

Instruction Manual

ELOshield: driver-assistance system for vehicle safety that automatically helps avoid collisions to reduce risk of vehicle-pedestrian accidents

Revision 20

For software version 1.2.0.9

09.03.2020

ASSISTANCE
SYSTEM



Winning solution



CONTENT

1.	IMPORTANT INFORMATION	4
1.1	Risk assessment	6
1.2	Electromagnetic wave radiation	7
1.3	Operation of ELOshield	7
2.	MAIN FUNCTIONALITY OF THE MODULES	8
2.1	Vehicle/stationary antenna modules (A)	8
2.2	Pedestrian module	8
2.3	Vehicle/stationary antenna module (B)	8
2.4	Vehicle module	8
3.	INTERACTION BETWEEN MODULES	9
4.	SCOPE OF DELIVERY	13
4.1	Vehicle set	13
4.2	Stationary set and verification unit	13
4.3	Pedestrian set	14
4.4	Accessories	15
5.	USE AND OPERATION OF THE PEDESTRIAN MODULE AND CHARGER.....	16
5.1	Operating modes	17
5.2	Q button	18
5.3	Warning and informing the operator	18
5.4	Charging the battery.....	19
5.4.1	Use the standard charger supplied with the pedestrian module as follows:	19
5.5	Correct use of the pedestrian module.....	20
6.	USE AND OPERATION OF THE VEHICLE MODULE	23
6.1	Operating modes	23
6.2	Warning and informing the operator	24
6.3	Inputs/outputs.....	25
6.4	Zones	25
6.5	Mechanical installation.....	25
6.5.1	Vehicle modules	26
6.5.2	Antenna modules (A)	26
6.5.3	Antenna module (B)	31
6.5.4	Vehicle module	32
6.6	Electrical installation	32
6.6.1	Assigning connection cables	33
6.6.2	Example connections in X1 group	35
7.	USE AND OPERATION OF THE STATIONARY MODULE	37
7.1	Warning and informing.....	37
7.2	Inputs/outputs.....	38
7.3	Zones	38
7.4	Mechanical installation.....	38

7.4.1	Stationary antenna modules (A)	39
7.4.2	Stationary antenna module (B)	43
7.4.3	Example of installed antenna modules (A/B)	45
7.5	Electrical installation	45
7.5.1	Connecting the power supply	46
7.5.2	Switching the stationary module on/off	47
7.5.3	Connecting inputs and outputs	47
7.5.4	CAN bus and terminator	49
7.6	Verification module	51
8.	SYSTEM CONFIGURATION	52
8.1	Minimum requirements:	52
8.2	Necessary cables	52
8.3	Starting the application	52
8.4	Establishing the connection	53
8.5	Saving current configuration of warehouses	53
8.6	Transferring settings from/to the device	53
8.7	Saving the current configuration of single devices	53
8.8	Setting up the stationary module / vehicle module	54
8.9	Configuration of the pedestrian module	59
8.9.1	Pedestrian module detection ranges	61
8.10	Circular, symmetric and custom shaped zones	62
8.11	Automatic calibration	64
8.12	Actions	64
8.12.1	Stationary, verification- and vehicle module action arguments	64
8.12.2	Stationary, verification- and vehicle module action results	66
8.12.3	Pedestrian module action arguments	68
8.12.4	Pedestrian module action results	69
8.12.5	Examples of actions	73
9.	MAINTENANCE	77
10.	FAILURES OF ELOSHIELD	78
11.	TECHNICAL DATA	79
11.1	Accuracy – worst case (small distance between antennas)	79
11.1	Vehicle set	80
11.2	Pedestrian set	81
11.3	Stationary set and verification unit	81
12.	EC DECLARATION OF CONFORMITY	83
13.	FCC DECLARATION OF CONFORMITY	84

1. Important information

 DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
---	--

 WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
--	--

 CAUTION	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
--	---

NOTICE	NOTICE indicates a property damage message.
---------------	--

	 WARNING
	Risk of injury due to inattention! Use of ELOshield can result in less attention being paid to the surroundings. This can lead to serious accidents and injuries. • Please always bear in mind that ELOshield is an assistant warning system which can only assist the driver of the vehicle in the driving task as well as the pedestrian within their respective system limits. • ELOshield is a radio-based warning system, whose accuracy and coverage can be influenced by onsite conditions such as reflections. The attention of all participants to the surroundings must always be maintained.

ELOKON cannot be held liable for damages caused due to misuse of the device. It must be remembered that:

- ELOshield is an assistant warning system. The user (operator) is responsible for safe operation of a vehicle.
- The depository/fleet manager is responsible for personnel training in the scope of operation of ELOshield.
- ELOshield is an assistant warning system and it absolutely does not release the users from an obligation to maintain full vigilance in view of potential dangers.
- During installation the manufacturer specification must be followed in the scope of installation of electrical and mechanical devices, and their integration with a vehicle.

- The installation, start-up and maintenance works must be performed by qualified personnel only.
- All cables and connections must be laid in a manner preventing damages and minimizing susceptibility to interference.
- ELOshield must be installed so as it does not obstruct the view and does not interfere with vehicle entry and exit.
- When ELOshield is installed and used, applicable standards and directives in a given country must be observed.
- The installation and all other works on the device must be performed with a vehicle switched off (with battery disconnected).
- ELOshield specification and technical data must be respected.
- When the device service life elapses, ELOshield must be disposed of in a correct and environment-friendly manner.



WARNING

Changes or modifications made to this equipment not expressly approved by (manufacturer name) may void the FCC authorization to operate this equipment.

NOTICE

The antenna module complies with the FCC radiation exposure limits set forth for an uncontrolled environment. Co-location of this module with other transmitters that operate simultaneously are required to be evaluated using the FCC multi-transmitter procedures. The RF exposure has been calculated with a 20 cm separation distance.

NOTICE

The pedestrian module complies with the FCC radiation exposure limits set forth for an uncontrolled environment.

NOTICE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

1.1 Risk assessment

The users vigilance may be limited as they become used to being warned by ELOshield. It may result in hazardous situations for the people and machinery. In order to minimize the risk of such hazards, the following guidelines must be observed:

- The ELOshield users must be repeatedly informed about potential technical failures of ELOshield.
- The system users must be fully familiar with the system operation and aware of consequences of activating special operating modes of the devices.

**WARNING**

Prior to the commencement of work, each operator (pedestrian, truck and station) must make sure that ELOshield operates correctly by checking its correct functionality – a test interaction of each ELOshield module and combination of modules must be evoked in order to trigger an alarm.

1.2 Electromagnetic wave radiation

As specified in the international standard ISO 14117:2012, the ELOshield electronic radio warning system operates in the frequency band of over 3 GHz and does not constitute a hazard to human life in accordance with their intended use.

ELOshield is intended to protect pedestrians (a pedestrian module), vehicles (a vehicle module) and zones (a stationary module). The system may also be used to create industrial automatic control systems reacting to an approaching/receding object.

1.3 Operation of ELOshield

Each person to whom a vehicle constitutes a potential threat must be equipped with the pedestrian module. Each vehicle which is meant to detect pedestrians/vehicles/stationary zones must be equipped with a vehicle module with antenna modules (A) (1-4) creating two protective zones around the vehicle. Locations that are especially hazardous or require additional interactions with vehicles/pedestrians must be secured using a stationary module with antenna modules (B) (1-4) and stationary modules (1-4). Examples of such locations include crossings with heavy traffic or entrance gates.

Each person/vehicle within the protective zone (span of the zone: up to 12 m for vehicles, 12 m for pedestrians) is detected by the system. Entering the zone triggers pre-configured actions of the vehicle or stationary infrastructures.

Example actions of the vehicle include: acoustical alarm, optical alarm, speed reduction and even breaking down the vehicle.

By proper configuration of the stationary module, vehicles and/or persons within the range of the stationary zone may trigger the following actions: opening of the entrance gate, change the state of traffic lights, vehicle speed reduction within the range of the stationary zone, stopping a vehicle entering an area where the pedestrian is present, etc.

The actions performed by the pedestrian module in an emergency situation include: a visual signal, acoustic alarm, vibration.

The alarm/warning may be muted by pressing the Q button.

2. Main functionality of the modules

2.1 Vehicle/stationary antenna modules (A)

- Recognition of objects equipped with the pedestrian module, vehicle module and stationary module.
- Transfer of information regarding detected objects to the vehicle module in order to control outputs and warn the driver.
- Generation of two configurable protection zones with a radius of 1 to 12 m (vehicles) and 1 to 12 m (pedestrians).

2.2 Pedestrian module

- Recognition of zones around vehicles and stationary devices equipped with antenna modules (A).
- Warning/alarms a pedestrian (by means of vibration/optical/acoustic alarm), when a recognized zone is breached.
- Releases a warning/alarm in a device, the zone of which has been breached by a pedestrian.
- Triggers outputs in the vehicle module in order to activate e.g. the creeping mode in a vehicle or to control an industrial automatic control system using the stationary module.

2.3 Vehicle/stationary antenna module (B)

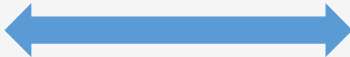
- Allows to detect a vehicle/zone by antennas
- Triggers an alarm/warning in devices, which have detected it.
- Triggers outputs in devices, which have detected it.
- Triggers an optical/acoustic alarm, when the zone is breached.
- Transfer of information regarding detected objects to the vehicle module in order to control outputs and warn the driver.

2.4 Vehicle module

- Warns/alarms a driver, when the zone around a vehicle is breached.
- Displays a number of objects breaching the alarm zone.
- Controls automated infrastructure objects, e.g. a gate
- 2 NO/NC relay outputs
- 2 digital open collector outputs
- 2 digital inputs
- Controls light signal column in the stationary module

3. Interaction between modules

Device	Name	Operation
	Vehicle antenna module (A) or stationary antenna module (A), depending on jumper setting.	Creates warning/alarm zones. Detects antenna modules (B) and pedestrian modules. Sends information about detected devices to the vehicle/stationary module which notifies an operator and controls outputs.
	Vehicle antenna module (B) or stationary antenna module (B), depending on a jumper setting.	The vehicle/stationary module is detected by antenna modules (A). It sends information about zones it breached to the vehicle/stationary module which notifies an operator and controls outputs.
	Pedestrian module	The pedestrian module is detected by antenna modules (A). When a warning/ alarm zone is breached, the pedestrian is informed.

Device 1	Possibility of communication between device 1 and device 2	Device 2
		
		
		
		
		
		

Antenna type devices send information to the vehicle/stationary module about detected objects such as:

- Pedestrian module
- Vehicle antenna module (B)
- Stationary antenna module (B)

Based on such information, the vehicle/stationary module may be used to control outputs. Implemented functions include:

- Vehicle slowing down (if provided by truck)
- Gate opening (a stationary device)
- Gate closing (a stationary device)
- Any other depending on a device connected to outputs.

Devices should be selected depending on a functionality to be implemented. Example implementations:

Vehicle detects pedestrians:

- Vehicle module, 2x vehicle antenna module (A) in each vehicle
- Pedestrian module used by each worker

Vehicle detects another vehicle:

- Vehicle module, 2x vehicle antenna module (A), 1x vehicle antenna module (B) in each vehicle

The stationary set detects vehicles and opens the gate:

- Vehicle module, 1x vehicle antenna module (B) in each vehicle
- Stationary module and stationary antenna module (A) in a stationary device

Vehicle detect a stationary zone and work in the *creeping mode* when the zone is breached:

- Vehicle module and vehicle antenna module (A) in each vehicle,
- Stationary module and stationary antenna module (B).

The stationary set detects pedestrians, vehicles and opens a gate, vehicles detect pedestrians, vehicles detect other vehicles:

- Vehicle module, 2x vehicle antenna module (A) in each vehicle, 1x vehicle antenna module (B) in every vehicle,
- Pedestrian module used by each employee,
- Stationary module and stationary antenna module (A).

The stationary set detects pedestrians and emergency—stops the hazardous machine:

- Pedestrian module used by each employee,
- Stationary module and stationary antenna module (A).

The stationary set detects pedestrians and antenna modules (B) in the symmetric zone and emergency—stops the hazardous machine:

- Pedestrian module used by each employee,
- Stationary module, 2x stationary antenna modules (A).

The stationary set detects pedestrians in the custom shaped zone and emergency–stops the hazardous machine:

- Pedestrian module used by each employee,
- Stationary module, 3 or 4x stationary antenna modules (A).

The stationary set detects pedestrians, vehicles and opens the gate, vehicles detect pedestrians, vehicles detect other vehicles:

- Vehicle module, 2x vehicle antenna modules (A) in each vehicle, 1x vehicle antenna module (B) in every vehicle,
- Stationary module, 2 to 4x stationary antenna modules (A)
- Pedestrian module used by each employee,
- Stationary module and stationary antenna modules (A).

Vehicles detect a stationary set and moves to *creeping mode* (if vehicle is capable to allow this), when the vehicle zone is breached:

- Vehicle module and vehicle antenna module (A) in each vehicle,
- Stationary module and stationary antenna module (B).

4. Scope of delivery

4.1 Vehicle set

- 1x vehicle module
- 2x vehicle antenna modules (A) for zone generation
- 1x feeding cable (9-wire) supporting 2 inputs and 2 *open-collector* outputs
- 1x cable (6-wire) supporting 2 NC/NO relay outputs
- 1x vehicle module – antenna cable
- 1x antenna module (A) to antenna module (A) cable

Optionally:

- 1x USB cable used to configure a vehicle/stationary set. One is sufficient for the entire fleet
- 1x configuration software including the license to use. One is sufficient for the entire fleet
- Additional antenna modules (A) to generate the zone around large-size vehicles (max. 4)
- Additional modules detecting other vehicles – vehicle modules. Used to protect vehicles against other vehicles (max. 4)



Figure 1. Baseline vehicle set to detect pedestrians with circular zones

4.2 Stationary set and verification unit.

- 1x stationary module
- 1x Choice of antenna module (A or B)
- 1x CAN Bus termination

Optionally:

- 1x USB cable for stationary zone configuration. One is sufficient for the entire system.
- 1x configuration software including the license to use. One is sufficient for the entire system.
- Stationary antenna modules (A) to create the zones detecting persons and vehicles equipped with vehicle modules (max. 4),
- Stationary antenna modules (B) which may be detected by vehicles equipped with vehicle antenna module(s) (A) (max.4)
- Additional stationary module to antenna module (A/B) cables (4 m or 15 m) and antenna module (A/B) to antenna module (A/B) cables (4 m or 30 m)
- Visual and acoustic signal column



Figure 2. Basic stationary set with optional visual and acoustic signaling

4.3 Pedestrian set

- 1x pedestrian module
- 1x charger
- 1x micro-USB cable for device charging and configuring



Figure 3. Pedestrian set

4.4 Accessories

- 10 port dedicated USB charger



- Pedestrian modules have to be placed as shown in the picture.

5. Use and operation of the pedestrian module and charger

The pedestrian module is used to warn about a potential threat from a vehicle equipped with ELOshield. The protection is realized by generating broadband electromagnetic pulses with ultra-low power.

	 WARNING
	Risk due to signal disruption! The water content of the human body can influence radio signals, either preventing or limiting the function of ELOshield. • Only wear the pedestrian module on the upper arm area. • Always check that the ELOshield is working before starting work. • ELOshield should only be viewed as an assistance system. • The attention of all participants to the surroundings must always be maintained.

	 CAUTION
	Radio radiation! Radio radiation is released due to the use of ELOshield. • Other devices could be disturbed and their function impaired. • Please check with the manufacturer of pacemaker or other medical devices, whether disturbance cannot be excluded.

   	 CAUTION
	Beware of electrical voltage and heat! Touching live parts can result in injuries. Also, a short circuit can occur which causes components to be heated. This can lead to injuries. • The power supply must be disconnected when working on electrical components. • Metal objects such as rings or watches must be removed beforehand. • Connection, testing and measuring work on electrical parts may only be carried out by a qualified electrician. • If the electrical parts are faulty or damaged, turn off the electrical power supply immediately and initiate repair.

	 DANGER Electrical voltage hazard. Touching live parts can result in death. Damage to insulation or individual components can be life-threatening. • The power supply must be disconnected when working on electrical components. • Metal objects such as rings or watches must be removed beforehand. • Connection, testing and measuring work on electrical parts may only be carried out by a qualified electrician. • If the electrical parts are faulty or damaged, turn off the electrical power supply immediately and initiate repair. • The regulations of the local energy supplier must be complied with.
---	---

5.1 Operating modes

- Normal – the default operating mode, when the device is switched on. Active warning and alarming for all threat types.
- *Driver's muting* mode – It may be activated by short-pressing the Q button, when the pedestrian module is within the muting zone range. This mode is designed for a vehicle operator and used to mute the pedestrian module, when the operator drives the vehicle, so as not to block its vehicle and other vehicles, as the vehicle is used. In this mode, the pedestrian module becomes invisible to all vehicles, and stops alarming and warning about threats. The visibility is restored, as the driver zone is exited by a driver. The driver zone must be small enough to cover only the inside of the vehicle with its range. Driver muting is only available with at least 2 antenna modules (A).

	 DANGER • Note that a different person than the driver can mute his pedestrian module, especially, if vehicle muting zone is too large.
---	---

- The *acknowledge* mode – It may be activated/deactivated by pressing the Q button for 2 seconds and is used to mute the alarm in the pedestrian module. Alerts in vehicles will still be active. The mode will be automatically deactivated as conditions deteriorate (when a new threat appears in the proximity) or when the configurable period of time elapses – from 0 seconds to 18 hours.

5.2 Q button

- When pressed – the device is switched on (if switched off), auto-test is completed or the driver's *muting* mode activating. The driver's *muting* mode may be switched on, when the pedestrian module is within the muting zone reach. The muting zone is configured from the application level in vehicle module.
- When pressed and held for 2 seconds – activate/deactivate the acknowledge mode.
- When pressed and held for 5 seconds – power off (signaled with vibrations)

5.3 Warning and informing the operator



Figure 4. Pedestrian module

The pedestrian module warns and informs the user by means of:

- Red alarm LED for zone 1
- Yellow warning LED for zone 2
- Acoustic signals
- Vibration signals
- Status LED
- Battery LED

Battery LED (when charging):

- Continuous yellow – battery charging in progress
- Continuous green – battery fully charged
- Off – charging error (check the charger/battery)

5.4 Charging the battery

- Charge the battery before usage.
- Use only ELOKON-approved chargers, and cables. Unapproved chargers or cables can cause the battery to explode or damage the device.
- Connecting the charger improperly may cause damage to the device. Any damage caused by misuse is not covered by the warranty.
- To save energy, unplug the charger when not in use. The charger does not have a power switch, so you must unplug the charger from the electric socket when not in use to avoid wasting power. The charger should remain close to the electric socket and easily accessible while charging.

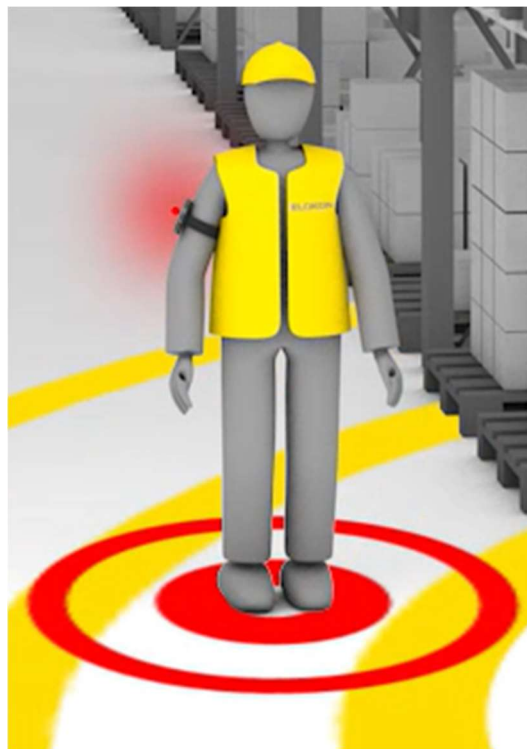
5.4.1 Use the standard charger supplied with the pedestrian module as follows:

1. Connect the USB cable to the USB power adapter and plug the USB cable into the device's multipurpose jack.
2. Plug the USB power adaptor into an electric socket.
3. After fully charging, disconnect the device from the charger. First unplug the charger from the device, and then unplug it from the electric socket.

 	 DANGER
	Danger to life due to electric shock! There is a danger to life resulting from electric shock if the charger is handled incorrectly. • Never use a defective or damaged charger. • Never open or dismantle the charger. • Check the charger connection lead regularly for damage. Disconnect the plug immediately, if the connection lead is damaged.

5.5 Correct use of the pedestrian module

- The function of the pedestrian module works best when worn with a bracelet on the upper arm.
- Carrying in a pocket or not in the direct view of the vehicle can reduce the range to 1.5 m or even make the function vanish completely.



	 WARNING
	Conductive materials in the radio link line between transmitter and receiver, such as metals, liquids, human bodies, etc., can cause the signal between the devices to disappear completely, resulting in a complete failure of the function!

	 DANGER
	Risk of death from explosion! • The ELOshield pedestrian module can cause sparks, which could ignite dust, gases or vapours. Switching sparks can occur when the on/off switch is operated, when it is removed from the charger or when internal relays are switched. • Never operate ELOshield in a potentially explosive environment! • Potentially explosive environments (EX) are environments where flammable liquids (vapours), gases or dusts are found.

	 WARNING
	Risk of injury or accident when handling the charger or the pedestrian module! Incorrect handling of the charger and the pedestrian module can lead to hazardous situations. The following points must be noted: • The electrical cable must only be plugged into an officially approved socket. • The plug must be always disconnected from mains supply after the charger has been used. • Fire hazard! Do not use on a readily combustible surface (e.g. paper, textiles), or in a readily combustible environment.

- Disconnect the plug immediately from mains supply if the charger catches fire or emits smoke.
- Do not cover the charger to allow it to cool without hindrance.
- Connection leads should be laid and labelled in such a way as to prevent damage to them and harm to persons. Avoid trip hazards!
- Ensure that the ELOshield module is not exposed to direct sunlight, heat, open fire or electric sparks.
- Do not smoke in the immediate vicinity.
- Never expose the pedestrian module to microwaves or high pressure.
- Comply with the environmental requirements according to the values in Chapter 12 "Technical Data".
- Never throw into fire.
- Never charge or use a defective, damaged or deformed pedestrian module.
- Never open, damage or drop the pedestrian module.

NOTICE

Risk of damage to the charger and pedestrian module!

When using the charger and the pedestrian module, the following must be noted:

- The charger must only be used and stored in enclosed and dry spaces. Protect the charger and pedestrian module from rain and moisture.
- Only use charger and battery in the temperatures specified in Chapter 12 "Technical Data".
- If it is to be stored for more than 6 months, the pedestrian module must be fully charged in order to retain the performance of the battery.
- Only use the pedestrian module with suitable chargers in accordance with the values in Chapter 12 "Technical Data".
- Do not remove the plug from the socket by pulling the connection lead; always remove by pulling the plug itself.

Damaged connecting leads must be repaired by a qualified electrician.

NOTICE

It is recommended to switch off the module when charging, since it shortens charging duration.

Battery LED (during normal operation of the device without the charger connected):

- Off – battery fully discharged or fully charged (if the status LED blinks)
- Blinking yellow - battery discharged in 70%
- Blinking red – battery discharged in 85%
- Continuous red – battery discharged - device will be switched off

Status LED

- Off – the pedestrian module is switched off
- Blinking green – the pedestrian module is active
- Blinking yellow - the acknowledge mode is active
- Blinking red – the auto-test is active
- Continuous red – pedestrian module failure or not configured

Acoustic and vibration signals

- The alarm/warning mode – the frequency and level may be configured from the application level.
- 3 short signals every 5 seconds – Low battery level, less than an hour to be completely discharged.
- Continuous signal for 10 seconds – the device is discharged, automatic switching off.
- Continuous signal when the **Q** button is pressed and held – the device is switched off; the button may be released.

6. Use and operation of the vehicle module

The vehicle module is used to warn the operator about an object equipped with ELOshield, which breaches configurable zones around vehicle antenna modules (A) installed on a vehicle. Depending on the configuration, the device will alert the user, switch the vehicle to the *creeping mode*, stop it completely or perform other action depending on a device connected to the module outputs. Please check with your vehicle manufacturer if this is generally possible.

6.1 Operating modes

Interactions of ELOshield with a vehicle and its reactions to various events are fully configurable by means of actions. The configuration method is described in chapter 8.11. However, the components of ELOshield contain a default configuration as delivered, which configuration is characterized by the following operating modes:

- Normal – the default operating mode, when the device is switched on. Active warning and alarming for all threat types. When an object appears in the alarm zone (red), relay 1 is switched on. When an object appears in the warning zone (yellow), relay 2 is switched on.
- The muting mode may be activated in three different modes:
 - Mode 1 – automatic muting of a vehicle without a driver
 - The mode is switched on automatically, when the digital input 1 is enabled. In this mode, antennas installed on a vehicle are deactivated. Vehicle modules installed on a vehicle maintain normal operation, and therefore other vehicles in the vicinity are still being warned. The mode is switched off automatically, when the digital input 1 is disabled. The digital input 1 should be connected to the seat sensor. In this mode, pedestrians are not warned about a vehicle, which does not pose a threat to them (the vehicle is stopped without a driver).
 - Mode 2 – temporary deactivation of the ELOshield system on a vehicle:
 - The mode is activated by pressing the Q button for at least 5 seconds. The antenna and vehicle modules are deactivated in this mode, while other vehicles and modules are not warned. The mode is deactivated, when:
 - The Q button is pressed;
 - When the configurable time elapses – from 0 seconds to 18 hours;
 - The digital input 1 (seat sensor) is deactivated.
 - Mode 3 – temporary muting of the alarm:
 - The mode is activated by pressing the Q button, when the digital input 1 is deactivated (the driver seats). In this mode, the vehicle antenna modules (A) and vehicle modules are active, relays and acoustic signaling are deactivated. The mode will be automatically deactivated as conditions deteriorate (when a new threat appears in the proximity) or when the configurable period elapses – from 0 seconds to 18 hours or when the Q button is pressed. The mode is used to mute the alarm or release the outputs in order to allow the driver to exit the location, in which the alarm is triggered.

The muting mode 1, 2, 3 is activated, when the yellow status LED blinks. In addition, the letter "A" appears on the display unit for mode 1, and blinks for mode 2.

The signal from the operator seat sensor should be connected to digital input 1.



Figure 5. Vehicle module

6.2 Warning and informing the operator

The vehicle module warns and informs the user by means of:

- Red alarm LEDs for zone 1 (red circle)
- Yellow warning LEDs for zone 2 (yellow circle)
- Acoustic signals
- Status LED

Status LED

- OFF – the vehicle module is deactivated
- Blinking green – the vehicle module is active
- Blinking yellow – the muting mode is active
- Blinking red - the auto test is active
- Continuous red – failure

Acoustic signals

- The alarm/warning mode – the frequency and level may be configured from the application level.

6.3 Inputs/outputs

Inputs

- Input 1 – the seat sensor should be connected, or the input should be left unconnected and deactivated in the configuration software.
- Input 2 – unused in default configuration

Outputs

- NC/NO relay 1 – activated by default, when an object is present in the zone which is closer
- NC/NO relay 2 – activated by default, when an object is present in the zone which is further
- *Open collector* digital output 1
- *Open collector* digital output 2

In principle, the relays control the creeping mode or vehicle locking.

6.4 Zones

The shape of the zone is closely dependent on the device configuration and the number of installed vehicle antenna modules (A):

- 1 vehicle antenna modules (A) – circular zone.
- 2 vehicle antenna modules (A) – combination of circular zones, symmetric zone.
- 3 or 4 vehicle antenna modules (A) – combination of circular zones and custom shaped zones. Custom shaped zones allow for establishing a precise position of the detected object. System with 4 vehicle antenna modules (A) is recommended for large vehicles.

6.5 Mechanical installation

	 CAUTION Beware of electrical voltage and heat! Touching live parts can result in injuries. Also, a short circuit can occur which causes components to be heated. This can lead to injuries. • The power supply must be disconnected when working on electrical components. • Metal objects such as rings or watches must be removed beforehand. • Connection, testing and measuring work on electrical parts may only be carried out by a qualified electrician. • If the electrical parts are faulty or damaged, turn off the electrical power supply immediately and initiate repair. • Cabling must be installed according to local laws, electrical standards and the technical properties of ELOshield and other connected devices.
---	---

6.5.1 Vehicle modules

Vehicle modules can be installed according to personal preferences. The modules can be screwed to the vehicle, or optionally fixed with RAM Mount clamps or suction caps.

In front of the driver, in the drivers view:

- On the dashboard
- At the pillar
- On the window

Out of the drivers view:

- Beside/below the seat
- In the engine compartment



Vehicle module on a dashboard



Vehicle module with RAM Mount/Suction cap

6.5.2 Antenna modules (A)

1 - 4 vehicle antenna modules (A) should be installed depending on a vehicle type to generate corresponding zones around the vehicle. The devices should be installed with the following guidelines considered:

- The antenna modules are delivered with an adjustable bracket, which must be screwed to the truck (screws are not included in scope of delivery), or, alternatively attached with a magnet (optionally available).
- The vehicle antenna modules (A) should be installed in a visible place without metal obstacles, which may obscure signal emission. (Example: on the roof, nearby mirrors or lights)
- Optimally, the vehicle antenna modules (A) should be located around the outline of the vehicle, as far away from each other as possible, as close as possible to the potential hazard.
- The vehicle antenna modules (A) should be installed upright so as cable connectors are pointing the floor.
- The vehicle antenna modules (A) should not be installed in places obscured by metal objects.

- If circular zones are to be used in a given location, it should be noted that they are arranged concentrically around the vehicle antenna modules (A).
- If symmetric zones are to be used in a given location, it should be noted that the line connecting the vehicle antenna module (A) is at the same time the symmetry axis of the symmetric zone.



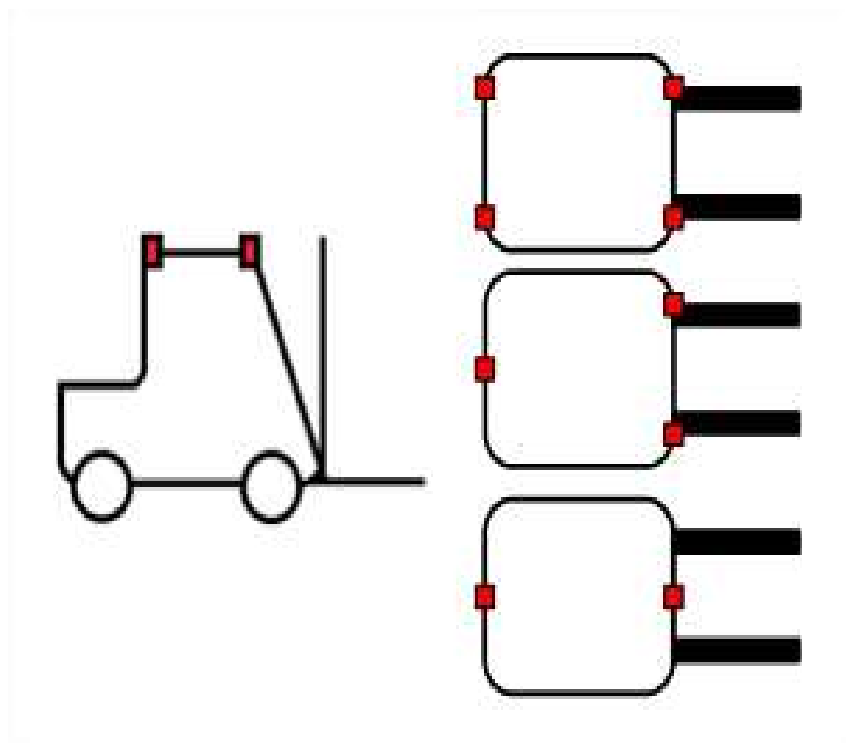
Antenna module with bracket



Typical roof installation



Example of how it shouldn't be done



4 antennas, available modes:

- Circular / combination of circles
- Custom shaped zone

3 antennas, available modes:

- Circular / combination of circles
- Custom shaped zone

2 antennas, available modes:

- Circular / combination of circles
- Symmetric

Figure 6. Recommended antenna installation place, the right figure shows the top view of the vehicle.

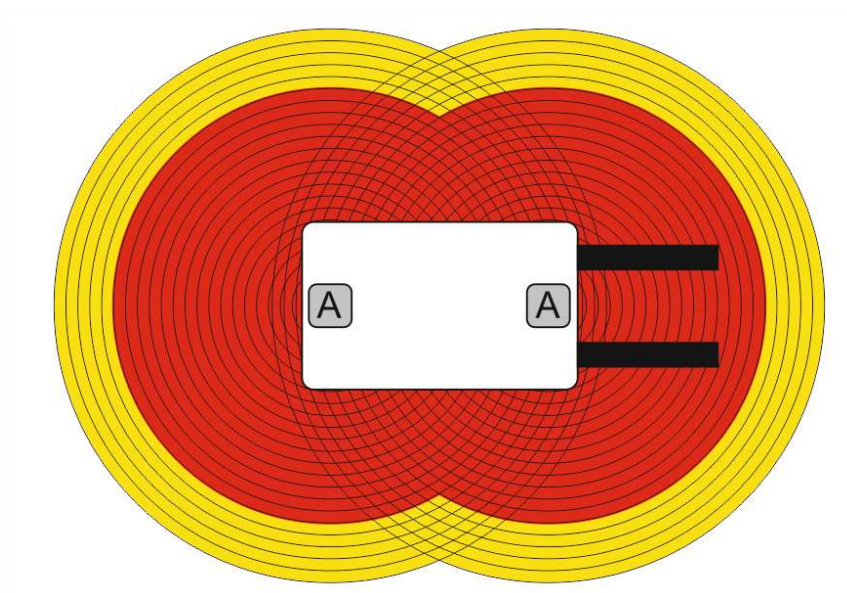


Figure 7. Impact of the arrangement of vehicle antenna modules (A) on the shape of the circular zones

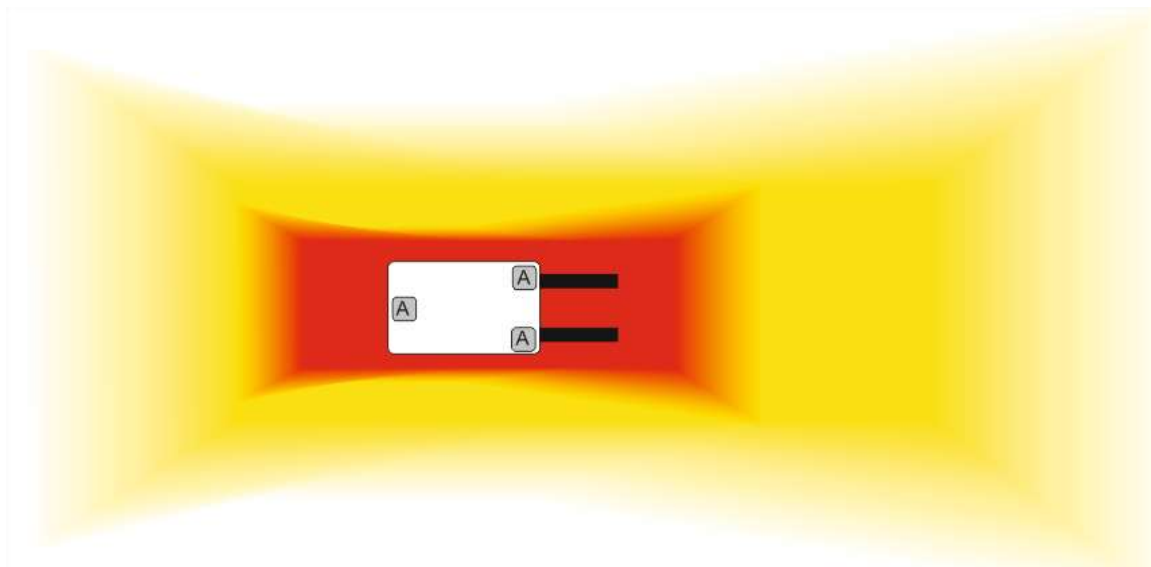


Figure 8. Custom shaped zones – position, size and shape of the zones are configurable.

Due to accuracy reasons fringes as depicted in the 2 pictures above cannot be exactly defined and may differentiate during operation.

More technical info about accuracy can be found in chapter 12.1



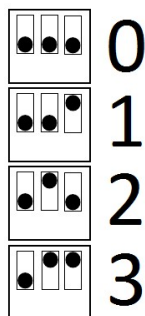
Figure 9. The vehicle antenna module (A) with the cover removed and the switch marked in red provided to set the CAN ID address

The vehicle module is connected to the vehicle antenna modules (A) using the CAN bus. In order to make connection, the unique CAN ID address should be correctly configured in each of the vehicle antenna modules (A). In order to do so, the cover should be removed by loosening 4 bolts, the unique address should be set in the switch and the cover should be replaced.

NOTICE

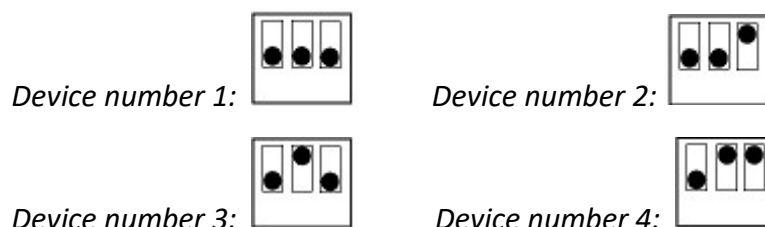
Any changes may only be carried out when the device is switched off.

The vehicle antenna modules (A) on the vehicle should have consecutive addresses from the 0-3 range set as in the example below:



- The first switch must always be set in the lower position. As in the above example. Otherwise, the module will report an error.
- The addresses must be consecutively numbered starting from 0. It is not allowed to install two devices with numbers 0 and 2. In the case of 2 devices, the available addresses are 0 and 1; in the case of 3 devices: 0, 1, 2 and in the case of 4 devices: 0, 1, 2, 3.

The example of correct configuration of the vehicle module with 4 vehicle antenna modules (A):



Each antenna module (A) is equipped with 2 LEDs:

- Status LED (*STATUS*) – blinks in green, when the device is active
- Error LED (*ERROR*) – lights in red, when the device reports an error

Possible error causes:

- Duplicated CAN ID address
- A given CAN ID is not configured in the panel
- Problems with the cable resulting in interrupted communication with the panel.
- Extreme left switch in the upper position
- Module ID is not set or duplicated in the configuration software

6.5.3 Antenna module (B)

The vehicle/stationary antenna module (B) is installed and configured just as the vehicle/stationary antenna module (A). The CAN ID address should be configured from 0-3 range, and it should be remembered that CAN ID in the vehicle/stationary modules is not in conflict with the CAN ID set in the antenna module (B). For example, one antenna module (B) with CAN ID = 0 and one vehicle/stationary module also with CAN ID = 0 may be present in the system. Maximum of 4 antenna modules (B) and 4 antenna modules (A) may be installed in the system.



Figure 10. The antenna module (B) with the cover removed and the switch marked in red provided to set the CAN ID address. Blue circle shows the jumper used to set the operating mode as the vehicle antenna module (B) or as the stationary antenna module (B).

The antenna module (B) is provided to select the operating mode using the jumper marked with a blue circle in the above figure. The jumper is set to determine operation in the stationary antenna module (B) mode and removed to switch to operate as the vehicle antenna module (B). The difference between the modes is that different IDs are sent, and therefore the antenna modules (B) are capable to differentiate between a stationary device and a vehicle.



Without jumper	Vehicle antenna module (A)	Vehicle antenna module (B) – will be seen as vehicle object by stationary antenna modules (A) and vehicle antenna modules (A)
With jumper	Stationary antenna module (A)	Stationary antenna module (B) – will be seen as stationary object by vehicle antenna modules (A) and stationary antenna modules (A)

6.5.4 Vehicle module

The vehicle module should be installed in a visible and safe place in the cab using mounting brackets. The **Q** button should be easily accessible.

6.6 Electrical installation

   	 CAUTION
Beware of electrical voltage and heat! Touching live parts can result in injuries. Also, a short circuit can occur which causes components to be heated. This can lead to injuries. • The power supply must be disconnected when working on electrical components. • Metal objects such as rings or watches must be removed beforehand. • Connection, testing and measuring work on electrical parts may only be carried out by a qualified electrician. • If the electrical parts are faulty or damaged, turn off the electrical power supply immediately and initiate repair.	

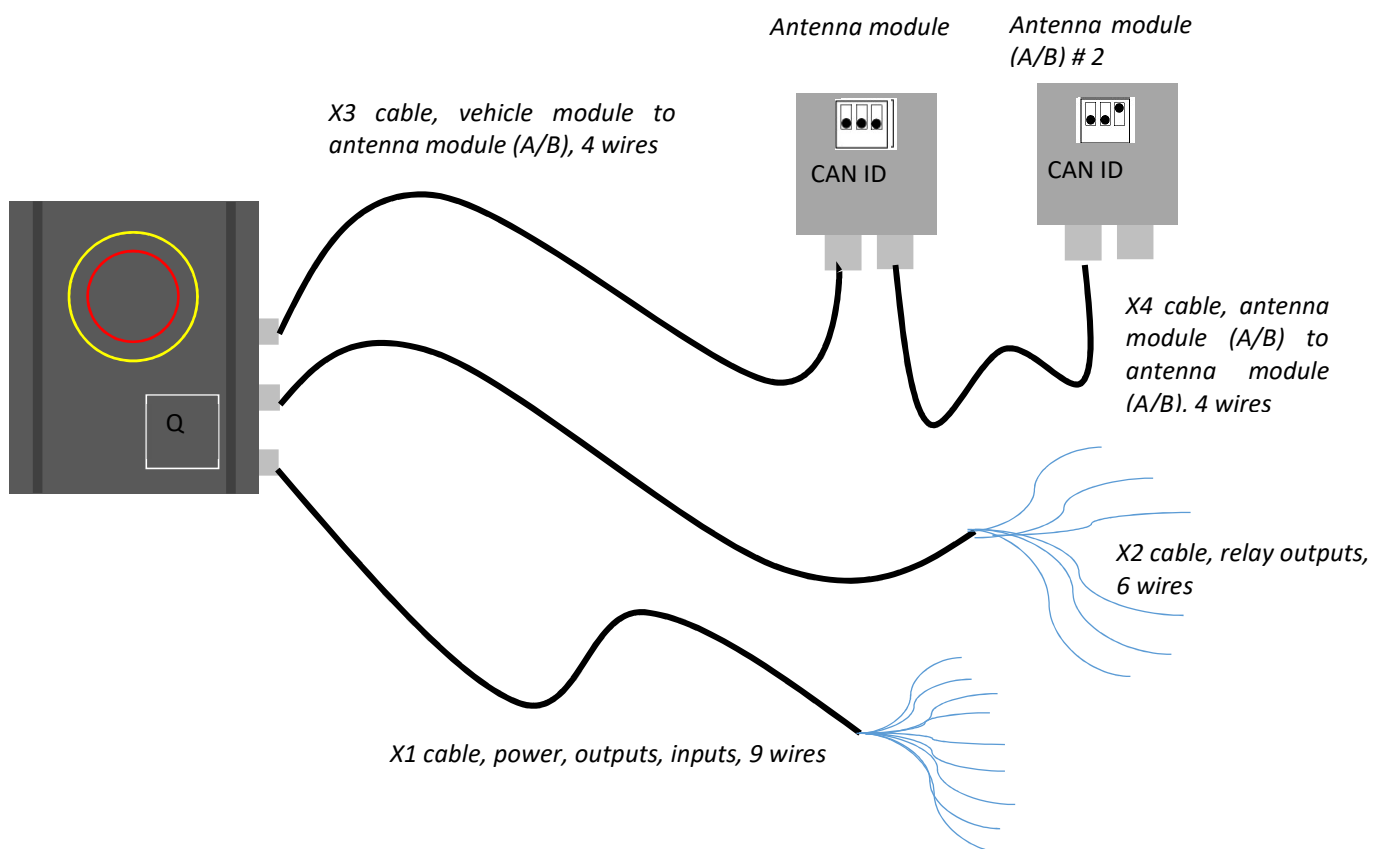


Figure 11. Wiring diagram of system elements

Each vehicle antenna module (A/B) and stationary antenna module (A/B) requires a unique hardware **CAN ID** to be set. The procedure is described in the previous chapter.

6.6.1 Assigning connection cables

Assigning the X1, 9 x 0.34 wire			
Signal designation	Wire color	Technical data	Comments
Power +	Red 	12 – 48 VDC, filtered (Tolerance: $\pm 10\%$)	Power supply voltage Apply voltage from a stabilized source only The device is equipped with a 2A fuse
Power -	Blue 	Power supply ground	Negative pole of power source

Assigning the X1, 9 x 0.34 wire				
Signal designation	Wire color		Technical data	Comments
DIN1 a*	Pink		Digital input 1, (5 - 48 VDC)	Connect to the operator seat sensor
DIN1 b*	Gray		Digital input 1, ground	Reference voltage for the seat sensor signal
DIN2 a	Yellow		Digital input 2	Currently unused
DIN2 b	Green		Digital input 2, ground	Currently unused
OC1	Brown		Open collector type outputs 1 (OC1)	Configurable
OC2	White		Open collector type outputs 2 (OC2)	Configurable
OC CM	Black		Open collector type digital output, reference voltage	Common for OC1 and OC2 outputs

Table1. Identification of wires in X1 group

* Input logic may be reversed

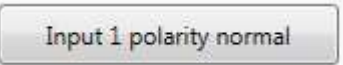
ELOshield Manager: Inputs	Description
	Voltage (5-48 VDC) on the DIN1 input signals that the operator sits behind the steering wheel. No voltage (0-2 VDC) on the DIN1 input means that the operator has left the seat.
	Voltage (5-48 VDC) on the DIN1 input signals that the operator has left the seat. No voltage (0-2 VDC) on the DIN1 input means that the operator sits behind the steering wheel.

Table 2.Reversal of input logic

Assigning the X2, 6 x 0.34 wire			
Signal designation	Wire color	Technical data	Comments
DOUT1 NO	Green 	Relay 1 Normally open contact	Connected with the breach of the inner (red) zone in the default configuration
DOUT1 NC	Brown 	Relay 1 Normally closed contact	Connected with the breach of the inner (red) zone in the default configuration
DOUT1 CM	Yellow 	Relay 1 Switching contact	Connected with the breach of the inner (red) zone in the default configuration
DOUT1 NO	Pink 	Relay 2 Normally open contact	Connected with the breach of the outer (yellow) zone in the default configuration
DOUT1 NC	Gray 	Relay 2 Normally closed contact	Connected with the breach of the outer (yellow) zone in the default configuration
DOUT1 CM	White 	Relay 2 Switching contact	Connected with the breach of the outer (yellow) zone in the default configuration

Table 3. Identification of wires in X2 group

6.6.2 Example connections in X1 group

Example 1: ELOshield is permanently activated.

- Pink and red wire are connected to the power supply voltage of +12 VDC ... +48 VDC
- Blue and gray wires are connected to the ground

Example 2: ELOshield is permanently activated (option two).

- Red wire is connected to the power supply voltage of +12 VDC ... +48 VDC
- Blue wire is connected to the ground
- Pink and gray wires are not connected (or connected to the ground)
- The input 1 logic is configured as "normal" in the software.

Example 3: ELOshield is active only when the operator is present.

- Red wire is connected to the power supply voltage of +12 VDC ... +48 VDC
- Blue wire is connected to the ground
- Pink wire is connected to the operator seat sensor
- Gray wire is connected to the seat sensor ground

7. Use and operation of the stationary module

The stationary module is used for detecting pedestrians and vehicles in circular and symmetric or custom shaped zones. Depending on its configuration, the device will control output signals or start an action of the vehicles when detecting an object within the range of the zone. The stationary set is most often used as a control device for industrial automatic control system.

The stationary set consists of a stationary module and antenna modules (A and/or B) connected to it. It is possible to integrate the stationary module and one stationary antenna module (A or B) into a single casing. Such solution decreases the number of devices and cables requiring installation works. In this variant, the proper positioning of the device is very important.

The stationary module should be installed in a location allowing for access to its terminals located in the lower part of the device. It is important to maintain visibility of the LEDs located on the front of the device as they inform about the device condition.



Figure 12. Picture of the stationary set with an optional signal column.

7.1 Warning and informing

Status LED:

- Off – the stationary module is switched off
- Blinking green – the stationary module is active
- Blinking red – the auto-test is active
- Continuous red – failure
- Blinking yellow intermittent – the muting is active

7.2 Inputs/outputs

The stationary module is equipped with 2 inputs which may be used to control the module operation, including activating the configurable actions.

Inputs:

- Input 1 – negated in the configuration application by default.
- Input 2.

Outputs:

- NC/NO relay 1 – activated by default when an object is present in zone 1.
- NC/NO relay 2 – activated by default when an object is present in zone 2.
- NC/NO relay 3 – activated by default when an object is present in zone 1
- NC/NO relay 4 – activated by default when an object is present in zone 2
- Output controlling external siren and light signal column
- Supply voltage – 24 VDC

Examples of input use:

- Optical sensor for detecting objects not equipped with ELOshield

Examples of output use:

- Alarm siren control
- Rotary gate control
- Entrance gate control
- Visual signal control
- Device stops

7.3 Zones

The shape of the zone is closely dependent on the device configuration and the number of installed antenna modules (A). Stationary antenna modules (B) connected to a stationary module can only be detected as a point by an antenna module (A) – no zone configuration possible.

Stationary antenna modules (A) can be configured:

- 1 vehicle antenna modules (A) – circular zone.
- 2 vehicle antenna modules (A) – combination of circular zones, symmetric zone.
- 3 or 4 vehicle antenna modules (A) – combination of circular zones and custom shaped zones. Custom shaped zones allow for establishing a precise position of the detected object. System with 4 vehicle antenna modules (A) is recommended for large vehicles.

7.4 Mechanical installation

Stationary module must be installed to the wall with attached DIN-rail (screws not included) in a safe area. Please slide the stationary module sideways onto the DIN-rail – don't press it onto the rail, this will cause damage. Power supply 110/230 VAC can be plugged into a power outlet or permanently connected.

7.4.1 Stationary antenna modules (A)

Stationary antenna modules (A) allow for generating stationary protective zones (circular, symmetric or customized) in locations which are particularly hazardous or intended for control using ELOshield (e.g. crossings, gates, areas where people and vehicles operate at the same time, etc.). The antenna module (A) allows for detecting people equipped with pedestrian modules and vehicles equipped with vehicle modules.

Depending on the required size and shape of the stationary zone, up to four antenna modules (A) should be installed. The devices should be installed with the following guidelines considered:

- Antenna modules (A) should be installed in a visible location far away from large metal obstacles which may obscure signal emission. The best place to install them is a location from which the entire protected zone can be seen.
- An optimum height of installation is as close as possible to the height at which the antenna modules (B) are installed on vehicles. If there are a lot of obstacles at this height (e.g. pallets with goods), the device may be installed higher.
- The antenna module (A) should be installed vertically so that the cable connections are facing the floor.
- The antenna modules are delivered with an adjustable bracket, which must be screwed to the wall, pillar or ceiling (screws are not included in scope of delivery), or, alternatively attached with a magnet (available as separate accessory item) to steel supports.
- If circular zones are to be used in a given location, it should be noted that they are arranged concentrically around the antennas.
- If symmetric zones are to be used in a given location, it should be noted that the line connecting the antenna module (A) is at the same time the symmetry axis of the symmetric zone.
- If custom shaped zones are to be used in a given location, it is best to install the antenna modules (A) so that the distances between them are similar and equal to 5 to 15 m [16 to 49 ft]. Smaller distances between the antenna modules (A) may have a negative impact on the precision of establishing the position of the detected object.
- The optimum layout has an outline of an equilateral triangle.
- If zones other than circular zones are used (symmetric or custom shaped), it is best to position the antenna modules (A) so that the target zone is located in the space between them.

Stationary antenna modules (A) must be equipped with the device type selection jumper (station).

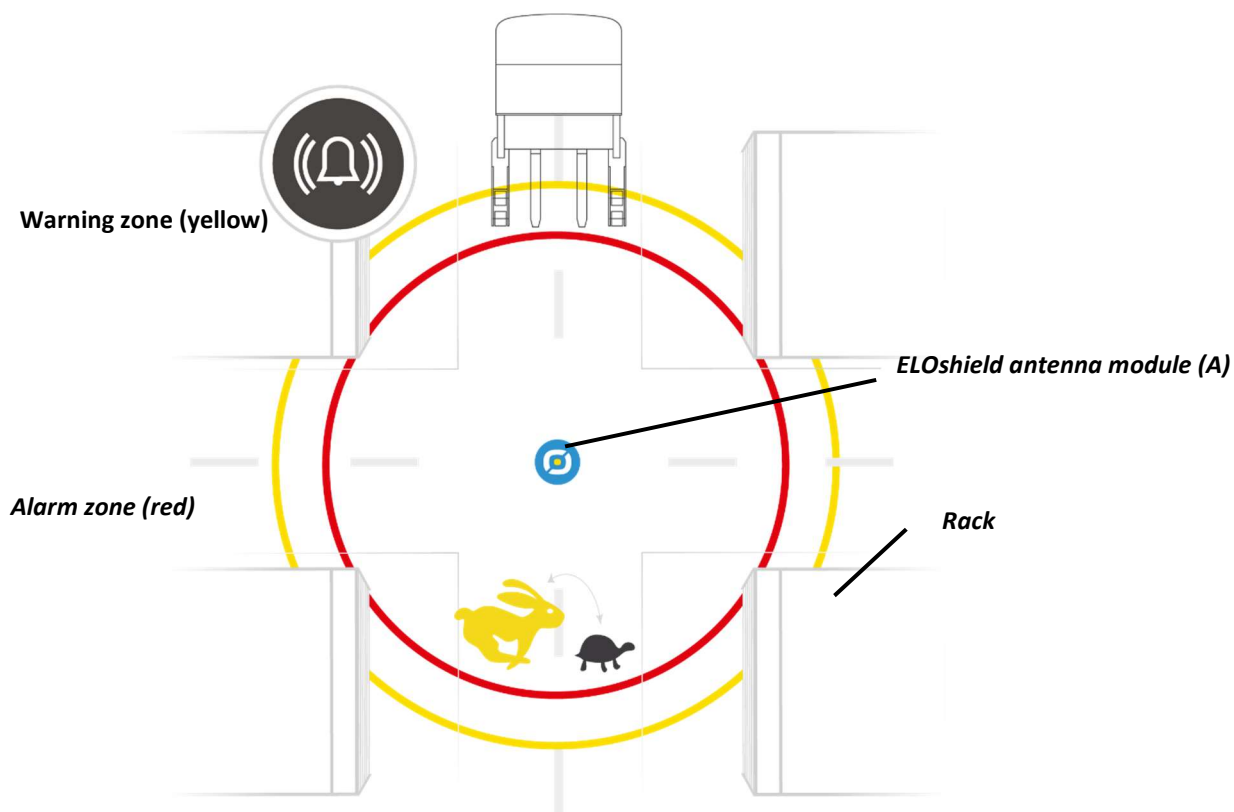


Figure 13. Impact of the arrangement of antenna modules (A) on the shape of the zone covering a crossing: circular zones (standard).

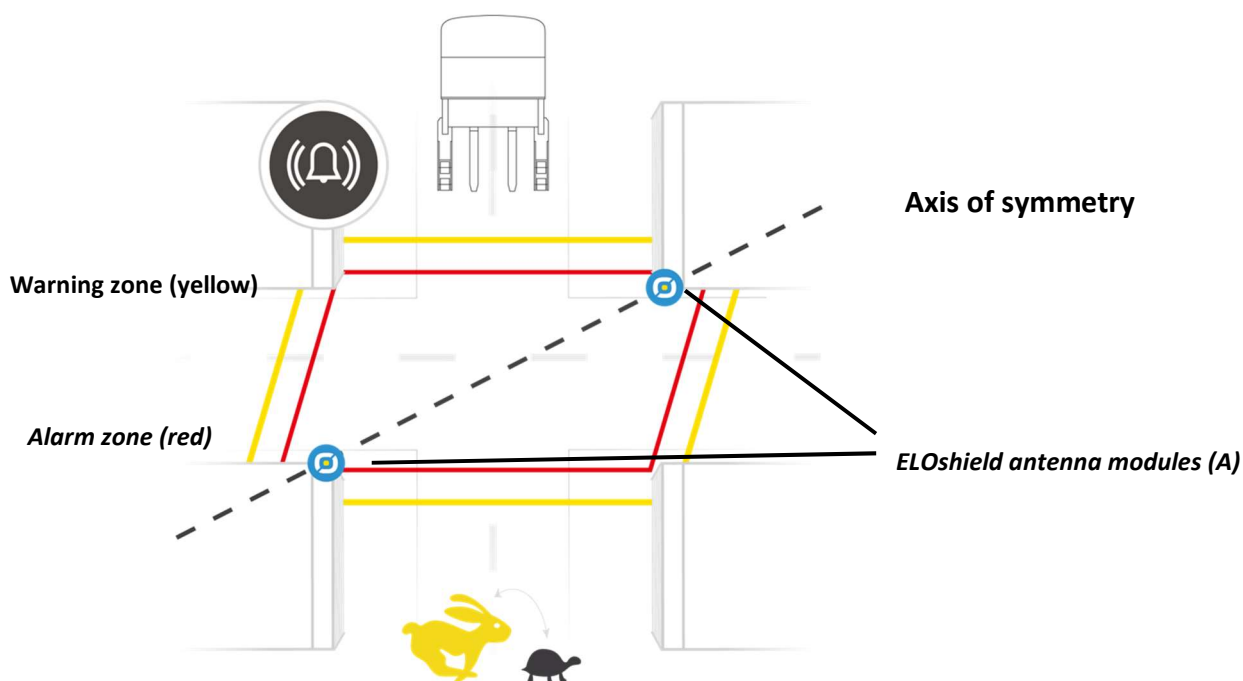


Figure 14. Impact of the arrangement of antenna modules (A) on the shape of the zone covering a crossing: simplified zones (example – the shape and size of the zone is configurable).

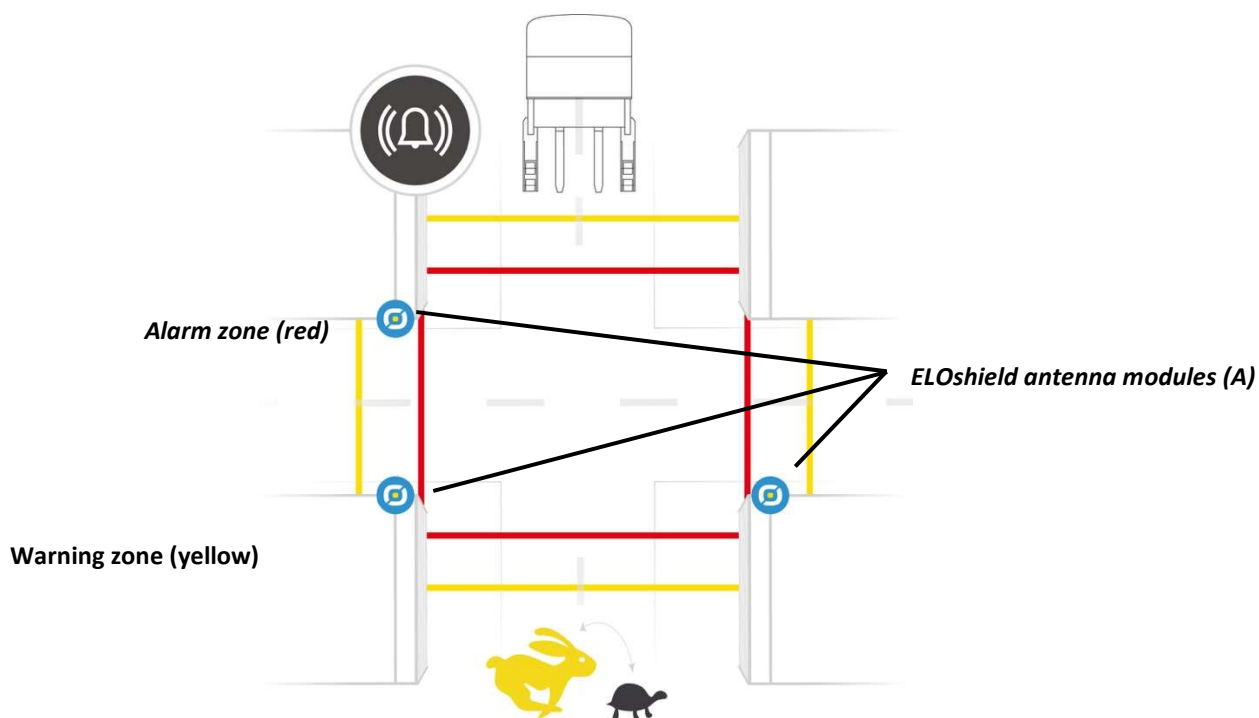


Figure 15. Impact of the arrangement of antenna modules (A) on the shape of the zone covering a crossing: custom shaped zones (example – the shape and size of the zone is configurable).



Figure 16. Antenna module (A) with the cover removed, the switch marked in red provided to set the CAN ID address and the SB select jumper marked in blue.

All antenna modules (A) connected to the stationary set must have the SB select jumper installed.

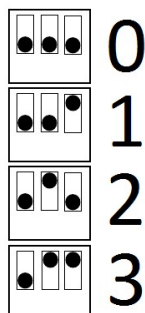
The stationary module is connected with the antenna modules (A) using the CAN bus. In order to make connection, the unique CAN ID address should be correctly configured in each of the antenna modules (A). In order to do so, the cover should be removed by unscrewing 4 bolts, the unique address should be set in the switch and the cover should be closed.

NOTICE

Any changes may only be carried out when the device is switched off.

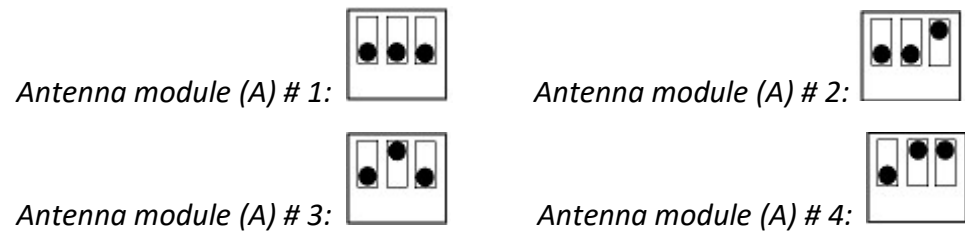
	 CAUTION Beware of electrical voltage and heat! Touching live parts can result in injuries. Also, a short circuit can occur which causes components to be heated. This can lead to injuries. • The power supply must be disconnected when working on electrical components. • Metal objects such as rings or watches must be removed beforehand. • Connection, testing and measuring work on electrical parts may only be carried out by a qualified electrician. • If the electrical parts are faulty or damaged, turn off the electrical power supply immediately and initiate repair.
--	---

The subsequent stationary antenna modules (A) should have consecutive addresses from the 0-3 range set as in the example below:



- The first switch must always be set in its lower position. As in the above example. Otherwise, the modules will report an error.

The example of correct configuration of the panel with 4 antenna modules (A):



The stationary antenna module (A) is equipped with 2 LEDs:

- Status LED (STATUS) – blinks in green when the device is active
- Error LED (ERROR) – lights in red when the device reports an error

Possible error causes:

- Duplicated CAN ID address
- A given CAN ID is not configured in the stationary module
- Problems with the cable resulting in lack of communication with the stationary module
- Extreme left CAN ID switch in the upper position
- No "Station." select jumper

7.4.2 Stationary antenna module (B)

The antenna module (B) equipped with an operating mode selection jumper operates as a stationary antenna module (B). Contrary to the stationary antenna module (A), it does not create its own detection zones but may be detected by vehicles equipped with vehicle antenna modules (A).

The stationary antenna module (B) is installed and configured identically as any other antenna – it must have a consecutive CAN ID address from the 0-3 range set and it should be remembered that CAN ID in the antenna is not in conflict with the CAN ID set in the stationary module. For example, one antenna with CAN ID = 0 and one stationary module also with CAN ID = 0 may be present in the system. Maximum 4 antenna modules (A) and 4 antenna modules (B) may be installed in the system.



Figure 17. Stationary antenna module (B) with the cover taken off. Marked in red is the switch used to set the CAN ID address. Also marked, in blue, is the link used to set its operation mode as a vehicle antenna module (B) or stationary antenna module (B).

The vehicle/stationary antenna module (B) is provided to select the operating mode using the jumper marked with a blue circle in the above figure. The jumper is set to determine operation in the stationary antenna module (B) mode and removed to switch to operate as the vehicle antenna module (B). The difference between the modes is that different IDs are sent, and therefore the antenna modules (B) are capable of differentiating between a stationary device and a vehicle device.

ELOshield ✓ ● ⚠ A ELOshield ✓ ● ⚠ B		
Without jumper	Vehicle antenna module (A)	Vehicle antenna module (B) – will be seen as vehicle object by stationary antenna modules (A) and vehicle antenna modules (A)
With jumper	Stationary antenna module (A)	Stationary antenna module (B) – will be seen as stationary object by vehicle antenna modules (A) and stationary antenna modules (A)

7.4.3 Example of installed antenna modules (A/B)



Antenna module with bracket.

Example of how it shouldn't be done:
horizontally mounted on metal sheet

7.5 Electrical installation

	DANGER Electrical voltage hazard. Touching live parts can result in death. Damage to insulation or individual components can be life-threatening. • The power supply must be disconnected when working on electrical components. • Metal objects such as rings or watches must be removed beforehand. • Connection, testing and measuring work on electrical parts may only be carried out by a qualified electrician. • If the electrical parts are faulty or damaged, turn off the electrical power supply immediately and initiate repair. • The regulations of the local energy supplier must be complied with.
---	--

In order to access the power supply terminals and stationary module inputs/outputs, unscrew the two bolts blocking the access to the terminal section under the stationary module front.

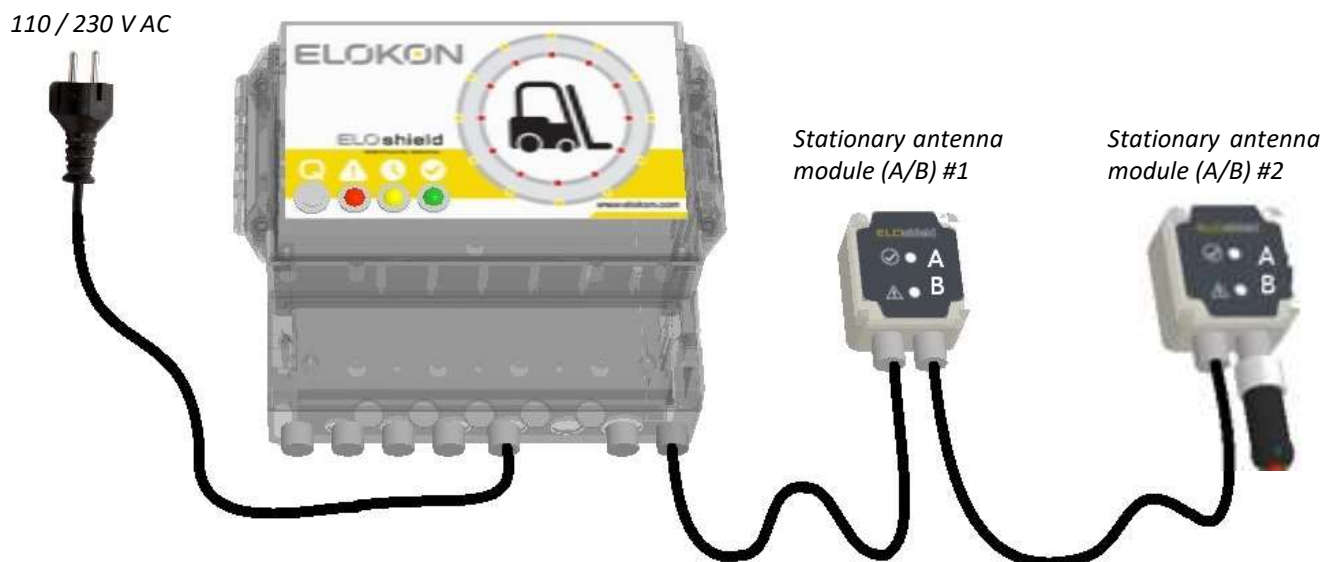


Figure 18. Circuit diagram of the system components

Each antenna module (A/B) requires a unique hardware **CAN ID** to be set. The procedure is described in the previous chapter.



Power Supply

Antenna port 1

Antenna port 2

Communication port RS 232

Cable glands for connection of relay 1-4

7.5.1 Connecting the power supply

The stationary module requires power supply from the 110 V / 230 V alternating voltage source or the stabilized 24 V direct voltage source. The selected voltage source shall be connected to the correct screw connection on the right side of the device.

110 V / 230 VAC power supply		24 VDC power supply	
Connector marking	Connect to	Connector marking	Connect to
AC L	Network phase conductor	AC L	Not connected
AC N	Network neutral conductor	AC N	Not connected
PE	Protective conductor (earthing)	PE	Protective conductor (earthing) or not connected
DC INPUT 24 V	Internal power supply unit (connected by default)	DC INPUT 24 V	Positive pole of the power supply source
DC INPUT GND	Internal power supply unit (connected by default)	DC INPUT GND	Negative pole of the power supply source

Table 4. Identification of power connectors

7.5.2 Switching the stationary module on/off

The key on the right side of the stationary module is used to switch on/off the stationary module.

7.5.3 Connecting inputs and outputs

Input and output signals should be connected using cable glands located in the lower part of the stationary module. Individual signals should be connected to spring – connectors on the left side of the stationary module.

Assignment of signal connectors		
Connector marking	Signal	Comments
COLUMN Z2	Signal for breach of outer (yellow) zone	For connection of the dedicated light signal column
COLUMN Z1	Signal for breach of inner (red) zone	For connection of the dedicated light signal column
COLUMN BUZ	Siren	For connection of the dedicated siren element

Assignment of signal connectors		
Connector marking	Signal	Comments
COLUMN GND	Signal column ground	For connection of the dedicated light signal column
IN1 A	Digital input 1; contact a	Input reads as „1” if there is voltage of 5 – 48 VDC present on contacts a and b. Input reads as „0” if the voltage is 0 – 2 VDC.
IN1 B	Digital input 1; contact b	
IN2 A	Digital input 2; contact a	Input reads as „1” if there is voltage of 5 – 48 VDC present on contacts a and b. Input reads as „0” if the voltage is 0 – 2 VDC.
IN2 B	Digital input 2; contact b	
DC SOURCE 24V	24V DC power supply source	Max. load: 100 mA; with a resettable fuse
DC SOURCE GND	Power supply source – ground	
RS232 GND	Currently unused	
RS232 TX	Currently unused	
RS232 RX	Currently unused	
Relay 1 CM	Relay 1; change-over contact	230 VAC / 24 VDC, 4A max
Relay 1 NO	Relay 1; normally-open contact	
Relay 1 NC	Relay 1; normally-closed contact	
Relay 2 CM	Relay 2; change-over contact	230 VAC / 24 VDC, 4A max
Relay 2 NO	Relay 2; normally-open contact	

Assignment of signal connectors		
Connector marking	Signal	Comments
Relay 2 NC	Relay 2; normally-closed contact	
Relay 3 CM	Relay 3; change-over contact	230 VAC / 24 VDC, 4A max
Relay 3 NO	Relay 3; normally-open contact	
Relay 3 NC	Relay 3; normally-closed contact	
Relay 4 CM	Relay 4; change-over contact	230 VAC / 24 VDC, 4A max
Relay 4 NO	Relay 4; normally-open contact	
Relay 4 NC	Relay 4; normally-closed contact	

Table 5. Identification of input and output signals

7.5.4 CAN bus and terminator

Stationary antenna modules (A) and stationary antenna modules (B) must be connected to the stationary module using the CAN bus. In the lower part of the device there are two connectors allowing for connecting these modules. The order in which the antenna modules (A/B) are connected is irrelevant. ELOKON offers CAN cables of multiple lengths: stationary module to antenna module (A/B) cable of 4 m and 15 m and antenna module (A/B) to antenna module (A/B) cable of 4 m and 30 m. The cables may be connected in a row to extend the distance. However, it should be noted that in order to correct data transmission to be stable, the stationary module and the most distant antenna module (A/B) must not be further apart than 80 m.

Use the CAN terminator on the last antenna in the row if distance to last antenna is more than 50 m.



Figure 19. CAN terminator

Examples of stationary device connection variants with and without the CAN terminator are depicted below:

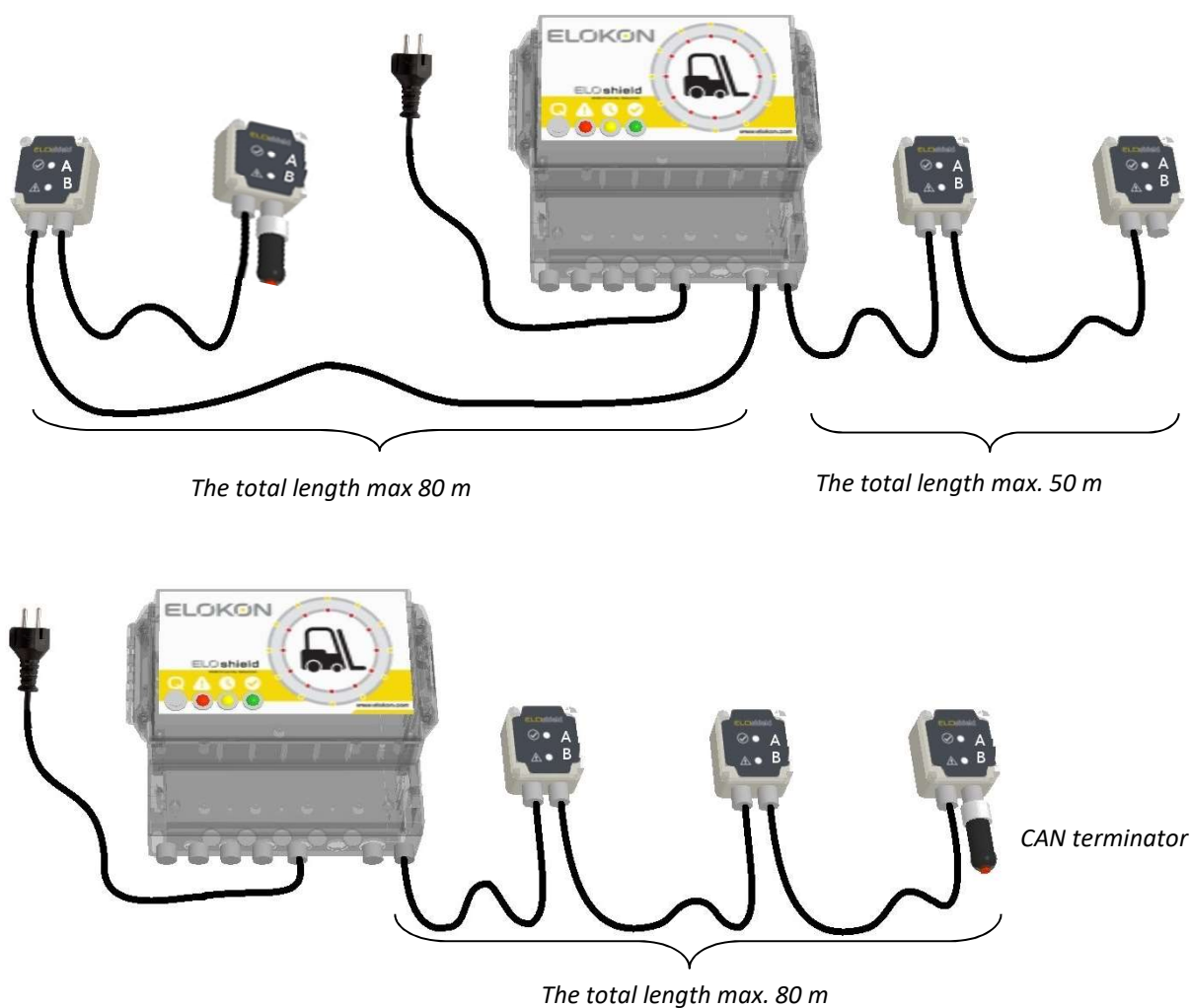


Figure 20. Example device connections

7.6 Verification module

The verification module is a special version of the stationary module. Its task is to verify the correct operation of the pedestrian modules. The green light on the device front signals that the pedestrian module was detected correctly. It is possible to use the relay output to integrate the device with an access control system, e.g. a rotary gate or an optical sensor. This way only employees with a proper working pedestrian module will have the possibility to enter the facility.



8. System configuration

The system should be configured by means of **ELOshield Manager** software. It should be installed by double clicking the *setup.exe* file and following the installer guidelines.

8.1 Minimum requirements:

- PC or laptop with Windows Vista / Windows 7 / Windows 8 / Windows 10
- 2 GB of RAM memory

8.2 Necessary cables

The pedestrian module and Vehicle/Stationary module use different USB cables for communication with the computer.

- Standard microUSB cable for the pedestrian module
- Dedicated USB cable for the vehicle/stationary module

8.3 Starting the application

The ELOshield software is not included in any ELOshield sets and must be purchased separately.

The **ELOshield Manager** application should be run from the START menu.

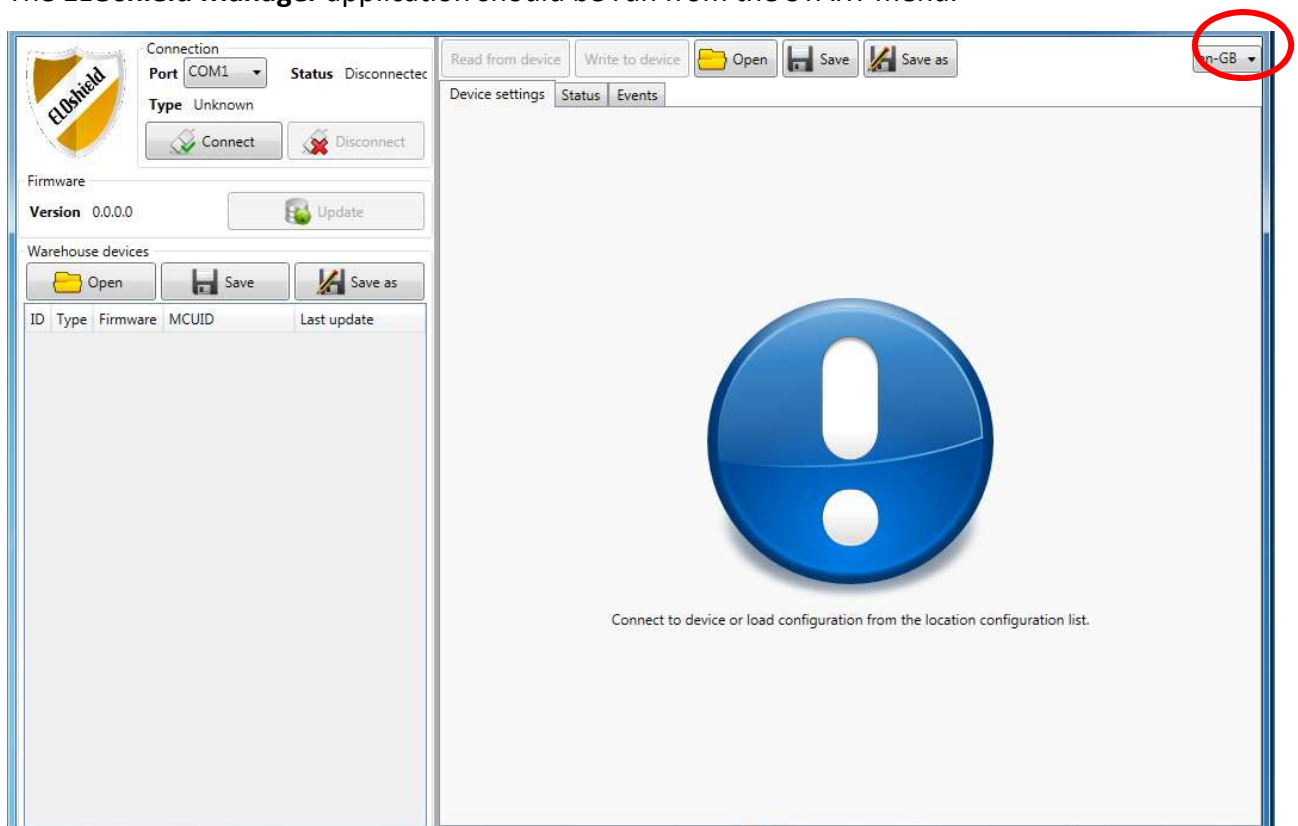


Figure 21 The home screen of the application with the language selection list highlighted.

The application language is selected in the right top corner.

8.4 Establishing the connection

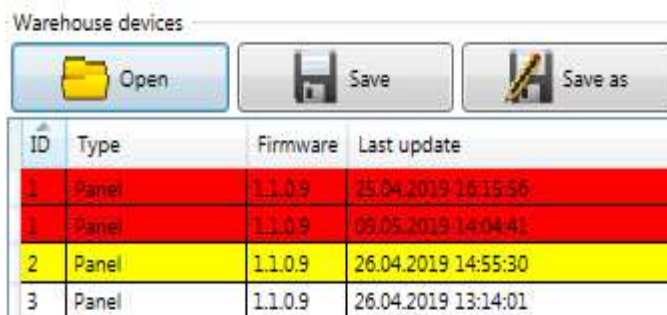
The serial connection control panel is provided in the top left section of the application panel.

To establish the connection, select the COM port from the list of available ports, and then press the **Connect** button.

If a corresponding ELOshield device (a pedestrian module, a stationary module or a vehicle module) is connected to the port, the connection status changes to **Connected**. Otherwise, the connection will not be established.

8.5 Saving current configuration of warehouses

Warehouse devices



ID	Type	Firmware	Last update
1	Panel	1.1.0.9	25.04.2019 16:15:56
1	Panel	1.1.0.9	09.05.2019 14:04:41
2	Panel	1.1.0.9	26.04.2019 14:55:30
3	Panel	1.1.0.9	26.04.2019 13:14:01

The connected device will be automatically added to the list of devices on the left panel of the main application window.

The entire list is an overview of all used devices in one warehouse and marks double used IDs and other failures in red as faulty.

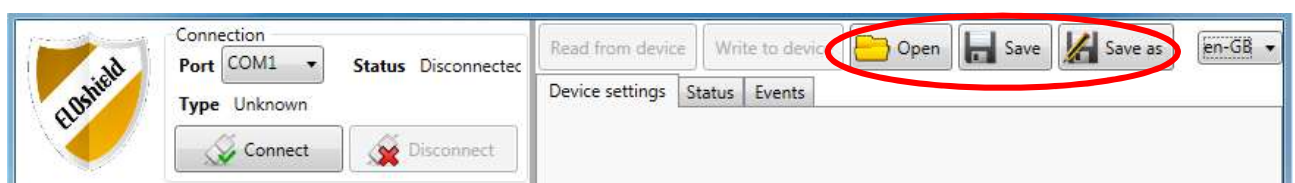
The list of devices including their configurations is strongly recommended to be saved to the indicated *.elsx* file. To do so, press the **Save As...** button above the list of devices. Such a file may be uploaded by pressing the **Open** file and pointing to the *.elsx* file.

8.6 Transferring settings from/to the device

In order to send the configuration, the device must be connected to the computer and application.

All configuration parameters will be saved to the device by pressing the **Send to the Device** button and will be uploaded from the device by pressing the **Read from the Device** button.

8.7 Saving the current configuration of single devices



The current configuration may be saved to the *.els* file. To do so, press the **Save As...** button and indicate a location and filename on the hard drive.

Such saved settings may be uploaded again to facilitate the configuration process of multiple devices. The configuration may be read from an *.els* file by pressing the **Open** button and pointing a corresponding file.

8.8 Setting up the stationary module / vehicle module

The stationary/vehicle module is a device identified depending on antenna modules (A and/or B) connected to it. Each set with a stationary/vehicle module is set up similarly.

Device settings

Custom shape zones

Actions config

Status

Events

Main parameters

Machine ID 245

Zones

Zone 1 Radius [cm]:

300

Zone 2 Radius [cm]:

600

Muting distance [cm]:

150

Internal zones ☐

Ranging devices

Settings

Inputs/outputs

Input 1 polarity normal

Input 2 polarity inverted

Outputs config

Indication settings

Common

LEDs intensity

50 %

Zone 1

Sound intensity

50 %

Sound buzz period

100 ms

Red LED blink period

50 ms

Reaction for

Zone 2

Sound intensity

50 %

Sound buzz period

300 ms

Yellow LED blink period

100 ms

Reaction for

Muting

Muting mode enabled

☒

Muting mode duration

0 h 00 m 30 s

Advanced settings

Auto test

☐

Ranging test

☐

Actions config

Configurable bits LSB

0

1

2

3

4

5

6

7

ELOshield

Rev. 20

09.03.2020

Page 54 of 85

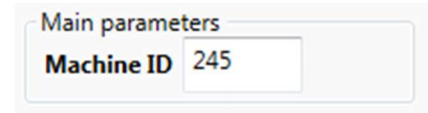
Configurable settings for the vehicle/stationary module:

Device settings tab

- Machine ID

For the vehicle/stationary module: Machine ID 1 to 253

- **Important: Each vehicle/stationary module present in the plant must have a different machine ID.**



Main parameters
Machine ID 245

- Zone 1 (alarm) radius – the first zone radius expressed in centimeters (min. 100 cm, max. 2,500 cm)
- Zone 2 (warning) radius – the second zone radius expressed in centimeters (min. zone 1 radius, max. 2,500 cm)
- Driver's muting zone – the driver's muting zone radius expressed in centimeters

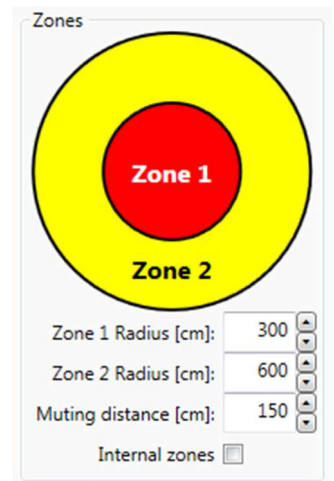
For the panel with the stationary module:

min. 0 cm, max. 0 cm

For other configurations:

min. 0 cm, max. Zone 1 radius

Driver's muting zone is to prevent ELOshield vehicle set from being triggered by the driver's pedestrian module. Once the operator enters the vehicle, he should press **Q** button on his pedestrian module to switch it to the driver's muting mode. From this moment on, driver's pedestrian module becomes invisible to other vehicles. If the operator exits his vehicle and moves outside the driver's muting distance, his pedestrian module returns to normal operation automatically.



Zones

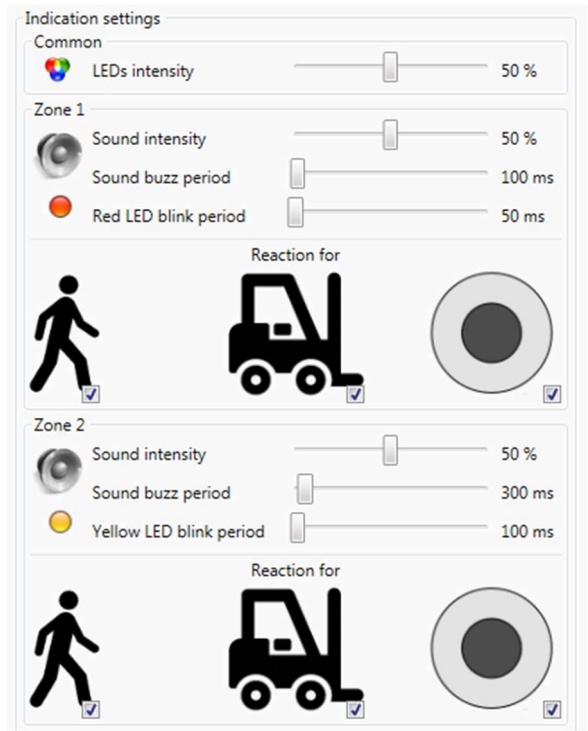
Zone 1 Radius [cm]: 300

Zone 2 Radius [cm]: 600

Muting distance [cm]: 150

Internal zones ☐

- Internal zones – when inner zones are selected, the panel used for signaling the breached zones uses its own configuration for zones i.e. 300 cm and 600 cm, as shown in the picture above. When inner zones are off, the panel works based on information about breached zones from other devices. For example, if we want the vehicle to react to the zones defined on the stationary panel, inner zones cannot be selected.
- LED intensity – indicates the light intensity in percentage as generated by LEDs on the panel.
- Zone 1 (alarm) sound intensity – indicates the sound signal loudness in percentage as generated by the panel, when the module is in the alarm zone.
- Zone 2 (warning) sound intensity – indicates the sound signal loudness in percentage as generated by the panel, when the module is in the warning zone.
- First zone sound pulsation – indicates the single sound duration as generated by the stationary/vehicle module, when the module is in the alarm zone.
- Second zone sound pulsation – indicates the single sound duration as generated by the stationary/vehicle module, when the module is in the warning zone.
- First zone blinking frequency – indicates the red LEDs blinking frequency, when the device is in the alarm zone.
- Second zone blinking frequency – indicates the yellow LEDs blinking frequency, when the device is in the warning zone.
- First zone stationary/vehicle module sensitivity – indicates device types, which will interact with the stationary/vehicle module in the alarm zone.
- Second zone stationary/vehicle module sensitivity – indicates device types, which will interact with the stationary/vehicle module in the warning zone.
- **Muting mode** – this is a mode, in which the stationary/vehicle module does not interact with other devices. It is intended for long term muting and therefore it is manually configured.
 - Switching on/off the possibility to activate the muting mode
 - Muting mode duration – specifies the time during which the stationary/vehicle module will not interact with other devices.



- **Switching on/off the autotest mode**

The LEDs, display and acoustic alarm are switched on during the autotest. The test is completed by pressing the Q button. The autotest is signaled by the blinking red status LED. It is used to check the device signaling system for correct operation.

- **Switching on/off the range test mode**

During the range test, the correctness of the detection of the other ELOshield devices is additionally tested. The range test is signaled by the blinking red status LED and the alarm and safety zone LEDs. The range test is completed, when the pedestrian module is located within any antenna module (A) zone.

- **Configurable bits LSB** – Settings for additional information sent to devices reacting to the stationary/vehicle module. It is possible to define detailed actions of the stationary/vehicle modules in the case of detecting a device with set configuration bits. By using the bits, it is possible to configure groups of devices which may, e.g., open a specific gate (by means of the stationary set).

- **Input settings**

- Negation of the first input
- Negation of the second input

- **Output settings** – contains control settings for open collector (OC) outputs.

- Open collector output 1 (OC1)
- Open collector output 2 (OC2)

Outputs configuration			
Name	OFFTime	ON Time	Signal level
Open Collector Zone 1	ON 50 ms		100 %
Open Collector Zone 2	ON 50 ms		100 %

Configurable output settings:

- Settings of periodicity of the signal generated at the output: activation and deactivation time. A full signal period is the sum of activation and deactivation time.
- The signal level is the percentage of the signal intensity at the output.

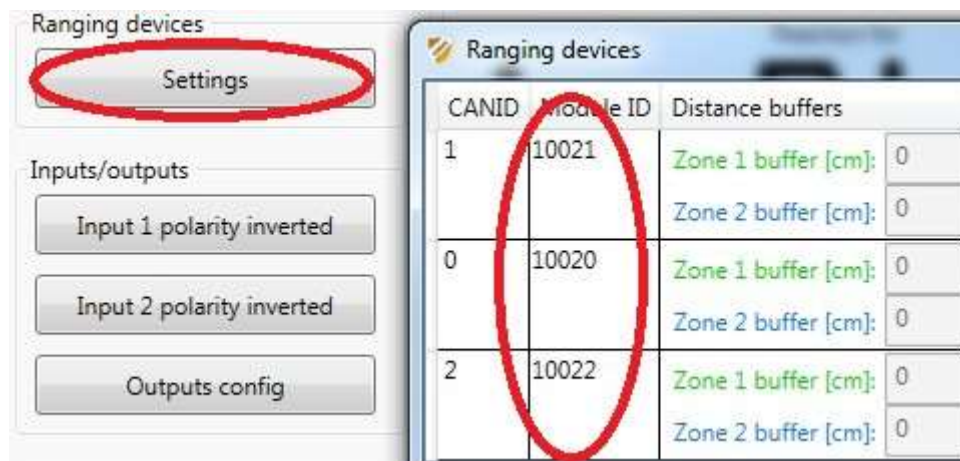
- **Settings of the antenna modules (A and B) connected to the stationary/vehicle module –** the list of configurable modules:

- Module ID

For the pedestrian module and antenna module (B): Module ID 0 to 499

For the antenna module (A): Module ID 10000 to 10253

Important: Each module present in the fleet must have a different module ID.



- Zone buffers (does not apply to the antenna modules (A)) – this is the additional distance, which adds to existing zones radiuses, in order to increase the detection range for selected devices (eg. new employees or visitors)
- Height of antenna modules (A/B) installation above the ground – this parameter should be set, when the vehicle antenna modules (A) operate at a different height than the stationary antenna modules (B).

Example:

(a vehicle module)	+	(a pedestrian module)	=	(distance)
Zone 1 radius: 700 cm	+	Zone 1 buffer: 100 cm	=	Zone 1: 800 cm
Zone 2 radius: 1,300 cm	+	Zone 2 buffer: 200 cm	=	Zone 2: 1,500 cm

8.9 Configuration of the pedestrian module

The pedestrian module is unambiguously identified by the application.

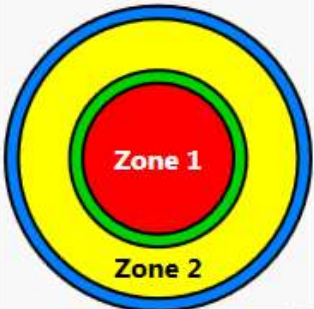
Device settings

Actions config

Status

Events

Zones



Zone 1 buffer [cm]:

0

Zone 2 buffer [cm]:

0

Ranging devices

Settings

Ranging test

Indication settings

Common

Reaction for


☒


☒

Zone 1

Sound intensity

100 %

Sound buzz period

400 ms

Vibration period

400 ms

Red LED blink period

100 ms

Zone 2

Sound intensity

100 %

Sound buzz period

1500 ms

Vibration period

1500 ms

Yellow LED blink period

100 ms

Muting

Muting mode enabled

☒

Muting mode duration

0 h 00 m 30 s

00:00:30

Actions config

Configurable bits LSB

0

1

2

3

4

5

6

7

Advanced settings

Power OFF locked

☐

Auto test

☐

Ranging test

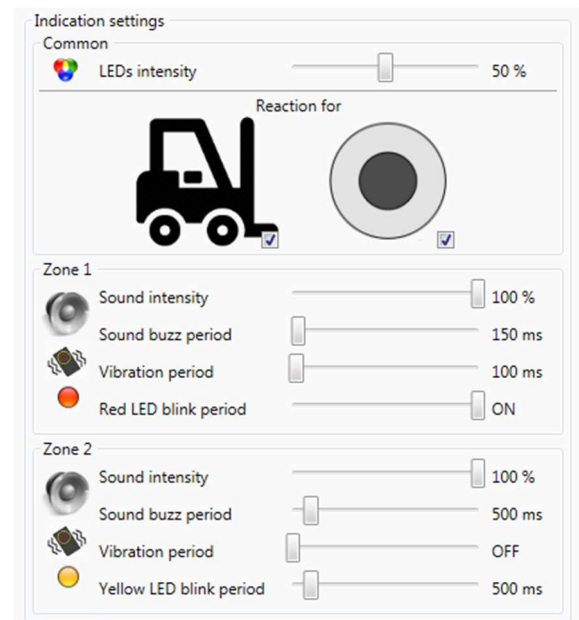
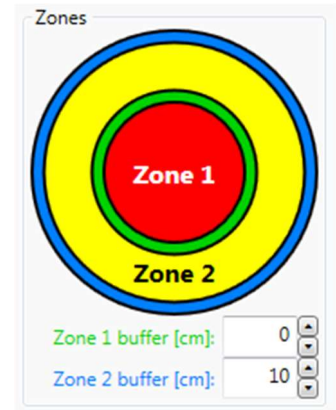
☐

Charge muting

☒

Signaling and zone settings

- Zone 1 (alarm) buffer – the first zone radius expressed in centimeters, by which alarm zone generated by antenna modules (A) is extended (min. 0 cm, max. 1,500 cm).
- Zone 2 (warning) buffer – the second zone radius expressed in centimeters, by which warning zone generated by antenna modules (A) is extended (min. 0 cm, max. 1,500 cm).
- LEDs brightness – indicates the light intensity in percentage as generated by LEDs.
- Signaling reactions to different types of devices: vehicle and stationary modules.
- First zone sound intensity – indicates the sound signal loudness in percentage as generated by the pedestrian module, when it is in the alarm zone.
- Second zone sound intensity – indicates the sound signal loudness in percentage as generated by the pedestrian module, when it is in the warning zone.
- First zone sound pulsation – indicates the single sound duration as generated by the pedestrian module, when it is in the alarm zone.
- Second zone sound pulsation – indicates the single sound duration as generated by the pedestrian module, when it is in the warning zone.
- First zone vibration rate – specifies the vibration rate of the pedestrian module, when it is in the alarm zone.
- Second zone vibration rate – specifies the vibration rate of the pedestrian module, when it is in the warning zone.
- First zone blinking frequency – indicates the red LED blinking frequency, when the pedestrian module is in the alarm zone.
- Second zone blinking frequency – indicates the yellow LED blinking frequency, when the pedestrian module is in the warning zone.



- **Muting mode** – in this mode, the pedestrian module does not signal the proximity of an antenna module (A). This mode is activated by pressing the Q button.
 - The muting mode may be switched on and off
 - Muting mode duration

- **Configurable bits LSB** – Settings for additional information sent to devices reacting to the pedestrian module. It is possible to define detailed actions of the stationary/vehicle modules in the case of detecting a pedestrian module with set configuration bits. By using the bits, it is possible to configure groups of pedestrian modules which may, e.g., open a specific gate (controlled by a stationary set).

The screenshot shows a configuration window with three main sections:

- Muting:** Contains a checkbox for "Muting mode enabled" and a duration selector for "Muting mode duration" set to "0 h 00 m 00 s".
- Actions config:** Features a row of eight colored buttons labeled 0 through 7. Button 0 is green, while buttons 1 through 7 are red.
- Advanced settings:** Includes a gear icon and three checkboxes: "Power OFF locked", "Auto test", and "Ranging test".

- **Power OFF lock**– the pedestrian module cannot be switched off.

- **Switching on/off the autotest mode**

The LEDs, vibrations and acoustic alarm are switched on during the autotest. The test is completed by pressing the Q button. The autotest is signaled by the blinking red status LED. In the case of the pedestrian modules, an auto-test is performed each time it is started and after each charging (after disconnecting from a charger). An auto-test of the vehicle set is performed once every 24 hours when a driver is present (driver muting mode is active in the driver's pedestrian module).

- **Switching on/off the range test mode**

During the range test, the correctness of detection of other ELOshield devices in the system is verified. The range test is signaled by the blinking red status LED and the alarm and safety zone LEDs. The zone LED stops blinking, when an antenna module (A) appears in the pedestrian module zone. The range test is completed by pressing the Q button, when the pedestrian module is located within any antenna module (A) zone.

8.9.1 Pedestrian module detection ranges

The main detection range settings are configured in the vehicle module. Additional zones may be programmed in the pedestrian module, which then will be summed up with zones of the vehicle antenna module (A). It may be used to create different detection ranges for different pedestrian modules. The sum should not exceed 15 meters.

Example: An unexpected visitor does not know much about working conditions in the depository and threats posed by vehicles. In this case, greater detection zones may be used than standard zones adopted for experienced workers.

(a vehicle module)	+	(a pedestrian module)	=	(distance)
Zone 1 radius: 700 cm	+	Zone 1 buffer: 100 cm	=	Zone 1: 800 cm
Zone 2 radius: 1,300 cm	+	Zone 2 buffer: 200 cm	=	Zone 2: 1,500 cm

8.10 Circular, symmetric and custom shaped zones

The antenna modules (A) create zones around them with radius set in the configuration. However, if the circular zones do not meet the requirements, ELOshield allows for setting non-standard shapes of the zones. The non-standard zone shapes are divided into:

1. **Symmetric zones** – when 2 antenna modules (A) are connected
2. **Custom shaped zones** – when 3 or 4 antenna modules (A) are connected

Symmetric zones are configurable and may be set independently for each type of device located nearby. ELOshield locates the pedestrian/vehicle/stationary modules and determines whether they are inside the area specified in the configuration. If a device is in the warning or alarm zone, procedures identical to those used in the case of standard (circular) zones are started.

The active symmetric zones replace the default circular zones. Their outline is a polygon defined during the configuration.

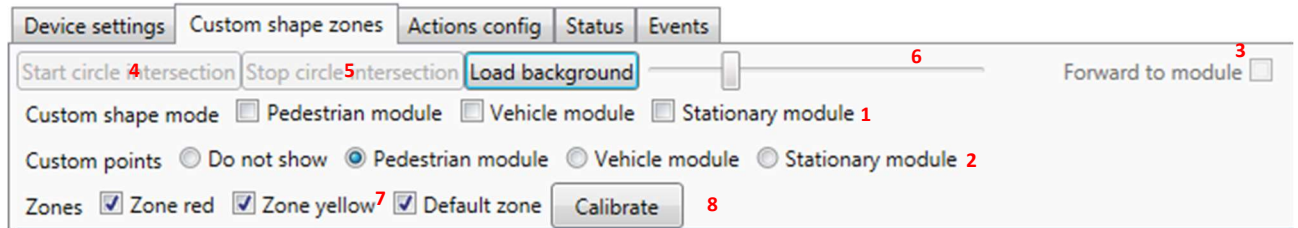
In the case of the **symmetric zones**, the opposite pairs of zone apexes are set symmetric in relation to the line connecting both antennas as the panel is unable to determine on which side of the symmetry axis the device is located.

Custom shaped zones are able to determine the location of the device so the zone created may have a variety of individually shaped zones, even non-symmetric.

ELOshield allows the following configurations of the symmetric and custom shaped zones:

- Creating different zone shapes for each type of module: pedestrian/vehicle/stationary module (2),
- Use of the symmetric/custom shaped zones only for selected types of module: pedestrian/vehicle/stationary module (1),

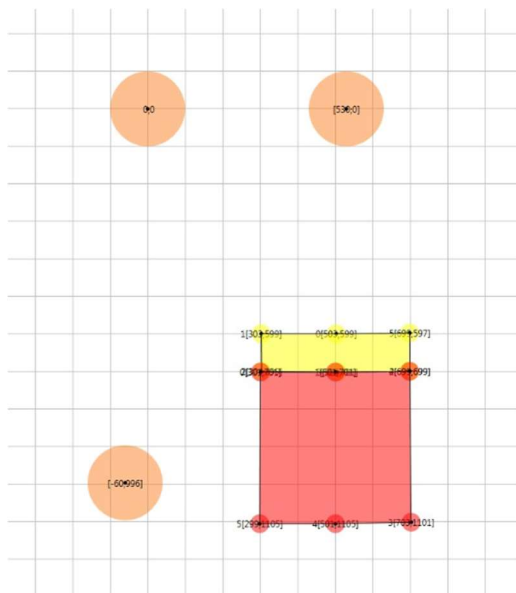
Activating and deactivating transmission of the zones to the detected modules (3) – this option requires the use of the symmetric/custom shaped zone on the detected object. This allows for precise detection of the object in the location where a specified zone is established. This is useful in the case of vehicles which have their own zones which may be completely different than the stationary module zones. In such case the vehicle no longer uses its zone and starts using a zone provided to it by devices with selected option No. (3).



Zone editor functions:

- Layout scaling (6),
- Switching the editing mode between the zones of the pedestrian/vehicle/stationary modules (2),
- Filtering the display of red zone, yellow zone and antenna module (A) positions with their created default zones (7),
- Import of zone apexes from zone configurations for other module types (menu options activated by right clicking),
- Starting (4)/ending (5) the presentation of module locations in the layout. Available only when the device has an active connection with the application.
- Automatic calibration of antenna module (A) positions (8).

Using the zone editor:



The figure shows an example configuration of the zones on a 100 cm x 100 cm grid.

The displayed positions of the antenna modules (A) and the distances between them are expressed in centimeters.

$$121 = 121\text{cm} = 1,21\text{m}$$

$$1300 = 1300\text{cm} = 13,00\text{m}$$

The device uses 3-4 antenna modules (A). The first antenna module (A) (with coordinates of [0, 0]) establishes the center of the coordinate system. Other antennas may be moved using the mouse.

The zones are positioned in relation to the first antenna module (A). In order to modify the zone, a proper apex should be moved and dropped in the required location in the layout.

When configuring the zones, special attention should be paid to correctly reflect the antenna module (A) positions in the field since they are responsible for correct operation of the zones. It is best to use the calibration function that is described in the next chapter.

NOTE: The highest precision in establishing the module location in the zone is obtained by placing the antenna modules (A) equidistant to one another. The optimum distance between the antenna modules (A) is 15 m.

8.11 Automatic calibration

The automatic calibration function allows for preliminary configuration of the antenna module (A) positions.

➤ Using the calibration function will overwrite the previous antenna setting.

To calibrate the antenna module (A) positions, one reliable and operating pedestrian module should be placed as close as possible to each antenna module (A). Then, the **Calibrate** button should be pressed and readiness for calibration should be confirmed.

It is necessary to wait approx. 10 seconds until the application collects the required number of measurements.

After this time the complete configuration should be sent to the device.

From this moment the system should be able to establish approximate locations of the antenna modules (A). Final manual calibration should be performed. To do so, the pedestrian/ or vehicle module should be used, their positions should be changed and the positions of antenna modules (A) should be moved so that all circles cross each other exactly at the locations of the pedestrian/vehicle module.

8.12 Actions

Actions are used to define non-standard actions of the device. With the use of actions, several logical dependencies may be combined into one result which will trigger a proper reaction of the device (e.g. activation of a relay). One action may have up to four arguments. Relations between the arguments are described using conjunction (and), alternative (or) equality or non-equality. The result of one action may be used as an input argument for another action. The stationary, the verification and the vehicle module has a total of 32 actions. An action is activated by marking the "Active" field.

NOTICE

Configuring the actions should only be performed by qualified personnel. This is a complicated procedure that requires a very good knowledge of the system.

8.12.1 Stationary, verification- and vehicle module action arguments

The action arguments may have two logical values:

- 0 – if the argument condition is not met
- 1 – if the argument condition is met

Arguments may have parameters. The description of individual arguments and their parameters can be found below:

Argument name	Parameter 1	Parameter 2	Result = 0	Result = 1	Comments
False			Always		
True				Always	
If number of objects in Zone 1	Type of object in the zone	Minimum number of objects in the zone	Number of objects in the zone lower than parameter 2	Number of objects in the zone greater than parameter 2	
If number of objects in Zone 2	Type of object in the zone	Minimum number of objects in the zone	Number of objects in the zone lower than parameter 2	Number of objects in the zone greater than parameter 2	
If input 1 state			Input status low	Input status high	Digital input status may be negated
If input 2 state			Input status low	Input status high	Digital input status may be negated
If muting	Mode 1/2/3		When the selected mode is inactive	When the selected mode is active	
If variable	Status variable number		When the status variable has value 0	When the status variable has value 1	Status variable stores the result of another action
If 1s timer counter expired	Counter number		When the set counter time has not expired	When the set counter time has expired	Counter time is set by the action result
If 5ms timer counter expired	Counter number		When the set counter time has not expired	When the set counter time has expired	Counter time is set by the action result
If configurable bits	Type of device setting the bit. Additionally, it is possible to select device	Bit number	When bit value = 0	When bit value = 1	The MSB configurable bits are set by the action results, LSB

Argument name	Parameter 1	Parameter 2	Result = 0	Result = 1	Comments
	relations in the zone and the set bit.				bits are assigned to a given device and are configured in the settings tab.
If device in error mode			When the device works correctly.	When the device does not work correctly.	

NOTE: The parameter "Any Module" or "All Modules" means pedestrian modules or antenna modules (B).

8.12.2 Stationary, verification- and vehicle module action results

The action result may take two values:

- 0 – if logical dependencies between all arguments of the action are not met.
- 1 – if logical dependencies between all arguments of the action are met.

The description of individual functions of the results and their parameters can be found below:

Name of the result function	Parameter 1	Parameter 2	Comments
Relay 1 state set to Relay 2 state set to Relay 3(OC1) state set to Relay 4(OC1) state set to	On		Set the output when the action result = 1
Relay 1 state set to Relay 2 state set to Relay 3(OC1) state set to Relay 4(OC1) state set to	Off		Clear the output when the action result = 1
Relay 1 state set to Relay 2 state set to Relay 3(OC1) state set to Relay 4(OC1) state set to	Function result		Output set when the action result = 1 Clear the output when the action result = 0
Deactivate antennas Deactivate antenna(B) vehicle Deactivate antenna(B) stationary	On		Deactivates devices connected to the vehicle/stationary/verification module when the action result = 1

Name of the result function	Parameter 1	Parameter 2	Comments
Deactivate all devices			
Deactivate antennas Deactivate antenna(B) vehicle Deactivate antenna(B) stationary Deactivate all devices	Off		Activates devices connected to the vehicle/stationary/verification modules when the action result = 1
Deactivate antennas Deactivate antenna(B) vehicle Deactivate antenna(B) stationary Deactivate all devices	Function result		Deactivates devices when the action result = 1 Activates devices when the action result = 0
Set function result to variable	Variable number		The action result is stored in the status variable memory which may be later used as an argument for another action.
Reset timer 1 second	Counter number	Number of seconds	The counter is set when the action result = 1
Reset timer 5 ms	Counter number	Number of milliseconds	The counter is set when the action result = 1
Configurable bits set to true	Type of device that is supposed to set the bit	MSB bit number	When the action result = 1, the set MSB bit is sent by the selected type of device and causes the reaction configured in the action of another device within the range.
Configurable bits set to false	Type of device that is supposed to clear the bit	MSB bit number	When the action result = 1, the cleared MSB bit is sent by the selected type of device and causes the reaction configured in an action of another device within the range.
Force error mode			When the action result = 1, the device enters the error mode. The device will leave the error mode only when the power supply is reset.

8.12.3 Pedestrian module action arguments

The action arguments may have two logical values:

- 0 – if the argument condition is not met
- 1 – if the argument condition is met

Arguments may have parameters. The description of individual arguments and their parameters can be found below:

Argument name	Parameter 1	Parameter 2	Result = 0	Result = 1	Comments
False			Always		
True				Always	
If in Zone 1 of	Type of machine in the zone	Minimum number of machines in the zone	Number of machines in the zone lower than parameter 2	Number of machines in the zone greater than parameter 2	
If in Zone 2 of	Type of machine in the zone	Minimum number of machines in the zone	Number of machines in the zone lower than parameter 2	Number of machines in the zone greater than parameter 2	
If muting	Mode 1/2		When the selected mode is inactive	When the selected mode is active	
If variable	Status variable number		When the status variable has value 0	When the status variable has value 1	Status variable stores the result of another action
If 1s timer counter expired	Counter number		When the set counter time has not expired	When the set counter time has expired	Counter time is set by the action result
If 5ms timer counter expired	Counter number		When the set counter time has not expired	When the set counter time has expired	Counter time is set by the action result

Argument name	Parameter 1	Parameter 2	Result = 0	Result = 1	Comments
If configurable bits	Type of device setting the bit. Additionally, it is possible to select device relations in the zone and the set bit.	Bit number	When bit value = 0	When bit value = 1	The MSB configurable bits are set by the action results, LSB bits are assigned to a given device and are configured in the settings tab.
If device in error mode			When the device works correctly.	When the device does not work correctly.	
If battery level	<	Battery voltage	If battery voltage is greater than parameter 2	If battery voltage is smaller than parameter 2	
If battery level	>	Battery voltage	If battery voltage is smaller than parameter 2	If battery voltage is greater than parameter 2	
If is in muting distance			If pedestrian module is not within muting distance	If pedestrian module is within muting distance	

8.12.4 Pedestrian module action results

The action result may take two values:

- 0 – if logical dependencies between all arguments of the action are not met.
- 1 – if logical dependencies between all arguments of the action are met.

The description of individual functions of the results and their parameters can be found below:

Name of the result function	Parameter 1	Parameter 2	Comments
Set function result to variable	Variable number		The action result is stored in the status variable memory which may be later used as an argument for another action.
Reset timer 1 second	Counter number	Number of seconds	The counter is set when the action result = 1
Reset timer 5 ms	Counter number	Number of milliseconds	The counter is set when the action result = 1
Configurable bits set to true	Type of device that is supposed to set the bit	MSB bit number	When the action result = 1, the set MSB bit is sent by the selected type of device and causes the reaction configured in the action of another device within the range.
Configurable bits set to false	Type of device that is supposed to clear the bit	MSB bit number	When the action result = 1, the cleared MSB bit is sent by the selected type of device and causes the reaction configured in an action of another device within the range.
Force error mode			When the action result = 1, the device enters the error mode. The device will leave the error mode only when the power supply is reset.
Configurable output bits	False	MSB bit number	When the action result = 1, the cleared MSB bit is sent and causes the reaction configured in the action of another device within the range.
Configurable output bits	True	MSB bit number	When the action result = 1, the set MSB bit is sent and causes the reaction configured in an action of another device within the range.

Name of the result function	Parameter 1	Parameter 2	Comments
Configurable output bits	Function result	MSB bit number	When the action result = 1, the set MSB bit is sent. When the action result = 0, the cleared MSB bit is sent and causes the reaction configured in the action of another device within the range.
Indications	Off	Machine type	When the action result = 1 indications are disabled for machine type from parameter 2
Indications	On	Machine type	When the action result = 1 indications are enabled for machine type from parameter 2
Indications	Function result	Machine type	When the action result = 1 indications are enabled When the action result = 0 indications are disabled for machine type from parameter 2
Ranging	Off	Machine type	When the action result = 1 ranging is disabled with machines type from parameter 2
Ranging	On	Machine type	When the action result = 1 ranging is enabled with machines type from parameter 2
Ranging	Function result	Machine type	When the action result = 1 ranging is enabled. When the action result = 0 ranging is disabled. with machines type from parameter 2
Create Event	Event Id		When the action result = 1 event is recorded in internal memory.

Name of the result function	Parameter 1	Parameter 2	Comments
None			No action is taken
Automatic muting in muting distance			Pedestrian module is automatically muted within muting distance of machine

8.12.5 Examples of actions

Example 1:

The default action configuration in the stationary, verification and vehicle modules is as follows:

Action number: 0 ☒ Active Argument 1: (Is acknowledge (Mode 1)) Or Argument 2: (Is acknowledge (Mode 2)) Or Argument 3: (Is acknowledge (Mode 3)) Or Argument 4: (Return false ()) Result: Digital state (0)
Action number: 1 ☒ Active Argument 1: (Digital state (0) Equal Return false ()) And Argument 3: (Is zone 1 triggered (Any badge 0)) Or Argument 4: (Is zone 1 triggered (Any machine 0)) Result: Digital state (1)
Action number: 2 ☒ Active Argument 1: (Digital state (0) Equal Return false ()) And Argument 3: (Is zone 2 triggered (Any badge 0)) Or Argument 4: (Is zone 2 triggered (Any machine 0)) Result: Digital state (2)
Action number: 3 ☒ Active Argument 1: (Digital state (1) Or Return false ()) Or Argument 3: (Return false ()) Or Argument 4: (Return false ()) Result: Relay 1 (Toggle)
Action number: 4 ☒ Active Argument 1: (Digital state (2) Or Return false ()) Or Argument 3: (Return false ()) Or Argument 4: (Return false ()) Result: Relay 2 (Toggle)
Action number: 5 ☒ Active Argument 1: (Is acknowledge (Mode 1)) Or Argument 2: (Is acknowledge (Mode 2)) Or Argument 3: (Return false ()) Or Argument 4: (Return false ()) Result: Antennas disable (Toggle)
Action number: 6 ☒ Active Argument 1: (Is acknowledge (Mode 2)) Or Argument 2: (Return false ()) Or Argument 3: (Return false ()) Or Argument 4: (Return false ()) Result: Vehicle badges disable (Toggle)
Action number: 7 ☒ Active Argument 1: (Digital state (1) Or Return false ()) Or Argument 3: (Return false ()) Or Argument 4: (Return false ()) Result: OC 1 (Toggle)
Action number: 8 ☒ Active Argument 1: (Digital state (2) Or Return false ()) Or Argument 3: (Return false ()) Or Argument 4: (Return false ()) Result: OC 2 (Toggle)

1. Action 0 checks if any of the three types of the muting mode is active and stores the result in the memory of status variable 0.
2. Action 1 checks if status variable 0 (muting mode) is active and if zone 1 has been breached by any module or device, the result is stored in status variable 1.

3. Action 2 checks if status variable 0 (muting mode) is active and if zone 2 has been breached by any module or device, the result is stored in status variable 2.
4. Action 3 checks the value of status variable 1. If the value of the status variable is equal to 1, relay 1 is activated, if not – the relay is deactivated.
5. Action 4 checks the value of status variable 2. If the value of the status variable is equal to 1, relay 2 is activated, if not, the relay is deactivated.
6. Action 5 checks if muting mode 1 or 2 is active, if so – the antenna modules (B) are deactivated.
7. Action 6 checks if muting mode 2 is active, if so – the antenna modules (A) are deactivated.
8. Action 7 checks the value of status variable 1. If the value of status variable is equal to 1, OC 1 output is activated, if not – OC 1 output is deactivated.
9. Action 8 checks the value of status variable 2. If the value of status variable is equal to 1, OC 2 output is activated, if not – OC 2 output is deactivated.

Example 2:

The stationary set (with the antenna module (B)) opens the gate only for specific vehicles (with antenna module (A)):

1. For every vehicle for which the gate should open, e.g., LSB bit 0 should be set as in the below figure. The LSB bits are set in the settings tab of the device.



2. In the configuration of the stationary panel the action should be set so that relay 1 reacts to the vehicle in zone 1 and to LSB bit 0.



3. Relay 1 is connected to the gate automatic control system.

Example 3:

Breach of zone 1 of the stationary set (with antenna modules (A)) by the pedestrian module makes the vehicle in zone 2 slow down and the vehicle in zone 1 stop (the vehicle is equipped with the antenna module (A)) and activate the visual signal by the stationary module:

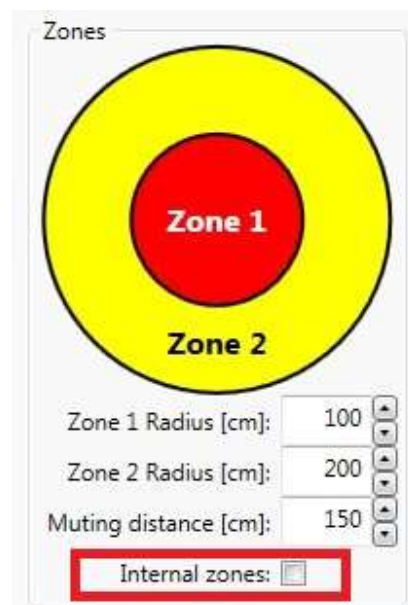
1. The stationary module actions are configured so that after detecting the pedestrian module MSB bit 0 is sent by the antenna modules (B) and relay 1 activates the visual signal:

Action number	0	☒ Active
(Argument 1 (Is zone 1 triggered (Pedestrian badge 0)) Or Argument 2 (Return false ()) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Output bits set (Antennas bit 0 MSB)	

Action number	1	☒ Active
(Argument 1 (Is zone 1 triggered (Pedestrian badge 0)) Equal Argument 2 (Return false ()) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Output bits reset (Antennas bit 0 MSB)	

Action number	2	☒ Active
(Argument 1 (Is zone 1 triggered (Pedestrian badge 0)) Or Argument 2 (Return false ()) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Relay 1 (Toggle)	

- The vehicle antenna modules (A) are configured so that it reacts to the stationary antenna module (B) zones and not to its own zones by unselecting the "Inner zones" option.



- The vehicle module actions are configured so that it activates relay 2 to slow down the vehicle or relay 1 to stop it:

Action number	0	☒ Active
(Input bit (Machines: any in zone 1 bit 0 LSB) Or Argument 2 (Return false ()) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Relay 1 (Toggle)	

Action number	1	☒ Active
(Input bit (Machines: any in zone 2 bit 0 LSB) Or Argument 2 (Return false ()) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Relay 2 (Toggle)	

Example 4:

A five-second delay for relay deactivation after leaving the zone:

Action number	0	☒ Active
(Argument 1 (Is zone 1 triggered (Any machine 0)) Or Argument 2 (Is zone 1 triggered (Any badge 0)) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Timer 1 second (0 5s)	

Action number	1	☒ Active
(Argument 1 (Timer 1 s expired (0)) Equal Argument 2 (Return false ()) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Relay 1 (Toggle)	

Action number	2	☒ Active
(Argument 1 (Is zone 2 triggered (Any machine 0)) Or Argument 2 (Is zone 2 triggered (Any badge 0)) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Timer 1 second (1 5s)	

Action number	3	☒ Active
(Argument 1 (Timer 1 s expired (1)) Equal Argument 2 (Return false ()) Or (Argument 3 (Return false ()) Or Argument 4 (Return false ()))		
Result	Relay 2 (Toggle)	

9. Maintenance

- Functions of ELOshield should be checked on a regular basis.
- Casings of ELOshield should be checked for damages on a regular basis.

10. Failures of ELOshield

In case of a failure or malfunction please check the following:

- Complete cabling
- Availability of power supply, fuses
- Switching of the controller output
- Unique CAN ID and jumper settings in the antenna modules (A/B)
- Battery level in the pedestrian module
- Unique machine identifiers in configuration
- Unique network identifiers in configuration
- Reset system to factory defaults settings and check again.

If a failure cause cannot be found, please contact ELOKON service:

GERMANY

ELOKON GmbH
Gärtnerweg 49
25436 Tornesch
T. +49 4122 9570-0
E. Info@elokon.com
www.elokon.com

UNITED STATES OF AMERICA

ELOKON Inc.
5126 S Royal Atlanta Dr.
Tucker, GA 30084
T. +1 770 3496335
E. Info@elokon.com
www.elokon.com

UNITED KINGDOM

ELOKON GmbH
Quayside Tower 2nd Floor
Broad Street, Birmingham
B1 2HF West Midlands
T. +44 121 3922499
E. info@elokon.co.uk
www.elokon.co.uk

POLAND

ELOKON Logistics Sp. z o.o.
Tytoniowa 22
04-228 Warsaw
T. +48 22 8127138
F. +48 22 6133632
E. logistyka@elokon.pl
www.elokon.pl

NOTICE

During repairs machines may be operated without ELOshield.

11. Technical Data

11.1 Accuracy – worst case (small distance between antennas)

ELOshield accuracy for vehicle applications at 5,5 m distance from vehicle *				
No. of Antennas			X Axis	Y Axis
1, 2 (Circular)				
	Systematic Error	±	30 cm	
	Statistic w/o Systematic Error			
		± σ	7,5 cm	
		± 2σ	15 cm	
		± 3σ	22,5 cm	
		± 4σ	30 cm	
		± 5σ	37,5 cm	
3 (Custom)				
	Systematic Error	±	30 cm	15 cm
	Statistic w/o Systematic Error			
		± σ	55 cm	12 cm
		± 2σ	110 cm	24 cm
		± 3σ	165 cm	36 cm
		± 4σ	220 cm	48 cm
		± 5σ	275 cm	60 cm
4 (Custom)				
	Systematic Error	±	15 cm	10 cm
	Statistic w/o Systematic Error			
		± σ	42 cm	10 cm
		± 2σ	84 cm	20 cm
		± 3σ	126 cm	30 cm
		± 4σ	168 cm	40 cm
		± 5σ	210 cm	50 cm

* Accuracy was measured for pedestrian badge in front of the vehicle. Antennas distance between each other was 1.25 m (triangle), for 4 antennas distance equals 1m (square), line of sight.

➤ This numbers are not relevant for stationary applications, where accuracy is significantly better.

11.1 Vehicle set

Vehicle module	Dimensions	120 x 125 x 35 mm
	Weight	500 g
	Protection class	IP 65
	Supply voltage	12...48 VDC ($\pm 10\%$)
	Power consumption with 2 installed antennas	< 4.0 W
	Temperature range	-25 to +60 °C, non-condensing humidity under 95%
	Relay output 1	Changeover contact Nominal (ohmic) load: 125 VAC/0.5 A; 24 VDC/1 A Contact current: 1 A Switching voltage: 125 VAC, 60 VDC Max. switching current: 0.5 AAC, 1 ADC Max. switching power (without ohmic load): 62.5 VA
	Relay output 2	Changeover contact Nominal (ohmic) load: 125 VAC/0.5 A; 24 VDC/1 A Contact current: 1 A Switching voltage: 125 VAC, 60 VDC Max. switching current: 0.5 AAC, 1 ADC Max. switching capacity (without ohmic load): 62.5 VA,
	MTTFd	> 23 years, according to EN13849-1, EN13849-2
Antenna module (A)	Dimensions	85 x 58 x 35 mm
	Weight	200 g
	Protection class	IP 65
	Working frequency	3.2 – 6.8 GHz, UWB
	Supply voltage	Supplied from vehicle module (12 V)
	Power consumption	Supplied from vehicle module (1W)
	Detection range	20 m – in the field of view of devices
	Temperature range	From -25 to +60, non-condensing humidity under 95%
Total system	MTTFd	> 12 years

11.2 Pedestrian set

Pedestrian module	Dimensions	64 x 125 x 14 mm
	Weight	200 g
	Protection class	IP 54
	Working frequency	3.2 – 6.8 GHz, UWB
	Acoustical signal volume	90 dB
	Supply voltage	Battery-operated, with USB charger
	Work time (mixed mode)	Up to 24h continuous work time on default indication settings. *
	Charging time	2 – 3 h
	Reaction time	Up to 100ms, typical 50ms, minimum 23ms
	Detection range	15 m – in the field of view of devices
	Temperature range	From -10 to +60 °C, non-condensing humidity under 95%
	Warning	Optical, acoustic and vibrating alarm (adjustable)
	MTTFd	> 12 years

*Work time can be increased by limiting vibration, buzzer and LED intensity.

11.3 Stationary set and verification unit

Stationary module / Verification module	Dimensions	225 x 200 x 95 mm
	Weight	600 g
	Protection class	IP 65
	Voltage source	110 / 230 VAC or 24 VDC ($\pm 10\%$)
	Power consumption with 2 installed antennas	< 4.0 W
	Temperature range	From -25 to +60 °C, relative humidity below 95%
	Relay outputs 1-4	Rated load (resistive) 230 VAC / 24 VDC; 4 A Max. current/contact 5 A Max. Switching voltage: 250 VAC / 150 VDC, Max. switching current: 4 A
	MTTFd	< 20 years in accordance with standards EN 13849-1 and -2

Antenna module (B)	Dimensions	85 x 58 x 35 mm
	Weight	200 g
	Protection class	IP 65
	Working frequency	3.2 – 6.8 GHz, UWB
	Voltage source	Supplied from stationary module (12 V)
	Power consumption	Supplied from stationary module (1W)
	Detection range	20 m – in field of view of the devices
	Temperature range	From -25 to +60 °C, relative humidity below 95%
Entire system	MTTFd	> 12 years

12. EC Declaration of Conformity



Manufacturer:

Elokon Logistics Sp. z o.o.

04-228 Warszawa, Tytoniowa 22, Poland

ELOKON GmbH

25436 Tornesch, Gärtnerweg 49, Germany

Declares under his sole responsibility that the product:

ELOshield

Complies to the essential requirements and other relevant requirement of the directive:

1. 2014/30/EU (EMC)
2. 1999/5/EC (R&TTE)
3. 2014/53/EU (RED)

and is compliant with the following standards what is confirmed by tests in accredited laboratory:

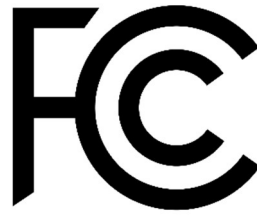
1. EN 302 065 - Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD) using Ultra Wide Band technology (UWB) for communications purposes
2. EN 55022:2011 - Information Technology Equipment - Radio disturbance characteristics - Limits and methods of measurement
3. EN 12895:2015 - Industrial trucks. Electromagnetic compatibility

A handwritten signature in black ink, appearing to read 'Thomas Da Ronch', with a horizontal line underneath it.

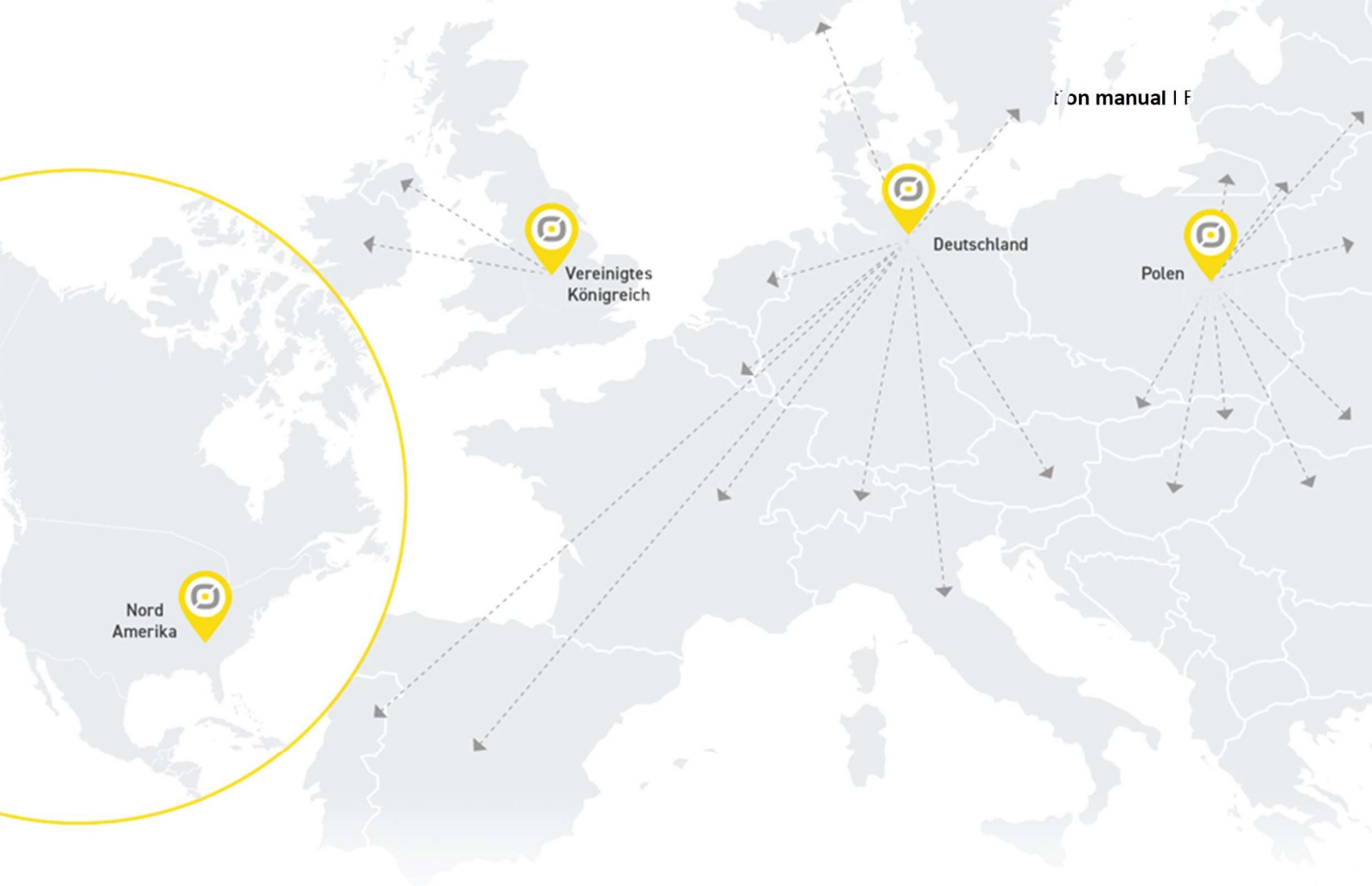
(Dipl.-Ing. (FH) Thomas Da Ronch)

Managing Director, Tornesch, 01.02.2016

13. FCC Declaration of Conformity



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.



This manual is provided for intended use only and remains the exclusive property of ELOKON Inc.

SAFE WAREHOUSE. SAFE WORKFORCE.

ELOKON Inc.

5126 South Royal Atlanta Drive
Tucker, GA 30084 / USA

T. +1-770-349-6335

E. mail@elokon.com

ELOKON GmbH

Gärtnerweg 49
25436 Tornesch / GERMANY

T. +49-412-295-700

E. info@elokon.com

ELOKON GmbH (Ltd.)

Quayside Tower 2nd Floor,
Broad Street, Birmingham
B1 2HF West Midlands / UK

T. +44-121-392-2499

E. info@elokon.co.uk

ELOKON Logistics Sp. z o.o.

ul. Tytoniowa 22
04-228 Warszawa / POLAND

T. +48-228-127-138

E. info@elokon.pl

ELOKON

www.elokon.com

Connect with us:

