



GEI - 52555

# DR-87 Recorder

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*GE Meter and Control*

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## Troubleshooting Guide

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GENERAL ELECTRIC

SOMERSWORTH, NEW HAMPSHIRE 03878

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## Introduction To The DR-87 Troubleshooting Manual

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**WARNING:** ANY WORK ON OR NEAR ENERGIZED METERS, METER SOCKETS OR OTHER METERING EQUIPMENT CAN PRESENT A DANGER OF ELECTRICAL SHOCK. ALL WORK ON THESE PRODUCTS SHOULD BE PERFORMED ONLY BY QUALIFIED INDUSTRIAL ELECTRICIANS AND METERING SPECIALISTS IN ACCORDANCE WITH LOCAL UTILITY SAFETY PRACTICES AND THE PROCEDURES OUTLINED IN THE HANDBOOK FOR ELECTRICITY METERING (8TH EDITION), CHAPTER 14 (AVAILABLE FROM THE EDISON ELECTRIC INSTITUTE, 1111 19TH STREET NW, WASHINGTON, DC 20036). THE INFORMATION CONTAINED WITHIN THIS BOOK IS INTENDED TO BE AN AID TO QUALIFIED METERING PERSONNEL. IT IS NOT INTENDED TO REPLACE THE EXTENSIVE TRAINING NECESSARY TO INSTALL OR REMOVE METERS FROM SERVICE.

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The DR-87 Troubleshooting Manual was developed as an aid in troubleshooting DR-87 recorders to a "module level" comprised of such items as the electronic circuit boards, cable assembly, optic assembly, battery and option board.

Although great efforts have been made to document every possible problem that may occur with the DR-87 recorder, problems that develop and are not fully described in this documentation should be referred to the General Electric Company.

Before attempting any type of troubleshooting or repair, it is strongly recommended that this troubleshooting guide and the instruction manual be thoroughly examined.

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These instructions do not purport to cover all details or variations in equipment nor provide for every possible contingency to be met in connection with installation, operation or maintenance. The equipment covered by these instructions should be operated and serviced only by competent technicians familiar with good safety practices, and these instructions are written for such personnel and are not intended as a substitute for adequate training and experience in safe procedures for this type of equipment. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the Meter and Control Business Department of General Electric Company.

## Method Of Troubleshooting

- A.) Before attempting any type of troubleshooting it is very important to be familiar with the complete contents of this documentation.
- B.) Begin troubleshooting by referring to the section entitled "Contents" and select the error description closest to the error which is presently being experienced.
- C.) Refer to the page pertaining to the mode of failure and fix for the problem.
- D.) Should hardware replacement be necessary, refer to the section entitled "Module Replacement" for part numbers and disassembly diagram.

## DR-87 Specifications

<u>POWER</u> 120/240/277 VAC -20 +15% @ 50/60HZ	<u>ON-SITE COMMUNICATIONS</u> 5000 Baud via OPTOCOM port	<u>PULSE INPUT CAPACITY</u> 16,382 pulses/interval per channel
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<u>ISOLATION</u> 2500 VAC RMS	<u>RECORDING CHANNELS</u> Programmable 1 thru 4	<u>MAX. PULSE INPUT RATE</u> 10 pulses per second
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<u>RECORDER BURDEN</u> 4W nominal	<u>BATTERY CARRYOVER</u> 40 day carryover	<u>BATTERY</u> 3.6V 850 MAH Lithium
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<u>RECORDING MEDIUM</u> CMOS RAM, with battery backup	<u>PI EXCITATION VOLTAGE</u> 6 to 20V @ 1-3mA	<u>PULSE INPUT REQUIREMENTS</u> Form A or C with solid state or mercury wetted relay or GE optics
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### MODEM

Internal 300/1200 Baud Bell 103/212 compatible full duplex modem

Transmit Level: -15.5 dBm (+/- 0.5 dBm)

Receive Sensitivity: -38.0 dBm (+/- 2.0 dBm)

Answer Tone Freq.: 2230 Hz (+/- 0.2%)

Answer Tone Detect: 2165 to 2290 Hz @ -10dBm

### Dialing:

Make Pulse: 60mS (+/- 1.0mS)

Break Pulse: 36mS (+/- 1.0mS)

Interdigit Break: 800mS (+/- 1.0mS)

Dial Tone Detect: 240 to 720Hz @ -20dBm

### Ring Detect:

30V min @ 15 to 70Hz

Ring On Time: 700mS min

Ring Off Time: 1000mS min

6000mS max

### MEMORY CAPACITY

Interval Length (Min.)	# Of Active Channels											
	--- CH-1 ---			--- CH-2 ---			--- CH-3 ---			--- CH-4 ---		
	RAM size			RAM size			RAM size			RAM size		
	16	32	64	16	32	64	16	32	64	16	32	64
1	4	10	21	2	5	10	1	3	7	1	2	5
5	21	50	107	10	25	53	7	16	35	5	12	26
15	65	150	321	32	75	160	21	50	107	16	37	80
30	130	301	642	65	150	321	43	100	214	32	75	160
60	261	602	1285	130	301	642	87	200	428	65	150	321

\* DAYS OF LOAD PROFILE DATA

## Hardware Malfunctions:

### NO POWER

- 1- Ensure A.C. power is properly terminated to the terminal block located on the lower right corner of the recorder base and that all wiring harnesses are secure.
- 2- Ensure the power input selection switch located on the upper right side of the recorder door is properly set for the applied input voltage and that input voltage is present.
- 3- Ensure the power switch located on the lower right of the recorder base is in the "ON" position.
- 4- Ensure the input fuse located on the lower right base of the recorder is present and not defective.

### RECORDER HOT

- 1- Ensure the input voltage selector switch located on the upper right corner of the main circuit board which is mounted on the cover is in the correct position. Replace the main circuit board if the recorder ceases to function properly.

### LED ERRORS

- 1- No LED's illuminated may indicate NO POWER error (SEE "NO POWER" error description in this section). Ensure that inputs to the lower left terminal block in the meter base are properly connected and that an input signal is present.
- 2- Low Battery Warning may indicate that the battery is not plugged in properly or that the battery is defective. If a known good battery doesn't correct the error, replace the main circuit board located on the door.
- 3- Unprogrammed Warning indicates the DR-87 must be programmed.
- 4- RAM and/or ROM Error Warning indicates that a RAM and/or a ROM checksum error has occurred. If replacing the RAM or ROM is not a fix, replace the main circuit board located in the recorder cover.
- 5- Interval Data Error Warning indicates a parity error has occurred. If replacing the RAM or ROM is not a fix, replace the main circuit board located in the recorder cover.
- 6- Clock Error Warning indicates that the external clock and software time are out of sync but this error should be self-correcting.

## Hardware Malfunctions:

### INPUT STATUS MONITOR NOT WORKING

- 1- Ensure the cable assembly is connected to the terminal header located in upper right corner of the option board. The option board is connected to the lower portion of the main circuit board located in the door of the recorder.
- 2- Ensure the polarity of the input signal is correct and that a signal is present. If no signal is present, check to see if the external signal circuit is energized and functioning properly.
- 3- Replace the option board to ensure it is not defective.

### MANUAL CALL BUTTON NOT FUNCTIONING

- 1- Recorder may not be programmed with central station phone number.
- 2- After using a handset to ensure a dial tone is present, ensure the phone line is properly terminated to the phone jack located mid-section on the main circuit board mounted on the recorder cover.
- 3- Review COMMUNICATION CONCERNS troubleshooting section.

### OUTPUT SWITCH NOT FUNCTIONING

- 1- Ensure the output switch is properly programmed.
- 2- Ensure the external circuit connected to the output switch is properly wired and energized.
- 3- Ensure the cable assembly from the terminal block located in the upper left corner of the recorder base is properly terminated to the option board located in the lower portion of the main circuit board located on the cover. The output switch cable assembly terminates on the lower, right header pins of the option board.

## Software Concerns:

### RECORDER TIME FAST/SLOW

- 1- Ensure the frequency setting of the S219 DIP switch is correct.
- 2- Ensure the timing of the programming device is correct.

### DATA STORAGE PROBLEM

- 1- Ensure the data storage capacity of the recorder has not been exceeded (SEE Recorder Specifications).
- 2- Ensure the S220 DIP switch is properly set for the amount of RAM available.
- 3- Ensure the maximum input pulse rate of 10 pulses per second and the maximum number of pulses per interval (16,382 pulses) has not been exceeded.

### RECORDER RESPONDS WITH DEFAULT PASSWORD

- 1- No password has been entered. Enter a password if desired.

### WRAP RESET OCCURS AT WRONG VALUE

- 1- Ensure the correct number of dials was used to calculate constant.
- 2- Ensure the proper K value was used to calculate constant.



## Software Concerns:

### INTERVAL DATA WON'T VALIDATE

- 1- Ensure the time stamping on the interval data is correct. If the interval data is not properly time stamped, the intervals must be manually edited to correct the time stamping. Re-program the recorder after reading and re-read after one interval to ensure re-programming corrected time stamping.

### ENERGY FROM PULSES VS. ENERGY READINGS DISAGREE

- 1- Ensure constant values are correct (i.e. K, SF, TF, R/P).
- 2- Ensure DR-87 is programmed for proper input device (i.e. Form 'A', Form 'C' or optics).
- 3- Review troubleshooting procedure entitled "Data Storage Problem" located in the Software Concerns Section.
- 4- Ensure KYZ or Optic inputs are properly connected and that the K input is not grounded at recorder end or meter end.
- 5- The DR-87 records pulses in the forward direction only. Ensure there was no reverse rotation and that the meter or device was programmed for forward disk rotation only.
- 6- Review LED status lights and related troubleshooting procedure located in the Hardware Malfunction section entitled "LED Errors".

## Communication Concerns:

### OPTOCOM READER/PROGRAMMER NOT COMMUNICATING

- 1- Ensure the reader/programmer probe is secure on the DR-87 OPTOCOM port.
- 2- Ensure proper communication I.D.'s have been established (i.e. present I.D. that the DR-87 is programmed with vs. the I.D. to be programmed are correct) and that security codes from the reader/programmer device match that of the program in the DR-87.
- 3- Ensure the OPTOCOM cable is properly terminated to the main circuit board located on the cover of the recorder. If communication still fails and the reader/programmer is known good, try another OPTOCOM port. If communication failure persists, replace the main circuit board.

### DR-87 ANSWERS ON A ROTARY PHONE

- 1- Tip and ring wires are reversed on the phone and should be reversed to correct the problem.

### DR-87 WON'T ANSWER

- 1- Ensure the phone number to the recorder is correct.
- 2- Ensure the DR-87 is not programmed not to answer the call.
- 3- Ensure there is not a power outage at the recorder site.
- 4- Ensure the number of rings does not exceed the carrier wait time of the modem (this is normally set to 255 seconds but is limited to 60 seconds for some modems).
- 5- Ensure the phone line is properly terminated to the phone jack located at mid-section on the right hand side of the main circuit board which is attached to the recorder cover.
- 6- Ensure the ring signal pulse width is of a duration no shorter than 0.7 seconds with 1 to 6 second between rings.
- 7- Ensure tip to ring is not reversed.

## Communication Concerns:

### DR-87 WON'T CALL CENTRAL STATION

- 1- Ensure the DR-87 is programmed with the correct central station phone number.
- 2- Ensure the telephone line is not being used.
- 3- Ensure the central station hardware is functioning with proper cabling to ports and modems and that the communication software at the central station is addressing the proper port for communication.
- 4- Ensure firmware is REV 6 or higher.
- 5- The ROM may be defective; If replacing the ROM isn't a fix, try replacing the main circuit board located on the cover of the recorder after ensuring the DR-87 can be called by the central station successfully (if not, proceed to the troubleshooting instructions entitled "DR-87 WON'T ANSWER" under Communication Concerns before replacing main circuit board.

### DR-87 PICKS UP, BUT WON'T COMPLETE CARRIER HANDSHAKE

- 1- Ensure for a master/slave configuration that:
  - 1. Master and slave have correct time and date.
  - 2. Master and slave are set to answer the same number of rings outside their answer windows.
  - 3. Answer windows start and stop times are the same.
- 2- Ensure the S219 selector switch is configured properly for the DR-87 application (configured as a master or slave unit).
- 3- Ensure the baud rate is correctly set and there is modem compatibility.

### TELEPHONE PASSWORD IS REJECTED

- 1- Ensure the password is correct.
- 2- Execute the troubleshooting procedure entitled "DR-87 PICKS UP, BUT WON'T COMPLETE CARRIER HANDSHAKE" in the Communication Concerns section for master/slave applications.

## Communication Concerns:

### 0% SUCCESS RATE IN COMMUNICATING WITH THE DR-87

- 1- Ensure the proper serial communications cable is being used.
- 2- A visit to the site may produce evidence of excessive voltage due to lightning or a high potential surge and the recorder should be replaced. If this is not the case and the LED indicators appear to be functioning normally with no errors, proceed with the troubleshooting procedure entitled "DR-87 WON'T ANSWER" in the Communication Concerns section.

### DR-87 CALLS IN WHEN NOT EXPECTED

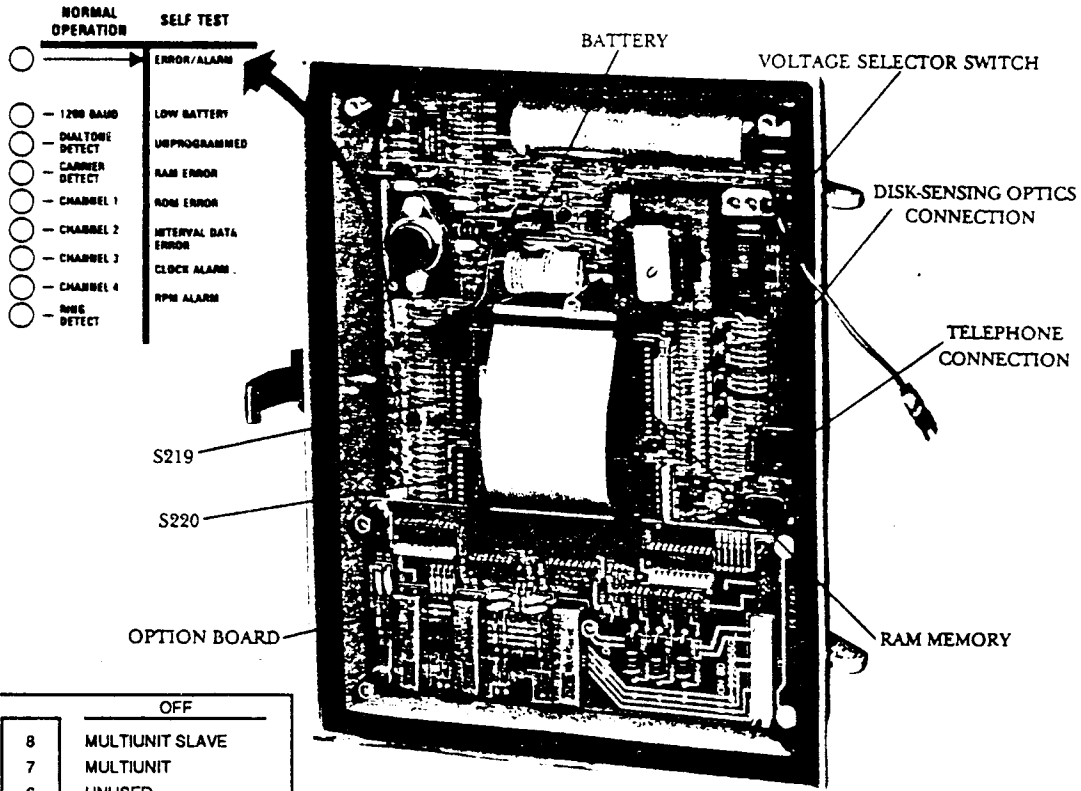
- 1- The phone line may have been busy when the DR-87 tried to call in and is using its retry algorithm. Complete the call to stop the recorder from calling in.
- 2- The recorder may be programmed to call in on an error alarm.
- 3- The manual call button may have been initiated in the field.

### VOICE USER OF SHARED PHONE LINE HEARS CLICKING

- 1- A faint click may be heard when the DR-87 goes "off-hook". No action is needed as the recorder notes the dial tone is not present, hangs up and tries to call again later.
- 2- DR-87 is in the process of dialing. Wait for the recorder to finish and press the "on-hook" button to free the phone line for use. The DR-87 will try to call again later.

### BAUD RATE CONTINUES AT ORIGINAL RATE AFTER CHANGE

- 1- Self correcting where the baud rate will change automatically on the next communication.

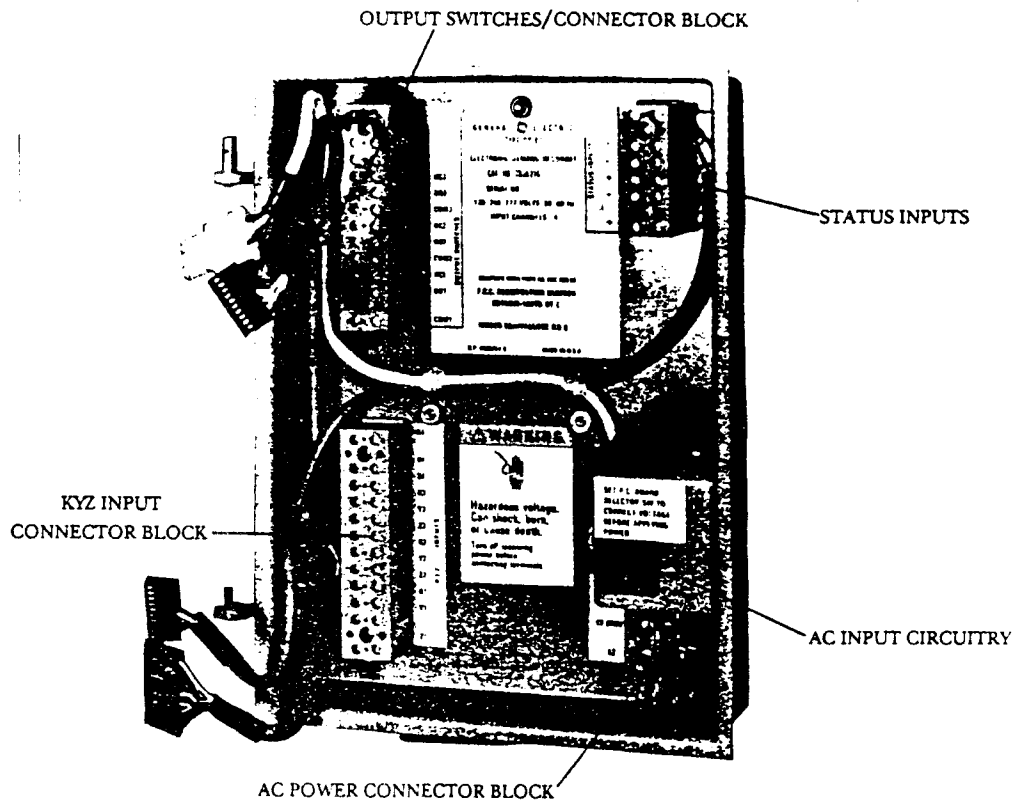


ON		OFF
MULTIUNIT MASTER	8	MULTIUNIT SLAVE
STAND ALONE	7	MULTIUNIT
UNUSED	6	UNUSED
60 HZ	5	50 HZ
NORMAL OPERATION	4	MFG. TEST
NO MEMORY PROTECT	3	MEMORY PROTECT
P/I INPUT	2	DISC SENSING OPTICS
FORM C CONTACTS	1	FORM A CONTACTS

S219

ON		OFF		
RAM	32 OR 64K	8	16K	RAM
	16K	7	32 OR 64K	
	32 OR 64K	6	16K	
	16K	5	32 OR 64K	
ROM	256K	4	512K	ROM
	512K	3	256K	
	256K	2	512K	
	512K	1	256K	

S220



**Reference  
Number**

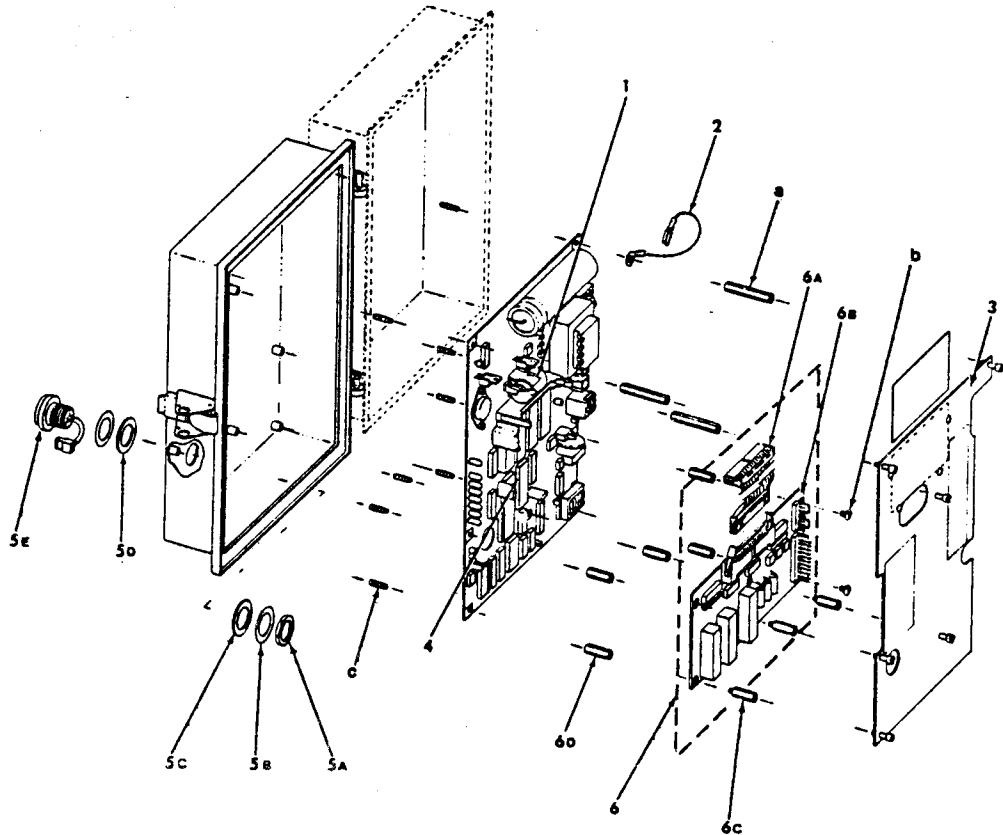
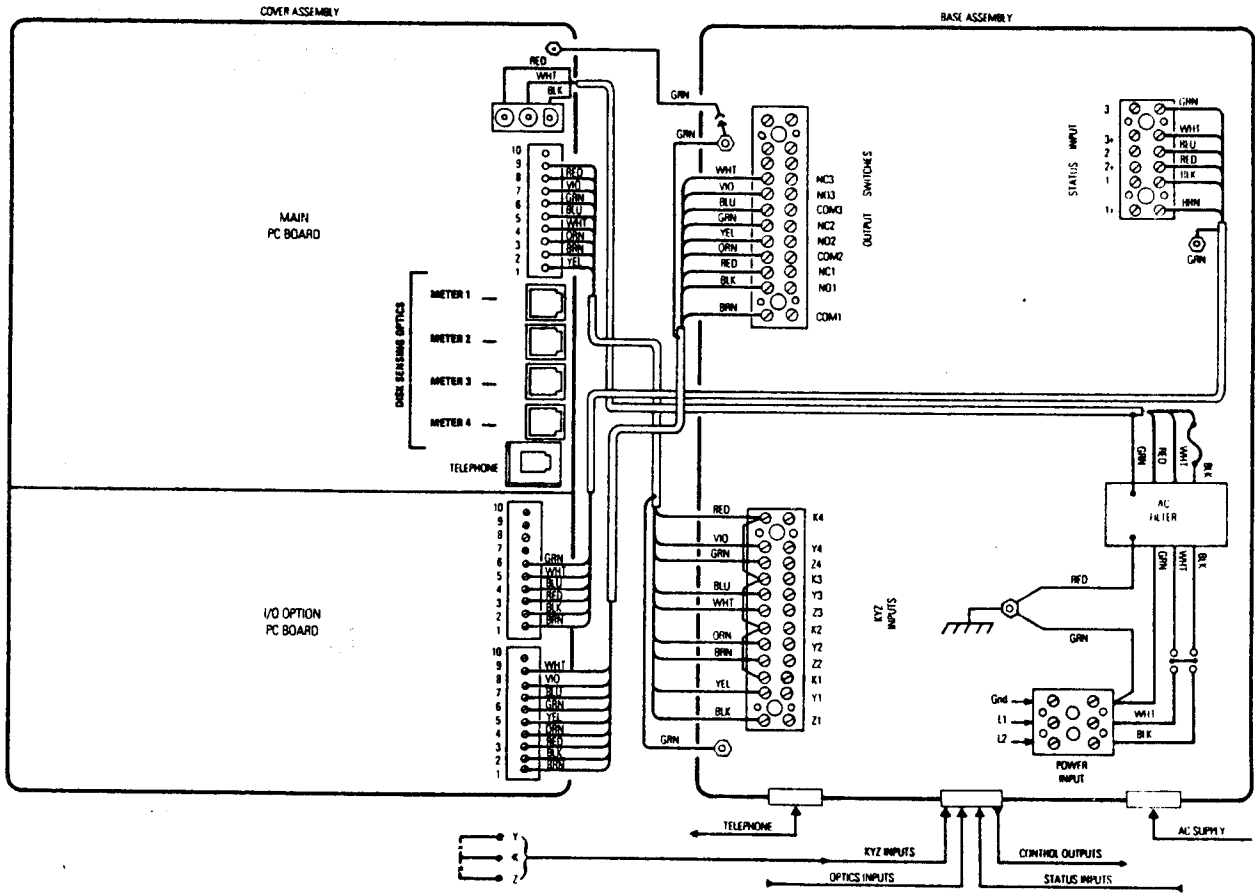
**Cover Assemblies and Components**

	Cover Assembly, 16K with Options*	9935686G1
	Cover Assembly, 16K without Options**	9935686G2
	Cover Assembly, 32K with Options*	9935686G3
	Cover Assembly, 32K without Options**	9935686G4
	Cover Assembly, 64K with Options*	9935686G5
	Cover Assembly, 64K without Options**	9935686G6
1	Lithium Battery	9936620G1
2	Ground Wire Assembly (green)	9936855G1
3	Protective Shield Assembly	9936792G1
4	Load Profile Memory Upgrade Kits	
	16 Kb RAM	(2) 9936931G7
	32 Kb RAM	(1) 9936931G8
	64 Kb RAM	
	16 Kb to 64 Kb	(2) 9936931G8
	32 Kb to 64 Kb	(1) 9936931G8
5	OPTOCOM Assembly	9937022G1
5A	Hex Nut	
5B	Washer	
5C	Inner Gasket	
5D	Outer Gasket	
5E	OPTOCOM Receptacle Assembly	
6	I/O Option Upgrade Kit	9936853G1
6A	Ribbon Cable***	
6B	Printed Circuit Board	
6C	Male-female Spacer	
6D	Double Female Spacer	
6 (Fig. 16)	Cable Harness Assembly - Output	
7 (Fig. 16)	Cable Harness Assembly - Status Input	

\* Includes all parts in Figure 17

\*\* Includes all parts in Figure 17 less Option Board Assembly (6)

\*\*\* Ribbon cable is available separately as 9935671G1



Reference  
Number

Base Assemblies and Components

	Base Assembly with Options Includes all parts in Figure 16	9935685G1
	Base Assembly without Options Includes all parts in Figure 16 less Cable Harness Assemblies for Options (6 & 7)	9935685G2
1	Fuse, slow blow (FLQ 1/4)	9688401G28
2	Fuse Holder Assembly	9937018G1
3	Rocker Switch	9935664G2
4	Power Input Assembly	9936841G1
4A	Screws	
4B	Terminals	
4C	Red Ground Wire Assembly	
4D	Printed Circuit Board	
4E	Nylon Spacer	
4F	Terminal Strip	
4G	Ground Connection Lead	
4H	Power Cable Assembly	
5	Cable Harness Assembly - KYZ	9937019G1
5A	Screws	
5B	Terminal Strip	
5C	KYZ Cable and Connector	
5D	Cable Clamp	
6	Cable Harness Assembly - Output	9937020G1
6A	Terminal Strip	
6B	Screws	
6C	Cable Clamp	
6D	Output Cable, Assembly and Connector	
7	Cable Harness Assembly - Status Input	9937021G1
7A	Terminal Strip	
7B	Screws	
7C	Cable Clamps	
7D	Hex Nuts	
7E	Status Input Cable and Connector	
7F	Cable Clamp	
	Nameplate	9935683G5
	Nameplate	9935683G6



