



Temperature Verification System Single Channel

Bedienungsanleitung
Operating Manual

eppendorf

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1 Introduction

The Temperature Verification System allows to test the temperature of the blocks of devices in the Mastercycler family, the devices of the Mastercycler pro, Mastercycler ep and Mastercycler nexus series and the devices of the Mastercycler ep *realplex* simply and quickly.

Moreover, the Temperature Verification System can be used to verify Eppendorf Thermomixer and ThermoStat plus. For this purpose, the temperature sensor 1.5 mL, which is available separately, will be required (see Ordering information).

The Mastercycler family, the Mastercycler pro, Mastercycler ep and Mastercycler nexus series as well as the Mastercycler ep *realplex* devices have, thus, a precise system which meets all requirements for documentation and the obligation of proof imposed on laboratories.

The Temperature Verification System consists of a digital display device with a temperature sensor connected. This temperature sensor exactly fits the 0.2 mL tube recesses of the thermoblock.

During verification the temperatures measured are compared to specified values for different block positions. Any deviations are determined at different temperatures. The Temperature Verification System is easy to handle: after the start of the verification / adjustment program the temperature sensor is inserted in the required positions one after the other. In every position different temperatures are selected, and the measured values recorded.

For adjustment different measuring points are selected, and the measured temperatures used for adjustment of the device.

If required, both verification and adjustment can be printed out as an indelible document recording the entire measuring process and the results. In addition to this, data can be exported on a MultiMediaCard™ (MMC) (Mastercycler pro and Mastercycler ep) or an USB storage medium.

2 Safety precautions

Startup and subsequent usage of the Temperature Verification System must be carried out according to the available operating manual to protect both the operator and the device. Further instructions and safety precautions to be followed are included in the operating manuals for Mastercycler, Mastercycler gradient, Mastercycler personal, Mastercycler pro, Mastercycler ep, Mastercycler nexus or Mastercycler ep *realplex*. The latest version of the operating manual is available on the internet at www.eppendorf.com

Voltage:

Before startup the voltage data on the i.d. plate should be compared with the mains power conditions.

Explosive materials:

It is not allowed to temper explosive, easily inflammable or highly reactive substances in the Mastercycler, Mastercycler gradient, Mastercycler personal or in devices of the Mastercycler pro, Mastercycler ep, Mastercycler nexus or Mastercycler ep *realplex* series! Do not operate the devices in explosive environments.

Liquids:

It must be ensured that no liquid can enter the device!



Danger of burning

The thermoblock and inside of the heated lid reach temperatures in excess of 50 °C very quickly. There is a danger of burning! Keep the heated lid closed until temperatures of approx. 30 °C are attained!

Repairs should only be performed by a technician authorized by Eppendorf AG. Authorization can only be obtained through certified training.

Eppendorf AG reserves the right to make technical modifications to this product.

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3 Delivery package

- Measuring device with temperature sensor for 0.2 mL tube positions
- Connecting cable for temperature sensor
- RS232 C connecting cable
- Adapter for galvanic separation with power supply
- Converter RS232 (Serial) to USB
- power plug adapter for USA and UK
- Personal card for the Temperature Verification System
- Zero modem adapter
- 4 spacers Mastercyclerep realplex
- Set of batteries (4 R6 round cell)
- Battery (R9 round cell, lithium CR2032) to maintain memory
- Operating manual for temperature verification (this manual)
- Operating manual for measuring device
- Certificate of Conformity

The parts are supplied in a transport case.

4 Software update

4.1 Software update Mastercycler ep



Note

For verification and adjustment of devices from the Mastercycler ep series with the temperature sensor for devices of the Mastercycler ep series the software version of the control Panel must be 1.630 or higher and the software version of the Mastercycler ep 1.405 or higher.

To perform a software update of the Control Panel:

- Log in as an administrator or service
- Insert the MMC in the card reader of the Control Panel (labeled side readable)
- Mark the MMC node
- Call up the update dialog by pressing the "Firmware" function key
- Select the option "Update Control Panel" and confirm with Enter
- Start the software update with "Start" and acknowledge the confirmation request with "Yes"

After the software of the Control Panel is updated, the software of Mastercycler ep will have to be updated as well. Proceed as follows:

- Log in as an administrator or service
- Select the "Update" function for the node system
- Select the address of the Mastercycler ep to be updated
- Start the software update with "Start" and acknowledge the confirmation request with "Yes"

Repeat the update for each Cycler which is connected to the Control Panel.

5 Preparation of the Temperature Verification System

First insert the battery for memory backup (button cell) and the main batteries. To do so, unscrew the rear of the measuring device. First insert the button cell in the opened battery compartment, followed by the AA cells, observing the polarity! Screw the battery compartment shut again. When doing so, please take note of the information in the operating manual for the measuring device.

Disposal of batteries: The used batteries should be disposed of according to the statutory provisions. The EU directive 91/157/EEC is applicable in Germany. Disposal of the batteries is possible for example via the GRS (German Joint Battery Returns System). They should not be discarded with household refuse or similar waste!

5

6 Startup

6.1 Startup Mastercycler pro and Mastercycler ep

Before connecting the sensor and connection cable the measuring device must be switched off! Do not remove the sensor while in operation.

To start up the measuring device first connect the temperature sensor (see Figure 1).

Insert the plug on the connecting cable of the temperature sensor in one of the two positions at the lower end of the measuring device. Screw the other side to the handgrip of the temperature sensor. Only one sensor should be connected to ensure proper functioning of the measuring device for automatic verification and adjustment.

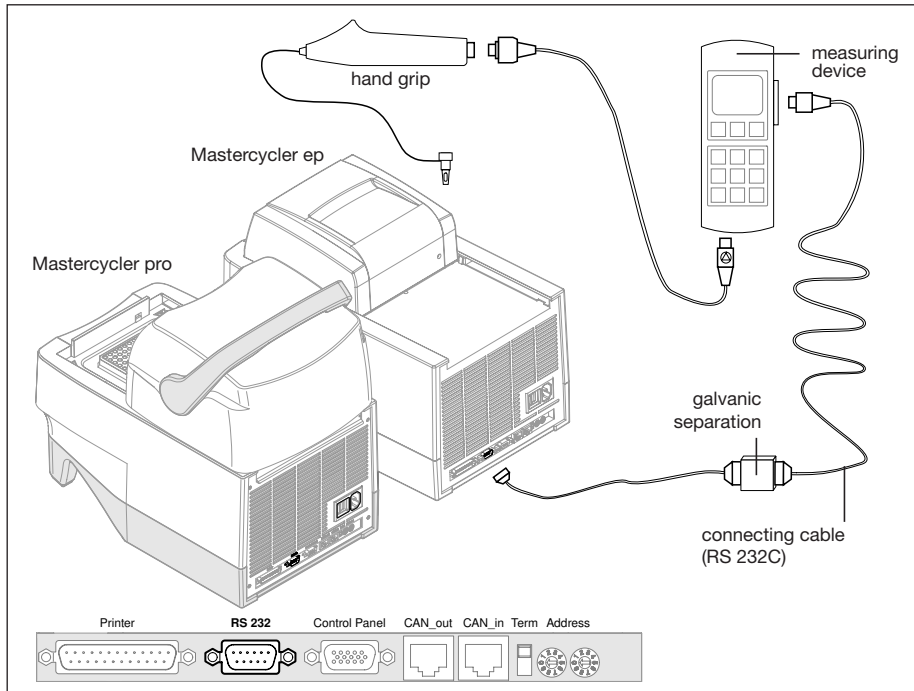


Figure 1: Layout of the Temperature Verification System for Mastercycler pro and Mastercycler ep

To verify and/or adjust devices of the series Mastercycler pro and Mastercycler ep, the connecting cable must be put into interface RS232 located on the connection strip on the back side of the device.

The adapter for galvanic separation is attached to the other end of the connection cable. The temperature measuring device is connected to the adapter.

Insert power supply to power socket (100 – 240 V, ~0.2 A, 50 – 60 Hz), use power plug adapter for USA and UK if necessary.

The measuring device can then be switched on with the $\frac{1}{0}$ switch.

6 Startup

Replace the batteries in the measuring device as soon as warning signs appear on the display. The cable of the temperature sensor is very damageable. We recommend to fix the cable of the temperature sensor in position.

Notice: The Temperature Verification System with the converter RS232 (Serial) to USB can not be used with the Mastercycler pro.

6.2 Startup Mastercycler nexus

The startup of the Temperature Verification System is similar to the startup of Mastercycler pro and Mastercycler ep (see Chapter 6.1).

You have to use the converter RS232 (Serial) to USB to connect the RS232 connecting cable to the USB interface of the Mastercycler nexus (see Fig. 2).

Using the Temperature Verification System with the Mastercycler nexus without using the converter RS232 (Serial) to USB is not possible.

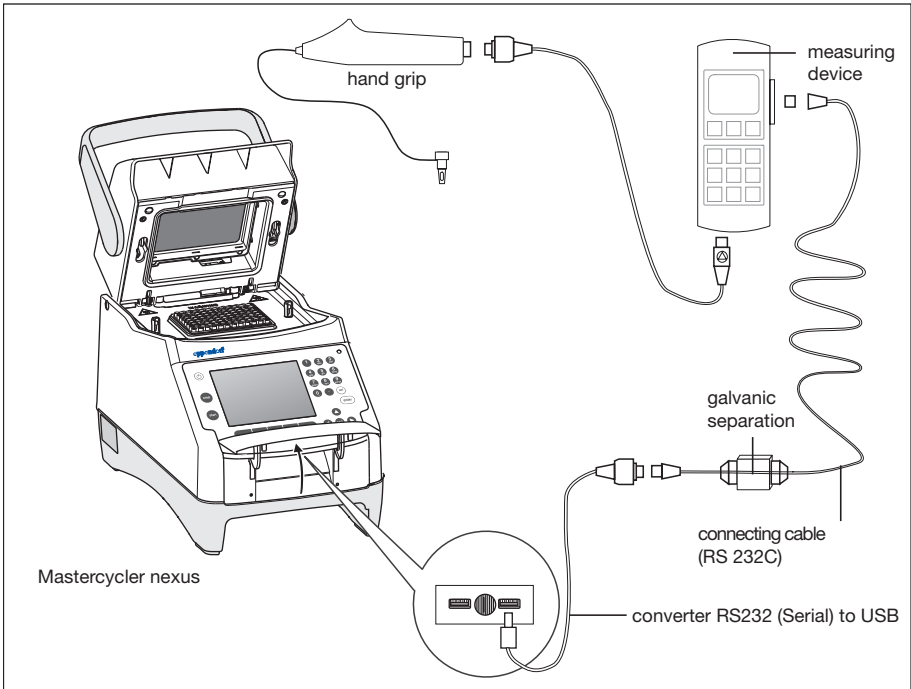


Figure 2: Layout of the Temperature Verification System for Mastercycler nexus

6 Startup

6.3 Startup Mastercycler ep *realplex*

The Temperature Verification System is started in exactly the same way as the Mastercycler pro and Mastercycler ep (see 6.1).

Four spacers must also be inserted in the corner positions of the thermoblock to prevent the increased lid pressure from damaging the sensor.



Attention

The spacers must be clean when inserted into the thermoblock to avoid contamination. If necessary, clean the spacers with a lint-free cloth soaked in ethanol.



Figure 3: Spacers in thermoblock of Mastercycler ep *realplex*

6 Startup

6.4 Startup Mastercycler

To start up the measuring device, first connect the temperature sensor (see fig. 3). To do so, plug the connecting cable plug into one of the two positions on the bottom end of the measuring device. Screw the other side to the handle of the temperature sensor. In order to ensure that the measuring device functions perfectly for automatic verification/adjustment, only one sensor may be connected.

For automatic verification with software version 2.10 and above, connect the measuring device to the adapter for galvanic separation with power supply with the zero modem adapter to the Mastercycler, Mastercycler gradient or Mastercycler personal using the RS 232 C connecting cable (plug in on the right-hand side of the measuring device, in the top plug position on the Mastercycler).

Note: Manual verification is possible only if the devices are not connected.

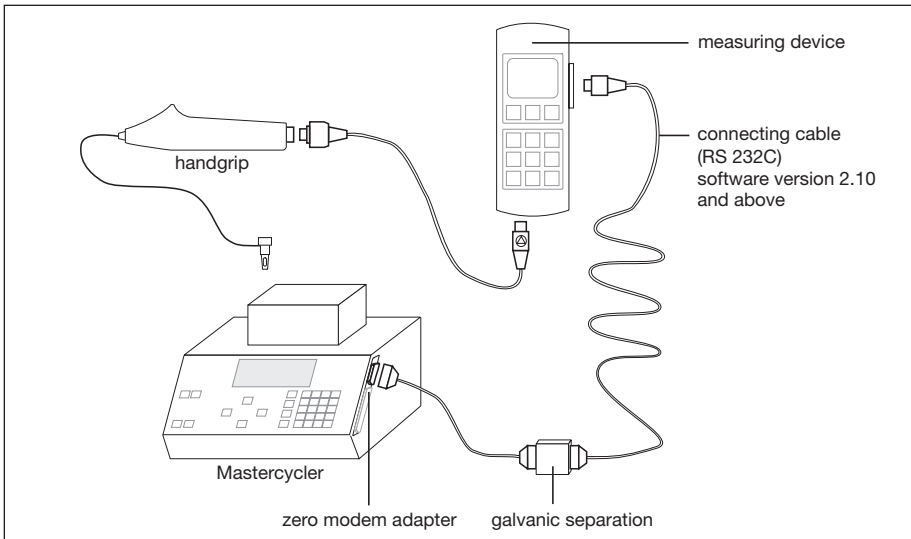


Figure 3: Connection of Mastercycler

- Switch on the measuring device with the $\frac{I}{O}$ switch.

The measuring device must be switched off before connecting the sensor and the connecting cable! Never disconnect the sensor while the device is running!

Replace the batteries of the measuring device as soon as warning signs appear on the display.

7 Accuracy of measuring device, accuracy of measurement

The accuracy of the measuring device and the temperature sensor is confirmed by the attached certificate of adjustment. This ensures the attributability to national and international standards according to MRA (Mutual Recognition Arrangement dated 14 October 1999, Paris / <http://www.bipm.org/pdf/mra.pdf>).

The adjustment regulations (time period, guidelines) should be observed according to the legal position in the country in which the device is used.

8 Verification of Mastercycler pro, ep and nexus

The verification program checks the temperature accuracy of the thermoblock. This is carried out by running a program that activates different temperatures one after the other. The temperatures of the device display and those of the measuring device are compared with the internal values. This cycle is carried out in six different block positions. Verification will take about 30 minutes.

For the devices, a protocol is compiled at the end of the verification process which can be printed, as required, for documentation purposes or saved on a MultiMediaCard™ (Mastercycler pro and Mastercycler ep) or USB storage medium (Mastercycler pro and Mastercycler nexus).

In the event of any deviation this should be followed by adjustment.

The accuracy of the measuring system is ± 0.3 K for the measurement range for 35 °C to 95 °C. The permitted tolerance for the Mastercycler pro and Mastercycler ep is ± 0.6 K (35 °C) and ± 1.0 K (95 °C).

Note The term validation has been replaced with the term verification in this operating manual. In some cases, there might be a difference between operating manual and software.

8.1 Performance of verification Mastercycler pro, ep and nexus



Attention

All Mastercycler nexus, which are connected together, must be in "Idle" status. Mastercycler pro and Mastercycler ep, which are connected to the Control Panel, must be in "Idle" status, too. No programs must be running!



Attention

Prior to verifying/adjusting a Mastercycler ep, a software update may be necessary (see section 4.1). Use the provided MultiMediaCard™.

Connect the Temperature Verification System as described in chapter 6.1 to the Mastercycler pro, Mastercycler ep or Mastercycler nexus.

Switch on the measuring device with the $\frac{1}{0}$ switch.




Call up the verification function.

Verification

Operate the function key Validation/ Verification under the Cyclor node with the menu item System.



8 Verification of Mastercycler pro, ep and nexus

The verification program takes place automatically. The user is prompted to insert the sensor in the required positions and to close the lid and then acknowledge repositioning of the temperature sensor with the function key  .



Attention

On Mastercycler ep with motorized lid, the heated lid will automatically move to the front position.

First wait for the lid temperature of 105 °C to be attained.



Danger of burning


Take care when removing and repositioning the temperature sensor during and at the end of verification! The temperature sensor is made very hot by the heated lid! Allow the temperature sensor to cool down with the heated lid open until temperatures of around or below 30 °C are reached! Take care not to touch the inside of the heated lid during removal and repositioning!



When removing and repositioning the temperature sensor do not drag on the cable!

After the prompt "Insert sensor in the position indicated" insert the sensor in the indicated position.

Shut the manually operated heated lid. (In case of Mastercycler ep with motorized heated lid the lid will automatically move to the front position).

Use  to start the first measuring cycle. The measuring process then runs for the temperatures 95 °C and 35 °C one after the other.

The process is repeated for the other measuring positions. With the prompt "Insert sensor in the position indicated" open the lid of the devices and after allowing the sensor to cool down, insert into the indicated position, move the lid to the front position and confirm with the function key

 .

The verification protocol is shown on the display and can be printed, as required, or saved on a MultiMediaCard™ (Mastercycler ep and Mastercycler pro) or USB storage medium (Mastercycler pro and Mastercycler nexus).



Note

The ongoing verification process can be aborted at any time using the function key

 .

9 Adjustment of Mastercycler pro, ep and nexus

The adjustment program checks and adjusts the temperature accuracy of the thermoblock. This is carried out via temperature control of the block to two different temperatures (95 °C and 35 °C). The program then compares the measured values of the measuring device with the internal values. This cycle is performed in different block positions. The temperatures determined this way will be used for temperature matching of the device.

The entire process takes approx. 30 minutes.

A verification must always be performed after adjusting the system.

Note The term calibration/adjustment has been replaced with the term adjustment in this operating manual. In some cases, there might be a difference between operating manual and software.

9.1 Performance of adjustment Mastercycler pro, ep and nexus



Attention

All Mastercycler nexus, which are connected together, must be in "Idle" status. Mastercycler pro and Mastercycler ep, which are connected to the Control Panel, must be in "Idle" status, too. No programs must be running!



Attention

Prior to the verification/adjustment of a Mastercycler ep, a software update may be necessary (see section 4.1). Use the provided MultiMediaCard™.

Connect the Temperature Verification System as described in chapter 6.1 to the Mastercycler pro, Mastercycler ep or Mastercycler nexus.

Switch on the measuring device with the switch .



Note

If the PIN option is activated you must be logged in as administrator (user name _admin).




Call up the calibration function.

Adjustment

Operate the function key Adjustment/Calibration under the Cyclor node with the menu item System.



The adjustment program takes place automatically. The user is prompted to insert the sensor in the required positions and to close the lid and then acknowledge repositioning of the temperature sensor with the function key . When doing so, the sensor cable should be laid loosely over the block extending forwards out of the device.



Attention

On Mastercycler ep with motorized lid, the heated lid will automatically move to the front position.

First wait for the lid temperature of 105 °C to be attained.



Danger of burning

Take care when removing and repositioning the temperature sensor during and at the end of adjustment! The temperature sensor is made very hot by the heated lid! Allow the temperature sensor to cool down with the heated lid open until temperatures of around or below 30 °C are reached! Take care not to touch the inside of the heated lid during removal and repositioning!




Attention

When removing and repositioning the temperature sensor do not drag on the cable!

After the prompt "Insert sensor in the position indicated" insert the sensor in the indicated position.

Shut the lid. In case of Mastercycler ep with motorized heated lid, the lid will automatically move to the front position.

Use  to start the first measuring cycle. The measuring process then runs for the temperatures 95 °C and 35 °C one after the other.


The process is repeated for the other measuring positions. With the prompt "Insert sensor in the position indicated" open the lid of the devices and after allowing the sensor to cool down, insert into the indicated position, move the lid to the front position and confirm with the function key

 .

The adjustment protocol is shown on the display and can be printed, as required, or saved on a MultiMediaCard™ (Mastercycler ep and Mastercycler pro) or USB storage medium (Mastercycler pro and Mastercycler nexus).



Note

The ongoing adjustment process can be aborted at any time using the function key  .

10 Verification of Mastercycler pro/ep using CycleManager pro/pro^{XL} or ep CycleManager

The verification program tests the temperature accuracy of the Thermoblock. This takes place in that a running program successively activates various temperatures. The display temperatures of the device and that of the measuring device are compared with the internal values. The cycle will be carried out in six different block positions.

Verification will take approx. 30 minutes per device.

At the end of the verification process a verification protocol will be compiled which can be printed, as required, for documentation purposes or saved as a text file. In the event of a deviation, an adjustment should then be carried out.

The accuracy of the measurement system for the measuring range from 35 °C to 95 °C is ± 0.3 K. The tolerance permitted for Mastercycler pro and Mastercycler ep is ± 0.6 K (35 °C) and ± 1.0 K (95 °C).

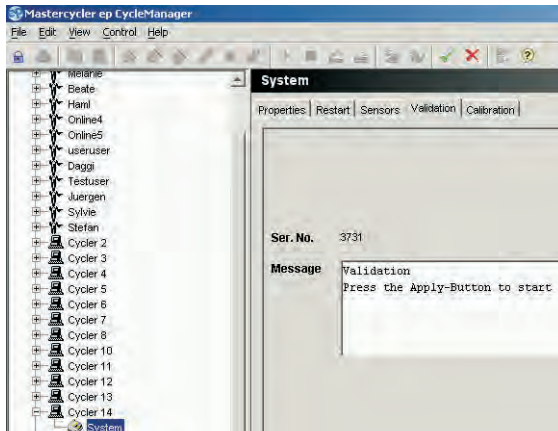
10.1 Performance of verification



During the verification procedure, all cyclers must be in "Idle" status.


Start CycleManager pro / pro^{XL} or ep CycleManager and log in. Both normal users (User) and administrators can carry out the verification.



Select the node of the Cycler to be verified from the navigation tree, open the "System" entry and select the "Validation" tabsheet.





During the verification procedure, all other functions of the ep CycleManager are deactivated.

10 Verification of Mastercycler pro/ep using CycleManager pro/pro^{XL} or ep CycleManager

Start the verification with the  button. A reference to the type of temperature sensor that must be used for the measurement will be shown. The type number must agree with the type number on the handgrip of the sensor.

The Temperature Verification System has to be switched on as per chapter 6.1, The Measuring Device with button  and confirmed by pressing button .

The verification program runs automatically. The user is instructed to insert the sensors into the required positions. The sensor cable should thereby be laid loosely toward the front of the device over the block. Following the positioning of the temperature sensor, non-motorized lids are to be closed manually and the verification procedure started by clicking the  button. For devices with motorized lids, this automatically moves to the front position following clicking the  button.



Warning

In case of devices with motorized lid, the heated lid will automatically move to the front position.

First wait until the lid temperature of 105 °C is reached.



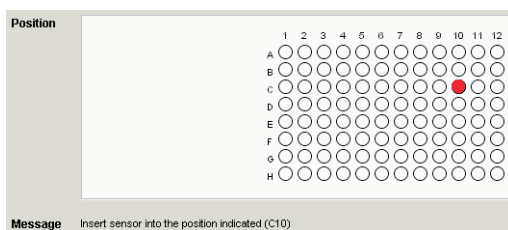
Danger of burns

Be careful when removing and repositioning the temperature sensor during or following verification! The temperature sensor is very hot due to the heated lid! Let the temperature sensor cool with the lid open until temperatures are at or less than 30 °C! Take care not to touch the inside of the heated lid during removal and repositioning!




Don't pull on the cable when removing or repositioning the temperature sensor.


Insert the sensor into the appropriate position following the prompt (e.g. Insert sensor into the position indicated (C10)).




Shut the manually operated heated lid (a motorized lid will automatically move to the front position).

Start the first measuring cycle with . The measuring procedure successively runs through the temperatures 95 °C and 35 °C.

10 Verification of Mastercycler pro/ep using CycleManager pro/pro^{XL} or ep CycleManager

The procedure is repeated for the other measuring positions. When the "Insert sensor into the position indicated (XY)" prompt appears, open the lid of the device and insert the sensor into the position shown following cooling of the sensor. Pull the lid to the front position and confirm with .

After measuring the last position the verification protocol will be displayed. It can be printed from the menu "File" or saved as a text file. Finish the verification procedure with .

Note



The running verification can be cancelled at any time with the  button.

The adjustment program tests and adjusts the temperature accuracy of the Thermoblock. This takes place through temperature control of the block at two different temperatures (95 °C and 35 °C). The program then compares the measured values of the measuring device with the internal values. The cycle will be carried out in various block positions. The newly determined temperatures will be used for the temperature adjustment of the device. The whole process will take about 30 minutes per Cycler.

Each adjustment has to be verified by a verification.

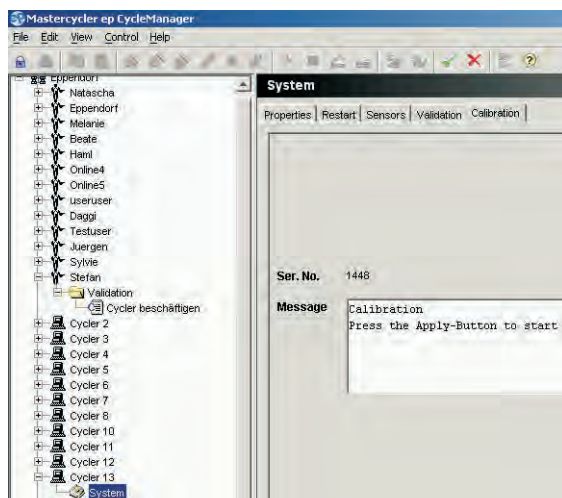
11.1 Performance of adjustment




During the adjustment procedure, all cyclers must be in "Idle" status.



Start CycleManager pro / pro^{XL} or ep CycleManager and log in. The adjustment can only be carried out by users from the "Administrators" group.



Select the node of the Cycler to be adjusted from the navigation tree, open the "System" entry and select the "Calibration" tabsheet.



During adjustment, all other functions are deactivated.

Start the adjustment with the  button. A reference to the type of temperature sensor that must be used for the measurement will be shown. This must agree with the type number on the handgrip of the sensor.

The Temperature Verification System has to be connected in accordance with chapter 6.1, the measuring device switched on with button  and confirmed by pressing button .

The adjustment program runs automatically. The user is instructed to insert the sensors into the required positions. The sensor cable should thereby be laid loosely toward the front of the device over the block. Following the positioning of the temperature sensor, non-motorized lids are to be closed manually and the adjustment procedure started by clicking the  button. For devices with motorized lids, this automatically moves to the front position following clicking the  button.



Warning

In case of devices with motorized lid, the heated lid will automatically move to the front position.

First wait until the lid temperature of 105 °C is reached.



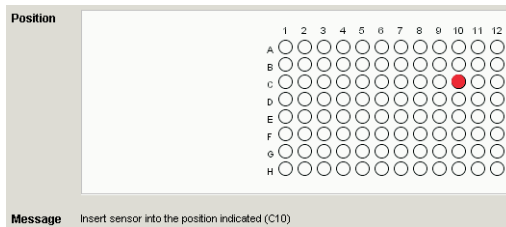
Danger of burns

Be careful when removing and repositioning the temperature sensor during or following adjustment! The temperature sensor is very hot due to the heated lid!
Let the temperature sensor cool with the lid open until temperatures are at or less than 30 °C! Take care not to touch the inside of the heated lid during removal and repositioning!





Don't pull on the cable when removing or repositioning the temperature sensor.


Insert the sensor into the appropriate position following the prompt (e.g. Insert sensor into the position indicated (C10)).



Close the manual lid (The automatic lid moves into the front position on its own).

Start the first measuring cycle with . The measuring procedure successively runs through the temperatures 95 °C and 35 °C.

The procedure is repeated for the other measuring positions. When the "Insert sensor into the position indicated (XY)" prompt appears, open the lid of the device and insert the sensor into the position shown following cooling of the sensor. Pull the lid to the front position and confirm with .

After measuring the last position, the adjustment protocol will be displayed. It can be printed from the menu "File" or saved as a text file. The adjustment procedure is concluded with .

Note

The running adjustment can be cancelled at any time with the  button.



12 Verification of Mastercycler ep *realplex*

The verification program checks that the temperature accuracy of the thermoblock. This is carried out by running a program that activates different temperatures one after the other.

The temperatures of the device display and those of the measuring device are compared with the internal values. This cycle is carried out in six different block positions.

The verification process takes around 30 minutes.

At the end of the verification process for the devices the result is output and can then be printed out or saved as required.

In the event of any deviation this should be followed by adjustment.

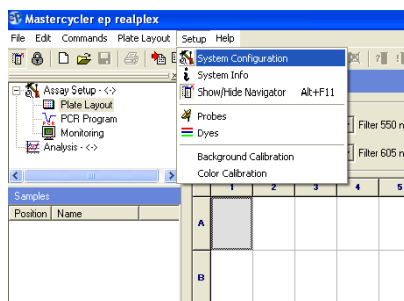
The accuracy of the measuring system is ± 0.3 K for the measurement range for 35 °C to 95 °C. The permitted tolerance for the Mastercycler ep *realplex* is ± 0.6 K (35 °C) and ± 1.0 K (95 °C).

12.1 Performance of verification Mastercycler ep *realplex*

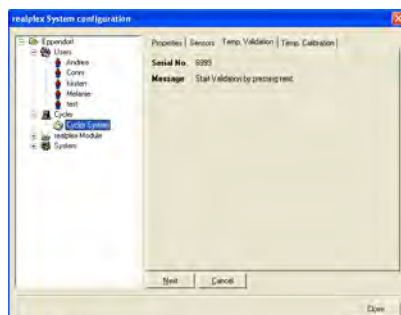
Connect the Temperature Verification System to the Mastercycler ep *realplex* as shown in 6.2.

Switch on the measuring device with the switch .

Call up the "System Configuration" dialog under the "System" menu item.



Select the "Temp. Validation" tab under the Cyclor node with the "System" menu item.



12 Verification of Mastercycler ep *realplex*

The verification program takes place automatically. The user is prompted to insert the sensor in the required positions and to close the *realplex* module and then acknowledge repositioning of the temperature sensor with the "Next" key. When doing so, the sensor cable should be laid loosely over the block extending forwards out of the device.

First wait for the heating plate temperature of 105 °C to be attained in the *realplex* module.



Danger of burning

Take care when removing and repositioning the temperature sensor during and at the end of verification! The temperature sensor is made very hot by the heating plate!

Allow the temperature sensor to cool down with the *realplex* module open until the temperatures of around or below 30 °C are reached! When removing and repositioning the sensor make sure you do not touch the heating plate!



Attention

When removing and repositioning the temperature sensor do not pull on the cable!

After the prompt insert the sensor in the indicated position.

Carefully close the *realplex* module. Use Start to start the first measuring cycle.

The measuring process then runs for the temperatures 95 °C and 35 °C one after the other.

The process is repeated for the other measuring positions. With the prompt, open the *realplex* module, wait until the sensor has cooled down and then insert the sensor in the position indicated. Close the *realplex* module and confirm with "Next".

Successful verification is confirmed on the display; this can be printed out or saved as required.



Note

The ongoing verification process can be aborted at any time using the "Cancel" key.

13 Adjustment of Mastercycler ep *realplex*

The adjustment program checks and adjusts the temperature accuracy of the thermoblock. This is carried out via temperature control of the block to two different temperatures (95 °C and 35 °C). The program then compares the measured values with the internal values. This cycle is performed in different block positions. The temperatures so determined are used for temperature adjustment of the device. The entire process takes approx. 30 minutes.

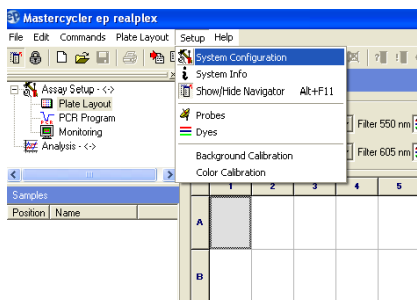
A verification must always be performed after adjusting the system.

13.1 Performance of adjustment Mastercycler ep *realplex*

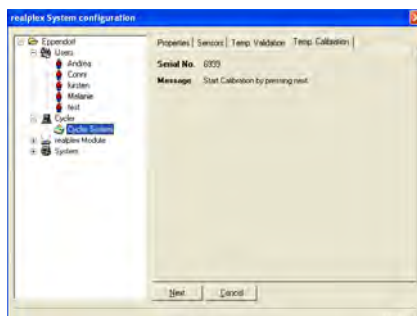
Connect the Temperature Verification System to the Mastercycler ep *realplex* as described in 6.2.

Switch on the measuring device with the switch .

Call up the "System Configuration" dialog under the "System" menu item.



Select the "Temp. Calibration" tab under the "Cycler" node with the "System" menu item.



The adjustment program takes place automatically. The user is prompted to insert the sensor in the required positions and to close the *realplex* module and then acknowledge repositioning of the temperature sensor with the "Next" key. When doing so, the sensor cable should be laid loosely over the block extending forwards out of the device.

13 Adjustment of Mastercycler ep *realplex*

First wait for the heating plate temperature of 105 °C to be attained in the *realplex* module.



Danger of burning

Take care when removing and repositioning the temperature sensor during and at the end of verification! The temperature sensor is made very hot by the heating plate!

Allow the temperature sensor to cool down with the *realplex* module open until the temperatures of around or below 30 °C are reached! When removing and repositioning the sensor make sure you do not touch the heating plate!



Attention

When removing and repositioning the temperature sensor do not pull on the cable!

After the prompt insert the sensor in the indicated position.

Carefully close the lid. Use Start to start the first measuring cycle. The measuring process then runs for the temperatures 95 °C and 35 °C one after the other.

The process is repeated for the other measuring positions. After the prompt open the lid, wait until the sensor has cooled down and then insert the sensor in the position indicated.

Close the lid and confirm with "Next".

Successful adjustment is confirmed on the display; this can be printed out or saved as required.



Note

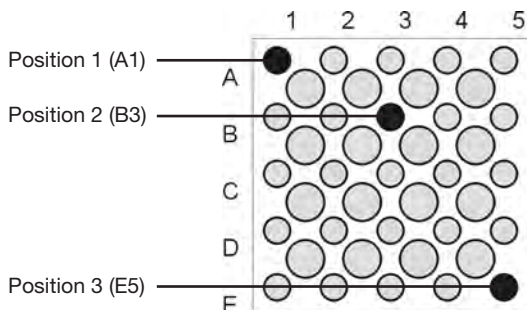
The ongoing adjustment process can be aborted at any time using the "Cancel" key.

14 Verification of Mastercycler

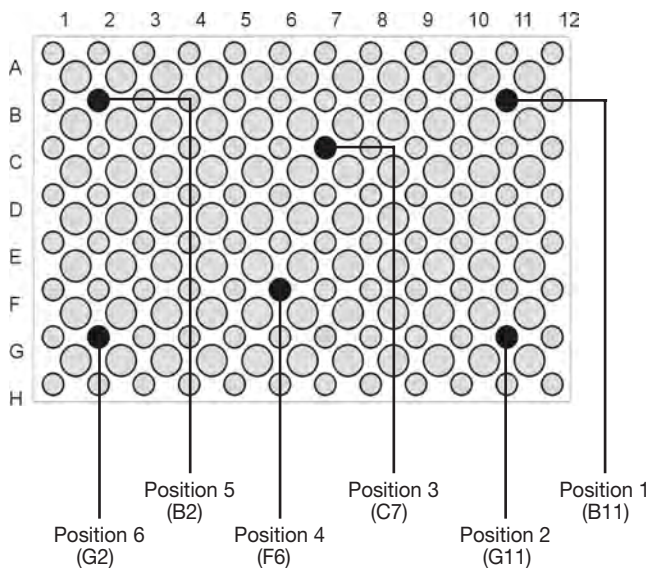
The verification program checks the accuracy of the temperature of the block. This is achieved by an automatic program selecting different temperatures one after the other.

The temperatures in the display of the device and those of the measuring device are compared with the internal values. This cycle is performed in six / three different block positions. The verification procedure for the Mastercycler and the Mastercycler gradient takes approx. one hour.

The measurement positions of the Mastercycler personal are: A1, B3 and E5



The measurement positions of the Mastercycler and the Mastercycler gradient are: B2 B11 C7 F6 G2 G11



In the event of any deviation adjustment should be subsequently performed.

14 Verification of Mastercycler

14

The VALGRA1 and VALGRA2 programs are provided on the personal card supplied for manual verification of the Mastercycler and Mastercycler gradient while the VALPER program is available on the card for Mastercycler personal devices. If required, the relevant programs can be entered by hand. The programs select different temperatures. They allow the temperatures displayed on the device to be compared manually with the temperatures shown in the measuring device. These values can be noted for documentation purposes (protocol sheet).

The accuracy of the measuring system is ± 0.3 K for the measurement range for 35 °C to 95 °C. The permitted tolerance is the Mastercycler and Mastercycler gradient is ± 0.6 K (35 °C and 72 °C) resp. ± 1.0 K (95 °C).

For Mastercycler ep gradient and Mastercycler ep gradient S, the tolerance is ± 0.6 K (35 °C) and ± 1.0 K (95 °C).

14.1 Performance of verification Mastercycler, Mastercycler gradient and Mastercycler personal with software version 2.10 and higher

If appropriate, connect a printer for documentation purposes.

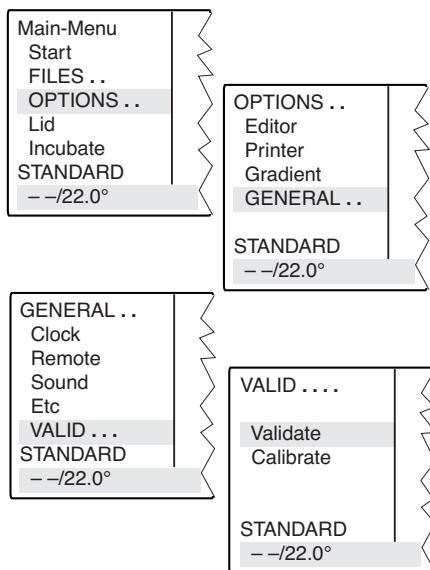
Switch on the measuring device by pressing $\left[\frac{1}{0} \right]$.

Switch on the Mastercycler.

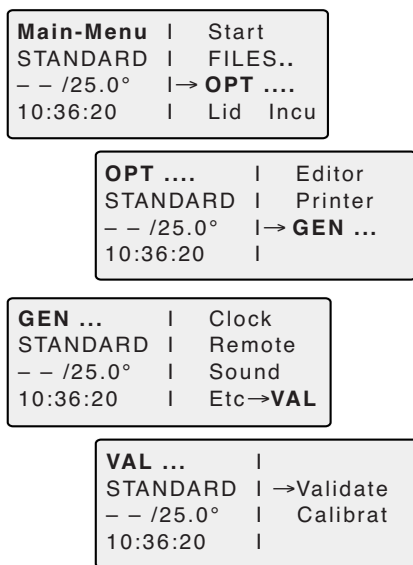
Insert the personal card (<MCARD>) supplied into the card reader of the Mastercycler.

Go to the Verification menu:

Mastercycler and Mastercycler gradient



Mastercycler personal



Select the verification program (Validate) and start by pressing $\left[\text{Enter} \right]$.

14 Verification of Mastercycler

VALID	
Validate	
Calibrate	
STANDARD	
--/22.0°	10:22:00

VAL ...	
STANDARD	→ Validate
-- /25.0°	Calibrat
10:36:20	

Note: If the personal card supplied is not in the card slot, the message "Memo Card: Missing! Insert Test Card!" is issued.

In the following menu, the key **Sel** can be used to select whether the intermediate results and summary should be printed out, "YES" or "NO".

VALID	Validation
Validate	Use Printer: YES
Calibrate	
STANDARD	
--/22.0°	10:22:01

- - - - Validation - - - - -
Use Printer: YES

Continue by pressing **Enter**.

Close the lid of the Mastercycler, Mastercycler gradient or Mastercycler personal. (Do not lock.)

Start the verification program by pressing **Start/Stop**.

VALID	Validation
Validate	Press START
Calibrate	TESTO950: 22.5°
STANDARD	
--/22.0°	10:22:02

- - - - Validation - - - - -
Start Validation
Press Start

First wait for the lid temperature to reach 105 °C.

VALID	Validation
Validate	Lid: Waiting 105°
Calibrate	TESTO950: 22.5°
	RIGHT-B11: 95.0° Lid: 53°
STANDARD	
--/22.0°	Lid: 53° 10:22:02

- - - - Validation - - - - -
Lid: Waiting 105°
TESTO950: 24.2°
Lid: 88°

14 Verification of Mastercycler



Risk of burns

Be careful when removing and moving the temperature sensor during and after verification. The temperature sensor is subjected to extreme heat from the heated lid. Allow temperature sensor to cool down with the lid open to around 30 °C or below due to potential risk of burns. When removing and moving, be sure not to touch the heated lid!

14

After the prompt (e.g. INSERT RIGHT B11) insert the sensor in the position indicated.

Close and lock lid.

VALID	Validation
Validate	Insert RIGHT-B11 ENTER
Calibrate	TESTO950: 48.8°
	RIGHT-B11: 95.0° Lid: 105°
STANDARD	
- -/22.0°	Lid: 105° 10:22:03

```
----- Validation -----  
Ins. BLOCK-B3 ENTER  
TESTO950: 24.2°  
BLOCK-C3: 42.1°
```

Press to start the first measuring cycle. The measuring cycle runs consecutively in this position for temperatures 95 °C, 72 °C and 35 °C.

Repeat the process for the other positions. After the prompt INSERT xy open the lid of the device, and after allowing the sensor to cool down, insert it in the position indicated. Close the lid, lock it and start a new measuring cycle with .

Successful verification is confirmed on the display and printed out as appropriate.

VALID	Validation
Validate	* FINISHED! *
Calibrate	TESTO950: 72.0°
	LEFT-G2: 72.0° Lid: 105°
STANDARD	
- -/22.0°	Lid: 105° 10:22:04

```
----- Validation -----  
*FINISHED!*  
TESTO950: 72.0°  
BLOCK-A1: 72.0°
```

Quit the program by pressing .

Note: The current verification process can be discontinued at any time by pressing the key



If the verification results are outside the permissible limit values, the message "Out of Tolerance"

is shown. In this case adjustment should subsequently be performed.

15 Adjustment of Mastercycler

15.1 Performance of adjustment Mastercycler, Mastercycler gradient and Mastercycler personal with software version 2.10 and higher

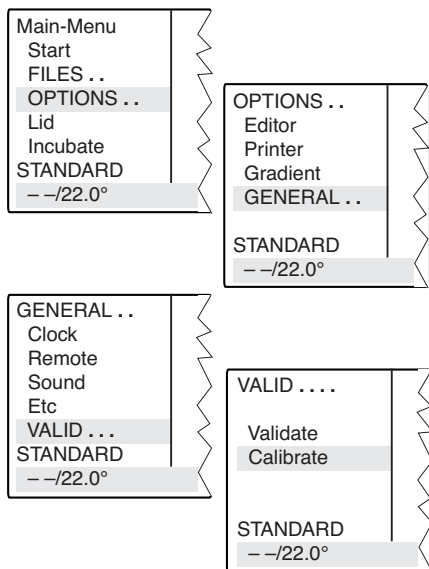
If appropriate, connect a printer for documentation purposes.

Switch on the measuring device with by pressing $\frac{1}{0}$.

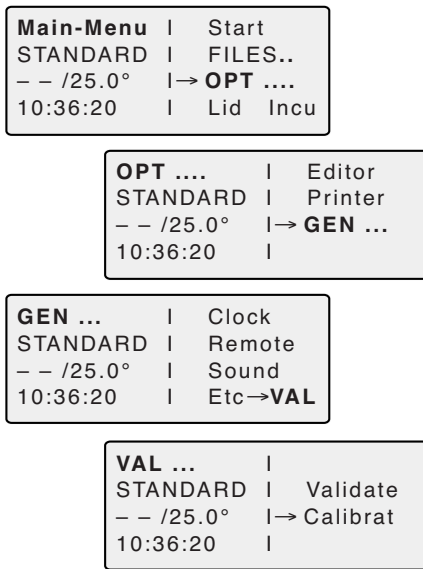
Switch on the Mastercycler.

Insert the personal card (<MCARD>) supplied into the card reader.

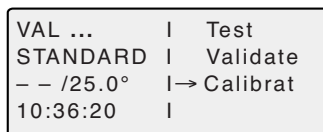
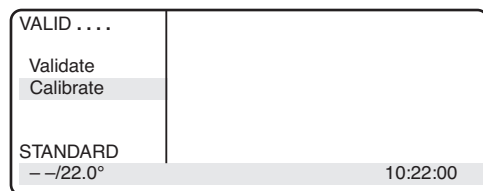
Mastercycler and Mastercycler gradient



Mastercycler personal



Select the adjustment program (Calibrate) and start by pressing Enter .



Note: If the personal card supplied is not in the card slot, the message "Memo Card: Missing! Insert Test Card!" is issued.

15 Adjustment of Mastercycler

In the following menu, the key **(Sel)** can be used to select whether the intermediate results and summary should be printed out, "YES" or "NO".

VALID	Calibration
Validate	Use Printer: YES
Calibrate	
STANDARD	10:22:01
--/22.0°	

```

----- Calibration -----
Use Printer: YES
    
```

Continue by pressing **(Enter)**.

Close the lid of the Mastercycler, Mastercycler gradient or Mastercycler personal. (Do not lock.)

VALID	Calibration
Validate	Press START
Calibrate	TESTO950: 22.5°
STANDARD	10:22:02
--/22.0°	

```

----- Calibration -----
Start Calibration
Press Start
    
```

Start the adjustment program by pressing **(Start/Stop)**.

First wait for the lid temperature to reach 105 °C.

VALID	Calibration
Validate	Lid: Waiting 105°
Calibrate	TESTO950: 22.5°
	RIGHT-B11:95.0° Lid: 53°
STANDARD	10:22:02
--/22.0°	Lid 53°

```

----- Calibration -----
Lid: Waiting 105°
TESTO950: 24.2°
Lid: 88°
    
```



Risk of burns

Be careful when removing and moving the temperature sensor during and after verification. The temperature sensor is subjected to extreme heat from the heated lid. Allow temperature sensor to cool down with the lid open to around 30 °C or below due to potential risk of burns. When removing and moving, be sure not to touch the heated lid!

After the prompt (e.g. INSERT RIGHT B11) insert the sensor in the position indicated.

Close and lock lid.

15 Adjustment of Mastercycler

15

VALID	Calibration
Test	Insert RIGHT-B11 ENTER
Validate	TESTO950: 48.8°
Calibrate	RIGHT-B11:95.0° Lid: 105°
STANDARD	
--/22.0°	Lid 53° 10:22:03

```

- - - - Calibration - - - - -
Ins. BLOCK-A1 ENTER
TESTO950: 24.2°
BLOCK-B1: 88.0°
    
```

Press to start the first measuring cycle.

The measuring cycle runs consecutively in this position for temperatures 95 °C and 35 °C.

Repeat the process for the other positions, i.e. after the prompt INSERT xy, open the lid, and after allowing the sensor to cool down, insert it in the position indicated. Close the lid, lock it and start a new measuring cycle with .

Successful adjustment is confirmed on the display and can be printed out.

VALID	Calibration
Validate	* FINISHED! *
Calibrate	TESTO950: 35.0°
	LEFT-G2: 35° Lid: 105°
STANDARD	
--/22.0°	Lid 105° 10:22:04

```

- - - - Calibration - - - - -
*FINISHED!*
TESTO950: 35.0°
BLOCK-A1: 35.0°
    
```

Quit the program by pressing .

Note: The current adjustment process can be discontinued at any time by pressing .

Each adjustment must be followed by a verification to verify the system.

16 Manual verification of Mastercycler

16.1 Manual verification of Mastercycler, Mastercycler gradient and Mastercycler personal with software version 2.0 and below

Switch on the measuring device by pressing $\frac{1}{0}$.

Switch on the Mastercycler.

Insert the personal card supplied (<MCARD>) into the card reader.

For Mastercycler and Mastercycler gradient load the programs VALGRA1 and VALGRA2 from the <MCARD> using the "Load" command and store in the internal memory.

Run the VALGRA1 program via the "Start" command in the main menu.

For Mastercycler personal call up the VALPER program from the <MCARD> using the "Load" command.

Run the VALPER program via the "Start" command.

Close the lid of the Mastercycler without locking.

Temperatures of 95 °C, 72 °C and 35 °C are selected.



Risk of burns

Take care when removing and repositioning the temperature sensor during and at the end of verification or adjustment. The temperature sensor is subjected to extreme heat from the heated lid. Allow the temperature sensor to cool down with the lid open to around 30 °C or below. When removing and repositioning the sensor take care not to touch the heated lid!

After being requested to do so (e.g. INSERT A1), insert the sensor in the positions indicated.

Close and lock the lid.

Start the measuring process by pressing .

After the first temperature (95 °C) is reached, this is maintained for two minutes. An acoustic signal is emitted.

Note the temperature displayed by the measuring device in the column provided on the protocol sheet.

Press .

The second temperature (72 °C) is selected and maintained for two minutes. Note the measured value and confirm by pressing .

The third temperature (35 °C) is selected and maintained for two minutes. Note the measured value and confirm by pressing .

16 Manual verification of Mastercycler

Repeat the process for the other measurement positions. After the prompt INSERT XX, open the lid, wait until the sensor has cooled down and then insert the sensor in the position indicated. Close the lid, lock it and confirm with .

After the program has come to an end, switch off the Mastercycler, Mastercycler gradient or Mastercycler personal and allow to cool down.

If the verification results are outside the permissible limit values, the device should be adjusted.

Program for the Mastercycler, Mastercycler gradient and Mastercycler personal:

Programm: VALGRA1			Programm: VALGRA2			Programm: VALPER		
	CNTRL	BLOCK		CNTRL	BLOCK		CNTRL	BLOCK
	LID 105°			LID 105°			LID 105°	
	WAIT	AUTO		WAIT	AUTO		WAIT	AUTO
1	PAUSE	INSERT B11	1	PAUSE	INSERT F6	1	PAUSE	INSERT A1
2	T=95°	0:02:00	2	T=95°	0:02:00	2	T=95°	0:02:00
3	SOUND	1	3	SOUND	1	3	SOUND	1
4	PAUSE	READ TEMP	4	PAUSE	READ TEMP	4	PAUSE	READ TEMP
5	T=72.0°	0:02:00	5	T=72.0°	0:02:00	5	T=72.0°	0:02:00
6	SOUND	1	6	SOUND	1	6	SOUND	1
7	PAUSE	READ TEMP	7	PAUSE	READ TEMP	7	PAUSE	READ TEMP
8	T=35°	0:02:00	8	T=35°	0:02:00	8	T=35°	0:02:00
9	SOUND	1	9	SOUND	1	9	SOUND	1
10	PAUSE	READ TEMP	10	PAUSE	READ TEMP	10	PAUSE	READ TEMP
11	PAUSE	INSERT G11	11	PAUSE	INSERT B2	11	PAUSE	INSERT B3
12	T=95°	0:02:00	12	T=95°	0:02:00	12	T=95°	0:02:00
13	SOUND	1	13	SOUND	1	13	SOUND	1
14	PAUSE	READ TEMP	14	PAUSE	READ TEMP	14	PAUSE	READ TEMP
15	T=72.0°	0:02:00	15	T=72.0°	0:02:00	15	T=72.0°	0:02:00
16	SOUND	1	16	SOUND	1	16	SOUND	1
17	PAUSE	READ TEMP	17	PAUSE	READ TEMP	17	PAUSE	READ TEMP
18	T=35°	0:02:00	18	T=35°	0:02:00	18	T=35°	0:02:00
19	SOUND	1	19	SOUND	1	19	SOUND	1
20	PAUSE	READ TEMP	20	PAUSE	READ TEMP	20	PAUSE	READ TEMP
21	PAUSE	INSERT C7	21	PAUSE	INSERT G2	21	PAUSE	INSERT E5
22	T=95°	0:02:00	22	T=95°	0:02:00	22	T=95°	0:02:00
23	SOUND	1	23	SOUND	1	23	SOUND	1
24	PAUSE	READ TEMP	24	PAUSE	READ TEMP	24	PAUSE	READ TEMP
25	T=72.0°	0:02:00	25	T=72.0°	0:02:00	25	T=72.0°	0:02:00
26	SOUND	1	26	SOUND	1	26	SOUND	1
27	PAUSE	READ TEMP	27	PAUSE	READ TEMP	27	PAUSE	READ TEMP
28	T=35°	0:02:00	28	T=35°	0:02:00	28	T=35°	0:02:00
29	SOUND	1	29	SOUND	1	29	SOUND	1
30	PAUSE	READ TEMP	30	PAUSE	READ TEMP	30	PAUSE	READ TEMP
31	LINK	VALGRA2	31	HOLD	22°ENTER	31	HOLD	22°ENTER
	end			end			end	

16 Manual verification of Mastercycler

Protocol sheet for the temperature verification with software version 2.0 and below

Mastercycler type: Device no:

Temp.	Position Mastercycler and Mastercycler gradient / Mastercycler personal	Measured on temperature measuring device (for manual validation)	Date	Time
a	b	c	g	h

95 °C	B11 / A1	°C		
	G11 / B3	°C		
	C7 / E5	°C		
	F6	°C		
	B2	°C		
	G2	°C		

72 °C	B11 / A1	°C		
	G11 / B3	°C		
	C7 / E5	°C		
	F6	°C		
	B2	°C		
	G2	°C		

35 °C	B11 / A1	°C		
	G11 / B3	°C		
	C7 / E5	°C		
	F6	°C		
	B2	°C		
	G2	°C		

(Date)

(Signature)

17 Maintenance

The temperature sensor does not require any regular maintenance. Dirt can be carefully wiped off with a damp cloth.

See separate operating manual for how to maintain the measuring devices.

18 Error messages

18.1 Error messages shown by temperature measuring device

Error message	Meaning	Remedy
TO-ERROR	Time exceeded (timeout) with communication	Check connection cable and adapter between temperature measuring device and Mastercycler ep. Switch devices off and on.
HI-ERROR	Temperature measurement greater than 130 °C	Do not expose temperature sensor to such a high temperature.
LO-ERROR	Temperature measurement below 0 °C	Do not expose temperature sensor to such a low temperature.

18.2 Error messages shown by Mastercycler pro, ep and nexus

With most faults it is generally sufficient to switch the device briefly off and back on again after approx. 10 seconds.

If the fault occurs again, please note down the error code (e.g. 0x0B04) and associated message along with the software versions of the Mastercycler ep, Mastercycler pro, Mastercycler nexus, and control panel (Mastercycler ep and Mastercycler pro) and contact Eppendorf Service.

19 Disposal / 20 Ordering information

Information on the disposal of electrical and electronic devices in the European Community

The disposal of electrical devices is regulated within the European Community by national regulations based on EU Directive 2002/96/EC on waste electrical and electronic equipment (WEEE).

According to these regulations, any devices supplied after 13.08.05 in the business-to-business sphere, to which this product is assigned, may no longer be disposed of in municipal or domestic waste. They are marked with the following symbol to indicate this.



As disposal regulations within the EU may vary from country to country, please contact your supplier if necessary.

20 Ordering information

Description	Order No. International	Order No. North America
Temperature Verification System - Single-channel	0055 000.298	950008059
Sensor für 384-Well Block	5331 233.007	on request
Temperatursensor – 1,5 mL	5354 850.500	on request

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Tel: +1 516 334 7500 · Toll free phone: +1 800-645-3050 · Fax: +1 516 334 7506 · E-mail: info@eppendorf.com

Application Support Europe: Tel: +49 1803 666 789 (Preis je nach Tarif im Ausland; 9 ct/min aus dem dt. Festnetz; Mobilfunkhöchstpreis 42 ct/min)
support@eppendorf.com

North America: Tel: +1 800 645 3050 · E-mail: techserv@eppendorf.com
Asia Pacific: Tel: +60 3 8023 6869 · E-mail: support_asiapacific@eppendorf.com