ProSoft TECHNOLOGY

Where Automation Connects.

HART

Stand-Alone Gateway

HART Master with Analog I/O

February 15, 2021

DRIVER MANUAL

Your Feedback Please

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HART Driver Manual

February 15, 2021

ProSoft Technology® Product Documentation

In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are provided at: **Error! Hyperlink reference not valid.**

Agency Approvals and Certifications

Please visit our website: www.prosoft-technology.com

For professional users in the European Union

If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

Prop 65 Warning – Cancer and Reproductive Harm – www.P65Warnings.ca.gov

Important Installation Instructions

Power, Input, and Output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods, Article 501-4 (b) of the National Electrical Code, NFPA 70 for installation in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations in Canada, and in accordance with the authority having jurisdiction. The following warnings must be heeded:

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2;

WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

THIS DEVICE SHALL BE POWERED BY CLASS 2 OUTPUTS ONLY.

Warnings

WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

AVERTISSEMENT – RISQUE D'EXPLOSION – AVANT DE DÉCONNECTER L'EQUIPMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DÉSIGNÉ NON DANGEREUX.

Gateways with Ethernet Ports

Series C ProLinx™ Gateways with Ethernet ports do **NOT** include the HTML Web Server. The HTML Web Server must be ordered as an option. This option requires a factory-installed hardware addition. The HTML Web Server now supports:

- 8 MB file storage for HTML files and associated graphics files (previously limited to 384K)
- 32K maximum HTML page size (previously limited to 16K)

To upgrade a previously purchased Series C model

Contact your ProSoft Technology distributor to order the upgrade and obtain a Returned Merchandise Authorization (RMA) to return the unit to ProSoft Technology.

To order a ProLinx Plus gateway with the -WEB option

Add **-WEB** to the standard ProLinx part number. For example, **5201-MNET-MCM-WEB**.

Contents

1 Start Here

In This Chapter

1.1 System Requirements

The ProSoft Configuration Builder configuration software for the ProSoft HART module requires the following minimum hardware and software components:

- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended
- 100 Mbytes of free hard disk space (or more based on application requirements)
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 x 768 recommended)

Supported operating systems:

- Microsoft Windows 10
- Microsoft Windows 7 Professional (32-or 64-bit)
- Microsoft Windows XP Professional with Service Pack 1 or 2
- Microsoft Windows Vista
- Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
- Microsoft Windows Server 2003

1.2 Package Contents

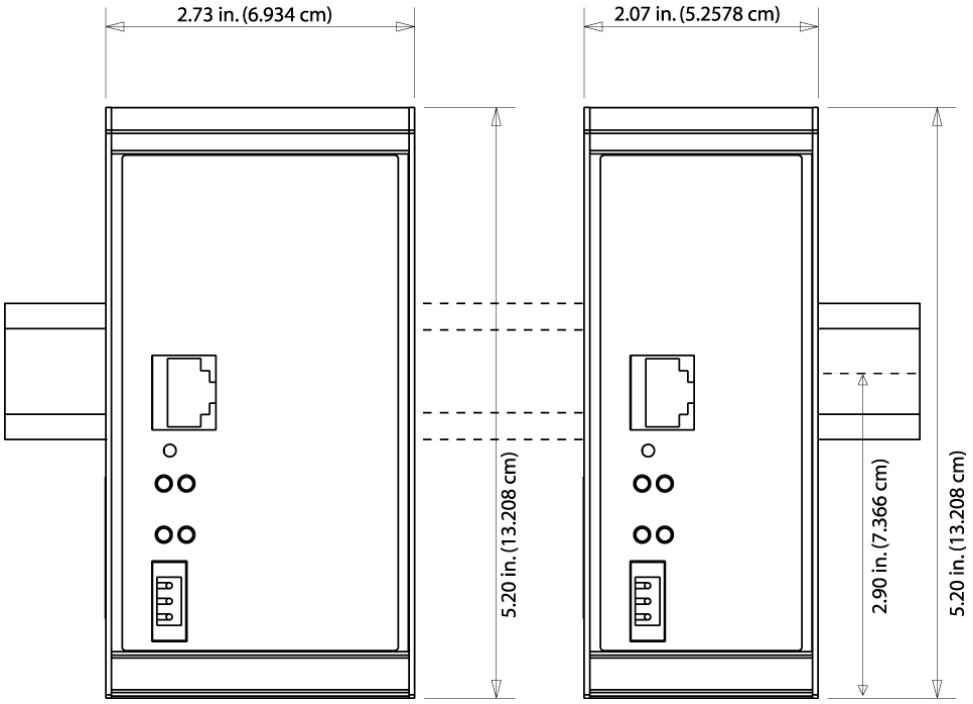
The following components are included with your ProSoft HART module, and are all required for installation and configuration.

Important: Before beginning the installation, please verify that all of the following items are present.

Qty.	Part Name	Part Number	Part Description
1	HART module	PLX-####	ProSoft HART Analog Stand-Alone gateway
1	Cable	Cable #15, RS232 Null Modem	For RS232 Connection from a PC to the CFG Port of the module
Varies	Cable	Cable #9, Mini-DIN8 to DB9 Male Adapter	For DB9 Connection to module's Port. One DIN to DB-9M cable included per configurable serial port, plus one for module configuration
Varies	Adapter	1454-9F	Adapters, DB9 Female to Screw Terminal. For RS422 or RS485 Connections to each serial application port of the module

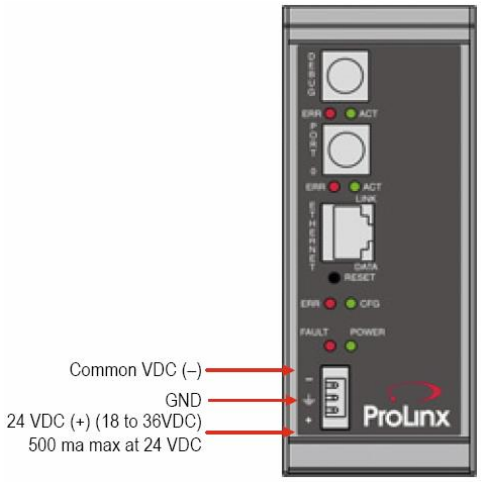
If any of these components are missing, please contact ProSoft Technology Support for replacements.

1.3 Mounting the Gateway on a DIN-rail



ProLinx 5000/6000 Series module

1.4 Connecting Power to the Unit



WARNING: Ensure that you do not reverse polarity when applying power to the module. This will cause damage to the module's power supply.

1.5 Installing ProSoft Configuration Builder Software

You must install the *ProSoft Configuration Builder (PCB)* software to configure the module. You can always get the newest version of *ProSoft Configuration Builder* from the ProSoft Technology website.

To install ProSoft Configuration Builder from the ProSoft Technology website

1. Open your web browser and navigate to *http://www.prosoft-technology.com*
2. Click the link at the *Current Release Version* section to download the latest version of *ProSoft Configuration Builder*.
3. Choose **SAVE** or **SAVE FILE** when prompted.
4. Save the file to your *Windows Desktop*, so that you can find it easily when you have finished downloading.
5. When the download is complete, locate and open the file, and then follow the instructions on your screen to install the program.

1.5.1 Using the Online Help

Most of the information needed to help you use P*roSoft Con*figuration Builder is provided in a Help System that is always available whenever you are running P*roSoft Con*figuration Builder. The Help System does not require an Internet connection.

To view the help pages, start P*roSoft Con*figuration Builder, open the **HELP** menu, and then choose **CONTENTS.**

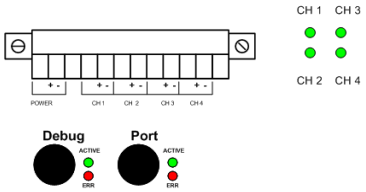
2 Functional Overview

In This Chapter

The HART Master + Analog I/O Protocol exists in 4 and 8 channel implementations. This driver can be configured on an individual channel basis to operate as a HART Master + Analog I/O Station and supports all the available HART commands including Universal, Common Practice and Device Specific Commands. Each HART channel is independently configured to interface with the internal database in the module.

2.1 HART Channels

The ProLinx module supports the HART protocol as a Master on up to 4 channels per interface card, with one or two cards per gateway. Each channel is individually configurable.



The relationship between the port labeling on the front of the ProLinx module and the application is as follows:

Port Label	Function
Debug	Debug/configuration
Port 0	Communications Port 0
Channel 1	Hart Port 0
Channel 2	Hart Port 1
Channel 3	Hart Port 2
Channel 4	Hart Port 3
Channel 5	Hart Port 4
Channel 6	Hart Port 5
Channel 7	Hart Port 6
Channel 8	HART Port 7

The HART protocol uses the Bell 202 standard frequency shift keying (FSK) signal to communicate at 1200 baud, superimposed at a low level on the 4 to 20 mA analog measurement signal. Having an average value of zero, an FSK signal causes no interference with the analog value. The HART devices are powered from this 4 to 20 mA analog loop.

User configured commands determine the HART commands to be issued on each channel to the HART devices. Up to 100 commands can be defined for each port. Data read from the devices are placed in the virtual database. Any write requests or device specific command for the HART slave devices are sourced with data from the virtual database or from a configured constant data block. In the commands it can be specified whether to use the HART device's short or long address. If the long address is selected, the device is polled first with short address to ask for the long one. Then the device is polled with the long address. The module does all this processing of the address automatically.

The module can be configured to place slave devices that are not responding to commands from the master ports at a lower priority. If the module recognizes that a slave device has failed to respond to a message after the user defined retry count, it will mark the slave as "in communication failure" and set the error delay time to the specified value. Each time that the error delay time expires, the slave will be polled and if the answer is successful, the slave is placed again in an active status. This facility can improve communication throughput on the HART network.

In a HART network, it is possible to have two masters. The ProLinx module fully supports the existence of a second master, but it can reduce the throughput on the HART network. This facility is enabled or disabled in the module's configuration. If the ability to have a second master on the network is disabled, then maximum throughput is achieved.

2.2 Functional Specifications - HART Analog

The HART Analog Protocol exists in 4 and 8 channel implementations. This driver can be configured on an individual channel basis to operate as a HART Master Station and supports all the available HART commands including Universal, Common Practice and Device Specific Commands. Each HART channel is independently configured to interface with the internal database in the module.

The auto-poll mode allows the module to automatically collect data from each HART instrument on the channel and store the data in the module's database without the use of user commands. The module automatically generates HART commands 0, 3, 13, 14 and 15.

General Parameters	
Internal Database	4000 registers (words) available
Communication parameters	Number of HART Preambles: 2 to 50 Enable Handheld: Y or N Primary Master: Y or N
Configurable Parameters per Channel	Auto-Poll Enable Short / Long Address Retries Retries After Error Poll Time After Error Number of Commands Slave List Error Pointer

HART Driver	
Command List	Up to 100 command per channel, each fully configurable for function, slave address, register to/from addressing and word count for Floating Point or Integer Data
Status Data	Error codes returned by the HART protocol available on an individual command basis. In addition, a slave status list is maintained per active channel.
Polling of command list	User configurable polling of commands, including disabled, continuous, on change of data (write only) and dynamically user or automatic enabled.

Isolated HART Analog Input Specifications	
Input Range	Current: 4 to 20mA with HART
Resolution	16bits
Input Filter	First Order Sync: 10 Hz
Current Input Resistance	247.6 ohms +/- 1%
Open circuit detection time	1/2 second maximum
Over current	+/-40mA continuous, maximum

Isolated HART Analog Input Specifications	
Common Mode Noise Rejection	105dB
Calibrated Accuracy @ 25°C	4 to 20 mA: 0.05% of reading
Input Isolation Voltage	2500 V RMS per UL 1577, transformer isolated
24V DC Isolation Voltage	1500 VDC

HART® is a registered trademark of the HART Communication Foundation

HART Commands supported

Universal Command Set

00	Read Unique Identifier
01	Read Primary Variable
02	Read Current And Percent Of Range
03	Read Dynamic Variables
06	Write Polling Address
11	Read Unique Identifier Associated With Tag
12	Read Message
13	Read Tag Descriptor Date
14	Read PV Sensor Info
15	Read Output Information
16	Read Final Assembly Number
17	Write Message
18	Write Tag Descriptor Date
19	Write Final Assembly Number

Common Practice Command Set

33	Read Transmitter Variables
34	Write Damping Value
35	Write Range Values
36	Set Upper Range Value
37	Set Lower Range Value
38	Reset Configuration Changed Flag
39	EEprom Control
40	Enter Exit Fixed Current Mode
41	Perform Transmitter Self Test
42	Perform Master Reset
43	Set Pv Zero
44	Write Pv Units
45	Trim Dac Zero
46	Trim Dac Gain
47	Write Transfer Function
48	Read Additional Transmitter Status
49	Write Pv Sensor Serial Number
50	Read Dynamic Variable Assignments
51	Write Dynamic Variable Assignments
52	Set Transmitter Variable Zero
53	Write Transmitter Variable Units
54	Read Transmitter Variable Information
55	Write Transmitter Variable Damping Value
56	Write Transmitter Variable Sensor Serial Number
57	Read Unit Tag Descriptor Date
58	Write Unit Tag Descriptor Date
59	Write Number Of Response Preambles
108	Write Burst Mode Command Number
109	Burst Mode Control
110	Read All Dynamic Variables

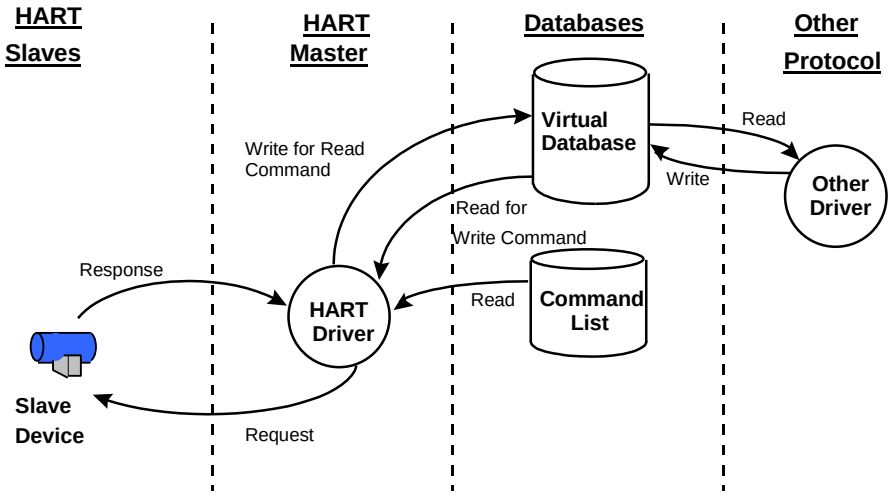
The ProSoft HART module supports version 5 of the HART protocol.

2.3 Module Internal Database

The internal database is central to the functionality of the module. This database is shared between all the ports on the module and is used as a conduit to pass information from one device on one network to one or more devices on another network. This permits data from devices on one communication port to be viewed and controlled by devices on another port. In addition to data from the slave and master ports, status and error information generated by the module can also be mapped into the internal database.

2.3.1 HART Channel Driver Access to Database

The following illustration describes the flow of data between the HART channel drivers and the internal database.



The HART Master + Analog I/O driver uses the database in two ways:

- A read command issued to a slave device by the master driver will return the slave data into the internal database
- A write command issued to a slave device by the master driver use the data in the internal database to write to the slave device

In addition to data from the Master HART channels, detailed status and error information generated by the module can also be mapped into the internal database.

2.3.2 HART Command List

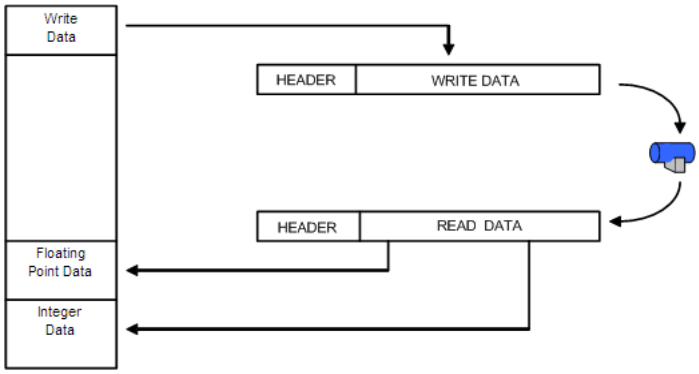
The HART Command List specifies the commands to be executed to the HART devices connected to a channel. A HART command can be seen as an outgoing message to the HART devices that provides Write Data for a specific command or a response message that carries process data (Read Data) back to the module. The ProLinx module supports three kinds of data blocks in the Universal and Common Practice commands. These data blocks are:

- Integers
- IEEE 754 Floating Point Numbers (32 bits)
- Packed ASCII character strings

The Packed ASCII character strings are unpacked and placed with the integers data block.

For all commands, it is possible to select where the Write Data comes from; it can be in the module's internal database or it can be configured as a fixed data block in the command.

For response messages from HART devices, it is possible to configure where the Floating Point Data and Integer Data will be placed in the module's internal database, but this is only possible for the Universal and Common Practice commands. In the case of Device Specific commands, all the Read Data is placed in the Integer data section. See HART Command Support for a listing of supported HART commands.



Burst Mode

If a slave on a network will be placed in burst mode, its data can be placed in the module's database. For the command to be burst by slave device, enter a command in the user command list with the appropriate HART command number. Set the type field to 0 to disable the command. The parameters in the command will be used to store the data received from the bursting slave. There can only be one slave bursting on the network at any one time. This mode can be used for faster update of data from a slave.

2.3.3 Auto-Polling

This feature is enabled by setting the AUTO-POLL CODE (in the configuration file) to a value of P (point-to-point). If the value N is entered for the parameter, the auto-poll feature is disabled. When the feature is disabled, the channel will only execute the commands enabled in the user command list. When the auto-polling mode is enabled, the module will automatically acquire data from the HART instruments attached to a channel without the use of user commands. If user commands are present and enabled when the feature is enabled, they will also be executed independent of auto-polling.

With the auto-poll feature enabled, the module automatically generates the following HART commands and stores the data in the module's database at the user-specified location:

CMD	Description
0	Read Unique Identifier
3	Read Current and Four Dynamic Variables
13	Read Tag, Descriptor and Date
14	Read PV Sensor Information
15	Read Output Information

If the unit is set for point-to-point mode, the module will automatically gather the information for the device with the polling address (short address) of zero and place the data into the database. Each device requires a 50-word database area with the format shown in the following table.

DB Byte Offset	Type	Description	Byte Cnt	Data Source	Use of Data
0	byte	Auto-polling command status bits	1	App	Status
1	byte	Last first status byte received from device	1	Resp	Status
2	byte	Last second status byte received from device	1	Resp	Status
3	byte	Manufacture ID Code	1	CMD 0	LongAddress
4	byte	Device Type Code	1	CMD 0	LongAddress
5	byte	Minimum number of preambles	1	CMD 0	Msgconstruction
6	byte	Universal Command Major Rev #	1	CMD 0	Msgchoice
7	byte	Device Revision Level	1	CMD 0	Info
8	byte	Software Revision Level	1	CMD 0	Info
9	byte	Hardware Revision Level/Physical Signaling Code	1	CMD 0	Info
10	byte	Device Flags	1	CMD 0	Info
11 to 13	byte	Device ID	3	CMD 0	Long Address
14	byte	Minimum number of preambles to be sent with the response message from the slave to the master.	1	CMD 0	
15	byte	Maximum number of device variables	1	CMD 0	Info
16 to 17	word	Configuration Change Counter	2	CMD 0	Info

DB Byte Offset	Type	Description	Byte Cnt	Data Source	Use of Data
18	byte	Extended Field Device Status	1	CMD 0	Info
19	byte	Primary variable units code	1	CMD 3	Cfg
20	byte	Secondary variable units code	1	CMD 3	Cfg
21	byte	Tertiary variable units code	1	CMD 3	Cfg
22	byte	Quaternary variable units code	1	CMD 3	Cfg
23 to 30	byte	Tag name	8	CMD 13	Info
31 to 46	byte	Descriptor	16	CMD 13	Info
47 to 49	byte	Tag/Descriptor data	3	CMD 13	Info
50 to 52	byte	Transducer serial number	3	CMD 14	Info
53	byte	Transducer limits and min span units code	1	CMD 14	Info
54	byte	PV alarm selection code	1	CMD 15	Info
55	byte	PV transfer function code	1	CMD 15	Info
56	byte	PV upper and lower range value units code	1	CMD 15	Info
57	byte	Write protection code	1	CMD 15	Status
58	byte	Private label distributor code	1	CMD 15	Info
59	byte	PV analogchannel flag	1	CMD 15	Info
		TOTAL BYTE COUNT	60		
		TOTAL WORD COUNT	30		

DB Byte Offset	Type	Description	Byte Cnt	Data Source	Use of Data
60 to 63	float	Primary variable value	4	CMD 3	Status
64 to 67	float	Secondary variable value	4	CMD 3	Status
68 to 71	float	Tertiary variable value	4	CMD 3	Status
72 to 75	float	Quaternary variable value	4	CMD 3	Status
76 to 79	float	Upper transducer limit	4	CMD 14	Cfg
80 to 83	float	Lower transducer limit	4	CMD 14	Cfg
84 to 87	float	Minimum span	4	CMD 14	Cfg
88 to 91	float	PV upper range value	4	CMD 15	Cfg
92 to 95	float	PV lower range value	4	CMD 15	Cfg
96 to 99	float	PV damping value (in seconds)	4	CMD 15	Cfg
		TOTAL FLOAT BYTE COUNT	40		
		TOTAL FLOAT WORD COUNT	20		

DB Regs/Device	50
Max DB Regs/channel for 15 Devices	750
Max DB Regs for HART Card	3000

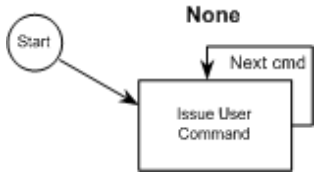
The following table defines the auto-polling command status bits:

Bit #	Description
0	Long Address Set (command 0 successful)
1	Command 13 successful (configuration)
2	Command 14 successful (configuration)
3	Command 15 successful (configuration)
4	Command 3 successful (data polling)
5	Reserved
6	Reserved
7	Reserved

The following topics describe the modes of module operation.

Auto-Poll Disabled Mode

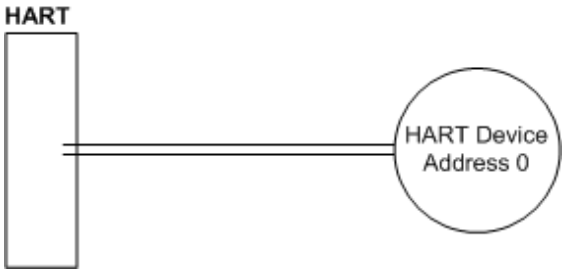
If the auto-polling feature is disabled (Auto-Poll Code = N), the module functions as shown in the following diagram:



Only the user commands are executed and all data is placed in and sourced from the module's internal database. The user is responsible for constructing all commands to control and monitor the instruments attached to the channel.

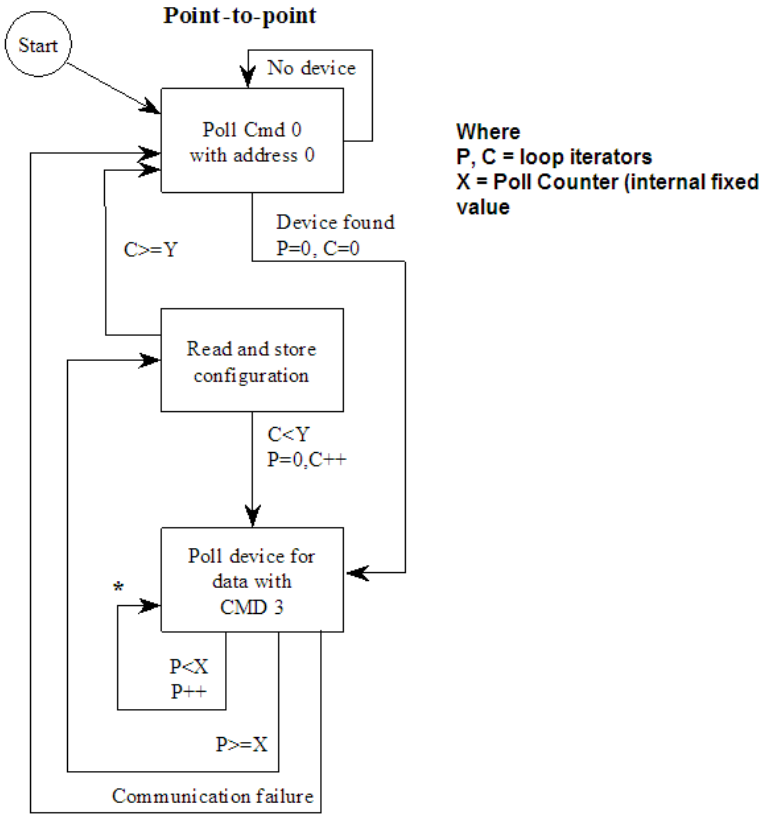
Point-to-Point Mode

Important: If the HART device address is 0 you must configure the channel for Point-to-Point mode.



In point-to-point mode, the module only polls for a single instrument with a polling address of zero. When the instrument is found by the channel, it continuously polls for the data using command 3. Occasionally, it will poll for the configuration information for the device. This is accomplished with HART commands 13, 14 and 15. Less frequently, the channel will perform a HART command 0 request to see if any of the data for the instrument has changed. If communications is lost with the device, the module will try to establish communications with the device using command 0. If user commands are present and enabled, they will be executed after each data poll.

When the point-to-point mode of auto-polling is enabled (Auto-Poll Code = P), the following diagram applies to the channel operation:



3 HART Protocol Configuration

In This Chapter

3.1 [Analog HART Card x]

3.1.1 Database Register

-1, 0 to 3984

This parameter sets the database address in the module where the following values will be placed:

- Digitized values (4 Registers)
- Counters (4 Registers)
- Scaled values (8 Registers, 4 floating values)

Counters are incremented, usually about 15 times per second, to show the number of times digital values have been scaled.

If the parameter is set to -1, these registers will not be placed in the database.

3.1.2 CHx Low

IEEE 32-bit (4-byte) floating-point numbers range in value from -3.402823e38 to 3.402823e38.

3.1.3 CHx High

IEEE 32-bit (4-byte) floating-point numbers range in value from -3.402823e38 to 3.402823e38.

These are user-defined scaling values to convert 4mA-20mA value to engineering units. All values are provided as digitized values and scaled values in the module database and are placed by the user if the Database Register (page 25) value is used.

For example, to disable these scaled values on all channels, enter a value of 0 (zero) for the CH Low and CH High. You may also disable one at a time.

If you enter 0 to 1000, these will be scaled:

- 4.0mA will be scaled to a value of zero (0)
- 20.0 mA will be scaled to a value of 1000

and so on.

3.2 [HART PORT x]

The configuration file sections [HART PORT 0] through [HART PORT 3] (for 4 channel modules) or [HART PORT 0] through [HART PORT 7] (for 8 channel modules) set HART channel communication parameters, define the protocol specific parameters, and set the command list parameters. The parameters are the same for all channels. The command list parameters for each HART channel are entered in a different section in the configuration file.

3.2.1 Enabled

Y or N

This parameter enables or disables the specific HART channel. If the parameter is set to "Y", the channel will be utilized. If set to "N", the channel will not be used.

3.2.2 Preambles

2 to 50

This parameter defines the number of 0xFF characters (preambles) that will be placed at the start of each HART frames.

3.2.3 Primary Master

Yes or No

This parameter specifies the Link Quiet / Slave Timeout. If set to Yes, the selected Link Quiet / Slave Timeout is 305 milliseconds which corresponds to the Primary Master. If set to No, then this time is 380 milliseconds which corresponds to the Secondary Master.

3.2.4 Retry Count

0 to 10

This parameter sets the number of retries for a command if the command response is not received from the slave device. This parameter is normally set to a value of 3. The module will accept values of 0 to 10.

3.2.5 DB Address Status

-1, 0 to 3999

This parameter is utilized to set the database address in the module where the status word for the channel will be placed. If the parameter is set to -1, the word value will not be placed in the database. If a value from 0 to 3999 is set for the parameter, the status word for the channel will be placed at the specified database offset. This word is bit mapped with each bit representing a slave device. The bit will be set if slave device has a communication error.

3.2.6 Command Count

0 to 99

This parameter sets the number of user commands to be utilized. The first command in the list is always reserved for the auto-poll command so the user should configure this value considering one command for the auto-poll. For example, if the user configures two commands, the command count parameter should be set as 3. This parameter can be set from 0 to 99. If the parameter is set to a value other than 0, commands should be present in the [HART PORT x COMMANDS] section.

3.2.7 Auto-Poll Code

p2p or Not used

This parameter sets the auto-poll mode of the channel. If the parameter is set to "p2p", the module will automatically poll device 0 in point-to-point mode. If the parameter is set to "Not used", the auto-polling option will be disabled and only commands in the command list will be utilized for the channel. In the auto-poll mode, the module will automatically execute HART commands 0, 3, 13, 14, and 15.

3.2.8 Auto-Poll DB Address

0 to 3700

This parameter sets the starting address for the data obtained by the auto-poll feature. Each device on a channel requires 50 words in the database. The data area selected must not overlap any portion of the database used by other channels or the module.

3.2.9 Auto-Poll Swap Float

0 to 3

This parameter swaps the floating-point data values received by the auto-poll feature.

Swap Code	Description
0	None - No Change is made in the byte ordering (1234 = 1234)
1	Words - The words are swapped (1234=3412)
2	Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)
3	Bytes - The bytes in each word are swapped (1234=2143)

Depending on the host processor using the data, the proper swap code must be utilized to present the data in the correct format.

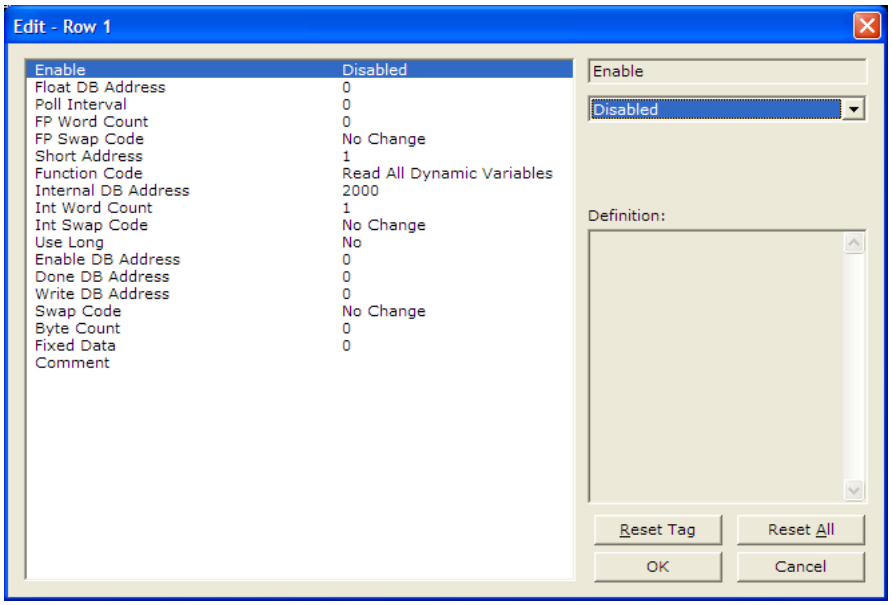
3.2.10 Max Device Count

1 to 15

This parameter sets the maximum number of slave devices to be utilized for the auto-poll feature. In point-to-point mode, the parameter should be set to a value of 1.

3.3 [HART PORT x COMMANDS]

The [HART PORT *x* COMMANDS] sections of the configuration file contain the user-defined HART command lists for each channel. The commands in these lists are sent to slave devices attached to the HART channels. The module supports up to 100 commands per channel.



3.3.1 Command List Overview

The ProSoft HART module uses a command list to interface with HART slave devices. The commands in the list specify

- the slave device to be addressed
- the function to be performed (read or write)
- the registers in the internal database to be associated with the device data.

There is a separate command list for each HART channel, with up to 100 commands allowed per channel. The command list is processed from top (Command #0) to bottom (Command #99), then the process is repeated.

A poll interval parameter is associated with each command to specify a minimum delay time in seconds between the issuance of a command. For example, a poll interval of 10 executes the command no more frequently than every 10 seconds.

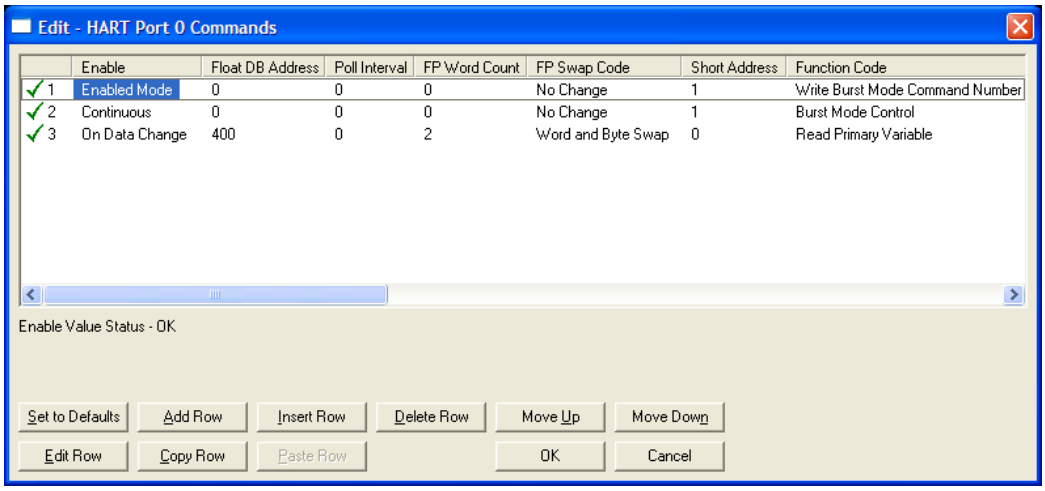
Write commands have a special feature, as they can be set to execute only if the data in the write command changes. If the register data values in the command have not changed since the command was last issued, the command will not be executed. If the data in the command has changed since the command was last issued, the command will be executed. Use of this feature can lighten the load on the HART network. In order to implement this feature, set the enable code for the command to a value of 2.

The module supports all the Universal (page 39) and Common Practice (page 52) commands, as well as device specific commands. A Device Specific command is supported without any translation of the data.

3.3.2 HART Command Entry Formats

Refer to the Reference (page 38, page 39, page 27) chapter for a complete discussion of the HART commands supported by the module, and the structure and content of the data returned for each command.

The following illustration shows a command list section of the configuration file:



3.3.3 Enable

0, 1, 2, 3, 4, 5

This field defines whether the command is to be executed and under what conditions.

Code	Description
0	The command is disabled and will not be executed in the normal polling sequence. This can be used to process a command from a bursting slave device.
1	Causes the command to be executed each scan of the command list if the Poll Interval Time is set to zero. If the Poll Interval time is set, the command will be executed, when the interval timer expires.
2	The command will execute only if the internal data associated with the command changes. This value is valid only when there is a specified "Write DB Address" (see below) with a non zero byte count for write commands.
3	The HART module will send the command if either the ProSoft HART module OR the HART device is powered up. This is mainly used for configuration of HART devices on startup.
4	Places the command in enabled mode. This option is valid only if there is a specified "Enabled DB Address" (see below). If the Virtual Database word specified in "Enabled DB Address" has "-1" the command will be executed otherwise it will not.
5	Places the command in one shot enabled mode. This option is valid only if there is a specified "Enabled DB Address" (see below). If the Virtual Database word specified in "Enabled DB Address" has a value of "-1" the command will be executed otherwise it will not. When the command has been successful the Virtual Database word specified in "Enabled DB Address" will be written with "0", so the command will be executed only once.

Refer to Command Enable Control Block (9902) and Command Disable Control Block (9903) for more information on how to use the enable code.

3.3.4 Float DB Address

0 to 3998

This field specifies the internal database register where the floating point values returned by the command will be placed.

3.3.5 Poll Interval

0 TO 65535

This parameter specifies the minimum interval between executions of a continuous commands (*Enable* code of 1). The value is in seconds. Therefore, if a value of 10 is entered, the command will execute no more frequently than once every 10 seconds.

3.3.6 FP Word Count

-1 to 125

This parameter specifies the number of words from the floating point data returned by a HART command that will be placed on the Virtual Database. If this parameter is 0 no data will be written to the Database. If this parameter is -1 then all the floating point data will be written in the integer block of data.

Special care should be taken with this number, because is a word count and a floating point value is 2 words long. For example if you execute a HART command 3 which takes 5 floating point values from the device, you should place a word count of 10 words.

3.3.7 Swap Code

0, 1, 2, 3

This parameter defines the byte order of each four-byte group of data received. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard byte order for storing these data types. The following table describes the values and their associated operations:

Swap Code	Description
0	None - No Change is made in the byte ordering (1234 = 1234)
1	Words - The words are swapped (1234=3412)
2	Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)
3	Bytes - The bytes in each word are swapped (1234=2143)

3.3.8 Short Address

0 = Point-to-Point Mode (only)

This parameter specifies the HART slave node address on the network to which the command will be sent. Since the Analog module supports only point-to-point mode (no multi-point support), only the value of 0 is permitted for this parameter. If the device to be addressed only accepts long address, then the parameter "Use Long" should be selected so the module can ask for the long address with the short one and then execute the command.

3.3.9 Function Code

0 to 255

This parameter specifies the HART function to be executed. Any HART function can be executed, even device specific ones, but only supported commands will return formatted data and classified in floating point data and integer data.

3.3.10 Int. DB Address

0 to 3999

This field specifies the internal database register where the integer or packed ASCII string values returned by the command will be placed.

If the Floating Point Word Count parameter is "-1", then all the data returned by the HART command will be placed in this address without any formatting.

3.3.11 Int Word Count

0 to 125

This parameter specifies the number of words from the integer or packed ASCII string data returned by a HART command that will be placed on the Virtual Database. If this parameter is "0", no data will be written to the Database.

3.3.12 Swap Code

0, 1, 2, 3

This parameter defines the byte order of each four-byte group of data received. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard byte order for storing these data types. The following table describes the values and their associated operations:

Swap Code	Description
0	None - No Change is made in the byte ordering (1234 = 1234)
1	Words - The words are swapped (1234=3412)
2	Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)
3	Bytes - The bytes in each word are swapped (1234=2143)

3.3.13 Use Long

0 or 1

This parameter defines if the command will be executed with short or long address. If the value is "0", then the configured command will be executed using the Short Address specified. If the value is "1" then the specified Short Address will be used only to ask for the long address and that will be used to execute the configured command.

3.3.14 Enable DB Address

0 to 3999

This field specifies the internal database register to be used to enable the execution of a command. This parameter is only used if "Enable" is "4" or "5". If the value of this database register is "-1", then the command will be executed, otherwise it will not. If the "Enable" value is "5", then after the successful execution of the command this value will become "0"

3.3.15 Done DB Address

-1 to 3999

This field specifies the internal database register to be used to signal the successful execution of a command. When a command is successfully executed a "-1" is written to this register. This "Done DB Address" can be shared with the "Enable DB Address" of another command to do a chained command execution.

3.3.16 Write DB Address

-1 to 3999

This field specifies the internal database register to be as a source of data for HART command which includes data. It is possible to include data with every HART command, but it depends of the command and of the device if it will accept this data.

If this value is "-1", it indicates that there will not be data with the command or that it will not come from database.

3.3.17 Swap Code

0, 1, 2, 3

This parameter defines the byte order of each four-byte group of data received. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard byte order for storing these data types. The following table describes the values and their associated operations:

Swap Code	Description
0	None - No Change is made in the byte ordering (1234 = 1234)
1	Words - The words are swapped (1234=3412)
2	Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)
3	Bytes - The bytes in each word are swapped (1234=2143)

3.3.18 Byte Count

0 to 250

This parameter specifies the number of bytes to be sent to a HART device in the command. If the command has no data then this value should be "0".

If the value of this field is different of "0" and "Write DB Address" is different of "-1" then the data for the command will be taken from the Virtual Database. If the value of this field is different of "0" and "Write DB Address" is "-1" then the data for the command will be from the "Fixed Data" field for the command.

3.3.19 Fixed Data

Up to 250 HEX values separated by space

This parameter is a string of HEX values to be sent with the HART command. There should be at least the number of bytes specified in the "Byte Count" parameter. The bytes should be written in hexadecimal format and separated by a space. This data will be sent if the Parameter "Write DB Address" is "-1" and "Byte Count" is greater than "0", and it will be sent in the same order that they are written.

3.4 Using the CommonNet Data Map

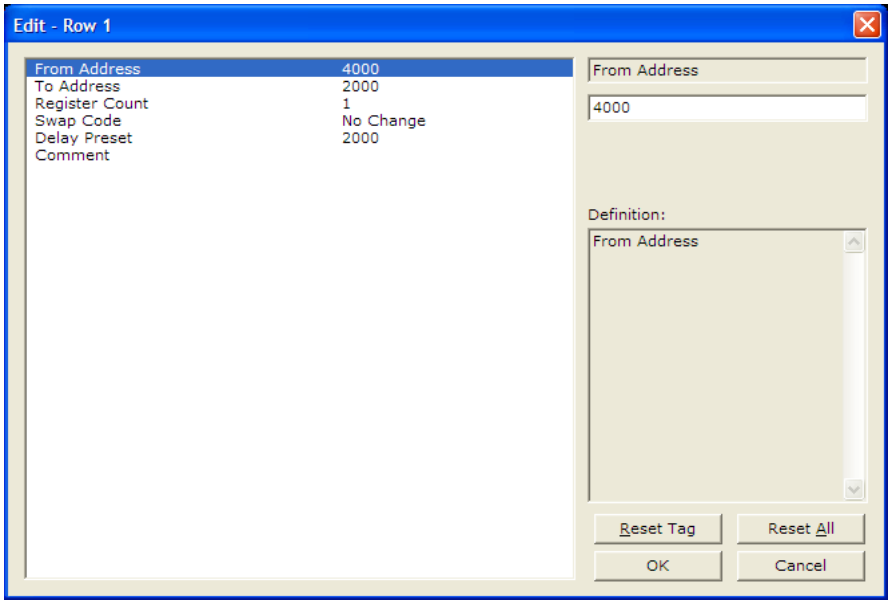
The *Data Map* section allows you to copy data between areas in the module's internal database.

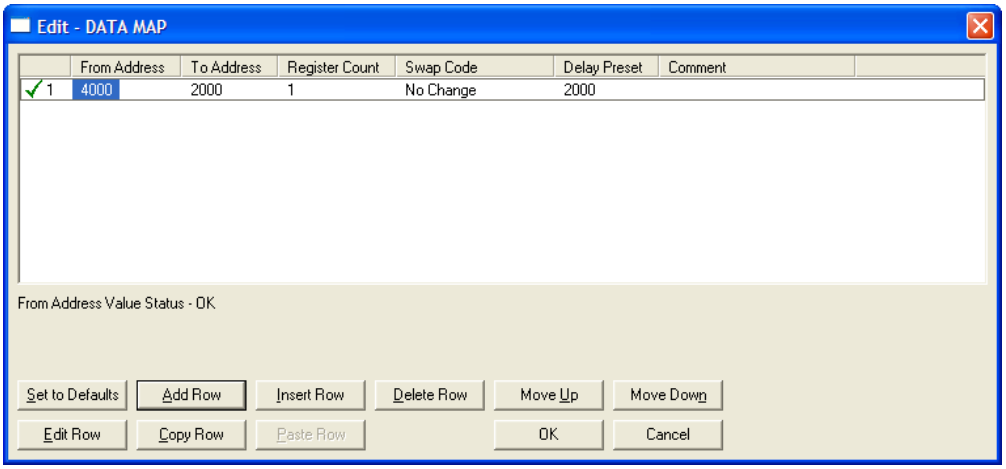
You can copy a maximum of 100 registers per *Data Map* command, and you can configure a maximum of 200 separate copy commands.

You can copy data from the error or status tables in upper memory to internal database registers in the *User Data memory* area.

You can rearrange the byte and/or word order during the copy process. For example, by rearranging byte or word order, you can convert floating-point values to the correct format for a different protocol.

You can also use the *Data Map* to condense widely dispersed data into one contiguous data block, making it easier to access.





3.4.1 Internal Database Re-mapping

Depending on the application, you may need to copy data from one section of the module's internal database to another section. The **[Data Map]** section of the CFG file allows a user to selectively copy data registers, one register up to 100 registers at a time, from one internal database to another. Up to 200 entries can be made in the **[Data Map]** section, providing a wide and powerful range of functionality.

3.4.2 From Address

0 to 3999

This field specifies the internal database register to copy from. This address can range from the Data area as well as the Status Data Area of the product

3.4.3 To Address

0 to 3999

The destination for the copy is always going to be the Register Data area.

3.4.4 Register Count

1 to 100

This parameter specifies the number of registers to copy.

3.4.5 Swap Code

0, 1, 2, 3

There may be a need to swap the order of the bytes in the registers during the copy process in order to change from alignment of bytes between dissimilar protocols. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard method of storage of these data types in slave devices.

The following table defines the values and their associated operations:

Swap Code	Description
0	None - No Change is made in the byte ordering (1234 = 1234)
1	Words - The words are swapped (1234=3412)
2	Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)
3	Bytes - The bytes in each word are swapped (1234=2143)

3.4.6 Delay Preset

This parameter sets an interval for each *Data Map* copy operation. The value you put for the *Delay Preset* is not a fixed amount of time. It is the number of firmware scans that must transpire between copy operations.

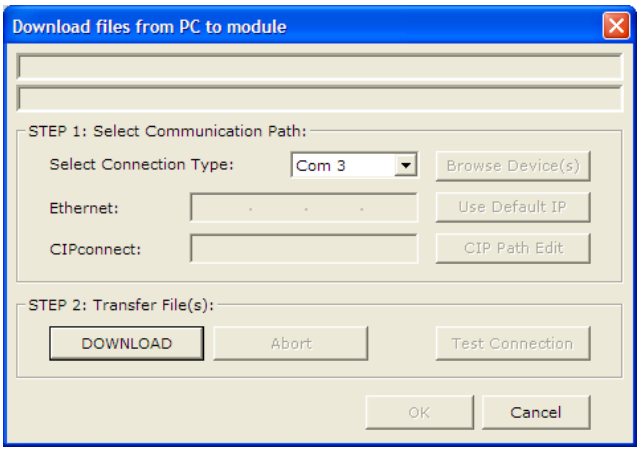
The firmware scan cycle can take a variable amount of time, depending on the level of activity of the protocol drivers running on the ProLinx gateway and the level of activity on the gateway's communication ports. Each firmware scan can take from 1 to several milliseconds to complete. Therefore, *Data Map* copy operations cannot be expected to happen at regular intervals.

If multiple copy operations (several rows in the *Data map* section) happen too frequently or all happen in the same update interval, they could delay the process scan of the gateway protocols, which could result in slow data updates or missed data on communication ports. To avoid these potential problems, you should set the *Delay Preset* to different values for each row in the *Data Map* section and set them to higher, rather than lower, numbers.

For example, *Delay Preset* values below 1000 could begin to cause a noticeable delay in data updates through the communication ports. And you should not set all *Delay Presets* to the same value. Instead, use different values for each row in the Data Map such as 1000, 1001, and 1002 or any other different *Delay Preset* values you like. This will prevent the copies from happening concurrently and prevent possible process scan delays.

3.5 Downloading a File from PC to the Module

1. Use a null-modem serial cable to connected the serial COM port on your PC and the Debug/Configuration serial port on the module.
2. Open the **PROJECT** menu, and then choose **MODULE.**
3. On the **MODULE** menu, choose **DOWNLOAD.** Wait while ProSoft Configuration scans for communication ports on your PC. When the scan is complete, the *Download* dialog box opens.



4. Select the **PORT** to use for the download.
5. Click the **DOWNLOAD** button.

4 Reference

In This Chapter

4.1 HART Universal Commands

COMMAND 00 - Read Unique Identifier

Description

This command gets the long address of the HART device plus other manufacturer information like Manufacturer ID, Device Type Code, Software Revision, Hardware Revision, and so on.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Constant "254"	Manufacturer Identification Code
2	Manufacturer Device Type Code	Number of Preambles
3	Universal Command Revision	Transmitter Specific Command Revision
4	Software Revision	Hardware Revision
5	Device Function Flags	Device ID Number 1
6	Device ID Number 2	Device ID Number 3

COMMAND 01 - Read Primary Variable

Description

This command gets the device Primary Variable and the Primary Variable Units

Write Parameters

NONE

Floating Point Data Returned

Word	High Byte	Low Byte
0	Primary Variable Value	
1		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Primary Variable Units Code	0

COMMAND 02 - Read Current And Percent Of Range

Description

This command gets the current of the loop that is forced by the HART device and the Percent of Range of the Current.

Write Parameters

NONE

Floating Point Data Returned

Word	High Byte	Low Byte
0	Current (mA)	
1		
2	Percent of Range	
3		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 03 - Read Dynamic Variables

Description

This command gets the current and four (predefined) dynamic Variables.

Write Parameters

NONE

Floating Point Data Returned

Word	High Byte	Low Byte
0	Current (mA)	
1		
2	Primary Variable	
3		
4	Second Variable	
5		
6	Third Variable	
7		
8	Fourth Variable	
9		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Primary Variable Units Code	Second Variable Units Code
2	Third Variable Units Code	Fourth Variable Units Code

COMMAND 06 - Write Polling Address

Description

This command sets the polling address of a HART device. Extreme care should be taken when you use this command because you can loose the communication with the device.

Write Parameters

Word	High Byte	Low Byte
0	Polling Address	Polling Address

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Polling Address	0

COMMAND 12 - Read Message

Description

This command reads an ASCII message contained in the HART Device and written by the Write Message command 17.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Message ASCII Character 0	Message ASCII Character 1
2	Message ASCII Character 2	Message ASCII Character 3
.	.	
.	.	
.	.	
14	Message ASCII Character 28	Message ASCII Character 29
15	Message ASCII Character 30	Message ASCII Character 31

COMMAND 13 - Read Tag, Descriptor and Date

Description

This command reads an ASCII Tag which identifies the device, an ASCII descriptor of the device and the last Date it has been configured.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	TAG ASCII Character 0	TAG ASCII Character 1
2	TAG ASCII Character 2	TAG ASCII Character 3
3	TAG ASCII Character 4	TAG ASCII Character 5
4	TAG ASCII Character 6	TAG ASCII Character 7
5	Descriptor ASCII Character 0	Message ASCII Character 1
.	.	
.	.	
.	.	
12	Descriptor ASCII Character 14	Message ASCII Character 15
13	Date	Date
14	Date	0

COMMAND 14 - Read PV Sensor Info

Description

This command gets information about the Primary Variable sensor, like limits and span.

Write Parameters

NONE

Floating Point Data Returned

Word	High Byte	Low Byte
0	Upper Sensor Limit	
1		
2	Lower Sensor Limit	
3		
4	Minimum Span	
5		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Sensor Serial Number 0	Sensor Serial Number 1
2	Sensor Serial Number 2	Unit Codes for Sensor Limits and Span

COMMAND 15 - Read Output Information

Description

This command gets information about the Primary Variable Output Information.

Write Parameters

NONE

Floating Point Data Returned

Word	High Byte	Low Byte
0	Upper Range Value	
1		
2	Lower Range Value	
3		
4	Damping Value (Sec)	
5		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Alarm Select Code	Transfer Function Code
2	Primary Variable Range Units Code	Write-Protect Code
2	Private-Label Distributor Code	0

COMMAND 16 - Read Final Assembly Number

Description

This command reads the final assembly number of the HART device.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Final Assembly Number 0	Final Assembly Number 1
2	Final Assembly Number 2	0

COMMAND 17 - Write Message

Description

This command writes an ASCII message contained in the HART Device and that can be read with command 12.

Write Parameters

Word	High Byte	Low Byte
0	Packed ASCII Message Byte 0	Packed ASCII Message Byte 1
1	Packed ASCII Message Byte 2	Packed ASCII Message Byte 3
.	.	
.	.	
.	.	
11	Packed ASCII Message Byte 22	Packed ASCII Message Byte 23

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 18 - Write Tag, Descriptor and Date

Description

This command writes an ASCII Tag which identifies the device, an ASCII descriptor of the device and the last Date it has been configured.

Write Parameters

Word	High Byte	Low Byte
0	Packed ASCII TAG Byte 0	Packed ASCII TAG Byte 1
1	Packed ASCII TAG Byte 2	Packed ASCII TAG Byte 3
2	Packed ASCII TAG Byte 4	Packed ASCII TAG Byte 5
3	Packed ASCII Descriptor Byte 0	Packed ASCII Descriptor Byte 1
.	.	
.	.	
.	.	
8	Packed ASCII Descriptor Byte 10	Packed ASCII Descriptor Byte 11
9	Date	Date
10	Date	0

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	TAG ASCII Character 0	TAG ASCII Character 1
2	TAG ASCII Character 2	TAG ASCII Character 3
3	TAG ASCII Character 4	TAG ASCII Character 5
4	TAG ASCII Character 6	TAG ASCII Character 7
5	Descriptor ASCII Character 0	Message ASCII Character 1
.	.	
.	.	
.	.	
12	Descriptor ASCII Character 14	Message ASCII Character 15
13	Date	Date
14	Date	0

COMMAND 19 - Write Final Assembly Number

Description

This command writes the final assembly number of the HART device.

Write Parameters

Word	High Byte	Low Byte
0	Final Assembly Number 0	Final Assembly Number 1
1	Final Assembly Number 2	Final Assembly Number 2

Floating Point Data Returned:

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Final Assembly Number 0	Final Assembly Number 1
2	Final Assembly Number 2	0

4.2 HART Common Practice Commands

COMMAND 33 - Read Transmitter Variables

Description

This command gets four user selected dynamic Variables.

Write Parameters

Word	High Byte	Low Byte
0	Transmitter Variable Code For Slot 0	Transmitter Variable Code For Slot 1
1	Transmitter Variable Code For Slot 2	Transmitter Variable Code For Slot 3

Floating Point Data Returned

Word	High Byte	Low Byte
0	Variable for Slot 0	
1		
2	Variable for Slot 0	
3		
4	Variable for Slot 2	
5		
6	Variable for Slot 3	
7		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Transmitter Variable Code For Slot 0	Units Code for Slot 0 Variable
2	Transmitter Variable Code For Slot 1	Units Code for Slot 1 Variable
3	Transmitter Variable Code For Slot 2	Units Code for Slot 2 Variable
4	Transmitter Variable Code For Slot 3	Units Code for Slot 3 Variable

COMMAND 34 - Write Damping Value

Description

This command writes the damping value of a HART device.

Write Parameters

Word	High Byte	Low Byte
0	Floating Point Damping Value (Sec)	
1		

Floating Point Data Returned

Word	High Byte	Low Byte
0	Floating Point Damping Value (Sec)	
1		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 35 - Write Range Values

Description

This command writes the Upper and Lower range of the Primary Variable

Write Parameters

Word	High Byte	Low Byte
0	Range Units Code	Floating Point Upper Range Value (Byte 0)
1	Floating Point Upper Range Value (Byte 1)	Floating Point Upper Range Value (Byte 2)
2	Floating Point Upper Range Value (Byte 3)	Floating Point Lower Range Value (Byte 0)
3	Floating Point Lower Range Value (Byte 1)	Floating Point Lower Range Value (Byte 2)
4	Floating Point Lower Range Value (Byte 3)	Floating Point Lower Range Value (Byte 3)

Floating Point Data Returned

Word	High Byte	Low Byte
0	Upper Range Value	
1		
2	Lower Range Value	
3		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Range Units Code	0

COMMAND 36 - Set Upper Range Value

Description

This command is similar in effect to push the SPAN button of the HART device but doing it remotely through the HART network.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 37 - Set Lower Range Value

Description

This command is similar in effect to push the ZERO button of the HART device but doing it remotely through the HART network.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 38 - Reset Configuration Changed Flag

Description

This command resets the status bit that indicates that configuration has been changed.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 39 - EEPROM Control

Description

This command operates over the EEPROM changing its settings.

Write Parameters

Word	High Byte	Low Byte
0	EEPROM Control Code	EEPROM Control Code

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	EEPROM Control Code	0

COMMAND 40 - Enter Exit Fixed Current Mode

Description

This command writes the damping value of a HART device.

Write Parameters

Word	High Byte	Low Byte
0	Floating Point Current (mA)	
1		

Floating Point Data Returned

Word	High Byte	Low Byte
0	Floating Point Current (mA)	
1		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 41 - Perform Transmitter Self Test

Description

This command starts the HART device Self Test to find if there is any problem with the device hardware.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 42 - Perform Master Reset

Description

This command performs a master reset in the HART device.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 43 - Set PV Zero

Description

This command forces the Primary Value to Zero.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 44 - Write PV Units

Description

This command changes the setting of the Primary Variable units.

Write Parameters

Word	High Byte	Low Byte
0	Primary Variable Units Code	Primary Variable Units Code

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Primary Variable Units Code	0

COMMAND 45 - Trim DAC Zero

Description

This command calibrates the device Digital to analog converter zero. This is done by writing the same current value that is measured in the loop.

Write Parameters

Word	High Byte	Low Byte
0	Floating Point measured current (mA)	
1		

Floating Point Data Returned

Word	High Byte	Low Byte
0	Floating Point Current (mA)	
1		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 46 - Trim DAC Gain

Description

This command calibrates the device Digital to analog converter gain. This is done by writing the same current value that is measured in the loop.

Write Parameters

Word	High Byte	Low Byte
0	Floating Point Measured Current (mA)	
1		

Floating Point Data Returned

Word	High Byte	Low Byte
0	Floating Point Current (mA)	
1		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	

COMMAND 47 - Write Transfer Function

Description

This command changes the setting of the Transfer Function of the HART device.

Write Parameters

Word	High Byte	Low Byte
0	Transfer Function Code	Transfer Function Code

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Transfer Function Code	0

COMMAND 48 - Read Additional Transmitter Status

Description

This command gets extended information about the status of the Transmitter. This information is specific for each transmitter.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Additional Status (Byte 0)	Additional Status (Byte 1)
2	Additional Status (Byte 2)	Additional Status (Byte 3)
.	.	
.	.	
.	.	
13	Additional Status (Byte 24)	0

COMMAND 49 - Write PV Sensor Serial Number

Description

This command changes the sensor serial number of the Primary Variable.

Write Parameters

Word	High Byte	Low Byte
0	Sensor Serial Number (Byte 0)	Sensor Serial Number (Byte 1)
1	Sensor Serial Number (Byte 2)	Sensor Serial Number (Byte 2)

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Sensor Serial Number (Byte 0)	Sensor Serial Number (Byte 1)
2	Sensor Serial Number (Byte 2)	0

COMMAND 50 - Read Dynamic Variable Assignments

Description

This command gets the actual assignment of the Dynamic Variables returned with command 3.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Transmitter Variable Code For Primary Variable	Transmitter Variable Code For Second Variable
2	Transmitter Variable Code For Third Variable	Transmitter Variable Code For Fourth Variable

COMMAND 51 - Write Dynamic Variable Assignments

Description

This command sets the assignment of the Dynamic Variables returned with command 3.

Write Parameters

Word	High Byte	Low Byte
0	Transmitter Variable Code For Primary Variable	Transmitter Variable Code For Second Variable
1	Transmitter Variable Code For Third Variable	Transmitter Variable Code For Fourth Variable

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Transmitter Variable Code For Primary Variable	Transmitter Variable Code For Second Variable
2	Transmitter Variable Code For Third Variable	Transmitter Variable Code For Fourth Variable

COMMAND 52 - Set Transmitter Variable Zero

Description

This command forces a selected transmitter variable to zero.

Write Parameters

Word	High Byte	Low Byte
0	Transmitter Variable Code	Transmitter Variable Code

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Primary Variable Units Code	0

COMMAND 53 - Write Transmitter Variable Units

Description

This command changes a selected transmitter variable unit.

Write Parameters:

Word	High Byte	Low Byte
0	Transmitter Variable Code	Transmitter Variable Units Code

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Primary Variable Units Code	Transmitter Variable Units Code

COMMAND 54 - Read Transmitter Variable Information

Description

This command gets information about any selected transmitter variable sensor.

Write Parameters

Word	High Byte	Low Byte
0	Transmitter Variable Code	Transmitter Variable Code

Floating Point Data Returned

Word	High Byte	Low Byte
0	Transmitter Variable Upper Limit	
1		
2	Transmitter Variable Lower Limit	
3		
4	Transmitter Variable Damping Value (Sec)	
5		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Transmitter Variable Code	Sensor Serial Number 0
1	Sensor Serial Number 1	Sensor Serial Number 2
2	Unit Code for Limits	0

COMMAND 55 - Write Transmitter Variable Damping Value

Description

This command writes the Damping Value of a user selected transmitter variable.

Write Parameters

Word	High Byte	Low Byte
0	Transmitter Variable Code	Transmitter Variable Damping Value (Byte 0)
1	Transmitter Variable Damping Value (Byte 1)	Transmitter Variable Damping Value (Byte 2)
2	Transmitter Variable Damping Value (Byte 3)	Transmitter Variable Damping Value (Byte 3)

Floating Point Data Returned

Word	High Byte	Low Byte
0	Transmitter Variable Damping Value	
1		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Transmitter Variable Code	0

COMMAND 56 - Write Transmitter Variable Sensor Serial Number

Description

This command writes the Serial Number of a user selected transmitter variable.

Write Parameters

Word	High Byte	Low Byte
0	Transmitter Variable Code	Transmitter Variable Sensor Serial Number (Byte 0)
1	Transmitter Variable Sensor Serial Number (Byte 1)	Transmitter Variable Sensor Serial Number (Byte 2)

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Transmitter Variable Code	Transmitter Variable Sensor Serial Number (Byte 0)
2	Transmitter Variable Sensor Serial Number (Byte 1)	Transmitter Variable Sensor Serial Number (Byte 2)

COMMAND 57 - Read Unit Tag Descriptor Date

Description

This command reads an ASCII Tag which identifies the device, an ASCII descriptor of the device and the last Date it has been configured.

Write Parameters

NONE

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	TAG ASCII Character 0	TAG ASCII Character 1
2	TAG ASCII Character 2	TAG ASCII Character 3
3	TAG ASCII Character 4	TAG ASCII Character 5
4	TAG ASCII Character 6	TAG ASCII Character 7
5	Descriptor ASCII Character 0	Message ASCII Character 1
.	.	
.	.	
.	.	
12	Descriptor ASCII Character 14	Message ASCII Character 15
13	Date	Date
14	Date	0

COMMAND 58 - Write Unit Tag Descriptor Date

Description

This command writes an ASCII Tag which identifies the device, an ASCII descriptor of the device and the last Date it has been configured.

Write Parameters:

Word	High Byte	Low Byte
0	Packed ASCII TAG Byte 0	Packed ASCII TAG Byte 1
1	Packed ASCII TAG Byte 2	Packed ASCII TAG Byte 3
2	Packed ASCII TAG Byte 4	Packed ASCII TAG Byte 5
3	Packed ASCII Descriptor Byte 0	Packed ASCII Descriptor Byte 1
.	.	
.	.	
.	.	
8	Packed ASCII Descriptor Byte 10	Packed ASCII Descriptor Byte 11
9	Date	Date
10	Date	0

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	TAG ASCII Character 0	TAG ASCII Character 1
2	TAG ASCII Character 2	TAG ASCII Character 3
3	TAG ASCII Character 4	TAG ASCII Character 5
4	TAG ASCII Character 6	TAG ASCII Character 7
5	Descriptor ASCII Character 0	Message ASCII Character 1
.	.	
.	.	
.	.	
12	Descriptor ASCII Character 14	Message ASCII Character 15
13	Date	Date
14	Date	0

COMMAND 59 - Write Number Of Response Preambles

Description

This command sets the number of preambles that the HART slave will use in every command response.

Write Parameters

Word	High Byte	Low Byte
0	Number of Response Preambles	Number of Response Preambles

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Number of Response Preambles	0

COMMAND 108 - Write Burst Mode Command Number

Description

This command sets the command number that the HART device will use in Burst Mode.

Write Parameters

Word	High Byte	Low Byte
0	Burst Mode Command Number	Burst Mode Command Number

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Burst Mode Command Number	0

COMMAND 109 - Burst Mode Control

Description

This command sets the HART device Burst Mode.

Write Parameters

Word	High Byte	Low Byte
0	Burst Mode Control Code	Burst Mode Control Code

Floating Point Data Returned

NONE

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Burst Mode Control Code	0

1 = ON

0 = Off

COMMAND 110 - Read All Dynamic Variables

Description

This command gets all dynamic Variables.

Write Parameters

NONE

Floating Point Data Returned

Word	High Byte	Low Byte
0	Primary Variable	
1		
2	Second Variable	
3		
4	Third Variable	
5		
6	Fourth Variable	
7		

Integer Data Returned

Word	High Byte	Low Byte
0	STATUS WORD	
1	Primary Variable Units Code	Second Variable Units Code
2	Third Variable Units Code	Fourth Variable Units Code

4.3 Error/Status Data

The module error/status data areas are discussed in this section. The module contains three areas related to this data. The user defines the location of these data sets in the virtual database of the module. The error/status data contains module data, the six command error list data sets contain the errors associated with each respective command list and the four slave status list tables contain the communication status of each port's slave devices.

4.3.1 Viewing Error and Status Data

The word addresses in the following topics are virtual addresses. To view the contents of these registers, use the Data Map section (page 34) of the module configuration file to map these values into the 4000-word database or use the Diagnostics menus in *ProSoft Configuration Builder (PCB)*. Refer to the *ProLinx Reference Guide* for detailed information on viewing error and status registers.

4.3.2 Status Data Mapping Addresses (HART Channels 0 through 7)

The following table lists the register address ranges for HART Channels 0 through 7. The status values are listed in the same order for every channel. The first eleven (11) registers in each range are used to hold general channel status data. The last 100 registers in each range are used to hold the Command Status/Error List for that channel.

Port	Address Range
0	10700 to 10899
1	10900 to 11099
2	11100 to 11299
3	11300 to 11499
4	11500 to 11699
5	11700 to 11899
6	11900 to 12099
7	12100 to 12299

HART Channel 0 Status Data Map

This table lists the status register addresses and status descriptions for HART Channel 0. Status values are listed in the same order for all installed HART channels (four or eight.) Address ranges for HART Channels 0 through 7 are listed in Status Data Mapping Addresses (page 82).

Status Register	Name	Description
10700	State	Channel 0 state machine value (used for debugging) 0 Polling 1 Config 2 Data Poll 3 User Poll 4 Wait Unique ID

Status Register	Name	Description
10701	Comm State	Channel 0 communication state machine value (used for debugging) 0 Startup 1 Idle 2 Transmit Pending 3 Transmit 4 Receive 5 Post Transmit 6 Idle, Waiting
10702	Device Status (bit mapped)	Each bit in this word corresponds to a slave address on the network starting at bit 1 for slave address 1. Bit 0 is not used. If the bit is set, the slave is in error. If the bit is clear (0), the slave is not in error.
10703	Device Poll List (bit mapped)	Each bit in this word corresponds to a slave address on the network starting at bit 1 for slave address 1. Bit 0 is not used. If the bit is set, the slave is in the poll list. If the bit is clear (0), the slave is not in the poll list.
10704	Device With Long Address (bit map)	Each bit in this word corresponds to a slave address on the network starting at bit 1 for slave address 1. Bit 0 is not used. If the bit is set, the slave uses the long address. If the bit is clear (0), the slave does not use the long address.
10705	Current Command	This field contains the index of the current command to execute.
10706	Command Request Count	This field contains the total number of request messages issued on the port.
10707	Command Response Count	This field contains the total number of response messages received from devices on the network.
10708	Configuration Error Word	Configuration error word (see HART Configuration Error Word (page 86))
10709	Current Error Code	Current error code for port
10710	Last Error Code	Last error code reported for port
10711	No Valid Data	
…		
10799		

Status Register	Description
10800	Command List Status and Errors
…	
10899	

HART Command List Error Data

Each command in the command list for each HART channel has a word value for a status/error code. This error data list can be read using the Configuration/Debug Port and can be placed in the module's internal database. Accessing the Debug capabilities of the module is accomplished easily by connecting a PC to the Debug port and loading a terminal program such as ProSoft Configuration Builder or HyperTerminal.

This status/error code is the first word of the Integer Data Block returned from every HART command executed. This word has information about the execution of the command by the HART device.

Refer to sections containing Error Codes to interpret the status/error codes present in the integer data area.

Module Error Codes

Error codes returned from the HART device are placed at the first word of the integer data block in the Virtual Database. The error codes are formatted in the word as follows: If the most-significant bit of the word contains "1", then the most significant byte has a communication error code. The least-significant byte of the word will contain "0".

If the most-significant bit of the word contains "0", the most significant byte contains a command error code. In this case, the least-significant byte contains a device malfunction information.

If this word value is "-1" (or 0xFFFF), it means that the command timed out.

Use the error codes returned for each command in the list to determine the success or failure of the command. If the command fails, use the error code to determine the cause of failure.

Protocol Error Codes

These are error codes that are part of the HART protocol. The standard HART error codes are shown in the following tables:

Error Code Word

First Byte								Second Byte							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Bit 7 of First Byte = 1 **COMMUNICATION ERROR**	
First Byte	
Bit 6	Parity Error
Bit 5	Overrun Error
Bit 4	Framing Error
Bit 3	Checksum Error
Bit 2	Reserved
Bit 1	Rx Buffer Overflow
Bit 0	Undefined
Second Byte	
Bit 0 To Bit 7	All 0

Bit 7 of First Byte = 0 **Command Error**	
First Byte	
Bits 6 To 0 (not Bit-mapped):	
0	No Error
1	Undefined
2	Invalid Selection
3	Passed Parameter Too Large
4	Passed Parameter Too Small
5	Too Few Data Bytes Received
6	Transmitter-specific Command Error
7	In Write-protect Mode
8 to 15	Command Specific Errors (see Below)
16	Access Restricted
32	Device Is Busy
64	Command Not Implemented
Second Byte	
Bit 7	Device Malfunction
Bit 6	Configuration Changed
Bit 5	Cold Start
Bit 4	Unused
Bit 3	Output Current Fixed

Bit 7 of First Byte = 0 **Command Error**	
Bit 2	Analog Output Saturated
Bit 1	Variable (not Primary) Out Of Limits
Bit 0	Primary Variable Out of Limits

Command Specific Errors	
8	Update Failed Update In Progress Set to Nearest Possible Value
9	Applied Process Too High Lower Range Value Too High Not in Fixed Current Mode
10	Applied Process Too Low Lower Range Value Too Low Multi-drop Not Supported
11	In Multi-drop Mode Invalid Transmitter Variable Code Upper Range Value Too High
12	Invalid Unit Code Upper Range Value Too Low
13	Both Range Values Out of Limits
14	Pushed Upper Range Value Over Limit Span Too Small

HART Configuration Error Word

Bit	Code	Description
0	0x0001	Enabled not set to Y or N
1	0x0002	Enable Handheld not set to Y or N
2	0x0004	Primary Master not set to Y or N
3	0x0008	Invalid Preambles (1 to 50)
4	0x0010	Invalid Short Address Retries (0 to 50)
5	0x0020	Invalid Long Address Retries (0 to 50)
6	0x0040	Invalid Retries After Error (0 to 50)
7	0x0080	Invalid Poll Time After Error (0 to 10000)
8	0x0100	Invalid DB Address Status
9	0x0200	Invalid Command Count
10	0x0400	Memory Error in allocating commands
11	0x0800	Memory Error in allocating command fixed data
12	0x1000	Memory Error in allocating TX/RX buffers
13	0x2000	HART Board not found
14	0x4000	Cannot initialize HART channel
15	0x8000	reserved

4.4 ProLinx 5108 / 5208 HART Field Connections

HART field instruments are divided into four types; A through D, depending on power requirements and whether the device sinks or sources a bias or operating current from the network. The following table defines the categories:

Type	Description
A	Type **A** field instruments sink direct current from the network and receive operating power from the network.
B	Type **B** field instruments sink direct current from the network but receive no operating power from the network.
C	Type **C** field instruments source direct current to the network and receive no operating power from the network.
D	Type **D** field instruments neither source nor sink direct current from the network, nor receive operating power from the network.

On a given network channel, Type **A, B,** and **D** devices may be combined. Type **C** and **D** devices may also be combined. Type **A** or **B** field instruments should not be combined with Type **C** devices.

4.4.1 Connections for HART Analog Point-to-Point Devices

The ProLinx 5108/5208 HART Analog interface module provides an isolated 24 Vdc power supply output which may be used as a Network Power Supply. It is sized for powering one HART Analog transmitter for each of the four HART Analog channels. This internal isolated power supply can supply 24 Vdc @125 mA maximum, which is sufficient to supply power to four HART analog transmitters, each connected in a point-to-point fashion. Since each HART Analog channel is independent and completely isolated, any mixture of loop powered and self powered transmitters may be accommodated. External loop power, internal loop power, or both may be used to power any HART Analog channel.

Important: The 5108/5208 HART Analog module may not be used for multi-drop applications. Only one HART transmitter per channel is allowed.

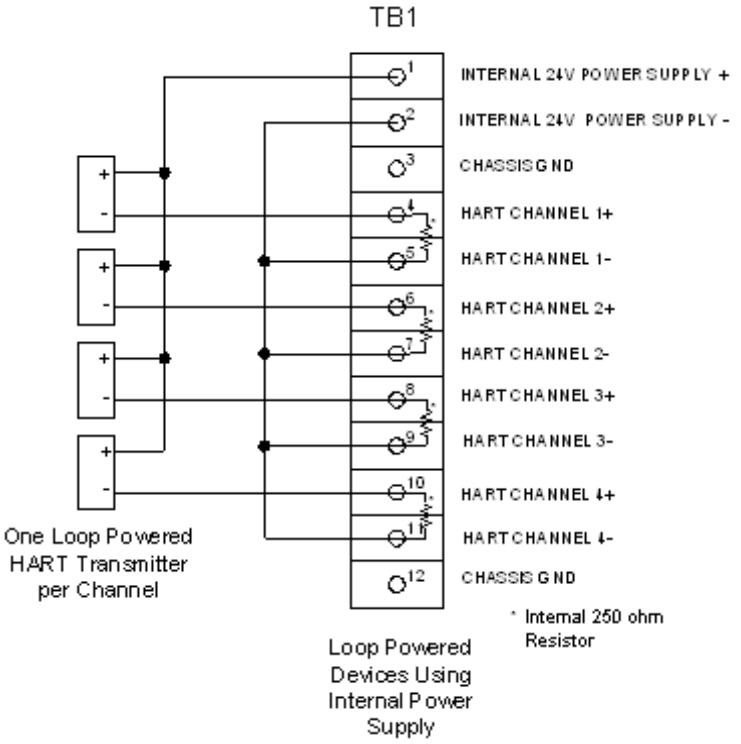
4.4.2 Network Power Supply Requirements

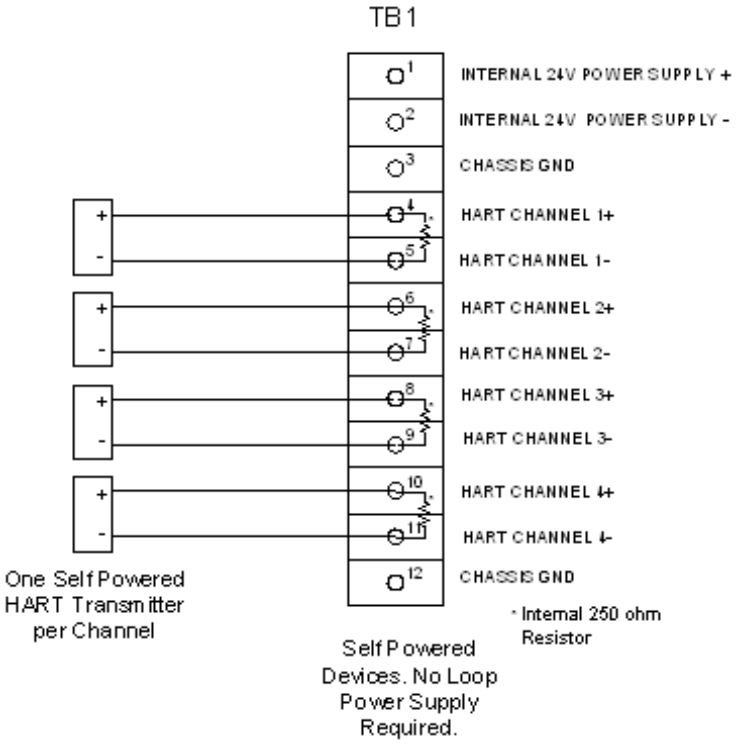
Type	Network Power Supply
A	Required
B	Required
C	Must not be used.
D	Not required, but may be used.

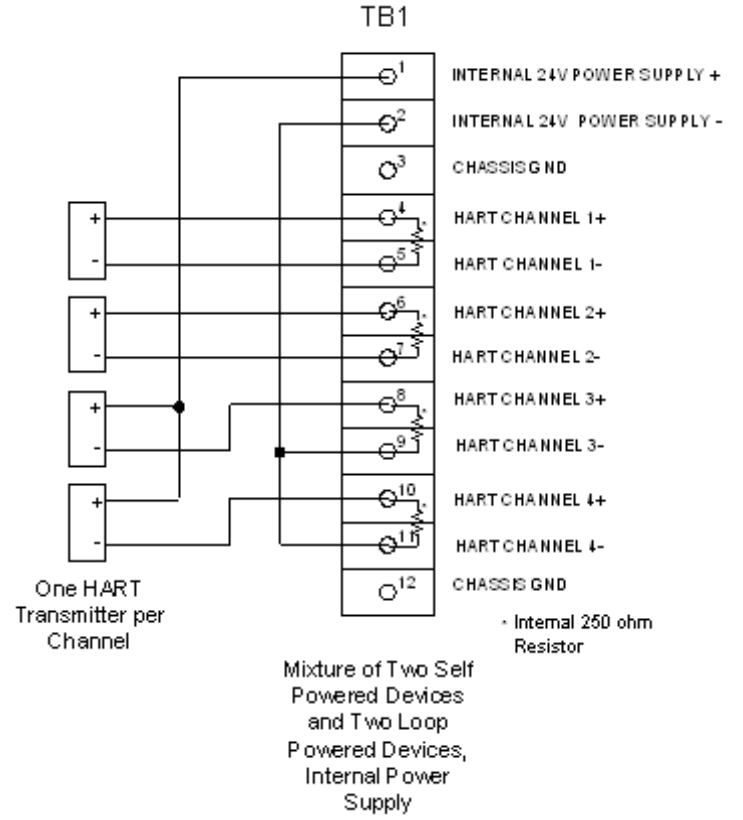
Note: The ProSoft 5108/5208 HART interface may be used with any HART field device transmitter.

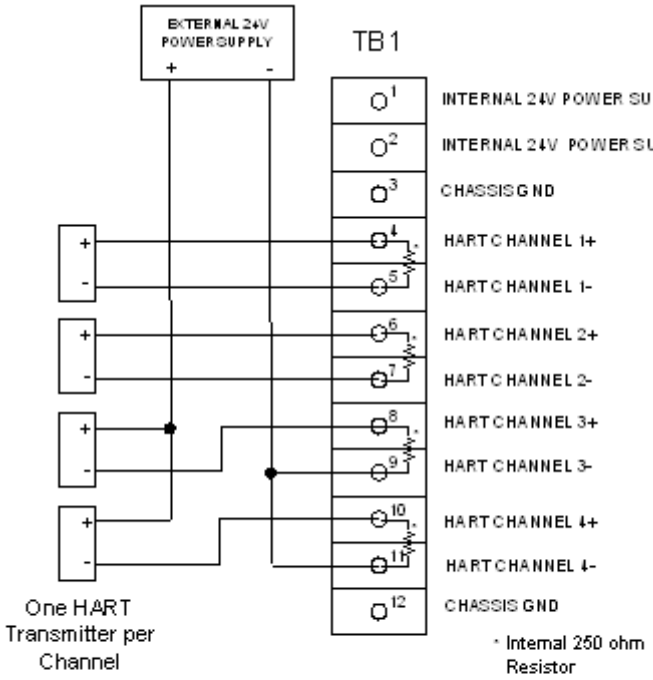
4.4.3 Wiring Diagrams

If field instrument wiring is shielded, terminate shields at the ground terminals of the HART connector TB1. Do not terminate the shields at the instrument.




TB1
1 INTERNAL 24V POWER SUPPLY +
2 INTERNAL 24V POWER SUPPLY -
3 CHASSIS GND
4 HART CHANNEL 1+
5 HART CHANNEL 1-
6 HART CHANNEL 2+
7 HART CHANNEL 2-
8 HART CHANNEL 3+
9 HART CHANNEL 3-
10 HART CHANNEL 4+
11 HART CHANNEL 4-
12 CHASSIS GND
* Internal 250 ohm Resistor
One Self Powered HART Transmitter per Channel
Self Powered Devices. No Loop Power Supply Required.


TB1
1 INTERNAL 24V POWER SUPPLY +
2 INTERNAL 24V POWER SUPPLY -
3 CHASSIS GND
4 HART CHANNEL 1+
5 HART CHANNEL 1-
6 HART CHANNEL 2+
7 HART CHANNEL 2-
8 HART CHANNEL 3+
9 HART CHANNEL 3-
10 HART CHANNEL 4+
11 HART CHANNEL 4-
12 CHASSIS GND
* Internal 250 ohm Resistor
One HART Transmitter per Channel
Mixture of Two Self Powered Devices and Two Loop Powered Devices, Internal Power Supply


EXTERNAL 24V POWER SUPPLY
+
-
TB1
1
INTERNAL 24V POWER SUPPLY +
2
INTERNAL 24V POWER SUPPLY -
3
CHASSIS GND
4
HART CHANNEL 1+
5
HART CHANNEL 1-
6
HART CHANNEL 2+
7
HART CHANNEL 2-
8
HART CHANNEL 3+
9
HART CHANNEL 3-
10
HART CHANNEL 4+
11
HART CHANNEL 4-
12
CHASSIS GND
* Internal 250 ohm Resistor
One HART Transmitter per Channel
Mixture of Two Self Powered Devices and Two Loop Powered Devices, External Power Supply

5 Support, Service & Warranty

5.1 Contacting Technical Support

ProSoft Technology, Inc. is committed to providing the most efficient and effective support possible. Before calling, please gather the following information to assist in expediting this process:

1. Product Version Number
2. System architecture
3. Network details

If the issue is hardware related, we will also need information regarding:

1. Module configuration and associated ladder files, if any
2. Module operation and any unusual behavior
3. Configuration/Debug status information
4. LED patterns
5. Details about the interfaced serial, Ethernet or Fieldbus devices

Note: *For technical support calls within the United States, ProSoft's 24/7 after-hours phone support is available for urgent plant-down issues.*

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For additional ProSoft Technology contacts in your area, please visit:
https://www.prosoft-technology.com/About-Us/Contact-Us.

5.2 Warranty Information

For complete details regarding ProSoft Technology's TERMS & CONDITIONS OF SALE, WARRANTY, SUPPORT, SERVICE AND RETURN MATERIAL AUTHORIZATION INSTRUCTIONS, please see the documents at:
www.prosoft-technology/legal

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