

222 SERIES

TWO CHANNEL RACK MOUNT DETECTOR



- Two detector channels in a single unit
- Eight front panel DIP switches for each channel provide:
 - ◆ Eight levels of sensitivity
 - ◆ Presence or Pulse mode
 - ◆ Four loop frequencies
 - ◆ Fail-Safe or Fail-Secure operation
 - ◆ Channel disable
- Loops are sequentially scanned to eliminate crosstalk
- Loop fail event monitor remembers and indicates intermittent and current loop failures
- Detector is self tuning and provides complete environmental tracking
- Dual color (red / green), high intensity LEDs provide detect and loop fail indications
- Complete built-in detector integrity test
- Space provided on front panel to label each channel
- Audible detect signal (buzzer) facilitates loop and/or detector troubleshooting

With Audible Detect Signal

Ordering Information

Model 222-XX ← R = Relay outputs
Blank = Solid State outputs

Overview

The Model 222 is a California Department of Transportation (Caltrans) approved vehicle detector. Model 222 detectors are two channel, DIP switch programmable, card rack type loop detectors with individual channel detect and loop fail indications provided via two dual color, high intensity LEDs.



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222 SERIES SPECIFICATIONS

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

General Characteristics:

Loop Frequency Each channel has four (4) DIP switch selectable loop frequencies (normally in the range of 20 to 100 kilohertz) that are a function of the actual loop / lead-in network.

Sensitivity Eight (8) sensitivity levels are available for each channel. The eight settings are selectable using three DIP switches. Each of the eight sensitivity levels are binary encoded from 0 to 7 (lowest to highest sensitivity). The sensitivity level selected determines the percentage of negative inductance change of the loop circuit required for a Call output signal. (See **Sensitivity, -ΔL/L, & Response Time** table.)

Channel Disable When set to the Disable position, 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 not activated when the channel is in the Disabled (ON) state. Changing this setting will reset the channel.

Presence / Pulse Mode Each channel can be independently set to operate in one of two modes by means of front panel mounted DIP switches.

Presence Mode Call hold time is a minimum of four minutes regardless of vehicle size, and is typically one to three hours for an automobile or truck.

Pulse Mode A pulse of 125 ±10 millisecond duration is generated for each vehicle entering the loop detection zone. Each vehicle detected is instantly tuned out if it remains in the loop detection zone longer than two seconds. This feature allows detection of vehicles subsequently entering the detection zone. After each vehicle leaves the loop detection zone, the channel resumes full detection sensitivity within one second. Changing the Presence / Pulse Mode switch will reset the channel.

Fail-Safe / Fail-Secure Operation During a loop failure condition, the state of the channel's output can be selected as Call in the Fail-Safe mode or No Call in the Fail-Secure mode. Fail-Safe operation during a loop failure is the standard mode of operation for intersection control. Fail-Secure operation during a loop failure is typically used for incident detection systems for freeway management. Fail-Secure selection also selects fast response for very accurate speed measurements. Changing this setting will reset the channel. (See **Sensitivity, -ΔL/L, & Response Time** table.)

Audible Detect Signal A front panel mounted pushbutton is used to enable an audible detect signal that is emitted any time a given channel's detection zone is occupied.

100 Millisecond Minimum Output When the detector is operating in Presence mode, two modes of operation are available for the Call outputs; Normal mode or 100 Millisecond Minimum Output mode. 100 Millisecond Minimum Output mode can be selected via a DIP switch on a PC board mounted two-position DIP switch module. When this feature is OFF, Call outputs will stay on only as long as the detection zone is occupied. When this feature is ON, every Call output will have a minimum duration of 100 milliseconds.

Detect / Fail Indicator Each channel has a super bright, high intensity, dual color (red / green) LED that indicates a Call output and/or the status of any current or prior loop fault condition. A continuous ON (green) state indicates a Call output. A continuous ON (red) state indicates that a current open loop failure condition or an inductance change condition of greater than +25% condition exists. A one Hz (red) flash rate indicates that a current shorted loop failure condition or an inductance change condition of greater than -25% condition exists. A flash rate of three 50 millisecond (red) pulses indicates a prior loop failure condition. A flash rate of three 50 millisecond (red) pulses followed by a 750 millisecond (green) pulse indicates a prior loop failure condition and a current Call output (detect state). If the audible detect signal is activated, any detect indication that would normally be displayed as green will be displayed as orange.

Loop Fail (Event) Monitor: If the total inductance of the loop input network goes out of the range specified for the detector, or rapidly changes by more than ±25%, the affected channel will immediately enter the programmed Fail-Safe or Fail-Secure mode of operation. Fail-Safe operation generates a continuous Call output in the Presence or Pulse mode. Fail-secure operation does not generate a Call output during a loop failure. In both modes of operation, the detect / fail LED will illuminate (red) and remain on for as long as the loop fault exists. If the loop self-heals, the channel will resume operation in a normal manner, but the detect / fail LED of the channel will begin to flash at a rate of three flashes per second as a means of indicating a prior loop fail condition. The detect / fail LED will continue its indication of a prior loop failure until the detector channel is reset, the detector channel is reset, or the detector is reset.

Specifications (Physical):

Weight 6.0 oz (170 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° F to +180° F (-40° C to +82° 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 30 VDC. Solid State outputs, 100 mA maximum; Relay outputs, 130 mA maximum.

Loop Inductance Range 20 to 2000 microhenries with a Q factor of 5 or greater.

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.

Scanning: The loop(s) connected to each detector channel are activated alternately to minimize crosstalk between adjacent loops connected to the same detector.

Lightning Protection The detector can tolerate, without damage, a 10 microfarad capacitor charged to 2,000 volts being discharged directly into the loop input terminals, or a 10 microfarad capacitor charged to 2,000 volts being discharged between either loop terminal and earth (chassis) ground.

Detector Reset Changing the position of either channel's DIP switches (except the frequency switches) will reset that detector channel. The detector can be reset by connecting a logic ground signal to Pin C (Reset Pin). Reapplication of power after a power loss will also cause the detector to reset. After changing either channel's frequency selection switches (DIP switches 2 & 3), the channel must be reset.

Solid State Outputs Optically isolated. 30 VDC max. collector (drain) to emitter (source). 100 mA max. saturation current. 2 VDC max. transistor saturation voltage. The output is protected with a 33-volt Zener diode connected between the collector (drain) and emitter (source).

Relay Outputs The relay contacts are rated for 6 Amps max., 150 VDC max., and 180 Watts max. switched power.

Response Time The response time of either channel is affected by the sensitivity level setting and Fail-Safe / Fail-Secure selection of that channel. When set to operate in Fail-Safe mode, response time is 65 ±25 milliseconds for all sensitivity levels. When set to operate in Fail-Secure mode, response time varies and depends on the sensitivity level selected. (See **Sensitivity, -ΔL/L, & Response Time** table.)

Self Tuning The detector automatically self tunes and is operational within two seconds after application of power or after being reset. Full sensitivity and hold time requires 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 one short to ground at a single point).

Test Mode A PCB mounted DIP switch enables Test Mode. Test Mode provides a means of verifying proper operation of the detector's controls and indicators (switches and LEDs). Each channel's loop oscillator circuit is also checked to verify the correct frequency in each of the four frequency settings.

Sensitivity, -ΔL/L, & Response Time

Sensitivity	-ΔL/L	Response Time	
		Fail-Safe Mode	Fail-Secure Mode
0	1.28%	65 +/-25 ms	3.5 +/-2.5 ms
1	0.64%	65 +/-25 ms	3.5 +/-2.5 ms
2	0.32%	65 +/-25 ms	3.5 +/-2.5 ms
3	0.16%	65 +/-25 ms	3.5 +/-2.5 ms
4	0.08%	65 +/-25 ms	4.5 +/-3.5 ms
5	0.04%	65 +/-25 ms	7.0 +/-6.0 ms
6	0.02%	65 +/-25 ms	11.5 +/-10.5 ms
7	0.01%	65 +/-25 ms	21.5 +/-20.5 ms

Factory Default Settings (Both Channels)

DIP Switch	ON	OFF	Factory Default
1	Channel Disabled	Channel Enabled	OFF
2	Four (4) Frequency Selections		OFF
3			OFF
4	Fail-Safe Mode	Fail-Secure Mode	ON
5	Presence Mode	Pulse Mode	ON
6			OFF
7	Eight (8) Sensitivity Selections		ON
8			ON

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) / Relay Normally Open	6	No Connection
H	Channel 1 Output, Emitter (Source) / Relay Common	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	No Connection	13	No Connection
R	No Connection	14	No Connection
S	No Connection	15	No Connection
T	No Connection	16	No Connection
U	No Connection	17	No Connection
V	No Connection	18	No Connection
W	Channel 2 Output, Collector (Drain) / Relay Normally Open	19	No Connection
X	Channel 2 Output, Emitter (Source) / Relay Common	20	No Connection
Y	No Connection	21	No Connection
Z	No Connection	22	No Connection

222S SERIES

TWO CHANNEL RACK MOUNT DETECTOR



- Two detector channels in a single unit.
- Eight front panel DIP switches for each channel provide:
 - Eight levels of sensitivity.
 - Presence or Pulse mode.
 - Four loop frequencies.
 - Fail-Safe or Fail-Secure operation.
 - Channel disable.
- Front panel mounted Call / Test switch can be used to simulate CALL output.
- Loops are sequentially scanned to eliminate Crosstalk.
- Loop Fail "Event" Monitor remembers and indicates intermittent and current loop failures.
- Detector is self tuning and provides complete environmental tracking.
- Dual color (Red / Green), high intensity LEDs provide "Detect " and "Loop Fail" indications.
- Complete built-in detector integrity test.
- Space provided on front panel to label each channel.
- Audible detect signal (buzzer) facilitates loop and/or detector troubleshooting.

Ordering Information:

Model 222S-R Two-channel detector with Relay outputs.

Model 222S-SS Two-channel detector with Solid State outputs.

Overview:

The Model 222S is a two channel, card rack type loop detector. It is designed for use in installations requiring a Type 332 / 170 detector. The Model 222S incorporates a three position Call / Test switch for each channel which can be used to simulate a continuous or momentary CALL output. This feature is useful when troubleshooting problems related to detector outputs and / or controller inputs.

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222S SERIES SPECIFICATION

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

Loop Frequency: Four (4) DIP switch selectable loop frequencies (normally in the range of 20 to 100 kiloHertz) are a function of the actual loop / lead-in network.

Sensitivity: Eight (8) sensitivity levels are available for each channel. The eight settings are selectable using three DIP switches. Each of the eight sensitivity levels are binary encoded from 0 to 7 (lowest to highest sensitivity). The sensitivity level selected determines the percentage of negative inductance change of the loop circuit required for a "CALL" output signal. See "SENSITIVITY, -Δ/L, & RESPONSE TIME in Fail-Secure mode" table.

Channel Disable: When set to the "Disable" position, 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 not activated when the channel is in the "Disabled" (ON) state. Changing this setting will RESET the channel.

Call / Test Switch: Each channel can be independently set to provide a simulated call output. Each detector channel has a front panel mounted, three position toggle switch that can be used to short the detector channel's output terminals in either a continuous (CALL) or momentary (TEST) closed state.

Presence / Pulse Mode: Each channel can be independently set to operate in one of two modes by means of front panel mounted DIP switches.

Presence Mode: Call hold time is a minimum of four minutes regardless of vehicle size, and is typically 1 to 3 hours for an automobile or truck.

Pulse Mode: A pulse of 125 ±10 milliseconds duration is generated for each vehicle entering the loop detection zone. Each vehicle detected is instantly tuned out if it remains in the loop detection zone longer than two seconds. This feature allows detection of vehicles subsequently entering the detection zone. After each vehicle leaves the loop detection zone, the channel resumes full detection sensitivity within one second. Changing the Presence / Pulse Mode switch will RESET the channel.

100ms Minimum Output: A PCB mounted DIP switch controls the 100ms Minimum Output feature. When any channel is set to operate in Presence Mode, two Call output modes for that channel's output are available based on the setting of the 100ms Minimum Output DIP switch. Setting the 100ms Minimum Output DIP switch to the On position activates the feature and every Call will have a minimum duration of 100ms. Setting the 100ms Minimum Output DIP switch to the Off position allows the detector to operate normally and the Call output duration is based on the amount of time a vehicle remains in the loop detection zone. This feature is useful as a means of ensuring that Calls output by the detector are seen by the controller since some controllers are unable to catch short (<100ms) events.

Fail-Safe / Fail-Secure Operation: During a loop failure condition, the state of a channel's output can be selected as "Call" in Fail-Safe mode or "No Call" in Fail-Secure mode. This is accomplished via two front panel mounted DIP switches. Operation in Fail-Safe mode during a loop failure is the generally accepted mode of operation for intersection control. Operation in Fail-Secure mode during a loop failure is typically used in incident detection systems used for freeway management. Changing a channel's Fail-Safe / Fail Secure setting will RESET the channel.

Audible Detect Signal: A PCB mounted DIP switch is used to enable an audible detect signal which is emitted any time that a given channel's detection zone is occupied.

Detect / Fail Indicator: Each channel has a super bright, high intensity, dual color (Red / Green) LED which indicates a Call output and / or the status of any current or prior loop fault condition for that channel. A green indication signifies a CALL output (detect state). A red indication signifies a loop failure condition. A continuous On (green) state indicates a CALL output. A continuous On (red) state indicates that a current open loop failure condition or an inductance change condition of greater than + 25% condition exists. When operating in Fail-Safe mode, this indication is also generates a CALL output. When operating in Fail-Secure mode, no CALL output is generated. A 1 Hz (red) flash rate indicates that a current shorted loop failure condition or an inductance change condition of greater than - 25% condition exists. When operating in Fail-Safe mode, this indication is also generates a CALL output. When operating in Fail-Secure mode, no CALL output is generated. A flash rate of three 50 millisecond (red) pulses indicates a prior loop failure condition. A flash rate of three 50 millisecond (red) pulses followed by a 750 millisecond (green) pulse indicates a prior loop failure condition and a current CALL output (detect state).

Loop Fail (Event) Monitor: If the total inductance of the loop input network goes out of the range specified for the detector, or rapidly changes by more than ±25%, the affected channel will immediately enter the programmed Fail-Safe or Fail-Secure mode of operation. Fail-Safe operation generates a continuous call output in Presence or Pulse mode. Fail-Secure operation does not generate a call during a loop failure. In both modes of operation, the DETECT / FAIL LED will illuminate or flash in the appropriate (red) state and continue to do so for as long as the loop fault exists. If the loop "self-heals", the channel will resume operation in a normal manner, but the DETECT / FAIL LED of the channel will begin to flash at a rate of three flashes per second as a means of indicating a prior Loop Fail condition. The FAIL LED will continue its indication of a prior loop failure until the detector channel is reset or the detector is manually reset.

Loop Inductance Range: 20 to 2000 microhenries with a Q factor of 5 or greater.

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

Loop Input: Transformer isolated. The minimum capacitance added by the detector is 0.068 microfarad.

Scanning: The loop(s) connected to each detector channel are activated alternately to minimize crosstalk between adjacent loops connected to the same detector.

Lightning Protection: The detector can tolerate, without damage, a 10 microfarad capacitor charged to 2,000 volts being discharged directly into the loop input terminals, or a 10 microfarad capacitor charged to 2,000 volts being discharged between either loop terminal and earth (chassis) ground.

Detector Reset: Changing the position of any channel's DIP Switches (except the Frequency switches) will reset that detector channel. The detector can be reset by connecting a logic ground signal to Pin C (Reset Pin). Reapplication of power after a power loss will also cause the detector to reset. After changing any channel's Frequency selection switches (DIP Switches 2 & 3), the detector will require a reset.

Solid State Outputs: Optically coupled transistors. 30 VDC max. collector to emitter. 50 mA max. collector current. 1.2 VDC max. transistor saturation voltage. The output transistors are protected by a 33 volt Zener diode connected between the emitter and collector.

Relay Outputs (Optional): The relay contacts are rated for 6 Amps max., 150 VDC max., and 180 Watts max. switched power.

Response Time: The response time of either channel is affected by the sensitivity level setting and Fail-Safe / Fail-Secure selection of that channel. When set to operate in Fail-Safe mode, response time is 65 ms ±25 ms for all sensitivity levels. When set to operate in Fail-Secure mode, response time varies and depends on the sensitivity level selected. See "SENSITIVITY, -Δ/L, & RESPONSE TIME in Fail-Secure mode" table.

Self Tuning: The detector automatically self tunes and is operational within two seconds after application of power or after being reset. Full sensitivity and hold time requires 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 one short to ground at a single point).

Detect Outputs: Conduction indicates detection output. The output is conductive in a DC power supply failure condition or during a loop failure (i.e. An open loop or shorted loop condition).

Test Mode: A PCB mounted switch enables Test Mode. Test Mode provides a means of verifying proper operation of all of the detector's input and output circuitry including switches, LEDs, and outputs. Each channel's loop oscillator circuit is also checked to verify the correct frequency in each of the four frequency settings. The frequency portion of testing requires that each channel be connected to a 100 microhenry loop; if other inductance values are used, the frequency test results will be invalid.

Weight: 6.0 oz (170 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°F to +180°F (-40°C to +82°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).

Power: 10.8 to 30 VDC. Solid State outputs, 100 mA max.; Relay outputs, 130 mA max.

TABLES

SENSITIVITY, -Δ/L, & RESPONSE TIME in Fail-Secure Mode:

Switch Position	0	1	2	3	4*	5	6	7
-Δ/L	1.28%	0.64%	0.32%	0.16%	0.08%	0.04%	0.02%	0.01%
Response Time (ms)	3.5 ±2.5	3.5 ±2.5	3.5 ±2.5	3.5 ±2.5	4.5 ±2.5	7 ±6	11.5 ±10.5	21.5 ±20.5

* Denotes factory default.

Notes:

Changing any of a channel's sensitivity switches will RESET that channel.

To achieve the exact response times listed above, the Sensitivity level settings for both channels must be the same and both channels must be set to operate in Fail-Secure mode.

PIN ASSIGNMENTS:

Pin	Function	Pin	Function
A	DC (-) Common	1	No Connection
B	DC (+) Power	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 / Normally Open	6	No Connection
H	Channel 1 Output, Emitter / Common	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	No Connection	13	No Connection
R	No Connection	14	No Connection
S	No Connection	15	No Connection
T	No Connection	16	No Connection
U	No Connection	17	No Connection
V	No Connection	18	No Connection
W	Channel 2 Output, Collector / Normally Open	19	No Connection
X	Channel 2 Output, Emitter / Common	20	No Connection
Y	No Connection	21	No Connection
Z	No Connection	22	No Connection

FACTORY DEFAULT SETTINGS:

Switch	Function	Setting	Factory Default
1	Disable	Off	OFF
2	Frequency	0	OFF
3			OFF
4	Fail-Safe / Fail Secure	Fail-Safe	ON
5	Presence / Pulse	Presence	ON
6	Sensitivity	4	OFF
7			OFF
8			ON

G-200 SERIES

TWO CHANNEL RACK MOUNT DETECTOR



- Two detector channels in a single unit
- Eight front panel DIP switches for each channel provide:
 - ◆ Eight levels of sensitivity
 - ◆ Presence or Pulse mode
 - ◆ Four loop frequencies
 - ◆ Fail-Safe or Fail-Secure operation
 - ◆ Channel disable
- Loops are sequentially scanned to eliminate crosstalk
- Loop fail event monitor remembers and indicates intermittent and current loop failures
- Detector is self tuning and provides complete environmental tracking
- Dual color (red / green), high intensity LEDs provide detect and loop fail indications
- Complete built-in detector integrity test
- Space provided on front panel to label each channel
- Audible detect signal (buzzer) facilitates loop and/or detector troubleshooting

With Audible Detect Signal

Ordering Information

Model G-200-XX ← R = Relay outputs
SS = Solid State outputs

Overview

The Model G-200 series is designed to meet or exceed NEMA Standards TS 2-1998 for Type A detectors and is downward compatible to NEMA Standards TS 1-1989. Model G-200 detectors are two channel, DIP switch programmable, card rack type loop detectors with individual channel detect and loop fail indications provided via two dual color, high intensity LEDs.



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G-200 SERIES SPECIFICATIONS

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

General Characteristics:

Loop Frequency Each channel has four (4) DIP switch selectable loop frequencies (normally in the range of 20 to 100 kilohertz) that are a function of the actual loop / lead-in network.

Sensitivity Eight (8) sensitivity levels are available for each channel. The eight settings are selectable using three DIP switches. Each of the eight sensitivity levels are binary encoded from 0 to 7 (lowest to highest sensitivity). The sensitivity level selected determines the percentage of negative inductance change of the loop circuit required for a Call output signal. (See **Sensitivity, -ΔL/L, & Response Time** table.)

Channel Disable When set to the Disable position, 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 not activated when the channel is in the Disabled (ON) state. Changing this setting will reset the channel.

Presence / Pulse Mode Each channel can be independently set to operate in one of two modes by means of front panel mounted DIP switches.

Presence Mode Call hold time is a minimum of four minutes regardless of vehicle size, and is typically one to three hours for an automobile or truck.

Pulse Mode A pulse of 125 ±10 millisecond duration is generated for each vehicle entering the loop detection zone. Each vehicle detected is instantly tuned out if it remains in the loop detection zone longer than two seconds. This feature allows detection of vehicles subsequently entering the detection zone. After each vehicle leaves the loop detection zone, the channel resumes full detection sensitivity within one second. Changing the Presence / Pulse Mode switch will reset the channel.

Fail-Safe / Fail-Secure Operation During a loop failure condition, the state of the channel's output can be selected as Call in the Fail-Safe mode or No Call in the Fail-Secure mode. Fail-Safe operation during a loop failure is the standard mode of operation for intersection control. Fail-Secure operation during a loop failure is typically used for incident detection systems for freeway management. Fail-Secure selection also selects fast response for very accurate speed measurements. Changing this setting will reset the channel. (See **Sensitivity, -ΔL/L, & Response Time** table.)

100 Millisecond Minimum Output When the detector is operating in Presence mode, two modes of operation are available for the Call outputs; Normal mode or 100 Millisecond Minimum Output mode. 100 Millisecond Minimum Output mode can be selected via a DIP switch on a PC board mounted two-position DIP switch module. When this feature is OFF, Call outputs will stay on only as long as the detection zone is occupied. When this feature is ON, every Call output will have a minimum duration of 100 milliseconds.

Audible Detect Signal A front panel mounted pushbutton is used to enable an audible detect signal that is emitted any time a given channel's detection zone is occupied.

Detect / Fail Indicator Each channel has a super bright, high intensity, dual color (red / green) LED that indicates a Call output and/or the status of any current or prior loop fault condition. A continuous ON (green) state indicates a Call output. A continuous ON (red) state indicates that a current open loop failure condition or an inductance change condition of greater than +25% condition exists. A one Hz (red) flash rate indicates that a current shorted loop failure condition or an inductance change condition of greater than -25% condition exists. A flash rate of three 50 millisecond (red) pulses indicates a prior loop failure condition. A flash rate of three 50 millisecond (red) pulses followed by a 750 millisecond (green) pulse indicates a prior loop failure condition and a current Call output (detect state). If the audible detect signal is activated, any detect indication that would normally be displayed as green will be displayed as orange.

Loop Fail (Event) Monitor: If the total inductance of the loop input network goes out of the range specified for the detector, or rapidly changes by more than ±25%, the affected channel will immediately enter the programmed Fail-Safe or Fail-Secure mode of operation. Fail-Safe operation generates a continuous Call output in the Presence or Pulse mode. Fail-secure operation does not generate a Call output during a loop failure. In both modes of operation, the detect / fail LED will illuminate (red) and remain on for as long as the loop fault exists. If the loop self-heals, the channel will resume operation in a normal manner, but the detect / fail LED of the channel will begin to flash at a rate of three flashes per second as a means of indicating a prior loop failure condition. The detect / fail LED will continue its indication of a prior loop failure until the detector channel is reset, the detector channel is reset, or the detector is reset.

Specifications (Physical):

Weight 6.0 oz (170 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° F to +180° F (-40° C to +82° 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 30 VDC. Solid State outputs, 100 mA maximum; Relay outputs, 130 mA maximum.

Loop Inductance Range 20 to 2000 microhenries with a Q factor of 5 or greater.

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.

Scanning: The loop(s) connected to each detector channel are activated alternately to minimize crosstalk between adjacent loops connected to the same detector.

Lightning Protection The detector can tolerate, without damage, a 10 microfarad capacitor charged to 2,000 volts being discharged directly into the loop input terminals, or a 10 microfarad capacitor charged to 2,000 volts being discharged between either loop terminal and earth (chassis) ground.

Detector Reset Changing the position of either channel's DIP switches (except the frequency switches) will reset that detector channel. The detector can be reset by connecting a logic ground signal to Pin C (Reset Pin). Reapplication of power after a power loss will also cause the detector to reset. After changing either channel's frequency selection switches (DIP switches 2 & 3), the channel must be reset.

Solid State Outputs Optically isolated. 30 VDC max. collector (drain) to emitter (source). 100 mA max. saturation current. 2 VDC max. transistor saturation voltage. The output is protected with a 33-volt Zener diode connected between the collector (drain) and emitter (source).

Relay Outputs The relay contacts are rated for 6 Amps max., 150 VDC max., and 180 Watts max. switched power.

Response Time The response time of either channel is affected by the sensitivity level setting and Fail-Safe / Fail-Secure selection of that channel. When set to operate in Fail-Safe mode, response time is 65 ±25 milliseconds for all sensitivity levels. When set to operate in Fail-Secure mode, response time varies and depends on the sensitivity level selected. (See **Sensitivity, -ΔL/L, & Response Time** table.)

Self Tuning The detector automatically self tunes and is operational within two seconds after application of power or after being reset. Full sensitivity and hold time requires 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 one short to ground at a single point).

Detect Outputs Per NEMA TS 2, a detection output (Call) is indicated by a closed relay contact (Relay output) or a conducting state (Solid State output). When operating in Fail-Safe mode, a channel's output defaults to a Call state for any loop failure condition on that channel. When operating in Fail-Secure mode, a channel's output defaults to a No Call state for any loop failure condition on that channel. In either Fail-Safe or Fail-secure mode, a channel's output defaults to a Call state upon loss of power.

NEMA TS 2 Channel Status Outputs Meets and/or exceeds all NEMA TS 2 status output specifications.

Test Mode A PCB mounted DIP switch enables Test Mode. Test Mode provides a means of verifying proper operation of the detector's controls and indicators (switches and LEDs). Each channel's loop oscillator circuit is also checked to verify the correct frequency in each of the four frequency settings.

Sensitivity, -ΔL/L, & Response Time

Sensitivity	-ΔL/L	Response Time	
		Fail-Safe Mode	Fail-Secure Mode
0	1.28%	65 +/-25 ms	3.5 +/-2.5 ms
1	0.64%	65 +/-25 ms	3.5 +/-2.5 ms
2	0.32%	65 +/-25 ms	3.5 +/-2.5 ms
3	0.16%	65 +/-25 ms	3.5 +/-2.5 ms
4	0.08%	65 +/-25 ms	4.5 +/-3.5 ms
5	0.04%	65 +/-25 ms	7.0 +/-6.0 ms
6	0.02%	65 +/-25 ms	11.5 +/-10.5 ms
7	0.01%	65 +/-25 ms	21.5 +/-20.5 ms

Factory Default Settings (Both Channels)

DIP Switch	ON	OFF	Factory Default
1	Channel Disabled	Channel Enabled	OFF
2	Four (4) Frequency Selections		OFF
3			OFF
4	Fail-Safe Mode	Fail-Secure Mode	ON
5	Presence Mode	Pulse Mode	ON
6			OFF
7	Eight (8) Sensitivity Selections		ON
8			ON

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) / Relay Normally Open	6	No Connection
H	Channel 1 Output, Emitter (Source) / Relay Common	7	Channel 1 TS 2 Status Output
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	No Connection	13	No Connection
R	No Connection	14	No Connection
S	No Connection	15	No Connection
T	No Connection	16	No Connection
U	No Connection	17	No Connection
V	No Connection	18	No Connection
W	Channel 2 Output, Collector (Drain) / Relay Normally Open	19	No Connection
X	Channel 2 Output, Emitter (Source) / Relay Common	20	Channel 2 TS 2 Status Output
Y	No Connection	21	No Connection
Z	No Connection	22	No Connection

GT-200 SERIES



TWO CHANNEL RACK MOUNT DETECTOR WITH TIMING



- Meets and exceeds NEMA TS 2 specification.
- Call Delay selectable in one-second increments up to 63 seconds.
- Call Extension selectable in 1/4-second increments up to 15.75 seconds.
- Eight front panel DIP switches for each channel provide:
 - Eight levels of sensitivity.
 - Presence or Pulse mode.
 - Four loop frequencies.
 - Fail-Safe or Fail-Secure operation.
 - Channel disable.
- Loops are sequentially scanned to eliminate crosstalk.
- Channel status outputs provide individual channel status states per NEMA TS 2.
- Loop Fail Event Monitor remembers and indicates intermittent and current loop failures.
- Detector is self tuning and provides complete environmental tracking.
- Dual color, high intensity LEDs:
 - Green indicates detect.
 - Red indicates loop fail.
- Audible detect signal (buzzer) facilitates loop and/or detector troubleshooting.
- Complete built-in detector integrity test.

Ordering Information:

Model GT-200-XX ← R = Relay outputs
SS = Solid State outputs

With Audible Detect Signal

Overview:

The Model GT-200 series is designed to meet or exceed NEMA Standards TS 2-1998 for Type C detectors and is downward compatible to NEMA Standards TS 1-1989. Model GT-200 detectors are two channel, card rack type loop detectors with delay and extension timing. Delay and extension timing condition the channel Call outputs in either Presence or Pulse mode.

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GT-200 SERIES SPECIFICATION

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

Loop Frequency: Each channel has four (4) DIP switch selectable loop frequencies (normally in the range of 20 to 100 kilohertz) that are a function of the actual loop / lead-in network.

Sensitivity: Eight (8) sensitivity levels are available for each channel. The eight settings are selectable using three DIP switches. Each of the eight sensitivity levels are binary encoded from 0 to 7 (lowest to highest sensitivity). The sensitivity level selected determines the percentage of negative inductance change of the loop circuit required for a CALL output signal. See **SENSITIVITY, -ΔL/L, & RESPONSE TIME** table.

Channel Disable: When set to the Disable position, 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 not activated when the channel is in the Disabled (ON) state. Changing this setting will RESET the channel.

Presence / Pulse Mode: Each channel can be independently set to operate in one of two modes by means of front panel mounted DIP switches.

Presence Mode: Call hold time is a minimum of four minutes regardless of vehicle size, and is typically one to three hours for an automobile or truck.

Pulse Mode: A pulse of 125 ±10 milliseconds duration is generated for each vehicle entering the loop detection zone. Each vehicle detected is instantly tuned out if it remains in the loop detection zone longer than two seconds. This feature allows detection of vehicles subsequently entering the detection zone. After each vehicle leaves the loop detection zone, the channel resumes full detection sensitivity within one second. Changing the Presence / Pulse Mode switch will RESET the channel.

Fail-Safe / Fail-Secure Operation: During a loop failure condition, the state of the channel's output can be selected as CALL in the Fail-Safe mode or NO CALL in the Fail-Secure mode. Fail-Safe operation during a loop failure is the standard mode of operation for intersection control. Fail-Secure operation during a loop failure is typically used for incident detection systems for freeway management. Fail-Secure selection also selects fast response for very accurate speed measurements. See **SENSITIVITY, -ΔL/L, & RESPONSE TIME** table. Changing this setting will RESET the channel.

Call Delay: Each channel's Call Delay is adjustable from 0 to 63 seconds in one-second steps by means of PCB mounted DIP switches. Call Delay time starts counting down when a vehicle first enters the loop detection zone. If the Delay feature is activated, the output will only be turned on after the selected delay time has passed with a vehicle continuously present in the loop detection area. If a vehicle leaves the loop detection area during the delay interval, detection is aborted and the next vehicle to enter the loop detection area will initiate a new full delay interval. Whenever a channel's Phase Green Input (call delay override) signal (pins 1 or 2) is active (low state), the Call Delay function for that channel is aborted and the Call delay time is forced to zero. The detector indicates that a vehicle is being detected but that the outputs are being delayed by flashing the channel's Detect / Fail LED (green) at four Hz with a 50% duty cycle.

Call Extension: Each channel's Call Extension is adjustable from 0 to 15.75 seconds in 1/4-second steps. Call Extension time starts counting down when the last vehicle leaves the loop detection zone. In the event a vehicle enters the loop detection zone before the extension time expires, the detector will return to the detect state (regardless of the setting of the delay timer) and the extension timer will be reset. When the last vehicle leaves the loop detection zone, full Extension time is reestablished and the detector begins counting down again. The detector will indicate that the extension interval is currently timing by flashing the channel's Detect / Fail LED (green) at 16 Hz with a 50% duty cycle.

Audible Detect Signal: A front panel mounted push button is used to enable an audible detect signal that is emitted any time a given channel's detection zone is occupied.

Detect / Fail Indicator: Each channel has a super bright, high intensity, dual color (Red / Green) LED that indicates a Call output and/or the status of any current or prior loop fault condition. A continuous On (green) state indicates a CALL output. A continuous On (red) state indicates that a current open loop failure condition or an inductance change condition of greater than +25% condition exists. A one Hz (red) flash rate indicates that a current shorted loop failure condition or an inductance change condition of greater than -25% condition exists. A flash rate of three 50 millisecond (red) pulses indicates a prior loop failure condition. A flash rate of three 50 millisecond (red) pulses followed by a 750 millisecond (green) pulse indicates a prior loop failure condition and a current CALL output (detect state). If the audible detect signal is activated, any detect indication that would normally be displayed as green will be displayed as orange.

Loop Fail (Event) Monitor: If the total inductance of the loop input network goes out of the range specified for the detector, or rapidly changes by more than ±25%, the affected channel will immediately enter the programmed Fail-Safe or Fail-Secure mode of operation. Fail-Safe operation generates a continuous Call output in the Presence or Pulse mode. Fail-secure operation does not generate a call during a loop failure. In both modes of operation, the FAIL LED will illuminate and remain on for as long as the loop fault exists. If the loop self-heals, the channel will resume operation in a normal manner, but the FAIL LED of the channel will begin to flash at a rate of three flashes per second as a means of indicating a prior Loop Fail condition. The FAIL LED will continue its indication of a prior loop failure until the detector channel is reset or the detector is manually reset.

Loop Inductance Range: 20 to 2000 microhenries with a Q factor of 5 or greater.

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

Loop Input: Transformer isolated. The minimum capacitance added by the detector is 0.068 microfarad.

Scanning: The loop(s) connected to each detector channel are activated alternately to minimize crosstalk between adjacent loops connected to the same detector.

Lighting Protection: The detector can tolerate, without damage, a 10 microfarad capacitor charged to 2,000 volts being discharged directly into the loop input terminals, or a 10 microfarad capacitor charged to 2,000 volts being discharged between either loop terminal and earth (chassis) ground.

Detector Reset: Changing the position of either channel's DIP switches (except the Frequency switches or Call Delay / Call Extension switches) will reset that detector channel. The detector can be reset by connecting a logic ground signal to Pin C (Reset Pin). Reapplication of power after a power loss will also cause the detector to reset. After changing either channel's Frequency selection switches (DIP switches 2 & 3), the channel will require a reset.

Phase Green Inputs: Meets and/or exceeds all NEMA TS 1 and TS 2 requirements. Application of a Low state voltage (0 to 8 VDC) to pin 1 (Ch. 1) and/or pin 2 (Ch. 2) causes the delay timer for the channel to abort the delay timing function.

Solid State Outputs: Optically isolated. 30 VDC max. collector (drain) to emitter (source). 100 mA max. saturation current. 2 VDC max. transistor saturation voltage. The output is protected with a 33-volt Zener diode connected between the collector (drain) and emitter (source).

Relay Outputs (Optional): The relay contacts are rated for 6 Amps max., 150 VDC max., and 180 Watts max. switched power.

Response Time: The response time of either channel is affected by the sensitivity level setting and Fail-Safe / Fail-Secure selection of that channel. When set to operate in Fail-Safe mode, response time is 65 ±25 milliseconds for all sensitivity levels. When set to operate in Fail-Secure mode, response time varies and depends on the sensitivity level selected. See **SENSITIVITY, -ΔL/L, & RESPONSE TIME** table.

Self Tuning: The detector automatically self tunes and is operational within two seconds after application of power or after being reset. Full sensitivity and hold time requires 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 one short to ground at a single point).

Detect Outputs: Per NEMA TS 2, a detection output (CALL) is indicated by a closed relay contact (Relay output) or a conducting state (Solid State output). When operating in Fail-Safe mode, a channel's output defaults to a CALL state for any loop failure condition on that channel. When operating in Fail-Secure mode, a channel's output defaults to a NO CALL state for any loop failure condition on that channel. In either Fail-Safe or Fail-secure mode, a channel's output defaults to a CALL state upon loss of power.

NEMA TS 2 Channel Status Outputs: Meets and/or exceeds all NEMA TS 2 status output specifications.

Test Mode: A PCB mounted DIP switch enables Test Mode. Test Mode provides a means of verifying proper operation of the detector's controls and indicators (switches and LEDs). Each channel's loop oscillator circuit is also checked to verify the correct frequency in each of the four frequency settings. The frequency portion of testing requires that each channel be connected to a 100 microhenry loop; if other inductance values are used, the frequency test results will be invalid.

Weight: 6.0 oz (170 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° F to +180° F (-40° C to +82° 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.

Power: 10.8 to 30 VDC. Solid State output, 100 mA max.; Relay output, 130 mA max.

TABLES

SENSITIVITY, -ΔL/L, & RESPONSE TIME:

Sensitivity Setting	0	1	2	3	4	5	6*	7
-ΔL/L	1.28%	0.64%	0.32%	0.16%	0.08%	0.04%	0.02%	0.01%
Response Time Fail-Secure Mode (ms)	3.5 ±2.5	3.5 ±2.5	3.5 ±2.5	3.5 ±2.5	4.5 ±2.5	7 ±6	11.5 ±10.5	21.5 ±20.5
Response Time Fail-Safe Mode (ms)	65 ±25	65 ±25	65 ±25	65 ±25	65 ±25	65 ±25	65 ±25	65 ±25

* Denotes factory default.

Notes: Changing a channel's sensitivity switch will RESET the channel.

Response times may vary depending on Sensitivity settings. Contact Reno A & E for details.

PIN ASSIGNMENTS:

Pin	Function	Pin	Function
A	DC (-) Common	1	Channel 1 Phase Green Input
B	DC (+) Power	2	Channel 2 Phase Green Input
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) / Normally Open	6	No Connection
H	Channel 1 Output, Emitter (Source) / Common	7	Channel 1 TS 2 Status Output
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	No Connection	13	No Connection
R	No Connection	14	No Connection
S	No Connection	15	No Connection
T	No Connection	16	No Connection
U	No Connection	17	No Connection
V	No Connection	18	No Connection
W	Channel 2 Output, Collector (Drain) / Normally Open	19	No Connection
X	Channel 2 Output, Emitter (Source) / Common	20	Channel 2 TS 2 Status Output
Y	No Connection	21	No Connection
Z	No Connection	22	No Connection

FACTORY DEFAULT SETTINGS:

Switch	Function	Setting	Factory Default
1	Disable	Off	OFF
2	Frequency	1	ON
3			OFF
4	Fail-Safe / Fail Secure	Fail-Safe	ON
5	Presence / Pulse	Presence	ON
6	Sensitivity	6	OFF
7			ON
8			ON

Y-200 SERIES



FOUR CHANNEL RACK MOUNT DETECTOR



- Meets and exceeds NEMA TS 2 specification
- Six front panel DIP switches for each channel provide:
 - Seven levels of sensitivity plus off
 - Presence or Pulse mode
 - Four loop frequencies
- Loops are sequentially scanned to eliminate crosstalk
- Channel status outputs provide individual channel status states per NEMA TS 2
- Loop Fail Event Monitor remembers and indicates intermittent and current loop failures
- Detector is self tuning and provides complete environmental tracking
- Dual color, high intensity, LEDs
 - Green indicates detect
 - Red indicates loop fail
- Complete built-in detector integrity test
- Space provided on front panel to label each channel
- Audible detect signal (buzzer) facilitates loop and/or detector troubleshooting

With Audible Detect Signal

Ordering Information:

Model Y-200-SS Four-channel, 2.00" wide (double width) detector with Solid State outputs.

Model Y/2-200-SS Four-channel, 1.12" wide (single width) detector with Solid State outputs.

Overview:

The Model Y-200 series is designed to meet or exceed NEMA Standards TS 2-1998 for Type B detectors and is downward compatible to NEMA Standards TS 1-1989. Model Y-200 detectors are four channel, card rack type loop detectors with individual channel detect and loop fail indications provided via four dual color, high intensity LEDs.

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Y-200 SERIES SPECIFICATION

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

Loop Frequency: Each channel has four (4) loop frequencies (normally in the range of 20 to 100 kilohertz) that are selectable by means of eight front panel mounted DIP switches (two per channel). The actual loop operating frequency is a function of the loop / lead-in network and the components of the loop oscillator circuit.

Sensitivity: Seven (7) sensitivity levels (plus off) are available for each channel. The eight settings are selectable by means of twelve front panel mounted DIP switches (three per channel). Each of the seven sensitivity levels are binary encoded from 1 to 7 (lowest to highest sensitivity). A setting of 0 turns the channel off. The sensitivity level selected determines the percentage of negative inductance change of the loop circuit required for a CALL output signal. (See **SENSITIVITY, -ΔL/L, & RESPONSE TIME** table.)

Presence / Pulse Mode: Each channel has a front panel mounted DIP switch that can be used to configure the channel to operate in one of two modes.

Presence Mode: Call hold time is a minimum of four minutes regardless of vehicle size, and is typically one to three hours for an automobile or truck.

Pulse Mode: A pulse of 125 ±10 milliseconds duration is generated for each vehicle entering the loop detection zone. Each vehicle detected is instantly tuned out if it remains in the loop detection zone longer than two seconds. This feature allows detection of vehicles subsequently entering the detection zone. After each vehicle leaves the loop detection zone, the channel resumes full detection sensitivity within one second. Changing the Presence / Pulse Mode switch will RESET the channel.

Noise Filter On / Off: A PC board mounted DIP switch controls the Noise Filter feature. When the Filter feature is On, a time filter is added before the output signal is activated when a vehicle is in the loop detection area. It is strongly recommended that the Filter feature be set to On for most traffic control applications.

100 Millisecond Minimum Output: A PC board mounted DIP switch controls the 100 Millisecond Minimum Output feature. When any channel is set to operate in Presence Mode, two Call output modes for that channel's output are available based on the setting of the 100 Millisecond Minimum Output DIP switch. Setting the 100 Millisecond Minimum Output DIP switch to the On position activates the feature and every Call will have a minimum duration of 100ms. Setting the 100 Millisecond Minimum Output DIP switch to the Off position allows the detector to operate normally and the Call output duration is based on the amount of time a vehicle remains in the loop detection zone. This feature is useful as a means of ensuring that Calls output by the detector are seen by the controller since some controllers are unable to catch short (<100ms) events.

Fail-Safe / Fail-Secure Operation: During a loop failure condition, the state of a channel's output can be selected as CALL in Fail-Safe mode or NO CALL in Fail-Secure mode. This is accomplished via four PC board mounted DIP switches. Operation in Fail-Safe mode during a loop failure is the generally accepted mode of operation for intersection control. Operation in Fail-Secure mode during a loop failure is typically used in incident detection systems used for freeway management. Changing a channel's Fail-Safe / Fail Secure setting will RESET the channel.

Audible Detect Signal: A front panel mounted pushbutton is used to enable an audible detect signal that is emitted any time a channel's detection zone is occupied.

Detect / Fail Indicator: Each channel has a super bright, high intensity, dual color (Red / Green) LED which indicates a Call output and / or the status of any current or prior loop fault condition for that channel. A green indication signifies a CALL output (detect state). A red indication signifies a loop failure condition. A continuous On (green) state indicates a CALL output. A continuous On (red) state indicates that a current open loop failure condition or an inductance change condition of greater than +25% condition exists. When operating in Fail-Safe mode, this indication is also generates a CALL output. When operating in Fail-Secure mode, no CALL output is generated. A 1 Hz (red) flash rate indicates that a current shorted loop failure condition or an inductance change condition of greater than -25% condition exists. When operating in Fail-Safe mode, this indication is also generates a CALL output. When operating in Fail-Secure mode, no CALL output is generated. A flash rate of three 50 millisecond (red) pulses indicates a prior loop failure condition. A flash rate of three 50 millisecond (red) pulses followed by a 750 millisecond (green) pulse indicates a prior loop failure condition and a current CALL output (detect state).

Loop Fail (Event) Monitor: If the total inductance of the loop input network goes out of the range specified for the detector, or rapidly changes by more than ±25%, the affected channel will immediately enter the programmed Fail-Safe or Fail-Secure mode of operation. Fail-Safe operation generates a continuous call output in the Presence or Pulse mode. Fail-secure operation does not generate a call during a loop failure. In both modes of operation, the FAIL LED will illuminate and remain on for as long as the loop fault exists. If the loop self-heals, the channel will resume operation in a normal manner, but the FAIL LED of the channel will begin to flash at a rate of three flashes per second as a means of indicating a prior Loop Fail condition. The FAIL LED will continue its indication of a prior loop failure until the detector channel is reset or the detector is manually reset.

Loop Inductance Range: 20 to 2000 microhenries with a Q factor of 5 or greater.

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

Loop Input: Transformer isolated. The minimum capacitance added by the detector is 0.068 microfarad.

Scanning: The loop(s) connected to each detector channel are activated alternately to minimize crosstalk between adjacent loops connected to the same detector.

Lightning Protection: The detector can tolerate, without damage, a 10 microfarad capacitor charged to 2,000 volts being discharged directly into the loop input terminals, or a 10 microfarad capacitor charged to 2,000 volts being discharged between either loop terminal and earth (chassis) ground.

Detector Reset: Changing the position of any channel's DIP Switches (except the Frequency switches) will reset that detector channel. The detector can be reset by connecting a logic ground signal to Pin C (Reset Pin). Reapplication of power after a power loss will also cause the detector to reset. After changing any channel's Frequency selection switches (DIP Switches 1 & 2), the detector must be reset.

Solid State Outputs: Optically coupled transistors. 30 VDC maximum collector (drain) to emitter (source). 50 mA maximum saturation current. 2 VDC maximum transistor saturation voltage. The output transistors are protected by a 33 volt Zener diode connected between the collector (drain) and emitter (source).

Response Time: Meets or exceeds NEMA TS 2 specifications. The response time of any channel is affected by the sensitivity level setting and Filter On / Off selection of that channel. (See **SENSITIVITY, -ΔL/L, & RESPONSE TIME** table.)

Self Tuning: The detector automatically self tunes and is operational within two seconds after application of power or after being reset. Full sensitivity and hold time requires 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 one short to ground at a single point).

Detect Outputs: Per NEMA TS 2, conduction indicates detection output. The output is conductive in a DC power supply failure condition or during a loop failure (i.e. An open loop or shorted loop condition).

NEMA TS 2 Status Outputs: Meets and / or exceeds all NEMA TS 2 status output specifications.

Test Mode: A PC board mounted DIP switch enables Test Mode. Test Mode provides a means of verifying proper operation of all of the detector's input and output circuitry including switches, LEDs, and outputs. Each channel's loop oscillator circuit is also checked to verify the correct frequency in each of the four frequency settings. The frequency portion of testing requires that each channel be connected to a 100 microhenry loop; if other inductance values are used, the frequency test results will be invalid.

Power: 10.8 to 30 VDC, 100 mA maximum.

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.

Operating Temperature: -40° F to +180° F (-40° C to +82° C).

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.)

Size: Y-200 (double width faceplate) - 4.50 inches (11.43 cm) high x 2.00 inches (5.08 cm) wide x 6.88 inches (17.46 cm) deep (including connector, excluding handle). Y/2-200 (single width faceplate) - 4.50 inches (11.43 cm) high x 1.12 inches (2.84 cm) wide x 6.88 inches (17.46 cm) deep (including connector, excluding handle). Handle adds 1.00 inch (2.54 cm) to depth measurement.

Weight: 6.0 oz (170 gm).

TABLES

SENSITIVITY, -ΔL/L, & RESPONSE TIME:

Switch Position	0	1	2	3	4	5	6*	7
-ΔL/L	OFF	0.64%	0.32%	0.16%	0.08%	0.04%	0.02%*	0.01%
Response Time (ms) (Filter Off)	N/A	17 ±5	17 ±5	35 ±10	50 ±15	75 ±25	120 ±40*	120 ±40
Response Time (ms) (Filter On)	N/A	120 ±40	120 ±40	120 ±40	120 ±40	120 ±40	120 ±40*	120 ±40

* Denotes factory default.

Notes: Changing any of a channel's sensitivity switches will RESET that channel.

To achieve the exact response times listed above, the Sensitivity level and Fail-Safe / Fail-Secure settings for all four channels must be set the same.

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	Channel 1 Output, Emitter (Source)	7	Channel 1 TS 2 Status Output
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	Channel 3 Output, Emitter (Source)	16	Channel 3 TS 2 Status Output
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	Channel 2 Output, Emitter (Source)	20	Channel 2 TS 2 Status Output
Y	Channel 4 Output, Collector (Drain)	21	No Connection
Z	Channel 4 Output, Emitter (Source)	22	Channel 4 TS 2 Status Output

FACTORY DEFAULT SETTINGS:

Switch	Function	Setting	Factory Default
1	Frequency	0	OFF
2			OFF
3	Presence / Pulse	Presence	ON
4	Sensitivity	6	OFF
5			ON
6			ON

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