HH4-TC

Hand Held

Digital Thermometer

Operation and Instruction Manual

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1   Introduction

This manual contains information for the operation of the AIC
HH4 Intelligent Digital Thermometer. The HH4 is a general purpose temperature monitor which may be configured to accept inputs from all common thermocouples (types B, E, J, K, N, R, S and T). The instrument may be calibrated to display the temperature in °C, °F or °K (absolute) with a resolution of 1 or 0.1°

Unless otherwise specified at the time of order, your HH4 has been factory set to a standard configuration (see "Read this first" in the "Operation" chapter). Like all other HH4 series instruments the configuration and calibration is easily changed by the user. General setup changes can be made via the instruments push buttons. Calibration changes require dismantling the instrument to gain access to the internal security pushbutton referred to in this manual as the PROGRAM pushbutton.

An automatic turn off function turns the instrument off after a preset time period - this feature is ideal for saving power.

By pressing the PEAK HOLD button the peak temperature may be held on the display - the peak reading may be configured for maximum or minimum temperature peak reading.

The HH4 series of Hand Held Digital Thermometers are designed for high reliability in industrial applications. The high contrast LCD display provide good visibility and are ideal for battery powered applications.

2   Operation

The HH4 digital thermometer is operated by pressing the on/off button. The following display sequence is executed during startup:

8.8.8.8   Display check
Ai C   Company name
tcX.X   Software version number
t8t   Thermocouple type selected (type T example shown here)

This sequence will take approximately eight seconds then the display will indicate the current temperature at the probe. If peak hold is required then press the PEAK HOLD button. The message **hol d** will be displayed every eight seconds. Make sure a probe of the correct type is plugged into the thermocouple connector. Place the probe in the environment to be measured and wait for the reading to stabilise or for the peak reading to be registered.

Note: When in the peak hold mode you may alternately display the current temperature by pressing the PEAK HOLD button (the display will alternate between **Li UE** and **hol d** each time the button is pressed momentarily. To reset the peak hold (to take a new peak reading) press and hold down the PEAK HOLD button for 2 seconds.

The instrument features an automatic turn off feature and will automatically turn off after a predetermined number of minutes (note: see chapter on setting up the instrument). This feature is ideal for saving power, when the instrument is accidentally left turned on. The automatic turn off function, may be disabled by selecting **0** minutes when setting up the instrument.

2 .1   Read this first

Your new HH4 has been supplied factory configured (unless otherwise specified), as follows:
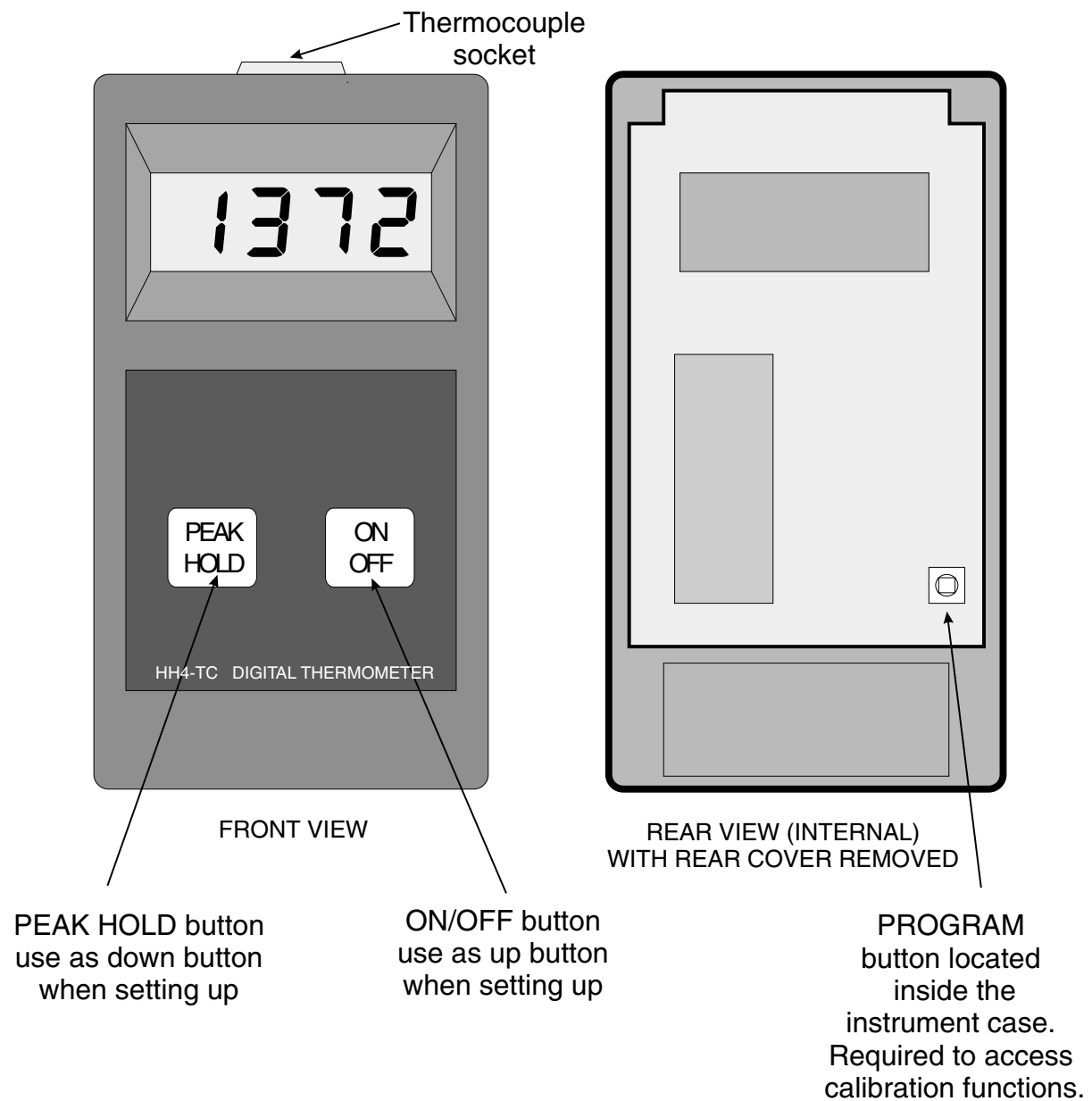
Input: Type K thermocouple
Calibration: -100 to 1372°C
Decimal point: Nil
Digital filter: Set to 3 (range 0 to 8, 8=max)
Auto turn off: 10 minutes
Peak Hold: Set to **hi 9h** i.e. maximum temperature

Note: the thermocouple socket should be fitted to match the selected thermocouple type. Where more than one type of thermocouple is to be used, a special copper socket is available.

3   Push Button Location & Function

The location and function of the instruments pushbuttons is indicated below use details in conjunction with chapters "Setting up the instrument" and "Calibration".

To gain access to the program button (only required for access to certain functions) - remove the four recessed self tapping screws, located on the rear of the case. When replacing the screws take care not to over tighten, as this may damage the plastic case material.

Thermocouple socket

1372

PEAK HOLD   ON OFF

HH4-TC   DIGITAL THERMOMETER

FRONT VIEW

REAR VIEW (INTERNAL)
WITH REAR COVER REMOVED

PEAK HOLD button
use as down button
when setting up

ON/OFF button
use as up button
when setting up

PROGRAM
button located
inside the
instrument case.
Required to access
calibration functions.

4   Setting up the Instrument

The HH4 meter has three modes of operation. Measurement mode is the mode used for everyday temperature measurement use. If the instrument is simply switched on then the display will be in measurement mode. Function mode allows access to certain setup functions and calibration mode allows access to all setup and calibration functions. Setting up and calibrating the HH4 is extremely easy, since the functions are changed or viewed by pressing the pushbuttons. Several functions are available to allow the operator to set up the operating modes, as follows:

4 .1   Step 1, Entering the function mode

To enter the function mode, a simple pushbutton sequence is necessary. With the instrument switched off press and hold in the PEAK HOLD button then press ON/OFF button to switch the instrument on. The display will now read `FUNC` followed by the first setup function thereby indicating that you have entered the function mode. You can now release all buttons. Once in function mode the ON/OFF button is used as an up button and the PEAK HOLD button is used as a down button.

4 .2   Step 2, Stepping through the settings

The display of `FUNC` is followed by the first setup message `tYPE` (this means thermocouple type). As with all other messages the first display lets you know which parameter will be affected when changes are made. Use one or other of the push buttons to change the setting if required. To step to the next function both the PEAK HOLD and ON/OFF buttons must be pressed simultaneously.

When moving to the next function care must be taken to ensure that the function you are leaving is set as required. For example if at the `tYPE` function `tbr` is required and selected then attempting to move to the next function may result in the selection being changed due to fact that one button has been pressed before the other i.e. they have not been pressed simultaneously. Once the end of the functions is reached the display returns to reading the normal temperature measurement.

4 .3   Step 3, Making changes to the settings

Whilst still in the function mode, press the PEAK HOLD and ON/OFF buttons simultaneously until you reach the parameter you wish to change. Initially the display will indicate the particular function (e.g. `unit`), this will be followed by a display showing the current status of that setting (e.g. `°C`) - press the ON/OFF or PEAK HOLD pushbutton until the desired selection is displayed. You may then proceed through the functions (by pressing the buttons simultaneously) until you reach the next function that you wish to change or until you exit the function mode.

4 .4   Programming Functions:

The functions are described as follows:

ᴌYPE (set thermocouple type)

Press the ON/OFF or PEAK HOLD buttons to select one of eight types. The display will show ᴌN X, where N is the number (1 to 8) and X is the thermocouple type (note type K cannot be displayed).

type B = **ᴌ ib**	type N = **ᴌ5ᴨ**
type E = **ᴌ2E**	type R = **ᴌ6r**
type J = **ᴌ3J**	type S = **ᴌ75**
type K = **ᴌ4**	type T = **ᴌ8ᴌ**

uni ᴌ (set temperature unit)

Press the ON/OFF or PEAK HOLD buttons to select the temperature display units i.e.; degrees Celsius **°C**, Fahrenheit **°F** or Kelvin **°R·**

drnd (display rounding)

Press the ON/OFF or PEAK HOLD buttons to select the display rounding value. Display rounding is useful for reducing the instrument resolution without loss of accuracy, in applications where it is undesirable to display to a fine tolerance. (example if set to **10** the instrument will display the temperature in multiples of 10°**.**

dCPᴌ (decimal point selection)

Press the ON/OFF or PEAK HOLD buttons to select the decimal point position, may be set to **1° or 0. 1°**. Note: when 0.1 is selected the maximum temperature display is limited to 999.9.

FLᴌr (digital filter)

Press the ON/OFF or PEAK HOLD buttons to select the digital filtering value. Digital filtering is used to reducing susceptibility to short term interference. The digital filter range is selectable from **0** to **8**, where
0 = none and **8** = most filtering. A typical value for the digital filter would be **3**.

RPdᴌ (set Auto Power Down Time)

Press the ON/OFF or PEAK HOLD buttons to select the Automatic Power Down Time (auto turn off time). The time is programmable over the range of **0** to **250** minutes. Note: if continuous operation is required, select **0** to disable the auto turn off function.

Calibration functions:

Accessible in calibration mode only - refer to calibration chapter

P.hi d (set peak hold, high or low)

CRL (calibrate current thermocouple)

iCE (calibrate cold junction compensation)

uCRL (uncalibrate unit)

Function table for HH4-TC Digital Thermometer			
Initial display	Meaning of display	Next display	Record Your Settings
ᴛYᴘᴇ	Set Thermocouple type note: when selecting t4 (type K) "K" is not displayed	ᴛ1ь = type B ᴛ2ᴇ = type E ᴛ3ᴊ = type J ᴛ4 = type K ᴛ5ᴨ= type N ᴛ6ᴦ = type R ᴛ7ꜱ = type S ᴛ8ᴛ = type T	
unıᴛ	Set Temperature Unit	°C,°F or°R	
dᴦnd	Display Rounding Selects Resolution	Value in in Memory	
dᴄᴘᴛ	Display Decimal Point	1or0.1	
FLᴛᴦ	Digital Filter Range 0 to 8	0 to 8 (8= most filtering)	
Aᴘdᴛ	Set Auto Turn Off Time	0 to 250 minutes	
P.hᴵd	Peak Hold Max or Min	Hᴵgh (maximum) or Lᴏ (minimum)	
ᴄᴀL	Calibration	See section on calibration	
ᴵᴄᴇ	Cold Junction Calibration	See section on calibration	
uᴄᴀL	Uncalibration	See section on calibration	

Note: Functions shown shaded are accessible only when in calibration mode see "Calibration" chapter.

6   Calibration

To enter the calibration mode a special "power up procedure" must be followed. This procedure prevents accidental alteration of calibration and provides a degree of calibration security.

6 .1   Preparing to initialise

Turn instrument off by pressing the ON/OFF button.

6 .2   Initialising the calibration mode

Press and hold the program button whilst applying power to the instrument (by pressing the ON/OFF button). The instrument will display **CAL** in the wake up message, indicating that the calibration level of the function mode may be accessed. You can release the program button when the **CAL** message is seen.

6 .3   Entering the calibration mode

Enter the Setup Mode by pressing the program button then pressing both the ON/OFF button and the PEAK HOLD button simultaneously (within 2 seconds) and then step through the functions by pressing and releasing the program button until the display indicates either **P.hi d**, **CAL**, **i CE** or **UCAL** depending on function required.

P.hi d (peak hold)

This function enables the display to show either the maximum (**hi gh**) or minimum (**LO**) value when the PEAK HOLD pushbutton is pressed in normal use. Use the ON/OFF or PEAK HOLD button to make a selection.

CAL (temperature calibration)

To enter the calibration mode with the display showing **CAL** press the ON/OFF and PEAK HOLD buttons simultaneously. The display will now indicate **CAL i** (calibration point) followed by the uncompensated temperature reading. Using thermocouple millivolt tables, apply an input to the instrument from an accurate millivolt source (note: the calibration temperature display does not include cold junction compensation, and is therefore read directly from the thermocouple tables). The millivolt value should be approximately 80 to 100% of the thermocouple measuring range (this value is not critical and should ideally be close to the normal measuring temperature of the instrument). When the reading has stabilised press the program button. The display will indicate **SCL i** (scale 1) followed by the scale value in memory. Now press the ON/OFF or PEAK HOLD button to obtain the required scale (calibration) value. Press the program button, the display will now read **CAL End** indicating that the calibration is complete.

The display will return to the measure mode (with calibration access still enabled).

Note: You must recalibrate the unit for each type of thermocouple that you intend to use. Each type has its own calibration information stored separately. It is not sufficient to calibrate for type K and then connect a type R thermocouple and just change the type setting.

i CE (cold junction calibration)

Note: You must complete the thermocouple calibration on the previous page before attempting to calibrate the cold junction. Ensure that the unit has been in a stable temperature environment for at least an hour and that the thermocouple probe

has stabilised in the icepoint. Failure to do this will result in an error which will affect all readings and all thermocouple types. Once the cold junction calibration has been completed for one thermocouple type it will be correct for all other thermocouple types available with the instrument.

This function sets the cold junction (reference junction) to 0°C. Connect a thermocouple of the selected type to the instrument and immerse the thermocouple in an ice point reference cell or alternatively place in a prepared mixture of 50% shaved ice and water in an insulated container (with this method keep well stirred). To enter the cold junction calibration mode follow the procedure described above but skip the **P.hi d** and **CAL** functions i.e. steps 6.4 and 6.5. Continue to press and release until the display shows **ICE** (cold junction calibration). Now press the ON/OFF and PEAK HOLD buttons simultaneously the display should now read **0°C** (**32°F**). Press the PROGRAM button the display will show **CAL End**. The display will now return to the measure mode (with calibration access). If the display does not indicate **0°C** (**32°F**) it may be necessary to repeat the ice calibration procedure.

UCAL (uncalibration)

This function returns the calibration of all thermocouple types to that of an ideal thermocouple and is useful when a temperature calibration error has occurred due to miscalibration and the conditions do not allow on the spot recalibration. To enter this mode follow the procedure described above but skip Steps 6.4, 6.5 and 6.6 continue to press and release the PROGRAM button until the display shows **UC°C** now press the ON/OFF and PEAK HOLD simultaneously the display will show **CAL** followed by **CLr** indicating that the calibration is cleared. The display will now return to the measure mode (with calibration access).

6 .4   Returning to the normal measure mode

When the calibration procedure has been completed, it is advisable to return the instrument to the normal mode (where calibration functions cannot be tampered with). To return to the normal mode turn the instrument off by pressing the ON/OFF button (to exit the calibration mode), wait a few seconds and then restore power. Do not press the PROGRAM button during the start up sequence.

7   Errors and Status Messages

The status message which represent conditions and errors, are as follows:

bAtt (low battery voltage)

Indicates that the battery voltage has reached approximately 6.4V. The unit will continue to operate for a while but a new battery should be fitted as soon as possible.

OPEn (open circuit thermocouple)

Either the thermocouple is not connected or it has malfunctioned to an open-circuit condition. If peak hold is active then the peak reading will be displayed and **OPEn** will flash every eight seconds. Out of peak hold will be displayed instead of the temperature reading.

hold (peak hold activated)

Indicates that the digital thermometer is in the peak hold mode. This mode is entered by pressing the PEAK HOLD button on the front panel. Peak hold will remain active until the unit is turned off. To reset the peak hold value (to take a new peak reading) press the PEAK HOLD button for 2 seconds.

cold (cold junction)

Indicates one of two conditions. If the function button inside the unit has been pressed, then **cold** will flash every eight seconds and the value displayed will be the temperature of the cold junction compensator sensor (reference junction sensor). The display will time out after 60 seconds and return to the thermocouple temperature display.

If this message is displayed during normal operation, then the cold junction compensation circuitry has failed. This will also occur if the ambient temperature is above 76°C or below -12°C. The display will show —— and flash **cold** every eight seconds.

CAL Err (calibration error)

If the display is in overrange during calibration and an attempt is made to calibrate, then this message will be displayed. The calibration will remain unchanged.

oooo (display overrange)

The value attempting to be displayed is above 9999 or below -1999. This indicates a circuit board component failure causing an ADC overrange, an overrange signal received at the input or incorrect scaling (**SCL 1**) of the instrument during calibration.

- - - - (ADC overrange)

This indicates an ADC or thermocouple table overrange. Either the input to the unit is out of the reading range of the ADC or is out of the range of the thermocouple tables for this type of thermocouple.

8 Specifications

Technical Specifications

Input Types:	Thermocouple types B, E, J, K, N, R, S & T
Temperature Range:	B 400 to 1866°C, E -100 to 1000°C
	J -100 to 870°C, K -100 to 1372°C ,
	N -100 to 1300°C, R -35 to 1768°C ,
	S -35 to 1768°C, T -100 to 400°C
ADC Resolution:	1 in 20,000
Accuracy:	Better than 1°C at 25°C
Linearity:	Better than 0.5°C
Conversion Method:	Dual Slope ADC, 4 samples per second
Microprocessor:	MC68HC05 CMOS
Ambient Temperature:	0 to 50°C
Humidity:	5 to 95% non condensing
Display:	LCD 4 digit 12.7mm
Power Supply:	9V 216 style battery, (Alkaline recommended)
Quiescent current:	10uA Maximum
Operating current:	10mA Maximum

Physical Characteristics

Case Size:	80mm (W) x 145mm (L) x 32 to 39mm (D)
Connections:	Plug in mini thermocouple socket
Weight:	250 gms including battery

Guarantee and Service

The product supplied with this manual is guaranteed against faulty workmanship for a period of 2 years from the date of dispatch.

Our obligation assumed under this guarantee is limited to the replacement of parts which, by our examination, are proved to be defective and have not been misused, carelessly handled, defaced or damaged due to incorrect installation. This guarantee is VOID where the unit has been opened, tampered with or if repairs have been made or attempted by anyone except an authorised representative of the manufacturing company.

Products for attention under guarantee (unless otherwise agreed) **must be returned to the manufacturer freight paid** and, if accepted for free repair, will be returned to the customers address in Australia free of charge.

When returning the product for service or repair a full description of the fault and the mode of operation used when the product failed must be given.

In any event the manufacturer has no other obligation or liability beyond replacement or repair of this product.

Modifications may be made to any existing or future models of the unit as it may deem necessary without incurring any obligation to incorporate such modifications in units previously sold or to which this guarantee may relate.