

Configuring MSP

Multiplex Section Protection (MSP) is a protection mechanism for SDH networks that enables SDH connections to switch to another SDH circuit when a port failure occurs. A protection interface serves as the backup interface for the working interface. When the working interface fails, the protection interface quickly assumes its traffic load.

The SDH protection schemes partially comply with ITU-T G.707 standard. It allows Optical Interface Module to work seamlessly as SDH Add or Drop Multiplexers (ADMs). The implementation of the above protection schemes allows a pair of SDH lines or paths to be configured for line or path redundancy. In the event of a fiber cut, the active line or path switches automatically to the standby line or path up to 60 milliseconds (2/5/10 millisecond for holdover and 50 millisecond switchovers).

Optical Interface Module supports the following SDH protection switching schemes:

- Linear Bidirectional 1+1 MSP
- Linear Unidirectional 1+1 MSP

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1+1 MSP

In the 1+1 architecture, there is one working interface (circuit) and one protection interface, and the same payload from the transmitting end is sent to both the receiving ends. The receiving end decides which interface to use. The line overhead (LOH) bytes (K1 and K2) in the SDH frame indicate both status and action.

The protection interfaces need to be configured with an IP address of the chassis that has the working interface, using MSP commands. The MSP Protect Group Protocol, which runs on top of UDP, provides communication between the process controlling the working interface and the process controlling the protection interface. Using this protocol, interfaces can be switched because of a chassis failure, degradation or loss of channel signal, or manual intervention. In bidirectional mode, the receive and transmit channels are switched as a pair.

Two SDH connections are required to support MSP.

The following option is available for linear bidirectional 1+1 MSP:

- Revertive option — For any failure on working line, the software switches to protection line and when the working line recovers, it waits based on the revertive timer and reverts back to working line as active link.
- Non-revertive option — When the signal fails, the software switches to the protection line and does not automatically revert back to the working line. This is the default option.

The following features are supported on 1+1 MSP:

- SDH PW (SAToP or CEP)
- SDH local connect

Benefits of MSP

The following lists the benefits of MSP:

- MSP performs switchovers with minimal loss of data, and time-consuming reroutes are avoided.
- There is no visibility that a failure has occurred beyond the network element in which it is residing; other nodes are not affected by the failure.
- Implementation of MSP guards a network against complex restarts and resynchronizations since failures are isolated to a local device.
- With MSP, the effect of a failure is greatly minimized, and a fast switchover guarantees minimal effect on the network.

Restrictions for MSP

- MSP is supported on all the ports except on the 8th port with STM-64.
- Loopback, BERT, ACR and DCR, and Clocking should be configured on physical member controllers.

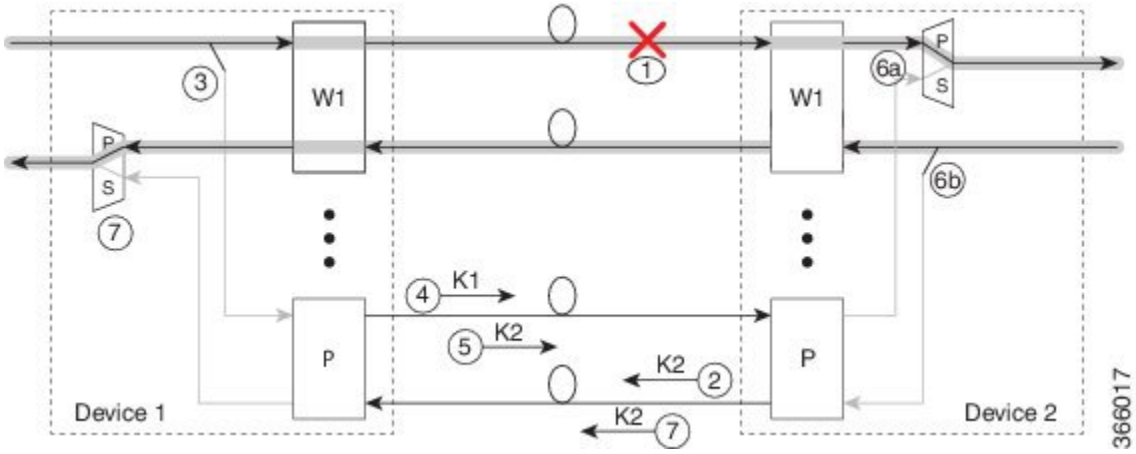
MSP 1+1 for SDH Layer 1 traffic

SDH linear MSP 1+1 provides protection against both fiber cuts and front card or back card failures. MSP 1+1 requires a redundant protection line for every working line. The traffic is simultaneously carried by the working and the protection lines. Hence, the receiver that terminates the MSP 1+1 should select the traffic from one of the line and continue to forward the traffic. MSP 1+1 provides protection in unidirectional and bi-directional modes:

- **Uni-directional Protection**: The receiving end can switch from working to protection line without any coordination at the transmit end since both lines transmit the same information.
- **Bi-directional Protection**: The receiving end switches from working to protection line by coordinating at the transmit end.

Scenario for Bidirectional MSP 1+1

Figure 1: Bidirectional MSP 1+1



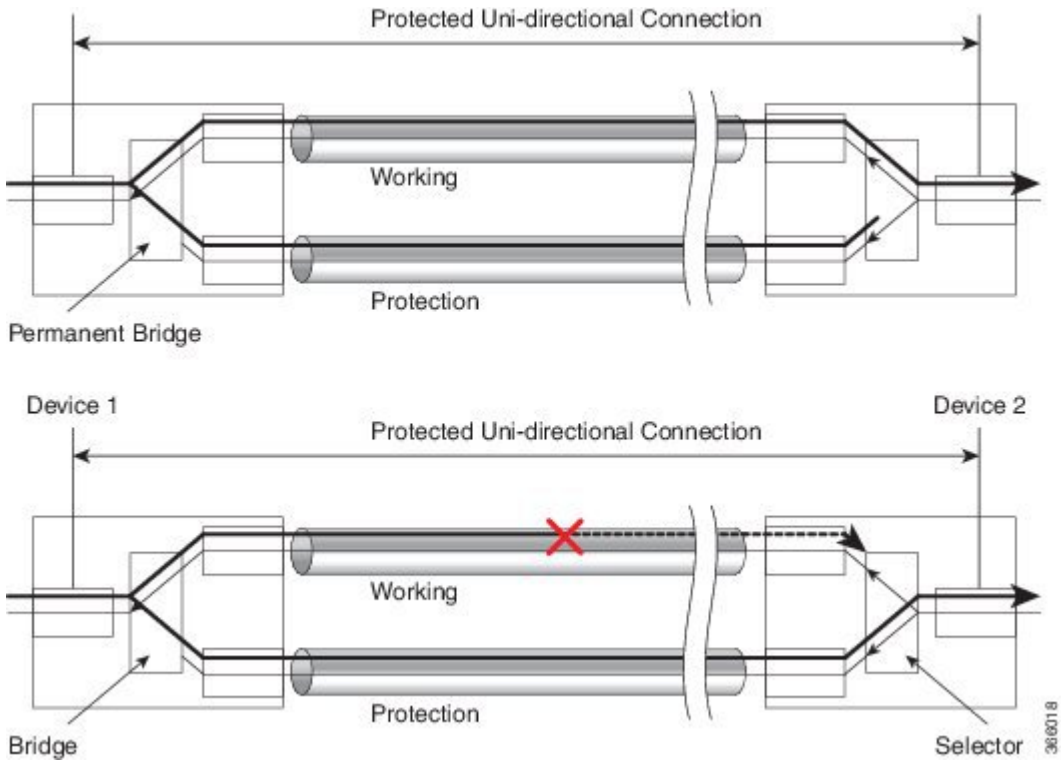
In the above figure, two devices are connected to provide MSP 1+1 bi-directional protection. The highlighted one is the working line and the other is the protection line. The traffic is transmitted on both working and protection lines and received only on one line.

In a scenario where you encounter a fiber cut,

1. There is a cable cut in the working line. So, the device 2 receives a Loss of Signal (LOS) on working line.
2. Device 2 starts generating K2 byte and sends it to the Device 1 over the protection line.
3. Device 1 receives the K2 byte and reacts on the receiving K2 byte.
4. Device 1 starts sending K1 byte to the Device 2 on the protection line.
5. Device 1 starts sending K2 byte to Device 2 on the protection line.
6. Device 2 receives the K1/K2 byte and starts receiving the data from protection line. The protection line now acts as the active line.
7. Device 2 sends K2 byte over the new active line to Device 1 . Device 1 receives this signal and starts accepting the data from this new active line.

Scenario for Unidirectional MSP 1+1

Figure 2: Unidirectional MSP 1+1



In the above figure, two devices are connected to provide MSP 1+1 unidirectional protection. The figure shows a working line and a protection line. The traffic is transmitted on both working and protection line and received only on one line.

In a scenario where you encounter a fiber cut,

1. Device 1 receives a LOS on RX working line.
2. Device 2 detects LOS and starts receiving the data from the protection line. The protection line now becomes the active line.
3. Device 1 receives the K2 byte and knows about switching event on device 2.

Configuring MSP for SAToP

This section describes the configuration of MSP.

Configuring Bi-directional MSP (SDH Framing)

To configure bi-directional MSP (SDH Framing):

```
enable
configure terminal
```

```
controller MediaType 0/5/0
mode sdh
controller sdh 0/4/0
clock source internal
aps group acr 1
aps working 1
exit
controller sdh 0/5/0
aps group acr 1
aps protect 1 10.7.7.7
end
```

Note To restore the system to its default condition, use the **no** form of the command.

Note '10.7.7.7' is the loopback interface IP address on the same router.

Configuring Revertive Mode

To configure revertive mode:

```
enable
configure terminal
controller MediaType 0/5/0
mode sdh
controller sdh 0/5/0
clock source internal
aps group acr 1
aps working 1
exit
controller sdh 0/5/0
aps group acr 1
aps protect 1 10.7.7.7
aps revert 3
aps adm
end
```

Note 3 is the time in minutes for reverting back to the working port after it becomes available.

Configuring Unidirectional MSP (SDH Framing)

To configure unidirectional MSP (SDH Framing):

```
enable
configure terminal
controller MediaType 0/5/0
mode sdh
controller sdh 0/5/0
clock source internal
aps group acr 1
aps working 1
exit
controller sdh 0/5/0
aps group acr 1
aps protect 1 10.7.7.7
```

```
aps unidirectional
aps adm
end
```



Note To restore the system to its default condition, use the **no** form of the command.

APS operational commands are supported only on protect controller. The following are the operational commands for MSP with APS.

- **aps lockout**:

  This command locks the switch to protect port so that APS does not switch to protect controller for any failure on working port or IM.

- **aps force** *1*:

  This command forces the traffic to switch from active working controller to switch to protect controller.

- **aps force** *0*:

  This command forces the traffic to switch from active protect controller to switch to working controller.

- **aps manual** *1*:

  This command switches the traffic from active protect controller to work controller in the absence of **aps force** and **aps lockout** commands.

- **aps manual** *0*:

  This command switches the traffic from active protect controller to work controller in the absence of **aps force** and **aps lockout** commands.

Verifying MSP Configuration for SAToP

Use **show aps** and **show cem circuit** commands to verify MSP configuration:

```
Device#show aps
SDH 0/4/6 APS Group 1: protect channel 0 (Active)
 Working channel 1 at 10.1.1.1 (Disabled)
  bidirectional, non-revertive
  PGP timers (default): hello time=1; hold time=3
  hello fail revert time=120
 SDH framing; SDH MSP signalling by default
 Received K1K2: 0x21 0x15
  Reverse Request (working); Bridging working
 Transmitted K1K2: 0x11 0x10
  Do Not Revert (working); Bridging working
 Remote APS configuration: (null)
SDH 0/3/6 APS Group 1: working channel 1 (Inactive)
 Protect at 10.1.1.1
 PGP timers (from protect): hello time=1; hold time=3
 SDH framing
 Remote APS configuration: (null)
Device#
```

```
Device#show cem circuit int cem-acr 1 1
CEM-ACR1, ID: 1, Line: UP, Admin: UP, Ckt: ACTIVE
Controller state: up, CEP state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
```

```
Dejitter: 6 (In use: 0
)Payload Size: 783
Framing: Not-Applicable
CEM Defects Set
None
Signalling: No CAS
RTP: No RTP
Ingress Pkts:    111851780           Dropped:             0
Egress Pkts:     111851778           Dropped:             0
CEM Counter Details
Input Errors:    0                   Output Errors:       0
Pkts Missing:    0                   Pkts Reordered:      0
 Misorder Drops:  0                   JitterBuf Underrun:  0
Error Sec:       0                   Severly Errored Sec: 0
Unavailable Sec: 0                   Failure Counts:      0
Pkts Malformed:  0                   JitterBuf Overrun:   0
Generated Lbits: 0                   Received Lbits:      0
Generated Rbits: 0                   Received Rbits:      0
Generated Nbits: 10950               Received Nbits:      9093
Generated Pbits: 0                   Received Pbits:      0
Device#
```

Configuring MSP for CESoPSN

This section describes the configuration of MSP for CESoPSN.

Configuring CEM Group for MSP on Virtual ACR AU3-T1 in CESoPSN

To configure CEM group on MSP, use the following commands:

```
enable
configure terminal
controller sdh-acr 200
aug mapping au-3
au-3 1
mode vc1x
Tug-2 1 payload vc11
T1 1 cem-group 0 timeslots 1 - 7
```

To configure the working controller, use the following commands:

```
enable
configure terminal
controller sdh 0/3/6
au-3 1
Tug-2 1 payload vc11
vc 1 overhead v5 2
```

To configure the protect controller, use the following commands:

```
enable
configure terminal
controller sdh 0/4/6
au-3 1
Tug-2 1 payload vc11
vc 1 overhead v5 2
```

Verifying CEM Group for MSP on Virtual ACR AU3-T1 in CESoPSN

This section includes show command to verify CEM Group for MSP on Virtual ACR AU3-T1 in CESoPSN:

```
Router# show cem circuit interface cem-acr 1

CEM-ACR1, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VC1X,Payload:VC11, AU3: 1, TUG-2: 1, T1: 1,CEM Mode: T1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 6 (In use: 0)
Payload Size: 192
Framing: Framed (DS0 channels: 1-24)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    54113124            Dropped:             0
Egress Pkts:     54112259            Dropped:             0

CEM Counter Details
Input Errors:    0                   Output Errors:       0
Pkts Missing:    0                   Pkts Reordered:      0
Misorder Drops:  0                   JitterBuf Underrun:  869
Error Sec:       0                   Severly Errored Sec: 0
Unavailable Sec: 0                   Failure Counts:      28
Pkts Malformed:  0                   JitterBuf Overrun:   0
Generated Lbits: 0                   Received Lbits:      0
Generated Rbits: 868                 Received Rbits:      1830
Generated Mbits: 146392              Received Mbits:      232588
```

Configuring CEM Group for MSP on Virtual ACR AU4-E1 in CESoPSN

To configure CEM group on MSP, use the following commands:

```
enable
configure terminal
controller sdh-acr 200
aug mapping au-4
au-4 1
mode tug-3
tug-3 1
mode vc1x
Tug-2 1 payload vc12
e1 1 cem-group 0 timeslots 1 - 7
```

To configure the working controller, use the following commands:

```
enable
configure terminal
controller sdh 0/3/6
au-4 1
tug-3 1
Tug-2 1 payload vc12
vc 1 overhead v5 2
```

To configure the protect controller, use the following commands:

```
enable
configure terminal
controller sdh 0/4/6
au-4 1
tug-3 1
Tug-2 1 payload vc12
vc 1 overhead v5 2
```

Verifying CEM Group for MSP on Virtual ACR AU4-E1 in CESoPSN

This section includes show command to verify CEM group for MSP on Virtual ACR AU4-E1 in CESoPSN:

```
Router# show cem circuit interface cem-acr 1

CEM-ACR1, ID: 0, Line: UP, Admin: UP, Ckt: ACTIVE
Path Mode : VC1X,Payload:VC11, AU4: 1, TUG-3: 1, E1: 1,CEM Mode: E1-CESoP
Controller state: up, T1/E1 state: up
Idle Pattern: 0xFF, Idle CAS: 0x8
Dejitter: 6 (In use: 0)
Payload Size: 56
Framing: Framed (DS0 channels: 1-7)
CEM Defects Set
None

Signalling: No CAS
RTP: No RTP

Ingress Pkts:    54113124            Dropped:             0
Egress Pkts:     54112259            Dropped:             0

CEM Counter Details
Input Errors:    0                   Output Errors:       0
Pkts Missing:    0                   Pkts Reordered:      0
Misorder Drops:  0                   JitterBuf Underrun:  869
Error Sec:       0                   Severly Errored Sec: 0
Unavailable Sec: 0                   Failure Counts:      28
Pkts Malformed:  0                   JitterBuf Overrun:   0
Generated Lbits: 0                   Received Lbits:      0
Generated Rbits: 868                 Received Rbits:      1830
Generated Mbits: 146392              Received Mbits:      232588
```

Configuring Clocking ACR for MSP AU3-T1 in CESoPSN

To configure clock source on MSP for the working controller, use the following commands:

```
enable
configure terminal
controller sdh 0/3/6
au-3 1
tug-2 1 payload vc11
t1 1 clock source recovered 1
end
```

To configure the recovered clock, use the following commands:

```
enable
configure terminal
```

```
recovered-clock acr 200
clock recovered 1 adaptive cem 1 priority 1
end
```

To configure clock source on MSP for the protect controller, use the following commands:

```
enable
configure terminal
controller sdh 0/4/6
au-3 1
tug-2 1 payload vc11
t1 1 clock source recovered 1
end
```

To configure the recovered clock, use the following commands:

```
enable
configure terminal
recovered-clock acr 200
clock recovered 1 adaptive cem 2 priority 2
end
```

Verifying Clocking ACR for MSP AU3-T1 in CESoPSN

Use the show recovered-clock command to verify the ACR for AU3-T1 in CESoPSN:

```
Router# show recovered-clock

Recovered clock status for MSP-ACR 200
----------------------------------------
Clock    Type     Mode        CEM    Status        Circuit-No          Working     Protect
   Priority
4      OCx-T1   ADAPTIVE     38   ACQUIRING  200/3/1/1(acr/path/vtg/t1) ACQUIRING  ACQUIRING
  1
```

Configuring Clocking DCR for MSP AU3-T1 in CESoPSN

To configure clock source on MSP for the working controller, use the following commands:

```
enable
configure terminal
controller sdh 0/3/6
au-3 1
tug-2 1 payload vc11
t1 1 clock source recovered 1
end
```

To configure CEM interface, use the following commands:

```
interface cem <bay>/<slot>/<port>
cem <cem-group-no>
rtp-present
```

To configure the recovered clock with priority 1, use the following commands:

```
enable
configure terminal
recovered-clock acr 200
```

```
clock recovered 1 differential cem 1 priority 1
end
```

To configure clock source on MSP for the protect controller, use the following commands:

```
enable
configure terminal
controller sdh 0/4/6
au-3 1
tug-2 1 payload vc11
t1 1 clock source recovered 1
end
```

To configure CEM interface, use the following commands:

```
interface cem <bay>/<slot>/<port>
cem <cem-group-no>
rtp-present
```

To configure the recovered clock with priority 1, use the following commands:

```
enable
configure terminal
recovered-clock acr 200
clock recovered 1 differential cem 2 priority 2
end
```

Verifying Clocking DCR for MSP AU3-T1 in CESoPSN

Use the show recovered-clock command to verify the DCR for AU3-T1 in CESoPSN:

```
Router# show recovered-clock

Recovered clock status for MSP-DCR 200
---------------------------------------
Clock    Type     Mode        CEM    Status        Circuit-No          Working     Protect
   Priority
5     OCx-T1   DIFFERENTIAL  44   ACQUIRING  200/4/1/1(acr/path/vtg/t1) ACQUIRING  ACQUIRING
  1
```

Configuring Clocking ACR for MSP AU4-E1 in CESoPSN

To configure clock source on MSP for the working controller, use the following commands:

```
enable
configure terminal
controller sdh 0/3/6
au-4 1
tug-3 1
tug-2 1 payload vc12
e1 1 clock source recovered 5
end
```

To configure the recovered clock, use the following commands:

```
enable
configure terminal
```

```
recovered-clock acr 200
clock recovered 5 adaptive cem 1 priority 1
end
```

To configure clock source on MSP for the protect controller, use the following commands:

```
enable
configure terminal
controller sdh 0/4/6
au-4 1
tug-3 1
tug-2 1 payload vc12
e1 1 clock source recovered 5
end
```

To configure the recovered clock, use the following commands:

```
enable
configure terminal
recovered-clock acr 200
clock recovered 5 adaptive cem 2 priority 2
end
```

Verifying Clocking ACR for MSP AU4-E1 in CESoPSN

Use the show recovered-clock command to verify the ACR for AU4-E1 in CESoPSN:

```
Router# show recovered-clock
Recovered clock status for MSP-ACR 200
---------------------------------------
Clock    Type     Mode        CEM    Status        Circuit-No          Working     Protect
   Priority
4     OCx-T1   ADAPTIVE      38   ACQUIRING  200/3/1/1(acr/path/vtg/t1) ACQUIRING  ACQUIRING
  1
```

Configuring Clocking DCR for MSP AU4-E1 in CESoPSN

To configure clock source on MSP for the working controller, use the following commands:

```
enable
configure terminal
controller sdh 0/3/6
au-4 1
tug-3 1
tug-2 1 payload vc12
e1 1 clock source recovered 5
end
```

To configure CEM interface, use the following commands:

```
interface cem <bay>/<slot>/<port>
cem <cem-group-no>
rtp-present
```

To configure the recovered clock with priority 1, use the following commands:

```
enable
```

```
configure terminal
recovered-clock acr 200
clock recovered 5 differential cem 1 priority 1
end
```

To configure clock source on MSP for the protect controller, use the following commands:

```
enable
configure terminal
controller sdh 0/4/6
au-4 1
tug-3 1
tug-2 1 payload vc12
e1 1 clock source recovered 5
end
```

To configure CEM interface, use the following commands:

```
interface cem <bay>/<slot>/<port>
cem <cem-group-no>
rtp-present
```

To configure the recovered clock with priority 1, use the following commands:

```
enable
configure terminal
recovered-clock acr 200
clock recovered 5 differential cem 2 priority 2
end
```

Verifying Clocking DCR for MSP AU4-E1 in CESoPSN

Use the show recovered-clock command to verify the DCR for AU4-E1 in CESoPSN:

```
Router# show recovered-clock
Recovered clock status for MSP-DCR 200
----------------------------------------
Clock    Type     Mode        CEM    Status        Circuit-No          Working     Protect
   Priority
5     OCx-T1   DIFFERENTIAL  44   ACQUIRING  200/4/1/1(acr/path/vtg/t1) ACQUIRING  ACQUIRING
  1
```