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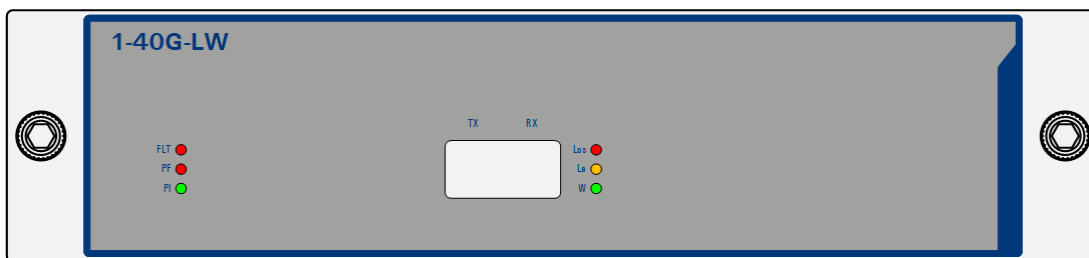
A **BELDEN** BRAND

User Manual

Installation

Dragon PTN

Interface Module PTN-1-40G-LW



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1. INTRODUCTION

1.1 General

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

This document describes the 1-40G-LW interface module (=IFM) which supports 40 Gigabit Ethernet according the IEEE 802.3ba-2010 standard. This standard specifies full duplex point-to-point links. This IFM must be used in core nodes, see Ref. [3b] in Table 1.

This module provides one 40 Gbps optical LAN/WAN port on the front panel (LAN = Local Area Network; WAN = Wide Area Network). 1-40G-LW refers to '1 port – 40 Gigabit – LAN WAN'. This port is configurable as LAN or WAN (=default) via HiProvision (=Dragon PTN Management System).

Verify the 'Dragon PTN Bandwidth Overview' manual (Ref. [100] in Table 1) to see in which node and IFM slot this IFM can be used.

Main supported features:

- ▶ 1 optical port supporting 40 Gbps Ethernet over fiber via QSFP+, full duplex. Which LAN and WAN QSFP+ modules are supported can be found in Ref. [8] in Table 1.
- ▶ LAN/WAN port function;
- ▶ Synchronization
 - ▶ SyncE;
 - ▶ PTP IEEE 1588v2 (=Precision Time Protocol) (future).
- ▶ E-Tree in an Ethernet Service;

1.2 Manual References

Table 1 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 1 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
[3b]	DRB-DRM840-&-*	Dragon PTN Core Nodes: PTN2215
[4]	DRB-DRM803-&-*	Dragon PTN Switching Module: PTN-CSM310-A/PTN-CSM540-A
[5]	DRE-DRM807-&-*	Dragon PTN Interface Module: PTN-4-GC-LW/PTN-4-GCB-LW
[6]	DRE-DRM817-&-*	Dragon PTN Interface Module: PTN-4-GO-LW
[7]	DRE-DRM819-&-*	Dragon PTN Interface Module: PTN-8-FXS
[8]	DRF-DRM811-&-*	Dragon PTN TRMs (Transmit Receive Modules: SFP, XFP, QSFP+)
[9]	DRA-DRM810-&-*	Dragon PTN General Specifications
[100]	DRA-DRM828-&-*	Dragon PTN Bandwidth Overview

2. MODULE DESCRIPTION

2.1 Front Panel

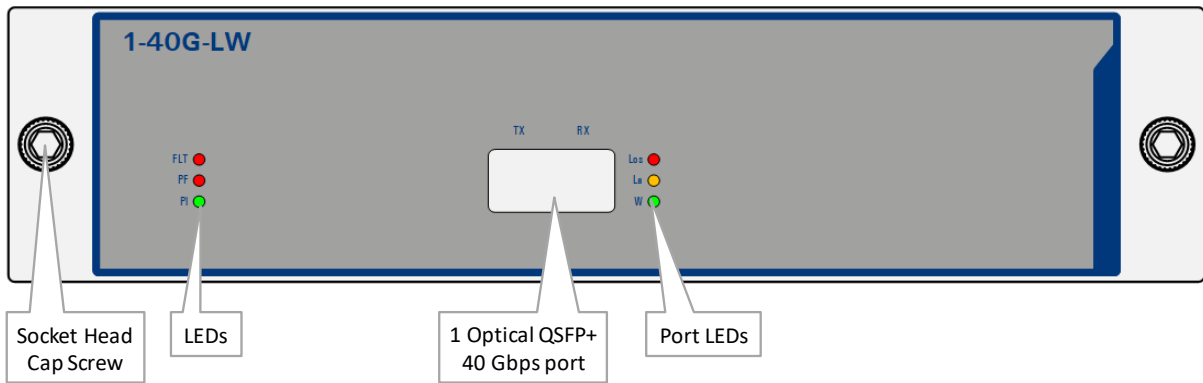


Figure 1 Front Panel

2.1.1 Insert/Remove Module from Node

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

2.1.2 LEDs

The meaning of the LEDs depends on the mode of operation (= boot or normal) in which the 1-40G-LW module currently is running. After plugging in the module or rebooting it, the module turns into the boot operation, see Table 2.

After the module has gone through all the cycles in the table below (=rebooted successfully), the module turns into the normal operation, see LEDs in Table 3.

Table 2 LED Indications In Boot Operation

Cycle	PI	PF	FLT	LOS	LA	W
1	✓	---	---	---	---	---
2	✓	---	✓	✓	---	✓
3	✓	---	✓	✓	---	✓
4	✓	---	✓	---	blinking	✓
5	✓	---	---	---	---	---

✓ : LED is lit / --- : LED is not lit
 The sub cycle times may vary.
 The entire boot cycle time [1-->5] takes approximately 2 minutes.

Table 3 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
LOS (=Loss of Signal)	Not lit, dark	Optical signal OK on the 40G port
	Red	Loss of optical signal on the 40G port
LA (=Link Activity: receive)	Not lit, dark	The link on the 40G port is down
	Yellow lit	The link on the 40G port is up, no receive activity (transmit activity is not shown)
	Yellow blinking	The link on the 40G port is up, with receive activity (transmit activity is not shown)
W	Not lit, dark	The 40G port is configured as LAN port
	Green	The 40G port is configured as WAN port (=default)

2.1.3 Connectors

This module has following port:

- ▶ **Port1 = Optical Ethernet port, QSFP+ connector:** A QSFP+ transceiver (40 Gigabit Quad Small Form Factor Pluggable) module must be plugged into this port, in order to interconnect the optical fiber with the 1-40G-LW IFM. These QSFP+ modules are hot-pluggable and can be replaced from the front, without removing the IFM from the node. The ejector clip (see figure below) must be used to lock/unlock the QSFP+ into/from the IFM. Just pull the ejector clip to remove the QSFP+ module from the IFM, the optical fibers remain in the QSFP+ module. The QSFP+ modules that can be used for this port can be found in Ref. [8] in Table 1.

NOTE: You can leave the fibers installed into the QSFP+ module while removing the module from the IFM.

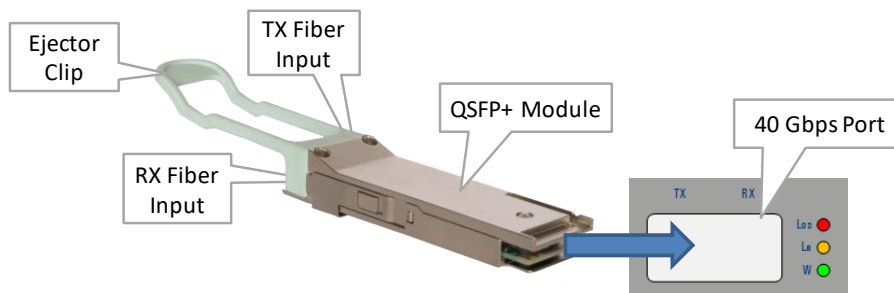


Figure 2 QSFP+ Module / Optical QSFP+ Ethernet Port

2.2 Functional Operation

The 1-40G-LW performs following major tasks:

2.2.1 Media Module for Ethernet: Interfacing to a LAN or WAN Network

WAN ports interconnect nodes within the Dragon PTN network (MPLS-TP) whereas LAN ports interconnect the nodes with their applications.

The front port can be configured individually as LAN or WAN port in HiProvision. By default, each port is configured as WAN port. A LAN port talks Ethernet and a WAN port talks MPLS-TP. As a result, the node can serve as an edge node (or LER = Label Edge Router) where traffic is received on a LAN port, mapped into pseudowire and forwarded to the correct label switched path on a WAN port.

For a configured application service, the node can operate as a:

- ▶ LER = Label Edge Router or access node: The node is located on the edge between the LAN and WAN. The node converts Ethernet into MPLS-TP and vice versa.
- ▶ LSR = Label Switching Router: The node is fully located in the WAN. The node has no end-points for the configured application service, it only forwards MPLS-TP traffic via label switched paths.

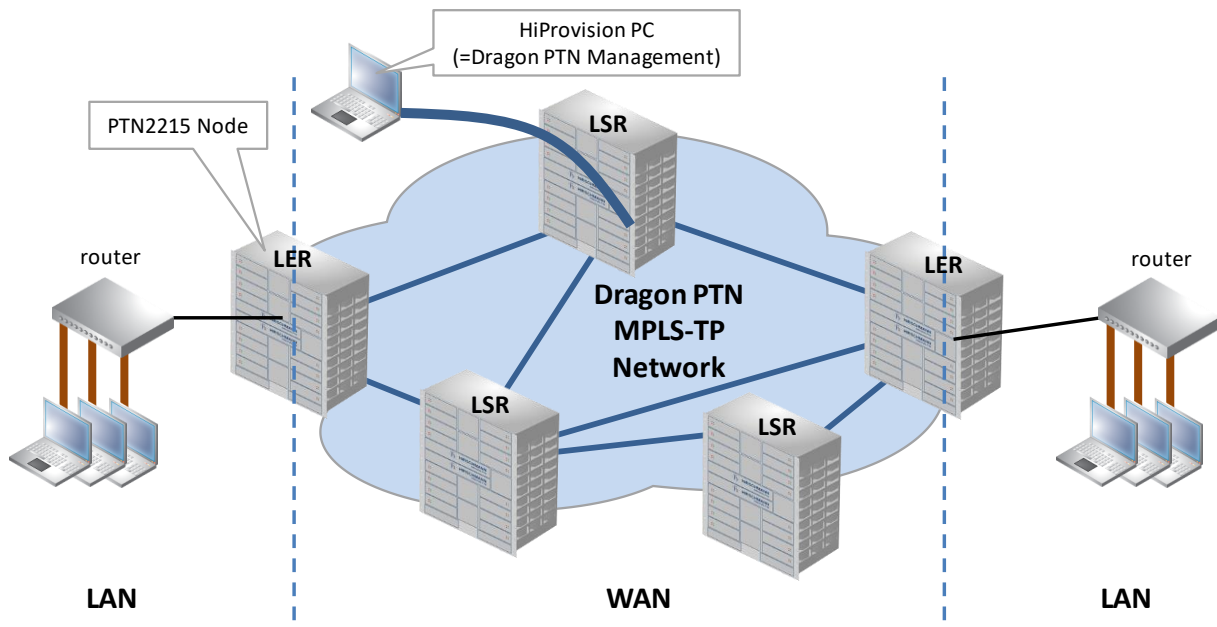


Figure 3 General Example: LAN/WAN

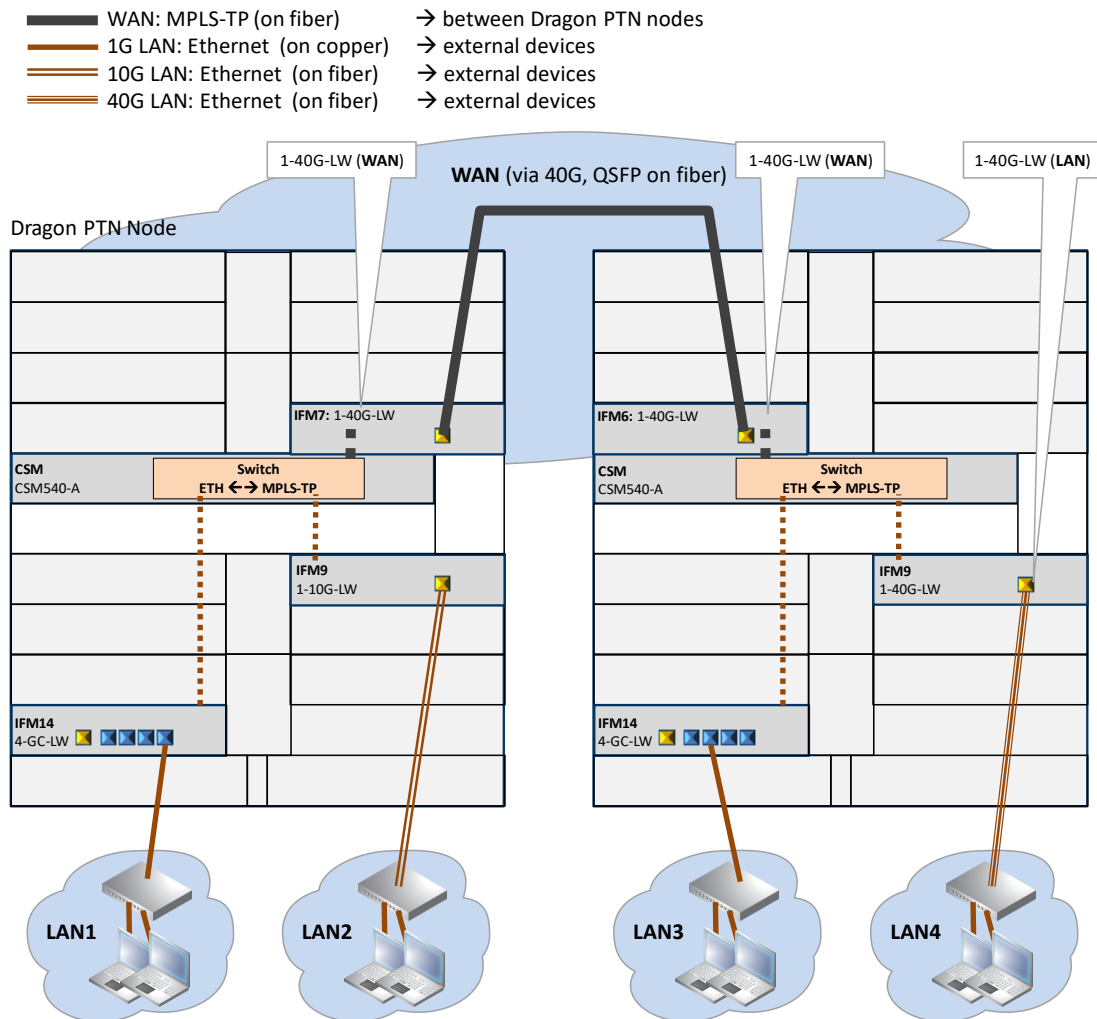


Figure 4 Detailed Example: 1-40G-LW Interfacing to a LAN/WAN Network

2.2.2 Ethernet Service

a. General

The 1-40G-LW IFM access or end-points communicate over the Dragon PTN network via an Ethernet service. This service must be configured via HiProvision. This service can operate port or VLAN based. An optional E-Tree can be configured as well on this Ethernet service.

b. Port Based / VLAN Based

- ▶ Port based: Use this mode if all the traffic on a port must be transported transparently in one and the same service;
- ▶ VLAN based/VLAN ID: Use this mode if each VLAN (ID) on a port must have its own service. Ethernet packets with the configured VLAN ID will be forwarded in this service, other VLAN IDs and untagged packets will be dropped. This behavior can be overruled by a more advanced VLAN processing in the 'VLAN Tagging/Untagging' feature in HiProvision. This feature also supports VLAN translation which replaces VLAN ID 'x' into VLAN ID 'y'.

c. E-Tree

An E-Tree is a rooted (not routed) point-to-multipoint partial service within a programmed Ethernet service. E-Tree can be used as a security precaution to separate different customers (=leaves) using the same Ethernet service while accessing one or more ISPs (=roots).

When an E-Tree is used, each service endpoint is designated as either **leaf** or **root**. A leaf can only communicate with a root. A root can communicate with all the roots and leaves.

NOTE: The 1-40G-LW IFM has one port that can be used as either a LAN or WAN port. For extra LAN or WAN ports, additional IFMs must be installed.

2.2.3 Voice Service

The 1-40G-LW IFM port can be configured in the Ethernet part of the Voice service. See Ref. [2Leg] and Ref.[7] in Table 1 for more information on the Voice service.

2.2.4 I/O with the Central Switching Module (=CSM)

The 1-40G-LW module receives traffic (Ethernet or MPLS-TP) via its front panel port and forwards this to the CSM via the backplane. The CSM does all the processing on this data (synchronization, CRC checks, conversions, switching...). The resulting data will be forwarded via the backplane to one of the IFMs in the node.

2.2.5 Synchronization / Clock Distribution / Network Timing (future)

The Dragon PTN network provides a number of mechanisms to perform synchronization / clock distribution / network timing. The CSM makes sure that all the included IFMs in the node are synchronized. See the table below for an overview of the mechanisms that are supported on the 1-40G-LW module.

It means that the front port of the 1-40G-LW module can be used to recover a clock from an incoming data stream and redistribute this clock via an outgoing datastream.

Table 4 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 (future)	Network wide	Timestamping	A protocol to synchronize real-time clocks (timestamping) in Dragon PTN network elements and/or connected devices.

a. SyncE (=Synchronous Ethernet)

See the manuals in Ref.[2Net] and Ref.[4] for more detailed information;

b. PTP IEEE 1588v2 (=Precision Time Protocol) (Future)

See the HiProvision manual in Ref.[2Net] for more detailed information.

2.2.6 EFM-F IEEE 802.3ah (=Ethernet in the First Mile – Fiber) (Future)

Future planned.

2.2.7 MPLS-TP Compliancy

See the CSM manual in Ref.[4] in Table 1.

2.2.8 Storm Control on Ethernet LAN Port

NOTE: Storm Control is not relevant/supported on WAN Ports;

A traffic storm is the growing of excessive network traffic due to Ethernet packets flooding the LAN. Such a storm can for example occur because of a data loop in the network due to no or misconfiguration of MSTP. These storms degrade the network performance and must be avoided whenever possible. The storm control feature:

- ▶ is an extra protection against these traffic storms;
- ▶ can be configured on the IFM ports;
- ▶ limits the amount of unlearned received data (Unicast, Broadcast, Multicast) on the LAN port ingress or input side;
- ▶ limits the amount of transmitted data (all data) on the LAN port egress or output side;
- ▶ Data that exceeds the configured limitations will be dropped. As a result, a possible data storm cannot overload the node processor or the node will limit outgoing data.

See Ref. [2Eth] in Table 1 for more configuration information in HiProvision.

2.2.9 BPDU Guard on Ethernet LAN Port

NOTE: BPDU Guard is not relevant/supported on WAN Ports;

BPDU Guard (=Bridge Protocol Data Unit) is a LAN port property or feature that:

- ▶ shuts down the LAN port when a BPDU packet enters this port;
- ▶ sends out dummy BPDU packets.

As a result, this feature or IFM:

- ▶ protects the network against possible loops created via this IFM, although this IFM does not support MSTP;
- ▶ protects a running MSTP protocol somewhere else in the Dragon PTN network from external MSTP influences via this LAN port, e.g. root bridge protection etc...

See Ref. [2Eth] in Table 1 for more configuration information in HiProvision.

2.2.10 Hardware Edition

The hardware edition of this IFM has been factory set and can not be changed! It can be read out via HiProvision, see Ref. [2Mgt] in Table 1.

2.3 Onboard Interfaces

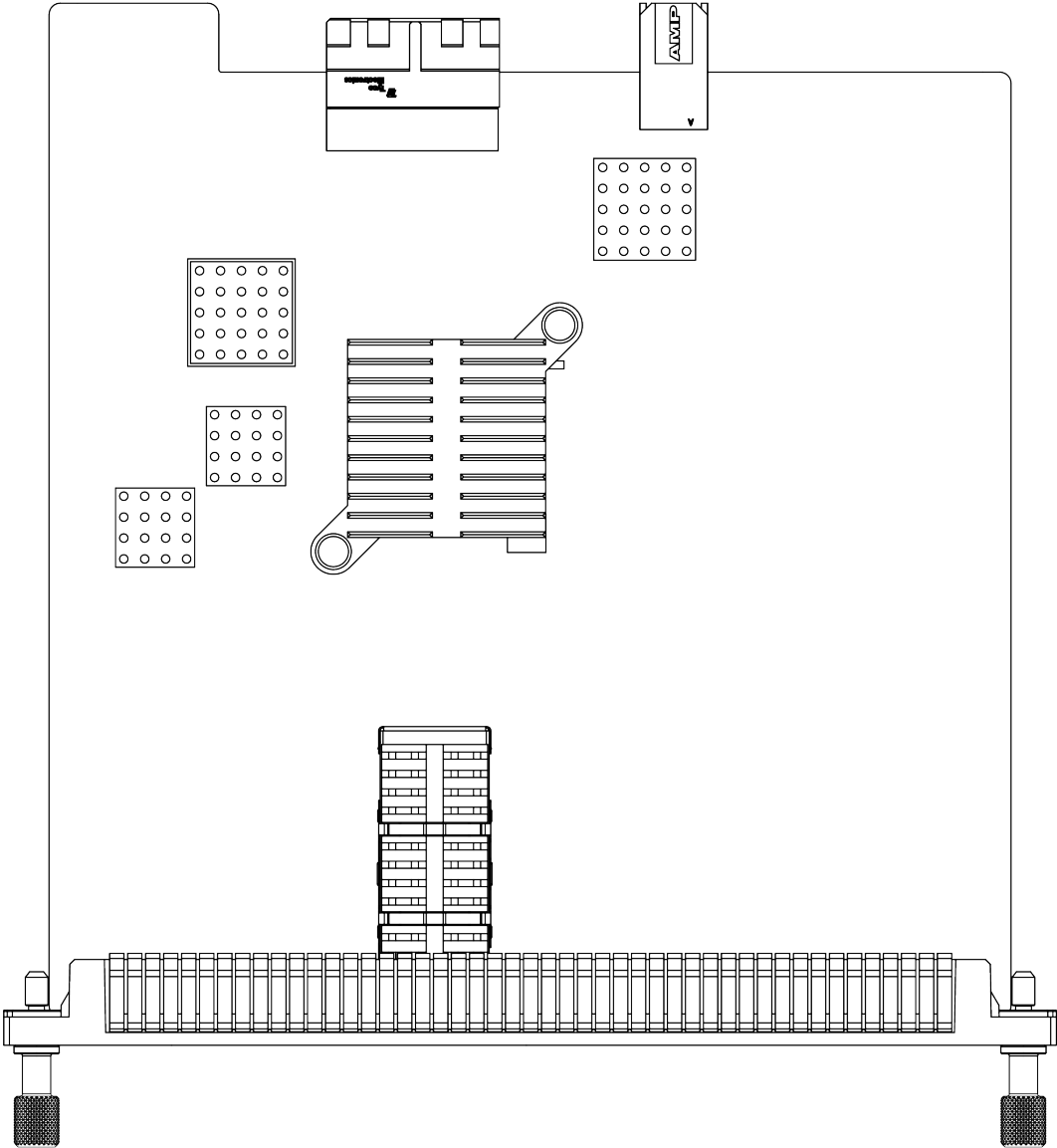


Figure 5 Top View

2.3.1 Straps

This IFM has no user relevant straps.

2.3.2 DIP Switches

This IFM has no user relevant DIP switches.

3. MODULE SPECIFICATIONS

3.1 General Specifications

For general specifications like temperature, humidity, EMI ... see Ref.[9] in Table 1.

3.2 Other Specifications

Table 5 Other Specifications

Description	Value
Weight	0.373 kg / 0.82 lb (with QSFP+) 0.333 kg / 0.72 lb (without QSFP+)
MTBF	143 years at 25°C/77°F
Power Consumption	19W (measured at 25°C/77°F, with QSFP+ data transport)
Module Size	width: 186 mm / 7.3 inches height: 43.05 mm / 1.69 inches depth: 195 mm / 7.68 inches

3.3 Ordering Information

- ▶ PTN-1-40G-LW: 942 236-027.

4. ABBREVIATIONS

BPDU	Bridge Protocol Data Unit
CE	Conformité Européenne
CSM	Central Switching Module
DWDM	Dense Wavelength Division Multiplexing
EFM-F	Ethernet in the First Mile Over Point-to-Point Fiber
EMI	Electromagnetic Interference
FLT	Fault
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IFM	InterFace Module
ISP	Internet Service Provider
LA	Link Activity
LAN	Local Area Network
LER	Label Edge Router
LOS	Loss of Signal
LSR	Label Switching Router

LVD	Low Voltage Directive
MSTP	Multiple Spanning Tree
MTBF	Mean Time Between Failures
PF	Power Failure
PI	Power Input
PSU	Power Supply Unit
PTN	Packet Transport Network
PTP	Precision Time Protocol
QSFP+	40 Gigabit Quad Small Form Factor Pluggable Module
SyncE	Synchronous Ethernet
WAN	Wide Area Network