

15 APR 1977

TELECOMMUNICATIONS INSTRUCTION

314

C MARKETING INSTALLATION

316

3 Internal

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I2432

DATTEL 2400 SERVICE

Dattel Modem No. 7B Installation and Testing

(As this instruction has been completely REVISED, individual paragraphs have not been "starred".)

1 **AUTHORITY** Given by an Advice Note (A/N) which will quote the Dattel Service Code.

2 **DATTEL SERVICE CODES** See I2420.

3 **EQUIPMENT REQUIRED** For the equipment required for each Service Code, see I2425 except where control installations are involved. For control installations see I8401 initially.

4 **HANDLING AND ASSEMBLY** Dattel Service modems should be handled carefully at all times. The Modem 7B units should be removed from their cartons and located in the Data Main Unit as shown in Appendix 1, Figure 1. The cartons and packing should be retained for re-use if the units are to be transported.

5 **INITIAL SETTING UP** Preliminary setting up and testing of the modem should normally be carried out on Post Office premises unless the installation is large enough for these tests to be carried out on the customer's premises.

6 **MODEM INTERNAL CONNEXIONS** Straps are required on the Control Unit No. 18B, depending on the particular Dattel Service Code, as indicated in Table 1.

The strapping tags are mounted on the rear of modules 1 and 3 of the Control Unit No. 18B, as shown in Appendix 1, Figure 2.

Table 1 follows

TABLE 1

STRAPPING ON CONTROL UNIT NO. 18B

Date/ Service Code	Remarks	Strapping
2401/. /..... 2411/. /..... 2421/. /..... 2431/. /..... 2441/. /.....		10A-11A 2C-3C 7C-8C 12C-12D 13C-13D 1H-2H 5H-5J 6H-6J 7H-7J 8H-8J 11J-12J 5K-6K
2402/. /..... 2412/. /..... 2422/. /..... 2432/. /..... 2442/. /.....		10A-11A 2C-3C 12C-13C 8C-8D 14C-14D 6D-7D 1H-2H 5H-5J 6H-6J 7H-7J 9H-9J 11H-11J 5K-6K
2403/. /..... 2413/. /..... 2423/. /..... 2433/. /..... 2443/. /.....		10A-11A 8A-8B 2C-3C 12C-13C 4C-5D 8C-8D 4H-4J 6H-6J 7H-7J 8H-8J 1J-2J 11J-12K
2404/. /..... 2414/. /..... 2424/. /..... 2434/. /..... 2444/. /..... 248. / . /.....		10A-11A 7C-8C 3C-3D 6C-6D 12C-12D 13C-13D 1H-2H 3H-3J 5H-5J 6H-6J 7H-7J 8H-8J 10H-10J 5K-6K

TABLE 1 (Cont'd)

Datel Service Code	Remarks	Strapping
2451/./.....		10A-10B 2C-3C 7C-8C 11C-11D 12C-12D 13C-13D 3D-4D 6D-7D 5K-6K 1H-2H 3H-3J 5H-5J 8H-8J 10H-10J
2461/./.....		10A-10B 2C-3C 7C-8C 6C-6D 11C-11D 12C-12D 13C-13D 3D-4D 5K-6K 1H-2H 3H-3J 5H-5J 8H-8J 10H-10J
24.5/./.....		10A-10B 2C-3C 12C-13C 8C-8D 14C-14D 3D-4D 6D-7D 1H-2H 3H-3J 5H-5J 6H-6J 7H-7J 9H-9J 10H-10J 11H-11J 5K-6K

TABLE 1 (Cont'd)

Datel Service Code	Remarks	Strapping
24.6/./.....		8A-8B 10A-10B 2C-3C 12C-13C 4C-5D 6C-6D 8C-8D 3D-4D 3H-3J 4H-4J 6H-6J 7H-7J 8H-8J 10H-10J 1J-2J
24.7/./.....	With Modulator No. 7A and Demodulator No. 5A	10A-11A 8A-8B 2C-3C 12C-13C 4C-5D 8C-8D 4H-4J 8H-8J 1J-2J 11J-12J
	With Modulator No. 5B and Demodulator No. 7A	10A-11A 2C-3C 12C-13C 8C-8D 14C-14D 6D-7D 1H-2H 5H-5J 9H-9J 11H-11J 5K-6K
24.8/./..... 24.9/./.....	With Modulator No. 7A and Demodulators No. 5A and 6A	8A-8B 10A-10B 2C-3C 12C-13C 4C-5D 6C-6D 8C-8D 3D-4D 3H-3J 4H-4J 8H-8J 10H-10J 1J-2J

314
30 JNE 1977

C3 I2432

TABLE 1 (Cont'd)

Datel Service Code	Remarks	Strapping
24.8/./..... 24.9/./.....	With Modulators No. 5B and 6A and Demodulator No. 7A	10A-10B 2C-3C 12C-13C 8C-8D 14C-14D 3D-4D 6D-7D 1H-2H 3H-3J 5H-5J 9H-9J 10G-10J 11H-11J 5K-6K
24..././.....	4 Wire telephone in	10F-10G 12F-12G
24.1/.Z/..... 24.2/.Z/..... 24.3/.Z/..... 24.4/.Z/..... 24.5/.Z/..... 24.6/.Z/.....	4 Wire telephone out 600Ω termination in	12E-13E 11F-12F 8G-9G 10G-11G
24.7/.Z/..... 24.8/.Z/..... 24.9/.Z/.....	4 Wire telephone out 1200Ω termination in	12E-13E 8G-9G
24../RZ/..... 24../R/.....	Connect Data Set to Line (CDSTL) from the terminal.	2A-2B 6A-6B 9C-9D
24../SZ/..... 24../S/.....	Locking Data button on telephone	3A-3B 6A-6B
24../TZ/..... 24../T/.....	Data Terminal Ready (DTR) working	2A-2B 6A-6B 7A-7B
24../U/.....	CDSTL from terminal with AUTO ANS controlled from PO equipment.	2A-2B 6A-6B 9C-9D
24..././1....	Internal Transmitter Signal Element Timing (TSET)	4A-4B 11B-12B 1G-2G 5G-6G
24..././2....	Receiver TSET	4A-4B 12A-12B 4B-5B 4G-5G

TABLE 1 (Cont'd)

Datel Service Code	Remarks	Strapping
24.../. /3....	External TSET via pin 15	14A-14B 4B-5B 4G-5G
24.../. /4....	External TSET via pin 9	14A-14B 5B-5C 4G-5G
24.../. /5....	External/Internal TSET	4A-4B 11B-12B 5B-5C 2G-3G 4G-5G
24.../. /.1...	Received Data cct-Binary 1	1C-1D
24.../. /.2...	Received Data cct-Binary 0	1D-2D
24.../. /..1..	Syn Pattern on	13A-13B
24.../. /..2..	Syn Pattern off	NIL
24.../. /...1.	Inhibit Data Demod No. 6A	10C-10D
24.../. /...2.	No inhibit Data Demod No. 6A	NIL
24.../. /....1	Stby Indicator off when data set ready (DSR) off	NIL
24.../. /....2	Stby Indicator on when DSR off	1A-1B
ALL	Hold Coil inserted	1K-2K 3K-4K

7 ALTERNATIVE PHASE CODING If the AN specifies an "Alternative Phase Coding", the Data Modulator No. 5B and/or Data Demodulator No. 5A should be modified as detailed in Table 2. Alternative Phase Coding can prevent loss of synchronism on some customers' systems which transmit a continuous stream of binary 0. This is done by introducing a -90° phase change to represent dibit 00 instead of 0° phase change.

TABLE 2
ALTERNATIVE PHASE CODING MODIFICATION

Data Modulator No. 5B		Data Demodulator No. 5A	
Remove Straps	Insert Straps	Remove Straps	Insert Straps
18-31	18-33	48-49	48-50
19-22	19-21	50-51	49-51
20-21	20-22	52-53	52-54
25-27	25-28	54-55	53-55
30-33	30-31		

The position of these straps on the Data Modulator No. 5B is shown in Appendix 1, Figure 4.

8 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. The following test equipment will be required:-

Attenuator No. 70A

Data Main Unit No. 7 suitably equipped with modulators and demodulators, and internally strapped, to operate on a back to back basis to the modem to be tested (see I2420 for the Service Codes for compatible modems).

2 Datel Testers No. 1

Frequency Counter No. 1000 (NOTE)

Measuring Set No. 44C

Meter, Multirange, No. 12A

Oscilloscope No. 14A

Tester, Line-Earth-Loop Impedance (see A2 E1006 - only required if preliminary test programme below is carried out at the customers premises).

1200 ohm Resistor

NOTE: If a Frequency Counter No. 1000 is not locally available, the frequency tests described in Table 3, para 7 can be performed by the Datel Test Centre.

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 tests described in A2 E1006. (iii) If prescribed limits are not met: (a) Do not connect the Modem No. 7 to the Mains Socket. (b) Report matter to ADCO.
2 MODEM EARTHING	(i) Set Meter, Multirange, No. 12A to measure resistance. (ii) Check that there is no internal connection in the modem between common return (BTA4) and protective earth. It should be noted that a 10 μ F capacitor is connected between these two point. (iii) Check that there is continuity between the earth (green/yellow) wire of the mains cord and the metalwork of the modem case.

TABLE 3 (Cont'd)

TEST	METHOD												
3 AC VOLTAGE SETTING	(i) Before connecting the modem to the mains supply remove the power unit from the modem. (ii) Set the strap on the voltage adjustment tag board of the mains transformer, which is located under the white protective cover marked "DANGER AC MAINS" to the nominal voltage quoted by the Local Electricity Authority. (iii) Replace the protective cover before replacing the power unit.												
4 DC VOLTAGE MEASUREMENT	(i) Depending on the customer's mains socket-outlet, terminate the Modem No. 7 power lead on a 5A or 13A (fused at 3A) 3-pin (BSI) plug and insert in the socket outlet. (ii) Measure and check with Meter, Multirange, No. 12A voltages between the following test points on the front of the power unit: <table border="1"> <thead> <tr> <th>TEST POINTS</th><th>TEST LIMITS</th></tr> </thead> <tbody> <tr> <td>+12 V and COMMON</td><td>+12 $\pm$ 0.6 V</td></tr> <tr> <td>-12 V and COMMON</td><td>-12 $\pm$ 0.6 V</td></tr> <tr> <td>+24 V and COMMON</td><td>+24 $\pm$ 1.2 V</td></tr> <tr> <td>+5 V and COMMON</td><td>+5 $\pm$ 0.25 V</td></tr> <tr> <td>5 V FLOATING</td><td>4.5 - 5.2 V</td></tr> </tbody> </table> (iii) If any of these readings are outside these limits change the Power Unit No. 93A.	TEST POINTS	TEST LIMITS	+12 V and COMMON	+12 $\pm$ 0.6 V	-12 V and COMMON	-12 $\pm$ 0.6 V	+24 V and COMMON	+24 $\pm$ 1.2 V	+5 V and COMMON	+5 $\pm$ 0.25 V	5 V FLOATING	4.5 - 5.2 V
TEST POINTS	TEST LIMITS												
+12 V and COMMON	+12 $\pm$ 0.6 V												
-12 V and COMMON	-12 $\pm$ 0.6 V												
+24 V and COMMON	+24 $\pm$ 1.2 V												
+5 V and COMMON	+5 $\pm$ 0.25 V												
5 V FLOATING	4.5 - 5.2 V												
5 4-WIRE LINE OUTPUT LEVELS (Not applicable to modems strapped to service codes 248)	Switch off the power to the modem and remove Module No. 3 of the Control Unit No. 18B and identify the 4-wire line output level straps as shown in Appendix 1, Figure 3. A DATEL SERVICE CODES 24-1, 24-2, 24-3, 24-4, 24-5, 24-6. (i) Set the output level to -13 dBm (strap 25-38). (ii) Replace the Module No. 3 of the Control Unit No. 18B in the modem. (iii) Connect the Measuring Set No. 44C, for a 600 ohm terminated reading, between BTA7 and BTA8. (iv) Connect a Datel Tester No. 1 to the modem. (v) Connect the power to the equipment and operate the "CONNECT D/S TO LINE" and "REQUEST TO SEND" buttons on the Datel Tester. (vi) Note that the level meter reading is -13 $\pm$ 1 dBm.												

TABLE 3 (Cont'd)

TEST	METHOD
5 4-WIRE LINE OUTPUT LEVELS (Cont'd)	(vii) If the level meter reading is not -13 ± 1 dBm check that strap 25-38 is connected. (viii) If the level meter reading is still not -13 ± 1 dBm, change the Control Unit No. 18B. B DATEL SERVICE CODES 24-7, 24-8, 24-9. (i) Set the output level to -19 dBm (strap 28-46) on the modem containing the Data Modulator No. 5B. (ii) Set the output level to -25 dBm (strap 31-49) on the modem containing the Data Modulator No. 7A. (iii) Replace the Modules No. 3 of the Control Units No. 18B in the modems. (iv) Connect the Measuring Set No. 440, for a 600 ohm terminated reading, between BTA7 and BTA8 of the modem containing the Data Modulator No. 5B. (v) Connect a Datel Tester No. 1 to each modem. (vi) Connect the power to the equipment and operate the "CONNECT D/S TO LINE" and "REQUEST TO SEND" buttons on the Datel Testers. (vii) Note that the level meter reading is -19 ± 1 dBm. (viii) If the level meter reading is not -19 ± 1 dBm check that strap 28-46 is connected. (ix) If the level meter reading is still not -19 ± 1 dBm change the Control Unit No. 18B. (x) Connect the Measuring Set No. 440 for a 600 ohm terminated reading, between BTA7 and BTA8 of the modem containing the Data Modulator No. 7A. (xi) Note that the level meter reading is -25 ± 1 dBm. (xii) If the level meter reading is not -25 ± 1 dBm check that strap 31-49 is connected. (xiii) If the level meter reading is still not -25 ± 1 dBm, change the Control Unit No. 18B.

TABLE 3 (Cont'd)

TEST	METHOD
6 2-WIRE LINE OUTPUT LEVELS	(i) The output level at the 2-wire line terminals (BTAll and l2) is set by straps EF 1-9 on the back of Module No. 3, of the Control Unit No. 18B for Data Demodulators No. 6A and 7A; and by straps on the circuit board of the modulator for a Data Modulator No. 5B, as shown in Appendix 1, Figure 5. (ii) Switch off the power and adjust the straps to give a level, within ± 1 dB (calculated as shown in NOTE at end of table) but subject to a maximum of 0 dBm. (If two modems are provided the signal level should be adjusted for each modem in turn.) (iii) Connect the Measuring Set No. 44C for a 600 ohm terminated reading between BTAll and BTAl2. (iv) Connect the power to the equipment and operate the "CONNECT D/S TO LINE" and "REQUEST TO SEND" buttons on the Datel Tester. (v) Check that the level meter reading is within ± 1 dB of the level calculated in the NOTE at the end of the table. (vi) If the level cannot be adjusted to within this range change the Control Unit No. 18B and/or the Data Modulator No. 5B. (vii) Disconnect the Measuring Set No. 44C.
7 SIGNAL FREQUENCY MEASUREMENTS	If a Frequency Counter No. 1000 is not locally available, it is possible for the Datel Test Centre (DTC) to perform the following measurements. This can be done by connecting the line terminals (BTAll and l2) of the modem to an exchange line and arranging for a call to be established from the DTC to this line. (i) Connect the Frequency Counter No. 1000 to BTAll and l2 (ii) Operate the "CONNECT D/S TO LINE" and "REQUEST to SEND" buttons on the Datel Tester. (iii) Measure the signal frequency with Binary 1 and Binary 0 signals applied in turn to the modem from the Datel Tester. (iv) If a Data Modulator No. 6A is provided, both the 600 and 1200 bit/s signal frequencies should be measured. (v) Adjust the appropriate SET FREQUENCY potentiometer at the front of the modulator to give the following line signal frequency.

TABLE 3 (Cont'd)

TEST	METHOD														
7 SIGNAL FREQUENCY MEASUREMENTS (Cont'd)	<table><tr><th>Signal Transmitted</th><th>Line Signal Frequency</th></tr><tr><td>Binary 1 75 bit/s</td><td>390 ± 2 Hz</td></tr><tr><td>Binary 0 75 bit/s</td><td>450 ± 2 Hz</td></tr><tr><td>Binary 1 600 bit/s</td><td>1300 ± 5 Hz</td></tr><tr><td>Binary 0 600 bit/s</td><td>1700 ± 5 Hz</td></tr><tr><td>Binary 1 1200 bit/s</td><td>1300 ± 5 Hz</td></tr><tr><td>Binary 0 1200 bit/s</td><td>2100 ± 5 Hz</td></tr></table> (vi) Disconnect the Frequency Counter No. 1000.	Signal Transmitted	Line Signal Frequency	Binary 1 75 bit/s	390 ± 2 Hz	Binary 0 75 bit/s	450 ± 2 Hz	Binary 1 600 bit/s	1300 ± 5 Hz	Binary 0 600 bit/s	1700 ± 5 Hz	Binary 1 1200 bit/s	1300 ± 5 Hz	Binary 0 1200 bit/s	2100 ± 5 Hz
Signal Transmitted	Line Signal Frequency														
Binary 1 75 bit/s	390 ± 2 Hz														
Binary 0 75 bit/s	450 ± 2 Hz														
Binary 1 600 bit/s	1300 ± 5 Hz														
Binary 0 600 bit/s	1700 ± 5 Hz														
Binary 1 1200 bit/s	1300 ± 5 Hz														
Binary 0 1200 bit/s	2100 ± 5 Hz														
8 RECEIVED LINE SIGNAL DETECTOR	(i) For each Data Demodulator the level at which the received line signal detector circuitry operates should be checked as follows:- (ii) Connect a Measuring Set No. 44C, set for a 600 ohm "through" measurement, to the line terminals of the modem indicated for the relevant Service Code. <table><tr><th>DEMOM UNDER TEST</th><th>SERVICE CODES</th><th>BTA</th></tr><tr><td>5A</td><td>24-1, 24-3, 24-4, 24-6, 24-7, 24-8, 245- and 246-</td><td rowspan="2">9 & 10</td></tr><tr><td>7A</td><td>24-2, 24-5, 24-7 and 24-8</td></tr><tr><td>6A</td><td>24-4, 24-6, 24-8, 246- and 248-</td><td rowspan="2">11 & 12</td></tr><tr><td>7A</td><td>24-5, 24-8 and 245-</td></tr></table> (iii) For Datel Service Codes 24-7, 24-8 and 24-9, connect a 1200 ohm resistor between BTA9 and 10 to simulate a 1200 ohm impedance at the 4-wire line terminals. (iv) Operate the "CONNECT D/S TO LINE" button on the Datel Tester. Operate SELECT STANDBY to test the Demodulator No. 6A for Service Codes 24-4, 24-6, 24-8, 248- and 246- and the Demodulator No. 7A for Service Codes 24-5, 24-8 and 245-. (v) Inject a Binary 0 signal via an Attenuator No. 70A to the line terminals of the modem. The source of Binary 0 signal can be derived from a Datel Modem No. 7 suitably equipped to work to the modem under test, or from the Measuring Set No. 44C. The Binary 0 signal at 2400 bit/s is 1800 Hz. Other frequencies as shown in table above (Test 7).	DEMOM UNDER TEST	SERVICE CODES	BTA	5A	24-1, 24-3, 24-4, 24-6, 24-7, 24-8, 245- and 246-	9 & 10	7A	24-2, 24-5, 24-7 and 24-8	6A	24-4, 24-6, 24-8, 246- and 248-	11 & 12	7A	24-5, 24-8 and 245-	
DEMOM UNDER TEST	SERVICE CODES	BTA													
5A	24-1, 24-3, 24-4, 24-6, 24-7, 24-8, 245- and 246-	9 & 10													
7A	24-2, 24-5, 24-7 and 24-8														
6A	24-4, 24-6, 24-8, 246- and 248-	11 & 12													
7A	24-5, 24-8 and 245-														

TABLE 3 (Cont'd)

TEST	METHOD
8 RECEIVED LINE SIGNAL DETECTOR (Cont'd)	(vi) Decrease the level of the injected signal in small steps until the signal on the Received Line Signal Detector circuit (test point 8 on the front of the module 1 of the control unit) changes from an ON (+6 V) to an OFF (-6 V) condition when measured with a Meter, Multirange No. 12A. (vii) Adjust the SET CARRIER FAIL potentiometer at the front of the appropriate demodulator if necessary so that the level measured at the line terminals are -47 ± 1 dBm for a Demodulator 6A or 7A, and -33 ± 1 dBm for a Demodulator No. 5A. (viii) Increase the level of the injected signal in small steps until the signal on the Received Line Signal Detector circuit changes from an OFF (-6 V) to an ON (+6 V) condition. (ix) The level measured at the line terminals should be -44 ± 1 dBm for a Demodulator No. 6A or 7A and -30 ± 1 dBm for a Demodulator No. 5A. (x) If the threshold of operation of the Demodulator No. 5A cannot be adjusted to lie within the appropriate range, set the fail/restore levels to -36/33 dBm respectively. (xi) Disconnect the Measuring Set No. 44C, the 1200 ohm resistor, and the Attenuator No. 70A.
9 PULSE-WIDTH ADJUSTMENT	(i) Connect the Meter, Multirange No. 12A between the "DET OUT" and "SIG ETH" test points on the front of the Demodulator No. 6A. (ii) Inject a Binary 0 signal at 600 bit/s (1700 Hz) from the Measuring Set No. 44C to the modem line terminals BTAll and 12. (iii) Check that the reading is 6 ± 0.2 volts on the Meter, Multirange No. 12A. (iv) Inject a Binary 0 signal at 1200 bit/s (2100 Hz) from the Measuring Set No. 44C. (v) Check that the reading is 5.5 ± 0.2 volts on the Meter Multirange No. 12A. (vi) If these readings are out of limits disconnect the Meter Multirange No. 12A, and connect an Oscilloscope No. 14A between the "DET OUT" and "SIG ETH" test points on the front of the Demodulator No. 6A. (vii) Set the Oscilloscope No. 14A for internal triggering. (viii) Inject a Binary 0 signal at 600 bit/s (1700 Hz) from the Measuring Set No. 44C.

TABLE 3 (Cont'd)

TEST	METHOD
9 PULSE-WIDTH ADJUSTMENT (Cont'd)	(viii) Inject a Binary 0 signal at 600 bit/s (1700 Hz) from the Measuring Set No. 44C to the modem line terminals BTAll and 12. (ix) Adjust the "PULSE WIDTH 600" potentiometer to obtain a mean pulse duration of 30 μs as observed on the oscilloscope. (x) Inject a Binary 0 signal at 1200 bit/s (2100 Hz) from the Measuring Set No. 44C. (xi) Adjust the "PULSE WIDTH 1200" potentiometer to obtain a mean pulse duration of 30 μs as observed on the oscilloscope. (xii) Disconnect the Oscilloscope No. 14A, and the Measuring Set No. 44C.
10 DISTORTION TESTS	(i) Connect the line terminals of the Modem No. 7 to the line terminals of the compatible Modem No. 7. If two modems are required for the service, (Service Code unit digits 7, 8 or 9) then the following tests must be performed for each modem in turn. (ii) When a modem contains a Demodulator No. 6A it is necessary, for test purposes only, to remove strap 6C-6D and insert strap 6D-7D on the Control Unit No. 18B. (iii) Perform the tests detailed overleaf, adjusting if necessary the appropriate BIAS potentiometer on the front of the Demodulators No. 6A and 7A for minimum distortion for the 1:1 signals. <pre> graph LR A[Datel Tester No. 1] --- B[Modem to be installed] B --- C[Compatible Modem] C --- D[Datel Tester No. 1] </pre> <u>TRANSMIT</u> 1.1 1.3 3.1 pseudo random <u>RECEIVE</u> 0% bias distortion +50% bias distortion -50% bias distortion 75% bias distortion <u>RECEIVE</u> 0% bias distortion +50% bias distortion -50% bias distortion 75% bias distortion <u>TRANSMIT</u> 1:1 1:3 3:1 pseudo random (iv) Disconnect the Datel Testers No. 1 and the compatible modem and restore the 6D-7D strap to 6C-6D on the Control Unit No. 18B if necessary.

NOTE: The required level which should not exceed 0 dBm, should be calculated as follows:

- (a) Local exchange in same building as serving trunk unit:

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

- (b) Local exchange not in same building as serving trunk unit:

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

(a) and (b) give sufficiently accurate approximations irrespective of the cable-conductor size used.

The loop resistance of the line can be obtained from the line records card or can be measured by the exchange testing officer. The Area Trunking and Grading Duty can advise whether (a) or (b) is appropriate.

9 ACCOMMODATION Before commencing installation check that the following accommodation requirements are met. (Further details of accommodation are given in I1000.)

POSITION OF THE MODEM:	Not more than 1.5 m 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.
VENTILATION:	Air must be able to circulate freely at room temperature on all sides of the modem.
SAFETY:	No change in floor level within 1 m of the modem and a minimum clear height above this area of 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 with adequate clearance for testing and maintenance, and it must be possible to remove the connector plug and operate the TEST key at the back of the modem without difficulty.
ACCIDENTAL DAMAGE:	There must be minimal risk of damage to the modem through excess sunlight, condensation etc.
MAINS SUPPLY:	The customer must supply a switched ac mains socket-outlet of 5A or 13A fusing capacity, for use exclusively with the modem, and must connect it to a 230-240 V 50 Hz mains supply, and an efficient connection to a protective earth.
CONNECTION OF OTHER EQUIPMENT:	Check that the Data Terminal Equipment which the customer proposes to use in connection with the modem is included in the "List of Privately Owned Equipment for which permission has been granted for connection to Post Office Telecommunications Services" held by GM(S) (see D5 C0010).

CUSTOMER RACK MOUNTING: Before mounting the modem in any customer provided rack ensure that the title of the rack appears in the list of acceptable attachments, a copy of which is held by Sales Special Service Division.

10 INSTALLATION Install to relevant DTW(L) and DT(L) diagrams, for which see I2425.

11 INSTALLATION TESTING Carry out the test programme detailed in Table 4, with the customer's equipment *not* connected to the Modem No. 7. The following test equipment will be needed:-

Datel Tester No. 1

Tester, Line-Earth-Loop-Impedance (see A2 E1006 - only required if Preliminary Test Programme, par 6, was not carried out at customer's premises).

NOTE: If the installation Service Codes are 24../T/..... or 24../TZ/..... and difficulty is found in obtaining satisfactory results in the following tests, connect a 1.5K resistor between the appropriate cord conductor and BTA18.

TABLE 4
INSTALLATION TESTING PROGRAMME

TEST	METHOD
1 AC MAINS (Perform only if Preliminary Test Programme, par 6, was not carried out at customer's premises)	(i) Connect the Tester, Line-Earth-Loop-Impedance to the mains socket-outlet. (ii) Perform tests described in A2 E1006. (iii) If prescribed limits are not met:- (a) Do not connect the Modem No. 7 to the mains socket. (b) Report matter to ADCO.
2 BIAS DISTORTION	(i) Connect the Datel Tester No. 1 to the modem. (ii) Arrange for a call to be established from the Datel Test Centre (DTC) to the 2-wire telephone associated with the modem. (iii) Perform the following tests as appropriate. A DATA MODULATOR NO. 6A (a) Transmit 1:1, 1:3 and 3:1 signal patterns in turn at 600 bit/s. (b) The DTC will measure and record the bias distortion for each pattern. (c) Repeat (a) and (b) at 1200 bit/s.

TABLE 4 (Cont'd)

TEST	METHOD
2 BIAS DISTORTION (Cont'd)	B DATA MODULATOR NO. 7A (a) Perform tests described in A (a) and (b) at 75 bit/s. C DATA DEMODULATOR NO. 6A (a) Alter the strap in the Control Unit No. 18B from 6C-6D to 6D-7D. (b) Arrange to receive a 1:1 signal pattern at 600 bit/s from the DTC and, if necessary, adjust the appropriate BIAS potentiometer at the front of the demodulator for minimum bias distortion. (c) Receive 1:3 and 3:1 signal patterns in turn from the DTC and check that a reading of approximately 50% is obtained on the Datel Tester No. 1 for each pattern, but that the polarity is reversed when the signal pattern changes from 1:3 to 3:1. (d) Repeat (b) and (c) at 1200 bit/s. (e) Restore the strap 6D-7D to 6C-6D. D DATA DEMODULATOR NO. 7A (a) Perform the tests described in C (b) and (c) at 75 bit/s.
3 AUTOMATIC ANSWERING	A SERVICE CODES 24../R/..... (i) If an Answering Set No. 1B is provided set the Auto/Man Switch to Auto. (ii) Operate the SELECT STANDBY press button on the Datel Tester No. 1. (iii) Arrange for the DTC to call on the 2-wire exchange line associated with the modem. (iv) Note that the CALLING INDICATOR lamp on the Datel Tester No. 1 glows on receipt of the call. (v) If an Answering Set No. 1B is provided, check that the ringing is tripped automatically and the recorded announcement is transmitted to line. (vi) If an Answering Set No. 1B is not provided operate the CONNECT D/S TO LINE press button on the Datel Tester No. 1 and check that the ringing is tripped.

TABLE 4 (Cont'd)

TEST	METHOD																		
3 AUTOMATIC ANSWERING (Cont'd)	B SERVICE CODES 24../T/..... (i) Operate the AUTO ANS press button on the telephone. (ii) Operate the SELECT STANDBY and CONNECT D/S TO LINE press buttons on the Datel Tester No. 1. (iii) Arrange for the DTC to call on the 2-wire exchange line associated with the modem. (iv) Check that on receipt of the call the modem switches to line. C SERVICE CODES 24../U/..... (i) Operate the AUTO ANS press button on the telephone. (ii) Perform tests described in A (ii), (iii), (iv) and (vi).																		
4 PEAK INDIVIDUAL DISTORTION AND ELEMENT ERROR COUNTS	(i) Arrange for the DTC to transmit the 511 element Pseudo Random patterns at the signalling rates given below and for a period of 5 minutes each. (Signals should be transmitted for about 1 minute before starting the 5 minute measurement to ensure correct synchronisation of the test.) (ii) Obtain a representative value of the peak individual distortion by operating the PEAK DISTORTION DISPLAY key on the Datel Tester No. 1 to the HOLD MAXIMUM position for three periods, each of 20 seconds, during the course of the 5 minute data transmission test. (The chosen periods to observe peak individual distortion should be error free.) (iii) The peak individual distortion is the highest value obtained during these three periods. <table><tr><th>Signalling Rate (bit/s)</th><th>Max permissible No. of errors</th><th>Max peak individual distortion</th></tr><tr><td>2400 on PW</td><td>18</td><td>35%</td></tr><tr><td>1200 on PSTN</td><td>360</td><td>35%</td></tr><tr><td>600 on PSTN</td><td>180</td><td>30%</td></tr><tr><td>75 on PW</td><td>2</td><td></td></tr><tr><td>75 on PSTN</td><td>2</td><td></td></tr></table> (iv) Transmit the 511 element Pseudo Random patterns from the Datel Tester No. 1 to the DTC who will measure error rates and peak individual distortion as in (i) to (iii) above.	Signalling Rate (bit/s)	Max permissible No. of errors	Max peak individual distortion	2400 on PW	18	35%	1200 on PSTN	360	35%	600 on PSTN	180	30%	75 on PW	2		75 on PSTN	2	
Signalling Rate (bit/s)	Max permissible No. of errors	Max peak individual distortion																	
2400 on PW	18	35%																	
1200 on PSTN	360	35%																	
600 on PSTN	180	30%																	
75 on PW	2																		
75 on PSTN	2																		

TABLE 4 (Cont'd)

TEST	METHOD
4 PEAK INDIVIDUAL DISTORTION AND ELEMENT ERROR COUNTS (Cont'd)	(v) If the above requirement cannot be met over the initial established connection request the DTC to release the call and re-establish the connection. (vi) Check the new connection for speech transmission and repeat tests (i) to (iv) above. (vii) If the test results are again unsatisfactory repeat the procedure in (v) and (vi) above. (viii) If none of the connections will transmit data signals satisfactorily change the modem. (ix) Repeat previous tests (i) to (vii) as necessary. (x) If test results are again unsatisfactory inform the ADCO immediately.
5 REMOTE TEST A	(i) Ensure there is no interface plug in the 25-way socket at rear of the modem. (ii) Perform the following tests as appropriate. A DATA MODULATOR 5B AND DATA DEMODULATOR 5A fitted (a) Hold the test key at the rear of the modem to the TEST A position for the duration of the test. (b) The DTC will send a few seconds of 1800 Hz carrier to stimulate oscillators within the modem, and will then demodulate the signal and observe it on a Oscilloscope No. 14A at the DTC. B DATA MODULATOR 5B AND DATA DEMODULATOR 7A fitted (a) Listen for a tone from the telephone receiver associated with the 2-wire exchange line. The receipt of this tone will indicate that the modem is connected to line at the DTC. (b) Operate the test key at the rear of the modem to the TEST A position. (c) This key may then be released except for installations with the suffix numbers 3.... or 5.... when the key must be held operated for the duration of the test. (d) The DTC will send a 1:1 pattern at 75 bit/s on the backward channel and should receive back a signal pattern of approximately 32:32 on the 2400 bit/s channel.

TABLE 4 (Cont'd)

TEST	METHOD
5 REMOTE TEST A (Cont'd)	(e) At the installation, the signals going into the Data Modulator No. 5B from the Data Demodulator No. 7A are not properly timed and there will be a few errors but these should be ignored by the DTC. C DATA MODULATOR 7A AND DATA DEMODULATOR 5A fitted (a) Operate momentarily the test key on the rear of the modem to the TEST A position on receipt of an 1800 Hz carrier from the DTC. (b) The DTC will send a 32:32 signal pattern on the 2400 bit/s channel and should receive back a 1:1 signal pattern on the Backward Channel.
6 REMOTE TEST B	(i) Ensure that there is no interface plug in the 25-way socket at the rear of the modem. (ii) Listen for a tone from the DTC on the telephone receiver associated with the 2-wire exchange line. (iii) On receipt of tone, operate the test key at the rear of the modem to the TEST B position for approximately 5 seconds, except if a Data Modulator No. 6A and a Data Demodulator No. 6A are fitted when the test key is held in the TEST B position for the duration of the test, and replace the telephone handset on its rest. (iv) The DTC will ring back when the tests are completed.
7 4-WIRE TELEPHONE	(i) When a 4-wire telephone is provided perform a functional check of the telephone to ensure that the calling and speech circuits operate correctly.

12 CUSTOMER'S EQUIPMENT CONNECTION TO THE MODEM NO. 7B See IO104.

When two Modems No. 7B are installed the connectors should be labelled to make them readily identifiable.

13 COMPLETION For modems connected to private circuits carry out commissioning tests detailed in C3 IO501 for point-to-point circuits or C3 II651 for multi-point circuits. When all tests have been satisfactorily concluded follow the completion procedure detailed in C3 IO502.

Appendix 1 follows

APPENDIX 1

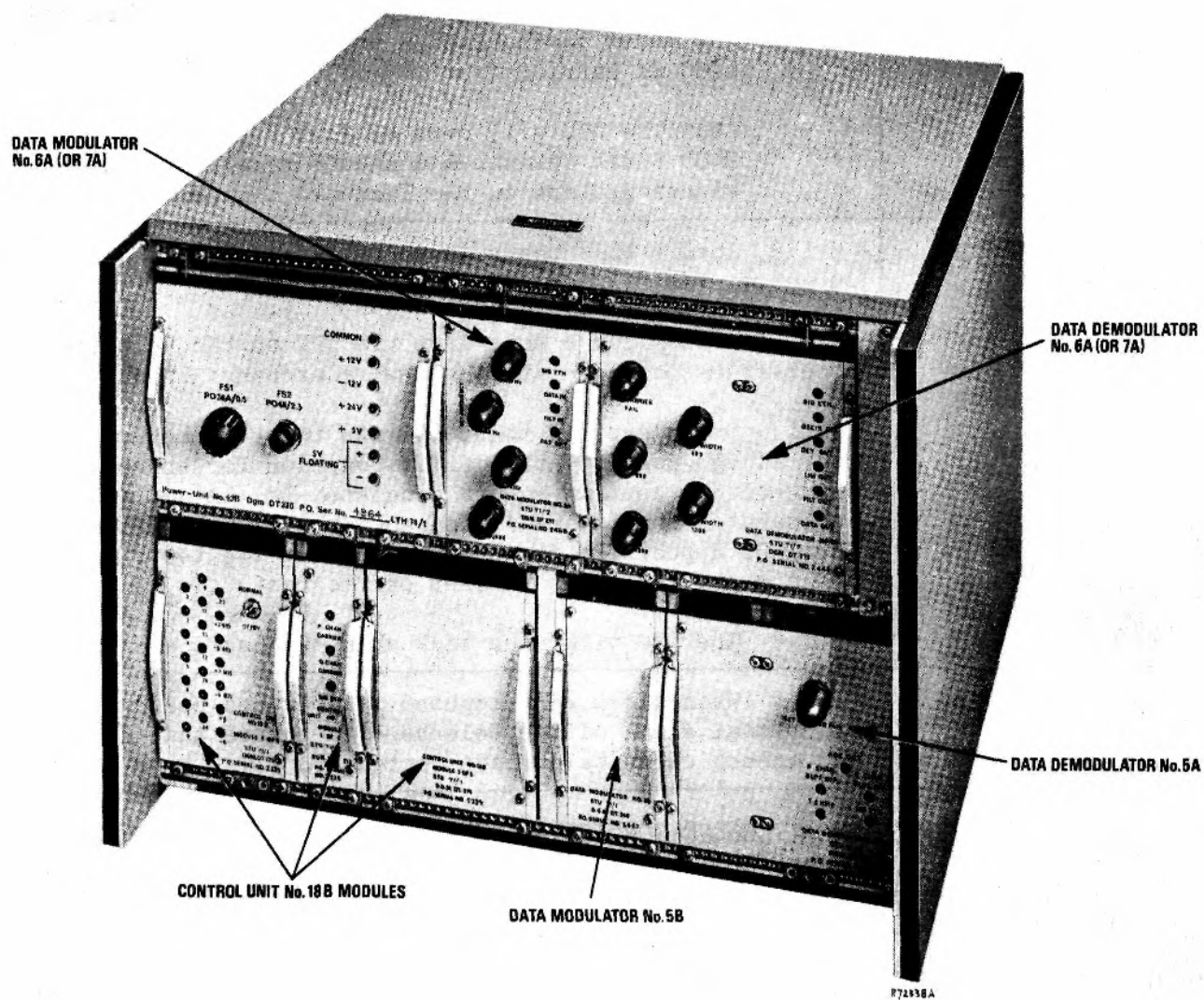


FIG 1. DATEL MODEM No. 7B: FRONT VIEW SHOWING POSITION OF UNITS

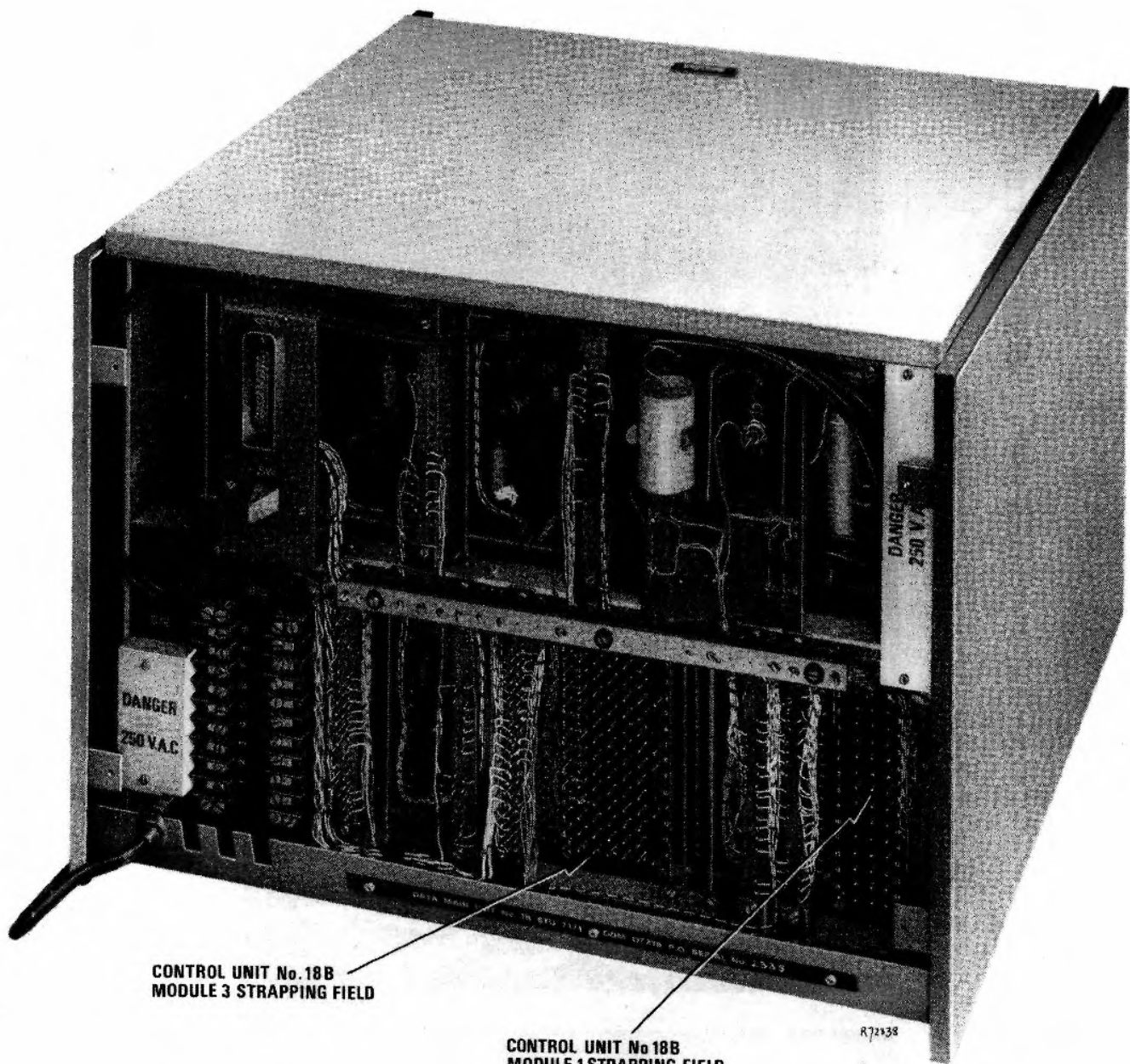


FIG.2 REAR VIEW OF MODEM 7B

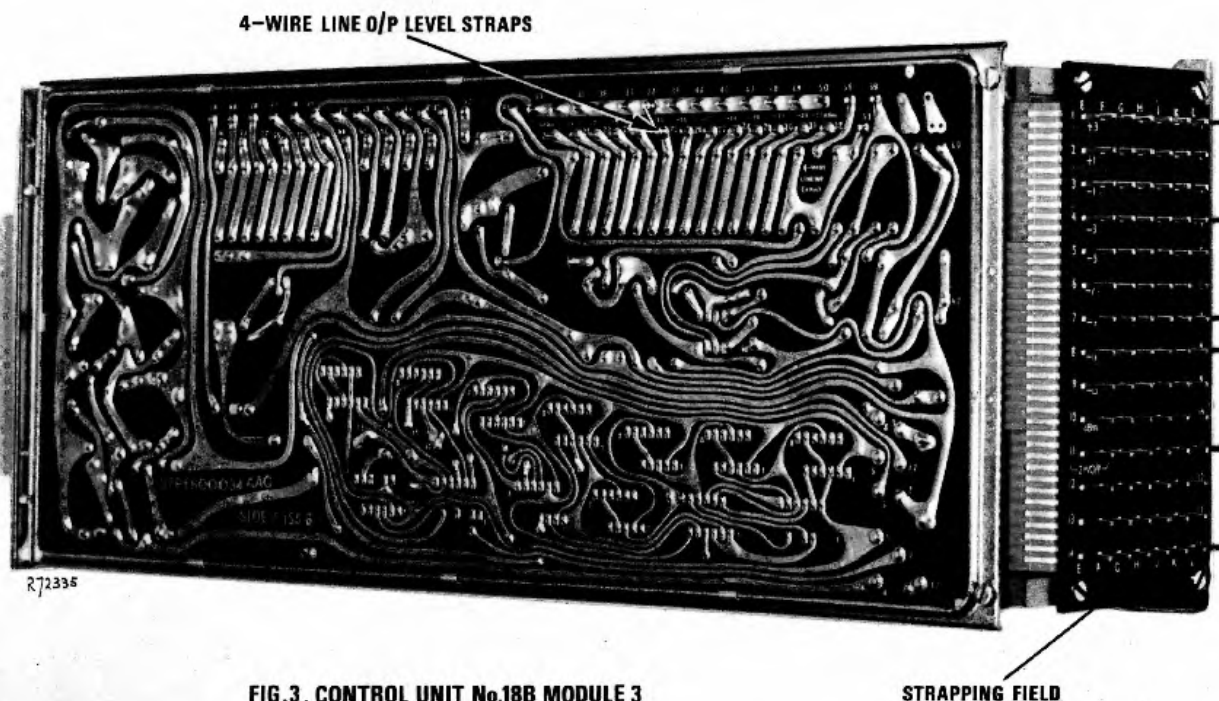


FIG.3. CONTROL UNIT No.18B MODULE 3



FIG. 4. DATA MODULATOR No. 58



2-WIRE TEST A OUTPUT STRAP (-15 dBm SHOWN)

FIG. 5. DATA MODULATOR No. 5B

References: A2 E1006, A8 H2301, C3 I0104, C3 I0501, C3 I0502,
C3 I1000, C3 I2420, C3 I2425, C3 I2451, D5 C0010.