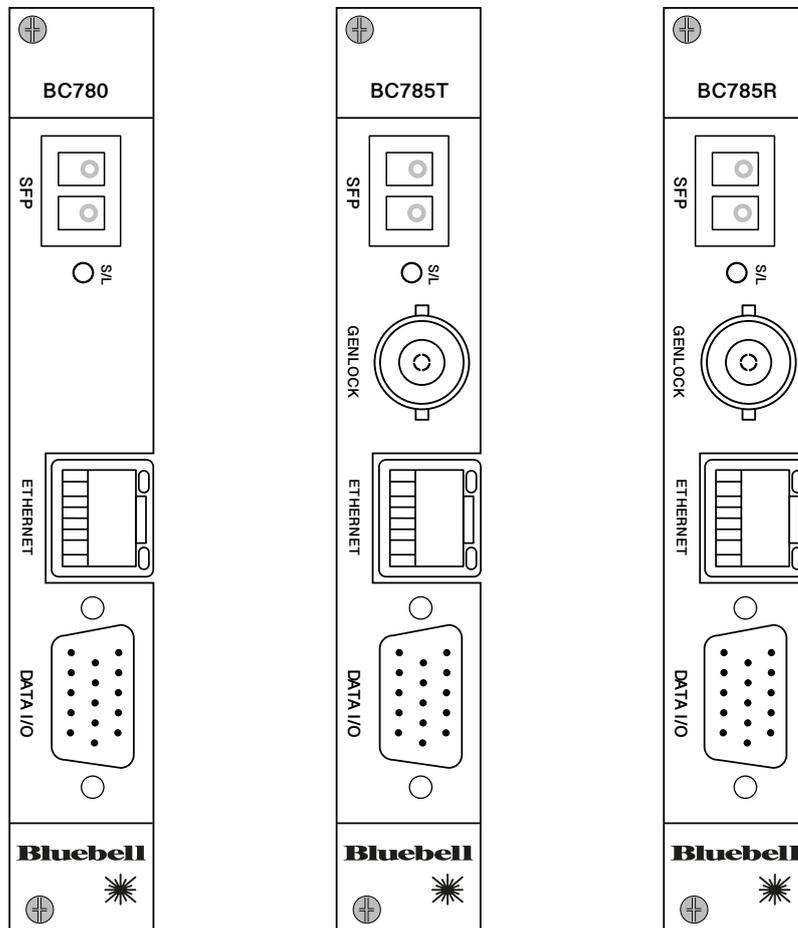


BC780, BC785T and BC785R Control data interfaces



Operations Guide

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Declaration of Conformities

Bluebell Opticom Ltd. hereby declares that the BC780, BC785T and BC785R Fibre Optic Transmission Equipment is in compliance with the essential requirements and other relevant provisions of the following EU directives: 89/336/EEC and has been assessed to EN55022B (European limits and methods of measurement of radio disturbance characteristics); EN61000-4-2, EN61000-4-4 (Level 2), EN61000-4-4FTB, EN61000-4-5 and EN61000-4-11 (EMC); EN61000-6-1, EN61000-6-2, EC61000-6-3 and EC61000-6-4 (Immunity to electrical emissions).

Class 1 Laser Safety compliant: additional conformities are dependent on SFP cartridges fitted.

RoSH and WEEE declaration

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Customer participation is important to minimize the potential effects on the environment and human health that can result from hazardous substances that may be contained in this product.

Please dispose of this product and its packaging in accordance with local and national disposal regulations, including those governing the recovery and recycling of waste electrical and electronic equipment. Contact your local waste administration, waste collection company or dealer.

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Overview

Thank you for purchasing this Bluebell Opticom professional broadcast video product. If you are new to Bluebell products, or to the subject of transmitting video and/or other types of signal over fibre links, please take the time to read through this document before putting the card to use.

Introduction

The BC780, BC785T and BC785R plug-in cards belong to the range of the Bluebell Opticom BC Series modular fibre interfaces, designed primarily for Outside Broadcast (OB) and studio applications. The cards have been designed for the transport of control commands or similar data over a fibre-optic link: a typical use would be to control and synchronise video cameras installed at remote locations, as may be the case at large-scale sporting events, music festivals and similar OB situations.

All three card types cater for control data in the following formats:

- 10/100base-T Ethernet
- RS-232
- RS-422
- RS-485

Cards will normally be used in pairs, one being installed at the control centre end (base station) and the other at the remote end (camera station). The cards are bidirectional, so that control response data such as command confirmations or status reports may be received by the controlling equipment at the base station.

A general purpose input (GPI) and general purpose output (GPO) are also provided, to allow a contact closure-generated command to be transmitted in both directions.

Card types BC785T and BC785R have the additional capability of handling a video genlock signal as well as the control data formats listed above. The BC785T has a BNC genlock input and the BC785R a BNC genlock output: again these two card types are intended to be used in pairs, with the BC785T at the base station end and the BC785R adjacent to the camera.

All card types are equipped with a dual SFP carrier: this will generally be fitted with a fibre-optic transceiver cartridge of the user's choice, pre-installed by Bluebell Opticom according to the user's requirements (specified at time of order). An alternative option is for the carrier to be supplied empty, so that it can be retrofitted with a cartridge by the user.

Singlemode operation will normally be at 1310 nm or 1550 nm; alternative CWDM grid wavelengths are also possible. The optical option is generally specified at the time of order. The optical receiver will be wideband.

Physical format

BC780, BC785T and BC785R cards fit the Bluebell BC100i and BC160i 19" modular frames. These frames can house fifteen (BC100i) or six (BC160i) interface cards, and are fitted with dual internal AC power supplies. The cards are also compatible with earlier Bluebell 19" modular frame types BC100 and BC160.

Alternatively, cards may be fitted into smaller aluminium chassis: the BC101 and BC102 hold one and two cards respectively and require an external DC power source, while the BC120 holds three cards and has an integral mains PSU.

Power requirements

Power supply requirements are dictated by the enclosure type used.

BC100i modular frame:

This is normally fitted with two identical AC mains PSU modules. Each module has sufficient capacity to power a fully-loaded frame. The AC connection is via standard IEC cables, DC power distribution inside the frame is via the motherboard. See the Operation Guide supplied with the frame for more details.

BC160i modular frame:

This is fitted as standard with dual internal AC mains power supplies, each of sufficient capacity to power a fully-loaded frame. The AC connection is via standard IEC cables, DC power distribution inside the frame is via the motherboard. See the Operation Guide supplied with the frame for more details.

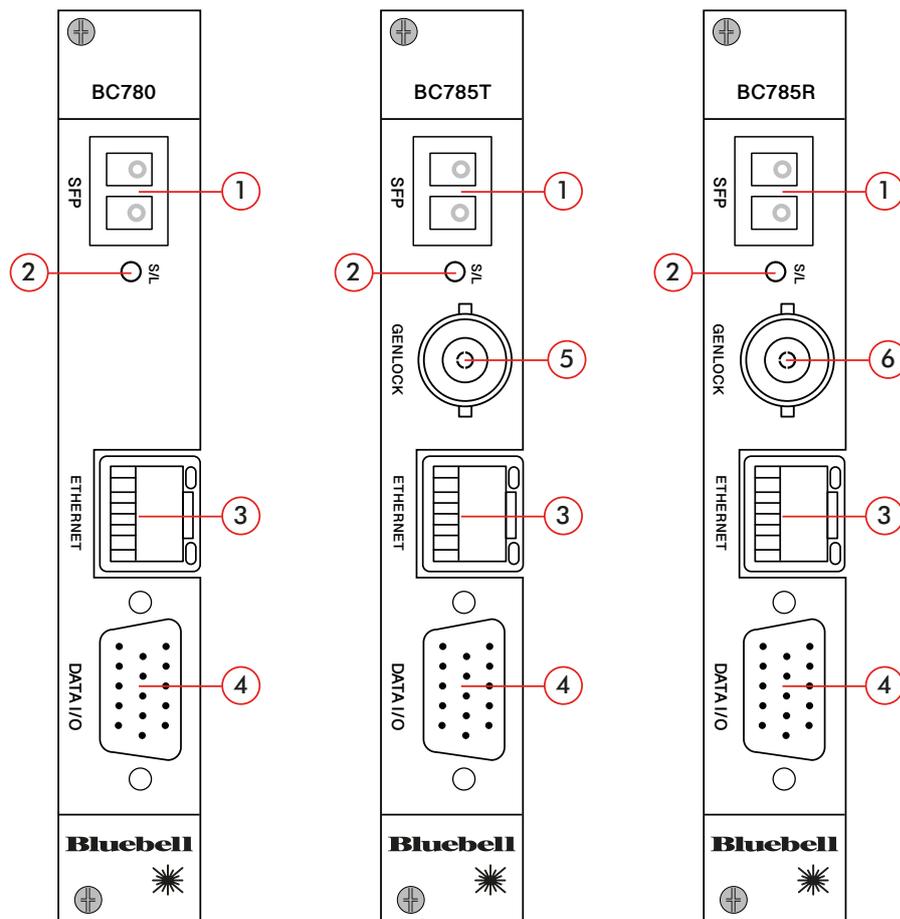
BC101 and BC102 single- and dual-slot chassis:

These are supplied with an external Universal AC adaptor which connects to the chassis via a flying lead terminated in a 4-pin locking XLR connector. Mains connection is via an IEC connector.

BC120 triple-slot chassis:

This housing for three plug-in modules is fitted with an internal AC mains supply; mains connection is via a rear IEC connector.

BC780, BC785T and BC785R connections and indicators



1. **SFP** – SFP carrier for optical input and output. User’s choice of transceiver cartridge may be fitted. The lower optical connector is “receive”, that is, an input to the module, while the upper connector is “transmit”, an output from the module.
2. **S/L** – bi-colour LED shows received data status. The LED illuminates green to indicate that valid data is detected at the SFP Rx port, and red when no valid signal is detected. “Data” in this context includes both Ethernet data and serial control commands/responses.
3. **ETHERNET** – Standard RJ45 Ethernet network port for transmission/reception of control data in Ethernet format. Auto-switches between 10base-T and 100base-T data rates.
4. **DATA I/O** – 15-pin female Dsub connector for serial control data to RS-232, RS-422 or RS-485 standards. Also provides GPIO connectivity. The pinout of this connector is as follows:

Pin	Use
1	RS-232 input (Tx)
2	RS-232 input GND
3	RS-422/485 input (Tx) '-'
4	RS-422/485 input (Tx) '+'
5	GND
6	RS-232 output (Rx) GND
7	RS-232 output (Rx)
8	RS-422/485 input GND
9	RS-422/485 output (Tx) '-'
10	RS-422/485 output (Tx) '+'
11	GPI GND
12	GPI
13	GPO GND
14	GPO
15	RS-422/485 output GND

BC785T only

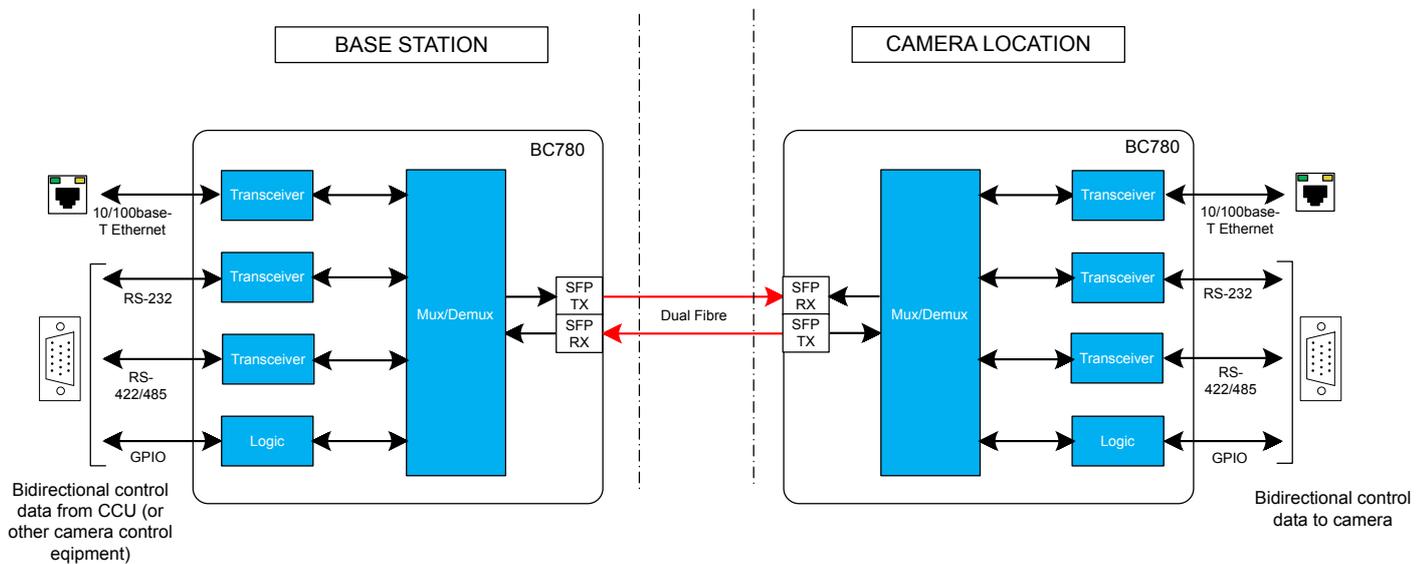
5. **GENLOCK** – BNC connector (75 ohms) for connection of standard house sync signals such as analogue composite video, black-and-burst or tri-level sync.

BC785R only

6. **GENLOCK** – BNC connector (75 ohms) for retrieval of a sync signal transported over a fibre link from the BC785T.

Signal routing

All card versions:

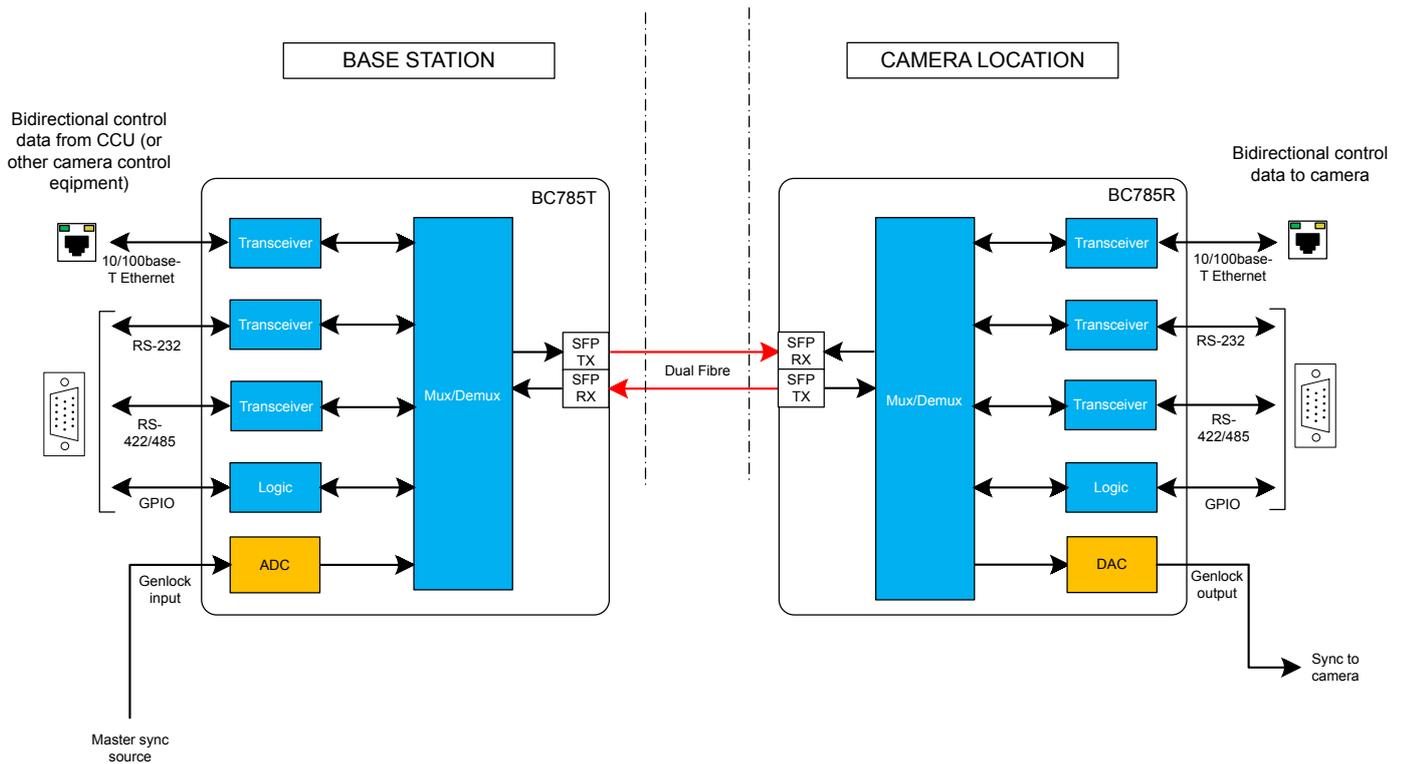


For bidirectional operation, the SFP carrier must be fitted with a transceiver cartridge and dual fibres used. If no return data is required from the remote location, a single fibre may be employed, with a single channel optical transmitter cartridge in the base station BC780 and a single channel optical receiver cartridge in the remote BC780.

The control data format in use – Ethernet, RS-232, RS-422 or RS-485 – will be determined by the camera and associated control equipment: the BC780 is capable of transporting both Ethernet and serial data in multiple formats, together with GPIO signals if needed, over the fibre link simultaneously. (However note that it is not possible to transmit/receive RS-422 and RS-485 data at the same time as these formats use the same pins on the Dsub connector.)

Control data applied to the BC780 in all formats is buffered and multiplexed onto the optical carrier. With a pair of BC780 cards, a second, symmetrical signal path is available in the opposite direction, as the diagram above shows.

BC785T and BC785R:



The signal processing for these cards is identical to that of the BC780, with the addition of the ability to add an analogue video genlock signal to the multiplexed control data being sent via the fibre link. The BC785T has a genlock input and the BC785R a corresponding genlock output. Clearly, the signal path for the genlock signal is only unidirectional: base station to camera.

Control data I/O

Ethernet

The cards are fitted with a standard RJ45 **ETHERNET** port; the pinout is standard. It is compatible with network data rates of 10base-T or 100base-T, automatically detecting the rate in use and auto-switching to suit. The RJ45 socket has two integral green and yellow LEDs indicating (green) - a valid data link has been detected, and (yellow) - port activity; this will blink in normal operation to indicate network activity.

RS-232

All card versions can handle bidirectional serial data compliant with RS-232 standards at data rates of up to 250 kbaud. Four pins of the 15-way Dsub connector are used:

Signal	Pin
Input - data transmit (Tx)	1
Tx common	2
Output – data receive (Rx)	6
Rx common	7

Note that as other pins of the Dsub connector are used for alternative data formats, ready-made, fully-populated cables may not operate correctly.

Most RS-232-controlled equipment will generate response messages on receiving commands, but in many cases, the controlling equipment and the camera will operate satisfactorily if the 'return path' (Tx at the remote location and Rx at the base station) is ignored. Check the OEM's own User Guides for details.

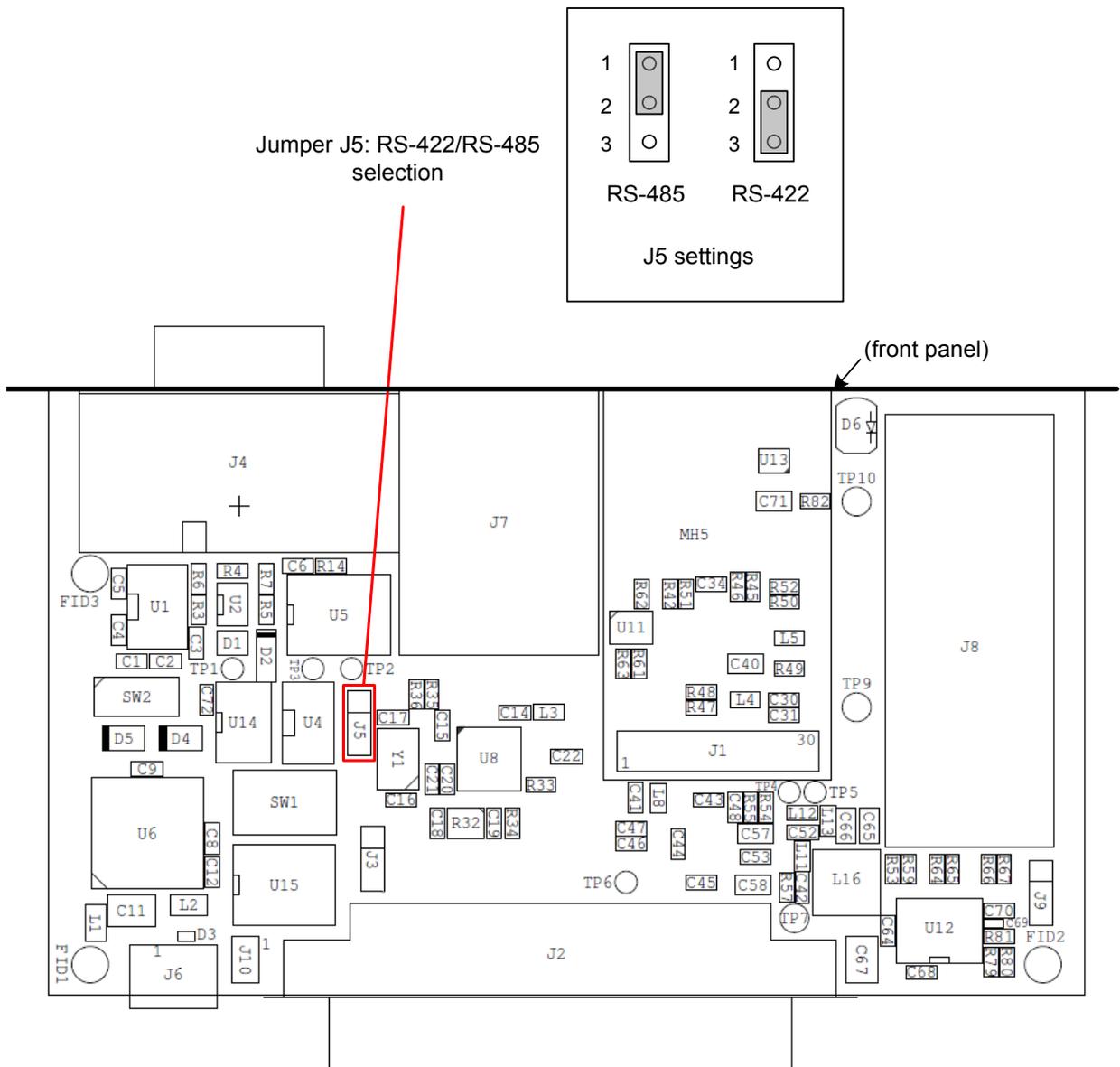
RS-422 and RS-485

RS-422 and RS-485 serial data formats differ from RS-232 in that the transmit and receive signals are electrically balanced. RS-485 operates at a higher voltage and provides improved noise immunity.

All card versions can handle bidirectional serial data compliant with RS-422 or RS-485 standards at data rates of up to 250 kbaud. Six pins of the 15-way Dsub connector are used:

Signal	Pin
Input - data transmit 'hot' (Tx+)	4
Input - data transmit 'cold' (Tx-)	3
Tx common	8
Output - data receive 'hot' (Rx+)	10
Output - data receive 'cold' (Rx-)	9
Rx common	15

The card will be supplied pre-configured for either RS-422 or RS-485 operation, the format having been specified at the time of order. If this serial format option needs to be changed at any time, the PCB jumper J5 can be moved from its factory-set position to the alternative setting. The setting should always be the same on both cards forming the fibre link.



Note that as other pins of the Dsub connector are used for alternative data formats, ready-made, fully-populated cables may not operate correctly.

Most RS-422/485-controlled equipment will generate response messages on receiving commands, but in many cases, the controlling equipment and the camera will operate satisfactorily if the 'return path' (Tx at the remote location and Rx at the base station) is ignored. Check the OEM's own User Guides for details.

GPIO

All card versions include one General Purpose Input (GPI) and one General Purpose Output (GPO). These may be used for signalisation, or any other purpose such as transporting additional clock or other data. The logic is non-inverting, so a 'high' input at the GPI will produce a 'high' output at the GPO of the card at the other end of the fibre link. Four pins of the 15-way Dsub are used:

Signal	Pin
GP input (GPI)	12
GPI common	11
GP output (GPO)	14
GPO Common	13

The GPI is an isolated input and will accept DC levels or signals or up to 3.3 V amplitude. Data rates of up to 300 MBps are supported.

The GPO uses an open-drain configuration with a maximum current sink capability of 32 mA.

Other setup options

The only user-selectable option on the PCB is jumper J5, used to select either RS-422 or RS-485 operation via the serial port. This will be factory-set to the position specified at the time of order.

The switches SW1 and SW2 are for factory set-up use only and should not be adjusted.

External monitoring

When installed in a BC100i, BC100, BC160i or BC160 frame, all cards in the Bluebell modular range can report their status to the frame's monitoring system. The BC100i and BC160i frames provide visual indication of correct card operation (or otherwise) on the Home page of the frames' LCD touchscreens: extended card data is available on other pages. Earlier BC100 and BC160 frames provide card status information using two LEDs per card slot.

On all the above frame types, remote monitoring is also available if the optional network interface card is fitted. Contact Bluebell for the relevant .mib file.

Frame monitoring

BC100i/160i Home page or BC100/160 Frame LEDs

		BC780/785T/785R
LED Ch A	Green	Valid optical signal detected at SFP
	Red	No valid optical signal detected at SFP
LED Ch B	Green	Data locked
	Red	Data not locked (invalid signal)

BC100i Card Info page

When operating correctly, the BC100i Card info page for a BC785T card will appear as below (items specific to individual cards excepted). The Card Info pages for BC780 and BC785R are very similar.


Slot 2

Card Information

Card Type	BC785T	S/N eeprom detected	yes
Card Function summary	RS232,422/485,10/100,Gen<->fibre	Card Serial number	10468.001
Card Hardware Revision	1	Card Firmware Revision	1.0
Card ch A signal status	good	Card ch B signal status	good

Card Specific Parameters

RS232 Input	-	RS232 Output	-
RS422/485 Input	Present	RS422/485 Output	Present
GPI	Present	GPO	Present
Eth Speed&Duplex	100BASE-TX full-duplex		

SFP 1

Home

BC160i Card Info page

When operating correctly, the BC160i Card info page for a BC785T card will display a subset of the data shown below (items specific to individual cards excepted). Use the Up and Down scroll buttons to show data not currently displayed. The Card Info pages for BC780 and BC785R are very similar.

Card Information in Slot 2:		Up	SFP1
Card type	BC785T	Down	
S/N eeprom detected	yes		
Card function summary	RS232,422/485,10/100,Gen<> fibre	Home	
Card serial number	10468.001		
Card hardware revision	1		
Card firmware revision	1.0		
Card ch A signal status	good		
Card ch B signal status	good		
Card Specific Parameters			
RS232 input	-		
RS232 output	-		
RS422/485 input	Present		
RS422/485 output	Present		
GPI	Present		
GPO	Present		
Eth Speed&Duplex	100BASE-TX full-duplex		

Monitoring via webpages

“Overview” webpage:

		BC780/785T/785R
LED Ch A	Green	Valid optical signal detected at SFP
	Red	No valid optical signal detected at SFP
LED Ch B	Green	Data locked
	Red	Data not locked (invalid signal)

“Frame Information” webpage:

Signal status		BC780/785T/785R
Ch A	“good”	Valid optical signal detected at SFP
	“fail”	No valid optical signal detected at SFP
	“unknown”	Card not recognised
Ch B	“good”	Data locked
	“fail”	Data not locked (invalid signal)
	“unknown”	Card not recognised

Remote monitoring via SNMP

Signal status		BC780/785T/785R
cardsigChA	“good”	Valid optical signal detected at SFP
	“fail”	No valid optical signal detected at SFP
	“unknown”	Card not recognised
cardsigChB	“good”	Data locked
	“fail”	Data not locked (invalid signal)
	“unknown”	Card not recognised

Appendix

Specifications – BC780, BC785T and BC785R

BC780, BC785T, BC785R		
Electrical Inputs and Outputs		
RS-232	Rx & Tx (unbalanced), max. 250 kbaud	15-pin Dsub connector (shared)
RS-422/RS-485	Rx & Tx (balanced), full duplex, max. 10 Mbaud	
GPIO	1 x input, 1 x output	
Ethernet	10/100base-T	RJ45
Genlock input (BC785T only)	Analogue composite video, black & burst, tri-level sync	BNC (75 ohms)
Genlock output (BC785R only)		
Optical Inputs and Outputs		
Most specs determined by SFP fitted. Typical values given below.		
Connector	2 x female LC	
Wavelength	1270 – 1610 nm	
Optical power output	-15 dBm @1310 nm multimode -6 dBm @ 1310 nm singlemode	
Optical receiver sensitivity	>-25.5 dBm @ 1.485 Gb/s >-26.0 dBm @ 270 Mb/s	
Monitoring		
Front panel	S/L: bi-colour LED indicating a valid and locked signal at optical receiver	
External via BC100/BC160 frame	Bi-colour LED indicating lock status of optical input	
External via BC100i/BC160i frame	On-screen lock status indication of optical input	
External via BC100/BC100i/BC160/BC160i frame with network card fitted	Bi-colour virtual LED per channel indicating lock status of optical input	
SNMP monitoring (via BC100/BC100i/BC160/BC160i frame with network card fitted)	Lock status of each optical input	
Conformities		
EMI/RFI	Complies with 89/336/EEC, EN55032B, EN61000-4-2	
Electrical	Complies with EN61000-4-4FTB, EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-6-4	
Laser Safety	Complies with Class 1 laser product	
RoHS & WEEE	Complies with Directive 2002/95/EC	
General		
Input Voltage	4 – 17 V	
Power consumption	5 W	
Depth	75 mm (60 mm excluding connectors)	
Width	20 mm (4HP)	
Height	129 mm (3RU)	
Weight	100 g	
Operating Temperature	-30 to +70 °C	

SFP Options

BC780, BC785T and BC785R cards require a fibre-optic transceiver cartridge to be fitted in the SFP carrier. Bluebell Opticom provides suitable SFPs upon order. Customers choosing their own SFPs do so at their own risk.