



# Thermocouple / Millivolt Input Module

**HE800THM000 / HE800THM100**  
**HE-THM000 / HE-THM100\***



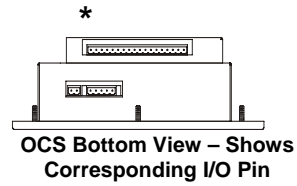
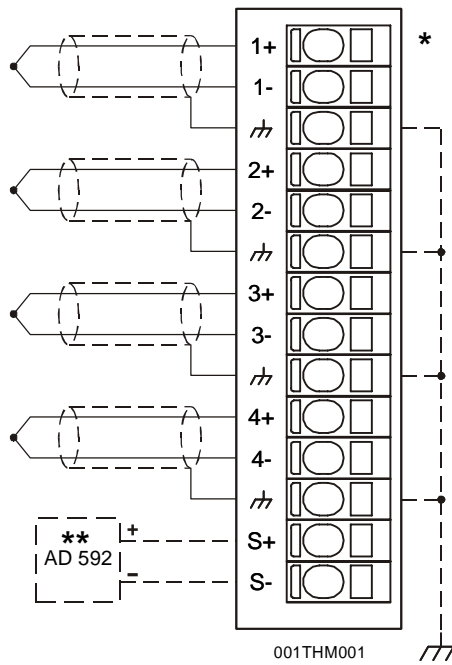
\* HE- denotes plastic case.

This datasheet also covers products starting with IC300.

## 1 SPECIFICATIONS

	THM000	THM100		THM000	THM100
Number of Channels	2	4	PLC Update Rate	Set by PLC Scan Rate	
Resolution	0.05°C		Analog Input Points Required	2	4
Input Impedance	10Meg Ohm clamped @ ±24VDC		Cold Junction Compensation	Internal or External; Automatically Selected	
A/D Conversion Type	Integrating		Maximum Sustained Differential O/L	Limited by Common Mode Range	
Required Power (Steady State)	0.34W (14.3mA @ 24VDC)		Common Mode Range	± 12VDC Max.	
Required Power (Inrush)	Negligible		A/D Conversion Time	16 channels per second	
Types Supported	J,K,T,E,C,R,S		Open Thermocouple Response	High Temperature	
Millivolt Ranges	±25mv, ±50mv, ±100mv		Operating Temperature	0° to 60° Celsius	
Millivolt Accuracy	0.1% Full Scale		Relative Humidity	5 to 95% Non-condensing	
Common Channel Points	None		<b>Accuracy</b> <small>(Accuracy Specifications not guaranteed below -200°C)</small>		
			Types <b>J,K,T, &amp; E</b>	Type <b>C</b> To Be Determined	Types <b>R &amp; S</b>
			±1°C		±4°C
<b>Thermocouple Type:</b>	<b>J</b>	<b>K</b>	<b>T</b>	<b>E</b>	
Input Range Temperature	-210°C to 770°C  (-346°F to 1418°F)	-270°C to 1380°C  (-454°F to 2516°F)	-270°C to 410 °C  (-454°F to 770°F)	-270°C to 1010°C  (-454°F to 1850°F)	
	<b>C</b>	<b>R</b>	<b>S</b>		
	0°C to 2320°C  (32°F to 4208°F)	0°C to 1760°C  (32°F to 3200°F)	0°C to 1760°C  (32°F to 3200°F)		
CE UL	See Compliance Table at <a href="http://www.heapg.com/Support/compliance.htm">http://www.heapg.com/Support/compliance.htm</a>				

2 WIRING



Pin	Signal	
	THM100	THM000
1+	Thermocouple 1 +	Thermocouple 1 +
1-	Thermocouple 1 -	Thermocouple 1 -
⌘	Shield	Shield
2+	Thermocouple 2 +	Thermocouple 2 +
2-	Thermocouple 2 -	Thermocouple 2 -
⌘	Shield	Shield
3+	Thermocouple 3 +	
3-	Thermocouple 3 -	
⌘	Shield	
4+	Thermocouple 4 +	
4-	Thermocouple 4 -	
⌘	Shield	
S+	External AD592 +	
S-	External AD592 -	

\*\* The AD592 is a 1uA/°K integrated circuit temperature sensor manufactured by Analog Devices. It may be used for external cold junction compensation for the THM100. The THM100 needs to be calibrated with a specific AD592 to meet accuracy specifications in external compensation mode.

### 3 CONFIGURATION

**Note:** The status of the I/O can be monitored in Cscape Software.

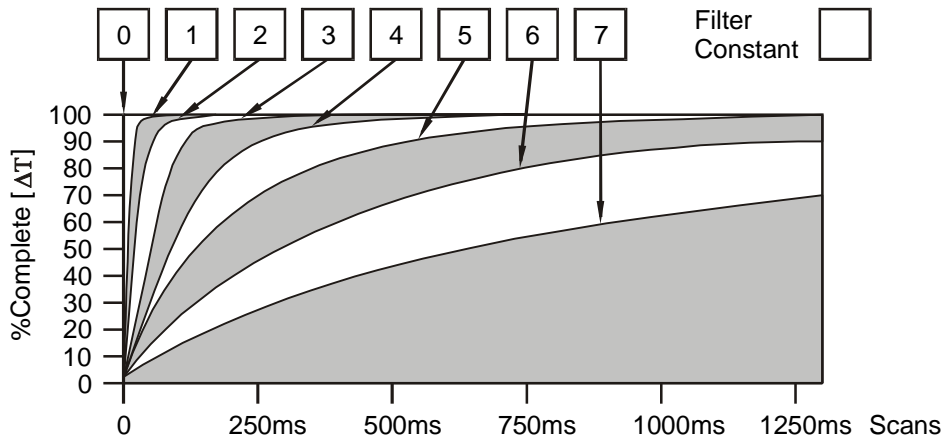
Preliminary configuration procedures that apply to SmartStack™ Modules are contained in the hardware manual of the controller you are using. Refer to the **Additional References** section in this data sheet for a listing of hardware manuals.

#### Module Setup Tab

- a) Sensor Type for each channel must match what is physically attached.
- b) Temperature format may be set for various C° or F° ranges. (This does not apply to millivolt ranges.)
- c) Filter Constant sets the level of digital filtering according to the chart below.
- d) Reject Rates sets the frequency level for noise rejection at 50 or 60HZ.

#### I/O Map Tab

The I/O Map describes which I/O registers are assigned to a specific SmartStack™ Module and where the module is located in the point map. The I/O Map is determined by the model number and location within the SmartStack™. The I/O Map is not edited by the user.



**Digital Filtering.** The illustration above demonstrates the effect of digital filtering (set with Filter Constant) on module response to a temperature change.

## 4 INPUT AND OUTPUT CONVERSIONS

For a given module configuration, use the appropriate formula in the table to obtain the actual temperature (°C or °F) that is represented by the value in the %AI register.

Thermocouple Configuration	Temperature Conversion	
	Celsius	Fahrenheit
0.05°	°C = %AI / 20 *	°F = %AI / 20 *
0.1°	°C = %AI / 10 **	°F = %AI / 10 **
0.5°	°C = %AI / 2	°F = %AI / 2
* Maximum reading in 0.05°F or 0.05°C format is limited to 1638.3 because of %AI resolution.		
** Maximum reading in 0.1°F or 0.1°C format is limited to 3276.7 because of %AI resolution.		

The following table describes how real-world inputs are scaled into the controller. Given a known input voltage, the data value is configured by using the conversion factor from the table. The following formula is used: **Data = Voltage In (Vin) / Conversion Factor**

**Example:** The user selects a voltage of 25mV.

- 1) The known input voltage is 25mV.
- 2) Using the table, the conversion factor for the voltage range of ± 25mV is 0.00078125.
- 3) To determine the data value, the formula is used:  

$$\text{Data} = \text{Vin} / \text{Conversion Factor}$$

$$32000 = 25\text{mV} / 0.00078125$$

Conversion of Real-World Inputs to the Controller			
	%AI Value		
Selected Voltage Range	Voltage In (Vin) VDC	Data Out	Conversion Factor
± 25mv	-25mv	-32000	0.00078125
	0	0	
	+25mv	+32000	
± 50mv	-50mv	-32000	0.0015625
	0	0	
	+50mv	+32000	
± 100mv	-100mv	-32000	0.003125
	0	0	
	+100mv	+32000	

## 5 INSTALLATION / SAFETY

**Warning:** Remove power from the OCS controller, CAN port, and any peripheral equipment connected to this local system before adding or replacing this or any module.

- 1) All applicable codes and standards should be followed in the installation of this product.
- 2) Shielded, twisted-pair wiring should be used for best performance.
- 3) Shields may be terminated at the module terminal strip
- 4) In severe applications, shields should be tied directly to the ground block within the panel.
- 5) Ungrounded thermocouple sensors are preferred due to their isolated electrical characteristics
- 6) Interposing terminal strips between the sensor and the module can cause errors due to cold junction effect.
- 7) If Interposing terminal strips must be used, use specially constructed terminal blocks which match the material characteristics of the thermocouple sensor.
- 8) Use the following wire type or equivalent: Omega TT-J-20-TWSH for thermocouple input and Belden 8441 for mV input.
- 9) Horner thermocouple input modules use a high impedance differential circuit to support the use of grounded or ungrounded thermocouples. For grounded thermocouples, the specified **Common Mode Range** allows for ground potential differences between the machine ground and the PLC ground within that range. For ungrounded or floating thermocouples the high impedance inputs are subject to common mode noise pickup. For noisy environments it is recommended that one side of all ungrounded thermocouples be grounded near the PLC. This does not affect open thermocouple detection or measurement accuracy and reduces the effect of common mode noise if present. This PLC side ground connection must not be used with grounded thermocouples or accuracy will be affected. Any thermocouple should be grounded in one place at most.

For detailed installation and a handy checklist that covers panel box layout requirements and minimum clearances, refer to the hardware manual of the controller you are using. (See the **Additional References** section in this document.)

When found on the product, the following symbols specify:



Warning: Consult user documentation.



Warning: Electrical Shock Hazard.

WARNING: To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

WARNING: To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

WARNING: Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

WARNING: In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

WARNING: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

For detailed installation and a handy checklist that covers panel box layout requirements and minimum clearances, refer to the hardware manual of the controller you are using. (See the **Additional References** section in this document.)

- All applicable codes and standards need to be followed in the installation of this product.
- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG or larger.

Adhere to the following safety precautions whenever any type of connection is made to the module.

- Connect the green safety (earth) ground first before making any other connections.
- When connecting to electric circuits or pulse-initiating equipment, open their related breakers. Do not make connections to live power lines.
- Make connections to the module first; then connect to the circuit to be monitored.
- Route power wires in a safe manner in accordance with good practice and local codes.
- Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- Ensure hands, shoes, and floor are dry before making any connection to a power line.
- Make sure the unit is turned OFF before making connection to terminals. Make sure all circuits are de-energized before making connections.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

## 6 ADDITIONAL REFERENCES

The following information serves as a *general* listing of Horner controller products and other references of interest and their corresponding manual numbers. Visit our website listed in the **Technical Support** section to obtain user documentation and updates.

<b>Note:</b> This list is <u>not</u> intended for users to determine which products are appropriate for their application; controller products differ in the features that they support. If assistance is required, see the <b>Technical Support</b> section in this document.	
Controller	Manual Number
XLE Series (e.g., HE-XExxx)	MAN0805
QX Series (e.g., HE-QXxxx)	MAN0798
NX Series (e.g., HE-NXxxx)	MAN0781
LX Series (e.g., LX-xxx; also covers RCS116)	MAN0755
Color Touch OCS (e.g., OCSxxx)	MAN0465
OCS (Operator Control Station) (e.g., OCS1xx / 2xx; Graphic OCS250)	MAN0227
Remote Control Station (e.g., RCS2x0)	
MiniOCS (e.g., HE500OCSxxx, HE500RCSxxx)	MAN0305
Other Useful References	
CAN Networks	MAN0799
Cscape Programming and Reference	MAN0313
Wiring Accessories and Spare Parts Manual	MAN0347
DeviceNet™ Implementation	SUP0326
Wiring Accessories and Spare Parts Manual	MAN0347

## 7 TECHNICAL SUPPORT

For assistance and manual up-dates, contact Technical Support at the following locations:

**North America:**  
(317) 916-4274  
[www.heapg.com](http://www.heapg.com)

**Europe:**  
(+) 353-21-4321-266  
[www.horner-apg.com](http://www.horner-apg.com)

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