DATEL 600 SERVICE

MODEM 22

FIG. 1.1

R18260

R18260

FIG. 1.2

PART 1

DATEL SERVICE CODES

CONTENTS

1 INTRODUCTION The Modem 22 is the operational title for the modem which is an alternative to the Modem 20 used with the Datel 600 Service.

The Modem 22 is compatible with a Modem 20 or 1, but the backward channel can then only be used at speeds up to 75 bit/s.

2 DATA TRANSMISSION FACILITIES The modem can be strapped in any one of four modes defined as follows and illustrated in Fig 1.3.

Mode 1:- Transmit 600/1200 bit/s. Receive 150 bit/s over a 2 wire PC or PSTN (equivalent of Modem 20 model 3).

Mode 2:- Transmit 150 bit/s. Receive 600/1200 bit/s over 2 wire PC or PSTN (equivalent of Modem 20 model 4).

Mode 3:- Transmit 600/1200 bit/s. Receive 600/1200 bit/s over a 4 wire PC, Full Duplex, or Half Duplex on a PSTN (equivalent to Modem 20 model 5).

Mode 4:- Transmit 600/1200 bit/s and receive 150 bit/s, or Transmit 150 bit/s and receive 600/1200 bit/s, over a 2 wire PC or PSTN, (equivalent of Modem 20 models 3 and 4 on 2 wire PC or PSTN). Note:- There is no equivalent Mode to the Modem 20 model 3 and 4 on a 4 wire PC.

NOTE 1: In Mode 4, when request to send (CCT 105) is 'ON' the Forward channel is selected for transmission and with CCT 105 'OFF', the Backward channel is selected.

NOTE 2: Modes 1, 2, and 4 can be used with a Data Control Equipment No. 1 (DCE1).

Fig 1.3 Modes of Operation

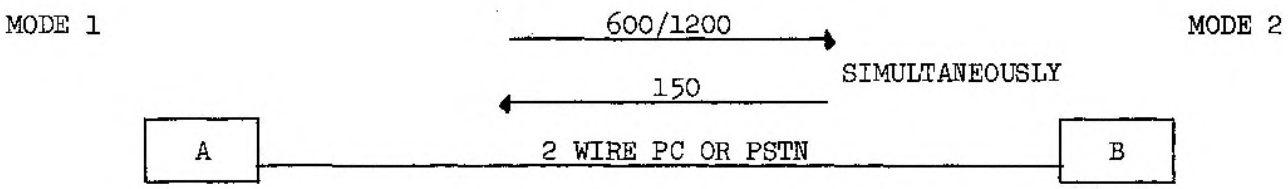
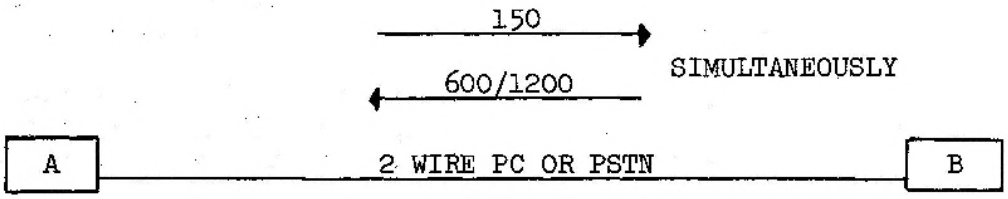
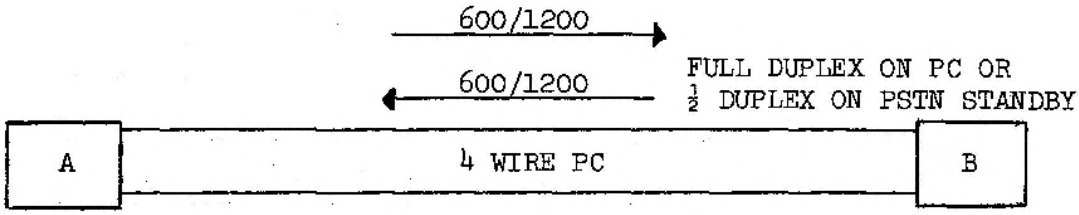


Fig 1.3 (Contd)

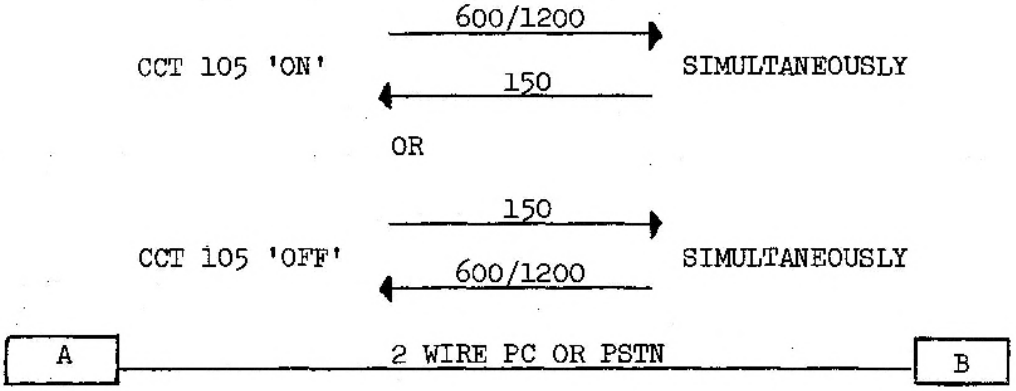
MODE 2 MODE 1



MODE 3 MODE 3

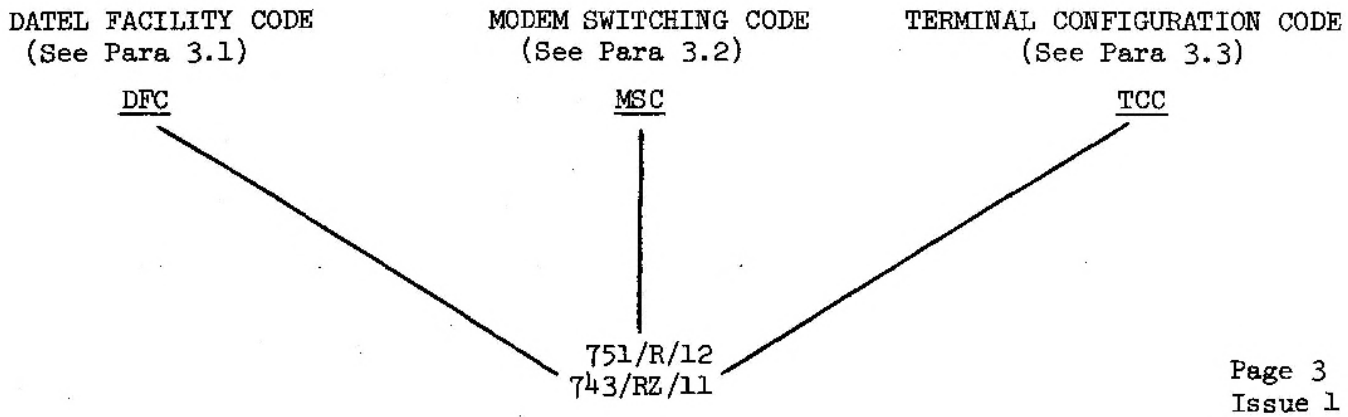


MODE 4 MODE 4



3 SERVICE CODES The Datel Service Code consists of a unique three section alpha-numeric code which defines each standard Datel equipment arrangement. These codes are used on Advice Notes by Sales Division to inform Installation Division of customer's service requirements. The three sections which make up a Datel 600 Service Code are described in this Section.

An example of a typical Service Code is shown below:-



3.1 **Datel Facility Code (DFC)** This 3 digit number denotes the Datel Service, the circuits provided and the data transmission facilities provided.

The hundred digit is 7, indicating a Datel 600 installation using a Modem 22. The tens digit specifies the circuits provided, as detailed in Table 1.1. The units digit specifies the Modem equipment and data transmission facilities as shown in Table 1.2.

TABLE 1.1

DATEL FACILITY CODE

DFC TENS DIGIT	CIRCUIT CONFIGURATION
1	2-WIRE PRESENTED PRIVATE CIRCUIT ONLY
2	2-WIRE PRESENTED PRIVATE CIRCUIT WITH STANDBY EXCHANGE LINE
3	4-WIRE PRESENTED PRIVATE CIRCUIT ONLY
4	4-WIRE PRESENTED PRIVATE CIRCUIT WITH STANDBY EXCHANGE LINE
5	EXCHANGE LINE ONLY

TABLE 1.2

DATEL FACILITY CODE

DFC UNITS DIGIT	FACILITIES
1	MODE-1 TRANSMIT DATA AT 600/1200 BIT/S, RECEIVE BACKWARD CHANNEL AT 150 BIT/S
2	MODE-2 TRANSMIT BACKWARD CHANNEL AT 150 BIT/S, RECEIVE DATA AT 600/1200 BIT/S
3	MODE-3 TRANSMIT DATA AT 600/1200 BIT/S, RECEIVE DATA AT 600/1200 BIT/S
4	MODE-4 TRANSMIT DATA AT 600/1200 BITS, RECEIVE BACKWARD CHANNEL AT 150 BIT/S OR TRANSMIT BACKWARD CHANNEL AT 150 BIT/S, RECEIVE DATA AT 600/1200 BIT/S
5	MODE 1 + DCE 1 PSTN ONLY
6	MODE 2 + DCE 1 PSTN ONLY
7	MODE 4 + DCE 1 PSTN ONLY

NOTE: For Transmit Data at 600/1200 Bit/s and receive data at 600/1200 Bit/s on 2-wire PC or PSTN Mode 4 must be used with the backward channels not being driven.

3.2 Modem Switching Code (MSC) This code indicates the method of switching the modem to line. The options and their descriptions are given in Table 1.3.

TABLE 1.3

MODEM SWITCHING CODE

CODE LETTER	LINE SWITCHING METHOD
R	THE MODEM IS CONNECTED TO AND DISCONNECTED FROM THE PRIVATE CIRCUIT OR PSTN ONLY, BY CONDITIONS ON INTERCHANGE CIRCUIT 108/1 (CONNECT DATA SET TO LINE), FROM THE CUSTOMER'S DATA TERMINAL EQUIPMENT (DTE). CONNECTION TO AND DISCONNECTION FROM PSTN STANDBY IS CONTROLLED BY A BUTTON/KEY ON BT EQUIPMENT IN CONJUNCTION WITH CONDITIONS ON CIRCUIT 108/1 FROM THE CUSTOMER'S DTE.
S	THE MODEM CONNECTS INITIALLY TO THE PRIVATE CIRCUIT WHEN POWERED; SUBSEQUENT DISCONNECTION AND RECONNECTION IS CONTROLLED BY A BUTTON/KEY ON BT EQUIPMENT ONLY. CONNECTION TO AND DISCONNECTION FROM THE PSTN IS CONTROLLED BY BUTTONS/KEYS ON BT EQUIPMENT ONLY.
T	THE MODEM CONNECTS INITIALLY TO THE PRIVATE CIRCUIT WHEN POWERED; SUBSEQUENT DISCONNECTION AND RECONNECTION IS CONTROLLED BY A BUTTON/KEY ON BT EQUIPMENT ONLY. CONNECTION TO THE PSTN IS CONTROLLED BY AN *ON* CONDITION ON INTERCHANGE CIRCUIT 108/2 (DATA TERMINAL READY) FROM THE CUSTOMER'S DTE IN CONJUNCTION WITH BUTTONS/KEYS ON BT EQUIPMENT. DISCONNECTION FROM THE PSTN IS EITHER BY AN *OFF* CONDITION ON INTERCHANGE CIRCUIT 108/2 OR A BUTTON/KEY ON BT EQUIPMENT.
RZ	AS FOR R BUT THE PRIVATE CIRCUIT IS NOT EQUIPPED WITH SIGNALLING FACILITIES. NO PRIVATE CIRCUIT TELEPHONE IS PROVIDED.
SZ	AS FOR S BUT THE PRIVATE CIRCUIT IS NOT EQUIPPED WITH SIGNALLING FACILITIES. NO PRIVATE CIRCUIT TELEPHONE IS PROVIDED.
TZ	AS FOR T BUT THE PRIVATE CIRCUIT IS NOT EQUIPPED WITH SIGNALLING FACILITIES. NO PRIVATE CIRCUIT TELEPHONE IS PROVIDED.

NOTE 1: Code letter 'W' may be used to indicate a non-standard installation, covered by a works specification, is required.

NOTE 2: Auto-Answering with 1300 Hz inland answering tone is available with 'R' and 'T' working on exchange line installations. Auto-Answering with 2100 Hz International Answer tone is available with 'T' working only.

3.3 Terminal Configuration Code (TCC) The two digits of this code are allocated as follows:-

The tens digit specifies the Ready for Sending delay as shown in Table 1.4. The units digit specifies the answer tone transmitted when the Modem is connected to line, as indicated in Table 1.5.

TABLE 1.4

TERMINAL CONFIGURATION CODE

TCC TENS DIGIT	INDICATES THE DELAY BETWEEN THE OFF-ON TRANSITIONS OF 'REQUEST TO SEND' TO 'READY FOR SENDING' INTERCHANGE CIRCUIT
1	SHORT DELAY PC (5 TO 7 ms) AND SHORT DELAY PSTN (22 TO 38 ms)
2	SHORT DELAY PC (5 TO 7 ms) AND LONG DELAY PSTN (206 TO 269 ms)
3	LONG DELAY PC (22 TO 38 ms) AND SHORT DELAY PSTN (22 TO 38 ms)
4	LONG DELAY PC (22 TO 38 ms) AND LONG DELAY PSTN (206 TO 269 ms)

TABLE 1.5

TERMINAL CONFIGURATION CODE

TCC UNITS DIGIT	ANSWER TONE
1	INLAND ANSWER TONE - INHIBIT 2100 Hz
2	INTERNATIONAL ANSWER TONE - ENABLE 2100 Hz

3.4 Standard Combinations of DFC and MSC All standard combinations of DFC and MSC for a Datel 600 installation using a Modem 22 are given in Table 1.6.

These codes can be used with appropriate TCC digits.

TABLE 1.6

STANDARD COMBINATIONS OF DFC AND MSC

	R	S	T	RZ	SZ	TZ
2 WIRE PC	711 712 714	711 712 714			711 712 714	
2 WIRE PC WITH PSTN ST/BY	721 722 724	721 722 724	721 722 724	721 722 724	721 722 724	721 722 724
4 WIRE PC	733	733			733	
4 WIRE PC WITH PSTN ST/BY	743	743	743	743	743	743
EXCHANGE LINE ONLY	751 752 754	751 752 754	751 752 754 755 756 757			

PART 2

EQUIPMENT REQUIRED

CONTENTS

1 **INTRODUCTION** Part 2 lists the equipment required to provide a Datel 600 service installation using a Modem 22, as indicated by the Datel Service Code on the Advice Note. Other Telecom Instructions relating to Part 2 are listed below:

C3 I8031 - Data Control Equipment 1A - Installation
C3 I8032 - Data Control Equipment 1B - Installation

Page 1 Fig 1.1 shows a photograph of the Modem 22 with Main Unit 1/TG 2587, Modem Module 1/TG 2527, Case 1/TG 2491 and Line Module 1/TG 2576.

2 **DIAGRAMS REQUIRED** Tables 2.1 to 2.6 list the installation diagrams according to the line configuration as follows:-

TABLE 2.1

INSTALLATION DIAGRAMS FOR 2 WIRE PRESENTED PRIVATE CIRCUIT (PC) ONLY

DATEL SERVICE CODE	DIAGRAM NO.
711SZ, 712SZ, 714SZ	DT/DTW(L) 1270
711R, 711S, 712R, 712S, 714R, 714S	DT/DTW(L) 1269

TABLE 2.2

INSTALLATION DIAGRAMS FOR 2 WIRE PRESENTED PC WITH

PUBLIC SWITCHED TELEPHONE NETWORK (PSTN) STAND-BY

DATEL SERVICE CODE	DIAGRAM NO.
721R, 721S, 721T, 722R, 722S, 722T, 724R, 724S, 724T	DT/DTW(L) 1268
721RZ, 721SZ, 721TZ, 722RZ, 722SZ, 722TZ, 724RZ, 724SZ, 724TZ	DT/DTW(L) 1267

TABLE 2.3

INSTALLATION DIAGRAM FOR 4 WIRE PC ONLY

DATEL SERVICE CODE	DIAGRAM NO.
733R, 733S 733SZ	DT/DTW(L) 1266 DT/DTW(L) 1265

TABLE 2.4

INSTALLATION DIAGRAMS FOR 4 WIRE PC WITH PSTN STAND-BY

DATEL SERVICE CODE	DIAGRAM NO.
743R, 743S, 743T 743RZ, 743SZ, 743TZ	DT/DTW(L) 1263 DT/DTW(L) 1264

TABLE 2.5

INSTALLATION DIAGRAMS FOR PSTN ONLY

DATEL SERVICE CODE	DIAGRAM NO.
751R, 751S, 751T 752R, 752S, 752T 754R, 754S, 754T	DT/DTW(L) 1261
755T, 756T, 757T	DT/DTW(L) 1262

3 **EQUIPMENT REQUIRED** The modem equipment necessary for a Datel 600 installation using a Modem 22 is detailed in Table 2.6.

Table 2.6 follows

TABLE 2.6

MODEM EQUIPMENT REQUIRED

DATEL FACILITY CODE		MODEM SWITCHING CODE	QUANTITY	MODEM EQUIPMENT
TENS DIGIT	UNITS DIGIT			
1	1		1	CASE 1/TG 2491
2	2	RZ	1	CORD CONNECTING 23/1A (0.5 m) OR 1B (3.0 m)
		SZ	1	LINE MODULE 1/TG 2576
3	3		1	MAIN UNIT 1/TG 2587
4	4	TZ	1	MODEM MODULE 1/TG 2527
			1	MOUNTING 1/TG 2540 (NOTE)
1	1	R	1	CASE 1/TG 2491
2	2		1	CORD CONNECTING 23/1A (0.5 m) OR 1B (3.0 m)
		S	1	LINE MODULE 1/TG 2578
3	3		1	MAIN UNIT 1/TG 2587
4	4	T	1	MODEM MODULE 1/TG 2527
			1	MOUNTING 1/TG 2540 (NOTE)
5	1	R	1	MAIN UNIT 1/TG 2587
	2	S	1	MODEM MODULE 1/TG 2527
	4	T		
5	5	T	1	MAIN UNIT 1/TG 2587
	6		1	MODEM MODULE 1/TG 2527
	7		1	DATA CONTROL EQUIPMENT NO. 1

NOTE: Only required when Case TG 2491 is to be wall mounted.

4 **CORD CONNECTING NO. 23/1A AND 1B** A cord connecting No. 23/1A or 1B is required at a table mounted installation on a private circuit, to interconnect the Modem 22 Main Unit (MU) and Line Unit (LU). These cords have a 25 way plug terminating both ends.

Two lengths of cord are available as follows:-

4.1 Cord Connecting No. 23/1A: This cord is 0.5 meters long and should be used when the MU and LU are table mounted.

4.2 Cord Connecting No. 23/1B: This cord is 3.0 meters long and should be used where LU is wall mounted.

5 **LINE MODULES** There are two types of Line Module available.

5.1 Line Module 1/TG 2576 This Module contains the terminating transformer only, and is for use on a PC with no speech or signalling.

5.2 Line Module 1/TG 2578 This Module contains the terminating transformer, Line Switching Module, and DC Signalling Module and is used on a PC with speech and signalling.

6 **PC SIGNALLING MODULE** The signalling Module has two strappable signalling options.

(i) Balanced Battery Bothways

(ii) Battery Reversal In/'B' Leg Earth Out.

For Rack Mounted Modem 22 the Balanced Battery Bothways option will always be used. (See TI C3 I8428 for Rack Mounting.)

Part 3 follows

PART 3

INSTALLATION AND TESTING

CONTENTS

1 **INTRODUCTION** Part 3 details the Workshop testing and installation of the Modem 22. Including the strapping for both the Modem and Line Modules.

2 **DESCRIPTION** When used solely on the PSTN the Modem 22 comprises a Modem Unit only. When used on a PC, with or without PSTN stand-by, the Modem 22 comprises a Modem Unit and a Line Unit.

2.1 Modem Unit (MU) This unit comprises a Main Unit 1/TG 2587 which houses a Modem Module 1/TG 2527. It provides Half-Duplex operation at 600/1200 bit/s forward channel with 150 bit/s backward channel over a 2 wire PC or PSTN circuit. Alternatively Duplex operation is provided at 600/1200 bit/s on a 4 wire private circuit, with Half-Duplex 600/1200 bit/s on PSTN stand-by.

The Modem Unit is 65 mm high, 232 mm wide, 455 mm deep and weighs 4.96 kg.

2.2 Line Unit (LU) This unit can be either table or wall mounted, and provides facilities for terminating a private circuit. It comprises a Case 1/TG 2491 which houses a Line Module 1/TG 2576 or 1/TG 2578.

The unit is 65 mm high, 455 mm deep, 232 mm wide and weighs 4.42 kg.

3 **AUTHORITY** Authority will be given by an Advice Note which will quote the Datel Service Code (shown in Part 1).

4 **HANDLING** Datel Service modems should be handled carefully at all times. Cartons and packing material from new units should be preserved for re-use if the units are to be transported again. When units are being transported, they should have suitable packing protections.

5 **SETTING UP** The wiring, setting-up and testing of the modem should normally be carried out on British Telecom premises unless it is judged that the installation is large enough to warrant these tests being carried out on the customers premises.

Wire the telephone(s) and modem to the relevant DT/DTW(L) diagram listed in Part 2.

In cases of defect or unusual difficulty the A646 procedure should be followed as shown in C1 A0050.

6 **MODEM INTERNAL CONNECTIONS** Soldered straps are required in the MU and the LU for selection of the various operational facilities provided by the Modem 22. Strap all modules to provide the facilities called for by the Datel Service Code on the Advice Note. The strapping required for individual modules is detailed in Figures 3.1 to 3.4.

Fig 3.1 - Modem Module 1/TG 2527

Fig 3.2 - Line Module 1/TG 2576

Fig 3.3 - Line Module 1/TG 2578

Fig 3.4 - Main Unit 1/TG 2587.

NOTE: When a DCE1 is provided (Service Codes 755, 756, 757/T/-) the modem must be strapped for switching code 'R'.

Fig 3.1-3.4 follow

D.F.C.							M.S.C.			T.C.C.					
TENS			UNITS							TENS				UNITS	
1 AND 3	2 AND 4	5	1 AND 5 NOTE 1	2 AND 6 NOTE 1	3	4 AND 7 NOTE 1	R	S	T	1	2	3	4	1	2
CONNECT LKG 1–3 LKJ 1–2 LKM 1–2	CONNECT LKH 1–2* LKG 1–3 LKJ 1–2 LKN 1–2 LKM 1–2 LKK SEE NOTE 2	CONNECT LKM 1–2* LKH 1–2 LKK SEE NOTE 2	CONNECT LKC 1–2 LKC 2–4 LKA 1–2 LKB 1–3	CONNECT LKC 1–3 LKC 3–4 LKA 1–2	CONNECT LKC 1–3 LKC 2–4 LKA 1–2 LKB 1–2	CONNECT LKC 1–3 LKC 3–4 LKB 1–3	CONNECT LKE 1–3 LKE 3–4	CONNECT LKE 1–2 LKE 3–4	CONNECT LKE 1–3 LKE 2–4	CONNECT LKD 1–3 LKD 3–4	CONNECT LKD 1–3 LKD 2–4	CONNECT LKD 1–2 LKD 3–4	CONNECT LKD 1–2 LDK 2–4	CONNECT LKF 1–2 LKF 2–4	CONNECT LKF 1–3 LKF 3–4
DISCONNECT LKL 1–2 LKN 1–2 LKM 1–2 LKG 1–2	DISCONNECT LKL 1–2 LKH 1–2 LKG 1–2	DISCONNECT LKG 1–3 LKJ 1–2 LKM 1–2 LKN 1–2	DISCONNECT LKD 1–3 LKC 3–4 LKB 1–2	DISCONNECT LKC 1–3 LKC 3–4 LKB 1–2 LKB 1–3	DISCONNECT LKC 1–2 LKC 3–4 LKB 1–3	DISCONNECT LKC 1–2 LKC 2–4 LKB 1–2 LKA 1–2	DISCONNECT LKE 1–2 LKE 2–4	DISCONNECT LKE 1–3 LKE 2–4	DISCONNECT LKE 1–2 LKE 3–4	DISCONNECT LKD 1–2 LKD 2–4	DISCONNECT LKD 1–2 LKD 3–4	DISCONNECT LKD 1–3 LKD 2–4	DISCONNECT LKD 1–3 LKD 3–4	DISCONNECT LKF 1–3 LKF 3–4	DISCONNECT LKF 1–2 LKF 2–4

NOTE 1:– FOR SERVICE CODE DIGITS 5 TO 7 D.E. FOR DCE INSERT STRAP LKD 1–2

NOTE 2:– P.S.T.N. OUTPUT LEVEL STRAPPING SEE TABLE 3.1. TO CALCULATE P.S.T.N. OUTPUT LEVEL SEE TABLE 3.2.
* FOR RACK MOUNTED MODEMS WITH CONTROL DISCONNECT LKH 1–3.

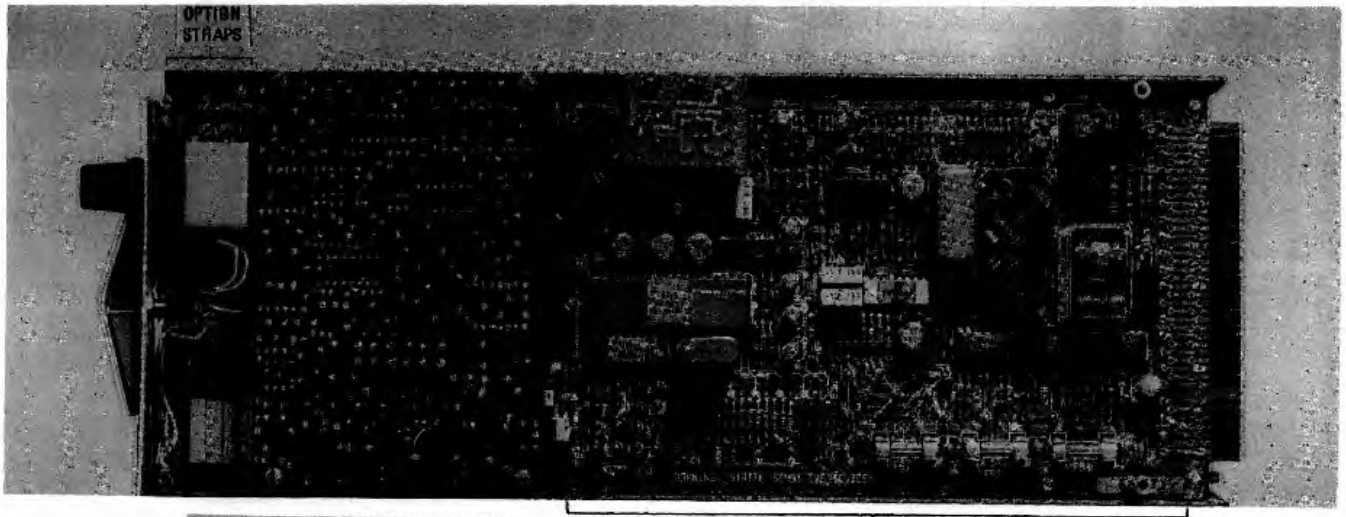


FIG. 3.1 MODEM MODULE 1/TG 2527

OPTION STRAPS

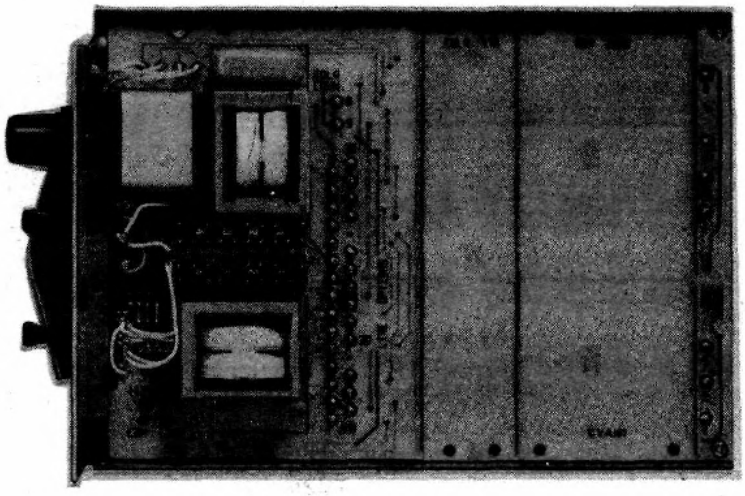


FIG. 3.2 LINE MODULE 1/TG 2576

STRAP OPTION	LINE IMPEDANCE		LOOP SWITCH		AMPLIFIER 225 A OUT
	600Ω	1200Ω	OUT	IN	
2 WIRE	25–26 37–38	25–27 37–39	17–20 33–34		
4 WIRE	TX 25–26 37–38 RC 11–12 23–24	TX 25–27 37–39 RC 10–12 21–23		13–15 28–30 14–16 29–31 17–19 33–35 20–22 34–36	1–2 3–5 4–6

R182C4

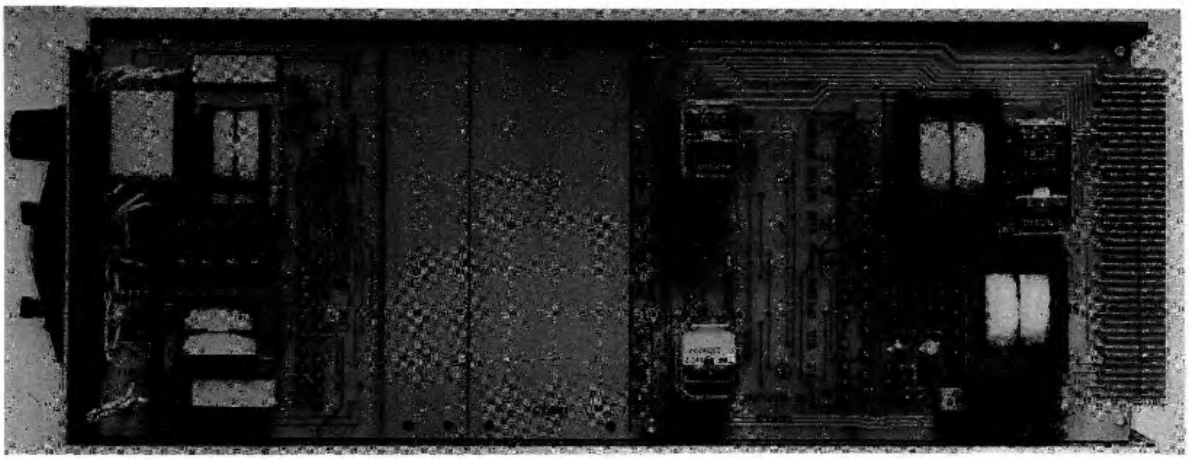


FIG. 3.3 LINE MODULE 1/TG 2578

STRAP OPTION	LINE IMPEDANCE		LOOP SWITCH		AMPLIFIER 225 A OUT	SPEECH	SIGNALLING BALANCED BATTERY	SIGNALLING BATTERY REVERSAL 'B' WIRE EARTH
	600Ω	1200Ω	OUT	IN				
2 WIRE	25–26 37–38	25–27 37–39	17–20 33–34			40–41 45–46 50–51 52–54	55–56 65–66 61–63 68–70 62–64	55–56 63–65 58–59 68–69 61–62
4 WIRE	TX 25–26 37–38 RC 11–12 23–24	TX 25–27 37–39 RC 10–12 21–23		13–15 28–30 14–16 29–31 17–19 33–35 20–22 34–36	1–2 3–5 4–6	40–42 47–48 41–43 49–51 44–46 52–54	55–56 65–66 61–63 68–70 62–64	55–56 63–65 58–59 68–69 61–62

R18266

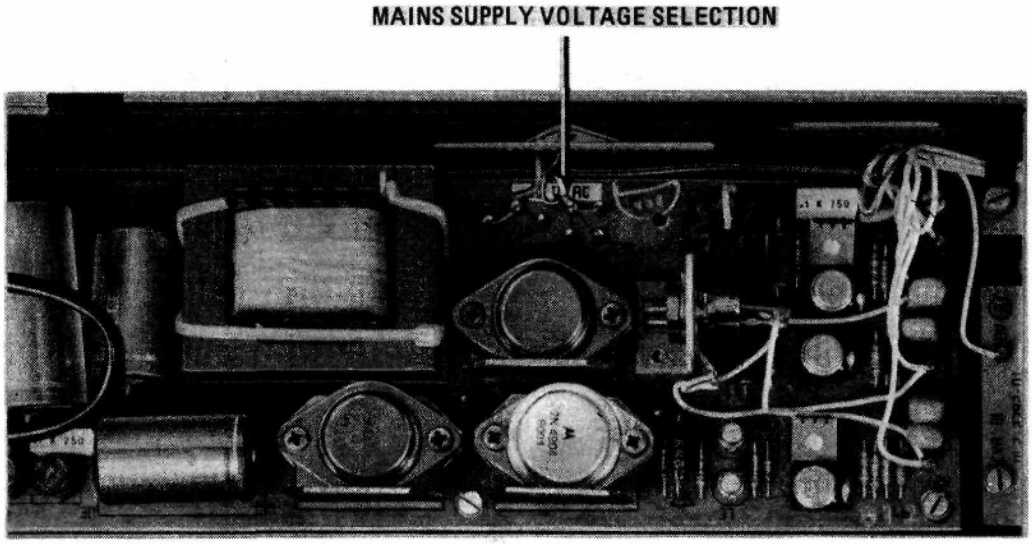


FIG. 3.4 MAIN UNIT 1/TG 2587

NOMINAL MAINS VOLTAGE	MAIN UNIT 1/TG 2587	
	STRAP BROWN WIRE	STRAP BLUE WIRE
250	240	10
240	240	0
230	220	10
220	220	0
210	200	10
200	200	0

R18263

TABLE 3.1

MODEM MODULE STRAP FUNCTION

STRAP	FUNCTION
LKC 1-2 LKC 2-4	SELECTION OF MODE 1
LKC 1-2 LKC 3-4	SELECTION OF MODE 2
LKC 1-3 LKC 2-4	SELECTION OF MODE 3
LKC 1-3 LKC 3-4	SELECTION OF MODE 4
LKD 1-3	CIRCUIT 106 RESPONSE 5 TO 7 ms PC
LKD 1-2	CIRCUIT 106 RESPONSE 22 TO 38 ms PC
LKD 4-3	CIRCUIT 106 RESPONSE 22 TO 38 ms PSTN
LKD 4-2	CIRCUIT 106 RESPONSE 206 TO 269 ms PSTN
LKE 1-3 LKE 4-3	CONNECTION TO LINE BY CCT 108/1 (IE MODEM SWITCHING CODE 'R')
LKE 1-2 LKE 4-3	CONNECTION TO LINE BY CONTROLS ON BT EQUIPMENT (IE MODEM SWITCHING CODE 'S')
LKE 1-3 LKE 4-2	CONNECTION TO LINE BY CCT 108/2 AND CONTROLS ON BT EQUIPMENT (IE MODEM SWITCHING CODE 'T')
LKF 1-2	AUTO ANSWER V25 SEQUENCE INHIBIT
LKF 1-3	AUTO ANSWER V25 SEQUENCE ENABLE
LKF 2-4	MANUAL INSTIGATION OF V25 ANSWER SEQUENCE INHIBIT
LKF 3-4	MANUAL INSTIGATION OF V25 ANSWER SEQUENCE ENABLE
LKM 1-3	+5 V TO INDICATOR COMMON
LKM 1-2	+5 V TO PIN 29 CONNECT TO PC
LKN 1-2	STANDBY PC/PSTN
LKG 1-3	-12 V TO LINE MODULES
LKJ 1-2	+12 V TO LINE MODULE
LKH 1-2	PSTN ONLY
LKA 1-2	MADE IN MODES 1, 2, AND 3 FOR LOOP TEST
LKB 1-2	MADE IN MODES 3 FOR LOOP TEST
LKB 1-3	MADE IN MODES 1 AND 4 FOR LOOP TEST
LKK	PSTN LINE LEVELS
NO CONNECTION	-1 dBm
1-2	-3 dBm
1-3	-5 dBm
1-4	-7 dBm
1-5	-9 dBm
1-6	-11 dBm

TABLE 3.1 (Contd)

STRAP	FUNCTION
1-7	-13 dBm
1-8	-15 dBm
LKL	PC LINE LEVELS
NO CONNECTION	-13 dBm
1-2	-15 dBm

7 **MODEM TESTING** The test program shown in Table 3.2 should be carried out on BT premises. The following test equipment is required:-

2 suitable Datel Testers
1 Meter Multirange
1 Modem 22 - to work as a test modem.

8 **INSTALLATION** The installation should be carried out by the fitter as detailed in Table 3.3.

Tables 3.2 and 3.3 follow

TABLE 3.2 MODEM TESTING

TEST	PROCEDURE
1 MODEM EARTHING	1.1 Set the Meter, Multirange, No. 12 to measure resistance 1.2 Check that there is no internal connection in the Main Unit 1/TG 2587 between loop common (BTA 11) and protective earth (BTA 17) 1.3 Check that there is continuity between the earth wire of the mains supply cord, the metalwork of the Main Unit 1/TG 2587, and the Case 1/TG 2491 (when provided) 1.4 If either check in (1.2) or (1.3) proves a unit to be faulty, change the faulty unit
2 AC VOLTAGE SETTING	2.1 Find out the nominal mains voltage available NOTE: The mains voltage is strapped for 240 volts in the factory; the following paras should only be followed for Mains of not 240 volts 2.2 Ensure that the mains supply is NOT connected to the Main Unit 2.3 Remove the yellow mains voltage tap cover which is situated adjacent to the mains transformer in the Main Unit 2.4 Strap the Main Unit in accordance with the table in Fig 3.4 2.5 Replace the mains voltage tap cover 2.6 Check that all fuses are fitted and are satisfactory
3 PSTN LEVEL SETTING	When the modem is directly connected to the PSTN the level, which must not exceed 0 dBm, should be calculated as detailed in 3.1 or 3.2. If the modem is connected to a PBX extension which has access to a Private Telephone Network, the level must be set to -13 dBm. 3.1 When the local exchange is co-sited with the serving trunk unit: $\left(\frac{\text{loop resistance of customer's line in ohms}}{100}\right) - 9$ dBm 3.2 When the local exchange is remote from the serving trunk unit: $\left(\frac{\text{loop resistance of customer's line in ohms}}{100}\right) - 4$ dBm These formulae give sufficiently accurate approximations irrespective of the cable-conductor size used.

TABLE 3.2 (Contd)

TEST	PROCEDURE
4 FACILITY CHECK	Check that the facilities offered by the telephone/s associated with the Modem, function correctly eg Auto Answer Data Button Tele Button Off PC A Form A6688 (label) should be completed and inserted under the plastic cover in the front flap of the Modem Unit and Line Unit (when required)
5 MODEM CHECK	Connect the Modem under test to a compatible Modem via the Private Circuit connections and/or the exchange line connections, depending on the service code. Connect a suitable Datel testers to both Modems and do a 2 minute 511 error check on main and stand-by (if applicable), provided both Modems are connected 'Back to Back' no errors should be observed. If the Modem appears to be faulty, check Modem as laid down in Part 4. If the Modem or Line Unit proves to be faulty change the appropriate item.

TABLE 3.3 INSTALLATION

CHECK	PROCEDURE
1 ACCOMMODATION	Check that the accommodation and safety requirements, detailed in C3 I1000, are met before commencing installation
2 AC MAINS TEST	For this test a Tester-Earth Loop Impedance is required (see A2 E1006) 2.1 Connect the Tester; Line-Earth Loop Impedance to the mains socket outlet. 2.2 Perform the tests described in A2 E1006 2.3 If the prescribed limits are not met:- 2.3.1 Do NOT connect the Modem 22 to the mains socket 2.3.2 Report the matter to the Assistant Datel Co-ordination Officer (ADCO)
3 INSTALLING MODEM	Install the equipment to the relevant DT/DTW(L) diagram as listed in Part 2 Tables 2.2 to 2.6. To gain access to the BTA terminals in the Modem Unit or Line Unit loosen the two slotted screws at the rear of the appropriate case, pull the cover forward and lift off. If the Line Unit is to be wall mounted, a Mounting 1/TG 2540, positioned within 3 m of the Modem Unit, must be used. This mounting must be fixed to the wall, with the single fixing hole at the top and the locking screw on the left, using three $1\frac{1}{2}$" No. 8 screws. With the cover removed, suspend the Line Unit from the top of the mounting by the two brackets on the underside of the LU and tighten the locking screw into the keyed hole to secure the LU to the mounting. When the LU is wall mounted, Cable Distribution can be used to terminate the PC and exchange line instead of the cords specified in the installation diagrams.
PSTN	If the PSTN Line tests are OK hand the service to the customer and ask him to test his terminal equipment via the Modem. If the test is OK inform the ADCO. If the terminal does not work ask the customer to check the terminal and inform the ADCO.
PC	Check that the PSTN stand-by, if provided, functions correctly. Inform ADCO that installation has been completed.

9 CUSTOMERS EQUIPMENT CONNECTION TO THE MODEM 22 The customer should ensure that a suitable cable, terminated with a 25 way D-type connector (see C3 I0104 for connector details) is provided for connecting the customer's terminal equipment to the modem.

10 MISCELLANEOUS INFORMATION This paragraph contains miscellaneous information which may be useful for reference.

TABLE 3.4

BLOCK TERMINAL CONNECTIONS

MAIN UNIT 1/TG 2587 (MU)		CASE 1/TG 2491 (LU)	
BTA NO.	FUNCTION	BTA NO.	FUNCTION
1	PSTN SPEECH	1	2 WIRE PC LINE
2	PSTN SPEECH	2	
3	DATA LOOP	3	NOT FOR MODEM 22 USE
4	PSTN LINE	4	
5	PSTN LINE	5	WETTING CURRENT CIRCUIT
6	0 VOLTS	6	CALL BUTTON
7	OFF PC/TELE LOOP	7	PC TELEPHONE SPEECH CIRCUIT
8	AUTO ANS LOOP	8	
9	RINGING DETECT	9	SIGNALLING COMMON
10	TELE PSTN LOOP	10	BUZZER DRIVE/CALL LATCH
11	LOOP COMMON	11	-50 VOLTS (FOR LOCALLY POWERED DC SIGNALLING)
12	CONTROL TO DCE1 OR -12 V SUPPLY	12	EARTH (FOR LOCALLY POWERED DC SIGNALLING)
13	CONTROL FROM DCE1 OR +12 V SUPPLY	13	PSTN LINE
14	ON LINE PC INDICATOR	14	
15	ON LINE PSTN INDICATOR	15	BUZZER + INCOMING CALL
16	OFF HOOK LOOP	16	SPARE
		17	OFF PC/TELE PC
		18	LOOP COMMON
		19	ON LINE PC INDICATOR
		20	ON LINE PSTN INDICATOR
		21	0 VOLTS
		22	SPARE
		-	
		-	

TABLE 3.5

INTERCHANGE CIRCUITS

CONNECTOR-PLUG PIN NO.	CCITT CIRCUIT NO.	INTER-CONNECTING CIRCUIT
1	-	NOT USED
2	103	TRANSMITTED DATA
3	104	RECEIVED DATA
4	105	REQUEST TO SEND
5	106	READY FOR SENDING
6	107	DATA SET READY
7	102	COMMON RETURN
8	109	DATA CHANNEL RECEIVE LINE SIGNAL DETECTOR
12	122	BACKWARD CHANNEL RECEIVE LINE SIGNAL DETECTOR
13	121	BACKWARD CHANNEL READY
14	118	TRANSMIT BACKWARD CHANNEL DATA
16	119	RECEIVE BACKWARD CHANNEL DATA
20	108	CONNECT DATA SET TO LINE/DATA TERMINAL READY
22	125	CALLING INDICATOR
23	111	DATA SIGNALLING RATE SELECTOR

TABLE 3.6

MODEM TO LINE UNIT INTERFACE CIRCUITS

CONNECTOR-PLUG PIN NO.	INTER CONNECTING CIRCUIT
1	4 WIRE RECEIVE
2	4 WIRE RECEIVE
3	4 WIRE TRANSMIT
4	4 WIRE TRANSMIT
8	ON LINE PC INDICATOR
9	0 V
10	PROTECTIVE EARTH
12	+12 V
13	PSTN 'A'
14	PSTN 'B'
20	TELE PC/OFF PC
21	LOOP COMMON
22	-12 V
23	ON LINE PSTN INDICATOR

11 COMMISSIONING AND ERROR LIMITS For a Modem connected to private circuit, carry out a commissioning test over the PC to the limits in Table 3.7.

The error limits shown in Table 3.7 are for a Modem 22 working to a Modem 22, 20 or 1 on the forward channel, and the backward channel at speeds of up to 75 bit/s, or to a Modem 22 only for a backward channel speed of up to 150 bit/s.

TABLE 3.7

ERROR LIMITS

TYPE OF CONNECTION	TYPE OF TEST AND PATTERN (BIT)	DATA SIGNALLING RATE (BIT/S)	DURATION OF TEST (MINUTES)	MAXIMUM PERMITTED ERRORS (BIT)
PC	STATIC, 511	1200	5	18
PSTN	STATIC, 511	1200	5	360
PC	STATIC, 511	600	5	9
PSTN	STATIC, 511	600	5	180
PC	STATIC, 511	150	5	3
PSTN	STATIC, 511	150	5	26
PC	STATIC, 511	75	5	2
PSTN	STATIC, 511	75	5	23

If the limits quoted in Table 3.7 cannot be met, the Datel Service is unsatisfactory. In this case, the ADCO should be informed, and the service should not be handed to the customer until the faults have been identified and cleared, and the error limits met.

Part 4 follows

PART 4

MAINTENANCE

1 SAFETY PROCEDURES

1.1 Testing of AC Mains Equipment Extreme care should be taken when working on equipment connected to the a.c. mains supply. Testing the supply should only be carried out if absolutely necessary by following the procedure laid down in TI A2 E1006. If the mains is suspect, the Modem should be disconnected from the mains supply until any fault has been rectified.

1.2 Hazard Warning Labels If a maintenance visit necessitates removing the cover of the Main Unit, check that a new type EEC standard Mains Hazard Warning Label (the electric shock symbol) is attached to the mains protective cover. If none is attached a suitable label, available from FaCD Cwmcarn, Label No. 567E, should be put on the mains protective cover.

2 FAULT LOCATION The Modem provides two test functions to assist in the location of a fault to the Local Modem, Remote Modem or interconnecting circuit, (PC or PSTN).

(i) A Digital Test switch, located on the Modem Module, for use with Modes 1, 2, 3 and 4.

(ii) An Analogue Test switch, located on the line unit, for use with Mode 3, on 4-wire PC working.

NOTE: A 3 position switch is located on the Modem Module which can pre-select the data rate ie 600 bit/sec, Normal, or 1200 bit/sec. Fig 1.2 shows a front view of the Modem Unit with the Digital Test switch, and Data Rate Selector switch. All the following tests assume a Modem 22 working to a Modem 22.

2.1 Analogue Loop Test This Test is for Mode 3, 4-wire Private Circuit working only. It puts an Analogue Loop between either the transmit and receive pair of the Modem, or the transmit and receive pair of the Private Circuit (PC).

2.1.1 Local Loop Test Connect a suitable Datel tester to the Modem, switch the Loopswitch on the Line Module to 'Loop Modem'. Send a pseudo random pattern from the tester. The pattern will be looped back to the tester via the Modem. No errors should be observed.

If a fault is shown, then it must be on either the Modem or Line Unit.

The Modem Unit can be looped back to itself using the 25-way 'Line Unit' connector, situated on the rear of the Modem, by looping Pin 1 to Pin 3 and Pin 2 to Pin 4. This will loop the Receiver (Pins 1 and 2) to the Transmitter (Pins 3 and 4). Any fault can thus be located to the appropriate Unit.

2.1.2 Remote Loop Test Connect a suitable tester to the local Modem and ask for the remote Modem Loopswitch to be switched to 'Loop Line'. The output from the tester should be looped back via the private circuit and the local Modem.

Definite error rate limits are not applicable for this test. The test should be used as a guide to fault location.

2.2 Digital Loop Test The Digital Test switch is a 4 position rotary switch situated on the front plate of the Modem and performs different functions depending on the Mode which the Modem is set for.

2.2.1 1200 Test 1

(i) In Mode 1 the Modem can receive data at up to 150 bit/s on the backward channel, and retransmit it at up to 150 bit/s on the forward 1200 bit/s channel.

(ii) In Mode 2 the Modem can receive data at up to 150 bit/s on the 1200 bit/s forward channel, and retransmit it at up to 150 bit/s on the backward channel.

(iii) In Mode 3, operating over a 4-wire PC, the Modem will, receive data on the forward channel at up to 1200 bit/s and retransmit it at up to 1200 bit/s on the forward channel.

(iv) In Mode 3, operating over the PSTN, data binary 1 or 0 applies to the forward channel puts the Modem into self oscillation.

(v) In Mode 4, an 'ON' condition is applied to Circuit 105 and the Modem will retransmit on the 1200 bit/s forward channel, and data signal received at up to 150 bit/s on the backward channel.

2.2.2 1200 Test 2

(i) Operation in Modes 1, 2 and 3 is the same as for the 1200 Test 1 position.

(ii) In Mode 4, an 'OFF' condition is applied to Circuit 105, and the Modem will retransmit on the backward channel any data signal received at up to 150 bit/s on the 1200 bit/s forward channel.

2.2.3 600 Test 1 The operation is the same as for the 1200 Test 1, except that the 600 bit/s forward channel is used.

2.2.4 600 Test 2 The operation is the same as for the 1200 Test 2, except that the 600 bit/s forward channel is used.

By sending a test pattern from a suitable Datel tester connected to the local Modem, and switching the digital test switch on the compatible Modem at the remote station to the correct test position a data check can be performed. Definite error rate limits are not applicable for these tests. The test should be used as a guide to fault location.

NOTE:- Remove customers DTE interface plug from the remote Modem before doing digital tests.

2.2.5 Datel Testers Available at Both Ends By sending a pseudo random pattern from a suitable Datel tester at both ends the error rate should be within the limits shown in Table 3.7.

3 MODEM TESTING A summary of the Modem 22 Specifications is shown in Table 4.1. The testing procedure for the parameters of the Modem is shown in Table 4.2.

Tables 4.1 and 4.2 follow

TABLE 4.1

SUMMARY OF THE MODEM 22 SPECIFICATIONS

Data transfer rate	Forward Channel	Up to 1200 bit/s
	Backward Channel	Up to 150 bit/s
Modulation		Frequency Shift Keying (FSK)
Operational data format to and from the DTE		Asynchronous, serial, negative logic, bipolar, non-return to zero
Operating Modes		Duplex or Half Duplex or Asymmetric Duplex
Line Configurations, Inland or International		4-wire or 2-wire private circuit, with or without a 2-wire standby exchange line; exchange line only
Standards: Modem		CCITT Recommendation V23
Interchange Circuit Allocations		CCITT Recommendation V24
Automatic Answering		CCITT Recommendation V25
Electrical Characteristics of Interchange Circuits		CCITT Recommendation V28
DTE-DCE Connector and Pin Assignments		British Standards Institution BS 4505 Part 5: 1981: International Organisation for Standardisation IS2110: 1981
Construction		Two units, a modem unit and line unit. With exchange line only operation, no line unit is provided
AC Power		200 to 250 V nominal, 50 ± 4 Hz
Power Consumption		6 W maximum for modem unit
Environmental Requirements		Ambient temperature range 5°C to 55°C Relative Humidity 0%-90%, non-condensing
Dimensions: Modem Unit (case) Line Unit (case) (Includes feed and D-Connector)		 65 mm Height, 232 mm Width, 455 mm Depth 65 mm Height, 232 mm Width, 455 mm Depth
Weight: Modem Unit (case) Line Unit (case)		 4.96 kg 4.42 kg
Colour		Grey
Finish		Textured

TABLE 4.2

TEST PROCEDURE

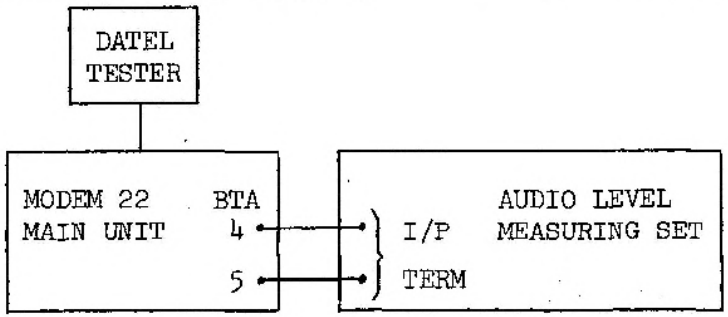
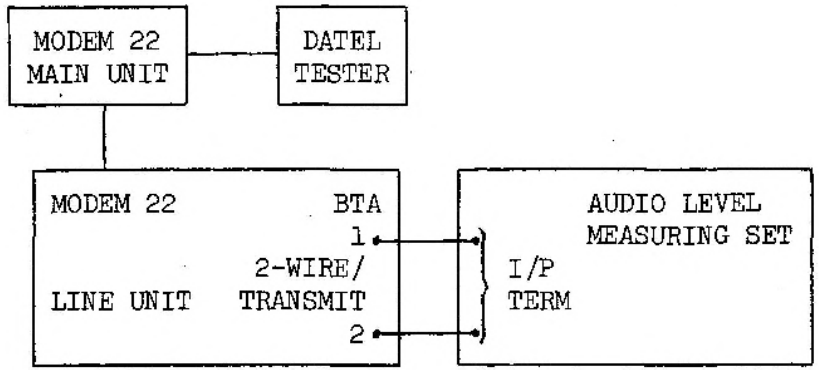
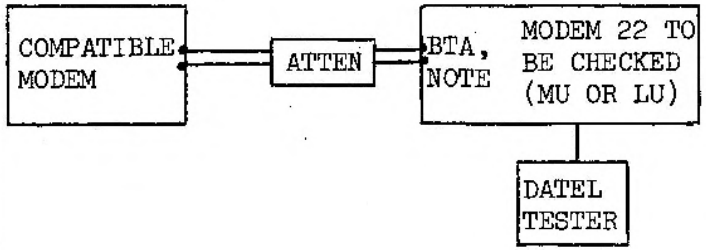
TEST	PROCEDURE	
	EQUIPMENT SET-UP	TEST OPERATIONS
1 MODEM OUTPUT LEVEL PSTN ONLY		1.1 Send a binary 1 from the Datel tester. 1.2 Check that the output level is within ±1 dBm of the level set (see Part 3, Tables 3.1 and 3.2). 1.3 If the level cannot be adjusted to within this range change the Modem Module only.
2 MODEM PC OUTPUT LEVEL		2.1 Send a binary 1 from the Datel tester. 2.2 Measure the Modem output level, and check that it is -13 ± 1 dBm. 2.3 If the level cannot be adjusted to within this range, check there is no loss through the Line Unit, and the Attenuator is strapped out. If the Line Unit is OK change the Modem.

TABLE 4.2 CONTD

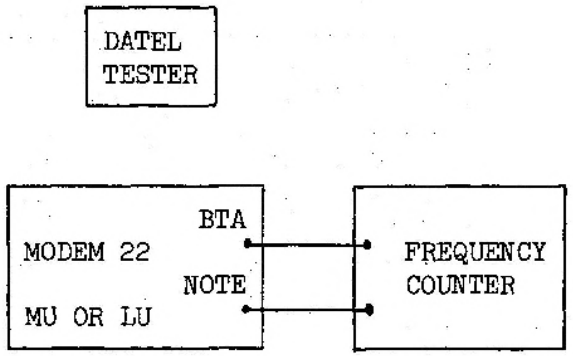
TEST	PROCEDURE	
	EQUIPMENT SET-UP	TEST OPERATIONS
3 MODEM PSTN STANDBY OUTPUT LEVEL	As for Test 2, but connect the measuring set between BTA 13 and 14 on the Lint Unit.	3.1 Operate the TELE button on the private circuit telephone or the OFF PW button on the PSTN telephone. 3.2 Send a binary 1 from the Datel tester. 3.3 Check that the Modem output level is within ±1 dBm of the level set (see Part 3, Tables 3.1 and 3.2). 3.4 If the level cannot be adjusted to within this range, check there is no undue loss through the Line Unit. If the Line Unit is OK change the Modem.

TABLE 4.2 CONTD

<table>
<tr><th rowspan="2">TEST</th><th colspan="2">PROCEDURE</th></tr>
<tr><th>EQUIPMENT SET-UP</th><th>TEST OPERATIONS</th></tr>
<tr><td>4 LINE SIGNAL FAIL TEST</td><td>


NOTE:- BTA CONNECTION
<table>
<tr><th>CONNECTION</th><th>MAIN UNIT BTA NO.</th><th>LINE UNIT BTA NO.</th></tr>
<tr><td>PSTN ONLY</td><td>4 AND 5</td><td></td></tr>
<tr><td>2-WIRE PC</td><td></td><td>1 AND 2</td></tr>
<tr><td>4-WIRE PC</td><td></td><td>3 AND 4</td></tr>
<tr><td>PSTN STANDBY</td><td></td><td>13 AND 14</td></tr>
</table>
</td><td>
8.1 Send a Binary 1 from the compatible Modem.
8.2 Increase the attenuation until the carrier fail indicator on the Datel tester shows CT 109 or CT 122 to be low.
8.3 Record the level on the attenuator plus the O/P level of the compatible Modem.
8.4 Decrease the attenuation until the carrier fail indicator on the Datel tester shows CT 109 or CT 122 to be high.
8.5 Record the level on the attenuator plus the O/P level of the compatible Modem.
8.6 Check that the levels recorded in 8.3 and 8.5 are within the limits:-
<table>
<tr><th>MODE</th><th>FAIL LEVEL dB (8.3)</th><th>RESTOR LEVEL dB (8.5)</th></tr>
<tr><td>1, 2, 4 (3 STANDBY)</td><td>-48 ± 1</td><td>-43 ± 1</td></tr>
<tr><td>3</td><td>-38 ± 1</td><td>-33 ± 1</td></tr>
</table>
8.7 If the levels fall outside the Limits in 8.6 change the Modem Module only.
</td></tr>
</table>

TABLE 4.2 CONTD

TEST	PROCEDURE	
	EQUIPMENT SET-UP	TEST OPERATIONS
5 FREQUENCY CHECK	 NOTE:- USE BTA CONNECTION, 4 AND 5 ON MU FOR PSTN ONLY, 1 AND 2 ON LU FOR PC.	1.1 Send a binary 1 and then a binary 0 from the Datel tester in each channel. 1.2 Check that the frequencies measured are within the limits:- RATE (bit/s) / Binary Data / Frequency (Hz) 600 / 1 / 1300 ± 5 600 / 0 / 1700 ± 5 1200 / 1 / 1300 ± 5 1200 / 0 / 2100 ± 5 150 / 1 / 390 ± 5 150 / 0 / 450 ± 5 1.3 If the frequencies fall outside the limits in 1.2 change the Modem Module only.

4 INTERFACE The Modem has 2 interface connections. The DTE interface is shown in Table 4.3 and, the Line Unit interface is shown in Table 3.6.

TABLE 4.3 DTE INTERFACE

CCITT CIRCUIT NUMBER	ISO 2110 PIN NUMBER (NOTE 1)	DIRECTION OF SIGNALLING	CIRCUIT DESCRIPTION	OPERATING MODE (NOTE 2)			
		DTE DCE		1	2	3	4
102	7	-	Common Return	X	X	X	X
103	2	⟶	Transmitted Data	X		X	X
104	3	⟵	Received Data		X	X	X
105	4	⟶	Request to Send (NOTE 3)			X	X
106	5	⟵	Ready for Sending	X		X	X
107	6	⟵	Data Set Ready	X	X	X	X
108/1	20	⟶	Connect Data Set to Line	X	X	X	X
108/2	20	⟶	Data Terminal Ready	X	X	X	X
109	8	⟵	Data Channel Received Line Signal Detector		X	X	X
111	23	⟶	Data Signalling Rate Selector	X	X	X	X
118	14	⟶	Transmit Backward Channel Data		X		X
119	16	⟵	Receive Backward Channel Data	X			X
121	13	⟵	Backward Channel Ready		X		X
122	12	⟵	Backward Channel Received Line Signal Detector	X			X
125	22	⟵	Calling Indicator	X	X	X	X

NOTES:

1 It is important to note that for satisfactory connection of DTE to the Modem 22, the pin allocations follow the NEW BT STANDARD (ISO 2110) for Datel 600 Service Modems. The Modems 1 and 20 followed the OLD and INTERIM PO STANDARD as detailed on Page 7 of Technical Guide No. 5. For this reason ensure that Circuits 103/118, 104/119, 106/121 and 109/122 are not strapped together on the DTE interface otherwise mis-operation may occur with half duplex working at 600/1200 bit/s.

2 X - Indicates those CCITT interchange circuits that are used in the various operating modes.

3 Request To Send will be clamped ON in the Modem when configured for Mode 1.

5 RESTORATION OF SERVICE If a fault condition exists, service should be restored according to the limits in Table 3.7.

5.1 The Line If either the private circuit or the plant associated with the exchange line is considered suspect, co-operation should be sought from the Repair Service Centre (RSC) or Trunk Maintenance Control Centre (TMCC) concerned.

General guidance on faulting of point to point speech band private circuits is given in TI E1 K0011.

5.2 Modem 22 If a Modem is found to be faulty, only the item that is faulty should be changed, ie Modem Module, Line Module, Main Unit or Case.

The replacement Modem Module or Line Unit should be set up to the same service code as the existing Module, following the strapping guide shown in Part 3 Figures 3.1, 3.2, 3.3.

6 REPAIRS

The repair of faulty Modems 22 (Modem and Line Units) will be carried out by Factories Division, as detailed in TI G3 B4005 Procedure 1, Appendix A. Unless agreement has been made to carry out repairs in the Area Repair Centres (ARCs).

6.1 Maintenance Spares Maintenance spares of both Line and Modem Units should be kept to a Maximum holding of 10% of the number in service, with a minimum of one per Area. Original packing material should be used for storing and transporting this equipment.

6.2 Fuses There are 3 fuses on the Modem Card FS1, FS2, FS3, which are 20 mm × 5 mm 630 mA fuses. There is also a mains-fuse on the front of the Main Unit, which is a 20 mm × 5 mm 100 mA fuse.

The mains plug should be equipped with a 3 amp fuse.

6.3 Technical Escalation Where difficult problems persist, or advice is required, the procedures detailed in E8 B0012 and E8 B0014 should be followed.

In cases of defects or unusual difficulty the A646 procedure should be followed (see TI E1 A0091).

6.4 Records Datel Test Centres (DTC) operating the revised Fault Report Recording procedures, (THQ7128) will not need to take any special action with the Modem 22. Until the Modem is included in the title box on the THQ589 (revised) a manuscript entry should be made on one of the spare title boxes.

DTC not operating the revised procedures should contact BTHQ/NE/T5.3.2 so that they receive the registers and or revised THQ589.

7 SPECIAL CHARACTERISTICS

7.1 Interworking The Modem 22 will work to a Modem 20 or 1, but the backward channel can then only be driven to a maximum of 75 bit/s.

There is no equivalent Modem 22 Mode to the Modem 20 Model 3 and 4 on a 4-wire PC.

8 REFERENCES

E1 A0091 A646 Procedure Defects or Unusual Difficulty
C3 I8428 Planning and Installation of Modem 22 DNCS
E8 B0012 Fault Reporting and Handling
E8 B0014 Technical Support for Field Staff
E1 C0011 Faulting of Point to Point Speech Band PCs
G3 B4005 Factory Repair Procedure

BTHQ/ME/BS7.3 E N D