DATEL 2400 DIAL-UP SERVICE

Datel Modem No. 7C: Installation

(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 Datel Service Code.

2 **SERVICE CODES** See I2421.

3 **EQUIPMENT REQUIRED** See I2426 except where control installations are involved. For control installations see I8401 initially.

4 **HANDLING AND ASSEMBLY** Datel Service modems should be handled carefully at all times. The modem 7C units should be removed from their cartons and located in the Data Main Unit as shown in Appendix II 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. 18C and Data Modulator No. 5B depending upon the particular Datel 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. 18C, as shown in Appendix II, Figure 2.

TABLE 1

Item	Service Code	Strapping Instructions		Remarks
		Disconnect	Connect	
1 Control Unit No. 18C	2 4 9 - / - /- - - - -		3C- 3D 12C-12D 13C-13D 1H- 1J 3H- 3J 4H- 4J 8H- 8J 10H-10J 5J- 6J-5K 10A-11A 7C- 8C 6C- 6D	
	- - - - /R/ - - - - - - - - - /U/ - - - - -		2A- 2B 6A- 6B 9C- 9D	Connect Data Set To Line (CDSTL) from terminal.

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TABLE 1 (Cont'd)

Item	Service Code	Strapping Instructions		Remarks
		Disconnect	Connect	
1 Control Unit No. 18C (Contd)	- - - - /S/ - - - - -		3A- 3B 6A- 6B	Locking DATA button on telephone
	- - - - /T/ - - - - -		2A- 2B 6A- 6B 7A- 7B	Data Terminal Ready (DTR) working
	- - - - / - /1 - - - -		4A- 4B 11B-12B 1G- 2G 5G- 6G	Internal Transmitter Signal Element Timing (TSET)
	- - - - / - /3 - - - -		14A-14B 4B- 5B 4G- 5G	External TSET pin 15
	- - - - / - /4 - - - -		14A-14B 5B-5C 4G-5G	External TSET pin 9
	- - - - / - /5 - - - -		4A- 4B 11B-12B 5B- 5C 2G- 3G 4G- 5G	External/Internal TSET
	- - - - / - /- 1 - - -		1C- 1D	Binary '1'
	- - - - / - /- 2 - - -		1D- 2D	Binary '0'
	- - - - / - /- - 1 - -		13A-13B	Sync Pattern On
	- - - - / - /- - - 1 -		10C- 1D	Received Data clamp/Request to send (RTS) ON.
	- - - - / - /- - - 2 -		No strap	Received data not clamped
	- - - - / - /- - - - 1		No strap	Standby (STBY) indicator with Data Set Ready (DSR)
	- - - - / - /- - - - 2		1A- 1B	STBY indicator from SELECT STBY
	All		1K- 2K 3K- 4K	Hold coil inserted

TABLE 1 (Contd)

Item	Service Code	Strapping Instructions		Remarks
		Disconnect	Connect	
1 Control Unit No. 18C (Contd)	All		1E-1F(+3 dBm) 2E-2F(+1 dBm) 3E-3F(-1 dBm) 4E-4F(-3 dBm) 5E-5F(-5 dBm) 6E-6F(-7 dBm) 7E-7F(-9 dBm) 8E-8F(-11 dBm) 9E-9F(-13 dBm)	Strap for output level required at 2-wire line terminals (see NOTE below)
2 Power Unit No. 93A Mains trans-former	All		See Remarks	Strap as required for nominal voltage quoted by local Elec-tricity Authority
3 Data Modulator No. 5B	See Remarks	18-31 19-22 20-21 25-27 30-33	18-33 19-21 20-22 25-28 30-31	When Advice-Note specifies alternative phase coding See Appendix II Figure 3 for location
	All		2-wire Test A Output to -15 dBm	See Appendix II Figure 4 for location
4 Data Demodul-ator No. 5A	See Remarks	48-49 50-51 52-53 54-55	48-50 49-51 52-54 53-55	When Advice-Note specifies alternative phase coding

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

Where the local exchange is:-

(a) In the same building as the trunk centre to which it has access, or

(b) Is connected to the trunk centre by means of junctions routed on channels in frequency-division multiplex carrier systems.

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

In all other cases:-

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

7 **MODIFICATION OF CONTROL UNIT NO. 18C, MODULE 1.** This modification should be carried out on all new installations except those where the Control Unit No. 18C bears a label indicating that the modem has been modified to Works Spec TG 19026.

By inhibiting the "carrier detector" circuit (ie clamping it OFF) when the "Request to Send" circuit is ON, this modification ensures that on turnaround, the receiver is in the coarse control setting and can rapidly synchronise in the normal way.

Diagram DT 1132 shows the required modification. Components D1 and R1 are all that are required for the alteration.

TABLE 2

	Modification Details
(i)	Remove module 1 of the Control Unit No. 18C from the main Unit No. 7C.
(ii)	Unscrew the strapping panel from the rear of the module.
(iii)	Remove the wires from tag 8A and solder them together.
(iv)	Remove the wires from tag 8B and solder them together.
(v)	Remove the wire from tag 9A.
(vi)	Sleeve all these wires and tie them back.
(vii)	Sleeve the leads of D1 and R1, and solder them to tags 8A, 8B and 9A as shown in DT 1132.
(viii)	Identify transistor TR t3 on the Printed Circuit Board (PCB) No. 4 (This is situated on the left hand side of the module when viewed from the rear.) See DT 315, sheet 9.
(ix)	On the printed side of the board, wire from the base connexion of TR t3 to tag 8B on the strapping panel, using WIRE, EQUIPMENT 1505/1W Gy.
(x)	Identify transistor TR u18 on the PCB No. 3 (situated on the right hand side of the module when viewed from the rear). See DT 315, sheet 5.
(xi)	On the printed circuit board, wire from the collector connexion of TR u18 to tag 9A on the strapping panel, using WIRE, EQUIPMENT 1505/1W Gy.
(xii)	Screw back the strapping panel to the rear of the module.
(xiii)	Replace the module in the Main Unit No. 7C.

8 **PRELIMINARY MODEM TESTING** Carry out the test programme detailed below either prior to, or at the time of installation, depending upon local arrangements. The following test equipment will be required:-

2 Datel Testers No. 1C or 1D
1 Meter, Multi-range No. 12A
1 Measuring Set No. 44C
1 Attenuator No. 70A
1 Data Main Unit No. 7C
1 Data Modulator No. 5B

} Test modem. Set up and strap as for modem being installed.

1 Data Modulator No. 6A
1 Data Demodulator No. 5A
1 Data Demodulator No. 6A
1 Frequency Counter No. 1000

} Test modem. Set up and strap as for modem being installed.

9 PRELIMINARY TEST PROGRAMME

TABLE 3

Subject of Test	Testing Procedure	Test Results
1 Modem Earthing	(i) Set, Meter, Multirange No. 12A to measure resistance. (ii) Check that there is no internal connexion in the modem between common return (BTA4) and protective earth. It should be noted that a 10 µF capacitor is connected between these two points. (iii) Check that there is continuity between the earth (green/yellow) of the mains cord and the metalwork of the modem case.	
2 Power Supplies	(i) Check voltages at the following test-points on front panel of Power Unit 93A using Meter, Multi-Range, 12A:- +12 V -12 V +24 V +5 V 5 V Floating	Voltages should conform to the following limits:- 12 ± 0.6 V. 12 ± 0.6 V. 24 ± 1.2 V. 5 ± 0.25 V. 4.5 to 5.2 V.
3 Signal Frequencies	With the aid of a Datel Tester connected to the modem, check binary 0 & 1 transmitted signal frequencies at the FILT OUT test points on the Data Modulator 6A at both 600 & 1200 bit/s using the Frequency Counter No. 1000, *Alternatively* connect modem to an exchange line and arrange for Datel Test Centre to establish a call and make the necessary measurements. Adjust frequencies if necessary by means of appropriate frequency-setting potentiometer on front of modulator.	Frequencies should conform to the following limits:- 600 bit/s Binary 1 1300 ± 5 Hz " 0 1700 ± 5 Hz 1200 bit/s Binary 1 1300 ± 5 Hz " 0 2100 ± 5 Hz
4 Received Line Signal Detector	(i) Connect the Measuring Set No. 44C, set for 600-ohm 'through' level measurement to the modem line terminals (BTA 11 & 12).	

TABLE 3 (Contd)

Subject of Test	Testing Procedure	Test Results
4 Received Line Signal Detector (contd)	(ii) Using the reference modem and a Datel Tester No. 1 as a pseudo-random signal source, connect the output of the combination via the Attenuator No. 70A (or equivalent) to the line terminals of the modem under test.	
	(iii) Decrease the level of the input signal in small steps until the output of the Received Line Signal Detector circuit (test-point 8 on the front of Module 1 of the Control Unit 18C) changes from ON (+6 V) to OFF (-6 V).	The level measured at the line terminals should be -47 ± 1 dBm
	(iv) Increase the level of the input signal in small steps until the output of the Received Line Signal Detector circuit changes from OFF (-6 V) to ON (+6 V). Adjust the SET CARRIER FAIL potentiometer on the appropriate demodulator if necessary.	The level measured at the line terminals should be -44 ± 1 dBm
5 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 BTA 11 and 12.	The meter multirange No. 12A should read 6 ± 0.2 Volts.
	(iii) Inject a Binary 0 signal at 1200 bit/s (2100 Hz) from the measuring Set No. 44C.	The meter multirange No. 12A should read 5.5 ± 0.2 Volts.
	(iv) 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.	
	(v) Set the oscilloscope for internal triggering.	
	(vi) Inject a Binary 0 signal at 600 bit/s (1700 Hz) from the Measuring Set No. 44C.	

TABLE 3 (Contd)

Subject of Test	Testing Procedure	Test Results
5 Pulse Width Adjustment (Contd)	(vii) Adjust the "PULSE WIDTH 600" potentiometer to obtain a mean pulse duration of 30 µs as observed on the oscilloscope. (viii) Inject a Binary 0 signal at 1200 bit/s (2100 Hz) from the Measuring Set No. 44C. (ix) Adjust the "PULSE WIDTH 1200" potentiometer to obtain a mean pulse duration of 30 µs as observed on the oscilloscope. (x) Disconnect the oscilloscope No. 14A and the Measuring Set No. 44C.	
6 Bias Distortion	(i) Make the following strap-connection changes *for the duration of the test only: restore normal strapping at conclusion of test:* Equalizing Unit: Disconnect 2-3 " 4-5 Connect 3-4 } Equalizing Unit disconnected Control Unit No. 18C: Disconnect 6C-6D Connect 6D-7D } Received data synchronising function made inoperative (ii) Interconnect line terminals (BTA 11 and 12) of reference and test modems. (iii) Using the Datel Testers, transmit 1:1, 1:3, and 3:1 signal patterns in turn from the reference modem, and measure the received bias distortion in each case. Adjust BIAS potentiometer if necessary.	Received bias-distortion figures should conform to the following:- 1:1 signals 0% 1:3 signals +50% 3:1 signals -50%

10 ACCOMMODATION Before commencing installation, check that the following accommodation requirements are met:-

Position of modem:	Not more than 1.5 m (5 ft) above floor level (normally table height).
Ventilation:	Air must be able to circulate freely at room temperature on all sides of the modem.
Security:	There is no potential danger to personnel engaged in testing and/or servicing the modem.
Customer access:	In the event of a fault, the customer must be able to remove the interconnecting plug and operate the TEST key at the rear of the modem without difficulty.
Testing and maintenance access:	There must be direct access to the modem and adequate clearance for testing and maintenance.
Accidental damage:	There must be a minimal risk of damage to the modem.
Mains supply:	The customer must provide a switched a.c. mains socket-outlet of 5A or 13A fusing capacity, for use exclusively with the modem, and must connect to it a 230-240 V 50 Hz mains supply and an efficient connection to a protective earth.

11 CONNECTIONS TO CUSTOMER'S EQUIPMENT See I0104.

12 INSTALLATION DIAGRAMS Diagrams Nos. DTW(L) 168 to 175 refer.

13 INSTALLATION Carry out the following operations in the order shown:-

(i) With the aid of a Tester, Earth-loop Impedance, check that the customer's mains socket is correctly wired, and that an efficient protective earth is connected to it (see A2 E1006).

(ii) Terminate the modem mains cord on a suitable 3-pin plug provided by the Post Office.

(iii) If the plug is fused, insert a 3A fuse.

(iv) Check that the modem mains transformer connections are correct for the supply.

(v) Connect mains supply.

14 INSTALLATION TESTING Carry out the test programme detailed below. The following test equipment will be required:-

1 Datel Tester No. 1C or 1D.

15 INSTALLATION TESTING PROGRAMME

TABLE 5

Subject of Test	Testing Procedure	Test Results
1 Bias Distortion	(i) Arrange for a call to be established from the Datel Test Centre to the Exchange-line concerned.	
	(ii) Operate Select Standby button on the Datel tester.	
	(iii) Transmit 1:1, 1:3 and 3:1 signal patterns in turn at 600 bit/s.	Recorded by Datel Test Centre.
	(iv) Operate Data Signalling Rate Selector button on the Datel tester.	
	(v) Transmit 1:1, 1:3 and 3:1 signal patterns in turn at 1200 bit/s.	Recorded by Datel Test Centre
	(vi) Release Signalling Rate Selector button.	
	(vii) Make the following strap-connection changes on the Control Unit 18C *for the duration of the remainder of the test only: restore normal strapping at conclusion of test.* Disconnect 6C-6D Connect 6D-7D } Received data synchronising function made inoperative.	
	(viii) Arrange for Datel Test Centre to send a 1:1 signal pattern at 600 bit/s. (Do NOT adjust BIAS potentiometer).	Bias distortion meter on Datel Tester should indicate 0% approximately.
	(ix) Arrange for Datel Test Centre to transmit 1:3 and 3:1 signal patterns in turn.	Bias distortion meter on Datel tester should indicate 50% approximately in each case. Polarity reversed when change made from 1:3 to 3:1 signals and vice versa.
	(x) Operate Signalling Rate Selector button on the Datel Tester.	
	(xi) Repeat tests (viii) and (ix) at 1200 bit/s.	See tests (vii) and (ix).

TABLE 5 (Contd)

<table>
<tr><th>Subject of Test</th><th>Testing Procedure</th><th>Test Results</th></tr>
<tr><td>2 Error Rates</td><td>(i) Transmit pseudo-random test signals to Datel Test Centre at the following signalling rates for the period stated. Datel Test Centre will check error rates in each case.</td><td></td></tr>
<tr><td></td><td>
<table>
<tr><th>Signalling Rate bit/s</th><th>Select Standby</th><th>Data Signalling Rate Selector</th><th>Duration (mins)</th><th>Max permissible No. of errors</th></tr>
<tr><td>2400</td><td>OFF</td><td>ON</td><td>5</td><td>720</td></tr>
<tr><td>1200</td><td>OFF</td><td>OFF</td><td>2</td><td>144</td></tr>
<tr><td>1200</td><td>ON</td><td>ON</td><td>2</td><td>144</td></tr>
<tr><td>600</td><td>ON</td><td>OFF</td><td>2</td><td>72</td></tr>
</table>
</td><td></td></tr>
<tr><td></td><td>(ii) Arrange with Datel Test Centre to transmit pseudo-random test signals as in (i), and check error-rates in each case.

NOTE: Signals should be transmitted in each direction for at least one minute before starting error-rate measurements to ensure correct synchronisation at the receiving end.

If the above requirements cannot be met over the initial established connection, proceed as follows:-

(iii) Request Datel Test Centre to release the call, and re-establish the connection.

(iv) Check the new connection for speech transmission and repeat tests (i) and (ii) above.

If the test results are again unsatisfactory,

(v) Repeat the procedure in (iii) and (iv) above, if necessary for a maximum of three attempts.

If none of the connections will transmit data signals satisfactorily,

(vi) Change the data Main Unit 7C.</td><td></td></tr>
</table>

TABLE 5 (Contd)

Subject of Test	Testing Procedure	Test Results
2 Error Rates (Contd)	(vii) Repeat previous tests (i) to (v). If test results are again unsatisfactory, inform the ADCO immediately, who will proceed as in A8 H0281.	
3 Remote Test Facilities	(i) Withdraw connector-plug. (ii) Request Datel Test Centre to check operation of Data Modulator 5B and Data Demodulator 5A. (iii) Operate test-key to TEST A position. (iv) Request Datel Test Centre to check operation of Data Modulator 6A and Data; Demodulator 6A. (v) Operate test-key to TEST B position. (vi) Restore test-key and connector-plug.	DTC performs test. DTC performs test.
4 Automatic Answering	Service Code - - - -/ R /- - - - - (i) If Answering Set 1B is provided, set AUTO/MAN switch to AUTO. (ii) Connect Datel Tester to modem and operate SELECT STANDBY button. (iii) Arrange for Datel Test Centre to establish a call to the exchange-line. If Answering Set 1B is not provided, (i) Operate Connect Data Set to Line, press button on Datel tester. Service Code - - - -/ T /- - - - - (i) Operate AUTO ANS press-button on telephone. (ii) Connect Datel Tester to modem and operate SELECT STANDBY and CONNECT DATA SET TO LINE press buttons. (iii) Arrange for Datel Test Centre to call the exchange-line.	CALLING INDICATOR lamp on tester lights on receipt of call. Ringing tripped automatically. Recorded announcement transmitted. Ringing tripped. Modem connected to line on receipt of call.

TABLE 5 (Contd)

Subject of Test	Testing Procedure	Test Results
4 Automatic Answering (Contd)	Service Code - - - -/ U /- - - - -	
	(i) Operate AUTO ANS press-button on telephone.	
	(ii) Connect Datel Tester to modem and operate SELECT STANDBY press-button.	
	(iii) Request Datel Test Centre to call exchange-line.	CALLING INDICATOR lamp on tester lights on receipt of call.
	(iv) Operate CONNECT DATA SET TO LINE press-button on tester.	Ringing tripped.
5 Error Rates when operating to another Datel Test Centre	(i) Ascertain Region to which customer intends to operate.	
	(ii) Request Datel Test Centre appropriate to the Region specified to establish a call to the exchange-line and to co-operate in performing error-rate checks as in 2 above.	Datel Test Centre will record the test results on A5 (SS281) paper in a format similar to that shown in Appendix 1.
	Alternatively, if it is impracticable to follow this course for any reason, the co-operation of the Datel Test Centre serving an adjacent Region should be sought in order to make the tests.	Two copies of the test results should be sent to the local Datel Test Centre for record purposes. For full procedure see A8 H0281.

16 COMPLETION When all tests have been satisfactorily concluded, follow the completion procedure detailed in I0502.

Appendix I follows

APPENDIX I

TO: Datel Test Centre .....

FROM: Datel Test Centre .....

DATEL 2400 DIAL-UP TEST RESULTS (TI C3 I2433 Par 15 Table 5, Test 5)

CUSTOMER: .....

.....

EXCHANGE LINE NUMBER .....

ERRORS RECEIVED AT DTC

2400 Phase _____

1200 Phase _____

1200 Frequency _____

600 Frequency _____

ERRORS RECEIVED AT INSTALLATION

2400 Phase _____

1200 Phase _____

1200 Frequency _____

600 Frequency _____

Signed .....

Date .....

Appendix II follows

APPENDIX II

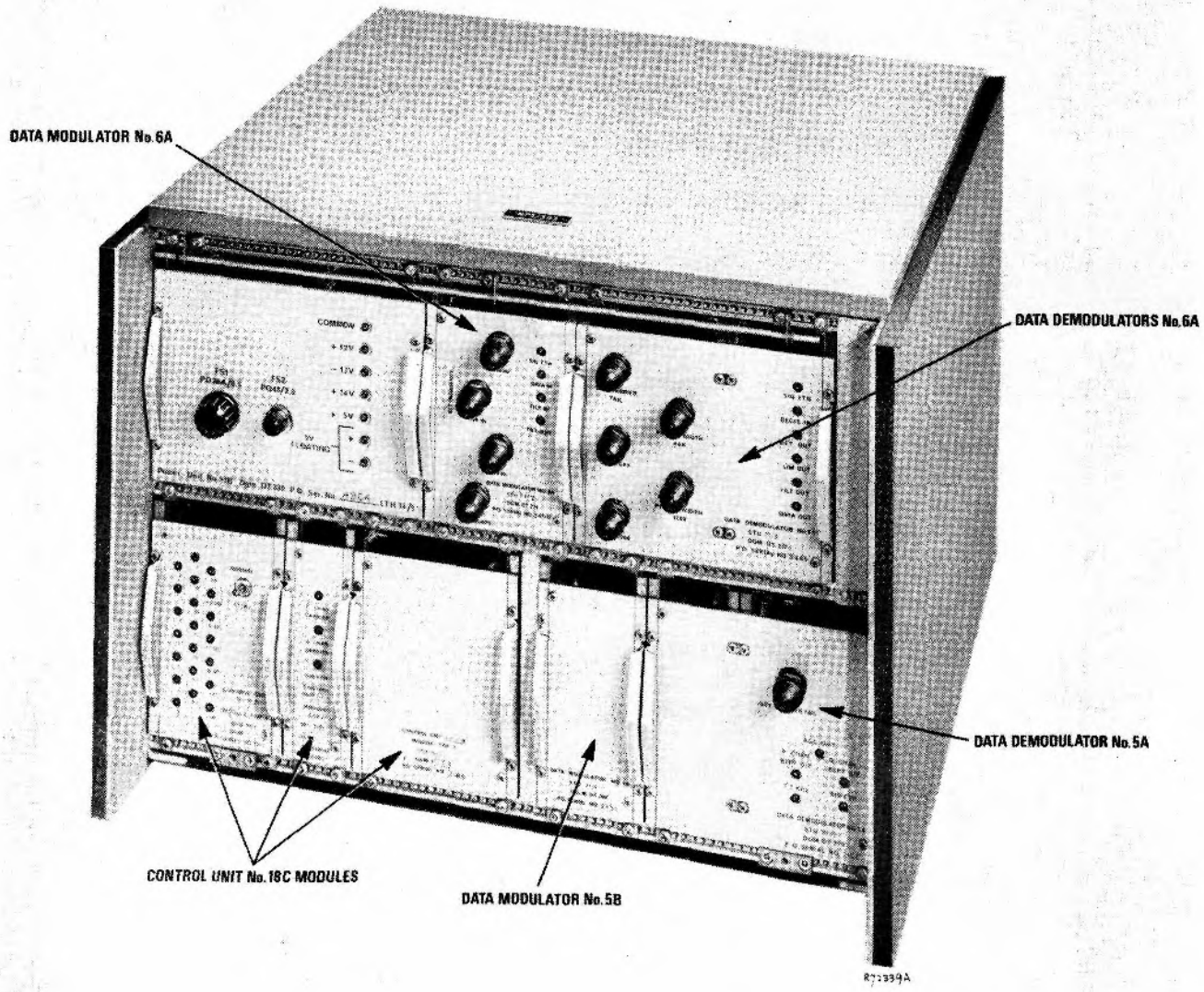

FIG. 1 DATEL MODEM No.7C: FRONT VIEW SHOWING POSITION OF UNITS

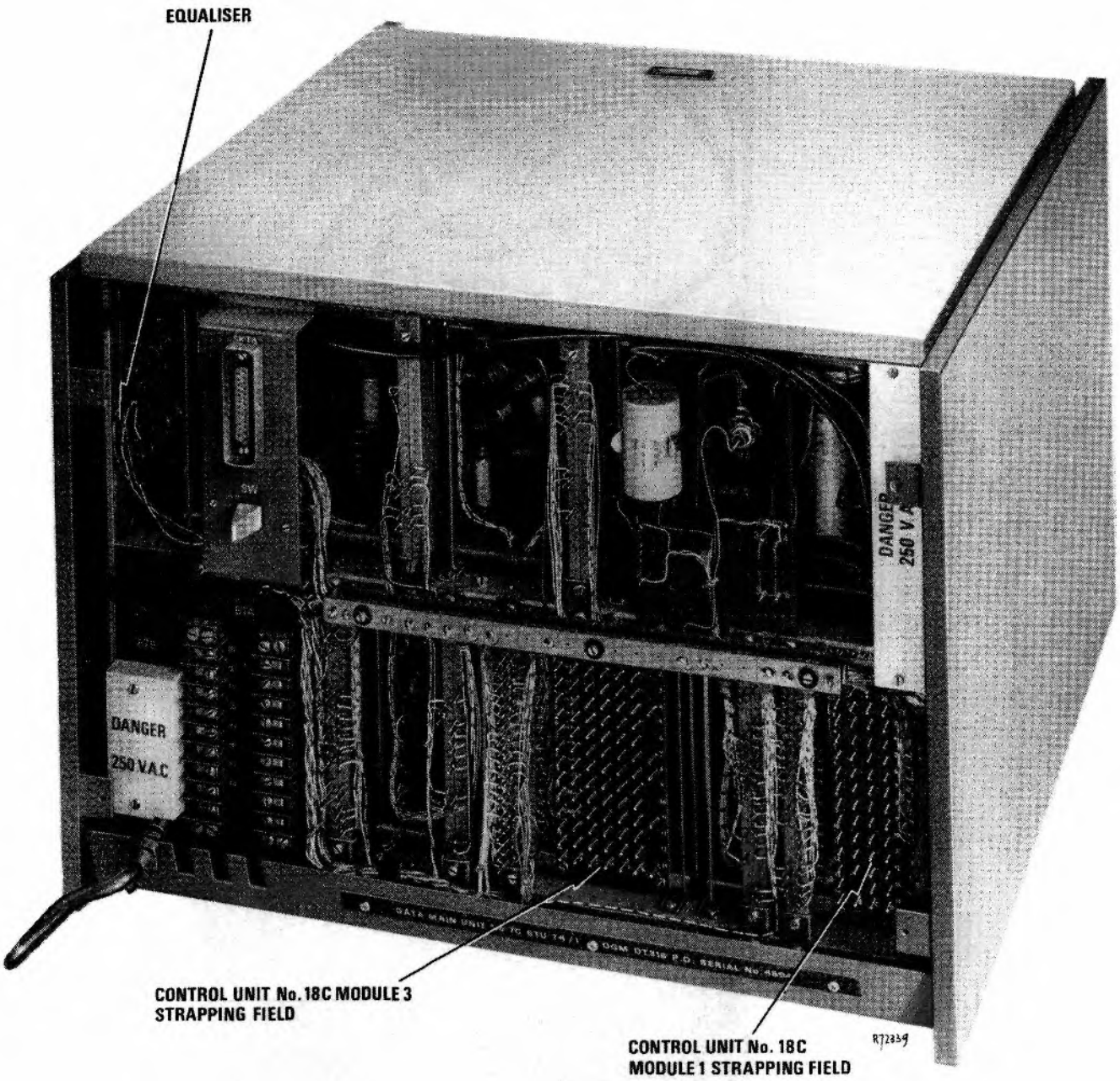

FIG.2 REAR VIEW OF MODEM 7C

FIG.3. DATA MODULATOR No.5B

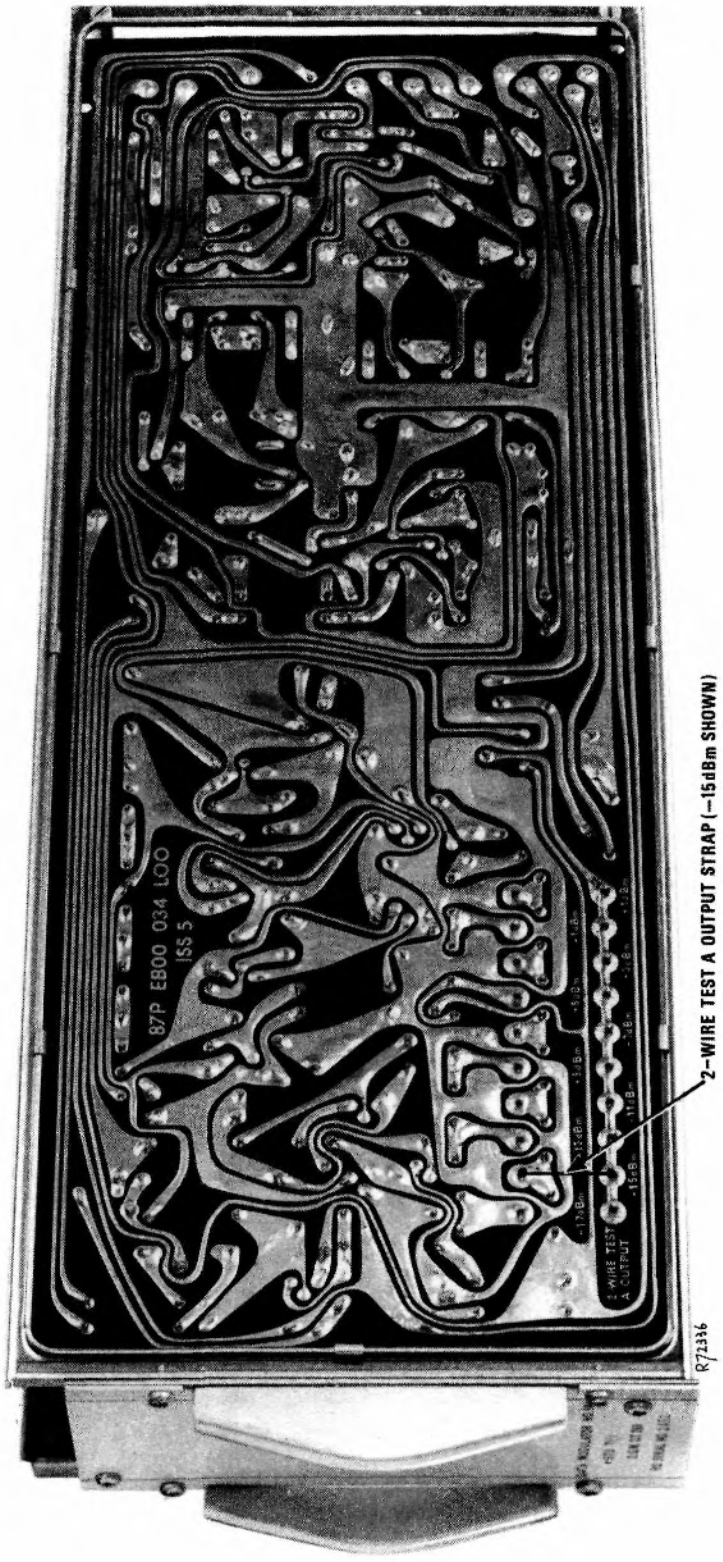

FIG.4. DATA MODULATOR No.5B

References: A2 E1006 C3 I0104 C3 I0502 C3 I2421 D5 C0010
AB H2301 C3 I0501 C3 I1000 C3 I2426

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