

Abeo MTU9005M/ MTU9012 Converters

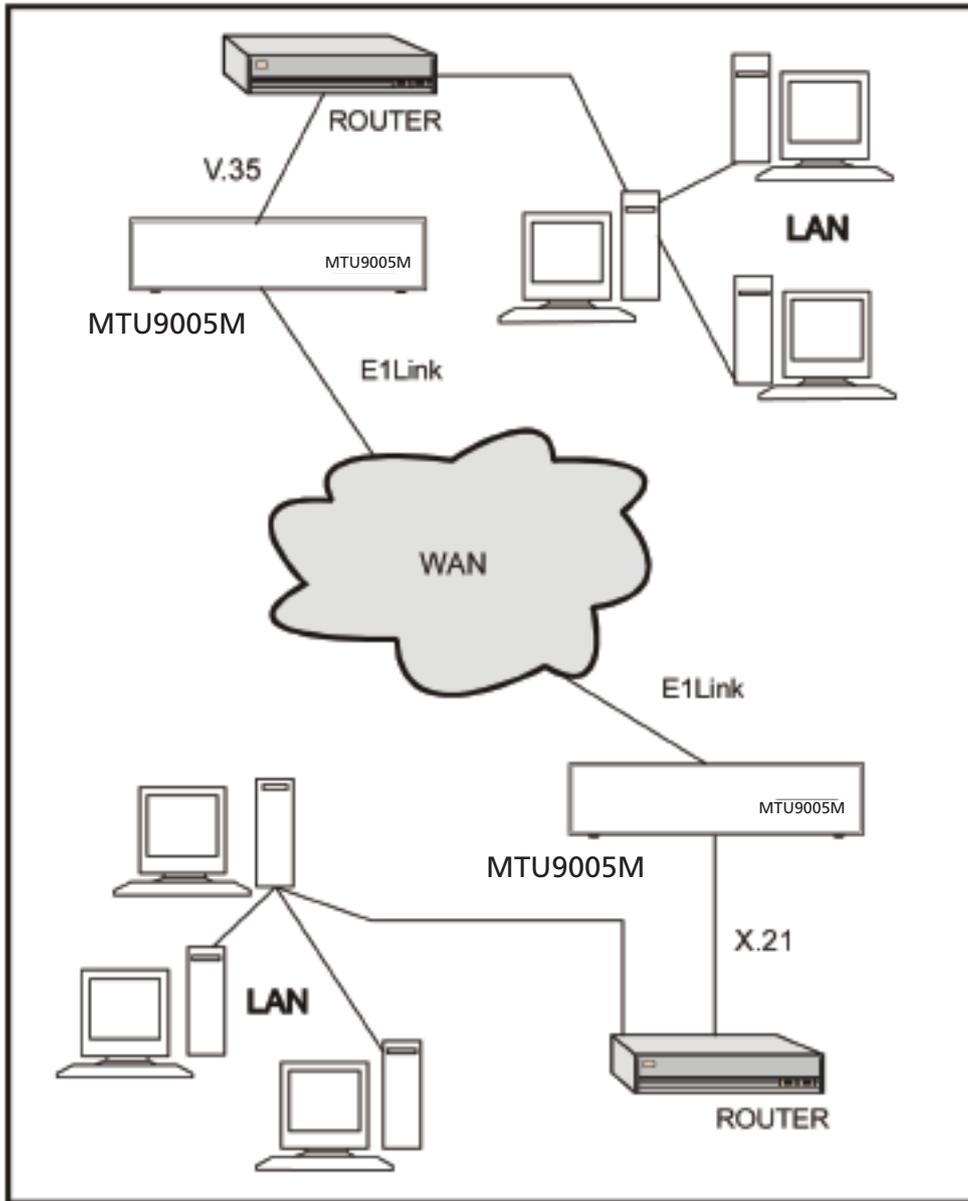


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1.1 About the MTU9005M/MTU9012

The Black Box MTU9005M/MTU9012 are used to interface between a fractional E1 (2.048Mbit/s) N*64K service and an X.21 or V.35 port which connects to a bridge or router. The model MTU9005M has an X.21 interface, and the model MTU9012 has a V.35 interface. Both models are described in this manual. There is a choice of either BNC or RJ-45 connectors for the E1 service on the rear panel of the unit. The MTU9005M and MTU9012 are used in pairs, one on either side of a WAN (Wide Area Network) link.



1.2 Safety

The MTU9005M or MTU9012 should not be connected to cabling which would be required by BS6701 to be equipped with over-voltage protection. The following ports are designated SELV (Safety and Extra Low Voltage) within the scope of EN41003:

- X.21 port
- V.35 port
- E1 Line port (BNC or RJ-45)
- Alarm extension RJ-45 port

These ports should only be connected to SELV ports on other equipment in accordance with EN60950 clause 2.3.

1.3 Electromagnetic Compatibility

In order to ensure EMC compliance all electrical signal and data cables and connectors must use a screened connector shell with a screened cable. The cable screen must be terminated to the screened connector shell and not connected to any pins of the connector. Failure to use the correct connector may compromise EMC compliance.

1.4 EN55022 Declaration

MTU9005M and MTU9012 units are Class A products. In a domestic environment it may cause radio interference in which case the user may be required to take adequate measures.

1.5 FCC Declaration

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the 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 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 its own expense.

1.6 Power Supply

The MTU9005M and MTU9012 are powered by a mains power supply with an input voltage range 100-250VAC, 50/60Hz, 30-12mA. The input power consumption is approximately 3 watts.

An alternative -48VDC power supply unit is available. Further details are given in Section 3.

Safety Notes: Excessive voltages are present inside the unit. There are no user serviceable parts inside the unit, and the cover should not be removed by unqualified personnel. The unit must not be exposed to damp or condensing conditions. The MTU900XMs must be connected to safety earth for correct operation.

1.7 Technical Overview

The MTU9005M is used on unframed E1/G.703, framed E1/G.704 (CRC4) or E1/G.704 (no CRC4) digital services. Technical overviews of G.703 and G.704 are provided.

1.8.1 G.703 Signal Transmission

The signal is transmitted on 75 ohm unbalanced coax or 120 ohm balanced twisted pair. The signal has alternate mark inversion (AMI) characteristics in accordance with G.703. A mark is transmitted as a 0.5 unit interval (UI) wide pulse of amplitude 2.37V on 75 ohm coax, or 3.0V on 120 ohm twisted pair. Alternate marks have opposing polarity so that '111' is transmitted as a positive pulse, a negative one and then another positive one. The pulses have a duration of 50% so that strings of '1s' can be identified as a series of pulses. This is because clocking information is derived from the transmitted signal. In addition, strings of zeros are replaced with high-density binary 3 (HDB3) code words to ensure pulse density (and therefore clocking information) and an average DC potential of 0V.

The transmission rate is 2.048 Mbps. The worst case delay through the MTU9005M and MTU9012 is 2 milliseconds, and the worst case round trip delay is 8 milliseconds.

1.8.2 G.704 Framing

Groups of 248 bits are grouped into frames together with an 8-bit overhead at the start of the frame called TIME SLOT 0 (TS0). The frame length is therefore 256 bits, and the frame repetition rate is 8KHz. The 248 bits of payload are divided into 31 timeslots of 8 bits each (TS1 - TS31). With the data in each timeslot regarded as an individual channel, 31 channels may be multiplexed together into one E1 trunk. As well as dividing the trunk between payload and overhead, groups of frames are associated into multi-frames. A synchronisation pattern is spread across the multiframe. Frames are alternately FAS (Frame Alignment Signal) and NFAS (Non Frame Alignment Signal) frames.

1.8.3 E1 Path Overhead

8 bits are used for path overhead and provide framing, alarm information, error detection and management. The bits of TS0 are used alternatively by the FAS and NFAS frames as follows:

Bit No	Function
FAS Frame	
1	CRC bit
2 to 8	Frame alignment signal (FAS) 0011011
NFAS Frame	
1	International bit: contains CRC multiframe alignment signal and remote block error (REBE) information.
2	NFAS bit
3	Remote alarm indication (RAI)
4 to 8	National bits

1.9 DTE Nx64K Payload

The MTU9005M and MTU9012 permit the 2.048Mbits/s E1 LINE port to operate with multiple channels of N*64Kbit/s where N may vary between 1 and 31. There are restrictions placed upon the utilisation of bandwidth:

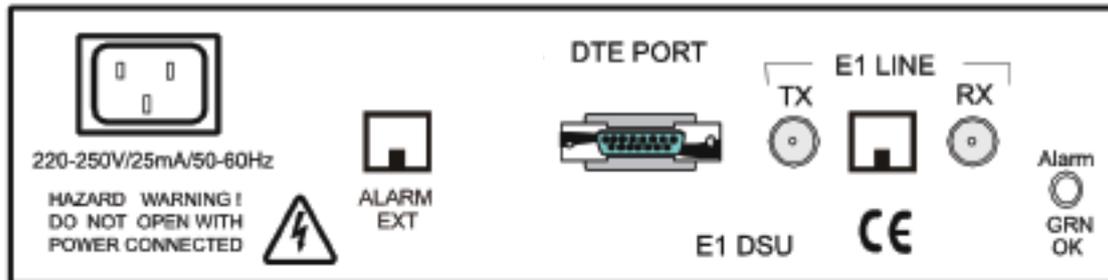
Timeslots used must form a contiguous block.

The total number of timeslots allocated must be less than or equal to 31 (or 30 if Timeslot 16 is by-passed).

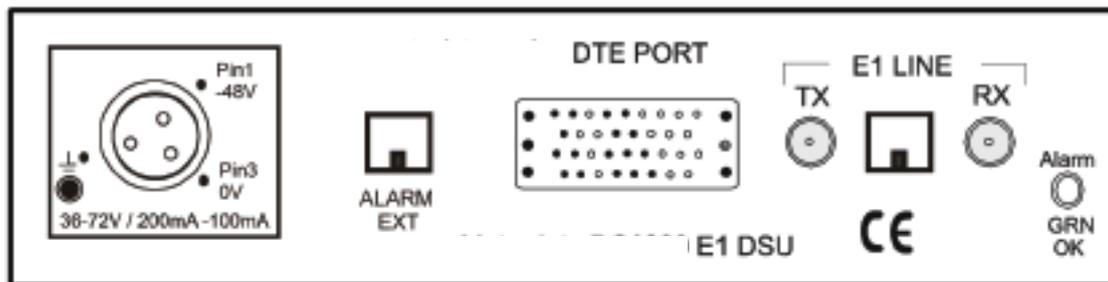
If Timeslot 16 by-pass is ENABLED by setting the bit-switch labelled BYP16 to ON, Timeslot 16 is by-passed in allocating channels sequentially to timeslots; i.e. you could then select Timeslots 14,15,17,18.....

2.1 Rear panels

All connections into and out of the MTU9005M and MTU9012 are made through the rear panel. The rear panels are shown in schematic form below:



MTU9005M rear panel (AC)



MTU9012-DC rear panel

2.2 Status display - rear panel

There is a status LED on the right hand side of the rear panel which indicates the status of the unit as shown in the figure below.

Status LED	Meaning
Off	No mains power present
Red Steady	LOS
Red/Off Flashing	LOS and DTE Alarm
Red/Green/Off Flashing	LOF or AIS Alarm
Green/Red/Off Flashing	AIS and DTE Alarm
Green/Off Flashing	DTE Alarm
Green Steady	Operating Normally

See page 19 for alarm definitions.

Notes: If the LED flashes red/green, disconnect the DTE (X.21 or V.35) signal to the MTU9005M or MTU9012 in order to distinguish between LOF and AIS alarms. The loss of the DTE signal will then cause either the red/green/off or the green/red/off sequence to occur, depending upon the condition which has occurred.

2.3 Power Supply.

The DSU is powered by a mains supply with an input voltage of 100-250VAC, 50-60Hz, 35- 15 mA. The input power consumption is approximately 3.5 watts. The MTU9005M and MTU9012 are provided ex-factory with 250mA internal fuses. Mains power is connected via the IEC inlet on the rear of the unit.

An alternative -48VDC powered unit is available. The input voltage and current ranges are minus 36 to minus 72 volts DC, 100-50mA. A Buccaneer type socket is fitted to the rear panel, and a plug is provided with the unit for the customer's own wiring. The connections are labelled on the rear panel of the MTU9005M and MTU9012.

Pin No,	Connection
1	-48VDC
2	Ground
3	0VDC

Note: The DSU must be connected to mains safety earth for correct operation

2.4 Unbalanced E1 Line Port (BNC)

The network is connected to the BNC connectors at the rear of the unit as shown below:

Pin	Function
Tip	Signal
Ring	Shield

Cable lengths should be restricted to those defined below:

Cable	Max Length (m)
UR202	720
RG59U	600
BT2002	650
BT2003	680

Note: The total maximum attenuation of each of the cables attached to the network port must not exceed 6dB when measured at 1.024 MHz. The frequency/attenuation characteristic of the cables attached to the network port shall follow a root frequency law.

2.5 Balanced RJ-45 E1 Line (Network) Port

The layout of the female RJ-45 network port mounted on the rear panel is shown below:

Pin	Function
1	Tx tip
2	Tx ring
3	Tx shield
4	Rx tip
5	Rx ring
6	Rx shield
7	Not connected
8	Not connected

2.5.1 Connecting to a terminal device

A connecting cable from the network port to a terminal port such as a router or a PABX is straight through. Connections are defined in the table below:

DSU port pin	DSU port function	Terminal port pin	Terminal port function
1	Tx tip	1	Rx tip
2	Tx ring	2	Rx ring
3	Tx shield	3	Rx shield
4	Rx tip	4	Tx tip
5	Rx ring	5	Tx ring
6	Rx shield	6	Tx shield
7	Not connected	Not connected	Not connected
8	Not connected	Not connected	Not connected

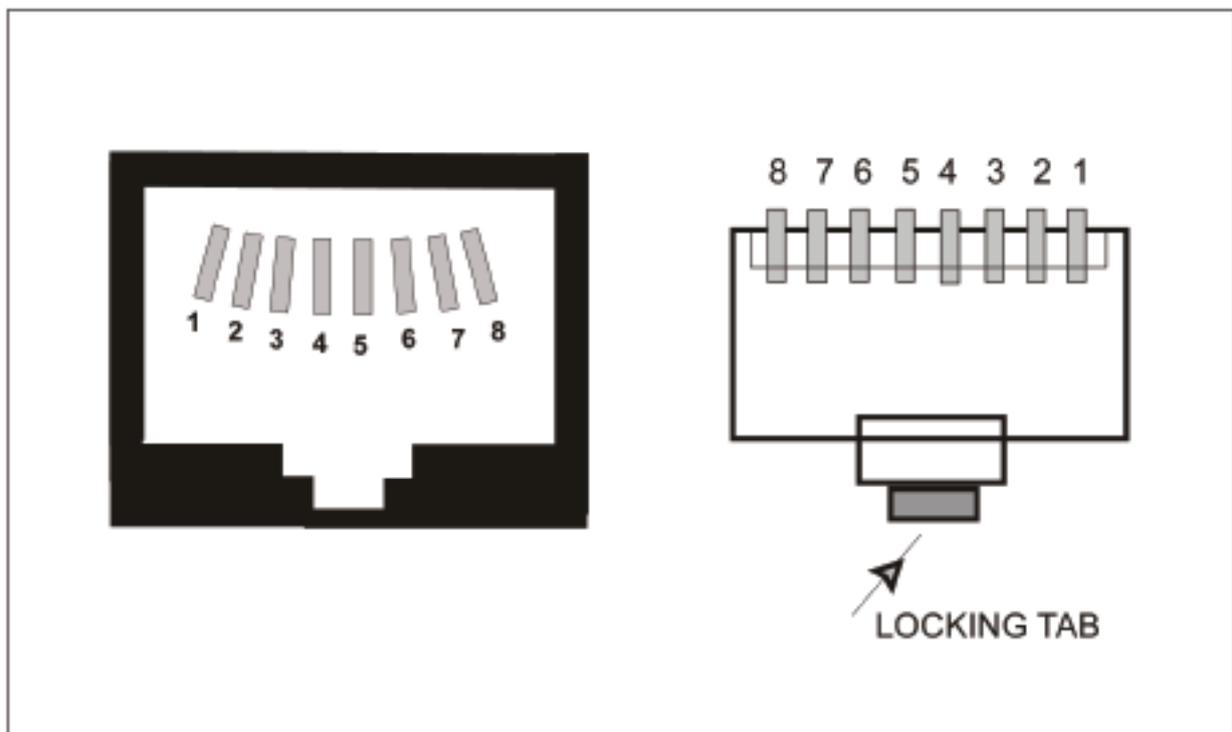
2.5.2 Connecting to a network device

A connection from the network port to a network device such as an E1 line or an NTU requires a crossover cable. Connections are defined in the table below.

DSU port pin	DSU port function	Network port pin	Network port function
1	Tx tip	4	Rx tip
2	Tx ring	5	Rx ring
3	Tx shield	6	Rx shield
4	Rx tip	1	Tx tip
5	Rx ring	2	Tx ring
6	Rx shield	3	Tx shield
7	Not connected	Not connected	Not connected
8	Not connected	Not connected	Not connected

2.5.3 RJ-45 Connector layout

The figure below shows both the plug and socket head on so that any connecting wires are behind the connector. The connector numbering is shown.



2.5.4 Cable lengths and types

Cable lengths should be restricted to those defined below.

Cable	Max Length (m)
Belden 8132 (28 AWG)	175
Belden 9841 (24 AWG)	300

Note: The total maximum attenuation of the cable attached to the network port must not exceed 6dB when measured at 1.024 MHz. The frequency/attenuation characteristic of the cables attached to the network port shall follow a root frequency law. This port type is approved to CTR12, CTR13.

2.6 Alarm Extension (RJ-45)

The alarm extension is an RJ-45 female socket mounted on the rear panel of the unit. It allows the connection of major and minor alarm relay contacts to a remote indicator such as a bell or a lamp. The alarm relay port is regarded as a SELV port within the scope of EN41003. Mains power failure is registered via Normally closed contacts as a major alarm.

Pin	Function
1	Major Normally Closed
2	Major Normally Open
3	Major common
4	Not connected
5	Minor Normally Open
6	Minor Normally Closed
7	Minor common
8	Ground

2.7 X.21 DTE Port

The X.21 DTE port equipped with a 15-way female D-type connector in accordance with ISO 4903. The connections are shown below.

Note: The X.21 port is regarded as a SELV port within the scope of EN 41003

Pin No.	Function	Definition	CCT No.
1	Chassis	Shield	101
2	Tx(A)	Transmit (A)	103
3	C(A)	Control (A)	107
4	Rx(A)	Receive (A)	104
5	I(A)	Indication (A)	109
6	S(A)	Signal timing (A)	115
7	X(A)	DTE Signal timing (A)	113
8	Ground	Ground	102
9	Tx(B)	Transmit (B)	103
10	C(B)	Control (B)	107
11	Rx(B)	Receive (B)	104
12	I(B)	Indication (B)	109
13	S(B)	Signal timing (B)	115
14	X(B)	DTE Signal timing (B)	113
15	Not Connected		

2.8 V.35 DTE Port

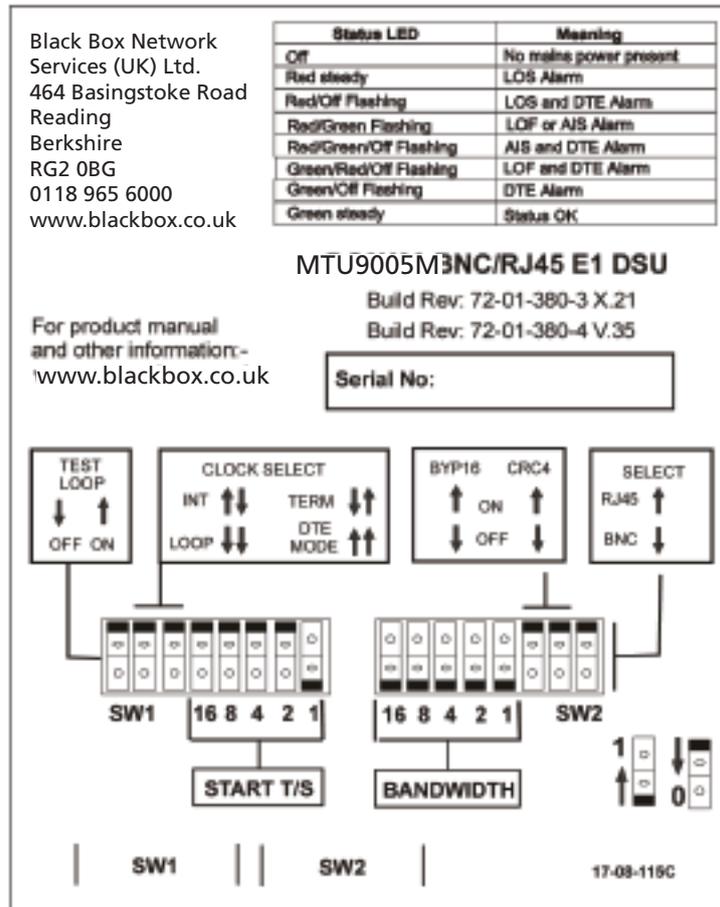
The V.35 DTE port equipped with a 34-way M rack female connector in accordance with ISO 4903. The connections are shown below.

Note: The V.35 port is a SELV port within the scope of EN 41003

Pin No.	Function	Definition	CCT No.
A	Chassis	Chassis ground	101
B	Ground	Signal ground	102
C	RTS	Request to send	105
D	CTS	Clear to send	106
E	DSR	Data set ready	107
F	DCD	Data carrier detect	109
H	DTR	Data terminal ready	108.2
P	Tx(A)	Transmit data(A)	103
R	Rx(A)	Receive data(A)	104
S	Tx(B)	Transmit data(B)	103
T	Rx(B)	Receive data(B)	104
U	XClk(A)	Terminal timing(A)	113
V	RxClk(A)	Receive timing(A)	115
W	XClk(B)	Terminal timing(B)	113
X	RxClk(B)	Receive timing(B)	115
Y	TxClk(A)	Transmit timing(A)	114
AA	TxClk(B)	Transmit timing(B)	114

3.1 Setting-up the Bit-switches

It is recommended that the two sets of 8-gang bit-switches labelled SW1 and SW2 on the base of the unit are set-up before making any connections to the unit. There is an explanatory label on the unit's base which defines the bit-switch set-up options and alarms.



Parameter	Label	Unit	Options
E1 Line Connector	Select	Up Down	RJ-45 BNC
Framing	CRC4	On Off	CRC4 No CRC4
By-pass T/S16	BYP16	On Off	By-Pass T/S16 T/S 16 Carries Payload
Bandwidth	Bandwidth	Binary	Switch 2 Binary Switches 0-31
Start Timeslot	Start T/S	Binary	Switch 1 Binary Switches 0-31
Timing	Clock select	Position	Internal, Terminal, Loop, DTE Mode
Test	Test Loop	On Off	Run Test Loop No test

3.1.1 Select RJ-45/BNC

This single switch is used to select which type of connector is to be used to connect the E1 line.

3.1.2 CRC4 and T/S 16 bypass

These two switches define whether CRC4 checking is to be done on the E1 line, and whether T/Slot 16 is to be bypassed.

CRC4	Comment		
On (Enabled)	TS0 for framing info & CRC4 data integrity check on frame		
Off (Enabled)	TS0 for framing info, no data integrity check on frame		
By-pass T/S 16	No of payload T/Slots	Bandwidth n*64K	Comment
On	30 max	(n=1-30) x 64K	TS16 by-passed for payload
Off	31 max	(n=1-31) x 64K	TS16 can carry payload

3.1.3 Framing

UNFRAMED mode can be selected by setting the *BANDWIDTH* bit-switches to 0 (zero). When this is done, the *START T/S* switches have no effect, and the unit remains in *UNFRAMED* mode.

In G.704(no CRC4) mode, TS0 is used to provide framing information. Bit 1 in TS0 is set to 1 and no data error checking occurs.

In G.704(CRC4) mode, TS0 is used to provide framing information and a Cyclic Redundancy Check (CRC) is performed to test for data errors. Note that *FALLBACK* can occur from G.704(CRC4) mode.

Fallback is a mechanism used in a CRC4 environment which allows G.704 framing to be maintained in the presence of high levels of CRC errors. In effect the receiver falls back to G.704 (no CRC4) mode. This allows traffic to pass from a CRC4 framed device to a non-CRC4 device without generating a Loss of Frame alarm (LOF).

3.1.4 Timeslot 16 by-pass & bandwidth

With Timeslot 16 by-pass *OFF*, TS16 may be used for payload. With by-pass *ON*, TS16 is always left idle. Thus, if by-pass is *ON* and *START TIMESLOT* is set to 15 and *N* is set to 2, then TS15 and TS17 are used and TS16 is by-passed.

3.1.5 Time Slot and Bandwidth Binary Dip Switch Conversion

N	(Nx64k)	Time Slot/Bandwidth Bitswitch				
		16	8	4	2	1
0	Unframed (2.048Mbps)	0	0	0	0	0
1	64kbps	0	0	0	0	1
2	128kbps	0	0	0	1	0
3	192kbps	0	0	0	1	1
4	256kbps	0	0	1	0	0
5	320kbps	0	0	1	0	1
6	384kbps	0	0	1	1	0
7	448kbps	0	0	1	1	1
8	512kbps	0	1	0	0	0
9	576kbps	0	1	0	0	1
10	640kbps	0	1	0	1	0
11	704kbps	0	1	0	1	1
12	768kbps	0	1	1	0	0
13	832kbps	0	1	1	0	1
14	896kbps	0	1	1	1	0
15	960kbps	0	1	1	1	1
16	1024kbps	1	0	0	0	0
17	1088kbps	1	0	0	0	1
18	1152kbps	1	0	0	1	0
19	1216kbps	1	0	0	1	1
20	1280kbps	1	0	1	0	0
21	1344kbps	1	0	1	0	1
22	1408kbps	1	0	1	1	0
23	1472kbps	1	0	1	1	1
24	1536kbps	1	1	0	0	0
25	1600kbps	1	1	0	0	1
26	1664kbps	1	1	0	1	0
27	1728kbps	1	1	0	1	1
28	1792kbps	1	1	1	0	0
29	1856kbps	1	1	1	0	1
30	1920kbps	1	1	1	1	0
31	1984kbps	1	1	1	1	1

3.1.6 Setting Up Start T/S and Bandwidth

The 5 binary switches for START TIMESLOT and BANDWIDTH permit numbers from 0-31 to be set-up. The decimal values of each switch are shown on the label. Thus, a START T/S of 11 and a BANDWIDTH of 4 would be set up as below.

Status T/S	Bandwidth
01011	00100

Permitted *BANDWIDTH* values are 1-30 with Bypass *ON* and 1-31 with Bypass *OFF*.

3.1.7 Timing

TIMING determines the source for the *LINE E1* transmit clock, and is set by two bit-switches. The options are *INT (INTERNAL)*, *LOOP*, *TERM (TERMINAL)*, or *DTE MODE*.

Note that the DTE clock must be accurate to within ± 50 ppm. of the Nx64K value. If the DTE clock is out of specification the E1 transmitter will free-run at 2.048 MHz.

The recommended timing mode for the MTU9005M or MTU9012 pair at either side of the WAN is **Internal** at one end of the link and **Loop** at the other end.

The tables below provide detailed timing definition.

Clocking mode	Bit switch position	E1 transmit clock source	V.35 Transmit timing	V.35 Receive timing
INT Internal	10	MTU9005M/ MTU9012 Internal oscillator	CCT114 Transmit timing A/B	CCT115 Receive timing A/B
LOOP	00	Derived from E1 line received clock	CCT114 Transmit timing A/B	CCT115 Receive timing A/B
TERM Terminal	01	Slaved to CCT 113 Terminal timing A/B	CCT113 Terminal timing A/B	CCT115 Receive timing A/B
DTE Mode	11	Slaved to CCT 113 Terminal timing A/B	CCT113 Terminal timing A/B	CCT113 Terminal timing A/B

Clocking mode	Bit switch position	E1 transmit clock source	X.21 Transmit timing	X.21 Receive data timing
INT Internal	10	MTU9005M/ MTU9012 Internal oscillator	CCT115 Signal timing A/B	CCT115 Signal timing A/B
LOOP	00	Derived from E1 line received clock	CCT115 Signal timing A/B	CCT115 Signal timing A/B
TERM Terminal	01	Slaved to CCT 113 DTE signal timing A/B	CCT113 DTE Signal timing A/B	CCT115 Signal timing A/B
DTE Mode	11	Slaved to CCT 113 DTE signal timing A/B	CCT113 DTE signal timing A/B	CCT113 DTE Signal timing A/B

3.1.8 Line coding

Line coding is HDB3 (High-Density Binary 3). This setting is built into the unit and cannot be altered. Therefore there is no bit-switch for this item.

3.1.9 Test Loop

This switch is used to initiate loop testing. It is fully described in the next section.

3.2 Connecting Up

Safety Notice: Ports that are identified as SELV in this manual should only be connected to SELV ports on other equipment in accordance with EN 60950 clause 2.3

Step 1: Mounting.

The MTU9005M & MTU9012 are housed in convenient 1U table top enclosures.

Step 2: Set up bit-switches SW1 & SW2

These switches are located on the base of the unit and are used to specify the functionality required.

Step 3: DTE

Connect the MTU9005M or MTU9012 to the DTE using either the 15-way X.21 connector (MTU9005M) or the 34 way M-rack connector (MTU9012) labelled DTE PORT on the rear panel. The DSU should ideally be placed close to the DTE, with no more than 2m of cable connecting the two.

Step 4: E1 Line (WAN)

Connect the WAN by means of either the two BNC bayonet connectors labelled E1 LINE Rx and E1 LINE Tx, or the single RJ-45 connector located between the two BNC connectors. Remember to set the SELECT bit-switch to the correct connector type before connecting.

Step 5: Power Supply

Finally, connect the main power lead and re-check all connections for security. Then turn on the power supply. Check the rear panel status LED to ensure that it is continuously lit (green).

Warning: Do not connect the MTU9005M or MTU9012 to excessive voltages. Read the safety information before continuing.

4.1 Alarms

The Status LED on the MTU9005M/MTU9012 rear panel shows a variety of alarm conditions as shown in the table below.

Status LED	Meaning
Off	No mains power present
Red Steady	LOS
Red/Off Flashing	LOS and DTE Alarm
Red/Green Flashing	LOF or AIS Alarm
Red/Green/Off Flashing	AIS and DTE Alarm
Green/Red/Off Flashing	LOF and DTE Alarm
Green/Off flashing	DTE Alarm
Green Steady	Status OK

The definitions of each alarm and the unit's response to them is tabulated below.

Alarm	Alarm Definition	Response
LOS	Loss of Signal: No data and therefore no clocking information	E1 port transmits RAI if in framed mode. Indication <i>DE-ASSERTED</i> .
LOF	Loss of Frame: Clocking information is there but the frame alignment pattern is full (Framed mode only)	E1 port transmits RAI if in framed mode. Indication <i>DE-ASSERTED</i> .
AIS	Alarm Indication Signal: All 1's being received	E1 port transmits RAI if in framed mode. Indication <i>DE-ASSERTED</i> .
RAI	Remote Alarm Indication: RAI signal being received (Framed mode only)	No response.
DTE	DTE Control signal absent	No response.

4.2 Troubleshooting

Step 1: Establish and verify the E1 WAN link.

Check the status LED on the rear panel of the unit at both ends of the link. If either is OFF, power is not present on that unit. Check the mains connection to the unit. If mains supply is satisfactory, we recommend that the unit be taken out of service and returned to a repair centre. Unqualified users should not open the units.

MTU9005M or MTU9012 with BNC connectors - Step 1A

If the status LED is RED or flashing RED/OFF, first check that the SELECT bit-switch on the base panel is set to BNC. If it is set correctly, try swapping the E1 LINE BNC connections at that unit.

If the status LED remains red or flashing red/off, try looping the BNC connections on the unit with a short piece of cable. If the status LED goes steady green or flashes green/off, red/green/off or red/green then the external BNC cabling is faulty. Check for cable continuity and network connections, etc.

MXU9005M or MTU9012 with RJ-45 connectors - Step 1B

If the status LED is red or flashing red/off, first check that the SELECT bit-switch is set to RJ45. If it is set correctly, check the connections on the RJ45 cable. Check for cable continuity and network connections, etc.

Step 2: Establish and verify the DTE link

If the status LED flashes RED/GREEN, this indicates that either an LOF or AIS Alarm is present. In order to distinguish between these, disconnect the DTE signal from the MTU9005M or MTU9012. Then observe carefully the colour sequence of the LED:

- a) If the status LED flashes GREEN/RED/OFF, an LOF Alarm is present. Check that the E1 configuration is compatible at either side of the link. Check especially that the operating mode set-ups as set by the base panel bit-switches are the same at both ends of the link.
- b) If the status LED flashes RED/GREEN/OFF, an AIS Alarm is present. Check that the remote router port status is UP and that the remote router cable is in place.

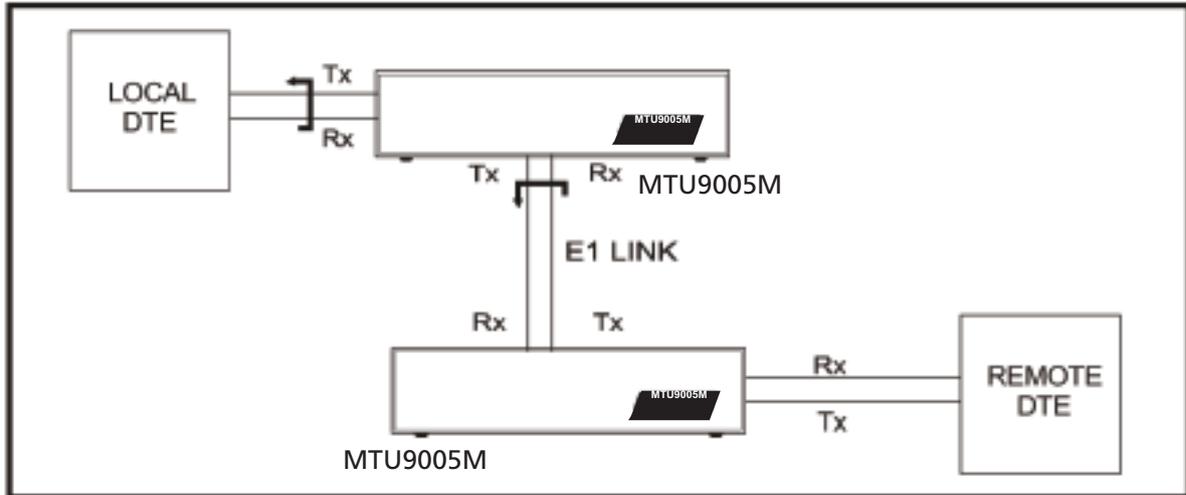
If the status LED flashes GREEN/OFF, check that the local router port status is UP and that the local router cable is in place.

If problems persist, check the DTE cabling configuration. Running TEST LOOPS will help to isolate the problem area - see next section. Transmit and Receive data connections may be crossed, as may any of the handshaking and/or signalling lines.

Step 3: Bridge/Router configuration

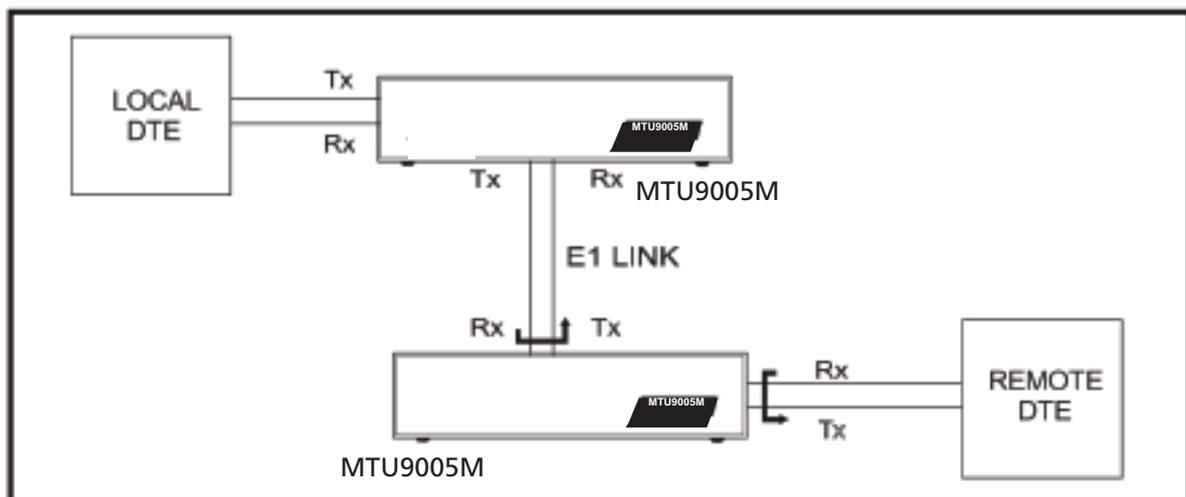
As the MTU9005M & MTU9012s are used in a variety of locations and with many different manufacturer's equipment it is impossible for us to cover all eventualities here, so please consult other manufacturer's operating manual for further information.

4.3 Test Loop



Set the local MTU9005M or MTU9012 base panel bit-switch labelled TEST LOOP to the ON position. When the TEST LOOP is activated at the local unit, the signal received at the E1 port is passed directly back to the link at the line interface. The signal from the DTE is looped adjacent to the DTE port. This effectively isolates the MTU9005M or MTU9012 running the test and validates:

- (a) the local DTE cable if the local DTE recognises its own transmissions.
- (b) the remote DTE and its cable, the remote unit and the E1 link if the remote DTE recognises its own transmissions.



Set the remote MTU9005M or MTU9012 base panel bit-switch labelled TEST LOOP to the ON position. The test loop validates:

- (a) the remote DTE cable if the remote DTE recognises its own transmissions.
- (b) the local DTE and its cable, the local unit and the E1 link if the local DTE recognises its own transmissions.

5.1 MTU9005M/MTU9012 Product Specification

Item	Description
E1 LINE Interface	G.703 compliant, Sensitivity -10dB. Line coding HDB3. Interface types: 75 ohm unbalanced coax (BNC) or 120 ohm balanced RJ-45. Interface selected by bit-switch.
Jitter Tolerance	Per G.823.
Barrier	EN 41003 compliant barrier provided on the E1 interface.
Framing	G.704 compliant with optional CRC4 (set by bit-switch)
DTE Interface	X.21: 15 way female DB15 per ISO4903 V.35: 34-way female M-rack
Clocking options	E1 Line: Internal, Terminal: DTE TT (Circuit 113), Loop: E1 Interface receive clock, DTE Mode: E1 transmit clock slaved to CCT113 with X.21 with X.21 received data timed off CCT113.
General	Definition
Power Supply	100-250 VAC, 50-60Hz, 35-15mA or -36 to -72VDC, 100-50mA
Dimensions	20.2(W) x 13.2(D) x 4.4(H) cm (Unit only) 20.2(W) x 13.2(D) x 4.8(H) cm (With feet)
Environmental	Range
Ambient Temperature	0°C to +50°C
Storage Temperature	-20°C to +70°C
Relative Humidity	0 to 95% non-condensing
Barometric Pressure	86 KPa - 106 KPa

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