

# DC COUPLED ANALOGUE FIBRE OPTIC LINK FOR USE OVER MULTIMODE FIBRE

## User Handbook

### PDX-1-HB-5



# **TABLE OF CONTENTS**

<b>1</b>	<b>INTRODUCTION</b>	<b>5</b>
<b>1.1</b>	<b>Transmitter Module</b>	<b>5</b>
<b>1.2</b>	<b>Receiver Module</b>	<b>5</b>
<b>1.3</b>	<b>Fibre Optic Cable</b>	<b>5</b>
<b>2</b>	<b>SETTING UP AND USING THE DC LINK</b>	<b>6</b>
<b>2.1</b>	<b>Module Operation</b>	<b>6</b>
2.1.1	Shielded Remote Modules	6
2.1.2	Rack Plug-In Modules	6
2.1.3	Plug-In Converter Sleeve	6
<b>2.2</b>	<b>Using the Transmitter Module</b>	<b>6</b>
<b>2.3</b>	<b>Using the Receiver Module</b>	<b>6</b>
<b>2.4</b>	<b>System Integration</b>	<b>7</b>
<b>2.5</b>	<b>Optical Budget</b>	<b>8</b>
<b>3</b>	<b>BATTERY PACKS</b>	<b>9</b>
<b>3.1</b>	<b>Battery Pack Operation</b>	<b>9</b>
<b>4</b>	<b>MAINTENANCE AND FAULT-FINDING GUIDE</b>	<b>10</b>
<b>5</b>	<b>PRODUCT WARRANTY</b>	<b>11</b>

## Safety Information

*Please read the whole of this section  
before using your **point2point** product.*

### Electrical Safety

The Rack Cases that are used in conjunction with the DC Digital Link family are Safety Class 1 instruments (they have a metal case that is directly connected to earth via the power supply cable).

When operating the equipment note the following:

- Hazardous voltages exist within the equipment.
- Do not remove equipment covers when operating.
- Make sure that only fuses of the required rated current, and of the specified type (anti-surge, quick blow, etc.) are used for replacement.
- There are no user serviceable parts inside this unit.

### Optical Safety

This **point2point** DC Analogue Transmitter modules contain laser diode sources operating at 850nm. These devices are rated at under IEC60825-1 "Safety of Laser Products", Part 1, First Edition, 1993 as CLASS 1 radiation emitting devices.

When operating the equipment note the following:

- Never look into the end of an optical fibre or connector directly or by reflection either with the naked eye or through an optical instrument.
- Never leave equipment with radiating bare fibres accessible – always cap the connectors.
- Do not remove equipment covers when operating.

**Adjustment, maintenance and repair of the equipment should only be carried out by suitably qualified personnel.**

**For more information on the Rack Case and Accessories, please refer to the generic system handbook Sxx-HB.**

## Important Handling Instructions

### Connecting Fibre Optic Connectors

The fibre optic cable supplied with your DC Link is terminated with **ST** spring-loaded bayonet type connectors. These connectors are mated by aligning the notch on the connector barrel, pushing the connector home, and twisting one-quarter turn clockwise. This locks the connector in place.

The optical connectors should be cleaned in accordance with the instructions in Appendix I **before each and every** connection, even if they have been protected with dust caps.

The protective dust caps on the equipment and cable connectors should only be removed immediately before the connectors are mated.

Care should be taken not to drop the optical connector or to subject it to any other excessive physical shock.

### Disconnecting Fibre Optic Connectors

The connectors should be removed by pushing the connector gently towards the equipment and rotating the connector one-quarter turn anti-clockwise and withdrawing the connector.

**UNDER NO CIRCUMSTANCES SHOULD THE FIBRE BE PULLED TO REMOVE THE CONNECTOR.**

Immediately after removing the connectors, all protective Dust Covers and End Caps should be fitted.

### Care Of Fibre Optic Connectors

When the fibre optic cables are not connected, it is essential that the cable and equipment connectors are protected by the dust caps provided with the system. Failure to do so may result in damage to the fibre ends, which are critical to the system performance.

System performance may be compromised by dirt on the connector end or its alignment surfaces. Refer to Appendix I for instructions on cleaning the optical connectors.

Connector performance will be compromised if its end face is scratched or chipped.

### Bend Radius

All fibre optic cable is subject to a minimum bend radius beyond which physical damage may occur to the cable. The cable supplied with this system consists of a simplex glass optical fibre with 3mm tight jacket ruggedisation. The minimum bend radius (MBR) for this type of fibre is 30mm.

# **1 Introduction**

The *point2point* DC Links are a family of non-galvanic link systems designed for the transmission of analogue signals from true DC up to your specified bandwidth, in electrically noisy environments.

The system consists of a Transmit Module, which converts the input electrical signal to an optical signal, a fibre optic cable down which the signal is conveyed, and a Receive Module that recovers the original signal.

This handbook covers *point2point* DC signal modules with part numbers starting PD- and ending in -1H and -1R denoting operation over multi-mode fibre.

## **1.1 Transmitter Module**

The Transmitter Module contains the signal conditioning circuitry, optical transmitter, power supply filtering/regulation and basic control circuitry.

The optional Battery Pack (Shielded Remote housing option only) attaches to the side of the Transmitter Module and provides electrical power to the transmit electronics. Battery packs are quickly and easily changed. This enables the system to be operated continuously, with minimum delays whilst batteries are charged.

## **1.2 Receiver Module**

The Receiver Module receives the optical signal from the Transmitter Module, and converts it back into an analogue electrical signal.

The optional Battery Pack (Shielded Remote options only) attaches to the side of the Receive Module and provides electrical power to the receive electronics.

## **1.3 Fibre Optic Cable**

The fibre optic cables used in conjunction with the *point2point* DC Links are terminated with a single ST optical connector at each end.

### **Care of fibre optic connectors**

When the fibre optic cables are not connected, it is essential that the cable and equipment connectors are protected by the Dust Caps provided with the system. Failure to do so may result in damage to the fibre ends, which are critical to the system performance.

System performance may be compromised by dirt on the connector end or in the detector.

**Refer to Appendix I for instructions on cleaning the optical connectors.**

Connector performance will be compromised if its end face is scratched.

## **2 Setting up and using the DC Link**

This section describes the connections between your DC Fibre Optic Link Transmitter and Receiver Modules, and the operation of both units in a system.

Please read fully document Sxx-HB for information on installing your *point2point* equipment before attempting to make any measurements.

### **2.1 Module Operation**

#### **2.1.1 Shielded Remote Modules**

The module is switched on automatically by connection to a fully charged battery pack using the battery pack U-link. Removal of the link powers down the module.

#### **2.1.2 Rack Plug-In Modules**

The module is powered up when the rack unit is switched on at the On/Standby switch or, if a system controller is fitted, when the controller is switched on.

#### **2.1.3 Plug-In Converter Sleeve**

The module is powered up when the rack plug-in module is plugged into the sleeve, and the 12V converter sleeve power supply is plugged into the 2.1mm connector socket on the rear of the converter sleeve.

### **2.2 Using the Transmitter Module**

The user's signal is applied to the front panel signal input on the transmitter module. Where the transmitter modules are of plug-in housing type, the signal connections at the rear of the module can be used. These are available on the 96 way backplane connector - see Appendix II for details. Maximum ratings for this input are also given in the technical specifications in Appendix II.

If the maximum ratings are exceeded, the signal LED on the transmitter module front panel will illuminate RED. If this occurs, the input signal will be distorted on recovery at the receiver module.

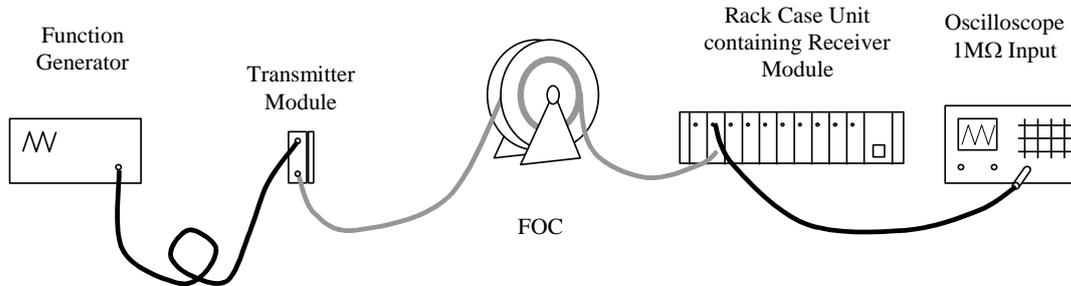
### **2.3 Using the Receiver Module**

The measured signal is retrieved from the front panel signal output connector. Where the receiver modules are of plug-in housing type, the signal connections at the rear of the module can be used. These are available on the 96 way backplane connector - see Appendix II for details. The output can be plugged directly into an oscilloscope but should be terminated with 1M $\Omega$ . Maximum loading conditions are also found in the technical specifications in Appendix II.

Output impedance, maximum current ratings and level specifications can be found in Technical Specifications Appendix II.

## 2.4 System Integration

The diagram below illustrates a typical system configuration comprising a Shielded Remote Transmitter Module and Rack Plug-In Receiver Module. The electrical source is a function generator and the recovered signal is displayed on an oscilloscope.



The sequence in which the equipment is initially set up to make a measurement is not critical, though it is recommended that the Fibre Optic Cable is attached to both Transmitter Module and Receiver Module before the Transmitter Module is powered up. This way, there is no optical hazard presented by laser light propagating through a free end of the fibre.

When the Transmitter and Receiver Modules are connected via the FOC and switched on, the Signal LED on the Receiver will change from RED to GREEN. This indicates that the Transmitter and Receiver Modules have established a "lock". At this point the signal presented at the Transmitter Module input is mirrored at the output of the Receiver Module. Lock will normally be established in a matter of milliseconds after valid data is received, but the process may take up to a second under some conditions.

In the situation where the Receiver Module is operating without the Transmitter Module being in place, for example while changing the Battery Pack on a Shielded Remote Transmitter Module, the Receiver Module output voltage will be  $0V \pm 100mV$ .

Once a lock has been re-established, the LED will illuminate GREEN and the Transmitter Module input signal will reappear at the Receiver Module Output.

## **2.5 Optical Budget**

While the DC coupled analogue fibre optic link is a system for transmitting analogue information, the transmission method used is digital. This means that, in practice, the links are extremely tolerant to fluctuations in insertion loss in the optical path while the signal to noise ratio and system gain remain unaffected. Of course, the amount of attenuation that can be introduced has a limit and this can be found in the technical specifications in Appendix II.

There are two limits imposed, a maximum path length over fibre, and a maximum attenuation. As a guide the following typical attenuations can be assumed for a multimode optical system at the wavelength of light used by this equipment.

Fibre Loss : 2.5 dB/km Typ  
ST Connection : 0.75dB

You might notice that the length of optical fibre required to achieve the maximum allowable insertion loss is less than the stated maximum fibre path length. This is because there are other deleterious mechanisms introduced by multimode optical fibres besides loss, which limit the performance. Exceeding either the maximum path length or insertion loss will result in a rapid degradation of signal integrity or loss of signal.

While small increases in optical insertion loss do not have an apparent effect on the link integrity, optical connector cleanliness is as important with these links as with any other. Please refer to Appendix I for instructions on how to correctly maintain your product.

## **3 Battery Packs**

The Battery Packs used on *point2point* Shielded Satellite Modules provide a nominal output voltage of 14.4V. A fully charged Battery Pack may have an open circuit voltage of more than 17V.

### **3.1 Battery Pack Operation**

The Modules have been designed for minimal current consumption, specified in Appendix II. For more details of the battery operation please refer to the battery handbook

All Shielded Satellite Modules have an automatic shutdown feature to protect damage to the Battery Packs. When a fully charged Battery Pack is attached to a Module, the Module powers up. This is indicated by the Power Status LED illuminating green.

As the batteries reach the end of their discharge cycle, the Power Status LED will illuminate red to warn the user that the Module will power down shortly. The Module will continue to function in this mode without performance impairment for several minutes allowing measurements to be completed

When a Battery Pack becomes fully discharged, the module to which it is attached will shut down. At this point, it is necessary to replace the Battery Pack with one that is fully charged.

Instructions on how to change a Battery Pack are detailed in the *point2point* generic system handbook Sxx-HB.

**Optical Transmit Modules in shut-down mode should not be left in this mode for extended periods with the Battery Pack attached, as this may over-discharge the Battery Pack, causing permanent damage.**

More information on the Battery Pack including Battery Pack Care and Charging can be found in the *point2point* generic system handbook, Battery Handbook and charger hand books.

## 4 Maintenance and Fault-Finding Guide

Refer to the following table that gives a list of commonly encountered problems and suggested solutions.

Fault	Possible Causes	Solution
<b>Power Problems</b>		
Power Status LED does not light on Plug-In Module while inserted into the rack.	Power is not attached to the rack unit. Mains switch is turned off. Fuse has blown in rack unit. Rack Mount Module is not correctly plugged into Rack Unit.	Connect mains power to the rack unit, and switch on power. Switch on mains switch. Replace fuse (2A anti-surge). Power down Rack Unit, Push Module fully home, Re-apply power to Rack Unit.
Power Status LED does not light on Shielded Remote Module when Battery Pack is attached.	Battery Pack is discharged. Battery Pack U-link is not fitted at rear of module.	Recharge/replace Battery Pack. Attach Battery Pack U-link.
Power Status LED on Shielded Remote Module illuminates red.	Battery Pack power is low. External Power Supply voltage is low.	Recharge/replace Battery Pack. See Specification for allowable range of supply voltages.
<b>Signal Problems</b>		
Receive Module Signal Status LED is illuminated red.	Contamination on the fibre optic connectors. Too much loss in optical path. Broken optical fibre.	Clean the fibre optic connector. Refer to Appendix I. See section on "Optical Budget". Contact PPM for replacement fibre.
Transmit Module Signal Status LED is illuminated red.	Over voltage on Transmit Module input.	Reduce input voltage.
Both Signal Status LEDs are illuminated green but signal is distorted.	Contamination on the fibre optic connectors. Too much loss in optical path.	Clean the fibre optic connector. Refer to Appendix I. See section on "Optical Budget".

The *point2point* range of DC link Transmitter and Receiver Modules are calibrated for optimum performance and accuracy before dispatch. In order to guarantee the continued performance and reliability of the link, it is strongly recommended that your fibre optic link be returned to PPM for calibration annually.

In the event of any problems or queries about the equipment, contact PPM or your local agent.

## **5 Product Warranty**

The Company guarantees its products, and will maintain them for a period of three years from the date of shipment and at no cost to the customer. Extended warranty options are available at the time of purchase.

Please note that the customer is responsible for shipping costs to return the unit to PPM.

The Company or its agents will maintain its products in full working order and make all necessary adjustments and parts replacements during the Company's normal working hours provided that the Customer will pay at the rates currently charged by the Company for any replacements made necessary by accident, misuse, neglect, wilful act or default or any cause other than normal use.

Claims must be made promptly, and during the guarantee period.

### **IMPORTANT:-**

**Please contact both your selling agent and PPM prior to returning any goods for Warranty or Non-Warranty repairs. Goods will not be accepted without a valid Goods Return Number (GRN).**

## Appendix I: Fibre Optic Connector Cleaning

This *point2point* fibre optic cable is fitted with bayonet type 'ST' optical connectors. It is important to keep these clean to ensure accurate measurements.

The optical connectors should be cleaned **before each and every use**, even where they have been protected with dust caps.

### Cleaning items required

- Lint free fibre cleaning tissues (normal cosmetic tissues produce dust and are not acceptable);
- Reagent grade Iso Propyl Alcohol;
- Air duster or FILTERED compressed air line.

### Cable Connector Cleaning

- Dampen a patch of cleaning tissue with IPA and clean all surfaces of the plug ferrule.
- Using a dry cleaning tissue, dry the ferrule and polish the end face.
- Using the air duster, blow away any residue from the end of the connector.

### Module Female Receptacle Cleaning (only recommended if problems are being experienced)

- Twist a cleaning tissue to form a stiff probe, and moisten with IPA. Gently push the probe into the receptacle and twist around several times to dislodge any dirt.
- Repeat the above process with a dry tissue.
- Using the air duster, blow away any residue from the receptacle.

### Important Notes

- IPA is flammable. Follow appropriate precautions / local guidelines when handling and storing.
- IPA can be harmful if spilt on skin. Use appropriate protection when handling.
- It should only be necessary to clean the female receptacles on the modules if problems are being experienced.
- **Never inspect an optical fibre or connector with the naked eye or an instrument unless you are convinced that there is no optical radiation being emitted by the fibre. Remove all power sources to all modules, and completely disconnect the optical fibres.**

## Appendix II : Specifications

### System Electrical Performance (at 25°C unless otherwise noted)

Passband	DC to 2MHz
Flatness	DC-1MHz : $\pm 1$ dB DC-2MHz : $\pm 3$ dB
Risetime	<200ns
Instantaneous Dynamic Range	>52dB (V.sig.p-p / V.noise.rms in 10MHz)
Phase Flatness	< $\pm 10^\circ$
End to End Delay	750ns
Output Noise (Full Band)	<5mV <sub>rms</sub> for $\pm 1$ V f.s.d. <50mV <sub>rms</sub> for $\pm 10$ V f.s.d.
Transmitter Input Impedance	1M $\Omega$ 50pF typ (2MHz Plug-in Module only) 1M $\Omega$ 25pF typ
Receiver Output Impedance	50 $\Omega$ @ $\pm 1$ V standard 300 $\Omega$ @ $\pm 10$ V optional
Maximum Receiver Load	25mA
Transmitter Input Voltage Range	$\pm 1$ V standard $\pm 10$ V, $\pm 20$ V, $\pm 50$ V & $\pm 100$ V options
Receiver Output Voltage Range	$\pm 1$ V into 50 $\Omega$ load standard $\pm 10$ V into 1M $\Omega$ // 125pF load optional
Output DC Temperature Drift (20mins warmup)	Better than 1mV/ $^\circ$ C for $\pm 1$ V f.s.d. Better than 10mV/ $^\circ$ C for $\pm 10$ V f.s.d
Output DC Offset (20mins warmup)	Better than 1% of f.s.d.
Gain Accuracy at 100Hz (excluding DC Offset error)	Better than $\pm 1\%$ with $\pm 1$ V f.s.d. receiver terminated in 50 $\Omega$ load (or $\pm 10$ V f.s.d. receiver terminated in 1M $\Omega$ load)
Operating Temperature	-10 $^\circ$ C to +40 $^\circ$ C
Optical Path Length	1m to greater than 500m
Maximum Optical Insertion Loss	3dB
Front Panel Indication Transmitter Module Receiver Module	Power supply status & Input Over-range warning Power supply status & Link Lock status
Electrical Signal Connector Shielded Module, front panel Plug-In Module, front panel Plug-In Module, rear backplane	TNC 50 $\Omega$ BNC 50 $\Omega$ Signal input / output                      pin B12 (2MHz Plug-In Module only) Signal 0V return                              pin B11 (2MHz Plug-In Module only)
Optical Signal Connector	ST Multimode
Supply Voltage    Shielded Module Plug-In Module	13 - 15Vdc 12 - 15Vdc
Backplane Supply Connections (Plug-In Module)	+V Supply                                      :    pins A31, A32, B31, B32, C31, C32 Supply 0V return                            :    pins A29, A30, B29, B30, C29, C30 Signal input / output                        :    pin B12 (2MHz Plug-In Module only) Signal 0V return                              :    pin B11 (2MHz Plug-In Module only)
Current Consumption	<500mA @14.4V                              <600mA @12.0V
Housing Options	Shielded Module Plug-In Module Standalone Module (using 75002)
Plug-In Case Suitability	SRK-3P, SRK-3RP

**point2point** DC COUPLED FIBRE OPTIC LINK HANDBOOK (PDX-1-HB) ISSUE 5  
CR3359

© PPM LTD 2015

NO PART OF THIS DOCUMENT MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT PRIOR WRITTEN PERMISSION.

PPM LTD., 65 SHRIVENHAM HUNDRED BUSINESS PARK, SWINDON, SN6 8TY, UK.

TEL: +44 1793 784389 FAX: +44 1793 784391

EMAIL : INFO@PPM.CO.UK WEBSITE : HTTP://WWW.PPM.CO.UK

---