ORDERING

M-EFC/U/*/$
Miniature Ethernet UTP to Fiber Optic Converter

* Specify optical interface:
ST85 for 850 nm multimode ST connector
ST13 for 1300 nm single mode ST connector
FC85 for 850 nm multimode FC connector
FC13 for 1300 nm single mode FC connector

$ Specify **AC** for 90–264 VAC switching power supply with integral AC connector (may be ordered seperately as P/S-AC/12/800)

Note: While M-EFC/U can operate with any 12 VDC, 150 mA power supply, the CE approval requires use of the RAD power supply listed above.

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339-101-03/00

M-EFC/U

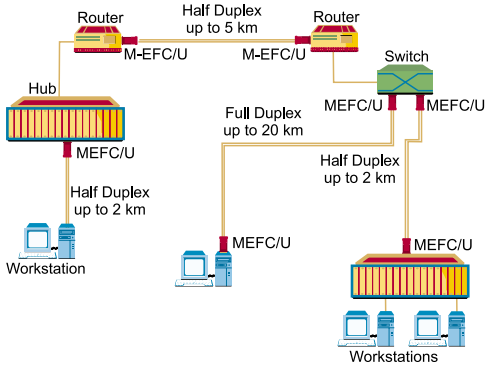
RAD

Miniature Ethernet UTP to Fiber Optic Converter

FEATURES

- Extends Ethernet LANs up to 20 km
- Supports 10BaseFL and 10BaseT IEEE 802.3 standards
- Supports half/full duplex Ethernet
- Multimode or single mode
- Powered from external power source
- Supports workstations, routers, hubs and switches

APPLICATION



DESCRIPTION

- M-EFC/U Miniature Ethernet UTP to Fiber Optic Converter for Ethernet LANs, converts between UTP (10BaseT) electrical signals and 10BaseFL optical signals for transmission over fiber optic cable.
- M-EFC/U is used to connect PCs with a UTP interface card to a fiber optic-based network.
- Supporting full/half duplex links, M-EFC/U takes full advantage of the unlimited range available on full duplex links (limited only by media attenuation and not by collision domain).
- Using fiber optic cable M-EFC/U increases range, improves network performance and achieves greater reliability. M-EFC/U also reduces susceptibility to electrical noise and radio interference, and increases communication security by providing immunity to tapping and eavesdropping along exposed cable segments.

SPECIFICATIONS

ELECTRICAL INTERFACE

- **Transmission Range**
  100m (330 ft)

OPTICAL INTERFACE

- **Transmission Line**
  Dual fiber optic cable
- **Wavelength**
  850 nm multimode
  1300 nm single mode
- **Optical Output Power**
  -18 dBm into 62.5/125 fiber multimode
  -18 dBm into 9/125 fiber single mode
- **Optical Power Budget**
  14.5 dB, 850 nm
  14.5 dB, 1300 nm
- **Sensitivity**
  32.5 dBm
- **Fiber Optic Connector**
  ST or FC (see *Ordering*)

GENERAL

- **Indicators**

PWR	ON when unit is powered (Green)
F LINK	ON when optical signal is received (Green)
T LINK	ON when link integrity is on UTP side (Green)
ACTIVITY	ON when RX activity is detected (Green) ON when Tx activity is detected (Orange) BLINKING when Rx and Tx activity is detected (Green, Orange)

- **Electrical Connectors**
  RJ-45 female, DC socket
- **Physical**

Length:	69	mm	/ 2.7 in
Width:	53	mm	/ 2.1 in
Height:	18	mm	/ 0.7 in
Weight:	30	gr	/ 1.0 oz

- **Power**
  Powered by an external power supply:
  115 VAC to 12 VDC @ 150 mA, or
  230 VAC to 12 VDC @ 150 mA
- **Environment**

Temperature:	0–50°C / 32–122°F
Humidity:	Up to 90%, non-condensing

Declaration of Conformity

Mfr. Name: RAD Data Communications Ltd.

Mfr. Address: 12 Hanechoshet St.
Tel Aviv 69710
Israel

declares that the product:

Product Name:M-EFC/U

Conforms to the following standard(s) or other normative document(s):

EMC: EN 55022 (1994): Limits and methods of measurement of radio disturbance characteristics of information technology equipment.

EN 50082-1 (1992): Electromagnetic compatibility - Generic immunity standards for residential, commercial and light industry.

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC. The product was tested in a typical configuration.

Tel Aviv, April 8th, 1997

Haim Karshen
VP Quality

European Contact: RAD Data Communications GmbH, Lyoner Strasse 14, 60528 Frankfurt am Main, Germany

INSTALLATION

Caution. *This is a delicate instrument. Be careful when setting jumpers or performing any actions within the product so that you do not break or shake any components.*

Remove the unit from its package and inspect it. Report any damage immediately.

The unit is a miniature interface card housed inside a small casing.

M-EFC/U has four connectors:

- One RJ-45 socket connects to the UTP cable plug
- Two fiber optic connectors forthe fiber optic cable (TX and RX)
- One DC power jack for a 12 VDC, 150 mA power supply.

To install M-EFC/U, proceed as follows:

1. Plug the UTP cable's male RJ-45 connector into M-EFC/U.
2. Identify the fiber optic TX and RX cables intended for connection to M-EFC/U and connect them to the respective M-EFC/U's TX and RX optical connectors.
3. Connect M-EFC/U to the external power source via the DC jack. Verify that the PWR LED is ON.
4. Upon connecting to the device at the remote end, the LINK LEDs should be ON.

OPERATION

- **LEDs**

  The four LED indicators, are as follows:
  - PWR indicates power
  - F LINK indicates optical power at receiver
  - T LINK indicates link integrity on UTP side
  - ACTIVITY indicates RX/TX activity on the fiber optic side.

  Following installation, M-EFC/U normally operates unattended. Intervention is required only when a cable fault condition exists or when the unit's power supply fails.

  In the event of a malfunction do the following:
  - Check that the power cord is properly connected.
  - Check that the fibers of the optical cable and the UTP cable are correctly connected.
  - Measure the optical power. The power reading at the RX cable entry should be above -32.5 dBm and less than -12.5 dBm. The reading at TX should be at least -18 dBm.

OPTICAL CALCULATION

- **Fiber Optic Budget Calculations**

  When used in half duplex links, the fiber optic link is limited to 2 km on a hub connection or 5 km between two routers or switches. When used in full duplex links, the fiber optic link length depends on the optical power budget available and the attenuation of the optical cable. The optical power budget equals the power coupled into the fiber at the transmitter side minus receiver sensitivity.

- **Preventing Saturation**

  Optical receivers are optimized for operation at low optical power levels (long cable runs). When the optical input power reaching the receiver is too high, the receiver may saturate. Saturation causes a very high bit error rate. It is therefore essential to prevent receiver saturation.

  The dynamic range of the optical receivers used by M-EFC/U is 20 dB, and their sensitivity is -32.5 dBm. Therefore, the maximum optical input power before saturation occurs is -12.5 dBm.

  The saturation power is high enough to ensure that M-EFC/U receiver will never saturate when receiving the signal generated by another M-EFC/U.

Typical Values of Link Budget (@850 nm and 1300 nm)

Output power	Sensitivity	Link budget
-18 dBm	-32.5 dBm	14.5 dB

Losses in Optical Fibers (@850 nm, 62.5/125 micron)

Cable Losses	Connector Losses	Splice Losses	Aging, Temperature
3.5-4 dB/km	1-2 dB/connector	0.1-0.3 dB/km	3 dB

Losses in Optical Fibers (@1300 nm, 9/125 micron)

Cable Losses	Connector Losses	Splice Losses	Aging, Temperature
0.6 - 0.8 dB/km	1 - 2 dB/connector	0.1 - 0.3 dB/km	3 dB

Notes:

1. The values given are for guidance only.
2. Always use cable and connector losses specified by their manufacturer.
   Connectors are the weakest point. The “cost” of a “bad” connector may be as high as 1 km of fiber.
3. Connector losses decrease as fiber diameter increases.