User Manual

Installation
Dragon PTN
Interface Module PTN-2-OLS with E1
PTN-2-OLS with T1

Interface Module PTN-2-OLS with E1/PTN-2-OLS with T1
Release 01 10/2019

Technical Support
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1. INTRODUCTION

1.1 General

This document is valid as of Dragon PTN Release 4.0DR.

The PTN-2-OLS interface module is an Optical Low Speed Serial interface module with four ports: two Optical Serial ports (=port1, port2) and two E1 ports (=port3, port4). Each optical port has two ST connectors: one Rx (=Receive) and one Tx (=Transmit) ST. Each E1 port is an RJ-45 connector. This Interface Module will be used in point-to-point connection and:

- converts the incoming serial signal on port1 into E1 on port3 and vice versa;
- converts the incoming serial signal on port2 into E1 on port4 and vice versa;

This Interface Module can be used in any Interface Module slot of any node. An Interface Module slot overview can be found in Ref. [3] in Table 1.

CAUTION: This Interface Module is only a convertor module that needs to be powered via the node. It will not have backplane or Dragon PTN network access. The MPLS-TP Dragon PTN network is not required (or optional) for this Interface Module.

The E1 links provide synchronous TDM links between two end points that can be used to transport over an external network e.g. SDH. The optical ports are the access ports whereas the E1 ports are the SDH interconnection ports. At the destination side, the PTN2-OLS receives the E1 traffic and converts it back to an optical low speed serial signal towards the end application.

In HiProvision (=Dragon PTN Management), an 'Optical Low Speed Serial' service can be configured between two optical ports, each port located in a different node. This service bundles together 32 TDM (Time Division Multiplex) connections resulting in a total bandwidth of 2.048 Mbps. The E1 side can slave its clock for example to the E1 clock from the external network.

NOTE: HiProvision can be configured redundantly.

Figure 1 PTN-2-OLS - SDH Example

Interface Module PTN-2-OLS with E1/PTN-2-OLS with T1
Release 01 10/2019
The main supported features are:
- No Dragon PTN network access;
- Converting optical serial into E1 and vice versa;
- Point-to-point connection;
- E1 port on PTN-2-OLS Interface Module can slave to E1 clock from external network;
- Services: Optical Low Speed Serial in HiProvision;
- Synchronous/asynchronous serial communication;

1.2 Manual References

Table 1 is an overview of the manuals referred to in this manual. All these manuals can be found in the HiProvision (=Dragon PTN Management System) Help function.

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Manual</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>UM_BasicConfig_Dragon-PTN_and_HiProvision-Operation_Rel_4-0DR_1019_en.pdf</td>
<td>Dragon PTN and HiProvision Operation</td>
</tr>
</tbody>
</table>

2. MODULE DESCRIPTION

2.1 Front Panel

![Figure 2 Front Panel](image-url)
2.1.1 Handle

a. Insert the Module into the Node

Take the front panel handles to insert or slide the module into the Dragon PTN node. Push the module thoroughly into the node’s backplane. Next, tighten the two fastening screws in the front panel corners.

b. Remove the Module from the Node

Untighten the two fastening screws in the front panel corners. Take the front panel handles to pull out and finally remove the module from the Dragon PTN node.

2.1.2 LEDs

The meaning of the LEDs depends on the mode of operation (= boot or normal) in which the PTN-2-OLS 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**

<table>
<thead>
<tr>
<th>Cycle</th>
<th>PI</th>
<th>PF</th>
<th>FLT</th>
<th>Spare LED</th>
<th>RX[1,2]</th>
<th>TX[1,2]</th>
<th>AIS[3,4]</th>
<th>LOS[3,4]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>x</td>
<td>---</td>
<td>Slow blinking</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2</td>
<td>x</td>
<td>---</td>
<td>Fast blinking</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>x</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>x</td>
<td>---</td>
<td>Fast blinking</td>
<td>---</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

x : LED is lit  
--- : LED is not lit  
The sub cycle times may vary.  
The entire boot cycle time [1→4] takes approximately 2 minutes.

**Table 3 LED Indications In Normal Operation**

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI (=Power Input)</td>
<td>Not lit, dark</td>
<td>+12V power input to the board not OK</td>
</tr>
<tr>
<td>Green</td>
<td>+12V power input to the board OK</td>
<td></td>
</tr>
<tr>
<td>PF (=Power Failure)</td>
<td>Not lit, dark</td>
<td>power generation on the board itself is OK</td>
</tr>
<tr>
<td>Red</td>
<td>power generation on the board itself is erroneous</td>
<td></td>
</tr>
<tr>
<td>FLT (=Fault)</td>
<td>Not lit, dark</td>
<td>no other fault or error situation, different from PF, is active on the module</td>
</tr>
<tr>
<td>Red</td>
<td>a fault or error situation, different from PF, is active on the module</td>
<td></td>
</tr>
<tr>
<td>RX&lt;port n&gt;</td>
<td>Not lit, dark</td>
<td>no service programmed on this optical serial port</td>
</tr>
<tr>
<td>Green, blinking</td>
<td>Service programmed, no optical serial port activity detected</td>
<td></td>
</tr>
<tr>
<td>Green, lit</td>
<td>Service programmed, optical serial port activity detected</td>
<td></td>
</tr>
<tr>
<td>TX&lt;port n&gt;</td>
<td>Not lit, dark</td>
<td>No service programmed on this optical serial port</td>
</tr>
<tr>
<td>Green, blinking</td>
<td>Service programmed, optical serial port not sending out data</td>
<td></td>
</tr>
<tr>
<td>Green, lit</td>
<td>Service programmed, optical serial port sending out data, no errors</td>
<td></td>
</tr>
<tr>
<td>LED</td>
<td>Color</td>
<td>Status</td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>AIS&lt;port n”&gt; (=Alarm Indication Signal)</td>
<td>Not lit, dark</td>
<td>- no service on this port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- service on this port: no alarms detected on backplane (=network) side, everything fine</td>
</tr>
<tr>
<td></td>
<td>Red, lit</td>
<td>service on this port: no network traffic or TX AIS detected on backplane (=network) side</td>
</tr>
<tr>
<td></td>
<td>Red, blinking</td>
<td>other errors different from TX AIS detected on backplane (=network) side</td>
</tr>
<tr>
<td>LOS&lt;port n”&gt; (Loss of Signal)</td>
<td>Not lit, dark</td>
<td>- no service on this port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- service on this port: local E1 traffic on this front port is OK</td>
</tr>
<tr>
<td></td>
<td>Red, lit</td>
<td>service on this port: local E1 signal is lost on this front port</td>
</tr>
<tr>
<td></td>
<td>Red, blinking</td>
<td>AIS, LOF or RAI received on this front port</td>
</tr>
</tbody>
</table>

### 2.1.3 Optical Serial Port (Fiber)

The PTN-2-OLS module provides two optical serial ports with each port having two ST (=Straight Tip) connectors: TX and RX. These ports can be used for communication over optical fiber.

![Figure 3 Optical Serial ST Connector](image)

### 2.1.4 E1 RJ-45 Ports (Copper) and Cables

The PTN-2-OLS module provides two E1 ports and each port connector has eight pins. Each port provides one tip/ring pair. See the table and figure below for an overview and description. The cables below can be ordered to connect these ports.

- E1 cable (120 Ω): ordering number 942 256-201.

![Figure 4 E1 RJ-45 Connector](image)

**Table 4 E1 RJ-45 Connector: Pin Assignments**

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Description</th>
<th>Cable Wire Colors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rx (Receive) RING</td>
<td>OG</td>
</tr>
<tr>
<td>2</td>
<td>Rx (Receive) TIP</td>
<td>WH/OG</td>
</tr>
<tr>
<td>3</td>
<td>Not connected</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Tx (Transmit) RING</td>
<td>BU</td>
</tr>
<tr>
<td>5</td>
<td>Tx (Transmit) TIP</td>
<td>WH/BU</td>
</tr>
<tr>
<td>6, 7,8</td>
<td>Not connected</td>
<td>-</td>
</tr>
</tbody>
</table>
2.2 Functional Operation

2.2.1 General

See §1.1.

2.2.2 E1 Framing

E1 is a 2.048 Mbps bi-directional (full duplex) link through which the data is transported in a digital way in frames. One frame consists of 32 time slots (Figure 5). Timeslot 0 is used for framing and synchronization, and time slot 16 for signaling. The bandwidth of one time slot is 64 kbps (=8 bits/125 µs). One frame thus consists of $32 \times 8 = 256$ bits and lasts 125 µs. Typically 16 frames are packed together in one multiframe.

**NOTE:** Multiframe = future support;

![Figure 5 E1 Framing](image)

2.2.3 E1 Coding: AMI, HDB3

AMI, HDB3 are different types of line coding. HDB3 is used in E1. The PTN-2-OLS module supports HDB3 for E1. HDB3 is an enhancement of AMI. For this reason, AMI is mentioned here as well.

As the E1 link has no separate clock transmission, the receiver will derive the clock from the incoming data stream. A minimum density of logical ones is required in order to guarantee a faultless clock recovery. This is achieved basically by AMI which encodes the data stream with bipolar violations. A more enhanced and better encoding is HDB3 which enhances the AMI stream by replacing successive zeros:

- E1 → HDB3: replace four successive zeros with a fixed bit pattern ‘000V’ or ‘B00V’;

A ‘B’ and ‘V’ can either be ‘-’ or ‘+’. Which pattern is used depends on the amount of ‘+’ and ‘-’ already received from send on the link.

![Figure 6 HDB3 Encoding](image)
2.2.4 FM0 Coding (Biphase Space Encoding)

FM0 Coding is a biphase 'space' encoding ('space' = 0-bit; 'mark' : 1-bit) that can be used in serial data communication. FM0 encoding guarantees to have a transition (from high to low or vice versa) in every data bit. This encoded data contains sufficient transitions to recover a clock from the data. Further advantages are the DC balancing resulting in enhanced signal reliability.

With FM0 Coding enabled, a 0-bit (= 'space') will always have an extra transition halfway its bit time (=2 phases = biphase) whereas a 1-bit will have no transition within its bit time.

![Figure 7 FM0 Coding](image)

2.2.5 Short Haul/Long Haul on E1 Ports

Long E1 links (>200m, Long Haul) have more signal attenuation than shorter links (<200m, Short Haul). As a result, the signal levels or sensitivity ('0' or '1') on the receiver side must be configured according the used link: Long Haul or Short Haul.

In HiProvision, a Short Haul parameter can be checked for Short Haul links and unchecked (=default) for Long Haul links. This parameter can be set on port level in the Interface Module or at service creation.

2.2.6 Service: Optical Low Speed Serial

The 'Optical Low Speed Serial service' is a point-to-point service between two optical serial ports, each port located in a different node, see §1.1. This service can be configured in HiProvision (=Dragon PTN management system). It converts the incoming serial signal into E1 and vice versa.

Within one PTN-2-OLS Interface Module, [port 1 <-> port3] and [port 2 <-> port4] are always linked via a fixed local loopback including the conversion. See next figure:
Following can be configured during service creation:

- **Optical Serial Ports:**
  - Synchronisation: synchronous or asynchronous;
  - Synchronous:
    - Bitrate: \([64 (=1*64), 128 (=2*64), 512 (=8*64), 1984 (=31*64)] \) kbps;
    - FM0 Coding (see §2.2.4): disabled/enabled;
  - Asynchronous:
    - Bitrate: \([1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200, 297600] \) bps; When a bit rate is selected, an incoming serial signal with a lower bitrate will operate as well, because PTN2-OLS samples at 6.6 times the selected bitrate;

- **E1 Ports:**
  - Short Haul (see §2.2.5): unchecked (=default) / checked;

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

The CSM is only needed to program the PTN-2-OLS Interface Module via HiProvision. Once the PTN2-OLS Interface Module has been configured, it does not need the CSM anymore.

### 2.2.8 Test and Loopback Selftests

Test and Loopback selftests can be performed (via HiProvision) in CESes, e.g when configuring or troubleshooting a CES. Following two functions can be used in a programmed CES:

- **Loopbacks:** on backplane or front port, direction towards line (=application) or network can be configured;
- **BERT:** test traffic generation and verification via Bit Error Ratio Tester.
2.3 Onboard Interfaces

See Figure 8 for a side view of the Interface Module module.

2.3.1 Straps

No user relevant straps.

2.3.2 DIP Switches

a. Hardware Edition

The Hardware Edition is set in decimal code using rotary switches S2 to S3 (=most significant). It can be read out as well via HiProvision. This edition has been factory set and MUST NOT BE CHANGED!

Example: Setting S3=’0’ and S2=’5’ indicates Hardware Edition ’5’ (dec).

![Figure 9 Hardware Edition](image)

b. E1/T1 Configuration

The E1/T1 configuration of the PTN2-OLS module is factory set by the S1 DIP switch into E1 mode and must not be changed. The configuration can be read out via HiProvision.

- Switch = E1: both E1/T1 ports operate as E1 ports, use the ‘PTN-2-OLS-E1-L’ Interface Module in HiProvision;
- Switch = T1 (=future): both E1/T1 ports operate as T1 ports, use the ‘PTN-2-OLS-T1-L’ Interface Module in HiProvision.

![Figure 10 E1/T1 Configuration](image)
3. MODULE SPECIFICATIONS

3.1 General Specifications
For general specifications like temperature, humidity, EMI... see Ref.[5] in Table 1.

3.2 Other Specifications

Table 5 Other Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>0.23 kg / 0.5 lb</td>
</tr>
<tr>
<td>MTBF</td>
<td>87 years at 25°C/77°F</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>8.4 W (measured at 25°C/77°F)</td>
</tr>
<tr>
<td>Module Size</td>
<td>width: 20.32 mm / 0.8 inches</td>
</tr>
<tr>
<td></td>
<td>height: 126 mm / 4.96 inches</td>
</tr>
<tr>
<td></td>
<td>depth: 195 mm / 7.68 inches</td>
</tr>
</tbody>
</table>

3.3 Ordering Information
- PTN-2-OLS with E1: future support;
- PTN-2-OLS with T1: future support;

4. ABBREVIATIONS

AIS          Alarm Indication Signal
AMI          Alternate Mark Inversion
CE           Conformité Européenne
CSM          Central Switching Module
DC           Direct Current
EMI          Electromagnetic Interference
ERR          Error
ETH          Ethernet
FLT          Fault
HDB3         High Density Bipolar of Order 3
IEEE         Institute of Electrical and Electronics Engineers
kbps         Kilobit per Second
LAN          Local Area Network
LOF          Loss Of Framing
LOS          Loss Of Signal
LVD          Low Voltage Directive
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mbps</td>
<td>Megabit per Second</td>
</tr>
<tr>
<td>MPLS-TP</td>
<td>MultiProtocol Label Switching – Transport Profile</td>
</tr>
<tr>
<td>MSB</td>
<td>Most Significant Bit</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failures</td>
</tr>
<tr>
<td>OLS</td>
<td>Optical Low Speed</td>
</tr>
<tr>
<td>PF</td>
<td>Power Failure</td>
</tr>
<tr>
<td>PI</td>
<td>Power Input</td>
</tr>
<tr>
<td>PTN</td>
<td>Packet Transport Network</td>
</tr>
<tr>
<td>PTP</td>
<td>Point to Point</td>
</tr>
<tr>
<td>RAI</td>
<td>Remote Alarm Indicator</td>
</tr>
<tr>
<td>SDH</td>
<td>Synchronous Digital Hierarchy</td>
</tr>
<tr>
<td>SF</td>
<td>Super Frame</td>
</tr>
<tr>
<td>ST</td>
<td>Straight Tip</td>
</tr>
<tr>
<td>TDM</td>
<td>Time Division Multiplex</td>
</tr>
</tbody>
</table>