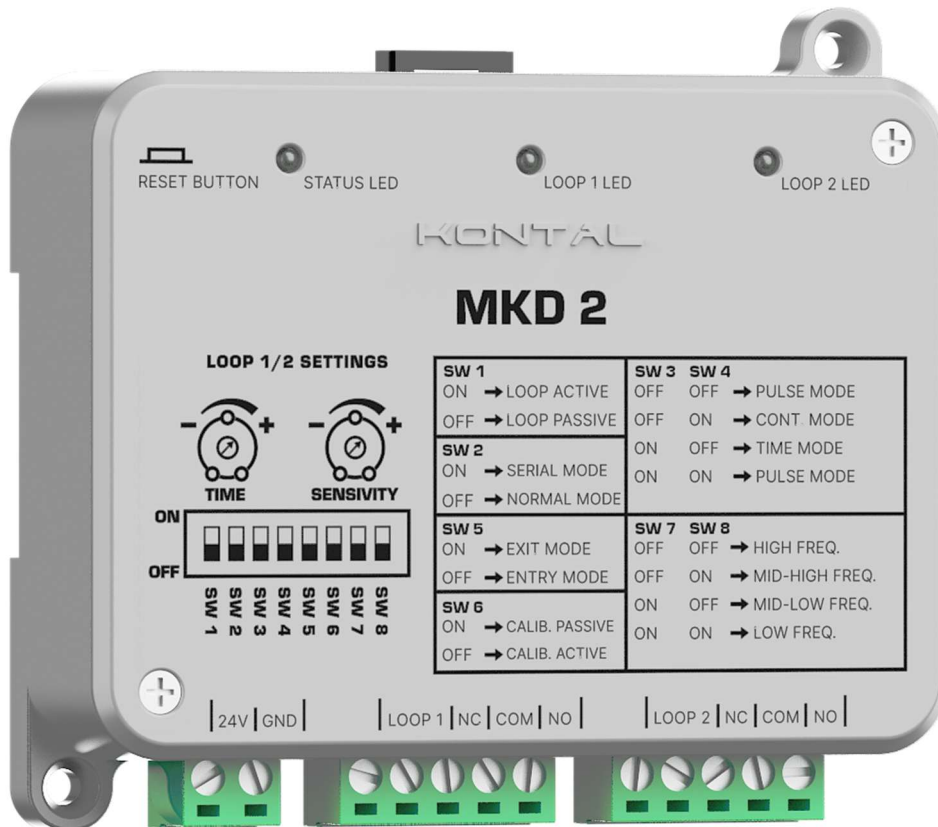


MKD 2

2 Channel Metal Mass Dedector



KONTAL



Before operating the device, be sure to read this user manual carefully. Follow the steps described in the installation, electrical connection, and initial startup sections with attention. After completing these steps, the product owner/user must keep this manual in a known and easily accessible location for the entire service life of the product.



- Store the product in a dry environment. Otherwise, malfunctions may occur.
- In battery- or accumulator-powered products, batteries and accumulators are not covered under warranty. Similarly, failures caused by battery discharge or leakage in products that have exceeded their shelf life are not covered under warranty.
- All service and repair operations must be carried out exclusively by Kontal Elektronik technical service. The product must not be tampered with by unauthorized personnel.
- The operating voltage of each product is indicated on the label. Do not supply the device with a voltage different from the specified value.



- ✓ Failure to comply with the above-mentioned conditions may result in fire, serious personal injury, or damage to the product or the structure in which it is installed. In such cases caused by user negligence or misuse, **Kontal Elektronik San. ve Tic. Ltd. Şti.** assumes no responsibility.
- ✓ This symbol will be used to highlight important notes in the following sections.



- ✓ Do not touch the power supply terminals of the device with bare hands.
- This symbol will be used to indicate warnings related to voltage in the following sections.



- This symbol on the label indicates that the device operates with a DC supply voltage.



- This symbol on the label indicates that the device is equipped with reinforced insulation.



- This symbol on the product or its packaging indicates that the product must not be disposed of as household waste. Instead, it should be delivered to designated collection points for the recycling of electrical and electronic equipment. Improper disposal or destruction of the product may have adverse effects on the environment and human health.



- This document and its revisions are the legal property and responsibility of **KONTAL ELEKTRONİK SAN. VE TİC. LTD. ŞTİ.** Any unauthorized modification or alteration is strictly prohibited.



- Ensure that the system is properly grounded for the device to operate reliably.

1. DEFINITION

MKD2 is a 2-channel, high-precision vehicle loop detector designed for panel mounting, developed for use in industrial automation, parking barrier systems, access control, and traffic management systems. The device generates an electromagnetic field via wire loops installed underground. When a vehicle (metallic mass) enters this loop area, the resulting change in the system's inductance is instantaneously detected by the device. The MKD2 processes this change and activates the independent dry contact relay output corresponding to the respective channel.

1.1 Box Content

1x MKD 2 – 2 Channel Metal Mass Dedector	1x MKD 2 User Manual
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**For special orders, the box contents may vary depending on the project or customer requirements.*

2. TECHNICAL SPECIFICATION

Model	MKD-2
Product Code	K164-02
Operating Voltage	24V DC
Operating Current	20mA @ 24V DC
Operating Temperature	-20 °C +55 °C
Number of Contact / Contact Type	2 / Dry Contact (NO / NC)
Contact Capacity(max.)	30V DC 1A / 125V AC 0,3A
Relay Response Time	1sn (min) – 20sn (max.) <i>Adjustable</i>
Weight	190 gr.
Dimensions (H x W x D)	116,08 x 87,26 x 32,85 mm

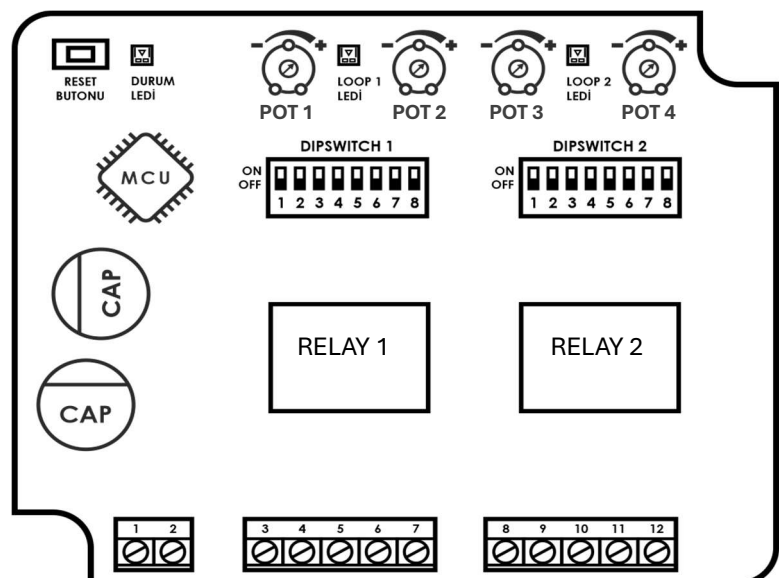
3. MKD 2 – USER CONTROL COMPONENTS

DIPSWITCH: Allows you to configure the operating modes of the device.

POT: Allows you to adjust the relay response times and the operating sensitivity of the device.

4. MKD 2 – CONTROL BOARD

Figure 4.1 MKD 2 Control Board



5. MKD 2 – SYSTEM INSTALLATION

5.1. Loop Cable Selection and Installation

For the **MKD2** detector card to operate with high efficiency and without errors, it is critical that the underground loop cable is correctly dimensioned and installed in accordance with standard regulations. Incorrect cable installation can lead to false detections, unstable detector operation, or complete system failure. The following parameters must be strictly observed during installation:

A- Required Inductance Value to be Obtained from the Installed Cable

The optimum operating range has been graphically determined to achieve maximum performance and the highest stability against environmental noise from the **MKD2** detector card. As shown in the graph below, although the system has a wide technically operable range, the region where the detector operates with the highest efficiency and stability is between 100 μH and 200 μH .

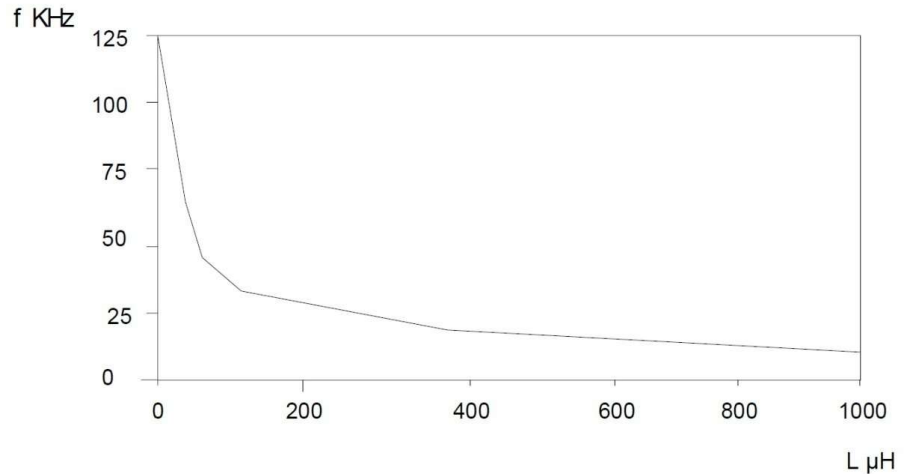


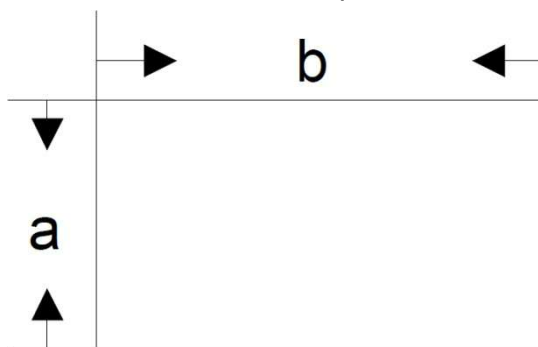
Figure 5.1 Required inductance range for the installed cable.

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

In many industrial vehicle detection applications, the most efficient and preferred cable installation geometries are square or rectangular structures. To achieve the ideal inductance value (100 μH – 200 μH) underground as specified in the previous section, the number of cable turns to be wound into the chiseled slot is determined by a simple geometric perimeter calculation.

In rectangular loop designs, it is recommended to maintain an aspect ratio of 1 to 3 (1:3) for the side lengths. This ensures that the under-chassis area of vehicles is scanned at the widest possible angle, maximizing detection sensitivity.

For example, if the short side is determined to be 1 meter, selecting 3 meters for the long side will ensure that the detector operates with much higher efficiency and stability.



The accompanying figure illustrates a loop area with side "a" and side "b". The perimeter of this loop area is calculated using the following formula:

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

Based on the perimeter value obtained from the formula above, the total number of cable turns required to be applied to the underground slot is listed in the table below:

Figure 5.2 Example Rectangular Cable Installation Diagram

Calculated Perimeter (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 us assume that we have chiseled a rectangular loop area in the field with a short side (*a*) of 1 meter and a long side (*b*) of 3 meters.

Step 1 (Perimeter Calculation): We find the total perimeter of this area by applying our formula:

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

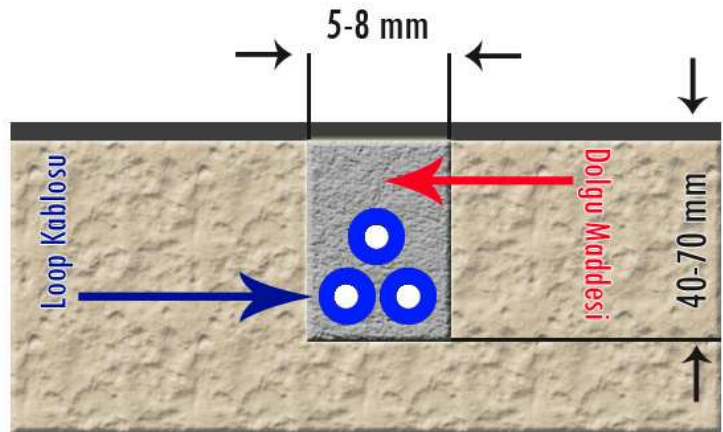
According to the accompanying table, the required number of turns for an application area with a perimeter of 8 meters is indicated as 4.

Winding the cable 4 turns on top of each other into the chiseled slot will be sufficient for the device to operate with the highest efficiency and

C- Loop Cable Installation

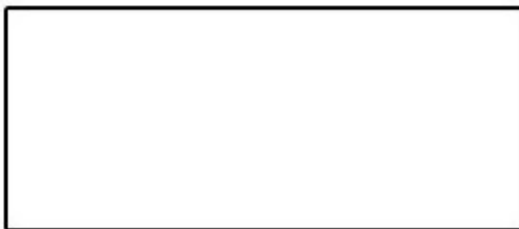
For the cable to withstand ground movements when installed in asphalt pavement, it must have a cross-section of at least 1.5 mm², and be flexible (stranded) and insulated. To place the cable, a slot must be chiseled into the asphalt using a diamond-blade cutter to a depth of 40–70 mm and a width of 5–8 mm. Before installing the cable, it is critical to clean the dust and sharp stones inside the slot using compressed air to prevent the cable from getting damaged over time and causing a short circuit.

Figure 5.3: Installation of the Loop Cable in Asphalt Pavement.

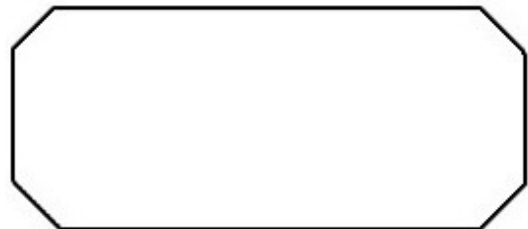


If you intend to seal the remaining space above the cable inside the slot with hot bitumen (asphalt filler) after installation, you must select a heat-resistant cable (such as silicone or Teflon-insulated) to prevent damage from high temperatures.

Another critical point is that the corners of the rectangular area to be cut in the asphalt should be turned at 45° angles (by chamfering) instead of a 90° right angle. This method prevents cable tension (stress) at the corners, thereby avoiding breakages and enabling the detector to generate a much more efficient electromagnetic field.



Loop Area with 90° Cut Corners
(Not Recommend Cutting Method)



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



Key Considerations in the Cable Installation Process

1- Use of Monolithic (Splice-Free) Cable: The cable to be installed must be a single continuous piece. Any subsequent splices, tapings, or hidden internal breaks in the cable will degrade the line's resistance and sensitivity, causing unstable operation of the detector.

2- Cleaning and Drying the Slot: Great care must be taken to ensure that the inside of the slot is completely clean, dust-free, and dry before laying the cable. Damp or muddy slots can weaken the cable insulation over time.

3- Securing the Cable: Once the cable is installed in the ground and sealed with filling material, it must absolutely not move. A cable that shifts inside the slot when vehicles pass over it will cause the detector to trigger false detections continuously.

4- Inductance Measurement Before Sealing: After the cable is laid into the slot, its inductance value must be measured before sealing it with filling material (bitumen/epoxy). You can use an LCR meter (inductance meter) for this measurement, or you can connect the cable directly to the MKD2 device and verify that it is within the appropriate operating range via the status LEDs.

D- Selection of Sealing and Filling Material

After the loop cable is installed in the slot, the slot must be completely sealed to protect it from external factors. Two different solutions can be applied for this purpose:

- **1. Cold Filling Material (Recommended):** Synthetic resin-based cold filling materials can be used for a practical application. Care must be taken to ensure that the selected material has a flexible structure, does not freeze and crack especially in cold weather, and is of a quality that will not crumble and dislodge.
- **2. Hot Asphalt Bitumen:** If a conventional hot bitumen application is to be performed, the cable must be heat-resistant (silicone/Teflon-insulated) to prevent damage from high temperatures. Before pouring the hot filling, it is recommended to pre-fill the inside of the slot with glass sand to protect the cable directly from the high heat.

E- Routing the Cable from the Loop to the Control Card

The leading cause of malfunctions and instability experienced in loop detector systems is installation errors in the loop cable running from the underground loop area to the MKD2 control card. To maintain system quality, the following rules must be strictly observed:

Twisting the Cables (Twisted Pair Application): The two cable ends exiting the loop slot must absolutely be wound (twisted) over each other until they reach the MKD2 card. To prevent external noise, a minimum of 20 to 50 twists per meter must be applied, depending on the cable type.



Figure 5.4 Example of Twisted – pair Cable Routing

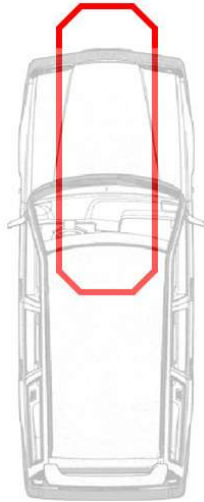
Avoiding Parallel Lines: While routing the feeder cable coming from the loop to the control panel, it must not be run parallel to the power or signal cables of other electronic devices. If using the same route is mandatory, a distance of at least 10 cm must be maintained between the loop cable and the other cables.

Separation of Multiple Loop Lines: Loop feeder cables belonging to multiple slots must absolutely not be run together inside the same pipe or conduit while being routed toward the panel. The signal of each line must be carried independently.

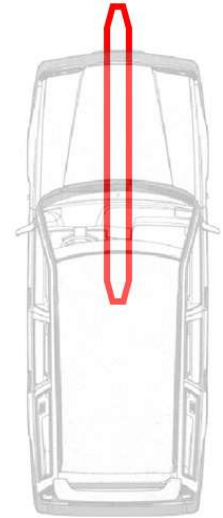
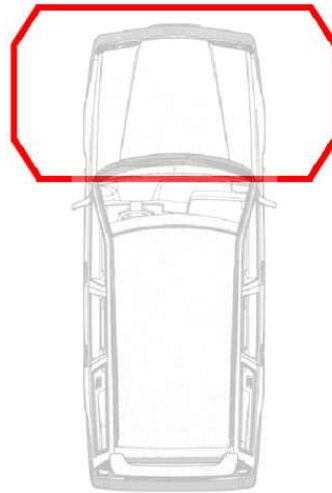
Physical Protection: The cable line running from the loop area to the control panel must be fully protected using spiral conduits or protective ducts against crushing, breakage, or damages caused by outdoor weather conditions.

F- Geometric Structure of the Loop Area

The ratio of the cable to be installed in the ground relative to the vehicles passing over it, along with its geometric shape, is a critical factor for the proper operation of the metal mass detector. The figures below illustrate the required geometric structure for the cable installation.



(Recommended Geometric Shape)

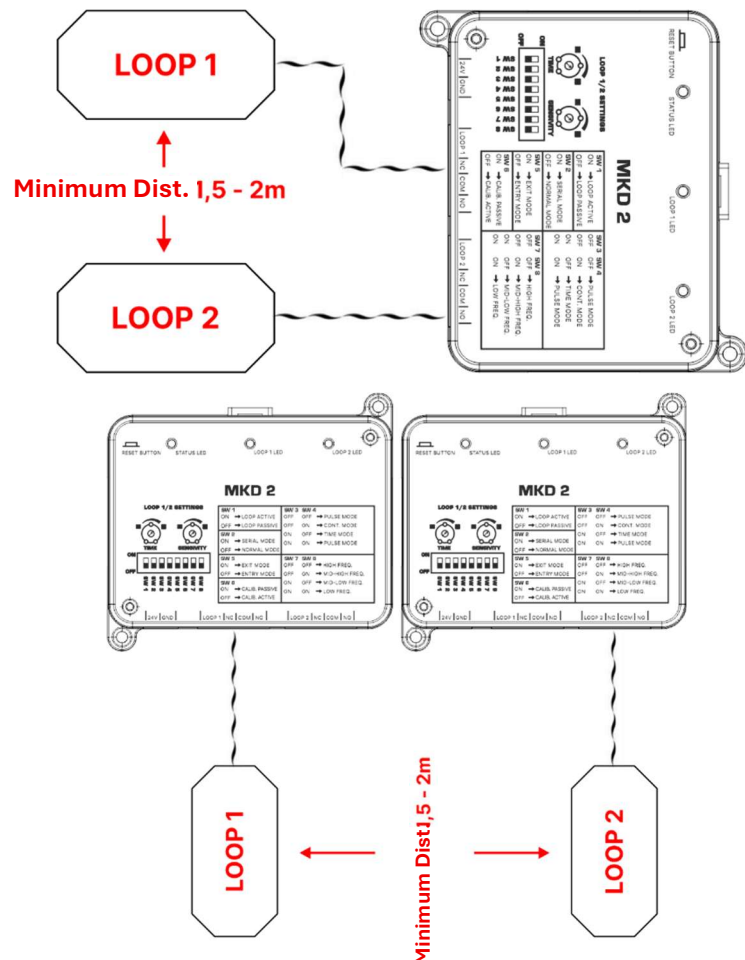


(Not Recommended Geometric Shapes)



Key Considerations During Installation

Closely Installed Loop Areas: If two different loop lines are to be installed close to each other, the distance between the two areas must be at least 1.5–2 meters to prevent their magnetic fields from affecting each other (causing interference).



5.2 MKD 2 – Cable Connections and Initial Commissioning

Make the cable connections of the **MKD2** as shown in the connection diagram.



There must be no vehicles on the loops when the product is operated for the first time.

A- MKD 2 – Operating Modes

Mode	Descriptipon
Serial Mode	In serial mode, loops are placed sequentially. For example, in an entry-priority system, the barrier opens when a vehicle first enters Loop 1, and the barrier closes when the vehicle exits Loop 2. If a vehicle approaches from the opposite direction and enters Loop 2 first, the system detects the vehicle but does not open the barrier.
Normal Mode	The two channels operate completely independently of each other. Settings are adjusted individually for each loop using the dip-switches and trimpots.
Pulse Mode	When a vehicle is detected, a trigger is given for only 500 ms (pulse). No new signal is generated until the vehicle leaves.
Continious Mode	The trigger remains active as long as the vehicle stays on the loop, and the trigger is cut off immediately when the vehicle leaves.
POT Time	When a vehicle is detected, a trigger is provided for the duration (1–20 seconds) adjusted via the trimpot on the card.
Entry Mode	A trigger is given the exact moment the vehicle enters (comes over) the loop area.
Exit Mode	A trigger is given the exact moment the vehicle leaves the loop. No trigger is generated as long as the vehicle waits on it.
Calibration Mode	If the vehicle does not leave the loop for 30 minutes, the system automatically cuts off the trigger for safety purposes and returns the system to normal.

You can adjust the operating modes for each loop using its own dip-switch.

(See also C – MKD2 Dip-switch Functions)

B- MKD 2 – Contact Output Duration and Sensitivity Adjustment

The trimpots located on the card are used to adjust the detection sensitivity and triggering durations.

- The duration of the trigger to be given when a vehicle is detected is determined by these trimpots (POT1 for Loop1, POT3 for Loop2).
- **Duration Range:** Minimum 1 second, maximum 20 seconds.
- **Increase (+):** Turning clockwise increases the trigger duration.
- **Decrease (-):** Turning counter-clockwise decreases the trigger duration.



Sensitivity Trimpots (POT2 / POT4)

Adjusts the detection depth and sensitivity of the detector for vehicles (POT2 for Loop1, POT4 for Loop2).

- **Sensitivity Range:** Between levels 1 and 15. As the trimpot is turned and the level changes, the corresponding loop LED flashes once for confirmation.

- **Increase (+):** Turning clockwise increases the sensitivity (Highest sensitivity at level 15; detects all vehicles, including small vehicles/motorcycles).
- **Decrease (-):** Turning counter-clockwise decreases the sensitivity (At level 1, only vehicles with large metal masses are detected).

C- MKD 2 – Dipswitch Functions

All operating modes and functions on the device are controlled via dip-switches. There are two dip-switch groups on the card: these are Dip-switch 1 (for Loop 1) and Dip-switch 2 (for Loop 2).

SW No	Switch State	Selected Mode	Description
SW 1	ON	Loop Active	Completely deactivates or activates the corresponding loop channel.
	OFF	Loop Close	
SW 2	ON	Serial Mode Active	Operates the channels independently or performs direction tracking with consecutive loops.
	OFF	Normal Mode Active	
SW 3 / SW 4	OFF / OFF	Pulse Mode	Provides a 500 ms pulse trigger and waits until the vehicle leaves.
	ON / ON		
	OFF / ON	Continuous Mode	Provides a continuous trigger while the vehicle is on the loop.
	ON / OFF	POT Time Mode	Provides a trigger for the duration of the trimpot (1–20s).
SW 5	ON	Exit Mode Active	Provides a trigger the exact moment the vehicle leaves the loop.
	OFF	Entry Mode Active	Provides a trigger the exact moment the vehicle enters the loop.
SW 6	ON	Calibration Mode Actv.	If Active: If the vehicle remains on the loop for 30 minutes, the system drops the trigger (Smart Parking).
	OFF	Calibration Mode Psv.	
SW 7 / SW 8	OFF / OFF	Highest Frequency	Changed to prevent frequency crosstalk if there are two adjacent loops.
	OFF / ON	Medium–High Freq.	
	ON / OFF	Medium – Low Freq.	
	ON / ON	Lowest Frequency	(If the device gives a high-frequency error, set to ON / ON)



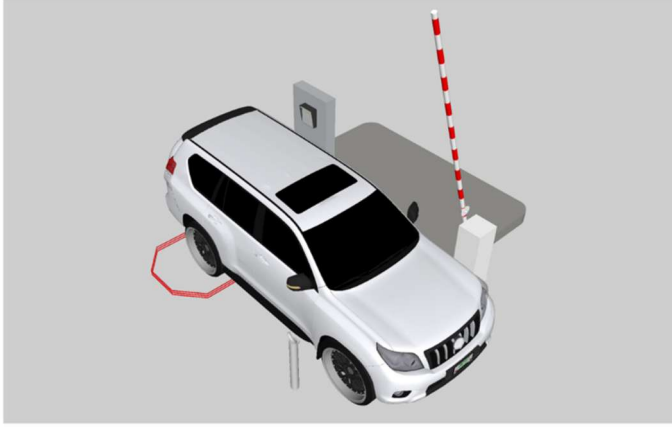
IMPORTANT SAFETY AND CONFIGURATION WARNING

Ensure There Is No Vehicle: Before changing the dip-switch settings or making loop connections, there must strictly be no vehicle on the loop.

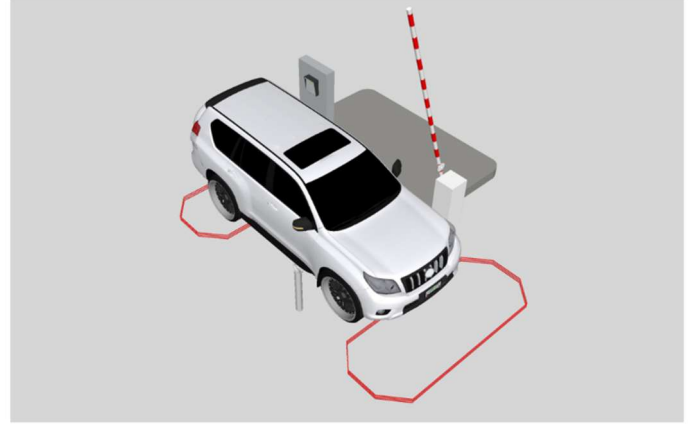
System May Close: Since the settings will be reconfigured, the barrier or shutter may suddenly switch to the closing position; precautions must be taken for the safety of life and property.

Resetting: In order to apply the changes to the card stably, it is recommended to press the RESET button for 2–3 seconds after the process is completed.

D- Serial Mode



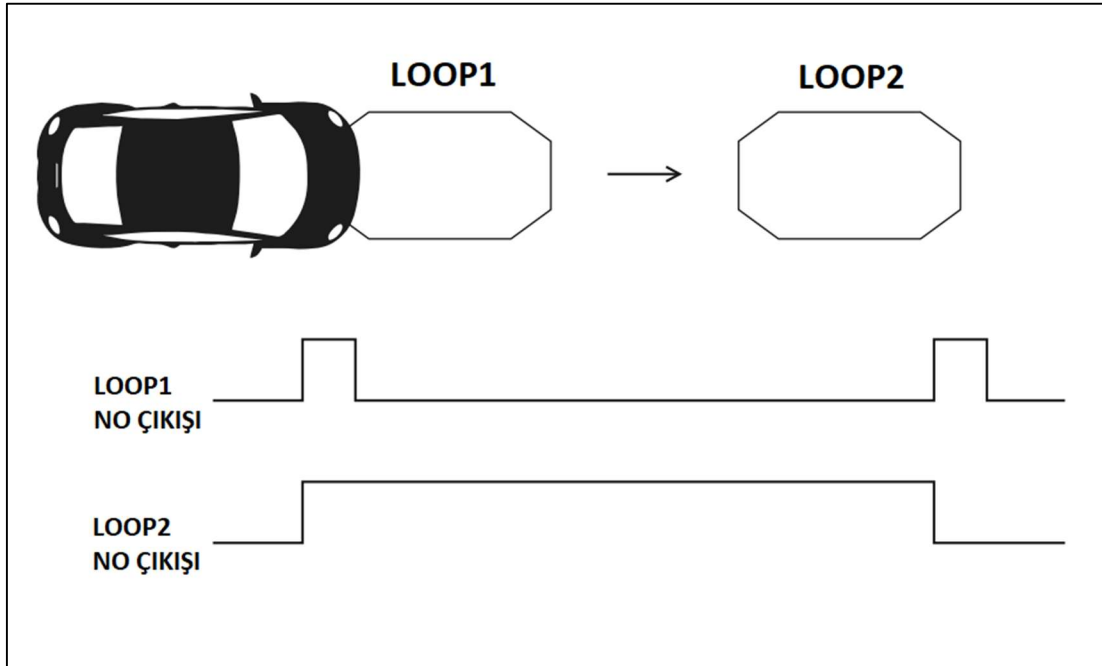
Normal Mode



Serial Mode

Serial mode operates with the help of two loops installed consecutively in the same transit corridor (in front of and behind the barrier). The main purpose of this mode is to provide full security by controlling the approaching and departing direction of the vehicle.

- **Transit Condition:** The system requires the vehicle to pass through both loops in sequence. No trigger is given to vehicles coming from the opposite direction.
- **Operating Logic (Example):** When a vehicle moving from left to right enters the first loop, the barrier opens and is kept open for a safe passage. Immediately after the vehicle advances, moves over the second loop, and completely leaves this area, the barrier is safely closed.



This mode operates with a one-way safety protocol. Even if the vehicle moves directly over the second loop (Loop 2) without detection occurring on the first loop (Loop 1), the system does not generate any trigger whatsoever.

Left-to-Right Transit Steps and Relay Responses:

- **Step 1 (Entry):** The exact moment the vehicle moves over Loop 1 while traveling from left to right, a short pulse (trigger) is given from the Loop 1 output. At the same time, the Loop 2 output switches to a continuously active (ON) position to keep the barrier open.

- **Step 2 (Exit):** The exact moment the vehicle continues to advance, moves over Loop 2, and completely leaves (exits) this area, a short pulse is given again from the Loop 1 output. Meanwhile, the Loop 2 output switches to the passive (OFF) state and the barrier closes.

Loop 1 State	Loop 2 State	Serial Mode Priority
Normal	Normal	Serial Mode Disabled
Serial	Normal	Loop1 Priority
Normal	Serial	Loop2 Priority
Serial	Serial	Loop1 Priority



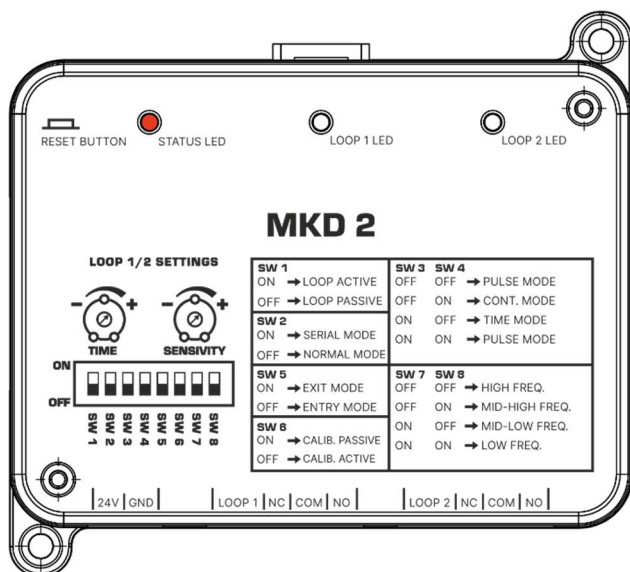
Even if the approach direction of the vehicles or the loop priority (Loop 1 or Loop 2) changes in serial mode, the operating behavior of the relays strictly does not change. Regardless of which direction the transit occurs, the Loop 1 output always continues to provide a trigger in Pulse (Instantaneous) mode, and the Loop 2 output always continues to provide a trigger in Presence (Continuous) mode. In short, even if the direction changes, these duties undertaken by the relays and the operating structure in the diagrams remain completely fixed.

Dip-switch number 2 activates Normal Mode in the OFF position, and Serial Mode in the ON position. This switch is used to determine the direction priority in the system: If only Loop 1 is set to serial mode (ON), transit detection is performed only from Loop 1 to Loop 2, and the opposite direction is rejected. In the reverse case, that is, if only Loop 2 is set to serial mode (ON), detection occurs only from Loop 2 to Loop 1. If the dip-switches of both channels are set to serial mode (ON), the system automatically operates with Loop 1 priority.

E- MKD 2 – LED STATE

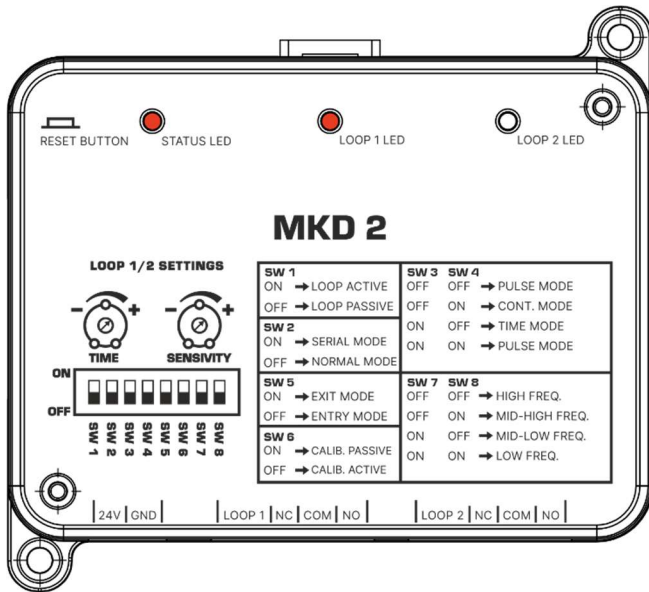
There are 3 status LEDs on the metal mass detector (MKD2) where you can monitor the operating status of the system and diagnose potential faults. The meanings and flash modes of these LEDs are as follows:

- **Status LED (Far Left):** Lights up continuously to indicate that the device is operating normally. If a break, loose connection, or fault occurs in the loop lines, it provides a warning by flashing.
- **Loop 1 LED (Middle) & Loop 2 LED (Right):** These LEDs are off when the line inductance is in the ideal state, and they light up continuously when a vehicle passes over them. If the loop impedance is low, they report an error by flashing 2 times per second, and if it is high, 5 times per second. If a break or loose connection occurs in the corresponding loop cable, these LEDs flash simultaneously with the Status LED.



Status LED is Continuously ON:

Under normal conditions, it is in a continuously illuminated state to indicate that the device is operating correctly and without any problems. It provides a warning by flashing only if a break or loose connection occurs in any of the loop lines. As long as there is no break in the cables, this LED continues to light up uninterruptedly.

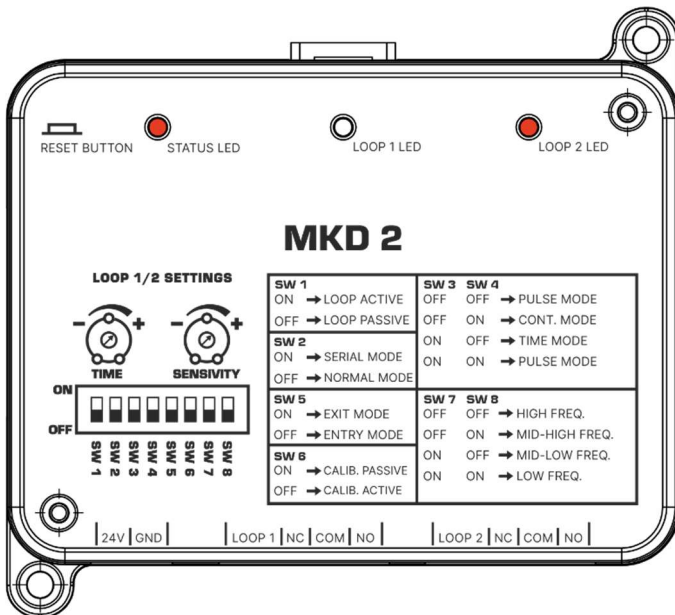


Status LED and Loop 1 LED are Solid ON:

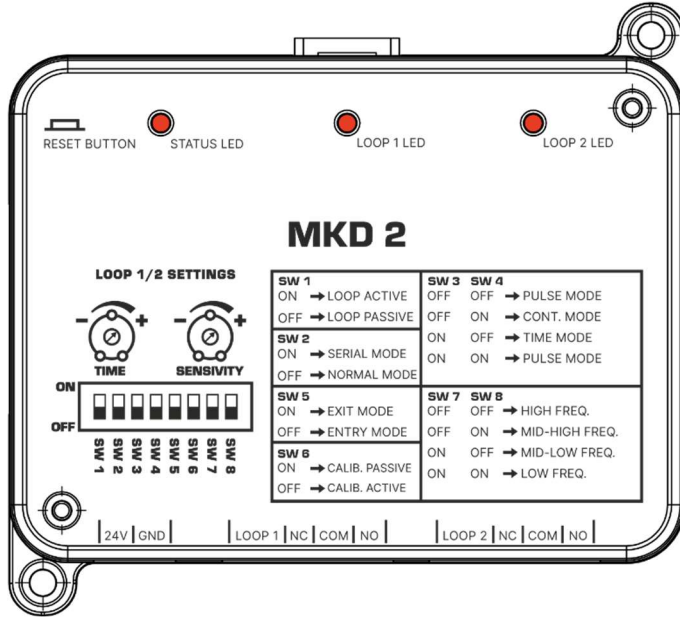
- **Status LED:** Under normal conditions, it lights up continuously to indicate that the device is operating correctly. If it flashes simultaneously with the Loop 1 LED, it means there is a break in the Loop 1 line. When the error is resolved, the LED returns to continuous illumination mode.
- **Loop 1 LED (Solid ON):** The continuous illumination of the Loop 1 LED indicates that a vehicle is detected by that channel. If this light remains on even though there is no vehicle on the loop, the RESET button must be pressed while there is no vehicle on the ground.
- **Loop 1 LED (Slow Flashing):** If the Loop 1 LED flashes slowly, it indicates that the loop frequency is low. In this case, the number of turns of the loop cable on the ground must be decreased.
- **Loop 1 LED (Fast Flashing):** If the Loop 1 LED flashes rapidly, it indicates that the loop frequency is high. In this case, the number of turns of the loop cable on the ground must be increased.

Status LED and Loop 2 LED are Solid ON:

- **Status LED:** Under normal conditions, it lights up continuously to indicate that the device is operating correctly. If it flashes simultaneously with the Loop 2 LED, it means there is a break in the Loop 2 line. When the error is resolved, the LED returns to continuous illumination mode.
- **Loop 2 LED (Solid ON):** The continuous illumination of the Loop 2 LED indicates that a vehicle is detected by that channel. If this light remains on even though there is no vehicle on the loop, the RESET button must be pressed while there is no vehicle on the ground.
- **Loop 2 LED (Slow Flashing):** If the Loop 2 LED flashes slowly, it indicates that the loop frequency is low. In this case, the number of turns of the loop cable on the ground must be decreased.
- **Loop 2 LED (Fast Flashing):** If the Loop 2 LED flashes rapidly, it indicates that the **loop frequency is high. In this case, the number of**



turns of the loop cable on the ground must be increased.



- The continuous illumination of the Status LED indicates that the system is operating correctly. If it flashes simultaneously with any loop LED, it means the corresponding loop is broken.
- The continuous illumination of both Loop 1 and Loop 2 LEDs indicates that a vehicle is detected by both loops. If a trigger is given while there is no vehicle on one of the loops, press the reset button when there is no vehicle on the loops.
- Slow flashing of either the Loop 1 or Loop 2 LED indicates that its frequency is low. The number of turns must be decreased.
- Rapid flashing of either the Loop 1 or Loop 2 LED indicates that the frequency is high. The number of turns must be increased.

Diagnosis	Loop 1 LED / Loop 2 LED	Status LED
Normal Operation / Loop Disabled	Off	Solid ON
Loop Triggered	Solid ON	Solid ON
Low Frequency	Flashes 2 times per second	Solid ON
Yüksek Frekans	Flashes 5 times per second	Solid ON
Loop Kopuk	Flashes 1 time per second	Flashes 1 time per second

6. MKD 2 – CONNECTION DIAGRAM

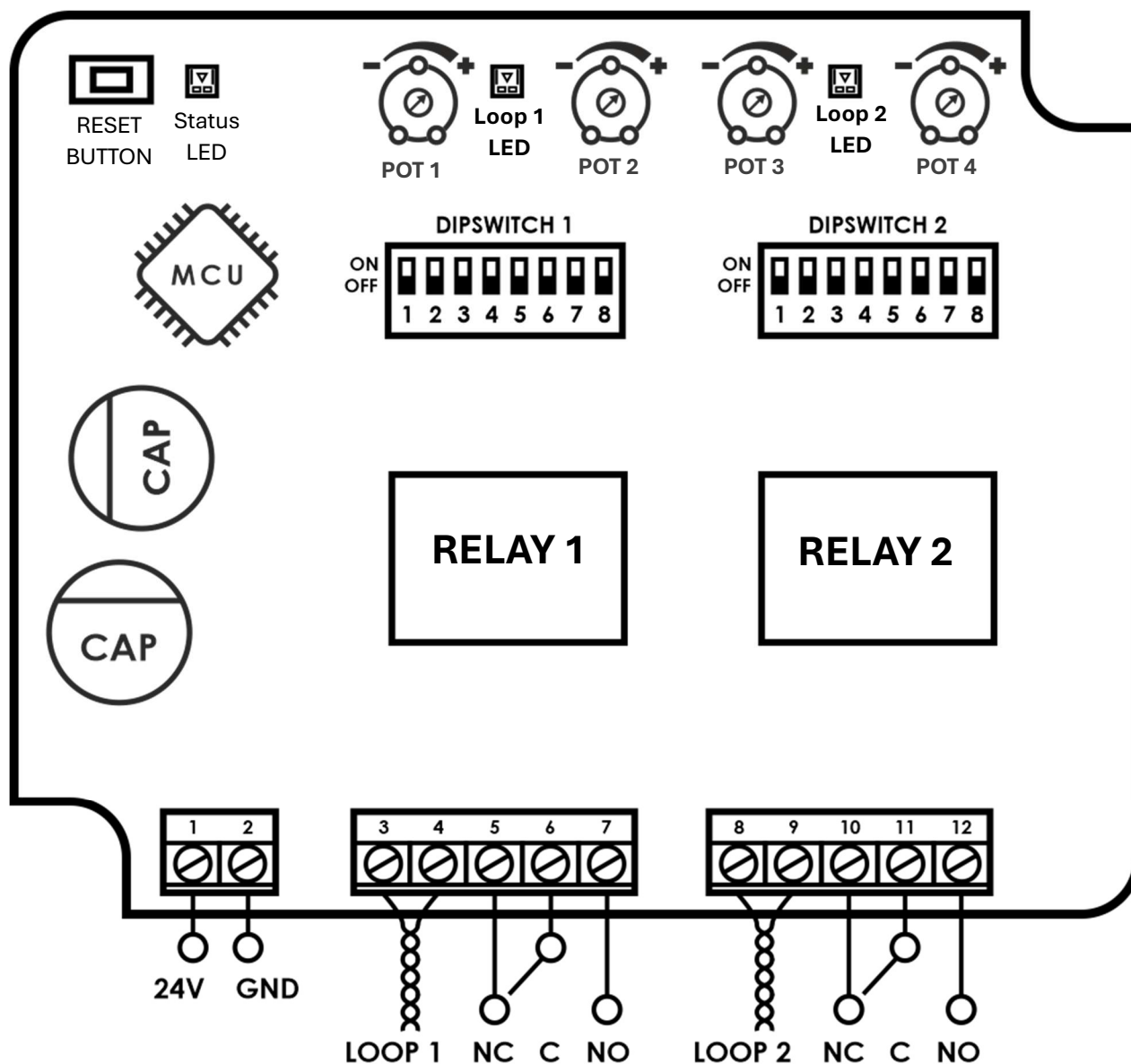


Figure 6.1 MKD 2 Connection Diagram



Pay attention to the "+" and "-" polarities when making the power connections of the product!



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



To ensure correct and stable operation of the device, it is recommended to use a power supply with an output power of at least 1 W on the supply line.

7. MKD 2 – MOUNTING

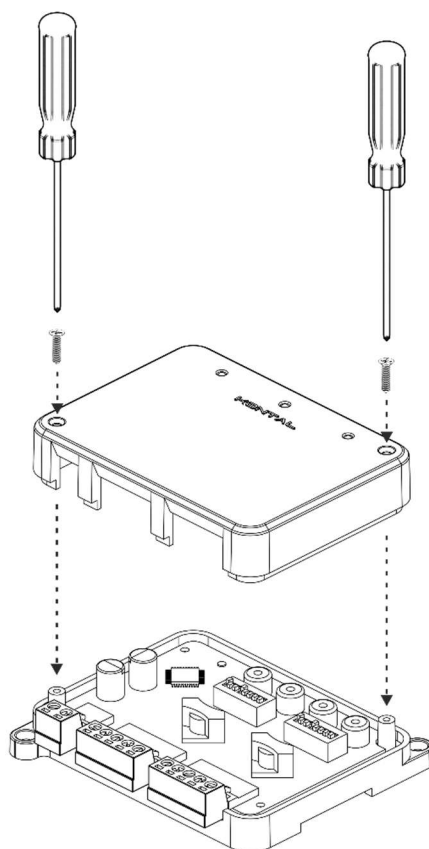


Figure 7.1 MKD 2 Closing the Top Cover

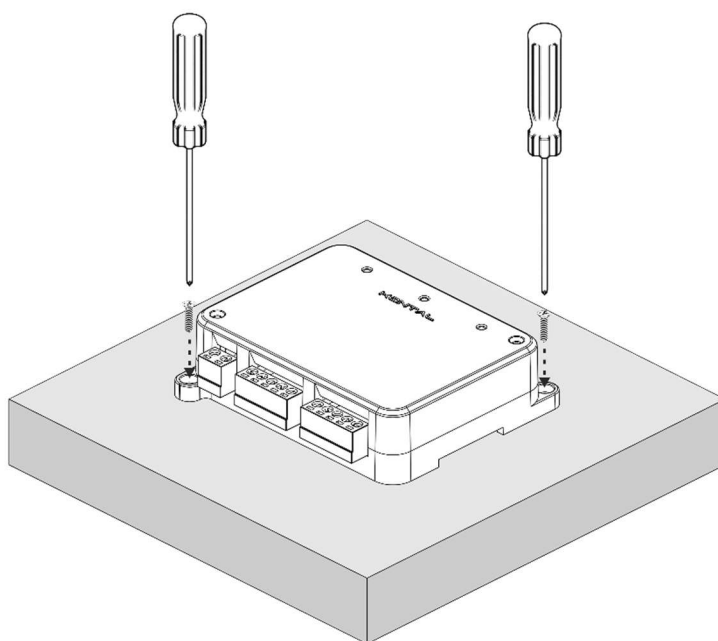


Figure 7.2 MKD 2 Mounting on a Flat Surface

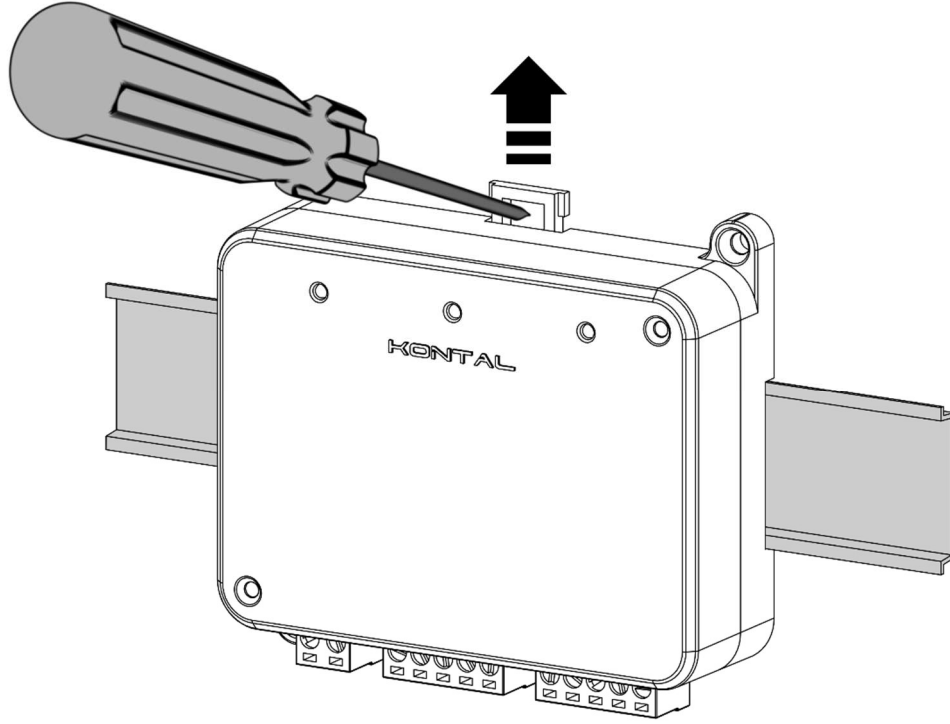
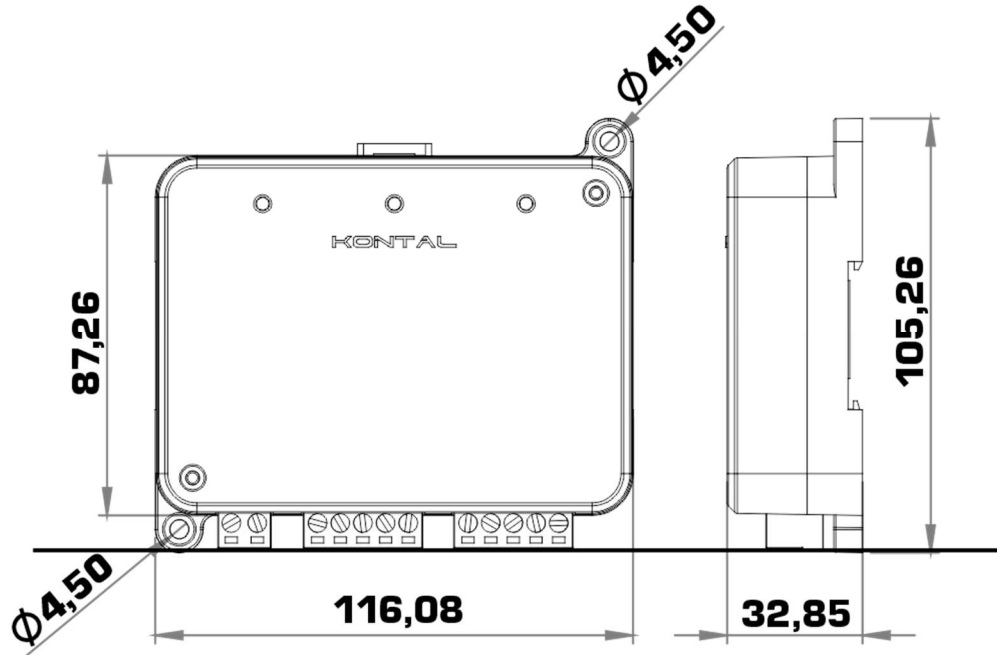


Figure 7.3 MKD 2 Mounting on a DIN Rail



Ölçü Birimi / Measurement Unit: mm

Figure 7.4 MKD 2 Dimensions (Unit: mm)

KONTAL
CE

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