ProSoft TECHNOLOGY

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PLX51-HART-4I
PLX51-HART-4O

HART Input/Output

Multidrop Field Devices

May 6, 2019

TECHNICAL NOTE

CONTENTS

1. Preface 3
1.1. Purpose of this Document 3
1.2. Additional Information 3
1.3. Support 3
2. Application Description 5
3. Setup 7
3.1. Field Device connection 7
Series Configuration 8
Parallel Configuration 9
3.2. HART Module Setup 11
3.3. RSLogix Setup 14
3.3.1. Relay Messaging 14
3.3.2. Relay Messaging Example 16
4. Considerations 19
4.1. Max Field Devices per Port 19

1. PREFACE

1.1. PURPOSE OF THIS DOCUMENT

This document will assist the user to configure the PLX51-HART-4x to connect to multiple field devices on a single port/drop.

1.2. ADDITIONAL INFORMATION

The following resources can assist the user with the module installation and operation:

Resource	Link
PLX50 Configuration Utility Installation	https://www.prosoft-technology.com/
User Manual, Datasheet Example Code & UDTs	https://www.prosoft-technology.com/
User Manual, Datasheet Example Code & UDTs	https://www.prosoft-technology.com/
Ethernet wiring standard	www.cisco.com/c/en/us/td/docs/video/cds/cde/cde205_220_420/installation/guide/cde205_220_420_hig/Connectors.html
HART Communication Foundation	https://fieldcommgroup.org/technologies/hart/hart-technology

1.3. SUPPORT

Technical support is available to assist with installation, operation, and diagnostics.

For additional support the user can use either of the following:

Web	https://www.prosoft-technology.com/
Support email	support@prosoft-technology.com

2. APPLICATION DESCRIPTION

The PLX51-HART-4x supports multiple field devices on a single HART port allowing for more field devices per HART interface module.

When using multidrop, the user can instruct the PLX51-HART-4x module to use a specific HART node address of normal operation (used in the input assembly of the Logix class 1 connection) whilst the other devices on the drop will have their information retrieved using a Logix message instruction.

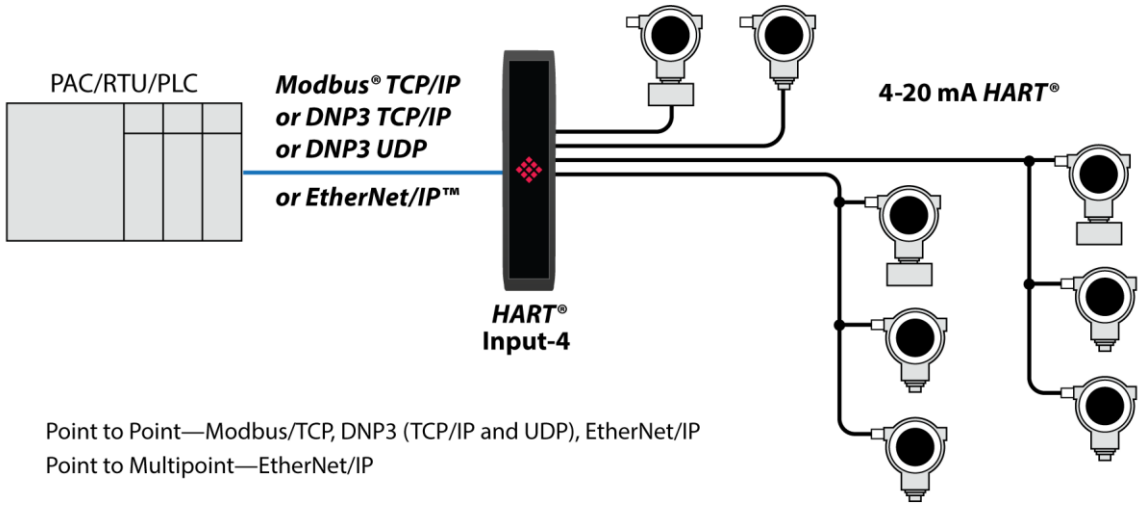

FIGURE 1 - EXAMPLE OF A MULTIDROP HART 4 NETWORK

3. SETUP

The following sections describe the installation and configuration of all the required devices to assist with the initial setup.

3.1. FIELD DEVICE CONNECTION

The Analog HART channels are connected using a two-way connector. The PLX51-HART-4I input channels are internally loop powered and can be connected directly to the field device signal terminals.

The PLX51-HART-4O output channels source the current directly and therefore can also be connected directly to the field device signal terminals. The input and output channels provide internal current limiting and electronic fuse protection.

In a multidrop setup, the field devices can be connected in a series or a parallel configuration. The maximum number of devices that can be connected per channel is as follows:

Connection Method	*PLX51-HART-4I*	*PLX51-HART-4O*
Series	**2**	**2**
Parallel	**7**	**5***

Table 1 - Maximum Device Count

*Note Output devices must be limited to 4mA

The above table should be considered as a maximum count, lower counts may be applicable for some field devices.

SERIES CONFIGURATION

The series connection method has the advantage of the (4-20mA) current being controlled by one of the devices. The disadvantage is that the supply voltage is divided by all connected devices, so the maximum number of devices is typically '2'. (Assuming a typical minimum of 10V, and a supply of 24V).

This applies to each channel of the PLX51-HART-4x gateways.

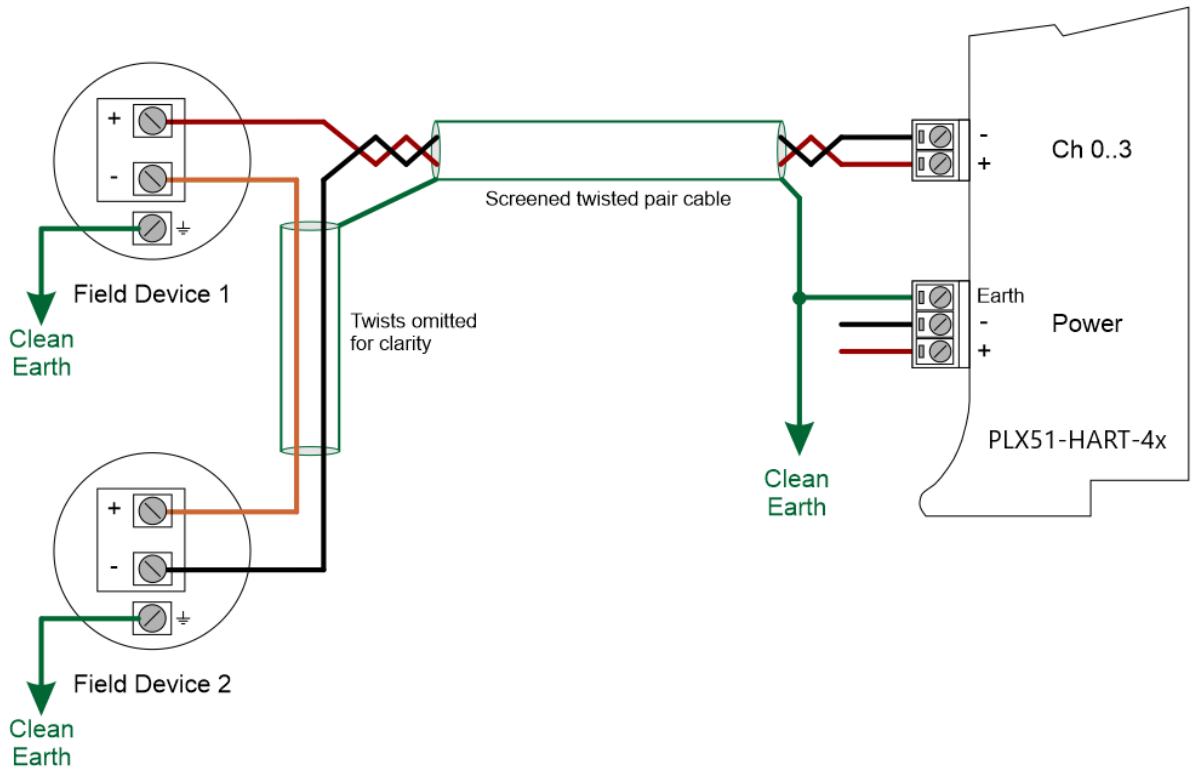

Figure 2 – PLX51-HART-4x Multidrop Field Device Wiring - Series

PARALLEL CONFIGURATION

Connecting field devices in parallel is more common. However, the 4-20 mA cannot be controlled by any device. All field devices remain at 4mA and share a common supply voltage.

The PLX51-HART-4O controls the current to a maximum of 20mA. Using the same 4mA per field device, the maximum number of connected devices is 5. This only applies to output devices (positioners etc.) that draw only 4mA when placed in a non-current modulating mode.

When an output field device attempts to draw more than 4mA, the number of allowable multidrop devices reduces.

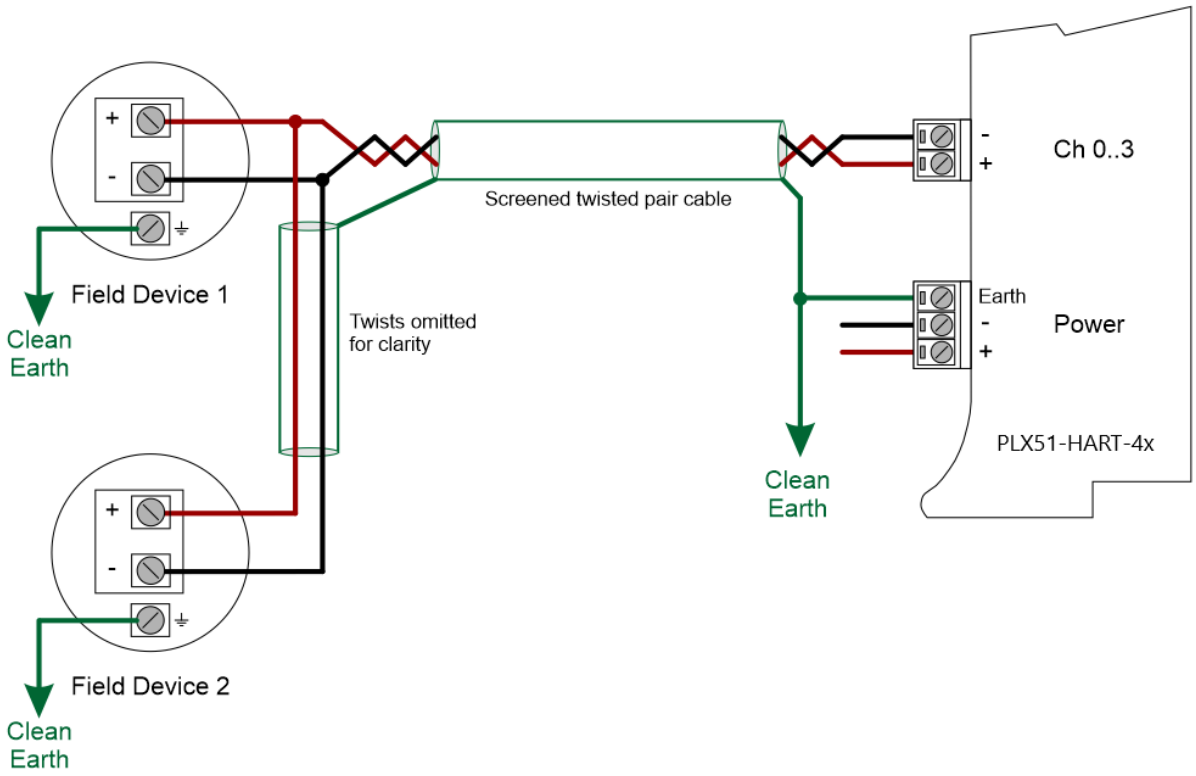

FIGURE 3 – HART4 MULTIDROP FIELD DEVICE WIRING - PARALLEL

The equivalent Analog Input and Output circuits are shown below.

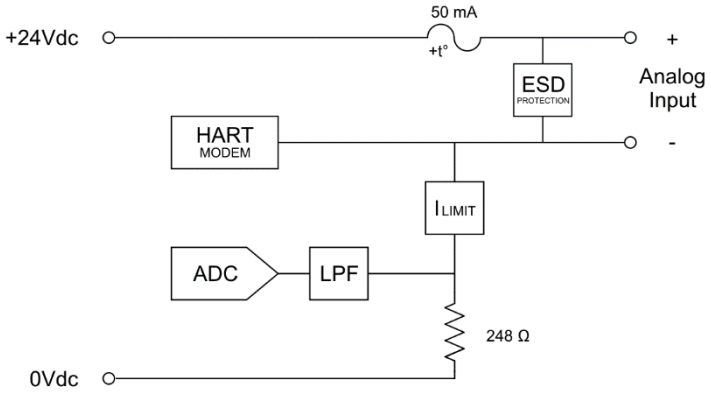

FIGURE 3 – ANALOG INPUT EQUIVALENT CIRCUIT

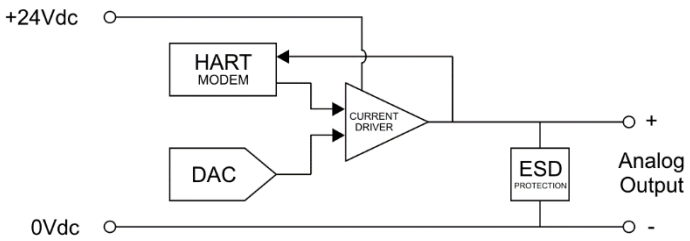

FIGURE 4 – ANALOG OUTPUT EQUIVALENT CIRCUIT

3.2. HART MODULE SETUP

The PLX51-HART-4I must be configured in the PLX50 Configuration Utility for normal, single device per port, operation except for the fixed address parameter. To ensure the correct field device is used as the "main" field device on the drop (which will be used to populate the Logix input assembly), the user will need to set the node address of the specific device. This is done by setting the *Fixed HART Address* parameter in the PLX50 Configuration Utility as shown below:

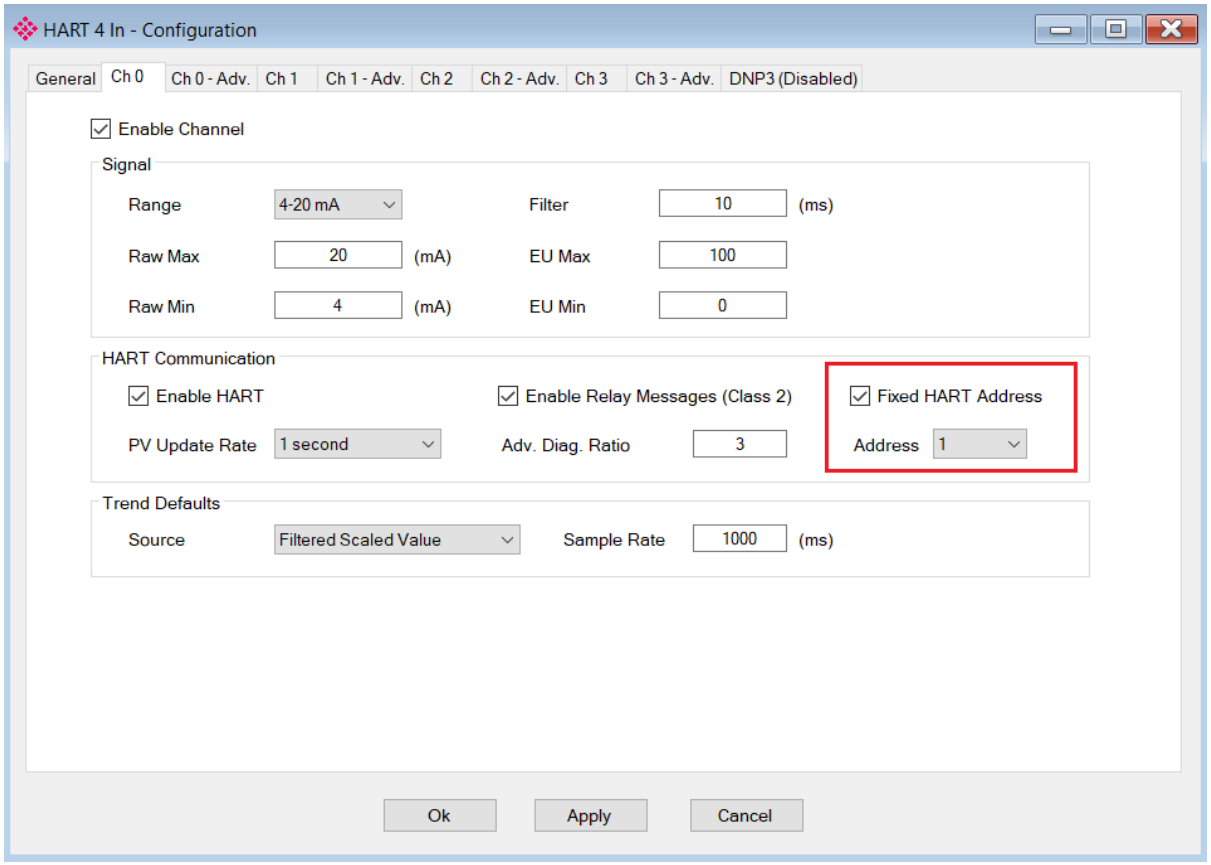

Figure 5 – Drop Fixed address

The user will need to ensure that each field device on the drop has a unique node address. This can be verified by doing a port scan and checking that each field device on the network has a unique node address (as shown below):

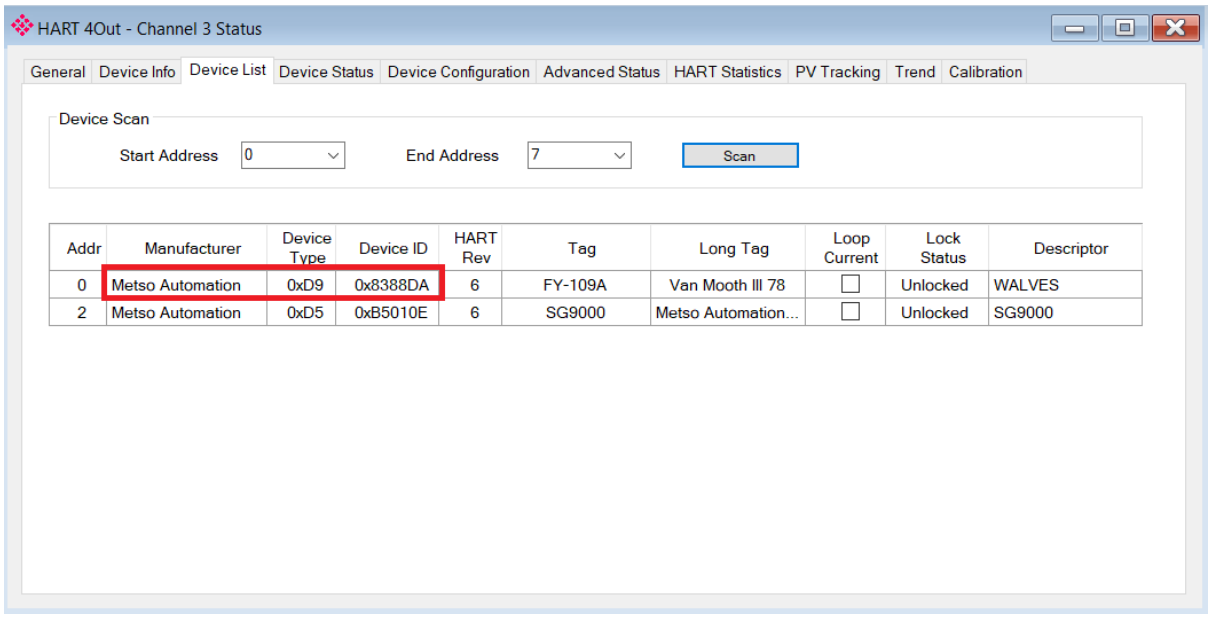

Figure 6 – Port Scan

If needed, the user can set the node address of a module from the PLX50 Configuration Utility as shown below:

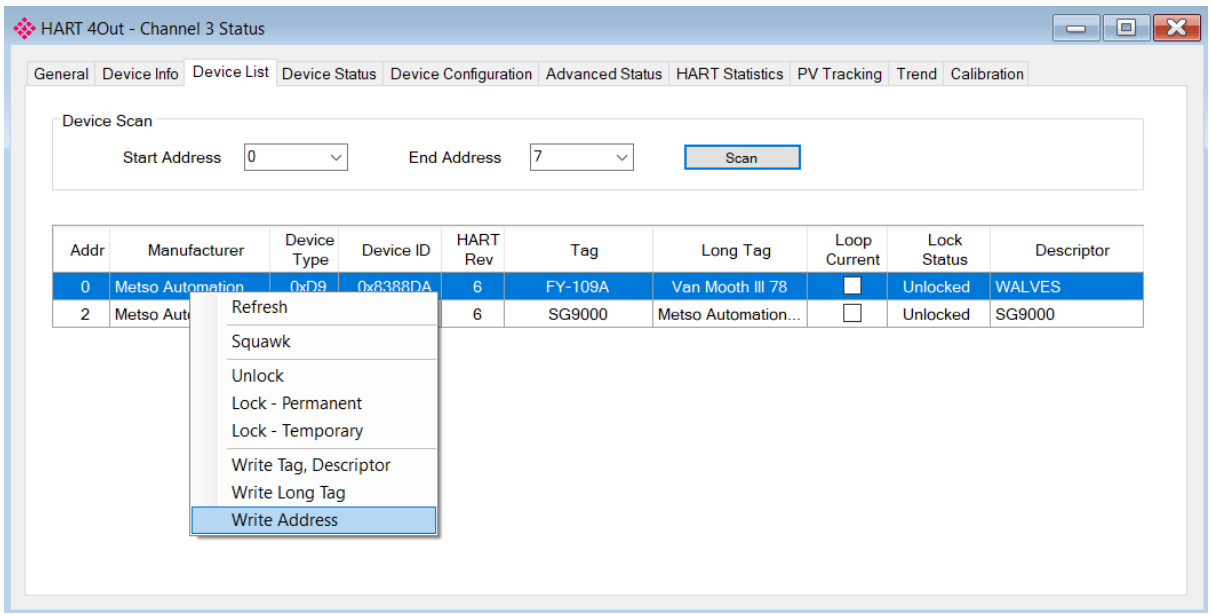

Figure 7 – Set Field Device Node Address

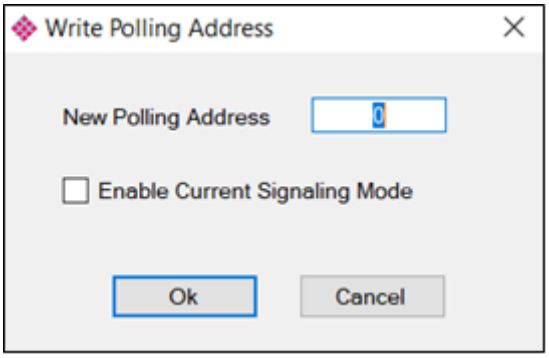

Figure 8 – Set Field Device Node Address

The user will also need to ensure that each field device on the drop has their loop current mode set to **Multidrop** and not **Current Signalling Mode**. This is done in the PLX50 Configuration Utility by selecting the *Write Address* option (as shown above) and setting the loop current mode (as shown below):

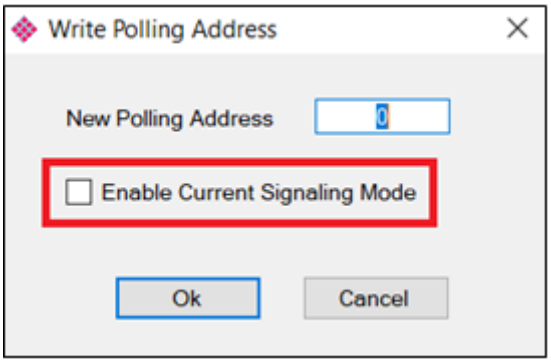

Figure 9 – Set Current Signalling Mode

3.3. RSLOGIX SETUP

3.3.1. RELAY MESSAGING

The PLX51-HART-4x supports the relaying of custom HART commands to a field device. This is achieved by building the HART command request and then sending it to the PLX51-HART-4x using an explicit message instruction. An example of this is shown in the figure below.

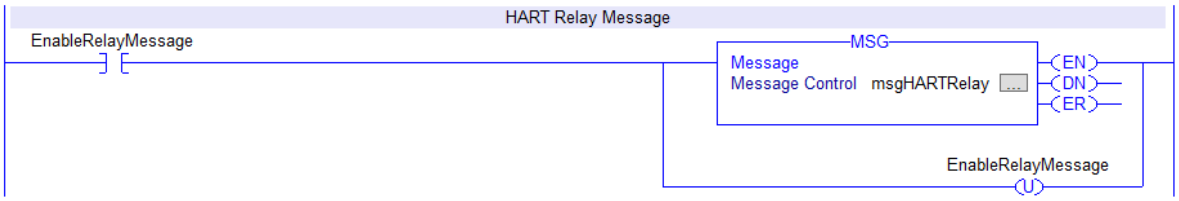

Figure 10 – Relay HART Message

The required attributes for the message instruction are as follows:

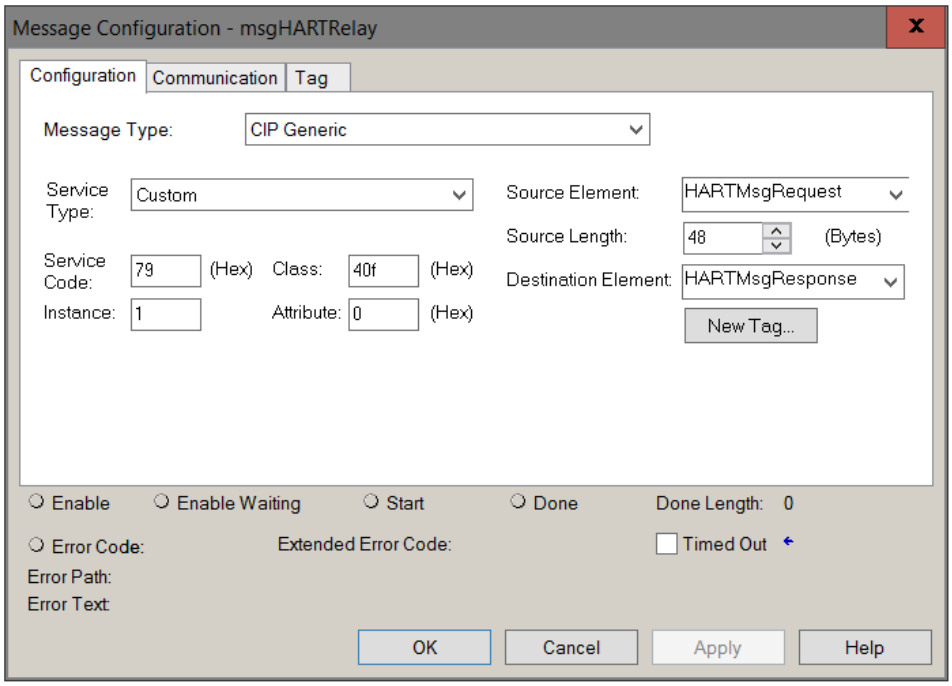

Figure 11 – Relay HART Message Configuration

Parameter	Value / Description
Message Type	CIP Generic
Service Type	Custom
Service Code	79 Hex (Relay HART Message service)
Class	40F Hex
Instance	Channel value + 1 1 for Channel 0 2 for Channel 1 3 for Channel 2 4 for Channel 3
Attribute	0
Source Element	Tag of type ProsoftHARTRelayMessageRequest
Source Length	48
Destination Element	Tag of type ProsoftHARTRelayMessageResponse

Table 1 – Relay HART Message Parameters

The required Request and Response HART Command structures are defined as follows:

HART Command Request		
Byte Offset	Data Type	Description
0	INT	Request Length
2	SINT	Start Character (0x82 for Long Address)
3	SINT	Long Address 0 (0x80 + Manufacturer ID)
4	SINT	Long Address 1 (Device Type Code)
5	SINT	Long Address 2 (Device ID Byte 0)
6	SINT	Long Address 3 (Device ID Byte 1)
7	SINT	Long Address 4 (Device ID Byte 2)
8	SINT	Command Code
9	SINT	Command Data Length (in bytes)
10	SINT[]	Command Data (If required)

Table 2 – Relay HART Message Request Structure

HART Command Response		
Byte Offset	Data Type	Description
0	INT	Status (See table below)
2	INT	Packet Length
4	SINT	Start Character
5	SINT	Long Address 0
6	SINT	Long Address 1
7	SINT	Long Address 2
8	SINT	Long Address 3
9	SINT	Long Address 4
10	SINT	Command Code (Echoed)
11	SINT	Reply Data Length
12	INT	Status (Same as at byte 0 above).
14	SINT[]	Command Reply Data

Table 3 – Relay HART Message Response Structure

3.3.2. RELAY MESSAGING EXAMPLE

In the example below, a Logix message instruction is used to read the Unique Identifier of the PLX51-HART-4x. This makes use of the Universal Command #0. The field device is connected to channel 0, hence the *Instance* value is set to 1.

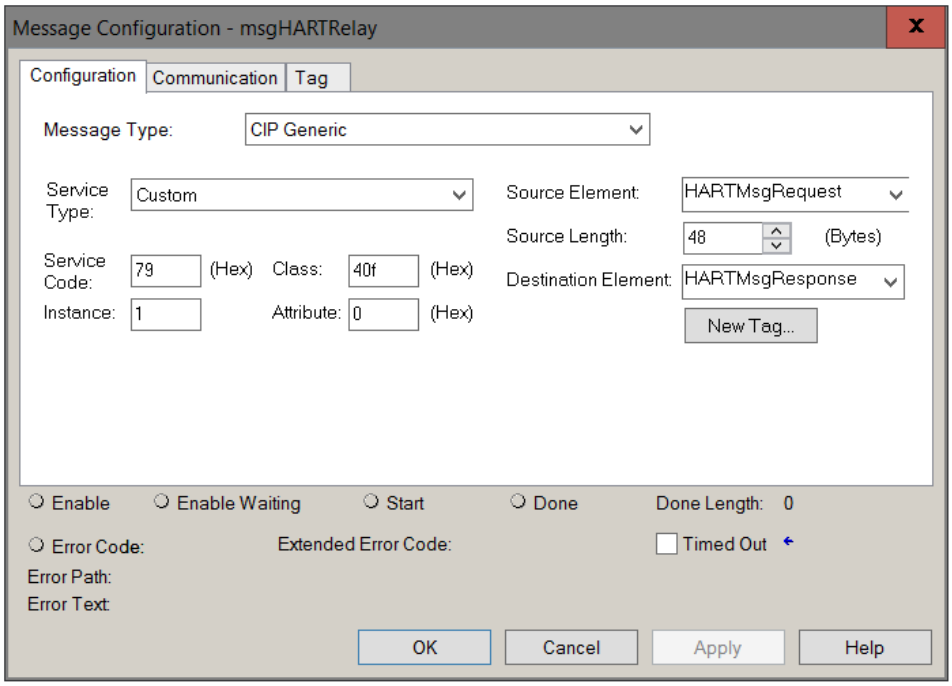

Figure 12 – Relay HART Message Example Configuration

HARTMsgRequest	{...}		AparianHARTRelayMessageRequest	
HARTMsgRequest.Length	8	Decimal	INT	Length = 8 bytes
HARTMsgRequest.StartCharacter	16#82	Hex	SINT	Start = 0x82 (Long Address)
HARTMsgRequest.AddressByte0	16#91	Hex	SINT	0x80 + ManufacturerID
HARTMsgRequest.AddressByte1	16#38	Hex	SINT	Device Type Code = 56 = 0x38
HARTMsgRequest.AddressByte2	16#79	Hex	SINT	DeviceID = 0xFF4F79
HARTMsgRequest.AddressByte3	16#4f	Hex	SINT	
HARTMsgRequest.AddressByte4	16#ff	Hex	SINT	
HARTMsgRequest.CommandData	{...}	Hex	SINT[40]	
HARTMsgRequest.CommandData[0]	16#00	Hex	SINT	Command = 0 Read Unique Identifier
HARTMsgRequest.CommandData[1]	16#00	Hex	SINT	Command Data Length = 0
HARTMsgRequest.CommandData[2]	16#00	Hex	SINT	Command Data (Not required for Cmd 0)
HARTMsgRequest.CommandData[3]	16#00	Hex	SINT	
HARTMsgRequest.CommandData[4]	16#00	Hex	SINT	
HARTMsgRequest.CommandData[5]	16#00	Hex	SINT	
HARTMsgRequest.CommandData[6]	16#00	Hex	SINT	

Figure 13 – Relay HART Command Example – Request

HARTMsgResponse	{...}		AparianHARTRelayMessageResponse	
HARTMsgResponse.Status	16#4000	Hex	INT	Status = 0x4000
HARTMsgResponse.PacketLength	32	Decimal	INT	
HARTMsgResponse.StartCharacter	16#86	Hex	SINT	Long Address
HARTMsgResponse.AddressByte0	16#91	Hex	SINT	
HARTMsgResponse.AddressByte1	16#38	Hex	SINT	
HARTMsgResponse.AddressByte2	16#79	Hex	SINT	
HARTMsgResponse.AddressByte3	16#4f	Hex	SINT	
HARTMsgResponse.AddressByte4	16#ff	Hex	SINT	
HARTMsgResponse.Command	0	Decimal	SINT	Command Echo
HARTMsgResponse.ByteCount	24	Decimal	SINT	Reply Length = 24
HARTMsgResponse.Data	{...}	Hex	SINT[50]	
HARTMsgResponse.Data[0]	16#00	Hex	SINT	Status = 0x4000 (repeated)
HARTMsgResponse.Data[1]	16#40	Hex	SINT	
HARTMsgResponse.Data[2]	16#fe	Hex	SINT	Command 0 Reply Data: Format 254
HARTMsgResponse.Data[3]	16#11	Hex	SINT	Command 0 Reply Data: ManufacturerID
HARTMsgResponse.Data[4]	16#38	Hex	SINT	Command 0 Reply Data: Device Type Code
HARTMsgResponse.Data[5]	16#05	Hex	SINT	Command 0 Reply Data: Number of Preambles
HARTMsgResponse.Data[6]	16#07	Hex	SINT	Command 0 Reply Data: Universal Cmd Rev
HARTMsgResponse.Data[7]	16#03	Hex	SINT	Command 0 Reply Data: Specific Cmd Rev
HARTMsgResponse.Data[8]	16#03	Hex	SINT	Command 0 Reply Data: Software Rev
HARTMsgResponse.Data[9]	16#08	Hex	SINT	Command 0 Reply Data: Hardware Rev

Figure 14 – Relay HART Command Example – Response

NOTE: The HART Long Address for a device is comprised of the Manufacturer ID, Device Type Code and Device ID. These values are displayed on the *Channel Status* screen in the PLX50 Configuration Utility when the device is Online.

In Multidrop operation, the user will need to get the field device details from the PLX50 Configuration Utility. This is done by using the *Scan* and *Identify* operation as shown below:

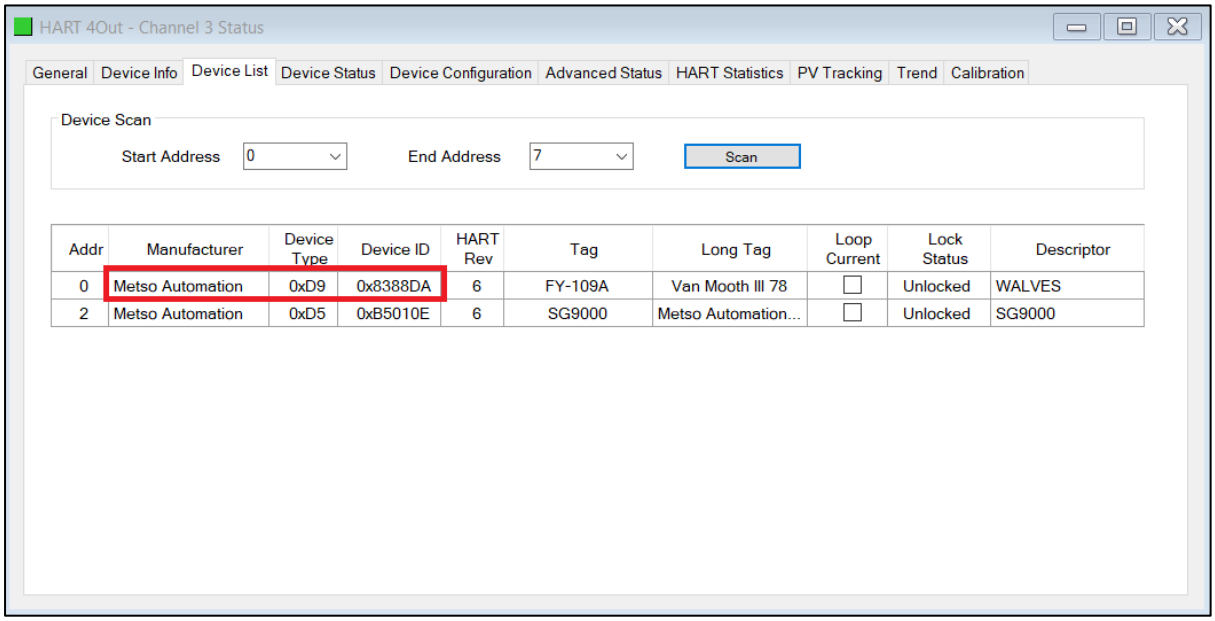

Figure 15 – Port Scan

Similar to the example above, the user can extract the field device process variables from any device on the drop using the *Relay Message*. Below is an example of the HART command to extract the process variables.

HART Command	Request Data	Response Data		
3 – Read current and four dynamic variables	None	Byte 0-3	Current (mA)	Float
		Byte 4	PV units code	Byte
		Byte 5-8	Primary Variable	Float
		Byte 9	SV units code	Byte
		Byte 10-13	Second Variable	Float
		Byte 14	TV units code	Byte
		Byte 15-18	Third Variable	Float
		Byte 19	FV units code	Byte
		Byte 20-23	Fourth Variable	Float

Table 4 – Process Variable HART command and response

4. CONSIDERATIONS

4.1. MAX FIELD DEVICES PER PORT

The number of allowable field devices will depend on the individual power consumption of each device.