

# E/2-1500

## FOUR CHANNEL RACK MOUNT DETECTOR



- Designed with fast response times for use in speed and occupancy applications
- Low power - LEDs and LCD backlighting are extinguished during normal operation
- Pushbutton programming ensures long term reliability by eliminating switch contacts
- All programmed detector parameters are stored in non-volatile memory
- Back-lit LCD screen displays complete detector status and function settings:
  - ◆ Eliminates guess work and provides critical information necessary for proper detector setup
  - ◆ Provides direct visual feedback of channel frequency and sensitivity settings
  - ◆ Built-in detector diagnostic features
- Audible detect (buzzer) helps in verifying vehicles passing over loop(s)

### Overview

The E/2-1500 detector is a four channel card rack loop detector with an easy to read LCD screen and individual channel detect and loop fail indications provided via four high intensity red LEDs. All detector settings and parameters are programmed using four pushbutton switches and the LCD screen. The E/2-1500 offers advanced features providing built-in diagnostic capabilities viewable on the LCD screen. These include: 1.) loop frequency, 2.) loop inductance, 3.) loop inductance change ( $-\Delta L/L\%$ ), 4.) a bargraph indication of relative inductance change, 5.) accumulated number of loop failures.



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# E/2-1500 SPECIFICATIONS

This is a Performance Specification. It is not intended to be used as Operating Instructions.

## General Characteristics:

**Loop Frequency** The LCD screen displays the actual loop operating frequency for each channel, which makes it easy to quickly identify and eliminate crosstalk. Eight (8) selectable loop frequency settings per channel (normally in the range of 20 to 100 kilohertz). The actual loop operating frequency is a function of the loop / lead-in network and the components of the loop oscillator circuit.

**Sensitivity** A unique bar graph displayed on the LCD makes it easy to quickly set the ideal sensitivity for any loop / lead-in network situation. Nine (9) selectable sensitivity levels per channel, plus settings for Continuous-Call and Channel-Off. The selected sensitivity level establishes the threshold at which the detector provides a vehicle detect output signal. [The threshold is defined as  $-\Delta L/L(\%)$ ]. (See **Sensitivity,  $-\Delta L/L$ , & Response Time** table.)

**Continuous-Call** When set to the Continuous-Call state, the channel output is continuously in the Call state regardless of the presence or absence of vehicles over the loop. The loop oscillator is disabled when in the Continuous-Call state. This state is indicated by **CALL** flashing on the LCD. This option is selected from the Sensitivity menu in Program Mode and is useful for checking controller response and other troubleshooting activities.

**Channel-Off** When set to the Channel-Off state, the channel output is continuously in the No-Call state regardless of the presence or absence of vehicles over the loop. The loop oscillator is disabled when in the Channel-Off state. This state is indicated by **OFF** flashing on the LCD. This option is selected from the Sensitivity menu in Program Mode and is useful for checking controller response and other troubleshooting activities.

**Call Delay** Each channel's Call Delay is adjustable from 0 to 255 seconds in one-second steps. Call Delay time begins when a vehicle enters the loop detection zone. The remaining Call Delay time is continuously displayed on the LCD. The channel LED flashes at a 4 Hz rate during delay timing.

**Call Extension** Each channel's Call Extension is adjustable from 0 to 25.5 seconds in 0.1-second steps. Extension time begins when the last vehicle clears the loop detection zone. Any vehicle entering the loop detection zone during the Extension time returns the channel to the Detect state, and later, when the last vehicle clears the loop detection zone, the full Extension time starts counting down again. The remaining Extension time is continuously displayed on the LCD. The channel LED flashes at a 16 Hz rate during extension timing.

**Presence / Pulse** One of two mutually exclusive modes of operation for each channel can be selected in Program Mode:

**Presence Mode** Provides a minimum Call hold time of at least four (4) minutes (regardless of vehicle size) and typically one to three hours for an automobile or truck.

**Pulse Mode** A single output Pulse of  $125 \pm 10$  milliseconds duration is generated for each vehicle entering the loop detection zone. Each detected vehicle is instantly tuned out if it remains in the loop detection zone longer than two (2) seconds. This enables detection of subsequent vehicles entering the loop detection zone. After each vehicle leaves the loop detection zone, the channel resumes full sensitivity within 0.5 seconds.

**Max Presence Timer** Each channel's Max Presence timer is adjustable from 1 to 999 seconds in one-second steps, plus OFF. The Max Presence function is used to limit presence time by automatically resetting a channel. If this function is enabled (On), the Max Presence timer begins counting down when a Call is initiated and the remaining time is continuously displayed on the LCD. If the loop becomes vacant before the Max Presence timer reaches zero, the Call is dropped and no automatic reset occurs.

**Option 1, Loop Inductance Display** When this option is enabled (On), the LCD screen displays the total loop inductance (actual loop inductance plus lead-in inductance) in microhenries for loop inductance values in the range of 20 to 2500 microhenries. NOTE: Enabling this option activates it for all channels. This option is automatically disabled five (5) minutes after the last switch activation or on loss of power.

**Option 2, Loop Inductance  $-\Delta L/L$  Display** When this option is enabled (On), the LCD screen displays the percentage of inductance change ( $-\Delta L/L$  value) during the Call state. To facilitate viewing of the maximum change in the  $-\Delta L/L$  value while traffic is in motion over the detection zone, the detector holds the peak  $-\Delta L/L$  value for a period of two (2) seconds. NOTE: Enabling this option activates it for all channels. This option is automatically disabled five (5) minutes after the last switch activation or on loss of power.

**Option 11, Audible Detect Signal** When this option is enabled (On), an audible signal will be activated whenever vehicles are in the detection zone. The audible signal indicates occupancy of the loop detection zone. Timing functions have no effect on the audible signal. This feature allows a technician to watch the detection zone to confirm correct detector operation without having to look at the detector display. Only one channel can have this feature active at a given time. Turning this option on for one channel automatically turns it off for all other channels. NOTE: This option is automatically disabled five (5) minutes after activation or on loss of power.

## Specifications (Physical):

**Weight** 7.0 oz (199 gm.).

**Size** 4.50 inches (11.43 cm.) high x 1.12 inches (2.84 cm.) wide x 6.875 inches (17.46 cm.) deep (including connector, excluding handle). Handle adds 1.00 inch (2.54 cm.) to depth measurement.

**Operating Temperature**  $-40^\circ\text{F}$  to  $+180^\circ\text{F}$  ( $-40^\circ\text{C}$  to  $+82^\circ\text{C}$ ).

**Circuit Board** Printed circuit boards are 0.062 inch thick FR4 material with 2 oz. copper on both sides and plated through holes. Circuit boards and components are conformal coated with polyurethane.

**Connector** 2 x 22 contact edge card connector with 0.156 inch (0.396 cm.) contact centers. Key slots located between pins B/2 & C/3, E/5 & F/6, and M/11 & N/12. (See **Pin Assignments** table.)

## Specifications (Electrical):

**Power** 10.8 to 14 VDC, 100 mA maximum, 40 mA during normal operation.

**Loop Inductance Range** 20 to 2500 microhenries.

**Loop Feeder Length** Up to 5000 feet (1500 m) maximum with proper feeder cable and appropriate loops.

**Loop Inputs** Transformer isolated. The minimum capacitance added by the detector is 0.068 microfarad.

**Reset** Application of a 30 millisecond low state (0 to 3 VDC) to pin C resets all channels. The detector can also be reset by removing and reapplying power. Each detector channel can be independently reset by pressing the **CHAN** pushbutton until the desired channel is selected, then holding the **CHAN** pushbutton for three (3) seconds. Also, changing either the sensitivity or loop frequency of a channel will reset that channel. NOTE: Resetting a channel does not disable any selectable diagnostic functions. If diagnostic options (Option 1, Option 2, or Option 11) have been activated, they will remain activated following the channel reset. Resetting the detector by applying a 30 millisecond low state to pin C or removing and reapplying power disables all selectable diagnostic features.

**Solid State Outputs** Field effect transistors (FETs). 30 VDC maximum drain to source. 50mA maximum current. 0.1 VDC maximum transistor saturation voltage. The output transistors are protected by 33 volt Zener diodes connected between the drain to source.

## Specifications (Operational):

**Display** The LCD backlighting illuminates whenever any pushbutton is pressed. If one or more channel is in a Call state, the corresponding LED(s) will also illuminate. The backlighting and LEDs will extinguish five (5) minutes after the last actuation of any pushbutton.

**Detect Indicators** Each channel has a high-intensity red light-emitting-diode (LED) to indicate a Call output, Delay Timing, Extension Timing, or failed loop.

**Response Time** See **Sensitivity,  $-\Delta L/L$ , & Response Time** table for actual response times.

**Self-Tuning** The detector automatically tunes and is operational within two (2) seconds after application of power or after being reset. Full sensitivity and hold time require 30 seconds of operation.

**Environmental & Tracking** The detector is fully self-compensating for environmental changes and loop drift over the full temperature range and the entire loop inductance range.

**Grounded Loop Operation** The loop isolation transformer allows operation with poor quality loops, which may include a single point short to ground.

**Loop (Fail) Monitor** If the total inductance of the channel's loop input network goes out of the range specified for the detector, or rapidly changes by more than  $\pm 25\%$ , the channel will immediately enter the Fail-Safe mode and display **LOOP FAIL** on the LCD screen. The type of loop failure will also be displayed as **L Io** (for  $-25\%$  change or shorted loop conditions) or **L Hi** (for  $+25\%$  change or open loop conditions). This will continue as long as the loop fault exists.

**However, if the detector is reset, or power is momentarily lost, the detector will return if the loop inductance is within the acceptable range. If any type of loop failure occurs in one (or more) loop(s) in a group of two or more loops wired in parallel, the detector will not respond with a fail-safe output following any type of reset. It is essential that multiple loops wired to a common detector channel always be wired in series to ensure fail-safe operation under all circumstances.** The Fail-Safe mode generates a continuous call in both Presence Mode and Pulse Mode. At the time of a loop failure, the channel's LED will begin repeating a burst of three flashes each one second. The LED will continue these bursts until the channel is manually reset or power is removed. If the loop self heals, the **LOOP FAIL** message on the LCD will extinguish and the channel will resume operation in a normal manner; except the LED will continue the bursts thus providing an alert that a Loop Fail condition occurred. Each loop failure for the channel is counted and accumulated into the Loop Fail Memory. The total number of loop failures written into the Loop Fail Memory (since the last power interruption or manual reset) is viewed by stepping through the channel's functions in Program Mode to the **LOOP FAIL** message.

**Full Restore To Factory Defaults** Pressing all four front panel switches simultaneously and continuously for five (5) seconds resets the detector and restores all the factory default settings. The countdown of the five second period is displayed on the LCD screen. Releasing any of the switches before the countdown ends will abort the Full Restore operation. (See **Factory Default Settings** table.)

**Display Test** Pressing any two of the front panel switches simultaneously will display all symbols and messages on the LCD screen.

## Sensitivity, $-\Delta L/L$ , & Response Time

Sensitivity	$-\Delta L/L$	Response Time
OFF	----	----
1	0.64%	35 +/-7ms
2	0.32%	35 +/-7ms
3	0.16%	35 +/-7ms
4	0.08%	35 +/-7ms
5	0.04%	35 +/-7ms
6	0.02%	48 +/-10 ms
7	0.01%	79 +/-17 ms
8	0.005%	138 +/-28 ms
9	0.0025%	261 +/-51 ms
CALL	---	---

## Factory Default Settings

Function	Channel 1	Channel 2	Channel 3	Channel 4
Frequency	2	4	6	8
Sensitivity	4	4	4	4
Delay Time	0	0	0	0
Extension Time	0	0	0	0
Max Presence Time	OFF	OFF	OFF	OFF
Presence / Pulse	Presence	Presence	Presence	Presence
Option 1, Loop Inductance	OFF	OFF	OFF	OFF
Option 2, Loop Inductance Change ( $-\Delta L/L$ )	OFF	OFF	OFF	OFF
Option 11, Audible Detect Signal	OFF	OFF	OFF	OFF

## Pin Assignments

Pin	Function	Pin	Function
A	DC Common	1	No Connection
B	DC +	2	No Connection
C	Reset Input	3	No Connection
D	Channel 1 Loop Input	4	Channel 1 Loop Input
E	Channel 1 Loop Input	5	Channel 1 Loop Input
F	Channel 1 Output, Collector (Drain)	6	No Connection
H	No Connection	7	No Connection
J	Channel 2 Loop Input	8	Channel 2 Loop Input
K	Channel 2 Loop Input	9	Channel 2 Loop Input
L	Chassis Ground	10	No Connection
M	No Connection	11	No Connection
N	No Connection	12	No Connection
P	Channel 3 Loop Input	13	Channel 3 Loop Input
R	Channel 3 Loop Input	14	Channel 3 Loop Input
S	Channel 3 Output, Collector (Drain)	15	No Connection
T	No Connection	16	No Connection
U	Channel 4 Loop Input	17	Channel 4 Loop Input
V	Channel 4 Loop Input	18	Channel 4 Loop Input
W	Channel 2 Output, Collector (Drain)	19	No Connection
X	No Connection	20	No Connection
Y	Channel 4 Output, Collector (Drain)	21	No Connection
Z	No Connection	22	No Connection