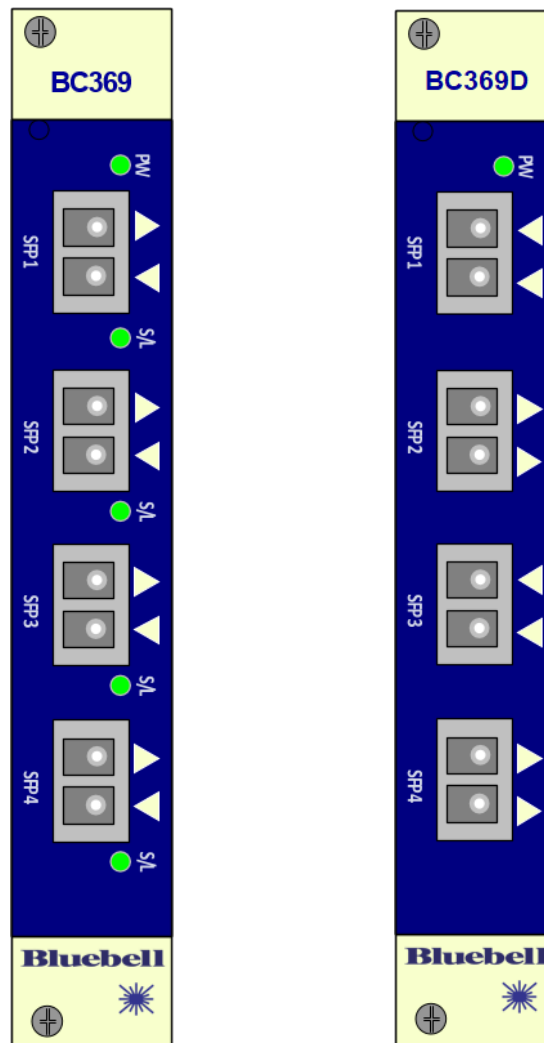# BC369 and BC369D
Multi-format interfaces

Operations & Technical Guide

Bluebell Opticom Ltd.
Unit 2, The Quadrant
Howarth Road
Maidenhead
Berkshire
SL6 1AP
United Kingdom

Tel: +44 (0) 1628 510055
Fax: +44 (0) 1628 510057
Email: support@bluebell.tv
Web: www.bluebell.tv

Please note that all documentation herein is of a confidential nature and may not be reproduced without written confirmation from Bluebell Opticom Ltd. The technical descriptions and schematics are to aid service and repair only. Dissemination to a third party or parties will constitute breach of copyright.

Information in this document is subject to change without notice and does not represent a commitment on the part of Bluebell Opticom Ltd.

Bluebell Opticom Limited has taken all possible steps to ensure that the information given here is both correct and complete. In no event can Bluebell Opticom Limited accept any liability or responsibility for any loss or damage to the owner of the equipment, any third party, or any equipment which may result from use of this manual or the equipment which it describes.

Declaration of Conformities

Bluebell Opticom Ltd. hereby declares that the BC369 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.

RoHS and WEEE declaration

Bluebell Opticom Limited manages its business and collaborates with its suppliers to comply with the European Union restriction of the use of certain hazardous substances in electrical and electronic equipment, RoHS Directive (2002/95/EC), that came into force on 1st July 2006, and similar restrictions in other jurisdictions.

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.

Table of Contents

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 module to use.

Introduction

The BC369 and BC369D plug-in modules belong to the Bluebell Opticom BC Series of modular fibre interfaces, designed primarily for Outside Broadcast (OB) and studio applications. The modules are equipped with four empty SFP carriers: the BC369 is configured for four transceiver cartridges each with an input (Rx) and an output (Tx), while the BC369D is configured for two dual-channel receiver cartridges (dual Rx) and two dual-channel transmitter cartridges (dual Tx). These will generally be fibre-optic cartridges of the user's choice, though compatible cartridges with coaxial or other types of connector may be installed if wished. Single-channel cartridges may be installed in either module type if only one signal path is required.

Fitting suitable SFP cartridges to the two carriers allows the modules to perform a variety of optical/optical (or optical/copper) operations often needed in OB and other broadcast situations. These include bidirectional format conversion, signal monitoring and wavelength management (conversion between optical wavelengths), and thus the BC369 and BC369D can be regarded as useful engineer's "toolkit" items as well as forming part of a fixed installation.

The BC369 and BC369D are intended for use with SDI video signals (12G, 6G, 3G, HD or SD) or DVB-ASI video signals. MADI, audio and Ethernet signals at bitrates between 150 Mbps to 11.88 Gbps are also supported.

Physical format

BC369 and BC369D modules fit the Bluebell BC100i or BC160i 19" modular frames. The frames can house fifteen (BC100i) or six (BC160i) interface modules, and are fitted with dual internal AC power supplies.

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

BC369 and BC369D modules are fitted with four SFP carriers. These will typically be fitted (by users) with dual fibre optic cartridges, but cartridges with copper connectivity may be fitted alternatively: options include composite video, SDI, HDMI and DVI.

For fibre optic implementation, 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.

Power requirements

Power supply requirements are dictated by the enclosure type used.

BC100i modular frames:
These may be fitted with either one or two AC mains PSU modules (number specified at time of order). 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 frames for more details.

BC160i modular frames:
These are 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 frames 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 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.
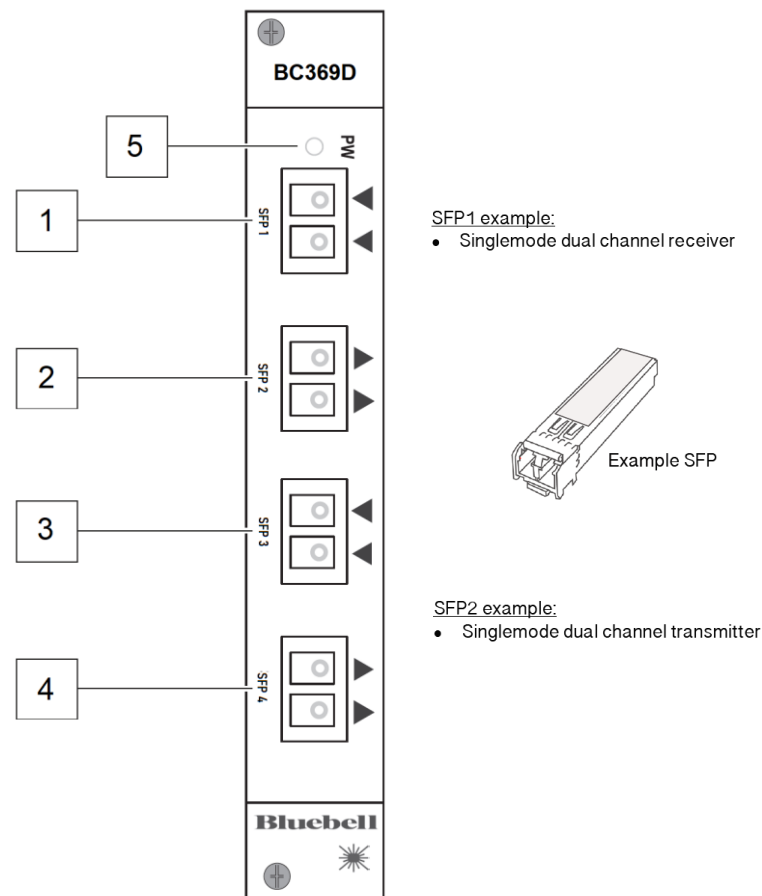
BC369:

Example SFP

Choice of SFP types will determine module's functionality.
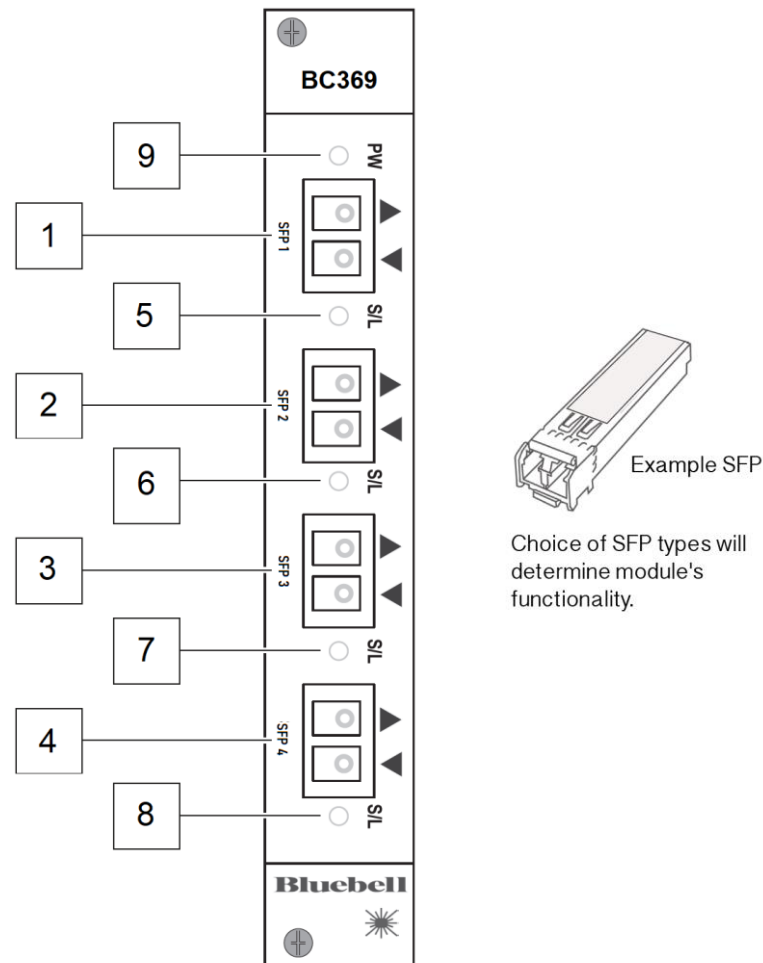
1. **SFP1** — SFP carrier for signal-pair 1. User's choice of transceiver cartridge may be fitted. The arrowheads adjacent to the carrier indicate the transmit and receive connectors - the lower optical connector is "receive", that is, an input to the module, while the upper connector is "transmit", an output from the module.
2. **SFP2** — SFP carrier for signal-pair 2. Details as [1].
3. **SFP3** — SFP carrier for signal-pair 3. Details as [1].
4. **SFP4** — SFP carrier for signal-pair 4. Details as [1].
5. **S/L** (SFP 1) — bi-colour LED for received input signal status at SFP 1. The LED illuminates green to indicate that a valid input signal is detected at the SFP1 Rx port, and red when no valid signal is detected.
6. **S/L** (SFP 2) — bi-colour LED for received input signal status at SFP 2. Details as [5].
7. **S/L** (SFP 3) — bi-colour LED for received input signal status at SFP 3. Details as [5].
8. **S/L** (SFP 4) — bi-colour LED for received input signal status at SFP 4. Details as [5].
9. **PW** — green LED; illuminates when DC power is applied to the module.

BC369D:

SFP1 example:
- Singlemode dual channel receiver

Example SFP

SFP2 example:
- Singlemode dual channel transmitter

1. **SFP1** — SFP carrier for two input signals. User's choice of single or dual receiver cartridge may be fitted. The arrowheads adjacent to the carrier indicate the direction of signal flow.
2. **SFP2** — SFP carrier for two output signals. User's choice of single or dual transmitter cartridge may be fitted. The arrowheads adjacent to the carrier indicate the direction of signal flow.
3. **SFP3** — SFP carrier for signal-pair 3. Details as [1].
4. **SFP4** — SFP carrier for signal-pair 4. Details as [2].
5. **PW** — green LED; illuminates when DC power is applied to the module.

Signal routing

BC369 only:
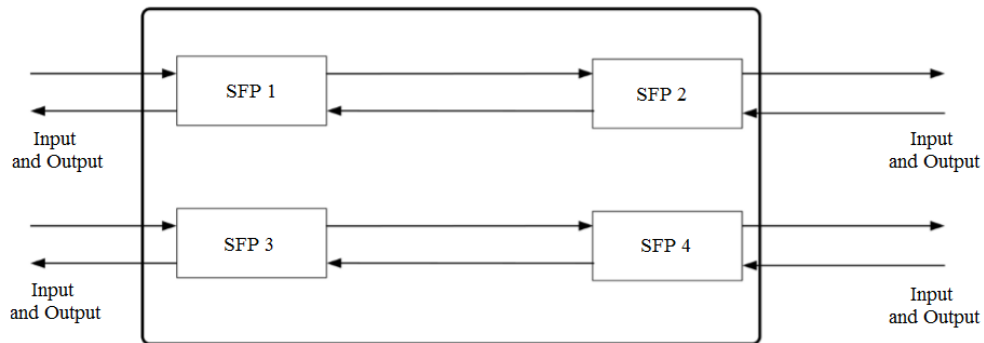
All four SFP 1, SFP 2, SFP3 and SFP4 must be fitted with transceiver cartridges. The signal at SFP1's input (the lower optical connector of the pair) will always be available at SFP2's output (the upper optical connector of the pair). A second, symmetrical signal path is available in the opposite direction. The same is with SFP3 and SFP4, as the diagram below shows:
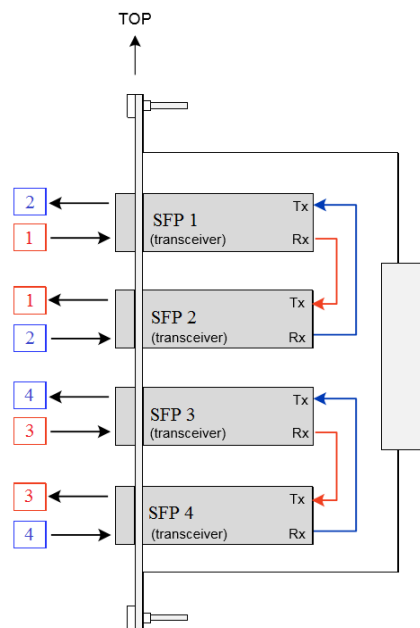
The receivers in fibre-optic SFP transceiver cartridges are wideband; the BC369 may therefore be used to retransmit a signal at a different optical wavelength from the one it is received at. This principle may, of course, be extended to two separate signals by using both signal paths.

If one transceiver is fitted with "copper" connectivity (e.g., SDI, HDMI, etc.), one optical signal applied to the module may be converted into electrical format while another in the corresponding electrical format is remodulated as an optical output.

Inputs from SFP 1 and SFP 3 report ChA and ChB status on the BC100i/BC160i front panel LEDs or the monitoring webpage.

BC369D

SFP 1 and SFP 3 must be fitted with a receiver cartridge, SFP 2 and SFP 4 must be fitted with a transmitter cartridge. The BC369D is configured for four separate, identical signal paths between the four SFPs; dual channel cartridges will need to be fitted in all four carriers to take advantage of this. However, single channel cartridges may be fitted if only a single signal path is needed. The signal paths are shown in the diagram below:
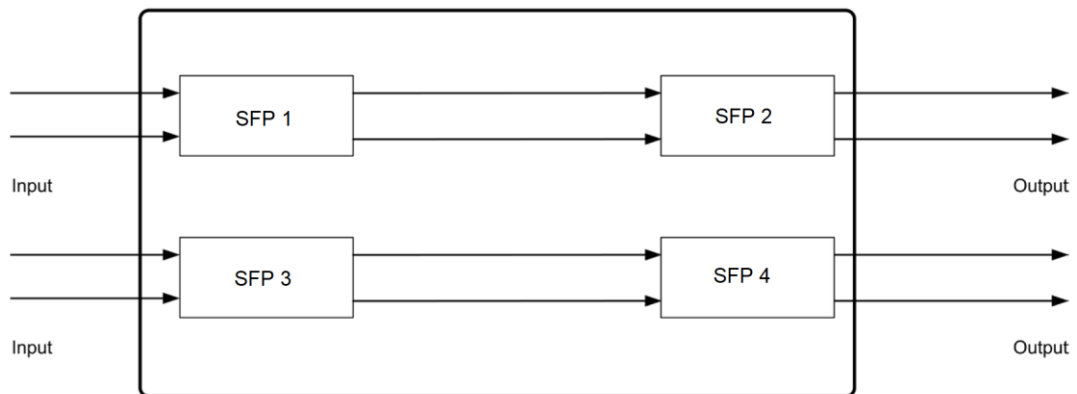

The receivers in fibre-optic SFP cartridges are wideband; the BC369D may therefore be used to retransmit a signal at a different optical wavelength from the one it is received at. This principle may, of course, be extended to two separate signals by using both signal paths.
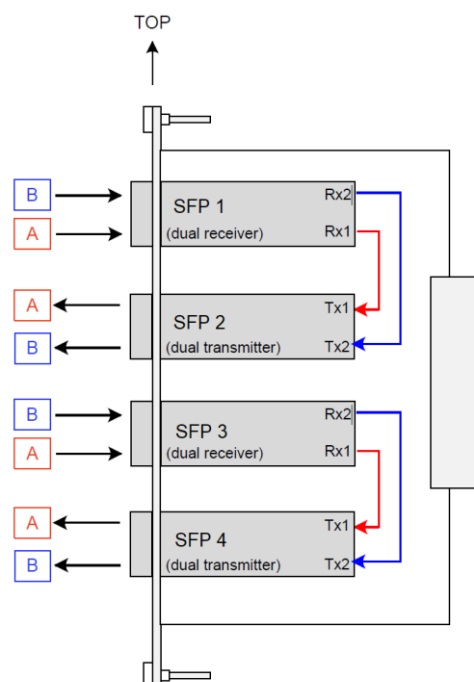
If one SFP is fitted with "copper" connectivity (e.g., SDI, HDMI, etc.), optical signals may be converted to or from electrical format.

SDI format compatibility

BC369 and BC369D interfaces are intended for use with serial digital video (SDI) signals at data rates up to 11.88 Gb/s. Standards supported are:

SD-SDI – SMPTE 259M-compliant at 270 Mb/s
HD-SDI – SMPTE 292M-compliant at 1.483 and 1.485 Gb/s
3G-SDI – SMPTE 424M-compliant at 2.967 and 2.970 Gb/s
6G-SDI – SMPTE ST-2081 compliant at 6 Gb/s
12G-SDI – SMPTE ST-2082 compliant at 12 Gb/s
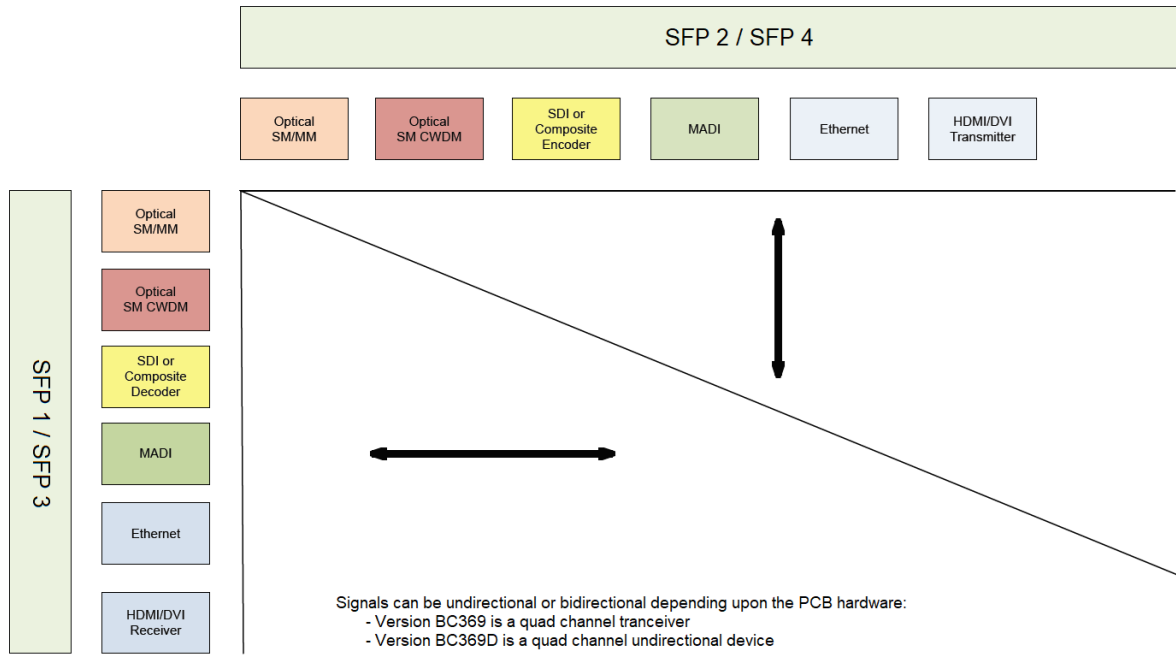
ASI baseband streams at 270 Mb/s are also compatible.
Signals at these standards will be passed through the cards to the other SFP. On the BC369, the relevant status LED(s) will illuminate green on receipt of a valid signal.
The BC369 and BC369D will also pass signals at other bit rates, such as MADI at 125 Mb/s and other digital video formats at 143 Mb/s, 177 Mb/s, 360 Mb/s, and 540 Mb/s. They will also pass digital audio signals and Ethernet data up to 10 gigabit.

BC369 and BC369D SFP combinations

The BC369 and BC369D are format converters whose functionality and application will always be determined by the type of cartridges fitted into the two SFP carriers. While the modules will generally be used with fibre optic cartridges, several other types exist and are compatible with the module.

The table on the following page illustrates some possible combinations of input and output formats. On the BC369, the cartridges in all four carriers (SFP 1, SFP 2, SFP 3 and SFP 4) must be bidirectional transceivers; on the BC369D, two cartridges (SFP 1, SFP 3) must be a single- or dual-channel receiver and the other two (SFP 2, SFP 3) a single- or dual-channel transmitter.

SFP 2 / SFP 4

Optical SM/MM | Optical SM CWDM | SDI or Composite Encoder | MADI | Ethernet | HDMI/DVI Transmitter

SFP 1 / SFP 3

Optical SM/MM

Optical SM CWDM

SDI or Composite Decoder

MADI

Ethernet

HDMI/DVI Receiver

Signals can be undirectional or bidirectional depending upon the PCB hardware:
- Version BC369 is a quad channel tranceiver
- Version BC369D is a quad channel undirectional device

In all cases, output signals are simply "passed-through" versions of an input signal. The modules do not convert any signal types but just re-generate them for output, and are transparent to any embedded audio or other data that the SFPs can carry.

On either type of module, the electrical input to an SFP transmitting port must be capable of handling the format of the electrical signal output from an SFP receiving port: i.e., both SFPs must be capable of handling the internal signal.

Please see also the Operations Guide section "SFP Options" on page 15.

Other setup options

BC369 and BC369D modules have five movable, internal PCB jumpers: J5, J6, J7, J8 and J9, whose positions modify the interface's operation. There are no other user adjustments. The links are all set on 3-pin headers: a jumper is positioned either on pins 1-2 or 2-3 of the header.

J5, J6, J7 and J8 should be set according to whether either or both of the SFPs fitted are MSA or non-MSA type (the default setting). J9 is for factory use only. In its default setting, the module's control EEPROM is write-protected. The table below summarises the jumper settings.

Jumper	Setting	Operation
J6 (SFP 1)	Pins 1, 2 linked	When SFP 1 is data type (MSA)
	Pins 2, 3 linked	When SFP 1 is video type (non-MSA) – Default
	Link removed	SFP 1 monitoring disabled
J7 (SFP 2)	Pins 1, 2 linked	When SFP 2 is data type (MSA)
	Pins 2, 3 linked	When SFP 2 is video type (non-MSA) – Default
	Link removed	SFP 2 monitoring disabled
J8 (SFP 3)	Pins 1, 2 linked	When SFP 3 is data type (MSA)
	Pins 2, 3 linked	When SFP 3 is video type (non-MSA) – Default
	Link removed	SFP 3 monitoring disabled
J5 (SFP 4)	Pins 1, 2 linked	When SFP 4 is data type (MSA)
	Pins 2, 3 linked	When SFP 4 is video type (non-MSA) – Default
	Link removed	SFP 4 monitoring disabled
J9	Pins 1, 2 linked	(or no link) – EEPROM protected – Default
	Pins 2, 3 linked	For factory use only
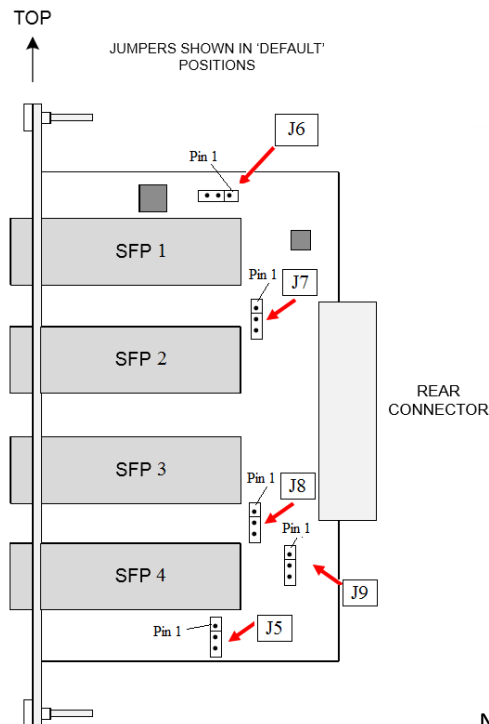
BC369 - PCB layout
SIMPLIFIED VIEW - ONLY PRIMARY COMPONENTS SHOWN

Note: Pin 1 is shown here as a square end on the connector. The cards have additional annotations for these links.

External monitoring

All modules in the Bluebell modular range can report their status to the frame in which they are housed. The frame's LEDs (two per module) will confirm correct operation (or otherwise), and if the optional SNMP/Ethernet interface module is fitted, remote monitoring is also available. Contact Bluebell for the relevant .mib file.

BC100i/BC160i Frame Panel LEDs:

		BC369	BC369D
LED A	Green	Signal detected by SFP 1 at Rx (lower) port	Module present
	Red	No signal detected by SFP 1 at Rx (lower) port	(Never - not used)
LED B	Green	Signal detected by SFP 3 at Rx (lower) port	(Never - not used)
	Red	No signal detected by SFP 3 at Rx (lower) port	(Never - not used)

Monitoring via webpages:

"Overview" webpage:

		BC369	BC369D
LED A	Green	Signal detected by SFP 1 at Rx (lower) port	Module present
	Red	No signal detected by SFP 1 at Rx (lower) port	(Never - not used)
LED B	Green	Signal detected by SFP 3 at Rx (lower) port	(Never - not used)
	Red	No signal detected by SFP 3 at Rx (lower) port	(Never - not used)

"Frame Information" webpage:

		BC369	BC369D
LED A	"good"	Signal detected by SFP 1 at Rx (lower) port	Module present
	"fail"	No signal detected by SFP 1 at Rx (lower) port	(Never - not used)
	"unknown"	Module not detected in this slot	Module not detected in this slot
LED B	"good"	Signal detected by SFP 1 at Rx (lower) port	(Never - not used)
	"fail"	No signal detected by SFP 1 at Rx (lower) port	(Never - not used)
	"unknown"	Module not detected in this slot	Module not detected in this slot

Remote monitoring via SNMP:

		BC369	BC369D
cardsigChA	"good"	Signal detected by SFP 1 at Rx (lower) port	Module present
	"fail"	No signal detected by SFP 1 at Rx (lower) port	(Never - not used)
	"unknown"	Module not detected in this slot	Module not detected in this slot
cardsigChB	"good"	Signal detected by SFP 1 at Rx (lower) port	(Never - not used)
	"fail"	No signal detected by SFP 1 at Rx (lower) port	(Never - not used)
	"unknown"	Module not detected in this slot	Module not detected in this slot

Appendix

Specifications – BC369 and BC369D

Output & Input	
Physical	SFP Module
Connector	SFP Module dependent*
Signal detections (Note: BC369 only)	Bicolour LED (green = valid signal, red = no valid signal)
Data rate	Up to 11.88 GHz (12G)
Conformities	
EMI/RFI	Complies with 89/336/EEC and EN55022B
EMC	Complies with EN61000-4-2, EN61000-4-4 (Level 2), EN61000-4-4FTB, EN61000-4-5 and EN61000-4-11
Electrical Immunity	Complies with EN 61000-6-1, EN61000-6-2, EN 61000-6-3 and EN 61000-6-4
Laser Safety	Class 1 Laser Safety compliant; for additional conformities see datasheets for SFP cartridges fitted.
RoHS	Complies with Directive 2002/95/EC
Conformities	
Depth	73 mm (exc. SFP cartridges)
Width	20 mm (4HP)
Height	129 mm (3RU)
Weight	100 g
Operating Temp	-30°C to +70°C
Power	2.5 W

* Unit functionality is defined by the SFP modules fitted. See diagram at "BC369 and BC369D SFP combinations" on page 10 for currently available combinations.

SFP Options

The functionality of the BC369 and BC369D is partly dependent on which type SFP cartridge is fitted to each of the four carriers (SFP 1, SFP 2, SFP 3 and SFP 4). Your module will be supplied with the cartridges that were specified at the time of ordering already factory-fitted; if no cartridges were specified, the carriers will be empty for users to fit cartridges of their choice. The applications to which the modules may be put can be changed at any time by fitting a different cartridge in either or all the SFP carriers.

In general, if the guidance below is followed, the BC369 and BC369D will operate within their design criteria. Please contact the Bluebell Sales Department with any specific requirements.

SFP cartridge selection

SFPs fitted to these modules must have the following characteristics:
- SFPs can be either MSA or non-MSA pinout as long as the card's jumper links are set accordingly (see 'Configuration' section)
- Data rates up to 11.88Gbps (12G) can be handled by the card
- The electrical input to an SFP transmitting port must be capable of handling the format of the electrical signal output from an SFP receiving port.

Additionally, the SFPs fitted must conform to the following module-specific requirements:

BC369:
>All SFPs should be transceivers.

(Note that a single-channel receiver and a single-channel transmitter may also work as a single-channel converter).

BC369D:
>SFP1 & SFP3 should be a dual-channel receiver and SFP2 & SFP4 should be a dual-channel transmitter.

(Note that a single-channel receiver and a single-channel transmitter may also work as a single-channel converter).

A list of suitable SFPs with the required characteristics can be found at:
http://bluebellcomms.co.uk/sfps/

Customers choosing their own SFPs do so at their own risk.