MOORE INDUSTRIES WORLDWIDE

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HCS

HART® Concentrator System
HART-to-MODBUS RTU Converter

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Table of Contents

Introduction

This is the user's manual for the Moore Industries HCS HART® Concentrator System. It contains all of the information needed to configure, install, operate and maintain this instrument.

About this Manual

Pay particular attention wherever you see a "***Note***", "***Caution***" or "***WARNING*** ".

Note– Information that is helpful for a procedure, condition or operation of the unit.

Caution– Hazardous procedure or condition that could damage or destroy the unit.

WARNING– Hazardous procedure or condition that could injure the operator.

The HCS

The HCS HART® Concentrator System converts a HART digital signal to a serial MODBUS RTU (RS-485 or RS-232, depending on Output type ordered) communication protocol. This allows HART transmitters and valves to interface directly with MODBUS-based monitoring and control systems.

The HCS uses the following HART commands to collect its data.

Command 0	Read transmitter unique identifier
Command 3	Read all dynamic variables and current
Command 13	Read tag, descriptor, date
Command 15	Read primary variable output information
Command 48	Read additional transmitter status

The 3rd generation HCS is now compatible with HART 7 protocol by the release of new HCS software v5.2. This version of the HCS is compatible with HART 5, 6 and 7, however it does not support ALL of the new features available in HART 6 and 7. Appendix B provides more details of HART compatibility for all generations of HCS.

Model and Serial Numbers

Moore Industries uses the model and serial numbers of our instruments to track information on each unit that we sell and service. If a problem occurs with your HCS, check for a tag affixed to the unit listing these numbers. Supply the Customer Support representative with this information when calling.

Inputs

The HCS is equipped with one input channel. This handles up to 16 HART devices in multidrop mode.

In a digital multidrop HART network, up to 16 HART instruments digitally communicate on the same wires. The HCS can be set to monitor any or all instruments and/or valves within the network. Only one MODBUS address and one communication link is needed to send the process and diagnostic data from up to 16 HART devices to a MODBUS host.

The instrument is equipped with a READY LED to indicate the health of the unit and an INPUT LED to indicate status of HART communication to the attached HART devices.

Outputs

The HCS offers a standard RS-485 or RS-232 port (depending on Output type ordered) that supports the MODBUS RTU protocol.

MB232

Allows for standard MODBUS RTU protocol interface over a RS-232 port.

MB485

Allows for standard MODBUS RTU protocol interface over a RS-485 port.

TX Power Supply

A transmitter excitation power supply (regulated 23.2Vdc ±3%@24mA, maximum) is standard on the HCS. You may access it at the terminals shown in Figure 2.

* HART is a registered trademark of the HART Communication Foundation

Specifications

Performance

Input Accuracy: Reflects the accuracy of the HART field device
Input Impedance: Transmit Mode: 150 ohms; Receive Mode: Less than 5k ohms
Isolation: 1000Vrms between case, input, output and power terminals and will withstand 1500Vac dielectric strength test for one minute continuous with no breakdown
Power Supply: 9-30DC
+TX Power Supply: 23.2Vdc ±3%@24mA
Digital Response Time: Equals the combination of the HART response time and the MODBUS response time; the HART delay is defined by the HART protocol as 500msec per device in normal mode and 333msec in burst mode; the MODBUS response time depends on how fast and how often a MODBUS Master requests data from the HCS; the data request to response time is 50msec
Output Type: Standard MODBUS RTU protocol interface over RS-485 (parameters as specified in U.S. Standard EIA-RS485) or RS-232 (parameters as specified in U.S. Standard EIA-RS232)
Output Protection: Transient protection on output

Performance (Continued)

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. MODBUS interface will support even, odd and no parities. Unit will assume a baud rate of 9600 and no parity by default
Transmission Range (MB485): Using 24AWG twisted pair wiring, maximum of 2 mi. (3.2km)@ 4800 baud or less; maximum of 1 mi. (1.6km)@9600 baud; maximum of 0.5 mi. (0.8km) @19200 baud
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: 1.5W, nominal; 2W@24Vdc maximum for units using transmitter excitation to supply loop power to a 2-wire instrument

Indicators

LED Type: Dual color red/green indicate:
INPUT LED: Input is present and normal (green); input signal is not found (red). Flashing (red/green) bad communications with one or more slaves
READY LED: Instrument is ready for operation and configuration (green); instrument has encountered an internal problem (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 (Standard): 10V/m@80-1000MHz, 1kHz AM, when tested according to IEC61326
RFI/EMI Immunity (with -RF Option): 20V/m@80-1000MHz, 1kHz, when tested according to IEC61326
Noise Rejection: Common Mode: 100dB@50/60Hz

Weight

290 g (10.2 oz)

Specifications and information subject to change without notice.

***Figure 1.** HCS Dimensions*

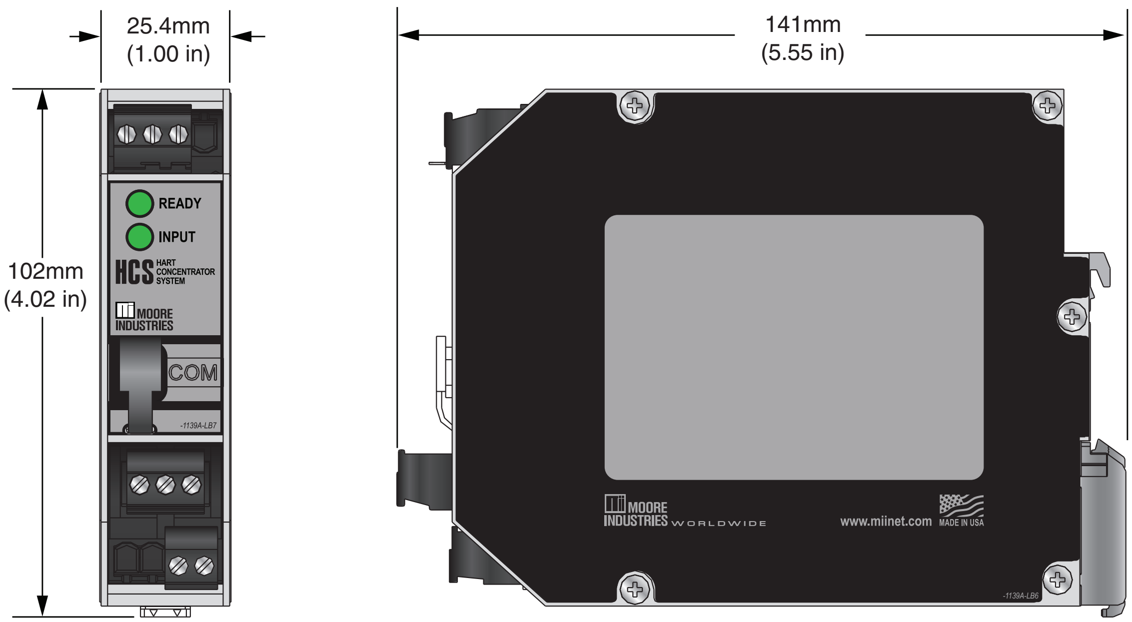
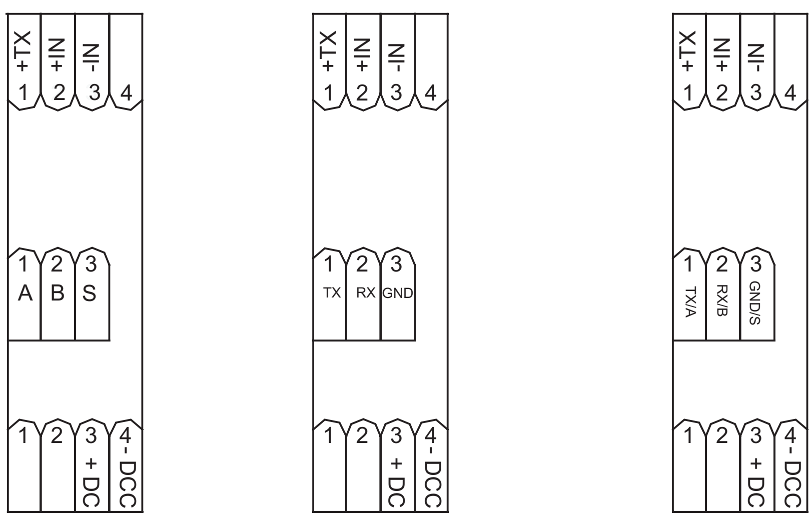


***Table 1.** Terminal Designations*



RS485 RS232 MB PRG

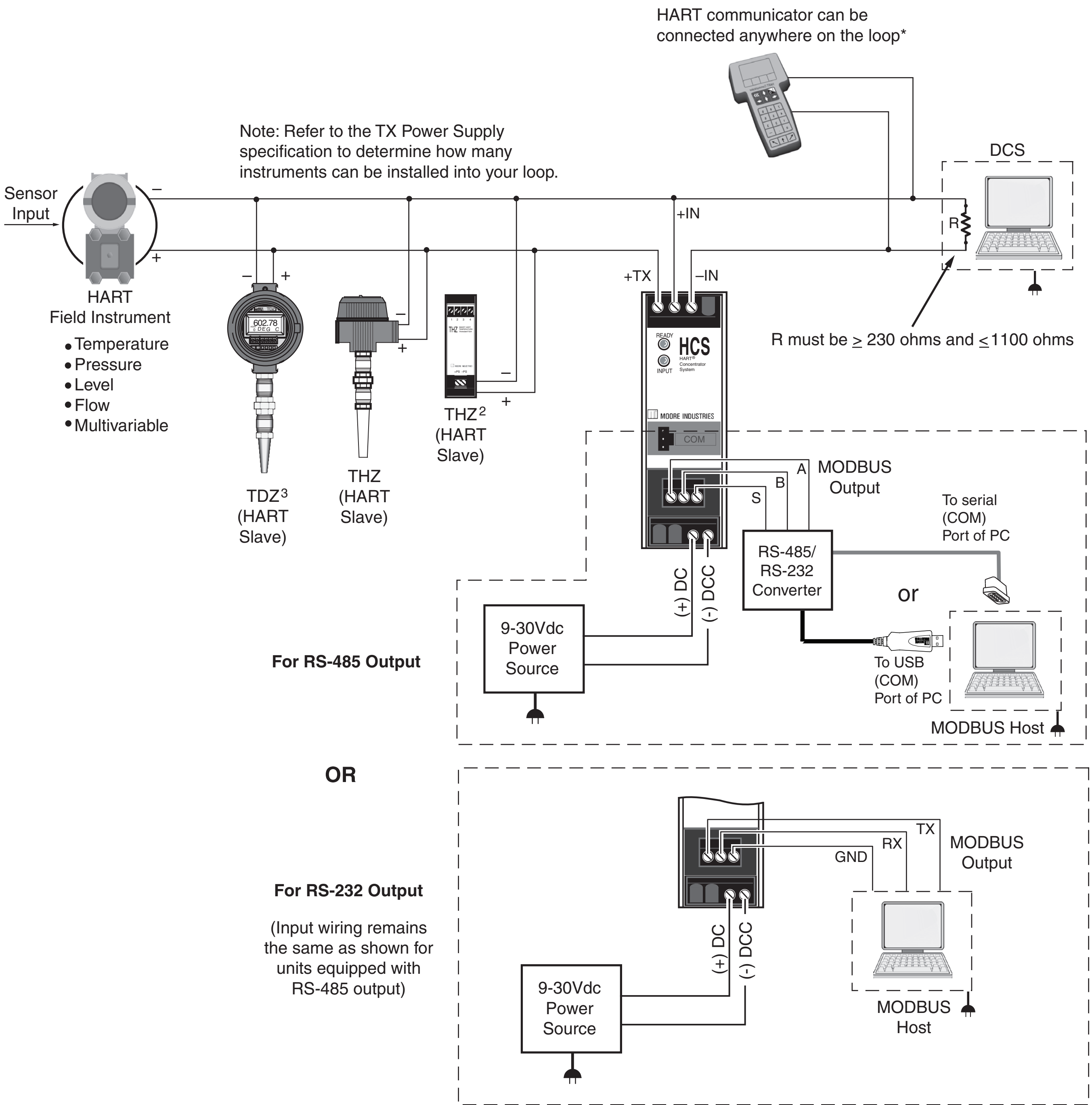
KEY:

+TX = Power for 2-Wire transmitter
+IN = Positive input
–IN = Negative input

A = A MODBUS
B = B MODBUS
S = S MODBUS
(+) DC = Positive power input
(-) DCC = Negative power input

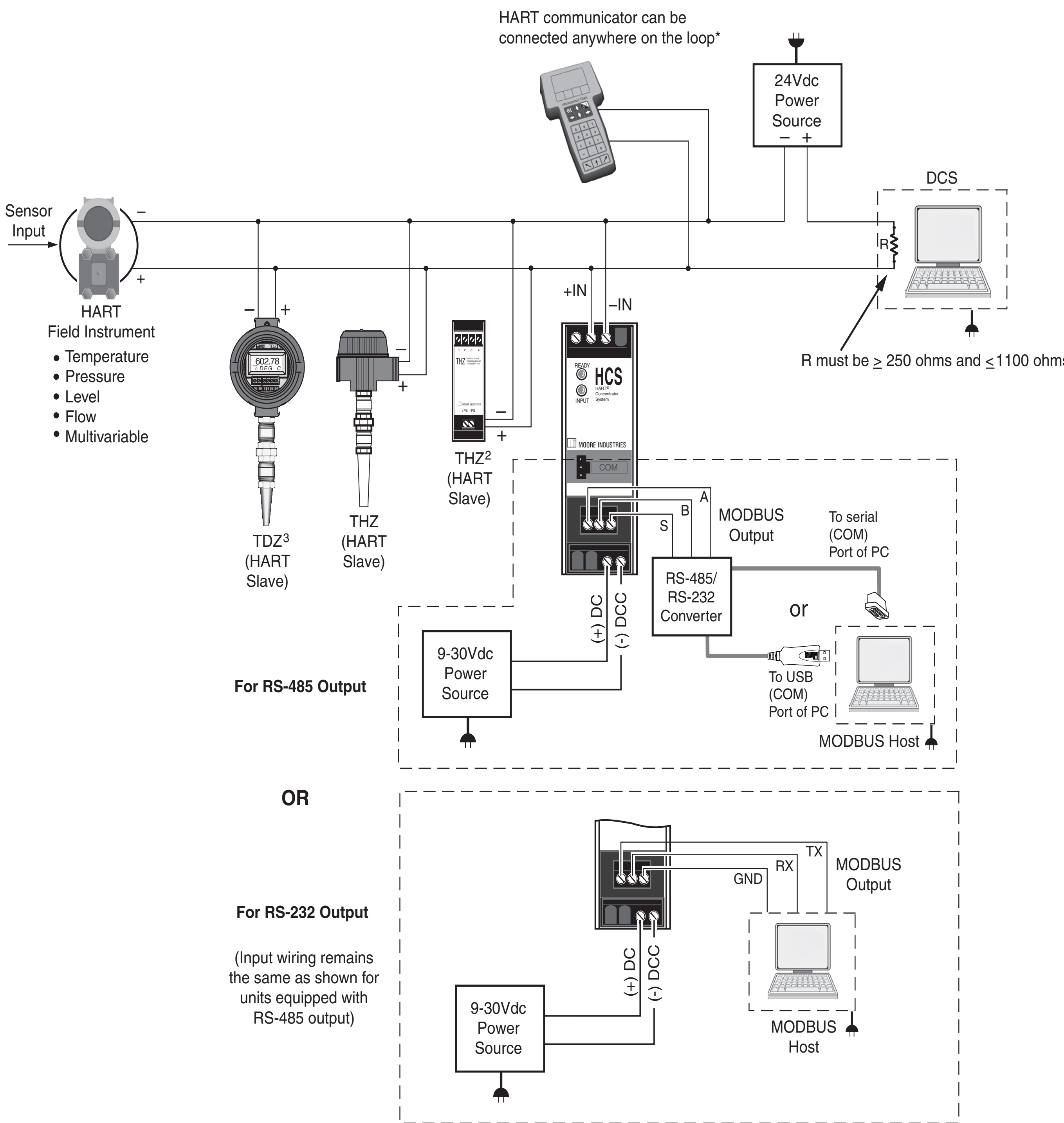
NOTE:
1. Terminal blocks can accommodate 14-22 AWG solid wiring.
2. Tighten terminals to four inch-pounds (maximum).

Figure 2. *Installing the HCS Into the Loop Using the TX Power Supply to Power a Transmitter*



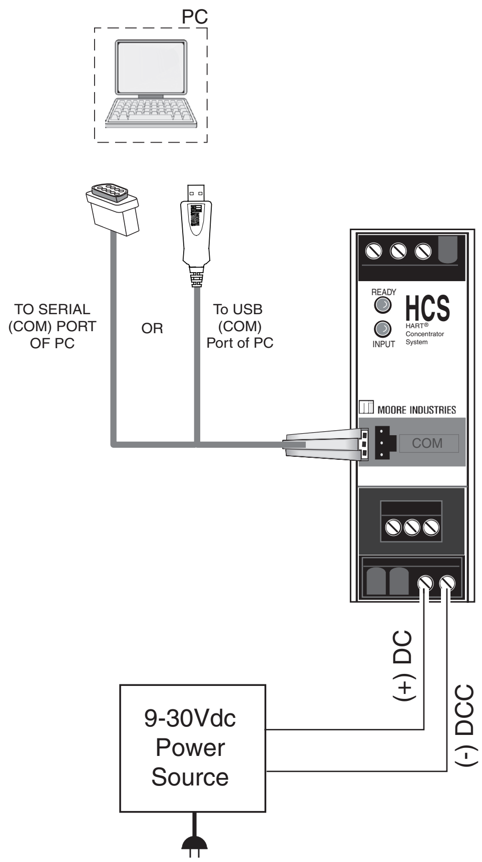
* HCS units shipped since April 2014 provide test points on the +IN & -IN terminals for connecting a HART communicator

***Figure 3.** Installing the HCS Into the Loop Using an External Power Source to Power a Transmitter*



* HCS units shipped since April 2014 provide test points on the +IN & -IN terminals for connecting a HART communicator

Figure 4. *HCS Configuration Port Connection*



Default Factory Configuration for HCS

The following are the factory default configuration settings for your HCS unit:

HART Settings-

Polled HART Slave Devices: 1
HCS is a Primary Master
No of HART retries: 1

MODBUS Settings-

Address: 1
Baud Rate:..9600
MODBUS Parity:......................................None
MODBUS Float Format:............Standard LSW
MODBUS Register Layout:.....By Variable Type
MOBUS Failed HART Mode:.............Hold Last
Decimal Places:...0

Configuring the HCS

One of the benefits of the HCS is that there are no internal or external controls to adjust or settings to change. All operating parameters are set using the PC Configuration software.

Once these software settings are made, they are downloaded to the instrument in the form of a Configuration File and stored in the unit's nonvolatile memory. You can choose to save a backup copy of the file on your PC hard drive or external media. The HCS communicates with the PC through a proprietary communications cable to the PC's serial (COM) port or optional proprietary USB cable to the PC's USB port.

Installing the Configuration Software

Refer to Table 2 for the equipment needed.

1. Insert the *Moore Industries Interface Solution PC Configuration Software* CD into the CD drive of the PC. Access the CD and open the "HCS PC Configuration Software" folder.
2. Double-click the installation program located in the folder. Follow the prompts to correctly install the program.

Connecting the HCS to the PC

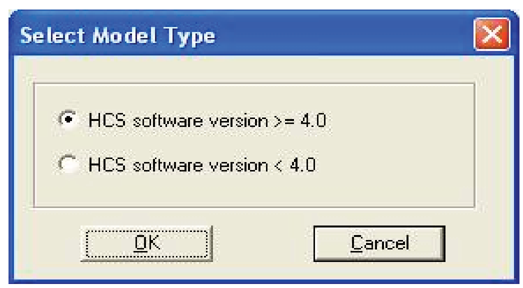
HCS can be connect to PC one of two ways:

- using the proprietary communications cable to connect to PC's serial (COM) port
- using the optional proprietary USB cable to connect to PC's USB port

See Table 2 for information on the necessary equipment.

Selecting Model Type

User must select the HCS type if the software is opened without an HCS being connected to the PC's COM port. When the HCS is connected, the software will automatically select the correct HCS type.



Note:

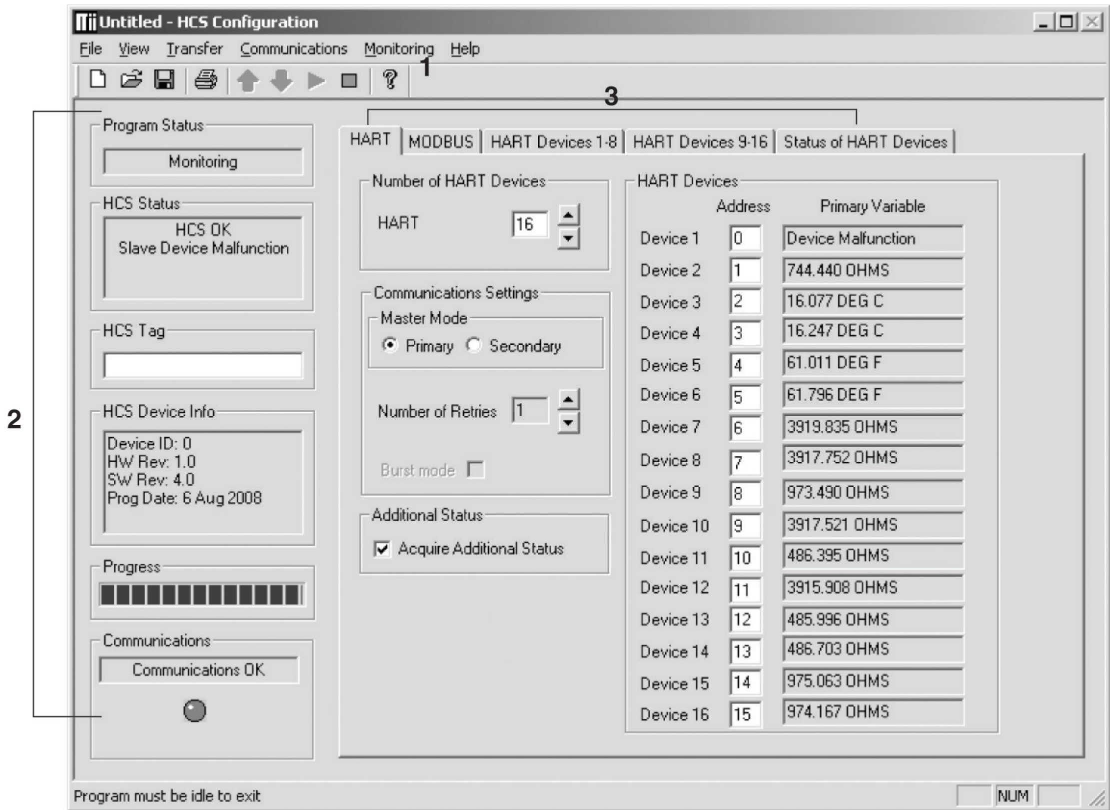
The following information applies only to units with software version 4.0 and greater, if you need information pertaining to units with a software less than 4.0 see Appendix A located at the end of this manual

Table 2. *Necessary Equipment Table*

Device	Specifications
Power Supply	9-30DC, ±10%
Personal Computer	Microsoft Windows based PC; 16Mb free RAM; 20MB free disk space on hard drive Microsoft Windows XP, 7, or 10 1 (one) serial port or one available USB port
Moore Industries PC Configuration Software	Version 1.0 or higher, successfully installed onto the hard drive
Communication Cable options	Serial Communications Cable (PN 803-053-26), Fuse Protected USB Cable (PN 804-030-26)

PC Configuration Software Summary

Figure 5. *HCS PC Configuration Software Screen*



The HCS PC Configuration Software can be used to program all of the instrument's parameters. Once the default configuration has been saved, it is safe to program other parameters.

The PC Software is composed of these sections:

1. Menu Bar/Tool Bar–Dropdown menus and corresponding icons allow you to perform various functions throughout the PC Configuration Program. *Refer to the Menu and Tool Bar Legend* section for a complete description.

2. Program Status–This portion of the program displays the activity (idle, monitoring, downloading, uploading) of the connected unit.

HCS Status–Notifies of any errors or conditions which are outside of the tolerance range. Displays *HCS OK* if the unit is operating normally.

HCS Tag–A phrase used to identify an HCS (eight alphanumeric characters, maximum).

HCS Device Info–Displays the individual characteristics of the attached HCS, such as the device ID (serial number), hardware and software revisions and the last date that the device was programmed.

Progress–This bar stays in motion any time the HCS is monitoring, uploading or downloading, to notify that a process is occurring.

Communications–Indicates current PC connection/communications status.

3. HART/MODBUS/HART Devices/Status of HART Devices Tabs–These tabs change the right side of the screen to allow you to set the appropriate part of the HCS's configuration. See corresponding sections of this manual for additional information on these tabs.

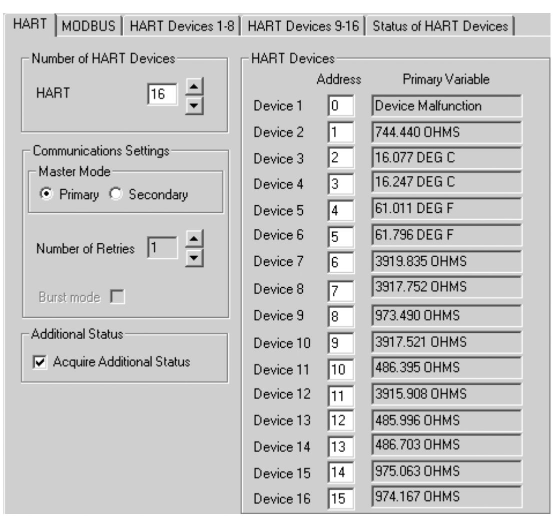
Menu and Tool Bar Legend

File	Allows such functions as New, Open, Save and Print
View	Controls whether Tool and Status Bars are viewed on the screen
Transfer	Allows you to Upload and Download configurations
Coms	Select the PC Port (Com Port) that you will use
Monitoring	Allows you to Monitor and Stop monitoring processes
Help	Displays the version of the HCS Configuration Program

Configuration Screens

HART

Figure 6. *HART Tab*



Number of HART Devices
Using the up and down arrows, or by manually entering the value from your keyboard, select the number of HART devices (16 maximum) that you will introduce into your loop. The number you have chosen will appear as enabled in the *Slave Devices* parameter.

Slave Devices
Once you have selected the number of HART slaves to be used in the loop, use this section to assign a specific address for each. Ensure that the address matches the address of the device you connected in the loop. Each must be a unique address between zero and 63. However, Address 0 is an analog address. Current readings at this address can vary from 3.6mA to 23.6mA.

Master Mode
The HART protocol allows for two communications masters on the loop: a Primary Master and a Secondary Master. Setting the HCS to function as the Primary HART Master in the application means that any other HART device in the loop must be configured either as a HART Secondary Master (1 per loop), or as a HART Slave (up to 16 per loop). Conversely, setting the HCS to function as the Secondary HART Master allows other HART devices to function either as a Primary Master, or as Slaves. Configuring more than one device on a single loop as a Primary or Secondary HART Master will cause a communications failure.

Note: *A HART hand-held communicator is typically a Secondary Master.*

Number of Retries
The *Number of Retries* can be set between 1 and 3, and will determine how many times the HCS will attempt to poll the HART transmitter (without success), before it indicates a HART communication failure.

Burst Mode

Allows selection of Normal or Burst modes.

Burst mode can only be used with a single HART device (slave).

The HCS can operate in one of two modes: *Normal* or *Burst*. In each of these modes the HCS attempts to find a HART transmitter. If the designated slave (or slaves) is found, the HCS will also read the device's Tag.

For software version 5.4 and greater, the PV Upper and Lower Range Values are also read. The device tag and range values are only read during HART initialization.

In *Normal* mode, the HCS polls the HART loop for a transmitter, then polls the HART instrument twice per second, requesting the current process status and the HART instrument's diagnostic status. The HART instrument responds with the requested data.

In *Burst* mode, the monitored HART instrument continuously transmits its process variable and health status. The HCS samples the continuous HART data three times per second.

The instrument will operate in Normal Mode by default. Selecting the *Burst Mode* button will enable Burst Mode reception in the HCS. An error is declared if no burst messages are received by the HCS.

HCS Units with software version 4 or earlier will send commands to the slave, configuring and enabling burst mode.

HCS Units with software version 5 or later do not send commands to configure the slave. The slave must be configured (using a handheld configurator, or by other means) to have burst mode enabled, and to burst either HART command 1 or 3. If the HCS is able to communicate with the slave but does not receive burst messages, the Input LED will alternate red and green.

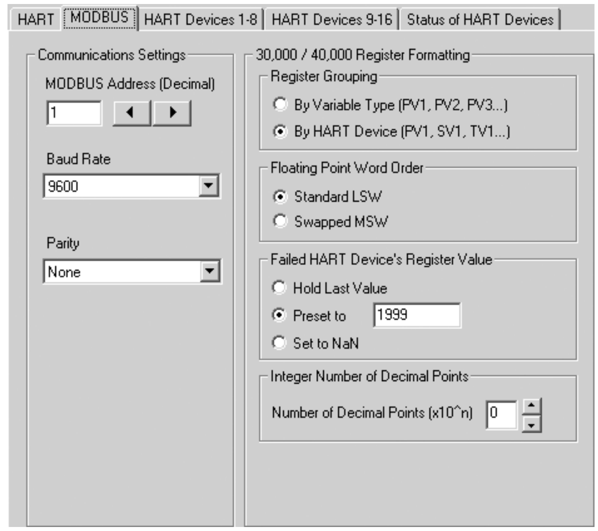
Additional Status
Checking the *Acquire Additional Status* box will allow *Additional Status* information to be displayed on the *Status of HART Devices* screen and also in the corresponding MODBUS register (refer to Tables 3 and 4). If the box remains unchecked, Additional Status information will be unavailable.

For software version 5.0 and greater, all 25 additional status bytes (0 to 24) are displayed and available in Modbus registers 1000-1024 (see Tables 3.1 and 4.1)

If this information is not needed, it is good practice to keep the box unchecked in order to keep polling of the additional status bytes from occurring. This will help maintain faster response times.

MODBUS

Figure 7. *MODBUS Tab*



The *MODBUS tab* allows you to set the MODBUS communications parameters.

Communications Settings
The Communications Settings include three areas:

MODBUS Address (Decimal)
The *MODBUS Address* is the number that the HCS monitor uses to identify itself on the MODBUS network. The MODBUS address is configurable from 1 to 247. By default, it will assume a MODBUS address of 1.

Baud Rate
The *Baud Rate* is the speed of MODBUS data transmission. It should be set to match the baud rate of the attached controller. The interface supports the following baud rates: 300, 600, 1200, 2400, 4800, 9600 and 19200.

Parity
The HART monitor supports even, odd and no *Parity.* The data format is one start bit, 8 data bits and one stop bit.

30,000 / 40,000 Register Formatting
This section includes the following areas:

Register Grouping
This allows you to select the manner in which to group the MODBUS registers.

Selecting *By Variable Type,* the registers are grouped in order of *variables*, i.e. all primary variables (PV) are grouped together, followed by secondary variables (SV), third (TV) and then fourth (FV).

Using *By HART Slave Device* grouping places your registers in order *numerically*. It groups a HART slave device's variables in contiguous registers. For example, your first HART device's primary, secondary, third and fourth variables (PV1, SV1, TV1 and FV1) are grouped together. Next in the order are your second HART device's primary, secondary, third and fourth variables (PV2, SV2, TV2 and FV2) and so on.

Floating Point Word Order
By default, the HART Concentrator will use the *Standard LSW* (least significant word) floating point word order format. This stores the most significant bits in the second register and the least significant bits in the first register. Selecting *Swapped MSW (most significant word)* will reverse the order, storing the most significant bits in the first register and the least significant bits in the second register.

Failed HART Device's Register Value
You may select what would occur to a HART device's register value in the event that communication is lost with the HCS.

If selecting *Hold Last Value* and a failure is detected, the last measured value before the failure occurred is held.

Entering a user-set value in the *Preset to* text box recalls that value when a slave device failure is detected.

Selecting *NaN* (Not a Number–as put forth by the IEEE-754 standard) causes the floating point NaN value to be stored in the registers used for holding floating point values.

Integer Number of Decimal Points
The MODBUS integer registers are 16 bit signed integers and have a range of -32767 to 32768.

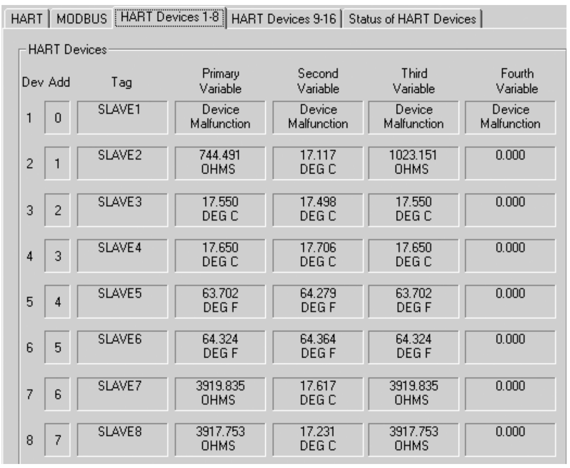
To obtain better resolution, the "Integer Number of Decimal Points" setting may be used. This can be set from 0-3, and will multiply the PV by 10^n where n is the number of decimal points. Care should be taken in selecting the resolution since the higher the resolution, the smaller the PV range which can be represented ie. for n=3 the maximum range is -32.767 to +32.768. Depending on the nature of the data obtained from the slave and the required resolution, this may be unacceptable and in this case, floating point registers should be used.

The table below shows the PV range for the selected number of decimal points and a PV example.

Number of Decimals	Allowed PV Range	Displayed Integer
0	-32767 to 32768	12
1	-3276.7 to 3276.8	123
2	-327.67 to 327.68	1234
3	-32.767 to 32.768	12345
Example PV = 12.345		

HART Devices

Figure 8. *HART Devices Tabs*



This following applies to both HART Device tabs (1-8 and 9-16).

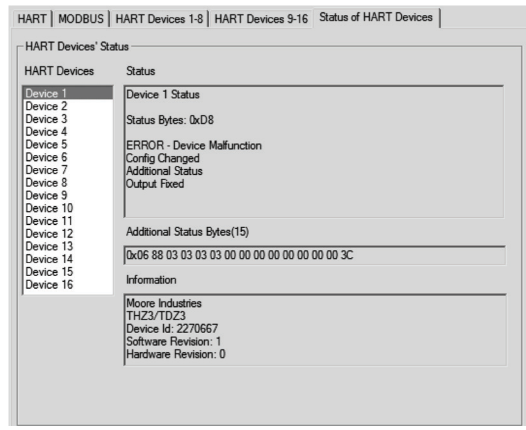
These are read-only screens that display the device number and its associated address, tag and the Primary, Second, Third and Fourth variables.

Note:
This displays the 8 character Tag and not the 32 character Long Tag.

When the HCS is in *Monitor* mode, all four variables constantly update. However, the *Tag* only updates once power is reapplied (upon a loss of power) or when communication with the HART device has been re-established.

Status of HART Devices

Figure 9. *Status of HART Devices Tab*



This screen displays Status the Additional Status and Information regarding the selected device. Use the *HART Devices* selection box to choose which device to view.

For software version 4.0 and less only the first six bytes (0-5) of additional status are available. For software version 5.0 and greater, up to 25 additional status bytes (0-24) are displayed and available in Modbus registers 1000-1024 (see Tables 3.1 and 4.1). The display will only show the additional status bytes sent by the slave (from 0 to 25).

MODBUS Register Definitions

Tables 3-6 define the MODBUS input and holding register assignment. These tables are zero based, your MODBUS host may require you to enter the MODBUS register. Often registers have an offset of "1" from the MODBUS address. For example, a MODBUS register listed below of 256 may have to be entered as address 257 in your host. Please refer to your MODBUS host documentation for verification.

Note: *The following information applies only to units with software version 4.0 and greater, if you need information pertaining to units with a software less than 4.0 see Appendix A located at the end of this manual.*

Table 3. *Register ranges and descriptions when MODBUS registers are grouped by the "By Variable Type" parameter (MODBUS register block mode = 0) and all dynamic variables are being stored*

Register Range	Description
0-15	HART Device 1-16 PV integer value x 10^no of DPs
16-31	HART Device 1-16 SV integer value x 10^no of DPs
32-47	HART Device 1-16 TV integer value x 10^no of DPs
48-63	HART Device 1-16 FV integer value x 10^no of DPs
64-79	HART Device 1-16 HART Field Device Status (see Table 6)
80-95	HART Device 1-16 PV + SV UOM (PV UOM = MSB, SV UOM = LSB)
96-111	HART Device 1-16 TV + FV UOM (TV UOM = MSB, FV UOM = LSB)
127	HCS Status (see Table 5)
256-287	HART Device 1-16 PV floating point value stored in 2x16-bit registers per float
288-319	HART Device 1-16 SV floating point value stored in 2x16-bit registers per float
320-351	HART Device 1-16 TV floating point value stored in 2x16-bit registers per float
352-383	HART Device 1-16 FV floating point value stored in 2x16-bit registers per float
512-517	HART Device 1 additional status byte 0 to byte 5
518-523	HART Device 2 additional status byte 0 to byte 5
524-529	HART Device 3 additional status byte 0 to byte 5
530-535	HART Device 4 additional status byte 0 to byte 5
536-541	HART Device 5 additional status byte 0 to byte 5
542-547	HART Device 6 additional status byte 0 to byte 5
548-553	HART Device 7 additional status byte 0 to byte 5
554-559	HART Device 8 additional status byte 0 to byte 5
560-565	HART Device 9 additional status byte 0 to byte 5
566-571	HART Device 10 additional status byte 0 to byte 5
572-577	HART Device 11 additional status byte 0 to byte 5
578-583	HART Device 12 additional status byte 0 to byte 5
584-589	HART Device 13 additional status byte 0 to byte 5
590-595	HART Device 14 additional status byte 0 to byte 5
596-601	HART Device 15 additional status byte 0 to byte 5
602-607	HART Device 16 additional status byte 0 to byte 5

KEY:
FV = Fourth Variable
LSB = Least Significant Bit
MSB = Most Significant Bit
PV = Primary Variable
SV = Secondary Variable
TV = Third Variable
*UOM = Unit of Measurement

*Moore Industries provides up to 169 HART Engineering Units listed in HART Communication Foundation document number: HCF-SPEC-183, Revision 14.0, Release Date 29 January 2004

Table 3.1. *Additional status byte 0 to byte 24 (for software version 5.0 and greater).*

Register Range	Description
1000-1024	HART Device 1 additional status byte 0 to byte 24
1025-1049	HART Device 2 additional status byte 0 to byte 24
1050-1074	HART Device 3 additional status byte 0 to byte 24
1075-1099	HART Device 4 additional status byte 0 to byte 24
1100-1124	HART Device 5 additional status byte 0 to byte 24
1125-1149	HART Device 6 additional status byte 0 to byte 24
1150-1174	HART Device 7 additional status byte 0 to byte 24
1175-1199	HART Device 8 additional status byte 0 to byte 24
1200-1224	HART Device 9 additional status byte 0 to byte 24
1225-1249	HART Device 10 additional status byte 0 to byte 24
1250-1274	HART Device 11 additional status byte 0 to byte 24
1275-1299	HART Device 12 additional status byte 0 to byte 24
1300-1324	HART Device 13 additional status byte 0 to byte 24
1325-1349	HART Device 14 additional status byte 0 to byte 24
1350-1374	HART Device 15 additional status byte 0 to byte 24
1375-1399	HART Device 16 additional status byte 0 to byte 24

Table 4. *Register ranges and descriptions when MODBUS registers are grouped by the "By HART Slave Device" parameter (MODBUS register block mode = 0) and PV, SV, TV and FV are being stored*

Register Range	Description
0	HART Device 1 PV integer value x 10^no of DPs
1	HART Device 1 SV integer value x 10^no of DPs
2	HART Device 1 TV integer value x 10^no of DPs
3	HART Device 1 FV integer value x 10^no of DPs
4	HART Device 1 HART Status Field Device (see Table 6)
5	HART Device 1 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
6	HART Device 1 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
7	Not assigned
8	HART Device 2 PV integer value x 10^no of DPs
9	HART Device 2 SV integer value x 10^no of DPs
10	HART Device 2 TV integer value x 10^no of DPs
11	HART Device 2 FV integer value x 10^no of DPs
12	HART Device 2 HART Status (see Table 6)
13	HART Device 2 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
14	HART Device 2 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
15	Not assigned
16	HART Device 3 PV integer value x 10^no of DPs
17	HART Device 3 SV integer value x 10^no of DPs
18	HART Device 3 TV integer value x 10^no of DPs
19	HART Device 3 FV integer value x 10^no of DPs
20	HART Device 3 HART Status (see Table 6)
21	HART Device 3 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
22	HART Device 3 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
23	Not assigned
24	HART Device 4 PV integer value x 10^no of DPs
25	HART Device 4 SV integer value x 10^no of DPs
26	HART Device 4 TV integer value x 10^no of DPs
27	HART Device 4 FV integer value x 10^no of DPs
28	HART Device 4 HART Status (see Table 6)
29	HART Device 4 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
30	HART Device 4 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
31	Not assigned
32	HART Device 5 PV integer value x 10^no of DPs
33	HART Device 5 SV integer value x 10^no of DPs
34	HART Device 5 TV integer value x 10^no of DPs
35	HART Device 5 FV integer value x 10^no of DPs
36	HART Device 5 HART Status (see Table 6)
37	HART Device 5 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)

Continued on next page

Table 4. Continued

Register Range	Description
38	HART Device 5 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
39	Not assigned
40	HART Device 6 PV integer value x 10^no of DPs
41	HART Device 6 SV integer value x 10^no of DPs
42	HART Device 6 TV integer value x 10^no of DPs
43	HART Device 6 FV integer value x 10^no of DPs
44	HART Device 6 HART Status (see Table 6)
45	HART Device 6 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
46	HART Device 6 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
47	Not assigned
48	HART Device 7 PV integer value x 10^no of DPs
49	HART Device 7 SV integer value x 10^no of DPs
50	HART Device 7 TV integer value x 10^no of DPs
51	HART Device 7 FV integer value x 10^no of DPs
52	HART Device 7 HART Status (see Table 6)
53	HART Device 7 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
54	HART Device 7 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
55	Not assigned
56	HART Device 8 PV integer value x 10^no of DPs
57	HART Device 8 SV integer value x 10^no of DPs
58	HART Device 8 TV integer value x 10^no of DPs
59	HART Device 8 FV integer value x 10^no of DPs
60	HART Device 8 HART Status (see Table 6)
61	HART Device 8 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
62	HART Device 8 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
63	Not assigned
64	HART Device 9 PV integer value x 10^no of DPs
65	HART Device 9 SV integer value x 10^no of DPs
66	HART Device 9 TV integer value x 10^no of DPs
67	HART Device 9 FV integer value x 10^no of DPs
68	HART Device 9 HART Status (see Table 6)
69	HART Device 9 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
70	HART Device 9 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
71	Not assigned
72	HART Device 10 PV integer value x 10^no of DPs
73	HART Device 10 SV integer value x 10^no of DPs
74	HART Device 10 TV integer value x 10^no of DPs
75	HART Device 10 FV integer value x 10^no of DPs

Continued on next page

Table 4. *Continued*

Register Range	Description
76	HART Device 10 HART Status (see Table 6)
77	HART Device 10 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
78	HART Device 10 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
79	Not assigned
80	HART Device 11 PV integer value x 10^no of DPs
81	HART Device 11 SV integer value x 10^no of DPs
82	HART Device 11 TV integer value x 10^no of DPs
83	HART Device 11 FV integer value x 10^no of DPs
84	HART Device 11 HART Status (see Table 6)
85	HART Device 11 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
86	HART Device 11 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
87	Not assigned
88	HART Device 12 PV integer value x 10^no of DPs
89	HART Device 12 SV integer value x 10^no of DPs
90	HART Device 12 TV integer value x 10^no of DPs
91	HART Device 12 FV integer value x 10^no of DPs
92	HART Device 12 HART Status (see Table 6)
93	HART Device 12 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
94	HART Device 12 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
95	Not assigned
96	HART Device 13 PV integer value x 10^no of DPs
97	HART Device 13 SV integer value x 10^no of DPs
98	HART Device 13 TV integer value x 10^no of DPs
99	HART Device 13 FV integer value x 10^no of DPs
100	HART Device 13 HART Status (see Table 6)
101	HART Device 13 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
102	HART Device 13 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
103	Not assigned
104	HART Device 14 PV integer value x 10^no of DPs
105	HART Device 14 SV integer value x 10^no of DPs
106	HART Device 14 TV integer value x 10^no of DPs
107	HART Device 14 FV integer value x 10^no of DPs
108	HART Device 14 HART Status (see Table 6)
109	HART Device 14 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
110	HART Device 14 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
111	Not assigned
112	HART Device 15 PV integer value x 10^no of DPs
113	HART Device 15 SV integer value x 10^no of DPs

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Table 4. *Continued*

Register Range	Description
114	HART Device 15 TV integer value x 10^no of DPs
115	HART Device 15 FV integer value x 10^no of DPs
116	HART Device 15 HART Status (see Table 6)
117	HART Device 15 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
118	HART Device 15 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
119	Not assigned
120	HART Device 16 PV integer value x 10^no of DPs
121	HART Device 16 SV integer value x 10^no of DPs
122	HART Device 16 TV integer value x 10^no of DPs
123	HART Device 16 FV integer value x 10^no of DPs
124	HART Device 16 HART Status (see Table 6)
125	HART Device 16 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
126	HART Device 16 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
127	HCS Status (See Table 5)
256-257	HART Device 1 PV floating point value stored in 2x16-bit register per float
258-259	HART Device 1 SV floating point value stored in 2x16-bit register per float
260-261	HART Device 1 TV floating point value stored in 2x16-bit register per float
262-263	HART Device 1 FV floating point value stored in 2x16-bit register per float
264-265	HART Device 2 PV floating point value stored in 2x16-bit register per float
266-267	HART Device 2 SV floating point value stored in 2x16-bit register per float
268-269	HART Device 2 TV floating point value stored in 2x16-bit register per float
270-271	HART Device 2 FV floating point value stored in 2x16-bit register per float
272-273	HART Device 3 PV floating point value stored in 2x16-bit register per float
274-275	HART Device 3 SV floating point value stored in 2x16-bit register per float
276-277	HART Device 3 TV floating point value stored in 2x16-bit register per float
278-279	HART Device 3 FV floating point value stored in 2x16-bit register per float
280-281	HART Device 4 PV floating point value stored in 2x16-bit register per float
282-283	HART Device 4 SV floating point value stored in 2x16-bit register per float
284-285	HART Device 4 TV floating point value stored in 2x16-bit register per float
286-287	HART Device 4 FV floating point value stored in 2x16-bit register per float
288-289	HART Device 5 PV floating point value stored in 2x16-bit register per float
290-291	HART Device 5 SV floating point value stored in 2x16-bit register per float
292-293	HART Device 5 TV floating point value stored in 2x16-bit register per float
294-295	HART Device 5 FV floating point value stored in 2x16-bit register per float
296-297	HART Device 6 PV floating point value stored in 2x16-bit register per float
298-299	HART Device 6 SV floating point value stored in 2x16-bit register per float
300-301	HART Device 6 TV floating point value stored in 2x16-bit register per float
302-303	HART Device 6 FV floating point value stored in 2x16-bit register per float

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Table 4. *Continued*

Register Range	Description
304-305	HART Device 7 PV floating point value stored in 2x16-bit register per float
306-307	HART Device 7 SV floating point value stored in 2x16-bit register per float
308-309	HART Device 7 TV floating point value stored in 2x16-bit register per float
310-311	HART Device 7 FV floating point value stored in 2x16-bit register per float
312-313	HART Device 8 PV floating point value stored in 2x16-bit register per float
314-315	HART Device 8 SV floating point value stored in 2x16-bit register per float
316-317	HART Device 8 TV floating point value stored in 2x16-bit register per float
318-319	HART Device 8 FV floating point value stored in 2x16-bit register per float
320-321	HART Device 9 PV floating point value stored in 2x16-bit register per float
322-323	HART Device 9 SV floating point value stored in 2x16-bit register per float
324-325	HART Device 9 TV floating point value stored in 2x16-bit register per float
326-327	HART Device 9 FV floating point value stored in 2x16-bit register per float
328-329	HART Device 10 PV floating point value stored in 2x16-bit register per float
330-331	HART Device 10 SV floating point value stored in 2x16-bit register per float
332-333	HART Device 10 TV floating point value stored in 2x16-bit register per float
334-335	HART Device 10 FV floating point value stored in 2x16-bit register per float
336-337	HART Device 11 PV floating point value stored in 2x16-bit register per float
338-339	HART Device 11 SV floating point value stored in 2x16-bit register per float
340-341	HART Device 11 TV floating point value stored in 2x16-bit register per float
342-343	HART Device 11 FV floating point value stored in 2x16-bit register per float
344-345	HART Device 12 PV floating point value stored in 2x16-bit register per float
346-347	HART Device 12 SV floating point value stored in 2x16-bit register per float
348-349	HART Device 12 TV floating point value stored in 2x16-bit register per float
350-351	HART Device 12 FV floating point value stored in 2x16-bit register per float
352-353	HART Device 13 PV floating point value stored in 2x16-bit register per float
354-355	HART Device 13 SV floating point value stored in 2x16-bit register per float
356-357	HART Device 13 TV floating point value stored in 2x16-bit register per float
358-359	HART Device 13 FV floating point value stored in 2x16-bit register per float
360-361	HART Device 14 PV floating point value stored in 2x16-bit register per float
362-363	HART Device 14 SV floating point value stored in 2x16-bit register per float
364-365	HART Device 14 TV floating point value stored in 2x16-bit register per float
366-367	HART Device 14 FV floating point value stored in 2x16-bit register per float
368-369	HART Device 15 PV floating point value stored in 2x16-bit register per float
370-371	HART Device 15 SV floating point value stored in 2x16-bit register per float
372-373	HART Device 15 TV floating point value stored in 2x16-bit register per float
374-375	HART Device 15 FV floating point value stored in 2x16-bit register per float
376-377	HART Device 16 PV floating point value stored in 2x16-bit register per float
378-379	HART Device 16 SV floating point value stored in 2x16-bit register per float
380-381	HART Device 16 TV floating point value stored in 2x16-bit register per float
382-383	HART Device 16 FV floating point value stored in 2x16-bit register per float

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Table 4. *Continued*

Register Range	Description
512-517	HART Device 1 additional status byte 0 to byte 5
518-523	HART Device 2 additional status byte 0 to byte 5
524-529	HART Device 3 additional status byte 0 to byte 5
530-535	HART Device 4 additional status byte 0 to byte 5
536-541	HART Device 5 additional status byte 0 to byte 5
542-547	HART Device 6 additional status byte 0 to byte 5
548-553	HART Device 7 additional status byte 0 to byte 5
554-559	HART Device 8 additional status byte 0 to byte 5
560-565	HART Device 9 additional status byte 0 to byte 5
566-571	HART Device 10 additional status byte 0 to byte 5
572-577	HART Device 11 additional status byte 0 to byte 5
578-583	HART Device 12 additional status byte 0 to byte 5
584-589	HART Device 13 additional status byte 0 to byte 5
590-595	HART Device 14 additional status byte 0 to byte 5
596-601	HART Device 15 additional status byte 0 to byte 5
602-607	HART Device 16 additional status byte 0 to byte 5

Table 4.1. *Additional status byte 0 to byte 24 (for software version 5.0 and greater).*

Register Range	Description
1000-1024	HART Device 1 additional status byte 0 to byte 24
1025-1049	HART Device 2 additional status byte 0 to byte 24
1050-1074	HART Device 3 additional status byte 0 to byte 24
1075-1099	HART Device 4 additional status byte 0 to byte 24
1100-1124	HART Device 5 additional status byte 0 to byte 24
1125-1149	HART Device 6 additional status byte 0 to byte 24
1150-1174	HART Device 7 additional status byte 0 to byte 24
1175-1199	HART Device 8 additional status byte 0 to byte 24
1200-1224	HART Device 9 additional status byte 0 to byte 24
1225-1249	HART Device 10 additional status byte 0 to byte 24
1250-1274	HART Device 11 additional status byte 0 to byte 24
1275-1299	HART Device 12 additional status byte 0 to byte 24
1300-1324	HART Device 13 additional status byte 0 to byte 24
1325-1349	HART Device 14 additional status byte 0 to byte 24
1350-1374	HART Device 15 additional status byte 0 to byte 24
1375-1399	HART Device 16 additional status byte 0 to byte 24

Table 4.2. *Device Tag (for software version 5.4 and later)*

Register Range	Description
2000-2003	HART Device 1 Tag stored as 8 ascii characters, 2 characters per register
2004-2007	HART Device 2 Tag stored as 8 ascii characters, 2 characters per register
2008-2011	HART Device 3 Tag stored as 8 ascii characters, 2 characters per register
2012-2015	HART Device 4 Tag stored as 8 ascii characters, 2 characters per register
2016-2019	HART Device 5 Tag stored as 8 ascii characters, 2 characters per register
2020-2023	HART Device 6 Tag stored as 8 ascii characters, 2 characters per register
2024-2027	HART Device 7 Tag stored as 8 ascii characters, 2 characters per register
2028-2031	HART Device 8 Tag stored as 8 ascii characters, 2 characters per register
2032-2035	HART Device 9 Tag stored as 8 ascii characters, 2 characters per register
2036-2039	HART Device 10 Tag stored as 8 ascii characters, 2 characters per register
2040-2043	HART Device 11 Tag stored as 8 ascii characters, 2 characters per register
2044-2047	HART Device 12 Tag stored as 8 ascii characters, 2 characters per register
2048-2051	HART Device 13 Tag stored as 8 ascii characters, 2 characters per register
2052-2055	HART Device 14 Tag stored as 8 ascii characters, 2 characters per register
2056-2059	HART Device 15 Tag stored as 8 ascii characters, 2 characters per register
2060-2063	HART Device 16 Tag stored as 8 ascii characters, 2 characters per register

During HART Initialization, Command 13 is issued, and the packed tag is read. The tag is unpacked to the 8 ascii bytes and placed in the Modbus Map. Each slave is allocated a contiguous block of 4 16-bit registers. Each register will contain two ascii characters.
For example:

- The tag in device 1 is “ABCDEFGH”
- The MB register map will contain:

Register	Register contents	Upper Byte	Lower Byte
2000	0x4142	0x41 (‘A’)	0x42 (‘B’)
2001	0x4344	0x43 (‘C’)	0x44 (‘D’)
2002	0x4546	0x45 (‘E’)	0x46 (‘F’)
2003	0x4748	0x47 (‘G’)	0x48 (‘H’)

Looking at the MODBUS response to the query, the data portion will be “human readable” in the same byte order as the tag, ie the first byte in the tag will be the first byte in the Modbus response data:

<MB HEADER> 0x41 0x42 0x43 0x44 0x45 0x46 0x47 0x48 <MB CRC>

Table 4.3. *PV Upper and Lower Range Values URV/LRV (for software version 5.4 and greater)*

Register Range	Description
3000-3001	HART Device 1 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3002-3003	HART Device 1 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3004-3005	HART Device 2 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3006-3007	HART Device 2 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3008-3009	HART Device 3 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3010-3011	HART Device 3 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3012-3013	HART Device 4 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3014-3015	HART Device 4 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3016-3017	HART Device 5 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3018-3019	HART Device 5 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3020-3021	HART Device 6 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3022-3023	HART Device 6 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3024-3025	HART Device 7 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3026-3027	HART Device 7 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3028-3029	HART Device 8 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3030-3031	HART Device 8 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3032-3033	HART Device 9 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3034-3035	HART Device 9 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3036-3037	HART Device 10 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3038-3039	HART Device 10 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3040-3041	HART Device 11 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3042-3043	HART Device 11 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3044-3045	HART Device 12 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3046-3047	HART Device 12 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3048-3049	HART Device 13 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3050-3051	HART Device 13 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3052-3053	HART Device 14 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3054-3055	HART Device 14 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3056-3057	HART Device 15 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3058-3059	HART Device 15 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float
3060-3061	HART Device 16 PV Upper Range (URV) floating point value stored in 2x16-bit register per float
3062-3063	HART Device 16 PV Lower Range (LRV) floating point value stored in 2x16-bit register per float

During HART initialization, Command 15 is issued, and the PV Upper and Lower Range Value for each device is extracted and stored. Each slave is allocated a contiguous block of 4 16-bit registers, used in pairs to store the two floating point values (storage is identical to that of the variables and will follow the MODBUS floating point order setting.) The first two registers (eg 3000 and 3001) are used for the Upper Range Value and the second two (eg 3002 and 3003) are used for the Lower Range Value.

***Table 5.** *HCS Status Word Bits*

Status Word Bit	Type	Description
0	Error	Configuration data error
1	Error	No HART communications
2	Error	EEPROM blank
3	Error	EEPROM failure
4	Status	Slave device malfunction
5	Error	Burst mode failure
6	Error	Software watchdog failure
7	Error	COP watchdog failure
8	Status	Slave device analog output fixed
10	Error	Software fail
11	Status	Device offline
12	Error	Partial Communications Failure **
13	Not Used	N/A
14	Not Used	N/A
15	Error	Configuration data area checksum error

*HCS Status is read by accessing register 127

** Status only available for software versions 5.4 and greater

HART Field Device Status Information

The following tables describe HART status information. These status registers contain the information transmitted by the slaves with each message. Their format is defined by the HART foundation. The upper (most significant) byte contains the Communication Status or Response Code, and the lower byte contains the Field Device Status.

Table 6. *MSB: HART First Byte*

MSB	Bit/Code	Description
Bit 7 = 1 Communications Error (The byte consists of error FLAGS)	0	0 (undefined)
	1	RX buffer overflow
	2	Communications failure
	3	Checksum error
	4	Framing error
	5	Overrun error
	6	Parity error
Bit 7 = 0 Command Response (The byte is a numerical value representing a single error condition)	0	No error
	1	Undefined
	2	Invalid selection
	3	Passed parameter too large
	4	Passed parameter too small
	5	Too few bytes received
	6	Device specific command error
	7	In write protect mode
	8-15	Multiple meanings
	16	Access restricted
	28	Multiple meanings
	32	Device is busy
	64	Command not implemented

Table 7. *LSB: HART Second Byte*

MSB	Bit	Description
0 not used when a communications error exists	0	Primary variable out of limits
	1	Non primary variable out of limits
	2	Analog output saturated
	3	Analog output current fixed
	4	More status available
	5	Cold start
	6	Configuration changed
	7	Field device malfunction

Installation

Installation consists of physically mounting the unit, grounding the instrument, and completing the electrical connections.

Mounting the HCS

The HCS is designed to snap easily onto 35mm Top Hat (EN50022) DIN rails.

Making the Electrical Connections

After mounting, you are ready to connect the HCS to the loop. Each unit comes equipped with a transmitter excitation terminal which allows it to supply power to the monitored HART instrument, if necessary. Figures 2 and 3 shows the connection diagram for an HCS.

Recommended Ground Wiring Practices

Moore Industries recommends the following ground wiring practices:

- Any Moore Industries product in a metal case or housing should be grounded.
- The protective earth conductor must be connected to a system safety earth ground before making other connections.
- All input signals to, and output signals from, Moore Industries' products should be wired using a shielded, twisted pair wiring technique. Shields should be connected to an earth or safety ground.
- For the best shielding, the shield should be run all the way from the signal source to the receiving device. (see Note below)
- The maximum length of unshielded input and output signal wiring should be 2 inches.

Note:
Some of Moore Industries' instruments can be classified as receivers (IPT2, IPX2, etc.) and some can be classified as transmitters (TRX, TRY, etc.) while some are both a receiver and a transmitter (SPA2, HIM, etc). Hence, your shield ground connections should be appropriate for the type of signal line being shielded. The shield should be grounded at the receiver and not at the signal source.

CE Certification-related Guidelines

Installation of any Moore Industries' products that carry the CE marking must adhere to the guidelines in the Recommended Ground Wiring Practices section in order to meet the EN 61326 requirements set forth in the applicable EMC directive.

Specific Conditions of Use

The following instructions must be adhered to when the HCS is used in hazardous locations and potentially explosive atmospheres.

cFMus Installations

Nonincendive Applications: Class 1, Division 2, Groups A-D

The HCS shall be installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application.

Connections shall not be made to the communications "COM" port in Hazardous (Classified) Locations

Power Sourcing Parameters for General Locations, Intrinsically Safe and Non-Incendive/Type N Applications

The input terminals must be connected to and/or supplied from a certified energy limiting Class 2 or a Separate Extra Low Voltage (S.E.L.V.) power supply separated from all mains by double/reinforced insulation.

Operation

Once programmed, calibrated, installed, and supplied with the correct power, the HCS begins to operate immediately. Depending upon environmental conditions, it can be expected to operate unattended for extended periods of time.

There are 2 leds which indicate the unit and input status:

<u>**INPUT LED: (Red/Green)**</u>

Green: Input is present and normal
Red: Input signal is not found
Red/Green blinking: When communications with one or more (but not all) of the slaves is bad* OR HCS is in burst mode but the slave is not

**Only applicable for software version 5.4 and greater*

<u>**READY LED: (Red/Green)**</u>

Green: Instrument is ready for operation and configuration

Red: Instrument has encountered an internal problem

Maintenance

Moore Industries suggests a check for terminal tightness and general unit condition every 6-8 months. Always adhere to any site requirements for programmed maintenance.

Customer Support

Moore Industries is recognized as the industry leader in delivering top quality to its customers in products and services. We perform a battery of stringent quality assurance checks on every unit we ship. If any Moore Industries product fails to perform up to rated specifications, call us for help.

Our highly skilled staff of trained technicians and engineers pride themselves on their ability to provide timely, accurate, and practical answers to your process instrumentation questions.

Factory phone numbers are listed on the back cover of this manual.

If problems involve a particular HCS, there are several pieces of information that can be gathered before you call the factory that will help our staff get the answers you need in the shortest time possible. For fastest service, gather the complete model and serial number(s) of the problem unit(s) and the job number of the original sale.

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
   a) A note listing the symptoms that indicate the unit needs repair
   b) Complete shipping information for return of the equipment after repair
   c) The name and phone number of the person to contact if questions arise at the factory

3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.

4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

WARRANTY DISCLAIMER

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ANY BUYER OF GOODS OR SERVICES FROM THE COMPANY AGREES WITH THE COMPANY THAT THE SOLE AND EXCLUSIVE REMEDIES FOR BREACH OF ANY WARRANTY CONCERNING THE GOODS OR SERVICES SHALL BE FOR THE COMPANY, AT ITS OPTION, TO REPAIR OR REPLACE THE GOODS OR SERVICES OR REFUND THE PURCHASE PRICE. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES EVEN IF THE COMPANY FAILS IN ANY ATTEMPT TO REMEDY DEFECTS IN THE GOODS OR SERVICES , BUT IN SUCH CASE THE BUYER SHALL BE ENTITLED TO NO MORE THAN A REFUND OF ALL MONIES PAID TO THE COMPANY BY THE BUYER FOR PURCHASE OF THE GOODS OR SERVICES.

ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

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Appendix A: Configuring the Legacy HCS

The following information applies only to units with firmware version older than 4.0.

Note:
All tables and figures within Appendix A relate only to Appendix A unless otherwise mentioned.

Configuring the HCS

One of the benefits of the HCS is that there are no internal or external controls to adjust or settings to change. All operating parameters are set using the PC Configuration software.

Once these software settings are made, they are downloaded to the instrument in the form of a Configuration File and stored in the unit's nonvolatile memory. You can choose to save a backup copy of the file on your PC hard drive or external media. The HCS communicates with the PC through a proprietary communications cable to the PC's serial (COM) port or optional proprietary USB cable to the PC's USB port.

Installing the Configuration Software

Refer to Table 2 for the equipment needed.

1. Insert the *Moore Industries Interface Solution PC Configuration Software* CD into the CD drive of the PC. Access the CD and open the "HCS PC Configuration Software" folder.
2. Double-click the installation program located in the folder. Follow the prompts to correctly install the program.

Connecting the HCS to the PC

HCS can be connect to PC one of two ways:

- using the proprietary communications cable to connect to PC's serial (COM) port
- using the optional proprietary USB cable to connect to PC's USB port

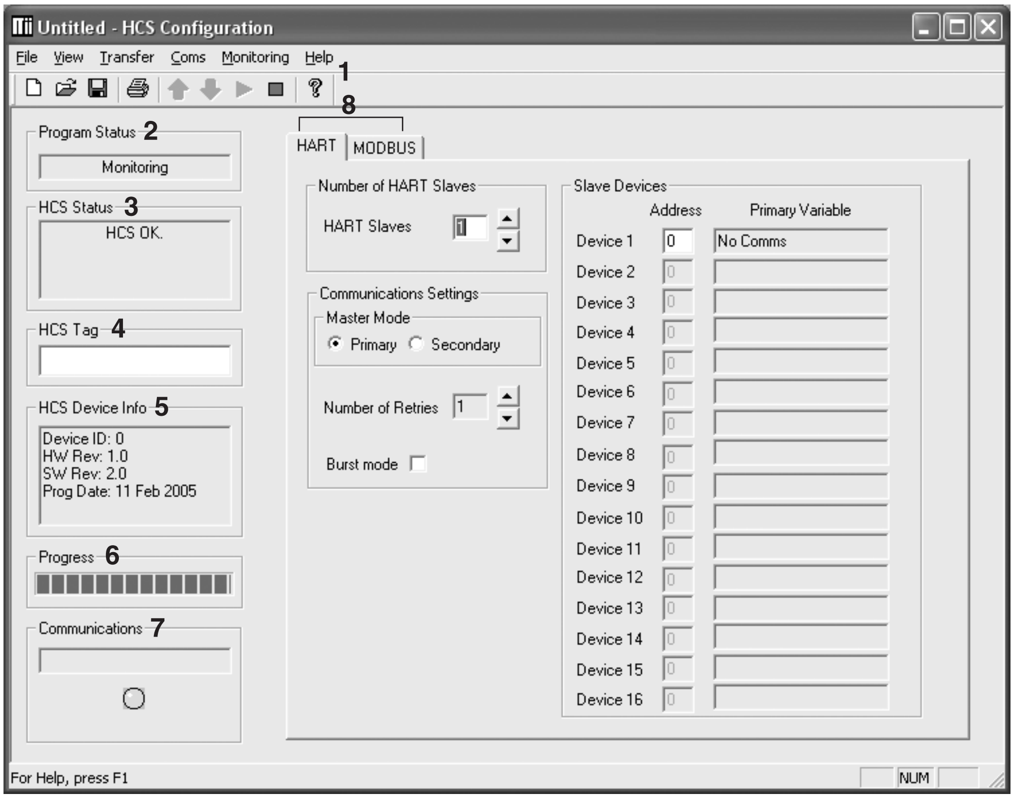
See Table A-1 for information on the necessary equipment.

Table A-1. *Necessary Equipment Table*

Device	Specifications
Power Supply	24Vdc, ±10%
Personal Computer	Microsoft Windows based PC; 16Mb free RAM; 20MB free disk space on hard drive Microsoft Windows XP, 7, or 10 1 (one) serial port or one available USB port
Moore Industries PC Configuration Software	Version 1.0 or higher, successfully installed onto the hard drive
Communication Cable options	Serial Communications Cable (PN 803-053-26), Fuse Protected USB Cable (PN 804-030-26)

PC Configuration Software Summary

Figure A-1. *HCS PC Configuration Software Screen*



The HCS PC Configuration Software can be used to program all of the instrument's parameters. Once the default configuration has been saved to disk, it is safe to program other parameters.

The PC Software is composed of these sections:

1. Menu Bar/Tool Bar–Dropdown menus and corresponding icons allow you to perform various functions throughout the PC Configuration Program. *Refer to the Menu and Tool Bar Legend* section for a complete description.

2. Program Status–This portion of the program displays the activity (idle, monitoring, downloading, uploading) of the connected unit.

3. HCS Status–Notifies of any errors or conditions which are outside of the tolerance range. Displays *HCS OK* if the unit is operating normally.

4. HCS Tag–A phrase used to identify an HCS (eight alphanumeric characters, maximum).

5. HCS Device Info–Displays the individual characteristics of the attached HCS, such as the device ID, hardware and software revisions and the last date that the device was programmed.

6. Progress–This bar stays in motion any time the HCS is monitoring, uploading or downloading, to notify that a process is occurring.

7. Communications–Indicates current PC connection/communications status.

8. HART/MODBUS Tabs–These tabs change the right side of the screen to allow you to set the appropriate part of the HCS's configuration. See corresponding sections of this manual for additional information on these tabs.

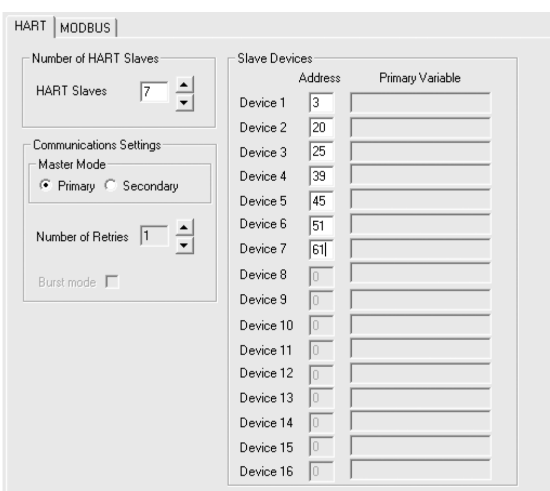
Menu and Tool Bar Legend

File	Allows such functions as New, Open, Save and Print
View	Controls whether Tool and Status Bars are viewed on the screen
Transfer	Allows you to Upload and Download configurations
Coms	Select the PC Port (Com Port) that you will use
Monitoring	Allows you to Monitor and Stop monitoring processes
Help	Displays the version of the HCS Configuration Program

Configuration Screens

HART

Figure A-2. *HART Tab*



Number of HART Slaves

Using the up and down arrows, select the number of HART slaves (16 maximum) that you will introduce into your loop. The number of slaves you have chosen will appear as enabled in the *Slave Devices* parameter.

Slave Devices

Once you have selected the number of HART slaves to be used in the loop, use this section to assign a specific address for each device. Ensure that the address matches the address of the slave you connected in the loop. Each must be a unique address between zero and 63. However, Address 0 is an analog address and is not used in HART multi-drop loops. Current readings at this address can vary from 3.6mA to 23.6mA.

Master Mode

The HART protocol allows for two communications masters on the loop: a Primary Master and a Secondary Master. Setting the HCS to function as the Primary HART Master in the application means that any other HART device in the loop must be configured either as a HART Secondary Master (1 per loop), or as a HART Slave (up to 16 per loop). Conversely, setting the HCS to function as the Secondary HART Master allows other HART devices to function either as a Primary Master, or as Slaves. Configuring more than one device on a single loop as a Primary or Secondary HART Master will cause a communications failure.

Note:
A HART hand-held communicator is typically a Secondary Master.

Number of Retries

The *Number of Retries* can be set between 1 and 3, and will determine how many times the HCS will attempt to poll the HART transmitter (without success), before it indicates a HART communication failure.

Burst Mode

Allows selection of Normal or Burst modes.

Burst mode may be enabled if there is only one slave in the loop.

The HCS can operate in one of two modes: *Normal* or *Burst*. In each of these modes the HCS attempts to find a HART transmitter.

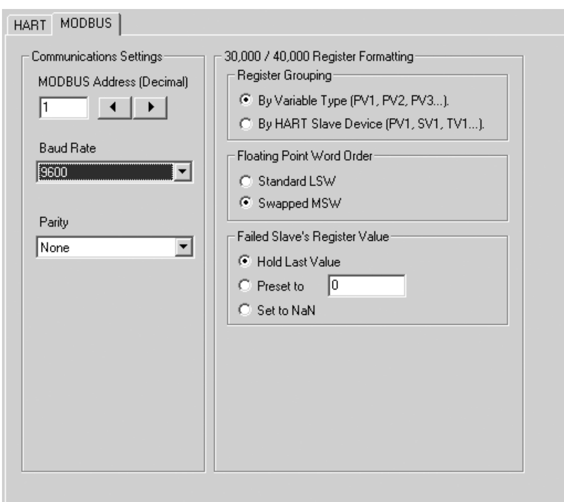
In *Normal* mode, the HCS polls the HART loop for a transmitter, then polls the HART instrument twice per second, requesting the current process status and the HART instrument's diagnostic status. The HART instrument responds with the requested data.

In *Burst* mode, the monitored HART instrument is programmed to continuously transmit its process variable and health status. The HCS samples the continuous HART data three times per second.

The instrument will operate in Normal Mode by default. Selecting the *Burst Mode* button will enable Burst Mode.

MODBUS

Figure A-3. *MODBUS Tab*



The *MODBUS tab* allows you to set the MODBUS communications parameters.

Communications Settings

The Communications Settings include three areas:

MODBUS Address (Decimal)

The *MODBUS Address* is the number that the HCS monitor uses to identify itself on the MODBUS network. The MODBUS address is configurable from 1 to 247. By default, it will assume a MODBUS address of 1.

Baud Rate

The *Baud Rate* is the speed of MODBUS data transmission. It should be set to match the baud rate of the attached controller. The interface supports the following baud rates: 300, 600, 1200, 2400, 4800, 9600 and 19200.

Parity

The HART monitor supports even, odd and no *Parity.* The data format is one start bit, 8 data bits and one stop bit.

30,000 / 40,000 Register Formatting

This section includes the following areas:

Register Grouping

This allows you to select the manner in which to group the MODBUS registers.

Selecting *By Variable Type,* the registers are grouped in order of *variables*, i.e. all primary variables (PV) are grouped together, followed by secondary variables (SV), third (TV) and then fourth (FV).

Using *By HART Slave Device* grouping places your registers in order *numerically*. It groups a HART slave device's variables in contiguous registers. For example, your first HART device's primary, secondary, third and fourth variables (PV1, SV1, TV1 and FV1) are grouped together. Next in the order are your second HART device's primary, secondary, third and fourth variables (PV2, SV2, TV2 and FV2) and so on.

Floating Point Word Order

By default, the HART Concentrator will use the *Standard LSW* (least significant word) floating point word order format. This stores the most significant bits in the second register and the least significant bits in the first register. Selecting *Swapped MSW (most significant word)* will reverse the order, storing the most significant bits in the first register and the least significant bits in the second register.

Failed Slave's Register Value

You may select what would occur to a slave device's register value in the event that communication is lost with the HCS.

If selecting *Hold Last Value* and a failure is detected, the last measured value before the failure occurred is held.

Entering a user-set value in the *Preset to* text box recalls that value when a slave device failure is detected.

Selecting *NaN* (Not a Number–as put forth by the IEEE-754 standard) causes the floating point NaN value to be stored in the registers used for holding floating point values.

MODBUS Register Definitions

Tables 2-5 define the MODBUS input and holding register assignment. These tables are zero based, your MODBUS host may require you to enter the MODBUS register. Often registers have an offset of "1" from the MODBUS address. For example, a MODBUS address listed below of 256 may have to be entered as 257 in your host. Please refer to your MODBUS host documentation for verification.

KEY:
FV = Fourth Variable
LSB = Least Significant Bit
MSB = Most Significant Bit
PV = Primary Variable
SV = Secondary Variable
TV = Third Variable
*UOM = Unit of Measurement

*Moore Industries provides up to 169 HART Engineering Units listed in HART Communication Foundation document number: HCF-SPEC-183, Revision 14.0, Release Date 29 January 2004

Table A-2. *Register ranges and descriptions when MODBUS registers are grouped by the "By Variable Type" parameter and only the PV and SV are being stored (when nine or more slaves are in the loop)*

Register Range	Description
32-47	HART Device 1-16 HART Status
48-63	HART Device 1-16 PV + SV UOM (PV UOM = MSB, SV UOM = LSB)
64	HCS Status
256-287	HART Device 1-16 PV floating point value stored in 2x16-bit registers per float
288-319	HART Device 1-16 SV floating point value stored in 2x16-bit registers per float

Table A-3. *Register ranges and descriptions when MODBUS registers are grouped by the "By Variable Type" parameter and all dynamic variables are being stored (when eight or fewer slaves are in the loop)*

Register Range	Description
32-39	HART Device 1-8 HART Status
40-47	HART Device 1-8 PV + SV UOM (PV UOM = MSB, SV UOM = LSB)
48-55	HART Device 1-8 TV + FV UOM (TV UOM = MSB, FV UOM = LSB)
64	HCS Status
256-271	HART Device 1-8 PV floating point value stored in 2x16-bit registers per float
272-287	HART Device 1-8 SV floating point value stored in 2x16-bit registers per float
288-303	HART Device 1-8 TV floating point value stored in 2x16-bit registers per float
304-319	HART Device 1-8 FV floating point value stored in 2x16-bit registers per float

Table A-4. *Register ranges and descriptions when MODBUS registers are grouped by the "By HART Slave Device" parameter (when nine or more slaves are in the loop)*

Register Range	Description
2	HART Device 1 HART Status
3	HART Device 1 UOM (PV UOM = MSB, SV UOM = LSB)
6	HART Device 2 HART Status
7	HART Device 2 UOM (PV UOM = MSB, SV UOM = LSB)
10	HART Device 3 HART Status
11	HART Device 3 UOM (PV UOM = MSB, SV UOM = LSB)
14	HART Device 4 HART Status
15	HART Device 4 UOM (PV UOM = MSB, SV UOM = LSB)
18	HART Device 5 HART Status
19	HART Device 5 UOM (PV UOM = MSB, SV UOM = LSB)
22	HART Device 6 HART Status
23	HART Device 6 UOM (PV UOM = MSB, SV UOM = LSB)
26	HART Device 7 HART Status
27	HART Device 7 UOM (PV UOM = MSB, SV UOM = LSB)
30	HART Device 8 HART Status
31	HART Device 8 UOM (PV UOM = MSB, SV UOM = LSB)
34	HART Device 9 HART Status
35	HART Device 9 UOM (PV UOM = MSB, SV UOM = LSB)
38	HART Device 10 HART Status
39	HART Device 10 UOM (PV UOM = MSB, SV UOM = LSB)
42	HART Device 11 HART Status
43	HART Device 11 UOM (PV UOM = MSB, SV UOM = LSB)
46	HART Device 12 HART Status
47	HART Device 12 UOM (PV UOM = MSB, SV UOM = LSB)
50	HART Device 13 HART Status
51	HART Device 13 UOM (PV UOM = MSB, SV UOM = LSB)
54	HART Device 14 HART Status
55	HART Device 14 UOM (PV UOM = MSB, SV UOM = LSB)
58	HART Device 15 HART Status
59	HART Device 15 UOM (PV UOM = MSB, SV UOM = LSB)
62	HART Device 16 HART Status
63	HART Device 16 UOM (PV UOM = MSB, SV UOM = LSB)
64	HCS Status
256-257	HART Device 1 PV floating point value stored in 2x16-bit register per float
258-259	HART Device 1 SV floating point value stored in 2x16-bit register per float
260-261	HART Device 2 PV floating point value stored in 2x16-bit register per float
262-263	HART Device 2 SV floating point value stored in 2x16-bit register per float
264-265	HART Device 3 PV floating point value stored in 2x16-bit register per float

Continued on next page

Table A-4. *Continued*

266-267	HART Device 3 SV floating point value stored in 2x16-bit register per float
268-269	HART Device 4 PV floating point value stored in 2x16-bit register per float
270-271	HART Device 4 SV floating point value stored in 2x16-bit register per float
272-273	HART Device 5 PV floating point value stored in 2x16-bit register per float
274-275	HART Device 5 SV floating point value stored in 2x16-bit register per float
276-277	HART Device 6 PV floating point value stored in 2x16-bit register per float
278-279	HART Device 6 SV floating point value stored in 2x16-bit register per float
280-281	HART Device 7 PV floating point value stored in 2x16-bit register per float
282-283	HART Device 7 SV floating point value stored in 2x16-bit register per float
284-285	HART Device 8 PV floating point value stored in 2x16-bit register per float
286-287	HART Device 8 SV floating point value stored in 2x16-bit register per float
288-289	HART Device 9 PV floating point value stored in 2x16-bit register per float
290-291	HART Device 9 SV floating point value stored in 2x16-bit register per float
292-293	HART Device 10 PV floating point value stored in 2x16-bit register per float
294-295	HART Device 10 SV floating point value stored in 2x16-bit register per float
296-297	HART Device 11 PV floating point value stored in 2x16-bit register per float
298-299	HART Device 11 SV floating point value stored in 2x16-bit register per float
300-301	HART Device 12 PV floating point value stored in 2x16-bit register per float
302-303	HART Device 12 SV floating point value stored in 2x16-bit register per float
304-305	HART Device 13 PV floating point value stored in 2x16-bit register per float
306-307	HART Device 13 SV floating point value stored in 2x16-bit register per float
308-309	HART Device 14 PV floating point value stored in 2x16-bit register per float
310-311	HART Device 14 SV floating point value stored in 2x16-bit register per float
312-313	HART Device 15 PV floating point value stored in 2x16-bit register per float
314-315	HART Device 15 SV floating point value stored in 2x16-bit register per float
316-317	HART Device 16 PV floating point value stored in 2x16-bit register per float
318-319	HART Device 16 SV floating point value stored in 2x16-bit register per float

Table A-5. *Register ranges and descriptions when MODBUS registers are grouped by the "By HART Slave Device" parameter and PV, SV, TV and FV are being stored (when eight or fewer slaves are in the loop)*

Register Range	Description
4	HART Device 1 HART Status
5	HART Device 1 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
6	HART Device 1 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
7	Not assigned
12	HART Device 2 HART Status
13	HART Device 2 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
14	HART Device 2 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
15	Not assigned
20	HART Device 3 HART Status
21	HART Device 3 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
22	HART Device 3 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
23	Not assigned
28	HART Device 4 HART Status
29	HART Device 4 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
30	HART Device 4 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
31	Not assigned
36	HART Device 5 HART Status
37	HART Device 5 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
38	HART Device 5 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
39	Not assigned
44	HART Device 6 HART Status
45	HART Device 6 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
46	HART Device 6 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
47	Not assigned
52	HART Device 7 HART Status
53	HART Device 7 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
54	HART Device 7 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
55	Not assigned
60	HART Device 8 HART Status
61	HART Device 8 PV & SV UOM (PV UOM = MSB, SV UOM = LSB)
62	HART Device 8 TV & FV UOM (TV UOM = MSB, FV UOM = LSB)
63	Not assigned
64	HCS Status
256-257	HART Device 1 PV floating point value stored in 2x16-bit register per float
258-259	HART Device 1 SV floating point value stored in 2x16-bit register per float
260-261	HART Device 1 TV floating point value stored in 2x16-bit register per float
262-263	HART Device 1 FV floating point value stored in 2x16-bit register per float
264-265	HART Device 2 PV floating point value stored in 2x16-bit register per float

Continued on next page

Table A-5. *Continued*

266-267	HART Device 2 SV floating point value stored in 2x16-bit register per float
268-269	HART Device 2 TV floating point value stored in 2x16-bit register per float
270-271	HART Device 2 FV floating point value stored in 2x16-bit register per float
272-273	HART Device 3 PV floating point value stored in 2x16-bit register per float
274-275	HART Device 3 SV floating point value stored in 2x16-bit register per float
276-277	HART Device 3 TV floating point value stored in 2x16-bit register per float
278-279	HART Device 3 FV floating point value stored in 2x16-bit register per float
280-281	HART Device 4 PV floating point value stored in 2x16-bit register per float
282-283	HART Device 4 SV floating point value stored in 2x16-bit register per float
284-285	HART Device 4 TV floating point value stored in 2x16-bit register per float
286-287	HART Device 4 FV floating point value stored in 2x16-bit register per float
288-289	HART Device 5 PV floating point value stored in 2x16-bit register per float
290-291	HART Device 5 SV floating point value stored in 2x16-bit register per float
292-293	HART Device 5 TV floating point value stored in 2x16-bit register per float
294-295	HART Device 5 FV floating point value stored in 2x16-bit register per float
296-297	HART Device 6 PV floating point value stored in 2x16-bit register per float
298-299	HART Device 6 SV floating point value stored in 2x16-bit register per float
300-301	HART Device 6 TV floating point value stored in 2x16-bit register per float
302-303	HART Device 6 FV floating point value stored in 2x16-bit register per float
304-305	HART Device 7 PV floating point value stored in 2x16-bit register per float
306-307	HART Device 7 SV floating point value stored in 2x16-bit register per float
308-309	HART Device 7 TV floating point value stored in 2x16-bit register per float
310-311	HART Device 7 FV floating point value stored in 2x16-bit register per float
312-313	HART Device 8 PV floating point value stored in 2x16-bit register per float
314-315	HART Device 8 SV floating point value stored in 2x16-bit register per float
316-317	HART Device 8 TV floating point value stored in 2x16-bit register per float
318-319	HART Device 8 FV floating point value stored in 2x16-bit register per float

Table A- 6. *HCS Status Word Bits*

Status Word Bit	Type	Description
0	Error	Configuration data error
1	Error	No HART communications
2	Error	EEPROM blank
3	Error	EEPROM failure
4	Status	Slave device malfunction
5	Error	Burst mode failure
6	Error	Software watchdog failure
7	Error	COP watchdog failure
8	Status	Slave device analog output fixed
10	Error	Software fail
11	Status	Device offline
12	Not Used	N/A
13	Not Used	N/A
14	Not Used	N/A
15	Error	Configuration data area checksum error

Table A-7. *Slave Device Status*

Status Bit	Description
0	Primary variable out of limits
1	Non-Primary variable out of limits
2	Analog output #1 saturated
3	Analog output #1 fixed
4	More status available
5	Cold start
6	Configuration changed
7	Field device malfunction

Appendix B: HCS HART compatibility

The Moore Industries HCS was updated in February 2014 to be multi-version compatible with HART 5, 6 and 7 devices by the release of new HCS software v5.2. It communicates with HART 5, 6, and 7 compliant devices in both multi-drop and single point networks. The HCS fully supports networks where HART slaves and other hosts have different HART versions. While this version of the HCS is compatible with HART 5, 6 and 7 it does not support ALL of the new features available in HART 6 and 7.

To configure this new version of HCS you must also use the newest version of the HCS PC Configuration software (v3.6 or newer).

Note:
This version of the HCS PC Configuration software is also backward compatible with all earlier versions of the HCS.

The HCS uses the following HART commands 0, 3, 15 and 48 to collect its data.

Command 0	Read transmitter unique identifier
Command 3	Read all dynamic variables and current
Command 13	Read tag, descriptor, date
Command 15	Read Primary Variable Output Information
Command 48	Read additional transmitter status

Table B-1. *The following table outlines how each generation of HCS works with HART devices:*

	3RD GENERATION (CURRENT VERSION)	**1st & 2ND GENERATION**
	HCS Software v5.2 and Later	**HCS Software v4.x (2 nd generation)** **HCS Software v3.x and earlier (1 st generation)**
PC Software	**HCS Software v3.6 and later**	**HCS Software v3.0 and later (2nd generation)**
Burst Mode	If Burst mode is selected on the HCS it will NOT send a command to the attached HART slave to set it into Burst mode. If there is a power cycle on the HART loop the HCS will NOT send a command to the attached HART slave to set it into Burst mode. **Note:** If you know your HART slave boots up in the Poll/Response mode you should configure the HCS for Normal Mode communication to avoid having to reconfigure the slave after power upsets.	If Burst mode is selected on the HCS it will send a command to the attached HART slave to set it into Burst mode. If there is a power cycle on the HART loop the HCS would again send a command to the attached HART slave to set it into Burst mode.
Extended Mfg's ID and Device Type	HART 5 supports 1 byte per HART slave; HART 6 and 7 support 2 bytes per slave. This version of HCS will read HART 5, 6, and 7 slave Manufacturer ID and Device Type.	HART 5 supports 1 byte per HART slave; HART 6 and 7 support 2 bytes per slave. This version of HCS will ONLY read HART 5 slave Manufacturer ID and Device Type but will NOT read the ID and Device Type from HART 6 and 7 slaves. This limitation with HART 6 and 7 slaves does not affect communications.
Additional Status Bytes	HART 5 supports 6 bytes per HART slave; HART 6 and 7 support 25 bytes per slave. This version of the HCS reads the 6 Additional Status Bytes in HART 5 slaves and reads all 25 Additional Status Bytes in HART 6 and 7 slaves.	HART 5 supports 6 bytes per HART slave; HART 6 and 7 support 25 bytes per slave. This version of the HCS only reads the first 6 Additional Status Bytes in HART 5, 6 and 7 slaves. This limitation with HART 6 and 7 slaves does not affect communications. Not supported in 1st generation HCS (legacy)
Error Bits	When communication from the HART slave to the HCS fails, only the Device Malfunction bit is set.	When communication from the HART slave to the HCS fails, ALL error bits are set.

HART 6 and 7 Features not currently supported:

Long Tag:
32 character tag. Only the regular 8 character tag is supported. The 8 character tag and the 32 character tag are completely different data objects and will not interfere with each other. The 32 character tag can be programmed in the slave without having any effect on the HCS operation, but it will not be read by the HCS.

Multi-Variable Statuses:
Provides “output quality” information for all variables. This information is not yet read by the HCS.

Enhanced Multi-Variable Communication (8):
Increases device output capability from 4 to 8 variables using command 9. Only 4 variables (Primary, Secondary, Third and Fourth) are currently read by the HCS using command 3.