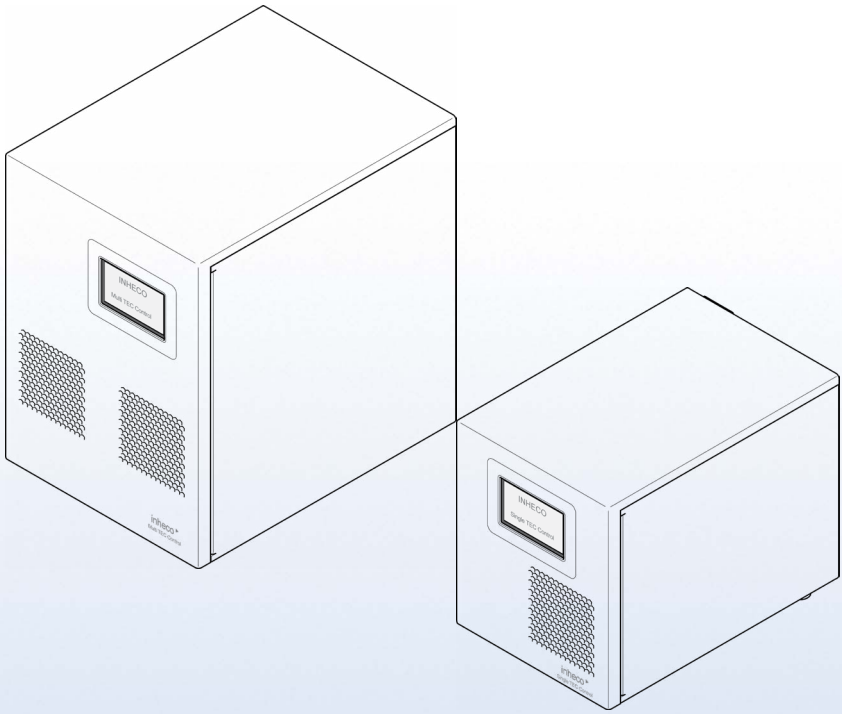
inheco
industrial heating & cooling



Multi TEC Control

Part No.: 8900030

Multi TEC Control Compact

Part No.: 8900029

Single TEC Control

Part No.: 8900031

Single TEC Control Compact

Part No.: 8900036

► **User´s Manual**

Doc ID: 900067-003
July 2020

INHECO Industrial Heating and Cooling GmbH reserves the right to modify their products for quality improvement. Please note that such modifications may not be documented in this manual.

This manual and the information herein have been assembled with due diligence. **INHECO GmbH** does not assume liability for any misprints or cases of damage resulting from misprints in this manual. If there are any uncertainties, please feel free to contact sales@inheco.com. → How to contact INHECO, page 5.

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1 IMPORTANT NOTES

1.1. General Information

Read the user instructions completely. The manual explains how to operate and handle INHECO's Multi TEC Control Unit (MTC) and Single TEC Control Unit (STC).

In case manual instructions are not followed, injury or product damage cannot be excluded.

Missing or insufficient knowledge of the manual leads to loss of liability against INHECO GmbH.

This manual is part of the TEC Control Unit (MTC/STC) and must be retained until the unit is disposed of and must be passed on with the TEC Control Unit when the unit is taken over by a new user.

The TEC Control Unit meets the acknowledged rules of technology and complies with today´s standards.

Manual instructions must be followed in order to ensure safe handling of the unit.

Security-related warnings in this manual are classified into three hazard levels:

- The signal word WARNING indicates hazards which – without precautionary measures – can result in serious injury or even death.
- The signal word CAUTION indicates hazards which – without precautionary measures – can result in minor to moderate injuries
- The signal word NOTE stands for general precautionary measures that are to be observed to avoid damaging the device when using it.
- The signal word NOTICE stands for the general measures that help using the device.

Contact INHECO in case there are any uncertainties of how to operate or how to handle the TEC Control Unit.

Your opinion about this manual provides us with valuable insights on how we can improve this document. Please do not hesitate to direct your comments to sales@inheco.com, → How to contact INHECO, page 5

1.2. Explanation of symbols

Symbol	Explanation
	Potential danger of serious injury or death → signal word WARNING or CAUTION indicate the severity.
	Caution: Potential danger of hot surface.
	Note: Potential danger of electrostatic discharge (ESD)
·	Bullet points indicate steps of instructions.
-	Hyphens refer to enumerations.
→	Arrows indicate: "refer to" and are mostly an active link

1.3. Explanation of Abbreviations

Symbol	Explanation
MTC	Multi TEC Control Unit = TEC Control Unit for control of up to 6 INHECO devices
STC	Single TEC Control Unit = TEC Control Unit for control of one INHECO device
FWCS	Firmware Command Set
DLL	Dynamic Link Library
TEC	ThermoElectric Cooler is a synonym for peltier element which is the heating cooling element of the device

1.4. Warranty

The warranty period starts on the date of shipment. Any damage caused by operating the TEC Control Unit outside the specifications and guidelines leads to the loss of warranty. Broken seals on INHECO devices lead to the loss of warranty as well.

NHECO will only accept parts / devices for return that do not pose a threat to the health of our staff. In particular, the devices may not have been used in Biosafety Level 3 and 4 environments, or have been exposed to radioactive or radiation materials. → Decontamination and Cleaning, page 28.

Devices exposed to Biosafety level 3 and 4 Environments or radioactive materials are not accepted by INHECO for return.

1.5. How to contact INHECO

INHECO GmbH	
Address	Fraunhoferstr. 11 82152 Martinsried Germany
Telephone - Sales	+49 89 899593 120
Telephone - Techhotline	+49 89 899593 121
Fax	+49 89 899593 149
E-Mail - Sales	sales@inheco.com
E-Mail - Technical -Hotline	techhotline@inheco.com
Website	www.inheco.com

Technical Support & Trouble Shooting Instructions:

http://www.inheco.com/service/technical-support.html

2 PRODUCT DESCRIPTION

2.1. Intended Use

The TEC Control Unit (MTC or STC) controls the temperature and shaking performance (frequency, amplitude, pattern) for a range of INHECO's heating/cooling units and shakers. Examples of devices which are controlled by the TEC Control Unit: CPAC, HeatPAC, Heated Lid, Teleshake 95, Thermoshake, etc.

The Multi TEC Control (MTC) controls up to six different devices simultaneously and independently. The Single TEC Control (STC) controls one device.

The TEC Control Unit (MTC/STC) is primarily used to operate within an automated liquid handling workstation and usually requires software integration for this purpose. This is not part of the INHECO scope of delivery please contact workstation manufacturer.

The TEC Control Unit is designed specifically for use in Life Science and In Vitro Diagnostics. The TEC Control Unit is prepared for easy integration into IVD applications, but the final IVD validation has to be performed by the first marketer (IVD application).

When using the TEC Control Unit in a Biosafety Laboratory Environment, the user of the TEC Control Unit is responsible for labeling the device according to the WHO Laboratory Biosafety Manual (ISBN 9241546506). Furthermore, the user is responsible for operating the TEC Control Unit in accordance with the biosafety level regulations of the WHO Laboratory Biosafety Manual.

A technical skilled integrator has to install and integrate the TEC Control Unit. The TEC Control Unit and its connected devices must be used exclusively by laboratory professionals trained in laboratory techniques and having studied the instructions for use of this instrument as well as the instructions of the workstation the device is used in.

2.2. Scope of Delivery

Before initial operation, make sure that the shipment of your unit and its scope of supply is complete and no parts are damaged.

In case of parcel or product damages, make photos of the damaged boxes and products and email them to **techhotline@inheco.com** without delay. Transportation damages must be reported to INHECO within 7 days of delivery. The following components should be included in each shipment:

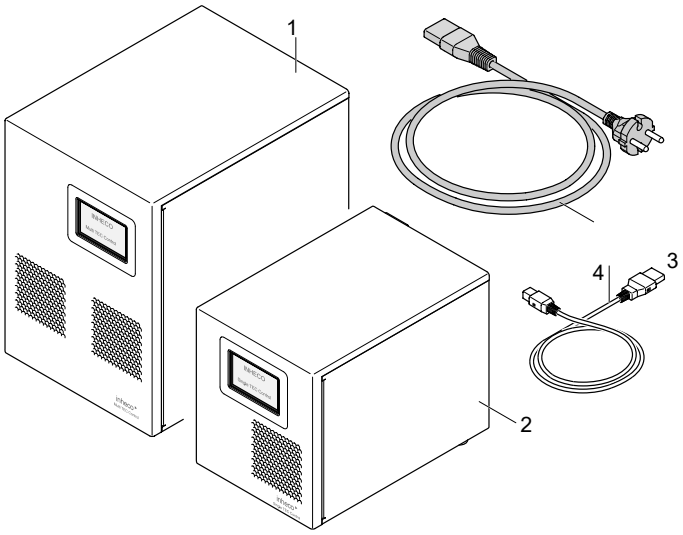


Fig.1: Figure of Delivery

(1) Multi TEC Control Unit (image may vary depening on device tape ordered)

(2) Single TEC Control Unit (image may vary depending on device type ordered)

(3) USB Cable (4) Power Cord Europe, UK or US

2.3. Functional Elements for MTC and STC with display (part # 8900030+8900031)

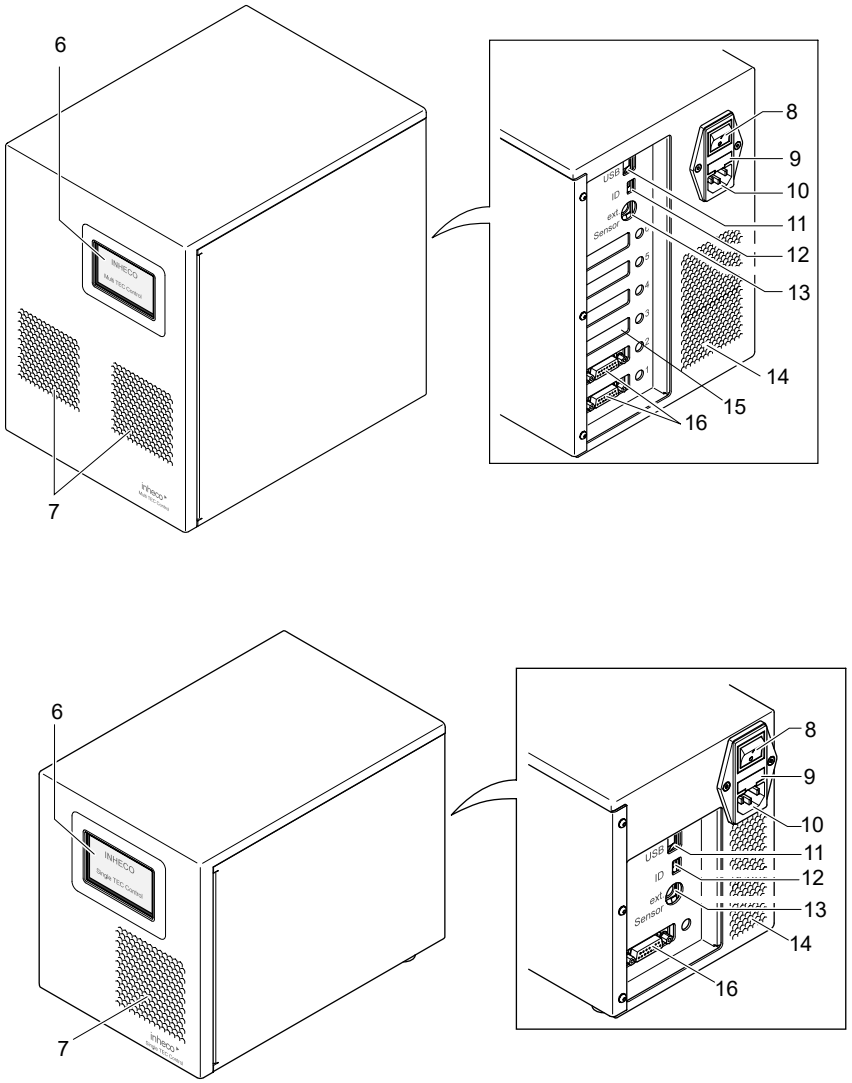


Fig.2: Functional Elements

(6) Touchscreen

(7) Air Inlet

(8) Main Power Switch

(9) Fuses

(10) Power Cord Connector

(11) USB Port

(12) ID Switch

(13) External Sensor Connector [1)]

(14) Air Outlet

(15) Empty Slots for additional Slot Modules -> Installation of Slot Modules, page 12

(16) Slot Modules for device connection

[1)] The External Sensor from INHECO for measuring ambient temperature and relative humidity has been removed from our product portfolio in April 2020 → If you still have the External Sensor from INHECO please visit a manual released before April 2020. Do not connect any other device which has a similar plug as this might damage the Controller.

2.4. Functional Elements STC/ MTC Compact (part # 8900036 + 8900029)

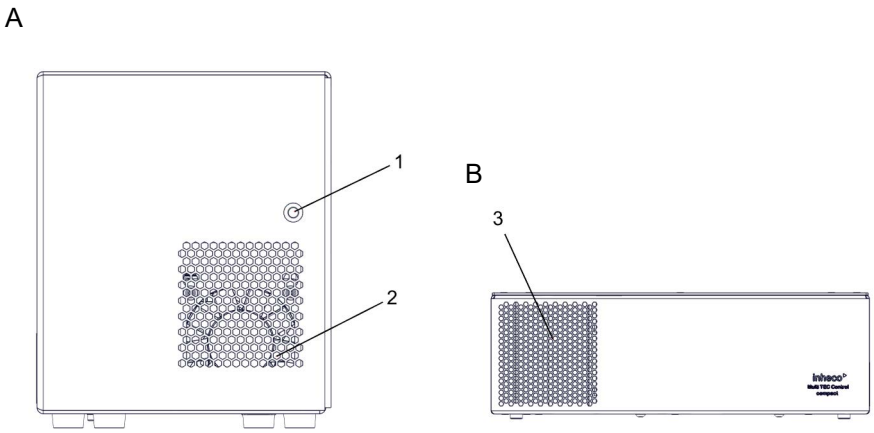


Fig.3: Functional Elements in the front

A: STC Compact without display

(1) LED with status blue for "ON" and no light for "OFF"

(2) Ventilation inlet

B: MTC Compact without display

(3) Ventilation inlet

The functional elements in the back of the STC Compact are the same as with the STC with display → fig. 2 on page 07.

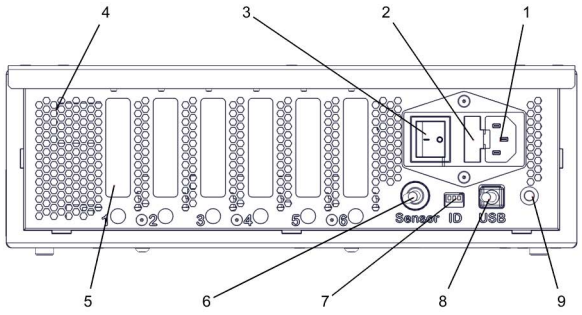


Fig.4: Functional Element in the back of the MTC Compact

(1) Power Cord Connector

(2) Fuses

(3) Power Switch

(4) Ventilation inlet

(5) Slot modules for device connection or emptly slot to install slot modules

(6) External Sensor Connector [1)]

(7) ID Switch

(8) USB Connector

(9) Status LED (blue for "ON" and no light for "OFF"

[1)] The External Sensor from INHECO for measuring ambient temperature and relative humidity has been removed from our product portfolio in April 2020 → If you still have the External Sensor from INHECO please visit a manual released before April 2020. Do not connect any other device which has a similar plug as this might damage the Controller.

2.5. Labels and Serial Numbers

The identification label with part number and serial number also contains important technical indications. The electrical specification on the label must meet your local situation. The label is placed on the side panel of the TEC Control Unit. The identification label must not be removed. If it has become illegible or falls off, it has to be replaced by a new identification label. New labels can be ordered at INHECO. In case the label is missing and you do not know the part number and serial number, they can also be read out with the software (MTC/STC Demo Tool), which can be downloaded from INHECO´ login section on www.inheco.com. → Trouble Shooting and Support, page 27.

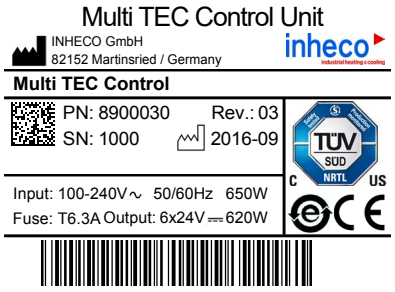


Fig.5: Examples of identification label

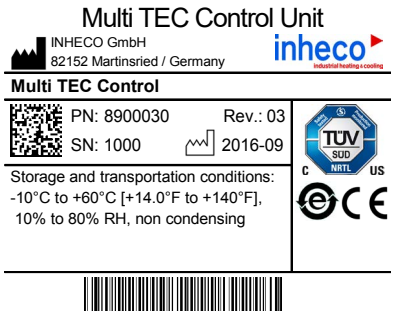


Fig.6: Examples of shipping label

2.6. Technical Data

Multi TEC Control Unit		8900030	8900029
Slot Modules		max. 6 units can be installed	
Sensor inputs Slot Modules		Pt100 (2 conductors)	
Dimensions	**Length**	255 mm (10.04 inch)	261.5 mm (10.29 inch)
	Width	185 mm (7.28 inch)	300.0 mm (11,81 inch)
	Height	260 mm (10.24 inch)	99.5 mm (3,92 inch)
Weight (including cables)		~ 5.8 kg (~ 12.79 lbs)	
Input Voltage		100 to 240 V/AC, ±10%, Safety Class 1	
Fuse		T 6.3 A (time lag)	
Interface		USB 1.1 or 2.0	
Protection Category		IP22	
EMV protection class		Group 1 / class A (industrial requirements)	
Power Frequency		50/60 Hz, ±5%	
Power		650W	
Acoustic Noise		about 50 dB(A)	
MTC Control Type		PID, separate parameter sets for cooling and heating mode	

Single TEC Control Units 8900031+8900036			
Slot Modules		1 unit	
Sensor inputs Slot Modules		Pt100 (2 conductors)	
Dimensions	**Length**	230 mm	9.06 inch
	Width	145 mm	5.71 inch
	Height	177 mm	6.97 inch
Weight (including cables)		~ 3.3 kg	~ 7.28 lbs
Input Voltage		100 to 240 V/AC, ±10%, Safety Class 1	
Fuse		T 2.0 A (time lag)	
Interface		USB	
Protection Category		IP22	
Power Frequency		50/60 Hz, ±5%	
Power		150W	
Acoustic Noise		about 45 dB(A)	
STC Control Type		PID, separate parameter sets for cooling and heating mode	

Environmental Conditions (Multi TEC Control Unit, Single TEC Control Unit)		
Max. Relative Humidity	Operation	75%, non condensing
	Transportation and storage	80%, non condensing
Temperature Limits	Operation	+15°C to +32°C [+59°F to 90°F]
	Transportation and storage	-10°C to + 60°C (+14°F) to 140°F), non condensing

3 SAFETY INSTRUCTIONS

3.1. Product-specific Risks

WARNING
Follow the safety instructions given below in order to avoid danger for user.

General

- The TEC Control Units (“the unit”) do not require any maintenance, except of the exchange or installation of Slot Modules, → Installation, page 13, or the exchange of fuses, → Maintenance, page 26.
- The unit has to be placed in an upright position.
- The unit and its accessories must not come into contact with water or chemicals.
- The main power switch must always be accessible
- Free air supply must be ensured to prevent damage to the unit. Do not cover the ventilation openings at the front and rear panel at any time.
- Ensure that there is no other device installed next to the unit increasing the inletair temperature for the unit above the specified temperatures. In case of doubt, please contact INHECO for further analysis.
- Ensure a minimum of at least 250 mm or 10 inches of free space between the ventilation openings and adjacent devices or walls.
- Do not insert any parts into the ventilation inlet or outlet.
- Do not exceed minimum or maximum ambient temperature and humidity conditions during operation or storage of the unit → Technical Data, page 10.
- The unit must not be used in environments with risk of explosion
- The unit is for indoor use only.

Burning Hazard

- Connected devices can burn your skin. Even after switching off the TEC Control Unit, the connected devices can still be hot and could seriously burn your skin. It takes a while to cool down after the unit and its devices have been used.

Electric Shock Hazard

- The unit must not be used if the unit itself or the power cable shows visible signs of damage.
- You can suffer an electric shock and injuries, if the TEC Control Unit is not connected properly or if you do not disconnect the unit from the wall power outlet before opening the housing.
- Never connect or remove the power plug with wet hands.
- Original power cable provided by INHECO has to be used to guarantee safe and proper operation.
- The wall power outlet must have a ground earth connection (Safety Class 1).
- Make sure that the electrical specification on the identification label at the side panel of the unit meets your local situation. → Labels and Serial Numbers, page 9.
- Make sure that the unit does not get in contact with liquids while it is connected to the power outlet.

Biosafety Laboratory Environment

- When using the unit in a Biosafety Laboratory Environment, the user is responsible for labeling it according to the WHO Laboratory Biosafety Manual (ISBN 92 4154650 6) and for operating the devices in accordance with the Biosafety Level Regulations of the WHO Laboratory Biosafety Manual.

ESD Electrostatic discharge

- The TEC Control Unit and the Slot Modules are ESD (electrostatic discharge) sensitive devices. Electrostatic charges as high as 4000V accumulated on the human body can discharge without detection.
- Although the unit and the Slot Modules feature proprietary ESD protection circuitry, permanent damages may occur to devices subjected to high energy electrostatic discharge.
- High risk of electrostatic discharge exists for Slot Modules when they are being installed. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

Electromagnetic field

- The MTC/STC is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

3.2. Technical Alterations

- Do not alter the product. Any modification or change which is not approved by INHECO leads to the loss of warranty. Broken seals on INHECO devices lead to the loss of warranty as well.
- Use only original parts provided by INHECO. Parts provided by other suppliers can impair the functionality of the unit.
- Damages due to the use of non-original parts are excluded from INHECO's liability.

3.3. Malfunctions

- In case of a malfunction, switch off and disconnect the TEC Control Unit immediately. Make sure to inform the authorized person in charge.
- Make sure that the malfunctioning unit is not accidentally re-installed and used before the malfunction is effectively eliminated. → Trouble Shooting and Support, page 27.

4 INSTALLATION

4.1. Installation of Slot Modules

TEC Control Units usually come without Slot Modules, unless Slot Modules are explicitly ordered. Slot Modules are usually not pre-installed by INHECO, unless pre-installation is explicitly ordered.

The TEC Control Units cannot be operated without at least one installed Slot Module. The Slot Module connects the TEC Control Unit with the controlled device (heating/ cooling/shaking unit).

One Slot Module can be installed inside the STC. Up to 6 Slot Modules for connection of up to 6 controlled devices can be installed inside the MTC.

Controlled devices require different Slot Modules, labeled in different colors: blue, black, and red. The colors of the cable sleeves of the connected unit and the Slot Module must match.

NOTICE
High risk of electrostatic discharge (ESD) exists for Slot Modules when they are being installed → Safety Instructions, page 10. Therefore, proper ESD precautions are to be taken to prevent performance degradation or damage to the Slot Module. Damage due to inappropriate handling is not covered by warranty.
Before touching the Slot Module or the inside of the TEC Control Unit, provide adequate grounding for the static electricity of your body, so that the device will not be damaged. Use a conductive wrist strap attached to a solid earth ground.

Installation of Slot Modules requires the following steps:

- Disconnect the power cord.
- Disconnect all other connectors from the unit.
- Remove the three screws as shown, slide out the side panel and set it aside. The mainboard and any installed Slot Modules are now accessible.

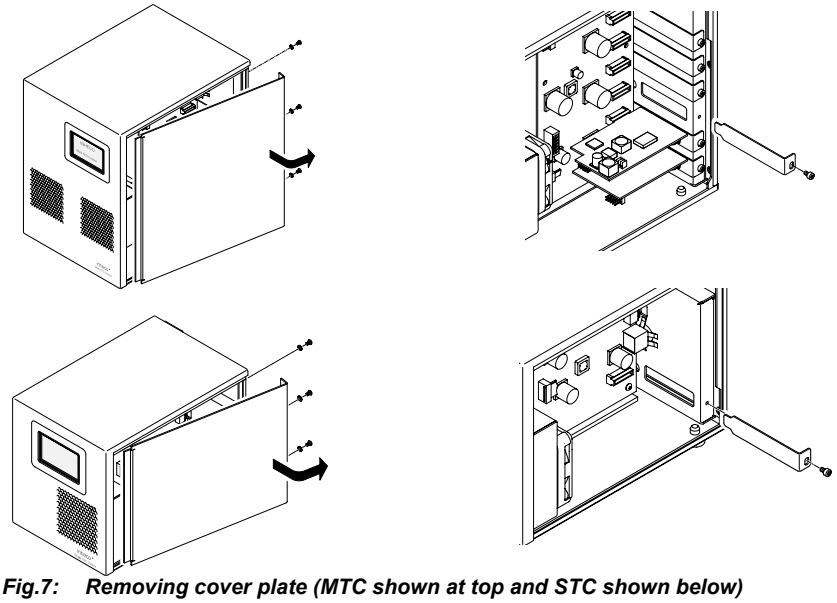


Fig.7: Removing cover plate (MTC shown at top and STC shown below)

For MTC compact you need to remove the cover by unscrewing 9 housing screws. The interior is the same as with the standard Controller.

NOTICE
ESD: Avoid touching the inner electronic parts. Do not use excessive force on the Slot Module or on the socket.

- Find an empty slot to install your Slot Module. It is advisable to install beginning from slot number 1 at the bottom and to continue upwards.
- Unscrew the cover plate of the chosen slot and remove it by sliding it out as shown in Figure 9.
- Take ESD precautions (see NOTICE) and unpack the Slot Module from the ESD bag.
- Place the Slot Module into the socket of the mainboard as shown below.

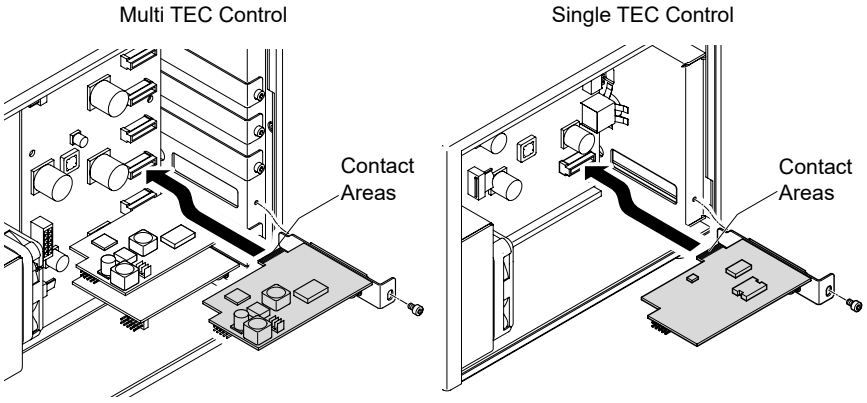


Fig.8: Insert Slot Module

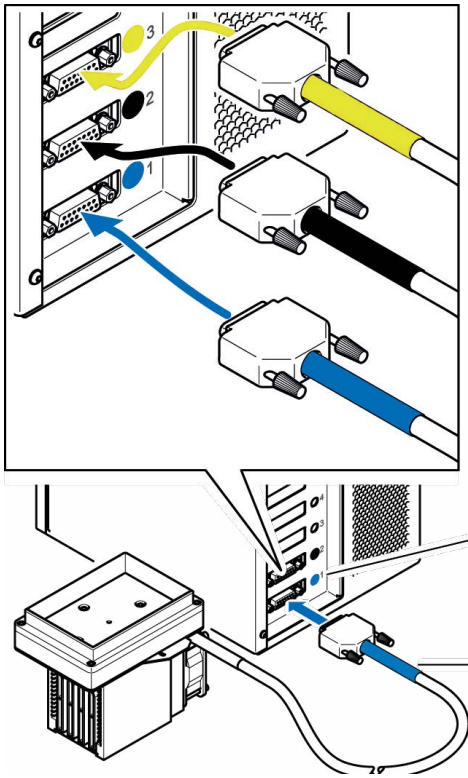
- Screw the module firmly using the screw of the removed cover plate.
- Make sure that no loose parts are left inside before closing the housing again.
- Slide the side panel back into place and screw it firmly with three screws.
- Connect the unit to the wall power outlet only. Leave all other plug connections unattached.
- Turn on the unit with the main power switch.
  The installed Slot Module on the rear panel must be blinking green. If not, switch off the TEC Control Unit, disconnect the unit from the wall power outlet and remove the side panel again. Check the Slot Module which was not blinking green. If you don´t detect any mistake yourself, please contact INHECO. → How to contact INHECO, page 5
- Once the installed Slot Module blinks green and operates correctly, switch off the TEC Control Unit´s main power switch.
- Connect the device to the appropriate Slot Module (blue, black or yellow). → Connecting a Heating/Cooling/Shaking Unit, page 15.
- Attach the USB cable → Connecting TEC Control Units to a computer by USB Interface, page 16 and connect the External Sensor on the rear panel if the External Sensor is available. → Connecting an External Sensor, please visit a manual released before April 2020

The unit is ready to operate

4.2. Connecting a Heating/Cooling/Shaking Unit

To connect an INHECO heating/cooling/shaking unit, the TEC Control Unit has to be equipped with the corresponding Slot Module. There are blue, black, and yellow Slot Modules available. The following table shows the appropriate Slot Module for each heating/cooling/shaking Unit

Product	Color	Article No.	Heating/cooling/shaking Unit
Blue Slot Module	blue	2400128	CPAC
Black Slot Module	black	2400125	CPAC HT 2-Tec, HeatPAC, Heated Lid, Teleshake 95, Thermoshake,
Yellow Slot Module	yellow	2400211	Thermoshake AC, Thermoshake AC 180, Teleshake AC, Teleshake 95 AC



For clear identification, all Slot Modules and connectors are marked in blue, black or yellow.

When connecting a new device, the color code has to be strictly respected.

In case of wrong connection, interaction will not be possible and an error message will be issued

The color coding of the Slot Modules is visible from the outside through small round windows.

At the connectors, the sleeve must be marked in the same color as the Slot Module.

Fig.9: Connecting a heating/cooling/shaking unit

- Disconnect the power cord.
- Connect a heating/cooling/shaking device to the appropriate (blue, black or yellow) Slot Module and lock the connector.
- Connect the power cord.
- Switch the TEC Control Unit on.
  The display shows the name (or abbreviation) of the currently connected device.
  When multiple devices are installed, you can switch between the devices by touch screen (not for STC/MTC Compact part# 8900029+36) → Select Device, page 19

NOTE
Never plug in our plug out a device while the Controller is running. Always turn off the Controller before disconnecting or connecting a device.

4.3. Connecting TEC Control Units to a computer by USB Interface

You can connect up to eight TEC Control Units to a single computer by USB interface.

- For each connection, a standard USB interface is required.
- Each TEC Control Unit needs its own address to be specified with the ID switch on the rear panel. If there is only one TEC Control Unit to be connected, the ID switch remains in the default position “0”, as shown below. In case you wish to connect more than one TEC Control Unit, switch the ID positions as shown below to assign each device a unique address for computer handling..

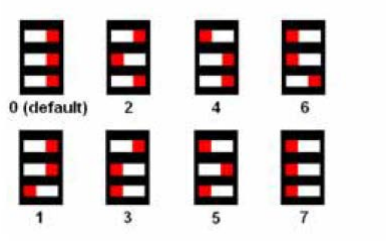


Fig.10: ID Switch settings

NOTICE
Since the USB interface is not optimized for a secure real time data transfer, all communication is secured by a cyclic checksum (CRC). In case the communication between the computer and the TEC Control Unit often fails due to timeouts, it is likely that it is due to the computer. Consider the following with regards to communication stability:

- In case you encounter communication instability, verify the communication stability with different computers of different configurations.
- Disconnect other devices from the computer which may interfere with the communication stability.
- De-activate the automated Windows update. For integration purpose, use INHECO’s DLL and Firmware Command Set which can be downloaded from INHECO´ login section on **www.inheco.com.**

4.4. Software Installation and Software Integration

The TEC Control Unit is usually operated by the software of a liquid handling workstation. Manual PC operation is also possible via INHECO’s software “Demo Tool MTC/STC”.

For the installation and use of INHECO’s software please refer to the “Manual Demo Tool MTC/STC” which can be downloaded from INHECO´ login section on www.inheco.com.

A DLL file and a Firmware Command Set for easy integration are available our login section on www.inheco.com. The Firmware Command Set also contains information on Error Codes, Status LEDs, Offsets, Boost Time, etc.

5 DAILY USE

The TEC Control Unit is usually integrated into a liquid handling workstation and operated by the software of the automation platform. The TEC Control Unit can also be used as stand-alone unit with manual operation. Manual operation is possible either by INHECO's software "MTC/STC Demo Tool" or by the touch screen at the front panel of the unit.

This chapter mainly describes manual operation by touch screen. The STC Compact needs to be controlled by a software. A separate manual, the "Manual MTC/STC Demo Tool", describes the operation by INHECO's software.

NOTE
Only instructed and skilled people are permitted to operate the TEC Control Units. → Important Notes, page 4

5.1. Switch on the unit

- Verify that the TEC Control Unit is properly connected to the heating/cooling/shaking unit(s).
- Verify that the TEC Control Unit is properly connected to the mains.
- Switch on the TEC Control Unit at the rear.

Only for MTC and STC with display:
For several seconds the firmware version of the main board is shown on the touch screen. After about 15 seconds, the main menu is displayed on the touch screen.

Multi TEC Control

Single TEC Control

Fig.11: Main Menus

NOTE
The firmware version should be 2.11 or higher for MTC and 2.14 or higher for STC, otherwise a firmware update is required → Firmware/Software Updates, page 26

5.2. Operate the TEC Control Unit by computer via USB interface.

You can connect up to eight TEC Control Units to a single computer by USB interface.
→ Connecting TEC Control Units to a computer by USB Interface, page 16.

The TEC Control Unit is usually operated by the workstation software which controls an automated process of a liquid handling workstation. Please contact workstation manufacturer for further information.

For manual PC operation with INHECO's software refer to the "Manual MTC/STC Demo Tool" which can be downloaded from INHECO´ login section on **www.inheco.com**.

More complex programming of temperature and shaking sequences within automated processes is also possible. A DLL file and a Firmware Command Set for easy integration are available on our login section on **www.inheco.com**. The Firmware Command Set also contains information on Error Codes, Status LEDs, Offsets, Boost Time, etc.

You can connect up to eight TEC Control Units to a single computer by USB interface.
→ Connecting TEC Control Units to a computer by USB Interface, page 16.

The unit can be basic operated with a software called MTC/STC Demo Tool. Please refer to our Manual Demo Tool which can be downloaded from INHECO´ login section on **www.inheco.com** . More complex programming of temperature and shaking sequences is possible. A DLL file for easier integration for the Command Set is available and can be found on our login section on **www.inheco.com**.

5.3. Feature Information

- Refer to Firmware Command Set on www.inheco.com:
    - Error Codes
    - Status LEDs
    - Offsets, Boost Time
- Refer to www.inheco.com:
    - Demo Tool Software

5.4. Operate the TEC Control Unit manually (only for part# 8900030+8900031)

Input through the touch screen is limited to the settings of the device (temperature, shaking speed and ambient temperature offsets).

5.4.1. Select device

For Multi TEC Control Units only

With a Multi TEC Control Unit, you can control up to six devices. The device has to be selected before you can set its control parameters.

Multi TEC Control

Fig.12: Main Menus

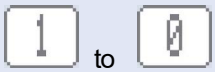
Main menu MTC Unit	
< >	Use these buttons to select the device. The selected device´s name or abbreviation is displayed in the upper left corner of the screen.

Fig.13: Device name shown

5.4.2. Temperature setting

For simple or individual tasks, the intended temperature can be set manually by touch screen of the Single or Multi TEC Control Unit.

Main menu	
	The [Set] button of the main menu shows the currently set target temperature. To change it, this button must be pressed.
	After the intended temperature has been entered, the temperature cycle must be set with the button [Temp.]
	When a temperature cycle is running, the button [Temp.] appears black. In this state, the intended temperature for the next cycle can be pre-set. The new target temperature will be displayed after the current cycle has been terminated by pressing the button [Temp.]

Menu "Set Temperature"	
	[Number] buttons for entering the target temperature.
	[Minus] button to enter temperatures below zero.
	[Verification] button to verify and confirm the setting.
	[Back] button to exit without changing the temperature.

- Select Set
- Enter your target temperature
- Select Button XX°C to verify the setting

NOTICE
When you verify and confirm your chosen temperature by pressing the [Verification] button you will not see the new temperature within the [Set] button without setting the temperature with the [Temp.] button.

- Select Temp

NOTICE
As soon as the [Temp.] button was pressed, the [Set] button shows the newly set temperature.

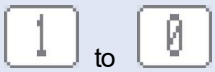
NOTICE
When the [Temp.] button is not pressed, the pre-set temperature will be cleared after about 10 minutes.

5.4.3. Shaking setting

For INHECO Thermoshake or Teleshake Units only

For simple or individual tasks, the intended shaker parameters can be set manually by touch screen.

Main menu	
	The [Set] button of the main menu must be pressed to change the shake settings.
	After the desired shaking speed has been entered, the shake cycle must be set with the button [Shaker].
	When a shake cycle is running, the button [Shaker] appears black. In this state, the intended shaking speed for the next cycle can be pre-set. The new target shaking speed will be displayed after the current cycle has been terminated by pressing the button [Shaker].

Menu "Set Temperature"	
	[Number] buttons for entering the target shaking speed.
	[Verification] button to verify and confirm the setting.
	[Back] button to exit without changing the shaking speed.

- Select Set
- Enter your target shaker frequency
- Select Button XXXXrpm to verify the setting

NOTICE
When you verify and confirm your chosen shaking speed by pressing the [Verification] button you will not see the new shaking speed within the [Set] button without setting the shaking speed with the [Shake] button.

- Select Shaker

NOTICE
As soon as the [Shake] button was pressed, the [Set] button shows the newly set shaker frequency.

NOTICE
When the [Shake] button is not pressed, the pre-set temperature will be cleared after about 10 minutes.

5.4.4. Temperature offsets

Aim of temperature offsets: the sample reaches and maintains the set temperature.

Unless an offset value is determined and set, the temperature of the sample is likely to differ from the set temperature due to heat loss between the device contact surface and the sample inside the disposable. To compensate this effect, an offset value can be set at a chosen temperature, e.g. at one of the target temperatures. After setting the offset value for one target temperature and setting the room temperature value, a relative offset value is added to all temperatures above room temperature and deducted from all temperatures below room temperature, resulting in a temperature offset line with a specific gradient.

By pressing the name (or abbreviation) of the selected device in the upper left corner of the main menu (even though the name of the selected device does not appear as a button), the display changes to the temperature offset menu. The temperature offset menu shows the temperature and humidity of the internal or External Sensor.

When the External Sensor is not connected to the Control Unit, the display shows the temperature inside the TEC Control Unit. With a connected External Sensor, the display shows the room temperature. → Temperature Offset Accuracy, page 24.

Temperature offset settings are limited via the touch screen. More complex settings are possible via computer especially for STC/MTC Compact the only way .

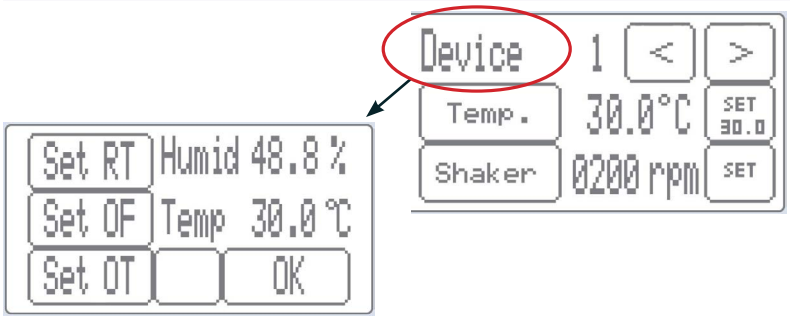


Fig.14: Temperature offset menu

Main menu	
Set RT	Room temperature. Allows entering the ambient temperature measured near the assay. The room temperature must be measured close to the sample. Without an accurate room temperature setting it is impossible to get correct offset values at more than one target temperature. The offset values are in a straight line crossing offset value 0°C at room temperature and the offset value determined at one target temperature. An incorrect room temperature setting changes the gradient of this line and therefore produces incorrect offset values along the line, see remarks at Set OT. INHECO's default setting is 25°C, it must be changed to the actual room temperature. The displayed temperature at the touch screen is not the ambient temperature near the sample, unless you have connected an External Sensor to the TEC Control Unit and have placed the sensor near the assay.

Main menu	
Set OF	Offset value. Allows entering the temperature value to be added to the target value. This value needs to be added in order to reach the target temperature inside the sample. Default setting is 0°C. The required value has to be individually determined and depends on a range of parameters, such as ambient temperature near the sample, type of microplate or tube, type of thermal adapter, type and volume of sample in tubes or wells, etc.
Set OT	Offset temperature or target temperature. Allows entering the temperature value at which the offset temperature is to be determined. This is usually the target temperature inside the sample. In case of more than one target temperature, choose one of them to determine and to set the offset value at this target temperature. The offset values of all other target temperatures are in a straight line. The gradient of this line is determined by the room temperature setting because the offset value is 0°C at the set room temperature, see remarks at Set RT and the offset value at one chosen target temperature. INHECO's default target setting is 70°C.
OK	Button to confirm the settings.

NOTICE
The offset you determine and set for one target temperature leads to a straight line of offset values for other target temperatures.

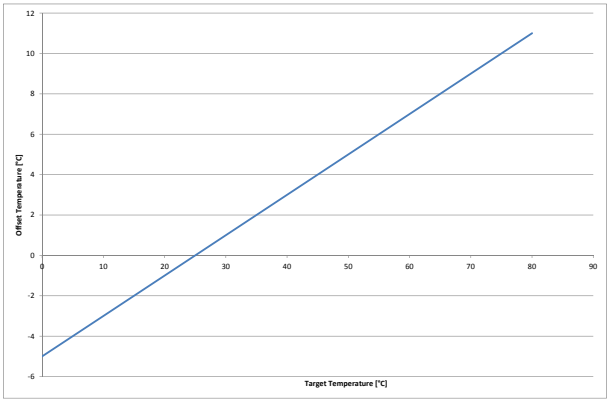


Fig.15: linear Off-set handling

Chart example:

1) you determined and set at 30°C target temperature the offset value of 1°C.
2) you measured near the sample 25°C which you set as room temperature.
3) the automatic offset is for example -3°C for the target temperature 10°C.

5.4.5. Temperature Offset Accuracy

It is essential to measure the temperature near the sample in order to determine accurate offset values, especially when more than one target temperature is required. The actual ambient temperature in immediate proximity of the assay needs to be entered and set for the correct gradient of the offset value line → Temperature Offsets, page 22.

You can measure the temperature with your own measurement device. Enter and set the measured temperature by clicking on Set RT.

5.4.6. Negative Offset and Firmware Bug (only for part # 8900030+8900031)

A firmware bug in firmware version 2.14 and in earlier FW versions changes negative offset values to positive offset values, when you control your device via the MTC/STC touch screen and you click on Set OF a second time, i.e. when the negative value was already set and you click on the button again. The bug is removed in subsequent FW versions.

Above mentioned issue can be avoided by the following procedure:

- select the device name

Fig.16: main screen

- Select Set OF

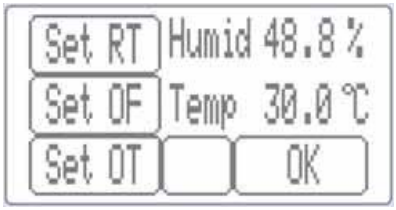


Fig.17: Set menu

- You will now see your negative disposable OFF-Set value.
- DO NOT tap on the [Verification] button showing a negative value to leave this menu. Use the back button to exit the menu without changing the OFF-Set value.

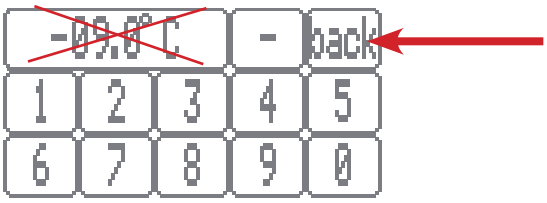


Fig.18: Do not tap on temperature button

- If you accidently select the Verification button, the negative OFF-Set changes to a positive OFF-Set. In this case you have to re-enter your negative OFF-Set.
- You will only see the change of the OFF-Set value in case you verify the OFF-Set again.

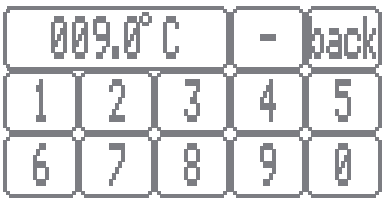


Fig.19: This figure shows the change from negative to positive Off-set

6 MAINTENANCE

6.1. Changing the Fuses

The fuses may be blown when the TEC Control Unit does not turn on. Blown fuses may indicate a defect inside the device. Replace the fuses only with fuses of exactly the same specification. Always replace both fuses. If the fuses blow again, the device must be sent to INHECO for repair. → **www.inheco.com**

For the change of fuses the following steps have to be taken:

- Disconnect the power cord.
- Disconnect all other connectors from the units.

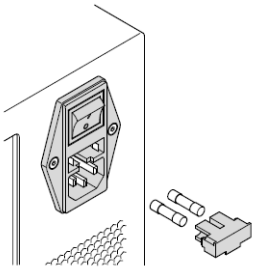


Fig.20: Changing the Fuses

- Pull the fuse holder out of the power entry module.
- Replace fuses only against those described on the identification plate.
- Replace the fuse holder back into the power entry module.
- Make sure that the fuse holder is locked securely into place.

6.2. Firmware/Software Updates

Firmware updates are required if your TEC Control Unit runs on firmware version 2.03 or on earlier firmware versions. The firmware version is displayed on the touch screen of the TEC Control Unit for several seconds after the MTC/STC has been switched on. The firmware can be updated with INHECO's firmware update tool.

For updates of the firmware, contact techhotline@inheco.com → How to contact INHECO, page 5 or your provider of your automated liquid handling workstation if the controller is controlled by that software.

For the latest version of the software "MTC/STC Demo Tool", contact INHECO as well. This software is required for trouble-shooting.

→ Trouble Shooting & Support, page 27

6.3. Trouble-Shooting & Support

In case of an operation failure follow the trouble-shooting instructions of this chapter. INHECO needs the below mentioned information including the serial numbers of your devices and the error code report. With this information INHECO can help you to trouble- shoot the reason for the operation failure.

Please provide the following when contacting INHECO for support:

- INHECO product number of the device (shown on device label)
- INHECO product name of the device (shown on device label)
- INHECO serial number of the device (shown on device label or via software)
- Detailed error description
- Error code report (generated with software “MTC/STC Demo Tool”)
- Information about setup of devices:
    - integrated in workstation
    - controlled by MTC or STC (incl. part number and serial number)
    - controlled by workstation software or INHECO Software

Serial numbers are shown on the device labels of the TEC Control Unit and connected devices, but you can also read them out by using INHECO’s software “MTC/STC Demo Tool” (Demo Tool). The Demo Tool can also be used to generate a report of error codes for the TEC Control Unit and all connected devices.

Based on the above information, INHECO’s Techhotline decides about the requirement of a return. → Return for Repair only with RMA Number, page 29.

6.3.1. Installation of the Software “MTC/STC Demo Tool”

The Demo Tool can be downloaded from INHECO´ customer login area at our website in the Multi / Single TEC Control General Information section. In this section you will also find the Demo Tool Manual with detailed instructions of the software.

Download the MTC/STC Demo Tool and the DLL file into the same folder. Both files must be saved **into the same folder, otherwise it is impossible to run the Demo Tool.**

6.3.2. Serial Numbers via Demo Tool

Start the Demo Tool and click on the button “find MTC” (or “find STC”). The software scans all com ports and subsequently displays the connected MTC/STC as well as connected devices.

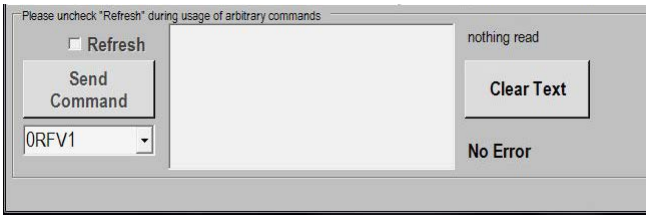


Fig.21: Command section of User Interface

- Make sure the Refresh Box is unchecked (as in fig. 24)
- Enter your command into the command field. (overwrite the last command written in this field e.g. 0RFV1
- Select button “Send Command”

- Enter following Commands:
    - for MTC/STC Mainboard serial number: 0RFV2
    - for Slot Module serial number: xRFV2 (x=slotID: 1-6)
    - for external connected device: RSNx (x=slotID: 1-6)

6.3.3. Error Code Report generated with “MTC/STC Demo Tool”

- Start the Demo Tool
- Click on the button “find MTC” (or “find STC”).
  The software scans all com ports and subsequently displays the connected MTC/ STC as well as connected devices.
- Click on the button “report error codes”.
  An additional window appears in which all error codes are displayed. Email a screenshot of this window along with all other required information to **techhotline@inheco.com.**

You will find the detailed explanations of error codes in Appendix B → page 30ff..

6.4. Decontamination and Cleaning

CAUTION
Before **cleaning,** the TEC Control Unit, disconnected the power. Make sure that no liquid enters the inside of the TEC Control Unit.

NOTICE
During **decontamination**, make sure that no liquid enters the inside of the TEC Control Unit. As this might lead to damages of the interior parts.

The unit can be decontaminated by disinfection with formaldehyde or ethylene oxide gas. It is recommended that the units is running during decontamination as the ventilation is needed to distribute the decontamination gas within the device and for at least 5 minutes afterwards in order to purge the atmosphere inside.

The surface decontamination and cleaning can include a wipe-down of the housing with a moistened cloth. Ethanol (70%) can be used, where effective, against target organisms.

6.5. Calibration/Verification

The TEC Control Unit is calibrated. For proper performance of the TEC Control Unit and its connected devices, it is recommended to verify the thermal and shaking performance at least once a year. Depending on the application, shorter verification intervals may be required. INHECO recommends to use the INHECO Measurement Plate (IMP) to perform the verification.

Please contact **techhotline@inheco.com** in case of performance deviations from set values.

6.6. Return to INHECO only with RMA Number

INHECO devices must be repaired by INHECO only. Parts must not be exchanged by the user. Exchange of parts or broken seals can lead to the loss of warranty. Spare Parts must be ordered from INHECO.

INHECO will only accept parts / devices for return that do not pose a threat to the health of our staff. In particular, the devices may not have been used in Biosafety Level 3 and 4 environments, or have been exposed to radioactive or radiation materials. → Decontamination and Cleaning, page 28.

Devices which were exposed to biosafety level 3 and 4 environments or radioactive materials are not accepted by INHECO for return.

Please contact **techhotline@inheco.com** or visit **www.inheco.com/service/returns-rma.html** for the return procedure before returning the device to INHECO. Do not return any devices without INHECO's RMA number. INHECO's RMA number must be shown on the outside of the return package. Returns without RMA number are not being processed by INHECO.

Devices should be returned in the original packaging. If not possible, ensure that devices are protected and cannot move within the package to avoid transportation damage or contact INHECO for a new packaging.

6.7. Transportation and Storage

It is recommended to keep the original packaging. INHECO devices should be shipped and stored in their original packaging with all accessories. Adhere to required environmental conditions for transportation and storage →Technical Data, page 9.

6.8. Disposal

INHECO devices must be disposed of in accordance with environmental and biosafety directives. You have to arrange for correct electric waste disposal following actual safety regulations for your country.

INHECO devices are RoHS and WEEE compliant

APPENDIX A

EC - Declaration of Conformity

in accordance with Directive 93/68/EEC (CE), 2014/30/EU (EMC), 2014/35/EU (LVD) and 2011/65/EU (RoHS II)

Product:	Single TEC Control (STC), Single TEC Control Compact (STCC), Multi TEC Control (MTC), Multi TEC Control Compact (MTCC) (with Slots 2400125+2400128+2400211+2400205) connected with corresponding devices: CPAC Microplate, CPAC Ultraflat, Thermoshake or Teleshake, HeatPAC, Heated Lid
Part No:	8900029, 8900030, 8900031, 8900036, 8900033 7000163, 7000168, 7000179, 7000190, 7000166, 7100136, 7100146, 7100144, 7100160, 7100161, 7900046, 7100150, 7100151
Standards (Safety):	EN 61010-1:2010 + A1:2019 + A1:2019/AC:2019 EN 61010-2-010:2014 EN 61010-2-101:2017
Standards (EMC):	EN 55011:2016 EN 61326-1:2013 EN 61000-3-2:2014 EN 61000-3-3:2013 EN 61000-4-2:2009 EN 61000-4-3:2006 A1:2009 A2: 2010 EN 61000-4-4.2004 A1.2010 EN 61000-4-5: 2006 EN 61000-4-6:2009 EN 61000-4-8:2010 EN 61000-4-11:2004

This product complies with the essential requirements of the Low Voltage Directive (LVD) and Electromagnetic Compatibility (EMC) directive, when used for its intended use.

International Standards	For international standards please see UL certificate U8 046515 0033 Rev.00, U8 046515 0034 Rev.00 and U8 046515 0037 Rev. 01 Download UL certificat: http://www.inheco.com/service/certificates.html
Manufacturer address:	INHECO Industrial Heating and Cooling GmbH Fraunhoferstr. 11 82152 Martinsried Germany

Martinsried, May 2020

APPENDIX B

ERROR CODES

Lots of different errors can be stored into the EEPROM of the µCs, one example is Error 11 when the TEC current is too low. Simultaneously to the storage of the error code, the LED of the respective slot (back of M/STC) or mainboard (not visible at closed housing) becomes red and blinks orange when communication is active. Whereas the red LED vanishes after a reset, the error code remains non versatile into the EEPROM and can be read with the command „Report error codes“. When the command „Report error codes“ is used a second window opens with more information for the error codes.

Reply Message Bytes

The following Codes are shown in the text field of each corresponding slot

Code	Flag set by	Error Message	Description	Impact	Additional Actions	Recommendations
0		Message O.K.	Normal return message.			
1[1)]	Dll or Slot	External message protocol violation	For example the crc of an external message was not correct. This error can be generated either by the dll or by the slot modules.	MTC/STC can not ensure that the command has been read correctly	if error message is consistent please use another PC or contact your workstation software provider	Resend message
2[1)]	MB or Slot	Internal message protocol violation	For example the crc of an internal message was not correct. This error can be generated by the MB or the slot modules.	MTC/STC can not ensure that the command has been read correctly	if error message is consistent please contact INHECO	Resend message
3	MB or Slot	Command not executable	Condition for the command is not fulfilled e.g. CPAC should shake.	MTC/STC does not execute the command		Check if there is e.g. a typo in your command and resend message
4	MB or Slot	Command unknown	Command does not exist.	MTC/STC does not execute the command		Check if there is e.g. a typo in your command and resend message
5	MB or Slot	Wrong parameter	e.g. RFV1 exists but RFV9 not	MTC/STC does not execute the command		Check the Parameter, e.g. value selected that is above maximum value or typo in the value and resend message
6	MB or Slot	Reset detected	After software, power on or watchdog reset. Please inform INHECO if this error occurs during normal operation.	No Impact after the first command, command will be executed		IF error message is consistent please contact INHECO

Code	Flag set by	Error Message	Description	Impact	Additional Actions	Recommendations
7[1)]	MB	Slot Id unknown	Slot Id > 6 (MTC) or respective slot module plug is empty. Slot Id > 2 (STC) or respective slot module plug is empty.	MTC/STC does not execute the command		Check the SlotID, the first character of the command. Is it reasonable? Check if the slot module is mounted correctly.
8	MB or Slot	Wrong keyword	The serial number specific keyword was wrong.	MTC/STC does not execute the command		Change password
9	Slot	Timeout from slot-module	Slot-module is/was connected but does not reply. Maybe configuration changed after reset. Reset MTC/STC.	MTC/STC can not ensure that the command has been read correctly	if error message is consistent please contact INHECO	Resend message
A[1)]	MB or Slot	I am busy with an action command or startup	Up to 20 seconds after power on and in some other cases the MTC/STC cannot handle additional commands. If the error code ‘A’ does not disappear after the startup it is a strong indication that the EEPROM memory of the connected device connected to the affected Slot Module is either out of order or something has destroyed its CRC. Please contact INHECO. In this situation the error code 2 becomes stored to the slot modules error memory (See Table 3)	MTC/STC does not execute the command		Wait 400-600 ms and resend message
B		Reserved				
C	MB	Housing temperature not OK	Housing temperature or humidity out of range	Command will be executed, If possible	Error Entry 4 Mainboard happens	Use REC command or the demo tool to check the error memory
D[1)]	DLL	Response time too long	Dll Error timeout from USB	MTC/STC can not ensure that the command has been read correctly	If error message is consistent please use another PC or contact your workstation software provider	Resend message

Code	Flag set by	Error Message	Description	Impact	Additional Actions	Recommendations
E	MB	Voltage power supply not OK	Voltage power supply out of range.	Command will be executed, if possible	Error Entry 1 Mainboard happens	Use REC command or the demo tool to check the error memory
F	MB	Housing fan not OK	Housing fan is blocked or disconnected	Command will be executed, if possible	Error Entry 7 Mainboard happens	
G	Slot	Device temp not OK	Device temperature too high (e.g. Thermoshake > 80 °C).	Command will be executed, if possible	Error Entry 8 or 13 Slot Module happens	
H	Slot	RPM too high	Setting increases limit set by SLO5	Command will be executed, if possible	Error Entry 3 Slot Module happens	
I	Slot	CPAC voltage not OK	CPAC voltage out of range.		Error Entry 4 or 5 Slot Module happens	
J	Slot	Shaker is currently busy	The Shkaer is working on another shaker related task	Shaker will not respond to any new ASE commands	If this state persists for 2 minutes please resatrt the device. If this problem is still present after the restart lease contact INHECO.	
K	Slot	TEC current too low	TEC current is below 1 A. TEC current is checked always when the Slot Module is heating or cooling.	Command will be executed, if possible	Error Entry 11 Slot Module happens	
L	Slot	Internal shaker Communication is down	The internal Shaker communication bus seems to be unresponisve. Please contact INHECO	Shaker commands will not be accepted.	Error Entry 27 Slot Module happens	
M	Slot	Shaker does not work properly	An issue with the clamping system or the shaker motor occurred.	Shaker becomes unresponsive	Error Entry 28, 29 Slot Module happens	
R	Slot	Cable break or shortcut PT100	µC reads extreme values at one of the two PT100 sensors. At Thermoshake shortcut to ground of the second PT100 sensor indicates that the reservoir is empty.	Command will be executed, if possible	Error Entry 7, 17, 18 or 19 Slot Module happens	
T	Slot	Delta T too high	Temperature difference between main sensor and supervisor sensor too high.	Command will be executed, if possible	Error Entry 12 Slot Module happens	

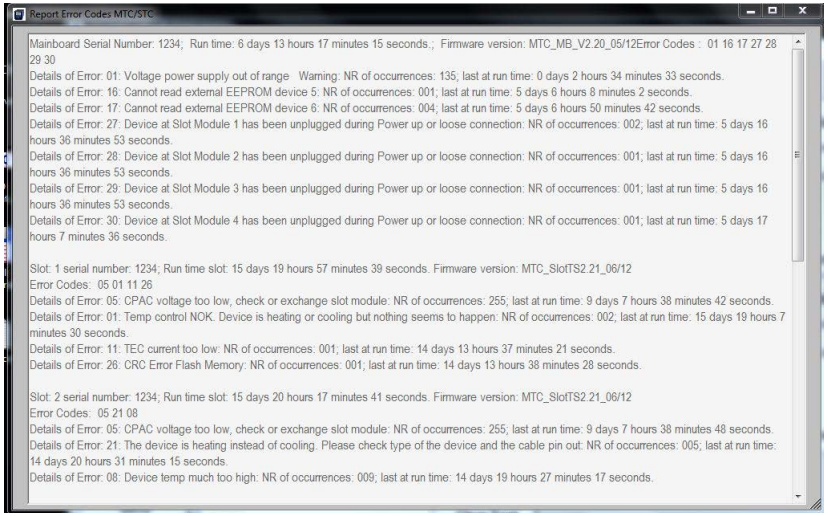
Code	Flag set by	Error Message	Description	Impact	Additional Actions	Recommendations
W	Slot	Wrong device connected	An 12 V device (blue) is connected to a 24 V Slot Module (black) or vice versa. Please unplug it and restart M/STC.	Command will be executed, if possible	Error Entry 15 Slot Module happens	Use REC command or the demo tool to check the error memory

1) Command may not be received by the MTC/STC. Please resend it after a short delay (recommended 400-600 ms).
With a dll Revision smaller than 1.2.6.0 please also erase HID buffer with the command find MTC (ID).

Reply Error Codes Mainboard

The following Codes are shown in the MTC/STC Display and in the Error Code log files. These error codes can be read out with the Demotool using the button „report error codes“ or with the command 0REC which reports the Error Code of the Mainboard (please refer to Firmware Command Set to learn more about using the commands). Up to 7 errors can be stored into the error memory.

When you use the button „report error codes“ following window will open.



In the first line the information about the overall run time of mainboard, the firmware version of mainboard and the error codes are displayed.

In the following the error codes are explained in detail with:

- short description
- Warning or Error (tells something about the severness of an error code)
- NR (Number) of occurences
- Time when the error occured Last at run time

After the information about the Mainboard the infomation for each slot follows correspondingly to the mainboard.

If an error occured just a fiew times e.g. once and compared to the overall runtime long ago (e.g. error 01 of mainboard in this screenshot) it can be neglected. For all other error codes please refer to the following tables to get more recommendations.

Error	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
1	W	Voltage power supply out of range	non, if the error code does not appear frequently	Send frequently 0RLO1to the Mainboard. If the reply is always 0rlo00250 the error entry happens accidently. If the reply is 0rloE0250 there seems to be a voltage problem and the Mainboard must be replaced	In addition you can send 0RHV0 to the Mainboard and check if the reply value is reasonable. E.g. if the Voltage is 0rhv00241
2	E	Digital housing temperature out of range	24 V Power supply is switched off, connected devices are no longer usable		Use the command 0RHV2 to watch the housing temperature. Check if ventilation slot is not covered and ensure that the air flow is granted and check temperature again.

Error	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
3	W	Analogue housing temperature out of range	non, if the error code does not appear frequently	Send frequently 0RLO5 to the Mainboard. If the reply is always 0rlo00050 the error entry happens accidently. If the reply is 0rloC0050 there seems to be a voltage problem and the Mainboard must be replaced	Use the command 0RHV4 to watch the value of the analogue housing temperature sensor. Check if ventilation slot is not covered and ensure that the air flow is granted and check temperature again.
4	W	Humidity out of range	non, if the error code does not appear frequently	Send frequently 0RLO6 to the Mainboard. If the reply is always 0rlo00850 the error entry happens accidently. If the reply is 0rloC0850 there seems to be a voltage problem and the Mainboard must be replaced	Use the command 0RHV3 to watch the value of the humidity sensor. Check if ventilation slot is not covered and ensure that the air flow is granted and check humidity again. Remark: The humidity inside the housing is usually lower then outside.
5	E	MUX or AD converter not OK	Controller disables all heating/cooling and shaking activities	Send 0RMA to the mainboard and report result to INHECO	Controller MTC / STC has to be returned to INHECO
6	W	Power switch not OK	non, if the error code does not appear frequently	Use the demo tool and report error codes to INHECO	If the number of occurences of error 6 increases after every power cycle, replace the M/STC.
7	W	Housing fan is not running when connected devices are in operation	Controller might overheat	check whether fan is running when connected devices are in operation.	If fan is not running when connected devices in operation, please check the cabling to the fan. If the plug is connected correctly return controller back to INHECO
8	W	Temperature difference betweeen analogue and digital sensor is too high	non, if the error code does not appear frequently	Send frequently 0RLO5 to the Mainboard. If the reply is always 0rlo00050 the error entry happens accidently. If the reply is 0rloC0050 there seems to be a voltage problem and the Mainboard must be replaced	Use the command 0RHV4 and 0RHV2 to watch the value of the analogue and the digital housing temperature sensor, respectively. Change the air flow and check temperatures again.
9		Reserved			

Error	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
10	W	RAM test of main board failed	Non	please contact INHECO	Check with 0REC10 the number of occurrences. If the number is higher then 20. Please contact INHECO
11	W	STC only, Power switch not working (no 24V power supply)	Controller disables alle heating/cooling and shaking activities		Controller STC has to be returned to INHECO
12	W	Cannot read external EEPROM of device 1	Controller cannot use data from external EEPROM	Check connection, if devices is correctly connected there are 2 options 1. Switch from external EEPROM (device) to internal EEPROM by using the command SPO0 2. Return device back to INHECO	if device is correctly connected, return device back to INHECO
13	W	Cannot read external EEPROM of device 2			
14	W	Cannot read external EEPROM of device 3			
15	W	Cannot read external EEPROM of device 4			
16	W	Cannot read external EEPROM of device 5			
17	W	Cannot read external EEPROM of device 6			
18		Reserved			
19		Reserved			
20	W	CRC error external EEPROM of device 1			Please contact INHECO
21	W	CRC error external EEPROM of device 2			
22	W	CRC error external EEPROM of device 3			
23	W	CRC error external EEPROM of device 4			
24	W	CRC error external EEPROM of device 5			
25	W	CRC error external EEPROM of device 6			
26	E	CRC error flash memory	Maybe something went wrong after an Firmware update. Contact INHECO to set the Checksum manually.		Switch M/STC on Wait 2 minutes Send 0RCF0 and 0RCF1 to the effected Mainboard and send xRCF0 and xRCF1 (x = SlotID 1-6) to effected Slot Module Send the reply to INHECO together with the Serialnumber of MTC/STC and the Serialnumber of the slot.

Error	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
27	W	Unplugged Device at **slot module 1** during power up or device lost connection	Non		Make sure that devices are not disconnected from controller when controller is in operation.
28	W	Unplugged Device at **slot module 2** during power up or device lost connection			
29	W	Unplugged Device at **slot module 3** during power up or device lost connection			
30	W	Unplugged Device at **slot module 4** during power up or device lost connection			
31	W	Unplugged Device at **slot module 5** during power up or device lost connection			
32	W	Unplugged Device at **slot module 6** during power up or device lost connection			

Error Codes Slot

The following Codes are shown in the MTC/STC Display and in the Error Code log files. These error codes can be read out with the Demotool using the button „report error codes“ or with the command XREC which reports the Error Code of the Devices. Up to 7 errors can be stored into the error memory.

Code	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
1	W	Temperature control not OK	non, if only shown at start up		
2	E	CRC error of external EEPROM of connected device(s). External EEPROM of device is no longer in use	heating and cooling of connected device is disabled	Send write Command 0SDOx,5,0, (x=SlotID) to EEPROM. Restart STC/ MTC/STC. If error is still shown 2 options are possible: 1. Switch from external EEPROM (device) to internal EEPROM by using the command xSPO0 (x=SlotID) 2. Return device back to INHECO	If the device is necessarily needed and you are sure you won´t exchange devices at this slot, switch to internal EEPROM,otherwise return the device (only the device) back to INHECO
3	W	RPM Shaker too high, speed of more than 2000 rpm was set	non	check set rpm (on display)	check set rpm (on display or with RSR command)
4	E	Voltage too high of connected device(s)	heating / cooling and shaking of connected device is disabled	non	Exchange Slot module
5	W	Voltage too low of connected device(s)	non, if message reply byte „I“ is not set	Send frequently 1RPO to the affected Slot (here Slot 1). If the reply is always 1rpo00001 the error entry happens accidently. If the reply is 1rpoI0001 there seems to be a voltage problem a decision must be made if low voltage is acceptable from customer.	If not acceptable Slot Module has to be exchanges

Code	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
6	W	Fan of device is not running	cooling is no longer working correctly if fan is not running during cooling	check whether fan of CPAC or Thermoshake device is running during cooling	If fan is running device is ok, ignor error message. If fan is not running, return CPAC or Thermoshake device back to INHECO. Attention: The fan runs at cooling processes only. The pump of the Thermoshake which is connected to the same circuit must run during all activities, of course.
7	W	Reservoir of Thermoshake is almost empty or shortcut to ground sensor 2	If message reply byte „R“ is set frequently, refill reservoir of Thermoshake	Start a cooling process and send the command RRS to the affected Slot ID. If reply is (at Slot Id =1) always 1 rrs00 then the reservoir is indeed empty. Refill the reservoir.	Refill reservoir of Thermoshake. If the device is no Thermoshake most probably sensor 2 is defect and the device must be repaired
8	E	Temperature of device is too high	Heating of device is disabled	check what maximum termperature is set xRMT1. Adjust temperature to maximum allowed limit or contact INHECO to clarify whether a change of the upper temperature limit is possible.	Adjust temperature to maximum allowed limit please contact INHECO to get full command and to clarify whether a change of the upper temperature limit is possible.
9	E	Could not read EEPROM of device	heating and cooling of connected device is disabled	Send write Command 0SDOx,5,0, (x=SlotID) to EEPROM. Restart MTC/STC. If error is still shown 2 options are possible: 1. Switch from external EEPROM (device) to internal EEPROM by using the command xSPO0 (x = Slot ID 1-6) 2. Return device back to INHECO	If the device is necessarily needed and you are sure you won´t exchange devices at this slot, switch to internal EEPROM,otherwise return the device (only the device) back to INHECO.
10	W	RAM test failed	non	please contact INHECO	Check with 1REC10 the number of occurrences. If the number is higher then 20 Please contact INHECO

Code	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
11	W	TEC current to low	non	TEC current is checked during the startup only. Therefor restart MTC/STC and check if error occurs again.	Use the demo tool and report error codes If the number of occurences of error 11 increases after every power cycle, replace the device. Check cable connections.
12	W	Temperature difference between control sensor and monitoring sensor is too high	non, device is still heating, cooling or shaking	check whether a asymetrical load is place on the contact surface of the device (e.g. only one half of the plate is filled with fluid).	Please contact INHECO
13	E	Temperature too low	non	check whether the temperature is set below the minimum allowed tempera-ture. Adjust temperature to minimum allowed limit or contact INHECO to clarify whether a change of the lower temperature limit is possible.	Adjust temperature to minimum allowed limit or contact INHECO to clarify whether a change of the lower tempera-ture limit is possible
14	E	Unknown device connected	heating and cooling of connected device is disabled	check whether appropiate device is connected (boot of connector has to have the same color as the slot module). Restart Controller, if Error is still shown return connected device to INHECO	check whether appropiate device is connected (boot of connector has to have the same color as the slot module). Restart Controller, if Error is still shown return connected device to INHECO
15	E	Type of device stored in EEEPROM does not fit to connected device. Wrong device connected (12V device to 24V slot or vice versa)	heating and cooling of connected device is disabled	check whether appropiate device is connected (boot of connector has to have the same color (black or blue) as the slot module)	Connect a correct device to Slot. After restart the error should be gone. If error is still shown, return Slot back to INHECO.
16		reserved			
17	E	short cut to ground controlling sensor (sensor 1)	heating and cooling of connected device is disabled		Return the device back to INHECO
18	E	cable break controlling sensor (sensor 1)	heating and cooling of connected device is disabled		Return the device back to INHECO

Code	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
19	W	cable break monitoring sensor (sensor 2)	non, if message reply byte „R“ is not set frequently	Send frequently 1RPO to the affected Slot (here Slot 1). If the reply is always 1rpo00001 the error entry happens accidently. If the reply is 1rpoR0001 there seems to be a cable break and the device must be repaired or replaced.	
20	E	Communication error between Slot module and controller main board. Error code will be only used for internal INHECO evaluation	if error 2 is also shown, heating, cooling and shaking of devices is disabled.	Please contact INHECO for further evaluation. Error 20 in conjunction with error 2 shows more detailed information for the failure evaluation.	Please contact INHECO for further evaluation
21	E	Connected device is heating instead of cooling	Heating of device is disabled	Report type device and send the information to INHECO. Best: Use the demo tool and report error codes.	This may happen accidently if the load is very heavy and very hot. Please ignore the error in such a case and restart cooling.
22	E	Cable break (ground) of controlling sensor (sensor 1) and / or monitoring sensor (sensor 2)	heating and cooling of connected device is disabled		connected device has to be returned to INHECO
26	E	CRC error Flash memory of Slot modul, Initialization or Firmware update of Slot might be not OK		Please contact INHECO for further evaluation	Please contact INHECO for further evaluation
27	E	I2C Communication Error	Thermoshake AC becomes inoperable	Stop using the device and please contact INHECO for further evaluation	Please contact INHECO for further evaluation
28	E	Error regarding the Clamp Mechanism	Thermoshake AC becomes inoperable	Stop using the device and please contact INHECO for further evaluation	Please contact INHECO for further evaluation
29	E	Shaker does not respond to commands	Shaker cannot be controlled	Please contact INHECO for further evaluation	Please contact INHECO for further evaluation

Code	Error (E) / Warning (W)	Description of Error Codes	Impact	Additional Actions	Recommendation
30	E	The Thermoshake AC has detected a motor fault	Device stops shaking	Please contact INHECO for further evaluation	Please contact INHECO for further evaluation
31	E	Current RPM value difference to set point >4000rpm	The device stops shaking	Please contact INHECO for further evaluation	Please contact INHECO for further evaluation