COGNEX
Vision for Industry®

In-Sight

TECH NOTE: PLC TO IN-SIGHT COMMUNICATIONS USING EIP

Copyright, Trademarks, Patents

Tech Note: In-Sight to PLC Communications Using EIP

Revision 3
June 2006

Table of Contents

1 Introduction

1.1 Purpose

The purpose of this document is to aid in the configuration of various Programmable Logic Controllers (PLCs) to communicate with In-Sight systems using the EtherNet Industrial Protocol (EIP). Users should already be familiar with the specific hardware and software configuration tasks pertinent to their system.

1.2 Scope

The scope of this document is to enable an operator familiar with the EIP protocol and the applicable PLC equipment and software to successfully communicate with In-Sight® systems. This document also provides examples of tested communication configurations.

This document is organized in four sections:

- Introduction – This section introduces the concepts of the Ethernet Industrial Protocol and it's application to In-Sight systems.
- Explicit Messaging Example – This section provides an example of PLC communications with the In-Sight system using explicit messaging.
- Implicit Messaging Example – This section provides an example of PLC communications with the In-Sight system using implicit messaging.
- PCCC (PC3) Communications Example - This section provides an example of PC^3 communications with the In-Sight system using explicit messaging and the SLC5/05.

1.3 EtherNet Industrial Protocol (EIP)

The EtherNet Industrial Protocol incorporates the TCP and UDP layers of the Ethernet protocol in the transmission of data.

Because TCP/IP is point-to-point, EIP uses this layer for explicit messaging only. Explicit messaging is described as those messages in which the data field carries both protocol information and instructions for service performance. With explicit messaging, nodes must interpret each message, execute the requested task and generate responses. These types of messages can be used for device and job configuration, setup, etc.

Explicit messaging uses one of two packet types: Generic CIP (Control/Information Protocol) or PCCC (PC^3).

The UDP/IP protocol, which can multicast, is used for implicit messaging. With implicit messaging, the data field contains no protocol information, only real-time I/O data. The meaning of the data is predefined at the time the connection is established and processing time in the node is therefore minimized during runtime. Such messages are low overhead, short and provide the required time-critical performance needed for control.

In-Sight systems support explicit or implicit messages from a single I/O client at any given time. An I/O client is described as the PLC device communicating with the host In-Sight system.

The protocol matrix for Rockwell's Allen-Bradley PLCs is shown in Table 1-1.

Table 1-1:EIP Protocol Matrix

HARDWARE	SOFTWARE	EIP PROTOCOL
PLC5	RSLogix 5	PC[3]
SLC	RSLogix 500	PC[3]
ControlLogix	RSLogix 5000	Implicit Explicit (Generic CIP, PC[3])

NOTE Every In-Sight sensor has a factory-assigned unique Media Access Control (MAC) address assigned to it, which cannot be changed or deleted. The MAC address is a hardware address that identifies a specific node of a network. The MAC address is made up of 6 bytes: 00-d0-24-xx-xx-xx. The first three bytes of the MAC address are the same for all In-Sight sensors: 00-d0-24. The last 3 bytes of the MAC address are unique to each sensor, represented as "xx-xx-xx". When sending the MAC address over Ethernet/IP, In-Sight reverses the last three bytes of the MAC address and an "f4" byte value is displayed as the last byte. For example, the MAC address 00-d0-24-01-02-03 is sent over Ethernet/IP as 0x030201f4.

1.3.1 Map Specification (MapSpec)

The map specification (MapSpec) provides the method of accessing or writing data to the applicable assembly object. The assembly object describes the communication services available and a common means by which information is exchanged between the Client (PLC) and the Server (In-Sight). The Input and Output assembly objects are configured as shown in Table 1-2 and Table 1-3.

Table 1-2: Input Assembly Object

3	2	1	0	
Cmd	Reserved			0
			12	0
1234.57				4
				8
				12
				16
1234				20
		123		24
				28
Cognex Corp				32
				...
				132

Input Assembly:

- Class 0x04
- Instance 0x01
- Size 132 bytes (33 32-bit words)

Data Configuration:

- Bytes 0-2 (3 bytes) - Reserved for future use
- Byte 3 (1 byte) – Command byte
- Bytes 4-132 (128-bytes) - Spreadsheet data (user definable via MapSpec).

Table 1-3: Output Assembly Object

3	2	1	0	
Reserved				0
			12	0
1234.57				4
				8
				12
				16
1234				20
		123		24
				28
Cognex Corp				32
				…
				132

Output Assembly:

- Class 0x04
- Instance 0x02
- Size 132-bytes (33 32-bit words)

Data Configuration:

- Bytes 0-3 (4 bytes) – Reserved for future use
- Bytes 4-132 (128-bytes) Spreadsheet data (user definable via MapSpec)

The relationship between the Input and Output Assembly is reversed between the Client (the PLC) and the Server (the In-Sight system). For example, the Client's Output Assembly outputs data to the Server Input Assembly as shown in Table 1-4.

Table 1-4: I/O Assembly Relationship

CLIENT MESSAGE	CLIENT ASSEMBLY	IN-SIGHT FUNCTION	IN-SIGHT ASSEMBLY
Write	Input Assembly	WriteEIP	Output Assembly
Read	Output Assembly	ReadEIP	Input Assembly

The input to the assembly object is specified in the MapSpec, which consists of a list of specifiers delimited by colon (:) characters. Each specifier has two parts: the byte offset, and a data type code. The data type codes are listed in Table 1-5.

Table 1-5: **MapSpec Data Type Codes**

DATA TYPE CODE	BYTE LENGTH	ROCKWELL EQUIVALENT
i or I	1 Byte	SINT
il or IL	2 Bytes	INT
d or D	4 Bytes	DINT (ControlLogix only)
f or F	4 Bytes	REAL
s or S	1 to 128 Bytes*	Array of SINTs
* Each byte after the start byte of the string will be interpreted as a character until a null (\00) byte is encountered or until another data type is specified (e.g., '8s:13i' means that starting at byte 8, all bytes until 13 will be interpreted as characters for a total of five characters).		

The MapSpec tells the applicable In-Sight functions how to encode or decode the data that exists in the assembly object. A colon (:) separates each data element. In Figure 1-1, the value of the Mapping parameter for the **ReadEIP** function, “0f:4f:8f”, has 3 elements: 0f, 4f, 8f. The first element indicates that starting at data byte 0 of the Input Assembly; translate the data into a float (0f → first byte, type float). Since a float is 4 bytes long, the next piece of data starts at the fourth byte and is also a float (4f → fourth byte, type float). The last piece of data starts at the eighth byte and is also a float (8f → eighth byte, type float).

The value of the Mapping parameter for the **WriteEIP** function, “0il:2il:4il”, also has 3 elements: 0il, 2il, 4il. The first element indicates that starting at data byte 0 of the Input Assembly, translate the data into an integer (0il → zero byte, type integer). Since an integer is 2 bytes long, the next piece of data starts at the second byte and is also an integer (2il → second byte, type integer). The last piece of data starts at the fourth byte and is also an integer (4il → fourth byte, type integer).

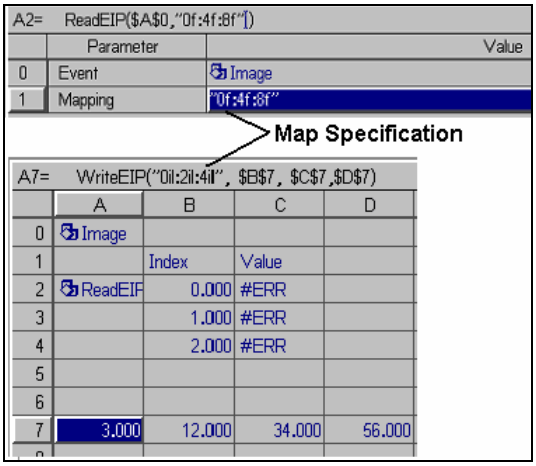


Figure 1-1: MapSpec Examples in ReadEIP and WriteEIP Functions

NOTE The maximum length for input data is 128-bytes.

When using the **ReadEIP** function, a corresponding **GetEIPData** function is required. **GetEIPData** has two parameters: **ReadEIP** structure (points to a **ReadEIP** function on the spreadsheet), and an Index (which tells it what element of the MapSpec to get data from). For example: **GetEIPData** (A2, 1) gets the 2nd element (In-Sight uses a 0 index as the first element) from the **ReadEIP** function in cell A2 (Figure 1-1).

1.3.2 Change of State Function

(In-Sight software version 2.43 and higher)

To provide an additional level of acquisition control using EtherNet/IP, a change of state (COS) field has been added to the assembly object.

Table 1-6 and Table 1-7 show the changes to the assembly object with the implementation of this function.

Table 1-6: **In-Sight Input Assembly (Prior to V2.43)**

	3	2	1	0
0	CMD	Reserved		
1	1	C	L	P
2	97	123	42	\0
3	3.14159			
4	0	2589		0
...				
132				

Table 1-7: **In-Sight Input Assembly (After V2.43)**

	3	2	1	0
0	CMD	COS	Reserved	
1	1	C	L	P
2	97	123	42	\0
3	3.14159			
4	0	2589		0
...				
132				

CMD – is still the command byte with 1 new acceptable data value:

- 99 (0x63) – to trigger on every packet (continuous trigger). This method is not recommended since it will attempt to trigger acquisitions at the RPI rate. It appears here only for backward compatibility with jobs developed older firmware.
- 100 (0x64) – to trigger only when the COS value has changed state

COS – Change of State value

In-Sight will trigger whenever it sees the COS byte's value change from its previous value to a different non-zero value. In-Sight will not trigger when the COS byte's value changes to 0.

EXAMPLE: If the COS byte is 0, the system will trigger when the COS byte is incremented from 0 to 1. The system will trigger again, each time the COS byte's value is changed to a different non-zero value such as when continuing to increment the COS byte.

Reserved – Reserved bytes. No data to be placed here.

The data portion of the assembly object (bytes 4 – 132) remains the same. For both methods of network triggering, the null terminated "Master Name" string (for example: "PLC1\0") has to appear in the first part of the data section. In the **AcquireImage** property sheet (cell A0), the Trigger parameter must be set to Network, and the Master Name Parameter must contain the same string that will appear in the first bytes of the data portion of the packet ("PLC1").

NOTES:

- If the Master Name Parameter is left blank, the string at the beginning of the assembly object is not required.
- Regardless of the state of the CMD and COS bytes, the PLC may still send and receive data to/from the In-Sight server. The CMD byte only affects the AcquireImage event.

Change of State Functionality

Assume the following initial setup from the Client:

	3	2	1	0
0	100	0	Reserved	
1	1	C	L	P
2	97	123	42	\0
3	3.14159			
4	0	2589		0
...				
132				

Initially In-Sight receives a COS byte with a value of 0, so regardless of the previous value of the COS byte, In-Sight will not trigger. The client then begins to send packets at the Request Packet Interval (RPI) and the server (In-Sight) receives them. The camera will not be triggered at this point because the COS byte has not changed (initial state was 0 and has remained 0). At some point later, the client wants to tell In-Sight to trigger, so it changes the COS byte to 1. That packet is sent out and received by In-Sight. In-Sight determines that the COS byte has changed from 0 to 1 and will fire an acquisition event. If, on the next cycle, the client does not change the COS byte, the camera will not acquire (client continues to send 1). If the client wants to trigger again, the COS byte must be set to a different non-zero value. In-Sight will receive that packet, determine that the COS byte has been changed from 1 to a different non-zero value and fire a second acquisition event.

To prevent the In-Sight from missing triggers, it is recommended that the COS byte be incremented rather than simply toggled between two non-zero values. To understand this problem, consider toggling the COS byte between 1 and 2 with the PLC's RPI set to 300 msec. If the PLC's logic updated the COS byte every 100 msec, with a sequence of changes such as 1->2->1->2, In-Sight would sometimes miss the value changing from 1 to 2. Instead In-Sight would see 1->1->2 and therefore miss a trigger.

1.3.3 PCCC (PC^3) and Implicit Messaging Formats

PC^3 and Implicit messaging protocols also employ the In-Sight's **ReadEIP** and **WriteEIP** functions. PC^3 may also use a limited Native Mode command set to access and write data to/from the In-Sight system. The **ReadEIP** and **WriteEIP** functions require the following inputs:

- Event
- MapSpec

The Event input specifies the update event on which to read data. This argument must reference cell A0 (the **AcquireImage** function), or a cell containing a soft event.

NOTE	Currently, only the AcquireImage event is supported with implicit messaging via the CMD byte. PC^3 cannot use the CMD byte.

The Native Mode commands provide access to the In-Sight spreadsheet. Generally, no additional functions are needed in the spreadsheet to support Native Mode. A client (the PLC) issues a command (such as load file) and the server (In-Sight) will attempt to execute the command and return a status.

Table 1-8 lists the Native Mode commands supported by PC^3 and Implicit messaging formats.

Native Mode commands are issued as strings to In-Sight. For more information on formulating Native Mode commands refer to the *In-Sight Guide and Reference*.

Table 1-8: Supported Native Mode Commands

COMMAND NAME	COMMAND	PARAMETERS	EXAMPLE
Delete File**	DF	<filename>.JOB	DFTESTFILE.JOB
Set Event*	SE	Soft Event 0-7 Acquire Event 8	SE2
Set Online*	SO	0 – Set Offline 1 – Set Online	SO1
Store File**	TF	<filename>.JOB	TFTESTFILE.JOB
Load File**	LF	<filename>.JOB	LFTESTFILE.JOB
* Must be manually set ONLINE for Native Mode command to work ** Must be set OFFLINE for Native Mode command to work			

- All Native Mode commands operate the same across Telnet or Serial connections.
- Refer to the command definitions for input parameter specifications.
- Carriage returns (0x0D) or line feeds (0x0A) are not required for any command sent from the PLC and will be ignored.
- Native Mode Commands other than those listed above may function correctly; however, they are not supported and are used at your own risk.

1.3.4 Explicit Messaging Formats

Explicit messaging protocols employ In-Sight's Native Mode commands to access and send data to the In-Sight system. Extended Native Mode commands are not supported at this time.

NOTES:

- The In-Sight 3000 does not support Native Mode commands using PC^3 Explicit Messaging.
- Native Mode commands can be separated into 4 distinct groups by command format.

Native Mode Commands by Group

Every command returns at least a status byte. So, for every Explicit Message configuration, the destination must be at least a DINT (4 byte integer).

- Type 1 (Command only)
- Type 2 (Command and one parameter)
- Type 3 (Command, column, and row)
- Type 4 (Command, column, row, and data)

Table 1-9: Type 1 Commands

COMMAND	MEMBER	TYPE	STYLE	DESCRIPTION
Get File *GF* Get Online *GO*	Command	SINT[2]	ASCII	2 characters making the command (e.g. GO for Get Online)

Table 1-10: **Type 2 Commands**

COMMAND	MEMBER	TYPE	STYLE	DESCRIPTION
Delete File *DF[filename]* Load File *LF[filename* Set Event *SE[int]* Set Job *SJ[id]* Set Online *SO[int]* Store File *TF[filename]*	Command	SINT[2]	ASCII	2 characters making the command (e.g. SO for Set Online)
	Data	SINT (make an array if commands takes more than 1 byte)	HEX	Data that follows command (e.g. if command is SO then data is 1 or 0)

Table 1-11: **Type 3 Commands**

COMMAND	MEMBER	TYPE	STYLE	DESCRIPTION
Get Value *GV[column][row]*	Command	SINT[2]	ASCII	2 characters making the command (e.g. GV for Get Value)
	Column	SINT	ASCII	1 byte for column A-Z
	Row	INT	HEX	Number 0 - 399 for the row

Table 1-12: **Type 4 Commands**

COMMAND	MEMBER	TYPE	STYLE	DESCRIPTION
Set Float *SF[column][row][float]* Set Integer *SI[column][row][int]* Set String *SS[column][row][string]*	Command	SINT[2]	ASCII	2 characters making the command (e.g. SF for Set Float)
	Column	SINT	ASCII	1 byte for column A-Z
	Row	INT	HEX	Number 0 - 399 for the row
	Data	INT (for SI) REAL (for SF) SINT (for SS)		

2 Explicit Messaging Example

2.1 Configuration

This section outlines an Explicit Communications configuration between the In-Sight system and the PLC. This example uses the ControlLogix Controller and Rockwell's RSLogix 5000 software.

2.1.1 Components Needed

- In-Sight system with Firmware version 2.30.08 or higher.
- ControlLogix Controller (1756-A4 in a 4-slot rack).
- 1756-ENET /B Ethernet gateway module.
- Rockwell's RSLogix 5000 programming software (version 8.0 or higher).

NOTE This section does not apply to In-Sight software version 2.21 or previous versions.

2.1.2 Summary of Steps

- Create user-defined data types to send and receive Native Mode commands (these are similar to C structures).
- Create tags based on these user-defined data types and fill them in with a Native Mode command.
- Create a Message Instruction (MSG) to send this data.

Because Native Mode commands are to be sent, there is no additional programming on the In-Sight spreadsheet other than what is normally done to create an In-Sight Job. The In-Sight system treats these messages the same as receiving a Native Mode command from a Telnet session.

Step 1: Create a New Project:

1. Open RSLogix 5000.
2. Create a new Project (File→New).

Step 2: Create User-Defined types:

1. Right click on the **User-Defined** folder and select **New Type**.

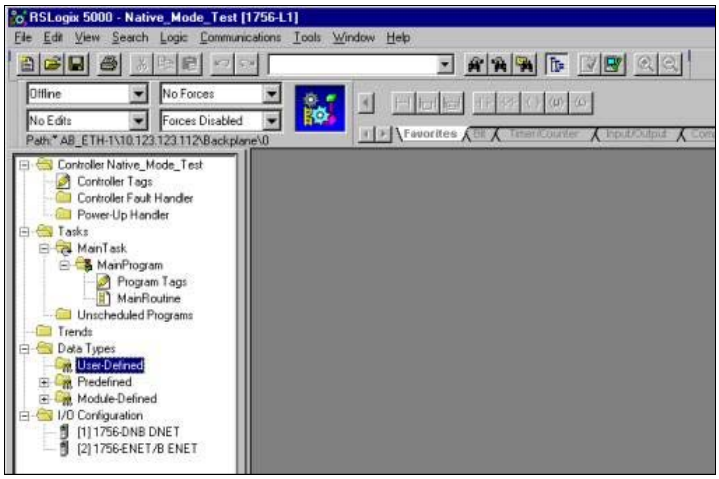


Figure 2-1: New Project showing User-Defined Folder

2. Create a Type 3 Command (refer to section 1.3.4 for information on Command Types). Enter a name for this tag (i.e., “Get_Value”). This tag will become a variable that contains the necessary information to formulate a Native Mode command to **send to In-Sight**.

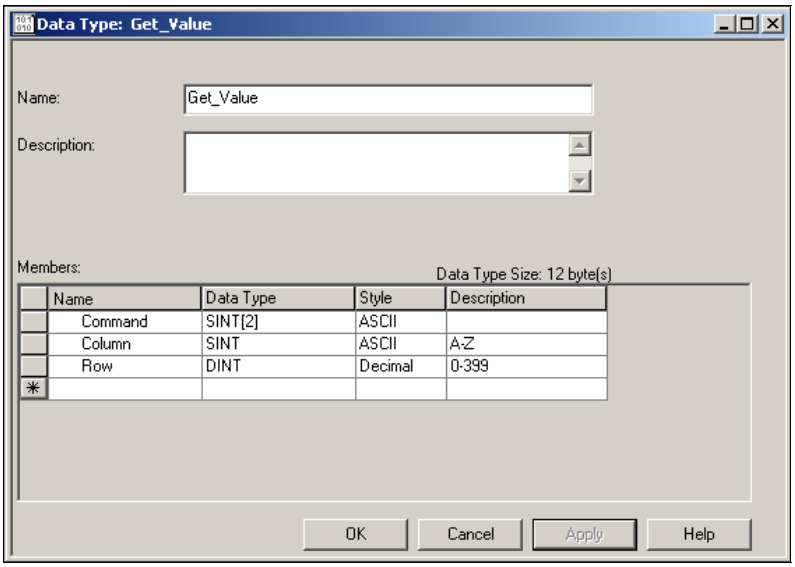


Figure 2-2: Type 3 Command Example

3. Click **Apply** to save the type and then **OK**. Note the size of this user-defined type (8 bytes).

4. Create another user-defined type to handle the data returned by In-Sight.

5. Name this data type “Get_Value_Result” and specify 2 members: “**Status**” as a 4-byte DINT value and “**Data**” as an arbitrarily sized array of characters (SINTS). The data is delimited with a carriage return (0x0D, ‘$r’).

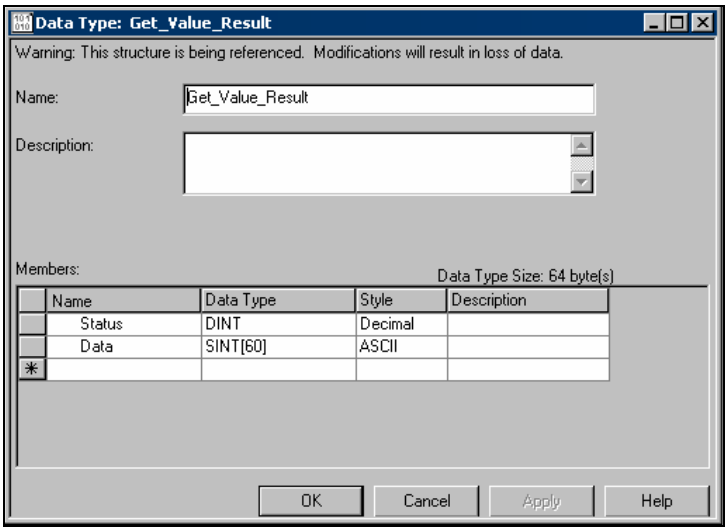


Figure 2-3: Type 3 Command Example

6. Click **Apply** to save the type and then **OK**.

NOTE	You can repeat this for each of the Command Types for sending different Native Mode commands to In-Sight (i.e., Set Event, Set Float, etc.).

Step 3: Create tags (*variables*) based on user-defined types:

1. From the left-hand panel, select **Controller Tags**, and then click the **Edit Tags** tab, to create a new tag.

2. Enter a name for this tag (i.e."Get_Value_Command"), and then select the ellipse button ("…") in the Type field to bring up the list of usable data types. Choose Get_Value (the user-defined data type we just created.) This tag will contain the Get Value Native Mode Command that is sent to In-Sight. Click **OK**.

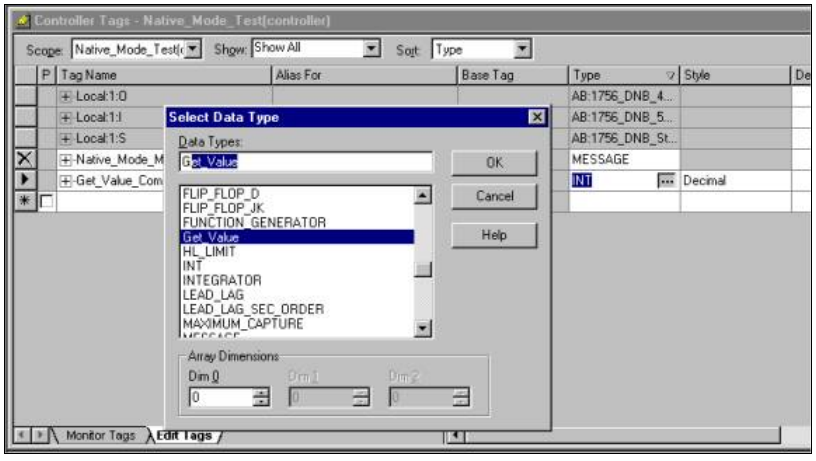


Figure 2-4: Select Data Type Dialog

3. Create another tag called "GV_Result" and make it of type Get_Value_Result. This will be the tag that receives the return value from In-Sight. Click **OK**.

4. Click the **Monitor Tags** tab.

5. Expand the Get_Value_Command tag that was created in step 2. Enter values appropriate for this command.

EXAMPLE: (Figure 2-5) Command element 0 is the letter 'G'. Command element 1 is the letter 'V'. The column is the letter 'A'. Row is the number 4.

NOTE	Column and row will have to reflect the In-Sight spreadsheet.

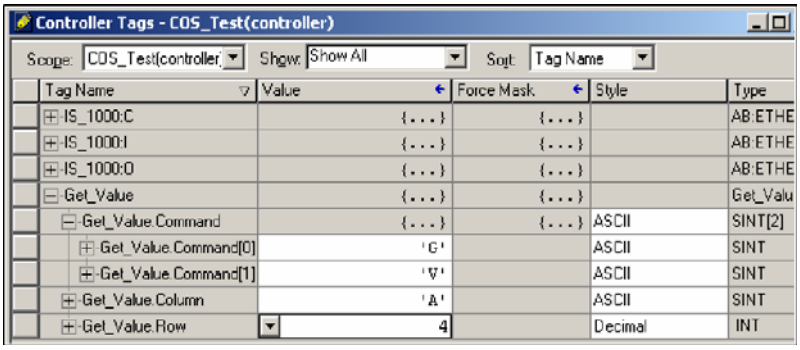


Figure 2-5: Controller Tags Dialog

At this point your command data is ready to be sent to In-Sight.

Step 4: Creating a Message (MSG) Instruction:

1. In the left-hand panel, click the **Main Routine** folder to open the ladder view and create a MSG instruction.

2. Configure the **Configuration** tab as shown in Table 2-1 and Figure 2-6.

Table 2-1: **Configuration Tab Parameters**

FIELD	VALUE (HEX)	DESCRIPTION
Class	78	Cognex Vendor Specific class
Instance	1	
Attribute	0	Command attribute
Service Code	33	Native Mode Service

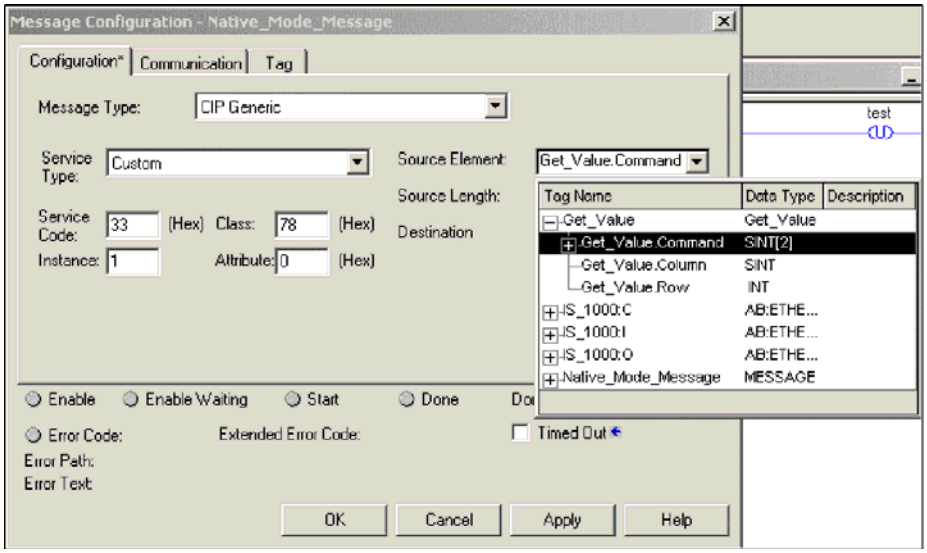


Figure 2-6: Message Configuration (Configuration Tab) Dialog

3. Set the Source Element to point to the Command element of the Get_Value_Command tag.

4. Set the Source Length to 12. This is the number of bytes the structure will use. This can be found in the Properties of the user-defined type.

5. Set the Destination to the GV_Result tag.

6. In the Communication tab, set the path to the In-Sight unit. The format is "**Source IP**, **Medium** (Ethernet = 2), **Destination IP**". For example (refer to Figure 2-7), **ENET_B_MODULE** is the module in the rack (selected by using the **Browse** button). The number **2** indicates “Use Ethernet Communication”; **10.123.1.11** is the IP address of the In-Sight unit.

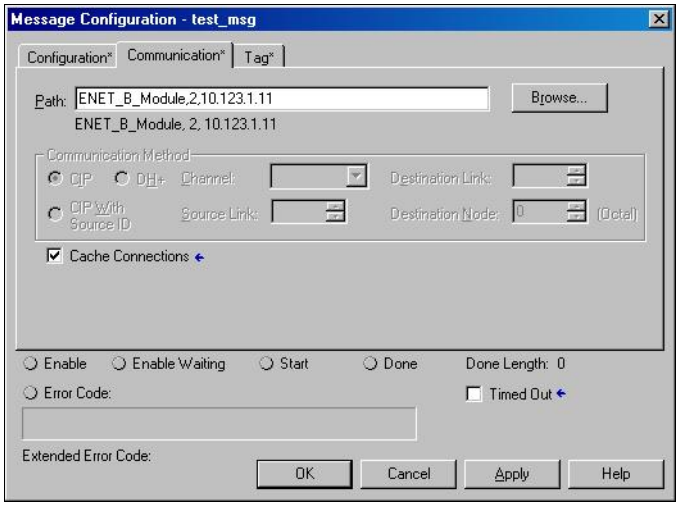


Figure 2-7: Message Configuration (Communication Tab) Dialog

7. Click **OK**.

8. Download your program to the controller.

9. Configure the In-Sight spreadsheet with data (A4 in this example).

10. Trigger the message instruction using the method that is appropriate for the application.

NOTE	This may require additional instructions in your logic program.

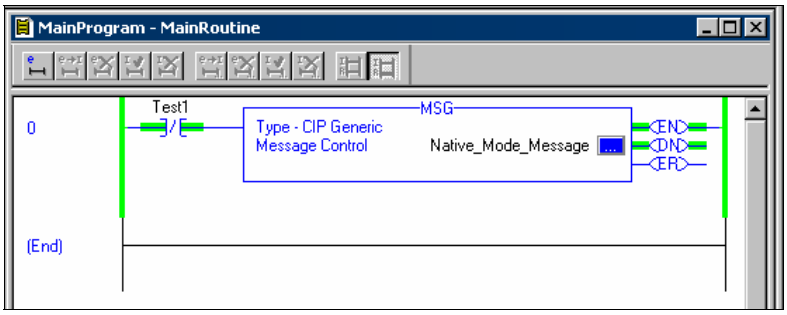


Figure 2-8: Example: Message Trigger Message Instruction

11. When the done (DN) bit is enabled, the message has completed. You can then examine the result data in the Controller Tags (see Figure 2-9).

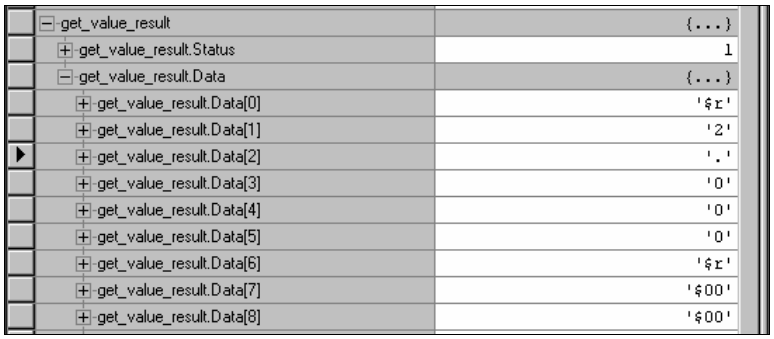


Figure 2-9: Control Tags dialog

12. For this example the result status is 1, indicating that the Native Mode command succeeded on the In-Sight system. In the result data we see the result value of “2.000” as a string with header and trailer of “$r”. The next step is to convert that string into a Real that the ControlLogix can use. Refer to the Rockwell documentation for more information and proper user of (MOV, COP, and STOR) instructions.

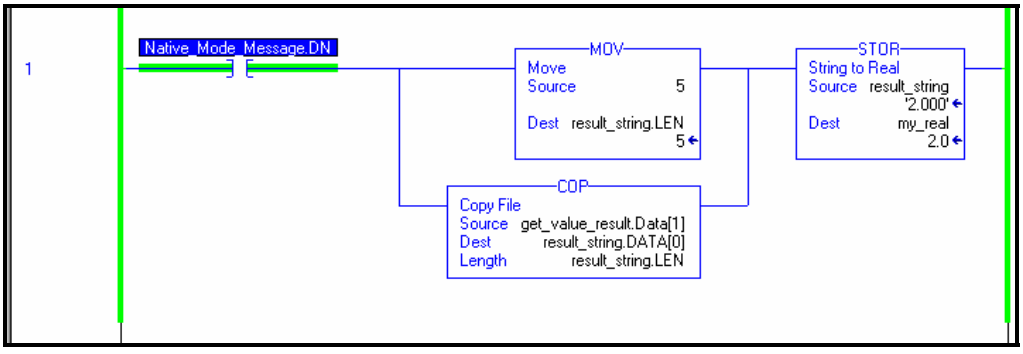


Figure 2-10: Convert from String to REAL Using STOR Example

3 Implicit Messaging Example

3.1 Configuration

This section outlines an Implicit Messaging configuration between the In-Sight system and the PLC. This example uses the ControlLogix 5550 Controller and Rockwell's RSLogix 5000 software.

3.1.1 Components Needed

- In-Sight Firmware (version 2.30.08 or higher)
- Rockwell's RSLogix 5000 programming software (version 8.0 or higher)
- Allen-Bradley ControlLogix controller with corresponding firmware to support RSLogix5000 v8.0.

3.1.2 Setting up in RSLogix 5000

1. Open RSLogix 5000 .
2. Create a new project (**File → New**).
3. In the left-hand pane, right click on the **I/O Configuration** folder and select **New Module.**
4. Select the current Allen-Bradley Ethernet module that is in the rack (e.g. 1756-ENET /B) and click **OK**.
5. Enter a name, slot, and IP address/host name for the module and click **FINISH**.
6. In the left-hand pane, right-click on the Ethernet module you just added and select **NEW MODULE**.
7. Select the **ETHERNET-MODULE: Generic Ethernet** Module type and click **OK**. This will be your connection to the In-Sight system.

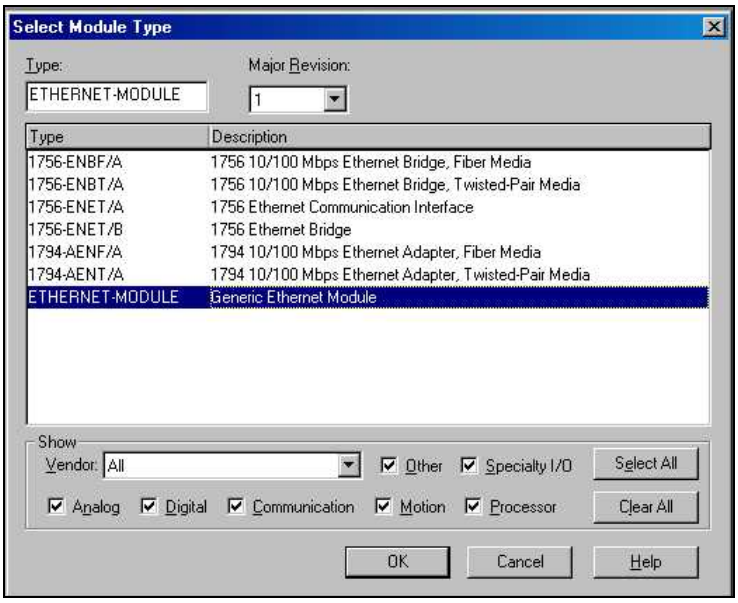


Figure 3-1: Select Module Type Dialog

8. In the Module Properties, General tab, enter a name for the In-Sight system, its IP address, and fill in the assembly information as follows:

NAME	ASSEMBLY INSTANCE	SIZE (4 BYTE WORDS)
Input	1	33
Output	2	33
Configuration	1	0

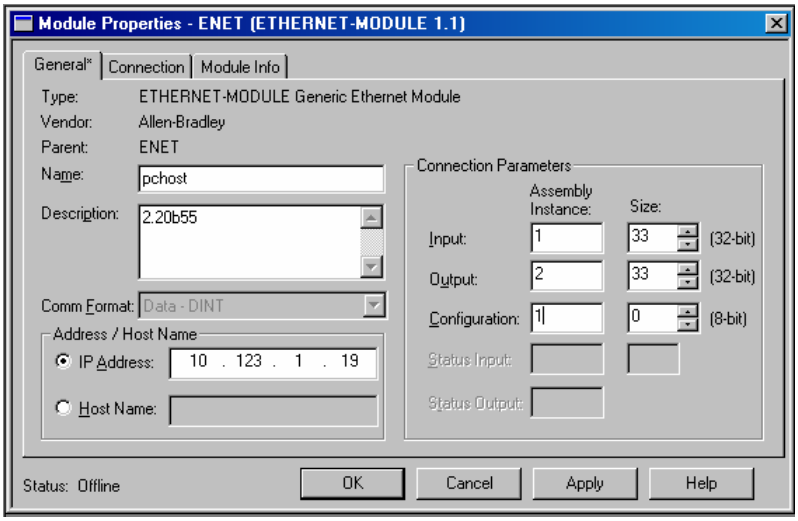


Figure 3-2: Module Properties Dialog

9. Click the **Connection** tab.

10. Enter an appropriate Request Packet Interval (RPI). This should be long enough to allow for all your vision processing to complete. Click **FINISH**.

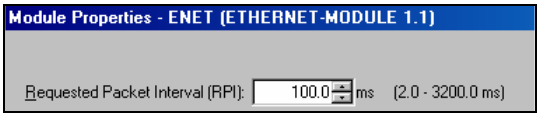


Figure 3-3: Module Properties Dialog – RPI Input Box

4 PCCC (PC^3) Communications Example

4.1 Configuration

This section outlines a PCCC (PC^3) Communications configuration between the In-Sight system and the PLC. This example uses the Allen-Bradley SLC5/05 and Rockwell's RSLogix 500 software.

4.1.1 Components Needed

- In-Sight Firmware (version 2.2 or higher)
- Rockwell's RSLogix 500 programming software (version 4.5 or higher)
- Allen-Bradley SLC5/05 controller with corresponding firmware to support RSLogix500

4.1.2 Using RSLogix 500

1. From within the RSLogix 500 software program, open the .RSS file, then open the Channel Configuration dialog (Project Folder→Controller Folder→Channel Configuration).

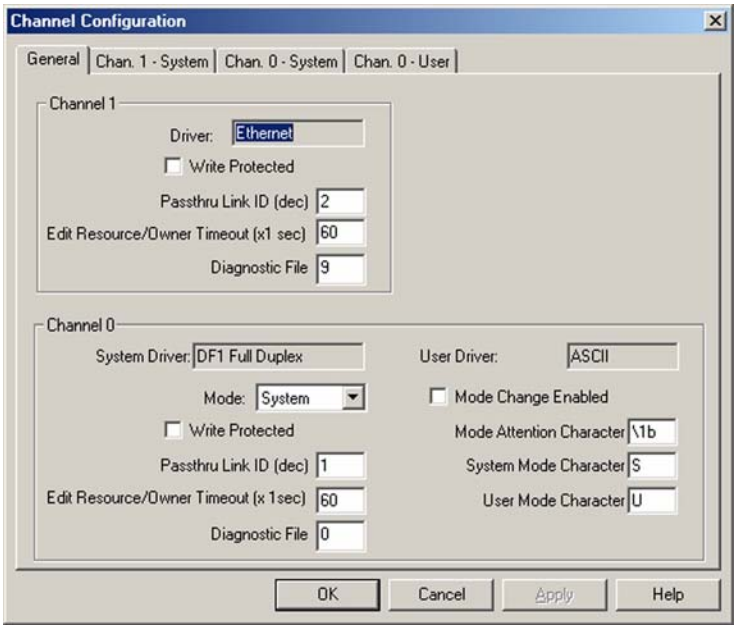


Figure 4-1: Channel Configuration Dialog (General Tab)

2. The Allen-Bradley SLC has 2 channels available for configuration: Channel 1 (Ethernet); and Channel 0 (DF1 Full Duplex - serial). Click on the **Chan. 1 – System** tab.

3. Refer to Figure 4-2. Configure Channel 1 (Ethernet) as necessary. Consult with a network administrator for proper settings.

NOTE	Verify that the IP/Subnet/Gateway parameters are correct on the PLC and the In-Sight unit.

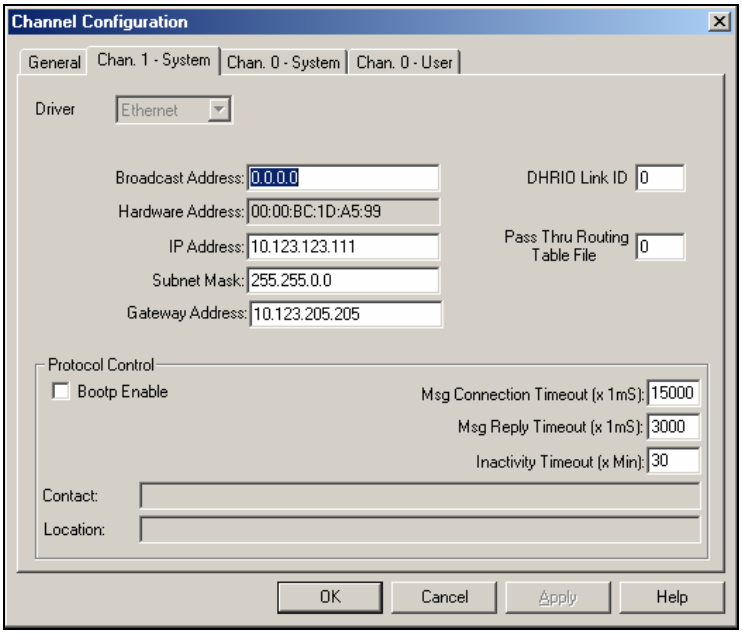


Figure 4-2: Channel Configuration Dialog (Channel 1 – System Tab)

4. Configure the Timeouts as required.

NOTE	The connection timeout and reply timeout are in milliseconds, inactivity is in seconds. These parameters will determine the Message Timeout parameter later used by the system when sending and receiving requests. (Msg Connection Timeout + Msg Reply Timeout + 5mS = Msg Timeout)

4.1.3 Message (MSG) Instruction

Message instructions may now be constructed within the application. Refer to the RSLogix 500 documentation for expanded instructions for developing messages.

The following setup parameters can be configured within a Message (MSG) Instruction.

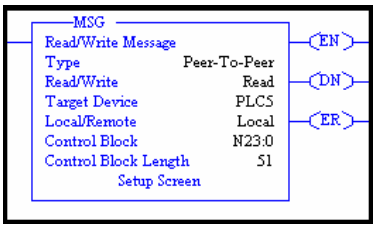


Figure 4-3: MSG Instruction

- **Type**: Peer-To-Peer. This cannot be modified.
- **Read/Write:** Select the function you want to perform on an In-Sight system. Read retrieves data from the In-Sight; write sends data to the In-Sight.

- **Target Device**: Choose PLC5 to talk to an In-Sight system. This tells the SLC which communication protocol to use. The In-Sight system acts much like a ControlLogix controller. (*See Rockwell document 13862.*)
- **Local/Remote**: Choose Local to indicate that the In-Sight system is on the same network as the SLC. Remote tells the SLC that you will be communicating to an In-Sight on another network. For remote communication, you must direct the message through another device acting as a gateway to that secondary network. Typically, this could be an Allen-Bradley ControlLogix controller. (*Refer to Rockwell documentation on how to address devices on other networks through a gateway*.)
- **Control Block**: This is a temporary integer file that the MSG instruction uses to store data (i.e., IP address, message type, etc.). This is typically not the user data to be sent.
- **Control Block Length**: This is automatically computed by the MSG instruction.
- **Setup Screen:** Selecting Setup Screen will open the Message Instruction Setup dialog.

4.1.4 Setup Screen for the MSG Instruction

The following setup parameters can be configured within a MSG Instruction setup screen.

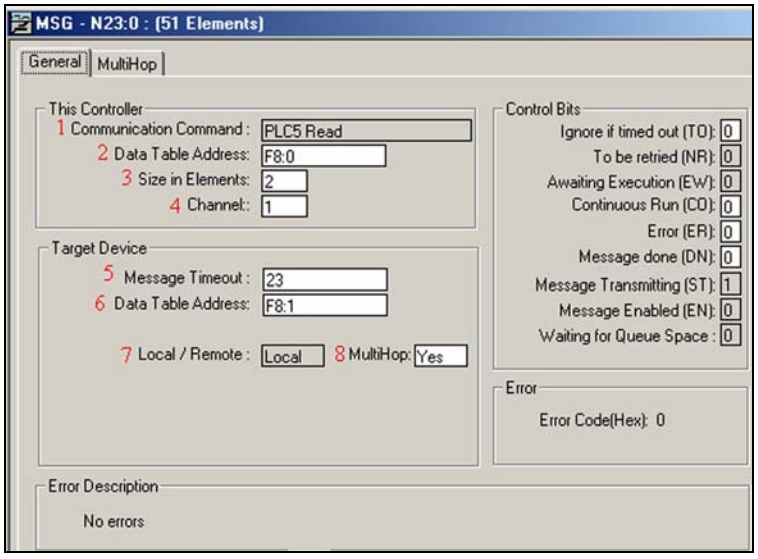


Figure 4-4: MSG Instruction Setup Screen

This Controller Section:

1. **Communication Command**: Should be the same command (Read/Write) that was chosen on the first screen (Figure 4-3).
2. **Data Table Address**: This is the location of the data file on the SLC where data will be written to (with a READ) or sent from (WRITE) (Figure 4-3).
3. F8:0 → 'F' indicates the float file, '8' indicates file number 8, ":0" indicates the offset into that file (in this case, start at the 0th element). Figure 4-5 shows an example of the Float Table accessed from the RSLogix 500 main screen.

4. **Size in Elements**: This is the number of elements (or individual data) to send. In this example we are sending two (2) elements (3.14 and 78.87).

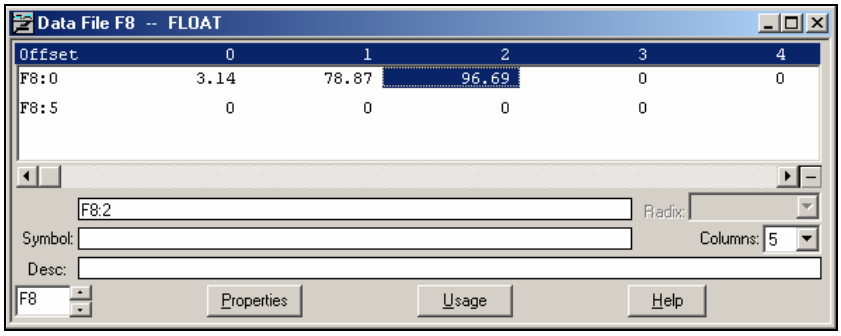


Figure 4-5: Float Table

5. **Channel**: Depends on the configuration of the SLC. In the SLC, Channel 1 is the Ethernet port.

Target Device Section:

6. **Message Timeout**: Choose an appropriate length of time in which you expect In-Sight to respond. If In-Sight does not respond within this length of time, the MSG instruction will error out. This parameter cannot be changed from this screen. Message Timeout is determined by the parameters entered in the Channel 1 setup dialog (refer to step 4, section 4.1.2).

7. **Data Table Address**: This is the location on the In-Sight system where data will be read or written to.

8. "F8:1" → 'F' indicates the data is of type float (real), "8" In-Sight will ignore (data is always written to the Input Assembly, and read from the Output Assembly), "1" has different meanings depending on whether you are doing a Read or a Write. With a Write Message the "1" indicates the actual data byte offset into the data portion of the Input Assembly. With a Read Message the "1" indicates the element (this is used like the index in the GetEIPData function above). For example: If the message were a READ, "F8:2" would indicate read the 3rd element ("**:2**" indicates the 3rd element. Remember the SLC uses a 0-based index), which is of type Float from the Output Assembly (remember Read gets data from the In-Sight's Output Assembly). If the message were a WRITE, "F8:12" would indicate to write a float value to the 12th byte of the data section of the Input Assembly.

9. WRITE indicated the actual byte of the assembly to begin writing data into. READ indicated an actual data element.

10. **Local/Remote**: Set to Local or Remote, depending on the application.

11. **MultiHop**: This setting is dependent on the information previously entered. For successful In-Sight communications, this should read YES at this time.

MultiHop Tab

The MultiHop tab is used to identify the address of the In-Sight system and the controller location. Both must be identified in order to route communications to the In-Sight device. As previously discussed, the In-Sight system acts as a ControlLogix module during PC^3 communications.

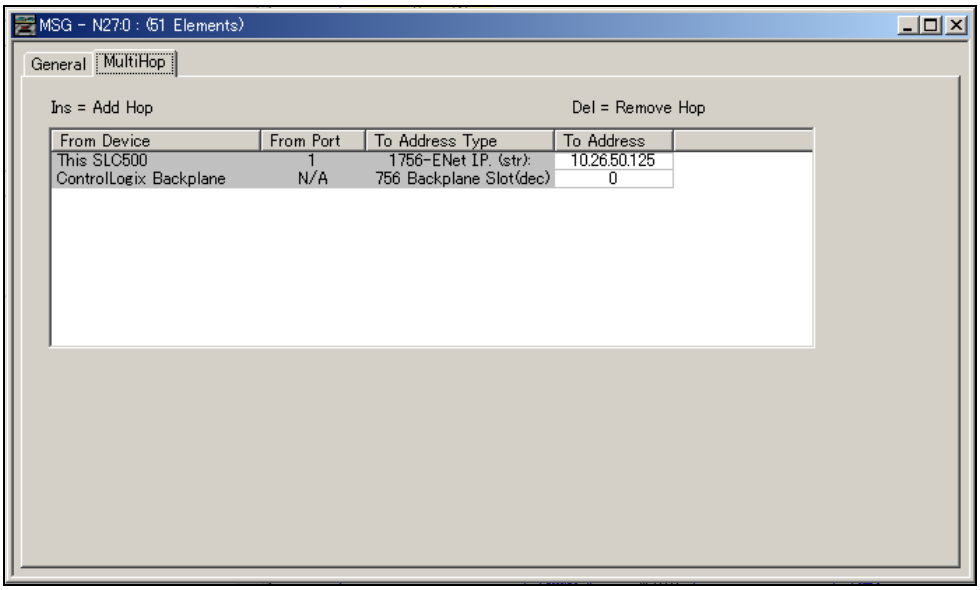


Figure 4-6: MultiHop Dialog

4.2 Using the MSG Instruction to Receive Data

In the following examples, assume that the In-Sight spreadsheet has a cell containing a **WriteEIP** function with a MapSpec of "**0f:4f:8il:10il:12il**"

EXAMPLE: In the RSLogix500 MSG instruction, we have "N8: 2" for target device data table address (DTA = "N8: 2") and we are requesting 3 elements (n = 3).

In the MSG instruction:
N indicates that we are going to transfer integers.
"2" indicates that we want to start at the 3rd item of the MapSpec.

NOTE All MapSpec parameters are zero-based.

The In-Sight system replies with the data at the third item in the MapSpec (8il), followed by 10il, and 12il (3 elements, all integers).

EXAMPLE: DTA = "F8: 1" n = 2

The reply would be the data at 4f (the 2nd item of the MapSpec) and In-Sight attempts to combine the data at 8il and 10il to make the second float. You can only request contiguous like elements (e.g. 2 float, 42 integers, 13 characters, etc.).

EXAMPLE: DTA = "F8:0" n = 2

The reply would be the data at 0f and 4f (2 elements, both floats).

EXAMPLE: DTA = "N8: 3" n = 2

The reply would be the data at 10il and 12il (2 elements, both integers). This example reinforces getting contiguous elements of the same type.

4.3 Sending Native Mode Commands from an SLC5/05

NOTE The In-Sight 3000 does not support Native Mode commands using PC³ Explicit Messaging.

1. Configure the SLC5/05 as necessary.
2. Create a String Table that will hold your Native Mode commands.

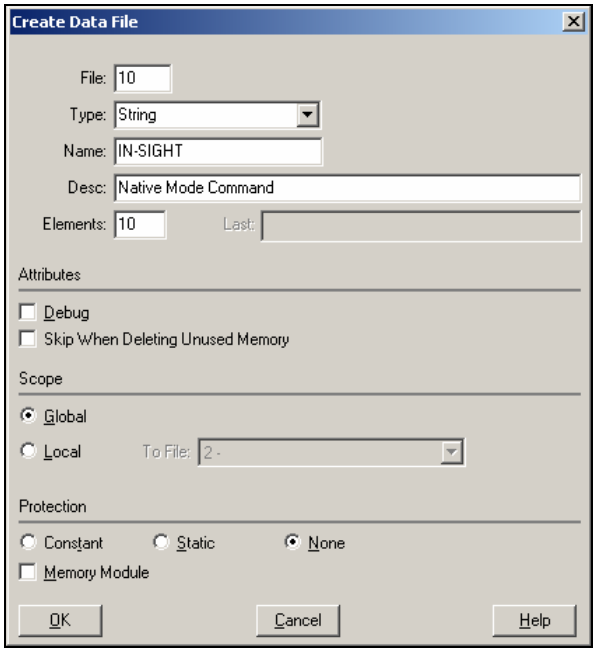


Figure 4-7: Create Data File Dialog

3. Add the required Native Mode command strings to the Data File

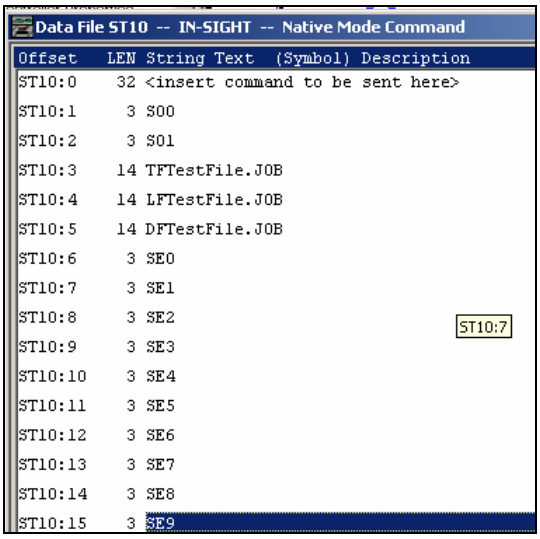


Figure 4-8: Data File String Table

4. Add a new Message (MSG) instruction to your ladder logic and configure it as shown in the following example:

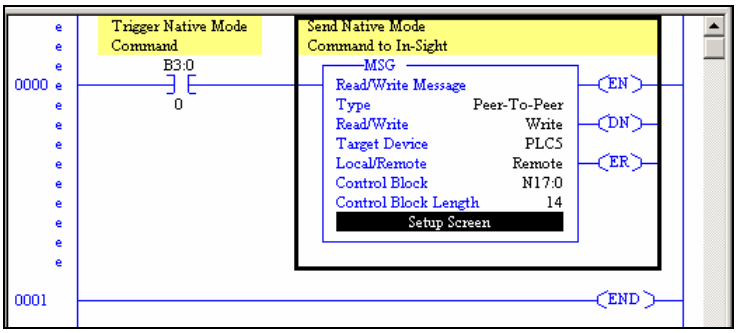


Figure 4-9: Add and Configure a Message Instruction

5. Enter the MSG Setup Screen and configure it as follows:

Table 4-1: **Configure MSG Setup Screen Parameters**

THIS CONTROLLER (SLC)	PARAMETER	DESCRIPTION
Data Table Address:	ST10:1	1st element from String Table (ST) created above
Size in Elements:	1	Always set to 1. PCCC MSG only allows for 1 string (therefore 1 command) to be sent at a time.
Channel:	1	Set this to the Ethernet Channel of your controller.
TARGET DEVICE (IN-SIGHT SYSTEM)	PARAMETER	DESCRIPTION
Message Timeout	(From the Channel Configuration dialog)	
Data Table Address:	ST10:0	This is the destination address. For native mode commands this will always be ST10:0

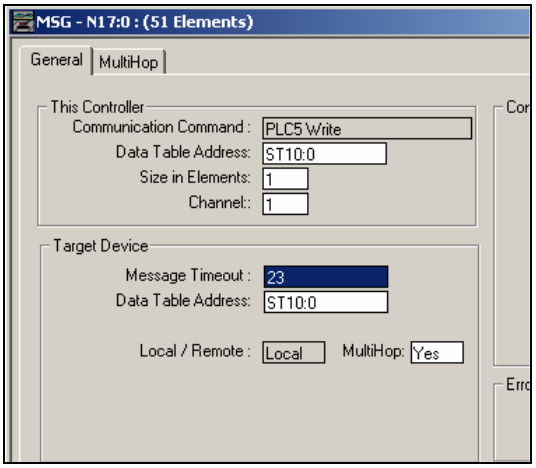
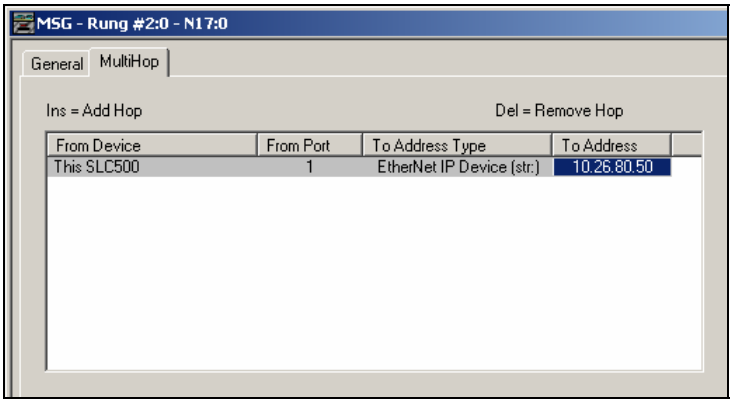


Figure 4-10: Message Setup Dialog

6. Click the **MultiHop** tab and configure it as required:

EXAMPLE: In this example, only the IP address of the destination In-Sight system needed to be set.



7. When everything is configured, close the MSG window.

8. Save your ladder logic, download it to the controller, then go online, and set the controller in RUN mode.

9. Trigger the message to send it to the In-Sight system.

4.4 Message Instruction Results

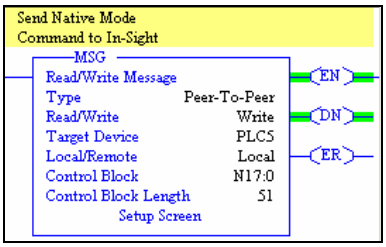


Figure 4-11: MultiHop Dialog

The Enable (EN) bit of the message instruction will be set to 1 when the input to the instruction is set high. The Done (DN) bit will be set to 1 when In-Sight has replied that the Native Mode command was received and executed with success. If the Error bit (ER) bit is enabled (set to 1), there has been a problem with the message instruction. If an error occurs, click the Setup Screen for the MSG instruction. The Error Code will be shown at the bottom of the window. Error codes are listed in Table 4-2.

Table 4-2: **Error Codes**

ERROR CODE	DESCRIPTION	NATIVE MODE RETURN CODE
00	Success – No Error	1
10	Illegal Command or format	0
EE	Command Cannot be executed	-2, -4, or -5
D9	Reply not received before user-specified timeout.	NA
F2	Invalid parameter or invalid data	-1