S/390

Planning for the 9032 Model 5 Director with FICON Converter Feature

SA22-7415-01

Note

Before using this information and the product it supports, read the general information under "Notices" on page ix.

Second Edition (August, 1999)

This is the second edition of SA22-7415. This manual supersedes information about the 9032 Model 5 Director that appears in SA22-7295.

This edition applies to the 9032 Model 5 Director (with FICON Converter feature) and to all subsequent releases and modifications until otherwise indicated in new editions or technical newsletters.

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About This Publication

This publication provides a general description of and planning information for the IBM 9032 Model 5 Director. The Director provides dynamic connections between:

- Fibre Connection (FICON™) channels and attached Enterprise Systems Connection (ESCON®) devices.
- ESCON channels and attached ESCON devices.

This publication also provides guidelines for ordering and configuring the Director, and includes connectivity considerations and recommendations.

Who Should Use This Publication

Use this publication if you are planning to install a Director. The publication contains information primarily for configuration planners and installation planners, however, it also contains information for system administrators, customer engineers, project managers, and system programmers.

Before installing a Director, it is important to understand how fiber-optic technology relates to FICON and ESCON products. For more information, refer to:

- *Introducing Enterprise Systems Connection* (GA23-0383).
- *Planning for S/390 Fiber Optic Links - ESCON, FICON, Coupling Links, and Open System Adapters* (GA23-0367).
- *S/390 Fibre Channel Connection (FICON) I/O Interface - Physical Layer* (SA24-7172).
- *S/390 FICON Migration Guide* (SG24-5169).
- *Introduction to IBM S/390 FICON* (SG24-5176).

How This Publication Is Organized

This publication includes three chapters and four appendices organized as follows:

- **Chapter 1 - Introduction.** This chapter provides a description of the Director and Director Console (including optional features), a brief introduction to FICON technology, operational requirements, port addressing, configuration, and connectivity considerations, migrating from earlier model Directors, logical partitioning capability, and the Multiple Image Facility (MIF).
- **Chapter 2 - Connectivity Considerations and Recommendations.** This chapter describes the factors to consider when planning an initial Director configuration, including Console selection, redundancy and backup, connectivity requirements, shared control units, port addresses, connections and cabling, and configuration enhancements.
- **Chapter 3 - Configuration Planning.** This chapter describes the configuration planning tasks that should be completed before installing a Director. Preparation of a site plan is described, including planning for Console support, local area network (LAN) connections, telephone connections, input/output (I/O) connections, ESCON Converters, and facility ac power.
- **Appendix A - Planning Checklist.** This appendix provides a checklist that summarizes Director planning and installation activities. Depending on the installation, all steps may not be required, or additional steps may be required. Modify the checklist accordingly.

- **Appendix B - Planning Worksheets.** This appendix contains example and blank worksheets for planning a Director configuration, including host channel, control unit, and converter connections, chained Director configurations, migrating from older model Directors, and logical partitioning.
- **Appendix C - IOCP Statement Examples.** This appendix contains sample Director configurations and the Input/Output Configuration Program (IOCP) statements required to define the configurations to a host system.
- **Appendix D - Architectural Deviations.** This appendix describes deviations to the architecture of earlier Director models.

A **Glossary** and **Index** are provided at the back of the publication.

Where to Find More Information

Other publications that provide additional planning information or material are listed in the following sections. The publications are grouped into general categories.

S/390 Server-Based Control Products

The following publications support System 390® (S/390®) servers and server-based control products:

- *Introducing Enterprise Systems Connection* (GA23-0383).
- *Introducing Enterprise Systems Connection Directors* (GA23-0363).
- *Planning for S/390 Fiber Optic Links - ESCON, FICON, Coupling Links, and Open System Adapters* (GA23-0367).
- *S/390 Fibre Channel Connection (FICON) I/O Interface - Physical Layer* (SA24-7172).
- *S/390 FICON Migration Guide* (SG24-5169).
- *Introduction to IBM S/390 FICON* (SG24-5176).
- *Enterprise Systems Connection: Planning for Migration* (GG66-3181).
- *Programming the Interface for Enterprise Systems Connection Directors: XDF Capable* (SA23-0356).
- *System Automation for OS/390, General Information* (GC28-1541).
- *System Automation for OS/390, Planning and Installation* (GC28-1549).
- *System Automation for OS/390, Technical Referenc*e (GC28-1593).
- *System Automation for OS/390, Operations* (GC28-1550).
- *System Automation for OS/390, Customization* (GC28-1566).

9032 Model 5 Director Publications

The following publications support the 9032-005 Director:

- *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).
- *Maintenance Information for the 9032 Model 5 Director* (SY28-1158).
- *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).
- *9032 Model 5 ESCON Director Physical Planning Template* (GX22-0046).

- *User's Guide Reference Summary for the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7298).
- *Operator Panel Reference Summary for the 9032 Model 5 Director* (SA22-7297).
- *Using Enterprise Systems Connection Directors: XDF Capable* (GA23-0354).

ESCON Converter Publications

The following publications support 9034 and 9035 ESCON Converters:

- *Introducing the 9034 Enterprise Systems Connection Converter* (GA23-0361).
- *Planning for the 9034 Enterprise Systems Connection Converter* (GA23-0362).
- *Introducing the 9035 Enterprise Systems Connection Converter* (GA23-0392).
- *Planning for the 9035 Enterprise Systems Connection Converter* (GA23-0393).

HCD and HCM-Related Publications

The following publications support Hardware Configuration Definition (HCD) and Hardware Configuration Management (HCM):

- *OS/390 V1R3.0 MVS HCD Planning* (GC28-1750).
- *OS/390 V1R3.0 MVS HCD User's Guide* (SC28-1848).
- *OS/390 V2R4.0 HCM User's Guide* (SC33-6595).
- *9672/9674 Hardware Management Console Operations Guide* (GC38-0470).

Other Planning-Related Publications

The following publications provide other planning-related information:

- *IBM System/360, System/370, 4300, 9370, and ES/9000 Processors Input/Output Equipment Installation Manual - Physical Planning* (GC22-7064).
- *S/390 9672 PTS, 9672 PES, and S390 CF Installation Manual - Physical Planning* (GC22-7101).
- *S/390 G3 and G4 Enterprise Servers and Coupling Facility Models C04 and C05: Installation Manual - Physical Planning* (GC22-7102).
- *S/390 G5 Enterprise Server: Installation Manual - Physical Planning* (GC22-7106).
- *System Overview - S/390 G3 Server* (GA22-7150).
- *System Overview - S/390 G4 Server* (GA22-7154).
- *System Overview - S/390 G5 Server* (GA22-7158).
- *Input/Output Configuration Program Users Guide* (GC38-0401).
- *IBM General Information: Installation Manual - Physical Planning* (GC22-7072).
- *ES/9000 and ES/3090 PR/SM Planning Guide* (GA22-7123).
- *S/390 PR/SM Planning Guide* (GA22-7236).
- *Fiber Transport Services (FTS) Direct Attach Physical and Configuration Planning* (GA22-7234).

ANSI Publications

The following publications related to Fibre Channel are provided by the American National Standards Institute (ANSI):

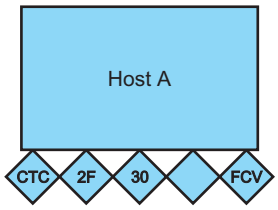
- *Fiber Channel Physical and Signaling Interface (FC-PH), Revision 4.3, June 1, 1994* (X3.230-1994).
- *Fiber Channel Physical and Signaling Interface - 2 (FC-PH-2), Revision 7.4, September 10, 1996* (X3.297-1997).
- *Fiber Channel Physical and Signaling Interface - 3 (FC-PH-3), Revision 9.1, October 16, 1996* (X3.303-1997).

Symbols Used in This Publication

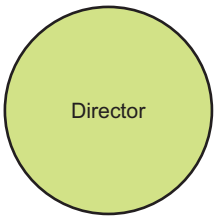
This publication contains several figures that represent configurations of host processors, Directors, converters, control units, and devices. The symbols used in the figures conform to symbols illustrated in *Using the Enterprise Systems Connection Manager* (SC23-0425). The symbols are similar to those shipped with the ESCON Manager Workstation feature. However, the symbols are not similar to those shipped with the I/O Operations function feature of System Automation for OS/390™ (SA OS/390™).

Host Processors - Host processors that support FICON or ESCON operation are shown as rectangles. Channel connections are shown as diamonds at the bottom of the host figure, and are labeled as follows:

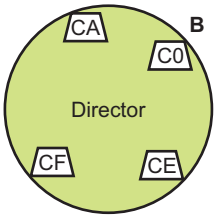
- ESCON channels are unmarked unless otherwise indicated.
- ESCON channels operating in channel-to-channel (CTC) mode are labeled CTC.
- FICON channels attached to a Fibre Channel Converter (FCV) port card (9032-005 Director only) are labeled FCV.
- Channel path identifiers (CHPIDs) are labeled *2F*, *30*, etc.



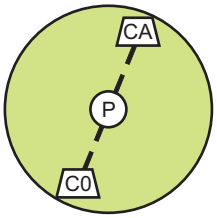
Directors - Directors are shown as circles and labeled as a Director, or labeled as a device number or logical switch number (LSN).



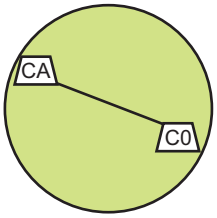
Logical Port Addresses - Director ports are shown as a trapezoids within the Director. Logical port addresses are shown as two-digit hexadecimal numbers inside each trapezoid. The letter **B** adjacent to a port (port *C0* in the example) indicates the port is blocked and cannot transfer information.



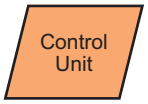
Dynamic Connection - A dynamic connection is shown as a dashed line between two ports in the Director. If a connection line is interrupted by a circle with the letter **P**, the connection (communication path) between the ports is prohibited.



Dedicated Connection - A dedicated connection is shown as a solid line between two ports in the Director.

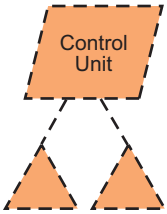


Control Units - Control units are shown as a parallelogram and labeled accordingly.

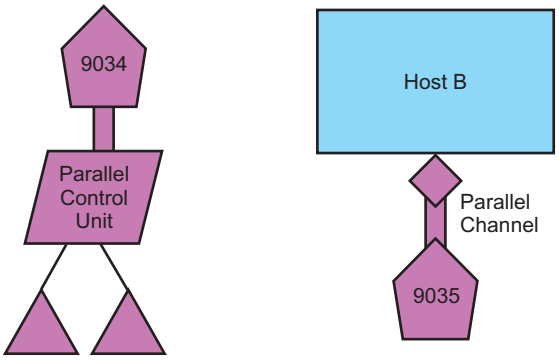


Devices - Devices are shown as a triangle and indicate *any* supported device. The triangle may sometimes contain a number (address).

Uninstalled or Example Units - Uninstalled or example units are shown as dashed lines to indicate the units are either planned but not installed, or added as part of an example.

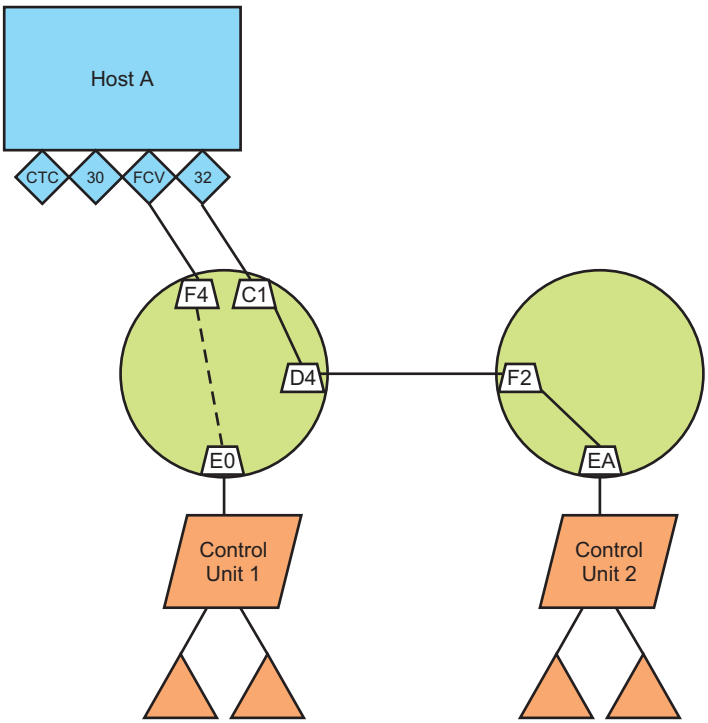


ESCON Converters - ESCON Converters are shown as shaded pentagons and labeled accordingly (9034 or 9035). A shaded thick line connecting a 9034 Converter with a parallel control unit or a 9035 Converter with a parallel channel indicates bus and tag cabling.

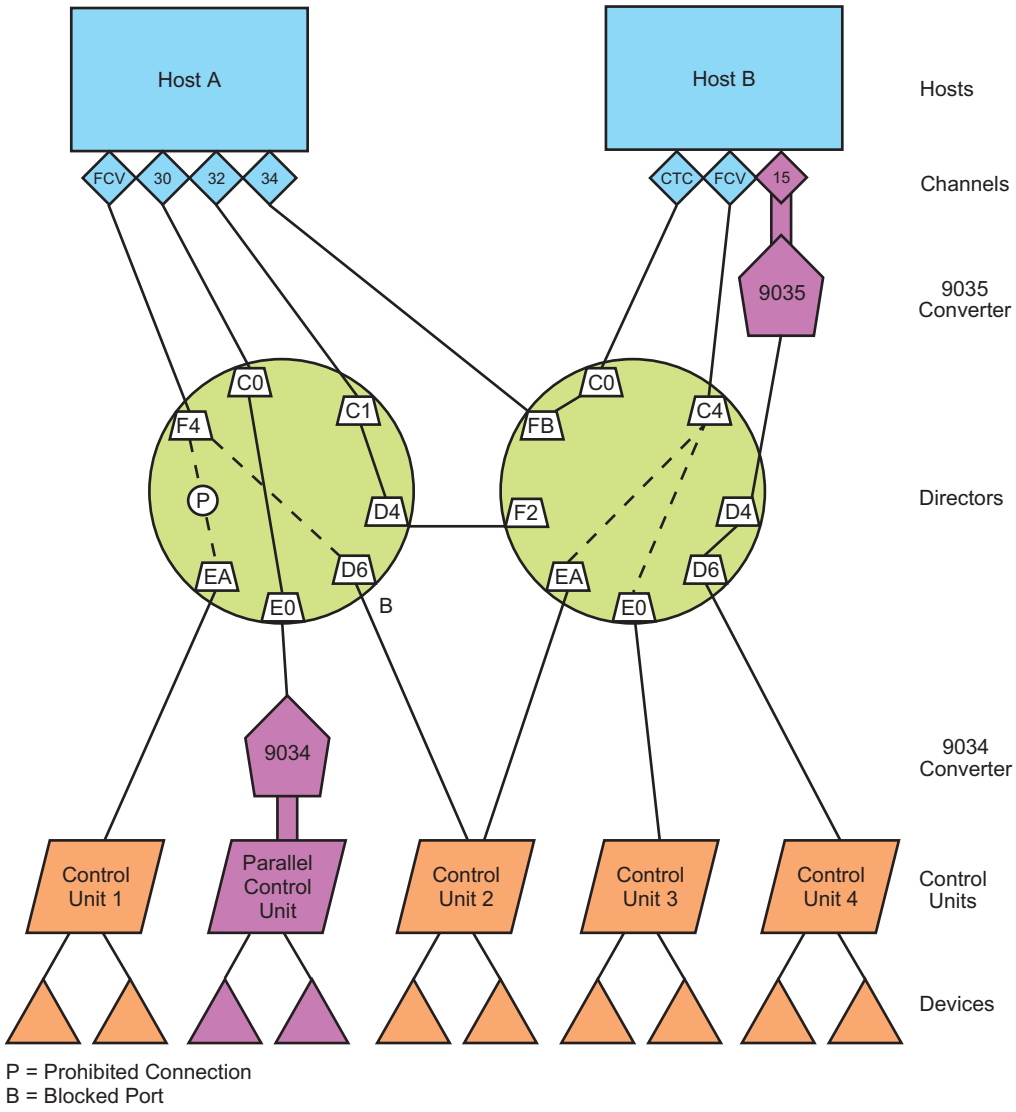


Fiber-Optic Cables - Fiber-optic cables are shown as solid lines between channels and Directors, between two Directors, and between Directors and control units. The solid lines shown between control units and devices *do not* represent fiber-optic cables.

Note: Control unit 2 cannot access the Host A FICON connection.



The following figure shows all of the described symbols in an example Director configuration diagram.


Host A
Host B
Hosts
FCV
30
32
34
CTC
FCV
15
Channels
9035
9035
Converter
C0
C1
F4
P
D4
EA
D6
E0
B
C0
C4
FB
F2
D4
EA
D6
E0
Directors
9034
9034
Converter
Control
Unit 1
Parallel
Control
Unit
Control
Unit 2
Control
Unit 3
Control
Unit 4
Control
Units
Devices
P = Prohibited Connection
B = Blocked Port

Chapter 1. Introduction

The 9032 Model 5 Director (9032-005 Director or Director) provides dynamic connections between Fibre Connection (FICON) or Enterprise Systems Connection (ESCON) channels and attached ESCON devices. The Director also provides dedicated ESCON-to-ESCON connections (for example, to a 9034 ESCON Converter).

This chapter provides an introduction to FICON technology, describes the Director, and summarizes the Director's capabilities and features. The chapter specifically discusses the:

- Director and Director Console.
- Logical partitioning capability.
- Optional features.
- Hardware, software, and programming support requirements.
- Control and operation of Directors.

Before reading this publication or using the Director, read and understand S/390 server concepts described in *Introducing Enterprise Systems Connection* (GA23-0383).

Throughout this Publication:

The term ***Director*** applies to the 9032-005 Director. The term ***FICON*** applies to a high-performance dynamic connection between an S/390 Generation 5 (or later model) server and the Director. The term ***ESCON*** refers to communication through dynamic connections established by the Director, including ESCON channels, ESCON XDF channels, and ESCON-compatible control units. To determine if a product is capable of communicating through dynamic connections or if communication restrictions apply, refer to the supporting publications for the product or contact your IBM marketing representative.

The Director provides single-link connections according to port feature availability and the fiber technology used in the customer's installation. The following port feature cards are available.

- **FCV** - A Fibre Channel Converter (FCV) port card provides one FICON port connection. The port provides a link attachment *only* to an IBM System/390 (S/390) Generation 5 (or later model) Parallel Enterprise Server™.
- **LED** - A light-emitting diode (LED) device port (DVP) card provides eight ESCON port connections. Each port provides a link attachment to an ESCON-capable server, ESCON-capable peripheral, 9034 or 9035 ESCON Converter, or another Director.
- **XDF Laser** - An Extended Distance Feature (XDF) laser DVP card provides eight ESCON port connections. Each port provides a link attachment to an ESCON XDF-capable server, 9036 ESCON Converter, or another Director.

Introduction to FICON Technology

FICON provides a high-performance, high-bandwidth input/output (I/O) channel optimized for efficiency and speed. FICON increases system I/O capacity to permit channel consolidation and growth of single images and logical partitions (LPARs). FICON also coexists with current ESCON link technology. FICON is based on the American National Standards Institute (ANSI) Fibre Channel Physical and Signaling Interface (FC-PH) standard, and IBM's performance-enhanced S/390 layer.

The 9032-005 Director can be ordered with optional hardware that supports FICON technology through the use of the FCV port card as a FICON-to-ESCON converter. The FCV port card provides investment protection for installed ESCON Directors and control units, while allowing the customer to upgrade to FICON technology. Investment protection is provided because:

- The FICON connection to the Director can use the existing fiber-optic cabling infrastructure. Connections to installed ESCON control units are left intact.
- Operating System/390® (OS/390®) single images or LPARs are restricted to 256 channel path identifiers (CHPIDs). The FCV port card allows customers restricted by this limitation to reduce channel path requirements by consolidating up to eight ESCON channels onto a single FICON channel.
- The FCV port card allows early deployment of FICON technology on S/390 servers without requiring the purchase of FICON-capable control units. Legacy control units that dynamically connect to internal ESCON ports on the FCV port card detect no difference between these ports and standard ESCON ports.
- The performance-enhanced S/390 layer allows existing channel programs to operate with current ESCON control units (and future FICON control units) through the FCV port card.

FICON channels provide significant improvement over ESCON channels by improving data transfer rates and permitting large and small I/O operations on the same link. FICON channels permit OS/390 single image or LPAR growth, and enable S/390 server consolidation, new application growth, and exploitation of network computing.

FICON Features

The following list summarizes the major features provided by FICON technology:

- **High bandwidth** - The communication bandwidth of a link depends on clock rate, baud rate, and protocol parameters. The primary factor is the clock rate. The base clock rate for data transfer over a bidirectional, point-to-point serial FICON channel is 1.0625 gigahertz (GHz), with one data bit transmitted per clock cycle.
- **Low communication overhead** - The FICON protocol provides efficient use of the transmission bandwidth, reduces interlocked handshakes across the communication interface, and efficiently implements low-level error recovery mechanisms. This results in little communication overhead in the protocol and a very low (10-^{12}) bit error rate.
- **Point-to-point topology** - FICON topology (Figure 1) provides a single, direct connection between two communication ports called node ports (*N_ports).* This topology supports bidirectional transmission between source and destination *N_ports*. The FICON port on the FCV port card provides the *N_port* (or *thin F_port*) connector for the Director.

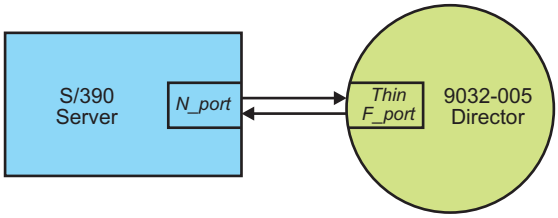


Figure 1. FICON Point-to-Point Topology

Note: The *thin F_port* connection (FICON) on the FCV port card provides the combined functions of an *N_port* and fabric port (*F_port*). The port has the external functionality of an *N_port*, but accepts fabric login (FLOGI) commands. Acceptance of these commands is an *F_port* function.

- **Class 3 transmission service** - FICON provides Class 3 transmission service (best-effort multiplexed datagram) as defined by the FC-PH standard. Class 3 service duplicates the functions of a packet-switching network, and allows multiple nodes to share links by multiplexing the transmitted data. Multiplexing is supported from a source to multiple destinations, or from a destination to multiple sources. This service allows data transmission with great flexibility and efficiency. However, data frames may be discarded without notification if high-traffic or error conditions are encountered. If a data frame is discarded or corrupted, error recovery or notification (if any) is performed at the upper level protocol (ULP) level.
- **Standard protocol mapping** - FICON operates as a data and control block transport mechanism for ULPs. Interfaces are provided to transport commands, data, and status messages across the FICON-to-ESCON interface.

Director Description

Figure 2 illustrates the Director and attached Console. The Director can contain a maximum of 31 port cards. The Director supports the installation of one to 16 FCV port cards (FICON) as optional features. The remaining port cards must be ESCON DVP cards (LED or XDF laser). An increase in physical FICON ports results in a corresponding decrease in physical ESCON ports. With the minimum or maximum number of FCV port cards installed, the number of port connections are as follows:

- If no FCV port cards and 31 DVP cards are installed, the Director supports 248 physically external ESCON connections.
- If one FCV port card and 30 DVP cards are installed, the Director supports one physically external FICON connection and 240 physically external ESCON connections.
- If 16 FCV port cards and 15 DVP cards are installed, the Director supports 16 physically external FICON connections and 120 physically external ESCON connections.

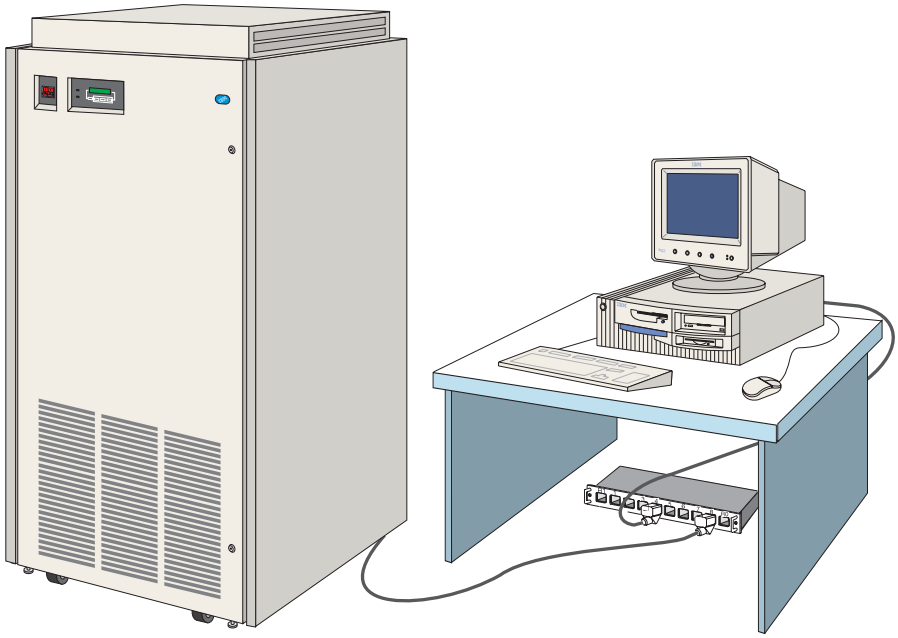


Figure 2. 9032-005 Director and Console

The FCV port card provides a function allowing consolidation of up to eight ESCON channels into one FICON channel. Therefore, the single FICON device port on the card connects to eight internal ESCON ports on the card that connect to the logic board assembly at the rear of the Director. The FCV port card acts as a converter between a FICON channel and ESCON peripherals.

The Director provides non–blocking switching between the FICON device port and enabled ESCON DVP ports. Any internal ESCON port on the FCV port card can be dynamically connected to any other ESCON DVP port. Dedicated connections between an internal ESCON port and an ESCON DVP port *are not* allowed. An internal ESCON port to internal ESCON port connection is also not allowed.

Native ESCON Versus FICON Converter Connectivity

Figure 3 shows an example of native ESCON server-to-control unit links through a Director *without* an FCV port card installed. For this ESCON connectivity example:

- An ESCON DVP card provides up to eight ESCON channel links to multiple servers and/or eight ESCON control unit links.
- One I/O operation at a time is allowed per channel. Operations for other control units wait until the channel I/O operation is complete.
- Dynamic or dedicated connections between ESCON DVP ports are allowed.

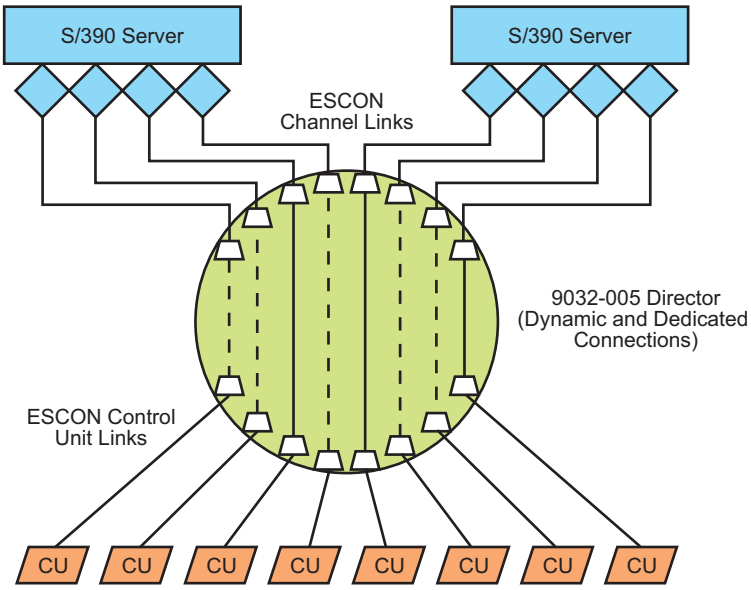


Figure 3. Director Connectivity with Native ESCON

Figure 4 shows an example of FICON converter server-to-control unit links through a Director *with* an FCV port card installed. For this FICON-to-ESCON connectivity example:

- An FCV port card provides one FICON channel link to one server and up to eight ESCON control unit links at a time.
- Up to eight I/O operations are allowed concurrently (each I/O operation to a different control unit).

  Note: To consolidate multiple ESCON channel paths (up to eight) to a single FICON channel path, the ESCON control unit links must be switched to separate logical control unit addresses.

- Multiple, dynamic paths exist between a channel and control units.

- Only dynamic connections between internal ESCON ports (on the FCV port card) and ESCON DVP ports are allowed. Dedicated connections *are not* allowed.

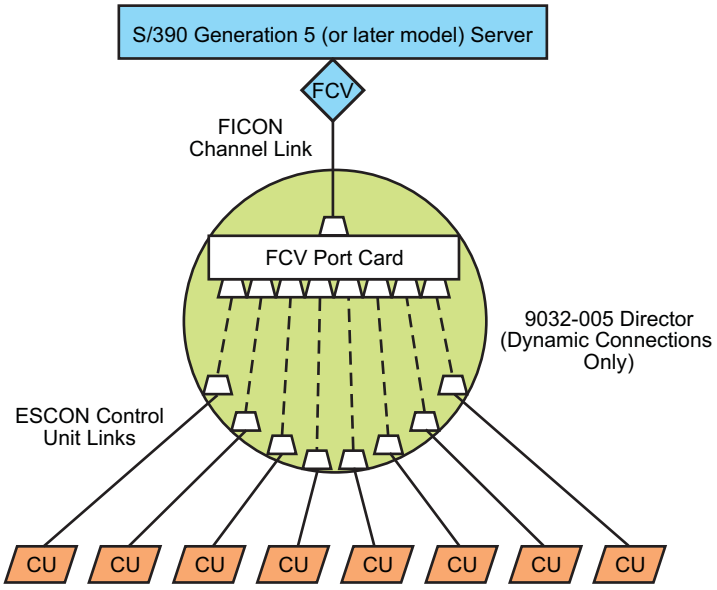


Figure 4. Director Connectivity with FICON Converter

Director Components

The following paragraphs and supporting illustrations describe Director components.

- **Power Switch** - Setting the power switch (Figure 5 and Figure 7) to the on position (**|**) supplies ac power to the dual power supplies and powers on the Director. Setting the power switch to the off position (**O**) powers off the Director. The power switch is a non-concurrent field-replaceable unit (FRU) that is removed and replaced only when the Director is powered off.

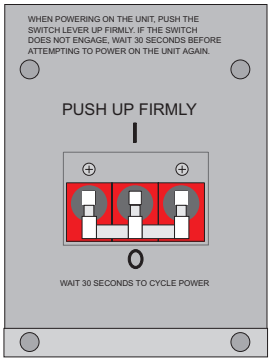


Figure 5. Power Switch

- **Operator Panel** - The operator panel (Figure 6 and Figure 7) includes a:
  - **Power Indicator** - The Power indicator is an LED that illuminates when power is supplied to the Director.
  - **Status Display** - The status display is a liquid-crystal display (LCD) that shows status and event messages on two 16-character lines.

- **IML Button** - Pressing the initial machine load (*IML*) button reloads Licensed Internal Code (LIC) and resets all hardware, except the Matrix Controller/Matrix Switch (MXC/MXS), FCV port cards, and DVP cards. The *IML* button is hidden when the front door is closed.
- **Control Buttons** - Four control buttons (*Advance*, *Entry*, *Detail*, and *Clear*) control information shown on the status display.
- **System Error Indicator** - The System Error indicator is an LED that illuminates when a software or hardware error occurs.

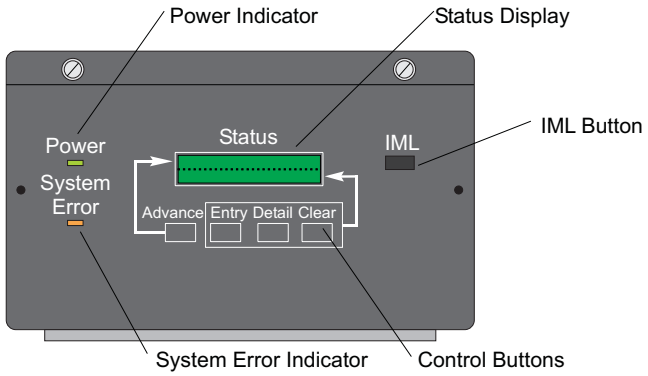


Figure 6. Operator Panel

The operator panel is a concurrent FRU that is removed and replaced while the Director is operational.

- **CTP Card** - The Control Processor (CTP) card (Figure 7) contains a microprocessor and associated logic that provides overall coordination for the Director. The card also initializes system hardware components after power on or reset. During Director operation, the CTP card controls the operator panel, port exception handling, error recovery, maintenance port operation, and control unit port (CUP) operation.

  It is recommended a backup CTP card (Feature Code #5600) be installed to operate the Director if the primary CTP card fails. The backup CTP card is installed concurrently while the Director is operational. With two CTP cards, Loader/Monitor Area (LMA) code and LIC can be upgraded concurrently. A CTP card can also be removed and replaced concurrently.

  The CTP card has a green LED that, when illuminated, indicates the card is active. The card also has an amber LED that, when illuminated, indicates the card failed or is loading code.

- **Spare Ports Card** - The spare ports card (Figure 7) is only used when ESCON ports on a standard DVP card are swapped for spare ports. The card does not increase the total number of active connections available. The spare ports card *cannot* be used to swap a FICON port on an FCV port card. The spare ports card contains either:
  - Four LED spare port interfaces for ESCON fiber-optic media (Feature Code #5245). Cables attach to the ports through IBM multimode duplex connectors.
  - Two LED and two XDF laser spare port interfaces for ESCON fiber-optic media (Feature Code #5255). Cables attach to the LED ports through IBM multimode duplex connectors and to XDF ports through singlemode Fibre Channel Standard/Subscriber Connector (FCS/SC) duplex connectors. An XDF adapter kit (part number 46H9223) is required for each port if cables from ESCON devices have IBM multimode duplex connectors.

- **Storage Compartment** - The storage compartment (Figure 7) provides storage for tools and supporting publications.

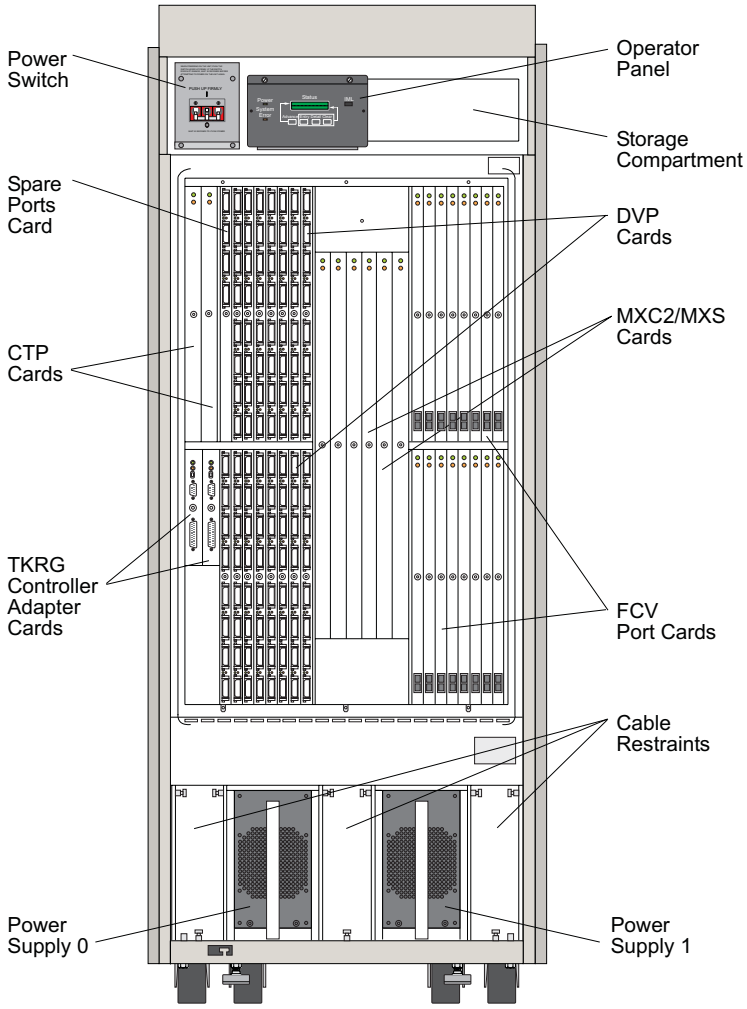


Figure 7. 9032-005 Director (Front View)

FCV Port Card - The FCV port card (Feature Code #5260) is the hardware interface for FICON fiber-optic media (Figure 7). Up to 16 FCV port cards can be installed in the Director. The card provides a multiplexing and conversion function that connects one FICON port to eight internal ESCON ports that connect to the Director's logic board assembly. The card acts a FICON-to-ESCON converter.

Each card contains one longwave laser port interface for FICON fiber-optic media. The port attaches to a FICON host channel (defined as FCV). A singlemode or multimode fiber-optic cable attaches to the port through an FCS/SC duplex connector. Multimode cables can be attached to an FCV port using a mode conditioning patchcord (part number 21L4175).

The FCV port card can operate in degraded mode. Up to seven internal ESCON ports may be disabled without affecting operation of the remaining internal ESCON port or ports. However, performance of the remaining ports is degraded because all data transmission is routed through these operational ports. The card is not operational if the FICON port is disabled. The FCV port card has a green status LED that indicates the following conditions:

— When illuminated, the FICON port is operational.

— When flashing, the port card is loading code (the amber LED may also be illuminated).

— When extinguished, the FICON port or *all* internal ESCON ports failed.

The FCV port card has an amber status LED that indicates the following conditions:

— When illuminated, one or more internal ESCON ports are disabled and the card is operating in degraded mode, the port card is loading code, or port card logic has failed.

— When flashing, an active MXC2 card is not recognized or the maximum number of installed FCV port cards (16) is exceeded.

— When extinguished, all internal ESCON ports are operational.

Each FCV port card is a concurrent FRU that is removed and replaced while the Director is operational.

- **MXC/MXS Card Set** - The Matrix Controller/Matrix Switch (MXC/MXS, shown in Figure 7) is a three-card set that controls dynamic connection requests and provides connection paths between ports specified by port attributes configured through the Director Console or System Automation for OS/390 (SA OS/390). There are two MXC card types:

  — The original card (labelled **MXC**) controls switching only for ESCON DVP cards. ***This card does not support operation of FCV port cards.***

  — The current card (labelled **MXC2**, Feature Code #5700) controls switching for *both* ESCON DVP cards and FCV port cards. This card is required to support FICON operation.

  Note: An older 9032-005 Director must be upgraded to the MXC2 card to support FICON operation. The card is provided automatically when an initial FCV port card is ordered as an upgrade.

  It is recommended a backup MXC/MXS card set (Feature Code #5500) be installed for redundancy in case the primary card set fails. The card set can be installed while the Director is operational. The MXC card has a green LED that, when illuminated, indicates the card is active. The card also has an amber LED that, when illuminated, indicates the card failed. Each MXS card has an amber LED that, when illuminated, indicates the card failed. With two card sets installed, each set is a concurrent FRU that is removed and replaced while the Director is operational.

  Note: ***Ensure the primary and backup MXC cards are the same type.*** If a Director contains an MXC card with a backup MXC2 card, FICON capability is not enabled. If a Director contains an MXC2 card with a backup MXC card, the MXC card is not capable of handling failover and preserving FICON capability (ESCON connectivity is still available).

- **DVP Card** - The DVP card (Figure 7) is the hardware interface for ESCON fiber-optic media. A minimum of three DVP cards (24 ports) must be installed in the Director. Each DVP card contains either:

  — Eight LED port interfaces for ESCON fiber-optic media. Cables attach to the ports through IBM multimode duplex connectors.

  — Eight XDF laser port interfaces for ESCON fiber-optic media. Cables attach to the ports through singlemode FCS/SC duplex connectors. An XDF adapter kit (part number 46H9223) is required for each port if cables from ESCON devices have IBM multimode duplex connectors.

Note: If the 9032-005 Director is replacing a 9032-002 0r 9032-003 Director with XDF ports (using IBM duplex connectors), an XDF adapter kit (part number 46H9223) is required for each port.

Each DVP card has eight amber LEDs (one per port). An illuminated LED indicates the associated port failed. Each card is a concurrent FRU that is removed and replaced while the Director is operational.

- **Cable Restraint** - Fiber-optic jumper cables are routed to the Director through access holes beneath three cable restraints (Figure 7). Removable covers restrain the cables after they are routed to port cards. The covers can be adjusted to allow for additional cables when port cards are added.
- **Power Supply** - Two variable-input power supplies (Figure 7) step down and rectify facility input power to provide dc power to Director components. An LED on the power supply illuminates when the supply is operational. Each supply is a concurrent FRU that is removed and replaced while the Director is operational. There are two power supply types:
  - The original power supply that provides +5 and +24 Vdc power to Director components. For identification, the face plate of this power supply is unfinished aluminum (silver) with an appropriate label. ***This power supply does not support operation of FCV port cards.***
  - The current power supply (Feature Code #5701) provides +3.3, +5, and +24 Vdc power to Director components and supports FCV port card operation. For identification, the face plate of this power supply is anodized (black). This power supply is required to support FICON operation. A +3.3 Vdc power sense cable must also be installed with this option.

    Note: An older 9032-005 Director must be upgraded to the current power supply to support FICON operation.
- **TKRG Controller Adapter Card** - The Token Ring (TKRG) Controller Adapter card (Figure 7) provides a:
  - **LAN Connection** - This port is a serial connector (9-pin female) that attaches the Director to a 4/16 megabit per second (Mbps) Token Ring LAN. The LAN connection allows the Director to communicate with a Director Console.
  - **Maintenance Port** - This port is an RS-232-D asynchronous serial connector (25-pin male) that attaches the Director to a maintenance terminal. The terminal accesses maintenance utilities and functions through the Director's monitor subsystem, and is intended for use only by a service representative.

  It is recommended a backup TKRG Controller Adapter card (Feature Code #5800) be installed for redundancy if the primary card fails. The card can be installed while the Director is operational. The TKRG Controller Adapter card has a green LED that, when illuminated, indicates the card is active. The card also has an amber LED that, when illuminated, indicates the card failed. With two cards installed, each card is a concurrent FRU that is removed and replaced while the Director is operational.
- **Fan Assembly** - The Director contains two fan assemblies (Figure 8). Each assembly contains two fans with associated LEDs that illuminate when the fans are operational. The fans provide cooling for Director components and redundancy in case of fan failure. With no FCV port cards installed, the Director can operate with any two of the four fans operational. With FCV port cards installed, the Director can operate with any three of the four fans operational. Each fan assembly is a concurrent FRU that is removed and replaced while the Director is operational.

- **Logic Board Assembly** - The logic board assembly (Figure 8) provides electrical and signal connections for the logic cards, power supplies, and fan assemblies. The logic board assembly is a nonconcurrent FRU that is removed and replaced only when the Director is powered off.
- **Ac Power Input** - The ac power input contains two plug receptacles for 180 to 264 Vac power (Figure 8). Each plug receptacle connects to one power supply. For redundancy, it is recommended each receptacle be connected to a separate facility power source.

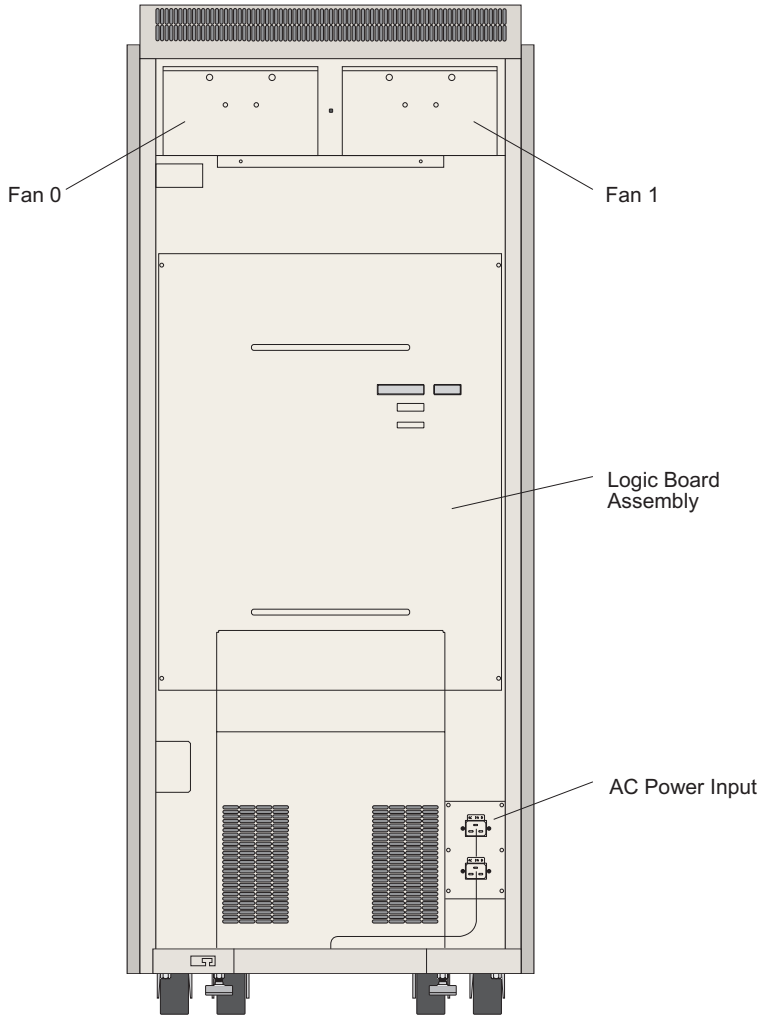


Figure 8. 9032-005 Director (Rear View)

Redundant and Backup Components

Redundant and backup FRUs provide continuous availability and allow concurrent maintenance for the Director. Redundant FRUs operate while the Director is powered on. The following are redundant FRUs:

- **Power Supply** – Two power supplies share the Director's power requirements unless one supply fails. The redundant (operating) supply provides all power requirements until the failed supply is removed and replaced.
- **Fan Assembly** – Two fan assemblies provide cooling for the Director. If one fan fails, three redundant (operating) fans provide all cooling air flow until the fan assembly associated with the failed fan is removed and replaced.

Backup FRUs can be delivered with the Director or installed as enhanced availability features (EAFs). A backup FRU does not operate while the corresponding primary FRU is in operation. The following backup FRUs can be installed:

- **CTP Card** - A backup CTP card is a concurrent FRU that is installed while the Director is operational. If the primary card fails, the Director automatically switches operation to the backup card.
- **TKRG Controller Adapter Card** - A backup TKRG Controller Adapter card is a concurrent FRU that is installed while the Director is operational. If the primary card fails, the Director automatically switches operation to the backup card (both TKRG Controller Adapter cards have the same Internet Protocol (IP) address).
- **MXC/MXS Card Set** - A backup MXC/MXS card set is a concurrent FRU that is installed while the Director is operational. If the primary card set fails, the Director automatically switches operation to the backup card set.
- **Spare Ports Card** - An LED spare ports card or LED/XDF laser spare ports card is a concurrent FRU that is installed while the Director is operational. Up to four failed ESCON ports can be manually swapped to ports on the card. A failed FICON port ***cannot*** be swapped to the spare ports card.
- **DVP Card** - An unused LED or XDF laser DVP card is a concurrent FRU that is installed as a backup while the Director is operational. Up to eight failed ESCON ports can be manually swapped to ports on the backup card (LED-to-LED or XDF laser-to-XDF laser). A failed FICON port ***cannot*** be swapped to the DVP card.
- **FCV Port Card** - An unused FCV port card is a concurrent FRU that is installed as a backup while the Director is operational. One failed FICON port can be manually swapped to the backup card. A failed ESCON port ***cannot*** be swapped to the FCV port card.

Concurrent maintenance can also be performed on attached servers, control units, or channel and control unit links while the Director is operational. For example:

- Fiber-optic cables from uninstalled FICON channels, ESCON channels, or control units can be attached to the Director while the Director is operational.
- If a server or control unit fails, the attached Director port can be blocked while the maintenance action is performed. While maintenance is performed, other Director ports remain operational. When the server or control unit is operational, the attached Director port is unblocked.
- FCV port cards or DVP cards can be installed, removed, or replaced while the Director is operational.

Replace or Add Components

If only one CTP card or MXC/MXS card set is installed in the Director, FRU removal and replacement *is not* concurrent. The Director must be powered off and port operation is interrupted. If two CTP cards or MXC/MXS card sets are installed, FRU removal and replacement is concurrent and port operation *is not* interrupted. A backup CTP card or MXC/MXS card set can be installed concurrently.

If one or two TKRG Controller Adapter cards are installed, FRU removal and replacement is concurrent and port operation *is not* interrupted. However, if only one card is installed, LAN communication with the Director Console is interrupted during the maintenance action. A backup card can be installed concurrently.

The Director contains two power supplies, two fan assemblies, and at least three DVP cards. Power supply and fan assembly removal and replacement is concurrent and port operation *is not* interrupted. DVP cards are removed and replaced concurrently if failed port connections are swapped to spare ports during the maintenance action. Additional cards can be installed concurrently.

FCV port card removal and replacement is concurrent. However, FICON port operation is interrupted. Additional FCV port cards can be installed concurrently.

Table 1 summarizes the effects of FRU removal, replacement, or addition on ESCON and FICON port operation.

Table 1. Effects of FRU Replacement on Director Operation

FRU	Remove and Replace (One FRU Installed)	Remove and Replace (Redundant FRU Installed)	Add Redundant or Backup FRU
CTP Card	Affects ESCON and FICON port operation	No effect	No effect
TKRG Controller Adapter Card	No effect	No effect	No effect
MXC/MXS Card Set	Affects ESCON and FICON port operation	No effect	No effect
DVP Card	Not Applicable	No effect	No effect
FCV Port Card	Affects FICON port operation	No effect	No effect
Logic Board Assembly	Affects ESCON and FICON port operation	Not Applicable	Not Applicable
Operator Panel	Affects ESCON and FICON port operation	Not Applicable	Not Applicable
Power Supply	Not Applicable	No effect	Not Applicable
Fan Assembly	Not Applicable	No effect	Not Applicable

Director Ship Group

The following are packaged and shipped with the Director:

- 6.1-meter (20-foot) cable to connect the Director's TKRG Controller Adapter card to a Token Ring LAN.
- Torque tool with hex adapter to remove and replace logic cards.
- Service key to open doors.
- Two LED wrap plugs, two XDF laser wrap plugs (if XDF laser port cards are installed), and two FCV Port wrap plugs (if FCV port cards are installed).
- Protective plugs for each ordered port.
- Two caster stops.
- Fiber-optic cables shipped according to facility requirements. Refer to *IBM System/360, System/370, 4300, 9370, and ES/9000 Processors Input/Output Equipment Installation Manual - Physical Planning* (GC22-7064) for information.
- Software diskettes: Although the Director ships with LIC installed, a diskette containing the current LIC version is shipped in case future installation is required. Console software is shipped for backup or if the Console option is not ordered with the Director. The following software diskettes are included:

— One Director LIC diskette, labeled *System Version XX.YY.ZZ*, where *XX.YY.ZZ* is the version number.

— One Director LIC diskette, labeled *System2 Version XX.YY.ZZ* (containing FICON operational code), where *XX.YY.ZZ* is the version number.

— One Director diagnostics diskette, labeled *Diag Version XX.YY.ZZ*, where *XX.YY.ZZ* is the version number.

— One LMA diskette, labeled *LMA Version XX.YY.ZZ*, where *XX.YY.ZZ* is the version number.

— One Console application software diskette, labeled *Console Version XX.YY.ZZ,* where *XX.YY.ZZ* is the version number.

— Four blank diskettes, labeled *Diskette DOS formatted for use by service personnel.*

— Two Data Collection diskettes, labeled *Data Collection Utility Version XX.YY.ZZ*, where *XX.YY.ZZ* is the version number.

- Power cord - One ac power cord is shipped for each Director power supply. Power cords are site-dependent and vary in length and type of outlet plug. The minimum length is 1.8 meters (6 feet). Table 2 lists standard power cords available. For additional information, refer to *IBM System/360, System/370, 4300, 9370, and ES/9000 Processors Input/Output Equipment Installation Manual - Physical Planning* (GC22-7064).

Table 2. Director Power Cord Options

Specify Code	Part Number	Description
9986	14F1547	Chicago: NEMA, nonlocking plug, 250V, 6-foot
9801	14F1548	USA, Canada, Taiwan, Thailand: nonlocking plug, 250V, 14-foot
9987	14F1549	Chicago: locking plug, 250V, 6-foot
9800	14F1550	USA, Canada, Mexico: locking plug, 250V, 14-foot
*	14F1553	Argentina, Uruguay, Paraguay, Columbia: 250V, 14-foot
*	14F1554	Iceland, Korea: EMEA, 250V, 14-foot
*	14F1555	Denmark, United Kingdom, Hong Kong, Singapore, Malaysia: water-tight connector, 250V, 14-foot
*	14F1557	South Africa, Bangladesh, Pakistan, Sri Lanka: 250V, 14-foot
*	14F1558	New Zealand: 250V, 14-foot
*	14F1559	Australia: 250V, 14-foot
*	14F1560	Somalia, Italy: 250V, 14-foot
*	14F1561	Israel: 250V, 14-foot
9896	86F2645	Chicago: water-tight connector, 250V, 6-foot
9797	86F2646	USA, Canada: water-tight connector, 250V, 14-foot
*	86F3439	Japan: 250V, 14-foot

*An asterisk (*) indicates the specify code is determined by the 3-digit DPRM country code*

- Supporting documentation:
  - *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).
  - *Maintenance Information for the 9032 Model 5 Director* (SY28-1158).
  - *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).
  - *User's Guide Reference Summary for the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7298).
  - *Operator Panel Reference Summary for the 9032 Model 5 Director* (SA22-7297).

A Multistation Access Unit (Feature Code #5400), Director Console (Feature Code #5900), or instructions to install the Director Console application on a Hardware Management Console (Feature Code #5901) can be ordered with the Director as optional features.

Director Console Description

The Director requires an attached Console (Figure 9) to perform operations and maintenance tasks. The Console can simultaneously communicate with up to 16 Directors. The Console is ordered separately or as an optional feature (Feature Code #5900). The Console is optional only if the customer has a PC platform that meets all of the minimum Director Console specifications listed under "Hardware Requirements" on page 22.

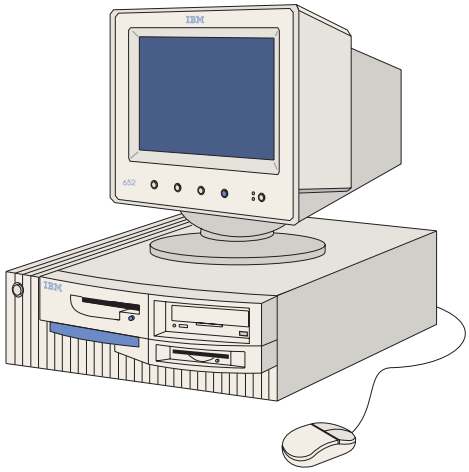


Figure 9. Director Console

The Console is used to:

- Install a Director and perform a Director Initial Program Load (IPL).
- Make configuration changes to a Director.
- Save Director configurations on the Console fixed disk.
- Store event logs on the Console fixed disk.
- Provide password protection for each level of Director management.
- Maintain an audit trail on the Console fixed disk.
- Fault isolate Director operation and connection problems.

- Check hardware and link status, and access diagnostics, error, event, link incident, and audit logs.
- Maintain a library of multiple Director configurations.
- Maintain a library of up to three Director LIC and three LMA versions for downloading to a Director.
- Map logical addresses to any physical port on a Director.
- View the current hardware configuration.

The IBM-supplied Console is an IBM personal computer (PC) that meets or exceeds the hardware and software requirements to perform the Director Console function. If a customer-supplied PC is used as the Console, refer to "Hardware Requirements" on page 22 for minimum Console specifications. For information on planning for Console support, refer to "Task 3: Plan Console Support" on page 72.

The Console communicates with the Director through a 4/16 Mbps Token Ring LAN using shielded, twisted-pair cable. The default LAN data rate is 16 Mbps, but can be changed to 4 Mbps. The Console is installed anywhere up to the limit of the Token Ring, or on a remote LAN that communicates with the Director (on a local LAN) through a bridge or router. Examples of LAN configurations are shown in Figure 44, Figure 45, Figure 46, Figure 47, and Figure 48, beginning on page 75.

Attention!

Operation of all Director models (9032-003, 9033-004, or 9032-005) is supported through a bridged LAN. Operation of all Director models (9032-003, 9033-004, or 9032-005) is supported through a routed LAN *only* if LIC Version 4.3 or higher is installed.

The Console is required to configure the Director, change configurations (without the system integrated change control of SA OS/390), and access logs. After a Director is configured and operational, it performs connection tasks without Console intervention. A Console failure does not cause an operating Director to fail.

Although a single Console can control multiple Directors, two or more Consoles cannot share control of a Director. For maximum availability, a backup Console should be maintained on the LAN in case the primary Console fails. The backup Console is maintained with current Director matrix configurations, critical system or application data, and other Director information for immediate access.

Note: The backup Console must have a different IP address than the primary Console.

Through a customized version of Distributed Console Access Facility (DCAF™) software, an operator on a remote PC can access the Director Console application to perform administration and operator tasks. The customized version of DCAF is supported only for the Director or Sysplex Timer Console applications.

Console Platforms

The Windows®-Operating System/2® (Win-OS/2®)-based Director Console application can be installed on three different platforms:

1. The recommended platform is a dedicated IBM PC with appropriate hardware and software (Figure 10). Refer to "Hardware Requirements" on page 22 for minimum specifications.

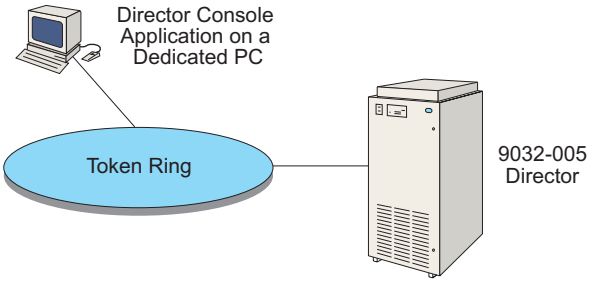


Figure 10. Director Console Application on a Dedicated PC

2. The IBM PC Console used with a 9037-002 Sysplex Timer network (Figure 11). Refer to "Hardware Requirements" on page 22 for minimum specifications.

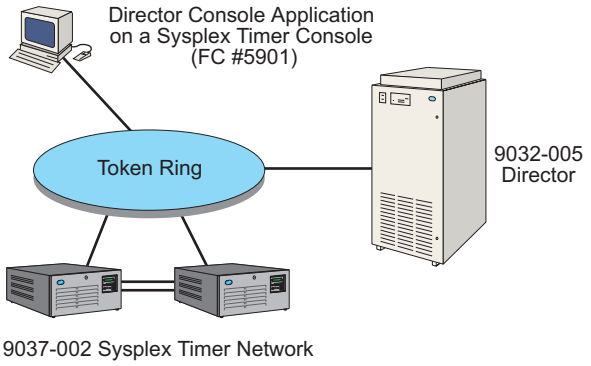


Figure 11. Director Console Application on a Sysplex Timer Console

3. The S/390 Server's Hardware Management Console (Figure 12). Refer to "Hardware Requirements" on page 22 for minimum specifications.

   Note: The S/390 Hardware Management Console must have a Token Ring adapter card installed to support this configuration.

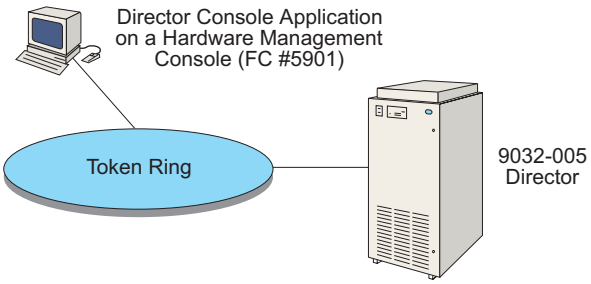


Figure 12. Director Console Application on a Hardware Management Console

For more information about planning Director Console support, refer to "Console Selection Considerations" on page 48.

Remote Access Console

With a remote access Console, an operator assumes functional control of the Director Console application. The *remote access* Console refers to the PC platform installed physically distant from the Director Console. The remote access Console is also called the *controller* Console. The remote Console can be a Director Console, Sysplex Timer Console, or S/390 Hardware Management Console. The *local*

Console refers to the PC platform locally running the Director Console application. The local Console is also called the *target* Console.

The remote Console communicates with the local console over a bridged or routed LAN, using a customized version of DCAF software and Transmission Control Protocol/Internet Protocol (TCP/IP) software. The customized version of DCAF is supported only for the Director or Sysplex Timer Console applications.

Figure 13 shows a remote Console attached to a Director Console through a LAN and TCP/IP connection. In this example, the remote Console controls 9032-003, 9033-004, and 9032-005 Directors.

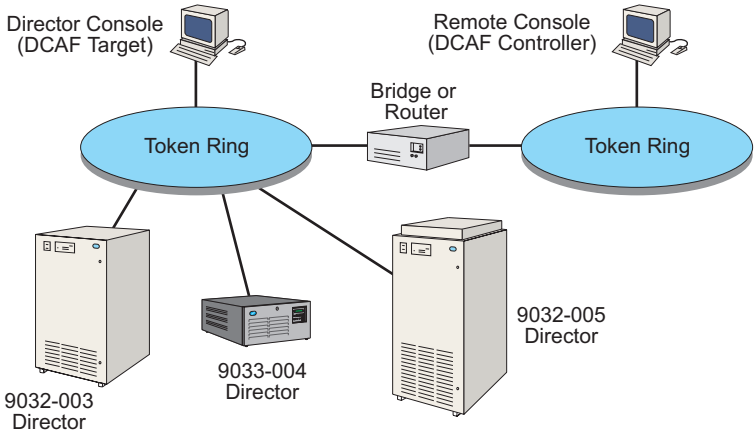


Figure 13. Remote Console Connection to the Director Console

To enable a DCAF session and use a remote access Console, an operator activates the software at both the remote and local Consoles, and starts the Director Console application on the local Console. The session can control up to 16 Directors. For instructions, refer to Chapter 4 of the *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).

Auto-Discovery Feature

An auto-discovery feature is provided with PC-365 and PC 300PL Consoles (Director and Sysplex Timer) that facilitates configuration and use of a DCAF session with an S/390 Hardware Management Console. When Director or Sysplex Timer Consoles (with the auto-discovery feature) are installed on a Token Ring LAN with a Hardware Management Console:

- The Hardware Management Console is automatically configured as a DCAF controller Console.
- Director or Sysplex Timer Consoles are automatically configured as DCAF target Consoles.
- Controller Console setup, target Console setup, and session parameter setup is not required.

To start a DCAF session from the Hardware Management Console, double-click the *Defined Director/Timer Consoles* icon at the *Hardware Management Console Workplace* window. For additional information, refer to the *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).

Director Console Ship Group

The following are packaged and shipped with the Director Console:

- IBM PC - Hardware specifications for the PC Console (processor type and speed, memory, fixed disk capacity) change as new PCs become available.
- 4/16 Mbps Token Ring Controller Adapter card.
- Keyboard and pointing device (mouse) and pad.
- 6.1-meter (20-foot) cable to connect the Console's Token Ring Controller Adapter card to a Token Ring LAN.
- Ac power cables (for the PC and color monitor) configured for length and plug type according to site requirements. The minimum length is 1.8 meters (6 feet).
- Data backup and restore peripherals - Peripherals used to back up and restore data (rewriteable optical cartridge (ROC) or tape cartridge) change as new PCs and utility software become available. Blank media (ROCs or tape cartridges) are provided with the Console.
- Fixed disk restore peripherals - Peripherals used to restore the Console fixed disk change as new PCs and utility software become available. Restoration software on diskette, tape cartridge, or compact disc read-only memory (CD-ROM) is provided with the Console.
- Software loaded on the PC fixed disk - Programs shipped with the PC change as new operating system software and associated utility software become available.
- Software diskettes:
  - One Console application software diskette, labeled *Console Version XX.YY.ZZ*, where *XX.YY.ZZ* is the version number.
  - One fixed disk restore diskette, labeled *Base Console Restore Version XX.YY.ZZ*, where *XX.YY.ZZ* is the version number.
  - Three blank diskettes, labeled *Diskette DOS formatted for use by service personnel.*
  - Four IBM Auto 16/4 Token-Ring Industry Standard Architecture (ISA) Adapter Diskettes.
- Supporting documentation:
  - *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).
  - *Maintenance Information for the 9032 Model 5 Director* (SY28-1158).
  - *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).
  - *User's Guide Reference Summary for the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7298).

Optional Director Features

Optional features are available for new Directors or to upgrade existing Directors, and to provide FRU redundancy or additional operational capability. These options include:

- Enhanced availability features (EAFs).
- ESCON DVP card features (LED or XDF laser).
- Spare ports card feature.
- FICON upgrade feature.
- Port configuration features.
- Hardware Management Console feature.
- Sysplex Timer Console feature.

Enhanced Availability Features

EAFs (backup FRUs) can be ordered and installed in the Director to provide redundancy and reduce operational disruption in case of failure. The Director automatically switches over to the backup FRU if the primary FRU fails. Backup FRUs can be added and failed FRUs can be removed and replaced without disrupting Director port operation. EAFs include:

- A backup CTP card (Feature Code #5600). In addition to providing redundancy, the backup CTP card provides the ability to concurrently upgrade Director LIC.
- A backup TKRG Controller Adapter card (Feature Code #5800).
- A backup MXC2/MXS card set (Feature Code #5500). This feature provides backup switching control for both ESCON DVP cards and FCV port cards.

  Note: ***Ensure the primary and backup cards are the same model.*** If a Director contains an MXC card with a backup MXC2 card, FICON capability is not enabled. If a Director contains an MXC2 card with a backup MXC card, the MXC card is not capable of handling failover and preserving FICON capability.

ESCON DVP Card Features

Operation of the Director requires a minimum of 24 ESCON ports (three DVP cards). These three cards can be any combination of LED or XDF laser cards. ESCON DVP card features can be ordered and installed in the Director as the need for increased port connections arises. 9032-005 Director DVP cards are not interchangeable with DVP cards for earlier model Directors.

LED Feature

The LED port card (Feature Code #5240) contains eight LED ports. The Director has sufficient card cage slots to install 28 additional ESCON DVP card features (224 ports). The 28 cards can be any combination of LED or XDF laser port cards, and can also include up to 16 FCV port cards (FICON connections).

Extended Distance Feature

The XDF laser port card (Feature Code #5250) contains eight XDF ports. The Director has sufficient card cage slots to install 28 additional ESCON DVP card features (224 ports). The 28 cards can be any combination of LED or XDF laser port cards, and can also include up to 16 FCV port cards (FICON connections).

When an XDF laser port is attached to a 9-micron, singlemode fiber-optic cable, this feature allows the Director to be connected to a second Director or other mode converter at a distance of up to 20 kilometers. Any ESCON-compatible control unit can be attached to the Director or mode converter at the remote site.

Spare Ports Card Feature

There is no operational requirement to install and maintain spare ports for the Director. However, it is recommended at least one spare LED port card and one spare XDF laser port card (if laser ports are a requirement) be installed in case a port or port card fails. If an individual port or entire port card fails, fiber-optic cables can be reconfigured to spare ports and the ports can be unblocked through the Console while the Director is operating. Spare ports can be maintained on any port card, or a complete card can be maintained as a spare.

If all available ESCON device ports are used (248 maximum without the FICON upgrade feature), a spare ports card feature can be ordered and installed to provide four spare ports. These ports function *only* as spare ports. The features include:

- A spare ports card (Feature Code #5245) that contains four LED ports that can attach to ESCON devices. *This feature does not provide spare FICON ports.*
- A spare ports card (Feature Code #5255) that contains two LED ports and two XDF laser ports that can attach to ESCON devices. *This feature does not provide spare FICON ports.*

FICON Upgrade Features

FICON compatibility is required to attach the Director to a FICON channel of an IBM S/390 Generation 5 (or later model) Parallel Enterprise Server. If the Director is not delivered with this capability, FICON upgrade features must be ordered and installed. These features include:

- A software upgrade (Feature Code #5702) that includes the Director Console application Version 5.0 (or later), LMA Version 5.0 (or later), and LIC Version 5.0 (or later).
- An FCV port card (Feature Code #5260) that provides a hardware interface for FICON fiber-optic media. Up to 16 cards can be ordered and installed. Because each card contains only one port connection, one or more additional cards must be installed (up to 16 total) if spare ports are a requirement. The spare ports card feature described above *does not* provide spare FICON ports.

  Note: The maximum number of FCV port cards that can be installed in the Director is 16. When upgrading the Director to support FICON operation, the *minimum* number of FCV port cards (FICON channel paths) installed should be equal to the *maximum* number of concurrent ESCON paths to a single control unit.

- An MXC2 card (Feature Code #5700) that provides switching control for both ESCON DVP cards and FCV port cards. The card must be installed in place of an ESCON MXC card to support FICON operation. In addition, it is recommended a second card be installed for redundancy.
- Redundant power supplies (Feature Code #5701) that provide additional +3.3 Vdc outputs to support operation of the FCV port card. The feature includes two power supplies. For older 9032-005 Directors, a 3.3-volt load-sharing jumper cable (Engineering Change D98133) is required to support power supply operation.

Port Configuration Features

Port configuration features can be installed to simplify the migration of ESCON port connections from an older model Director to the 9032-005 Director. These features include:

- The Director with the 9032-002 port card addressing configuration installed (Feature Code #5902).

- The Director with the 9032-003 port card addressing configuration installed (Feature Code #5903).

For additional information about migrating ports, refer to "Migrating from Earlier Directors to the 9032-005 Director" on page 30.

Hardware Management Console Feature

If a Director Console is not ordered and installed, the Director Console application can be installed on the S/390 Server's Hardware Management Console by ordering Feature Code #5901. This feature includes the following diskettes and publications:

- One Director Console Tools diskette.
- One blank diskette for migrating Director Console definitions to the Hardware Management Console.
- The supporting Miscellaneous Equipment Specification (MES) instructions.
- *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).
- *Maintenance Information for the 9032 Model 5 Director* (SY28-1158).
- *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).
- *User's Guide Reference Summary for the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7298).

Sysplex Timer Console Feature

If a Director Console is not ordered and installed, the Director Console application can be installed on 9037-002 Sysplex Timer Console by ordering Feature Code #5901. This feature includes the following diskettes and publications:

- One Director Console Tools diskette.
- One blank diskette for migrating Director Console definitions to the Sysplex Timer Console.
- The supporting MES instructions.
- *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).
- *Maintenance Information for the 9032 Model 5 Director* (SY28-1158).
- *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).
- *User's Guide Reference Summary for the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7298).

Operational Requirements

This section describes operational requirements for the Director, including:

- Hardware requirements.
- Software requirements.
- Security requirements.
- Programming support requirements.

Hardware Requirements

Before a service representative installs the Director, ensure host hardware, host software, and engineering changes (ECs) are at the level required to support Director operation. In addition, ensure availability of the following:

- **Host Processor** - The host processor must have at least one ESCON or FICON I/O channel. The Director can attach to ESCON channels on any IBM ESCON-capable processor. If FCV port cards are installed, the Director can attach to FICON channels on any IBM S/390 Generation 5 (or later model) Parallel Enterprise Server.
- **Fiber-Optic Cables** - The required number of jumper cables (of proper length, cable type, and connector type) must be available to connect the Director to a channel, device, or distribution panel. The end of each cable should be labelled to indicate the to-and-from attachment. Use the following cable and connector types:
  - **LED ports** - For LED ports (ESCON), use graded-index fiber-optic cable with a core diameter of 50 or 62.5 microns, a cladding diameter of 125 microns, and orange jacket color, with multimode IBM duplex connectors.
  - **XDF Laser ports** - For XDF laser ports (ESCON), use dispersion-unshifted fiber-optic cable with a core diameter of 9 microns, a cladding diameter of 125 microns, and yellow jacket color, with singlemode FCS/SC duplex connectors.
  - **FCV ports** - For FCV ports (FICON), use either:
    - Graded-index fiber-optic cable with a core diameter of 50 or 62.5 microns, a cladding diameter of 125 microns, and orange jacket color, with multimode FCS/SC duplex connectors. When using multimode cable, mode conditioning patchcords (part number 21L4175) are required at both ends of the link.
    - Dispersion-unshifted fiber-optic cable with a core diameter of 9 microns, a cladding diameter of 125 microns, and yellow jacket color, with singlemode FCS/SC duplex connectors.

  For additional information about fiber-optic cabling, refer to *Planning for S/390 Fiber Optic Links - ESCON, FICON, Coupling Links, and Open System Adapters* (GA23-0367).
- **Console** - A PC that meets or exceeds the hardware requirements to perform the Director Console function is required. The Console can operate a cluster of up to 16 units (any combination of 9032-003, 9033-004, or 9032-005 Directors), and up to two 9037-002 Sysplex Timer networks (each network comprised of up to two Timers). Although the Director can operate normally without Console intervention, the Director cannot be installed without a Console.

  It is strongly recommended that customers use an IBM-supplied Director Console. When ordering the Director, order the Console PC simultaneously to ensure coordinated shipment. ***It is also strongly recommended the Director Console be dedicated solely to running the Director Console application and performing Director support functions.*** To provide better security, better reliability, and simplified fault isolation, no additional or unrelated applications should be installed on the Console.

  Although not recommended, the Director Console application can be installed on a customer-supplied PC, Sysplex Timer Console, or Hardware Management Console. Refer to "Console Platforms" on page 15 for additional information. If a customer-supplied console or Sysplex Timer Console is used, the PC must meet the following minimum hardware specifications:

— System unit with an Intel® Pentium® microprocessor operating at a clock speed of 166 megahertz (MHz) or greater, and:
  - 32 megabytes (MB) or greater of random access memory (RAM).
  - 1.44/2.88 MB diskette drive.
  - One gigabyte (GB) or greater fixed disk.
  - CD-ROM drive.
  - 640 MB ROC drive with a small computer system interface (SCSI) cable and adapter.

— Color display monitor.

— Keyboard and pointing device (mouse).

— Serial communications port and modem (used for remote service access).

— 4/16 Mbps Token Ring Controller Adapter card to provide the interface between the Console PC and Token Ring LAN.

— Token Ring adapter cable (shielded, twisted-pair) with a 9-pin male connector for the Token Ring Controller Adapter card in the PC and a multistation access unit (MAU) connector for the Token Ring LAN. An IBM-supplied cable is 6.1 meters (20 feet) long.

— Ac power cables (for the PC and color monitor) configured for length and plug type according to site requirements. The minimum length is 1.8 meters (6 feet).

Note: Model PC-330 (or earlier) Director or Sysplex Timer Consoles do not meet the minimum requirements listed above and cannot be used in configurations that include a 9032-005 Director.

If a Hardware Management Console is used, the PC system unit must meet the following minimum hardware specifications:

— System unit with an Intel Pentium microprocessor operating at a clock speed of 166 MHz or greater.

— 32 MB or greater of RAM.

Verify the RAM and EC level on the Hardware Management Console using instructions in *Hardware Management Console Support for ESCON Directors - Installation and Maintenance Information* (FC #5901).

- **LAN Hardware** - A Token Ring LAN is required for installation of Directors and the Director Console. The LAN is comprised of shielded, twisted-pair wiring and the requisite number of 4/16 Mbps MAUs. Optional MAUs can be ordered with the Director. ***It is recommended the Directors and Director Console be installed on a dedicated LAN.*** A dedicated LAN provides:

  — Higher security to prevent unauthorized users from disrupting Director Console operations.

  — Better reliability. Failures associated with unrelated hardware and applications on a public LAN may impact Director Console operations.

  — Simplified and more reliable problem determination.

  — Less traffic. A LAN with heavy traffic unrelated to a Director can impair Console operation.

Console Software Requirements

A PC that meets or exceeds the software requirements to perform the Director Console function is required. ***It is strongly recommended that customers use an IBM-supplied Director Console.*** When supplied by IBM, the Director Console is delivered with the required software installed. Table 3 lists Consoles (PC models and operating systems that support 9032-003, 9033-004, and 9032-005 Directors).

Table 3. Director Requirements by PC Model and Operating System

PC Model and Operating System	9032-003 Director	9033-004 Director	9032-005 Director
PS/2™ with OS/2® Warp Connect 3.0	Yes	Yes	No
PS/2 with OS/2 Warp 4.0	No	No	No
PC-330 (6571/6576) with OS/2 Warp Connect 3.0	Yes	Yes	No
PC-330 (6571/6576) with OS/2 Warp 4.0	No	No	No
PC-365 (6589) with OS/2 Warp Connect 3.0	No	No	No
PC-365 (6589) with OS/2 Warp 4.0	Yes	Yes	Yes
PC 300PL with OS/2 Warp Connect 3.0	No	No	No
PC 300PL with OS/2 Warp 4.0	Yes	Yes	Yes
Hardware Management Console with OS/2 Warp Connect 3.0	Yes	Yes	No
Hardware Management Console with OS/2 Warp 4.0	Yes	Yes	Yes

If a customer-supplied Console, Sysplex Timer Console, or Hardware Management Console is used, the PC system unit must meet the following minimum software specifications:

- OS/2 Warp 4.0 or higher.
- Director Console application (shipped with the Director).
- Automatic backup system for backing up Director libraries from the Console fixed disk to a ROC.
- LAN Adapter Installation and Diagnostics (LANAID™) Version 2.21 (or higher) to configure Token Ring LAN parameters.
- Transmission Control Protocol/Internet Protocol (TCP/IP) Version 2.0 (or higher) for OS/2 Base Kit to provide TCP/IP protocols that allow the Console to connect with and transfer data to and from the LAN.
- TCP/IP Version 2.0 (or higher) for OS/2:DOS/Windows Access Kit to allow the Console software and interface to work with the LAN.
- DCAF Version 1.32 (or higher) for remote Console access. With DCAF installed on a remote PC, an operator can connect to the Director Console (through TCP/IP) to perform operations and maintenance functions.

Security Requirements

Effective security measures are recommended for Directors and the Director Console. Consider these factors when planning security requirements:

- Directors and the Director Console are installed on a LAN and are thus open to access by unrelated devices on the LAN (or a remote LAN).

- Remote operations and maintenance access to the Director Console is available through a TCP/IP LAN connection and DCAF session.
- Remote maintenance access to the Director is possible through a modem connection to the Director maintenance port.

Refer to "Task 6: Establish Security Measures" on page 78 for additional information.

Programming Support Requirements

Operating system support for the Director should be installed on at least one attached host. Device support should also be installed on at least one host, and a logical path must exist to that host. For multiple hosts, device support must be installed on each host that controls a Director, and a logical path must exist to each controlling host. Device support allows the operating system to:

- Define a Director as an I/O device.
- Handle I/O communication with the Director.
- Handle error information (transmitted by the Director) that is stored and displayed at the host.

For detailed support information on host operating system release levels and device support release levels, contact your IBM S/390 representative.

Port Addressing and Connectivity

This section describes port addressing and connectivity for the Director. All device ports in the Director (ESCON and FICON) are assigned physical port numbers and logical port addresses. Logical port addresses are configured in host I/O definition statements.

Figure 14 on page 27 and Figure 15 on page 29 illustrate the layout of logic cards and device ports for the Director. Logic cards include the CTP card, TKRG Controller Adapter card, and the MXC/MXS card set. Figure 14 illustrates physical port numbers (bold) and logical port addresses (italics) for each port in a Director fully populated with 31 DVP cards (ESCON). Figure 15 illustrates physical port numbers (bold) and logical port addresses (italics) for each port in a Director populated with 15 DVP cards (ESCON) and 16 FCV port cards (FICON).

Note: Port addresses shown in Figure 14 and Figure 15 are default addresses. The actual addresses may differ due to port swapping.

Physical Port Numbers (ESCON Only)

As shown in Figure 14, the Director contains 31 DVP card slots, numbered 0 through 30. When fully populated with DVP cards, the Director contains 248 ESCON device ports (eight per card). The spare ports card is installed in slot 31 to provide four reserved spare ESCON ports. ***The spare ports card does not increase the number of usable ports.***

DVP card slots are grouped into quadrants. Quadrants A, B, and C contain eight cards each. Quadrant D (upper left) contains seven DVP cards and the optional spare ports card. In general, DVP cards can be installed in any available port card slot. However, installation is subject to the following constraints:

- When delivered from the factory, the Director is populated with DVP cards starting at slot 0. If a Director is ordered with both LED and XDF laser cards:
  - LED cards are installed first as a consistent practice (starting at slot 0).
  - XDF laser cards are installed after the LED cards are installed.

- If Feature Code #5902 is ordered, the first eight DVP cards are installed in slots 23 through 30. Additional cards are installed in slots 0 through 22 (depending on the number of cards). Refer to "Migrating from the 9032-002 to 9032-005 Director" on page 30 for additional information.
- If Feature Code #5903 is ordered, the first 16 DVP cards are installed in slots 15 through 30. Additional cards are installed in slots 0 through 14 (depending on the number of cards). Refer to "Migrating from the 9032-003 to 9032-005 Director" on page 31 for additional information.
- If DVP cards must be installed to provide redundant connections for maximum availability (subject to Feature Code #5902 and #5903 constraints), refer to "Configuring Port Use for Maximum Availability" on page 58 for additional information.

DVP cards do not have to be installed contiguously. For example, DVP cards could be installed in slots 0 through 2, 8 through 10, 16 through 18, and 24 through 26, and all other slots could be left empty.

Each port is assigned a physical port number. These port numbers are used to fault isolate port problems and perform port maintenance. As shown in Figure 14, port numbers (bold) are assigned sequentially in hexadecimal format. The first port (in slot 0 at the bottom right of the Director) is assigned physical port number **00.** The 248th port (in slot 30 at the top left of the Director) is assigned physical port number **F7.** If a spare ports card is installed in slot 31, ports are assigned physical port numbers **F8** through **FB**.

Logical Port Addresses (ESCON Only)

As shown in Figure 14, each port is assigned a logical port address in addition to a physical port number. These addresses are used by the Director to provide dynamic, dedicated, prohibited, and blocked connections that are configured through the Director Console.

Logical port addresses (italics) are assigned sequentially in hexadecimal format by adding four to the physical port number. The first port (in slot 0 at the bottom right of the Director) is assigned logical port address **04.** The 248th port (in slot 30 at the upper left of the Director) is assigned logical port address **FB**. If a spare ports card is installed in slot 31, ports are assigned logical port addresses **S1** through **S4**.

If there are empty DVP slots, there are gaps in the sequence of logical port addresses. For example, if DVP cards are installed only in slots 0 through 7 and 16 through 23, only port addresses **04** through **43** and **84** through **C3** are assigned.

Logical port addresses can be physically mapped to other ports using a port swapping procedure from the Console. The address of a failed port can be transferred to (swapped with) any other addressable unused port. Refer to “Swap Ports” in *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296) for instructions.

This procedure is useful to quickly transfer connections from a failed port to a spare port. For example, port number **7B** has a logical port address of **7F**. Address **7F** can be reassigned at the Console to spare port number **FA** (logical port address **S3**) if port number **7B** fails. After the address is remapping the fiber-optic cable is moved from port **7B** to port **FA**. Using this procedure, I/O definitions for the host do not require modification.

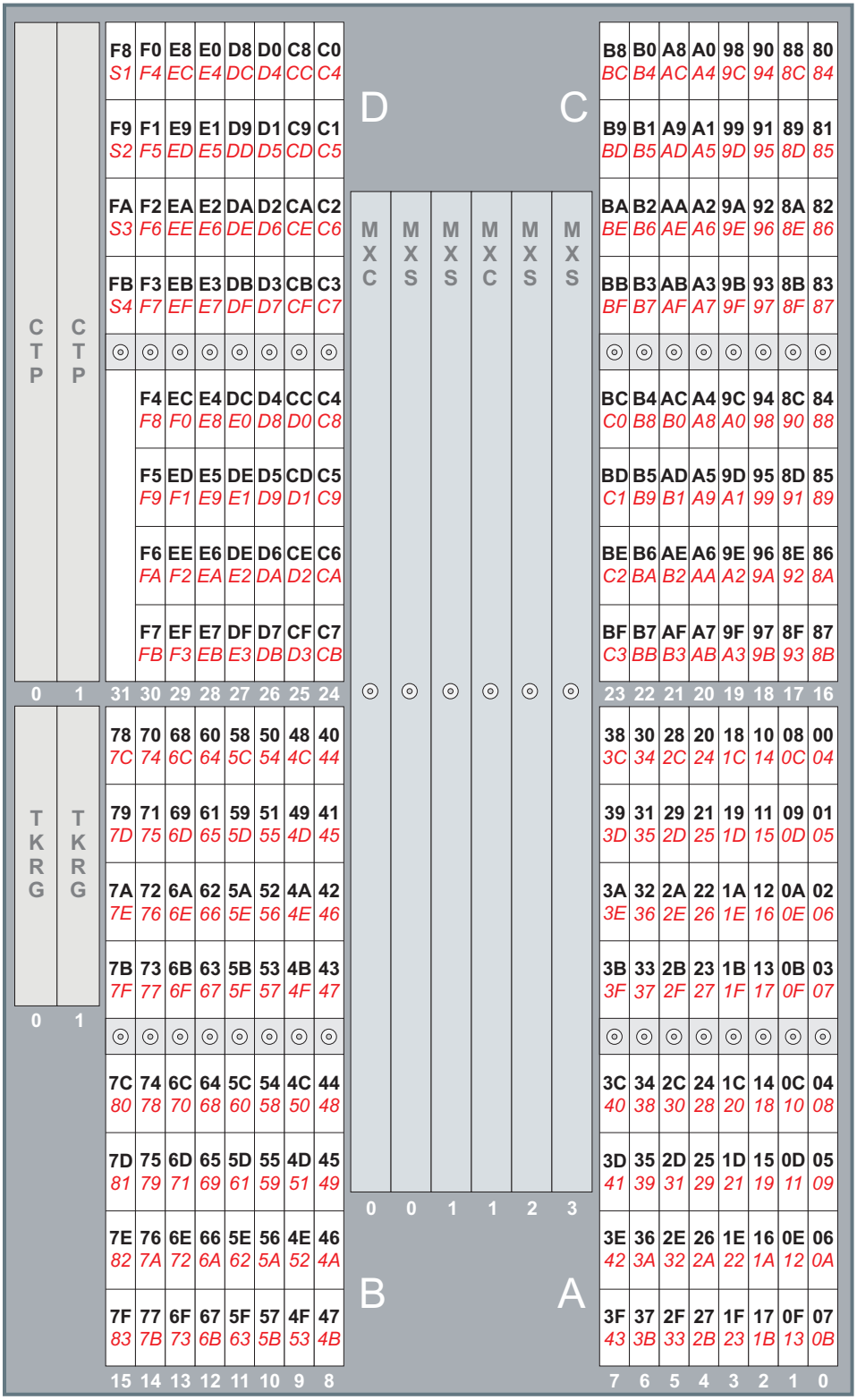


Figure 14. Director Logic Cards, Physical Port Numbers, and Logical Port Addresses (ESCON Only)

Physical Port Numbers (ESCON and FICON)

Figure 15 shows the Director fully populated with 16 FCV port cards (16 FICON ports) and 15 DVP cards (120 ESCON ports). The spare ports card is installed in slot 31 to provide four reserved spare ESCON ports. ***The spare ports card does not increase the number of useable ports, nor does it provide spare FICON connections.*** In general, port cards can be installed in any available port card slot. However, installation is subject to the following constraints:

- When delivered from the factory, the Director is populated with port cards starting at slot 0. If a Director is ordered with LED cards, XDF laser cards, and FCV port cards:
  - LED cards are installed first as a consistent practice (starting at slot 0).
  - XDF laser cards are installed after the LED cards are installed.
  - FCV port cards are installed last.
- If Feature Code #5902 is ordered, an FCV port card *cannot* be installed in slots 23 through 30. The feature preferentially maps ESCON port connections to those slots.
- If Feature Code #5903 is ordered, an FCV port card *cannot* be installed in slots 15 through 30. The feature preferentially maps ESCON port connections to those slots.
- If port cards (LED, XDF laser, and FCV) must be installed to provide redundant connections for maximum availability (subject to Feature Code #5902 and #5903 constraints), refer to "Configuring Port Use for Maximum Availability" on page 58 for information.

FCV Port and DVP cards do not have to be installed contiguously. For example, FCV port cards could be installed in slots 0 through 2 and 8 through 10, DVP cards could be installed in slots16 through 18 and 24 through 26, and all other slots could be left empty.

Each port is assigned a physical port number. These port numbers are used to fault isolate port problems and perform port maintenance. As shown in Figure 15, both FICON and ESCON port numbers (bold) are assigned sequentially in hexadecimal format.

Because one FICON port maps to eight ESCON ports, an FCV port card uses eight consecutive physical port numbers. The first FCV port card (in slot 0) is assigned physical port number **00**, the second card (in slot 1) is assigned physical port number **08**, and the 16th card (in slot 23) is assigned physical port number **B8**. The first ESCON port (in slot 8) is assigned physical port number **40**. The 120th port (in slot 30) is assigned physical port number **F7**. If a spare ports card is installed in slot 31, ports are assigned physical port numbers **F8** through **FB**.

The port card slots are grouped into quadrants. Quadrants A and C contain eight FCV port cards each. Quadrant B contain eight DVP cards. Quadrant D contains seven DVP cards and the optional spare ports card.

Logical Port Addresses (ESCON and FICON)

As shown in Figure 15, each port is assigned a logical port address in addition to a physical port number. These addresses are used by the Director to provide dynamic, dedicated, prohibited, and blocked connections that are configured through the Director Console.

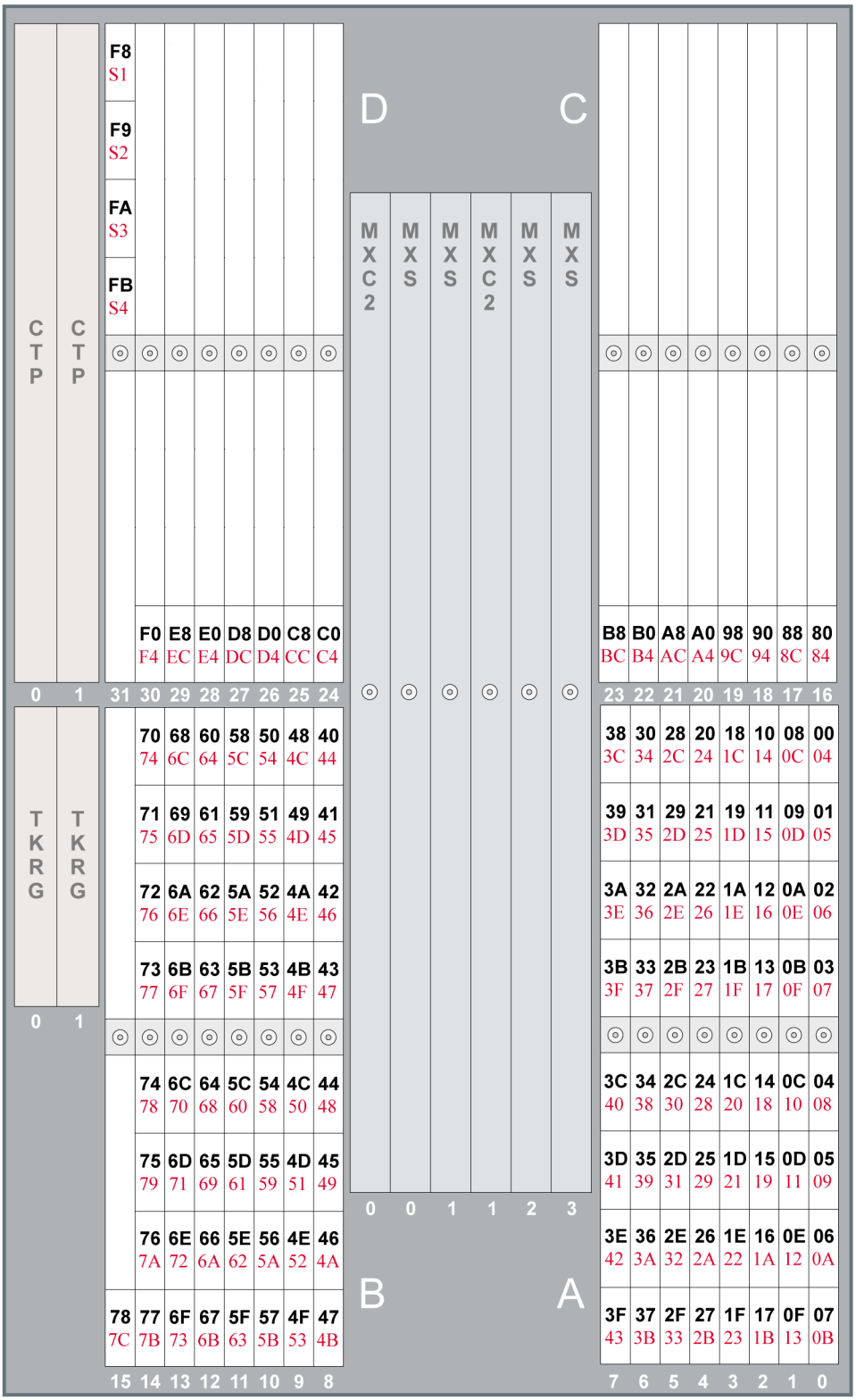


Figure 15. Director Logic Cards, Physical Port Numbers, and Logical Port Addresses (ESCON and FICON)

Logical port addresses (italics) are assigned sequentially in hexadecimal format by adding four to the physical port number. The first port (in slot 0) is assigned logical port address **04.** The last port (in slot 30) is assigned logical port address **FB**. If a spare ports card is installed in slot 31, ports are assigned logical port addresses **S1** through **S4**. If there are empty port card slots, there are gaps in the sequence of logical port addresses.

Logical port addresses can be physically mapped to other ports using a port swapping procedure from the Console. The address of a failed ESCON port can be transferred to (swapped with) any other addressable unused ESCON port, and the address of a failed FICON port can be transferred to (swapped with) any other addressable unused FICON port. ***ESCON ports cannot be swapped with FICON ports.*** Refer to "Swap Ports" in *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296) for instructions.

Migrating from Earlier Directors to the 9032-005 Director

This section describes the process to migrate device and channel port connections from a 9032-002 ESCON Director to a 9032-005 Director, or from a 9032-003 ESCON Director to a 9032-005 Director.

Migrating from the 9032-002 to 9032-005 Director

If replacing an existing 9032-002 ESCON Director with a 9032-005 Director, port connections on the older Director can be migrated to corresponding port connections on the 9032-005 Director without changing I/O definitions for attached devices and channels. Figure 16 illustrates default logical port addresses for a fully-configured (60 ports) 9032-002 Director.

F8	*F4*	*F0*	*EC*	*E8*	*E4*	*E0*	*C0*	*C4*	*C8*	*CC*	*D0*	*D4*	*D8*	*DC*
F9	*F5*	*F1*	*ED*	*E9*	*E5*	*E1*	*C1*	*C5*	*C9*	*CD*	*D1*	*D5*	*D9*	*DD*
FA	*F6*	*F2*	*EE*	*EA*	*E6*	*E2*	*C2*	*C6*	*CA*	*CE*	*D2*	*D6*	*DA*	*DE*
FB	*F7*	*F3*	*EF*	*EB*	*E7*	*E3*	*C3*	*C7*	*CB*	*CF*	*D3*	*D7*	*DB*	*DF*

Figure 16. Default Port Addresses for the 9032-002 Director

Figure 17 illustrates corresponding logical port addresses for the 9032-005 Director. The ports are located in the upper two DVP card areas (quadrants C and D).

To migrate connections from a fully-configured 9032-002 Director (60 ports) to a 9032-005 Director without changing I/O definitions for attached devices and channels, migrate the 60 port connections to the ports in the upper port card areas (slots 23 through 30 in quadrants C and D) of the 9032-005. When migrating port connections from a 9032-002 to 9032-005 Director:

- Transfer fiber-optic cables from ports with logical addresses **E0** through **FB** (9032-002 Director) to ports with logical addresses **E0** through **FB** (9032-005 Director).
- Transfer fiber-optic cables from ports with logical addresses **C4** through **DF** (9032-002 Director) to ports with logical addresses **C4** through **DF** (9032-005 Director).

- Transfer fiber-optic cables from ports with logical addresses **C0** through **C3** (9032-002 Director) to ports with logical addresses **C0** through **C3** (9032-005 Director).

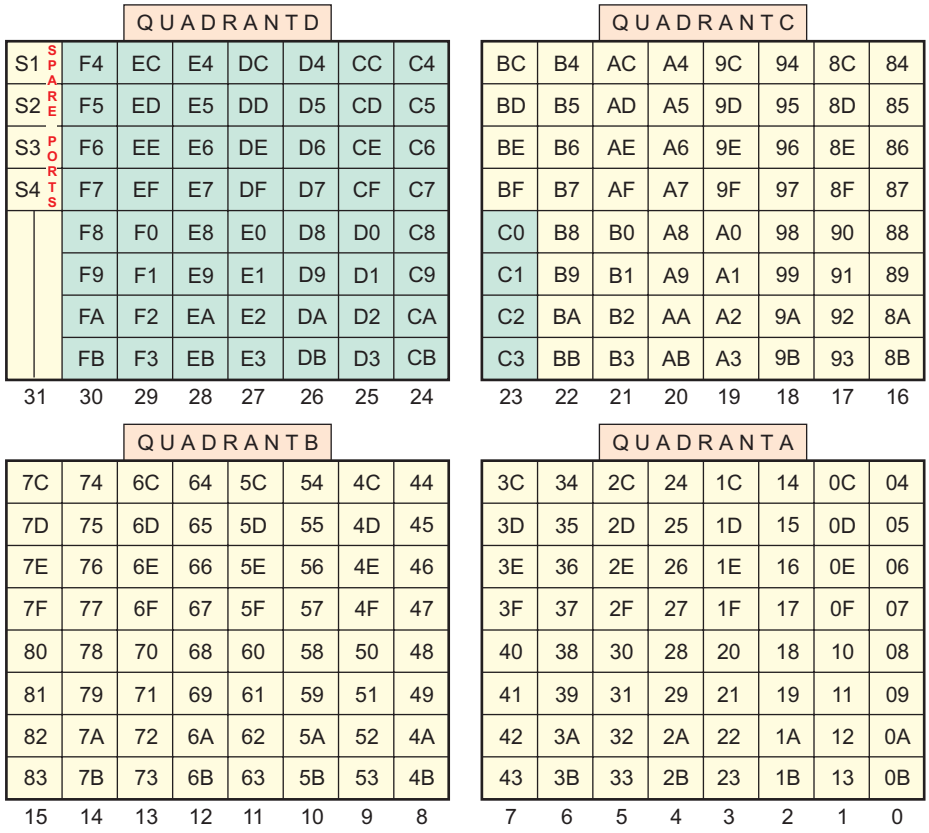


Figure 17. Default Port Addresses for the 9032-005 Director

Note: The 9032-005 Director can be ordered with Feature Code #5902. This feature provides the Director with the 9032-002 DVP card address configuration installed, so that DVP cards do not have to be moved to the correct slots. If ordered, DVP cards are installed sequentially from slot 30 to slot 0, depending on the number of additional port cards ordered. In addition, using this port configuration feature requires up to 2 meters (6.2 feet) of additional fiber-optic cable for each connection.

Migrating from the 9032-003 to 9032-005 Director

If replacing an existing 9032-003 ESCON Director with a 9032-005 Director, port connections on the older Director can be migrated to corresponding port connections on the 9032-005 Director without changing I/O definitions for attached devices and channels. Figure 18 illustrates default logical port addresses for a fully-configured (124 ports) 9032-003 Director.

Addresses of Ports in Upper Left and Right Port Card Quadrants of 9032-003 Director

QUADRANT D							QUADRANT C							
F8	F4	F0	EC	E8	E4	E0	DC	D8	D4	D0	CC	C8	C4	C0
F9	F5	F1	ED	E9	E5	E1	DD	D9	D5	D1	CD	C9	C5	C1
FA	F6	F2	EE	EA	E6	E2	DE	DA	D6	D2	CE	CA	C6	C2
FB	F7	F3	EF	EB	E7	E3	DF	DB	D7	D3	CF	CB	C7	C3

Addresses of Ports in Lower Left and Right Port Card Quadrants of 9032-003 Director

QUADRANT B								QUADRANT A							
BC	B8	B4	B0	AC	A8	A4	A0	9C	98	94	90	8C	88	84	80
BD	B9	B5	B1	AD	A9	A5	A1	9D	99	95	91	8D	89	85	81
BE	BA	B6	B2	AE	AC	A6	A2	9E	9A	96	92	8E	8A	86	82
BF	BB	B7	B3	AF	AB	A7	A3	9F	9B	97	93	8F	8B	87	83

Figure 18. Default Port Addresses for the 9032-003 Director

Figure 19 illustrates corresponding logical port addresses for the 9032-005 Director. The ports are located in three DVP card areas (quadrants B, C, and D).

To migrate connections from a fully-configured 9032-003 Director (124 ports) to a 9032-005 Director without changing I/O definitions for attached devices and channels, migrate the 124 port connections to the ports in the upper (right and left) and lower left port card areas (slots 15 through 30 in quadrants B, C, and D) of the 9032-005. When migrating port connections from a 9032-003 to 9032-005 Director:

- Transfer fiber-optic cables from ports with logical addresses **80** through **83** (9032-002 Director) to ports with logical addresses **80** through **83** (9032-005 Director).
- Transfer fiber-optic cables from ports with logical addresses **84** through **BF** (9032-002 Director) to ports with logical addresses **84** through **BF** (9032-005 Director).
- Transfer fiber-optic cables from ports with logical addresses **C0** through **C3** (9032-002 Director) to ports with logical addresses **C0** through **C3** (9032-005 Director).
- Transfer fiber-optic cables from ports with logical addresses **C4** through **FB** (9032-002 Director) to ports with logical addresses **C4** through **FB** (9032-005 Director).

  Note: The 9032-005 Director can be ordered with Feature Code #5903. This feature provides the Director with the 9032-003 DVP card address configuration installed, so that DVP cards do not have to be moved to the correct slots. If ordered, DVP cards are installed sequentially from slot 15 to 30, then slot 14 to 0, depending on the number of additional port cards ordered. In addition, using this port configuration feature requires up to 2 meters (6.2 feet) of additional fiber-optic cable for each connection.

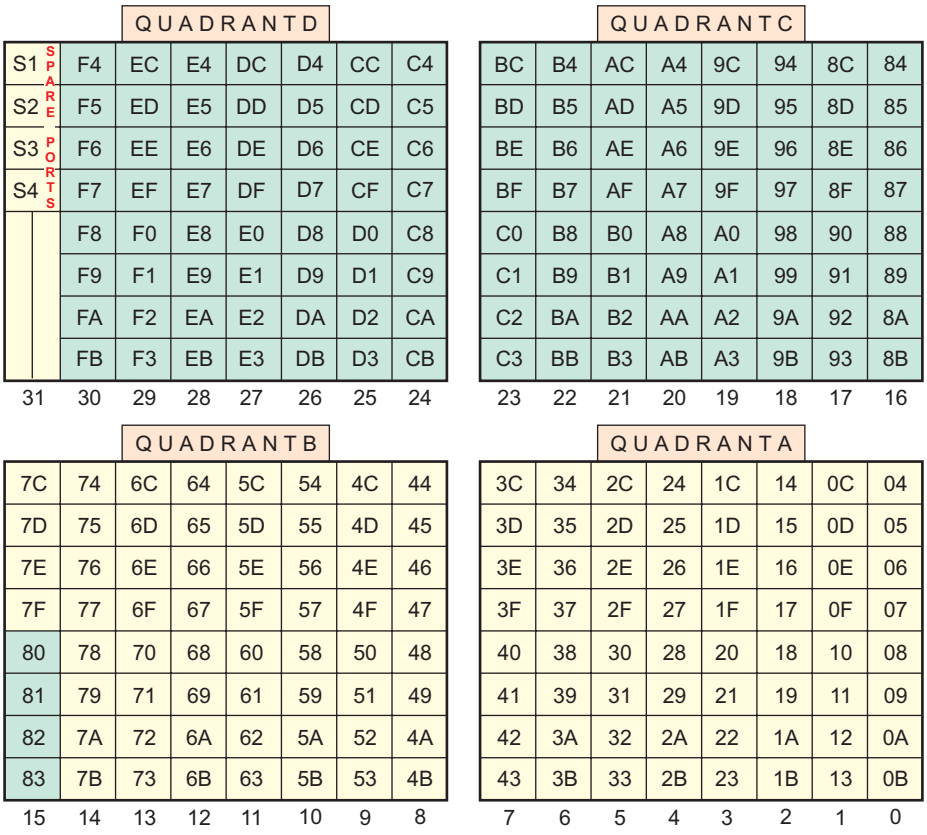


Figure 19. Default Port Addresses for the 9032-005 Director

Migrating from Earlier Director Consoles to the 9032–005 Director Console

If replacing a 9032-003 or 9033-004 Director Console with a 9032-005 Director Console, definitions are stored on floppy disk and installed on the new Director Console. Definitions include Director IP addresses, identifications, model numbers, and matrix configuration files. Definitions provide the information required to define the Directors when the Director Console application is installed on the 9032-005 Console.

For Console migration instructions, refer to “Migrate Director Definitions” in the *Console Installation and User’s Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).

Configuration and Connectivity Considerations

This section describes Director system configurations, controlling Director connectivity, and the hierarchy of connectivity control attributes.

System Configurations

Each host in a configuration can have ESCON or FICON channels attached to one or more Directors, except that FICON channels can only attach to the 9032-005 Director. In addition, either 9032-003, 9033-004, or 9032-005 Directors can all coexist in a configuration, depending on connectivity needs. Figure 20 shows a configuration with two 9032-005 Directors. Note the channel-to-channel (CTC) and FICON (FCV) host connections.

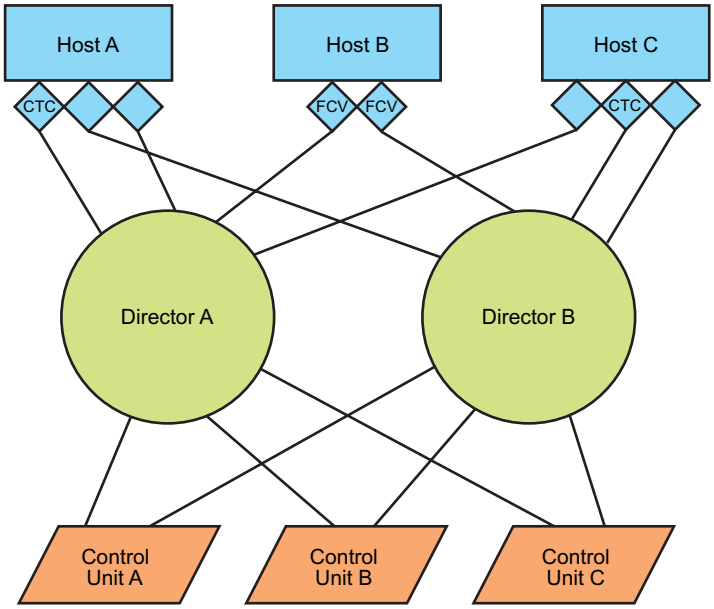


Figure 20. Two Directors in a System Configuration

Information that defines the connectivity capability for all Director ports is called a ***Director configuration.*** This configuration can be changed from either the Director Console or an attached processor (such as an S/390 server). In addition, IBM offers system-integrated changes and the capability to control Directors through the SA OS/390 product. Refer to "Controlling Director Operation" on page 37 for additional information.

Controlling Director Connectivity

When first installed, the Director allows any port to dynamically connect with any other port in the Director. However, port connectivity can be limited (for example, limiting connections between ports supporting a test system and ports supporting a production system). The connectivity capability of a Director port can be changed or controlled through four attributes:

- **Allowed** - A dynamic connection is allowed through a port. If blocked, dedicated, or prohibited attributes are not assigned to a port, the port is open for a connection to another port.
- **Blocked** - All communication is blocked through a port. How the blocking is done is a function of the connection type. When a port is blocked:
  - Dynamic connections cannot be established.
  - Established dedicated connections still exist, but data transfer through the port cannot occur.

  Ports can be blocked for several reasons. For example, a port can be temporarily blocked during a maintenance action to suppress link error reporting, and can be unblocked when the maintenance action is complete.

  The number of blocked ports that can be established is not limited. However, to allow host communication at least one unblocked port must have a channel connection on which the Director control unit port (CUP) is defined.

- **Dedicated** - A static connection between two ports is dedicated and restricts two ports from communicating with any other ports. Dedicated connections are required to support communication through a Director to a 9034 ESCON Converter and to support chained Directors. The number of dedicated connections that can be established is not limited. To allow host communication, however, the CUP must have at least one non-dedicated channel connection.

  Dynamic and dedicated connections transmit data differently. Enabling a dedicated connection between two ports is not the same as prohibiting all but one connection between the ports. Dedicated connections exist primarily to support converters and chained Directors.

  A dedicated connection between an FCV port card and an ESCON DVP port is not allowed because static connectivity logic is not supported by the FICON protocol.

- **Prohibited** - A prohibited connection means two specific ports cannot be dynamically connected. However, this attribute does not affect the port's ability to connect dynamically with other ports on the Director. For example, a connection between a port supporting a test system and a port supporting a production system can be prohibited to isolate the two systems. Communication can be prohibited between as many pairs of ports as necessary. A port can be prohibited from communicating with only one other port, with several ports, or with all ports on a Director.

  A connection between an internal ESCON port (on an FCV port card) and another internal ESCON port is prohibited.

  Note: Communication requirements and limitations of attached channels or control units apply to connectivity attributes. For example, a control unit cannot communicate with another control unit (except the CUP). Refer to the supporting documentation for each ESCON control unit for more information.

Hierarchy of Port Connectivity Control Attributes

Assigning more than one connectivity attribute to a port (ESCON or FICON) creates the following hierarchy.

1. The ***Blocked*** attribute has the highest precedence and overrides all other attributes (dedicated, prohibited, allowed) assigned to a port.
2. The ***Dedicated*** attribute has second precedence and overrides the prohibited and allowed attributes.
3. The ***Prohibited*** attribute has third precedence and overrides only the allowed attribute.
4. The ***Allowed*** attribute has the lowest precedence and does not override any other attributes.

As an example, Figure 21 shows a control unit (attached to logical port address C7) used only by an application on Host A. The port should not be accessed by channels on Host B. Therefore, connections between ports C3 and C7 and between ports C4 and C7 are prohibited.

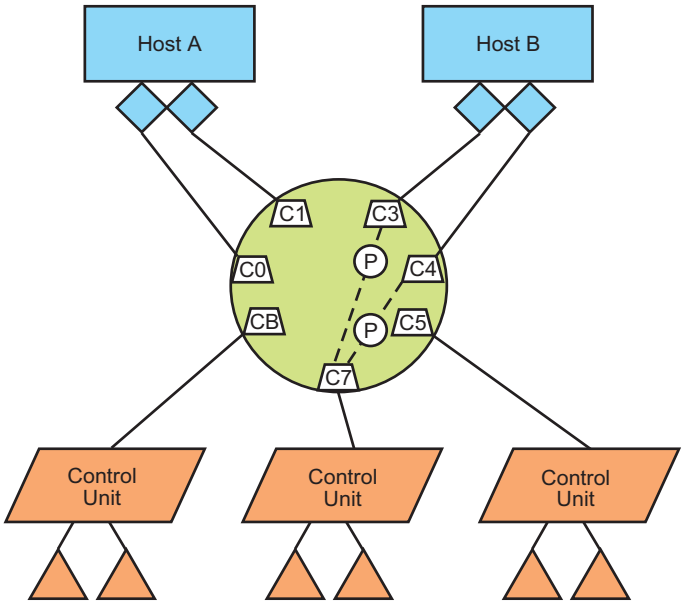


Figure 21. Hierarchy of Port Connectivity Attributes (Normal Operation)

In Figure 22, assume the control unit attached to port C7 fails and requires service. All connection attempts to port C7 are blocked. The blocked attribute overrides any allowed attributes from any other port to port C7, and overrides the two prohibited attributes already in effect from C3 and C4 to C7. When the control unit attached to port C7 is available, the port is unblocked and the applications on Host A can again access the unit. The two prohibited attributes from C3 and C4 to C7 remain in effect.

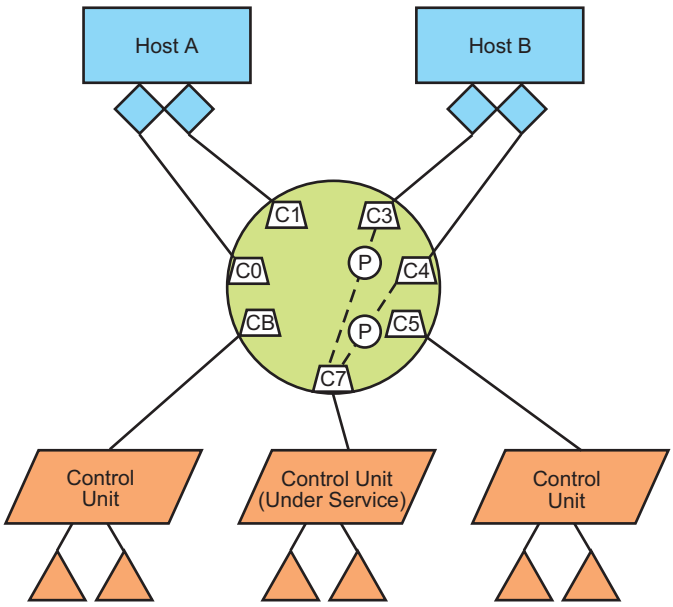


Figure 22. Hierarchy of Port Connectivity Attributes (Control Unit Being Serviced)

Controlling Director Operation

The Director can be controlled using a Director Console, SA OS/390, or a host program. The following sections describe these operations.

Controlling from the Director Console

The Director Console is used to install, initialize, or service a Director, and to change connectivity attributes. The Console uses a graphical user interface (GUI) under the Win-OS/2 operating system. Console operation consists of using a series of windows, dialog boxes, and menus that:

- Manage multiple 9032-003, 9033-004, or 9032-005 Directors and multiple configurations on each Director.
- Display and change port connectivity attributes.
- Assign, change, or delete port names and Director names.
- Upgrade LIC versions.
- Upgrade LMA code.
- Perform utilities such as assigning passwords.

The Director Console also provides windows for a service representative to run diagnostics and retrieve log information. Online help is available for customer and service tasks. For information about using the Console, refer to *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).

After making connectivity changes from the Console, an operator can name and save the resulting configuration for later use or activate the configuration immediately. A maximum of 32 configuration files can be saved on the Console fixed disk. Configuration files can also be saved to a diskette or copied between Director libraries located on the Console fixed disk.

One configuration file must be an IPL file. The IPL file contains the default configuration stored in Director memory that activates when the Director is powered on. The IPL file (and other configuration files) can be activated from the Console at any time during operation to meet the needs of off-shift operations, test systems, and weekend operations. Configuration files can also be examined, read, written, and deleted by a host program. Refer to "Controlling from a Host Program" on page 45 for additional information.

Password Facility

The Director provides a password facility that protects against unauthorized use of specific functions. A password is not required to display Director configuration data or use some Director functions. The password facility, which is controlled at the Console and is independent of other system security methods, has three levels of password control, each with up to 30 unique passwords.

- **Level 1 (Administrative)** - This level password is intended for use by password administrators, and controls passwords for all three levels.
- **Level 2 (Maintenance)** - This level password is intended for use by service representatives, and allows access to maintenance procedures.
- **Level 3 (Operator)** - This level password is intended for use by Director operators, and allows changing Director configuration data (for example, port connectivity) and access to certain Director utilities.

Refer to "Task 16: Plan Console User Access to Directors and Devices" on page 90 for additional information about passwords.

Monitoring the Director

The Director Console maintains a series of logs that provide an audit trail and allow an operator to monitor operation of the Director and Director Console. These logs include the:

- Console audit log.
- Console error log.
- Director audit log.
- Director event log.
- Director link incident (LIN) log.
- Hardware audit log.

Console Audit Log

The Director Console maintains a log of events initiated by a Console operator. This log contains the time, date, and password identification for each event. The audit trail also includes other information as appropriate for the event, such as the Director and LIC version. Events can include:

- Installing a new LIC version to the Director library.
- Installing a new LMA version to the Director library.
- Making changes to passwords or password user descriptions.
- Starting and terminating the Console.
- Adding or deleting a Director definition.
- Setting the date and time.

The Console audit log also includes the date and time when a link becomes available, even though the action creating the event is not initiated by an operator.

Console Error Log

The Console error log records Console exception conditions (errors) that are not severe enough to cause Console failure, such as insufficient memory, memory corruption, file read/write errors, subsystem internal errors, printing errors, or inability to access a resource. The date and time the exception condition occurred and a qualifying code identifying the failing subsystem are included.

Director Audit Log

The Console maintains a log of events reported by the Director. Events are logged that are initiated through the Director operator panel, the Director Console, or SA OS/390. Events with the related time, date, and password identification are logged when:

- Changing Director connectivity at the Director Console, or through SA OS/390.
- Using maintenance procedures.
- Using the *Active = Saved* utility.
- Saving, changing, deleting, or activating configuration files.
- Setting attributes for port connections (allowed, blocked, dedicated, or prohibited).
- Modifying port names or the CUP name.
- Performing a Director IPL.
- Setting the Director date or time.
- Activating port names, saving connection attributes, or saving configuration files.

Director Event Log

The Director event log records hardware and software incidents reported by the Director. Each event log entry contains a message describing the event, the event code (displayed on the Director operator panel), the date and time, and 32 bytes of sense data for use in fault isolating the cause of the event.

Director LIN Log

The Director LIN log records link incidents reported by the Director. Each LIN log entry lists the port number and address where the incident occurred, the date and time of the incident, and the hardware attached to the port. In addition, the log displays 32 bytes of sense data for use in fault isolating the cause of the link incident.

Hardware Audit Log

The hardware audit log records configuration changes of Director FRUs. Each log entry contains the FRU name, position, status, part number, serial number, and the date and time the change was detected.

The Director Matrix

The Director Console application displays port connectivity attributes in a matrix format for all Director ports. The display modes are nongraphic and graphic. If logical partitioning is enabled, unauthorized ports are darker in the Director matrix. Refer to “Logical Partitioning Capability” in *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296) for additional information.

Note: The intersection of a port column with the same port row contains a diagonal line, indicating a port cannot connect with itself.

Nongraphic Display Mode - Figure 23 shows the Director matrix in non-graphic display mode with no FCV port cards installed (no FICON capability) and no logical partitioning enabled. Logical port addresses are listed on the left side of the matrix (under the *Addr* column) and above the matrix grid. Port addresses *04* through *12* are displayed.

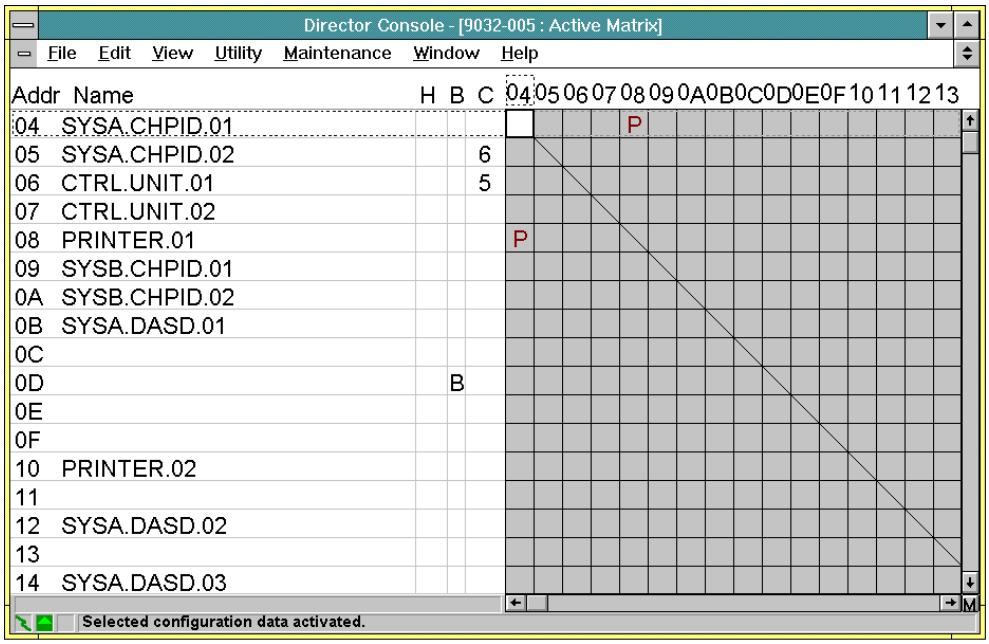


Figure 23. Matrix Window (Nongraphic Display Mode, No FCV Port Cards)

The following columns of information are displayed:

- **Addr** - The logical port address expressed in hexadecimal notation.
- **Name** - The user-assigned port name (up to 24 characters).
- **H** - The hardware status of the port as indicated below. This column is not completed by the user; the Director automatically supplies the appropriate data.
  - An **A** indicates a wrap plug is installed on the port or an attached device is invalid (sending unexpected responses).
  - An **L** indicates a link failure.
  - An **M** indicates the port is set to maintenance mode.
  - An **N** indicates the port is not installed.
  - An **O** indicates the port is offline.
  - An **S** indicates service is required.
  - A **T** indicates a device error threshold was exceeded (detected by the Director) and the port attached to the disruptive device was set offline.
  - A **D** indicates the port card is degraded or not operating at peak capacity (FCV port card only).
  - A **G** indicates the attached host system performed an explicit logout from the port card (FCV port card only).
  - An **I** indicates the port card is inactive or will not come online (FCV port card only).
  - A **U** indicates the port is unaddressable (FCV port card only).
- **B** - A **B** in this column indicates a port is blocked. If the column is blank, the port is unblocked. In Figure 23, port *0D* is blocked.
- **C** - A port address in this column indicates a dedicated connection to that port. In Figure 23, ports *05* and *06* have a dedicated connection. This is indicated by a **6** in port row *05* and a **5** in port row *06*.
- **Matrix Columns** - Each square in the matrix represents the intersection of one port row and one port column, and indicates connectivity status between the two ports. A blank matrix square indicates a connection between ports is allowed. A red **P** in a matrix square indicates a connection between ports is prohibited. In Figure 23, a connection between ports *04 and 08* is prohibited.

Figure 24 shows the Director matrix in nongraphic display mode with two FCV port cards installed (FICON-capable) and no logical partitioning enabled. Logical port addresses are listed on the left side of the matrix (under the *Addr* column*)* and above the matrix grid. Port addresses *04* through *14* are displayed.

Information columns for the Director matrix are identical, with or without FCV port cards installed. However, because eight ESCON ports map to one FICON port, an FCV port card uses one logical port address and eight port numbers. In Figure 24, FICON-capable cards are installed in ports *04* and *0C*. Ports *05* through *0B* (corresponding to port card *04*) and *0D* through *13* (corresponding to port card *0C*) are rendered unaddressable, indicated by a **U** in the hardware **(H)** column.

An FCV port card can only connect to a FICON-capable channel, and not to another FCV port card. As a result, Figure 24 indicates (with a pair of red **Ps**) a connection between ports *04* and *0C* is prohibited. The prohibited state is set by the Director and cannot be modified by an operator while the FCV port cards are installed.

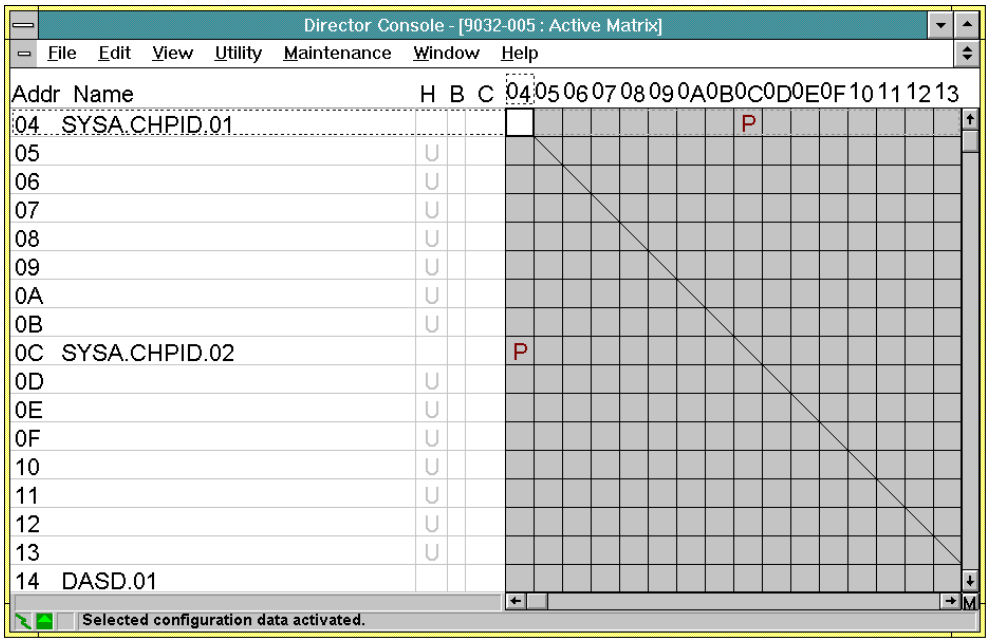


Figure 24. Matrix Window (Nongraphic Display Mode, Two FCV Port Cards)

Graphic Display Mode - Figure 25 shows the Director matrix in graphic display mode with no FCV port cards installed (no FICON capability) and no logical partitioning enabled. Logical port addresses are listed on the left side of the matrix (under the *Addr* column) and above the matrix grid. Port addresses *04* through *13* are displayed.

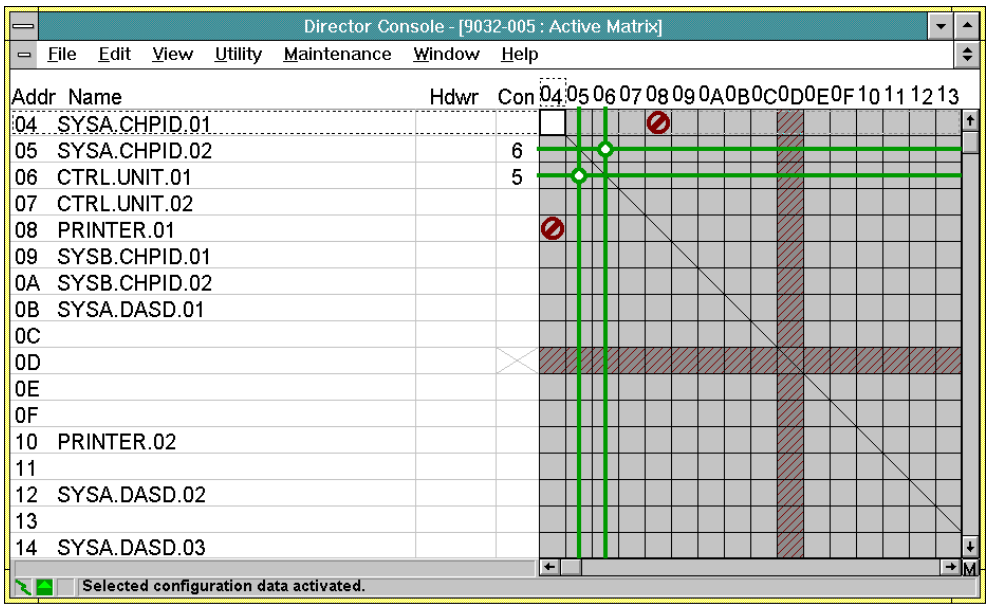


Figure 25. Matrix Window (Graphic Display Mode, No FCV Port Cards)

The following columns of information are displayed:

- **Addr** - The logical port address expressed in hexadecimal notation.
- **Name** - The user-assigned port name (up to 24 characters).

- **Hdwr** - The hardware status of the port as indicated below. This column is not completed by the user; the Director automatically supplies the appropriate data.
  - **Invalid** indicates a wrap plug is installed on the port or an attached device is invalid (sending unexpected responses).
  - **LnkFail** indicates a link failure.
  - **Maint** indicates the port is set to maintenance mode.
  - **NotInst** indicates the port is not installed.
  - **Offline** indicates the port is offline.
  - **Service** indicates service is required.
  - **Thrshld** indicates a device error threshold was exceeded (detected by the Director) and the port attached to the disruptive device was set offline.
  - **Degrad** indicates the port card is degraded or not operating at peak capacity (FCV port card only).
  - **Inactive** indicates the port card is inactive or will not come online (FCV port card only).
  - **Logout** indicates the attached host system performed an explicit logout from the port card (FCV port card only).
  - **Unaddr** indicates the port is unaddressable (FCV port card only).
- **Con** - A port address in this column indicates a dedicated connection to that port. An **X** in the column indicates a port is blocked. In Figure 25, ports *05* and *06* have a dedicated connection. This is indicated by a **6** in port row *05* and a **5** in port row *06*. Port *0D* is blocked.
- **Matrix Columns** - Each square in the matrix represents the intersection of one port row and one port column, and indicates connectivity status between the two ports. A blank matrix square indicates a connection between ports is allowed. A red circle with a slash in a matrix square indicates a connection between ports is prohibited. In Figure 25, a connection between ports *04* and *08* is prohibited.

  In addition to an **X** in the **Con** column, diagonal red slashes through a matrix row and corresponding matrix column indicate a port is blocked. These red slashes in Figure 25 indicate port *0D* is blocked.

  In addition to logical port addresses in the **Con** column, small white circles in matrix squares at the intersection of two ports indicate a dedicated connection. Solid green lines extend both horizontally and vertically from the circles to indicate other ports cannot have a dynamic connection to the dedicated ports. Figure 25 indicates ports *05* and *06* have a dedicated connection.

Figure 26 shows the Director matrix in graphic display mode with two FCV port cards installed (FICON-capable). Logical port addresses are listed on the left side of the matrix (under the *Addr c*olumn) and above the matrix grid. Port addresses *04* through *15* are displayed.

Information columns for the Director matrix are identical, with or without FCV port cards installed. However, because eight ESCON ports map to one FICON port, an FCV port card uses one logical port address and eight port numbers. In Figure 26, FICON-capable cards are installed in ports *04* and *0C*. Ports *05* through *0B* (corresponding to port card *04*) and *0D* through *13* (corresponding to port card *0C*) are rendered unaddressable, indicated by **Unaddr** in the hardware (**Hdwr**) column.

Internal ESCON ports on an FCV port card cannot connect to internal ESCON ports on another FCV port card. As a result, Figure 26 indicates (with a pair of red circles with slashes) a connection between ports *04* and *0C* is prohibited. The prohibited state is set by the Director and cannot be modified while FCV port cards are installed.

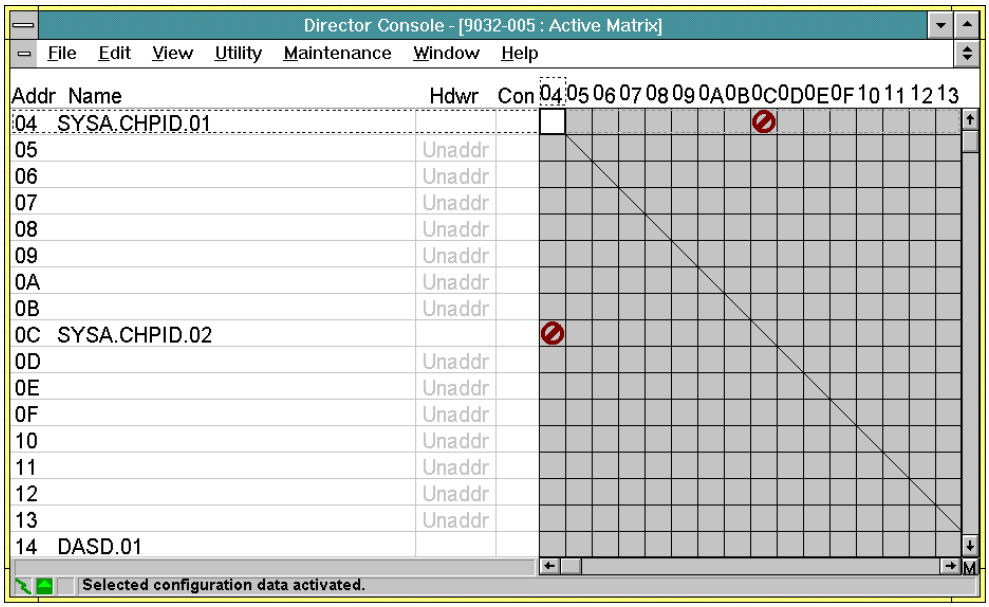


Figure 26. Matrix Window (Graphic Display Mode, Two FCV Port Cards)

Command Lists Function

The Director Console application provides a command lists function that allows an operator to compile a series of frequently-used commands (block, dedicate, prohibit) into a file for batch execution. The batch file runs and assigns port connectivity attributes, rather than the operator assigning attributes on an individual port basis.

As an example, assume an Enterprise downloads customer transaction data to a series of storage devices on a nightly basis. To download the data, a defined set of port connections is dedicated, and connectivity to other ports is prohibited. The following morning, port attributes are reassigned to accommodate daily business activity. Instead of assigning port connectivity attributes individually (twice daily), two command lists are created to assign port connectivity attributes as a batch process. One command list is executed each evening, and the second command list is executed the following morning.

To access the command lists function, select the *Command Lists* option from the *Edit* menu. The *Command Lists* dialog box appears (Figure 27).

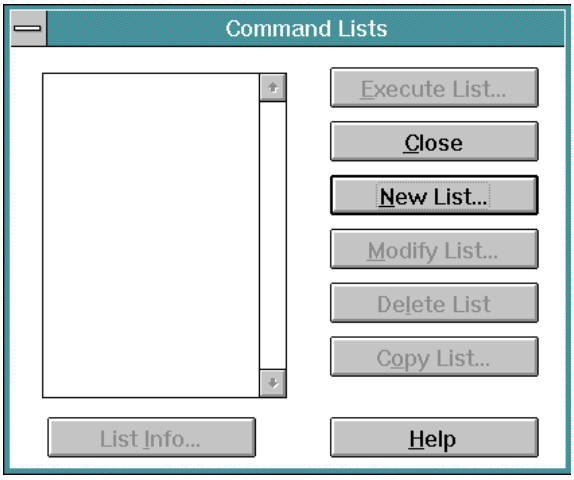


Figure 27. Command Lists Dialog Box

Refer to “Command Lists” in *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296) for instructions about using the command list function.

Controlling from SA OS/390

Directors are managed more effectively with SA OS/390. This IBM-licensed program provides host connectivity control of Directors defined to the system image on which the program is running. The programs also coordinate connectivity changes across several hosts if the programs are running on hosts with intersystem communication.

Note: SA OS/390 Version 1.2 is required for FICON operation.

SA OS/390 is a strategic follow-on product to ESCON Manager. SA OS/390 supports the functions and interfaces of ESCON Manager, and includes new I/O operation functions and enhanced versions of Automated Operations Control for Multiple Virtual Storage (AOC/MVS™) and Target System Control Facility (TSCF) functions. SA OS/390 reduces the risk of server outages due to inadvertent loss of critical data when making a Director configuration by:

- Integrating Director changes with required changes on host images, including:
  - Dynamically determining paths to be varied online or offline to safely enable or disable connectivity to devices affected by changes to Director ports.
  - Dynamically determining paths to be varied online or offline to safely enable or disable connectivity to all system images that run SA OS/390 and share connectivity to the Director being changed.
  - Disabling connectivity at Directors only after affected hosts have varied offline all paths through the affected ports.
  - Implementing a “two-phase commit” procedure to coordinate changes across all affected system images and to back out changes that are not successfully processed on all images.
- Providing a single point of control, including:
  - Multiple Directors.
  - Channel path **CONFIG** and device **VARY** operations across multiple system images.
  - Exploitation by Hardware Configuration Definition (HCD) on OS/390 to activate or save Director configurations created in conjunction with path definitions.
  - Full-function application program interface (API) for automation.
  - Relocatable point-of-control across system images.
- Providing information about the I/O configuration, including:
  - Current Director connectivity status and saved configurations.
  - Paths between channels and devices (as known to one or more system images) dynamically discovered and kept current across dynamic reconfiguration changes.
  - Physical connectivity and identification derived from I/O resources, including serial numbers and model information.
  - Exploitation by HCD on OS/390 to prime the input/output definition file (IODF).

Refer to the list of publications in the preface of this manual for additional information about SA OS/390.

Controlling from a Host Program

The Director includes a host-addressable integrated control unit. If the control unit is defined to the host I/O configuration and the host has the required Director device support code, a host program can:

- Examine, read, write, or delete saved configuration files.
- Remove the Director's communication capability.
- Display and change port connectivity attributes.
- Assign, change, or delete port and Director names.
- Receive Director error information.

For information about commands that provide the interface between the Director control unit and host, refer to *Programming the Interface for Enterprise Systems Connection Directors: XDF Capable* (SA23-0356).

When using a host program control, do not enter connectivity changes at the Director Console. Using the Director Console negates benefits provided by host control. If changes are made at the Director Console while the Director is under host control, a warning message is sent to the host Console.

Logical Partitioning Capability

The Director has a logical partitioning capability that allows an administrator to create port-level configuration access control unique to each defined operator. Director port addresses are divided into distinct groups or logical regions with operator-specific management authority. This LPAR capability allows operators to access only authorized ports, and restricts unauthorized operators from changing the port connectivity configuration of any device or set of devices under control of the Director. The administrator can also define groups of ports whose configuration access is shared between operators. The LPAR feature offers increased security and maximizes the flexibility of system configuration. An LPAR can be:

- One port up to the maximum number of ports (FICON and ESCON) available on the Director.
- A set of contiguous or non-contiguous ports (any increment or location).
- A different size from another LPAR.
- Mutually exclusive to one operator or common to multiple operators.
- Easily changed or modified.

Logical partitioning is enabled by selecting the *Port Authorization* option from the *Utility* pull-down menu. By default, port authorization is not enabled and all operators have connectivity management authority for all ports. For additional information about creating logical partitions and granting port authorization, refer to "Create Logical Partitions" and "Enable Operator" in *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296). The following examples illustrate uses for logical partitioning.

Example 1:

A disaster recovery site controls several tape storage devices that manage data for many businesses. Each device is allocated to a different business. Through the Director, access to each device is restricted so only the operator in charge of a specific business's data can control port connectivity to that device. For example, one business may have authority to manage connectivity to ports 24, 64, A4, and E4; and another business may have authority to manage connectivity to ports 25, 65, A5, and E5.

Example 2:

A test group and production group share use of a mainframe computer. With the Director, each group can access the mainframe through a set of ports allocated only to that group. This allows the test group to complete its tests without interfering with the production group's computer access.

Example 3:

A service bureau owns a mainframe computer that processes data for many businesses. Each business uses the mainframe only when required. During peak periods for one business, the service bureau can allocate more port connectivity management to that business and remove port connectivity management from the other businesses.

Example 4:

The Information Systems (IS) department is responsible for a Director that is shared among three departments. The IS department wants to grant port connectivity control to a person in each department but retain overall control of the Director. In addition, the Director is configured with more ports than are required. Using the logical partitioning, the IS department dedicates 44 ports to software engineering, 72 ports to business systems, and 52 ports to manufacturing. The remaining 80 ports are dedicated to the IS department for future use by other departments. Ports are reallocated to these departments as their needs increase.

Example 5:

In a manufacturing company, all operators require access to the printer, but the remaining devices need to be restricted only to authorized personnel. Through the Director, authority to manage connectivity to all ports except those attached to the printer can be restricted.

Example 6:

A large bank recently acquired two small banks. The data centers for the small banks are consolidated into the large bank's data center, and the small banks' workload is added to the current set of Directors. The workloads are segregated during this process. The IS department uses logical partitioning to allocate 42 unused ports to the workload of one small bank, and 30 ports to the workload of the other small bank. After workload consolidation, the IS department can change the logical partition's port authorization matrix as required.

Multiple Image Facility

Directors can participate in using the Multiple Image Facility (MIF). This facility allows multiple LPARs to directly share ESCON channels, ESCON channel-to-channel functions, and control units and associated I/O devices configured to these channels. For additional information, refer to the *ES/9000 and ES/3090 PR/SM Planning Guide* (GA22-7123) or the *S/390 PR/SM Planning Guide* (GA22-7236).

Chapter 2. Connectivity Considerations and Recommendations

This chapter provides information to select a Director Console, determine the number of Directors required, and determine the number and type of ports required. The chapter also describes how an Enterprise can take advantage of Director capabilities and provides recommendations about attaching fiber-optic cables to Director ports.

A configuration can be created using several Directors, hosts, and control units. Factors that affect configuration planning include:

- Requirements for Fibre Connection (FICON) or Enterprise Systems Connection (ESCON) port connections.
- Enhancing the availability of control units.
- Sharing control units across host systems.
- Distance requirements for channel-to-channel or channel-to-control unit connections.
- Nondisruptive growth (FICON or ESCON) and service requirements, such as those for redundant connections and ports.
- Increased distances between hosts and control units.

Planning the Initial Configuration

To maintain high availability of channels and control units when planning an ESCON configuration, or a combined FICON and ESCON configuration, consider the following:

- Connect to host systems based on the type of channel (FICON or ESCON).
- Connect to host systems based on the intended use of host control for the Director. For example, using the System Automation for Operating System/390 (SA OS/390) focal point system and backup focal point system greatly simplifies host operator access to the Director for required changes.
- Connect multiple channel path identifiers (CHPIDs) from each host system to each Director. However, consider data security and integrity issues before connecting multiple CHPIDs.
- Provide control unit connections through multiple Directors. However, consider that not all control units allow multiple connections.
- Separate multiple port connections from a single application across different Director port card quadrants when possible.
- Maintain spare ports for control units that require high availability. Refer to "Determining Number and Type of Spare Ports" on page 54 for additional information.
- Plan for the correct types of fiber-optic cables (and connections) and ensure the cables are available for the installation. Refer to "Planning Port Connections and Cabling" on page 57 for additional information.

After Director installation, new port cards (FICON or ESCON) can be installed, fiber-optic cables can be attached to ports, and port connection configurations can be changed through the Director Console or host program while the Director is powered on and operating.

Console Selection Considerations

A Director Console is required to configure and initialize the Director during installation, to change configurations (without the system integrated change control of SA OS/390), and to access logs. After a Director is configured and operational, it performs all connection tasks without Console intervention. A Console failure does not cause an operating Director to fail. Although a Console is not required for normal Director operation, it is recommended a Console always be connected to a Director cluster to provide status and error reporting.

The Console communicates with the Director through a 4/16 megabit per second (Mbps) Token Ring local area network (LAN). The Console can be installed anywhere up to the limit of the Token Ring, or can be installed on a remote LAN and communicate with the Director (on a local LAN) through a bridge or router. The LAN can be public or dedicated to the Director cluster. ***It is recommended the Directors and Director Console be installed on a dedicated LAN.***

Attention!

Operation of all Director models (9032-003, 9033-004, or 9032-005) is supported through a bridged LAN. Operation of all Director models (9032-003, 9033-004, or 9032-005) is supported through a routed LAN *only* if Licensed Internal Code (LIC) Version 4.3 or higher is installed.

Director Console Configurations

The Windows-Operating System/2 (Win-OS/2)-based Director Console application can be installed in three different configurations:

1. The recommended platform is a dedicated IBM PC with appropriate hardware and software (Figure 28).

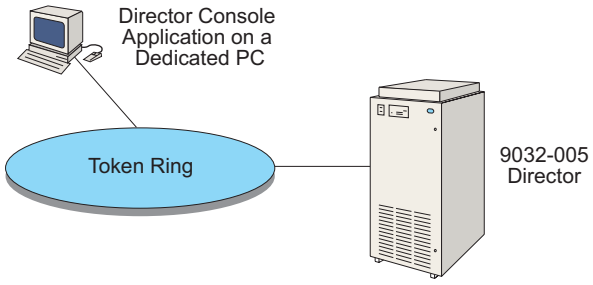


Figure 28. Director Console Application on a Dedicated PC

2. The Sysplex Timer Console (Figure 29).

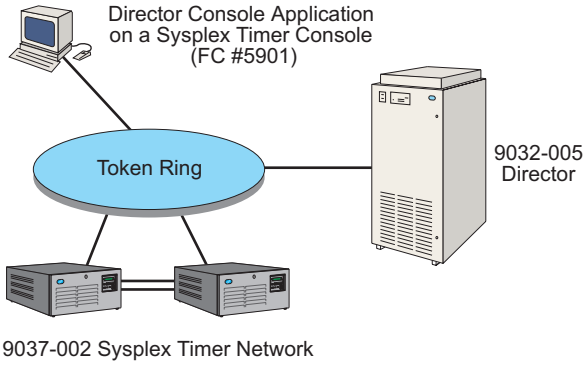


Figure 29. Director Console Application on a Sysplex Timer Console

3. The S/390 Server's Hardware Management Console (Figure 30).

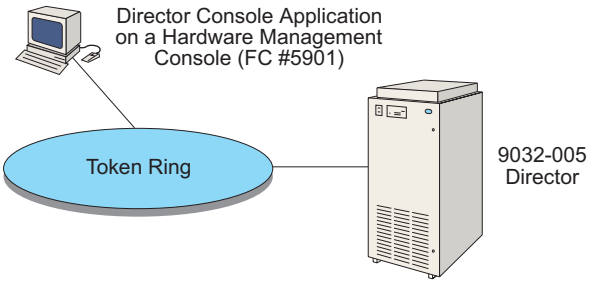


Figure 30. Director Console Application on a Hardware Management Console

The Director Console application can also be accessed to perform operator and administrative tasks by a remote Console (or S/390 Hardware Management Console) that communicates with a Director Console over a bridged or routed LAN. Remote communication requires a customized version of Distributed Console Access Facility (DCAF) software and Transmission Control Protocol/Internet Protocol (TCP/IP) software that are provided with the Director Console. The customized version of DCAF is supported only for the Director or Sysplex Timer Console applications.

Figure 31 illustrates remote Director control through a DCAF session. Several Directors (9032-003, 9033-004, and 9032-005) are controlled by a remote Hardware Management Console (DCAF controller) that communicates through a Director Console (DCAF target) over a bridged or routed LAN.

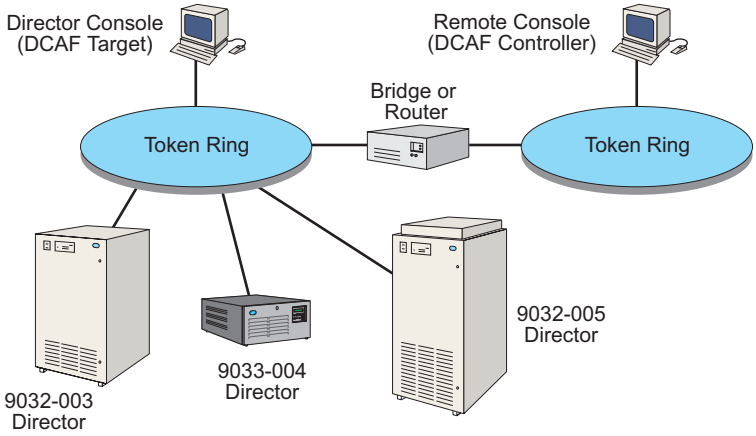


Figure 31. Remote Hardware Management Console Control Through DCAF

Considerations

Consider the following when selecting a Console to support the Director:

- When planning a new Director installation, it is recommended that customers use an IBM-supplied Director Console. However, the Director Console application can be installed on a customer-supplied PC, a Sysplex Timer Console, or a Hardware Management Console.
  - — If an IBM-supplied Director Console is used, order the Console PC with the Director to ensure coordinated shipment.

- If a customer-supplied Console, Sysplex Timer Console, or Hardware Management Console is used, ensure the PC platform meets minimum hardware specifications. Refer to "Hardware Requirements" on page 22 for information.

- When adding a Director to an existing configuration, be aware the Director Console can operate a cluster of up to 16 units (any combination of 9032-003, 9033-004, or 9032-005 Directors), and 9037-002 Sysplex Timer networks.
  - If adding a Director exceeds maximum configuration specifications, a new Director Console is required.
  - If adding a Director does not exceed maximum configuration specifications, a new Director Console is not required. However, Consoles that support the 9032-003 and 9033-004 Directors may not support the 9032-005 Director because of memory, microprocessor, and operating system requirements. Refer to "Hardware Requirements" on page 22 for information.
- Be aware that the Director Console described in this publication does not support the 9032-002 or 9033-001 Director, nor does the IBM-supplied 9032-002 or 9033-001 Director Console support the 9032-005 Director.

  Note: ***The IBM-supplied 9032-003 or 9033-004 Director Console does not support operation of the 9032-005 Director.***
- A Console failure does not cause an operating Director to fail. However, to provide maximum Console availability and continued access to critical data, consider installation of a backup or replacement Console. Refer to "Task 4: Plan for a Backup or Replacement Console" on page 73 for additional information.
- Consider the requirements for Director Console installation on a LAN (including cabling and multistation access unit (MAU) requirements), LAN addressing schemes, LAN security, and use of a remote access Console. Refer to "Task 5: Plan LAN and Remote Console Installation" on page 73 for additional information about LAN installation. Refer to "Task 6: Establish Security Measures" on page 78 for additional information about LAN security.

Redundancy and Backup

Enhanced availability features (EAFs) can be ordered and installed in the Director to provide redundancy or backup and reduce operational disruption in case of failure. EAFs are field-replaceable units (FRUs) that can be added to the Director (or removed and replaced) without disrupting Director port operation. Refer to "Enhanced Availability Features" on page 19 for more information about these FRUs.

Determining Port, Director, and Host Connection Requirements

The following sections provide guidelines to plan for the number and type of ports, number and type of spare ports, number of Directors, and number and type of host connections required for the planned configuration. Table 4 summarizes factors that must be considered when planning to meet these requirements.

Table 4. Factors Affecting Port, Director, and Host Connection Requirements

Requirement	Factors	Page Number
Number of required ports	Number of host, control unit, chained Director (ESCON only), or ESCON Converter connections. Number of channel-to-channel connections (ESCON-to-ESCON or FICON-to-ESCON).	52
Type of port	Planned distances between connections. Fiber-optic cable requirements (multimode or singlemode). Host restrictions (FICON or ESCON), control unit restrictions, and performance needs.	52
Number and type of spare ports	Requirements to maintain high availability for critical host and control unit connections.	54
Number of Directors	Number of required ports (248 maximum ESCON and 16 maximum FICON per Director). Requirements to maintain high availability for critical host and control unit connections. Requirements for increased channel-to-channel and channel-to-control unit distance (using chained Directors as ESCON repeaters).	54
Number and type of host connections	ESCON versus FICON. Requirements for hosts to share control units or channel-to-channel attachments. Requirements to maintain high availability for critical host connections.	55

Determining Number and Type of Required Ports

Plan for sufficient ports to meet the current requirements of the Enterprise. In addition, consider planning for changes in port requirements. Because of channel consolidation and port reduction, this is particularly important when incorporating FICON technology into the ESCON environment. To provide redundancy in case of port failure, consider providing unused or spare ports.

In addition to the number of ports, plan for the correct types of ports. The available port cards are:

- Fibre Channel Converter (FCV) port cards that provide one FICON port connection.
- Light-emitting diode (LED) device port (DVP) cards that provide eight ESCON port connections.
- Extended Distance Feature (XDF) laser cards that provide eight ESCON port connections.

Determining Number of Ports

The number of ports required equals the sum of the host, control unit, chained Director, and ESCON Converter connections (including redundant connections). The number of host connections includes channel-to-channel connections. Consider the following when determining the number of ports required:

- The Director provides 31 port card slots that can be populated with FCV port cards (one FICON port each), and LED or XDF laser DVP cards (eight ESCON ports each), subject to the following constraints:
  - A minimum of three DVP cards (LED or XDF laser) must be installed. There is no minimum installation requirement for FCV port cards. A maximum of 31 DVP cards or 16 FCV (with a maximum of 15 DVP cards) port cards can be installed.
  - If no FCV port cards and 31 DVP cards are installed, the Director supports 248 ESCON connections.
  - If one FCV port card and 30 DVP cards are installed, the Director supports one FICON connection and 240 ESCON connections.
  - If 16 FCV port cards and 15 DVP cards are installed, the Director supports 16 FICON connections and 120 ESCON connections.
- ***It is recommended that redundant connections be provided for critical hosts, control units, and applications that require high availability. Plan for redundancy according to the following hierarchy:***
  - If possible, provide redundant connections to multiple Directors. This eliminates the risk of the entire Director as a single point of failure.
  - If multi-Director connections are not possible, provide redundant connections to different port card quadrants (upper or lower) in a single Director. Refer to "Configuring Port Use for Maximum Availability" on page 58 for additional information.
  - If multi-port card quadrant connections are not possible, provide redundant connections to different port cards. This eliminates the risk of the individual port card as a single point of failure. ***At a minimum, it is recommended that all critical connections be attached to multiple port cards.***
- When planning for CTC connections, be aware the Director supports ESCON-to-ESCON and FICON-to-ESCON connections. ***The Director does not support FICON-to-FICON CTC connections.***
- Up to eight ESCON channel paths (to separate control units) can be consolidated to a single FICON channel path with a commensurate reduction in number of ports. Be aware of this port reduction when planning the current installation or when planning FICON upgrades to the Enterprise.

  Note: To consolidate multiple ESCON channel paths (up to eight) to a single FICON channel path, the ESCON control unit links must be switched to separate logical control unit addresses.

Determining Type of Ports

One type of FICON port and two types of ESCON ports are available for the Director. Consider the following when planning the types of ports to use:

- Distance requirements for hosts, control units, and Directors, distance requirements for CTC connections, and if chained Directors are planned.

- Requirements of the existing or planned fiber-optic cable infrastructure, including use of multimode or singlemode cable, and use of IBM multimode duplex or Fibre Channel Standard/Subscriber Connector (FCS/SC) duplex connectors.
- Type of host channel (FICON or ESCON), control unit restrictions, and control unit performance needs.

The following paragraphs describe the three port types. Fiber-optic cable requirements, connector requirements, and distance limitations are provided for each port type.

- **FCV** - FCV ports provide a FICON link attachment to an IBM S/390 Generation 5 (or later model) Parallel Enterprise Server. An FCS/SC duplex connector is required to attach optical fiber to a port. Either singlemode or multimode fiber-optic cable is used. The exterior jacket of singlemode cable is typically yellow, and the exterior jacket of multimode cable is typically orange. An FCV port transmits data through a longwave laser (1310 nanometer) optical transceiver. The transceiver has an operating distance of:
  - — Up to 550 meters (1,804 feet) using 50-micron or 62.5-micron multimode fiber-optic cable with a mode conditioning patchcord (part number 21L4175) at each end of the link. The grade of cable can affect the maximum operating distance.
  - — Up to 10 kilometers (6.2 miles) using 9-micron singlemode fiber-optic cable. The grade of cable can affect the maximum operating distance.

  FCV ports provide FICON connections only. Chained Director, ESCON converter, FICON-to-FICON CTC connections, and dedicated connections are not supported.
- **LED** - LED ports provide an ESCON link attachment to any ESCON-capable server, ESCON-capable peripheral, 9034 or 9035 ESCON Converter, or another Director. An IBM multimode duplex connector is required to attach optical fiber to a port, and only multimode fiber-optic cable is used. The exterior jacket of multimode cable is typically orange. An LED port transmits data through an LED optical transceiver, and has an operating distance of:
  - — Up to 2 kilometers (1.24 miles) for single links using 50-micron multimode fiber-optic cable.
  - — Up to 6 kilometers (3.72 miles) CTC or channel-to-control unit using 50-micron multimode fiber-optic cable and chained Directors as ESCON repeaters (2 km from channel to first Director, 2 km between Directors, and 2 km from second Director to control unit).
  - — Up to 3 kilometers (1.86 miles) for single links using 62.5-micron multimode fiber-optic cable.
  - — Up to 9 kilometers (5.58 miles) channel-to-control unit using 62.5-micron multimode fiber-optic cable and chained Directors as ESCON repeaters (3 km from channel to first Director, 3 km between Directors, and 3 km from second Director to channel or control unit).

  Variables such as the number of connections, grade of cable, control unit restrictions, and control unit requirements can affect the maximum distances. For additional information about distance specifications and limitations for LED ports, refer to *Introducing Enterprise Systems Connection* (GA23-0383).
- **XDF Laser** - XDF laser ports provide an ESCON link attachment to any ESCON XDF-capable server, 9036 ESCON Converter, or another Director. An FCS/SC duplex connector is required to attach optical fiber to a port. Only singlemode fiber-optic cable is used. The exterior jacket of singlemode cable is typically yellow. An XDF laser port transmits data through a laser optical transceiver. The transceiver has an operating distance of:

— Up to 20 kilometers (12.4 miles) for single links using 9-micron singlemode fiber-optic cable.

— Up to 43 kilometers (26.7 miles) channel-to-control unit using 9-micron singlemode fiber-optic cable and chained Directors as ESCON repeaters.

— Up to 60 kilometers (37.3 miles) CTC using 9-micron singlemode fiber-optic cable and chained Directors as ESCON repeaters.

Variables such as the number of connections, grade of cable, control unit restrictions, and control unit requirements can affect the maximum distances. For additional information about distance specifications and limitations for XDF laser ports, refer to *Introducing Enterprise Systems Connection* (GA23-0383).

XDF laser port cards shipped with the Director have FCS/SC duplex connectors. If cables from control units have IBM multimode connectors, an XDF adapter kit (part number 46H9223) is required for each cable.

Determining Number and Type of Spare Ports

If a port card or individual port fails, cable connections can be swapped to unused ports and connections can be reconfigured (at the Console) while the Director is operational. It is recommended that unused (spare) ports be made available to allow for transfer of connections in case of port failure. At least one type of spare port (LED, XDF laser, or FCV) should be available for each type of port connection.

If the Director is fully populated (248 port connections), unused ports are provided by installing the spare ports card feature. The spare ports card provides either four LED ports or two LED ports and two XDF laser ports. The spare ports card provides only ESCON spare ports, and does not increase the total number of ports available for connection. To provide a spare FICON port, an unused FCV port card must be installed in the Director.

Note: EAFs, spare ports, and the ability to configure dynamic connections to unused ports provide redundancy in case of component failure. However, for maximum redundancy in case of failure, consider installing more than one Director in the Enterprise.

Determining Number of Directors

Consider the following when determining the number of Directors to install in the Enterprise:

- **Total number of ports required** - One Director supports installation of a maximum of 31 port cards (248 ESCON ports), including up to 16 FCV port cards (16 FICON ports) and 15 DVP cards (120 ESCON ports). If additional port connections are required, a second Director is required.
- **Host and control unit availability** - Host and control unit availability are increased by creating a configuration with every device attached to at least two Directors. If one Director fails, all devices are accessible through the redundant Director.
- **Host-to-control unit distance** - An increase in host-to-control unit distance is provided by FICON or ESCON channels, fiber-optic cabling, and the extended distance feature. Although these factors provide increased distance, they can adversely affect performance. Refer to control unit planning and installation documentation to ensure increased distances are supported. In addition, refer to *Planning for S/390 Fiber Optic Links - ESCON, FICON, Coupling Links, and Open System Adapters* (GA23-0367).

The distance from a host to a control unit can also be extended by chaining two Directors as shown in Figure 32. This requires a dedicated connection through at least one Director and a physical connection (through a fiber-optic cable) from a port on one Director to a port on the other Director. Chained Directors must meet these criteria:

— The chain path *must* consist of ESCON-to-ESCON connections. FICON-to-FICON or FICON-to-ESCON chained connections are not supported.

— One or both Directors must provide a dedicated connection. In Figure 32, a dedicated connection exists on Director *A* between the ports with addresses C1 and C4.

— The chained path cannot pass through more than two Directors.

— The path between Directors, dedicated connections within the Directors, and input/output configuration program (IOCP) definitions must all agree for the chain to work. Refer to "IOCP Statement Examples" in Appendix C for IOCP coding for chained Directors.

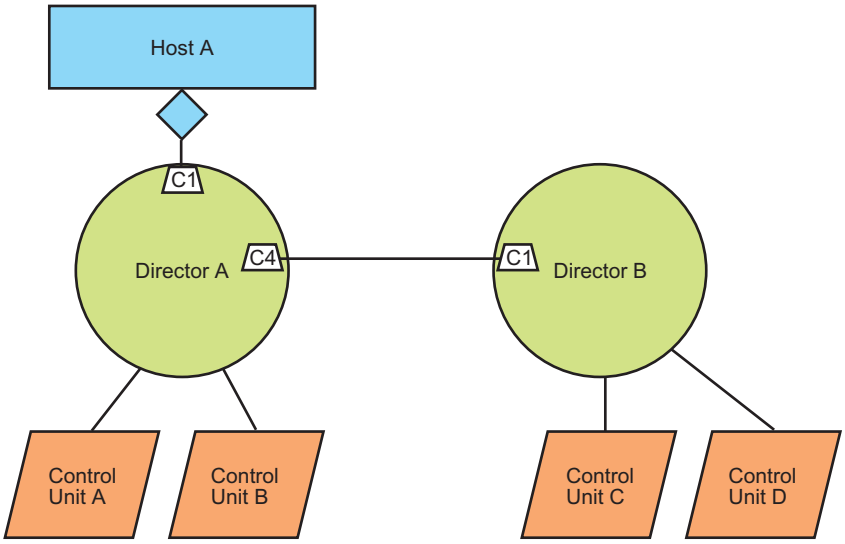


Figure 32. Chained Directors

Determining Number and Type of Host Connections

Consider the following when determining the number and type of host connections required:

- **FICON versus ESCON connectivity** - FICON channel connectivity requires installation of FCV port cards in the Director. ESCON channel connectivity requires installation of DVP cards (LED or XDF laser). Installation of FCV port cards reduces physical channel paths by consolidating eight ESCON channels (connected to separate control units) onto a single FICON channel. The corresponding decrease in host port connections (8 to 1) must be planned accordingly.
- **Host availability** - Host availability is increased by attaching the host to at least two Directors. If one Director fails, the host is accessible through the redundant Director. The corresponding increase in host connections must be planned accordingly.

- **Sharing control units between host systems** - Figure 33 shows an existing configuration with one ESCON host (A), one Director, and two ESCON control units (1 and 2). A FICON-capable host (B) and two ESCON control units (3 and 4) are planned for installation (shown by the dashed lines). Both hosts share access to all four ESCON control units through Director connectivity.

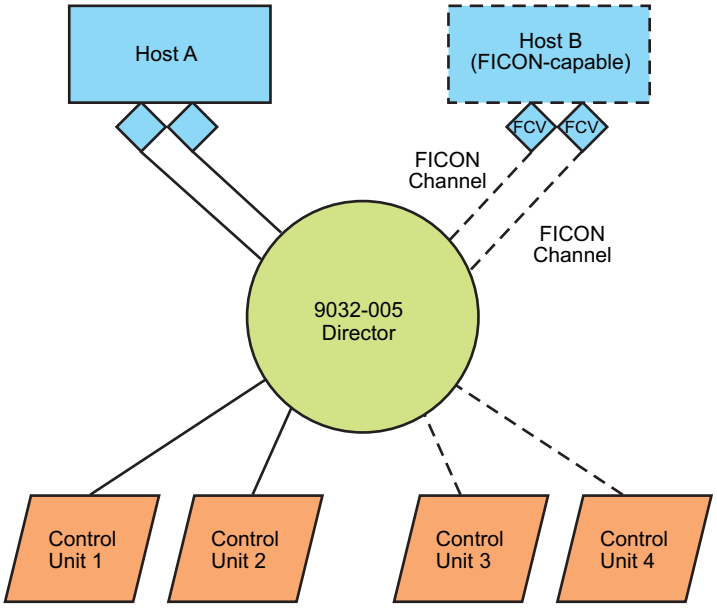


Figure 33. Two Hosts Connected through One Director

Figure 34 illustrates how two Directors are used to improve availability of control units to both hosts. Assume the applications on host A normally access control units 1 and 2 (through either Director). If necessary, host A can also access control units 3 and 4 for backup or sharing. Similarly, assume the applications on host B normally access control units 3 and 4. If necessary, host B can access control units 1 and 2.

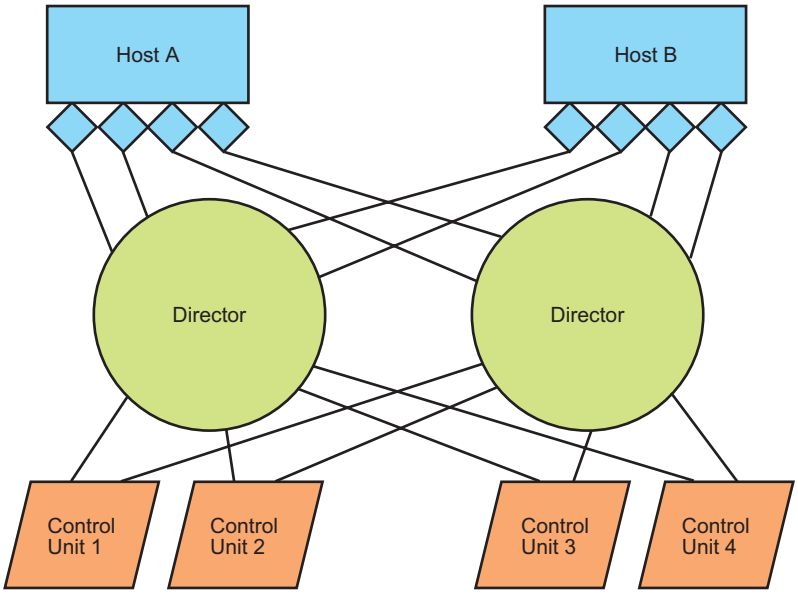


Figure 34. Two Hosts Connected through Two Directors

Planning Port Addresses for Multiple Directors and Channels

Another planning consideration is to provide parallel port addresses. When a configuration has multiple hosts, Directors, control units, and interfaces, redundant or backup configuration paths are usually provided. As shown in Figure 35, identical logical port addresses are assigned at each Director to indicate redundancy, making it easier to determine the device configuration.

- When a configuration has the same number of hosts and Directors, assign the same logical port address on each Director to the same CHPID on each host. For example, channel 2F on host A connects to logical port address 80 on Director A, and channel 2F on host B connects to logical port address 80 on Director B.
- When a control unit has connections to multiple Directors, assign the same logical port address on each Director to the control unit. For example, control unit 1 connects to port address 81 on all Directors.

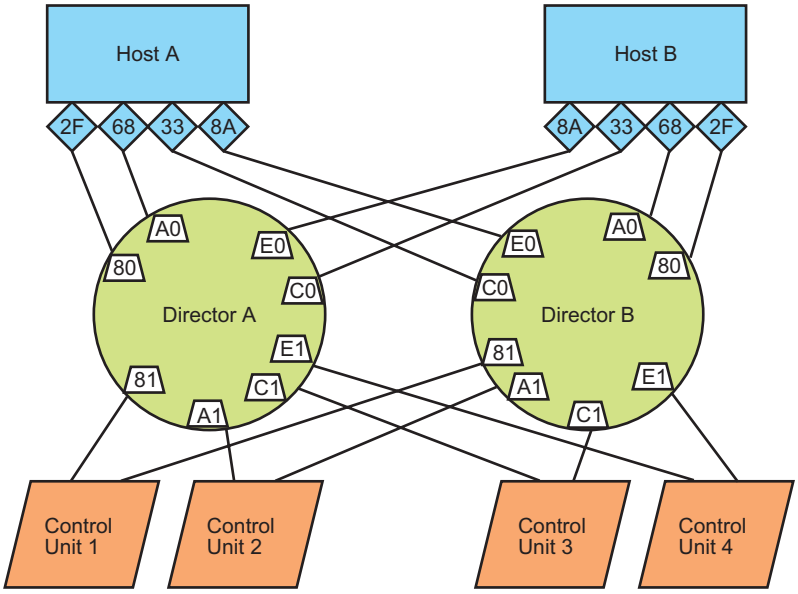


Figure 35. Parallel Port Addressing

Planning Port Connections and Cabling

The following sections provide guidelines to plan for port connections and cabling. Topics include:

- Configuring port use for maximum availability.
- Organizing port cards.
- Determining cable types and connectors.
- Determining cable lengths.
- Planning for Fiber Transport Services (FTS) direct-attach trunk cables.
- Planning cable routing.

Configuring Port Use for Maximum Availability

It is recommended that multiple port connection paths be provided for attached hosts and control units. These redundant or backup connection paths ensure maximum availability of critical data and applications. Use the following port separation hierarchy to achieve maximum availability:

- If possible, provide redundant connections to multiple Directors (at least one path through each Director). This eliminates the risk of the entire Director as a single point of failure. Although EAFs minimize the risk of an entire Director failure, such a risk cannot be entirely eliminated.
- If multi-Director connections are not possible, provide redundant connections to different port card quadrants (upper or lower) in a single Director. This eliminates the risk of the logic board as a single point of failure.

  Note: Port quadrants A and B share a common data bus, address bus, ready bit, read/write bit, and port interrupt lines. A failure of any of these components can cause a failure of one or more ports in the lower half of the Director.

  Note: Port quadrants C and D share a common data bus, address bus, ready bit, read/write bit, and port interrupt lines. A failure of any of these components can cause a failure of one or more ports in the upper half of the Director.

- If multi-port card quadrant connections are not possible, provide redundant connections to different port cards. This eliminates the risk of the individual port card as a single point of failure. ***At a minimum, it is recommended that all critical connections be attached to multiple port cards.***

Port card separation should also be considered for paths that access the Director through a Control Unit Port (CUP) connection. It is recommended that at least two paths be provided to the CUP, each through a different port card in a different port card quadrant.

Organizing Port Cards

When planning the organization and installation of port cards and associated port connections for the Director, consider organizing the port cards to:

- Minimize complexity and allow easier cable routing.
- Provide redundant connections to different port cards and port card quadrants (lower, slots 0 through 15, or upper, slots 16 through 30) to ensure maximum availability.
- Make provisions to efficiently change or add port cards and port card connections.

DVP (ESCON) and FCV (FICON) cards do not have to be installed contiguously. For example, cards could be installed in slots 0 through 2, 8 through 10, 16 through 18, and 24 through 26, and all other slots could be left empty. If there are empty port card slots, there are gaps in the sequence of logical port addresses. For example, if port cards are installed only in slots 0 through 7 and 16 through 23, only port addresses 04 through 43 and 84 through C3 are assigned. Port card organization is also subject to the following restrictions:

- If FC #5902 is ordered, port cards are installed sequentially (in descending order) beginning at slot 30. The order of installation is all LED port cards, then all XDF laser port cards, then all FCV port cards.
- If FC #5903 is ordered, port cards are installed sequentially (in ascending order) from slot 15 through slot 30, then sequentially (in descending order) from slot 14 through slot 0. The order of installation is all LED port cards, then all XDF laser port cards, then all FCV port cards.

Logical Address Groups

It is recommended port cards be organized into logical address groups to separate host and control unit connections, and to separate port card types. The following are practical examples:

- Attach host connections to the bottom ports of DVP cards and control unit connections to the top ports. Separate multiple connections to multiple DVP cards in different port card quadrants.
- Attach host connections to DVP cards in quadrant A, starting at port address 04 and continuing in ascending order to address 43. Attach control unit connections to DVP cards in quadrant B, starting at port address 44 and continuing in ascending order to address 83. Attach backup host connections to DVP cards in quadrant C, starting at port address 84 and continuing in ascending order to address C3. Attach backup control unit connections to DVP cards in quadrant D, starting at port address C4 and continuing in ascending order to address FB.
- Install FCV port cards (FICON) in quadrants A and B (subject to FC #5902 and FC #5903 constraints). Install DVP cards (ESCON) in quadrants C and D. Within quadrants C and D, separate LED and XDF laser cards into logical address groups.

Determining Cable Types and Connectors

After planning all port card requirements for the Enterprise (refer to "Determining Number and Type of Required Ports" on page 51), plan for the correct types of fiber-optic cables and connectors. Cables (singlemode or multimode) and connectors (IBM multimode duplex or FCS/SC duplex) are subject to the following constraints with respect to port cards:

- **LED** - An IBM multimode duplex connector is required to attach multimode fiber-optic cable. Only multimode cable is used. The exterior jacket of multimode cable is typically orange. Figure 36 shows an IBM multimode duplex connector.

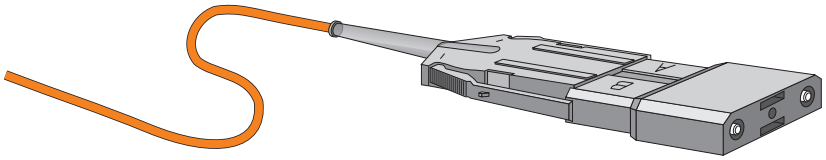


Figure 36. IBM Multimode Duplex Connector

- **XDF Laser** - A singlemode FCS/SC duplex connector is required to attach singlemode fiber-optic cable. Only singlemode cable is used. The exterior jacket of singlemode cable is typically yellow. Figure 37 shows an FCS/SC duplex connector.

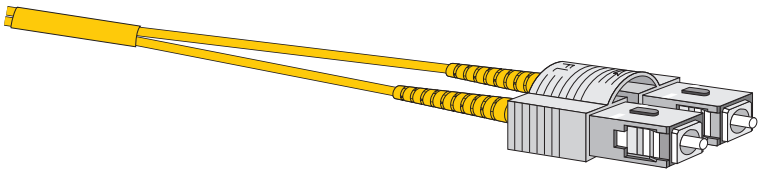


Figure 37. FCS/SC Duplex Connector

- **FCV** - A singlemode FCS/SC duplex connector is required to attach singlemode fiber-optic cable. The exterior jacket of singlemode cable is typically yellow. Figure 37 shows an FCS/SC duplex connector.

A mode conditioning patchcord (part number 21L4175) is required to attach multimode fiber-optic cable to FCV port card receptacles. Figure 38 shows the mode conditioning patchcord.

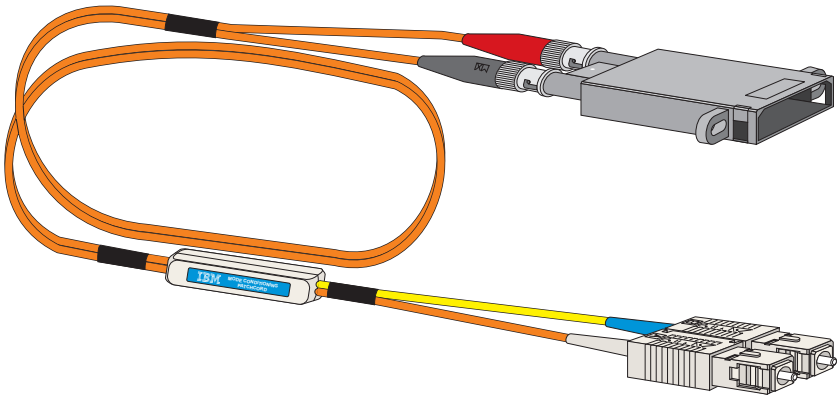


Figure 38. Mode Conditioning Patchcord

Determining Cable Lengths

When planning fiber-optic cabling requirements, ensure enough cable exists outside the Director (under the Director or under the floor) for reconnecting cables to other port cards, limited machine movement, and inadvertent pulls on the cable outside the Director.

To provide slack for cable routing, plan for 2.8 meters (110.24 inches) of cable inside the Director. To provide slack for limited machine movement and inadvertent pulls on the cable, plan for an additional 1.0 meter (39.37 inches) of cable outside the Director. Also position cables for easier migration from an ESCON to a FICON environment.

Additional cable is also required when upgrading from a 9032-002 (Feature Code #5902) or 9032-003 Director (Feature Code #5903). When upgrading Directors, plan for an additional 2.0 meters (78.74 inches) of cable.

The need for additional fiber-optic cables could grow rapidly. More cable may be required for connections to additional hosts or control units. The Director may require movement for more efficient connection to other units (while maintaining the original connections). Therefore, consider installing excess fiber-optic cable, especially in hard to reach places like underground trenches. For additional information, refer to *Planning for S/390 Fiber Optic Links - ESCON, FICON, Coupling Links, and Open System Adapters* (GA23-0367).

Planning for FTS Direct-Attach Trunk Cables

Fiber Transport Services III (FTS-III) direct-attach trunk cables can be routed inside the Director to connect to direct-attach fiber-optic harnesses. The harnesses connect to individual FICON or ESCON ports.

Each harness has one multifiber terminated push-on (MTP) connector at one end, and six duplex connectors (FCS/SC) at the other end. Each MTP harness contains 12 optical fibers and is the equivalent of six duplex cables. FTS-III trunk cables enter the rear of the Director and have MTP connectors that plug directly into the harness. The harness runs from the rear to the front of the Director to minimize cable clutter.

When an FTS-III direct-attach harness is installed, cable connects and disconnects are performed using the trunk cable. The harness remains in the Director (attached to FICON or ESCON ports), while the trunk cable is quickly removed. If a Director is relocated, trunk cables are quickly routed to the new location and connected to the harness. This process greatly reduces time spent disconnecting, rerouting, and connecting individual duplex cables during relocation.

The FTS-III direct-attach solution enhances the traditional connectivity method of routing all ESCON processor and Director ports to a main distribution panel for central control. The FTS-III solution eliminates the need for zone distribution panels at processors and Directors. In addition, MTP-to-MTP trunk cables allow cable harnesses attached to FICON or ESCON channels at a S/390 processor to connect directly to cable harnesses attached to Director ports.

To avoid connecting singlemode ESCON cables into FICON ports (and vice-versa), do not combine FICON and ESCON port connections in one direct-attach cable harness. Ensure FICON-only harnesses and ESCON-only harnesses are separated and appropriately labelled. For planning and configuration information, refer to *Fiber Transport Services (FTS) Direct Attach Physical and Configuration Planning* (GA22-7234).

Planning Cable Routing

In an ESCON-only configuration, the Director can have a maximum of 248 fiber-optic cables attached to DVP ports. In a fully-populated configuration with 16 FCV port cards and 15 DVP cards, the Director can have a maximum of 136 fiber-optic cables attached to ports. In general, most configurations require a substantial cable routing effort. Follow a logical plan for routing cables to avoid confusion during installation and operation. Cable routing considerations are shown in Figure 39.

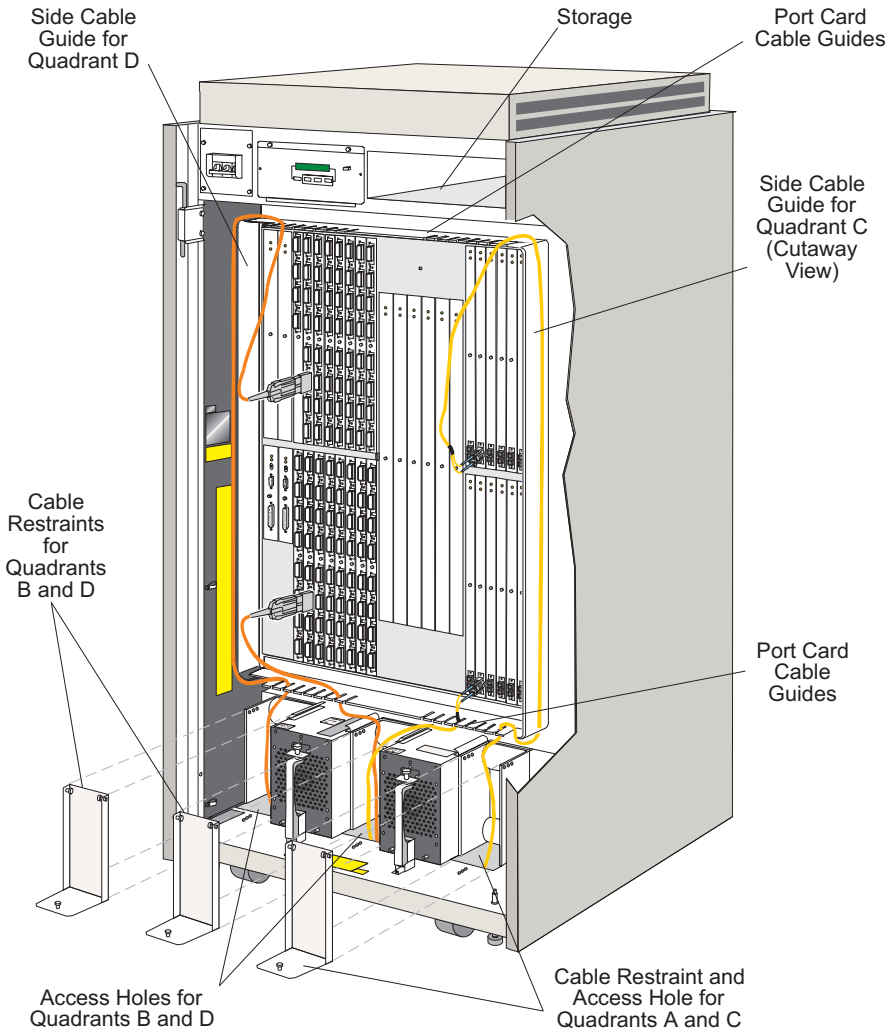


Figure 39. Director Cable Routing

Cables that connect to port cards in quadrants A and C route through cable restraints and access holes at the right side the Director. Cables that connect to port cards in quadrants B and D route through cable restraints and access holes at the center and left side the Director.

During installation, route and connect fiber-optic cables that attach to ports at the bottom of the Director first. Route and connect fiber-optic cables that attach to ports at the top of the Director last.

Enhancing the Initial Configuration

An Enterprise can use Directors more efficiently by increasing the number of FICON or ESCON ports available for connection, or by increasing the host channels and control units that connect through the Director.

Increasing Ports Available for Connection

To increase available FICON ports, either add Directors to the Enterprise or install additional FCV port cards in existing Directors. To increase available ESCON ports, either add Directors to the Enterprise or install additional DVP cards (LED or XDF laser) in existing Directors.

Adding Port Cards to a Director

If a Director does not have the maximum number of FICON or ESCON port cards, additional port card features (FCV, LED, or XDF laser) can be ordered and installed. The port cards can be installed, additional host and control unit cables attached, and paths between hosts and control units configured without disrupting Director operation.

Adding a Director

As shown in Figure 40, an additional Director increases the number of ports available for host and control unit connections.

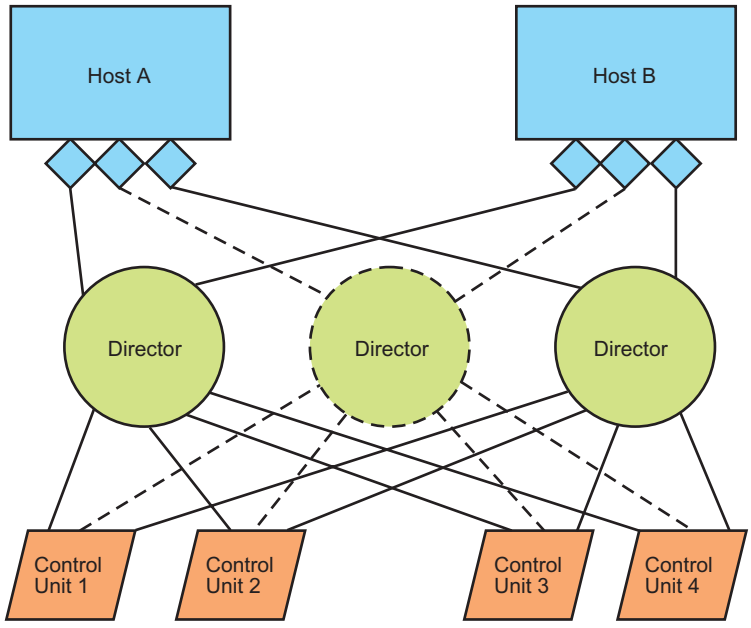


Figure 40. Adding a Director

After a new Director is in position and fiber-optic cables are installed:

1. Ask the local service representative to connect fiber-optic cables from hosts to the new Director and from the new Director to control units.
2. Ensure that for each host attached to the new Director, I/O definitions exist that define the Director and attached control units.
3. Initialize any host with new I/O definitions and load the operating system, or use Hardware Configuration Definition (HCD) to perform a comparable dynamic change.
4. Verify the new Director and associated paths are varied online.

Adding Host Channels and Control Units to Directors

Host channels and control units can be attached to Directors without disrupting system operations on existing port connections. This requires planning to ensure the necessary I/O definitions exist.

Adding Host Channels

As shown in Figure 41, an additional host system (Host C) can be installed and attached to existing Directors.

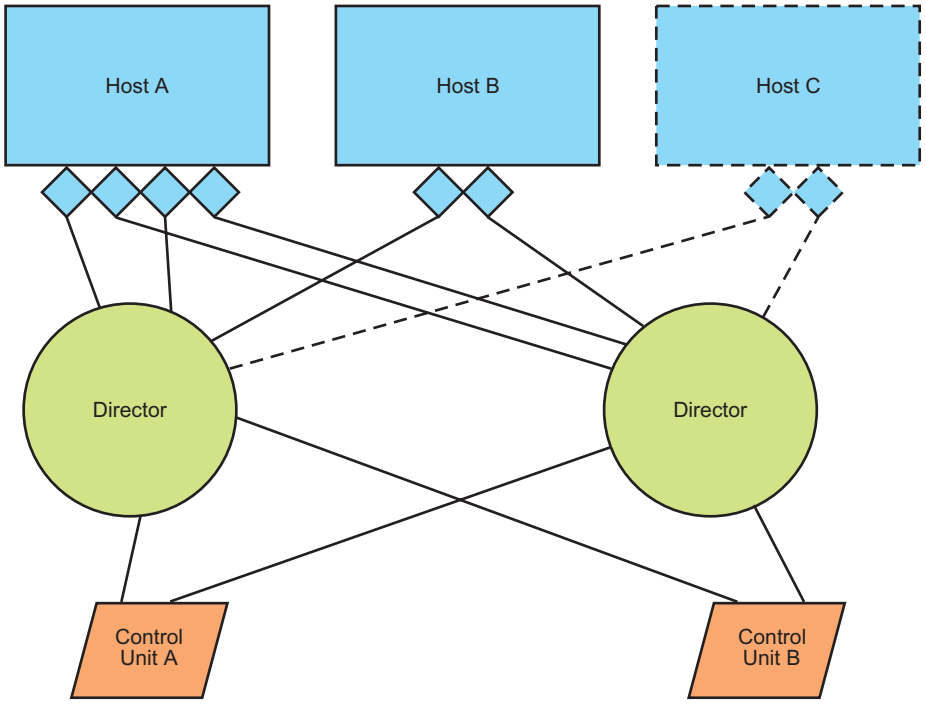


Figure 41. Adding Host Connections to Director

After a new host system and fiber-optic cables are installed:

1. Ask the local service representative to connect fiber-optic cables from new host channels to existing Directors.
2. Ensure that for the new host, I/O definitions exist that define all attached Directors and control units.
3. Initialize the new host with I/O definitions and load the operating system, or use an HCD to perform a comparable dynamic change.
4. Ensure Director ports attached to new host channels are unblocked (the ports may be blocked because they were not in use).
5. Ensure paths from the new host through the Director are varied online.

Adding Control Units

As shown in Figure 42, an additional control unit (Control Unit B) can be installed and attached to existing Directors.

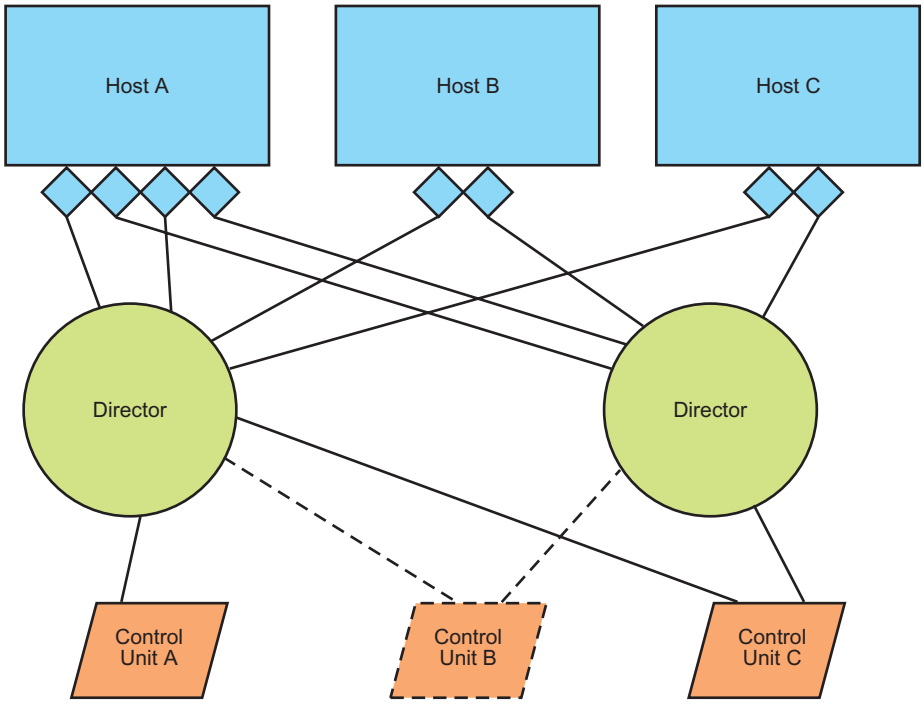


Figure 42. Adding Control Unit Connections to Directors

After a new control unit and fiber-optic cables are installed:

1. Block all ports on existing Directors that are to be connected to the new control unit.
2. Ask the local service representative to connect fiber–optic cables from the new control unit to existing Directors.
3. Ensure that for each host with paths to the new control unit, I/O definitions exist that define existing Directors, the new control unit, and attached devices.
4. Unblock all Director ports attached to the new control unit.
5. Ensure paths from the new control unit through the Director are varied online.

FICON Upgrade Considerations

When upgrading the Director to support FICON operation, installation of FCV port cards depends on the availability of I/O slots in the S/390 Parallel Enterprise Server and DVP card slots in the Director. Installation of FCV port cards is also performed in accordance with a FICON implementation plan that is jointly developed by IBM and the customer. The following installation scenarios must be considered in the FICON implementation plan:

- If spare I/O slots are available in the S/390 server and spare DVP card slots are available in the Director, FICON channels and FCV port cards can be installed concurrently (server and Director remain powered on and operational) with no impact to ongoing operations. However, ESCON channel cards in the S/390 server may have to be moved because installation of FICON channel cards is I/O slot and CHPID dependent.

- If the S/390 server and Director are fully populated and no spare I/O or DVP card slots are available, the upgrade to support FICON operation is implemented as follows:
  - — ESCON channel cards identified in the implementation plan are rearranged or removed from the S/390 server.
  - — DVP port cards (LED or XDF laser) identified in the implementation plan are rearranged or removed from the Director.
  - — FICON channel cards are installed in the S/390 server and FCV port cards are installed in the Director.
  - — FICON channels, Director ports, control units, control unit paths, and I/O devices are defined. Multiple (up to eight) ESCON channels are aggregated to each new FICON channel.
  - — Fiber-optic jumper cables are rearranged or installed in accordance with the implementation plan.

  The S/390 server and Director can be upgraded to support FICON operation using one of the following approaches:
  - — The server and Director are powered off during a scheduled service time, and the FICON upgrade is performed non-concurrently. This approach requires significant cable movement, impacts a large number of CHPIDs, and makes backout difficult if a problem occurs during the upgrade.
  - — The server and Director are upgraded concurrently during one installation. This approach requires significant cable movement, impacts a large number of CHPIDs, and poses a significant risk to ongoing operations if a problem occurs during the upgrade.
  - — The server and Director are upgraded concurrently during multiple installation phases. One FICON channel (server) and one FCV port card (Director) are installed and tested during each phase. This approach requires significant planning because the installation sequence and the relationship between FICON channel cards, FICON channel paths, and FCV port cards must be well documented. However, this approach minimizes risk to ongoing operations and simplifies backout if a problem occurs during the upgrade.

Chapter 3. Configuration Planning

This chapter describes configuration planning tasks to be performed prior to installing the 9032-005 Director. The configuration planning tasks are summarized in Table 5.

Table 5. Configuration Planning Tasks

Task	Page
1. Prepare a site plan	67
2. Consider language requirements	71
3. Plan Console support	72
4. Plan for a backup or replacement Console	73
5. Plan LAN and remote Console installation	73
6. Establish security measures	78
7. Plan for analog phone connections	79
8. Diagram the planned configuration	79
9. Assign names to Director ports	79
10. Identify Directors	81
11. Obtain LAN addresses	81
12. Complete configuration planning worksheets	82
13. Define the I/O configuration for Director and attached control units	83
14. Plan for 9034 ESCON Converters	86
15. Plan for 9035 ESCON Converters	89
16. Plan Console user access to Directors and devices	90
17. Plan AC power	91
18. Complete planning checklist	92

Task 1: Prepare a Site Plan

For each Director installed, design a site plan that provides efficient work flow, operator convenience and safety, and adequate service clearances. For additional information and specifications for these items, refer to:

- Processor-specific *Installation and Physical Planning* manuals for processors incorporated into the site plan.
- *9032 Model 5 Director Physical Planning Template* (GX22-0046).
- "Environment, Power, and Physical Characteristics" on page 69.
- The "Planning Checklist" in Appendix A.

Customer management and an IBM installation planning representative should review the site plan. During the review, consider the following:

- Location and relationships of physical facilities, such as walls, doors, windows, partitions, furniture, and a telephone to aid in installation and serviceability.
- Proximity of the Director to host processors and control units.

- Location of analog telephone lines and availability of a modem to provide remote dial-in access to the Director maintenance port.
- Location of analog telephone lines and availability of a modem to provide remote dial-in access to the Console (optional).
- Availability of Token Ring local area network (LAN) connections and cabling for Console support.
- Service, operator, and access clearances.
- Weight restrictions.
- Heat dissipation, temperature, and humidity requirements.
- Power requirements, including lengths of power cables and the location of electrical outlets having the proper phase, voltage, and amperage.
- Several types of power cables and power plugs are available to meet local electrical requirements. Refer to "Director Ship Group" on page 12 for a list of power cables and lengths. For more information, contact an IBM installation planning representative or refer to processor-specific *Installation and Physical Planning* manuals.
- Ground connections.

CAUTION

An insulated earthing conductor identical in size, insulating material, and thickness to the earthed and unearthed branch-circuit supply conductors (except it is green with or without one or more yellow stripes) shall be installed as part of the branch circuit supplying the Director. The earthing conductor described shall be connected to earth at the Director, or if supplied by a separately derived system, at the supply transformer or motor generator. The plug receptacles near the Director shall all be an earthing type, and earthing conductors serving these receptacles shall be connected to earth ground at the Director.

- Security necessary to protect the installation's physical integrity while maintaining accessibility to the Director.
- Rights-of-way (when necessary) for the placement of fiber-optic trunk cables.
- Fiber-optic cable routing:
  - The Director is a floor-standing unit. Ensure proper relocation procedures are followed when moving a Director to prevent cable or connector damage.
  - To provide slack for fiber-optic cable routing, plan for 2.8 meters (110.24 inches) of cable inside the Director. To provide slack for limited machine movement and inadvertent pulls on the cable, plan for an additional 1.0 meter (39.37 inches) of cable outside the Director. Also position cables for easier migration from an ESCON to a FICON environment.

    Note: Extended Distance Feature (XDF) laser port cards shipped with the Director have Fibre Channel Standard/Subscriber Connector (FCS/SC) connectors. An XDF adapter kit (part number 46H9223) is required for each port if cables from channels or other ESCON Directors have multimode duplex connectors.

— The need for additional fiber-optic trunk cabling could grow rapidly. Consider installing cable with extra fibers, especially in hard to reach places like underground trenches. Also consider locating the Director near a fiber-optic patch panel. For more information, refer to *Planning for S/390 Fiber Optic Links - ESCON, FICON, Coupling Links, and Open System Adapters* (GA23-0367).

Environment, Power, and Physical Characteristics

The Director has the following operating and nonoperating environment requirements, electrical and power requirements, cooling requirements, and physical characteristics. For more information, refer to *IBM System/360, System/370, 4300, 9370 Processors Input/Output Equipment Installation Manual - Physical Planning* (GC22-7064).

Operating Environment

- Temperature: 4.4˚ to 40.5˚C (40˚ to 105˚F).
- Humidity (noncondensing): 10% to 80%.
- Maximum Wet-Bulb Temperature: 23˚C (73.4˚F).
- Altitude: up to 3,048 meters (10,000 feet).

Nonoperating Environment

- Temperature: -40˚ to 60˚C (-40˚ to 140˚F).
- Humidity (noncondensing): 10% to 90%.
- Maximum Wet-Bulb Temperature: 27˚C (80.6˚F).
- Altitude: up to 12,192 meters (40,000 feet).

Electrical Requirements

- Phases: Two phase-to-phase connections.
- Voltage: 180 to 264 volts alternating current (Vac), actual operating voltage. Underwriters Laboratories (UL) rating on the power supply is 208 to 240 Vac and 9 amperes.
- Frequency: 47 to 63 hertz (Hz). UL rating on the power supply is 50 to 60 Hz.
- Plan for two 15-ampere dedicated services. It is recommended the services be provided through two separate power distribution units (PDUs) or panels.
- A customer-supplied outlet or connector must be provided that attaches to the country-specific power cord shipped with the Director. Refer to "Director Ship Group" on page 12 for power cord types.

AC Power (not including the Console)

The following specifications, as certified by UL, apply to a fully-populated Director with enhanced availability features (EAFs):

- Rated Input Voltage: 208 to 240 Vac.
- Rated Input Frequency: 50 to 60 Hz.
- Rated Input Current: 9.0 amperes.
- Leakage Current: 2.9 milliamperes.

Heat Dissipation (not including the Console)

- 248-port Director: 4,969 British Thermal Units per hour (BTU/hr).

Airflow (not including the Console)

- 35.79 cubic meters (1,264 cubic feet) per minute. Cooling airflow exits the cabinet from the rear bottom and top.

Dimensions

The dimensions listed below are also illustrated in Figure 43.

- Depth: 660.4 mm (26 inches).
- Width: 660.4 mm (26 inches).
- Height: 1,644.7 mm (64.75 inches).

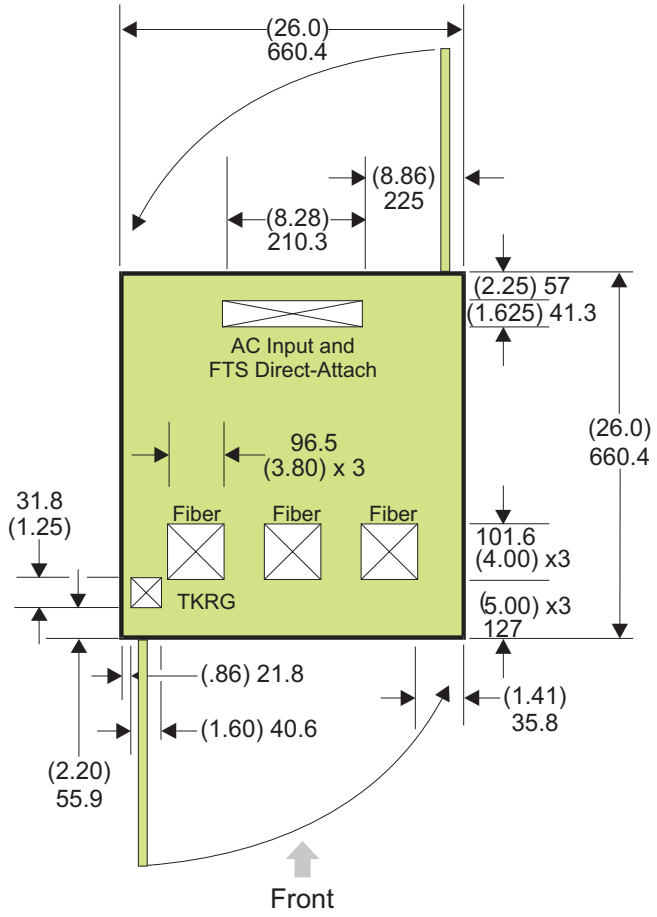


Figure 43. Director Dimensions and Service Clearances

Service Clearances

The service clearances listed below are also illustrated in Figure 43. No service clearance is required for the right side, left side, or top. However, the top must be clear for cooling air exhaust.

- Front: 900 mm (35.5 inches).
- Rear: 900 mm (35.5 inches).

Weight

- 233 kilograms (514 pounds), fully configured.

Acoustical Data

LWAd		$< L_{pA} > m$	
Operating (bels) 7.2	Idling (bels) 7.2	Operating (dB) 55	Idling (dB) 55

Task 2: Consider Language Requirements

When ordering the Director and Console, consider the language required for the keyboard and the port name display that appears through the Console or System Automation for Operating System/390 (SA OS/390).

Console Keyboard

When ordering the Director Console, consider the language required for the keyboard. The following keyboard languages are supported:

United Kingdom English	French	Finnish
United States English	Belgian French	Danish
Italian	Canadian French	Dutch
Portuguese	Swiss French	
Swedish	Norwegian	
German	Spanish	
Swiss German	Latin American Spanish	

To modify the Console's keyboard layout, refer to the *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291) for instructions.

Port Name Display

Consider the language required for the port name display that appears through the Director Console or SA OS/390. Language support is provided through character set 697 for all Extended Binary-Coded Decimal Interchange Code (EBCDIC) pages, allowing the Director to use any supported code page with any Console keyboard. When planning the installation, select the EBCDIC code page used to display host-assigned port names. For host communication with the Director, use the same code page for the host terminal and Console. The default code page is **037** (United States and Canada - CECP). Other supported code pages are listed in Table 6.

Table 6. Supported Code Pages

Code Page Name	Code Page
Germany and Austria	273
Brazil	275
Italy	280
Japan	281
Spain and Latin America	284
United Kingdom	285
France	297
International	500

Message Display

Messages appear on the Director operator panel and Director Console in United States English only.

Task 3: Plan Console Support

Consider the following when planning Director Console support:

- A Console is required for Director installation and configuration, changing configurations, and accessing logs. The Director can be powered on and off without the Console.
- If not ordering a Console from IBM, refer to "Hardware Requirements" on page 22 and "Console Software Requirements" on page 24 for specifications.
- Directors and Consoles connect through a 4/16 megabit per second (Mbps) Token Ring LAN. The Console can be connected through a bridged or routed LAN. Refer to "Task 5: Plan LAN and Remote Console Installation" on page 73 for additional information.
- The Director Console can manage a cluster of up to 16 Directors (any combination of 9032-003, 9033-004, or 9032-005 Directors) and up to two 9037-002 Sysplex Timer networks. Each network can contain one or two Timers.
- Although a single Console can control multiple Directors, two or more Consoles *cannot* share control of a Director.
- A Console failure does not cause an operating Director to fail. However, a Console is required to monitor Director operations, access critical system or application data, and access logs. For maximum Console availability, consider maintaining either a backup or replacement Console for installation on the Token Ring LAN.
- The Console described in this publication supports *only* the 9032-003, 9033-004 and 9032-005 Director. The Console *does not* support the 9032-002 or 9033-001 Director.

  In addition, Consoles for the 9032-002 and 9033-001 Director *do not* support the 9032-003, 9033-004, or 9032-005 Director.
- Due to hardware enhancements, consoles that support the 9032-003 or 9033-004 Director may not support the 9032-005 Director. Additional memory and a faster microprocessor are required for 9032-005 Director operation. Refer to "Operational Requirements" on page 21 for specifications and additional information.
- Determine which PC platform is to be used for the Director Console application. Refer to "Console Selection Considerations" on page 48 for additional information.
- Provide and maintain regular backups of the Director Console database. Timed automatic backups are recommended using the tape drive or rewriteable optical cartridge (ROC) drive and software supplied with the Console. To back up the database, refer to the *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291) for instructions.

Task 4: Plan for a Backup or Replacement Console

It is recommended a backup or replacement Console be maintained in case the primary Director Console fails.

- **Replacement Console** - A replacement Console remains disconnected from the Token Ring LAN on which the Director Console is attached. However, the Director and replacement Consoles are maintained with *identical* Internet Protocol (IP) addresses. Regular backups (tape or ROC) of the Director Console's system library are transferred to the replacement Console to ensure the Console libraries are synchronized.

  If the Director Console fails, it is disconnected from the Token Ring and the replacement Console is connected in its place. The customer's LAN addressing scheme does not require additional consideration because the Console IP addresses match.

Attention!

Because the IP address for the replacement Console is identical to the IP address for the Director Console, *do not* maintain the replacement Console on the same Token Ring LAN to which the Director Console is attached.

- **Backup Console** - A backup Console remains connected to the same Token Ring LAN on which the Director Console is attached, but the Consoles are maintained with *different* IP addresses. The Console application *cannot* operate on both Consoles simultaneously. Regular backups (tape or ROC) of the Director Console's system library are transferred to the backup Console to ensure the Console libraries are synchronized.
- If the Director Console fails, it is powered off. The backup Console is powered on and the Console application is started. The backup Console option provides faster replacement in case of Console failure.

Attention!

You *cannot* simultaneously operate the Console application on the Director and backup Consoles. Console communications conflict and critical data may be lost. Use the backup Console *only* if the Director Console fails and is powered off.

The backup or replacement Console must be regularly maintained to synchronize the system library with the Director Console and ensure a fully-configured Console is available in case of failure. To configure and maintain a backup or replacement Console, refer to Chapter 5 of *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).

A fully-configured Director Console is recommended as the PC platform for the backup or replacement Console. If another platform is used, ensure it meets the minimum specifications described in "Hardware Requirements" on page 22 and "Console Software Requirements" on page 24.

Task 5: Plan LAN and Remote Console Installation

Before installation, determine if the Director and Console are to be installed on a new (dedicated) Token Ring LAN, or if the Director and Console are to be integrated into an existing (public) Token Ring LAN. Determine if remote access to the Director Console is to be allowed. Consider the following:

- Plan for sufficient Multistation Access Units (MAUs) and shielded twisted-pair cabling to connect the Director and Console to the Token Ring. The MAU operates at a 4/16 Mbps rate, and can be ordered as an option with the Director.
- Plan the physical locations of Directors and the Director Console. Consider the number and location of required MAUs, LAN cable lengths, and distances between Directors and the Director Console.
- A dedicated LAN segment containing only Directors and the Director Console is recommended because:
  - A dedicated LAN provides high security to prevent unauthorized users from disrupting Director Console operations.
  - A dedicated LAN provides better reliability. Failures associated with unrelated hardware and applications on a public LAN may impact Director Console operations.
  - Problem determination is simplified.
  - A LAN with heavy traffic unrelated to the Director can impair Console operation.
- If Directors and the Director Console are to be installed on a public LAN, a high-traffic, congested LAN *should not* be used.
- Two Director Consoles *cannot* be defined to a Director. Although the LAN can have multiple Director Consoles attached, each Console must be defined to a different Director or Director cluster.
- The Director Console can be located at any distance from the Director, up to the limit of the installed Token Ring (essentially unlimited if routers are used). The Console can attach to a local LAN containing the Director, or through a remote LAN connected by a bridge or router.

Attention!

Router support for Directors and the Director Console is available *only* for Licensed Internal Code (LIC) Version 4.3 or higher.

- Default IP and Media Access Control (MAC) addresses are assigned to Token Ring (TKRG) controller adapter cards in both the Director and Director Console. A default subnet mask is also assigned to the Console's TKRG adapter card. If the Director and Director Console are to be installed on an public LAN segment, these addresses may require change to conform to the customer's LAN addressing scheme. New IP and MAC addresses should be assigned *only* by the customer's LAN Administrator.
- If remote access is a requirement, a remote Console communicates with the Director Console over a bridged or routed LAN using a customized version of Distributed Console Access Facility (DCAF) software and Transmission Control Protocol/Internet Protocol (TCP/IP) software. For instructions about use of a remote Console, refer to Chapter 4 of the *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).

  Note: The customized version of DCAF is supported *only* for the Director Console or Sysplex Timer Console applications.

Example Token Ring Configurations

Directors and the Director Console can be installed according to a variety of LAN configurations. Examples of some typical LAN configurations are shown in Figure 44 through Figure 48. Figure 44 shows a simple configuration with one Director and one Director Console installed on a dedicated Token Ring LAN.

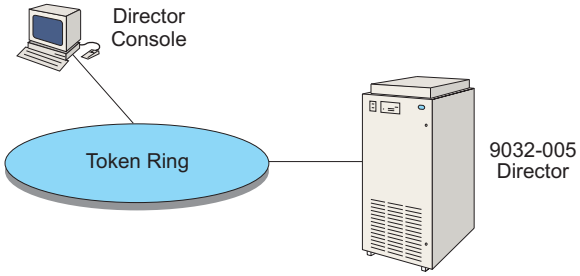


Figure 44. Director and Console Installed on Dedicated LAN

Figure 45 shows a simple configuration with three Directors (9032-003, 9033-004, and 9032-005) and one Director Console installed on a dedicated Token Ring LAN.

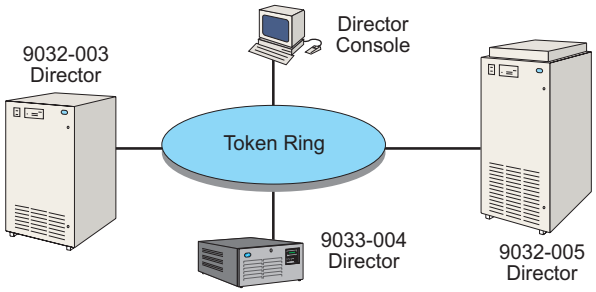


Figure 45. Three Directors and Console Installed on Dedicated LAN

Figure 46 shows a more complex configuration with two 9032-003 Directors, two 9033-004 Directors, eight 9032-005 Directors, two 9037-002 Sysplex Timer networks, and one Director Console installed on a dedicated Token Ring LAN. The Director Console is also running the Sysplex Timer Console application.

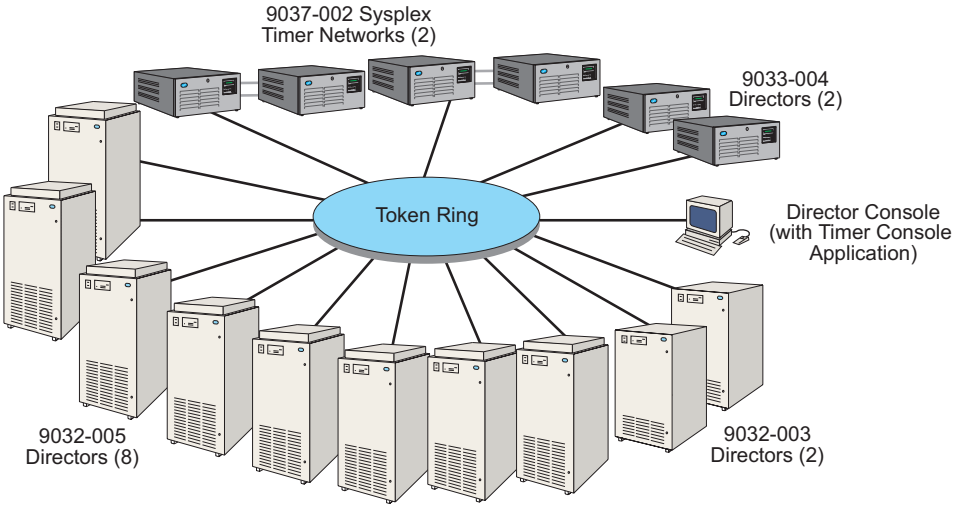


Figure 46. Twelve Directors, Two Timer Networks, and Console Installed on LAN

Figure 47 shows multiple Directors (9032-003, 9033-004, and 9032-005) attached to a local Token Ring LAN that communicate with a Director Console attached to a remote Token Ring LAN. Directors are also attached to the remote LAN. The local and remote LANs are connected through a bridge or router.

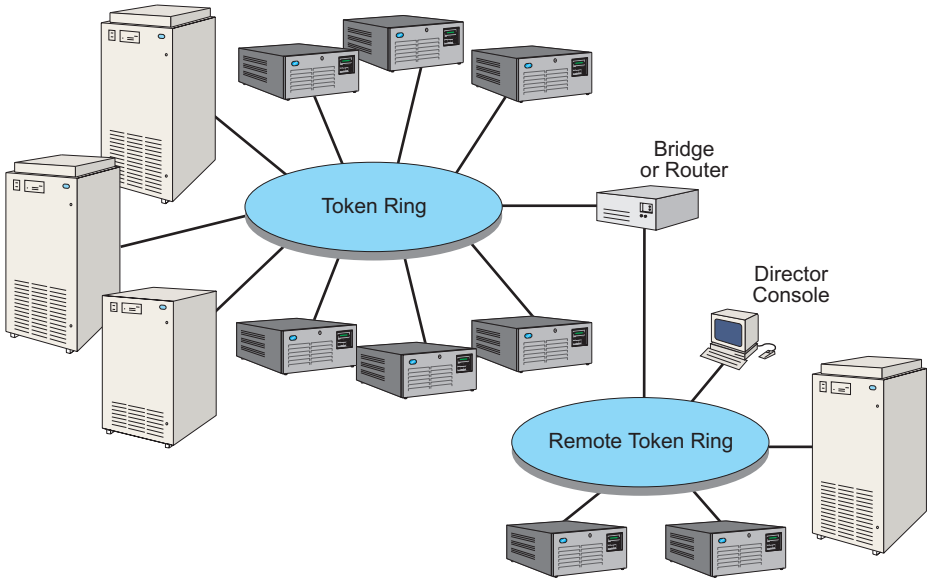


Figure 47. Directors and Console Installed on Bridged or Routed LAN

Figure 48 shows multiple Directors (9032-003, 9033-004, and 9032-005) on three Token Ring LANs (one local and two remote). A remote Console (DCAF controller) communicates with a Director Console (DCAF target) through a bridge and router, and assumes control of Directors attached to the local LAN and first remote LAN. The remote Console controls the Director attached to the second remote LAN through the Console application only (not DCAF).

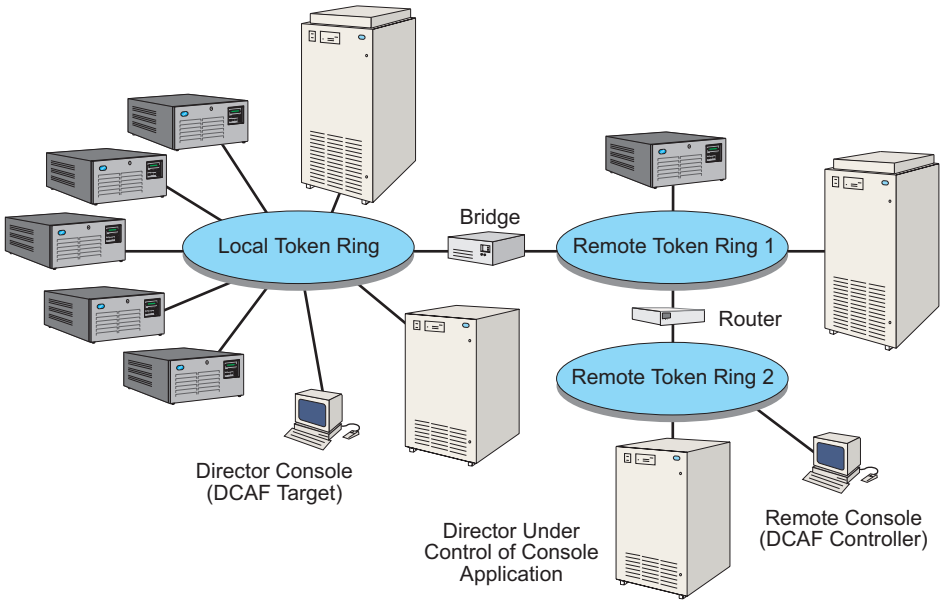


Figure 48. Directors Controlled by Remote Console Using DCAF

Cables and MAUs

All Directors and the Director Console attach to a LAN through Token Ring adapter cables and one or more MAUs. A MAU can be ordered with the Director as an option.

Each Director is shipped with a 6.1-meter (20-foot) Token Ring adapter cable. The cable attaches to a MAU and the **CONS** connector on the Director's Token Ring (TKRG) Controller Adapter card. Each Director Console is also shipped with a 6.1-meter (20-foot) Token Ring adapter cable. The cable attaches to a MAU and the Console's Token Ring interface card. If a customer-supplied Console is used, the PC platform must have a Token Ring interface card. A shielded, twisted-pair cable with a 9-pin male connector and standard MAU connector is also required.

Figure 49 illustrates how the Director and Console attach to a MAU. If the Director contains a redundant TKRG Controller Adapter card, attach both cards to the same MAU (or separate MAUs on the same network). If the primary card fails, the redundant card automatically provides communication with the Console. The primary card is configured with the same LAN addresses as the redundant card.

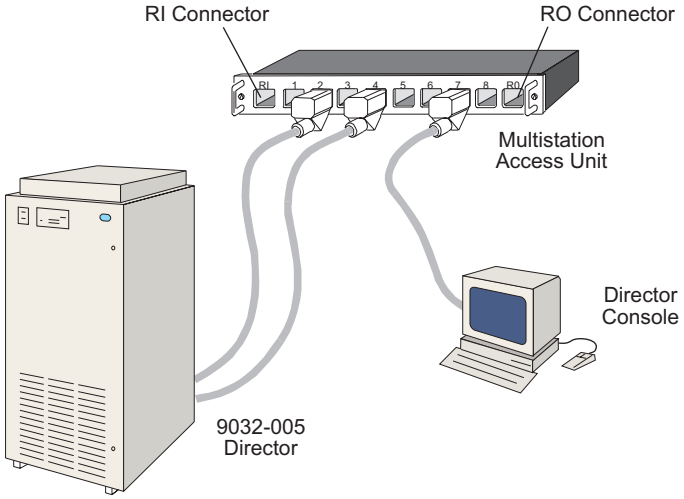


Figure 49. Director and Console Connection through MAU

Multiple MAUs can be connected in series to enlarge a Token Ring network and provide additional LAN connections. To daisy-chain two MAUs, connect the ring-out (RO) connector of the first MAU to the ring-in (RI) connector of the second MAU. *Do not* attach devices (Directors and Consoles) to either the RI or RO connectors on the MAU.

Bridges and Routers

If components of a Director configuration (Directors or the Console) are to be installed on both a local and remote LAN, the LANs can be connected through a bridge or router. When determining if either a bridged or routed LAN is appropriate, consider the following:

- A bridged connection typically provides faster data transmission and is less expensive to implement. However, a routed connection typically provides greater flexibility and LAN security.
- A router operates at a higher level in the Open Systems Interconnection (OSI) protocol stack. A router transmits data packets between nodes at the network layer using the destination packet's network layer address, while a bridge transmits data frames at the data link layer using the destination frame's MAC address.

- A bridge or router can connect Token Ring LANs that operate at different speeds. For example, either a bridge or router can connect a 4 Mbps Token Ring to a 16 Mbps Token Ring.
- A router provides greater flexibility and can operate in a complex LAN topology that would constrain bridge operation.
  - A bridge cannot connect different types of LANs (Token Ring versus Ethernet). For example, a bridge can connect a Token Ring LAN to another Token Ring LAN, but cannot connect a Token Ring LAN to an Ethernet LAN.
  - A router can connect different types of LANs. For example, a router can connect a Token Ring LAN to an Ethernet LAN, and a second router can connect the Ethernet LAN to another Token Ring LAN.

Attention!

Operation of all Director models (9032-003, 9033-004, or 9032-005) is supported through a bridged LAN. Operation of all Director models (9032-003, 9033-004, or 9032-005) is supported through a routed LAN *only* if Licensed Internal Code (LIC) Version 4.3 or higher is installed.

Task 6: Establish Security Measures

It is recommended effective security measures be implemented for Directors and the Director Console because:

- Directors and the Director Console are on installed on a LAN and are thus open to access by other devices on the LAN.
- Remote sequence access to the Director is possible through modem connection to the Director's maintenance port.
- Remote access to a Director or Director Console is possible through a DCAF session.

Plan to implement as many of the following security measures as possible for the installed Director configuration:

- Ensure all Directors and the Director Console are physically located in a secure area.
- Use a dedicated (private) LAN segment with password protection for Directors and the Director Console to preclude unauthorized access.
- Use an 8230 LAN Hardware-Controlled Access Unit or compatible technology to control access to LAN devices and data associated with the devices.
- If remote access to the Director is to be made available through the RS-232 maintenance port or through DCAF and TCP/IP software, ensure the following security measures are implemented:
  - Document the risk associated with an active, unattended DCAF session. For example, an unauthorized operator may inherit an active session and operational control of several Directors.
  - Shut down the remote Console (DCAF controller) when a DCAF session is not in use.
  - Ensure adequate security controls are implemented to control use of the remote access Console.
  - Use a modem connection to the Director's RS-232 maintenance port only under direction of an authorized service representative.

Task 7: Plan for Analog Phone Connections

Telephone connections may be required for Directors and the Director Console to provide dial-in support from a remote location.

- A service representative at a remote PC may require dial-in modem access to the Director Console to change port configurations, access maintenance and utility functions, check status, and perform other Director-related tasks. Plan for an analog telephone connection near each Director Console for dial-in support.
- A service representative at a remote maintenance terminal may require dial-in modem access to a Director's RS-232 maintenance port and the Director's monitor function. Plan for an analog telephone connection near each Director for dial-in support.

Task 8: Diagram the Planned Configuration

Determine the host channels and control units to be attached to each Director in the installation. Determine if and where connectivity is to be limited. Portions of this task were completed when determining the required number of Directors, number of ports, and type of ports.

Draw a configuration diagram similar to those shown in Figure 56 on page 99 and Figure 59 on page 103. Label the diagram appropriately, indicate FICON versus ESCON connections, and indicate distances as necessary. If possible, incorporate plans for growth of the Enterprise into the diagram. Consider using the IBM-supplied Hardware Configuration Manager for MVS (Program Product 5697-119) to create the diagram.

Use the configuration diagram to complete planning worksheets while performing "Task 12: Complete Configuration Planning Worksheets" on page 82.

Task 9: Assign Names to Director Ports

Consider assigning a name (from one to 24 alphanumeric characters) to each Director port. Although port naming is not required, it provides convenience and ease of identification for attached hosts and control units. Port naming is recommended because:

- For operations and service personnel, a port name provides a better description of a host or control unit connection than a port number or logical port address.
- A port name can be some type of acronym that clearly identifies what type of device is attached to a port. The name makes it easier to identify a port if connectivity must be changed.

Port names can be assigned to all logical port addresses, ranging from *04* to *FB*. A name can also be assigned to the Control Unit Port (CUP). The CUP's logical port address is *FE*.

The CUP is a port that communicates with SA OS/390. A name assigned to the CUP (described under "Identify Each Director as a Control Unit and Device" on page 84) is used by SA OS/390 to refer to the Director.

To assign port names, use the *Edit* pull-down menu from the Console's matrix window, or (if available) SA OS/390. For instructions, refer to Chapter 3 of *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).

Rules for Port Names

A port name can contain from one to 24 alphanumeric characters and *must* be unique for a single Director. Although identical port names can be used on separate Directors, it is recommended unique port names be used for all Directors in a configuration. Port names should contain only the following characters:

- Upper case characters *A* through *Z*.
- Numbers *0* through *9*.
- Periods (**.**).
- Hyphens (**-**).
- Underscores (_).

Port names *cannot* contain the following characters:

- Parenthesis at the start or end of the name.
- Leading or embedded blank spaces.
- Asterisks (*****).
- Commas (**,**).

If Director configurations are created from a host using Hardware Configuration Definition (HCD), or created directly through SA OS/390, follow the rules listed above for names entered from all interfaces (including the Console) to ensure the names are usable.

The Director Console application accepts any format for a port name, as long as 24 or fewer alphanumeric characters are used and the name is not preceded by a space. For more information, refer to *System Automation for OS/390, Planning and Installation* (GC28-1549).

Suggestions for Port Names

Port names are entered from and used in a wide variety of environments. Certain characters might be acceptable in one environment and cause unpredictable results in another environment (for example, ESCON Manager™ or SA OS/390). Consider these recommendations when naming ports:

Note: ESCON Manager supports ESCON operation only. SA OS/390 is required to support FICON operation.

- Establish a consistent naming convention that uniquely identifies what is attached to all ports.
- Identify FICON and ESCON (LED or XDF Laser) ports in a Director. Consider including the acronyms *FCV, LED, or XDF* in port names.
- If multiple Directors are installed and multiple control units are attached to the Directors, assign a unique port name to each Director-to-control unit connection. Figure 50 shows two Directors (A and B) connected to two control units (1 and 2). Note that both Directors connect to control unit 1 through logical port address C6. However, one port is assigned the unique name ***9032A.CNTL1***, indicating a connection between Director A and control unit 1. The other port is assigned the unique name ***9032B.CNTL1***, indicating a connection between Director B and control unit 1.

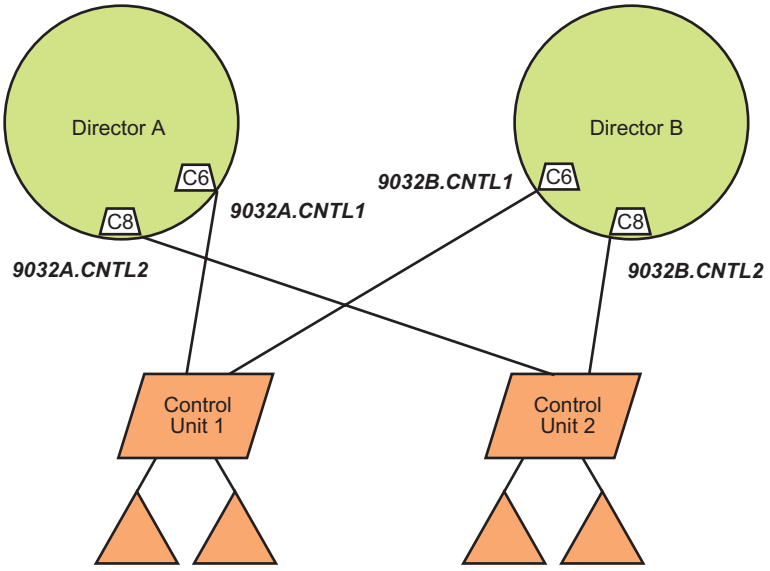


Figure 50. Unique Port Names for Multiple Directors

Task 10: Identify Directors

Because the Director Console must be able to identify each Director under its control, each Director must be assigned a unique name. The name must be from one to eight alphanumeric characters in length.

To identify Directors, use the *File* pull-down menu from the Console's matrix window or (if available) SA OS/390. For instructions, refer to Chapter 6 of *Maintenance Information for the 9032 Model 5 Director* (SY28-1158).

If Director identifications are created from a host system using an HCD, or created directly through SA OS/390, follow naming rules entered from all interfaces (including the Console) to ensure the names are usable. SA OS/390 provides command support to assign generic port names. This command support function can affect multiple ports on multiple Directors with one command, provided the ports have a common name prefix. Refer to *System Automation for OS/390, Technical Reference* (GC28-1593) for additional information.

Task 11: Obtain LAN Addresses

The TKRG adapter cards in the Director and Director Console have the following default LAN addresses.

- Director:
  - — The MAC address is set by the manufacturer and is unique for each TKRG adapter card.
  - — The IP address is *1.1.1.x*, where *x* is derived from the MAC address.

  Note: A Director subnet mask and gateway address are not required to provide the routing function supported by LIC Version 4.3 or higher.

- Director Console:
  - The MAC address is set by the manufacturer and is unique for each TKRG adapter card.
  - The IP address is *1.1.1.1*.
  - The subnet mask is *255.0.0.0*.

If all devices are installed on a dedicated Token Ring LAN, default IP and MAC addresses do not require change. If the devices are installed on an existing Token Ring LAN, default IP and MAC addresses may require change to conform to the customer's LAN addressing scheme and avoid address conflicts with existing devices. If new network addresses are required, consult with the customer's LAN administrator to establish the addresses for all Directors and Director Consoles in the configuration.

The MAC and IP addresses for a Director are verified or changed at the Director's operator panel. For instructions, refer to *Maintenance Information for the 9032 Model 5 Director* (SY28-1158).

Note: If the Console application is installed on a Hardware Management Console, obtain new network addresses from the customer's LAN administrator (if required) and follow change procedures described in the Hardware Management Console documentation.

The MAC address, IP address, and subnet mask for the Director Console are verified or changed using TCP/IP software installed on the Console. For instructions, refer to Chapter 5, 6, 7 or 8 (depending on the Console model) of the *Console Installation and User's Guide: 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, 9032 Model 5 Director, and 9037 Model 2 Sysplex Timer* (GA22-7291).

If a backup Console is installed, it remains connected to the same Token Ring LAN on which the Director Console is attached, but the Consoles are maintained with *different* IP addresses.

Attention!

You cannot simultaneously operate the Console application on the Director and backup Consoles. Console communications conflict and critical data may be lost. Use the backup Console *only* if the Director Console fails and is powered off.

If a replacement Console is available, it must remain disconnected from the Token Ring LAN on which the Director Console is attached (until it is used to replace a failed Director Console). The replacement and Director Consoles are maintained with *identical* IP addresses.

Attention!

Because the IP address for the replacement Console is identical to the IP address for the Director Console, *do not* maintain the replacement Console on the same Token Ring LAN to which the Director Console is attached.

Task 12: Complete Configuration Planning Worksheets

Planning a Director configuration is complex. To make the task easier and more systematic, "Planning Worksheets" with instructions and examples are provided in Appendix B. Various Director configurations and the worksheets used to implement those configurations are illustrated.

Make photocopies of the blank planning worksheets as required. Complete a separate worksheet for each Director in the installation. In addition, use the planning worksheet map to track the worksheets used.

Transfer information to the worksheets from the configuration diagram created while performing "Task 8: Diagram the Planned Configuration" on page 79. On each worksheet, record the name and connectivity attributes for each port. Information from the worksheets is easily transferred to the Director's matrix window during Director installation and configuration. Refer to "Port Addressing and Connectivity" on page 25 for more information about default port numbers and logical port addresses.

If logical partitioning is enabled, complete a port authorization planning worksheet. Refer to "Task 16: Plan Console User Access to Directors and Devices" on page 90 and *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296) for more information about logical partitioning and authorizing ports.

Task 13: Define the I/O Configuration for Director and Attached Control Units

After planning host channel and control unit configurations, define the configuration to the channel subsystem. Identify all host channels, Directors (both as control units and input/output (I/O) devices), control units, and attached devices.

This section discusses I/O Configuration Program (IOCP) statements used to create an I/O Configuration Data Set (IOCDS) that defines the Director configuration to the channel subsystem. For detailed information about IOCP statements, refer to the *Input/Output Configuration Program Users Guide* (GC38-0401). "IOCP Statement Examples" and configuration examples are also provided in Appendix C.

Identify Channel Paths that Connect through the Director

The following is an example of an IOCP channel path identifier (CHPID) statement, and an explanation of parameters that identify a channel path connecting through a Director.

CHPID PATH=(3E,3F),TYPE=CNC,SWITCH=01

The following paragraphs describe parameters that appear in the CHPID statement.

- The **PATH** parameter identifies channel paths from the processor that are attached to the Director. In the example, paths 3E and 3F are identified.
- The **TYPE** parameter specifies the I/O mode of operation for the channel path. The following parameters are used:
  - **CNC** - defines an ESCON channel. Use this parameter when connecting channel paths through the Director to ESCON control units. If two ESCON channels participate in channel-to-channel communication, one channel must be specified CNC and the other channel must be specified CTC.
  - **CTC** - defines an ESCON path that permits channel-to-channel operation. Use this parameter when the channel path connects through the Director to another host channel.
  - **FCV** - defines a FICON-to-ESCON channel. Use this parameter when connecting a FICON channel path (using an FCV port card) through the Director to ESCON control units or an ESCON channel specified as CTC.
  - **CVC** - defines block mode converter operation. Use this parameter when the channel path connects through the Director to a Model 9034 converter operating in block mode.
  - **CBY** - defines byte mode converter operation. Use this parameter when the channel path connects through the Director to a Model 9034 converter operating in byte mode.

- The **SWITCH** parameter specifies any two-digit hexadecimal number for the Director to which all channel paths on the CHPID statement are assigned. In the example, the **SWITCH** parameter is set to 01.

  Notes: If an ESCON channel path is not connected through a Director, the **SWITCH** parameter is not required.

  If a channel path is part of a dedicated connection through a Director, the path can attach to *only one* ESCON control unit or ESCON channel (CTC operation). However, if the same channel path is attached to two Directors, a dedicated connection is required to one Director. When an ESCON channel is defined in the IOCP statement as having paths to more than one control unit, and an attempt is made to establish a dedicated connection to the port for that channel, the host disables the channel.

  For an ESCON converter channel path (CVC or CBY), the **SWITCH** parameter is not required, but is recommended for documentation.

Additional "IOCP Statement Examples" for Director configuration definitions are provided in Appendix C.

Identify Each Director as a Control Unit and Device

To allow a host control program (such as SA OS/390) to send channel commands to a Director, display switch configurations, or allow a Director to send error information to a host, either:

- Device support must be installed on the host, or
- The Director must be defined both as a control unit and device to that host.

Device support or a Director definition must be provided for at least one host connected to the Director. When using SA OS/390 or another host control program, the Director must be defined to all connected hosts, and device support must be installed on those hosts. When using an HCD to create an I/O configuration definition, refer to the *OS/390 HCD User's Guide* (GC28-1750) for information.

The following is a Multiple Virtual Storage (MVS®) example of a CNTLUNIT statement defining a Director as a control unit. For additional information about IOCP statements and parameters, refer to the *Input/Output Configuration Program Users Guide* (GC38-0401).

CNTLUNIT CUNUMBR=0C00,PATH=(3E,3F),UNIT=SWCH,
UNITADD=((00,1)),LINK=(FE,FE)

The following paragraphs describe parameters that appear in the CNTLUNIT statement.

- The **CNTLUNIT** parameter identifies the Director as a control unit. In the example, the control unit number (CUNUMBR) is set to 0C00.
- The **PATH** parameter identifies channel paths from the processor that are attached to the Director. In the example, paths 3E and 3F are identified.
- The **UNIT** parameter identifies the control unit type. In the example, the control unit type is a switch (SWCH), which is the correct identification for a Director.
- The **UNITADD** parameter identifies the unit address of the Director (two hexadecimal digits that range from 00 to FF), and the number of sequential units recognized by the Director as a control unit (default of 1). In the example, the unit address is 00 (always 00 for a switch).

- The **LINK** parameter identifies the terminating link port address for the host channel path where SA OS/390 (on the host) communicates with the Director. This logical port address is always FE for each channel path attached to the Director.

  Recall that FE is the CUP's logical port address. The CUP is the Director component that interprets and responds to all connectivity commands received from a host program, and allows the host to display or change a Director configuration.

  When a host program transmits a connectivity command, the request is sent to the Director through any channel that can communicate with the CUP. The port to which the channel is attached directs the request to the CUP, and the CUP then implements the connectivity change requested by the host.

  Because the CUP (logical port address FE) provides the only access from the host to the Director, multiple ESCON paths to the CUP should be defined.

The following is an MVS example of an IODEVICE statement defining a Director as a device to the host. For additional information about IOCP statements and parameters, refer to the *Input/Output Configuration Program Users Guide* (GC38-0401).

IODEVICE ADDRESS=(0C25),CUNUMBR=0C00,UNIT=SWCH, UNITADD=00,STADET=Y

The following paragraphs describe parameters that appear in the IODEVICE statement.

- The **IODEVICE** parameter identifies the Director as a device. In the example, the device address (ADDRESS) is set to 0C25 and the control unit number (CUNUMBR) is set to 0C00.
- The **UNIT** parameter identifies the device type. In the example, the device type is a switch (SWCH), which is the correct identification for a Director.

  Note: The Director port to which a host channel attaches is not defined in the Director IOCP statement. The channel path that connects to a specific control unit, converter, or other host channel through the Director is identified in the IOCP statement that defines these entities. For example, the **LINK** parameter of the CNTLUNIT statement for a control unit attached to a Director lists the specific link addresses (Director ports) that can attach to the control unit.
- The **UNITADD** parameter identifies the unit address of the Director (two hexadecimal digits that range from 00 to FF). In the example, the unit address is 00 (always 00 for a switch).
- The **STADET** parameter allows a status verification facility to be enabled or disabled. **Y** enables the facility and **N** disables the facility. The default for ESCON devices is enabled.

Additional "IOCP Statement Examples" for Director configuration definitions are provided in Appendix C.

Identify the Link Addresses for Control Units Connected through the Director

Use CNTLUNIT statements to define link addresses for control units attached to channels through the Director. The following is an example of a CNTLUNIT statement defining link addresses. For additional information about IOCP statements and parameters, refer to the *Input/Output Configuration Program Users Guide* (GC38-0401).

CNTLUNIT CUNUMBR=0100,UNIT=3745,UNITADD=((20,16)), PATH=(3E,3F),LINK=(C2,CF)

The following paragraphs describe parameters that appear in the CNTLUNIT statement.

- The **CNTLUNIT** parameter identifies the Director as a control unit. In the example, the control unit number (CUNUMBR) is set to 0100.
- The **UNIT** parameter identifies the device type. In the example, the device type is a remote controller unit (Model 3745).
- The **UNITADD** parameter identifies the unit address of the Director (two hexadecimal digits that range from 00 to FF), and the number of sequential units recognized by the Director as a control unit. In the example, the unit address is 20 and the number of sequential units recognized is 16.
- The **PATH** parameter specifies channel paths that connect through the Director to the control unit. In the example, logical port addresses 3E and 3F are identified, which are the same channel paths defined in the CHPID statement on page 91. The CHPID statement specifies an ESCON control unit connection (CNC).
- The **LINK** parameter identifies the terminating link addresses that correspond to the ESCON channel paths specified in the **PATH** parameter. In the example, channel path 3E can access control unit 0100 through logical port address C2 and channel path 3F can access control unit 0100 through logical port address CF.

  The physical cabling from control units to Director ports must match what is specified in the **LINK** parameter. The physical cabling from a port to control unit cannot be altered without changing the I/O definition for the control unit.

Additional "IOCP Statement Examples" for Director configuration definitions are provided in Appendix C.

Defining a Director to VM/ESA

Define a Director to the Virtual Machine/Enterprise Systems Architecture (VM/ESA®) operating system by using an RDEVICE statement in a Host Command Processor Real Input/ Output (HCPRIO) file. The following is an example of a RDEVICE statement.

RDEVICE ADDRESS=C00,DEVTYPE=9032

- The **RDEVICE** parameter identifies the Director to VM/ESA. In the example, the device address (ADDRESS) is set to C00.
- The **DEVTYPE** parameter identifies the device type. In the example, the device type (9032) is a 9032–003 or 9032–005 Director.

Task 14: Plan for 9034 ESCON Converters

A Model 9034 ESCON Converter allows an ESCON channel to connect to a parallel-channel control unit. Use this task to plan for 9034 Converters that are part of a Director configuration.

Attaching a 9034 Converter to a Director makes it easier to transfer communication capability of the Converter from one host system to another host system. Figure 51 shows a 9034 Converter in a mixed ESCON and parallel-channel environment.

To use a 9034 Converter through a Director, a dedicated connection must be provided between the port supporting the Converter and the port supporting the host channel configured for communication with the Converter. Use the Director Console application or SA OS/390 (if available) to establish the dedicated connection.

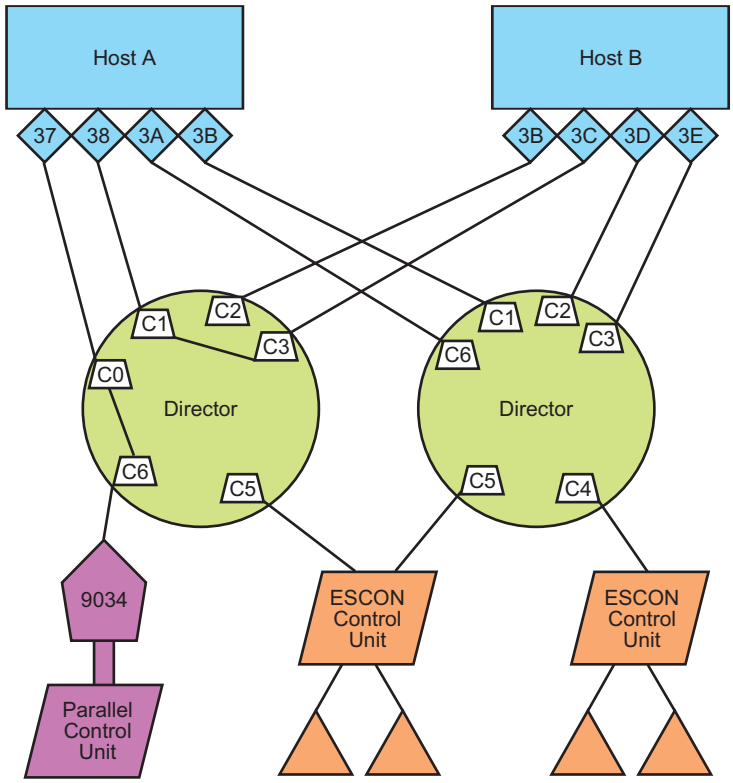


Figure 51. Using a Model 9034 ESCON Converter

Requirements for 9034 Backup

Using 9034 Converters when one host system backs up another system requires planning and preparation. Figure 52 shows two hosts, each with a channel configured to communicate with a Converter. For host system A, the required dedicated connection is established between logical port addresses C0 and CF. Each channel is defined in the IOCP as CVC (block mode converter) or CBY (byte mode converter), and has paths defined to parallel–channel devices.

To transfer parallel-channel device connections from host A (CHPID 2C) to backup host B (CHPID 2A), perform the following steps.

1. Ensure host system B has an available channel configured for communication with a 9034 Converter. To enable the configuration, normal operations for the channel are suspended.

   Note that backup host system B has an available channel configured for Converter communication attached to logical port address CA.

2. Remove the dedicated connection between logical port addresses C0 and CF using the Director Console application or SA OS/390.

   Before removing this dedicated connection, enter appropriate hardware system configuration commands to support Director connectivity change and path removal, and configure the CHPID offline (for example, an MVS **CONFIG** command for channels).

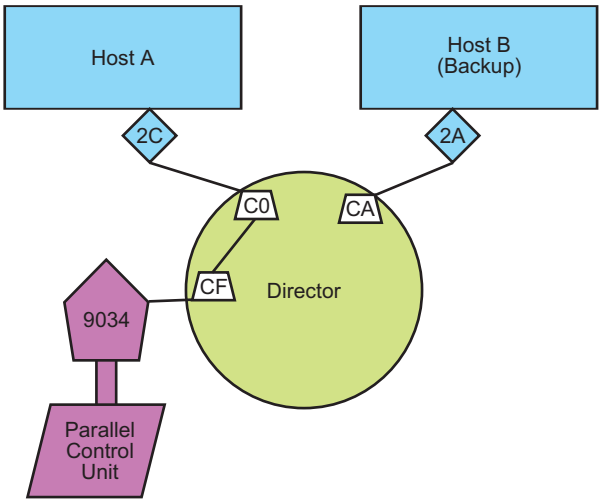


Figure 52. Two Hosts with Access to an ESCON Converter (Host A)

3. Establish a dedicated connection for backup host B between logical port addresses CA and CF using the Director Console application or SA OS/390. The dedicated connection is shown in Figure 53.

   After establishing this dedicated connection enter appropriate hardware system configuration commands to bring CHPID paths online (for example, an MVS **CONFIG** command for channels).

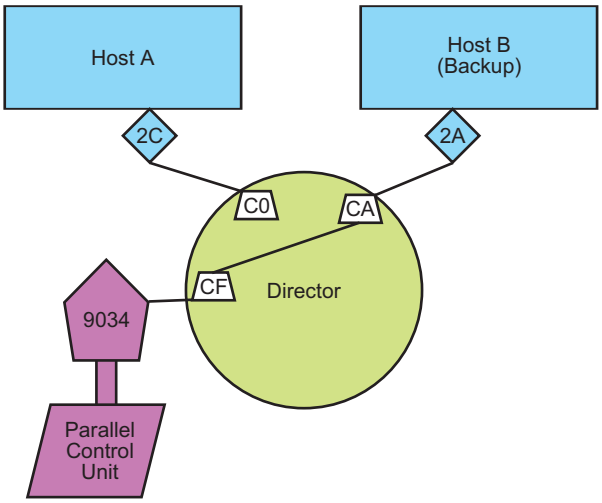


Figure 53. Two Hosts with Access to an ESCON Converter (Backup Host B)

Upgrading from 9034 Converters to ESCON-Capable Control Units

To replace a 9034 Converter and associated parallel-channel control units with ESCON-capable control units *without performing a Power-on reset (POR) at the host,* the new control unit must be defined in the current IOCP. In addition, other ESCON channels must be attached to the Director with paths to the new control unit. To replace the Converter, perform the following steps:

1. Attach the fiber-optic cable from the ESCON-capable control unit to an unused LED port on the Director.
2. Vary offline *all* devices attached to parallel-channel control units.

3. Vary offline the 9034 Converter channel path.
4. Disconnect device I/O cables from the parallel-channel control units and attach device I/O cables to the ESCON-capable control unit.
5. Vary online the new ESCON channel path.
6. Remove the dedicated connection between the 9034 Converter and the host channel. Before removing this dedicated connection, enter appropriate hardware system configuration commands to support Director connectivity change and path removal, and configure the CHPID offline (for example, an MVS **CONFIG** command for channels).
7. Vary online *all* devices attached to the ESCON-capable control unit.
8. Remove the 9034 Converter and parallel-channel control units.

The channel that communicated with the Converter is no longer used. However, the channel can be reused as another 9034 Converter channel or be redefined (CNC, CTC) in future IOCPs.

Defining planned control units to the IOCP should be considered to allow for future conversion from 9034 Converters to ESCON-capable control units and, ultimately, FICON-capable control units. After completing a conversion, the IOCP can be updated (when convenient) to redefine channels and to POR the host. To use the Director port to which the Converter was attached for ESCON-capable control units, update the IOCP to define ESCON channel paths to that port, then POR the host.

Task 15: Plan for 9035 ESCON Converters

A Model 9035 ESCON Converter allows parallel channels to communicate *only* with ESCON-capable 3990-002 and 3990-003 direct access storage device (DASD) control units. The device converts the parallel-channel protocol to an ESCON protocol accepted by the DASD control unit. This task illustrates two ways to incorporate a 9035 Converter in a Director configuration.

Note: When connecting a 9035 Converter to a 9032-005 Director, the connection must attach to a Director port with a logical address ranging from C0 through FB.

As shown in Figure 54, ESCON-capable control unit 1 is directly attached to a 9035 Converter. The channel on host system A attached to the Converter is dedicated to the single control unit.

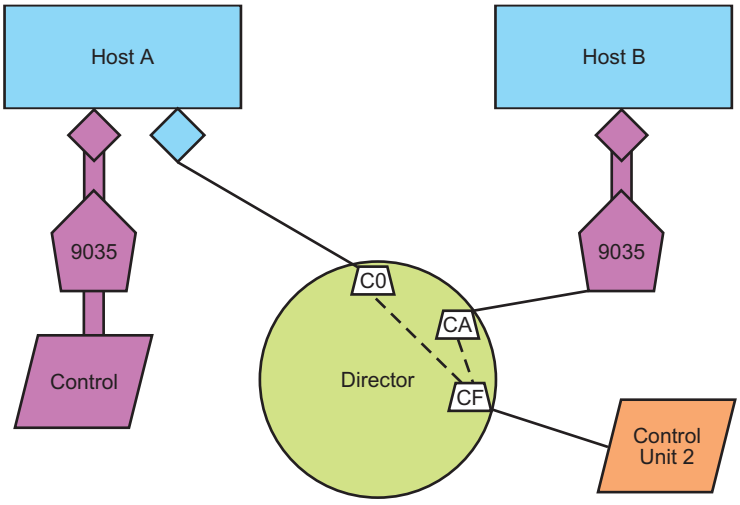


Figure 54. Use of 9035 ESCON Converters with ESCON-Capable Control Units

Alternately, ESCON-capable control unit 2 is attached to a Director (port CF) that is connected to another 9035 Converter (port CA). Control unit 2 can be accessed (through dynamic connections) by any ESCON channel or 9035 Converter attached to the Director. In Figure 54, host system A can function as a backup for applications running on host system B that use a Converter to access control unit 2. An ESCON channel from host A (attached to the Director through port C0), can access control unit 2 with no other action necessary.

Task 16: Plan Console User Access to Directors and Devices

Inventory and document all possible users of the Director Console and the level of password access they require. Determine which users are allowed to change connectivity attributes, access utilities, access specific ports (if the Director is to be logically partitioned), perform maintenance functions, or administer Console users. Perform this task before installing Directors and the Director Console to ensure appropriate and authorized password access is available after installation.

Note: Assigned passwords are used to access all Directors controlled through the Console.

Password Levels

Three password levels protect Directors from unauthorized or inadvertent changes at the Console. Password levels are not hierarchical. Each password level controls a different set of functions.

- **Level 1 (Administrative)** - An administrative authorization (LEVEL001) password provides control of users who access the Director Console. An administrative authorization password allows a user to display, add, change, or delete passwords at all levels (LEVEL001, LEVEL002, and LEVEL003). The password does not allow a user to access utilities or maintenance procedures.
- **Level 2 (Maintenance)** - A maintenance authorization (LEVEL002) password allows a service representative to perform maintenance procedures. Maintenance authorization password users cannot view other user passwords, change passwords, change connectivity attributes, or access utilities.
- **Level 3 (Operator)** - An operator authorization (LEVEL003) password allows a user to change connectivity attributes and access certain Director utilities. Operator authorization password users cannot view other user passwords, change passwords, or perform maintenance procedures. Utilities that require an operator authorization password include:
  - Synchronizing the Director time and date with the Console time and date.
  - Automatically saving changes to the active configuration.
  - Saving a configuration file to the Console fixed disk.
  - Deleting a saved configuration file.

A user is prompted to enter a password before entering changes, accessing utilities, or accessing maintenance procedures.

The Director Console allows the password administrator to assign up to 30 users for each password level. However, the administrator should grant administrative authorization to only a select and small group of users.

Assigning Passwords

From the Director Console application, select the *Passwords* option from the *Utility* pull-down menu to assign password access to Directors. When first assigning passwords, access the Console using the default administrative authorization password (LEVEL001) supplied with the Director. Default passwords are listed in Table 7.

Table 7. Default Passwords

Password Level	Default Password
1 (Administrative)	LEVEL001
2 (Maintenance	LEVEL002
3 (Operator)	LEVEL003

Rules for Passwords

- Passwords can be from one to eight alphanumeric characters (upper or lower case) in length.
- A password identifier and description (entered by the administrator at the *Passwords* dialog box) is associated with each password.
- Multiple users can be supplied with the same password. However, the administrator should carefully control multiple-user passwords.
- Users can be assigned passwords for more than one level of access. For example, an administrator (LEVEL001) can also be authorized to change Director connectivity settings (LEVEL003). For ease of use, consider assigning the same password for both levels.
- If password protection is not required for a particular level, erase the default password for that level and do not assign any new passwords. If password protection is required for a particular level, change the default password as soon as possible after installing the Director.

Logical Partitioning

Determine if logical partitioning is to be used in the configuration. Consider the personnel or groups that should (or should not) have access to certain devices. Refer to "Plan Logical Partitioning" in Appendix B, and complete port authorization planning worksheets as appropriate before enabling logical partitioning at the Director Console.

To authorize access to a subset of Director ports and devices for specific operators, assign an operator authorization password to each operator. Then select the *Port Authorization* option from the *Utility* menu to grant port authorizations for each user with an operator authorization password. Refer to *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296) for additional information.

Task 17: Plan AC Power

Plan for sufficient facility power sources to supply redundant ac power to all Directors and the Director Console. If required, plan for multiple facility power sources and an uninterruptable power supply (UPS). The Director requires a 180 to 264 Vac power source. Depending on the setting for the voltage selection switch, the Director Console requires a 90 to 137 Vac or a 180 to 265 Vac power source.

A power cord that meets facility requirements is supplied with each Director. Refer to "Director Ship Group" on page 12 for a list of available power cords.

Attention!

To provide redundancy and maximum availability, ensure separate ac power circuits are provided for each Director power supply.

Task 18: Complete Planning Checklist

To ensure all planning tasks are addressed, complete the "Planning Checklist" in Appendix A. The checklist summarizes planning activities, provides space for the planned completion date for each activity, and indicates if the activity is the responsibility of the customer or IBM. References are provided for each activity to applicable sections of the chapters of this document.

The customer's Information System (IS) manager and an IBM representative should examine the planning checklist and determine the resources required to complete planning tasks. These resources should include:

- System programming personnel to update I/O definitions that identify Directors.
- Network administrators to obtain LAN addresses for Directors and the Director Console, and to determine requirements for MAUs and LAN cabling.
- Facility planners to outline the installation floor plan, and arrange for electrical wiring, receptacles, and telephone lines.
- Installation planners to determine fiber-optic and Token Ring cabling and routing requirements, and to plan connectivity between host channels (FICON or ESCON), Directors, ESCON Converters, and control units.
- Training personnel to determine training and education needs for operation and administration, and maintenance personnel.
- Console administrators to determine Director port names, Director identifications, and password levels required for Console operators.

Appendix A. Planning Checklist

Use the planning checklist in this appendix to check off planning activities and indicate planned completion dates (for those activities) for the Director installation. The checklist also indicates the responsible party for each planning activity (customer representative, IBM representative, or joint customer/IBM responsibility).

	Planning Activity	Planned Completion Date	Responsibility: Customer	IBM
	Order required devices and device support: • 9032-005 Directors • ESCON-capable devices • 9034 and 9035 ESCON Converters • One Director Console for each Director or for a cluster of up to 16 Directors • Device support for the appropriate level of operating system. For this activity, refer to the diagram of the planned configuration ("Task 8: Diagram the Planned Configuration" on page 79), planning worksheets ("Task 12: Complete Configuration Planning Worksheets" on page 82), and planning worksheets completed for Converters ("Task 14: Plan for 9034 ESCON Converters" on page 86 and "Task 15: Plan for 9035 ESCON Converters" on page 89).		X	X
	Determine the number of FCV port cards (FICON), LED port cards (ESCON), and XDF laser port cards (ESCON) required. Refer to "Determining Number and Type of Required Ports" on page 51 for instructions.		X	X
	Determine planned completion dates for each item in this checklist. Indicate the dates and give a copy of the checklist to your local IBM marketing representative.		X	X
	Review this checklist with the project leader.		X	
	Review fiber-optic cable requirements listed under "Hardware Requirements" on page 22. If required, obtain procurement source information for the fiber-optic cables.		X	
	Complete all structural, mechanical, and electrical design specifications.		X	
	Decide if facility maintenance personnel or an electrical contractor will install electrical wiring and receptacles.		X	
	Order cables, trunk cables, patch panels, and additional installation equipment as required. Refer to the processor-specific *Installation and Physical Planning* manual.		X	
	Select a vendor for fiber-optic cables and ensure the cables are installed on schedule.		X	
	Define Token Ring LAN cable routing and connections to Directors and the Director Console. Refer to "Task 5: Plan LAN and Remote Console Installation" on page 73.		X	

	Planning Activity	Planned Completion Date	Responsibility: Customer	IBM
	Establish security measures for Directors and the Director Console installed on the LAN. Refer to "Task 6: Establish Security Measures" on page 78.		X	X
	Assign identification parameters to each Director in the planned configuration. Refer to "Task 10: Identify Directors" on page 81.		X	
	Outline the floor plan of the area where the Director configuration will be located. Refer to the *9032 Model 5 Enterprise Systems Connection Director Physical Planning Templat*e (GX22-0046).		X	
	If required, obtain IP and MAC addresses for all Directors and Consoles in the proposed configuration. Consult with the customer's Token Ring LAN administrator. Refer to "Task 11: Obtain LAN Addresses" on page 81.		X	
	Review the site plan with your IBM marketing representative. Refer to "Task 1: Prepare a Site Plan" on page 67.		X	X
	Arrange for the installation of electrical wiring, receptacles, and analog telephone connections. Refer to "Task 7: Plan for Analog Phone Connections" on page 79 and "Task 17: Plan AC Power" on page 91.		X	
	Label all fiber-optic jumper cables. Develop a new naming convention or follow the established site naming convention. Review fiber-optic cable requirements under "Hardware Requirements" on page 22.		X	
	Assess the requirements for Director device support, including HCD, EREP, SA OS/390, and ESCON Manager. Place orders with the IBM marketing representative as required.		X	
	Assess the requirements for SA OS/390 or ESCON Manager. Place orders with the IBM marketing representative as required.		X	
	Establish a naming convention for Director ports. Refer to "Task 9: Assign Names to Director Ports" on page 79.		X	
	Plan for Director Console support. Refer to "Task 3: Plan Console Support" on page 72.		X	X
	Plan connectivity for each Director using the worksheets provided in Appendix B. Refer to "Task 8: Diagram the Planned Configuration" on page 79 and "Task 12: Complete Configuration Planning Worksheets" on page 82. Also refer to "Port Addressing and Connectivity" on page 25 and Chapter 2 in general for help with this planning activity.		X	
	Document all Director connectivity. Identify fiber optic-cables, host channels attached (FICON or ESCON), Director ports assigned, and control units attached. Refer to "Task 8: Diagram the Planned Configuration" on page 79 and "Task 12: Complete Configuration Planning Worksheets" on page 82. Also refer to "Port Addressing and Connectivity" on page 25 and Chapter 2 in general for help with this planning activity.		X	
	Update input/output definitions to identify Directors. Refer to "Task 13: Define the I/O Configuration for Director and Attached Control Units" on page 83.		X	

	Planning Activity	Planned Completion Date	Responsibility: Customer	IBM
	Check the progress of site preparation and complete any remaining items required. Refer to "Task 1: Prepare a Site Plan" on page 67.		X	
	Determine user authorization for the Director Console and the level (or levels) of password authorization for each user. Assign an administrator to maintain the passwords. Refer to "Task 16: Plan Console User Access to Directors and Devices" on page 90.		X	
	Determine if logical partitioning is to be implemented, If so, determine user access to devices. Refer to "Task 16: Plan Console User Access to Directors and Devices" on page 90.		X	
	Plan for training and education of Director operations and administrative personnel.		X	
	Review the installation plan with the appropriate personnel.		X	
	Check the Director (and Director Console if ordered) shipment to ensure everything on order has arrived. Report any discrepancies to your IBM marketing representative.		X	X
	Transport Directors to the desired locations and remove all external packaging according to the instructions.		X	
	Unpack Director Consoles and position in desired locations.		X	
	Notify your IBM marketing representative that the equipment arrived, site preparations are complete, and you are ready for IBM to install the Directors and Director Console.		X	

Appendix B. Planning Worksheets

This appendix contains planning worksheets for use in setting up a Director configuration. Several examples of planned configurations with completed worksheets are provided. Blank worksheets are provided at the end of the appendix. Make photocopies of the blank worksheets as required to plan a configuration. The types of planning worksheets are:

- **Planning Worksheet Map** - Use a planning worksheet map to assign numbers to each configuration planning worksheet for a Director, and to track the worksheets used. Use one map for each Director.
- **Configuration Planning Worksheets** - Use configuration planning worksheets to plan connectivity for the Director. On each worksheet, record the name and connectivity attributes for each Director port. Complete a separate set of worksheets for each Director. Completed worksheets are used as a guide when entering connectivity attributes at the Director Console.
- **Port Authorization Planning Worksheets** - Use port authorization planning worksheets when logical partitioning is to be implemented. Use the worksheets to plan and record operator authorizations. In addition, the worksheet numbers should be recorded on a planning worksheet map. If required, refer to "Logical Partitioning Capability" on page 45 for more information.

A Director can have fewer active ports than the maximum number available. If so, complete worksheets for only those ports installed. In addition, port cards can be installed in any order in the Director chassis. However, ports used for Fibre Connection (FICON) or Enterprise Systems Connection (ESCON) channel, control unit, or ESCON Converter connections should be organized to minimize complexity, make identification easier, and allow easier cable routing. Refer to "Organizing Port Cards" on page 58 for information.

Configuration Planning

Planning a Director configuration is a complex task. Planning worksheets in this appendix are designed to make the task easier and more systematic. A typical configuration planning process should follow this pattern:

1. Ensure all configuration planning decisions are made.
2. Complete "Task 8: Diagram the Planned Configuration" on page 79.
3. Transfer all information from the configuration diagram to configuration planning worksheets. Complete planning worksheet maps to track the worksheets used.
4. Complete port authorization planning worksheets if logical partitioning is to be implemented.
5. Use information recorded on the planning worksheets during matrix configuration at the Director Console.
6. Retain the planning worksheets and maps as reference material.

Refer to "Port Addressing and Connectivity" on page 25 for information about port numbering and default logical port addresses.

Planning Worksheet Map

Use planning worksheet maps to assign sequential numbers to each configuration planning worksheet for a Director. As shown in Figure 55, to configure ports in the logical address range *04* through *53*, make 15 copies of the Configuration Planning Worksheet (at the end of this appendix), and sequentially number them.

In the example, the ports to be configured are shaded. In addition, complete header information for the map as follows:

- **Director Identification** - Enter a Director identification (DIR001 in the example). This is the Director ID entered at the *Director Definition* dialog box.
- **CUP Name** - Enter the name (CUP001 in the example) assigned to the Director's control unit port (CUP). Refer to "Task 9: Assign Names to Director Ports" on page 79 for information about naming ports.
- **Configuration Matrix Name** - Enter a configuration matrix name (CONFIG01 in the example). This is the matrix name entered at the *Save Configuration Matrix* dialog box.
- **Prepared by/date** - Enter the name (or initials) of the person responsible for completing all planning worksheets for the Director configuration, and the date completed.
- **Date to be activated** - Enter the date on which the planned Director configuration is to be installed and activated.

Planning Worksheet Map

Director Identification: DIR001 CUP Name: CUP001

Configuration Matrix Name: CONFIG01 Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99

Complete appropriate configuration planning worksheets for installed and planned Director ports. Indicate on this map which worksheets are used.

Address	04 - 13	14 - 23	24 - 33	34 - 43	44 - 53	54 - 63	64 - 73	74 - 83	84 - 93	94 - A3	A4 - B3	B4 - C3	C4 - D3	D4 - E3	E4 - F3	F4 - FB
04 - 13	1	2	4	7	11	16	22	29	37	46	56	67	79	92	106	122
14 - 23		3	5	8	12	17	23	30	38	47	57	68	80	93	107	123
24 - 33			6	9	13	18	24	31	39	48	58	69	81	94	108	124
34 - 43				10	14	19	25	32	40	49	59	70	82	95	109	125
44 - 53					15	20	26	33	41	50	60	71	83	96	110	126
54 - 63						21	27	34	42	51	61	72	84	97	112	127
64 - 73							28	35	43	52	62	73	85	98	113	128
74 - 83								36	44	53	63	74	86	99	114	129
84 - 93									45	54	64	75	87	100	115	130
94 - A3										55	65	76	88	101	116	131
A4 - B3											66	77	89	102	117	132
B4 - C3												78	90	103	118	133
C4 - D3													91	104	119	134
D4 - E3														105	120	135
E4 - F3															121	136
F4 - FB																137

Notes: 15 ports configured (shaded blocks)

Figure 55. Sample Planning Worksheet Map

Configuration Planning Worksheets

This section provides examples of diagramed Director configurations and shows how to complete configuration planning worksheets that correspond to the diagrams. The examples shown include a:

- Configuration with 9034 ESCON Converters.
- Change to an existing configuration.
- Configuration with chained Directors.
- Configuration with FICON ports.
- Migration from a 9032-003 to 9032-005 Director.

Note: On the worksheets, indicate *exceptions* to any-to-any (all allowed) or none-to-none (all prohibited) connectivity environments. In the following examples, the default connectivity is any-to-any, and connections not specifically blocked or prohibited are assumed to be unblocked and allowed.

Example 1: Configuration with 9034 ESCON Converters

This example shows a Director configuration that includes 9034 ESCON Converters. Figure 56 shows a diagram of the planned configuration.

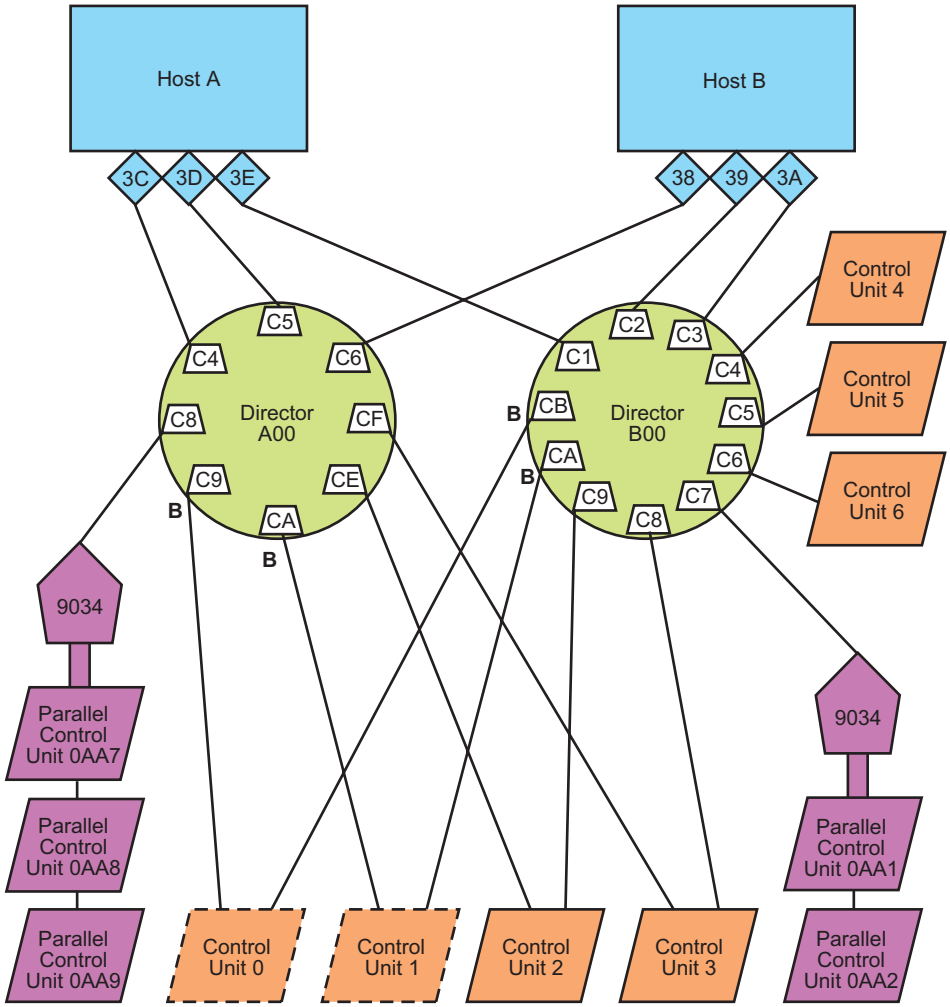


Figure 56. Configuration with 9034 ESCON Converters

The configuration consists of:

- Two host systems (A and B). Host A communicates with the Directors through ESCON channel path identifiers (CHPIDs) 3C, 3D, and 3E, and host B communicates with the Directors through ESCON CHPIDs 38, 39, and 3A.
- Two 9032-005 Directors. The Director identifications are the same as the assigned device numbers (A00 and B00).
- Control units 0 through 6, qualified as follows:
  - Control units 0 and 1 are planned for future installation (but not part of the current installation), as indicated by the dashed outlines. Director ports are reserved for future connectivity. Upon installation, these control units will have full dynamic connectivity to both host systems.
  - Control units 2 and 3 are part of the current installation. These control units have full dynamic connectivity to both host systems.
  - Control units 4, 5, and 6 are part of the current installation. These control units have only partial dynamic connectivity to both host systems. CHPID 39 on host system B (attached to Director port address C2) can communicate only with control units 4, 5, and 6. The channel is not permitted to access any other control units.
- Parallel control units 0AA7, 0AA8, and 0AA9 communicate through parallel bus and tag channels to a 9034 ESCON Converter, then through an ESCON channel to host system A.
- Parallel control units 0AA1 and 0AA2 communicate through parallel bus and tag channels to a 9034 ESCON Converter, then through an ESCON channel to host system B.

Complete two configuration planning worksheets (one for Director A00 and one for Director B00). Figure 57 shows a partial sample planning worksheet for Director A00. Figure 58 shows a partial sample planning worksheet for Director B00.

Remember that each Director requires a separate planning worksheet map and set of configuration planning worksheets. Complete worksheet information according to the following steps. Complete the information for one Director at a time to avoid confusion.

1. Complete heading information for the worksheet, including the Director identification and model number, configuration matrix name, CUP name, and relevant dates. Use a planning worksheet map to number each worksheet appropriately. This example requires one configuration planning worksheet set for Director A00 and one set for Director B00.
2. Use the **Notes:** area at the bottom of the worksheet to record any special notation used, or to refer to a project or activity associated with the planned configuration.
3. Assign a name to each Director port and enter the names in the *Port Names* column. Refer to "Task 9: Assign Names to Director Ports" on page 79 for information about naming ports.
4. Indicate FICON ports by entering **FCV** in the *FCV* column. No FICON ports are installed. All entries in the column are left blank.
5. Indicate blocked ports by entering **B** in the *B* column.

   Ports C9 and CA on Director A00 are reserved for future control unit installation. Although not required, the ports are blocked. Ports CA and CB on Director B00 are reserved for future control unit installation. Although not required, the ports are blocked.

Configuration Planning Worksheet

Director Identification: A00 Director Model Number: 9032-005

Configuration Matrix Name: CONFIG01 CUP Name: ESCDA00 Worksheet C - 14 of 15

Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99

Column Headings: **FCV:** Indicates FICON port (FCV) or ESCON port (blank) **B:** Indicates blocked status (B) or unblocked status (blank)

C: Indicates dedicated connection with specified port address **Port Address:** Indicates allowed status (blank), dedicated status (D), or prohibited status (P)

					Port Address															
Port Address	Port Name	FCV	B	C	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF
C0	not used																			
C1	not used																			
C2	not used																			
C3	not used																			
C4	HOSTA_CHPID3C			C8									D							
C5	HOSTA_CHPID3D																			
C6	HOSTB_CHPID38																			
C7	not used																			
C8	9034.A			C4					D											
C9	CNTLUNIT.0		B																	
CA	CNTLUNIT.1		B																	
CB	not used																			
CC	not used																			
CD	not used																			
CE	CNTLUNIT.2																			
CF	CNTLUNIT.3																			

Notes: D = Dedicated

Figure 57. Sample Planning Worksheet with 9034 Converters (Director A00 - Partial View)

6. Indicate all dedicated connections by entering the appropriate logical port address in the C column. In addition, indicate (with a **D**) the dedicated connections in the corresponding port address rows and columns.

   Note: When entering the configuration at the Director Console, the Console application automatically completes reciprocal settings.

   For host system A, CHPID 3C (attached to port C4 on Director A00) communicates with a 9034 Converter attached to port C7. Indicate a dedicated connection between ports C4 and C8, and ports C8 and C4.

   For host system B, CHPID 3A (attached to port C3 on Director B00) communicates with a 9034 Converter attached to port C8. Indicate a dedicated connection between ports C3 and C7, and ports C7 and C3.

7. Indicate all prohibited connections by entering a **P** in the appropriate port address rows and columns.

Configuration Planning Worksheet

Director Identification: B00 Director Model Number: 9032-005
Configuration Matrix Name: CONFIG01 CUP Name: ESCDB00 Worksheet C - 15 of 15
Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99
Column Headings: **FCV:** Indicates FICON port (FCV) or ESCON port (blank) **B:** Indicates blocked status (B) or unblocked status (blank)
C: Indicates dedicated connection with specified port address **Port Address:** Indicates allowed status (blank), dedicated status (D), or prohibited status (P)

					Port Address														
Port Address	Port Name	FCV	B	C	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF
C0	not used						P													
C1	HOSTA_CHPID3E						P													
C2	HOSTB_CHPID39				P	P		P				P	P	P	P	P	P	P	P	P
C3	HOSTB_CHPID3A			C7			P					D								
C4	CNTLUNIT.4																			
C5	CNTLUNIT.5																			
C6	CNTLUNIT.6																			
C7	9034.B			C3			P	D												
C8	CNTLUNIT.3						P													
C9	CNTLUNIT.2						P													
CA	CNTLUNIT.1		B				P													
CB	CNTLUNIT.0		B				P													
CC	not used						P													
CD	not used						P													
CE	not used						P													
CF	not used						P													

Notes: D = Dedicated, P = Prohibited

Figure 58. Sample Planning Worksheet with 9034 Converters (Director B00 - Partial View)

Note: When entering the configuration at the Director Console, the Console application automatically completes reciprocal settings. Intersecting squares of a port column with the same port row contain a diagonal line (\ ) at the matrix window of the Console application, indicating a port is prohibited from connecting with itself. Such a diagonal line can be included on the worksheet.

For host system B, CHPID 39 (attached to port C2 on Director B00) is prohibited from connecting to any ports except control unit 4 (port C4), control unit 5 (port C5), and control unit 6 (port C6). Connectivity is allowed only between ports C2 and C4, ports C2 and C5, and ports C2 and C6. All other connectivity to port C2 is prohibited.

8. Several port addresses have no status indication. For reference, devise a notational convention to indicate the situations listed as follows. Use the **Notes:** area at the bottom of the worksheet to explain the convention. ***Ensure the Director operator entering data from the worksheet understands the convention.*** A port with no status indication may:

a. Not be installed - enter **Not Installed** in the *Port Name* field to clarify the status. However, this entry can be used only once (as an address name) because address names cannot be duplicated. Instruct the Director operator to ignore duplicate addresses.

b. Be installed but not in use - enter **Not Used** in the *Port Name* field to clarify the status. However, this entry can be used only once (as an address name) because address names cannot be duplicated. Instruct the Director operator to ignore duplicate addresses.

c. In use (with a host channel or control unit attached) but with any-to-any connectivity and no assigned name - leave the *Port Name* field blank. The worksheet indicates *exceptions* to any-to-any connectivity.

Example 2: Change to an Existing Configuration

This example shows a change to an existing configuration. The configuration shown in Figure 56 is changed to replace 9034 Converters and parallel control units with ESCON control units. Figure 59 shows the changed configuration. The configuration is identical to that shown in Example 1, with the exceptions listed as follows.

- All 9034 Converters and parallel control units are removed from the configuration.
- ESCON control units A and B are added to the configuration. Both host systems can dynamically communicate with the new control units.

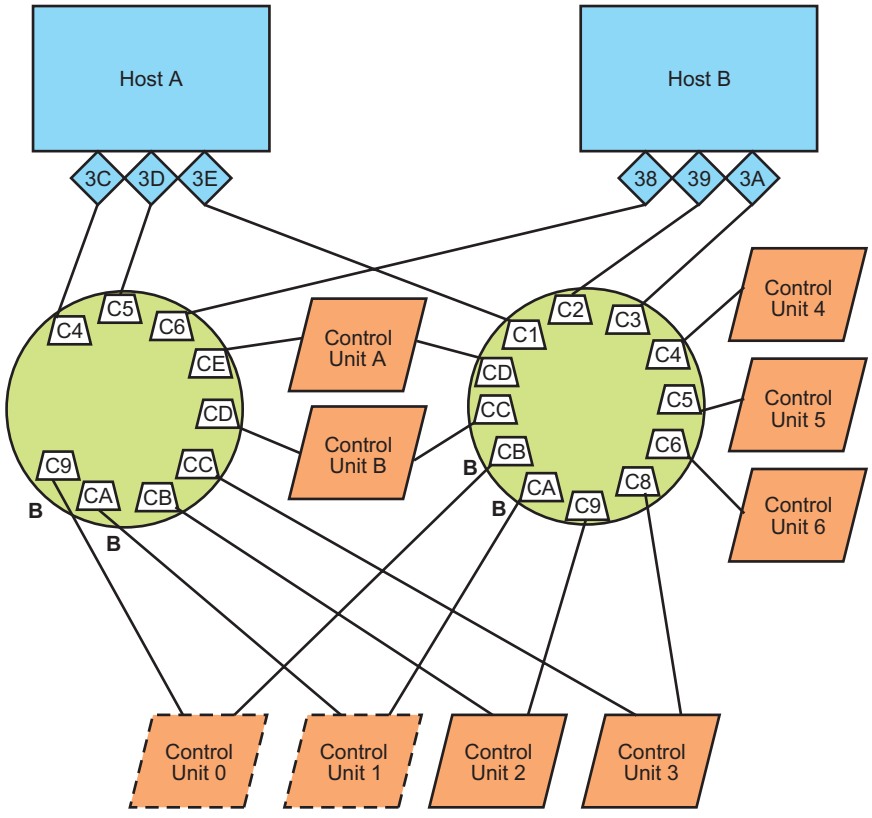


Figure 59. Changed Configuration

Complete two configuration planning worksheets (one for Director A00 and one for Director B00). Figure 60 shows a partial sample planning worksheet for Director A00. The differences between this example and Example 1 are listed as follows.

- The dedicated connection between ports C4 and C8 is removed. The notation is removed from the *C* and *Port Address* columns.
- The 9034 Converter is removed from the configuration and port C8 is not used.
- The connection for control unit 2 is moved to port CB. The connection for control unit 3 is moved to port CC.
- Control units A and B are added to the configuration. Control unit A is attached to port CE. Control unit B is attached to port CD.
- Port CF is not used.

Configuration Planning Worksheet

Director Identification: A00 Director Model Number: 9032-005
Configuration Matrix Name: CONFIG01 CUP Name: ESCDA00 Worksheet C - 14 of 15
Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99
Column Headings: **FCV:** Indicates FICON port (FCV) or ESCON port (blank) **B:** Indicates blocked status (B) or unblocked status (blank)
C: Indicates dedicated connection with specified port address **Port Address:** Indicates allowed status (blank), dedicated status (D), or prohibited status (P)

					Port Address															
Port Address	Port Name	FCV	B	C	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF
C0	not used																			
C1	not used																			
C2	not used																			
C3	not used																			
C4	HOSTA_CHPID3C																			
C5	HOSTA_CHPID3D																			
C6	HOSTB_CHPID38																			
C7	not used																			
C8	9034.A																			
C9	CNTLUNIT.0		B																	
CA	CNTLUNIT.1		B																	
CB	CNTLUNIT.2																			
CC	CNTLUNIT.3																			
CD	CNTLUNIT.B																			
CE	CNTLUNIT.A																			
CF	not used																			

Notes:

Figure 60. Sample Planning Worksheet - Changed Configuration (Director A00 - Partial View)

Figure 61 shows a partial sample planning worksheet for Director B00. The differences between this example and Example 1 are listed as follows.

- The dedicated connection between ports C3 and C7 is removed. The notation is removed from the *C* and *Port Address* columns.
- The 9034 Converter is removed from the configuration and port C7 is not used.
- Control units A and B are added to the configuration. Control unit A is attached to port CD. Control unit B is attached to port CC.

Configuration Planning Worksheet

Director Identification: B00 Director Model Number: 9032-005
Configuration Matrix Name: CONFIG01 CUP Name: ESCDB00 Worksheet C - 15 of 15
Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99
Column Headings: **FCV:** Indicates FICON port (FCV) or ESCON port (blank) **B:** Indicates blocked status (B) or unblocked status (blank)
C: Indicates dedicated connection with specified port address **Port Address:** Indicates allowed status (blank), dedicated status (D), or prohibited status (P)

					Port Address															
Port Address	Port Name	FCV	B	C	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF
C0	not used						P													
C1	HOSTA_CHPID3E						P													
C2	HOSTB_CHPID39				P	P		P				P	P	P	P	P	P	P	P	P
C3	HOSTB_CHPID3A						P													
C4	CNTLUNIT.4																			
C5	CNTLUNIT.5																			
C6	CNTLUNIT.6																			
C7	not used						P													
C8	CNTLUNIT.3						P													
C9	CNTLUNIT.2						P													
CA	CNTLUNIT.1		B				P													
CB	CNTLUNIT.0		B				P													
CC	CNTLUNIT.B						P													
CD	CNTLUNIT.A						P													
CE	not used						P													
CF	not used						P													

Notes: P = Prohibited

Figure 61. Sample Planning Worksheet - Changed Configuration (Director B00 - Partial View)

Example 3: Configuration with Chained Directors

This example shows a chained Director configuration that includes one 9034 ESCON Converter. Figure 62 shows a diagram of the planned configuration. The configuration consists of:

- Two host systems (A and B). Host A communicates with the Directors through ESCON CHPIDs 38, 39, and 3A, and host B communicates with the Directors through ESCON CHPIDs 3B, 3C, 3D, 3E, and 3F.
- Two chained 9032 Model 5 Directors. The Director identifications are the same as the assigned device numbers (0C00 and 0D00). Chained Directors require a dedicated connection provided by least one Director. This connection is provided between ports C2 and C5 by Director 0C00.
- Control units 0100 through 0500, qualified as follows:
  - Control unit 0100 is accessed dynamically by both host systems.
  - Control unit 0200 is used only by applications on host A. Access by host B is prohibited.

- Control unit 0300 is planned for later installation (dashed lines). Upon installation, the control unit is to be accessed dynamically by both host systems.
- Control units 0400 and 0500 is accessed dynamically by host B. Host A accesses the control units through the chained Director configuration.

- Parallel control unit 0011 that communicates through parallel bus and tag channels to a 9034 ESCON Converter, then through an ESCON channel to host system A. The 9034 Converter requires a dedicated connection through the Director.

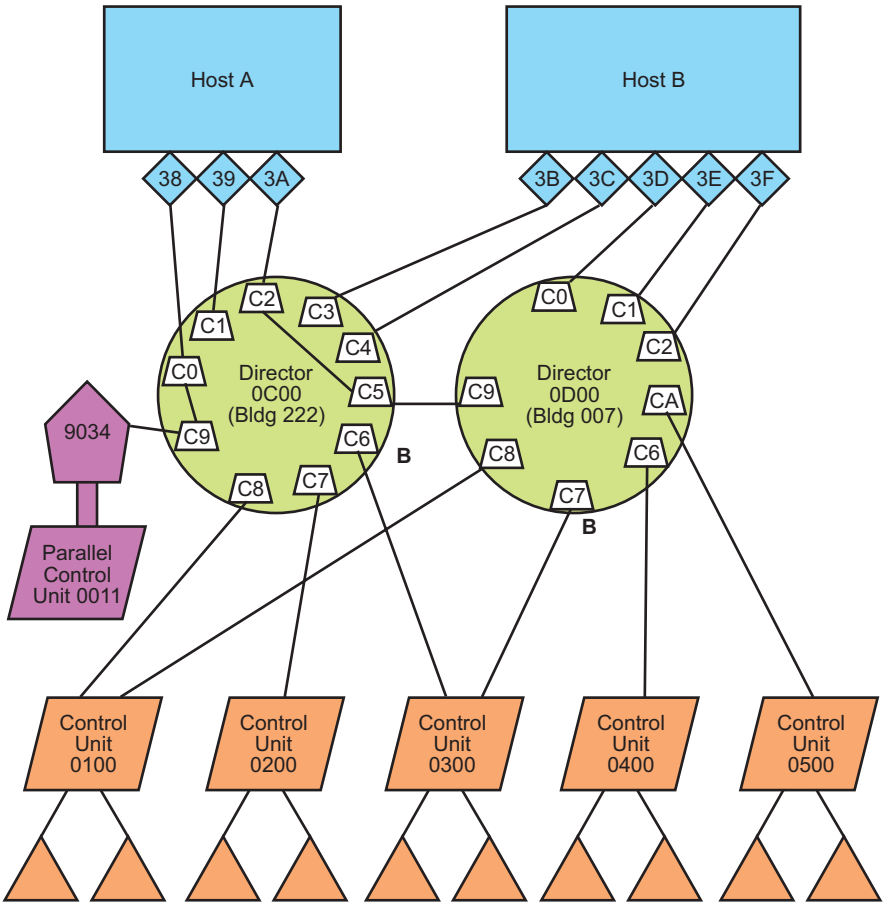


Figure 62. Chained Director Configuration

Complete two configuration planning worksheets (one for Director A00 and one for Director B00). Figure 63 shows a partial sample planning worksheet for Director 0C00. Figure 64 shows a partial sample planning worksheet for Director 0D00. ***Remember that each Director requires a separate planning worksheet map and set of configuration planning worksheets.*** Complete worksheet information according to the following steps. Complete the information for one Director at a time to avoid confusion.

1. Complete heading information for the worksheet, including the Director identification and model number, configuration matrix name, CUP name, and relevant dates. Use a planning worksheet map to number each worksheet appropriately. This example requires one configuration planning worksheet set for Director 0C00 and one set for Director 0D00.

Configuration Planning Worksheet

Director Identification: 0C00 Director Model Number: 9032-005
Configuration Matrix Name: CONFIG01 CUP Name: BLDG222ESCD Worksheet C - 14 of 15
Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99
Column Headings: **FCV:** Indicates FICON port (FCV) or ESCON port (blank) **B:** Indicates blocked status (B) or unblocked status (blank)
C: Indicates dedicated connection with specified port address **Port Address:** Indicates allowed status (blank), dedicated status (D), or prohibited status (P)

					Port Address															
Port Address	Port Name	FCV	B	C	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF
C0	HOSTA_9034CHAN			C9										D						
C1	HOSTA_CHPID39																			
C2	HOST_CHAIN			C5						D										
C3	HOSTB_CHPID3B											P								
C4	HOSTB_CHPID3C											P								
C5	CHAIN_to_0D00			C2			D													
C6	CNTLUNIT.300		B																	
C7	CNTLUNIT.200							P	P											
C8	CNTLUNIT.100																			
C9	9034_BLDG222			C0	D															
CA	not used																			
CB	not used																			
CC	not used																			
CD	not used																			
CE	not used																			
CF	not used																			

Notes: D = Dedicated, P = Prohibited

Figure 63. Sample Planning Worksheet - Chained Directors (Director 0C00 - Partial View)

2. Use the **Notes:** area at the bottom of the worksheet to record any special notation used, or to refer to a project or activity associated with the planned configuration.
3. Assign a name to each Director port and enter the names in the *Port Names* column. Refer to "Task 9: Assign Names to Director Ports" on page 79 for information about naming ports.
4. Indicate FICON ports by entering **FCV** in the *FCV* column. No FICON ports are installed. All entries in the column are left blank.
5. Indicate blocked ports by entering **B** in the *B* column.

   Port C6 on Director 0C00 is reserved for future control unit installation. Although not required, the port is blocked. Port C7 on Director 0D00 is reserved for future control unit installation. Although not required, the port is blocked.

Configuration Planning Worksheet

Director Identification: 0D00 Director Model Number: 9032-005

Configuration Matrix Name: CONFIG01 CUP Name: BLDG007ESCD Worksheet C - 15 of 15

Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99

Column Headings: **FCV:** Indicates FICON port (FCV) or ESCON port (blank) **B:** Indicates blocked status (B) or unblocked status (blank)

C: Indicates dedicated connection with specified port address **Port Address:** Indicates allowed status (blank), dedicated status (D), or prohibited status (P)

					Port Address															
Port Address	Port Name	FCV	B	C	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF
C0	HOSTB_CHPID3D																			
C1	HOSTB_CHPID3E																			
C2	HOSTB_CHPID3F																			
C3	not used																			
C4	not used																			
C5	not used																			
C6	CNTLUNIT.400																			
C7	CNTLUNIT.300		B																	
C8	CNTLUNIT.100																			
C9	CHAIN-FROM_222																			
CA	CNTLUNIT.500																			
CB	not used																			
CC	not used																			
CD	not used																			
CE	not used																			
CF	not used																			

Notes:

Figure 64. Sample Planning Worksheet - Chained Directors (Director 0D00 - Partial View)

6. Indicate all dedicated connections by entering the appropriate logical port address in the *C* column. In addition, indicate (with a **D**) the dedicated connections in the corresponding port address rows and columns.

   Note: When entering the configuration at the Director Console, the Console application automatically completes reciprocal settings.

   For host system A, CHPID 38 (attached to port C0 on Director 0C00) communicates with a 9034 Converter attached to port C9. Indicate a dedicated connection between ports C0 and C9, and ports C98 and C0.

   The dedicated connection required to support chained Directors is between ports C2 and C5 for Director 0C00. Indicate a dedicated connection between ports C2 and C5, and ports C5 and C2.

7. Indicate all prohibited connections by entering a **P** in the appropriate port address rows and columns.

Note: When entering the configuration at the Director Console, the Console application automatically completes reciprocal settings. Intersecting squares of a port column with the same port row contain a diagonal line (****) at the matrix window of the Console application, indicating a port is prohibited from connecting with itself. Such a diagonal line can be included on the worksheet.

For host system B, CHPID 3B (connected to port C3 on Director 0C00) and CHPID 3C (connected to port C4 on Director 0C00) are prohibited from communicating with control unit 0200 (connected to port C7).

8. Several port addresses have no status indication. For reference, devise a notational convention to indicate the situations listed as follows. Use the **Notes:** area at the bottom of the worksheet to explain the convention. ***Ensure the Director operator entering data from the worksheet understands the convention.*** A port with no status indication may:
   a. Not be installed - enter **Not Installed** in the *Port Name* field to clarify the status. However, this entry can be used only once (as an address name) because address names cannot be duplicated. Instruct the Director operator to ignore duplicate addresses.
   b. Be installed but not in use - enter **Not Used** in the *Port Name* field to clarify the status. However, this entry can be used only once (as an address name) because address names cannot be duplicated. Instruct the Director operator to ignore duplicate addresses.
   c. In use (with a host channel or control unit attached) but with any-to-any connectivity and no assigned name - leave the *Port Name* field blank. The worksheet indicates *exceptions* to any-to-any connectivity.

Example 4: Configuration with FICON Ports

This example shows a single Director configuration that includes FICON and ESCON host channels. Figure 65 shows a diagram of the planned configuration. The configuration consists of:

- Two host systems (A and B). Host A communicates with the Director through ESCON CHPIDs 3C and 3D. Host B communicates with the Director through a FICON channel and ESCON CHPID 3E.
- One 9032-005 Director. The Director identification is the same as the assigned device number (F00).
- Control units 0100 and 0200, qualified as follows:
  – Control unit 0100 is used only by ESCON applications. Access by the FICON channel on host B is prohibited.
  – Control unit 0200 is used only by FICON applications. Access by ESCON channels on host A and B are prohibited.

Complete a configuration planning worksheet for Director port addresses C4 through D3 as described in the following steps. Figure 66 shows the sample planning worksheet.

1. Complete heading information for the worksheet, including the Director identification and model number, configuration matrix name, CUP name, and relevant dates. Use a planning worksheet map to number the worksheet appropriately. This example requires one configuration planning worksheet for Director F00.
2. Use the **Notes:** area at the bottom of the worksheet to record any special notation used, or to refer to a project or activity associated with the planned configuration.

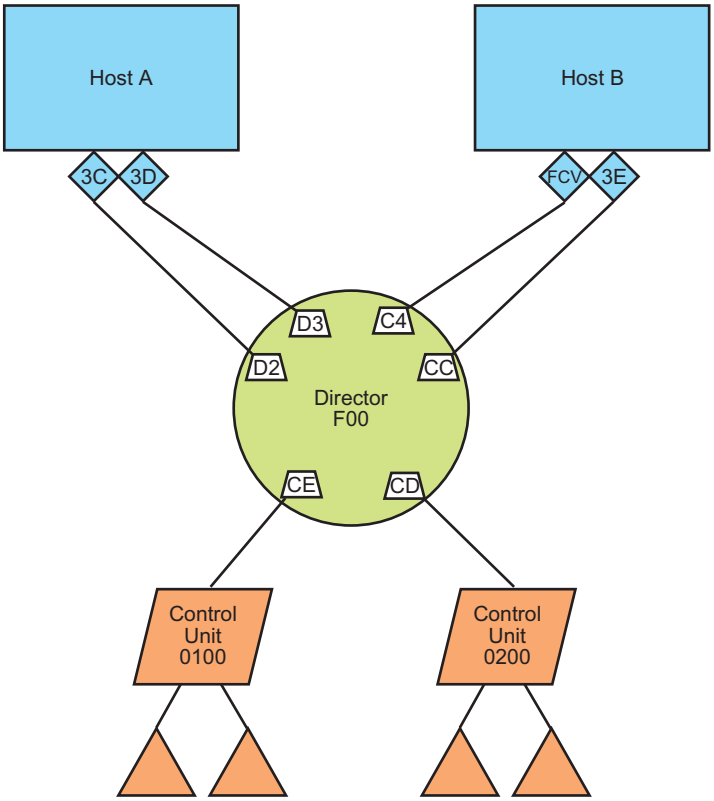


Figure 65. Configuration with a FICON Port

3. Assign a name to each Director port and enter the names in the *Port Names* column. Refer to "Task 9: Assign Names to Director Ports" on page 79 for information about naming ports.

   Note: Because installation of an FCV Port card (FICON) uses eight logical port addresses, the seven consecutive addresses after the actual FICON port are labelled **Unaddressable** in the *Port Names* column.

4. Indicate FICON ports by entering **FCV** in the *FCV* column. Port address C4 is a FICON port. As a result, port addresses C5 through CB are unaddressable.
5. Indicate blocked ports by entering **B** in the *B* column. No ports are blocked.
6. Indicate all dedicated connections by entering the appropriate logical port address in the *C* column. In addition, indicate (with a **D**) the dedicated connections in the corresponding port address rows and columns. No port connections are dedicated.
7. Indicate all prohibited connections by entering a **P** in the appropriate port address rows and columns.

   Note: When entering the configuration at the Director Console, the Console application automatically completes reciprocal settings. Intersecting squares of a port column with the same port row contain a diagonal line (****) at the matrix window of the Console application, indicating a port is prohibited from connecting with itself. Such a diagonal line can be included on the worksheet.

Configuration Planning Worksheet

Director Identification: F00 Director Model Number: 9032-005
Configuration Matrix Name: CONFIG01 CUP Name: CUP007 Worksheet C - 1 of 1
Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99
Column Headings: **FCV:** Indicates FICON port (FCV) or ESCON port (blank) **B:** Indicates blocked status (B) or unblocked status (blank)
C: Indicates dedicated connection with specified port address **Port Address:** Indicates allowed status (blank), dedicated status (D), or prohibited status (P)

					Port Address															
Port Address	Port Name	FCV	B	C	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF	D0	D1	D2	D3
C4	HOSTB_FICON	FCV													P					
C5	unaddressable																			
C6	unaddressable																			
C7	unaddressable																			
C8	unaddressable																			
C9	unaddressable																			
CA	unaddressable																			
CB	unaddressable																			
CC	HOSTB_CHPID3E													P						
CD	CNTLUNIT.200												P						P	P
CE	CNTLUNIT.100				P															
CF	not used																			
D0	not used																			
D1	not used																			
D2	HOSTA_CHPID3C													P						
D3	HOSTA_CHPID3D													P						

Notes: P = Prohibited

Figure 66. Sample Planning Worksheet with FICON Channel (Director F00)

For host system A, CHPIDs 3C and 3D (connected to port addresses D2 and D3) are prohibited from communicating with control unit 0200 (connected to port address CD).

For host system B, CHPID 3E (connected to port address CC) is prohibited from communicating with control unit 0200 (connected to port address CD). A FICON channel (connected to port address C4) is prohibited from communicating with control unit 0100 (connected to port address CE).

8. Several port addresses have no status indication. For reference, devise a notational convention to indicate the situations listed as follows. Use the **Notes:** area at the bottom of the worksheet to explain the convention. ***Ensure the Director operator entering data from the worksheet understands the convention.*** A port with no status indication may:

   a. Not be installed - enter **Not Installed** in the *Port Name* field to clarify the status. However, this entry can be used only once (as an address name) because address names cannot be duplicated. Instruct the Director operator to ignore duplicate addresses.

b. Be installed but not in use - enter **Not Used** in the *Port Name* field to clarify the status. However, this entry can be used only once (as an address name) because address names cannot be duplicated. Instruct the Director operator to ignore duplicate addresses.

c. In use (with a host channel or control unit attached) but with any-to-any connectivity and no assigned name - leave the *Port Name* field blank. The worksheet indicates *exceptions* to any-to-any connectivity.

Example 5: Migration from a 9032 Model 3 to 9032 Model 5 Director

This example assumes a fully-configured 9032-003 Director is installed and is to be upgraded to a 9032-005 Director.

If configuration planning worksheets are complete for the existing Model 3 Director, do not complete new ones. Instead, renumber the worksheets to reflect port coverage for the new Model 5 planning worksheet map. There is port address overlap between those covered by Model 3 worksheets and those represented on the Model 5 map.

If configuration planning worksheets are not complete for the existing Model 3 Director, use the planning worksheet map to number and develop new worksheets to migrate to the Model 5 Director. Figure 67 shows a planning worksheet map for the existing Model 3 Director.

Planning Worksheet Map

9032 Model 3 ESCON Director

Director Identification: DIR007 CUP Name: CUP001

Configuration Matrix Name: CONFIG01 Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99

Complete appropriate configuration planning worksheets for installed and planned Director ports. Indicate on this map which worksheets are used.

Address	80 - 8F	90 - 9F	A0 - AF	B0 - BF	C0 - CF	D0 - DF	E0 - EF	F0 - FB
80 - 8F	1	2	4	7	11	16	22	29
90 - 9F		3	5	8	12	17	23	30
A0 - AF			6	9	13	18	24	31
B0 - BF				10	14	19	25	32
C0 - CF					15	20	26	33
D0 - DF						21	27	34
E0 - EF							28	35
F0 - FB								36

Notes: Shaded blocks indicate active worksheets (9032-003 Director)

Figure 67. Sample Planning Worksheet Map (9032-003 Director)

Figure 68 shows a planning worksheet map for the 9032-005 Director, with shaded blocks that indicate configuration planning worksheets used for migrating ports. The content of the worksheets is the same as that for the Model 3 Director, but the worksheet numbers change to reflect the Model 5 Director ports.

The map can also be used to add Director ports after the migration process is complete. For example. if new connections are activated for ports in the port address range 14 through 23, create a new configuration planning worksheet and shade block 3 on the planning worksheet map.

Planning Worksheet Map

Director Identification: DIR007 CUP Name: CUP001

Configuration Matrix Name: CONFIG01 Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99

Complete appropriate configuration planning worksheets for installed and planned Director ports. Indicate on this map which worksheets are used.

Address	04 - 13	14 - 23	24 - 33	34 - 43	44 - 53	54 - 63	64 - 73	74 - 83	84 - 93	94 - A3	A4 - B3	B4 - C3	C4 - D3	D4 - E3	E4 - F3	F4 - FB
04 - 13	1	2	4	7	11	16	22	29	37	46	56	67	79	92	106	122
14 - 23		3	5	8	12	17	23	30	38	47	57	68	80	93	107	123
24 - 33			6	9	13	18	24	31	39	48	58	69	81	94	108	124
34 - 43				10	14	19	25	32	40	49	59	70	82	95	109	125
44 - 53					15	20	26	33	41	50	60	71	83	96	110	126
54 - 63						21	27	34	42	51	61	72	84	97	112	127
64 - 73							28	35	43	52	62	73	85	98	113	128
74 - 83								36	44	53	63	74	86	99	114	129
84 - 93									45	54	64	75	87	100	115	130
94 - A3										55	65	76	88	101	116	131
A4 - B3											66	77	89	102	117	132
B4 - C3												78	90	103	118	133
C4 - D3													91	104	119	134
D4 - E3														105	120	135
E4 - F3															121	136
F4 - FB																137

Notes: Shaded blocks indicate active worksheets (9032-005 Director)

Figure 68. Sample Planning Worksheet Map (9032-005 Director)

Plan Logical Partitioning

If logical partitions (LPARs) are used, port access restrictions are typically implemented to ensure operators (or groups of operators) do not have authorization to change attributes for ports dedicated to specific LPARs. Use a port authorization planning worksheet to plan and record the operator authorizations.

Each worksheet cell represents the intersection of an operator identification and a logical port address. Enter an **X** in a cell to indicate a specific operator is allowed to change attributes for a specific port. Record the worksheet numbers on the planning worksheet map. Figure 69 shows a sample port authorization planning worksheet.

Port Authorization Planning Worksheet

Director Identification: A00 Director Model Number: 9032-005

Configuration Matrix Name: DIR001 CUP Name: CUP0001 Worksheet A - 1 of 1

Prepared by/date: SCC 4/18/99 Date to be activated: 6/15/99

Column Heading: **Operator ID (Level 3):** Indicates authorized status (X) or unauthorized status (blank) for each operator ID

		Operator ID (Level 3)															
Port Address	Port Name	301	302	303	304												
C0	SYSA.CHPID.01	X															
C1	CNTLUNIT.01	X															
C2	PRINTER.01	X															
C3	DASD.01	X															
C4	SYSA.CHPID.02		X														
C5	CNTLUNIT.02		X														
C6	PRINTER.02		X														
C7	DASD.02		X														
C8	SYSA.CHPID.03			X													
C9	CNTLUNIT.03			X													
CA	PRINTER.03			X													
CB	DASD.03			X													
CC	SYSA.CHPID.04				X												
CD	CNTLUNIT.04				X												
CE	CONVERTER.01				X												
CF	PRINTER.04	X	X	X	X												

Notes: X = authorized operator

Figure 69. Port Authorization Planning Worksheet Example

By default, *all* operators have authorization to change attributes for *all* Director ports. During Director installation and configuration, use the Director Console application to implement the port authorization data recorded on the planning worksheet.

To grant port authorization access to specific operators, use the *Port Authorization* dialog box. To open the dialog box, select the *Port Authorization* option from the *Utility* pull-down menu. Figure 70 shows dialog box entries that correspond to entries for the port authorization planning worksheet shown in Figure 69.

For additional information about granting port authorization, refer to *Using the 9032 Model 3 ESCON Director, 9033 Model 4 ESCON Director, and 9032 Model 5 Director* (SA22-7296).

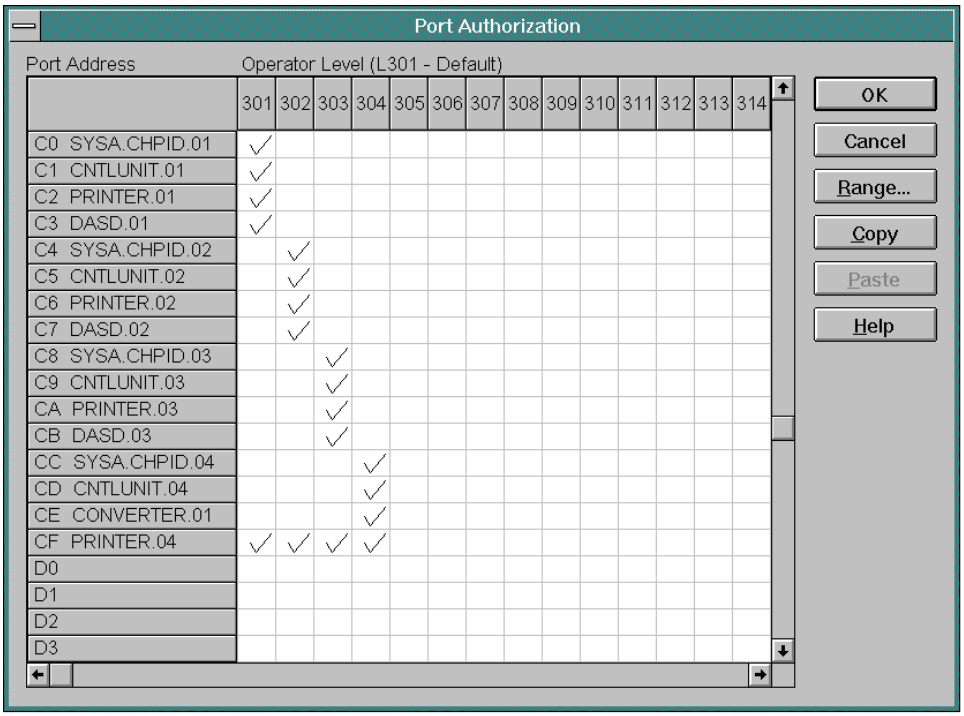


Figure 70. Port Authorization Dialog Box

Blank Planning Worksheets

Blank planning worksheets are provided at the back of the publication. Make photocopies of the worksheets as required to plan a Director configuration. The blank worksheets provided are a:

- Planning Worksheet Map
- Configuration Planning Worksheet
- Port Authorization Planning Worksheet.

Appendix C. IOCP Statement Examples

This appendix contains Director configuration examples and corresponding input/output configuration program (IOCP) statements required to define the configurations to a host system. The examples show how configuration elements are defined to an IOCP and assist in developing IOCP configuration definitions. IOCP statements are input at the host's system control program (SCP) Console. Hardware Configuration Definition (HCD) can also be used to dynamically input or change I/O definition statements. For more information on using HCD, refer to HCD-related publications listed in the preface. A basic understanding of IOCP statements is assumed. For additional IOCP information, refer to:

- "Task 13: Define the I/O Configuration for Director and Attached Control Units" on page 83.
- *Input/Output Configuration Program Users Guide* (GC38-0401).

Example 1: One Host System, Two ESCON Converters, and Three Directors

The first example defines two Enterprise Systems Connection (ESCON) Converters and three Directors to one host system. Figure 71 shows the Director configuration.

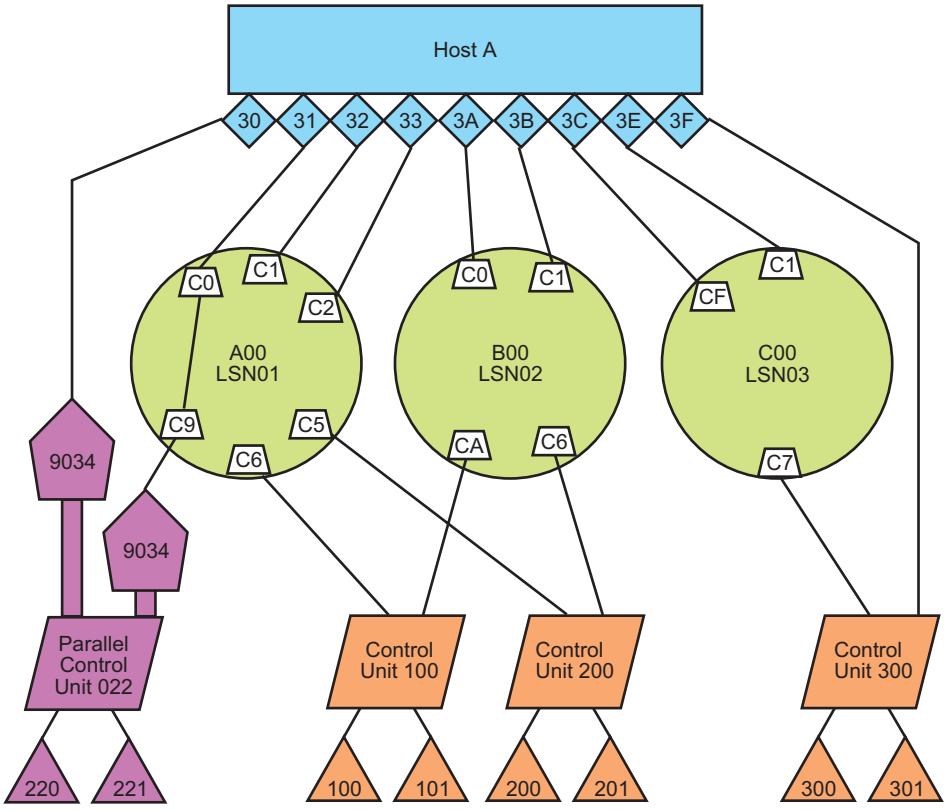


Figure 71. IOCP Configuration Example 1

In the example configuration, one dedicated connection is required for a channel path to a 9034 Converter (ports C0 to C9 on Director A00). This dedicated connection is established using the Director Console application, System Automation for Operating System/390 (SA OS/390), or ESCON Manager.

IOCP Statements

The following sections list IOCP statements that define the configuration shown in Figure 71. The statements define:

- Channel paths to 9034 Converters.
- Channel paths to ESCON control units.
- Directors.

Define Channel Paths to 9034 Converters

Channel paths to 9034 Converters are defined with the channel path identifier (CHPID) macroinstruction. The **TYPE** parameter is set to **CVC** (block mode converter operation) or **CBY** (byte mode converter operation). Because channel path 31 is connected through a Director, a **SWITCH** parameter is required. The following IOCP statements define the converter channel paths:

```
CHPID PATH=30,TYPE=CVC
CHPID PATH=31,TYPE=CVC,SWITCH=01
```

Define Channel Paths to ESCON Control Units

Channel paths to ESCON control units are also defined using the CHPID macroinstruction. The **TYPE** parameter is set to **CNC** to define an ESCON channel. Because channel path 3F is not connected through a Director, a **SWITCH** parameter is not required. The following IOCP statements define the control unit channel paths:

```
CHPID PATH=(32,33),TYPE=CNC,SWITCH=01
CHPID PATH=(3A,3B),TYPE=CNC,SWITCH=02
CHPID PATH=(3C,3E),TYPE=CNC,SWITCH=03
CHPID PATH=3F,TYPE=CNC
```

Define Directors

Directors are defined using control unit (CNTLUNIT) and input/output device (IODEVICE) macroinstructions. When defining Directors, the **CUNUMBR** parameter (A00, B00, and C00) for all corresponding CNTLUNIT and IODEVICE statements must match. The **UNIT** parameter is set to **SWCH** (switch or Director) and the **UNITADD** (unit address) is set to 00 (always 00 for a switch). The **PATH** parameter defines the channel paths to the host system. The **LINK** parameter defines the Control Unit Port (CUP), which provides the interface between the Director and host system. The logical port address for the CUP is FE. The following IOCP statements define the Directors:

```
CNTLUNIT CUNUMBR=A00,UNIT=SWCH,UNITADD=((00,1)),
PATH=(32,33),LINK=(FE,FE)
IODEVICE CUNUMBR=A00,UNIT=SWCH,ADDRESS=A00,
UNITADD=00
CNTLUNIT CUNUMBR=B00,UNIT=SWCH,UNITADD=((00,1)),
PATH=(3A,3B),LINK=(FE,FE)
IODEVICE CUNUMBR=B00,UNIT=SWCH,ADDRESS=B00,
UNITADD=00
CNTLUNIT CUNUMBR=C00,UNIT=SWCH,UNITADD=((00,1)),
PATH=(3E,3C),LINK=(FE,FE)
IODEVICE CUNUMBR=C00,UNIT=SWCH,ADDRESS=C00,
UNITADD=00
```

Example 2: Two Hosts and Two Directors

The second example defines two Directors to two host systems. Figure 72 shows the Director configuration.

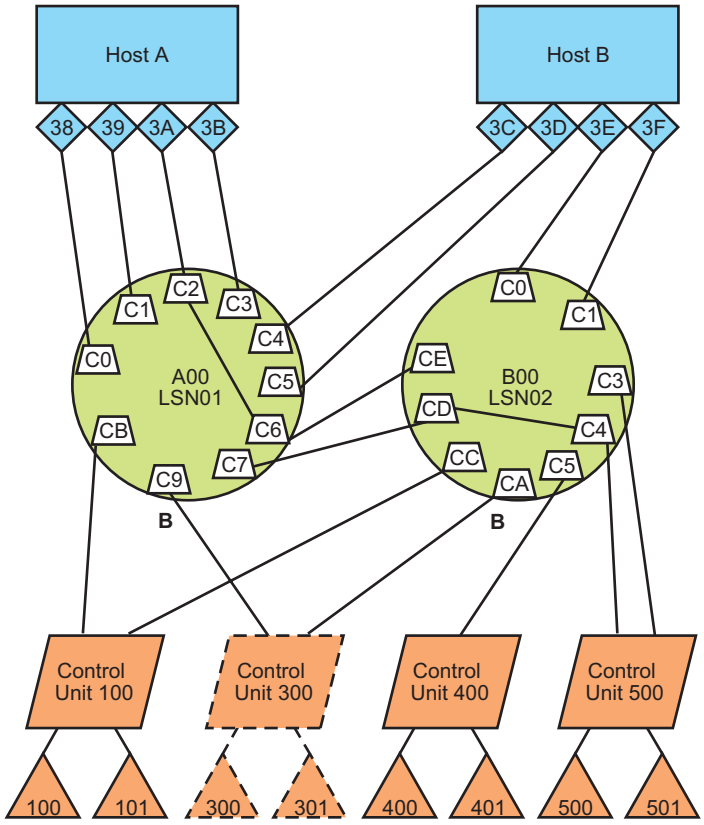


Figure 72. IOCP Configuration Example 2

In this example configuration, control unit 300 is to be installed at a later date (indicated by dashed lines). Port connections to the control unit are blocked using the Director Console application. In addition, two dedicated port connections are established (ports C2 to C6 on Director A00, and ports CD to C4 on Director B00). Dedicated connections are established using the Director Console application, SA OS/390, or ESCON Manager.

IOCP Statements (Host A)

The following sections list IOCP statements that define the configuration for host system A shown in Figure 72. The statements define channel paths to ESCON control units and Directors.

Define Channel Paths

Channel paths to ESCON control units are defined with the CHPID macroinstruction. For channel paths 38, 39, and 3A, the **TYPE** parameter is set to **CNC** to define ESCON channels. For channel path 3B, the **TYPE** parameter is set to **CTC** to define a channel-to-channel (CTC) connection. When two channels participate in CTC communication, one channel must be set to **CTC** and one channel must be set to **CNC.** When two Directors are chained, the **SWITCH** parameter points to the Director logically associated with the channel path and control unit.

For channel path 3A, the parameter points to the second Director (B00). The following IOCP statements define the control unit channel paths:

CHPID PATH=(38,39),TYPE=CNC,SWITCH=01

CHPID PATH=3A,TYPE=CNC,SWITCH=02

CHPID PATH=3B,TYPE=CTC,SWITCH=01

Define Directors

Directors are defined using CNTLUNIT and IODEVICE macroinstructions. When defining Directors, the **CUNUMBR** parameter (A00 and B00) for all corresponding CNTLUNIT and IODEVICE statements must match. The **UNIT** parameter is set to **SWCH** (switch or Director) and the **UNITADD** (unit address) is set to 00 (always 00 for a switch). The **PATH** parameter defines the channel paths to the host system. The **LINK** parameter defines the CUP, which provides the interface between the Director and host system. The logical port address for the CUP is FE. The following IOCP statements define the Directors:

CNTLUNIT CUNUMBR=A00,UNIT=SWCH,UNITADD=((00,1)),
PATH=(38,39),LINK=(FE,FE)

IODEVICE CUNUMBR=A00,UNIT=SWCH,ADDRESS=A00,
UNITADD=00

CNTLUNIT CUNUMBR=B00,UNIT=SWCH,UNITADD=((00,1)),
PATH=(3A),LINK=(FE,FE)

IODEVICE CUNUMBR=B00,UNIT=SWCH,ADDRESS=B00,
UNITADD=00

IOCP Statements (Host B)

The following sections list IOCP statements that define the configuration for host system B shown in Figure 72. The statements define channel paths to ESCON control units and Directors.

Define Channel Paths

Channel paths to ESCON control units are defined with the CHPID macroinstruction. For channel paths 3C, 3D, 3E, and 3F, the **TYPE** parameter is set to **CNC** to define ESCON channels. The following IOCP statements define the control unit channel paths:

CHPID PATH=(3C,3D),TYPE=CNC,SWITCH=01

CHPID PATH=(3E,3F),TYPE=CNC,SWITCH=02

Define Directors

Directors are defined using CNTLUNIT and IODEVICE macroinstructions. When defining Directors, the **CUNUMBR** parameter (A00 and B00) for all corresponding CNTLUNIT and IODEVICE statements must match. The **UNIT** parameter is set to **SWCH** (switch or Director) and the **UNITADD** (unit address) is set to 00 (always 00 for a switch). The **PATH** parameter defines the channel paths to the host system. The **LINK** parameter defines the CUP, which provides the interface between the Director and host system. The logical port address for the CUP is FE. The following IOCP statements define the Directors:

CNTLUNIT CUNUMBR=A00,UNIT=SWCH,UNITADD=((00,1)),
PATH=(3C,3D),LINK=(FE,FE)

IODEVICE CUNUMBR=A00,UNIT=SWCH,ADDRESS=A00,
UNITADD=00

CNTLUNIT CUNUMBR=B00,UNIT=SWCH,UNITADD=((00,1)),
PATH=(3E,3F),LINK=(FE,FE)

IODEVICE CUNUMBR=B00,UNIT=SWCH,ADDRESS=B00,
UNITADD=00

Example 3: One Host and Director with FICON and ESCON Connectivity

The third example defines one Director to one host system, with FICON and ESCON channel connectivity. Figure 73 shows the Director configuration.

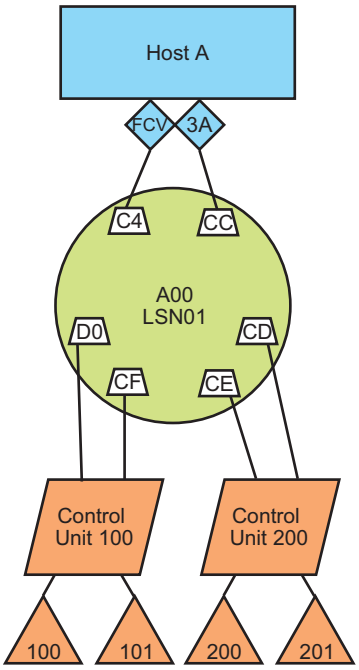


Figure 73. IOCP Configuration Example 3

IOCP Statements

The following sections list IOCP statements that define the configuration shown in Figure 73. The statements define channel paths to ESCON control units and Directors.

Define Channel Paths

Channel paths to ESCON control units are defined with the CHPID macroinstruction. For channel path 39 (labelled FCV), the **TYPE** parameter is set to **FCV** to define a FICON-to-ESCON channel conversion. For channel path 3A, the **TYPE** parameter is set to **CNC** to define an ESCON channel. The following IOCP statements define the control unit channel paths:

CHPID PATH=39,TYPE=FCV,SWITCH=01

CHPID PATH=3A,TYPE=CNC,SWITCH=01

Define the Director

The Director is defined using CNTLUNIT and IODEVICE macroinstructions. When defining the Director, the **CUNUMBR** parameter (A00) for CNTLUNIT and IODEVICE statements must match. The **UNIT** parameter is set to **SWCH** (switch or Director) and the **UNITADD** (unit address) is set to 00 (always 00 for a switch). The **PATH** parameter defines the channel paths to the host system. The **LINK** parameter defines the CUP, which provides the interface between the Director and host system. The logical port address for the CUP is FE. The following IOCP statements define the Director:

CNTLUNIT CUNUMBR=A00,UNIT=SWCH,UNITADD=((00,1)),
PATH=(39,3A),LINK=(FE,FE)

IODEVICE CUNUMBR=A00,UNIT=SWCH,ADDRESS=A00,
UNITADD=00

Appendix D. Architectural Deviations

This appendix describes deviations to the architecture of earlier Enterprise Systems Connection (ESCON) Director models.

- The 9032-003, 9033-004, and 9032-005 ESCON Directors are designed to transmit only the five port-to-port sequences defined by the *ESCON I/O Interface Specification* (SA22-7202) when ports have a dedicated connection established, including the case where a port is dedicated to itself when placed in diagnostic wrap mode. The five port-to-port sequences are:
  - — Idle (sequence of idle characters).
  - — Not-operational sequence (NOS).
  - — Offline sequence (OLS).
  - — Unconditional-disconnect (UD) sequence.
  - — Unconditional-disconnect response (UDR) sequence.

  Note: Dedicated connections apply *only* to ESCON operation. For Fibre Connection (FICON) operation (9032-005 Director only), dedicated connections *are not* supported.
- Earlier models of the 9032 and 9033 Directors are designed to transmit all port-to-port data for a dedicated connection, even if the data is not structured as one of the five sequences defined by the *ESCON I/O Interface Specification* (SA22-7202).
- The *only* FICON-capable Director is the 9032-005 Director with one or more Fibre Channel Converter (FCV) port cards installed. No earlier Director models are FICON capable.

Glossary

This glossary includes terms and definitions from:

- The *IBM Dictionary of Computing* (ZC20-1699).
- The *American National Standard Dictionary for Information Systems* (ANSI X3.172-1990), copyright 1990 by the American National Standards Institute (ANSI). Copies can be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018. Definitions from this text are identified by the symbol (*A*).
- *ANSI/EIA Standard - 440A: Fiber Optic Terminology*, copyright 1989 by the Electronic Industries Association (EIA). Copies can be purchased from the Electronic Industries Association, 2001 Pennsylvania Avenue N.W., Washington, D.C. 20006. Definitions from this text are identified by the symbol (*E*).
- The *Information Technology Vocabulary*, developed by Subcommittee 1 (SC1), Joint Technical Committee 1 (JTC1), of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Definitions of published parts of this vocabulary are identified by the symbol (*I*). Definitions taken from draft international standards, committee drafts, and working papers developed by ISO/IEC SC1/JTC1 are identified by the symbol (*T*), indicating that final agreement has not been reached among the participating national bodies of SC1.

The following cross references are used in this glossary:

Contrast with - Refers to a term with an opposite or substantively different meaning.

See - Refers the reader to multiple-word terms in which this term appears.

See also - Refers the reader to terms with a related, but not synonymous, meaning.

Synonym for - Indicates the term has the same meaning as a preferred term defined in the glossary.

A

ac. See *alternating current*. Contrast with *dc*.

accelerator. A short-cut keystroke method to perform a menu operation. Menu options may have accelerator keys listed to the right of the menu option. Use the listed accelerator to perform the menu option's function when no menu is selected for the window.

active configuration. In an ESCON or FICON environment, the Director configuration that is determined by the status of the connectivity attributes. Contrast with *saved configuration*.

adapter. (1) Hardware that provides transitional functions between multiple devices. (2) In a fiber-optic environment, the link hardware used to join different optical fiber connector types. Contrast with *coupler*.

address. (1) To refer to a device or an item of data by its address *(I, A)*. (2) The location in a computer where data is stored. (3) In data communication, the unique code assigned to each device or workstation connected to a network. (4) The identifier of a location, source, or destination.

address name. See *port name*.

address resolution protocol (ARP). The protocol by which a host computer maintains a cache of address translations, allowing the physical address of the computer to be derived from the Internet address.

administrative password authorization. The level-one password authorization that allows access to a Director to perform administrative, maintenance, and operator functions. Contrast with *maintenance password authorization* and *operator password authorization*.

allowed connection. In a Director, the attribute that when set, establishes dynamic connectivity capability. Contrast with *prohibited connection*.

alternating current (ac). Electric current that reverses direction at regular sinusoidal intervals. Contrast with *direct current*.

American National Standard Code for Information Interchange (ASCII). A standard character set consisting of 7-bit coded characters (8-bit including parity check) used for information exchange between systems and equipment.

American National Standards Institute (ANSI). A national organization consisting of producers, consumers, and general interest groups that establishes procedures by which accredited organizations create and maintain industry standards in the United States (*A*).

ANSI. See *American National Standards Institute*.

AOC/MVS. See *Automated Operations Control for MVS*.

application. (1) The use to which a data processing system is put, for example, a payroll application, an airline reservation application, or a network application. (2) A collection of software components used to perform specific types of work on a computer.

application-specific integrated circuit (ASIC). A circuit designed for a specific application or purpose, such as implementing the lower-layer Fibre Channel protocol (FC-0). ASICs differ from general-purpose devices such as memory chips or microprocessors.

AR. IBM parts list acronym for *A*s *R*equired. AR indicates the parts quantity is not the same for all machines.

ARP. See *address resolution protocol.*

ASCII. See *American National Standard Code for Information Interchange.*

ASIC. See *application-specific integrated circuit*.

attribute. The connection status of the address on a configuration matrix; allowed, blocked, dedicated, or prohibited.

Automated Operations Control for MVS (AOC/MVS). An IBM-licensed program that automates routine processor management tasks, including, shutdown, recovery, startup, and initialization procedures, and automates operator responses to messages. AOC/MVS functions are now integrated into SA OS/390.

B

backup diskette. A diskette that contains duplicate information from an original diskette. The backup diskette is used in case information on the original diskette is unintentionally changed or destroyed.

bit. Acronym for *bi*nary digi*t*, the smallest unit of data in computing, with a value of zero or one. Abbreviated as lowercase *b*.

blocked. In a Director, the attribute that when set, removes the communication capability of a specific port. Contrast with *unblocked*.

bridge. (1) An attaching device that connects two LAN segments to allow the transfer of information from one LAN segment to the other. A bridge can connect the LAN segments directly by network adapters and software in a single device, or can connect network adapters in two devices through software and use of a telecommunication link between the two adapters. (2) A functional unit that connects two LANs that use the same logical link control protocol, but may use different media access control protocols *(T)*. Contrast with *router.*

British Thermal Unit (BTU). The quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

BTU. See *British Thermal Unit.*

button. On a graphical user interface, a virtual display element (a rectangle containing text) that is selected with an input device and programmed to operate as a function key *(T)*.

byte. An 8-bit quantity that computers treat as a single unit, often called an octet or word. Abbreviated as uppercase *B*. See also *octet*.

C

cascade. Windows on a console are cascaded to show all open windows in a way that allows any window to be viewed by clicking its title (window is brought to the front). Cascaded windows are overlapped. To cascade windows, use the *Window* pull-down menu and select *Cascade*. Contrast with *Tile*.

CBY. Acronym for *channel operations running in byte mode* (ESCON channel attached to ESCON converter), and specifies the I/O operation mode for the channel path under the IOCP CHPID statement *Type* parameter. Contrast with *CVC*.

CD-ROM. See *compact disk read-only memory.*

cell. On the Director matrix window, a cell is the intersection point between a horizontal port address and a vertical port address. A selected cell is indicated by the cell cursor.

cell cursor. A white square on the Director's matrix window indicating the selected intersection cell. Attribute modifications that require two port addresses, such as prohibit or dedicate, are performed on the selected cell.

chained. In an ESCON environment, means that two Directors are physically attached.

channel. A system element that controls one channel path, and whose mode of operation depends on the type of hardware attached. Each channel controls an I/O interface between the channel control element and the attached control units.

channel-attached. (1) Pertaining to direct attachment of devices by data I/O channels to a computer. (2) Pertaining to devices attached to a control unit by cables, not telecommunication lines.

channel path (CHP). A single interface between a central processor and one or more control units, along which signals and data is sent to perform I/O requests.

channel path identifier (CHPID). In a channel subsystem, a value assigned to each channel path of the system that uniquely identifies the path.

channel subsystem (CSS). A collection of subchannels that direct the flow of information between I/O devices and main storage, relieve the processor of communication tasks, and perform path management functions.

CHP. See *channel path*.

CHPID. See *channel path identifier*.

Class 3 Fibre Channel service. Class 3 service duplicates the functions of a packet-switched network and allows multiple nodes to share links by multiplexing transmitted data. Class 3 service does not acknowledge data frame delivery. Class 3 service is supported by the 9032-005 Director.

CNC. Acronym for *ESCON channel-attached to ESCON-capable* device**,** and specifies the I/O operation mode for the channel path under the IOCP CHPID statement *Type* parameter.

column. Vertical arrangement of data. Contrast with *row*.

command. (1) A character string from an external source to a system that represents a request for system action. (2) A request from a terminal to perform an operation or execute a program. (3) A value sent through an I/O interface from a channel to a control unit that specifies the operation to be performed.

compact disk read-only memory (CD-ROM). High capacity read-only memory in the form of an optically read disk.

component. (1) Hardware or software that is part of a functional unit. (2) A functional part of an operating system; for example, the scheduler or supervisor.

concurrent maintenance. The ability to perform maintenance tasks, such as the removal and replacement of FRUs, while the Director is operating. In addition, fiber-optic cables can be connected or disconnected from ports while the Director is operating. See also *hot pluggable* and *nondisruptive installation*.

configuration matrix. A configuration matrix defines a Director's address configuration. The three matrix types are new matrix, saved matrix, and active matrix. Synonym for *matrix*.

connectivity attribute. The characteristic that determines port status for the Director. See *allowed connection, dedicated connection, prohibited connection, blocked,* and *unblocked*.

connectivity capability. (1) The capability that allows attachment of a device to a system without requiring physical reconfiguration of either the device or the interconnections. (2) The Director capability that allows logical manipulation of link connections to provide physical device attachment. See also *configuration matrix, connectivity control,* and *dynamic connection*.

connectivity control. In a Director, the method used to change port connectivity attributes and determine the communication capability of the link attached to the port.

connector. See *optical fiber connector*.

Console. The Director device used to perform administrative, maintenance, and operations tasks. Synonym for *display device* or *terminal*.

Console Audit log. A log that tracks and records Director Console operator activities, including changing passwords, adding or deleting LIC versions, adding or deleting Director definitions, and entering or exiting the application. Each log entry contains a description of the action performed, an action identifier, and the date and time the action occurred.

Console Error log. A log of abnormal errors that were encountered by the Director Console software during operations, but did not cause Console failure. For example, errors caused by insufficient PC memory are logged.

Console library. An information database for the Director, maintained by the Console application. The library is stored on the PC platform running the Console application, and contains logs, LIC versions, and saved configurations.

Control Processor (CTP) card. In the Director, the circuit card that provides the processor and associated logic. The card initializes hardware after power on. While in operation, the card supports the switch CUP, maintenance port, and operator panel, and supports port exception handling and error recovery. It also contains the fiber channel controller for I/O requirements.

control program. A computer program that schedules and supervises execution of programs in a computer system *(I)*.

control unit. Hardware that controls the reading, writing, or display of data at one or more I/O units.

Control Unit Port (CUP). An internal Director port (on the CTP card and labelled *FE*) that communicates with channels to report error conditions and link initialization.

converter. In an ESCON environment, a device that allows attachment of parallel channel (bus and tag) I/O control units to ESCON channels.

coupler. In a fiber-optic environment, the link hardware used to join optical fiber connectors of the same type. Contrast with *adapter*.

CSS. See *channel subsystem*.

CTC. Acronym for an ESCON channel attached to another ESCON channel (*channel-to-channel*), and specifies the I/O mode of operation for the channel path under the IOCP CHPID statement *Type* parameter.

CTP. See *Control Processor card.*

CUP. See *Control Unit Port*.

CVC. Acronym for *channel operations running in block mode* (ESCON channel attached to ESCON converter), and specifies the I/O operation mode for the channel path under the IOCP CHPID statement *Type* parameter. Contrast with *CBY*.

D

DASD. See *direct access storage device*.

dB. See *decibel.*

dBm. Decibels referenced to one milliwatt. Zero dBm equals one milliwatt, with a logarithmic relationship as the value increases.

dc. See *direct current*. Contrast with *ac.*

DCAF. Acronym for IBM-licensed *D*istributed *C*onsole *A*ccess *F*acility software. Through DCAF, the Director Console is accessed and controlled by a remote PC.

decibel (dB). A standard unit used to express gain or loss of optical power, expressed as the ratio of input power to output power on a logarithmic basis.

dedicated connection. A connection between two Director ports not affected by information in the transmission frames. The connection restricts those ports from communicating with any other port, and can be established only as a result of actions performed by a host control program or at the Director Console. Contrast with *dynamic connection*.

default. Pertaining to an attribute, value, or option assumed by a system when none is specified *(I)*.

destination. A point or location, such as a processor, Director, or Console, to which data is transmitted.

device. Mechanical, electrical, or electronic hardware with a specific purpose.

device number. In a channel subsystem, four hexadecimal digits that uniquely identify an I/O device.

device port (DVP) card. The Director's hardware interface for ESCON fiber-optic media. Each port card contains either LED or XDF laser port interfaces. See also *port card*.

dialog box. A pop-up window on a console with information messages or fields to be modified or completed with desired options.

diagnostics. (1) The process of investigating the cause or nature of a problem in a product or system. (2) Modules or tests used by computer users and service personnel to diagnose hardware problems.

direct access storage device (DASD). A storage device that provides direct access to data, and in which access time is independent of data location.

direct current (dc). Electric current that continuously flows in one direction. Contrast with *alternating current*.

Director. A device that provides dynamic switching of fiber-optic connections between ESCON channel paths and control units, and FICON channel paths and ESCON control units. The Director also extends the operational distance between processors (ESCON or FICON) and ESCON control units.

Director Audit log. A log containing summaries of actions taken by the Console operator or the host-based software, recording an audit trail of changes affecting the Director. For example, prohibiting or dedicating an address intersection is recorded (with the date and time).

Director Event log. A log of abnormal hardware or software incidents that are reported by the Director during operations. For example, a CTP card failure is logged as a hardware incident. A corrupt configuration file is logged as a software incident.

Director LIN log. A log of abnormal link incidents reported by the Director during operations. For example, a loss of synchronization condition or a bit error rate threshold exceeded condition is reported as a link incident.

disconnected. In a Director, the attribute that when set, disables a dedicated connection. Contrast with *connected*.

diskette. A thin magnetic disk enclosed in a plastic jacket, which is removable from a computer and is used to store and transport data.

diskette drive. The hardware mechanism by which a computer reads data from and writes data to removable diskettes.

display device. A computer peripheral that presents information on a screen. A synonym for *Console* or *terminal*.

distribution panel. In an ESCON environment, a panel that provides a central location to attach trunk and jumper cables, and is mounted in a rack, wiring closet, or on a wall.

DRAM. See *dynamic random access memory.* See also *RAM* and contrast with *SRAM.*

duplex. In data communication, pertaining to transmission in which data is sent and received at the same time. Contrast with *half-duplex* and *simplex*.

duplex connector. An optical fiber component that terminates jumper cable fibers in one housing and provides physical keying for attachment to a duplex receptacle. See also *Fibre Channel Standard connector*, *multimode connector*, and *subscriber connector*.

duplex receptacle. A fixed or stationary optical fiber component that provides a keyed attachment method for a duplex connector.

DVP card. See *device port card*.

dynamic connection. In a Director, a connection between two ports established by the Director that appears as one continuous link when active. The duration of the connection depends on the protocol defined for the frames transmitted and on the state of the ports. Contrast with *dedicated connection*.

dynamic connectivity. The Director capability that allows connections to be enabled or disabled at any time.

dynamic random access memory (DRAM). Random access memory that resides in a cell comprised of a capacitor and transistor. DRAM data deteriorates (i.e. is dynamic) unless the capacitor is periodically recharged by the controlling microprocessor. DRAM is slow, but relatively inexpensive. See *random access memory* and contrast with *static random access memory*.

E

EAF. See *enhanced availability feature*.

EBCDIC. See *extended binary-coded decimal interchange code*.

EC. See *engineering change*.

EIA. See *Electronic Industries Association*. See also *TIA*.

electromagnetic interference (EMI). Refers to undesirable electromagnetic emissions generated by solar activity, lightning, and electronic devices. The emissions interfere with or degrade the performance of another electronic device.

Electronic Industries Association (EIA). The governing body that publishes recommended standards for physical devices and associated interfaces. For example, RS-232 is the EIA standard that defines computer serial port connectivity. See also *TIA*.

electrostatic discharge (ESD). The undesirable discharge of static electricity that can damage or degrade electronic circuitry.

ELP. See *establish logical path*.

EMI. See *electromagnetic interference.*

engineering change (EC). A change to the design, construction, or operation of a hardware or software system that improves the operation, reliability, or serviceability of the system. The EC process involves submission of a formal proposal that is reviewed and authorized. Implementation of an authorized EC is carefully tracked and controlled.

Enhanced Availability Feature (EAF). Enhanced availability features are backup FRUs that are ordered and installed in the Director to provide redundancy and reduce disruption in case of failure.

Enterprise Systems Architecture (ESA). A computer architecture introduced by IBM in 1988 as ESA/370. The architecture added access registers to improve virtual memory management and increase storage from 2 gigabytes to 16 terabytes. The architecture was enhanced with the introduction of ESA/390 in 1990.

Enterprise Systems Connection (ESCON). An IBM architecture, technology, and set of products and services introduced in 1990 that provides a dynamically connected environment using fiber-optic cables as the data transmission medium.

erase. To remove electrically or magnetically stored data, leaving the space where the data was stored unoccupied.

EREP. Acronym for IBM's *E*nvironmental *R*ecord *E*diting and *P*rinting software. Through EREP, data contained in a system recorder file is made available for maintenance analysis.

error message. An indication an error is detected. See also *information message* and *warning message*.

ESA. See *Enterprise Systems Architecture*.

ESCON. See *Enterprise Systems Connection*.

ESCON channel. A data communications channel that uses ESCON technology with fiber-optic cables as the transmission medium, rather than copper bus and tag cables. Contrast with *FICON channel* and *parallel channel*.

ESCON Converter. See *converter*.

ESCON Manager. An IBM-licensed program that provides host control and intersystem communication with the Director connectivity operations. ESCON Manager was discontinued in 1998 and its functions are now integrated into SA OS/390.

ESD. See *electrostatic discharge*.

establish logical path (ELP). An ESCON protocol command issued from host to establish a connection between host and port or between two ports on a Director. The command frame contains a destination and source address.

event code. A multi-digit code that displays at the operator panel or Director Event log. The code is used by maintenance personnel to determine corrective actions to be taken.

extended binary-coded decimal interchange code (EBCDIC). A coded character set comprised of 256 8-bit characters.

Extended Distance Feature (XDF). A means to extend the propagation distance of a fiber-optic signal. Essentially a singlemode laser ESCON port.

F

fabric. A network of one or more switch elements that can transmit, route, and receive data using the Fibre Channel protocol. A fabric can support multiple, concurrent Fibre Channel connections.

fabric port (F_port). A port on a switch to which N_ports are directly connected. Contrast with *node port*. See also *thin fabric port*.

FC-0. The Fibre Channel layer that describes the physical link between two ports, including the transmission media, transmitter and receiver circuitry, and interfaces.

FC-1. The Fibre Channel layer that describes the IBM-patented 8B/10B transmission code that provides DC balance in the transmitted bit stream, separates control bytes from data bytes (for simplification), and detects transmit and receive errors.

FC-2. The Fibre Channel layer that specifies the signaling protocol, rules, and mechanisms required to transfer data blocks. The FC-2 layer is very complex, and provides different classes of service, packetization, sequencing, error detection, segmentation, and reassembly of transmitted data.

FC-3. The Fibre Channel layer that provides a set of services common across multiple N_ports of a Fibre Channel node. The services are not commonly used and are essentially reserved for Fibre Channel architecture expansion.

FC-4. The Fibre Channel layer that provides mapping of Fibre Channel capabilities to upper level protocols, including IP and SCSI.

FC-PH. See *Fibre Channel Physical and Signaling Interface*.

FCS. See *Fibre Channel Standard*.

FCS Connector. See *Fibre Channel Standard connector*.

FCV. (1) Acronym for *Fibre Channel Converter* port card, the Director's hardware interface for FICON fiber-optic media. See also *port card*. (2) Acronym for *FICON channel-attached converted to ESCON-capable* device**,** and specifies the I/O operation mode for the channel path (using an FCV port card) under the IOCP CHPID statement *Type* parameter.

feature. A part of an IBM-licensed product that may be ordered separately or as an option by the customer.

fiber. See *optical fiber*.

fiber-optic cable. See *optical cable*.

fiber optics. The branch of optical technology concerned with the transmission of radiant power through fibers of transparent materials such as glass, fused silica, or plastic *(E)*. Telecommunication applications of fiber optics use optical fibers. A single fiber or a nonspatially aligned fiber bundle is used for each information channel. Such fibers are often called optical fibers to differentiate them from fibers that are used in noncommunication applications.

Fiber Transport Services (FTS). An IBM service that provides installation of fiber-optic cable trunk lines and strategically-located distribution panels in a data center. Optically-connected equipment can then be installed with either short jumper cables, harnesses, or factory-terminated trunk cables.

Fibre Channel Converter (FCV) port card. The Director's hardware interface for FICON fiber-optic media. See also *port card*.

Fibre Channel Standard (FCS). ANSI standard that provides a common, efficient data transport system that supports multiple protocols. The architecture integrates both channel and network technologies, and provides active, intelligent interconnection among devices. All data transmission is isolated from the control protocol, allowing use of point-to-point, arbitrated loop, or switched fabric topologies to meet the needs of an application.

Fibre Channel Standard (FCS) connector. A connector that terminates fiber-optic jumper cables in a pair of connected housings (one transmit and one receive), and provides physical keying for attachment to an SC receptacle. An FCS connector is synonymous with an SC connector. An FCS connector can attach to an FCV port card or XDF laser port card. See also *multimode connector* and *subscriber connector*.

Fibre Channel Physical and Signaling Interface (FC-PH). The ANSI document that specifies the FC-0 (physical signaling), FC-1 (data encoding), and FC-2 (frame construct) layers of the Fibre Channel protocol.

Fibre Connection (FICON). An IBM set of products and services introduced in 1999 that is based on the Fibre Channel Standard. FICON technology uses fiber-optic cables as the data transmission medium, and significantly improves I/O performance (including one Gbps bidirectional data transfer). FICON is designed to coexist with ESCON channels, and FICON-to-ESCON control unit connections are supported.

FICON. See *Fibre Connection*.

FICON channel. A data communications channel that uses FICON technology (rather than ESCON technology) with fiber-optic cables as the transmission medium. Contrast with *ESCON channel* and *parallel channel*.

Field Replaceable Unit (FRU). An assembly that is removed and replaced in its entirety when any one of its components fails. A logic card is an example of a FRU.

FLASH memory. Reusable nonvolatile memory that is organized as segments for writing, and bytes or words for reading. FLASH memory is faster than read-only memory, but slower than random access memory.

FLOGI. Acronym for the fabric login command. The command establishes the initial operating parameters and topology for a fabric. The command is accepted by an *F_port* or *thin F_port*.

F_port. See *fabric port.* See also *thin F_port*.

FRU. See *Field Replaceable Unit*.

FTS. See *Fiber Transport Services*.

G

GB. See *gigabyte*.

Gbps. Acronym for *g*iga*b*its *p*er *s*econd.

GHz. See *gigahertz*.

gigabyte (GB). A unit of measure for data storage, equal to 1,073,741, 824 bytes. Generally approximated as one billion bytes.

gigahertz (GHz). One billion cycles per second (hertz).

GND. Acronym for *g*rou*nd* (e.g. that portion of a conducting circuit connected to the earth).

graphic display. The Director's configuration matrix may be displayed in a graphic mode on the Console. This mode shows all connection types as unique graphic symbols in the matrix region of the window. When graphic display mode is disabled, only prohibited connections appear.

graphical user interface (GUI). A GUI is a visually oriented interface where the user interacts with representations of real-world objects displayed on the computer screen. Interactions with such objects produce actions that are intuitive to the user.

GUI. See *graphical user interface*.

H

half-duplex. In data communication, pertaining to transmission in only one direction at a time. Contrast with *duplex*, synonym for *simplex*.

hardware. Physical equipment (Director or Console) as opposed to computer programs, procedures, rules, and associated documentation. Contrast with *software*.

Hardware Audit log. A log that records all configuration changes for Director FRUs. Each entry contains a FRU name, position, status, part number, serial number, and date and time a change was detected.

Hardware Configuration Definition (HCD). A program that defines all available I/O devices and channel paths to a processor system and the MVS operating system. This program replaced the Input Output Configuration and MVS Configuration Programs starting with MVS/ESA Version 4.0.

hardware information block (HIB). A Director status register that defines if a port is installed, has a dynamic connection, has a link failure, is blocked, or is offline. The MXC reads the register in response for connection requests to the port.

HCD. See *Hardware Configuration Definition.*

Hertz (Hz). A unit of frequency equal to one cycle per second.

hexadecimal. A numbering system with base of sixteen; valid numbers use the numbers 0 through 9 and characters A through F, where A represents 10 and F represents 15.

HIB. See *hardware information block.*

host-based software. Pertains to ESCON Manager, the software used in configuring and managing multiple Directors on the network.

host processor. (1) A processor that controls all or part of a user application network *(T)*. (2) In a network, the processing unit in which resides the access method for the network.

hot pluggable. Pertains to a FRU that is removed and replaced from a device while the device is powered on and operational. See also *concurrent maintenance* and *nondisruptive installation*.

Hz. See *Hertz.*

I

ID. See *identifier*.

identifier (ID). (1) One or more characters used to identify or name a data element and possibly to indicate certain properties of that data element *(T)*. (2) A sequence of bits or characters that identifies a program, device, or system to another program, device, or system. (3) A user-defined symbolic name of 24 characters or less that identifies a Director. See also *password identifier* and *port name*.

IEEE. See *Institute of Electrical and Electronics Engineers.*

IML. See *Initial Machine Load*.

information message. A message informing a user that a function is performing normally or has completed normally. User acknowledgment may not be required, depending on the message. See also *error message* and *warning message*.

Initial Machine Load (IML). Process of loading the operating system and applications software from secondary storage to a central processor after machine power-on. Sometimes referred to as booting the machine.

Initial Program Load (IPL). (1) Initialization procedure causing an operating system to commence operation. (2) Process by which a configuration image is loaded into storage at the beginning of a work day or after a system malfunction. (3) Process of loading system programs and preparing a system to run jobs.

Initial Program Load (IPL) file. Information stored in Director's nonvolatile memory that contains default connection configurations. The Director loads the file for operation when powered on. The file can be modified or another file can be specified as the IPL file.

input/output (I/O). (1) Pertaining to a device whose parts can perform an input process and an output process at the same time *(I)*. (2) Pertaining to a functional unit or channel involved in an input process, output process, or both, concurrently or not, and to the data involved in such a process. (3) Pertaining to input, output, or both.

input/output configuration. A collection of channel paths, control units, and I/O devices that attaches to a processor.

input/output configuration data set (IOCDS). A data set that contains an I/O configuration definition built by the IOCP.

Input/Output Configuration Program (IOCP). A program that defines all available I/O devices and channel paths to a processor system. Replaced by the Hardware Configuration Definition Program starting with MVS/ESA Version 4.0.

input/output controller (IOC). A functional unit in a data processing system that controls one or more devices or units of peripheral equipment.

Institute of Electrical and Electronics Engineers (IEEE). A technical professional society that promotes the development and application of electrotechnology and allied sciences.

interface. (1) A shared boundary between two functional units, defined by functional, signal, or other characteristics. The concept includes the specification of the connection of two devices having different functions *(T)*. (2) Hardware, software, or both, that link systems, programs, or devices.

Internet Protocol (IP). Network layer for the TCP/IP protocol used on Ethernet networks. IP provides packet routing, fragmentation, and reassembly through the data link layer.

I/O. See *input/output.*

IOC. See *input/output controller*.

IOCDS. See *input/output configuration data set*.

IOCP. See *Input/Output Configuration Program*.

IP. See *Internet Protocol.*

IP address. A unique string of numbers that identifies a device on the Internet. The address consists of four groups of numbers delimited by periods (dotted quad). All resources on the Internet must have an IP address.

IPL. See *Initial Program Load*.

ISA. See *Industry Standard Architecture.*

ITE. Acronym for *I*nformation *T*echnology *E*quipment.

J

jack. A hardware-connecting device to which the wire or wires of a circuit are attached, and that is arranged for the insertion of a plug.

jumper cable. In a fiber-optic environment, a cable having two conductors that provide a physical connection between two devices, or between a device and a distribution panel. Contrast with *trunk cable*.

K

kB. See *kilobyte*.

kilobyte (kB). A unit of measure for data storage, equal to 1,024 bytes. Generally approximated as one thousand bytes.

L

LAN. See *Local Area Network.*

LAN Adapter Installation and Diagnostics (LANAID). An IBM-licensed installation tool providing a graphical and command-line interface for manual installation and configuration of a Token Ring LAN or LAN devices.

LAN Adapter and Protocol Support (LAPS). IBM - licensed software that manages and controls network adapter cards in a device, including the device drivers for those cards as well as the protocols that are used to communicate with other devices on the network.

LANAID. See *LAN Adapter Installation and Diagnostics.*

LAPS. See *LAN Adapter and Protocol Support.*

laser. Acronym for *L*ight *A*mplification by *S*timulated *E*mission of *R*adiation. A device that produces optical radiation using a population inversion to provide amplification and an optical resonant cavity to provide positive feedback. Laser radiation is highly coherent temporally, or spatially, or both *(E)*.

LCD. See *liquid crystal display.*

LED. See *light-emitting diode.*

LIC. See *Licensed Internal Code*.

Licensed Internal Code (LIC). Software provided for use on IBM machines and licensed to customers under the terms of lBM's customer agreement.

light-emitting diode (LED). A semiconductor chip that emits visible or infrared light when activated. Often used as an indicator light on computer hardware.

LIN. See *link incident*.

link. In a fiber-optic environment, the physical connection and transmission medium between an optical transmitter and receiver. A link consists of two conductors, one used for sending and the other for receiving, thereby providing a duplex communication path.

link address. In an ESCON environment, an address assigned at initialization that identifies a channel or control unit and allows it to send and receive transmission frames and perform I/O operations. See also *port address*.

link incident. A failure associated with a link, rather than a hardware or software failure associated with the Director. Examples of link incidents include an invalid sequence, sequence timeout, bit error rate threshold exceeded, loss of signal or synchronization, or a not-operational sequence recognized.

LMA Code. See *Loader/Monitor Area Code*.

Loader/Monitor Area (LMA) Code. Code that resides in the loader/monitor area of the CTP card, and provides input/output functions (through a maintenance port, operator panel, or Console), terminal window command functions, power-on diagnostics, FRU power-on hours, data read/write control, and LMA/LIC download functions.

local. Synonym for channel-attached.

Local Area Network (LAN). A computer network in a localized geographical area (e.g. a building or campus), and whose communications technology provides a high-bandwidth medium to which many nodes are connected.

log. (1) To record or print all messages on a system printer. (2) A record or compilation of system events that have occurred.

logical partition (LPAR). A processor hardware subset defined to support the operation of a system control program, and can be used without affecting any of the applications in another partition.

logical switch number (LSN). A two-digit number used by the IOCP to identify a Director.

LPAR. See *logical partition*.

LSN. See *logical switch number*.

M

MAC. See *Media Access Control.*

MAC Address. The hardware address of a device connected to a shared network.

Maintenance Agreement Qualification (MAQ). After a period of equipment service by another vendor, the MAQ is the verification procedure that ensures the equipment is eligible for maintenance by IBM customer engineers.

Maintenance Analysis Procedure (MAP). A written or online set of procedures that guide maintenance personnel through step-by-step instructions for hardware fault isolation, repair, and verification.

maintenance password authorization. The level-two password authorization that allows access to a Director to perform maintenance and operator functions. Contrast with *administrative password authorization* and *operator password authorization*.

management information system (MIS). (1) management performed using automatic data processing *(I, A)*. (2) An information system that aids in performing management functions *(A)*.

MAP. See *Maintenance Analysis Procedure*

MAQ. See *Maintenance Agreement Qualification.*

matrix. A matrix defines a Director's address configuration. The three matrix types are new matrix, saved matrix, and active matrix. Synonym for *configuration matrix*.

Matrix Controller-2 (MXC2) card. A Director circuit card that replaces a standard MXC card and upgrades the Director to support FICON operation.

Matrix Controller/Matrix Switch (MXC/MXS) card. A set of Director circuit cards that makes decisions on dynamic connection requests between channels, control units attached to the Director, and provides for connection paths between ports.

MAU. See *Multistation Access Unit*.

MB. See *megabyte*.

Mbps. Acronym for *m*ega*b*its *p*er *s*econd.

MBps. Acronym for *m*ega*b*ytes *p*er *s*econd.

MCL. See *microcode level.*

Media Access Control (MAC). In LANs, the sublayer of the data link control layer that supports media dependent functions and uses the functions of the physical layer to provide services to the logical link control sublayer. The MAC sublayer includes a method of determining when a device has access to the transmission media.

megabyte (MB). A unit of measure for data storage, equal to 1,048,576 bytes. Generally approximated as one million bytes.

menu. A list of items displayed on the Console from which a user can make a selection. See also *pull-down menu*.

menu bar. The menu bar is located across the top of a Console window. Pull-down menus are displayed by clicking on the menu bar option with the mouse, or by pressing **Alt** with the underlined letter of the name for the menu bar option.

MES. See *miscellaneous equipment specification*.

microcode level (MCL). The release level (1.0, 1.2, 2.0, etc.) of a set of developed and tested microcode instructions that is made public.

micrometer. One millionth of a meter.

MIF. See *Multiple Image Facility*.

MIS. See *management information system.*

miscellaneous equipment specification (MES). A set of stand-alone instructions provided by IBM that supports the installation of a hardware or software replacement or upgrade.

modem. Acronym for *mo*dulator/*dem*odulator. A device that converts digital computer data to an analog signal that is transmitted over a telecommunication line and converts a received analog signal to digital data for the computer.

mouse. In computer graphics, a hand-held locating, pointing, and selection device. A mouse usually contains a control ball, and is operated by moving it on a flat surface.

MTP. See *multifiber terminated push-on*.

multifiber terminated push-on (MTP). A 12-fiber quick-disconnect push-on connector that provides fast and effective reconnection of processors and devices without disturbing channel hardware configurations.

multimode optical fiber. A graded-index or step-index optical fiber that allows more than one mode (light path) to propagate. Contrast with *singlemode optical fiber*.

Multiple Image Facility (MIF). An IBM-licensed program that allows multiple logical partitions to concurrently share native ESCON or FICON channels. This reduces the number of channel paths required to support a configuration.

Multiple Virtual Storage (MVS). The generic name for an IBM-licensed operating system used on System/370 and later mainframe processors. See also *virtual storage* and *OS/390.*

Multistation Access Unit (MAU). A cabling or wiring attachment device that can connect up to eight nodes to an IBM Token Ring network.

MVS. See *Multiple Virtual Storage*.

MVS Configuration Program (MVSCP). A program that defines all available I/O devices and channel paths to the MVS operating system. Replaced by Hardware Configuration Definition Program starting with MVS/ESA Version 4.0.

MVSCP. See *MVS Configuration Program.*

MVS/ESA. Acronym for *M*ultiple *V*irtual *S*torage/ *E*nterprise *S*ystems *A*rchitecture. See also *MVS* and *ESA*.

MXC2 card. *See Matrix Controller-2 card.*

MXC/MXS card. *See Matrix Controller/Matrix Switch card.*

N

network. An arrangement of hardware, software, nodes, and connecting branches that comprises a data communication system. The ISO seven-layer specification partitions a computer network into independent modules from the lowest (physical) layer to the highest (application) layer.

new matrix. A Director's saved matrix that is blank (contains default configuration attributes) but does not have a saved name. It is used for creating a new configuration, and updating a saved matrix the first time configuration changes are saved. Contrast with *saved matrix*.

node. (1) In a network, a point at which one or more functional units connect channels or data circuits *(I)*. In network topology, the point at an end of a branch *(T)*.

node port (N_port). A port on a computer, storage system, or other end device through which the device performs Fibre Channel communication. Contrast with *fabric port*. See also *thin fabric port*.

nondisruptive installation. The installation of units or FRUs while normal equipment operation continues without interruption. Contrast with *nondisruptive removal*. See also *concurrent maintenance* and *hot pluggable*.

nondisruptive removal. The removal of units or FRUs without interrupting normal equipment operation. Contrast with *nondisruptive installation*. See also *concurrent maintenance* and *hot pluggable*.

nonvolatile. A term used to describe a data storage device or memory chip that retains its contents when power is removed or off.

NP. IBM parts list acronym for *N*ot *P*rocurable. NP indicates the part is not procurable and the next higher assembly should be ordered.

N_port. See *node port.*

NR. The IBM parts list acronym for *N*ot *R*ecommended. NR indicates the part is procurable but is not recommended, and the next higher assembly should be ordered.

O

octet. An 8-bit quantity, often called a byte or word, and often used to explain specific segments of a LAN address. A LAN address is a 32-bit number in decimal format, normally represented as four 8-bit octets with each byte or octet separated by a decimal point. See also *byte*.

ohm. A unit of electrical resistance equal to that of a conductor in which a current of one ampere is produced by a potential of one volt across the conductor terminals.

Open Systems Interconnection (OSI). A model that represents a network as a hierarchical structure of functional layers. Each layer provides a set of functions that can be accessed and used by the layer above. Layers are independent, in that implementation of a layer can be changed without affecting other layers.

operating system (OS). Software that controls execution of applications and provides services such as resource allocation, scheduling, I/O control, and data management. Most operating systems are predominantly software, but partial hardware implementations are possible *(T)*.

operator password authorization. The level-three password authorization that allows access to a Director to perform operator functions only. Contrast with *administrative password authorization* and *maintenance password authorization*.

optical cable. A single fiber, multiple fibers, or a fiber bundle in a structure constructed to meet certain optical, mechanical, or environmental specifications *(E)*. See also *jumper cable, optical cable assembly,* and *trunk cable*.

optical cable assembly. A connector-terminated optical cable. The cable is generally terminated by the manufacturer and is ready for installation *(E)*. See also *jumper cable* and *optical cable*.

optical drive backup. A data backup system that uses rewriteable optical cartridges (ROCs) as the storage medium.

optical fiber connector. A hardware component that transfers optical power between two optical fibers or bundles, and is designed to be repeatedly connected and disconnected.

optical waveguide. (1) A structure capable of guiding optical power *(E)*. (2) In optical communications, a fiber designed to transmit optical signals. See also *optical fiber*.

OS. See *operating system*.

OS/2. Acronym for *O*perating *S*ystem *2*, the operating system developed by IBM for personal computers. The OS/2 licensed program can perform multiple tasks at the same time.

OS/390. Acronym for *O*perating *S*ystem *390*, an integrated, open-enterprise server operating system developed by IBM that incorporates a leading-edge and open communications server, distributed data and file services, Parallel Sysplex support, object-oriented programming, distributed computing environment, and open application interfaces.

OSI. See *Open Systems Interconnection.*

P

parallel channel. A data communications channel that uses copper bus and tag cables as a transmission medium, rather than fiber-optic cables. Contrast with *ESCON channel* and *FICON channel*.

parameter. (1) Variable that is given a constant value for a specified application and that may denote the application *(I, A)*. (2) Item in a menu for which the user specifies a value, or for which the system provides a value when the menu is interpreted. (3) Data passed between programs or procedures.

password. A unique string of characters known to a computer system, and to a user who must specify the password to gain full or limited access to the system and the information stored within.

password identifier. In a Director, a user-defined symbolic name of 24 characters or less that identifies the password user.

path. (1) In a network, any route between two nodes *(T)*. (2) In systems network architecture, the series of path control network components (path control and data link control) traversed by the information exchanged between two network-addressable units.

PC. See *personal computer*.

PDCM. See *port dynamic connect mask*.

personal computer (PC). A portable computer that consists of a system unit, display, keyboard, mouse, one or more diskette drives, and internal fixed-disk storage. PCs are designed to give independent computing power to a single user.

point-to-point. A Fibre Channel topology that provides a single, direct connection between two communication ports. The Director supports only point-to-point topology.

POR. See *Power-on Reset.*

port. (1) An access point for data entry or exit. (2) A receptacle on a device to which a cable for another device is attached.

port address. In a Director, the address used to specify port connectivity parameters and to assign link addresses for attached channels and control units.

port authorization. Feature of the password definition function that allows an administrator to extend operator-level passwords to specific port addresses for each Director definition managed by a Console. Port authorization affects only operator-level actions for active and saved matrices.

port card. In a fiber-optic environment, a FRU that provides an optomechanical attachment method for fiber cables, and performs specific device-dependent logic functions. See also *Device port card* and *FCV port card*.

port dynamic connect mask (PDCM). Register that controls blocking between two ports and defines the blocked status between the ports. This provides information about blocked status of two ports with a static connection so requests can be denied for dynamic connections.

port name. In a Director, a user-defined symbolic name of 24 characters or less that identifies a port.

POST. See *Power-on Self-Test.*

Power-on Reset (POR). Method by which a device is set to a prescribed or clear state. The device is powered off, then powered on and re-IPLed.

Power-on Self-Test (POST). A series of diagnostic tests that are automatically executed by a device when the power is switched on.

processor. A computer's functional unit that interprets and executes instructions. A processor consists of an instruction control unit, and an arithmetic and logic unit. *(I, A)*.

prohibited connection. In a Director, the attribute that when set, removes dynamic connectivity capability. Contrast with *allowed connection*.

protective plug. In a fiber-optic environment, a type of duplex connector (or cover) that provides physical protection. Contrast with *wrap plug*.

protocol. (1) Set of semantic and syntactic rules that determines the behavior of functional units in achieving communication *(I)*. (2) In systems network architecture, the meanings of and sequencing rules for requests and responses for managing the network, transferring data, and synchronizing network component states. (3) A specification for the format and relative timing of data exchanged between communicating devices.

pull-down menu. A menu that is displayed below, or *pulled down* from a menu bar at the top of a window.

Q

quadrant. One of four areas in a Director where device port cards are installed. The quadrants are designated A through D.

query. (1) The process by which a master device asks a slave device for identification and status *(T)*. (2) For interactive systems, an operation at a Console that elicits a response from the system. (3) A request for information from a file based on specific conditions.

queue. (1) A list constructed and maintained so the next data element to be retrieved is the one stored first. This method is characterized as first in-first out *(T)*. (2) A line or list of items that is waiting to be processed.

R

R. The IBM parts list acronym for *R*estricted. R indicates the part is procurable but has a restricted availability.

RAM. See *random access memory.* See also *DRAM* and *SRAM*, and contrast with *ROM.*

random access memory (RAM). A group of computer memory locations that is numerically identified to allow high-speed access by the controlling microprocessor. A memory location is randomly accessed by referring to its numerical identifier. See *dynamic random access memory* and *static random access memory*, and contrast with *read-only memory*.

read-only memory (ROM). An information storage chip with permanent memory. Stored information cannot be changed or deleted except under special circumstances. Contrast with *random access memory.*

rewriteable optical cartridge (ROC). A plastic cartridge with a recording medium that uses magneto-optical read/write technology, and is removable from a computer and used to store and transport data.

RI. See *ring-in.* Contrast with *RO.*

ring-in (RI). In an IBM Token Ring network, the receive or input receptacle on a multistation access unit. Contrast with *ring-out.*

ring-out (RO). In an IBM Token Ring network, the transmit or output receptacle on a multistation access unit. Contrast with *ring-in.*

ring topology. A logically circular, unidirectional transmission path without defined ends, in which control is distributed or centralized. See also *Token Ring.*

RO. See *ring-out.* Contrast with *RI.*

ROC. See *rewriteable optical cartridge.*

ROM. See *read-only memory.* Contrast with *RAM.*

router. An attaching device that connects two LAN segments, which use similar or different architectures, at the reference model network layer. Contrast with *bridge.*

row. Horizontal arrangement of data. Contrast with *column*.

RS-232. The EIA-recommended specification for asynchronous serial interfaces between computers and communications equipment. It specifies both the number of pins and type of connection, but does not specify the electrical signals.

S

SA. See *Service Agreement.*

SA OS/390. See *System Automation for OS/390*.

saved configuration. In an ESCON or FICON environment, a stored set of connectivity attributes whose values determine a configuration used to replace all or part of a Director's active configuration matrix. Contrast with *active configuration*.

saved matrix. A matrix modified for a particular purpose, then saved to the Director Console fixed disk. Multiple saved matrices are maintained in the Console library for each Director. Contrast with *new matrix*.

SC Connector. See *subscriber connector*.

SCP. See *System Control Program.*

SCSI. See *small computer system interface.*

Service Agreement (SA). A tailored hardware, software, or combined support contract between IBM and the customer.

simplex. In data communication, pertaining to transmission in only one direction at a time. Contrast with *duplex*, synonym for *half-duplex*.

singlemode optical fiber. An optical fiber that allows one wavelength-dependent mode (light path) to propagate. Contrast with *multimode optical fiber*.

small computer system interface (SCSI). An input and output bus that provides a standard interface between the OS/2 operating system and peripheral devices.

software. Computer programs, procedures, rules, and associated documentation pertaining to the operations of a system. See also *application*, and contrast with *hardware*.

spare ports card. A card feature for the Director that contains either four LED ports (#5245), or two LED and two XDF ports (#5255).

SRAM. See *static random access memory.* See also *RAM* and contrast with *DRAM.*

static random access memory (SRAM). SRAM is microprocessor-cache random access memory. SRAM is built internal to the microprocessor or on external chips. SRAM is fast, but relatively expensive. See *random access memory* and contrast with *dynamic random access memory.*

stop bit. In start-stop transmission, a signal at the end of a character that prepares the receiving device for reception of a subsequent character *(I)*.

subnet mask. For internet subnetworking, a 32-bit mask used to identify the subnetwork address bits in the host portion of the IP address.

subscriber connector (SC). A connector that terminates fiber-optic jumper cables in two housings (one transmit and one receive), and provides physical keying for attachment to an SC receptacle. An SC connector is synonymous with an FCS connector. An SC connector can attach to an FCV port card or XDF laser port card. See also *Fibre Channel Standard connector* and *multimode connector*.

subsystem. A secondary or subordinate system, or programming support, usually capable of operating independently of or asynchronously with a controlling system *(T)*.

SWCH. The acronym used in ESCON Manager to represent a Director and identify the Director in the *UNIT* parameter.

switch. A synonym used in ESCON Manager for a Director. Identifies the Director in the *CHPID* statement.

Sysplex Timer. An IBM table top unit that provides the synchronization for time-of-day clocks in multiple central processing complexes.

System Automation for OS/390 (SA OS/390). IBM-licensed software that provides System/390 Parallel Sysplex management, automation capabilities, and integrated systems and network management. SA OS/390 manages host, remote processor, and I/O operations. SA OS/390 integrates the functions of Automated Operations Control for MVS, ESCON Manager, and Target System Control Facility.

system configuration. A process that specifies the devices and programs that form a particular data processing system.

System Control Program (SCP). An IBM-supplied program that is fundamental to the operation and maintenance of a mainframe system. The software serves as an interface with licensed programs and other user programs.

T

Target System Control Facility (TSCF). An IBM-licensed program that designates one processor in a Parallel Sysplex as a focal-point system that controls target systems. The focal point system can load, configure, start, control, and monitor applications on target systems. The focal point system can also coordinate processes across systems. TSCF functions are now integrated into SA OS/390.

TCP. See *transmission control protocol.*

TCP/IP. See *transmission control protocol/internet protocol.*

Telecommunications Industry Association (TIA). TIA is a member organization of the Electronic Industries Association, and is the trade group representing the communications and information technology industries. See also *EIA*.

terminal. In data communication, a device, usually equipped with a keyboard and display, capable of transmitting and receiving information. Synonym for *Console* or *display device*.

thin fabric port (thin F_port). The port connection on the FCV port card that behaves externally as an N_port, but has the F_port ability to accept a fabric login (FLOGI) command. Contrast with *node port*. See also *fabric port*.

thin F_port. See *thin fabric port*.

TIA. See *Telecommunications Industry Association*. See also *EIA*.

tile. Windows on a console are tiled to simultaneously display all open windows side-by-side in a reduced-size format. No overlapping of windows occurs. To tile windows, use the *Window* pull-down menu and select *Tile*. Contrast with *Cascade*.

TKRG. See *Token Ring Controller Adapter card.*

toggle. A procedure to change the state of a feature. If the feature is **On**, toggling will turn it **Off**, and vice versa.

token. A sequence of bits passed from one device to another on a Token Ring network that signifies permission to transmit over the network. The token consists of a starting delimiter, access control field, and end delimiter. If a device has data to transmit, it appends the data to the token.

Token Ring. A LAN configuration where devices attach to a network cable in a closed path or ring. A token (unique sequence of bits) circulates on the ring to allow devices to access the LAN for data transmission. See also *ring topology.*

Token Ring Controller Adapter (TKRG) card. The circuit card that provides a port to connect a Director to a 4/16 Mbps Token Ring LAN. The card is labelled *TKRG*.

topology. The physical or logical arrangement of nodes in a computer network.

TPF. See *Transaction Processing Facility.*

Transaction Processing Facility (TPF). IBM-licensed software that supports interactive applications in which requests submitted at terminals are processed upon receipt. TPF provides a message-based, real-time, high-capacity transaction processing environment.

transmission control protocol (TCP). The transport layer for the TCP/IP protocol widely used on Ethernet networks and any network that conforms to U.S. Department of Defense standards for network protocol. TCP provides reliable communication and control through full-duplex connections.

transmission control protocol/internet protocol (TCP/IP). A layered set of protocols (network and transport) that allows sharing of applications among devices on a high-speed LAN communication environment. See also *TCP* and *IP.*

trunk cable. In an fiber-optic environment, a cable consisting of multiple fiber pairs that does not directly attach to an active device. The cable usually exists between distribution panels and can be located within, or external to, a building. Contrast with *jumper cable*.

TSCF. See *Target System Control Facility.*

U

UL. See *Underwriters Laboratories.*

ULP. See *upper level protocol*.

unblocked. In a Director, the attribute that when set, establishes communication capability for a specific port. Contrast with *blocked*.

Underwriters Laboratories (UL). A laboratory organization accredited by the Occupational Safety and Health Administration, and authorized to certify products for use in the home and workplace.

uninterruptable power supply (UPS). A buffer between public utility power or an other power source, and a system that requires precise, uninterrupted power.

URL. Acronym for *U*niform *R*esource *L*ocator. A URL is the address of a document or other resource on the internet.

upper level protocol (ULP). Protocols that map to and run on top of Fibre Channel FC-4 layer. Upper level protocols include IP and SCSI.

UPS. See *uninterruptable power supply.*

V

Vac. Acronym for volts alternating current. See *alternating current*.

Vdc. Acronym for volts direct current. See *direct current*.

Virtual Machine (VM). (1) A virtual data processing system that appears to be at the exclusive disposal of a single user, but whose functions are accomplished by sharing the resources of a real data processing system *(T)*. (2) A functional simulation of a computer system and its associated devices, multiples of which can be controlled concurrently by one operating system.

Virtual Storage (VS). (1) Storage space that may be regarded as addressable main storage by the user of a computer system in which virtual addresses are mapped to real addresses. The size of virtual storage is limited by the addressing scheme of the computer system and by the amount of auxiliary storage available, not by the number of main storage locations *(I, A)*. (2) Addressable space that is apparent to the user as processor storage space, from which the instructions and the data are mapped to the processor storage locations.

Virtual Storage Extended (VSE). An IBM-licensed software operating system that controls the execution of programs.

VM. See *Virtual Machine.*

VM/ESA. Acronym for *V*irtual *M*achine/*E*nterprise *S*ystems *A*rchitecture. See also *VM* and *ESA*.

volt. A measure of the difference in electrical potential between two points in a conductor, equal to one ohm resistance carrying a constant current of one ampere, with a power dissipation of one watt.

VS. See *Virtual Storage.*

VSE. See *Virtual Storage Extended*.

W

watt. A unit of power in the International System equal to one joule (Newton-meter) per second.

warning message. An indication that a system error or other problem has been detected. See also *error message* and *information message*.

window. A portion of the Director Console screen in which one of several concurrent applications or data sets can display information. The user sees what appears to be several sheets of paper, much as the sheets would appear on a desktop. See also *cascade* and *tile*.

Windows. A graphical user interface and windowing system introduced by Microsoft Corporation in 1985. Windows runs on top of the MS-DOS operating system.

Win-OS/2. Win-OS/2 is the Windows component of IBM's OS/2 Version 2.0 operating system. It is based partially on Windows 3.0 and Windows 3.1. Win-OS/2 is the operating system used by the Director Console application.

wrap plug. (1) A connector attached to the plug end of a cable that connects input and output pins together for testing. See *wrap test*. (2) In a fiber-optic environment, a type of duplex connector used to wrap the optical output signal of a device directly to the optical input. Contrast with *protective plug*.

wrap test. A test that checks attachment or control unit circuitry, without checking the mechanism itself, by returning the output of the mechanism as input. A wrap test can transmit a specific character pattern through a system, and compare the pattern received with the pattern transmitted.

X

XDF. See *Extended Distance Feature*.

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Planning Worksheet Map

Director Identification: _____ CUP Name: _____

Configuration Matrix Name: _____ Prepared by/date: _____ Date to be activated: _____

Complete appropriate configuration planning worksheets for installed and planned ports. Indicate on this map which worksheets are used.

Address	04 - 13	14 - 23	24 - 33	34 - 43	44 - 53	54 - 63	64 - 73	74 - 83	84 - 93	94 - A3	A4 - B3	B4 - C3	C4 - D3	D4 - E3	E4 - F3	F4 - FB
04 - 13	1	2	4	7	11	16	22	29	37	46	56	67	79	92	106	122
14 - 23		3	5	8	12	17	23	30	38	47	57	68	80	93	107	123
24 - 33			6	9	13	18	24	31	39	48	58	69	81	94	108	124
34 - 43				10	14	19	25	32	40	49	59	70	82	95	109	125
44 - 53					15	20	26	33	41	50	60	71	83	96	110	126
54 - 63						21	27	34	42	51	61	72	84	97	112	127
64 - 73							28	35	43	52	62	73	85	98	113	128
74 - 83								36	44	53	63	74	86	99	114	129
84 - 93									45	54	64	75	87	100	115	130
94 - A3										55	65	76	88	101	116	131
A4 - B3											66	77	89	102	117	132
B4 - C3												78	90	103	118	133
C4 - D3													91	104	119	134
D4 - E3														105	120	135
E4 - F3															121	136
F4 - FB																137

Notes:

Configuration Planning Worksheet

Director Identification: _____ Director Model Number: _____

Configuration Matrix Name: _____ CUP Name: _____ Worksheet C- _____ of _____

Prepared by/date: _____ Date to be activated: _____

Column Headings: **FCV:** Indicates FICON port (FCV) or ESCON port (blank) **B:** Indicates blocked status (B) or unblocked status (blank)

C: Indicates dedicated connection with specified port address **Port Address:** Indicates allowed status (blank), dedicated status (D), or prohibited status (P)

Port Address	Port Name	FCV	B	C	Port Address															

Notes:

Port Authorization Planning Worksheet

Director Identification: _____ Director Model Number: _____
Configuration Matrix Name: _____ CUP Name: _____ Worksheet A- _____ of _____
Prepared by/date: _____ Date to be activated: _____
Column Heading: **Operator ID (Level 3):** Indicates authorized status (X) or unauthorized status (blank) for each operator ID

		Operator ID (Level 3)															
Port Address	Port Name																

Notes:

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