Operating Instructions

Model C-1100-B, C-1200-B

Firmware Version 36.00A

TWO CHANNEL BICYCLE DETECTOR

I. General Description:

The Model C-1100-B and C-1200-B are designed to detect **all** vehicles with the added ability of differentiating bicycles from all other vehicles. **This allows the traffic engineer to detect and provide safe passage time for bicycles without compromising the intersection's operating efficiency.** The unique capability to identify bicycles from other vehicles allows the user to program initial time and extension time in the detector for **bicycles only**, thus providing a safe passage time through the intersection. When a bicycle is detected passing through the bicycle loop (a single 6' x 6' loop or smaller) the channel's output is latched in the call state. **The call output is only latched during the absence of phase green.** The latched call is held until the detector's phase green input becomes active. At the time the phase green input becomes active the latch is reset, the call is held, and the initial time, which has been programmed in the detector, begins counting down to zero. If the loop is vacant when the initial time reaches zero, the call is dropped. If additional bicycles are detected before the initial time reaches zero each subsequent bicycle extends the call by either the remaining amount of initial time or the extension time, whichever is greater. During phase green, after the initial time expires, all bicycle calls are extended by the amount of the programmed extension time. When the extension time is set to zero the extension time value defaults to the initial time value. If it is desired to provide an extension time different from the initial time the detector's extension time can be programmed for any value ranging from 0.1 seconds to 25.5 seconds. When the extension time is set to any value other than zero the detector provides the initial time plus a separate extension time during phase green. **The detector's latched call, initial time, and extension time respond only to bicycles.** For all other vehicles, the detector output functions as a standard presence detector without timing.

The detector can also be set for **Bicycle Detect Only Mode**. In the Bicycle Detect Only Mode the detector does not output call signals for other vehicles passing over the bicycle detection loop.

The Model C-1100-B is configured for 170/332 applications. 170/332 applications require a Phase Green Interface Module (Reno A&E Model PG-4C). The Model PG-4C module accepts up to four 120 VAC green signals. The outputs are optically isolated open collector transistors, which are connected to the phase green inputs on the detector through a RJ 45 connector located on the Model C-1100-B Bicycle Detector.

The Model C-1200-B is configured for NEMA TS 1 / TS 2 applications.

II. Factory Default Settings:

Function		Channel 1	Channel 2
Loop Frequency:	8 Operating Frequencies	3	7
Sensitivity:	Off - 1 to 9 - Call	7	7
Delay Time:	0 - 255 seconds	0	0
Extension Time:	0 - 25.5 seconds	0.0	0.0
Bicycle Initial Time:	OFF*, 1 - 999 seconds	15	15
Option 1:	L (Loop Inductance)	OFF (all channels)	
Option 2:	-ΔL/L (% Inductance Change)	OFF (all channels)	
Option 11:	Audible Detect (Buzzer)	OFF	OFF
Option 15.0:	Bicycle Detect Only	OFF	OFF
Option 15.1:	Phase Green Input Disable**	OFF	OFF

***WARNING:** When the Bicycle Initial Timer is OFF, the channel operates as a standard detector.

****WARNING:** When Option 15.1 is turned "ON", there will not be any initial time. The programmed initial time value becomes extension time value. The extension time starts counting down immediately when the bicycle leaves the loop area.

The following table is from CALTRANS Policy Directive TR-0011 (Rev 9/2009) issued on August 29, 2007. Please consult the local agency regulations for the time required to allow a bicycle to safely cross the intersection.

The following table defines the minimum phase time to allow a 6-foot-long bicycle to clear the last conflicting lane. The time is defined by a bicycle start up time of 6 seconds and constant velocity of 14.7 feet/second. The time is calculated using the formula below:

Where: W (feet) = Distance from stop bar to far side of last conflicting lane
Minimum phase time (seconds) $\geq$ 6 seconds + (W + 6 feet) ÷ (14.7 feet/second)
Bicycle initial time is calculated as follows: (B = Bicycle initial time)
Minimum phase time = B + Yellow clearance interval (Y) + Red clearance (R)
Bicycle initial time (B) = Minimum phase time - Y - R
Note: Y and R are programmed in the controller

TABLE	
Distance from stop bar to far side of last conflicting lane (Feet)	**Minimum phase time B + Y + R (Seconds)**
40	9.1
50	9.8
60	10.5
70	11.2
80	11.9
90	12.5
100	13.2
110	13.9

TABLE (cont)	
Distance from stop bar to far side of last conflicting lane (Feet)	**Minimum phase time B + Y + R (Seconds)**
120	14.6
130	15.3
140	15.9
150	16.6
160	17.3
170	18.0
180	18.7

III. How to View and Program Detector Functions:

• Enter the PROGRAM mode by momentarily pressing the FUNC pushbutton. Use the FUNC pushbutton to step through the functions described below.

•Press the CHAN pushbutton to select the channel. The channel that is in PROGRAM mode is indicated by a flashing numbered-loop symbol at the bottom of the LCD.

• To change a function's setting or to toggle a function ON or OFF, press the ▲ (UP) or ▼ (DOWN).

• To exit the PROGRAM mode and return to the NORMAL mode, press and hold the CHAN pushbutton continuously for one second.

LOOP FREQUENCY

Press the ▲ (UP) or ▼ (DOWN) pushbuttons to change the programmed loop frequency. The filled segment on the bar graph indicates the setting. The left-most segment represents setting 1 and the right-most segment represents setting 8. The LCD displays the actual loop operating frequency. A separation of at least 5 KHz for adjacent loops, not connected to the same detector, is recommended. **NOTE:** Changing the frequency will reset the detector channel. Care should be taken to ensure that the detector channel is not reset while the detection zone is occupied.

SENSITIVITY

Press the ▲ (UP) or ▼ (DOWN) pushbuttons to change the programmed sensitivity. The lowest Sensitivity Level is "1" and the highest Sensitivity Level is "9". The channel can be configured to place a permanent call by selecting CALL (one setting above Sensitivity Level "9"). The channel can be disabled by selecting OFF (one setting below Sensitivity Level "1"). When CALL or OFF is selected the LCD flashes the message ***CALL*** or ***OFF*** during NORMAL DISPLAY mode. **NOTE:** Changing the sensitivity will reset the detector channel. Care should be taken to ensure that the detector channel is not reset while the detection zone is occupied.

DELAY TIME

Delay Time can be adjusted from 0 to 255 seconds by pressing the ▲ (UP) or ▼ (DOWN) pushbuttons. When the Delay Time is 0 pressing the DOWN pushbutton steps the value to 255 seconds. Holding either the ▲ (UP) or ▼ (DOWN) buttons will increase the speed of change. When the Delay Time is 255 seconds pressing the UP pushbutton steps the value to 0. During the DELAY PERIOD, the channel's LED flashes at a four Hz rate with a 50% duty cycle and the LCD shows a countdown of the Delay Time. When the Phase Green Input is active the Delay Time is inhibited.

EXTENSION TIME

Extension Time can be set from 0.0 to 25.5 seconds by pressing the ▲ (UP) or ▼ (DOWN) pushbuttons. When the Extension Time is 0.0, pressing the DOWN pushbutton steps the value to 25.5 seconds. When the Extension Time is 25.5 seconds, pressing the UP pushbutton steps the value to 0.0. Holding either the ▲ (UP) or ▼ (DOWN) buttons will increase the speed of change. During the EXTENSION PERIOD, the channel's LED flashes at a 16 Hz rate with a 50% duty cycle and the LCD shows a countdown of the Extension Time.

Extension Time provides extension time for only bicycles. If a bicycle is detected while Bicycle Initial Time is counting down, the call continues until both initial time and extension time reaches zero. Additional bicycles detected while the phase green is active will extend the detection by the extension time.

The Extension Time should be set for the time it takes a bicycle to safely cross the intersection.

BICYCLE INITIAL TIME

When in the program mode the Bicycle Initial Time will flash between "bcL" and "OFF" or "bcL" and "XXX" (programmed time). The timer can be adjusted from OFF to 999 seconds by pressing the ▲ (UP) or ▼ (DOWN) pushbuttons. When the time is set to OFF pressing the DOWN pushbutton steps the value to 999 seconds. Holding either the ▲ (UP) or ▼ (DOWN) buttons will increase the speed of change. When set to OFF the detector channel operates as a standard detector.

In normal operation "bc" is displayed on the LCD for each channel with Bicycle Initial Time programmed. When a bicycle passes through the bicycle loop area, the bicycle detection latches the call output. When Option 15.1 is OFF the Bicycle Initial Time starts to countdown when the phase green input becomes active. When Option 15.1 is ON there will not be any initial time. The programmed initial time will be extension time. The extension time starts to countdown immediately when the bicycle leaves the loop area. When the timer reaches zero and the loop is vacant the call is dropped. When the Extension Time is programmed to zero the Bicycle Initial Time value becomes the default extension time value. If Extension Time is programmed it will extend each bicycle detection by the extension time value.

The Extension Time should be set for the time it takes a bicycle to safely cross the intersection.

OPTION 1: LOOP INDUCTANCE

Pressing either the ▲ (UP) or ▼ (DOWN) pushbuttons toggles between ON and OFF. When Option 1 is OFF the LCD indicates three dashed lines (**- - -**) during the No Call state. When Option 1 is ON the LCD continuously indicates the Loop Inductance value in microhenries while in the NORMAL DISPLAY mode. Option 1 automatically turns OFF 15 minutes after the last actuation of any of the four-front panel pushbutton switches. The display shows three digits if the inductance is between 15 μH and 999 μH. If the inductance is greater than 999 μH, the display alternately flashes between ***1*** or ***2*** and the lower three digits. The four digits represent inductance values from 1000 μH to 2500 μH. When a vehicle is detected the Detect LED and bargraph display indicate the call. The countdown of the Delay, Extension, and Bicycle Initial timers is **<u>not</u>** displayed when Option 1 is ON. **NOTE:** Turning this option ON for any channel turns it ON for both channels.

OPTION 2: INDUCTANCE CHANGE (-ΔL/L)

Pressing either the ▲ (UP) or ▼ (DOWN) pushbuttons toggles between ON and OFF. When Option 2 is OFF the LCD indicates a steady Call when a vehicle is detected. When Option 2 is ON the LCD indicates the -ΔL/L value when a vehicle is detected. The maximum -ΔL/L that occurs is displayed for two seconds unless a greater change occurs. **NOTE:** Turning this option ON for any channel turns it ON for both channels.

OPTION 11: AUDIBLE DETECT SIGNAL

Pressing either the ▲ (UP) or ▼ (DOWN) pushbuttons toggles between ON and OFF. When Option 11 is OFF the Audible Detect Signal is disabled. When Option 11 is ON for a channel an audible signal is emitted when the channel's detection zone is occupied by any bicycle or other vehicle, regardless of Delay or Extension timing. This option can only be turned ON for one channel at a time. The last channel to have Option 11 turned ON will be the only channel with Option 11 turned ON. Following the last switch actuation Option 11 automatically turns off after 15 minutes.

OPTION 15.0: BICYCLE DETECT ONLY

Pressing either the ▲ (UP) or ▼ (DOWN) pushbuttons toggles Option 15.0 between ON and OFF. When Option 15.0 is OFF the channel provides a call output for all vehicles. When Option 15.0 is ON "bc0" is displayed on the LCD. When Option 15.0 is turned ON the channel will only provide a call output for bicycles. Larger vehicles do not provide a call output.

OPTION 15.1: PHASE GREEN INPUT DISABLE

Pressing either the ▲ (UP) or ▼ (DOWN) pushbuttons toggles Option 15.1 between ON and OFF. When Option 15.1 is OFF the channel begins counting down the bicycle Initial Time at the time the Phase Green Input becomes active. When Option 15.1 is turned ON the initial time is disabled. Any programmed initial time functions as extension time. The extension time starts to countdown immediately when the bicycle leaves the loop area.

LOOP FAIL

The number of loop failures logged in the loop fail register is displayed on the LCD. Any time a channel enters the Fail Safe Mode due to a loop failure, the loop fail register is incremented by one count. When in the Loop Fail view mode pressing either the ▲ (UP) or ▼ (DOWN) pushbuttons clears the loop fail register. The number of loop fail counts is reset to zero whenever power is lost or the channel is reset. The loop fail register is not reset when the channel's sensitivity or frequency is changed.

After each detector channel is initialized and operating in a normal manner, the channel is continuously monitored for faulty loop conditions (e.g. broken wires, poor splices, bad solder connections, etc.). If the measured loop inductance value rapidly changes by more than ±25%, the channel is considered to have failed. The channel then enters the Fail-Safe Mode, which generates a constant call output. When a channel is in Fail Safe Mode, the Loop Fail message located at the bottom of the LCD will be illuminated. The LCD displays ***L lo*** for shorted or low loop inductance values. The LCD displays ***L hi*** for open or high loop inductance values. In addition, the corresponding channel's LED begins to emit a flashing pattern (three flashes per second). However, if the detector is reset, or power is momentarily lost, the detector will retune if the loop inductance is within the acceptable range. If any type of loop failure occurs in one (or more) loop(s) in a group of two or more loops wired in parallel, the detector will not respond with a Fail-Safe output following any type of reset. **It is essential that multiple loops wired to a common detector channel are wired in series to ensure Fail-Safe operation under all circumstances.** If the loop self-heals the detector resumes normal operation. The LED continues to flash as a means of indicating a prior loop fail condition until the loop fail register is cleared.

FIRMWARE VERSION

The firmware version and revision for the detector is displayed on the LCD. The display alternates between the model letter and firmware version (example ***E36***) and the firmware revision number (example ***.00***).

IV. How to Reset the Detector:

- Momentarily press the CHAN pushbutton to select either channel 1 or channel 2. Press and hold the CHAN pushbutton continuously for three (3) seconds. After three seconds the channel is reset maintaining all previous settings.

- Changing the frequency or sensitivity setting will enter the new setting and reset the channel. Changing any of the other parameter values takes effect immediately without resetting the detector channel. **Simply entering the program mode, without changing any parameter, will not reset the channel.**

- Pressing and holding all four pushbuttons **simultaneously** and **continuously** for five (5) seconds resets both channels and restores the factory default settings.

- The detector can be reset by removing and reapplying power.

- **Loop Fail History** is cleared by all reset procedures described above except changing frequency or sensitivity. Pressing either the ▲ (UP) or ▼ (DOWN) pushbuttons while viewing the Loop Fail History also clears the Loop Fail History.

V. Sensitivity Setting:

Sensitivity is controlled by selecting the Sensitivity Level for each channel. The recommended sensitivity setting for bicycles is "7", which is the factory default setting. Sensitivity settings of "1" through "9" represent thresholds from the least sensitive to the most sensitive. Setting the proper sensitivity level for the bicycle detector is essential for reliable bicycle detection.

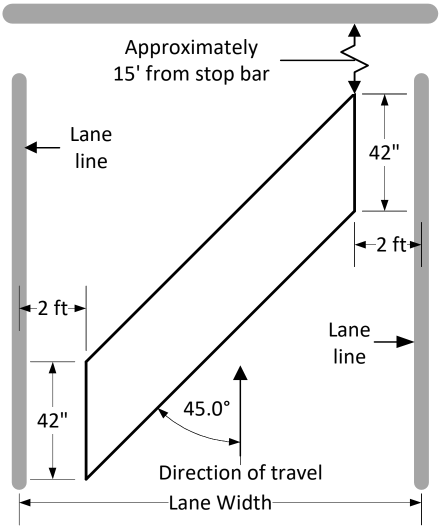
The LCD includes an eight (8) segment bar graph that provides a representation of the relative change of inductance as seen by the detector. The first (left-most) bar graph segment represents the minimum inductance change necessary for the detector to output a call. Larger inductance changes are indicated by more segments. Each segment on the display is equal to one sensitivity level.

BICYCLE DETECTION requires adjusting the sensitivity level to the proper setting. The bar graph can be used to assist in selecting the proper sensitivity level. Adjust the sensitivity level for the channel until seven (7) segments of the bar graph are shaded when a standard automobile is present in the loop zone. Bring a bicycle down the center of the loop. If the bar graph shows **more than** two segments, reduce the sensitivity level by the number of segments above two. If the bicycle is not detected when moving through the center of the loop, increase the sensitivity until the bicycle causes the shading of at least one segment of the bar graph. *Important: A bicycle will cause about 10 to 20 times more change when riding over the loop wires parallel to the direction of travel than when riding in the center of the loop (6' x 6' loop).*

Bicycle Loop Geometry Recommendations

The Reno A&E Model C-1100-B and Model C-1200-B Bicycle Detectors are capable of detecting bicycles on many small loop geometries. The recommended loop area should not exceed 40 square feet. The bicycle loop requires a dedicated lead-in cable connected to the loop input on the bicycle detector. The bicycle must pass through the bicycle detector loop area. The preferred location for the loop is approximately 15 feet behind the stop bar.

The optimum bicycle loop geometry is a 4-turn 42-inch parallelogram shown below.



Notes:

The 42-inch side of the loop should be 2 feet from the lane line.

Bicycle detection is consistent across the traffic lane.

The detector sensitivity level should be initially set to level "7". Verify bicycles are detected when traveling through the loop. Verify automobiles are not detected when traveling 2 or more feet from the 42-inch side of the loop.

When using an existing (four) 6' x 6' loop configuration (square or round), the second loop from the stop bar should be isolated and designated as the bicycle loop. The bicycle loop requires a dedicated lead-in cable connected to the loop input on the bicycle detector.

Contact Reno A&E for other loop configurations.

RECOMMENDED LOOPS

The **PLB Preformed Loop** or **PLH Preformed Loop** can be configured as a 42-inch parallelogram bicycle loop. The **PLB Preformed Loop** is constructed using 0.23" XLPE cable and is designed for installation in a 1/4 inch saw cut. The design provides for adjustment of the loop cable to adapt to small variations in the perimeter of the saw cut. There is no need for 45-degree corner cuts. Remove sharp inside corners of the saw cut with a small chisel to protect the loop cable from damage. The lead-in cable is 0.23" OD and can be supplied in any length necessary to provide a continuous run to the traffic cabinet without the need for splicing a separate lead-in cable.

The **PLH Preformed Loop** is constructed using 0.375" XLPE cable and is designed to be overlaid with asphalt or embedded in concrete.

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