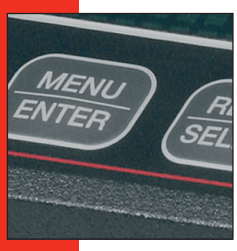
AMETEK®
SENSORS, TEST & CALIBRATION

Reference Manual
Compact Temperature Calibrator
Jofra CTC-155/350/652/660/1205 A/C









Reference Manual
Compact Temperature Calibrator
JOFRA CTC-155/350/652/660/1205 A/C

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About this manual….

- **The structure of the manual**

This reference manual is aimed at users who are familiar with AMETEK calibrators, as well as those who are not. The manual is divided into 11 sections which describe how to set up, operate, service and maintain the calibrator. The technical specifications are described and accessories may be ordered from the list of accessories.

- **Safety symbols**

This manual contains a number of safety symbols designed to draw your attention to instructions which must be followed when using the instrument, as well as any risks involved.



Warning

Conditions and actions that may compromise the safe use of the instrument and result in considerable personal or material damage.



Caution…

Conditions and actions that may compromise the safe use of the instrument and result in slight personal or material damage.



Note…

Special situations which demand the user’s attention.

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1.0 Introduction

Congratulations on your new AMETEK JOFRA CTC Calibrator!

With the AMETEK JOFRA Compact Temperature Calibrator, you have chosen an extremely effective instrument which we hope will live up to all your expectations.
This CTC calibrator is a fast, timesaving, and reliable true industrial temperature calibrator designed for on-site use.

During the past several years, we have acquired extensive knowledge of industrial temperature calibration. This expertise is reflected in our products which are all designed for daily use in an industrial environment. Please note that we would be very interested in hearing from you if you have any ideas or suggestions for changes to our products.

This reference manual applies to the following instruments:

- **JOFRA CTC-155 A – Temperature calibrator**
- **JOFRA CTC-155 C – Temperature calibrator with reference sensor input**
- **JOFRA CTC-350 A – Temperature calibrator**
- **JOFRA CTC-350 C – Temperature calibrator with reference sensor input**
- **JOFRA CTC-652 A – Temperature calibrator**
- **JOFRA CTC-652 C – Temperature calibrator with reference sensor input**
- **JOFRA CTC-660 A – Temperature calibrator**
- **JOFRA CTC-660 C – Temperature calibrator with reference sensor input**
- **JOFRA CTC-1205 A – Temperature calibrator**
- **JOFRA CTC-1205 C – Temperature calibrator with reference sensor input**

<u>The calibrator has the following features and functions:</u>

- Wide temperature range
- Fast heating and cooling time as well as a short stabilization time
- Signal input for external reference sensor, which makes it possible to improve accuracy even more.
- External sensor control for running in two modes.
- Multi-Information colour Display and Function keys
- Useful features such as Set function, Preset mode, Auto Switch Test and Auto Stepping
- IRI – Intelligent Recalibration Information
- Plug and play STS reference sensors with memory chip
- Broad range of inserts
- Reference sensor protection
- Silent mode operation
- JOFRACAL calibration software
- Protective carrying case with compartments for inserts, cables, manuals, plugs etc.

ISO-9001 certified

AMETEK Denmark A/S was ISO-9001 certified in September 1994 by Bureau Veritas Certification Denmark.

CE-label

Your new temperature calibrator bears the CE label and conforms to the Electromagnetic Compatibility (EMC) Directive 2014/30/EU, the Low Voltage Directive 2014/35/EU and the RoHS Directive 2011/65/EU amended by Directive 2015/863/EU.*

Technical assistance

Please contact the dealer from whom you acquired the instrument if you require technical assistance.

1.1 Warranty

This instrument is warranted against defects in workmanship, material and design for two (2) years from date of delivery to the extent that AMETEK will, at its sole option, repair or replace the instrument or any part thereof which is defective, provided, however, that this warranty shall not apply to instruments subjected to tampering or, abuse, or exposed to highly corrosive conditions.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED AND AMETEK HEREBY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY. AMETEK SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, ANY ANTICIPATED OR LOST PROFITS.

This warranty is voidable if the purchaser fails to follow any and all instructions, warnings or cautions in the instrument's User Manual.

If a manufacturing defect is found, AMETEK will replace or repair the instrument or replace any defective part thereof without charge; however, AMETEK's obligation hereunder does not include the cost of transportation, which must be borne by the customer. AMETEK assumes no responsibility for damage in transit, and any claims for such damage should be presented to the carrier by the purchaser.

* CTC-155 A / CTC-155 C from serial no. xxxxxx-00984, CTC-350 A / CTC-350 C from serial no. xxxxxx-00430, CTC-652 A / CTC-652 C from serial no. xxxxxx-00097, CTC-660 A / CTC-660 C from serial no. xxxxxx-00772 and CTC-1205 A / CTC-1205 C from serial no. xxxxxx-00157

1.2 Receiving the Compact Temperature Calibrator

When you receive the instrument…

1) Unpack and check the calibrator and the accessories carefully.
2) Check the parts according to the list shown below.

   If any of the parts are missing or damaged, please contact the dealer who sold you the calibrator.

You should receive:

- 1 CTC Calibrator
- 1 USB memory stick containing electronic Reference manual and software package JOFRACAL
- 1 mains cable
- 1 sets of test leads and test clips (black and red)
- Thermal protection shield (CTC-652/660 only)
- 1 tool for insertion tube
- 1 USB cable
- 1 Calibration certificate (International traceable)



When reordering, please specify the part numbers according to the list of accessories, section 11.0

1.3 Dimensioning drawing



2.0 Safety instructions



Read this manual carefully before using the instrument!

Please follow the instructions and procedures described in this manual. They are designed to allow you to get the most out of your calibrator and avoid any personal injuries and/or damage to the instrument.



Disposal – WEEE Directive

These calibrators contain Electrical and Electronic circuits and must be recycled or disposed of properly (in accordance with the WEEE Directive 2012/19/EU).



Warning

About the use:

- The calibrator **must not** be used for any purposes other than those described in this manual, as protection provided by the calibrator may be impaired and it might cause a hazard.
- The calibrator has been designed for **indoor use only** and is not to be used in wet locations.
- The calibrator is **not to be used in hazardous areas**, where vapour or gas leaks, etc. may constitute a danger of explosion.
- The calibrator is **not** designed for operation in altitudes above 2000 meters (CTC-155/350/652/660) / 3000 meters (CTC-1205).
- The calibrator is a CLASS I product and must be connected to a mains outlet with a protective earth connection. Ensure the ground connection of the calibrator is properly connected to the protective earth before switching on the calibrator. Always use a mains power cable with a mains plug that connects to the protective earth.
- To ensure the connection to protective earth any extension cord used **must** also have a protective earth conductor.
- Only use a mains power cord with a current rating as specified by the calibrator and which is approved for the voltage and plug configuration in your area.
- **Always** make sure to position the power cord and other connected cables in a secure way to prevent the risk of personnel falling.
- To prevent the calibrator from tipping over and causing damage to equipment or systems, please avoid pulling the cables connected to the calibrator.
- Before switching on the calibrator make sure that it is set to the voltage of the mains electricity supply.
- **Always** position the calibrator to enable easy and quick disconnection of the power source (mains inlet socket).
- The calibrator **must** be kept clear within an area of 20 cm on all sides and 1 metre above the calibrator due to fire hazard.
- After transport or storage in humid conditions or if the calibrator has not been heated up to minimum 100°C within the last 10 days, the instrument needs to be operated with a well temperature of at least 140°C for 2 hours before it can be assumed to meet all safety requirements of EN61010-1(CTC-350/652/660 only).
- **Never** use heat transfer fluids such as silicone, oil, paste, etc. in the dry-block calibrators. These fluids may penetrate the calibrator and cause electrical hazard, damage or create poisonous fumes.

- The calibrator **must** be switched off before any attempt to service the instrument is made. There are no user serviceable parts inside the calibrator.
- When cleaning the well or the insertion tube, **REMEMBER** to wear goggles when using compressed air!
- Remember to use appropriate protective equipment or get help when carrying the calibrator (for a longer distance) in order to prevent injuries from dropping the calibrator.

About the frontpanel:

- The connectors, on the front panel of the calibrator, must **NEVER** be connected to a voltage source.
- Thermostats connected to the switch test input must **not** be connected to any other voltage source during a test.

About insertion tubes and insulation plugs:

- **Never** leave hot insertion tubes, which have been removed from the calibrator, unsupervised – they may constitute a fire hazard or personal injury.

  If you intend to store the calibrator in the aluminium carrying case after use, you **must** ensure that the instrument has cooled down to a temperature **below 50°C/122°F** before placing it in the carrying case.
- **Never** place a hot insertion tube in the optional carrying case.
- Use only insulation plugs supplied by AMETEK Denmark A/S.
- Never try to modify the insulation plugs to make them fit the sensor (CTC-1205 only)

About the fuses:

- The fuse box must not be removed from the power control switch until the mains cable has been disconnected.
- The two main fuses must have the specified current and voltage rating and be of the specified type. The use of makeshift fuses and the short-circuiting of fuse holders are prohibited and may cause a hazard.



Caution – Hot surface

This symbol is visible on the grid plate. 

- **Do not touch** the grid plate, the well or the insertion tube as the calibrator is heating up – they may be very hot and cause burns.
- **Do not touch** the tip of the sensor when it is removed from the insertion tube/well – it may be very hot and cause burns.
- **Do not touch** the handle of the calibrator during use – it may be very hot and cause burns.
- **Over 50°C/122°F**

  If the calibrator has been heated up to temperatures above 50°C/122°F, you must wait until the instrument reaches a temperature **below 50°C/122°F** before you switch it off.
- **Do not** remove the insert from the calibrator before the insert has cooled down to less than 50°C/122°F.



Caution – Cold surface

Below 0°C/32°F (applies only to the CTC-155 C models)

- **Do not** touch the well or insertion tube when these are below 0°C/32°F - they might create frostbite.
- If the calibrator has reached a temperature below 0°C/32°F, ice crystals may form on the insertion tube and the well. This, in turn, may cause the material surfaces to oxidize
  To prevent this from happening the insertion tube and the well must be dried. This is done by heating up the calibrator to 100°C/212°F until all water left has evaporated.
  Remove the insulation plug while heating up.

  It is very important that humidity in the well and insertion tube is removed to prevent corrosion and frost expansion damages.



Caution…

About the use:

- **Do not** use the instrument if the internal fan is out of order.
- Before cleaning the calibrator, you **must** switch it off, allow it to cool down and remove all cables.

About the well, insertion tube and grid plate:

- The well and the insertion tube **must** be clean and dry before use.
- **Do not** pour any form of liquids into the well. It might damage the well or cause a hazard.
- Scratches and other damage to the insertion tubes should be avoided by storing the insertion tubes carefully when not in use.
- The insertion tube must **never** be forced into the well. The well could be damaged as a result, and the insertion tube may get stuck.
- **Before** using new insertion tubes for the calibration, the insertion tubes **must** be heated up to maximum temperature 350°C (662°F) / 650°C (1202°F) / 660°C (1220°F) / 1205°C (2201°F) for a period of minimum 30 minutes (CTC-350/652/660/1205 only).
- The insertion tube must **always** be removed from the calibrator after use.
  The humidity in the air may cause corrosion oxidation on the insertion tube inside the instrument. There is a risk that the insertion tube may get stuck if this is allowed to happen.
- If the calibrator is to be transported, the insertion tube **must** be removed from the well to avoid damage to the instrument. If the insertion tube is not removed from the CTC-1205 the ceramic well might crack.



Note…

The product liability **only** applies if the instrument is subject to a manufacturing defect. This liability becomes void if the user fails to follow the instructions set out in this manual or uses unauthorised spare parts.

3.0 Setting up the calibrator for use

3.1 Preparing the calibrator



Warning

- The calibrator has been designed for **indoor use only** and is not to be used in wet locations.
- The calibrator is **not to be used in hazardous areas**, where vapour or gas leaks, etc. may constitute a danger of explosion.
- The calibrator is **not** designed for operation in altitudes above 2000 meters / 3000 meters (CTC-1205).
- The calibrator is a CLASS I product and must be connected to a mains outlet with a protective earth connection. Ensure the ground connection of the calibrator is properly connected to the protective earth before switching on the calibrator. Always use a mains power cable with a mains plug that connects to the protective earth.
- To ensure the connection to protective earth any extension cord used **must** also have a protective earth conductor.
- Only use a mains power cord with a current rating as specified by the calibrator and which is approved for the voltage and plug configuration in your area.
- **Always** make sure to position the power cord and other connected cables in a secure way to prevent the risk of personnel falling.
- To prevent the calibrator from tipping over and causing damage to equipment or systems, please avoid pulling the cables connected to the calibrator.
- Before switching on the calibrator make sure that it is set to the voltage of the mains electricity supply.
- **Always** position the calibrator to enable easy and quick disconnection of the power source (mains inlet socket).
- The calibrator **must** be kept clear within an area of 20 cm on all sides and 1 metre above the calibrator due to fire hazard.
- After transport or storage in humid conditions or if the calibrator has not been heated up to minimum 100°C within the last 10 days, the instrument needs to be operated with a well temperature of at least 140°C for 2 hours before it can be assumed to meet all safety requirements of EN61010-1(CTC-350/652/660 only).



Note…

The instrument must **not** be exposed to draughts.

When setting up the calibrator, you must…

① Place the calibrator on an even horizontal surface where you intend to use it.



Caution…

Do not use the instrument if the internal fan is out of order.

② Ensure a free supply of air to the internal fan located at the bottom of the instrument (pos. 2). The area around the calibrator should be free of draught, dirt, flammable substances etc.

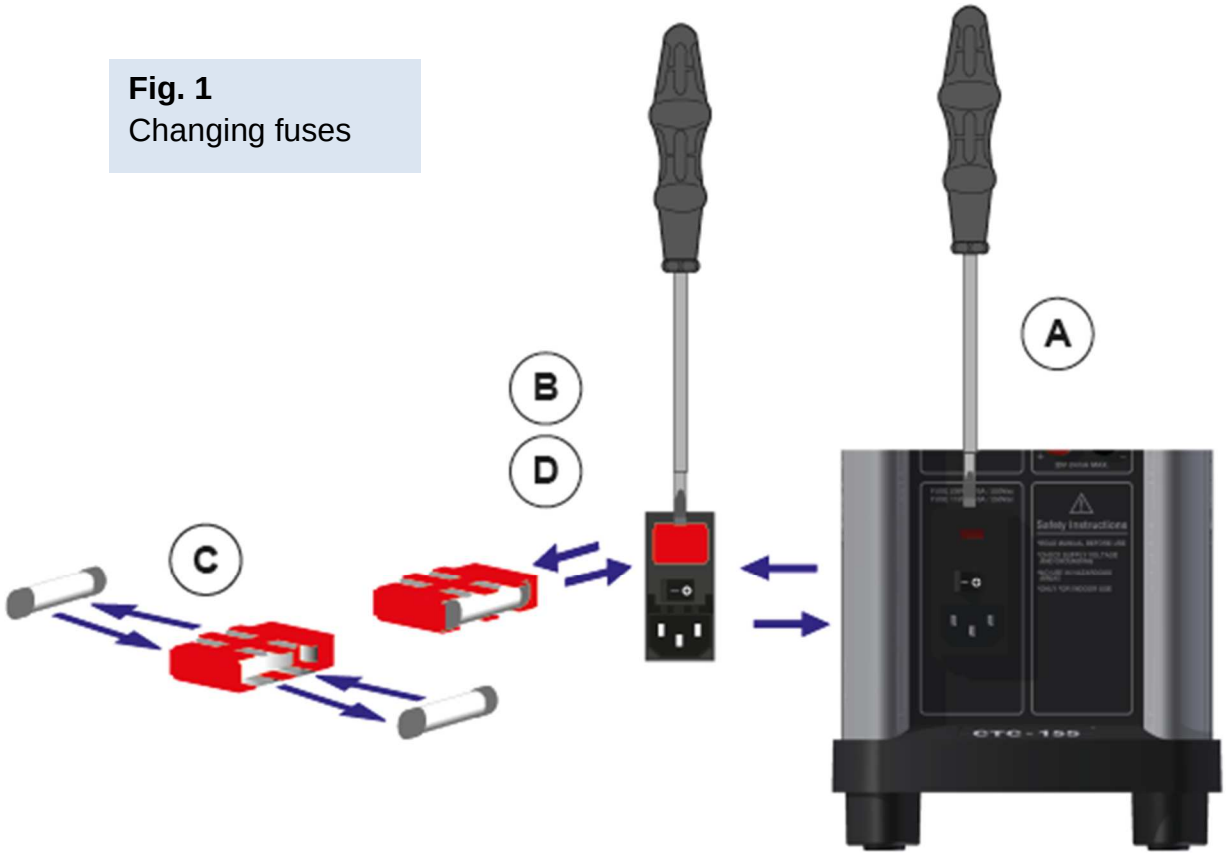
③ Check that the fuse size corresponds to the applied voltage on (pos. 3). The fuse is contained in the power control switch (on/off switch (230V/115V)). To check; do as follows (see Fig. 1):



Warning

The two main fuses must have the specified current and voltage rating and be of the specified type. The use of makeshift fuses and the short-circuiting of fuse holders are prohibited and may cause a hazard.

Fig. 1
Changing fuses



A. Open the fuse box lid using a screwdriver.
B. Take out the fuse box.
C. Remove both fuses replacing them with two new fuses. These must be identical and should correspond to the line voltage. See section 11.0.
D. Slide the fuse box back into place.

④ Check that the earth connection for the instrument is present and attach the cable.

⑤ Select an insertion tube with the correct bore diameter. See section 3.2 for information on how to select insertion tubes.

The calibrator is now ready for use.

3.2 Choosing an insertion tube



Caution…

To get the best results out of your calibrator, the insertion tube dimensions, tolerance and material are critical. We highly advise using the JOFRA insertion tubes, as they guarantee trouble free operation. Use of other insertion tubes may reduce performance of the calibrator and cause the insertion tube to get stuck.



Caution…

Before using new insertion tubes for the calibration in the CTC-350/652/660/1205 instruments the insertion tubes **must** be heated up to maximum temperature 350°C(662°F) / 650°C (1202°F) / 660°C (1220°F) / 1205°C (2201°F) for a period of minimum 30 minutes.

Insertion tubes are selected on the basis of the diameter of the sensor to be calibrated.

Use the table for insertion tubes in section 3.2.1 to find the correct parts number.

Alternatively, you may order an undrilled insertion tube and drill the required hole yourself. The finished dimension should be as follows:

- Sensor diameter ød +0.2mm +0.05 / -0.00mm for CTC-155/350/652/660 and ød +0.5mm ±0.05mm for CTC-1205.
- Reference sensor hole ø4.2mm +0.05 / -0.00mm for CTC-155/350/652/660 and ø5.0mm ±0.05mm for CTC-1205.
- When drilling the holes it is important that the distance of the material between the drillings is at least 2mm. If the distance is less than 2 mm the calibration result could be compromised.

3.2.1 Standard insertion tubes



Caution…

To get the best results out of your calibrator, the insertion tube dimensions, tolerance and material are critical. We highly advise using the JOFRA insertion tubes, as they guarantee trouble free operation. Use of other insertion tubes may reduce performance of the calibrator and cause the insertion tube to get stuck.

PARTS NO. FOR STANDARD INSERTION TUBES – SINGLE HOLES											
Sensor size	**CTC-155**	**CTC-350**	**CTC-652**	**CTC-660**	**CTC-1205**	**Sensor size**	**CTC-155**	**CTC-350**	**CTC-652**	**CTC-660**	**CTC-1205**
3 mm	129407	129429	130156	129459	130015	Undrilled	129418	129445	130154	129475	130006
4 mm	129408	129430	130157	129460	130016	Undrilled/ref. hole	129419	129446	130155	129476	130007
5 mm	129409	129431	130158	129461	130017						
6 mm	129410	129432	130159	129462	130018	1/8”	129420	129447	130172	129477	130008
7 mm	129411	129433	130160	129463	130019	3/16”	129421	129448	130173	129478	130009
8 mm	129412	129434	130161	129464	130020	1/4”	129422	129449	130174	129479	130010
9 mm	129413	129435	130162	129465	130021	5/16”	129423	129450	130175	129480	130011
10 mm	129414	129436	130163	129466	130022	3/8”	129424	129451	130176	129481	130012
11 mm	129415	129437	130164	129467	130023	7/16”	129425	129452	130177	129482	130013
12 mm	129416	129438	130165	129468	130024	1/2”	129426	129453	130178	129483	130014
13 mm	129417	129439	130166	129469	-	9/16”	129427	129454	130179	129484	-
14 mm	-	129440	130167	129470	-	5/8”	129428	129455	139180	129485	-
15 mm	-	129441	130168	129471	-	11/16”*	-	129456	130181	129486	-
16 mm*	-	129442	130169	129472	-	13/16”*	-	129457	139183	129487	-
18 mm*	-	129443	130170	129473	-	3/4”*	-	129458	130182	129488	-
20 mm*	-	129444	130171	129474	-						

The CTC-155 and the CTC-1205 single-hole insertion tubes are delivered with a matching insulation plug.
***Note:** Insertion tubes without reference holes.

PART NO. FOR STANDARD INSERTION TUBES – MULTI-HOLE				
Description	**CTC-155**	**CTC-350**	**CTC-652**	**CTC-660**
Metric Type 1				
Sensor size 3, 4, 5, 6, 9 mm and 4mm REF	129489	129491	130152	129493
Inch Type 2				
Sensor size 1/8”, 3/16”, 1/4”, 3/8” and 4 mm REF	129490	129492	130153	129494

The CTC-155 multi-hole insertion tubes are delivered with matching insulation plugs.

3.3 Inserting the sensor

Before inserting the sensor and switching on the calibrator, please note the following important warning:

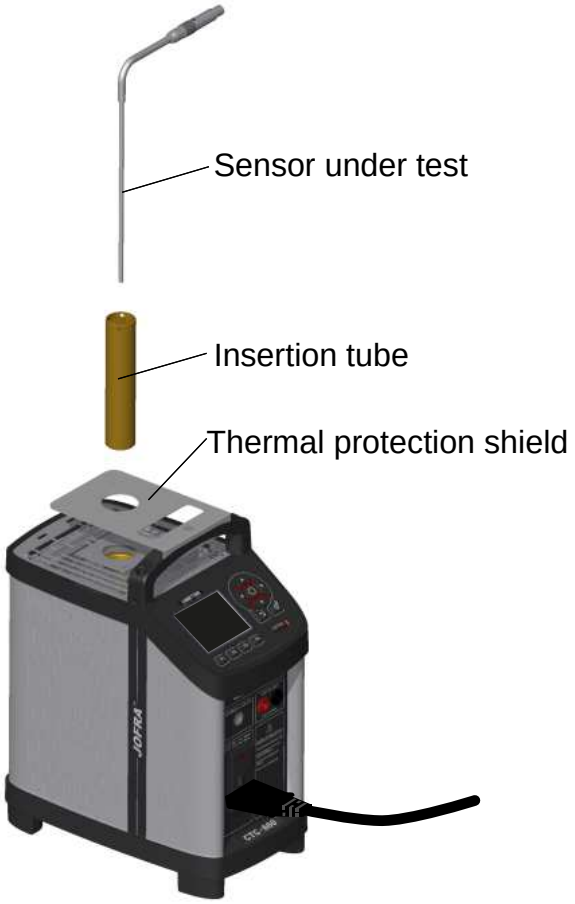


Warning

- **Never** use heat transfer fluids such as silicone, oil, paste, etc. in the dry-block calibrators.
  These fluids may penetrate the calibrator and cause electrical hazard, damage or create poisonous fumes.
- **Never** try to modify the insulation plugs to make them fit the sensor. Use only insulation plugs supplied by AMETEK Denmark A/S.

Insert the sensor as shown below in fig. 2.

Fig. 2
Inserting sensor and insertion tube



Check that the insulation plug fits the diameter of the sensor. Otherwise replace it (CTC-155/CTC-1205 only).

In order to spare the sensor and its connections it is recommended to use a thermal protection shield (129264) at high temperatures (CTC-652/660 only).



Caution…

- The well and the insertion tube **must** be clean before use.
- **Do not** pour any form of liquids in the well. It might damage the well.
- Scratches and other damage to the insertion tubes should be avoided by storing the insertion tubes carefully when not in use.
- The insertion tube must **never** be forced into the well. The well could be damaged as a result, and the insertion tube may get stuck.



Caution – Hot surface

- **Do not touch** the grid plate, the well or the insertion tube as the calibrator is heating up – they may be very hot and cause burns.
- **Do not touch** the tip of the sensor when it is removed from the insertion tube/well – it may be very hot and cause burns.
- **Do not touch** the handle of the calibrator during use – it may be very hot and cause burns.
- **Do not remove** the insertion tube from the calibrator before the insertion tube has cooled down to less than 50°C/122°F.



Caution – Cold surface

Below 0°C/32°F (applies only to the CTC-155 models)

- **Do not** touch the well or insertion tube when these are below 0°C/32°F - they might create frostbite.
- If the calibrator has reached a temperature below 0°C/32°F, ice crystals may form on the insertion tube and the well. This, in turn, may cause the material surfaces to oxidize
  To prevent this from happening the insertion tube and the well must be dried. This is done by heating up the calibrator to 100°C/212°F until all water left has evaporated. Remove the insulation plug while heating up.

  It is very important that humidity in the well and insertion tube is removed to prevent corrosion and frost expansion damages.

3.4 External reference sensor

The following JOFRA STS Reference sensors can be used with the varies models:

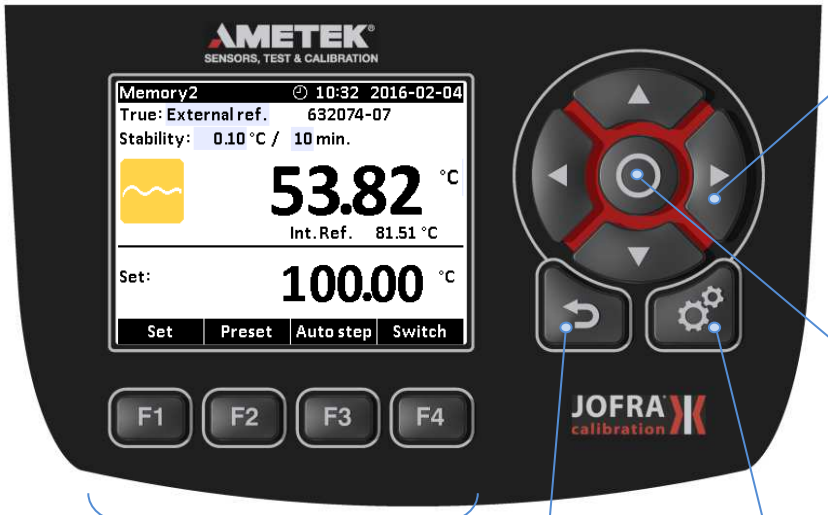
CTC-155	CTC-350	CTC-652	CTC-660	CTC-1205
STS-102 A 030	STS-120 A 935	STS-200 A 970	STS-120 A 966	STS-TC-N-A-1205
STS-120 A 915	STS-120 A 966		STS-150 A 966	
STS-150 A 912	STS-150 A 935		STS-200 A 970	
STS-150 A 915	STS-150 A 966			
STS-200 A 915	STS-200 A 970			
STS-200 A 916				

Use the configuration software CON050 supplied with CTC to program and to update calibration information in STS sensors.

For instructions read the software manual for CON050 installed on the USB key.

4.0 Calibrator Interface

4.1 Keypad - Functions



Arrow Keys
Serve different functions depending on the mode of operation.
Navigation mode: Use the four keys to move the cursor in the desired direction.
Edit mode: The Up and Down Arrow keys scroll through the lists of options. If entering a number, the Left and Right Arrow keys move the cursor one character in the desired direction.

Action key / Enter key
Action function: Open and close edit fields or a menu button. The action key also accepts the selected option or entered value.

Enter function: Accept selected options or entered values. When a value is entered with the Enter Key the cursor selects the next configurable field in the list.

System menu key
Press the key to enter the System menu.

Back key
Press the key to cancel a selection or return to previous menu.

Function keys F1, F2, F3, F4
To operate the horizontal menu bar use the Functions keys.

4.2 Display - Functions

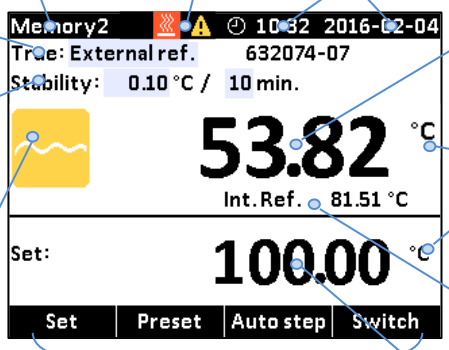
Reference sensor info
Shows the reference sensor selected. The serial number of the external reference sensor is read from the intelligent reference sensor and displayed in this field.

Memory reading
Shows the current memory selected from the System menu.

Warning/Error symbols. See 4.2.2

Real Time Clock and date display.

True temperature reading
Shows the numeric value of the temperature being measured. Can be either the internal reference sensor or an external reference sensor.



"Time to stable" Selection
Shows the selected specified stability criteria and states a time when the stable situation can be achieved.

Units
Shows the unit of the current measurement.

Internal Reference temperature reading
Shows the temperature of the well.

Process Indicator
Indicates the status of the current process.

Horizontal menu bar
Provides you with the relevant menu options that can be selected at the present point. Each option can be selected and activated by pressing the function keys (F1, F2, F3 and F4).

Set temperature reading
Shows the numeric value of the current set temperature selected.

4.2.1 Main screen temperature values

Two temperatures are always displayed:

- TRUE temperature: This is the reference temperature of the calibrator. The TRUE temperature can either be the internal reference or the external reference.

- SET temperature: This is the target temperature for the well. SET temperature displays the last value entered. If no value has been entered previously, "---,--" is displayed.

Additional temperatures displayed:

- If External reference is selected as TRUE temperature, the temperature of the internal reference is also displayed.

4.2.2 Stability of temperature values

The stability of the TRUE temperature is indicated by the following messages:

- "Not stable": Indicates that the measured temperature is not yet within the specified stability criteria.
-

Indicates "Time to stable": The temperature changes are within the specified stability criteria (see section 10.0) and states a time (in minutes and seconds) when the stable situation can be achieved.
- 

Indicates that the “stable” situation is achieved and for how long the calibrator has been stable. When the calibrator has been stable for more than 99 minutes, only the stable sign is displayed (time is no longer displayed).



- If External reference is selected as TRUE, the stability criteria will refer to this. The criteria can be changed, however, if the temperature stability criteria is set wider or the stability time is set shorter, the calibrator may not reach the SET temperature.

When the instrument is heating up and cooling down indication of this will be shown as following symbols:

- The instrument is heating up.
- The instrument is cooling down (CTC-155 only).
- The instrument is cooling down (CTC-350/652/660/1205 only).

Heating and cooling symbols will be displayed in the upper black info bar when:

-  the well temperature is below 5°C.

-  the well temperature is above 45°C.

Warning and error symbols will be displayed in the upper black info bar indicating that action needs to be taken:

-  Warning symbol.

-  Error symbol.

If a warning or an error symbol occurs during operation, a list of alarms will be displayed showing the warning and/or error messages. See section 7.0 – Error messages.

Note…

A warning will always surpass an error, even if the error occurs after the warning.

4.3 Input/Output Connections

Warning

- The input terminals must **NEVER** be connected to voltage exceeding 30V with reference to ground.

Fig. 3
Input and Output



Device
USB 2.0 Device Port, 1 x USB.

Reference Sensor
Input for reference sensor.

Power Control Switch
With a cable connection and On/Off switch. It also contains the main fuse. See section 3.1 for information on how to change the fuse. The text above the Power Control Switch indicates the fuse value.

Switch Test
Connection for thermostat switch test. **Note** that this connection is for voltage free switches.

5.0 Operating the calibrator

Warning **Caution…**

Please inspect the Safety Instructions in section 2.0 before using the instrument.

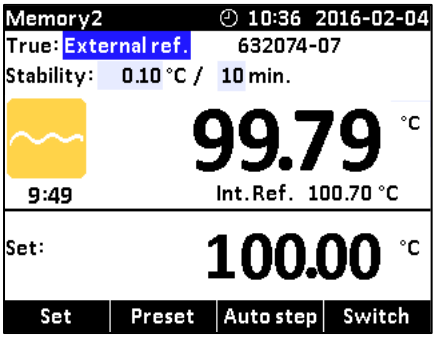
5.1 Operating principle

The calibrator is operated using the Functions keys, the Arrow keys and the Action/Enter key.

1. Press the Functions keys to operate the horizontal menu bar.



2. Press any of the (Arrow) keys to enter Navigation Mode. Editable fields will be highlighted in blue.
3. Use the (Arrow) keys to move between the configurable fields within the display. Selected fields will be highlighted in **dark blue..**

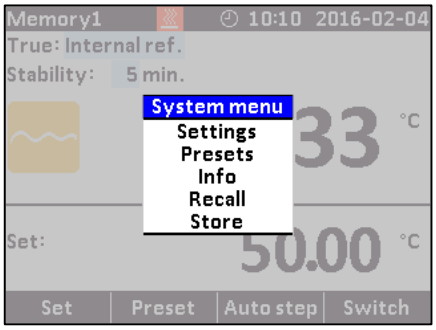


4. Press the (Enter) key to access the selected field for editing.
5. Use the ▲ (Up) and ▼ (Down) Arrow keys to select a new value.
6. Press the (Enter) key to accept the new value
7. To exit the Navigation Mode press the (Back) key. The (Back) key is also used to cancel a selection or to return to a previous menu.

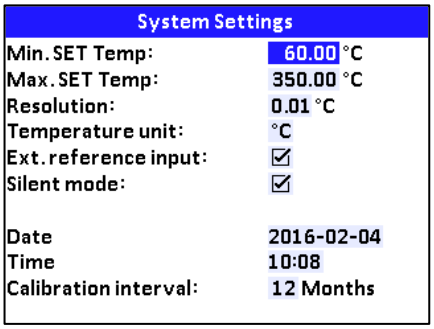
5.1.1 System menu

The System menu can be accessed at any stage of operation:

1. Press the (System) key to display the System menu.
2. Use the ▲(Up) and ▼(Down) Arrow keys to scroll in the list.



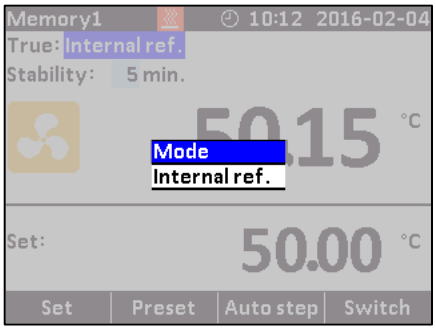
System Settings menu



1. Use the (Enter) key and the ▲(Up) and ▼(Down) Arrow keys to access editable fields, select new values and accept new values.

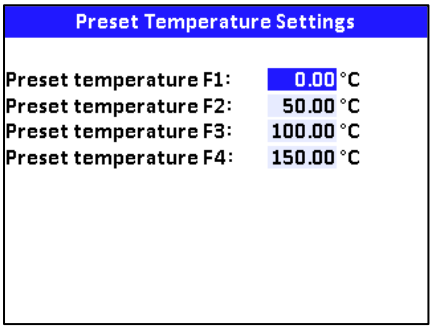
Note…

- If the current set-temperature is higher than the new max-temperature, you will need to adjust the set-temperature. The instrument will immediately begin to cool (if required) as soon as the new max-temperature is accepted.
- The calibration interval can be set between 1 and 99 months. When the calibration interval is exceeded, a yellow warning symbol ⚠ will appear in the upper part of the display. The recalibration interval is not used for the external reference sensor. The interval for this sensor is stored in the intelligent sensor.
- If the Ext. reference input setting is disabled, it will not be possible to select the external reference or SET follows true from the Mode menu. Only the internal reference can be selected and displayed in the main display (C-models only).



- If Silent mode is selected, the cooling speed will be reduced.

Presets menu

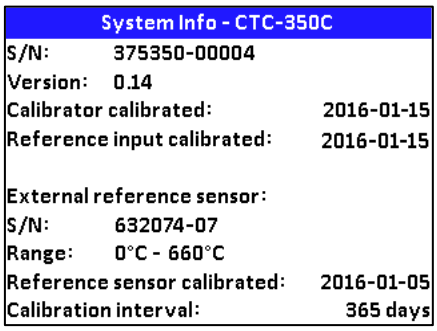


The preset temperatures can be changed manually using the (Arrows) keys.

Note…

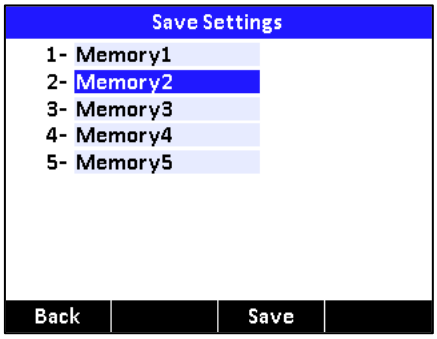
Temperature range is limited by Min. SET Temp. and Max. SET Temp. settings editable in the System Settings menu and by the temperature range of the external reference sensor, if connected.

System Info menu



In the System Info menu important information such as serial numbers and calibration dates of both the instrument and the external reference sensor are given.
It is not possible to edit any fields in this menu.

Store menu (Save Settings)



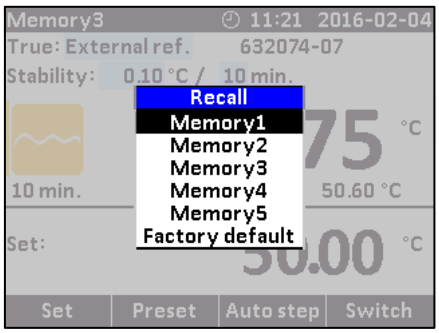
After you have configured the instrument, you can save the setup for future use using the Store function.

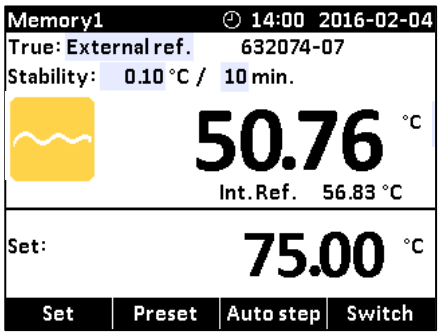
1. Use the ▲ (Up) and ▼ (Down) Arrow keys to select the Memory-setup you want to modify, and press F3 (Save). The new configuration is now saved.
2. You can change the name of the highlighted saved setup by pressing (Enter), and then using the ▲ (Up) and ▼ (Down) Arrow keys to change the characters.

The name is limited to seven (7) characters.

3. Press F3 to save the new name.

Recall menu





To recall your memory setups select the Recall function.

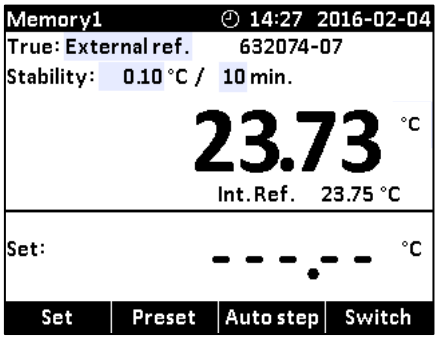
1. Use the ▲ (Up) and ▼ (Down) Arrow keys to to scroll in the setup-list.
2. Select the requested setup, and press ◯ (Enter).

   The name of the setup will appear in the upper-left corner of the display.

   If selecting the Factory default function the active setup will be reset and change to the initial setting.

5.2 Starting the calibrator

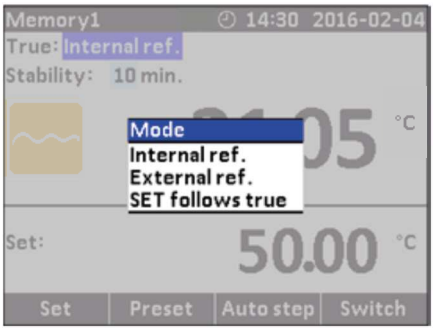
Switch on the calibrator using the power control switch (see section 4.3).
A start up screen is displayed and then replaced with the main menu screen:



The functions in the horizontal menu bar are available using the Functions soft keys F1 – F4. For Operating principle – See section 5.1.

5.3 Selecting a TRUE – reference sensor (C-models only)

1. Press one of the ✥ (Arrow) keys and the ◯ (Enter) key to access the Mode menu.

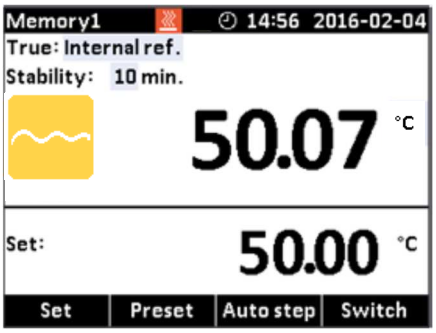


You can choose between one of the following sensor constellations:

- Internal reference source (A and C models)
- External reference source (C models only)
- SET follows TRUE (C-models only)

Internal reference source

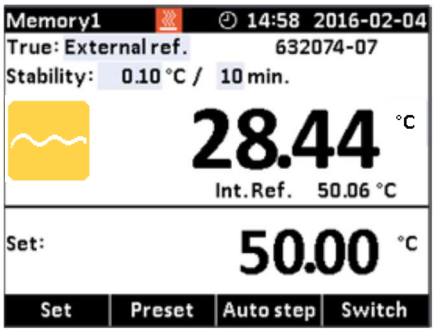
The internal reference sensor will be displayed as the TRUE value on the main screen.



The calibrator has a set of internal stability criteria it shall meet before stability is indicated. The stability time may be set beyond the internal stability criteria.
The stability time can be set (in minutes) using integers from 5 – 99

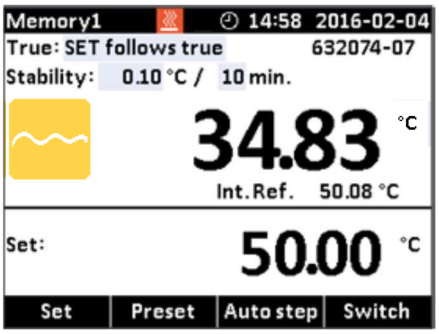
External reference source (C-models only)

The TRUE value on the main screen will be read from the Intelligent Reference Sensor connected to the REF. INPUT on the front panel (see section 4.3, fig 3). The calibrator automatically reads the calibration data and serial number of the Sensor.



SET follows TRUE (C-models only)

This function enables you to reach the TRUE temperature measured by the External reference sensor.
The TRUE value on the main screen will be read from the Intelligent Reference Sensor connected to the REF. INPUT on the front panel (see section 4.3, fig 3). The calibrator automatically reads the calibration data and serial number of the Sensor.



Note…

that when “SET follow true” is selected, the calibrator will control the temperature to the TRUE temperature. This means that it could take longer time before the calibrator indicates stability.

5.4 Stability setting

True: Internal reference

When internal reference is selected the calibrator uses a set of minimum internal stability criteria that shall be met before stability is indicated.

The stability time can be adjusted from the minimum internal stability time (typical 5 min) up to 99 min.

True: External reference

When internal reference is selected the user can adjust both stability tolerance and stability time.

The Stability tolerance can be set between 0.01°C to 1.00°C. The tolerance should be set low enough to utilize the good temperature stability of the calibrator – however a low value also gives a longer time to be stable.

The stability time can be set from 1 – 99 minutes.

When the TRUE temperature has reached the specified Stability tolerance during the specified Stability time, then the stability indicator in the main screen will turn green.

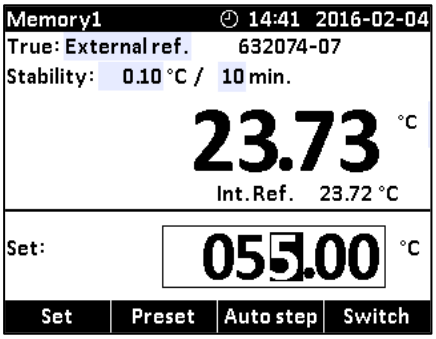
5.5 Selecting the set-temperature

Note…

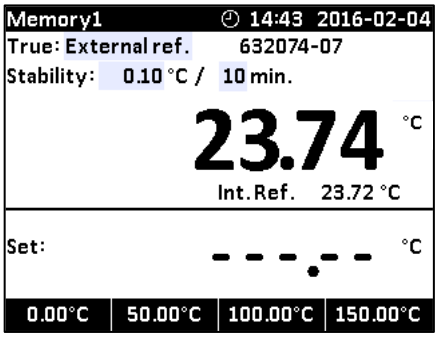
Temperature range is limited by Min. SET Temp. and Max. SET Temp. settings editable in the System Settings menu and by the temperature range of the external reference sensor, if connected.

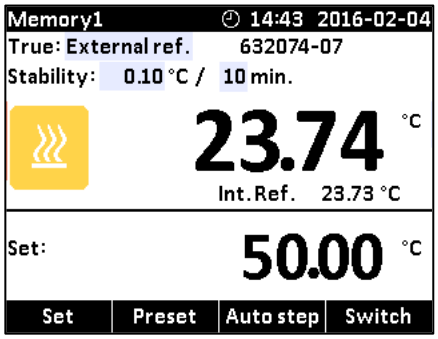
The set-temperature can be entered both manually and by selecting a preset temperature.

2. For manually use press F1 (Set)
3. Use the (Arrow) keys to enter the temperature requested.
4. Press (Enter) to accept the entered temperature.



1. For selecting the preset temperature press F2 (Preset).
2. Select one of the 4 temperature options available from the menu bar by pressing the correspondent Function key (F1 – F4).
3. The set-temperature is selected, once the Function key has been pressed.



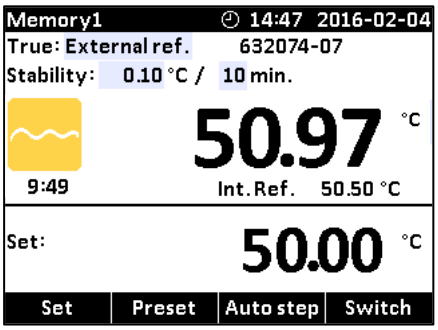


The calibrator will now heat up / cool down.

The starting point is the last chosen set-temperature (even if the instrument has been switched off).

The top display continuously shows the read-temperature and the lower display shows the set-temperature.

In the top display the calibrator will indicate the estimated time in whole minutes until the calibrator will be stable.



When the calibrator is stable the display will show a green 

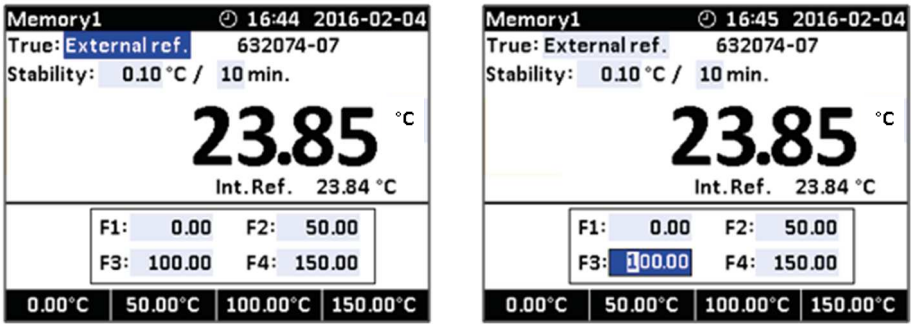
checkmark symbol and the instrument will emit an audible alarm. The instrument will indicate in minutes and seconds for how long the instrument has been stable.

5.5.1 Editing the preset set-temperature

It is possible to change the preset set temperature to whatever value desired.

1. Press F2 (Preset).
2. Press one of the  (Arrow) keys and an editable field displaying the preset set temperatures appears.

3. Navigate to the set temperature field using the arrows.

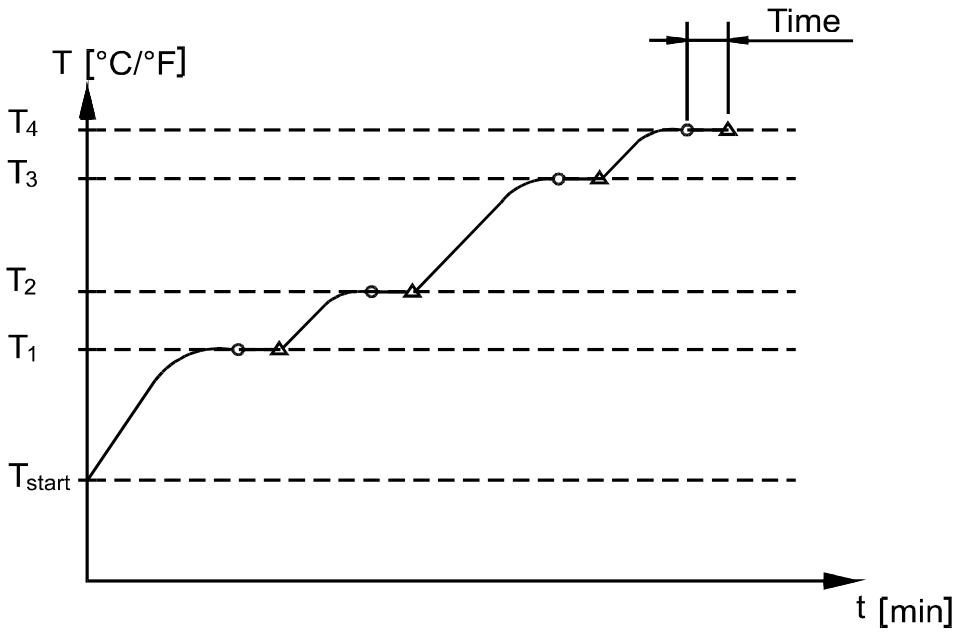


4. Press (Enter) to access the editable field and use the arrows ▲ (Up) and ▼ (Down) to select a new set value.
5. Press (Enter) to accept the new set value.
6. Press (Back) to return to the previous menu.

5.6 Auto Step function

Auto Step is used to step automatically between a range of different calibration temperatures. This is useful when calibrating sensors in places which are hard to reach, and when calibrating sensors for which the output is displayed in a different location.

The function can be illustrated using the following example:



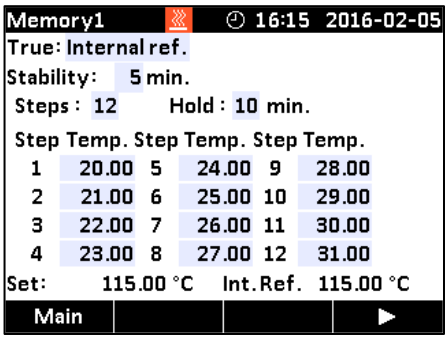
- ○ Calibrator stable
- △ Calibrator starts working towards next temperature

Note…

Temperature range is limited by Min. SET Temp. and Max. SET Temp. settings editable in the System Settings menu and by the temperature range of the external reference sensor, if connected.

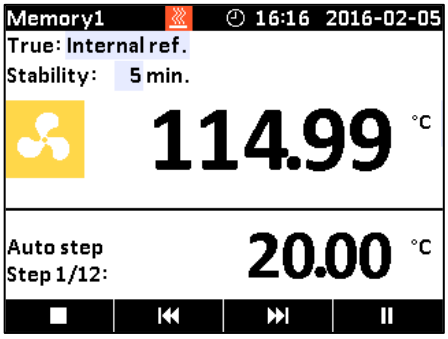
5.6.1 Running an Auto Step test

1. Press F3 (Auto Step) to access the Auto Step setup. If you wish to return to the Main screen press F1 (Main).



2. Press one of the (Arrow) keys to access the editable fields for new values:
   - **No of steps**: the number of temperature steps per direction (T_1➔T_x) can be set using integers from 2 to 12. You must select minimum 2 steps, maximum 12 steps.
   - **Hold time**: defines the time (in minutes) the temperature is maintained (after it is stable) for each step.
   - **Step** values: must be set within the sensors permitted range.

3. Press ▶ (F4) to start the Auto Step test.



The Auto Step test is now in progress.

While the Auto Step test is in progress, 4 options are available:

- **Stop** : Press ■ (F1) to stop the Auto Step test. The process will end.
  Pressing the ▶ (F4) key the process will start again running step 1.
- **Previous** : Press ⏮ (F2) to force the test to jump a step backwards to the previous running step regardless of the step's stability.
- **Next** : Press ⏭ (F3) to force the test to jump a step forwards to the next running step regardless of the step's stability.
- **Pause** : Press ⏸ (F4) to pause the test. Pressing start ▶ (F4) again, the process will continue running from the current step.

5.6.2 The calibrator's Auto Step procedure

1) Once the Auto Step test is started, the calibrator starts working towards the given set-temperature. An audible alarm will be emitted once the calibrator is stable.

2) The calibrator will wait the specified amount of hold time. The instrument indicates this by counting down the amount of time remaining:

3) The calibrator will then go to the next step. The procedure is the same as for the first step. This process will be repeated until the last step has been executed and the function has been completed.

4) The measured TRUE temperatures for each step are displayed during operation.



5.7 Switch Test function

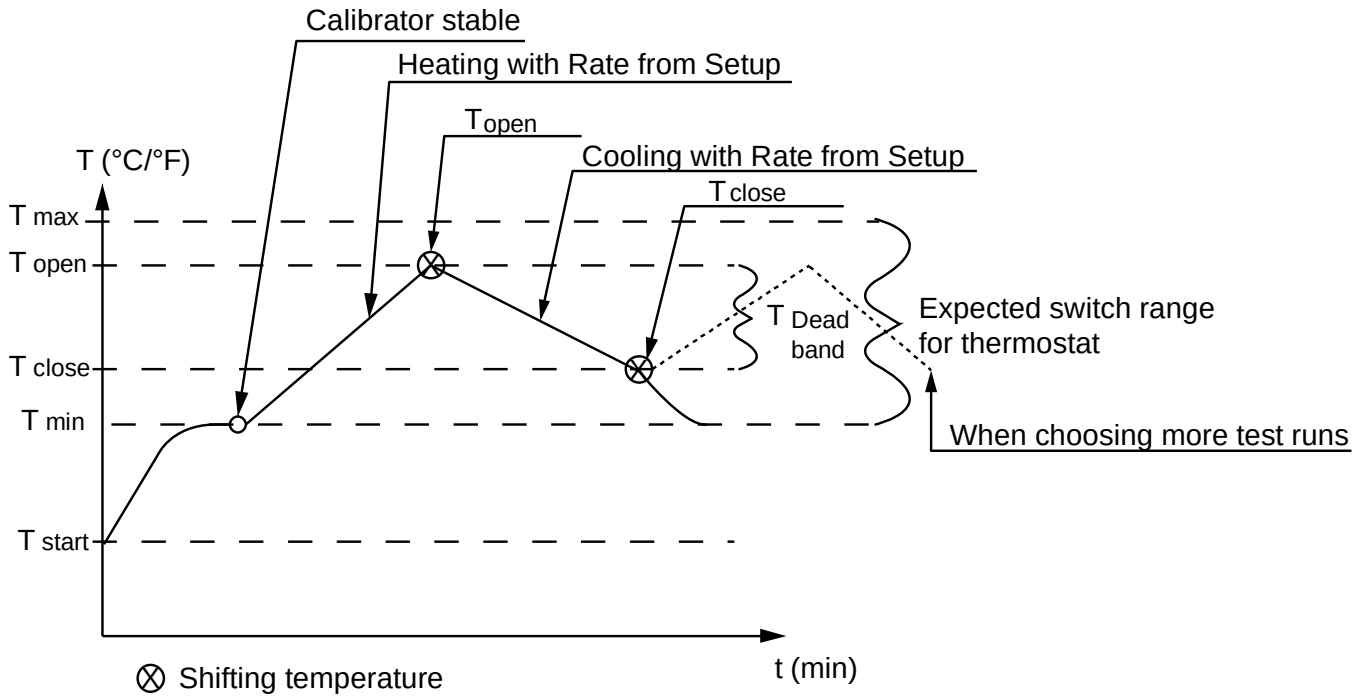
Switch Test automatically locates the switch temperature of a thermostat.

Three parameters are required:

- Start temperature (T_1)
- End temperature (T_2)
- Rate of change in temperature pr. minute (Rate).

Dead band of a thermostat can also be determined here. Where the dead band determines the tolerance between the upper switch temperature and the lower switch temperature of the thermostat.

The function can be illustrated using the following example:



5.7.1 Running a Switch Test

Note…

Before running the Switch Test, make sure that the switch is connected to the Switch Test input.

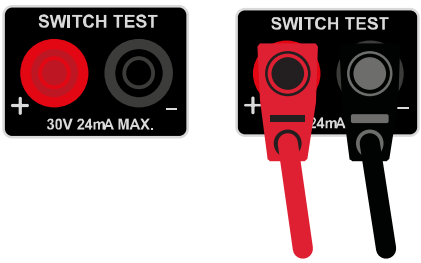
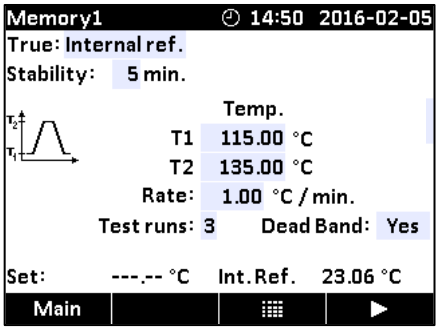


Fig. 4
Switch Test input

Note…

Temperature range is limited by Min. SET Temp. and Max. SET Temp. settings editable in the System Settings menu and by the temperature range of the external reference sensor, if connected.

1. Press F4 (Switch) to access the Switch Test setup. If you wish to return to the Main screen press F1 (Main).



The small graph illustrates the current T_1, T_2 and dead band selections. Note that T_1 can be greater than T_2.

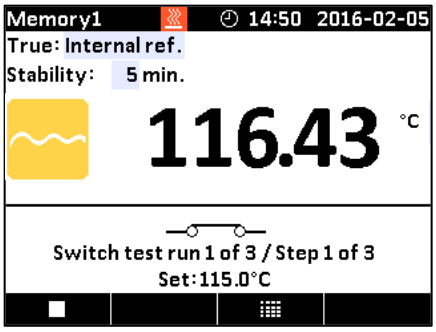
2. Press one of the (Arrow) keys to access the editable fields for new values:

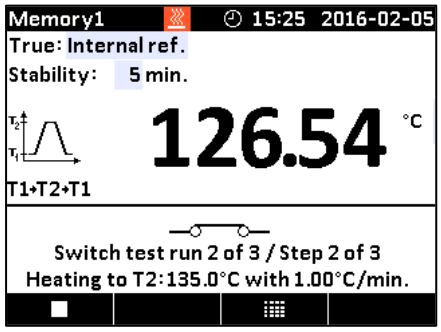
- **T_1** : First set temperature
- **T_2** : Second set temperature
- **Dead band** : To determine dead band, toggle between "Yes" (a two-way-temperature measurement) and "No" (a one-way-temperature measurement). A dead band result is only measured when dead band is set to “Yes”.
- **Rate** : The permitted range is 0.01 - 10.0°C/min. / 0.02 - 18.0°F/min.
- **Test runs**: Can be set from 1 to 3 making it possible to run the test more than once.

Note…

the Rate should be set so that the thermostat sensor can follow the temperature in the calibrator's well.

3. Press ▶ (F4) to start the Switch Test.





The Switch test is now in progress.

While the Switch Test is in progress, 2 options are available:

- **Stop** : Press ■ (F1) to stop the Switch Test. The process will end and the results will be deleted from the results list.
  Pressing the ▶ (F4) key the process will start from the beginning heating towards T_1.

- **Results** : Press (F3) to display the current Switch Test result. The results change as the test progresses. The results list is also accessible from the Switch Test menu screen.

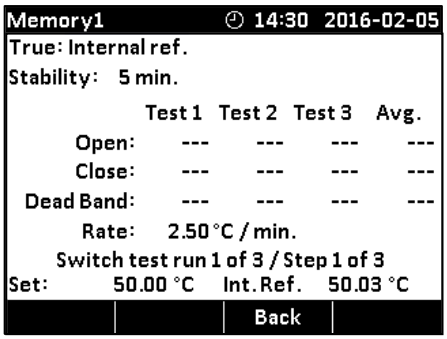
5.7.2 The calibrator's Switch Test procedure

1) Once the Switch Test is started, the calibrator starts working towards T_1 as quickly as possible. The calibrator's temperature changes (heating or cooling) and switch status are shown in the display.

2) When T_1 is achieved and the temperature is stable, the text and the graphic in the bottom of the screen will change accordingly.

3) The calibrator now starts working towards T_2 at the specified Rate.

4) In a normal situation, the thermostat changes state before T_2 is achieved. If T_2 is achieved and the temperature is stable, no results will be displayed.

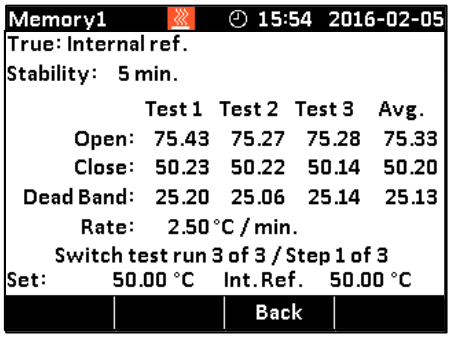


5) When dead band is not selected (single temperature change) (the graphic indicates the choice), the finished switch test result is displayed.

   When dead band is selected (two switch changes), the calibrator starts working towards T_1 at the specified Rate.

6) Normally, the thermostat changes state before T_1 is achieved. If T_1 is reached and the temperature is stable, no results will be displayed.

7) The finished switch test results are displayed in the results list by pressing (F3).
   The results show the temperature when the thermostat has closed and the temperature when it has opened – whichever comes first. The difference between these 2 temperatures is calculated as the dead band.



6.0 Storing and transporting the calibrator



Caution…

The following guidelines should always be observed when storing and transporting the calibrator. This will ensure that the instrument and the sensor remain in good working order.



Warning

- The calibrator **must** be switched off before any attempt to service the instrument is made. There are no user serviceable parts inside the calibrator.
- Remember to use appropriate protective equipment or get help when carrying the calibrator (for a longer distance) in order to prevent injuries from dropping the calibrator.

The following routine must be observed **before the insertion tube is** removed and the instrument switched off:



Over 50°C/122°F

If the calibrator has been heated up to temperatures above 50°C/122°F, you must wait until the instrument reaches a temperature **below 50°C/122°F** before you switch it off.



Below 0°C/32°F
(applies only to the CTC-155 models)

- **Do not** touch the well or insertion tube when these are below 0°C/32°F - they might create frostbite.
- If the calibrator has reached a temperature below 0°C/32°F, ice crystals may form on the insertion tube and on the well. This, in turn, may cause the material surfaces to oxidize.
  To prevent this from happening, the insertion tube and the well must be dried. This is done by heating up the calibrator to min. 100°C/212°F until all water left has evaporated.

  Remove the insulation plug while heating up.

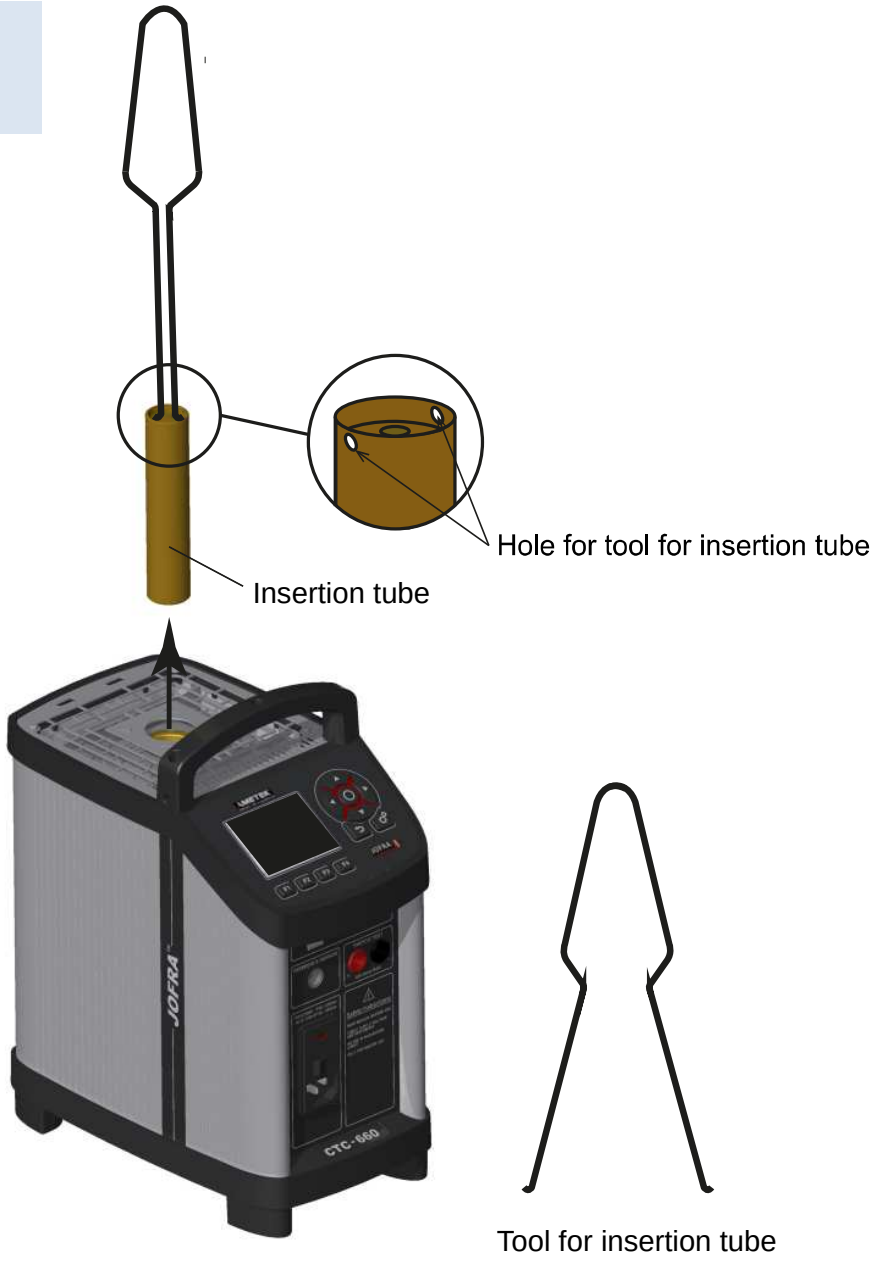
  It is very important that humidity in the well and insertion tube is removed to prevent corrosion and frost expansion damages.

1. Switch off the calibrator using the power control switch.

   Note that the calibration procedure may be interrupted at any time using the power control switch. Switching off the calibrator during the calibration process will not damage either the instrument or the sensor.

2. Remove the insertion tube from the calibrator using the tool for insertion tube supplied with the instrument as shown in fig. 5.

Fig. 5
Removing insertion tube





Caution – Hot surface

Do not remove the insert from the calibrator before the insert has cooled down to less than 50°C/122°F



Caution…

- The insertion tube must **always** be removed from the calibrator after use.

  The humidity in the air may cause corrosion oxidation on the insertion tube inside the instrument. There is a risk that the insertion tube may get stuck if this is allowed to happen.
- If the calibrator is to be transported long distances, the insertion tube **must** be removed from the well to avoid damage to the instrument. If the insertion tube is not removed from the CTC-1205 the ceramic well might crack.



Warning

- **Never** leave hot insertion tubes which have been removed from the calibrator unsupervised – they may constitute a fire hazard or personal injury.

  If you intend to store the calibrator in the optional aluminium carrying case after use, you **must** ensure that the instrument has cooled to a temperature **below 50°C/122°F** before placing it in the carrying case.
- **Never** place a hot insertion tube in the optional carrying case.
- **Do not** touch the well or insertion tube when these are deep frozen – they might create frostbite.

7.0 Error messages (List of alarms)

Warning

The calibrator **must** be switched off before any attempt to service the instrument is made. There are no user serviceable parts inside the calibrator.

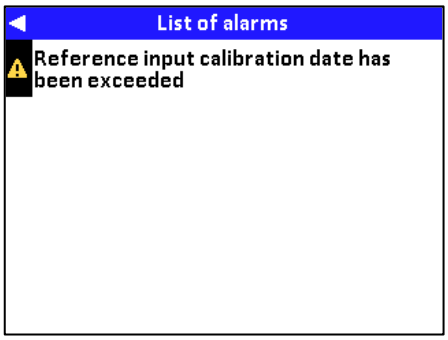
Note…

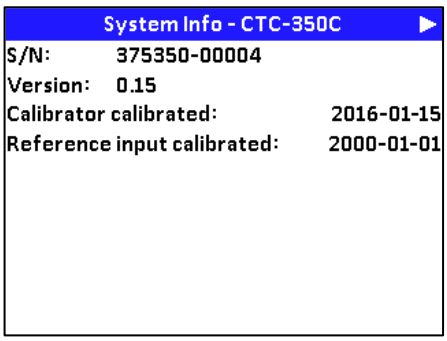
AMETEK Denmark's liability ceases if:

- parts are replaced/repaired using spare parts which are not identical to those recommended by the manufacturer.
- non-original parts are used in any way when operating the instrument.

AMETEK Denmark's liability is restricted to errors which originated from the factory.

If the calibrator detects an error during operation, the instrument will terminate all functions and display a list of alarms. Make a note of the error message and contact your distributor or AMETEK Denmark's service department.





1. Press ◀ (Left) to access the System Info display for status information on the instrument.

2. Press ▶ (Right) to return to the list of alarms.

Note…

Errors that are critical to safety and the calibrator remain on the list of alarms until the instrument is switched off and on again.

The following alarms can occur:

Error message:	Solution:
Wrong mains frequency Please enter code to proceed	Contact your local distributor in order to obtain a special pin code.
Mains frequency cannot be measured	Please report the error to your local distributor or to AMETEK Denmark's service department.
Temperature cut off error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Heater 1-2 error	Please report the error to your local distributor or to AMETEK Denmark's service department.

Error message:	Solution:
Heater 3-4 error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Temperature control error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Ambient temperature too high	Cool down instrument. Check that ambient temperature is within specified values. Check fan inlet. If the error still occurs, please report the error to your local distributor or to AMETEK Denmark's service department.
Well temperature too high	Please report the error to your local distributor or to AMETEK Denmark's service department.
Watchdog reset has occurred	Please report the error to your local distributor or to AMETEK Denmark's service department.
Software reset has occurred	Please report the error to your local distributor or to AMETEK Denmark's service department.
Calibrator calibration date has been exceeded	The instrument needs to be calibrated. Please return the instrument to AMETEK Denmark's service department or to your national laboratory.
Reference input calibration date has been exceeded	The instrument needs to be calibrated. Please return the instrument to AMETEK Denmark's service department or to your national laboratory.
Reference sensor calibration date has been exceeded	The instrument needs to be calibrated. Please return the instrument to AMETEK Denmark's service department or to your national laboratory.
Communication error, RTC	Please report the error to your local distributor or to AMETEK Denmark's service department.
Communication error, safety DAC	Please report the error to your local distributor or to AMETEK Denmark's service department.
EEPROM read/write error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Calibrator coefficients have not been set	Please report the error to your local distributor or to AMETEK Denmark's service department.
Default configuration loaded Model number has to be set	Please report the error to your local distributor or to AMETEK Denmark's service department.
Default configuration loaded	Please report the error to your local distributor or to AMETEK Denmark's service department.
Wrong PCB according to configured variant	Please report the error to your local distributor or to AMETEK Denmark's service department.
Illegal hardware version	Please report the error to your local distributor or to AMETEK Denmark's service department.
Fan speed to low	Please check that the fan is not blocked

Error message:	Solution:
Extension board not connected	Please report the error to your local distributor or to AMETEK Denmark's service department.
Sensor type not found	This particular external reference type is not designed to be used in the CTC-calibrator
Illegal sensor type	This particular external reference type is not designed to be used in the CTC-calibrator
Internal RTD excitation current too low	Please report the error to your local distributor or to AMETEK Denmark's service department.
Internal RTD excitation current too high	Please report the error to your local distributor or to AMETEK Denmark's service department.
Internal ref. temperature too high	Internal reference temperature has measured a value outside the temperature calibrator temperature range. Please report the error to your local distributor or to AMETEK Denmark's service department.
Internal ref. temperature too low	Internal reference temperature has measured a value outside the temperature calibrator temperature range. Please report the error to your local distributor or to AMETEK Denmark's service department.
Safety sensor temperature too high	Temperature protection sensor has measured a value outside the temperature calibrator temperature range. Please report the error to your local distributor or to AMETEK Denmark's service department.
Safety sensor temperature too low	Temperature protection sensor has measured a value outside the temperature calibrator temperature range. Please report the error to your local distributor or to AMETEK Denmark's service department.
Temperature sensor error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Peltier power 1 error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Peltier power 2 error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Heater 1 error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Heater 2 error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Heater 3 error	Please report the error to your local distributor or to AMETEK Denmark's service department.
Heater 4 error	Please report the error to your local distributor or to AMETEK Denmark's service department.

Error message:	Solution:
 Safety circuit activated by well temp.	Information after “Well temperature too high” error. Will remain active until a new SET-temperature is activated.
 Safety circuit activated by ambient temp.	Information after “Ambient temperature too high” error. Will remain active until a new SET-temperature is activated.
 Safety circuit activated	Information when the temperature safety circuit is trigged. Will remain active until a new SET-temperature is activated.

8.0 Returning the calibrator for service

When returning the calibrator to the manufacturer for service, please enclose a fully completed service information form. Simply copy/print out the form on the following page and fill in the required information.
The calibrator should be returned in the original packing.
Furthermore please follow the guidelines for transportation described in section 6.0 – Storing and transporting the calibrator.

Service info

Customer data: **Date:**

Customer name and address:_____

Attention and dept.:_____

Fax no./phone no.:_____

Your order no.:_____

Delivery address:_____

Distributor name:_____

Instrument data:

Model and serial no.:_____

Warranty claimed Yes:_____ No:_____ Original invoice no.:_____

Temp. calibration	Sensor input	**Service request:**	**This instrument is sent for (please check off):**
☐	☐	___ Calibration as left	___ Check
☐	☐	___ Calibration as found and as left	___ Service
☐	☐	___ Accredited calibration as left	___ Repair
☐	☐	___ Accredited calibration as found and as left.	

Diagnosis data/cause for return:

Diagnosis/fault description:_____

Special requests:_____

Safety precautions: if the product has been exposed to any hazardous substances, it must be thoroughly decontaminated before it is returned to AMETEK Denmark A/S. Details of the hazardous substances and any precautions to be taken must be enclosed.

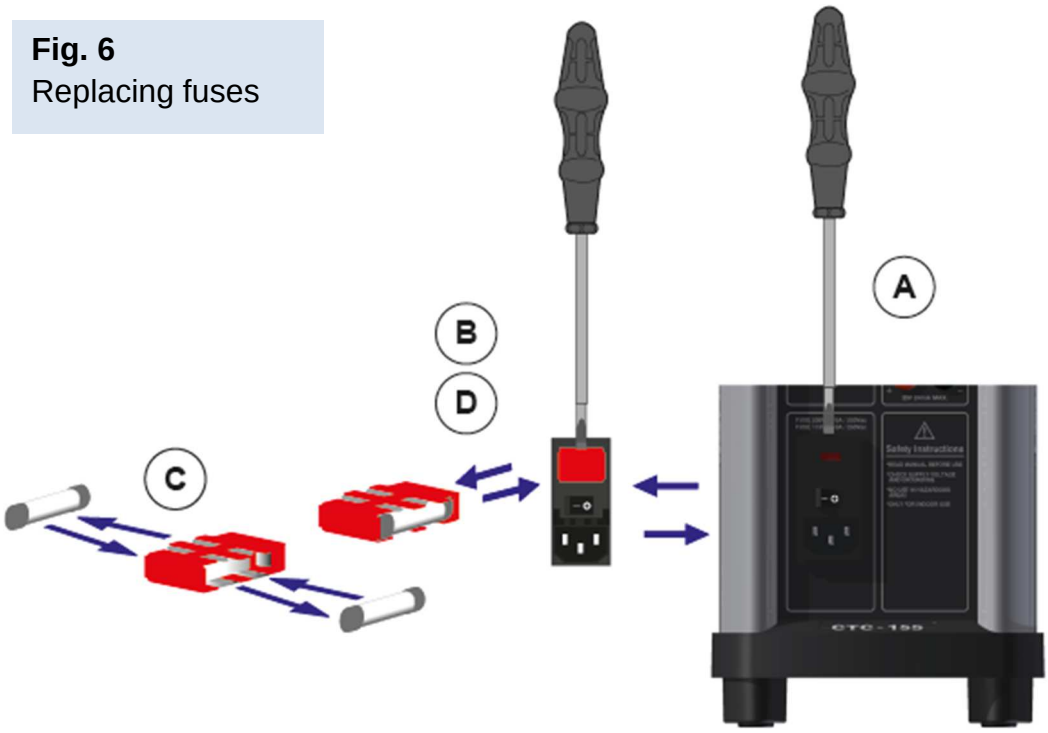
9.0 Maintenance

9.1 Replacing the main fuses

Warning

- The calibrator **must** be switched off before any attempt to service the instrument is made. There are no user serviceable parts inside the calibrator.
- The fuse box **must not** be removed from the power control switch until the mains cable has been disconnected.
- The two main fuses must have the specified current and voltage rating and be of the specified type. The use of makeshift fuses and the short-circuiting of fuse holders are prohibited and may cause a hazard.

Fig. 6
Replacing fuses



A. Locate the main fuses in the fuse box in the power control switch and check the voltage of the power control switch (on/off switch (230V/115V)). If the voltage of the power control switch differs from the line voltage, you must adjust the voltage of the power control switch.

B. Open the lid of the fuse box using a screwdriver and remove the fuse box.

C. Replace the fuses. The fuses must be identical and should correspond to the line voltage.

- CTC-155/350/652/660: 115V: 10AF/250V = 60B302 / 230V: 5AF/250V = 127573
- CTC-1205: 115V: 8AT/250V = 127211 / 230V: 4AT/250V = 127210

If the fuses blow immediately after you have replaced them, the calibrator should be returned to the manufacturer for service.

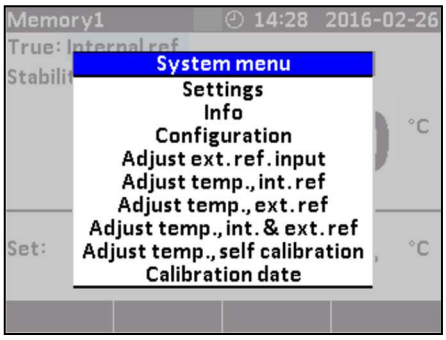
D. Slide the fuse box into place with the correct voltage turning upwards.

9.2 Maintenance mode

The user can change the configuration of the instrument by accessing the Maintenance mode.

1. Press (Enter) while switching on the calibrator using the ON/OFF switch.

2. Wait a few seconds and press the (System) key to access the Maintenance System menu.



From the Maintenance System menu you can access the System Settings, the System Info, the Configuration and the Calibration date. You are also presented to a selection of adjustment options.
The editable possibilities in the System Settings and the System Info are the same as described in section 5.1.1.

Configuration

If the system is locked on a specific main frequency it is possible to change this frequency.

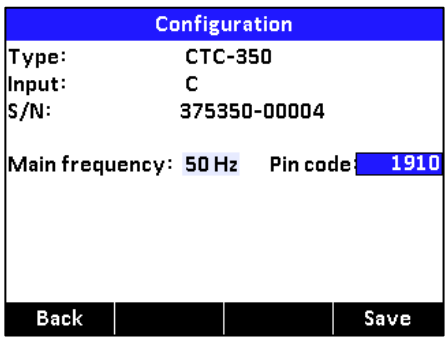
The alarm list will be displayed with the following text:

Wrong mains frequency

Note…

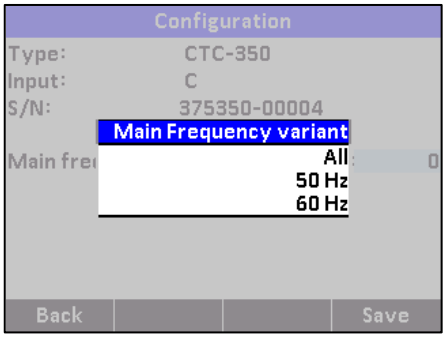
In order to change the main frequency a pin code is needed. Please contact your local distributor to obtain your special pin code.

1. Select the Configuration mode.



2. Type in the pin code obtained from the distributor using the ▲ (Up) and ▼ (Down) keys. The pin code must consist of 4 digits.

3. Select a new main frequency from the Main Frequency variant list



4. Press F4 (Save) to save the configuration set up.

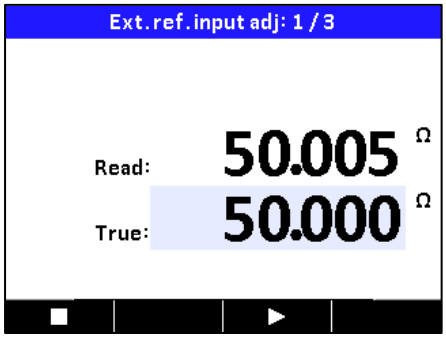
Adjusting external reference input (CTC-155/350/652/660)

In order to adjust the external reference input a 50Ω and a 330Ω resistance must be connected to external reference input using cable 128999 or 129093.

Fig. 7
Resistance connected to the external ref. input



1. Select the Adjust ext. ref. Input mode.



Read and True are displayed, True as an editable line.

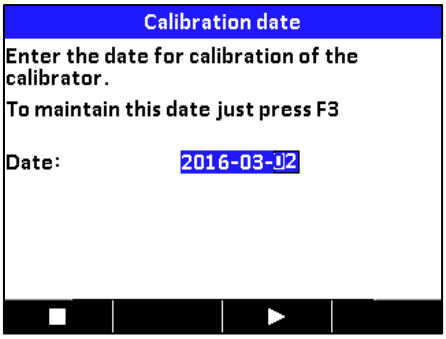
2. The Read value is automatically read and when the calibrator is stable an audible alarm will be emitted.
3. Type in the True value of the connected resistance using the ▲ (Up) and ▼ (Down) keys.
4. Press ▶ Continue (F3) to activate the heating up/cooling down process and

wait until the first calibration temperature has been reached.

5. Once the calibrator indicates stability, press ▶ Continue (F3) again and wait for the next stability indication.
6. Now the adjusting process is complete (the ▶ (Continue) key can only be pressed twice), and a new calibration date must be typed in. The calibrator will automatically ask for a new date.

Calibration date

1. Select the Calibration date mode.



2. Use the ▲ (Up) and ▼ (Down) keys to enter a new date.
3. Press ◯ (Enter) to accept the new date.
4. Press ▶ (F3) to continue to the next screen setup.
5. Continue pressing the ▶ (Continue) key until the process is completed.

Adjusting external reference input (CTC-1205)

In order to adjust the external reference CJC input, a 50Ω and a 1500Ω resistance must be connected to external reference input using cable 128999.

In order to adjust the external reference mV input, a 0mV and a 78mV voltage source must be connected to external reference input using cable 128999.

Fig. 8
mV source connected to the external ref. input

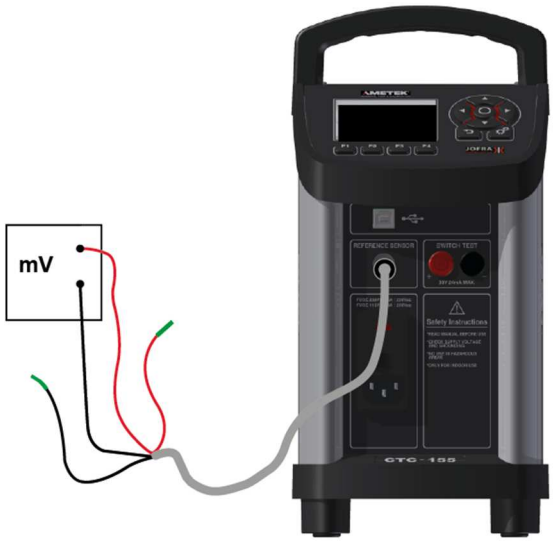
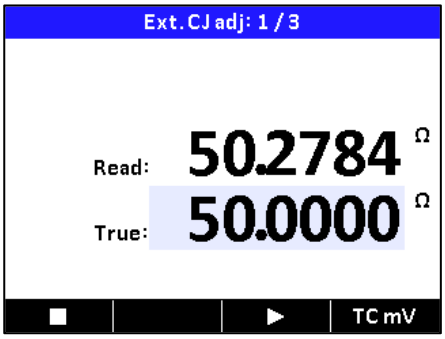
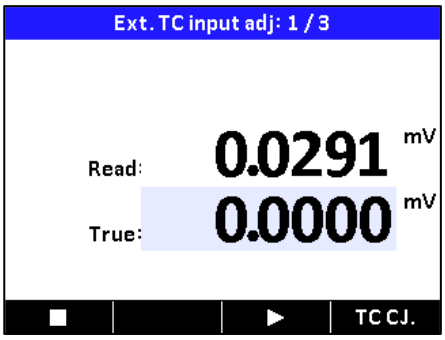


Fig. 9
Resistance connected to the external ref. input



1. Select the Adjust ext. ref. Input mode. Change mode CJC or mV by pressing F4 (TC mV or TC CJ).



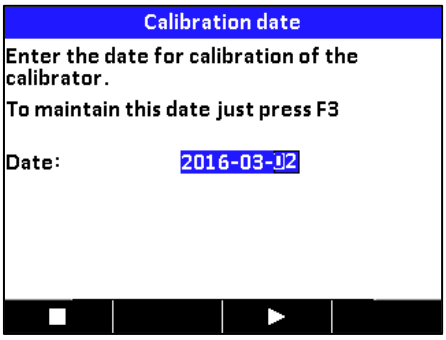


Read and True are displayed, True as an editable line.

2. The Read value is automatically read and when the calibrator is stable an audible alarm will be emitted.
3. Type in the True value of the connected resistance using the ▲ (Up) and ▼ (Down) keys.
4. Press ▶ Continue (F3) to activate the heating up/cooling down process and wait until the first calibration temperature has been reached.
5. Once the calibrator indicates stability, press ▶ Continue (F3) again and wait for the next stability indication.
6. Now the adjusting process is complete (the ▶ (Continue) key can only be pressed twice), and a new calibration date must be typed in. The calibrator will automatically ask for a new date.

Calibration date

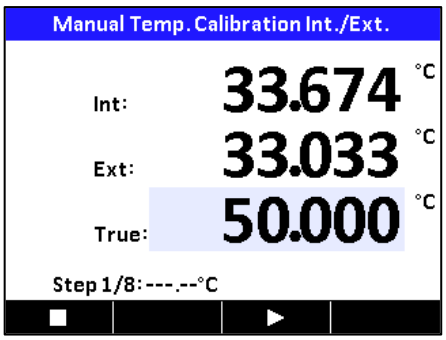
1. Select the Calibration date mode.



2. Use the ▲ (Up) and ▼ (Down) keys to enter a new date.
3. Press ◉ (Enter) to accept the new date.
4. Press ▶ (F3) to continue to the next screen setup.
5. Continue pressing the ▶ (Continue) key until the process is completed.

Adjusting temperature, internal reference
Adjusting temperature, external reference
Adjusting temperature, internal & external reference

1. Place the reference sensor in the calibrator.
2. Select the Adjust temp., mode for the wanted adjustment procedure.
3. Press ○ (Enter) and the calibrator starts heating up/cooling down to reach the first calibration temperature.
4. When the calibrator is stable an audible alarm will be emitted.
5. Type in the reference temperature found using the reference thermometer. Use the ▲ (Up) and ▼ (Down) keys to type in the value.



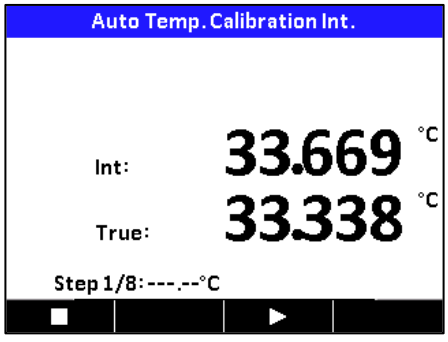
6. Press ○ (Enter) to accept the value.
7. Press ▶ Continue (F3) to activate the heating up/cooling down process and wait for the stability indication.
8. Once the temperature is stable, press ▶ Continue (F3) again.
9. Continue pressing the ▶ (Continue) key until the adjusting process is completed.
10. When the temperature has been adjusted a new calibration date must be typed in. The calibrator automatically asks for a new date.

Adjusting temperature, self calibration

Note…

Performing this adjustment will overwrite the above-mentioned adjustment.

1. Place the external JOFRA STS reference sensor in the calibrator and connect it to the external reference input.
2. Select the Adjust temp., self calibration mode.
3. Press ▶ Start (F4). The self calibration starts running automatically step by step as shown in the table below.



Adjustment temperature – Calibration Steps				
CTC-155	CTC-350	CTC-652	CTC-660	CTC-1205
-25°C, -10°C, 0°C, 50°C, 100°C, 155°C	50°C, 100°C, 200°C, 300°C, 350°C	50°C, 200°C, 350°C, 500°C, 650°C	50°C, 200°C, 350°C, 500°C, 660°C	100°C, 300°C, 450°C, 600°C, 750°C, 900°C, 1050°C, 1205°C

9.3 Cleaning



Caution…

- Before cleaning the calibrator, you **must** switch it off, allow it to cool down and remove all cables.
- The insertion tube must **always** be removed from the calibrator after use.

  The humidity in the air may cause corrosion oxidation on the insertion tube inside the instrument. There is a risk that the insertion tube may get stuck if this is allowed to happen.



Caution – Hot surface

Do not remove the insert from the calibrator before the insert has cooled down to less than 50°C/122°F



Warning (all versions)

- **Never** leave hot insertion tubes that have been removed from the calibrator unsupervised – they may constitute a fire hazard or personal injury.

  If you intend to store the calibrator in the optional aluminium carrying case after use, you **must** ensure that the instrument has cooled to a temperature **below 50°C/122°F** before placing it in the carrying case.
- **Do not** touch the well or insertion tube when these are deep frozen – they can create frostbite.

Users should/must carry out the following cleaning procedures as and when required:

- **The exterior of the instrument –** Clean using water or isopropyl alcohol and a soft cloth. The cloth should be wrung out hard to avoid any water penetrating the calibrator and causing damage.
  The keyboard may be cleaned using isopropyl alcohol when heavily soiled.

- **The insertion tube -** Must **always** be clean and should be regularly wiped using a soft, lint-free, dry cloth.
  You must ensure there are no textile fibres on the insertion tube when it is inserted in the well. The fibres may adhere to the well and damage it.

  If the calibrator has reached a temperature below 0°C/32°F, ice crystals may form on the insertion tube. This, in turn, may cause the material surfaces to oxidize (CTC-155 only).

  To prevent this from happening, the insertion tube must be dried. This is done by heating up the calibrator to min. 100°C/212°F until all water left has evaporated.
  Remove the insulation plug while heating up.

  It is very important that humidity in the insertion tube is removed to prevent corrosion and frost expansion damages.

- **The well -** Must **always** be clean.
  Dust and textile fibres should be removed from the well using e.g. compressed air.



Warning

REMEMBER! Wear goggles when using compressed air!

If the calibrator has reached a temperature below 0°C/32°F, ice crystals may form on the well. This, in turn, may cause the material surfaces to oxidize (CTC-155 only).

To prevent this from happening, the well must be dried. This is done by heating up the calibrator to min. 100°C/212°F until all water left has evaporated.
Remove the insulation plug while heating up.

It is very important that humidity in the well is removed to prevent corrosion and frost expansion damages.

9.4 Adjusting and calibrating the instrument

You are advised to return the calibrator to AMETEK Denmark A/S or another accredited laboratory at least once a year for calibration.

9.5 Maintenance of STS-reference sensor

Use the configuration software CON050 supplied with the CTC to update calibration information in the intelligent reference sensor.

Read the STS- and CON050 manuals for instruction about calibration and up-/download procedure.

The following information in the sensor is used by the CTC and must be filled in correctly:

- Serial number
- Model number
- Sensor type
- Temperature range Min/Max
- Electrical output Min/Max
- RTD type (CvD or ITS-90) or TC-type (eg. N)
- Calibration date
- Calibration initials
- Calibration period
- R0, A, B and C (RTD type = CvD)
- RTPW, A(LR), B(LR)C(LR)/C1(LR), C2(LR), C3(LR), C4(LR), C5(LR) A(HR), B(HR), C(HR), D(HR) and W(HR) (RTD type = ITS-90)
- CJC R0, A, B, C and TC A, B, C (TC types)

All other data are not used by the CTC.

10.0 Technical specifications

All specifications are given with an ambient temperature of 23°C/73.4°F ± 3°C/5.4°F

MECHANICAL SPECIFICATIONS	**CTC-155 A/C**
Dimensions l × w × h	248 x 148 x 305 mm / 9.76 x 5.83 x 12.01 inch
Weight	5.5 kg / 12.1 lbs (without insertion tube)
Bore diameter/depth of well	Ø26 mm / 100 mm – ø1.02 inch / 3.94 inch
Weight non-drilled insertion tube	136 g / 4.8 oz
POWER SUPPLY	
Line voltage/frequency	90-127VAC / 180-254VAC 47-63 Hz
Power consumption	130 VA max.
Type of connection	IEC320
COMMUNICATION INTERFACES	
Type of connections	USB type B
ENVIRONMENT	
Ambient operating temperature range	0-50°C / 32-122°F
Storage temperature range	-20-50°C / -4-122°F
Humidity range	5-90% RH, non-condensing
Protection class	IP10
Altitude	0-2000 m
READOUT SPECIFICATIONS	
Resolution	1 / 0.1 / 0.01
Temperature units	°C / °F / K

THERMAL SPECIFICATIONS	**CTC-155 A/C**
Maximum temperature	155°C / 311°F
Minimum temperature *	-7°C / 19.4°F @ ambient temperature 50°C / 122°F -25°C / -13°F @ ambient temperature 23°C / 73.4°F -39°C / -38.2°F @ ambient temperature 0°C / 32°F

* The minimum temperature will be affected by the number of sensors and the dimensions of the sensors being calibrated.

THERMAL SPECIFICATIONS	CTC-155 A/C
Well specifications	Loaded with up to 4 mm external reference, one 4 mm and one 6 mm sensor : 30 mm / 1.18 inch axial homogeneity: 0.15°C / 0.37°F @ -25°C / -13°F to 23°C / 73.4°F 0.15°C / 0.27°F @ 23°C / 73.4°F to 155°C / 311°F 40 mm / 1.57 inch axial homogeneity: 0.25°C / 0.45°F @ -25°C / -13°F to 23°C / 73.4°F 0.30°C / 0.54°F @ 23°C / 73.4°F to 155°C / 311°F Difference between borings : 0.02°C / 0.036 @ -25°C / -13°F to 23°C / 73.4°F 0.03°C / 0.054 @ 23°C / 73.4°F to 155°C / 311°F Influence from 6 mm load : 0.20°C / 0.36°F Influence from 6 mm load with Ext. Reference : 0.01°C / 0.02°F Long term drift (1 year) : ±0.10°C / ±0.18°F
Temperature coefficient	±0.015°C/°C (0-20°C and 26-50°C) / ±0.027°F/°F (32-68°F and 79-122°F)
Stability	±0.04°C / ±0.07°F
Total accuracy	Internal reference: ±0.30°C / 0.54°F
Total accuracy – C models only	With STS-120 A 915 External reference: ±0.20°C / 0.36°F
Heating time incl. insertion tube	-25°C / -13°F to 23°C / 73.4°F : 4 min. 23°C / 73.4°F to 155°C / 311°F : 13 min.
Time to stability	10 min.
Cooling time incl. insertion tube	155°C / 311°F to 23°C / 73.4°F: 12 min. (12 min. silent mode) 23°C / 73.4°F to –25°C / -13°F : 16 min. (20 min. silent mode)

MECHANICAL SPECIFICATIONS	CTC-350 A/C
Dimensions l × w × h	248 x 148 x 305 mm / 9.76 x 5.83 x 12.01 inch
Weight	5.0 kg / 11.0 lbs (without insert tube)
Bore diameter/depth of well	Ø26 mm / 120 mm – ø1.02 inch / 4.72 inch
Weight non-drilled insertion tube	160 g / 5.6 oz
POWER SUPPLY	
Line voltage/frequency	90-127VAC / 180-254VAC 47-63 Hz
Power consumption	1150 VA max.
Type of connection	IEC320
COMMUNICATION INTERFACES	
Type of connections	USB type B
ENVIRONMENT	
Ambient operating temperature range	0-50°C / 32-122°F
Storage temperature range	-20-50°C / -4-122°F
Humidity range	5-90% RH, non-condensing
Protection class	IP10
Altitude	0-2000 m
READOUT SPECIFICATIONS	
Resolution	1 / 0.1 / 0.01
Temperature units	°C / °F / K

THERMAL SPECIFICATIONS	CTC-350 A/C
Maximum temperature	350°C / 662°F
Minimum temperature	55°C / 131°F @ ambient temperature 50°C / 122°F 28°C / 82°F @ ambient temperature 23°C / 73.4°F 5°C / 41°F @ ambient temperature 0°C / 32°F

THERMAL SPECIFICATIONS	CTC-350 A/C
Well specifications	Loaded with up to 4 mm external reference, one 4 mm and one 6 mm sensor : 30 mm / 1.18 inch axial homogeneity: 0.07°C / 0.13°F @ 28°C / 82.4°F to 200°C / 392°F 0.15°C / 0.27°F @ 200°C / 392°F to 350°C / 662°F 40 mm / 1.57 inch axial homogeneity: 0.10°C / 0.18°F @ 28°C / 82.4°F to 200°C / 392°F 0.20°C / 0.36°F @ 200°C / 392°F to 350°C / 662°F Difference between borings : 0.02°C / 0.036 @ 28°C / 82.4°F to 200°C / 392°F 0.04°C / 0.072 @ 200°C / 392°F to 350°C / 662°F Influence from 6 mm load : 0.25°C / 0.36°F @ 28°C / 82.4°F to 200°C / 392°F 0.35°C / 0.63°F @ 200°C / 392°F to 350°C / 662°F Influence from 6 mm load with Ext. Reference : 0.01°C / 0.02°F Long term drift (1 year) : ±0.15°C / ±0.27°F
Temperature coefficient	±0.015°C/°C (0-20°C and 26-50°C) / ±0.027°F/°F (32-68°F and 79-122°F)
Stability	±0.05°C / ±0.09°F
Total accuracy	Internal reference: ±0.40°C / 0.72°F @ 28°C / 82.4°F to 200°C / 392°F ±0.45°C / 0.81°F @ 200°C / 392°F to 350°C / 662°F
Total accuracy – C models only	With STS-120 A 935 External reference: ±0.25°C / 0.45°F @ 28°C / 82.4°F to 200°C / 392°F ±0.25°C / 0.45°F @ 200°C / 392°F to 350°C / 662°F
Heating time incl. insertion tube	23°C / 73.4°F to 350°C / 662°F : 6 min.
Time to stability	10 min.
Cooling time incl. insertion tube	350°C / 662°F to 100°C / 212°F: 20 min. (27 min. silent mode) 100°C / 212°F to 50°C / 122°F: 14 min. (22 min. silent mode)

MECHANICAL SPECIFICATIONS	CTC-652 A/C
Dimensions l × w × h	248 x 148 x 390 mm / 9.76 x 5.83 x 15.35 inch
Weight	9.0 kg / 19.8 lbs (without insertion tube)
Bore diameter/depth of well	Ø26 mm / 200 mm – ø1.02 inch / 7.87 inch
Weight non-drilled insertion tube	860 g / 30,3 oz
POWER SUPPLY	
Line voltage/frequency	90-127VAC / 180-254VAC 47-63 Hz*
Power consumption	1150 VA max.
Type of connection	IEC320
COMMUNICATION INTERFACES	
Type of connections	USB type B
ENVIRONMENT	
Ambient operating temperature range	0-50°C / 32-122°F
Storage temperature range	-20-50°C / -4-122°F
Humidity range	5-90% RH, non-condensing
Protection class	IP10
Altitude	0-2000 m
READOUT SPECIFICATIONS	
Resolution	1 / 0.1 / 0.01
Temperature units	°C / °F / K

THERMAL SPECIFICATIONS	CTC-652 A/C
Maximum temperature	650°C / 1202°F
Minimum temperature	55°C / 131°F @ ambient temperature 50°C / 122°F 28°C / 82°F @ ambient temperature 23°C / 73.4°F 5°C / 41°F @ ambient temperature 0°C / 32°F

*103V-127 VAC/206V-254 VAC 47-63 Hz for full temperature range. At mains voltage below 103 VAC / 206 VAC, maximum temperature will be reduced.

THERMAL SPECIFICATIONS	CTC-652 A/C
Well specifications	Loaded with up to 4 mm external reference and one 6 mm sensor : 40 mm / 1.57 inch axial homogeneity: 0.30°C / 0.54°F @ 28°C / 82.4°F to 200°C / 392°F 0.40°C / 0.72°F @ 200°C / 392°F to 400°C / 752°F 0.50°C / 0.9°F @ 400°C / 752°F to 650°C / 1202°F 60 mm / 2.36 inch axial homogeneity: 0.40°C / 0.72°F @ 28°C / 82.4°F to 200°C / 392°F 0.80°C / 1.44°F @ 200°C / 392°F to 400°C / 752°F 1.00°C / 1.80°F @ 400°C / 752°F to 650°C / 1202°F 80 mm / 3.15 inch axial homogeneity: 0.80°C / 1.44°F @ 28°C / 82.4°F to 200°C / 392°F 1.20°C / 2.16°F @ 200°C / 392°F to 400°C / 752°F 2.00°C / 3.60°F @ 400°C / 752°F to 650°C / 1202°F Difference between borings : 0.03°C / 0.054°F @ 28°C / 82.4°F to 400°C / 752°F 0.08°C / 0.14°F @ 400°C / 752°F to 650°C / 1202°F Influence from 6 mm load : 0.10°C / 0.18°F Influence from load with Ext. Reference : 0.03°C / 0.054°F Long term drift (1 year) : ±0.25°C / ±0.45°F @ 650°C / 1202°F ±0.20°C / ±0.36°F @ 400°C / 752°F ±0.15°C / ±0.27°F @ 200°C / 392°F
Temperature coefficient	±0.03°C/°C (0-20°C and 26-50°C) / ±0.03°F/°F (32-68°F and 79-122°F)
Stability	±0.05°C/ ±0.09°F
Total accuracy	Internal reference: ±0.50°C / 0.90°F @ 28°C / 82.4°F to 200°C / 392°F ±0.60°C / 1.08°F @ 200°C / 392°F to 400°C / 752°F ±0.65°C / 1.19°F @ 400°C / 752°F to 650°C / 1202°F
Total accuracy – C models only	With STS-200 A 970 External reference (40 mm zone): ±0.35°C / 0.63°F @ 28°C / 82.4°F to 200°C / 392°F ±0.40°C / 0.72°F @ 200°C / 392°F to 400°C / 752°F ±0.45°C / 0.81°F @ 400°C / 752°F to 650°C / 1202°F
Heating time incl. insertion tube	23°C / 73.4°F to 650°C / 1202°F : 33 min.
Time to stability	5 min.
Cooling time incl. insertion tube	650°C / 1202°F to 100°C / 212°F: 48 min. (65 min. silent mode)

THERMAL SPECIFICATIONS	CTC-652 A/C	
	100°C / 212°F to 50°C / 122°F:	25 min. (35 min. silent mode)
	50°C / 122°F to 33°C / 91.4°F:	25 min. (35 min. silent mode)
	33°C / 91.4°F to 28°C / 82.4°F:	25 min. (35 min. silent mode)

MECHANICAL SPECIFICATIONS	CTC-660 A/C
Dimensions l × w × h	248 x 148 x 305 mm / 9.76 x 5.83 x 12.01 inch
Weight	6.1 kg / 13.4 lbs (without insertion tube)
Bore diameter/depth of well	Ø26 mm / 120 mm – ø1.02 inch / 4.72 inch
Weight non-drilled insertion tube	510 g / 18.0 oz
POWER SUPPLY	
Line voltage/frequency	90-127VAC / 180-254VAC 47-63 Hz
Power consumption	1150 VA max.
Type of connection	IEC320
COMMUNICATION INTERFACES	
Type of connections	USB type B
ENVIRONMENT	
Ambient operating temperature range	0-50°C / 32-122°F
Storage temperature range	-20-50°C / -4-122°F
Humidity range	5-90% RH, non-condensing
Protection class	IP10
Altitude	0-2000 m
READOUT SPECIFICATIONS	
Resolution	1 / 0.1 / 0.01
Temperature units	°C / °F / K

THERMAL SPECIFICATIONS	CTC-660 A/C
Maximum temperature	660°C / 1220°F
Minimum temperature	55°C / 131°F @ ambient temperature 50°C / 122°F
	28°C / 82°F @ ambient temperature 23°C / 73.4°F
	5°C / 41°F @ ambient temperature 0°C / 32°F

THERMAL SPECIFICATIONS	CTC-660 A/C
Well specifications	<u>Loaded with up to 4 mm external reference, one 4 mm and one 6 mm sensor :</u> 30 mm / 1.18 inch axial homogeneity: 0.40°C / 0.72°F @ 28°C / 82.4°F to 200°C / 392°F 0.50°C / 0.9°F @ 200°C / 392°F to 400°C / 752°F 0.50°C / 0.9°F @ 400°C / 752°F to 660°C / 1220°F 40 mm / 1.57 inch axial homogeneity: 0.50°C / 0.9°F @ 28°C / 82.4°F to 200°C / 392°F 0.70°C / 1.26°F @ 200°C / 392°F to 400°C / 752°F 1.00°C / 1.8°F @ 400°C / 752°F to 660°C / 1220°F Difference between borings : 0.03°C / 0.054 @ 28°C / 82.4°F to 400°C / 752°F 0.10°C / 0.18 @ 400°C / 752°F to 660°C / 1220°F Influence from 6 mm load : 0.15°C / 0.27°F @ 28°C / 82.4°F to 200°C / 392°F 0.30°C / 0.54°F @ 200°C / 392°F to 400°C / 752°F 0.30°C / 0.54°F @ 400°C / 752°F to 660°C / 1220°F Influence from 6 mm load with Ext. Reference : 0.03°C / 0.054°F Long term drift (1 year) : ±0.40°C / ±0.72°F
Temperature coefficient	±0.03°C/°C (0-20°C and 26-50°C) / ±0.054°F/°F (32-68°F and 79-122°F)
Stability	±0.08°C/ ±0.14°F
Total accuracy	Internal reference: ±0.65°C / 1.17°F @ 28°C / 82.4°F to 200°C / 392°F ±0.75°C / 1.35°F @ 200°C / 392°F to 400°C / 752°F ±0.85°C / 1.53°F @ 400°C / 752°F to 660°C / 1220°F
Total accuracy – C models only	With STS-120 A 966 External reference: ±0.40°C / 0.72°F @ 28°C / 82.4°F to 200°C / 392°F ±0.45°C / 0.81°F @ 200°C / 392°F to 400°C / 752°F ±0.45°C / 0.81°F @ 400°C / 752°F to 660°C / 1220°F
Heating time incl. insertion tube	23°C / 73.4°F to 660°C / 1220°F : 18 min.
Time to stability	5 min.
Cooling time incl. insertion tube	660°C / 1220°F to 100°C / 212°F: 39 min. (52 min. silent mode) 100°C / 212°F to 50°C / 122°F: 18 min. (26 min. silent mode)

MECHANICAL SPECIFICATIONS	CTC-1205 A/C
Dimensions l × w × h	248 x 148 x 390 mm / 9.76 x 5.83 x 15.35 inch
Weight	7.1 kg / 15.7 lbs (without insertion tube)
Bore diameter/depth of well	Ø27 mm / 157 mm – ø1.06 inch / 6.18 inch
Weight non-drilled insertion tube	490 g / 17.3 oz
POWER SUPPLY	
Line voltage/frequency	90-127VAC / 180-254VAC 47-63 Hz
Power consumption	650 VA max.
Type of connection	IEC320
COMMUNICATION INTERFACES	
Type of connections	USB type B
ENVIRONMENT	
Ambient operating temperature range	0 to 50°C / 32 to 122°F
Storage temperature range	-20 to 50°C / -4 to 122°F
Humidity range	5 to 90% RH, non-condensing
Protection class	IP10
Altitude	0 - 3000 m
READOUT SPECIFICATIONS	
Resolution	1 / 0.1 / 0.01
Temperature units	°C / °F / K

THERMAL SPECIFICATIONS	CTC-1205 A/C
Maximum temperature	1205°C / 2201°F
Minimum temperature	127°C / 261°F @ ambient temperature 50°C / 122°F 100°C / 212°F @ ambient temperature 23°C / 73.4°F 100°C / 212°F @ ambient temperature 0°C / 32°F

THERMAL SPECIFICATIONS	CTC-1205 A/C
Well specifications	20 mm / 0.79 inch axial homogeneity, loaded with up to 4.5 mm external reference, one 4 mm and one 6 mm sensor: 1.0°C / 1.8°F @ 100°C / 212°F 3.0°C / 5.4°F @ 300°C / 572°F 4.0°C / 7.2°F @ 600°C / 1112°F to 1205°C / 2201°F Difference between borings : 0.4°C (0.7°F) @ 600°C (1112°F) 1.0°C (1.8°F) @ 900°C (1652°F) 1.0°C (1.8°F) @ 1205°C (2201°F) Influence from 6 mm load : 0.25°C / 0.45°F Influence from 6 mm load with Ext. Reference : 0.15°C / 0.27°F Long term drift (1 year typical) : ±1.0°C / ±1.8°F
Temperature coefficient	±0.03°C/°C (0-20°C and 26-50°C) / ±0.054°F/°F (32-68°F and 79-122°F)
Stability	±0.1°C/ ±0.18°F
Total accuracy*	Internal reference: ±2.0°C / 3.6°F
Total accuracy – C models only*	With STS-TC-N-A-1205 External reference: ±2.0°C / 3.6°F
Heating time incl. insertion tube	23°C / 73.4°F to 1205°C / 2201°F : 50 min.
Time to stability**	15 min typical.
Cooling time incl. insertion tube	1205°C / 2201°F to 300°C / 572°F: 45 min. (55 min. silent mode) 300°C / 572°F to 50°C / 122°F: 45 min. (70 min. silent mode)

*Accuracy measured at the bottom of the well.
**For increasing temperatures without use of “SET Follows True”. Time to stability may be longer for decreasing temperatures or when using “SET Follows True”.

INPUT SPECIFICATIONS

Switch Test Input

Signal range	Closed : 0-1kΩ / Open : >1kΩ
Internal power supply	1 mA test current, max. 14 V (open)
Type of connection	ø4 mm safety test sockets

External reference PT-100 (4 wire true ohm PT100) – CTC-155/350/652/660 C MODELS ONLY

Signal range	0Ω – 400Ω
Internal power supply	Measuring current max. 1 mA (pulsed)
Resolution	1 / 0.1 / 0.01 °C/°F/K
Accuracy	±(0.005%rdg + 0.001% F.S.) ohms ±0.02°C(±0.04°F) @ -200°C(-328°F) ±0.02°C(±0.04°F) @ -100°C(-148°F) ±0.03°C(±0.05°F) @ -25°C(-13°F) ±0.03°C(±0.05°F) @ 0°C(32°F) ±0.04°C(±0.07°F) @ 155°C(311°F) ±0.05°C(±0.09°F) @ 350°C(662°F) ±0.05°C(±0.09°F) @ 420°C(788°F) ±0.07°C(±0.12°F) @ 650°C(1202°F) ±0.07°C(±0.12°F) @ 660°C(1220°F)
Temperature coefficent	10 ppm/°C = 0.004 ohm/°C = ±0,012°C/°C (0-20°C and 26-50°C)
Type of connection	LEMO Redel 6 pole –connector for sensor with 1 wire EEPROM

External reference TC-N – CTC-1205 C MODELS ONLY

Signal range	-10 mV to 78 mV (TC-input) 0 ohm to 1500 ohm (CJC input)
Internal power supply (CJC input)	Measuring current max. 1 mA (pulsed)
Resolution	1 / 0.1 / 0.01 °C/°F/K
Accuracy (TC-input)	±(0.01%rdg + 10 uV) TC type N: ±0.39°C(±0.70°F) @ 0°C(32°F) ±0.35°C(±0.63°F) @ 100°C(212°F) ±0.31°C(±0.55°F) @ 400°C(752°F) ±0.33°C(±0.59°F) @ 800°C(1472°F) ±0.39°C(±0.70°F) @ 1205°C(2201°F)
Accuracy (CJC-input)	0.25 ohm = 0.07°C (PT1000)
Temperature coefficient (TC-input)	10 ppm/°C = 0.8 uV°C = ±0,022°C/°C (0-20°C and 26-50°C)
Temperature coefficient (CJC-input)	10 ppm/°C = 0.015 ohm/°C = ±0,004°C/°C (0-20°C and 26-50°C)
Type of connection	LEMO Redel 6 pole –connector for sensor with 1 wire EEPROM

STANDARDS

The following standards are observed according to the EMC-Directive 2014/30/EU	EN 61326-1: 2013: Electrical equipment for measurement, control and laboratory use – EMC requirements Part 1: General requirements Emission: Class B - equipment suitable for use in domestic estabilishment and in estabilishments directly connected to low voltage power supply network which supplies buildings used for domestic purposes. Immunity: Table 2 - Immunity test requirements for equipment intended to be used in an industrial electromagnetic environment.
The following standards are observed according to the low voltage-directive 2014/35/EU	EN61010-1:2010/A1:2019 : Safety requirements for electrical equipment for measurement, control and laboratory use, part 1: General requirement EN61010-2-010:2020 Safety requirements for electrical equipment for measurement, control and laboratory use, part 2-010: Particular requirements for laboratory equipment for the heating of materials

11.0 List of accessories

All parts listed in the list of accessories can be obtained from the factory through our dealers.

Please contact your dealer for assistance if you require parts which do not appear on the list.

List of accessories

Accessories	Part no.
Fuse 115V: 10AF/250V (CTC-155/350/652/660)	60B302
Fuse 230V: 5AF/250V (CTC-155/350/652/660)	127573
Fuse 115V: 8AT/250V (CTC-1205)	127211
Fuse 230V: 4AT/250V (CTC-1205)	127210
Alu. carrying case (CTC-155/350/660)	129540
Alu carrying case (CTC-652/1205)	130029
Electronical ref. manual +JOFRACAL PC software	124915
Tool for insertion tube	60F170
Thermal protection shield (CTC-652/660/1205 only)	129264
Mains cable, 115V, US, type B	60F135
Mains cable, 240V, UK, type C	60F136
Mains cable, 220V, South Africa, type D	60F137
Mains cable, 220V, Italy, type E	60F138
Mains cable, 240V, Australia, type F	60F139
Mains cable, 230V, Europe, type A	60F140
Mains cable, 230V, Denmark, type G	60F141
Mains cable, 220V, Switzerland, type H	60F142
Mains cable, 230V, Israel, type I	60F143
Cable w. REDEL/Banana connection, 0.8 mtr.	128999
USB cable	127278
Set of test cables	104203
Cleaning brush, 4 mm	122832
Cleaning brush, 6 mm	60F174
Cleaning brush, 8 mm	122822
Support rod set	129539
Sensor grip	125067
Fixture for sensor grip	125066
Holder for burette clamp (CTC-652/1205 only)	129989
Reference probe STS-120 A 90°, with accredited certificate, diameter 4mm, (-45°C to 155°C) (CTC-155)	STS120A915EH
Reference probe STS-102 A with accredited certificate, diameter 4mm, (-50°C to 155°C) (CTC-155)	STS102A030EH
Reference probe STS-120 A 90°, with accredited certificate, diameter 4mm, (0°C to 350°C) (CTC-350)	STS120A935EH
Reference probe STS-200 A 90°, with accredited certificate, diameter 4mm, (0°C to 650°C) (CTC-652)	STS200A970EH

Reference probe STS-120 A 90°, with accredited certificate, diameter 4mm, (0°C to 660°C) (CTC-660)	STS120A966EH
Reference probe STS-TC-N-A with accredited certificate, diameter 4.5mm (100°C to 1205°C) (CTC-1205)	STSTCNA1205EH

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www.ametekcalibration.com

UK
Tel +44 (0)1243 833 302
stc.uk@ametek.com

France
Tel +33 (0)1 30 68 89 40
general.lloyd-instruments@ametek.fr

Germany
Tel +49 (0)2159 9136 510
info.mct-de@ametek.de

Denmark
Tel +45 4816 8000
jofra@ametek.com

USA - California
Tel +1 (800) 444 1850
crystal@ametek.com

USA - Florida
Tel +1 (800) 527 9999
cal.info@ametek.com

India
Tel +91 22 2836 4750
jofra@ametek.com

Singapore
Tel +65 6484 2388
jofra@ametek.com

China - Shanghai
Tel +86 21 5868 5111
stc.china@ametek.com

China - Beijing
Tel +86 10 8526 2111 ext. 19
stc.china@ametek.com

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