



## Card Protection for 48-Port T1/E1 CEM and 48-Port T3/E3 CEM Interface Modules

The Card Protection feature is introduced for the 48-Port T1/E1 and 48-port T3/E3 interface modules. In this feature, the interface module bay is protected by another interface module of the same type.

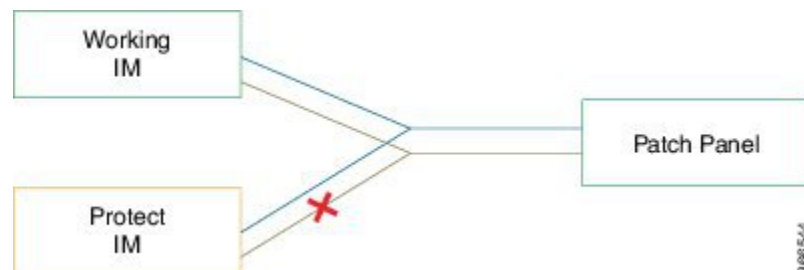
The Card Protection feature is required to protect traffic flow either when an interface module is out of service, when the software fails or a hardware component has issues. Because card protection is supported only on redundant interface modules, traffic is switched to the protect interface module when the active interface module does not respond, and vice-versa.



**Note** This feature does not require any change in the patch panel of the interface modules.

In card protection, a Y Cable is used to multiplex the signal from the patch panel to both the ports of active and protect interface modules. Both ports receive the signal, but only the active interface module transmits the signal from its port.

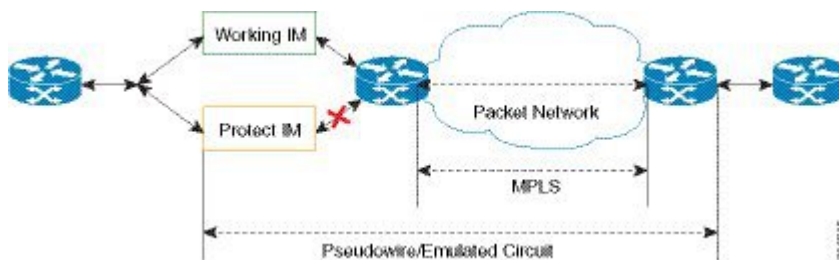
**Figure 1: Y Cable**



To support the Card Protection feature, the configuration on the active and protect interface module must be same. To achieve this, a virtual interface module is created with the same interface module type as the active interface module. A virtual controller is also created, which broadcasts the configuration to both the interface modules. The configuration on the physical controllers is then blocked and you can make configuration changes only on the virtual controller. The user configuration can only be performed on the virtual controller.

The virtual controller supports CEM level configuration and all other configurations. These configurations are blocked on physical controllers.

Figure 2: Card Protection Topology



**Note** DS3 (T3) channelized into T1 and E3 channelized into E1s are supported in card protection. For more information on configuration, see the [Configuring the Controller of Channelized T3/T1 Interfaces](#) section.

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## Y Cable

In card protection, a Y cable is used to multiplex the signal from the patch panel to both the ports of active and standby interface modules. Both the active and protect ports receive the signal, but only the active port transmits the signal from its port. Protect port transmitter is disabled.

## Card Protection Switchover

The following table shows the card protection switchover trigger and time to complete the switchover between the working and protect interface module.

Trigger	Time
Interface Module Reload with CLI OIR	Less than 50 millisecond
Non-responsive Interface Module Process (interface module reloads on its own, the reload is initiated due to software error)	100 millisecond to 200 millisecond
Interface Module shuts down due to high temperature	Less than 50 millisecond
Interface Module shuts down using CLI	Less than 50 millisecond
Interface Module stops using CLI	Less than 50 millisecond

Trigger	Time
Card Physical Jackout	100 millisecond to 200 millisecond
Serializer/Deserializer (SerDes) Failures	250 millisecond to 1 second
Alarm Based Switchover	Based on Hold Over Time or Soak Time
Card Protection Commands	20 millisecond to 30 millisecond
Non-responsive Interface Module Process (interface module reloads on its own, the reload is initiated due to software error)	200 millisecond to 1 second
Card Physical Jackout	200 millisecond to 1 second

## Alarm Based Switchover

Alarm based switchover is only applicable for Loss Of Signal (LOS) alarm. Switchover happens only when the number of ports with LOS alarm in working interface module is greater than that on the protect interface module.

Each card protection group maintains a weight for each working and protect interface module. This weight is updated when the LOS alarms are asserted or cleared. The switchover happens only if the weight of working interface module and protect interface module stays same for a certain amount of time called soak time.

When there is any issue with the Patch Panel, both working interface module and protect interface module have the same number of LOS alarms (weights are same). Hence, switchover does not happen.

## Restrictions

- Card physical jack out convergence time for card protection switchover is more than 50 milliseconds.
- The time taken to restart the interface module due to any software error is more than 50 milliseconds.
- Alarm toggle on active or backup card causes at least one card protection switch.
- When BERT is started from the virtual controllers, the syslog displays the physical controllers instead of the virtual controller port.

## Supported Features on Interface Module

The supported features are:

- Switching Mode
  - Non-revertive mode
  - Revertive mode
- Alarm Based Switchover

- SerDes Based Switchover
- Adaptive Clock Recovery (ACR) on virtual CEM
- Differential Clock Recovery (DCR) on virtual CEM
- Maintenance Commands
  - Lockout
  - Force
  - Manual




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**Note** All controller configurations are performed on the virtual controller.

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You can create card protection with one slot (either primary or backup) and the remaining slots can be added later.

## Configuring Maintenance Commands

To configure maintenance commands:

```
enable
configure terminal
card-protection 4
primary slot 0 bay 0
backup slot 0 bay 5
end
card-protection 4
card-protection [manual {backup|primary} | force {backup|primary} | lockout]
end
```




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**Note** Maintenance commands are not synced in the standby environment. After Redundancy Force Switchover (SSO), maintenance commands must be executed again on the new active environment.

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## Priority Table

The following table shows the priority of the actions:

Priority	Configurations
1	Lockout
2	Force
3	Alarm or Card Failure
4	Manual Switch

Priority	Configurations
5	Revert

## Configuring T3/E3 Card Protection

### Pre-requisites

The interface module should be free from any configuration.

### Configuring Card Protection Group:

```
enable
configure terminal
card-protection [1-16]
primary slot 0 bay 0
backup slot 0 bay 5
end
```



**Note** The card protection number 1 to 16 refers to the Card Protection Group Number (CPGN).



**Note** This is a non-revertive mode.

### Configuring Virtual Card and Virtual Controller:

When card protection group is configured, it creates virtual card for card protection object, denoted by 8/x/port. Slot 8 is a fixed slot number for all card protection-created virtual card. Bay number 'x' is derived from the CPGN, where x=CPGN-1. Since card protection group number ranges from 1 to 16, bay number ranges from 0 to 15. Virtual controllers can be configured from 8/x/0 to 8/x/47.

### Physical Card Configuration:

Configures mode T3/E3 on physical controllers of both primary (0/0) and backup (0/5) card.

```
enable
configure terminal
controller mediatype 8/0/0
mode t3
end
```

### Virtual Card Configuration:

- Configures mode T3/E3 on virtual controllers.
- Configures CEM on virtual controller (8/x/port).
- Configures xconnect and local connect on CEM interface.

```
enable
configure terminal
controller t3 8/0/0
cem 0 unframed
interface cem 8/0/0
```

```

cem 0
xconnect 11.1.1.1 112 encapsulation mpls
end

```




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**Note** This is a non-revertive mode.

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**Note** To un-configure a CEM group under a virtual controller, first perform shutdown of the virtual controller and then un-configure the CEM group.

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## Configuring Revertive Mode

To configure revertive mode:

```

enable
configure terminal
card-protection 4
primary slot 0 bay 0
backup slot 0 bay 5
end
card-protection 4
revertive time [30-720]
end

```




---

**Note** The revertive time ranges from 30 to 720 seconds.

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## Verifying T3/E3 Card Protection Configuration

Use **show card-protection detail** command to verify card protection group configuration.

```

#show card-protection 2 detail
Working(0/1:A900-IMA48T-C NCS4200-48T3E3-CE):
  Number of LOS Alarms:7
  ok,Active
  1:1, Revertive

Protect(0/2:A900-IMA48T-C NCS4200-48T3E3-CE):
  Number of LOS Alarms:7
  ok,Inactive
  1:1, Revertive

```

```

Revert Timer : (Not Started)
Last switchover reason :None

```

```

#show card-protection 4
CPGN   Primary Card           Backup Card           Active
-----
4      0/1                       0/2                   Primary

```

```

#show running-configuration | b 8/0/
controller mediatype 8/0/0
!

```

```

controller mediatype 8/0/1
!
controller mediatype 8/0/2
#

```

Use **show xconnect all** command to verify xconnect configuration.

```

#show xconnect all
XC ST=Xconnect      State  S1=Segment1 State  S2=Segment2 State
UP=Up  DN=Down      AD=Admin Down  IA=Inactive
SB=Standby HS=Hot Standby  RV=Recovering  NH=No Hardware
XC  ST   Segment 1          S1 Segment 2          S2
-----
UP  pri  ac CE8/0/0:0 (SATOP T3)      UP mpls 11.1.1.1:112      UP
#

```

## Configuring T1/E1 Card Protection

### Configuring Card Protection Group:

```

enable
configure terminal
card type t1 0 2
card type t1 0 1
card-protection [1-16]
primary slot 0 bay 1
backup slot 0 bay 2
end

```



**Note** The card protection number 1 to 16 refers to CPGN.

### Configuring Virtual Card and Virtual Controller:

When card protection group is configured, it creates virtual card for card protection object, denoted by 8/x/port. Slot 8 is a fixed slot number for all card protection created virtual card. Bay number 'x' for virtual card is x = CPGN - 1 = 15. Virtual controllers can be configured from 8/15/0 to 8/15/47.

#### Physical Card Configuration:

- No configuration is required for traffic.

#### Virtual Card Configuration:

- Configures CEM on virtual controller (8/x/port).
- Configures xconnect and local connect on CEM interface.

```

enable
configure terminal
controller t1 8/15/0
cem 0 unframed
interface cem 8/15/0
cem 0
xconnect 11.1.1.1 212 encapsulation mpls
end

enable
configure terminal
controller t1 8/15/11

```

```

cem 0 unframed
interface cem 8/15/11
cem 0
connect testLC cem 8/15/0 0 cem 8/15/11 0
end

```




---

**Note** To un-configure a CEM group under a virtual controller, first perform shutdown of the virtual controller and then un-configure the CEM group.

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## Configuring Revertive Mode

To configure revertive mode:

```

enable
configure terminal
card-protection 4
primary slot 0 bay 0
backup slot 0 bay 5
end
card-protection 4
revertive time [30-720]
end

```




---

**Note** The revertive time ranges from 30 to 720 seconds.

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## Verification of T1/E1 Card Protection Configuration

Use **show card-protection** command to verify card protection group configuration.

```

#show card-protection 2 detail
Working(0/1:A900-IMA48T-C NCS4200-48T1E1-CE):
  Number of LOS Alarms:7
  ok,Active
  1:1, Revertive

Protect(0/2:A900-IMA48T-C NCS4200-48T1E1-CE):
  Number of LOS Alarms:7
  ok,Inactive
  1:1, Revertive

Revert Timer : (Not Started)
Last switchover reason :None

```

Use **show xconnect all** command to verify xconnect configuration.

```

#show xconnect all | I CE8/15/
UP   pri   ac CE8/15/0:0(SATOP T1)          UP mpls 11.1.1.1:212          UP
#

#show xconnect all | i CE8/15/
72   testLC      CE8/15/11 SAT1 0          CE8/15/12 SAT1 0          UP
#

```



## Associated Commands

The following table shows the commands for the IM configuration:

Command	Link
<b>Card Protection Creation Commands:</b> <b>card-protection</b> <i>CPGN</i> <b>card-protection</b> { <i>primary</i>   <i>backup</i> } <b>card-protection</b> <i>revertive time</i>	<a href="https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp1208639895">https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-c1.html#wp1208639895</a>
<b>Card Protection Maintenance Commands:</b> <b>card-protection</b> <i>CPGN</i> [ <b>manual</b> { <i>primary</i>   <i>backup</i> }   <b>force</b> { <i>primary</i>   <i>backup</i> }   <b>lockout</b> ]	
<b>show card-protection</b> <i>CPGN</i> <b>detail</b>	<a href="https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-s2.html#wp1628614402">https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/interface/command/ir-cr-book/ir-s2.html#wp1628614402</a>

## Additional References

### Related Documents

Related Topic	Document Title
Cisco IOS commands	<a href="#">Cisco IOS Master Commands List, All Releases</a>
Compact-SFP	<a href="#">Cisco SFP Modules for Gigabit Ethernet Applications Data Sheet</a>

### Standards and RFCs

Standard/RFC	Title
—	<i>There are no standards and RFCs for this feature.</i>

### MIBs

MIB	MIBs Link
—	<i>There are no MIBs for this feature.</i> <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

**Technical Assistance**

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></p>