



A Sierra Monitor Company

Driver Manual
(Supplement to the FieldServer Instruction Manual)

FS-8704-14 EtherNet/IP

APPLICABILITY & EFFECTIVITY

Effective for all systems manufactured after January 2009

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1 ETHERNET/IP DESCRIPTION

The Ethernet IP driver allows the FieldServer to transfer data to and from devices over Ethernet using the EtherNet/IP protocol. The FieldServer can emulate either a Server or Client.

EtherNet/IP uses CIP (Control and Information Protocol), the common network, transport and application layers also shared by ControlNet and DeviceNet. EtherNet/IP then makes use of standard Ethernet and TCP/IP technology to transport CIP communications packets. The result is a common, open application layer on top of open and highly popular Ethernet and TCP/IP protocols.

The Driver is able to read/write using the Data Table structure employed by all Logix Series PLC's.

PCCC support is also provided for legacy devices that do not fully support CIP encapsulation. EIP PCCC Encapsulation was tested at FST factory using PLC5 1785 ENET card. The following data types were tested:

- N
- F
- S

The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer.

1.1 ODVA Status.

ODVA is an international association comprised of members from the world's leading automation companies. Collectively, ODVA and its members support network technologies based on the Common Industrial Protocol (CIP™). These currently include DeviceNet™, EtherNet/IP™, CIP Safety™ and CIP Sync™. ODVA manages the development of these open technologies, and assists manufacturers and users of CIP-based networks through tools, training and marketing activities.

FieldServer Technologies is an ODVA member and our device is ODVA tested to be Ethernet/IP Compliant.

Vendor Code	875
Product Type Code	12 or "Communications Adapter"

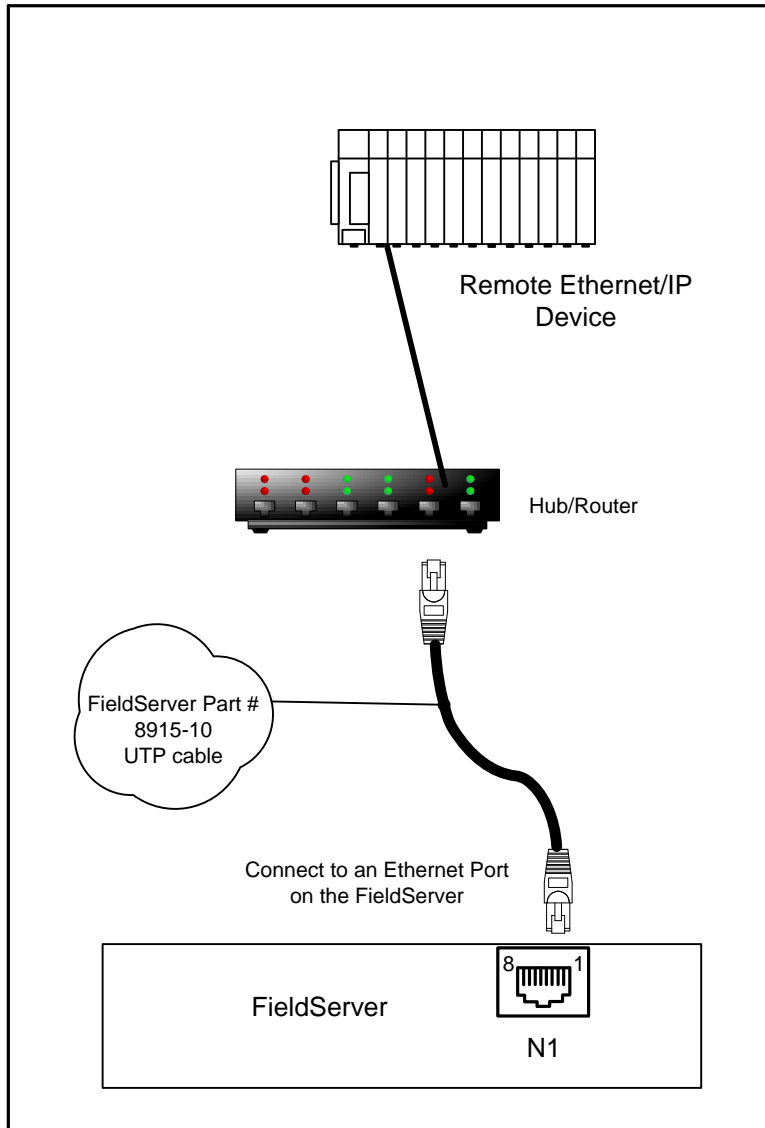
2 DRIVER SCOPE OF SUPPLY

2.1 Supplied by FieldServer Technologies for this driver

FieldServer Technologies PART #	Description
FS-8915-10	UTP cable (7 foot) for Ethernet connection
FS-8704-14	Driver Manual

3 HARDWARE CONNECTIONS

It is possible to connect an EtherNet/IP device to either port N1 or N2¹ on the FieldServer. These ports must just be configured to use EtherNet/IP in the configuration file.



¹ Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

4 CONFIGURING THE FIELDSEVER AS AN ETHERNET/IP CLIENT

For a detailed discussion on FieldServer configuration, please refer to the FieldServer Configuration Manual. The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer.

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with an EtherNet/IP Server.

4.1 Data Arrays/Descriptors

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for EtherNet/IP communications, the driver independent FieldServer buffers need to be declared in the "Data Arrays" section, the destination device addresses need to be declared in the "Client Side Nodes" section, and the data required from the servers needs to be mapped in the "Client Side Map Descriptors" section. Details on how to do this can be found below.

Note that in the tables, * indicates an optional parameter, with the bold legal value being the default.

Section Title			
Data_Arrays	Column Title	Function	Legal Values
	Data_Array_Name	Provide name for Data Array	Up to 15 alphanumeric characters
	Data_Array_Format	Provide data format. Each Data Array can only take on one format.	Float, Bit, UInt16, SInt16, Packed_Bit, Byte, Packed_Byte, Swapped_Byte
	Data_Array_Length	Number of Data Objects. Must be larger than the data storage area required by the Map Descriptors for the data being placed in this array.	1-10,000

Example

```

// Data Arrays
Data_Arrays
Data_Array_Name ,Data_Format ,Data_Array_Length
DA_AI_01 ,UInt16 ,200
DA_AO_01 ,UInt16 ,200
DA_DI_01 ,Bit ,200
DA_DO_01 ,Bit ,200
    
```

4.2 Client Side Connection Descriptions

Section Title		
Adapter		
Column Title	Function	Legal Values
Adapter	Adapter Name	N1, N2 ²
Protocol	Specify protocol used	EtherNet/IP

Example

```
// Client Side Connections

Adapters
Adapter           ,Protocol
N1                ,EtherNet/IP
```

4.3 Client Side Node Descriptors³

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for node	Up to 32 alphanumeric characters
IP_Address	Address of Server	Any valid address on subnet
Protocol	Specify protocol used	EtherNet/IP
Adapter	Specify port Adapter used	N1, N2 ²

Example

```
// Client Side Nodes

Nodes
Node_Name         ,IP_Address   ,Adapter  ,Protocol
PLC 1             ,192.168.1.174 ,N1       ,EtherNet/IP
```

² Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

³ Only one explicit connection is created per node. All explicit Map Descriptors attached to that node will use the same explicit connection.

4.4 Client Side Map Descriptors

4.4.1 FieldServer Related Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor	Up to 32 alphanumeric characters
Data_Array_Name	Name of Data Array where data is to be stored in the FieldServer	One of the Data Array names from "Data Array" section above
Data_Array_Offset	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Function	Function of Client Map Descriptor	Rdbc, Wrbc, Wrbx

4.4.2 Driver Related Map Descriptor Parameters – Unconnected Messages

Column Title	Function	Legal Values
EIP_Service	The action to be performed.	Get_Attrib, Set_Attrib
EIP_Class	Class to be polled.	One of the classes supported by the driver. Refer to Appendix A.4
EIP_Attribute	Attribute associated with the class given.	See particular attributes of each class. Refer to Appendix A.4
EIP_Con_Typ	The type of data transfer required. Also referred to as the "Transport Method"	Unconnected Explicit
EIP_Path*	Used to stipulate the path to the CPU in certain PLC's. Paths vary and are dependent on the structure of the network.	Any space delimited numerical value. Refer to vendor's device documentation. Also see Appendix A.3, 00
Length	Number of data elements to be mapped. If the number of data elements exceeds the Map Descriptor length, the list of data elements will be truncated and an error message will be printed once per Map Descriptor. Refer to Appendix C for further information.	For any given Map Descriptor there can be 200 Floats, 400 Integers or 800 Bytes
Address	Instance of the class to be polled.	Depends on the supported instances for each class.

4.4.3 Driver Related Map Descriptor Parameters – Data Table Read/Write.

Column Title	Function	Legal Values
EIP_Service	The action to be performed.	Data_Table_Read, Data_Table_Write
EIP_Con_Typ	The type of data transfer required.	Explicit
EIP_Path*	Used to stipulate the path to the CPU in certain PLC's. Paths vary and are dependent on the structure of the network.	Any space delimited numerical value. Refer to vendor's device documentation. Also see Appendix A.3, 00
EIP_Tag_Name	Tag name expressed in PLC program. The data type of this parameter is used to set the data format of the Data Array if the EIP_DATA_TYPE parameter is not specified.	Maximum length 48 characters.
EIP_Data_Type*	If the parameter is specified, the data will be stored in the specified format which may be different to the format of the tag being polled. If the parameter is not set, the Data Type of the Data Array will be used. This parameter is only applicable to Data Table Write when FieldServer is the Client. The Data Type of the Data Array will be used for Data Table Reads when the FieldServer is the Client. Refer to Appendix A.4 for more information.	Float, Uint16, Uint32, Bit, Byte, Boolean, -
Length	Number of data elements to be mapped. If the number of data elements exceeds the Map Descriptor length, the list of data elements will be truncated and an error message will be printed once per Map Descriptor. See Appendix C for further information.	For any given Map Descriptor there can be 200 Floats, 400 Integers or 800 Bytes
EIP_Structure_Handle*	This parameter is required to read/write structures. The driver supports read/write structures having members of same type, i.e. all members are of type Byte, UINT16, UINT32 or Float etc When this parameter is defined, the number of structure members must be specified as the length of the Map Descriptor. Refer to Appendix A.7 for more information.	Any 16bit Integer number (e.g. 59592), 0

4.4.4 Driver Related Map Descriptor Parameters – PCCC

Column Title	Function	Legal Values
EIP_Service	Action to be performed	Exec_PCCC (Encapsulation using Allen Bradley PCCC)
EIP_Con_Typ	The type of data transfer required	Explicit
EIP_Path*	Used to stipulate the path to the CPU in certain PLC's. Paths vary and are dependent on the structure of the network.	Any space delimited numerical value. Refer to vendor's device documentation. Also see Appendix A.3, 0 0
File_Type	Allen Bradley file type	N Integer F Float O Output B Boolean I Input S Status
File_Number	Allen Bradley file number	Any valid numerical value
Length	Number of data elements to be mapped. If the number of data elements exceeds the Map Descriptor length, the list of data elements will be truncated and an error message will be printed once per Map Descriptor. Refer to Appendix C for further information.	For any given Map Descriptor there can be 200 Floats, 400 Integers or 800 Bytes
Address	Address in the file	Any valid numerical value between 0 to 255

4.4.5 Timing Parameters

Column Title	Function	Legal Values
Scan_Interval	Rate at which data is polled	≥0.001s

4.4.6 Map Descriptor Example 1: Unconnected Messages

```
// Client Side Map Descriptors
```

Map_Descriptors											
Map_Descriptor_Name	,Scan_Interval	,Data_Array_Name	,Data_Array_Offset	,Function	,EIP_Con_Typ	,Node_Name	,EIP_Class	,Address	,EIP_Attribute	,EIP_Service	,Length
CMD_PRO_03	,0s	,DA_AI_01	,0	,Rdbc	,Unconnected	,EIP_01	,10	,1	,3	,Get_Attrib	,1
CMD_PRO_02	,0s	,DA_AI_01	,1	,Rdbc	,Unconnected	,EIP_01	,10	,2	,3	,Get_Attrib	,1

4.4.7 Map Descriptor Example 2: Data Table Messages

```
// Client Side Map Descriptors
```

Map_Descriptors											
Map_Descriptor_Name	,Scan_Interval	,Data_Array_Name	,Data_Array_Offset	,EIP_Con_Typ	,Node_Name	,Function	,EIP_Service	,EIP_Path	,EIP_Tag_Name	,Length	
Cmd_Pro_09	,0s	,DA_AI_05	,0	,Explicit	,EIP_01	,Rdbc	,Data_Table_Read	,1 1	,analog_in_3	,2	
Cmd_Pro_10	,0s	,DA_AI_06	,0	,Explicit	,EIP_01	,Rdbc	,Data_Table_Read	,1 1	,analog_in_4	,2	

4.4.8 Map Descriptor Example 3: PCCC Messages

```
// Client Side Map Descriptors
```

Map_Descriptors											
Map_Descriptor_Name	,Data_Array_Name	,Data_Array_Offset	,Function	,EIP_Con_Typ	,Node_Name	,EIP_Service	,EIP_Path	,File_Type	File_Number	,Address	,Length
CMD_01	,DA_F_01	,0,	,Rdbc	,Explicit	,EIP_01	,Exec_PCCC	,1 0	,F	8,	,30	,10

5 CONFIGURING THE FIELDSEVER AS AN ETHERNET/IP SERVER

For a detailed discussion on FieldServer configuration, please refer to the FieldServer Configuration Manual. The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer.

This section documents and describes the parameters necessary for configuring the FieldServer to communicate with an EtherNet/IP Client.

The configuration file tells the FieldServer about its interfaces, and the routing of data required. In order to enable the FieldServer for EtherNet/IP communications, the driver independent FieldServer buffers need to be declared in the "Data Arrays" section, the FieldServer virtual node(s) needs to be declared in the "Server Side Nodes" section, and the data to be provided to the Clients needs to be mapped in the "Server Side Map Descriptors" section. Details on how to do this can be found below.

Note that in the tables, * indicates an optional parameter, with the bold legal value being the default.

5.1 Server Side Connection Descriptors

Section Title		
Connections		
Column Title	Function	Legal Values
Adapter	Adapter Name	N1, N2 ⁴
Protocol	Specify protocol used	EtherNet/IP

Example

```

// Server Side Connections

Adapters
Adapter           ,Protocol
N1                ,EtherNet/IP
```

⁴ Not all ports shown are necessarily supported by the hardware. Consult the appropriate Instruction manual for details of the ports available on specific hardware.

5.2 Server Side Node Descriptors³

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for Node	Up to 32 alphanumeric characters
Protocol	Specify protocol used	EtherNet/IP
Server_Hold_Timeout*	Specifies time FieldServer will reserve server side connection while waiting for the Client side to update data.	>1.0s

Example

```
// Server Side Nodes

Nodes
Node_Name      ,Protocol
EIP_01        ,EtherNet/IP
```

5.3 Server Side Map Descriptors

5.3.1 FieldServer Specific Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor	Up to 32 alphanumeric characters
Data_Array_Name	Name of Data Array where data is to be stored in the FieldServer	One of the Data Array names from "Data Array" section above
Data_Array_Offset	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Function	Function of Server Map Descriptor	Server
Server_Hold_Timeout*	Specifies the length of time that the FieldServer will reserve the Server side connection while waiting for the Client side to update data in Data Array (if necessary)	>1.0s

5.3.2 Server Specific Map Descriptor Parameters – Unconnected Messages

Column Title	Function	Legal Values
EIP_Service	The action to be performed.	Get_Attrib, Set_Attrib
EIP_Class	Class to be served.	One of the classes supported by the driver. Refer to Appendix A.4
EIP_Attribute	Attribute associated with the class served.	See particular attributes of each class. Refer to Appendix A.4
Length	Number of data elements to be mapped. If the number of data elements exceeds the Map Descriptor length, the list of data elements will be truncated and an error message will be printed once per Map Descriptor. Refer to Appendix C for further information.	For any given Map Descriptor there can be 200 Floats, 400 Integers or 800 Bytes
Address	Instance of the class to be served.	Depends on the supported instances for each class.

5.3.3 Server Specific Map Descriptor Parameters – Data Table Read/Write.

Column Title	Function	Legal Values
EIP_Service	The action to be performed.	Data_Table_Read, Data_Table_Write
EIP_Tag_Name	Tag name expressed in PLC program. The data type of this parameter is used to set the data format of the Data Array if the EIP_Data_Type parameter is not specified.	Maximum length 48 characters.
EIP_Data_Type*	If set, the data will be stored in the specified format which may be different to the format of the tag being polled. If the parameter is not set, the data type of the Data Array will be used. This is only applicable to Data Table Read when FieldServer is the Server. Refer to Appendix A.4 for further information.	Float, Uint16, Uint32, Bit, Byte, Boolean, -
Length	Number of data elements to be mapped. If the number of data elements exceeds the Map Descriptor length, the list of data elements will be truncated and an error message will be printed once per Map Descriptor. Refer to Appendix C for further information.	For any given Map Descriptor there can be 200 Floats, 400 Integers or 800 Bytes
EIP_Structure_Handle*	This parameter is required only for read structures i.e. where EIP_Service is Data_Table_Read. The driver supports read structures having members of same type, i.e. all members are of type Byte, Uint16, Uint32 or Float etc. When this parameter is defined, the number of structure members must be specified as the length of the Map Descriptor.	Any 16bit Integer number e.g. 59592, 0

5.3.4 Driver Related Map Descriptor Parameters – PCCC

Column Title	Function	Legal Values
EIP_Con_Typ	The type of data transfer required	Explicit
EIP_Service	Action to be performed	EXEC_PCCC (Encapsulation using Allen Bradley PCCC)
File_Type	Allen Bradley file type	N Integer F Float O Output B Boolean I Input S Status
File_Number	Allen Bradley file number	Any valid numerical value
Length	Number of data elements to be mapped. If the number of data elements exceeds the Map Descriptor length, the list of data elements will be truncated and an error message will be printed once per Map Descriptor. Refer to Appendix C for further information.	For any given Map Descriptor there can be 61 Floats, 122 Integers or 244 Bytes. .
Address	Address in the file	Any valid numerical value between 0 to 255

5.3.5 Map Descriptor Example 1: Unconnected Messages

```
// Server Side Map Descriptors
```

```
Map_Descriptors
```

Map_Descriptor_Name	,Data_Array_Name	,Data_Array_Offset	,Function	,Node_Name	,EIP_Class	,Address	,EIP_Attribute	,EIP_Service	,Length
SMD_PRO_01	,DA_AI_01	,0	,Server	,EIP_01	,10	,1	,3	,Get_Attrib	,1
SMD_PRO_02	,DA_AI_01	,1	,Server	,EIP_01	,10	,2	,3	,Get_Attrib	,1

5.3.6 Map Descriptor Example 2: Data Table Messages

```
// Server Side Map Descriptors
```

```
Map_Descriptors
```

Map_Descriptor_Name	,Data_Array_Name	,Data_Array_Offset	,Node_Name	,Function	,EIP_Service	EIP_Tag_Name	,Length
SMD_PRO_09	,DA_AI_05	,0	,EIP_01	,Server	,Data_Table_Read	,Analog_in_3	,2
SMD_PRO_10	,DA_AI_06	,0	,EIP_01	,Server	,Data_Table_Read	,Analog_in_4	,2

5.3.7 Map Descriptor Example 3: PCCC Messages

```
// Server Side Map Descriptors
```

```
Map_Descriptors
```

Map_Descriptor_Name	,Data_Array_Name	,Data_Array_Offset	,Function	,EIP_Con_Typ	,Node_Name	,EIP_Service	,File_Type	,File_Number	,Address	,Length
SRV_AI_01	,DA_F_01	,0	,Server	,Explicit	,EIP_01	,Exec_PCCC	,F	,8	,30	,20

Appendix A. Advanced Topics

Appendix A.1. General Notes

- The connection type does not need to be specified in the Server side Map Descriptor, but must be stipulated on the Client side of the driver.
- Data_Table_Read as a service can only be used when creating an explicit connection.

Appendix A.2. FieldServer as an Adapter and Scanner.

It is possible for the FieldServer to act as a scanner and an adapter at the same time so long as the scanner and adapter are configured on different ports. Consequently this functionality is not possible on an FS-X20 platform.

Appendix A.3. Common Paths

Device	Typical Path
Direct AB	1 0
AB ENI module	3 1
AB ControlLogix 1756-L55 (With network card 1756-ENBT/A)	1 1 or 1 0
CompactLogix ENI (1769-L31 using the 1761-NET-ENI)	3 1
CompactLogix Direct Connection (P/N 1769-L35E)	1 1 or 1 0

Appendix A.4. Setting the Data Type for stored data.

The default Data Type of stored data is determined by the Data Type of the Data Array. It is possible to configure the driver to store the data as a different type. This can be achieved by specifying the data type under the parameter EIP_Data_Type.

Note that the EIP_DATA_TYPE parameter has meaning only for DATA_TABLE_WRITE where the FieldServer is the Client and for DATA_TABLE_READ where the FieldServer is the Server.

Appendix A.5. Configuring a PLC to read and write data to and from FieldServer

This example makes use of the Data Table Read/Write method for passing data between the FieldServer and an Allen Bradley PLC. The example shows configuration of a ControlLogix PLC, but all Rockwell PLC's that support Ethernet IP communications and Data Table Read/Write operations in Message blocks should be able to communicate this way. The Map Descriptors create an explicit connection to the Server and then transfer data in the data table format. The EIP_Tag_Name field contains the tag name polled from the client. DATA_TABLE_READ and DATA_TABLE_WRITE are the only legal values for EIP_SERVICE.

Note that this is by far the preferred method for communicating with Allen Bradley PLC's due to its ease of configuration, quantity of data that can be transferred and speed of transfer.

Appendix A.5.1. FieldServer Configuration File

The configuration file used for this example is configured with the following Connection, Node and Map Descriptor Parameters:

```
// Data Arrays
//
Data_Arrays
Data_Array_Name ,Data_Format ,Data_Array_Length
DA_Read ,Float ,100
DA_Write ,Float ,100
```

```
// Server Side Connections
//
Connections
Adapter ,Protocol ,Turnaround_delay
N1 ,Ethernet/IP ,0.01s
```

```
// Server Side Nodes
//
Nodes
Node_Name ,Protocol
EIP_01 ,Ethernet/IP
```

```
// Server Side Map Descriptors
//
Map_Descriptors
Map_Descriptor_Name ,Data_Array_Name ,Data_Array_Offset ,Node_Name ,Function ,EIP_SERVICE ,EIP_TAG_NAME ,Length
FS_TO_PLC_DATA ,DA_Read ,0 ,EIP_01 ,Server ,DATA_TABLE_READ ,Read_Data ,20
PLC_TO_FS_DATA ,DA_Write ,0 ,EIP_01 ,Server ,DATA_TABLE_WRITE ,Write_Data ,20
```

“FieldServer “Tag names that will be called in the PLC Message Block. The names must match what is written in the Message block in the PLC exactly.

Note: The corresponding PLC Tag Name can be different and probably will be. See Message Block Below.

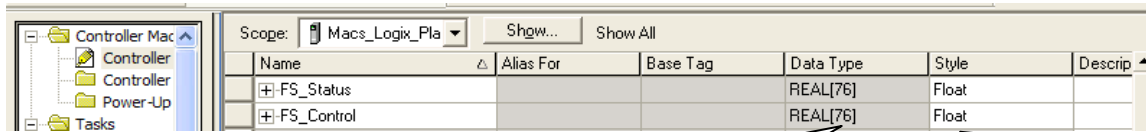
Number of data points made available for reading or writing within the Tag.

Appendix A.5.2. The PLC Program

The PLC program example below shows the minimum steps necessary to program communications with the FieldServer. Depending on the real intended application, additional steps may be necessary for completeness.

Step 1

Configure Tags in the PLC for storing FieldServer read and write data:



Tag Length Must be equal to or greater than the number of points being written/read

Avoid Using UDT Types. The Data will be read but the exact placement of the data in the Tags and Arrays will be hard to determine

Step 2

Configure Message Tags for storage of Message Block data:

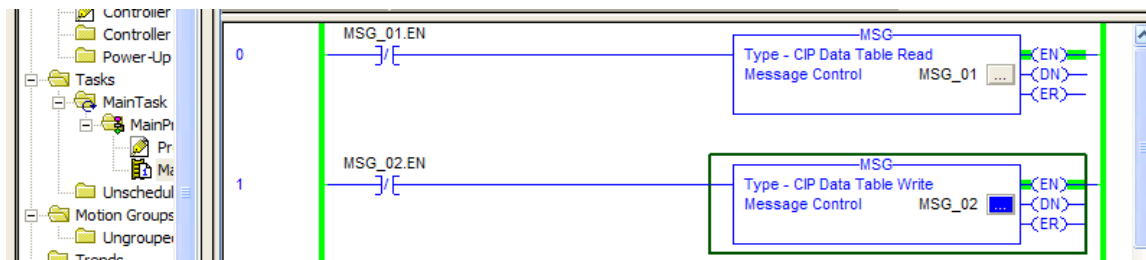


MESSAGE Data Type must be used.

Note that this logic shown will cause the PLC to poll the FieldServer at a very high speed. This may overload network traffic - logic that schedules the communication at a slower rate is generally more advisable.

Step 3

Write Ladder Logic to exercise a Read and Write Message Block



Step 4

Configure the Properties for the two Message Blocks by clicking on the “...” button:

Read Message Block:

The screenshot shows the 'Message Configuration - MSG_01' dialog box with the 'Tag' tab selected. Callouts provide the following information:

- Remote FieldServer Tag Configured in the FieldServer (see example above):** Points to the 'Message Type' dropdown, which is set to 'CIP Data Table Read'.
- Number of points transferred from FieldServer to PLC regardless of Tag and Array Sizes:** Points to the 'Number Of Elements' spinner, which is set to 20.
- Local PLC Tag configured in the PLC Tag List (see example above):** Points to the 'Destination Element' text box, which contains 'FS_Status'.

Write Message Block:

The screenshot shows the 'Message Configuration - MSG_02' dialog box with the 'Tag' tab selected. Callouts provide the following information:

- Local PLC Tag configured in the PLC Tag List (see example above):** Points to the 'Message Type' dropdown, which is set to 'CIP Data Table Write'.
- Number of points transferred from PLC to FieldServer regardless of Tag and Array Sizes:** Points to the 'Number Of Elements' spinner, which is set to 20.
- Remote FieldServer Tag configured in the FieldServer (see example above):** Points to the 'Destination Element' text box, which contains 'Write_Data'.

Communication Tab for both Message Blocks:

The screenshot shows the 'Message Configuration - MSG_01' dialog box with the 'Communication' tab selected. Callouts provide the following information:

- The Tag Tab requires no configuration.** Points to the 'Tag' tab.
- EIP_Card is the name of the Ethernet ENBT Card in the ControlLogix Rack. "2" refers to the port number on the ENBT Card. 192.168.1.75 is the IP Address of the FieldServer.** Points to the 'Path' text box, which contains 'EIP_Card, 2, 192.168.1.75'.

Step 5

Download the program and set the PLC to Run Mode.

Appendix A.6. Configuring a FieldServer to read and write Data to and from a PLC.

This example makes use of the Data Table Read/Write method for passing data between the FieldServer and an Allen Bradley PLC. The example shows configuration of a ControlLogix PLC, but all RockWell PLC's that support Ethernet IP communications and Data Table Read/Write operations in Message blocks should be able to communicate this way. . These map descriptors will create an explicit connection to the server and will then transfer data in the data table format. The EIP_Tag_Name field contains the tag name referenced in the server and the EIP_Path field represents the path (through different ports) to the server. Each port jump is separated by a space. This field generally holds a backplane / cpu slot combination. DATA_TABLE_READ and DATA_TABLE_WRITE are the only legal values for EIP_SERVICE.

Note that this is by far the preferred method for communicating with Allen Bradley PLC's due to it's ease of configuration, quantity of data that can be transferred and speed of transfer.

When the FieldServer is the active component as shown below (i.e: the FieldServer Polls the PLC and not the other way around), then very little programming is needed in the PLC, other than the Tag Creation and setting the PLC IP Address.

Appendix A.6.1. FieldServer Configuration File

```
// Data Arrays
//
Data_Arrays
Data_Array_Name ,Data_Format ,Data_Array_Length
DA_Read ,Float ,50
DA_Write ,Float ,50
```

```
// Client Side Connections
//
Connections
Adapter ,Protocol
N1 ,Ethernet/IP
```

```
// Client Side Nodes
//
Nodes
Node_Name ,IP_Address ,Protocol ,Adapter
EIP_01 ,192.168.1.9 ,Ethernet/IP ,N1
```

```
// Client Side Map Descriptors
//
Map_Descriptors
Map_Descriptor_Name ,Scan_Interval ,Data_Array_Name ,Data_Array_Offset ,EIP_CON_TYP ,Node_Name ,Function ,EIP_SERVICE ,EIP_PATH ,EIP_TAG_NAME ,Length
PLC_TO_FIELDSEVER ,.0.1 ,DA_Read ,0 ,EXPLICIT ,EIP_01 ,Rdbc ,DATA_TABLE_READ ,1 0 ,FS_Status ,20
FIELDSEVER_TO_PLC ,.0.1 ,DA_Write ,0 ,EXPLICIT ,EIP_01 ,Wrbc ,DATA_TABLE_WRITE ,1 0 ,FS_Control ,20
```

These are the PLC Tag names that will be accessed in the PLC. The names must match the PLC tag name exactly.

Appendix A.3 lists the paths for specific devices

Appendix A.6.2. The PLC Program

The PLC program example below shows the minimum steps necessary to program communications with the FieldServer. Depending on the real intended application, additional steps may be necessary for completeness.

When the FieldServer is polling the PLC, all that is needed is to configure the tags being accessed:

Name	Alias For	Base Tag	Data Type	Style
FS_Status			REAL[76]	Float
FS_Control			REAL[76]	Float

Step 2

Avoid Using UDT Types. The Data will be read but the exact placement of the data in the Tags and Arrays will be hard to determine

Tag Length must be equal to or greater than the number of points being written/read

Note that providing dedicated (long), flat structured (not UDT) tags for communications interface to the FieldServer is preferable to polling single length tags in the PLC as it allows for much more efficient communications and reduces complexity when mapping data in the FieldServer. It is better to think of these tags as a “I/O Buffer” Interface that the real tags in the PLC get mapped to.

Appendix A.7. Read/write structures and value of EIP_Structure_Handle :

Some devices require that a specific value be used for the EIP_Structure_Handle field while writing the structure to them. This value may be specified in the vendor documentation. If any non-zero integer is used in a Read Map Descriptor for EIP_Structure_Handle, the value will be updated internally. The Map Descriptor can then be browsed to obtain this value. Other devices do not validate this field when the structure is written by the third-party device. A summary of the procedures to obtain this value is presented below:

FieldServer as a Client:

- Read:
 - Use a value of 1, the driver will automatically update the field when a response is received from the device. The Map Descriptor can then be browsed to obtain the value if required.
- Write:
 - Use the value supplied by the vendor OR
 - Use the value obtained in the Read Map Descriptor above OR
 - Use any non-zero value if the other device doesn't validate it.

FieldServer as a Server:

- Read:
 - Use the value supplied by the vendor OR
 - Use the value obtained in the Read Map Descriptor above OR
 - Use any value if the other device doesn't validate it.
- Write:
 - Not required – use any non-zero value if the parameter is specified.

Example: Consider a situation where a customer defines a a type in RSlogix SSS_SINT3 with 3 members of each type SINT.

```
SSS_SINT3
  SINT room1_temp
  SINT room2_temp
  SINT room3_temp
```

Now he has his own type SSS_SINT3 and he can define tags: TAG_3ROOM_TEMPS of type SSS_SINT3

```
// Read/write structures

Map_Descriptors
Map_Descriptor_Name ,Data_Array_Name ,Data_Array_Offset ,Function ,EIP_CON_TYP ,Node_Name ,EIP_SERVICE ,EIP_Path ,EIP_TAG_NAME ,EIP_Structure_Handle ,Length ,Scan_Interval
CMD_Struct_SINT3 ,DA_STRUCT_R ,0 ,Rdbc ,EXPLICIT ,EIP_01 ,DATA_TABLE_READ ,1 0 ,TAG_3ROOM_TEMPS ,59592 ,3 ,1.0s
```


Appendix A.8. Classes and Attributes Supported

EtherNet/IP is an object orientated protocol. The Object Oriented structure therefore allows for classes, instances, attributes and services. The 'data types' listed below are to be considered as the objects supported in the protocol. Each of these has attributes that have been supported to differing degrees.

FieldServer Data Type	Description (or Device Data Type)	
Identity – Class Code 0x01	Attributes Supported: <i>One instance supported (0x01)</i> Attributes List: Vendor ID Device Type Product Code Device Revision Status Serial Number Device Description (text)	Services Supported: Get_Attribute_All; Get_Attribute_Single
Message Router – Class Code 0x02	Attributes Supported: <i>One instance supported (0x01)</i> Attribute List: Max Connections	Services Supported: Get_Attribute_Single
Assembly – Class Code 0x04	Attributes Supported: <i>Class Instance Support (0x00)</i> Class Attributes: 0x02 (Max Instance) <i>Two instances supported (0x0100 and 0x0101)</i> Attribute List: Member List Not Supported Data	Services Supported: Get_Attribute_Single
Connection Manager – Class Code 0x06	Forward Open Service Forward Close Service	
Register – Class Code 0x07	Attributes Supported: <i>Class Instance Support (0x00)</i> Class Attributes: 0x02 (Max Instance) <i>Two instances supported (0x01 and 0x02)</i> Attribute List: Status Flag Direction (read/write) Size of Data (bits)	Services Supported: Get_Attribute_Single
Discrete Input Point – Class Code 0x08	No visible interface currently	
Discrete Output Point – Class Code 0x09	No visible interface currently	

FieldServer Data Type	Description (or Device Data Type)	
Analog Input Point – Class Code 0x0A	<p>Attributes Supported: <i>Class Instance Support (0x00)</i> Class Attributes: 0x02 (Max Instance) <i>Two instances supported (0x01 and 0x02)</i> Attribute List: Number of Attributes Not Supported Analog value (UINT16) not supported Vendor ID</p>	<p>Services Supported: Get_Attribute_Single</p>
Analog Output Point – Class Code 0x0B	<p>Attributes Supported: <i>Class Instance Support (0x00)</i> Class Attributes: 0x02 (Max Instance) <i>Two instances supported (0x01 and 0x02)</i> Attribute List: Number of Attributes not supported Analog value (UINT16) not supported Vendor ID</p>	<p>Services Supported: Set_Attribute_Single; Get_Attribute_Single</p>
TCP/IP Interface Object – Class Code 0xF5	<p>Attributes Supported: <i>One instance supported (0x01)</i> Attribute List: Status Configuration Capability Configuration Control Physical Link Object Interface Configuration Host Name</p>	<p>Services Supported: Get_Attribute_Single</p>
EtherNet Link Object – Class Code 0xF6	<p>Attributes Supported: <i>One instance supported (0x01)</i> Attribute List: Interface Speed Interface Flags Physical Address Interface Counters Media Counters</p>	<p>Services Supported: Get_Attribute_Single</p>
Data Table Object – Private Object	<p>Attributes Supported: This object does not support instances or attributes but uses the data table structure, and associated tags, in Logix5000 PLC's.</p>	<p>Services Supported: CIP Read Data</p>

Appendix A.9. Error Codes

Err Code	Extd Err Code	Description	Action
0001		Connection Failure	
	0100	Connection in Use	
	0103	Transport not Supported	
	0106	Ownership conflict	
	0107	Connection not found	
	0108	Invalid connection type	
	0109	Invalid connection size	
	0110	Module not configured	
	0111	EPR not supported	
	0114	Wrong module	
	0115	Wrong device type	
	0116	Wrong revision	
	0118	Invalid configuration format	
	011A	Application out of connections	
	0203	Connection timeout	
	0204	Unconnected message timeout	
	0205	Unconnected send parameter error	
	0206	Message too large	
	0301	No buffer memory	
	0302	Bandwidth not available	
	0303	No screeners available	
	0305	Signature match	
	0311	Port not available	
	0312	Link address not available	
	0315	Invalid segment type	
	0317	Connection not scheduled	
0002		Insufficient Resource	
0003		Invalid value	
0004		IOI syntax error	
	0000	Extended status out of memory	
	0001	Extended status out of instances	
0005			
	0000	Extended status out of memory	
	0001	Extended status out of instances	
0006		Insufficient packet space	
0007		Connection lost	
0008		Service unsupported	
0009		Error in data segment or invalid attribute value	
000A		Attribute list error	
000B		State already exists	
000C		Object model conflict	
000D		Object already exists	
000E		Attribute not settable	
000F		Permission denied	
0010		Device state conflict	

Err Code	Extd Err Code	Description	Action
0011		Reply will not fit	
0012		Fragment primitive	
0013		Insufficient command data	
0014		Attribute not supported	
0015		Too much data	
001A		Bridge request too large	
001B		Bridge response too large	
001C		Attribute list shortage	
001D		Invalid attribute list	
001E		Embedded service error	
001F		Connection related failure	
	0203	Connection timeout	
0022		Invalid reply received	
0025		Key segment error	
0026		Invalid IOI error	
0027		Inexpected attribute in list	
0028		DeviceNet error - invalid member ID	
0029		DeviceNet error - member not settable	
00D1		Module not in run state	
00FB		Message port not supported	
00FC		Message unsupported data type	
00FD		Message uninitialized	
00FE		Message timeout	
00FF		General error (see extended error codes)	
	2001	Excessive IOI	
	2002	Bad parameter value	
	2018	Semaphore reject	
	201B	Size too small	
	201C	Invalid size	
	2100	Privilege failure	
	2101	Invalid keyswitch position	
	2102	Password invalid	
	2103	No password issued	
	2104	Address out of range	
	2105	Address and how many out of range	
	2106	Data in use	
	2107	Type is invalid or not supported	
	2108	Controller in upload or download mode	
	2109	Attempt to change number of array dimensions	
	210A	Invalid symbol name	
	210B	Symbol does not exist	
	210E	Search failed	
	210F	Task cannot start	
	2110	Unable to write	
	2111	Unable to read	
	2112	Shared routine not editable	
	2113	Controller in faulted mode	
	2114	Run mode inhibited	

Appendix B. Troubleshooting Tips

Appendix B.1. Firmware Update Downloading

If you are trying to update firmware and continuously get failed messages it might be due to the traffic on the N1 or N2 ports. EtherNet/IP is a high traffic protocol and once a connection is created continuous data transfer occurs. In this situation the best way to download new firmware would be to manually disconnect the scanner or adapter that the FieldServer is connected to.

Appendix B.2. Connection information – Allen Bradley Message Blocks

When configuring message blocks it is necessary to enter a path to the FieldServer in the communications tab. The Path is usually made up of the installed Ethernet card, the port on the Ethernet card and the IP address of the FieldServer

e.g. Eth_IP_Card1,2,192.168.2.41

- Eth_IP_Card1 is the name given to the Ethernet Card
- 2 is the port on the card
- The IP address is for the FieldServer

Appendix B.3. FieldServer not recognised by RSLinx

If RSLinx does not recognise the FieldServer (message “? Unrecognized Device”), load the Ethernet IP EDS file into RSLinx. This file is available at: <http://www.fieldserver.com/techsupport/utility/utility.php>

- Press Start|all programs|Rockwell Software|RSLinx tools|EDS Hardware Installation tool|add|register a single file and browse to the location of the Ethernet IP EDS file.
- Run RSLinx, press communication|RSwho and all EIP devices on the network should be visible.

Appendix C. Error Messages

Message	Description
"EIP:#01 FYI. %d out of %d data elements will be stored" "MD=%s, data_type=0x%04X, raw bytes=%d"	If the number of data elements exceeds the Map Descriptor length only the number of data elements corresponding to the Map Descriptor will be stored. This message will print once per Map Descriptor.

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