



**Haliplex**  
Communication Systems

# **HPX-1600 USER GUIDE**

**Chapter 2-11:  
HPX-IM-1620-T1  
Dual T1 IM**

# TABLE OF CONTENTS

**1. GENERAL CHARACTERISTICS ..... 1**

**2. IM CONFIGURATION ..... 2**

    2.1. INTERFACE PARAMETERS ..... 2

        2.1.1. FRAMING OPTIONS..... 2

        2.1.2. LINE CODING OPTIONS..... 3

        2.1.3. LINE BUILD OUT OPTIONS ..... 3

    2.2. SIGNALLING ..... 3

    2.3. PERFORMANCE / STATISTICS PARAMETERS ..... 4

    2.4. TESTING PARAMETERS..... 5

    2.5. AUTOMATIC PROTECTION SWITCHING (APS) PARAMETERS..... 6

        2.5.1. PROTECTED BY ..... 6

        2.5.2. INACTIVE CHANNEL TX ..... 6

        2.5.3. SWITCHING EVENTS ..... 6

        2.5.4. SWITCHING..... 6

        2.5.5. REVERTIVE..... 6

    2.6. CONVERSIONS PARAMETERS ..... 7

        2.6.1. COMPANDING ..... 7

        2.6.2. SIGNALLING..... 7

            2.6.2.1. PROPRIETY CONVERSION ..... 7

            2.6.2.2. TWO (2) BIT AB CONVERSION..... 7

            2.6.2.3. FOUR (4) BIT ABCD CONVERSION..... 7

**3. IM TESTING..... 8**

**4. IM ALARMS ..... 9**

**5. IM INDICATORS ..... 11**

**6. IM CABLES ..... 12**

**7. INTERFACE SPECIFICATIONS ..... 13**

---

<b>8. INTERNATIONAL COMPLIANCES .....</b>	<b>14</b>
8.1. ELECTROMAGNETIC COMPATIBILITY (EMC) .....	15
8.2. SAFETY .....	15
8.3. IMMUNITY .....	15
8.4. PERFORMANCE .....	15

## TABLE OF FIGURES

FIGURE 1: DUAL T1 IM ..... 1

FIGURE 2: DUAL T1 IM CONFIGURATION DIALOG INTERFACE` TAB ..... 2

FIGURE 3 : DUAL T1 IM RBS CONFIGURATION ..... 3

FIGURE 4: DUAL T1 IM CONFIGURATION DIALOG STATISTICS TAB..... 4

FIGURE 5: DUAL T1 IM CONFIGURATION DIALOG TESTING TAB ..... 5

FIGURE 6: DUAL T1 IM CONFIGURATION DIALOG APS TAB..... 6

FIGURE 7: E1 IM CONFIGURATION DIALOG CONVERSION TAB ..... 7

FIGURE 8: DUAL T1 IM LOOPBACK OPTIONS..... 8

FIGURE 9: DUAL T1 IM ALARM MONITOR SETUP WINDOW ..... 9

FIGURE 10: LOS, RDI AND RXAIS ALARMS ..... 10

## LIST OF TABLES

TABLE 1: DUAL T1 IM LED INTERPRETATIONS ..... 11

TABLE 2: HPX-1600 CABLE 006 ..... 12

TABLE 3: HPX-1600 CABLE 007 ..... 12

TABLE 4: INTERFACE SPECIFICATIONS ..... 13

## RECORD OF CHANGES

4.09	Addition	Section 2.2	Statistics counters
------	----------	-------------	---------------------

## 1. GENERAL CHARACTERISTICS

The Dual T1 IM operates at nx64kB/s up to 1544kB/s and allows connection via two RJ48 ports to equipment that supports T1. The IA or SS support DACS connection synch or framed mode. Asynch and unframed is only supported by the SS.

The Dual T1 IM is shown below in Figure 1.



**Figure 1: Dual T1 IM**

## 2. IM CONFIGURATION

The IM configuration dialog has configuration tabs as discussed below.

### 2.1. INTERFACE PARAMETERS

The interface tab allows the user to select the framing, line coding and line build out options.

The **Port Enable** section is used to turn the IM ON or OFF. When the IM is disabled, all front panel LED indicators are turned off. By default, the IM is set enabled.

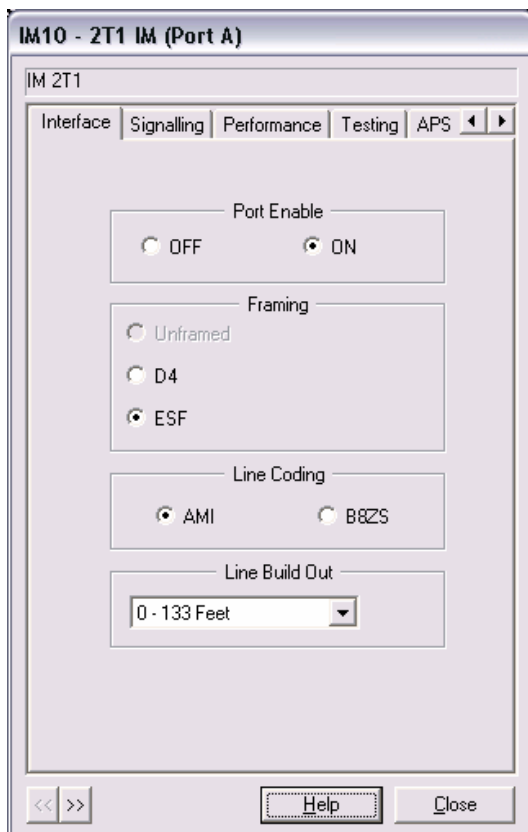
The “On” position enables port to become active and all IM operations perform as normal.

Initially the IM is set to “Off” where the port is not active but can be configured. Switching to the “Off” position network traffic is ignored, no traffic will pass through the IM and therefore no statistics are kept, alarm monitoring will also be disabled.

#### 2.1.1. FRAMING OPTIONS

Unlike E1 Channel Associated Signalling (CAS), which transmits signalling bits out of band (in time slot 16), T1 CAS transmits signalling information in-band, using bits from specified frames in the data channel for signalling. (The 8<sup>th</sup> bit in every 6<sup>th</sup> frame). This is called Robbed Bit Signalling. T1 CAS can be selected with D4 or ESF signalling.

D4 and ESF are alternative methods for framing (identifying) a DS1 channel. If D4 is selected, each DS1 channel is framed so that it consists of 2 D4 superframes (12x193 bit frames). If ESF is selected, each DS1 channel is framed so that it consists of a single ESF superframe (24x193 bit frames). Alternatively, an unframed channel can be set. The IA and SS can have a frame connection in DACS, whereas as an unframed connection to DACS can only occur in the SS.



**Figure 2: Dual T1 IM Configuration Dialog Interface` Tab**

### 2.1.2. LINE CODING OPTIONS

AMI (Alternate Mark Inversion) and B8ZS (Bipolar 8 Zero Substitution) are 2 available line coding methods to meet 1s density requirements. AMI does not account for potential 1s density problems, while B8ZS does.

Usually when ESF signalling is in use, the line coding is B8ZS and when the line is D4 signalling, the line coding is AMI.

### 2.1.3. LINE BUILD OUT OPTIONS

The line build out section requires the user to estimate the length of the cable connecting the dual T1 IM to the tributary circuit. The range into which the estimated length falls should then be selected in the Line Build Out frame. This will ensure that the strength of the signal arriving at the IM is within the IM's operating range.

## 2.2. SIGNALLING

As described above in Section 2.1.1 Signalling Options, Channel Associated Signalling for T1 trunks uses Robbed Bit Signalling. RBS reduces the maximum bandwidth of each time slot from 64Kbps to just 56Kbps. In T1 trunks that shared for both voice and data services, RBS should be set for only those time slots that carry voice circuits that require associated signalling.

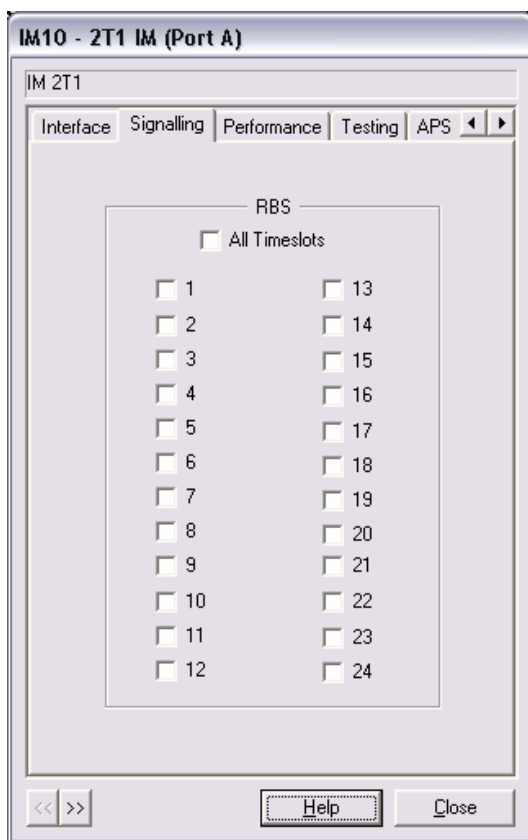


Figure 3 : Dual T1 IM RBS Configuration

### 2.3. PERFORMANCE / STATISTICS PARAMETERS

Software versions SP4-5-0 and later display a “Statistics” tab. This tab displays a summary of collective interface errors.

**Bipolar Code Violations** is the total number of bipolar violations in the bipolar coding AMI or HDB3 of the T1 signal.

**CRC Errors** is the total number of a Cyclic Redundancy check errors calculated if CRC is enabled. CRC errors counters stop during a Loss of sync.

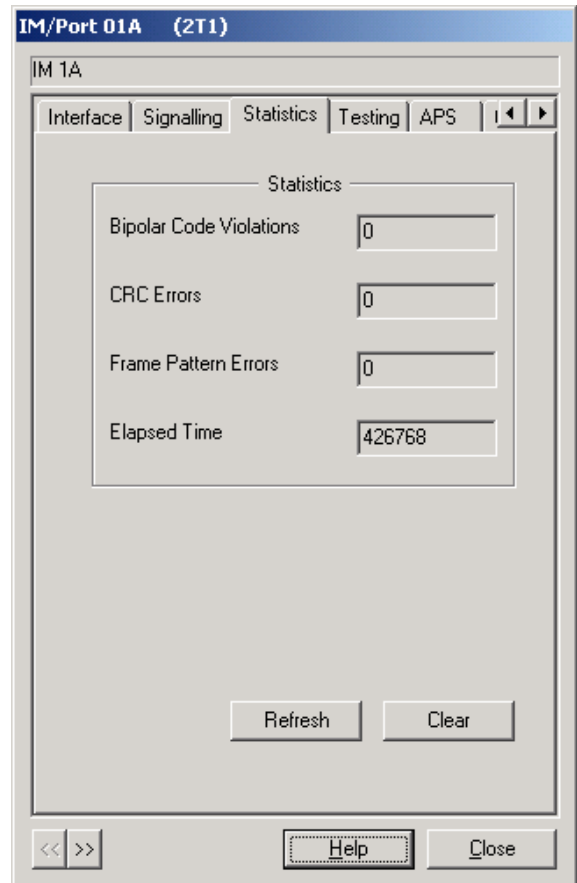
**Frame Pattern Errors** counts the framing errors.

**Elapsed time** displays in seconds the elapsed time since power on or the most recent “clear” of statistics total.

**Refresh** button updates the display counters.

**Clear** button clears the statistics counters.

Software versions earlier than SP4-5-0 have a “Performance” tab. This tab does not contain any information.



**Figure 4: Dual T1 IM Configuration Dialog Statistics Tab**

## 2.4. TESTING PARAMETERS

The testing tab allows the user to select a loopback mode for testing.

The available loopback modes are

- IM Connector
- LIU Analoge Line

For further detail on the loopback options available, refer to section 3.

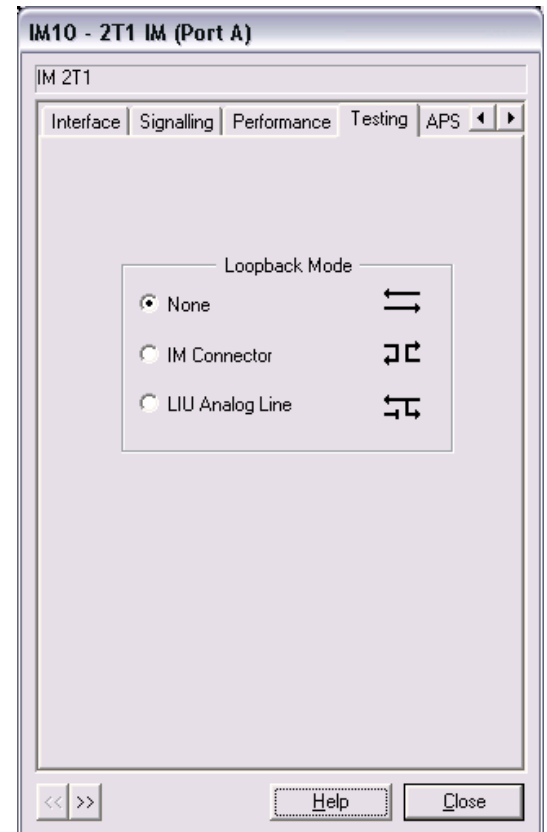


Figure 5: Dual T1 IM Configuration Dialog Testing Tab

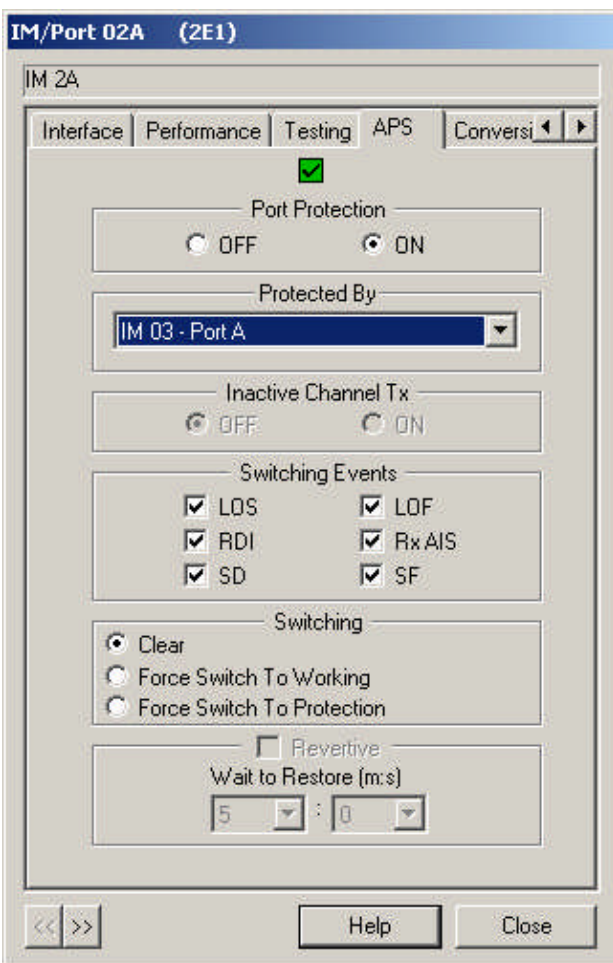
## 2.5. AUTOMATIC PROTECTION SWITCHING (APS) PARAMETERS

The APS Tab allows the user to set up APS on that IM. To enable APS for the Dual T1 IM, select ON from T1 Port Protection. To disable APS switch the T1 Port Protection OFF.

### 2.5.1. PROTECTED BY

The interface selection in the “Protected By” field will determine the type of protection. Selection of the “B” port of the same interface module will modify the IM to be configured as a single stream, allowing only one connection into the DACS. The APS uses Port A as the working path and Port B as the protected.

Selection of the same port of another interface module will require the use of an external “Y-cable”.



### 2.5.2. INACTIVE CHANNEL TX

If using a “Y-cable” the Inactive Transmitter must be configured off.

### 2.5.3. SWITCHING EVENTS

Switching Events is the selection of events (alarms) that determines when the path of transmission is to switch from working path to protected path. Explanations on the listed events can be read about in Section 4 IM Alarms. To select the events, simply select the check box appropriate to your application.

### 2.5.4. SWITCHING

The switching section has a default setting to ‘Clear’ this allows the switching to occur based on the events selected in the ‘Switching Events’ section.

The user can opt to Force Switch to Working, or Protection. The force switch uses the new path as the path of transmission and is not selected by any of the above conditions. When a force is selected the switch will apply regardless of whether there are any errors on the path.

Figure 6: Dual T1 IM Configuration Dialog APS Tab

### 2.5.5. REVERTIVE

Enable for APS to revert. If a switch has occurred, it attempts to restore itself after the specified time period, selected from the drop down list. As default, 5 seconds minimum is required.

## 2.6. CONVERSIONS PARAMETERS

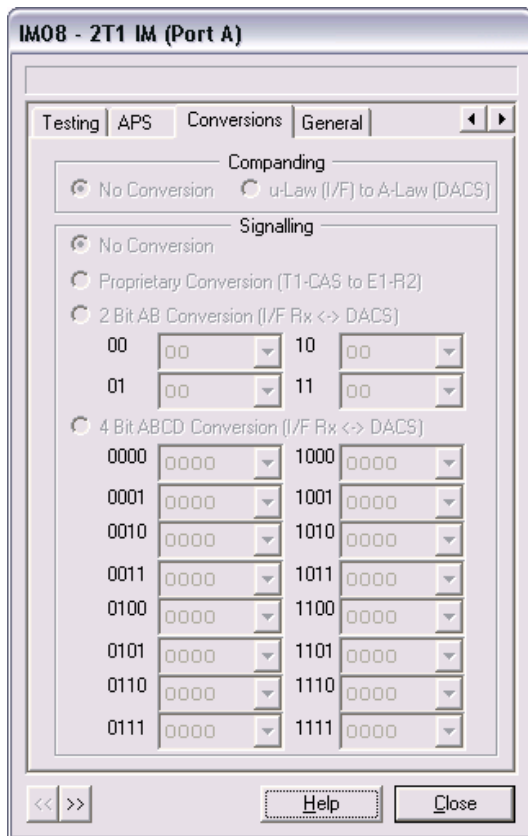
The Dual T1 interface can be used to provide connection between different signalling and companding protocols. A T1 connection has different companding and signalling rules to an E1. The conversions parameters allow the user to convert the E1 signal and companding of the IM to suit its connection to the T1 IM.

### 2.6.1. COMPANDING

Companding is used to provide a means of compressing speech into a 64kbit stream with the minimal loss of the intelligibility of the speech. In T1 networks  $\mu$ -Law companding is used, in E1 networks A-Law is used, therefore the companding conversion option for the Dual T1 IM is  $\mu$ -Law to A-Law. Companding conversion exists for both framing options, PCM 30 (CAS) and PCM 31 (CCS) and with CRC4.

### 2.6.2. SIGNALLING

Signalling is the information exchange concerning the establishment and control of a connection and the management of a network.



There are many different forms of signal that are used throughout the world and there is a need to be able to convert between different signalling formats. There are three main types of conversions:

- Proprietary Conversion
- 2 Bit AB Conversion
- 4 Bit ABCD Conversion.

#### 2.6.2.1. PROPRIETY CONVERSION

Proprietary conversion is the conversion between T1-CAS to E1-R2 as used by Haliplex voice IMs by default. This conversion is compatible with D4 framing and ESF framing.

#### 2.6.2.2. TWO (2) BIT AB CONVERSION

This conversion uses two bit signalling. For each two bits entering the IM from the front panel connector the user selects the applicable signaling bits to enter the DACS. This conversion is compatible with D4 and ESF framing, refer to Section 2.1. For ESF framing, using 4 signalling bits, the remaining two bits, CD are set to and follow the conversion rule for bits AB.

Figure 7: E1 IM Configuration Dialog Conversion Tab

#### 2.6.2.3. FOUR (4) BIT ABCD CONVERSION

This conversion uses four bit signalling. For each four bit pattern entering the IM from the front panel connector the user configures the applicable signaling bits to enter the DACS. User defined fields other than zero must be unique.

### 3. IM TESTING

The Dual T1 IM has loopback set to none as the default setting for normal IM operation. However, for testing purposes, one of two loopback options can be set. The two available loopback options are illustrated below in Figure 8.

- LIU analog line loopback (1)
  - Data is sent through the IM connectors to the backplane and loops back to the IM connector, whilst the data sent from the backplane through the IM is dropped.
- IM connector loopback (2)
  - Data that is sent through the IM connector loops back out to the IM connector. Data that is sent from the backplane through the IM is looped back out to the backplane.

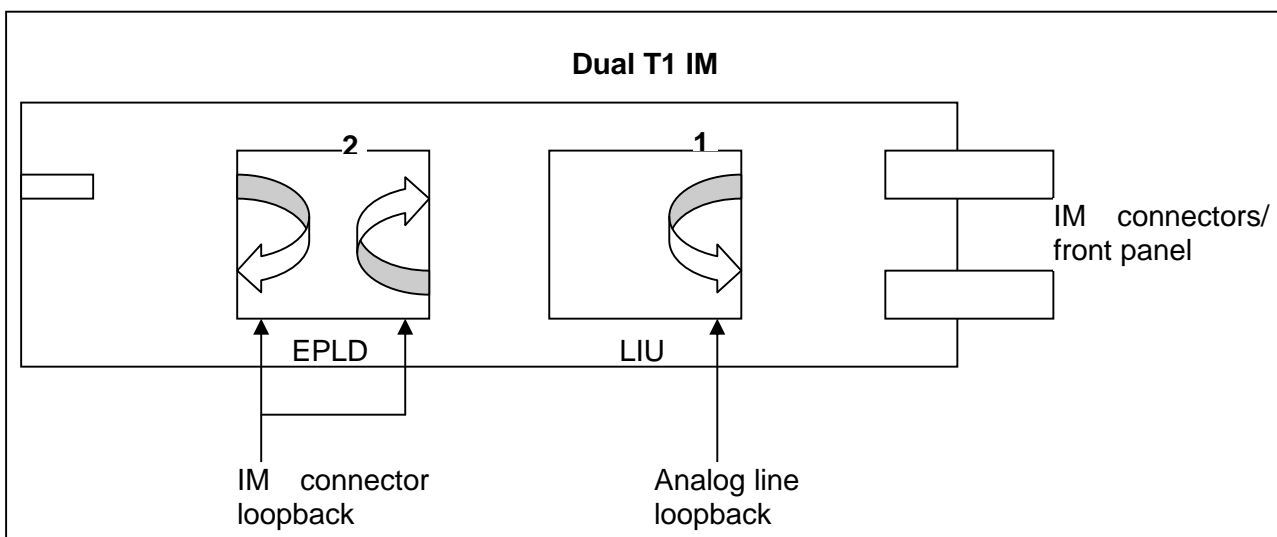
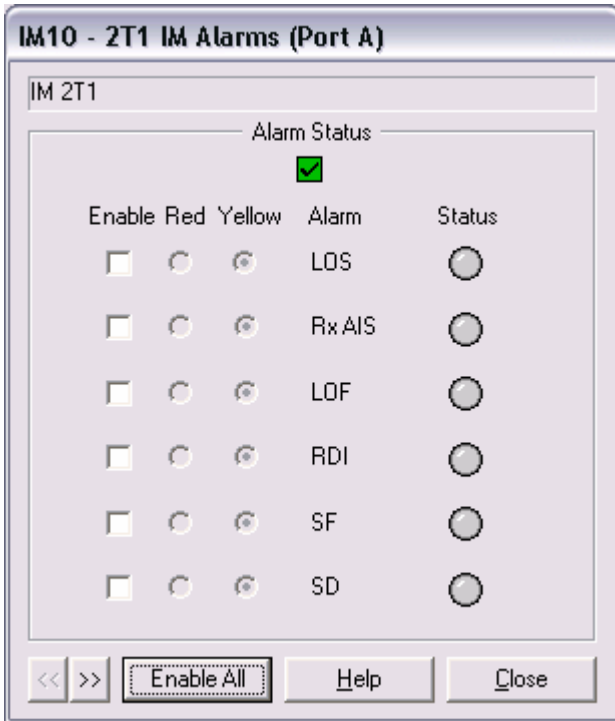


Figure 8: Dual T1 IM loopback options

## 4. IM ALARMS

A Loss of Sync/Signal Alarm is available for the Dual T1 IM. It can be configured as a red or yellow alarm via the IM alarm monitor setup window shown below in Figure 7.



**Key:**

- LOS – Loss of signal
- LOF – Loss of framing
- RDI – Receive defect indicator
- RxAIS – Receive alarm indicator signal
- SD – Signal degrade
- SF – Signal fail

**Figure 9: Dual T1 IM alarm monitor setup window**

**LOS**

The LOS alarm is set if the node identifies a loss of signal. On the occurrence of a LOS, all the other options are irrelevant.

**LOF**

The LOF alarm is set if the node identifies a loss of framing. For a LOF to occur there must be a signal.

**RDI**

The RDI alarm is sent downstream from the node that detects a LOS (Refer to Figure 8).

**SD**

The SD alarm is set on a signal degrade. A signal degrade is detected within the frame aligner signal, this knows what the error-free frame should be and if the frame alignment detects an error in the frame it identifies as the frame payload having errors. The signal degrade is taken as  $1 \times 10^6$ .

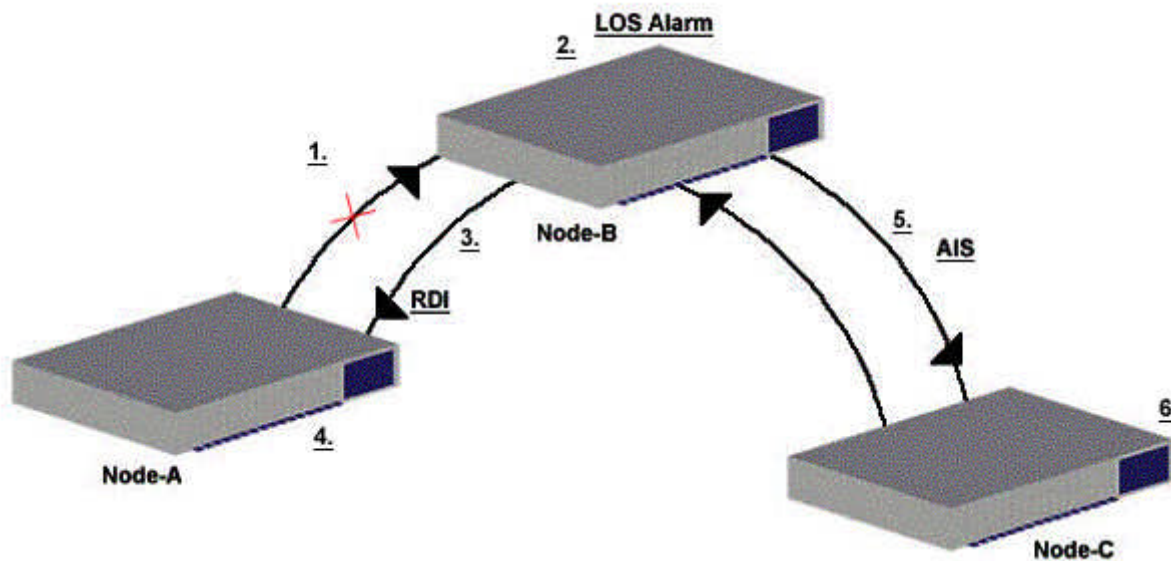
**SF**

Same instance as the SD but within  $1 \times 10^3$ .

**RxAIS**

An AIS is transmitted when there is a LOS detected AIS is sent downstream for other nodes to identify a LOS has occurred in the network.

1. Break upstream from Node-A to Node-B
2. LOS alarm detected at Node-B
3. RDI is sent upstream to inform Node-A of the LOS
4. Node-A detects RDI alarm
5. Node-B transmits an AIS downstream to Node-C
6. Node-C detects AIS alarm and identifies a LOS in the network



**Figure 10: LOS, RDI and RxAIS Alarms**

If there is a broken signal, Node-B generates a LOS alarm, it transmits upstream to Node-A an RDI and downstreams to Node-C an AIS. Node-C receives the AIS and can then identify that there is a LOS. Refer to Figure 8.

## 5. IM INDICATORS

Each RJ45/48 connector has two LEDs. The state of both the LEDs indicates the status of the software load, clock configuration and the data communications for each port. The LED interpretations for the Dual T1 IM are shown below in Table 1.

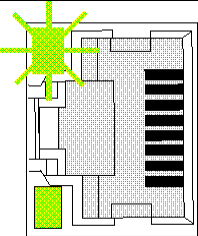
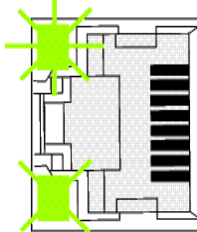
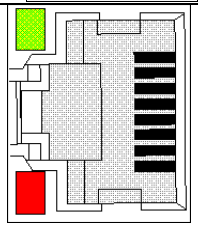
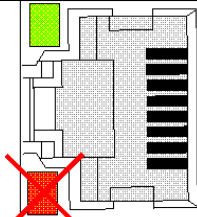
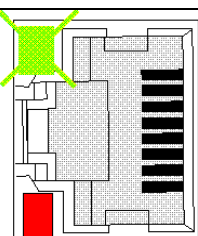
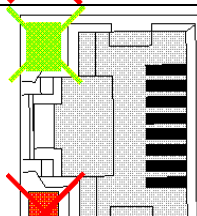
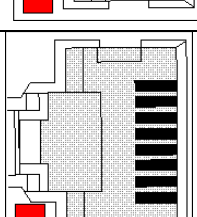
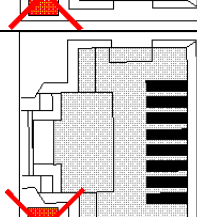
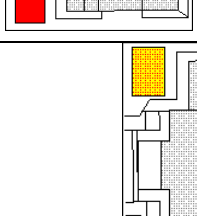
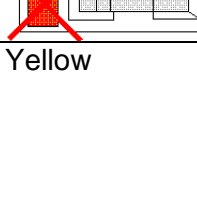
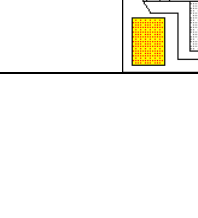
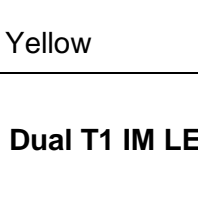
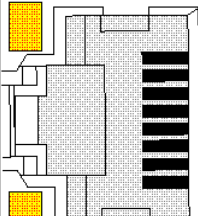
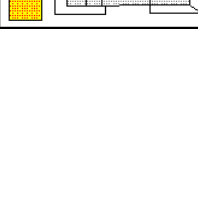
RJ45 LED Display				Interpretation
Not Clock source		Port is an External Clock source		
	Green flashing		Green flashing	<b>Normal Data Transmission</b>
	Green		Green flashing	
	Green		Green	<b>Error AIS</b>
	Red		Red flashing	
	Green flashing		Green Flashing	<b>Error Loss of Frame or Loss of Signal</b>
	Red		Red flashing	
		Yellow		<b>Firmware loaded waiting for Configuration files to be loaded</b>
		Yellow		

Table 1: Dual T1 IM LED Interpretations

## 6. IM CABLES

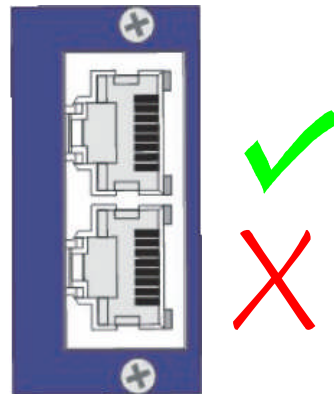
There are two types of cables to connect devices to the Dual T1 IM, one for Network Interface mode and the other for Network Terminal mode of operation. Each cable connects to the IM, 8 pin RJ45 connector.



**Note:**

In IA applications, the lower RJ45 connector is not used.

In OM, EM or SS applications both RJ45 connectors are used.



**Note:** Unused pins are not connected at the IM. The metal shell of the RJ45 socket may optionally be used as shield.

HPX-1600 Cable 006 Network Interface Mode			
P1 RJ45	Signal Name	P2 RJ45	Signal Name
1	Tx Tip	4	Rx Tip
2	Tx Ring	5	Rx Ring
3			
4	Rx Tip	1	Tx Tip
5	Rx Ring	2	Tx Ring
6			
7			
8			

Table 2: HPX-1600 Cable 006

HPX-1600 Cable 007 Network Terminal Mode			
P1 RJ45	Signal Name	P2 RJ45	Signal Name
1	Tx Tip	1	Tx Tip
2	Tx Ring	2	Tx Ring
3		3	
4	Rx Tip	4	Rx Tip
5	Rx Ring	5	Rx Ring
6		6	
7		7	

Table 3: HPX-1600 Cable 007

## 7. INTERFACE SPECIFICATIONS

Connector	Dual RJ-48, 100 Ohm
Trunk Speed	nx64/56kb/s up to 1544kb/s
Signalling	RBS/CAS
Loopbacks	Line loopback and Interface Module loopback
Power Consumption	< 5 Watts
Alarms	LOS: Loss of signal LOF: Loss of frame RDI: Remote defect indicator RxAIS: Receive alarm indicator signal SD: Signal Degrade SF: Signal Fail
LED Indicators	Normal Data Transmission Error AIS Error LOF or LOS Firmware loaded waiting for configuration files to be loaded

**Table 4: Interface Specifications**

## 8. INTERNATIONAL COMPLIANCES

- CE
- A Tick
- C Tick
- FCC part 15 class B
- UL



### FCC COMPLIANCE STATEMENT

*This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.*

#### **NOTE:**

*This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures*

- *Reorient or relocate the receiving antenna*
- *Increase the separation between the equipment and the receiver*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected*
- *Consult the dealer or an experienced radio/TV technician for help*

**Warning:** *Any changes or modifications not expressly approved by Haliplex Pty Ltd could void the user's authority to operate this equipment.*

## **8.1. ELECTROMAGNETIC COMPATIBILITY (EMC)**

- CISPR 22 class B
- EN55022
- FCC part 15 class B
- AS/NZS3548

## **8.2. SAFETY**

The Dual T1 IM complies with the following

- IEC60950, UL60950, and AS/NZS60950:2000 for General safety
- FCC68

## **8.3. IMMUNITY**

The Dual T1 IM complies with

- EN61000-4-2
- EN61000-4-3
- EN61000-4-4
- EN61000-4-5

## **8.4. PERFORMANCE**

- G-703, FCC-68