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GE Fanuc Manual Series 90-30

I/O Link Slave Interface

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GE Fanuc Automation

Programmable Control Products

***Series 90TM-30
I/O Link
Interface Module***

User's Manual

GFK0631

January 1992

Warnings, Cautions, and Notes as Used in this Publication

Warning

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

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

Caution

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

Note

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

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CIMPLICITY 90-ADS	Helpmate	Series 90	Workmaster
CIMSTAR	Logicmaster		

Content of this Manual

This book is a reference to the features, operation, installation, and configuration of the GE Fanuc Series 90™-30 I/O Link Interface Module (IC693BEM320).

Chapter 1. Introduction: Describes the functions and features of the Series 90-30 I/O Link Interface Module.

Chapter 2. Installation: Includes basic setup procedures for the I/O Link and for the I/O Link Interface Module.

Chapter 3. Series 90-30 PLC Configuration: Describes configuration for an I/O Link Interface Module, using either Logicmaster 90-30 or a Hand-held Programmer.

Related Publications

Logicmaster Programming Software User's Manual (GFK-0467). Reference manual for system operators and others using the Logicmaster 90-30 software to program, configure, monitor, or control a Series 90-30 PLC and / or a remote drop.

Hand-held Programmer User's Manual (GFK-0402). Operator's guide for the Hand-held Programmer.

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

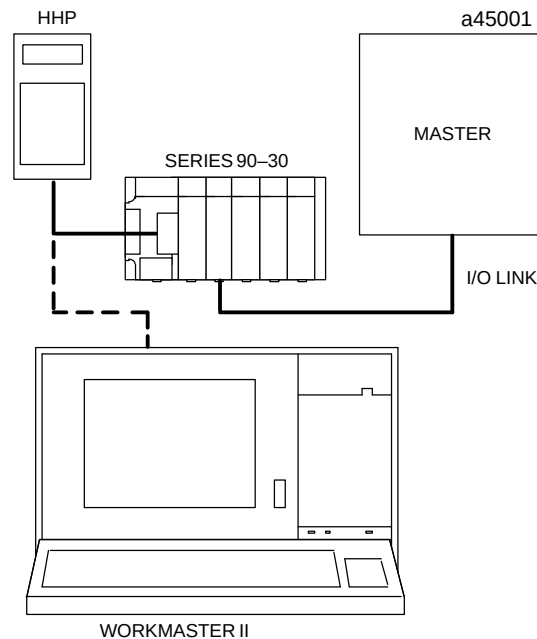
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Chapter 1

Introduction

System Overview

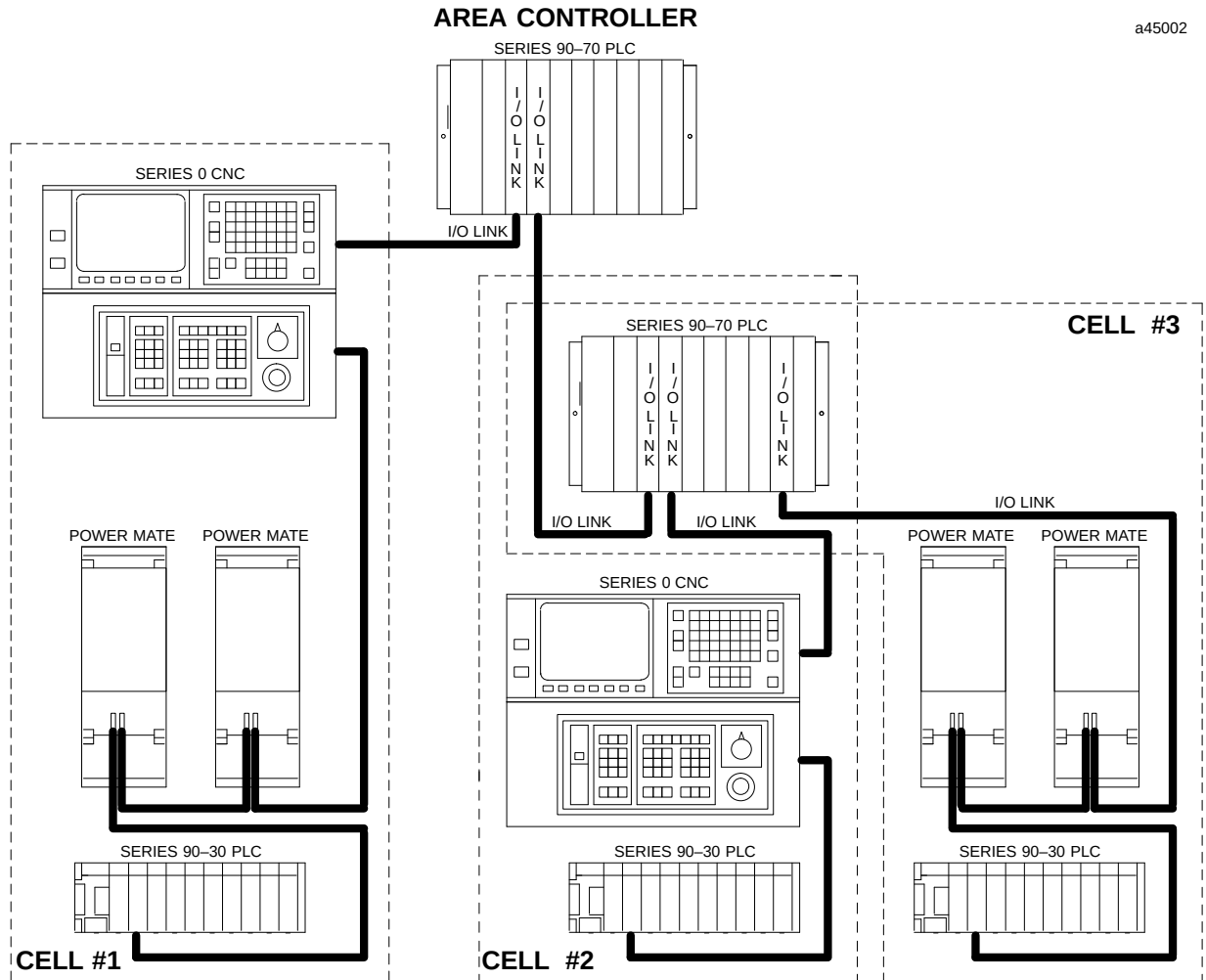
The Series 90-30 I/O Link Interface Module (IC693BEM320) is used to interface a Series 90-30 PLC to a proprietary Fanuc I/O Link. The Fanuc I/O Link is a serial interface which provides high-speed exchange of I/O data between a master device and up to 16 slaves.



The Series 90-30 I/O Link Interface Module operates as a slave on the link. It can exchange either 32 or 64 inputs and outputs with the master. The master may be a Series 90-70 PLC, a Fanuc Series 15, Series 16, or Series 18 CNC, a Fanuc Series 0 Model C CNC, or a Fanuc F-D Mate CNC. The Series 90-70 PLC and Series 0 CNC can be used as either master or slave. The illustration above shows basic system components--a master, an I/O Link, and a Series 90-30 used as a slave. The Hand-held Programmer and the computer running Logicmaster software can be used for configuration, and to monitor I/O states. For the Model 331, the HHP and computer can also be used to override and force the states of I/O data exchanged with the master.

Any number of I/O Link Interface Modules can be installed in a Series 90-30 PLC. Usually, when there are multiple I/O Link Interface Modules in the same PLC, they are on separate I/O Links. However, it is possible to have more than one I/O Link Interface Module in the Series 90-30 connected to the same link, if that suits the needs of the application.

A more complex system is shown below. In this example, a Series 90-70 PLC shown at the top functions as an area controller for three machine cells. The area controller has two I/O Link Interface Modules, each of which operates as an I/O Link master.



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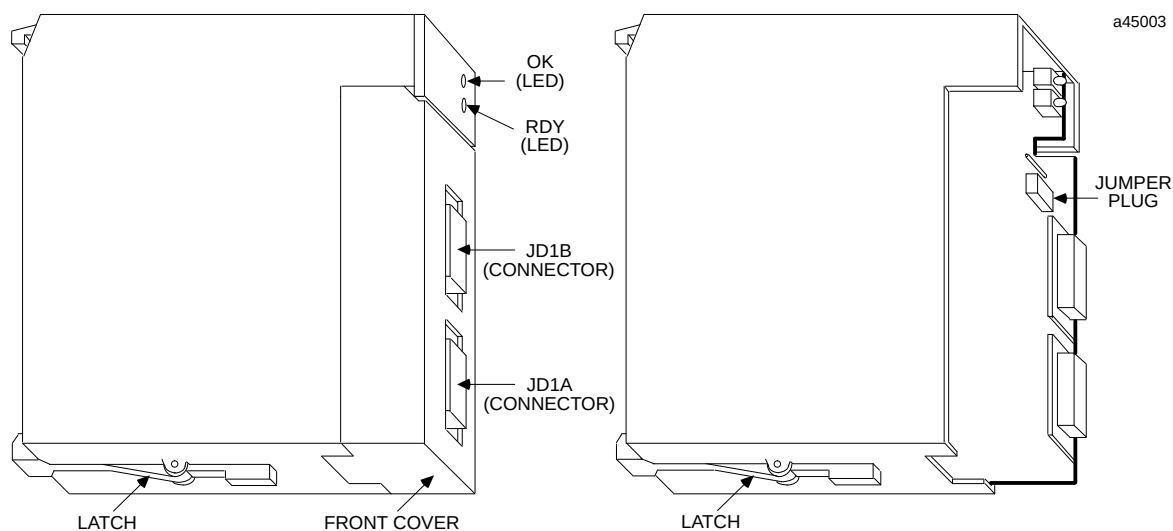
In the illustration, the left I/O Link from the area controller goes to cell 1, where a Series 90-30 PLC, a Series 0 CNC, and two single-axis Power Mate CNCs on the link control the operations of a large machine and its auxiliary equipment.

The right I/O Link from the area controller goes to another Series 90-70 PLC. That PLC serves as a slave on the link to the area controller, and as a master on two other links to smaller machine cells. In cell 2, a Series 0 CNC and a Series 90-30 PLC are the controllers. In cell 3, machine control is provided by a Series 90-30 PLC and two Power Mate CNCs.

Module Description

The Series 90-30 I/O Link Interface Module is a standard Series 90-30 PLC module. It plugs easily into the PLC's baseplate. The latch on the bottom of the module secures it in position. The module's front cover is removable. A single jumper plug inside the front cover is used to set up the module as a 32-point or 64-point I/O module.

An I/O Link Interface Module occupies one module slot in a Series 90-30 PLC rack. It can be installed in any rack, in any slot except rack 0 slot 1, which is reserved for the CPU Module.



LEDs

The module has two LEDs that show its operating, and communications status.

OK:	indicates the module's operating status.
RDY:	indicates the module's communications status.

After power-up, the OK LED should remain ON. The RDY LED will be ON only after the I/O Link master has established communications with the module.

Serial Ports

The front of the module has two 20-pin, Honda-type connectors, which are used for connection to the GE Fanuc I/O Link. One connector is used to connect to the previous device on the link--either the master or another slave. The other connector is used to connect to the next slave on the link, if there is one. Signal levels are RS422 / 485 compatible.

Module Specifications

Module type:	Series 90-30 PLC module, providing I/O Link communications with I/O master.
LEDs:	OK, RDY
I/O Points:	32 or 64, jumper selectable
Environmental:	
Operating temperature	0°C to + 60°C (32°F to +140°F)
Storage temperature	–40 °C to +85°C (–40°F to +185°F)
Humidity	5% to 95% (non-condensing)
Vibration	3.5mm peak-to-peak displacement 5 to 150Hz
Shock	15G for 11mS duration
Altitude	Operating: 10,000 feet Non-operating: 40,000 feet

Cable Types for the I/O Link

The following cables and connectors can be used to complete the I/O Link between devices.

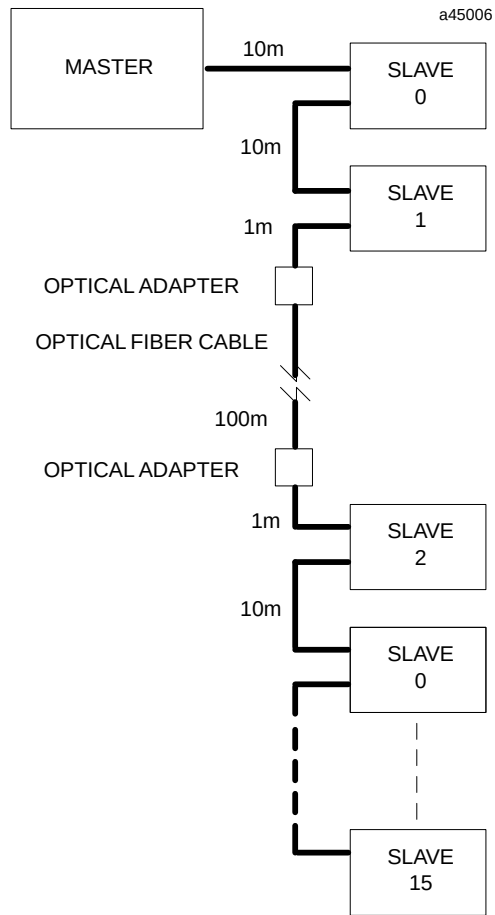
Item	Catalog Number	Vendor	Description
Cable	A03B-0807-K801	GE Fanuc	5 meter length with connectors on both ends. Connects between master and slave device, or between two slave devices.
Cable	A03B-0807-K802	GE Fanuc	10 meter length with connectors on both ends. Connects between master and slave device, or between two slave devices.
Cable	AMW2076	OKI Electric Cable	10-pair shielded cable without connectors, for making custom-length cable. Connects between master and slave device, or between two slave devices.
Connector	A02B-0120-K301	GE Fanuc	20-pin connector with solder lug. Consists of the two following parts.
Connector	PCR-E20FS	Honda	20-pin female connector with solder lug.
	PRC-V20L	Honda	Connector cover.
Cable	A03B-0807-K803	GE Fanuc	1 meter length with connectors on both ends. Connects between master or slave and Optical Adapter. This cable can only be used with an Optical Adapter; do not use it for master / slave or slave / slave connections.
Optical Adapter	A138-154-B001	GE Fanuc	Required for optical fiber cable.
Cable	A66L-6001-009	GE Fanuc	Optical fiber cable for use with Optical Adapter.
	" #L10R03		10m
	" #L15R03		15m
	" #L20R03		20m
	" #L30R03		30m
	" #L40R03		40m
	" #L50R03		50m
	" #L60R03		60m
	" #L80R03		80m
	" #L90R03		90m
	" #L100R03		100m

Cable Lengths on the I/O Link

The maximum distance between the master and the first slave, and between successive slaves, depends on whether electrical or optical cable is used.

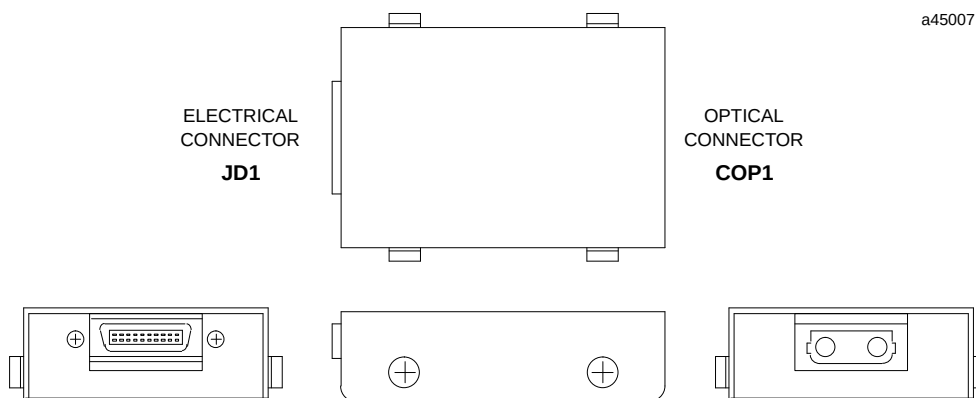
- The maximum length of an electrical cable link is 10 meters (33 feet).
- The maximum length of an optical fiber cable is 100 meters (330 feet).

Electrical and optical cables can be used in the same I/O Link.



Optical Adapter

An Optical Adapter (A138-154-B001) can be used to interface the electrical cable of the I/O Link with optical cable.



Use pairs of adapters in applications where:

- distances of up to 100 meters (330 feet) are required between any two devices on the I/O Link.
- the I/O Link runs between different cabinets, and it is not possible to connect the cabinets with a wire of 5.5mm² or thicker.
- excessive electromagnetic noise may affect the cable. This includes noise from machinery such as a welding machine, and noise-generating cable such as power cable that run for long distances with the I/O Link cable.

Operation of the I/O Link

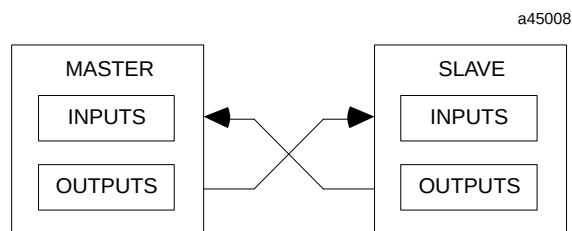
The I/O Link consists of a full duplex serial data communications channel. Physically, the link consists of two twisted pairs of wire and a signal ground conductor. These wires are contained in a cable that has an over-all shield. Signals are of the differential type and a wire pair is used for each signal. Signal levels are compatible with specification EIA RS-422 / RS-485. The signal baud rate is 1.5 Mbaud maximum.

Input and Output Data

The Series 90-30 I/O Link Interface Module can exchange either 32 or 64 inputs and outputs with the master. For each link device:

- **Input Data** is data received from the link.
- **Output Data** is data sent to the link.

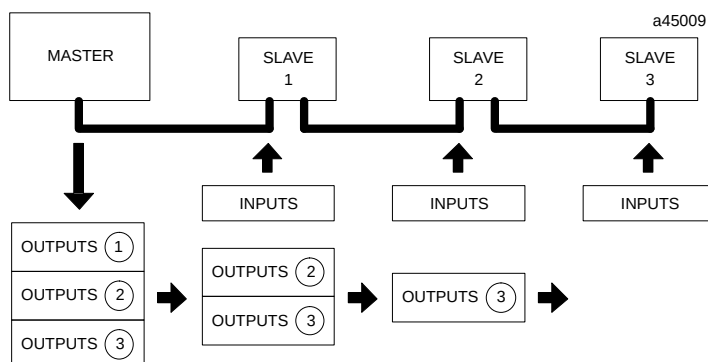
So the *same* set of data is considered output data by the device that sends it and input data by the device that receives it.



Selection of 32 or 64 inputs and outputs is selected using the jumper behind the module cover. The data uses %I and %Q references which are assigned by configuration with a Hand-held Programmer or with Logicmaster 90 programming software.

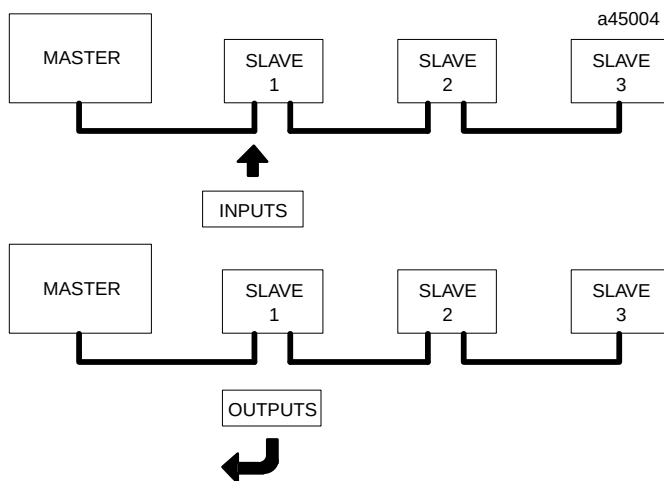
Data Sent by the Master

The master sends output data for all slave devices in a continuous serial string. Slaves receive the data in order of their positions on the link. Each slave in turn reads out its configured amount of data, and passes the remainder on to the next slave. To a slave, data received from the master is input data. The application program in the Series 90-30 PLC reads the data from the %I input references assigned to the I/O Link module.



Data Returned by Slaves

The master also continuously reads output data from each slave. To provide this output data, the application program in a Series 90-30 PLC simply places it into the %Q output references assigned to the I/O Link module.



The master identifies each set of data it receives with respect to the slave's position on the link. To the master, data received from slaves is input data.

Multiple slaves on a link are connected in a daisy-chain fashion so that the output of the first slave drives the input to the second, and so on. With this cabling sequence, each input appears as a single load to the slave that is driving it; therefore, loading on a particular slave output will not change with the total number of slaves in a system.

Series 90-30 PLC Interface

To the Series 90-30 PLC, an I/O Link Interface Module looks like either a 32-point or 64-point I/O module, depending on how the jumper is set. It uses %I and %Q references like a discrete input or output module.

Programming for the I/O Link Interface Module

Because the master device controls operation of the I/O Link, the Series 90-30 requires no special programming for the I/O Link Interface Module to transfer data on the link. The application program can handle its data in the same way as any other I/O data.

Using a Hand-held Programmer

A Hand-held Programmer will configure an I/O Link Interface Module as though it were an I/O module. It will also monitor I/O Link data like conventional I/O data.

Using Logicmaster 90-30

Logicmaster 90-30 can also be used to configure an I/O Link Interface Module. Configuration instructions for both Logicmaster 90-30 and a Hand-held Programmer are summarized in chapter 3.

Because the data transferred by an I/O Link Interface Module is handled like regular I/O data, it can be viewed in the I/O Tables using Logicmaster 90. For the model 331, both inputs and outputs can be forced and overridden from Logicmaster.

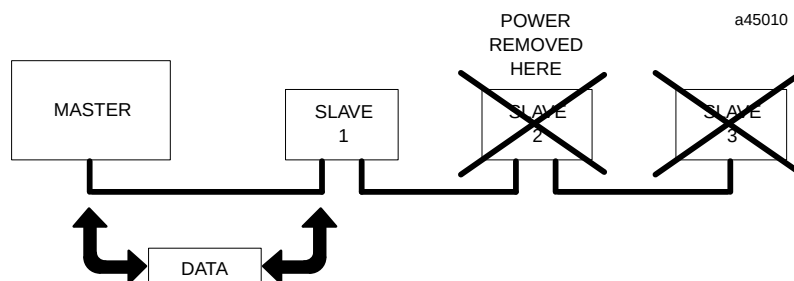
Faults on the I/O Link

How faults are handled depends on the types of devices on the link.

- A. **The Series 90-30 PLC, Series 90-70 PLC, and Power Mate CNC without a separate encoder port handle faults as described below.** The following information applies only if there are no other types of devices on the link.

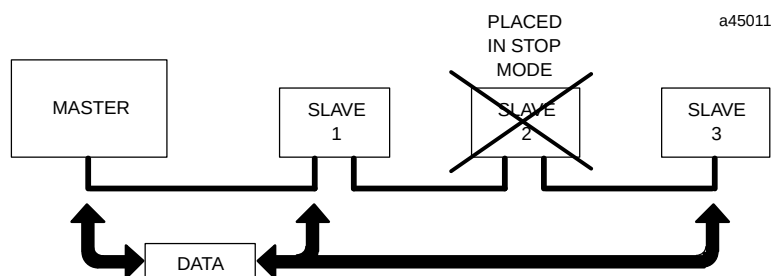
If one of the following faults occurs, communications stop at the fault location. If there are prior devices on the link, they are still able to transfer data with the master. If there are subsequent devices on the link, however, they cannot.

- Power is removed from any device.
- There is a fault in the I/O Link cable such as an open or shorted wire.
- A module fault, software fault, or hardware fault occurs in the master or slave.



If the master is a Series 90-70 PLC and one of the following faults occurs, communications continue on the rest of the link.

- A slave has been set up for the wrong amount of data.
- A Series 90-30 slave is in Stop mode.
- The sequence of slaves on the link is not the same as the sequence expected by the master.



- B. **If the link is connected to any other type of device, including a Power Mate CNC that has a separate encoder port, a fault on any device causes the entire link to shut down as a safety precaution.** If that happens, follow this procedure to restore link operation.
1. Correct the condition that caused the fault.
 2. With the master inactive on the link, clear system errors by power cycling each CNC slave (turn power off, then on again).
 3. Cycle power to each Series 90-30 I/O Link module, to clear the Logicmaster fault table.
 4. Reset the I/O link from the master.

Clearing a Fault on the Series 90-30 I/O Link Module

If a fault occurs that causes the module to stop operating (either a fault within the module itself, or a fault elsewhere on the I/O Link that causes it to stop), a fault is logged into the Logicmaster I/O Fault Table. It must be cleared by cycling power to the I/O Link Module.

How I/O States Are Affected by a Fault

The inputs and outputs of the *I/O Link Interface Module* will hold their last states if any of the following events occurs:

- the link is broken.
- the master resets.
- the slave resets.
- the Series 90-30 PLC is put into STOP mode.
- the Series 90-30 PLC is powered down.

When the disruption is corrected, the module initializes all inputs and outputs to zero, then quickly resets them to their actual states.

Getting Started

To install and configure a Series 90-30 I/O Link Interface Module, follow these basic steps:

1. Install the module and complete the I/O Link

Follow the instructions in the next chapter to install the Series 90-30 I/O Link Module. After installing the other devices on the link (as instructed in their individual User's Manuals), complete the I/O Link cabling as instructed in chapter 2.

2. Add the I/O Link Module to the Series 90-30 PLC Configuration

Follow the instructions in chapter 3 to configure the module with Logicmaster 90-30 or with a Hand-held Programmer.

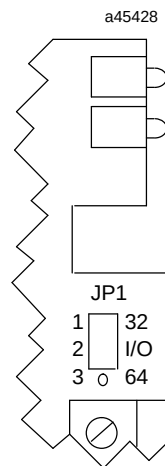
Chapter 2

Installation

This chapter tells how to set the Link Interface Module's on-board jumper, and how to install it in the Series 90-30 PLC. It also explains how to connect the module to an I/O Link.

Setting the Jumper

The jumper on the I/O Link Interface Module is used to set it up for either 32-point or 64-point input/output module operation. The factory default is 32. Before installing the module on a baseplate, check the jumper setting to be sure it is correct for your application. The upper position selects 32 I/O. The lower position selects 64 I/O.



To check or change the jumper position, follow these steps:

1. Remove the module's front cover. To do that, grasp the cover, placing a moderate amount of pressure on the cover sides while pulling it away from the module.
2. Check the jumper position. To select 32 inputs and outputs, the jumper should be on the top and middle pins. To select 64 inputs and outputs, the jumper should be on the middle and bottom pins.
3. Replace the cover by pressing it back onto the module.

Note

If the module is set up for 64-point mode, the Series 90-30 automatic configuration feature should *not* be used. Supply the configuration using either Logicmaster 90 or a Hand-held Programmer.

Installing the I/O Link Interface Module on a Baseplate

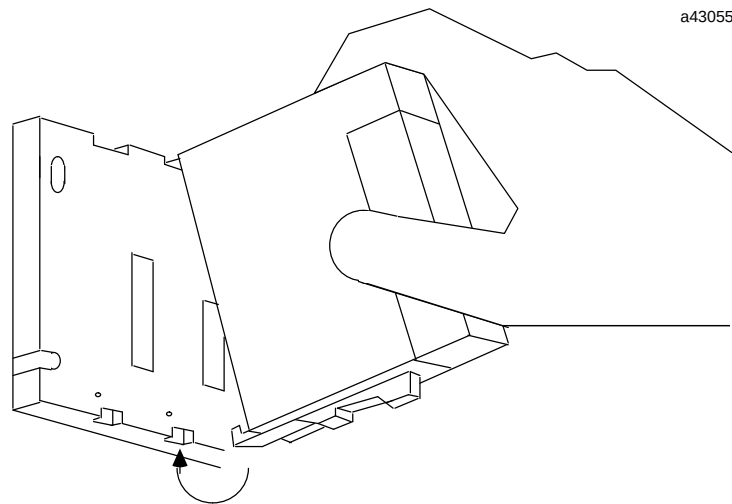
The I/O Link Module may be installed in any I/O slot of the following Series 90-30 baseplates:

- IC693CPU311 (5-slot with CPU)
- IC693CPU321 (10-slot with CPU)
- IC693CPS391 (10-slot CPU base)
- IC693CHS392 (10-slot expansion base)
- IC693CHS393 (10-slot remote base)
- IC693CHS397 (5-slot CPU base)
- IC693CHS398 (5-slot expansion base)
- IC693CHS399 (5-slot remote base)

Caution

Rack power should be OFF when installing or removing the I/O Link Module.

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.



4. Note the slot number; this will need to be entered when the module is configured. Configuration steps are described in chapter 3.

Caution

Make sure no exposed wiring touches any conductive material. Such contact could damage the module, and other units to which it is connected.

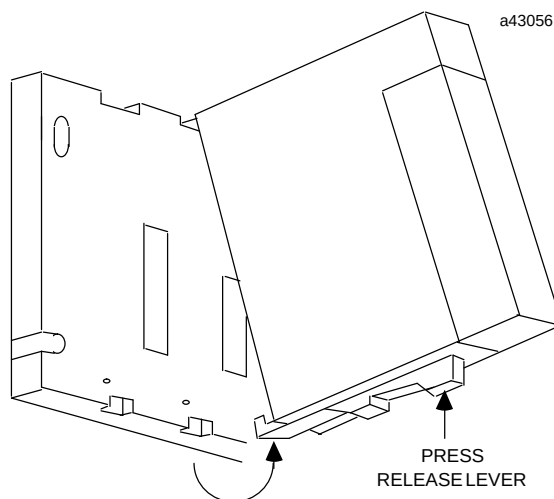
5. If CPU model 331 is to be used, make sure that the CPU is present before applying power to the I/O Link Interface Module. Turn on power, and observe the LEDs.

Observing the Module LEDs

LED Name	LED Status	Indication
OK	On	The I/O Link Interface Module hardware is operating properly.
	OFF	The module has failed.
RDY	On	The module is ready to communicate with the I/O Link.
	OFF	A failure has occurred with the I/O Link, and communications are not possible.

Removing the I/O Link Interface Module from the Baseplate

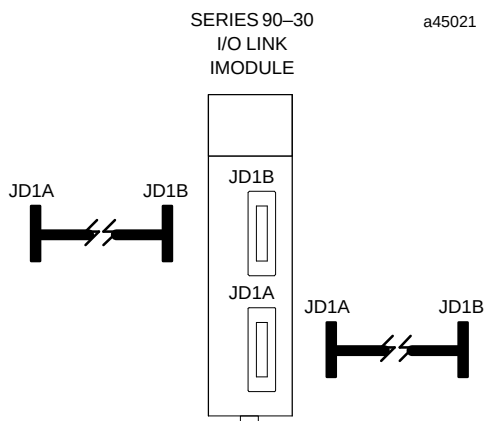
1. Remove power from the PLC.
2. Remove the I/O Link connectors on the front of the module.
3. Locate the release lever on the bottom of the module. Firmly press it up toward the module.
4. While holding the module firmly at the top, continue fully depressing the release lever and swing the module upward.
5. Disengage the hook at the top of the module by raising the module up and moving it away from the baseplate.



Connecting the I/O Link Interface Module to Other Devices

Using the correct cable type, connect the upper port (JD1B) on the Series 90-30 I/O Link Module with the previous device on the link. The device may be the master or another slave. If there is a subsequent slave on the link, connect the cable to that device to the I/O Link Interface Module's lower port (JD1A).

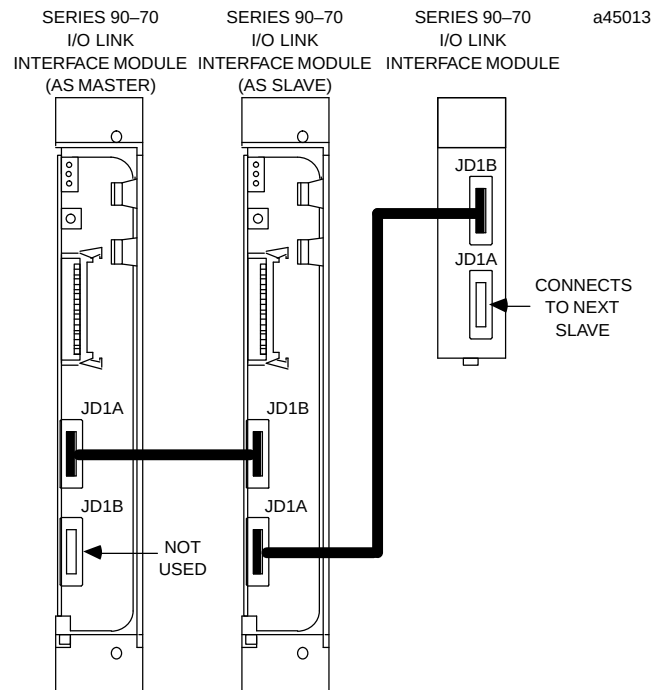
Notice that the Fanuc cables are marked JD1A on one end, and JD1B on the other.



Be sure that the cable routing between modules on the I/O Link matches the configuration expected by the master. The excellent noise reduction of the cable used for the I/O Link allows it to be mixed with other signalling systems and 120VAC control circuits, without needing added shielding or conduits. Conservative wiring practices, as well as national and local codes, require physical separation between control circuits and power distribution or motor power. Refer to sections 430 and 725 of the National Electric Code.

Note

If the link also includes a Series 90-70 PLC, you will notice that the positions of the connectors on the Series 90-30 I/O Link Interface Module are the same as the port assignments on the Series 90-70 I/O Link Interface Module when it is used in slave mode. When the Series 90-70 I/O Link Interface Module is used as a master, the port assignments are reversed.



Serial Port Pin Assignments

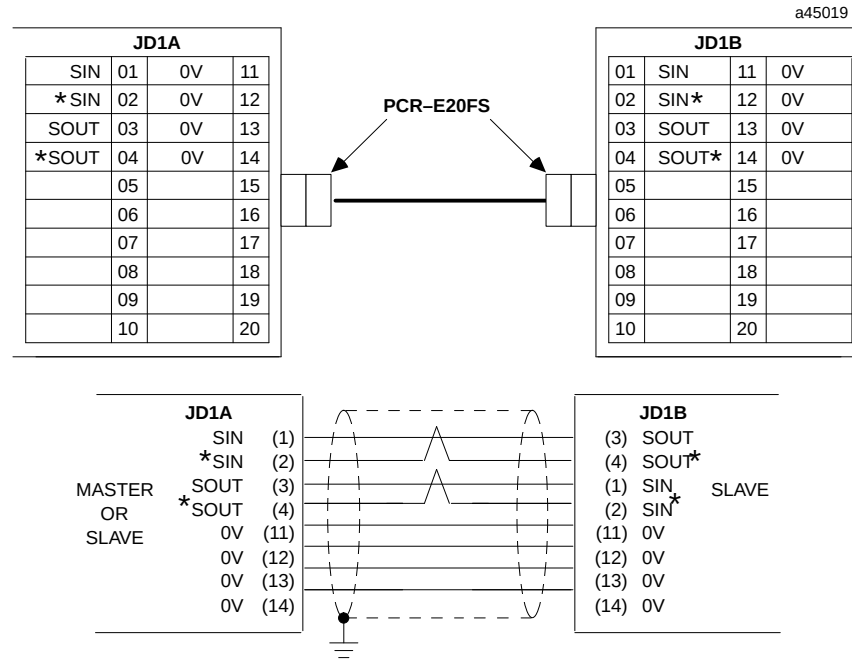
Pin #	Signal
1	SIN
2	*SIN
3	SOUT
4	*SOUT
5	
6	
7	
8	
9	+5 volts
10	

Pin #	Signal
11	0 volts
12	0 volts
13	0 volts
14	0 volts
15	0 volts
16	0 volts
17	
18	+5 volts
19	
20	+5 volts

The +5-volt output from each connector powers the fiber optic link modules for long distance applications. The +5-volt output is not used otherwise.

Cable Diagram, No Optical Adapter

The following illustration shows connection details for electrical cable used between a master and slave or between two slave devices. This cable (A03B-0807-K801, A03B-0807-K802, or cable made using AMW 2076 and connectors A02B-0120-K301) does not include the +5-volt signal. Optical Adapter cable, which includes the +5 volt signal, **must** not be used to directly connect master and slave devices.



The differential signals, SIN / *SIN, and SOUT / *SOUT must be connected using twisted pair wires.

Caution

The I/O Link cable's shield must be connected to chassis ground in your system. Use the grounding cable (44A729227) provided.

Optical Adapter Installation

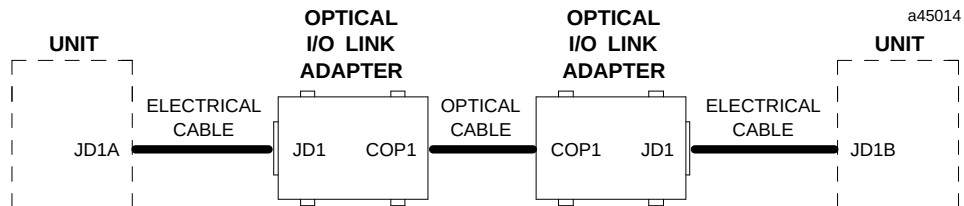
The Optical Adapter is an optional component used to interface the electrical cable to optical cable.

An Optical Adapter must be installed in a sealed enclosure. Avoid contact with other electrical components or wiring, which could short the unit.

Use the adapter's casing screws to make earth ground connection. The electrical potential of the earth ground used for the adapter must be the same as that of the I/O Link to which it is connected.

Cable Connections

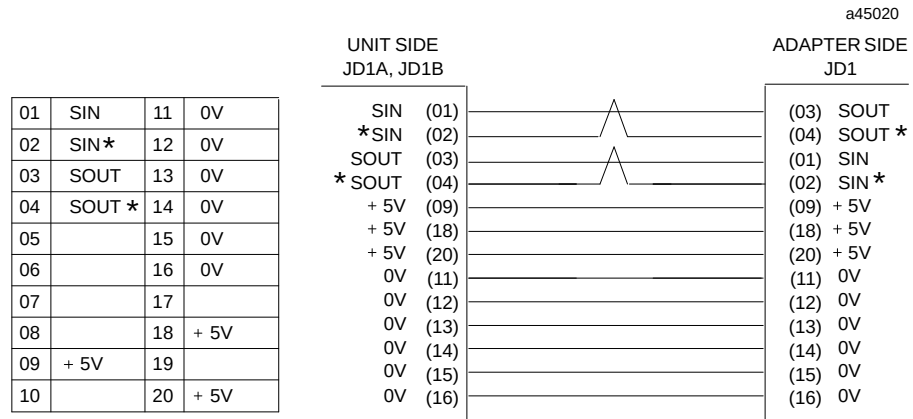
Connection between two Optical Adapters is made using optical fiber cable A66L-6001-009. Lengths of 10 to 100 meters are available. Connect the optical fiber cable to COP1 on the adapter unit.



Connection between a master or slave device and an Optical Adapter is made using electrical cable A03B-0807-K803, which is a one-meter cable with connectors on both ends. Connect this cable to JD1 on the adapter. A connection diagram is shown on the next page.

Cable Diagram, Electrical Cable to Optical Adapter

Cable A03B-0807-K803 provides the +5-volt signal required by the Optical Adapter. **Do not use this cable to directly connect master or slave devices; use it only with an Optical Adapter.**



Note

The +5-volt output on the Series 90-70 I/O Link Module is fused with a 0.5 Amp fuse. The fuse is not field replaceable.

Chapter 3

Series 90-30 PLC Configuration

This chapter explains how to configure the Series 90-30 I/O Link Interface Module using a Hand-held Programmer or Logicmaster 90-30 software. It may also be configured using the automatic configuration feature of the Series 90-30 PLC. The choice of a configuration method depends on whether the module is set up for 32-point or 64-point operation.

- If the module is set up for 32-point operation, it can be auto-configured, or configured with a Hand-held programmer or Logicmaster 90-30 software (release 3 or later).
- If the module is set up for 64-point operation, it can be configured with a Hand-held Programmer or Logicmaster 90-30 software (any version). *Auto-configuration of the PLC cannot be done when a 64-point module is present.*

Configuration with a Hand-held Programmer

When a Hand-held Programmer is used to configure the PLC, it will automatically configure an I/O Link Interface Module as an input/output module. The same number of references, 32 or 64, will be automatically assigned as the number selected using the module's on-board jumper (see chapter 2, if necessary, for an explanation of this jumper).

For example, the HHP screen for the I/O Link Interface Module might look like this:

R0:07 QI	<3
I32:I0033-I0064	

In this example, the module is installed in rack 0, slot 7. It has been configured as a 32-point I/O module, and automatically assigned references %I0033 through %I0064. The assigned references can be changed if others are preferred.

Configuration with Logicmaster 90-30

Follow the steps below to include an I/O Link Interface Module in the configuration of the Series 90-30 PLC, when using Logicmaster 90-30. Release 3 or a later version of Logicmaster is required to configure the I/O Link Module for 32-point operation.

1. In the LM90 configuration software, select I / O Configuration.
2. Display the configuration screen for the rack where the module will be located. The Next Page and Prev Page keys are used to move between rack configuration screens.
3. In the correct rack display, move the reverse video cursor to the module's intended slot. (Use the left and right cursor keys to move the cursor).
4. Press **m30 io** (F1) to locate an I / O Link Interface Module in the slot. The detail screen appears.
5. Then, press **d mix** (F3) to display the catalog list. The list for Logicmaster 90-30 release 3 or later is shown below.

```

RACK 0 SLOT 7
SOFTWARE CONFIGURATION

SLOT 7
Catalog #: IC693BEM320

=====
  CATALOG #      DESCRIPTION      32/64PT      TYPE
1 IC693BEM320    FANUC      INPUT/OUTPUT      LINK
2 INOUT8         GENERIC      INPUT/OUTPUT      8 PT
3 INOUT16        GENERIC      INPUT/OUTPUT      16PT
4 INOUT32        GENERIC      INPUT/OUTPUT      32PT
5 INOUT64        GENERIC      INPUT/OUTPUT      64PT

<<CURSOR TO THE DESIRED CATALOG NUMBER AND PRESS THE ENTER KEY>>
<< PRESS PGDN KEY FOR NEXT PAGE, PGUP KEY FOR PREVIOUS PAGE  >>

=====

ID:CENTRAL RUN/IOSCAN 7ms ONLINE L4: ACC; WRITE CONFIG EQUAL
REPLACE FIXED PRG: LESSON CONFIG VALID

```

6. Select IC693BEM320 from the list.

If the software is earlier than release 3, this entry will not appear. Instead, select “INOUT64”. No further configuration is required; press Rack (Shift-F1) or the Escape key to return to the rack display.

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