INTELLIGENT MEDIA CONVERTER™
“redundant twister”™
MODULES

Installation & User Guide

CUSTOMER SUPPORT INFORMATION
Order toll-free in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: 877-877-BBOX
FREE technical support, 24 hours a day, 7 days a week: Call 724-746-5500 or fax 724-746-0746
Mail order: Black Box Corporation, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: www.blackbox.com • E-mail: info@blackbox.com
# Table of Contents

## Intelligent “redundant twister” Module

### Installation & User Guide

#### Product Overview

4

#### Installation Guide

7

- STEP 1: Unpacking the Intelligent “redundant twister” Module .. 7
- STEP 2: Setting the DIP Switches ................................. 7
- STEP 3: Setting the MDI-II/MDI-X Switch ........................ 10
- STEP 4: Installing the Intelligent “redundant twister” Module .. 12
- STEP 5: Connecting to the Network ................................. 13

#### User Guide

15

- Module LED Operation .............................................. 15
- Reset Push Button .................................................... 16
- Link Loss Carry Forward (LLCF) ................................. 17
- Topology Solutions .................................................... 18
- Technical Specifications .............................................. 19
- Product Safety, EMC and Compliance Statements .......... 21
The Intelligent “redundant twister” Module offers the resiliency of data link redundancy to ensure network integrity with no down time. This link duplication provides the non-stop networking capability essential for high priority traffic and mission-critical applications. The Intelligent “redundant twister” Modules provide full redundant data paths for Ethernet or Fast Ethernet devices. The Fast Ethernet Intelligent “redundant twister” Modules also provide 100BASE-TX to FX conversion. The Intelligent “redundant twister” Module actively monitors the primary link and if it fails, automatically activates the secondary link without interruption to network operation. The addition of management functionality allows communication between the chassis and a management station providing software control over the Intelligent “redundant twister” Module configuration and notification of a failure to the management station.

The Intelligent “redundant twister” Module has the following features:

- Can be configured to operate in Dynamic Recovery Mode (DRM) to ensure session integrity and increased uptime.
- Can be configured to operate in Network Select Mode (NSM) to redirect and isolate traffic adding extra security.
- Immediately switches over from the primary link to the secondary link if the primary link fails.
- Provides minimal impact on the round trip delay for communication in half duplex collision domains.
- Fast Ethernet modules demonstrate a maximum loss of 2-3 packets (measured with minimum packet size and minimum inter-packet gap) during fail-over transition.
- Can be configured to return automatically to the primary link after the failure condition is resolved or only upon secondary failure; or manually switched back to primary after fail-over.
- Supports full and half-duplex operation.
• All twisted-pair ports are equipped with an MDI-II to MDI-X switch eliminating the need for crossover cables.

• Auto-polarity support on all twisted-pair ports.

• In addition to providing link and data on the active ports, the Intelligent “redundant twister” Module can be configured to provide link or link and redundant transmit data on the non-active port.

• Link Loss Carry Forward* enable/disable functionality.

• Functions with devices configured for auto-negotiation.

• Fused power on each module protects the system from a short circuit on a module. This prevents a faulty module from bringing down the entire system.

* Please refer to the page titled “Link Loss Carry Forward (LLCF)” in the User Guide section of this document for more detailed information.
The Intelligent “redundant twister” Module is available in six models and can be installed in any Intelligent Media Converter chassis. These models each contain a MAIN port, a PRIMARY port and a SECONDARY port. Redundancy is provided between the PRIMARY and SECONDARY ports. Because of the size of the Intelligent “redundant twister” fiber optic modules, each TX-FX module uses two slots in the chassis. The TP-TP and TX-TX modules use only one slot.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Mbps</th>
<th>Connectors</th>
<th>Maximum Supported Link Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE7111A-TP</td>
<td>10</td>
<td>RJ-45 to redundant RJ-45</td>
<td>100m/100m</td>
</tr>
<tr>
<td>LH7731A-RTX</td>
<td>100</td>
<td>RJ-45 to redundant RJ-45</td>
<td>100m/100m</td>
</tr>
<tr>
<td>LH7731A-RFXSC</td>
<td>100</td>
<td>RJ-45 to redundant FX multimode SC</td>
<td>100m/2km</td>
</tr>
<tr>
<td>LH7731A-RFXSCSM</td>
<td>100</td>
<td>RJ-45 to redundant FX singlemode SC</td>
<td>100m/15km</td>
</tr>
<tr>
<td>LH7731A-RFXST</td>
<td>100</td>
<td>RJ-45 to redundant FX multimode ST</td>
<td>100m/2km</td>
</tr>
<tr>
<td>LH7731A-RFXSTSM</td>
<td>100</td>
<td>RJ-45 to redundant FX singlemode ST</td>
<td>100m/15km</td>
</tr>
</tbody>
</table>

![Diagram](image-url)
Follow the simple steps outlined in this section of the manual to install and start using your Black Box Intelligent “redundant twister” Module.

1 Unpack the Intelligent “redundant twister” Module.
Your order has been provided with the safest possible packaging, but shipping damage does occasionally occur. Inspect your order carefully for damage that may have occurred during shipment. If you discover any shipping damage, notify the carrier and follow their instructions for damage and claims. Save the original shipping carton in case return or storage of the unit is necessary.

2 Set the DIP Switches.
A set of 5 DIP switches, located on the module board, provide user-selectable configurability options for several modes of operation. These switches are clearly marked on the module’s printed circuit board. Refer to the table on the next page for the proper setting of the DIP switches.

NOTE: When setting the DIP switches, the UP position is when the lever of the DIP switch is pushed furthest away from the circuit board. The DOWN position is when the lever of the DIP switch is pushed closest to the printed circuit board.

* DIP switches can also be managed with console commands or with NetBeacon™ Management Software. Refer to the Intelligent Media Converter™ Command Line Interface Guide, or the NetBeacon™ Management Software Installation & User Guide for software management information.
The DIP switches are marked on the printed circuit board and can be set for the following operational functions:

<table>
<thead>
<tr>
<th>Switch Name</th>
<th>Position</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
<td>UP</td>
<td>Data transmits on both the PRIMARY and SECONDARY ports simultaneously. Link on both must be enabled.</td>
</tr>
<tr>
<td></td>
<td>DOWN</td>
<td>Data transmits on the active port only.</td>
</tr>
<tr>
<td>AUTO</td>
<td>UP</td>
<td>Active port automatically reverts back to the PRIMARY port when the primary link is re-established.</td>
</tr>
<tr>
<td></td>
<td>DOWN</td>
<td>Active port will not revert back to the PRIMARY port when a primary link is re-established until the SECONDARY link fails. If the SECONDARY link does not fail, the SECONDARY port remains active. Use the RESET push button located on the front of the module to force the active port back to the PRIMARY port and clear the SW LED.</td>
</tr>
<tr>
<td>LINK</td>
<td>UP</td>
<td>Link symbols are sent out on both the PRIMARY and SECONDARY ports (i.e. Link is sent out both ports).</td>
</tr>
<tr>
<td></td>
<td>DOWN</td>
<td>Link symbols are sent out on the active port only. With the LINK switch in this position, data is not transmitted out the non-active port regardless of the TX switch setting.</td>
</tr>
<tr>
<td>LLCF</td>
<td>UP</td>
<td>Link Loss Carry Forward is enabled.</td>
</tr>
<tr>
<td></td>
<td>DOWN</td>
<td>Link Loss Carry Forward is disabled.</td>
</tr>
</tbody>
</table>

* When setting the DIP switches, the UP position is when the lever of the DIP switch is pushed furthest away from the circuit board. The DOWN position is when the lever of the DIP switch is pushed closest to the printed circuit board.
<table>
<thead>
<tr>
<th>RED</th>
<th>UP (default)</th>
<th>Operates in Dynamic Recovery Mode (DRM). If the PRIMARY link fails, the SECONDARY port becomes active. Refer to the description of the AUTO switch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOWN</td>
<td>Operates in Network Select Mode (NSM). Use the RESET push button to toggle between PRIMARY and SECONDARY. In NSM, the AUTO switch sets the initial active port on power up. Up is SECONDARY and down is PRIMARY. Note that the SW LED remains off in the Network Select Mode.</td>
<td></td>
</tr>
</tbody>
</table>

**DIP Switches**

**RJ-45**

**FX SC (ST)**
Set the MDI-II/MDI-X Switch.

For every twisted-pair port, a switch is used to implement the transmit and receive crossover functionality. The switch is positioned just behind its associated RJ-45 connector. On TX-FX modules, the switch is hidden from direct view by the smaller daughter circuit board. Use a small paperclip for easy access. Refer to the illustration below for the location of the MDI-II/MDI-X switch(es):
The switch connects the transmit and receive signal pairs in either straight through or crossover configurations.

The signal routing is as follows:

<table>
<thead>
<tr>
<th>Switch Position</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TX- to TX-</td>
</tr>
<tr>
<td></td>
<td>RX+ to RX+</td>
</tr>
<tr>
<td></td>
<td>RX- to RX-</td>
</tr>
<tr>
<td>X</td>
<td>TX+ to RX+</td>
</tr>
<tr>
<td></td>
<td>TX- to RX-</td>
</tr>
<tr>
<td></td>
<td>RX+ to TX+</td>
</tr>
<tr>
<td></td>
<td>RX- to TX-</td>
</tr>
</tbody>
</table>

When setting the MDI-II/MDI-X switch, observe the positioning of the following symbols:
- the parallel symbol (||) indicates a straight through or parallel connection (*default*)
- the cross symbol (X) indicates a crossover connection.

These two symbols are clearly marked on the printed circuit board. Simply slide the switch in the direction of the appropriate symbol. Because of the smaller space between boards on TX-FX modules, use a paperclip to reach in and push or pull the switch toward the appropriate symbol.
Install the Intelligent “redundant twister” Module.

Intelligent “redundant twister” Modules offer the ease of plug-and-play installation and are hot-swappable. All modules must be firmly secured to the chassis before network connections are made. Follow the simple steps outlined below to install the Intelligent “redundant twister” Module:

**NOTE:** Each TX-FX module uses two slots in the chassis. The TX-TX module uses only one.

- Grasp the module by the front panel as shown.

- Insert the module into a slot on the chassis making sure that the top and bottom edges of the main module board are aligned with the top and bottom card guides in the chassis. Do not force the module into the chassis unnecessarily. It should slide in easily and evenly.

- Slide the module in until the top and bottom edges of the front panel are flush and even with the top and bottom edges of the chassis.

- Turn the thumbscrew clockwise until it is snug to secure the module to the chassis.

- The Intelligent “redundant twister” Module is now properly installed and ready for connection to the network.
5 Connect to the Network.

A total of three connections must be made on the front panel when connecting the Intelligent “redundant twister” Module to the network. Be sure that all modules are firmly secured to the chassis before making network connections.

- Connect to the MAIN port.
  Each Intelligent “redundant twister” Module provides one shielded RJ-45 jack for 10BASE-T/100BASE-TX connections and supports a maximum segment length of 100 meters over Category 3, 4 or 5 Twisted-pair Cable for 10Mbps and Category 5 Twisted-pair Cable for 100Mbps.

Refer to STEP 3 for MDI-II to MDI-X switch functionality. Before making the proper twisted-pair connection, you must verify the port configuration of the connected device.

<table>
<thead>
<tr>
<th>Embedded Parallel Function</th>
<th>Embedded Crossover Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device with Straight Through TP Port Configuration</td>
<td>redundant twister TP Port Configuration</td>
</tr>
<tr>
<td>1</td>
<td>TD+</td>
</tr>
<tr>
<td>2</td>
<td>TD-</td>
</tr>
<tr>
<td>3</td>
<td>RD+</td>
</tr>
<tr>
<td>6</td>
<td>RD-</td>
</tr>
<tr>
<td>Typical Hub TP Port Configuration</td>
<td>redundant twister TP Port Configuration</td>
</tr>
<tr>
<td>1</td>
<td>MDI</td>
</tr>
<tr>
<td>2</td>
<td>TD+</td>
</tr>
<tr>
<td>3</td>
<td>TD-</td>
</tr>
<tr>
<td>6</td>
<td>RD+</td>
</tr>
</tbody>
</table>

A device that is wired straight through, needs one crossover connection:

- If the cable is straight through, the MDI-II to MDI-X Switch Setting should be X.
- If the cable is crossover, the MDI-II to MDI-X Switch Setting should be II.

A device that is wired crossover, needs a parallel connection:

- If the cable is straight through, the MDI-II to MDI-X Switch Setting should be II.
- If the cable is crossover, the MDI-II to MDI-X Switch Setting should be X.

If you do not know the internal wiring configuration of the other device’s RJ-45 port, consult the product documentation.

- Connect to the PRIMARY port.
- Connect to the SECONDARY port.

The LE7111A-TP and LH7731A-RTX Intelligent “redundant twister” Modules provide two additional RJ-45 jacks for 10BASE-T/100BASE-TX connections and support a maximum segment length of 100 meters over Category 3, 4 or 5 Twisted-pair Cable for 10Mbps and Category 5 Twisted-pair Cable for 100Mbps.
The LH7731A-RFXSC and LH7731A-RFXST Intelligent “redundant twister” Modules provide two sets of 100BASE-FX multimode SC or ST connectors that support a maximum segment length of up to 2km.

The LH7731A-RFXSCSM and LH7731A-RFXSTSM Intelligent “redundant twister” Modules provide two sets of 100BASE-FX singlemode SC or ST connectors that support a maximum segment length of up to 15km.

When making fiber optic connections, be sure that the transmit (TX) optical conductor of the intelligent “redundant twister” module connects to the receive (RX) optical conductor of the connected device; and be sure that the transmit (TX) optical conductor of the device connects to the receive (RX) optical conductor of the Intelligent “redundant twister” Module for both the PRIMARY and SECONDARY links.

Use the Link (LK) LEDs on the front panel of the module to verify correct segment connectivity. As you insert the cable into each port, the LK LED illuminates provided there is power being applied to the chassis and that there is an active device connected to the other end of the cable sending idle link symbols.
Module LED Operation
Several LEDs are visible from the front panel. These include SW, PWR, SECONDARY, LK and AT LEDs. There are separate LK and AT LEDs for each of the three ports (MAIN, PRIMARY and SECONDARY). Refer to the table below for a description of each:

<table>
<thead>
<tr>
<th>LED Label</th>
<th>Color (Status)</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>Amber (steady)</td>
<td>SECONDARY port was the active port at some point. This LED functions in Dynamic Recovery Mode (DRM) only.</td>
</tr>
<tr>
<td>PWR</td>
<td>Green (steady)</td>
<td>Power ON</td>
</tr>
<tr>
<td>SECONDARY</td>
<td>Green (steady)</td>
<td>ON SECONDARY active</td>
</tr>
<tr>
<td>(MAIN) LK</td>
<td>Green (steady)</td>
<td>Receive link present</td>
</tr>
<tr>
<td>(MAIN) AT</td>
<td>Green (blinking)</td>
<td>Receiving data</td>
</tr>
<tr>
<td>(PRIMARY) LK</td>
<td>Green (steady)</td>
<td>Receive link present</td>
</tr>
<tr>
<td>(PRIMARY) AT</td>
<td>Green (blinking)</td>
<td>Receiving data</td>
</tr>
<tr>
<td>(SECONDARY) LK</td>
<td>Green (steady)</td>
<td>Receive link present</td>
</tr>
<tr>
<td>(SECONDARY) AT</td>
<td>Green (blinking)</td>
<td>Receiving data</td>
</tr>
</tbody>
</table>
**Reset Push Button**

A small RESET push button is located on the front panel of the Intelligent “redundant twister” Module. When used in conjunction with the module’s SW and SECONDARY LEDs, and the AUTO DIP switch setting, this push button allows a network administrator to effectively maintain or troubleshoot a PRIMARY link connection.

Because of its small size and recessed placement within the front panel, press the RESET push button with the tip of a pointed object. Pushing and holding the RESET push button has no effect. It is the act of pressing the push button that causes a reset.

In the event of a PRIMARY link failure, pressing the RESET push button has the following effect:

<table>
<thead>
<tr>
<th>If the AUTO switch is UP and RED switch is UP</th>
<th>The active port automatically reverts to PRIMARY when primary link is re-established and pressing the RESET switch clears the SW LED.</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the AUTO switch is DOWN and RED switch is UP</td>
<td>The active port does not automatically revert to PRIMARY when a primary link is re-established. Pressing the RESET switch clears the SW LED and the SECONDARY LED and forces the PRIMARY port to be the active port. If the SECONDARY link is disabled, it reverts to the PRIMARY if the PRIMARY has a good link.</td>
</tr>
<tr>
<td>If there is only a SECONDARY link, then the SW and SECONDARY LEDs remain illuminated and pressing the RESET switch has no effect.</td>
<td></td>
</tr>
<tr>
<td>If the RED switch is DOWN</td>
<td>The module operates in Network Select Mode (NSM). The RESET push button toggles the active link between the PRIMARY and SECONDARY ports. Note that the SW LED remains off during Network Select Mode (NSM) operation.</td>
</tr>
</tbody>
</table>
**Link Loss Carry Forward (LLCF)**

The Intelligent “redundant twister” Modules have been designed with an LLCF function for troubleshooting a remote connection. The modules are shipped with the LLCF disabled.

When LLCF is enabled, the fiber optic ports as well as the twisted-pair ports on the module do not transmit a link signal until they receive a link signal from the opposite port. For example, if LLCF is enabled and two Intelligent “redundant twister” Modules are connected via a fiber cable with nothing else connected to them, the Link LED does **not** illuminate. When a valid link is established at the twisted-pair port, a complete connection is accomplished.

The diagram below shows a typical network configuration using an Intelligent “redundant twister” Module for remote connectivity:

![Network Diagram](image)

If the fiber connection breaks, or the remote device fails, the Intelligent “redundant twister” Module carries that link loss all the way to the switch/hub which generates a trap to the management station. The administrator can then look at the module to determine the source of the loss.

**IMPORTANT:** When connecting a “redundant twister” Module to a port that supports auto-negotiation, it is strongly recommended to fix the port setting to the appropriate speed (100Mbps or 10Mbps) and to either full or half-duplex. This allows the “redundant twister” Module to sense receive link and select the active port.
**Topology Solution**

Server Cluster A  
Server Cluster B  

Servers with 100Mbps NICs  

Intelligent Media Converter with "redundant twister" Modules  

Secondary F/O Link A  
Primary F/O Link A  

Secondary F/O Link B  
Primary F/O Link B  

100Mbps F/O Switch  

PC running Network Management Software  

Enterprise Switch  

Intelligent Media Converter with "redundant twister" Modules  

Secondary F/O Link B  
Primary F/O Link B  

100Mbps F/O Switch  

Enterprise Switch  

Intelligent Media Converter with "redundant twister" Modules  

Secondary F/O Link B  
Primary F/O Link B  

100Mbps F/O Switch  

Enterprise Switch
Technical Specifications

Data Rate

<table>
<thead>
<tr>
<th>Interface</th>
<th>Half-duplex</th>
<th>Full-duplex</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE7111A-TP</td>
<td>10Mbps</td>
<td>20Mbps</td>
</tr>
<tr>
<td>LH7731A-XX</td>
<td>100Mbps</td>
<td>200Mbps</td>
</tr>
</tbody>
</table>

10Mbps Twisted-Pair Interface (LE7111A-TP)

- **Connector**: Shielded RJ-45, 8-pin jack
- **Impedance**: 100 Ohms nominal
- **Signal Level Output** (differential): 2.2 to 2.8V
- **Signal Level Input**: .3 to 3.1V p-p
- **Supported Link Length**: 100m
- **Cable Type**: Category 3, 4, or 5 UTP

100Mbps Twisted-Pair Interface (LH7731A-XX)

- **Connector**: Shielded RJ-45, 8-pin jack
- **Impedance**: 100 Ohms nominal
- **Signal Level Output** (differential): .95 to 1.05V
- **Signal Level Input**: 350mV minimum
- **Supported Link Length**: 100m
- **Cable Type**: Category 5 UTP

100Mbps Multimode Fiber Optic Interface (LH7731A-XX)

- **Connector**: ST or SC
- **RX Input Sensitivity**: -31 dBm peak minimum
- **Output Power**: -14 dBm to -23.5 dBm (50/125 µm)
  - -14 dBm to -20 dBm (62.5/125 µm)
- **Supported Link Length**: up to 2km full duplex
- **Cable Type**: 50/125, 62.5/125, 100/140 µm F/O

100Mbps Singlemode Fiber Optic Interface (7731-XX)

- **Connector**: ST or SC
- **RX Input Sensitivity**: -31 dBm peak minimum
- **Output Power**: -8 dBm to -15 dBm (9/125 µm)
- **Supported Link Length**: up to 15km full duplex
- **Cable Type**: 8.3/125, 8.7/125, 9/125, 10/125 µm F/O
**Power Requirements**

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage (VDC)</th>
<th>Current (Amps)</th>
<th>Power (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE7111A-TP</td>
<td>5</td>
<td>0.750</td>
<td>3.75</td>
</tr>
<tr>
<td>LH7731A-RTX</td>
<td>5</td>
<td>0.750</td>
<td>3.75</td>
</tr>
<tr>
<td>LH7731A-RFXSC</td>
<td>5</td>
<td>1.300</td>
<td>6.50</td>
</tr>
<tr>
<td>LH7731A-RFXSCSM</td>
<td>5</td>
<td>1.300</td>
<td>6.50</td>
</tr>
<tr>
<td>LH7731A-RFXST</td>
<td>5</td>
<td>1.300</td>
<td>6.50</td>
</tr>
<tr>
<td>LH7731A-RFXSTSM</td>
<td>5</td>
<td>1.300</td>
<td>6.50</td>
</tr>
</tbody>
</table>

**Environmental**

- **Operating Temperature**: 0 – 50°C
- **Storage Temperature**: -30 – 70°C
- **Operating Humidity**: 5% – 95% non-condensing
- **Weight**: 5 oz.
Product Safety, EMC and Compliance Statements

This equipment complies with the following requirements:

- UL
- CSA
- EN60950 (safety)
- FCC Part 15, Class A
- EN55022 Class A (emissions)
- EN50082-1 (immunity)
- IEEE 802.3/802.3u
- IEC 825-1 Classification
  Class 1 Laser Product

Radio Frequency Interference Statements

FCC Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of FCC Rules. These limits 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 instruction manual, may cause harmful interference to radio communication. 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.

CAUTION: Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Canadian Radio Frequency Interference Statement

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.