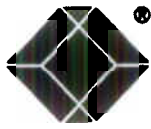2 MAR 2001

# ◆BLACK BOX

## NETWORK SERVICES

Broadband Fibre
Multiplexor.

Models
MXUF004-SC-MM
MXUF004-SC-SM
MXUF004-ST-MM
MXUF004-ST-SM

# Broadband Fibre Multiplexor
# Model MXUF004 User Manual
### Revision 1.0.1

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| | | |
|---|---|---|
| **Technical** | : | 0118 965 6000 |
| **Sales** | : | 0118 965 5000 |
| **Fax** | : | 0118 965 5001 |
| **Address** | : | 464 Basingstoke Road, |
| | | Reading, Berkshire RG2 OBG |
| **Website** | : | www.blackbox.co.uk |

# Broadband Fibre Multiplexor

## 1. How To Contact your Local Black Box

**Italy:**

Black Box Italia S.P.A

Tel: 0227400280
Fax: 0227400219
Web Site: www.blackbox.it

**Australia:**

Black Box Catalog Australia PTY LTD

Tel: 0398797100
Fax: 0398702955

**Brazil:**

Black Box Do Brasil.

Tel: (011) 5515-4000
Fax: (011) 5515-4002
Web Site: www.blackbox.com.br

**Canada:**

Black Box Canada Corp.

Tel: 0416-736-8000
Fax: 0416-736-7348
Web Site: www.blackbox.com

**Netherlands:**

Black Box Datacom BV

Tel: 03032417799
Fax: 0302414746
Web Site: www.blackbox.nl/

**Mexico:**

Black Box De Mexico S.A. de C.V

Tel: 05-420-0100
Fax: 05-420-0123
Web Site: www.blackbox.com.mx

**Belgium:**

Black Box

Tel: 027258550
Fax: 027259212
Web Site: www.blackbox.be

**Japan:**

Black Box Catalog

Tel: 03-3820-5011
Fax: 03-3820-5010
Web Site: www.blackbox.co.jp/

# Broadband Fibre Multiplexor

**Deutschland:**

**Black Box Deutschland**

Tel: 0811/5541-0
Fax: 0811/5541-499

Web Site: www.blackbox-deutschland.com

**Switzerland:**

**Datacom Black Box Services AG**

Tel: 0554517070
Fax: 0554517075
Web Site: www.black-box.ch

**France:**

**Black Box Catalogue**

Tel: 0145606700
Fax: 0145606747
Web Site: www.blackbox.fr

**U.S.A:**

**Black Box Corporation**

Tel: 724-746-5500
Fax: 724-746-0746
Web Site: www.blackbox.com

**Spain:**

**Black Box Comunicaciones S.A.**

Tel: 34 91 663 0200
Fax: 34 91 661 84 35
Web Site: www.blackbox.es

**Chile**

**Black Box Chile**

Tel: 00 562 223 8811
Fax: 00 562 225 1002
Web Site: www.Blackbox.cl

# Broadband Fibre Multiplexor

## Contents

*TECHNICAL: 0118 965 6000*

# Broadband Fibre Multiplexor

## Introduction

The MXUF004 Broadband Fibre Multiplexor is designed to support the transmission of circuit and packet data simultaneously over a fibre optic access loop, maintaining the characteristics of both without affecting the quality of service of either. The MXUF004 is essentially a multi-port access multiplexor, containing a single system environment, centred on a logic based multiplexing engine connected to a fibre based transmission system.

The MXUF004 has a fixed configuration of tributary ports. There are four G.703 interfaces and two Ethernet interfaces

The G.703 interfaces can support both T1 and E1. Systems can be delivered set up for either T1 (North America) or E1 (Europe and most of the rest of the world). The E1 is presented as 75 ohm, using co-axial cable, and 120 ohm balanced, using twisted pair on an RJ45 connector. The T1 is presented through the RJ45 connector using the sub-set of T1 pins. In some cases the hardware will be customised for T1 only i.e. the BNC connectors for 75 ohm E1 will not be present.

The Ethernet interfaces are presented as RJ45. One of them can support 10/100M, either conventional CSMA/CD or full duplex, and the other is 10M only, either conventional CSMA/CD or full duplex. The MXUF004 systems are operating as repeaters therefore full duplex is the preferred mode of operation.

In addition to the tributary ports the MXUF004 has an async management port for local configuration of the system set up parameters. The async management port supports a command line interface. It also can be used as the link to the proxy management server to enable a full browser based management access with SNMP trap support. In-band remote access to a partner MXUF004, at the opposite end of the fibre link, is also supported in both command line and proxy server mode. There is also an optional modem port on the MXUF004 for remote dial-up access to the command line management system. The internal socket modem to support this function is a factory fit option. Connectors of the fibre main link are model dependant.

There is one other port on the MXUF004. This is a G.703-10 2MHz external timing source input. This is used, if required, to re-time the T1 / E1 circuits to PRC quality. There is a relay contact closure interface presented on a three way terminal plug and socket.

# Broadband Fibre Multiplexor

## Theory of operation

The MXUF004 is a multi-service access multiplexor with a fibre up-link. The native physical circuit content, from the T1 / E1 ports, is combined with packet data from the Ethernet ports, in its native form, in a time-spaced physical layer deterministic protocol for transmission between the two units at either end of a fibre link.

The T1 / E1 circuit information can be voice or data. It is carried as a bit steam without modification or protocol conversion of any kind. The timing of each individual T1 / E1 circuit is preserved rigorously end-to-end. The four bit streams carrying the traffic for the ports are kept physically separate. They can run at four different clock rates within the 50ppm limit of the G.703 specification. The set-up of the end systems determines the actual clock rate. If the clock of a T1 / E1 stream is PRC 'sync' quality when the stream enters the MXUF004 then it will be PRC 'sync' quality when it exits the MXUF004 at the other end of the link.

The MXUF004 also supports a re-timing function for the circuit interfaces. Some other forms of fibre transport, notably SONET / SDH, can have a detrimental affect on the quality of 'sync' due to justification bits. If a T1 / E1 circuit with wander and / or jitter is an input to the MXUF004, then the MXUF004 can re-time the circuit stream using the reference clock input, connected to the G.703-10 2MHz external timing source input. The G.703-10 signal is usually obtained either from a local GPS system, a bearer clock derivative from a SONET / SDH system, or from a dedicated clock sync distribution system within the POP/CO.

The Ethernet packets are carried as a bit stream without modification or protocol conversion of any kind. The two pairs of Ethernet ports on a pair of MXUF004 systems operate as two separate long distance Ethernet repeaters in full duplex, full bandwidth mode, one at 10M and one selectable to be 10/100M. The two bit streams for the two pairs of Ethernet ports are kept physically separate. There is total physical security between the two streams.

The in-band management channel is carried within the fibre optic link transparently, without taking bandwidth away from the traffic, as required.

## Power supplies

The MXUF004 is available with two types of power supply, an auto-ranging, self-sensing AC power supply, and an auto-ranging DC power supply. There is also a central site rack system available with DC power supply, known as the Fibrerack. This system can incorporate the proxy management server and the model MXUF045 aggregation / up-link system.

# Broadband Fibre Multiplexor

## Management

### Basic management

The MXUF004 can be configured and managed using the command line interface available via the async port. The set-up parameters are stored in on-board non-volatile memory to ensure correct behaviour should the system suffer a power outage and a subsequent cold start.

Black Box Broadband Fibre Multiplexor systems are used in pairs. The remote system can be configured and managed from the local system's async command port.

### Browser based management with SNMP traps

The Fast Management System is a proxy management system that enables the user to access the management parameters of up to sixteen MXUF004 or MXUF0045 systems, in any combination of pairs, from a browser interface over an IP network. The Fast Management System is usually configured and installed as part of the Fibrerack aggregation system at a POP/CO location.

The proxy system has an Ethernet interface to the user's IP management network. It supports a standard http: server that can be accessed using any browser with http: support. The proxy also supports SNMP traps for event and alarm notification. No additional software needs to be installed on the user's network management platforms, so long as they support a browser and an SNMP client system with trap support.

# Broadband Fibre Multiplexor

## Installation

### Connectors and port identification

The G.703 E1 ports are presented on BNC for 75 ohm un-balanced and RJ45 for 120 ohm balanced. The T1 configuration uses the RJ45 connectors and a sub-set of the pins to conform to the T1 specifications. The ports are identified as port 1, port 2, port 3 and port 4.

The Ethernet ports are presented on RJ45 connectors with a standard pin out. The Ethernet 10/100M port is identified as port A, and the 10BaseT is identified as port B.

The async management port is presented on RJ45 with a proprietary pin out. It is identified as the console port.

The up-link connection is made to the fibre connectors. The type provided are model dependant.

### Jumpers / link fields

Changing the internal link fields / jumpers is not a user option. Only a qualified electrical engineer in a workshop where full safety precautions are understood and implemented can undertake this process. Anti-static Damage (ESD) precautions should be observed whilst configuring the link fields / jumpers of the MXUF004.

# Broadband Fibre Multiplexor

## Installation (cont.)

Configuration for the G.703 interface options, the default configuration is 120 ohm.

BNC 75 Ohm I/F operation.

| G.703 #1 | G.703 #2 | G.703 #3 | G.703 #4 | Setting | Connection |
|---|---|---|---|---|---|
| LK15 | LK12 | LK9 | LK6 | Open | RJ-45 |
| | | | | Closed | BNC |
| LK16 | LK13 | LK10 | LK7 | Closed | Optional chassis connection on pin 3 of RJ45 |
| LK17 | LK14 | LK11 | LK8 | Open | RJ-45 |
| | | | | Closed | BNC |

RJ45 Pin-out for E1.

| PCB Reference. | | | | | |
|---|---|---|---|---|---|
| Ch. #1 | Ch. #2 | Ch. #3 | Ch. #4 | Pin No. | Description |
| | | | | 1 | Rx Tip |
| | | | | 2 | Rx Ring |
| | | | | 3 | Optional Ground |
| | | | | 4 | Tx ring |
| | | | | 5 | Tx Tip |
| | | | | 6 | Ground |
| | | | | 7 | No Connect |
| | | | | 8 | No Connect |

# Broadband Fibre Multiplexor

## Status indicators

| Channels | PCB Ref. | IDENT | Description | Notes |
|---|---|---|---|---|
| G.703 #4 | LED1 | LOI3 | Loss Of Input | |
| | LED2 | LOS3 | Loss Of Sync | 1 |
| G.703 #3 | LED3 | LOI2 | Loss Of Input | |
| | LED4 | LOS2 | Loss Of Sync | 1 |
| G.703 #2 | LED5 | LOI1 | Loss Of Input | |
| | LED6 | LOS1 | Loss Of Sync | 1 |
| G.703 #1 | LED7 | LOI0 | Loss Of Input | |
| | LED8 | LOS0 | Loss Of Sync | 1 |
| ETH #A | LED9 | Tx | Tx data present | |
| | LED10 | Rx | Rx data present | |
| | LED11 | COL | Collision detected | |
| | LED12 | LNK | Link established | |
| | LED13 | 100M | 100Mbit link speed | |
| | LED14 | 10M | 10Mbit link speed | |
| | LED15 | DPX | Full duplex link | |
| ETH #B | LED21 | Tx | Tx data present | |
| | LED22 | Rx | Rx data present | |
| | LED23 | COL | Collision detected | |
| | LED24 | LNK | Link established | |
| | LED27 | DPX | Full duplex link | |
| FIBRE | LED16 | LOCLP | Local loop-back | |
| | LED17 | LINLP | Line loop-back | |
| | LED18 | NET | Link established | |
| | LED19 | (TBD) | | 2 |
| | LED20 | PWR | Unit Powered-up | |

**Status indicators: - Notes**:

1. LOS will not illuminate when operating in unframed mode (i.e. when FRAME = E1UN or T1UN)
2. LED19 function is currently uncommitted.

## Initial set up of the MXUF004 Broadband Fibre Multiplexor

The factory default configuration of the MXUF004 is as follows, unless otherwise agreed by special request at the time of ordering.

Port A – 10/100M Ethernet port set to 100M full duplex.

Port B – 10M Ethernet port set to full duplex.

Ports 1 to 4    – European and ROW shipments set to E1 120 ohm.
            – USA and Canadian shipments set to T1.

# Broadband Fibre Multiplexor

## Management port

To access the MXUF004 async management command line interface connect the serial interface cable to the serial console port via the RJ45 connector. The other end of the cable is a DB9 connector. This should be connected via a serial port on a P.C. to a terminal emulation programme, usually Windows'95 and Hyper-terminal, or to a suitable terminal. The settings for the terminal emulation programme are as follows:

9600 baud, 8-bits, no parity, one stop bit, no flow control

# Broadband Fibre Multiplexor

## MXUF004 Management Command Syntax

The command line interface can be accessed in one of three ways:

1. Through the management port via a terminal or terminal emulator.
2. Through the modem port (if optional modem is fitted) via a dial-up connection.
3. Through the in-band management channel from the remote MXUF004 unit.

### User commands

This set of commands is used to control and obtain status from the MXUF004. The command set is broken up into four groups. Some commands appear in more than one group.

All of the commands have a fixed format of the command word and some arguments. The arguments can be none, action on its own, or channel and action. Action may include more than one argument.

The general syntax is as follows:

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | FRAME | A | T1 |

### RESET – Power-up reset.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | RESET |  |  |

Forces a power-on system reset.

### NAME – System name assignment.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | NAME |  | <system name> |

Assigns a system name. Any printable character may be used, including white space. All characters are converted to upper case. The name string can be a maximum of 30 characters long.

When entering the name, any end of line white space counts towards the maximum name length, but they are striped out when the name is stored.

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12

# Broadband Fibre Multiplexor

## MXUF004 Management Command Syntax (Cont.)

### READ – non-volatile storage read.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | READ | | |

System configuration is restored from the non-volatile storage and implemented.

### UPDATE – Implement changed configuration.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | UPDATE | | |

Implements all changed system configuration settings.

### SAVE – non-volatile storage write.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | SAVE | | |

Implemented system configuration is written to the non-volatile storage.

### UNDO – reset changes.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | UNDO | | |

Resets all changes back to the implemented configuration.

### STATUS – system configuration & status information.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | STATUS | | |

*TECHNICAL: 0118 965 6000*

# Broadband Fibre Multiplexor

## MXUF004 Management Command Syntax (Cont.)

Displays system implemented & changed configuration, & status information.

```
Name: Black Box #1

  G.703: #1      #2        #3        #4
  Framing: T1     E1        T1 -> E1  E1
  Imp/Term: SH0   75R       SH1 -> 75R  120R
   CRC4: OFF      ON        OFF       OFF
  Loopback: OFF -> LOC OFF        REM          OFF -> REM
   ExtClk: ON     ON -> OFF  OFF       OFF


    LOI: GOOD      GOOD      BAD       BAD
    LOS: GOOD      BAD       BAD       BAD


  Ethernet: _____#A_____      _____#B_____
  loopback: OFF       10M     REM -> OFF  N/C
   Speed: N/C -> 100M  HALF      N/A       N/C
   Duplex: N/C -> HALF           N/A
  Auto Neg: ON -> OFF            ON


   Fibre:
  Loopback: OFF -> REM
                ExtClk:
    LOI: GOOD            LOI: BAD
  Changed>
```

Name – If not set then '<not set>' is displayed.

G.703 – There are four channels, #1 to #4 each with common, tabulated information.

Ethernet – There are two channels, A and B each with common, tabulated information.

Fibre – There is a single channel with tabulated information.

Each channel section is split into 2 groups, configuration and status. The status information reflects the condition of the associated channel and the configuration reflects the implemented and changed information. For details on each entry see the appropriate sections.

Each configuration entry is split into three further columns:

|  | <configuration> | <implemented> | (->) | (<changed >) |
|---|---|---|---|---|
| E.G. | Loopback: | OFF | (->) | (LOC) |

If the implemented does not match the changed, then an arrow is displayed along with the changed information.

# Broadband Fibre Multiplexor

## MXUF004 Management Command Syntax (Cont.)

### REMOTE – Invoke in-band management

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax | REMOTE |  |  |

In-band management allows the far end (remote) MXUF004 to be configured and interrogated from the near end (local) MXUF004. By executing the 'remote' command a communication channel is established. The cursor is preceded by 'Remote: ' to indicate to the user that the local MXUF004 is talking to the remote unit. In this mode all responses are from the remote unit.

### FRAME – G.703 framing selection.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax: | FRAME | [1/2/3/4] | [E1/E1UN/T1] |
| Channel: | G703 channel number. |  |  |
| Action: | E1 or T1 framing [E1/T1]. E1 or T1 unframed [E1UN/T1UN]. |  |  |
| Notes: | Resets IMP / TERM settings. |  |  |

### IMP – G.703 channel (E1) line impedance configuration.

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax: | IMP | [1/2/3/4] | [75R/120R] |
| Channel: | G703 channel number. |  |  |
| Action: | 75R:BNC termination. 120R: RJ-45 termination. |  |  |
| Notes: | Only applies to E1 framed channels. Requires internal link configuration. |  |  |

# Broadband Fibre Multiplexor

## MXUF004 Management Command Syntax (Cont.)

### TERM – G.703 channel (T1) line termination configuration.

| | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax: | TERM | [1/2/3/4] | [SH0/SH1/SH2/SH3] |

Channel: G703 channel number.

Action:    SH0: T1 short haul termination    0 – 110 ft
SH1: T1 short haul termination 110 – 220 ft
SH2: T1 short haul termination 220 – 330 ft
SH3: T1 short haul termination 330 – 440 ft

Notes:    Only applies to T1 framed channels.

### CRC4 – G.703 channel Cyclic redundancy check-4 control.

| | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax: | CRC4 | [1/2/3/4] | [OFF/ON] |

Channel: G703 channel number.

Action:    OFF: Disables CRC-4 generation & checking.
ON:    Enables CRC-4 generation & checking.

Notes:    CRC-4 errors are currently not reported.
Only applies to E1 framing mode.

### EXTCLK – G.703 channel external G.703 table-10 clock input enable

| | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax: | EXTCLK | [1/2/3/4] | [OFF/ON] |

Channel: G703 channel number.

Action:    OFF: Disables G.703 table-10 use.
ON:    Enables G.703 table-10 use.

Notes:    If the G.703 table-10 input is in LOI state the G.703 channel
will recover clock from Rx input.

*TECHNICAL: 0118 965 6000*

# Broadband Fibre Multiplexor

## MXUF004 Management Command Syntax (Cont.)

### LBACK – channel loop-back control.

|  | \<command\> | \<channel\> | \<action \> |
|---|---|---|---|
| Syntax: | LBACK | [1/2/3/4/A/B/F] | [OFF/LOC/REM] |

Channel:  G703 channel number.

Action:  OFF: Normal operation.
LOC: Local loop-back. Tx O/P is connected to Rx I/P.
REM: Remote loop-back. Rx I/O is connected to Tx O/P

Notes:

### SPEED – Ethernet manual speed selection.

|  | \<command\> | \<channel\> | \<action \> |
|---|---|---|---|
| Syntax: | SPEED | [A/B] | [10M/100M] |

Channel:  Ethernet channel number.

Action:  10M: 10Mbits/s.
100M: 100Mbits/s.

Notes:  The speed setting is ignored when auto negotiation mode is enabled.

### DUPLEX – Ethernet manual duplex selection.

|  | \<command\> | \<channel\> | \<action \> |
|---|---|---|---|
| Syntax: | DUPLEX | [A/B] | [HALF/FULL] |

Channel:  Ethernet channel number.

Action:  HALF: half duplex.
FULL: full duplex.

Notes:  The duplex setting is ignored when auto mode negotiation is enabled.

*TECHNICAL: 0118 965 6000*

# Broadband Fibre Multiplexor

## MXUF004 Management Command Syntax (Cont.)

**AUTO – Ethernet auto negotiation.**

|  | <command> | <channel> | <action > |
|---|---|---|---|
| Syntax: | AUTO | [A/B] | [OFF/ON] |

Channel:  Ethernet channel number.

Action:  OFF: Auto negotiation is disabled.
ON:  Auto negotiation is enable.

Notes:  The speed and duplex setting are ignored when auto
negotiation mode is enabled.

The recommended configuration for the Ethernet ports is the full duplex mode. In most cases the Ethernet ports will be connected directly to a port on a router or Ethernet Switch at both ends. These ports will likely support full duplex operation. Defining the MXUF004 Ethernet ports as full duplex ensures that full duplex mode will be used, even if the Ethernet ports on the mating equipment are in auto-negotiation mode. Using the half duplex mode over a fibre repeater system can result in confusion to the collision detection mechanism of conventional Ethernet. Using the full duplex mode eliminates that possibility completely and also provides double the bandwidth for traffic.

# Broadband Fibre Multiplexor

## MXUF004 management with the proxy system

The MXUF004 Proxy Management System is an application designed to run in client-server mode, providing a browser-based front-end GUI for the MXUF004 management command line interface. The system can also be run with both client and server applications on a laptop or PC platform, with the PC connecting directly to the MXUF004 async serial port via a COM port.

The proxy system supports local management of the MXUF004 system to which it is directly connected, and remote management of the MXUF004 that is connected via fibre to the local system.

## MXUF004 with POP / CO system

The Fibrerack POP / CO system supports up to seven MXUF004 line cards (blades). The reason that this is seven is simply because each MXUF004 can support up to four T1s, and seven times four is twenty eight, which is the number of T1s that can be multiplexed into a T3 composite. There is also a standard mechanism for multiplexing twenty-one E1s into a T3 composite.

The T1 and E1 tributaries delivered to the Fibrerack POP / CO system by the MXUF004 line cards can be combined into a T3 composite by a MXUF0045 line card (blade) within the Fibrerack system.

The Ethernet tributaries can be aggregated using an Ethernet Switch or router of the Service Providers choice. The Fibrerack can also be supplied with an OEM Ethernet Switch if required. The 100M Ethernet up-link from the packet aggregation system is combined with the T3 composite within the MXUF0045 system into a combined fibre circuit and packet up link.

The final element in the Fibrerack system is the Proxy Management Server. This system can manage eight local line cards (blades) i.e. seven MXUF004 systems and a MXUF0045 system. It can also manage the seven remote, customer premise, MXUF004 systems, and the remote MXUF0045 at the up link site. The access interface to the Proxy Management Server is http: over Ethernet 10Base-T.

# Broadband Fibre Multiplexor

## Cable specifications for the MXUF004

The serial console port requires a standard Black Box serial management cable RJ45 to DB9. Every MXUF004 system is shipped with a serial management cable.

Detailed specifications for the Black Box serial management cable are as follows:

**Cable part number:  CAB-MAN-1**

Description:    MXUF004 management card serial cable

Cable type:    Category 5 cable

Jacket type:    PVC

Length:        2 metres

| **MXUF004 end** | **Terminal end** |
|---|---|
| RJ45M | DB9F |
| PLASTIC | PLASTIC SHELL |
| | MALE SCREWLOCKS |

LABEL: CAB-MAN-1

| | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | 5 |
| 5 | 2 |
| 6 | 3 |
| 7 | |
| 8 | |

**RJ45 end should be fully loaded when terminating for greater strain relief.**

---