



# LM602

## INDUCTIVE LOOP MONITOR™

- DUAL CHANNEL – RACK MOUNT
- NEMA TS-1 Type

For over 30 years Eberle Design, Inc. (EDI), has provided technicians and engineers with reliable, high quality mission critical component products that improve the performance and lifecycle of traffic control systems.

EDI's wide range of traffic control vehicle detection products help technicians save valuable time and bank budgeted dollars by quickly installing, accurately troubleshooting, and reliably maintaining traffic control systems with easy to use hi-tech vehicle detectors.

The LM602 has been specifically designed to deal with all traffic and highway applications and meets or exceeds all requirements of NEMA Standard TS1-1989 (R2000), Section 15 (Inductive Loop Detectors).

### ENHANCED FEATURES

#### Rugged Handle Assembly:



The rugged integrated handle assembly is made of GE Lexan™, which is a super durable polycarbonate resin. The design of this assembly strengthens and protects the whole PCB assembly much better than conventional metal face plates. The temperature stability of critical components is improved with the larger more encompassing enclosure. Detailed operating instructions are conveniently attached directly on the side of the unit, eliminating the need for instruction cards.

#### Separate Detect / Fault LEDs:

The Fault (FLT) indicator 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. Individual indicators eliminate the confusion encountered with other detectors that use only one LED to display both faults and detection.

#### Loop Fault Memory:

Loop Fault Memory reports previous loop fault information. If a loop problem self-heals, the detector channel will resume normal operation. The contents of the memory will be displayed on the Fault (FLT) indicator. This feature can be used to isolate the source of intermittent loop failures.

### STANDARD FEATURES

#### Automatic Tuning / Loop Configuration:

No manual tuning is required and works effectively on all inductive loops from 20 to 2500 uH.

#### Fifteen (15) Levels of Sensitivity:

Allows users to fine tune to their application.

#### Four Loop Frequencies and Sequential Scanning:

Together these features greatly reduce the incidence of crosstalk.

#### Three Selectable Modes:

**Short Presence:** For normal detection.

**Long Presence:** For sites where loops may be occupied for extended periods of time.

**Pulse:** For counting and volume.

#### Environmental Tracking:

Ensures reliable operation by continuously adjusting for changes in ambient conditions.

#### Options:

Relay Outputs, Model LM602R

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## MODEL LM602 DUAL CHANNEL INDUCTIVE LOOP VEHICLE DETECTOR SPECIFICATION

### GENERAL CHARACTERISTICS

**Controls:** Front panel switches allow the user to set up sensitivity, operational mode, and frequency independently on each channel.

**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.

Sensitivity	$\Delta L/L$	Sensitivity	$\Delta L/L$	Sensitivity	$\Delta L/L$
15	0.010%	10	0.057%	5	0.320%
14	0.014%	9	0.080%	4	0.453%
13	0.020%	8	0.113%	3	0.640%
12	0.028%	7	0.160%	2	0.905%
11	0.040%	6	0.226%	1	1.280%

### SPECIFICATION

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

#### Environmental:

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

**Storage 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 (114.30mm) x 6.875"D (174.63mm) x 1.14"W (28.96mm), 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

#### Pin Assignment:

Pin	Function	Pin	Function
A	Logic Ground	1	Reserved
B	Detector Unit DC Supply	2	Reserved
C	External Reset	3	Reserved
D	Channel 1 Loop Input	4	Channel 1 Redundant Loop Input
E	Channel 1 Loop Input	5	Channel 1 Redundant Loop Input
F	Channel 1 Output (+)	6	Reserved
H	Channel 1 Output (-)	7	Reserved
J	Channel 2 Loop Input	8	Channel 2 Redundant Loop Input
K	Channel 2 Loop Input	9	Channel 2 Redundant Loop Input
L	Chassis Ground	10	Reserved
M	Reserved	11	Reserved
N	Reserved	12	Reserved
P	Reserved	13	Reserved
R	Reserved	14	Reserved
S	Reserved	15	Reserved
T	Reserved	16	Reserved
U	Reserved	17	Reserved
V	Reserved	18	Reserved
W	Channel 2 Output (+)	19	Reserved
X	Channel 2 Output (-)	20	Reserved
Y	Reserved	21	Reserved
Z	Reserved	22	Reserved

**Power Supply:** 10.8 to 28.8 VDC, 50mA nominal both channels operating.

**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.

### ELECTRICAL (Cont.)

**Reset:** The detector may be reset by applying a ground true logic level to the reset input Pin C. Changing any DIP switch selection will also reset the detector.

#### Output Ratings:

**Optically Isolated Output (LM602):** 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 2,500 Vrms.

**Relay Output Option (LM602R):** Contacts are rated 5A@120 VAC, 5A@30 VDC. Relay outputs are fail-safe; should the detector lose power, the output will give a constant CALL output.

### OPERATIONAL

**High Intensity Color-Coded LED Indicators:** Two indicators are used per channel. The DET indicator is red and the FLT indicator is yellow. During normal operation the DET indicator will be On solid to indicate a Call state.

**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 DET (Red) and FLT (Yellow) LEDs continuously emit a sequence of flashes followed by a pause. The sequence is repeated until the fault is removed. 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	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 DET LED and the output will return to normal operation. The FLT 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.

#### Operational Modes:

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

**Short Presence:** ..... 15 minutes.

**Long Presence:** ..... 2 hours.

**Note:** When operating in pulse mode, a vehicle remaining over a loop will inhibit further pulse outputs from being issued for a period of 2 seconds after which time vehicles passing over the uncovered portion of the loop will be detected.

**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. This table assumes that both channels are set to the same Sensitivity.

Sensitivity	Response	Sensitivity	Response	Sensitivity	Response
15	76-96 ms	10	13-17 ms	5	4-6 ms
14	57-75 ms	9	9-12 ms	4	4-6 ms
13	38-50 ms	8	7-9 ms	3	4-6 ms
12	26-35 ms	7	5-7 ms	2	4-6 ms
11	18-24 ms	6	5-6 ms	1	4-6 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.

**Sequential Scanning:** Only one channel is energized at any given time, thus reducing the possibility of crosstalk between adjacent loops connected to the same unit.