

IBM zSystems and LinuxONE

*FICON Channel-to-Channel Reference*



**Note**

Before using this information and the product it supports, read the information in “[Safety](#)” on page v, Appendix A, “[Notices](#),” on page 41, and *IBM Systems Environmental Notices and User Guide*, Z125-5823.

This edition, SB10-7181-01, applies to IBM zSystems and IBM LinuxONE servers. This edition replaces SB10-7181-00.

There might be a newer version of this document in a **PDF** file available on **IBM Documentation**. Go to <https://www.ibm.com/docs/en/systems-hardware>, select **IBM zSystems** or **IBM LinuxONE**, then select your configuration, and click **Library Overview** on the navigation bar.

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# Safety

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## Safety notices

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Safety notices may be printed throughout this guide. **DANGER** notices warn you of conditions or procedures that can result in death or severe personal injury. **CAUTION** notices warn you of conditions or procedures that can cause personal injury that is neither lethal nor extremely hazardous. **Attention** notices warn you of conditions or procedures that can cause damage to machines, equipment, or programs.

## World trade safety information

Several countries require the safety information contained in product publications to be provided in their local language(s). If this requirement applies to your country, a safety information booklet is included in the publications package shipped with the product. The booklet contains the translated safety information with references to the US English source. Before using a US English publication to install, operate, or service this product, you must first become familiar with the related safety information in the *Systems Safety Notices*, G229-9054. You should also refer to the booklet any time you do not clearly understand any safety information in the US English publications.

## Laser safety information

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All IBM Z and IBM LinuxONE (LinuxONE) models can use I/O cards such as FICON®, Open Systems Adapter (OSA), RoCE Express, Integrated Coupling Adapter (ICA SR, ICA SR1.1), zHyperLink Express, or other I/O features which are fiber optic based and utilize lasers (short wavelength or long wavelength lasers).

## Laser compliance

All lasers are certified in the US to conform to the requirements of DHHS 21 CFR Subchapter J for Class 1 or Class 1M laser products. Outside the US, they are certified to be in compliance with IEC 60825 as a Class 1 or Class 1M laser product. Consult the label on each part for laser certification numbers and approval information.

**Laser Notice:** U.S. FDA CDRH NOTICE if low power lasers are utilized, integrated, or offered with end product systems as applicable. Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

**CAUTION: Data processing environments can contain equipment transmitting on system links with laser modules that operate at greater than Class 1 power levels. For this reason, never look into the end of an optical fiber cable or open receptacle. (C027)**

**CAUTION: This product contains a Class 1M laser. Do not view directly with optical instruments. (C028)**



## About this publication

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This publication describes the Fibre Connection (FICON) Channel-to-Channel adapter. FICON allows a Fibre Channel path to function as both a channel and a Channel-to-Channel (CTC) simultaneously.

## What is included in this publication

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This publication contains the following information:

- Chapter 1, “FICON channel-to-channel introduction,” on page 1 is an introduction of the FICON channel-to-channel function.
- Chapter 2, “Using IOCP to define a FICON CTC configuration,” on page 7 describes how to define a FICON channel-to-channel configuration.
- Chapter 3, “FICON Configuration Examples,” on page 13 describes and illustrates FICON CTC configurations, including IOCP statements.
- Chapter 4, “FICON CTC device-specific functions,” on page 33 describes the device specific functions for the FICON channel-to-channel function.

## Related publications

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The following publications contain information on topics related to IOCP.

### z/VM

- *z/VM General Information*, GC24-6193, describes the features of z/VM®.

### z/VSE

- *z/VSE Planning*, SC34-2635, provides information on how to set up z/VSE® on a managed system.

## Input/Output Configuration Program

- *IOCP User's Guide for IYP IOCP*, SB10-7029
- *IOCP User's Guide for ICP IOCP*, SB10-7177

## Revisions

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A technical change from the previous edition of this document is indicated by a thick vertical line to the left of the change.

## Summary of changes

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### May 2023

This update contains only minor editorial updates. No technical updates have been made.

## Accessibility features

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Accessibility features help users who have physical disabilities such as restricted mobility or limited vision use software products successfully. The accessibility features can help users do the following tasks:

- Run assistive technology such as screen readers and screen magnifier software.
- Operate specific or equivalent features by using the keyboard.
- Customize display attributes such as color, contrast, and font size.

## Consult assistive technologies

Assistive technology products, such as screen readers, function with the user interfaces found in this product. Consult the product information for the specific assistive technology product that is used to access our product information.

## Keyboard navigation

This product uses standard Microsoft Windows navigation keys.

## IBM and accessibility

See <http://www.ibm.com/able> for more information about the commitment that IBM® has to accessibility.

## How to provide feedback to IBM

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We welcome any feedback that you have, including comments on the clarity, accuracy, or completeness of the information.

For additional information use the following link that corresponds to your configuration:

Configuration	Link
IBM z16™ Model A02	<a href="#">How to send feedback to IBM</a>
IBM z16 Rack Mount Bundle	<a href="#">How to send feedback to IBM</a>
IBM LinuxONE Rockhopper 4 Model LA2	<a href="#">How to send feedback to IBM</a>
IBM LinuxONE Rockhopper 4 Rack Mount Bundle	<a href="#">How to send feedback to IBM</a>



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# Chapter 1. FICON channel-to-channel introduction

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## CTC communication and connection

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A FICON channel-to-channel (CTC) connection consists of an input/output (I/O) device that is used by a program in one system to communicate with a program in another system. A CTC communication is established between two programs when the adapter is selected to respond to channel-command words (CCWs) that are issued by the channels in the CTC connection.

FICON CTC increases the connectivity options for customers. Now, each of any two systems that have at least one FICON channel connected to the network can have CTC connections set up between them with no additional cost. Customers no longer have to dedicate channel path (CHPID) resources to the CTC function. In the Fibre Connection (FICON) channel I/O interface environment, a stand-alone CTC adapter unit is not used to provide the switching function. The switching function is provided by the FICON Director. CTC connections between channels can be made by going through a FICON Director. The CTC adapter function is implemented logically between connecting channels and resides in the FICON channel.

The fibre channel path functions as both a channel and a channel-to-channel at the same time. It provides self configuration and load balancing of the CTC function among FICON channel paths, including proper configuration when the target channel does not have an integrated CTC.

FICON CTC connections require that at least one end of the connection be on the following CPC which supports the FICON CTC control unit function:

- IBM zSystems and LinuxONE general purpose models at EC J10638 or later.

The other end of the FICON CTC connection can be on any CPC that supports FC channel paths. If neither FC channel path is on a CPC listed above, no FICON CTC connection will be established and the CTC devices will be unusable.

FICON CTC acts as a dual-sided control unit, providing control unit function for both the local inboard channel and an outboard channel on the other side of the fibre channel network. CTC function does not access storage or any system facilities.

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## Auto-configuration

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In the FICON architecture, device level communication between a channel and control unit requires that a Logical Path is established between them. In the case of FICON CTC, one or two channels each talk to a two-sided control unit which is internal to the FICON channel. Therefore, two logical paths are required for a complete CTC connection.

The Local logical path is established across the internal link between the channel function and the CTC function on the same CHPID. The Remote logical path is established across the Fibre Channel link. This path connects the two CHPIDs through the switch in [Figure 1 on page 2](#) or can also be point-to-point. In the case of a single FICON channel used to configure LPAR to LPAR communication within a CPC, the channel establishes both the local and remote logical paths.

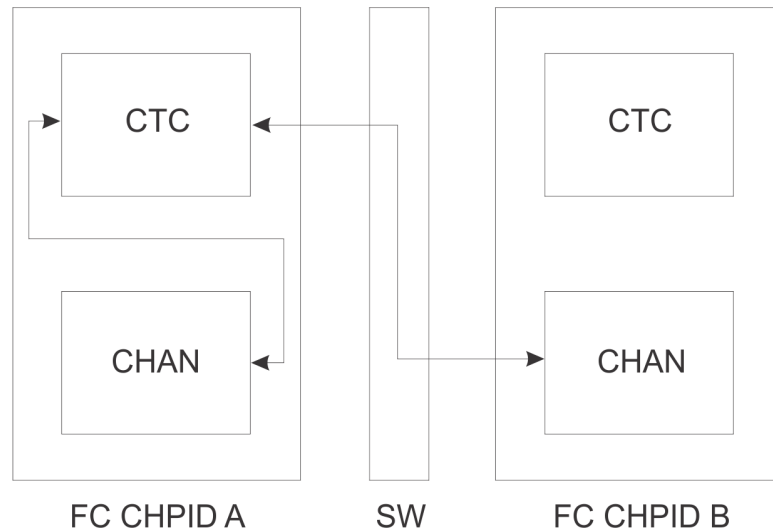


Figure 1. Typical Logical Path pair between two FC CHPIDs

To define a FICON CTC connection, you must define two FICON CTC control units with control unit types of FCTC. The FICON channels negotiate with each other and only one of the channels will contain a single CTC control unit internal to the channel for the CTC connection. This negotiation is described as auto-configuration. Auto-configuration determines which FICON channel contains the CTC control unit for each connection and pair of logical paths. If only one of the channels is on a CPC that supports the FICON CTC control unit function, the FICON CTC control unit is always on that channel. If both channels are on a CPC that supports the FICON CTC control unit function, the channels perform load balancing to determine which channel will have the FICON CTC control unit. The channel with the fewest CTC logical paths will have the FICON CTC control unit for the connection. This balances the load that FICON CTC connections will place on each channel.

## Partition-to-partition communication

The local CTC function is always used by definition for partition-to-partition communication so load balancing is not an issue. With FICON partition-to-partition communication technology, communication between logical partitions of a single physical system can be achieved utilizing only a single physical FICON channel attached to a FICON Director switch.

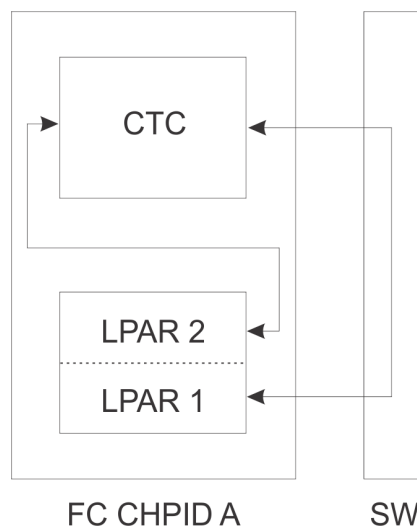


Figure 2. FICON partition-to-partition

## FICON CTC channel

A FICON channel with CTC capability may behave as both a standard FICON channel connecting to standard FICON I/O control units, as well as having an internal CTC control unit function in support of CTC connections. There is no special channel type. There is only a new control unit type (FCTC) that must be specified to IOCP or HCD in the control unit definition.

A CTC connection requires one or two FICON channels, at least one of which is capable of providing CTC control unit functionality (i.e. the CPC is at EC J10638 or later). A CTC connection supports bidirectional CTC communications. The FICON channels involved in a CTC connection can send and receive information to each other.

Two FICON channels can be connected to each other point-to-point or using dynamic communication within a FICON Director. One FICON channel can connect to itself using a FICON Director.

Neither FICON channel must be dedicated exclusively to CTC operations. They can be configured to dynamically access any other FICON I/O control units attached to the same FICON Director.

The FICON CTC control unit function is integrated into the FICON channel on the CPCs listed in “CTC communication and connection” on page 1. A virtual link exists between the channel section and the CTC control unit section of the FICON channel. Logically, a CTC control unit exists between its own channel section and the FICON channel to which it is connected. When connecting two FICON channels, auto-configuration determines which FICON channel contains the CTC control unit for that connection. See Figure 3 on page 3. In Figure 6-5, the FICON FC channels attached to the FICON Director can also attach to other I/O devices (e.g. disk, tape, etc.).

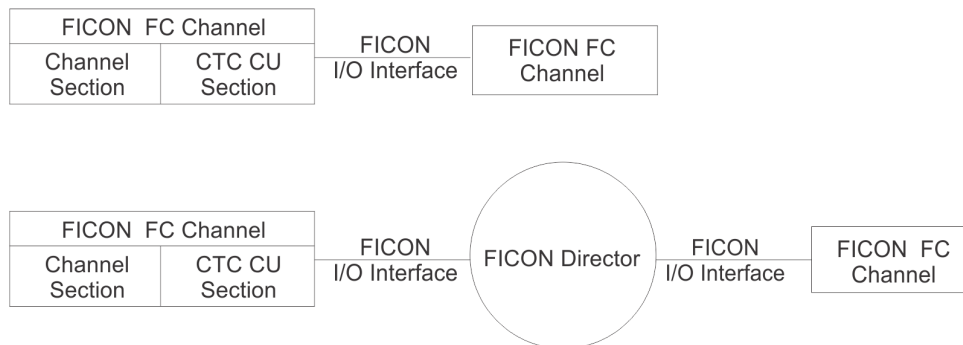


Figure 3. FICON CTC channel structure

You can also establish a FICON CTC connection between LPARs on the same CPC using a single FICON FC channel. See Figure 4 on page 3. The FICON channel must attach to a FICON Director for this type of CTC connection. In addition, the FICON channel can attach to other I/O devices (e.g. disk, tape, etc.).

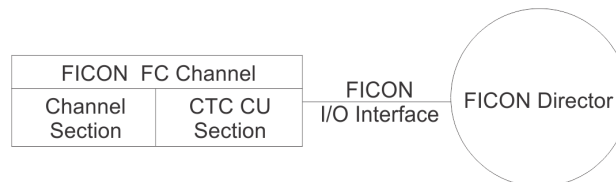


Figure 4. FICON CTC connection using a single FICON FC channel

In Figure 5 on page 4, assuming that each FICON channel is on a CPC that supports the FICON CTC control unit function:

- Each FICON channel can form a CTC connection with every other FICON channel.
- Each FICON channel can form a CTC connection with itself.
- Each FICON channel can access other FICON I/O control units (e.g. FICON DASD and FICON Tape).

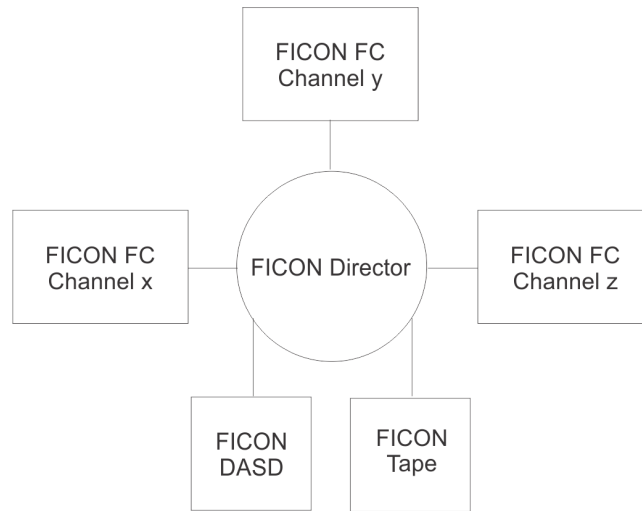


Figure 5. FICON FC channel configuration with a FICON director

## Unshared channel

Unshared channels are dedicated to a single partition in LPAR mode or are on a processor running in basic mode. If an unshared channel is reconfigurable, it can be deconfigured from one partition and reconfigured to another partition.

Channels at either or both ends of a CTC connection can be shared or unshared.

## Shared channel

If a processor complex is running in LPAR mode, its logical partitions can share channel paths to reduce the number of physical connections between processor complexes. FC channels can be defined as shared channels.

## FICON CTC control unit

The CTC control unit section in a FICON channel can consist of multiple CTC control units. A CTC control unit is a two-sided control unit. One side is internal to the FICON channel that is providing the CTC control unit functions. The other side is connected to another FICON channel on a FICON interface. Each side is configured individually to its corresponding channel as a CTC control unit and is accessed independently by its corresponding channel. Each separately configured control unit represents one side of a two-sided CTC control unit in the FICON channel. See [Figure 6 on page 5](#).

1. When an unshared FICON channel (FC) with integrated CTC function is connected to another unshared FC channel, only one CTC control unit can be configured for the CTC connection. The two-sided control unit is used between the partitions owning the FC channel with integrated CTC function and the other FC channel.

In [Figure 6 on page 5](#), the CTC control unit 1 is configured for the CTC connection between FC channel x (with integrated CTC function) on System A and FC channel x on System B. CTC control unit 2 is configured for the CTC connection between FC channel x on System A and FC channel y on System B. CTC control unit 3 is configured for the CTC connection between FC channel x on System A and FC channel z on System B.

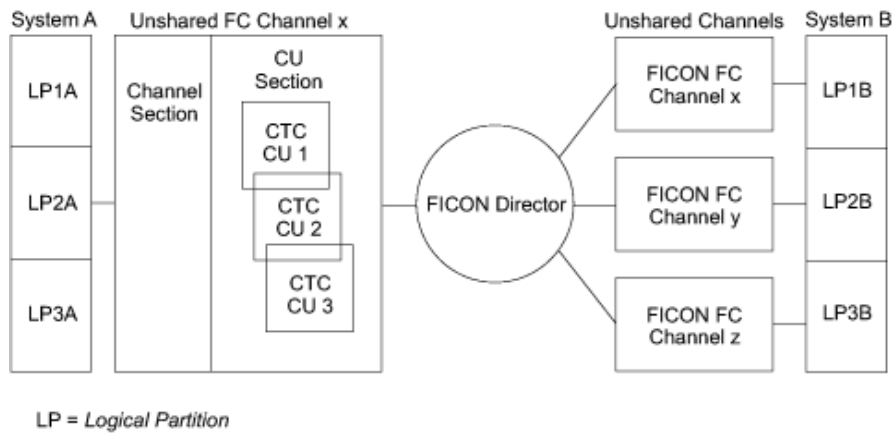


Figure 6. Unshared FC channel to unshared FC channel

- When an unshared FC channel with integrated CTC function is connected to a shared FC channel, a two-sided control unit can be configured between the partition owning the FC channel with integrated CTC function and each partition sharing the other FC channel.

In Figure 7 on page 5, three CTC control units can be configured between LP2A in System A and each partition in System B.

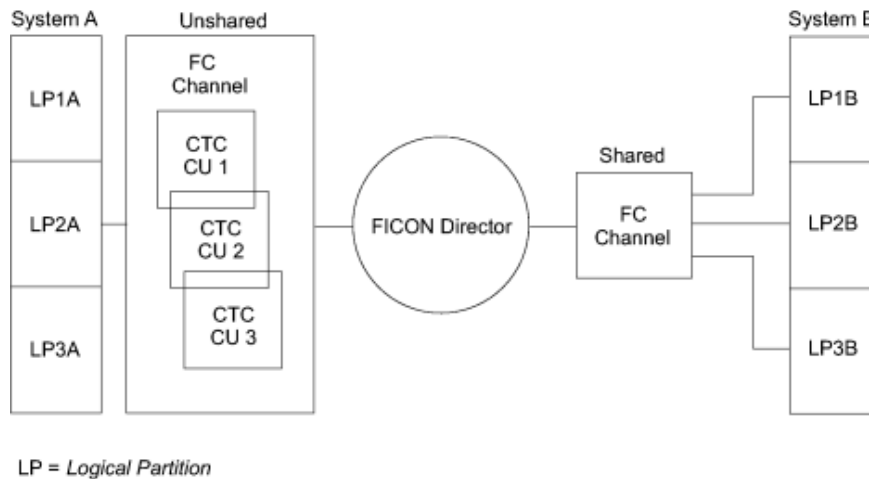


Figure 7. Unshared FC channel to shared FC channel

- When a shared FC channel with integrated CTC function is connected to an unshared FC channel, a two-sided control unit can be configured between each partition sharing the FC channel with integrated CTC function and the partition owning the unshared FC channel.

In Figure 8 on page 6, three CTC control units can be configured between each partition in System A and LP2B in System B.

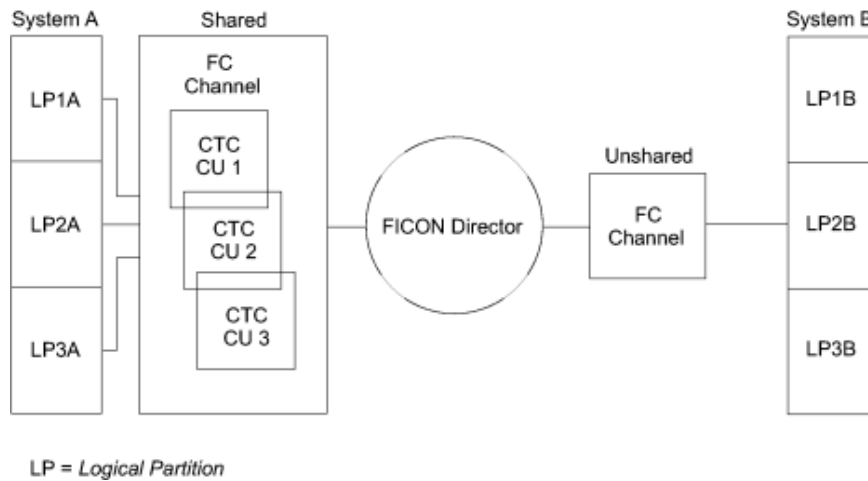


Figure 8. Shared FC channel to unshared FC channel

- When a shared FC channel with integrated CTC function is connected to another shared FC channel, a two-sided CTC control unit can be configured between each partition sharing the FC channel with integrated CTC function and each partition sharing the other FC channel.

In [Figure 9](#) on page 6, only three CTC control units need to be configured for the CTC connection between System A and System B. CTC control unit (CU) 1 is configured for the CTC connections between all logical partitions accessing FC channel x with integrated CTC function on System A and LP1B on System B. CTC CU 2 is configured for the CTC connections between all logical partitions accessing FC channel x with integrated CTC function on System A and LP2B on System B. CTC CU 3 is configured for the CTC connections between all logical partitions accessing FC channel x with integrated CTC function on System A and LP3B on System B.

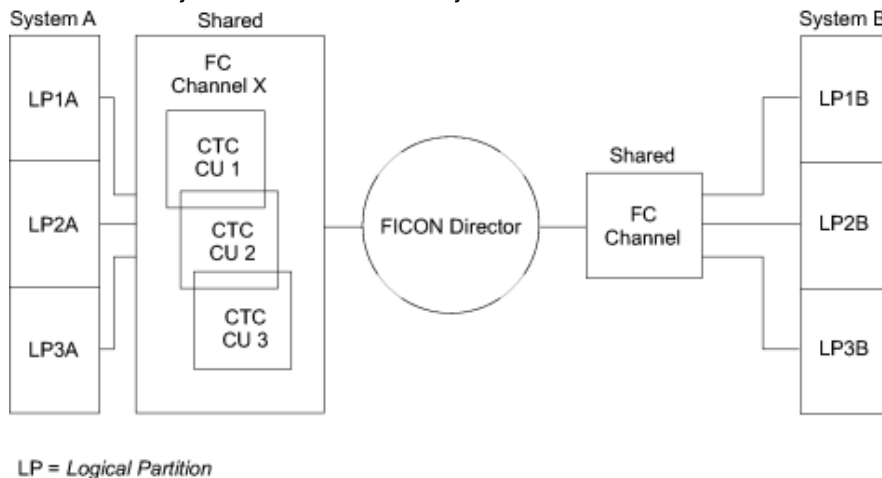


Figure 9. Shared FC channel to shared FC channel

## FICON CTC device

Multiple CTC devices can be configured to a CTC control unit after the CTC control unit is defined.

A FICON CTC device is a two-sided device. It provides the data path and synchronization for data transfer between the two channels it connects. Each side is configured individually to its corresponding channel as a CTC device and is accessed independently by its corresponding channel. Each separately configured CTC device represents one side of a two-sided CTC device.

**Both sides of the CTC device must have the same unit address defined in IOCP.**

Each two-sided CTC device is capable of supporting a CTC communication between two programs. There can be multiple CTC communications in progress between an FC channel with integrated CTC function and the FC channel to which it connects at any given time.

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# Chapter 2. Using IOCP to define a FICON CTC configuration

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## FICON CTC configurations

This chapter describes the methods of defining FICON CTC configurations to the Input/Output Configuration Program (IOCP). See [Chapter 3, “FICON Configuration Examples,”](#) on page 13 for IOCP source input examples.

Hardware configuration definition (HCD) can also be used for defining FICON CTC configurations. Rules and recommendations described in this document are applicable. For more information on IOCP, see the *IOCP User's Guide for IYP IOCP*.

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## Peer-to-peer

When defining FICON CTC control units and devices, the integrated CTC control units, as described in “FICON CTC channel” on page 3, are not considered by IOCP to be within the channel. Instead, IOCP views the CTC control units and devices to be within the FC channel at the other end of a CTC connection. From the viewpoint of IOCP, the two channels in a FICON CTC connection can be considered as communicating directly with each other in a peer-to-peer fashion, without the integrated CTC control units in between. With unshared channels, each channel defines a CTC control unit for the channel at the other end of a CTC connection. With shared channels, each channel defines a CTC control unit for each partition which shares the channel at the other end of a CTC connection.

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## Configuration limits

A FICON channel supports up to 256 two-sided CTC control units and 16384 two-sided CTC devices. A maximum of 256 FICON CTC devices can be configured to a CTC control unit.

It is recommended that you use your FC channels for non-CTC devices in addition to CTC devices to take advantage of the throughput capacity of the channels as well as their full-duplex capability.

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## Shared and unshared configurations

Channels that are unshared are configured to a single logical partition in LPAR mode (or to the entire processor in basic mode). Channels that are shared can be simultaneously configured to multiple logical partitions in LPAR mode.

This section describes how to define FICON CTC configurations to IOCP for both shared and unshared channel paths. Figure 7-1 is referenced throughout the following IOCP statement examples. FC CHPID 50 is shared and configured to logical partitions LP1A, LP2A and LP3A in System A. FC CHPID 60 is unshared and configured to logical partition LP1B in System B.

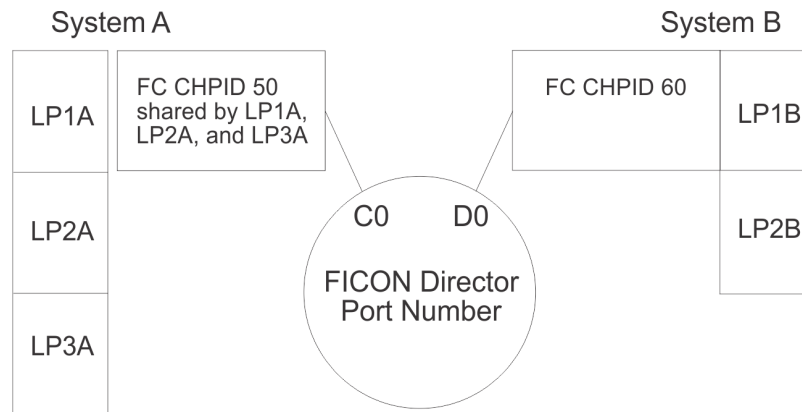


Figure 10. Shared and unshared configuration

**Note:** The terms source and destination are used in this document to indicate two ends of a CTC connection. When you define CTC control units and devices to the system at one end (source) of a CTC connection, the other end of the CTC connection is referred as the destination. A CTC connection supports bidirectional CTC communications. The FC channels of a FICON CTC connection can be viewed as both source and destination depending on which end is the connection being defined.

## Defining CHPIDs

Code the *chpid* number with the PATH keyword. Code the TYPE keyword as FC. If the connection is by means of a FICON Director, specify a number on the SWITCH keyword.

The following RESOURCE and CHPID statement example defines shared FC channel *chpid* 50 in System A:

```
RESOURCE PARTION=((LP1A,1),(LP2A,2),(LP3A,3))
CHPID PATH=50,TYPE=FC,SHARED,PART=((LP1A,LP2A,LP3A),(=)),SWITCH=01
```

The following CHPID statement example defines unshared FC channel CHPID 60 in System B:

```
CHPID PATH=60,TYPE=FC,PART=LP1B,SWITCH=01
```

## Defining CTC control units

When you define FICON CTC control units, an unshared channel at the other end of a CTC connection is associated with a single CTC control unit. When you have a shared channel at the other end of a CTC connection, each partition sharing the channel path is associated with a separate control unit. It does not matter which channel actually has the FICON CTC control unit function.

- If the CTC connection is through a FICON Director, specify the port address of the channel at the other end of the CTC connection with the LINK keyword in the CNTLUNIT statement for that channel.
- If the CTC connection is point-to-point, do not specify the LINK keyword in the CNTLUNIT statement.

Control unit type keyword UNIT must be coded as FCTC to enable the CTC control unit in the FICON channel. Also, the unit addresses specified for each CTC connection must be identical. For the FICON CTC connection to be successful, at least one end of the connection must be on the following CPC:

- IBM zSystems and LinuxONE general purpose models at EC J10638 or later.

The other end of the FICON CTC connection can be on any CPC that supports FC channel paths. If neither FC channel path is on a CPC listed above, no FICON CTC connection will be established and the CTC devices will be unusable.

When connecting to a shared channel path (as System B is doing with CHPID 50 in System A), it is necessary to specify a control unit for each logical partition that the shared CHPID has access to and with which you want to communicate. Also, it is necessary to identify to which logical partition each control unit is associated. This is accomplished by specifying the partition number or CSS ID and MIF image ID



of the destination partition in the CUADD keyword. When communicating to a shared FC channel path on a System z9® or zSeries processor other than a z/800 or z/900, the CUADD keyword value must be two digits if the destination logical partition has a non-zero CSS ID. For example, if the destination logical partition is in CSS 1 and has MIF image ID 5, specify CUADD=15.

Do not code the CUADD keyword if the destination CHPID is not shared.

Define a CTC control unit for each destination partition to which you want to connect. For System A, specify the following:

```
CNTLUNIT CUNUMBR=4B10,PATH=50,LINK=D0,UNITADD=((40,8)),UNIT=FCTC
```

For System B, specify the following:

```
CNTLUNIT CUNUMBR=5A10,PATH=60,LINK=C0,UNITADD=((40,8)),UNIT=FCTC,CUADD=1
CNTLUNIT CUNUMBR=5A20,PATH=60,LINK=C0,UNITADD=((40,8)),UNIT=FCTC,CUADD=2
CNTLUNIT CUNUMBR=5A30,PATH=60,LINK=C0,UNITADD=((40,8)),UNIT=FCTC,CUADD=3
```

All three partitions in System A will use control unit 4B10 to communicate with partition LP1B in System B. System B will use control unit 5A10 to communicate with partition LP1A in System A, control unit 5A20 to communicate with partition LP2A and control unit 5A30 to communicate with partition LP3A.

Using the recommended control unit numbering method described in Chapter 3, we could assign CTC image IDs of A1 to LP1A, A2 to LP2A, A3 to LP3A and B1 to LP1B. We would also define separate Send and Receive control units. But to do so requires a second pair of FC channels. Assume CHPID 51 is on System A, connects to port C1 on the FICON Director, and is shared by the same partitions as CHPID 50. Assume CHPID 61 is on System B, connects to port D1 on the FICON Director, and is dedicated to partition LP1B. For System A, we could specify the following:

```
CNTLUNIT CUNUMBR=4B10,PATH=50,LINK=D0,UNITADD=((40,8)),UNIT=FCTC
CNTLUNIT CUNUMBR=5B10,PATH=51,LINK=D1,UNITADD=((40,8)),UNIT=FCTC
```

For System B, we could specify the following:

```
CNTLUNIT CUNUMBR=4A10,PATH=61,LINK=C1,UNITADD=((40,8)),UNIT=FCTC,CUADD=1
CNTLUNIT CUNUMBR=4A20,PATH=61,LINK=C1,UNITADD=((40,8)),UNIT=FCTC,CUADD=2
CNTLUNIT CUNUMBR=4A30,PATH=61,LINK=C1,UNITADD=((40,8)),UNIT=FCTC,CUADD=3
CNTLUNIT CUNUMBR=5A10,PATH=60,LINK=C0,UNITADD=((40,8)),UNIT=FCTC,CUADD=1
CNTLUNIT CUNUMBR=5A20,PATH=60,LINK=C0,UNITADD=((40,8)),UNIT=FCTC,CUADD=2
CNTLUNIT CUNUMBR=5A30,PATH=60,LINK=C0,UNITADD=((40,8)),UNIT=FCTC,CUADD=3
```

This would result in control unit 4B10 sending data to be received by control units 5A10-5A30 and control units 4A10-4A30 sending data to be received by control unit 5B10.

## Defining CTC devices

CTC devices must be defined so that a connection is established between each logical partition.

The following IODEVICE statement example defines 8 CTC devices to the above control unit number 4B10 in System A:

```
IODEVICE ADDRESS=(4B10,8),CUNUMBR=4B10,UNITADD=40,UNIT=FCTC
```

The following IODEVICE statement example defines 8 CTC devices to each of the following control unit numbers 5A10-5A30 in System B:

```
IODEVICE ADDRESS=(5A10,8),CUNUMBR=5A10,UNITADD=40,UNIT=FCTC
IODEVICE ADDRESS=(5A20,8),CUNUMBR=5A20,UNITADD=40,UNIT=FCTC
IODEVICE ADDRESS=(5A30,8),CUNUMBR=5A30,UNITADD=40,UNIT=FCTC
```

All three partitions in System A use devices 4B10-4B17 to communicate with partition LP1B in System B. System B uses devices 5A10-5A17 to communicate with partition LP1A in System A, devices 5A20-5A27 for partition LP2A and devices 5A30-5A37 for partition LP3A. Each pair of CTC devices that are to communicate with each other must have the same unit address.

The following recommendations are useful when assigning unit addresses:

1. Assign the same starting unit address to all CTC CNTLUNIT statements defined to a channel with the same LINK address.
2. Assign the same starting unit address to all CNTLUNIT statements on both ends of a CTC connection.

Using the recommended device numbering method described in Chapter 3, we could assign CTC image IDs of A1 to LP1A, A2 to LP2A, A3 to LP3A and B1 to LP1B. We would also define separate Send and Receive devices. For System A, we could specify the following:

```
IODEVICE ADDRESS=(4B10,8),CUNUMBR=4B10,UNITADD=40,UNIT=FCTC
IODEVICE ADDRESS=(5B10,8),CUNUMBR=5B10,UNITADD=40,UNIT=FCTC
```

For System B, we could specify the following:

```
IODEVICE ADDRESS=(4A10,8),CUNUMBR=4A10,UNITADD=40,UNIT=FCTC
IODEVICE ADDRESS=(4A20,8),CUNUMBR=4A20,UNITADD=40,UNIT=FCTC
IODEVICE ADDRESS=(4A30,8),CUNUMBR=4A30,UNITADD=40,UNIT=FCTC
IODEVICE ADDRESS=(5A10,8),CUNUMBR=5A10,UNITADD=40,UNIT=FCTC
IODEVICE ADDRESS=(5A20,8),CUNUMBR=5A20,UNITADD=40,UNIT=FCTC
IODEVICE ADDRESS=(5A30,8),CUNUMBR=5A30,UNITADD=40,UNIT=FCTC
```

This would result in devices 4B10-4B17 being used to send data to be received by devices 5A10-5A37 and devices 4A10-4A37 being used to send data to be received by devices 5B10-5B17.

## Redundant CTC configuration

---

### Minimum configuration

When using a single FICON Director, the minimum number of shared FC channels required to allow any partition to communicate with any other partition is:

```
FC channels = M
where M = number of processor complexes
```

For unspanned FC channels that are shared on a processor complex that supports multiple logical channel subsystems, the value M above is equal to the total number of logical channel subsystems on the processor complexes.

When using a single FICON Director, the minimum number of unshared FC channels required to allow any partition to communicate with any other partition is:

```
FC channels = n
where n = number of processor complexes in basic mode
or number of logical partitions in LPAR mode
```

### Channel-redundant configuration

The minimum configuration does not provide for alternative paths. The availability of a CTC communication, in the event of a single channel or FICON Director port failure, can be increased by defining a second shared FC channel for each processor or a second unshared FC channel for each partition. The number of shared FC channels required to allow any partition to communicate with any other partition is:

```
FC channels = 2xM
where M = number of processor complexes
```

For unspanned FC channels that are shared on a processor complex that supports multiple logical channel subsystems, the value M above is equal to the total number of logical channel subsystems on the processor complexes.

The number of unshared FC channels required to allow any partition to communicate with any other partition is:

```
FC channels = 2xn
  where n = number of processor complexes in basic mode
          or number of logical partitions in LPAR mode
```

## Fully redundant configuration

The previous channel redundant configuration does not provide for FICON Director failure. Full redundancy can be achieved with two FICON Directors, each supporting a minimum CTC configuration. The number of shared FC channels required to allow any partition to communicate with any other partition is:

```
FC channels = 2xM
  where M = number of processor complexes
```

For unspanned FC channels that are shared on a processor complex that supports multiple logical channel subsystems, the value M above is equal to the total number of logical channel subsystems on the processor complexes.

**Note:** This is the same number of channels as the channel redundant configuration.

The number of unshared FC channels required to allow any partition to communicate with any other partition is:

```
FC channels = 4xn
  where n = number of processor complexes in basic mode
          or number of logical partitions in LPAR mode
```



## Chapter 3. FICON Configuration Examples

This chapter describes a methodology for choosing control unit numbers and device numbers for FICON CTC configurations. Several examples are provided to illustrate various FICON CTC configurations. IOCP statements included with each figure show the correct way to code the configuration.

### Numbering CTC control units and devices

It is recommended to use a Send and Receive pair of CTC devices for communicating. The send devices will be on one control unit while the receive devices will be on another control unit. Some applications require the use of Send and Receive pairs of devices and cannot use a single device for both sending and receiving data.

Assign a CTC image ID to every logical partition or basic mode CPC to which you want to establish CTC communication. This CTC image ID is only for managing your CTC definition and is not used by CTC communication. The CTC image ID is a two-digit hexadecimal number in the range X'00' to X'FF' and must be a unique value within your complex. The ID therefore will identify a specific image in your complex and is used by every other image to address that specific image.

The control unit and device numbers will consist of 4 digits. The first digit identifies the control unit or device as being used to Send or Receive. Use an even hexadecimal number when defining Send control units and devices and use an odd hexadecimal number when defining Receive control units and devices. The second and third digits are the CTC image ID. The fourth hexadecimal digit identifies primary and secondary connections. A value of 0 to 7 is used for the primary connection. A value of 8 to F is used for secondary connections which are used to increase availability of the CTC connections.

This methodology allows each system control program (SCP) to use the same subsystem definition. The subsystem definitions for each SCP are independent of the CPC image in which the SCP is operating.

### FICON CTC and Director with single path

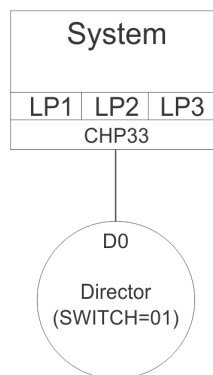


Figure 11. FICON CTC and director with single path

### IOCP input for the configuration

```
RESOURCE PARTITION=((LP1,1),(LP2,2),(LP3,3))
*
CHPID PATH=(33),TYPE=FC,SWITCH=01,PART=(LP1,LP2,LP3),SHARED
*
CNTLUNIT CUNUMBR=4010,PATH=33,LINK=D0,UNIT=FCTC,UNITADD=((00,2)),CUADD=1
IODEVICE ADDRESS=(4010,2),CUNUMBR=4010,UNIT=FCTC,UNITADD=00,NOTPART=LP1
*
CNTLUNIT CUNUMBR=4020,PATH=33,LINK=D0,UNIT=FCTC,UNITADD=((00,2)),CUADD=2
IODEVICE ADDRESS=(4020,2),CUNUMBR=4020,UNIT=FCTC,UNITADD=00,NOTPART=LP2
*
CNTLUNIT CUNUMBR=4030,PATH=33,LINK=D0,UNIT=FCTC,UNITADD=((00,2)),CUADD=3
IODEVICE ADDRESS=(4030,2),CUNUMBR=4030,UNIT=FCTC,UNITADD=00,NOTPART=LP3
```

**Note:** You must specify the same unit address for devices from different logical partitions to communicate with each other. In this example, device 100 in LPAR1, device 200 in LPAR2, and device 300 in LPAR3 can all communicate with each other. This example defines separate send and receive devices to be used by application programs as follows:

- LP1 sends data to LP2 with device 4020 and LP3 with device 4030. LP2 and LP3 both receive data from LP1 with device 4010.
- LP2 and LP3 send data to LP1 with device 4011. LP1 receives data from LP2 with device 4021 and from LP3 with device 4031.
- LP2 sends data to LP3 with device 4030. LP3 receives data from LP2 with device 4020.
- LP3 sends data to LP2 with device 4021. LP2 receives data from LP3 with device 4031.

## FICON CTC fully redundant and half duplex

Two sets of a CTC minimum configuration, each CTC configuration associated with a separate FICON Director, make up a fully redundant any-to-any CTC configuration. CTC communication is configured such that the definitions operate in half duplex on the FICON channels. See [Figure 12 on page 14](#).

**Note:** All shared CTC examples within a single CPC exclude an LP from communicating with itself. This exclusion is required for some subsystems (for example, XCF). Other subsystems may not have this restriction and may support an LP communicating with itself.

**Note:** The following IOCP statements follow the control unit and device numbering recommendations in “Numbering CTC control units and devices” on page 13. Logical partitions LP1A through LP4A have been assigned CTC image IDs of 01 through 04 and logical partitions LP1B through LP3B have been assigned CTC image IDs of 21 through 23.

This example uses a simple CTC configuration approach where the same channel path is always used for sending or receiving data and the same destination link address for a control unit number is always used. For example, System A always uses CHPID 50 on switch 01 for sending data and always uses CHPID 51 on switch 01 for receiving data. Also, FCTC control unit 4010 is always used by all CPCs to send data to LP1A on System A via link address C1 (CHPID 51) on System A. So a single destination link address (C1) is always associated with the same control unit number (4010).

This approach results in the FICON channels having half duplex definitions. That is, all FCTC I/O data flow will be on one fibre of the FICON channel resulting in it being half duplex. To balance I/O data flow on the FICON channel in this case, put tape devices on the channels used for receive FCTC control units and put DASD devices on the channels used for send FCTC control units. For example, you would put tape devices on CHPID 51 in System A and DASD devices on CHPID 50 in System A.

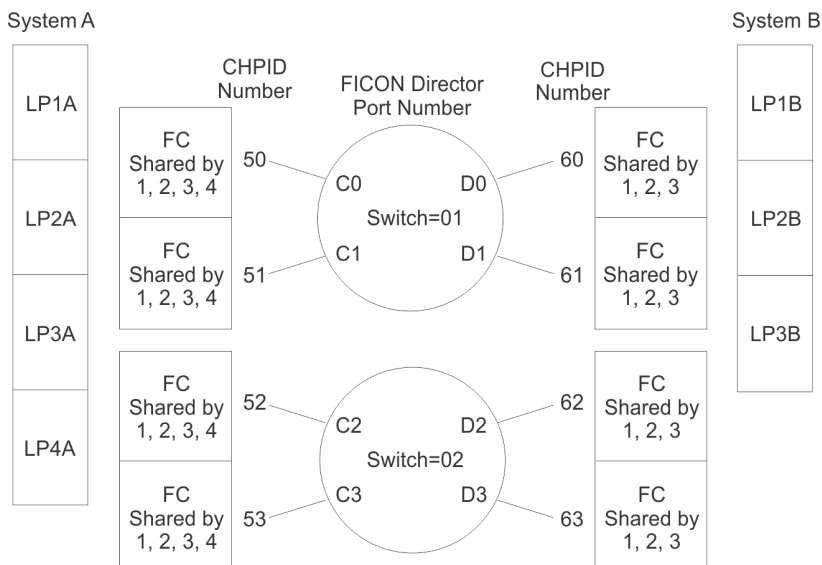


Figure 12. FICON CTC (fully redundant)

Every logical partition has 8 primary and 8 secondary CTC connections with every other logical partition. The primary connections use switch 01 and the secondary connections use switch 02.

## IOCP statements for system A

```
*RESOURCE PART=((LP1A,1),(LP2A,2),(LP3A,3),(LP4A,4))
*
CHPID PATH=50,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=51,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=52,TYPE=FC,SWITCH=02,SHARED
CHPID PATH=53,TYPE=FC,SWITCH=02,SHARED
*
*****
* Primary any-to-any CTC connections with Switch=01 *
*****
*
*****
* Primary wrap-around connections for logical partitions on System A *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4010,PATH=50,LINK=C1,CUADD=1,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4010,8),CUNUMBR=4010,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP1A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4020,PATH=50,LINK=C1,CUADD=2,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4020,8),CUNUMBR=4020,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP2A
** Send FCTC Control Unit and Device Definitions to CTC image ID 03
*
CNTLUNIT CUNUMBR=4030,PATH=50,LINK=C1,CUADD=3,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4030,8),CUNUMBR=4030,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP3A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
*
CNTLUNIT CUNUMBR=4040,PATH=50,LINK=C1,CUADD=4,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4040,8),CUNUMBR=4040,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP4A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
*
CNTLUNIT CUNUMBR=5010,PATH=51,LINK=C0,CUADD=1,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5010,8),CUNUMBR=5010,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP1A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5020,PATH=51,LINK=C0,CUADD=2,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5020,8),CUNUMBR=5020,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP2A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
*
CNTLUNIT CUNUMBR=5030,PATH=51,LINK=C0,CUADD=3,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5030,8),CUNUMBR=5030,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP3A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
*
CNTLUNIT CUNUMBR=5040,PATH=51,LINK=C0,CUADD=4,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5040,8),CUNUMBR=5040,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP4A
*****
* Primary CTC connections on Switch=01 to System B. *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
```

```

*
CNTLUNIT CUNUMBR=4210,PATH=50,LINK=D1,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4210,8),CUNUMBR=4210,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4220,PATH=50,LINK=D1,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4220,8),CUNUMBR=4220,UNIT=FCTC,UNITADD=00 +
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4230,PATH=50,LINK=D1,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4230,8),CUNUMBR=4230,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5210,PATH=51,LINK=D0,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5210,8),CUNUMBR=5210,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*
CNTLUNIT CUNUMBR=5220,PATH=51,LINK=D0,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5220,8),CUNUMBR=5220,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5230,PATH=51,LINK=D0,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5230,8),CUNUMBR=5230,UNIT=FCTC,UNITADD=00 +
*
*****
* Secondary any-to-any CTC connections with Switch=02 *
*****
*
*****
* Secondary wrap-around connections for LPs on System A *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4018,PATH=52,LINK=C3,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4018,8),CUNUMBR=4018,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4028,PATH=52,LINK=C3,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4028,8),CUNUMBR=4028,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
*
CNTLUNIT CUNUMBR=4038,PATH=52,LINK=C3,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4038,8),CUNUMBR=4038,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
*
CNTLUNIT CUNUMBR=4048,PATH=52,LINK=C3,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4048,8),CUNUMBR=4048,UNIT=FCTC,UNITADD=00, +
NOTPART=LP4A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
*
CNTLUNIT CUNUMBR=5018,PATH=53,LINK=C2,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5018,8),CUNUMBR=5018,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5028,PATH=53,LINK=C2,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC

```



```

IODEVICE ADDRESS=(5028,8),CUNUMBR=5028,UNIT=FCTC,UNITADD=00, +
      NOTPART=LP2A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
*
CNTLUNIT CUNUMBR=5038,PATH=53,LINK=C2,CUADD=3,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(5038,8),CUNUMBR=5038,UNIT=FCTC,UNITADD=00, +
      NOTPART=LP3A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
*
CNTLUNIT CUNUMBR=5048,PATH=53,LINK=C2,CUADD=4,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(5048,8),CUNUMBR=5048,UNIT=FCTC,UNITADD=00, +
      NOTPART=LP4A
*****
* Secondary CTC connections on Switch=02 to System B. *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4218,PATH=52,LINK=D3,CUADD=1,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(4218,8),CUNUMBR=4218,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4228,PATH=52,LINK=D3,CUADD=2,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(4228,8),CUNUMBR=4228,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4238,PATH=52,LINK=D3,CUADD=3,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(4238,8),CUNUMBR=4238,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5218,PATH=53,LINK=D2,CUADD=1,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(5218,8),CUNUMBR=5218,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*
CNTLUNIT CUNUMBR=5228,PATH=53,LINK=D2,CUADD=2,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(5228,8),CUNUMBR=5228,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5238,PATH=53,LINK=D2,CUADD=3,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(5238,8),CUNUMBR=5238,UNIT=FCTC,UNITADD=00 +

```

## IOCP statements for system B

```

*RESOURCE PART=((LP1B,1),(LP2B,2),(LP3B,3))
*
CHPID PATH=60,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=61,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=62,TYPE=FC,SWITCH=02,SHARED
CHPID PATH=63,TYPE=FC,SWITCH=02,SHARED
*
*****
* Primary any-to-any CTC connections with Switch=01 *
*****
*
*****
* Primary wrap-around connections for logical partitions on System B *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4210,PATH=60,LINK=D1,CUADD=1,UNITADD=((00,8)), +
      UNIT=FCTC
IODEVICE ADDRESS=(4210,8),CUNUMBR=4210,UNIT=FCTC,UNITADD=00, +
      NOTPART=LP1B

```

```

*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4220,PATH=60,LINK=D1,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4220,8),CUNUMBR=4220,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4230,PATH=60,LINK=D1,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4230,8),CUNUMBR=4230,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5210,PATH=61,LINK=D0,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5210,8),CUNUMBR=5210,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1B*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*
CNTLUNIT CUNUMBR=5220,PATH=61,LINK=D0,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5220,8),CUNUMBR=5220,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5230,PATH=61,LINK=D0,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5230,8),CUNUMBR=5230,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3B
*****
* Primary CTC connections on Switch=01 to System A. *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4010,PATH=60,LINK=C1,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4010,8),CUNUMBR=4010,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4020,PATH=60,LINK=C1,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4020,8),CUNUMBR=4020,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
*
CNTLUNIT CUNUMBR=4030,PATH=60,LINK=C1,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4030,8),CUNUMBR=4030,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
*
CNTLUNIT CUNUMBR=4040,PATH=60,LINK=C1,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4040,8),CUNUMBR=4040,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
*
CNTLUNIT CUNUMBR=5010,PATH=61,LINK=C0,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5010,8),CUNUMBR=5010,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5020,PATH=61,LINK=C0,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5020,8),CUNUMBR=5020,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
*
CNTLUNIT CUNUMBR=5030,PATH=61,LINK=C0,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5030,8),CUNUMBR=5030,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
*

```

```

CNTLUNIT CUNUMBR=5040,PATH=61,LINK=C0,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5040,8),CUNUMBR=5040,UNIT=FCTC,UNITADD=00 +
*
*****
* Secondary any-to-any CTC connections with Switch=02 *
*****
*
*****
* Secondary wrap-around connections for LPs on System B *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4218,PATH=62,LINK=D3,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4218,8),CUNUMBR=4218,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4228,PATH=62,LINK=D3,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4228,8),CUNUMBR=4228,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4238,PATH=62,LINK=D3,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4238,8),CUNUMBR=4238,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5218,PATH=63,LINK=D2,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5218,8),CUNUMBR=5218,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*
CNTLUNIT CUNUMBR=5228,PATH=63,LINK=D2,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5228,8),CUNUMBR=5228,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5238,PATH=63,LINK=D2,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5238,8),CUNUMBR=5238,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3B
*****
* Secondary CTC connections on Switch=02 to System A. *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4018,PATH=62,LINK=C3,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4018,8),CUNUMBR=4018,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4028,PATH=62,LINK=C3,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4028,8),CUNUMBR=4028,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
*
CNTLUNIT CUNUMBR=4038,PATH=62,LINK=C3,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4038,8),CUNUMBR=4038,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
*
CNTLUNIT CUNUMBR=4048,PATH=62,LINK=C3,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4048,8),CUNUMBR=4048,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01

```

```

*
CNTLUNIT CUNUMBR=5018,PATH=63,LINK=C2,CUADD=1,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5018,8),CUNUMBR=5018,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5028,PATH=63,LINK=C2,CUADD=2,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5028,8),CUNUMBR=5028,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
*
CNTLUNIT CUNUMBR=5038,PATH=63,LINK=C2,CUADD=3,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5038,8),CUNUMBR=5038,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
*
CNTLUNIT CUNUMBR=5048,PATH=63,LINK=C2,CUADD=4,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5048,8),CUNUMBR=5048,UNIT=FCTC,UNITADD=00 +

```

## FICON CTC fully redundant and full duplex

Two sets of a CTC minimum configuration, each CTC configuration associated with a separate FICON Director, make up a fully redundant any-to-any CTC configuration. CTC communication is configured so that it takes advantage of the full duplex capability of FICON channels. See [Figure 13 on page 21](#).

**Note:** All shared CTC examples within a single CPC exclude an LP from communicating with itself. This exclusion is required for some subsystems (for example, XCF). Other subsystems may not have this restriction and may support an LP communicating with itself.

**Note:** The following IOCP statements follow the control unit and device numbering recommendations in “[Numbering CTC control units and devices](#)” on page 13. Logical partitions LP1A through LP4A have been assigned CTC image IDs of 01 through 04 and logical partitions LP1B through LP3B have been assigned CTC image IDs of 21 through 23.

This example balances FICON CTC workload on the FICON channels by alternating the destination link addresses associated with a control unit number. When connecting the first two FICON channels to communicate with each other, each channel has only receive FCTC control units or send FCTC control units. For example, control units 4010 through 4040 are all send FCTC control units on CHPID 50 on System A and connect to link address C1 (CHPID 51) on System A. CHPID 50 is only used for sending I/O data to System A.

When connecting another pair of channels to the first two, alternate the role that they play by selecting different destination link addresses. For example, control units 4010 through 4040 are all send FCTC control units on CHPID 61 on System B but connect to link address C0 (CHPID 50) on System A instead of link address C1. CHPID 50 is only used for receiving I/O data from System B. Therefore, the configuration has balanced the workload on CHPID 50 by configuring the CTC communications to take advantage of the full duplex capability of the FICON channel. When connecting more CPCs and channels, continue to alternate destination link addresses so that the CTC communications on channels are kept balanced between receiving and sending and are full duplex.

A simpler configuration approach that can be used is to always use the same destination link address for a control unit number as illustrated in the preceding section, “[FICON CTC fully redundant and half duplex](#)” on page 14. The simpler approach results in the FICON channels having half duplex definitions.

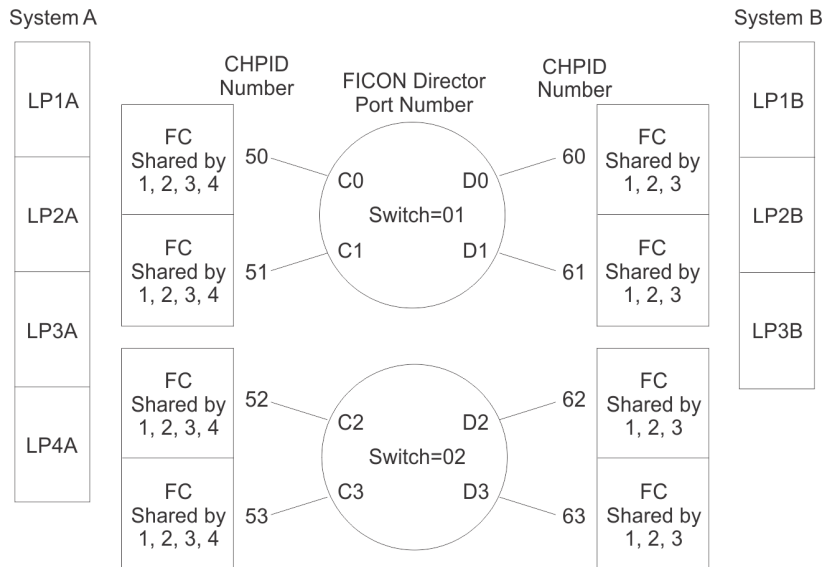


Figure 13. FICON CTC (fully redundant)

Every logical partition has 8 primary and 8 secondary CTC connections with every other logical partition. The primary connections use switch 01 and the secondary connections use switch 02.

## IOCP statements for system A

```

RESOURCE PART=((LP1A,1),(LP2A,2),(LP3A,3),(LP4A,4))
*
CHPID PATH=50,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=51,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=52,TYPE=FC,SWITCH=02,SHARED
CHPID PATH=53,TYPE=FC,SWITCH=02,SHARED
*
*****
* Primary any-to-any CTC connections with Switch=01 *
*****
*
*****
* Primary wrap-around connections for logical partitions on System A *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4010,PATH=50,LINK=C1,CUADD=1,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4010,8),CUNUMBR=4010,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP1A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4020,PATH=50,LINK=C1,CUADD=2,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4020,8),CUNUMBR=4020,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP2A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
*
CNTLUNIT CUNUMBR=4030,PATH=50,LINK=C1,CUADD=3,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4030,8),CUNUMBR=4030,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP3A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
*
CNTLUNIT CUNUMBR=4040,PATH=50,LINK=C1,CUADD=4,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4040,8),CUNUMBR=4040,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP4A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
*
CNTLUNIT CUNUMBR=5010,PATH=51,LINK=C0,CUADD=1,UNITADD=((00,8)), +

```

```

UNIT=FCTC
IODEVICE ADDRESS=(5010,8),CUNUMBR=5010,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5020,PATH=51,LINK=C0,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5020,8),CUNUMBR=5020,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
*
CNTLUNIT CUNUMBR=5030,PATH=51,LINK=C0,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5030,8),CUNUMBR=5030,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
*
CNTLUNIT CUNUMBR=5040,PATH=51,LINK=C0,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5040,8),CUNUMBR=5040,UNIT=FCTC,UNITADD=00, +
NOTPART=LP4A
*****
* Primary CTC connections on Switch=01 to System B. *
* To balance workload and have FICON channels be full duplex on *
* System A, send control units (CUs) use 51 and receive CUs use 50. *
* To balance workload and have FICON channels be full duplex on *
* System B, send CUs use destination CHPID 60 and receive CUs use 61.*
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4210,PATH=51,LINK=D0,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4210,8),CUNUMBR=4210,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4220,PATH=51,LINK=D0,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4220,8),CUNUMBR=4220,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4230,PATH=51,LINK=D0,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4230,8),CUNUMBR=4230,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5210,PATH=50,LINK=D1,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5210,8),CUNUMBR=5210,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*
CNTLUNIT CUNUMBR=5220,PATH=50,LINK=D1,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5220,8),CUNUMBR=5220,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5230,PATH=50,LINK=D1,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5230,8),CUNUMBR=5230,UNIT=FCTC,UNITADD=00 +
*
*****
* Secondary any-to-any CTC connections with Switch=02 *
*****
*****
* Secondary wrap-around connections for LPs on System A *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4018,PATH=52,LINK=C3,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4018,8),CUNUMBR=4018,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1A

```

```

*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4028,PATH=52,LINK=C3,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4028,8),CUNUMBR=4028,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
*
CNTLUNIT CUNUMBR=4038,PATH=52,LINK=C3,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4038,8),CUNUMBR=4038,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3A
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04*
CNTLUNIT CUNUMBR=4048,PATH=52,LINK=C3,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4048,8),CUNUMBR=4048,UNIT=FCTC,UNITADD=00, +
NOTPART=LP4A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
*
CNTLUNIT CUNUMBR=5018,PATH=53,LINK=C2,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5018,8),CUNUMBR=5018,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5028,PATH=53,LINK=C2,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5028,8),CUNUMBR=5028,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
*
CNTLUNIT CUNUMBR=5038,PATH=53,LINK=C2,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5038,8),CUNUMBR=5038,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3A
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
*
CNTLUNIT CUNUMBR=5048,PATH=53,LINK=C2,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5048,8),CUNUMBR=5048,UNIT=FCTC,UNITADD=00, +
NOTPART=LP4A
*****
* Secondary CTC connections on Switch=02 to System B. *
* To balance workload and have FICON channels be full duplex on *
* System A, send control units (CUs) use 53 and receive CUs use 52. *
* To balance workload and have FICON channels be full duplex on *
* System B, send CUs use destination CHPID 62 and receive CUs use 63. *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4218,PATH=53,LINK=D2,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4218,8),CUNUMBR=4218,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4228,PATH=53,LINK=D2,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4228,8),CUNUMBR=4228,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4238,PATH=53,LINK=D2,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4238,8),CUNUMBR=4238,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5218,PATH=52,LINK=D3,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5218,8),CUNUMBR=5218,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*

```

```

CNTLUNIT CUNUMBR=5228,PATH=52,LINK=D3,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5228,8),CUNUMBR=5228,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5238,PATH=52,LINK=D3,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5238,8),CUNUMBR=5238,UNIT=FCTC,UNITADD=00 +

```

## IOCP statements for system B

```

RESOURCE PART=((LP1B,1),(LP2B,2),(LP3B,3))
*
CHPID PATH=60,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=61,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=62,TYPE=FC,SWITCH=02,SHARED
CHPID PATH=63,TYPE=FC,SWITCH=02,SHARED
*
*****
* Primary any-to-any CTC connections with Switch=01 *
*****
*
*****
* Primary wrap-around connections for logical partitions on System B *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4210,PATH=60,LINK=D1,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4210,8),CUNUMBR=4210,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4220,PATH=60,LINK=D1,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4220,8),CUNUMBR=4220,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4230,PATH=60,LINK=D1,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4230,8),CUNUMBR=4230,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5210,PATH=61,LINK=D0,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5210,8),CUNUMBR=5210,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*
CNTLUNIT CUNUMBR=5220,PATH=61,LINK=D0,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5220,8),CUNUMBR=5220,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5230,PATH=61,LINK=D0,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5230,8),CUNUMBR=5230,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3B
*****
* Primary CTC connections on Switch=01 to System A. *
* To balance workload and have FICON channels be full duplex on *
* System B, send control units (CUs) use 61 and receive CUs use 60. *
* To balance workload and have FICON channels be full duplex on *
* System A, send CUs use destination CHPID 50 and receive CUs use 51.*
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4010,PATH=61,LINK=C0,CUADD=1,UNITADD=((00,8)), +

```



```

UNIT=FCTC
IODEVICE ADDRESS=(4010,8),CUNUMBR=4010,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4020,PATH=61,LINK=C0,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4020,8),CUNUMBR=4020,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
*
CNTLUNIT CUNUMBR=4030,PATH=61,LINK=C0,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4030,8),CUNUMBR=4030,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
*
CNTLUNIT CUNUMBR=4040,PATH=61,LINK=C0,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4040,8),CUNUMBR=4040,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
*
CNTLUNIT CUNUMBR=5010,PATH=60,LINK=C1,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5010,8),CUNUMBR=5010,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5020,PATH=60,LINK=C1,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5020,8),CUNUMBR=5020,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
*
CNTLUNIT CUNUMBR=5030,PATH=60,LINK=C1,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5030,8),CUNUMBR=5030,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
*
CNTLUNIT CUNUMBR=5040,PATH=60,LINK=C1,CUADD=4,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5040,8),CUNUMBR=5040,UNIT=FCTC,UNITADD=00 +
*
*****
* Secondary any-to-any CTC connections with Switch=02 *
*****
*
*****
* Secondary wrap-around connections for LPs on System B *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4218,PATH=62,LINK=D3,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4218,8),CUNUMBR=4218,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4228,PATH=62,LINK=D3,CUADD=2,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4228,8),CUNUMBR=4228,UNIT=FCTC,UNITADD=00, +
NOTPART=LP2B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4238,PATH=62,LINK=D3,CUADD=3,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(4238,8),CUNUMBR=4238,UNIT=FCTC,UNITADD=00, +
NOTPART=LP3B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5218,PATH=63,LINK=D2,CUADD=1,UNITADD=((00,8)), +
UNIT=FCTC
IODEVICE ADDRESS=(5218,8),CUNUMBR=5218,UNIT=FCTC,UNITADD=00, +
NOTPART=LP1B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22

```

```

*
CNTLUNIT CUNUMBR=5228,PATH=63,LINK=D2,CUADD=2,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5228,8),CUNUMBR=5228,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP2B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5238,PATH=63,LINK=D2,CUADD=3,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5238,8),CUNUMBR=5238,UNIT=FCTC,UNITADD=00, +
          NOTPART=LP3B
*****
* Secondary CTC connections on Switch=02 to System A. *
* To balance workload and have FICON channels be full duplex on *
* System B, send control units (CUs) use 63 and receive CUs use 62. *
* To balance workload and have FICON channels be full duplex on *
* System A, send CUs use destination CHPID 52 and receive CUs use 53. *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4018,PATH=63,LINK=C2,CUADD=1,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4018,8),CUNUMBR=4018,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4028,PATH=63,LINK=C2,CUADD=2,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4028,8),CUNUMBR=4028,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
*
CNTLUNIT CUNUMBR=4038,PATH=63,LINK=C2,CUADD=3,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4038,8),CUNUMBR=4038,UNIT=FCTC,UNITADD=00 +
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
*
CNTLUNIT CUNUMBR=4048,PATH=63,LINK=C2,CUADD=4,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(4048,8),CUNUMBR=4048,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
*
CNTLUNIT CUNUMBR=5018,PATH=62,LINK=C3,CUADD=1,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5018,8),CUNUMBR=5018,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5028,PATH=62,LINK=C3,CUADD=2,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5028,8),CUNUMBR=5028,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
*
CNTLUNIT CUNUMBR=5038,PATH=62,LINK=C3,CUADD=3,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5038,8),CUNUMBR=5038,UNIT=FCTC,UNITADD=00 +
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
*
CNTLUNIT CUNUMBR=5048,PATH=62,LINK=C3,CUADD=4,UNITADD=((00,8)), +
          UNIT=FCTC
IODEVICE ADDRESS=(5048,8),CUNUMBR=5048,UNIT=FCTC,UNITADD=00 +

```

## FICON CTC with multiple logical channel subsystems

System z9 and zSeries processors other than z800 and z900 support multiple logical channel subsystems (CSSs). When communicating to a shared FC channel path on a System z9 or zSeries processor other than a z/800 or z/900, the logical address (CUADD keyword on CNTLUNIT statement) specified must be two digits if the destination logical partition has a non-zero CSS ID. This example illustrates when two-digit CUADD values are required and when they are not. The CTC connections for switch 02 illustrate that no CUADD value is used when communicating with an unshared channel path.

**Note:** All shared CTC examples within a single CPC exclude an LP from communicating with itself. This exclusion is required for some subsystems (for example, XCF). Other subsystems may not have this restriction and may support an LP communicating with itself.

**Note:** The following IOCP statements follow the control unit and device numbering recommendations in “Numbering CTC control units and devices” on page 13. Logical partitions LP01A through LP14A have been assigned CTC image IDs of 01 through 04 and logical partitions LP1B through LP3B have been assigned CTC image IDs of 21 through 23.

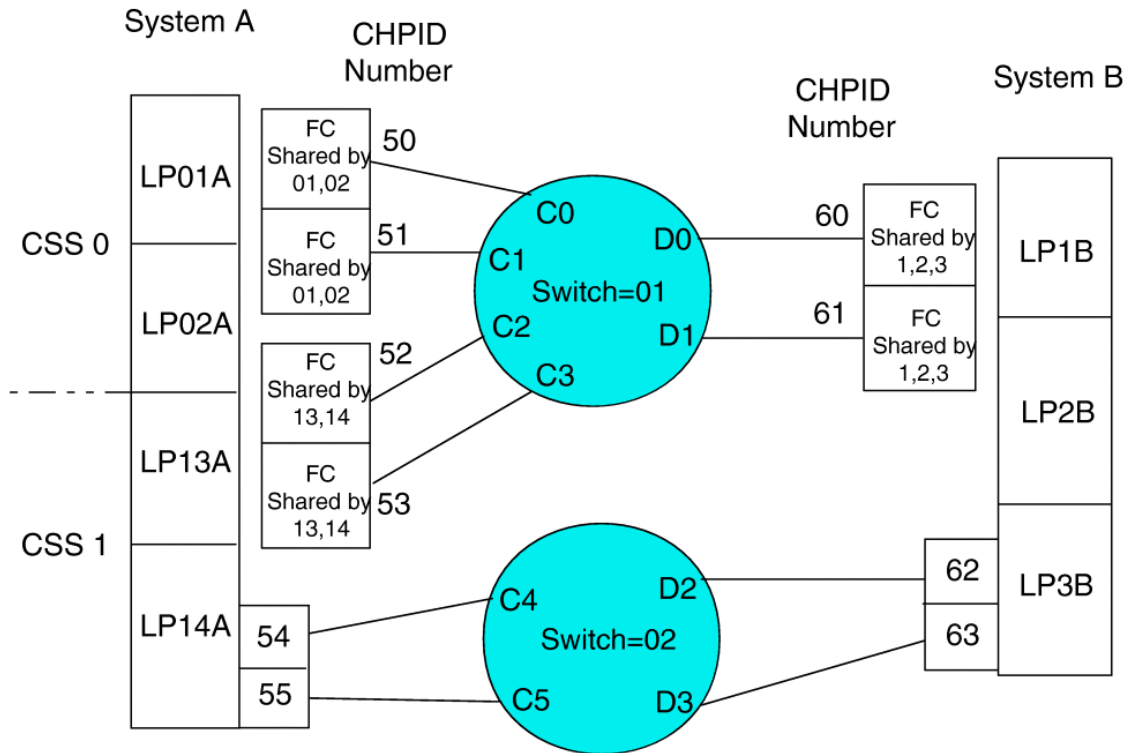


Figure 14. FICON CTC with multiple logical channel subsystems

## IOCP statements for system A

```

RESOURCE PART=((CSS(0),(LP01A,1),(LP02A,2)),
              (CSS(1),(LP13A,3),(LP14A,4)))
*
CHPID PATH=(CSS(0),50),PCHID=100,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=(CSS(0),51),PCHID=101,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=(CSS(1),52),PCHID=110,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=(CSS(1),53),PCHID=111,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=(CSS(1),54),PCHID=120,TYPE=FC,SWITCH=02,PART=LP14A
CHPID PATH=(CSS(1),55),PCHID=121,TYPE=FC,SWITCH=02,PART=LP14A
*
*****
* CTC connections with SWITCH=01 *
*****
*
*****
* Wrap-around connections for logical partitions on System A *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
* (CUADD value can be 01 or 1)

```

```

*
CNTLUNIT CUNUMBR=4010,PATH=((CSS(0),50),(CSS(1),52)),          +
        LINK=((CSS(0),C1),(CSS(1),C1)),CUADD=1,                +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(4010,8),CUNUMBR=4010,UNIT=FCTC,UNITADD=00,  +
        NOTPART=(CSS(0),LP01A)
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
* (CUADD value can be 02 or 2)
*
CNTLUNIT CUNUMBR=4020,PATH=((CSS(0),50),(CSS(1),52)),          +
        LINK=((CSS(0),C1),(CSS(1),C1)),CUADD=02,              +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(4020,8),CUNUMBR=4020,UNIT=FCTC,UNITADD=00,  +
        NOTPART=(CSS(0),LP02A)
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
* (CUADD value must be 13 for CSS ID 1 and MIF image ID 3)
*
CNTLUNIT CUNUMBR=4030,PATH=((CSS(0),50),(CSS(1),52)),          +
        LINK=((CSS(0),C3),(CSS(1),C3)),CUADD=13,              +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(4030,8),CUNUMBR=4030,UNIT=FCTC,UNITADD=00,  +
        NOTPART=(CSS(1),LP13A)
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
* (CUADD value must be 14 for CSS ID 1 and MIF image ID 4)
*
CNTLUNIT CUNUMBR=4040,PATH=((CSS(0),50),(CSS(1),52)),          +
        LINK=((CSS(0),C3),(CSS(1),C3)),CUADD=14,              +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(4040,8),CUNUMBR=4040,UNIT=FCTC,UNITADD=00,  +
        NOTPART=(CSS(1),LP14A)
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
* (CUADD value can be 01 or 1)
*
CNTLUNIT CUNUMBR=5010,PATH=((CSS(0),51),(CSS(1),53)),          +
        LINK=((CSS(0),C0),(CSS(1),C2)),CUADD=01,              +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(5010,8),CUNUMBR=5010,UNIT=FCTC,UNITADD=00,  +
        NOTPART=(CSS(0),LP01A)
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
* (CUADD value can be 02 or 2)
*
CNTLUNIT CUNUMBR=5020,PATH=((CSS(0),51),(CSS(1),53)),          +
        LINK=((CSS(0),C0),(CSS(1),C2)),CUADD=2,                +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(5020,8),CUNUMBR=5020,UNIT=FCTC,UNITADD=00,  +
        NOTPART=(CSS(0),LP02A)
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
* (CUADD value must be 13 for CSS ID 1 and MIF image ID 3)
*
CNTLUNIT CUNUMBR=5030,PATH=((CSS(0),51),(CSS(1),53)),          +
        LINK=((CSS(0),C0),(CSS(1),C2)),CUADD=13,              +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(5030,8),CUNUMBR=5030,UNIT=FCTC,UNITADD=00,  +
        NOTPART=(CSS(1),LP13A)
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
* (CUADD value must be 14 for CSS ID 1 and MIF image ID 4)
*
CNTLUNIT CUNUMBR=5040,PATH=((CSS(0),51),(CSS(1),53)),          +
        LINK=((CSS(0),C0),(CSS(1),C2)),CUADD=14,              +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(5040,8),CUNUMBR=5040,UNIT=FCTC,UNITADD=00,  +
        NOTPART=(CSS(1),LP14A)
*
*****
* CTC connections with SWITCH=01 to System B *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4210,PATH=((CSS(0),50),(CSS(1),52)),          +
        LINK=((CSS(0),D1),(CSS(1),D1)),CUADD=1,                +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(4210,8),CUNUMBR=4210,UNIT=FCTC,UNITADD=00
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22

```

```

*
CNTLUNIT CUNUMBR=4220,PATH=((CSS(0),50),(CSS(1),52)),          +
        LINK=((CSS(0),D1),(CSS(1),D1)),CUADD=2,                +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(4220,8),CUNUMBR=4220,UNIT=FCTC,UNITADD=00
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4230,PATH=((CSS(0),50),(CSS(1),52)),          +
        LINK=((CSS(0),D1),(CSS(1),D1)),CUADD=3,                +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(4230,8),CUNUMBR=4230,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5210,PATH=((CSS(0),51),(CSS(1),53)),          +
        LINK=((CSS(0),D0),(CSS(1),D0)),CUADD=1,                +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(5210,8),CUNUMBR=5210,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*
CNTLUNIT CUNUMBR=5220,PATH=((CSS(0),51),(CSS(1),53)),          +
        LINK=((CSS(0),D0),(CSS(1),D0)),CUADD=2,                +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(5220,8),CUNUMBR=5220,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5230,PATH=((CSS(0),51),(CSS(1),53)),          +
        LINK=((CSS(0),D0),(CSS(1),D0)),CUADD=3,                +
        UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(5230,8),CUNUMBR=5230,UNIT=FCTC,UNITADD=00
*
*****
* Secondary CTC connections for LP14A and LP3B *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
* (Destination CHPID is unshared so no CUADD is required)
*
CNTLUNIT CUNUMBR=4238,PATH=(CSS(1),54),LINK=D3,UNITADD=((00,8)),  +
        UNIT=FCTC
IODEVICE ADDRESS=(4238,8),CUNUMBR=4238,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
* (Destination CHPID is unshared so no CUADD is required)
*
CNTLUNIT CUNUMBR=5238,PATH=(CSS(1),55),LINK=D2,UNITADD=((00,8)),  +
        UNIT=FCTC
IODEVICE ADDRESS=(5238,8),CUNUMBR=5238,UNIT=FCTC,UNITADD=00

```

## IOCP statements for system B:

```

RESOURCE PART=((LP1B,1),(LP2B,2),(LP3B,3))
*
CHPID PATH=60,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=61,TYPE=FC,SWITCH=01,SHARED
CHPID PATH=62,TYPE=FC,SWITCH=01,PART=LP3B
CHPID PATH=63,TYPE=FC,SWITCH=01,PART=LP3B
*
*****
* CTC connections with SWITCH=01 *
*****
*
*****
* Wrap-around connections for logical partitions on System B *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 21
*
CNTLUNIT CUNUMBR=4210,PATH=60,LINK=D1,CUADD=1,UNITADD=((00,8)),  +
        UNIT=FCTC
IODEVICE ADDRESS=(4210,8),CUNUMBR=4210,UNIT=FCTC,UNITADD=00,  +
        NOTPART=LP1B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 22
*
CNTLUNIT CUNUMBR=4220,PATH=60,LINK=D1,CUADD=2,UNITADD=((00,8)),  +

```

```

UNIT=FCTC
IODEVICE ADDRESS=(4220,8),CUNUMBR=4220,UNIT=FCTC,UNITADD=00,      +
NOTPART=LP2B
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 23
*
CNTLUNIT CUNUMBR=4230,PATH=60,LINK=D1,CUADD=3,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(4230,8),CUNUMBR=4230,UNIT=FCTC,UNITADD=00,      +
NOTPART=LP3B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 21
*
CNTLUNIT CUNUMBR=5210,PATH=61,LINK=D0,CUADD=1,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(5210,8),CUNUMBR=5210,UNIT=FCTC,UNITADD=00,      +
NOTPART=LP1B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 22
*
CNTLUNIT CUNUMBR=5220,PATH=61,LINK=D0,CUADD=2,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(5220,8),CUNUMBR=5220,UNIT=FCTC,UNITADD=00,      +
NOTPART=LP2B
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 23
*
CNTLUNIT CUNUMBR=5230,PATH=61,LINK=D0,CUADD=3,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(5230,8),CUNUMBR=5230,UNIT=FCTC,UNITADD=00,      +
NOTPART=LP3B
*
*****
* CTC connections with SWITCH=01 to System A *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 01
*
CNTLUNIT CUNUMBR=4010,PATH=60,LINK=C1,CUADD=1,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(4010,8),CUNUMBR=4010,UNIT=FCTC,UNITADD=00
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 02
*
CNTLUNIT CUNUMBR=4020,PATH=60,LINK=C1,CUADD=2,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(4020,8),CUNUMBR=4020,UNIT=FCTC,UNITADD=00
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 03
* (CUADD value must be 13 for CSS ID 1 and MIF image ID 3)
*
CNTLUNIT CUNUMBR=4030,PATH=60,LINK=C3,CUADD=13,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(4030,8),CUNUMBR=4030,UNIT=FCTC,UNITADD=00
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
* (CUADD value must be 14 for CSS ID 1 and MIF image ID 4)
*
CNTLUNIT CUNUMBR=4040,PATH=60,LINK=C3,CUADD=14,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(4040,8),CUNUMBR=4040,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 01
*
CNTLUNIT CUNUMBR=5010,PATH=61,LINK=C0,CUADD=1,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(5010,8),CUNUMBR=5010,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 02
*
CNTLUNIT CUNUMBR=5020,PATH=61,LINK=C0,CUADD=2,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(5020,8),CUNUMBR=5020,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 03
* (CUADD value must be 13 for CSS ID 1 and MIF image ID 3)
*
CNTLUNIT CUNUMBR=5030,PATH=61,LINK=C2,CUADD=13,UNITADD=((00,8)),    +
UNIT=FCTC
IODEVICE ADDRESS=(5030,8),CUNUMBR=5030,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04

```

```

* (CUADD value must be 14 for CSS ID 1 and MIF image ID 4)
*
CNTLUNIT CUNUMBR=5040,PATH=61,LINK=C2,CUADD=14,UNITADD=((00,8)),      +
        UNIT=FCTC
IODEVICE ADDRESS=(5040,8),CUNUMBR=5040,UNIT=FCTC,UNITADD=00
*
*****
* Secondary CTC connections for LP3B and LP14A *
*****
*
* Send FCTC Control Unit and Device Definitions to CTC image ID 04
* (Destination CHPID is unshared so no CUADD is required)
*
CNTLUNIT CUNUMBR=4038,PATH=62,LINK=C5,UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(4038,8),CUNUMBR=4038,UNIT=FCTC,UNITADD=00
*
* Receive FCTC Control Unit and Device Definitions from CTC image ID 04
* (Destination CHPID is unshared so no CUADD is required)
*
CNTLUNIT CUNUMBR=5038,PATH=63,LINK=C4,UNITADD=((00,8)),UNIT=FCTC
IODEVICE ADDRESS=(5038,8),CUNUMBR=5038,UNIT=FCTC,UNITADD=00

```

**Note:** When communicating to a shared FC channel path on an IBM System z9 or zSeries processor other than a z/800 or z/900, the logical address (CUADD keyword on CNTLUNIT statement) specified must be two digits if the destination logical partition has a non-zero CSS ID. For example, if the destination logical partition is in CSS 1 and has MIF image ID 5, specify CUADD=15.





## Chapter 4. FICON CTC device-specific functions

This chapter describes device-specific functions that the FICON CTC implementation supports.

### Sense ID command

The Sense ID command response contains 12 bytes. The first 7 bytes are basic identification information and the next 5 bytes are extended identification information.

Control unit model number (byte 3) =X'1E' indicates that it is a channel with integrated CTC control unit function. Device-model number (byte 6) will always be X'00' for FICON CTC devices.

*Table 1. Sense ID data for a FICON CTC device that supports FICON CTC mode*

Sense Byte	Hex Value	Field Description
Byte 0	FF	
Byte 1	30	Control unit type number
Byte 2	88	Control unit type number
Byte 3	1E	Control unit model number
Byte 4	00	Device type number
Byte 5	00	Device type number
Byte 6	00	Device model number
Byte 7	00	
Byte 8	40	
Byte 9	C4	
Byte 10	00	
Byte 11	80	

Beginning with byte 8, a 4-byte command information word is provided. It describes a command that can cause the device to perform a specific operation.

- Byte 8 is a flag indicating that the Read Configuration Data command is supported.
- Byte 9 contains the command code for the Read Configuration Data command.
- Bytes 10-11 contain the data transfer byte count for the read configuration data command.

### Read configuration data command

The program sends a Read Configuration Data command, command code X'C4', to read a configuration record that contains information describing the internal configuration of the device.

The 128-byte configuration record consists of four 32-byte fields:

- Node element descriptor (NED) of the node where the CTC function is local (integrated with the channel) for this CTC connection.
- Specific Node Element Qualifier (SNEQ) of the node where the CTC function is remote for this connection.
- Token node element descriptor (token NED)
- General node element qualifier (general NEQ)

See *ESA/390: Common I/O Device Commands, SA22 7204*, for a description of NED and NEQ fields.

## Node Element Descriptor (NED)

The sequence number indicator field (bits 3-4 of the flags byte) contains a code of X'01' to indicate that the sequence number in the NED may not be the sequence number of the processor complex. The first 4 bytes of the sequence number field are used for nonsequenced number purposes. See [Table 2 on page 34](#).

All FICON CTC devices for every FICON CTC channel on a processor complex share the processor complex's sequence number; the last 7 bytes of which are stored in the last 7 bytes (bytes 23-29) of the sequence number field.

The information in bytes 18-21 and bytes 30-31 are needed to make FICON CTC devices NED-unique to an operating system.

Programs sending Read Configuration Data commands to either side of an FICON CTC device receive the same NED data.

The NED has the following format:

Word	NED Format				
0	Flags	Type	Class	Reserved.	Level
1	Type Number				
2	Type Number (c)		Model Number		
3	MN (c)	Manufacturer			
4	Plant of Mfg.		Sequence Number		
5	Sequence Number (c)				
6	Sequence Number (c)				
7	Sequence No. (c)		Tag		

### Flags

X'C8'

### Type

X'01'

### Class

X'09'

### Reserved

B'0000000'

### Level

B'0'

## Type number

Characters in EBCDIC code that indicate the machine type for the processor complex to which the FICON channel is configured. For example, X'F0F0F2F0F6F4' is used to indicate a zSeries 900 processor complex.

## Model number

Three characters in EBCDIC code that indicate the FICON CTC device model. For FICON CTC devices, X'C3E3C3' (character CTC) is used.

## Manufacturer

Three characters in EBCDIC code that indicate the manufacturer of the processor complex to which the FICON CTC channel is configured. X'C9C2D4' indicates IBM.

## Plant of manufacture

Two characters in EBCDIC code that indicate the plant of manufacture of the processor complex to which the FICON CTC channel is configured.

## Bytes 0-4 of sequence number

These bytes are used for nonsequenced number purposes.

- Bytes 0 -1 on systems z900 and earlier indicate the link address in EBCDIC of the FICON channel.
- Bytes 0 -1 on systems z990 and later indicate the Inbound CSSID.IID in EBCDIC
- Byte 2 contents on systems z900 and earlier depend on whether the FICON channel is shared:
  - If the FICON channel is shared, byte 2 indicates the logical partition number on the local channel side of the CTC communication associated with the device.
  - If the FICON channel is not shared, byte 2 indicates the partition number 0 in X'F0' EBCDIC code is indicated.
- Byte 2 on systems z990 and later indicates the Outbound CSSID in EBCDIC
- Byte 3 contents on systems z900 and earlier depend on whether the FICON channel is shared:
  - If the FICON channel is shared, byte 3 indicates the logical partition number on the remote FICON channel side of the CTC communication associated with the device.
  - If the FICON channel is not shared, byte 3 indicates partition number 0 in X'F0' EBCDIC code.
- Byte 3 on systems z990 and later indicates the Outbound IID in EBCDIC
- Byte 4:
  - Contains a value of "C1" (or EBCDIC "A") if this NED is describing the channel that issued the Read Configuration Data command.
  - Contains a value of "C2" (or EBCDIC "B") if this NED is describing the channel to which the channel that issued the command is connected.

## Bytes 5-11 of the sequence number

Characters in EBCDIC code indicating the last 7 bytes of the sequence number for the processor complex to which the FICON channel is configured.

## Tag

Two bytes, as follows:

- Byte 1 on systems z900 and earlier indicates the physical channel number on the processor complex to which the FICON channel is configured.
- Byte 1 on systems z990 and later is currently reserved at 0 for future expansion.
- Byte 2 indicates the unit address used for this CTC access, which is the same for both sides of the CTC connection.

## Specific Node Element Qualifier (SNEQ)

The sequence number indicator field (bits 3-4 of the flags byte) contains a code of X'01' to indicate that the sequence number in the SNEQ may not be the sequence number of the processor complex. The first 4 bytes of the sequence number field are used for nonsequenced number purposes. See [Table 3 on page 36](#)

All FICON CTC devices for every FICON CTC channel on a processor complex share the processor complex's sequence number; the last 7 bytes of which are stored in the last 7 bytes (bytes 23-29) of the sequence number field.

The information in bytes 18-21 and bytes 30-31 are needed to make FICON CTC devices SNEQ-unique to an operating system.

Programs sending Read Configuration Data commands to either side of an FICON CTC device receive the same NED data.

The SNEQ has the following format:

<i>Table 3. Contents of Specific Node Element Qualifier</i>		
<b>Word</b>	<b>SNEQ Format</b>	
0	Flags	Reserved
1	Type Number	
2	Type Numbers (c)	Model Numbers
3	MN (c)	Manufacturer
4	Plant of Mfg.	Sequence Number
5	Sequence Number (c)	
6	Sequence Number (c)	
7	Sequence Number (c)	Tag

#### **Flags**

X'40'

#### **Reserved**

X'000000'

### **Type number**

Characters in EBCDIC code that indicate the machine type for the processor complex to which the FICON channel is configured. For example, X'F0F0F2F0F6F4' is used to indicate a zSeries 900 processor complex.

### **Model number**

Three characters in EBCDIC code that indicate the FICON CTC device model. For FICON CTC devices, X'C3E3C3' (character CTC) is used.

### **Manufacturer**

Three characters in EBCDIC code that indicate the manufacturer of the processor complex to which the FICON CTC channel is configured. X'C9C2D4' indicates IBM.

### **Plant of manufacture**

Two characters in EBCDIC code that indicate the plant of manufacture of the processor complex to which the FICON CTC channel is configured.

### **Bytes 0-4 of sequence number**

These bytes are used for nonsequenced number purposes.

- Bytes 0-1 on systems z900 and earlier indicate the link address in EBCDIC of the FICON channel.

- Bytes 0-1 on systems z990 and later indicate the Inbound CSSID.IID from Remote Node Descriptor in EBCDIC
- Byte 2 contents on systems z900 and earlier depend on whether the FICON channel is shared:
  - If the FICON channel is shared, byte 2 indicates the logical partition number on the remote channel side of the CTC communication associated with the device.
  - If the FICON channel is not shared, byte 2 indicates the partition number 0 in X'F0' EBCDIC code is indicated.
- Byte 2 on systems z990 and later indicates the Outbound CSSID from Remote Node Descriptor in EBCDIC
- Byte 3 contents on systems z900 and earlier depend on whether the FICON channel is shared:
  - If the FICON channel is shared, byte 3 indicates the logical partition number on the local FICON channel side of the CTC communication associated with the device.
  - If the FICON channel is not shared, byte 3 indicates partition number 0 in X'F0' EBCDIC code.
- Byte 3 on systems z990 and later indicate the Outbound IID from Remote Node Descriptor in EBCDIC
- Byte 4:
  - Contains a value of "C1" (or EBCDIC "A") if this SNEQ is describing the channel that issued the Read Configuration Data command.
  - Contains a value of "C2" (or EBCDIC "B") if this SNEQ is describing the channel to which the channel that issued the command is connected.

### Bytes 5-11 of the sequence number

Characters in EBCDIC code indicating the last 7 bytes of the sequence number for the processor complex to which the FICON channel is configured.

### Tag

Two bytes, as follows:

- Byte 1 on systems z900 and earlier indicates the physical channel number on the processor complex to which the FICON channel is configured.
- Byte 1 on systems z990 and later is currently reserved at 0 for future expansion.
- Byte 2 indicates the unit address used for this CTC access, which is the same for both sides of the CTC connection.

## Token Node Element Descriptor (Token NED)

The serial number contained in the token NED is the 10-byte serial number of the processor complex to which the FICON CTC channel is configured. The serial number indicator field of the flags byte has a value of X'10'.

The configuration data for each FICON CTC device for an FICON CTC channel has the same token NED.

The token NED has the following format:

Word	Token NED Format				
0	Flags	Type	Class	Reserved	L
1	Type Number				
2	Type Number (c)		Model Number		
3	MN (c)	Manufacturer			

Table 4. Contents of Token Node Element Descriptor (continued)

Word	Token NED Format	
4	Plant of Manufacturing	Sequence Number
5	Sequence Number (c)	
6	Sequence Number (c)	
7	Sequence Number (c)	Tag

**Flags**

X'C8'

**Type**

X'01'

**Class**

X'09'

**Reserved**

B'0000000'

**Level**

B'0'

**Type number**

Characters in EBCDIC code that indicate the machine type for the processor complex to which the FICON channel is configured. For example, X'F0F0F2F0F6F4' is used to indicate a zSeries 900 processor complex.

**Model number**

Three characters in EBCDIC code that indicate the FICON CTC device model. For FICON CTC devices, X'C3E3C3' (character CTC) is used.

**Manufacturer**

Three characters in EBCDIC code that indicate the manufacturer of the processor complex to which the FICON CTC channel is configured. X'C9C2D4' indicates IBM.

**Plant of manufacture**

Two characters in EBCDIC code that indicate the plant of manufacture of the processor complex to which the FICON CTC channel is configured.

**Sequence number**

Ten characters in EBCDIC code that indicate the sequence number for the processor complex to which the FICON CTC channel is configured.

**Tag**

- Byte 1 on systems z900 and earlier is X'00'
- Byte 1 on systems z990 and later contains the CSSID Mask
- Byte 2 on systems z900 and earlier indicates the physical channel number on the processor complex to which the FICON CTC channel is configured.
- Byte 2 on systems z990 and later indicates the CHPID

## General Node Element Qualifier (NEQ)

The general NEQ has the following format:

Word	General NEQ Format		
0	Flags	RS	Interface ID
1	Reserved		
2	X '00000000'		
3	X '00000000'		
4	X '00000000'		
5	X '00000000'		
6	X '00000000'		
7	X '00000000'		

### Flag

X'80"

### RS

X'00'

### Interface ID

- Byte 1 is X'00'
- Byte 2 is:
  - X'01' if the configuration record is requested by the system to which the CTC function is local.
  - X'02' if the record is requested by the system to which the CTC function is remote

### Reserved

X'00000000'

## Data chaining

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The data chaining function is not supported by the FICON CTC channel. If a FICON CTC device receives a command frame with the chain data flag set, the command is rejected with unit check status. Bit 0 (command reject bit) of sense byte 0 is set to 1 to indicate this condition.

## Error reporting

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The FICON channel CTC function reports errors and unusual conditions to the control program by presenting both 'unit check' status and the proper ending status. The causes of the errors are indicated in the sense bytes which can be retrieved by the Sense Adapter State command.





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## Appendix A. Notices

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The following Class A statements apply to this IBM product. The statement for other IBM products intended for use with this product will appear in their accompanying manuals.

### **Federal Communications Commission (FCC) Statement**

**Note:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### **Industry Canada Compliance Statement**

This Class A digital apparatus complies with Canadian ICES-003.

### **United Kingdom Notice**

This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

### **Avis de conformité à la réglementation d'Industrie Canada**

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

### **European Community Compliance Statement**

This product is in conformity with the protection requirements of EU Council Directive 2014/30/EU on the approximation of the laws of the Member States relating to electromagnetic compatibility. IBM cannot accept responsibility for any failure to satisfy the protection requirements resulting from a non-recommended modification of the product, including the fitting of non-IBM option cards.

This product has been tested and found to comply with the limits for Class A Information Technology Equipment according to European Standard EN 55032. The limits for Class A equipment were derived for commercial and industrial environments to provide reasonable protection against interference with licensed communication equipment.

European Community contact:  
IBM Deutschland GmbH

Technical Regulations, Department M372  
IBM-Allee 1, 71139 Ehningen, Germany  
Tele: +49 (0) 800 225 5423 or +49 (0) 180 331 3233  
email: halloibm@de.ibm.com

**Warning:** This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

### Japan Voluntary Control Council for Interference (VCCI) Notice

この装置は、クラス A 機器です。この装置を住宅環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

V C C I - A

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This statement applies to products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

These statements apply to products greater than 20 A, single-phase.

高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。

回路分類：6（単相、PFC回路付）

換算係数：0

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回路分類 : 5 (3相、PFC回路付)

換算係数 : 0

### People's Republic of China Notice

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**Declaration:** This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may need to perform practical action.

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於居住環境中使用時，  
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使用者會被要求採取某些適當的對策。

**CNS 15936:**

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**IBM Taiwan Contact Information:**

台灣IBM 產品服務聯絡方式：  
台灣國際商業機器股份有限公司  
台北市松仁路7號3樓  
電話：0800-016-888

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Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2014/30/EU zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55032 Klasse A ein.

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Dieses Gerät ist berechtigt, in Übereinstimmung mit dem Deutschen EMVG das EG-Konformitätszeichen - CE - zu führen.

Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:

International Business Machines Corp.  
New Orchard Road  
Armonk, New York 10504  
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:

IBM Deutschland GmbH  
Technical Regulations, Abteilung M372  
IBM-Allee 1, 71139 Ehningen, Germany  
Tel: +49 (0) 800 225 5423 or +49 (0) 180 331 3233  
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Generelle Informationen:

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SB10-7181-01

