GE Fanuc Automation

Programmable Control Products

Series 90™ -70
FIP Bus Controller

User's Manual

GFK-1038A   *November 1997*

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

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CIMPLICITY 90-ADS	Helpmate	PROMACRO	VuMaster
CIMSTAR	Logicmaster	Series Five	Workmaster

Preface

Content of this Manual

Chapter 1. Introduction: This chapter describes the Series 90™-70 PLC FIP Bus Controller (FBC) and its operation.

Chapter 2. Installation: This chapter explains how to install and remove the Bus Controller, connect the FIP bus, observe the LEDs, restart the Bus Controller, and upgrade the Bus Controller firmware.

Chapter 3. Configuration: This chapter explains how to configure the FIP network and its hardware. It describes the configuration tools, and explains how they can be used to create basic or customized configurations.

Chapter 4. Operation: This chapter describes operation of the Bus Controller and gives basic details of FIP bus operation.

Chapter 5. Fault Reporting and Diagnostics: This chapter describes diagnostics capabilities of interest in Series 90-70 PLC systems on a FIP network.

Chapter 6. Programming Communications Requests: This chapter explains the basics of programming Communications Requests from the Series 90-70 PLC CPU to the FIP Bus Controller. It describes the structure of a Communications Request, and explains actions the application program should take before initiating a Communications Request. It also gives program troubleshooting suggestions.

Chapter 7. Channel Commands: This chapter describes COMREQs that can be used to establish or stop communications between the Series 90-70 PLC and one or more other PLCs on the FIP network.

Chapter 8. Network Diagnostics. This chapter describes normal logging of network faults by the FIP Bus Controller. It explains how network fault information can also be stored in a selected area of PLC memory.

Chapter 9. FIP Generic Message Operation: This chapter describes how FIP messages, normally ignored by the FIP Bus Controller, may be read or sent using special COMREQs in the application program.

Appendix A. Glossary. This appendix summarizes special terms relating to the Series 90-70 FIP Bus Controller and its operation.

Appendix B. Error Codes. The tables in this appendix list the status codes that are reported in the COMREQ Status word after the execution of a COMREQ function. Some of these codes are also returned in Word 1 of the Detailed Channel Status words.

Related Publications

For more information, refer to these publications:

Series 90™-70 PLC Installation and Operation Manual (GFK-0262). This book describes the modules of a Series 90-70 PLC system, and explains system setup and operation.

Series 90™-70 System User's Manual (GFK-1192). This book describes the operation of the Series 90-70 PLC, including timing, fault handling, program organization, and memory use.

Series 90-30 FIP Remote I/O Scanner User's Manual (GFK-1037). Reference manual for the Remote I/O Scanner, which interfaces an I/O Nest containing Series 90-30 modules to a FIP bus.

Field Control FIP Bus Interface Unit User's Manual (GFK-1175). Reference manual for the FIP Bus Interface Unit, which interfaces an I/O Station of Field Control modules to a FIP bus.

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Jeanne L. Grimsby

Senior Technical Writer

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Introduction

A Series 90-70 PLC FIP Bus Controller (catalog number IC697BEM742 or IC697BEM744) is used to interface a FIP bus to a Series 90-70 PLC. Operation of the network is based on WorldFIP (EN50170) exchanges.
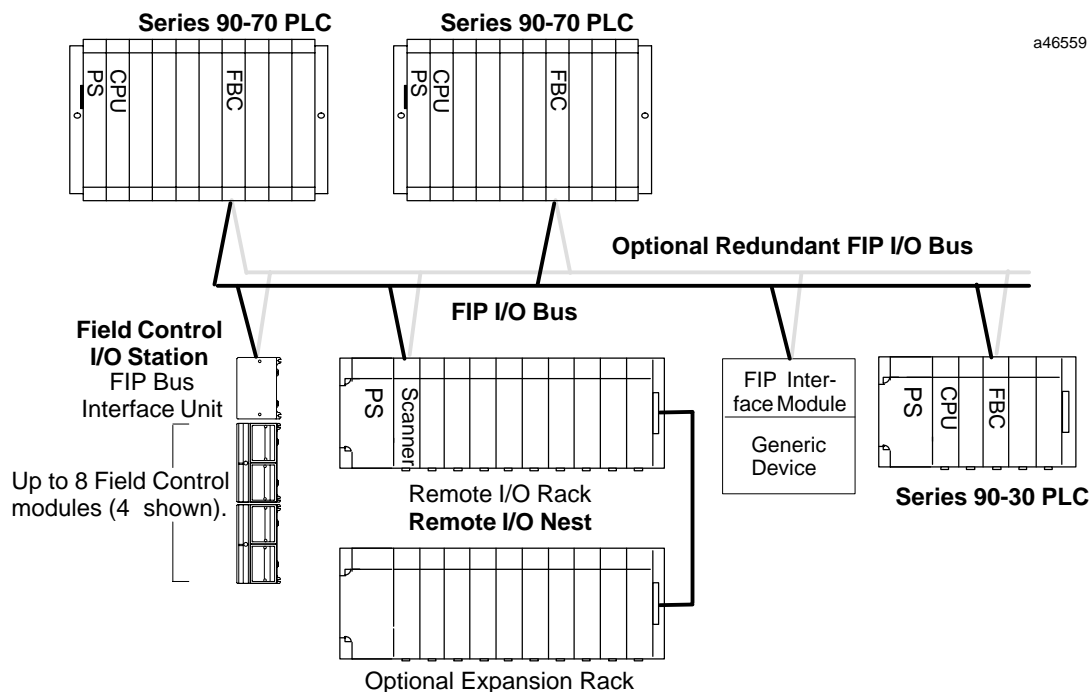
The FIP Bus Controller can serve as an I/O controller for devices such as Series 90-30 I/O modules in remote I/O nests and Field Control I/O modules located in I/O Stations on the FIP bus. In addition, the FIP Bus Controller provides high-level TCP/IP communications and generic messaging support. Dual bus connectors on the front of the FIP Bus Controller support the use of an optional redundant bus cable.

The FIP bus may serve up to 128 devices, including:

■ **Field Control Stations**, Field Control I/O modules that are interfaced to the bus via a FIP Bus Interface Unit (BIU).

■ **Series 90-70** and **Series 90-30 PLCs** interfaced to the bus by FIP Bus Controllers.

■ **Remote I/O Racks**, Series 90-30 I/O racks interfaced to the bus via FIP Remote I/O Scanner Modules. Each remote I/O rack can include one 5- or 10-slot main rack, one 5- or 10-slot expansion rack and any mix of discrete and analog I/O modules.

■ **Generic Devices**, such as general-purpose computers that are interfaced to the bus via a FIP Interface Module.

Number of FIP Bus Controllers in a Series 90-70 PLC

Up to 31 Bus Controllers of any kind can be included in a Series 90-70 PLC system. Of these, a maximum of four (4) may be FIP Bus Controllers. An FBC cannot be placed in a PLC expansion rack.

Versions of the FIP Bus Controller

There are four different FIP Bus Controllers for the IC697 family of PLCs:

- IC697BEM742: a full-slot module for operation on a 1.0MHz FIP or WorldFIP network.

- IC687BEM742: a half-slot module for operation on a 1.0MHz FIP or WorldFIP network.

- IC697BEM744: a full-slot module for operation on a 2.5MHz WorldFIP network.

- IC687BEM744: a half-slot module. This module has a half-width faceplate for use in an integrated rack for operation on a 2.5MHz WorldFIP network.

Compatibility

The table below lists configuration and compatibility requirements for network devices.

Device	Compatible Versions	Configuration Tool
Series 90-30 FIP Remote I/O Scanner (FR3)		Remote I/O Scanner and modules in the I/O nest are configured using the CIMPLICITY Control 90 Programming Software (rel. 2.0 or later).
FIP Field Control Bus Interface Unit (FBIU)		FIP Bus Interface Unit and the modules in the I/O Station are configured using the CIMPLICITY Control 90 Programming Software (rel. 2.0 or later).
Series 90-70 PLC	PLC CPU: Version 7.0 or later. Series 90-70 FIP Bus Controller: Version 2.0 or later.	PLC system is configured using the CIMPLICITY Control 90 Programming Software (rel. 2.0 or later).
Series 90-30 PLC	PLC CPU: Version 6.5 or later.	PLC system is configured using the CIMPLICITY Control 90 Programming Software (rel. 2.0 or later).
Generic devices, drives, and other devices		Configured using the Network Configuration Tool.

FIP Bus Controller Description

The FIP Bus Controller is a rack-mounted Series 90-70 PLC module. It is available in full-slot (shown below) and half-slot widths. Both types are functionally identical.

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Module OK
Bus Arbiter
Carrier Detect Ch. 1
Transmit Enable Ch. 1   LEDs
Carrier Detect Ch. 2
Transmit Enable Ch. 2

Restart
Pushbutton

15-Pin Serial Connector
RS-485

9-Pin FIP Fieldbus
Connector (channel 1)

9-Pin FIP Fieldbus
Connector (channel 2)
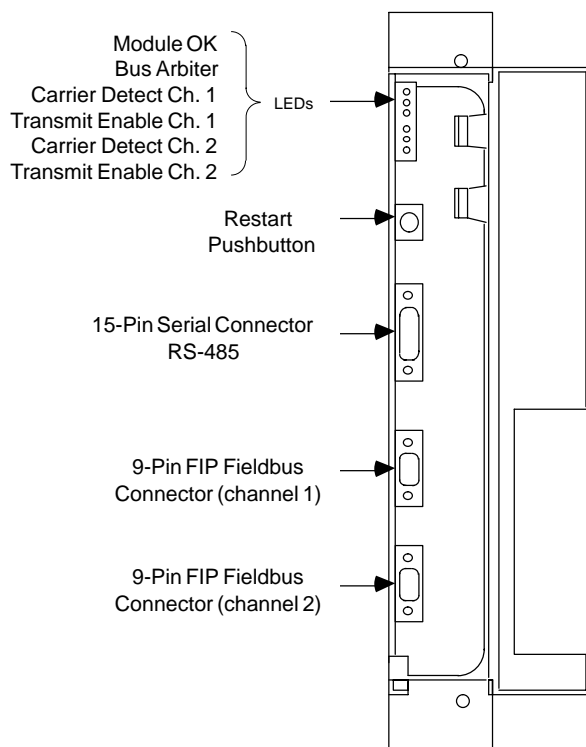
The FIP Bus Controller has six status LEDs, a Restart pushbutton, an RS-485 serial port, and two identical FIP bus connectors.

Status LEDs

The 6 LEDs on the front of the FIP Bus Controller display module status and communications activity.

Restart Pushbutton

The Restart button is used to Restart the module or Reload the software and Restart the module.

Serial Port

The 15-pin serial port is used to connect a computer for upgrading the operating firmware of the Bus Controller.

FIP Bus Connectors

The two 9-pin connectors on the FIP Bus Controller provide for attachment of one or two FIP busses. The two busses provide a redundant bus capability.

Finding Information in this Book

Configuring the Network and its Devices

Chapter 3 explains how to configure the FIP network.

The Network Configuration Tool is used to define network segments and identify devices. The Network Configuration tool provides built–in defaults that can be used to simplify configuring the network. Customized configurations can also be created.

The CIMPLICITY Control 90 Programming Software is used to configure each Series 90-70 PLC, FIP Remote I/O Scanner and FIP Field Control I/O Station on the network.

Understanding How the FIP Bus Controller Operates

Chapter 4 addresses the basics of FIP Bus Controller operation. It describes how the Bus Controller interfaces the functions of the Series 90-70 PLC with the regular cycle of the FIP bus.

The differences between Asynchronous operation and Synchronous operation of the FIP network are also covered in this chapter. Because selecting either Asynchronous or Synchronous operation is a major step in configuring the system, the distinction between them should be understood first.

Programming Information

The first four chapters of this book cover the basic details of installation, operation and configuration. The remainder of the chapters describe diagnostics and messaging features that can be included in the PLC application program that controls the operations of the FIP Bus Controller.

Utilizing Point Faults and Network Diagnostics

The application program in the Series 90-70 PLC can take advantage of conventional point fault and alarm contacts, plus additional fault contacts that have been defined specifically for FIP. These Subscriber Fault Contacts can be used to identify faults reported by devices on the FIP network. See chapter 5 for details.

In addition to point faults in the PLC's fault table, the FIP Bus Controller normally logs *loss of bus* faults for its own connections to the FIP network as well as for all configured remote I/O and generic devices. This capability can be extended by sending the FIP Bus Controller a Start Network Diagnostic COMREQ from the application program. The FIP Bus Controller will begin periodically updating a specified area in PLC memory with network presence and bus fault information for devices on the FIP network. See chapter 8 for more information.

Establishing Communications Channels

The Series 90-70 PLC can maintain up to 32 individual communications channels through which it exchanges data with other PLCs or controllers via TCP/IP protocol. The application program can use Communications Request (COMREQ) instructions

to open, re-task, or abort these communications channels. Once opened, a communications channel can remain open indefinitely or for a specified duration.

Chapter 7 gives the details of programming communications channels. Chapter 6 gives general instructions for programming Communications Requests to a FIP Bus Controller.

Sending and Receiving Generic FIP Messages

Normally, the FIP Bus Controller ignores any FIP messages on the FIP Network. However, it is possible to send and receive FIP messages via the FIP Bus Controller. Chapter 9 explains how the application program can use Communications Requests to the FIP Bus Controller to:

■ Receive State Change messages from remote I/O devices and place them in a specified area of memory in the Series 90-70 PLC

■ Receive other FIP messages from the network and place them in a specified area of memory in the Series 90-70 PLC

■ Send FIP messages on the network.

Chapter 2	*Installation*

This chapter describes:

- **Installing the Bus Controller**
- **Removing the Bus Controller**
- **The FIP Bus**
    - Connecting the FIP Bus
    - Pin Assignments for the FIP Bus Connectors
- **Observing the LEDs**
    - Status LEDs
- **Restarting the Bus Controller**
- **Upgrading the Bus Controller Firmware**

Installing the Bus Controller

The FIP Bus Controller should be installed in the main CPU rack.

Always insert modules carefully to avoid damaging components.

1. **Be sure the rack is powered-down**.

<div style="text-align:center">

Caution

</div>

Do not insert a module when power is applied to the rack. This could cause the system to stop.

2. Position the Bus Controller at its intended location, with its component side to your right, away from the power supply. The LEDs are at the top of the module's front edge.

3. Grasp the module firmly and insert it into the card guide.

4. Align the module's printed circuit board with the connector on the rack backplane and slide it towards the connector until it has started to seat.

5. *Important* - Place hands as shown with thumbs on the **extreme left** side of module. Push the board into the connector until the top and bottom latches click onto the rack rails. Visually inspect the board to be sure it has seated properly.
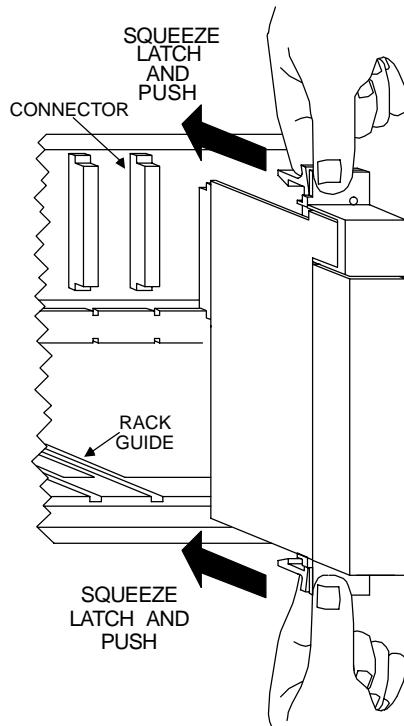
Removing the Bus Controller

1. Power down the rack in which the Bus Controller is located. Before removing power, it is important to consider the impact on the controlled process.

<div style="text-align:center">

Caution

</div>

Do not remove a module when power is applied to the rack. This could cause the system to stop.

2. Remove the bus wiring from the Bus Controller.

3. Squeeze the retaining clips at the top and bottom of the cover to disengage them from the rack rails.

4. Pull the board firmly to remove it from the backplane connector.

5. Slide the board out of the card guide to remove it from the rack.

SQUEEZE LATCH
AND PULL
TO REMOVE,
PUSH TO
INSTALL

CONNECTOR

RACK
GUIDE

SQUEEZE LATCH
AND
PULL TO REMOVE,
PUSH TO INSTALL
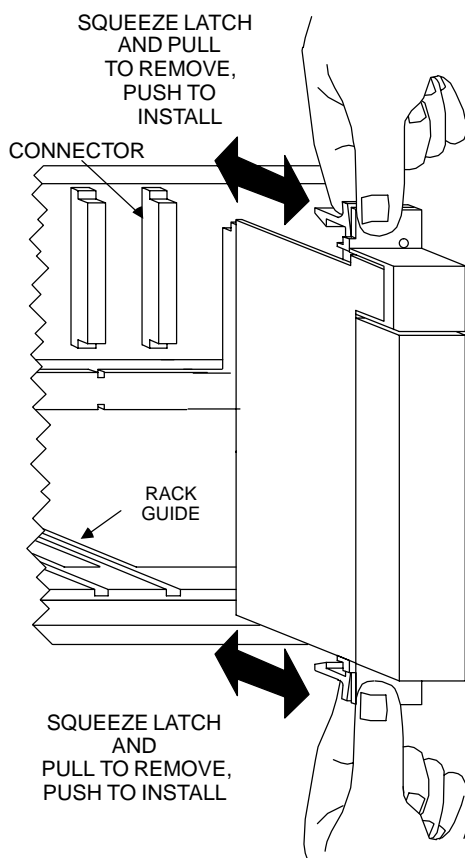
The FIP Bus

The FIP bus can consist of one to four sections. Maximum length per section is 500 meters at 2.5MHz or 1000 meters at 1.0MHz. A repeater must be used between sections of cable. Each section can serve up to 32 FIP devices.

500/1000 meters   500/1000 meters   500/1000 meters   500/1000 meters

Section 1   repeater   *Section 2*   repeater   *Section 3*   repeater   *Section 4*

2000 meters total length at 2.5MHz
4000 meters total length at 1.0MHz

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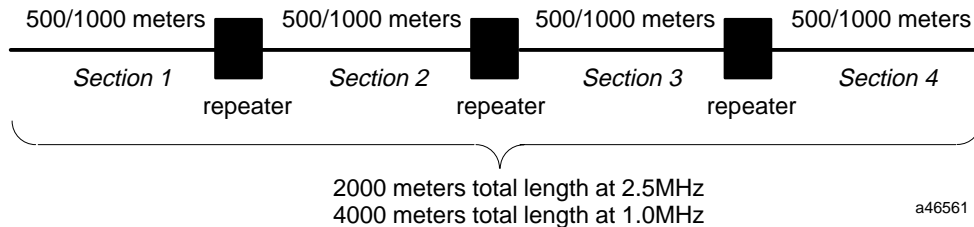
Bus Specifications

Proper cable selection is critical to successful operation of the system.

Bus Type	Single twisted pair plus shield. Fiber optics cable and modems can also be used.
Baud Rate	1.0 Mbaud and 2.5 Mbaud.
Maximum Bus Length	1000 meters per section, 4000 meters per network, 1.0 Mbit. 500 meters per section, 2000 meters per network, 2.5 Mbit. Maximum length also depends on cable type.
Maximum Number of Devices	32 devices per section, 128 per network.
Data Encoding	Manchester II Encoding.
Recommended Cable	Belden 3078F; Shielded 1-pair stranded 22 AWG
Cable Characteristics	
Maximum loss at +20C	6.5dB/km at 250kHz; 13dB/km at 1.25MHz
Attenuation distortion between 200kHZ and 1.25MHZ at +20C	< 8 dB/km
Characteristic impedance between 250kHz and 1.25MHz	150W $\pm$10%
Differential transfer impedance	< 2mW/m up to 20MHz
Resistance per unit length per conductor at +20C	< 65 W/km
Propagation speed (C=speed of light)	>0.78C (0.2m/ns)
Capacitance per unit length between conductors	<37pF/m
Crosstalk between pairs in differential mode between 3 and 5MHz	>52dB/km
Current per conductor	$\leq$ 3A at +20C, $\leq$ 1A at +85C
Insulation resistance at 500VDC between: conductors conductors and shield	$\geq$ 5000MW $\geq$ 5000MW
Dielectric strength (1 min) between: conductors conductors and shield in relation to environment	500VDC 1500$\sqrt{2}$ VDC 1500$\sqrt{2}$ VDC

Bus Wiring

The diagram below shows cabling for a daisy-chain configuration using shielded, twisted pair cable. Conservative wiring practices, as well as national and local codes, require physical separation between control circuits and power distribution or motor power. Refer to sections 430 and 725 of the National Electric Code.
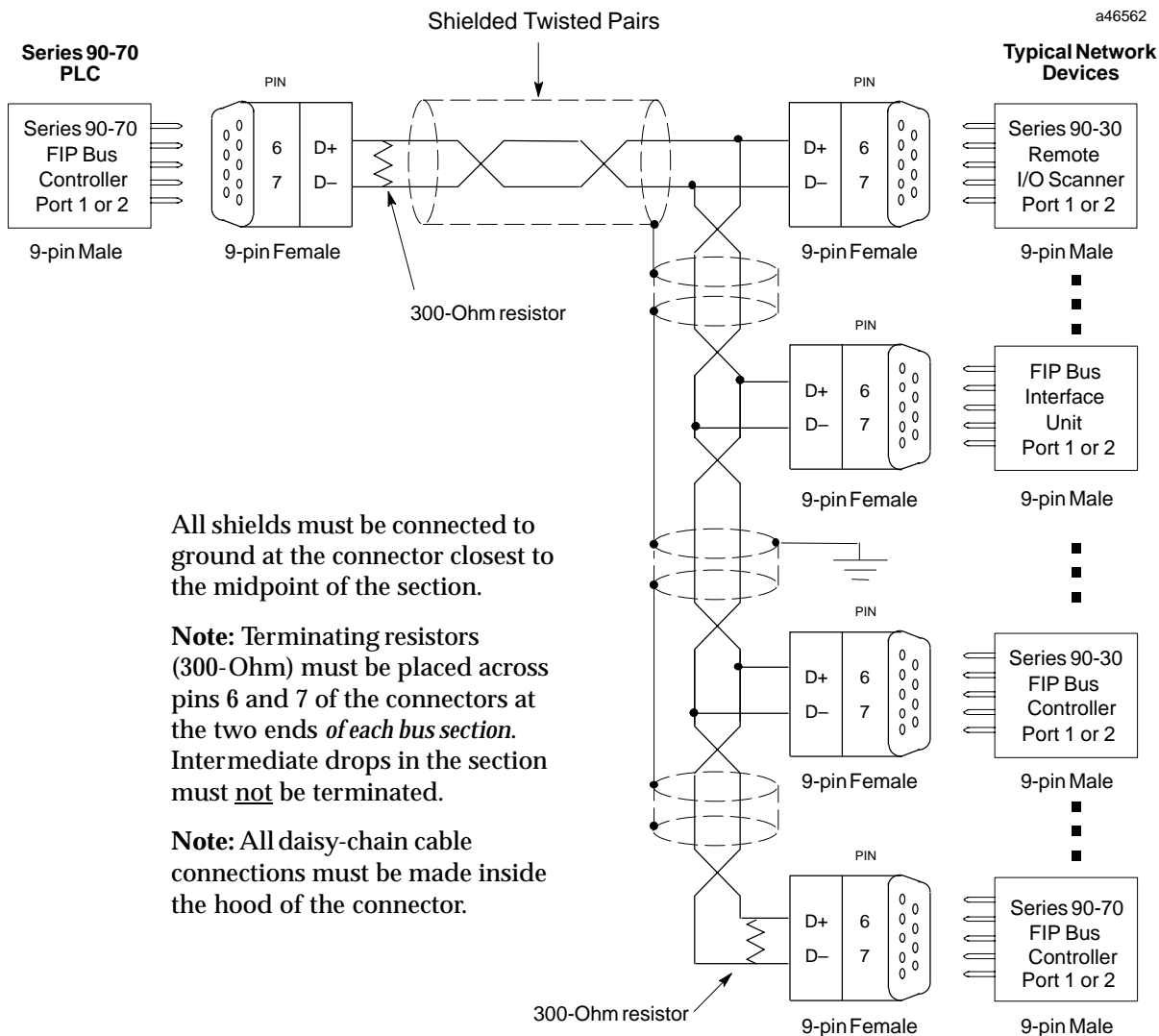
All shields must be connected to ground at the connector closest to the midpoint of the section.

Note: Terminating resistors (300-Ohm) must be placed across pins 6 and 7 of the connectors at the two ends *of each bus section*. Intermediate drops in the section must not be terminated.

Note: All daisy-chain cable connections must be made inside the hood of the connector.

Connecting the FIP Bus to the Bus Controller

Attach FIP bus cable(s) to the connectors on the front of the Bus Controller.

When installed in a single media or simplex configuration, either connector may be used. When installed in a dual media or redundant configuration, both the Channel 1 and 2 connectors must be used. Both connectors accept a standard 9–pin D–type male connector.

a46555

Connector for Channel 1

Connector for Channel 2
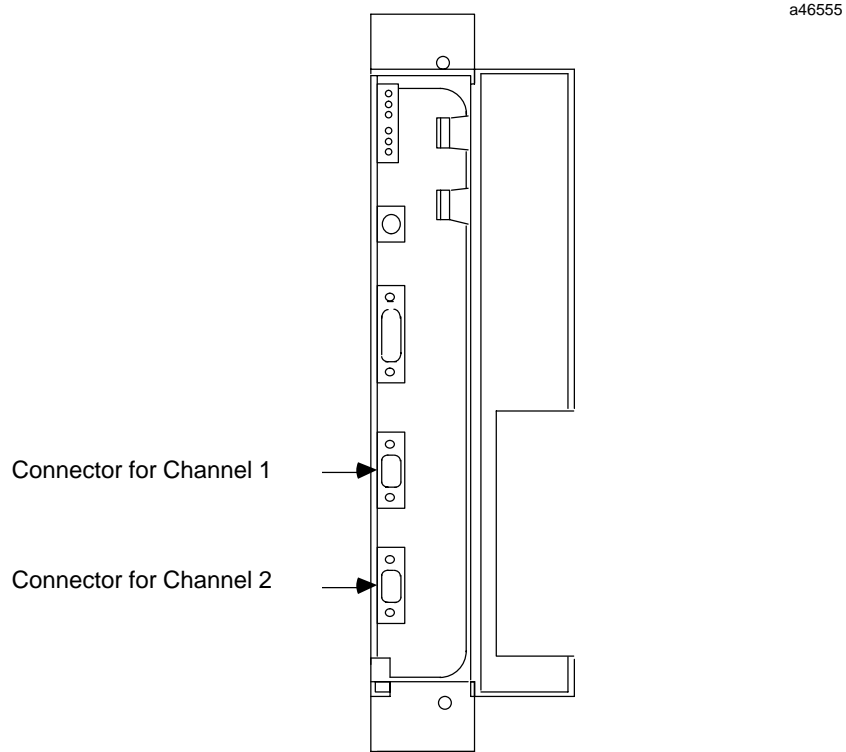
Note: If only one FIP bus is used, cover the unused FIP bus connector with an anti-static cap. The unused connector must be protected in this manner to meet IEEE specification 801.2.

Pin Assignments for the FIP Bus Connectors

The diagram below shows pin assignments for both FIP bus connectors on the front of the Bus Controller.

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D+   6   1
      7   2
D–   8   3
      9   4
           5
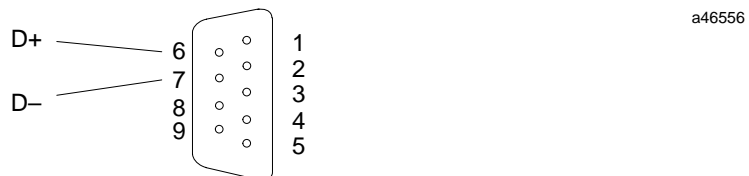
Observing the LEDs

When power is applied, the LEDs on the Bus Controller indicate operating status.

a46557

Module OK
Bus Arbiter
Carrier Detect Ch. 1
Transmit Enable Ch. 1
Carrier Detect Ch. 2
Transmit Enable Ch. 2
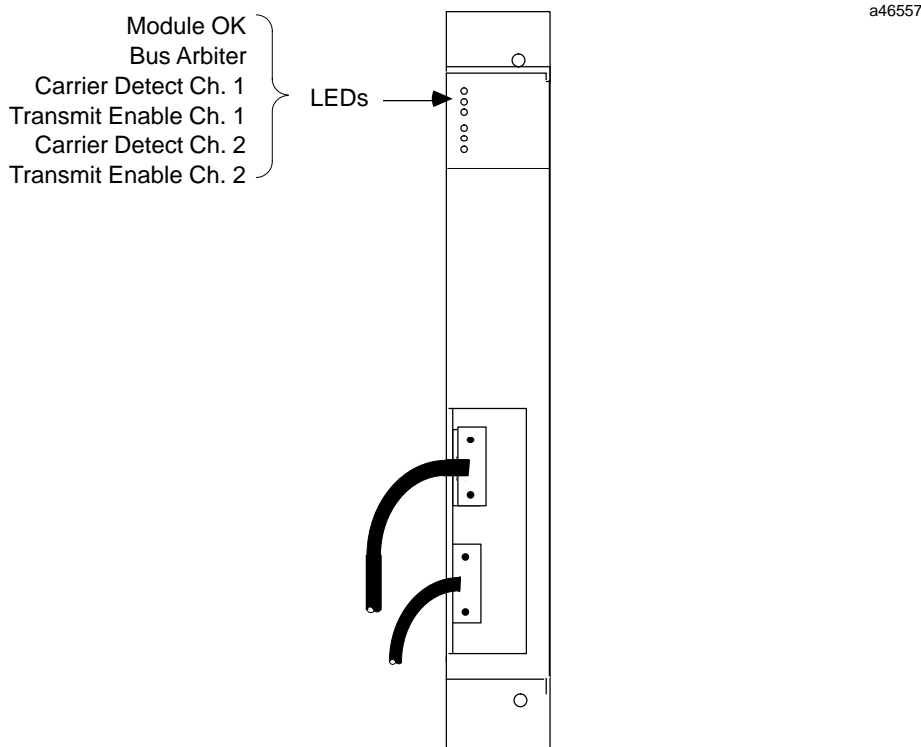
LEDs →

The top LED indicates module health. The bottom 5 LEDs indicate communications activity on the FIP bus. Two LEDs are dedicated to each of the two FIP channels.

MODULE OK – Shows the status of the FIP Bus Controller. This LED blinks during power-up diagnostics and should remain on as long as power is applied to the Bus Controller.

BUS ARBITER –Shows the operational status of the Bus Arbiter function.

CARRIER DETECT – A Carrier Detect LED is ON when the Bus Controller is detecting a carrier signal on the FIP bus attached to that channel.

TRANSMIT ENABLE – A Transmit Enable LED is ON when the Bus Controller transmits data on the FIP bus attached to that channel. The intensity of this LED indicates the level of transmission activity in the bus. A dimly-lit Transmit Enable LED indicates low activity; a brightly-lit Transmit Enable LED indicates high activity.

Restarting the Bus Controller

Use the Restart button to Restart the module or Reload the software and Restart the module. Note that the Restart button does not function during the module's diagnostic phase (Module OK is blinking) or when the PLC is actually scanning I/O (CPU RUN is ON).

To Restart the Module: Press the Restart button for less than 3 seconds.

a46558

Restart
Pushbutton
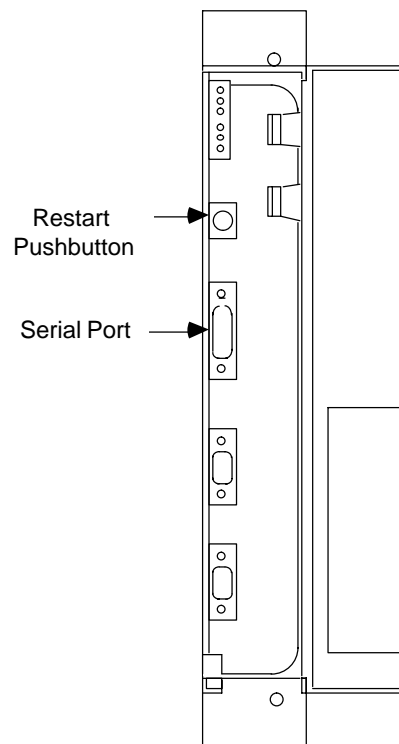
Serial Port

Upgrading the Bus Controller Firmware

To upgrade the Bus Controller firmware, connect the computer with the new firmware to the (15-pin) serial port on the front of the Bus Controller.

To Reload the Module: Press and hold the Restart button for more than 3 seconds. The Bus Controller runs its power-up diagnostics and begins to blink the Module OK and Bus Arbiter LEDs in unison at 1/2-second frequency. The upgrade process can then proceed. Upon completion, restart the module as described above.

Chapter 3

Configuration

A Series 90-70 PLC FIP system requires both network configuration and hardware configuration. Each has its own configuration software tool. The hardware configuration tool can be used to configure both Series 90-70 and Series 90-30 Bus Controllers.

Network Configuration Tool   **Hardware Configuration Tool**

PROJECT A	(WORKBENCH)	

■ Network1
   ■ 90–70 PLC
   ■ 90–30 PLC
   ■ Remote I/O Racks
   ■ Field Control I/O
 FOLDER #1
	■ H/W Config
	   ■ 90–70 PLC
	   ■ Remote I/O Racks
	   ■ Field Control I/O
	
	 90–70 FOLDER #1
		■ H/W Config
		   ■ 90–30 PLC
		
		 90–30 FOLDER #1
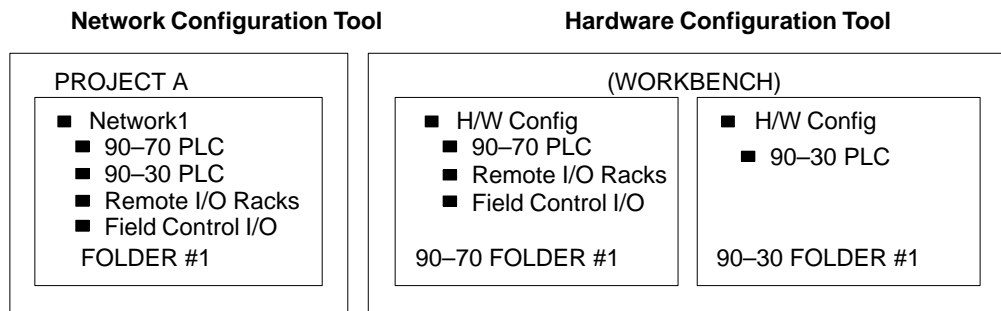
These are the overall steps to configuring a FIP system:

1. The Network Configuration Tool predefines the macrocycle, the timeslots, and the set of TVAs associated with each I/O module in each I/O rack. For most applications, these predefined exchanges should not be altered.

2. Use the Network Configuration Tool to configure the FIP network by creating network segments and identifying devices.

3. With the Network Configuration Tool, create an association to each GE Fanuc PLC, FIP Remote I/O Scanner, and FIP Bus Interface Unit.

4. With the Network Configuration Tool, create an association in the Hardware Configuration Tool to configure the devices on the network, such as remote I/O racks and other devices that will be exchanging data with the Series 90-70 PLC.

5. With the Network Configuration Tool, edit the MPS exchanges of the devices on the network. This includes assigning producers and consumers for variables, defining application variables and COMVs, and optionally, selecting time slots.

6. Using the Network Configuration Tool, build the binary configuration files.

7. With the Hardware Configuration Tool, configure the PLC CPU and Bus Controller. Assign the TVAs and COMVs that are produced/consumed by the FIP Bus Controller to memory in the PLC CPU. Also, assign each a CPU scan set.

8. Store the resulting IOCFG and CPUCFG files to the PLC using the Hardware Configuration Tool. The FIP Bus Controller Configuration File(s), Remote I/O Nest File(s), Scan Set File, Name Resolution File, and other relevant files can also be stored.

Configuring the Network

First, use the Network Configuration Tool to configure the FIP network by creating network segments and identifying devices. The Network Configuration tool provides two levels of configuration:

■ Basic configuration enables you to build network configurations very rapidly using the default data provided. You can customize individual items as needed.

■ For applications with higher performance restrictions, you can customize the standard configuration parameters.

Basic Configuration

Basic configuration uses as many as possible of the defaults built-into the Network Configuration Tool. Basic configuration includes:

■ standard predefinition of the exchanges on the I/O module level,

■ standard creation of exchanges with the remote I/O rack correspondents:

  □ create the hardware module with the Hardware Configuration Tool

  □ perform a build

  □ make updates on the subscriber I/O

  □ define exchanges by selecting the segment,

■ default network segment,

■ default connection of a device,

■ default characteristics of I/O modules,

■ that remote I/O rack correspondents consume by default all the TVAs of the I/O modules.

The configuration defaults assume standardized definitions for I/O data exchanges, network segment, device connection, and I/O modules.

Custom Configuration

For higher performance, you can customize the configuration by:

■ carefully selecting the correspondents for exchanges,

■ modifying transport time slots,

■ adjusting the network and device operating parameters.

■ modifying the list and characteristics of transport time slots,

■ modifying the list of TVAs that can be exchanged for each device category.

It is important to fully understand both the device implementation restrictions and the consequences of modifying the default exchange definitions on the performance of the system.

Using the Network Configuration Tool

The Network Configuration Tool provides the functions listed below. The ability to access a specific function depends on what is presently selected (for example, an entire network or an individual device on that network).

- File

    □ New Project
    □ Open Project
    □ Close Project
    □ Save Segment

    Plus these standard functions: Print, Print Preview, Print Setup, Properties, and Exit

- Edit

    □ New Segment
    □ New Device
    □ Lock

    Plus the editing functions: Cut, Copy, Paste, Delete, Rename

    You can use the Edit functions to copy and paste a segment into any project. Copying enables data from the copied network segment to be reused. You can move a network segment from one project to another (using cut and paste commands). You can also delete, lock or unlock, save, rename, and print a network segment.

- Association

    □ Update
    □ Setting
    □ Restore

    These functions are used to integrate device hardware configurations with the FIP Network Configuration.

- Tools

    □ Predefine Exchanges –sets up MPS exchanges between network subscribers.
    □ Edit Exchanges – edits MPS exchanges after associating hardware configurations with the network configuration.
    □ Edit HW Configuration – brings up the CIMPLICITY Control 90 software.
    □ Build –creates the binary files for the Bus Arbiter program, FBC70, and remote I/Oracks.
    □ Export Configuration

- Plus: View, Window, Help

Chapter 3 Configuration

Defining the Parameters of a Network Segment

To start Network Configuration, open a project folder. On the **File** menu:

A. Click on **Open Project** to open an existing project, or,

B. Click on **New Project** to start a new project folder.

Create a network segment. On the **Edit** menu:

A. Click on **New Segment,** or,

B. Click on **Copy** to copy a segment. **Paste** the segment, then change it as needed. If you copy a network segment, its exchange predefinitions are used for the pasted segment. However the exchanges for individual devices are not.

The system illustrated below includes 4 network segments (repeaters are "transparent" to the system). Each network segment has its own configuration, which is included in the project folder for the system. So the system illustrated below would include four network configurations in its project folder.
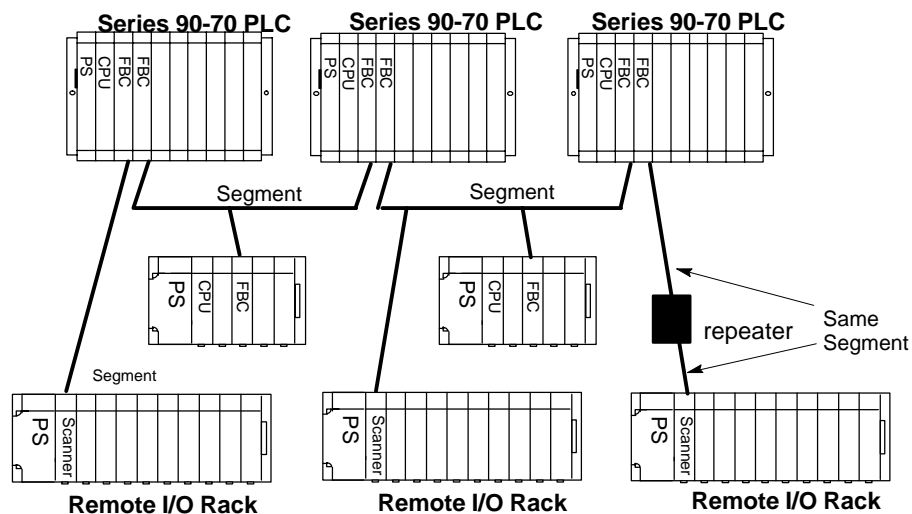
Locked Network Segment

A network segment can be locked to protect its configuration. You cannot connect a device to a locked network segment. Also, you cannot modify:

■ the network segment parameters

■ the definition of the master device for the locked remote I/O rack

■ the connection parameters for devices that are correspondents (including master devices) of the locked remote I/O rack

■ the transport time slots for the locked remote I/O rack

■ Exchanges for the locked remote I/O rack

It is not possible to cut, delete, rename, or change the subscriber number of locked remote racks, devices connected to locked network segments, and certain related devices.

Editing the Parameters of the Network Segment

The following parameters apply to the entire network segment. The default settings are suitable for most applications. Parameters with an asterisk are used in building the bus arbiter program.

PARAMETER	Default	Range or Choices	Comments
Segment number	0	0–127	Network segment identification number. This number must be unique.
Physical layer	WorldFIP 1Mbit/s	WorldFIP, Slow-FIP	Compatible with the Bus Controller's FullFIP 2 chip operating at 64 MHz. Select SlowFIP for a network with GE Fanuc devices.
Number of MSG repetitions	1	0–3	Number of message retries that will be performed for all FIP messages.
Number of TEST_P/Macrocycle *	1	1–20	Number of TEST_P (test subscriber presence) instructions in the bus arbiter program. The bus arbiter can use TEST_P instructions to test for the presence of critical devices on the network. Using this instruction, it can detect more quickly when remote devices are lost. Since loss of devices is routinely detected during the normal scan, this instruction is most suitable for applications where the scan time is relatively slow.
Duration of a TEST_P (ms) *	5	2–5	Amount of time required to carry out a TEST_P (test subscriber presence) instruction. The default should be used for the Series 90-70 FIP Bus Controller.
Presence of Aperiodic Exchanges (MPS or messages) *	Yes	Yes, No	Permits the transfer of all aperiodic messages. Should be set to Yes for most applications.
(%)Aperiodic messaging per COMV *	90	30–100	The percent of aperiodic messaging in the aperiodic window. The default should not need to be changed.
Duration of an MPS sequence *	IP_DAT+RP_DAT	IP_DAT+RP_DAT or Max(RP_DAT / SILENCE)	Basis for calculating transfer time of periodic COMVs in MPS exchanges, used by bus arbiter to build the bus arbiter program. This should not be changed.
Marking of Time Slots	No	No, Yes	Used to force the synchronization of the COMVs. When set to YES, the COMV transfer cannot be done before the beginning of the appropriate time slot.
Monoperiod Bus arbiter:	No	No, Yes	Used to build a simplified Bus Arbiter program. If set to YES, transport time slot activities (predefinition and definition of MPS exchanges) are disabled.
If Monoperiodic Bus arbiter, % Aperiodic	20	10 – 65000 in increments of 1.	If Monoperiodic has been selected, this parameter determines the proportion of time allotted to aperiodic transfer to variables and messages, compared to the time for all periodic variables.
Bi/Mono Medium Segment	Bi-medium	Bi-medium, Mono-medium	Whether the network uses a single or double (redundant) bus cable.
Time Production Via	Message	None, COMV, Message, COMV+message	How the network time is maintained. The default should be used for the FIP Bus Controller.
Clock Synchronization Period	5	1 – 10	The pulse period in seconds for devices on the network that have separate external synchro connections.

Predefining Exchanges for Network Subscribers

The Network Configuration tool provides default definitions for the data exchanges that will be made by different types of subscribers on the network. Most applications use the default definitions. These include:

- Default definitions of transport time slots (length, start/end, asynchronous/synchronous).Transport time slots are used to group similar data on the network. There are predefined transport time slots for status data, discrete I/O data, analog I/O data, control data, the network clock, and the end of cycle message.

- Default assignment of the I/O and status data of remote I/O racks to the appropriate time slots.

- Default assignment of the system variables exchanged by PLCs to the appropriate time slots.

- Default assignment of the communications variables of generic devices to appropriate time slots.

Because the Network Configuration tool automatically sets up time slots for data transfer, all of the data exchange configuration steps described here are optional. For most applications, it should not be necessary to access this information at all.

Changing the Predefined Exchange Definitions

The data exchange definitions should be changed only with great caution. To successfully change the default data exchanges, you must be very familiar with the system and its devices, and with FIP communications.

It is possible to refine the exchanges of each device category by connecting the data (COMV, system variable, TVA or data class) to the transport time slots. This is done by adjusting the list of transport variables to be taken into account or ignored.

Data exchanges and time slots should be defined before performing the step of associating the devices with the network configuration. To predefine exchanges, select the network segment icon in the left pane of the Network Configuration Tool window. On the **Tools** menu, click on **Predefine Exchanges**.

The Exchange Predefinition window has six tabs:

- Transport Time Slots
- I/ORacks
- PLCs
- Drives
- Stations
- Generics

Transport Time Slot Definitions

The definitions of transport time slots are used to group similar data. All of the data placed within a group will have the same exchange parameters. To display the defined transport time slots, click on the **Transport Time Slots** tab. For each defined transport time slot, the screen lists its name, type, period, start, and end.

Predefined Time Slot names and their uses are:

- SYST (System). There is one status variable for each device on a network.

- DI for discrete inputs, their validators, and chatter data (if chatter is selected).

- DO for discrete outputs and blink data (if blink selected).

- AI contains analog inputs, their validators, and AT (alarm) data.

- AO contains analog outputs.

- CONT intercontrol.

- TIME carries the network clock.

- CYCLE end of macrocycle.

It is possible to create new time slots and modify or delete existing time slots to adapt the flowrate on the network segment. (If at least one remote I/O rack of the network segment is locked, the time slots cannot be modified or deleted). Note that a time slot cannot be deleted if it is currently included in the predefined exchanges or in the MPS exchanges. For each transport time slot, you can edit the following parameters.

Parameter	Default	Range or Choices	Comments
Name			Up to 16 alphanumeric characters; no spaces or hyphens.
Type	A	S or A	Synchronous or Asynchronous.
Period		up to 2000mS in 5mS increments	For synchronous exchanges, no zero period allowed. For asynchronous exchanges, if period is zero, the COMV period is the same as the duration of the macrocycle.
Start	0	increments of 1 mS	(Synchronous time slots only) the moment the time slot begins.
End	same length as **period**	increments of 1 mS	(Synchronous time slots only) the moment the time slot ends.
Comment			Up to 40 characters.

After making any changes to this tab, click on **ok**. The Network Configuration tool recalculates the Macrocycle Duration. If you have changed an existing time slot, the changes are reflected in devices that already use the time slot.

Time Slot Lengths and Macrocycle Duration

The calculated Macrocycle Duration, displayed on this screen, defaults to 150mS. The Macrocycle Duration is the smallest common multiple of all the time slot periods. Of the time slots listed, most also have been assigned a period of 150mS. However, the period assigned to discrete inputs and discrete outputs is 50mS. So the discrete inputs and discrete outputs will be exchanged three times during the Macrocycle period.

Remote I/O Rack Exchange Predefinitions

For each type of remote I/O rack or Field Control I/O Station, it is possible to define system TVAs (transport variables), module TVAs, and transport time slots. TVA names are:

_S	System TVA	**_I**	discrete input state	**_Q**	discrete output
_AI	analog input value	**_AQ**	analog output	**_V**	discrete validator
_AV	analog validator	**_AT**	analog alarm	**_B**	blinking bit
_C	chattering bit				

You can eliminate unnecessary exchanges for a module type by removing the allocation of the time slot to that TVA. For example, for performance reasons, validator TVAs for that module type could be eliminated. (You cannot eliminate exchanges for an entire module type).

If you edit exchange definitions for remote racks, the changes will take effect when a remote I/O rack connects to the network segment or when an I/O module is inserted. Changed exchange definitions do not affect devices already in place.

For remote I/O racks (and Field Control I/O Stations), the I/O Racks tab has three tabs:

- System TVAs
- Input Modules
- Output Modules

System TVAs for I/O Racks

For the remote I/O rack or station chosen, the System TVAs tab lists the system TVAs attached to the rack type, and the direction and transport time slot of each. It also indicates whether the exchange of this system TVA is predefined or has been eliminated. This is the status information for the remote I/O rack; it should not need to be changed.

Parameter	Range or Choices	Comments
Name	cannot be changed	The name of the system TVA attached to this type of rack.
(D)irection	P or C	Direction of the exchange (produced or consumed).
Time Slot		Name of the transport time slot currently allocated to the TVA. For example, SYST.
v		The character **v** in this column shows that the exchange of the system TVA is defined. If there is no **v** character, the exchange has been eliminated.

Input Module and Output Module Exchanges for I/O Racks

For each type of input and output module that may be present, the Network Configuration Tool lists predefined TVAs, the module transport time slot, and the TVA transport time slots. You can choose another transport time slot for a TVA.

Remember that the module transport time slot is related to module's TVA timeslots. If you change the module transport time slot, the module's TVA times slots also change.

PLC Exchange Predefinitions

You can set or change the transport time slot allocated to each System Variable for each type of PLC and Control Station. You can also eliminate unnecessary exchanges. The PLCs tab and the Stations tab list predefined system variables by name, type, number, direction, and time slot.

Parameter	Range or Choices	Comments
Name	cannot be changed	The name of the system variable.
Type		For certain variables, the type has been given a name, such as STAT_IO. For others, the standard data types are used (boolean, integer, etc...).
Number		The number of variables of the type exchanged. For special variables, this number is 1. Otherwise, it is the number of elementes that constitute the system variable.
(D)irection	P or C	Direction of the exchange (produced or consumed).
Time Slot		Name of the transport time slot currently allocated to the TVA. For example, SYST.
v		The character **v** in this column shows that the exchange of the system variable is defined. If there is no **v** character, the exchange has been eliminated.

Changes made using the Network Configuration Tool take effect on connection of the PLC or the Control Station to the network segment. They have no effect on the PLCs and Control Stations that are already connected.

Predefined exchanges that specify the correspondents of devices connected to the network segment can be modified individually using the command Edit exchanges (see Edit Exchanges).

Generic Device Exchange Predefinition

For each type of Generic Device, you can set or change the transport time slot allocated to each System COMV, as well as its FIP identifier.

Parameter	Range or Choices	Comments
Name	cannot be changed	The name of the system COMV.
FIP Identifier		2 bytes. The LSB is reserved for the device subscriber number, which cannot be modified. The MSB can be changed. It must be a hex number preceded by 0x characters. Use the recommended IDs listed below.
Length	cannot be changed	Length in bytes.
(D)irection	P or C	Direction of the exchange (produced or consumed).
Time Slot		Name of the transport time slot currently allocated to the system COMV. For example, SYST.

Certain ranges of FIP IDs are protected or reserved. The recommended range to be used for Applicative COMVs exchanged by a generic device at address xy is 0x00xy to 0x0Fxy. Outside this range, it is preferable to use identifiers in the range 0x81xy to 0x8Fxy.

You can also change the number of produced and consumed application COMVs for each type of Generic Device. Generic devices are limited to 2000 COMV exchanges.

Changes take effect on connection of the Generic Device to the network segment. They have no effect on the Generic Devices that are already connected.

Adding Subscribers to a Network Segment

After defining the overall network parameters and predefining data exchanges, add devices ("subscribers") to the network segment.
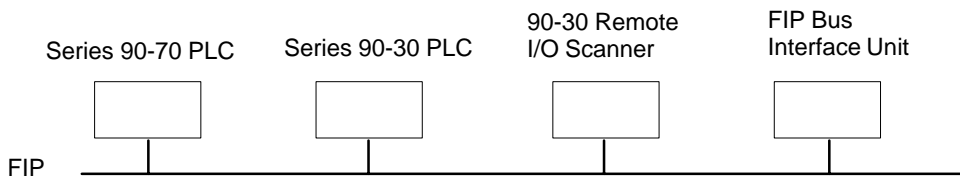
You can create a device or copy a device (from the same or another network segment) and paste it into this network segment. Pasting allows the data of the copied device to be re–used (except the exchanges which no longer mean anything in the new context).

You can also delete a device that is no longer needed. The following devices cannot be deleted: locked remote I/O racks, devices that are connected to a locked network segment, devices that are correspondents of a locked remote I/O rack.

To add a device to the segment, on the **Edit** menu:

A.   Click on **New Device,** or,

A.   Click on **Copy** to copy a device. **Paste** the device, then change it as needed.

Device Identification

For each device on the network segment, specify:

■   A **subscribernumber** from 0 to 255. It must be unique on the network segment.

■   The **name** of up to 16 alphanumeric characters. For remote I/O racks, the name must be unique to the project. For other categories, the name must be unique to the network segment.

■   The device **category**: PLC, Remote I/O rack, or Generic Device.

■   The device **type** within the selected category.

■   The type of **communication board** (eg. Bus Controller IC697BEM742).

If you have copied an existing device configuration, give it a unique name and subscriber number.

Editing the Network Configuration for a Device

To add subscribers to the network segment:

1. With the Network Segment selected, on the **Edit** menu, click on **New Device.**

2. Select the category (PLC, I/O Rack, or Generic) and type of device (for example, 90-70)..

3. Enter a name and subscriber number for the device.

Individual network subscribers have several parameters that can be edited. Click on the device's icon in the left pane of the Network Configuration Tool window. There are two tabs in the right pane:

■ Parameter

■ Master Device

Configuring Device Parameters

Device parameters have default values that are suitable for many applications. They may be edited if necessary. Not all devices have all the parameters listed below. See the device types in column 2: 9070 (Series 90-70 PLC), 9030 (Series 90-30 PLC), FBIUrack (FIP Field Control BIU I/O Station, and FR3rack (Series 90-30 FIP remote I/O rack.

PARAMETER	Type of Device	Default	Range or Choices	Comments
MasterDevice Ability	90-70	Able to	Able to, no	Whether the device is the master of any remote I/Odevices. A master device controls the operating mode and configuration of the remote device.
BA carrier	90-70	Yes	Yes, no	Whether or not the device is a carrier for the bus arbiter program. A segment may have multiple carriers, but only one is active at a time.
If BA carrier: priority	90-70	0	0–15	Not used. For the Series 90-70, this is always 0.
Bi/Mono Medium	All	Bi-Medium	Bi-Medium, Mono-Medium	One or two bus connections with a single subscribernumber.
Network Access	90-70	Asynchronous	Asynchronous, synchronous	Read/writeaccesstonetworkinterface: asynchronous or synchronized on transport time slots.
Discrete and Analog fallback/hold	90-70,90-30	0	Fall back to 0, hold	In the event of network interface failure, values canbesetto0orholdtheirmostrecentrefreshvalues.
Promptness coefficient	All	3	3 – 10	For the consumer of a variable, promptness is its capacity to consume the variable during the configured period. Used to calculate the promptness period. *Promptnessperiod (ms) = (promptness coefficient) x (transfer period) + promptnessoffset*
Promptness offset(x0.1ms)	All	20	20–65000, increments of 10	Offset used to calculate promptness period.
Refresh Coefficient	All	3	3–10	For the producer of a variable, the refresh is its capacity to update that variable during the refresh period. Used to calculate the refresh period: *Refresh period (ms) = (refresh coefficient) x (transfer period) + refreshoffset*

PARAMETER	Type of Device	Default	Range or Choices	Comments
Refreshoffset (x0.1ms)	All	5000	10–65000, increments of 10. Higher number for slower refreshment period	Used to calculate refresh period. For a very slow CPU scan, it may be necessary to increase the refreshment period. Otherwise, data may be produced with an unrefreshed status.
Tslot (μs):	All	250		Real time clock rate of the FIP Bus Controller's FULLFIP2chip. Not editable.
Time Consumption via	90-70, FR3rack	Message	No, message	The method of consuming the System Timereference.
Time Reference byCOMV	90-70	No	No, Yes	Whether the System Time Reference is distributed by COMV.
Time Reference byMessage	90-70	No	No, Yes	Whether the System Time Reference is distributed by Message.
Restart/on Powercycle	FR3rack, FBIUrack	Auto		Reserved for future use.

Master Device

For each device identified as NOT being a master device (on the Settings tab), you can specify a master device on the Master Device tab. (The Master Device tab cannot be displayed for a device that is able to be a master device.)

For a remote I/O device, the Master Device tab lists the configured devices that are capable of controlling its operating mode and configuration. You will need to specify which device is the master of the remote I/O device.

If there is only one master device on the segment, by default that device will control all non-master devices.

Associating Subscribers with the Network Configuration

Each PLC and remote I/O rack identified with the Network Configuration Tool must be associated with an equipment folder. Associations are manually done before configuring the devices with the Hardware Configuration Tool.

To create associations:

1. Expand the network configuration in the left pane of the Network Configuration window to show the individual devices that have been identified.

2. Click on the icon of the device for which you want to create an association.

3. On the **Associate** menu, click on **Setting** to create an association. The **Device Association** box is displayed. It shows the name of the selected device.

Additional Steps for a Series 90 PLC

1. (optional) You can define a network drive by clicking on **network**. The **Connecting to a network drive** box appears. Select the network drive then click on **ok**.

2. If you have defined a network drive, you can select that drive in the **drives** list by pointing to the desired drive.

3. Select a directory for the equipment folder by double-clicking on the directories list.

4. Display an existing equipment folder or the place with the new equipment folder will be saved.

5. Define the equipment folder. If the folder does not exist, you can enter a name. The name must not begin with a number. If the folder already exists, click on **equipment folder** in the list.

6. Click on **ok.**

Additional Steps for a Remote I/O Rack

1. The **name of equipment folder** is empty. The **name of rack system in equipment folder** initially displays the name of the selected device. The name can be edited.

2. (optional) You can define a network drive by clicking on **network**. The **Connecting to a network drive** box appears. Select the network drive then click on **ok**.

3. If you have defined a network drive, you can select that drive in the **Drives** list by pointing to the desired drive.

4. Select a directory for the equipment folder by double-clicking on the directories list.

5. Display an existing equipment folder or the place with the new equipment folder will be saved.

6. Define the equipment folder. If the folder does not exist, you can enter a name. The name must not begin with a number. If the folder already exists, select the desired **equipment folder** in the list.

7. Define the rack system. If one does not exist, you can enter a name that does not begin with a number. If the rack system exists, click on "available rack...". Select and click on the device.

8. Click on **ok.**

The association process produces a new equipment folder and a new rack system for the PLC unless an existing equipment folder is being used.

Using the editing features of the Network Configuration tool, you can also:

- clear an association.

- modify an association.

- update an association.

- restore an association. This must be done if the Network Configuration tool indicates that an association is "broken". A folder association is broken by:

    □ Changing the network directory

    □ Changing the Equipment Folder directory

    □ Renaming the device

    □ Deleting the device

- restore all project associations

Restoring All Associations After Moving a Folder using the Windows Explorer

If you use the Windows Explorer to move a folder, all the associations for that folder will be broken.

1. Select the project icon or the network segment icon.

2. In the **Association** menu, click on **Restore**.... The dialog box shows the old and new access path to the folder. It also shows the list of equipment folders or existing associations.

3. Click on **start**. After a successful restoration, an **x** character will appear to the right of the access paths to the associated equipment folders. If the association was unsuccessful, the **x** character is not displayed.

Configuring Remote I/O Devices

With the Hardware Configuration Tool, configure the individual I/O on the network, such as remote I/O racks and other devices that will be exchanging data with the Series 90-70 PLC.

Configuring a Remote I/O Rack

In a FIP network, a Remote I/O Rack is a Series 90-30 I/O rack that is interfaced to the network by a FIP Remote I/O Scanner. Up to 19 I/O modules can be accommodated by using two 10-slot baseplates connected by an expansion cable.

CPU Baseplate   Expansion Baseplate

FIP Bus
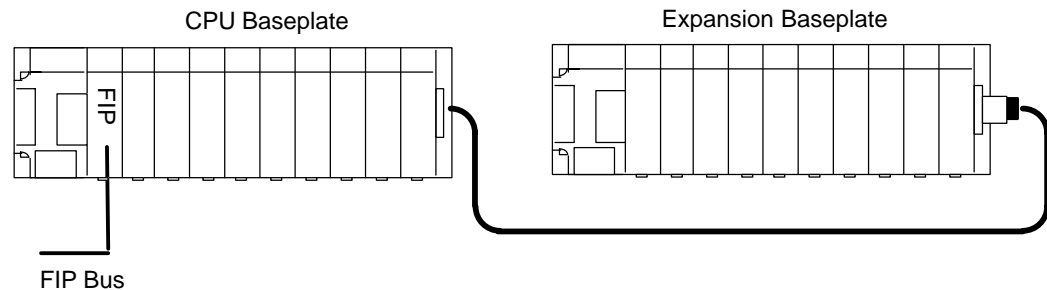
To edit the hardware configuration of a Remote I/O Rack:

1. Select its icon in the left pane of the Network Configuration tool window.

2. On the **Tools** menu, click on **Edit HW Configuration**.

This will start up the CIMPLICITY Control 90 Software. Information entered from the Network Configuration tool will already be in place.

Settings for the FIP Remote I/O Scanner

Select the Settings tab to configure the Remote I/O Scanner. Non-editable items for the Remote I/O Scanner include its Station ID and use of redundant media (dual bus cable). Configure the following additional parameters:

SETTING	Range/Selections	Comments
Clock Synchronization Type	External Synchronization, Network Synchronization	Select External if the Remote I/O Scanner will receive a clock pulse signal via a cable attached to the front of the module.
		The Remote I/O Scanner receives a message containing the time and date from another FIP subscriber (usually a CPU) which is in charge of maintaining an accurate network time. The Remote I/O Scanner stores this information until it receives the next Synchro signal (via the Synchro cable). The Remote I/O Scanner then synchronizes its time-of-day clock.
Synchronization Period	0–10 seconds (increments of 1)	The frequency of the Synchro pulse.
Forcing Management	Volatile, non-volatile	Determines whether I/O forces will be retained through loss of power.
Fault Management	Hold, Not Hold	Determines whether clearing faults removes them from the status data provided to the CPU.
CPU Mode	Normal, Security	Determines the normal/safe operating mode of the FIP Remote I/O Scanner.

Module Configuration in a Remote I/O Rack

The modules in the Remote I/O Scanner rack are configured in the normal manner for Series 90-30 I/O modules. Inputs and outputs in a Remote I/O Rack can be configured for additional FIP features, including blinking and chattering.

FIP-Related Parameters for Discrete Inputs

SETTING	Range/Selections	Comments
Filtering on N Values	0, 1, 2, 4	Select 1, 2, or 4 samples as the value for all inputs on the module. For example if you selected 2, each input on this module would need to remain changed for two successive samples before the change is considered valid.
Chattering Mode	On, Off	If Chatter detection is turned on, the Remote I/O Scanner processes inputs after the inputs are filtered (see above). If the input changes state more than the specified number of times during the selected time period, the Remote I/O Scanner informs the CPU that the input is chattering.
Chattering Maximum Number	1–255 (increments of 1)	If Chattering Mode is ON, this is the number of transitions that must occur during the selected time period before an input is considered chattering.
Chattering Period	1 Sec, 10 Sec, 100 Sec.	If Chattering Mode is ON, this is the time period used for chatter detection.

FIP-Related Parameters for Discrete Outputs

POINT DATA	Range/Selections	Comments
Default Value	Off, On	Editable only if **DefaultMode** is Fall Back.
Output Mode	Normal, Blinking, Pulse–Delay	**Blinking:** For blinked outputs, the Remote I/O Scanner synchronizes output data transitions with an internal clock which may be synchronized with the network system clock.
		Pulse-Delay: When the Remote I/O Scanner receives the output state for a pulsed output from the CPU, it processes the output as defined by the **Choice**, **Polarity**, **Duration**, and **Return to Zero** parameters.
Choice	Pulse, Delay	If **OutputMode** is Pulse–Delay, determines whether the response will be a true pulse or simply a delayed transition. A delayed response will return to its original state whenever the commanded state does so.
Polarity	Slope+, Slope–	If **OutputMode** is Pulse–Delay, determines whether the point will respond to positive-edge or negative-edge transitions of the commanded state. The output itself will respond in the same direction.
Return to 0	No or Yes	If **OutputMode** is Pulse–Delay and **Choice** is Pulse, if this is set to YES, the pulse will terminate whenever the state commanded by the CPU goes back to its original state. If set to NO, the pulse will last for its configured duration whether or not the CPU changes the output's commanded state.

Configuring a FIP Field Control Bus Interface Unit

In a FIP network, a Field Control I/O Station that is interfaced to the network by a FIP Bus Interface Unit is also considered a type of remote I/O rack. Up to 8 Field Control modules can be accommodated in one I/O Station.
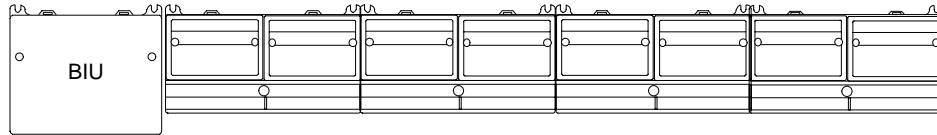
To edit the hardware configuration of a Field Control I/O Station, select its icon in the left pane of the Network Configuration tool window then choose TOOLS–EDIT HW CONFIGURATION. This will start up the CIMPLICITY Control 90 Software. Information entered from the Network Configuration tool will already be in place.

To edit the hardware configuration of a Field Control I/O Station:

1. Select its icon in the left pane of the Network Configuration tool window.

2. On the **Tools** menu, click on **Edit HW Configuration**.

This will start up the CIMPLICITY Control 90 Software. Information entered from the Network Configuration tool will already be in place.

Configure the Bus Interface Unit and the I/O modules in the normal manner, as detailed in the BIU User's Manual. There are no special parameters for Field Control products when used in a FIP network.

Defining MPS Exchanges

After completing the hardware configuration of the remote I/O racks, return to the Network Configuration tool and edit data exchanges between devices connected to the network segment.

You must:

- Define the following exchange information for each PLC:
  - The other devices on the network that will be correspondents of the PLC.
  - The name, data type, length, transport time slot, and consumers of all Application Variables produced by the PLC.
  - The time slot and consumers of all System Variables produced by the PLC.
- Define the following exchange information for each remote I/O rack:
  - The correspondents of the I/O rack
  - Correspondents of I/O modules and of specific module TVAs
  - The consumer of the remote I/O Rack's system TVA data
  - You can also modify the transport time slots of individual module TVAs
- Define the following exchange information for Generic Devices:
  - The parameters of the device's Application COMVs.
  - Producers and consumers of the device's Application COMVs.
  - The consumers of the device's System COMVs.
  - You can also modify the time slots of individual COMVs.

If the network segment is locked, the device correspondents may not be modified. If an I/O rack is locked, the correspondents of that rack may not be modified.

Accessing MPS Exchange Definition

To define or edit the MPS exchanges of a network segment:

1. Go to the Network Configuration tool.

2. In the left pane, select the network segment icon.

3. In the **Tools** menu, click on **Edit exchanges**.

   The **definition of MPS Exchanges** window lists network segment devices that have been configured. For each subscriber, the list includes the device's Name (for example, fbc70x10), its Type (for example, 90-70), and its Category (in this case: PLC).

4. Select the device for which you want to define exchanges.

5. Continue at the appropriate heading below.

Defining MPS Exchanges for a PLC

Define the following exchange information for each PLC:

□ the other devices on the network that will be correspondents of the PLC.

□ the name, data type, length, transport time slot, and consumers of all Application Variables produced by the PLC.

□ the time slot and consumers of all System Variables produced by the PLC.

Modifying the Correspondents of the Selected PLC

The rightmost pane of the **Exchange Paths** tab lists its potential correspondents. Remote I/O racks by default are considered potential correspondents and are not included in the list. The **Consumers** list is empty if no correspondents have been defined for the device. To add a correspondent, select the device in the list and click on **add**. To remove a device, select it in the **correspondents** list and click on **remove**.

CAUTION: Removing a correspondent deletes all the exchanges which may have been defined previously between the device and the correspondent.

Creating or Modifying a Produced Application Variable

To create or modify a produced application variable:

1. Select the **Produced App Vars** tab.

2. To create a variable, click on the **New Var** button. To modify a variable, select the variable and click on the **Modify Var** button.

3. In the dialog box, enter or edit the following as appropriate:

   A. The name of the variable (no more than 12 alphanumeric characters).

   B. The **Type** (Boolean, Signed Integer, Unsigned Integer).

   C. The **Number** of bits or 16-bit words in the variable.

4. If the **Transport Time Slot** is not appropriate, select a different one from the list. Click on **OK**.

To delete a produced application variable, click on the **Delete Var** button.

Editing a Produced System Variable

1. Select the **Produced System Vars** tab.

2. In the **Variables** list, click on the name of the variable.

   A. To change the transport time slot of a produced application or system variable:

      – In the **On selected Time Slot** list, select the time slot.

      – Click on the **Apply** button.

   B. To define the consumers of the selected variable, in the **Consumers** list click in the **v** column opposite the intended consumer device.

Defining MPS Exchanges for Remote I/O Racks

Define the following exchange information for each remote I/O rack:

- □ The correspondents of the I/O rack
- □ Correspondents of I/O modules and of specific module TVAs
- □ The consumers of the remote I/O Rack's system TVA data

You can also modify the transport time slots of individual module TVAs

Specifying the Correspondents of the Remote I/O Rack

By default, each correspondent of a remote I/O rack consumes all TVAs produced by the I/O modules of the rack. When you add a new correspondent, the defaults are applied. You can eliminate unnecessary exchanges at the I/O module level.

The rightmost pane of the **Exchange Paths** tab lists its correspondents and devices that are not presently configured as correspondents, but which are able to be correspondents. To add a correspondent, select a **potential device** in the list and click on **add**. To remove a device, select it in the **correspondents** list and click on **remove**.

CAUTION: Removing a correspondent deletes all the exchanges which may have been defined previously between the device and the correspondent.

Configuring Exchanges for Output Modules in the Remote Rack

To configure exchanges for output modules in a remote I/O rack:

1. Click on the **Output Modules** tab.

   The Output Modules tab lists configured output modules and their correspondents. With a module selected, the **Correspondents** list shows devices that may produce the TVAs for this module. A symbol in the **Priv** column shows which device is the Privileged Correspondent for all output modules in the selected remote I/O rack. A symbol in the **v** column shows which correspondent is the producer.

   With a correspondent selected, the **Modules** list displays the output modules for which this device produces TVAs. The **Modules** list shows the location of the module in the I/O rack, the module's part number, a description of the module, the transport time slot associated with the module. The column **v** indicates what device produces the TVAs for this module.

2. In the **Modules** list, click on the **Slot** of the module.

   A. To specify the producer(s) of data for an output module, in the **Correspondents** list, click in Column **v** opposite the **Name** of the producer device, or else in the **Priv** column to designate the Privileged Correspondent.

   B. To modify the transport time slots of the TVA(s) of an output module, click on the **Module TVAs** button. The **Output Module: <location>** dialog box appears

      – Click on **Name of the TVA.**

      – In the **On selected time slot** zone, select the name of the time slot desired. Click on **Apply**. The **TVAs** list is updated. Click on **Close**.

Configuring Exchanges for Input Modules in the Remote Rack

1. Click on the **Input Modules** tab.

The **Input Modules** tab lists configured input modules and their correspondents. If you have selected a module, the **Correspondents** list shows devices that may consume the TVAs for this module.

2. In the **Modules** list, click on the **Slot** of the module.

   A. To specify the consumer(s) of an input module:

       –   In the **Correspondents** list click in Column **v** opposite the **Name** of the consumer device.

       –   Or, in the **Correspondents** list, click on the **Name** of the device that will be the consumer of module TVAs. Then , in the **Modules** list, click in Column **v** opposite the **Slot** of the module.

   B. To specify correspondents for specific TVAs of an input module, click on the **Modify TVAs** button.

       –   In the **TVAs** list, click on the **Name** of the TVA. In the **Correspondents** list, click in Column **v** opposite the **Name** of the consumer device.

       –   Or, in the **Correspondents** list, click on the **Name** of the device that will be the consumer of the TVA. Then, in the **TVAs** list, click in Column **v** opposite the **Name** of the TVA.

   C. To modify the transport time slot of the TVAs of the input module, click on the **Module TVAs** button. The **TVAs of the Input Module: (location)** dialog box appears

       –   Click on the **Name** of the TVA.

       –   For **On selected time slot**, select the name of the time slot desired. Click on **Apply**. Click on **Close**.

Configuring Exchanges of Produced System TVAs for the Remote I/O Rack

1. Select the **Produced Sys TVAs** tab.

2. In the **TVAs** list, click on the **Name** of the TVA.

3. To modify the transport time slots of produced System TVAs from the remote I/O rack:

   –   In the **On selected Time Slot** list, select the name of the time slot desired.

   –   Click on **Apply**. The **TVAs** list is updated. Click on **Close**.

4. The master device of the I/O rack must consume all the System TVAs produced by this rack. To specify the other consumer(s) of a produced System TVA:

   –   In the **Correspondents** list, click in Column **v** opposite the **Name** of the consumer device. The presence of the **v** means the device is a consumer of the selected TVA in the **TVAs** list.

   –   Or, in the **Correspondents** list, click on the **Name** of the device for which you wish to define the consumed TVAs. In the **TVAs** list, click in Column **v** opposite the **Name** of the consumed TVA. In the **TVAs** list, the presence of the **v** means that the TVA is consumed by the selected device in the **Correspondents** list.

Specifying Exchanges of Consumed System TVAs for the Remote I/O Rack

The master device of the I/O rack must produce all the System TVAs consumed by this rack.

Defining MPS Exchanges for Generic Devices

For Generic Devices, you can:

- □ Define, edit, and delete Application COMVs.
- □ Specify producers and consumers of the device's Application COMVs.
- □ Specify the consumers of the device's System COMVs.

You can also modify the time slots of individual COMVs.

Creating or Modifying a COMV

To create or edit a COMV:

1. Click on the **Applicative COMVs** or **System COMVs** tab.

   A. To create an application COMV, click on the **New COMV** button. The **Creation of COMV** dialog box is displayed.

   B. To modify or change the time slot of a COMV:

      - In the **COMVs** list, click on the **Name** of the COMV.
      - Click on the **Modify COMV** button.

2. You can enter/edit:

   A. for Application COMVs only, the **Name** of the application COMV.

   B. the FIP identifier (**Fip Id**). Certain ranges of FIP IDs are protected or reserved. The recommended range to be used for Applicative COMVs exchanged by a generic device at address xy is 0x00xy to 0x0Fxy. Outside this range, it is preferable to use identifiers in the range 0x81xy to 0x8Fxy.

      For the FIP ID of a STAT COMV produced by a Generic device, the FIP ID should be 0x00nn, where nn is the subscriber number of the device.

   C. the **Length (bytes)** of the application COMV.

   D. the **Time Slot** for the applicative COMV.

3. When you are finished, click on **OK**.

Deleting an Application COMV

CAUTION: Removing a correspondent deletes all the exchanges which may have been defined previously between the device and the correspondent.

1. In the **COMVs** list, click on the **Name** of the application COMV to delete.

2. Be sure you really want to delete the COMV. No confirmation is requested when you choose to delete the COMV. If you are sure, click on the **Delete COMV** button.

Specifying the Producers and Consumers of COMVs

To specify the producers/consumers of an application COMV or the consumers of a System COMV:

1. Select the Generic device in the left pane of the **MPS Exchange Definition** window.

2. In the right pane, click on the **Applicative COMVs** or **System COMVs** tab. The right pane of the window contains two lists, **COMVs** and **Devices**.

3. In the **COMVs** list, click on the **Name** of the COMV for which you wish to specify the producers or consumers.

4. To specify producers or consumers:

    –   In the **Devices** list, click in **Pr** column opposite the **Name** of the device producing the application COMV. In the **Devices** list, the presence of the **v** means that the device produces the selected application COMV.

    –   In the **Devices** list, click in the **Cr** column opposite each **Name** of each consumer device of the application COMV. In the **Devices** list, the presence of the **v** means the device is a consumer of the selected application COMV.

    Or:

    –   In the **Devices** list, click on the **Name** of the device for which you wish to specify application communication variables produced (for application COMVs only) or consumed.

    –   In the **COMVs** list, click in Column **P** opposite the **Name** of each COMV produced by this device. In the **COMVs** list, the presence of the **v** indicates that the COMV is produced by the selected device.

    –   In the **COMVs** list, click in Column **C** opposite the **Name** of each COMV consumed by this device. In the **COMVs** list, the presence of the **v** means that the COMV is consumed by the selected device.

Building the Configuration of a Network Segment

The final step in creating a configuration is "building" the binary configuration files. This is done using the Network Configuration Tool.

Building a network segment establishes the bus arbiter program. It also produces configuration elements for certain devices. When the bus arbiter program is being built, the COMVs are placed in the transport time slots, beginning with the time slots with the shortest period.

The results of the build operation can be printed out. The detailed printout includes:

- project identification
- revision codes
- the TEST_P instruction period
- the duration of the bus arbiter macrocycle (in milli–seconds)
- the percentage of aperiodic messages in the macrocycle
- the percentage of aperiodic variable transmissions in the macrocycle
- the description of the bus arbiter
- the fill rate for each transport time slot
- the building report for each device
- the exchange description
- the links between the application variables and the TVAs
- the report of the network interface building for each device
- the report of the processing interface building for each I/O rack

Configuring the PLC Hardware

Hardware configuration includes assigning mapping for all of the data into the selected memory areas in the Series 90-70 PLC reference area. It also includes specifying how to scan data (data can be in different CPU scan sets).

To edit the hardware configuration:

1. Select the Series 90-70 PLC device icon in the left pane of the Network Configuration tool window.

2. On the **Tools** menu, click on **Edit HW Configuration**.

This will start up the CIMPLICITY Control 90 Software. Devices entered from the Network Configuration tool will already be in place.

Basic Configuration Steps

1. Configure the CPU scanning mode.

2. Configure the scan sets.

3. Configure the FIP Bus Controller.

4. Configure the devices on the network, such as I./O racks, PLCs, and generic devices.

CPU Configuration

Select the PLC CPU from the Control 90 rack display to edit the Hardware Configuration for the CPU. The following tabs are now available:

■ Settings
■ Scan
■ Memory
■ Faults
■ Scan Sets
■ Power Consumption

In addition to other CPU configuration needed for the application, make the following selections for a FIP system. (Other CPU configuration steps are not described here).

Scan

On the **Scan** tab, select the sweep mode.

–   For synchronous operation, select **microcycle**. For optimal operation, the microcycle period should be the same as the fastest synchronous scan set (shown in the **Scan Sets** tab).

–   For Asynchronous operation, any mode can be selected.

Scan Sets

Select the **Scan Sets** tab. Up to 32 total scan sets can be assigned. Of these, up to 15 can be synchronous.

Guidelines for Configuring Scan Sets

1.   CPUs configured for non-Microcycle modes (Normal, Constant Sweep, Constant Window) can only be configured for Asynchronous Scan Sets. The default scan set assigned to I/O is the Fixed Scan Set (#1).

2.   CPUs configured for Microcycle mode can be configured to have both Asynchronous and Synchronous Scan Sets.

3.   Synchronous Scan Sets can be assigned to local rack I/O and to FIP Bus Controllers that are not the triggerable FBC. This allows a synchronous scan set to include asynchronousI/O.

4.   In the triggering FIP Bus Controller, all TVAs and COMVs assigned to one Synchronous Scan Set can have different time slots. However, the time slots must share the same period. The Output Delay is 0 and cannot be changed.

5.   If a Synchronous Scan Set has been configured but has not been assigned to a FIP Bus Controller's time slot (so its period is 0), the entire configuration is invalid.

Scan Set Configuration Steps

A.   To configure an asynchronous scan set:

1.   Enter the description of the scan set.

2.   Select "Async" as the **type** of scan set.

3.   The entries for **Event Source** and **Single Name** cannot be edited.

4. Select the **# of Sweeps** as the frequency for the scan set.

5. Select the **Output Delay** indicating the number of sweeps to delay before sending the outputs.

B. To configure a synchronous scan set:

1. Enter the description of the scan set.

2. Select "Sync" as the **type** of scan set. (To configure a synchronous scan set, the Network Access parameter for the PLC must be set to " ╱time slots" (synchronous) in the Network Configuration Tool.

3. Enter the **Event Source** in rack . slot format to identify the triggering FIP Bus Controller. For example, if the FIP Bus Controller in rack 0 slot 2 is the triggering FIP Bus Controller, enter 0.2.

4. The **Single Name** will be assigned by the Programmer and will be used to specify the "Single" field in the task definitions to trigger the application program.

5. The # **Sweeps/Period** is a non-editable field for synchronous scan sets. Th period of this scan set will be shown here when the timeslots are assigned to this scan set in the FIP Bus Controller **Scanning** tab.

Scan Set Configuration Parameters

Parameter	Range or Choices	Comments
# (of scan set)	1–32	Scan Set 1 is fixed and not editable; its Type is Asynchronous, Number of Sweeps 1 and Output Delay 0.
Description		Up to 32 characters
Type	Sync, Async	In Asynchronous sweep mode, data is read as part of the sweep cycle. In synchronous mode, data is read when triggered by the FIP Bus Controller.
		If Type is Synchronous, you must specify the Event Source (see below).
		If Type is Asynchronous, specify the Number of Sweeps and the Output Delay.
Event Source		If **type** is SYNC, This is the rack/slot address of the FIP Bus Controller the scan set is synchronized with. For example, 0.4 for rack 0 slot 4.
Single Name		If **type** is SYNC, the single name will be automatically provided.
Number of Sweeps or Period (mS)	0–1024mS	If **type** is SYNC, this field cannot be edited. The Period (mS) shown here is initially zero. It is updated after timeslots are assigned to the scan set.
	0–64 sweeps	If **type** is ASYNC, the **Number of Sweeps** can be specified. **Number of Sweeps** for Scan Set 1 is always 1 and is not editable.
Output Delay	0 to 64 (Number of Sweeps –1)	If the Type is ASYNC, this is the number of sweeps the output scan will be delayed after the input scan has occurred. The Output Delay can only be selected when the Number of Sweeps is non–zero. If **type** is SYNC, **Output Delay** must be 0 (zero).
		Not editable for Scan Set 1, which is fixed.

Hardware Configuration for the Series 90-70 Bus Controller and the Network

Select the Bus Controller from the Control 90 rack display to edit the Hardware Configuration for the Bus Controller and the network. When you select **Tools** then **Edit Hardware Configuration**, the following tabs are available:

- Settings
- I/O Racks
- Drives
- PLCs
- Stations (control stations)
- Generic Devices
- Scanning
- Correspondents
- Protocol Files
- Power Consumption

When selected, these tabs display parameters that have been configured from the FIP Network Configuration tool. Parameters that have been configured with the Network Configuration Tool appear only after an update.

Settings

Select the Settings tab to configure the Bus Controller. Non-editable items for the Bus Controller include whether it is the master subscriber, whether it is the bus arbiter, clock synchronization, and others. The status data length (80 bits or 5 words) is not editable, but you can change the reference address that is presently assigned for the Bus Controller's status data.

Parameter	Default	Range or Choices	Comments
Adapter Name		Any 31 character string.	This name will identify the node on the network.
Status Address	Next available %I reference.	%I, %Q, %AI, %AQ, or %R	The Reference Address for the Bus Controller's status data.
Network Routing Pair #1, #2, #3	0	0 or 2–9	The slot number of the FIP Bus Controller that **this** FIP Bus Controller is paired with in the main rack.
IP Address	0.0.0.0	X.X.X.X, where X is 0–255.	The IP Address, Subnet Mask, and Gateway IP Address should be assigned by your network administrator. If addresses are improperly set, your device may not communicate on the network and could disrupt communications. For a simple, isolated network with no gateways, assign a Unique address in the format 3.0.0.x (x ranges from 1 to 255).
Subnet Mask			Should be assigned by network administrator. For an isolated network with no gateways, use the default.
Gateway IP Address			Should be assigned by network administrator. For an isolated network with no gateways, use the default.
Name Server IP Address			

Protocol Files

Directory path specifications for up to 8 User Protocol Files may be entered here.

Correspondents

A list of all the devices that exchange I/O data with this FIP Bus Controller is displayed. All the fields are non-editable.

– If "Controlled Device" is NO, this device is only monitored by the FIP Bus Controller. The FIP Bus Controller cannot configure or affect the operating mode of the I/O rack.

– If "Controlled Device" is YES, this device is controlled by the FIP Bus Controller. The FIP Bus Controller can configure the device and control its operating mode.

I/O Racks, Drives, PLCs, Stations , and Generic Devices

Select the I/O Racks, Drives, PLCs, Stations, and Generic Devices tabs as necessary to configure the devices on the network. Non-editable items on these tabs include the device name, rack, slot, TVA type, and whether the listed devices produce or consume data. Configure the following parameters for individual devices.

Parameter	Default	Range or Choices	Comments
Ref Addr	Next available reference off-set. (Length cannot be edited here).	%I, %Q, %AI, %AQ	If the TVA type is PRODUCED, the valid reference address types are %Q and %AQ. The defaults are %Q for discrete and %AQ for analog.
			If the TVA type is CONSUMED, the valid reference address types are %I and %AI. The defaults are %I for discrete and %AI for analog.
Variable Name			
Variable Description			Description of up to 64 characters.

Scanning

On the Bus Controller's Scanning tab, you can enter a description of the scan set using up to 32 characters. The rest of the parameters are set in the FIP Network Configuration tool. They are not editable here.

Each CPU Scan Set is tied to one or more time slots that have been configured using the Network Configuration tool.
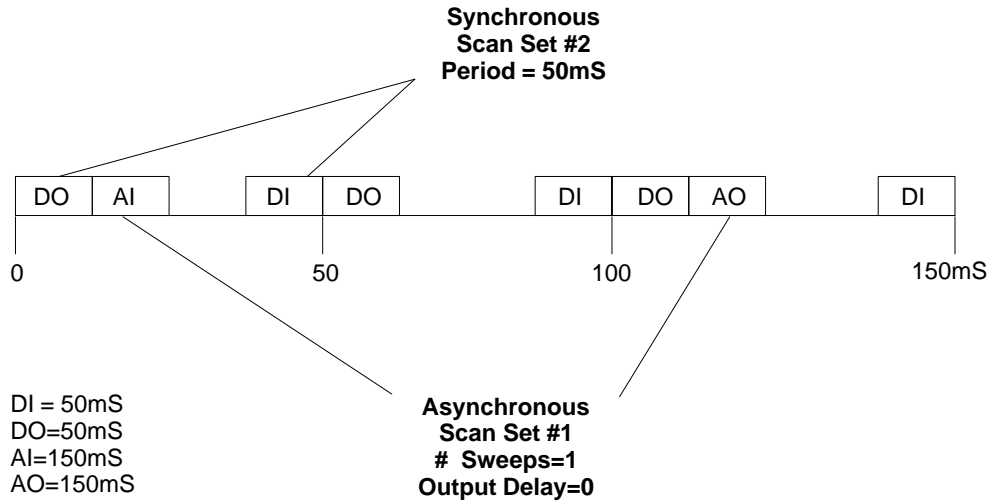
The time slots, which are defined in the Network Configuration tool, are used to group similar data, such as discrete inputs and their validators.

Scan sets are configured via the CPU. They control how the PLC CPU scans data to and from the bus controller (and other devices).

Parameter	Range or Choices	Comments
Time Slot	Up to 12 characters	The time slot name (defined in the Network Configuration). It is non-editable.
Description	Up to 32 characters	Description of the Scan Set.
Scan Set		By default this is the Fixed Scan Set, #1. If the CPU mode is Microcycle and a scan set has been predefined that has the same Time Slot value, the default value is that scan set.
Type	Async or Sync	This is not editable.

Operation

PLC I/O Scanning

In the Series 90–70 PLC, the FIP Bus Controller scans I/O data to and from the FIP network. This scanning may be configured to be synchronous or asynchronous to the FIP network.

The PLC CPU scans I/O data to and from the FIP Bus Controller. Likewise, the PLC CPU scan may be configured to be synchronous or asynchronous to the FIP Bus Controller.

Scan Sets

In the PLC CPU, I/O data is grouped into scan sets. The FIP Bus Controller can exchange data with up to 32 scan sets.

A **scan set** is a collection of input and/or output data that serves a specific I/O need of a PLC application program. For example, a PLC application program may need to process all of the discrete inputs and outputs. Another PLC application program may need to process only the analog inputs and outputs.

An individual scan set may contain I/O data from a variety of sources. For example, a scan set might combine discrete input and output data from one FIP Bus Controller with I/O data from another FIP Bus Controller, or I/O data from a local I/O module in the PLC rack.

There are two types of scan sets in the PLC: asynchronous and synchronous.

Asynchronous scan sets are scanned by the PLC CPU without any synchronization with the FIP Bus Controller. For example, asynchronous scan sets may be scanned every PLC sweep, every 20 PLC sweeps, etc.

Synchronous scan sets are scanned by the PLC CPU only when the FIP Bus Controller has consumed the input data from the network. The FIP Bus Controller informs (triggers) the PLC CPU of the arrival of the data and only then does the PLC CPU schedule the application program and scan the input data. When the application program completes, the PLC CPU scans the output data. In this manner, the PLC application program is said to be synchronized with the FIP network. The FIP Bus Controller can exchange data for up to 15 synchronous scan sets.

The PLC CPU may simultaneously be configured with both synchronous and asynchronous scan sets. For each synchronous scan set it is necessary to specify the particular FIP Bus Controller which must trigger the scan set. A synchronous scan set may be triggered by only one FBC. Asynchronous scan sets do not require or permit the specification of a trigger.

FIP Bus Controller Data Handling

The exchange of I/O data among the FIP network, the FIP Bus Controller and the PLC CPU occurs via the FIP Bus Controller's dual–port memory. Data in dual–port memory is organized in a manner necessary to support the various scanning operations of the FIP Bus Controller and PLC CPU.

The following diagram shows the arrangement of the I/O data in the FBC dual– port memory and the direction of data flow. Each input and output area is subdivided into the individual scan sets configured between the PLC CPU and the FIP Bus Controller.
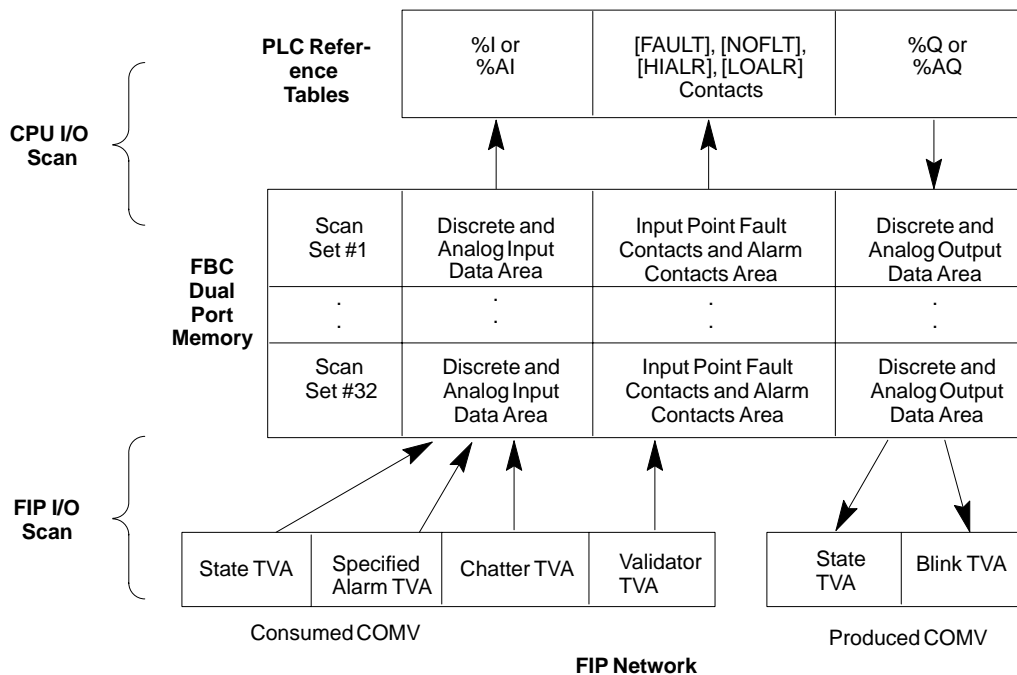
Application Transfer Variables (TVAs)

I/Odata in the exchanged between the FIP Bus Controller and the network consists of application transfer variables (TVAs), as shown at the bottom of the diagram.

There are two types of TVAs, data TVAs and validator TVAs..

■   Data TVAs—consist of input data TVAs (including state, chatter, and specialized alarm data) and output data TVAs (including state and blink data);

■   Validator TVAs—consist of discrete input validators (1 bit per point) and analog input validators (1 byte per channel);

AllTVAs (data and validators) of an I/O module are automatically placed in the same COMV.

Discrete and Analog Input Data Area of FBC Memory

This area of the FBC's dual-port memory contains each configured input application transfer variable (TVA). The FIP Bus Controller places consumed data TVAs, including state, chatter, and specialized alarm data, directly into this I/O data area of its memory. This is the data that will subsequently be mapped to the PLC's %I and %AI reference tables. If a data TVA cannot be consumed from the network, usually for lack of promptness or refreshment, the FIP Bus Controller defaults the data (to 0 or to hold its last state) according to its configuration.

Input Point Fault Contacts and Alarm Data Area of FBC Memory

This area contains validator TVAs associated with input data. The PLC uses validator information to drive the states of point fault contacts associated with discrete points and analog channels. The PLC also uses this information to drive any high and low alarm contacts associated with some analog inputs. There is a bit point fault contact for each discrete input bit. A single byte containing the point fault and alarm fault contacts is present for each analog input channel.

The FIP Bus Controller places successfully consumed validator TVAs in this area without modification. If a validator TVA cannot be consumed, usually for lack of promptness or refreshment, the FBC sets only the bit that affects the point fault contact for the discrete and analog data. The remaining bits of the analog TVA hold their last state. Therefore, if any alarm contact bit is set, it remains set if the validator TVA can no longer be consumed.

Discrete and Analog Output Data Area of FBC Memory

This area of FBC memory contains each configured output application transfer variable (TVA). The CPU places the output data, including state and blink data from the PLC's %Q and %AQ reference table into this area. When the FBC detects new output data, it copies the data directly into one or more COMVs and produces each COMV on the FIP network. If the FIP Bus Controller does not receive new data from the PLC CPU, it does not refresh the COMV. The COMV may then become unrefreshed based on the configured refreshment timers.

FIP Bus Controller I/O Scanning

The FIP Bus Controller scans I/O data to and from the FIP network. On the FIP network, each I/O data TVA is assigned to a time slot.

Time Slots

A time slot is a specific segment of the FIP macrocycle that occurs at a designated period.

In the PLC CPU, each time slot must be associated with one of the CPU scan sets. One or more time slots may be included in the same scan set.

On the FIP network, I/O data TVAs assigned to the same time slot are combined into Communication Variables (COMVs). The COMVs are then transferred on the FIP network in the same time slot that was defined for the TVAs.

Asynchronous or Synchronous Network Access

The FBC provides two methods of Network Access, asynchronous and synchronous. The choice of which method to use depends on the needs of the PLC application program(s). If the application program must be synchronized with the actual production of the data on the FIP network, then the synchronous scanning method must be used. In all other cases, the asynchronous Network Access method is probably preferable.

Default Network Settings

By default, the Network Access method is Asynchronous. In Asynchronous mode, all I/O data is still attached to time slots but the FIP Bus Controller is not synchronized to the actual production and consumption of the data on the network.

Transport Time Slot Defaults

The following table lists the default settings for the Transport time slots. See chapter 3 for more detailed information about Transport Time Slots.

Network Access: Asynchronous FIP Macrocycle duration: 150mS		
Name of time slot	**Period**	**Description**
DI	50ms	Contains all discrete input data
DO	50ms	Contains all discrete output data
AI	150ms	Contains all analog input data
AO	150ms	Contains all analog output data

Asynchronous I/O Scanning

Asynchronous Input Scanning

In Asynchronous I/O Scanning mode, the FIP Bus Controller scans input data from the FIP network at the period that it is produced on the network, but asynchronously. This means the FBC consumes the data from the network without regard for the actual moment when the data appears on the network. Therefore, the data provided to the CPU may have been produced at different times on the network. If it is necessary for all of the data in a time slot to be coherent, synchronous operation should be set up instead.

In Asynchronous I/O Scanning mode, the FIP Bus Controller continuously scans the input data at the specified period and makes the data available to the CPU. The CPU scans the input data from the FBC per the requirements of the scan set, e.g. every sweep, every 5 sweeps, etc.

Asynchronous Output Scanning

The FIP Bus Controller refreshes the output data in a time slot *only* when the CPU performs the output scan of the scan set which contains the time slot. Therefore, if the CPU delays the first output scan, the output data of the FBC will have an insignificant status. Once the CPU performs an output scan, the FBC refreshes the output data for that time slot(s).

If the CPU performs output scans for a while and then stops, the output data of the FBC becomes unrefreshed after the Refreshment Period has expired. (See the Network Configuration FBC parameters Refresh Coefficient and Refresh Offset. If the CPU must have a very long time between output scans, it may be necessary to adjust the Refresh parameters to avoid having unrefreshed data on the network.)

Configuring Asynchronous I/O Scanning

By default in the PLC CPU, all time slots are assigned to Fixed Scan Set #1. Scan Set #1 is an asynchronous scan set with its period equal to the sweep period and no output delay. As part of this scan set the inputs are scanned before the logic execution and the outputs are scanned immediately after the logic is executed.

It is possible to define up to 32 asynchronous scan sets, each with a different period and output delay. Any number of time slots may be assigned to a single scan set. But a given time slot may be assigned to only one scan set. Scan sets in the PLC CPU have a variety of configurable parameters that are defined in the *Series 90–70 System Manual* (GFK–1192).
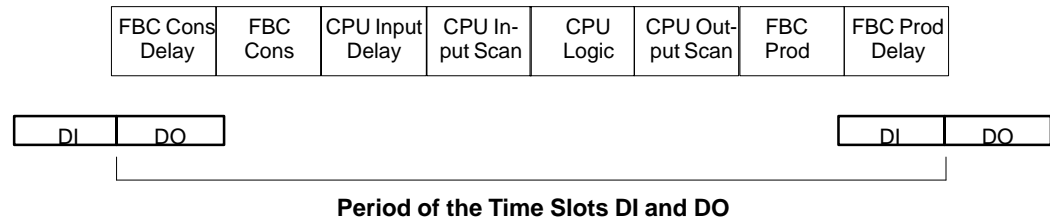
Synchronous I/O Scanning

If it is necessary to periodically process a coherent set of input data, synchronous I/O scanning is required. It is possible to define up to 15 synchronous scan sets for the FIP Bus Controller.

In Synchronous I/O Scanning mode, the PLC CPU executes a synchronous application program after the FIP Bus Controller has completed the consumption of all of the input data and validators in the synchronizing scan set. The FIP Bus Controller triggers the PLC CPU and the CPU schedules the specified application program.

The PLC CPU scans the scan set inputs into the PLC reference tables, and the program starts. At the end of the logic the PLC CPU performs the output scan, if one is configured. For proper operation, the program should complete the logic and perform the output scan before the FIP Bus Controller is scheduled to produce the outputs to the network.

For more detailed information about timing, please refer to the Important Product Information document, GFK-1200.

The illustration below represents the timing characteristics of a typical synchronous application. In this example, a single synchronous scan set is configured to contain the time slots DI and DO.

FBC Cons Delay	FBC Cons	CPU Input Delay	CPU In-put Scan	CPU Logic	CPU Out-put Scan	FBC Prod	FBC Prod Delay

| DI | DO | | | | | DI | DO |

Period of the Time Slots DI and DO

DI	**Discrete Input Transport Time Slot:** The defined transport time slot containing the input data for the synchronous scan set. To allow the maximum time for the PLC application program, the input time slot is configured at a phase earlier than but adjacent to the output time slot.
DO	**Discrete Output Transport Time Slot:** The defined transport time slot containing the output data for the synchronous scan set. To allow the maximum time for the PLC application program, the output time slot is configured at a phase later than but adjacent to the input time slot.
FBC Cons Delay	**FBC Consumption Delay:** A fixed delay in the FBC before scheduling the consumption of the input TVAs. This time is fixed at 1ms.
FBC Cons	**FBC Consumption of TVAs in DI time slot:** The time necessary to read the COMVs from the network and transfer the individual TVAs to the dual–port memory. The length of time depends on the number and length of the COMVs and TVAs.
FBC Prod	**FBC Production of TVAs in DO time slot:** The time necessary to transfer the individual TVAs from the dual–port memory and write the COMVs to the network. The length of time depends on the number and length of the COMVs and TVAs.
FBC Prod Delay	**FBC Production Delay**: A fixed delay in the FBC before scheduling the production of the output TVAs and COMVs. This time is fixed at 3ms.
CPU Input Delay	**CPU Input Scan Delay:** The delay in the CPU before the application program can be scheduled and the input scan operation begun. Depends on the needs and priorities of other non–preemptive operations in the PLC CPU, such as another I/O scan and the communications window time.

CPU Input Scan	**CPU Input Scan of TVAs:** The time necessary for the CPU to transfer the input data from the dual–port memory of the FBC to the PLC reference tables. The length of time depends on the amount of I/O data to be scanned.
CPU Logic	**CPU Logic Execution of Application Program:** The time necessary to execute the user application program. This time depends on the amount of logic and the needs and priorities of other non–preemptive operations in the PLC CPU, such as another I/O scan and the communications window time.
CPU Output Scan	**CPU Output Scan of TVAs:** The time necessary for the CPU to transfer the output data from the PLC reference tables to the dual–port memory of the FBC. The length of time depends on the amount of I/O data to be scanned.

Configuring Synchronous I/O Scanning

To set up Synchronous I/O Scanning:

1. In the Network Configuration tool specify the Network Access method for the FIP Bus Controller as Synchronous (/time slot).

2. Configure the CPU sweep mode as MICROCYCLE mode.

3. Configure a period for the microcycle. A typical value for the microcycle period is equal to the period of the fastest synchronous scan set in the PLC.

4. Define a synchronous scan set using the Hardware Configuration tool, from the PLC CPU Scan Set tab.

    –   Identify the physical location (rack/slot) of the FIP Bus Controller as the Sync Source.

5. From the Scanning tab for the FIP Bus Controller, attach the desired time slot(s) to the Synchronous Scan Set.

    The periods of the time slots must be identical when associating to the same synchronous scan set. In addition, it is possible to attach time slots from other FIP Bus Controllers to the same synchronous time slot. But only one FBC can be configured as the Sync Source. It is also possible to attach local PLC I/O data to a synchronous scan set.

    If you want to synchronize both the inputs and the outputs, assign the default time slots DI and DO to one sync scan set and the time slots AI and AO to another sync scan set.

    If you want to synchronize to inputs only, assign DI to a sync scan set and AI to another sync scan set. The DO and AO time slots would be scanned asynchronously.

6. For each synchronous scan set, specify an application program that is scheduled when the FIP Bus Controller triggers the PLC CPU upon reception of the scan set inputs. This is done using the Task Definitions tab in the Software Configuration utility.

Specifications

Maximum FBCs per PLC	4
Maximum subscribers per PLC	291
Maximum subscribers per FBC	255
Maximum I/O per FBC	16K bytes (data+validators)
Maximum size of FBC Configuration file	64K bytes
Maximum COMVs per FBC	500 (including STATIO and System COMVs)
Maximum number of scan sets per FBC	32
Maximum synchronous scan sets per FBC	15

Chapter	*Fault Reporting and Diagnostics*
5	

This chapter describes mechanisms for checking the status of the system:

- System Fault Contacts. Use these predefined contacts in the program to check for specific faults such as System Configuration Mismatch, Loss of Rack, or Bus faults.

- Fault/NoFault Point Contacts. Use these contacts to monitor individual discrete and analog points for their fault or lack of fault status.

- Fault/NoFault Subscriber Contacts. Use these contacts to monitor the status of devices on the FIP network.

- Alarm Contacts: Use these contacts to monitor whether analog references have reached their upper or lower alarm limits.

- Fault Table: the PLC's fault tables provide a broader view of system operations and help indicate causal relationships among multiple faults and alarms.

- Bus Controller and Channel Status Bits: Use these 80 status bits to monitor the operation of the Bus Controller and two busses and to monitor the status of up to 32 TCP/IP communications channels.

Additional Diagnostics

This chapter describes normal logging of network faults by the FIP Bus Controller. Chapter 8 explains how network fault information can also be stored in a selected area of PLC memory, and how logging certain network faults into the PLC fault table can be disabled.

System Fault Contacts

System fault contacts have pre-defined nicknames and locations in %S memory. They can be included in an application program to check for fault-related conditions. The following system fault contacts are of special interest for a system with a FIP Bus Controller:

Reference	Nickname	Conditions Indicated When Set
%SA0009	CFG_MM	System Configuration Mismatch
%SA0012	LOS_RCK	Loss of Rack
%SA0013	LOS_IOC	Loss of Bus Controller
%SA0014	LOS_IOM	Loss of I/O module
%SA0017	ADD_RCK	Addition of Rack
%SA0018	ADD_IOC	Addition of Bus Controller
%SA0019	ADD_IOM	Addition of I/O module
%SA0022	IOC_FLT	Bus fault or Bus Controller fault
%SA0023	IOM_FLT	I/O module fault
%SA0029	SFT_IOC	Bus Controller software failure
%SB0016	MAX_IOC	Too many Bus Controllers (maximum is 31)
%SC0011	IO_FLT	I/O fault occurred
%SC0013	IO_PRES	Fault logged into I/O Fault Table
%S00010	IO_FULL	I/O Fault Table is full

These references and their Nicknames can be used like any other type of reference.

Example:

A PLC system includes one Bus Controller. During CPU configuration, the system status fault **LOS_IOC** has been designated a diagnostic (rather than fatal) fault. **LOS_IOC** represents loss of the Bus Controller; if this occurs, the Loss of IOC fault will be placed in the I/O Fault Table. In this example, the application program also monitors the **LOS_IOC** reference. If this reference is set, the contact passes power flow to an output coil, which energizes a warning light on an operator panel.

```
    LOS_IOC                                                         %Q00023
-----| |----------------------------------------------------------------()-
```
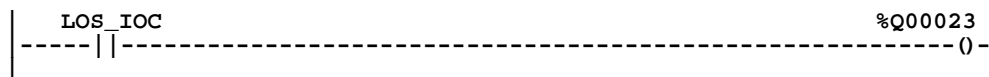
Fault/No Fault Point Contacts

Fault and No Fault contacts can be used to detect fault or lack of fault conditions on a discrete (%I) or analog (%AI) reference.

A Fault contact [FAULT] will detect a fault in a discrete or analog input or output, or a hardware component of the system. The contact passes power flow if the reference has a fault.

Example:

```
    %AI0034                                                    %M00053
---[FAULT]----------------------------------------------------( )-
```
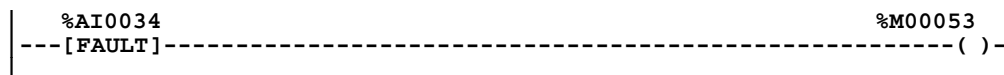
When used with a %I or %AI reference, a fault associated with the -**[FAULT]**- contact must be cleared to remove it from the fault table and stop the contact passing power flow.

No Fault Contacts [NOFLT] will also detect faults in discrete or analog inputs. A No Fault Contact passes power flow if its associated reference does not have a circuit fault.

Example:

```
    %I00167                                                    %Q00168
---[NOFLT]----------------------------------------------------()-
```
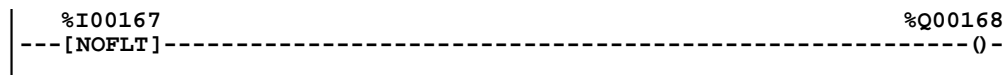
Fault and No Fault contacts are driven by consumption of validator information from the input module. If the validator information cannot be consumed, for example, if a remote device loses power or network connection, or data is unrefreshed or unprompt, the Fault contacts will be set by the FIP Bus Controller. If no validator information is configured for consumption, the Fault contact will never be set.

Fault/No Fault Subscriber Contacts

Subscriber contacts can be used to monitor devices on the FIP network for their fault or no fault status by programming them with FIP fault-locating references as shown below.

The FIP Bus Controller initially sets all Subscriber Fault contacts to [FAULT]. Only after the subscriber status (STAT_IO and/or Network Presence List) is retrieved from the network can the Subscriber Fault Contacts reflect the actual state of the subscribers. The length of time before this occurs varies with each configuration but is normally in the range of 30–60 seconds after the CPU enters RUN mode.

These Subscriber Fault Contacts summarize subscriber faults reported in the I/O Fault Table in the PLC. If an I/O Fault is logged in the I/O Fault Table and it is still pending, the Subscriber Fault Contact is set. The Subscriber Fault Contact is cleared only when there are no subscriber faults. I/O Faults are logged as a result of errors reported in either the Subscriber's STAT_IO or the Network Presence List. The Subscriber Fault Contact of the FIP Bus Controller itself is set when any of the Subscriber Fault Contacts for its remote subscribers are set.

A fault [FAULT] contact will detect any fault in a remote subscriber. For remote I/O devices, a fault is any network fault (redundant bus failure or loss of device) or any fault in an individual I/O module. For generic devices, a fault is any network fault (redundant bus failure or loss of device). The contact passes power flow if the reference has a fault.

Example:

```
    F_02128                                                      %M00025
---[FAULT]----------------------------------------------------( )-
```

A no fault [NOFLT] contact is used to detect the absence of faults in a remote subscriber. The contact passes power flow if the reference does not have a fault.

Example:

```
    F_02128                                                      %Q00026
---[NOFLT]----------------------------------------------------()-
```

Fault Locating References

The format of the fault-locating references used with Subscriber Fault Contacts is **F_rsmmm**. The first two digits alway indicate the rack and slot address of the FIP Bus Controller:

> **r** is the rack number of the FIP Bus Controller, which must be 0
> **s** is the slot number of the FIP Bus Controller

For all modules and for the Bus Controller itself, the following 1 to 3 digits (leading zeros are not used) show the Subscriber ID of the affected FIP device (000 to 255).

For example, **F_0328** represents rack 0, slot 3, subscriber 128.

Alarm Contacts

Alarm Contacts indicate when an analog reference has reached one of its alarm limits. Both the high and low alarm limits are detected and reported separately. The High Alarm Contact [HIALR] indicates when the configured high alarm setting has been reached or exceeded. The Low Alarm Contact [LOALR] indicates when the configured low alarm setting has been reached or exceeded. Alarm Contacts are generated by the remote I/O device and are reported to the FIP Bus Controller in the validator associated with the Analog data. Alarms are not considered fault conditions and are not reported in the I/O Fault Table. Alarms also do not affect the Subscriber or Point Fault Contacts.

Example

The analog input assigned to reference %AI00015 has been configured to have the following Alarm Limits:

150ft/sec	High Alarm
25 ft/sec	Low Alarm

If the input exceeds a rate of 150 feet per second, a High Alarm contact energizes internal coil %M00002.

```
  %AI0015                                                         %M00002
---[HIALR]-------------------------------------------------------()-
```
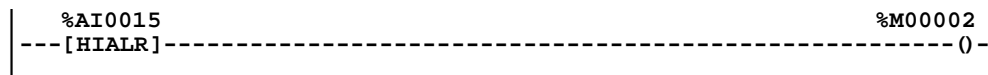
Example

If the same analog input slows to a rate of 22 feet per second, its Low Alarm contact energizes internal coil %M00003.

```
  %AI0015                                                         %M00003
---[LOALR]-------------------------------------------------------()-
```
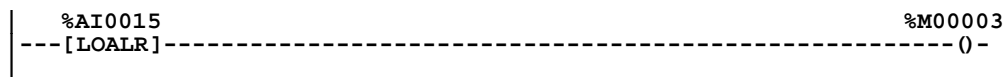
Fault Tables

While the types of program contacts described on the previous pages can be used as needed to capture the fault or alarm status of selected points, modules, or elements in the system, the PLC's fault tables are an automatically-generated log of faults of all types as they occur. This grouping together of fault information provides a broader view of system operations and helps indicate causal relationships among multiple faults and alarms.

Number of Faults in the I/O Fault Table

The I/O Fault Table can contain up to 32 faults. Additional faults cause the table to overflow, and faults are lost. The system reference **IO_FULL** (%S00010) is set to indicate that the fault table is full.

As faults occur, the first 16 are logged into the table and remain there until the table is cleared again; none of these 16 faults will be dropped if the table overflows. For faults 17 through 32, the Fault Table operates as a First-In-First-Out stack. When fault 33 occurs, fault 17 is dropped from the table. Clearing the Fault Table removes all the fault listings.

```
┌─────────────────────────┐
│        Fault 1          │
│          .              │
│          .              │
│        Fault 16         │
├─────────────────────────┤
│        Fault 17          │     ▶  Faults overflow here
│          ▲               │
│          ▲               │
│        Fault 33          │     ◀  New faults are added here
└─────────────────────────┘
```
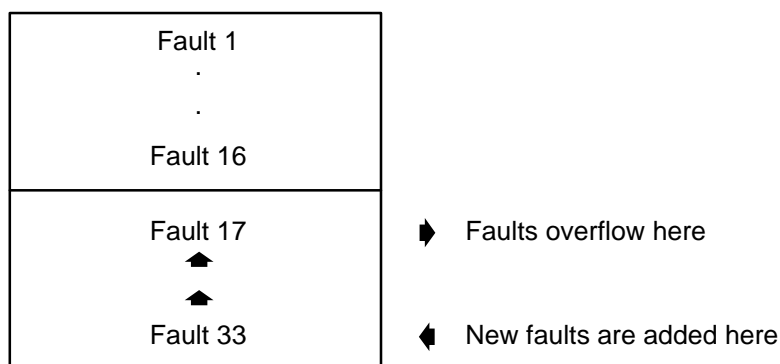
Clearing Faults

Faults must be cleared from the I/O Fault Table to be cleared in the PLC CPU and for the associated fault contacts to be cleared.

Faults can be cleared from the Fault Table either from the programmer screen or by the application program.

Clearing the fault table removes the faults it contains; it does not clear fault conditions in the system. If the condition that caused a fault still exists and is detected, the fault will normally be reported again. However, if the fault has been configured as a Fatal fault (one that stops the PLC), the fault will not be reported again after clearing. This allows the PLC to go to Run mode.

Loss of Device Faults Caused by High Bus Error Rate

If the bus is experiencing a high error rate (possibly due to electrical interference or damaged cable), Loss of Device faults may be logged into the Fault Table. Loss of Device faults that are logged in conjunction with I/O Bus Faults can usually be attributed to the poor quality of the bus installation. The condition causing the bus errors should be corrected as soon as possible.

Faults Generated by the FIP Bus Controller

For a FIP bus fault, the display shows the date and time the fault occurred, and the following information:

Fault Location: The location of an I/O fault always includes the rack and slot of the FIP Bus Controller and optionally includes the remote subscriber address. The fault location may also include the remote rack and slot of the faulted I/O module within a remote I/O device.

Circ No: Not used.

Ref. Addr: Not used.

Fault Category: The general type of fault that has occurred. For diagnostic faults, the CPU sets fault references. For fatal faults, the CPU sets fault references and places itself in STOP mode.

Fault Type: Further explains fault categories: Circuit Fault, Module Fault, I/O Bus Fault, Loss of Block, and IOC Software Exception.

Fault Description: Provides additional information about Circuit and Module Faults.

Category	Fault type	Description
FIP Bus Controller Faults: Fault location = rack.slot		
Loss of IOC		The FBC itself has been lost. The Additional Fault Data field contains the specific reason for the fault.
I/O Bus Fault	Local Loss Bus 1	The FBC has lost Bus 1 of a redundant FIP Network.
I/O Bus Fault	Local Loss Bus 2	The FBC has lost Bus 2 of a redundant FIP Network.
I/O Bus Fault	Loss All Comm	The FBC has lost all communication with the FIP Network.
I/O Bus Fault	Resync To Network	The FBC has detected a resynchronization of the FIP macrocycle. This fault only occurs when the FBC is configured for synchronous operation.
Remote Device Faults: Fault location = rack.slot.subscriber ID		
Loss of Device	Device Not Run	Remote device is lost on the FIP Network.
Loss of Device	Checksum Mismatch	The configuration checksum in the remote device does not match the configuration checksum required by the Master Subscriber. The remote device is not permitted to enter RUN mode.
Add'n of Device		Remote device that was previously reported as lost, has been added to the FIP Network.
Config Mismatch	Mdl Num Mismatch	The remote device does not match the device type required by the Master Subscriber. The device is not permitted to enter RUN mode.
Loss of I/O Module	Module Fault	The remote device is present but reports a module fault. The fault description field specifies a STORE_FAIL or HEADEND_FAULT.
I/O Bus Fault	Remote Loss Bus 1	Remote device has lost Bus 1 of a redundant FIP Network.
I/O Bus Fault	Remote Loss Bus 2	Remote device has lost Bus 2 of a redundant FIP Network.
Remote I/O Module Faults: Fault location = rack.slot.subscriber ID.remote rack.remote slot		
Add'n of I/O Module		An extra I/O module is present in the remote device.
Loss of I/O Module		The I/O module is not present in the remote device.
Loss of I/O Module	Circuit Fault	The I/O module in the remote device is present but reports a circuit fault. The fault description field specifies a USER_FAULT or FFAULT (fatal fault).
Config Mismatch	Mdl Num Mismatch	The I/O module does not match the configuration of the remote device.

Faults Generated by the CPU

The following CPU-reported faults are related to the operation of the FIP Bus Controller. The location is always that of the PLC CPU.

Location	Description
0.1	Program Not Readied: "program name". This fault occurs if a sync program is still running when the next synchronizing event for that program occurs. The program has taken too long to complete.
0.1	Constant Sweep Time Exceeded. The CPU cannot complete the main logic program before the configured Microcycle period expires. The infrequent occurrence of this fault is considered normal and can be ignored. Nearly continuous occurrence of this fault indicates too much logic and/or too short a Microcycle period.

Bus Controller and Channel Status Bits

Each scan, the FIP Bus Controller automatically provides 80 bits of status data to the PLC CPU. The starting location of the Bus Controller Status bits is the "Status Address" selected during hardware configuration of the Bus Controller.

Bus Controller Status Bits

Bits 1–16 consist of status information about the Bus Controller itself (bits 11–15 are not used). Note that if bit 16 (Bus Controller OK) is 0, the other bits are not valid.

Bus Controller Status Bits	Function	Description
1-3	Reserved	
4	Bus Arbiter Active	Set to 1 when this FIP Bus Controller is actively arbitrating the FIP Network (that is, its Bus Arbiter is active). Otherwise it is set to 0. At any one time on the network, no more than one FIP Bus Controller should have this bit set to 1.
5	Reserved	
6	Redundant Status	In a configuration where this FIP Bus Controller is in a Redundant PLC, this bit is set to 1 when this FIP Bus Controller is in the Active State. This bit is set to 0 when this FIP Bus Controller is in the Backup state. In a Simplex PLC, this bit is always set to 1.
7	FIP Network Present	Set to 1 when the FIP Bus Controller is able to communicate on at least one of its FIP busses. Otherwise, this bit is set to 0.
8	Bus 1 Failure	Set to 1 when this FIP Bus Controller is not able to communicate on its FIP bus 1. Otherwise, this bit is set to 0.
9	Any Channel Error (error on any channel)	Set to 1 if there is presently an error on any of the established channels; i.e., if the individual Channel Error bit is set for any channel.
10	Bus 2 Failure	Set to 1 when this FIP Bus Controller is not able to communicate on its FIP bus 2. Otherwise, this bit is set to 0.
11–15	Reserved	
16	FIP Bus Controller OK	Set to 1 by the FIP Bus Controller each PLC scan. If the FIP Bus Controller cannot access the PLC, the CPU will set this bit to 0. *When this bit is 0, all other FIP Bus Controller Status bits are invalid.*

Channel Status Bits

Bits 17–80 contain status information about communications channels that may be established using the Establish Read/Write Channel Commands. There is an *error* bit and a *data transfer* bit for each of the 32 channels that can be established.

For more information, see the bit descriptions that follow.

Channel Status Bits	Description
17	Data Transfer - Channel 1
18	Channel Error - Channel 1
...	...
79	Data Transfer - Channel 32
80	Channel Error - Channel 32

(Status Bits 17, 19, 21 ... 79) Data Transfer Bit: This bit is normally set to 0. It is pulsed to 1 and back to 0 on successive PLC scans each time a transfer completes successfully. *Do not assume that when the Data Transfer bit goes to 1 that a transfer has just completed during the last scan.* The Data Transfer bit is not closely synchronized in time with the transfer. The bit only indicates that a transfer has occurred during the preceding read (or write) period. A rising edge on the Data Transfer bit indicating that a transfer has completed successfully does not guarantee that the next transfer has not begun or completed. In the case of an Establish Channel command, the COMREQ Status Word is always up dated *before* the Data Transfer bit is set to 1.

(Status Bits 18, 20, 22 ... 80) Channel Error Bit: This bit is set to 1 when an error is de tected on this channel. It is set to 0 when the channel is initially established and if the channel resumes normal operation after a transient error condition subsides. The Chan nel Error bit is also set to 0 when the channel is aborted by an Abort Channel command or when the PLC CPU transitions from RUN to STOP. In the case of an Establish Chan nel command, the COMREQ Status Word is always updated *before* the Channel Error bit is set to 1.

The program can monitor this bit and reinitiate the Read or Write Channel command if the bit indicates an error. Or the program may execute the Retrieve Detailed Channel Status Command (see chapter 8 for more information) to find out if the channel is idle and obtain the latest status codes for that channel.

Programming Communications Requests

This chapter describes how to program communications requests (COMREQs) to a FIP Bus Controller.

COMREQs are program functions of the Series 90-70 PLC that can be used to send instructions from the CPU to an intelligent module such as the FIP Bus Controller. COMREQs for the FIP Bus Controller include:

Function	COMREQ Number		Description of COMREQ
	Decimal	Hex	
Abort Channel	02001	07D1	Used to disconnect an active TCP/IP communications channel.
Retrieve Detailed Channel Status	02002	07D2	Used to retrieve information about all active/inactive channels and error codes.
Establish Read Channel	02003	07D3	Used to establish a TCPIP channel to read data from another PLC on the network.
Establish Write Channel	02004	07D4	Used to establish a TCPIP channel to write data to another PLC on the network.
Send Information Report	02010	07DA	Used to send data periodically from the PLC to a host application on the network.
Start Message Delivery Request for State Changes	05000	1388	Used to enable reception of State Change messages from the State Change LSAP.
Start Message Request	05001	1389	Used to enable reception of all FIP messages on the specified LSAP.
Send Message Request	05002	138A	Used to send a message on the FIP network.
Stop Message Delivery Request	05003	138B	Used to disable reception of messages being logged into a specific message buffer.
Stop All Message Delivery Request	05004	138C	Used to disable reception of all currently-open FIP Message buffers.
Start Network Diagnostic	05100	13EC	Used to start logging network device presence and bus faults from devices on the FIP network.
Stop Network Diagnostic	05101	13ED	Used to disable the Network Diagnostic feature after it has been enabled by the Start Network Diagnostic COMREQ.

Structure of the Communications Request

The Communications Request is made up of the following elements.

■ The logic program controlling execution of the COMREQ Function Block

■ The COMREQ Function Block. This ladder instruction triggers the FIP command. The Command Block pointer points to the location in memory you are using for the Command Block.

■ The COMREQ Command Block. This structure contains information about the FIP command to be executed.

■ COMREQ Status Word. The FIP interface updates the COMREQ Status Word to show success or failure of the command. This and other available status data (FIP Interface Status and Channel Status bits) can be used to troubleshoot the program and for diagnostics during system operation.

```
CONTROL          COMREQ
  LOGIC      FUNCTION BLOCK

INITIATES    ┌──────────────────┐
 COMREQ      │  INPUTS          │
FUNCTION     │   AND            │         COMREQ
 BLOCK       │  OUTPUTS         │     COMMAND BLOCK          COMREQ
             │ FOR COMREQ       │                         STATUS WORD
             │  FUNCTION        │    ┌─────────────┐
             │                  │    │  COMREQ     │    ┌──────────┐
             │ COMMAND          │    │  STATUS     │    │  STATUS  │
             │  BLOCK           │───▶│  WORD       │───▶│  CODES   │
             │  POINTER         │    │  POINTER    │    └──────────┘
             └──────────────────┘    │             │
                                     │  DETAILS    │       STATUS BITS
                                     │  OF THE     │  ┌──────────────────┐
                                     │ FIP COMMAND │  │ FIP BUS CONTROLLER│
                                     └─────────────┘  │ STATUS AND CHANNEL│
                                                      │   STATUS BITS    │
                                                      └──────────────────┘

                         Location in PLC memory specified when
                            configuring the FIP Bus Controller
```
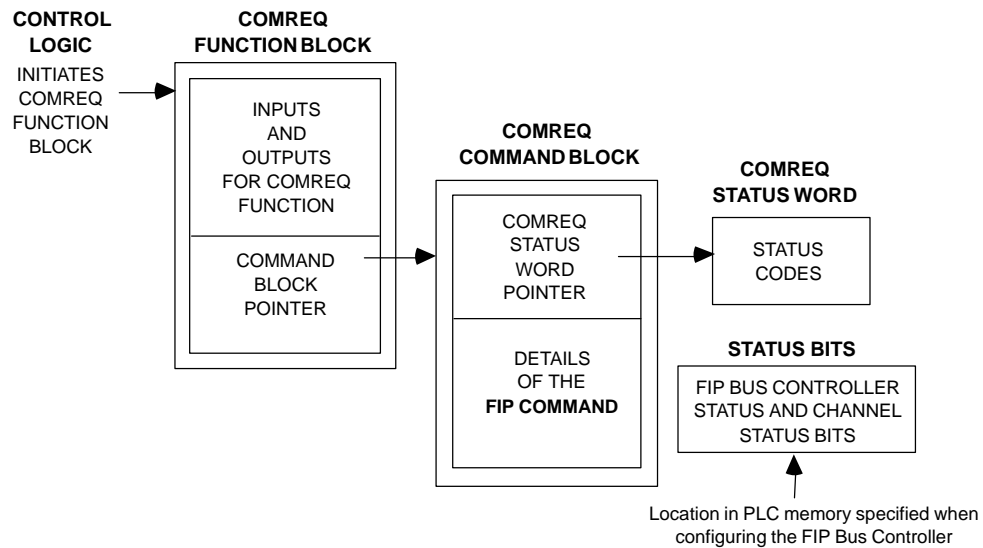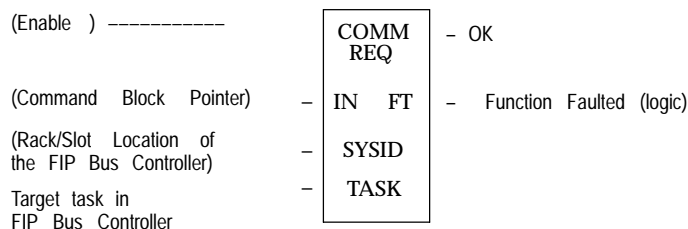
The COMREQ Function Block

The COMREQ Function Block is the ladder instruction that triggers the execution of the FIP command. In the COMREQ Function Block, you specify the rack and slot location of the FIP Bus Controller and a pointer to a location in memory that contains the Command Block. There is also a fault output on the COMREQ Function Block that indicates certain programming errors.

The Communications Request is triggered when the logic program passes power to the COMREQ Function Block. The COMREQ is sent to the FIP Bus Controller _immediately_ upon execution of the function block. It does not occur during the communications window.

The COMREQ Function Block has four inputs and two outputs:

```
(Enable  ) –––––––––––        ┌─────────┐  – OK
                              │  COMM   │
                              │  REQ    │
                              │         │
(Command   Block   Pointer)  –│ IN   FT │  –    Function  Faulted  (logic)
(Rack/Slot  Location  of     –│ SYSID   │
the  FIP  Bus  Controller)    │         │
Target  task  in             –│ TASK    │
FIP  Bus  Controller          └─────────┘
```

Enable: Control logic for activating the COMREQ Function Block.

IN: The location of the Command Block. It may be any valid address within a word-oriented area of memory (%R, %AI, %AQ, %P, or %L).

SYSID: A hexadecimal value that gives the rack (high byte) and slot (low byte) location of the FIP Bus Controller. For example:

Rack	Slot	Hex Word Value
0	4	0004h

(The FIP Bus Controller must be located in the main PLC rack (rack number 0)).

TASK: Must be: 0 for Channel Command COMREQs (command numbers 020xx)
 2 for Network Diagnostics COMREQs (command numbers 051xx)
 13 (0Dh) for Generic Message COMREQs (command numbers 050xx)

OK Output: The OK output is set if the PLC CPU was successful in transferring the COMREQ data to the FIP Bus Controller. This does not indicate that the FIP Bus Controller has processed the COMREQ, only that it has been received. Barring programming errors, the OK and FT outputs should not both be set in the same scan by the same COMREQ.

FT Output: The FT output is set if the PLC (rather than the FIP Bus Controller) detects that the COMREQ fails. It may indicate a programming error in the COMREQ Function Block itself, or it may indicate that the rack and slot specified in the COMREQ Task parameter is not configured by Control 90 to contain a FIP Bus Controller, or that the data block length specified in the Command Block is out of range. This output also may indicate that no more COMREQ functions can be initiated in the ladder program until the FIP Bus Controller has time to process some of the pending COMREQ functions. In this case, the other status indicators are not updated for this COMREQ.

If the FT Output is set, the CPU does not transfer the Command Block to the FIP Bus Controller. In this case, the other status indicators are not updated for this COMREQ.

The COMREQ Command Block

The COMREQ Command Block contains information about the specific command to be executed. When the COMREQ function is initiated, the Command Block is sent from the PLC CPU to the FIP Bus Controller. The Command Block is set up using an appropriate programming instruction (the BLOCK MOVE Function Block is recommended). The Command Block has the following structure:

Word 1	Data Block Length (words)
Word 2	WAIT/NOWAIT Flag = 0
Word 3	COMREQ Status Word Pointer Memory Type
Word 4	COMREQ Status Word Pointer Offset
Word 5	Reserved
Word 6	Reserved
Words 7 up to 128 (decimal)	Data Block (FIP command details)

(Word 1) Data Block Length: This is the length in words of the Data Block portion of the Command Block (up to 122 words-decimal). The Data Block portion starts at Word 7 of the Command Block. <u>The length is measured from the beginning of the Data Block at Word 7</u>, not from the beginning of the Command Block.

(Word 2) WAIT/NOWAIT Flag: This flag must be set to zero for all FIP communications.

(Word 3) COMREQ Status Word Pointer Memory Type: This word specifies the memory type for the COMREQ Status Word. For Network Diagnostic and Generic Message COMREQs, the memory type may be %R, %AI, or %AQ. For Channel Command COMREQS (command numbers 010xx), the valid memory types are:

Type	Value (Decimal)	Value (Hex.)	Description
%R	8	08h	Register memory (word mode)
%AI	10	0Ah	Analog input memory (word mode)
%AQ	12	0Ch	Analog output memory (word mode)
%I	16	10h	Discrete input memory (byte mode)
	70	46h	Discrete input memory (bit mode)
%Q	18	12h	Discrete output memory (byte mode)
	72	48h	Discrete output memory (bit mode)
%T	20	14h	Discrete temporary memory (byte mode)
	74	4Ah	Discrete temporary memory (bit mode)
%M	22	16h	Discrete momentary internal memory (byte mode)
	76	4Ch	Discrete momentary internal memory (bit mode)
%G	56	38h	Discrete global data table (byte mode)
	86	56h	Discrete global data table (bit mode)

(Word 4) COMREQ Status Word Pointer Offset: This is the offset within the memory type selected. ***The status word pointer offset is a zero-based number.*** For example, if %R1 is the location of the COMREQ Status Word, the offset is zero. The offset for %R100 is 99. This word is the only zero-based field in the FIP commands.

(Words 5 and 6): Reserved. Set to zero.

(Words 7 - 128) Data Block: The Data Block defines the FIP command to be performed.
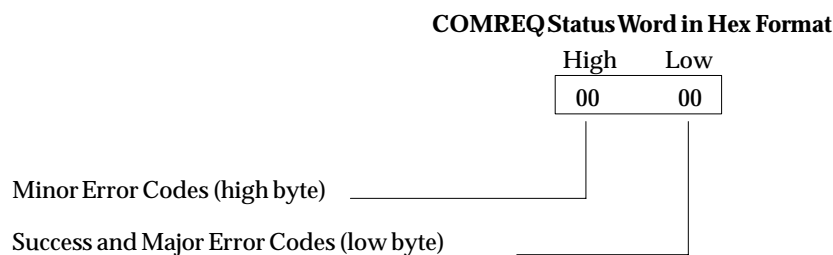
The COMREQ Status Word

The COMREQ Status word can be monitored to determine the *cause* of a communications error after the COMREQ function is initiated.   The location of the COMREQ status word is defined in the Command Block for the COMREQ function.

After executing a COMREQ if the COMREQ Status Word is not one (1) indicating success, it means that there were:

- Errors in the Command Block or

- For an Establish Read or Write FIP command, the command parameters were valid but there was an error in establishing a channel.

If the COMREQ Status Word does not contain a 1 indicating success, then it contains either a 0 or a code (see below) indicating what error occurred.

The COMREQ Status word is not updated in the CPU each scan. The Bus Controller returns the COMREQ Status word to the CPU immediately if the Command Block contains a syntax error or if the command is local (for example, the Abort Channel and Retrieve Detailed Channel Status commands).   Communication occurs between the PLC CPU and the FIP Bus Controller only. For these commands, the COMREQ Status word is sent immediately to the CPU. For remote commands with no syntax error, it is returned either after the channel is established successfully and the first transfer has completed or if there is an error establishing the channel.

COMREQ Status Word in Hex Format

High	Low
00	00

Minor Error Codes (high byte)

Success and Major Error Codes (low byte)

Interpreting the COMREQ Status Word

There are several points to remember when interpreting the contents of the COMREQ Status word:

1. *Display the Status Words in hexadecimal form* to more easily differentiate the high and low bytes.   A good way to do this is to use a MOVE WORD function block to display the hexadecimal value within the ladder program.

2. The FIP Bus Controller will never send a zero for the COMREQ Status Word to the PLC CPU. The program should zero the COMREQ Status word *before* issuing the COMREQ function and then check for a non-zero value indicating that the FIP Bus Controller is responding to the COMREQ. A good way to do this is to use a MOVE WORD function block to zero the COMREQ Status Word.

3. A status code of 1 in the low byte and 0 in the high byte indicates that the request was successful. All other non-zero values indicate errors. Refer to the tables in Appendix B for a complete listing of major and minor error codes.

Elements of the Ladder Program

Care must be taken in developing the logic that controls the execution of the COMREQ function. Every ladder program, whether in the developmental phase or the operational phase, should do the following before initiating a COMREQ function. In the following example, Nicknames are used to make the program easier to follow.

```
| << RUNG 1 >>
|
|FIPIFOK                                                                      HEALTHY
+——][————————————————————————————————————————————————————————————————————————————()——
|
| << RUNG 2 >>
|
|BEGREAD                                                                      READREQ
+——[]—————————————————————————————————————————————————————————————————————————(↑)——
|
| << RUNG 3 >>
|
|HEALTHY READREQ +——————+                                                     CMRQFLT
+——][————][——+MOVE_+—————————————————————————————————————————————————————————————(R)——
|           | WORD |
|           |      |
|     CONST —+IN  Q+—%R00010
|     +0000 | LEN  |
|           |00001 |
|           +——————+
| << RUNG 4 >>
|HEALTHY READREQ +——————+               +——————+                +——————+
+——][————][——+BLKMV+——————————————————+BLKMV+——————————————————+BLKMV+
|           | INT  |               | INT  |                | WORD |
|           |      |               |      |                |      |
|     CONST —+IN1 Q+—%R00301   CONST —+IN1 Q+—%R00308   CONST —+IN1 Q+—%R00315
|     +00017 |      |         +00005 |      |          +00008 |      |
|           |      |               |      |                |      |
|     CONST —+IN2  |         CONST —+IN2  |          CONST —+IN2  |
|     +00000 |      |         +00010 |      |          +00050 |      |
|           |      |               |      |                |      |
|     CONST —+IN3  |         CONST —+IN3  |          CONST —+IN3  |
|     +00008 |      |         +00003 |      |          +00008 |      |
|           |      |               |      |                |      |
|     CONST —+IN4  |         CONST —+IN4  |          CONST —+IN4  |
|     +00009 |      |         +00004 |      |          +00001 |      |
|           |      |               |      |                |      |
|     CONST —+IN5  |         CONST —+IN5  |          CONST —+IN5  |
|     +00000 |      |         +00050 |      |          +00004 |      |
|           |      |               |      |                |      |
|     CONST —+IN6  |         CONST —+IN6  |          CONST —+IN6  |
|     +00000 |      |         +00008 |      |          +00003 |      |
|           |      |               |      |                |      |
|     CONST —+IN7  |         CONST —+IN7  |          CONST —+IN7  |
|     +02003 +——————+        +00100 +——————+         +00000 +——————+
|
| << RUNG 5 >>
|
|HEALTHY READREQ +——————+
+——] [————] [——+BLKMV+—
|           | INT  |
|           |      |
|     CONST —+IN1 Q+—%R00322
|     +00000 |      |
|           |      |
|     CONST —+IN2  |
|     +00001 |      |
|           |      |
|     CONST —+IN3  |
|     +00000 |      |
|           |      |
|     CONST —+IN4  |
|     +00000 |      |
|           |      |
|     CONST —+IN5  |
|     +00000 |      |
|           |      |
|     CONST —+IN6  |
|     +00000 |      |
|           |      |
|     CONST —+IN7  |
|     +00000 +——————+
|
| << RUNG 6 >>
|
|HEALTHY READREQ +——————+
+——] [————] [——+COMM_+—
|           | REQ  |
|           |      |                                                          CMRQFLT
|   %R00301—+IN FT+————————————————————————————————————————————————————————————(S)
|           |      |
|     CONST |
|     0004—+SYSID |
|           |      |
|     CONST —+TASK |
|   00000000 +——————+
```

The example logic illustrates these important points:

1. Initiate the COMREQ function with a one-shot transitional coil or contact. This prevents sending the same COMREQ Command Block more than once.

2. Include at least the Bus Controller OK bit in the Bus Controller Status Word as an interlock contact for the COMREQ function. You may add more interlocks.

3. Zero the word location for the COMREQ Status (CRS) word, and OK and FT Outputs of the COMREQ Function Block before initiating the COMREQ.

4. Move the command code and parameters for the COMREQ into the memory location specified in IN input of the COMREQ Function Block before the COMREQ function is initiated.

In the example logic:

Rung # 1: Input FIPIFOK (bit 16 of the FIP Bus Controller Status bits) monitors the FIP Bus Controller. If it is OK to send a COMREQ, the HEALTHY coil is ON. HEALTHY is used as an interlock for Rungs 3-6.

Rung # 2: Input BEGREAD triggers READREQ, which enables execution of the MOVE and COMREQ functions. READREQ is a one-shot coil, activating once when BEGREAD transitions from OFF to ON.

Rung # 3: The MOVEWORD function moves a zero to the COMREQ Status Word referenced in the Command Block (see rung #4). This clears the status word. This rung also resets the FT output coil of the COMREQ Function Block in rung #6. It is vital that the status word be cleared and the COMREQ fault output coil be cleared each time before initiating a COMREQ function.

Rungs # 4-5: The BLKMVINT functions set up the COMREQ Command Block contents. When these rungs are activated, the constant operands are moved into memory beginning at the address indicated in the instruction.

Rung # 6: The COMREQ Function Block has three input and two output parameters.

- The IN field points to the starting location of the Command Block parameters (%R00301 in this example).

- The SYSID field defines the target rack and slot to receive the command data. The first two digits of SYSID (00 in this example) indicate the rack number, the last two digits (04 in this example) indicate the slot number.

- The TASK field indicates which mailbox task ID to use for the specified rack and slot. It can be 0 for Channel commands, 2 for Network Diagnostics, or 13 (0Dh) for Generic Messages.

- The FT output (CMRQFLT in this example) is turned on (set to 1) if there were problems preventing the delivery of the Command Block to the FIP Bus Controller. In this case, the other status indicators are not updated for this COMREQ.

- The OK output is not used in this example so that the sample code can equally apply to a Series 90-70 or a Series 90-30 PLC.

Chapter 7

Channel Commands

The Series 90-70 PLC can maintain up to 32 individual TCP/IP communications channels through which it can exchange data with other PLCs or controllers on the network.

This chapter explains how to use COMREQ instructions to:

- Allow the Series 90-70 PLC to read up to 2048 bytes of data from a specified range of memory in another PLC on the network.

- Allow the Series 90-70 PLC to write up to 2048 bytes of data into a specified range of memory in another PLC on the network.

- Allow the Series 90-70 PLC to write up to 2048 bytes of data to a host application on the network.

- Monitor communications channels using the Channel Status bits and the Detailed Channel Status words.

See Chapter 6 for more general instructions about programming Communications Requests to the FIP Bus Controller and monitoring COMREQ status.

Operation of Channel Commands

Communications channels utilize the concept of periodic data transfers. The local PLC uses a single COMREQ to establish a channel (connection) to another device (PLC or controller) and to request that specific data be periodically transferred between them. The COMREQ's Command Block specifies the frequency and direction of the transfer and the memory locations to be used in the transfer.

After a channel is established, the Bus Controller automatically manages the establishment of communications and the periodic data transfer.

The COMREQ specifies whether the channel will remain open for a specific number of transfers (including just one), or indefinitely. If a channel is set up for a specific number of transfer, the Bus Controller will close the channel automatically when that number of transfers has taken place. If a channel is set up to remain open indefinitely, it can later be closed or re-tasked.

Closing or Re-tasking a Channel

There are four ways a channel can be closed or re-tasked.

1. When the PLC CPU is stopped, all channels in use are aborted.

2. A channel is automatically closed if a fatal error occurs.

3. A channel (or all channels) can be closed by issuing an Abort Channel command.

4. A channel can be re-tasked by issuing another command for its channel number. This ends the previous channel operation and begins the new channel operation.

Guidelines for Issuing Channel Commands

Be sure the PLC does not send Command Blocks to the FIP Bus Controller faster than the Bus Controller can process them. If that happens, the Bus Controller will log an exception event 08, Entry 2=0024 and log the PLC Fault Table entry:

"Backplane Communications with PLC Fault; Lost Request"

For each channel, there should be only one COMREQ function pending at a time. A COMREQ function is pending from the time it is initiated in the program until its COMREQ Status Word has been updated to a non-zero value by the FIP Bus Controller.

The application program should avoid quickly using up all available TCP connections. The program should <u>not</u> do all the following.

■ Set the number of repetitions to 1 then issue a new COMREQ immediately upon completion of the prior one.

■ Direct each successive COMREQ to the same target device or to the same channel number.

To avoid using up all TCP connections, set the number of repetitions (COMREQ word 9) to 2 and set the read/write period (COMREQ words 10 and 11) to be very large, for example, 60 seconds. With these parameters the program will issue the first COMREQ, wait for the COMREQ Status (CRS) word to turn to 1, then issue the next COMREQ, wait for the COMREQ Status Word to turn to 1, and so forth.

Operation of a Channel Command

The figure and text below explain how a Communications Request is used to open a communications channel. The figure specifically illustrates the operation of an Establish Read Channel command.
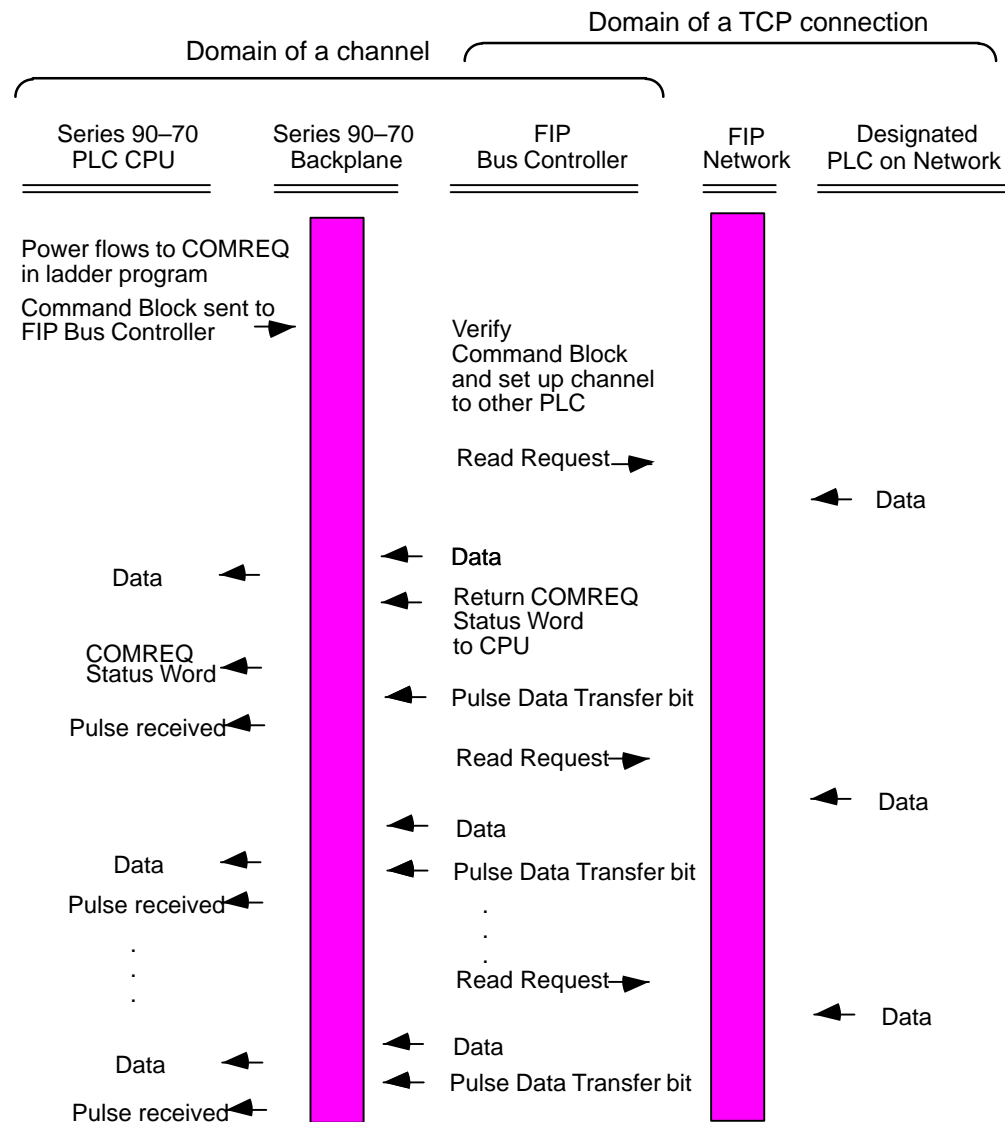
1. A Communications Request begins when there is power flow to a COMREQ function in the PLC. At this time, the Command Block data is sent from the PLC CPU to the FIP Bus Controller.

2. For the Establish Read Channel command, the COMREQ Status word is returned immediately if the Command Block is invalid. If the syntax is correct, the status word is returned after the next significant event: upon failure to establish a channel correctly and in a timely manner or upon the first successful transfer of data.

   Once the channel is successfully set up, the FIP Bus Controller performs the periodic reads as specified in the Command Block.

Monitoring a Communications Channel

You can use the status data provided to the application program to monitor your communications activity and take the desired action upon certain events. The primary indicators of a communications channel are the Channel Status bits: Channel Error bit and Data Transfer bit. In addition, the COMREQ Status Word and the Detailed Channel Status Words can be used to more precisely troubleshoot any problems that may occur.

Monitor the COMREQ Status Word for the Channel Command

It is critical to monitor the COMREQ Status Word for each COMREQ function. First, zero the associated COMREQ Status Word before executing the COMREQ function. When the COMREQ Status Word becomes non-zero, you know the Bus Controller has updated it. If the COMREQ Status Word is updated to a one (1), the Command Block was processed successfully by the Bus Controller. If the COMREQ Status Word is updated to a value other than 1, an error occurred in processing the Command Block. See chapter 7 for more information about the COMREQ Status Word.

Do not use data received from a channel until the COMREQ Status Word for that channel is 1 or the Data Transfer bit goes to 1.

Monitor Bit 9 of the Bus Controller Status Bits

Bit 9 of the status bits automatically returned by the Bus Controller Status is the Channel Error bit. This bit (normally 0) is the primary indicator for an error on a channel. It indicates any channel error, fatal or non-fatal. The program can monitor this bit and reinitiate the Read or Write Channel command if the bit indicates an error. Or the program may execute the Retrieve Detailed Channel Status Command to find out if the channel is idle and obtain the latest status codes for that channel. Keep in mind that the status code may change between the time the Channel Error bit indicates an error and the time the Retrieve Detailed Channel Status Command retrieves the error code.

The Channel Error bit for a channel is not meaningful until after the Bus Controller updates the COMREQ Status Word confirming the Read or Write command for that channel. In the case of an Establish channel command, the COMREQ Status Word is updated before the Channel Error bit is set to 1.

Monitor the Channel's Data Transfer Bit in the Status Bits

Typically you will set up a channel to perform repetitive reads or writes. The Bus Controller automatically returns a Data Transfer bit for each of 32 potential communications channels. This bit pulses $(0 \rightarrow 1 \rightarrow 0)$ each time there is a successful read or write. This can alert the program to move the most recent data to another location.

The Data Transfer bit is not meaningful until after the Bus Controller updates the COMREQ Status Word confirming the Read or Write command for that channel.

The Data Transfer bit is not closely synchronized in time with the transfer. The bit only indicates that a transfer has occurred in a past scan. A rising edge on the Data Transfer bit indicating that a transfer has completed successfully does not guarantee that the next transfer has not begun or completed. Do not use data received from a server until the COMREQ Status Word confirming the Read command for that channel is 1 or the Data Transfer bit goes to 1.

Channel Command Definitions

Establish a Read Channel to Another PLC

Use the Establish Read Channel Command to open a communications channel to a remote PLC and to read data from that PLC.

As shown in the example below, the Command Block specifies the period, the number of reads from the remote PLC to perform, and the timeout allowed in waiting for each transfer to complete. The first read is performed immediately, regardless of the period specified.

Example Establish Read Channel Command Block

This example command block establishes a channel (channel 5) to a remote PLC at IP address 3.0.0.1. It returns the COMREQ Status Word to %R10. Following successful execution of the command, the Bus Controller will read "remote" PLC registers %R50-%R57 into "local" PLC registers %R100-%R107. This communication will be repeated 10 times at 7 second intervals. The timeout period is 500 ms for each read.

	Dec	(Hex)	
Word 1	00017	(0011)	Length of Channel Command Data Block (17 - 25 words)
Word 2	00000	(0000)	Always 0 (no-wait mode request)
Word 3	00008	(0008)	Memory type of COMREQ Status Word (%R)
Word 4	00009	(0009)	COMREQ Status Word address minus 1 (%R10)*
Word 5	00000	(0000)	Reserved
Word 6	00000	(0000)	Reserved
Word 7	02003	(07d3)	Establish Read Channel Command number
Word 8	00005	(0005)	Channel number (5)
Word 9	00010	(000A)	Number of read repetitions (read 10 times)
Word 10	00003	(0003)	Time units for read period (3=seconds)
Word 11	00007	(0007)	Number of time units for read period (every 7 seconds)
Word 12	00050	(0032)	Timeout for each read (500 ms)
Word 13	00008	(0008)	Local PLC - memory type at which to store data (%R)
Word 14	00100	(0064)	Local PLC - starting address at which to store data (%R100)
Word 15	00008	(0008)	Remote PLC - memory type from which to read data (%R)
Word 16	00050	(0032)	Remote PLC - starting address from which to read data (%R50)
Word 17	00008	(0008)	Remote PLC - number of memory units (8 registers)
Word 18	00001	(0001)	Remote PLC - PLC (node) address type (IP Address)
Word 19	00004	(0004)	Remote PLC - PLC (node) address length in words (4)
Word 20	00003	(0003)	Remote PLC - Register 1 of IP address (3)
Word 21	00000	(0000)	Remote PLC - Register 2 of IP address (0)
Word 22	00000	(0000)	Remote PLC - Register 3 of IP address (0)
Word 23	00001	(0001)	Remote PLC - Register 4 of IP address (1)
Word 24 - 27			Remote PLC - Program Name (needed for access to remote %P or %L) (zero terminated and padded)
Word 28 - 31			Remote PLC - Program Block name (needed for access to remote %L) (zero terminated and padded)

* Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Channel Command Number: Word 7 (02003 decimal or 07D3 hex) requests that a read channel be set up.

(Word 8) Channel Number: Word 8 specifies the channel to be used for the read. This value must be in the range of 1 to 32. If the channel is out of range, a command error indication is placed in the COMREQ Status word. If the channel number is the same as a channel already in use, the channel is retasked to perform this new command.

(Word 9) Number of Read Repetitions: Word 9 specifies the number of reads to perform before automatically closing the channel. If this value is set to 1, only a single read is issued. If this value is set to 0, reads are issued on the requested period until the channel is aborted.

(Word 10) Time Units for Read Period: Words 10 is a number that specifies the time units for the read period:

1	hundredths of seconds
2	tenths of seconds
3	seconds
4	minutes
5	hours

(Word 11) Number of Time Units for Read Period: Word 11 specifies the number of time units for the read period. The read period is in effect even when the channel command is set up to issue a single read.

> **Example Read Period:** If Word 10 contains a value of 3 specifying seconds as the time unit and Word 11 contains a value of 20, then the read period is 20 seconds.

A read is normally issued at the start of each read period. If the pending read transfer is not completed during the read period, the Channel Error bit and Detailed Channel Status words are set to indicate a non-fatal period error. If the Number of Time Units is set to zero, a subsequent transfer is issued as soon as the previous transfer completes, no period errors occur.

A pending transfer can still complete after the period error occurs.

For channel commands set up to issue multiple reads, the next read transfer is issued only after the pending read transfer completes.

A channel command set up to issue a single read can have only one pending read transfer.

(Word 12) Timeout for Each Read: Word 12 specifies the time (in hundredths of a second) the FIP Bus Controller waits for a read transfer to complete before setting the Channel Error bit and Detailed Channel Status words to indicate a non-fatal timeout error. The transfer can still complete even after a timeout occurs. As a result, an application can choose what to do if one occurs. If the timeout value is specified as zero, no timeout errors are reported.

For most applications a timeout need not be specified because the read period, in effect, acts as a timeout. (Word 12 should be zero for no timeout). However, there are two special circumstances in which specifying a timeout is recommended:

A. When the number of time units (word 11) is zero, so that a subsequent transfer will be issued as soon as the previous transfer completes and no period errors will be reported. In this case a timeout value can be specified so that timeout errors will be reported by the Channel Error bit.

B. When the read period is very long (minutes or hours). In this case a shorter timeout value can be specified so the application doesn't have to wait for the read period to expire before taking action.

(Word 13) Local PLC - Memory Type: Words 13-14 specify the location in the local PLC where the FIP Bus Controller will store data received from the remote PLC. The size of this area is set by the size of the data read from the remote PLC (Word 17). Be sure this area is large enough to contain the requested data without overwriting other application data. Valid memory types are:

Type	Value (Decimal)	Description
%L*	0	Program Block Local register memory (word mode)
%P*	4	Program register memory (word mode)
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)
%I	16	Discrete input memory (byte mode)
	70	Discrete input memory (bit mode)
%Q	18	Discrete output memory (byte mode)
	72	Discrete output memory (bit mode)
%T	20	Discrete temporary memory (byte mode)
	74	Discrete temporary memory (bit mode)
%M	22	Discrete momentary internal memory (byte mode)
	76	Discrete momentary internal memory (bit mode)
%SA †	24	Discrete system memory group A (byte mode)
	78	Discrete system memory group A (bit mode)
%SB †	26	Discrete system memory group B (byte mode)
	80	Discrete system memory group B (bit mode)
%SC †	28	Discrete system memory group C (byte mode)
	82	Discrete system memory group C (bit mode)
%S †	30	Discrete system memory (byte mode)
	84	Discrete system memory (bit mode)
%G	56	Discrete global data table (byte mode)
	86	Discrete global data table (bit mode)

† Read-only memory, cannot be written to.
* Can only be accessed in the Remote PLC.

(Word 14) Local PLC - Memory Starting Address: Word 14 specifies the starting address in the local PLC in which the data from the remote PLC is to be stored (1-based).

(Word 15) Remote PLC - Memory Type: Words 15-16 specify the memory type and starting address in the remote PLC from which the data is to be read. If %P memory is used, you must specify a Program name in words 24 - 27. If %L memory is used, you must specify a Program name in words 24 - 27 and a Program Block name in words 28 - 31.

(Word 16) Remote PLC - Memory Starting Address: Word 16 specifies starting address in the remote PLC from which the data is to be read (1-based). Valid ranges of values depend on the remote PLC .

(Word 17) Remote PLC - Number of Memory Units: Word 17 specifies the number of bits, bytes or words to be read, determined by the remote PLC memory type specified. For example, if the memory type is %I in bit mode this is the number of bits. If the memory type is %R, this is the number of words. A maximum of 16384 bits/2048 bytes/1024 words of data may be specified.

(Word 18) Remote PLC - PLC (Node) Address Type: Word 18 specifies the format of the remote PLC address. In this release, Word 18 must contain the value one (1), indicating a dotted-decimal IP address expressed using a separate register for each decimal digit.

(Word 19) Remote PLC - PLC (Node) Address Length: Word 19 specifies the length in words of the remote PLC IP address. In this release Word 19 must contain four (4).

(Words 20-23) Remote PLC - PLC (Node) IP Address: Words 20-23 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

Words 24 - 27 Remote PLC - Program Name: Word 24 - 27 specify the case-sensitive, zero-terminated and padded program name (also called task name) to be used with access to remote %P or%L memory. These words are required only for access to such memory and are ignored if the Memory Type field is not %P or %L. See Note below.

Word 28 - 31 Remote PLC - Program Block Name: Words 28 - 31 specify the case-sensitive, zero-terminated and padded program block name (which can be found in the program block declaration in the server ladder program) to be used with access to remote %L memory. These words are required only for access to such memory and are ignored if the Memory Type field is not %P or %L.

Note

The Program Name (words 24 - 27) and Program Block Name (words 28 - 31) must have each pair of ASCII characters reversed within the PLC memory. For example, the name "MARY" ("M" = 4DH, "A" = 41H, "R" = 52H, "Y" = 59H) would have 414D in the first word and 5952 in the second word.

Establish a Write Channel to Another PLC

Use the Establish Write Channel command to open a channel to a remote PLC and to periodically transfer data from the local PLC to the remote PLC.

As shown in the example below, the Command Block specifies the period, the number of writes to perform, and the timeout allowed in waiting for each transfer to complete. The first write is performed immediately, regardless of the period specified.

Example Establish Write Channel Command Block

This example establishes a write channel (channel 6) to a remote PLC at IP address 3.0.0.1. It returns the COMREQ Status word to %R10. Following successful execution of the command, the FIP Bus Controller will write data from local PLC registers %R50-%R57 to remote PLC registers %R100-%R107. This communication will be repeated indefinitely a the rate of once every 7 seconds. The timeout period for each write is 500 ms.

	Dec	(Hex)	
Word 1	00017	(0011)	Length of Channel Command Data Block (17 - 25 words)
Word 2	00000	(0000)	Always 0 (no-wait mode request)
Word 3	00008	(0008)	Memory type of COMREQ Status Word (%R)
Word 4	00009	(0009)	COMREQ Status Word address minus 1 (%R10) *
Word 5	00000	(0000)	Reserved
Word 6	00000	(0000)	Reserved
Word 7	02004	(07d4)	Establish Write Channel Command number
Word 8	00006	(0006)	Channel number (6)
Word 9	00000	(0000)	Number of write repetitions (write indefinitely)
Word 10	00003	(0003)	Time units for write period (3=seconds)
Word 11	00007	(0007)	Number of time units for write period (every 7 seconds)
Word 12	00050	(0032)	Timeout for each write (500 ms)
Word 13	00008	(0008)	Local PLC - memory type from which to write data (%R)
Word 14	00050	(0032)	Local PLC - starting address from which to write data (%R50)
Word 15	00008	(0008)	Remote PLC - memory type at which to store data (%R)
Word 16	00100	(0064)	Remote PLC - starting address at which to store data (%R50)
Word 17	00008	(0008)	Remote PLC - number of memory units (8 registers)
Word 18	00001	(0001)	Remote PLC - PLC (node) address type (IP address)
Word 19	00004	(0004)	Remote PLC - PLC (node) address length in words (4)
Word 20	00003	(0003)	Remote PLC - register 1 of IP address (3)
Word 21	00000	(0000)	Remote PLC - register 2 of IP address (0)
Word 22	00000	(0000)	Remote PLC - register 3 of IP address (0)
Word 23	00001	(0001)	Remote PLC - register 4 of IP address (1)
Word 24 - 27			Remote PLC - Program Name (needed for access to remote %P or %L) (zero terminated and padded)
Word 28 - 31			Remote PLC - Program Block Name (needed for access to remote %L) (zero terminated and padded)

* Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Channel Command Number: Word 7 (02004 decimal or 07D4 hex) requests that a write channel be set up.

(Word 8) Channel Number: Word 8 specifies the channel to be used for the write. This value must be in the range of 1 to 32. If the channel is out of range, a command error indication will be placed in the COMREQ Status word. If the channel number is the same as a channel already in use, the channel will be re-tasked to perform this new command.

(Word 9) Number of Write Repetitions: Word 9 specifies the number of writes to be performed before closing the channel. If this value is set to 1, only a single write will be issued. If this value is set to 0, reads will be issued on the requested period until the channel is aborted.

(Word 10) Time Units for Write Period: Word 10 is a number that specifies the time unit such as seconds or minutes for the write period:

1	hundredths of seconds
2	tenths of seconds
3	seconds
4	minutes
5	hours

(Word 11) Number of Time Units for Write Period: Word 11 specifies the number of time units for the write period. The write period is in effect even when the Channel Command is set up to issue a single write

> **Example Write Period Calculation:** If Word 10 contains a value of 3 specifying seconds as the time units and Word 11 contains a value of 20, then the write period is 20 seconds.

A write is normally issued at the start of each write period. If the pending write transfer has not completed during the write period, the Channel Error bit and Detailed Channel Status words are set to indicate a non-fatal period error. The pending transfer can still complete after the period error occurs. For Channel Commands set up to issue multiple writes, the next write transfer is issued only after the pending write transfer completes.

A Channel Command set up to issue a single write can have only one pending write transfer.

If the Number of Time Units is zero, a subsequent transfer will be issued as soon as the previous transfer completes; no period errors are reported by the Channel Error bit.

(Word 12) Timeout for Each Write: Word 12 specifies the time (in hundredths of a second) the FIP Bus Controller will wait for a write transfer to complete before setting the Channel Error bit and Detailed Channel Status bits to indicate a non-fatal timeout error. The transfer can still complete even after a timeout occurs. As a result, an application can choose what to do if one occurs. If the timeout value is specified as zero, no timeout errors will be reported.

For most applications a timeout need not be specified because the write period, in effect, acts as a timeout. (Word 12 should be zero for no timeout.) However, there are two special circumstances in which specifying a timeout is recommended:

A. When the number of time units (word 11) is zero, so that a subsequent transfer will be issued as soon as the previous transfer completes and no period errors are reported. In this case a timeout value can be specified so that timeout errors will be reported by the Channel Error bit.

B. When the write period is very long (minutes or hours). In this case a shorter timeout value can be specified so the application doesn't have to wait for the write period to expire before taking action.

(Word 13) Local PLC - Memory Type: Words 13-14 specify the location in the local PLC from where the FIP Bus Controller will get the data to be written to the remote PLC. The size of this area is set by the size of the data written to the remote PLC. Valid memory types are:

Type	Value (Decimal)	Description
%L*	0	Program Block Local register memory (word mode)
%P*	4	Program register memory (word mode)
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)
%I	16	Discrete input memory (byte mode)
	70	Discrete input memory (bit mode)
%Q	18	Discrete output memory (byte mode)
	72	Discrete output memory (bit mode)
%T	20	Discrete temporary memory (byte mode)
	74	Discrete temporary memory (bit mode)
%M	22	Discrete momentary internal memory (byte mode)
	76	Discrete momentary internal memory (bit mode)
%SA †	24	Discrete system memory group A (byte mode)
	78	Discrete system memory group A (bit mode)
%SB †	26	Discrete system memory group B (byte mode)
	80	Discrete system memory group B (bit mode)
%SC †	28	Discrete system memory group C (byte mode)
	82	Discrete system memory group C (bit mode)
%S †	30	Discrete system memory (byte mode)
	84	Discrete system memory (bit mode)
%G	56	Discrete global data table (byte mode)
	86	Discrete global data table (bit mode)

(Word 14) Local PLC - Memory Starting Address: Word 14 specifies the starting address in the local PLC from which the data is to be written (1-based).

(Word 15) Remote PLC - Memory Type: Words 15-16 specify the memory type and starting address in the remote PLC to which the data is to be stored. Valid memory types are listed above. Be sure this area is large enough to contain the requested data without overwriting other application data.

(Word 16) Remote PLC - Memory Starting Address: Word 16 specifies starting address in the remote PLC to which the data is to be stored. Valid ranges of values depend on the remote PLC (1-based).

(Word 17) Remote PLC - Number of Memory Units: Word 17 specifies the number of bits, bytes or words to be written, determined by the remote PLC memory type specified. For example, if the memory type is %I, this is the number of bits. If the memory type is %R, this is the number of words. A maximum of 16384 bits/2048 bytes/1024 words of data may be specified.

(Word 18) Remote PLC - PLC (Node) Address Type: Word 18 specifies the format of the remote IP address. In this release Word 18 must contain one (1), the address type indicating a word-oriented, dotted-decimal IP address of a remote PLC.

(Word 19) Remote PLC - PLC (Node) Address Length: Word 19 specifies the length in words of the remote IP address. In this release Word 19 must contain four (4).

(Words 20-23) Remote PLC - PLC (Node) IP Address: Words 20-23 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

Words 24 - 27 Remote PLC - Program Name: Word 24 - 27 specify the case-sensitive, zero-terminated and padded program name (also called task name) to be used with access to remote %P or%L memory. These words are required only for access to such memory and will be ignored if the Memory Type field is not %P or %L.

Word 28 - 31 Remote PLC - Program Block Name: Words 28 - 31 specify the case-sensitive, zero-terminated and padded program block name (which can be found in the program block declaration in the server ladder program) to be used with access to remote %L memory. These words are required only for access to such memory and will be ignored if the Memory Type field is not %P or %L.

Note

The Program Name (words 24 - 27) and Program Block Name (words 28 - 31) must have each pair of ASCII characters reversed within the PLC memory. For example, the name "MARY" ("M" = 4DH, "A" = 41H, "R" = 52H, "Y" = 59H) would have 414D in the first word and 5952 in the second word.

Send Information Report to a Host Server

Use the Send Information Report COMREQ to open a communications channel to a Host Application SRTP (Service Request Transfer Protocol) server and to transfer data from the local PLC CPU reference tables to that SRTP Server. The Command Block specifies the repetition period, the number of transfers to the server to perform, and the timeout allowed in waiting for each transfer to complete. The first send is performed immediately, regardless of the period specified.

Example Send Information Report Command Block

This example Command Block establishes a channel (channel 7) to a remote Host application server at IP address 3.0.0.1. It returns the COMREQ Status word to %R10. Following successful execution of the COMREQ, the FIP Bus Controller sends local PLC registers %R50–%R57 to the remote server. This communication is repeated 10 times at the rate of once every 7 seconds. The timeout period for each read is 500 ms.

	Dec	(Hex)	
Word 1	00017	(0011)	Length of Send Information Report Data Block (17 words)
Word 2	00000	(0000)	Always 0 (no–wait mode request)
Word 3	00008	(0008)	Memory type of COMREQ Status Word (%R)
Word 4	00009	(0009)	COMREQ Status Word address minus 1 (%R10)*
Word 5	00000	(0000)	Reserved
Word 6	00000	(0000)	Reserved
Word 7	02010	(07DA)	Send Information Report Channel Command number
Word 8	00007	(0007)	Channel number (7)
Word 9	00010	(000A)	Number of repetitions (send 10 times)
Word 10	00003	(0003)	Time units for send period (3=seconds)
Word 11	00007	(0007)	Minimum interval between host accesses (every 7 seconds)
Word 12	00050	(0032)	Timeout on each individual transfer response (500 ms)
Word 13	00008	(0008)	Local PLC CPU - memory type from which to send data (%R)
Word 14	00050	(0032)	Local PLC CPU - starting address from which to send data (%R50)
Word 15	00008	(0008)	Local PLC CPU - number of memory units (8 registers)
Word 16	00000	(0000)	Reserved
Word 17	00000	(0000)	Reserved
Word 18	00001	(0001)	SRTP Server Host Address Type (IP Address)
Word 19	00004	(0004)	SRTP Server Host Address Word Length (4)
Word 20	00003	(0003)	SRTP Server Host Address Data Word 1 (3)
Word 21	00000	(0000)	SRTP Server Host Address Data Word 2 (0)
Word 22	00000	(0000)	SRTP Server Host Address Data Word 3 (0)
Word 23	00001	(0001)	SRTP Server Host Address Data Word 4 (1)

* Word 4 (COMREQ Status Word address) is the only zero–based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Channel Command Number: Word 7 (02010 decimal or 07DA hex) requests that a Send Information Report channel be set up.

(Word 8) Channel Number: Word 8 specifies the channel to be used for the send. This value must be in the range of 1 to 32. If the channel is out of range, a command error indication will be placed in the COMREQ Status word. If the channel number is the same as a channel already in use, the channel will be re-tasked to perform this new command.

(Word 9) Number of Send Repetitions: Word 9 specifies the number of transfers to be performed before automatically closing the channel. If this value is set to 1, only a single transfer will be issued. If this value is set to 0, transfers will be issued on the requested period until the channel is aborted.

(Word 10) Time Units for Send Period: Word 10 is a number that specifies the time units for the send period:

1	hundredths of seconds
2	tenths of seconds
3	seconds
4	minutes
5	hours

(Word 11) Number of Time Units for Send Period: Word 11 specifies the number of time units for the send period. The send period is in effect even when the Channel Command is set up to issue a single send.

> **Example Send Period Calculation:** If Word 10 contains a value of 3 specifying seconds as the time unit and Word 11 contains a value of 20, then the send period is 20 seconds.

A send will normally be issued at the start of each send period. If the pending transfer has not completed during the send period, the Channel Error bit and Detailed Channel Status words will be set to indicate a non-fatal period error. The pending transfer can still complete after the period error occurs. For Channel Commands set up to issue multiple sends, the next transfer will be issued only after the pending transfer completes.

A Channel Command set up to issue a single send can have only one pending send transfer.

If the Number of Time Units is zero, a subsequent transfer will be issued as soon as the previous transfer completes; no period errors are reported by the Channel Error bit.

(Word 12) Timeout for Each Send: Word 12 specifies the time (in hundredths of a second) the FIP Bus Controller will wait for a send transfer to complete before setting the Channel Error bit and Detailed Channel Status bits to indicate a non-fatal timeout error. The transfer can still complete even after a timeout occurs. As a result, an application can choose what to do if one occurs. If the timeout value is specified as zero, no timeout errors will be reported.

For most applications a timeout need not be specified because the send period, in effect, acts as a timeout. (Word 12 should be zero for no timeout.) However, there are two special circumstances in which specifying a timeout is recommended:

A. When the number of time units (word 11) is zero, so that a subsequent transfer will be issued as soon as the previous transfer completes and no period errors are reported. In this case a timeout value can be specified so that timeout errors will be reported by the Channel Error bit.

B. When the send period is very long (minutes or hours). In this case a shorter timeout value can be specified so the application doesn't have to wait for the send period to expire before taking action.

(Word 13) Local PLC - Memory Type: Words 13-14 specify the location in the local PLC from where the FIP Bus Controller will get the data to be written to the remote SRTP server. Valid memory types are:

Type	Value (Decimal)	Description
%L*	0	Program Block Local register memory (word mode)
%P*	4	Program register memory (word mode)
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)
%I	16	Discrete input memory (byte mode)
	70	Discrete input memory (bit mode)
%Q	18	Discrete output memory (byte mode)
	72	Discrete output memory (bit mode)
%T	20	Discrete temporary memory (byte mode)
	74	Discrete temporary memory (bit mode)
%M	22	Discrete momentary internal memory (byte mode)
	76	Discrete momentary internal memory (bit mode)
%SA †	24	Discrete system memory group A (byte mode)
	78	Discrete system memory group A (bit mode)
%SB †	26	Discrete system memory group B (byte mode)
	80	Discrete system memory group B (bit mode)
%SC †	28	Discrete system memory group C (byte mode)
	82	Discrete system memory group C (bit mode)
%S †	30	Discrete system memory (byte mode)
	84	Discrete system memory (bit mode)
%G	56	Discrete global data table (byte mode)
	86	Discrete global data table (bit mode)

† Read-only memory, cannot be written to.
* Can only be accessed in the Remote PLC.

(Word 14) Local PLC - Memory Starting Address: Word 14 specifies the starting address in the local PLC from which the data is to be sent (1-based).

(Word 15) Local PLC - Number of Memory Units: Word 15 specifies the number of memory units to be transferred. The units may be bits, bytes, or words depending on the memory type specified in Word 13. For example, if the memory type is %I, this is the number of bits. If the memory type is %R, this is the number of words. A maximum of 16384 bits/2048 bytes/1024 words of data may be specified.

(Words 16, 17) Reserved: Words 16 and 17 are reserved and should be zero.

(Word 18) Remote Host - Node Address Type: Word 18 specifies the format of the remote IP address. Word 18 must contain one (1), the address type indicating a word-oriented, dotted-decimal IP address of a remote PLC.

(Word 19) Remote Host - Node Address Length: Word 19 specifies the length in words of the remote IP address. Word 19 must contain four (4).

(Words 20-23) Remote Host - Node IP Address: Words 20-23 specify the four integers, one integer per word, of the dotted-decimal IP address of the remote PLC to be accessed.

Abort a Communications Channel

Use the Abort Channel COMREQ to immediately disconnect an active channel and render the channel idle. The Channel Transfer bit, the Channel Error bit, and the Detailed Channel Status words for the channel are set to zero.

Example Abort Channel Command Block

This example disconnects Channel 5 and renders it idle. It returns the COMREQ Status Word to %R10.

	Dec	(Hex)	
Word 1	00002	(0002)	Length of Channel Command Data Block (2 words)
Word 2	00000	(0000)	Always 0 (no-wait mode request)
Word 3	00008	(0008)	Memory type of COMREQ Status Word (%R)
Word 4	00009	(0009)	COMREQ Status Word address minus 1* (%R10)
Word 5	00000	(0000)	Reserved
Word 6	00000	(0000)	Reserved
Word 7	02001	(07d1)	Abort Channel Command number
Word 8	00005	(0005)	Channel number 5

* Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Channel Command Number: Word 7 (02001 decimal or 07D1 hex) requests that a channel be aborted. If the command is processed successfully, it will terminate the processing on the channel by the time success is indicated in the COMREQ Status word.

(Word 8) Channel Number: The channel number specifies the channel to be disconnected (1-32). As a convenient way to abort all channels, if the channel number parameter is -1 (ffffH), all channels in use will be aborted. It is *not* an error to abort all channels when there are none in use. Neither is it an error to abort an idle channel.

Note

For the Abort Channel and Retrieve Detailed Channel Status commands, no actual data is transmitted on the network. Communication occurs between the PLC CPU and the FIP Bus Controller only. For these commands, the COMREQ Status Word is sent immediately to the CPU.

Retrieve Detailed Channel Status

If bit 9 (Channel Error) of the Bus Controller Status bits indicates a channel error, the program can request Detailed Channel Status data from the Bus Controller. (The command has no effect on the value of the Bus Controller Status bits).

When this data is returned, the first word will contain an error code indicating the cause of the error. Refer to the tables in Appendix B for a complete listing of major and minor error codes.

The second word will indicate whether the channel is active or idle.

Detailed Channel Status Words in Hex Format

Word 2	Word 1	
	High	Low
0000	00	00

Channel Active (0001 = channel active, 0000 = channel not active)

Minor Error Codes (high byte)

Success and Major Error Codes (low byte)
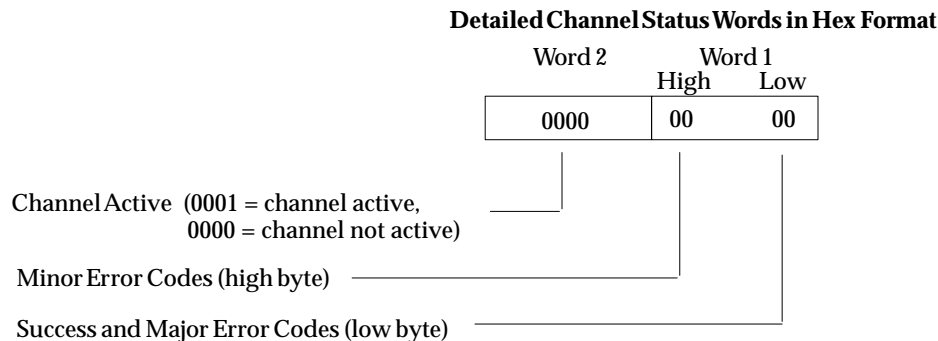
The Bus Controller refreshes this data in its own memory every time the status of the channel changes. However, it supplies the data to the CPU only on request. If the channel is operating with a fast repetition rate, its status may change faster than the CPU can request the status data. In that case, some status values may be missed by the CPU.

The initial value of the Detailed Channel Status words is all zeros. The Detailed Channel Status Words are reset to zero when:

- The FIP Bus Controller is powered up or restarted
- The CPU transitions from STOP to RUN
- A channel abort COMREQ aborts the channel

Example Retrieve Detailed Channel Status Command Block

This example retrieves detailed channel status data for channel 5 and places it in Registers 100-101. It returns the COMREQ Status word to %R10.

	Dec	(Hex)	
Word 1	00004	(0004)	Length of Channel Command Data Block (4 words)
Word 2	00000	(0000)	Always 0 (no-wait mode request)
Word 3	00008	(0008)	Memory Type of COMREQ Status Word (%R)
Word 4	00009	(0009)	COMREQ Status Word address minus 1 (%R10)*
Word 5	00000	(0000)	Reserved
Word 6	00000	(0000)	Reserved
Word 7	02002	(07d2)	Retrieve Detailed Channel Status Command number
Word 8	00005	(0005)	Channel number 5
Word 9	00008	(0008)	Local PLC - memory type to store Detailed Chan. Stat. (%R)
Word 10	00100	(0064)	Local PLC - starting address (%R100)

*   Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Channel Command Number: Word 7 (02002 decimal or 07D2 hex) requests that Detailed Channel Status words be returned. If the command is processed successfully, the Detailed Channel Status words will be written to the location specified in Words 9 and 10. Then the COMREQ Status Word will indicate successful completion of the command. If the specified channel is not currently in use, the latest status will be returned.

(Word 8) Channel Number: The channel number in Word 8 specifies the channel whose status is to be read. This value must be a channel number in the range of 1 to 32 decimal.

(Word 9) Local PLC - Memory Type: Words 9 and 10 specify the starting point in the client CPU memory where the Detailed Channel Status words are to be written. The length of the transfer is implied and is equal to 2 words. Word 9 specifies the memory type:

Type	Value (Decimal)	Description
%L*	0	Program Block Local register memory (word mode)
%P*	4	Program register memory (word mode)
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)
%I	16 70	Discrete input memory (byte mode) Discrete input memory (bit mode)
%Q	18 72	Discrete output memory (byte mode) Discrete output memory (bit mode)
%T	20 74	Discrete temporary memory (byte mode) Discrete temporary memory (bit mode)
%M	22 76	Discrete momentary internal memory (byte mode) Discrete momentary internal memory (bit mode)
%SA †	24 78	Discrete system memory group A (byte mode) Discrete system memory group A (bit mode)
%SB †	26 80	Discrete system memory group B (byte mode) Discrete system memory group B (bit mode)
%SC †	28 82	Discrete system memory group C (byte mode) Discrete system memory group C (bit mode)
%S †	30 84	Discrete system memory (byte mode) Discrete system memory (bit mode)
%G	56 86	Discrete global data table (byte mode) Discrete global data table (bit mode)

† Read-only memory, cannot be written to.
* Can only be accessed in the Remote PLC.

(Word 10) Local PLC - Memory Starting Address: Starting address to store the Detailed Channel Status words.

Network Diagnostics

This chapter describes normal logging of network faults by the FIP Bus Controller. It explains how network fault information can also be stored in a selected area of PLC memory, and how to disable logging certain network faults into the I/O fault table.

- Normal logging of network faults
- Network Diagnostic COMREQ
    - □ Start Network Diagnostic
    - □ Stop Network Diagnostic

Normal Logging of Network Faults

The FIP Bus Controller normally logs two types of network faults to the I/O fault table:

A. **I/O Bus Faults**

If the FIP Bus Controller loses one of the busses in a redundant network, an I/O Bus Fault is logged of the type "Local Loss Bus 1" or "Local Loss bus 2".

If the FIP Bus Controller loses <u>both</u> busses in a redundant network or it loses the one and only bus in a simplex network, an I/O Bus Fault is logged of the type "Loss All Comm".

If a remote I/O device or generic device loses one of the busses in a redundant network, an I/O Bus Fault is logged of the type "Remote Loss Buss 1" or "Remote Loss Bus 2". In a simplex network, I/O Bus Faults are not logged. (See *Loss/Addition of Device Faults*).

B. **Loss/Addition of Device Faults (Network Presence)**

The FIP Bus Controller also logs *loss/addition of device* (network presence) faults for configured remote I/O and generic devices. This logging of *loss/addition of device* faults cannot be disabled.

For remote I/O devices, fault logging starts immediately after the FIP Bus Controller is operational. For generic devices, there is a time delay of approximately 30 seconds after the FIP Bus Controller is operational.

Using COMREQs for Network Diagnostics

COMREQs can be used to change normal logging of network faults in two ways:

A. To set up additional reporting of network diagnostics into a selected area of PLC memory.

B. To disable logging I/O Bus Faults for remote I/O and generic devices to the PLC fault table.

Reporting Network Diagnostics to PLC Memory

In addition to logging network faults in the PLC fault table, the FIP Bus Controller can place network diagnostics into a specified area of PLC memory. By default, this fault reporting is disabled. It can be enabled by issuing a Start Network Diagnostic COMREQ and disabled using a Stop Network Diagnostic COMREQ.

Format of the Network Diagnostics Data in PLC Memory

The optional Network Diagnostics feature requires 49 words of PLC memory. The memory type can be selected, but the length is fixed. Within this area of memory, diagnostics data is structured as follows:

Word	Data	Description
1	Format Identifier	Always 1
2 – 17	Network Presence (Loss of Device)	1 bit per 256 device IDs on FIP network* 0 = Absent 1 = Present
18 – 33	Bus 1 Faults (Loss/ Addition of Bus)	1 bit per 256 device IDs on bus 1 0 = OK 1 = Loss of bus 1
34 – 49	Bus 2 Faults (Loss/ Addition of Bus)	1 bit per 256 device IDs on bus 2 0 = OK 1 = Loss of bus 2

*   Although there are 256 potential device IDs per network segment, the maximum number of devices in a segment is 128.

If the FIP Bus Controller loses both buses, the Network Presence (Loss of Device), Bus 1 Fault, and Bus 2 Fault bits are all <u>cleared</u>, indicating all devices are absent. An I/O Bus Fault of the type "Loss All Comm" is logged for the FIP Bus Controller. All configured remote I/O and generic devices are logged with *loss of device* faults.

Disabling Logging I/O Bus Faults to the PLC Fault Table

The Network Diagnostics COMREQ can also be used to disable or re-enable reporting of I/O Bus Faults into the PLC fault table.

Start Network Diagnostics COMREQ

The Start Network Diagnostic COMREQ can be used to begin reporting network diagnostics to PLC memory and to disable or re-enable logging I/O Bus Faults for remote devices to the PLC fault table. This COMREQ need only be executed once to enable the feature. Issuing the COMREQ again cancels any existing network diagnostic function, so the COMREQ can be sent on the first scan (FST_SCN contact) of the program without sending a Stop Network Diagnostic COMREQ first. Any Start Network Diagnostic COMREQ that returns an error status also cancels any existing network diagnostic feature.

Example Start Network Diagnostic Command Block

In this example, the COMREQ specifies %R1 as the location of the COMREQ Status Word and %R100 as the starting location in memory to receive the 49 words of diagnostic data. Logging of "Loss of bus" faults is not disabled.

	Dec (Hex)	
Word 1	00005 (0005)	Length of Data Block (5 words)
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMREQ Status Word (%R)
Word 4	00000 (0000)	COMREQ Status Word address minus 1 (%R1)*
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	05100 (13EC)	Start Network Diagnostics Command number
Word 8	00001 (0001)	Reserved (must be 1)
Word 9	00008 (0008)	Memory Type for the data (%R)
Word 10	00100 (0064)	Starting reference for the data (%R100)
Word 11	00000 (0000)	Bus Fault Disable/Enable (enable=0, disable=1)

*   Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Channel Command Number: Word 7 (05100 decimal or 13EC hex) specifies the Start Network Diagnostics command.

(Word 8) Reserved: Word 8 must be set to 1.

(Word 9) Memory Type for the Data: Words 9 and 10 specify the location where the FIP Bus Controller will store the network diagnostic data. Valid memory types are:

Type	Value (Decimal)	Description
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)
%I	16	Discrete input memory (byte mode)
%Q	18	Discrete output memory (byte mode)
%M	22	Discrete momentary internal memory (byte mode)

(Word 10) Starting Reference for the Data: Word 10 specifies the starting reference in the selected memory type for the 49-word diagnostics data area.

(Word 11) Bus Faults Enable/Disable: Word 11 selects whether or not the FIP Bus Controller will log I/O Bus Faults.

Stop Network Diagnostic COMREQ

Use the Stop Network Diagnostic COMREQ to disable the Network Diagnostic feature. When the feature is disabled, the periodic updating of the diagnostic data stops. The logging of remote bus faults, if enabled, also stops. The FIP Bus Controller returns to normal operation.

The Network Diagnostic feature is also disabled when a new configuration is stored to the PLC, the FBC is reset by the pushbutton, or the PLC is power–cycled.

The Network Diagnostic feature is not disabled if the PLC CPU transitions to STOP mode. It can be disabled by including a Stop Network Diagnostic COMREQ on the last scan (LST_SCN contact) of the PLC logic.

Example Stop Network Diagnostic Command Block

In this example, the COMREQ requests Stop the Network Diagnostic feature. It specifies %R1 as the location of the COMREQ Status Word.

	Dec	(Hex)	
Word 1	00002	(0002)	Length of Data Block (2 words)
Word 2	00000	(0000)	Always 0 (no-wait mode request)
Word 3	00008	(0008)	Memory type of COMREQ Status Word (%R)
Word 4	00000	(0000)	COMREQ Status Word address minus 1 (%R1)*
Word 5	00000	(0000)	Reserved
Word 6	00000	(0000)	Reserved
Word 7	05101	(13ED)	Stop Network Diagnostics Command number
Word 8	00001	(0001)	Reserved (must be 1)

* Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Channel Command Number: Word 7 (05101 decimal or 13ED hex) stops network diagnostics.

(Word 8) Reserved: Word 8 must be set to 1.

Chapter	*FIP Generic Message Operation*
9	

Normally, the FIP Bus Controller ignores any FIP messages which may be sent on the FIP Network. However, it is possible to send and receive FIP messages via the FIP Bus Controller. The application program can use Communications Requests to the FIP Bus Controller to:

- Receive State Change messages from remote I/O devices and place them in a specified area of memory in the Series 90-70 PLC

- Receive other FIP messages from the FIP network and place them in a specified area of memory in the Series 90-70 PLC

- Send FIP messages on the network.

- Discontinue receiving FIP messages.

Chapter 6 gives general instructions for sending and monitoring COMREQs.

Request FIP Messages from the State Change LSAP COMREQ

Use this COMREQ to request all FIP messages received on the State Change LSAP (Link Service Access Point). Messages received via this LSAP will include the SC, RC, and PI message types. The value for this LSAP is fixed by the FIP Bus Controller at 9100h.

As messages are received from the network, they will be stored in the Message Buffer Area. The format and use of the Message Buffer Area are explained below.

Example Request State Change Messages Command Block

This example requests messages from the State Change LSAP. It specifies %R1 as the location of the COMREQ Status Word and %R100 as the starting location in PLC memory for the message buffer with a size of 2 messages.

	Dec (Hex)	
Word 1	00006 (0006)	Length of Data Block (6 words)
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMREQ Status Word (%R)
Word 4	00000 (0000)	COMREQ Status Word address minus 1 (%R1)*
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	05000 (1388)	Request FIP Messages from State Change LSAP Command number
Word 8	00008 (0008)	Memory type for the data in the PLC (%R)
Word 9	00100 (0064)	Starting reference in the selected memory type (%R100)
Word 10	00002 (0002)	Number of records in the buffer (2 to amount of available memory)
Word 11	00000 (0000)	Unused. Must be 0
Word 12	00000 (0000)	Unused. Must be 0

* Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Command Number: Word 7 (05000 decimal or 1388 hex) requests FIP Messages from the State Change LSAP.

(Word 8) Memory Type for the Data: Word 8 specifies the PLC reference table location (memory type) of the Message Buffer Area. Valid memory types are:

Type	Value (Decimal)	Description
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)

(Word 9) Starting Reference for the Data: Word 9 specifies the starting reference in the selected memory type for the data area.

(Word 10) Number of Records in the Buffer: Word 10 specifies the number of records being requested. Each record will occupy 132 words (264 bytes) of PLC memory.

(Words 11, 12) Reserved: Words 11 and 12 must be set to 0.

Message Buffer Area

Once the COMREQ is successfully executed, the FIP Bus Controller places incoming State Change or generic Link Service Access Point messages into PLC memory at the specified location. The structure of the message data in PLC memory is shown below. Each record occupies 132 registers, regardless of the actual message length. The second word of each record indicates the length of the message's content.

The following example shows a Message Buffer Area with 2 words.

Word	Data	Description
Record 1		
1	Sequence Number	The sequence number of the message indicating its order of reception. This number begins at 1 and increments by 1 until the value 65535. The sequence number is then reset to 1.
2	Message Length	The number of bytes in the Message Content part of the record.
3, 4	Source LSAP	Source LSAP of the message
5–132	Message Content	0–256 bytes of the message. This field normally begins with the message heading containing the loading type, reference, and selector data.
Record 2		
133	Sequence Number	The sequence number of the next message
134	Message Length	The number of bytes in the next message
135–136	Source LSAP	The source LSAP of the next message
137–264	Message Content	The content of the next message

When more messages are received than there are records to hold them, records are overwritten beginning at record 1. The Message buffer Area behaves like a circular buffer.

Message Number	Record Number	Sequence Number
1	1	1
2	2	2
3	1	3
4	2	4
5	1	5
.	.	.
.	.	.
.	.	.

For an application to process all messages it must monitor the Sequence Number to detect the arrival of the next message. If monitoring is too slow or messages are received too quickly, a message may be overwritten before it is processed. The speed of the monitoring or the size of the Message Buffer Area may need to be increased to avoid this problem.

Request FIP Messages from Generic LSAP COMREQ

Use this COMREQ to request FIP messages received on the specified Link Service Access Point (LSAP). The format of this data in PLC memory is shown on the previous page.

Example Request Generic Messages Command Block

This example requests to receive messages from the generic Link Service Access Point 0x1005. It specifies %R1 as the location of the COMREQ Status Word and %R100 as the starting location in PLC memory for the Message Buffer Area of size of 2 messages.

	Dec (Hex)	
Word 1	00006 (0006)	Length of Data Block (6 words)
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMREQ Status Word (%R)
Word 4	00000 (0000)	COMREQ Status Word address minus 1 (%R1)*
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	05001 (1389)	Request FIP Messages from Generic LSAP Command number
Word 8	00008 (0008)	Memory type for the data in the PLC (%R)
Word 9	00100 (0064)	Starting reference in the selected memory type (%R100)
Word 10	00002 (0002)	Number of records in the buffer
Word 11	04101 (1005)	FIP LSAP and station, or group number.
Word 12	00000 (0000)	Segment Number. Must be 0

* Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Command Number: Word 7 (05001 decimal or 1389 hex) specifies the Request FIP Messages from Generic LSAP command.

(Word 8) Memory Type for the Data: Word 8 specifies the PLC reference table location (memory type) of the Message Buffer Area. Valid memory types are:

Type	Value (Decimal)	Description
%R	8	Register memory (word mode)
%AI	10	Analog input memory (word mode)
%AQ	12	Analog output memory (word mode)

(Word 9) Starting Reference for the Data: Word 9 specifies the starting reference in the selected memory type for the data area.

(Word 10) Number of Records in the Buffer: Word 10 specifies the number of records being requested. Each record will occupy 132 words (264 bytes) of PLC memory.

(Word 11) LSAP Number: For individual addresses, the MSB specifies the LSAP (00– 7F) and the LSB identifies the station (00– FF). For physical group addresses, the MSB specifies the LSAP (80– 8F) and the LSB identifies the station (00– FF). For group addresses, Word 11 specifies the group number (9000– FFFF). For example, FFFF is the Time broadcast address.

(Word 12) Segment Number: Word 12 must be set to 0.

Send Message Request COMREQ

Use this COMREQ to send a FIP message onto the FIP Network to a specified destination Link Service Access Point. The message may be up to 240 bytes in length. Once the COMREQ is successfully executed, the FIP Bus Controller sends the message onto the FIP Network.

Example Send Message Request Command Block

This example requests sending a 2-byte FIP message to LSAP 0x1001. It specifies %R1 as the location of the COMREQ Status Word.

	Dec (Hex)	
Word 1	00009 (0009)	Length of Data Block (9 words). If the length of the message is longer than 2 bytes, this value must be adjusted to include the number of words required for the entire message.
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMREQ Status Word (%R)
Word 4	00000 (0000)	COMREQ Status Word address minus 1 (%R1)*
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	05002 (138A)	Send FIP Message command number
Word 8	00000 (0000)	Transmission Mode – always 0 for unacknowledged message mode
Word 9	00000 (0000)	Channel Number – always 0 for aperiodic message transmission channel
Word 10	04097 (1001)	Destination LSAP (MSB=LSAP=0x10, LSB=Station=0x01)
Word 11	00000 (0000)	Destination Segment Number (always 0)
Word 12	00000 (0000)	Source LSAP (MSB=LSAP, LSB=Station)
Word 13:	00000 (0000)	Source Segment Number – always 0
Word 14:	00002 (0002)	Message Length (1 to 240 bytes) – ex. 2 bytes
Word 15:	17735 (4547)	Message Content "GE"

* Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block. Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Command Number: Word 7 (05002 decimal or 138A hex) specifies the Send Message Request command.

(Word 8) Transmission Mode: Word 8 must be 0.

(Word 9) Channel Number: Word 9 must be 0.

(Word 10) Destination LSAP: Word 10 specifies the destination Link Service Access Point. The MSB specifies the LSAP number. The LSB contains the station number.

(Word 11) Destination Segment Number: Word 11 must be 0.

(Word 12) Source LSAP: Word 12 specifies the source Link Service Access Point. The MSB of specifies the LSAP number. The LSB contains the station number.

(Word 13) Source Segment Number: Word 13 must be 0.

(Word 14) Message Length: message length may be 1 to 240 bytes.

(Word 15) Message Content: the actual text of the message

Stop (Specific) Message Delivery Request COMREQ

Use this command to disable the reception of messages into one specified memory area.

Example Stop Message Delivery Request Command Block

This example disables messages sent to the PLC memory area that begins at %R100.

	Dec (Hex)	
Word 1	00003 (0003)	Length of Data Block (3 words).
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMREQ Status Word (%R)
Word 4	00000 (0000)	COMREQ Status Word address minus 1 (%R1)*
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	05003 (138B)	Send FIP Message command number
Word 8	00008 (0008)	Memory Type (%R)
Word 9	00100 (0064)	Starting reference in the selected memory type (%R100)

*   Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block.
    Only this address requires subtracting 1 from the intended address.

Command Block Definitions

(Word 7) Command Number: Word 7 (05003 decimal or 138B hex) specifies the Stop Message Delivery Request command.

(Word 8) Memory Type for the Data: Words 8 and 9 specify the location where the FIP Bus Controller has been storing the message data.

(Word 9) Starting Reference for the Data: Word 9 specifies the starting reference in the selected memory type for the data area.

Stop All Message Delivery Request COMREQ

Use this command to disable the reception of all FIP messages. Once the COMREQ is successfully executed, the FIP Bus Controller stops placing incoming messages into all of the currently open FIP Message Buffer Areas.

Example Stop All Message Delivery Request Command Block

	Dec (Hex)	
Word 1	00001 (0001)	Length of Data Block (1 word).
Word 2	00000 (0000)	Always 0 (no-wait mode request)
Word 3	00008 (0008)	Memory type of COMREQ Status Word (%R)
Word 4	00000 (0000)	COMREQ Status Word address minus 1 (%R1)*
Word 5	00000 (0000)	Reserved
Word 6	00000 (0000)	Reserved
Word 7	05004 (138C)	Send FIP Message command number

*   Word 4 (COMREQ Status Word address) is the only zero-based address in the Command Block.
    Only this address requires subtracting 1 from the intended address.

Command Block Definition

(Word 7) Command Number: Word 7 (05004 decimal or 138C hex) specifies the Stop All Message Delivery Request command.

Alarm Contacts

Logical contacts that can be included in the application program of the Series 90-70 PLC. These contacts can be used to indicate when an analog value has reached an assigned alarm limit.

Application COMV

An Application COMV is a Communication Variable (COMV) that transports one or more application variables. Except for Generic Devices, application COMVs are created when the network segment is built. Application COMVs are created by grouping together the application variables produced by the one device. The COMV identifier, its size and its composition are also defined when the network segment is being built.

In the case of Generic Devices, the COMV identifier and its size are supplied by the user. The transferred data take the form of a byte table.

Application Variable

Set of application data put on the network segment which may be grouped together in communication variables (COMVs).

Association

A link created between a device configuration in the Network Configuration Tool and a rack system described in the Hardware Configuration Tool.

Bus Arbiter

In every FIP Network, one or more of the FIP devices must act as Bus Arbiter. The Bus Arbiter is the device that controls access to the FIP Network. Without a Bus Arbiter no data can be exchanged on a FIP Network.

Bus Interface Unit

A DIN-rail mounted unit that interfaces Field Control I/O modules to a FIP bus.

Bus Controller

The FIP Bus Controller is a rack-mounted PLC module that interfaces the PLC to a FIP bus or busses.

Bus Controller Status Bits

An 80-bit status area in the PLC reference table for Bus Controller, network, and channel status data. The location of this status area is assigned during hardware configuration of the Bus Controller.

Bus Scan

The FIP Bus Scan involves the constant repetition of the FIP macrocycle. The FIP macrocycle is executed by the FIP Bus Arbiter. The Series 90-70 FIP Bus Controller may be a potential Bus Arbiter in a FIP network. The macrocycle is generated by the configuration software based on the configuration of the remote devices and their associated I/O modules, and other user input.

Channel Status Bits

The Channel Status bits are bits 17-80 of the Bus Controller Status Bits. They consist of an *error* bit and a *data transfer* bit for each of the 32 potential communications channels that can be established.

COMREQ

A "Communications Request" that can be included in the application program of the Series 90-70 PLC. Many different types of COMREQs have been defined for the Series 90-70 PLC. Some COMREQs can be used to send commands from the PLC CPU to the FIP Bus Controller.

COMREQ Command Block

This structure contains information about the FIP command to be executed.

COMREQ Status Word

A selected area in Series 90-70 memory where the results of the COMREQ are placed.

COMV

COMmunication Variable. This is the unit of exchange for I/O data on a FIP network. A COMV has only one producer. It is distributed on the network and can be consumed by all the other network subscribers. A COMV carries one or several transport variables (TVAs).

Connection Point

A device is logically connected to a network segment by a connection point that corresponds to a subscriber number. Only one logical connection point is permitted per device.

Consumer

A device that consumes a system or application variable (or COMV) on the network.

Detailed Channel Status Words

This optional status data may be retrieved using the Retrieve Detailed Channel Status Command.

Fault Contacts

Logical contacts that can be included in the application program of the Series 90-70 PLC. These contacts can be used to detect fault and lack of fault conditions reported by the FIP Bus Controller.

FIP

Factory Instrumentation Protocol

Full FIP Chip

The hardware component on the Series 90-70 FIP Bus Controller that manages communications between the FIP Bus Controller and the network.

Generic Device

Term used to designate devices supporting Communication Standard EN 50170 (WorldFip profile). This includes third party devices that can be integrated into the FIP system. A generic device exchanges data only with PLCs, operating Control Stations or other generic devices. The exchange always consists of a table of bytes carried in an MPS communication variable (COMV) that is identified by the user.

Macrocycle

The set of operations that occurs during one scan of the FIP bus.

Master Device

The operating modes of a remote I/O rack are controlled by the master device to which it is attached. There is only one master device per remote I/O rack. However, there can be several remote I/O rack master devices on the same network segment.

Master Subscriber

In a FIP Network, all of the devices are also known as subscribers. One or more acts as a Master Subscriber. The Master Subscriber stores configuration files to the subscribers, controls the subscribers' operating mode, and reports faults discovered on the network.

MPS (Manufacturing Periodic Services) Exchanges

MPS is one of the application layers of the FIP network. It consists, in particular, of the notions of promptness and refresh.

The periodic MPS exchange is asynchronous if only the period of the exchange time slot is defined by the user.

The periodic MPS exchange is synchronous if the period of the exchange time slot as well as the earliest beginning moments and the latest ending moments of the time slot are defined by the user.

Network Segment

A network segment can support up to four sections interconnected by repeaters. Each section can support up to 32 subscribers, for a total of up to 128 subscribers.

Predefinition of MPS Exchanges

Default initialization rules for MPS exchanges. These rules are applied when connection points are being created and I/O modules are being added to the racks.

Privileged Correspondent (also called the Output Producer)

A privileged correspondent is the device you designate to produce all the TVAs consumed by one or more output modules or mixed modules (Inputs and Outputs) in a remote I/O rack. If you subsequently designate another producer for the TVAs consumed by an I/O module, the privileged correspondent device loses its status.

Producer

Device transmitting an application or system variable or COMV on the FIP network.

Project

Work context used to configure one or more FIP network segments.

Promptness

Promptness is a measurement of the ability to consume an MPS COMV from the network within the defined period. If the COMV is consumed within this time period, the data in the COMV is considered prompt.

Promptness Period

Every I/O Variable consumed on a FIP Network has a promptness period associated with it. This is the period of time within which the I/O Variable is expected to be broadcast and received on the FIP Network. If the I/O Variable is not received within this period of time, the data contained in the I/O Variable is marked as invalid.

Refreshment Period

Every MPS COMV produced on a FIP Network also has a refreshment period associated with it. A refreshment period is a period of time within which the COMV is expected to be updated or refreshed by the application program that produces the data. If the producer of the data does not refresh the data within the refreshment period, the COMV is marked as unrefreshed.

Remote I/O Scanner

The FIP Remote I/O Scanner is a module mounted in a remote PLC rack that interfaces the devices in that rack to a FIP bus.

Subscriber

Device connected to the FIP network.

System COMV

Communication variable transporting one or more system variables. The COMV identifier, its size and the semantics of the transported data are predefined in the network interface specification of the devices.

System Status References

Specific references in the %S memory area of the Series 90-70 PLC CPU. Some have been assigned for FIP use.

Transport Time Slot

Each MPS exchange of a COMV on the FIP network is carried out in a time slot. The time slot may be either asynchronous or synchronous.

A transport time slot corresponds to a time slot range which is periodic and phased in relation to the beginning of the Bus Arbiter cycle. In a transport time slot, a set of COMVs is transported by the network. Transport time slots are set up by the Network Configuration Tool.

TVA

Transport Variable. A TVA is the unit of exchange between two subscribers. A COMV contains 1 or more TVAs. A TVA is never divided into multiple COMVs. A TVA generally carries a table of variables manipulated by the applications supported by the devices.

COMREQ Status Codes

The tables in this appendix list the status codes that are reported in the COMREQ Status word after the execution of a COMREQ function. These codes also may appear in Word 1 of the Detailed Channel Status words.

Status Codes are a single word containing a major code in the low byte and a minor code in the high byte. The meaning of a Minor Status Code depends upon the associated Major Status Code.

Status Codes are grouped into the following tables:

- Major Status Codes
- Minor Status Codes
  - □ Minor Status Codes for Major Status Codes 05H (at Remote Server PLC) and 85H (at Client PLC)
  - □ Minor Status Codes for Major Status Code 11H (at Remote Server PLC)
  - □ Minor Status Codes for Major Status Code 14H (at Client PLC)
  - □ Minor Status Codes for Major Status Code 90H (at Client PLC)

Major Status Codes

Status Code (hex)	Description
01H	Successful Completion. (This is the expected completion value in the COMREQ Status word.)
02H	Insufficient Privilege at server PLC. For a Series 90-70 server PLC, the minor Status Code contains the privilege level required for the service request.
04H	Protocol Sequence Error. The server CPU has received a message that is out of order. *Call GE Fanuc Automation for assistance.*
05H	Service Request Error at server PLC. The minor Status Code contains the specific Status Code. See table of Minor Status Codes below.
06H	Illegal Mailbox Type at server PLC. Service request mailbox type is either undefined or unexpected. *Call GE Fanuc Automation for assistance.*
07H	The server PLC CPU Service Request Queue is full. The client should retry later. The client should wait at least 10 milliseconds before sending another service request.
0bH	Illegal Service Request. The requested service is either not defined or not supported at the server PLC. (This value is returned in lieu of the actual service request error (01h), to avoid confusion with the normal successful COMREQ completion.) *Call GE Fanuc Automation for assistance.*
11H	SRTP Status Codes at server. An error was detected at the SRTP server. See table of Minor Status Codes below.
14H	Generic Messaging or Network Diagnostics error.
82H	Insufficient Privilege at client PLC. For Series 90-70 PLC, the minor Status Code contains the privilege level required for the service request.
84H	Protocol Sequence Error. The CPU has received a message that is out of order. *Call GE Fanuc Automation for assistance.*
85H	Service Request Error at the client PLC. The minor Status Code contains the specific Status Code. See table of Minor Status Codes below.
86H	Illegal Mailbox Type. Service request mailbox type is either undefined or unexpected. *Call GE Fanuc Automation for assistance.*
87H	The client PLC CPU Service Request Queue is full. The client should retry later. The client should wait at least 10 milliseconds before sending another service request.
8bH	Illegal Service Request. The requested service is either not defined or not supported. (This value is returned in lieu of the actual service request error (01h), to avoid confusion with the normal successful COMREQ completion.). *Call GE Fanuc Automation for assistance.*
90H	Client API error. See table of Minor Status Codes below.

Minor Status Codes

Minor Status Codes for Major Status Codes 05H (Remote PLC) and 85H (Local PLC)

Status Code (hex)	Description
c105H/c185H	Invalid block state transition.
c305H/c385H	Text length does not match traffic type.
c605H/c685H	Control Program (CP) tasks exist but requestor not logged into main CP.
c705H/c785H	Passwords are set to inactive and cannot be enabled or disabled.
c805H/c885H	Password(s) already enabled and cannot be forced inactive.
c905H/c985H	Login using non-zero buffer size required for block commands.
ca05H/ca85H	Device is write-protected.
cb05H/cb85H	A comm or write verify error occurred during save or restore.
cc05H/cc85H	Data stored on device has been corrupted and is not reliable.
cd05H/cd85H	Attempt was made to read a device but no data has been stored on it.
ce05H/ce85H	Specified device has insufficient memory to handle request.
cf05H/cf85H	Specified device is not available in the system (not present).
d105H/d185H	Packet size or total program size does not match input.
d205H/d285H	Invalid write mode parameter.
d505H/d585H	Invalid block name specified in datagram.
d605H/d685H	Total datagram connection memory exceeded.
d705H/d785H	Invalid datagram type specified.
d805H/d885H	Point length not allowed.
d905H/d985H	Transfer type invalid for this Memory Type selector.
da05H/da85H	Null pointer to data in Memory Type selector.
db05H/db85H	Invalid Memory Type selector in datagram.
dc05H/dc85H	Unable to find connection address.
dd05H/dd85H	Unable to locate given datagram connection ID.
de05H/de85H	Size of datagram connection invalid.
df05H/df85H	Invalid datagram connection address.
e005H/e085H	Service in process cannot login.
e405H/e485H	Memory Type for this selector does not exist.
e905H/e985H	Memory Type selector not valid in context.
ea05H/ea85H	Not logged in to process service request.
ee05H/ee85H	Could not return block sizes.
ef05H/ef85H	Programmer is already attached.
f005H/f085H	Request only valid in stop mode.
f105H/f185H	Request only valid from programmer.
f205H/f285H	Invalid program cannot log in.
f405H/f485H	Invalid input parameter in request.
f505H/f585H	Invalid password.
f605H/f685H	Invalid sweep state to set.
f705H/f785H	Required to log in to a task for service.
f805H/f885H	Invalid task name referenced.
f905H/f985H	Task address out of range.
fc05H/fc85H	I/O configuration is invalid.
fe05H/fe85H	No privilege for attempted operation.
ff05H/ff85H	Service request has been aborted.

Minor Status Codes for Major Status Code 11H (at Remote Server PLC)

Status Code (hex)	Description
0111H	Generic SRTP error.
0211H	The PLC is inaccessible.
0311H	Reserved.
0411H	Unexpected SRTP version encountered in received message.
0511H	Unrecognized SRTP message received.
0611H	Data present in SRTP message which should not contain data.
0711H	Generic resource problem detected.
0811H	SRTP message encountered in inappropriate connection state.
0911H	Generic refusal by backplane driver to handle request.
0a11H	Recognized but unsupported SRTP message received.
0b11H	Lost transaction in server.
1411H	Request failed due to an error in the remote device. The Remote device log will have more information.
2711H	Backplane driver not initialized.
2a11H	The backplane driver could not access the PLC.
2b11H	Invalid binding on the message sent to the backplane driver.
2c11H	The message could not be sent to destination because the mailbox was not open.
2d11H	The maximum number of transfers to the destination is already taking place.
2e11H	The maximum number of transfers of this type is already taking place.
2f11H	Cannot obtain a backplane transfer buffer.
3011H	Cannot obtain resources other than backplane transfer buffers.
3111H	Connection ID or block transfer ID is not valid.
3211H	Timed out waiting for PLC CPU response.
3311H	The PLC CPU aborted the request.
3411H	An invalid message type was specified.
3511H	The specified task is not registered.
3611H	The mailbox offset specified is invalid.
3a11H	More than the allowable byte length in a single transfer.
3b11H	Bad sequence number in the request.
3c11H	Invalid command in request.
3f11H	Request failed due to error on remote device, most likely running out of Dual-Port RAM text buffers.

Minor Status Codes for Major Status Code 14H (at Client PLC)

Status Code (hex)	Description
0114H	Invalid command number
0214H	Invalid COMREQ length
1014H	invalid buffer segment selector
1114H	invalid number of records
1214H	transfer already enabled
1314H	buffer area out of range
1414H	circular buffer already in use or overlap has occurred
1514H	maximum number of LSAPs exceeded
1614H	unable to register Link Service Access Point (LSAP)
1714H	duplicate Link Service Access Point (LSAP)
2014H	circular buffer is unknown or in process of unregistering
2114H	unable to unregister Link Service Access Point (LASP)
3014H	invalid transmission mode
3114H	invalid channel number
3214H	invalid message length
3314H	unable to send message
3414H	busy – another message already being sent
7114H	Invalid format id. The format identified must be set to 1.
7214H	Invalid memory type selected for network diagnostic data.
7314H	Invalid byte memory address in area offset. This error is normally caused by specifying a %I, %Q, or %M reference that is not on a byte boundary. Valid references are %I1, %I9, %I17, etc.
7414H	Invalid command. Only the two commands (5100 and 5101) are valid.

Minor Status Codes for Major Status Code 90H (at Client PLC)

Status Code (hex)	Description
0190H	Timeout expired before transfer completed; still waiting.
0290H	Period expired before transfer completed; still waiting.
8190H	COMREQ data block too short for the command.
8290H	COMREQ data block too short for server PLC node address.
8390H	Invalid server memory type.
8490H	Invalid Program Name.
8590H	Invalid Program Block Name.
8690H	Zero server unit length is not allowed.
8790H	Server unit length is too large. (Maximum is 1024 bytes)
8890H	Invalid channel number.
8990H	Invalid time unit for period. (Maximum is 3965 hours)
8a90H	Period value is too large.
8b90H	Zero server starting address is not allowed.
8c90H	Invalid client memory type.
8d90H	Invalid server host address type.
8e90H	Invalid IP address integer value. (Must be 0-255)
8f90H	Invalid IP address class.
9090H	Insufficient TCP connection resources to do request.
9190H	Zero local starting address is not allowed.
9290H	Server host address length value is too short for server host address type.
9390H	COMREQ data block too short for Program Block name (including 0 pad).
9490H	COMREQ data block too short for Program name (including 0 pad).
9590H	Internal API error. See PLC fault table or exception log for details. This problem may occur if the FIP interface is asked to perform beyond its capacity. Try transferring less data per message or establishing fewer simultaneous connections.
9690H	Underlying TCP connection aborted (reset) by server end point.
9790H	Underlying TCP connection aborted by client end point.
9890H	The remote server has no Service Request Processor
9a90H	Response to session request did not arrive in proper order.
9b90H	Session denied by server PLC.
9c90H	Data response did not arrive in proper order.
9d90H	Data response had unexpected size.
9e90H	Unrecognized COMREQ command code.
a190H	Invalid CRS word memory type.
a290H	Failed an attempt to update the CRS word.

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