

LM 602-ST

Two Channel "Speed Trap" Inductive Loop Vehicle Detector

The LM series of Loop Monitors™ from Eberle Design take vehicle detection one step further. They not only indicate vehicle presence with great accuracy and reliability, but also monitor the condition of the loop for diagnostic purposes.

The LM 602-ST "Speed Trap" or "Traffic Calming" detector is designed to use two loops spaced 16 feet apart to measure vehicle speed. If the measured speed exceeds a switch selectable threshold, a pulse output is generated on the Channel 1 output. Applications include traffic calming and advanced warning indications.

DETECTION FEATURES

- Automatic Tuning:** No manual tuning is required.
- Environmental Tracking:** Ensures reliable operation by continuously adjusting for changes in ambient conditions.
- Sensitivity:** Each channel offers 15 selectable sensitivity settings.
- Loop Frequency/Sequential Scanning:** Each channel offers 4 selectable loop frequency settings. Sequential scanning allows only one channel energized at any given time. Together, these features greatly reduce the incidence of crosstalk.

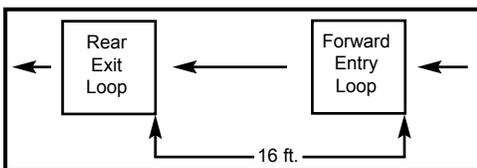
DIAGNOSTIC & SPECIAL FEATURES

- Speed Threshold:** DIP Switch selectable. Measures speed from 1 to 127 mph. If the measured speed exceeds the switch selectable threshold, a pulse output is generated on the Channel 1 output.
- Separate Detect / Fault LEDs:** Eliminates the confusion encountered with other detectors that use only one LED to display both faults and detection. The Fault LED displays the type of fault: Short, Open, or 25% change of inductance. Each type of fault is indicated by a unique sequence of flashes allowing the user to diagnose loop failures at a glance.
- Fault Memory:** Records previous fault information. If a problem self-heals, the LM 602-ST will resume normal operation. The contents of the memory will be displayed on the Fault LED. This feature can be used to isolate the source of intermittent loop failures.

LOOP PREPARATION & SPEED TRAP PROGRAMMING

Loop Set-up: The leading edge of the forward entry loop (Channel 1) should be spaced exactly sixteen feet from the leading edge of the rear exit loop (Channel 2).

Programming: Speed Trap Programming: The pcb mounted DIP switches (SW9) 1 through 7 determine the speed threshold that the unit uses to produce an output. The switches should be set to the binary weighted speed to be detected, from 1 MPH to 127 MPH. When the speed of a vehicle moving through the detection zone exceeds the switch programmed setting, Channel 1 produces a pulse output.



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GENERAL CHARACTERISTICS

Controls: Front panel switches allow the user to set up sensitivity, operational mode, and frequency independently on each channel. PCB mounted DIP switch allows user to set speed measurement thresholds.

Loop Frequency: One of four settings may be selected to alleviate interference which may occur when loops connected to different detectors are located adjacent to one another.

Sensitivity: One of fifteen settings may be selected to optimize detection on varying loop and lead-in configurations. Sensitivity is stated in terms of $\Delta L/L$, which is the minimum percentage change in the total inductance (loop plus lead-in) to which the unit will respond at the given level setting. Selecting level 0 will switch the Channel OFF. In this condition, the loop oscillator is de-energized, and the output will remain in the no-call state.

Sens.	$-\Delta L/L$	Sens.	$-\Delta L/L$	Sens.	$-\Delta L/L$
15	0.01%	10	0.06%	5	0.32%
14	0.015%	9	0.08%	4	0.48%
13	0.02%	8	0.12%	3	0.64%
12	0.03%	7	0.16%	2	0.96%
11	0.04%	6	0.24%	1	1.28%

SPECIFICATION

Construction: Printed circuit boards are double sided 2 oz. (56.70 gm.) copper with plated through holes. Circuit boards are conformally coated for environmental protection.

Environmental:

Operating Temperature Range: -30°F to 165°F (-34°C to 74°C)

Storing Temperature Range: -50°F to 185°F (-45°C to +85°C)

Humidity Range: 0 to 95% relative.

Mechanical:

Dimensions/Connector: International Card 4.500"H x 6.875"D x 1.200"W (excluding handle) with 44 pin double sided edge connector

Weight: 7 oz. (199 gm.)

Lead-in Length: The unit will operate with lead-in (feeder) lengths up to 5,000 feet (1,524 m.) with appropriate loops and proper lead-in cable.

ELECTRICAL

Power Supply: 10.8 to 28.8 VDC, 100 mA max.

Loop Inductance (Tuning) Range: 20 to 2500 micro Henry with a Q factor greater than 5.

Loop Input (Lightning Protection): The loop input incorporates lightning and transient protection devices and the loop oscillator circuitry is transformer-isolated. The lightning protection will withstand the discharge of a 10 uF capacitor charged to 2,000V across the loop inputs or between either loop input and earth ground. The transformer isolation allows operation with a loop which is grounded at a single point.

Reset: The detector may be reset by applying a ground true logic level to the reset input Pin C for a period exceeding 15 microseconds. Changing any DIP switch selection, excluding frequency, will also reset the detector.

Output Ratings:

Optically Isolated Output (LM 602-ST): The output transistors are rated for a maximum collector voltage of 80 VDC. Maximum collector current is 100mA. In the saturated condition the collector voltage will be less than 1.5Volts with a collector current of 50mA. Maximum off state leakage current is 1 microampere. Isolation exceeds 7,500 VAC.

Relay Output (LM 602R-ST): Contacts are rated 5A, 120 VAC, 30 VDC. Relay outputs are failsafe - Should the detector lose power, the output will give a constant CALL output.

Pin Assignment (Connections):

LM 602-ST (LM 602R-ST)

Pin	Channel
A	Logic Ground
B	DC Power +24 VDC
C	Reset
D & 4	Loop Input Channel 1
E & 5	Loop Input Channel 1
F	Channel 1 Output Collector (Relay Output N.O.)
H	Channel 1 Output Emitter (Relay Output Common)
J & 8	Loop Input Channel 2
K & 9	Loop Input Channel 2
L	Earth Ground
W	Channel 2 Output Collector (Relay Output N.O.)
X	Channel 2 Output Emitter (Relay Output Common)

NOTE: Relay contacts are shown with power applied, loops connected and no vehicle present. Pins not listed have no connection.

OPERATIONAL

High Intensity Color-Coded LED Indicators: Two indicators are used per channel:

Red DETECT Indicator:

- Solid ON = Vehicle Detect.
- Open Circuit = 1 single flash followed by a pause.
- Shorted Circuit = 2 flashes followed by a pause.
- 25% Change in Inductance = 3 flashes followed by a pause.

Yellow FAULT Indicator:

- Open Circuit = 1 single flash followed by a pause.
- Shorted Circuit = 2 flashes followed by a pause.
- 25% Change in Inductance = 3 flashes followed by a pause.

Loop Fault Monitoring: Each detector channel continuously checks the integrity of the loop. The system is able to detect open or shorted circuit loops, or sudden changes in inductance exceeding 25% of the nominal inductance. If a fault is detected on a channel, both the DETECT (Red) and FAULT (Yellow) LEDs continuously emit a sequence of flashes followed by a pause. the signal is repeated until the fault is rectified. Each type of fault is identified by a different flash sequence. While the unit is in the fault condition, the channel output will remain in the detect (CALL) state.

Flash Sequence

Flash Sequence	Fault
1 flash (per second)	Open Circuit Loop.
2 flashes (per second)	Shorted Circuit Loop.
3 flashes (per second)	25% change in inductance.

If the fault is removed, both the detect LED and the output will return to normal operation. the fault LED will continue to emit the sequence signifying the type of fault that was last detected. In the case of the excessive inductance change fault, the unit will return to the new inductance after a period of two seconds and continue operation. The fault condition will be indicated by the flash sequence of the fault LED's.

Operational Pulse Mode: 125ms +/- 25ms momentary output.

Response Times: The following are typical response times at different sensitivity levels for units with optically isolated outputs. Response times on units with relay output will reflect the effects of contact bounce.

Level	Response	Sens.	Response	Sens.	Response
15	46 ms	10	12 ms	5	5 ms
14	26 ms	9	10 ms	4	5 ms
13	20 ms	8	9 ms	3	6 ms
12	16 ms	7	8 ms	2	5 ms
11	14 ms	6	8 ms	1	5 ms

Self Tuning: Each detector channel will automatically tune to any loop and lead-in combination within the tuning range upon application of power. See also "Reset".

Environmental Tracking: The detector automatically and continuously compensates for component drift and environmental effects throughout the tuning range and across the entire temperature range.

Grounded Loop Operation: The detector will operate when connected to poor quality loops including those that have a short to ground at a single point.