

OPERATIONS MANUAL
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SSM-18LEPR
CONFLICT / VOLTAGE MONITOR

THIS MANUAL CONTAINS TECHNICAL INFORMATION FOR THE FOLLOWING SERIES OF CONFLICT/VOLTAGE MONITORS: **SSM-18LEPR**. INCLUDED ARE GENERAL DESCRIPTION, OPERATIONAL DESCRIPTION, INSTALLATION AND SPECIFICATIONS.

THE SSM-LE SERIES CONFLICT/VOLTAGE MONITORS ARE DESIGNED AND MANUFACTURED IN THE U.S.A. BY EBERLE DESIGN INC., PHOENIX, ARIZONA.

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MAINTENANCE NOTE

The Eberle Design Inc. Conflict/Voltage Monitors have been carefully inspected and tested to assure proper operation. It is recommended that the Conflict/Voltage Monitor be tested at least annually to ensure proper operation and compliance with NEMA and factory specifications.

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CHAPTER 1
INTRODUCTION

SECTION 1-1 Introduction

This operations manual covers the equipment usage and design considerations of the SSM-18LEPR series CONFLICT/VOLTAGE MONITOR. It provides the user with a general understanding of the operating principles necessary to install and maintain the SSM-LE series CONFLICT/VOLTAGE MONITOR.

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CHAPTER 2
STANDARD FUNCTIONS

SECTION 2-1 Standard Functions

The SSM-LE series CONFLICT/VOLTAGE MONITOR is a device used in a traffic controller assembly to monitor traffic signals at an intersection for conflicting proceed indications or the absence of voltage on all of the field signal outputs of a channel caused by malfunctions of the controller, load switches, or miswiring of the cabinet. The SSM-LE series CONFLICT/VOLTAGE MONITOR also provides error sensing of two +24VDC supplies and the controller power supplies via +24V-I, +24V-II, and Controller Voltage Monitor (CVM) inputs respectively. The SSM-LE series CONFLICT/VOLTAGE MONITOR is directly interchangeable with a standard NEMA Conflict/Voltage Monitor and meets with or exceeds all specifications outlined in Chapter 6 (Conflict Monitors) of the Traffic Control Systems Specifications (NEMA TS 1-1989).

The SSM-LE series CONFLICT/VOLTAGE MONITOR is an 18 channel Monitor. Each channel has the capability of monitoring a Green, a Yellow, a Red, and a Walk field signal output at the field terminals. A Program Card is provided for assigning conflicting channels. The SSM-LE series CONFLICT/VOLTAGE MONITOR detects the presence of conflicting Green or Yellow or Walk signals on the AC field terminations between any two or more channels assigned to conflict on the Program Card. The Red Enable input, when tied to AC+, activates the Red Monitoring capabilities of the Monitor causing the monitor to trigger when it detects the absence of voltage on all four of the field signal outputs of a channel. The monitoring circuitry is capable of detecting either full wave or positive and negative half-wave field signal outputs at the specified voltage levels.

When triggered by the detection of a fault condition which exists longer than the minimum period defined by the NEMA Traffic Control Systems Specifications (TS-1, part 6), the SSM-LE series CONFLICT/VOLTAGE MONITOR will enter the fault mode causing the Output relay to de-energize and two sets of contacts on the Output relay to transfer. The cabinet assembly should be wired such that the closure of the conflict monitor Output relay contacts will cause an automatic switching of the field signal outputs from normal operation to flashing operation. The SSM-LE series CONFLICT/VOLTAGE MONITOR will then display the appropriate fault status along with the proceed indications active at the time of the fault. The SSM-LE series CONFLICT/VOLTAGE MONITOR will remain in this fault mode until a reset command is issued via the front panel RESET button or External Test Reset Input. The loss of AC+ power will not reset the fault mode of the Output relay contacts. In the event of AC+ power loss the SSM-LE series CONFLICT/VOLTAGE MONITOR will retain the status of all fault and channel indicators and will display the correct fault and channel status upon restoration of AC+ power.

SECTION 2-2 Voltage Monitoring

Inputs are provided for monitoring two +24VDC supplies and the Controller Voltage Monitor output from the controller. Should loss of proper signal occur at any of these inputs, the SSM-LE series CONFLICT/VOLTAGE MONITOR will de-energize the Output Relay causing the two sets of contacts to transfer and will illuminate the appropriate front panel indicator(s) and the FAULT led. The Monitor will automatically reset when the correct input signals are restored to these inputs if the unit had not already been triggered by a previous fault condition. A 24V Monitor Inhibit input is provided to facilitate the use of these monitors with pre-timed mechanical controller installations.

SECTION 2-3 AC+ Brown-out/Interruption Detection

When the AC+ line voltage is below the drop-out level of 92Vrms for 475 msec (± 25 msec) the SSM-LE series CONFLICT/VOLTAGE MONITOR will suspend all fault monitoring functions, de-energize the Output relay, and de-energize the Start relay. The AC indicator on the front panel will flash at a rate of 2Hz to indicate the brown-out status.

When the AC+ line voltage returns above the restore level of 100Vrms for 100 msec (± 16 msec) the monitor will resume normal operation and the AC power indicator on the front panel will remain illuminated. After a 2.5 second (± 1 second) delay the Start relay will be energized. After a programmable delay determined by the minimum flash function switches on the front panel the Output relay will be energized.

The AC+ and AC- inputs are used to generate the internal voltage supplies required to operate the monitor. AC- also serves as return for all AC signals including Red Enable. Chassis Ground provides an independent connection to the chassis

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of the unit and is isolated from AC- and Logic Ground. A Logic Ground input is provided for functions which are isolated from AC- (i.e. +24V monitors, CVM, Controller Watchdog, Ext Reset, and 24V Inhibit). Logic Ground may, however, be tied to AC- if desired.

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CHAPTER 3
EXTENDED FEATURES

The following extended features are provided on the SSM-LE series CONFLICT/VOLTAGE MONITOR for additional monitoring functions and to increase the reliability of the monitor's operation.

SECTION 3-1 Hardware Features

The model SSM-LE series CONFLICT/VOLTAGE MONITOR is a CMOS microprocessor-based unit. All monitoring functions and features are firmware programmable which permits upgrades or modifications by simply replacing the EPROM device containing the firmware with the upgraded version. Thus, most changes to the SSM-LE series CONFLICT/VOLTAGE MONITOR specifications may be accommodated without modifying the hardware.

Since all critical timing functions are accomplished by the microprocessor, it's quartz crystal based accuracy results in very precise and repeatable measurements. This accuracy is maintained on functions from timing fault conditions to implementing a unique firmware based digital sampling and filtering algorithm. This algorithm is applied to all AC field signals to help eliminate false detection in a "noisy" AC line environment.

The use of voltage comparators for detecting field signal output status provides precise voltage level sensing of the field signals. Voltage references are temperature compensated for constant voltage levels within the operating temperature range.

A low power CMOS RAM device is utilized to retain fault status information in the event of an AC+ power interruption. The correct fault indications will be displayed upon restoration of AC+ power. This RAM device utilizes a built-in lithium battery power source during AC+ interruptions.

SECTION 3-2 Dual Indication Monitoring

This monitoring function detects simultaneous indications of active Green, Yellow, Walk, and Red field signal outputs on the same channel. A Dual Indication fault places the SSM-LE series CONFLICT/VOLTAGE MONITOR into the fault mode causing the Output relay contacts to transfer. Dual Indication Monitoring is enabled concurrently with Clearance Monitoring on a per channel basis via the front panel SSM switches.

One of three different groups of prohibited dual combinations may be selected via the front panel "DUAL SEL" switches for all channels which have been enabled for Dual Indication Monitoring.

Dual Select Switch

A	B	<u>Combinations Prohibited</u>
OFF	OFF	NONE (no Dual Monitoring)
OFF	ON	[(G or W) and Y]
ON	OFF	[(G or W or Y) and R]
ON	ON	[(G or W) and Y] or [(G or W or Y) and R]

(note: A and B ON is equivalent to only (G and W) allowed.)

* Dual Indication Monitoring is disabled when the Red Monitoring Enable input is removed.

An open or no load condition (i.e., burned-out bulb) may be detected as an active signal depending on the output impedance characteristics of the load switch, and may cause a Dual Indication fault. Dual Indication Monitoring may also anticipate a possible Conflict in the event that a proceed signal on a channel is constantly detected as active.

SECTION 3-3 GY-Dual Indication Monitoring

This monitoring function detects a simultaneous indication of active Green and Yellow field signal outputs on the same channel. It can be used to monitor channels which have an unused Red field signal output tied to AC+ (i.e. five section

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signal head) and is enabled by placing the front panel option switch labeled "GY ENABLE" in the ON position. A GY-Dual Indication fault places the SSM-LE series CONFLICT/VOLTAGE MONITOR into the fault mode causing the Output relay contacts to transfer. GY-Dual Indication Monitoring may be enabled concurrently with Dual Indication Monitoring. When GY-Dual Indication Monitoring is enabled, **ALL** channels which have **NOT** been selected for Dual Indication Monitoring via the front panel SSM switches will be individually monitored for simultaneous indications of active Green and Yellow field signal outputs. Any channels which have been selected for Dual Indication Monitoring will function as described above in SECTION 3-2. GY-Dual Indication Monitoring is disabled for all channels when the Red Monitoring Enable input is removed.

SECTION 3-4 Clearance (Short or Absent Yellow) Monitoring

This function detects the absence of a minimum 2.8 second period of an active Yellow field signal output during a Red to Green to Yellow to Red sequence. Clearance Monitoring is enabled concurrently with Dual Indication Monitoring on a per channel basis via the front panel SSM switches.

Clearance Monitoring is disabled for all channels when the Red Monitoring Enable input is removed.

A Clearance (short or absent Yellow) fault condition will place the SSM-LE series CONFLICT/VOLTAGE MONITOR into the fault mode causing the Output relay contacts to transfer. This occurs when a Red input signal to a channel is active following the termination of an active Yellow input signal which is less than 2.8 seconds in duration.

SECTION 3-5 Controller Watchdog Monitoring

This function monitors an optional watchdog output from the cabinet controller circuitry. The cabinet controller should toggle the watchdog output's logic state once every 100 msec. Failure of the SSM-LE series CONFLICT/VOLTAGE MONITOR to receive a change in state from the controller unit for 1500 msec (+100 msec) will place the SSM-LE series CONFLICT/VOLTAGE MONITOR into the fault mode causing the Output relay contacts to transfer. This function is enabled by the front panel option switch labeled "WD ENABLE". An AC+ brownout condition or a complete loss of AC+ power will reset the Watchdog fault state of the monitor.

note: The Watchdog logic input must be harnessed to a spare pin on the front panel connector.

SECTION 3-6 Walk Disable (Red Monitoring)

This option will modify the operation of Red Monitoring. When enabled, the Red Monitoring function will not monitor the Walk field outputs. Absence of signals on the Green, Yellow, and Red field outputs of a channel will place the SSM-LE series CONFLICT/VOLTAGE MONITOR into the fault mode causing the Output relay contacts to transfer. This function is enabled by the front panel option switch labeled "WALK DISABLE".

SECTION 3-7 Non-Volatile Fault Memory

The loss of AC+ power to the monitor will not reset a fault condition (Conflict, Dual Indication, Red Failure, Clearance, or a voltage monitor fault if the VM Latch option is enabled). A BND or Controller Watchdog fault will be reset by an AC+ brownout or dropout condition. The SSM-LE series CONFLICT/VOLTAGE MONITOR stores the fault and channel indicator status and the time and date the fault occurred into a non-volatile RAM memory device. Should an AC+ power interruption occur while the monitor is in the fault mode, then upon restoration of AC+ power, the Output relay will remain in the fault mode and the correct fault and channel information will be displayed. This fault mode is maintained until the monitor receives a reset command from the RESET button or the External Test Reset input.

SECTION 3-8 Real Time Clock/Calendar

A real time clock is provided on the SSM-LE series CONFLICT/VOLTAGE MONITOR to identify each fault occurrence with the time of day and date. This information is displayed and stored along with the fault status and field output status when the monitor is triggered by a fault condition. The real time clock is backed-up by a long life lithium energy cell and thus maintains accurate timekeeping even during AC+ interruptions. This accuracy should remain within approximately

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± 3 minutes per month. Daylight Savings Time adjustments are made to the time of day on the last Sunday of October and the first Sunday of April. The date and month are adjusted for leap years.

Setting the correct time of day and date is accomplished using the MODE and INC buttons on the front panel (see section 5-4).

SECTION 3-9 Fault Data Logging

In addition to displaying the fault status and field output status for a fault condition which may have the monitor unit currently triggered, the SSM-LE series CONFLICT/VOLTAGE MONITOR automatically updates and maintains a complete record of the last nine faults which caused the unit to trigger. These events can be reviewed at any time by depressing the "INC/PREV.FAIL" button (see section 5-4). This fault "history" is maintained in non-volatile RAM memory and will not be lost due to AC+ power interruptions.

Faults due to the Program Card not in place or monitor failures due to internal hardware/firmware problems (MONITOR FAIL LED illuminated), are not included in the datalog.

A CVM LOG DISABLE option switch is provided on the front panel to disable data logging of CVM failures. This option preserves the fault "history" when the CVM input is used to transfer from normal operation to flashing operation for night-time flash or time-of-day flash requirements.

SECTION 3-10 AC Power Interruption/Restoration Logging

The SSM-LE series CONFLICT/VOLTAGE MONITOR automatically updates and maintains a complete record of the last 10 AC+ power interruptions and restorations. A power interruption is detected when the AC+ line voltage level is below 92 VAC for a duration of 475 ± 25 milliseconds. A power restoration is detected when the AC+ line voltage level is above 100 VAC for 100 milliseconds. The time and date of the AC power interruption or restoration is maintained in non-volatile RAM memory. These events can be reviewed by using the MODE and INC buttons on the front panel (see section 5-4).

SECTION 3-11 Program Card Readback

In order to verify that the Program Card information has been properly read by the SSM-LE series CONFLICT/VOLTAGE MONITOR, the channels programmed as "permissive" on the program card can be displayed on the Field Output Status Display. This is accomplished using the MODE and INC buttons on the front panel (see section 5-4).

SECTION 3-12 Program Card Absent Indication

If the Program Card is absent or not seated properly in the edge connector, the SSM-LE series CONFLICT/VOLTAGE MONITOR will enter the fault mode causing the Output relay contacts to transfer. The "PROGRAM CARD" indicator on the Fault Status Display will be displayed to indicate this condition. A Manual Reset or External Test Reset is required after the Program Card is properly seated.

SECTION 3-13 Internal Watchdog

The SSM-LE series CONFLICT/VOLTAGE MONITOR generates an internal watchdog pulse from the microprocessor. This occurs once per line cycle near the start of its program loop. If the internal hardware does not detect a watchdog pulse within 100 milliseconds, the SSM-LE series CONFLICT/VOLTAGE MONITOR will enter the fault mode causing the Output relay contacts to transfer. The "MONITOR FAIL" LED on the front panel will illuminate to indicate a monitor hardware and/or firmware failure.

SECTION 3-14 Reset Input Detection

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This function prevents the cabinet controller from being operated with the monitor disabled due to a faulty RESET button or External Test Reset input. The SSM-LE series CONFLICT/VOLTAGE MONITOR monitors the state of the front panel RESET button and the External Test Reset input. While a Reset command is detected from either input, the SSM-LE series CONFLICT/VOLTAGE MONITOR will remain in the reset mode with all indicators illuminated, the Output and Start relays energized, and monitoring functions disabled. If the Reset command lasts for a more than 0.5 seconds, the monitor will then automatically enter the normal mode and begin monitoring functions, ignoring the state of the reset inputs.

SECTION 3-15 Voltage Monitor Fault Latch

When the Voltage Monitor Fault Latch option is enabled by the front panel switch labeled "VM LATCH", the absence of the proper voltage level at either the CVM input or the two 24VDC inputs (24V-I & 24V-II) will place the SSM-LE series CONFLICT/VOLTAGE MONITOR into the fault mode causing the Output relay contacts to transfer. The appropriate fault indicator(s) and the time and date will be displayed on the Fault Status Display along with the field output signals active at the time of the voltage fault. Restoration of the voltage levels will not reset the fault state of the Monitor. Only a Manual Reset or External Test Reset command will reset the Monitor. If the VM LATCH and CVM LOG DISABLE option switches are both ON, CVM failures will **not** be latched or data logged.

SECTION 3-16 Display LCD & LED Test

The monitor will display all front panel LCD indicators and illuminate all front panel LED indicators when a Reset command is issued by the front panel RESET button or External Test Reset input. This function provides a way to check the operation of all front panel indicators.

SECTION 3-17 Memory Test

The SSM-LE series CONFLICT/VOLTAGE MONITOR verifies the proper operation of the memory (RAM & EPROM) devices required to operate the monitor. This test is performed when AC+ power is applied or a Reset Command is issued to the monitor. If a memory failure is detected, the SSM-LE series CONFLICT/VOLTAGE MONITOR will enter the fault mode causing the Output relay contacts to transfer. The "MONITOR FAIL" LED indicator on the front panel will illuminate to indicate a monitor hardware and/or firmware failure. Due to the nature of these hardware/firmware failures, other fault indicators that may be concurrently displayed may not be valid for trouble shooting purposes.

SECTION 3-18 Fault Timing and Configuration Display

The fault timing specifications for Conflict, Red Fail, Voltage Monitoring, Dual Indication, Clearance Fail, and Controller Watchdog Fail (if enabled) as set by the factory may be reviewed on the Fault Status Display. This is accomplished using the MODE and INC buttons on the front panel (see section 5-4). Timing values for Conflict, Red Fail, Voltage Monitoring, and Dual Indication are shown in milliseconds. Timing values for Clearance Fail and Controller Watchdog Fail are shown in seconds. Also displayed are the channels selected by the SSM switches. If the 24V INHIBIT input is active, the value displayed for +24V-1 and +24V-2 will show as "OFF". Similarly, if RED ENABLE is not active the value shown for Red Fail, Dual Indication, and Clearance Fail will be "OFF". If both DUAL SELECT switches and the GY ENABLE switch are off the value shown for Dual Indication will be "OFF". If the BND monitoring function is disabled the display will show "OFF". The "OFF" display indicates that the selected monitor function is disabled.

SECTION 3-19 Internal Power Supply Monitoring

This function facilitates the orderly initialization and "shut-down" of the SSM-LE series CONFLICT/VOLTAGE MONITOR's microprocessor. If the internal unregulated DC supply falls below 9.5 ± 1 VDC, the microprocessor is forced into reset to suspend the execution of the firmware program. The SSM-LE series CONFLICT/VOLTAGE MONITOR will enter the fault mode causing the Output relay contacts to transfer. The "MONITOR FAIL" LED indicator on the front panel will illuminate to indicate a monitor hardware and/or firmware failure.

When the internal unregulated DC supply voltage level goes above 14 ± 1 VDC, the reset is removed from the microprocessor which enables it to initialize and execute the program loop. This internal power supply monitoring insures that

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normal operation of the microprocessor only occurs when the internal power supply of the SSM-LE series CONFLICT/VOLTAGE MONITOR is at the required voltage levels.

SECTION 3-20 BND (Blinking/Noise/Dimming) Error Detection

This error detection function supplements the unique firmware sampling and digital filtering method for sensing the field input signals. The SSM-LE series CONFLICT/VOLTAGE MONITOR unit field input sensing algorithm is designed to filter out relatively short term noise transients commonly found on the electrical service and provide noise immunity against false signal detections. The BND Error Detection function is designed to detect and respond to irregular input waveforms which exhibit a longer time constant in comparison to the short term digital filtering time constant. This detection algorithm is intended to detect a signal that is: irregularly **Blinking** (flickering); has constant extraneous **Noise**; or is **Dimmed** invalidly under Controller Unit software control. These signals are differentiated in part due to the large time constants which may be associated with these irregular input waveforms and may indicate a malfunctioning component or improper operating mode within the cabinet assembly.

The BND Error Detection function is designed to recognize many of these possible input waveforms and will place the SSM-LE series CONFLICT/VOLTAGE MONITOR unit into the fault mode. If the aforementioned signal conditions exist for a pre-determined period of time, the SSM-LE CONFLICT/VOLTAGE MONITOR unit will enter the fault mode, transfer the OUTPUT relay contacts to the Fault position, and illuminate the BND FAIL indicator. The SSM-LE series CONFLICT/VOLTAGE MONITOR unit will remain in the fault mode until the unit is reset by the RESET button or the EXTERNAL RESET input. A Power Failure will reset the BND Fail fault state of the monitor. The Channel Status display will indicate the channels on which the fault occurred.

a) **Blinking**

This blinking or flickering signal condition may exist under certain abnormal circumstances such as: controller output malfunction (i.e. output toggling, pinwheeling, etc.); load switch malfunction (output shorting intermittently, zero cross failure, phase firing, etc.); intermittent field wiring or NEUTRAL return (due to corrosion, poor termination, improper or poor cabinet grounding system, etc.). Another cause of flickering occurs when excessive AC voltage to a channel input in the OFF state occurs due to load switch "leakage current" and high load impedance. This high impedance load may be caused by dimmers, low wattage loads (7 watt test lamps, solid state loads, etc.), poor wire terminations, etc.. When the voltage level of a field input signal is near the threshold level of the input comparators, AC ripple and noise may produce a flickering effect.

NOTE: When the voltage level of a field input signal is reduced to within approximately 100 mV of the threshold level of the input comparators, the front panel channel indicators may flicker due to ac ripple and cause a BND error to be detected. This input threshold level may lie between 17 Vrms and 23 Vrms (55 Vrms and 65 Vrms for RED). The NEMA Traffic Control Systems Specification (TS-1, part 6) states that the input monitoring circuitry may or may not detect within a voltage range of 15 Vrms to 25 Vrms (50 Vrms and 70 Vrms for RED). A BND TEST DISABLE option (option dip switch #E) is provided to disable the BND error detection function during test and/or calibration if required. The SSM-LE series CONFLICT/VOLTAGE MONITOR should never be operated at an intersection with the BND error detection function disabled.

b) **Noise**

Constant high energy noise or transients on the field signal inputs may affect the integrity of the input sample if it occurs exactly within the narrow sampling "window" of the SSM-LE series CONFLICT/VOLTAGE MONITOR unit. Depending on the severity and repetition rate of the input noise, a BND error may be detected after the samples have been corrupted for a period of 90 to 200 line cycles.

This condition may not always be due to extraneous input noise. A faulty input comparator device may also result in reading invalid sampling data.

c) **Dimming**

The sampling and filtering algorithm allows **ONLY** half wave (positive or negative) suppressed dimming. Other dimming waveforms may be achieved under cabinet controller software control and will be detected as a BND error within approximately 90 periods of the input waveform.

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SECTION 3-21 RS-232C Port Interface

An RS-232C port is provided on the **SSM-18LEPR** to interface with a PC or IBM compatible printer with an asynchronous serial interface. This feature provides a printed copy of the monitor's current intersection status; fault data log; AC+ power log; program card verification; fault timing and configuration. This is accomplished by using the MODE and INC buttons on the front panel (see section 5-4) and may be activated while the monitor is in the cabinet during normal operation. An IBM compatible software package is available from EDI which will receive the data log and store it to a file. Contact the factory for availability. The "Tx" segment of the Fault Status Display will illuminate when the unit is transmitting.

A nine position subminiature "D" connector is provided on the front panel to mate with the interface cable. The pin assignments may be found listed in section 7-5. The XMIT data pin is used to transfer data from the **SSM-18LEPR** to the receiving device. The DTR input pin is used by the receiving device to halt data transfer from the **SSM-18LEPR** when the receive buffer is full. The DTR input should be in the high state to enable data transfer. The data format is configured as 1200 baud, 8 bit word, no parity, 1 stop bit.

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**CHAPTER 4
INSTALLATION**

SECTION 4-1 Function Dip Switch Programming

The function programming dip switches are located below the main Fault Status Display. These switches are separated into two groups. The first group programs the minimum flash period corresponding to the delay to energize the Output relay from AC+ restoration. The second group programs the Dual Indication Monitoring prohibited combinations. A Manual Reset or External Test Reset is required after the function dip switches are programmed.

Programming of the minimum flash period is in a binary encoded format:

MINIMUM FLASH SWITCH				<u>DELAY PERIOD</u> (seconds)
<u>8</u>	<u>4</u>	<u>2</u>	<u>1</u>	
OFF	OFF	OFF	OFF	0.6 (test purposes only)
OFF	OFF	OFF	ON	4
OFF	OFF	ON	OFF	4
OFF	OFF	ON	ON	4
OFF	ON	OFF	OFF	4
OFF	ON	OFF	ON	5
OFF	ON	ON	OFF	6
OFF	ON	ON	ON	7
ON	OFF	OFF	OFF	8
ON	OFF	OFF	ON	9
ON	OFF	ON	OFF	10
ON	OFF	ON	ON	11
ON	ON	OFF	OFF	12
ON	ON	OFF	ON	13
ON	ON	ON	OFF	14
ON	ON	ON	ON	15

It is recommended that the Minimum Flash Time be programmed on the conflict monitor to facilitate an orderly start-up sequence of the cabinet assembly upon application or restoration of AC+ power to the cabinet.

The amount of flash time is typically equal to the amount programmed on the controller (minimum 4 seconds), so that if the controller fails to execute a minimum flash period, the conflict monitor will serve as a backup to provide the minimum flash time. The 0.6 seconds minimum flash time setting is strictly for out-of-cabinet bench testing of the conflict monitor.

Programming of the Dual Indication Monitoring prohibited combinations is as follows:

Dual Select Switch		<u>Combinations Prohibited</u>
<u>A</u>	<u>B</u>	
OFF	OFF	NONE (no Dual Monitoring)
OFF	ON	[(G or W) vs Y]
ON	OFF	[(G or W or Y) vs R]
ON	ON	[(G or W) and Y] or [(G or W or Y) vs R]

(note: A and B = ON is equivalent to only (G and W) allowed.

SECTION 4-2 SSM Dip Switch Programming

The SSM dip switches are located below the Field Output Status Display (ch 1:6) on the front panel and are labeled "1" to "18" corresponding to channels 1 through 18, respectively. These switches determine whether a channel will be individually monitored for Dual Indications **AND** Clearance Faults. Positioning a switch in the ENABLE position (UP) enables a channel for Dual Indication **AND** Clearance Monitoring. **The corresponding channel dip switch must be placed in the**

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DISABLE position (DOWN) when an unused Red field output terminal is connected to AC+. A Manual Reset or External Test Reset is required after the SSM dip switches are programmed.

SECTION 4-3 Option Dip Switch Programming

The SSM-LE series CONFLICT/VOLTAGE MONITOR provides five independently programmed options:

- A - GY-Dual Indication Monitoring Enable
- B - Watchdog Enable
- C - Voltage Monitor Latch Enable
- D - Walk Disable
- E - BND Disable (Test purposes only)
- F - CVM Log Disable

The options dip switch is located below the main Fault Status Display. These features are activated by placing the respective switch of the "OPTIONS" dip switch in the ON position (UP).

If the VM LATCH and CVM LOG DISABLE option switches are both ON, CVM failures will **not** be latched or data logged.

SECTION 4-4 Program Card Programming

This universal card provides the means to assign conflicting proceed channels. It is designed to the NEMA Traffic Control Systems Specifications (TS-1, part 6) and therefore is interchangeable between other units complying with the NEMA standard. The card is initially supplied with 153 empty wire jumper locations on the card. This permits all channels to conflict with all other channels. To program a compatible channel, solder a wire jumper into the appropriate location for that channel combination on the program card. **Make sure that any disconnected leads do not make contact with any other lead on the card or the cabinet chassis when the program card is inserted into the slot of the front panel.**

Example: If channel 2 Green or Yellow or Walk is permissive with channel 4 Green or Yellow or Walk, solder a wire jumper into the jumper pair labeled "2-4".

If the Program Card is removed or not seated properly in the edge connector, the SSM-LE series CONFLICT/VOLTAGE MONITOR will enter the fault mode causing the Output relay contacts to transfer. The "PROGRAM CARD" indicator will be displayed to indicate this condition. A Manual Reset or External Test Reset is required after the Program Card is properly seated.

SECTION 4-5 Harnessing Connectors

All field terminations are brought into the SSM-LE series CONFLICT/VOLTAGE MONITOR by means of Military Specification MIL-C-26482 connectors. The outside harnesses are not interchangeable between any of the SSM-LE series Monitors as defined by NEMA Traffic Control Systems Specification (TS-1, part 6), i.e., an 18 channel harness assembly will not mate with a 12 channel conflict monitor.

SECTION 4-6 Clearing The Data Log

Erasing the contents of the fault data log requires two deliberate steps to prevent inadvertent erasure of the fault data log. The first step is to depress and hold in both the MODE and INC/PREV.FAIL buttons simultaneously followed by a momentary depression of the RESET button. The top LCD will flash the letters "clr" to indicate it is in the **clear** data log mode and is waiting for the next step. Release the MODE and INC/PREV.FAIL buttons. The final step to clear the fault data log is to depress and hold in the MODE button, then simultaneously depress the INC/PREV.FAIL button and then release both buttons. The top LCD will return to alternately displaying the time and date. Verify the contents of the fault data log using the INC/PREV.FAIL button. The RESET button can be depressed at any time to exit this mode without clearing the data log.

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**CHAPTER 5
FRONT PANEL DESCRIPTION**

SECTION 5-1 Field Output Status Display

The three Field Output Status Displays are liquid crystal displays (LCD) as shown in figure A. The SSM-LE series CONFLICT/VOLTAGE MONITOR displays exceed the minimum NEMA requirements by showing all four field output signals per channel. If the unit is operating normally without a fault condition present, the currently active field output signals will be displayed. Once triggered by a fault condition, the displays will retain the signals active at the time of the fault. In the event of a BND FAIL, the field signal output display will flash the field signal on which the fault occurred. Dark solid arrows will be displayed below the channel number for each channel involved in the fault.

```

1 2 3 4 5 6
+)))))))))) ,
*
*R R R R R R *
*Y Y Y Y Y Y *
*G G G G G G *
*W W W W W W *
.)))))))))) -
    
```

Figure A

SECTION 5-2 Fault Status Display

The main Fault Status Display is a liquid crystal display (LCD) as shown in Figure B. The SSM-LE series CONFLICT/VOLTAGE MONITOR displays nine fault conditions in addition to the time and date that the fault occurred. If the unit is operating normally without a fault or voltage monitor condition present, only the current time and date will be displayed.

```

o FAULT          o MONITOR FAIL
+)))))))))) ,
*CVM/WD 24V-1 24V-2 *
*CONFLICT DUAL INDICATION*
*RED FAIL PROGRAM CARD *
*BND FAIL CLEARANCE FAIL*
*   AM 18:88 DATE   *
*PREV FAIL RE OFF Rx Tx*
.)))))))))) -
o RESET
o POWER
o MODE
o INC
o PREV. FAIL
    
```

Figure B

Voltage Monitor Indicators (CVM/WD, 24V-1, 24V-2)

One or more of these indicators will be displayed along with the field output signals active at the time the unit was triggered if the corresponding voltage input is below the minimum specified level. If the Voltage Monitor Latch (VM LATCH) option is enabled and the unit is triggered by a improper voltage condition, the corresponding indicator(s) will remain displayed until the unit receives a reset command from the Manual Reset or External Test Reset input. If the VM LATCH and CVM LOG DISABLE option switches are both enabled (ON), CVM failures will **not** be latched or data logged.

If the Controller Watchdog monitor option (WD ENABLE) is enabled and the unit is triggered by a controller watchdog output failure, the CVM/WD indicator will remain displayed until the unit receives a reset command from the Manual Reset or External Test Reset input or the AC+ voltage level drops below the specified drop-out level.

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CONFLICT Indicator

The CONFLICT indicator will be displayed when a conflicting proceed signal fault is detected. The Field Output Status display will show all active field output signals at the time of the conflict. Dark solid arrows will be displayed below the channel number for each channel involved in the fault.

DUAL Indicator

The DUAL INDICATION indicator will be displayed when a Dual Indication fault is detected on a channel(s). The Field Output Status display will show all active field output signals at the time of the Dual Indication fault. Dark solid arrows will be displayed below the channel number for each channel involved in the fault.

RED FAIL Indicator

The RED FAIL indicator will be displayed when an absence of signal (dark signal head) is detected on a channel(s). The Field Output Status display will show all active field output signals at the time of the Red Failure. Dark solid arrows will be displayed below the channel number for each channel involved in the fault.

CLEARANCE Indicator

The CLEARANCE FAIL indicator will be displayed when a short (less than 2.8 seconds) Yellow signal or absence of Yellow signal is detected on a channel(s) during a Red to Green to Yellow to Red sequence. The Field Output Status display will show all active field output signals at the time of the Clearance fault. Dark solid arrows will be displayed below the channel number for each channel involved in the fault.

BND Indicator

The BND FAIL indicator will be displayed when a **B**linking/**N**oise/**D**imming fault is detected on a channel(s). Dark solid arrows will be displayed below the channel number for each channel involved in the fault. The Field Signal Status display for the channel(s) involved in the fault will flash the field signal(s) on which the fault occurred. For channels not involved in the fault, the Field Output Status display will show all active field output signals at the time of the BND fault. If the BND fault is detected on the Red Enable input then no dark arrows will be displayed.

PROGRAM CARD Indicator

The PROGRAM CARD indicator will be displayed if the program card is absent or not seated properly in the edge connector. The Field Output Status display will show all active field output signals at the time of the fault. A Manual Reset is required after the program card is properly seated.

PREV FAIL Indicator

The SSM-LE series CONFLICT/VOLTAGE MONITOR will retain complete information on the last nine consecutive faults which triggered the Monitor in addition to the current fault information if the unit has been triggered by a fault condition. The previous fault information can be displayed at any time by depressing the "INC/PREV.FAIL" button. The "PREV FAIL" indicator will be displayed with the number of the fault also shown (PREVIOUS FAILURE 1 (PF 1) is the most recent failure logged). Each button closure will display the next previous failure information, returning to the current display on the tenth button closure.

Time and Date Display

The clock and calendar display will alternate between the time of day and the date. The time will be denoted by either an "AM" or a "PM" indicator. The date will be denoted by the "DATE" indicator. If the Monitor is displaying current fault information then the time and date will indicate when the fault occurred. If the Monitor is displaying previous fault information then the time and date will alternate with the previous fault number and indicate when the fault occurred. Otherwise, the current time of day and date will be displayed.

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RE OFF Display

The "RE OFF" indicator will be displayed if the RED ENABLE input is not active. This indicates that Red Fail Monitoring, Dual Indication Monitoring, and Clearance Monitoring are disabled.

Rx Display

The "Rx" indicator will be displayed when the RS-232 port has received a character.

Tx Display

The "Tx" indicator will be displayed when the Infrared Printer or RS-232 port has transmitted a character.

SECTION 5-3 LED Display

POWER Indicator

The POWER LED indicator will flash at a rate of 2Hz when the AC+ line voltage goes below the drop-out level (92 Vrms). It will illuminate steadily when the AC+ line voltage returns above the brown-out restore level (100 Vrms). The indicator will extinguish when the AC+ line voltage is no longer sufficient to provide the DC voltages necessary for proper monitor operation (approximately 60 Vrms).

FAULT Indicator

The FAULT LED indicator will illuminate when the unit has been triggered by a fault condition or has sensed a +24V voltage monitor condition and indicates that the Monitor has caused the Output relay contacts to transfer. The Fault Status Display and Field Output Status Display should be consulted for more detailed information about the failure.

MONITOR FAIL Indicator

The MONITOR FAIL LED indicator will illuminate when one of the following internal monitor failures are detected: internal watchdog failure, memory test failure, or internal power supply failure. This indicator is used to inform the service technician of a monitor hardware and/or firmware failure.

Due to the nature of these hardware/firmware failures, other fault indicators that may be concurrently displayed may not be valid for trouble shooting purposes.

SECTION 5-4 Buttons

RESET Button

Depressing the RESET button resets the SSM-LE series CONFLICT/VOLTAGE MONITOR after it has been triggered by a fault. The monitor remains in the reset mode only if the fault condition has been restored to normal. While the RESET button is depressed (0.5 seconds maximum) all front panel indicators will be displayed and the Output relay and Start relay energized. A Manual Reset also causes the current fault information to be logged into the non-volatile fault memory if applicable.

In the event of a monitor hardware or firmware fault (MONITOR FAIL LED is illuminated) the RESET button may not reset the monitor.

MODE Button

Depressing the MODE button changes the format of the front panel displays to display the Program Card settings (Program Card mode), Fault Timing and Configuration values (Fault Timing mode), AC+ Power Interruption and

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Restoration Log Information (AC Data Log mode), Print mode, and allow the time of day and date to be modified (Set mode). The Set mode can only be entered when the Monitor is **not** in the fault mode.

In the Program Card mode the Fault Status Display will show the "PROGRAM CARD" indicator flashing at a 2Hz rate. The Field Output Status Display will present the compatible channel programming for each channel in a sequential fashion for each closure of the INC button. The primary channel being displayed will be denoted by a dark solid arrow and the Yellow, Green, and Walk indicators illuminated. For each channel programmed as "permissive" with this primary channel, the Yellow, Green, and Walk indicators will be illuminated. This corresponds to having a wire jumper in place on the Program Card for each of the illuminated channels.

The next closure of the MODE button advances the mode to the Fault Timing and Configuration mode. The RESET button may be used to return to a normal display format. In this mode each closure of the INC button will display the factory setting for the fault timing indicated on the Fault Status Display. If the fault timing value is shown as "OFF" the corresponding fault monitoring function is disabled (check the status of Red Enable, +24V Inhibit, Dual Select switches, and the SSM switches). If Dual Indication and Clearance monitoring are enabled, the dark solid arrows will indicate which channels are being monitored.

The next closure of the MODE button advances the mode to the AC Data Log mode. The RESET button may be used to return to the normal operation display format. In this mode each closure of the INC button will advance the Fault Status Display to the next AC Data Log information. A total of 10 power interruptions and restorations labeled "AC" to "AC9" can be reviewed. Each log will scroll the following data through the Fault Status Display approximately every 12 seconds:

"AC" -> "OFF" -> TIME -> DATE (**most recent interrupt**)
"AC1" -> "ON" -> TIME -> DATE (**most recent restore**)
"AC2" -> "OFF" -> TIME -> DATE
"AC3" -> "ON" -> TIME -> DATE
"AC4" -> "OFF" -> TIME -> DATE
"AC5" -> "ON" -> TIME -> DATE
"AC6" -> "OFF" -> TIME -> DATE
"AC7" -> "ON" -> TIME -> DATE
"AC8" -> "OFF" -> TIME -> DATE (**"oldest" interrupt**)
"AC9" -> "ON" -> TIME -> DATE (**"oldest" restore**)

The next closure of the MODE button on an **SSM-18LEPR** advances the mode to the Printer mode. The letters "**P r t**" will be flashing on the top LCD to indicate that the monitor is in the Printer mode but is not yet transmitting data.

SSM-18LEPR Printing

Ensure that a correctly wired cable has been attached between the RS-232C port and a properly configured printer device. Then depress the INC button until the letters "**P r t**" on the top LCD stop flashing. The "Tx" indicator will be displayed when the port is transmitting a character. The printer should now begin to print. The RESET button may be used at any time to stop printing and exit the Printer Mode. The monitor will return to the normal display mode. If the Monitor detects a fault while it is transmitting to the printer, the displays will indicate the fault and the status of the channels. The monitor will continue to transmit to the printer until the RESET button is depressed or until all data is transmitted.

The next closure of the MODE button advances the mode to the Set mode. The RESET button may be used to return to a normal display format without modifying the clock. In the Set mode each successive closure of the MODE button addresses a new clock field:

1st Field - MINUTES
2nd Field - HOURS
3rd Field - DATE
4th Field - MONTH

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5th Field - YEAR

(note: the year is required for leap year compensation and automatic daylight savings time update. It is not displayed in normal operation.)

Each closure of the INC button will cause the currently addressed field to increment by one. After setting the year value **the next closure of the MODE button actually sets the new time of day and date into the clock** and returns the format of the front panel displays to normal.

INC/PREV.FAIL Button

The INC/PREV.FAIL button is normally used to display previous fault information which has been logged in the non-volatile fault memory. Each closure of the button will display the next previous failure information with PREVIOUS FAILURE 1 (PF1) being the most recent failure logged and PREVIOUS FAILURE 9 (PF9) being the "oldest" failure information logged. If the INC/PREV.FAIL Button is kept depressed longer than 500 msec. the previous failure information will continuously scroll at a 2Hz rate until the button is released.

If the unit is in the Program Card mode, depressing the INC/PREV.FAIL button will cause the next channel's compatible channel information to be displayed. If the INC/PREV.FAIL Button is kept depressed longer than 500 msec. the primary channel number will continuously increment at a 2Hz rate until the button is released. If the unit is in the Fault Timing and Configuration mode, depressing the INC/PREV.FAIL button will cause the next fault timing value to be displayed. If the INC/PREV.FAIL button is kept depressed longer than 500 msec. the fault timing values will continuously scroll at a 2Hz rate until the button is released.

If the unit is in the AC Data Log mode, depressing the INC/PREV.FAIL button will cause the next AC interrupt or restore log information to be displayed. If the INC/PREV.FAIL button is kept depressed longer than 500 msec. the AC Data Log will continuously scroll at a 2Hz rate until the button is released.

If the unit is in the Print mode, depressing the INC/PREV.FAIL button for 500 msec. will start the printer action.

If the unit is in the Set mode, depressing the INC/PREV.FAIL button will cause the currently addressed field of the clock to increment by one. If the INC/PREV.FAIL button is kept depressed longer than 500 msec. the field will continuously increment at a 2Hz rate until the button is released.

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NORMAL OPERATION

○ FAULT	○ MONITOR FAIL
---------	----------------

```

+)))))))))) ,
*
*
*   AM   10:35   *
*
.)))))))))) -
1  2  3  4  5  6
+)))))))))) ,
*
*   R   R   R   R   *
*
*G           G   *
*
.)))))))))) -
  
```

○ RESET
○ POWER
○ MODE
○ INC PREV. FAIL

The Fault Display will toggle between the Time and the Date. The Channel Display will indicate all active field signals.

FAULT MODE

FAULT	○ MONITOR FAIL
--------------	----------------

```

+)))))))))) ,
*
*   RED FAIL   *
*
*   AM   10:35   *
*
.)))))))))) -
1  2  3  4  5  6
+)))))))))) ,
*
*   ?           *
*
*           R   R   R   *
*
*G           G   *
*
.)))))))))) -
  
```

○ RESET
○ POWER
○ MODE
○ INC PREV. FAIL

The Fault LED will illuminate. The type of fault is indicated. The Time and Date of the fault is latched. Cursors (?) will indicate the channels involved in the fault.

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PREVIOUS FAIL MODE

	○ FAULT	○ MONITOR FAIL	
+)))))))))))))))))))))) ,	+)))))))))))))))))))))) ,		○ RESET
* * * * *	* CONFLICT * * * * *		○ POWER
* * * * *	* * * * *		○ MODE
* PF 1 * * * * *	* PM 11:10 * * * * *		
* PREV FAIL * * * * *	* * * * *		INC
.)))))))))))))))))))))) -	.)))))))))))))))))))))) -		PREV.FAIL

	1	2	3	4	5	6	
+)))))))))))))))))))))) ,	* ?			* ?		*	
* * * * *	* R R			* R R		*	
* * * * *	* G			* G		*	
.)))))))))))))))))))))) -							

While in Normal Operation, depress the **INC/PREV.FAIL** button to recall the previous nine failures. The upper Fault Display will scroll through the **PF** number and the Time & Date of the previous fault. The Channel Display will indicate the status of the field signals at the time of the previous fault, including the cursors (?) if applicable to the fault. Depressing the **INC/PREV.FAIL** button will recall the next previous failure.

PROGRAM CARD MODE

While in Normal Operation, depress the **MODE** button once to enter the Program Card Mode. The **RESET** button will exit this mode and return to the Normal Operation display. The Fault Display will flash PROGRAM CARD to indicate the mode.

	○ FAULT	○ MONITOR FAIL	
+)))))))))))))))))))))) ,			○ RESET
* * * * *	* PROGRAM CARD * * * * *		○ POWER
* * * * *	* * * * *		○ MODE
.)))))))))))))))))))))) -			INC
			PREV.FAIL

	1	2	3	4	5	6	
+)))))))))))))))))))))) ,	* ?					*	
* * * * *	* Y			* Y	* Y	*	
* * * * *	* G			* G	* G	*	
* * * * *	* W			* W	* W	*	
.)))))))))))))))))))))) -							

The cursor (?) in the Channel Display Indicates the Primary Channel. The example above shows channel 1 as the primary channel and is permissive with channels 5 and 6. This corresponds to jumpers on the Program Card in positions labeled 1-5 and 1-6. Depressing the **INC/PREV.FAIL** button will increment the display to the next Primary channel.

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FAULT TIMING MODE

While in Normal Operation, depress the **MODE** button 2 times to enter the Fault Timing Mode. Each closure of the **INC/PREV.FAIL** button will display the factory setting for the fault timing indicated on Fault Display. Depressing the **RESET** button will exit this mode and return to the Normal Operation display. The Fault Display will flash the monitoring function corresponding to the timing parameter.

<pre> o FAULT +))))))))))))))))))))))))), * CVM/WD * * * * * 150 * * * * * * * .))))))))))))))))))))))))- </pre>	<pre> o MONITOR FAIL o RESET o POWER o MODE INC PREV. FAIL </pre>
--	---

The above example shows that the CVM fault timing is factory set at 150 milliseconds. The **INC/PREV.FAIL** button will increment the display to the next fault timing value.

<pre> o FAULT +))))))))))))))))))))))))), * 24V-1 24V-2 * * * * * 150 * * * * * * * .))))))))))))))))))))))))- </pre>	<pre> o MONITOR FAIL o RESET o POWER o MODE INC PREV. FAIL </pre>
---	---

The above example shows that the Voltage Monitoring timing is factory set at 150 milliseconds. An **"OFF"** display indicates that Voltage Monitoring is disabled through the 24V Monitor Inhibit input.

<pre> o FAULT +))))))))))))))))))))))))), * * * * RED FAIL * * 783 * * * * * * * .))))))))))))))))))))))))- </pre>	<pre> o MONITOR FAIL o RESET o POWER o MODE INC PREV. FAIL </pre>
--	---

The above example shows that the Red Monitoring timing is factory set at 783 milliseconds. An **"OFF"** display indicates that Red Monitoring is disabled due to the absence of a Red Enable Input to the CMU.

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<pre> o FAULT +))))))))))))))))))))), * * DUAL INDICATION * * 285 * * * * * .))))) - 1 2 3 4 5 6 +))))))))))))))))))))), * * * * * * * * * .))))) - </pre>	<pre> o MONITOR FAIL o RESET o POWER o MODE INC PREV. FAIL </pre>
---	---

If Dual Indication or Clearance monitoring is enabled, the cursors (?) on the Channel Display will indicate which channels are being monitored. It corresponds to the SSM Enable switches in the "ON" position. An "OFF" display indicates that Dual Indication or Clearance Monitoring is disabled (check the status of the Red Enable Input, Dual Select switches, SSM Enable switches).

<pre> o FAULT +))))))))))))))))))))), * * CLEARANCE FAIL * * 2:8 * * * * * .))))) - 1 2 3 4 5 6 +))))))))))))))))))))), * * * * * * * * * .))))) - </pre>	<pre> o MONITOR FAIL o RESET o POWER o MODE INC PREV. FAIL </pre>
--	---

The fault timing parameter for Clearance Monitoring is displayed in seconds.

AC+ DATA LOG MODE

While in Normal Operation, depress the **MODE** button 3 times to enter the AC+ Data Log Mode. Each closure of the **INC/PREV.FAIL** button will increment the Fault Display to the next AC data log information. The **RESET** button will exit this mode and return to the Normal Operation display. Each AC data log will scroll the following data on the Fault Display: AC Log # --> "ON or OFF" --> Time --> Date (see section 5-4).

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CHAPTER 6
SPECIFICATIONS

SECTION 6-1 Electrical

Power Requirements

Operating Line Voltage	75 to 135 VAC RMS
Operating Line Frequency	60 \pm 3Hz
Power Consumption	5W (nominal)
Battery Life Time (Ta = 60 °C)	minimum 8 years
Minimum Battery Voltage (Ta = 20 °C)	2.2 volts

AC Voltage Monitors

Green Signal Inputs	(no detect)	less than 15 Vrms*
	(detect)	greater than 25 Vrms*
Yellow signal Inputs	(no detect)	less than 15 Vrms*
	(detect)	greater than 25 Vrms*
Walk Signal Inputs	(no detect)	less than 15 Vrms*
	(detect)	greater than 25 Vrms*
Red Signal Inputs	(no detect)	less than 50 Vrms
	(detect)	greater than 70 Vrms
Red Enable Input	(no detect)	less than 50 Vrms
	(detect)	greater than 70 Vrms

DC Voltage Monitor

+24 VDC Inputs	(inactive)	less than +18 VDC
	(active).	greater than +22 VDC

Logic Inputs

Controller Voltage Monitor, Ext. Reset, +24V Monitor Inhibit,	
Controller Watchdog Input (active)	less than +8 VDC
(inactive)	greater than +16 VDC

* Positive or negative half wave input.

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SECTION 6-2 Timing Functions

Conflict:	(no fault)	less than 200 milliseconds
	(fault)	greater than 450 milliseconds
	(typical)	350 milliseconds
Red Fail:	(no fault)	less than 700 milliseconds
	(fault)	greater than 1000 milliseconds
	(typical)	783 milliseconds
Dual Indication	(no fault)	less than 200 milliseconds
	(fault)	greater than 450 milliseconds
	(typical)	280 milliseconds
Clearance Fail		
Short Yellow (fault)		less than 2.6 seconds
(no fault)		greater than 2.8 seconds
Controller Voltage Monitor, +24V Monitors (no fault)		less than 100 milliseconds
	(fault)	greater than 300 milliseconds
	(typical)	150 milliseconds
External Watchdog (no fault)		less than 1400 milliseconds
	(fault)	greater than 1600 milliseconds
	(typical)	1500 milliseconds
AC+ Interruption (disable)		greater than 475 milliseconds (+25 milliseconds)
Minimum flash after disable		4 to 15 seconds (± 1 second)
Start Delay Relay timer		2.5 seconds (± 1 second)

SECTION 6-3 Mechanical

Dimensions

Height	10.5 inches
Width	4.5 inches
Depth	11.0 inches

SECTION 6-4 Environmental

Storage Temperature Range	-55 to +90 °C
Operating Temperature Range	-37 to +74 °C
Humidity Range	0 to 95% Relative

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**CHAPTER 7
WIRING ASSIGNMENTS**

SECTION 7-1 Monitor Unit Connector A

	<u>PIN</u>	<u>FUNCTION</u>		<u>PIN</u>	<u>FUNCTION</u>
1	A	AC+ INPUT	32	i	CHANNEL 6 WALK
2	B	OUTPUT RELAY 1 OPEN	33	j	CHANNEL 5 WALK
3	C	OUTPUT RELAY 2 CLOSED	34	k	CHANNEL 4 RED
4	D	START DELAY RELAY OPEN	35	m	CHANNEL 4 WALK
5	E	CHANNEL 8 GREEN	36	n	CHANNEL 3 WALK
6	F	CHANNEL 8 YELLOW	37	p	CHANNEL 2 WALK
7	G	CHANNEL 7 GREEN	38	q	CHANNEL 1 WALK
8	H	CHANNEL 6 GREEN	39	r	CHANNEL 1 YELLOW
9	J	CHANNEL 6 YELLOW	40	s	RED ENABLE
10	K	CHANNEL 5 GREEN	41	t	CABINET INTERLOCK A
11	L	CHANNEL 5 YELLOW	42	u	+24V MONITOR INHIBIT
12	M	CHANNEL 4 GREEN	43	v	OUTPUT RELAY 1 CLOSED
13	N	CHANNEL 4 YELLOW	44	w	OUTPUT RELAY 2 OPEN
14	P	CHANNEL 3 GREEN	45	x	START DELAY RELAY CLOSED
15	R	CHANNEL 3 YELLOW	46	y	CHANNEL 8 RED
16	S	CHANNEL 2 GREEN	47	z	CHANNEL 7 RED
17	T	CHANNEL 2 YELLOW			
18	U	CHANNEL 1 GREEN	48	AA	CHANNEL 6 RED
19	V	RESET	49	BB	CHANNEL 5 RED
20	W	+24V MONITOR II	50	CC	CHANNEL 3 RED
21	X	CONT. VOLTAGE MONITOR	51	DD	CHANNEL 2 RED
22	Y	+24V MONITOR I	52	EE	CHANNEL 1 RED
23	Z	LOGIC GROUND	53	FF	CABINET INTERLOCK B
			54	GG	SPARE 1
24	a	CHASSIS GROUND	55	HH	SPARE 2
25	b	AC-	56	JJ	SPARE 3
26	c	OUTPUT RELAY 1 COMMON	57	KK	SPARE 4
27	d	OUTPUT RELAY 2 COMMON	58	LL	SPARE 5
28	e	START DELAY RELAY COMMON	59	MM	SPARE 6
29	f	CHANNEL 8 WALK	60	NN	SPARE 7
30	g	CHANNEL 7 WALK	61	PP	SPARE 8
31	h	CHANNEL 7 YELLOW			

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SECTION 7-2 Monitor Unit Connector B

<u>PIN</u>	<u>FUNCTION</u>	<u>PIN</u>	<u>FUNCTION</u>	
62	A	CHANNEL 18 GREEN	85 a	CHANNEL 16 RED
63	B	CHANNEL 18 YELLOW	86 b	CHANNEL 15 WALK
64	C	CHANNEL 17 GREEN	87 c	CHANNEL 14 WALK
65	D	CHANNEL 17 YELLOW	88 d	CHANNEL 13 WALK
66	E	CHANNEL 16 GREEN	89 e	CHANNEL 13 RED
67	F	CHANNEL 16 YELLOW	90 f	CHANNEL 12 WALK
68	G	CHANNEL 15 GREEN	91 g	CHANNEL 11 WALK
69	H	CHANNEL 15 YELLOW	92 h	CHANNEL 10 WALK
70	J	CHANNEL 14 GREEN	93 i	CHANNEL 10 RED
71	K	CHANNEL 14 YELLOW	94 j	CHANNEL 9 WALK
72	L	CHANNEL 13 GREEN	95 k	CHANNEL 18 RED
73	M	CHANNEL 13 YELLOW	96 m	CHANNEL 17 RED
74	N	CHANNEL 12 GREEN	97 n	CHANNEL 15 RED
75	P	CHANNEL 12 YELLOW	98 p	CHANNEL 14 RED
76	R	CHANNEL 11 GREEN	99 q	CHANNEL 12 RED
77	S	CHANNEL 11 YELLOW	100 r	CHANNEL 11 RED
78	T	CHANNEL 10 GREEN	101 s	CHANNEL 9 RED
79	U	CHANNEL 10 YELLOW	102 t	SPARE
80	V	CHANNEL 9 GREEN		
81	W	CHANNEL 9 YELLOW		
82	X	CHANNEL 18 WALK		
83	Y	CHANNEL 17 WALK		
84	Z	CHANNEL 16 WALK		

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SECTION 7-3 Program Card Connector

PIN	CHANNEL (JUMPER SIDE)	PIN	CHANNEL (BOTTOM SIDE)
1	SPARE	2	1-2
3	1-3	4	1-4
5	1-5	6	1-6
7	1-7	8	1-8
9	1-9	10	1-10
11	1-11	12	1-12
13	1-13	14	1-14
15	1-15	16	1-16
17	1-17	18	1-18
19	2-3	20	2-4
21	2-5	22	2-6
23	2-7	24	2-8
25	2-9	26	2-10
27	2-11	28	2-12
29	2-13	30	2-14
31	2-15	32	2-16
33	2-17	34	2-18
35	3-4	36	3-5
37	3-6	38	3-7
39	3-8	40	3-9
41	3-10	42	3-11
43	3-12	44	3-13
45	3-14	46	3-15
47	3-16	48	3-17
49	3-18	50	4-5
51	4-6	52	4-7
53	4-8	54	4-9
55	4-10	56	4-11
57	4-12	58	4-13
59	4-14	60	4-15
61	4-16	62	4-17
63	4-18	64	5-6
65	5-7	66	5-8
67	5-9	68	5-10
69	5-11	70	5-12
71	5-13	72	5-14
73	5-15	74	5-16
75	5-17	76	5-18
77	6-7	78	6-8
79	6-9	80	6-10

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81	6-11	82	6-12
83	6-13	84	6-14
85	6-15	86	6-16
87	6-17	88	6-18
89	7-8	90	7-9
91	7-10	92	7-11
93	7-12	94	7-13
95	7-14	96	7-15
97	7-16	98	7-17
99	7-18	100	8-9
101	8-10	102	8-11
103	8-12	104	8-13
105	8-14	106	8-15
107	8-16	108	8-17
109	8-18	110	9-10
111	9-11	112	9-12
113	9-13	114	9-14
115	9-15	116	9-16
117	9-17	118	9-18
119	10-11	120	10-12
121	10-13	122	10-14
123	10-15	124	10-16
125	10-17	126	10-18
127	11-12	128	11-13
129	11-14	130	11-15
131	11-16	132	11-17
133	11-18	134	12-13
135	12-14	136	12-15
137	12-16	138	12-17
139	12-18	140	13-14
141	13-15	142	13-16
143	13-17	144	13-18
145	14-15	146	14-16
147	14-17	148	14-18
149	15-16	150	15-17
151	15-18	152	16-17
153	16-18	154	17-18
155	SPARE	156	SPARE
157	SPARE	158	COMMON
159	COMMON	160	SPARE

The Program Card mates with a 40/80 pin double sided edgecard connector having 0.1" centers.

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SECTION 7-4 RS-232 Port Connector

<u>PIN</u>	<u>FUNCTION</u>
1	N/C
2	XMIT DATA
3	RX DATA
4	DTR
5	SIGNAL GROUND
6	N/C
7	N/C
8	N/C
9	N/C

A typical cable assembly for a DB-9 connector on a Personal Computer port would be as follows:

<u>PC DB-9</u>			<u>Monitor DB-9</u>	
RX pin 2		connect to	TX pin 2	
TX pin 3		connect to	RX pin 3	
DTR pin 4		connect to	DTR pin 4	
GND pin 5		connect to	GND pin 5	

DTR pin 4 would also be connected to DSR pin 6 and CTS pin 8 on the PC DB-9 connector.

A typical cable assembly for a DB-25 connector on a Personal Computer port would be as follows:

<u>PC DB-25</u>			<u>Monitor DB-9</u>	
RX pin 3		connect to	TX pin 2	
TX pin 2		connect to	RX pin 3	
DTR pin 20		connect to	DTR pin 4	
GND pin 7		connect to	GND pin 5	

DTR pin 20 would also be connected to DSR pin 6 and CTS pin 5 on the PC DB-25 connector.