1 Description

The MATRIX (10MATRIX) Digital Inductive Loop Detector is the ideal solution for parking barrier control, motorized gates and doors, vehicle access control and industrial control systems. The MATRIX is a high performance single or dual-channel vehicle detector packaged in a compact housing. The connection is made with a standard industrial 11-pin round connector. The six versions listed below include single or dual-channel, and 3 possible power supplies:

- 10MATRIXS110: Single loop detector with 110 to 120 V AC power supply.
- 10MATRIXS220: Single loop detector with 220 to 240 V AC power supply.
- 10MATRIXS1224: Single loop detector with 12 to 24 V AC/DC power supply.
- 10MATRIXD110: Dual loop detector with 110 to 120 V AC power supply.
- 10MATRIXD220: Dual loop detector with 220 to 240 V AC power supply.
- 10MATRIXD1224: Dual loop detector with 12 to 24 V AC/DC power supply.

2 Specifications

<table>
<thead>
<tr>
<th>TERMINOLOGY</th>
<th>SPECIFICATION</th>
<th>TERMINOLOGY</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>TECHNOLOGY</td>
<td>Inductive Loop</td>
<td>POWER FREQUENCY</td>
<td>48 to 62 Hz</td>
</tr>
<tr>
<td>TUNING</td>
<td>Automatic</td>
<td>POWER CONSUMPTION</td>
<td>&lt; 2.5 W</td>
</tr>
<tr>
<td>DETECTION MODE</td>
<td>Presence</td>
<td>TEMPERATURE RANGE</td>
<td>-22°F to 158°F (-30°C to 70°C)</td>
</tr>
<tr>
<td>PRESENCE TIME</td>
<td>1 min to infinity with 250 steps</td>
<td>DEGREE OF PROTECTION</td>
<td>IP40</td>
</tr>
<tr>
<td>PULSE TIME OUTPUT</td>
<td>100 ms or 500 ms</td>
<td>WEIGHT</td>
<td>7 oz. (&lt;200g)</td>
</tr>
<tr>
<td>LED INDICATORS</td>
<td>Power: Green</td>
<td>PROTECTIONS</td>
<td>Loop Insulation Transformer</td>
</tr>
<tr>
<td></td>
<td>Loop Status 1: Red</td>
<td>Zener Diodes</td>
<td>Gas Discharge Clamping</td>
</tr>
<tr>
<td></td>
<td>Loops Status 2: Red</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FREQUENCY RANGE</td>
<td>20 kHz to 130 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FREQUENCY STEPS</td>
<td>Single Loop: 4 Double Loop: 2 (for each loop)</td>
<td>INDUCTANCE RANGE</td>
<td>20 H to 1000 H</td>
</tr>
<tr>
<td>SENSITIVITY (ΔL / L)</td>
<td>0.005% to 0.5% with 250 steps</td>
<td>DIMENSIONS</td>
<td>3.0 in (H) x 1.5 in (W) x 3.0 in (D) (76mm x 38mm x 76mm)</td>
</tr>
<tr>
<td>REACTION TIME</td>
<td>Single Loop: 25ms Double Loop: 50ms (ea. channel)</td>
<td>CONNECTION</td>
<td>86CP11 (Standard 11-Pin Round)</td>
</tr>
<tr>
<td>SETUP TIME AFTER CONFIGURATION</td>
<td>2 s max by channel</td>
<td>2 OUTPUT RELAYS (free potential change-over contact)</td>
<td>Max Contact Voltage: 230 VAC</td>
</tr>
<tr>
<td>POWER SUPPLY</td>
<td>(depending on model)</td>
<td>Max Contact Current: 5A (res.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12-24 AC/DC ± 10% 230 VAC ± 10% 115 VAC ± 10%</td>
<td>SETUP TIME AT POWER ON</td>
<td>8 s max by channel</td>
</tr>
</tbody>
</table>

3 Precautions

- Shut off all power before attempting any wiring procedures.
- Maintain a clean & safe environment when working in public areas.
- Constantly be aware of pedestrian traffic around the door area.
- Always stop pedestrian traffic through the doorway when performing tests that may result in unexpected reactions by the door.
- ESD: Circuit boards are vulnerable to damage by electrostatic discharge. Before handling any board ensure you dissipate your body’s charge.
- Always check placement of all wiring before powering up to insure that moving door parts will not catch any wires and cause damage to equipment.
- Ensure compliance with all applicable safety standards (i.e. ANSI A156.10 / A156.19) upon completion of installation.
- DO NOT attempt any internal repair of the sensor. All repairs and/or component replacements must be performed by BEA, Inc. Unauthorized disassembly or repair:
  1. May jeopardize personal safety and may expose one to the risk of electrical shock.
  2. May adversely affect the safe and reliable performance of the product will result in a voided product warranty.
4 FCC Compliance

FCC ID#: G9B-MATRIX   IC ID#: 4680A-MATRIX

10MATRIXS110 : Single loop detector with 110 to 120 V AC power supply.
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The Digital Transmitters and Receivers comply with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1) This device may not cause harmful interference and;
2) This device must accept any interference received including interference that may cause undesired operations.

Changes or modifications not expressly approved by BEA, Inc. for compliance could void the user’s authority to operate the equipment.

5 Loop Installation Tips

A. CABLE SPECIFICATIONS FOR LOOP AND FEEDER

- 16 AWG (1.5mm²) cross section area;
- Multi-strand cable;
- Insulation material: PVC or Silicone;
- For the feeder cable, the wire must be twisted at least 15 times per yard for each cable;
- Feeder for long runs used for foil screened cable is recommended (earth at equipment end only);
- The feeder cable must be firmly fixed to avoid any false detection (max length: 330 ft. / 100m);
- Waterproof cable junction box is required.

B. LOOP GEOMETRY

- When two adjacent loops are connected to a dual channel sensor, it is possible for these loops to share a common slot, if so required. As the channels are multiplexed, no interference will occur.
- Avoid large loops or long feeder (max 330 ft. / 100 m), or else the sensitivity will be affected.

C. NUMBER OF LOOP TURNS

- Measure the length (L) and width (Ea) of one loop. Multiply these numbers together to determine the loop surface area.
- For example: If L=10 ft, Ea= 3 ft, then the area = 30 ft²; 4 loop turns are recommended - or -
  If L=2m, Ea=1m, then the area = 2 m²; 4 loop turns are recommended.

**WARNING:** FOR CONFORMITY REASONS, IN ANY INSTALLATION, THE LOOP SURFACE MULTIPLIED BY THE NUMBER OF TURNS SHOULD NOT EXCEED 215 SQUARE FEET OR 20 SQUARE METERS.

Recommended values for the turns:

<table>
<thead>
<tr>
<th>Area</th>
<th>Number of turns</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;32 ft²</td>
<td>3 – 5 m²</td>
</tr>
<tr>
<td>32 – 54 ft²</td>
<td>3 – 5 m²</td>
</tr>
<tr>
<td>65 – 108 ft²</td>
<td>6 – 10 m²</td>
</tr>
</tbody>
</table>

D. SLOT DEPTH

- 1 ¼ - 2" (30 – 50mm) depending on the cable turns number
- Clean and dry slots prior to inserting cable

6 Wiring

**UL Requirement:** Shall be used with suitable UL Recognized SWIVZ Relay Socket.

PIN 1: Power Supply
PIN 2: Power Supply
PIN 3: Relay 2 (NO)
PIN 4: Relay 2 (COM)
PIN 5: Relay 1 (NO)
PIN 6: Relay 1 (COM)
PIN 7: Loop A
PIN 8: Loop Common (Connect to Ground)
PIN 9: Loop B
PIN 10: Relay 1 (NC)
PIN 11: Relay 2 (NC)

**WARNING:** DO NOT REMOVE THE GREASE ON THE CONNECTOR’S PINS.

**WARNING:** PIN #8 MUST BE CONNECTED TO THE LOOP AND TO GROUND.
I. THE 3 CONFIGURATIONS

A. Configuration A: Single Loop Detector (MATRIX-S)
B. Configuration B: Dual Loop Detector in Independent Mode with Dipswitch #10 OFF (MATRIX-D)
C. Configuration C: Dual Loop Detector in Combined Mode with Dipswitch #10 ON (MATRIX-D)

II. POTENTIOMETERS

A Potentiometer for Adjustment of the Maximum Duration of a Presence Detection: from 1 min to Infinity (See PRESENCE TIME)

A Potentiometer for Adjustment of the Linear Sensitivity (Δ) for the Loop A: from 0.005% to 0.5% (See SENSITIVITY)

A Potentiometer for Adjustment of the Linear Sensitivity (Δ) for the Loop B: from 0.005% to 0.5% (See SENSITIVITY)

III. RELAY CONFIGURATION (DIPSWITCH #3)

A 10 position dip switch is located on the front of the Matrix single detector. Dip switch 3, 5, 6, 7 and 8 configure the relay, while dip switch 9 controls the duration of the pulse when the Matrix is configured for pulse operation, (as opposed to presence). Configurations are as follows:

DIPSWITCH 3:
OFF = FAIL-SECURE MODE Relay is NOT energized when power is applied. Relay is energized upon detection only. In this mode, the NO circuit is open, and the NC circuit is closed. Thus, if a closed circuit is required upon detection, one must use the NO and COM terminals since they would close upon detection. When the Matrix is NOT powered, it is in the same state as it would be for non-detection.

ON = FAIL-SAFE MODE Relay is energized as soon as power is applied and de-energizes upon detection or power loss. In this mode, upon powering the detector, the NO circuit becomes closed, and the NC circuit becomes open. Thus, if a closed circuit is required upon detection, one must use the NC and COM terminals, since they would now be OPEN during non-detection, and would close upon detection. When the Matrix is NOT powered, it is in the same state as it would be for detection.
IV. DIPSWITCHES

A. After each dipswitch change the sensor launches a learning process.

<table>
<thead>
<tr>
<th>DIPSWITCH</th>
<th>LEARNING PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Frequency Adjustments of Loop A (see ADJUSTMENTS)</td>
</tr>
<tr>
<td>#2</td>
<td>Frequency Adjustments of Loop A (with single loop) or Loop B (with Dual Loops)</td>
</tr>
<tr>
<td>#3</td>
<td>Relay configuration: Active (Fail-Secure) or Passive (Fail-Safe)(See Programming Step III.)</td>
</tr>
<tr>
<td>#4</td>
<td>Automatic Sensitivity Boost (ASB option) [recommended for improved truck detection]: During a detection, the sensitivity increases automatically to 8 times the preset sensitivity given by the sensitivity potentiometer adjustment. It is limited to the maximum sensitivity ($\Delta f = 0.005%$). It goes back to the preset value after detection stops.</td>
</tr>
<tr>
<td>#5</td>
<td>Relay A Function: Presence or Pulse (not used with dual loop in combined mode)</td>
</tr>
</tbody>
</table>
| #6        | Relay A Pulse type: Entry or Exit (used only at pulse function) or Relay B Mode (with dual loop in combined mode) (see drawing on next page)  
  • Non-Directional: Relay B provides a pulse according to the dip switches #7 and #8 setting.  
  • Directional A→B: Relay B provides a pulse only if loop A is detecting before loop B. The logic detection takes place according to dip switches #7 and #8.  
  WARNING: DURING THE DETECTION, THE 2 LOOPS HAVE TO DETECT SIMULTANEOUSLY FOR A SHORT PERIOD TO BE ABLE TO DETERMINE THE MOVEMENT DIRECTION. DURING LOOP INSTALLATION MAKE SURE THE 2 LOOPS ARE CLOSE ENOUGH TO EACH OTHER TO ENSURE A COMMON DETECTION (TYPICAL 3 FEET). |
| #7        | Relay B Function: Presence or Pulse - or - Loop Selection for Relay B Pulse: Pulse on Loop B or Pulse on Loop A (used with dual loop in combined mode) |
| #8        | Relay B Pulse Type: Entry or Exit (used only at pulse function) |
| #9        | Pulse Duration for Both Relays (used only at pulse function): 100 ms or 500 ms |
| #10       | Dual Loop Mode: Independent or Combined A→B (not used with single loop) |

8 Adjustments

**FREQUENCY ADJUSTMENT FOR LOOP A FOR SINGLE LOOP DETECTOR**

<table>
<thead>
<tr>
<th>LOOP FREQUENCY</th>
<th>DIPSWITCH #1</th>
<th>DIPSWITCH #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>MID HIGH (High - 20%)</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>MID LOW (High - 25%)</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>LOW (High - 30%)</td>
<td>On</td>
<td>On</td>
</tr>
</tbody>
</table>

**Dual Loop Configuration A**

- Loop A
- Loop B
- Relay A
  - Pulse on entry A
  - Pulse on exit A
  - Pulse on entry B
  - Pulse on exit B
  (Non-Directional)
  - Pulse on entry A
  - Pulse on exit A
  - Pulse on entry B
  - Pulse on exit B
  (Directional A→B mode)

**Dual Loop Configuration B**

- Loop A
- Loop B
- Relay A
  - Pulse on entry A
  - Pulse on exit A
  - Pulse on entry B
  - Pulse on exit B
  (Non-Directional)
  - Pulse on entry A
  - Pulse on exit A
  - Pulse on entry B
  - Pulse on exit B
  (Directional A→B mode)
9 Adjustments

GREEN LED shows when the module is powered.

RED LED gives:
- The corresponding loop detection state in normal situation;
- The value of the oscillation frequency measurement or an error message on power ON.

Normally, the RED LED stays ON as long as the loop is in a state of detection.

On POWER ON, the sensor measures the oscillation frequency of each loop. The result of this measurement is displayed using the corresponding RED LED. The number of flashes indicates the tens value of the frequency. For example, 4 short flashes correspond to a frequency between 40 kHz and 49 kHz. After this message the LED goes back to normal display. If the loop oscillation frequency falls outside the limits (20 kHz to 130 kHz) the RED LED displays an error message and the sensor activates the corresponding relay. The blinking frequency shows the type of error according to the next table. The sensor will stay in error mode until the error is cleared and the frequency goes to the right range.

Remark: The sensor launches automatically a learning process if the oscillation frequency varies more than 10% in comparison with the measurement value.

<table>
<thead>
<tr>
<th>LOOP FREQUENCY ERROR</th>
<th>LED DISPLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscillation frequency too LOW or loop opened</td>
<td>LED blinking at 1Hz</td>
</tr>
<tr>
<td>Oscillation frequency too HIGH</td>
<td>LED blinking faster at 2 Hz</td>
</tr>
<tr>
<td>Loop shorted or no oscillation</td>
<td>LED blinking slower at 0.5 Hz</td>
</tr>
</tbody>
</table>

10 Troubleshooting

**SYMPTOMS**

- The Loop Detector will NOT Work. The Green LED is OFF.
- The Loop Detector will NOT Work. The Red LED is Flashing Slowly (0.5Hz).
- The Loop Detector will NOT Work. The Red LED Blinks at either 1Hz or 2Hz.
- The Loop LED is Detecting Properly but the Contact is Not Made.
- Dipswitches 5 to 8 are NOT Responding Properly.

**POSSIBLE CAUSES**

- There is no Power Supply to the Loop Detector.
- The Corresponding Loop is Shorted.
- The Frequency of Oscillation Fails Outside the Allowed Range.
- Bad Connection of the Relay Contacts.
- Their Function Varieties According to Dipswitch #10 Setting.

**CORRECTIVE ACTION**

- Check the Power Supply.
- Check the Loop Cable.
- Adjust Frequency with Dipswitches.
- Change Loop Turns.
- Check Relay Connections.
- Increase the Microwave Rejection.

11 Company Contact

Do not leave problems unresolved. If a satisfactory solution cannot be achieved after troubleshooting a problem, please call BEA, Inc. If you must wait for the following workday to call BEA, leave the door inoperable until satisfactory repairs can be made. Never sacrifice the safe operation of the automatic door or gate for an incomplete solution.

The following numbers can be called 24 hours a day, 7 days a week. For more information, visit www.beasensors.com.

- US and Canada: 1-866-249-7937
- Southeast: 1-800-407-4545
- Canada: 1-866-836-1863
- Midwest: 1-888-308-8843
- Northeast: 1-866-836-1863
- West: 1-888-419-2564