DATEL 2412 SERVICE

Modem 12 - Installation, Testing and Commissioning

This instruction has been revised to take account of the introduction of Modems 12 with 2/TG 25.. units.

CONTENTS

1 **INTRODUCTION** This instruction details the installation and testing procedure for the Modem 12. It includes in Appendix 1 the commissioning information for point-to-point and multipoint installations.

The Modem 12 is used to provide the Datel 2412 service operating at 2400 or 1200 bit/s on private circuits and exchange lines. It also has options for international operation and a 150 bit/s channel.

2 **DESCRIPTION OF MODEMS** Two versions of the Modem 12 are available, 1/TG 25.. and 2/TG 25.. respectively.

2.1 Mechanical Description Both versions of the Modem 12 are mechanically similar comprising two units, a Modem Unit (MU) and a Line Switching Unit (LSU), each available in two separate models.

The Model 1 Modem Units provide for operation at 2400 or 1200 bit/s and 150 bit/s, measure 100 mm high, 300 mm wide, 441 mm deep and weigh 7.6 kg

(16.78 lb). The Model 2 Modem Units provide for operation at 2400 or 1200 bit/s only, measure 75 mm high, 300 mm wide, 411 mm deep and weigh 5.7 kg (12.8 lb).

The Line Switching Units, which may be either table or wall-mounted, are available with a choice of two Line Modules (LM), one version providing for operation on a private circuit and a standby exchange line and the other providing for operation on an exchange line only. The LSU are 71 mm high, 225 mm wide, 399 mm deep and weigh 5.9 kg (18 lb).

2.2 Electrical Description Modems 2/TG 25.. provide all the facilities offered by the 1/TG 25.. modems with several enhancements; the most significant of these being as follows.

(a) Data Signalling Rate Selector Switch
(b) Type A/Type B Modulation Technique Selector Switch
(c) National/International (RFS delay) Selector Switch

} Located on Modem Unit front panel.

(d) Re-engineered test links on Line Module 2/TG 2510.

(e) Third Transmitter Signal Element Timing (TSET) source option (from Receiver Signal Element Timing - RSET)

(f) Oms (constant carrier) Ready for Sending Delay option for use on private circuits.

(g) "Unattended Standby Switching" option for special installations.

2.3 Rack Mounting For large installations the Modem 12 can be rack mounted, and C3 I8401 should be consulted first for these installations.

3 AUTHORITY Given by an Advice Note quoting the Datel Service Code.

4 DATEL SERVICE CODES See C3 I2422.

5 EQUIPMENT REQUIRED For the equipment required for each Datel Service Code, see C3 I2427, except for control installations. For these see C3 I8401 initially.

6 HANDLING Datel Service modems should be handled carefully at all times. Cartons from new units should be retained for re-use if the units are to be transported again. When units are being transported, they should have suitable packing protection.

7 INITIAL SETTING UP Preliminary setting-up and testing of the modem should normally be carried out on PO premises unless it is judged that the installation is large enough to warrant these tests being carried out on the customer's premises.

Since the Datel 2412 Service may be provided without a test access exchange line, it will no longer be possible to carry out 2-wire tests to the Datel Test Centre (DTC) for these installations. It is necessary, therefore, for staff to ensure that all the requisite equipment is available for any test to be performed at the customer's premises (See section 9.2). In some Areas, 4-wire test access to the DTC via the TMCC may be available.

If any defects are found in the equipment to be installed, complete a Form A646 as detailed in C1 A0050, including the Serial No. of the defective equipment.

8 MODEM INTERNAL CONNEXIONS

8.1 Modems 1/TG 25.. Soldered straps are required on modem unit modules and line modules, depending on the particular Datel Service Code and line termination, as indicated in Table 1.1. *Remove any existing straps not required by the service code specified on the Advice Note.*

Strapping points on the line modules and MU Module 3 are on the printed circuit side of the boards, and on the component side of the board for MU Modules 1, 2, 4 and 5.

8.2 Modems 2/TG 25.. Straps are required on the modem unit modules and line module depending upon the particular Datel Service Code and line termination as indicated in Table 1.2. Figures 1-9 show the straps referred to in Table 1.2.

"Push-on" strapping links are provided on the component side of all modules with the exception of MU Module 3. Soldered wire straps are required on the printed circuit side of the MU Module 3 and LM boards. Parking positions are provided for unused strapping links. Strapping points are outlined in white on the photographs at the end of this instruction and the relevant figure numbers are quoted in Table 1.2.

Table 2 lists all straps provided on the Modem 12 with their functions.

Tables 1.1 and 1.2 follow

TABLE 1.1

STRAPS TO BE INSERTED FOR MODEMS 12 1/TG 25 . .

(Blank boxes mean no additional straps for that part of the Service Code)

Strap Location	All Service Codes	Datel Facility Code						Modem Switching Code				Terminal Configuration Code												
		Line Connexion: Tens Digit			Equip Req'd Units Digit							Timing Source 1st Digit			PW & PSTN RFS Delays 2nd Digit				3rd Digit		USS Option 4th Digit		
		3	4	5	1	2	3	R	S	T	Z	1	2	5	1	3	4	6	0	1	0	1	2
		4W Only	4W & PSTN	PSTN Only	Model 1	Model 2	Model 2 & DCE1					Int	RX	Ext	Inland	Inter-national	Switchable				Out	In: Short Delay	In: Long Delay
LSU Line Module 1/TG 2510 (Note 1)		PW TERMINATION Ω (600 or 1110) / ALL 4W STRAPS (4 off)									NO PW TELE (2 off)		Note 2				Note 2			Note 2		Note 2	
MU Module 1 1/TG 2507–8 (Line Control) Up to Serial No. 1552	USE 116	4 WIRE		116 ON			DCE 1	CDSTL	108 ON / DTR	DTR													
Serial No. 1552 Onwards	N BK UP	4 WIRE		116 ON			DCE 1	CDSTL / N DTR	108 ON / DTR	DTR													
MU Module 2 1/TG 2507–8 (2400/1200 TX)	B MODE	RFS ms 4W 12			MOD 1	MOD 2 (4 off)						INT TIM		EXT TIM	2W RFS ms 20 / 4W RFS ms 12	2W RFS ms 235							
MU Module 3 1/TG 2507–8 (2400/1200 RX)	B MODE / DATA CLAMP	PSTN				MOD 2 (2 off)									EDC ms 24								
MU Module 4 1/TG 2507 (150 TX)																							
MU Module 5 1/TG 2507 (150 RX)	DATA CLAMP														EDC ms 24								

NOTE 1: Insert the PW and PSTN output level straps as specified in section 9, Table 3, Test 5.
Line Module 1/TG 2511 has only the PSTN output level straps specified in section 9, Table 3, Test 5.

NOTE 2: The options specified by these TCC digits are available on the 2/TG 2507–8 only and are not available with the 1/TG 2507–8 modem.

TABLE 1.2

STRAPS TO BE INSERTED FOR MODEMS 12 2/TG 25 . .

(Blank boxes mean no additional straps for that part of the Service Code)

Strap Location	All Service Codes	Datel Facility Code						Modem Switching Code				Terminal Configuration Code											
		Line Connexion: Tens Digit			Equip Req'd Units Digit			R	S	T	Z	Timing Source 1st Digit			PW & PSTN RFS Delays 2nd Digit				3rd Digit		USS Option 4th Digit		
		3	4	5	1	2	3					1	3	5	1	3	4	6	0	1	0	1	2
		4W Only	4W & PSTN	PSTN Only	Model 1	Model 2	Model 2 & DCE1					Int	RX	Ext	Inland	Inter-national	Switchable				Out	In: Short Delay	In: Long Delay
LSU Line Module 2/TG 2510 (Note 1) Figs 1A & 1B		PW TERMINATION Ω						PW TELE			NO PW TELE												
		ALL 4W STRAPS (4 off)																					
MU Module 1 2/TG 2507–8 (Line Control) Fig 2		4 WIRE		116 ON			DCE 1	CDSTL	108 ON	DTR											NBK UP	BK UP	
								NDTR	DTR												DIS-CONN NORM	DISCONN AUTO	
																						Short	Long
MU Module 2 2/TG 2507–8 (2400/1200 TX) Fig 3					MOD 1 (2 off)	ALL MOD 2 STRAPS (5 off)						2W–T INT		2W–T EXT	PSTN 80								
												4W–T INT	4W–T RXT	4W–T EXT	PW 12			CONST CARR					
MU Module 3 2/TG 2507–8 (2400/1200 RX) Fig 4	PSTN	–26 dBm				MOD 2 (2 off)									EDC ms 24								
	DATA–CLAMP																						
MU Module 4 2/TG 2507 (150 TX) Fig 5		0 dB																					
MU Module 5 2/TG 2507 (150 RX) Fig 6	DATA CLAMP														EDC ms 24								

NOTE 1: Insert the PW and PSTN output level straps as specified in section 9, Table 3, Test 5.
Line Module 1/TG 2511 has only the PSTN output level straps specified in section 9, Table 3, Test 5.

TABLE 2

FUNCTION OF MODEM STRAPS USED

Module	Strap	Function	Provided on:
LSU Line Module	OUTPUT LEVEL PSTN	Sets PSTN Output Level	
	OUTPUT LEVEL PW	Sets private circuit output level	
	4W	Enables modem to operate on a 4-wire private circuit.	1/TG 2510 and 2/TG 2510
	NO PW TELE	Disables speech facilities on private circuits.	
	PW TERMINATIONΩ	Line matching straps.	
	PW TELE	Enables private circuit speech facility.	2/TG 2510 only
MU Module 1 Line Control	USE 116	Select Standby controlled from terminal or telephone.	1/TG 2507-8 up to serial No. 1552 only
	116 ON	Modem conditioned to operate on PSTN only.	1/TG 2507-8 serial Nos. 1552 on - and 2/TG 2507-8
	CDSTL	Terminal controls connection to line.	
	NDTR	Used in conjunction with CDSTL to give terminal control of connection to line.	
	DCE1	Auto-calling equipment associated with the modem.	
	DTR	Permits the use of a non-locking data button on the telephone.	
	108 ON	Connection to line controlled from telephone only.	
	4 WIRE	Enables modem to operate on 4-wire private circuits.	
	BK UP	When modem conditioned for Auto Answering, permits ringing on PSTN to interrupt PW working.	
	NBK UP	Does not permit ringing on PSTN to interrupt PW working.	
	DISCONN AUTO	Enables automatic line disconnexion facility when BK UP facility selected.	
	DISCONN NORM	Disables automatic line disconnexion facility.	2/TG 2507-8 only
	SHORT	Introduces 60s "idle time" delay before automatic disconnexion when BK UP selected.	

Table 2 (Contd)

Module	Strap	Function	Provided on:
MU Module 1 Line Control (Contd)	LONG	Introduces 240s "idle time" delay before automatic disconnexion when BK UP selected.	2/TG 2507-8 only
MU MODULE 2 2400/1200 bit/s TX	INT/EXT TIM	Source of modem transmitter timing.	
	RFS ms 4W 12/35/80/235	4-wire private circuit Ready for Sending delay.	1/TG 2507-8 only
	2W RFS ms 12/35/80/235	PSTN Ready for Sending delay.	
	MOD 1	Modem Unit conditioned to operate with 150 bit/s channels.	1/TG 2507-8 and 2/TG 2507-8
	MOD 2	Modem Unit conditioned to operate without 150 bit/s channels.	
	2W-T EXT/INT	Source of modem transmitter timing when connected to 2-wire circuit.	
	4W-T EXT/INT/ RXT	Source of modem transmitter timing when connected to 4-wire circuit.	
	PW 12/35/80	4-wire private circuit Ready for Sending delay.	2/TG 2507-8 only
	PSTN 12/35/80	2-wire (PSTN) Ready for Sending Delay.	
	CONST CARR	Enables modem to operate in constant carrier mode on 4-wire private circuit with Oms Ready for Sending delay.	
MU MODULE 3 2400/1200 bit/s RX	-26 dBm	Private circuit carrier-fail level set to -26 dBm.	2/TG 2507-8 only
	EDC ms 9/24/150	2400/1200 bit/s channel echo delay clamp.	
	DATA CLAMP	Clamps received data in the absence of Received Line Signal Detector.	1/TG 2507-8 and 2/TG 2507-8
	IN/OUT/PSTN	Fixed compromise equalizer permanently in/permanently out/in on PSTN only.	
	MOD 2	Modem Unit conditioned to operate without 150 bit/s channels.	1/TG 2507-8 and 2/TG 2507-8
	B MODE	Internationally approved modulation technique	1/TG 2507-8 only
	A MODE	Modulation technqiue not approved internationally	

TABLE 2 (Contd)

Module	Strap	Function	Provided on:
MU Module 4 150 bit/s TX	0 dB	Sets output level of 150 bit/s channel to same level as that of 2400/1200 bit/s channel.	2/TG 2507-8 only
MU Module 5 150 bit/s RX	DATA CLAMP EDC ms 24/65	Clamps received data in the absence of Backward Channel Received Line Signal Detector. 150 bit/s channel echo delay clamp.	1/TG 2507-8 and 2/TG 2507-8

9 PRELIMINARY MODEM TESTING Carry out the test programme detailed in Table 3 either prior to, or at the time of installation, depending on local arrangements.

9.1 Modem/Tester Compatibility It is important to note that, in order to conform with the revised ISO (International Standards Organisation) modem interface pin allocation standard, ISO/DIS 2110, the interface of the Modem 12 has been amended for 2/TG 25.. modems. The resulting differences between the 2/TG 25.. and 1/TG 25.. interfaces are as follows:

Interface interchange circuit		Pin Allocation	
CCITT No.	Function	1/TG 25..	2/TG 25..
111	Data Signalling Rate Selector	11 and 23	23 only
113	Transmitter Signal Element Timing (DTE to modem)	9	24
116	Select Standby	24	9
117	Standby Indicator	10 and 25	10 only

Therefore, when *testing* 2/TG 25.. modems to be installed to Service Codes for which this change of pin allocation is relevant (eg Service Codes 22.././5... and 22../R/.....), it will be necessary to connect a Datel Tester No. 12A (or suitable equivalent) in the tester/modem interface, in order that circuit 113 may be presented to the Modem on *pin 24 only* and circuit 116 on *pin 9 only*. In addition the "Alternate pin select" control on the Datel Tester must always be operated to enable circuit 111 to be presented to the modem on *pin 23 only*.

9.2 Test Equipment Required The following test equipment will be required:

1 Attenuator No. 70A
2 Datel Tester No. 10A (NOTES 1 and 2)
1 Datel Tester No. 12A
1 Measuring Set No. 44C
1 Meter Multirange No. 12
1 Tester; Line-Earth loop impedance (see A2 E1006-only required if test programme is carried out at customer's premises).
1 Modem 12, suitably equipped to work back-to-back to the modem under test (see C3 I2422 for Service Codes for compatible modems).

NOTE 1: Should Datel Testers No. 10A be unavailable then the following equipment may be used instead (and the appropriate testing procedures 9 and 10 followed):

2 Adaptor 1/TG 2494 (required for Model 1 modems only)

2 Datel Tester No. 1

NOTE 2: When performing automatic turnround tests it is necessary that the modem be strapped for internal timing. If necessary temporarily restrap the modem to be installed.

9.3 Testing Procedure

TABLE 3

PRELIMINARY TEST PROGRAMME

Test	Method
1 AC MAINS (perform only if test carried out at customer's premises)	(i) Connect the Tester; Line-Earth Loop Impedance to the mains socket-outlet. (ii) Perform the tests described in A2 E1006. (iii) If the prescribed limits are not met:- (a) Do not connect the Modem 12 to the mains socket. (b) Report matter to the Assistant Datel Co-ordination Officer (ADCO)
2 MODEM EARTHING	(i) Set the Meter, Multirange, No. 12 to measure resistance. (ii) Check that there is no internal connection in the LSU between common return (BTA 25) and protective earth. (iii) With the two units connected, check that there is continuity between the earth wire of the mains supply cord and the metalwork of the Main Unit -/TG 2509, and the Main Unit -/TG 2505 or 2506. (iv) If either check in (ii) or (iii) prove a unit to be faulty, change the relevant Main Unit.
3 AC VOLTAGE SETTING	(i) Find out the nominal mains voltage available. (ii) Ensure that the mains supply is *not* connected to the LSU. (iii) For Main Units coded 1/TG 2509 follow the procedure detailed in (A) below: for Main Units coded 2/TG 2509 follow the procedure detailed in (B) below: <u>A:Main Units Coded 1/TG 2509</u> (i) Remove the screws retaining the white "Danger" label at the front right-hand side of the LSU and remove the "Danger" label. (ii) Strap points "a" and "b" to the correct terminals in accordance with the following table:-

TABLE 3 (Contd)

<table>
<tr><th>Test</th><th>Method</th></tr>
<tr><td>3 AC VOLTAGE SETTING (Contd)</td><td>
<table>
<tr><th>Nominal Mains Voltage</th><th>Strap "a" to:</th><th>Strap "b" to:</th></tr>
<tr><td>250</td><td>240</td><td>10</td></tr>
<tr><td>240</td><td>240</td><td>0</td></tr>
<tr><td>230</td><td>220</td><td>10</td></tr>
<tr><td>220</td><td>220</td><td>0</td></tr>
<tr><td>210</td><td>200</td><td>10</td></tr>
<tr><td>200</td><td>200</td><td>0</td></tr>
</table>
(iii) Replace Danger label.
(iv) Check that the mains fuse is fitted and intact.

<u>B:Main Units Coded 2/TG 2509</u>
(i) Remove the screws securing the metal cover labelled "Danger" at the front right hand side of the Main Unit (see Fig 8), and remove the cover.
(ii) Position power strapping links in accordance with the following table (see Fig 9):-
<table>
<tr><th>Nominal Mains Voltage</th><th>Position upper link to:</th><th>Position Lower link to:</th></tr>
<tr><td>250</td><td>240</td><td>10</td></tr>
<tr><td>240</td><td>240</td><td>0</td></tr>
<tr><td>230</td><td>220</td><td>10</td></tr>
<tr><td>220</td><td>220</td><td>0</td></tr>
<tr><td>210</td><td>200</td><td>10</td></tr>
<tr><td>200</td><td>200</td><td>0</td></tr>
</table>
(iii) Replace Danger label.
(iv) Check that the mains fuse is fitted and intact (See Fig 9).
</td></tr>
<tr><td>4 DC VOLTAGE MEASUREMENT</td><td>(i) It should have been ascertained at the planning stage which length cord is needed to connect the LSU to the MU. If this is not the length supplied with the LSU, change the cord to the required length, and connect the LSU to the MU. (Wiring information for cords for use with 1/TG 25.. modems is given in Table 4.)
(ii) Depending on the customers' mains socket-outlet, terminate the mains connector cord on a 5A or 13A (fused at 3A) 3-pin (BSI) plug and insert in the socket outlet.
(iii) Measure with a Meter, Multirange, No. 12 the voltages between the following test points on the front of Module 1 of the MU.</td></tr>
</table>

TABLE 3 (Contd)

<table>
<tr><th>Test</th><th>Method</th></tr>
<tr><td>4 DC VOLTAGE MEASUREMENT (Contd)</td><td>
<table>
<tr><th>Test Points</th><th>Test Limits</th></tr>
<tr><td>+12 V and 0 V</td><td>+12 ± 1.0 V</td></tr>
<tr><td>-12 V and 0 V</td><td>-12 ± 1.0 V</td></tr>
<tr><td>+ 5 V and 0 V</td><td>+ 5 ± 0.5 V</td></tr>
</table>
(The test points are protected by a cover adjacent to the indicator check button - Fig 7.

(iv) If the readings are outside these limits, change the Main Unit -/TG 2505 or -/TG 2506.</td></tr>
<tr><td>5 MODEM OUTPUT LEVEL ADJUSTMENT</td><td>(i) There are two sets of straps for output level adjustment; one for PSTN, provided on all line modules, and another for PW appearing on Line Modules -/TG 2510 only. Line Modules 1/TG 2510 and 1/TG 2511 are provided with solder tags on the printed circuit side of the board for the output level adjustment.

Line Modules 2/TG 2510 and 2/TG 2511 are provided with "push-on" straps on the component side of the board for the output level adjustment.

(ii) The output level can be varied in 2 dB steps from -1 dBm to -15 dBm.

(iii) Levels above -9 dBm are set by using a combination of the +8 strap and one of the others, eg, -5 dBm is set with straps +8 and -13 dBm.</td></tr>
<tr><td>6 MODEM OUTPUT LEVEL SETTING</td><td><u>A:Modems for Connection to the Public Switched Telephone Network (PSTN)</u>

<u>(Datel Facility Codes 224-225-)</u>

(i) Adjust the PSTN output level by means of the straps (see Test 5 above) to give the level, within ± 1 dB, calculated as in NOTE 1 at the end of Table 3, but subject to a maximum of 0 dBm.

(ii) Calibrate the Measuring Set No. 44C.

(iii) Connect the equipment, with the switches set as shown below. All switches not shown should be left in the 'Normal' position. (See Fig 7).

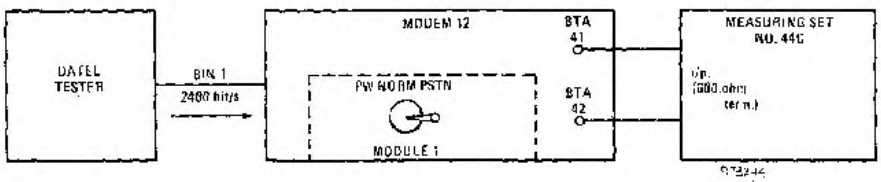
 
</td></tr>
</table>

TABLE 3 (Contd)

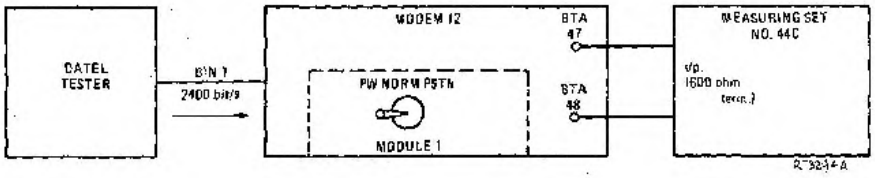
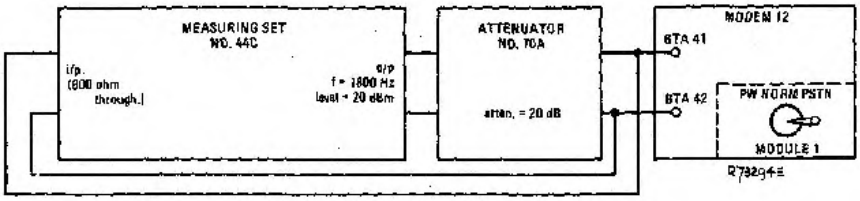
Type	Method
6 MODEM OUTPUT LEVEL SETTING (Contd)	(iv) Check that the level meter reading is within the limits specified in (i). (v) If the level cannot be adjusted to within this range, change the Line Module -/TG 2510 or -/TG 2511. (vi) Restore the test switches to normal. B:Modems for Connection to 4 wire Private Circuits (Datel Facility Codes 223-, 224-) (i) Strap the PW TERMINATION setting on the Line Module -/TG 2510 to 600 ohms (see Fig 1A). (ii) Adjust the PW output level by means of the straps (see Test 5 above) to give a level of -13 ± 1 dBm. (iii) Calibrate the Measuring Set No. 44C. (iv) Connect the equipment, with the switches set as shown below. All switches not shown should be left in the 'Normal' position. (See Fig 7)  (v) Check that the level meter reading is within the limits specified in (ii). (vi) If the level cannot be adjusted to within this range, change the Line Module -/TG 2510. (vii) Restore the test switches to normal and PW TERMINATION to the required setting.
7 LINE SIGNAL FAIL TEST	A:Modems for Connection to the Public Switched Telephone Network (PSTN). (Datel Facility Codes 224-, 225-) (i) Calibrate the Measuring Set No. 44C. (ii) Connect the equipment, with the settings as shown below. All other settings are 'Normal'. 

TABLE 3 (Contd)

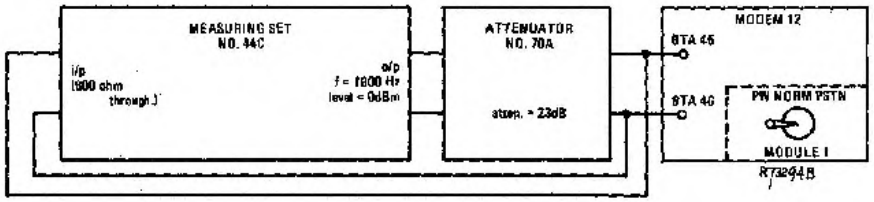
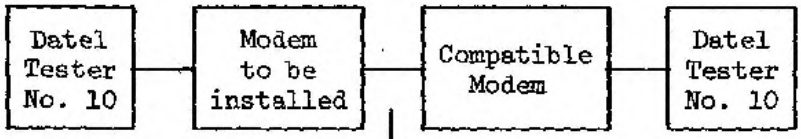
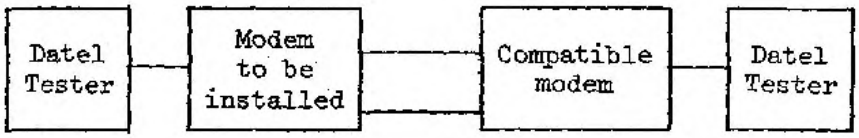
Test	Method
7 LINE SIGNAL FAIL TEST (Contd)	(iii) Press the "IND CHECK" button on Module 1, and verify that all lamps glow. (iv) Check that the green LINE SIG lamp on Module 3 (2400/1200 bit/s receiver) is glowing. (v) Decrease the output level of the Measuring Set slowly until the LINE SIG lamp on Module 3 is extinguished. (vi) Note the level measurement. (vii) Increase the output level of the Measuring Set slowly until the LINE SIG lamp on Module 3 glows. (viii) Note the level measurement. (ix) The levels measured in (vi) and (viii) should not be less than -48 dBm and not greater than -43 dBm respectively, as shown below. The difference between the two levels should be at least 2 dB. (x) If the levels measured are outside these limits, change the Modem Unit. (xi) For Datel Facility Codes 22-1, repeat (i) to (x) at a frequency of 420 Hz, noting the condition of the green LINE SIG lamp on Module 5. B:Modems for Connection to 4 Wire Private Circuits (Datel Facility Codes 223-, 224-) (i) Calibrate the Measuring Set No. 44C (ii) Connect the equipment, with the settings as shown below. All other settings are 'Normal'.  (iii) Perform the operations described in A (iii) to A (x) above. (iv) The levels measured in A (ix) should be -31 dBm and -26 dBm for this test. (v) For Datel Facility Codes 22-1, repeat A (xi), but set the Attenuator to -32 dB and the Measuring Set output level to 0 dBm.

TABLE 3 (Contd)

<table>
<tr><th>Test</th><th>Method</th></tr>
<tr><td>7 LINE SIGNAL FAIL TEST (Contd)</td><td>(vi) The levels measured should be -39 dBm and -34 dBm for this test.
LINE SIGNAL FAIL TEST LIMITS
<table>
<tr><th rowspan="2">PSTN/PW SWITCH POSITION</th><th colspan="2">LINE SIG LEVEL (dBm)</th><th rowspan="2">CHANNEL</th></tr>
<tr><th>FAIL</th><th>RESTORE</th></tr>
<tr><td>PSTN</td><td>-48</td><td>-43</td><td>2400/1200 bit/s & 150 bit/s channels.</td></tr>
<tr><td>PW</td><td>-31</td><td>-26</td><td>2400/1200 bit/s channel only.</td></tr>
<tr><td></td><td>-39</td><td>-34</td><td>150 bit/s channel only (Model 1 only).</td></tr>
</table></td></tr>
<tr><td>8 BIAS DISTORTION (Model 1 Modems Only).</td><td>(i) Connect the line terminals of the modem under test to the line terminals of a compatible modem.
(ii) Connect a Datel Tester No. 10 to each modem.
(iii) Perform the following tests on the 150 bit/s channel only.
 

TRANSMIT
1:1
Pseudo Random
RECEIVE
0% bias distortion
⩾5% bias distortion
RECEIVE
0% bias distortion
⩾5% bias distortion
TRANSMIT
1:1
Pseudo Random
(iv) If these tests are unsatisfactory, change the Modem Unit -/TG 2507 or 2508.</td></tr>
<tr><td>9 ERROR COUNTS AND PEAK INDIVIDUAL DISTORTION</td><td>(i) Set up the equipment as shown below. Should Datel Testers 10 be unavailable Datel Testers 1 (with Adaptors 1/TG 2494 for Service Codes 22-1) may be used exceptionally, the turnround test detailed in (ii) below omitted, and the full duplex test detailed for Datel Facility Code 22-1 carried out on channels as appropriate.</td></tr>
</table>

TABLE 3 (Contd)

<table>
<tr><th>Test</th><th>Method</th></tr>
<tr><td>9 ERROR COUNTS AND PEAK INDIVIDUAL DISTORTION (Contd)</td><td>


(ii) Carry out tests detailed below relevant to the Datel Facility Code.
<table>
<tr><th rowspan="2">Datel Facility Code</th><th rowspan="2">Type of test and pattern</th><th rowspan="2">Data Rate (bit/s)</th><th rowspan="2">Test duration (minutes</th><th rowspan="2">Channel monitored</th><th colspan="2">Maximum</th></tr>
<tr><th>errors</th><th>dist-ortion</th></tr>
<tr><td rowspan="3">22-1</td><td rowspan="3">511 bit pseudo random full duplex</td><td rowspan="2">2400 and 150 simu-ltaneously</td><td rowspan="2">5</td><td>150 bit/s</td><td>0</td><td>2% (NOTE A)</td></tr>
<tr><td>2400 bit/s</td><td>0</td><td></td></tr>
<tr><td>1200 and 150 sim</td><td>5</td><td>1200 bit/s</td><td>0</td><td></td></tr>
<tr><td rowspan="2">22-1
22-2
22-3</td><td rowspan="2">511 bit automatic turnround (NOTES B & C)</td><td>2400</td><td>5</td><td>2400 bit/s</td><td>0</td><td></td></tr>
<tr><td>1200</td><td>5</td><td>1200 bit/s</td><td>0</td><td></td></tr>
</table>
NOTE A: Obtain a representative value of the peak individual distortion by operating the function switch on the tester to 'peak distortion hold max' for 3 periods, each of twenty seconds, during the course of the 5 minute test.

NOTE B: If necessary the modem must be restrapped for internal timing for the duration of this test.

If the modem is strapped for CONST CARR then it must be restrapped for a 12 ms RFS delay for the duration of this test.

NOTE C: The test must run continuously for a period of 5 minutes without stopping. If the test stops it must be restarted and run continuously for a further 5 minute period.
</td></tr>
<tr><td>10 RECEIVER SIGNAL ELEMENT TIMING (RSET) CHECK</td><td>This test need only be carried out where a Datel Tester No. 1 is used.

(i) Connect the Datel Tester No. 12 to the modem under test.

(ii) Set up the equipment as shown in 9(i).</td></tr>
</table>

TABLE 3 (Contd)

Test	Method
10 RECEIVER SIGNAL ELEMENT TIMING (RSET) CHECK (Contd)	(iii) Transmit 511 bit PR patterns to the modem under test at 2400 bit/s. (iv) Using the Datel Tester No. 12 check that timing (RSET) signals are present on pin 17 and that the frequency is 2400 Hz ± 1%. (v) If this test proves unsatisfactory change the MU.

NOTE 1: Modems for connexion to the PSTN must be strapped for a PSTN output level as follows:

(i) If the modem is to be connected to an extension of a PBX, through which access may be gained to a private circuit, set the output level to -13 dBm.

(ii) If the modem is to be directly connected to the PSTN:

(a) Determine the loop resistance of the line. This may either be obtained from the line record card or measured by the exchange testing officer.

(b) Determine whether or not the local exchange and serving trunk unit are in the same building.

(c) If the local exchange and serving trunk unit are in the same building set the PSTN output level to:-

$$\left\{\frac{\text{loop resistance of the customer's line in ohms}}{100} - 9\right\} \text{dBm}$$

up to a maximum of 0 dBm.

(d) If the local exchange and serving trunk unit are not in the same building set the PSTN output level to:-

$$\left\{\frac{\text{loop resistance of the customer's line in ohms}}{100} - 4\right\} \text{dBm}$$

up to a maximum of 0 dBm.

10 ACCOMMODATION FOR FREE-STANDING MODEMS Before commencing installation, check that the following accommodation requirements are met. (Further details of accommodation are given in C3 I1000). Note that the modem consists of the Modem Unit and Line Switching Unit.

Position of the modem: Not more than 1.5 m (5 ft) above floor level (normally table height), and it must be possible to change the modem without removing or requiring access to any non-Post Office apparatus other than the customer's power socket-outlet. Whenever the LSU is wall mounted, the test access links must be accessible, and there should be no obstruction preventing cable entry, and the

	removal of the Line Module. The LSU should be positioned within 3 m of the mains socket, and 5 m of the final position of the MU.
Ventilation:	Air must be able to circulate freely at room temperature on all sides of the modem.
Safety:	No sudden change in floor level within 1 m of the modem and a minimum clear height above this area of 2.2 m, and no other object in this area that would hinder PO staff or render maintenance activity unsafe.
Testing and Maintenance Access:	There must be direct access to the Modem Unit AND Line Switching Unit with adequate clearance for testing and maintenance, and it must be possible to remove the connector plugs without difficulty.
Accidental Damage:	There must be minimal risk of damage to the modem through excess sunlight, condensation etc.
Mains Supply:	The customer must provide a switched mains socket-outlet of 5A or 13A fusing capacity, for use exclusively with the modem, and must connect it to a 200-250 V 50 Hz mains supply, and an efficient connection to a protective earth.
Customer-Provided Rack Mounting:	Before mounting the modem in any customer-provided rack ensure that the title of the rack appears in "List 1 of Permissable Attachments (Datel Services) held by GM(S)".
Connection of Other Equipment:	Check that the Data Terminal Equipment which the customer proposes to use in connection with the modem is included in "List 1 of Permissable Attachments (Datel Services)" held by GM(S) (see D5 C0010).

11 **INSTALLATION** Install the equipment to the relevant DT/DTW(L) diagrams, listed in C3 I2427. To gain access to the LSU, remove the cover by loosening the Phillips screw on the front of the unit, and lifting the cover upwards towards the back of the unit. Details of the LSU can be seen in Fig 8. Cables should be positioned in the cable clamp according to size, and clamped tight when wiring has been completed. The mains cable may be shortened if necessary. If the LSU is to be wall-mounted, using woodscrews, use three No. 8 woodscrews, each at least 1½ in in length, bearing in mind the construction of the wall. Remove the Line Module before wall mounting the LSU. Check that the buttons on any telephones supplied are working according to the relevant diagram.

When installing the modem, it is recommended that, in addition to the cord already provided with the LSU, one of each of the other two lengths of cord (Cord Connecting No. 22/2- for 1/TG 25.. modems or Cord Connecting No. 22/3- for 2/TG 25.. modems) be taken with the equipment, in case the installation requirements have changed.

If a 1/TG 25.. modem is provided, and the cord already fitted has to be changed for one of a different length, wire it up according to the information in Table 4.

On some short, unamplified 4-wire lines, data can be exchanged between each end, but speech may not be possible. If this is the case, and speech is required, reverse the A and B legs of the transmit or receive pair at one end only.

A Form A6629 should be trimmed at the top to fit alongside the metal label in the front of the MU. Both these labels and the label in the front of the LSU should be completed in soft pencil.

TABLE 4

CONDUCTOR COLOURS FOR CORD, CONNECTING: NO. 22/2-

(RELEVANT TO 1/TG 25.. MODEMS ONLY)

BTA NO.	COLOUR	FUNCTION
1	Green	Supply 0 V
2	-	-
3	Brown	+18 V, Unregulated
4	Pink	-18 V, Unregulated
5	Orange	+11 V, Unregulated
6	-	-
7	Black	Protective Earth
8	Red } twisted	Transmitted Line Signal (0 V rail)
9	Blue } pair	Transmitted Line Signal
10	Yellow } twisted	Received Line Signal (0 V rail)
11	White } pair	Received Line Signal
12	Blue/Black	Common Return
13	Violet	'Connected to Line' indication
14	Red/Blue	PSTN TELE input
15	Red/Yellow	PW TELE/DATA input
16	Red/White	Auto Answer input
17	Red/Green	PSTN DATA input
18	Red/Black	+12 V, Regulated (power for telephone lamps)
19	Turquoise	DCE1 Control input
20	Blue/Yellow	PSTN Relay Drive
21	Blue/White	PW Relay Drive
22	Blue/Orange	Local Test Relay Drive
23	Blue/Green	Ringing Detector
24	Grey	Main/Standby input

Block Terminal connections 1-24 for modems coded 1/TG 25.. are detailed above. The remaining block terminal connections are detailed overleaf in Table 5.

Table 5 follows

TABLE 5

BLOCK TERMINAL CONNECTIONS

BTA NO.	FUNCTION
25	Common Return
26	PSTN 'DATA' button input (commoned to BTA 39)
27	'Auto Answer' button input
28	PSTN 'TELE' button input
29	Telephone 'off normal' input (commoned to BTA 40)
30	PSTN Bell Cct
31	
32	PSTN Speech Cct
33	
34	Main/Standby input
35	'On PSTN' lamp indication
36	'On PW' lamp indication
37	PSTN to DCE1
38	
39	PSTN 'DATA' button input (commoned to BTA 26)
40	Telephone 'off normal' input (commoned to BTA 29)
41	PSTN line
42	
43	Control from DCE1
44	Signalling earth (commoned to BTA 54)
45	PW Receive Line
46	
47	PW Transmit Line
48	
49	Common Return
50	PW 'TELE' button input
51	+12 V, Regulated (commoned to BTA 18 for 1/TG 2509)
52	PW Speech Cct
53	
54	Signalling Earth (commoned to BTA 44)
55	PW Bell Cct
56	
57	Spare
58	Receive Phantom
59	Transmit Phantom
60	

Diagrams for the modem equipment are as follows:-

Main Unit 1/TG 2505	DT 372
Main Unit 1/TG 2506	DT 373
Modem Unit 1/TG 2507	DT 374
Modem Unit 1/TG 2508	
Main Unit 1/TG 2509	DT 375
Line Module 1/TG 2510	DT 376
Line Module 1/TG 2511	DT 377
Modem 12 Block Diagram (1/TG.... modems)	DT 382
Main Unit 2/TG 2505	DT 372/1
Main Unit 2/TG 2506	DT 373/1
Modem Unit 2/TG 2507	DT 374/1
Modem Unit 2/TG 2508	

Main Unit 2/TG 2509 DT 375/1
Line Module 2/TG 2510 DT 376/1
Line Module 2/TG 2511 DT 377/1
Modem 12 Block Diagram (2/TG.... modems) DT 382/1

12 **INSTALLATION TESTING** Perform the test detailed in Table 6, only if the Preliminary Test Programme, para 9, was not carried out on the customer's premises. Check also the mains voltage setting as in Table 3, test 3.

The following test equipment will be required:-

Tester-Line-Earth Loop Impedance (see A2 E1006)

TABLE 6

AC MAINS TEST

	Method
(i)	Connect the line earth loop tester to the mains socket-outlet.
(ii)	Perform the tests described in A2 E1006.
(iii)	If the prescribed limits are not met:-
	(a) Do not connect the Modem 12 to the mains socket.
	(b) Report the matter to the ADCO.

13 **DATA TESTS** These tests apply to modems with Datel Service Codes 224- and 225-, and modems on private circuits only (223-) which have 4-wire test access to the DTC via the TMCC. For modems on private circuits only without this facility, data tests may be carried out on the same occasion as commissioning tests (see Appendix 1.)

Carry out the test programme detailed in Table 7, with the customer's equipment *not* connected to the Modem 12. The following test equipment will be required:-

1 Datel Tester No. 10A
1 Datel Tester No. 12A

Should the Datel Tester No. 10A be unavailable the following may be used instead:

Datel Tester No. 1

Adaptor 1/TG 2494 (for Model 1 modems only).

Table 7 follows

TABLE 7

DATA TEST PROCEDURE

Test	Method
1 BIAS DISTORTION (Model 1 Modems only)	(i) Arrange for a call to be established from the DTC to the telephone associated with the modem. (ii) Connect the Datel Tester No. 10 (or Datel Tester No. 1) to the 25- way socket at the rear of the modem. (iii) Transmit 1:1 signals at 150 bit/s. (iv) The DTC will measure the bias distortion. (v) Arrange to receive 1:1 signal patterns at 150 bit/s from the DTC. (vi) Check that the bias distortion readings for the patterns received in (iii) and (v) above are 0%. (vii) If these results are unsatisfactory, change the Modem Unit -/TG 2507.
2 AUTOMATIC ANSWERING (when facility is provided)	(i) Operate the AUTO ANS button on the telephone. (ii) Arrange for the DTC to call the telephone associated with the modem. (iii) Do not lift the handset on receipt of ringing, but observe that the CALLING INDICATOR lamp on the Datel Tester glows. (iv) Operate the CONNECT D/S TO LINE button on the Datel Tester and note that the ringing is tripped. (v) Restore the AUTO ANS button to normal. (vi) If these results are unsatisfactory, change the Modem Unit -/TG 2507 or 2508.
3 ERROR COUNTS AND PEAK INDIVIDUAL DISTORTION	(i) Connect a Datel Tester No. 10 to the Modem 12. Should a Datel Tester 10 be unavailable a Datel Tester 1 (with Adaptor 1/TG 2494 for Service Codes 22-1) may exceptionally be used. (ii) Establish an exchange line connexion to the DTC and co-operate to carry out the tests detailed below relevant to the particular Datel Facility Code for both directions of transmission.

Table 7 (Contd)

<table>
<tr><th>Test</th><th>Method</th></tr>
<tr><td>3 ERROR COUNTS AND PEAK INDIVIDUAL DISTORTION (Contd)</td><td>
<table>
<tr><th rowspan="2">Datel Facility Code</th><th rowspan="2">Type of test and pattern</th><th rowspan="2">Data Rate (bit/s)</th><th rowspan="2">Test duration (minutes)</th><th rowspan="2">Channel monitored</th><th colspan="2">Maximum</th></tr>
<tr><th>errors</th><th>distor-tion</th></tr>
<tr><td rowspan="3">22-1</td><td rowspan="3">511 bit pseudo random</td><td rowspan="2">2400 and 150</td><td rowspan="2">5</td><td>150 bit/s</td><td>5</td><td>10% (NOTE A)</td></tr>
<tr><td>2400 bit/s</td><td>720</td><td></td></tr>
<tr><td>1200</td><td>5</td><td>1200 bit/s</td><td>360</td><td></td></tr>
<tr><td rowspan="2">22-1
22-2
22-3</td><td rowspan="2">511 bit automatic turnround (NOTES B & C)</td><td>2400</td><td>5</td><td>2400 bit/s</td><td>182</td><td></td></tr>
<tr><td>1200</td><td>5</td><td>1200 bit/s</td><td>108</td><td></td></tr>
</table>
NOTE A: Obtain a representative value of the peak individual distortion by operating the function switch on the tester to 'peak distortion hold max' for 3 periods each of twenty seconds during the course of the 5 minute test.

NOTE B: If necessary the modem must be restrapped for INTERNAL timing for the duration of this test.

NOTE C: The test must run continuously for a period of 5 minutes without stopping. If the test stops it must be restarted and run continuously for a further 5 minute period.

(iii) If the above requirements cannot be met over the initial connexion, request the DTC to release the call, and re-establish a connexion.

(iv) Check the new connexion for speech transmission and repeat test (ii).

(v) If the results are again unsatisfactory repeat (iii) and (iv) above.

(vi) If none of the connexions will transmit data satisfactorily, change the MU.

(vii) Repeat tests (ii) to (v) above.

(viii) If tests are still unsatisfactory, inform the ADCO immediately, who will proceed as in A8 H1281/C3 I0503.
</td></tr>
</table>

TABLE 7 (Contd)

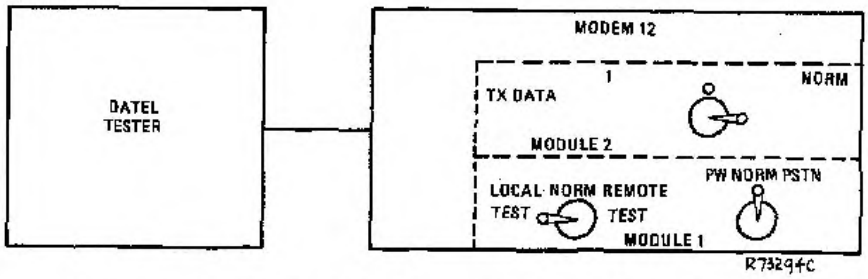
Test	Method
4 REMOTE TEST (Loops interface back to distant end)	(i) Withdraw the tester interface plug. (ii) Press the "IND CHECK" button on Module 1, and verify that all lamps glow. (iii) Request the DTC to perform a remote test. (iv) Operate the two test keys on Module 1 of the MU to "REMOTE TEST" and "PSTN". (v) On completion of the test, restore the test keys to normal, and replace the connector plug. (vi) If this test is unsatisfactory, change the Modem Unit -/TG 2507 or 2508.
5 LOCAL TEST Provides local analogue loop at office side of line transformers (and simultaneously loops the private circuit - 1/TG25.. modems only)	(i) Connect the equipment with the switches set as shown below, and perform the following tests. (All switches not shown are set to 'Normal'. Datel Testers No. 1 or 10 may be used as available for this test).  *Ensure the modem is NOT connected to line* (ii) Transmit the 511 element Pseudo Random patterns at 2400 bit/s, and ensure that the Datel Tester phases into the incoming signal. (iii) Where a Model 1 modem is provided, repeat (ii) at a data rate of 150 bit/s. (iv) Ensure that "Request to Send" is not operated on the Datel Tester, and operate the test switch on Module 2 of the MU to binary '0' and '1' alternately. (v) Check that the 'LINE SIG' lamp on Module 3 glows, and that only the appropriate binary '0' and '1' indicator glows in response to the signal from Module 2. (vi) Where a Model 1 modem is provided, repeat (iv) and (v) for the 150 bit/s channel on Module 4 and 5. (vii) If this test is unsatisfactory, change the Modem Unit -/TG 2507 or 2508. (viii) Restore all test switches to normal.

Table 7 (Contd)

Test	Method
6 ERROR RATES WHEN OPERATING TO A SECOND DTC (Perform for Service Codes 225-/-/ only)	(i) Ascertain the Region to which the customer intends to operate. (ii) Request the DTC appropriate to the Region specified to establish a call to the exchange line and to co-operate in performing the tests detailed in 3 and 4 above. (iii) The DTC will record the test results on A5 (Plain) paper in a format similar to that shown in Appendix 2.

14 CUSTOMER'S EQUIPMENT CONNECTION TO THE MODEM 12 See C3 I0104.

15 COMPLETION For modems connected to private circuits, carry out commissioning tests detailed in Appendix 1 for point-to-point circuits, or multipoint circuits. When all tests have been satisfactorily concluded, follow the completion procedure detailed in C3 I0502.

Figs 1-9 follow

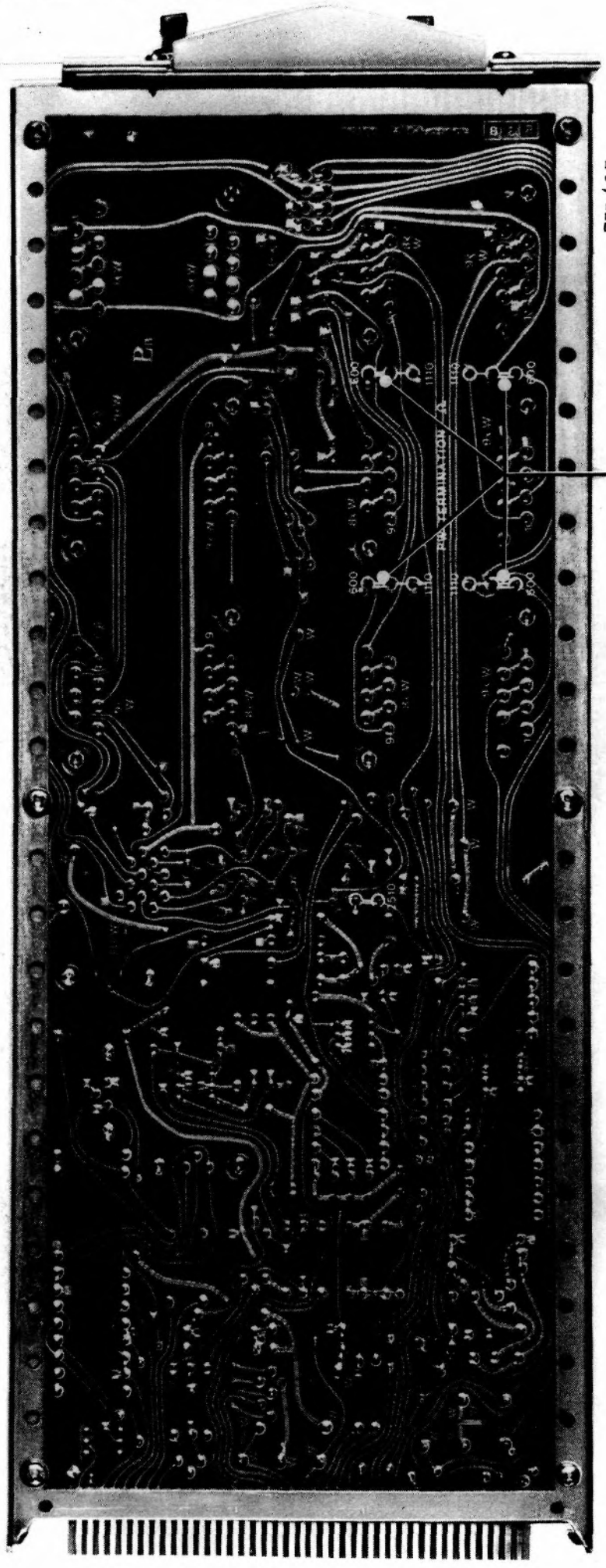


FIG. 1A. SOLDER STRAPS FOR LINE MODULE 2/TG2510

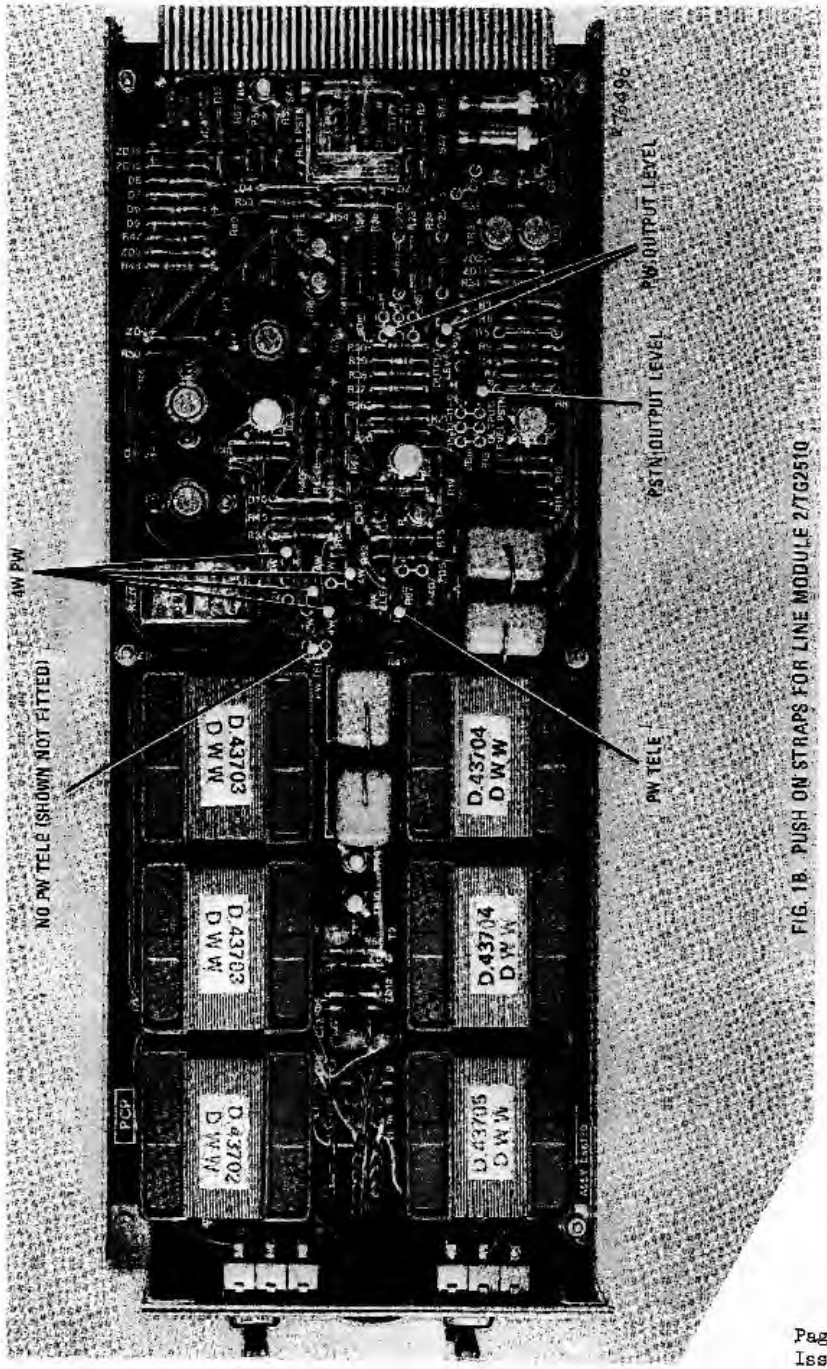


FIG. 1B. PUSH ON STRAPS FOR LINE MODULE 2/TG2510

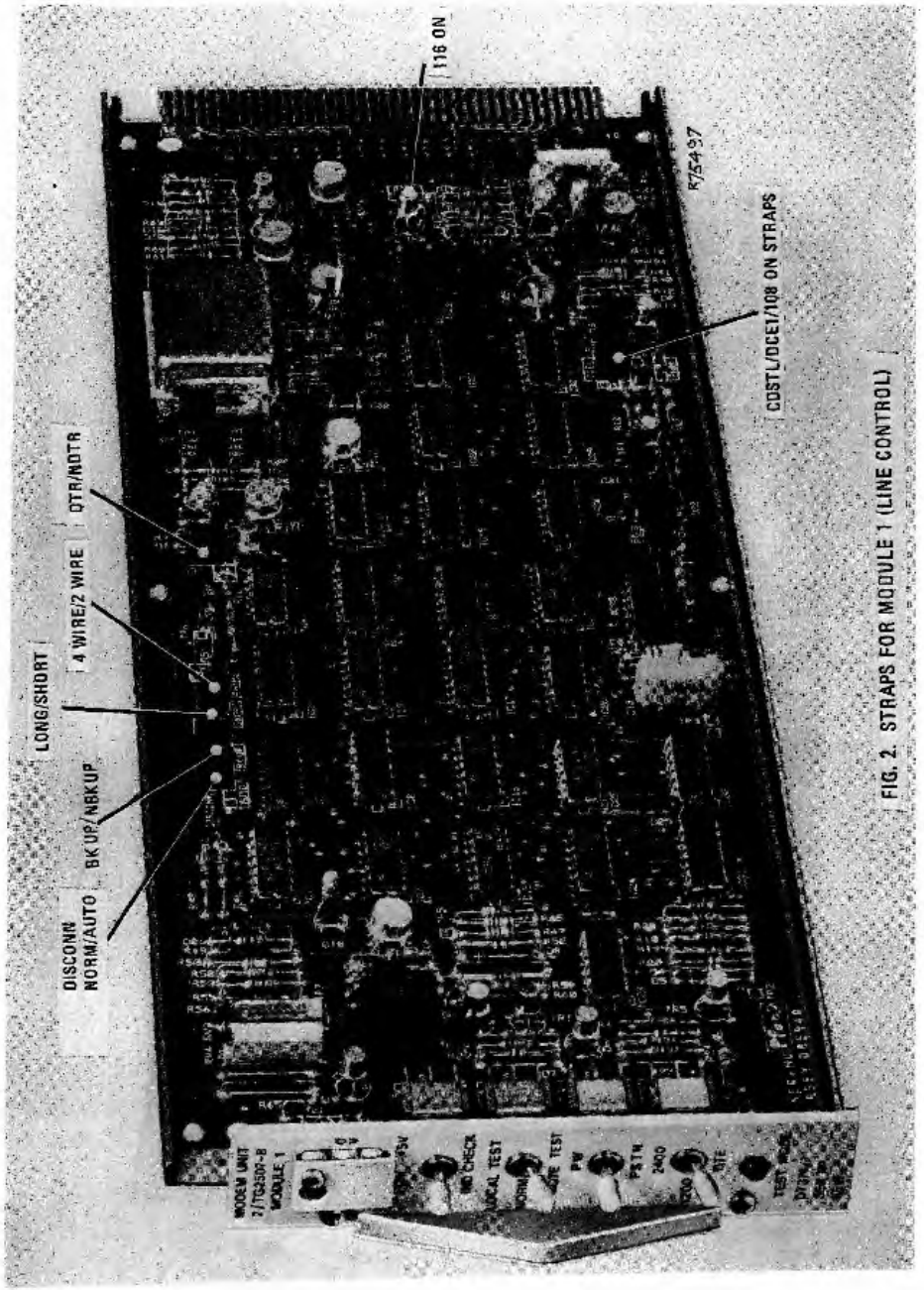


FIG. 2. STRAPS FOR MODULE 1 (LINE CONTROL)

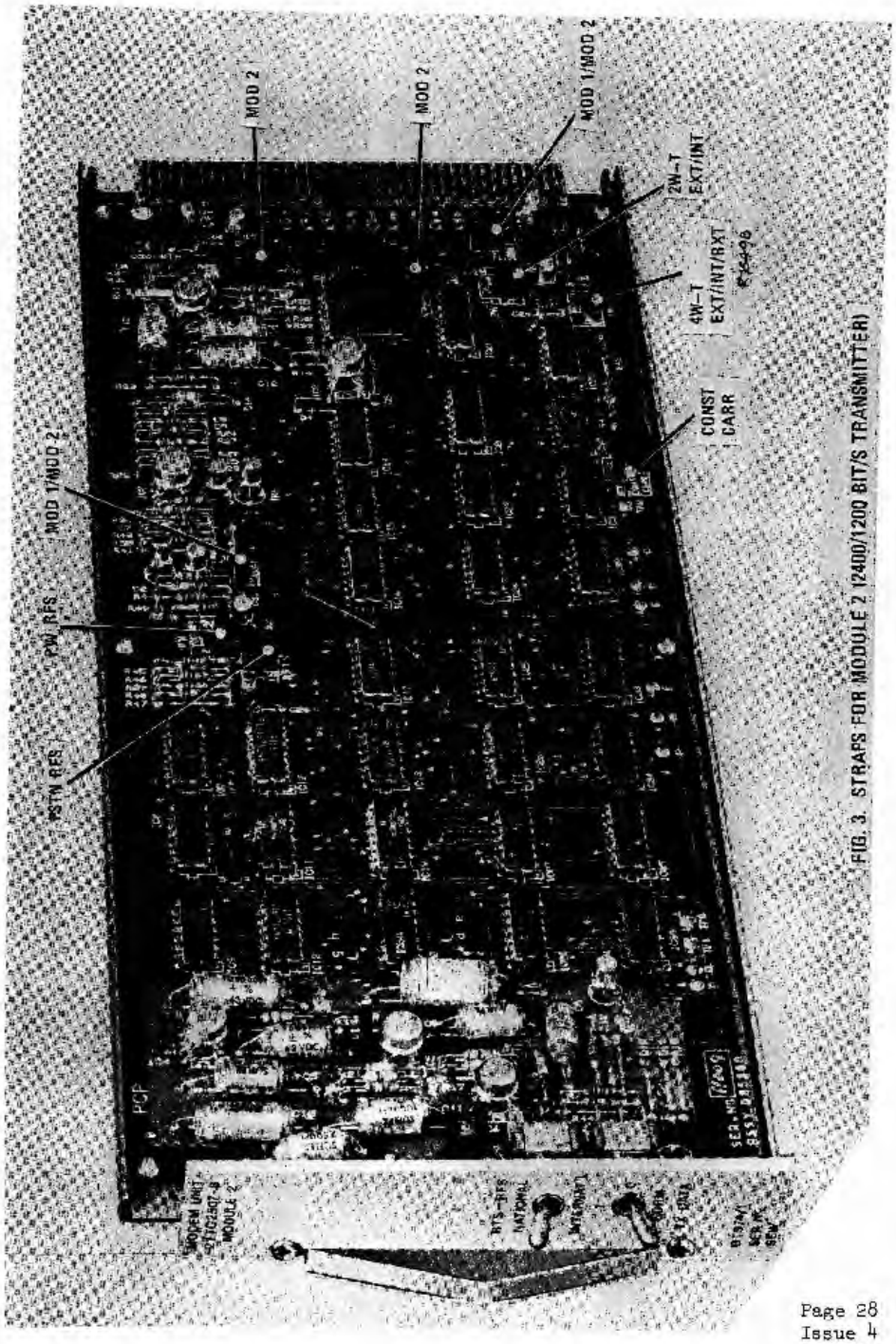


FIG. 3. STRAPS FOR MODULE 2 (2400/1200 BIT/S TRANSMITTER)

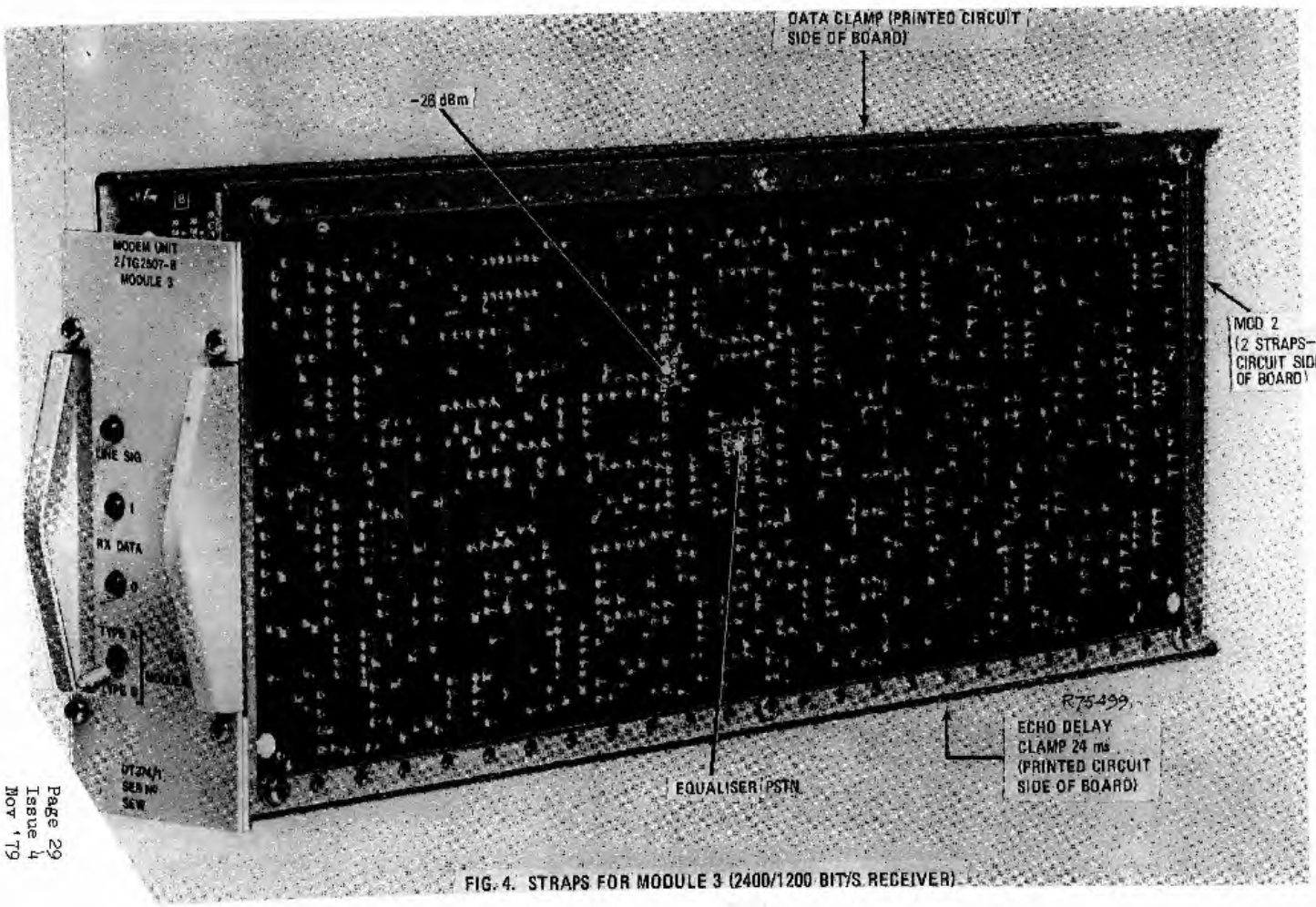


FIG. 4. STRAPS FOR MODULE 3 (2400/1200 BIT/S RECEIVER)

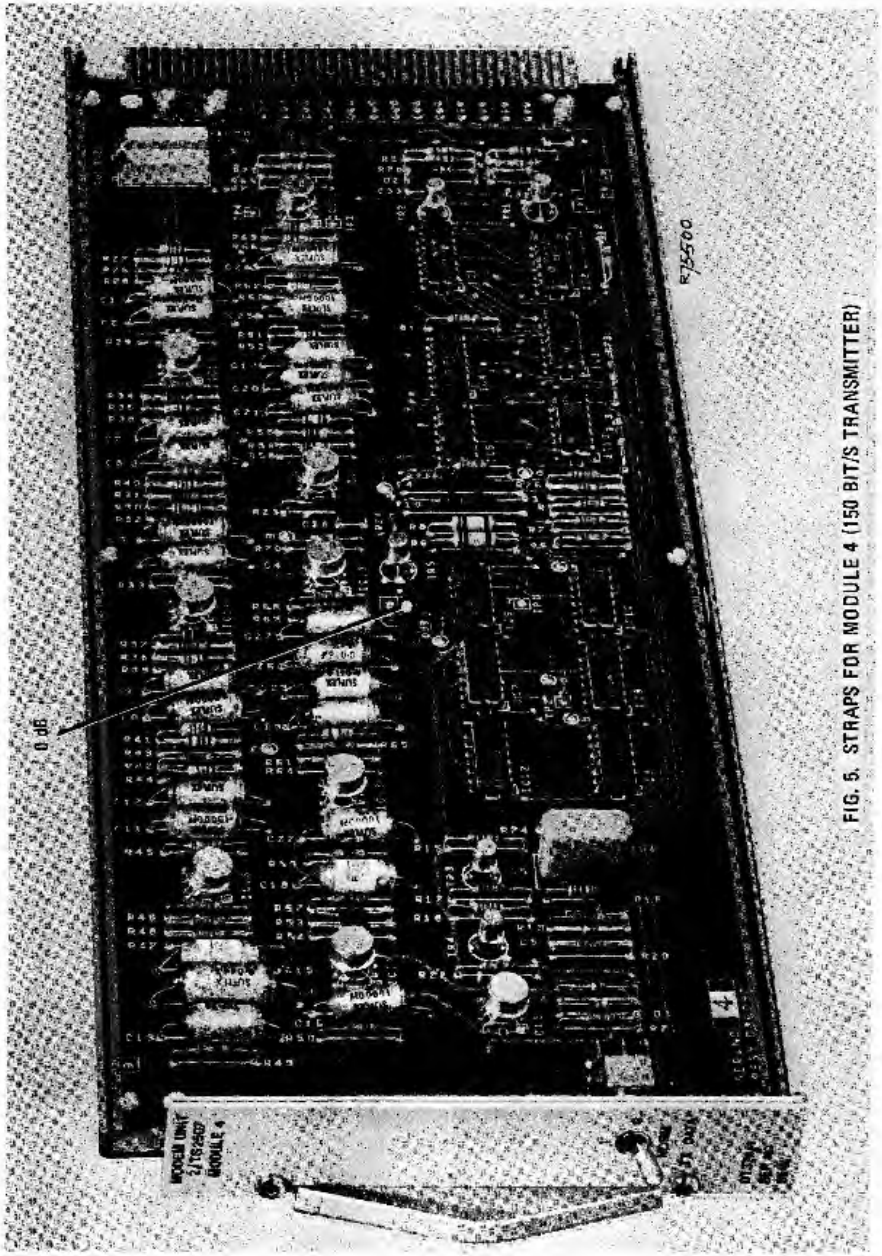


FIG. 5. STRAPS FOR MODULE 4 (150 BIT/S TRANSMITTER)

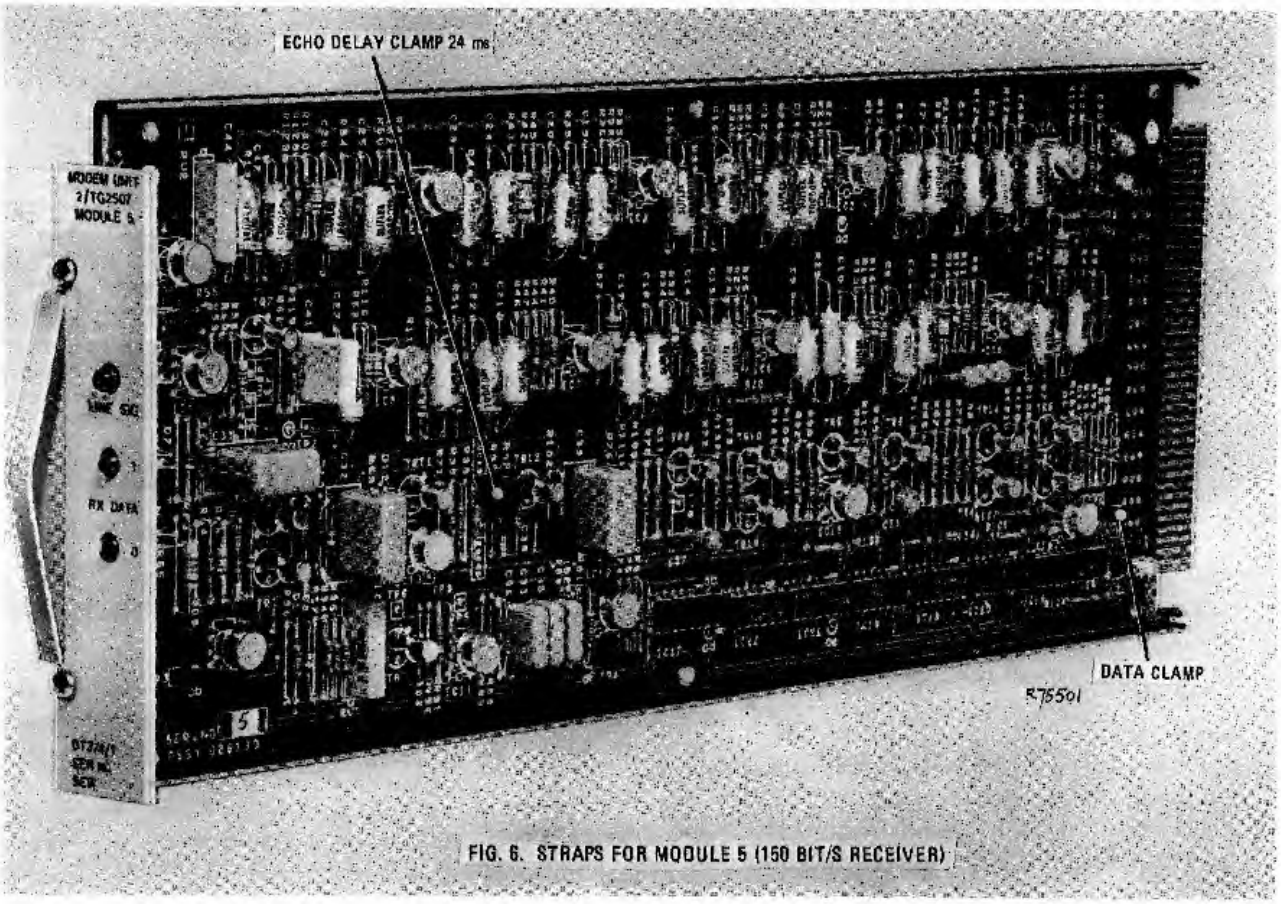


FIG. 6. STRAPS FOR MODULE 5 (150 BIT/S RECEIVER)

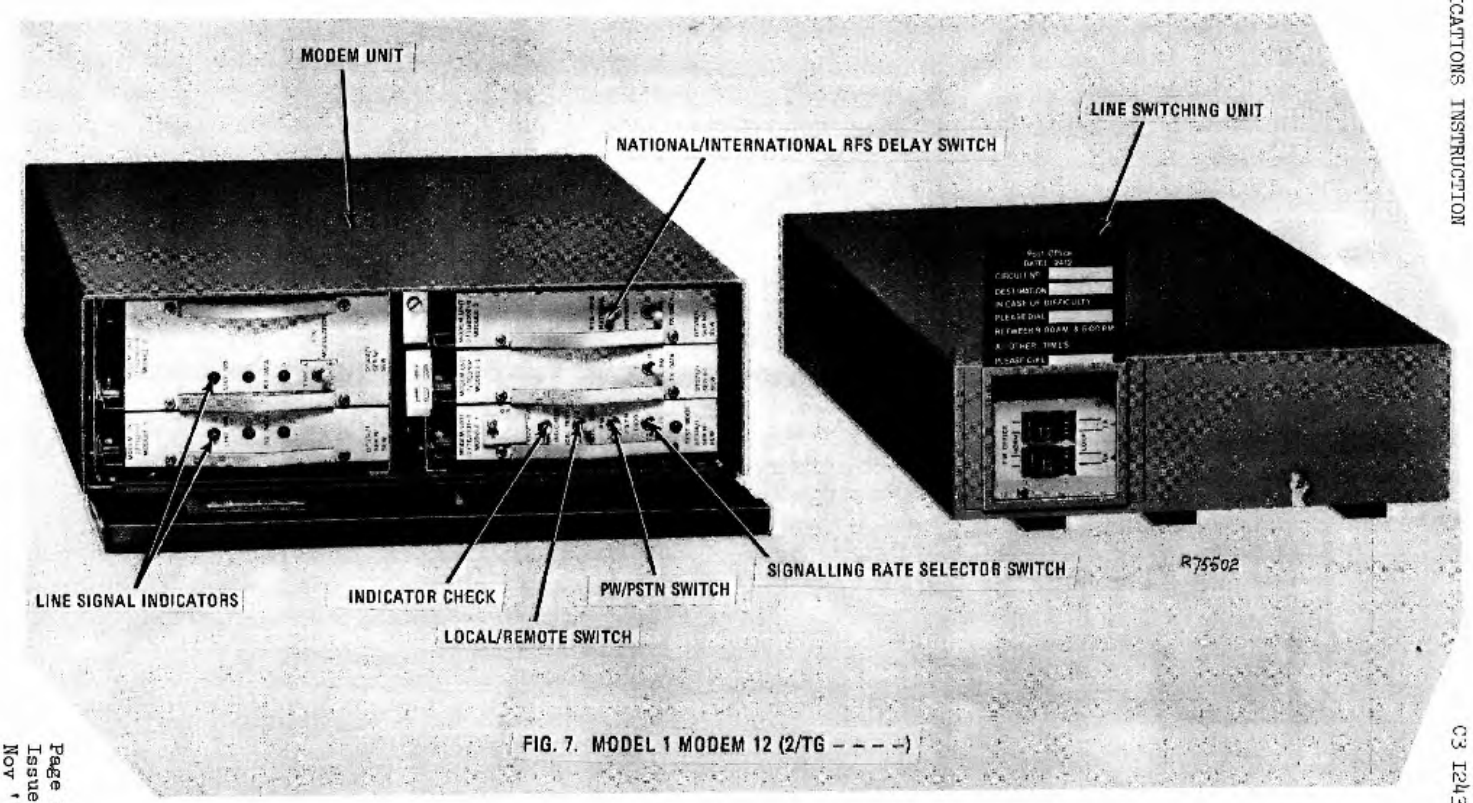


FIG. 7. MODEL 1 MODEM 12 (2/TG – – – –)

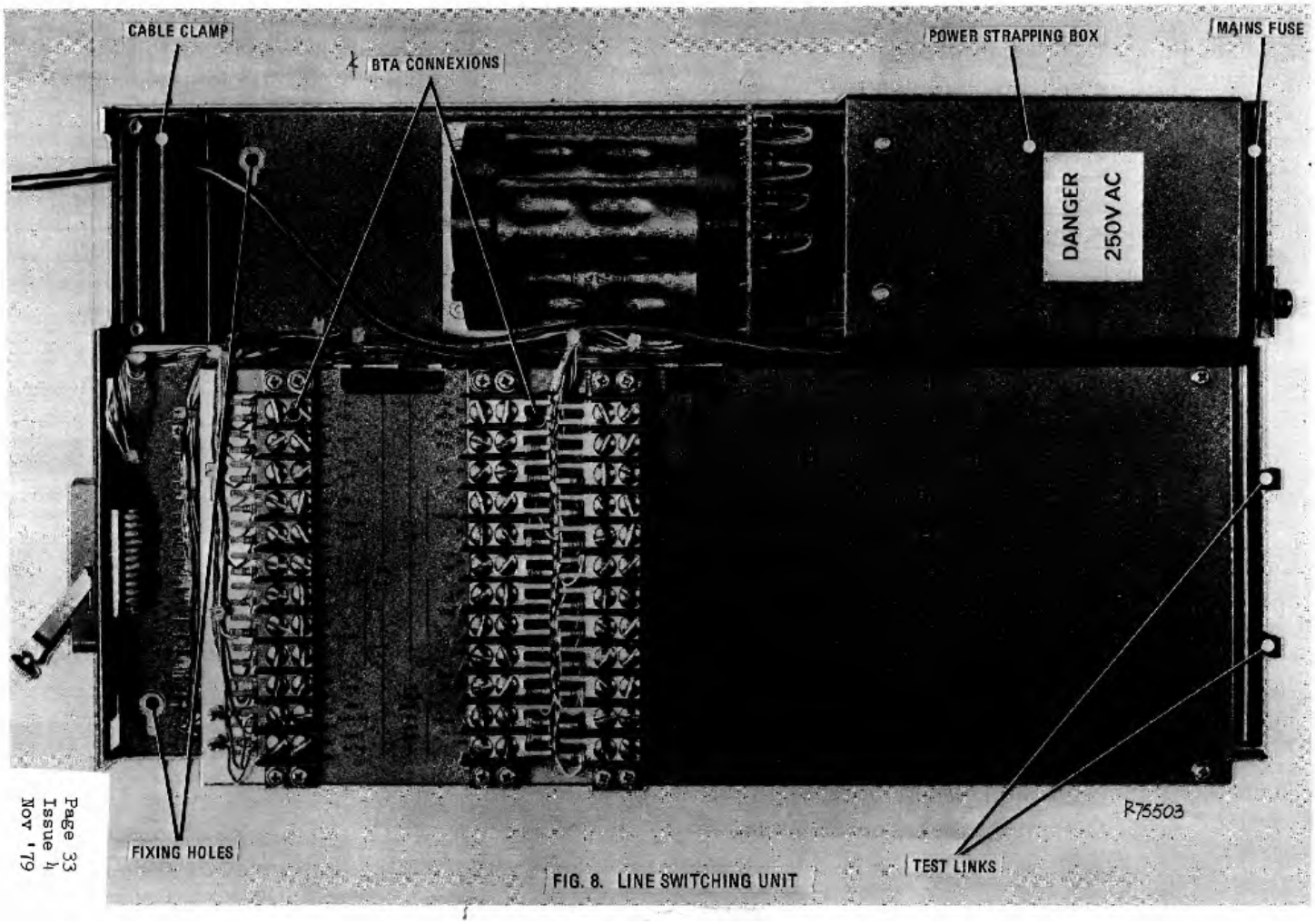


FIG. 8. LINE SWITCHING UNIT

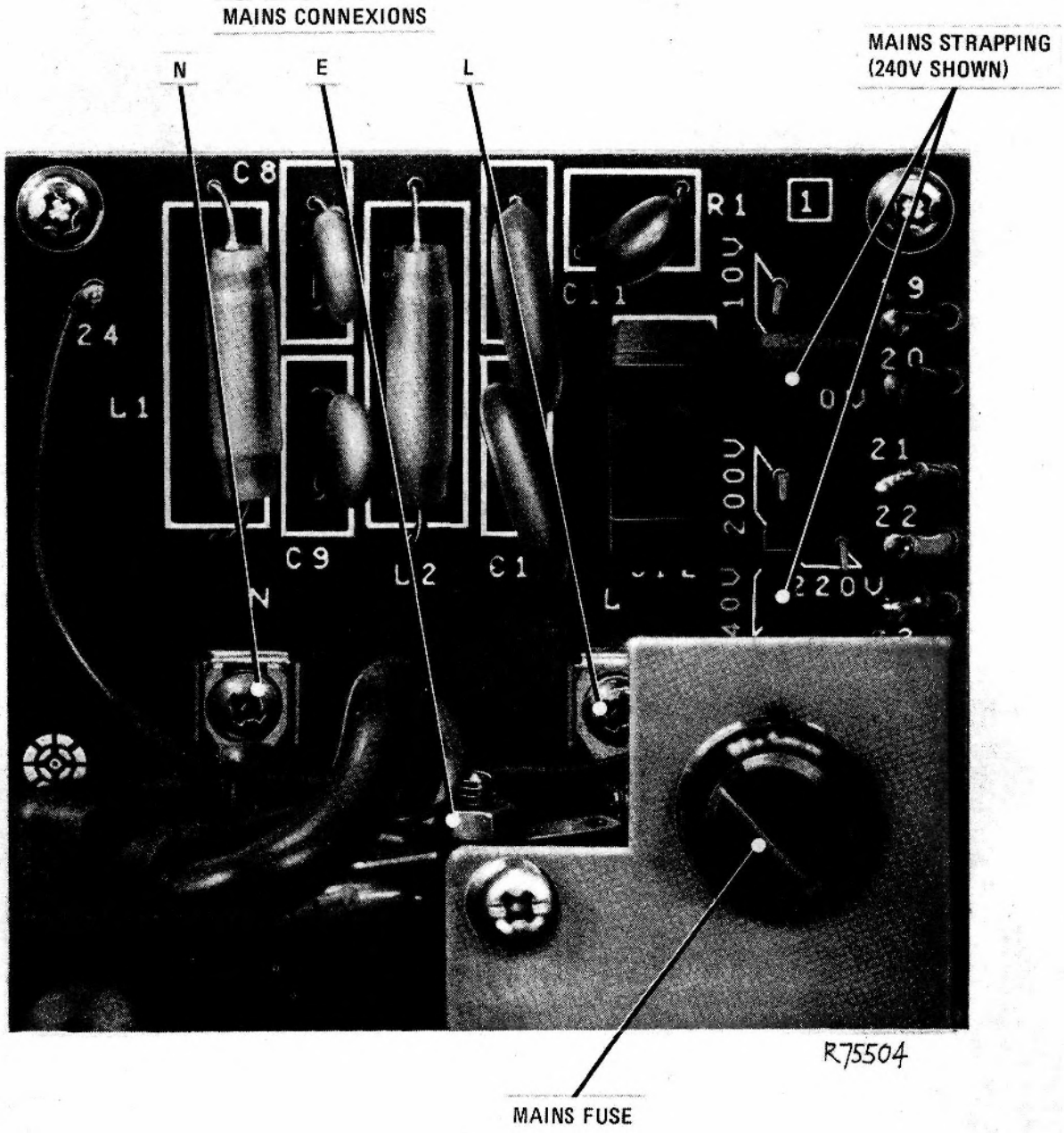


FIG. 9. MAINS POWER STRAPPING BOARD

APPENDIX 1

DATEL 2412 SERVICE

Commissioning Limits for Private Circuit Services

(Extract from TI C3 I2451)

1 GENERAL The arrangements for commissioning tests are described in C3 I0501.

2 COMMISSIONING LIMITS

2.1 Modem 12 working to a Modem 12 with or without backward channels or PSTN standby facilities.

Datel Tester	Type of Connection	Type of Test and Pattern (bit)	Data Signalling Rate (bit/s)	Duration of Test (minutes)	Maximum Permitted Errors (bit)
1 BASIC COMMISSIONING TESTS					
10A	PC (Main or Reserve)	Turnround (Note 1 (a))	2400	15 (without stopping	35
10A	PSTN Standby	Turnround (Notes 1 & 2)	2400	5 (without stopping)	182
10A	PSTN Standby	Turnround (Notes 1, 2 & 3)	1200	5 (without stopping)	108
2 ADDITIONAL TESTS WHEN BACKWARD CHANNEL FACILITIES ARE PROVIDED					
10A or 1+ Adaptor 1/TG 2494	PC (Main or Reserve)	Static, 511 (Note 4)	2400 and 150	15	108 7
10A or 1	PSTN Standby	Static, 511 (Notes 2 & 4)	2400 (Tx or Rx) 150 (Rx or Tx)	5	720 45
10A or 1	PSTN Standby	Static, 511 Notes 2, 3 & 4)	1200 (Tx or Rx) 150 (Rx or Tx)	5	360 45
3 ALTERNATIVE BASIC TESTS, IF AUTHORISED BY ADCO DUE TO NON-AVAILABILITY OF DATEL TESTER NO. 10A					
1	PC (Main or Reserve)	Static, 511 (Note 4)	2400	15	108
1	PSTN Standby	Static, 511 (Note 2 & 4)	2400	5	720

Datel Tester	Type of Connection	Type of Test and Pattern (bit)	Data Signalling Rate (bit/s)	Duration of Test (minutes)	Maximum Permitted Errors (bit)
3 ALTERNATIVE BASIC TESTS, IF AUTHORISED BY ADCO DUE TO NON-AVAILABILITY OF DATEL TESTER NO. 10A (Contd)					
1	PSTN Standby	Static, 511 (Note 2, 3 & 4)	1200	5	360

NOTES: 1 (a) If the modem is strapped for external timing (ie from the DTE) it must be restrapped to internal timing for the duration of this test. If the modem is strapped for constant carrier operation it must be restrapped to provide 12 ms Ready for Sending delay for the duration of this test.

(b) If a modem unit 2/TG 2507-8 is provided for an 'R' Service Code (Select Standby is on pin 9), a Datel Tester No. 12A will be required to make the necessary cross-connexion.

2 PSTN calls should be dialled in the direction normally to be used by the customer.

3 This test should be carried out only if unsatisfactory results were obtained at 2400 bit/s due to the PSTN routing employed. The ADCO must be advised immediately if unsatisfactory results were obtained at 2400 bit/s.

4 If a Modem Unit 2/TG 2507-8 is provided either for an 'R' Service Code (Select Standby on Pin 9) or strapped for external timing (Pin 24), a Datel Tester No. 12A will be required to make the necessary cross connexions.

2.2 Failure to meet commissioning limits. If any one of the limits specified in para 2.1 cannot be met the Datel Service is unsatisfactory; and should not be handed to the customer until any faults have been identified and cleared, and the commissioning limits met.

Appendix 2 follows

APPENDIX 2

TO: Datel Test Centre .....

FROM: Datel Test Centre .....

DATEL 2412 TEST RESULTS (TI C3 I2434, Para 13
Table 7, Test 6)

CUSTOMER: .....

.....

EXCHANGE LINE NUMBER .....

ERRORS RECEIVED AT DTC

2400 _____

1200 _____

ERRORS RECEIVED AT INSTALLATION

2400 _____

1200

Signed .....

Date .....

References: A2 E1006, C1 A0050, C3 I0104, C3 I0502, C3 I1000, C3 I2422, C3 I2427
C3 I8401, D5 C0010.

THQ/NP3.3.5

E N D