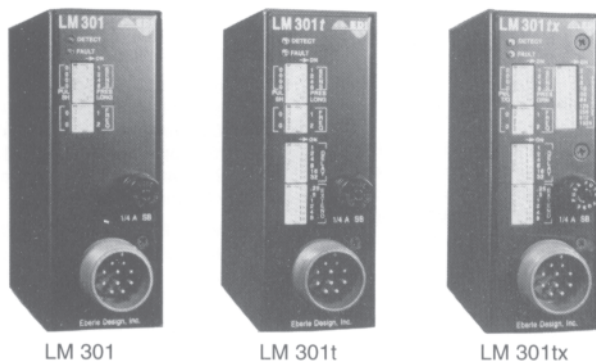


# LM 301 SERIES

## SINGLE CHANNEL LOOP MONITOR™



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 LM301 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.

#### 16 Levels of Sensitivity

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

#### Four Loop Frequencies

Provides optimum frequency separation between adjacent loops greatly reducing the possibility 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

#### 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 LM301 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

Delay and Extension Timing  
Presence Retention Timing (Texas)  
Optically isolated Outputs  
Eleven pin connector

# LM 301 SERIES

## SINGLE CHANNEL LOOP MONITOR™

### Specifications

#### Power Supply:

115 VAC ±20%, 50/60 Hz, 1.5 W max.

#### Fuse:

1/4A Slo Blo

#### Loop Input:

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 10µF 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.

#### Tuning:

The LM301 series will automatically tune to any loop and lead-in combination within the tuning range upon application of power. The unit may be retuned by adjusting any of the front panel controls 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 LM301 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 LM301 series will operate when connected to poor quality loops including those that have a short to ground at a single point.

#### 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, 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 output will remain in the detect (call) state.

#### Flash Sequence

1 flash  
2 flashes  
3 flashes

#### Fault

Open Circuit Loop.  
Short Circuit Loop.  
25% change in inductance.

If the fault condition 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 Red LED Indicators:

Two indicators are used: the first indicates the detect state and also the status of the delay and extension timers, the second indicates the status of the fault monitor.

#### Front Panel Controls:

Front panel mounted DIP switches allow the user to set up sensitivity, operational mode and frequency. Units with timing capability include DIP switch selection of delay and extension time. LM301tx version also includes DIP switches to select presence retention time.

#### Sensitivity:

One of sixteen settings may be selected to optimize detection on varying loop and lead-in configurations. Sensitivity is stated in terms of  $\Delta L / L$  i.e. as the minimum percentage change in the total inductance (loop plus lead-in) to which the unit will respond at the given level setting.

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	2.56%

#### Operational Modes:

Pulse Mode: ..... 125ms ±25ms momentary output.  
Short Presence (LM301/LM301t): ..... 15 minutes (restarts on vehicle entry).  
Long Presence (LM301/LM301t): ..... 2 hours.  
Presence Time-out (LM301tx): ..... see presence retention timing.  
Presence Green (LM301tx): ..... see presence retention timing.

Note: When operating in pulse mode, a vehicle remaining over the 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 (LM301t and LM301tx):

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.

#### Presence Retention Timing (LM301tx):

A presence time of between 2 and 2,046 seconds in 2 second increments may be selected by setting the appropriate front panel DIP switches to the ON position. If all of the switches are set OFF a presence time of 2 hours will be used as a default.

When used in presence time-out mode, the detector will retune upon expiration of the set presence time. When operating in Presence Green mode, retune will occur on the first active to inactive transition of the timer control input following the expiration of the presence time.

#### Timer Control Input:

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

#### 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	18 ms	Level 11	6 ms	Level 7	4 ms	Level 3	3 ms
Level 14	12 ms	Level 10	5 ms	Level 6	4 ms	Level 2	2 ms
Level 13	10 ms	Level 9	5 ms	Level 5	3 ms	Level 1	2 ms
Level 12	8 ms	Level 8	4 ms	Level 4	3 ms	Level 0	2 ms

#### Output Ratings:

Relay Output Versions (LM301 & LM301t): Contacts are rated 5A, 120 VAC, 30 VDC. Relay output is failsafe -- should the detector lose power, the output will give a constant call.

Optically Isolated Output Versions (LM301s, LM301ts, LM301tx): The output transistor is 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 1.5 Volts with a collector current of 50mA. Maximum off state leakage current is 1 microampere. Isolation exceeds 7,500 VAC.

#### Mechanical:

Dimensions (Excluding Connector): ..... 2" wide, 5.5" tall, 5.5" deep.  
Weight: ..... 1.3 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:

Connector is type MS3102A-18-1P which mates with socket type MS3106A-18-1S.

PIN	301/301s	301t/301ts	301tx
A	Neutral	Neutral	Neutral
B	Relay O/P Com	Relay O/P Com	Opto O/P -
	Opto O/P - (LM301s)	Opto O/P - (LM301ts)	
C	115 V a.c.	115 V a.c.	115 V a.c.
D	Loop Input	Loop Input	Loop Input
E	Loop Input	Loop Input	Loop Input
F	Relay O/P N.O.	Relay O/P N.O.	No Connection
	Opto + (LM301s)	Opto + (LM301ts)	
G	Relay O/P N.C.	Relay O/P N.C.	No Connection
H	Earth Ground	Earth Ground	Earth Ground
I	No Connection	No Connection	Opto O/P +
J	No Connection	Timer Control I/P	Timer Control I/P

N.O. is Normally Open, N.C. is Normally Closed, Opto + is Opto-transistor collector and Opto - is Opto-transistor emitter.

Relay Contacts are shown with power applied, loops connected and no vehicle present.

Engineered, Manufactured and Tested in the United States of America.  
Loop Monitor is a registered trademark of Eberle Design Inc.