BLACK BOX NETWORK SERVICES

LMC5022C-R3 LMC5110C-R3 LMC5116C-R3 LMC5182C-R3
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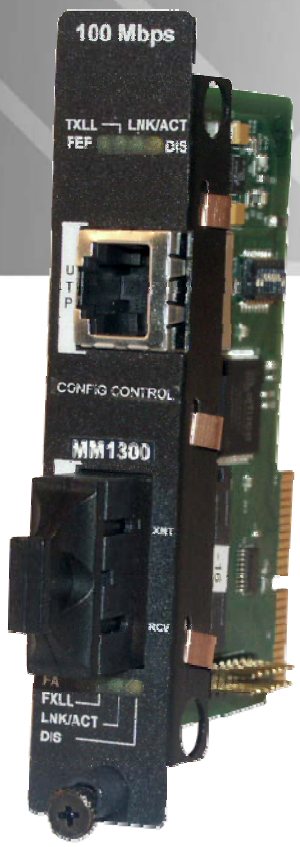
High-Density Media Converter System II Layer 2 Modules

True Layer 2 conversion enables you to extend your network up to 40 kilometers over duplex fiber.



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FCC and Industry Canada RF Interference Statements

Class B Digital Device. This equipment has been tested and found to comply with the limits for a Class B computing device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or telephone reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult an experienced radio/TV technician for help.

CAUTION

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

To meet FCC requirements, shielded cables and power cords are required to connect this device to a personal computer or other Class B certified device.

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Certifications

CE

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European Directive 2002/96/EC (WEEE) requires that any equipment that bears this symbol on product or packaging must not be disposed of with unsorted municipal waste. This symbol indicates that the equipment should be disposed of separately from regular household waste. It is the consumer's responsibility to dispose of this and all equipment so marked through designated collection facilities appointed by government or local authorities. Following these steps through proper disposal and recycling will help prevent potential negative consequences to the environment and human health. For more detailed information about proper disposal, please contact local authorities, waste disposal services, or the point of purchase for this equipment.

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Part Numbers

Part Number	Description
LMC5022C-R3	TX/FX-MM1300-ST
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LMC5026C-R3	TX/FX-SM1310/PLUS-ST
LMC5027C-R3	TX/FX-SM1310/PLUS-SC
LMC5110C-R3	TX/FX-SM1310/LONG-SC
LMC5111C-R3	TX/FX-SM1310/LONG-ST
LMC5113C-R3	TX/SSFX-SM1310-SC (1310xmt/1550rcv)
LMC5114C-R3	TX/SSFX-SM1550-SC (1550xmt/1310rcv)
LMC5116C-R3	TX/SSFX-SM1310/PLUS-SC (1310xmt/1550rcv)
LMC5117C-R3	TX/SSFX-SM1550/PLUS-SC (1550xmt/1310rcv)
LMC5180C-R3	TX/FX-SM1550/LONG-SC
LMC5181C-R3	TX/FX-MM850-SC
LMC5182C-R3	TX/FX-MM850-ST

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1. Specifications

DC Input	L2 w/LFPT: 0.80 Amp @ 5V
Operating Temperature:	+32° F to +122° F (0° C to +50° C)
Storage Temperature:	0° F to +122° F (-20° C to +70° C)
Humidity:	5 - 95% (non-condensing)
Fiber Optic Specifications	For fiber optic specifications, please visit: http://www.blackbox.com

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2. Overview: About the High-Density Media Converter System II Layer 2 Modules

The L2 is a Fast Ethernet module which provides a single conversion between 100BASE-TX twisted pair and 100BASE-FX/SX single-mode or multi-mode fiber. Each L2 includes one RJ-45 connector and one pair of ST or SC fiber optic connectors

Also available in a single-strand fiber version, L2 TX/SSFX allows two wavelengths to share one fiber strand — Full-Duplex data travels on different wavelengths, for example (1310 nm and 1550 nm) — doubling the capacity of fiber.

The L2 is SNMP-manageable and can be installed into the modular, SNMP-manageable High-Density Media Converter System II Layer 2 chassis, which is unmanaged.

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3. Configuration

The L2 has user-configurable features (e.g., FiberAlert (FA), TX LinkLoss (TXLL), FX LinkLoss (FXLL), Link Fault Pass-Through (LFPT) and Far End Fault (FEF)). Refer to the Managed Media Converter Module DIP Switch Configuration Table for information on available features. Instructions for installing and configuring both managed (via an SNMP-compatible management application like iView²) and unmanaged modules follow.

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4. Install the High-Density Media Converter System II Layer 2 Modules

The Managed Media Converter Modules install in Black Box SNMP manageable High-Density Media Converter System II chassis.

NOTE
All modules are hot-swappable.

To install a Managed Media Converter Module:

1. Remove the blank bracket covering the slot where the module is to be installed by removing the screws on the outside edges of the bracket.
2. Slide the Managed Media Converter Modules into the chassis, via the cardguides, until the module is seated securely in the connector.
3. Secure the module to the chassis by tightening the captive screw.
4. Save any “blanks” removed during installation for future use if the configuration requirements change

4.1 Managed Modules

To manage one or more L2(s), an SNMP agent must be present in the chassis. To configure Managed Modules, install the module first, and then configure using the management software.

All Fiber Type information is now loaded into the NVRAM during manufacturing. This is viewed only via iView² software, within the modules details.

Requirements:

- SNMP Firmware version C2
- iView² 1.8.6 or higher

4.1.1 Configuration Control and SNMP Management

Some High Density L2 Modules offer Configuration Control; labels on the front faceplate are identified as such. Configuration Control has been implemented to assist the end user by retaining the latest configuration regardless of how that configuration was implemented (via DIP Switch settings or SNMP), when an SNMP Management Module is present in a managed chassis.

Historically, if an SNMP Management Module was installed in a chassis, SNMP would override the DIP Switch settings of a module. Using Configuration Control, the end user has three conditions under which the configuration of an SNMP Manageable Module may be impacted:

- Changing or installing an SNMP Management Module into a chassis with a High Density L2 Modules with Configuration Control populated in a chassis
  - The High Density L2 Module with Configuration Control will transfer its saved configurations to the SNMP Management Module. If there is no

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SNMP Management Module, the High Density L2 Module with Configuration Control will function based on its DIP Switch settings. If the DIP Switches have not been changed, the stored configuration will be used. The stored configuration can be extracted from the SNMP Management Module or the DIP Switches.

- Replacing the same type of a High Density L2 Module with Configuration Control
  - If the DIP Switch settings are the same as the settings on the removed High Density L2 Module, the new High Density L2 Modules with Configuration Control gets its configuration settings from the SNMP Management Module.
  - If the DIP Switch settings are different, then the configuration of the module is determined by the DIP Switch settings. (The settings are forwarded to the SNMP Management Module and the values are saved.)

- Installing a different model of a High Density L2 Module with Configuration Control
  - If another type of module is installed into the same slot in a chassis, the SNMP Management Module clears the memory of the previous configuration for that slot; the installed SNMP Manageable Module configures itself, and its configuration is forwarded to the SNMP Management Module, where the values are saved.

The SNMP Write Lock switch does not impact any High Density L2 Module or High Density L2 Module with Configuration Control. Removing and installing a new SNMP Management Module will no longer impact these modules either. However, if there is a mixture of High Density L2 Modules with and without Configuration Control, the Write Lock Switch and a new SNMP Management Module must be taken into consideration.

If the command cleandb is applied to an SNMP Management Module, all the settings for the modules will be removed, but the Configuration Control modules will still be based on the last change made, while those without Configuration Control will be set to their default settings.

4.2 Unmanaged Modules

Before installing, configure the L2 modules for desired features. The table on the next page indicates the available features and settings for the L2 modules. After configuring the DIP Switches for the desired settings, install the module and connect the appropriate cables (refer to the Installating a High-Density Media Converter System II Layer 2 section for more information).

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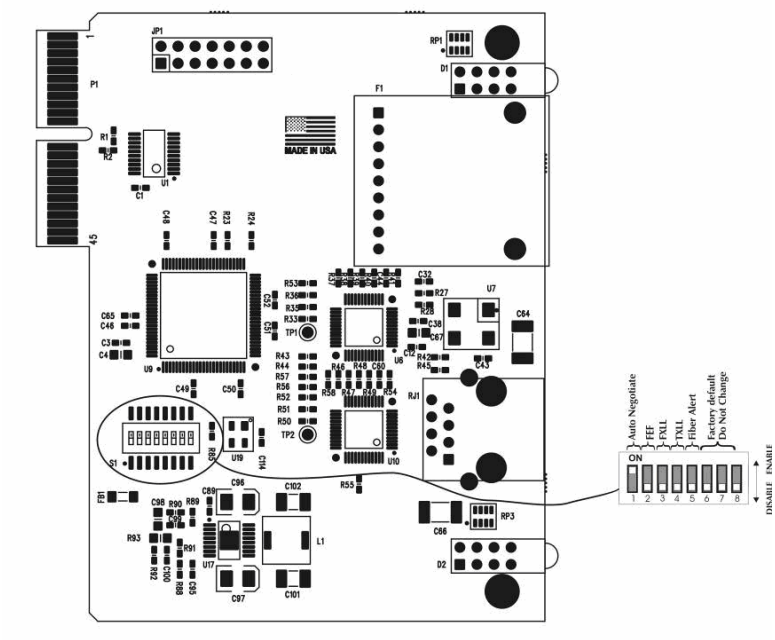

DIP Switch on S1	Feature	Default Setting
1	Auto Negotiation (AN)	ON
2	Far End Fault (FEF)	OFF
3	FX LinkLoss (FXLL)	OFF
4	TX LinkLoss (TXLL)	OFF
5	FiberAlert (FA)	OFF
6	Factory Default	OFF
7	Factory Default	OFF
8	Factory Default	OFF

4.3 FX LinkLoss, TX LinkLoss, Link Fault Pass-Through, Far End Fault and FiberAlert

L2 modules include the troubleshooting features FiberAlert, TXLL, FXLL, FEF and LFPT that help locate silent failures on a network. Before attempting to install the module(s), understand how these features work and react to a specific network configuration.

4.3.1 Link Integrity

During normal operation, link integrity pulses are transmitted by all point-to-point Ethernet devices. When a Black Box media converter receives valid link

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pulses, it knows that the device to which it is connected is up and sending pulses, and that the copper or fiber cable coming from that device is intact. The appropriate “LNK” (link) LED is lit to indicate this.

The Black Box media converter also sends out link pulses from its copper and fiber transmitters, but normally has no way of knowing whether the cable to the other device is intact and the link pulses are reaching the other end. The combination of FiberAlert and LinkLoss allows this information to be obtained even when physical access to a remote device (and its link integrity LED) is not available.

4.3.2 FX LinkLoss (FXLL)

FX LinkLoss is a troubleshooting feature. When enabled, if a fault occurs on the fiber segment of a conversation, FX LinkLoss detects the fault and passes this information to the twisted pair segment. If a media converter is not receiving a fiber link, FX LinkLoss disables the transmitter on the media converter’s twisted pair port. This results in a loss of link on the device connected to the twisted pair port.

4.3.3 TX LinkLoss (TXLL)

TX LinkLoss is a troubleshooting feature. When enabled, if a fault occurs on the twisted pair segment of a conversion, TX LinkLoss detects the fault and passes this information to the fiber segment. If a media converter is not receiving a twisted pair link, TX LinkLoss disables the transmitter on the media converter's fiber port. The result is in a loss of the link on the device connected to the fiber port.

4.3.4 Link Fault Pass-Through (LFPT)

Link Fault Pass-Through (LFPT) is a troubleshooting feature that combines TX and FX LinkLoss from both the local and remote L2 modules. LFPT is enabled by turning on both FX and TX LinkLoss on both modules. This feature allows either end of the conversion to detect a link fault occurring at the other end of the media conversion chain.

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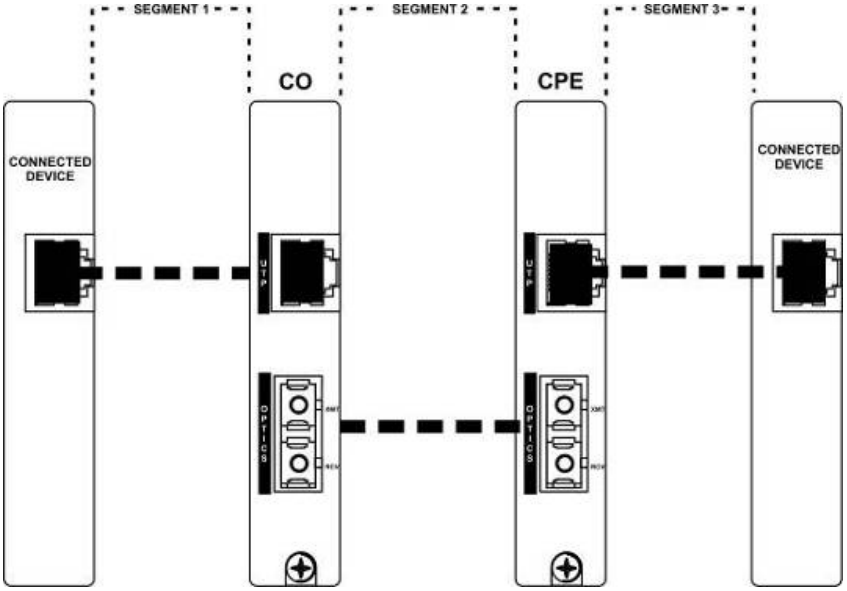


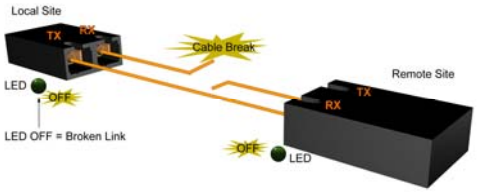
Regardless if there is a break in segment 1, 2 or 3, the link will drop on the switches at both ends. The link fault is passed through the media conversion and is observed at each end. It acts just like it would if the devices were directly connected.

For more information on LinkLoss/FiberAlert, visit the Black Box Web site at http://www.blackbox.com. If unsure of how to implement these features in a specific configuration, contact Black Box Technical Support at 877-877-2269.

4.3.5 FiberAlert and Far End Fault

Modules ship from the factory with troubleshooting features disabled.

FiberAlert (FA)



FiberAlert minimizes the problems associated with the loss of one strand of fiber. If a strand is unavailable, the Black Box device at the receiver end notes the loss of link. The device will then stop transmitting data and the link signal until a signal or link pulse is received. The result is that the link LED on BOTH sides of the fiber connection will go out indicating a fault somewhere in the fiber loop. Using FiberAlert, a local site administrator is notified of a fault and can quickly determine where a cable fault is located.

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WARNING
Enable FiberAlert at the remote side of a media conversion only. Enabling it on both sides would keep both transmitters disabled indefinitely.

By default FA is disabled. When enabled if, a fault occurs on the fiber line, affecting data in one direction, FA stops sending signal in the opposite direction. FXLL will act on this lack of signal, propagating the loss of like to the copper port when FXLL is enabled.

Far End Fault
By default, FEF is disabled. When enabled, and a fault occurs on the fiber line, affecting data in one direction, an FEF signal will be sent in the opposite direction, indicating the fault. FXLL will act on this signal propagating the loss of link to the copper port when FXLL is enabled.

FEF versus FA
FEF is preferred when the devices at both ends of the fiber can interpret the FEF signal. This allows FEF to be turned on at both ends, which will engage the FEF regardless of which direction the fault occurs. (Please refer to diagram on previous page) For example if a fault should occur on segment 2 in the direction of segment 1 to 3, FEF would be engaged on the L2 between segment 2 and 3. This would then send a signal back to the L2 between segment 1 and 2. If the L2 between segment 1 and 2 is in a managed chassis, the chassis would send a trap that the port is down. Alternatively, if the L2 is not in a managed chassis, FXLL could be engaged to propagate the fault onto the copper port; this would cause segment 1 to show no link on both ends.

FA is used when connecting to a device that does not support FEF. If an FEF signal is sent to a device that does not support FEF, the device acts as if there is still a good connection. The FEF signal is mistaken for data. FA works similar to FEF, in that when there is a fault in one direction of the fiber, it acts on the fiber in the opposite direction. But unlike FEF, FA sends no signal. Because of this, FA can not be enabled on both ends. If it is enabled and a fault occurs, FA will turn signal off in the opposite direction; the device on the other side of the fiber will see the loss of signal and engage FA, turning off signal. The net result will be the signal turned off in both directions, even after the fault has been repaired.

It is highly recommended that only one is chosen, either FEF or FA. If both are selected FA will take precedence over FEF.

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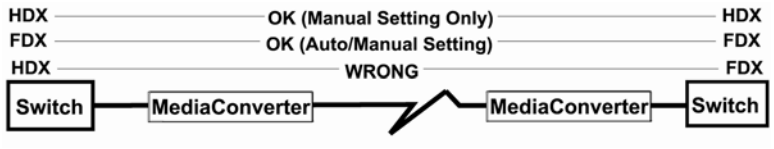
4.4 Auto Negotiation on High-Density Media Converter System II Layer 2 Modules

L2 modules include the feature Auto Negotiation. When Auto Negotiation is enabled, the module negotiates as a 100 Mbps full-duplex device. If the connected device can operate at 100 Mbps full-duplex, a link is established. Auto Negotiation (DIP Switch #1) is enabled by default.

If the twisted pair port on the other device does not have the ability to Auto Negotiate or if the 100 Mbps half-duplex connection is desired, then Auto Negotiation must be disabled. Half- and full-duplex settings must be set manually and match on both devices.

The following diagram shows a typical application and with three possible configurations.



End-to-End Connection	Switch	TX/FX
Half-Duplex	Configure HDX manually	Auto Negotiation is OFF
Full-Duplex	Configure FDX manually	Auto Negotiation is OFF
Full-Duplex	Auto Negotiation is ON	Auto Negotiation is ON

Configure Auto Negotiation on a L2 by adjusting the DIP Switch setting (for unmanaged modules) or via the management software. Refer to the DIP Switch table for switch location and settings.

4.5 AutoCross Feature for Twisted Pair Connection

All twisted pair ports on the L2 includes AutoCross, a feature that automatically selects between a crossover workstation and a straight-through connection depending on the connected device.

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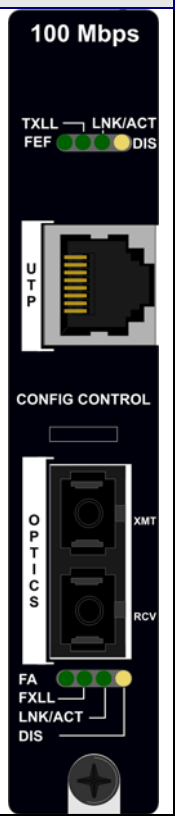
5. Operation

5.1 LED Operation

Each L2 module features diagnostic LEDs that provide information on features and ports.

Upgrade LED Stacks			
Upper	**Function**	**State**	
FEF	Fiber Far End Fault	ON Green	
TXLL	TX LinkLoss/Blink if Active	ON Green	
LNK	FiberLink is valid/Flash on Activity	ON Green	
DIS	Software Disabled TX Port	On Yellow	
Upper	**Function**	**State**	
FA	FiberAlert enabled/Blink Active	ON Green	
FXLL	FX LinkLoss/Blink if Active	ON Green	
LNK	FX LinkLoss is valid/Flash on Activity	ON Green	
DIS	Software Disabled fiber port (via iView²)	On Yellow	

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6. Troubleshooting

- During installation, first test the fiber and twisted pair connections with all troubleshooting features disabled, then enable these features, if desired, just before final installation. This will reduce the features' interference with testing.

- When working with units where the features cannot be disabled, establish both the twisted pair and fiber connections before the link LEDs will light.

- To test a L2 by itself, first, have an appropriate fiber patch cable, then follow these steps:
  1. Connect the L2 to the twisted pair device with a twisted pair cable.
  2. Loop a single strand of fiber from the transmit port to the receive port of the L2.
  3. Verify that both the twisted pair and the fiber link are lit (see LEDs, below) on the L2.

- Use the appropriate twisted pair cable, and have the crossover/pass-through switch set correctly.

- Whenever possible, set the devices connected to the L2 (hub, switch, NIC card) to the desired speed and Duplex setting, and turn Auto Negotiation OFF. Refer to Auto Negotiation on L2, also configure the devices on the opposite sides of the L2 to operate at the same speed and Duplex setting.

NOTE
Some 10/100 devices can not be set by the end user, and must Auto Negotiate to receive a signal.

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7. Contacting Black Box

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E-mail: info@blackbox.com

WARNING	
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8. Fiber Optic Cleaning Guidelines

Fiber Optic transmitters and receivers are extremely susceptible to contamination by particles of dirt or dust, which can obstruct the optic path and cause performance degradation. Good system performance requires clean optics and connector ferrules.

1. Use fiber patch cords (or connectors, if you terminate your own fiber) only from a reputable supplier; low-quality components can cause many hard-to-diagnose problems in an installation.
2. Dust caps are installed at Black Box to ensure factory-clean optical devices. These protective caps should not be removed until the moment of connecting the fiber cable to the device. If you need to disconnect the fiber device, reinstall the protective dust caps.
3. Store spare caps in a dust-free environment such as a sealed plastic bag or box so that when reinstalled they do not introduce any contamination to the optics.
4. If you suspect that the optics have been contaminated, alternate between blasting with clean, dry, compressed air and flushing with methanol to remove particles of dirt.

Electrostatic Discharge Precautions

Electrostatic discharge (ESD) can cause damage to any product, add-in modules or stand alone units, containing electronic components. Always observe the following precautions when installing or handling these kinds of products.

1. Do not remove unit from its protective packaging until ready to install.
2. Wear an ESD wrist grounding strap before handling any module or component. If the wrist strap is not available, maintain grounded contact with the system unit throughout any procedure requiring ESD protection.
3. Hold the units by the edges; do not touch the electronic components or gold connectors.
4. After removal, always place the boards on a grounded, static-free surface, ESD pad or in a proper ESD bag. Do not slide the modules or stand alone units over any surface.

WARNING! Integrated circuits and fiber optic components are extremely susceptible to electrostatic discharge damage. Do not handle these components directly unless you are a qualified service technician and use tools and techniques that conform to accepted industry practices.

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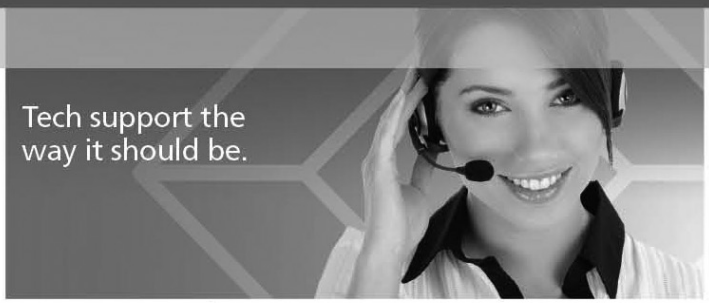

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