Racal–Milgo

Installation and Operation Manual

MODEM MPS1222

RACAL
The Electronics Group

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Supplementary Information

APPROVED for use with telecommunications systems run by British Telecommunications in accordance with the conditions in the instructions for use.

The information in this manual has been carefully compiled and checked for technical accuracy. However, Racal-Milgo Limited accept no responsibility for inaccuracies which may occur. Comments or correspondence regarding this manual should be addressed to:-

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MODEM MPS1222

Technical Data

DTE Interface	EIA-RS232/CCITT V24.

Transmitter

Format:	Serial binary, negative logic, bipolar, non-return to zero.
Amplitude:	CCITT V28, ±3V to ±25V, (+) = 0 = Space, (−) = 1 = Mark.
Input Lines:	Single wire, ground return.
Data Rate:	Synchronous: 600 or 1200 bit/s. Asynchronous: 0-300, 600 or 1200 bit/s.
Input Load:	3000-7000 ohms.

Output to Line

Output Signal:	Differential Phase Shift Keying (DPSK), four-phase at 1200 bit/s data rate and two-phase at 600 bit/s. Carrier is 1200Hz (originate mode) and 2400Hz (answer mode).
Output Level:	Switch selectable in 1.0dB increments from −0.5dBm to 15.5dBm.
Output Impedence:	600 ohms.

Frequency

Low Channel (originate mode):	1200Hz ±0.12Hz.
High Channel (answer mode):	2400Hz ±0.24Hz.
Answer Tone:	2100Hz ±1Hz.
Injector Tone:	1800Hz or 550Hz (strap selectable) with amplitude 6dB ±1dB below data level.

Clock

Waveform:	Squarewave, negative-going edge coincides with centre of data bit and positive-going edge with change of data.
Frequency:	For external use: 600Hz or 1200Hz ±0.02% with 50% ±5% duty cycle. For internal use: 600Hz or 1200Hz ±0.01% with 50% ±5% duty cycle.
Amplitude:	CCITT V28, ±3V to ±25V.

Receiver

Input From Line:	Differential Phase Shift Keying (DPSK), four-phase at 1200 bit/s data rate and two phase at 600 bit/s.
Line Level:	Equalizers disabled: 0dBm to − 43dBm. Equalizers enabled: Low Channel 0dBm to − 43dBm. Equalizers enabled: High Channel 0dBm to − 46dBm. These levels can be raised by 10dBm as a switchable option.

Input

Impedance:	600 ohms.

Data Output

Format:	Serial binary, negative logic, bipolar non-return to zero.
Amplitude:	CCITT V28, + 10V ± 2V = 0 = Space, − 10V ± 2V = 1 = Mark.
Output Lines:	Single wire, ground return.
Output Impedance:	Approximately 300 ohms.

Clock

Waveform:	Squarewave, negative-going edge coincides with centre of data bit and positive-going edge with change of data. The receive clock is derived from the input data stream and is synchronous with the transmit clock of the other modem (when operating in a synchronous mode).
Frequency:	Equal to the data rate (when synchronous).
Amplitude:	CCITT V28, ± 10V ± 2V.

Power Requirements

Table Top Models:	183-267 volts, or 94-132 volts, 47-63Hz, without adjustment. Consumption approx. 10 watts.
High Density Model:	9-0-9 volts and 12-0-12 volts, 47-63Hz; consumption approx. 10 watts.

Dimensions

	Desk-Top	High Density
Height:	66mm	190mm
Width:	206mm	50mm
Depth:	328mm	300mm
Weight:	2.04kg	0.79kg

Operating Environment

Ambient Temperature:	0°C to + 5°C.
Relative Humidity:	95% (non-condensing).
Maximum Altitude:	3000 metres.
Storage Temperature:	− 10°C to + 70°C.

Features

Modem MPS1222 is a microprocessor based modem, which provides full-duplex communication, using differential phase shift keying (DPSK) on two-wire PSTN lines. It can be used for synchronous operation at 600 or 1200 bit/s (CCITT V22, Alternative A), synchronous or asynchronous operation at 600 or 1200 bit/s (CCITT V22, Alternative B), or synchronous or asynchronous operation at 600 or 1200 bit/s plus anisochronous operation at 0-300 bit/s (CCITT V22, Alternative C). Normal operation is in Alternative C in which the modem automatically accepts data at 0-300 or 1170 - 1204 bit/s and has provision to accept DTE overspeed to 1221 bit/s. When in asynchronous mode (Alternative C only), the modem accommodates character lengths (with start/stop bits) of 8, 9, 10 or 11 bits and has the facility to automatically determine whether received data consists of 9-bit or 10-bit characters.
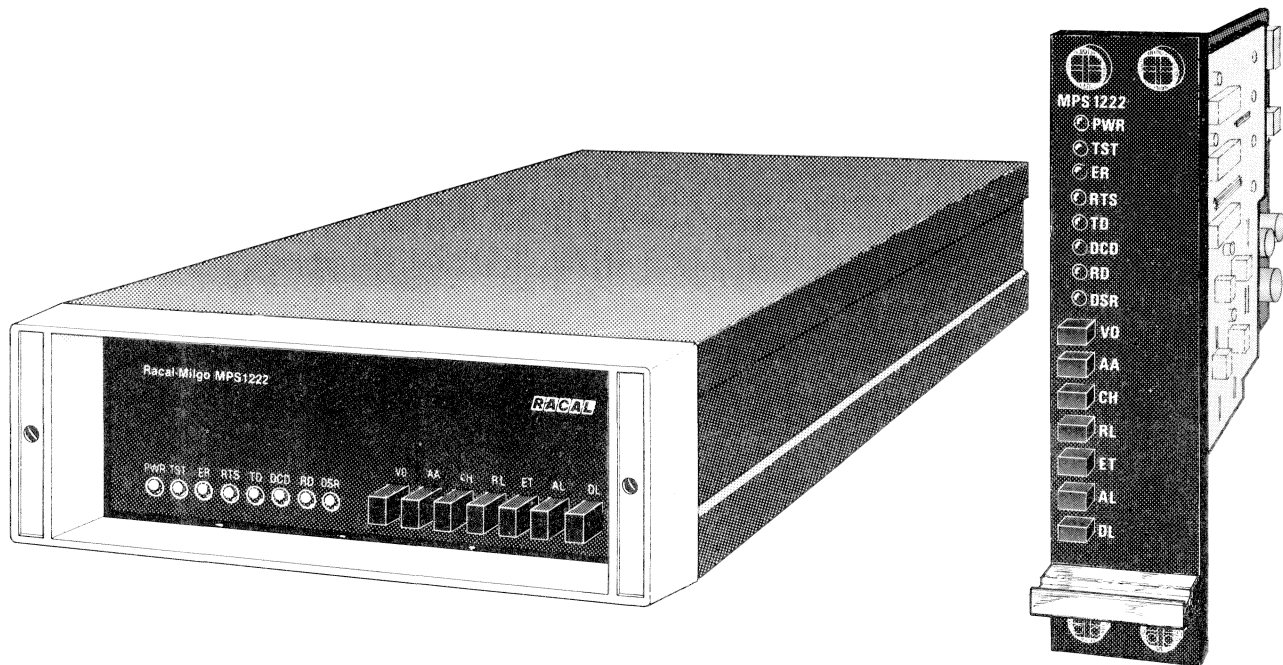

Figure 1 Modem MPS1222

The following are standard features of Modem MPS1222:

- Manual originate, manual answer and automatic answer.

- Self-test and loop tests conforming, where applicable, to CCITT Recommendation V54.

- Front panel controls to perform modem and system tests, to change from voice to data, to select transmission on the high (2400Hz) or low (1200Hz) channel, and to enable the automatic answer feature.

- Front panel indicators for power, test status, errors during test when using the internal test generator, DTR, transmit data, DCD, receive data and DSR.

- A 'No Option' option strap to permit rapid setting of 14 functions providing at least 80% of all the operating conditions required for most installations.

- The provision of an injection tone, operating at 6dB below the data level, which maintains sufficient energy distribution in the band to prevent the telephone equipment (in some systems) from interpreting a data frequency as a disconnect signal.

MPS1222 can be used as a free-standing table-top unit or in high density configuration in a card nest (Figure 1) and consists of two printed circuit boards joined to form a single assembly. In the desk top modem this assembly is attached to a rear panel, the front panel forming part of the bezel assembly. The complete sub-assembly is housed in an aluminium extrusion, the outer surface of which has bevel guides for the attachment of a rack mounting kit.

Only a front panel is attached to the printed circuit board assembly when used in the high density configuration. The assembly then slides into a card nest and is secured by quick-release fasteners.

A power supply module can be included in the card nest leaving space for up to seven modems, alternatively a separate power source can be used, thereby enabling the nest to accommodate eight modems.

Alternatives and Modes

In accordance with CCITT Recommendation V22, the modem can be operated in the following Alternatives and Modes:

Alternative A
(Synchronous only).
     Mode i   - 1200 bit/s synchronous.
     Mode iii   - 600 bit/s synchronous.

Alternative B
(Synchronous and Asynchronous).
     Mode i   - 1200 bit/s synchronous.
     Mode iii   - 600 bit/s synchronous.
     Mode ii   - 1200 bit/s asynchronous.
     Mode iv   - 600 bit/s asynchronous.

Alternative C
(Synchronous, Asynchronous and Low Speed).
     Mode i   - 1200 bit/s synchronous.
     Mode iii   - 600 bit/s synchronous.
     Mode ii   - 1200 bit/s asynchronous.
     Mode iv   - 600 bit/s asynchronous.
     Mode v   - 1200 bit/s asynchronous
                 and 0-300 bit/s anisochronous.

Modem MPS1222 is normally operated in Alternative C, Mode v and data at either 1200 bit/s or 0-300 bit/s is accommodated automatically without operator intervention.

Switched Network Operation

For full-duplex operation on PSTN lines a standard telephone handset can be used with the modem to manually originate or answer calls for data transmission (Figure 2). Once a call has
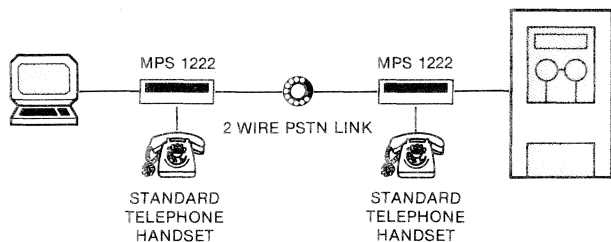
been established by manual operation the modem is connected to line by the operation of a front panel switch.

The Automatic Answer facility is front panel switch selectable and allows the modem to automatically connect to line three seconds after the first incoming ring is received.

The modem also includes an automatic disconnect facility which disconnects the modem from line after a predetermined period of inactivity.

Leased Line Operation

Modem MPS1222 can be configured for two-wire point-to-point data links over leased lines (See Figure 3).
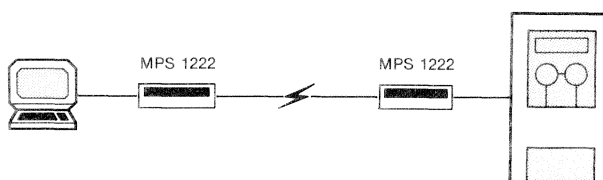

Figure 3 Leased Line Operation

Accessories
Rack Mounting Kits

Rack Mounting Kits are available to mount a single MPS1222 or two units side-by-side in a standard 19-inch rack.

- Single Unit - Kit Part No. 4415-113A-1.
- Dual Unit - Kit Part No. 4415-113A-2.

Card Nest

Card Nest, Part No. 4415-228AA-2 is required to mount the high density configuration.

Power Modules

When using the high density configuration 115 or 230V a.c., power can be supplied to the modems by the insertion of Power Module 201 in the card nest.

Technical Support Manual

A Technical Support Manual, Publication No. TP3083.2, is available containing parts lists, schematics and printed circuit board descriptions to component level.

Figure 2 Switched Network Operation

INSTALLING MODEM MPS1222

Procedures in this section should be performed in the sequence and manner prescribed. Any deviation may damage the equipment.

Unpacking and Inspection

Inspect the shipping carton immediately upon receipt. If the carton has been damaged, request that the carrier's agent be present during unpacking. Inspect contents for physical damage and/or missing parts. If the contents have been damaged or parts are missing, immediately notify the nearest Racal-Milgo sales office representative.

Initial Adjustments

Set the printed circuit board straps and switches, with reference to the Strapping Instructions at the rear of this section, to match the chosen mode of operation. (Factory strap selections are marked (F) in the Tables). Any straps not listed in the strapping instructions have mandatory settings and should not be altered without prior consultation with a Racal-Milgo representative.

It will be necessary to separate the two printed circuit boards to gain access to the straps on the Digital (lower) printed circuit board.

A 'No Option' option strap (W7 on the Digital printed circuit board) enables group setting of several of the available options to provide the modem functions most frequently required.

WARNING: The modem must be disconnected from the mains supply before removal of the printed circuit boards, as high voltages exist on the inside of the rear panel.

Pre-Installation Checks

Prior to installation, make the following preliminary checks:

- Ensure that the interface cables between the modem and its DTE do not exceed 15 metres in length. The location of the modem must allow connections to be made without stressing the cables and connectors.

- Ensure that the modem is installed within three metres of a grounding type a.c. power outlet. This should be the same earth that is used for the DTE. Noise interference may result from the use of different earths.

- Check that the modem fits securely into the selected location. The modem must be mechanically stable and protected from corrosive atmosphere and spray.

- Check the voltage at the power outlet. Either 94-132V a.c. or 183-267V a.c., 47-63Hz single phase power is required.

- Ensure that telephone lines have been installed for the system.

Installation

The table-top model of MPS1222 may be installed in a standard 19-inch rack using Single Unit Kit, Part No. 4415-113A-1 or Dual Unit Kit, Part No. 4415-113A-2. Refer to publication TP3091 supplied with the mounting kit for further details. When using the high density configuration, the modems slide into Card Nest, Part No. 4415-228AA-2 and are secured by quick release fasteners. Once the unit is mounted as required proceed as follows:

- Connect the DTE to the standard 25-pin connector, J1, located on the modem rear panel (Figure 4). This connector is designated J3 on the printed circuit board.

- For PSTN use, connect the telephone and line to connector J6, using cable assembly 1298 (supplied with the modem), or alternatively, the telephone may be connected to terminal block TB1 located at the rear of the Digital printed circuit board.
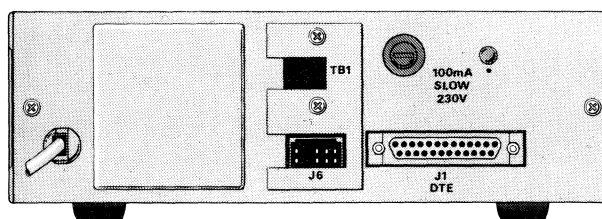

Figure 4 Rear Panel

- For leased line operation, cable assembly 1298 should be used to connect the line to J6. Soldered links V and W on the Digital printed circuit board should be placed in the IN position and links R and S should be removed. Strap W3 on the Digital printed circuit board should also be set for leased line operation.

Operational Test Procedure

- Connect the modem to a.c. power: the PWR indicator should light.

- Check that all the front panel controls are in the released OUT position.

- Perform a Self Test following the instructions given in the preceding section of the manual. The operator at the remote site modem should also perform a Self Test.

- When both modems have been tested, set up a telephone link and perform an End-to-End Test.

Strapping - Digital Printed Circuit Board, Part No. 81169
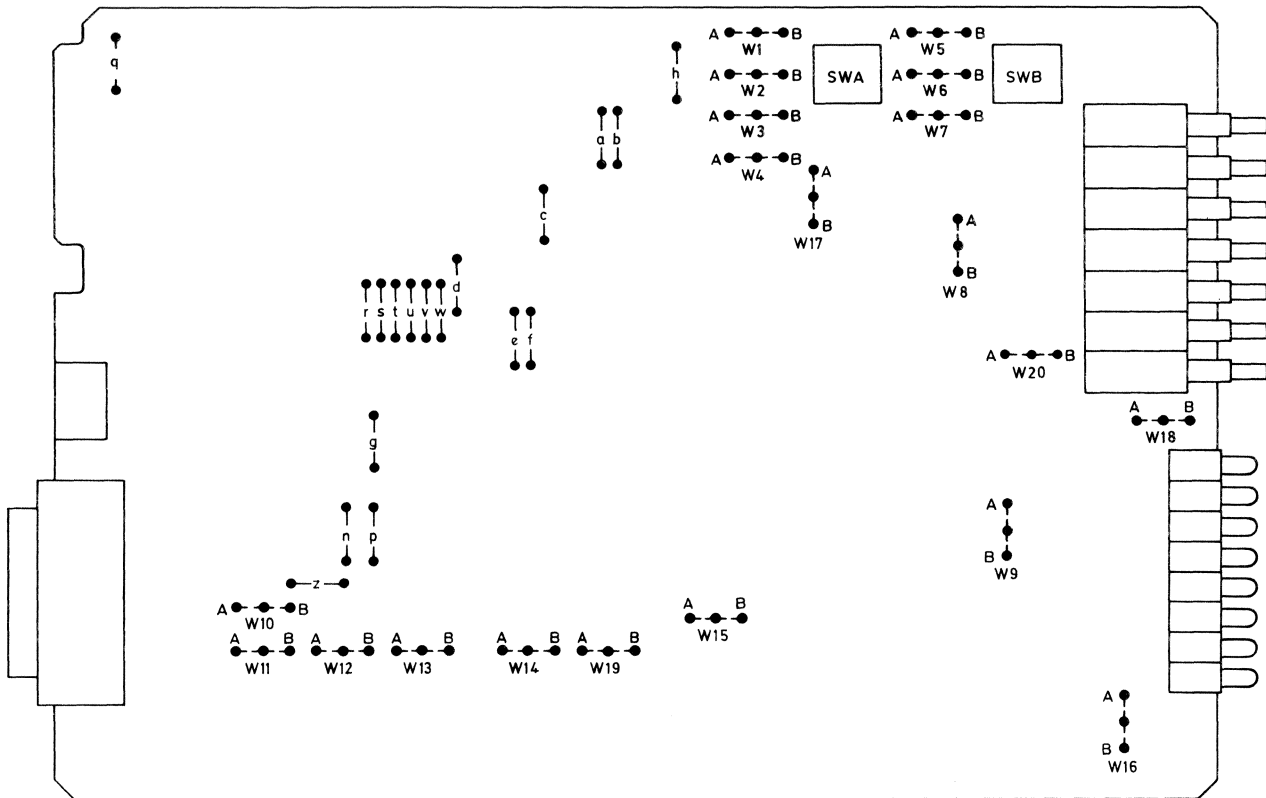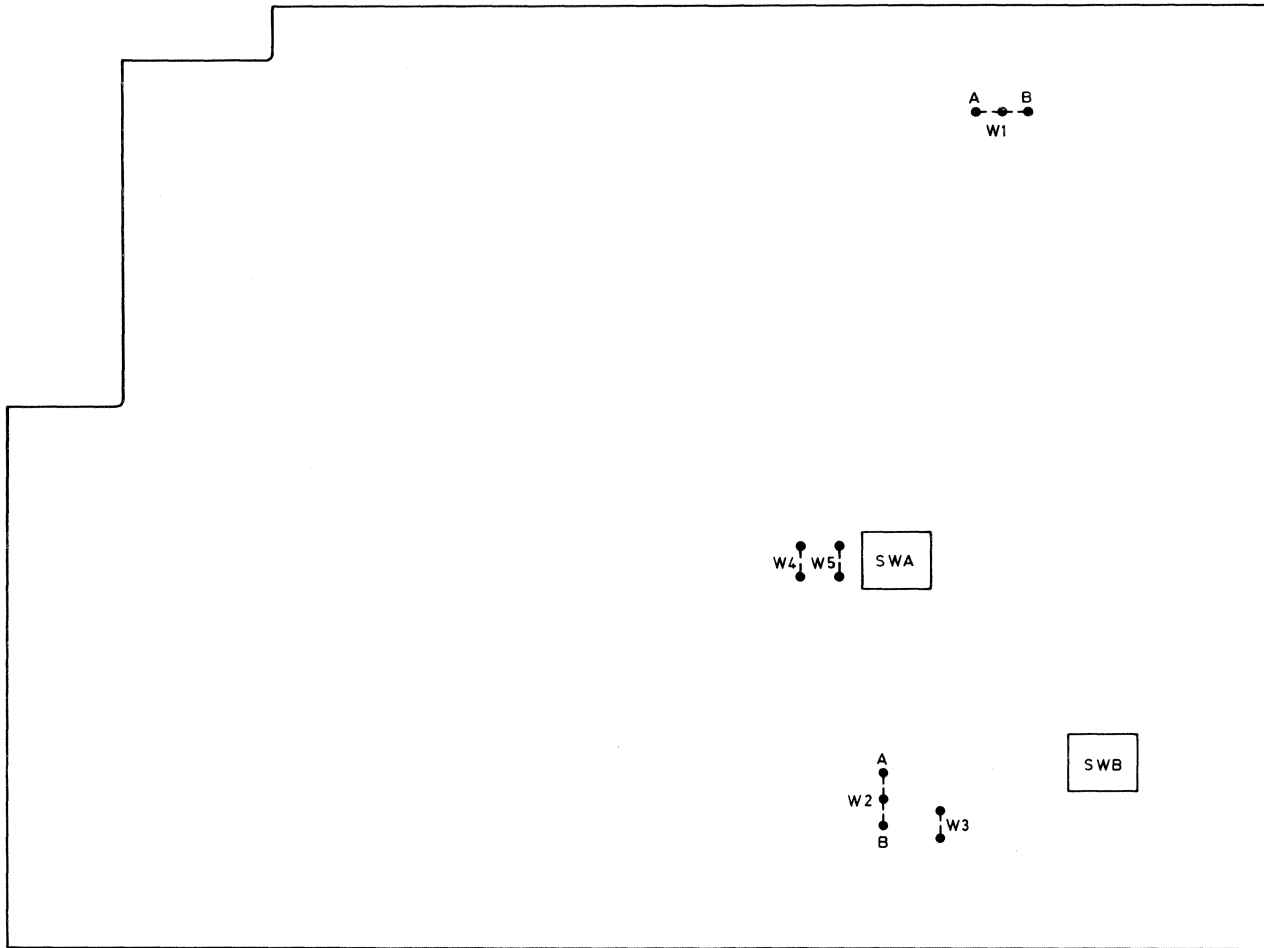
FUNCTION	STRAP/ SWITCH	POSITION	OPERATION
Alternative Selection	W4	A(F) B	Alternative C enabled. Alternative A and B enabled.
Answer Tone	(SW)B5	Open(F) Closed	Answer tone enabled. Answer tone disabled.
Answer Delay	W6	A B(F)	5 second answer delay. 3 second answer delay.
Asynchronous/ Synchronous	(SW)A4	Open Closed(F)	Synchronous operation. Asynchronous operation. *When set for asynchronous operation, the character length must be set by the 'No Option' strap (W7) or by switches (SW)A6 and (SW)A7.*
Automatic Character Recognition	W1	A B	Modem automatically recognizes an asynchronous 9- or 10-bit character. Automatic recognition disabled.
Carrier Select	W2	B A(F)	Switched carrier. Constant carrier. *When W2 is in position B the line signal is controlled by RTS and the RTS/CTS delay is about 235ms. When the strap is in the A position the line signal is always transmitted and the RTS/CTS delay is less than 2ms.*
Channel Select	W8	A B(F)	Front panel CH control disabled. Front panel CH control enabled.
DTE Channel Select	W11	A B(F)	Enable Channel Select via Interface. Disable Channel Select Interface input.

FUNCTION	STRAP/SWITCH	POSITION		OPERATION
Character Length	(SW)A6/A7 O = Open C = Closed	A6 O O C C	A7 O C(F) O C	Character length is 11 bits. Character length is 10 bits. Character length is 9 bits. Character length is 8 bits.
Circuit 108 (CCITT) V24	(SW)B6	Open Closed(F)		Circuit 108 input is Connect Data Set to Line (CDSTL). (108/1 mode). Circuit 108 input is DTR. (108/2 mode).
				Normally the 108/2 mode is used. When DTR is high the modem may automatically answer a call. Dropping DTR will cause the relay to drop out, terminating the call. Alternatively 108/1 can be selected and the DTE provides direct control over line relay operation by the use of the signal CDSTL. (See also W20).
Data Rate	W10	A B(F) OUT		Data rate 600 bit/s. Data rate 1200 bit/s. Data rate selected from the DTE via Pin 23 of the interface connector. (Defaults to 1200 bit/s).
DSR Control	W19	A(F) B		Clamp DSR off during test. No clamp on DSR during test.
DTR Control	(SW)B7	Open(F) Closed		DTR controlled by DTE. DTR held high in the modem.
				When the Circuit 108/2 mode is selected [(SW)B6], DTR is normally controlled by the DTE and is dropped at the end of a transmission to cause a line disconnect. Alternatively, DTR can be held high in the modem and disconnect can be initiated by the abort timer [(SW)B3] or the loss of carrier disconnect [(SW)B4].
Leased Line/ Dial-Up Select	W3	A(F) B		System is dial-up. System is leased line.
Line Disconnect	(SW)B3	Open Closed(F)		Abort timer enabled. Abort timer disabled.
	(SW)B4	Open(F) Closed		Disconnect on loss of carrier disabled. Disconnect on loss of carrier enabled.
Loop Test Control By DTE	W12	A(F) B		Remote Digital loop test control by DTE disabled. Remote Digital loop test control by DTE enabled.
	W13	A(F) B		Analogue loop test control by DTE disabled. Analogue loop test control by DTE enabled.
'No Option' Option	W7	A(F)		The following list of functions is set:-

1. Abort timer enable.
2. Loss of carrier disconnect enable.
3. Circuit 108 in 108/2 mode.
4. Automatic recognition of 9 and 10 bit characters.
5. Asynchronous operation.
6. Data rate 1200 bit/s.
7. Overspeed disable.
8. Originate and Answer capability enable.
9. Answer tone enable.
10. Dial-up operation.
11. Alternative C.
12. Remote test response enable.
13. 3 second answer delay.
14. Constant carrier.

| | | B | | Above functions are set individually. |

FUNCTION	STRAP/ SWITCH	POSITION		OPERATION
Originate/ Answer Capability	(SW)A1	Open(F) Closed		Originate and Answer capability enabled. Force answer mode.
Overspeed DTE	(SW)A2	Open Closed(F)		Compensation for overspeed DTE enabled. Compensation for overspeed DTE disabled.
				With Alternative B, overspeed must be enabled at both modems but with Alternative C it need only be enabled at the modem that transmits from the overspeed DTE.
Remote Test Response	W5	A B(F)		Remote test response disabled. Remote test response enabled.
RTS Control	W14	A B(F)		RTS controlled by DTE. RTS constant high.
Scrambler Enable	W9	A		Enable scrambler. Mandatory setting.
Transfer Control	W17	A B		Transfer pulse from line controls Voice/Data. Disabled.
Transmitter Timing	W15 and W16	W15 B B A	W16 B(F) A —	Transmitter uses internal clock. Transmitter slaves to external transmit clock input on Pin 24 of the interface connector. Transmitter slaves to clock derived from the receive data.
				In a dial-up system it is normal to have both modems strapped for internal clock.
Voice/Data Control	W18	A(F) B		Front panel VO control enabled. Front panel VO control disabled.
	W20	A(F) B		VO switch only operates if DTR is high. DTR has no effect on VO switch.

The following soldered straps are 'In' or 'Out' for the functions described.

a and c	In		Normal, 2-wire operation.
b and d	Out		Normal, 2-wire operation.
e and f	In Out(F)		Transfer input enabled by switch. Normal, transfer enabled by line current.
g	Out		Sets impedance of ring detector circuit.
h	Out(F) In		Microprocessor may access external memory. No external memory access.
n and p	In		Matches line to modem.
q	In		Signal common is chassis ground.
r, s and z	In Out		Normal, PSTN operation. Leased line operation.
t	Out		2-wire operation.
u	In		2-wire operation.
v and w	In Out		Leased line operation. Normal, PSTN operation.

Strapping - Analogue Printed Circuit Board, Part No. 81170

FUNCTION	STRAP/ SWITCH	POSITION		OPERATION
Receiver Phase Equalisation	W1	A(F) B		Receive phase equalization disabled. Receive phase equalization enabled.
Transmitter Phase Equalisation	W2	A(F) B		Transmit phase equalization disabled. Transmit phase equalization enabled.
Receiver Amplitude Equalisation	(SW)A2	Open(F) Closed		Receive amplitude equalization disabled. Receive amplitude equalization enabled.
Transmitter Amplitude Equalisation	(SW)A3	Open(F) Closed		Transmit amplitude equalization disabled. Transmit amplitude equalization enabled.
				Initially disable all equalizers and if the error rate on either or both channels is unsatisfactory, vary the combination to achieve best quality.
Answer Tone Level	W3	In		Mandatory setting.
Receiver Sensitivity	(SW)A1	Open Closed		No alteration to sensitivity. Receiver sensitivity reduced by 10dB.
Injector Tone	(SW)A4	Open(F) Closed		Injector tone disabled. Injector tone enabled.
W4 and W5		4 In Out	5 Out In(F)	550Hz Injector Tone selected. 1800Hz Injector Tone selected.

FUNCTION	STRAP/SWITCH	POSITION	OPERATION
Transmitter Output Level	(SW)B1	Open Closed(F)	No alteration to level. 1dB attenuation from 0dBm.
	(SW)B2	Open(F) Closed	No alteration to level. 2dB attenuation from 0dBm.
	(SW)B3	Open(F) Closed	No alteration to level. 4dB attenuation from 0dBm.
	(SW)B4	Open Closed(F)	No alteration to level. 8dB attenuation from 0dBm.

OPERATING MODEM MPS1222

Controls and Indicators

The controls are of the push-in-and-lock type except the VO control which has momentary action. Figure 5 shows the modem front panel.
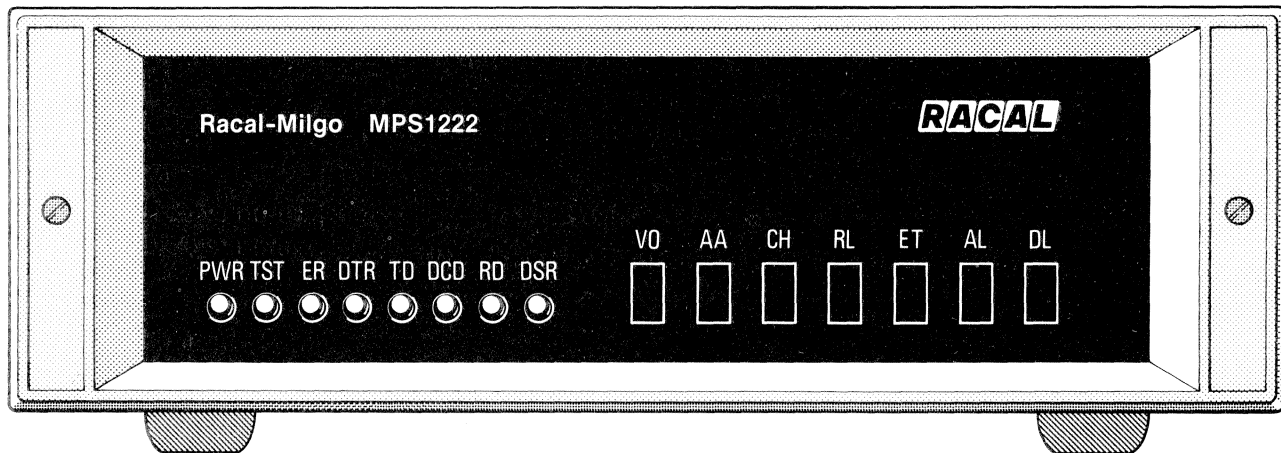
Figure 5 Controls and Indicators

VO (Voice/Data - transfers the telephone circuit from voice (the telephone handset) to data (the modem data receive and transmit circuits). When in the data mode, pressing the control transfers the telephone line back to voice.

AA (Automatic Answer) - senses whether or not the ringing current is present and automatically chooses the correct channel. The control should always be depressed for PSTN dial up lines. On leased lines it is not valid and CH must be depressed at one end.

CH (Channel Select) - should be OUT on an originating modem and IN on an answering modem. These settings cause the originate modem to transmit on the low channel (1200Hz) and the answering modem to transmit on the high channel (2400Hz). This control is overridden by the AA control when operating over the PSTN.

RL (Remote Loop) - causes a test command to be transmitted to the remote site modem which then activates a digital loop.

ET (Error Test) - activates test pattern generation and error detection circuits.

AL (Analogue Loop) - loops the data path at the phone line interface.

DL (Digital Loop) - loops the data path at the DTE interface.

PWR (Power) - lights when the power supply circuits are operating correctly.

TST (Test) - lights when any of the test functions are selected.

ER (Error) - flashes when an error is detected in a received test pattern.

DTR (Data Terminal Ready) - lights when the DTE is ready to transmit data.

TD (Transmit Data) - flashes when a 0-bit is transmitted and thus, flickers rapidly when data is being sent from the DTE to the modem.

DCD (Data Carrier Detect) - lights when the modem is receiving the carrier from another modem.

RD (Receive Data) - flashes when a 0-bit is received and thus, flickers rapidly when data is being received from the line and sent to the DTE.

DSR (Data Set Ready) - lights when the modem is connected to line and not in a test mode.

Operating Procedure

The modem provides facilities for manual originate and for either manual or automatic answer. The data transfer is set up on a dialled (PSTN) line and after completion of the transfer, the telephone line is normally released by the DTE dropping DTR.

Manual Originate

- Check that the AA control is IN.

- Dial the telephone at the site to or from which the data transfer is to be made.

- If the called modem is set for automatic answer, a distinctive tone (answer tone) will be heard after the modem answers; press the VO control (or the telephone transfer control) and replace the handset to initiate data transfer.

- If the called modem is set for manual answer, an operator at the other site will answer the telephone. Ask the operator to press the VO control (or the telephone transfer control) to switch the remote site modem to the data causing an answer tone to be sent. On hearing the answer tone, press the VO control (or the telephone transfer control) and replace the handset. The data transfer will then begin.

- If the called modem is configured for CDSTL (108/1) mode, the terminal senses RI and raises CDSTL, connecting the modem. The caller will again hear the answer tone and press VO in the normal way.

Manual Answer

- Check that the CH control is IN and the AA control OUT.

- Answer the modem-connected telephone when it rings.

- Press the VO control (or the telephone transfer control) and replace the handset. Data transfer will commence when the operator at the originating modem presses the VO control (or the telephone transfer control).

Automatic Answer

- Press the AA control and check that the DTR indicator lights.

Leased Line

In a leased line system, the CH control of one modem must be OUT (transmission at 1200Hz and reception at 2400Hz) while the CH control of the other modem is IN causing it to transmit at 2400Hz and receive at 1200Hz.

Telephone handsets cannot be used with leased lines making the AA and VO control inoperative.

Test Procedures

The communication link (local modem, transmission lines and remote modem) can be checked from the local modem by using the built-in testing features described below.

Local Analogue Loop Test (with Error Test)

- Depress the ET and AL controls and check that the TST indicator lights.

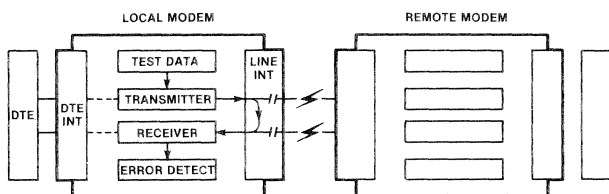- The ER indicator should not flash during a Self Test, if it does, the modem is defective.

Figure 6 Local Analogue Loop Test

End-To-End-Test

- Depress the ET control and ask the operator at the remote site to do the same.

- Check that both TST indicators light.

- An acceptable error rate for this test is one ER flash during 80 seconds of testing for the 1200 bit/s data rate. If more errors occur, there is a fault.

An End-to-End test has the advantage of testing the high (2400Hz) and low (1200Hz) channels separately which is not achieved in a Self test. It
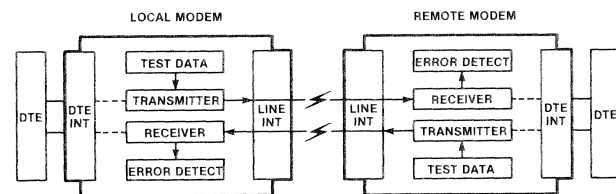

Figure 7 End-to-End Test

may be possible to improve the error rate of a channel by changing the amplitude and phase equalization. (Refer to the Strapping Instructions).

Remote Digital Loop Test (with Error Test)

- Depress the RL and ET controls and check that the TST indicator lights.

- An acceptable error rate for this test is Two ER flashes per 80 seconds of testing at the 1200 bit/s data rate.
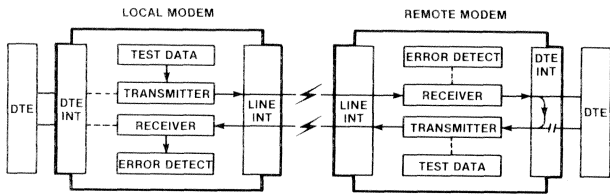
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Figure 8 Remote Digital Loop Test

This test is useful for testing modems at unattended sites because it requires no remote site operator intervention.

Local Digital Loop Test

This test is the same as a Remote Digital Loop test except that it is implemented at the local modem by depressing the DL control rather than by a command transmitted from the remote modem.
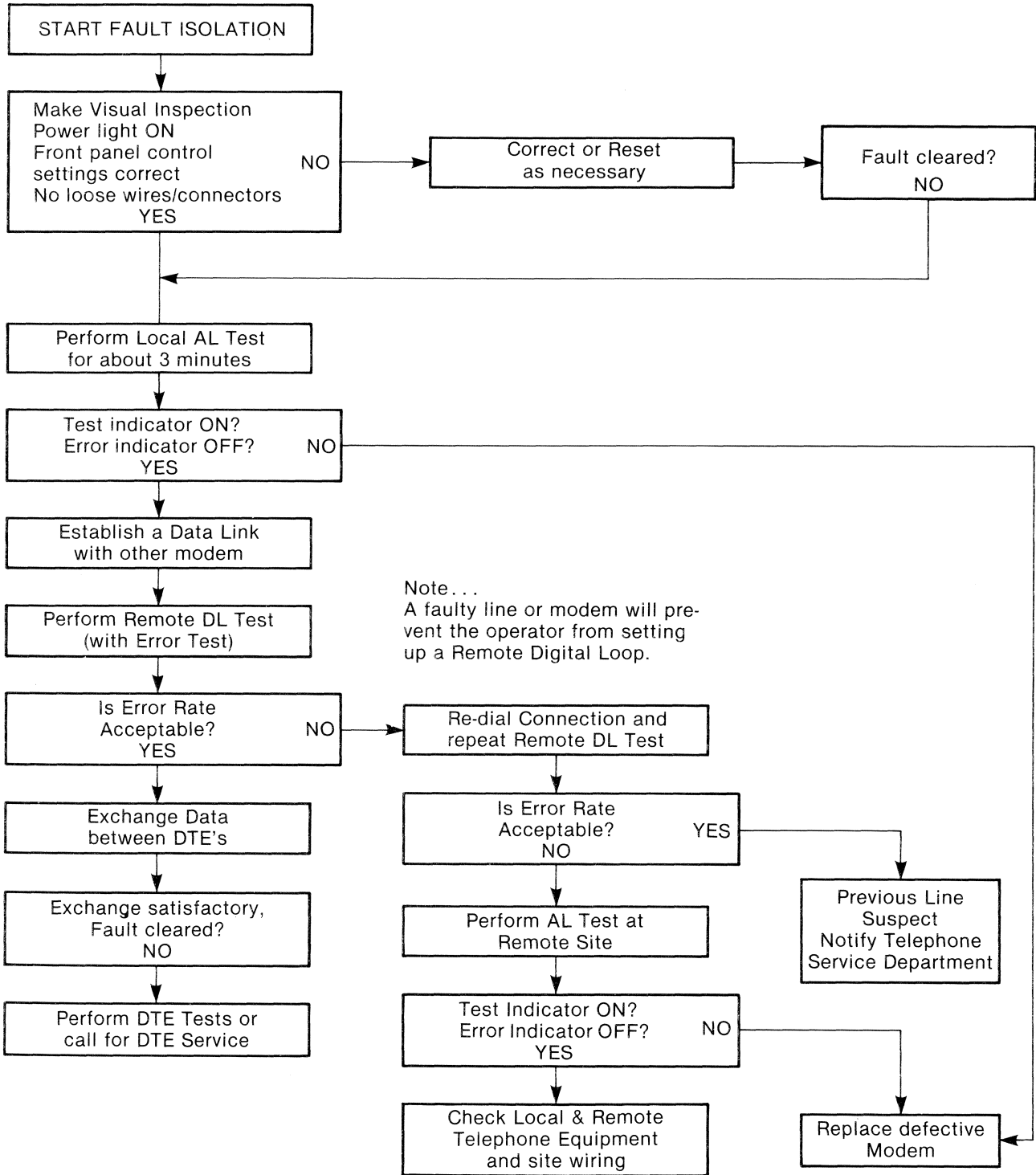

Figure 9 Test Procedure

SUPPLEMENTARY INFORMATION

This section describes the hardware interfaces used by MPS1222.

System Connectors

Modem MPS1222 contains three connectors (J1, J6 and TB1); J1 and J6 are located on the rear panel of the unit and TB1 is mounted at the rear of the Digital printed circuit board. These connectors are used as follows:

J1 A 25-way female connector providing the interface to the computer equipment. Connection should be made using a Cannon DB-25P male plug, or equivalent, with a Cannon DB110963-3 hood. Table 1 gives the pin/signal assignment for this connector.

J6 A 10-way male connector which provides a direct connection to the PSTN line and telephone. Connection should be made using cable assembly 1298 supplied with the modem. Table 2 lists the pin/signal assignment for this connector.

TB1 A 6-way terminal block which provides an alternative connection to the PSTN line and telephone. Table 3 lists the pin/signal assignment for the connector.

Table 1 DTE Connector Pin/Signal Assignment

Pin No.	CCITT No.	Input/ Output	Function	Pin No.	CCITT No.	Input/ Output	Function
1			Protective Ground	15	114	Out	Transmit Signal Element Timing
2	103	In	Transmit Data (TxD)	16			Not Used
3	104	Out	Receive Data (RxD)	17	115	Out	Receive Signal Element Timing
4	105	In	Request to Send (RTS)	18	141	In	Local Analogue Loopback
5	106	Out	Clear to Send (CTS)	19			Not Used
6	107	Out	Data Set Ready (DSR)	20	108	In	Data Terminal Ready (DTR)
7	102		Signal Ground	21	140	In	Remote Digital Loopback
8	109	Out	Data Carrier Detect (DCD)	22	125	Out	Ringing Indicator
9			+ 8V Test Voltage	23	111	In	Data Rate Select (DRS)
10			− 8V Test Voltage	24	113	In	External Transmit Clock
11	126	In	Channel Select	25	142	Out	Test Indicator (TI)
12-14			Not Used				

Table 2 J6 Pin/Signal Assignment

Pin No.	Signal	Colour	Pin No.	Signal	Colour
1	Transfer Common	Black	6	Transfer	Brown or Orange
2	Keyed	-	7	Keyed	-
3	Telephone Tip	Red	8	Telephone Ring	White
4	Line Tip	Blue or Yellow	9	Line Ring	Green
5	Not Used	-	10	Not Used	-

Table 3 TB1 Pin/Signal Assignment

Pin No.	Signal	Pin No.	Signal
1	Line Tip	4	Telephone Ring
2	Line Ring	5	Transfer
3	Telephone Tip	6	Transfer Common

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