2-Channel
Rack Mount Type

4-Channel Rack Mount Type

ORACLE
ENHANCED SERIES

INTELLIGENT LCD INDUCTIVE LOOP MONITORS

- ORACLE 2E SERIES – DUAL CHANNEL
- ORACLE 4E SERIES – QUAD CHANNEL
- ORACLE 4H SERIES – QUAD CHANNEL ½ WIDTH
- ORACLE ECX SERIES – REMOTE COMMUNICATIONS

The ORACLE 2E, 2EC, 4E, 4H & 4EC "ENHANCED" Series Loop Monitors from Eberle Design takes vehicle detection well into the 21st century. The ORACLE "ENHANCED" detectors not only indicate vehicle presence with great accuracy and reliability, but also incorporate a complete built-in loop analyzer for optimum detector set-up and loop diagnostic purposes.

Knowing More . . . Telling More . . .

For over 35 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. The ORACLE "ENHANCED" series meet or exceed all applicable requirements in NEMA TS 1-1989 and NEMA TS2-2016.

ORACLE ENHANCED FEATURES

LCD View Screens: The Loop Frequency, -ΔL/L%, Loop Inductance, DEFLECTOMETER® Pie Graph, DEFLECTOMETER® Numeric Optimizer, DEFLECTOMETER® Streaming Graph, Frequency Stability Graph, Sensitivity Level, Mode of Operation, and Vehicle Counting Accumulator can be viewed on the front panel LCD for each channel simultaneously.

DEFLECTOMETER® Pie Graph & Numeric Value Indictor: The LCD screen displays a pie graph which assists in determining the optimum sensitivity setting by showing the change in inductance caused by traffic moving over the loop. Changes to the sensitivity setting are reflected on the graph in real time during a Call state. Optimum sensitivity setting is reached when the DEFLECTOMETER® value reaches the value of 10 or 50% of the graph, based on typical size vehicles.

DEFLECTOMETER® Streaming Graph: While the DEFLECTOMETER® pie graph displays an instantaneous indication of the current Call strength, the Streaming Graph display graphically shows the Call strength over time. The horizontal axis represents a six second interval. The vertical axis represents Call strength. The graph streams when there is a Call present.

Frequency Stability Graph: The frequency stability graph provides the capability to analyze each frequency level to ensure proper selection of the nominal loop tuning frequency. The XY graph displays detector frequency samples with respect to the reference. A variation from the center of the graph depicts frequency instability on the channel. Basically a thin smooth graph offers a more optimum frequency selection over a thick uneven line.

Paired Channel Functions Directional Logic and 3rd Car Logic: Directional Logic is intended to be used in freeway ramps for wrong way detection and left turn lanes where other movements in the intersection tend to clip the detection zone of the left turn lane.

3rd Car Logic provides a Call output when both channels are in the Call state. 3rd Car Logic is typically used in left turn queues to provide logic for Protected-Permissive movements.

AccurateCount Mode: **Model ORACLE 2EC & 4EC Only** AccurateCount mode produces a secondary output in addition to the primary CALL output for each vehicle entering the loop zone. Loop configurations ranges from a single loop to eight loops connected together in series. The LCD screen will report counts from the secondary "Count" outputs. Note: The ORACLE 4EC (4-ch. model) does not provide secondary count outputs to the edge card connector.

Communications Port: The ORACLE 2ECX, 4ECX, and 4HCX models provide an EIA-232 port for external or remote communications using an advanced protocol to monitor and configure all aspects of the Oracle.

Loop Fault History Log: For each channel, the LCD screen can display the last 25 loop fault conditions and power events.

Loop Inductance Display Indicator: In the "Induct" display mode the LCD screen displays the equivalent system loop inductance (loop and lead-in inductance) within the range of 20 to 2500 microHenries.

-ΔL/L Percentage Indicator: The "Induct" display mode shows the percentage of inductance change during the CALL state.

LCD Display Back Lighting and Heater: The Liquid Crystal Display (LCD) incorporates a white LED backlight. The backlight improves visibility in poor lighting conditions. A built-in heater improves operation in very cold temperatures.

Variable Character Channel ID: Up to five characters or numbers can be selected to identify each channel of detection.

Rail Mode: The EC models provide a Rail Mode for use with light rail applications to prevent lock-ups on loops deployed under rails.

Point Probe Micro Sensor Support: **Model ORACLE 2EC & 4EC Only** The ORACLE 2EC and ORACLE 4EC models support the use of point probe type micro sensors. Consult the factory for compatibility details.

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ORACLE "ENHANCED" Series - Intelligent LCD Two & Four Channel Inductive Loop Monitors

Front Panel Controls: Two high-reliability sealed front panel toggle switches for each channel are used to select operational and display settings. One switch is designated "MENU (Back/Select)" and is used to accept the setting displayed and to move to the next menu item or go back to the previously displayed screen. The second switch is designated "SCROLL (Up/Down)" and allows you to move through each selected menu.

Sensitivity: There are twenty (20) selectable sensitivity levels per channel. The DEFLECTOMETER Pie Graph, DEFLECTOMETER Numeric Value and a DEFLECTOMETER Streaming Graph, make it easy to set-up and optimize sensitivity for each channel. Sensitivity can be selected from the "Set up" or "QuikSet" menus, to optimize vehicle detection on varying loop and lead-in configurations. Sensitivity is stated in terms of -ΔL/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.]

Sens.	-ΔL/L	Sens.	-ΔL/L	Sens.	-ΔL/L	Sens.	-ΔL/L
20	0.0035%	**15**	0.020 %	**10**	0.113 %	**5**	0.640 %
19	0.0050%	**14**	0.028 %	**9**	0.160 %	**4**	0.905 %
18	0.0071%	**13**	0.040 %	**8**	0.226 %	**3**	1.280 %
17	0.010 %	**12**	0.057 %	**7**	0.320 %	**2**	1.810 %
16	0.0141 %	**11**	0.080 %	**6**	0.453 %	**1**	2.560 %

Loop Frequency: The LCD screen displays the actual loop frequency to help avoid interference which may occur when loops connected to different detectors are located adjacent to one another. One of eight (8) settings (normally in the range of 20 to 60 kilohertz) may be selected for each channel via the "Setup" or the "QuikSet" menu options. It is recommended that adjacent loops have a frequency separation of at least 5 KHz.

Frequency Stability Graph: In the Frequency display mode the LCD screen also displays a frequency stability graph that allows you to analyze each channels frequency level to ensure proper selection of frequency levels. The XY graph displays detector frequency samples with respect to the reference. The channel reference is in the center of the graph. A variation from the center of the graph depicts frequency instability on the channel. Basically a thin smooth graph offers a more optimum frequency selection over a thick or uneven line.

Presence / Pulse Modes: For each channel, a Presence or Pulse output mode may be selected via the "SET UP" menu. If presence mode is selected then a choice of short, long, or user defined presence can be selected. Short Presence is defined as 30 minutes and Long Presence is defined as 120 minutes. In User Defined mode, a setting between 1 and 120 minutes can be entered. On the expiration of short or long presence time a detect CALL will be reset. In user defined mode, the detect CALL can be selected to reset on timer expiration or at the next End-Of-Green (EOG) signal after the expiration of the timer. The green signal is applied to the Timer Control input via the edge card connector. In Pulse mode, a 125 ms ± 25ms width pulse will be output for each vehicle entering the loop.

Loop Inductance Display: For each channel, when in the "Induct" display mode, the LCD screen displays the equivalent system loop inductance (loop and lead-in inductance) within the range of 20 to 2500 microHenries.

Loop Inductance -ΔL/L Display: For each channel, when in the "Induct" display mode, the LCD screen displays the percentage of inductance change during the CALL state.

DEFLECTOMETER® Pie Graph: For each channel, the LCD screen displays a pie graph which assists in determining the optimum sensitivity setting by showing the change in inductance caused by traffic moving over the loop. Optimum sensitivity setting is reached when the DEFLECTOMETER is at 50% and the numeral to the right of the pie graph reaches the value of 10, based on typical size vehicles. *Changes are reflected during the Call, so sensitivity can be (re)adjusted while a vehicle is stopped over the loop*. Selecting the optimum sensitivity level insures detection of all vehicles, including motorcycles and hi-bed trucks. This helps to eliminate any further service calls to adjust detector sensitivities.

DEFLECTOMETER® Streaming Graph: For each channel, while the DEFLECTOMETER displays an instantaneous indication of the current Call strength, the Streaming Graph display graphically shows the Call strength over time. The horizontal axis represents a six second interval. The vertical axis represents Call strength. The graph only streams when there is a Call present and displays approximately six seconds of data.

Event Log: For each channel, the LCD screen can display the last 25 loop fault conditions and power events via the "Event Log" menu. A channel reset will not clear the Event Log from memory. To clear the Event Log memory, select either "Clear Log" or "Clear All" from the "Event Log" menu.

Channel ID: Up to five (5) characters can be selected to identify each channel of detection.

Call Delay Timer: For each channel, a delay time of 0.1 seconds to 5 minutes can be set via the "SET UP" menu. Call Delay time starts counting down when a vehicle enters the loop detection area. Delay time can be overridden by a green signal at the Timer Control input.

Call Extension Timer: For each channel, an extension time of 0.1 seconds to 1 minute can be set via the "SET UP" menu. Call Extension time starts counting down when the last vehicle clears the loop detection zone. Any vehicle entering the loop detection zone during the Extension time period causes the channel to return to the CALL state. The Extension timer can be enabled upon the following options: Extend Always Mode, Extend On-Green Mode**,** Extend Disconnect, and Extension Plus Disconnect

Timer Control Inputs: Timer Control inputs are provided for each channel to modify the operation of the Delay and Extension functions. The application of a True (low) state voltage will inhibit the Delay timing function and/or enable the Extend timing function. Timer Control inputs are primarily provided for downward compatibility.

3rd Car Model: A "3rd Car" mode setting can be enabled by selecting the "3rd Car" option in the "Paired Channels" menu. The "3rd Car" mode is intended to be used in Protected / Permissive left turn situations. "3rd Car" mode links ch. 1 and 2 together, and links ch. 3 and 4 together.

Directional Logic: A Directional Logic setting can be enabled by selecting the "Direction" option in the "Paired Channels" menu. This feature is intended to be used in freeway ramps for wrong way detection and left turn lanes where other movements in the intersection tend to clip the detection zone of the left turn lane. Directional logic mode links ch. 1 and 2 together, and links ch. 3 and 4 together.

Channel Output Control: Each channel has one of three output options to choose from in the Setup menu; OFF, ON, or CALL.

Display: The Liquid Crystal Display (LCD) incorporates a white LED backlight. The backlight is energized when any switch is actuated and remains on for 1 hour after the last switch actuation.

Loop Fault Monitor: The detector continuously checks the integrity of the loop. The system is able to detect open circuit loops, shorted loops, or sudden changes in inductance exceeding 25% of the nominal inductance. If a fault is detected, both the DETECT (Red) and FAULT (Yellow) LEDs continuously emit a sequence of flashes. Each type of fault is identified by a different flash sequence. In addition to the LED flash sequence, the LCD will display the type of fault condition during the fault state. If the fault condition is removed, the LCD "Fault" indication and the DETECT (Red) LED will return to normal operation. The FAULT (Yellow) LED will continue to flash with the sequence signifying the type of fault that was last detected. In the case of the 25% Change in Inductance fault (possible loss of a loop within a parallel of loops), the unit will log the fault and retune to the new inductance after a period of two seconds. The logged fault will be stored in the Event Log memory. The backlight improves visibility in poor lighting conditions.

High Intensity Color-Coded LED Indicators:

Red DETECT Indicator:
- Vehicle Detection = Solid ON
- Delay Timing = 2 Hz flash rate.
- Extension Timing = 4 Hz flash rate.
- 3rd Car Mode = 10 flashes per second.
- Directional Logic Mode = 10 flashes per second.
- 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.

Vehicle Counting (AccurateCount) Display (ORACLE 2EC & 4EC models): If *AccurateCount* (Enable Vehicle Counting) mode is enabled, the LCD will report vehicle accumulated counts. For each channel, when a vehicle occupies the loop zone, the LCD counter accumulates one vehicle count per output. The counter is capable of accumulating 999,999 vehicle counts per channel before rolling over to zero.

For each channel of the Oracle 2EC model, the *AccurateCount* (Enable Vehicle Counting) output feature can be enabled via the "Set up" menu to produce a secondary output in addition to the primary CALL output for every vehicle entering the loop zone. Each vehicle entering the loop will cause an output pulse of 125ms ± 25ms from the secondary "Count" output on pin S [(Channel 1) and pin Y (Channel 2) Model ORACLE 2EC only)] irrespective of the size of the loop.

For each channel, when the *AccurateCount* (Enable Vehicle Counting) feature is enabled, a loop configuration must be selected, via the "Set up Counting Type" menu for either a single loop or up to eight loops connected together in series.

Mechanical:

Height = 4.5 inches (114.3 mm)
Depth = 6.875 inches (174.6 mm)
Width = 1.14"W (28.96mm) ***2E, 2EC, & 4H,*** and 2.34 inches (59.44 mm) ***4E & 4EC***

Environmental:

Operating Temperature: -30 to +165° F (-34 to +74° C)
LCD Operating Temperature: -4 to 165° F (-20 to +70° C)
Humidity Range (non-condensing): 0 to 95% Relative

Electrical:

DC Supply Voltage = 10.8 Vdc to 28.8 Vdc
DC Supply Current = 100 mA maximum (2E, 2EC), 175 mA maximum (4E, 4EC, 4H)
DC Supply Heater Current = 250 mA maximum (2E, 2EC,4H), 500 mA maximum (4E, 4EC)
DC Inputs:
True (low) = Less than 8 Vdc
False (high) = Greater than 16 Vdc
Optically Isolated Outputs:
True (low, 50 mA) = Less than 1.5 Vdc
False (high) = Greater than 16 Vdc
Maximum Current = 100 mA

Loop Inductance (Tuning) Range: The detector will automatically tune to a loop and lead-in combination within the tuning range of 20 to 2500 microHenry with a Q factor greater than 5.

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: Each detector channel will operate when connected to poor quality loops including those that have a short to ground at a single point.

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.

Loop Input Transient Protection: The loop input incorporates transient protection devices and the loop oscillator circuitry is transformer-isolated for each channel. The transient protection will withstand the discharge of a 10 uF capacitor charged to 2,000V across the loop inputs or between a loop input and Earth Ground for each channel. The transformer isolation allows operation with a loop which is grounded at a single point.

Response Timing: (Two channel operation with both channels at same sensitivity, Filter Off)

Sens.	Response	Sens.	Response	Sens.	Response	Sens.	Response.
20	59-104 ms	**15**	12-21 ms	**10**	4-7 ms	**5**	4-7 ms
19	43-76 ms	**14**	12-21 ms	**9**	4-7 ms	**4**	4-7 ms
18	32-55 ms	**13**	8-14 ms	**8**	4-7 ms	**3**	4-7 ms
17	24-41 ms	**12**	8-14 ms	**7**	4-7 ms	**2**	4-7 ms
16	16-28 ms	**11**	8-14 ms	**6**	4-7 ms	**1**	4-7 ms

Connector Pin Assignment:

Pin	ORACLE 2E, 2EC	Pin	ORACLE 2E, 2EC
A	Logic Ground	**1**	Ch 1 Timer Control Input
B	DC Supply	**2**	Ch 2 Timer Control Input
C	Ext. Reset	**3**	Det. Address Bit #3
D	Ch 1 Loop Input	**4**	Ch 1 Redundant Loop Input
E	Ch 1 Loop Input	**5**	Ch 1 Redundant Loop Input
F	Ch 1 Output (+)	**6**	Det. Address Bit #0
H	Ch 1 Output (-)	**7**	Ch 1 Status Output
J	Ch 2 Loop Input	**8**	Ch 2 Redundant Loop Input
K	Ch 2 Loop Input	**9**	Ch 2 Redundant Loop Input
L	Chassis Ground	**10**	Det. Address Bit #1
P	Reserved	**13**	Reserved
R	Reserved	**14**	Reserved
S	Ch 1 Cnt Output (+)	**15**	Det. Address Bit #2
T	Ch 1 Cntt Output (-)	**16**	Reserved
U	Reserved	**17**	Reserved
V	Reserved	**18**	Reserved
W	Ch 2 Output (+)	**19**	Data Trans. Output (TX)
X	Ch 2 Output (-)	**20**	Ch 2 Status Output
Y	Ch 2 Cnt Output (+)	**21**	Data Receive Input (RX)
Z	Ch 2 Cnt Output (-)	**22**	Reserved

Pin	ORACLE 4E,4EC,4H	Pin	ORACLE 4E,4EC,4H
A	Logic Ground	**1**	Ch 1 Timer Control Input
B	DC Supply	**2**	Ch 2 Timer Control Input
C	Ext. Reset	**3**	Det. Address Bit #3 Ch 3 Timer Control Input
D	Ch 1 Loop Input	**4**	Ch 1 Redundant Loop Input
E	Ch 1 Loop Input	**5**	Ch 1 Redundant Loop Input
F	Ch 1 Output (+)	**6**	Det. Address Bit #0
H	Ch 1 Output (-)	**7**	Ch 1 Status Output
J	Ch 2 Loop Input	**8**	Ch 2 Redundant Loop Input
K	Ch 2 Loop Input	**9**	Ch 2 Redundant Loop Input
L	Chassis Ground	**10**	Det. Address Bit #1 Ch 4 Timer Control Input
P	Ch 3 Loop Input	**13**	Ch 3 Redundant Loop Input
R	Ch 3 Loop Input	**14**	Ch 3 Redundant Loop Input
S	Ch 3 Output (+)	**15**	Det. Address Bit #2
T	Ch 3 Output (-)	**16**	Ch 3 Status Output
U	Ch 4 Loop Input	**17**	Ch 4 Redundant Loop Input
V	Ch 4 Loop Input	**18**	Ch 4 Redundant Loop Input
W	Ch 2 Output (+)	**19**	Data Trans. Output (TX)
X	Ch 2 Output (-)	**20**	Ch 2 Status Output
Y	Ch 4 Output (+)	**21**	Data Receive Input (RX)
Z	Ch 4 Output (-)	**22**	Ch 4 Status Output

Note: Pins M & N and 11 & 12 are RESERVED