature sensors or accessories for PHYSICS 1000, please don´t hesitate to contact us.

17.3. Index

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With subject to technical alterations.