

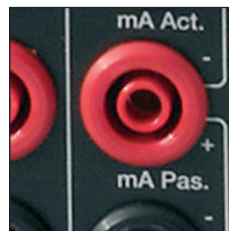
## **Remote Communication Manual**

### **Compact Temperature Calibrator**

**JOFRA CTC-155/350/652/660/1205**

### **Marine Temperature Calibrator**

**JOFRA MTC-650 MKII**



# Remote Communication Manual

## Compact Temperature Calibrator

JOFRA CTC-155/350/652/660/1205

## Marine Temperature Calibrator

JOFRA MTC-650 MKII

© Copyright 2016 AMETEK Denmark A/S



# List of contents

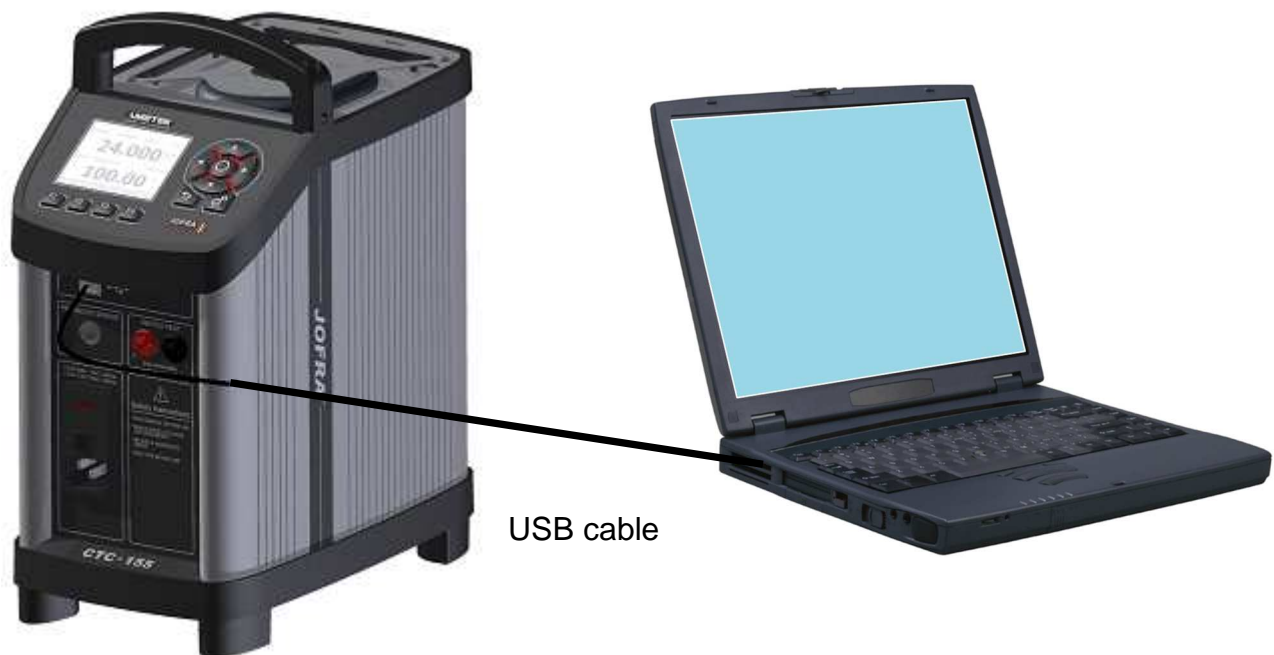
---

<b>1.0</b>	<b>USB driver installation and remote Operation</b>	<b>3</b>
1.1	Installation of USB communications driver	4
1.2	Setting up the CTC/MTC calibrator for Remote Control	4
<b>1.3</b>	<b>Changing between Remote and Local Operation</b>	<b>5</b>
<b>2.0</b>	<b>Using commands</b>	<b>6</b>
2.1	Command categories	6
<b>3.0</b>	<b>Data Processing and Response Data</b>	<b>7</b>
3.1	Character Processing	7
3.2	Response Data Types	7
<b>4.0</b>	<b>Calibrator Status</b>	<b>8</b>
<b>5.0</b>	<b>Remote Commands and Error Codes</b>	<b>10</b>
5.1	Common command list	10
5.2	Common command list	11
5.3	Command parameter list	11
5.4	Command Error codes	12
<b>6.0</b>	<b>Entering Commands</b>	<b>13</b>
6.1	Common Commands in detail.	13
6.2	Calibrator Commands in detail.	15

## 1.0 USB driver installation and remote Operation

---

The calibrator can be remotely controlled using a PC terminal, or by a computer program running the calibrator in an automated system. It uses an USB port connection for remote operation. With this connection the user can write programs on the PC, with Windows languages like Visual Basic to operate the calibrator, or use a Windows terminal, such as Hyper Terminal (Windows XP), to enter single commands. Typical USB remote configurations are shown in Figure 1.

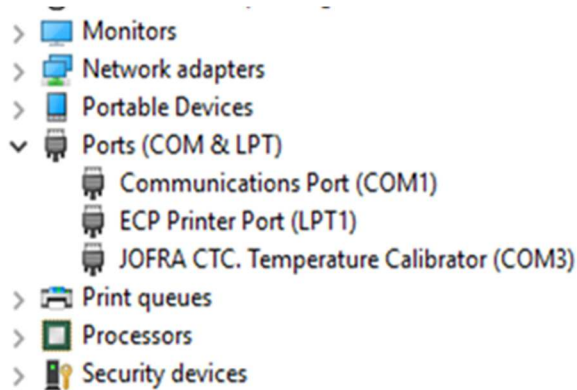


**Figure 1**  
Calibrator-to-computer  
USB connection

## 1.1 Installation of USB communications driver

When the CTC/MTC calibrators are connected for the first time, Windows identifies the Device and will request the location of the driver which is found on the AMETEK software thumb drive supplied with the calibrator.

When installation is complete the CTC/MTC calibrator is allocated a virtual port number in the device manager as displayed below.



### Note...

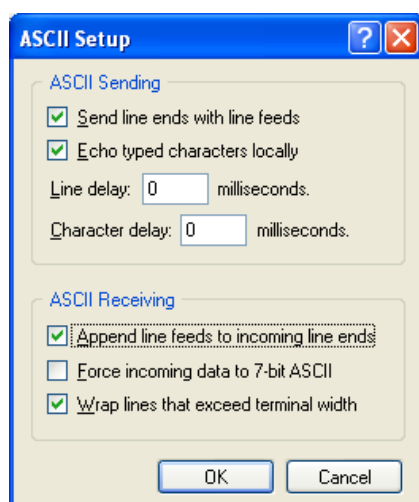
The recommended length of the USB connection cable is 2m (max 3m).

## 1.2 Setting up the CTC/MTC calibrator for Remote Control

To set up remote operation of the calibrator the remote terminal of your choice the only configuration required is the selection of the serial comport used by the CTC/MTC calibrator.

The CTC/MTC calibrator USB interface creates a Virtual Communications Port and the data flow parameters are irrelevant as they are handled by the USB.

Commands should end with EOL (End of Line) character or CR (Carriage Return) or both.



Select *Echo typed characters locally* to see your input.

Choose *Wrap lines that exceed terminal width* to see long response lines.

To test the communication, type in the identification request command.

\*idn? This command will return information on the unit.

“**JOFRA, CTC-350C, 641969-00002, 1.00**”

### 1.3 Changing between Remote and Local Operation

There are three modes of operation of the calibrator: Local, Remote, and Remote with Lockout.

Local mode is the default mode. Commands may be entered using the keypad on the unit or using a computer. In local mode only “?” commands is accepted from the computer.

In Remote mode the keypad is disabled, and commands may only be entered using a computer, but choosing [GO TO LOCAL] from the menu on the calibrator display will restore keypad operation.

In Remote with Lockout, the keypad cannot be used at all. To switch modes proceed as follows:

1. To enable Remote mode, type in the serial command **REMOTE** at the computer terminal.
2. To enable Remote with Lockout, type in **LOCKOUT** at the computer terminal.
3. To switch back to local operation, enter **LOCAL** at the terminal. This command also turns off LOCKOUT if it was on. For more information on commands refer to the Remote Commands section.

## 2.0 Using commands

---

### Command types

Refer to the Section on Remote Commands for all available commands.

The calibrator may be controlled using commands and queries. All commands may be entered using upper or lower case.

### Calibrator Commands

Configure the calibrator.

SETTEMP 25 CEL

Sets the CTC/MTC calibrator to 25 Celsius

### Query Commands

Commands that ask for information. They always end with a "?".

DECIMALS?

Returns the displayed number of DECIMALS

## 2.1 Command categories

### Common Commands

Standard commands used by most devices. These commands always begin with an "\*". For example:

\*IDN?

tells the calibrator to return its identification.

### Calibrator Commands

Standard commands used by the device to configure or always query calibration configuration

READINGS? (returns current reading values)

## 3.0 Data Processing and Response Data

---

### 3.1 Character Processing

The data entered into the calibrator is processed as follows:

- ASCII characters are discarded if their decimal equivalent is less than 32 (space), except 10 (LF) and 13 (CR)
- Data is taken as 7-bit ASCII
- The most significant data bit is ignored.
- Upper or lower case is acceptable.
- DECIMALS character in float values must be FULLSTOP.

### 3.2 Response Data Types

The data returned by the calibrator can be divided into four types:

#### **Integer**

For most computers and controllers, they are decimal numbers ranging from -32768 to 32768. For example:

DECIMALS? returns 2

#### **Floating**

Numbers that have up to 15 significant figures and exponents. For example: SETTEMP? +3.200000E+01, CEL

#### **Indefinite ASCII (IAD)**

Any ASCII characters followed by a terminator. For example:

\*IDN? returns JOFRA, CTC-350C, 641969-00002, 1.004



## 4.0 Calibrator Status

---

Status registers, enable registers, and queues provide status information on the calibrator. Each status register and queue has a summary bit in the Serial Poll Status Byte. Enable registers generate summary bits in the Serial Poll Status Byte. The following is a list of registers and queues along with their function.

### Serial Poll Status Byte (STB)

The STB is sent when the calibrator responds to the \*STB? command. Cleared when power is reset.

### Service Request Enable Register (SRE)

Enables or disables the bits of the STB. Cleared when power is reset.

Setting bits to 0 disables them in the STB. Setting the bits to 1 enables them. Bit assignments for the SRE and the STB are shown below.

7	6	5	4	3	2	1	0
0	MSS	ESB	0	EAV	0	0	0

### MSS

Master Summary Status. Set to 1 when ESB or EAV are 1 (enabled). Read using the \*STB? command.

### ESB

Set to 1 when at least one bit in ESR is 1.

### EAV

Error Available. An error has been entered into the error queue, and may be read using the Fault? command.

### Event Status Register (ESR)

A two-byte register, in which the lower bits represent conditions of the Calibrator. Cleared when read and when power is reset.

### Event Status Enable Register (ESE)

Enables and disables bits in the ESR. Setting a bit to 1 enables the corresponding bit in the ESR, and setting it to 0 disables the corresponding bit. Cleared at power reset. Bit assignments for the ESR and the ESE respectively are shown below.

15	14	13	12	11	10	9	8
0	0	0	0	0	0	0	0

7	6	5	4	3	2	1	0
PON	0	CME	EXE	DDE	QYE	0	OPC

**PON**

Power On. Set to 1 if power was turned on and off before the Event Status Register was read.

**CME**

Command Error. Set to 1 when the calibrator receives an invalid command. Entering an unsupported RTD type may cause such an error.

**EXE**

Execution Error. Set to 1 when the calibrator runs into an error while executing its last command. A parameter that has too significant figures may cause such an error.

**DDE**

Device-dependent Error. Set to 1 when, for example, the output of the calibrator is overloaded.

**QYE**

Query Error.

**OPC**

Operation Complete. Set to 1 when the calibrator has finished executing all commands before the command \*OPC was entered.

**Error Queue**

If an error occurs due to invalid input or buffer overflow, its error code is sent to the error queue. The error code can be read from the queue with the command FAULT?. The error queue holds 15 error codes. When it is empty, FAULT? returns 0. The error queue is cleared when power is reset or when the clear command \*CLS is entered.

**Input Buffer**

Calibrator stores all received data in the input buffer. The buffer holds 250 characters. The characters are processed on a first in, first out basis.

## 5.0 Remote Commands and Error Codes

---

The following tables list all commands, and their descriptions, that are accepted by the calibrator.

### 5.1 Common command list

**Table 1: Common Commands**

Command	Description
*CLS	*CLS (Clear status.) Clears the ESR, the error queue, and the RQS bit in the status byte. Terminates pending Operation Complete commands
*DATE_TIME	Sets the calibrators system date/time. < YYYY><MM><DD> <HH> <MM> <SS>
*DATE_TIME?	Returns the system date/time. For example: "2016, 6, 1, 10, 42, 32"
*ESE	Loads a byte into the Event Status Enable register.
*ESE?	Returns the contents of the Event Status Enable register.
*ESR?	Returns the contents of the Event Status register and clears the register.
*IDN?	Identification query. Returns Calibrator details.
*OPC	Enables setting of bit 0 (OPC for "Operation Complete") in the Event Status Register to 1 when all pending device operations are complete.
*OPC?	Returns a 1 after all pending operations are complete. This command causes program execution to pause until all operations are complete.
*RST	Resets the state of the instrument to the power-up state. This command holds off execution of subsequent commands until it is complete.
*SRE	Loads a byte into the Service Request Enable register.
*SRE?	Returns the byte from the Service Request Enable register.
*STB?	Returns the status byte.
*WAI	Prevents further remote commands from being executed until all previous remote commands have been executed.

## 5.2 Common command list

**Table 2: Calibrator Commands**

Command	Description
CALDATE? <n>	Return calibration date & time of either Intern or Extern sensor.
CALDATE <n> <date>	Set calibration date & time of either Intern or Extern sensors.
DECIMALS <n>	Set the display DECIMALS on the calibrator (int)
DECIMALS?	Returns the number of display DECIMALS.
ERROR?	Returns any system error.
FAULT?	Returns the error code of an error that has occurred
IDENTIFY?	Returns: Maker, Model type, Serial number, Firmware ver, Model ID, Control PCB rev, Input PCB rev, Display PCB rev.
LOCAL	Returns user to manual operation of the calibrator
LOCKOUT	Locks out the keypad of the calibrator, and allows for remote operation only
MINMAXTEMP	Set the calibrator min / max temperature ranges. (float)
MINMAXTEMP?	Returns the current Min Max temperature settings.
PROBESTATUS?	Returns status of the External reference. See further details below.
READINGS?	Returns current measure values, stability, switch, active sensor.
REMOTE	Puts the calibrator in remote mode
REMOTE_MODE?	Returns state of Calibrator LOCAL, REMOTE, LOCKOUT, BUSY
SETTEMP <n>, <U>	Set temperature. SETTEMP 25 CEL (float)
SETTEMP?	Returns current set temperature.
SLOPE	Set the SLOPE rate in °C/min. (float)
SLOPE?	Returns the switch SLOPE rate. +0.000000E+00, CEL
STABTIME_INT <n>	Set the Intern sensor stability time in minutes
STABTIME_INT?	Returns the internal sensor stability time.
STABTIME_EXT <n>	Set the Extern sensor reference stability time in minutes.
STABTIME_EXT?	Returns the External sensor stability time.
STABTOL_EXT <n> <U>	Set the Extern sensor stability tolerance (float). n=temperature U=Unit
STABTOL_EXT?	Returns the Extern reference sensor stability tolerance (float).
STABLE?	Returns stability status. TRUE or FALSE & seconds since or to stability.
SLOPESTATUS <P1>	Activate slope (int). 1=activate 0=deactivate
SLOPESTATUS?	Return slope status. 1=activated 0=deactivated
TEMPUNIT <P1>	Set the calibration temperature unit to Celsius, Fahrenheit or Kelvin
TEMPUNIT?	Returns current temperature unit. CEL, FAR or KEL
TRUESENSOR <P1>	Set the active true reading sensor. Intern, Extern or SFT(Extern)
TRUESENSOR?	Returns the current true reading sensor. INT, EXT or SFT.

## 5.3 Command parameter list

**Table 3: Parameter units**

Units	Meaning
CEL	Temperature in Celsius
FAR	Temperature in Fahrenheit
KEL	Temperature in Kelvin

## 5.4 Command Error codes

**Table 4: Error codes**

Error Number	Error Description
100	A non-numeric entry received where it should be a numeric entry
102	Invalid units or parameter value received
103	Entry is above the upper limit of the allowable range
104	Entry is below the lower limit of the allowable range
105	A required command parameter was missing
110	An unknown command was received
112	The serial input buffer overflowed
113	Too many entries in the command line
114	The serial output buffer overflowed
119	Indicates the CTC/MTC is in the wrong mode to accept the command

## 6.0 Entering Commands

---

Following protocol must be followed when sending commands to the calibrator:

- Commands may be entered in upper or lower case.
- At least one space required between the command and parameter, all other spaces are optional.
- Almost all commands for the calibrator are sequential, any overlapped commands will be indicated as such.

This section will briefly explain each of the commands and describe their general use, which will include any parameters that may be entered with the command as well as what the output of the command is.

### 6.1 Common Commands in detail.

#### **\*CLS**

Clears the ESR, the error queue and the RQS bit. Also terminates all pending operations. When writing programs, use before each procedure to avoid buffer overflow.

#### **\*DATE\_TIME <yyyy> <mm> <dd> <hh> <mm> <ss>**

Sets the system date on the CTC/MTC calibrator.

\*DATE\_TIME 2016 6 1 13 15 0

#### **\*DATE\_TIME?**

Returns the system date on the CTC/MTC calibrator.

\*DATE\_TIME? "2016, 6, 1, 13, 15, 52"

#### **\*ESE**

Loads a byte into the Event Status Enable register. The command is entered with a decimal number that, when converted to binary, enables the right bits in the Event Status Register. For example:

\*ESE 133

When 133 is converted to binary it is 10000101. Bits 7, 2, and 0 will be enabled.

#### **\*ESE?**

Returns the contents of the Event Status Enable register. The value returned is a decimal. For example, if the register has the following settings:  
10000101 then the value returned will be 133.

#### **\*ESR?**

Returns the contents of the Event Status Register in decimal form. For example:

If the ESR contains 10111001, \*ESR? will return 185.

#### **\*IDN?**

Returns the manufacturer, model number, and firmware revision of the Calibrator. For example: \*IDN? will return

JOFRA, CTC-350C, 641969-00002, 1.04

### **\*OPC**

Enables the Operation Complete setting in the ESR. This setting makes it possible to check if an operation is complete after it has been initialized.

For example, this operation could be used with the command TRIG. **\*OPC?**

Returns 1 when all operations are complete, and causes program execution to pause until all the operations are complete. For example:

TRIG ; \*OPC? will return a 1 when the pulse train initiated by TRIG is complete.

### **\*RST**

Resets the state of calibrator to the power-up state. All subsequent commands are held off until the execution of the command is complete.

### **\*SRE**

Loads a byte into the Service Request Enable register. A decimal number must be entered, which when converted to binary, corresponds to the correct settings.

For example:

\*SRE 8 enters the binary number 00001000 to the SRE. This enables bit 3. Bit 6 is not used.

### **\*SRE?**

Returns a byte from the SRE. The byte is returned in decimal format. For example:

If 40 is returned, bits 5 and 3 are enabled. **\*STB**

Returns the status byte in decimal form from the Serial Poll Status Byte. For example;

If 72 is returned, bits 6 and 3 are enabled. **\*WAI**

Prevents further remote commands from being executed until all previous commands are executed.

## 6.2 Calibrator Commands in detail.

### **CALDATE <int n> <date string>**

Set calibration date & time of either Intern or Extern sensor.  
Parameter n can be either 0=Internal or 1=External sensor.

Date string must be in the following format : **yyyymmdd:hhmm**

For example:

(Internal) CALDATE 0 20160309:2253 ( 9<sup>th</sup> March, 2016. 10.53 pm)

(External) CALDATE 1 20151203:1225 ( 3<sup>rd</sup> Dec, 2015. 12.25 pm)

### **DECIMALS <int>**

Set the display resolution. 0,1 or 2.

For example: DECIMALS 2

### **DECIMALS?**

Return current resolution.

### **ERROR?**

Returns any CTC/MTC calibrator system errors.

### **FAULT?**

Returns the error code number of an error that has occurred. The command may be entered when the previous command did not do what it was meant to do.

For example, if a value for current output is entered that is bigger than the supported range (0-24mA) FAULT? Would return:

103 which is the code number for an entry over range.

Refer to the Error Codes table for more information on error code numbers.

For example:

“+2.600000E+01, CEL, +2.597692E+01, CEL, +2.604165E+01, CEL, +1.102221E+02,  
+2.597692E+01, CEL, +1.101493E+02, OPEN, FALSE, 589, SEC, EXT”

### **IDENTIFY?**

Returns following calibrator details in a comma separated string.

1. Maker,
2. Model type,
3. Serial number,
4. Firmware version.
5. Model Id,
6. Control PCB revision,
7. Input PCB revision.
8. Display PCB revision.

### **LOCAL**

Restores the calibrator to local operation if it was in remote mode. Also clears LOCKOUT if the unit was in lockout mode.

### **LOCKOUT**

Puts the calibrator in remote mode and disables the keyboard on the CTC/MTC calibrator.  
User must send the LOCAL command to get back to local operation.



## MINMAXTEMP?

Return current calibrator Minimum & Maximum temperature range.  
Values followed by measure unit. CEL, FAR or KEL.

For Example: +0.000000E+00, CEL, +3.500000E+02, CEL

## MINMAXTEMP <int n1> <U> <int n2> <U>

Set the calibrator Minimum & Maximum temperature range.  
n1=Min, n2=Max, each value must be followed by the temperature unit.

For example: MINMAXTEMP 0 CEL 350 CEL

## PROBESTATUS?

Returns the status of the External reference probe. Informs the user if any probe is currently connected and if so its serial number and model ID.

The command returns one of the following:

1. "638714-09, STS-150 A 935" - Serial no. & model
2. "Not Found" - No probe found
3. "Invalid" - Probe found but defect and unable to read.

## READINGS?

Returns current reading values.

1. Set temperature value,
2. Display value,
3. Intern temperature,
4. Intern Ohm, or Internal TC voltage (mV) (CTC-1205)
5. External Reference temperature,
6. External Reference Ohm, or External Reference TC voltage (mV) (CTC-1205)
7. Switch
8. Stability (True/False)
9. Stable time criteria, countdown to stability or time since stability achieved.
10. Sensor in use INT (Internal), EXT (External) or SFT (Set Follows True)

NOTE!. Numbers regarding stability 8 & 9.

Returns stability status TRUE or FALSE., time to or after stability is reached. Returns the following:

- FALSE, 300 - Unstable – stability time. (5 min)  
FALSE, 185 - Counting down to stability.  
TRUE, 408 - Stable and the time since stability achieved.

For example: +5.000000E+01, CEL, +5.002000E+01, CEL, +5.000000E+01, CEL,  
+1.193255E+02, +5.002000E+01, CEL, +1.194274E+02, OPEN, TRUE, 637, SEC,  
EXT

## REMOTE

Puts the calibrator in remote mode. While in remote mode the user can still use the keypad to get back to local.

## REMOTE\_MODE?

Returns either of 3 Calibrator states:

- LOCAL - Calibrator is in local mode for operator use, PC can only read.

REMOTE - PC has control and can write to calibrator. Keyboard enabled.

LOCKOUT - PC has full control and keyboard disabled.

BUSY - Calibrator in Service or Switch mode and cannot be accessed.

### **SETTEMP <float> <str>**

Write calibrator set temperature, value followed by temperature unit.  
Valid units are CEL, FAR & KEL.

For example: SETTEMP 25 CEL.

### **SETTEMP?**

Returns the current set temperature value and the default temperature unit.

For example: +3.200000E+01, CEL

### **SLOPE <float>**

Set the slope rate in °C per minute.

For example: SLOPE 4 CEL

### **SLOPE?**

Return the slope rate in °C per minute.

For example: +4.000000E+00, CEL

### **SLOPESTATUS<int>**

Activate slope. 0 = deactivate, 1 = activate

For example: **SLOPESTATUS 1**

### **SLOPESTATUS?**

Returns the slope status. 0 (deactivated) or 1(activated)

For example: 0

### **STABLE?**

Returns stability status TRUE or FALSE., time (*seconds*) to or after stability is reached.  
Returns the following:

FALSE, 300 - Unstable – stability time. (5 min)

FALSE, 185 - Counting down to stability.

TRUE, 408 - Stable and time since stability achieved.

### **STABTIME\_EXT <int>**

Set the Extern sensor stability time in minutes.

For example: STABTIME\_EXT 10

### **STABTIME\_EXT?**

Return the Extern sensor stability time in minutes.

For example: 5

**STABTIME\_INT <int>**

Set the Intern sensor stability time in minutes.

For example: STABTIME\_INT 5

**STABTIME\_INT?**

Return the intern sensor stability time in minutes.

For example: 10

**STABTOL\_EXT <float>**

Set the Extern sensor stability time in minutes.

For example: STABTOL\_EXT 0.2 CEL

**STABTOL\_EXT?**

Return the Extern sensor stability tolerance.

For example: +2.000000E-01, CEL

**TEMPUNIT**

Sets the display temperature unit.

After the command add

CEL = Celsius

FAR = Fahrenheit.

KEL = Kelvin

For example: TEMPUNIT CEL

*Sets the temperature unit to Celsius.*

**TEMPUNIT?**

Returns the temperature unit that is currently used for measuring.

**TRUESENSOR <str>**

Set the active true reading sensor.

INT=internal, Ext =external, SFT= Set follows True (External)

For example: TRUESENSOR EXT

**TRUESENSOR?**

Returns active true reading sensor.

INT=internal, Ext =external, SFT= Set follows True (External)

For example: SFT



[www.ametekcalibration.com](http://www.ametekcalibration.com)

**UK**

Tel +44 (0)1243 833 302  
[stc.uk@ametek.com](mailto:stc.uk@ametek.com)

**France**

Tel +33 (0)1 30 68 89 40  
[general.lloyd-instruments@ametek.fr](mailto:general.lloyd-instruments@ametek.fr)

**Germany**

Tel +49 (0)2159 9136 510  
[info.mct-de@ametek.de](mailto:info.mct-de@ametek.de)

**Denmark**

Tel +45 4816 8000  
[jofra@ametek.com](mailto:jofra@ametek.com)

**USA - California**

Tel +1 (800) 444 1850  
[crystal@ametek.com](mailto:crystal@ametek.com)

**USA - Florida**

Tel +1 (800) 527 9999  
[cal.info@ametek.com](mailto:cal.info@ametek.com)

**India**

Tel +91 22 6196 8200  
[jofra@ametek.com](mailto:jofra@ametek.com)

**Singapore**

Tel +65 6484 2388  
[jofra@ametek.com](mailto:jofra@ametek.com)

**China - Beijing**

Tel +86 10 8526 2111 ext. 19  
[stc.china@ametek.com](mailto:stc.china@ametek.com)