

# AC resistance thermometry bridge Model CTR6500



WIKA data sheet CT 60.40

## Applications

- High-performance AC resistance thermometry bridge for very accurate temperature measurements in a range of -200 ... +962 °C
- High-precision instrument designed for laboratory, commercial and industrial temperature measurement and calibration applications

## Special features

- Resolution 0.1 ppm / 0.001 mΩ / 0.01 mK
- 25 Ω and 100 Ω internal reference resistors
- Channels expandable from 1 to 60 via multiplexers
- Multifunction VFD with numeric, statistical or graphical information



AC resistance thermometry bridge model CTR6500

## Description

The performance of the model CTR6500 resistance thermometry bridge is improved significantly by using the proven AC bridge technology. Due to the elimination of thermal EMF errors and the automatic cancellation of probe and cable reactance effects, the CTR6500 provides exceptional stability with time and ambient temperature and has an excellent resolution thanks to inherently low noise.

These make the CTR6500 perfectly suited to high-accuracy temperature measurement and calibration.

The CTR6500 has 25 Ω and 100 Ω internal standard resistors and can also be used with external standard resistors. It has a ratio range of 0 ... 4.9999999 or 0 ... 500 Ω resistance and is capable of measuring temperature ranges to meet ITS 90, CVD and EN 60751 standards.

The results are shown on the large-scale, multi-function VFD screen. The mean, min and max value, standard deviation and the sampling rate can also be displayed with a separate graphical display. To ensure the long-term reliability the CTR6500 uses surface mount technology with no mechanical relays.

Specifications	Model CTR6500
Probe types	Industrial platinum resistance thermometers (PRTs) and standard platinum resistance thermometers (SPRTs) with $R_0 = 25 \Omega$ and $100 \Omega$ up to an alpha of 0.00392
Input channels	2 on the main device (one PRT, SPRT or resistor + one reference resistor) 60 over multiplexer CTS9000
Input connections	4 x BNC + shield (front panel)
Data entry format	ITS 90 and CVD for calibrated probes; or EN 60751 for uncalibrated probes
<b>Measuring ranges</b>	
Sense current	100 $\mu$ A, 200 $\mu$ A, 500 $\mu$ A, 1 mA, 2 mA, 5 mA, 10 mA
Sense current multipliers	$\times \sqrt{2}$
Temperature range	-200 ... +962 °C, depending on thermometer probe
Resistance range	0 ... 500 $\Omega$
<b>Internal resistors</b>	
Values	25 $\Omega$ , 100 $\Omega$
Thermal stability TCR	$\pm 0.1$ ppm/°C
Accuracy	$\pm 0.01$ % (uncalibrated)
<b>Accuracy 1)</b>	Ratio range 0 ... 1 accuracy 0.4 ppm equivalent to 0.1 mK at 0 °C Ratio range 1 ... 2 accuracy 0.6 ppm equivalent to 0.3 mK full range Ratio range 2 ... 3 accuracy 0.8 ppm equivalent to 0.8 mK full range Ratio range 3 ... 5 accuracy 1 ppm equivalent to 1.25 mK full range
<b>Display</b>	
Screen	large graphic VFD display screen (adjustable brightness)
Units	Ratio, °C, °F, K or $\Omega$
Resolution	0.1 ppm 0.01 mK 0.001 m $\Omega$
<b>Functions</b>	
Real-time clock	integrated clock with date
<b>Voltage supply</b>	
Power supply	AC 90 ... 264 V, 47 ... 63 Hz; universal rear input on rear panel
Power consumption	max. 95 VA
<b>Permissible ambient conditions</b>	
Operating temperature	15 ... 25 °C
Storage temperature	-20 ... +50 °C
<b>Communication</b>	
Interface	USB, RS-232 or IEEE-488.2
<b>Case</b>	
Dimensions	455 x 150 x 450 mm (W x H x D)
Weight	9 kg

1) The accuracy in K defines the deviation between the measured value and the reference value. (Only valid for indicating instruments.)

## CE conformity, certificates

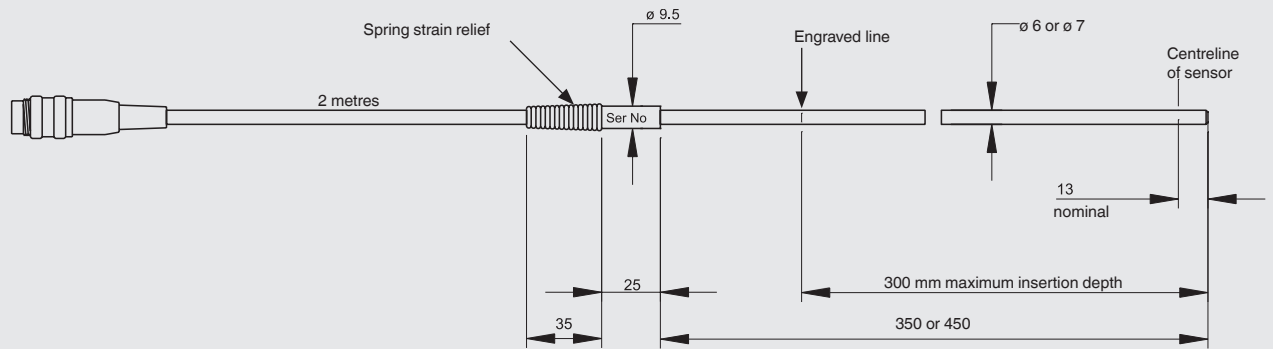
### CE conformity

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

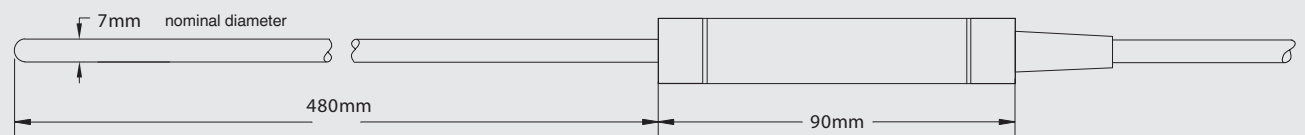
## Recommended temperature probes

### Resistance thermometer



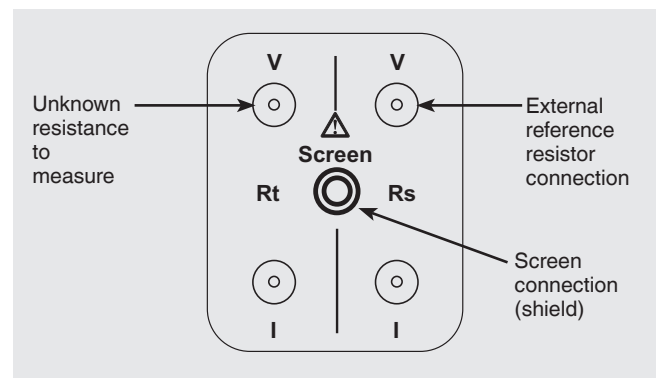
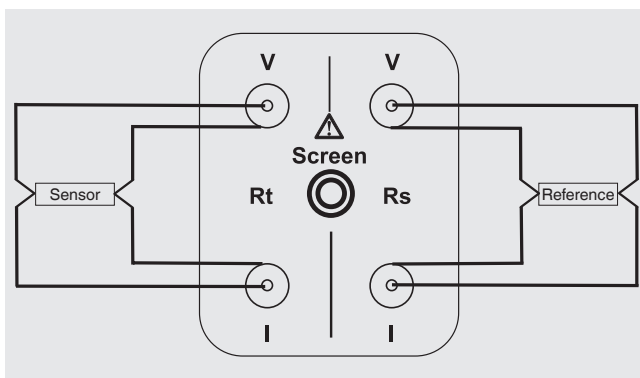
Model	Dimensions	Temperature range	Detector length
CTP5000-652	Pt100, d = 6 mm, l = 450 mm (without spring strain relief, 100 mm handle)	-70 ... +650 °C	30 mm
CTP5000-651	Pt100, d = 7.5 mm, l = 450 mm (125 mm handle)	-189 ... +650 °C	50 mm

### Resistance thermometer



Model	Dimensions	Temperature range	Detector length
CTP5000-T25	Pt25, d = 6.5 ... 7.5 mm, l = 480 mm	-189 ... +660 °C	45 mm

## Input connections



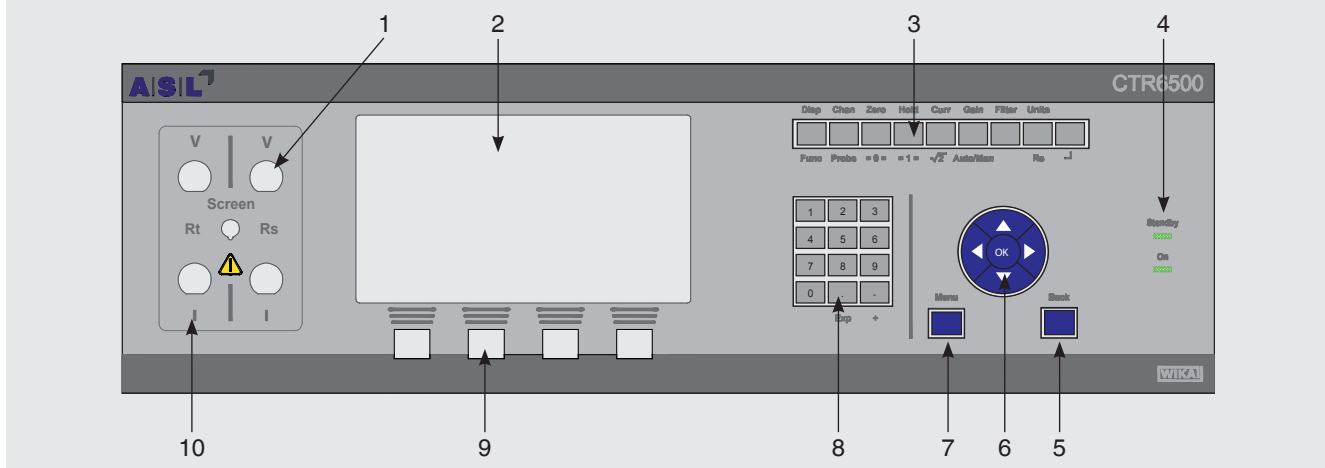
The BNC input connectors are located to the left of the display. The central connector is used when a screen connection is required. The two right-hand connections are only used when an external reference resistor is selected;

they are not required when one of the internal reference resistors is used. The unknown resistance or probe is connected to the left-hand BNCs.

## Features of the precision thermometer

- Easy to use
- Large graphic VFD display screen
- 4-wire measurement
- 2 channels as standard with optional up to 60 channels over multiplexer CTS9000

### Front panel

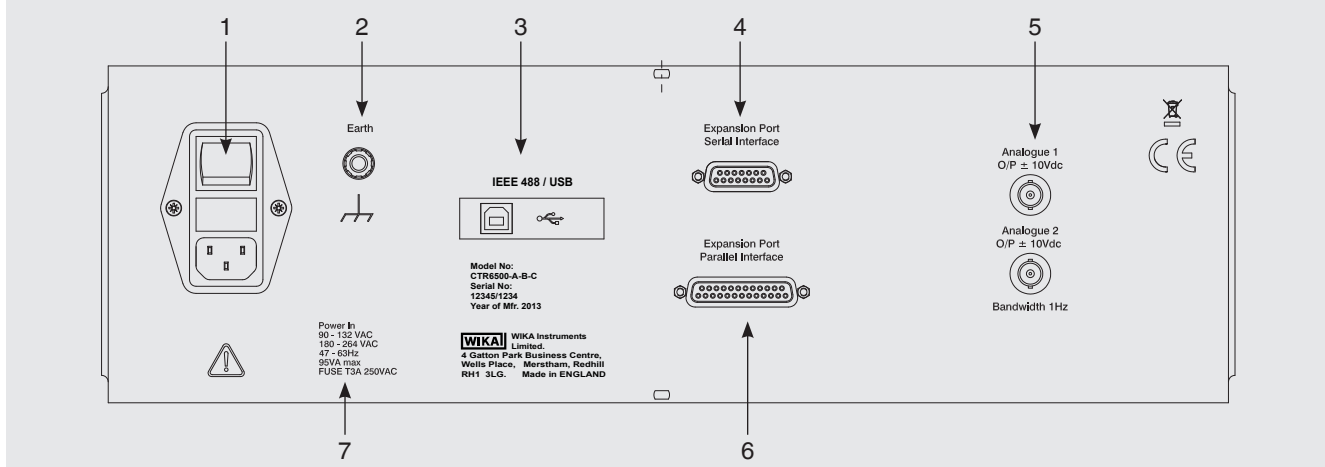


- |                        |                     |
|------------------------|---------------------|
| 1 Reference channel RS | 6 Navigation keys   |
| 2 VFD display          | 7 Menu key          |
| 3 Function keys        | 8 Numeric keypad    |
| 4 Status LED           | 9 Four soft keys    |
| 5 Back key             | 10 Input channel Rt |

The two indicator LEDs to the right are used to indicate that electrical power is applied and to indicate that the bridge is in standby mode (graphical display in low power mode). The four keys under the display are **soft keys** so their function varies with the instrument operating mode

(whenever these keys can be used, their current function is displayed above each key).

### Rear panel



- |                                 |                     |
|---------------------------------|---------------------|
| 1 Main input, switch and fuse   | 5 Analogue output   |
| 2 Earth connector               | 6 Expansion port 2  |
| 3 USB, RS-232 or IEEE connector | 7 Electrical rating |
| 4 Expansion port 1              |                     |

## Operation

The instrument's keys are grouped by type and consist of nine function keys, a twelve-key numerical keypad, navigation keys and an OK key, four soft keys and separate menu and back keys. The combination of function and soft keys is used to access data and/or functions within the instrument.

The keys are used to select the various menu options and to control the instrument. Generally, no more than one

menu level is required for commonly used settings. A few (infrequently used options) require two or three menu levels.

The functions under the keys are accessed by pressing the right-hand shift key and then the required key (e.g. to access the probe menu press shift and then the chan key).

### Instrument functions keys

Key	Description	Function
<b>Instrument function keys</b>		
Disp	Select display type	Alternates numerical, graphical, standby display
Chan	Select input channel	Opens and closes the R <sub>t</sub> /R <sub>s</sub> channel select menu
Zero	Zero display measurement	Opens and closes the display zero (null) menu
Hold	Hold display measurement	Starts and stops display (measurement continues)
Curr	Select operating current	Opens and closes the sensor-current menu
Gain	Select instrument gain	Opens and closes the instrument-gain menu
Filter	Select filter value	Opens and closes measurement-bandwidth menu
Units	Select display units	Opens and closes the display-units menu
Shift key	Shift key	Selects lower function keys (and, Exp or +)
<b>Instrument function shift keys</b>		
Func	Select function menu	Selects function menu
Probe	Select probe menu	Opens and closes probe menu
=0=	Zero check	Selects zero check
=1=	Unity check	Selects unity check
√2	Set current	Sets root 2 current
Auto/Man	Reserved turns	Automatic gain selection ON/OFF
Rs	Select reference resistor	Opens the reference resistor menu
<b>Menu function keys</b>		
Back	Clear data entry/return	Clears any data entry errors or returns from a menu
Menu	Menu selection	Displays other submenus
▲▼◀▶	Arrow keys	Used to navigate through the menus
OK	Save entry	Saves data entry and returns to previous menu

The numeric keypad is used to enter numerical values (and may also be used to select submenu options when these are shown on the screen).

### Numeric keypad function

Key	Description	Function
<b>Numeric keys</b>		
0 ... 9	Numerical data entry	Enters a numerical digit or selects a numeric menu
-	Minus key	Used during numerical data entry
.	Decimal point	Used during numerical data entry
<b>Numeric shift keys</b>		
Exp	Exponent key	Used for numerical data entry (with the shift key)
+	Plus key	Used for numerical data entry (with the shift key)

## Model CTS9000 multi-channel systems for thermometry bridges

ASL's thermometry bridges can be used with up to six 10-channel multiplexers. The multiplexers, available as stand-alone units or as part of a fully integrated system as shown, can be operated manually or under remote control via the driver. The RS-232-C or IEEE interfaces are optional.

The CTR6500 can be used with either one model CTS9000 multiplexer without a driver or with a driver for multi-channel calibration of up to 60 channels.

The model CTS9000 is a 10-channel multiplexer which provides full 4-wire plus ground switching using high-performance reed relays and has two unique features:



Model CTS9000 multi-channel systems for thermometry bridges

### ■ Multiplexer standby current

When in use the temperature of a platinum resistance thermometer (PRT) is increased slightly by the "self-heating effect" of the constant current. This effect may vary by PRT and is therefore determined during calibration. The problem arises if you wish to take a measurement as soon as you select a PRT as probes can take a minute, sometimes more to stabilise once selected.

The solution is to keep the probes always selected with an identical current, standby current, from its own power source. When the PRT is selected for the bridge it is already at "operating temperature" and a precise measurement can be made immediately! Any value up to 10 mA may be factory set, individually for each channel.

### ■ Optimised bridge performance

To optimise bridge performance when using PRT's of different  $R_0$  values, for example 25  $\Omega$  and 100  $\Omega$ , measurements are made against a reference fixed resistor of matching values.

Up to four channels of the first CTS9000 scanner can be configured to switch reference resistors ( $R_s$ ) rather than platinum resistance thermometers so that as thermometers are selected, the correct value of  $R_s$  can also be automatically selected.

Usual configurations ( $R_t:R_s$ ) are 10:0 (10 platinum resistance thermometers, 0 reference fixed resistors), 8:2, 7:3 and 6:4.

## Scope of delivery

- Model CTR6500 AC resistance thermometry bridge incl. power cord and USB cable
- Choice of model CTP5000 temperature probes
- Choice of model CTS9000 multiplexer
- Choice of model CER6000 resistances

## Option

- Model CTS9000, 10-channel automatic/remote scanner, current source for unselected PRTs
- Precision resistor module FR4 (standard values = 1, 10, 25 and 100  $\Omega$ , oven controlled)

## Accessories

- 100  $\Omega$ , test resistor, 0.1 %, 3 ppm/ $^{\circ}\text{C}$
- BNC to BNC cable (3 m) - connection bridge to adapter box FA3
- BNC to open end (3 m) - connection bridge to reference resistors
- PRT adapter box (4 terminals to BNC)
- BNC to 2 x 4 mm banana terminals (2 per pack)
- BNC to 2 x 4 mm banana plugs (2 per pack)
- Adapter BNC to 5-pin DIN plug (1 m)

## Software

- ULog



**Precision resistor module, model FR4**

Specifications	Precision resistor module, model FR4
Accuracy	1 ... 10 $\Omega$ $\pm 0.005$ % (50 ppm) > 10 ... 100 $\Omega$ $\pm 0.0025$ % (25 ppm) > 100 ... 1,000 $\Omega$ $\pm 0.001$ % (10 ppm)
Stability	< 2 ppm per year
Temperature coefficient	< 0.6 ppm/ $^{\circ}\text{C}$

## Ordering information

CTR6500 / Interface / Numbers of multiplexer CTS9000 / Standby current / Definition standby current / Interface driver module / Housing / Precision resistor module / Resistor value 1 / Resistor value 2 / Resistor value 3 / Resistor value 4 / Additional order information

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