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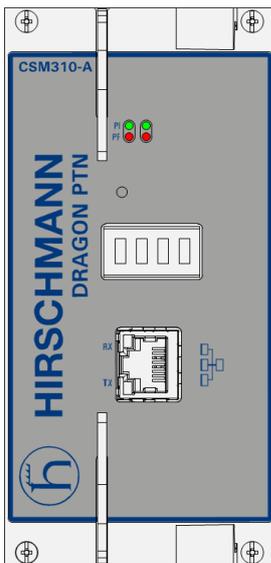
User Manual

Installation

Dragon PTN

Central Switching Module

PTN-CSM310-A/PTN-CSM540-A



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1. INTRODUCTION

1.1 General

This document is valid as of Dragon PTN Release 4.3DR.

This document describes the CSM310-A/CSM540-A Central Switching module (=CSM), which is the heart of the Dragon PTN nodes. This module provides the main processing within the Dragon PTN nodes via an Integrated Ethernet Multilayer Switch and onboard Traffic Manager. The CSM must be plugged into a CSM slot in the node.

The CSM310-A must be used aggregation nodes whereas the CSM540-A must be used in core nodes. For an overview of the CSM slots and different aggregation nodes and core nodes, see the 'Dragon PTN Bandwidth Overview' manual Ref. [100] in Table 2.

Table 1 Differences CSM310-A/CSM540-A

Item	CSM310-A	CSM540-A
Digit1	3 in 310 refers to 3 series	5 in 540 refers to 5 series
Digit2 and 3	10 in 310 refers to the ability to drive 10 Gbps ports	40 in 540 refers to the ability to drive 40 Gbps ports
Nodes Types	Use in aggregation nodes, see Ref. [3] in Table 2	Use in core nodes, see Ref. [3b] in Table 2
Switching capacity	- Non-blocking capacity for - 4 x '1 Gbps / 10 Gbps' ports - 24 x '1 Gbps' ports	- Non-blocking capacity for - 60 x '1 Gbps / 10 Gbps' ports

Main supported features:

- ▶ Central switching fabric
- ▶ Ethernet
 - ▶ (future) Linear Protection switching: ITU G.8031
 - ▶ (future) Ring Protection switching: ERP ITU G.8032v2/Y.1731
 - ▶ Layer2: Link Aggregation/LAG on CSM310-A
- ▶ MPLS-TP
 - ▶ Label switched paths
 - ▶ Pseudowires
 - ▶ Linear Protection switching
 - ▶ Ring Protection switching: ERP ITU G.8032v2/Y.1731
 - ▶ OAM (Y.1731 / BFD)
- ▶ Service plane
 - ▶ Virtual switches
 - ▶ L2 / L3 Ethernet features
- ▶ Synchronization
 - ▶ SyncE
 - ▶ PTP IEEE 1588v2 (=Precision Time Protocol)
- ▶ Hot Swappable (only relevant for nodes with two redundant CSMs)

1.2 Manual References

Table 2 is an overview of the manuals referred to in this manual. ‘&’ refers to the language code, ‘*’ refers to the manual issue. All these manuals can be found in the HiProvision (=Dragon PTN Management System) Help function.

Table 2 Manual References

Ref.	Number	Title
[1]	DRA-DRM801-&-*	Dragon PTN Installation and Operation
[2Mgt]	DRA-DRM830-&-*	HiProvision Management Operation
[2Eth]	DRA-DRM831-&-*	Dragon PTN Ethernet Services
[2Leg]	DRA-DRM832-&-*	Dragon PTN Legacy Services
[2Net]	DRA-DRM833-&-*	Dragon PTN Network Operation
[3]	DRB-DRM802-&-*	Dragon PTN Aggregation Nodes: PTN2210, PTN2206, PTN1104, PTN2209
[3b]	DRB-DRM840-&-*	Dragon PTN Core Nodes: PTN2215
[4]	DRA-DRM810-&-*	Dragon PTN General Specifications
[100]	DRA-DRM828-&-*	Dragon PTN Bandwidth Overview

2. MODULE DESCRIPTION

2.1 Front Panel

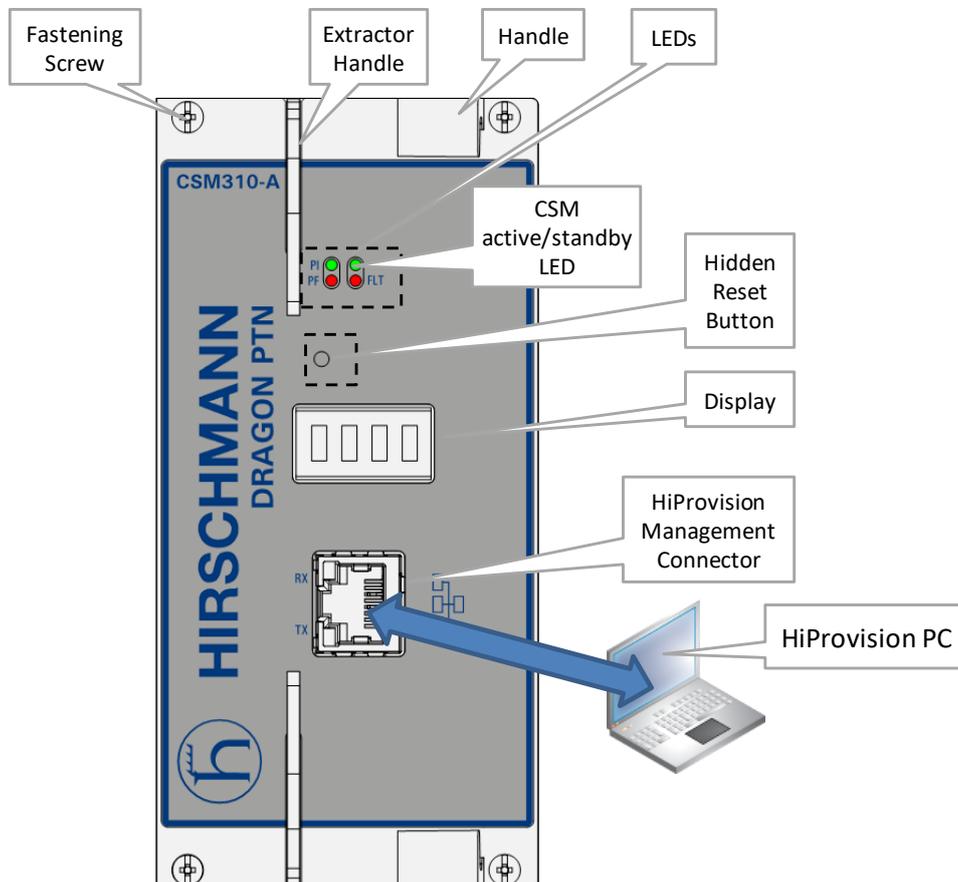


Figure 1 Front Panel CSM310-A In Aggregation Node

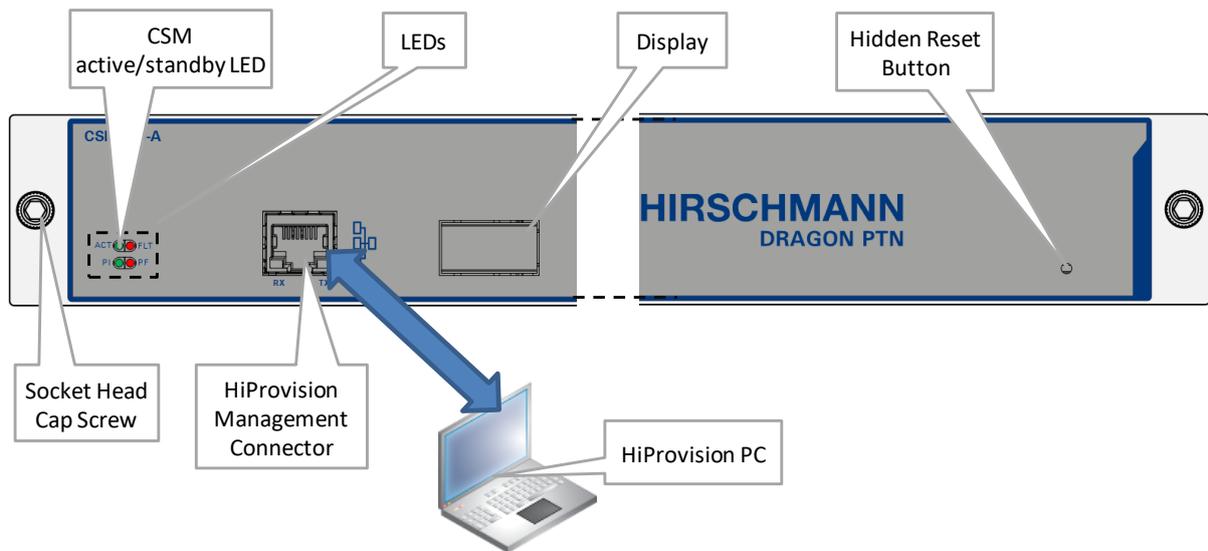


Figure 2 Front Panel CSM540-A In Core Node

2.1.1 Insert/Remove Module into/from Node

See 'Dragon PTN Installation and Operation Manual' Ref.[1] in Table 2.

CAUTION:

- 1) Do not touch the heat sink when the CSM is in operation, or when removing the CSM from the node. It can be extremely hot. Risk of getting burned!
- 2) The CSM could be heavier than expected because of the heat sink.

2.1.2 LEDs

The meaning of the LEDs depends on the mode of operation (= boot or normal) in which the CSM module currently is running. After plugging in the module or rebooting it, the module turns into the boot operation, see Table 3. After the module has rebooted successfully, the module turns into the normal operation, see LEDs in Table 4.

Table 3 LED Indications In Boot Operation

Cycle	PI	PF	FLT	ACT LED
1	✓	---	Slow blinking	✓ (=active CSM) or --- (=standby/passive CSM)
2	✓	---	Fast blinking	
3	✓	---	---	

✓ : LED is lit ; --- : LED is not lit; The sub cycle times may vary.
 The entire boot cycle time [1→ 3] takes approximately 5 minutes.
 The node is reachable again when it can be discovered and measured by HiProvision (=Dragon PTN Management System, see also Ref. [2Net] in Table 2);

Table 4 LED Indications in Normal Operation

LED	Color	Status
PI (=Power Input)	Not lit, dark	+12V power input to the board not OK
	Green	+12V power input to the board OK
PF (=Power Failure)	Not lit, dark	power generation on the board itself is OK
	Red	power generation on the board itself is erroneous
FLT (=FauLT)	Not lit, dark	no other fault or error situation, different from PF, is active on the module
	Red	a fault or error situation, different from PF, is active on the module
ACT (=Active)	Not lit, dark	This CSM is the standby/passive CSM in case of CSM Redundancy
	Green	This CSM is the active CSM

CAUTION: At installation time, if the spare LED (for CSM310-A) or the ACT LED (for CSM540-A) on both redundant CSMs are lit together, it means that both CSMs are active at the same time. This is not allowed! Make sure that both CSMs are plugged in properly.

2.1.3 Reset Button - Factory Default - Reboot Node

This pushbutton is hidden and accessible through a small hole on the front panel. When pushing this button, it must be pushed with a fine non-conductive object e.g. a toothpick...

- ▶ **Push short:** Warm restart:
 - ▶ **Single CSM:** Pushing the RESET button forces a warm start of the CSM without affecting the CSM configuration;
 - ▶ **Redundant CSMs:** Pushing the RESET button on...
 - ▶ ... both CSMs simultaneously force a warm start without affecting the CSM configuration, the CSM that was active before the reboot becomes the active one again after the reboot;
 - ▶ ... the Standby/Passive CSM forces a warm reboot of this CSM only, the other active CSM keeps up and running to keep the node alive;
 - ▶ ... the Active CSM initiates a switchover. The current active CSM will warm reboot and the other standby CSM takes over and becomes the active one to keep the node alive.
- ▶ **Push long:** Warm restart + factory default settings:
 - ▶ **Single CSM:** Pushing the RESET button for at least seven seconds forces a warm start or reboot of the node and reloads the CSM and its micro SD memory card (see §2.3.4) with factory default settings. As a result, reloading the CSM configuration from HiProvision will be necessary;
 - ▶ **Redundant CSMs:** Pushing the RESET button for at least seven seconds...
 - ▶ ...on both CSMs simultaneously affects the entire node. The node reboots and both CSMs get a new default configuration as described for a single CSM. The CSM-1 becomes the active one by default;

- ▶ ...in any other way than described above is not relevant because the CSM that remains active keeps the current configuration and will overwrite the default configuration of the reset CSM immediately after it has rebooted.
- ▶ During the (re)boot of a CSM, its LEDs (see §2.1.2) and display (see §2.1.4) will follow a boot-cycle. If the entire node boots (single CSM, or both redundant CSMs together), the node will be reachable again three minutes after the reset has been released. The entire (re)boot will be finished approximately five minutes after the reset button has been released. The node is reachable again when it can be discovered and measured by HiProvision;

CAUTION: A reboot of a single CSM or active CSM (with redundant CSMs) will affect all communication through this node.

2.1.4 Alphanumeric Display

The 4-character alphanumeric display provides some basic information on the node. The display shows information during reboot of the node and during normal operation.

a. During Reboot of the Node

The display reboot cycle takes approximately 20 seconds whereas the reboot of the entire CSM310-A/CSM540-A takes approximately 5 minutes. After the display reboot cycle, the display returns to the normal operation cycle, see next paragraph.

Table 5 Display: Reboot Operation

Display	Description
Normal (re)boot, boot cycle	
Boot	1 st step of the display reboot cycle.
Ld1, Ld2, Ld1t, Ld2t	2 nd step of the display reboot cycle. The CSM can have two firmware loads (active and spare load) onboard that have been uploaded via HiProvision. If load1 is active, load2 is the spare load and vice versa. This display cycle shows which firmware load is used to boot the CSM: Ld1: Load1 is active and used by the CSM during this boot; Ld2: Load2 is active and used by the CSM during this boot; Ld1t: The CSM boots with testload1 (=not the active one). This is a result of a commit in the firmware upgrade phase via HiProvision. If the user accepts this load in HiProvision within 20 minutes, this test load becomes the active one. If not, the CSM will again reboot with load2 and indicate Ld2; Ld2t: The CSM boots with testload2 (=not the active one). This is a result of a commit in the firmware upgrade phase via HiProvision. If the user accepts this load in HiProvision within 20 minutes, this test load becomes the active one. If not, the CSM will again reboot with load1 and indicate Ld1;
Init	3 rd step of the display reboot cycle.
FAC RST (optional)	This cycle is only shown if a factory reset has been initiated (see §2.1.3).
Erroneous (re)boot	
DDR!	Indicates a hardware failure on the CSM module. Replace the CSM (§2.3.4).
RBT!	Indicates a hardware failure on the CSM module. Replace the CSM (§2.3.4).
NLD!	Indicates an invalid load. Reboot the node. If the problem persists, replace the CSM (§2.3.4).
CLD!	Indicates a corrupt load. Reboot the node. If the problem persists, replace the CSM (§2.3.4).

b. During Normal Operation

Table 6 CSM Display: Normal Operation

Display	Description
<Redundancy State>	<p>Indicates the redundancy (=RDST) state of the CSM. In case of a single CSM (or non-redundant CSM), the value will always be RDST ACT.</p> <p>Possible values with redundant CSMs:</p> <ul style="list-style-type: none"> - RDST ACT: Indicates the active CSM. This CSM is currently managing and monitoring all the activity and connections in the node. The active NSM is also indicated via the NSM LEDs, see Ref. [3], [3b] in Table 2. - RDST STB: Indicates the redundant CSM which is in hot-standby mode. This CSM is ready, doing nothing and just waiting for a switchover to occur, which can be initiated either automatically or manually, see also §2.4. - RDST PAS: Indicates the redundant CSM which is in passive mode. This CSM has started up, without (serious) errors during the self-test. The CSM software is operational but the node configuration data on this CSM has not been synchronized yet with the configuration data on the active CSM. The RDST PAS mode will shortly turn into the RDST STB mode. - RDST SWO: Indicates the switchover state, only possible on the active CSM, after a switchover on user request either via HiProvision or by pushing the NSM switchover button, the state is only briefly displayed.
IP <IP Address>	<p>This is the 'front IP address' or the IP address of the HiProvision management port on the front panel, which is in the range [172.16.0.1 -> 172.20.100.209]. This dedicated IP address depends on the node number and the slot in which the CSM has been plugged (CSM-1 or CSM-2). If two redundant CSMs are plugged into the node, both CSMs have an IP address in a different /28 subnet.</p> <p>Note: For security reasons:</p> <ul style="list-style-type: none"> - this port is by default up but can be disabled in HiProvision; - it can be configured in HiProvision how many times ('n') the IP address must scroll on the CSM display after plugging in the management cable. By default, it is displayed forever in every display cycle. <p>Note: More info on the HiProvision IP address and the CSM Front IP address and how to change it can be found in, see §2.1.5.</p>
VERS <Load Version>	<p>Example: VERS 1.2.9</p>
NODE <Node Number>	<p>Indicates the node number (of the own node) that has been configured via the rotary DIP switches on the NSM. Example: NODE 830.</p> <p>NODE 9001 indicates a problem with the node number. See NODENUMBER INVALID in error list in Table 7.</p>
SHDN	<p>is only shown on the display when a reboot has been initiated</p>
ERR <Error list> (see Table 7)	<p>Everything is fine, no errors: OK</p> <p>errors active: Only the active CSM displays errors. Example with cable faults (S indicates the slot number, I indicates the interface or port number): ERR <error 1> , ... , <error n> ERR CBLF S1 I1 , CBLF S1 I2</p>

Table 7 CSM Display: Error List

Display	Description	Curative Action
AMBIENT TEMP OUT OF BOUND (only CSM540-A)	Indicates that the measured node temperature (=ambient temperature) is not in the range [-20 °C ... + 55 °C] or [-4 °F ... 133 °F].	Verify the ambient temperature, cooling in the room.
CBLF S<x> P<y>	Indicates a cable fault in interface slot <x> on port <y>. Example: CBLF S1 P1	Check the cabling in that slot or port and reconnect cables where necessary.
CSM<x> FW1	Can only occur on redundant CSMs. If it occurs, it is displayed on both CSMs. It indicates that the firmware version on CSM1 differs from the version on CSM2. (x = 1 or 2)	Make sure that both CSMs run on the same firmware version. If the mismatch remains, there will be no CSM Redundancy. The last active CSM will remain active, the other CSM will not become standby but remains passive.
CSM<x> HW1	Switch error on CSM<x> (x = 1 or 2).	Replace the CSM (§2.3.4).
CSM<x> HW2	Clock distribution error on CSM<x> (x = 1 or 2).	Replace the CSM (§2.3.4).
CSM<x> HW3	SD Memory card error on CSM<x> (x = 1 or 2). The CSM stays fully operational while the error is active.	<p>The SD card replacement (see below) is not urgent and can be postponed until a later maintenance timeframe. A new SD Card can be ordered via order number: V30812-A6073-C3</p> <p>Single CSM: Pull out the CSM (the node goes down), and replace the broken SD card. Plug in the CSM again.</p> <p>Redundant CSMs: If the broken SD card is in the active CSM, switch over first to make this CSM standby. Pull out the standby CSM, replace the SD card and plug in the CSM again.</p> <p>In both cases above, the new SD card will get a copy of the current CSM configuration after CSM insertion.</p>
CSM<x> HW4	Processor error on CSM<x> (x = 1 or 2).	Replace the CSM (§2.3.4).
CSM<x> HW5	Flash memory error on CSM<x> (x = 1 or 2).	Replace the CSM (§2.3.4).
CSM<x> HW6	Sync persistent CSM configuration error on CSM<x> (x = 1 or 2). Active CSM cannot reach or sync the standby CSM.	Replace the standby CSM (§2.3.4).
CSM<x> TEMP	High temperature on CSM<x> (x = 1 or 2).	Provide enough room below and above the node for ventilation as described in the installation manual in Ref. [1] in Table 2.
FAN<x> FAILURE (only CSM540-A)	Fan<x> does not operate as expected and is probably broken (x = 1..5).	Replace Fan<x> module.
FAN<x> NOT PRESENT (only CSM540-A)	Fan<x> slot is empty, Fan<x> is missing or not present (x = 1..5).	Insert a fan module in the Fan<x> slot.
FAN<x> UNREACHABLE (only CSM540-A)	The CSM can not communicate with Fan<x> (x = 1..5).	Replace Fan<x> module.
MULTIPLE NEIGHBORS WAN	Multiple neighbors detected on WAN link. The network discovery function in Dragon PTN expects one-to-one WAN links in which each node detects only one neighbor on the other side of the link. A possible badly configured switch or router is on the WAN link, with access to multiple nodes or neighbors.	Verify your WAN links, and make sure that a possible switch or router on that WAN link has been configured properly to assure a one-to-one WAN link.

Display	Description	Curative Action
NODENUMBER MISMATCH	Indicates a mismatch between the configured node number on the NSM and HiProvision.	Make sure that both node numbers on the NSM and HiProvision match.
NSM BACKPLANETYPE INVALID	NSM backplane type invalid	Probably the NSM is defect. Replace the NSM.
NSM BACKPLANETYPE MISMATCH	NSM backplane type mismatch. The configuration on the CSM is not compatible with the node backplane. E.g. the CSM was initially configured in another node type (e.g. PTN2210) than the node type in which it is intalled now (e.g. PTN2206).	Clear the CSM (=factory default) via pushing the hidden reset button (§2.1.3) with a fine non-conductive object and reconfigure it in HiProvision.
NSM ERROR	NSM not reachable.	Make sure the NSM is plugged in correctly. If it is still not reachable, replace the NSM.
NSM NODENUMBER INVALID	The NSM cannot read its configured node number or its node number is configured beyond the valid node number range of 0001 to 8999. E.g. node number 9307 generates this error. In case of this error, 'NODE 9001' will be displayed as in the normal cycle. 9001 is a special node number to indicate node number problems.	Verify the configured node number and make sure to have it configured in the valid range of 0001 to 8999. If it is in the valid range, replace the NSM.
PSU<x> INPUT	PSU<x> input voltage missing (x = 1 or 2).	Make sure that the PSU<x> is plugged in correctly and powered up. If the problem persists, replace PSU<x>.
PSU<x> OUTPUT	PSU<x> output voltage missing (x = 1 or 2).	
PSU<x> TEMP	PSU<x> temperature out of range (x = 1 or 2).	
POE<x> FAILURE	PoE PSU<x> (Power over Ethernet) has not enough input voltage to deliver the normal PoE power (x = 1 or 2).	Check the input voltage of the PoE PSU<x>.
S<x> IFM HWERR	The module in slot S<x> has a hardware error. Example: S4 IFM HWERR	Replace the IFM.
S<x> IFM MISMATCH	The interface slot <x> has a module type mismatch. The module plugged in in slot <x> in this node, differs from the HiProvision configuration in that node slot <x>. Example: S3 IFM MISMATCH	Make sure that the configured module in HiProvision is the same as the module plugged in in that specific slot.
S<x> IFM TEMP	High temperature on the IFM in interface slot<x> (x = 1 or 2). Example: S4 IFM TEMP	Make sure that the node has enough room below and above the node for ventilation as described in the installation manual in Ref. [1] in Table 2.
S<x> INCOMPATIBLE MODULE	Node slot<x> has plugged in a module that is not compatible in this slot<x>. This plugged in IFM will not work or get any bandwidth in this slot.	Move the inserted module into another slot that is compatible for the module. See Ref.[100] in Table 2 to find out which slots allow which modules.

2.1.5 HiProvision Management Port/Channel

a. General

This RJ45 Ethernet connector must be used to manage the Dragon PTN network via HiProvision (=Dragon PTN Management System). This connector allows HiProvision to access the Dragon PTN management or DCN channel, which is built up dynamically between all the connected nodes within the network.

NOTE: DCN = Data Communication Network

NOTE: The management port can be disabled via HiProvision for security reasons, see Ref. [2Mgt] in Table 2. The management port is by default up.

Table 8 RJ45 HiProvision Management Connector: Pin Assignments

Pin No.	Signal 100/100Base-T	Signal 1000Base-T
1	Transmit output (+)	DA+
2	Transmit output (-)	DA-
3	Receive input (+)	DB+
4	---	DC+
5	---	DC-
6	Receive input (-)	DB-
7	---	DD+
8	---	DD-

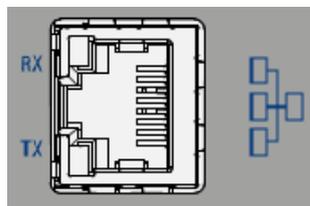


Figure 3 HiProvision Management Connector

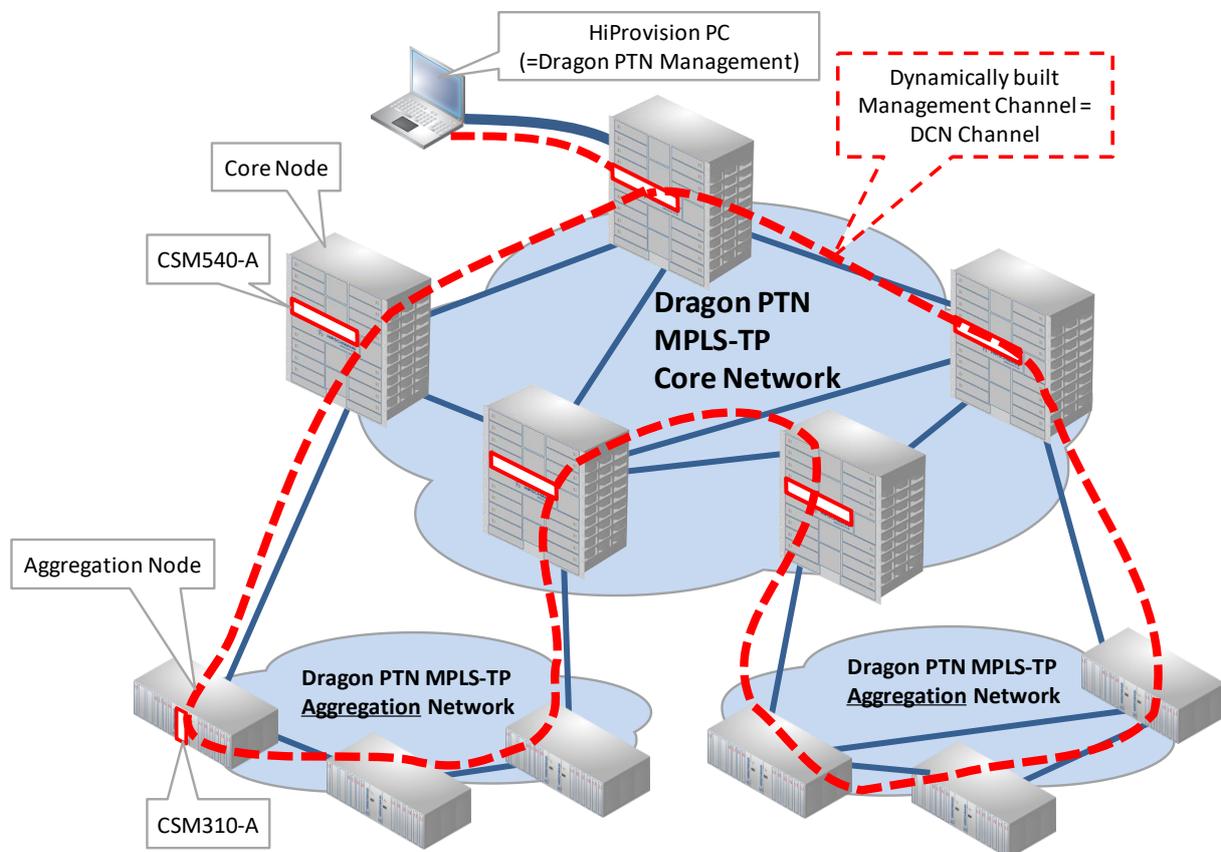


Figure 4 Dragon PTN Management, Both CSM Types Included, Core, Aggregation

b. HiProvision - CSM Connection Scenarios

There are multiple connection scenarios possible between the HiProvision PC and the CSM (or Dragon PTN network).

- ▶ Direct connection;
- ▶ Connection via switch, router;
- ▶ Connection with CSM Redundancy;
- ▶ Connection with HiProvision Redundancy;
- ▶ Connection with Entry Point Redundancy.

Depending on the connection scenario, the configuration differs and IP addresses must be configured in different places. All these connection scenarios are described in detail in Ref. [2Mgt] in Table 2. In this manual, verify following chapters:

- ▶ HiProvision: Discover and Approve the Dragon PTN Network Topology (DCN);
- ▶ HiProvision Connectivity Redundancy: Use Cases.

c. IP Address

The IP address of this management port (= CSM Front IP Address) can be changed via HiProvision, see Ref. [2Mgt] in Table 2. How to set up the IP address on the HiProvision PC, see also Ref. [2Mgt].

CAUTION: When changing IP addresses or IP ranges:

- **Make sure that the Device IP Range of your network does not conflict with the CSM Front IP Addresses of your entry points for this network. All these IP addresses and ranges can be verified in the Entry Point(s) in the Discovery Tile in HiProvision.**
- **Make sure that the CSM Front IP address of each node only belongs to its own unique subnet. Therefor each node must be configured in a different subnet.**
- **Redundant CSMs can be configured in the same subnet. If they are configured in a different subnet, make sure each subnet is unique network wide.**

2.2 Functional Operation

2.2.1 Exchange Data with the Outside World

The node exchanges services data (Ethernet, MPLS-TP, E1/T1, SHDSL, C37.94, Serial data...) with the outside world via the IFMs that are plugged into the Dragon PTN node. This means that a Dragon PTN node communicates with other Dragon PTN nodes via its IFMs, not via the CSM. The only data to enter/leave the front panel of the CSM is the management data exchanged with HiProvision.

2.2.2 I/O with NSM, PSUs, IFMs and Dragon PTN Network

The active CSM processes status & control data between the NSM, PSUs, IFMs, backup CSM and the Dragon PTN network via the node's backplane. The active CSM communicates this and its own status & control data to HiProvision.

Furthermore, the active CSM controls the flow of user data by switching MPLS-TP packets between the Dragon PTN network and the IFMs in its node. The IFMs are connected to the active CSM in a star configuration resulting in an individual data bus for each IFM. Data transfer is full duplex. See also §2.2.3.

2.2.3 Central Node Switching

The switch on the CSM is non-blocking and has following data bus:

- ▶ CSM310-A:
 - ▶ 4 x '1 Gbps / 10 Gbps' ports
 - ▶ 24 x '1 Gbps' ports
- ▶ CSM540-A:
 - ▶ 60 x '1 Gbps / 10 Gbps' ports

Which node slot supports which speeds and bandwidths is described in the 'Dragon PTN Bandwidth Overview' manual, see Ref. [100] in Table 2.

The onboard switch supports the features described in §1.1.

2.2.4 Management Channel / DCN Channel / HiProvision Interface

The management or DCN channel (=Data Communication Network) is a dedicated channel needed by HiProvision to configure, monitor and manage the Dragon PTN network.

The management channel is built up dynamically during the HiProvision Discovery phase. This channel is a collection of inter-node MPLS-TP WAN connections. All the Dragon PTN management packets travelling over the Dragon PTN network will have a high priority QoS (=Quality of Service) to ensure that these packets always reach their destination.

NOTE: See also §2.1.5, for the Discovery function, see Ref. [2Mgt] in Table 2;

2.2.5 Synchronization / Clock Distribution / Network Timing

The Dragon PTN network provides a number of mechanisms to perform synchronization / clock distribution / network timing. The CSM makes sure that all the IFMs included in the node are synchronized. See the table below for an overview of the mechanisms.

Table 9 Synchronization / Clock Distribution / Network Timing Overview

Mechanism	Domain	What is synchronized?	Purpose
SyncE	Network wide	Clock Frequency	Distribute a synchronous clock, based on a PRC (=Primary Reference Clock), network wide over all the nodes that need it.
PTP IEEE 1588v2	Network wide	Timestamping	A protocol to synchronize real-time clocks (timestamping) in Dragon PTN network elements and/or connected devices.

a. SyncE (=Synchronous Ethernet)

SyncE distributes a synchronous clock, based on a PRC, network wide over all the nodes that need such a synchronous signal. The PRC is a very stable high quality clock that can be used as a reference for network wide clock distribution.

In HiProvision, an operator can configure (see manual Ref. [2Net] in Table 2) a clock distribution tree with the participating nodes and IFMs together with the necessary clock priorities. A clock is recovered from an incoming data signal on an IFM interface port (e.g. Data1 on a 4-GC-LW module,) and forwarded to the CSM via the backplane, see figure below.

The CSM cleans up and redistributes this clock over the entire node to all the interface slots. If multiple recovered clocks are available in a node, the CSM will select the best available clock.

- ▶ SyncE Support: Verify the 'PROTOCOL AND FEATURE SUPPORT MATRIX' in Ref. [2Net] in Table 2 to find out which IFMs support this feature;

How the best available clock is determined must be configured in HiProvision:

- ▶ Ethernet services: the best available clock can be determined dynamically via SSMS (=Sync Status Message) or statically via a dedicated interface port. SSMS are transmitted to downstream neighbor nodes to report the stability and accuracy of its distributed clock;
- ▶ Circuit Emulation Services: the best available clock must be assigned statically to a dedicated interface port;

- NOTE:** The IFM manual indicates whether an IFM port can participate in SyncE;
- NOTE:** The CSM management port does not participate in the SyncE clock distribution;
- NOTE:** If no distributed clock is available in a node, the node falls back to the local clock oscillator on the CSM;
- NOTE:** The figure below is an example of the CSM310-A. It is similar for the CSM540-A.

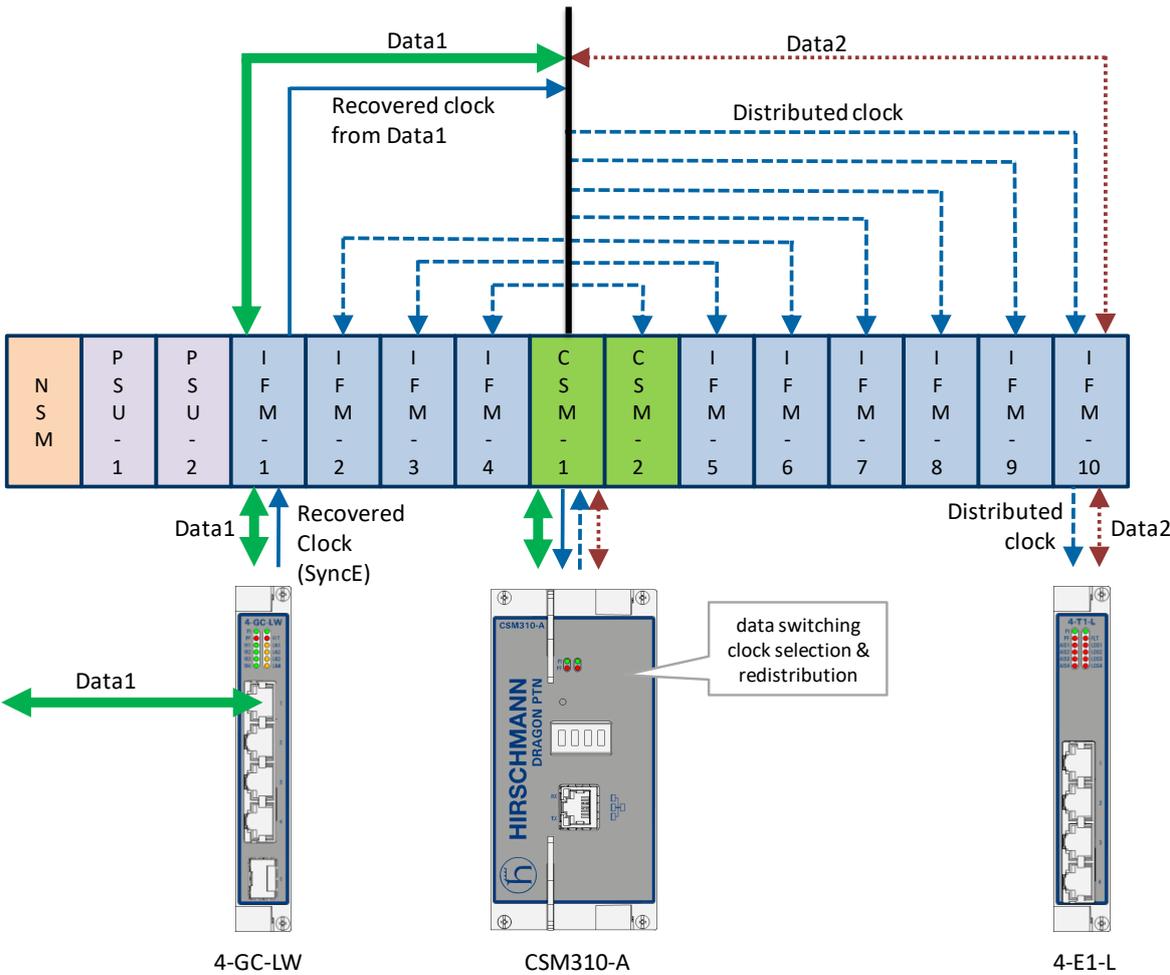


Figure 5 SyncE Clock Recovery

b. (=Precision Time Protocol)

The Precision Time PTP IEEE 1588v2 Protocol (=PTP), as defined in IEEE 1588v2, is a protocol that manages the distribution of a synchronous timestamp clock (micro-second accuracy), network wide between an external grandmaster clock and its slaves or substations. The CSM verifies that all the IFMs in the node have the same node-internal timestamp. If not, the CSM will raise an alarm. This node-internal timestamp must be the same on each IFM to guarantee that the calculated node-traverse time needed for IEEE 1588 messages, will be consistent and correct through the entire node. More detailed info can be found in Ref. [2Net] in Table 2.

- ▶ PTP IEEE 1588v2 support: Verify the 'PROTOCOL AND FEATURE SUPPORT MATRIX' in the HiProvision manual (Ref. [2Net] in Table 2) to find out which IFMs support this feature;

NOTE: The figure below is an example with the CSM310-A. It is similar for the CSM540-A.

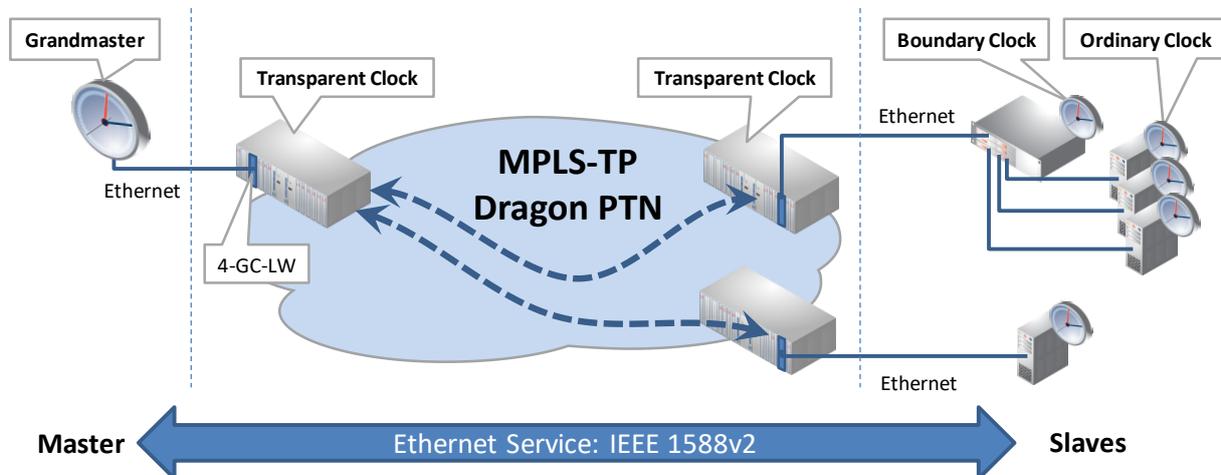


Figure 6 IEEE 1588v2

2.2.6 Layer2: Link Aggregation/LAG (=Link Aggregation Group) on CSM310-A

Link Aggregation is the bundling (=aggregation) of multiple physical Ethernet links between a source and destination side into one combined logical Ethernet link. A LAG is a combination of multiple Ethernet LAN ports within one logical port group, maximum 8 ports per LAG and 8 LAGs per node. The Link Aggregation is the communication between two LAGs. E.g. one LAG in one Dragon PTN node and the second LAG in a third party switch/application. For 1G ports, all the ports of the source and destination LAG must be in autonegotiation. On the Dragon PTN side, ports with the same speed and linked to the same switch ASIC (CSM, L2 or L3) can be added to the same LAG. Each bullet shows the possible LAG ports per switch ASIC:

- ▶ CSM: all Ethernet IFM ports (4-GC-LW, ...) of the same speed in the same node;
- ▶ L2: all 6-GE-L IFM ports;
- ▶ L3: all 9-L3A-L / 9-L3EA-L IFM ports of the same speed;

NOTE: Example: Ports in different nodes can not be added to the same LAG because they are linked to different switch ASICs. CSM (4-GC-LW, ...), L2 and L3 ports in a same node can not be added to the same LAG because they are linked to different switch ASICs.

NOTE: LAG on WAN ports and L2/L3 back end ports is not supported.

The resulting combined logical link:

- ▶ has at least the bandwidth of one individual link (1 Gbps bandwidth for a 1G port, 10 Gbps for a 10G port), but can have more bandwidth if both conditions below are met:
 - ▶ multiple streams from different MAC addresses are streamed over the LAG;
 - ▶ the LAG algorithm loadshares these streams over different links within the LAG;
- ▶ offers loadsharing based on the source and destination MAC addresses;
- ▶ offers redundancy in case one of the individual links should fail.

LAG is configured in HiProvision. See Ref. [2Eth] in Table 2 for more configuration information in HiProvision.

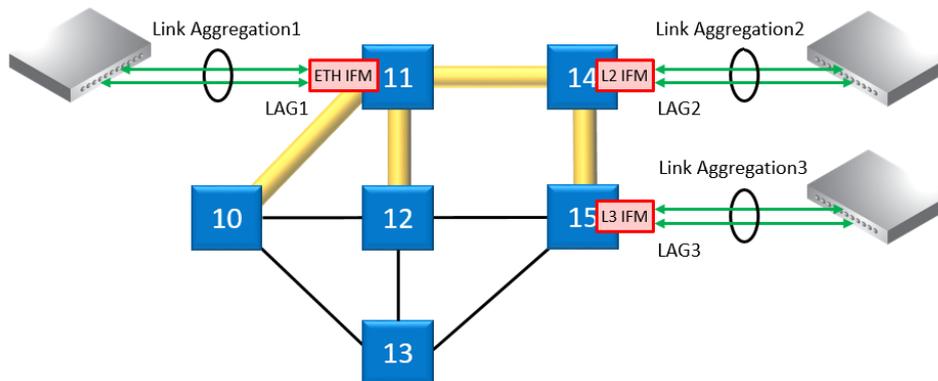


Figure 7 Link Aggregation and LAGs

2.2.7 Self-test

When switching on the supply voltage, the node goes through a self-test, before switching itself into the network. During this test, the main function blocks are tested e.g. processor, memories etc....

2.2.8 Alarming

a. Hardware Device Alarms

The CSM supervises all the hardware in the node and generates the necessary device alarms when something goes wrong in the node. These alarms are collected by HiProvision. It can be configured in HiProvision via the Device Settings to output one or more of these alarms to the digital output contacts (=DO) on the NSM in the node, see also Ref. [2Mgt], [3], [3b] in Table 2.

b. SNMP Traps (future)

Every module in a Dragon PTN node, either NSM, CSM or IFM has a MIB onboard. Every parameter in each MIB can be configured for alarming. The CSM will monitor all the MIBs in its node. If a parameter value changes somewhere in the node, the CSM will send out an (SNMP) trap via the management or DCN channel on the network. HiProvision decides whether the captured (SNMP) trap results in an alarm or not. All the alarms will be visualized by HiProvision.

E.g. the user can configure the minimum and maximum value of a temperature parameter on an IFM. If the temperature exceeds the allowed configured temperature range, HiProvision will show a temperature alarm for this module on that specific node.

2.2.9 Health Monitor

If you have problems with a specific node, a service in a node, responsiveness of a node, possible traffic loss in a node, it is always a good idea to verify the Health Monitor in HiProvision (See also Ref. [2Net] in Table 2). This monitor shows more info on the CSM(s) usage in a node:

- ▶ CPU usage;
- ▶ Memory usage;
- ▶ Disk (=Flash, SD memory card) usage.

2.2.10 Hardware Edition

The hardware edition of the CSM has been factory set and can not be changed! It can be read out via HiProvision, see Ref. [2Mgt] in Table 2.

2.3 Onboard Interfaces

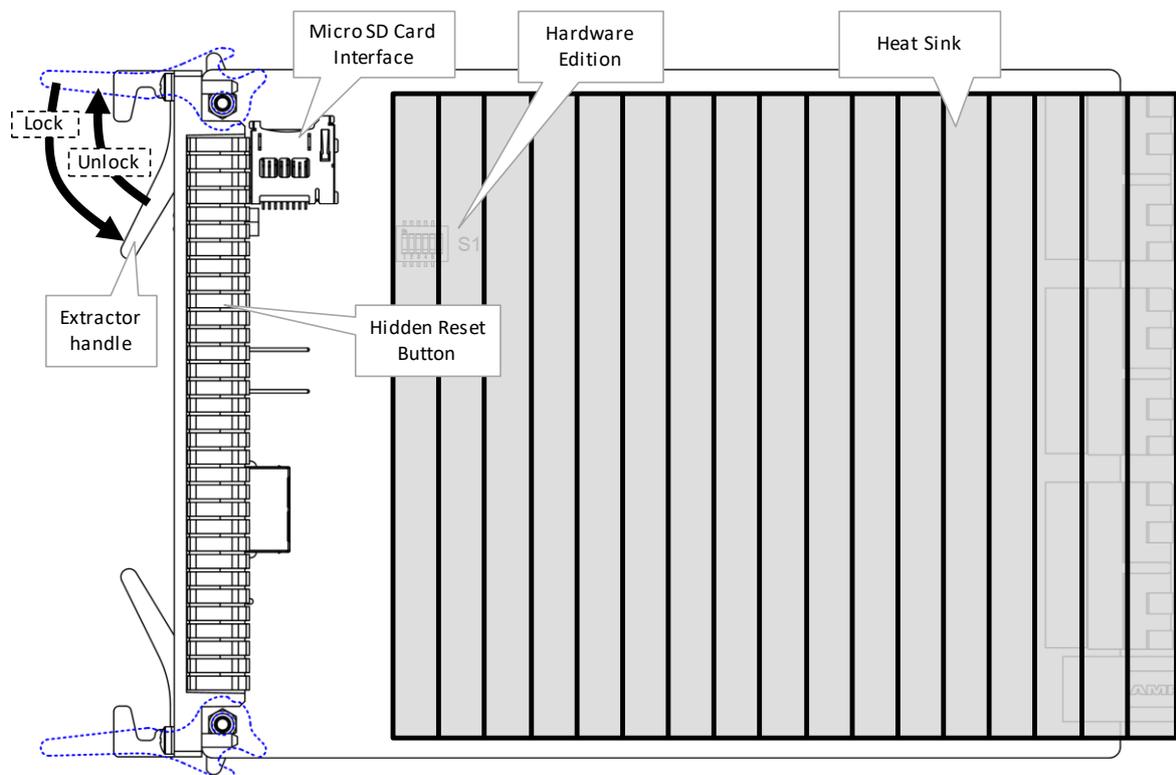


Figure 8 CSM310-A: Side View

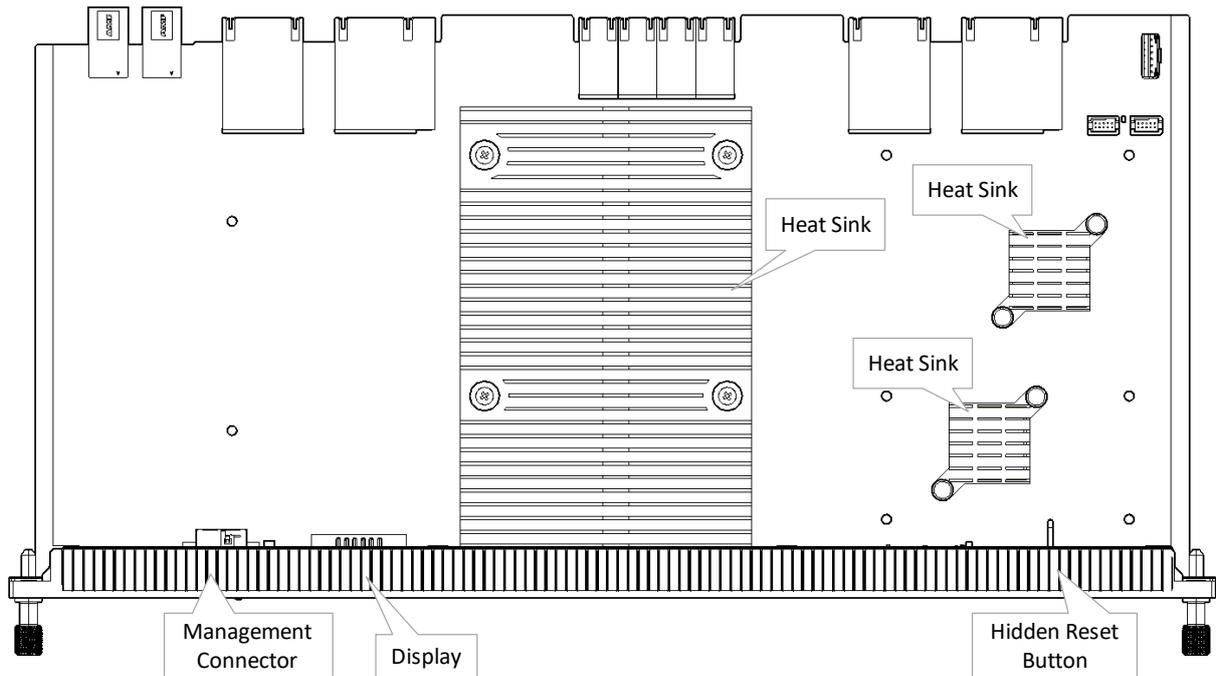


Figure 9 CSM540-A: Top View

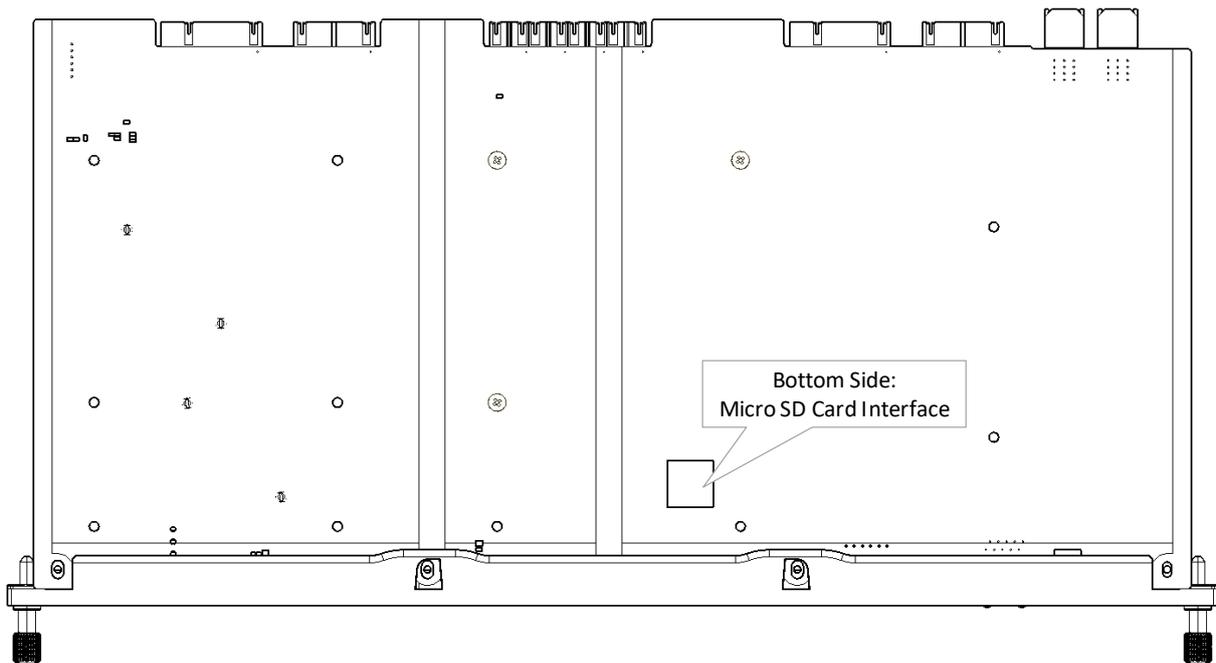


Figure 10 CSM540-A: Bottom View (Including Micro SD Card)

2.3.1 Heat Sink

A heat sink is required for the natural cooling of the CSM module. A heat sink can reach a high temperature during operation.

CAUTION: Do not touch the heat sink when the CSM is in operation, or when removing the CSM from the node. It can be extremely hot. Risk of getting burned!

2.3.2 Straps

No user relevant straps.

2.3.3 DIP Switches

The CSM has no user relevant DIP switches.

2.3.4 CSM Replacement / Micro SD Memory Card

The SD card location can be found in the pictures in §2.3.

The SD card has two purposes:

- ▶ Allow the easy and fast replacement of a broken CSM in the live network without further HiProvision interaction. The SD card on the broken CSM always holds the latest node configuration downloaded via HiProvision.
- ▶ Offer a container for 'network database' backups. When a backup of the database to this node has been initiated in HiProvision via 'network backups', HiProvision will store this database on this SD card. See also Ref. [2Mgt] in Table 2.

CAUTION:

The SD card from a broken CSM can be reused in the new replacing CSM, provided that both CSMs have the same firmware version and are used in the same node.

This SD card interface has an SD card plugged in by default. Every time HiProvision loads a new or updated configuration into the node, this SD card will be updated. As a result, this SD card always holds the latest node configuration.

Follow the steps below to replace a broken CSM with a new CSM:

- ▶ Remove the SD card from the new CSM by pushing down and releasing the SD card;
- ▶ In case of CSM redundancy: If the active CSM has to be replaced, switch over first to make this CSM the standby CSM;
- ▶ Remove the broken CSM (=hot-swappable) from the powered node;
- ▶ Remove the SD card from the broken CSM and insert it into the new CSM;
- ▶ Plug in the new CSM into the node. The node will reboot with the new CSM, which already has the correct node configuration from the SD card. A new load of the node via HiProvision will not be necessary.

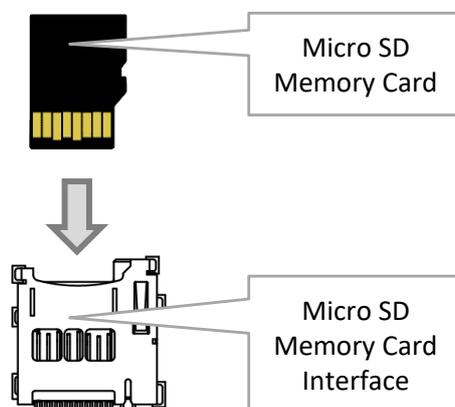


Figure 11 Micro SD Memory Card Interface

NOTE: This SD card is neither required nor essential for the CSM to operate, but it makes a possible CSM replacement in the future a lot easier and faster.

NOTE: If the reset button has been pushed at least for seven seconds (see §2.1.3), the latest configuration on the SD card will be replaced with the factory default settings.

NOTE: A new SD Card can be ordered via order number: V30812-A6073-C3.

2.4 CSM Redundancy

2.4.1 General

Prerequisite: both CSMs must have the same firmware version.

All the Dragon PTN node types, except for the Dragon PTN aggregation node PTN1104, can be equipped with redundant CSM modules.

CSM Redundancy means that two CSMs are installed in the node. One CSM will be the active one while the other CSM will be the redundant one. Both CSMs will contain the complete configuration data of all connections that are configured in that node.

CSM Redundancy provides a higher availability of the services through a node if one CSM should fail. If one fails, the redundant hot-standby CSM will take over automatically to keep the node and all its services alive (with a minimal service interrupt).

In normal operation one CSM actively controls the backplane and IFMs, whereas the other CSM is in standby mode. Both CSMs have a dedicated heartbeat mechanism to control which CSM is active and which CSM is in standby mode.

2.4.2 Redundancy States

A CSM can be in three different redundancy states: ACT (=Active), STB (=Standby) or PAS (=Passive). The current state of each CSM can be viewed on the CSM display (see §2.1.4) or on the LEDs of the NSM.

CAUTION: At installation time, if the spare LED (for CSM310-A) or the ACT LED (for CSM540-A) on both redundant CSMs are lit together, it means that both CSMs are active at the same time. This is not allowed! Make sure that both CSMs are plugged in properly.

2.4.3 CSM Switchover

An automatic switchover from the active CSM (=ACT) to the standby CSM (=STB) occurs when:

- ▶ The active CSM gets broken;
- ▶ The active CSM is pulled out from the node. It is strongly advised not to pull out the active CSM intentionally! When a CSM has to be pulled out, make sure it is in standby/passive mode first via switching-over.

A manual switchover from the active CSM (=ACT) to the standby CSM (=STB) can be done via:

- ▶ The hidden CSM1/2 switchover button on the NSM module has been pushed for approximately 4 seconds until the other CSM becomes active, indicated by the LEDs on the NSM;
- ▶ The hidden reset button on the active CSM has been pushed (see also §2.1.3);
- ▶ HiProvision, see Ref. [2Net] in Table 2;

NOTE: With CSM redundancy, a switchover is only possible when both CSMs have the same firmware version and one CSM is 'active' and the other CSM is 'standby'.

When a switchover occurs, the connections or services going through that node will be interrupted shortly.

CAUTION: In case of CSM redundancy, never pull out or reset the active CSM. If you want to pull out or reset the active CSM (e.g. CSM1), switchover first via HiProvision or the CSM1/2 button on the NSM. As a result, the intended CSM becomes standby and can be pulled out or reset.

2.4.4 Revertive/Non-revertive Behavior

CSM Redundancy is non-revertive: once a switchover of the CSM has occurred, the new active CSM stays active until a manual switchover or switchover caused by an error occurs. No automatic switchback to the original CSM will occur when this one returns back up and running after an error.

2.4.5 HiProvision - CSM Connection

CAUTION: When using CSM Redundancy, it is advised that HiProvision is connected to both CSMs (=each CSM having its own management cable) whenever possible, either directly or via a router/switch. If only one cable is available, make sure that HiProvision is connected to the active CSM when performing load actions. If the cable is connected to the standby CSM, it is possible in HiProvision to make the standby CSM the active one and vice versa.

For more connection scenarios, see §2.1.5b

2.4.6 Reset Button - Factory Default - Reboot Node

See §2.1.3.

2.4.7 Micro SD Card

The Micro SD Card of the redundant CSM will automatically get the configuration of the active CSM, see also §2.3.4.

2.4.8 In Service Upgrade/In Service Revert (Redundant CSMs Only)

The 'In Service Upgrade' procedure is an enhanced way to upgrade redundant CSMs to a higher firmware version. It takes less downtime than the normal upgrade procedure for redundant CSMs.

- ▶ In service upgrade: downtime is only a few seconds. As a result, running services in that node will only go out of service for a few seconds, actually it is only the switchover time from the standby ← → active CSM;
- ▶ Normal upgrade: downtime is a few minutes;

Prerequisites:

- ▶ both CSMs have the same active firmware version;
- ▶ both CSMs have the same backup firmware version;

- ▶ both CSMs must be in synchronization. It means that one CSM must be in the Active state, and the other one in the Standby state.

How to perform such an upgrade procedure has been described in Ref. [2Mgt] in Table 2.

NOTE: ‘In Service Revert’ (Redundant CSMs only) is a procedure is for falling back to a previous firmware version and is similar to ‘In Service Upgrade’, see also Ref. [2Mgt] in Table 2.

2.5 Add a New Node to a Live Network

See Ref.[1] in Table 2.

3. MODULE SPECIFICATIONS

3.1 General Specifications

For general specifications like temperature, humidity, EMI ... see Ref.[4] in Table 2.

3.2 Other Specifications

Table 10 Other Specifications

Description	Value
CSM310-A	
Weight	1.1 kg / 2.4 lb
MTBF	71 years at 25°C/77°F
Power Consumption	27W (measured at 25°C/77°F, with data transport)
Module Size	width: 60.6 mm / 2.39 inches height: 126 mm / 4.96 inches depth: 195 mm / 7.68 inches
HiProvision Connection	Via a twisted pair RJ45 connector for 10/100 Mbps BASE-T Ethernet interface
CSM540-A	
Weight	1.53 kg / 3.36 lb
MTBF	54.3 years at 25°C/77°F
Power Consumption	50W (measured at 25°C/77°F, without data transport)
Module Size	width: 372.5 mm / 14.66 inches height: 43 mm / 1.69 inches depth: 202 mm / 7.95 inches
HiProvision Connection	Via a twisted pair RJ45 connector for 10/100 Mbps BASE-T Ethernet interface

3.3 Ordering Information

- ▶ PTN-CSM310-A: 942 230-001
- ▶ PTN-CSM540-A: 942 230-002

4. ABBREVIATIONS

ASIC	Application-Specific Integrated Circuit
BFD	Bidirectional Forwarding Detection
CE	Conformité Européenne

CSM	Central Switching Module
DCN	Data Communication Network
EC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ERP	Ethernet Ring Protection
FLT	Fault
I²C	I-Squared-C / Inter Integrated Circuit
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IFM	InterFace Module
ITU	International Telecommunication Union
LAG	Link Aggregation Group
LED	Light Emitting Diode
LVD	Low Voltage Directive
MIB	Management Information Base
MPLS-TP	Multiprotocol Label Switching – Transport Profile
MTBF	Mean Time Between Failures
NSM	Node Support Module
OAM	Operations, Administration and Maintenance
PF	Power Failure
PI	Power Input
PRC	Primary Reference Clock
PSU	Power Supply Unit
PTN	Packet Transport Network
PTP	Precision Time Protocol
SD	Secure Digital
SHDSL	Symmetrical High Bitrate Digital Subscriber Line
SNMP	Simple Network Management Protocol
SSM	Sync Status Message
SyncE	Synchronous Ethernet
WAN	Wide Area Network
WEEE	Waste of Electrical and Electronic Equipment