

★  
UNCLASSIFIED

TECHNICAL MANUAL

*for*

REMOTE CONTROL UNIT

MODEL LRCF-1



THE TECHNICAL MATERIEL CORPORATION  
MAMARONECK, N.Y.

OTTAWA, ONTARIO

★

★  
UNCLASSIFIED

TECHNICAL MANUAL

*for*

REMOTE CONTROL UNIT

MODEL LRCF-1



THE TECHNICAL MATERIEL CORPORATION  
MAMARONECK, N.Y.

OTTAWA, ONTARIO

COPYRIGHT 1967  
THE TECHNICAL MATERIEL CORPORATION

## NOTICE

THE CONTENTS AND INFORMATION CONTAINED IN THIS INSTRUCTION MANUAL IS PROPRIETARY TO THE TECHNICAL MATERIEL CORPORATION TO BE USED AS A GUIDE TO THE OPERATION AND MAINTENANCE OF THE EQUIPMENT FOR WHICH THE MANUAL IS ISSUED AND MAY NOT BE DUPLICATED EITHER IN WHOLE OR IN PART BY ANY MEANS WHATSOEVER WITHOUT THE WRITTEN CONSENT OF THE TECHNICAL MATERIEL CORPORATION.



# THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S   E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

## W a r r a n t y

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,\*fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes\*furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

\*Electron tubes also include semi-conductor devices.

### *PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT*

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

### *PROCEDURE FOR ORDERING REPLACEMENT PARTS*

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

### *PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT*

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION  
Engineering Services Department  
700 Fenimore Road  
Mamaroneck, New York



# TABLE OF CONTENTS

<u>Paragraph</u>		<u>Page</u>
<u>SECTION 1 - GENERAL INFORMATION</u>		
1-1	Functional Description . . . . .	1-1
1-2	Physical Description . . . . .	1-1
1-3	Technical Specification. . . . .	1-2
<u>SECTION 2 - INSTALLATION</u>		
2-1	Unpacking and Handling. . . . .	2-1
2-2	Mechanical Installation . . . . .	2-1
2-3	Electrical Installation. . . . .	2-1
2-4	Remote Control Interconnection . . . . .	2-3
<u>SECTION 3 - OPERATOR'S SECTION</u>		
3-1	General . . . . .	3-1
<u>SECTION 4 - PRINCIPLES OF OPERATION</u>		
4-1	General. . . . .	4-1
4-2	Block Diagram Analysis. . . . .	4-1
<u>SECTION 5 - MAINTENANCE</u>		
5-1	Preventive Maintenance . . . . .	5-1
5-2	Troubleshooting. . . . .	5-2
5-3	Repair and Replacement. . . . .	5-3
<u>SECTION 6 - PARTS LIST</u>		
6-1	Introduction . . . . .	6-1
<u>SECTION 7 - SCHEMATIC DIAGRAMS</u>		

# LIST OF ILLUSTRATIONS

Figure		<u>Page</u>
<u>SECTION 1 - GENERAL INFORMATION</u>		
1-1	Remote Control Unit, Model LRCF-1. . . . .	1-0
<u>SECTION 2 - INSTALLATION</u>		
2-1	Rear Panel Terminal Connections . . . . .	2-2
2-2	Typical Remote Channel Selection Control. . . . .	2-3
<u>SECTION 4 - PRINCIPLES OF OPERATION</u>		
4-1	Simplified Block Diagram . . . . .	4-3
<u>SECTION 7 - SCHEMATIC DIAGRAMS</u>		
7-1	Schematic Diagram, LRCF-1 . . . . .	7-2/7-3

## LIST OF TABLES

<u>Table</u>		<u>Page</u>
<u>SECTION 4 - PRINCIPLES OF OPERATION</u>		
4-1	Relay Sequence and Code-Bit Output . . . . .	4-2



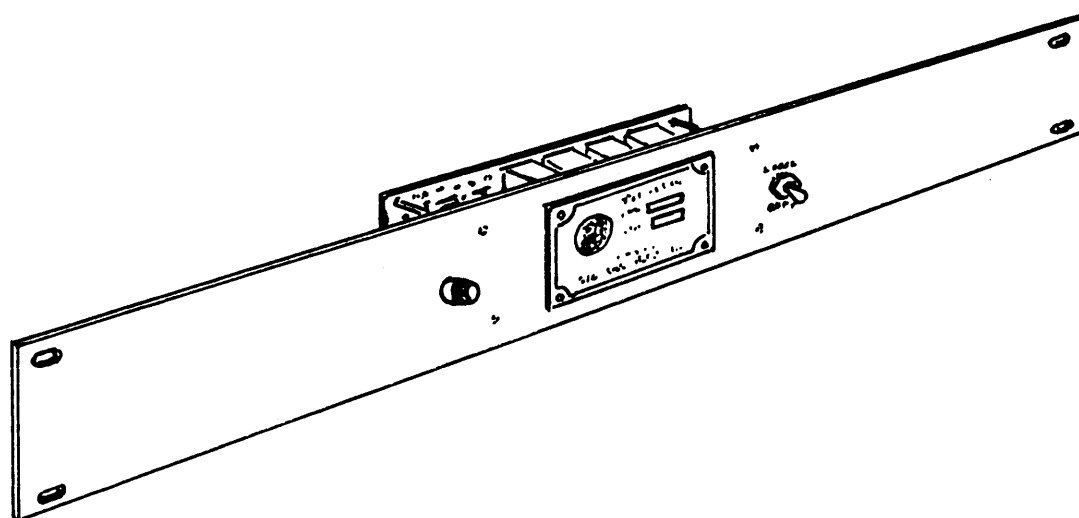


Figure 1-1. Remote Control Unit, Model LRCF-1

# **SECTION 1**

## **GENERAL INFORMATION**

### 1-1. FUNCTIONAL DESCRIPTION

Remote Control Unit, Model LRCF-1 (Figure 1-1) is a remote control termination unit.

The LRCF accepts eight channel selection outputs from an external remote control unit, converts them to a coded output and routes them to an associated exciter unit.

The coded channel selection output, applied to the exciter's channel selector switch, sets the exciter to the channel setting selected at the external remote control unit.

### 1-2. PHYSICAL DESCRIPTION

The LRCF front panel measures 19-inches wide, designed for mounting into any standard width equipment cabinet or console.

The unit measure 2-1/2-inches deep, by 1-3/4-inches high and wights approximately 5-pounds.

Front panel controls consists of a LOCAL/REMOTE toggle switch, and a 26 VDC fuse.

### 1-3. TECHNICAL SPECIFICATIONS

INPUTS:	Dry contact to ground.
OUTPUTS:	26 volts d-c for selected function, 4-bit code output.
INPUT VOLTAGE REQUIREMENTS:	-26 volts d-c for a -26 vdc output. +26 volts d-c for a +26 vdc output.
DIMENSIONS:	19-inches wide x 1-3/4-inches high x 2-1/2-inches deep.
WEIGHT:	5 lbs. (approx.)

## **SECTION 2 INSTALLATION**

### **2-1. UNPACKING AND HANDLING**

The LRCF is tested at the factory and is carefully packaged to prevent damage during shipment. Upon receipt of the equipment, inspect the packing case and its contents for damage that might have occurred during transit. Unpack the equipment carefully and inspect all packing material for parts that may have been shipped as loose items.

With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

### **2-2. MECHANICAL INSTALLATION**

The LRCF is equipped with a 19-inches wide front panel, suitable for mounting into any standard 19-inches wide equipment cabinet or console. Mounting is accomplished by means of securing the LRCF to the equipment rack frame by means of four screws and washers (supplied).

### **2-3. ELECTRICAL INSTALLATION**

The LRCF is factory wired to operate from an external input of -26 volts d-c. For +26 volts d-c operation, remove the jumper wire from the rear panel terminals 2 and 4.

Output connector P8004 is to be connected to the exciter unit of the associated transmitter system. Refer to the appropriate system technical manual for connection details.

Input connector P8014 is to be connected to the external remote channel

selection control unit.

See figures 2-1 and 2-2 for rear panel terminal connections and a typical remote channel selection control circuit.

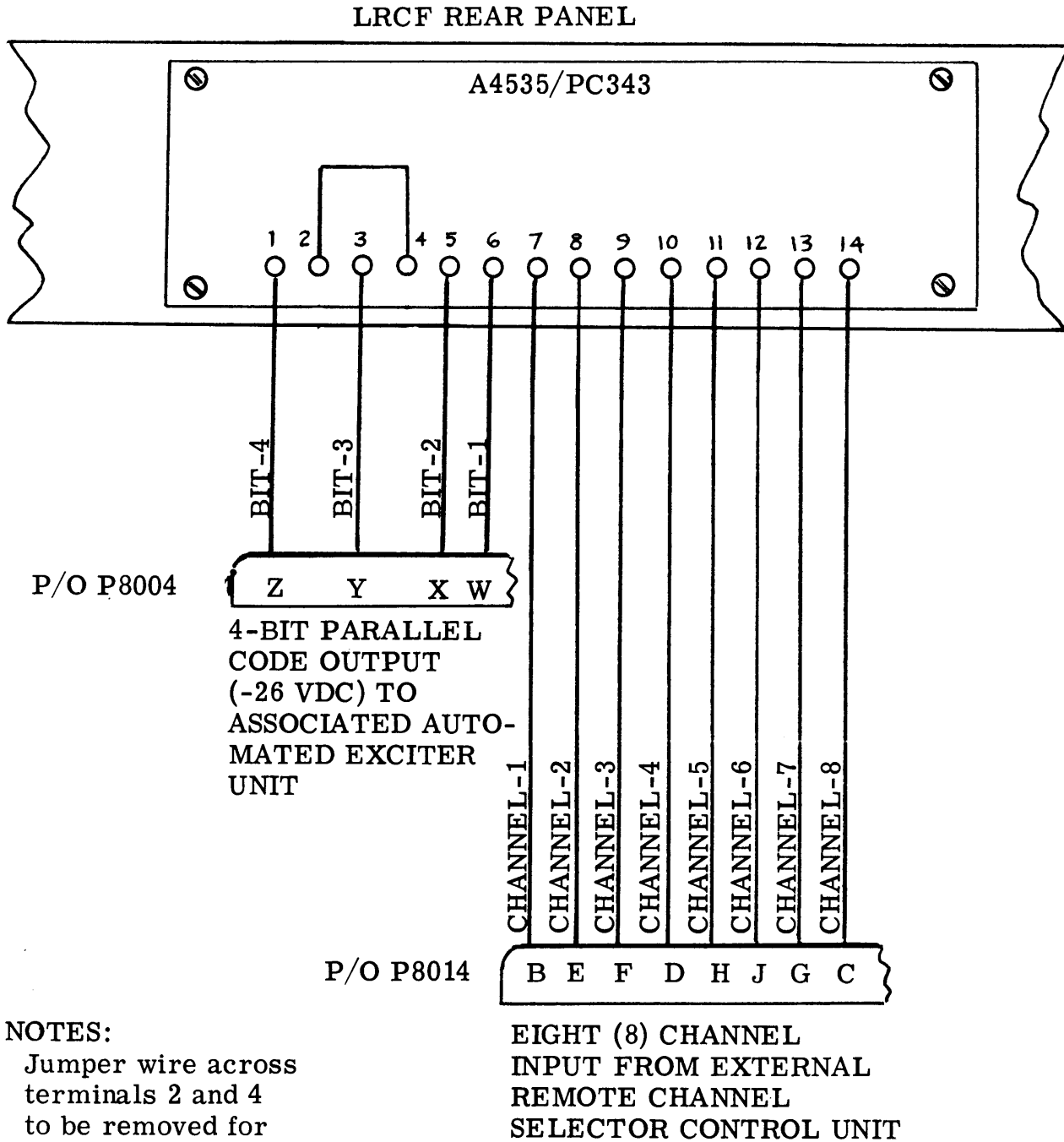


Figure 2-1. Rear Panel Terminal Connections.

## 2-4. REMOTE CONTROL INTERCONNECTION

Remote channel selection control is accomplished by supplying the LRCF with ground return lines. The ground return lines, one for each of eight selectable channels, may be initiated by means of an 8-position rotary selector switch. A twelve-position rotary selector switch lamps. See Figure 2-2 for a typical remote channel selection control circuit.

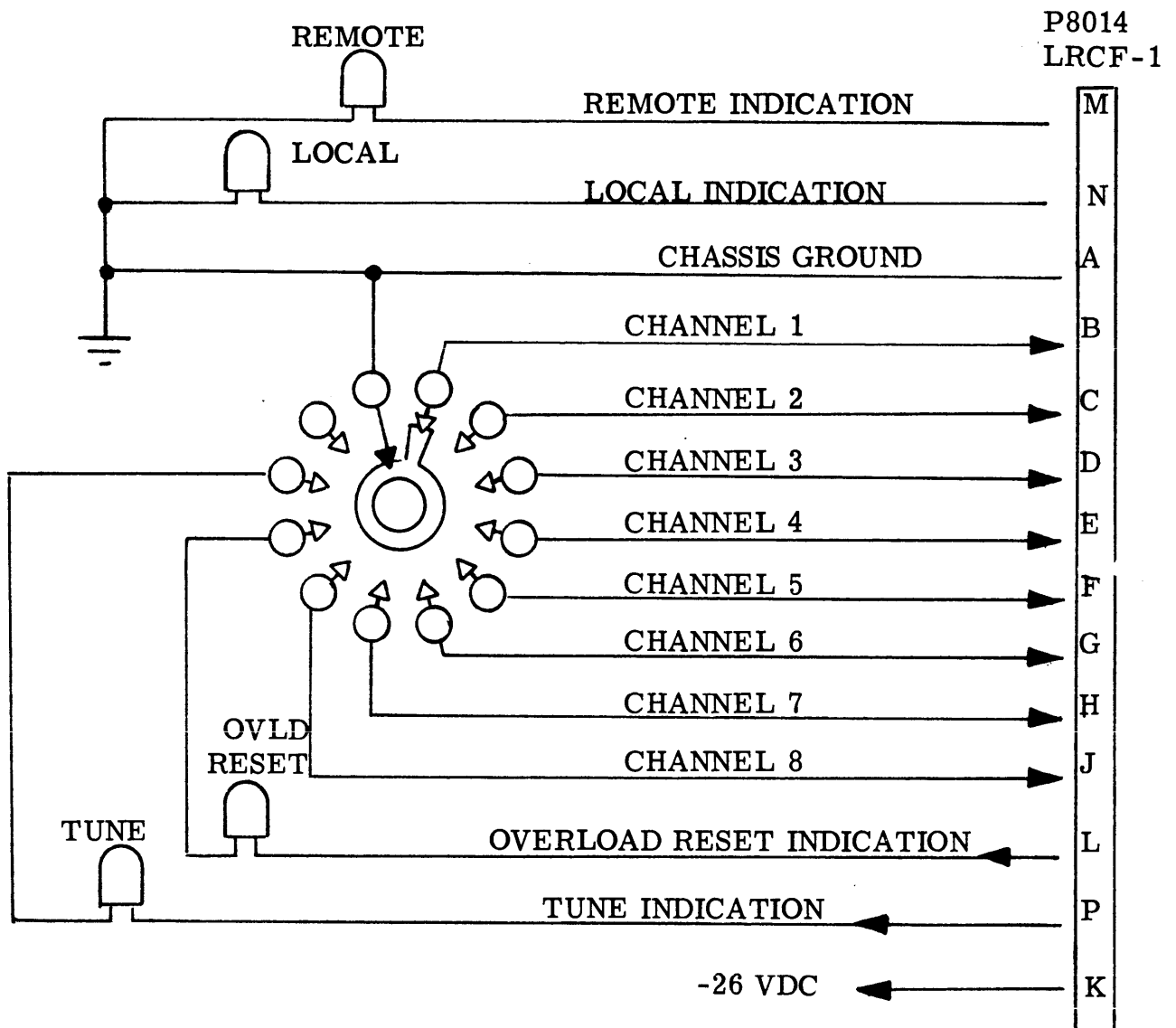


Figure 2-2. Typical Remote Channel Selection Control

## **SECTION 3**

### **OPERATOR'S SECTION**

#### 3-1. GENERAL

The LRCF contains two front panel mounted components: a LOCAL/REMOTE toggle switch and a 26VDC fuse.

The LOCAL/REMOTE toggle switch is used to select either local (manual) operation, or remote (remote control) operation of the associated system's exciter unit channel selector.

When set at LOCAL, the channel selector switch on the associated exciter unit must be manually set to the desired channel setting.

When set at REMOTE, the channel selector switch on the associated exciter unit may be set to the desired channel setting by means of an external remote channel selection control. This is accomplished by applying remote channel selection signals to the LRCF. The LRCF in turn applies these signals to the solenoid stepping switch in the exciter unit, setting the channel selector switch to the corresponding remote switch setting.

The 26 VDC fuse acts as a protective device to the 26 vdc input voltage line in the LRCF.

## **SECTION 4**

### **PRINCIPLES OF OPERATION**

#### 4-1. GENERAL

The LRCF is designed to operate in conjunction with an automated exciter unit in the associated transmitter system. Channel selection signals, derived from an external remote control unit (in the form of ground returns), is accepted by the LRCF, routed through a diode matrix, and applied to the appropriate relay solenoids for activation. The activated relay or relays produce an output, in a code-bit form, which is routed to a solenoid-stepping switch in the associated exciter unit. This action sets the exciter unit's channel selector switch to the corresponding setting selected at the external remote control unit.

#### 4-2. BLOCK DIAGRAM ANALYSIS (figure 4-1).

The external remote control channel selection signal is functionally a ground return used to energize four 26 vdc code-bit relays in the LRCF. Setting the eight-position remote channel selector switch at the desired channel setting routes a ground return path to the LRCF. The LRCF accepts the ground return at one of the eight input connections, routes the ground return through a diode matrix, and applies it to the solenoid of the appropriate code-bit relay.

The diode matrix accepts one of eight ground returns from the remote control unit, and passes it through a series of diode networks; the output applied to the code bit relays in a predetermined pattern. This pattern enables eight possible combinations of relay activation using the four basic code-bit relays. Therefore, a channel selection ground return may activate one or more code-bit relays, the combined outputs representing a particular exciter channel setting. (See table 4-1).



The code-bit relays, K1, K2, K3 and K4, have a constant -26 vdc applied to their solenoids. This voltage is supplied by the associated transmitter system power supply.

Activation of the code-bit relays is achieved by the ground return, initiated by the external remote control unit, routed through the diode matrix, to the ground return side of the appropriate relay solenoid.

The LRCF output is in the form of a -26 vdc parallel code structure, comprised of one or a combination of the four basic code-bits; bit-1, bit-2, bit-3, and bit-4. This -26 vdc output is routed to the associated exciter unit, applied to it's channel selector switch, thus setting it to the remote selected setting.

TABLE 4-1. RELAY SEQUENCE AND CODE BIT OUTPUT

CHANNEL	GROUND AT P8014	TERMINAL	RELAYS ACTIVATED	CODE BIT OUTPUT
1	PIN-B	7	K4	1000
2	PIN-C	14	K3	0100
3	PIN-D	10	K2	0010
4	PIN-E	8	K1, K4	1001
5	PIN-F	9	K3, K4	1100
6	PIN-G	13	K2, K3	0110
7	PIN-H	11	K1, K2, K4	10011
8	PIN-J	12	K1, K3, K4	1101

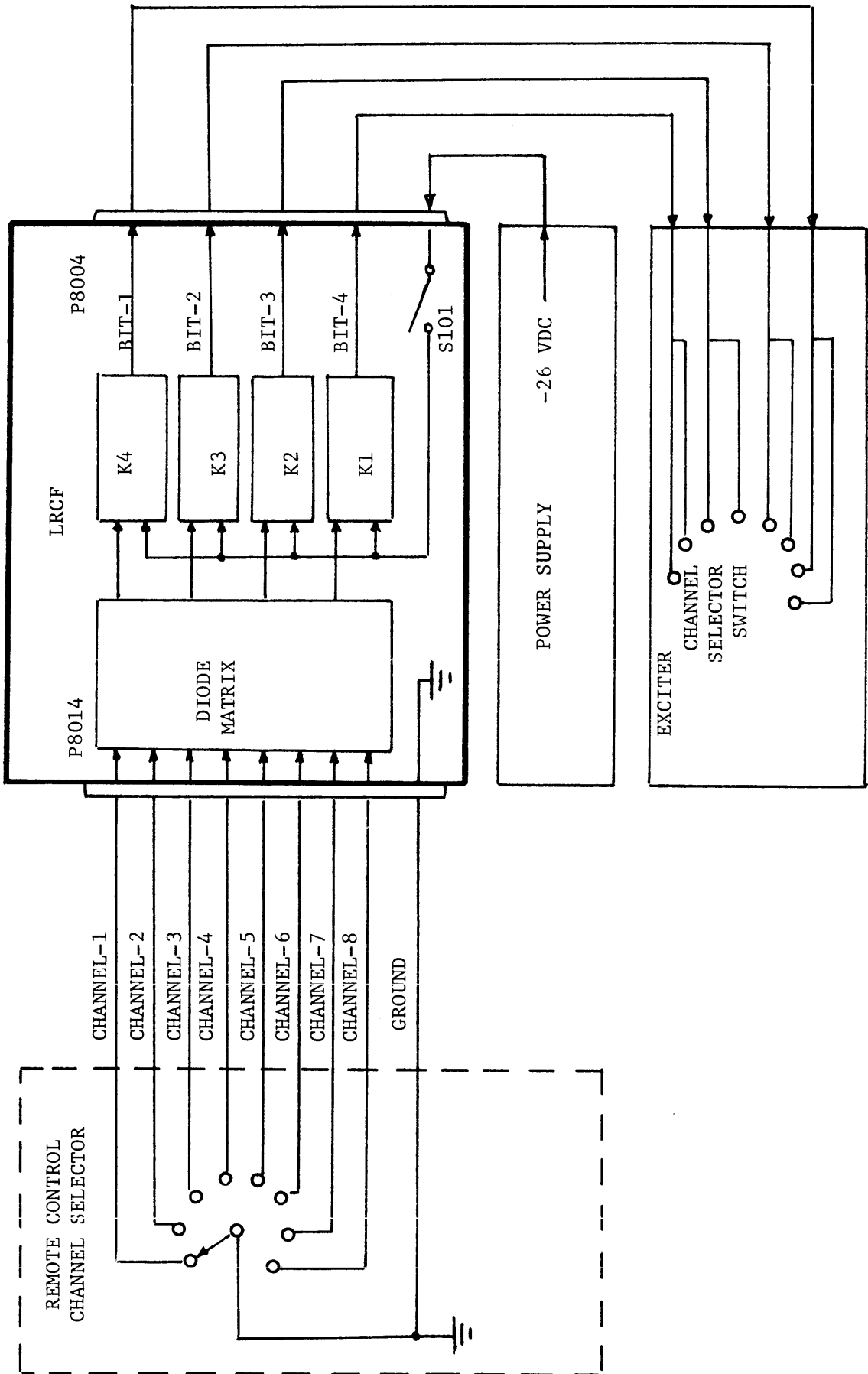


Figure 4-1. Simplified Block Diagram

## **SECTION 5**

### **MAINTENANCE**

#### 5-1. PREVENTIVE MAINTENANCE.

In order to prevent equipment failure due to dust, dirt or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

At periodic intervals, the equipment should be removed from its mounting for cleaning and inspection. The wiring and all components should be inspected for dirt, dust, corrosion, grease or other harmful conditions. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichlorethylene or methyl chloroform may be used, providing the necessary precautions are observed.

#### **WARNING**

When using toxic solvents, make certain that adequate ventilation exists. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on energized equipment or near any equipment from which a spark may be received. Smoking, "hot work", etc. is prohibited in the immediate area.

#### **CAUTION**

When using trichlorethylene, avoid contact with painted surfaces, due to its paint removing effects.

## 5-2. TROUBLESHOOTING

When a piece of equipment has been operating satisfactorily and suddenly fails, the cause of failure may be due to symptoms of past failures or due to component aging.

The first step in troubleshooting is to ascertain that proper equipment voltages are present and that all interconnecting cables are secure and functional.

If the above mentioned checks fail to locate the the fault, and the fault is known to be that of the LRCF, disconnect all interconnecting cables and remove unit from its mounting and perform a visual check. Observe for trouble-causing conditions such as arcing, grease, dirt, dust or other harmful conditions. Observe for loose connections, broken or burned wires, charred or discolored components. Proceed with the following troubleshooting procedures.

To check operation of relays K1 through K4, proceed as follows:

(1) With switch S101 set at REMOTE and -26 vdc applied to the LRCF, disconnect connector PL8014 from the associated remote control unit.

(2) Ground pin D of connector PL8014. Relay K2 should activate.

Using a Simpson 260 multimeter (or equivalent), check output voltage (-26 vdc) at terminal 3 (see figure 2-1).

### NOTE

Contact arm (armature) movement inside the relays can be observed through the clear protective cover.

(3) Ground pin C. Relay K3 should activate. Check for output voltage

at terminal 5.

(4) Ground pin E. Relays K1 and K4 should activate. Check output voltage at terminals 1 and 6, respectively.

### 5-3. REPAIR AND REPLACEMENT

Maintenance of the LRCF will consist mainly of component replacement, requiring no tuning or aligning. It should be noted that when replacing components having many wires connected, such as switches, relays, etc., the wires should first be tagged and marked for accurate identification when replacing.

When replacing components, the technician should observe for exact or equivalent replacements, by referring to the parts list in section 6.

Positioning and polarity of certain components should be observed before removing, so that the replacement component will fit and operate correctly.

## SECTION 6

### PARTS LIST

#### 6-1. INTRODUCTION

The parts list presented in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

- a. Reference symbol.
- b. Description as indicated in parts list.
- c. TMC part number.
- d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

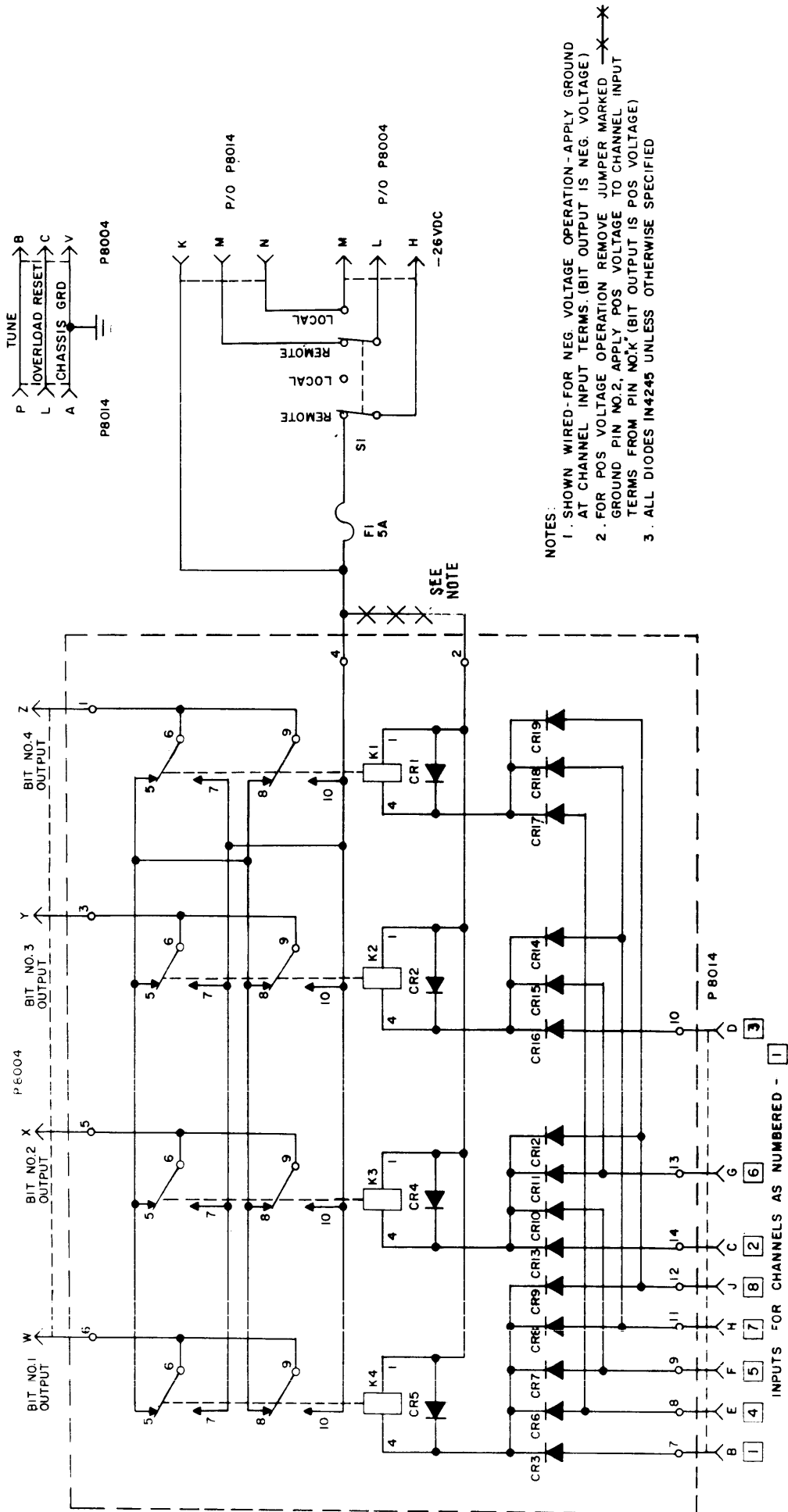
The Technical Materiel Corporation  
Attention: Sales Department  
700 Fenimore Road  
Mamaroneck, New York

PARTS LIST  
for  
REMOTE CONTROL UNIT, MODEL LRCF-1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR1	SEMICONDUCTOR DEVICE, DIODE: Silicon	1N4245
CR2 thru CR19	Same as CR1	
F1	FUSE, CRTRIDGE: 5 amps; 1-1/4" long x 1/4" dia. ; quick acting.	FU100-5
K1	RELAY, ARMATURE: DPDT; 700 ohms, $\pm 10\%$ DC resistance; operating voltage 24 VDC; current rating 35 ma; nominal power rating 700 mw at 25°C; eight contacts rated for 3 amps at 115 VAC or 5 amps at 29 VDC; clear high impact styrene dust cover case.	RL156-1
K2 thru K4	Same as K1	
P8004	CONNECTOR, PLUG, ELECTRICAL: male	MS3106B24-28P
P8005 thru P8013	NOT USED	
P8014	CONNECTOR, PLUG, ELECTRICAL: female	MS3102A20-29S
S1	SWITCH, TOGGLE: DPDT; 28° angle of throw; bat type handle.	ST22N
XF1	FUSEHOLDER: extractor post type, with moveable end terminals	FH100-1
XK1	SOCKET, RELAY: with retainer; 6 male beryllium copper gold plated contacts; black phenolic body.	TS171-5
XK2 thru XK4	Same as XK1.	

**SECTION 7**  
**SCHEMATIC DIAGRAMS**





- NOTES:
1. SHOWN WIRED FOR NEG. VOLTAGE OPERATION - APPLY GROUND AT CHANNEL INPUT TERMS. (BIT OUTPUT IS NEG. VOLTAGE)
  2. FOR POS VOLTAGE OPERATION REMOVE JUMPER MARKED \*  
GROUND PIN NO.2, APPLY POS VOLTAGE TO CHANNEL INPUT TERMS FROM PIN NO.1 (BIT OUTPUT IS POS VOLTAGE)
  3. ALL DIODES IN4245 UNLESS OTHERWISE SPECIFIED

Figure 7-1. Schematic Diagram, LRCF-1