# INSTRUCTIONS for

# SHANDINGS OF THE STATE OF THE S

# **VMS SERIES**

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THE SUPERIOR ELECTRIC COMPANY

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### INTRODUCTION

The Superior Electric STABILINE AC Voltage Monitor is a single phase portable instrument designed to identify a broad variety of line aberrations while offering simplicity of operation.

The system consists of a Detector Module and a Printer/Controller Module housed together in a briefcase. Threshold limits, calendar and clock settings, as well as a monitor identification number can easily be entered with the aid of push button keys on the Printer/Controller Module.

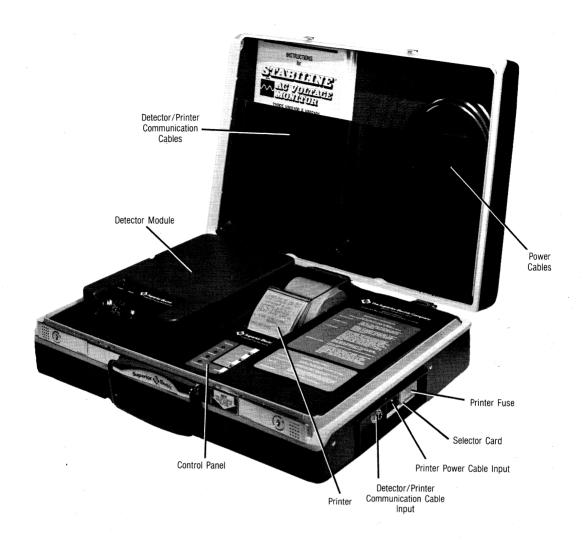
The Detector Module can be removed from the briefcase and left at a site to perform its monitoring function. Any number of Detectors with identical or different threshold values may be left at various sites to gather information. Each is provided with an audible alarm as well as a visible LED lamp to signal AC line events. An event is a power line condition which exceeds the preset threshold. When the Detector is attached to the Printer, the event, its character, time and duration may be printed out as it occurs or the 10 worst cases stored and printed on demand only.

If the Detector Module is operated independently of a Printer, the contents of its memory may be printed out by simply connecting it through a cable to a Printer/Controller and pushing the PRINT key. The data is presented in a categorized format with a summary of the 10 worst events in each category followed by a list of the last 10 chronological events that qualify by threshold.

The Detector Module and Printer/Controller can both be interfaced to an industry standard modem through optional Modem Adapters. This feature permits communication over a conventional telephone line under Bell System Standard 103B. Ten rates are available with 110 or 300 baud acceptable for telephone line implementation. The data transmission is full duplex asynchronous.

The Voltage Monitor is able to distinguish and identify the following AC line perturbations exceeding preset thresholds:

- LOW & HIGH VOLTAGE levels based on a moving 16 cycle time period.
- SAGS & SURGES of ½ to 511 cycle length including dropouts.
- IMPULSES with a rise time of less than 50 microseconds and up to 1000 volts.
- COMMON MODE NOISE between Line and Ground exceeding a 5 volt factory set threshold.
- BLACKOUTS exceeding a 16 cycle duration at 120 volts nominal.



# STABILINE® AC VOLTAGE MONITOR SYSTEM

The system is capable of totalizing up to 28,675 events (seven times 4095 in any one category plus 10 last events). It can also categorize and identify 80 detailed worst case events and retain them for 2 to 3 months under its backup battery power. Either 120 or 240 VAC lines may be monitored by simply changing the power cable and the threshold settings.

The complete unit contained in the briefcase consists of a thermal Printer, the function control panel and associated circuitry. The case has a convenient space for the removable Detector Module which houses the main functional memory, an audible and a visible event alarm system, a rechargeable NiCad reserve battery pack and the Detector safety fuses.

### PREPARATION FOR USE

Examine the Voltage Monitor for signs of damage before and after removing it from its shipping container. Any damage should be reported immediately to the carrier and/or The Superior Electric Company.

The unit comes shipped with a set of two keys for the briefcase and 5 cables. Any Samsonite dealer can replace lost keys.



CABLE 1-84 INCH 120 VAC DETECTOR POWER CABLE NO. B209693G1



CABLE 2-72 INCH 240 VAC DETECTOR POWER CABLE NO. B209723G1



CABLE 3-12 INCH 120 VAC CONVENIENCE POWER CABLE NO. B209692G1



CABLE 4-84 INCH 120 VAC PRINTER POWER CABLE NO. B209571G1\*



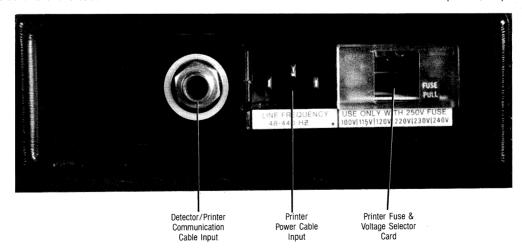
CABLE 5—72 INCH REMOTE DETECTOR/PRINTER COMMUNICATION CABLE NO. B209920G1

### **EXTERNAL CABLE INPUTS**

Before connecting the cables, become familiar with the cable receptacles and the panel located on the outside of the briefcase as shown. NOTE: Remove cover door by pressing inward at one end.

### PRINTER FUSE

Should the fuse need to be replaced, expose it by



\*Cable 4 (120 VAC Printer Power Cable) is supplied with a U.S. specification plug. For use with Type VMS101, it may be necessary to replace it with a different plug to match the power source receptacle.

sliding the plastic window to the left. Pull the FUSE PULL lever all the way to the left to lift the fuse out. Replace with Type AGC 250V,1 Ampere fuse.

### **VOLTAGE SELECTOR CARD**

This card permits external selection of different transformer taps for use of only the Printer at voltages other than those available in the Continental U.S. or Canada. The Voltage Monitor comes shipped with the voltage card inserted for 115/120 VAC operation. There should be no need to change it unless the only AC lines available have voltages other than 115/120 VAC must be used, see Appendix for details on changing the card.

### 120 VAC OPERATION

The 120 VAC Printer and Detector cables shown should be used for normal 120 VAC operation.

- 1. Insert the 3-lead female Printer power plug of Cable 4 into the Printer power input socket.
- 2. Insert the brown 6-lead Detector power plug of Cable 1 into the power cable receptacle of the Detector. Push it into the socket until it clicks in place. To disconnect this brown plug from the front panel of the Detector, first remove the adjacent phone plug. Grip the sides of the brown plug near the panel and squeeze them together to release the locking tabs. Do not use force.
- 3. Recheck the Printer voltage selector card for correct position. Plug both male ends of Cables 4 and 1 together "piggyback" style and plug them into the 120 VAC outlet of the line to be monitored.
- 4. The equipment originally plugged into that outlet may be added to the two Voltage Monitor plugs. Be certain that the 120 VAC outlet is wired for 120 VAC. If it is improperly wired for 240 VAC, the Voltage Monitor fuses will blow.

Cable 3 is provided for use when the 120 VAC line to be monitored is inaccessible through an ordinary outlet but is accessible via a terminal strip within a piece of equipment. Observe the standard NEC color coding.

Cable 5 serves as a communications link be-

- tween an operating Detector and the Printer.
- With the Voltage Monitor and Detector plugged in, check the Printer control panel to make certain the MEMORY LED is ON. Check the front panel of the Detector to make certain the POWER LED is ON

### 200-300 VAC OPERATION OF DETECTOR MODULE

Use Cable 2 for 240 VAC operation. This Detector power cable is not provided with an AC line plug because of the wide variety of outlet receptacles in common use.

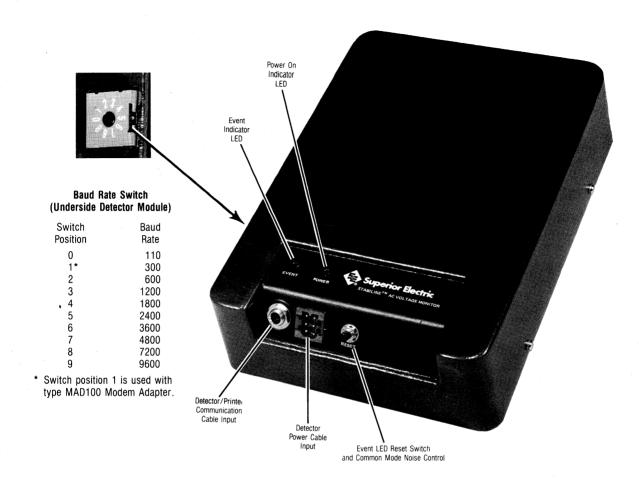
- 1. Insert the 3-lead female Printer power plug of Cable 4 into the Printer power input socket.
- Attach the bare leads of the Detector power cable (Cable 2) to a suitable plug or to the terminal strip of the equipment wired to the 240 VAC line to be monitored. Connect black and red to L<sub>1</sub> and L<sub>2</sub>, white to neutral, and green to safety ground.
- Plug the male end of the Printer power cable into a convenient 120 VAC outlet. If none exists, see Appendix for 240 VAC printer operation.
- 4. Insert the brown 6-lead Detector power plug of Cable 2 into the power cable receptacle of the Detector. Push it into the socket until it clicks in place. To disconnect the brown plug, grip and squeeze the sides to release the locking tabs. Do not use force.
- 5. With the Voltage Monitor and Detector plugged in, check the Printer control panel to make certain the MEMORY LED is ON. Check the front panel of the Detector to make certain the POWER LED is on. If the Printer MEMORY LED is flashing, one of the cable connections is loose. Check Detector connections also.

The Voltage Monitor always begins its operation in the MEMORY mode when power is applied to the Printer Module.

CAUTION: DO NOT ENERGIZE PRINTER until the voltage selector card has been re-checked for correct voltage position. DO NOT USE CABLES 1 AND 3.

NOTE: VMS Series units manufactured for distribution by The American Superior Electric Company, Ltd. (Canada) and Superior Electric Nederland B. V. (Europe) differ in the tape label printouts.

Additionally, because Type VMS101 is set up at the factory for Printer operation from a 120 volt power source, it will be necessary to follow the procedure given on page 20 if conversion to 220 volt or 230/240 volt Printer operation is desired.



### DETECTOR MODULE

The Detector is a completely self-contained functional unit in a stand-alone case. It may be used in the brief-case or externally as an integrated system when setting thresholds, identification number, the calendar and clock, and when monitoring of a power line is desired.

Once the above settings have been made, the unit can be left at a site to monitor line activity over extended periods of time. It can be placed atop a piece of equipment or hung on a wall using its mounting bracket and one or two screws.

Only a 120 or 240 VAC line is needed for operation. This must be accomplished by using the proper input power cable. The POWER LED will indicate when the unit is ON. Whenever an AC line event exceeds the

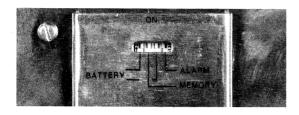
preset thresholds, the EVENT LED will emit light and an audible alarm will produce a pulsing sound. The EVENT LED will remain ON until it is manually reset with the RESET switch or until memory is cleared.

Turning the Detector upside down will reveal the mounting bracket on the bottom. Four small switches can be seen through the rectangular cutout at the top of the bracket. These switches can be easily reached and reset with the aid of a straightened paper clip or small screwdriver. The switch functions are labeled on the surface of the bracket as shown.

### **BATTERY (Switches 1 and 3)**

Both switches should be ON at all times. Should both be switched off while the Detector is disconnected

from the power line, all data including threshold settings and clock will be lost from the memory. Both switches should be left ON unless the unit is to be stored for more than 3 months. If both switches are OFF when power is applied, the alarm will sound without pulsation and cannot be defeated. Should this occur, de-energize for 30 seconds then turn switches ON and re-energize.



### MEMORY (Switch 2)

This switch only affects incoming signals. Turning it off will prevent the storage of any new events. This may be desirable prior to unplugging a Detector from a power line to prevent a disconnect from being read as a BLACKOUT. The switch must be kept ON at any time it is desired to add events to memory.

### ALARM (Switch 4)

This switch disables the audible alarm signal without affecting the EVENT LED. It may be desirable to switch the alarm off if the line monitored is particularly noisy or while resetting threshold levels. The alarm cannot be defeated in event of a battery problem.

### REMOTE OPERATION

The Detector can be interfaced with an industry standard RS232 modem through the use of Modem Adapter type MAD100. The Adapter allows communication over standard telephone lines under Bell System Standard 103B.

The baud rate switch is located on the underside of the Detector Module. Ten baud rates are available with 110 or 300 acceptable for telephone line implementation. The output from the Modem Adapter unit is by a standard RS232 25-pin male plug utilizing pins 2, 3, 7 and 20. The transmission is full duplex asynchronous.

### COMMON MODE SENSING CONTROL

Because the common mode threshold is factory set to a rather low value, it may be desirable to defeat the common mode sensing in a poor ground or high noise environment. The status of the common mode sensing is printed whenever the ID number is printed. The status can be sensed and/or changed by pressing and holding the RESET switch. If the event LED flashes when the switch is held, the common mode sense circuit is OFF. If the LED remains dark, the common mode sense circuit is active. If the RESET switch is depressed for approximately 5 seconds, the common mode status will change and the event LED will indicate the new status as described. Releasing the switch in either the flashing or OFF mode will result in the common mode and sensing circuit being OFF or ON.

### **PRINTER**

The Printer is a 20-column thermal line unit generating a  $5 \times 7$  dot matrix at the rate of 1.75 lines per second.

To reload or clean the Printer, remove the plastic cover by gently squeezing its sides and lifting its front up and out to the front.

To CLEAN the Printer head, periodically feed through the Printer, before reloading, a 2½ inch wide strip of clean bond paper or the head cleaning card provided in the paper pack. For extremely dirty Printer heads, dampen the bond paper with isopropyl alcohol and repeat the procedure.

To RELOAD paper, use 2½ inch wide thermal printer paper such as Texas Instruments No. TP30250 or Superior Electric No. A209720G1 having a 3 inch roll diameter. Remove the spool leaving a short section of paper in the Printer. Transfer the spindle to the new spool. Replace the spindle in its cradle with the paper

feeding from the bottom of the roll. Overlap the new paper with the end of the section left from the previous roll. A wetted finger helps feed the paper into the mechanism. Be certain that the paper roll friction springs are forward, clear of the spindle cradles.

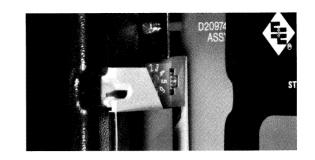
Depress the FEED key until the paper has fed through and appears to be properly aligned. Feed the leading edge of the paper through the slot in the cover so it runs under the sharp edge.

To reinstall the plastic cover (Superior Electric No. C210274G1), hook its rear lip under the edge of the liner. Then push to the rear and down. The notches in the cover should fall behind the Printer mechanism rails.

Should the feed roller become displaced upward during reloading, push it down.

CAUTION: Do not operate the Printer without paper.

BAUD RATE ADJUSTMENT SWITCH — The Printer/Controller can be interfaced with an industry standard RS232 modem by using Superior Electric Modem Adapter type MAP100 which allows communication over standard telephone lines. The baud rate switch is located beneath the left side of the Printer paper roll. The ten baud rates and switch positions are listed on page 6. The data transmission is full duplex asynchronous.



### CONDENSED OPERATING INSTRUCTIONS

- 1. Plug in Printer power cable after checking voltage selection card.
- 2. Plug in Detector power cable.
- 3. Plug in communications cable.
- 4. Push PRINT while in MEMORY mode.
- 5. Advance to CLOCK mode. Check clock and set if necessary.

- 6. Advance to THRESHOLD mode. Check thresholds and set if required.
- Set Voltage Monitor identification number.
   This can only be accomplished after the threshold setting procedure has been completed. Check the common mode status.
- Advance to either ON LINE or MEMORY mode. Printout of the header will begin immediately.

### **IMPORTANT OPERATING NOTES**

- Be certain that the Printer voltage selector card is at the proper value before applying power.
- Do not operate the Voltage Monitor in the ON LINE mode with the case closed. Excessive paper buildup may jam the Printer.
- To avoid recording operator-induced blackouts, turn the MEMORY switch off before unplugging the Detector from its power connection. Turn MEMORY switch back on after reconnecting to power.
- If a pulsating alarm sounds continuously, the preset threshold limits may be set too close to the existing AC line condition. Check and reset the threshold. A continuous common mode event exceeding the internal threshold may be present. See section on common mode sensing control on page 7.
- The BATTERY switch on the Detector should not be turned off unless the unit is to be stored for three months or longer.

- If a steady alarm sounds continuously and cannot be defeated by the ALARM switch, check the BAT-TERY switch then de-energize and re-energize after 30 seconds. A continued alarm indicates a low battery charge.
- Whenever disconnecting the brown 6-lead power plug from the Detector front panel or its socket on the exterior of the briefcase, remove the phone plug first. Then squeeze the sides of the plug together close to the panel to release its locking tabs from the socket. Do not use force to pull it free.
- Hand carry the Voltage Monitor when traveling by air. Remember it is a delicate instrument. Baggage X-rays will not harm the unit nor destroy nor alter data in memory.
- Be certain that the baud rate setting is the same on the Detector and the Printer. Factory setting is position 9 (9600 baud). Normal setting for use with telephone lines is position 1 (300 baud).

### OPERATIONAL FUNCTIONS (MODES)

**MEMORY** — When Printer and Detector are linked together, each time this mode is entered, the Printer provides a tape bearing a standard label, common mode status, Detector identification number and current line voltage. Left in this mode, the instrument prints nothing further until midnight when it

automatically produces a summary printout. This occurrence also clears and resets the memory of the Detector Module. If desired, interim printouts may be obtained on demand by actuating the PRINT button.

When the Detector is separated from the printer, its memory continues storing the ten worst events in each category and the last ten chronological events for as long as it remains in operation independent of the Printer. These events will be assembled in chronological order for a maximum of 58 consecutive days.

### **CLEARING MODUTECTOR UNIT MEMORY**

To clear the Detector Module memory, place the Voltage Monitor in the ON LINE mode and depress the SELECT and PRINT keys. While holding these keys down, depress the MODE key. The memory will be cleared of all event data. However, the preset thresholds, date and time, common mode status and Detector ID will be retained. Memory clear will be verified by a reset start-up printout immediately following this procedure.

The memory is automatically cleared following the completed midnight printout while the Voltage Monitor is operating in the MEMORY mode with the Detector and Printer in communication.

Turning off the battery will also clear the memory as well as reset thresholds, date and time and Detector ID to default values.

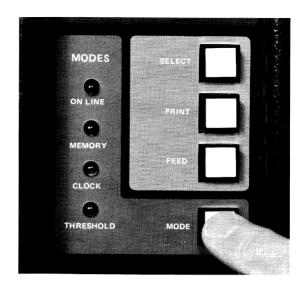
**ON-LINE** — Each time this mode is entered, the Printer provides the same initial information as above followed by a list of the last ten events. Left in the ON LINE mode, the unit will respond directly to all new incoming line events by printing the information as it occurs. Should a blackout occur on the Printer power line, the unit automatically will shift to the MEMORY mode when power is restored.

**CLOCK** — Each time this mode is entered, the Printer provides a tape containing the prevailing date and time. In this mode the operator is able to change any of this information, if desired.

**THRESHOLD** — Each time this mode is entered, the Printer provides a tape containing all of the preset threshold information. The operator may change any of these limits as well as enter a new Detector identification number, if desired.

**CHANGING FUNCTION MODES** — Depressing the MODE key will increment the function of the Monitor to the next mode as shown.

**CLOCK FUNCTION** — Upon entering this mode, the Printer produces a printout of the prevailing date and time. This information is kept up to date by a 24-hour clock located in the Detector Module. The clock has an accuracy of  $\pm$  10 seconds per day and is sup-



ported by a backup battery when AC power is discontinued. The clock permits the tracking of AC line events in real time.

DATE TIME MO/DA/YR HR:MN:SE 06/01/81 16:02:06

### SETTING THE CALENDAR AND CLOCK

During this procedure, it is a good idea to set the clock ahead by 1 or 2 minutes and let real time catch up to this setting before fixing it in memory.

Only useful digits have been retained to save time and effort in setting:

MO DA YR HR MN (Month) (Day) (Year) (Hour) (Minutes) 0-1, 0-9 0-3, 0-9 0-9, 0-9 0-2, 0-9 0-5, 0-9

- 1. Press SELECT key and enter CLOCK SET mode.
- 2. Press SELECT key to print "?" under the first digit enabling it to be changed. Pressing the key again moves the "?" to the next digit, etc. Continue until the digit to be changed is reached.
- 3. Press PRINT key to increment the enabled digit up to the numeral desired.
- 4. Press SELECT key to advance "?" to last minutes digit. Press it once more and the entire new setting will print with the seconds reset to 00 and an asterisk (\*) at the end of the column concluding the setting routine.
- Press MODE key to set the clock with the new values.

**FEED KEY** — The FEED key advances the Printer tape when depressed.

**EXAMPLE:** Operator desires to change date from 06/08/81 to 06/03/81 and the time from 09:38 to 09:40 p.m.

DATE TIME MOZDAZYR HR:MN:SE 06/08/81 21:38:12 CLOCK SET 99 99 06/09/81 21 38/12 06/00/81 21:38:12 06/01/81 21:38:12 06/02/81 21:38:12 06/03/81 21:38:12 99 99 9 06/03/81 21:48:12 06/03/81 21:49:12 06/03/81 21:40:12 06/03/81 21:40:00\*

Press MODE key until CLOCK mode is reached.

Press SELECT to enter CLOCK SET mode, printing one "?"

SELECT key pressed 3 times to address appropriate digit.

Press PRINT to increment 8 to 9.

Printout obtained.

Press PRINT to increment 9 to 0.

Press PRINT to increment 0 to 1.

Press PRINT to increment 1 to 2.

Press PRINT to increment 2 to 3.

Press SELECT 5 times to address appropriate digit.

Press PRINT to increment 3 to 4.

Press SELECT once to address next digit.

Press PRINT to increment 8 to 9.

Press PRINT to increment 9 to 0.

Press SELECT once to end routine, printing 06/03/81 09:40:00\*

6. When time is synchronized, press MODE key to enter and fix the new setting. In event of an error, continue to press the SELECT key after the asterisk (\*) and re-enter the CLOCK setting mode. The CLOCK setting mode can be escaped provided the asterisk (\*) is not set, or has been bypassed, by pressing the mode key. The clock will be undisturbed.

### **PRINT KEY**

The PRINT key functions in the CLOCK mode to provide a printout of the current time and date each time it is pressed or to increment digits when setting as described.

### THRESHOLD FUNCTION

Upon entering the THRESHOLD function mode, the

Printer produces a printout of the preset VOLTAGE THRESHOLDS.

VOLTAGE THRESHOLDS SAG LO HI SUR IMP 105 110 130 130 050

This information, once entered into the Voltage Monitor, is stored in a non-volatile memory for use in comparing AC line excursions. If thresholds more consistent with the operating parameters of the specific equipment are desired, the following procedure is required:

### **SETTING THE THRESHOLDS**

Setting is done in the THRESHOLD mode.

- 1. Press SELECT key to enter THRESHOLD SET mode placing "?" under the first digit.
- Press SELECT key to print "?" under the next digit enabling it to be changed. Pressing the key again moves the "?" to the next digit, etc. Continue until the digit to be changed is reached.
- Press PRINT key to increment the enabled digit up to the desired numeral.
- 4. Press SELECT key to advance "?" to the last digit. Press it once more and the entire setting as altered will print with an asterisk (\*) at the end of the column ending the setting routine.
- Press MODE key to enter the printed data into memory. As the printed data is entered, the line "DET ID:1234 CM-ON" is printed. If it is desired to change the identification number at this point, press SELECT. If change is not desired, press MODE again.

### **ENTERING DETECTOR ID NUMBER**

This is a continuation of the THRESHOLD mode function. If entering a new identification number is desired, press SELECT key as in Step 1 above. This will

print "?" under the first of the 4 ID digits enabling it to be changed. Pressing the SELECT key again will move the "?" to the next digit, etc.

Pressing the PRINT key will increment the enabled digit up to the desired numeral.

After the SELECT key has been pressed five times, the ID setting routine is finished. The entire new number will be printed with an asterisk (\*) to its right followed by common mode status indication.

Pressing the MODE key will enter the printed ID into memory and advance the MODE to ON LINE.

### **PRINT**

The PRINT key functions in the THRESHOLD mode or the Detector ID mode to provide a printout of the thresholds or the Detector ID number stored in the memory or to increment digits once the setting mode is entered.

**EXAMPLE:** To change threshold setting of sags from 105 to 100 volts, high average threshold from 130 to 132 volts and surge threshold from 130 to 135 volts. Low average and impulse threshold will remain the same.

Printout after pressing MODE key to advance to THRESHOLD mode.

Press SELECT key.

Printout plus 1 "?".

Press SELECT key two times.

Press PRINT key to increment 5 to 6.

Press PRINT key to increment 6 to 7.

Press PRINT key to increment 7 to 8.

Press PRINT key to increment 8 to 9.

Press PRINT key to increment 9 to 0.

Press SELECT key 6 times to high average units digit.

Press PRINT key to increment 0 to 1.

Press PRINT key to increment 1 to 2.

Press SELECT key 3 times, "?" moves to SURGE units digit.

100	110	132	131	950	Press PRINT key to increment 0 to 1.
100	110	132	132	Ø50	Press PRINT key to increment 1 to 2.
100	110	132	133	050	Press PRINT key to increment 2 to 3.
190	110	132	134	050	Press PRINT key to increment 3 to 4.
100	110	132	135	050	Press PRINT key to increment 4 to 5.
				777	Press SELECT key 4 times to end setting routine.
100	110	132	135	050*	Printout after last SELECT.
	and the second second			1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	

	41.025.00 <b>1</b> (0.056)	STATE OF THE STATE OF	WODE Key
DET ID	1234	CM-ON	Printout afte
ID SET	<b>7</b>		SELECT key
	2234		PRINT key
			SELECT key
	2334		PRINT key
	97		SELECT key
	2334*		SELECT key
	11 - 36 M 10 SEPT 10		

MODE key pressed to fix new settings in memory.

Printout after MODE pressed.

SELECT key pressed once.

PRINT key pressed to increment 1 to 2.

SELECT key pressed once.

PRINT key pressed to increment 2 to 3.

SELECT key pressed twice.

SELECT key pressed once more to end set.

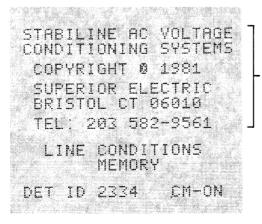
MODE key pressed to enter new ID.

Any time an \* is not present, the threshold/ID mode can be escaped by pressing the MODE key.

### **MEMORY MODE FUNCTION**

Whenever the Voltage Monitor is started, it automatically begins its operation in the MEMORY mode. The

Printer produces a printout of the standard label, functional mode, current on line voltage, the Detector ID number and common mode status.



- Label.

Mode.

Detector ID Number. Common Mode Status. After this point, no further data will be printed in this mode until midnight. At this time, a summary printout is produced of the preceding day's line monitoring activity. At the completion of this summary printout, the memory registers are cleared of all the accumulated data.

The summary printout is organized by categories

showing the total events count in each category as well as the ten worst cases of each category in chronological order. At the end of the categorized list, the Printer lists up to ten of the last events in order of occurrence. This summary printout is a maximum of 22 inches in length.

To illustrate a summary midnight printout:

STABILINE AC VOLTAGE SYSTEMS CONDITIONING COPYRIGHT 0 1981 Label. SUPERIOR ELECTRIC BRISTOL CT 06010 TEL: 203 582-9561 LINE CONDITIONS Mode. MEMORY: DET ID 2334 CM-ON Detector ID number and common mode status. OW-LINE 118 VOLTS Current average voltage. VOLTAGE THRESHOLDS Preset thresholds. SAG LO HI SUR IMP 100 110 132 135 050 DATE TIME Date and time of printout. MO/DA/YR HR:MN:SE 06/10/81 00:00:03 Voltage sag category and total number of sag events. SAG 0006 HITS DAY TIME VOLTS CYC 09 12:01:16 1 A MAR 09 12:45:24 001 09 12:45:31 09 12:45:43 Time, level and duration of event in cycles. 5 A **MM1** 5.0 001 13:52:15 09 001 09 16:45:25 001 Voltage surge category and total number of surge events. SURGE 0028 HITS DAY TIME VOLTS CYC 09 12 01 ∴74 137 12 137 91 34 0.5 09 09 12 :01:34 136 Ø 55 09 12 :01:34 136 0. Time, level and duration of event in cycles. Only the 10 worst cases 09 12 01:34 136 M are saved and shown here. Day of month, time of occurrence and peak 09 12:01:34 136 voltage are printed. 12 09 :01:34 136 Ø 03 12 :01:34 136 0. 12:01:34 136 89 0. 12:01:34

```
LO AVG
               MMM7 HITS
                                    Low average category and total number of low average events.
DAY TIME VOLTS
                  107
                         002
93
    MR
        · MM
    08:00:48
08
                  109
                        001
    12:45:24
09
                  067
                         001
            :31
                                   - Time, level and duration of event in seconds.
09 12:45
                  083
                        MM1
    12:45:43
                  083
                        001
09
    13:52
            : 15
                  056
03
                        001
    16:45:25
                  083
                        001
                                    High average category and total number of high average events.
               MAMP HITS
HI AVG
DAY TIME VOLTS SEC
    12:01:34 135
                        คดา
                                    Time, level and duration of event in seconds.
09 16:45:34 135
IMPULSE
               0006 HITS
                                    Impulse category and total number of impulse events.
      TIME VOLTS
09 12:01
            :15
   12:45:24
12:45:31
12:45:31
09 12:45
                  064
09
                  104

    Time and level of event.

09 12:45:43
                  108
   13:52
                  148
                  192
    16:45:25
                                    Common mode category and total number of common mode events.
COM MODE
               0006 HITS
DAY
        TIME
                         CYC
09 12:45:24
                         0.5
99
   12:45
             ₹1
A9
    12
        :45
            :43
                                   - Time and duration of event in cycles.
    13:52
Ø9
09 13:52:
              15
09 16:45
                                    Blackout category and total number of blackout OFF events.
BLK OUT
               0000 HITS
TOTAL
              00055 HITS
                                    Total of all events.
```

LAST EVENTS			
LO AVG		SEC	
	083	001	
IMPULSE			
09 12:45:43	108	oue	
·5AG 09 12:45:43	aa4	CYC 5 A	
COM MODE	OOL	ĊŶĊ	
09 12:45:43		$\tilde{1}.\tilde{5}$	
LO AVG		SEC	
09 12:45:43	083	001	
SAG	en en e	ČAČ -	
09 16:45:25   IMPHUSE	AAT	5.0	
09 16:45:25	199		
COM MODE		CYC	
09 16:45:25		0.5	
LO AVG		SEC	
09 16:45:25	983	001	
HI AVG 09 16:45:34	475	SEC NOT	
. UP LU. 7J. 37	الدفيد	002	
RESET-STARTUP			

The last ten events occurring before the midnight summary printout.

They are identified in chronological order according to type, day, time of event, intensity and/or duration.

Memory automatically cleared and reset.

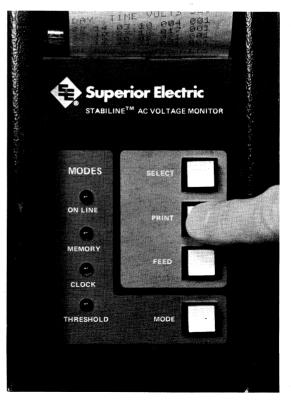
An identical printout format is obtained any time the PRINT key is pressed while in the MEMORY mode. However, the Detector memory is not cleared and reset after each manual printout request.

To obtain replicate copies of the memory contents:

- 1. Turn Detector memory switch off to prevent any incoming events from changing each copy.
- 2. Press PRINT key for printout. Repeat this step as often as necessary for additional copies.

The SELECT key functions only during memory printout to bypass printing of events listed in each category.

Shown is a sample of a printout tape produced by pressing the PRINT key subsequent to the midnight summary printout. The memory had been cleared after start-up and no data was captured since. This can be used to verify memory reset.



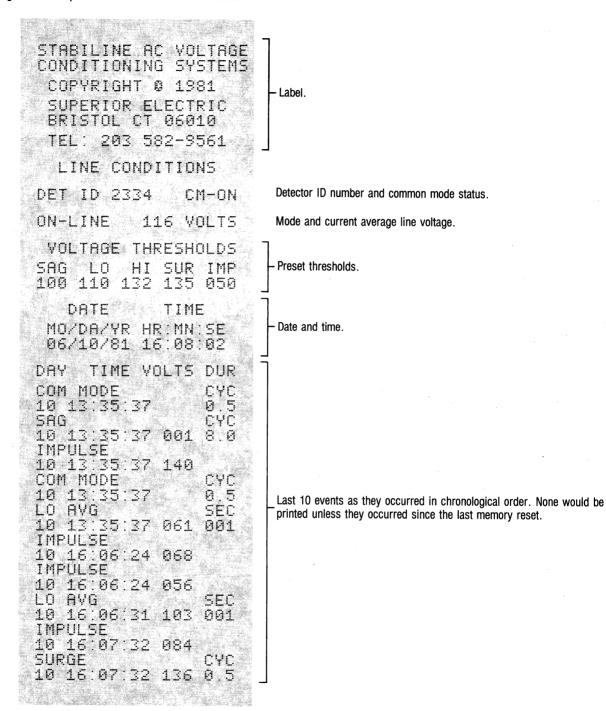
STABILINE AC VOLTAGE CONDITIONING SYSTEMS COPYRIGHT # 1981 SUPERIOR ELECTRIC BRISTOL CT 06010 TEL: 203 582-9561 LIME CONDITIONS MEMORY DET ID 2334 CM-ON NN-LINE 117 VOLTS VOLTAGE THRESHOLDS HI SUR IMP SAG LO 100 110 132 135 050 DATE TIME MO/DA/YR HR: MN: SE 06/08/81 21:59:44 SAG 0000 HITS 0000 HITS SURGE LO AVG nana HITS 0000 HITS HI AVG IMPULSE MAMM HITS 0000 HITS COM MODE BLK OUT 0000 HITS TOTAL 00000 HITS LAST EVENTS

Label. Mode. Detector ID Number and common mode status. Current line voltage. Preset thresholds. Current date and time. No events stored in memory.

No last events.

### **ON-LINE FUNCTION**

Upon entering this mode, the Printer automatically generates a printout similar to the one shown.



If the Voltage Monitor is left in the ON LINE mode beyond the initial printout of the 10 most recent events stored in memory, if any, all new events will be printed out as they are taking place.

IMPULSE 10 16:10:08	096	
COM MODE 10 16:13:56		CYC 0.5
IMPULSE 10 16:19:20	192	* 44
SAG 10 16:19:19	001	CYC 4.5
COM MODE 10 16:19:20		CYC 0.5
LO AVG 10 16:19:19	987	SEC 001

LINE mode only to interrupt and terminate the last 10 events printout.

### PRINT KEY

The PRINT key functions during the ON LINE mode to produce a printout of the line voltage at the moment this key is pressed.

ON-LINE 117 VOLTS

# AN EXAMPLE OF THE PRINTOUTS GENERATED IN THE ON LINE MODE AS EVENTS ARE TAKING PLACE

The printout identifies the event and gives the day of the month, time of the event, the amplitude and/or its duration in either cycles or seconds where appropriate. The SELECT key is functional alone during the ON It should be noted that when the Printer is operated in the ON LINE mode, a power blackout will cause it to automatically enter the MEMORY mode when power is restored. Summary printouts will then occur at each midnight thereafter.

### TROUBLE SHOOTING

### • No Detector POWER ON LED

### CAUSE:

- 1. Faulty Detector power cable connection.
- 2. Faulty Detector power cable.
- 3. Detector fuses blown (Possible miswired receptacle).
- 4. Connected to dead circuit.

### REMEDY:

- 1. Check cable connection.
- 2. Check cable continuity.
- 3. Check 6-pin Detector power cable socket for continuity between pins (see page 21). Contact factory.

### • No Printer MEMORY LED

### CAUSE:

- 1. Faulty Printer power cable connection.
- 2. Faulty Printer power cable.
- 3. Printer fuse blown (Possible miswired receptacle or improper selector card position.)

### REMEDY:

- 1. Check cable connection.
- 2. Check cable continuity.
- 3. Check selector card position.
- 4. Check Printer fuse and replace.
- 5. Re-energize Printer.

### Flashing MEMORY LED

### CAUSE:

- 1. Faulty Detector/Printer communication cable connection.
- 2. Faulty Detector/Printer communication cable.
- 3. Legitimate communications interrupt.
- 4. Incompatible Detector/Printer baud rates.

### REMEDY:

- 1. Check cable connection.
- 2. Check cable continuity.
- 3. Re-establish communications.
- 4. Correct the baud rate settings.

# Continuous alarm sound (Steady 10 minute duration)

### CAUSE:

- Battery switches under Detector have both been turned off.
- 2. Battery low.

### REMEDY:

- 1. Check battery switches. Turn on and unplug the Voltage Monitor for 10 seconds to clear the "battery low" alarm.
- Unplug the Voltage Monitor for 10 seconds to clear the "battery low" alarm. The battery should become recharged once AC power is restored. If the battery fails to accept a charge and the alarm persists after one hour the battery will have to be replaced by factory authorized service. The ALARM OFF switch will not turn off this alarm.

# Printer loss of definition (Fading or unclear characters)

### CAUSE:

- 1. Build-up of debris on the Printer head.
- 2. Poor roll of paper.

### REMEDY:

 Pass a 2½ inch wide strip of bond paper dampened with isopropyl alcohol through the Printer. Try a new roll of paper. Should this not correct the problem after several passes, permanent damage to the Printer head may have occurred. Contact the factory.

### No MEMORY printout (Unit in MEMORY mode, PRINT key pressed).

### CAUSE:

1. Detector fuses blown.

### REMEDY:

1. Check 6-pin Detector power cable sockets.

### • Continuous pulsating alarm

### CAUSE:

- 1. Line voltage exceeds a threshold.
- 2. Impulse occuring on each half cycle.
- 3. Common mode event continuously.

### REMEDY:

- Set Printer to ON LINE mode and check ON LINE voltage against thresholds. Reset thresholds where necessary.
- 2. Watch printout for stream of impulse events. Set impulse thresholds higher.
- 3. Cause an intentional blackout and re-energize after turning off MEMORY. Observe the last ten events printout for common mode event with "\*\*\*" duration or many common mode events with duration of .5 cycle and same time of event. Defeat the common mode circuitry (see page 7).

NOTE: Lost briefcase keys can be replaced by any Samsonite dealer.

### **ERROR MESSAGES**

### THRESHOLD ERROR MESSAGE

The threshold value selected for low average is used to establish the nominal Detector operating range. If a low average value of 159 volts or less is entered, the system will be in the 120-volt mode. In this mode, maximum threshold value for sag, surge, or high average is 170 volts. Any value entered above this will cause the threshold error message to be printed, and the system will retain the old values.

If a low average of 160-255 volts is selected, the system is placed in the 240-volt mode. In this mode, maximum threshold value for sag, surge, or high average is 340 volts. Any value entered above this will cause the threshold error message to be printed, and the system will retain the old threshold values.

Impulse threshold settings are independent of nominal Detector operating ranges.

### **COMMUNICATION ERROR MESSAGE**

Incorrectly transmitted or received data between the Detector and the Printer/Controller will cause a Communication Error message. Poor cable connections, noisy telephone lines, bad handset microphone, incorrect baud rates or handset not properly placed in the acoustic coupler will also cause this error message.

### PRINTER OVERFLOW

Printer overflow indicates that events are occurring at a more rapid rate than the Printer can accommodate. During an overflow situation, several events may be lost.

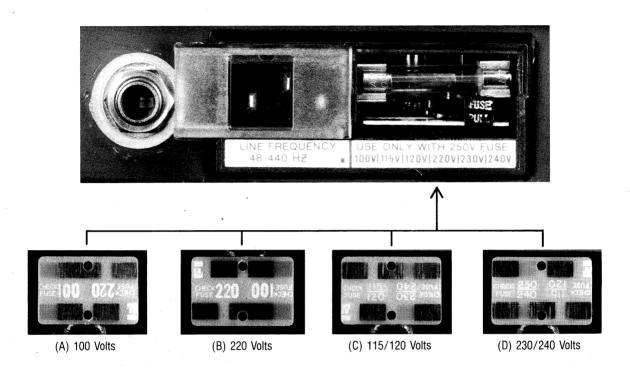
NOTE: The Superior Electric Company will recalibrate the Detector Module for a nominal service fee. Recalibration is recommended annually.

### **APPENDIX**

### **VOLTAGE SELECTOR CARD**

The Voltage Selector Card affects the Printer power voltage only. To expose the card, remove the line cord and slide the transparent plastic window covering the

Printer fuse all the way to the left. The Voltage Selector Card is visible under the fuse. The facing numbers should be "115/120". If not, remove the card and arrange it in the proper orientation as shown.



To remove the Voltage Selector Card, move the "Fuse Pull" lever to the left and remove fuse. Insert a slender rod into the opening and lever or pry the card out by pulling it forward while moving it from side to side.

Shown are the four possible choices of card arrangement. The voltages are given below each example. The orientation shown in C and D will be the two most commonly used in the United States and Canada.

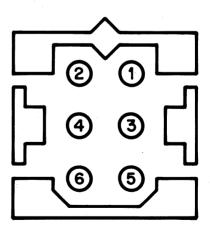
Under normal operation in the United States, insert the card so the label ''115/120'' is facing as shown in C.

### **BLOWN FUSES**

The following diagrams may be used to check for blown fuses.

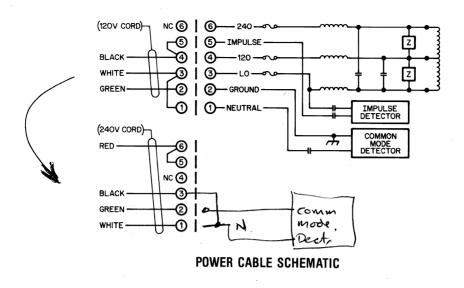
# CAUTION: Do not attempt to replace any of the fuses. Replacement may void the warranty.

The inside of the plastic case is protected against static. Exposing the circuit boards to static may cause serious damage.



### **Power Cable Socket**

Pins 3 to 4 = Normally low resistance (fuses) 30 ohms. Pins 3 to 6 = Normally low resistance (fuses) 90 ohms. Pins 4 to 6 = Normally low resistance (fuses) 60 ohms.



### **SPECIFICATIONS**

### PHYSICAL

Briefcase packaging with one detachable Detector Module inside. Overall dimensions, 18-1/8'' L x 12-7/8'' W x 5'' H (46cm L x 33cm W x 13cm H). Total weight is 23 lbs (11kgs). Detachable Detector dimensions are 9-3/4'' L x 7'' W x 2-3/4'' H (25cm L x 18cm W x 7cm H) and weight is 8lbs (4kgs).

### **VOLTAGE MONITORING**

All channels are responsive to the peak value of the applied voltage. Sag, surge, low average and high average are scaled (X .707) to indicate the RMS value of a sinusoidal input.

**Low Average, High Average** — The voltage of the previous 32 half cycles is compared with operator set thresholds and is updated every half cycle with time duration in seconds up to 999 (16.7 seconds). Accuracy is  $\pm 2$  volts between 80 and 140 volts.

**Sag, Surge** — The value of each half cycle is compared with operator set thresholds with time duration in half cycles up to 9.5 and full cycles up to 511 cycles (8.5 seconds). Accuracy is  $\pm 2$  volts between 80 and 140 volts. For durations less than 6 cycles, the accuracy of measurement of amplitude is sag -0, +4 volts; surge +0, -4 volts. Actual line dropouts of less than 12 to 14 cycles will be identified in this category.

**Impulse** — The peak voltage of transients is recorded

with rise time less than 50 microseconds from point of occurrence on sine wave to the peak which exceeds operator set threshold. Each half cycle of the sine wave is analyzed with the worst transient of each half cycle being recorded. 60 Hz line voltage component is filtered out and maximum impulse of 999 volts is recorded. Accuracy is  $\pm 15\%$  or  $\pm 15$  volts, whichever is greater, with response down 6 dB at both 200 nanosecond and 50 microsecond rise time points.

**Common Mode Noise** — Voltage is sensed between green safety ground wire and the grounded neutral conductor with a factory set threshold of 5 volts peak between 1 kHz and 50 kHz. Accuracy is  $\pm 1.5$  volts with sensitivity down 6dB at 300 Hz. Duration of events are in cycles with no amplitude printed.

**Blackouts** — Power OFF initiated when low average drops below 65 volts with the STABILINE AC Voltage Monitor entering an orderly shutdown and retaining all data. Power ON initiated when power once again rises to 70 volt nominal level. Both Power OFF and Power ON events correlated with real time (day, hour, minute, second).

NOTE: The measurement accuracy is ± one second when seconds are measured and ±1/2 cycle when cycles are measured. Timing accuracies can be affected when line conditions approximate threshold values.

Over-range values are printed as "\*\*\*".

### PRINTER

The STABILINE AC Voltage Monitor utilizes a 5 x 7 dot matrix thermal printer with a print rate of 1.5 lines per second. Printer paper is 2.5 inches wide thermal paper. (Texas Instruments No. TP-30250 or Superior Electric No. A209720G1) with a maximum diameter of 3.0 inches.

### **PRINTOUT**

All printouts are alphanumeric and are read from top to bottom.

**Memory Mode** — Printout starts with verification of date, time of day, and operator set thresholds. Total number of events exceeding thresholds in each of the seven voltage categories (Low Ave., High Ave., Sag, Surge, Impulse, Common Mode Noise, and Blackout) are quantified, and the ten worst events in each category are printed in chronological order with real time correlation. Memory printouts may be produced on demand by pressing print button or automatically at midnight when the Detector and Printer/Controller are mated.

**On-Line Mode** — Printout starts with verification of date, time of day, and operator set thresholds. Instantaneous RMS line voltage is printed followed by the last ten chronological events that exceed the thresholds. Subsequent to this initial printout, events exceeding thresholds are printed as they occur. Summary printouts are available at any time by entering memory mode.

### **CONTROL SWITCHES**

The STABILINE AC Voltage Monitor initiates operation upon being plugged in and automatically enters the memory mode. There are four Control Switches. The SELECT and PRINT buttons are used in the clock, threshold, and detector I.D. setting routine, the PRINT button initiates printouts, the FEED button advances paper, and the MODE button changes operating mode (on-line, memory, clock, or threshold).

The Detector has a button for resetting the event LED as well as defeating the common mode noise circuit and four switches on the underside for Battery (2), Memory Freeze (1), and Acoustic Alarm Defeat (1).

### **INPUTS**

The STABILINE AC Voltage Monitor System has a receptacle for Printer/Controller power which may be 100 VAC, 115/120 VAC, 220 VAC or 230/240 VAC. There is also a special Amp Metramite receptacle for

the power line cord (2 supplied) of the circuit to be analyzed. There is a phone jack provided for communicating with the Detector (Cable 5).

### INPUT VOLTAGE REQUIREMENTS

100 Volts	67V-125V @ 60 Hz	.300 Amperes
RMS Nominal	67V-105V @ 50 Hz	Nominal
120 Volts	80V-150V @ 60 Hz	.250 Amperes
RMS Nominal	80V-125V @ 50 Hz	Nominal
220 Volts	146V-275V @ 60 Hz	.15 Amperes
RMS Nominal	146V-250V @ 50 Hz	Nominal
240 Volts	160V-300V @ 60 Hz	.125 Amperes
RMS Nominal	160V-250V @ 50 Hz	Nominal

### **ENVIRONMENTAL RANGES**

Ambient temperature range of 0  $^{\circ}$  to +45  $^{\circ}$ C operating and -20  $^{\circ}$  to +70  $^{\circ}$ C storage. Humidity range 5% to 90% relative humidity noncondensing.

### OTHER FEATURES

- Modular design and construction allows one Printer/Controller to set and read as many Detector Modules as site analysis requirements demand. The STABILINE AC Voltage Monitor system reduces costs of site analysis and improves productivity.
- Easy-to-set thresholds via operator interactive printout allows precise threshold settings at single volt increments.
- Printout of data includes total events, automatic data characterization of ten worst events in each of seven categories, plus the ten last chronological events exceeding thresholds.
- Memory and clock supported by nickel cadmium battery with charging circuit which eliminates the need for repetitive clock and threshold resetting. Battery will hold clock, thresholds, and data for several months.
- Secure monitoring system. With Detector Module only on site, no settable parameters can be altered.
- Audible alarm when thresholds are exceeded. Can be defeated by operator. Audible signal coincidental with event LED which is resettable.
- Permanent identification of data via settable Detector ID which appears on each printout.
- Multiple printouts of data available on demand.
- Can operate over standard voice telephone lines when used with Modem Adapters (types MAD100 and MAP100) and standard Bell System 103 compatible modems.

### INTERPRETATION OF A TYPICAL PRINTOUT

```
STABILINE AC VOLTAGE
CONDITIONING SYSTEMS
COPYRIGHT 0 1981
 SUPERIOR ELECTRIC
 BRISTOL CT 06010
 TFL: 203 582-9561
  LINE CONDITIONS
        MEMORY
DET ID 1753
                 CM-ON
ON-LINE
            116
                 VOLTS
 WOLTAGE THRESHOLDS
SAG IO
          HI SUR
                  IMP
096 108 126 132 050
   DATE
              TIME
 MO/DA/YR HR:MN:SE
 й6/15/81 11:15:23
SAG
            0072 HITS
DAY
     TIME VOLTS CYC
   08:
       09:16
              иии
12
   43
       92
          15
              085
                   i A
   08
       03
          * 4 9
              ини
                   1
19
      102
          48
              087
                   1.0
   08
       57
          10
              093
                   2.0
22
   06
       58
26
          51
   MA
              ЙΒ
31
   AA:22
          16
              ийи
   00:24
08:01
71
       24
          21
              000
                   ***
          17
12
              083
15 10:27:43
              йΘй
SURGE
            0015 HITS
           VOLTS
DAY TIME
                  CYC
15
   16
       ₹1
          22
              135
                   й 5
  16
          07
              136
18
       29
   18
              138
26
          43
      :07
   19
          15
              145
                   1
                     И
          55
28
   18
       28
              138
                   1.
                     Ø
29
              138
   18
           15
                   1
                     Ø
   00:22
          16
                   Ø
31
      :36
              149
31
                   7
   ЙΝ
   20:14
         :42
              142
10
                   Я
14
   05:
              141
```

EXAMPLE: The voltage thresholds and other operating parameters were set on the morning of May 12 and the MODUTECTOR unit was delivered and installed at the site the same morning. The Printer/Controller was brought to the site to read the data on the morning of June 15.

Detector identification number 1753 is consistent with account number and common mode noise circuit is ON.

Instantaneous line voltage at site measured at 116 volts RMS.

Thresholds set according to computer manufacturer's electrical specifications.

Monitor memory read on June 15, 1981 at 11:15 a.m.

- During period of installation, voltage sagged below 96 volt threshold 72 times.
- · Ten worst sags listed below.

Sag to 0 volts when Detector Module unplugged from Printer/Controller without turning MEMORY switch OFF. See blackout category for information on "self-induced" blackout.

Voltage sags caused by in-plant processes.

Sag to 0 volts for 3.5 cycles at 12:22 a.m. during thunderstorm.

Sag to 0 volts for the period exceeding 511 cycles (blackout) at 12:24 a.m. during thunderstorm.

Voltage sags caused by in-plant processes.

- During installation, voltage surged above 132 volt threshold 15 times.
- Ten worst surges listed below:

Voltage surges caused by equipment, process or major area loads being shut down.

Surge to 153 volts for 1/2 cycle at 12:22 a.m. following thunderstorm dropout recovery.

Surge to 149 volts for 7.5 cycles at 12:36 a.m. following 11 minute, 23 second blackout.

. Voltage surges caused by loads being shut down.

```
0253 HITS
In AVG
DAY
      TIME VOLTS SEC
12
        09:17
                P61
                      001
    08
            25
                105
15
    16
        97
                      324
        27
            15
                103
                      154
15
    1 \, \mathrm{K}
            21
18
    18
        A2
                100
                      **
            21
18
    18
        18
                ggg
                      379
19
    15
                104
                     129
            29
20
                192
    16
                      673
        24
            21
    00:
                ARA
                      MAR
31
12
    15
            19
                106
                      427
    16:15:24
42
                105
                     ***
             0006 HITS
HI
    AVG
DAY
       TIME
             VOLTS
                     SEC
    ЙΒ
        17
            22
                      973
24
    95
        22
            16
                127
25
    何飞
        01
                128
                      ***
07
    04:07
            53
                127
                      ***
        52
            17
                127
                      173
14
    03
   04:01:18
                128
                      062
             3726 HITS
TMPIII SE
             VOLTS
DAY
      TIME
       :02:15 08A
            25
    18
        16
                084
    18
        7.1
                096
            43
20
    16:
        42
                088
                856
        22
            16
31
    00:
            21
        24
    ии
            52
        35
31
                284
    ии
31
            52
    ЯЙ
        38
                472
            29
12
    10:32
                080
    16:23:
            52
12
                088
             0324 HITS
COM MODE
                      CYC
DAY
       TIME
12
    08:07
                        Ø
    10:
        29
                        5
12
                        5
12
    11
        MA
            42
                      1
12
    11
        58
            21
                      4
                        Ø
                      Ø
                        5
12
            42
    13
        17
                      1
12
        23
                        0
    15
            36
            29
 2
                        5
    16
            52
26
                      Э А
    08:03
15
 5
    09:48
                      1.0
                        5
                      4
    10:
        27:
            43
```

- During installation, average voltage dropped below low average threshold of 108 volts 253 times.
- Ten worst low averages listed below:

Low average associated with "self-induced" blackout. The 61 volts reading due to time of instantaneous interpretation.

Low averages caused by heavy loads being switched on.

Low average to 100 volts at 2:21 p.m. exceeding 999 seconds (16.7 min. +) caused by high electrical demand during heat wave. Remaining low averages with long time periods also caused by load usage on hot days. Note low average of 105 volts on June 12 at 4:15 p.m. also exceeded 16.7 minutes. Also note that since the Detector Module was left on site for longer than 1 month and since worst case events are listed in chronological order, the month in which the events occurred can be determined.

 During installation, average voltage exceeded high average threshold of 126 volts 6 times. All 6 events are listed below:

High averages caused by shutdown of equipment and other major loads. It can be noted that one event on May 25 and one on June 7 exceeded 999 seconds or 16.7 minutes.

- During installation there were 3,726 impulses which exceeded the 50 volt threshold.
- The 10 worst impulses are listed below:

Impulses in the 80-90 volt area caused by characteristics of in-plant equipment.

Very high impulse level associated with events during the thunderstorm and subsequent
- blackout during the early morning hours of May 31.

Note that the first impulse occurred on May 12 while the 9th and 10th impulses occurred on June 12.

- During installation, factory set common mode noise threshold level of 5 volts was exceeded 324 times
- The 10 worst events (length of time exceeding 5 volts) are listed below:

All common mode noise events associated with equipment operational characteristics. In this example, the first occurrence on day 12 is obviously June 12 since the time of 8:07 a.m. is well before installation time of 10:06 a.m. on May 12 (see blackout data below). It follows that all remaining data is for June since occurrences are printed chronologically.

BLK OUT 0	002 HITS
DAY TIME	
12 08:09:16	OFF.
12 10:06:51	<u>ON</u> _
31 00:24:29 31 00:35:52	OFF
6. 32 3400 0	
TOTAL 04:	398 HITS
LAST EVENTS	
IMPULSE	
15 08:03:52	
COM MODE 15 08:03:52	CYC 2.0
IMPHISE -	
15 08:23:21	.060 M
IMPULSE   15 08:55:43	OPK
IMPULSE	8JB
<b>15</b> 09:22:16	
COM MODE	ÇYÇ
715 09:48:26 IMPULSE	1.0
15 03:48:26	
COM MODE	CYC 1.5
15 10:27:43 IMPULSE	1.5
100056 15 10:27:43	<b>052</b>
SAG	CYC
15 10:27:43	090 2.5
	10 To 10 May 10 To

- During installation, total power loss occurred twice.
- Both blackouts are listed below:

Power off after setting thresholds, etc. Could have been avoided by switching memory to OFF.

Detector Module installed at site at 10:06 a.m. on May 12.

- Utility power blackout for 11 minutes, 23 seconds during thunderstorm on May 31.

- Total number of events exceeding thresholds was 4,398.
- The last 10 chronological events exceeding any threshold setting are listed below:

The 10 last events exceeding thresholds before Detector Module memory was printed.

Note that the four events identified in the illustration by arrows were the only ones that qualified for the appropriate "worst 10" summary printout.



### WARRANTY AND LIMITATION OF LIABILITY

The Superior Electric Company (the "Company"), Bristol, Connecticut, warrants to the first end user purchaser (the "purchaser") of equipment manufactured by the Company that such equipment, if new, unused and in original unopened cartons at the time of purchase, will be free from defects in material and workmanship under normal use and service for a period of one year from date of shipment from the Company's factory or a warehouse of the Company in the event that the equipment is purchased from the Company or for a period of one year from the date of shipment from the business establishment of an authorized distributor of the Company in the event that the equipment is purchased from an authorized distributor.

THE COMPANY'S OBLIGATION UNDER THIS WARRANTY SHALL BE STRICTLY AND EXCLUSIVELY LIMITED TO REPAIRING OR REPLACING, AT THE FACTORY OR A SERVICE CENTER OF THE COMPANY, ANY SUCH EQUIPMENT OR PARTS THEREOF WHICH AN AUTHORIZED REPRESENTATIVE OF THE COMPANY FINDS TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP UNDER NORMAL USE AND SERVICE WITHIN SUCH PERIOD OF ONE YEAR. THE COMPANY RESERVES THE RIGHT TO SATISFY SUCH OBLIGATION IN FULL BY REFUNDING THE FULL PURCHASE PRICE OF ANY SUCH DEFECTIVE EQUIPMENT. This warranty does not apply to any equipment which has been tampered with or altered in any way, which has been improperly installed or which has been subject to misuse, neglect or accident.

THE FOREGOING WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANT-ABILITY OR FITNESS FOR A PARTICULAR PURPOSE, and of any other obligations or liabilities on the part of the Company; and no person is authorized to assume for the Company any other liability with respect to equipment manufactured by the Company. The Company shall have no liability with respect to equipment not of its manufacture. THE COMPANY SHALL HAVE NO LIABILITY WHATSOEVER IN ANY EVENT FOR PAYMENT OF ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, WITHOUT LIMITATION, DAMAGES FOR INJURY TO ANY PERSON OR PROPERTY.

Written authorization to return any equipment or parts thereof must be obtained from the Company. The Company shall not be responsible for any transportation charges.

IF FOR ANY REASON ANY OF THE FOREGOING PROVISIONS SHALL BE INEFFECTIVE, THE COMPANY'S LIABILITY FOR DAMAGES ARISING OUT OF ITS MANUFACTURE OR SALE OF EQUIPMENT, OR USE THEREOF, WHETHER SUCH LIABILITY IS BASED ON WARRANTY, CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE, SHALL NOT IN ANY EVENT EXCEED THE FULL PURCHASE PRICE OF SUCH EQUIPMENT.

Any action against the Company based upon any liability or obligation arising hereunder or under any law applicable to the sale of equipment, or the use thereof, must be commenced within one year after the cause of such action arises.



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