

# LM 302 SERIES

## TWO CHANNEL LOOP MONITOR™



LM 302



LM 302t

The LM series of Loop Monitors™ from Eberle Design takes 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 LM302 Series meet or exceed all standards specified in NEMA publication TS 1-1989 part 15 (Inductive Loop Detectors).

### DETECTION FEATURES

#### Automatic Tuning

No manual tuning is required.

#### Environmental Tracking

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

#### 15 Levels of Sensitivity

Allows users to fine tune the Loop Monitor™ to their application.

#### Four Loop Frequencies and Sequential Scanning

Together, these features greatly reduce the incidence of crosstalk.

#### Three Selectable Modes

**Pulse:** For counting and volume.  
**Short Presence:** For normal detection.  
**Long Presence:** For sites where loops may be occupied for extended periods of time.

### DIAGNOSTIC FEATURES

#### Color-Coded, Separate LEDs for Detect & Fault Indication

Eliminates the confusion encountered with other detectors that use only one LED to display both faults and detection. The Yellow Fault LED works independently from the Red detect LED to display 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 LM302 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.

#### Options

Optically Isolated Solid State Outputs  
Delay and Extension Timing



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**Specifications**

**Power Supply:**

115 VAC ±20%, 60 Hz, 3 W max.

**Loop Input:**

The loop inputs incorporate lightning and transient protection devices and the loop oscillator circuitry is transformer isolated. The lightning protection will withstand the discharge of a 10µF capacitor charged to 2,000V across the loop inputs or between any loop input and earth ground. The transformer isolation allows operation with loops which are grounded at a single point.

**Tuning:**

Each channel of the LM302 unit will automatically tune to any loop and lead-in combination within the tuning range upon application of power or when a valid reset signal is received. Each channel may be retuned by adjusting sensitivity, mode or frequency and resetting to the desired value.

**Tuning Range:**

20 to 2500 microhenry with a Q factor greater than 5.

**Lead-in Length:**

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

**Environmental Tracking:**

The LM604 series automatically and continuously compensates for component drift and environmental effects throughout the tuning range and across the entire temperature range.

**Grounded Loop Operation:**

The LM302 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.

**Fault Monitoring:**

The Loop Monitor™ continuously checks the integrity of the loop. The system is able to detect shorted or open circuit loops, or sudden changes in inductance exceeding 25% of the nominal inductance. If a fault is detected on a channel, both the detect and fault LEDs emit a sequence of flashes followed by a pause. This 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**

**Fault**

1 flash	Open Circuit Loop.
2 flashes	Short Circuit Loop.
3 flashes	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 retune 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.

**High Intensity LED Indicators:**

Each channel has two indicators, a Red Led indicates the detect state and also the status of the delay and extension timers, a Yellow Led indicates the status of the fault monitor memory.

**Front Panel Controls:**

Front panel mounted DIP switches allow the user to set up sensitivity, operational mode and frequency independently on each channel. Units with timing capability include board mounted DIP switch selection of delay and extension time.

**Sensitivity:**

One of fifteen settings may be selected to optimize detection on varying loop and lead-in configurations. Sensitivity is stated in terms of ΔL / L i.e. the minimum percentage change in 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.

Level 15	.01%	Level 11	.04%	Level 7	.16%	Level 3	.64%
Level 14	.015%	Level 10	.06%	Level 6	.24%	Level 2	.96%
Level 13	.02%	Level 9	.08%	Level 5	.32%	Level 1	1.28%
Level 12	.03%	Level 8	.12%	Level 4	.48%	Level 0	OFF

**Operational Modes:**

Pulse Mode: ..... 125ms ±25ms momentary output.  
 Short Presence: ..... 15 minutes (restarts on vehicle entry).  
 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.

**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.

**Delay and Extension Timing (LM302t):**

Delay times up to 63 seconds in 1 second increments, and extension times up to 15.75 seconds in 0.25 second increments, may be selected by setting the appropriate front panel DIP switches to the ON position. The DETECT LED indicator will flash at a 2 Hz rate while the delay timer is running and at a 4 Hz rate while the extension timer is running.

**Timer Control Input:**

Both Delay and Extension timers may be controlled by the timer control input via the front panel connectors. An active input voltage level is one greater than 70 VAC (reference AC neutral). A voltage less than 15 VAC is considered the inactive level. As standard, an active timer control input will inhibit the delay timers. Other timer control options are available; please consult the manufacturer for details.

**Reset:**

The LM302 resets automatically on application of power. Additionally an individual channel may be reset by moving a sensitivity, operational mode or frequency switch to a different setting and then returning it to the original position.

**Response Times:**

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

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

**Output Ratings:**

Relay Output Versions: contacts are rated 5A, 120 VAC, 30 VDC. Relay output is failsafe -- should the detector lose power, the outputs will give a constant call.

Optically Isolated Output Versions: the output transistor is rated for a maximum collector voltage of 50 VDC. Maximum collector current is 100mA. In the saturated condition the collector voltage will be less than 1.5 VDC with a collector current of 50mA. Maximum off state leakage current is 1 microampere. Isolation exceeds 7,500 VAC.

**Mechanical:**

Dimensions (Excluding Connector): ..... 3.0" wide, 6.2" tall, 7.3" long.  
 Weight: ..... 2.25 lb

**Environmental:**

Storage Temperature Range: ..... -55°C to +85°C (-67°F to 185°F).  
 Operating Temperature Range: ..... -40°C to +80°C (-40°F to 176°F).  
 Humidity Range: ..... 0 to 95% relative.

**Connections:**

Front panel connectors mate with type MS3106A-18-1S.

PIN	Channel 1	Channel 2
A	AC Neutral	No Connection
B	CH 1 Relay COM/ Opto (-)	CH 2 Relay COM/ Opto (-)
C	AC Line 115 VAC 60 Hz	No Connection
D	Loop Input CH 1	Loop Input CH 2
E	Loop Input CH 1	Loop Input CH 2
F	CH 1 Relay N.O./ Opto (+)	CH 2 Relay N.O./ Opto (+)
G	CH 1 Relay N.C.	CH 2 Relay N.C.
H	Chassis Ground	Chassis Ground
I	No Connection	No Connection
J	Timer Control I/P CH 1	Timer Control I/P CH 2

N.O. is Normally Open, N.C. is Normally Closed, Opto is optically isolated output, Opto (+) is Collector, Opto (-) is Emitter.

Engineered, Manufactured and Tested in the United States of America.

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