Bluebell

BC372 Series
12G Quad Channel Electrical to Optical Interfaces

Operation Guide

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Optical transmitter elements are Class 1 Laser Safety compliant with 24 CFR 1040.10 and 1040.11.

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 (2011/65/EU), and similar restrictions in other jurisdictions.

The "crossed out wheelie bin" symbol on the product and represented above is there to remind users of the obligation of selective collection of waste. This label is applied to various products to indicate that the product is not to be thrown away as unsorted municipal waste. At the end of life, dispose of this product by returning it to the point of sale or to your local municipal collection point for recycling of electric and electronic devices.

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.

Safety Warning – Important Precautions

To reduce the risk of fire or electric shock, do not expose this equipment to rain, moisture, or wet conditions.

General Safety Guidelines

- Always **disconnect the entire system from the AC mains** before cleaning or servicing.
- The following product frames – **BC100, BC100i, BC101, BC102, BC120, BC160i** – must be connected using a **three-conductor AC mains power cord with an earth ground**. All three conductors must be used at all times to prevent electric shock.
- Do **not** bypass or disable any fuse.
- Only replace fuses with those of the **specified type and rating**.
- Do **not** use flammable or combustible chemicals for cleaning.
- Do **not** pour or spill liquids directly onto the unit.
- Do **not** allow any liquid to enter the unit or wet the internal components.
- Do **not** operate the unit with any cover or panel removed.
- Do **not** obstruct the ventilation slots—**adequate airflow must be maintained**.
- Do **not** operate the unit in environments with **extreme temperatures**.
- Do **not** use or store the unit in **explosive atmospheres**.
- Do **not** attempt to repair the unit yourself. If servicing is required, please contact your local **Bluebell Opticom** distributor.

Product Warranty

Bluebell Opticom Ltd provides warranty coverage as detailed in our general terms and conditions.

Please note that warranty support is only valid **if product serial numbers remain intact and legible**. Tampering with or removing serial numbers may void your warranty.

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 signals over fibre links, please take the time to read this document before putting the module to use.

Introduction

The BC372, BC372T and BC372R plug in cards are part of the Bluebell Opticom BC Series range of modular fibre interfaces, designed for use across a wide range of broadcast, live production, AV and professional media applications, including Outside Broadcast, studios, venues and fixed installations.

The cards have been designed for the transport of 4K SDI video over a fibre-optic link: typically, they will be used to connect video cameras installed at remote locations, as may be the case at large-scale sporting events, music festivals and similar OB situations. They are compatible with SD, HD, 3G, 6G and 12G SDI video standards: alternatively, they can be used for the transport of MADI data.

The BC372 range comprises three variants:

- BC372T transmitter – four independent channels, quad SDI inputs to quad fibre outputs
- BC372R receiver – four independent channels, quad fibre inputs to quad SDI outputs
- BC372 – four independent channels, direction configurable via on-board switches

The three variants are of similar construction, and in outward appearance differ only in the silk-screened labelling on the faceplate.

Cards will normally be used in pairs, typically with a BC372T installed at the remote end (camera station) and a BC372R at the control centre end (base station). If bidirectional operation is needed, a BC372 may be installed at both locations.

On all variants, the "copper" connections for SDI video use 12G-compliant 75-ohm BNC sockets, while the fibre optic connectivity is quad LC optical connector in two standard SFP carriers.

Single-mode fibre operation will normally be at 1310 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 formats

All BC372 Series 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.

BC100/BC100i modular frames:
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.

BC160/BC160i modular frames:
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-slot 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.

Inputs and outputs

SDI Video:

BC372 interfaces can be used with serial digital video signals having data rates up to 12 Gb/s. Standards supported are:

SD-SDI : SMPTE ST 259 compliant
HD-SDI : SMPTE ST 292 compliant
3G-SDI : SMPTE ST 424 compliant
6G-SDI : SMPTE ST 2081 compliant
12G-SDI : SMPTE ST 2082 compliant

ASI baseband streams are also compatible.

Video inputs and outputs are on 75-ohm BNC sockets. All variants have four connectors:

- BC372T: each BNC channel is an input, and the corresponding optical channel is an output.
- BC372R: each BNC channel is an output, and the corresponding optical channel is an input.
- BC372: each BNC has the capability of being an input/output, configured via switches.

MADI:

BC372 interfaces can also be used to transmit and/or receive MADI data streams. The MADI signal is passed transparently, and operation is independent of channel count, frame format, or sample rate. The line data rate is fixed at 125 Mb/s, regardless of the MADI content.

Note: When carrying MADI signals, the BC372 electrical outputs operate at SDI-compliant levels (approximately 800 mV p-p), which exceed the nominal MADI electrical specification of 300–600 mV p-p. In practice, most receiving equipment will tolerate this; however, compatibility with SDI-level signals should be confirmed.

Optical (BC372T, BC372R, BC372):

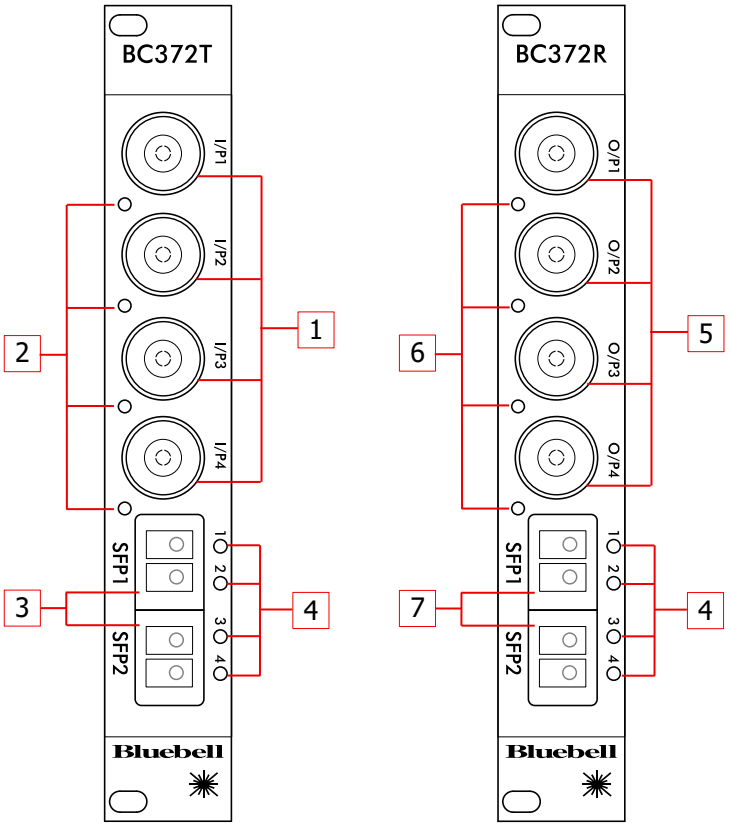
The BC372 interfaces are fitted as standard with a dual SFP cage, each accommodating an SFP module with dual LC optical connectors. The SFP type fitted is variant-dependent, and each SDI stream uses one of the four available optical fibre ports.

Optical operating characteristics, including fibre type (single-mode or multimode), wavelength, optical power, and supported reach, are determined by the installed SFP module. Refer to the SFP's datasheet for optical specifications. Both single-mode and multimode SFPs are supported.

For standard single-mode operation, SFPs with a nominal transmission wavelength of 1310 nm are typically supplied. SFPs using CWDM wavelengths or alternative optical specifications may also be provided, where specified at the time of order.

On receiver variants (BC372R and BC372), the optical receiver bandwidth and supported wavelength range are dependent on the installed SFP. Where wideband receiver SFPs are fitted, operation is generally supported across the wavelength range 1270-1610 nm, subject to the SFP specification.

BC372 Series Connections and Indicators

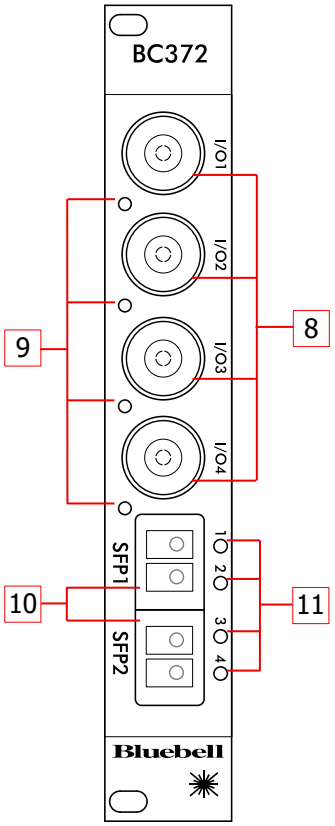


BC372T – Four Independent Transmission Channels

1. **TX I/P** – 75-ohm BNC sockets for connection to an SDI video (or MADI) source.
2. **S/L** – a bi-colour LED for each channel indicating the SDI signal lock status. The LED illuminates green to confirm that valid data is detected at the channel's SDI input, and red if no valid signal is detected.
3. **OPT O/P** – SFP carrier factory-fitted with dual LC optical connector. This port is a dual transmitter, one LC connector per channel. The standard operating wavelength is 1310 nm; alternative wavelengths may have been specified at time of order.
4. **OPT POWER STAT** – red/yellow/green LED indicating the optical power status. The optical power status is reported by the SFP's digital diagnostic monitoring (DDM).

BC372R – Four Independent Receive Channels

5. **RX O/P** – 75-ohm BNC sockets carrying the SDI video (or MADI) signal recovered from the optical input.
6. **S/L** – a bi-colour LED for each channel indicating the SDI signal lock status. The LED illuminates green to confirm that valid data is available at the channel's RX O/P socket, and red if not.
7. **OPT I/P** - SFP carrier factory-fitted with dual LC optical connector. This port is a dual receiver, one LC connector per channel. The optical receiver is wideband, and the wavelength is dependant on the SFP.



BC372 – Switch Configurable I/O

8. **I/O** – 75-ohm BNC socket: this will be either an input or output, depending on how the card is configured via the on-board switches
9. **S/L** – a bi-colour LED indicating SDI status. The LED illuminates green to confirm a valid SDI signal, and red otherwise; its point of signal detection will be either the SDI input or output, depending on the card's configuration.
10. **OPT I/P** – These two ports can be populated with either dual transmitter, dual receiver or transceiver SFP, where the input or output is dependent on the card's configuration.
11. **OPT I/O POWER STAT** – red/yellow/green LED indicating the optical power status. The optical power status is reported by the SFP's digital diagnostic monitoring (DDM).

SFP Optical Power LEDs

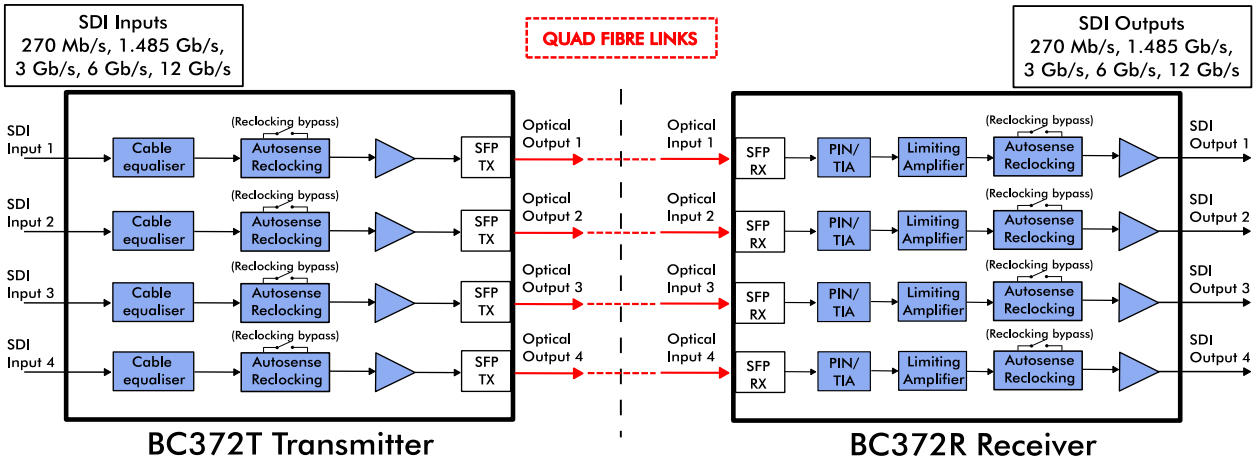
Most SFP modules support Digital Diagnostic Monitoring (DDM), which reports several parameters including transmit (Tx) and receive (Rx) optical power. Each SFP cage includes a LED per channel that provides a visual indication of the optical power status as shown below.

LED State	Indication
OFF	No SFP Detected
Solid green	Optical power transmitted or received is within the normal operating range
Solid red	Optical power transmitted or received is too low (low alarm)
Solid yellow	Optical power transmitted or received is low (low warning)
Green + red flash	Optical power transmitted or received is too high (high alarm)
Green + yellow flashes	Optical power transmitted or received is high (high warning)

Note: These indications are based solely on diagnostic data reported by the SFP module. Thresholds and alarm behaviour are defined by the SFP manufacturer; please refer to the relevant SFP datasheet for detailed warning and alarm definitions.

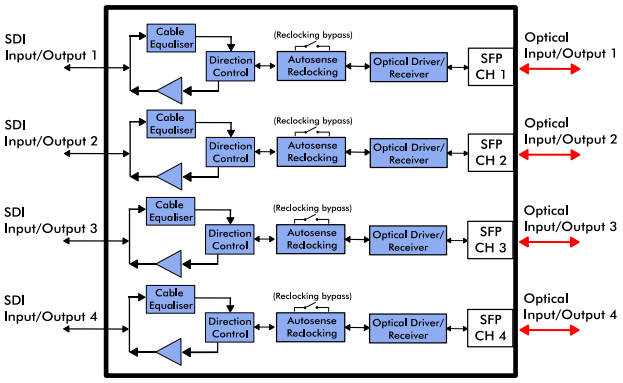
Signal Routing

BC372T/BC372R

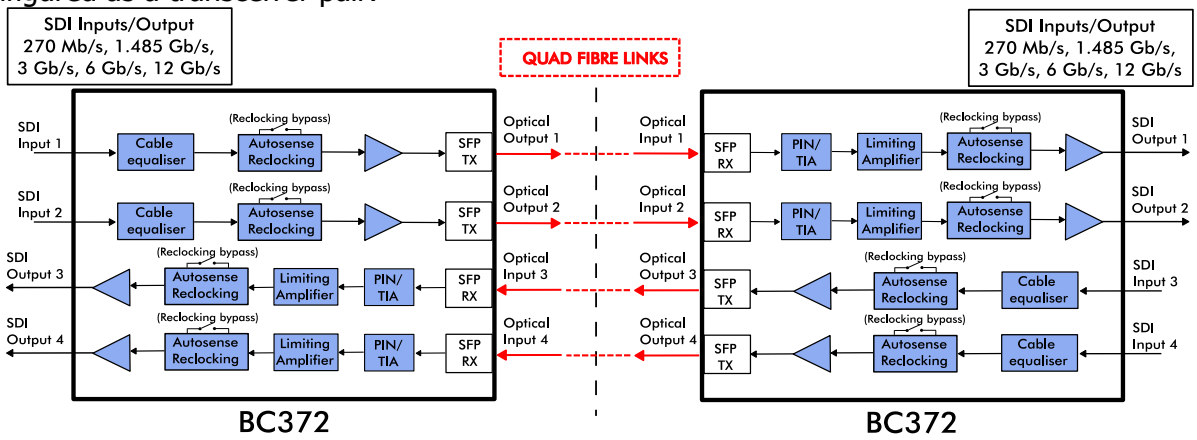


In this application, a BC372T will typically be installed at a remote camera location and a BC372R at the base location. Four independent SDI signals applied at Channel 1, 2, 3 and 4 inputs of the BC372T will be transported over separate optical links, and can be recovered at the Channel 1, 2, 3 and 4 outputs of the BC372R. The video signal in each channel may be of any of the supported SDI standards.

BC372



Configured as a transceiver pair:

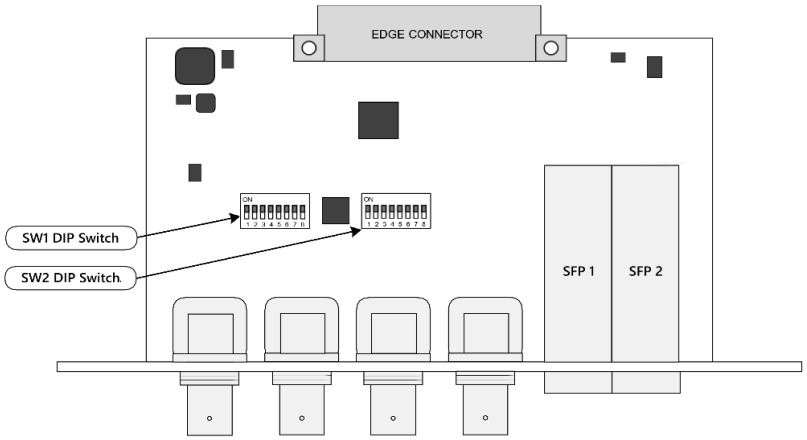


For bidirectional operation, two BC372 cards may be used. In this application, the left is configured as Tx/Tx/Rx/Rx while the right is configured as Rx/Rx/Tx/Tx.

In use, the BC372 variant can have each channel independently configured as a Tx or Rx. Ensure the correct dual-Tx, dual-Rx or transceiver video SFPs are fitted for each use. See Setup Options for further information.

Setup Options

The PCBs for all card variants have 2x 8-pole DIP switches, indicated in the diagram below.



NOT TO SCALE – FOR LOCATION PURPOSES ONLY.

DIP switch – summary

Switch		Function	OFF*	ON	Remarks
DIP-SW1	1	Ch1 signal direction	Tx	Rx	BC372 Variant only
	2	Ch2 signal direction	Tx	Rx	
	3	Ch3 signal direction	Tx	Rx	
	4	Ch4 signal direction	Tx	Rx	
	5	Ch1 Reclocker Bypass	Auto	Force Bypass	**Auto:** Locked signals are reclocked, otherwise signal is bypassed. **Force Bypass:** Bypasses all signals. Note: - Force bypass will have the Tx Laser always enabled, regardless of SW2-3 position. - Lock status detection is disabled when channel is forced In bypass mode.
	6	Ch2 Reclocker Bypass	Auto	Force Bypass	
	7	Ch3 Reclocker Bypass	Auto	Force Bypass	
	8	Ch4 Reclocker Bypass	Auto	Force Bypass	
DIP-SW2	1	Frame ChA and ChB Fail LED status (bit 0)	0	1	**00:** ChA = ch1/ch2, ChB = ch3/ch4 **01:** ChA = ch1&ch2, ChB = ch3&ch4 **10:** ChA = ch1, ChB = ch2 **11:** ChA = ch1, ChB = ch3
	2	Frame ChA and ChB fail status LED (bit 1)	0	1	
	3	SFP Laser auto-override	Auto	Always Enabled	**Auto:** Tx Laser only turns on when a locked signal is detected. **Always enabled:** Tx Laser is always enabled. Note: - Only valid on Tx channels, ignored on Rx channels.
	4	MADI Detect	Enable	Disable	Enable: Allow MADI lock detection Disable: Do not show MADI lock detection. Note: - Used if false-locks are detected
	5	SD-SDI Detect	Enable	Disable	Enable: Allow SD-SDI lock detection Disable: Do not show SD-SDI lock detection. Note: - Used if false-locks are detected
	6	Not assigned	-	-	Keep in off position
	7	Not assigned	-	-	Keep in off position
	8	Not assigned	-	-	Keep in off position

***OFF** is the default switch position for all card variants

DIP Switch SW1

Signal direction – SW1 -1, -2, -3, -4

Each channel's signal direction is defined by the corresponding DIP switch:

- SW1-1: Channel 1
- SW1-2: Channel 2
- SW1-3: Channel 3
- SW1-4: Channel 4

Switch operation:

- OFF → Forces the channel into optical Tx (Transmit) mode
- ON → Forces the channel into optical Rx (Receive) mode

Each channel operates independently and may be configured as required.

Note: These switches are functional only on the BC372 card variant. They have no effect on other card variants.

Reclocker bypass – SW1 -5, -6, -7, -8

All BC372 card variants support automatic SDI signal reclocking on each of the four channels.

- Auto-reclocking is enabled by default.
- Signals are reclocked unless a non-standard data rate is detected, in which case reclocking is automatically bypassed.

Manual reclocking bypass (per channel):

- SW1-5: Channel 1
- SW1-6: Channel 2
- SW1-7: Channel 3
- SW1-8: Channel 4

Setting the switch to ON forces the channel into reclock bypass mode.

Notes:

- Lock-status detection is disabled when a channel is forced into bypass mode.
- When reclock bypass is enabled, the Tx laser remains permanently enabled, regardless of the position of SW2-3.

DIP Switch SW2

Frame ChA & ChB Fail Status Indicator – SW2 -1, -2

The BC100i/BC160i enclosures are limited to displaying two bi-colour LEDs (ChA and ChB) per card on its overview page and via SNMP traps, these report the failure status as chA and chB.

Since the BC372 is a four-channel card, switches SW2-1 and SW2-2 define how channel fail statuses are mapped to ChA and ChB.

The switches operate as a 2-bit value, where:

- OFF = 0
- ON = 1

Fail-status mapping

- 00: chA = ch1/ch2, chB = ch3/ch4
- 01: chA = ch1&ch2, chB = ch3&ch4
- 10: chA = ch1, chB = ch2
- 11: chA = ch1, chB = ch3

SFP Laser Auto-Override – SW2-3

This switch controls laser-enable behaviour for Tx-type SFP modules.

- Auto (OFF)
  - The Tx laser is enabled only when a valid signal lock is detected, preventing transmission of invalid or unstable data.
  - If reclock bypass is enabled for a channel (SW1-5 to SW1-8), lock detection is overridden and the laser will remain enabled.
- Always Enabled (ON)
  - The Tx laser is enabled continuously, regardless of signal lock status.

Note: If an Rx-type SFP is fitted to a channel, the laser auto-override setting has no effect.

MADI/SD-SDI Detect – SW2 -4, -5

If false locking of MADI or SD-SDI is observed, typically caused by noise on the optical input, this behaviour can be suppressed using the following switches:

- SW2-4: Disable MADI lock detection.
- SW2-5: Disable SD-SDI lock detection.

When enabled, the relevant signal will continue to be passed through the device, but it will no longer be reported as a valid lock.

Switch settings:

- OFF (Disabled) – Normal operation; MADI/SD-SDI lock detection enabled.
- ON (Enabled) – Lock detection disabled; signal is passed but not reported as locked.

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.

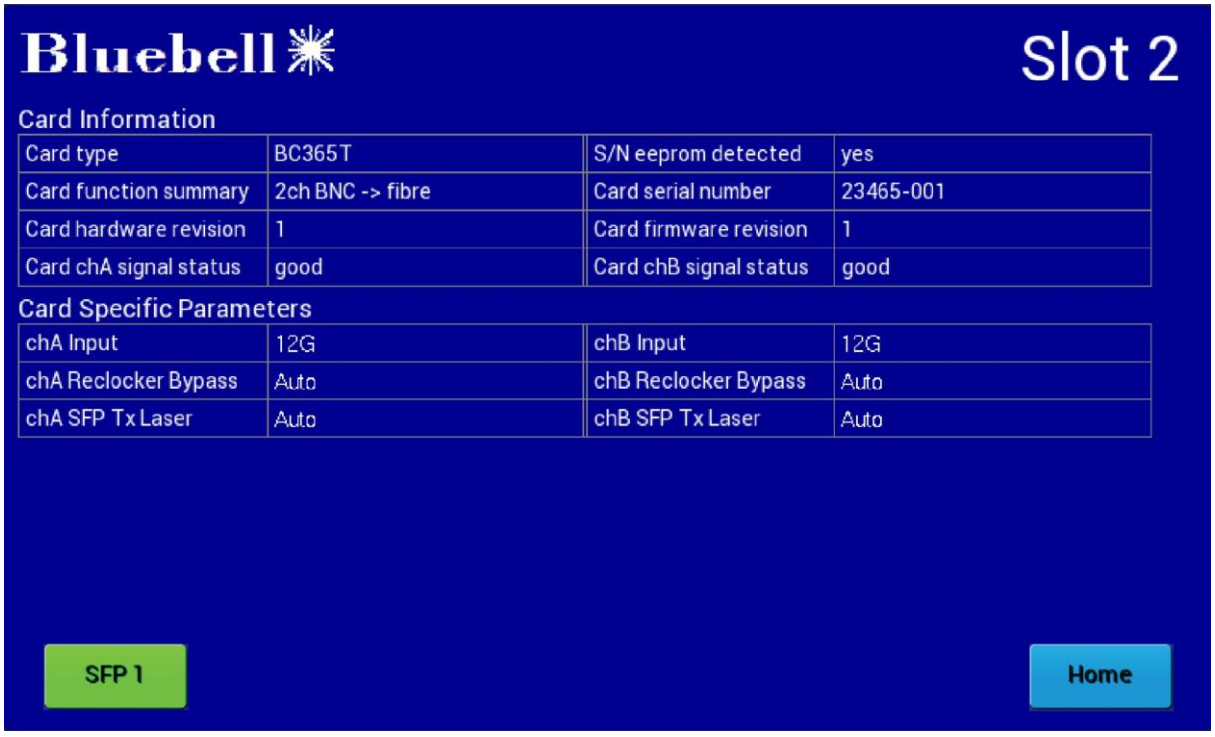
BC100i/160i or BC100/160 ChA and ChB LEDs

		BC372T/BC372R/BC372
LED ChA	Green	ChA data locked
	Red	ChA data not locked (invalid signal)
LED ChB	Green	ChB data locked
	Red	ChB data not locked (invalid signal)

See Setup Options to assign ChA and ChB fail status LEDs to specific I/O.

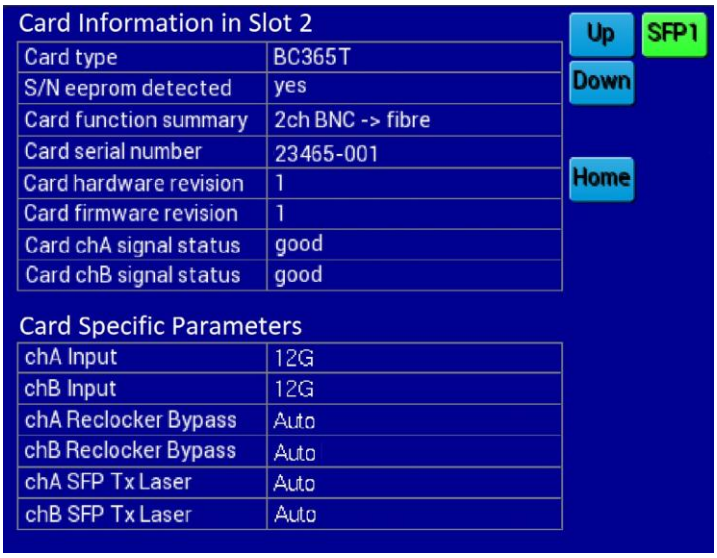
BC100i Card Info page

When operating correctly, the BC100i Card info page for a BC372T card will appear as below (items specific to individual cards excepted). The Card Info pages for BC372R and BC372TR are very similar.



BC160i Card Info page

When operating correctly, the BC160i Card Info page for a BC372T 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 BC372R and BC372TR are very similar.



Monitoring via Webpages

"Overview" webpage:

		BC372/365T/365TR
LED Ch A	Green	Ch A data locked
	Red	Ch A data not locked (invalid signal)
LED Ch B	Green	Ch B data locked
	Red	Ch B data not locked (invalid signal)

"Frame Information" webpage:

Signal status		**BC372T/365R/365TR**
LED Ch A	"good"	Ch A data locked
	"fail"	Ch A data not locked (invalid signal)
	"unknown"	Card not recognised
LED Ch B	"good"	Ch B data locked
	"fail"	Ch B data not locked (invalid signal)
	"unknown"	Card not recognised

Remote monitoring via SNMP

		BC372T/365R/365TR
cardsigChA	"good"	Ch A data locked
	"fail"	Ch A data not locked (invalid signal)
	"unknown"	Card not recognised
cardsigChB	"good"	Ch B data locked
	"fail"	Ch B data not locked (invalid signal)
	"unknown"	Card not recognised

Appendix

Specifications – BC372 Series

	BC372 – Tx channels	BC372 – Rx channels
Electrical Inputs and Outputs		
SDI standards – conformities	Compliant with: SD-SDI : SMPTE ST 259 compliant HD-SDI : SMPTE ST 292 compliant 3G-SDI : SMPTE ST 424 compliant 6G-SDI : SMPTE ST 2081 compliant 12G-SDI : SMPTE ST 2082 compliant	
Signal standards:	SD-SDI, HD-SDI, 3G-SDI, 6G-SDI, 12G-SDI, DVB-ASI, MADI at 125 Mb/s	
Equalisation (T only)	Automatic to: SD-SDI : 400 m @ 270 Mb/s HD-SDI : 240 m @ 1.485 Gb/s 3G-SDI : 170 m @ 2.97 Gb/s 6G-SDI : 90 m @ 5.94 Gb/s 12G-SDI : 70 m @ 11.88 Gb/s	
Return Loss	<15 dB, 5 Mb/s – 1.485 Gb/s <12 dB, 1.485 Gb/s – 2.97 Gb/s <8 dB, 2.974 Gb/s – 5.94 Gb/s <5 dB, 5.94 Gb/s – 11.88 Gb/s	<17 dB, 5 Mb/s – 1.485 Gb/s <12 dB, 1.485 Gb/s – 2.97 Gb/s <8 dB, 2.974 Gb/s – 5.94 Gb/s <5 dB, 5.94 Gb/s – 11.88 Gb/s
Connectors	4 x 75-ohm BNC per IEC 60169-8, Amendment 2	
Format	Re-clocked (may be bypassed)	
Polarity (R only)		Non-inverting
Signal Level (R only)		800 mV +/-10%
Timing Jitter (R only)		0.2 UI line equalised @ 270 Mb/s 1 UI line equalised @ 1.485 Gb/s 2 UI line equalised @ 2.97 Gb/s 4 UI line equalised @ 5.94 Gb/s 8 UI line equalised @ 11.88 Gb/s
Alignment Jitter (R only)		0.2 UI line equalised @ 270 Mb/s 0.2 UI line equalised @ 1.485 Gb/s 0.3 UI line equalised @ 2.97 Gb/s 0.3 UI line equalised @ 5.94 Gb/s 0.3 UI line equalised @ 11.88 Gb/s
Optical Inputs and Outputs		
Optical specifications are dependent on the installed SFP module. Refer to the SFP manufacturer's datasheet for detailed optical performance parameters, including wavelength, optical power, sensitivity, and reach. Contact Bluebell Opticom for more details.		

Monitoring		
Front panel	S/L: bi-colour LED per channel indicating a valid and locked signal	
External via BC100/ BC160 rack frame	Bi-colour LED indicating lock status of electrical inputs	Bi-colour LED indicating lock status of optical inputs
External via BC100i/ BC160i rack frame screen or BM102i monitoring web page	Bi-colour virtual LED indicating lock status of electrical inputs	Bi-colour virtual LED indicating lock status of optical inputs
SNMP monitoring (via BC100i/BC160i rack frame with BM102i card fitted)	Lock status of electrical inputs	Lock status of optical input
General		
Input Voltage	6 – 18 V	
Power consumption	6 W typical	
Depth	85 mm (60 mm excluding connectors)	
Width	20 mm (4HP)	
Height	129 mm (3RU)	
Weight	100 g (excluding SFP)	
Operating Temperature	-30 to +70 °C	

Contact details

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