



AUSTRALIAN ARMY

TECHNICAL MANUAL

USER HANDBOOK

REGULATOR SET MX - F1

6110-66-029-4770

USED WITH RADIO SET PRC - F1

5820-66-025-9722

AMENDMENT NO 1

Under heading "REFORMING PROCEDURE" Page 6

Delete: existing paragraph 17

Insert: new paragraph 17 and 17A attached herewith

ISSUED

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TABLE 2 – FUNCTIONS OF TOP PANEL CONTROLS

Control, Indicator or Connector	Function
TRICKLE CHARGE – 1 & 2 FULL CHARGE 3 & 4 5 & 6 7 & 8	Switch pairs of batteries in the positions indicated to full charge (100 mA) or to trickle charge (20 mA).
DISCHARGE – 9 & 10 FULL CHARGE	Switches batteries in positions 9 and 10 to full charge (100 mA) or to discharge (250 mA).
DC IN – 24V	Input connector from power source.
(1) Indicating Lamps	Glow to indicate discharge of batteries 9 and/or 10.
(2) Meter Switch	In the OFF position, switches off input to the Regulator. In all other positions, switches the meter to monitor the charging rate of each of the 10 batteries, except that the discharge rate at positions 9 and 10 is not metered.
(3) Meter	Monitors the charging current. Full charge reading should be within the red scale area. Trickle charge reading should be within the green scale area.
(4) Humidity Indicator	Turns pink when moisture is present inside the unit.

CHARGING PROCEDURE

16. (a) First determine the approximate condition of the batteries as follows. If a battery has been in use for a period of 6 hours or more it will require a full charge. If used for a lesser period, a battery may be charged at the full rate for a limited period, corresponding to 1.1/2 times the period of use. In all cases where the battery voltage measures less than 24V, a full charge should be applied.
- (b) Place the batteries in the rack in pairs or singly, according to charging requirements. The batteries must be inserted with the contacts downwards and towards the rear so that the word **FRONT** on the battery is towards the front of the regulator. Connection will not be made if the battery is incorrectly inserted, and no charging indication will be shown on the meter when switched to indicate charging of this battery.
- (c) Close the clamping brackets and secure by means of the spring clips.
- (d) Set the switches on the regulator to **FULL**, **TRICKLE** or **DISCHARGE** as required.
- (e) Connect the regulator to the power source by means of the cable assembly supplied.
- (f) Switch on the external power source and set the meter switch away from the **OFF** position.
- (g) Check the charging rate into each battery by means of the current meter and the metering switch. For full charge the meter pointer should be within the red area on the scale. For trickle charge the pointer should be within the green area.

NOTE: Do not leave any battery on full charge for longer than the time indicated on the battery. The trickle charge rate may be used for an unlimited period to keep the battery in a fully charged condition if required, without damage to the battery.

It should be noted that the battery will self discharge to 90% of its capacity in 3 days, to 80% in 12 days and to 75% in 1 month. The trickle charge facility may be used to combat this effect.

REFORMING PROCEDURE

17. Batteries which have been idle for a period of 6 months or more should be reformed as follows:

- (a) Place 2 of the batteries in position 9 and 10 in the rack.
- (b) Set the "9 & 10" switch to DISCHARGE.

NOTE: The indicating lamps may or may not glow on the first discharge, depending on the initial condition of the battery.

- (c) Leave the batteries on discharge until the terminal voltage (under no-load conditions) is reduced to 20V.

OR

leave them in the regulator for 2½ hours and then measure the no-load terminal voltage every 10 minutes until the voltage is in the range 20 – 24 volts.

NOTE: Regulators which have modification number 1 incorporated will automatically shut off when the battery reaches 20.7V ($\pm 10\%$) and the indicating lamp will cease to glow.

- (d) Set the switch to FULL charge rate for the period indicated on the battery.
- (e) Repeat steps (b) to (d) three more times.
- (f) If only one battery is to be reformed, place it in position 9 or 10 in the rack and carry out steps (a) to (e) above. In this case only one indicating lamp will glow when the switch is set to DISCHARGE.

OPERATOR MAINTENANCE (BATTERY BB-F1)

17A. Your battery (and radio) will give you much better service if you observe the following:

- (a) Do not allow any electrolyte or white powder deposit to collect on the outside of the battery or the inside of the radio set battery compartment, wipe clean with a clean dry cloth.
- (b) Remove batteries from radio sets which are not in use.
- (c) If the battery will no longer operate the radio transmitter (check the battery test facility), replace it. Continued operation of the receiver only, past the normal discharge point of the battery, can lead to cell breakdown (and leaking electrolyte).

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USED WITH RADIO SET PRC-F1

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AMENDMENT RECORD

Amendment No.	By whom amended	Date of insertion

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ASSOCIATED PUBLICATIONS

(a) REGULATOR, BATTERY CHARGER F1, used on RADIO SET PRC-F1

Data Summary EMEI
Technical Description EMEI
Unit Repairs EMEI
Field and Base Repairs EMEI
Inspection Standards EMEI

Telecommunications K560
Telecommunications K562
Telecommunications K563
Telecommunications K564
Telecommunications K568

(b) RADIO SET PRC-F1

User Handbook

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CHAPTER ONE – INTRODUCTION

SECTION I – GENERAL

SCOPE

1. This handbook describes the REGULATOR SET, MX-F1 for RADIO SET PRC-F1 and covers its use, operation and user maintenance. Brief notes on the characteristics and limitations of nickel-cadmium batteries are also included.
2. The main component of the regulator set is the REGULATOR, BATTERY CHARGER F1. Throughout this handbook, this component will be referred to as the REGULATOR.

SECTION 2 – DESCRIPTION AND DATA

PURPOSE AND USE

3. The Regulator is designed to charge, simultaneously, up to 10 of the internal secondary batteries used in the RADIO SET PRC-F1, when supplied with power from any one of the sources defined in para 4. Two charge rates are provided for up to 8 batteries and a charge-discharge facility is provided for a further 2 batteries. The latter facility is used for reforming batteries which have been idle for six months or more. The regulator is designed for use at a fixed station.

TECHNICAL CHARACTERISTICS

4.
 - Inputs
 - (a) 20V to 40V dc. Up to 20% ripple of 1000 Hz to 2500 Hz can be tolerated.
 - (b) An unfiltered full wave rectified sinusoidal ac supply of 45 to 55 Hz and peak voltage between 32V and 60V.
 - Outputs
 - (a) 8 outputs, switched in pairs, to provide a full charge rate of 100 mA or a trickle charge rate of 20 mA.
 - (b) 2 outputs, switched simultaneously, to provide a full charge rate of 100 mA or a discharge rate of 250 mA.
 - Power Consumption
 - (a) 3.0A at 20V input at full load.
 - (b) 1.5A at 40V input at full load.
 - Power Sources
 - (a) A nominally 24V dc battery bank.
 - (b) A nominally 24V dc vehicle battery with negative earth.
 - (c) A nominally 24V dc vehicle generator with negative earth.
 - (d) A dc generator or rectifier having an output within the limits stated above.

COMPONENTS

5. The components of the Regulator Set are listed in Table 1.

TABLE 1 – LIST OF COMPONENTS

Item	Description	Dimensions (in)	Weight	Qty
1	REGULATOR, BATTERY CHARGER F1	13. 1/4 x 8. 5/8 x 13. 3/4	18 lb	1
2	CABLE ASSEMBLY, SPECIAL PURPOSE, Electrical, Branched CX- F3	72	3. 1/2 oz	1
3	USER HANDBOOK	11 x 8 1/2		1
4	CASE ASSEMBLY, TRANSIT, CY-F3 (Holds items 1 to 3 incl)	18 1/4 x 12 x 16	21 1/2 lb.	1

GENERAL DESCRIPTION

6. The Regulator is housed in a case of cast aluminium alloy, consisting of a top hollow casting in which all electrical components are mounted, and a lower hollow casting which is panelmatically sealed to the top casting by a synthetic rubber ring and secured to it by four captive screws at the corners. The case is surmounted by a battery rack with compartments for 10 batteries in 2 rows of 5. Two hinged clamps at the top press the batteries down onto spring contacts when the clamps are locked in position by spring catches. The battery rack is a complete sub-assembly and can be removed from the case by undoing 8 screws. A small compartment on the front of the battery rack holds the input cable when not in use.

MINOR COMPONENTS

7. An input cable assembly (CABLE ASSEMBLY, SPECIAL PURPOSE, Electrical, Branched CX - F3) is provided for connection to the power source. It consists of a 2 core sheathed cable, terminated at one end in a connector to suit the regulator input, and the other end by lugs for securing of appropriate connectors for the power source. No output cables are required as the batteries are plugged directly into the regulator.

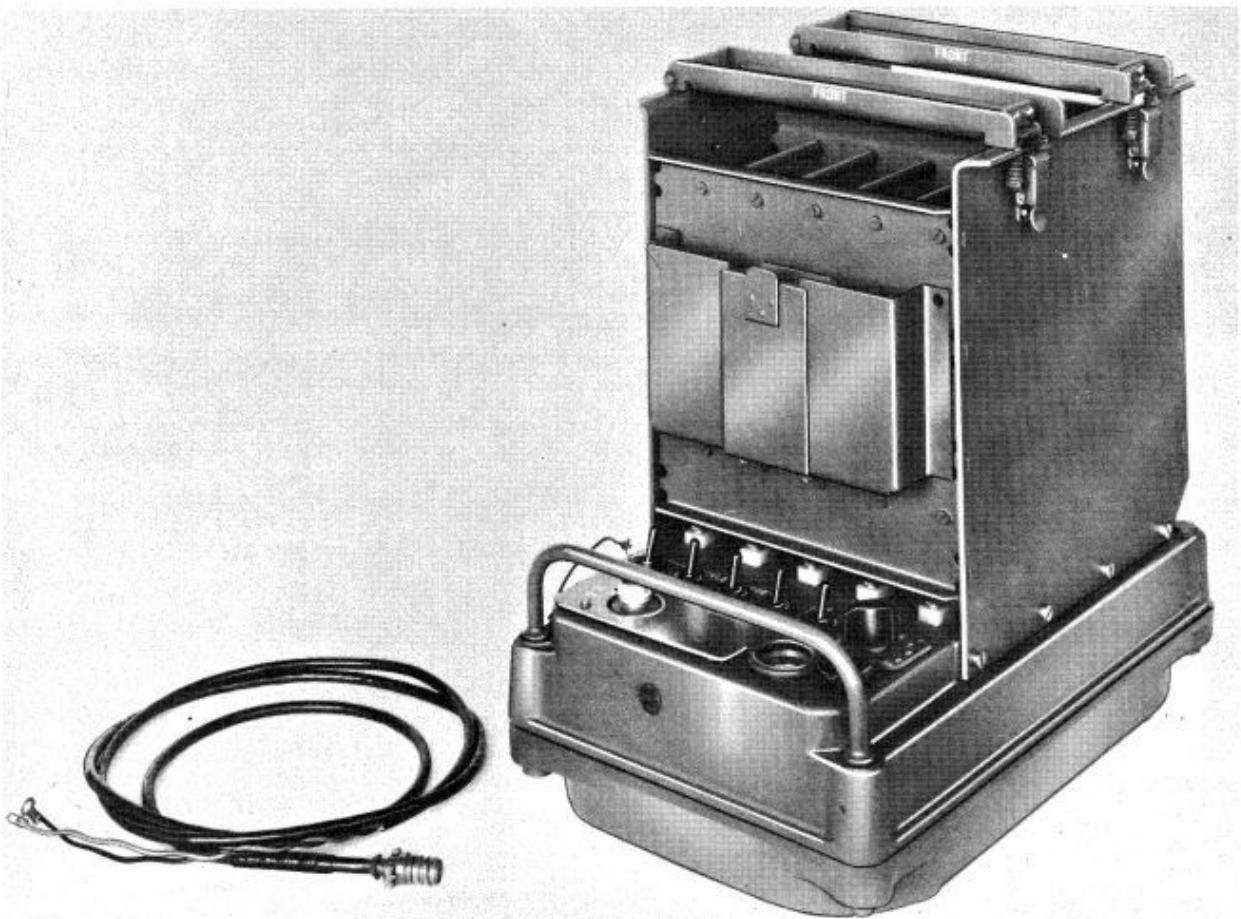


FIG 1 - REGULATOR SET MX-F1

CHAPTER TWO – INSTALLATION

LOCATION

8. No provision is made for mounting the regulator in a vehicle as it is intended only to be used at a fixed station. However if used in a stationary vehicle, it must be replaced in the transit case before moving.

INSTALLATION

9. The only connection required is that from the input connector to the power source. If required, suitable spade lugs, battery clamps or battery clips should be fastened to the lugs on the CABLE ASSEMBLY CX-F3. When connecting, check for correct polarity of the leads. Connect the positive battery clip to the positive side of the power source and the negative clip to the negative side of the source. If any doubt exists as to the polarity of the source, place a battery in position 1 in the rack, set switch "1 & 2" to TRICKLE, and set the meter switch to position 1. Connect the power source and check that the meter reads in the green area. If not, reverse the connections to the power source and recheck.

CHAPTER THREE – OPERATION

BATTERIES

10. In order to operate the regulator efficiently, the user should know something of the characteristics and limitations of the type of battery being charged. The RADIO SET PRC-F1 batteries are composed of 22 nickel-cadmium cells of small size, connected in series and sealed in an insulating case. The batteries are intended for use with the RADIO SET PRC-F1 only and should not be used as a dc source for any other purpose without permission.

11. The state of charge of a nickel-cadmium battery cannot be determined by a voltage or other test. The only guide to its condition is a knowledge of the period of use since the previous charge. However, a battery may be considered to be fully discharged when the terminal voltage drops to 24V in operation. After recharging, the terminal voltage should be 30.8V under "no-load" conditions.

12. The time for full charge at the 100 mA rate should not exceed the value given on the battery. Overcharging, especially in hot conditions, will speed up oxidation of the cell components and reduce the battery life. When used under normal conditions a battery life of approximately 400 charge-discharge cycles can be expected. However, operation at temperatures in excess of 45°C (113°F) will reduce this life expectancy. Wherever possible the batteries should be charged at a temperature as close to 21°C (70°F) as practicable under the circumstances. At high temperatures the battery will not accept a full charge.

13. Short circuiting of the battery must be avoided, as this will cause excessive heat to be generated, and may lead to a battery failure. The vent holes, if fitted, should be kept clear, as they are designed to release any internal pressure above 2 psi. The vent can be replaced by hooking out the cover and replacing the neoprene valve, convex side uppermost. The cover is a press fit in the vent receptacle.

WARNING

DO NOT ATTEMPT TO DISPOSE OF DISCARDED BATTERIES BY BURNING.
THE BATTERY WILL EXPLODE IF HEATED EXCESSIVELY.

TEMPERATURE LIMITATIONS

14. To prolong the life of the battery, the following temperature limits should be observed whenever possible under the prevailing circumstances.

Charging	0° C to +45° C (+32° F to +113° F)
Discharging	-20° C to +45° C (-2° F to +113° F)
Storing	-40° C to +60° C (-40° F to +140° F)

CONTROLS

15. Fig 2 shows the top panel controls and Table 2 lists their functions.

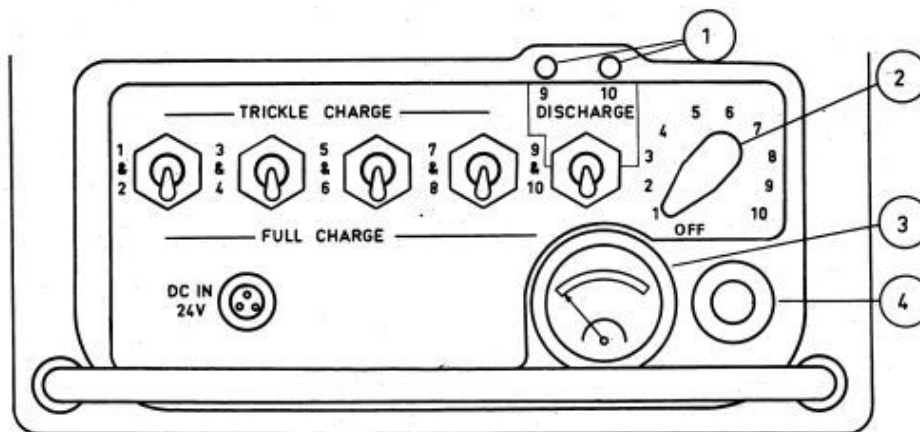


FIG 2 – TOP PANEL CONTROLS, REGULATOR, BATTERY CHARGER F1

TABLE 2 – FUNCTIONS OF TOP PANEL CONTROLS

Control, Indicator or Connector	Function
TRICKLE CHARGE – 1 & 2 FULL CHARGE – 3 & 4 5 & 6 7 & 8	Switch pairs of batteries in the positions indicated to full charge (100 mA) or to trickle charge (20 mA).
DISCHARGE – 9 & 10 FULL CHARGE	Switches batteries in positions 9 and 10 to full charge (100 mA) or to discharge (250 mA).
DC IN – 24V	Input connector from power source.
(1) Indicating Lamps	Glow to indicate discharge of batteries 9 and/or 10.
(2) Meter switch	In the OFF position, switches off input to the Regulator. In all other positions, switches the meter to monitor the charging rate of each of the 10 batteries, except that the discharge rate at positions 9 and 10 is not metered.
(3) Meter	Monitors the charging current. Full charge reading should be within the red scale area. Trickle charge reading should be within the green scale area.
(4) Humidity indicator	Turns pink when moisture is present inside the unit.

CHARGING PROCEDURE

16. (a) First determine the approximate condition of the batteries as follows. If a battery has been in use for a period of 6 hours or more it will require a full charge. If used for a lesser period, a battery may be charged at the full rate for a limited period, corresponding to 1.1/2 times the period of use. In all cases where the battery voltage measures less than 24V, a full charge should be applied.
- (b) Place the batteries in the rack in pairs or singly, according to charging requirements. The batteries must be inserted with the contacts downwards and towards the rear so that the word FRONT on the battery is towards the front of the regulator. Connection will not be made if the battery is incorrectly inserted, and no charging indication will be shown on the meter when switched to indicate charging of this battery.
- (c) Close the clamping brackets and secure by means of the spring clips.
- (d) Set the switches on the regulator to FULL, TRICKLE or DISCHARGE as required.
- (e) Connect the regulator to the power source by means of the cable assembly supplied.
- (f) Switch on the external power source and set the meter switch away from the OFF position.
- (g) Check the charging rate into each battery by means of the current meter and the metering switch. For full charge the meter pointer should be within the red area on the scale. For trickle charge the pointer should be within the green area.

NOTE: Do not leave any battery on full charge for longer than the time indicated on the battery. The trickle charge rate may be used for an unlimited period to keep the battery in a fully charged condition if required, without damage to the battery.
It should be noted that the battery will self discharge to 90% of its capacity in 3 days, to 80% in 12 days and to 75% in 1 month. The trickle charge facility may be used to combat this effect.

REFORMING PROCEDURE

17. Batteries which have been idle for a period of 6 months or more should be reformed as follows:

- (a) Place 2 of the batteries in position 9 and 10 in the rack.
- (b) Set the "9 & 10" switch to DISCHARGE and the meter switch to OFF.

NOTE: The indicating lamps may or may not glow on the first discharge, depending on the initial condition of the battery.

- (c) Leave the batteries on discharge until the terminal voltage (under "no load" conditions) is reduced to 19.8V,
OR
leave them in the regulator for 4 hours.
- (d) Set the meter switch away from the OFF position and set the "9 & 10" switch to FULL charge rate for the period indicated on the battery.
- (e) Repeat steps (b) to (d) three more times.
- (f) If only battery is to be reformed, place it in position 9 or 10 in the rack and carry out steps (a) to (e) above. In this case only one indicating lamp will glow when the switch is set to DISCHARGE.

CHAPTER FOUR – OPERATOR'S MAINTENANCE

SCOPE OF OPERATOR'S MAINTENANCE

18. The maintenance duties assigned to the operator of the regulator are listed below. The duties assigned do not require the use of tools or test equipment.

NOTE: The regulator is a sealed unit and must not be opened by the user.

- (a) Preventive Maintenance (para 19)
- (b) Visual Inspection (para 20)
- (c) Operational Checklist (para 21)

PREVENTIVE MAINTENANCE

19. Carry out the following duties daily.

- (a) Clean the unit of all dust or mud accumulation. If grease or oil is present, remove with gasoline or cleaning fluid.
- (b) Clean the cable receptacle thoroughly. Clean out the dust cap and check that the synthetic rubber seal is in place in the cap.
- (c) Check the operation of the switches. Check that the knob on the metering switch is tight on its spindle.
- (d) Check the humidity indicator. If it has turned pink, return the unit as soon as practicable to RAEME Workshops for drying and resealing.

VISUAL INSPECTION

20. When the equipment fails to perform properly, as indicated by incorrect reading on the meter or failure of the indicator lamps to glow on DISCHARGE, switch off the power source and make the following checks.

- (a) Improper setting of switches.
- (b) Disconnected or improperly connected input cable.
- (c) Broken or damaged input cable.
- (d) Dirty or weak contact springs in battery rack.

If the above checks do not locate the trouble, proceed to the operational checklist (para 21).

OPERATIONAL CHECKLIST

21. Carrying out the following checklist will assist in locating faults due to simple causes. If the fault cannot be remedied by the suggested corrective measures, return the unit to an Ordnance depot or RAEME Workshop for further investigation. Note on the proper form what corrective measures were taken and how the equipment performed at the time of the trouble.

TABLE 3 – OPERATIONAL CHECKLIST

Step	Action	Normal Indication	Corrective Measure
1	Batteries in positions 1 and 2 Switch "1 & 2" to TRICKLE.	Meter reads in green area on scale	Check for correct insertion of batteries. Check for weak or damaged contact springs. Check power source voltage, 20V to 40V. Check input cable for broken wires or connections.
2	Batteries in positions 1 and 2 Switch "1 & 2" to FULL	Meter reads in red area on scale.	Make the checks described above for step 1.
3	Batteries in positions 3 and 4, 5 and 6 or 7 and 8 Set the appropriate switch to FULL or TRICKLE.	Meter reads in green area for TRICKLE or in the red area for FULL.	Make the checks described above for step 1.
4	Batteries in positions 9 and 10 Switch "9 & 10" to DISCHARGE.	The two indicating lamps glow.	Check for correct insertion of batteries. Check for weak or damaged contact springs.

It may be found that one or more of the regulator outputs perform satisfactorily while others do not. In this case the serviceable outputs may be used temporarily without fear of damage to the equipment, but the unit should be returned for repair as soon as practicable.

NOTE: If a weak or bent contact spring is discovered, the battery rack should be removed by undoing the 8 screws, (4 on each side), and the spring gently bent back to its original shape. Do not use excessive force or the spring will break.

CHAPTER FIVE—DESTRUCTION TO PREVENT ENEMY USE

METHOD OF DESTRUCTION

22. Any of the methods of destruction given below may be used upon the order of the officer in charge. The time available and the tactical situation will determine the method to be used.

- (a) Smash Smash the control panel and interior with the heaviest tool available if time does not permit the dismantling of the equipment. Use sledges, handaxes, pickaxes, hammers, crowbars or heavy tools.
- (b) Cut Cut the input cables in a number of places; use axes, knives, machetes or similar tools. If time permits, slash the interior wiring.
- (c) Burn Burn the instruction literature first, and as much of the equipment and spare parts as are flammable; use gasoline, oil or a flamethrower.
- (d) Explode Use explosives when time does not permit destruction by other means. HE charges or frag grenades should be placed against the control panel.
- (e) Dispose Bury the destroyed parts in trenches or holes.