User Guide

BV10

Performance Endpoint Unit

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Telecom Test and Measurement

EXFO
EXPERTISE REACHING OUT

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Units of Measurement

Units of measurement in this publication conform to SI standards and practices.

December 4, 2014

Version number: 3.0.0.1

Certification Information

North America Regulatory Statement

This unit was certified by an agency approved in both Canada and the United States of America. It has been evaluated according to applicable North American approved standards for product safety for use in Canada and the United States.

Electronic test and measurement equipment is exempt from FCC part 15, subpart B compliance in the United States of America and from ICES-003 compliance in Canada. However, EXFO Inc. makes reasonable efforts to ensure compliance to the applicable standards.

The limits set by these standards are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

European Community Declaration of Conformity

An electronic version of the declaration of conformity for your product is available on our website at **www.exfo.com**. Refer to the product's page on the Web site for details.

Laser

This product complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007 and with IEC/EN 60825-1.

Contents

1 Introducing the BV10

Highly cost-effective Ethernet performance monitoring device providing complete network visibility for mobile backhaul, Carrier Ethernet, and PTN networks.

Features

- Fully integrated in EXFO's end-to-end mobile backhaul solution for service turn-up, troubleshooting, and performance monitoring.
- Offers complete network visibility at a third of the cost of traditional Ethernet NID solutions.
- Simple and remote management for zero-truck-roll network maintenance.
- Completely standards-based, supporting Ethernet OAM, with 802.1ag and Y.1731 message response as a performance endpoint, as well as TWAMP (RFC 5357).
- Capability to perform full-line-rate loopback from layer 2 up to layer 4 with rates of 10/100/1000 Mbit/s.

BrixWorx for Turn Up

BrixWorx for Turn Up is a system designed for Turn-Up and reflector testing with no monitoring capability. BrixWorx for Turn Up supports a central management system, Verifier management for the supported Verifier models, and user management. BrixWorx for Turn Up does not support active or passive testing.

The BV10 Verifier is designed specifically for Ethernet OAM Handling, UDP Echo Responder, TWAMP Light Responder, and Smart Loopback test features. These features are enabled by loading the tests on the Verifier Information page (Additional Services section) and in some cases specifying parameters, such as a UDP Listening port for TWAMP or the mode for Smart Loopback.

For more information, refer to the *BrixWorx for Turn Up Getting Started* guide to learn more about the features of the BrixWorx for Turn Up system and the *BrixWorx User Guide* to learn more about the Verifier Information page.

Conventions

Before using the product described in this guide, you should understand the following conventions:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in *death or serious injury*. Do not proceed unless you understand and meet the required conditions.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *minor or moderate injury*. Do not proceed unless you understand and meet the required conditions.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *component damage*. Do not proceed unless you understand and meet the required conditions.

IMPORTANT

Refers to information about this product you should not overlook.

2 Safety Information

WARNING

Do not install or terminate fibers while a light source is active. Never look directly into a live fiber and ensure that your eyes are protected at all times.

WARNING

The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.

IMPORTANT

When you see the following symbol on your unit  **, make sure that you refer to the instructions provided in your user documentation. Ensure that you understand and meet the required conditions before using your product.**

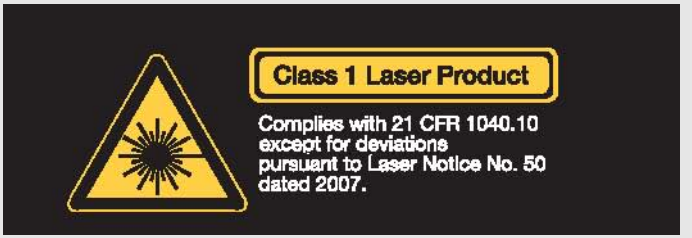
IMPORTANT

Other safety instructions relevant for your product are located throughout this documentation, depending on the action to perform. Make sure to read them carefully when they apply to your situation.

Additional Laser Safety Information

WARNING

This product employs Class 1 Laser SFP. Invisible laser radiation may be encountered at the output port. The laser classification is reproduced on the pluggable transceiver or in its documentation.



WARNING

When the LASER LED is on or flashing, the BV10 is transmitting an optical signal on the SFP transceiver port.

Installation Instruction Warnings

CAUTION

No user serviceable parts are contained inside. Contact the manufacturer regarding service of this equipment.

IMPORTANT

All wiring and installation must be in accordance with local building and electrical codes acceptable to the authorities in the countries where the equipment is installed and used.

CAUTION

Electrostatic Discharge (ESD) Sensitive Equipment:

Units can be damaged by static electrical discharge. To minimize the risk of damage, dissipate static electricity by touching a grounded unpainted metal object

- ➤ before removing, inserting, or handling the unit.
- ➤ before connecting or disconnecting cables to/from the unit.
- ➤ before inserting or removing SFP transceiver to/from the unit.

CAUTION

For DC version, the BV10 must be installed in Restricted Access Locations.

IMPORTANT

Unauthorized modifications to this equipment shall void the user's authority to operate this equipment.

Other Safety Symbols on Your Unit

One or more of the following symbols may also appear on your unit.

Symbol	Meaning
	Direct current.
	Alternating current.
+	Plus; positive polarity.
–	Minus, negative polarity.
	The unit is equipped with an earth (ground) terminal.
	The unit is equipped with a protective conductor terminal.

3 Getting Started

Installing the BV10 in a Rack

The BV10 can be mounted in a rack using the rack mount accessory kit (ordered separately). The accessory kit shelf holds up to four BV10.

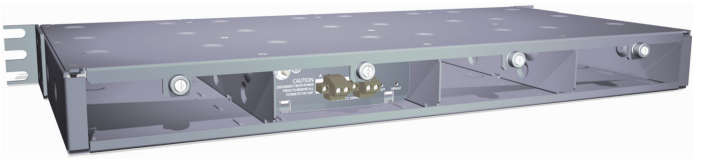
To install the BV10 in a rack:

1. Attach the brackets of the supplied shelf unit to your rack using the supplied screws.

2. If cables have been attached to the BV10, disconnect all of them as well as the ground lug from the unit.

3. Slide the unit into the desired slot from front to back.

4. With the unit completely inserted into the slot, tighten the thumb screw at the back of the unit.



5. Connect all cables and the ground lug, as explained in the next sections.

Connecting the Power

The BV10 is available with either an AC power supply, DC +24 V connector, or DC –48 V connector.

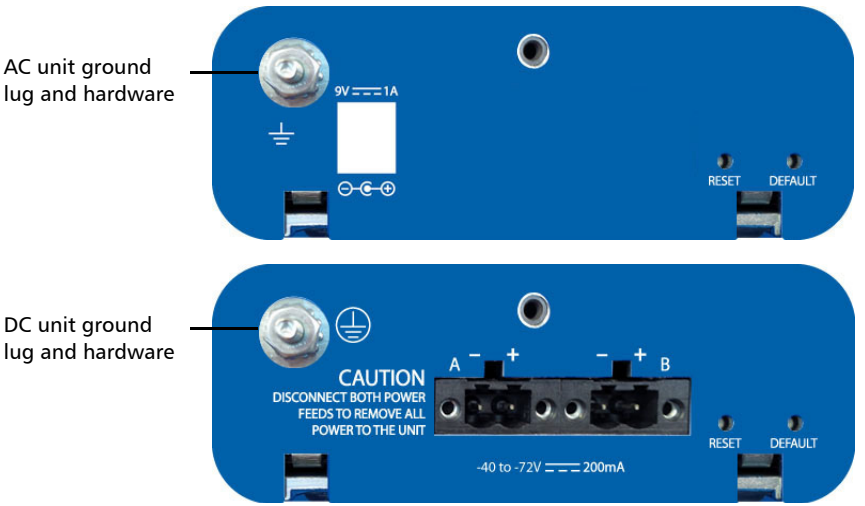
As soon as the BV10 is connected to a live power supply, the **POWER** LED turns on. If the **POWER** LED does not turn on, there is a power failure at the source or the unit is damaged. The **STATUS** LED indicates whether or not the unit is ready for use. If the **STATUS** LED is off the unit is booting up. If it is green or red the unit has booted (refer to *STATUS* on page 20).

Grounding the BV10

The BV10 is equipped with a ground lug and hardware attached to the back of the unit. The grounding hardware consists of a washer with external teeth facing the unit and a locking nut. You will need to supply a #12 AWG wire.

WARNING

The BV10 DC version is intended to be grounded. Ensure that the unit is connected to earth ground during normal use.



To ground the BV10:

1. Loosen the locking nut on the grounding lug.
2. Using a #12 AWG wire, twist the wire around the lug so that it is touching the flat surface of the washer. The wire must be twisted between the washer and the locking nut.
3. Tighten the locking nut.
4. Connect the other end of the wire to the ground distribution network.

Connecting the BV10 using an AC/DC Power Source

The typical output voltage of the external brick AC power supply is 9 V DC.

To connect the BV10 to an AC power source:

1. Connect the supplied AC power cord to the AC/DC adapter and the other end to an AC wall outlet.
2. Connect the other end of the power supply to the DC barrel power connector on the BV10.

Connecting the BV10 using a DC Power Source

The BV10 DC version is equipped with either +24 V DC or –48 V DC connector.

WARNING

Powering a BV10 +24 V DC unit with a –48 V power source will permanently damage the unit. The +24 V input range is 20-32 V.

Powering a BV10 –48 V DC unit with a +24 V power source will permanently damage the unit. The –48 V input range is –40 to –72 V.

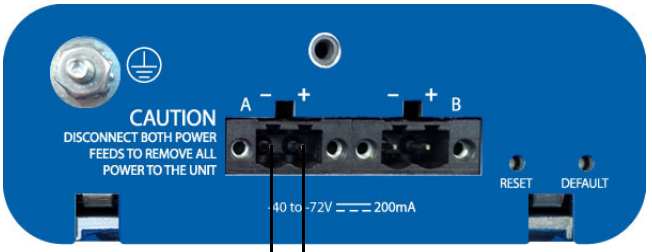
To connect the BV10 to a DC power source:

1. Using 14-16 AWG copper insulated wires and the supplied connector, insert the two stripped wires into the connector and tighten the screws firmly. Either use non-stranded wire or crimp a ferrule onto the wire. Be sure to respect the polarity.

   The positive supply wire lead must be on the right side of the connector and the negative supply wire on the left side.

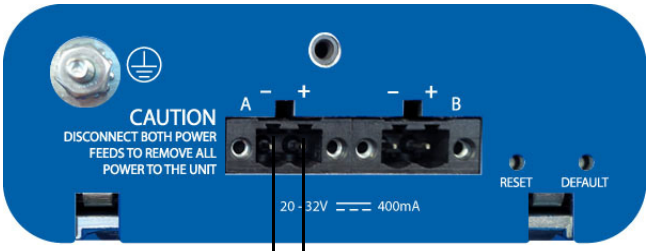
The following figures show the –48 V and +24 V DC units.

–48 V DC Unit



Supplied connector
Negative (–) supply wire lead on the left
Positive (+) supply wire lead on the right

+24 V DC Unit



Supplied connector
Negative (–) supply wire lead on the left
Positive (+) supply wire lead on the right

2. Connect the plug to one of the two DC input connectors on the BV10 unit and tighten the screws firmly.

3. Connect the other end of the wires to the DC power source.

CAUTION

The DC input feeds to the equipment must be protected by 20 A rated maximum breaker provided as part of the building installation.

Permanently connected equipment must have a switch or circuit-breaker for disconnection. If the switch is not part of the kit:

- ➤ Include a switch or circuit-breaker in the installation.
- ➤ The switch must be located easily, and placed near the equipment.
- ➤ The switch must be specified as the disconnecting device for the equipment.

4. To add a redundant DC power source on the BV10, repeat step 1 through step 3.

WARNING

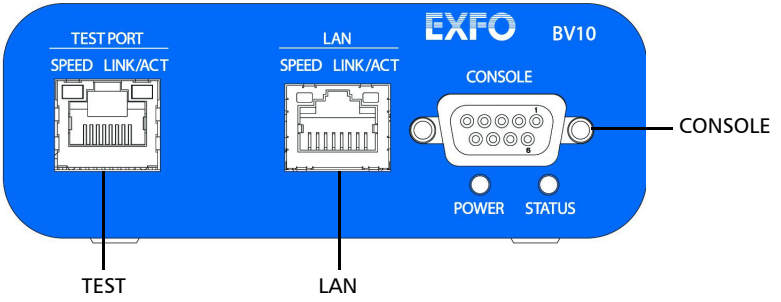
To avoid serious injuries as well as irreparable damages to your unit, ALWAYS TURN OFF BOTH DISCONNECT DEVICES BEFORE OPENING OR SERVICING THE UNIT.

4 Physical Interfaces, LEDs, and Buttons

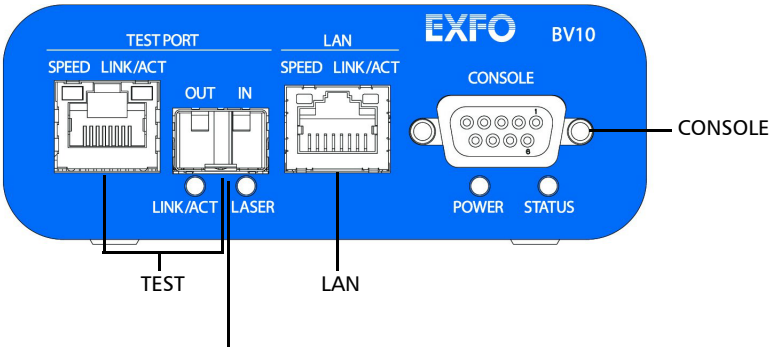
This section describes all connectors (ports), LEDs, and buttons available on the BV10-100 and BV10-1000 units.

BV10 Models

BV10-100



BV10-1000



Laser radiation emitted from this port when LASER LED is on.

Port Availability on BV10

Port Label	Description	Model	
		BV10-100	BV10-1000
TEST PORT	10/100 Mbit/s electrical RJ45 Test port (10Base-T and 100Base-TX)	X	
	10/100/1000Mbit/s electrical RJ45 Test port (10Base-T, 100Base-TX and 1000Base-T)		X
	1000 Mbit/s optical SFP Test port (1000Base-SX/LX/ZX; 850/1310/1550nm)		X
LAN	10/100 Mbit/s electrical Management port	X	X
CONSOLE	RS-232 DE-9F DCE (referred as DB9) Console port	X	X

Connecting the TEST Port Interface

The BV10-100 provides an electrical 10/100 Mbit/s Ethernet Test interface while the BV10-1000 provides an electrical 10/100/1000 Mbit/s and an optical 1000 Mbit/s SFP laser Ethernet Test interfaces. The two BV10-1000 Test interfaces are mutually exclusive.

RJ45 Port

Connect the 10/100/1000 Mbit/s electrical interface to be tested to the RJ45 test port. The electrical ports is RJ45 for category 5 unshielded twisted pair (UTP). Refer to *Ethernet Cables* on page 102 for cable specifications.

Supported electrical rates are:

- For BV10-100: 10 Mbit/s and 100 Mbit/s.
- For BV10-1000: 10 Mbit/s, 100 Mbit/s, and 1000 Mbit/s.

SFP Port (BV10-1000)

The BV10-1000 provides an optional optical port for 1000Base-SX/LX/ZX testing capability. The optical port is a Small Form Factor Pluggable (SFP) slot type with LC connector.

Insert an SFP module into the SFP test port slot on the BV10. Refer to *Optical Interface* on page 95 for more information on supported SFP.

Carefully connect optical fibre cables to the SFP's IN and OUT ports. To ensure good signal quality, make sure that the optical fibre connector is fully inserted into the optical connector port.

CAUTION

To prevent exceeding the maximum input power level please use an attenuator when a loopback configuration is used.

Connecting the Management Interfaces

The management interface can be connected locally using the **CONSOLE** port or remotely using the **LAN** Port.

LAN Port

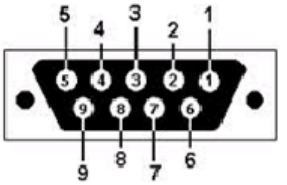
Connecting a typical management network to the 10/100 Mbit/s Ethernet **LAN** port provides remote access to the BV10 Command Line Interface (CLI) using either Telnet or SSH session.

To connect remotely to the BV10 using the **LAN** port, connect both the BV10 **LAN** port and the remote PC to the same Management network using a standard straight through Ethernet cable with RJ45 connectors.

CONSOLE Port

Connecting a PC to the **CONSOLE** port provides local access to the BV10 using CLI commands.

The following figure shows the DB9 (RS-232 DE-9F DCE) pinouts as viewed from the front of the BV10.



The following table indicates the DB9 pinouts.

Pin Number	Description
1, 4, and 6	Connected together inside the BV10
7 and 8	Connected together inside the BV10
5	Signal ground
2	TX (output of the BV10)
3	RX (input of the BV10)
9	Not internally connected
DB9 casing	Chassis ground

To connect locally, connect a PC to the **CONSOLE** port using an RS-232 straight cable with a DB9 connector.

LEDs

POWER

- On (Green) indicates that the BV10 unit is receiving power from an external source.
- Off indicates that the BV10 unit is not receiving power from the external source or the unit is damaged.

STATUS

- On (Green) indicates that the link on the test port is up.
- On (Red) indicates that the link on the test port is down.
- Off indicates that the unit is not yet booted.

SPEED

- Off indicates 10 Mbit/s
- On (Green) indicates 100 Mbit/s
- On (Amber) indicates 1000 Mbit/s (BV10-1000 only)

LINK/ACT (Electrical and Optical Ports)

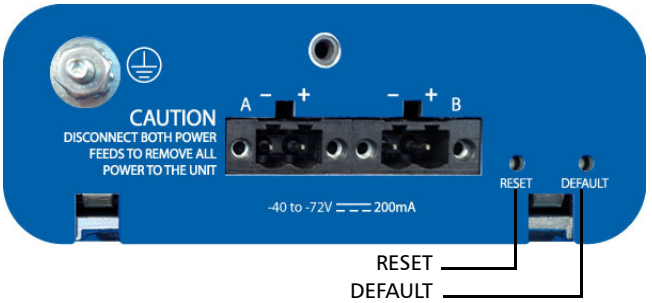
- On (Green) indicates that the link is up; there is no activity.
- Off indicates that the link is down; there is no activity.
- Blinking (Green) indicates that the link is up; there is activity.

LASER

- Off indicates that the laser is off.
- On (Red) indicates that the laser is on.

RESET and DEFAULT Buttons

The **RESET** and **DEFAULT** buttons are recessed on the back of the BV10 to avoid accidental use.



RESET Button

The **RESET** button is used to reboot the BV10. Press the **RESET** button once to reboot the BV10. While rebooting, the BV10 displays a series of messages if the unit is connected to a console.

The reboot command can also be used to reboot the BV10 (refer to reboot *on page 45*).

DEFAULT Button

The **DEFAULT** button is used to reset the BV10 to the factory default settings. Press the **DEFAULT** button once to reset the BV10 to its factory default settings then the unit reboots by itself.

5 Managing BV10 Verifier on BrixWorx

This chapter describes how to configure and use BV10 hardware on BrixWorx. It explains the CLI commands used to communicate with the BrixWorx registry and describes how to set up tests using the BrixWorx user interface.

Note: *When the BV10 is used in a BrixWorx environment, you must use BrixWorx GUI rather than CLI prompt to manage the BV10 device. When you change a reflector to run or not through the CLI, this is not updated on the BrixWorx GUI Additional Services page. The GUI changes override the changes done using the CLI prompt.*

Configuring BV10 Verifier for BrixWorx Registry

The BV10 Verifier must be configured before you can use it in the BrixWorx system. Once the configuration of a BV10 Verifier is complete, you must add it to BrixWorx just like any other Verifier.

Configure the BV10 Verifier

To configure the BV10 Verifier for use in the BrixWorx system:

1. Access the CLI prompt using Telnet or SSH. To log on to the Telnet or SSH server, use the following login information:

   Login ID: exfo
   Password: exfo123

   The CLI prompt name contains the BV10 model number followed by **(DEBUG)**. For example:

   BV10-1000 (DEBUG)>

2. To configure the IP address of the local BrixWorx registry, type the following command:

   BV10-1000 (DEBUG)> server discovery local *IP address*

3. To configure the port of communication, type the following command:

   BV10-1000 (DEBUG)> server discovery port *value*

   The default port value is 80.

4. To save the new port value, type the following command:

   BV10-1000 (DEBUG)> server discovery write

Add the BV10 to BrixWorx

Once you have configured a BV10, you must add it to BrixWorx.

Refer to the BrixWorx User Guide for more information on how to add the BV10 Verifier to the BrixWorx system.

Configuring a Test

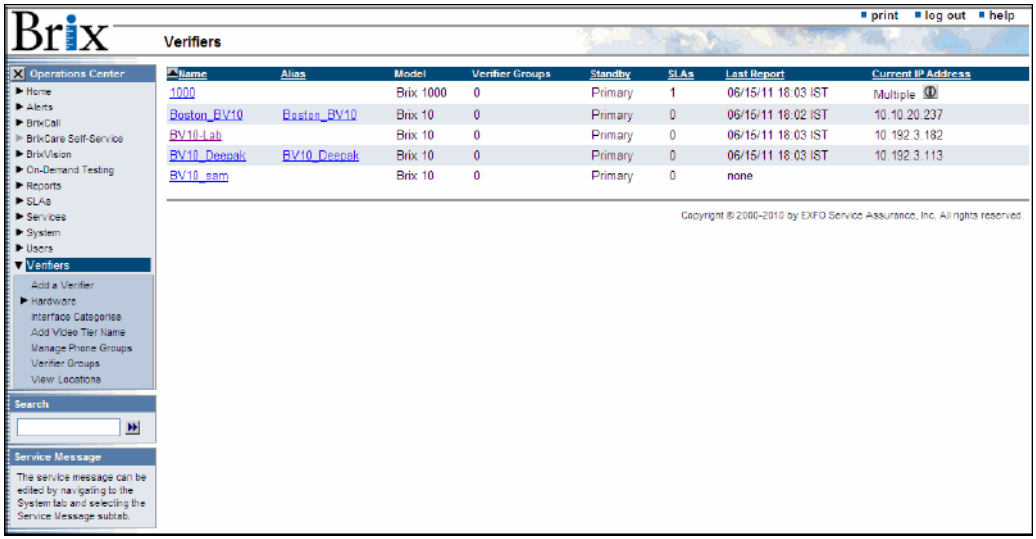
Only a specific set of BrixWorx tests are supported by the BV10 Verifier. All tests supported on the BV10 Verifier are available through BrixWorx:

- Ethernet OAM Handling
- UDP Echo Responder
- TWAMP Light Responder
- Smart Loopback
- SSH service
- Telnet service

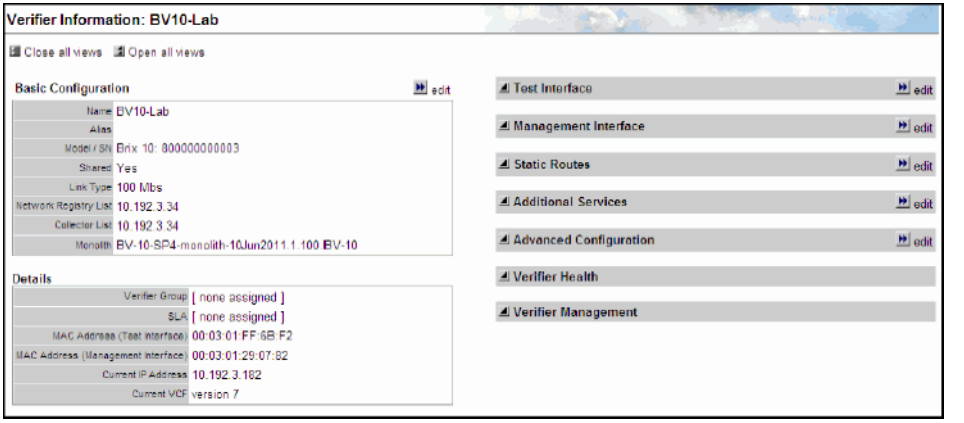
Refer to *Test Applications* on page 73 for more information on the tests supported on the BV10 Verifier.

To configure a test on a BV10 Verifier using the BrixWorx Operations Centre:

1. Login to BrixWorx.
2. Select **Verifiers**.



3. Click the name of the Verifier on which you want to configure the test.



4. Click the **edit** button for Additional Services. You can choose to load a specific test or service on this page.

5. Enter the time interval at which you want the BV10 Verifier to report the health information. See *Verifier Health Information* on page 28 for more information.

6. Select **Load** for the tests that you want to configure on the BV10 Verifier.

   - For the TWAMP Light Responder test, you must enter the UDP port value to load the test.
   - For Smart Loopback test, select **Ethernet**, **Ethernet all unicast**, **IP**, or **UDP-TCP** to load the specific test.

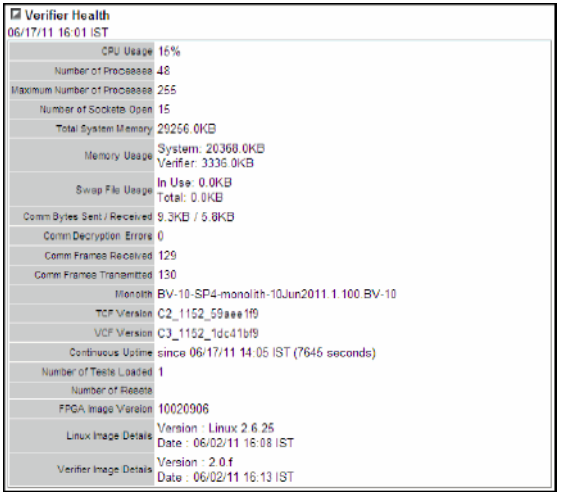
   Refer to *Test Applications* on page 73 for more information about the tests that you can load on the BV10 Verifier.

7. To run the SSH or Telnet service, select **Run**.

   The selected tests and services are loaded on the BV10 Verifier.

Verifier Health Information

The BV10 Verifier runs its health status test based on the interval set in the Status field in the Additional Services category of the Verifier's advanced parameters. It reports results to BrixWorx based on its polling interval. The following figure shows an example of Verifier health information.



To display the Verifier Health page, select the Verifier Health category on the Verifier Information page.

See *Configure the BV10 Verifier* on page 23 for more information on how to set the interval for Verifier status reporting and refer to the Verifiers chapter in the BrixWorx User Guide for information on the fields from the Verifier Health page.

6 Introducing the BV10 CLI

This chapter describes the BV10 Ethernet Performance Endpoints Command Line Interface (CLI), its uses, and its features.

Note: *Refer to CLI Command Reference* on page 39 *for more information on command definition and syntax.*

Command Line Interface

The Command Line Interface (CLI) allows to configure and manage the operation of the BV10 by sending commands to the BV10 using either the CONSOLE Port, a Telnet session (LAN or TEST Port), or Secure Shell (SSH) session (LAN or TEST Port).

Note: *Telnet and SSH provide the same functionality except SSH provides a secure channel. Refer to* console telnet|ssh server enable|disable *on page 61 for more information on enabling Telnet or SSH.*

Connecting to the BV10 to a Console

Connect the BV10 to a Console for management through **CONSOLE**, **LAN**, or **TEST** port.

CONSOLE Port

A console is directly connected to the BV10 (**CONSOLE** Port). The **CONSOLE** port is always available for CLI use.

To use the CONSOLE port:

1. Ensure that your PC is connected to the BV10‘s CONSOLE port. Refer to *CONSOLE Port* on page 19.
2. Use a terminal application to connect with the BV10 through its CONSOLE port.
   - **2a.** Start the terminal application.
   - **2b.** Set the connection configuration to 9600bps, 8 data bits, no parity, 1 stop bit (9600/8-N-1).
   - **2c.** Establish the connection with the BV10.

LAN Port

A console it connected to the BV10 (LAN port) for remote access through the network using either Telnet or SSH session.

To use the LAN port:

1. Ensure that both your PC network interface and the BV10‘s LAN port are connected to the same Management network. Refer to *LAN Port* on page 18.
2. On your PC, run a terminal application.
3. Select Telnet or SSH connection type.

   The use of Telnet server is enabled by default on the BV10.

   The use of SSH server is disabled by default on the BV10 and must be enabled as well as the password must be defined; refer respectively to *console telnet|ssh server enable|disable* on page 61 and *password set password* on page 61; the user name is **exfo**. The CLI supports SSHv2. Encryption keys are factory generated.
4. Enter the BV10 LAN port IP address and Netmask. Default values are:
   IP address: 10.10.10.10
   Netmask: 255.255.0
5. Establish the connection with the BV10.

TEST Port

In-band management activities on the TEST port is provided for basic configuration and software upgrade tasks in situations where the Management port is inaccessible.

It is important to note that in-band management through the TEST port should be performed with low traffic volume so that management responses have minimal impact on test traffic. With high traffic volume, management responses might add jitter/latency or dropped packets to results. When a CLI session is opened on the TEST port, the following warning message appears:

WARNING: Session opened on the TEST Port. Any action may interfere with traffic.

Not all CLI commands are available on the TEST port.

The console in-band enable|disable command controls in-band management on the test port. By default, in-band management on the test port is enabled. Refer to *console in-band enable|disable* on page 62 for more information.

To use the TEST port:

1. Ensure that both your PC network interface and the BV10's TEST port are connected to the same Management network. Refer to *Connecting the TEST Port Interface* on page 16.
2. On your PC, run a terminal application.
3. Select Telnet or SSH connection type.

   The use of Telnet server is enabled by default on the BV10.

   The use of SSH server is disabled by default on the BV10 and must be enabled as well as the password must be defined; refer respectively to *console telnet|ssh server enable|disable* on page 61 and *password set password* on page 61; the user name is **exfo**. The CLI supports SSHv2. Encryption keys are factory generated.
4. Enter the BV10 TEST port IP address and Netmask.
5. Establish the connection with the BV10.

Entering Commands

Once you have connected to the BV10, you can enter CLI commands at the command prompt. The CLI command prompt is either BV10-100> or BV10-1000>, depending on the BV10 model you are communicating with.

Basic Command Format

The basic format of a CLI command is:

command parameter,...

Both upper and lower case alphanumeric characters and special characters, such as the slash (/) and colon (:) are supported. Commands and parameters are not case sensitive.

You can specify no parameter, one parameter, or multiple parameters separated with comma.

Abbreviating Commands

The CLI allows you to type only as much of a command that it is required to make it unambiguous. For example, sh ve is the equivalent of typing show version because show is the only keyword that starts with sh and version is the only keyword that starts with ve. If it cannot be unambiguously determined, the CLI displays a list of possible commands and parameters that begin with the partial keyword.

Completing Commands

To submit a CLI command, press the Enter key.

The CLI command completion feature lets you type part of a command and use the Tab key to complete the remainder of the command. Consider the following examples.

sh <tab> resolves to show

con <tab> resolves to console

sh <tab> ve <tab> resolves to show version

Command completion works as long as what you have typed is unambiguous – that is, there are no other CLI commands that start with the letter or letters you have typed. Typing just c, for example, does not allow the CLI to distinguish console from clear. If it cannot be unambiguously determined, the CLI displays a list of possible commands and parameters that begin with the partial keyword.

When the rest of the command can be completed, it appears in its completed form on the same line when you press the Tab key. If the command cannot be completed, the possible values appear on the following line when you press the Tab key.

Tip: You can combine abbreviated commands with command completion on the same line. For example, if you type sh v <tab>, the command resolves to sh version. When you then press Enter, the CLI abbreviated command feature allows it to successfully resolve the sh and the v to show version and displays the current software/firmware versions.

Command Editing Keys

The CLI uses common line editing key sequences, as shown in the following table.

Key Sequence	Result
Enter	Executes the command.
Backspace	Deletes the character to the left of the cursor's position.
Delete	Deletes the character to the left of the cursor's position.
Home	Moves the cursor to the beginning of the line.
End	Moves the cursor to the end of the line.
<right arrow>	Moves the cursor to the right one character.
<left arrow>	Moves the cursor to the left one character.
Ctrl C	Interrupts/cancels the command.
<up arrow>	Recalls the most recently entered command; scrolls back through the command history buffer each time you press the up arrow key.
<down arrow>	Scrolls forward through all of the commands that have been recalled using the up arrow.
Tab	Completes the command or keyword. See *Completing Commands* on page 34 for more information.
Ctrl D	Deletes the character at the cursor's position.
Ctrl H	Deletes the character to the left of the cursor's position.
Ctrl I	Re-displays the current line, completing the last word in the line.
Ctrl J	Executes the command.
Ctrl K	Deletes all characters from the cursor's position to the end of the line.
Ctrl L	Re-displays the current line.
Ctrl M	Executes the command.
Ctrl N	Scrolls forward through all of the commands that have been recalled using Ctrl P or the Up arrow, one command at a time.
Ctrl P	Recalls the most recently entered command; scrolls back through the command history buffer each time you repeat the key sequence.

Key Sequence	Result
Ctrl U	Deletes all characters on the line.
Ctrl W	Deletes the previous word.
Ctrl Y	Pastes from the clipboard.
Esc B	Moves the cursor to the start of the previous word.
Esc C	Capitalizes the current character.
Esc D	Deletes all characters in a word from the cursor's position to the end of the word.
Esc F	Moves the cursor forward one word at a time.
Esc L	Lowercases the current character and those that follow in the current word.
Esc U	Uppercases the current character and those that follow in the current word.
Esc Delete	Deletes the previous word.

Note: *Not all key sequences are available to the SSH client. Because an SSH client buffers data before sending it to the BV10, line editing keys are interpreted by the SSH client and not by the CLI shell on the BV10. It might be required to press Enter after using certain keys, such as Tab and ? for example, to get the result described in the above table.*

Command History

The BV10 CLI stores commands performed during a session in a history buffer. You can recall most recent commands from the history buffer using either: Up arrow key, Ctrl P, Down arrow key, and Ctrl N (see above table for more information).

CLI Session

All commands are available at any time once a communication session has been established with the BV10.

All commands are executed immediately and any configuration changes are saved automatically.

Idle Timeout

The BV10 has a security feature, called the idle timeout, that logs users out of a CLI session and closes the connection if there has been no activity for a specified period of time. An idle timeout can be set for each type of access (**CONSOLE** port, Telnet session, or SSH session). It can also be disabled.

Refer to *console telnet|ssh|serial idle-timeout value_in_seconds* on page 62 for more information on how to configure the timeout period.

In addition to the session timeout, a communication session is automatically closed when the connection is closed or lost (for a LAN connection).

7 CLI Command Reference

This chapter describes the BV10 command line interface (CLI). The commands are grouped under Operation and Configuration commands.

Note: *When the BV10 is used in a BrixWorx environment, you must use BrixWorx GUI rather than CLI prompt to manage the BV10 device. When you change a reflector to run or not through the CLI, this is not updated on the BrixWorx GUI Additional Services page. The GUI changes override the changes done using the CLI prompt.*

Note: *Refer to* Introducing the BV10 CLI *on page 29 for more information on CLI and its features.*

Conventions

The following table lists the conventions used in this chapter to represent command syntax.

Convention	Description	Example
Pipe symbol |	Choice between two or more parameters.	all | lan | test Select one of the keywords: all, lan or test.
Square brackets [ ]	Optional parameters.	[timeout *value_in_ms*] The timeout parameter and its value *value_in_ms* are optional.
Italics	Variable information.	size *size_in_bytes* Enter a number in place of *size_in_bytes*.

Command Availability

All CLI commands can be sent through the LAN and **CONSOLE** ports. Only a subset of commands can be sent through the Test port.

Alphabetical List of CLI Commands

The following table lists the BV10 CLI commands in alphabetical order.

Operation Commands

Operation commands allow to view and change the operational behavior of the BV10. Operation commands do not change the configuration of the unit.

The Operation commands are organized as follows:

Help Commands

help

Description Displays a list of top-level CLI commands with a description of each command.

To display context sensitive help for commands that begin with a certain string of characters (either a complete or partial keyword), use any of the following commands at the prompt:

- partial-keyword?

  Displays a list of commands and parameters that begin with the partial-keyword entered.

- keyword<space>?

  Displays a list of possible parameters associated with the keyword.

Syntax help

Example **bv10-100>** help

List of commands:

clear	Clears Statistics
console	Configure Telnet/SSH/Serial/In-Band management settings
eth-oam	Enables/disables Ethernet OAM
exit/logout	Logout of the CLI
help	Shows help information
interface1	Configures network interface
load	Upgrades system image
password	Changes password
ping	Ping IP address
reboot	Reboots the system
show	Show statistics, configurations, version, system, server information
smart-loopback	Configures Smart Loopback mode
twamp	Configures TWAMP
udp-echo	Enables/disables UDP echo
server	Configures local/network/universal registry and port information

?

Description Displays context-sensitive help. You can enter the ? alone at the CLI prompt, at the end of a partial keyword (command or parameter), or at the end of a complete keyword (command) preceded by a space. The help that is displayed varies accordingly. If you type ?

- at the CLI prompt: displays the names of the top-level CLI commands.
- at the end of a complete or partial keyword (command or parameter): displays the complete keyword on the next line if the keyword is unambiguous. If the partial keyword is ambiguous, displays the possible choices on the next line.
- after a complete or partial keyword and a space: displays a list of parameters. If the partial keyword is ambiguous, displays the possible choices.

The question mark character is not echoed on the screen.

Syntax ?

Examples

```
bv10-100> ?
clear       help        password     smart-loopback
console     interface   ping         twamp
eth-oam     load        server       udp-echo
exit        logout      show

bv10-100> c?
clear       console
```

System Commands

reboot

Description Restarts the BV10. Before restarting the unit, the CLI prompts for confirmation.

The RESET button can also be used to reboot the BV10. Refer to *RESET Button* on page 21 for more information.

Syntax reboot

Example
```
bv10-100> reboot
Reboot system? [y|n]:
```

logout or exit

Description Logs out of the CLI session. The logout and exit commands are exactly the same.

Syntax logout | exit

Example
```
bv10-100> logout
```

show sysinfo

Description Displays the following BV10 unit information:

- Software/firmware versions
- Hardware model, version, and identification
- Serial number
- Manufacturing date
- Unit Health Status of the test port: LINK DOWN or OK (link up)
- DC Feed A Status, DC Feed B Status. Applied to DC version only and are monitored every 5 seconds.

Syntax show sysinfo

Example

```
bv10-100> show sysinfo
S/W VERSION     : Linux 2.6.25 #8 Wed Apr 16 14:47:51 EDT 2014
H/W             : BV10-1000-AC
H/W VERSION     : C
H/W ID          : 800000638428
SERIAL NUMBER   : 638428
MFG DATE        : 23-03-12
UNIT HEALTH     : OK
```

Software Management Commands

show version

Description Displays the current software/firmware versions.

Syntax show version

Example

```
bv10-100> show version
S/W VERSION     : Linux 2.6.25 #8 Wed Apr 16 14:47:51 EDT 2014
F/S VERSION     : 4.0.1.2, Thu Aug 21 11:50:11 EDT 2014
F/W VERSION     : 10021906
```

load image

Description

Loads a software upgrade/downgrade image from TFTP or FTP (using a username and password) server. The BV10 acts as a client.

The BV10 can be upgraded or downgraded to the next or previous two versions, preserving the unit's settings. The unit can be upgraded or downgraded more than two versions; however, there is no guarantee that the unit's settings will be preserved.

The upgrade/downgrade process preserves the unit's current settings such as IP parameters and Smart Loopback mode. As the software loads, informative messages are displayed for each step, including instructions when user input is required. If the installation fails, the unit automatically reverts to the previous software image. Once the software is loaded, the BV10 must be rebooted in order for the new software image to be applicable. You can use either the RESET button or the reboot command. Refer to *RESET Button* on page 21 and *reboot* on page 45 for more information.

The LAN or the Test port can be used for loading a software image. However loading a software image using the Test port stops all applications running on the BV10, the following message is displayed requiring a confirmation.

Test Port used to load the image. All Test Applications will be stopped during upgrade.
Are you sure you want to continue? (Y/N)

Enter Y to stop all applications and proceed with the image loading. Enter N to cancel the command.

State and configuration settings are preserved and restored when the software upgrade is complete and the BV10 is rebooted. The Ping test remains enabled during software upgrades.

The load image command can be entered through the CONSOLE port or the LAN/Test port running Telnet or SSH. Refer to *Connecting to the BV10 to a Console* on page 30 for more information.

load image

Syntax

load image lan|test *uri*

The *URI* can use one of the following formats, depending on the server type (TFTP or FTP) from which the unit is being updated:

tftp://192.168.1.1/image_name.img
ftp://username:password@192.168.1.1/image_name.img

Example

bv10-100> load image lan tftp://10.17.1.75/BV-10_4.0SP1.img

WARNING: Performing image upgrade.

Please DO NOT power down!! Use CTRL-C to abort.

Shutting down processes for upgrade...done.
Transferring BV-10_4.0SP1.img from 10.17.1.75 using tftp...done(5149757 bytes).
Unpacking image file...done.
Writing to device(1)...done.
Writing to device(2)...done.
Updating configs...done.
Updating boot(1)...done.

Upgrade Successful!

*** Reboot is required! ***

Statistics Commands

show statistics

Description Displays the following status and statistics:

- Smart Loopback Control (enabled or disabled)
- Smart Loopback operational status
  - Link status of the test port
  - DHCP Status (when DHCP is enabled)
- Laser control (optical transceiver only)
- Number of processed Smart Loopback packets
- Number of processed Ping requests on Test port only
- TWAMP Light Control (enabled or disabled)
- TWAMP Light UDP listening port
- Number of processed TWAMP Light packets
- UDP Echo Control (enabled or disabled)
- Number of processed UDP Echo packets
- Ethernet OAM Global Control (enabled or disabled)
- Number of processed Ethernet OAM Loopback messages
- Number of processed Ethernet OAM Delay Measurement messages
- Number of processed Ethernet OAM Link Trace messages

Syntax show statistics

Example

```
bv10-100> show statistics
Smart Loopback Control              = enabled
Smart Loopback Status
  Link                              = 1
  DHCP                              = enabled (lease acquired)
Smart Loopback Packets              = 731
Ping Packets                        = 408
TWAMP Light Control                 = enabled
TWAMP Light UDP port                = 9495
TWAMP Light Packets                 = 0
UDP Echo Control                    = enabled
UDP Echo Packets                    = 0
Ethernet OAM Control                = enabled
Ethernet OAM Loopbacks Packets      = 70
Ethernet OAM Delay Meas. Packets    = 55
Ethernet OAM Link Trace Packets     = 42
```

clear statistics

Description	Clears the counter of all statistics.
Syntax	clear statistics
Example	**bv10-100>** clear statistics Clearing statistics

Interface Information Command

show interface

Description Displays information about the LAN, Test, or both ports.

For the LAN and TEST ports:

IP address
Net Mask
MAC Address
Default Gateway
Speed
Duplex
Link status
Auto-negotiation status
DHCP status
VLAN
MDI/MDI-X status
Flow control
Transceiver type (Test port on BV10-1000 only)

Additional information for BV10-1000 optical port:

Laser Control

SFP vendor manufacturing information (as per SFF-8472): **ID**, **Part Number**, **Serial Number**, **Vendor Name**, **Connector Type** (e.g.: LC, MT-RJ...), **Speed**, **Type** (for example: SR, IR, LR), **Wavelength**, and **Mode** (SMF or MMF).

Syntax show interface all|lan|test

show interface

Example

```
bv10-100> show interface all
LAN PORT
IP_ADDRESS          = 10.17.16.32
NETMASK             = 255.255.0.0
MAC_ADDRESS         = 00:E0:0C:BC:E5:60
GATEWAY             = 10.17.1.2
SPEED               = 100Mb/s
DUPLEX              = Full
LINK                = yes
AUTO-NEG            = on
DHCP                = Disabled
VLAN                = Disabled
MDI                 = 0
FLOW CONTROL        =

TEST PORT
IP_ADDRESS          = 10.16.7.138
NETMASK             = 255.255.0.0
MAC_ADDRESS         = 00:03:01:FF:6B:70
GATEWAY             = 10.16.1.1
SPEED               = 1000Mb/s
DUPLEX              = Full
LINK                = yes
AUTO-NEG            = on
DHCP                = Disabled
VLAN                = Disabled
MDI                 = Normal
FLOW CONTROL        = None
TRANSCEIVER         = Electrical
```

Tools Command

ping

Description Initiates a ping of a specified destination using the LAN or Test port and displays the results. Refer to *Ping Test* on page 76 for more information.

Syntax

ping *destination_IP*
[repetition *number_of_packets* | continuous]
[size *size_in_bytes*]
[ttl *value*]
[delay *value_in_ms*]
[timeout *value_in_ms*]
exit_interface

The delay parameter is the interval between packets.
The exit_interface parameter can be either lan or test and is required.

The parameters can be entered in any order. If a parameter is not specified, the default value is used as follows:

4 for repetition *number_of_packets*
32 for size *size_in_bytes*
128 for ttl *value*
1000 for delay *value_in_ms*
4000 for timeout *value_in_ms*

Example

```
bv10-100> ping 10.10.10.20 lan
PING 10.10.10.20 (10.10.10.20) from 10.10.10.180 eth0: 24(52) bytes of data.
32 bytes from 10.10.10.20: icmp_seq=1 ttl=128 time=10.0 ms
32 bytes from 10.10.10.20: icmp_seq=2 ttl=128 time=0.000 ms
32 bytes from 10.10.10.20: icmp_seq=3 ttl=128 time=0.000 ms
32 bytes from 10.10.10.20: icmp_seq=4 ttl=128 time=0.000 ms

--- 10.10.10.20 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3010ms
rtt min/avg/max/mdev = 0.000/2.500/10.000/4.330 ms
```

Server Discovery Commands

Note: *The following commands are only effective when used in a BrixWorx environment.*

server discovery local

Description	Sets the BrixWorx local registry IP address for communication.
Syntax	server discovery local *IP address*
Example	**bv10-100>** server discovery local 10.192.3.34

server discovery network

Description	Sets the BrixWorx network registry IP address for communication.
Syntax	server discovery network *IP address*
Example	**bv10-100>** server discovery network 10.192.3.3

server discovery universal

Description	Sets the BrixWorx universal registry IP address for communication.
Syntax	server discovery universal *IP address*
Example	**bv10-100>** server discovery universal 10.192.3.33

server discovery port

Description Sets the BrixWorx local registry port for communication. The default port value is 80.

Syntax server discovery port *IP address*

Example **bv10-100>** server discovery port 80

server discovery write

Description Changes the IP address or Port number to the new value set by the server discovery local|network|port|universal and saves the setting. Once the configuration is changed, the Verifier is rebooted.

Syntax server discovery write

Example

```
bv10-100> server discovery write
Writing changes...
Password:
Configuration changed
Rebooting verifier
Password:
./brix-verifier: line 31: /usr/bin/whoami: No such file or directory
Stopping the Brix Verifier Agent... done
Verifier application stopped
Password:
Starting verifier application
Password:
./brix-verifier: line 31: /usr/bin/whoami: No such file or directory
Starting the Brix Verifier Agent... done
Verifier application started
```

show server discovery local

Description Displays the IP address of the currently set local BrixWorx registry.

Syntax show server discovery local

Example
```
bv10-100> show server discovery local
discovery-host = 10.192.3.34
```

show server discovery network

Description Displays the BrixWorx network registry IP address for communication.

Syntax show server discovery network

Example
```
bv10-100> show server discovery network
network-host = 10.192.2.3
```

show server discovery universal

Description Displays the BrixWorx universal registry IP address for communication.

Syntax show server discovery universal

Example
```
bv10-100> show server discovery universal
universe-host = 10.192.2.33
```

show server discovery port

Description Displays the currently set port number for the local BrixWorx registry.

Syntax show server discovery port

Example
```
bv10-100> show server discovery port
discovery-port = 80
```

show server log

Description	Displays the server log for the local BrixWorx registry.
Syntax	show server log
Example	bv10-100> show server log

Configuration Commands

BV10 Configuration commands allow to view and change the configuration of the BV10.

The Configuration commands are organized into the following subgroups:

Subgroup	Command	Page
Test Application	smart-loopback enable|disable	70
	smart-loopback mode ethernet-all-unicast|ethernet|ip|udp-tcp	70
	twamp enable|disable	71
	twamp udp-port value	71
	udp-echo enable|disable	71
	eth-oam enable|disable	72

General Command

show config

Description Displays all BV10 configuration parameters as follows:

- Console:
  Console in-band management[a], Console Password[a], Console Timeout, Telnet[a], Telnet Timeout, SSH[a], and SSH Timeout
- Interfaces:

  LAN port:
  IP Address, Subnet Mask, Gateway, Auto Speed, Speed, Duplex, Flow, MDI, VLAN ID

  TEST port:
  IP Address, Subnet Mask, Gateway, Auto Speed, Speed, MDI, Transceiver, Transceiver type, VLAN ID, VLAN Priority.
- Test applications:
  Smart Loopback[a], Smart Loopback Mode, Ethernet OAM[a], TWAMP[a], TWAMP port, UDP Echo[a]

Syntax show config

show config

Example

```
bv10-100> show config
Console
  CONSOLE_IN_BAND              = enabled
  CONSOLE_PASSWORD             = disabled
  CONSOLE_TIMEOUT              = 0
  TELNETD_ENABLE               = enabled
  TESNETD_TIMEOUT              = 0
  SSHD_ENABLE                  = disabled
  SSHD_TIMEOUT                 = 0

Interfaces
  LAN_ADDRESS                  = 10.17.16.32
  LAN_MASK                     = 255.255.0.0
  LAN_GATEWAY                  = 10.17.1.2
  LAN_AUTO_SPEED               = on
  LAN_SPEED                    = 10/100
  LAN_DUPLEX                   = auto
  LAN_FLOW                     = 0
  LAN_MDI                      = 0
  LAN_VLAN_ID                  = none

  TEST_ADDRESS                 = 10.16.7.138
  TEST_MASK                    = 255.255.0.0
  TEST_GATEWAY                 = 10.16.1.1
  TEST_AUTO_SPEED              = on
  TEST_SPEED                   = 10/100/1000
  TEST_MDI                     = 2
  TEST_TRANSCEIVER             = off
  TEST_TRANSCEIVER_TYPE        = electrical
  TEST_VLAN_ID                 = none
  TEST_VLAN_PRIORITY           = 1

Test Applications
  SMART_LOOPBACK_ENABLE        = enabled
  SMART_LOOPBACK               = UDP-TCP
  ETH_OAM                      = enabled
  TWAMP                        = disabled
  TWAMP_PORT                   = 9495
  UDP_ECHO                     = enabled
```

a. Enabled or disabled.

Console Commands

password set *password*

Description Defines a password for the BV10. By default, no password is set. The password is case sensitive. When you enter a password, the CLI prompts you to confirm the password by entering it again.

Syntax password set *password*

Example
```
bv10-100> password set chidley
Please re-enter password
chidley
setting password
```

password clear

Description Clears the BV10 password.

Syntax password clear

Example
```
bv10-100> password clear
clearing password
```

console telnet|ssh server enable|disable

Description Enables or disables the Telnet and/or SSH servers.

Before enabling SSH, you must set a password for the CLI (see *password set password* on page 61). If you attempt to enable SSH before setting a password, the following message is displayed:

```
Please set password first!
```

This command displays no output unless there is an error.

Syntax console telnet|ssh server enable|disable

Example
```
bv10-100> console telnet server enable
```

console in-band enable|disable

Description Enables or disables in-band management on the Test port. By default, in-band management on the Test port is enabled.

This command displays no output unless there is an error.

This command is not available through the Test port.

Syntax console in-band enable|disable

Example **bv10-100>** console in-band disable

console in-band port *port_value*

Description Configures the port number that can be used to communicate with the BrixWorx server from the Test port.

Syntax console in-band port *port_valueh*

Example **bv10-100>** console in-band port 300

console telnet|ssh|serial idle-timeout *value_in_seconds*

Description Sets the idle timeout for the Telnet server, SSH server, or serial console communication session. Each connection method can have its own timeout.

By default, no idle timeout is set. The minimum idle timeout is 30 seconds. To disable the idle timeout, enter 0 (zero).

This command displays no output.

Syntax console telnet|ssh|serial idle-timeout *value_in_seconds*

Example **bv10-100>** console telnet idle-timeout 900

Interface Configuration Commands

The following commands allow setting the port interface parameters such as the IP addressing (static IP or DHCP), auto-negotiation (speed, duplex, flow control), VLAN support, transceiver (electrical or optical), laser (ON or OFF), and cable (straight or auto detection).

Note: *Most of the interface commands do not display output. Use the* show interface *(see page 51) and* show config *(see page 59) commands to display the BV10's current interfaces and configuration.*

Note: *For the **TEST** port: **Duplex** and **Flow Control** are not configurable and respectively set to **Full** and **None**.*

interface test transceiver electrical|optical

Description	Sets the TEST port transceiver type to either electrical or optical. This command applies to the BV10-1000 only. This command cannot be sent through the Test port.
Syntax	interface test transceiver electrical|optical
Example	**bv10-100>** interface test transceiver optical

interface test laser on|off

Description	Turns the laser of the TEST optical interface on or off. This command applies to the BV10-1000 only and is available only when the transceiver type is set to optical. This command cannot be sent through the Test port.
Syntax	interface test laser on|off
Example	**bv10-100>** interface test laser on

interface lan|test speed auto

Description Auto-negotiates all supported LAN (10/100) or Test (10/100/1000 for electrical or 1000 for optical) port speeds.

This command cannot be sent through the Test port.

Syntax interface lan|test speed auto

Example **bv10-100>** interface lan speed auto

interface test speed 10|100|1000 auto

Description Auto-negotiates the specified electrical TEST port speed (10/100/1000).

This command cannot be sent through the Test port.

Syntax interface test speed 10|100|1000 auto

Example **bv10-100>** interface test speed 100 auto

interface test speed 10|100|1000 force

Description Forces the electrical TEST port speed (10/100/1000) to the specified value; no auto-negotiation is performed.

This command cannot be sent through the Test port.

Syntax interface test speed 10|100|1000 force

Example **bv10-100>** interface test speed 1000 force

interface lan speed 10|100 force

Description Forces the LAN port speed (10/100) to the specified value; no auto-negotiation is performed.

This command cannot be sent through the Test port.

Syntax interface lan speed 10|100 force

Example **bv10-100>** interface lan speed 100 force

interface test speed 1000 auto

Description Auto-negotiates the specified optical TEST port speed (1000).

This command cannot be sent through the Test port.

Syntax interface test speed 1000 auto

Example **bv10-1000>** interface test speed 1000 auto

interface lan duplex auto

Description Auto-negotiates the LAN duplex speed.

This command cannot be sent through the Test port.

Syntax interface lan duplex auto

Example **bv10-100>** interface lan duplex auto

interface lan duplex half|full

Description Sets the LAN duplex to either half or full; no auto-negotiation is performed.

This command cannot be sent through the Test port.

Syntax interface lan duplex half | full

Example **bv10-100>** interface lan duplex full

interface lan flow auto

Description Auto-negotiates the flow control for the LAN port to either receive (rx) or none.

This command cannot be sent through the Test port.

Syntax interface lan flow auto

Example **bv10-100>** interface lan flow auto

interface lan flow rx|none

Description Sets the flow control for the LAN port to the receive (rx) or none; no auto-negotiation is performed.

This command cannot be sent through the Test port.

Syntax interface lan flow rx|none

Example **bv10-100>** interface lan flow rx

interface lan|test cable auto

Description Automatically detects the LAN or electrical Test port cable type: crossover or straight through (MDI or MDI-X).

This command cannot be sent through the Test port.

Syntax interface lan|test cable auto

Example **bv10-100>** interface lan cable auto

interface test cable straight

Description Sets the electrical Test port cable as straight.

This command cannot be sent through the Test port.

Syntax interface test cable straight

Example **bv10-100>** interface test cable straight

interface lan|test vlan *value*|none

Description Sets the VLAN ID of the LAN or TEST port to the specified value, or disables VLAN (none).

Syntax interface lan | test vlan *value* | none

Example **bv10-100>** interface lan vlan none

interface test vlan priority *value*

Description Sets the VLAN priority of the TEST interface.

Syntax interface test vlan priority *value*

Example **bv10-100>** interface test vlan priority 1

interface lan|test address-netmask *IP_address*/*netmask*|dhcp

Description Sets the IP address and subnet mask for the LAN or TEST port either manually or using DHCP.

DHCP is enabled by default on the TEST port; it is disabled by default on the LAN port.

The LAN port is set to IP address 10.10.10.10/255.255.0.0. When DHCP is enabled, the local IP parameters are acquired from a DHCP server, as defined in RFC2131. The CLI provides information about the DHCP acquisition status and the lease (expiration time). For more information, refer to *show interface* on page 51

The BV10 supports IPv4 addressing. The netmask value can be specified in either dotted decimal notation or CIDR format. For example:

192.168.1.1/255.255.255.0
192.168.1.1/24

Syntax interface lan|test address-netmask *IP_address*/*netmask*|dhcp

Example **bv10-100>** interface test address-netmask 10.10.10.181/24
address-mask: changing static address to 10.10.10.181/255.255.255.0.

interface lan|test gateway *IP_address*|none

Description When the LAN or TEST interface IP address of the port is manually set, sets the gateway to the specified IP address or none. When the IP address of the port is changed from DHCP to manual, the default gateway is automatically set to manual using the last acquired default gateway IP address. The gateway can still be configured to none.

Syntax interface lan|test gateway *IP_address*|none

Example **bv10-100>** interface lan gateway none

interface lan|test gateway dhcp|none

Description When the LAN or TEST interface IP address of the port is set to DHCP, sets the gateway to the specified IP address or none. When the IP address of the port is changed from manual to DHCP, the default gateway is automatically set to DHCP. The gateway can still be configured to none.

Syntax interface lan|test gateway dhcp|none

Example **bv10-100>** interface lan gateway 10.17.1.2

Test Application Commands

smart-loopback enable|disable

Description Enables or disables the Smart Loopback application. Smart Loopback is enabled by default.

This command acts on the Smart Loopback application only; it is not a global switch for all test applications. For example, if Smart Loopback is disabled but TWAMP Light is enabled, TWAMP packets continue to be reflected.

Refer to *Smart Loopback Test* on page 74 for more information.

Syntax smart-loopback enable|disable

Example
bv10-100> smart-loopback disable
smart-loopback disable

smart-loopback mode ethernet-all-unicast|ethernet|ip|udp-tcp

Description Sets the Smart Loopback feature to one of the following modes:

- Ethernet All Unicast
- Ethernet
- IP
- UDP/TCP (default)

Refer to *Smart Loopback Test* on page 74 for more information.

Syntax smart-loopback mode
ethernet-all-unicast|ethernet|ip|udp-tcp

Example
bv10-100> smart-loopback mode udp-tcp
smart-loopback mode udp-tcp
bv10-100> smart-loopback mode ethernet
smart-loopback mode ethernet

twamp enable|disable

Description Enables or disables the TWAMP Light application. TWAMP Light is enabled by default.

Syntax twamp enable|disable

Example
bv10-100> twamp disable
TWAMP disabled

twamp udp-port *value*

Description Sets the TWAMP UDP listening port.

When UDP Echo is enabled, it uses port 7. If you attempt to set the TWAMP UDP listening port to 7, the following error message is displayed:

Command is not allowed - UDP Echo is enabled.

Syntax twamp udp-port *value*

Example
bv10-100> twamp udp-port 4444
twamp udp-port 4444

udp-echo enable|disable

Description Enables or disables the UDP Echo application. UDP Echo is enabled by default.

Syntax udp-echo enable | disable

Example
bv10-100> udp-echo disable
UDP-ECHO disabled

eth-oam enable|disable

Description Globally enables or disables the Ethernet OAM handling application. Ethernet OAM handling is enabled by default.

Syntax eth-oam enable | disable

Example
```
bv10-100> eth-oam disable
eth-oam disabled
```

8 Test Applications

The BV10 supports the following test applications:

Test Application	Page
Smart Loopback Test	74
Ping Test	76
TWAMP Light Responder Test	77
UDP Echo Responder Test	78
Ethernet OAM Handling Test	79

Smart Loopback supports wire-speed operation with TWAMP, UDP, and OAM handlers.

In addition to the test applications listed above, the BV10 responds to ARP and Ping packets targeted to the unit (not wire-speed).

The BV10 provides counters for the number of packets processed by each test and each Ethernet OAM message type. Refer to *show statistics* on page 49 for more information. The test application counters are automatically reset when there is:

- Link-up event on the Test port.
- Any Test port configuration change.
- Test control changes from disabled to enabled (applies to TWAMP Light, UDP Echo, and Ethernet OAM handling).
- The Smart Loopback Operational Status changes from Not Operational to Operational (applies to Smart Loopback test).
- The Smart Loopback mode is changed (applies to Smart Loopback test).

All test application counters can be manually reset by entering the clear statistics command. Refer to *clear statistics* on page 50 for more information.

Note: *All tests at the exception of Ping are disabled during software upgrades on the Test port.*

Smart Loopback Test

The Smart Loopback feature loops back the stream of data (frames/packets). It retransmits incoming frames/packets after exchanging the source and destination addresses as well as ports at multiple layers (Ethernet MAC, IP, and UDP/TCP).

Smart Loopback can be enabled (default) or disabled. Refer to *smart-loopback enable|disable* on page 70 for more information.

Modes

The Smart Loopback mode limits the address/port swapping to a specific layer. The BV10 supports the following Smart Loopback modes:

- UDP/TCP (default) – Swap MAC addresses, IP addresses, UDP or TCP ports when present and addressed to the unit's TEST port MAC/IP address. In other words, swap from Layer 2 up to Layer 4 when present.
- IP – Swap MAC addresses, IP addresses when present and addressed to the unit's TEST port MAC/IP address. In other words, swap from Layer 2 up to Layer 3 when present.
- Ethernet – Swap MAC addresses when addressed to the unit's TEST port MAC address. In other words, swap Layer 2 when present.
- Ethernet All Unicast – Swap MAC addresses when the address is unicast, regardless of the unit's MAC address.

Refer to *smart-loopback mode ethernet-all-unicast|ethernet|ip|udp-tcp* on page 70 for more information.

Operational Status

The following table indicates the rules that determine the Smart Loopback operational status for each mode.

Smart Loopback Mode	Link Down	Link Up	
		DHCP Acquired, DHCP Renewing, or Manual IP address	DHCP Acquiring or DHCP Failed
Ethernet All Unicast	Not Operational	Operational	Operational
Ethernet	Not Operational	Operational	Operational
IP	Not Operational	Operational	Not Operational
UDP/TCP	Not Operational	Operational	Not Operational

Note: *Laser Off produces a Link Down status for the optical transceiver port.*

Ping Test

The Ping test (applicable to the LAN and Test ports) provides the ability to generate ICMP Echo Requests and provides statistics on the ICMP Echo Replies received in response to the ICMP Echo Request. ICMP Echo Replies are expected on the same interface on which the ICMP Echo Requests were sent.

The Ping test is always enabled, even during software upgrades on the Test port.

The following table lists the Ping test parameters and default values where applicable.

Parameter	Default Value
Destination IP address	
Number of packets or continuous	4
Size in bytes	32
Time-To-Live (TTL)	128
Delay (interval between packets)	1000 ms
Timeout	4000 ms

The Ping test returns the following statistics:

- Number of packets transmitted.
- Number of packets received.
- Percentage of packet loss.
- Round-trip time (rtt) in ms (minimum, average, maximum, and standard deviation values).

Refer to *ping* on page 53 for more information.

TWAMP Light Responder Test

The TWAMP Light Responder test listens for TWAMP Light messages on the specified UDP port and responds with a reflected packet when all of the following criteria are met:

- TWAMP Responder control is enabled (default).
- Destination MAC address equals the MAC address of the Test port.
- VLAN ID equals the VLAN ID of the Test port (if configured).
- Destination IP address equals the IP address of the Test port.
- Protocol equals UDP (17).
- UDP destination port equals the configured TWAMP Listening UDP port.

The TWAMP Light Responder test supports wire-speed operation. Unauthenticated mode is assumed.

The TWAMP Light Responder test can be enabled (default) or disabled. Refer to *twamp enable|disable* on page 71 for more information.

The UDP Listening port (default is 9495) is specified with the twamp udp-port command. Refer to *twamp udp-port value* on page 71 for more information.

UDP Echo Responder Test

The UDP Echo Responder test listens for UDP Echo messages and responds with a reflected packet when all of the following criteria (as defined in RFC962) are met:

- UDP Responder control is enabled (default).
- Destination MAC address equals the MAC address of the Test port.
- VLAN ID equals the VLAN ID of the Test port (if configured).
- Destination IP address equals the IP address of the Test port.
- Protocol is UDP (17).
- UDP destination port is 7 (UDP Echo, as per RFC862).

The UDP Echo Responder test supports wire-speed operation.

The UDP Echo Responder test can be enabled (default) or disabled. Refer to *udp-echo enable|disable* on page 71 for more information.

Ethernet OAM Handling Test

The Ethernet OAM handling test listens for Ethernet OAM messages in both Ethernet II and 802.3 LLC/SNAP frame format and responds in the received format.

No VLAN ID checking is done. The Ethernet OAM feature responds with VLAN parameters of the received packet. In addition, no MEG-level discrimination is done, which allows the BV10 to operate in promiscuous mode (the unit operates as a MEP at multiple levels without any MEG-level configuration).

Ethernet OAM handling can be globally enabled (default) or disabled. Refer to *eth-oam enable|disable* on page 72 for more information.

The BV10 listens for and responds to the following Ethernet OAM messages:

- Loopback

  The BV10 responds to Unicast OAM Loopback messages when all of the following criteria are met:

  - Global Ethernet OAM handling is enabled (default).
  - Destination MAC address equals the MAC address of the Test port.
  - EtherType is 0x8902.
  - OpCode is 3 (LBM).

- Frame Delay (two-way)

  The BV10 supports two-way Frame Delay. The BV10 responds to Ethernet OAM Frame Delay messages when all of the following criteria are met:

  - Global Ethernet OAM handling is enabled (default).
  - Destination MAC address equals the MAC address of the Test port.
  - EtherType is 0x8902.
  - OpCode is 47 (DMM).

- Link Trace

  The BV10 responds to Ethernet OAM Link Trace messages when all of the following criteria are met:

  - Global Ethernet OAM handling is enabled (default).
  - Destination MAC address is 01-80-C2-00-00-3y, where y is a value between [8-F] hexidecimal.
  - EtherType is 0x8902.
  - OpCode is 5 (LTM).
  - Target MAC address equals the MAC address of the Test port.
  - TTL is greater than 1.
  - LTM Egress Identifier TLV is present (Type equals 7).

9 Power Failure Recovery

In the case of a power failure, the BV10 unit:

- recovers automatically when power is restored.
- returns to the same state as before the power failure.
- maintains all configuration parameters such as Test port, Management port, and Smart Loopback mode settings.

10 Maintenance

To help ensure long, trouble-free operation:

- Always inspect fiber-optic connectors before using them and clean them if necessary.
- Keep the unit free of dust.
- Clean the unit casing and front panel with a cloth slightly dampened with water.
- Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.
- Avoid high humidity or significant temperature fluctuations.
- Avoid unnecessary shocks and vibrations.
- If any liquids are spilled on or into the unit, turn off the power immediately, disconnect from any external power source and let the unit dry completely.

WARNING

The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.

Cleaning LC Connectors

Under normal circumstances the cleaning of the LC connector is not required. However if the connector shows signs of debris or contamination, cleaning may be required.

To clean a LC/SC/MPO-24 connector

1. Use a clean dry air (CDA) or a air gun to blow out the dust or contamination.
2. Re-inspect the connector.
3. If the connector is still not clean, use a commercial cleaner recommended by the SFP manufacturer.

Note: *Refer to the transceiver manufacturer for more detailed cleaning recommendations and instructions.*

Recycling and Disposal (Applies to European Union Only)

For complete recycling/disposal information as per European Directive WEEE 2012/19/UE, visit the EXFO Web site at www.exfo.com/recycle.

11 Troubleshooting

Solving Common Problems

Before calling EXFO's technical support, please read the following common problems that can occur and their respective solution.

Problem	Possible Cause	Solution
Optical Laser LED is off and the SFP is not generating the signal.	There is a configuration mismatch between the inserted SFP and the rate selected for the test.	Ensure that the SFP is supporting the rate used for the test.
	The SFP is not compatible with the BV10-1000.	Ensure to use a compatible SFP.
CLI command returns: **Operation failed, address/netmask not permitted. Same subnet as other interface.**	LAN and TEST ports IP addresses are under same subnet or within its range.	Make sure to define IP addresses under different subnet range.

Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America).

Technical Support Group
400 Godin Avenue
Quebec (Quebec) G1M 2K2
CANADA

1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
Fax: 1 418 683-9224
support@exfo.com

For detailed information about technical support, and for a list of other worldwide locations, visit the EXFO Web site at www.exfo.com.

If you have comments or suggestions about this user documentation, you can send them to customer.feedback.manual@exfo.com.

To accelerate the process, please have information such as the name and the serial number (see the product identification label), as well as a description of your problem, close at hand.

Transportation

Maintain a temperature range within specifications when transporting the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

- Pack the unit in its original packing material when shipping.
- Avoid high humidity or large temperature fluctuations.
- Keep the unit out of direct sunlight.
- Avoid unnecessary shocks and vibrations.

12 Warranty

General Information

EXFO Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of 1 year from the date of original shipment. EXFO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, EXFO will, at its discretion, repair, replace, or issue credit for any defective product, as well as verify and adjust the product free of charge should the equipment need to be repaired or if the original calibration is erroneous. If the equipment is sent back for verification of calibration during the warranty period and found to meet all published specifications, EXFO will charge standard calibration fees.

IMPORTANT

The warranty can become null and void if:

- **unit has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel.**
- **warranty sticker has been removed.**
- **case screws, other than those specified in this guide, have been removed.**
- **case has been opened, other than as explained in this guide.**
- **unit serial number has been altered, erased, or removed.**
- **unit has been misused, neglected, or damaged by accident.**

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL EXFO BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Liability

EXFO shall not be liable for damages resulting from the use of the product, nor shall be responsible for any failure in the performance of other items to which the product is connected or the operation of any system of which the product may be a part.

EXFO shall not be liable for damages resulting from improper usage or unauthorized modification of the product, its accompanying accessories and software.

Exclusions

EXFO reserves the right to make changes in the design or construction of any of its products at any time without incurring obligation to make any changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps, batteries and universal interfaces (EUI) used with EXFO products are not covered by this warranty.

This warranty excludes failure resulting from: improper use or installation, normal wear and tear, accident, abuse, neglect, fire, water, lightning or other acts of nature, causes external to the product or other factors beyond the control of EXFO.

IMPORTANT

In the case of products equipped with optical connectors, EXFO will charge a fee for replacing connectors that were damaged due to misuse or bad cleaning.

Certification

EXFO certifies that this equipment met its published specifications at the time of shipment from the factory.

Service and Repairs

EXFO commits to providing product service and repair for five years following the date of purchase.

To send any equipment for service or repair:

1. Call one of EXFO's authorized service centers (see *EXFO Service Centers Worldwide* on page 91). Support personnel will determine if the equipment requires service, repair, or calibration.
2. If equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) number and provide an address for return.
3. If possible, back up your data before sending the unit for repair.
4. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.
5. Return the equipment, prepaid, to the address given to you by support personnel. Be sure to write the RMA number on the shipping slip. *EXFO will refuse and return any package that does not bear an RMA number.*

Note: *A test setup fee will apply to any returned unit that, after test, is found to meet the applicable specifications.*

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, you will be invoiced for the cost appearing on this report. EXFO will pay return-to-customer shipping costs for equipment under warranty. Shipping insurance is at your expense.

Routine recalibration is not included in any of the warranty plans. Since calibrations/verifications are not covered by the basic or extended warranties, you may elect to purchase FlexCare Calibration/Verification Packages for a definite period of time. Contact an authorized service center (see *EXFO Service Centers Worldwide* on page 91).

EXFO Service Centers Worldwide

If your product requires servicing, contact your nearest authorized service center.

EXFO Headquarters Service Center
400 Godin Avenue
Quebec (Quebec) G1M 2K2
CANADA

1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
Fax: 1 418 683-9224
support@exfo.com

EXFO Europe Service Center
Winchester House, School Lane
Chandlers Ford, Hampshire S053 4DG
ENGLAND

Tel.: +44 2380 246800
Fax: +44 2380 246801
support.europe@exfo.com

EXFO Telecom Equipment (Shenzhen) Ltd.
3rd Floor, Building 10,
Yu Sheng Industrial Park (Gu Shu Crossing), No. 467,
National Highway 107,
Xixiang, Bao An District,
Shenzhen, China, 518126

Tel: +86 (755) 2955 3100
Fax: +86 (755) 2955 3101
support.asia@exfo.com

To view EXFO's network of partner-operated Certified Service Centers nearest you, please consult EXFO's corporate website for the complete list of service partners:
http://www.exfo.com/support/services/instrument-services/exfo-service-centers.

A Specifications

General Specifications

BV10

Size (H x W x D)	38 mm x 103 mm x 210 mm (1 1/2 in x 4 1/16 in x 8 1/4 in)
Weight (without transceiver)	0.6 kg (1.3 lb)
Temperature Operating: Storing:	 0 °C to 50 °C (32 °F to 122 °F) -40 °C to 70 °C (-40 °F to 158 °F)
Relative humidity	5% to 95%, non-condensing
Maximum operation altitude	4000 m (13123 ft)
Pollution degree	2 (for indoor use only)
Measurement category	Not rated for measurement categories II, III, or IV.
Overvoltage category	I
AC version input power	⎓ 9 V; 1 A
DC –48 V input power	⎓ –40 - –72 V; 0.2 A
DC +24 V input power	⎓ 20 - 32 V; 0.4 A

AC/DC Adapter

Temperature Operating: Storing:	 –10 °C to 50 °C (14 °F to 122 °F) –20 °C to 85 °C (–4 °F to 185 °F)
Relative humidity	5% to 95%, non-condensing
Maximum operation altitude	2000 m (6562 ft)
Pollution degree	2 (for indoor use only)
Measurement category	Not rated for measurement categories II, III, or IV.
Overvoltage category	II[a]
Power Supply Rating[bc] Input: Output:	  100 - 240 V; 50/60 Hz; 0.7 A Max.  Output: 9 V; 1.66 A

a. AC/DC adapter must be a Listed/Certified (external direct plug-in SMPSU, Overvoltage (Installation) category II) having reinforced insulation between primary and secondary and suitably rated for the extended BV10 operating environmental conditions (altitude, temperature, and humidity) and with output rating (voltage and current) compatible with above specifications.
b. Use the external power supply indoors only.
c. No exceeding ± 10% of the nominal voltage.

Electrical Interface

Electrical interface	One 10/100/1000 Base-T port		
Tx bit rate	10 Mbit/s	125 Mbit/s	1 Gbit/s
Rx bit rate	10 Mbit/s	125 Mbit/s	1 Gbit/s
Duplex mode	Half and full duplex	Half and full duplex	Full duplex
Jitter compliance	IEEE 802.3	IEEE 802.3	IEEE 802.3
Connector	RJ-45	RJ-45	RJ-45
Maximum reach (m)	100	100	100

Optical Interface

Optical interface	One GigE port		
Available wavelengths (nm)	850, 1310 and 1550		
	1000 Base-SX	1000 Base-LX	1000 Base-ZX
Wavelength (nm)	850	1310	1550
Tx level (dBm)	–9 to –3	–9.5 to –3	0 to 5
Rx level sensitivity (dBm)	–20	–22	–22
Maximum reach	550 m	10 km	80 km
Transmission bit rate (Gbit/s)	1.25	1.25	1.25
Reception bit rate (Gbit/s)	1.25	1.25	1.25
Tx operational wavelength (nm)	830 to 860	1270 to 1360	1540 to 1570
Maximum Rx before damage (dBm)	6	6	6
Jitter compliance	IEEE 802.3	IEEE 802.3	
Ethernet classification	IEEE 802.3	IEEE 802.3	
Laser type	VCSEL	FP	DFB
Eye safety	Class 1	Class 1	Class 1
Connector	LC	LC	LC
Transceiver type	SFP	SFP	SFP

B Glossary

Acronym List

?	Help

A

A	Ampere
AC	Alternating Current
ACT	Activity
ARP	Address Resolution Protocol
AWG	American Wire Gage

B

bit/s	Bit per second

C

CAGE	Commerce And Government Entities
CDA	Clean Dry Air
CIDR	Classless Inter-Domain Routing
CLI	Command Line Interface
CO	Central Office

D

DC	Direct Current
DCE	Data Communications Equipment

CDA	Clean Dry Air
DHCP	Dynamic Host Configuration Protocol
DMM	Delay Measurement Message

E

ESD	Electrostatic Discharge
EUI	EXFO Universal Interfaces

F

FCC	Federal Communications Commission
FTP	File Transfer Protocol

G

GUI	Graphical User Interface

I

ICMP	Internet Control Message Protocol
ID	Identification
IEC	International Electrotechnical Commission
in	inches
IN	Input
IP	Internet Protocol

K

kg	Kilogram

L

LAN	Local Area Network
LBM	Loopback Message
LC	Lucent Connector
LED	Light-Emitting Diode
lb	Pound
LTM	Link Trace Message

M

MAC	Media Access Control
Mbit/s	Megabit per second
MDI	Media Dependant Interface (straight through Ethernet cable)
MDIX	Media Dependant Interface Crossover (crossover Ethernet cable)
MEG	ME Group
MEP	MEG End Point

N

NATO	North Atlantic Treaty Organization
nm	Nanometer

O

OAM	Operation, Administration, and Maintenance
OUT	OUTput

P

PC	Personal Computer

R

RMA	Return Merchandise Authorization
rtt	Round-trip time
RX	Receive

S

SFP	Small Form Factor Pluggable
SSH	Secure Shell

T

TCP	Transport Control Protocol
TFTP	Trivial File Transfer Protocol
TLV	Type, Length, and Value
TTL	Time To Live
TWAMP	Two-Way Active Measurement Protocol
TX	Transmit

U

UDP	User Data Protocol
USA	United States of America
UTP	Unshielded Twisted Pairs

V

V	Volt
VLAN	Virtual Local Area Network

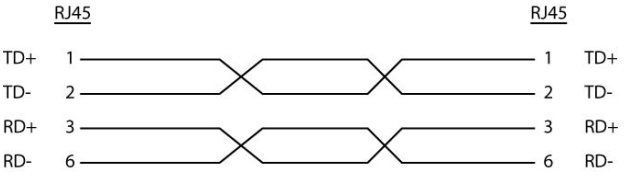
Ethernet Cables

Minimum Category 3 cable is required for 10Base-T connection while Category 5 cable is required for 100Base-TX and 1000Base-T connections.

Maximum cable length (between two nodes) for 10Base-T, 100Base-TX, or 1000Base-T connection is 328 feet (100 meters).

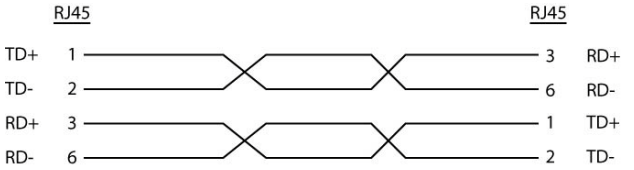
➤ Straight Through Cable (10/100 Mbit/s)

An Unshielded Twisted Pair (UTP) straight through cable is required to connect a 10Base-T/100Base-TX BV10 port to a layer 1 or 2 device (ex: HUB, switch).

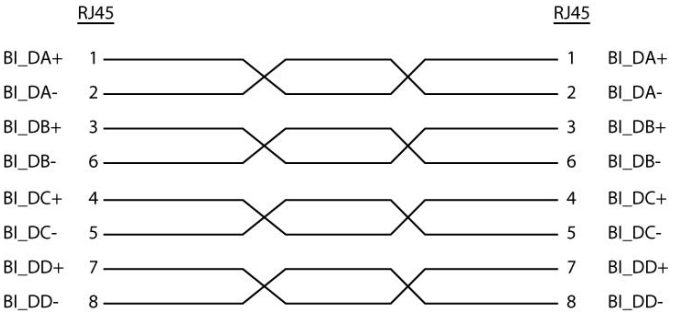


➤ Crossover Cable (10/100 Mbit/s)

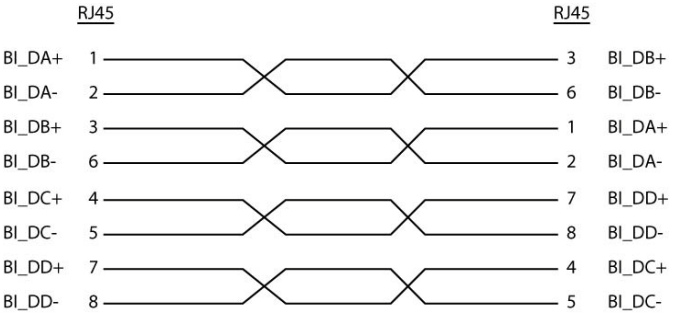
An Unshielded Twisted Pair (UTP) crossover cable is required to connect the 10Base-T/100Base-TX BV10 port to a layer 3 device (ex: router).



➤ Straight Through Cable (1000 Mbit/s)



➤ Crossover Cable (1000 Mbit/s)



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NOTICE

通告

CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES

中国关于危害物质限制的规定

NAMES AND CONTENTS OF THE TOXIC OR HAZARDOUS SUBSTANCES OR ELEMENTS CONTAINED IN THIS EXFO PRODUCT

包含在本 **EXFO** 产品中的有毒有害物质或元素的名称和含量

O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

Part Name 部件名称	Toxic or hazardous Substances and Elements 有毒有害物质和元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 隔 (Cd)	Hexavalent Chromium 六价铬 (Cr VI)	Polybrominated biphenyls 多溴联苯 (PBB)	Polybrominated diphenyl ethers 多溴二苯醚 (PBDE)
Enclosure 外壳	O	O	O	O	O	O
Electronic and electrical sub-assembly 电子和电子组件	X	O	X	O	X	X
Optical sub-assembly[a] 光学组件 [a]	X	O	O	O	O	O
Mechanical sub-assembly[a] 机械组件 [a]	O	O	O	O	O	O

a. If applicable.
如果适用。

MARKING REQUIREMENTS
标注要求

Product 产品	Environmental protection use period (years) 环境保护使用期限 (年)	Logo 标志
This EXFO product 本 EXFO 产品	10	
Battery[a] 电池 [a]	5	

a. If applicable.
如果适用。

P/N: 1067241

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