HIM

Smart HART® Loop
Interface and Monitor

January 2005 Data Sheet 9.80

Description

The HIM HART Loop Interface and Monitor unlocks the full potential of new and in-place smart HART multivariable transmitters and valves.

Converts HART to 4-20mA Signals

The HIM allows up to three additional analog process variable measurements from a smart device with no additional process penetrations or wiring.

Take Full Advantage of “Legacy” Instruments

The HIM lets you leave trusted (and paid for) smart HART transmitters and valves in place, yet still take advantage of all the information they have to offer.

Works With Every Smart HART Device

With a very simple PC program, the HIM programs in minutes to interface with every HART-compatible monitoring and control device:

- Multivariable Mass Flow Transmitters
- Dual-Sensor Temperature Transmitters
- Pressure Transmitters
- Coriolis, Magnetic, Ultrasonic and Vortex Flow Meters
- pH Transmitters
- Radar and Hydrostatic Level Transmitters
- Valve Positioners and Damper Operators

Certifications

Canadian Standards Association (CSA-Int’l)
General/Ordinary Locations

Non-Incendive Apparatus (except -1PRG models)
Class I, Division 2, Groups A, B, C, D

Temperature Code: T5@70°C Max. Op. Amb.

CE Conformant–EMC Directive 89/336/EEC
EN 61326

***The HIM HART Loop Monitor** features a compact metal housing that mounts on a standard DIN-rail or on a surface*

Features

- **“Break Out” up to three analog signals.** The HIM provides additional analog signals proportional to a multivariable transmitter’s primary, second, third or fourth variables, or to user-selectable valve parameters such as stem position.
- **High/Low process and loop diagnostic alarms.** Two relays individually configure to respond to high or low process conditions, or trip when transmitter diagnostics or loop fault conditions are sensed.
- **Sets up as a Primary or Secondary Master, or in “Listen” Mode.** User configurable to act as a HART Master, or in passive “Listen” Mode (see Page 5 for details).
- **Normal or Burst HART Modes.** The HIM can be set to monitor smart HART instruments operating in either Normal (Poll/Response) Mode or in Burst Mode (see Page 5 for details).
- **Large, 5-digit display.** Shows a selected process variable in engineering units (input or output) or toggles between any two variables. The display also provides on-site indication of HART instrument fault conditions.
- **Isolated output channels.** Delivers superior protection against the harmful effects of ground loops and other plant noise.

Monitor Smart Multivariable Transmitters

The HIM extracts useful information from multivariable transmitters that was previously unavailable (see Table 1 for details).

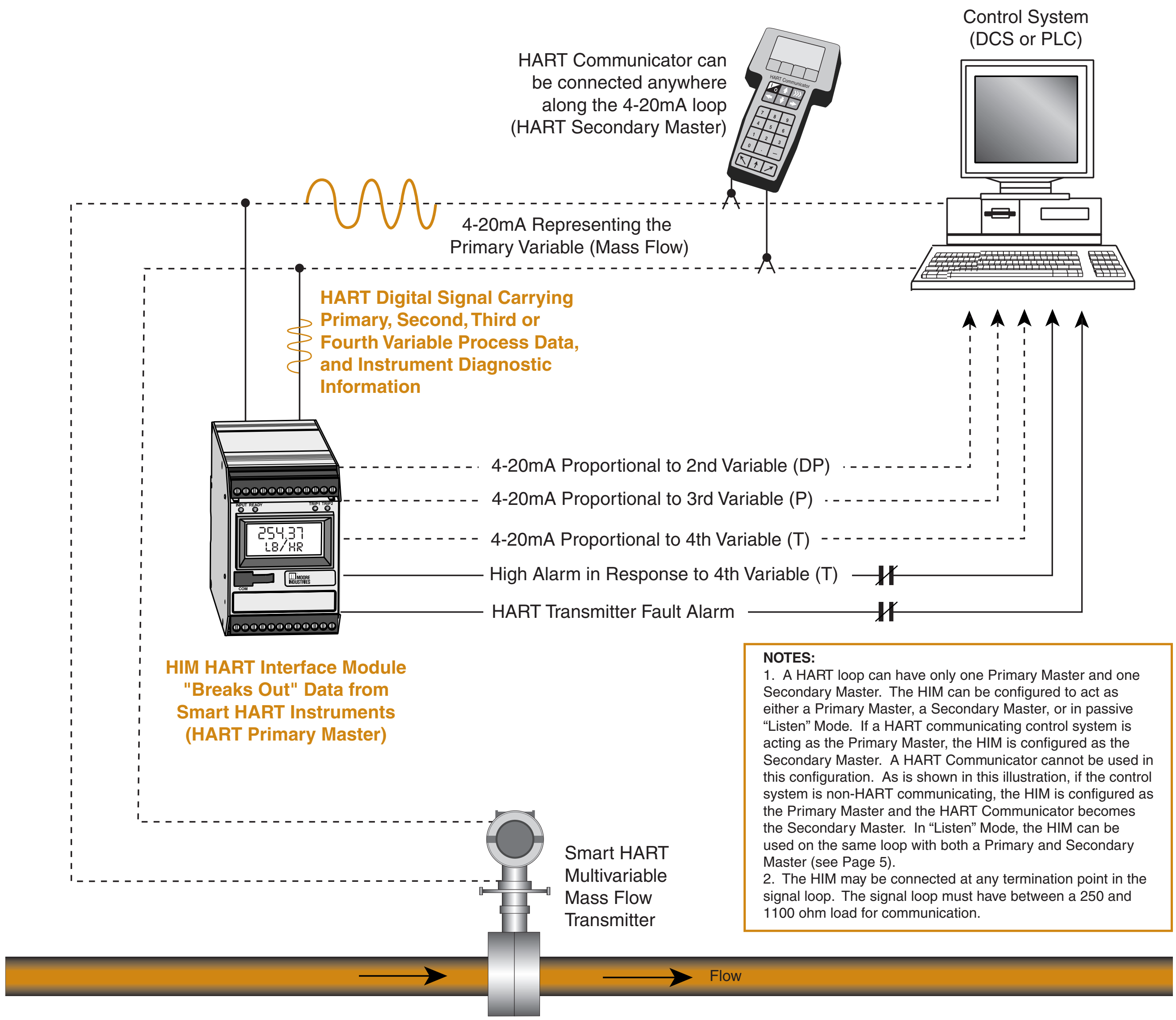
For example, smart HART multivariable mass flow transmitters sense three process variables (pressure, temperature, and differential pressure or raw flow). Using these, they perform an internal calculation to derive mass flow. The mass flow information is transmitted as a 4-20mA signal to the control system.

Unfortunately, unless you have a HART-based control system, there is no way to continously monitor the non-primary variables used to make the calculation. Monitoring non-primary variables may be desirable if one or more of the variables is especially important to the quality or safety of the process.

Convert HART to 4-20mA Signals

Installed transparently across the 4-20mA instrument loop, the HIM reads the HART digital data that is continuously being transmitted on the smart transmitter's analog loop wires (Figure 1), and

Figure 1. *The HIM converts HART digital data to 4-20mA values proportional to a multivariable transmitter's primary, second, third or fourth variables. Its alarm trip outputs warn of unwanted high/low process conditions or of instrument diagnostic problems.*



NOTES:

1. A HART loop can have only one Primary Master and one Secondary Master. The HIM can be configured to act as either a Primary Master, a Secondary Master, or in passive "Listen" Mode. If a HART communicating control system is acting as the Primary Master, the HIM is configured as the Secondary Master. A HART Communicator cannot be used in this configuration. As is shown in this illustration, if the control system is non-HART communicating, the HIM is configured as the Primary Master and the HART Communicator becomes the Secondary Master. In "Listen" Mode, the HIM can be used on the same loop with both a Primary and Secondary Master (see Page 5).
2. The HIM may be connected at any termination point in the signal loop. The signal loop must have between a 250 and 1100 ohm load for communication.

Table 1. *Typical process data (primary and non-primary) available within the digital signal of smart HART devices**

Device Type	Typical Available Process Data*
Multivariable Mass Flow Transmitters	• Mass Flow • Pressure • Differential Pressure • Process Temperature • Flow Rate • Flow Total • Sensor Temperature
Coriolis Flow Meters	• Mass Flow • Volumetric Flow • Density • Process Temperature • Sensor Temperature • Brix/Baume • Concentration • Corrected Volume • Total Solute Flow
Magnetic Flow Meters	• Flow • Raw Flow • Volumetric Flow • Smoothed Flow • Positive Total • Negative Total • Net Total
Ultrasonic Flow Meters	• Flow • Sound Velocity • Positive Total • Negative Total
Vortex Flow Meters	• Flow • Total Flow • Process Temperature • Vortex Frequency
Hydrostatic Level Meters	• Level • Volume • Pressure • Differential Pressure • Sensor Pressure • Process Temperature • Sensor Temperature
Radar Level Transmitters	• Level • Distance • Interface Volume/Mass • Percent Level • Percent Range • Internal Temperature • Output Percentage • Percent Distance • Product Volume/Mass • Reflection • Volume of Empty Space (Ullage)
Pressure Transmitters	• Pressure • Differential Pressure • Percent Range • Electronics Temperature • Sensor Temperature
pH Transmitters	• pH • Process Temperature • Electrode Performance
Valve Positioners and Damper Operators	• Stem Position Percentage • Input • Supply Pressure • Set Point • Deviation from Set Point • Actuator Pressure • Positioner Temperature

* Available data differs from each manufacturer. Consult the HART device manufacturer or Moore Industries for variables available for a specific device.

converts it to 4-20mA signals that can be readily accepted by a DCS or PLC. This allows you to continuously track a multivariable transmitter's second, third, and fourth variables. Each HIM analog channel may be individually programmed to monitor the variables of your choice.

Process and Diagnostic Alarm Trips

The HIM can be ordered with one or two alarm trip (relay) outputs. These can be used just like a traditional alarm trip to warn of high and/or low process conditions based on user-set trip points. They can also be set as diagnostic alarms to warn of problems with a smart HART transmitter or valve positioner.

Process High/Low Alarms—The difference between the HIM and a traditional alarm trip is that the HIM responds to HART's digital information, rather than to a loop's analog signal. This allows the HIM to be set to monitor any available dynamic HART variable. For example, for a multivariable mass flow transmitter, a relay can be set to trip when the transmitter's Fourth Variable (temperature) exceeds a user-set trip point (Figure 1).

Each trip can be individually assigned. Both alarms can be assigned to monitor one process variable, or each can be set to respond to different process variables.

Monitor HART Instrument Diagnostics—Using the Field Device Status Byte data that is available in HART's digital information, the HIM can be set to initiate an alarm if any of the following fault conditions are detected:

- Smart Device Configuration Changed
- Primary Variable Out of Limits
- Non-Primary Variable Out of Limits
- Primary Variable Analog Output Out of Limits
- Primary Variable Analog Output Fixed
- Cold Start
- Field Device Malfunction
- More Status Available

NEW!

Device Specific "Additional Status Byte" Alarms

Some Smart HART positioners and Multivariable HART transmitters have "Additional Status" alarms that can be accessed using "HART Command 48". This new feature allows the user to configure the HIM to alarm, for example, on "Stuck Valve" in ESD valve applications or "Valve has exceeded a stroke count limit" alerting the fact that maintenance may be due to avoid possible breakdown.

Smart HART Valve Monitoring and On-Line ESD Valve Testing

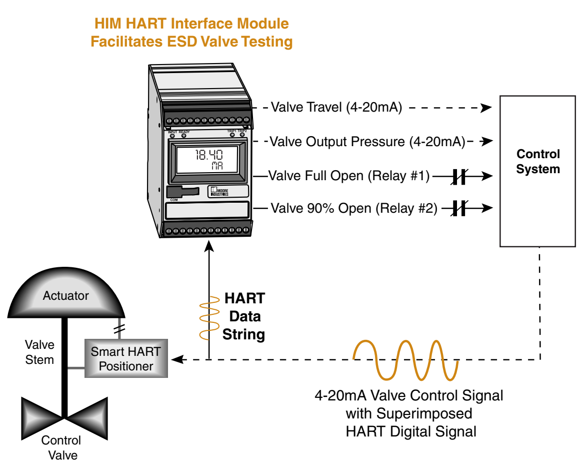
The HIM HART Loop Interface also monitors smart HART valve positioners and damper operators. Its 4-20mA analog outputs can be used to keep track of important parameters such as valve stem position, actuator pressure or temperature. Alarm (relay) outputs can also be set to alert of a smart valve condition such as valve position (open/closed), low actuator pressure, and positioner temperature (high/low).

Partial Valve Stroke Testing—For on-line testing of Emergency Shutdown valves, the HIM can be used to verify that the valve is operational without the disruption of completely closing the valve (which is the traditional way to verify ESD valve operation).

For example, use a Logic Solver (DCS or PLC) to apply a 90% (18.4mA) signal to the valve. When the valve reaches the 90% set point, the relay in the HIM will trip to verify that the valve has reached 90%. The test signal is then returned to 100% value by the Logic Solver, and the valve is reopened. A second HIM relay trip is set at 100% (full open) travel to ensure that the valve did reopen completely after the test. This procedure verifies that the valve did reach 90%, proving that the valve is not stuck. Because the valve was immediately reopened, the test has not impeded the process flow long enough to cause significant process disruption.

The HIM's analog outputs can be used to provide status information for other important valve parameters such as valve travel and valve output pressure.

Figure 2. The HIM facilitates on-line testing of Emergency Shutdown (ESD) Valves

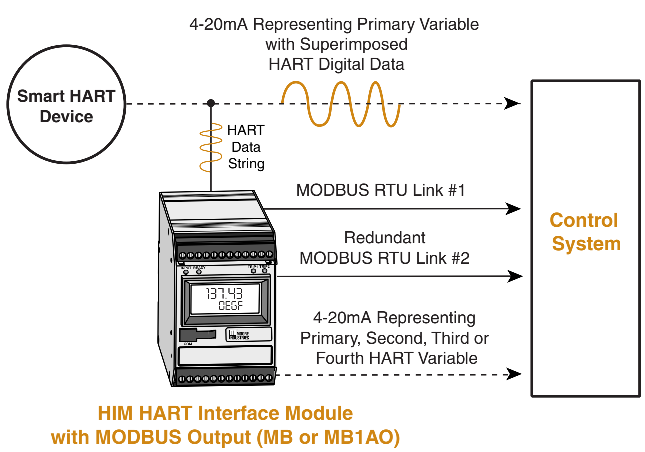


NEW! HART to MODBUS RTU Converter

With the **MB** or **MB1AO** output types, the HIM converts the HART digital signal to a MODBUS RTU output (Figure 3). This allows HART devices to interface directly with control systems using the MODBUS RTU digital communications protocol. For added security, these HIM models provide for a redundant MODBUS communications link identical to the primary MODBUS link. Communications continues uninterrupted even if one of the MODBUS links is compromised.

The HIM model with the MB1AO output also provides a 4-20mA analog output. The output can be mapped to any HART variable (primary, secondary, third or fourth) allowing an additional measurement to be continually tracked.

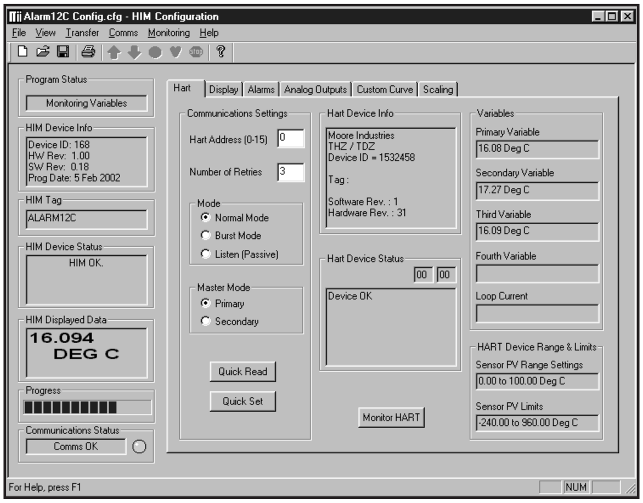
Figure 3. *The HIM converts the HART digital protocol to MODBUS RTU (with MB or MBAO1 output type)*



Operates in Analog and Digital Multidrop HART Networks

Typically, HART instruments are used in the analog mode, with a 4-20mA signal being sent by the HART instrument to or from a control system (as shown in Figure 1). In this mode, the HIM is set to monitor address "0". In a digital HART multidrop network, up to 15 HART instruments digitally communicate on the same wires. The HIM can be set to monitor any instrument (address 1-15) within the network. The HART address that the HIM monitors can be changed at any time, allowing any of the instruments in the network to be periodically monitored.

Figure 4. *In just a few minutes, you can set up the HIM using our single window Intelligent PC Configuration Software*



PC-Programmable in Minutes

All operating parameters configure quickly and easily using our Intelligent PC Configuration Software. Programmable functions include:

- **HART Parameters**—Instrument (HART) address to monitor, number of retries, Normal or Burst Mode, and Primary/Secondary Master or "Listen" Mode.
- **Analog Outputs** —Selection of measured variables; output range, output trimming, upscale or downscale on input failure.
- **Alarm Selections**—Process or fault alarms, trip points, high or low alarms, deadband, time delay, and failsafe or non-failsafe.
- **Display Parameters**—Selection of displayed variable, engineering unit readout, number of decimal points, and toggle between two measured process variables.
- **Custom Curves**—Up to 128 custom linearization points that can be applied to any one of the measured (primary, second, third or fourth) variables. The ability to plot a custom linearization curve is beneficial when non-linear input signals must be converted to linear output representations.
- **Output/Display Scaling**—Variable selection, zero and full scale values.

HelpMap Navigation System

Just click the Help icon on the toolbar of our Intelligent PC Configuration Software, and up pops HelpMap, our searchable help system. It provides quick and complete answers to performance, setup, installation, and maintenance questions, smoothly guiding you from hook-up to startup.

Programs as a Primary or Secondary Master, or in "Listen Mode"

The HIM can be configured as a HART loop's Primary or Secondary Master (in a HART master/slave system), or in passive "Listen" Mode. A HART loop can have only one Primary Master and one Secondary Master

Primary Master—The HIM is set as a Primary Master when a HART master is not present on the loop, such as when the control system is non-HART communicating. This allows a Secondary Master, such as a HART hand-held communicator, to be used on the loop along with the HIM.

Secondary Master—When a HART-based control system, such as an Asset Management System, is acting as the Primary Master, the HIM can be set to act as the Secondary Master. However, since a HART loop can have only one Primary Master and one Secondary Master, a HART hand-held communicator can not be used in this configuration.

"Listen" Mode—If the loop has a Primary and Secondary Master, the HIM can be set in "Listen" Mode. In this mode, the HIM can be added to a loop with a Primary and Secondary HART Master because it connects passively without assuming the role of a Master (Figure 5). In "Listen" Mode, the HIM continuously samples HART data from a smart instrument without affecting normal loop operation.

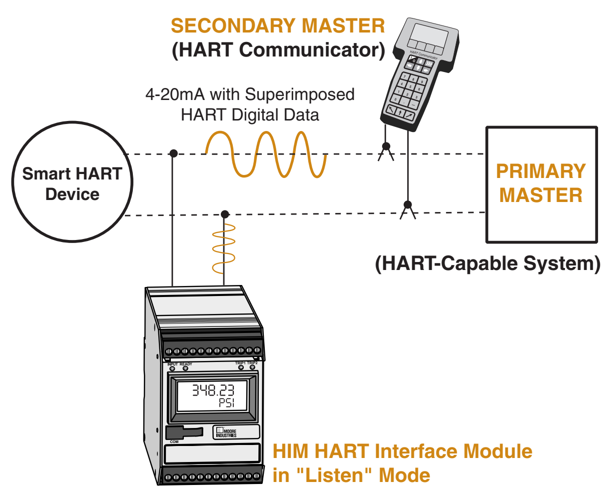
Sets to Read Normal or Burst Mode

When configured as either the loop's Primary or Secondary Master, the HIM can be set to monitor:

Normal Mode—The HIM polls the HART instrument 2 times per second requesting the current process status and the HART instrument's diagnostic status. The HART instrument responds with the requested data.

Burst Mode—In this mode, the smart HART instrument is programmed to continuously transmit its process variable and health status. The HIM samples the continuous HART data 3 times per second.

Figure 5. *In "Listen" Mode, the HIM can be used on the same loop with both a HART Primary Master and Secondary Master*



Specifications

Performance

Input Accuracy: Reflects the accuracy of the HART field device
Input Impedance: Transmit Mode: 150 ohms; Receive Mode: Less than 5 kohms
Input Over-Range Protection: ±5Vdc

ANALOG OUTPUTS
Output Accuracy: ±0.015% of maximum output span (20mA). Includes the combined effects of linearity, hysteresis, repeatability and adjustment resolution)
Output Response Time: <120msec, 10-90%
Isolation: 500Vrms channel-to-channel isolation; 1000Vrms between case, input, outputs and power terminals, and will withstand 1500Vac dielectric strength test for one minute with no breakdown
Ripple: Less than 10mV peak-to-peak when measured across a 250 ohm resistor
Output Limiting: 130% of span maximum; 125% of span typical
Output Protection: Transient protection on output
Load Capability: 0-20mA, 1100 ohms maximum
Load Effect: ±0.01% of span from 0 to maximum load resistance
Line Voltage Effect: ±0.005% of output span for a 1% change in line voltage
Input Fail Modes: PC programmable to fail high, fail low, hold last, hold last then fail high, or hold last then fail low (configurable hold time, 0-60 seconds)
Output Limits on Input Failure:
0-20mA: Fail Low to 0mA or Fail High to 23.6mA

4-20mA: Fail Low to 3.6mA or Fail High to 23.6mA

X-20mA (0<X<4): Fail Low to 90% of XmA or Fail High to 23.6mA

Performance (Continued)

ALARM OUTPUTS
Digital Response Time: Defined by HART protocol as 500msec maximum in Normal HART Mode; 333msec maximum in HART Burst Mode
Alarm Response Time: Digital Response Time + 150msec (Defined as time from the field instrument's reporting a fault until the HIM alarm is tripped)
Alarm Trip Delay: Programmable from 0-120 seconds

MODBUS OUTPUTS
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 01 by default
Baud Rate: Interface supports the following: 300, 600, 1200, 4800, 9600, 19.2k. MODBUS interface will support even, odd and no parities. Unit will assume a baud rate of 9600 and no parity by default
Character Format: One start bit, 8 data bits and one stop bit
Data Format: User-selectable Standard LSW (Least Significant Word) or Swapped MSW (Most Significant Word). Unit will assume Standard LSW by default

Power Consumption: 2-3.5W, nominal; 4.5W@24Vdc maximum for units using transmitter excitation to supply loop power a 2-wire instrument

Indicators

LCD Type: Two-line LCD; Top Row, 10mm (0.4 in) high black digits on a reflective background; Bottom Row, 6mm (0.225 in) high digits on a reflective background; two-digit HART address indicator

Indicators (Continued)

Format: Top row is five alphanumeric characters, plus sign and decimal point; bottom row is five alphanumeric characters
Decimal Points: User-selectable for 0, 1, 2 or 3 places after the decimal point or automatically adjusting with a four decimal point maximum
Range: -99999 to 99999
Minimum Display Span: 1.00
Display Update Rate: 100msec
LED Type: Dual color red/green indicate:
INPUT LED: Whether (green) or not (red) the HART input is connected and functioning properly
READY LED: Whether (green) or not (red) the HIM is initialized and operating properly
TRIP 1 and 2 LED: Shows the status of alarm off (green) or alarm on (red)

Ambient Conditions

Operating & Storage Range: -40°C to +85°C (-40°F to +185°F)
Display Range: -25°C to +85°C (-13°F to +185°F)
Relay Range: -25°C to +70°C (-13°F to +158°F)
Relative Humidity: 0-95%, non-condensing
Ambient Temperature Effect: ±0.0065% of span/°C maximum
RFI/EMI Immunity:
STANDARD: 20V/m@20-1000MHz, 1kHz AM, when tested according to IEC1000-4-3-1995
WITH -RF OPTION: 30V/m@20-1000MHz, 1kHz, when tested according to IEC1000-4-3-1995
Noise Rejection: Common Mode: 100dB@50/60Hz

Weight

567 grams (16 ounces)

Ordering Information

Unit	Input	Output	Power	Options	Housing
HIM HART Interface Module	**HART** Accepts a HART digital protocol input directly from a smart HART multivariable temperature, pressure, level, flow transmitter or from a valve positioner	**2AO** Two programmable analog output channels (see Table 2 for details) **3AO** Three programmable analog output channels (See Table 2 for details) <u>MODBUS COMMUNICATIONS</u> **MB** Two redundant MODBUS RTU (RS-485) data links **MB1AO** Two redundant MODBUS RTU (RS-485) data links with one analog output channel (see Table 2 for description of analog output)	**24DC** ±10%	**-1PRG** One user-programmable alarm output; DPDT relay, 1 form C, rated 5A@250Vac, 50/60Hz, non-inductive (see Table 2 for details). CSA Approved for use in General/Ordinary Locations only. **-2PRG** Two user-programmable alarm outputs; SPDT relay, 1 form C, rated 5A@250Vac, 50/60Hz, non-inductive (see Table 2 for details). CSA Approved for use in General/Ordinary & Hazardous 'Classified' Locations (Class I, Division 2, Groups A-D). **-FMEDA** Unit comes with Failure Modes, Effects and Diagnostic Analysis (FMEDA) data for evaluating the instrument for suitability of use in a safety-related application **-RF** Enhanced RFI/EMI protection (see "Specifications" for details)	**DIN** Universal DIN-style housing mounts on 32mm (EN50035) G-type and 35mm (EN50022) Top Hat DIN-rails

To order, specify: Unit / Input / Output / Power / Options [Housing]
Model Number Example: HIM / HART / 3AO / 24DC / -2PRG [DIN]

Table 2. *The HIM converts HART digital data to analog and relay output signals*

Channel	Order Type*	Output	Description
1	2AO Output or MB1AO Analog Output	0-20mA 4-20mA	**Convert HART Digital Data to 4-20mA Signals—**Each user-programmable channel provides an analog value proportional to any available dynamic HART variable (such as the primary, second, third or fourth variables of a multivariable transmitter or valve stem position); Outputs are fully scaleable for any range, such as 4-20mA, between 0-20mA (4mA span minimum) into 1100 ohms; Internally- or externally-powered, sink or source.
2	2AO Output	0-20mA 4-20mA	
3 (Optional)	3AO Output	0-20mA 4-20mA	
4 (Optional)	-1PRG Option	Relay	**Process and Diagnostic Fault (Relay) Alarms—**User-programmable alarm (relay) outputs are individually configurable: • **Process and Status High/Low Alarm** with user-selectable trip point(s) that respond to any available dynamic HART variable (such as the primary, second, third or fourth variables of a multivariable transmitter; open/closed valve position; low valve actuator pressure; or high valve actuator temperature) • **HART Instrument Diagnostic/Fault Alarm** that responds to one, some or all (user-selectable) of the following HART Status Bit conditions: primary variable out of limits; non-primary variable out of limits; primary variable analog output out of limits; primary variable analog output fixed; cold start; field device malfunction; and more diagnostic information available. • **HIM Self-Diagnostic/Fault Alarm** continuously monitors its own status, and initiates an alarm if it senses an abnormal condition.
5 (Optional)	-2PRG Option	Relay	

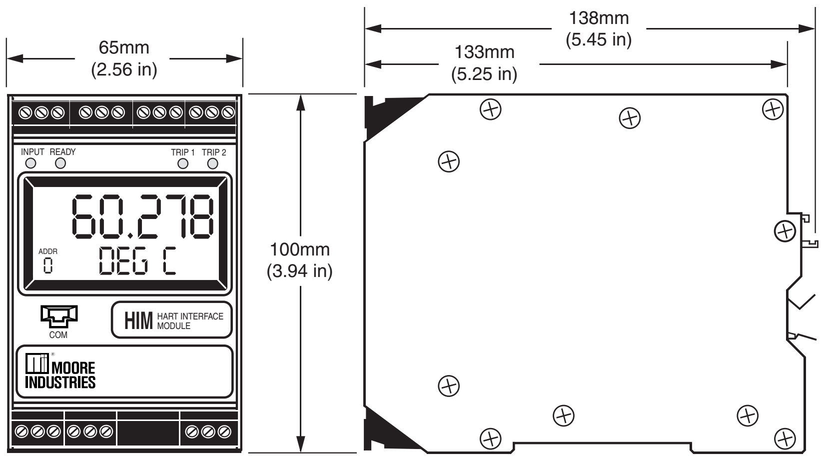
*See "Ordering Information for "Output Type" information.

Accessories

Each HIM order comes with one copy of our Intelligent PC Configuration Software (Windows® '95, '98, 2000, and NT compatible) and a configuration cable. Use the chart to the right to order additional parts.

Part Number **224-75120-01**	**HIM Intelligent PC Configuration Software** (One copy provided free with each order)
Part Number **803-053-26**	**HIM Configuration Cable** for use connecting the HIM to the PC.

Figure 6. *HIM Installation Dimensions*



Terminal Position Guide

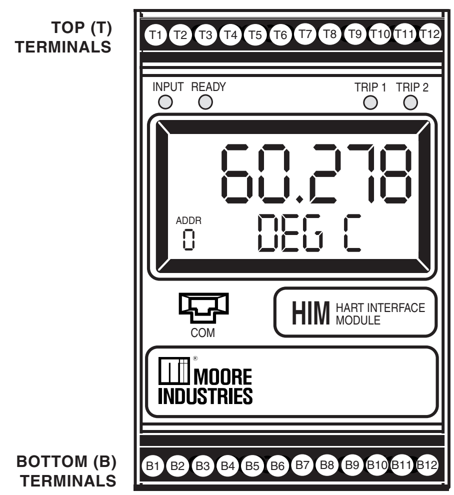


Table 3. *Terminal Designations*

INPUT / OUTPUT	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
HART Input, 2 Analog Outputs (2AO)	TX	+IN	–IN	No Label			+I Source (AO2)	–I Source or +I Sink (AO2)	–I Sink (AO2)	+I Source (AO1)	–I Source or +I Sink (AO1)	–I Sink (AO1)
HART Input, 3 Analog Outputs (3AO)	TX	+IN	–IN	+I Source (AO3)	–I Source or +I Sink (AO3)	–I Sink (AO3)	+I Source (AO2)	–I Source or +I Sink (AO2)	–I Sink (AO2)	+I Source (AO1)	–I Source or +I Sink (AO1)	–I Sink (AO1)
HART Input, 2 MODBUS Oututs and 1 Analog Output (MB1AO)	TX	+IN	-IN	+I Source (AO)	–I Source or +I Sink (AO)	–I Sink (AO)	A MODBUS 2	B MODBUS 2	S MODBUS 2	A MODBUS 1	B MODBUS 1	S MODBUS 1
HART Input, 2 MODBUS Outputs (MB)	TX	+IN	IN	No Label			A MODBUS 2	B MODBUS 2	S MODBUS 2	A MODBUS 1	B MODBUS 1	S MODBUS 1
ALARM RELAYS / POWER	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**	**B11**	**B12**
Single Alarm (–1PRG)	NO1	CM1	NC1	NO2	CM2	NC2	No Label			DC	DCC	Ground
	Relay 1											
Dual Alarm (–2PRG)	NO1	CM1	NC1	NO2	CM2	NC2				DC	DCC	Ground
	Relay 1			Relay 2								

KEY:
IN+/– = Current input into HIM from HART device
+I/–I Source = Analog Source Output
A/B = MODBUS Output
NC/NC# = Normally Closed
DC/DCC = 24VDC Connection
TX = Transmitter Excitation Current
+I/–I Sink = Analog Sink Output
NO/NO# = Normally Open
CM/CM# = Common
(AO#) = Analog Output

NOTE:
Terminal blocks can accommodate 14-22 AWG solid wiring (torque to 4 inch-pounds maximum).

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