

CHAPTER 2

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OPERATING INSTRUCTIONS

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CONTENTS

<u>Para.</u>		<u>Page</u>
1	OPERATING INSTRUCTIONS	2-1
2	DISPLAY FACILITIES	2-1
	EQUIPMENT FACILITIES	2-2
4	Off/Gain/Erase Switch	2-2
5	Display Brightness	2-2
6.	Channel Selection	2-2
9	MODE OF OPERATION	2-2
	INPUT CONTROL MODES	2-4
22	Local	2-4
25	Remote	2-4
28	Setting-Up for Remote Operation	2-4
29	Intercom	2-4
33	Setting-Up for Intercom	2-5
34	Automatic Rebroadcast	2-5
40	Setting-Up for Automatic Rebroadcast	2-5
41	Squelch Selection	2-6
42	Transmitter Power	2-7
43	Test Facility	2-7
45	E (Display Character)	2-7
46	Error Message	2-7
47	PROGRAM STORE CONTENTS	2-8
49	FREQUENCY SELECTION	2-8
50	Channel Loading using the Equipment Keyboard	2-8
53	Channel Loading using the MA.4073 VHF Programmer or the MA.4083 Fill Gun	2-9
54	OPERATION MODE SELECTION	2-10
55	Programming of Operation Mode using the Equipment Keyboard	2-10
56	ENCRYPTION AND DECRYPTION	2-10
58	Encryption Code Loading using the Equipment Keyboard	2-10
64	Encryption Code Loading using the MA.4073 VHF Programmer or the MA.4083 Fill Gun	2-12
65	Correction of Program Store Contents	2-12

CHAPTER 2

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OPERATING INSTRUCTIONS

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OPERATING INSTRUCTIONS (Refer to Fig. 1)

1. (1) Switch on the equipment. Set the Off/Gain/Erase switch clockwise. Refer to para. 4.
- (2) Select display brilliance. Depress **LAMPS** to obtain required display brilliance. Refer to para. 5.
- (3) Select channel. Depress **CHAN** and the numerical pushbutton of the required channel. Refer to para. 6.
- (4) Select mode of operation. Depress **CLEAR**, **CLEAR WIDE** or **SEC** (secure) as required. Refer to para. 9.
- (5) Select input control mode. Depress **LOCAL**, **REM** (remote) or **AUTO REBRO** (automatic rebroadcast) as required. Refer to para. 22.
- (6) Select squelch. Carrier squelch is selected automatically. For alternative squelch modes refer to para. 41.
- (7) Select transmitter power. Depress **HIGH**, **MED** (medium) or **LOW** as required. Refer to para. 42.
- (8) Communicate. To transmit, depress pressel and speak into microphone. Sidetone is heard during transmission.
- (9) Adjust volume. Refer to para. 4.

NOTE: Antenna matching is performed automatically on selection of a new transmission frequency. When used with the BCC 543 AAMTU, initial matching is performed into the dummy load within the AAMTU. Fine tuning of the AAMTU into the antenna is performed on initial operation of the pressel switch. The transmit sidetone may be inhibited during the matching process.

DISPLAY FACILITIES

2. The equipment display is a 16 digit alphanumeric display. The normal display format provides control, frequency and test information. An explanation of the normal display format is given in Fig. 2. For a more detailed description of the functions, the operator should refer to the appropriate paragraphs.
3. When programming frequency, mode of operation or encryption codes, the normal display format is replaced by the appropriate programming format. The programming formats are discussed in paras. 49, 54 and 56.

EQUIPMENT FACILITIES

Off/Gain/Erase Switch

4. The switch in the top right hand corner of the front panel has seven positions. The switch has an equipment off position and provides four audio output levels to the audio/data and audio sockets. Additionally, the fully-clockwise position provides a medium volume level with squelch held open whilst the fully anti-clockwise position labelled Z erases all the frequency and encryption code information stored in the memory. The erase position is protected by a mechanical interlock in order to prevent accidental erasure. In order to overcome the mechanical interlock, the interlock lever on the front of the switch should be pivoted outwards thereby permitting the switch to be set to the Z position.

Display Brightness

5. The readout from the alphanumeric display can be varied through three levels of brightness and off by successive operation of the **LAMPS** key.

Channel Selection

6. Channel 0 to 9 may be programmed to any of the 1841 channels in the frequency range 30 to 76 MHz. Channels 1 to 9 are protected against accidental corruption and in normal operation the channel frequencies should not be re-programmed. Where it is required to operate on a frequency other than one of the nine protected channels, channel 0 should be programmed as follows:
7. Depress **CHAN**, **0** and key in the required frequency in kHz in the form XXXYZ (where, within the frequency range 30 to 76 MHz, X = any number 0-9, Y = 0, 2, 5, 7 and Z = 0, 5. The last digit is displayed automatically by the equipment to give the correct 25 kHz channel spacing).

NOTES:

- (1) If an error is made when keying-in the frequency, the operator should continue depressing the numeric keys. After making the fifth keypress, a new frequency may be entered (over-writing the original selection).
 - (2) As the data store is non-volatile, the store contents is not lost when the equipment is switched off.
8. Where it is necessary to re-program channels 1-9, the operator should refer to para. 49.

MODE OF OPERATION

9. The VRM 5080C equipment can process clear traffic only (normal FM or wideband signals).

10. The equipment is primarily designed to operate with 5 kHz deviation signals (25 kHz channel spacing). Normal deviation is selected by depressing the **CLEAR** key. If, however, it is required to operate the equipment using 10 kHz frequency deviation signals (50 kHz channel spacing), the **CLEAR WIDE** key should be depressed. The **CLEAR WIDE** key affects the transmitter only and when selected the second digit of the alphanumeric display is set to w. The receiver accepts both normal and wide deviation signals without switching.
11. The VRM 5080S (or VRM 5080C plus MA.4261 External Encryption Unit) has an additional encryption facility permitting the processing of secure traffic (audio input encrypted as a 16 kbit/sec data stream).
12. Using the equipment keyboard, each of the ten channels can be pre-programmed to clear normal deviation or secure operation. It is not possible, however, to pre-program a channel for clear wide deviation operation.
13. Where the transmission mode has been pre-programmed, the fifteenth digit of the alphanumeric display is set to the appropriate C or S character as each channel is selected.
14. Following selection of a pre-programmed channel, the transmission mode may be changed by means of a **CLEAR**, **CLEAR WIDE** or **SEC** key. On subsequently returning to this channel however, the mode will revert to the pre-programmed state.
15. The transmission mode for a given channel returns to the non-programmed state when a new frequency is loaded into that channel.
16. Where the transmission mode has not been pre-programmed for a given channel, the equipment retains the transmission mode of the previously selected channel, unless changed by means of a **CLEAR**, **CLEAR WIDE** or **SEC** key.
17. When secure mode is selected the receiver detects whether the received signal is clear or encrypted and processes the signal automatically.
18. Where the transmission mode has been set to secure and a clear signal is received, the fifteenth and sixteenth digits of the alphanumeric display are set to S and C respectively.
19. Where a clear transmission mode has been selected and the operator hears 16 kbit/sec narrowband filtered noise, he should depress **SEC**. If the operator is receiving secure signals and has the correct encryption code entered, he will hear the decoded signal. If however, the incorrect code is loaded and the operator is receiving 16 kbit/sec data signals, he will hear very heavily filtered noise.
20. When transmitting or receiving secure traffic, an interrupted pip tone will be heard on the operators headset.
21. Where it is required to program the mode of operation using the equipment keyboard, the operator should refer to para. 54.

INPUT CONTROL MODES

Local

22. This is the normal method of operation when operating from the front panel and is selected by depressing the **LOCAL** key. On selection, the eleventh digit of the alphanumeric display is set to L.
23. In local operation carrier squelch is used and voice communication is made by means of the local operator's handset connected to the audio or audio/data socket or via the vehicle radio harness connected to the harness socket.
24. Where it is required to transmit wideband signals, the data source should be connected to the audio/data or harness socket.

Remote

25. Remote operation is selected by depressing the **REM** (remote) key. On selection, the eleventh digit of the alphanumeric display is set to R.
26. In remote operation the equipment may be controlled by both remote and local operators. By connecting D10 twin cable to the line terminals, a remote operator with a remote control handset can transmit and receive clear speech from a distance of up to 3 km. Alternatively, when connected to an auxiliary data source via D10 cable the VRM 5080S can transmit and receive 16 kbit/sec data signals from a distance of up to 3 km.
27. If required, two VRM 5080 equipments can be connected together via the line terminal in a similar manner to that used for intercom and automatic rebroadcast (paras. 29 and 34 respectively). If two VRM 5080S equipments are used, the remote operation can be in either clear or secure speech.

Setting-Up for Remote Operation

28. (1) Set-up the equipment for operation as detailed in the preceding paragraphs.
(2) Connect D10 twin cable to the + and - terminals on the equipment front panel.
(3) Run out the cable to the remote site and connect it to the terminals of the appropriate remote control handset, auxiliary data source or second VRM 5080. If, on operating the equipment, a continuous tone is heard, the cable connections at one end of the line should be reversed.

Intercom

29. Intercom is selected by depressing the **INTERCOM** key. On selection, the eleventh digit of the alphanumeric display is set to I.
30. When intercom is selected, the local and remote operators may communicate with each other without transmitting.

31. If the key is held down, a 2 kHz steady tone is transmitted down the line to alert the remote operator. The eleventh digit of the alphanumeric display is set to C. (A corresponding facility is provided by the call button fitted to the remote control handset.)
32. If required, two VRM 5080 equipments can be connected together via the line terminals in a similar manner to that used for remote and automatic rebroadcast (paras. 25 and 34 respectively). If two VRM 5080S equipments are used, the intercom can be in either clear or secure speech.

Setting-Up for Intercom

33. The setting-up procedure for intercom is identical to that detailed in para. 28.

Automatic Rebroadcast

34. Automatic rebroadcast is selected by depressing the **AUTO REBRO** key. On selection, the eleventh digit of the alphanumeric display is set to A.
35. The VRM 5080 equipments can be used in automatic rebroadcast mode, either using the remote line terminals or via a harness system.
36. In either application, the rebroadcast network consists of four or more units operated in pairs. Each equipment pair operates on a different frequency. The pairs are interconnected to form a rebroadcast chain using landline links of up to 3 km in length.
37. Typical rebroadcast systems are shown in Figs. 3 and 4. 'A' and 'B' are operated as an equipment pair as are 'C' and 'D'. A frequency separation of not less than 5% should be used by the two pairs A-B and C-D.
38. A signal received by set 'B' automatically switches set 'C' to the transmit condition allowing the signal from set 'A' to be received by set 'D'. A similar action occurs when set 'D' transmits to set 'A'.
39. The 'A' and 'D' sets can be units other than VRM 5080 but 150 Hz pilot tone must be embodied for automatic operation.

NOTE: Tone Squelch is automatically provided when **AUTO REBRO** is selected.

Setting-Up for Automatic Rebroadcast

40. Considering the typical rebroadcast systems shown in Figs. 3 and 4.
 - (1) Connect sets 'B' and 'C' together either using up to 3 km of D10 twin cable connected to the line terminals or the vehicle radio harness. If, on operating a line connected system, a continuous tone is heard, the connections at one end of the line should be reversed.
 - (2) Set-up equipment pair 'A' - 'B' to operate as a normal voice link in local mode.

- (3) Set-up equipment pair 'C' - 'D' to operate as a normal voice link in the local mode. Refer to Note 1.
- (4) Select **AUTO REBRO** on sets 'B' and 'C' and advise operators, by means of a handset plugged into the socket of either set, that the rebroadcast link is established. Transmission and reception will now be carried out in both directions using the automatic voice switching circuits of the 'B' and 'C' sets.
- (5) If required a 'break-in' facility can be provided for set 'B' or 'C' by connecting a handset to either the audio/data or audio connector. (Where the automatic rebroadcast link is operating in secure mode, the correct encryption code must be loaded in the 'break-in' equipment.)

NOTES:

- (1)✓ For optimum performance the equipment pairs should have a frequency separation of not less than 5% and an antenna separation of not less than 2 metres.
- (2) Where an automatic rebroadcast link is set-up using the vehicle harness the switches on the harness control box must be set accordingly.
- (3) The automatic rebroadcast link may operate in clear mode using VRM 5080C units and clear or secure mode using VRM 5080S units.
- (4) When using VRM 5080S equipments, the complete net must be set-up and operated in clear or secure mode. If the VRM 5080S net is to be operated in secure mode, sets 'B' and 'C' (refer to Figs. 3 and 4) do not need to be programmed with the encryption codes in use unless the net is to be monitored at set 'B' or 'C'. In this case, the net should be set-up in clear mode before switching to secure mode for operation.
- (5) Where it is required to transmit along the automatic rebroadcast link in one direction only e.g. set 'A' transmit, set 'D' receive, the rebroadcast link should be established in the normal manner after which **REM** should be selected on set C.

Squelch Selection

41. Carrier squelch is selected automatically. If the tone squelch facility is required, depress **AUTO REBRO** (automatic rebroadcast). Squelch override is obtained by turning the Off/Gain/Erase switch fully clockwise or by depressing and holding down the **TEST** key.

Transmitter Power

42. Three power levels are selectable by the keys labelled:

HIGH 50 W nominal

MED 10 W nominal

LOW 3 mW nominal

The selected levels are indicated by the thirteenth digit of the alphanumeric display by the letters H, M or L.

Test Facility

43. If the **TEST** key is depressed and held down, the eleventh, thirteenth and fifteenth digits of the alphanumeric display change to the form of 0, 1, 2 or 3 horizontal bars to provide a measure of the quantities detailed below: (The value displayed corresponds to the condition at the instant that **TEST** is depressed.)

digit 11: Transmitter power (pressel down) or Received signal strength (pressel up)

digit 13: Output voltage level from power supply unit

digit 15: Power amplifier heat sink temperature

In the case of the eleventh and thirteenth digits, 1 horizontal bar corresponds to a low level, 2 bars a medium level and 3 bars a high level. In the case of the fifteenth digit, one horizontal bar is illuminated when the temperature exceeds 85°C. When the temperature exceeds 105°C two bars are illuminated and, where high power is selected, the equipment will automatically override the selection and set the transmitter power to medium. Three bars are illuminated when the temperature exceeds 125°C. In this case the equipment should be switched off immediately and allowed to cool.

44. When the **TEST** key is held down, the squelch is held open.

E (Display Character)

45. When either the harness or the audio/data socket is programmed wideband, the fifteenth digit of the alphanumeric display (normally displaying S or C depending upon the selected mode) will be set to E to indicate that an external data device is connected. The E character is incorporated to remind the operator that the VRM 5080S cannot encrypt data and that the key selection may be invalid. Refer to para. 46.

Error Message

46. A two-tone audio warning will be heard on the operator's handset under any of the following conditions:

(1) An out-of-range frequency is selected. (In this case the equipment ignores the new frequency and re-writes the old frequency.)

- (2) A parity error is detected on the serial control system. (In this case the equipment will blank the alphanumeric display.)
- (3) When secure mode is selected and an external data device is connected to either harness or audio/data connectors. Refer to para. 45.

The audio warning may be cancelled by any valid instruction to the equipment.

PROGRAM STORE CONTENTS

47. The information contained in the program store (channel frequencies, encryption codes and modes of operation) will not require up-dating in normal use.
48. The following sections detail the procedure where it is necessary to re-program the data store.

NOTE: When the Off/Gain/Erase switch is turned fully anti-clockwise to the Z position, all frequency, encryption code and programmed mode of operation information is erased. The switch position is protected by a mechanical interlock in order to prevent accidental erasure. In order to overcome the mechanical interlock, the interlock lever on the front of the switch should be pivoted outwards thereby permitting the switch to be set to the Z position.

FREQUENCY SELECTION

49. Two methods of channel programming can be used:
 - (1) Channel loading using the Equipment Keyboard.
 - (2) Channel loading using the MA.4073 VHF Programmer or the MA.4083 Fill Gun.

Channel Loading using the Equipment Keyboard

50. The following procedure details the reprogramming sequence for channels 1 to 9.
 - (1) Depress **CHAN** (channel).
 - (2) Depress the numerical pushbutton corresponding to the required channel and confirm that the first digit of the alphanumeric display is set to the channel number.
 - (3) Depress **PROG** (program) and confirm that the right hand half of the 16 digit alphanumeric display is as shown.

 F R X T X

- (4) Key in the required frequency in the form XXXYZ (where, within the frequency range 30 to 76 MHz, X = any number 0-9, Y = 0, 2, 5, 7 and Z = 0, 5. The last digit is selected automatically by the equipment to give the correct 25 kHz channel spacing). The selected frequency is displayed by digits 3 to 7 of the alphanumeric display. If required, a new frequency may be entered (over-writing the original selection) after making a fifth keypress of the numeric keys. The above sequence gives single frequency operation. If two frequency operation is required, the above sequence programs the transmission frequency and, in order to program the receiving frequency, the following items should be performed.
- (5) Depress **PROG** (program) and confirm that the right hand half of the alphanumeric display is as shown.

F _ R X _ _ _ _

- (6) Key in the required frequency in kHz as detailed in item (4).

51. The following procedure details the programming sequence for channel 0.

- (1) Depress **CHAN** (channel).
- (2) Depress **0** and confirm that the first digit of the alphanumeric display is set to 0.
- (3) Key in the required frequency in kHz in the form XXXYZ (where, within the frequency range 30 to 76 MHz, X = any number 0-9, Y = 0, 2, 5, 7 and Z = 0, 5. The last digit is selected automatically by the equipment to give the correct 25 kHz channel spacing). The selected frequency is displayed by digits 3 to 7 of the alphanumeric display. If required, a new frequency may be entered (over-writing the original selection) after making a fifth keypress of the numeric keys. Single channel operation only is possible with channel 0.

52. Once programmed, the contents of any of the stored channels 0 to 9 may be recalled by pressing **CHAN** and the numerical pushbutton corresponding to the required channel. As the data store is non-volatile, the store contents is not lost when the power supplies are switched off.

Channel Loading using the MA 4073 VHF Programmer or the MA 4083 Fill Gun

53. The following procedure details the reprogramming sequence for channels 0 to 9.

- (1) Connect the VHF Programmer or Fill Gun via the connecting lead to the audio/data or audio socket on the VRM 5080.
- (2) In the case of the Fill Gun, the green ON lamp and the red NR (not ready) lamp will be illuminated. The ON lamp indicates that the Fill Gun is receiving DC power from the VRM 5080 and the NR lamp indicates that the Fill Gun is loading program into the store. When the NR lamp is extinguished, the VRM 5080 is programmed and the Fill Gun may be disconnected.

- (3) In the case of the VHF Programmer, the operator is advised to consult the MA 4073 VHF Programmer Technical Manual.

NOTE: The above procedure also loads encryption codes. Refer to para. 64.

OPERATION MODE SELECTION

54. Using the equipment keyboard, each of the ten channels can be pre-programmed to clear normal deviation or secure operation. It is not possible, however, to pre-program a channel for clear wide deviation operation.

Programming of Operation Mode using the Equipment Keyboard

55. (1) Depress **CHAN** (channel).
- (2) Depress the numerical pushbutton corresponding to the required channel and confirm that the first digit of the alphanumeric display is set to the channel number.
- (3) Depress the appropriate **CLEAR** or **SEC** key and whilst holding it down press and release **PROG** (program). The programmed mode will be displayed by the appropriate C or S character in the fifteenth digit of the alphanumeric display.

ENCRYPTION AND DECRYPTION

56. The codes required for encryption comprise 40 octal characters, 20 of which are common to all 10 channels (channel common characters) whilst the remaining 20 can be programmed differently for each channel (channel variable characters).
57. The encryption codes can be loaded into the VRM 5080S by one of two methods:
- (1) Encryption code loading using the Equipment Keyboard.
- (2) Encryption code loading using the MA 4073 VHF Programmer or the MA 4083 Fill Gun.

Encryption Code Loading using the Equipment Keyboard

58. If it is intended that the channel variable characters are to be different for each channel, the programming sequence of paras. 60, 61 and 62 must be used.
59. However, if it is intended that the 40 character encryption codes are to be the same for each of the 10 channels, the programming sequence of paras. 60 and 63 should be used to remove the necessity to program each of the channels separately.

60. The channel common characters are entered using the following sequence:
- (1) Depress **SEC** and confirm that the fifteenth digit of the alphanumeric display is set to S.
 - (2) Depress **PROG** (program) and confirm that the right hand half of the 16 digit alphanumeric display is as shown:

S _ _ C O M _ 1 _

- (3) Using the numerical pushbuttons 0 to 7, insert the first block of 5 octal characters noting that the block is entered in digits 3 to 7 of the alphanumeric display.

NOTE: If an error is made when keying-in the 5 octal characters, the operator should continue depressing numerical pushbuttons 0 to 7 to complete a 5 character block after which further keypresses will over-write the original entry and permit insertion of the correct 5 character block.

- (4) Depress **PROG** (program) and confirm that the 15th digit of the alphanumeric display is set to 2.
- (5) Insert the second block of octal characters as detailed in item 3.
- (6) Repeat items (4) and (5) in order to enter the third and fourth blocks of characters observing that, at the start of each block, the fifteenth digit of the display is set to 3 and 4 respectively.

61. The channel variable characters for a given channel are entered using the following sequence:

- (1) Depress **SEC** and confirm that the fifteenth digit of the alphanumeric display is set to S.
- (2) Depress the numerical pushbutton corresponding to the required channel and confirm that the first digit of the alphanumeric display is set to the channel number.
- (3) Depress **PROG** (program) and confirm that the right hand half of the 16 digit alphanumeric is as shown:

S _ _ _ _ _ 1 _

- (4) Using the numerical pushbuttons 0 to 7, insert the first block of 5 octal characters noting that the block is entered in digits 3 to 7 of the alphanumeric display. Refer to the note in para. 60 item 3 above.
- (5) Depress **PROG** (program) and confirm that the fifteenth digit of the alphanumeric display is set to 2.
- (6) Insert the second block of octal characters as detailed in item (4).
- (7) Repeat items (5) and (6) in order to enter the third and fourth blocks of characters observing that, at the start of each block, the fifteenth digit of the alphanumeric display is set to 3 and 4 respectively.

62. The channel variable characters for the remainder of the channels are entered by repeating para. 61 for each of the channels in turn.
63. The following sequence is adopted where the channel variable characters are to be the same for each channel (after performing para. 60 above).
- (1) Depress PROG (program) and confirm that the right hand side of the 16 digit alphanumeric display is as shown:

S _ A L L _ 1 _

- (2) Using the numerical pushbuttons 0 to 7, insert the first block of 5 octal characters noting that the block is entered in digits 3 to 7 of the alphanumeric display. Refer to the note in paragraph 60 item (3) above.
- (3) Depress PROG (program) and confirm that the fifteenth digit of the alphanumeric display is set to 2.
- (4) Insert the second block of octal characters as detailed in item (2).
- (5) Repeat items (3) and (4) in order to enter the third and fourth blocks of characters observing that, at the start of each block, the fifteenth digit of the display is set to 3 and 4 respectively.
- (6) Depress PROG (confirming that the right hand half of the display is as shown:

S (A L L) _ _)

and, whilst holding the key down, depress SEC (noting that the brackets in the tenth and fourteenth digits disappear) to transfer the 20 channel variable characters into each of the ten channels. The transfer may be made at any time: not only following entry of the data.

Encryption Code Loading using the MA 4073 VHF Programmer or the MA 4083 Fill Gun

64. When using the MA 4073 Programmer or the MA 4083 Fill Gun to load the encryption codes, the loading operation is performed at the same time as the programming of the channel frequencies the procedure for which is detailed in para. 53.

Correction of Program Store Contents

65. If the operator makes an incorrect selection when programming para. 63, he must return to para. 60 and step through the sequence using the SEC and PROG keys as appropriate. Throughout the program stepping operation, the data will remain unaltered unless the operator overwrites a 5 character block using the numerical pushbuttons.

NOTE: For security reasons, no encryption code recall facility is provided on the keyboard display.

In all other cases the program store contents may be overwritten by returning to the start of the given section, stepping through the sequence and updating the contents as mentioned above.