3M
Installation Instructions

Canoga™
Vehicle Detection System

Model C822-F Loop Detector
Model C822-O Loop Detector
Model C824-F Loop Detector
Model C824-O Loop Detector
Model C822T-F Loop Detector
Model C822T-O Loop Detector
Model C824T-F Loop Detector
Model C824T-O Loop Detector
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1 About This Manual

1.1 Manual Organization
This manual is divided into nine sections.

Section 1. About This Manual
Contains information about the organization and content of this manual.

Section 2. Safety
Contains important information about safety messages and safety precautions.

Section 3. Intended Use Statement
Describes the intended use of the 3M™ Canoga™ Vehicle Detection System.

Section 4. Product Description
Briefly describes 3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, and C824T Loop Detectors and their companion products.

Section 5. Installation Requirements
Describes the components, tools, and information you must have before installing the loop detectors.

Section 6. Installation Procedure
Contains step-by-step procedures for installing the loop detectors and setting up the operating parameters.

Section 7. Product Features
Describes important features and characteristics of the loop detectors.

Section 8. Diagnostic Codes
Describes the codes displayed by the front panel LED indicators when faults occur.

Section 9. Testing and Adjusting
Contains information about checking the operation of the installed loop detector.

1.2 Purpose of Manual
We prepared this manual to provide the installation and setup information required to successfully install the Model C822, C822T, C824, and C824T loop detectors. In addition to installation instructions, this manual contains information useful for troubleshooting and maintaining systems containing loop detectors.

1.3 Manual Audience
This manual is written for traffic system installers and maintenance technicians.

1.4 Model Numbers
The Canoga C800 family of loop detectors includes the following model numbers:

<table>
<thead>
<tr>
<th>2-Channel</th>
<th>4-Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>C822-F</td>
<td>C824-F</td>
</tr>
<tr>
<td>C822-O</td>
<td>C824-O</td>
</tr>
<tr>
<td>C822T-F</td>
<td>C824T-F</td>
</tr>
<tr>
<td>C822T-O</td>
<td>C824T-O</td>
</tr>
</tbody>
</table>

Models with an F suffix have a fail-safe FET output, which is NEMA TS2-1992 compatible.

Models with an O suffix have a standard darlington optoisolated output, which is NEMA TS1 compatible.

Models with a T suffix have a Delay and/or Extension timing feature.

Throughout this manual, the F or O suffix will be included only when it is necessary to show the NEMA TS1 or TS2 compatibility.
1.5 Manual Conventions

The conventions listed in Table 1-1 help to make this manual easier to use by presenting a uniform approach to the descriptions, phrases, and nomenclature.

<table>
<thead>
<tr>
<th>Element</th>
<th>Convention</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acronyms</td>
<td>Uppercase</td>
<td>LED</td>
</tr>
<tr>
<td>Abbreviations</td>
<td>Lowercase</td>
<td>ms (milliseconds)</td>
</tr>
<tr>
<td></td>
<td>…except where standard usage is uppercase</td>
<td>Mb (megabits)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MB (megabytes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dB (decibel)</td>
</tr>
<tr>
<td>Model Names</td>
<td>First or formal reference: initial caps</td>
<td>3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, and C824T Loop Detectors</td>
</tr>
<tr>
<td></td>
<td>Subsequent use or informal reference: initial caps for Model, lowercase for remainder</td>
<td>Model C824T loop detector, loop detector, or detector</td>
</tr>
<tr>
<td>Mode/Sensitivity Switches</td>
<td>Mode: initial caps Sensitivity: uppercase</td>
<td>the Presence mode select position X</td>
</tr>
</tbody>
</table>
2 Safety

We include important safety information and warnings to help you understand and avoid potential harm to yourself, and possible damage to the equipment, during the installation of the Model C822, C822T, C824, and C824T loop detectors. Although we have included many potential hazards that you may encounter during the installation of this equipment, we cannot predict all of the possible hazards and this list should not be a substitute for your judgment and experience.

Please read and understand all of the safety messages and safety labels before beginning the work.

If you are unsure about any part of this installation or of the potential hazards discussed, please contact your supervisor immediately.

2.1 Safety Messages

We include safety messages in this manual to help you protect your safety and the safety of others. This section contains important information to help you recognize and understand these safety messages. Please read these messages before proceeding with the installation.

2.1.1 Safety Message Format

Safety messages are designed to alert you to potential hazards that can cause personal injury to you or others. They can also indicate the possibility of property damage.

Each safety message box contains a safety alert symbol, (⚠️), one of three signal words: DANGER, WARNING, or CAUTION, and a safety message.

The signal words and symbols, and their meanings, are shown below:

⚠️ DANGER

The safety message is in this box.

DANGER means you and/or someone else WILL be KILLED or SERIOUSLY HURT if you do not follow these instructions.

⚠️ WARNING

The safety message is in this box.

WARNING means you and/or someone else MAY be KILLED or SERIOUSLY HURT if you do not follow these instructions.

⚠️ CAUTION

The safety message is in this box.

CAUTION means you and/or someone else MAY be HURT or property damage may result if you do not follow these instructions.

In addition to the symbols and words explained above, each safety message identifies the hazard, describes what you can and should do to avoid the risk of exposure to the hazard, and tells the probable consequences of not avoiding the hazard.
2.1.2 Safety Messages Contained in This Manual

The following safety messages appear in this manual:

⚠️ WARNING
Improper operation of the traffic control system may result in personal injury. To avoid improper use of the Canoga C800 series loop detectors, installation is to be done only by qualified professionals who are trained to operate and maintain traffic control systems, and who are familiar with this equipment. Improper use of the loop detectors may cause improper operation of the traffic control system and/or unsafe driver action.

⚠️ WARNING
Plugging the loop detector into the wrong connector may cause improper operation of the traffic control system, which may result in personal injury. To avoid this problem, be sure to plug the loop detector into a 44-contact connector (22-contact, double sided). Improper operation of the traffic control system may result in unsafe driver action.

⚠️ WARNING
Improper wiring of the card rack connector may cause incorrect operation of the loop detector and affect the traffic control system, which may result in personal injury. To avoid this problem, verify that the card rack connectors and wiring are appropriate. Improper operation of the traffic control system may result in unsafe driver action.

⚠️ WARNING
When you change the Mode, Sensitivity, or Frequency switch or reset the loop detector, all vehicles currently on the loops will be tuned out and possibly left undetected at the intersection. This may cause improper operation of the traffic control system, which may result in personal injury. To avoid this problem, take the appropriate steps to prevent vehicles from being left undetected at the intersection when you change switch settings or reset the loop detector. Improper operation of the traffic control system may result in unsafe driver action.
2.2 Damage Prevention Messages

Damage prevention messages are designed to help you prevent damage to the device, other devices, and to the environment. Each damage prevention message includes the word NOTICE.

This word and its meaning are shown below:

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The damage prevention message is in this box.</td>
</tr>
</tbody>
</table>

NOTICE means that this device, or another device, may be damaged if you do not follow these instructions.

2.3 Safety Considerations

Please consider the following safety issues before beginning the installation.

Although we have compiled this list of common safety considerations, it should not be considered as complete. It is not intended to take the place of your good judgment, training, and experience.

2.3.1 Personal Safety Equipment and Clothing

Personal safety equipment and clothing including high visibility vests, hard hats, gloves, electrical shock or electrocution protection clothing and equipment, safety shoes, safety glasses, face shields, goggles, and hearing protection devices are just some of the items available to you. Choose the right equipment for the job. If you are unsure of which safety equipment is recommended or appropriate for the job, ask your supervisor or foreman.

2.3.2 Work Zone Traffic Control

Proper control of vehicle traffic is important during many procedures. When necessary, we recommend that you have people trained in manual traffic control, such as police officers, assist you.

When you install devices that require you to position vehicles, equipment, or people in or near the roadway; it is important that you use appropriate work zone traffic control techniques, equipment, and procedures. Sometimes you may have to work on or near the roadway and these same techniques, equipment, and procedures should be used for your protection.

If you are unsure of which procedures are recommended or appropriate for the job, ask your supervisor or foreman.

2.3.3 Electric Shock

The possibility of electrical shock exists when installing 3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, and C824T Loop Detectors if not installed properly. Follow proper work procedures and read and understand the safety messages in this manual.

As a trained installer of electrical equipment you are aware of the dangers associated with installation of electrical devices. Always be sure that the power to the equipment, and all associated equipment, is off before beginning any procedure. Use the equipment, techniques, and procedures that you learned during your training or apprenticeship or other electrical industry recognized safety procedures.

If you are unsure of which procedures are recommended for the job, ask your supervisor or foreman.

2.4 Disposal of Device

Please dispose of the device in accordance with all local, state, and federal laws and regulations.
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3 Intended Use Statement

The 3M Canoga® Vehicle Detection System used with 3M Canoga® C800IS Interface and Data Acquisition Software is intended to provide current measurement and vehicle detection information on the last vehicle for use in Advanced Traffic Management Systems.

This Canoga system consists of the C800IS software and C800 series loop detectors connected to inductive sensors. The inductive sensors can be wire loops, 3M Canoga® Vehicle Detection System Model 701 Microloops, or Model 702 Non-invasive Microloops.
4 Product Description
The 3M™ Canoga™ Vehicle Detection System Model C822 and C822T Loop Detectors are high-performance, 2-channel, digital loop detectors. The Model C824 and C824T loop detectors are high-performance, 4-channel, digital loop detectors. The basic functions of all four loop detectors are similar, but each detector has unique features. For example, the T suffix on Model C822T and C824T loop detectors indicates presence of the Delay and/or Extension timing feature.

Each loop detector is a single printed circuit module that plugs into either a standard NEMA TS1 card rack (models with O suffix) or TS2-1992 card rack (models with F suffix), or a Type 170 input file. A companion power supply is available that supplies +24 VDC power for up to four loop detectors.

The loop detectors are compatible with conventional wire-wound loop designs and with compact Canoga microloops.

The loop detectors are compatible with NEMA TS1, TS2-1992, and CAL/NY Type 170 standards.

4.1 Companion Products
Each loop detector is one component within a family of Canoga C800 vehicle detection matched-component systems. Each of the other components described on this page is an integral part of this matched-component system.

C800IS Interface and Data Acquisition Software
The 3M™ Canoga™ C800IS Interface and Data Acquisition Software greatly expands the features of the loop detectors. The software allows you to quickly set up and customize the loop detectors for your application.

This communication link allows remote access, with password-protected security to the detector, for reading or changing its configuration, for fault identification and verification, and for real-time system monitoring and data collection on up to four channels of detection.

Optional Accessory Modules
The 3M™ Model 832 Communications Module is a plug-in communication interface board.

The 3M™ Model 814 Memory Module is a plug-in programmable memory board.

Either module plugs directly into the loop detector board.

Power Supply
The 3M™ Canoga™ Model R124A Power Supply is a plug-in device that supplies +24 Volts DC. It can power up to four loop detectors. The Model R124A power supply requires 115 VAC input power and draws less than 0.375 Ampere.
4.2 Loop Detector Specifications

**Electrical**

Input Voltage — 10.8 to 37 VDC.

Current — Less than 50 MA per loop for 2- and 4-loop configurations at +24 VDC.

Board Edge Connector — Gold-plated contacts. Contact spacing: 0.156 inch between centers. Mates with a Cinch-Jones 50-44A-30M connector or equivalent. See Table 6-1, on page 13, for pin assignments.

Lightning Resistance — Optically isolated loop outputs.

Power Loss Protection — Includes fail-safe feature in the event of power loss.

**Dimensions**

Width:  
- 1.9 in [4.8 cm] 4-channel
- 1.1 in [2.8 cm] 2-channel

Height: 4.5 in [11.4 cm]

Depth: 8.3 in [21.2 cm]

**Operational Environment**

Temperature: –30° to +165°F  
[-34° to +74°C]

Humidity: 5% to 95% (Noncondensing)
5 Installation Requirements

This section describes the components, tools, and information you must have available before installing the 3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, and C824T Loop Detectors.

5.1 Equipment Requirements

In addition to the loop detector to be installed, you will need the following items:

1. Card rack or input file.
   The loop detectors are compatible with NEMA TS1 card racks (models with O suffix), TS2-1992 card racks (models with F suffix), and Type 170 input files.

   The loop detectors are designed to plug into a 44-contact (22-contact, dual sided) connector, Cinch-Jones 50-44A-30M or equivalent. The card rack or input file must contain this type of connector.

2. 3M™ Canoga™ Model R124A Power Supply or equivalent. This power supply can power up to four loop detectors.

   If you use an equivalent power supply, refer to Paragraph 4.2, Loop Detector Specifications, for loop detector power requirements.

3. Connection wire that meets applicable electrical codes and any standards established at the installation site.

   **NOTE**
   All communication cables and loop lead-in cables connected to the loop detectors must be shielded to comply with CE requirements.

4. Card rack mounting tools and hardware as required by the installation site.

5.2 Software Requirements

If you plan to use the optional 3M™ Canoga™ C800IS Interface and Data Acquisition Software, you will need the following items:

1. IBM compatible PC that meets the following requirements:
   - 486 or higher processor.
   - 8 MB RAM, minimum.
   - VGA or Super VGA video interface and monitor.
   - 3.5-inch disk drive.
   - One free RS232 serial port.
   - Microsoft® Windows™ 95 or NT 4.0\(^1\) or higher.
   - At least 10 MB free hard disk space.

2. C800IS Interface and Data Acquisition Software.
   This software package includes a serial port cable to connect the PC to the loop detector.

Without the PC, you can manually set up the operating parameters (listed in Paragraph 5.3) by using switches on the loop detector.

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\(^{1}\) Windows is a trademark of Microsoft Corporation.
5.3 Operating Parameters

You will need the following information to set up operating parameters for the loop detectors. There is more information about these parameters later in this manual.

1. **Loop Type** — You must determine the type of loop that will be connected to each loop input channel. The two types are: standard loop or 3M™ Canoga™ Vehicle Detection System Model 701 Microloop or Model 702 Non-invasive Microloop.

   All loops are classified as standard loops except Canoga microloops.

2. **Mode** — Choices are: Pulse mode or Presence mode. This parameter is set separately for each loop channel.

   Refer to Paragraph 7.3, Operating Modes, for more information.

3. **Sensitivity** — A sensitivity level must be set for each loop channel. There are 8 sensitivity levels within Pulse mode and 7 levels within Presence mode.

   Figure 7-1, on page 28, gives recommended sensitivity level settings for various types of loops.

4. **Delay or Extension Requirements (Model C822T and C824T Loop Detectors Only)** — Delay and Extension timing can be enabled or disabled for each of the loop channels. Several timing intervals are available for both Delay and Extension functions.

   Refer to Paragraph 7.4, Delay and Extension, for more information.

5. **Recovery Method** — Either Normal or Fast Recovery settings can be set from a front panel switch. The Fast Recovery option is not available on any channels connected to Canoga microloops and set to Microloop mode.

6. **Frequency** — Three frequency selections are available from a front panel switch: Low, Medium, or High.

   Refer to Paragraph 7.9, Crosstalk Elimination, for more information.
6 Installation Procedure

This section describes how to set up and install the 3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, and C824T Loop Detectors.

6.1 Pre-Installation

1. Check the card rack or input file connector to be sure that it is a 44-contact connector.

   A 44-contact (22-contact, double sided) connector that is wired for green sensing, backpanel addressing, and serial communication is required to take advantage of the advanced features of the Canoga C800 series loop detectors. Refer to Table 6-1 for connector pin assignments.

   **WARNING**

   Improper wiring of the card rack connector may cause incorrect operation of the traffic control system, which may result in personal injury. **To avoid this problem, verify that the card rack connectors and wiring are appropriate.** Improper operation of the traffic control system may result in unsafe driver action.

2. If necessary, replace the connector with a Cinch-Jones 50-44A-30M connector or equivalent.

   **WARNING**

   Improper operation of the traffic control system may result in unsafe driver action.

6.2 Card Rack Wiring

1. If your card rack is not pre-wired or you replaced a connector in the card rack, install the wiring. Use Table 6-1 to determine the required connections.

   Make all connections to the terminals on the rear of the card rack connector that the loop detectors will plug into. Any of the inputs or outputs not used in your application can be left unconnected.

   **WARNING**

   Plugging the loop detector into the wrong connector may cause improper operation of the traffic control system, which may result in personal injury. **To avoid this problem, be sure to plug the loop detector into a 44-contact connector (22-contact, double sided).** Improper operation of the traffic control system may result in unsafe driver action.

2. Check card rack wiring.

   If your card rack is pre-wired, verify that the wiring is compatible with Table 6-1.

3. Install connector keys (optional).

   You can install connector keys in the card rack connector that the loop detectors plug into. Keys are used to ensure that only loop detector units can be inserted into the slots. The keys also help to align the board edge connector.

   These connector keys must be placed to match the notches in the board edge connector. Refer to Table 6-1 for connector key positions.

   Connector keys are not supplied with the loop detectors. The keys may be provided with the card rack.

4. Set up backpanel addressing.

   You can hard-wire up to 16 separate addresses (0 through 15) for the loop detectors. The Backpanel Addressing feature of the detector must be enabled using the 3M™ Canoga™ C800IS Interface and Data Acquisition Software before the software can communicate with the loop detector residing at that address.

   To hard-wire an address, refer to Table 6-2, on page 14, for the pin configuration that corresponds to the address.
NOTES

Table 6-1 shows the pin assignments viewed from the front of the card rack (looking into the slot). Pin letters (A, B, C, …) are on the right side of the slot; pin numbers (1, 2, 3, …) are on the left.

Table 6-1 shows a fully-wired board edge connector. Signals for Channel 3 and Channel 4 are wired as shown, but are not used by 2-channel loop detectors.

Table 6-1. Board Edge Connector Pin Assignments

<table>
<thead>
<tr>
<th>Signal</th>
<th>Pin Label (*)</th>
<th>Pin Label</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 1 Green (DC+ Input)</td>
<td>1</td>
<td>A</td>
<td>DC Ground</td>
</tr>
<tr>
<td>Channel 2 Green (DC+ Input)</td>
<td>2 KEY</td>
<td>B</td>
<td>+24 VDC</td>
</tr>
<tr>
<td>Channel 3 Green or Detector Address 3</td>
<td>3 C</td>
<td></td>
<td>Remote Reset Input</td>
</tr>
<tr>
<td>Channel 1 Loop (same as pin D)</td>
<td>4 ----- D</td>
<td></td>
<td>Channel 1 Loop</td>
</tr>
<tr>
<td>Channel 1 Loop (same as pin E)</td>
<td>5 ----- E</td>
<td></td>
<td>Channel 1 Loop</td>
</tr>
<tr>
<td>Detector Address 0</td>
<td>6</td>
<td>F</td>
<td>Channel 1 Output(+)</td>
</tr>
<tr>
<td>Channel 1 Status Output</td>
<td>7</td>
<td>H</td>
<td>Channel 1 Output(–)</td>
</tr>
<tr>
<td>Channel 2 Loop (same as pin J)</td>
<td>8 ----- J</td>
<td></td>
<td>Channel 2 Loop</td>
</tr>
<tr>
<td>Channel 2 Loop (same as pin K)</td>
<td>9 ----- K</td>
<td></td>
<td>Channel 2 Loop</td>
</tr>
<tr>
<td>Channel 4 Green or Detector Address 1</td>
<td>10</td>
<td>L</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>No connection</td>
<td>11 KEY</td>
<td>M</td>
<td>No connection</td>
</tr>
<tr>
<td>No connection</td>
<td>12</td>
<td>N</td>
<td>No connection</td>
</tr>
<tr>
<td>Channel 3 Loop (same as pin P)</td>
<td>13 ----- P</td>
<td></td>
<td>Channel 3 Loop</td>
</tr>
<tr>
<td>Channel 3 Loop (same as pin R)</td>
<td>14 ----- R</td>
<td></td>
<td>Channel 3 Loop</td>
</tr>
<tr>
<td>Detector Address 2</td>
<td>15</td>
<td>S</td>
<td>Channel 3 Output(+)</td>
</tr>
<tr>
<td>Channel 3 Status Output</td>
<td>16</td>
<td>T</td>
<td>Channel 3 Output(–)</td>
</tr>
<tr>
<td>Channel 4 Loop (same as pin U)</td>
<td>17 ----- U</td>
<td></td>
<td>Channel 4 Loop</td>
</tr>
<tr>
<td>Channel 4 Loop (same as pin V)</td>
<td>18 ----- V</td>
<td></td>
<td>Channel 4 Loop</td>
</tr>
<tr>
<td>Transmit Data (data comm. port)</td>
<td>19</td>
<td>W</td>
<td>Channel 2 Output(+)</td>
</tr>
<tr>
<td>Channel 2 Status Output</td>
<td>20</td>
<td>X</td>
<td>Channel 2 Output(–)</td>
</tr>
<tr>
<td>Receive Data (data comm. port)</td>
<td>21</td>
<td>Y</td>
<td>Channel 4 Output(+)</td>
</tr>
<tr>
<td>Channel 4 Status Output</td>
<td>22</td>
<td>Z</td>
<td>Channel 4 Output(–)</td>
</tr>
</tbody>
</table>

* A dashed line between two pin labels indicates that both pins carry the same signal (pins are shorted together on the board).
Table 6-2. Pin Configuration for Backpanel Addressing

<table>
<thead>
<tr>
<th>Detector Address Bit</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>Hard-Wired Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin Number</td>
<td>3</td>
<td>15</td>
<td>10</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Grd</td>
<td>Grd</td>
<td>Grd</td>
<td>Grd</td>
<td>Grd</td>
<td>15</td>
</tr>
<tr>
<td>Grd</td>
<td>Grd</td>
<td>Grd</td>
<td>Open</td>
<td>Grd</td>
<td>14</td>
</tr>
<tr>
<td>Grd</td>
<td>Grd</td>
<td>Open</td>
<td>Grd</td>
<td>Grd</td>
<td>13</td>
</tr>
<tr>
<td>Grd</td>
<td>Grd</td>
<td>Open</td>
<td>Open</td>
<td>Grd</td>
<td>12</td>
</tr>
<tr>
<td>Grd</td>
<td>Open</td>
<td>Grd</td>
<td>Grd</td>
<td>Grd</td>
<td>11</td>
</tr>
<tr>
<td>Grd</td>
<td>Open</td>
<td>Grd</td>
<td>Open</td>
<td>Grd</td>
<td>10</td>
</tr>
<tr>
<td>Grd</td>
<td>Open</td>
<td>Open</td>
<td>Grd</td>
<td>Grd</td>
<td>9</td>
</tr>
<tr>
<td>Grd</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Grd</td>
<td>8</td>
</tr>
<tr>
<td>Open</td>
<td>Grd</td>
<td>Grd</td>
<td>Grd</td>
<td>Grd</td>
<td>7</td>
</tr>
<tr>
<td>Open</td>
<td>Grd</td>
<td>Grd</td>
<td>Open</td>
<td>Grd</td>
<td>6</td>
</tr>
<tr>
<td>Open</td>
<td>Grd</td>
<td>Open</td>
<td>Grd</td>
<td>Grd</td>
<td>5</td>
</tr>
<tr>
<td>Open</td>
<td>Grd</td>
<td>Open</td>
<td>Open</td>
<td>Grd</td>
<td>4</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>Grd</td>
<td>Grd</td>
<td>Grd</td>
<td>3</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>Grd</td>
<td>Open</td>
<td>Grd</td>
<td>2</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Grd</td>
<td>Grd</td>
<td>1</td>
</tr>
<tr>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Grd</td>
<td>0</td>
</tr>
</tbody>
</table>

Grd  = Wire connected to DC ground.
Open = No connection.

**Example:**

To hard-wire address 13, connect pins 3, 15, and 6 to DC ground.
Leave pin 10 open (not connected).
6.3 Accessory Module Installation

If you are installing either the optional 3M™ Model 832 Communication Module or the optional 3M™ Model 814 Memory Module, perform the following steps. Otherwise, skip to Paragraph 6.4, Loop Detector Setup.

1. Remove the two jumpers from connector J4 on the 3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, or C824T Loop Detector (see Figure 6-1).

2. Plug the optional accessory module into the loop detector board (see Figure 6-1). Be sure the pins on the accessory module match the pin configuration on the loop detector.

3. Secure the accessory module to the loop detector board by installing the screw (see Figure 6-1).

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use care when inserting or removing accessory modules to avoid bending or breaking the pins.</td>
</tr>
</tbody>
</table>

⚠️ WARNING

Plugging a loop detector that contains an optional communication module into a Type 170 22-pin input file causes pin 19 to short to pin W and pin 21 to short to pin Y. This causes channel 2 and 4 call outputs to malfunction causing improper operation of the traffic control system, which may result in personal injury. **To avoid this problem, be sure to plug the loop detector into a standard NEMA TS1 or TS2 card rack.** Improper operation of the traffic control system may result in unsafe driver action.

---

Figure 6-1. Accessory Module Installation
6.4 Loop Detector Setup

1. Determine which setup procedure to use.
   
   You can set up the operating parameters for the loop detector in either of two ways:
   
   - Manual Setup — using several switches on the loop detector.
   
   - Software Setup — using the 3M™ Canoga™ C800IS Interface and Data Acquisition Software that runs on an IBM compatible personal computer. The computer must be connected to the RS232 communication port on the loop detector front panel.

2. Set the Override switch on S3 to the CLOSED position (see Figure 6-2) only if the configuration source setting in the C800IS software is set to EEPROM (programmable memory) and you want to change settings from the loop detector front panel. Refer to Table 8-1 for diagnostic codes displayed on the front panel.

   Leave the Override switch on S3 in the OPEN position for software setup (see Figure 6-2).

3. Set the Transmit and Receive switches on S3 to the CLOSED position if the card rack is wired for communication from the rear serial port.

   **WARNING**

   If the Transmit and Receive switches on S3 are set to the CLOSED position and you plug the loop detector into a Type 170 input file, pin 19 will short to pin W and pin 21 will short to pin Y. This causes channel 2 and 4 call outputs to malfunction causing improper operation of the traffic control system, which may result in personal injury. **To avoid this problem, set the Transmit and Receive switches on S3 to the OPEN position.** Improper operation of the traffic control system may result in unsafe driver action.

   **NOTICE**

   Unless a 3M™ Model 832 Communication Module is installed on the loop detector board, the front and rear serial ports cannot be connected to more than one modem or computing device at the same time without causing the communication to malfunction.

4. If you selected the software setup, go to Paragraph 6.4.1, Software Setup Procedure.

5. If you selected the manual setup, go to Paragraph 6.4.2, Manual Setup Procedure (4-Channel), or to Paragraph 6.4.3, Manual Setup Procedure (2-Channel).

6.4.1 Software Setup Procedure

Plug the loop detector into the card rack. Then refer to the C800IS software On-Line Help for setup instructions.
Figure 6-2. Switch S3 Functions (4-Channel)
6.4.2 Manual Setup Procedure (4-Channel)

Perform the following steps to set up the 3M™ Canoga™ Vehicle Detection System Model C824 and C824T Loop Detectors. Perform steps 1 and 2 before plugging the loop detector into the card rack or input file.

1. **Select Loop Type.**

   Select the loop type using switch S3. Switch segments 1 through 4 correspond to the four loop input channels (see Figure 6-2).

   Set these switches to match the type of loop connected to each channel. Set the switch to the CLOSED position if a 3M™ Canoga™ Vehicle Detection System Model 701 Microloop or Model 702 Non-invasive Microloop is connected; set the switch to the OPEN position for all other loop types.

2. **Set Delay and Extension timing (Model C824T loop detectors only).** Refer to Paragraph 7.4, Delay and Extension, for a description of Delay and Extension timing.

   You can enable Delay and Extension timing and set the time intervals by using DIP switches LSW1 through LSW4 (see Figure 6-3).

   Switch LSW1 controls Delay and Extension timing for channel 1, LSW2 for channel 2, and so on. Switch segment 1 enables Delay timing; segment 2 enables Extension timing. The remaining five segments control the Delay or Extension interval. See Table 6-3 for the switch segment values.

   For example, to enable Delay timing for channel 1, set LSW1 segment 1 to the CLOSED position. Then set the time interval using segments 3 through 7. The times are cumulative. For example, if you set only segments 3 and 4 to CLOSED, the delay interval is 3 seconds.

   If you enable both Delay and Extension timing, you may have to find a compromise between the two timing intervals since they cannot be set independently by using the DIP switches.

   **NOTE**

   Delay and Extension timing intervals can be set independently using the 3M™ Canoga™ C800IS Interface and Data Acquisition Software.

   If your application does not require either Delay or Extension timing, set switch segments 1 and 2 to OPEN.

---

**Figure 6-3. Delay/Extension Switches (4-Channel)**
3. Plug the loop detector into the card rack or input file.

4. Plug the card rack power supply into the connector.

<WARNING>
When you change the Mode, Sensitivity, or Frequency switch or reset the loop detector, all vehicles currently on the loops will be tuned out and possibly left undetected at the intersection. This may cause improper operation of the traffic control system, which may result in personal injury. **To avoid this problem, take the appropriate steps to prevent vehicles from being left undetected at the intersection when you change switch settings or reset the loop detector.** Improper operation of the traffic control system may result in unsafe driver action.

5. Set Mode and Sensitivity. Refer to Paragraph 7.6, Sensitivity and Mode Selection, for a description of these functions.

**NOTE**
If you are using the C800IS software and you selected Configuration Source = EEPROM, changes made to the Mode and Sensitivity using the front panel switches will be ignored by the loop detector. Refer to Table 8-1 for diagnostic codes displayed on the front panel.

Select both the Mode (Pulse or Presence) and Sensitivity level using the push-button Mode/Sensitivity switches on the loop detector front panel. There is a switch for each input channel (see Figure 6-4).

Each switch has 16 positions:
- Position X (off).
- Positions C and 1 - 6 (Presence mode sensitivity levels).

The channel is in Presence mode when any of these positions is selected. A number on the switch without a square wave symbol indicates Presence mode.
- Positions C and 1 - 7 (Pulse mode sensitivity levels).

The channel is in Pulse mode when any of these positions is selected. A number on the switch with a square wave symbol indicates Pulse mode.

The two push buttons on each switch change the switch setting up or down.

Refer to Figure 7-1, on page 28, for recommended initial sensitivity settings for various loop types.

If a channel is not in use, select position X.

Table 6-4 lists the sensitivity levels and the corresponding threshold and response times.

---

### Table 6-3. Delay and Extension Switch Values

<table>
<thead>
<tr>
<th>Switch Segment</th>
<th>Open</th>
<th>Closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delay Off</td>
<td>Delay On</td>
</tr>
<tr>
<td>2</td>
<td>Extension Off</td>
<td>Extension On</td>
</tr>
<tr>
<td>3</td>
<td>1 second Delay</td>
<td>0.25 second Extension</td>
</tr>
<tr>
<td>4</td>
<td>2 seconds Delay</td>
<td>0.50 second Extension</td>
</tr>
<tr>
<td>5</td>
<td>4 seconds Delay</td>
<td>1 second Extension</td>
</tr>
<tr>
<td>6</td>
<td>8 seconds Delay</td>
<td>2 seconds Extension</td>
</tr>
<tr>
<td>7</td>
<td>16 seconds Delay</td>
<td>4 seconds Extension</td>
</tr>
</tbody>
</table>

---
6. Select Frequency. Refer to Paragraph 7.9, Crosstalk Elimination, for information on selecting frequency to eliminate crosstalk between loop detectors. Select Low, Medium, or High frequency by setting the 3-position Frequency switch on the 3M™ Canoga™ Vehicle Detection System Model C824 or C824T Loop Detector front panel (see Figure 6-4).

7. Set Recovery Method. Refer to Paragraph 7.7, Recovery Method, for information on selecting the recovery method.

You can select either of two recovery methods: Normal or Fast Recovery. Select the method by setting the 3-position Recovery/Reset switch on the loop detector front panel (see Figure 6-4).

The Fast Recovery mode of operation may be desirable when the loop detector is used for presence-type detection in left-turn lanes or for high-occupancy, passage-type detection.

This completes the manual setup procedure for 4-channel loop detectors.

---

### Table 6-4. Sensitivity, Threshold, and Response Time Values

<table>
<thead>
<tr>
<th>Sensitivity Level</th>
<th>Threshold in Nanohenries</th>
<th>Typical Loop System Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1024</td>
<td>&lt; 6 milliseconds</td>
</tr>
<tr>
<td>1</td>
<td>512</td>
<td>&lt; 7 milliseconds</td>
</tr>
<tr>
<td>2</td>
<td>256</td>
<td>&lt; 7 milliseconds</td>
</tr>
<tr>
<td>3</td>
<td>128</td>
<td>&lt; 9 milliseconds</td>
</tr>
<tr>
<td>4</td>
<td>64</td>
<td>&lt; 13 milliseconds</td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>&lt; 21 milliseconds</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td>&lt; 35 milliseconds</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>&lt; 64 milliseconds</td>
</tr>
</tbody>
</table>

---

**Figure 6-4. Front Panel Switches and Indicators (4-Channel)**
This page intentionally left blank.
6.4.3 Manual Setup Procedure (2-Channel)

The setup procedure for 2-channel 3M™ Canoga™ Vehicle Detection System Model C822 and C822T Loop Detectors is nearly the same as the setup procedure for 4-channel loop detectors. The only difference is 2 channels rather than 4 channels.

1. Read the setup procedure described in Paragraph 6.4.2, Manual Setup Procedure (4-Channel). Please read and understand all of the safety messages.

2. Perform the following steps to set up 2-channel loop detectors. This procedure includes only the basic steps. For details, see Paragraph 6.4.2, Manual Setup Procedure (4-Channel).

   a) Select the loop type using segments 1 and 2 of switch S3 (see Figure 6-5).

   b) Set Delay and Extension timing (Model C822T loop detectors only) using switches LSW1 and LSW2 (see Figure 6-6). See Table 6-3, on page 19, for the switch segment values.

   c) Plug the loop detector into the card rack or input file.

   d) Plug the card rack power supply into the connector.

   e) Set Mode and Sensitivity using the push-button Mode/Sensitivity switches on the loop detector front panel (see Figure 6-7).

   f) Select Low, Medium, or High frequency by setting the 3-position Frequency switch on the loop detector front panel (see Figure 6-7).

   g) Select Normal or Fast Recovery by setting the 3-position Recovery/Reset switch on the loop detector front panel (see Figure 6-7).

Refer to Figure 7-1, on page 28, for recommended initial sensitivity settings for various loop types. See Table 6-4, on page 20, for the sensitivity levels and the corresponding threshold and response times.

![Figure 6-5. Switch S3 Functions (2-Channel)](ssten-455c)
Figure 6-6. Delay/Extension Switches (2-Channel)

Figure 6-7. Front Panel Switches and Indicators (2-Channel)
7 Product Features

This section describes some of the important features of the 3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, and C824T Loop Detectors.

The loop detectors contain two or four input channels for the connection of traffic sensing loops. Model C822T and C824T loop detectors include Green-Gated output options for the Delay and Extension timing features. For information on green gating, refer to Paragraph 7.5, Green Gating.

The Canoga C800 series loop detectors are fully-digital, self-tuning, microprocessor-based and incorporate sophisticated digital signal processing technology to provide superior detection performance. The time-proven operational characteristics of the Canoga vehicle detection systems are incorporated into the loop detectors. These characteristics include a unique $\Delta L$ threshold setting technique to provide constant and predictable sensitivity and sequential excitation and scanning of each channel.

Improved electrical environment noise rejection is available with the 3M™ Canoga™ Power-Line-Filter. This feature allows you to set power line noise rejection processes into effect to practically eliminate interference caused by nearby power lines.

NOTE

You can control the power line filter only with the 3M™ Canoga™ C800IS Interface and Data Acquisition Software.

The loop detectors are compatible with NEMA TS1, TS2-1992, and CAL/NY Type 170 standards.

The loop detectors also have improved performance with the 3M™ Canoga™ Vehicle Detection System Model 701 Microloops or Model 702 Non-invasive Microloops. Each channel includes a switch to invoke a special microloop mode. Setting this switch changes the operating mode to be specific to microloop probes.

7.1 Data Communication Port

Each loop detector includes a serial communication port that is accessible from a front panel connector.

The purpose of the communication port is to connect to a computer. You can use an IBM compatible personal computer with special interface software to set up loop detector operating parameters. The C800IS software, which operates in a Microsoft® Windows™ environment, also allows you to monitor both channel measurement data and channel activity data.

Channel measurement data includes:

- Loop frequency
- Reference frequency
- Loop inductance
- Maximum $\Delta L$
- Detection duration
- Detection time and date

Channel activity data includes:

- Type of last loop system fault and time of occurrence
- Call output status
- Green input status
- Vehicle count
- Directional detection
- Long loop count
- Period remaining

The C800IS software also enables the loop detectors to measure and log vehicle speed, vehicle length, duration of the call, and loop-to-loop travel time. And, the software allows you to take a snapshot of live data for further analysis.

Binning features support setup and collection of binned count and occupancy data.

Directional mode can be enabled on each channel to sense vehicle travel direction using overlapped 6-foot by 6-foot loops with an output for directional call duration.
Long Loop Counting can be enabled in Presence mode to provide turning-movement counts.

Microloop mode can be enabled to enhance operation when channels are connected to Canoga microloop sensors.

Refer to the C800IS software On-Line Help for more information on monitoring loop detector operation.

**NOTE**

We recommend using the C800IS software to obtain the benefit of the many advanced features of the Canoga C800 series loop detectors.

### 7.2 Front Panel Indicator Lights

The loop detector front panel includes two wide angle LED indicators for each of the input channels. The red Channel Fault LEDs provide diagnostic codes to identify loop system faults. The green Channel Detect LEDs indicate vehicle detection and Delay or Extension time. Refer to Table 8-1, on page 29, for a list of the diagnostic codes that the LED indicators display when a fault occurs.

The green Channel Detect LEDs visually distinguish between periods of Delay and Extension timing. During Delay periods, the green Channel Detect LED flashes at 4 Hz. This indicates that a vehicle has entered the loop system but the loop detector output is temporarily inhibited. During Extension periods, the green Channel Detect LED flashes at 16 Hz. This indicates that all vehicles have left the loop system but the output is temporarily being held in the Detect state.

If neither Delay nor Extension timing is enabled, the green Channel Detect LEDs light when a vehicle is detected and remain on until the loop is cleared.

If you use the C800IS software to change loop detector channels to do directional detection, the green Channel Detect LEDs light when a vehicle presence is detected and flash at 16 Hz to indicate a call output is activated following a wrong way directional detection. See the C800IS software On-Line Help for more information on directional detection.

### 7.3 Operating Modes

Each loop detector has two main operating modes: Presence mode and Pulse mode. You can modify these two modes by adding Delay or Extension timing intervals to create a total of five operating modes.

- Presence
- Presence with Delay
- Presence with Extension
- Presence with Delay and Extension
- Pulse

These modes can be set independently for each channel. You can select an operating mode either by using a combination of front panel and PC board switches, or by using the C800IS software.

In Presence mode, without Delay or Extension, the detect output duration corresponds to the period of vehicle presence over the loop.

In Presence-with-Delay mode, the output/indication is inhibited for a Delay interval after vehicle detection.

In Presence-with-Extension mode, the output/indication continues for an Extension interval after the vehicle leaves the loop.

You can set up a Delay or Extension interval either by using switches on the PC board, or by using the C800IS software.

Momentary selection of Pulse mode can be used to cancel a Presence detection.

In Pulse mode, each vehicle produces an output pulse of approximately 118 milliseconds. If the vehicle remains over the loop, further detection is inhibited for a 1.9-second rephase delay. Then, full sensitivity returns immediately regardless of continued presence of the vehicle.
7.4 Delay and Extension

The 3M™ Canoga™ Vehicle Detection System Model C822T and C824T Loop Detectors have Delay and Extension timing functions.

Delay timing inhibits the detector output for a period of time after detection. You can select the Delay interval in 1-second increments up to 31 seconds.

Extension timing extends the detector output for a period of time after the detection is over. You can select the Extension interval in 0.25-second increments up to 7.75 seconds.

You can select the Delay and/or Extension functions manually using DIP switches located on the printed circuit board (see Figure 6-3, on page 18). There is a separate DIP switch for each channel. The first two segments of each switch enable or disable Delay and Extension functions.

The remaining five segments control the time intervals for both functions. The time intervals are cumulative, as the switch segments are set, to give total time of the interval. Table 6-3, on page 19, lists the timing interval for each switch segment. Delay and Extension times are digitally controlled. Each new detection restarts the timer.

You can also set up Delay and Extension functions using the 3M™ Canoga™ C800IS Interface and Data Acquisition Software.

The green Channel Detect LEDs on the front panel provide a visual display of Delay and Extension timing as explained in Paragraph 7.2, Front Panel Indicator Lights.

7.5 Green Gating

In many applications, intersection efficiency is enhanced if Delay or Extension functions are made to depend on the state of the green indication of the associated traffic movement. To provide this traffic signal control, an external Green control input is built into each channel. You can connect a Green signal from a traffic controller to each of these inputs. If True (ground level), the Green input disables Delay and enables Extension; and if False (+8 to +30 VDC or Open), the Green input disables Extension and enables Delay.

For unconditional Delay, leave the Green input open or connected to +24 VDC. For unconditional Extension, connect the Green input to ground.

For unconditional Delay and/or Extension, use the C800IS software to disable Green Gating.

7.6 Sensitivity and Mode Selection

You can select either Pulse mode or Presence mode manually, and select a sensitivity level for each channel by setting the Mode/Sensitivity switches on the front panel of the loop detectors. There is one switch for each channel.

These 16-position switches provide a choice of 8 sensitivities in Pulse mode, 7 sensitivities in Presence mode, and an Off position. Presence and Pulse modes alternate on the switch with Pulse mode designated by a square wave symbol over the numerical sensitivity level. Sensitivity increases in regular 2:1 steps from least in position C to greatest in position 7.

You can also use the C800IS software to select mode and sensitivity.

In general, you should select the lowest sensitivity setting that will reliably detect all vehicles of interest in the weakest area (center) of the loop system. Lower sensitivity settings present less exposure to environmental noise, allow faster response, and are less susceptible to adjacent lane detection.
7.7 Recovery Method

You can select either Normal or Fast Recovery using the 3-position switch on the front panel. The recovery method you select applies to all channels with the exception that Fast Recovery is disabled automatically for any channel set for a 3M Canoga™ Vehicle Detection System Model 701 Microloop or Model 702 Non-invasive Microloop.

You can also use the C800IS software to select the recovery method.

When Normal is selected and a vehicle is not being detected, the detector adapts to changes in apparent loop inductance at a default rate of 0.50 threshold every second (the background adapt rate is adjustable using C800IS software). A threshold is the amount of inductance change required to detect a vehicle at the current sensitivity setting (see Table 6-4, on page 20).

When Fast Recovery is selected, the loop detector adapts instantly to large changes of apparent inductance in the non-call direction. This option may be desirable for Presence-type detection in left-turn lanes or other detection areas that remain occupied for several traffic signal cycles.

7.8 Loop and Lead-in Wiring

Loop wires should be encapsulated with a suitable sealant (such as 3M™ Detector Loop Sealant) to minimize wire motion and prevent moisture penetration. Any number of loops can be connected in series up to the inductance limit of 2,000 microhenries.

Electrical connections should be twisted pairs, which are soldered and carefully waterproofed. All lead-in and cabinet wiring must be twisted.

NOTE

All communication cables and loop lead-in cables connected to the loop detectors must be shielded to comply with CE requirements.

Connection of the shield is not critical. Generally, floating the shield provides the best performance. However, in certain noisy situations (for example, noisy wires adjacent to the loop lead-in cable), connection of the shield to earth ground within the cabinet may be beneficial. In other situations (i.e., high lightning areas, etc.), floating the shield may provide the best performance.

Many types of cable can be used successfully for lead-in wiring; however, 3M™ Canoga™ Vehicle Detection System Model 30003 Lead-in Cable is designed specifically for this purpose. The cable contains two pairs and is polyethylene jacketed, shielded, and water blocked. Because of the high degree of decoupling inherent in the loop detector’s sequential scanning detection method, this cable can be used to connect two channels of the same loop detector to two different loops.

7.9 Crosstalk Elimination

To minimize crosstalk between channels, the loop detector scans its input channels sequentially.

Because there is an active signal on only one channel at a time, the probability of crosstalk is low.

NOTE

To minimize crosstalk in systems with multiple loop detectors, connect adjacent loops or loops sharing the same lead-in conduit to the same loop detector.

Crosstalk may occur between two loop detectors if their loop lead-in wiring cannot be isolated sufficiently. To minimize this problem, each loop detector can operate on low, medium, or high frequency. If two loop detectors are interacting, select different frequencies for the two units.

A Frequency switch on the loop detector front panel allows you to select one of the three frequencies. If you are using the C800IS software (Configuration Source = EEPROM), you must make the frequency choice by using the software instead of the switch.

NOTE

We recommend that you set the Frequency switch on the front panel to agree with the frequency choice selected by the software.

7.10 Remote Reset

A remote reset input is available on the loop detector edge connector. When the remote reset input is forced to a voltage below 8 volts for a period greater than 17 milliseconds, the loop detector will reset and establish a new reference for each loop that is turned on. This new reference is established within 2 seconds for sensitivities C–4, and within 4 seconds for sensitivities 5–7.
7.11 Power Loss Fail-Safe Feature

If a 3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, or C824T Loop Detector experiences a power failure, the detector enters a fail-safe condition and places a call to the traffic controller on each channel until power is restored.

7.12 Selected Loop Designs and Sensitivity Settings

The sensitivity settings shown in Figure 7-1 are recommended initial settings. When you test a new system, adjust the sensitivity setting on each channel to provide reliable detection. Use the lowest sensitivity that will detect vehicles of interest in the center of the loop.

![Figure 7-1. Sensitivity Settings](image-url)
8 Diagnostic Codes

The Canoga series C800 loop detectors have LED indicators on the front panel that display fault conditions. Table 8-1 lists the diagnostic codes that the LED indicators display when a fault occurs. There is one green LED and one red LED for each input channel (see Figure 6-4, on page 20).

<table>
<thead>
<tr>
<th>Diagnostic Codes</th>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 1 and 2 red fault LEDs repetitively cycle on then off in sequence.</td>
<td>Settings stored in the EEPROM (programmable memory) are corrupt.</td>
<td>Press any Mode/Sensitivity switch button. The error should clear in about 5 seconds. All settings will return to factory defaults.</td>
</tr>
<tr>
<td>Red fault LEDs cycle two times on and off in sequence after any front panel switch is pressed.</td>
<td>Unit configuration is from EEPROM. Front panel switch settings are ignored by the loop detector.</td>
<td>Either close the Override switch on S3 (see Paragraph 6.4, step 2, on page 16) or use the 3M™ Canoga™ C800IS Interface and Data Acquisition Software to select Configuration Source = Switches.</td>
</tr>
<tr>
<td>A red fault LED repetitively cycles on for one long pulse (6 sec.) and one short pulse (.25 sec.).</td>
<td>Historical open loop.</td>
<td>Use C800IS software to check the Date/Time when the most recent fault was recorded. Reset the unit to clear the fault indication.</td>
</tr>
<tr>
<td>A red fault LED repetitively cycles on for one long pulse (6 sec.) and two short pulses (.25 sec.).</td>
<td>Historical shorted loop.</td>
<td>Use C800IS software to check the Date/Time when the most recent fault was recorded. Reset the unit to clear the fault indication.</td>
</tr>
<tr>
<td>A red fault LED repetitively cycles on for one long pulse (6 sec.) and three short pulses (.25 sec.).</td>
<td>Historical inductance change greater than 25%.</td>
<td>Use C800IS software to check the Date/Time when the most recent fault was recorded. Reset the unit to clear the fault indication.</td>
</tr>
<tr>
<td>A red fault LED repetitively cycles on for one long pulse (1 sec.) and one short pulse (.25 sec.).</td>
<td>Open loop.</td>
<td>Correct the problem with the loop. If there is not a loop connected to the detector channel, turn the channel off.</td>
</tr>
<tr>
<td>A red fault LED repetitively cycles on for one long pulse (1 sec.) and two short pulses (.25 sec.).</td>
<td>Shorted loop.</td>
<td>Correct the problem with the loop.</td>
</tr>
<tr>
<td>A red fault LED repetitively cycles on for one long pulse (1 sec.) and three short pulses (.25 sec.).</td>
<td>Inductance change greater than 25%.</td>
<td>Correct the problem with the loop. (Check the loop connections. Make sure all connections are secure.)</td>
</tr>
<tr>
<td>All green detect LEDs flash at the same time (twice per second).</td>
<td>Remote reset input is active (tied to ground).</td>
<td>Correct the situation causing the remote reset input to be continuously active.</td>
</tr>
</tbody>
</table>


9 Testing and Adjusting

After installing any of the 3M™ Canoga™ Vehicle Detection System Model C822, C822T, C824, or C824T Loop Detectors, you should observe the operation of the vehicle detection system and check the following items:

- Verify that the loop detectors reliably detect the traffic in the target areas. If necessary, adjust the sensitivity to detect vehicles of interest in the center of the loop (see Figure 7-1, on page 28).

- Check for false detection caused by crosstalk (typically short, repeated calls) between loops connected to different loop detectors. For information on eliminating crosstalk, refer to Paragraph 7.9, Crosstalk Elimination.
The following is made in lieu of all warranties, expressed or implied, including the implied warranty of merchantability or fitness for a particular purpose.

3M will, at its option, either repair or replace any Canoga™ Vehicle Detection System component or components found to be defective in materials or manufacture within five (5) years from the date of purchase provided the component has been installed, maintained, and used as instructed. This warranty does not apply to components that have been subjected to misuse, neglect or accident or that have been damaged by extreme atmospheric or weather-related conditions, including chemical corrosion, hail, windstorm, lightning or flooding.

In no event shall 3M be liable for any injury, loss, or damage, whether direct, indirect, incidental, or consequential, arising out of the use or inability to use the Canoga system or any component thereof. The remedies set forth herein are exclusive.

3M has designed, developed and tested each Canoga C800 system component as a part of a matched component system. 3M makes no assurance or representation whatsoever concerning the reliability or safety of Canoga system components when used with non-Canoga system products. 3M shall not repair, replace or otherwise be responsible for any Canoga C800 system component that 3M determines has been damaged in whole or in part by its use with a non-Canoga system product.