

400/96, 96FP, 48
Reference
Manual

CASE

CASE
400/96, 400/96FP, 400/48
REFERENCE MANUAL

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CHAPTER 1

1.1 General

1.2 Versions

1.0 Introduction

1.1 General

This manual applies to 400/96, 400/96FP and 400/48 modems.

The 400/96 is a high performance modem, capable of full duplex operation at 9600, 7200, 4800, or 2400 bits per second (bps.)

The 400/48 modem is capable of full duplex operation at 4800 or 2400 bps.

Each modem will accept synchronous data. They are primarily intended for operation over four - wire private circuits, but can be used in half - duplex mode on two - wire circuits.

Operating modes are easy to select using the internal switches and test modes are activated via the front panel buttons. Operation of the modem is totally automatic. In the event of a line disturbance the data link is immediately restored without operator intervention.

The modems are designed to transmit data over conditioned or unconditioned lines. However, to ensure successful data transmission over very poor lines, a fixed equaliser may be switch selected to extend the range of the automatic adaptive equaliser.

The modem complies with the following CCITT recommendations :-

V29	9600 / 7200 / 4800 bps.
V27 bis / ter	4800 / 2400 bps.

For operation in the UK this equipment is approved for connection to private circuits provided by British Telecom or Hull City Council Telephone Department, subject to the conditions set out in these instructions for use.

1.2 Versions

The following versions are available :

400/96	Standalone boxed V29 modem
400/96C	Rack Mounting version of 400/96
400/96FP	Standalone boxed V29 modem with fast retraining sequence for multi - drop applications.
400/96FPC	Rack Mounting version of 400/96FP
400/48	Standalone boxed V27 modem
400/48C	Rack Mounting version of 40/48

Except where stated, this manual applies to all versions.

CHAPTER 2

Installation

- 2.1 Stand - Alone Versions
- 2.2 Rack - Mounted Version
- 2.3 Front Panel Controls

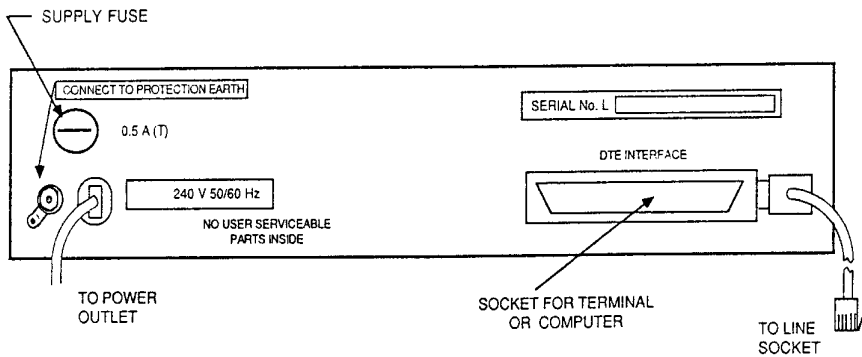
2.0 Installation

The information contained in this section will enable the user to correctly install the modems.

2.1 Stand-Alone Versions (400/96, 400/96FP, 400/48)

These versions are supplied in a table-top enclosure. The front panel, shown in Fig.2, has six light emitting diode indicators (LED's) and four push buttons.

The rear panel (below) includes a 25-way 'D' socket for the connection of the data terminal equipment (DTE - either a VDU or a computer.) A cable terminated as described below is provided for connection to the BT Private Circuit socket and the power cable is terminated in a 13A plug.



The modems should be installed within five metres of the associated data terminal or computer and within two metres of a power socket.

NOTE : The modem is suitable for connection to an a.c. mains source in the range 210 - 260 volts a.c., 47 - 63 Hz.

No internal adjustments are necessary to accommodate the above voltage and frequency ranges. The case should not be opened, except as described in Section 7, or for maintenance by qualified personnel.

The mains cable from the modems is provided with a 13amp plug for connection to a standard socket outlet.

If a different type of 3 pin plug / socket is to be used, re - wire the mains lead, ensuring that the earth wire is correctly connected. If in doubt about the earthing, consult a qualified electrician.

The modem is supplied with either a cable terminated in a standard BT type 6 - way plug, or a terminal block (as specified when ordering.) In the UK, BT must be asked to terminate the private circuit with either the corresponding socket or a terminal block.

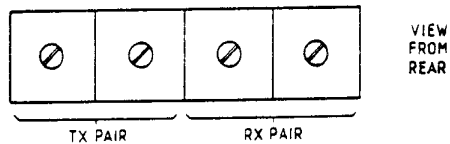
The pin allocation for the 6 way plug / socket is :

PIN	CIRCUIT
1	Tx
2	Rx
3	no connection
4	no connection
5	Rx
6	Tx

If the plug is not required, it can be cut off. The individual wires in the cable are colour coded as follows :

Transmit A	-	Orange
Transmit B	-	Black
Receive A	-	Red
Receive B	-	White
No connection	-	Green & Blue

When a terminal block is fitted, the connections are as in the diagram below.



2.2 Rack Mounting Version. (400/96C, 400/96FPC, 400/48C)

For sites where a number of modems are to be used together, rack mounting versions of the modems are available. These are identical to the boxed version, except for the power supply arrangements.

The BABT approval for these versions is dependant on the modems being installed in accordance with the following instructions. THE APPROVAL WILL BE INVALIDATED if any other configuration is used.

The modems must be installed in a Case Communications card housing type 400 PLUS/CF. The housing will take up to 12 modems.

The 400 PLUS/CF housing includes an approved power supply which provides the low voltages required by the modem card.

The modem card is designed for operation with low voltage supplies of 11 and 8 volts ac. There is no user protection in the apparatus against supplies having voltages in excess of these. Users of the modem card should ensure that any power supply or other equipment provided for use with this apparatus complies with the relevant legal safety requirements when properly assembled, installed and maintained; and when being used with proper care having regard to the purpose for which the equipment is intended.

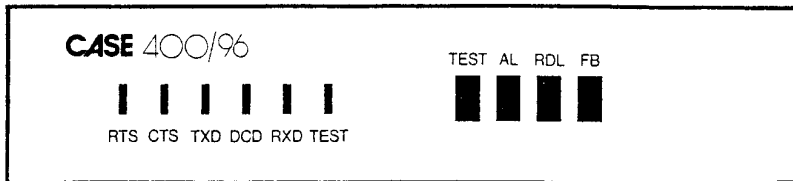
The above statutory requirement is met when the modem cards are used in the 400 PLUS/CF housing and power supply.

The line connection uses either a BT type 6 way socket (standard for UK) or a terminal block (as specified when ordering.) The pin allocation is as described for the stand-alone versions.

When a terminal block is fitted, the upper pair of terminals are the receive pair and the lower are the transmit pair.

2.3 Front Panel Controls

The front panel of the boxed modem is shown below. The front of the rack mounted version is similar. There are six LED indicators, which have the following significance.



- RTS** Indicates the state of the RTS line from the DTE. The LED is ON when RTS is high (active.)
- CTS** Indicates the state of the CTS line from the modem to the DTE. The LED is ON when CTS is high (active.) The modem raises this line in response to the RTS signal, provided that it is not in test mode.
- TXD** Transmit Data
Flashes when data is being transmitted. The LED is on when the SPACE condition is being transmitted.
- DCD** Data Carrier Detect
Reflects the state of the received data carrier. The LED is ON when a carrier is being received.
- RXD** Receive Data
Flashes when data is being received. The LED is ON when the SPACE condition is being received. Also used to indicate errors when in test mode.
- TEST** ON when any of the test functions are active.

There are four push buttons on the modem, functioning as follows :

TEST (push on, push off)

When this button is depressed it activates Self Test which transmits the CCITT 511 pseudo random test pattern and checks and displays the received data for errors. When this test is running, the RxD does not indicate received data, but flashes for each error detected in the received data stream.

AL (push on, push off)

This button, when depressed, connects the transmitter output to the receiver input (analogue loop) for local testing. In addition, when in four wire mode only, the receive line is connected to the transmit line for testing from the far end.

RDL (push on, push off)

When depressed causes a digital loopback at the DTE interface of the remote modem for end to end testing of the link. Will only operate correctly if the remote modem is a compatible type, with remote testing enabled. This function can also be initiated by CCITT circuit 140. The switch and circuit 140 can be disabled as described in section 3.3.

FB (push on, push off)

When depressed causes the modem to transmit and receive at the Fallback speed determined by the internal switches. (Chapter 3)

Further information on the use of the TEST, AL and RDL buttons is in Chapter 4. (Diagnostic Testing.)

CHAPTER 3

Switch Selected Options

- 3.1 Summary of Switched Functions
- 3.2 Transmit Level
- 3.3 RDL Options
- 3.4 Normal Mode Options
- 3.5 Fallback Options
- 3.6 2 / 4 Wire Line Selection
- 3.7 Auto-Retraining Option
- 3.8 Echo Suppressor Tone Option
- 3.9 Transmitter Control Option
- 3.10 Synchronous Modes & Clock Source
- 3.11 Receiver DCD Thresholds
- 3.12 Equalisation
- 3.13 Summary of Switch Functions

3.0 Switch Selected Options

There are a number of switches inside the modem which have to be set according to the operating requirements.

Before opening the case, disconnect the power and BT line connections.

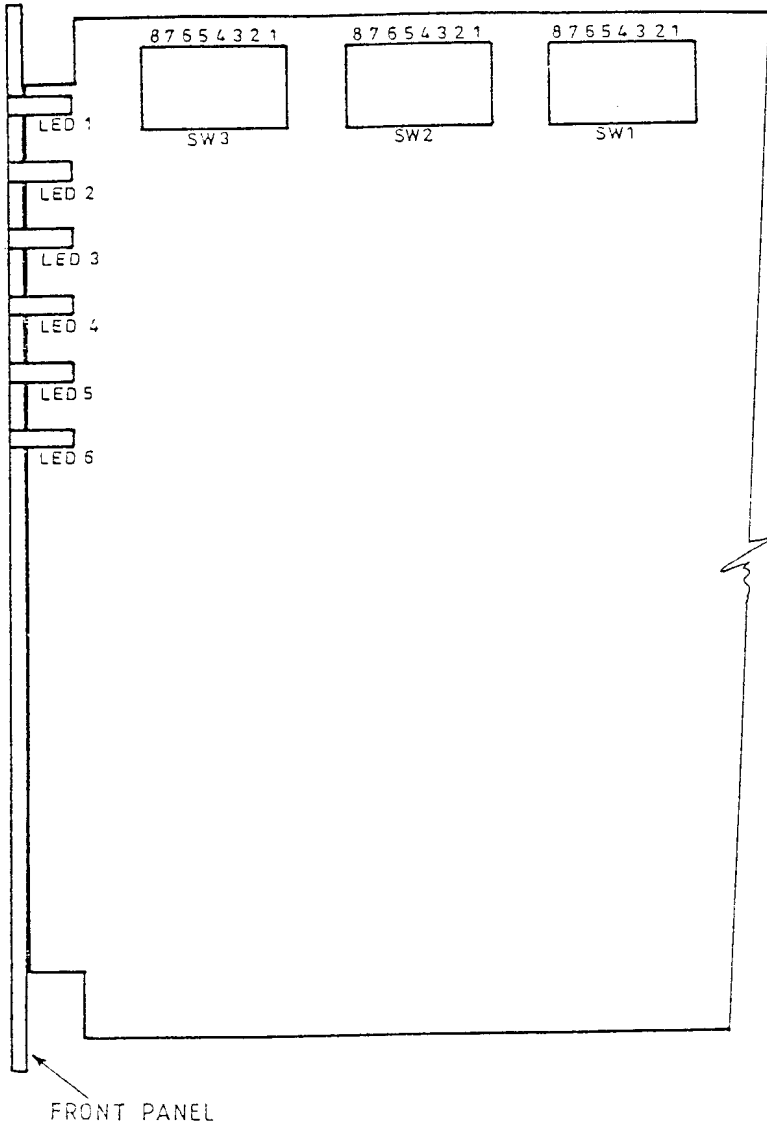
Remove two screws from each side, which will allow the top cover to slide off.

The position of the switch banks are shown below. The following sections explain the function of each switch.

When the switches have been set correctly, replace the cover before re-connecting the power and line.

3.1 Summary of Switched Functions

Function	Section
Transmit level	3.2
RDL option	3.3
Normal Mode Option	3.4
Fallback options	3.5
2 / 4 Wire Line Selection	3.6
Auto-Retraining Option (4 Wire Only)	3.7
Echo Suppressor Tone Option (2 Wire)	3.8
Transmitter Control option	3.9
Synchronous modes clock source	3.10
Receiver DCD Thresholds	3.11
Equalisation	3.12



3.2 Transmit Level

Switch bank 1, sections 1-4 define the transmit level. For use on private circuits in the UK, the maximum permitted level is -13dbm.

This level is selected with switches 1 - 1, 1 - 3 and 1 - 4 in the CLOSED or ON position and switch 1 - 2 in the OPEN or OFF position. The other levels possible are given in the table below.

Modems supplied for use in the UK will have the switches preset for -13dbm.

SWITCHES				
4	3	2	1	
0	0	0	0	0dbm
0	0	0	C	-1dbm
0	0	C	0	-2dbm
0	0	C	C	-3dbm
0	C	0	0	-4dbm
0	C	0	C	-5dbm
0	C	C	0	-6dbm
0	C	C	C	-7dbm
C	0	0	0	-8dbm
C	0	0	C	-9dbm
C	0	C	0	-10dbm
C	0	C	C	-11dbm
C	C	0	0	-12dbm
C	C	0	C	-13dbm
C	C	C	0	-14dbm
C	C	C	C	-15dbm

(C = Closed, 0 = Open.)

3.3 RDL Options

The action of the RDL front panel switch and CCITT circuit 140 is controlled by switch bank 1, section 5. With switch 1 - 5 in the CLOSED or ON position, they can be used for the RDL test as described in section 2.3. With the switch in the OPEN or OFF position, they are ignored.

The RDL pattern used is selected by switch bank 2, section 3. With the switch in the CLOSED or ON position a new, recommended, pattern is used.

3.4 Normal Mode Options

The 400/96 modem can be set to normally operate at 9600 bps or 7200 bps, using switch 3 - 1 as shown in the table below.

The 400/96FP modems normally operate at 9600 bps only, but switch 3 - 1 selects V29 or fast retaining pattern.

The 400/48 modems normally operate at 4800 bps only, but have two training patterns selected by switch 3 - 1.

	Switch 3 - 1			
	OPEN or OFF		CLOSED or ON	
	bps	training pattern	bps	training pattern
400/96	9600	253 m S	7200	253 m S
400/96FP	9600	proprietary 23mS	9600	253 m S
400/48	4800	50 m S	4800	708 m S

3.5 Fallback Options

Switches 3 - 2, 3 - 3 and 3 - 4 are used to select the required fallback mode.

The 400/96 modems can be set up to fallback to either 7200, 4800 OR 2400 bps in various modes as shown in the table below.

The 400/96FP modems have additional fallback modes, allowing selection of proprietary or standard training patterns. These are shown in the table overleaf.

The V27 modems have a single fallback speed of 2400 bps. When the normal mode is 4800 bps with a 50mS training pattern, the fallback mode can be 4800 bps with a 708mS training pattern. These are shown in the table overleaf.

Fallback Mode - 400/96			
Switches 3-2,3-3,3-4	Mode	bps	Training Pattern
0 0 0	V29	7200	253mS
0 0 C	V29	4800	253mS
0 C 0	V27	4800	50mS
0 C C	V27	4800	708mS
C 0 0	V27	2400	67mS
C 0 C	V27	2400	943mS
C C 0	not used		
C C C	not used		

For the switches in the above table

0 = OPEN or OFF
C = CLOSED or ON

Fallback Mode - 400/96FP			
Switches 3-2,3-3,3-4	Mode	bps	Training Pattern
0 0 0	V29	7200	P 23mS
0 0 C	V29	4800	P 23mS
0 C 0	V27	2400	P 30mS
0 C C	V29	9600	253mS
C 0 0	V29	7200	253mS
C 0 C	V29	4800	253mS
C C 0	V27	4800	50mS
C C C	V27	2400	67mS

For the switches in the above table,

0 = OPEN or OFF
C = CLOSED or ON
P = Proprietary Training Pattern

Fallback Mode - 400/48					
Switches 3-2,3-3,3-4	Mode	bps	Training Pattern		
0 0 0	V27	4800	708mS		
0 0 C	V27	2400	67mS		
0 C 0	V27	2400	943mS		
0 C C	}				
C 0 0	}				
C 0 C	}	not used			
C C 0	}				
C C C	}				

For the switches in the above table,

- 0 = OPEN or OFF
- C = CLOSED or ON
- P = Proprietary Training Pattern.

Operation at the selected fallback speed is controlled by either the FB front panel button or the CCITT circuit 111.

Switch bank 1 section 6 enables or disables circuit 111. With switch 1 - 6 in the CLOSED or ON position, circuit 111 is enabled. This switch does not affect the operation of the FB button.

Switch bank 1 section 7, in the CLOSED or ON position forces the modem to operate at the selected fallback speed, irrespective of the position of the FB button or the state of circuit 111. With this switch in the OPEN or OFF position, the modem will operate at normal speed unless fallback is selected as above.

3.6 2 / 4 Wire Line Selection

Switch bank 1 section 8 determines whether the modem is set up for 2 or 4 wire operation.

With this switch in the CLOSED or ON position, the modem operates in the 4 wire mode.

With the switch in the OPEN or OFF position, the modem operates in 2 wire mode . The "Transmit" pair is used for both transmission and reception. For 2 wire operation, the modem must be operated in half duplex mode, with the RTS signal line used to control the modem. (With RTS high the modem will be in transmit mode; with RTS low it will be in receive mode.) See also Section 3.9

3.7 Auto - Retraining Option

This option applies when in 4 - wire mode only. It is controlled by switch bank 2, section 1.

Normal operation is with this switch in the OPEN or OFF position.

With this switch in the CLOSED or ON position and 4 - wire line selected (3.6) the modem will operate normally so long as a good signal is received. However, if the received carrier degrades, the modem transmits a training pattern as a request for a training pattern from the remote modem. Similarly, if it receives a training pattern from the remote modem, it will reply with a training pattern.

Obviously, this function will only operate if the remote modem is of the same type, with this facility enabled.

This option is not selectable in the 400/96FP and must be left in the OPEN or OFF position.

3.8 Echo Suppressor Tone Option

This option applies when in 2 - wire mode only. It is controlled by switch bank 2, section 1.

Normal operation is with this switch in the OPEN or OFF position.

With this switch in the CLOSED or ON position and 2 - wire line selected (3.6,) the modem will prefix each transmission with carrier frequency tone. This is sent for 185mS, before the training pattern, in order to switch over any echo suppressors in the bearer circuit.

3.9 Transmitter Control Options

The facilities are provided for controlling the modem transmitter. The anti-streaming feature prevents the transmitter remaining on for too long, particularly useful in multi-drop slave (pollled) applications.

The other facility allows the transmitter to be controlled by the RTS signal, necessary in two-wire and multi-drop slave situations.

The functions are controlled by switch 2, sections 2 and 4, as shown in the following table :-

Switches		MODE
2-4	2-2	
0	0	The modem transmitter is controlled by RTS. RTS-CTS delay depends on the normal or fallback selection. This setting should be used in multi-drop slave situations.
0	C	The modem transmitter is controlled by RTS. RTS-CTS delay depends on the normal or fallback selection. If RTS remains high for longer than approximately 3 seconds, CTS is lowered and the modem stops transmitting to line. The setting should be used in multidrop slave situations where antistreaming is required.
C	0	The modem transmitter is constantly enabled. RTS-CTS delay is less than 2mS. This setting should be used in multi-drop master or point to point situations.
C	C	The modem transmitter is constantly enabled. RTS-CTS delay is less than 2mS. If RTS remains high for longer than approximately 3 seconds, CTS is lowered and the modem transmits a mark condition to line. This setting should be used in multidrop slave situations where both constant carrier and anti-streaming are required.

3.10 Synchronous Modes & Clock Source.

In the synchronous mode, one of three sources must be selected for the transmitter clock. These options are controlled by switch bank 2, sections 5 and 6, as shown in the table below.

Switches		Synchronous (S)	Transmitter Clock Source
2-6	2-5		
0	0	S	Internal External on Pin 24 of 'D' connector Receiver derived clock Not used
0	C	S	
C	0	S	
C	C	A	

0 = OPEN or OFF
C = CLOSED or ON

3.11 Receiver DCD Thresholds

Four different DCD thresholds are selectable, using switch bank 2, sections 7 and 8, as shown in the table below :-

Switches		DCD ON for carrier greater than	DCD OFF for carrier less than
2-8	2-7		
0	0	-16dBm	-21dBm
0	C	-26dBm	-31dBm
C	0	-33dBm	-38dBm
C	C	-43dBm	-48dBm

0 = OPEN or OFF
C = CLOSED or ON

3.12 Equalisation

The modem receiver includes an automatic adaptive equaliser, which will usually be sufficient to ensure successful data transfer. When poor lines are used, or the link includes a number of tandem connections, additional equalisation may be necessary. The modem includes two types of switch selectable equalisers.

Switch bank 3, sections 5 and 6 select amplitude comprise equalisers in the transmit and receive paths, as shown in the following table :-

Switches		Equaliser set for cable length
3-6	3-5	
0	0	7.2 Km
0	C	3.6 Km
C	0	1.8 Km
C	C	Equalisers omitted

Switch bank 3, sections 7 and 8 switch a link amplitude and delay comprise equaliser in the receive path. Two versions are selectable, as shown in the table.

Switches		Equaliser standard
3-8	3-7	
0	0	Not Used
0	C	Japanese 3-Link
C	0	US Survey, long
C	C	Equalisers omitted

In the above tables 0 = OPEN or OFF
 C = CLOSED or ON

The normal factory setting is with the equalisers omitted; all four switch sections in the CLOSED position.

3.13 Summary of Switch Settings

Switch Bank 1

Switch	Function	Section
1}	Transmitter output level	3.2
2}	Transmitter output level	3.2
3}	Transmitter output level	3.2
4}	Transmitter output level	3.2
5}	RDL switch and circuit 140 control	3.3
6}	FB switch and circuit 111 control	3.5
7}	FB switch and circuit 111 control	3.5
8}	2 / 4 - wire line selection	3.6

Switch Bank 2

Switch	Function	Section
1}	Auto re - training (4 wire)	3.7
	Echo suppressor tone (2 wire)	3.8
2}	Anti-streaming control	3.9
3}	RDL Pattern selection.	
4}	Transmitter Control	3.9
5}	Synchronous modes	3.10
6}	and transmitter clock source	
7}	Receiver DCD threshold level	3.11
8}	Receiver DCD threshold level	3.11

Switch Bank 3

Switch	Function	Section
1}	Normal mode selection	3.4
2}	Fallback mode selection #1	3.5
3}	Fallback mode selection #1	3.5
4}	Fallback mode selection #1	3.5
5}	Equalisation options #2	3.12
6}	Equalisation options #2	3.12
7}	Equalisation options #2	3.12
8}	Equalisation options #2	3.12
#1	Switch 3-2 is not used in the 400/48 and must be left in the OPEN position. Some combination of switches 3-2 3-3 and 3-4 are not used (and must not be set up,) see details for each version of the modem.	
#2	The factory setting is all four switches CLOSED, no equalisation is included. Switches 3-7 and 3-8 must not both be in the OPEN position.	

CHAPTER 4

Diagnostic Tests

- 4.1 Introduction
- 4.2 Tests Available
- 4.3 Use of front panel switches for testing
- 4.4 Local Analogue Loopback
- 4.5 Local Analogue Loopback with Self Test
- 4.6 Remote Digital Loopback
- 4.7 Remote Digital Loopback with Self Test

4.0 Diagnostic Tests

4.1 Introduction

The modems are equipped with several diagnostic tests to aid the operator to determine the problem source. A failure may be caused by any of the following :

Local or remote data terminal equipment.

The local or remote modem.

or The private circuit (leased line.)

A 4 - wire private circuit must be connected in order to use the remote digital loopback tests.

4.2 Tests Available.

The modems can perform the following tests :

- a. Local Analogue Loopback.
- b. Local Analogue Loopback with Self Test.
- c. Remote Digital Loopback.
- d. Remote Digital Loopback with Self Test.

To verify the integrity of the modems, the Local Analogue Loopback with Self Test can be performed at both the local and remote stations, section 4.6. If the results are good then the Remote Digital Loopback with Self Test can be performed to verify the complete modem to modem communications path (section 4.7.)

If the Remote test fails (after passing the Local Analogue Loopback test,) then this is a good indication that the private circuit is at fault. If these symptoms remain consistent, the problem should be reported to the telephone company.

To verify both the modem and the data terminal equipment, the operator should use the Local Analogue Loopback test, section 4.5. If the local analogue test fails after the local analogue loopback with self test passes, then the data terminal equipment should be checked for faults.

Note that the remote tests are only valid when a four wire line is used and the modem is set in four wire mode.

4.3 Use of Front Panel Switches for Testing.

The test functions are initiated using the front panel buttons, TEST, AL and RDL.

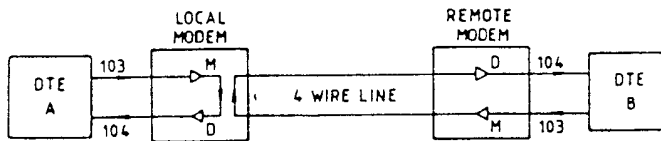
The functions of the buttons are as follows :-

- AL** This button, when depressed, connects the transmitter output to the receiver input (analogue loop) for local testing. At the same time the line is looped.
- RDL** Causes a digital loopback at the DTE interface of the remote modem for end to end testing of the link. Will only operate correctly if the remote modem has compatible test facilities.
- TEST** When this button is depressed it activates Self Test, which transmits the CCITT 511 pseudo random test pattern and checks and displays the received data for errors.

Combinations of the buttons are used to perform the test as described in the following sections.

4.4 Local Analogue Loopback (L3)

This test is used to check the path which includes the local modem and local data terminal equipment. The line is also looped, as shown in the diagram, so that the received line signal is transmitted with approximately 0dB loss.

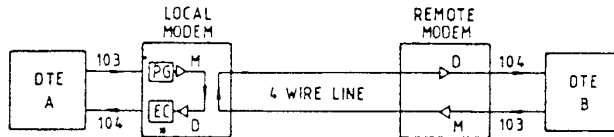


To initiate the test, depress the AL button. If the modem is set for synchronous data, the terminal's loop test facility should now be enabled. If the modem is set for asynchronous data, a message can be keyed in, which will be echoed back to the screen via the modem's analogue loopback connection.

To terminate the test release the AL button.

4.5 Local Analogue Loopback (L3) with Self Test

This test will verify the status of the local modem transmit and receive circuits. The line is looped as in the previous test.



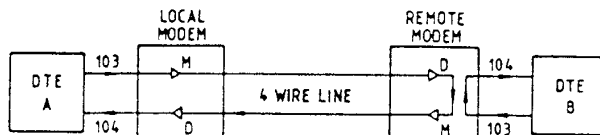
- * Check for 511 Test Pattern
- PG = 511 Pattern generator
- EC = Error check

To initiate the test, depress the TEST and AL buttons. The modem generates the 511 pseudo random test pattern. This is transmitted to its own receiver via the internal analogue loop (see diagram.) The modem checks the received data for errors and flashes the RXD LED each time an error is detected. Note that the 'flash' is extended to make it visible, so errors in consecutive bits will appear as one error to the viewer.

The test is terminated by releasing the TEST and AL buttons.

4.6 Remote Digital Loopback (L2)

This test is used to test the local data terminal equipment, the local and remote modem, and the telephone circuit. The local terminal sends a test message to the remote station, which loops its receive stream back to the local end. The local data terminal compares the receive stream with the transmitted message to verify connection. At the same time, the remote terminal is looped, as shown in the diagram.



If the message is not the same as the one transmitted, then the local and remote stations should perform the analogue loopback test to determine if the problem lies with the local data terminal, the local or remote modem, or the private circuit (leased line.)

NOTE : This test requires a compatible modem at the remote end.

To initiate the test, depress the RDL button. If the modem is set for synchronous data, the terminal's loop test facility should now be enabled. If the modem is set for asynchronous data, a message can be keyed in. This will be transmitted to the remote end, looped back, retransmitted to the local end and displayed on the screen.

To terminate the test, release the RDL button.

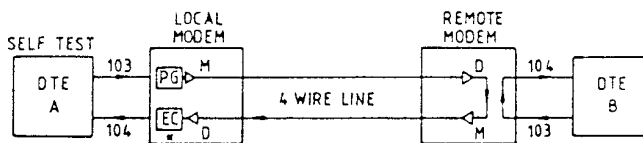
4.7 Remote Digital Loopback (L2) with Self Test

This test is used to test the remote modem and the telephone circuit.

The local modem sends a standard test message to the remote station, which in turn loops its receive stream back to the local data station. The modem examines the receive pattern for any errors, and upon test completion, displays the error count.

If the test shows errors, a local analogue loopback test should be initiated to determine the exact problem area.

Note that this test requires a compatible modem at the remote end.



- * Check for 511 Test Pattern
- PG = 511 Pattern generator
- EC = Error check

To initiate the test depress the TEST and RDL buttons. The modem generates the 511 pseudo random test pattern. This is transmitted to the remote modem which loops the received data (at its digital interface, see diagram) and re-transmits it to the local modem. The local modem checks the received data for errors and flashes the RXD LED each time an error is detected. Note that the 'flash' is extended to make it visible, so errors in consecutive bits will appear as one error to the viewer.

The test is terminated by releasing the TEST and RDL buttons.

APPENDIX A

Technical Specifications

<i>Transmitter:</i>	Signal	400/96 8 Phase 2 amplitude 2400 baud	400/48 8 Phase 1600 baud
	Speed	9600 / 7200 / 4800 / 2400 bit / s	4800 / 2400 bit / s
	Level	Zero to -15dBm switchable in 1dB steps	
	Carrier Freq	1700Hz	1800Hz
	RTS / CTS delay (23mS for 400/96FP)	253 ms	50ms
<i>Data Format</i>	Serial synchronous		
<i>Timing</i>	Internal, external or receive clock		
<i>Receiver</i>	Unconditioned 4 wire / 2 wire Private Lines		
	Range 0dBm to -43dBm		
	Carrier Detect ON at -43dBm, -33dBm, -26dBm, -16dBm OFF at -48dBm, -38dBm, -31dBm, -21dBm (The levels are switch selectable.)		
	Hysteresis minimum 2dBm		
	Equaliser Automatic adaptive transversal equaliser Switchable compromise equalisers		
	Impedance 600 ohms balanced		
	Initialisation Train on data Forced retrain		
<i>Tests</i>	Local analogue loop / line analogue loop Remote digital loop (4 wire) 511 test pattern generator		

<i>Switch Options</i>	Transmit level Receive carrier threshold Fallback speed select Antistreaming Timing source 4 - wire / 2 - wire Fixed compromise equalisers
<i>Front Panel Switch</i>	Local analogue loop Remote digital loop Test pattern generator Fallback
<i>Indicators</i>	Request to send Clear to send Transmit data Data carrier detect Receive data Test
<i>Physical</i>	Standalone 28 cm x 19 cm x 5 cm Rackmount 12 modems, any mix, in any frame occupying 4U of standard rack space
<i>Environment</i>	0 to +50 degrees C - operating -50 to +70 degrees C - storage Relative humidity 5% to 95% non - condensing Altitude to 3000 metres
<i>Power</i>	210 to 260 volts 47 to 63 Hz 10 watts maximum - standalone 120 watts maximum - 400/24 PLUS/CF

APPENDIX B

CCITT V.24 / EIA RS232C INTERFACE PIN ASSIGNMENT

P i n	EIA Ref	CCITT Ref	Description	Gnd		Data		Control		Timing	
				Fr DCE	To DCE	Fr DCE	To DCE	Fr DCE	To DCE	Fr DCE	To DCE
1	AA	101	Protective Ground	x							
7	AB	102	Signal Ground	x							
2	BA	103	Transmitted Data				x				
3	BB	104	Received Data			x					
4	CA	105	Request to Send						x		
5	CB	106	Clear to Send					x			
6	CC	107	Data Set Ready					x			
8	CF	109	Received Signal Detector					x			
24	DA	113	Transmitter Signal Element Timing (DTE)								x
15	DB	114	Transmitter Signal Element Timing (DCE)							x	
17	DD	115	Receiver Signal Element Timing (DCE)							x	
18	CN	141	Local Loopback						x		
21	----	140	Remote Digital Loopback						x		
23		111	Fallback						x		
9		+12V						x			
10		-12V						x			
25		Test Indicator						x			

APPENDIX C

Compliance with BSI Requirements (for use in the UK only)

European Low Voltage Directive

When correctly installed and maintained, the modem will present no hazard to the user. When correctly installed, the modem will be connected to the PSTN or a PW and to a Data Terminal Equipment (DTE,) whose modem connections comply with CCITT recommendation V28. The DTE connections are therefore taken to be safe voltages (less than + / - 30 volts.)

Compliance with BS6301 Clause 7.2 (Safety Requirements)

When the only earth connection to the modem is via the three pin mains plug, the cable to the BT socket must be unplugged before the mains plug is removed. See also the Installation information in Section 2.

Compliance with BS6328 Part 1 and BABT / SITS / 82 / 01 / C Clause 8 (Use on Private Circuits)

- a. The modem is not suitable for use on circuits with British Telecommunications signalling at a nominal frequency of 2280Hz.
- b. It is suitable for Omnibus, Point to Point and Multipoint Private Circuits.
- c. The modem does not require signalling or otherwise employ the frequency range dc to 200Hz.
- d. The modem may be connected directly to a Private Circuit, see Chapter 2.
- e. The modem does not require dc from the Private Circuit for correct operation. The modem may be damaged if connected, in private circuit mode, to a circuit supplying dc current (the maximum permissible direct current is zero amps.)
- f. The approval of this modem for connection to British Telecom Private Speechband circuits is INVALIDATED if the apparatus is subject to any modification in any material way not authorised by BABT or if it is used with, or connected to :-
 - 1) internal software that has not been formally accepted by BABT.
 - 2) external control software or external control apparatus which causes the operation of the modem or associated call set - up equipment to contravene the requirements of the standard set out in BABT / SITS / 82 / 01 / C.

All apparatus connected to this modem and thereby connected directly or indirectly to British Telecom Private Speechband circuits must be approved apparatus as defined in Section 22 of the British Telecommunications Act 1984.

- g. The modem is suitable for household, office and similar general indoor use.

APPENDIX D

Quick Reference Switch Setting

SWITCH BANK 1

Text Ref.	Function		Switch			
			1	2	3	4
3.2	TRANSMITTER O/P LEVEL (dBm)	0	-	-	-	-
		-1	C	-	-	-
		-2	-	C	-	-
		-3	C	C	-	-
		-4	-	-	C	-
		-5	C	-	C	-
		-6	-	C	C	-
		-7	C	C	C	-
		-8	-	-	-	C
		-9	C	-	-	C
		-10	-	C	-	C
		-11	C	C	-	C
		-12	-	-	C	C
		* -13	C	-	C	C
		-14	-	C	C	C
-15	C	C	C	C		
3.3	REMOTE DIGITAL LOOP (DTE/Front Panel)	* enable	5			
		disable	C			
3.5	DTE FALLBACK	* enable	6			
		disable	C			
3.5	FORCE FALLBACK	* enable	7			
		disable	C			
3.6	2/4 WIRE OPERATION	* 4 wire	8			
		2 wire	C			

NOTE: C = Closed (switch is down/closed).

- = Open (switch is up/open).

x = This refers to switch 2 - 3, it selects the RDL pattern used. If the RDL function is required, it is recommended this is selected to the CLOSED position.

* = This is the factory setting.

SWITCH BANK 2

Text Ref.	Function	Switch
3.7	AUTO RETRAIN (4 wire) *enable disable -	1 C -
3.8	ECHO SUPPRESSION (2 wire) enable disable	1 C -
3.9	ANTI-STREAMING - CONTROL OF TRANSMITTER * Tx Controlled by RTS (use H.Duplex) Tx/Anti-stream controlled by RTS Tx enabled (use FP master or pt - pt) Tx/Anti-stream enabled, (use FP slave)	2 3 4 - x - C x - - x C C x C
3.10	CLOCK SOURCE *Internal (sync) External (pin 24) Slave receive not used	5 6 - - C - - C C C
3.11	RECEIVE CARRIER THRESHOLD -16/-21 dBm *-26/-31 dBm -33/-38 dBm -43/-48 dBm	7 8 - - C - - C C C

SWITCH BANK 3

Text Ref.	Function	Switch	
3.4	TRAIN UP TIME	400/96 - 253 ms	1 x
		400/96 FP - 23 ms - 253 ms	- C
		400/48 - 50 ms - 708 ms	- C
3.5	FALLBACK SPEED SELECTION	V29/7200bps - 253 ms	2 3 4 - - -
		*V29/4800bps - 253 ms	- - C
400/96		V27/4800bps - 50 ms	- C -
		V27/4800bps - 708 ms	- C C
		V27/2400bps - 67 ms	C - -
		V27/2400bps - 943 ms	C - C
		not used	C C -
		not used	C C C
3.5	FALLBACK SPEED SELECTION	V29/7200bps - 23 ms	2 3 4 - - -
		V29/4800bps - 23 ms	- - C
400/96FP		V27/2400bps - 30 ms	- C -
		V29/9600bps - 253 ms	- C C
		V29/7200bps - 253 ms	C - -
		V29/4800bps - 253 ms	C - C
		V27/4800bps - 50 ms	C C -
		V27/2400bps - 67 ms	C C C
3.5	FALLBACK SPEED SELECTION	V27/4800bps - 708 ms	2 3 4 - - -
		V27/4800bps - 67 ms	- - C
400/48		V27/2400bps - 943 ms	- C -
		not used	- C C
		not used	C - -
		not used	C - C
		not used	C C -
		not used	C C C
3.12	COMPROMISE EQUALISER	7.2 Km	5 6 - -
		3.6 Km	C -
		1.8 Km	- C
		*Disable	C C
3.12	RECEIVER AMPLITUDE, DELAY COMPROMISE EQUALISER	not used	7 8 - -
		3 - links	C -
		US Long	- C
		*Disable	C C