



Hand-held thermometer, model CTH7000

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Prior to starting any work, read the operating instructions!

Keep for later use!

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Declarations of conformity can be found online at [www.wika.com](http://www.wika.com).

## 1. General Information

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- The instrument described in the operating instructions has been designed and manufactured using state-of-the-art technology. All components are subject to stringent quality and environmental criteria during production. Our management systems are certified to ISO 9001 and ISO 14001.
- These operating instructions contain important information on handling the hand-held thermometer model CTH7000. Working safely requires that all safety instructions and work instructions are observed.
- Observe the relevant local accident prevention regulations and general safety regulations for the range of use of the hand-held thermometer CTH7000.
- The operating instructions are part of the instrument and must be kept in the immediate vicinity of the hand-held thermometer model CTH7000 and readily accessible to skilled personnel at any time.
- Skilled personnel must have carefully read and understood the operating instructions, prior to beginning any work.
- The general terms and conditions, contained in the sales documentation, shall apply.
- Subject to technical modifications.
- Factory calibrations/DKD/DAkkS calibrations are carried out in accordance with international standards.

Further information:

### WIKA Alexander Wiegand SE & Co. KG

- Internet address: [www.wika.de / www.wika.com](http://www.wika.de / www.wika.com)
- Relevant data sheet: CT 55.50
- Application consultant: Tel.: +49 9372 132-0  
Fax: +49 9372 132-406  
[info@wika.de](mailto:info@wika.de)

### Abbreviations, definitions

Alpha, or $\alpha$ ,	is the temperature coefficient, or temperature sensitivity, of the platinum wire used in PRTs. In general, the greater the alpha value, the better the PRT thermometer measurement reproducibility, stability and performance
PRT	(Platinum Resistance Thermometer)
Pt100	PRT with nominally 100 $\Omega$ resistance at 0°C
RTD	Resistance Temperature Device

System accuracy refers to the overall, combined accuracy of the CTH7000 and thermometer.

## 2. Design and function

### 2.1 Overview

EN



1. LCD display
2. Keypad
3. Inputs at the top
4. USB

### 2.2 Description

The CTH7000 is a precision instrument designed for laboratory, commercial and industrial temperature measurement and calibration applications.

Features include:

- Two input channels
- A large graphic LCD display for excellent viewing of temperature measurement values and instrument settings
- USB communication interface as standard for automated monitoring and calibration applications
- Calibration against traceable external standards

The CTH7000 will operate with all 4-wire Pt100 (100 ohm) Platinum Resistance Thermometers (PRTs) and with virtually all thermistors.

Temperature measurement units are user-selectable and can display °C, °F, K and Ω.

Overall system accuracy will depend on the sensor quality and calibration - see the specification section.

### 2.3 Scope of delivery

- CTH7000 precision thermometer
- Battery charger
- Operator's handbook on CD
- Calibration certificate
- USB lead
- Software U-Log

Please contact the Service Team immediately if any of these items are missing or damaged.

Please retain the packaging. In case of return, servicing or calibration, use the original packaging. Failure to do so may invalidate the warranty and/or incur additional costs outside the warranty period. Please contact your agent, dealer or supplier when the original packaging is unavailable.



## 3. Safety

### 3.1 Explanation of symbols



#### **DANGER!**

... indicates a directly dangerous situation resulting in serious injury or death, if not avoided.



#### **WARNING!**

... indicates a potentially dangerous situation that can result in serious injury or death, if not avoided.



#### **CAUTION!**

... indicates a potentially dangerous situation that can result in light injuries or damage to property or the environment, if not avoided.



#### **DANGER!**

... identifies hazards caused by electrical power. Should the safety instructions not be observed, there is a risk of serious or fatal injury.



#### **Information**

... points out useful tips, recommendations and information for efficient and trouble-free operation.

### 3.2 Intended use

#### 3.2.1 Application

The model CTH7000 hand-held thermometer is a high performance 2-channel thermometer for Pt100 and thermistor probes. The hand-held thermometer CTH7000 is a step up in measurement accuracy with a battery power.

The CTH7000 is designed for laboratory and industrial temperature measurement and calibration applications intended to be used in a basic electromagnetic environment.

#### 3.2.2 Functionality

The CTH7000 can handle all needs, with accuracies and resolutions normally associated with a bench top thermometer. Two inputs give direct temperatures from Pt100 or thermistor probes or can display the temperature difference between them. Measurements can be logged directly to memory or, use the USB port to control and data log with the PC.

Due to the wide range of this instrument it makes individual instruments needless and makes the calibration cost-effective.

Features included:

- Simple handling
- Large display with dual temperature display
- Min/Max value for monitoring of temperature limits
- Mean value function for statistical evaluation
- Selectable channel can be switched off to improve the clarity of the display data
- Recording and visualisation of temperature cycles with the help of the ULog software
- Data logger

This instrument is not permitted to be used in hazardous areas!

The instrument has been designed and built solely for the intended use described here, and may only be used accordingly.

The technical specifications contained in these operating instructions must be observed. Improper handling or operation of the instrument outside of its technical specifications requires the instrument to be taken out of service immediately and inspected by an authorised WIKA service engineer.

Handle electronic precision measuring instruments with the required care (protect from humidity, impacts, strong magnetic fields, static electricity and extreme temperatures, do not insert any objects into the instrument or its openings). Plugs and sockets must be protected from contamination.

The manufacturer shall not be liable for claims of any type based on operation contrary to the intended use.

For indoor use only.

Don't connect lines within a building which are longer than 30 m, or leave the building (including lines of outdoor installations).

### 3.3 Improper use



#### **WARNING!**

#### **Injuries through improper use**

Improper use of the instrument can lead to hazardous situations and injuries.

- ▶ Refrain from unauthorised modifications to the instrument.
- ▶ Do not use the instrument within hazardous areas.
- ▶ Do not use the instrument with abrasive or viscous media.

Any use beyond or different to the intended use is considered as improper use.

### 3.4 Responsibility of the operator

The model CTH7000 hand-held thermometer is a high performance 2-channel thermometer for Pt100 and thermistor probes.

The operator is therefore responsible for legal obligations regarding safety at work.

The safety instructions within these operating instructions, as well as the safety, accident prevention and environmental protection regulations for the application area must be maintained.

The operator is obliged to maintain the product label in a legible condition.

To ensure safe working on the instrument, the operating company must ensure

- that suitable first-aid equipment is available and aid is provided whenever required.
- that the operating personnel are regularly instructed in all topics regarding work safety, first aid and environmental protection and know the operating instructions and in particular, the safety instructions contained therein.
- that the instrument is suitable for the particular application in accordance with its intended use.
- that personal protective equipment is available.

### 3.5 Personnel qualification



#### **WARNING!**

#### **Risk of injury should qualification be insufficient**

Improper handling can result in considerable injury and damage to equipment.

- ▶ The activities described in these operating instructions may only be carried out by skilled personnel who have the qualifications described below.

#### **Skilled personnel**

Skilled personnel, authorised by the operator, are understood to be personnel who, based on their technical training, knowledge of measurement and control technology and on their experience and knowledge of country-specific regulations, current standards and directives, are capable of carrying out the work described and independently recognising potential hazards.

Special operating conditions require further appropriate knowledge, e.g. of aggressive media.

### 3.6 Personal protective equipment

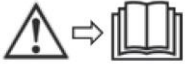
The personal protective equipment is designed to protect the skilled personnel from hazards that could impair their safety or health during work. When carrying out the various tasks on and with the instrument, the skilled personnel must wear personal protective equipment.

**Follow the instructions displayed in the work area regarding personal protective equipment!**

### 3.7 Safety marks

#### 3.7.1 Symbols

EN



Before mounting and commissioning the instrument, ensure you read the operating instructions!



#### **CE, Communauté Européenne**

Instruments bearing this mark comply with the relevant European directives.



This marking on the instruments indicates that they must not be disposed of in domestic waste. The disposal is carried out by return to the manufacturer or by the corresponding municipal authorities (see EU directive 2012/19/EU).

## 4. Design and Function

### 4.1 Principles of measurement

The CTH7000 measures the voltage ( $V_t$ ) developed across the unknown sensor resistance ( $R_t$ ) and the voltage ( $V_s$ ) across a stable internal reference resistance ( $R_s$ ). The voltages are proportional to the resistances so the thermometer resistance is derived from –

$$R_t = R_s \times \frac{V_t}{V_s}$$

This technique achieves immunity from slow moving time and temperature drifts in the electronics, as it is not affected by voltage measurement gain variations or current source fluctuations. In the same way that AC resistance measurement eliminates thermal EMFs, switched DC achieves a similar advantage. Switched DC works by reversing the current flow on alternate measurement cycles and taking the average value, thereby cancelling any thermal EMF offsets from the measurement.

For PRTs, the relationship between resistance and temperature varies slightly from one PRT to another. Therefore, no matter how accurately the CTH7000 measures the PRT resistance, if the relationship between resistance and temperature for a particular PRT is not known, accurate temperature measurement is not possible. For thermistors, the relationship depends totally on the thermistor type and specifications.

The CTH7000 uses PRT and thermistor calibration data to overcome this problem and calculates the result from temperature conversion functions stored in either the sensors 'SMART' connector or the CTH7000's internal non-volatile memory. This method enables the CTH7000 to convert resistance to temperature, uniquely for each sensor used.

It is very important, therefore, that a sensor without a 'SMART' connector is used on a properly configured input channel and that the probes' coefficients are correctly entered into the instrument. System accuracy is a combination of the CTH7000 accuracy in measuring sensor resistance and the calibration uncertainty placed on PRTs and thermistors by the calibrating laboratory.

### 4.2 Front panel

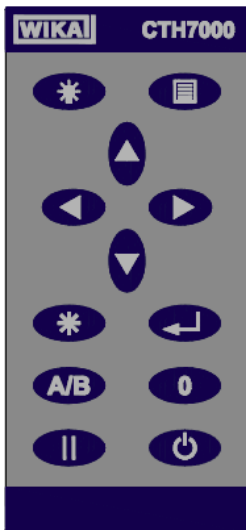
#### 4.2.1 Overview

EN



1. LCD display
2. Keypad
3. Inputs at the top
4. USB

## 4.2.2 Keypad



Key	Function
	Menu display
	Backlight
	Up arrow
	Down arrow
	Left arrow
	Right arrow
	Clear (view statistics)
	Enter
<b>A/B</b>	A/B channel select
<b>0</b>	Zero (offset) reading
<b>  </b>	Hold reading
	Power on/off

The **Power** (⏻) key turns power on and off<sup>1</sup> to the CTH7000.

The CTH7000 uses a menu system. The **Menu** (☰) key is located at the top right of keypad. Use the **Menu** key to access to the less frequently used CTH7000 functions.

The four **Arrow** (▲ ▼ ◀ ▶) keys are used to navigate through the menus<sup>2</sup>; the **Enter** (↵) and **Clear** (✳) keys are used to act on the menu selections<sup>3</sup>.

The **Backlight** (✳) key located at the top left of the keypad provides LCD illumination when the ambient light-level is too low for normal viewing.

The **A/B** key is used to select one of the two channels or the difference (A – B)

The **Zero** (0) key is used to provide relative (offset) readings.

The **Hold** (||) key is used to freeze the current reading.

<sup>1</sup> The CTH7000 may also be set to power-off after a preset period.

<sup>2</sup> The Up (▲) and Down (▼) keys can be used to change the displayed units

<sup>3</sup> The Clear (✳) key is also used to view CTH7000 statistics; press once to select the statistics page. Press any key to return.

### 4.2.3 About the display screen

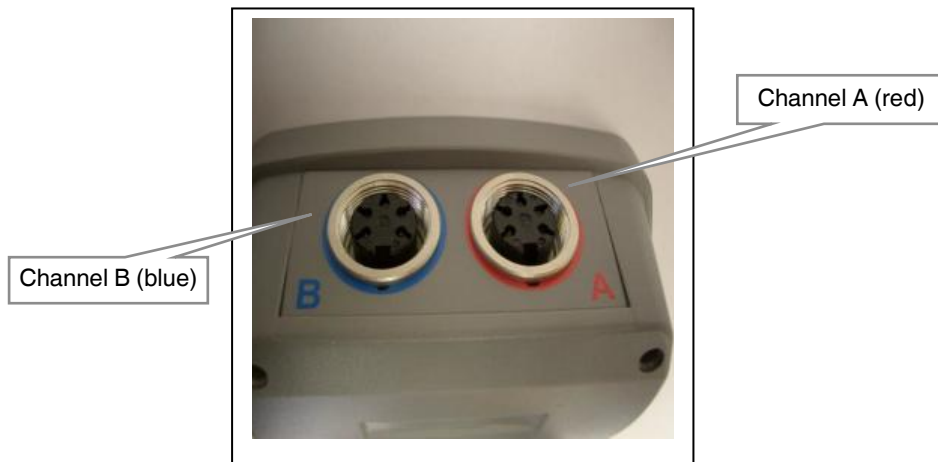
The large graphic LCD screen is the direct link to the instrument, presenting the measurement results and information or menus to set and control the instrument.

EN

The LCD screen is designed for reflective-viewing under normal ambient lighting; a backlight is provided for use when ambient conditions are darker.

### 4.2.4 CTH7000 thermometer inputs

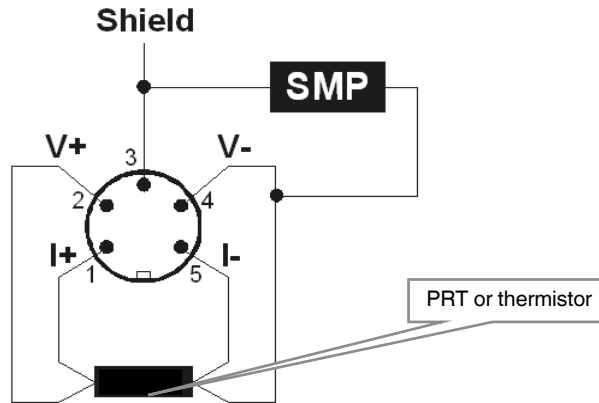
There are two input channels; two 5 pin DIN input-sockets are located at the top of the instrument. These are designed to take either PRT or thermistor probes. Channel A is colour-coded red. Channel B is colour-coded blue.



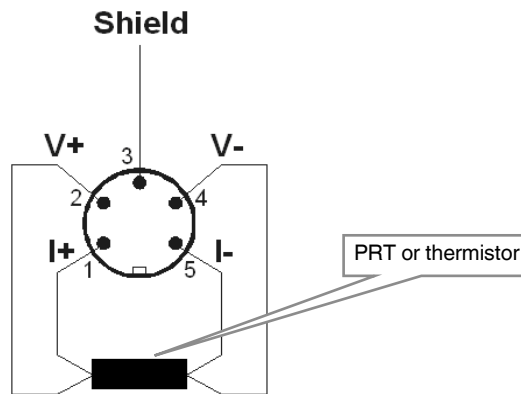


Either channel can accept either Smart or Passive probes; any combination of probes can be used together. Smart probes (described in section 4.5) contain their own calibration information and communicate this to the CTH7000 as soon as they are used. Passive probes do not contain calibration information and the CTH7000 must be set-up with the calibration information for each probe used (and each time the probe is changed).

Probe connection information for both PRTs and thermistors<sup>4</sup> is shown below (viewed looking towards the sockets) -



4-Wire SMART probe (SMP) PRT/thermistor input



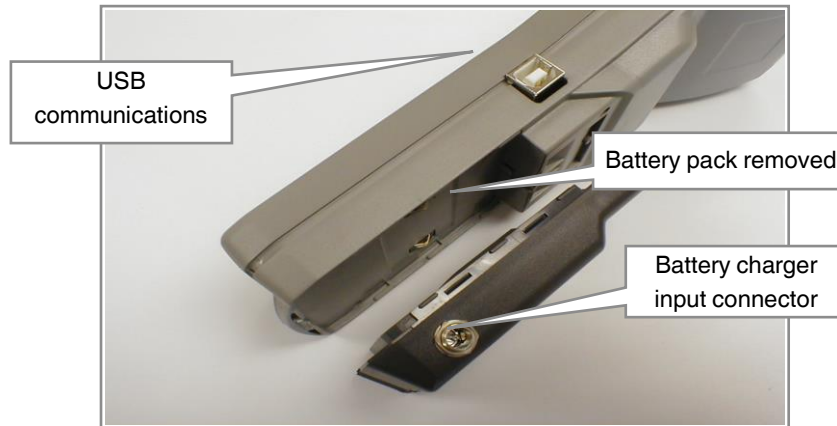
4-Wire Passive probe PRT/thermistor input

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<sup>4</sup> Two wire PRTs/thermistors must have pins 1 & 2 connected together and also pins 4 & 5 connected together.

4.2.5 Battery Pack

EN



The instrument operates from battery power. The battery pack is replaceable. A low battery indication is shown on the LCD when the battery needs recharging; the instrument also audibly indicates a low battery condition. The battery may be d when attached to the instruments.

4.2.6 Removing and replacing the battery pack

To remove the battery pack, press the latching tab and slide the battery pack backwards.



To replace the battery pack, place the pack in position before sliding home. Check that the battery pack is securely in position before using the instrument.

4.2.7 Battery charger

Please observe the following warnings (repeated from the front of the manual).



**WARNING!**

**Only use the battery charger supplied.**

Use of any other charger will invalidate the warranty and may lead to the danger of overheating and to permanent instrument damage.



**WARNING!**

Take care not to short the battery packs' contacts with any metal object when the pack is not connected to the instrument.



**WARNING!**

Take care not trap any part of your hand when closing the battery compartment.



**WARNING!**

Never cover the battery pack or charger during use.

The batteries are located in a removable pack located on the base of the instrument.

The battery pack contains two NiMH cells (in series) and a charger control circuit. The battery pack must only be charged using the unit supplied.

The battery pack has a socket on its side that accepts the charger's connector. A LED (viewable through an aperture on the top-rear of the pack) indicates the charger status.

The battery charger is provided with various interchangeable mains connectors; select the one that you require - see the charger PSU pack for details.



**Information**

Disconnect the charger when not charging the battery pack.



Charge indication LED

4.2.7.1 **Charging the battery pack**

The CTH7000 battery pack may be charged during instrument use, when the instrument is off, or when the pack is detached from the CTH7000.

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**Information**

Performance may degrade if the batteries are charged during use.

Please follow the instructions below to ensure that the battery pack is fully charged (LED charge status is shown in the table below) –

- Turn off power to the adapter before plugging it into the side of the battery pack.
- Switch on the power adapter (6 Vdc), ensuring the LED flashes orange.
- Leave the battery pack to fully charge. An overnight charge of about 10 hours (for a flat battery with the CTH7000 off<sup>5</sup>) will ensure that the pack is fully charged (the actual time depends on the initial battery state)<sup>6</sup>. Charge time will increase if the CTH7000 is used during this period.
- Turn off and remove the power adapter after charging is complete.  
The meaning of the various LED indications is shown on below –

Status LED	LED indication	LED indication
Slow orange flash (1 s)		Trickle charge
Fast orange flash (0.2 s)		Fast charge
Solid green		Charged (trickle charge enabled)
Slow red flash (1 s)		Low battery temperature (trickle charge enabled)
Solid red		PSU voltage too high <sup>7</sup>
Fast red flash (0.2 s)		Hardware error <sup>8</sup>

<sup>5</sup> Allow 5 minutes before use if the batteries are completely flat.

<sup>6</sup> Charge times may increase at higher ambient temperatures.

<sup>7</sup> Charge times may increase at higher ambient temperatures.

<sup>8</sup> Refer to customer services.

### 4.2.8 Name plate(s)

The instrument rating plate shows the instruments maximum power consumption and instrument serial number.

The label on the battery charger shows its operating voltage, current, frequency and pack's serial number.

### 4.2.9 USB Communication interface connector

The USB connector is fitted as standard. Communication requires the installation of the USB driver on a PC. See the separate information supplied on the CD. A standard USB cable is supplied with the CTH7000.

The instrument can be used with the ULOG program (supplied on the CD) or simply used to transmit ASCII data, which may be recorded using a simple terminal program.



#### Information

Communication via an USB cable connected to a PC may cause the CTH7000 to be noisy. WIKA can accept no responsibility for any performance degradation when connected to a PC.

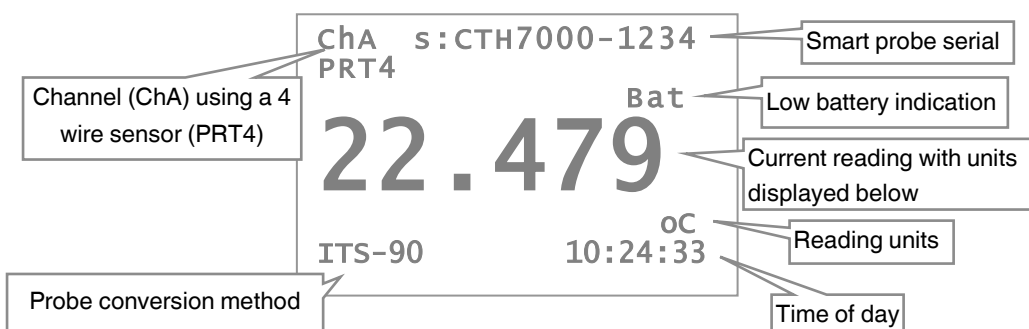
## 4.3 Instrument operating modes

The instrument has two operating modes -

- **Measurement Mode** which displays the measurement readings and status information
- **Menu Mode** which lets you select and alter the instrument operation and its settings

### 4.3.1 Measurement Mode

In Measurement Mode, the LCD displays the current reading (temperature or resistance), the unit symbol, the channel and type of sensor selected (and conversion method); the time of day is also shown. This is the normal operating display for the CTH7000. The display will look similar to the one shown below -



<sup>9</sup> The time will be replaced by 'Logging' or 'Remote' when these modes are selected

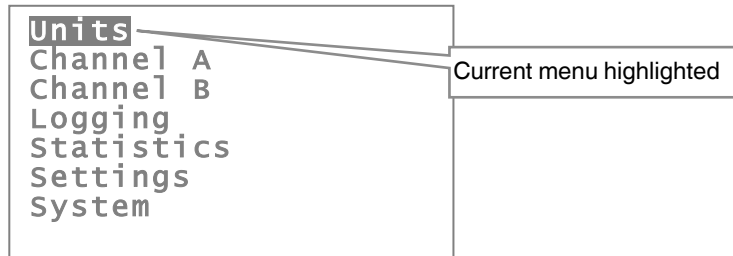
This display will always reflect the operation of the instrument, showing the current reading and settings. Readings are updated at the normal conversion rate of one every two seconds.

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### 4.3.2 Menu Mode (☰ key)

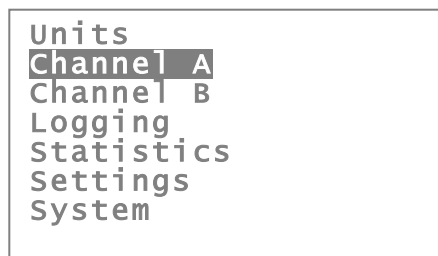
In menu mode, the LCD displays the various options available to control CTH7000 operation.

Press the **Menu** key (☰) to select the menu screen.



The reverse-video background indicates the menu that will be selected should the **Enter** key (↵) be pressed (Units selection in the example above). Further menu options will follow once the **Enter** key has been pressed.

Press the **Up** (▲) and **Down** (▼) keys to move through the options. Pressing an up/down key will move the reverse video selection one line up or down one line<sup>10</sup>. Once the selection is correct, press the **Enter** key. So, for example, to change channel A options, press the **Down** key (▼) once to obtain the following display -



Now press the **Enter** key (↵) to select this option. The following screen will appear (when a Smart probe is connected to channel A). The display will be different for a passive probe -



<sup>10</sup> The selection line will wrap round from top to bottom (or bottom to top) on repeated arrow presses.

Press the **Down** key ( ▼ ) once to obtain –

```
SMP Probe Info
SMP Coefficients
```

Now that this menu has been highlighted, press the **Enter** key ( ↵ ) once to obtain –

```
          ChA(s)      CVD
R0      +1.00000e+02
A       +3.90830e-03
B       -5.77500e-03

          Read only
Up/Down          Move
Clear           Exit
```

In this example, pressing the **Up** or **Down** key will display more of the Smart probes' coefficients. Pressing the **Clear** key ( ✱ ) will return the display to the previous menu. Press the **Clear** key ( ✱ ) once more to return to Measurement mode. Pressing the **Enter** key ( ↵ ) will return the CTH7000 immediately to Measurement Mode (generally applies to all lower level menu options).

No changes can be made in this example. When changes are made, all settings are stored and retained when power is removed.

Refer to the sections on Smart Probes for more details.

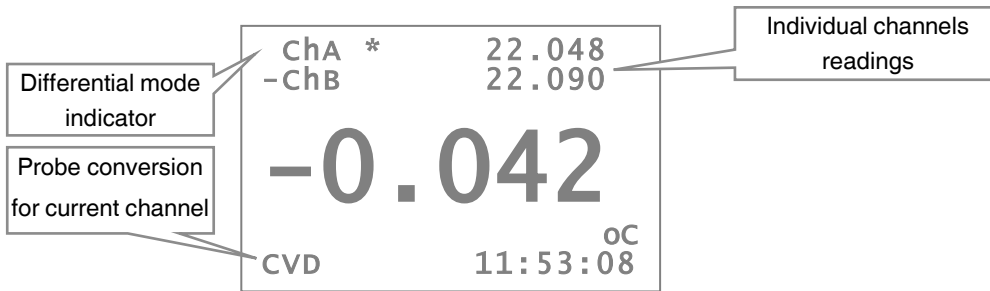
4.3.2.1 **Selecting the thermometer input channel and differential mode (A/B key)**

The channel **Select** key ( **A/B** ) is used to change between channels and also to select the differential mode ( **A – B** ). The channel selection order is –

**Channel A → Channel B → Channel (A – B) → Channel A**

A missing probe will be indicated on the display by a series of dashed lines.

In differential mode (when both channel A and channel B have probes connected), the screen will look similar to the following example. The asterisk next to the ChA and ChB legends will alternate as readings are updated.

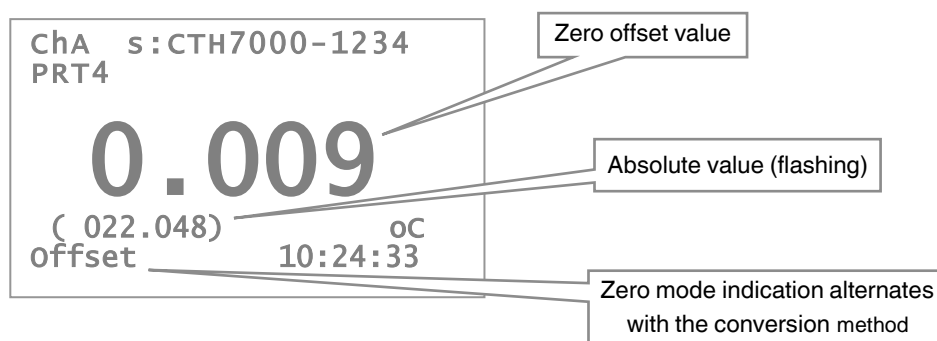


The probe conversion indicator (bottom-left) displays the conversion method for the current reading (and so will alternate if the two channels have different conversion methods).

4.3.2.2 **Selecting relative temperature measurement (0 key)**

The instrument displays a reading value relative to a fixed offset in Zero (or relative) mode. Press the **Zero ( 0 )** key to select this mode.

In Zero mode, the instrument stores the last reading (at the time of **Zero** key press) to subtract from all subsequent readings. It continues doing this until it is either cancelled by pressing the Zero key again or until power is removed.



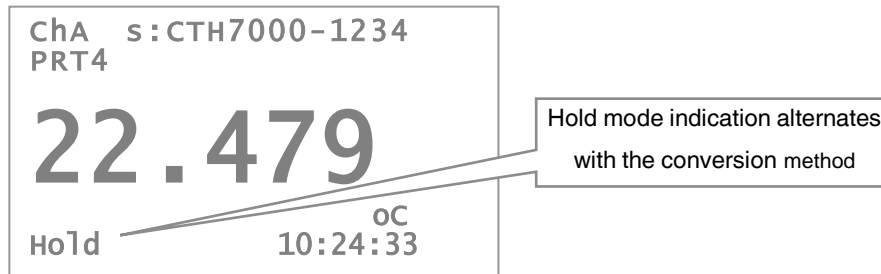
Zero mode may be used on differential measurements (A – B). In this case, the difference is set to zero at the time the key is pressed and the absolute value in the example above, is replaced by the absolute difference value.

To cancel the relative measurement mode, press the **Zero ( 0 )** key again. Zero mode is cancelled when power is turned off.



#### 4.3.2.3 **Selecting run/hold mode ( II )**

Instrument measurements stop completely when **Hold** mode is active. This is indicated on the bottom-left of the display where **Hold** mode indication alternates with the current conversion method, providing a flashing indication. Hold mode may be used when the CTH7000 is in differential mode.



Press the **Hold ( II )** key to alternate between run and hold modes. **Hold** mode is cancelled when power is turned off.

#### 4.3.2.4 **Backlight key ( ★ )**

Press the **Backlight** key ( ★ ) to illuminate the display. Once on, the backlight will go automatically off after about 10 seconds; alternatively, press the key again to turn it off.



#### **Information**

When the CTH7000 is battery operated, using the backlight will dramatically reduce battery life (by about 30% if used continually at full-brightness).


The brightness level can be set on the **Settings** menu (see later section). Reducing the brightness value will increase battery life when the backlight is used.

### 4.3.3 **Other menu options**

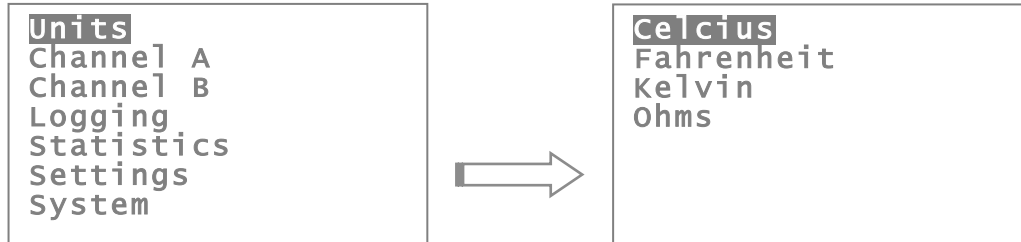
This section describes the other options available through menu selection. Generally, these options are set once and then altered rarely. The set-up is stored in non-volatile memory and recalled when power is reapplied.

In the following sections, the top level menu is shown, followed by the sub-menu(s) that it selects.

4.3.3.1 *Selecting Units*<sup>11</sup>

Press the **Menu** key (  ) to change the measurement units. The **Units** menu will be highlighted. Press the **Enter** key once to reach the **Units** selection menu.

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Select the units required with the **Up/Down** keys and then press the **Enter** key. Units of Celsius (°C), Fahrenheit (°F), Kelvin (K) or Resistance ( $\Omega$ ) can be selected; the current units are shown on the Measurement Menu screen. Changing units will automatically clear any statistics. The current measurement units are retained when power is removed.

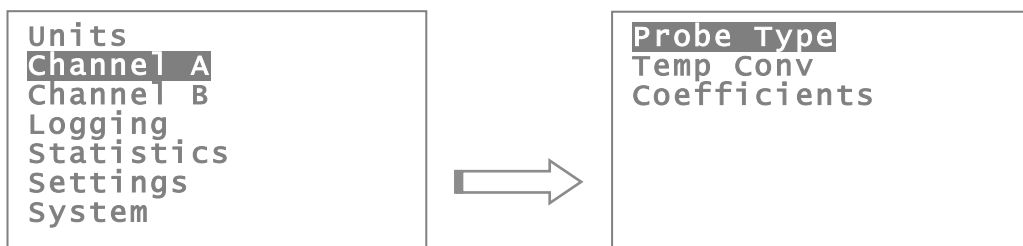
Having selected the new units, press the **Menu** key to return to Measurement Mode.

4.3.3.2 *Channel options menu (Channel A or Channel B)*

Operation of channel A and channel B is identical; Press the **Enter** key to select the sub-menu –

a) **Probe type**

The sub-menu is used to select the type of probe attached. There are two completely different probe types - either PRT or Thermistor. This probe selection sub-menu is used to set these options.



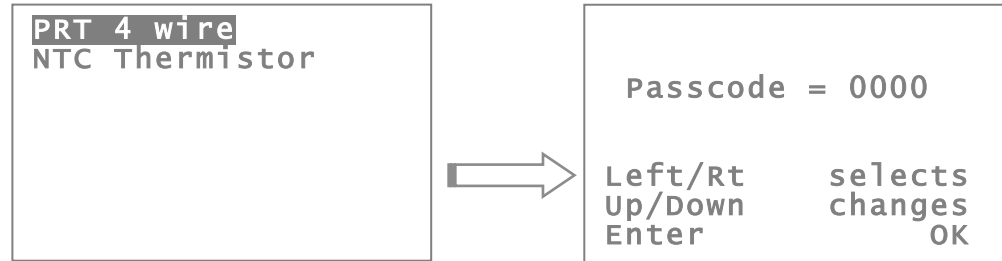
The currently selected sensor type is always shown at the top left of the measurement screen (see the example shown in section 4.3.1).

Channel A is always used for the PRT probe and channel B is always used for the Thermistor probe.

<sup>11</sup> Alternatively, the Up ( $\blacktriangle$ ) and Down ( $\blacktriangledown$ ) keys can be used to change the displayed units

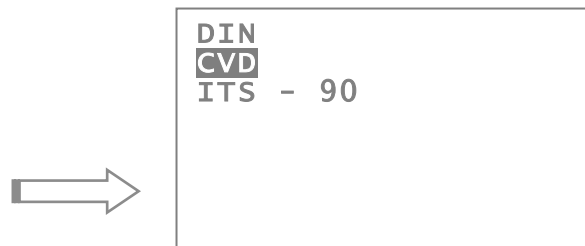
Use the **Down** key (twice) to select the thermistor probe on channel B. When the menu is entered again, the thermistor line will be highlighted.

Selection of PRTs is more involved since the conversion method has to be set at the same time as the probe is changed. Selecting one of the PRT menus will display the passcode screen –



#### b) Conversion method

Use the **Up/Down** arrow keys to increment or decrement the passcode. Use the **Enter** key once the correct passcode has been set; this procedure helps to prevent inadvertent changes. The default passcode setting<sup>12</sup> is 4300.



This screen will only appear once the correct passcode has been entered. This screen shows that the CVD conversion method is currently selected. Use the **Up** and **Down** keys to highlight the required conversion method and then use the **Enter** key to select it.

<sup>12</sup> This can be changed using the Settings menu; keep careful note of the new value if changed. A lost password can be retrieved, but you will need to contact WIKA directly for further information.

For PRTs, the instrument provides three standard algorithms for converting resistance to temperature. The choice of algorithm will depend on the type of PRT and its calibration –

- DIN (1992) - used for un-calibrated industrial PRTs with 0.00385 'alpha' value, to provide a conversion of resistance to temperature in accordance with BS EN60751 (ITS 90) standard
- CVD coefficients - Callendar van Dusen used for calibrated industrial or low alpha PRT's of 0.00385
- ITS-90 coefficients - used for calibrated high alpha PRT's of values 0.003926 to 0.003928

The choice of conversion method and the relevant coefficients are set from this menu.

For Thermistors, the instrument provides one standard algorithm for converting resistance to temperature –

- Steinhart and Hart

#### c) Probe coefficients

Both PRT and Thermistor probes must be correctly calibrated to produce their most accurate performance. The CTH7000 can store calibration data for each of the two channels; this information is only required when passive probes are being used. When Smart probes are used, the calibration data is stored in the probe and the coefficients held in the CTH7000 are not required or used.

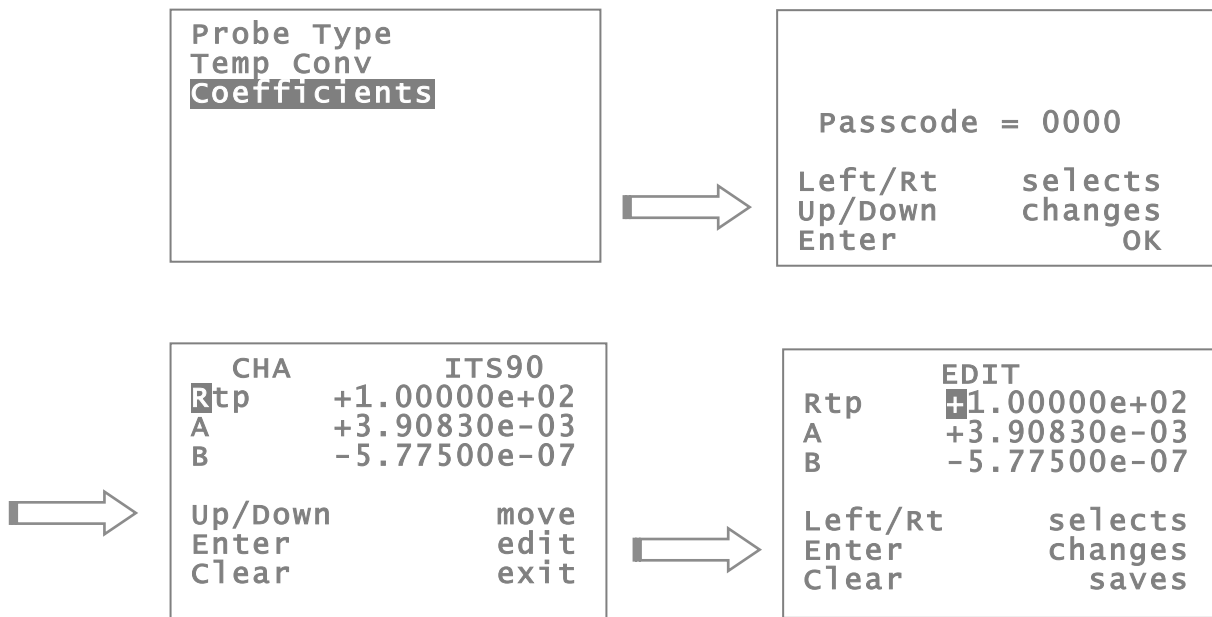


#### Information

Smart probes use their own internal calibration data. The instrument coefficients are ignored when a Smart probe is attached.

When passive probes are used, correct entry of the parameter values is absolutely critical to obtain accurate readings. For this reason, the coefficients menu is passcode protected. The passcode screen (below) will appear once the **Coefficients** menu has been selected. Use the **Up** and **Down** arrow keys to increment or decrement the passcode value.

Use the **Enter** key once the correct passcode has been set; this procedure helps to prevent inadvertent changes. The default passcode setting<sup>13</sup> is 4300.



The coefficient edit screen will appear once the correct passcode has been entered. In this example, the edit screen for CVD coefficients is shown; the first digit of the  $R_{tp}$  coefficient will be highlighted (in this case the '1'). This is the current cursor position.

Use the **Up** and **Down** keys to change the value under the cursor. Once this value is correct, use the **Left** and **Right** keys to select the next digit to set.

Use the **Enter** key once the complete coefficient has been edited correctly; alternatively use the **Clear** key to move on to the next coefficient<sup>14</sup>. The coefficients will be set to the value shown when the **Enter** key is pressed.

Once the first coefficient has been edited, the screen will scroll (if more than three coefficients are required). Note that DIN coefficients cannot be edited.

Follow a similar procedure for entry of NTC thermistor coefficients.

<sup>13</sup> This can be changed using the Settings menu; keep careful note of the new value if changed. A lost password can be retrieved, but you will need to contact WIKA directly for further information.

<sup>14</sup> Use the Clear key repeatedly to exit without changing any of the coefficients.

4.3.3.3 **Data logging menu**

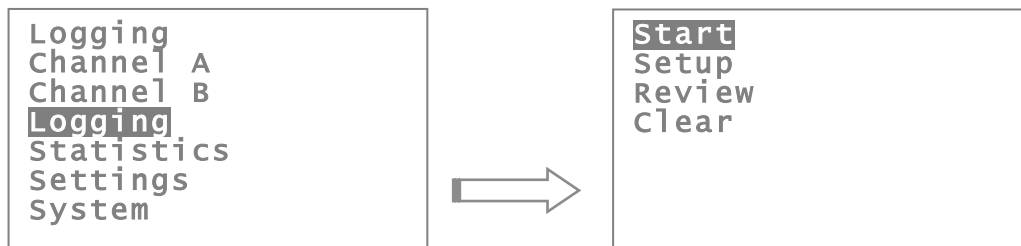
The CTH7000 can log data. Logging status is always shown at the bottom right-hand of the measurement screen.

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Data can be logged at regular intervals (the interval is set when **Setup** selected), reviewed and logging can be turned on and off.

Press the **Enter** key to select the sub-menu used to set the various logging options.

Note that there are a finite number of data points that can be stored, so eventually, any old results will be overwritten as the selected log will eventually wrap-round – i.e. the oldest reading will be overwritten first<sup>15</sup>.

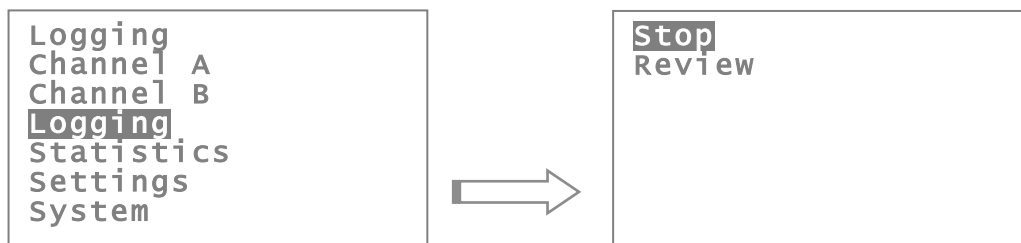


Use the **Start** menu item to begin logging.

Select **Clear** to clear the log and return to the main menu.

Selecting **Stop** (see below) will halt logging. Logging can be restarted using the **Start** menu item (logging will then continue after the last point previously logged).

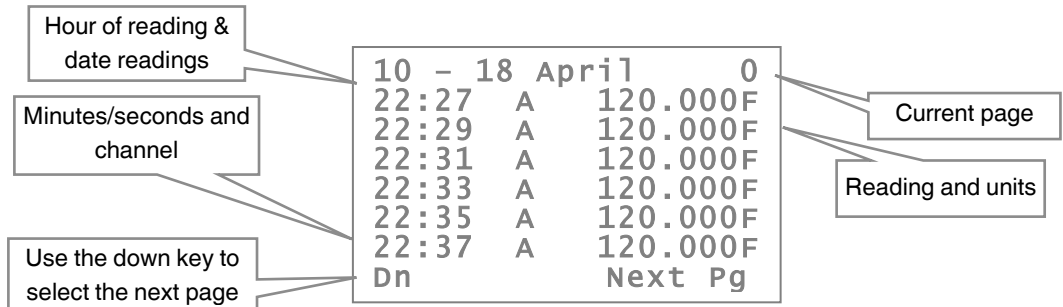
Only two menu options will be available when the instrument is logging.



<sup>15</sup> After approximately 8000 points when continuously logging; starting and stopping the log will decrease this number points available.

**a) Review**

Results similar to the following example will appear once the **Review** key has been pressed.; exact details will vary with the instrument setup. The example shows channel A results logged at 2 second intervals.



Use the **Down** key to scroll through the logged readings a page at a time. Press the **Clear** key ( \* ) to return to the main menu screen.

**b) Setup**



Use the setup menu to set the logging interval. Either select the required interval with the **Enter** key or use the **Clear** key to return to the measurement menu.

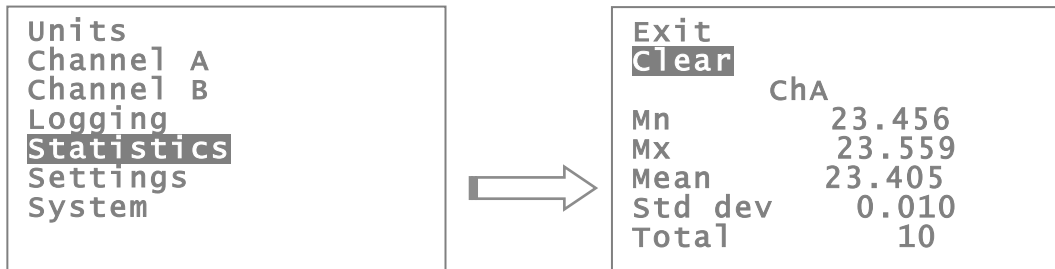
The interval can be set anywhere between 1 second and 59 minutes 59 seconds (a logging interval of 2 seconds is shown in the example). Selecting an interval of 00:00 will log data as fast as possible; select an interval that best matches your requirements. Logging with a larger data intervals effectively increases the total period for which data can be logged. Logging will stop when the power is turned off.

4.3.3.4 *Statistics menu*

The CTH7000 provides statistics on the data it is collecting. Press the **Enter** key to select the statistics sub-menu.

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Statistical information is calculated continuously from the moment statistics are cleared (see sub-menu). Changing any parameter that affects the calculation (e.g. units) will automatically clear and restart calculation.



The **Exit** option is used to return to the Measurement Menu after viewing statistics. Alternatively, press the **Clear** key ( \* ) to return to Measurement Menu without clearing statistics.

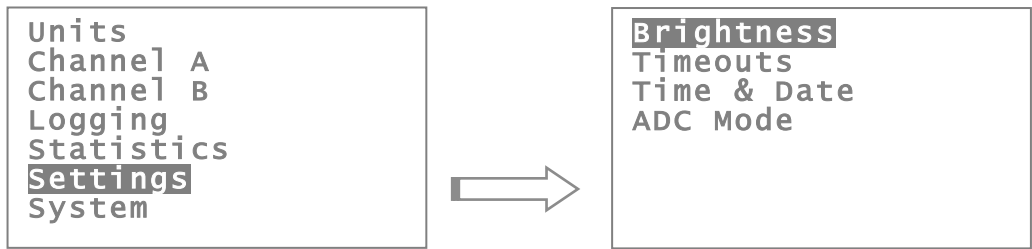
The minimum, maximum, mean, standard deviation and total number of readings are displayed on this screen<sup>16</sup>. Select **Clear** to immediately clear and restart the statistical calculations.

<sup>16</sup> The maximum and minimum values are also displayed continuously on the measurement menu screen.

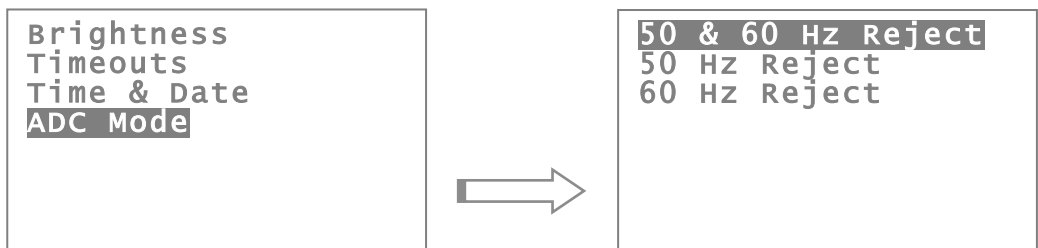


4.3.3.5 **Settings menu**

Several operational parameters can be changed in the Settings menu. Press the **Enter** key to select the Settings sub-menu. For example, to change the ADC mode (50/60 Hz) setting -

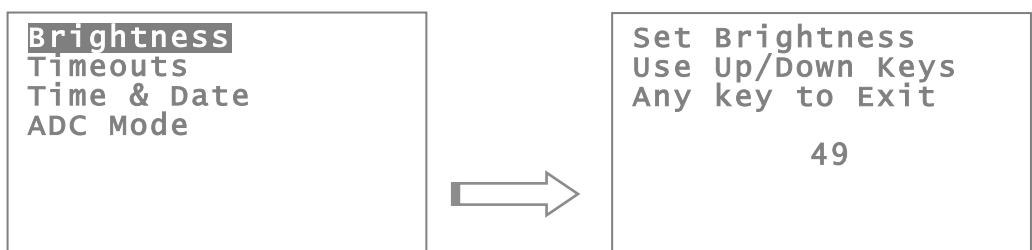


CTH7000 has been set to 50 Hz & 60 Hz reject (rejection filter) by default. Select 50 Hz or 60 Hz, depending on the operational mains frequency in your area. This can provide better noise rejection. See the menu screen shown below.



a) **Brightness**

Selecting this option allows the brightness of the LCD backlight to be adjusted. Use the **Enter** key once you are happy with the backlight intensity. Use the **Clear** key to exit without altering the set value.



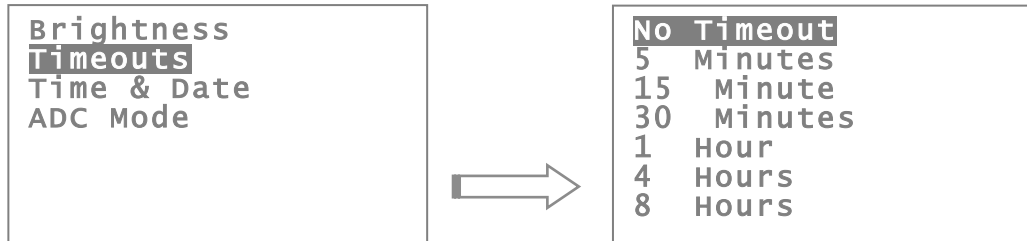
**Information**

When the CTH7000 is battery operated, using the backlight will dramatically reduce battery life. The current used increases as the backlight intensity rises.

**b) Timeouts**

The CTH7000 can be set to timeout after a preset period (to save battery life); by default the timeout is off.

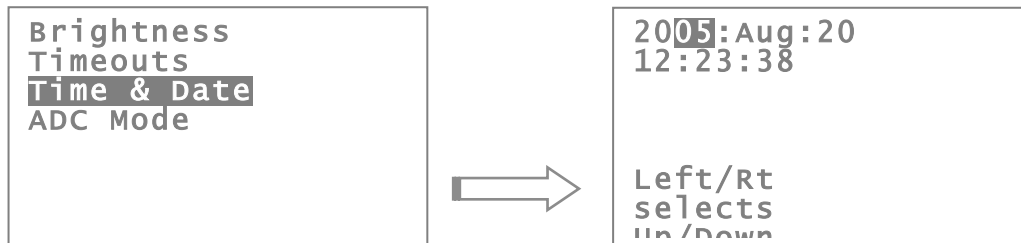
Selecting this option allows the various timeout values to be set. Use the **Up** and **Down** keys to select the required timeout and then press the **Enter** key to select it (or use the **Clear** key to return to the Measurement Menu).

**c) Time/Date menu**

The CTH7000 contains a real-time clock<sup>17</sup>. The Time/Date menu is used to set the clock.

The menu keys are used to change the settings. Use the **Up** and **Down** keys to alter the value under the reverse-video cursor. Once the correct value is set, use the **Right** and **Left** keys to move to the next field. Use the **Clear** key to exit without changing the values. The **Enter** key will set the clock to the new values.

It is important to set the clock correctly when using data logging.

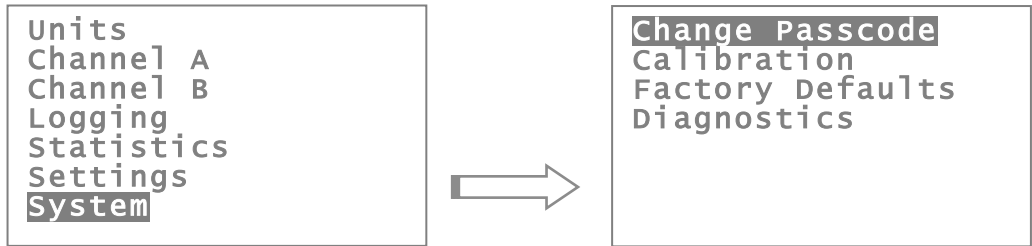
**d) ADC mode**

See the example at the start of this section.

<sup>17</sup> The clock battery is contained internally; the battery pack is not used for the real time clock.

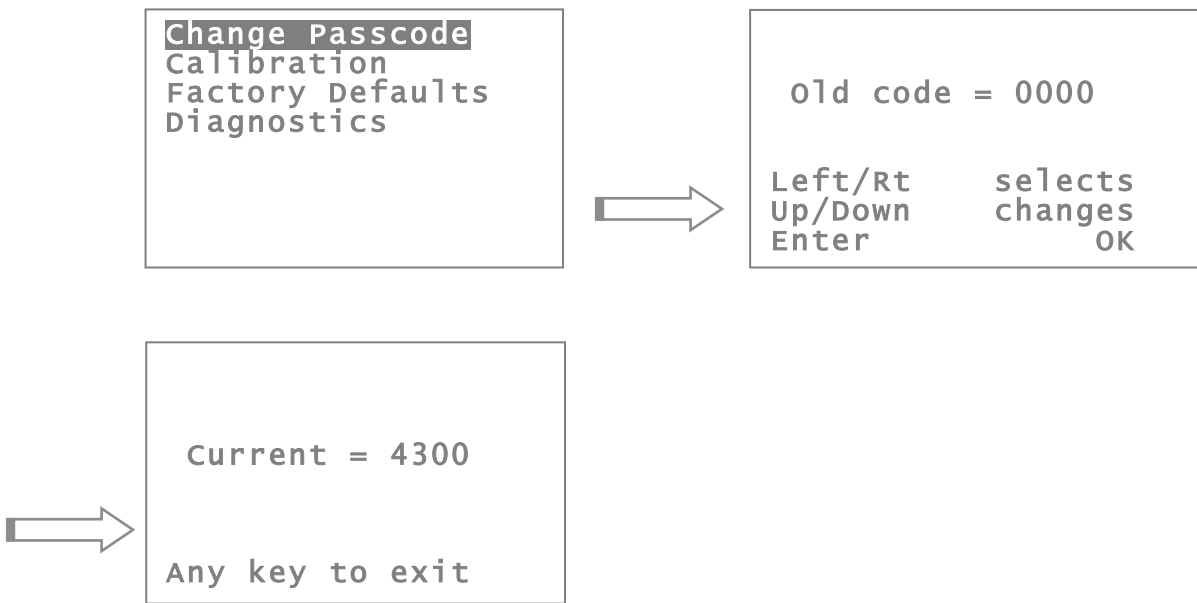
4.3.3.6 **System menu**

The settings menu allows the remainder of the instrument parameters to be set.



**a) Change Passcode**

Selecting this option allows the CTH7000 passcode to be set to another value<sup>18</sup>. The current passcode has to be entered before it can be altered. The passcode screen will always show the value '0000' when it is first displayed; use the **Up** and **Down** keys to change this to the current passcode value. Press **Enter** when the current passcode is correct. The new value can then be set. In the example below, the passcode is '4300'.



<sup>18</sup> Set to 4300 by default

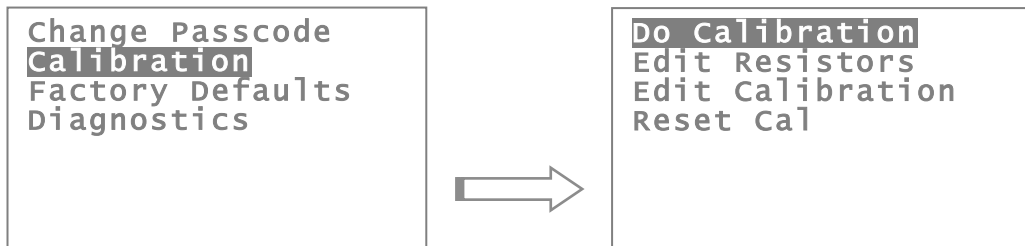
**b) Instrument calibration**

Selecting this option allows the CTH7000 to be calibrated; this option will overwrite and replace the existing calibration data. The correct equipment, environment and accurately calibrated resistors are required. For this reason, a passcode (9900) has to be entered first –

**Information**

**Selecting this option will overwrite the instrument calibration data.**

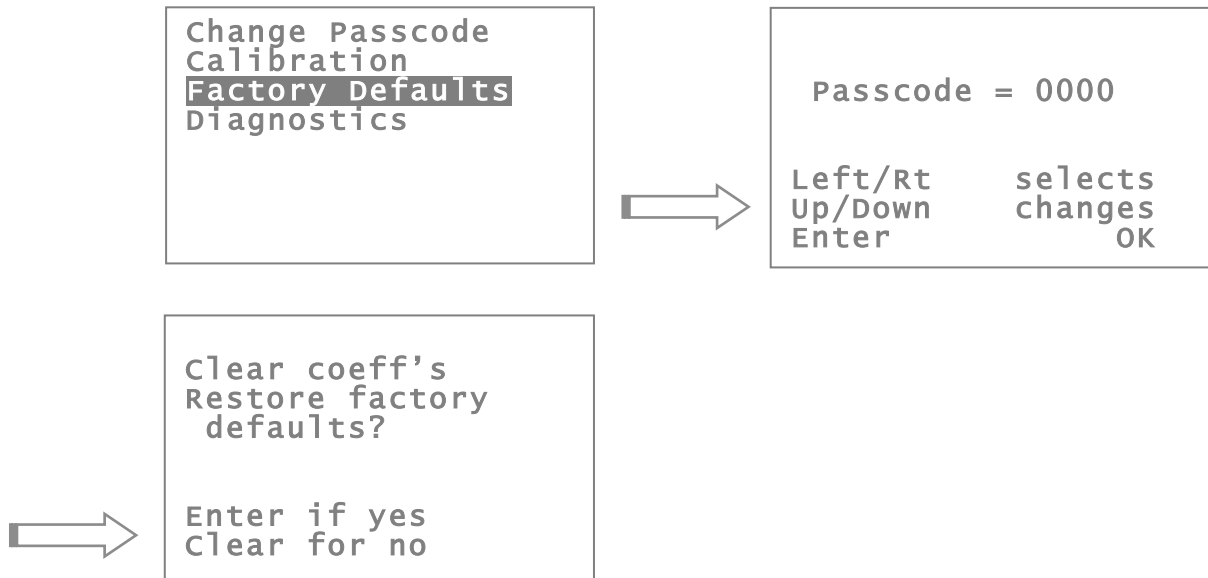
Do not attempt to do this unless you have the correct equipment, environment and suitably trained personnel.

**Information**

Specialised equipment is required to proceed further with this procedure.

## Factory defaults

The instrument parameters can be set to the factory defaults. Selecting this option will overwrite any existing calibration data. For this reason, a passcode (9900) must be entered (see below) -



### Information

Selecting this option will overwrite all instrument calibration data and settings. Do not attempt to do this unless you have the correct equipment, environment and suitably trained personnel.

### c) Diagnostics

Not available for use.

### 4.3.4 Setting up Temperature measurement

To enable accurate resistance to temperature conversion to be carried out by the instrument, PRT or characterisation data is required for both –

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- temperature conversion algorithm, and
- temperature conversion algorithm coefficients

For Thermistors, characterisation data is only required for –

- temperature conversion algorithm coefficients

The data can be stored in either a Smart probe or the instruments' internal non-volatile memory, each thermometer input channel stores one set of PRT/Thermistor characterisation data. See the relevant section above for details on entering the data.

#### 4.3.4.1 *Temperature measurement with Smart probe (s)*

If a Smart probe is detected on a selected input channel, the PRT calibration data is loaded directly from the Smart probe. Smart probe data always takes precedence over the internal CTH7000 coefficient data (but does not overwrite the instrument data).



#### **Information**

The CTH7000 may take up to 5 seconds to recognise and acquire data from the Smart Probe after switch-on before displaying a measurement.

#### 4.3.4.2 *Instrument calibration*

This is not usually a customer option; refer to separate documentation.

#### 4.3.4.3 *Firmware Version*

The firmware version is shown at the bottom of the LCD when the instrument is first powered.

### 4.3.5 Smart Probe review

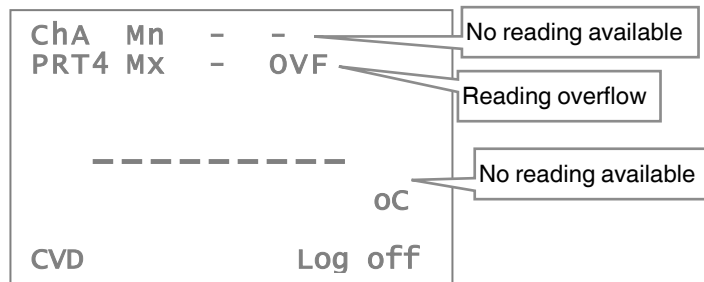
The Smart probe data can be reviewed, but not changed on the CTH7000. The Smart probe data contains the following information –

<b>Version</b>	Smart probe data format
<b>Lock</b>	Password protection state 00 = Smart probe data locked can not be changed from the instrument 01 = Smart probe data unlocked can be changed from the instrument
<b>Cal type</b>	Selected method of resistance to temperature conversion algorithm to use, DIN, ITS90, CvD or Steinhart and Hart (for thermistors)
<b>Cal date</b>	Date of the Smart probe calibration
<b>Due date</b>	Date the Smart probe calibration is next due
<b>Source</b>	Company that carried out the Smart probe calibration
<b>Serial Number</b>	Serial number of the Smart probe
<b>Max since cal</b>	Maximum recorded temperature the Smart probe has been exposed to since it was last calibrated (units are in resistance)
<b>Min since cal</b>	Minimum recorded temperature the Smart probe has been exposed to since it was last calibrated (units are in resistance)
<b>Max ever</b>	Maximum recorded temperature the Smart probe has been exposed to during its working life (units are in resistance)
<b>Min ever</b>	Minimum recorded temperature the Smart probe has been exposed to during its working life (units are in resistance)

4.4 Instrument Measurement Range

EN 4.4.1 Instrument measurement working range

The instrument can detect the following conditions Open Circuit Probe<sup>19</sup>, Over Range measurement and Under Range measurement. These conditions are shown by a line of dashes ‘-----’ on the LCD display.



4.4.2 Measurement Ranges

Measurement Units	Conversion	Under Range	Over Range	Units
<b>Thermistor</b>				
Resistance	None	0	400 Ω	ohms
Temperature	S & H	Thermistor dependent		°C/°F/K

Measurement Units	Conversion	Under Range	Over Range	Units
<b>PRT</b>				
Resistance	None	0	410 Ω	ohms
Temperature	Din90	-201°C	+851 °C	°C/°F/K
	CvD	-201°C	+850 °C	°C/°F/K
	ITS90	-201°C	+963 °C	°C/°F/K

<sup>19</sup> Because of the potentially high resistances of thermistors, it may not be possible to determine the difference between connected and disconnected probes for these sensors.



### 4.5 Smart Probes

#### 4.5.1 About Smart Probes

Smart probes are similar to passive probes except for one key advantage - all the probe details, calibration data and probe history are stored within the probe itself and not within the measurement instrument.

Smart probes can be moved freely from channel to channel or from instrument to instrument without the need to manually enter any data into the instrument.

#### 4.5.2 How Smart Probes Work

Each Smart probe is fitted with a small non-volatile memory device; this device is transparent during normal temperature measurement.

The probe is interrogated before a measurement cycle and the probe data is read into the instrument for use in the measurement process.

#### 4.5.3 Smart Probe Data Security

To maintain a high level of data security, the Smart probe has a built in data-lock. If the data-lock is set, the Smart probe data cannot be modified.

#### 4.5.4 Smart Probe Calibration Supervisor

To assist in maintaining valid calibration, the instrument checks the Smart probe calibration date and compares it with the instrument's current date. If the Smart probe date is found to have expired, the instrument will warn the operator 'Probe is out of calibration'.

#### 4.5.5 Smart Probe Working Range Monitor

The Smart probe working range monitor is used to monitor a Smart probe's working range and to notify a user if it is used outside its specified range.

#### 4.5.6 Smart Probe Errors

Smart probe errors should never occur. They take the form – "Error 0xNN", where NN is the error code. Please refer to WIKA Technical Support if this error is seen.

### 5. Transport, packaging and storage

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#### 5.1 Transport

Check the instrument for any damage that may have been caused by transport. Obvious damage must be reported immediately.



#### **CAUTION!**

##### **Damage through improper transport**

With improper transport, a high level of damage to property can occur.

- ▶ When unloading packed goods upon delivery as well as during internal transport, proceed carefully and observe the symbols on the packaging.
- ▶ With internal transport, observe the instructions in chapter 5.2 “Packaging and storage”.

If the instrument is transported from a cold into a warm environment, the formation of condensation may result in instrument malfunction. Before putting it back into operation, wait for the instrument temperature and the room temperature to equalise.

#### 5.2 Packaging and storage

Do not remove packaging until just before mounting.

Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, sending for repair).

##### **Permissible conditions at the place of storage:**

- Storage temperature: -20°C ... +50°C

##### **Avoid exposure to the following factors:**

- Direct sunlight or proximity to hot objects
- Mechanical vibration, mechanical shock (putting it down hard)
- Soot, vapour, dust and corrosive gases
- Hazardous environments, flammable atmospheres

Store the instrument in its original packaging in a location that fulfils the conditions listed above. If the original packaging is not available, pack and store the instrument as described below:

1. Wrap the instrument in an antistatic plastic film.
2. Place the instrument, along with shock-absorbent material, in the packaging.
3. If stored for a prolonged period of time (more than 30 days), place a bag, containing a desiccant, inside the packaging.

## 6. Commissioning, operation

**Personnel:** Skilled personnel

Only use original parts (see chapter 12 “Accessories”).



**CAUTION!**

**Damage to the instrument**

When working on open electrical circuits (printed circuit boards) there is a risk of damaging sensitive electronic components through electrostatic discharge.

- ▶ The correct use of grounded working surfaces and personal armbands is required.



**DANGER!**

**Danger to life caused by electric current**

Upon contact with live parts, there is a direct danger to life.

- ▶ The instrument may only be installed and mounted by skilled personnel.
- ▶ Operation using a defective power supply unit (e.g. short-circuit from the mains voltage to the output voltage) can result in life-threatening voltages at the instrument!

## 7. Faults

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For contact details, please see chapter 1 “General information”

## 8. Maintenance, cleaning and servicing

**Personnel:** Service personnel

### 8.1 Maintenance

This instrument is maintenance-free.

Repairs must only be carried out by the manufacturer. This does not apply to the battery replacement.

Only use original parts (see chapter 12 “Accessories”).

### 8.2 Recalibration

#### **DKD/DAkkS certificate - official certificates:**

We recommend that the instrument is regularly recalibrated by the manufacturer, with time intervals of approx. 12 months. The basic settings will be corrected if necessary.

#### **8.2.1 Equipment**

Temperature controlled environment at  $+20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

Set of stable, calibrated (1ppm) resistors (3 ranges, 6 resistors).

## 9. Dismounting, return and disposal

Personnel: Skilled personnel



### WARNING!

#### Physical injuries and damage to property and the environment through residual media

Residual media in the dismantled instrument can result in a risk to persons, the environment and equipment.

- ▶ Observe the information in the material safety data sheet for the corresponding medium.
- ▶ Wash or clean the dismantled instrument, in order to protect persons and the environment from exposure to residual media.

### 9.1 Dismounting



### WARNING!

#### Physical injuries and damage to property and the environment through residual media

Upon contact with hazardous media (e.g. oxygen, acetylene, flammable or toxic substances), harmful media (e.g. corrosive, toxic, carcinogenic, radioactive), and also with refrigeration plants and compressors, there is a danger of physical injuries and damage to property and the environment.

- ▶ Before storage of the dismantled instrument (following use) wash or clean it, in order to protect persons and the environment from exposure to residual media.
- ▶ Observe the information in the material safety data sheet for the corresponding medium.



### WARNING!

#### Risk of burns

During dismantling there is a risk of dangerously hot media escaping.

- ▶ Let the instrument cool down sufficiently before dismantling it!



### DANGER!

#### Danger to life caused by electric current

Upon contact with live parts, there is a direct danger to life.

- ▶ The dismantling of the instrument may only be carried out by skilled personnel.
- ▶ Only disconnect the pressure measuring instrument/measuring assembly/test and calibration installations once the system has been disconnected from the power!

### 9.2 Return

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#### **WARNING!**

#### **Physical injuries and damage to property and the environment through residual media**

Residual media in the dismantled instrument can result in a risk to persons, the environment and equipment.

- ▶ With hazardous substances, include the material safety data sheet for the corresponding medium.

When returning the instrument, use the original packaging or a suitable transport packaging.

#### **To avoid damage:**

1. Wrap the instrument in an antistatic plastic film.
2. Place the instrument along with shock-absorbent material in the packaging. Place shock-absorbent material evenly on all sides of the transport packaging.
3. If possible, place a bag containing a desiccant inside the packaging.
4. Label the shipment as carriage of a highly sensitive measuring instrument.



Information on returns can be found under the heading “Service” on our local website.

### 9.3 Disposal

Incorrect disposal can put the environment at risk.

Dispose of instrument components and packaging materials in an environmentally compatible way and in accordance with the country-specific waste disposal regulations.



This marking on the instruments indicates that they must not be disposed of in domestic waste. The disposal is carried out by return to the manufacturer or by the corresponding municipal authorities (see EU directive 2012/19/EU).

## 10. Specifications

### 10.1 Resistance thermometer measurement

PRT characterization	ITS90	
	Din90 BS EN60751:1996, IEC60751:1983	
Thermistor characterization	CvD BSEN1904:1984, IEC751:1983	
	Steinhart and Hart (NTC)	
Resistance measurement range (PRT)	1 to 400 ohm	
Resistance measurement range (Thermistor)	1 to 400,000 ohm	
Temperature measurement range	ITS90 -200 to +962°C	
	Din90 -200 to +850°C	
	CvD -150 to +850°C	
	Thermistor – type dependent	
Accuracy (PRT)	± 0.015°C (15mK)	
Accuracy (NTC Thermistor)	1 to 400 ohm	± 0.006 ohm
	400 to 50k ohm	± 0.01% of reading
	50k to 400k ohm	± 0.02% of reading
Resistance measurement uncertainty	± 6mΩ (+20°C ±5°C)	
Temperature coefficient (resistance measurement)	0.2ppm/°C (0.05mK/°C)	
Long term stability (resistance measurement)	± 25ppm (±2.5m°) / year	
Sense current (PRT)	1mA (DC) polarity switchable	
Sense current (NTC Thermistor)	1mA, 10µA, 3µA auto-select	
User selectable measurement display units	°C/ °F/ K or ohms	
Input channels	2	
Input connection	2 x 5 pin DIN	
Measurement configuration	4 wire	
Input impedance	> 10MΩ	
Max common and differential mode input voltage	±40VDC, 28Vrms	

### 10.2 Display

User interface, display	128 x 64 LCD with (optional) backlight
Resolution	0.001 °C

## 10. Specifications

### 10.3 Functions

Memory	8,000 values approx
Statistical analysis	Min/max, average, standard deviation
Functions	Hold, Zero, one-shot measurement, log
Real-time clock	Integrated clock with date and year
Interface	USB

### 10.4 Supply

Mains charger supply voltage range	90 – 264 Vac
Power consumption	3 VA max
Supply frequency range	47 – 63 Hz
Battery supply	Nickel-Metal Hydride (Ni-MH) rechargeable battery, low battery indicator
Battery life	20 hours of operation approx.

### 10.5 Environmental

Storage temperature range	-20°C to +50°C
Specified operating temperature range	0°C to +40°C
Operating relative humidity conditions	<80 % RH, non-condensing

### 10.6 Dimensions and weight

Dimensions	232 x 97 x 53 mm (L x W x D)
Weight	0.5 kg (1.1 lbs)

### 10.7 CE conformity

EMC directive	2004/108/EC, EN 61326 (group 1, class B) and interference immunity (portable test and measuring equipment)
Approvals and certificates, see website	

For further specifications see WIKA data sheet CT 55.50 and the order documentation.



# 11. Communications Interface

## 11.1 Introduction

The CTH7000 is fitted with USB communication interface as standard. The connected PC must have the correct USB driver installed. Please refer to the installation CD and the ULOG help system.

The USB PC interface will be installed as a virtual COM driver. The communication protocol is –

EN

Bits per second	9600
Data bits	8
Stop bits	1
Parity	none
Flow control	none

An interval of 1 ms to 2 ms should be allowed between transmitted characters.

## 11.2 USB Command syntax

The programming command language is based on the SCPI command format. Commands are case insensitive.

Commands consist of one or more command words with each command word separated by a colon (:) or a question mark (?). For commands requiring a response, a white space character is used to separate the command parameter from the command words (e.g. UNIT:TEMP <units>).

A response to a command returns a list of parameters (<parameter>) with each parameter separated by a comma (,). The last parameter will be followed by a command terminator carriage return (CR).

:	(colon)	Separates command words
?	(question mark)	Command requires a response
,	(comma)	Separates parameters list

Unrecognized commands will return ERR CMD after the CR character.

### 11.2.1 Command terminators (CR) or (CR)(LF)

All commands sent to the instrument must be terminated with a carriage return (CR) character. A carriage return/line feed pair (CR)(LF) can also be sent to terminate a message; the (LF) is ignored.

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## 11.2.2 Command details

### 11.2.2.1 **SYSTEM:REMOTE**

Command	SYSTEM:REMOTE
Return	None
Function	Places the CTH7000 in remote mode for USB control. CTH7000 indicates remote on the instrument display. Disables the instrument front panel keys (excluding backlight and power keys).

### 11.2.2.2 **SYSTEM:LOCAL**

Command	SYSTEM: LOCAL
Return	None
Function	Returns the instrument to local mode. Removes the remote indication from the instrument display. Enables the instrument front panel keys.

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

Command	*IDN?	
Return	<manufacturer>,<model no>,<serial no>,<firmware version>,<date>	
Parameters	<manufacture>	ASL
	<model no>	CTH7000
	<serial no>	Serial number of the instrument.
	<firmware version>	Current firmware version
	<date>	date.
Function	Reads the instrument's identification code consisting of the manufacturers name, instrument model number, instrument serial number, firmware version and date.	

NB: If the serial number is not entered, the instrument will return 00000

### 11.2.2.4 **MEASURE:CHANNEL? <channel>**

Command	MEASURE:CHANNEL? <channel>	
Parameters	<channel> 1 to 2	single channel measurement
	<channel> -	differential measurement mode
	<measurement>	last measurement value.
	<units>	currently selected units.
Return	<channel>,<measurement>,<units>	
Function	Responds when a measurement is available.	

**12. Accessories**

11.2.2.5 **UNIT:TEMP? <units>**

Command	UNIT:TEMP <units>	
Parameters	<units>	
	C or CEL	Degrees celcius
	F or FAR	Degrees fahrenheit
	K	Degrees kelvin
	R	Resistance
Return	None	
Function	Sets the temperature units.	

11.2.2.6 **LOG:DUMP 1**

Command	LOG:DUMP 1
Return	<date>,<time>,<units>,<measurement CH1>,<measurement CH2>,<differential>
Function	Downloads the complete CTH7000 data log.

11.2.2.7 **LOG:ERASE 1**

Command	LOG:ERASE
Return	<complete>
Function	Erases (clears) the complete CTH7000 data log.

**12. Accessories**

Spare battery pack – to clip onto rear	CTX-A-H6-Z-ZZZZBP-ZZZZ-ZZ-ZZZZ-ZZZZZZZ-Z
Replacement battery charger	CTX-A-H6-Z-ZZZZBC-ZZZZ-ZZ-ZZZZ-ZZZZZZZ-Z
Carrying case	CTX-A-H6-Z-ZZZZCC-ZZZZ-ZZ-ZZZZ-ZZZZZZZ-Z
Windows datalogger software ULog	CTX-A-H6-Z-ZZZZSG-ZZZZ-ZZ-ZZZZ-ZZZZZZZ-Z

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