

STR1

Single-Channel Loop Detector



KONTAL

CE



Before using your device, be sure to read this user manual. Carefully follow the steps described in the installation, electrical connection, and first start-up sections. After this stage, the product owner/user must keep this user manual in a known and accessible place for the entire service life of the product.

- The product is designed for indoor and dry-environment use only; it does not provide protection against water or dust ingress.
- Store the product in a dry environment. Otherwise, the product may malfunction.
- For products powered by a battery, the battery itself is not covered by the warranty. Likewise, faults caused by battery discharge or leakage in products that have reached the end of their shelf life are not covered by the warranty.
- All service and repair operations may only be carried out by Kontal Elektronik technical service. The product must not be tampered with by any other person.
- The operating voltage of each product is stated on its label. Do not power the product from a source outside this voltage value.



- ✓ Using the product in a manner that does not comply with the items stated above may cause fire, serious personal injury, or damage to the product or the structure it is installed in. Kontal Elektronik San. ve Tic. Ltd. Şti. accepts no responsibility for such situations caused by the user.
- ✓ This symbol will be used for important points in the following sections.



- ✓ Do not touch the product's power terminals with bare hands.
- This symbol will be used for voltage-related warnings in the following sections.



- This symbol on the label indicates that the product's supply voltage is DC.



- This symbol on the label indicates that the product has reinforced insulation.



- This symbol on the product or its packaging indicates that the product must not be treated as ordinary household waste. Instead, it must be handed over to a designated collection point for the recycling of electronic equipment. Improper disposal of the product may lead to negative consequences for the environment and human health.



- The legal owner of this document and its revisions is **KONTAL ELEKTRONİK SAN. VE TİC. LTD. ŞTİ. Unauthorized modification or alteration of this document is prohibited.**



- Make sure the system is properly grounded so that the product can operate reliably.

1. DESCRIPTION

STR1 is a single-channel, high-sensitivity metal mass (loop) detector designed for use in parking barrier systems, access control, and traffic management systems. The device creates an electromagnetic field by means of the cable loop laid under the ground. When a vehicle (metal mass) enters this loop area, the resulting change in the system's inductance is instantly detected. STR1 processes this change and automatically activates the first relay output as soon as the loop becomes active. Using the 2x8 LCD screen and **M (Menu) / D (Value) buttons** on the device, operating parameters (sensitivity, calibration, second relay operating mode, etc.) can be easily configured.

1.1 Box Contents

1x STR1 – Single-Channel Loop Detector	1x STR1 User Manual
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**For custom orders, the box contents may vary depending on the project or customer request.*

2. TECHNICAL SPECIFICATIONS

Model	STR1
Product Code	K011-01
Operating Voltage	24V DC
Operating Current	45mA @ 24V DC
Number of Loop Connections	1
Operating Temperature	-20 oC +55 oC
Contact Count / Contact Type	2 / Dry Contact (NO / NC)
Contact Rating (max.)	30V DC 1A / 125V AC 0.3A
Interface	2x8 LCD Screen + M (Menu) / D (Value) Buttons
2nd Relay Pull-in/Drop-out Time	1s (min) – 20s (max.) Adjustable via menu
Weight	150 g.
Dimensions (W x H x D)	70 x 141.5 x 34.5 mm

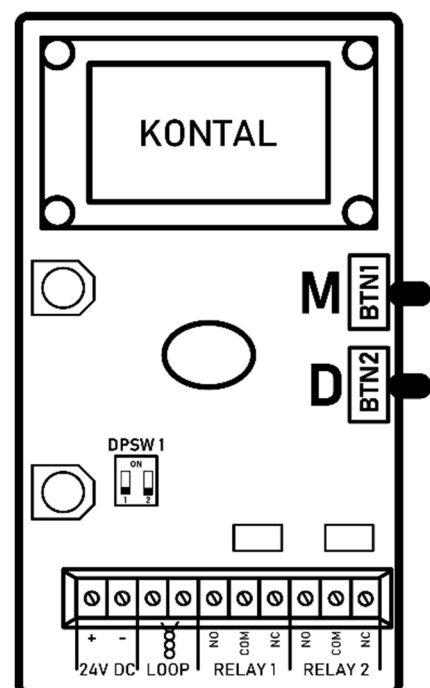
3. STR1 – USER CONFIGURATION COMPONENTS

LCD SCREEN: The 2x8 character screen that shows the device's operating status, menus, and setting values.

M / D BUTTONS: With these buttons you can navigate between menus (M) and adjust your product's operating modes, sensitivity, and relay timings (D).

4. STR1 – CONTROL BOARD

Figure 4.1 STR1 Control Board



5. STR1 – SYSTEM INSTALLATION

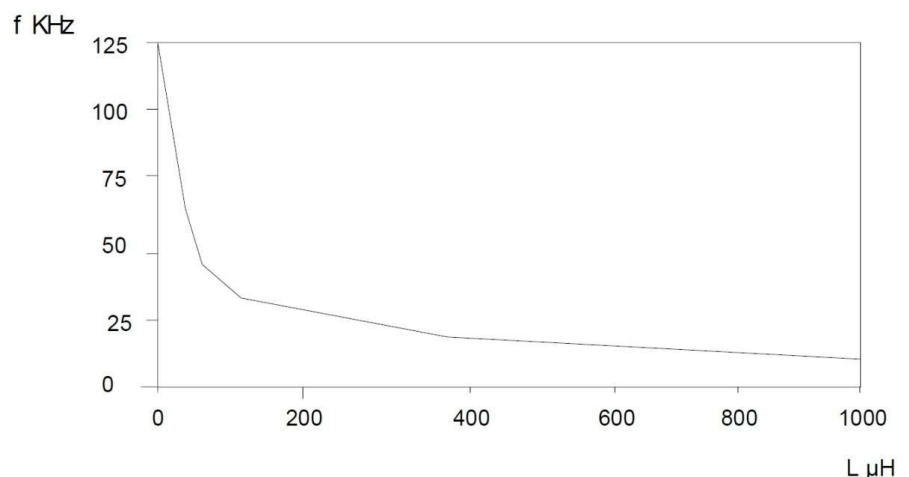
5.1. Selecting and Laying the LOOP Cable

For the STR1 detector board to operate efficiently and reliably, it is critical that the loop cable to be laid under the ground is installed with the correct dimensions and in accordance with standards. Incorrect cable installation may cause false detections, unstable operation of the detector, or the system not activating at all. The following parameters must be strictly observed during installation. These are;

A- Inductance (Coil) Value to Be Obtained from the Laid Cable

To achieve maximum performance and the highest stability against ambient electrical noise from the STR1 detector board, the optimum operating range has been determined graphically. As shown in the graph below, although the system can technically operate over a wide range, the detector performs most efficiently and stably when this value is between **100uH** and **200uH**.

Figure 5.1 Required coil value range for the cable to be laid.

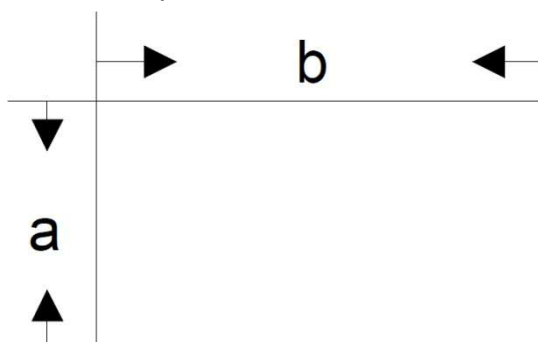


B- Calculating the Required Cable Length and Number of Turns for the Loop

In most industrial vehicle detection applications, the preferred cable-laying geometry providing the highest efficiency is a **square or rectangular** shape. To achieve the ideal inductance (coil) value (**100uH – 200uH**) under the ground, as mentioned in the previous section, the number of turns to be wound in the cut channel is determined with a simple perimeter calculation.

In rectangular loop designs, it is recommended that the side lengths have a ratio of **1 to 3 (1:3)** in order to scan the underside of the vehicle's chassis at the widest possible angle and maximize detection sensitivity.

For example; if the short side is set to 1 meter, choosing 3 meters for the long side will allow the detector to operate much more efficiently and reliably.



In the figure alongside, a loop area is shown with one side as “a” and the other side as “b”. The perimeter of this loop area is calculated using the following formula;

$$\text{Loop Perimeter} = 2a + 2b$$

Based on the perimeter length value obtained from the formula above, the total number of cable turns you need to apply to the channel under the ground is listed in the table below:

Figure 5.2 Example Rectangular Cable Layout

Calculated Perimeter Length (2a + 2b)	Number of Cable Turns
4-5 meters	6 turns
5-6 meters	5 turns
6-15 meters	4 turns
15-25 meters	3 turns

Practical Application Example;

Scenario: Let's assume we have cut a rectangular loop area in the field with the short side (a) 1 meter and the long side (b) 3 meters.

- **1st Step (Perimeter Calculation):** Applying our formula, we find the total perimeter of this area:

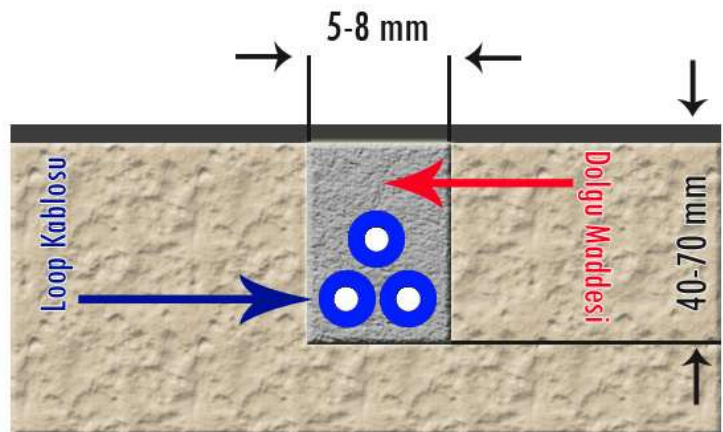
$$\text{Perimeter length} = (2 \times 1\text{m}) + (2 \times 3\text{m}) = 8\text{ meters}$$

The table alongside shows that for an application area with a perimeter of 8 meters, the required number of turns is 4. Winding the cable 4 times, one on top of the other, in the cut channel and then closing it will be sufficient for the product to operate with the highest efficiency and

C- Laying the Loop Cable in the Ground

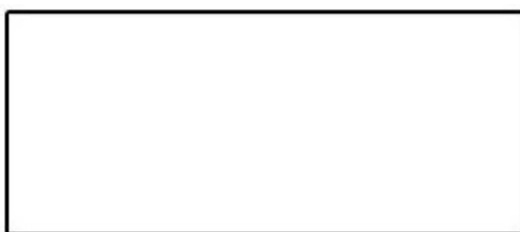
To withstand ground movement, the cable to be laid in the asphalt surface must have **a cross-section of at least 1.5 mm², be flexible (multi-strand), and insulated**. To lay the cable, a channel must be cut into the asphalt with a diamond-blade cutter, **40–70 mm deep** and **5–8 mm wide**. Before laying the cable, it is very important to clean the dust and sharp stone fragments from inside the channel using compressed air, in order to prevent the cable from being damaged and short-circuiting over time.

Figure 5.3 Application of the Loop Cable in the Asphalt Surface.

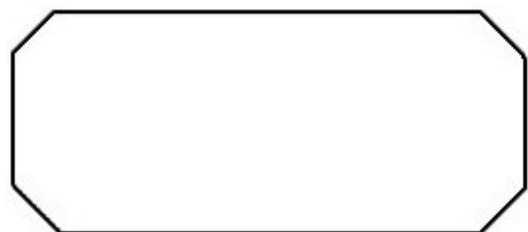


If you plan to cover the remaining gap over the channel with hot bitumen (asphalt sealant) after laying the cable, you must choose a heat-resistant cable (silicone or Teflon insulated) to prevent it from being damaged by the high heat.

Another important point is that the corners of the rectangular area to be cut in the asphalt should be rounded with **45° chamfered angles** instead of 90° right angles. This method prevents cable tension (stress) at the corners, avoiding breakage, and enables the detector to form a much more efficient electromagnetic field.



Loop Area with 90° Cut Corners
(Not Recommended Cutting Style)



Loop Area with 45° Cut Corners
(Recommended Cutting Style)



Points to Note During the Cable-Laying Process

1- **Use a Single, Unspliced Cable:** The cable to be laid must be a single piece. Any splices, tape joints, or hidden breaks added later degrade the line's resistance and sensitivity, causing unstable operation of the detector.

2- **Channel Cleanliness and Dryness:** Before laying the cable, the inside of the channel must be completely clean, dust-free, and dry. Damp or muddy channels can weaken the cable insulation over time.

3- **Securing the Cable:** Once the cable is laid and covered with filling material, it must never shift from its position. A cable that moves inside the channel as vehicles pass over it will cause the detector to trigger falsely on a continuous basis.

4- **Inductance Measurement Before Filling:** After the cable is laid in the channel, the coil value must always be measured before it is covered with filling material (bitumen/epoxy). You can use an LCR meter (inductance meter) for this measurement, or connect the cable directly to the STR1 device and verify that it is within the correct operating range via the “LOOP MEASURE” menu on the LCD screen.

D- Selecting the Filling Material

After the loop cable is laid in the channel, the top of the channel must be completely closed to protect the cable from external factors. Two different solutions can be applied for this:

- **1. Cold Filling Material (Recommended):** For a practical application, synthetic resin-based cold filling materials can be used. Care must be taken to select a material that is flexible, does not crack when it freezes in cold weather, and is of a quality that will not break apart or come loose over time.
- **2. Hot Asphalt Sealant (Bitumen):** If a classic hot-bitumen application will be used, it is essential to select a heat-resistant cable (silicone/Teflon insulated) so it is not damaged by the high temperature. Before pouring the hot filling material, it is recommended to first fill the inside of the channel with sand in order to directly protect the cable from the high heat.

E- Running the Cable from the Loop to the Control Board

The most common cause of faults and instability in loop detector systems is installation errors in the **Loop** cable that runs from the loop area under the ground to the STR1 control board. The following rules must be strictly observed to maintain system quality:

Twisting the Cables (Making a Twisted Pair): The two cable ends coming out of the loop channel must always be wound around each other (twisted) all the way to the STR1 board. To prevent external interference, at least 20 to 50 twists per meter should be applied, depending on the cable type.



Figure 5.4 Example of a Twisted Cable

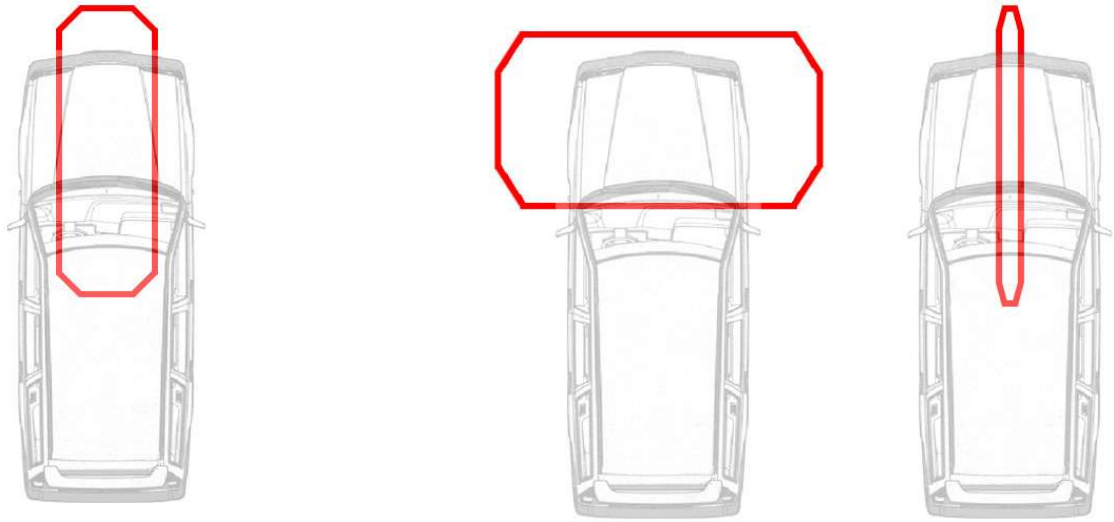
Avoiding Parallel Runs: The supply cable coming from the loop must not be run parallel to the power or signal cables of other electronic devices when carried to the control panel. If using the same route is unavoidable, a minimum distance of 10 cm must be kept between the loop cable and other cables.

Separating Multiple Loop Lines: When supply cables belonging to more than one channel's loop are run toward the panel, they must never be passed together through the same conduit or channel. The signal of each line must be carried independently.

Physical Protection: The cable line running from the loop area to the control panel must be fully protected with spiral conduit or protective ducting against damage from crushing, breakage, or outdoor weather conditions.

F- Geometric Shape of the Loop Area

The proportion and geometric shape of the cable you will lay in the ground, relative to the vehicles passing over it, is an important factor for the metal mass detector to operate correctly. The images below show what geometric shape the cable you lay should have.



(Recommended Geometric Shape)

(Not Recommended Geometric Shapes)



Points to Note During Installation: If two different loop lines are to be laid close to each other, the distance between the two areas must be at least 1.5 - 2 meters so that their magnetic fields do not interfere with each other. Since the STR1 board has only a single loop input, a second STR1 board must be used for a separate loop area.

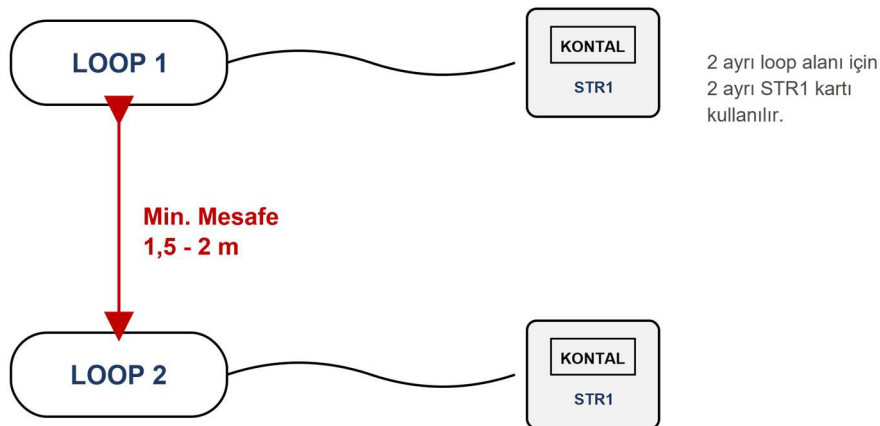


Figure 5.5 Side-by-Side Application of Two Different Loop Areas

5.2 STR1 – Making Cable Connections and Initial Start-up

Make the STR1's cable connections as shown in the wiring diagram (see Section 6). After twisting the two ends of the loop cable you have laid in the ground with the appropriate number of turns, connect them to the **LOOP** terminal. Make the connections you need at the **RELAY 1** and **RELAY 2** terminals. Finally, connect the **24V DC** supply terminal to power up and start your device.



There must be no vehicle on the loop when the product is powered up for the first time.



The STR1 board you are using has a SINGLE INPUT; do not connect 2 different loop cables to the same LOOP input. A second STR1 board must be used for a separate loop area.

A-STR1 Start-up Screens

After making your board's connections as described above and applying power, your device will display the following information messages on the screen in sequence:

SCREEN DISPLAY	DESCRIPTION
STR1 KONTAL.COM	When the device is powered on, the product name and our company's website "www.kontal.com" will appear on the screen.
VERSION 3.0	Provides information about the device's firmware version.
FREQUENCY 41.5 khz	Shows the frequency generated by the cable you have laid. This value varies depending on how the cable is laid and the number of turns. Make sure the frequency value generated by the cable you lay is between 25-50 kHz.

After the start-up messages, if there is no problem with the system, your device will start operating. The screen will show the message indicating that you are in the device's main menu:

SCREEN DISPLAY	DESCRIPTION
S:15 K:5 00000000	S:15 – Shows the DETECTION LEVEL value. K:5 – Shows the AUTOMATIC CALIBRATION MODE; if calibration is set to "No Calibration", an "X" appears next to "K". 00000000 – This is the loop detector's counter; it increases by 1 with every active/inactive cycle.

B-Buttons (M / D) and Menu Usage

Once the main menu screen appears, the buttons on the device become active and let you navigate through the menus. The STR1 has 2 LCD control buttons:

Button	Description
M (MENU)	Switches between menus on the LCD. Once the device is powered on and the main menu appears, you can use this button to move between menus.
D (VALUE)	Within the menu you have entered, if different options or functions are available, pressing this button lets you change the values shown on the screen or execute the function of that menu.

Once your device is powered on and you are in the main menu, you can enter other menus and change your device's settings. If you do not perform any action in the menu you have entered, you will automatically return to the main menu after approximately 15 seconds.

C- Loop Frequency Measurement

SCREEN DISPLAY	DESCRIPTION
LOOP MEASURE	This message briefly informs you about the menu you are about to enter. Whenever you move between menus, an information message about the menu you are entering will always appear on the screen.
MEASURE 41.5 khz	After the information message appears, you enter the menu where you can read the FREQUENCY value of the loop you have laid. While in this menu, pressing the "D" (VALUE) button reads the frequency of the loop you have laid and sets the new loop value that the system will operate with.

D- Adjusting the Detection Sensitivity

SCREEN DISPLAY	DESCRIPTION
SENSING LEVEL	This is the information message indicating that you have entered the menu where you can adjust the vehicle detection sensitivity.
SENS LVL LEVEL 15	After the information message appears, you enter the menu where you set the loop's sensitivity and operating level. While in this menu, pressing the “D” button lets you increase or decrease the sensitivity of the loop you have laid. The value range is between 1 and 20. Detection sensitivity increases as the value goes from 1 towards 20.

E-Setting the 2nd Relay to Active or Inactive Mode

SCREEN DISPLAY	DESCRIPTION
RELAY 2 STATUS	The information message for the menu that indicates the status of the 2nd relay on the STR1.
RL2 STAT PASSIVE	After the information message appears, you enter the menu that lets you set the 2nd relay on the board to active or inactive. “INACTIVE” mode means this relay is disabled, while “ACTIVE” means this relay is enabled. You can select between Inactive and Active using the “D” (Value) button.

F- Selecting the 2nd Relay Operating Mode

SCREEN DISPLAY	DESCRIPTION
RELAY 2 MODE	The information message for the menu that indicates which mode the 2nd relay on the STR1 is operating in.
RELAY 2 MODE 1	After the information message appears, you enter the menu where the operating mode of the 2nd relay on the board is set. You can select one of 8 different operating modes using the “D” button. What these 8 operating modes are is explained in detail in the next section. Remember that, for the operating conditions you have set for the 2nd relay to take effect, you must set the 2nd relay's status to ACTIVE in the “2ND RELAY STATUS” menu.

G- 2nd Relay Operating Modes

The STR1 loop detector has 2 relays. The first relay pulls in when the loop becomes active (a metal mass is over it) and drops out when the loop becomes inactive. The second relay is an optional relay that can be used if desired and has 8 different operating modes based on the state of the first relay. The operating modes of the second relay are as follows:

Mode	Description
Mode 1	Pulls in at the same time as the first relay and drops out at the same time.
Mode 2	Pulls in at the same time as the first relay and automatically drops out after the set “2nd Relay Drop-out Time”. The second relay's drop-out does not depend on whether the first relay drops out or not.
Mode 3	Pulls in after the “2nd Relay Pull-in Time” following the first relay's pull-in, and drops out at the same time as the first relay.
Mode 4	Pulls in after the “2nd Relay Pull-in Time” following the first relay's pull-in, stays energized for the “2nd Relay Drop-out Time”, and then drops out. In this mode, as long as the first relay stays energized, the second relay

	operates according to the “2nd Relay Pull-in Time” and “2nd Relay Drop-out Time” values. However, if the first relay drops out, the second relay will drop out automatically regardless of whether it is energized. In other words, the second relay's drop-out does not need to wait for the “2nd Relay Drop-out Time” to elapse.
Mode 5	Pulls in at the same time as the first relay pulls in, and after the first relay drops out, stays energized for the set “2nd Relay Drop-out Time” before dropping out.
Mode 6	Pulls in after the “2nd Relay Pull-in Time” following the first relay's pull-in, stays energized for the “2nd Relay Drop-out Time”, and then drops out. This mode has a similar structure to “Mode 4”, with one difference: in Mode 4, when the first relay drops out, the second relay drops out immediately without waiting for the “2nd Relay Drop-out Time” to elapse. In Mode 6, however, even if the first relay drops out, the second relay will wait for the “2nd Relay Drop-out Time” to elapse before dropping out.
Mode 7	Pulls in when the first relay drops out, stays energized for the “2nd Relay Drop-out Time”, and then drops out.
Mode 8	After the first relay drops out, pulls in following the “2nd Relay Pull-in Time”, stays energized for the “2nd Relay Drop-out Time”, and then drops out.

H- Adjusting the 2nd Relay Pull-in Time

SCREEN DISPLAY	DESCRIPTION
RELAY 2 OPN TIME	This is the information message for the menu where the pull-in time of the 2nd relay on the STR1 loop detector is set.
RL2 OPN 04SN	After the information message appears, you enter the menu where the pull-in time of the 2nd relay on the board is set. In this menu, where you can set a value between 1 and 20, each value you assign specifies how many seconds later the 2nd relay will pull in. This function will not work if the 2nd relay is inactive.

I- Adjusting the 2nd Relay Drop-out Time

SCREEN DISPLAY	DESCRIPTION
RELAY 2 CLS TIME	This is the information message for the menu where the drop-out time of the 2nd relay on the STR1 loop detector is set.
RL2 CLS 04SN	After the information message appears, you enter the menu where the drop-out time of the 2nd relay on the board is set. In this menu, where you can set a value between 1 and 20, each value you assign specifies how many seconds later the 2nd relay will drop out. This function will not work if the 2nd relay is inactive.

J- Adjusting the Calibration Mode

SCREEN DISPLAY	DESCRIPTION
AUTO CAL MODE	This is the information message for the menu where the automatic calibration mode of the STR1 loop detector is set.
AUTO.CAL NO CLB	After the information message appears, you will enter the menu where the STR1 loop board's automatic self-calibration mode is set. There are two options in this mode: “5 MIN” and “NO CLB”. You can select one of these 2 options by pressing the “D” (Value) button.

5 MIN: If this 5-minute setting is selected and a vehicle arrives on the loop you have laid and stays on it for more than 5 minutes, the STR1 control board assumes this new condition is the newly established loop value and automatically releases its relays. It automatically self-calibrates to the new condition.

NO CLB: If this mode is selected, when a vehicle arrives on the loop you have laid, your relays will pull in and remain energized until that vehicle leaves the loop. In other words, the relays will hold the energized state for as long as a vehicle is present and will not **self-calibrate automatically**.

K-“Setting Saved” Information Message

If you make any change in the menu you are in, the following information message will appear on the screen during the menu transition:

SCREEN DISPLAY	DESCRIPTION
SAVED	This is the information message you will see if you make any change in the menu you are in.

6. STR1 - WIRING DIAGRAM

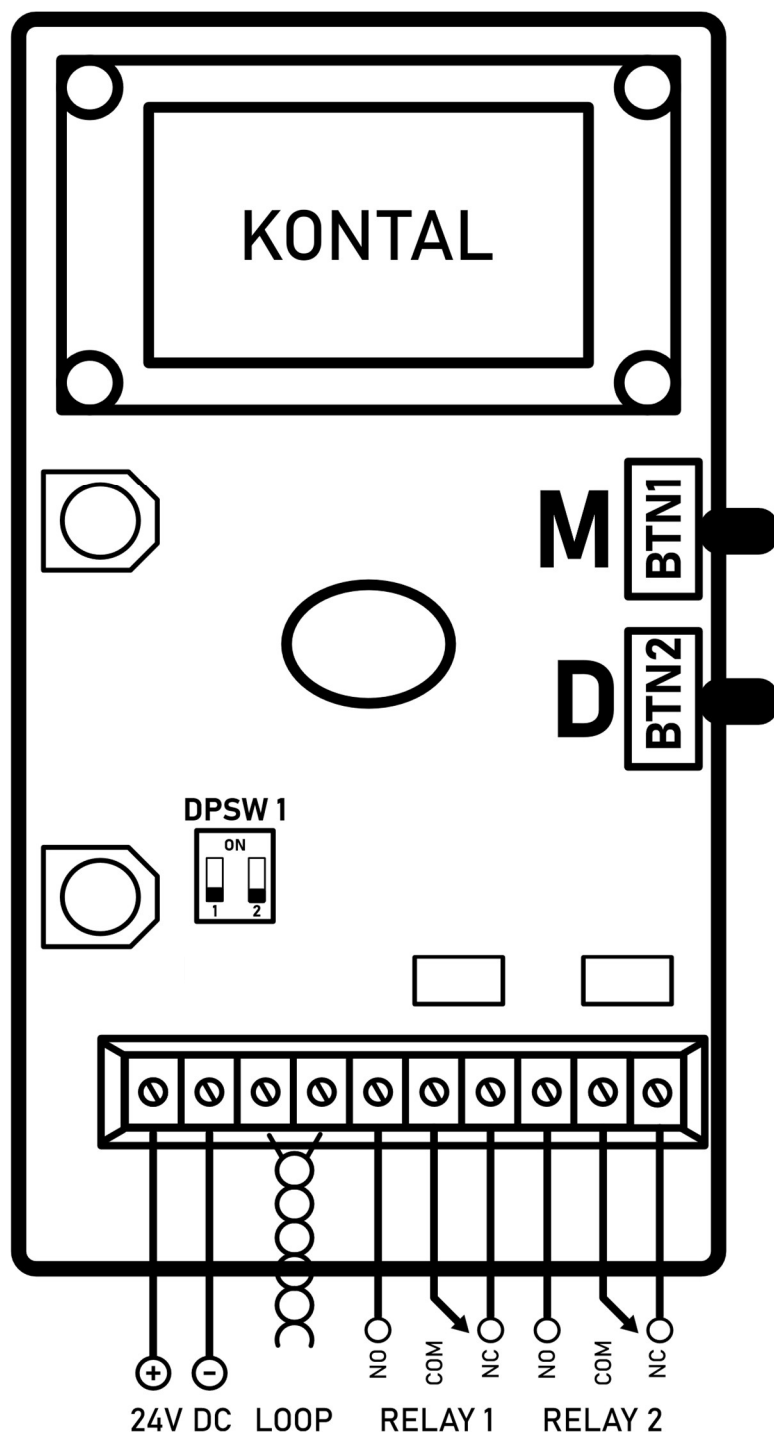


Figure 6.1 STR1 Wiring Diagram



Pay attention to the "+" and "-" polarity when making the product's power connections!



Do not supply the product with power outside the specified operating voltage. Otherwise, the device may be damaged!



For the device to operate correctly and reliably, it is recommended to use a power supply with an output power of at least 1 W on the supply line.



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