GFK-1037

GE Fanuc Manual Series 90-30

FIP Remote I/O Scanner

GE Fanuc Automation

Programmable Control Products

Series 90-30 FIP
Remote I/O Scanner

User's Manual

GFK-1037B *July 1996*

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.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

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Preface

Content of this Manual

This book is a reference to installing, configuring, and using a GE Fanuc Series 90™-30 FIP Remote I/O Scanner (IC693BEM330).

Chapter 1. Introduction: This chapter describes the FIP Remote I/O Scanner and other equipment that may be used with it.

Chapter 2. Installation: This chapter describes installation procedures for the Remote I/O Scanner and I/O Nest.

Chapter 3. Remote I/O Scanner Operation: This chapter explains how a Remote I/O Scanner interacts with the modules in its I/O Nest, how it stores data, and how it exchanges data with the system host.

Chapter 4. Using the Hand-held Programmer: This chapter explains how to use a Hand-held Programmer to read configuration data from the Remote I/O Scanner, temporarily delete a module configuration, temporarily change some parameters of I/O modules, display data, and temporarily force data.

Appendix A. Baseplate Power Supplies: This appendix gives information about the two types of baseplate power supply that may be used in an I/O Nest.

Related Publications

For more information, refer to these publications:

Series 90-30 Hand-held Programmer Manual (GFK–0402). This book provides operating instructions for the Hand-held Programmer.

Logicmaster 90 Software Reference Manual (GFK-0265). Reference manual which describes program structure and defines program instructions for the Series 90–70 PLC.

Series 90™-70 FIP Bus Controller User's Manual (GFK-1038). Reference manual for the Bus Controller, which interfaces a FIP bus to a Series 90-70 PLC.

We Welcome Your Comments and Suggestions

At GE Fanuc Automation, we strive to produce quality technical documentation. After you have used this manual, please take a few moments to complete and return the Reader's Comment Card located on the next page.

Jeanne Grimsby
Senior technical writer

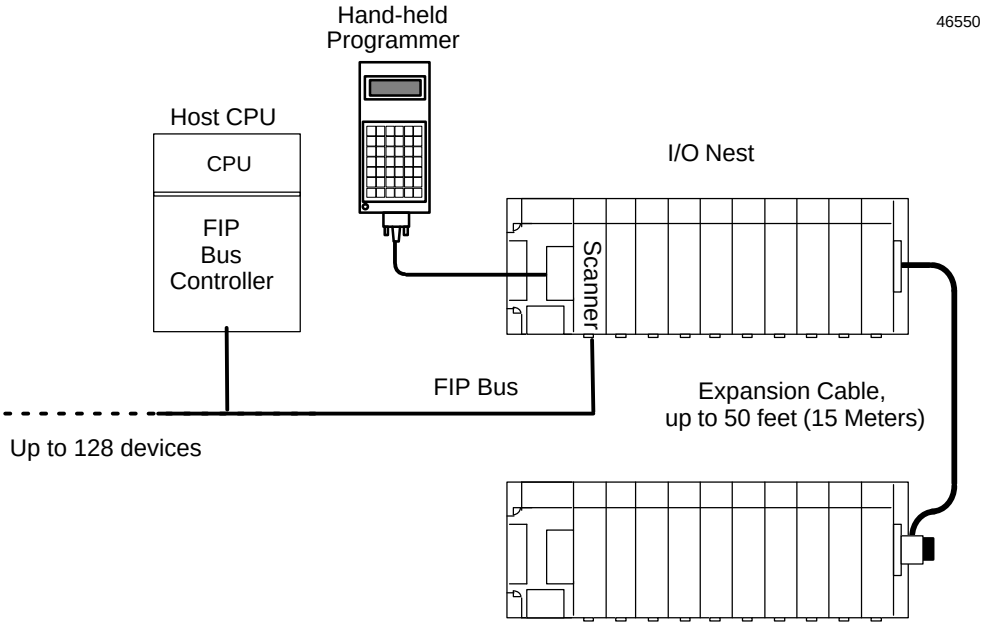
Chapter 1 Introduction

This chapter describes the FIP Remote I/O Scanner (IC693BEM330) and other equipment that may be used with it.

Overview

The FIP Remote I/O Scanner is an intelligent module that interfaces Series 90-30 I/O modules to a FIP bus. Up to 19 I/O modules can be accommodated by using two 10-slot baseplates connected by an expansion cable. Together, the Remote I/O Scanner and the modules it serves are referred to as a FIP I/O Nest. The FIP Nest can include any of the modules listed on page 1-7.

The host CPU can be any type of CPU capable of communicating on a FIP bus. A module in the host (such as a FIP Bus Controller) provides the necessary interface between the FIP bus and the host CPU.



The Series 90-30 Hand-held Programmer, which attaches to the Power Supply next to the Remote I/O Scanner, provides a convenient way to perform setup, monitoring, and control functions.

Features of the Remote I/O Scanner

The FIP Remote I/O Scanner performs the following basic functions:

- controls operation of the I/O nest in the selected mode
- scans discrete and analog I/O modules and maintains I/O scan timing
- maps I/O data to FIP application variables
- detects module and system faults and reports them to the FIP network
- permits Stand–Alone monitoring and limited configuration using Hand-held Programmer
- retains its network configuration through loss of power
- permits I/O forcing from the Hand-held Programmer
- detects and records input transitions
- supports FIP messaging services
- responds to an external synchronization signal
- can provide blinking or pulsed outputs
- can provide input filtering and chatter detection

FIP Bus Interface

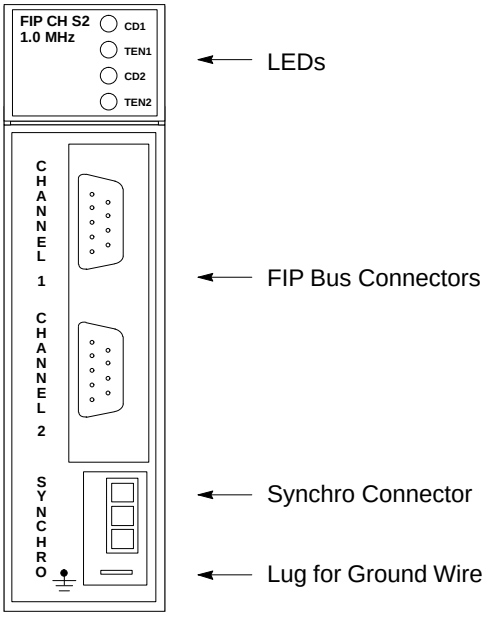
The Remote I/O Scanner communicates at a data rate of 1MHz.

The Remote I/O Scanner has two 9–pin male D connectors for redundant FIP bus cables (see next page).

There are two versions of the FIP communications standard: FIP and WORLD FIP. A DIP switch on the module is used to select the version that will be used by the Remote I/OScanner. (The same communications method will then be used on both bus cables).

Module Description

The FIP Remote I/O Scanner is a standard Series 90–30 PLC module that plugs easily into the rack backplane.



Connectors

The front of the module has the following connectors:

CHANNEL 1
CHANNEL 2 9–pin male D connectors for two FIP bus cables. A bus may be disconnected from the module without disturbing the continuity of the bus. The second bus is a backup for the first bus; its use is optional.

SYNCHRO Connector for a FIP synchronization cable. It requires a mating connector such as Molex/Waldom #39–01–4 0381.

(ground) The lug below the Synchro connector is used for the module ground wire (provided). The other end of the ground wire must be connected to the mounting bolt on the lower left corner of the baseplate and to chassis ground.

LEDs

There are two pairs of LEDs at the top of the module. The upper pair is for channel 1 and the lower pair is for channel 2. Page 2-11 explains LED operation in more detail.

CD1/CD2 the green Carrier Detected LEDs indicate the presence of a carrier-detect signal on their respective channels.

TEN1/TEN2 the red Transmission Enabled LEDs indicate the module is generating transmissions on their respective channels.

For more information, please see:

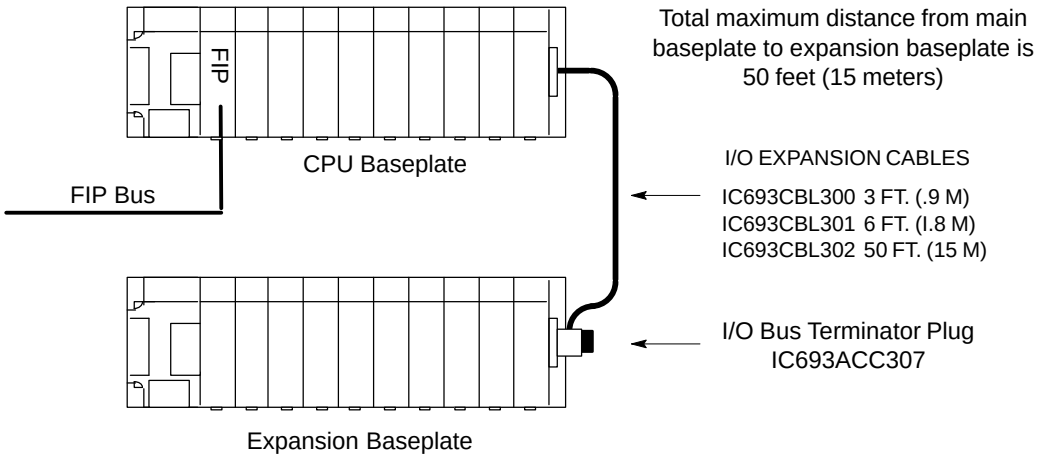
The *FIP Bus Controller Manual* for information about bus installation and operation.

FIP Remote I/O Scanner Specifications

Climatic Operating Conditions	
Ambient Air Temperature	0 C to 60 C
Relative Humidity	5% to 95% non-condensing
Atmospheric Pressure	80 kPa to 108 kPa
Mechanical Operating Characteristics	
Vibration	IEC 68–2–6 Fc
Electric Environmental Operating Conditions	
IEC 801.2	8 kV (air). Unused FIP bus connector must be covered by anti-static cap, such as DCC12. 4 kV (contact)
IEC 801.3	10V / m
IEC 801.4	1 kV peak
IEC 801.5	2 kV peak (12 ohm)
EN55011 (radiation)	CISPR 11
Storage and Transport Characteristics	
Storage Temperature	–40 C to 85 C
Relative Humidity	5% to 95% non-condensing
Atmospheric Pressure	66 kPa to 108 kPa
Vibration	IEC 68–2–6 Fc
Free Fall	250 mm
Data Rate	1 Mbit / sec
Protocol	FIP / World FIP
Bus Address	0 to 127 decimal / 0 to 7F hex
Current Required from 5V Bus	609 mA

Parts of a FIP Nest

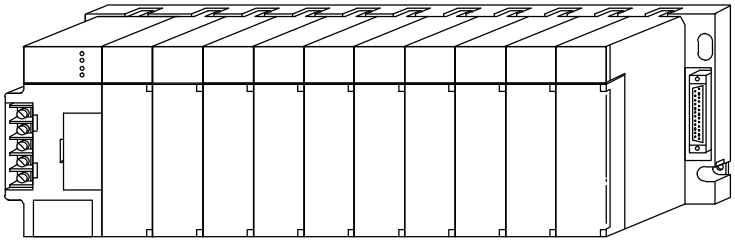
A FIP nest may consist of either one or two ten-slot or five-slot baseplates. With two ten-slot baseplates, the FIP Remote I/O Scanner can control up to 19 I/O modules.



The Remote I/O Scanner is installed on the first (CPU) baseplate. An Expansion baseplate may be connected to the CPU baseplate using an expansion cable up to 50 feet (15 Meters) in length.

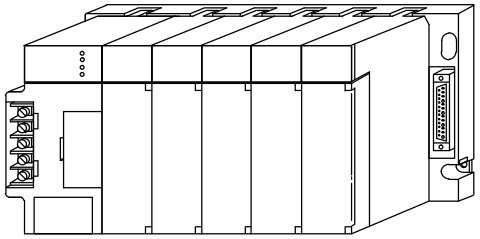
Ten-Slot Baseplates with Modules

The ten-slot CPU baseplate can accommodate the FIP Remote I/O Scanner and up to nine I/O modules. A ten-slot Expansion Baseplate can accommodate ten I/O modules.



Five-Slot Baseplates with Modules

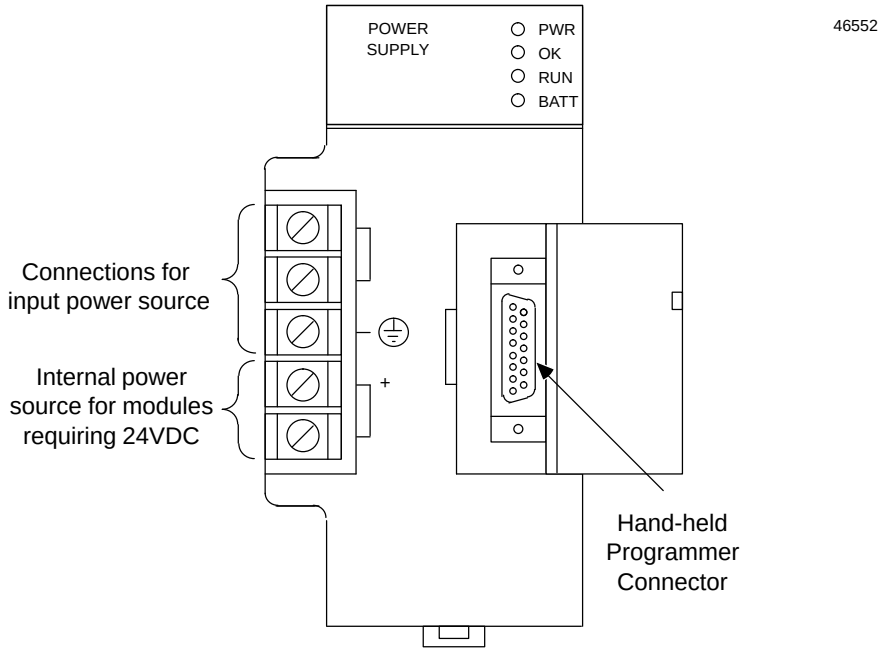
The five-slot CPU baseplate can accommodate the FIP Remote I/O Scanner and up to four I/O modules. A five-slot Expansion Baseplate can accommodate five I/O modules.



Power Supplies

Each baseplate requires its own Power Supply module. Two power supplies are available:

- 120 / 240VAC or 125 VDC input, 30W total output
- 24 / 48 VDC input, 30W total output



Both versions provide +5 VDC output, +24 VDC relay power output for circuits on Output Relay modules, and an isolated 24 VDC output. The isolated 24 VDC is used internally by some modules, and can be used to provide power for some input modules.

For More Information About Power Supplies:

Appendix A, *Baseplate Power Supplies*, gives the following additional information:

- Load Rating, Temperature, and Mounting Position
- 120 / 240VAC or 125 VDC Input Power Supply Specifications
- 24 / 48 VDC Input Power Supply Specifications
- Estimating Power Supply Loads

Consult Appendix A to determine the I / O module capacity of your system.

Modules for a FIP Nest

The I/O Nest can include most types of standard Series 90-30 I/O modules. Compatible modules include those listed in the table below.

Description	Catalog #	Description	Catalog #
Input Simulator Module	IC693ACC300	Input 24VDC 16 Pt Pos (1 mS)	IC693MDL643
Input Analog 4 Pt Voltage	IC693ALG220	Input 24VDC 16 Pt Neg (1 mS)	IC693MDL644
Input Analog 4 Pt Current	IC693ALG221	Input 24VDC 16 Pt Pos / Neg	IC693MDL645
Input Analog 16 Sgl / 8 Diff Voltage	IC693ALG222	Input 24VDC 16 Pt Pos / Neg Fast	IC693MDL646
Input Analog 16 Sgl / 8 Diff Current	IC693ALG223	Input 24VDC 32 Pt Neg / Pos 20 mS	IC693MDL652
Output Analog 2 Pt Voltage	IC693ALG390	Input 24VDC 32 Pt Neg / Pos 2 mS	IC693MDL653
Output Analog 2 Pt Current	IC693ALG391	Input 5 / 12VDC Neg / Pos 32 Pt	IC693MDL654
Mixed I/O 8 In / 8 AC Out	IC693MAA550	Input 24VDC Neg / Pos 32 Pt 1 mS	IC693MDL655
Mixed I/O 8 120VAC In / 8 Relay Out	IC693MAR590	Output 12 / 24VDC 2A 8 Pt Pos	IC693MDL730
Mixed I/O 8 24VDC In / 8 VDC Out	IC693MDD330	Output 12 / 24VDC 2A 8 Pt Neg	IC693MDL731
Input 120VAC 8 Pt Isolated	IC693MDL230	Output 12 / 24VDC 0.5A 8 Pt Pos	IC693MDL732
Input 240VAC 8 Pt Isolated	IC693MDL231	Output 12 / 24VDC 0.5A 8 Pt Neg	IC693MDL733
Input 120VAC 16 Pt	IC693MDL240	Output 125VDC 2A 6 Pt Isol Neg	IC693MDL734
Input 24VAC / VDC 16 Pt	IC693MDL241	Output 12 / 24VDC 0.5A 16 Pt Pos	IC693MDL740
Output 120VAC 0.5A 12 Pt	IC693MDL310	Output 12 / 24VDC 0.5A 16 Pt Neg	IC693MDL741
Output 120 / 240VAC 1A 8 Pt	IC693MDL330	Output 12 / 24VDC 1A 16 Pt Pos Fuse	IC693MDL742
Output 120VAC .5A 16 Pt	IC693MDL340	Output 12–24VDC 32 Pt Neg Logic	IC693MDL750
Output 120 / 240VAC 2A 5 Pt Isolated	IC693MDL390	Output 12 / 24VDC 32 Pt Pos Logic	IC693MDL751
Input 24VDC 8 Pt Pos Logic	IC693MDL630	Output 5 / 12 / 24 (TTL) 32 Pt	IC693MDL752
Input 125VDC 8 Pt Neg / Pos Logic	IC693MDL632	Output 12–24VDC 32 Pt Pos Logic	IC693MDL753
Input 24VDC 8 Pt Neg Logic	IC693MDL633	Output Relay 4A 8 Pt Isolated	IC693MDL930
Input 24VDC 8 Pt Neg / Pos Logic	IC693MDL634	Output Relay 8A 4 / 4 Form B / C Isol	IC693MDL931
Input 24VDC 16 Pt Pos Logic	IC693MDL640	Output Relay 2A 16 Pt	IC693MDL940
Input 24VDC 16 Pt Neg Logic	IC693MDL641	Mixed I/O 8 24VDC In / 8 Relay Out	IC693MDR390
Input 125VDC 16 Pt Pos / Neg	IC693MDL642		

Compatible Miscellaneous Series 90-30 Products

The following products can be included in an I/O Nest.

Description	Catalog #	Description	Catalog #
CPU Baseplate, 10-Slot *	IC693CHS391	Hand Held Programmer & Cable	IC693PRG300
CPU Baseplate, 5-Slot *	IC693CHS397	Expansion Cable: 3 ft (1 M)	IC693CBL300
Expansion Baseplate, 10-slot	IC693CHS392	Expansion Cable: 6 ft (2 M)	IC693CBL301
Expansion Baseplate, 5-Slot	IC693CHS398	Expansion Cable: 50 ft (15 M)	IC693CBL302
Power Supply 120/240 VAC 30 W	IC693PWR321	Expansion Cable: 0.5 ft (0.15 M), shielded	IC693CBL312
Power Supply 24/48 VDC 30 W	IC693PWR322	Expansion Cable: 25 ft (8 M)	IC693CBL313
Filler Module	IC693ACC310	Expansion Cable: 50 ft (15 M), shielded	IC693CBL314

* FIP Scanner can be located here

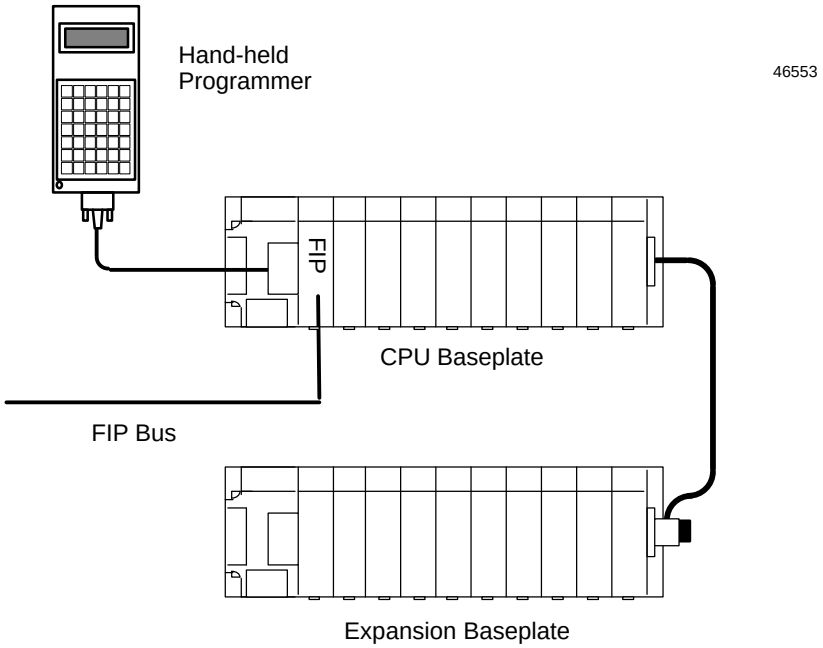
Incompatible 90–30 Products

These modules and baseplates CANNOT be used in an I/O Nest.

Description	Catalog #	Description	Catalog #
Alpha–numeric Display Module	IC693ADC311	CCM, RTU, SNP Communications	IC693CMM311
Mixed Analog 4in/2out Voltage	IC693ALG440	Base 5–slot with CPU 311	IC693CPU311
Mixed Analog 4in/2out Current	IC693ALG441	Base 5–slot with CPU 313	IC693CPU313
High Speed Counter Module	IC693APU300	Base 10–slot with CPU 311	IC693CPU321
Axis Positioning Module	IC693APU301	Base 10–slot with CPU 323	IC693CPU323
Axis Positioning Module (2 Axis)	IC693APU302	Series 90–30 CPU 331	IC693CPU331
I/O Link Module (Slave)	IC693BEM320	Series 90–30 CPU 341	IC693CPU341
I/O Link Module (Master)	IC693BEM321	PCM300, 64K	IC693PCM300
Base 10–slot Remote Expansion	IC693CHS393	PCM301, 85KB	IC693PCM301
Base 5–slot Remote Expansion	IC693CHS399	PCM311 Module, 640KB	IC693PCM311
Genius Communications Module	IC693CMM301	Ethernet Interface	IC693CMM321
Enhanced Genius Comm Module	IC693CMM302		

Hand-held Programmer

The Series 90-30 Hand-held Programmer provides a convenient portable operator interface to the Remote I/O Scanner and the I/O Nest.



The Hand-held Programmer can be used to:

- Monitor, force, and unforce I/O
- Be set for different levels of security that control the amount of read/write access available from the Hand-held Programmer. Instructions for setting the security level of the HHP are included in the *Hand-held Programmer Manual.*

For more information, please see:

Chapter 4, Using the Hand-held Programmer, which explains how to temporarily configure an I/O Nest using a Hand-held Programmer.

The ***Hand-held Programmer Manual*** for basic HHP operating instructions.

The ***FIP Bus Controller Manual*** for system configuration instructions and more detailed information about system operation.

Configuration

The FIP Remote I/O Scanner may be configured in two ways.

- temporarily with a Hand-held Programmer.
- over the FIP network.

Hand-held Programmer Configuration

A Hand-held Programmer can be used to temporarily configure I/O modules so I/O data can be monitored, forced and unforced, before the Remote I/O Scanner is operational on the FIP network.

For more information about this type of configuration see **Chapter 4, Using the Hand-held Programmer**

Network Configuration

A Network Configuration must be received before the Remote I/O Scanner can exchange I/O data on the network. Until it has a valid configuration, the Remote I/O Scanner is only capable of identifying itself on the network, then accepting the configuration supplied.

Items set up by System Configuration include.

- I/O module rack and slot locations
- Communications Variable (COMV) definitions and attributes.
- Input filtering, chatter detection, transition detection, hold last state or default state
- Output pulsing, blinking, hold last state or default state

Chapter 2 Installation

This chapter describes installation procedures for the Remote I/O Scanner and I/O Nest.

- Hardware Packaging
- Baseplate Installation
- System Grounding
- Installing the Power Supply
- Installing the Remote I/O Scanner Module
- Installing I/O Modules
- Connections to the Remote I/O Scanner
- Observing the LEDs
- Upgrading the Remote I/O Scanner

Hardware Packaging

Each module, baseplate, and prewired expansion cable is shipped in its own carton.

An expansion baseplate carton also includes an I/O bus Terminator plug, used for terminating the expansion cable. This plug is not needed if you use the prewired 50 foot (15 meter) expansion cable, which has a built-in terminating resistor.

Visual Inspection

When you receive your equipment, carefully inspect all shipping containers for damage. If you notice any damage, notify the carrier immediately. Save the damaged shipping container to show the carrier.

As the consignee, it is your responsibility to register a claim with the carrier for damage that happened during shipment. However, GE Fanuc will fully cooperate with you, if such action is necessary.

Pre-installation Check

After unpacking the equipment, record all serial numbers. These serial numbers may be required if you should need to contact Product Service during the warranty period of the equipment.

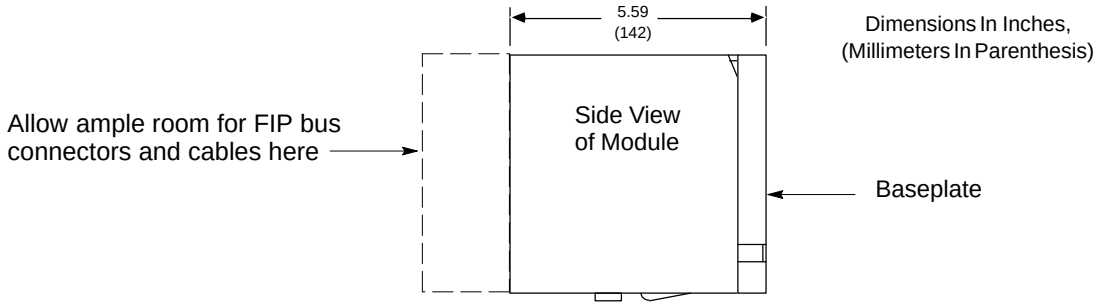
Baseplate Installation

The baseplates have standard attachment flanges for mounting on an electrical panel.

Baseplate dimensions and proper spacing are shown below.

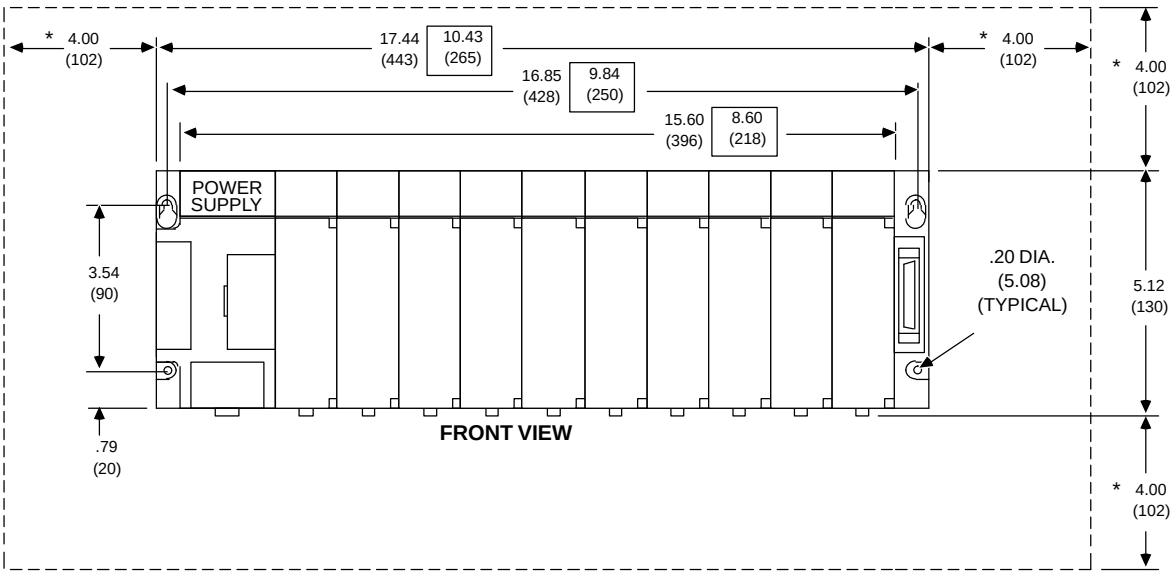
Note

Baseplates must *be mounted in the orientation shown below for proper cooling.* Mounting the baseplate on a horizontal surface may affect the power supply load rating. See appendix A for more information.



Be sure to provide enough space in front of the module to allow the FIP cables and connectors to be installed easily..

If expansion cable is used, allow about 6 inches horizontal clearance on the right side of the backplate for access to the connector.

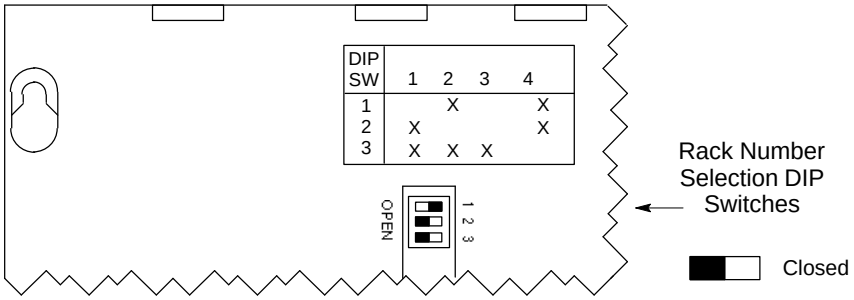


* = Allowance for cooling

= Dimensions for 5 slot rack

Checking the Rack-Number DIP Switches

An Expansion Baseplate is always designated “rack 1”. Before installing any modules on an Expansion Baseplate, check the DIP switches to be sure they are set as shown below:



Connecting the Expansion Cable

If there is an Expansion Baseplate, it must be connected to the CPU Baseplate by an Expansion Cable. The catalog numbers of prewired Expansion Cables are:

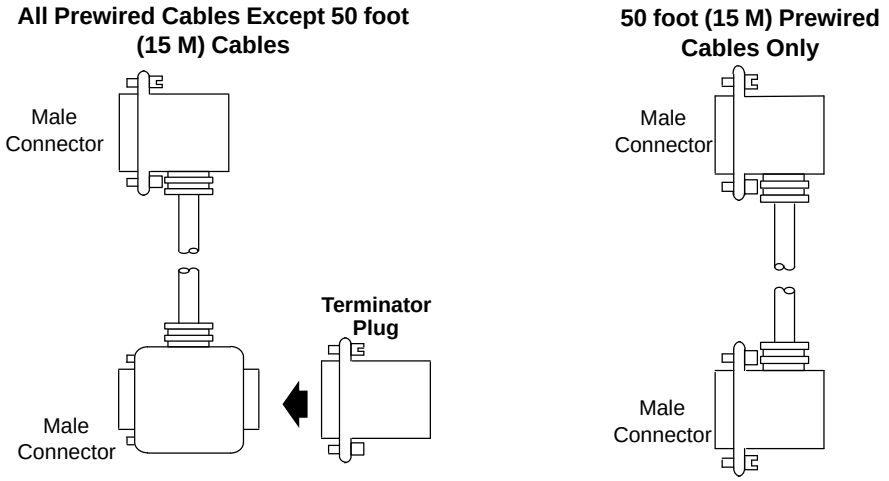
IC693CBL300 - 3 feet (1 meter)
IC693CBL301 - 6 feet (2 meters)
IC693CBL302 - 50 feet (15 meters)
IC693CBL312 - 0.5 feet (.15 meters), shielded
IC693CBL313 - 25 feet (8 meters)
IC693CBL314 - 50 feet (15 meters), shielded

Cables can be made to other lengths by following the instructions in the *Series 90-30 PLC Installation Manual*.

To connect an Expansion Cable:

1. Attach the single male connector to the right of the CPU baseplate.
2. For any cable except the 50-foot (15 Meter) prewired cables, connect the male end of the dual connector to the mating connector on the Expansion Baseplate. Attach the I/O Terminator plug (part number IC693ACC307) to the female connector.

   If you are using a 50-ft (15M) prewired cable, attach the terminated male connector to the mating connector on the expansion baseplate.



3. Make the ground connections according to the instructions on the next page. Be sure both racks are at the same ground potential.

System Grounding

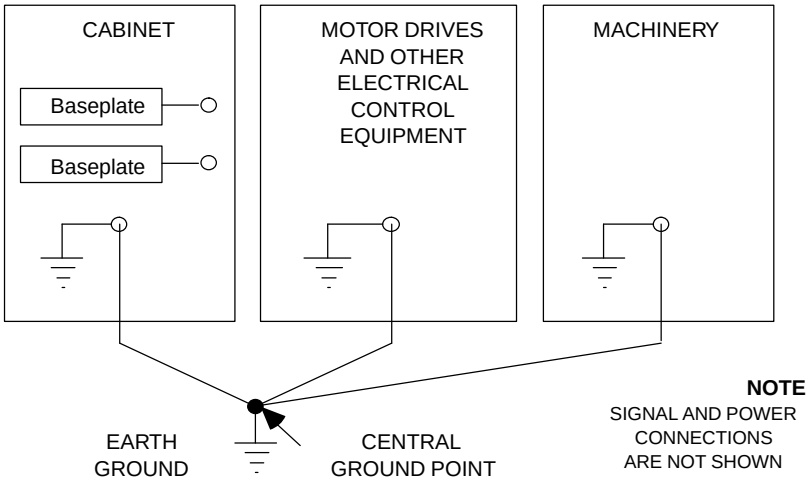
All components of a system must be properly grounded to ensure both personal safety and proper operation of the equipment.

The importance of a properly-grounded system cannot be overemphasized.

See the *FIP Bus Controller User's Manual* for recommendations on grounding a FIP network.

Ground Conductors

- Ground conductors should be connected in a tree fashion with branches routed to a central earth ground point. This ensures that no ground conductor carries current from any other branch.



- Ground conductors should be as short and as large in size as possible. Braided straps or ground cables (typically green insulation with a yellow tracer - AWG #12 (3.3 mm^2) or larger) can be used to minimize resistance. Conductors must be large enough to carry the maximum short circuit current of the path being considered.

Safety and Reference Ground

Each baseplate metal frame should be connected to earth ground. Following applicable electical safetly codes, connect a ground strap from one of the baseplate ground lugs to the control panel or cabinet. Use of a nut and star washer for each wire on the ground connection lug is recommended.

Warning

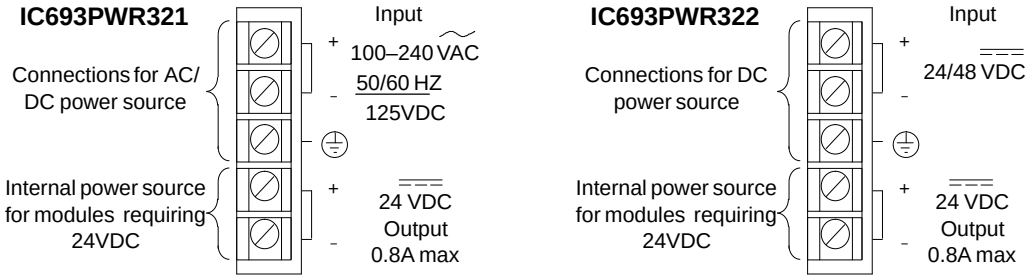
The baseplate must be grounded to minimize electrical shock hazard which may result in severe personal injury.

All baseplates grouped together in a system must have a common ground connection. This is very important for baseplates that are not mounted in the same control cabinet.

Installing the Power Supply

Install the appropriate power supply in the leftmost slot of each baseplate.

Connections for power supply wiring are shown below.



Power Supply vs. Temperature Considerations

The normal load rating of the power supply at 60°C (140°F) is 100% when a baseplate is mounted in its normal upright position on a panel. Power supply load ratings with the baseplate mounted horizontally are:

- temperature at 25°C (77°F) - full load
- temperature at 60°C (140°F) - 50% of full load

DC Power Source Connections to the Power Supply

The DC power source can be from 18 to 56 VDC for the 24/48 VDC supply or 100 to 150 VDC for the 125 VDC supply.

Connect the + and – wires from the power source to the top two protected terminals on the terminal board (+ to the top terminal, – to the second terminal).

Warning

If the same DC power source is used to provide DC power to other baseplates, be sure the DC input connections are identical at each rack.

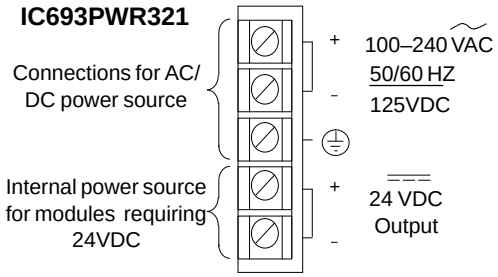
Do not cross the Positive (+) and Negative (–) lines. A resulting difference in potential can injure personnel or cause damage to equipment.

+24 VDC Output

The bottom two terminals on the Power Supply can be used (within the power limitations of the supply) to provide 24VDC power for input circuits.

AC Power Source Connections to the Power Supply

An AC power source must be within the range of 100VAC to 240VAC at 50 / 60 Hz. The 120 VAC supply can range from 90 to 132 VAC, and the 240 VAC supply can range from 180 to 264 VAC. No jumper is required for selection of power source voltage.



The power supply terminal board accepts one AWG #14 (2.1 mm^2) or two AWG #16 (1.3 mm^2) copper 75° C (167° F) wires. Each terminal can accept solid or stranded wires, but the wires for any given terminal should be the same type. The suggested torque for the power supply terminal board is 12 in-lbs.

Be sure the power cord plug has the correct pin configuration for 100 VAC or 240 VAC.

1. Open the door protecting the terminal board.
2. Make the power connections to the upper two terminals on the terminal board:
   A. for 100VAC nominal input connect the hot (L1, black) and neutral (N, white) wire.
   B. for 240 VAC nominal input, connect L1 and L2 of a three-wire AC power cord.

Warning

If the same power source is used to provide AC power to other baseplates in the system, ensure that all AC input connections are identical at each rack. Do not cross Line 1 (L1) and Line 2 (L2). A resulting difference in potential can injure personnel or cause damage to equipment.

3. Connect the safety ground wire (green wire) to the center ground terminal.
4. Carefully reinstall the protective cover plate.

Warning

During normal operation with an AC power source either 120 VAC or 240 VAC is present on the AC Power Supply. The cover protects against accidental shock hazard which could cause severe or fatal injury to the operator or maintenance personnel.

Power Supply Line Filter for AC Power Supply

The Remote I / O Scanner and its associated hardware components have been designed for use in industrial applications which are, in general, exempt from FCC requirements. The AC Power Supply may not comply with FCC requirements in non-industrial applications for conducted EMI on AC power lines. A line filter can be added in series with the AC power line, to satisfy the FCC requirements for non-industrial applications. A suitable line filter that will satisfy the FCC requirements for non-industrial applications is available from GE Fanuc as part number 44A720084-001. For more information about this filter, see the *Series 90-30 Installation Manual* (GFK-0356).

Installing the Remote I/O Scanner Module

The FIP Remote I/O Scanner Module must be installed in the slot next to the Power Supply of the CPU baseplate.

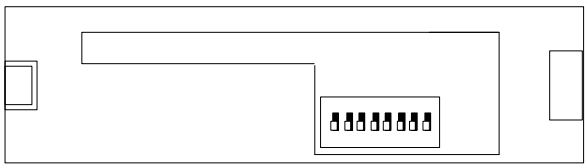
Caution

Rack power should be OFF when installing or removing the module.

Setting the Board Address DIP Switch

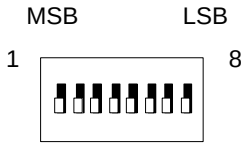
Before installing the Remote I/O Scanner, it may be necessary to set its address-selection DIP switches.

Back of Module



Switch positions are numbered 1 through 8. Switch 1 selects FIP or World FIP protocol, as shown in the table below.

Set switches 2 through 8 to represent a board network address from 0 to 127 (decimal).

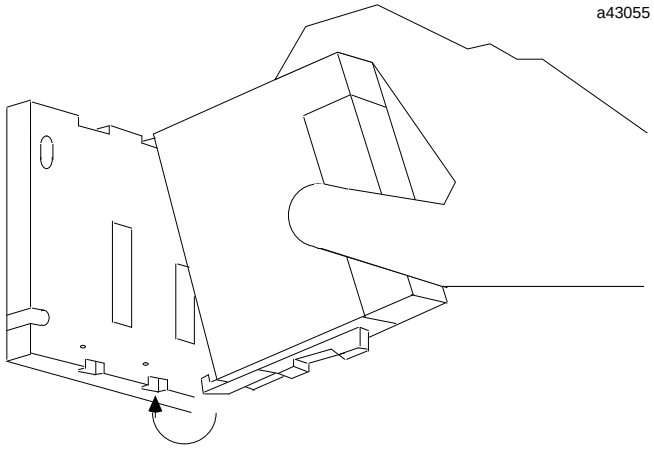


" (up, away from board) = 0
(down, toward board) = 1

Switch 1	Switches 2 to 8							Address Represented
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
# FIP = 1 " World FIP = 0	"	"	"	"	"	"	"	0
	"	"	"	"	"	"	#	1
	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.
	#	#	#	#	#	#	#	127

Installing the Remote I/O Scanner on the Baseplate

1. Grasp the module with the front cover toward you and the rear hook facing away from you.
2. Align the module with its intended slot and connector. Tilt the module upward so that its top rear hook engages the slot on the baseplate.
3. Swing the module downward until the connectors mate and the locking lever on the bottom of the module snaps into place, engaging the baseplate notch.



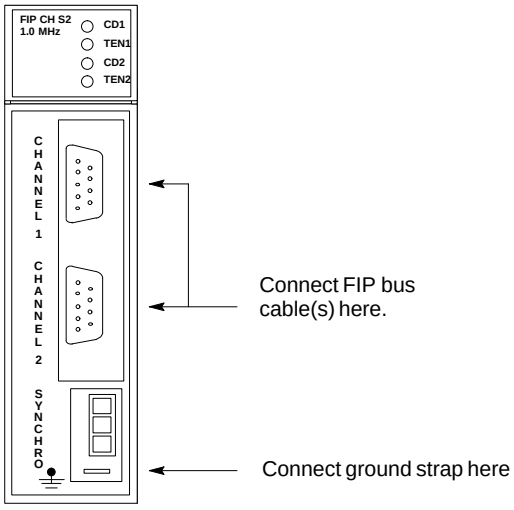
Installing I/O Modules

Install I/O modules on the baseplate as shown at the top of the page. Refer to the *I/O Modules User's Manual* for information about completing field wiring to the I/O modules.

Connections to the Remote I/O Scanner

Connecting the FIP Bus

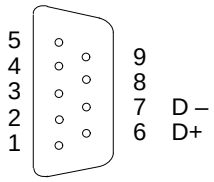
Attach FIP bus cable(s) to the connectors on the front of the module.



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.

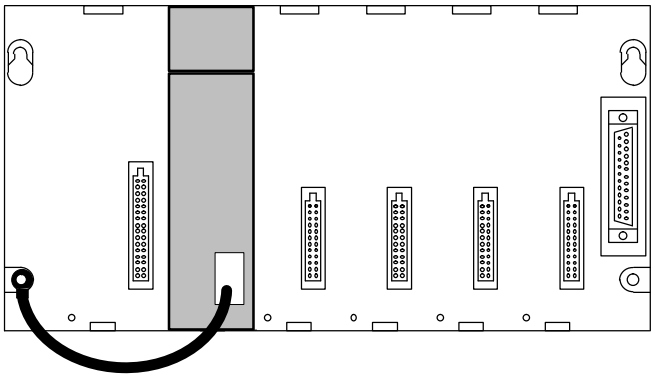
Pin Assignments for the FIP Bus Connectors

The diagram below shows pin assignments for both of the FIP bus connectors on the front of the Remote I/O Scanner.



Attaching the Module Ground Strap

Attach the grounding strap to the spade connector on the front of the module (see illustration below for location), and to the baseplate's lower left mounting screw.

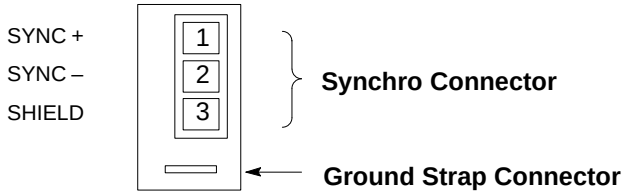


Attaching the Synchro Cable

The Synchro signal can be used to synchronize the timing information used by all FIP I/O components on the network. If used, the Synchro cable attaches to the lower connector on the front of the module. The mating connector for the Synchro cable should be Molex/Waldom #39-01-4031 or an equivalent connector.

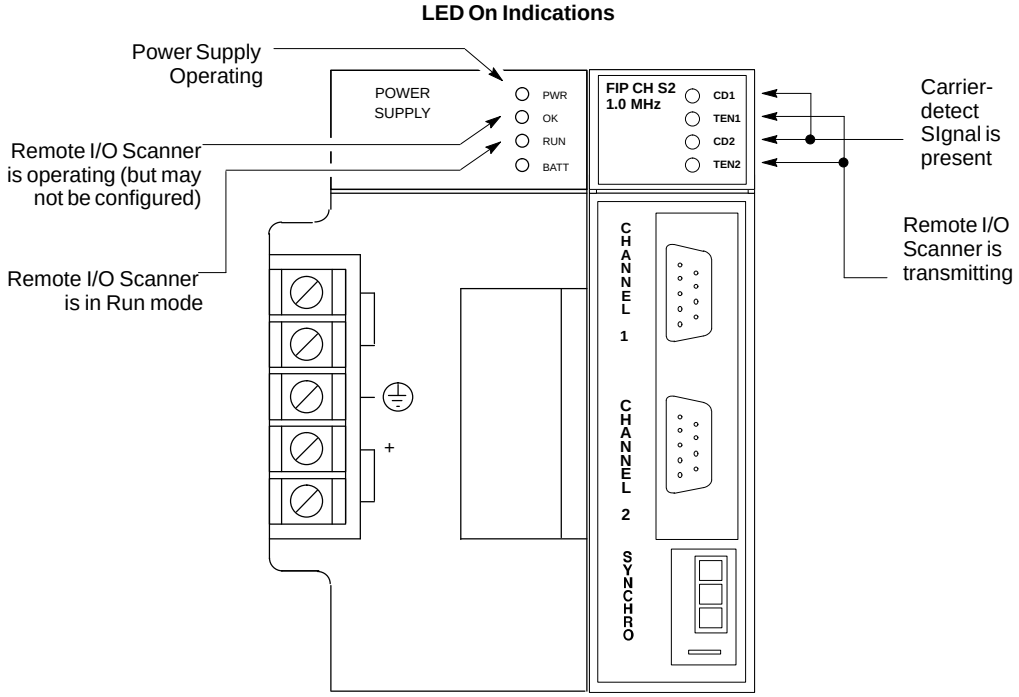
Pin Assignments for the Synchro Cable Connector

The diagram below shows pin assignments for the Synchro connector.



Observing the LEDs

When power is applied, the LEDs on the Remote I/O Scanner and the Power Supply on the CPU baseplate indicate operating status. The Remote I/O Scanner controls the OK and RUN LEDs on the CPU baseplate Power Supply.



Power Supply LEDs on the CPU Baseplate

PWR: Indicates correct operation of the Power Supply.

OK: Goes on when the Remote Scanner passes its powerup diagnostics. This LED stays on unless a backplane failure or Remote I/O Scanner failure occurs. Note that this LED does NOT indicate whether or not the Remote I/O Scanner has been configured.

RUN: This LED is on when the Remote Scanner is in its running mode. On an expansion rack, the Run LED is on whenever the OK LED is on in the main rack and the power supply of the expansion rack is also on.

BATT: The Battery Status LED is not used. It is always off.

If there is an Expansion Baseplate, its PWR and OK LEDs come on as soon as the Expansion Baseplate receives power. The RUN LEDs come on as soon as the Main Rack OK LED comes on.

Remote I/O Scanner LEDs

CD1, CD2: The green carrier-detect LEDs indicate the presence of a carrier-detect signal on their respective channels.

TEN1, TEN2: The red Transmit Enabled LEDs flicker rapidly when the module is generating transmissions on their respective channels.

Upgrading the Remote I/O Scanner

To upgrade the Remote I/O Scanner firmware, connect the serial port of a personal computer to the HHP connector (on the CPU baseplate Power Supply). This requires an RS-422/RS-485 to RS-232 converter. Download the contents of the upgrade diskette to the Remote I/O Scanner, using the instructions included with the upgrade diskette.

By default, communications will be at 19.2 kBaud (8 bits/character, odd parity, one stop bit).

Chapter 3 Remote I/O Scanner Operation

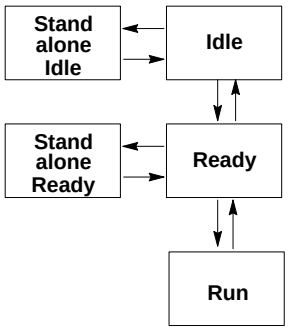
This chapter explains how a Remote I/O Scanner interacts with the modules in its I/O Nest, how it stores data, and how it exchanges data with the system host.

Operation

The primary runtime operations of the Remote I/O Scanner are to accept data from the FIP bus and pass this to the corresponding output modules and to acquire updated input data for transmission onto the FIP bus.

If a problem occurs (or is corrected) with any module or circuit, it is included in the status information regularly transmitted by the Remote I/O Scanner. Such module problems do not affect operation of the Remote I/O Scanner or its communications on the network.

Operating Modes of the Remote I/O Scanner



The Remote I/O Scanner can operate in the following modes:

- Idle Mode
- Standalone Idle Mode
- Ready Mode
- Standalone Ready Mode
- Run Mode

How Communications Affect Operating Mode

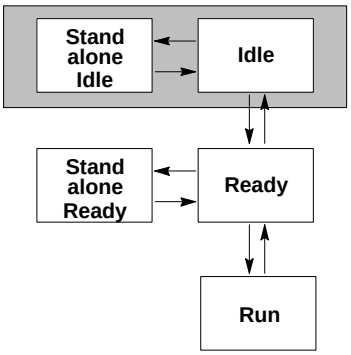
The operating mode of the Remote I/O Scanner depends on whether or not it is communicating with the FIP network.

A. If it is communicating with the FIP network, the Remote I/O Scanner may be commanded by the network controller to operate in Idle, Ready, or Run mode. An HHP may be used to change the operating mode from Ready to Standalone Ready and back.

B. If a FIP network is not present, the Remote I/O Scanner remains in Idle mode at powerup. A Hand-held Programmer may be used to change the operating mode from Idle to Standalone Idle and back.

C. If a FIP network is present but communications between the Remote I/O Scanner and the network controller have been lost, the Remote I/O Scanner returns from Run mode back to Ready mode. The Hand-held Programmer may be used to change the operating mode from Ready to Standalone Ready and back.

Idle Mode



In Idle mode, the Remote I/O Scanner can indicate its presence on the FIP bus, but it cannot exchange I/O data.

There are two sub-types of Idle mode: Idle mode and Standalone Idle mode. Both are described below.

Idle Mode

The Remote I/O Scanner is in Idle mode after it is powered up, but when no configuration or mode change commands have been received from the network. During normal operation, the Remote I/O Scanner is only in Idle mode during the first few seconds after powerup. If a FIP network controller is not present, the Remote I/O Scanner remains in Idle mode. In Idle mode:

- password protection is level 4.
- the Remote I/O Scanner scans I/O modules for identification information and input data only: all outputs remain off.
- the I/O default data and, if force retention is enabled, the force conditions are recovered from non-volatile memory for later use.
- all I/O validator data is set to "invalid".
- a Hand-held Programmer can be used to monitor I/O and validators and module configuration.
- The Remote I/O Scanner can receive a system configuration from the FIP network. No forcing via FIP messages is permitted.

After receiving a system-level configuration the Remote I/O Scanner can be commanded (from the network) to go to Ready mode. If a Hand-held Programmer is attached and the **MODE** and **#** keys are pressed simultaneously, the Remote I/O Scanner goes to Standalone Idle mode instead.

Standalone Idle Mode

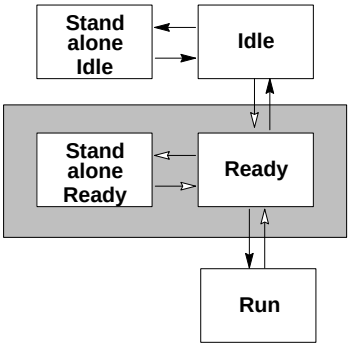
In Standalone Idle mode:

- The Remote I/O Scanner ignores any messages from the FIP network.
- HHP communications are permitted at 9600 baud.
- default password protection is set to level 4.
- limited configuration changes may be entered from a Hand-held Programmer. Configurable features are the rack and slot locations of I/O modules and discrete input module filter values.
- I/O data may be monitored and/or forced, The Remote I/O Scanner scans default and/or forced data to all installed I/O modules. Scanning is independent of FIP network activity.

Standalone Idle mode may be exited by pressing the **MODE** and **#** keys on the Hand-held Programmer simultaneously. **At that time, the Force table is again cleared and all outputs are set to zero.**

Ready Mode

The Remote I/O Scanner goes to Ready mode when a system-level configuration has been received.



There are two subtypes of Ready mode: Ready mode and Standalone Ready mode.

Ready Mode

In Ready mode:

- the Remote I/O Scanner waits for permission to enter Run mode from the FIP network controller.
- default password protection is level 2.
- a Hand-held Programmer can be used to monitor I/O and validators and module configurations.
- configuration can NOT be changed by a Hand-held Programmer.
- the Remote I/O Scanner scans I/O in accordance with the configuration it received from the FIP network. If it was previously in Idle mode, any unforced outputs are set to 0.
- the Remote I/O Scanner accepts forcing information from the network.

The Remote I/O Scanner can be commanded (from the network) to go to Idle mode for reconfiguration or it may be commanded to go to Run mode.

Standalone Ready Mode

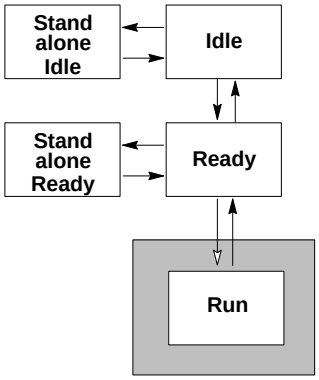
If the Remote I/O Scanner is in Ready mode with a Hand-held Programmer attached and the HHP **MODE** and **#** keys are pressed simultaneously, the Remote I/O Scanner goes to Standalone Ready mode. In Standalone Ready mode:

- The Remote I/O Scanner ignores any messages from the FIP network.
- HHP communications are permitted at 9600 baud.
- default password protection is set to level 2.
- I/O data may be monitored and/or forced, The Remote I/O Scanner scans default and/or forced data to all of the installed I/O modules. The scanning is independent of FIP network activity.

Standalone Ready mode may be exited by pressing the **MODE** and **#** keys on the Hand-held Programmer simultaneously. **Upon exiting, any forces that have been applied with the Hand-held Programmer remain in effect.**

Run Mode

In Ready mode, when the Remote I/O Scanner receives a command to do so, it goes to Run mode. In Run mode:



- all configured modules are operational
- data is communicated to and from the FIP network.
- default password protection is level 2.
- the Remote I/O Scanner scans I/O in accordance with the configuration it received from the FIP network.
- the Remote I/O Scanner generates and observes validators.
- the Remote I/O Scanner can communicate fully on the FIP network.
- configuration changes are not permitted.
- HHP use is not permitted.

The mode changes back to Ready upon command from the network, or if the Remote I/O Scanner loses communications.

Run Unlocked Mode

Run Unlocked mode is the same as described above, except that the Remote I/O Scanner does not check refreshment and promptness status in Run Unlocked mode.

I/O Data

The Remote I/O Scanner scans I/O modules in its I/O Nest in the same manner in which a PLC CPU scans I/O modules in the PLC. I/O updates and data types are described in detail on the following pages.

Remote I/O Scanner Data Tables

The Remote I/O Scanner stores I/O data, as well as additional data representing forced conditions and "validator" status, in separate memory areas.

Data Description	Data Type Displayed on HHP	Series 90-70 PLC Data Type	Remote I/O Scanner Data Type
discrete input states	I	%I	IF
discrete output states	Q	%Q	QF
analog input values	AI	%AI	AIF
analog output values	AQ	%AQ	AQF
discrete input validators	IV	Fault / No Fault Contacts	IVF
output validators	QV		QVF
analog input validators	AIV		AIVF
analog output validators	AQV		AQVF
unforced discrete input states			I
unforced discrete output states			Q
unforced analog input states			AI
unforced analog output states			AQ
unforced discrete input validators			IV
unforced discrete output validators			QV
unforced analog input validators			AIV
unforced analog output validators			AQV

In the Remote I/O Scanner, the I/O state and validator tables contain the actual input and output data. The unforced I/O state and validator tables contain the same information as in the actual I/O state and validator tables, except that they reflect the states and validators without regard to the effect of applied forces.

Displaying Data with a Hand-held Programmer

The Hand-held Programmer can read data directly from the Remote I/O Scanner. If the Remote I/O Scanner is in Standalone Idle or Standalone Ready mode, the Hand-held Programmer can also force the states of I/O data. Validators are forced to "valid" for forced inputs.

Synchronous or Non-synchronous Scanning

I/O scanning for the devices on the network may be set up in the Network Configuration as synchronous. Synchronous operation means that devices on the network are capable of maintaining a local time and date which is coherent with a system clock. Scanning is referenced to the network timing as described below.

To use this feature, the Remote I/O Scanner must be connected to other devices and to a system clock pulse source by a cable that attaches to the Synchro terminals on the front of the module.

Updating the Remote I/O Scanner Time and Date

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 according to this new time and date information.

The frequency with which the time and date information is sent to the Remote I/O Scanner is set up in the Network Configuration.

Frequency of Synchro Pulse

The frequency of the Synchro pulse is called its "periodicity". Periodicity is also set up in the Network Configuration. The periodicity range is 1 second to 10 seconds.

Status Information Sent to the CPU

If the Remote I/O Scanner does not receive a new time-and-date message or detect a Synchro pulse within the configured period, it keeps operating using the existing time and date. However, it notifies the CPU that it is using the "non-synchronous" time and date by setting a bit in the status information (described later in this chapter).

Discrete Inputs

The Remote I/O Scanner has the following discrete input tables:

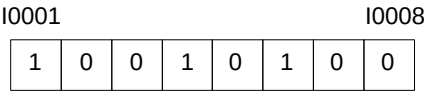
I	discrete input states
IV	discrete input validators
IF	force applied: discrete inputs
IFV	force applied: discrete input validators

The Remote I/O Scanner processes input data as described below.

1. the Remote I/O Scanner scans input and I/O modules in the I/O Nest and then places discrete input data in its discrete input table

   Example:

   The Remote I/O Scanner reads the inputs configured to use I0001 through I0008 during its input scan. It places the data into its discrete input table:

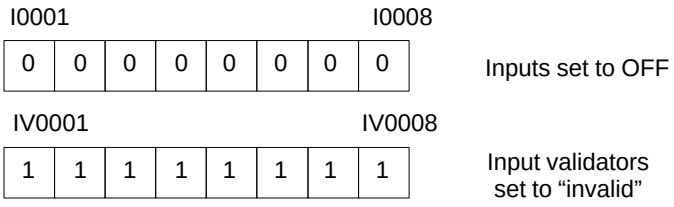
   

   If set up by the Network Configuration, the Remote I/O Scanner may also process inputs for filtering, chatter detection, and time-stamping. See page 3-9.

2. if the Remote I/O Scanner detects a module fault while reading the input data, it defaults all inputs for that module to the configured on/off or last state, and marks them as "invalid" by setting to the input validator (IV) locations associated with those inputs.

   Example:

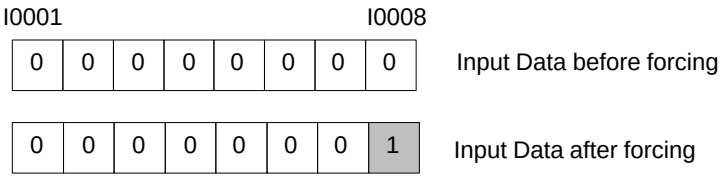
   If the module supplying inputs I0001 through I0008 is configured to default inputs OFF, and the module is subsequently removed, the Remote I/O Scanner sets its inputs OFF and also sets the corresponding input validator data:

3. Discrete inputs may be forced. The Remote I/O Scanner sets the corresponding inputs in the input table. When a force is removed, the input table displays the normal data following the next I/O scan.

   Example:

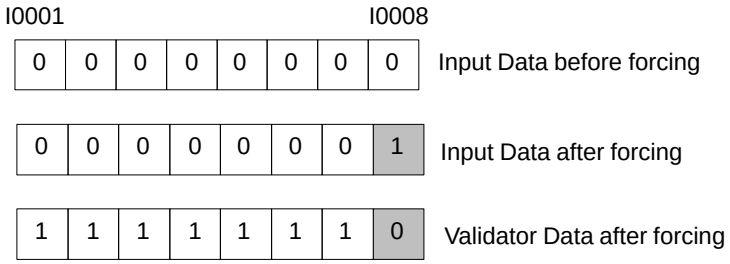
   The HHP is used to force input I0008 to 1.

4. When you force the state of a point, the Remote I/O Scanner also forces the corresponding validator (IVF) to the valid state.

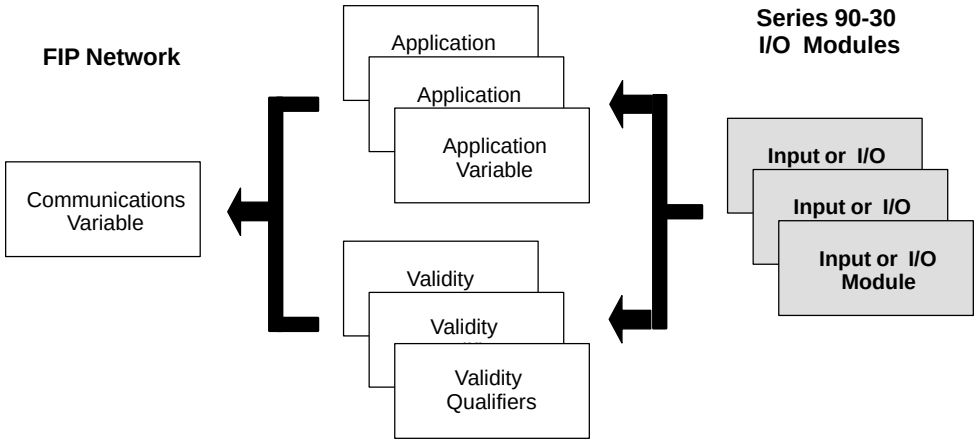
Example:

When the HHP forces input I0008, the input validator is also forced.



Input Data Sent on the Bus

The Remote I/O Scanner treats the data acquired from each Input or Input/Output module as an "application variable". It combines these (input) application variables into one or more Communications Variables (COMVs). It periodically transmits these COMVs on the FIP Network.



The Remote I/O Scanner honors requests for input data even when it is invalid (e.g. the corresponding input module has been removed). By monitoring the validity data, the host can know whether the data it receives from the Remote I/O Scanner is real or defaulted input data.

Optional Input Processing

If set up by Network Configuration discrete inputs can be processed for filtering, chatter detection, and time-stamping. These features are described below.

Filtering

A discrete input module or mixed I/O module can be configured for input filtering. In the Network Configuration, 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.

Chatter Detection

Individual input circuits can be set up in the Network Configuration as chattering inputs. The Remote I/O Scanner processes all chattering inputs on a module identically. This processing occurs after the inputs are filtered (see above). The Network Configuration specifies a time period which is a multiple (0, 100, 1000, or 10,000) of the 10 mS acquisition rate. It also defines the number of transitions that must occur during the selected time period before the input is considered to be chattering. 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.

Time-Stamping

Individual input circuits and/or their validators can be set up in the Network Configuration for time-stamping. If an input set up for time-stamping changes after filtering, the Remote I/O Scanner supplies the time and date of the change to the host.

The format for the time and date stamp and for the State Change message to the host are defined in the FIP Standard.

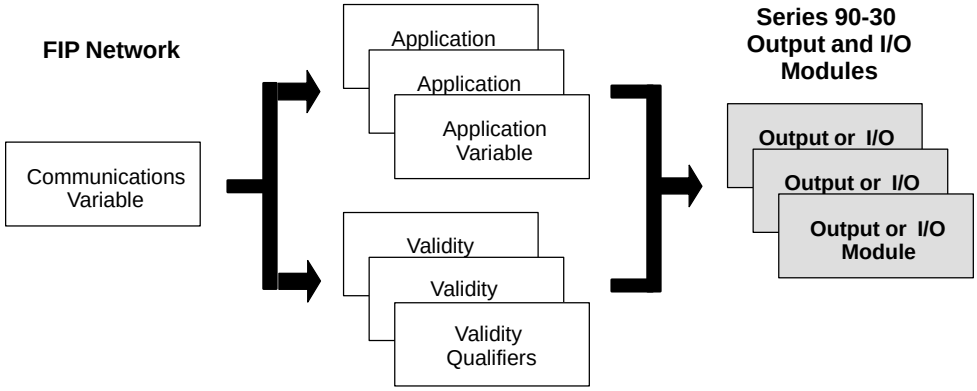
Discrete Outputs

The Remote I/O Scanner has the following discrete output tables:

Q	discrete output states
QV	discrete output validators
QF	force applied: discrete outputs
QVF	force applied: discrete output validators

The Remote I/O Scanner processes output data as described below.

1. The Remote I/O Scanner periodically receives Communications Variables (COMVs) containing discrete output data. The content of these COMVs may depend on the system host.



2. The Remote I/O Scanner places the output data into its discrete output table. Outputs that are set up as pulsed outputs or blinked outputs are handled differently, as explained on a later page.

Example:

The Remote I/O Scanner receives output data from the host, including outputs Q0009 through Q0016. It places those outputs into its discrete output table as illustrated below:

Q0009							Q0016
0	0	1	1	0	1	1	1

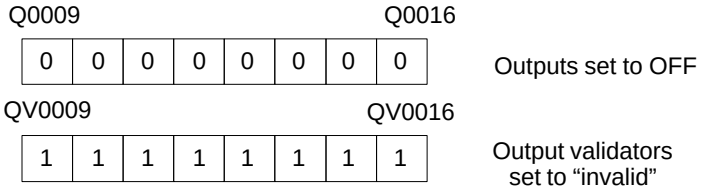
3. The Remote I/O Scanner checks the corresponding validity data to determine whether or not the output data received from the host is valid.

   The specific way output validators are set may depend on the system host. The Remote I/O Scanner sets output validators if it doesn't receive output data from the FIP bus during a specified period of time.

   If an output validator is set to invalid, the Remote I/O Scanner discards the actual output data and sets the corresponding output to OFF or holds their last state (as configured).

Example:

If the host stopped sending outputs, the Remote I/O Scanner could set all discrete outputs to off (as shown here) or to their last state, and also set the corresponding output validator data:

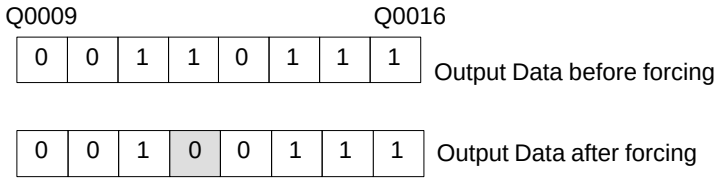


4. The Remote I/O Scanner passes outputs (either actual outputs or outputs that are defaulted) to the output modules.

5. If outputs are forced, the forced state becomes the state of the output circuit. The Remote I/O Scanner sets the corresponding outputs in the output force (QF) table.

Example:

The HHP is used to force output Q0012 to 0.

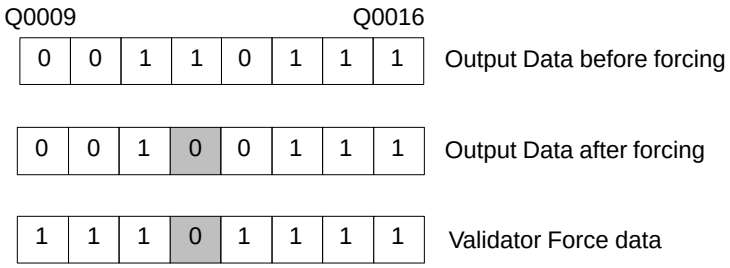


When a force is removed, the data in the corresponding I/O table displays the normal data following the next I/O scan. Outputs retain an up–to–date processed value, which is used whenever the forced value is removed.

6. When you force the state of a point, the Remote I/O Scanner also forces the corresponding validator (QVF).

Example:

When output Q0012 is forced, the output validator is also forced.



Optional Output Processing

Normal/Temporizing: Each output can be set up as a normal or temporizing output. If an output is set up as temporizing, it may be configured to behave as a pulsed or delayed output as described below.

Pulsed Outputs

Individual discrete outputs can be set up in the Network Configuration to be pulsed outputs. 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 following configuration parameters.

Polarity: This parameter 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. This parameter can be individually selected for each point.

Pulse or Delay: This parameter 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. This parameter can be individually selected for each point.

Duration: If Pulse is selected (see above), this parameter defines the maximum length of the pulse. If Delay is selected, this parameter defines the delay time. The duration selection is applied to all points on the module.

Return to Zero or Non-Return to Zero: This parameter is used only if Pulse is selected. Choosing Return to Zero will cause the pulse to terminate whenever the state commanded by the CPU does back to its original state. Choosing Non-Return to Zero will cause the pulse to last for its configured duration (see item above) regardless of whether the CPU changes the output's commanded state. This parameter can be individually selected for each point.

Blinked Outputs

Individual discrete outputs can be set up in the Network Configuration to be blinked outputs. 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. Operation of blinked outputs depends on the state of the output bit itself and on the state of another bit sent by the CPU, called the blink bit. There is a unique blink bit for each blinked output. The table below shows the relationship between the state of the blink bit and the state of the output bit. A blinked output always blinks while its blink bit is set to 1. The state of the output point bit determines the rate of blinking. While the state of the output bit is 0, the physical output blinks at 0.5 Hz. While the state of the output bit is 1, the physical output blinks at 2.0 Hz.

Communications Variable		Physical Discrete Output
Blink Bit	State Bit	
0	0	0
0	1	1
1	0	2 Hz Blink
1	1	0.5 Hz Blink

Analog Inputs

The Remote I/O Scanner has the following analog input tables.

AI	analog input values
AIV	analog input validators
AIF	force applied: analog inputs
AIVF	force applied: analog input validators

The Remote I/O Scanner processes analog input data as described below (analog input modules filter data locally, so the data is already filtered when the Remote I/O Scanner reads it.)

1. The Remote I/O Scanner scans analog input modules in the I/O Nest and places analog input data in its analog input table

Example:

During the analog input scan, the Remote I/O Scanner reads the inputs configured to use AI001 through AI004. It places the inputs into its analog input table:

AI001	57143
AI002	16385
AI003	36884
AI004	1141

2. If the Remote I/O Scanner detects a module fault while reading the input data, it defaults all inputs associated with that module to their default/hold last state values, and marks them as "invalid" by setting to one the AIV locations associated with those inputs.

Example:

If the module supplying inputs AI001 through AI004 were removed and the module were configured for Hold Last State, the Remote I/O Scanner would hold the inputs for that module to their last values, and set the corresponding validators to invalid (1).

	Analog Input Data
AI001	57143
AI002	16385
AI003	36884
AI004	1141

	Validator Status
AIV001	1
AIV002	1
AIV003	1
AIV004	1

1 = invalid

3. Analog inputs may be forced. The Remote I/O Scanner sets the corresponding inputs in the analog input table, which also contains the current states of unforced inputs. When a force is removed, the input table displays the normal data following the next I/O scan.

Example:

The HHP is used to force analog input AI002 to a different value. The forced value replaces the actual value in the analog input table:

	Analog Input Data before forcing	Analog Input Data after forcing
AI001	57143	57143
AI002	16385	500
AI003	36884	36884
AI004	1141	1141

4. When you force the state of a point, the Remote I/O Scanner also forces the corresponding validator (IVF).

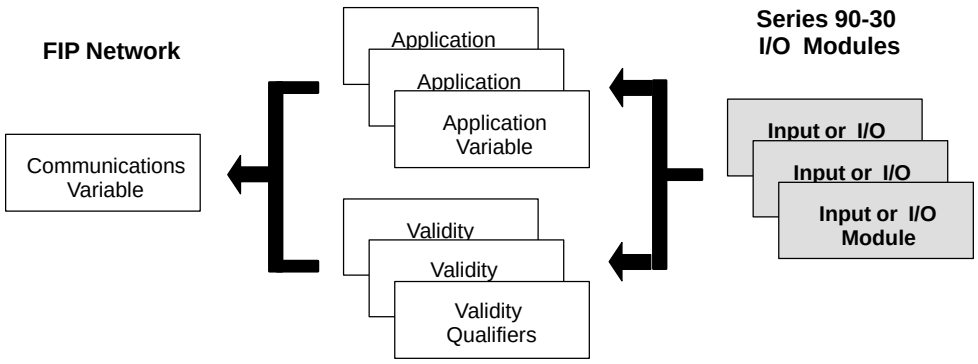
Example:

When the HHP forces input AI002 its input validator is also forced.

	Analog Input Data before forcing	Analog Input Data after forcing	Validator Status
AI001	57143	57143	1
AI002	16385	500	0
AI003	36884	36884	1
AI004	1141	1141	1

Analog Input Data Sent on the Bus

The Remote I/O Scanner combines analog input data into one or more Communications Variables (COMVs). It periodically transmits these COMVs on the Network.



The Remote I/O Scanner honors requests for input data even when it is invalid (e.g. the corresponding input module has been removed). By monitoring the validity data, the host can know whether the data it receives from the Remote I/O Scanner is real or defaulted input data.

Smart Analog Modules

In addition to the analog input data described above, "smart" analog modules (IC693ALG392 and ALG442) use 5 bytes of discrete input data, which is used for diagnostic status bits. If the first byte of this data *is not zero*, each analog input validator (AIV) for the module is set to invalid.

Analog Outputs

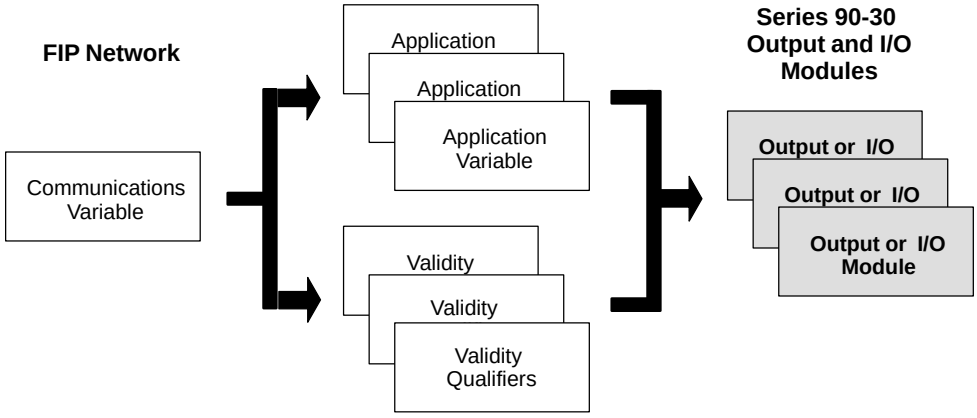
The Remote I/O Scanner has the following analog output tables.

AQ	analog output values
AQV	analog output validators
AQF	force applied: analog outputs
AQVF	force applied: analog output validators

The Remote I/O Scanner processes analog output data as described below.

1. The Remote I/O Scanner periodically receives Communications Variables (COMVs) containing analog output data.

   The content of these COMVs may depend on the system host.



2. The Remote I/O Scanner places the output data into its Analog Output table.

   Example:

   The Remote I/O Scanner receives output data from the host, including outputs AQ005 through AQ008. It places those outputs into its AQ data table as illustrated below:

AQ005	114
AQ006	72
AQ007	106
AQ008	93

3. The Remote I/O Scanner checks the corresponding validity data to determine whether or not the output data received from the host is valid.

   The Remote I/O Scanner sets output validators if it doesn't receive output data from the FIP bus during a specified period of time.

4. If output validators are set to invalid the Remote I/O Scanner defaults the output data or holds its last state, as configured.

Example:

If the host stopped sending outputs, the Remote I/O Scanner would hold all analog outputs at their last values and also set the corresponding output validator data:

	Analog Output Data		Validator Status	
AQ005	114	AQV005	1	1 = invalid
AQ006	72	AQV006	1	
AQ007	106	AQV007	1	
AQ008	93	AQV008	1	

5. Analog outputs may be forced. The Remote I/O Scanner sets the corresponding outputs in the output force (AQF) table. The forced value becomes the value of the output circuit.

Example:

The HHP is used to force analog input AQ007 to a different value. The forced value replaces the actual value in the analog output table:

	Analog Output Data	Forced Data
AQ005	114	114
AQ006	72	72
AQ007	106	75
AQ008	93	93

6. When you force the state of a point, the Remote I/O Scanner also forces the corresponding validator (AQVF) to valid.

Example:

When the HHP forces input AQ007, its output validator is also forced.

	Analog Input Data	Forced Data	Validator Status
AQ005	114	114	1
AQ006	72	72	1
AQ007	106	75	0
AQ008	93	93	1

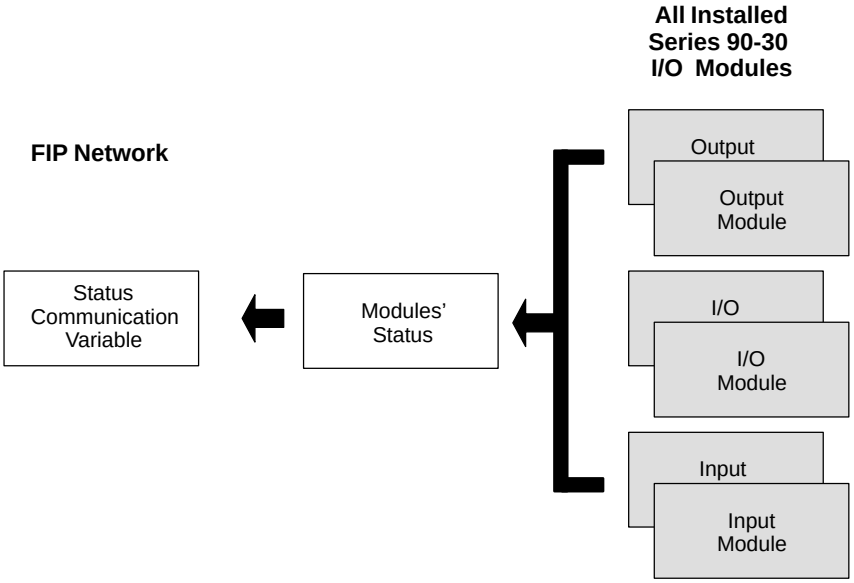
Outputs retain an up–to–date processed value, which is used whenever the forced value is removed.

Diagnostics

The Remote I/O Scanner provides status information for each I/O module in the I/O Nest. If a fault occurs, the fault is logged and the corresponding fault contact is activated. It remains activated only while the fault is in effect. After the condition that caused the fault is corrected, the Remote I/O Scanner deactivates the corresponding fault contact and resumes normal operation of the affected circuit(s).

Status Data Transmitted by the Remote I/O Scanner

The Remote I/O Scanner periodically transmits status information as a separate Communications Variable.



If a problem occurs (or is corrected) with any module or circuit, it is included in this status information. Such module problems do not affect the operation of the Remote I/OScanner, or its communications on the network.

Remote I/O Scanner Status Data Format

The format of the status (IOSTAT) COMV sent by the Remote I/O Scanner is shown below.

Offset (Byte #)	Content		Description
0 1	1 0		Remote I/O Scanner Identification
2, 3	0 to 65535		Version number
4	00 = Non-operational fault 01 = Operational: Idle 02 = Operational: Ready 03 = Operational: Running Locked 04 = Operational: Running Unlocked		Operating mode
5	**Bit**	Status Bits	
	0	Loss of FIP Status bits	Set when status bits (refreshment and promptness) associated with any consumed COMVs are invalid. Cleared when all status bits are valid.
	1	reserved	
	2	I/O are currently forced	Set when any points are forced.
	3	HHP forcing is permitted	Set when it is possible to force I/O with the HHP. Operating mode changes are not allowed.
	4	HHP password violation	Set when a password access violation occurs
	5	Configuration rejected by scheduler	Set when the most recent CONFIG_ENABLE command failed because the downloaded configuration could not be used to build a valid internal schedule table.
	6	reserved	
	7	Ready mode disconnected	Set if the I/O nest is in READY mode following disconnection of the network. Cleared as soon as a command is received regardless of whether or not the command is valid. Loss of more than two consecutive EOC in synchronous mode is also treated as disconnection of the network.
6	**Bit**	Fault Type	
	0	Blocking (fatal) fault	Always 0.
	1	Non-blocking fault	Set when any faults are detected. Cleared when none is present.
	2	I/O Scanner blocking fault	Always 0.
	3	I/O Scanner non-blocking fault	Set when the Scanning Module Fault (byte 8) is not 0.
	4	I/O module fault	Set when any I/O modules have the status: empty, discordant, user-fault, or fault.
	5–7	reserved	
7		0	

Offset (Byte #)	Content		Description
8	**Bits**	Scanning module faults	
	0	Loss of time synchronization	Set when the Remote I / O Scanner is not able to synchronize its local clock with the external clock. Cleared when synchronization with the external clock is restored.
	1	reserved	
	2	Store operation failure	Set when an error occurs during a non-volatile memory store operation. Cleared by a successful store operation.
	3	Watchdog expired	Set when a watchdog fault occurs after a transition to Idle mode. Cleared when a CONFIG_ENABLE command is received. This bit remains set until the next time the Remote I / O Scanner is commanded to go to Ready or Run mode.
	4, 5	reserved	
	6	Loss of FIP media redundaucy	Set when a redundancy error has been detected. Cleared when the redundancy is restored.
	7	Timing Fault	Set when an RTC interrupt has taken more than 10 mS to execute. Once it is set, it stays set until as new CONFIG_ENABLE command is received.
9		reserved (19)	Maximum number of I / O slots
10, etc...		I / O Slot status (*repeated for each I/O module)*. May have the following values for a Remote I / O Scanner application:	
		01 = empty	The configuration is installed, but there is not anything present in the slot even though that slot has been configured.
		02 = discordant	The configuration is installed, but the module in the slot does not match the configuration.
		04 = operational	Configuration installed, correct module is present in slot, and it is fully functional.
		05 = user fault	For a discrete input module, this bit is set when an input is chattering. For an intelligent analog module, this bit is set when a fault is reported by the module
		ff = fault (255 decimal)	Configuration is installed, correct module is present in slot, but it is not functional.

Chapter 4 Using the Hand-held Programmer

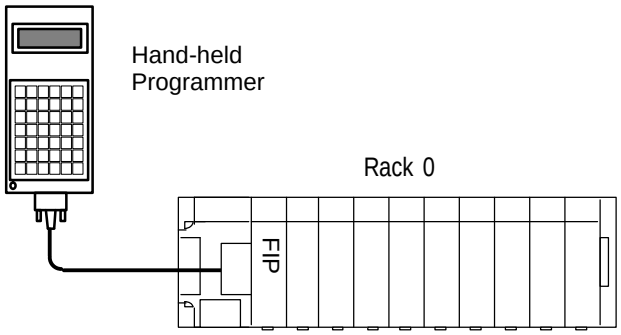
This chapter explains how to use a Hand-held Programmer to:

- read configuration data from the Remote I/O Scanner
- temporarily delete a module configuration
- temporarily change some parameters of I/O modules
- display data
- temporarily force data

For additional information on basic Hand-held Programmer functions, please refer to the *Hand-held Programmer User's Manual* (GFK-0402).

Connecting the HHP

Connect the Hand-held programmer to the power supply of Rack 0 (the rack that contains the Remote I/O Scanner).



Apply power to the PLC. During powerup, the HHP displays:

```
CONFIGURING
SYSTEM
```

Then the following screen appears:

```
_ 1. DATA    <ID
  2. PROTECT
```

On this screen, selecting **DATA** displays I/O data (see chapter 5 for more information). Selecting **PROTECT** displays the current protection level of the Remote I/O Scanner. Cursor down to **CONFIG** to display or change configuration data.

(You can return to the above screen from any other screen by pressing the **MODE** key.)

Operating Mode and Protection Level

If you try to edit the configuration during the wrong operating mode or with the wrong privilege level, the HHP displays the message PROTECT:

```
0: 02  PROTECT<ID
AI16
```

Press any key to clear the error message.

Viewing the Protection Level

By default, the protection level of a new Remote I/O Scanner permits use of the Hand-held Programmer for reading or changing data. If the protection level has been changed to Level 1 or Level 2, you will not be able to read or change data. See the "PLC Control and Status" chapter of the *Hand-held Programmer User's Manual* (GFK-0402) for instructions to change the protection to Level 3 or Level 4.

If you want to see the current protection level of the Remote I/O Scanner, select **2 Protect** from the Mode menu.

Press the **ENT** key to display the current level:

```
LEVEL4        <ID
```

With Level 4 access, you can view or write selected configuration parameters.

Entering and Exiting Standalone Mode

You can read configuration and data parameters while the Remote I/O Scanner is in any mode that supports HHP communications.

If you want to change configuration parameters or force data, the Remote I/O Scanner must be in Standalone Idle or Standalone Ready mode.

Press the **MODE** and **#** keys at the same time to change the Remote I/O Scanner from Idle to Standalone Idle (SI) mode or from Ready to Standalone Ready (SY) mode.

Entering and Exiting Standalone Idle Mode

When you press **MODE** and **#** from Idle mode the screen displays:

```
CLEAR FORCES?
<ENT>=Y  <CLR>=N
```

You must press **ENT** and clear forces to enter Standalone Idle mode. When you do all forces (including any forces previously applied from the network) will be cleared immediately.

To exit Standalone Idle mode, press the **MODE** and **#** key. The screen again prompts:

```
CLEAR FORCES?
<ENT>=Y  <CLR>=N
```

You must press **ENT** and clear any forces that have been applied in Standalone mode before exiting Standalone mode.

If you press the **CLR** key, forces are not cleared and no mode change is made.

Entering and Exiting Standalone Ready Mode

Press the **MODE** and **#** keys at the same time to change the Remote I/O Scanner from Ready to Standalone Ready (SY) mode

```
ENTER STANDALONE
<ENT>=Y  <CLR>=N
```

If you enter Standalone Ready mode, the Remote I/O Scanner will continue to exchange I/O data with the network. However, you will be able to force inputs and outputs locally. Press **ENT** if you want to enter Standalone Ready mode.

To exit Standalone Ready mode, press the **MODE** and **#** key. The screen prompts:

```
EXIT STANDALONE?
<ENT>=Y  <CLR>=N
```

If you press the **ENT** key, the Remote I/O Scanner returns to Ready (RY) mode. If you press the **CLR** key, no mode change is made.

When you exit Standalone Ready mode, the Hand-held Programmer relinquishes control of the Remote I/O Scanner to the network. After exiting, you will be able to display I/O data, but not change it with the Hand-held Programmer.

Note

The only way to exit one of the standalone modes is with the Hand-held Programmer or by cycling power.

Although the Remote I/O Scanner can exchange I/O and status data on the network while in standalone mode, it cannot respond to any network commands, including any command to exit standalone mode, force data, or change configuration.

Be sure to take the Remote I/O Scanner out of standalone mode when you are finished using the HHP.

Displaying Configuration Parameters

When the Remote I/O Scanner powers up, it uses the Network Configuration if one has previously been received. If no Network Configuration has been received, the Remote I/O Scanner automatically creates its own configuration by reading the modules that are present in the rack(s). You can read the configuration information as described below.

Go to the HHP mode screen as described previously and press the DOWN ARROW key twice to display this screen:

```
_ 3. CONFIG  <ID
```

Press the **ENT** key to enter Configuration mode.

If there is a Network Configuration present, the HHP screen displays:

```
Netcfg Present:
PRESS <-/+>KEY
```

When you press the **–/+** key, the screen displays:

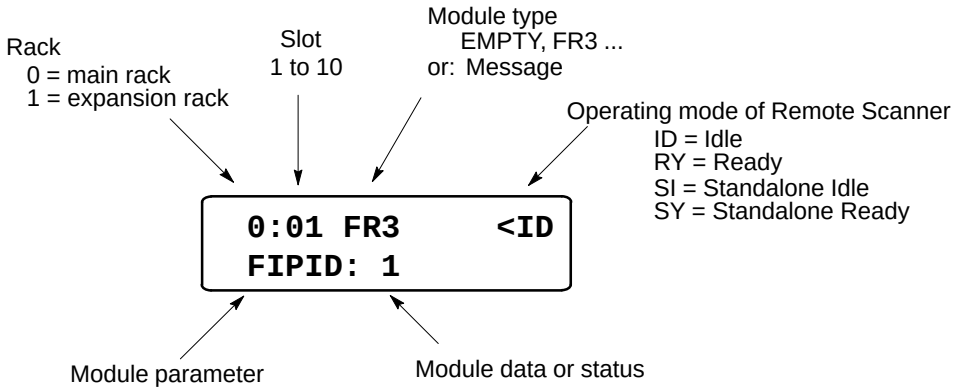
```
Proceed?
<ENT>=Y  <CLR>=N
```

If you do not want to proceed, press the **CLR** key to return to the mode screen.

If you want to view the current configuration, press the **ENT** key.

Configuration Parameters Display Format

The HHP displays configuration parameters in the format shown below.



Displaying the Remote I/O Scanner Configuration

The first screen that appears shows whether the Remote I/O Scanner is configured for FIP or WorldFIP protocol. It also shows the FIP Station ID (3 in this example). The FIP Station ID allows the FIP Remote I/O Scanner to communicate on a FIP network. The screen looks like one of the following illustrations.

```
0:01 FR3     <SI
WORLD FIPID: 3
```

or:

```
0:01 FR3     <SI
FIPID: 3
```

Press the RIGHT ARROW key to display other Remote I/O Scanner parameters. Parameters appear in this order:

- FIPID / WORLDFIPID
- HHP KEY CLICK: ON / OFF
- PROTOCOL
- IDLE TIME
- BAUD RATE
- DATA BIT
- STOP BIT
- PARITY

These parameters are read-only. The only one you can change is the HHP key click.

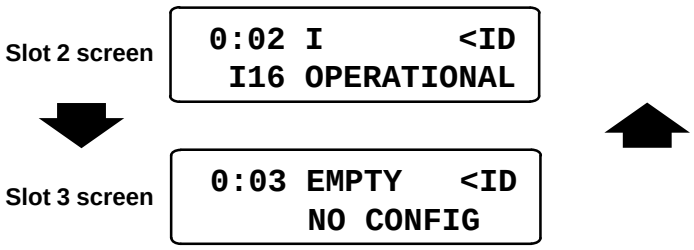
Press the DOWN ARROW key from any of the above screens to display the first I/O module screen.

Displaying I/O Module Configurations

Display or configure I/O modules by selecting an adjacent slot or a specific slot, as described below.

Selecting an Adjacent Slot

To select an adjacent slot, use the UP ARROW and DOWN ARROW arrow keys.



In the example above, slot 2 has a 16-point input module and slot 3 is not configured.

Selecting a Non–adjacent Slot

To display a non-adjacent slot, use the # key and enter the rack (0 or 1) number. Press the **ENT** key. Enter the slot number and press **ENT** again. For example, to display rack 0, slot 9, you would press: **O ENT 9 ENT**

```
0:09 AI      <SI
AI4 OPERATIONAL
```

In this example, slot 9 in the main rack has a configured analog input/output module.

Module Display Formats

Discrete (Input) Module

```
0:02 I       <SI
I32 OPERATIONAL
```

Analog (Output) Module

```
0:02 AQ      <SI
AQ02 OPERATIONAL
```

Smart Analog Module

```
0:02HI-DENS C<SI
I40 OPERATIONAL
```

Combination I/O Module

```
0:02 QI      <SI
QI8 OPERATIONAL
```

Changing I/O Module Configurations

In addition to viewing I/O module configurations as described on the previous page, you can make a limited number of configuration changes using the HHP. The Remote I/O Scanner must be in standalone mode.

- You may delete (but not enter) a module configuration. Select the module and press the **DEL** key.
- change discrete input filter times. See the instructions below.

Changes you make using the HHP are not stored through loss of power. If you cycle power to the Remote I/O Scanner, the default or Network Configuration is restored. If you want to make a permanent configuration change, you must revise the Network Configuration.

Changing an Input Filter Value

A discrete input or mixed I/O module can be configured for input filtering. 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 for the change to be considered valid.

1. Display the module configuration as described previously.
2. Press the RIGHT ARROW key to display the screen for the input filter:
3. To change the value, press the appropriate number key.

```
0:02 I        <SI
FILTER: 1
```

4. Press the LEFT ARROW key to return to the first module screen.

Displaying I/O Data

If a Network Configuration has been received and it does not match the actual I/O module physically present in the slots, only I/O data associated with the Network Configuration is displayed. Data for non-matching modules is not displayed.

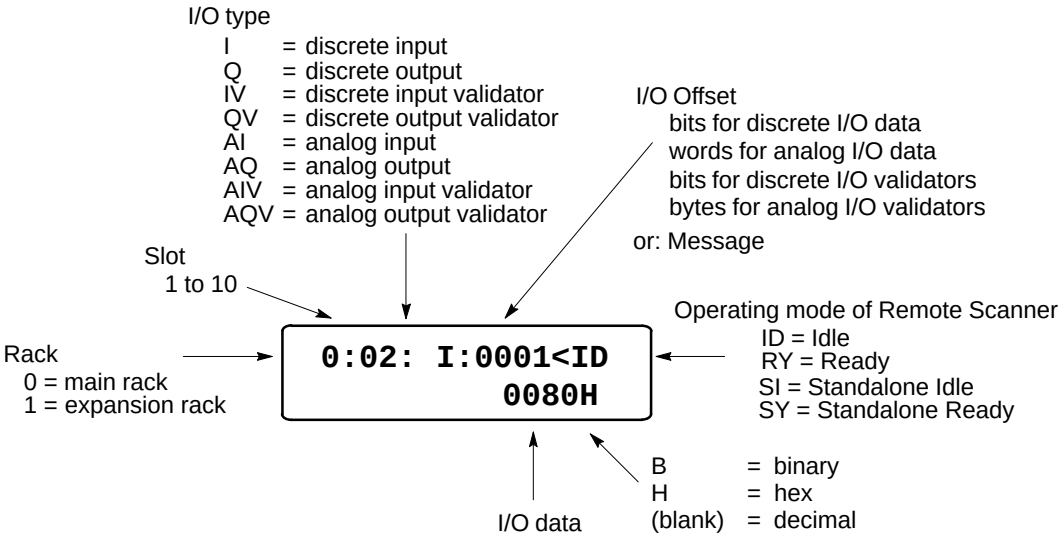
To display data, go to the Mode screen as described previously and select **1** (see below).

```
_ 1. DATA    <ID
  2. PROTECT
```

(You can return to the above screen from any other screen by pressing the **MODE** key.)

HHP Screen Format

The illustration below shows the I/O display format for the Remote I/O Scanner.



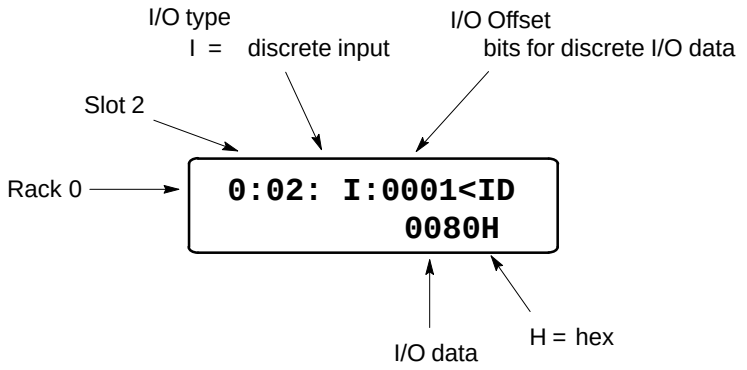
Possible Data and Validators that May Be Displayed

The type of data displayed by the HHP depends on the type of module in a slot. The list below shows the HHP abbreviations for the types of data associated with each module type.

Discrete Input	I,	IV
Discrete Output	Q,	QV
Analog Input	AI,	AIV
Analog Output	AQ,	AQV
16–pt smart analog input	I, AI,	AIV
Combo I/O modules	I,	IV,
	Q,	QV

Display for the First I/O Module

The HHP displays data for the first data point of the module in slot 2 in rack 0 (the slot next to the Remote I/O Scanner). In the following example, this is an input module with a current value of 80 hex.



If you go to a different rack / slot location then exit Data Monitoring mode, the last screen you viewed will be displayed when you re-enter Data Monitoring mode.

If a slot configuration is deleted its screen looks like this:

```
0:03:NO DATA <ID
```

Changing the Data Display Format: Binary, Hex, Decimal

After a power cycle, data is displayed in hexadecimal format, which is not appropriate for discrete data. If the module in the first slot is a discrete module, change the display format to binary.

When you go from module to module, remember to change the display format to match the type of data being displayed—binary format for discrete data, hex or decimal format for analog data.

To change the data format, press the DEC / HEX key. The data changes from hex to binary to decimal, then back to hex with repeated key presses.

Changing the Display Format to Hex or Decimal when Viewing Discrete Data

In binary mode, the HHP displays bit values. In decimal or hex mode, the HHP displays byte or word values beginning on a byte boundary (1, 9, 17, 25)

So with the HHP in binary mode, if you selected IV0007 the HHP would display the value of that bit:

```
0:02: IV:0007<ID
              0B
```

If you then pressed the HEX / DEC key, the HHP would display the decimal value of the starting at IV0001 (the beginning reference of the byte that includes the reference IV0007):

```
0:02: IV:0001<ID
          -32768
```

Once the HHP changes the reference being displayed as described above, it does not return to the original reference (which was IV0007 in this example). So if you return to binary mode, the HHP displays the binary value of the first bit of that byte or word:

```
0:02: IV:0001<ID
              0B
```

Displaying the Next or Previous Data and Validators

To display the next data / validators for a slot use the DOWN ARROW key. To display the previous data / validators, use the UP ARROW key. The display mode determines how data is accessed; for a discrete module, the display mode must be binary to access the individual point data.

If you press the DOWN ARROW key past the last validator for a slot, the HHP shows the first I / O data offset for the next slot. If you press the UP ARROW key past the first I / O offset of a slot, the HHP shows the last validator for the previous slot. (Smart I / O modules do not have validators associated with their status data). Validator data should be displayed in binary.

Example 1: Decimal Display Format

If the display data format is decimal, offsets are displayed on 16-bit boundaries. In this example, rack 0 slot 2 has a 32-point discrete input module and the display is in decimal format:

```
 0:02:  I:0001<ID
          -32768
```

Pressing the DOWN ARROW key once displays the next data offset. Since the display mode is decimal, the next data offset is I0017.

```
 0:02: I:0017<ID
         -32767
```

Pressing DOWN ARROW again displays the first validator for the slot or the first 16 bits in the currently-selected data format.

```
 0:02: IV:0001<ID
              1
```

Example 2: Binary Display Format

Similarly, if the display data format is binary, offsets are displayed on single-bit boundaries. The next example shows the same discrete module as above, with the data display in binary format. (For an analog module, the HHP displays 16 bits in binary mode).

```
 0:02: I:0001<ID
           0B
```

Pressing the DOWN ARROW key once displays the screen for I0002 (not I0017, as above):

```
 0:02: I:0002<ID
           0B
```

Pressing DOWN ARROW again displays the screen for I0003:

```
 0:02: I:0003<ID
           0B
```

The HHP displays all I references, followed by all IV references.

Displaying a Specific Rack and Slot

To go to a specific rack and slot, enter the rack number (0 or 1) and press the **ENT** key, then the slot number from 1 to 10. (If you want to cancel an entry, press the CLR key.) Press the **ENT** key again. For example, to display rack 1 slot 5, press: **1 ENT 5 ENT**

```
1:05: I:0005<ID
              0B
```

Selecting a Data or Validator I/O Offset for a Slot

To display a data or validator I/O offset for the selected slot, first enter the data type by pressing the **I/AI** or **Q/AQ** key as many times as needed to display the correct data type (see below). Press the **ENT** key. Enter the offset number then press **ENT** again..

Data Type	HHP Input Characters
I (discrete input)	I
AI (analog input)	I I
IV (discrete input validator)	I I I
AIV (analog input validator)	I I I I
Q (discrete input)	Q
AQ (analog output)	Q Q
QV (discrete output validator)	Q Q Q
AQV (analog output validator)	Q Q Q Q

For example, to display input I0018 from the slot shown above, you would:

1. Press the **I** key, then the **ENT** key.
2. Enter **1 8** , then press the **ENT** key.

```
1:05: I:0018<ID
              0B
```

If the module has validator offsets (IV references), they are located after the Data offsets (I references) in the display sequence. (For validator data, 0 = valid and 1 = invalid.) If you wanted to display input validator IV0009, you would:

1. Press **I I I**. Press the Enter key.
2. Enter **9** , then press then Enter key.

```
0:02: IV:0009<ID
              0B
```

If You Enter an Incorrect Data Type

If you enter an incorrect data or validator type, the HHP displays:

```
0:02:NOT FND <ID
```

Press any key to clear the error screen.

Forcing Data

Data can be forced from the Hand-held Programmer with the Remote Scanner in either Standalone Idle mode or Standalone Ready mode. (Data can be forced from the FIP network only when the Remote I/O Scanner is in Run mode.)

The Force Table

The Remote I/O Scanner stores force data in an area of memory that is referred to as the Force Table. The contents of the Force Table are handled differently in Standalone Idle mode and Standalone Ready mode.

- Upon entering Standalone Idle mode, the current contents of the Force Table are erased. Upon exiting Standalone Idle mode, the Force Table is again cleared and all outputs are set to zero.
- In Standalone Ready mode, any forces applied by the Hand-held Programmer remain in effect when you enter and exit, and the Force Table is not erased.

Force Retention

If force retention is enabled, during Idle mode the force conditions are recovered from non-volatile memory for later use.

If the Remote I/O Scanner is not in either Standalone Idle or Standalone Ready mode, pressing either the # or Right Arrow key causes the HHP to display the message: PROTECT.

```
1:05:PROTECT <ID
             0B
```

Press the MODE and # keys at the same time to change the Remote I/O Scanner mode to SI. See page 4-4.

Forcing Data with the Hand-held Programmer

To force data with the Hand-held Programmer:

1. Place the HHP in the correct display format:
   A. Binary for discrete data.
   B. Hex or decimal for analog data.
2. In Data mode, select the data to be forced or unforced. For example:

```
1:05: I:0015<SI
          0B
```

3. Press the **#** key. The # sign blinks next to the current point state or value to indicate that the point is ready to accept a force value:

```
1:05: I:0015<SI
      #     0B
```

4. Enter the intended force value state or value then press the **ENT** key. This forces the point and places the value you enter in the Force Table.

   Note: If you select a value but decide to change it before pressing the **ENT** key, press the **CLR** key. The original screen will reappear. Press the **CLR** key again to exit forcing.

   When you force a discrete or analog value, the data value blinks in binary mode to indicate that the force is in effect.

Blinking →

```
1:05: I:0015<SI
          1B
```

   The HHP screen also blinks when displaying validators that correspond to a selected range of forced data.

5. Press **#** to remove the force.

Changing Values While Forced

If you want to change the value of a forced point without removing the force, press the RIGHT ARROW key. Enter the new force value and press the **ENT** key.

Appendix A Baseplate Power Supplies

This appendix gives additional information about the two types of baseplate power supply that may be used in an I/O Nest.

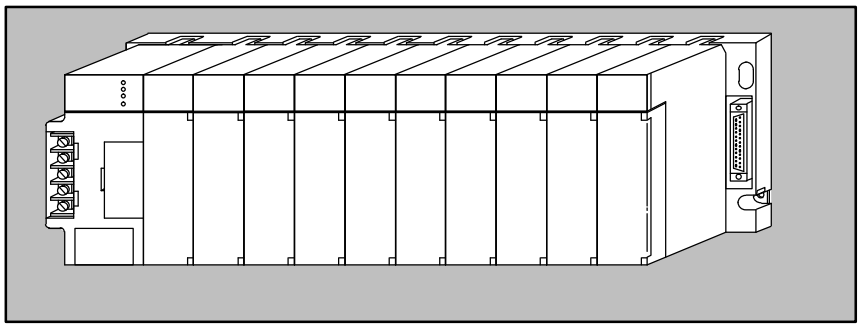
- Load Rating, Temperature, and Mounting Position
- 120 / 240VAC or 125 VDC Input Power Supply Specifications
- 24 / 48 VDC Input Power Supply Specifications
- Estimating Power Supply Loads

Load Ratings, Temperature, and Mounting Position

The power supply load rating depends on the mounting position of the baseplate and the ambient temperature.

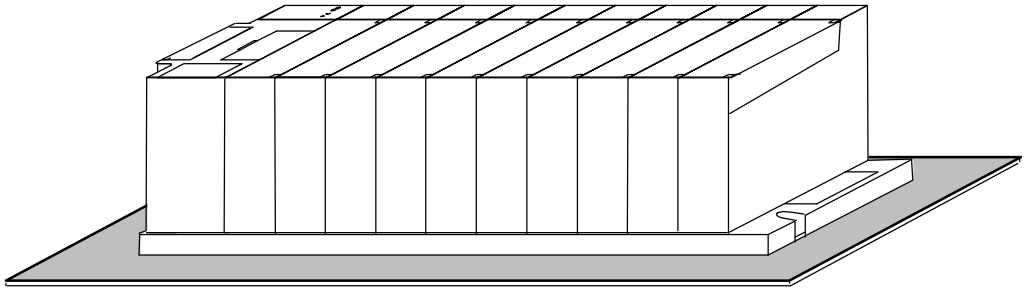
The load rating with the baseplate mounted upright on a panel is:

- 100% at 60°C (140°F)



Power supply load ratings with the baseplate mounted horizontally are:

- temperature at 25°C (77°F) - full load
- temperature at 60°C (140°F) - 50% of full load



Power Supply Specifications, 120/240 VAC or 125 VDC Input

The AC / DC input power supply (IC693PWR321) is a 30 watt wide range supply. It can operate from a voltage source in the range of 100 to 240 VAC or 100 to 150 VDC.

Nominal Rated Voltage	120 / 240 VAC or 125 VDC
Input Voltage Range	
AC	85 to 264 VAC
DC	90 to 150 VDC
Input Power	50 amps maximum at full load
Inrush Current	4A peak, 250 ms maximum
Output Power	15 watts maximum, each output 30 watts maximum total (all three outputs)
Output Voltage	5 VDC: 5.0 VDC to 5.2 VDC (5.1 VDC nominal) Relay 24 VDC: 24 to 28 VDC Isolated 24 VDC: 21.5 VDC to 28 VDC
Protective Limits	
Overvoltage:	5 VDC output: 6.4 to 7 V
Overcurrent;	5 VDC output: 4 A maximum
Holdup Time:	20 ms minimum
Operating Temperature	0 to 60° C (32 to 140° F)
Storage Temperature	-40 to +85° C (-40 to +185° F)
Humidity	5 to 95% non-condensing
Vibration	3.5 mm 5-9 Hz, 1G 9-150 Hz
Shock	15 g's for 11 msec
Standards	UL, CSA

The AC Power Supply may not comply with FCC requirements in non-industrial applications for conducted EMI on AC power lines. A suitable line filter that will satisfy FCC requirements for these applications is available as GE Fanuc part *44A720084-001*.

Power Supply Specifications, 24/48 VDC Input

The DC input power supply (IC693PWR322) is a 30 watt wide range supply designed for 24VDC or 48VDC nominal inputs. It accepts input voltage range from 18VDC to 56VDC.

Nominal Rated Voltage	24 or 48 VDC
Input Voltage Range	
Start	21 to 56 VDC
Run	18 to 56 VDC
Input Power	50 watts maximum at full load
Inrush Current	4A peak, 100 ms maximum
Output Power	15 watts maximum, each output 30 watts maximum total (all three outputs)
Output Voltage	5 VDC: 5.0 VDC to 5.2 VDC (5.1 VDC nominal) Relay 24 VDC: 24 to 28 VDC Isolated 24 VDC: 21.5 VDC to 28 VDC
Protective Limits	
Overvoltage:	5 VDC output: 6.4 to 7 V
Overcurrent;	5 VDC output: 4 A maximum
Holdup Time:	14 mS minimum
Operating Temperature	0 to 60° C (32 to 140° F)
Storage Temperature	-40 to +85° C (-40 to +185° F)
Humidity	5 to 95% non-condensing
Vibration	3.5 mm 5-9 Hz, 1G 9-150 Hz
Shock	15 g's for 11 msec
Standards	UL, CSA

Estimating Power Supply Loads

The load capacity of a Power Supply is the total of the loads placed on it by all the modules. The power output of the power supply voltages is 30 Watts, maximum.

The total current for any one module must not exceed the rating for that voltage.

The sum of all loads must not exceed the maximum rating of the power supply. Use of the isolated +24 Volt power supply output is optional; however, this output can be used to drive a limited number of input devices.

The following table shows the DC load required by each module and hardware component. All ratings are in milliamps. Input and Output module current ratings are with all inputs or outputs on.

Three voltages are listed in the table:

- +5 VDC, which provides primary power to operate most internal circuits.
- +24 VDC Relay Power, which provides power for circuits that drive the relays on Relay modules.
- +24 VDC Isolated, which provides power to operate a number of input circuits (input modules only).

Note that the figures listed in the table are maximum requirements, not typical.

Catalog Number	Description	+5 VDC	+24 VDC Relay Power	+24 VDC Isolated
IC693MDL230	120 VAC Isolated, 8 Point Input	60	-	-
IC693MDL231	240 VAC Isolated, 8 Point Input	60	-	-
IC693MDL240	120 VAC, 16 Point Input	90	-	-
IC693MDL241	24 VAC / DC Pos / Neg logic, 16 Point	80	-	125
IC693MDL630	24 VDC Positive Logic, 8 Point Input	2.5	-	60
IC693MDL632	125 VDC Pos / Neg Logic, 8 Point Input	40	-	-
IC693MDL633	24 VDC Negative Logic, 8 Point Input	5	-	60
IC693MDL634	24 VDC Pos / Neg Logic, 8 Point Input	80	-	125
IC693MDL640	24 VDC Positive Logic, 16 Point Input	5	-	120
IC693MDL641	24 VDC Negative Logic, 16 Point Input	5	-	120
IC693MDL643	24 VDC Positive Logic, FAST, 16 Point Input	5	-	120
IC693MDL644	24 VDC Negative Logic, FAST, 16 Point Input	5	-	120
IC693MDL645	24 VDC Pos / Neg Logic, 16 Point Input	80	-	125
IC693MDL646	24 VDC Pos / Neg Logic, FAST, 16 Point Input	80	-	125
IC693MDL652	24 VDC Pos / Neg Logic 32 Point Input	5	-	-
IC693MDL653	24 VDC Pos / Neg Logic, FAST, 32 Point Input	5	-	-
IC693MDL654	5 / 12 VDC (TTL) Pos / Neg Logic, 32 Point	195 / 440	-	-
IC693MDL655	24 VDC Pos / Neg, 32 Point Input	195	-	224
IC693ACC300	Input Simulator, 8 / 16 Points	120	-	-
IC693MDL310	120 VAC, 0.5A, 12 Point Output	210	-	-

Catalog Number	Description	+5 VDC	+24 VDC Relay Power	+24 VDC Isolated
IC693MDL330	120 / 240 VAC, 1A, 8 Point Output	160	-	-
IC693MDL340	120 VAC, 0.5A, 16 Point Output	315	-	-
IC693MDL390	120 / 240 VAC Isolated, 2A, 5 Point Output	110	-	-
IC693MDL730	12 / 24 VDC Positive Logic, 2A, 8 Point Output	55	-	-
IC693MDL731	12 / 24 VDC Negative Logic, 2A, 8 Point Output	55	-	-
IC693MDL732	12 / 24 VDC Positive Logic, 0.5A, 8 Point Output	50	-	-
IC693MDL733	12 / 24 VDC Negative Logic, 0.5A, 8 Point Output	50	-	-
IC693MDL734	125 VDC Pos / Neg Logic, 6 Point Output	90	-	-
IC693MDL740	12 / 24 VDC Positive Logic, 0.5A, 16 Point Output	110	-	-
IC693MDL741	12 / 24 VDC Negative Logic, 0.5A, 16 Point Output	110	-	-
IC693MDL742	12 / 24 VDC Pos. Logic ESCP, 1A, 16 Point Output	130	-	-
IC693MDL750	12 / 24 VDC Negative Logic, 32 Point Output	21	-	-
IC693MDL751	12 / 24 VDC Positive Logic, 32 Point Output	21	-	-
IC693MDL752	5 / 24 VDC (TTL) Negative Logic, 0.5A, 32 Point	260	-	-
IC693MDL753	12 / 24 VDC Positive Logic, 0.5A, 32 Point Output	260	-	-
IC693MDL930	Relay, N.O., 4A Isolated, 8 Point Output	6	70	-
IC693MDL931	Relay, N.C. and Form C, 8A Isolated, 8 Point Out	6	110	-
IC693MDL940	Relay, N.O., 2A, 16 Point Output	7	135	-
IC693MDR390	24 VDC Input, Relay Output, 8 In / 8 Out	80	70	-
IC693MAR590	120 VAC Input, relay Output, 8 In / 8 Out	80	70	-
IC693ALG220	Analog Input, Voltage, 4 Channel	27	-	98
IC693ALG221	Analog Input, Current, 4 Channel	25	-	100
IC693ALG222	Analog Input, Voltage, High Density (16 Channel)	112		41
IC693ALG223	Analog Input, Current, High Density (16 Channel)	120	-	-
IC693ALG390	Analog Output, Voltage, 2 Channel	32	-	120
IC693ALG391	Analog Output, Current, 2 Channel	30	-	215
IC693CHS391	10-slot CPU Baseplate (Model 331 / 340 / 341)	250	-	-
IC693CHS392	10-slot Expansion Baseplate (Model B31 / 340 / / 341)	150	-	-
IC693CHS397	5-slot CPU Baseplate (Model 331 / 340 / 341)	270	-	-
IC693CHS398	5-slot Expansion Baseplate (Model 331 / 340 / 341)	170	-	-
n / a	Expansion Bus Termination Pack	72	-	-
IC690ACC900	RS-422 / RS-485 to RS-232 Converter	170	-	-
IC693PRG300	Hand-Held Programmer	170	-	-

† Refer to module specifications in GFK-0898, *Series 90-30 I/O Module Specifications Manual* for more details.