

May 2025

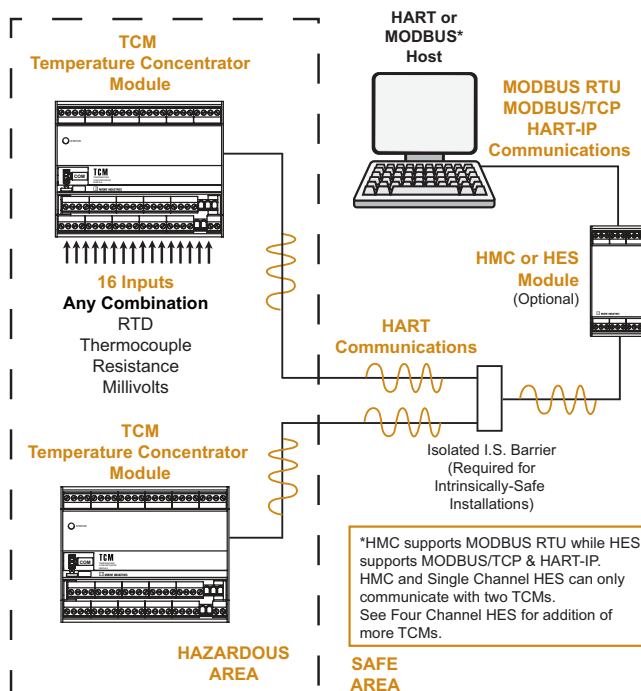
► Description

The TCS Temperature Concentrator System substantially reduces the cost of transmitting multiple temperature sensor measurements in general purpose and hazardous area applications by “concentrating” several signals over digital network links.

The TCM’s 16 I/O channels are quickly configured to accept any combination of RTD, T/C, mV and resistance/potentiometer signal inputs. It converts the inputs to the HART® digital communications protocol, and transmits the data long distances from the field to the control room, on an economical HART digital data link.

All process, status and diagnostic information can then be accessed by a HART-based control system or host. When used with a Moore Industries HMC HART-to-MODBUS Converter, the TCM interfaces with a MODBUS RTU-based host. Alternatively, the TCM can be coupled with a Moore Industries HES HART-to-Ethernet Gateway System and connected to a MODBUS/TCP or HART-IP host.

Figure 1. TCMs can be connected to a HMC HART-to-MODBUS RTU converter or a HES HART-to-Ethernet Gateway System to economically transmit several temperature signals to a host system.



Certifications (see Page 8 for details)



IECEX



The TCM Temperature Concentrator Module (left), HMC HART-to-MODBUS RTU Converter (middle) and HES HART-to-Ethernet Gateway System feature rugged metal, RFI/EMI resistant housings that snap onto standard DIN-style rails.

► Features

- **Substantially reduce hardware, wire, installation and I.S. barrier costs.** The TCS eliminates the need to install a dedicated transmitter and twisted wire pair (or expensive sensor extension wires) for each measurement. Only one I.S. barrier is needed to support up to 16 temperature points in intrinsically-safe applications.
- **Installs in hazardous areas.** Intrinsically-safe design allows the TCM Temperature Concentrator Module to be safely installed in any Class I, II, III, Division 1 (Zone 0/1) hazardous area.
- **Universal input options.** The TCM can be set to accept RTD (2-, 3-, 4-wire; Pt, Cu, Ni); thermocouple (J, K, E, T, R, S, N, B, C); resistance/potentiometer (0-4000 ohms); and millivolt (-50 to 1000mV) inputs.
- **HART, MODBUS RTU, MODBUS/TCP & HART-IP communications.** These standard communication protocols facilitate interface with a wide range of BPCS, PLC and other host systems.
- **Ethernet and IIoT Temperature Monitoring.** With the HES HART-to-Ethernet Gateway System module you can bring critical temperature measurements over your Ethernet backbone to control and monitoring host systems, or view real time process variable data with a web browser.

MODBUS RTU Communications Mode

If interfacing with a MODBUS RTU-based host system is required, the TCS is offered with the HMC HART-to-MODBUS Converter. When used with the HMC, two TCM Temperature Concentrator Modules can be used within a system, allowing up to 32 inputs to be monitored.

HMC HART-to-MODBUS Converter—Acting as the HART Primary Master, the HMC issues HART commands instructing the TCM to transmit all of its data in a single poll.

The HMC converts the TCM's HART digital data to a serial MODBUS RTU (RS-485) communications protocol to allow direct connection with MODBUS-based monitoring and control systems (such as a PLC or DCS). The HMC offers dual MODBUS communication ports so redundant communications can take place with one or more MODBUS RTU hosts.

If the HMC is specified for the application, the TCM can still be configured from any termination point along the twisted wire pair, beyond the input side of the HMC, using a HART hand-held.

The HMC is configured using Moore Industries' FREE HMC Intelligent PC Configuration Software.

HMC Powers Two TCM Modules—When installed on the communications link, the HMC can supply loop power (transmitter excitation) to one or both TCM Temperature Concentrator Modules. This eliminates the need to install an additional external supply to power the TCM modules.

HMC Fault Alarms—The HMC can be programmed via the PC software to provide two relay outputs (one for each TCM) rated 2A@250Vac (non-inductive loads, 50/60Hz). The relays can be set to send a master alarm when the HMC detects one, any, or all of the following fault conditions within the system: No HART signal; broken wire; hardware error; bad configuration; input saturated; and input out of table range.

The alarms can be set with a time delay, which specifies how long (in seconds) the alarm condition needs to exist before the alarm trips. Failsafe and Non-Failsafe alarm action is also configurable.

There are two ways to set up communications to a HART master. If your HART master can poll multiple transmitters on a HART network you can set up the TCM similarly. Each TCM channel would have a HART address 0-15 and the HART master would poll each address. Updating 16 channels would take about 16 seconds.

If your HART master can implement HART command 184, all 16 channels can be returned in bulk in one message string. This is how the HMC communicates with the TCM and 16 channels come back in less than 2 seconds.

Figure 4. TCS in MODBUS RTU Communications Mode.

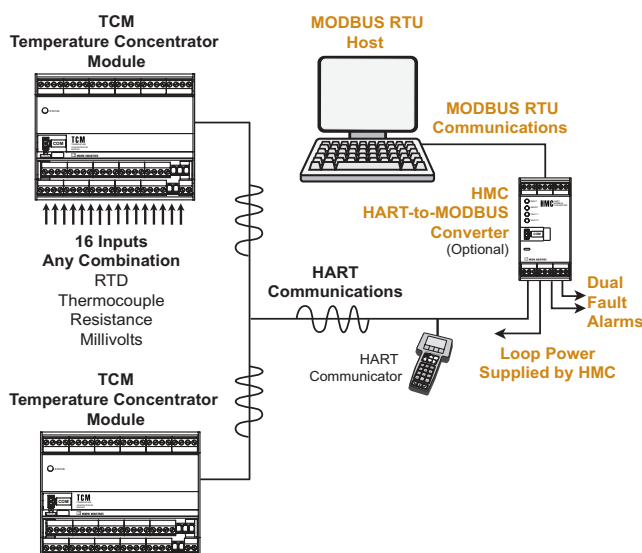
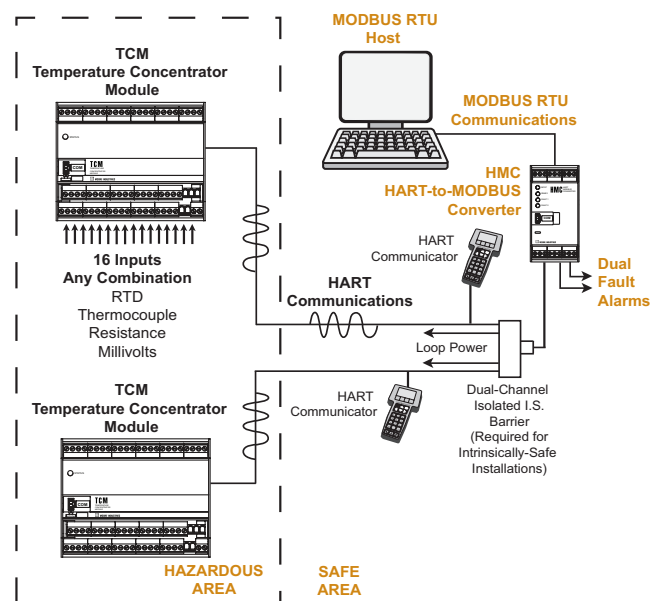


Figure 5. TCS in Intrinsically-Safe MODBUS RTU Communications Mode.



► System Architecture, with HES

When Ethernet based communication is required for your TCS Temperature Concentrator System, a single channel or four channel version of the HES HART-to-Ethernet Gateway System is required. The HES is able to communicate with a MODBUS/TCP or HART-IP based host. Once fitted with the TCM option, the single channel HES can connect to one or two TCMs. Alternatively, the four channel HES can connect with up to eight TCMs (maximum of two per channel).

Unlike the HMC, the HES can communicate with up to sixteen HART devices per channel. Each 16 channel TCM is considered one HART device, so this means that if two TCMs are connected on a particular HES channel, 14 devices can still be connected to the channel along with the TCMs.

The TCM converts the signal inputs to standard HART protocol which allows the HES to poll each TCM using a device specific HART command. This device specific command enables the TCM to send all 16 channel values in one HART message packet, thus increasing throughput and response time.

HES Additional Features

The HES HART-to-Ethernet gateway system is easily and quickly programmable using any FDT compliant host, such as PACTware. The HES' DTM and a free copy of PACTware are downloadable from our website.

A built-in web server in the HES provides quick and easy read-only viewing of connected TCMs and all other connected HART devices. The web pages include simple to navigate menus and tables that neatly lay out all of the HART variables from each of the connected TCMs and HART devices. To make communication setup with a MODBUS/TCP host easier, the tables within the web pages include MODBUS memory map address referencing so users can more easily configure the MODBUS/TCP host settings.

The HES supports up to four concurrent MODBUS/TCP and up to four HART-IP connections. For more secure network environments, the number of active MODBUS/TCP and HART-IP connections can be limited. This will ensure that there are not multiple unauthorized or undesired MODBUS/TCP or HART-IP hosts polling the HES. See HES data sheet for more features.

Figure 6. TCS consisting of two TCMs, three HART field devices and a single channel HES HART-to-Ethernet Gateway System.

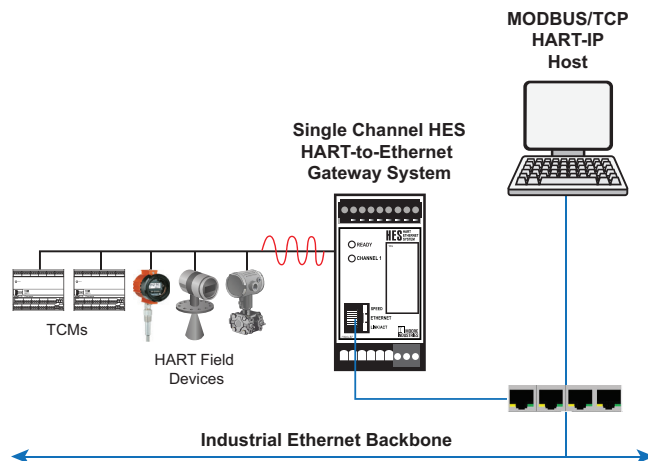
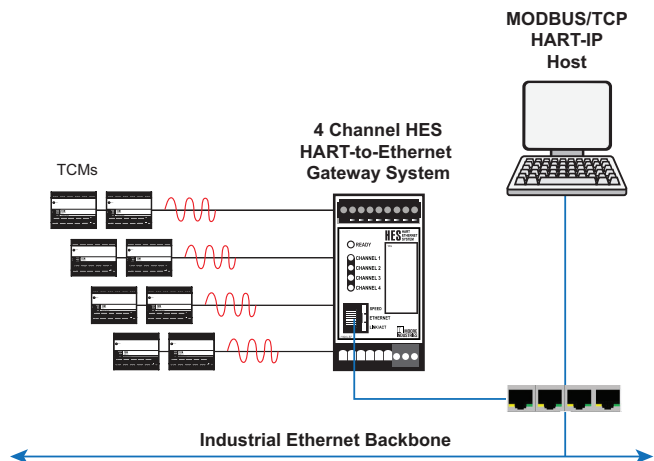


Figure 7. TCS consisting of eight TCMs and a four channel HES HART-to-Ethernet Gateway System monitoring 128 temperature points.



► Specifications (TCM Temperature Concentrator Module)

HART Specifications Address Range: 0-15 (in HART Communications Mode) Transmission Speed: 1200bps Character Format: 1 Start Bit - 8 Data Bits - 1 Odd Parity Bit - 1 Stop Bit	Performance Input Accuracy: Refer to Table 4 Overall Accuracy: The overall accuracy of the unit is the input accuracy. It includes the combined effects of linearity, hysteresis, repeatability and adjustment resolution. It does not include ambient temperature effect. For T/C input, add the Reference Junction Compensation error Reference (Cold) Junction Compensation: $\pm 0.65^{\circ}\text{C}$ ($\pm 1.17^{\circ}\text{F}$) Stability: Refer to Table 2 Isolation: 500Vrms between inputs and outputs and between I/O to case. (no isolation between individual input channels) Input Overload Protection: $\pm 5\text{Vdc}$, maximum	Performance (Continued) Digital Input Filter: 50/60 Hz, User-configurable Power Supply Requirements: 15-42Vdc for Standard version, 15-30Vdc for Intrinsically-Safe version, 15mA maximum, 12.5mA typical Input Impedance: T/C and mV: 40Mohms, nominal RTD and Ohms Excitation: 210microamps, $\pm 10\%$ RTD Lead Wire Resistance Maximum: RTD resistance + 2X lead wire resistance: < 4000 ohms max; Recommended lead wire resistance for 3-wire connections: <35 ohms/wire; 10 ohm copper sensor <5 ohms	Ambient Temperature Operating and Storage Range: -40°C to $+85^{\circ}\text{C}$ (-40°F to $+185^{\circ}\text{F}$) Relative Humidity: 0-95%, non-condensing Ambient Temperature Effect: Refer to Table 3 Startup Time: <0.5sec, maximum Loss of Input: HART status byte indicates faults Noise Rejection: Common mode, 100dB@50/60Hz; Normal Mode: Refer to Table 2 RFI/EMI Immunity: 10V/m@80-1000MHz, 1kHz AM, when tested according to IEC61326
		Indicators LED Type: STATUS LED: Red indicates Power On, Not-Initialized; Green indicates Power On, System OK; Green/Amber (flashing): Power On, Communication detected Red/Green (flashing): Power On, Error	Weight 749g (1.7 lbs) I.S. Entity Parameters (Power/Loop, +PS & -PS): Vmax or Ui = 30Vdc Imax or Ii = 110mA Pmax or Pi = 0.825W Ci = 0F Li = 0H Sensor Outputs (Combined Total) Ca or Co = 396μF La or Lo = 9.4μH Voc or Vt = 4.0Vdc Isc or It = 254.14mA Po = 0.71738W

Table 1. Long-Term Stability

Stability (% of maximum span)	Input-to-HART (Years)		
	1	3	5
RTD, Ohm & Pot Inputs	0.047	0.081	0.104
T/C & mV Inputs	0.08	0.14	0.18

Table 2. Normal Mode Rejection Ratio Table

Sensor Type	Max. p-p Voltage Injection for 60dB at 50/60Hz	
T/C: J, K, N, C, E	125mV	
T/C: T, R, S, B	80mV	
Pt RTD: 100, 200, 300 ohms	250mV	
Pt RTD: 400, 500, 1000 ohms	500mV	
Ni: 120 ohms	500mV	
Resistance		mV
1-4kohms		500mV
0.25-1kohms	250-1000	200mV
0.125-0.25kohms	62.5-250	100mV

Table 3. Ambient Temperature Effect

Input Type	Accuracy per 1°C (1.8°F) change in Ambient
*RTD	0.0035°C
Millivolt	0.5 microvolts + 0.005% of reading
Ohm	0.002 ohms + 0.005% of reading
Thermocouples	
Input Type	Accuracy per 1°C (1.8°F) change in Ambient
J	0.00016°C + 0.005% of reading
K	0.0002°C + 0.005% of reading
E	0.00026°C + 0.005% of reading
T	0.0001°C + 0.005% of reading
R, S	0.00075°C + 0.005% of reading
B	0.0038°C + 0.005% of reading
N	0.0003°C + 0.005% of reading
C	0.00043°C + 0.005% of reading

*Accuracy of Ni672 is 0.002°C

Table 4. TCM Input and Accuracy Table

Input	Type	α	Ohms	Conformance Range	Minimum Span	Input Accuracy**	Maximum Range
RTD	Platinum	0.003850	100	-200 to 850°C -328 to 1562°F	10°C (18°F)	±0.5°C ±0.9°F	-240 to 960°C -400 to 1760°F
			200				
			300				
			400				
			500				
			1000				
		0.003902	100	-100 to 650°C -148 to 1202°F		±0.5°C ±0.9°F	-150 to 720°C -238 to 1328°F
			200				
			400				
			500				
1000							
0.003916		100	-200 to 510°C -328 to 950°F	-240 to 580°C -400 to 1076°F			
Nickel	0.00672	120	-80 to 320°C -112 to 608°F	±0.5°C ±0.9°F	-100 to 360°C -148 to 680°F		
Copper	0.00427	9.035	-50 to 250°C -58 to 482°F	±1.5°C ±2.7°F	-65 to 280°C -85 to 536°F		
Ohms	Direct Resistance	n/a	0-4000 ohms	0-4000 ohms	10 ohms	±2 ohms	0-4095 ohms
	Potentiometer		125, 250, 500, 1k, 2k, 4k ohms	0-100%	10%	±0.5%	0-100%
T/C	J	n/a	n/a	-180 to 760°C -292 to 1400°F	35°C 63°F	±0.5°C ±0.9°F	-210 to 760°C -346 to 1400°F
	K	n/a	n/a	-150 to 1370°C -238 to 2498°F	40°C 72°F	±0.75°C ±1.35°F	-270 to 1372°C -454 to 2501°F
	E	n/a	n/a	-170 to 1000°C -274 to 1832°F	35°C 63°F	±0.5°C ±0.9°F	-270 to 1000°C -454 to 1832°F
	T	n/a	n/a	-170 to 400°C -274 to 752°F	35°C 63°F	±0.5°C ±0.9°F	-270 to 400°C -454 to 752°F
	R	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.85°C ±1.53°F	-50 to 1768°C -58 to 3214°F
	S	n/a	n/a	0 to 1760°C 32 to 3200°F	50°C 90°F	±0.85°C ±1.53°F	-50 to 1768°C -58 to 3214°F
	B	n/a	n/a	400 to 1820°C 752 to 3308°F	75°C 135°F	±1.0°C ±1.8°F	0 to 1820°C 32 to 3308°F
	N	n/a	n/a	-130 to 1300°C -202 to 2372°F	45°C 81°F	±1.0°C ±1.8°F	-270 to 1300°C -454 to 2372°F
	C	n/a	n/a	0 to 2300°C 32 to 4172°F	100°C 180°F	±1.25°C ±2.25°F	0 to 2315°C 32 to 4200°F
Millivolts	DC	n/a	n/a	-1000 to 1000mV	4mV	150 microvolts	-1000 to 1000mV

**Ambient Temperature Reference Conditions for Specifications = 25°C

► Specifications (HMC HART-to-MODBUS Converter)

Performance Input Accuracy: Reflects the accuracy of the TCM Input Impedance: Transmit Mode: 150 ohms; Receive Mode: Greater than 5kohms Maximum Input Over-Range: ±5Vdc Isolation: 1000Vrms between case, input, MODBUS outputs and power terminals, continuous, and will withstand 1500Vac dielectric strength test for one minute (with no breakdown) Power Supply: 24Vdc, nominal; 20-30Vdc limits Power Consumption: 4-7W, nominal; 9W@24Vdc, maximum for units using TX +TX Power Supply: 25.8Vdc ±3%@40mA Digital Response Time: 1 second from TCM input to MODBUS output; MODBUS response time depends on how fast and how often a MODBUS Master requests data from the HMC; the data response time from request is 50msec	Performance Alarm Response Time: (Continued) Digital Response Time + 150msec, maximum (defined as the time from when the field instrument reports a fault until the HMC alarm is tripped) Alarm Trip Delay: Programmable from 0-120sec Output Type: Standard MODBUS RTU protocol interface over RS-485 (parameters as specified in U.S. Standard EIA-RS485) Address Range: Configurable from 1 to 247. Unit will assume a MODBUS address of 1 by default Baud Rate: Interface supports the following: 300, 600, 1200, 2400, 4800, 9600 and 19.2k. Unit will assume a baud rate of 9600 and no parity by default Parity: MODBUS interface will support even, odd or no parity Character Format: One start bit, 8 data bits and one stop bit Data Format: User-selectable; Standard LSW (Least Significant Word) first or Swapped MSW (Most Significant Word) first. Unit will assume Standard LSW by default	Indicators LED Type: Dual color red/green indicate: INPUT LED: Input is present and normal (green); input signal is not found (red) READY LED: Instrument is ready for operation and configuration (green); instrument has encountered an internal problem (red) FAULT 1: Shows status of TCM 1. No alarm condition (green); Instrument is in an alarm state (red) FAULT 2: Shows status of TCM 2. No alarm condition (green); Instrument is in an alarm state (red) Ambient Conditions Operating and Storage Range: -40°C to +85°C (-40°F to +185°F) Relative Humidity: 0-95%, non-condensing RFI/EMI Immunity: 20V/m@80-1000MHz, 1kHz AM, when tested according to IEC61326 Noise Rejection: Common Mode: 100dB@50/60Hz Weight 454g (1.0 lb)
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TCM Certifications



Factory Mutual US/Canada

Intrinsically-Safe

Class I, Division 1, Groups A,B,C & D
T4@85°C/T5@40°C.
Class I, Zone 0, AEx ia IIC,
T4@85°C/T5@40°C.

Non-Incendive

Class I, Division 2, Groups A,B,C & D
T4@85°C/T5@40°C.



CE Conformant – EMC Directive 2014/30/EU
EN61326

IECEX IECEx Scheme (FM Approvals)

Intrinsically-Safe

Ex ia IIC T4 Ga -40°C ≤ Tamb ≤ 85°C
Ex ia IIC T5 Ga -40°C ≤ Tamb ≤ 40°C

Type “n”

Ex nA [nL] IIC T4 Gc -40°C ≤ Tamb ≤ 85°C
Ex nA [nL] IIC T5 Gc -40°C ≤ Tamb ≤ 40°C



ATEX Directive 2014/34/EU (FM Approvals)

Intrinsically-Safe

Ex II 1 G Ex ia IIC T4 -40°C ≤ Tamb ≤ 85°C;
T5 -40°C ≤ Tamb ≤ 40°C

Type “n”

Ex II 3 G Ex nA [nL] IIC T4 -40°C ≤ Tamb ≤ 85°C;
T5 -40°C ≤ Tamb ≤ 40°C

► Specifications (HES HART-to-Ethernet Gateway System)

Communications HART Primary or Secondary Master: Supports up to 16 HART 5,6 & 7 devices per channel; supports normal and burst mode communication Address Range: 0-63 Number of retries:1-9 Ethernet: 10/100Base-T supports speeds up to 100Mb/second Standard RJ-45 Connection Auto negotiation, Auto MDIX, DHCP or fixed IP address Protocol Types: MODBUS/TCP, HART-IP, HTTP (read only) Performance Digital Response Time: Equals the combination of the HART field device(s) response time, HES update rate and the Ethernet response time. HART field device response is defined by the HART protocol as 500msec in Normal Mode and 333msec in Burst Mode. HES typical update rate (Normal Mode): One HART device per channel (CMD3. No additional Status) : 800 milliseconds One HART device per channel (CMD3 + Additional Status) : 1.2 seconds One HART device per channel (CMD9 No additional Status) : 2 seconds One HART device per channel (CMD9 + Additional Status) : 3 seconds Ethernet response (excludes external network delays): MODBUS/TCP: the data request to response time is less than 10msec HART-IP: the data request to response time is less than 10msec	HTTP: response time to transfer the entire web page is less than 2 seconds Input Accuracy: Reflects the accuracy of the HART field device Input Impedance: Transmit Mode: 150 ohms; Receive Mode: Less than 5 kohms MODBUS/TCP: Configurable MODBUS Register map (by variable or device) User-selectable Standard LSW (Least Significant Word) or Swapped MSW (Most Significant Word) 32 bit floats and 16 bit signed integers (0-3 decimal places) Isolation: 500Vrms between case, input, output and power terminals and will withstand 1000Vac dielectric strength test for one minute continuous (with no breakdown) Power Supply: 9-30Vdc TX Power Supply: On channel 1 only; 25.8Vdc $\pm 3\%$@35mA; capable of powering up to two Moore Industries TCMS or 6 HART field devices configured in multi-drop mode Power Consumption: 1.5W maximum for units not using TX supply; 3.5W maximum for units using TX supply @35mA Security User Configuration: Jumper sets Read only or Read/Write access to HES settings Network Configuration: Limit number of concurrent HART-IP sessions (1-4), Limit number of concurrent MODBUS/TCP sessions (0-4); Jumper sets Read only or Read/Write access to IP and Network settings	Indicators Ethernet: Ready LED: System normal and ready (green); Initializing on power up or unit fault (red) Channel (1-4) LED: Input and communication with all devices normal (green); Input is initializing, fault or no communication (red); Not all devices are communicating (flashing red/green) LINK/ACT: This LED indicates transmit and receive activity in addition to the status of the Link. The LED will be ON when Link is good. It will blink when the transmitter or receiver is active. Speed LED: When yellow, indicates 100Mb/second, off indicates 10Mb/second Ambient Conditions Operating & Storage Range: -40°C to +85°C (-40°F to +185°F) Relative Humidity: 5-95% non-condensing RF/EMI Immunity: 20V/m@80-1000MHz, 1kHz, when tested according to IEC61000-4-3 Noise Rejection: Common Mode: 100dB@50/60Hz Weight 680 g (24 oz.)
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► Ordering Information

TCM Temperature Concentrator Module

Unit	Input	Output	Power	Options	Housing
TCM Temperature Concentrator Module	TPRG 16 input channels program to accept: RTD (2-, 3-, 4-wire; platinum, copper and nickel) Thermocouple: (J, K, E, T, R, S, N, C, B) Resistance:0-4000 ohms Millivolts: -50 to +1000mV (see Table 4 for additional information)	HART HART Digital Communications Protocol	15-42DC for non-Intrinsically-Safe installations 15-30DC for Intrinsically-Safe applications	None	DIN DIN-style housing mounts on 35mm (EN50022) Top Hat DIN-rails

To order, specify: Unit / Input / Output / Power / Options [Housing]

Model Number Example: TCM / TPRG / HART / 15-42DC / [DIN]

HMC HART-to-MODBUS Converter

Unit	Input	Output	Power	Options	Housing
HMC HART-to-MODBUS Converter	HART Accepts a HART communications protocol input from the TCM Temperature Concentrator Module	MB MODBUS RTU (RS-485) Communications	24DC (20-30Vdc)	None	DIN DIN-style housing mounts on 35mm (EN50022) Top Hat DIN-rails

To order, specify: Unit / Input / Output / Power / Options [Housing]

Model Number Example: HMC / HART / MB / 24DC [DIN]

HES HART-to-Ethernet Gateway System

Unit	Input	Output	Power	Options	Housing
HES HART to Ethernet Gateway System	HART Single HART channel input that accepts digital input signals from 1-16 HART smart field devices 4HART Four HART channel inputs, each accepting digital input signals from 1-16 HART smart field devices (64 total)	ETH Ethernet output	9-30DC	-MB MODBUS/TCP Output (Required) -TCM Connectivity to Temperature Concentrator Modules	DIN DIN-style housing mounts on 35mm Top Hat (EN50022) rails

To order, specify: Unit / Input / Output / Power / Options [Housing]

Model Number Example: HES/4HART/ETH/9-30DC/-MB [DIN], HES/HART/ETH/9-30DC/-MB -TCM [DIN]

I.S. Barrier

To use the TCS Temperature Concentrator System in an Intrinsically-Safe* Class I, II, III, Division 1 (Zone 0) hazardous area, specify an I.S. Barrier listed below or equivalent.

Model D1010S —Single-Channel Isolated I.S. Barrier (GMI Model D1010S; Consult the GMI data sheet for details and specifications)
Model D1010D —Dual-Channel Isolated I.S. Barrier (GMI Model D1010D; Consult the GMI data sheet for details and specifications)

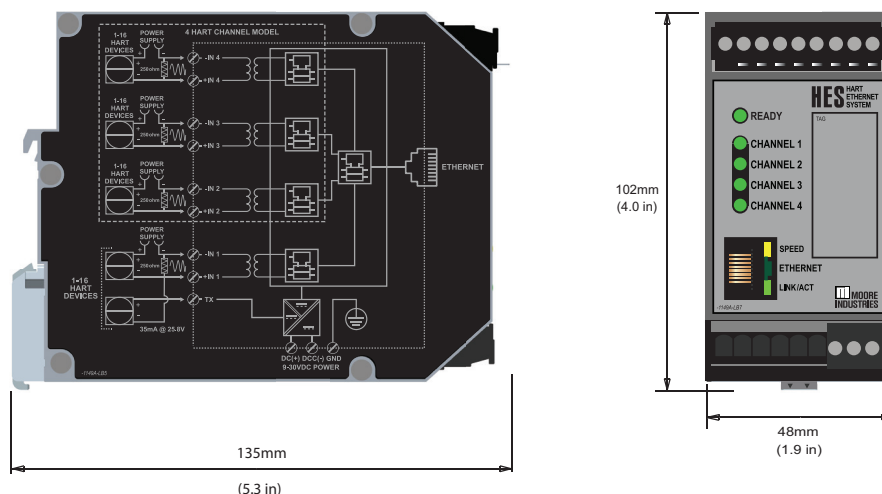
* **IMPORTANT:** It is the responsibility of the installer to select and install per the manufacturer's guidelines an agency approved I.S. Barrier appropriate for the specific application.

Accessories

All TCM, HMC and HES configuration software can be downloaded from our website.
Use the following information to order additional parts:

803-040-26	Non-Isolated PC Configuration Cable (9-pin Serial Port)
804-030-26	Fuse Protected, Non-Isolated USB Communication Cable (required by ATEX for products installed in Intrinsically-Safe areas)
803-039-26	Isolated PC Configuration Cable (9-pin Serial Port)
804-021-26	HART-to-USB Smart Interface Cable with HART Modem

Figure 8. HES HART-to-Ethernet Gateway System Installation Dimensions, Same for 1 and 4 Channel Version (4 channel shown)



TCS

Temperature Concentrator System™ Multi-Channel Transmitter

Figure 9. TCM Temperature Concentrator Module Dimensions.

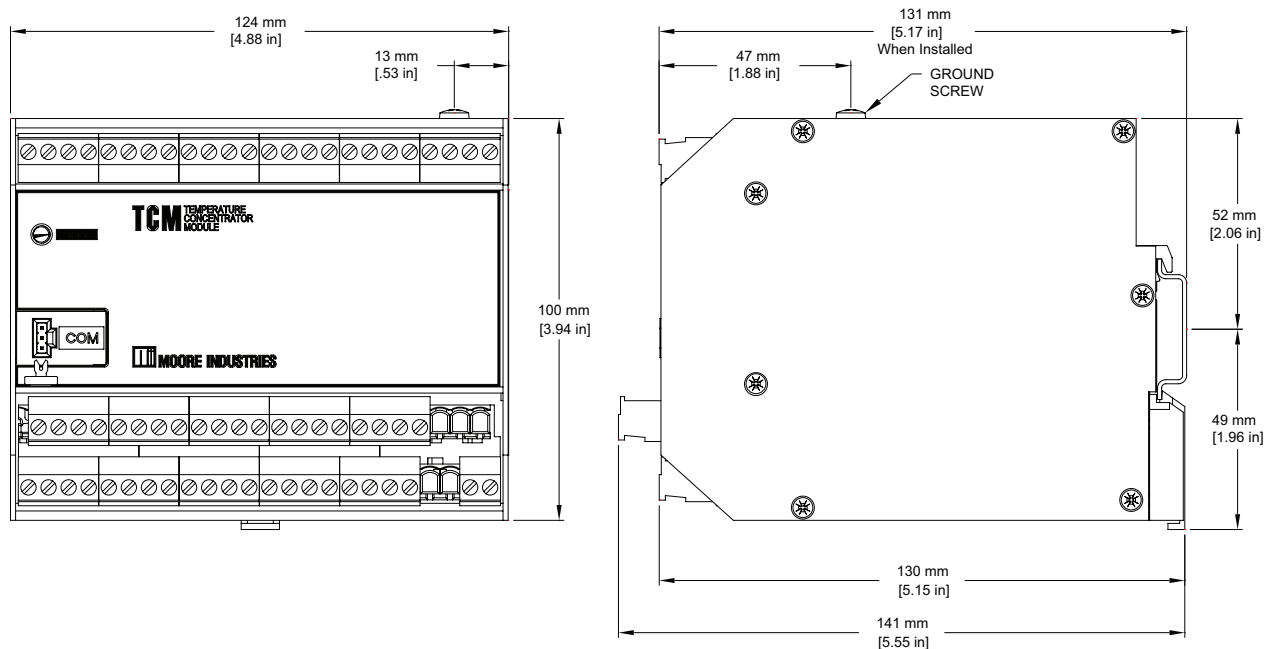
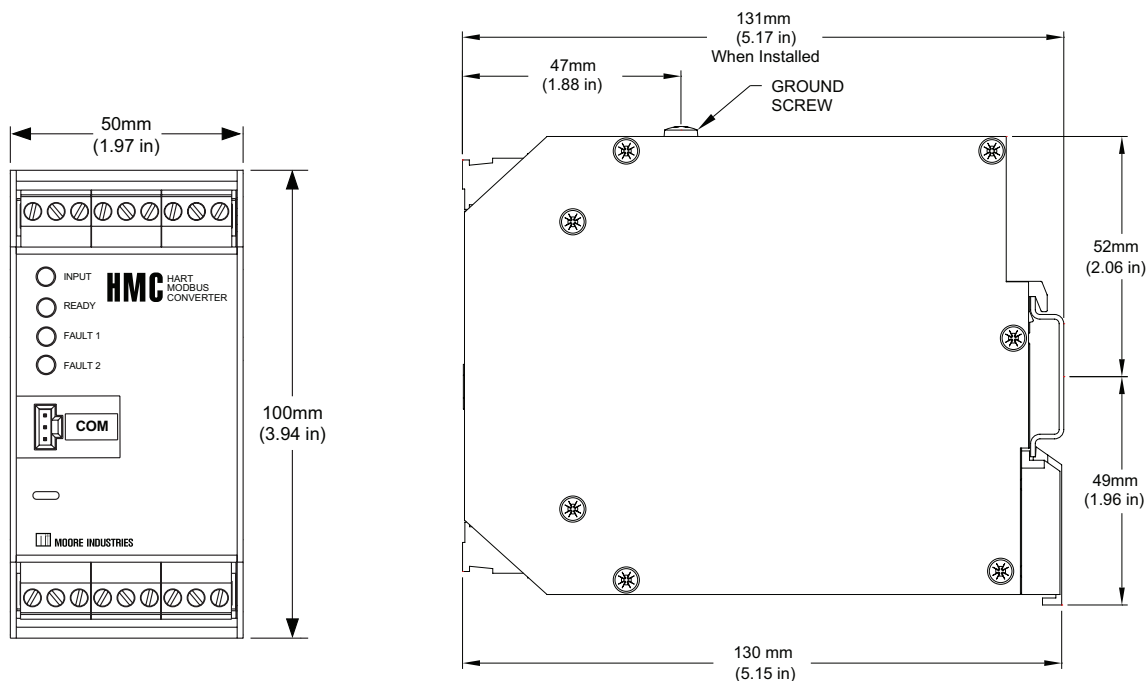


Figure 10. HMC HART-to-MODBUS Converter Dimensions.



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