

TELEDYNE HASTINGS INSTRUMENTS



INSTRUCTION MANUAL

THCD-100 CONFIGURABLE DISPLAY



Manual Print History

The print history shown below lists the printing dates of all revisions and addenda created for this manual. The revision level increases alphabetically as the manual undergoes subsequent updates. Addenda, which are released between revisions, contain important change information that the user should incorporate immediately into the manual. Addenda are numbered sequentially. When a new revision is created, all addenda associated with the previous revision of the manual are incorporated into the new revision of the manual. Each new revision includes a revised copy of this print history page.

Revision A (165-072011) July 2011



Visit www.teledyne-hi.com for WEEE disposal guidance.



Please read this manual carefully before using the instrument.

Use of this equipment in a manner not specified in this manual may impair the user's protection.

Hastings Instruments reserves the right to change or modify the design of its equipment without any obligation to provide notification of change or intent to change.

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1. GENERAL INFORMATION

The THCD-100 is a multi featured process display controller, capable of interfacing directly to a mass flow meter, mass flow controller or another process transducer such as the THPS-760S Vacuum Transducer. The THCD-100 is a single channel unit which can be used to power a bipolar ($\pm 15\text{dc @ } 250\text{mA}$) device and/or display the output from a transducer that supplies voltage signals up to 10 VDC. There is also an input that can be used for external command (setpoint) control (+5v full scale). Digital interfaces to the THCD-100 include RS485 and RS232.

1.1. Features

16-bit Resolution

$\pm 0.2\%$ Reading + 1 Digit Accuracy

0-5 Volt Set Point Via Front Panel Or Digitally (RS232/RS485)

Dual Programmable Alarms with Relays

RS232/485 and Analog Output (Standard)

CE Approved

1.2. Specifications

For a list of specifications, please see the PB-185_rev-0711_THCD-100 Power Supply.

2. Installation and Interconnections

2.1. Installation

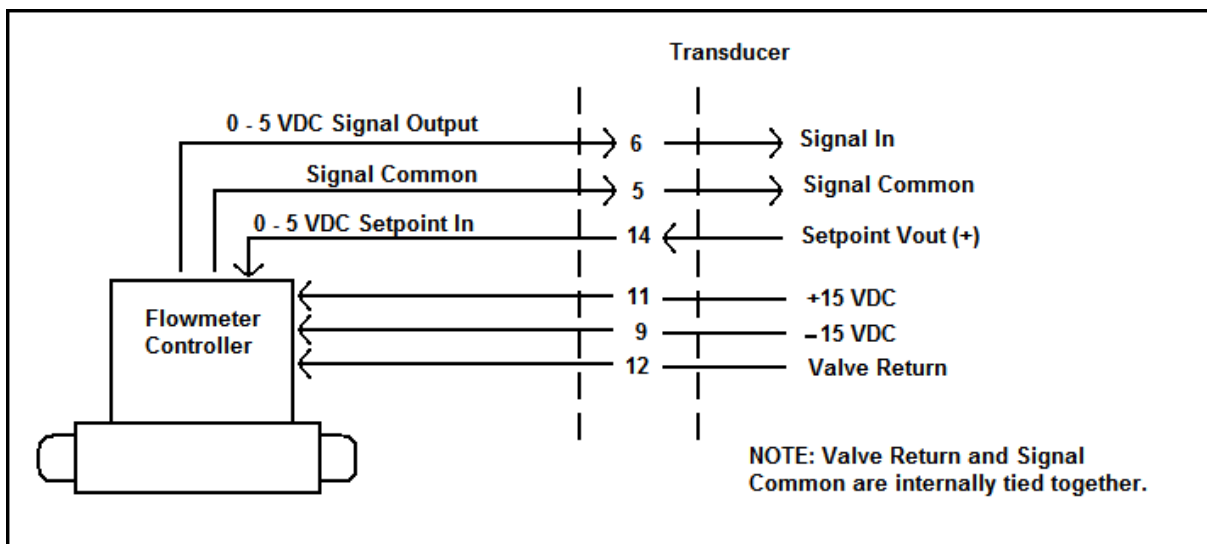
The THCD-100 can be panel mounted, or used on a bench top and is a standard 96 x 48mm panel meter enclosure. Note that the instrument must always be situated in such a way as to enable adequate air circulation about the unit. If a transducer was supplied with the THCD-100 a suitable cable may have been included.

See Section 2.6 for a cut out detail for panel mounting.

2.2. Transducer socket Pinout – 15 Pin 'D' Type

Pin Number	Designation
5	Signal Common
6	Signal In (VDC)
7	Case Gnd
9	-15 VDC
11	+15 VDC
12	Valve Return
13	+24 VDC
14	Set Point Out (VDC)
All other pins	Not Connected

If the transducer is being powered from another source (e.g. a mains powered supply) it will only be necessary to connect to the two signal pins. Note: The THCD-100 has a fully floating differential input. For single ended use (i.e. transducers with differential output) join 0V (pin5) & Signal Return (pin12) at the transducer. Ensure the common mode input range is not exceeded.



2.3. Interface Socket Pin out – Miniature 15 Pin 'D' Type

Pin Number	Designation
1	Analog Output
2	Relay 2 Common
3	Relay 2 Normally Open contact
4	Relay 2 Normally Closed contact
5	0V (Signal Ground)
6	External Setpoint Return
7	N/C
8	External Setpoint
9	N/C
10	0V (Signal Ground)
11	TTL Input - Disable Menu
12	TTL Input - Disable Zero
13	Relay 1 Common
14	Relay 1 Normally Open contact
15	Relay 1 Normally Closed contact

2.4. Serial Socket Pinout – 9 Pin 'D' Type

Interface

Pin Number	Designation ^{1 2}
1	RS485 Tx +
2	RS232 Rx
3	RS232 Tx
4	RS485 Tx -
5	Common
6	RS485 Rx +
7	RS485 Rx -
8	N/C
9	Common

¹ For RS232 only, connect only the pins designated in **bold font**.

² For RS485 only, connect only the pins designated in normal font.

See section 4 for instructions on changing the serial protocol.

2.5. Power Connection Socket

The THCD-100 requires a 24V, 500mA supply to operate. This must be a rectified and regulated direct current supply, capable of 15W (recommended). Although the THCD-100 has an internal fuse and power supply overload shutdown protection the supply to the THCD-100 should be protected by fuse or other suitable electronic method. A standard 5.5mm diameter 'dc power jack' is required to connect to the THCD-100. Connect the positive conductor to the center pin. Connect the negative (0V) conductor to the outer of the jack.

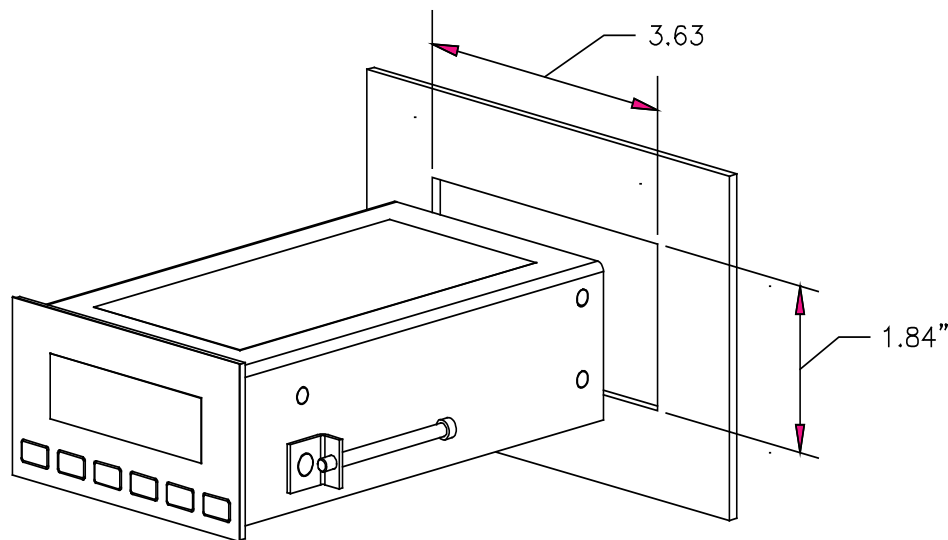
For convenience, Hastings offers a compatible supply (12-01-169) that, when matched with the US (12-01-160), Euro (12-01-164) or the UK (12-01-165) plug adapters, converts wall power to specified levels.



Cautions: Ensure correct power supply rating and polarity. Do not use a partially assembled or faulty unit. Incorrect use of this equipment, or use in a manner not specified may impair the user's protection.

2.6. Panel Mounting

A panel mount kit will have been supplied with the instrument. This consists of: 2 screws (M3x6), 2 brackets and 2 screws (50mm). Fit the M3x6 screws into the side of the unit into the diagonally opposed holes. Do not tighten these screws, to allow the bracket to slide over the screw head. Thread locking adhesive may be used but is not required as these screws cannot rotate once the bracket is tightened. Insert the meter into the panel. A cutout of 3.63" x 1.84" (92 x 45mm) is recommended. Slip the mounting bracket over the screw head and tighten the 50mm screws. The unit should now be secure.



3. FEATURES

3.1. Introduction

This section describes the principles used in the THCD-100. It details the various settings for the inputs and the outputs including setpoint control. It does not detail any servicing or calibration procedures.

3.2. Analog Inputs

The THCD-100 has two analog voltage input channels. The main input can be configured to accept any input voltage from 0V to a full scale of up to 10V. This input is calibrated using a straight line fit method and then can be displayed on the THCD with an applied range. The secondary input is used to accept an external command setpoint and has a non-configurable full scale of 5V. This input is used when the setpoint is set to slave source.

The main input channel has a number of associated setup parameters:

a) **Range**

Each device attached to the THCD will be outputting a voltage that represents some form of units and the range is used with the full scale to determine what the user sees on the screen for any input voltage.

b) **Full Scale Voltage**

Each device attached to the THCD will have a full scale voltage which is the maximum voltage the device should output under normal operating conditions. Typical values are 10V, 5V and 1V. The full scale is used with the range to determine what the user sees on the screen for any input voltage. The THCD will show the over range error ("RANGE!") for any channel whose voltage input is more than 15% over the full scale voltage set for that channel.

c) **Units String**

To inform the user of what units are being dealt with, each channel has an associated units string. This is a free form text field (maximum 5 characters) that is displayed on the right side of the Main screen.

Example A device has a full scale voltage of 10V and a range of 100 mbar.

If the device now outputs 10V, the THCD-100 display will nominally show 100 (pending input calibration). If the device outputs 5V, the THCD-100 will show 50, and so on.

3.3. Analog Outputs

There are two analog outputs on the THCD-100, both voltage outputs. One is for setpoint control with its own set of setup parameters (see next section) and the other is a simple retransmission of the main input voltage and has no user setup control. Typically this output can be used for data logging purposes or for providing an external setpoint control to another THCD or similar instrument.

3.4. Setpoint Control

As mentioned above, there is one analog output that is used for command setpoint control that can be used to operate a mass flow controller or similar. The setpoint command output always has a voltage full scale of 5V.

Example If the input channel is setup for a 100 slpm 5V full scale device, and the setpoint value is 10.0

(assuming setpoint is in AUTO mode and not a slave source), then the output voltage of the setpoint would be 0.5V.

The setpoint does have some configuration parameters that can be used to alter the function of the setpoint control and they are detailed as follows:

a) **Setpoint Mode**

The setpoint can be configured in one of three modes – AUTO, OPEN and CLOSED.

- In AUTO mode the setpoint output is dependant on the setpoint source and value settings (see below).
- In OPEN mode the setpoint outputs a voltage greater than the full scale of the device. Given that the setpoint command full scale is 5V, the output in this mode is 7V.
- In CLOSED mode the setpoint outputs a voltage less than the minimum output voltage of most devices, the setpoint output voltage is $-0.25V$.

b) **Setpoint Source**

The setpoint source dictates where the setpoint value comes from, assuming the mode is set to AUTO (see above). This can be one of two possibilities - Internal or Slave.

- Internal source – the setpoint uses the value set internally via the ‘▲’ & ‘▼’ switches or via external communications.
- Slave source – in this case the setpoint uses a percentage of an externally produced value. The percentage is set via the ‘▲’ & ‘▼’ switches and the external value comes from the secondary input channel (as mentioned 5.2 in above)

3.5. User Re-zero

Over time it is possible that the input may ‘drift’ slightly due to various conditions (temperature changes, etc.). As such it may be necessary for the channel to be re-zeroed by the user.

The user re-zero function is provided for this task. It simply takes the current reading (sampled and averaged over 3 seconds) and uses that as an additional offset for the channel in question, subtracting the value from all subsequent readings. Ensure any process value to be zeroed, is in fact truly zero before performing this function. This would mean isolating flow devices or fully pumping a pressure device.

Note that the user re-zero via serial communications also provides the facility for clearing any user re-zero value that may have already been set. This should be used before any input calibration is performed to ensure that the calculated calibration points are not distorted by the user zero offset.

3.6. Adaptive Filtering

The THCD-100 includes an adaptive averaging filter on the display and serial communication readings output to aid in ‘smoothing out’ unwanted ‘noise’ on the displayed readings.

a) **Operational Band**

The filter can be configured to only operate within a certain band, meaning that excursions between subsequent readings that fall outside that band are shown as real (and not filtered) readings. The band is configurable between 0.01% and 1.00% of the full scale range of the input channel. It can also be set to OFF, which means that no filtering is performed (i.e. every reading is a ‘real’ one) and can also be set to ON which means that filtering is always shown no matter how big of an excursion occurs.

b) **Filter Size**

The size of the filter is currently configurable between 0 and 6 seconds and simply indicates the amount of readings that are taken and buffered to calculate and show the averaged reading. A filter size of 0 will naturally turn off the filtering, irrespective of the band setting.

It should be noted that this type of adaptive filtering can cause readings to be displayed abnormally, particularly if the buffer size is one of the larger available settings, where the displayed readings seem to 'jump about' as the filter is disabled and then re-enabled when the data excursions fall into the preset band. This is because outside of the band, the display will show the 'real' unfiltered readings (whilst constantly taking an average in the background). When the excursions fall into the band then the display will switch to showing the filtered data. If this data is quite significantly slugged (due to a large buffer size) then the display will appear to nearly reach the new data value (due to 'real' values being shown) and then jump back to the filtered data which could be several seconds behind. Because of this, the setting of a buffer size greater than 5 seconds will automatically change the band to ON, meaning that filtered data will always be shown.

Selecting different filter band/size combinations will reduce these anomalies, turning the band OFF and ON will stop this anomaly.

4. Front Panel Operation

4.1. Introduction

The front panel consists of a 112x16 dot matrix VFD display with 6 membrane key switches below it. Each switch has legends on and above or below it to indicate its function under different conditions, although there are certain common functions to each screen, as detailed below.

For the purpose of the following subsections, the switches shall be referred to using the legends on the buttons.



4.2. Common Switch Functions

The switches on certain types of screens and in certain modes have the same functionality as detailed here:

a. Menu Screens

On all menu screens, the '◀' & '▶' switches are used to navigate through the menu options. The 'Func' switch is used to go back to the parent menu, except on the Main Menu screen where it goes back to the normal display mode. The 'Zero' switch doubles up as an Enter switch and this actions the chosen menu selection. This may be to go to a submenu or to an editable or information screen (see HMI breakdown for more details).

b. Editable Screens

On any screen that has editable fields, switches '▲' & '▼' move the selection between the possible editable fields. 'Func' goes back to the parent screen which is usually the menu that was used to get to the screen in question. 'Zero' activates edit mode (see below).

c. Edit Mode

When in edit mode, the edit cursor appears on the first character in the editable field (the cursor is a horizontal bar below the character being edited). If the field is bigger than 1 character then switches '◀' & '▶' are used to move left and right across the field. If the field is only one character (e.g. a Yes/No selection) or has a rolling selection (e.g. for selection of a percentage) then '◀' & '▶' do nothing. Switches '▲' & '▼' are used to change the character being edited within the valid range (field position dependant). 'Func' cancels edit mode and returns the field to its previous value. 'Zero' accepts any changes to the field and also comes out of edit mode.

4.3. Front Panel Screens

Here follows a complete breakdown of all THCD-100 screens:

a) **Main Screen (not changing setpoint)**



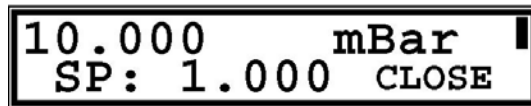
The main screen comes in two forms. The first shows the main channel input data (with range, fullscale and calibration applied) and the associated units string. If an input is over range (more than 15% above full scale voltage) then the data value is replaced with the over range error – “**RANGE!**”. This screen also shows the current mode of the setpoint, if not in AUTO (i.e. OPEN or CLOSE). If either of the relays have been tripped then they are also indicated as such on the far right of the screen.

Switch Functions:

Func	No function *
◀	Go to Main Menu screen
▶	Enable setpoint mode override, active for 2 seconds
▶ (override mode)	Change setpoint mode to AUTO
▲	Change setpoint value (main screen changes as below)
▲ (override mode)	Change setpoint mode to OPEN
▼	Change setpoint value (main screen changes as below)
▼ (override mode)	Change setpoint mode to CLOSE
Zero	Perform input rezero (if held for 3 seconds)

* By default, the Func switch does nothing while this screen is displayed.

b) **Main Screen (changing setpoint)**

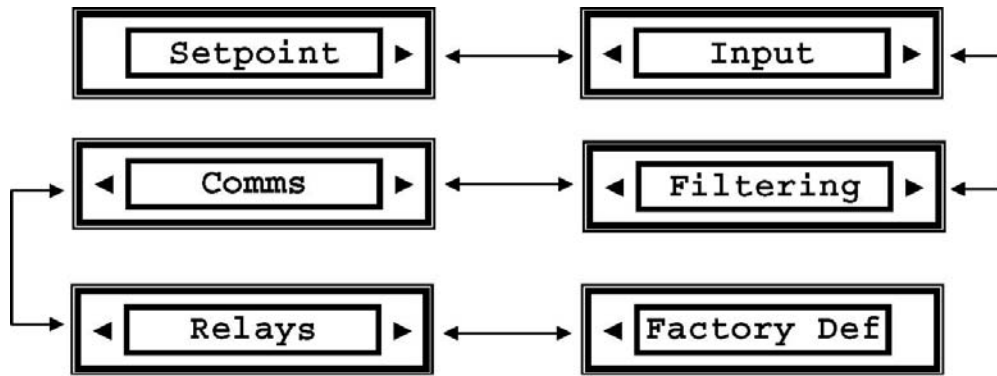


The other form of main screen is shown when changing the live setpoint (via an initial press of the ‘▲’ or ‘▼’ switches). All the information shown on the first main screen is shown here (albeit some items are resized or repositioned) but in addition the current setpoint value is also shown. Note that this screen is not permanent – if the ‘▲’ or ‘▼’ switches are not pressed at all for 5 seconds, then the main screen reverts to the first variety shown previously.

Switch Functions:

Func	No function ^{*(See (a) above)}
◀	Go to Main Menu screen
▶	Enable setpoint mode override, active for 2 seconds
▶ (override mode)	Change setpoint mode to AUTO
▲	Change setpoint value (hold for continuous change)
▲ (override mode)	Change setpoint mode to OPEN
▼	Change setpoint value (hold for continuous change)
▼ (override mode)	Change setpoint mode to CLOSE
Zero	Perform input rezero (if held for 3 seconds)

c) **Main Menu Screen**



The Main Menu screen provides a path to select screens that are used for the configuration of the THCD-100 – the setpoint (value, mode, source), input (range, full scale, units string), digital communications, display filtering and relays can all be configured from screens selected via the main menu. It is also possible to reset settings to their factory defaults from the Main Menu screen. Only one option is shown at any one time, in the order shown above. Pressing Enter (Zero) accesses the next level.

Descriptions of successive levels are described below.

Switch Functions:

Func	Go back to Main screen
◀	Go to previous menu selection
▶	Go to next menu selection
▲	No function
▼	No function
Zero	Go to screen associated with menu selection

d) **Setpoint Screen**



From the setpoint screen you can edit the value of the command setpoint as well as change the mode (AUTO, OPEN, CLOSED) and the source (INTERNAL, SLAVE). If SLAVE is selected then the percentage sign (%) appears next to the SP value. For more information on the command setpoint, see the Principles section 5.4.



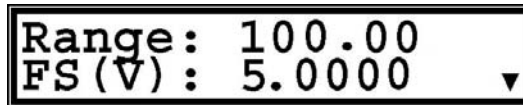
Switch Functions:

Func	Go back to Main Menu screen
◀	Select previous character when in edit mode
▶	Select next character when in edit mode
▲	Move edit field selection up
▼	Move edit field selection down
Zero	Go to edit mode for currently selected field

Input Screen



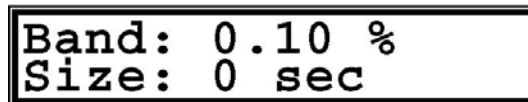
This screen allows you to change the input channel range and fullscale voltage (see the Principles section (5.2) for more information on this) and also assign a units label (up to 5, non-scaling characters) for the channel data. The number of decimal places selected on the range field dictates the number of decimal places shown for the input channel data on the Main screen. To reduce the number of decimal places, change the number under the edit cursor to a decimal point and the system will auto format the field when 'Zero' is pressed.



Switch Functions:

Func	Go back to Main Menu screen
◀	Select previous character when in edit mode
▶	Select next character when in edit mode
▲	Move edit field selection up
▼	Move edit field selection down
Zero	Go to edit mode for currently selected field

e) Filtering Screen



This screen allows the user to modify the band and buffer size of the adaptive filter. The filter only applies to the display and serial communications output readings. The band is represented as a percentage of FS and can be set between 0.00% (OFF) and 1.00% and also to ON. The buffer size allows settings between 0 and 6 seconds of filtering. For more information on the adaptive filter, see the Principles section (5.6)

Switch Functions:

Func	Go back to Main Menu screen
◀	Select previous character when in edit mode
▶	Select next character when in edit mode
▲	Move edit field selection up
▼	Move edit field selection down
Zero	Go to edit mode for currently selected field

f) Comms Menu Screen

The Comms Menu screen provides options for setting the serial communication's baud rate, address and RS232/RS485 protocol.



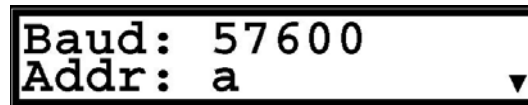
Switch Functions:

Func	Go back to Main Menu screen
◀	Go to previous menu selection
▶	Go to next menu selection
▲	No function
▼	No function
Zero	Go to screen associated with menu selection

g) Serial Screen



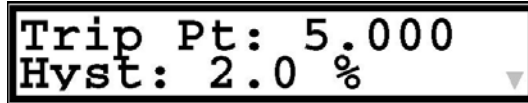
The main configuration item on the serial screen allows you to select the baud rate of the THCD-100 for serial communication. The allowed baud rates are 9600, 19200 & 57600. There is also an address field that is mainly used for identifying a particular unit if several are connected together on an RS485 network. All commands sent to the unit must be prefixed with the address letter (see section 5.2 for more information). Valid letters are 'a' to 'h'. The other editable field is used to tell the THCD-100 whether it is on an RS485 serial network.



Switch Functions:

Func	Go back to Main Menu screen
◀	Select previous character when in edit mode
▶	Select next character when in edit mode
▲	Move edit field selection up
▼	Move edit field selection down
Zero	Go to edit mode for currently selected field

h) Relay Screen



Trip Pt: 5.000
Hyst: 2.0 %

This screen allows you to set the trip point for when the relay switches. The relay also contains some hysteresis to stop it 'chattering'. This is configurable from this screen as well and is represented as a percentage of full scale of the input channel, with limits of 0.0% (i.e. no hysteresis) to 10.0%. If the second relay option is factory fitted then the above fields are duplicated for the second relay and are changed to Trip 1, Hyst 1 & Trip 2, Hyst 2 as appropriate.

Switch Functions:

Func	Go back to Main Menu screen
◀	Select previous character when in edit mode
▶	Select next character when in edit mode
▲	Move edit field selection up
▼	Move edit field selection down
Zero	Go to edit mode for currently selected field

i) Factory Defaults Confirmation Screen



Hold Menu & Hit
Enter to Confirm

If Factory Defaults is selected from the Main Menu, this screen appears to ask for confirmation of the requested function. If confirmed then the screen changes to show a percentage of completion of the factory defaults and once completed the THCD-100 will restart.

Switch Functions:

Func	Go back to Main Menu screen
◀	If held, starts factory default when Zero is pressed
▶	No function
▲	No function
▼	No function
Zero	Starts factory default if ◀ is held as well.

5. SERIAL COMMUNICATION

5.1. Introduction

The THCD-100 allows full control and feedback via serial communication protocols (RS232 or RS485). Calibration, in fact, all controls available through the front panel, are available as commands sent using serial communications.

Serial communications is available using an RS232 or RS485 link between the client (typically a PC) and the THCD. A baud rate must be configured, along with the selection of protocol. Valid baud rates are 9600, 19200 & 57600. Additional communication setup parameters (e.g. parity, stop bits, etc.) are always the same and nonconfigurable. By default the THCD is setup to communicate via RS232 with the following communication parameters:

Baud: 57600
Data bits: 8
Parity: None
Stop bits: 1
Handshaking: None

5.2. Command/Query Format

The format of the commands and queries is common between all available communication protocols. That is, the address must be included whether using RS232 or 485.

Format: `acc[?] [p][,p][,p]↵`

... where 'a' = address, 'ccc' = command/query, '?' = query identification; 'p' = parameter (separated by commas if more than one)

The first letter to be entered on the command line, before any command or query, is the address identifier. This is a letter between a & h and is particularly important when communicating via RS485, if there are several units on the same RS485 network. On RS232 this address doesn't really mean anything because RS232 is single point to point communication. However as mentioned above, the address letter is left in (and therefore required) between communication methods. By default the THCD has the letter 'a' for its address.

Most commands are identified by three letters (although this is not always the case) and a query is identified by following the command letters with a '?' character. For all commands with parameters, you must separate the command from its parameters with a space, and separate multiple parameters with commas.

Table 1 in Appendix A summarizes all commands and queries available. Note that where a command is also a query, you do not enter any parameters for the query 'version' unless explicitly stated in the table.

For everything sent through the communications port, the THCD will reply by informing the user of the command/query it has just received, along with any parameters identified, any data requested (if it was a valid command/query) and a line indicating whether the command was accepted. This reply block is the same for anything sent to the THCD and is as follows . ('↵' indicates a carriage return/line feed pair):

For a command:

```
*<a>*<cmd>;<params>↵  
!<a>!<response>!↵
```

For a query:

```
*<a>*<cmd>;<params>↵  
<data>↵  
!<a>!<response>!↵
```

... where: <a> is the address letter
<cmd> is the command/query (query identified by a '?' after the three chars)
<params> is the comma separated parameter list, if any
<response> is the acceptance indicator.
<data> is the data requested if a query was sent.

NOTE: The data usually consists of some identification string, in CAPS, followed by a colon (:) and then the actual data. Some queries return multiple lines of information. See individual commands for details as appropriate.

The acceptance indicator is a single character as follows:

- 'o' = OK: if the command/query was recognized and accepted;
- 'b' = BADCMD: if the command/query was not recognized or has incorrect/invalid parameters
- 'e' = ERROR: if there was some internal communications error.
- 'w' = BUSY: if the communications port is currently busy.

5.3.Main Commands

a. Output Current Readings – 'r'

This command tells the THCD to get the current reading of the input channel data. If the input voltage of the channel is more than 15% over the full scale voltage set for the channel, the <reading> below will be replaced with the over range error – "RANGE!".

The readings output format is as follows with the channel data followed by a setpoint mode indication, separated by a semicolon:

```
READ:<reading>;<setpoint mode>↵
```

The <setpoint mode> is a single number that represents the current mode of the setpoint: 0 = AUTO, 1 = OPEN, 2 = CLOSED. This number is mainly included for use with the THCD-100's frontend software and is mainly useful when outputting repeated readings, where it effectively provides a constant update of the current mode of the setpoint.

b. Output Current Readings Repeatedly – 'rp'

The THCD is also able to report the current readings repeatedly, at a given interval. This command starts and stops this repeat activity by setting the parameter accordingly:

0 = Repeat off

1 = Repeat every 100ms (not allowed if using a baud rate < 57600)

2 = Repeat every 500ms (not allowed if using a baud rate < 57600)

3 = Repeat every second

4 = Repeat every minute The timing commences from the point at which the 'rp' command is entered. Use this command with care on a RS485 multidrop network! 'r' is recommended.

NOTE for 100ms repeat readings: The data output is effectively lots of small data packets. On TCP networks, this can cause problems when communicating with front end software running on MS Windows. It has been found that the Winsock control, commonly used in TCP communications development on Windows, does not handle lots of small data packets very well, coming in at speeds of around 10Hz or faster. As such, it has been decided that, when 100ms repeated output is used,

the data will be taken every 100ms and buffered up, to be sent out every 500ms in blocks of 5 readings. This has proven to be a more robust output method.

c. **Setpoint Value – ‘spv’**

This command is used to set the value of the command setpoint. The command takes one parameter which is the actual value to set.

The current value of the setpoint can be retrieved using the query ‘spv?’. Returned data is:

SP VALUE: <setpoint value>

d. **Setpoint Mode – ‘spm’**

This command sets the mode for the command setpoint. The command takes one parameter which is a number between 0 & 2, identifying the mode, as follows:

- 0 = AUTO mode
- 1 = OPEN mode
- 2 = CLOSED mode

For more information on setpoint modes, see the Principles section 5.4(a).

The current mode of the setpoint can be retrieved by using the query ‘spm?’. The returned data is:

SP MODE: (<x>) <mode string>

... where ...

<x> = 0, 1, or 2 and <mode string> = AUTO, OPEN, or CLOSED respectively.

e. **Setpoint Source – ‘sps’**

The setpoint source can be an internally set value or a percentage of the secondary THCD input (known as slave input). This source is set using this command and as with the other setpoint commands, it takes just one parameter which is as follows:

- 0 = Internal source
- 1 = Slave source

For more information on setpoint sources, see the Principles section 5.4(b). The current source of the setpoint can be retrieved by using the query ‘sps?’. The returned data is:

SP SOURCE: (<x>) <source id>

...where...

<x> = 0 or 1 as above, <source id> = string identifier for <x> : INTERNAL or SLAVE.

f. **Setpoint Initial Value – ‘siv’**

The setpoint value set with the ‘spv’ command (above) is not nonvolatile. This command can be used to set an initial setpoint value on system startup. It takes one parameter which is the initial setpoint value.

The current value of the setpoint can be retrieved using the query ‘siv?’. Returned data is:

SP INIT VAL: <initial setpoint value>

g. **Setpoint Initial Mode – ‘sim’**

As with the value, the setpoint mode set using the ‘spm’ command (above) is a volatile setting. Again this command provides a way of setting an initial startup mode for the setpoint on power up of the THCD. It takes one parameter which is a number between 0 & 2, identifying the initial mode, as follows:

0 = AUTO mode 1 = OPEN mode 2 = CLOSED mode

The current mode of the setpoint can be retrieved by using the query ‘spm?’. The returned data is:

SP INIT MODE: (<x>) <mode string>

... where ...

<x> = 0, 1, or 2 and <mode string> = AUTO, OPEN, or CLOSED respectively.

5.4. Serial Commands

a) **Serial Baud Rate – ‘bra’**

The serial baud rate (BR) can be set using this command. Any value can be entered as the parameter and the THCD decides on the actual baud rate using the following criteria:

Parameter value (BR)	Actual baud rate
BR < 14400	9600
14400 ≤ BR < 28800	19200
BR ≥ 28800	57600

When changing baud rate using serial commands, the THCD will give the usual response to the command at the current baud, then change baud rate and give the !<address>!o!␣ response at the new baud rate. Host front ends can therefore monitor for this to confirm that the baud rate has changed. If this command is used with

To retrieve the current baud, use the query ‘bra?’. Returned data is:

BAUD: <baud rate>

b) **Serial Communication Protocol – ‘pro’**

This command switches the serial protocols between RS232 & RS485. The parameter passed should be one of the following:

0 = RS485

1 = RS232

To retrieve the current protocol setting, use the query ‘pro?’. Returned data is:

PROTOCOL: <protocol>

... where

<protocol> = 0 or 1 as above.

c) **Serial Communication Address – ‘add’**

As mentioned previously (section 4.2), all commands are prefixed with an address letter. This command allows you to change that address. Valid addresses are a through h. When the THCD replies to the command, the first line will contain the old address and the response line will contain

the new address. All subsequent communications must use the new address.

The current communication address can be obtained using the query 'add?'. The returned data is:

ADDR: <address>

5.5.Channel Setup Commands

a) **Input Channel Units String – 'uiu'**

The input channel has an associated freeform text field that can be used to identify the units being used. This command is used to set this and its only parameter is a max of 5 characters for the units string.

The current units string can be retrieved using the query 'uiu?'. The data returned is as follows:

INPUT UNITS STR: <units>

... where... <units> = the exact units string as displayed on the front panel

b) **Input Channel Range – 'uir'**

Use this command to set the range of the input channel. The single parameter is the actual value for the range. The number of decimal places passed in the range value dictates the number of decimal places shown for the main data output (up to a max of 4 decimal places

– any more will get chopped off)

The current range of the input channel is retrieved using the query 'uir?'. The data returned is as follows:

INPUT RANGE: <range>

... where...

<range> = the range of the channel (engineering units)

c) **Input Channel Full Scale – 'uif'**

This command is used to set the full scale voltage for the input channel. The single parameter is the actual full scale value. The full scale voltage setting for the input channel is retrieved using the query 'uif?'. The data returned is as follows:

INPUT FULLSCALE: <fs>

... where...

<fs> = the full scale voltage of the channel.

For more information on the use of input range and full scale, see the Principles section 5.2.

5.6.Filtering Commands

a. **Filter Band – 'flb'**

This command is used to set the point at which the adaptive filtering kicks in. It takes one parameter which is the percentage of full scale of the input. Valid values are between 0.01% and 1.00%. Additionally the parameter can be OFF which will mean the filtering will never kick in, or ON which means the filtering is always used. Note that if the filter size is set to greater than 5 seconds, the filter band command will return a Bad Command acknowledgement because the filter is always on in this

situation and it therefore makes no sense to attempt to change the band setting. For more information on this see the Principles section (5.6).

To retrieve the current filter band, use the query 'flb?'. The returned data is:

FILTERING BAND: <band>%

b. **Filter Size – 'fls'**

Use this command to set the size of the adaptive filtering buffer. The one parameter this command takes is the buffer size in seconds, between 0 and 6 seconds (integer values only). (0 can be used to effectively turn the adaptive filtering off).

To retrieve the current filter size, use the query 'fls?'. The returned data is:

FILTERING SIZE: <x> sec

... where

<x> = number of seconds of filtering

[Note if current size is 0 then returned data is: FILTERING SIZE: 0 (NO FILTER)]

5.7. Relay Control Commands

a) **Relay Trip Point – 'rlt'**

This command sets the point at which the relay switches from one state to the other. When the source data is below this point then the relay is CLOSED, so therefore when the source data rises above this point then the relay is OPEN. The command takes two parameters – the first is the relay whose trip point is to be set (1 or 2) and the second is the trip point in engineering units, as configured with the Input Channel range command (see 5.2(a)). Note that the first parameter is always required even if the second relay has not been factory fitted.

The current trip point values can be retrieved using the query 'rlt?'. The returned data is one line for each relay, as follows:

RELAY <x>,TRIP POINT: (comma req'd, no space)

... where ...

<x> = the relay number and TRIP POINT is in terms of the set full-scale display value.

b) **Relay Hysteresis – 'rlh'**

This command configures the hysteresis setting of the relay. It takes two parameters – the first if the relay in question, the second is the percentage hysteresis, represented as a percentage of full scale of the source channel, with limits of 0.0% (i.e. no hysteresis) to 10.0%.

The current hysteresis setting can be retrieved using the query 'rlh?'. The returned data is one line for each relay, as follows:

RELAY <x>,HYSTERESIS: (comma req'd, no space)

... where ...

<x> = the relay number and HYSTERESIS is in percent.

Other Commands

a) **User Input Re-zero – ‘irz’**

To perform a user input re-zero function, use this command. The command needs no parameters.

To find the current user re-zero values for all input channels, use the query ‘irz?’. The data returned is as follows:

CH<x> REZERO: <re-zero>

...where...

<x> = the input channel number <re-zero> = the current re-zero value

b) **Date of Last Factory Calibration – ‘dlc?’**

This query is used to retrieve the date of the last factory calibration run. The data is returned as follows:

LAST CAL DATE: <yymmdd>

...where...

yy = year, mm = month & dd = day.

E.g. 051201 means the last calibration run was 1st December 2005.

c) **Retrieve All Settings – ‘ras’**

As well as issuing some of the above commands as queries to retrieve individual settings, this command has been provided which will return a comma separated list of most of the settings for the input channel.

The exact settings provided by this command are detailed in Table 3 in Appendix C.

6. SERVICE & CALIBRATION

6.1. Service

There are no user serviceable parts inside the instruments. Should any difficulties be encountered in the use of the THCD-100, it is recommended that you contact Hastings Instruments for advice and instructions.

6.2. Analog Inputs

There is no user calibration for the THCD-100. It is recommended that the instrument be returned to Hastings Instruments whenever such service is required.

There are no user adjustments in the instrument, indeed, the presence of lethal voltages within the instrument means that the user is strictly forbidden from removing the covers without invalidating Hastings Instrument's obligations under warranty.

6.3. Cleaning

A dirty instrument may be wiped clean with a soft cloth that has been sprayed with a mild foaming cleaner then wiped dry immediately.



Under no circumstances should the instrument be wetted directly or left damp

6.4. End of Life

Hastings Instruments complies with the WEEE legislation and is registered as a manufacturer and importer of Electrical and Electronic Equipment. Once this equipment reaches its end of life, or is no longer required it may be returned to Hastings Instruments to be reused or recycled in accordance with the legislation. Please contact Hastings Instruments for full details. Terms and conditions apply.

7. Appendices

7.1. Appendix A

Table 1 – THCD-100 Command Set Summary

Purpose	Cmd	Query	Parameters	Notes
Output current readings	r			
Output current readings repeatedly	rp		0 - 4	P1: 0 = Repeat off 1 = Repeat every 100ms 2 = Repeat every 500ms 3 = Repeat every second 4 = Repeat every minute (1 & 2 not allowed when using serial communication at baud < 57600)
Setpoint value	spv	spv?	#	P1: Real value to set
Setpoint mode	spm	spm?	0 - 2	P1: 0 = AUTO mode 1 = OPEN mode 2 = CLOSED mode
Setpoint source	sps	sps?	0 - 1	P1: 0 = Internal source 1 = Slave (External) source
Setpoint initial value	siv	siv?	#	P1: Real value to set
Setpoint initial mode	sim	sim?	0 - 2	P1: 0 = AUTO mode 1 = OPEN mode 2 = CLOSED mode
Retrieve all settings	ras			Comma separated string returned See Table 3 for actual settings
Serial baud rate	bra	bra?	9600, 19200, 57600	BR < 14400 = 9600 14400 ≤ BR < 28800 = 19200 BR ≥ 28800 = 57600
Serial protocol	pro	pro?	0 or 1	P1: 0 = RS485 1 = RS232
Communications address	add	add?	a through h	
Input channel units str	uiu	uiu?	cccc	P1: Max length 5 chars
Input channel range	uir	uir?	#	P1: Real value for range to set
Input channel full scale	uif	uif?	#	P1: Real value for full scale to set
Adaptive filter band	flb	flb?	#	P1: Band percentage (0.011.00) or OFF, or ON
Adaptive filter size	fls	fls?	0 - 6	P1: Buffer size in seconds
Relay switch threshold	rlt	rlt?	1 - 2, #	P1: Relay number P2: Real number for switching point
Relay hysteresis	rlh	rlh?	1 - 2, 0.01 - 0.0	P1: Relay number P2: Hysteresis percentage value
User input rezero function	irz	irz?	[0]	P1 (optional): clears current user input rezero setting
Date of last calibration		dlc?		Returned date format: yymmdd

7.2. Appendix B

Table 2 – Factory Defaults

Setting	Default Value	Additional Information
Repeat Rate (for output readings)	0	Repeat off
Serial Communications Baud	57600	
Serial Communications Protocol	1	RS232
Communications Address	a	
Input Channel Units String	""	No units strings set
Input Channel Range	10.00	
Input Channel Full Scale	10.000	
Input Channel Display Precision	2	2 decimal places
Input Channel User Rezero	0.0	No rezero set
Setpoint Value	0.0	
Setpoint Slave Value	0.0%	
Setpoint Source	0	Internal source
Setpoint Mode	0	AUTO mode
Date of Last Factory Calibration	010101	
Adaptive Filter Band	0.2%	
Adaptive Filter Buffer Size	2	2 seconds
Relay Trip Point (for both relays, if factory fitted)	10.0	
Relay Hysteresis (for both relays, if factory fitted)	2.0%	

7.3. Appendix C

Table 3 – Settings in ‘ras’ command string

Description	Type and size
Input channel units string	5 char string
range	8 char string representation of a float
full scale	8 char string representation of a float
Setpoint value	8 char string representation of a float
slave value	8 char string representation of a float
mode	1 byte (02 as for spm? query)
source	1 byte (01 as for sps? query)
initial value	8 char string representation of a float
initial slave value	8 char string representation of a float
initial mode	1 byte (02 as for sim? query)
Adaptive filter band	4 char string representation of a float
size	1 byte (06 as for fls? query)
Relay 1 trip point	8 char string representation of a float
hysteresis value	4 char string representation of a float
Relay 2 trip point (if factory fitted)	8 char string representation of a float
hysteresis value (if factory fitted)	4 char string representation of a float
Last factory calibration date	6 char string (format as for dlc? query)

8. WARRANTY

8.1. Warranty Repair Policy

Hastings Instruments warrants this product for a period of one year from the date of shipment to be free from defects in material and workmanship. This warranty does not apply to defects or failures resulting from unauthorized modification, misuse or mishandling of the product. This warranty does not apply to batteries or other expendable parts, or to damage caused by leaking batteries or any similar occurrence. This warranty does not apply to any instrument which has had a tamper seal removed or broken.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty as to fitness for a particular use. Hastings Instruments shall not be liable for any indirect or consequential damages.

Hastings Instruments, will, at its option, repair, replace or refund the selling price of the product if Hastings Instruments determines, in good faith, that it is defective in materials or workmanship during the warranty period. Defective instruments should be returned to Hastings Instruments, **shipment prepaid**, together with a written statement of the problem and a Return Material Authorization (RMA) number.

Please consult the factory for your RMA number before returning any product for repair. Collect freight will not be accepted.

8.2. Non-Warranty Repair Policy

Any product returned for a non-warranty repair must be accompanied by a purchase order, RMA form and a written description of the problem with the instrument. If the repair cost is higher, you will be contacted for authorization before we proceed with any repairs. If you then choose not to have the product repaired, a minimum will be charged to cover the processing and inspection. Please consult the factory for your RMA number before returning any product repair.

TELEDYNE HASTINGS INSTRUMENTS
804 NEWCOMBE AVENUE
HAMPTON, VIRGINIA 23669 U.S.A.
ATTENTION: REPAIR DEPARTMENT

TELEPHONE (757) 723-6531
TOLL FREE 1-800-950-2468
FAX (757) 723-3925
E MAIL hastings_instruments@teledyne.com
INTERNET ADDRESS <http://www.teledyne-hi.com>

Repair Forms may be obtained from the "Information Request" section of the Hastings Instruments web site.

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