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Temperature Verification System – USB – Single Channel

Operating manual

0056000402-02/012018

Table of contents

1 Operating instructions

1.1 Using this manual

1. Read this operating manual completely before using the device for the first time. Observe the instructions for use of the accessories if applicable.
2. This operating manual is part of the product. Please keep it in a place that is easily accessible.
3. Enclose this operating manual when transferring the device to third parties.
4. The current version of the operating manual for all available languages can be found on our webpage www.eppendorf.com/manuals.
5. This operating manual is valid for the Temperature Verification System – USB – Single Channel. Also observe the operating manuals and safety instructions of the thermal cycler with which you operate the Temperature Verification System – USB – Single Channel.
6. Read the operating manual of the measuring device manufacturer and observe the safety instructions contained in it.

1.2 Danger symbols and danger levels

1.2.1 Danger symbols

The safety instructions in this manual have the following danger symbols and danger levels:

	**Hazard point**		**Biohazard**
	**Electric shock**		**Hot surface**
	**Material damage**		**Strong magnetic field**

1.2.2 Danger levels

DANGER	*Will* lead to severe injuries or death.
WARNING	*May* lead to severe injuries or death.
CAUTION	May lead to light to moderate injuries.
NOTICE	May lead to material damage.

1.3 Symbols used

Depiction	Meaning
1. 2.	Actions in the specified order
▸	Actions without a specified order
•	List
Text	Display or software texts
	Additional information

1.4 Abbreviations used

PDF
Portable document format

USB
Universal serial bus

1.5 Glossary

A

Adjustment
Tuning or alignment of a device to prevent systematic deviations to the extent required for the observance of specifications. An adjustment requires an intervention that permanently modifies the device.

T

Temperature accuracy
Deviation of the measured temperature from the specified temperature at a given position on the thermoblock.

Temperature homogeneity
Maximum temperature difference between two positions of the thermoblock.

V

Verification
Objective proof of the observance of defined specifications.

2 Safety

2.1 Intended use

The Temperature Verification System – USB – Single Channel is a single-channel temperature measuring device for verification and adjustment of thermoblocks temperature control of thermal cyclers. It supports verification and adjustment exclusively for Eppendorf thermal cyclers.

The Temperature Verification System – USB – Single Channel is to be used only by trained operators.

The Temperature Verification System – USB – Single Channel may only be used indoors.

2.2 User profile

The device and accessories may only be operated by trained and skilled personnel.

Before using the device, read the operating manual carefully and familiarize yourself with the device's mode of operation.

2.3 Information on product liability

In the following cases, the designated protection of the device may be compromised. Liability for any resulting property damage or personal injury is then transferred to the operator:

- The device is not used in accordance with the operating manual.
- The device is used outside of its intended use.
- The device is used with accessories or consumables which are not recommended by Eppendorf.
- The device is maintained or repaired by individuals not authorized by Eppendorf.
- The user makes unauthorized changes to the device.

2.4 Warnings for intended use

First read the operating manual. Observe the following safety instructions before using the Temperature Verification System – USB – Single Channel.

WARNING! Danger due to incorrect voltage supply.

- Only connect the device to voltage sources which correspond with the electrical requirements on the name plate.

WARNING! Infection by contaminated material.
There may be contaminated material on the device and accessories. You may become infected by contaminated material.

- Find out more about the risk of contamination before starting work.
- Check the decontamination certificate of the device.
- Work on decontaminated devices only.
- Wear your personal protective equipment (protective gloves, protective goggles).

CAUTION! Risk of burns from hot temperature sensor, thermoblock and heated lid on the thermal cycler.
The temperature sensor, the thermoblock and the inside of the heated lid can reach temperatures of over 50 °C.

- Take note of the symbols on the thermoblock and the heated lid warning that surfaces may be hot.
- Wear suitable protective gloves when inserting the temperature sensor into the thermoblock or removing it from the thermoblock.

CAUTION! Risk of burns on the silicone mat.
The heated lid heats up the silicone mat to temperatures of around 100 °C.

- Open the heated lid without touching the silicone mat.
- Wait until the temperature of the silicone mat is below 30 °C.

CAUTION! Risk of burns due to flammable cleaning substances.
After cleaning, there are still small amounts of cleaning substance on the thermoblock.
When heating up the thermoblock, cleaning substances such as ethanol or solvent can ignite.

- Open the heated lid.
- Let the cleaning substance completely evaporate.

WARNING! Burns from hot surfaces.
The metal surfaces of the thermoblocks and the heating plate reach temperatures in excess of 100 °C.

- Do not touch any hot surfaces.
- Wait until the Eppendorf ThermoMixer or Eppendorf ThermoStat have cooled down to ambient temperature.
- Then start your test, service or repair.

NOTICE! Material damage from incorrect connections.

- Only electrical connections may be made to devices described in the operating manual.
- Other connections are permitted only with the agreement of Eppendorf AG.
- Only connect devices that meet the safety requirements defined in IEC 60950-1.

2.5 Warnings for unintended use

WARNING! Danger due to strong magnetic field
Magnetic fields may affect pacemakers and defibrillators. Pacemakers may be reset.

- Keep a distance of at least 15 cm from the magnet.

CAUTION! Poor safety due to incorrect accessories and spare parts.
The use of accessories and spare parts other than those recommended by Eppendorf may impair the safety, functioning and precision of the device. Eppendorf cannot be held liable or accept any liability for damage resulting from the use of incorrect or non-recommended accessories and spare parts, or from the improper use of such equipment.

- Only use accessories and original spare parts recommended by Eppendorf.

NOTICE! Damage as a result of improper packing.
Eppendorf AG is not liable for any damage caused by improper packing.

- The device may only be stored and transported in its original packaging.

NOTICE! Damage to the sensor and thermal cycler due to improper use.

- Do not insert the sensor into thermal cyclers that are not compatible with the Temperature Verification System – USB – Single Channel.
- When inserting the sensor or closing the heated lid, never use an operational force significantly higher than the force recommended by the thermal cycler manufacturer for handling a PCR plate.

Eppendorf accepts no warranty or liability for damage caused by incorrect use of the Temperature Verification System – USB – Single Channel.

NOTICE! Damage to the sensor/cable connection as a result of the cable being pulled.
Repeatedly pulling on the cable to remove the temperature sensor from the thermoblock will cause damage to the sensor/cable connection.

- Pull the thermosensor out of the thermoblock via the thermosensor housing.
- Do not apply tractive forces to the cable.

2.6 Safety instructions on the device

Depiction	Meaning	Location
	Warns of a strong magnetic field.	Rear of the measuring device. On the carrying case.

3 Product description

3.1 Delivery package

3.1.1 Temperature Verification System – USB – Single Channel

For Mastercycler X50, Mastercycler nexus, Mastercycler pro, Mastercycler ep, ThermoMixer and ThermoStat

1× measuring device

1× plug head line (connecting cable between measuring device and temperature sensor)

1× mains/power supply device

4× international plug adapter

1× operating manual

1× device case

3.1.2 Temperature sensor 96 well

1× Temperature sensor 96 well

4× spacers

1× certificate

3.1.3 Temperature sensor 384 well

1× Temperature sensor 384 well

1× silicone mat for the Temperature sensor 384 well

4× spacers

1× bottle with parrafin oil (25 mL)

1× certificate

3.1.4 1.5 mL temperature sensor

1× 1.5 mL temperature sensor

1× certificate

3.2 Features

3.2.1 Temperature Verification System – USB – Single Channel

- The term "validation" has been replaced by "verification" in these instructions. The term "validation" is still used in older software versions.
- The term "calibration" has been replaced by "adjustment" in these instructions. The term "calibration" is still used in older software versions.

The Temperature Verification System – USB – Single Channel enables simple and fast inspection of the block temperature of the following Mastercycler products:

- Mastercycler X50
- Mastercycler nexus
- Mastercycler pro
- Mastercycler ep

The Temperature Verification System – USB – Single Channel requires a minimum software version in the control panel of the thermal cycler.

This table contains the minimum software versions required to use the Temperature Verification System – USB – Single Channel. If the device or CycleManager pro software has an older version, install the software version listed below.

Device	Software version
Mastercycler X50	1.0.4.0
Mastercycler nexus	1.4.0.0
Mastercycler pro	3.029
Mastercycler ep	3.029
CycleManager pro/pro^{XL}	2.5 / 2.6
Mastercycler pro Panel	1.023
Mastercycler ep Panel	4.605

Furthermore, the temperature of corresponding block formats in the Eppendorf ThermoMixer and ThermoStat devices can be measured using the 1.5 mL temperature sensor and Temperature sensor 384 well.

The Temperature Verification System – USB – Single Channel consists of a digital display device with connected temperature sensor. Various temperature sensors, which are geometrically adapted to the various thermoblock bores, are available.

Verification and adjustment is based on a 2-point measurement with the Temperature Verification System – USB – Single Channel at 95 °C and 35 °C. The verification compares the difference between the block temperature and the measured value using limit values. If the limit values are exceeded, the adjustment uses the measured values from the Temperature Verification System – USB – Single Channel to set the thermoregulation of the tested device.

The user will be guided through the program via the instructions and the display of sensor positions on the display. The measurements and calculations are performed automatically.

The verification and adjustment can optionally be provided as a print out, which contains the entire measuring procedure and results, and can be documented. Depending on the device type, the data can be exported to a MultiMediaCard (MMC) or a USB storage medium.

3.2.2 Design of the temperature sensor

The temperature sensor consists of a grip and a temperature probe.

The grip contains the galvanic separation, adjustment data, and all of the data for the temperature measurement.

3.2.3 Temperature sensor 96 well

The Temperature sensor 96 well and Temperature Verification System – USB – Single Channel are used to verify and adjust the following devices:

- Mastercycler X50 (all device variants except Mastercycler X50h and Mastercycler X50t)
- Mastercycler nexus (all device variants except Mastercycler nexus flat)
- Mastercycler pro, Mastercycler pro S
- Mastercycler ep gradient, Mastercycler ep gradient S

3.2.4 Temperature sensor 384 well

The Temperature sensor 384 well and Temperature Verification System – USB – Single Channel are used to verify and automatically adjust the following devices.

- Mastercycler pro 384
- Mastercycler X50h
- Mastercycler X50t

The following device can be verified and manually adjusted.

- Mastercycler ep 384

The following devices can only be verified.

- ThermoMixer C
- ThermoMixer F0.5
- ThermoMixer F1.5
- ThermoMixer F2.0
- ThermoMixer FP
- ThermoStat C

The temperature settings for the ThermoMixer and the ThermoStat are stored in the thermoblock and not in the device.

3.2.5 1.5 mL temperature sensor

The 1.5 mL temperature sensor and Temperature Verification System – USB – Single Channel are used to verify the following devices:

- Thermomixer comfort
- Thermomixer compact
- ThermoStat plus

3.3 Certificate

The accuracy of the temperature sensor is confirmed by the accompanying certificate. This ensures traceability to national and international standards according to MRA (Mutual Recognition Arrangement from October 14, 1999, Paris, https://www.bipm.org/en/cipm-mra/mra_main_text.html).

The country-specific laws and quality assurance standards must be observed.

Each temperature sensor is verified after the adjustment and receives its own certificate with information on validity.

4 Installation

4.1 Temperature adaptation time

The measuring device will only provide constant measured values once it has reached the ambient temperature.

- Wait at least 1 hour before starting the measurement.

4.2 Initial charging of the battery

The *Initial setup* chapter of the Manufacturer's operating manual contains a description of the initial charging.
The charging time can be found in the technical data.

The Measuring device is delivered with a partially charged rechargeable battery.

- Fully charge the battery before using it for the first time.

4.3 Connecting the temperature sensor to the Measuring device

Only connect the temperature sensor to the plug-head cord when the Measuring device is switched off.

Do not remove the sensor from the Measuring device when it is switched on.

Make sure the plug is securely positioned. Do not use force during insertion.

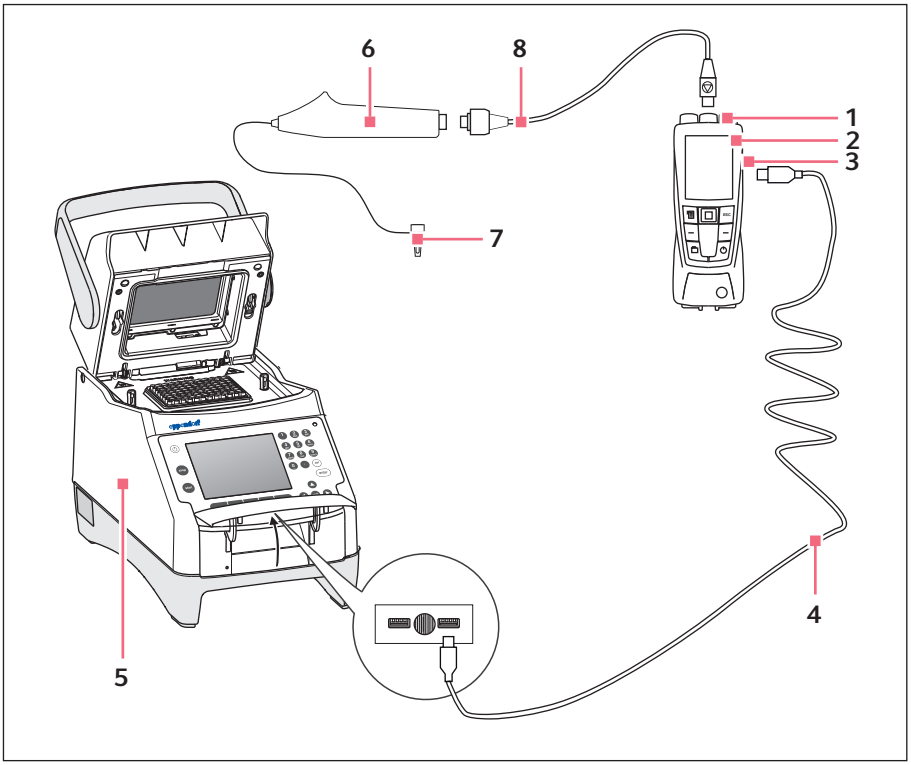
Additional information on the push/pull plug connection is available in the Manufacturer's operating manual.

1. Select the temperature sensor that matches the bores in the thermoblock.
2. Connect the temperature sensor grip to the Measuring device using the connecting cable.

Additional information can be found in the Measuring device operating manual.

4.4 Connecting the Mastercycler X50 and nexus

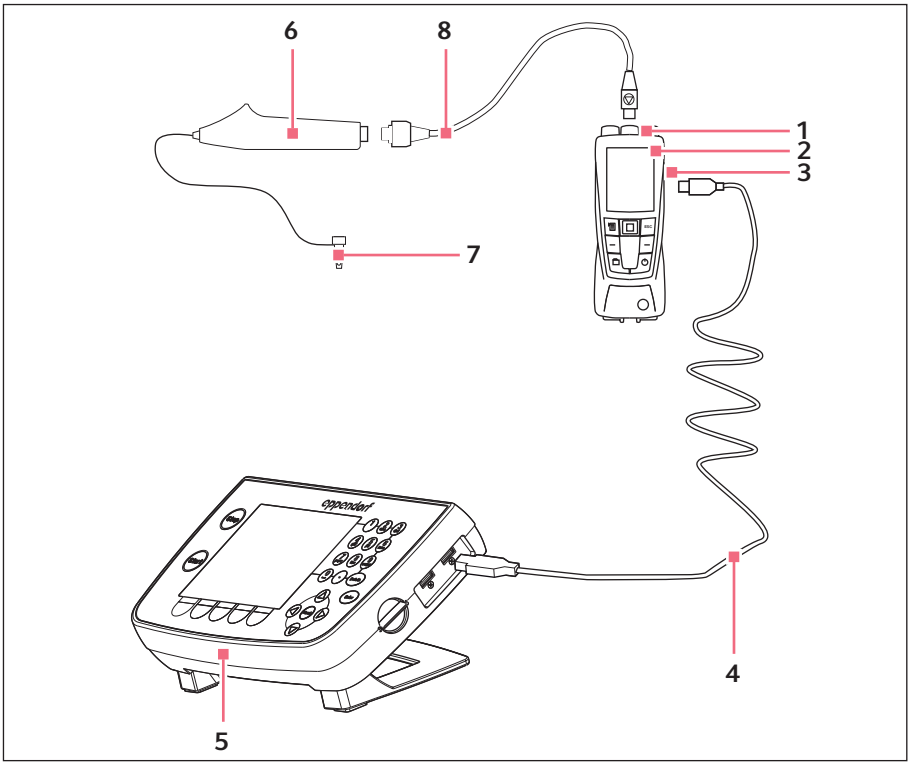
1. Use the temperature sensor (plug-head cord) connecting cable to connect the grip and the Measuring device.
2. Use the USB cable to connect the Measuring device and the Mastercycler.
3. Switch on the Measuring device.
4. Check the rechargeable battery capacity.
5. Charge the rechargeable battery or use the mains/power supply device if the battery capacity is low.



1	**Port for plug-head cord**	5	**Mastercycler**
2	**Measuring device**	6	**Grip**
3	**Mini USB interface**	7	**Temperature probe**
4	**USB connecting cable**	8	**Plug-head cord**

4.5 Connecting the Mastercycler pro

1. Use the temperature sensor (plug-head cord) connecting cable to connect the grip and the Measuring device.
2. Connect the Measuring device and control panel using the USB cable.
3. Switch on the Measuring device.
4. Check the rechargeable battery capacity.
5. Charge the rechargeable battery or use the mains/power supply device if the battery capacity is low.



1	**Port for plug-head cord**	5	**USB control panel**
2	**Measuring device**	6	**Grip**
3	**Mini USB interface**	7	**Temperature probe**
4	**USB connecting cable**	8	**Plug-head cord**

4.6 Connecting the Mastercycler ep

The Mastercycler ep control panel (5340) can only be used for manual verification and adjustment. A direct cable connection cannot be established between the measuring device and thermal cycler.

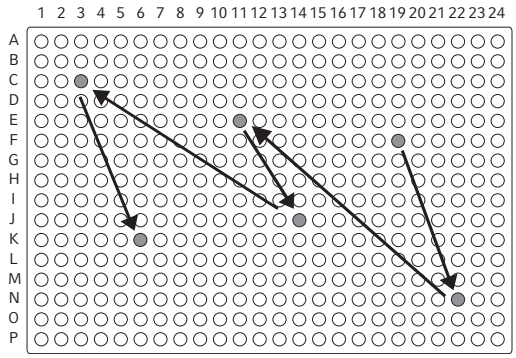
1. Use the temperature sensor connecting cable to connect the grip to the Measuring device.
2. Switch on the Measuring device.
3. Check the rechargeable battery capacity.
4. Charge the rechargeable battery or use the mains/power supply device if the battery capacity is low.

4.7 Filling thermoblock 384 with oil

Oil in the space between the temperature sensor and the thermoblock improves the heat transmission. For measurements with the Temperature Verification System – USB – Single Channel, the bores of the thermoblock 384 are filled with 5 µL oil at the specified measuring positions.

Prerequisites

The thermoblock with 384 wells is cooled to room temperature.



1. Fill the bores with 5 µL oil at the following positions:

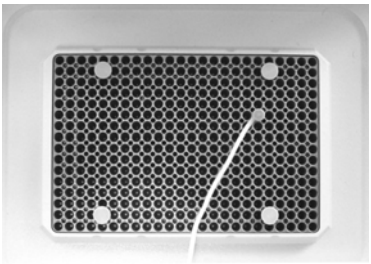
- F19
- N22
- E11
- J14
- C3
- K6

▸ Remove the oil after the last measurement.
The procedure is described in the cleaning chapter (see *Removing oil from the thermoblock on p. 42)*.

4.8 Inserting the spacers
4.8.1 96 thermoblock

- Insert the spacers before starting the program.
  The spacers will be inserted at the following positions:
  - A1
  - A12
  - H1
  - H12

4.8.2 384 thermoblock



- Insert the spacers before starting the program.
  The spacers will be inserted at the following positions:

- B5
- B20
- O5
- O20

4.9 Inserting the temperature sensor
4.9.1 Thermoblock 96 and thermoblock 384

1. Insert the temperature sensor after the program has started.
   The position and the request to insert the sensor will be shown in the Mastercycler display.
   The sensor cable will be guided outward over the thermoblock on the front of the Mastercycler. It should be freely movable and should not be positioned near the lid closing mechanism.

4.10 Positioning the silicone mat (thermoblock 384)

Positioning the silicone mat

- Place the silicon mat over the spacers and the sensor so the thermoblock is evenly covered.
- Close and lock the heated lid.

4.11 Connecting the Mastercycler pro/ep to a computer and CycleManager pro / pro^{XL}

1. Use the temperature sensor connecting cable to connect the grip and the Measuring device.
2. Use the USB cable to connect the Measuring device and computer.
3. Switch on the Measuring device.
4. Check the rechargeable battery capacity.
5. Charge the rechargeable battery or use the mains/power supply device if the battery capacity is low.

4.12 Installing the Thermomixer and ThermoStat

4.12.1 Preparing the Thermomixer comfort and ThermoStat plus

1. Mount the 1.5 mL thermoblock on the device to be verified if another thermoblock is mounted on the device.
2. Switch on the device.

4.12.2 Connecting the Thermomixer and ThermoStat

1. Use the temperature sensor connecting cable to connect the grip to the Measuring device.
2. Switch on the Measuring device.
3. Check the rechargeable battery capacity.
4. Charge the rechargeable battery or use the mains/power supply device if the battery capacity is low.

5 Operation

CAUTION! Risk of burns from hot temperature sensor, thermoblock and heated lid on the thermal cycler.
The temperature sensor, the thermoblock and the inside of the heated lid can reach temperatures of over 50 °C.

- Take note of the symbols on the thermoblock and the heated lid warning that surfaces may be hot.
- Wear suitable protective gloves when inserting the temperature sensor into the thermoblock or removing it from the thermoblock.

WARNING! Burns from hot surfaces.
The metal surfaces of the thermoblocks and the heating plate reach temperatures in excess of 100 °C.

- Do not touch any hot surfaces.
- Wait until the Eppendorf ThermoMixer or Eppendorf ThermoStat have cooled down to ambient temperature.
- Then start your test, service or repair.

NOTICE! Damage to the sensor/cable connection as a result of the cable being pulled.
Repeatedly pulling on the cable to remove the temperature sensor from the thermoblock will cause damage to the sensor/cable connection.

- Pull the thermosensor out of the thermoblock via the thermosensor housing.
- Do not apply tractive forces to the cable.

NOTICE! Damage to the sensor cable caused by trapping it between the lid and the housing
The sensor cable runs via the thermoblock and the housing to the measuring device. The lid can trap and damage the sensor cable when it is closed.

- Guide the sensor cable in the middle to the front over the edge of the thermoblock and the housing.
- Only close the lid if the sensor cable is not trapped.

5.1 Verifying the Mastercycler X50, nexus, pro and ep

Only users who are logged in as *User*, *Administrator* or *Service* can verify the Mastercycler X50, nexus, pro or ep.

5.1.1 Overview

The verification program checks the temperature accuracy of the thermoblock.

The Mastercycler heats the thermoblock to 95 °C and then to 35 °C. In the process, the user will be prompted to measure the temperature in 6 different block positions that are shown on the display. The verification procedure lasts 15 to 30 minutes.

The Mastercycler outputs the measuring results on the display and on a printer or storage medium.

The CycleManager generates a protocol of the measurement on the monitor. The protocol can be printed or saved as a text file using the *File* menu.

The following Mastercyclers save the measuring results on a MultiMediaCard:

- Mastercycler ep
- Mastercycler pro

The following Mastercyclers save the measuring results on a USB stick:

- Mastercycler pro
- Mastercycler nexus
- Mastercycler X50

The Mastercycler must be adjusted if the measured values are outside of the maximum permissible error.

The maximum permissible errors for the Temperature Verification System – USB – Single Channel and the devices are listed in the technical data.

5.1.2 Verifying the Mastercycler X50

Prerequisites

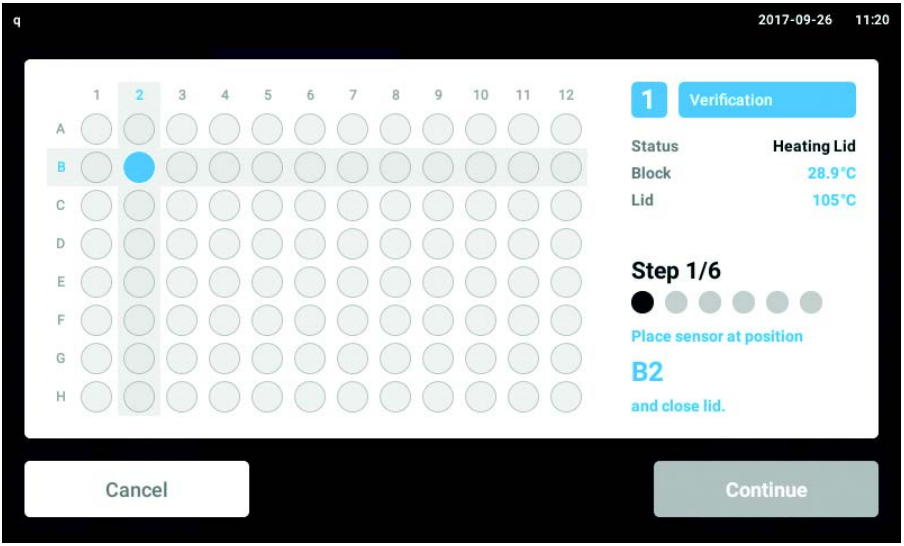
- The Mastercycler is switched on.
- The Measuring device with the temperature sensor is connected to the Cycler and switched on.

A Mastercycler with touch screen interface controls the verification of a Mastercycler without touch screen interface.

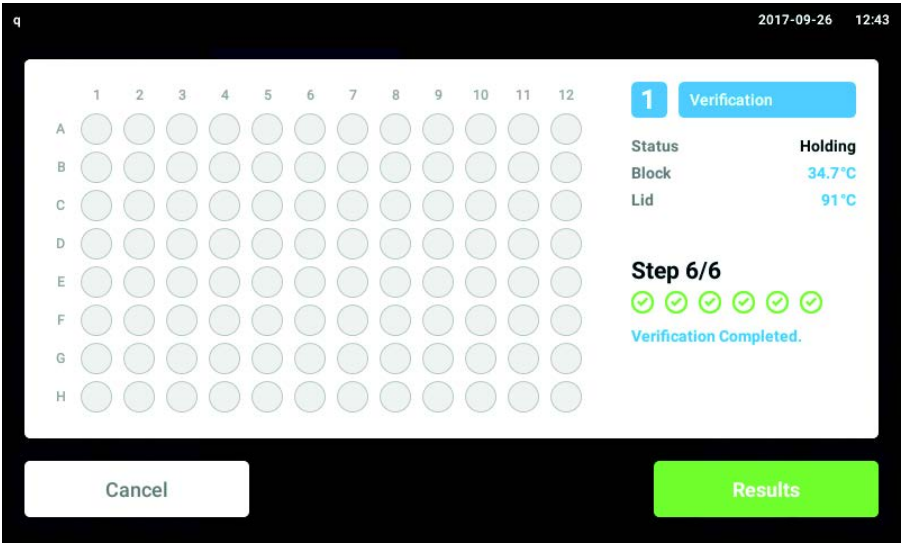
All Mastercycler X50 that are connected to each other must be in "Idle" state. No programs may be running.

The current verification can be interrupted at any time using *Cancel*.

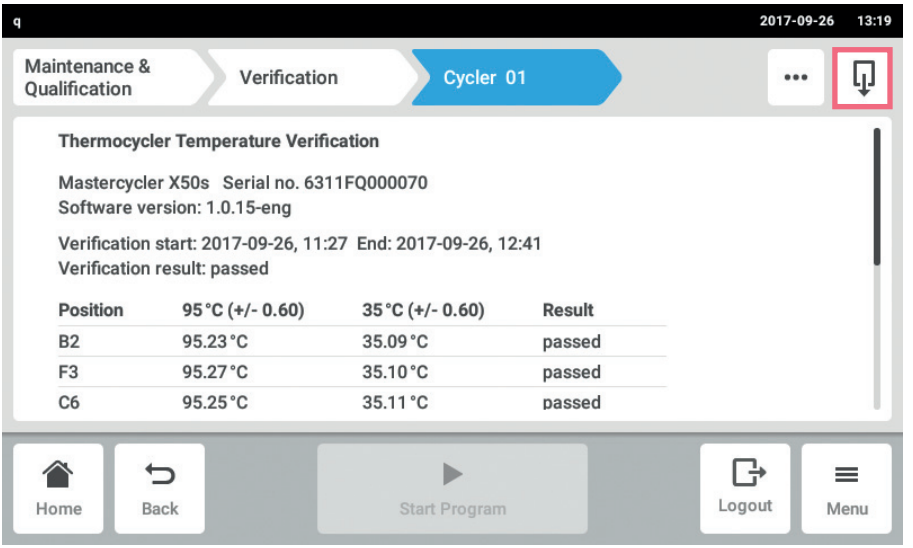
1. Log in as *User* or *Administrator*.
2. Select *Menu*.
3. Select *Maintenance & Qualification*.
4. Select *Verification*.
5. Select the Cycler to be verified.
   If a Cycler without touch screen interface is verified, position the probe in the thermoblock of the Cycler without touch screen interface. The measuring device is connected to the Cycler with touch screen interface.
   The temperature sensor will be checked by the Mastercycler.
   If the certification of the temperature sensor is no longer valid, an error message will be shown. End the verification. Arrange to have the temperature sensor certified.
   The verification program starts and heats the heated lid to 105 °C.
   The first measuring position is displayed.



6. Open the heated lid.
7. Insert the temperature sensor at the indicated position.
8. Close the heated lid.
   The *Continue* button changes from gray to green.
9. Select *Continue*.
   The first measuring cycle begins by checking the temperatures 95 °C and 35 °C.
   Each additional measuring cycle begins with the request to move the temperature sensor to a different position. The position will be shown on the display.
10. Follow the instructions on the display.

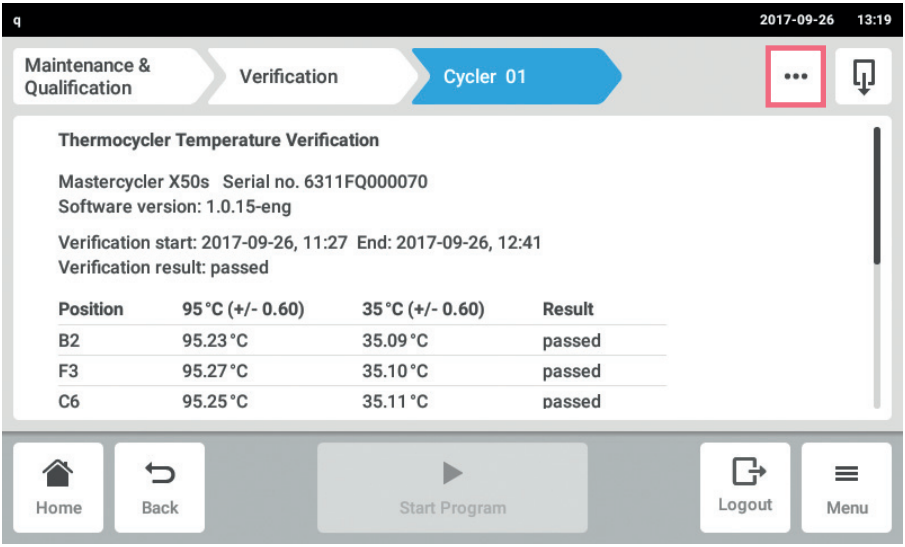


11.After verification is complete, select *Results*.



The protocol appears on the display.

12. To export the protocol to a USB stick, select the *Export* button in the upper right corner.
    The protocol can only be exported directly after the measurement. It is not stored in the Cycler.



13. To adjust the Cycler, select the button with the 3 dots.
14. To return to the start screen, select *Home*.

5.1.3 Verifying the Mastercycler nexus and Mastercycler pro

Prerequisites

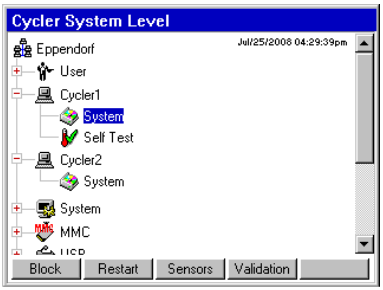
- The Mastercycler is switched on.
- The Measuring device with the temperature sensor is connected to the Cycler or Control Panel and switched on.

The Mastercycler nexus flat cannot be adjusted using the Temperature Verification System – USB – Single Channel.

All Mastercycler nexus that are connected to each other must be in "Idle" state. This also applies to all Mastercycler pro devices that are connected to a control panel. No programs may be running.

The current verification can be interrupted at any time using the *Exit* softkey.

1. Log in as *User* or *Administrator*.



2. Select the *System* menu item under the cycler node.
3. Press the *Verification* softkey.
   A note to use the Temperature Verification System – USB – Single Channel will be shown.
4. Confirm the note with the *OK* softkey.
   You will be prompted to connect the Temperature Verification System – USB – Single Channel.
5. Connect and switch on the Temperature Verification System – USB – Single Channel.
   The connection of the Temperature Verification System – USB – Single Channel to the various Mastercycler devices is described in the installation chapter.
6. Confirm the request with the *OK* softkey.
   The temperature sensor will be checked by the Mastercycler.
   If the certification of the temperature sensor is no longer valid, an error message will be shown. End the verification. Arrange to have the temperature sensor certified.
   The verification program starts and heats the heated lid to 105 °C. You will then be prompted to open the lid.
7. Open the heated lid.
8. Confirm the request with the *OK* softkey.
   You will be prompted to insert the temperature sensor (*Insert sensor in the position indicated*).
9. Insert the temperature sensor at the indicated position.
10. Confirm the request with the *OK* softkey.
    You will be prompted to close the heated lid.
11. Close the heated lid.
12. Confirm the request with the *OK* softkey.
    The first measuring cycle begins by checking the temperatures 95 °C and 35 °C.
    Each additional measuring cycle begins with the request to move the temperature sensor to a different position. The position will be shown on the display.
13. Repeat steps 7 to 12.
    The protocol will be shown on the display after verification.
    You now have the option to print or save the protocol.
14. Press the *Exit* softkey.
    The *Cycler System Level* window will be shown.

5.1.4 Verifying the Mastercycler ep

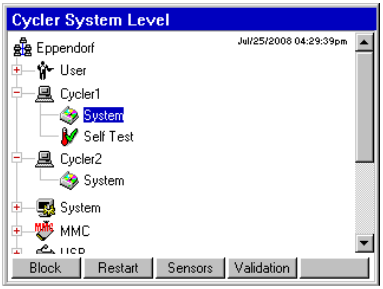
Prerequisites

- The Mastercycler is switched on.
- The Measuring device is connected to the temperature sensor and switched on.

The Mastercycler ep control panel (5340) can only be used for manual verification and adjustment. A direct cable connection cannot be established between the measuring device and thermal cycler.

Any Mastercycler ep connected to a control panel must be in the "Idle" state. No programs may be running.

1. Log in as *User*, *Administrator* or *Service*.



2. Select the *System* menu item under the cycler node.
3. Press the *Verification* softkey.
   A note to use the Temperature Verification System – USB – Single Channel will be shown.
4. Confirm the note with the *OK* softkey.
   You will be asked if you would like to use the Temperature Verification System – USB – Single Channel.
5. Answer the question using the *Yes* softkey.
   You will be prompted to connect the Temperature Verification System – USB – Single Channel.
6. Connect and switch on the Temperature Verification System – USB – Single Channel.
   The connection of the Temperature Verification System – USB – Single Channel to the various Mastercycler devices is described in the installation chapter.
7. Confirm the request with the *OK* softkey.
   The verification program starts and heats the heated lid to 105 °C. You will then be prompted to open the lid.
8. Open the heated lid.

9. Confirm the request with the *OK* softkey.
   You will be prompted to insert the temperature sensor (*Insert sensor in the position indicated*).
10. Insert the temperature sensor at the indicated position.
11. Confirm the request with the *OK* softkey.
    You will be prompted to close the heated lid.
12. Close the heated lid.
13. Confirm the request with the *OK* softkey.
    The measuring cycle begins by tempering the thermoblock to 95 °C and 35 °C.
14. After each temperature control, read the temperature value of the measuring device and enter it in the control panel twice.
    Each additional measuring cycle begins with the request to move the temperature sensor to a different position. The position will be shown on the display.
15. Repeat steps 8 to 14.
    The protocol will be shown on the display after verification.
    The *StoreMMC* softkey is used to save the protocol.
    The *Print* softkey is used to print the protocol.
16. Press the *Exit* softkey.
    The *Cycler System Level* window will be shown.

5.1.5 Verifying the Mastercycler pro/ep using the CycleManager pro

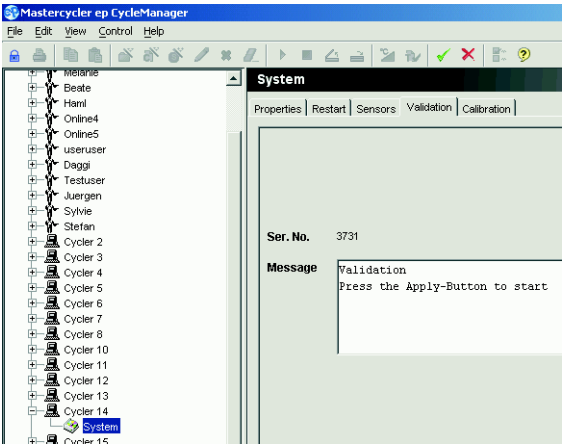
Prerequisites

- The Mastercycler is switched on.
- The Measuring device with the temperature sensor is connected to the computer and switched on.

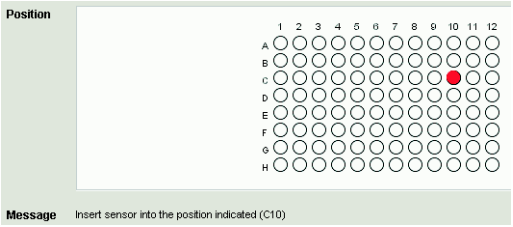
All other functions of the CycleManager pro/pro^{XL} are deactivated during the verification.

The current verification can be interrupted at any time using the icon.

1. Start the CycleManager pro/pro^{XL}.
2. Log in as *User*, *Administrator* or *Service*.



3. In the navigation tree, open the node of the cycler to be verified.
4. Select the *System* menu item.
5. Select the *Verification* tab.
6. Start the verification using the icon.
7. Select the Temperature Verification System – USB – Single Channel using the checkbox.
8. Use the icon to confirm the selection.
   You will be prompted to connect the Temperature Verification System – USB – Single Channel.
9. Connect the Temperature Verification System – USB – Single Channel.
10. Switch on the Measuring device.
    The temperature sensor will be checked by the Mastercycler.
    If the certification of the temperature sensor is no longer valid, an error message will be shown. End the verification. Arrange to have the temperature sensor certified.
11. Confirm the query on the screen using the icon.
    The verification program starts and heats the heated lid to 105 °C. You will then be prompted to insert the temperature sensor (*Insert sensor in the position indicated*).
12. Open the heated lid.



13. Insert the temperature sensor at the indicated position.
14. Close the heated lid.
    If a motor-driven heated lid is mounted, it automatically moves to the front position during the next step.
15. Start the measuring cycle using the icon.
    The measuring procedure runs at 95 °C and then at 35 °C. Each additional measuring cycle begins with the request to move the temperature sensor to a different position.
16. Start each new measuring cycle using the icon.
    The protocol will be shown on the monitor after the verification.
17. Complete the verification procedure using the icon.

5.2 Adjusting the Mastercycler X50, nexus, pro and ep

Only users who are logged in as *Administrator* or *Service* can adjust the Mastercycler X50, nexus, pro or ep.

5.2.1 Overview

The adjustment program checks the temperature accuracy of the thermoblock and adjusts the temperature measurement in the Mastercycler.

The Mastercycler heats the thermoblock to 95 °C and then to 35 °C. In the process, the user will be prompted to measure the temperature in 6 different block positions that are shown on the display. The temperature measurement in the Mastercycler will be adjusted using the externally measured values. The procedure lasts 15 to 30 minutes.

The Mastercycler outputs the measuring results on the display and a printer or a USB flash drive.

The CycleManager generates a protocol of the measurement on the monitor. The protocol can be printed or saved as a text file using the *File* menu.

The following Mastercyclers save the measuring results on a MultiMediaCard:

- Mastercycler ep
- Mastercycler pro

The following Mastercyclers save the measuring results on a USB stick:

- Mastercycler pro
- Mastercycler nexus
- Mastercycler X50

Then, an adjustment is always confirmed by a verification.

5.2.2 Adjusting the Mastercycler X50

Prerequisites

- The Mastercycler is switched on.
- The Measuring device with the temperature sensor is connected and switched on.
- The verification is complete and the results are displayed.

Once verification is complete, the adjust button will become accessible (Fig. 5-2 on p. 34). The adjustment of the Mastercycler X50 uses the data from the previous verification.

All Mastercycler X50 that are connected to each other must be in "Idle" state. No programs may be running.

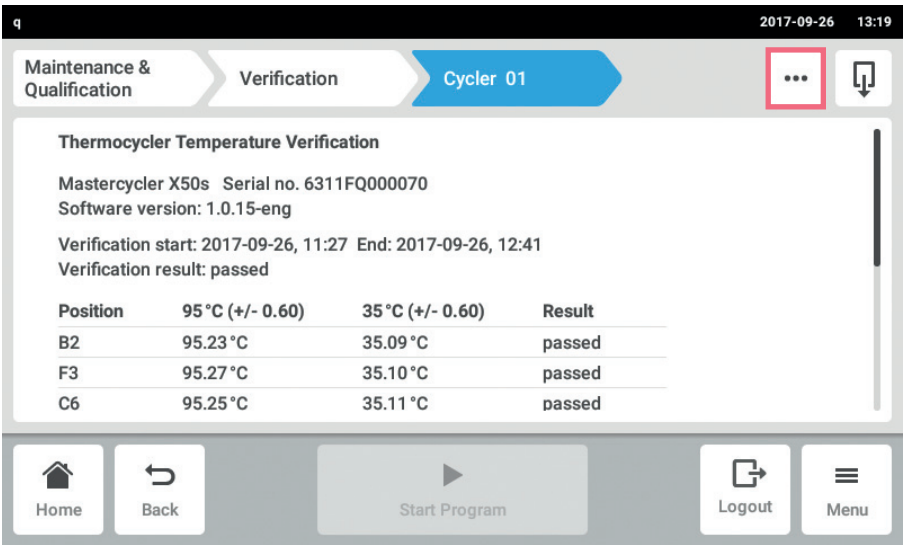


Fig. 5-1: Switch to the next screen for adjustment or new verification.

1. To adjust the Cycler, select the button with the 3 dots.

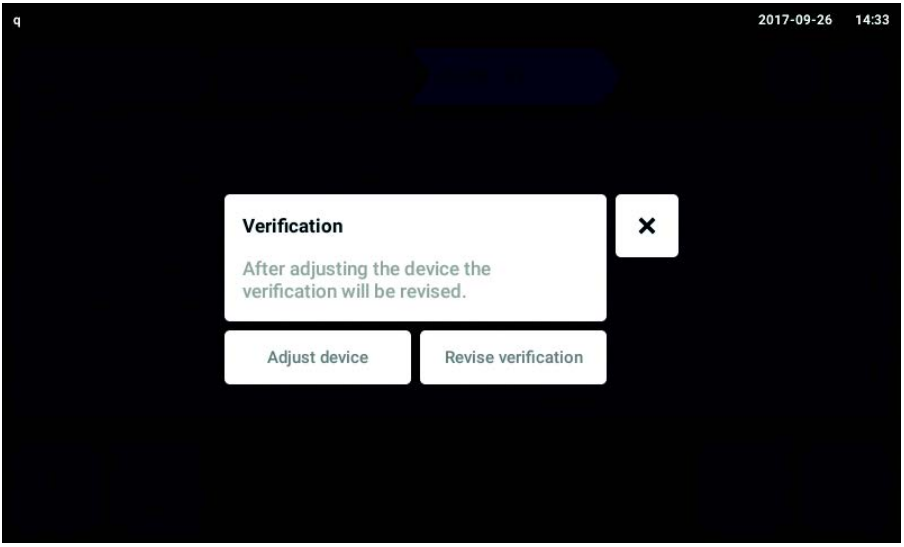


Fig. 5-2: Start adjustment or new verification.

2. Start the adjustment using the *Adjust device* button.
   The Mastercycler is adjusted and verification restarted.

5.2.3 Adjusting the Mastercycler nexus and Mastercycler pro

Prerequisites

- The Mastercycler is switched on.
- The Measuring device with the temperature sensor is connected and switched on.

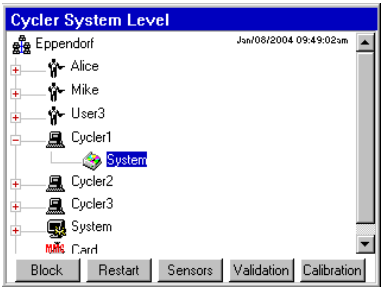
The Mastercycler nexus flat cannot be adjusted using the Temperature Verification System – USB – Single Channel.

All Mastercycler nexus that are connected to each other must be in "Idle" state. This also applies to all Mastercycler pro devices that are connected to a control panel. No programs may be running.

You must be logged in as administrator (_admin) if the PIN option is activated.

The current adjustment can be interrupted at any time using the *Exit* softkey.

1. Log in as *Administrator*.



2. Select the *System* menu item under the cycler node.
3. Press the *Adjustment* softkey.
   The adjustment program starts and heats the heated lid to 105 °C. You will then be prompted to insert the temperature sensor (*Insert sensor in the position indicated*).
4. Open the heated lid.
5. Insert the temperature sensor at the indicated position.
6. Close the heated lid.
7. Start the measuring cycle using the **Enter** key.
   The measuring procedure runs at 95 °C and then at 35 °C.
   Each additional measuring cycle begins with the request to move the temperature sensor to a different position. The position will be shown on the display.
8. Repeat steps 3 to 5.
9. Start each new measuring cycle using the **OK** softkey.
   The protocol will be shown on the display after the adjustment.
10. Check the adjustment via a subsequent verification (see *Verifying the Mastercycler nexus and Mastercycler pro on p. 27)*.
11. Press the *Exit* softkey.
    The *Cycler System Level* window will be shown.

5.2.4 Adjusting the Mastercycler ep

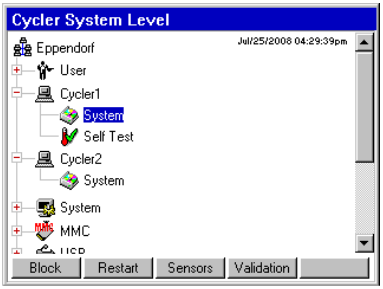
Prerequisites

- The Mastercycler is switched on.
- The Measuring device is connected to the temperature sensor and switched on.

Any Mastercycler ep connected to a control panel must be in the "Idle" state. No programs may be running.

The Mastercycler ep can only be adjusted manually.

1. Log in as *Administrator*.



2. Select the *System* menu item under the cycler node.
3. Press the *Adjustment* softkey.
   A note to use the Temperature Verification System – USB – Single Channel will be shown.
4. Confirm the note with the *OK* softkey.
   You will be asked if you would like to use the Temperature Verification System – USB – Single Channel.
5. Answer the question using the *Yes* softkey.
   You will be prompted to connect the Temperature Verification System – USB – Single Channel.
6. Connect and switch on the Temperature Verification System – USB – Single Channel.
   The connection of the Temperature Verification System – USB – Single Channel to the Mastercycler devices is described in the installation chapter.
7. Confirm the request with the *OK* softkey.
   The adjustment program starts and heats the heated lid to 105 °C. You will then be prompted to open the lid.
8. Open the heated lid.
9. Confirm the request with the *OK* softkey.
   You will be prompted to insert the temperature sensor (*Insert sensor in the position indicated*).

10. Insert the temperature sensor at the indicated position.
11. Confirm the request with the *OK* softkey.
    You will be prompted to close the heated lid.
12. Close the heated lid.
13. Confirm the request with the *OK* softkey.
    The measuring cycle begins by tempering the thermoblock to 95 °C and 35 °C.
14. After each temperature control, read the temperature value of the measuring device and enter it in the control panel twice.
    Each additional measuring cycle begins with the request to move the temperature sensor to a different position. The position will be shown on the display.
15. Repeat steps 8 to 14.
    The protocol will be shown on the display after the adjustment.
    The *StoreMMC* softkey is used to save the protocol.
    The *Print* softkey is used to print the protocol.
16. Press the *Exit* softkey.
    The *Cycler System Level* window will be shown.

5.2.5 Adjusting the Mastercycler pro/ep using the CycleManager pro

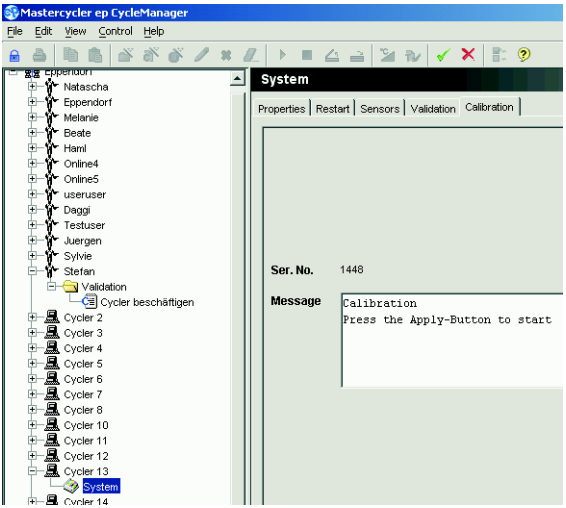
Prerequisites

- The Mastercycler is switched on.
- The Measuring device with the temperature sensor is connected to the computer and switched on.

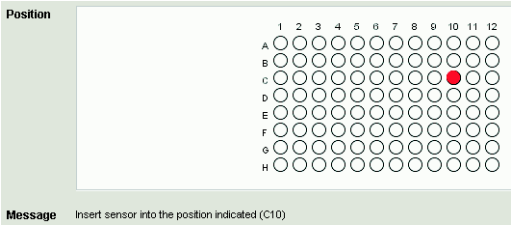
All other functions of the CycleManager pro/pro^{XL} are deactivated during the adjustment.

The current adjustment can be interrupted at any time using the  icon.

1. Start the CycleManager pro/pro^{XL}.
2. Log in as *Administrator*.



3. In the navigation tree, open the node of the cycler to be adjusted.
4. Select the *System* menu item.
5. Select the *Adjustment* tab.
6. Start the adjustment using the icon.
7. Select the Temperature Verification System – USB – Single Channel using the checkbox.
8. Use the icon to confirm the selection.
   You will be prompted to connect the Temperature Verification System – USB – Single Channel.
9. Connect the Temperature Verification System – USB – Single Channel.
10. Switch on the Measuring device.
    The temperature sensor will be checked by the Mastercycler.
    If the certification of the temperature sensor is no longer valid, an error message will be shown. End the adjustment. Arrange to have the temperature sensor certified.
11. Confirm the query on the screen using the icon.
    The adjustment program starts and heats the heated lid to 105 °C. You will then be prompted to insert the temperature sensor (*Insert sensor in the position indicated*).
12. Open the heated lid.



13. Insert the temperature sensor at the indicated position.
14. Close the heated lid.
    If a motor-driven heated lid is mounted, it automatically moves to the front position during the next step.
15. Start the first measuring cycle using the ✓ icon.
    The measuring procedure runs at 95 °C and then at 35 °C. Each additional measuring cycle begins with the request to move the temperature sensor to a different position.
16. Repeat steps 13 to 16.
17. Start each new measuring cycle using the ✓ icon.
    The protocol will be shown on the monitor after the adjustment.
18. Complete the adjustment procedure using the ✓ icon.

5.3 Verifying the Thermomixer and ThermoStat

Do not verify the thermomixer during mixing. The sensor may be damaged by vibration.

Tolerances for the temperatures can be found in the technical data for the devices. The data is available in the operating manual and the service manual.

5.3.1 Thermomixer comfort, Thermomixer compact, Thermostat plus

The temperature can only be checked with the 1.5 mL temperature sensor in the 1.5 mL block.

The verification is described in the service manual of the devices.

5.3.2 ThermoMixer C, ThermoMixer F0.5/F1.5/F2.0, ThermoMixer FP, ThermoStat C

The temperature is checked with the temperature sensor 384 well. All thermoblocks have a test bore that matches the sensor.

The verification is described in the service manual of the devices.

6 Troubleshooting

6.1 General errors

6.1.1 Troubleshooting for the Measuring device

Troubleshooting, definitions and remedies can be found in the Manufacturer's operating manual.

6.1.2 Troubleshooting for the Mastercyclers

Troubleshooting by the user

1. Switch off the device.
2. Switch the device back on after 10 seconds.
   Many errors can be remedied by this step.
   If the error occurs again, perform the following steps.

Troubleshooting via the local service organization

3. Note the error code and corresponding text.
4. Note the software version of the Mastercycler.
5. Note the software version of the control panel, if available.
6. Notify the local service organization.

7 Transport, storage and disposal

7.1 Packing

WARNING! Risk to health from contaminated device

1. Observe the information on the decontamination certificate. You can find it as a PDF document on our webpage (www.eppendorf.com/decontamination).
2. Decontaminate all the parts you would like to dispatch.
3. Include the fully completed decontamination certificate in the package.

A decontamination certificate must be included when the system is sent to Eppendorf for recertification or repair.

Proceed as follows to pack the Temperature Verification System – USB – Single Channel for storage or transportation.

1. If necessary, decontaminate the Temperature sensor or disinfect (see p. 43) the (see p. 42).
2. Pack the system, and all assemblies, in the supplied carrying case.

The storage conditions are listed in the Manufacturer's operating manual.

7.2 Disposal

If the product needs to be disposed of, the relevant legal regulations must be observed.

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

Within the European Community, the disposal of electrical devices is regulated by national regulations based on EU Directive 2012/19/EU pertaining to waste electrical and electronic equipment (WEEE).

According to these regulations, any devices supplied after August 13, 2005, in the business-to-business sphere, to which this product is assigned, may no longer be disposed of in municipal or domestic waste. To document this, they have been marked with the following marking:

Do not dispose of batteries together with domestic waste. Dispose of batteries in accordance with local, legal regulations.

Because disposal regulations may differ from one country to another within the EU, please contact your supplier if necessary.

8 Maintenance

8.1 Servicing the Measuring device

A description of the measuring device service can be found in the Manufacturer's operating manual.

8.2 Servicing the Temperature sensor

Do not use organic solvents such as phenol, chloroform or acetone.

The Temperature sensor does not require regular servicing.

Follow these steps to remove contamination on the Temperature sensor:

1. Switch off the Measuring device.
2. Clean the Temperature sensor with a mild soap solution or lint-free cloth.
3. Thoroughly rinse it using distilled water.

8.3 Removing oil from the thermoblock

1. Switch off the device.
2. Let the thermoblock cool off.
3. Remove oil from the bores.
   Use a pipette to do so.
4. Rinse out the bores 4 times using 20 µL alcohol.
5. Remove oil on the thermoblock
   For this, use a towel that has been moistened with alcohol.

80% ethanol is recommended as cleaning agent.

8.4 Disinfection/Decontamination

NOTICE! Damage from UV and other high-energy radiation.

- Do not use UV, beta, gamma, or any other high-energy radiation for disinfecting.
- Avoid storage in areas with strong UV radiation

NOTICE! Damage to the device due to autoclaving.

- Do not autoclave any of the Temperature Verification System – USB – Single Channel assemblies.

Auxiliary aids

- Lint-free cloth
- Disinfectant

1. Switch off the Temperature Verification System – USB – Single Channel and remove it from the mains/power supply.
2. Let the Temperature sensor cool off.
3. Select a disinfection method that complies with the legal requirements and regulations in place for your range of application.
4. Spray the Temperature sensor with a disinfectant. After the exposure time of the disinfectant has elapsed, wipe off the sensor using a damp, lint-free cloth.

8.5 Decontamination before shipment

If you are shipping the device to the authorized Technical Service for repairs or to your authorized dealer for disposal please note the following:

WARNING! Risk to health from contaminated device

1. Observe the information on the decontamination certificate. You can find it as a PDF document on our webpage (www.eppendorf.com/decontamination).
2. Decontaminate all the parts you would like to dispatch.
3. Include the fully completed decontamination certificate in the package.

9 Technical data

9.1 Temperature Verification System – USB – Single Channel

Technical data can be found in the Manufacturer's operating manual.

9.2 Mastercycler, Thermomixer and ThermoStat

The technical data is available in the operating manual of the devices you are verifying or adjusting.

9.3 Maximum permissible errors and accuracy

9.3.1 Temperature Verification System – USB – Single Channel

Temperature Verification System – USB – Single Channel	Measuring range	Accuracy
Measuring device with grip and sensor	35 °C – 95 °C	±0,3 °C

9.3.2 Mastercycler

Mastercycler family	Temperature	Maximum permissible errors
Mastercycler X50	35 °C	±0,6 °C
	95 °C	±0,6 °C
Mastercycler nexus	35 °C	±0,9 °C
	95 °C	±1,3 °C
Mastercycler ep	35 °C	±0,9 °C
	95 °C	±1,3 °C
Mastercycler pro	35 °C	±0,9 °C
	95 °C	±1,3 °C

9.3.3 Thermomixer and ThermoStat

Temperature	Thermomixer comfort	Thermomixer compact	ThermoStat plus
0 °C	———	———	±1,0 °C
10 °C below RT	±2,0 °C	———	———
37 °C	±0,5 °C	±1,0 °C	±0,5 °C
56 °C	±2,0 °C	±2,0 °C	±1,0 °C
75 °C	±2,0 °C	±2,0 °C	±1,0 °C
90 °C	±2,0 °C	±2,0 °C	±1,0 °C

RT ≙ room temperature

9.3.4 ThermoMixer C, ThermoMixer F0.5/F1.5/F2.0, ThermoMixer FP and ThermoStat C

Temperature	Maximum permissible errors
20 °C-45 °C	±1,0 °C
<20 °C and >45 °C	±1,0 °C

10 Ordering information

Order no. (International)	Description
	Temperature Verification System – USB – Single Channel
0056 000.003	Measuring device without temperature sensor
	Temperature sensor for 96 Well
0056 001.000	ISO 9001
0056 001.506	ISO 17025
	Temperature sensor for 384 Well
0056 002.006	ISO 9001
0056 002.502	ISO 17025
	Temperature sensor for 1,5 mL bore
0056 003.002	ISO 9001
0056 003.509	ISO 17025

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