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1. Introduction

The GJD Laser-Watch is a powerful sensor for detecting objects and humans with high accuracy at long distances, without the need for lights, reflectors or separate transmitters/receivers used by other systems. Calculating the distance to any object up to 500 meters away at 250 Hz, the sensor has the ability of lowering the false alarm rate to a minimum while increasing the number of genuine detected objects.

1.1. Features

Field of application	Outdoor surveillance and monitoring
Alarm zones	Up to 20 fully adaptable zones, each zone has individual alarm sensitivity settings and alarm actions
Alarm actions	Network alarm, discreet relay. Easy direct integration with IP to VMS, enabling PTZ control, automatic video recording and object position
Self awareness	Adaptive digital processing algorithm suppresses noise from fog and snow, and detects challenging weather to allow alarms to VMS
Detection range	0 - 500 meters
Detection resolution	+/- 1 dm
Update rate	250 Hz
Laser wavelength	905 nm
Beam divergence	2.0 x 0.2 m Rad
Alignment laser	Yes
Laser class	Class 2 laser product, eye-safe
Power supply	Power over Ethernet (48V DC) or 12 V DC
Power consumption	4W (PoE class 2)
Operating temperature	- 30°C to + 60°C
Interface	Ethernet IEEE 802.3af, TCP/IP, web browser user interface
Relay switch	Max 30V 200mA, N/C and N/ O
Mounting	4 x M5 - Bosch compatible (73 x 41 mm) 4 x M5 - Axis compatible (40 x 62 mm) 2 x M6 - Common standard (73 mm C-C) 5/8”-11 UNC (Tripod mount)
Enclosure rating	IP66
Color	Shell: grey, sensor: black
Weight	2.3 kg

1.2. Before operation

The GJD Laser-Watch laser sensor is designed to be intuitive and easy to use, but to ensure best performance all users of the unit should carefully read this instruction manual before use.

This manual uses the following warning indications to provide information regarding usage of the product to prevent you and others from being harmed and your assets from being damaged. These warning indications are described below. Ensure you understand these precautions before proceeding with the installation.

WARNING	Failure to follow the instructions provided by this warning and improper handling may cause death or serious injury
CAUTION	Failure to follow the instructions provided by this caution and improper handling may cause injury and/or property damage

This symbol indicates prohibition. The specific prohibited action is provided in and/or around the figure.

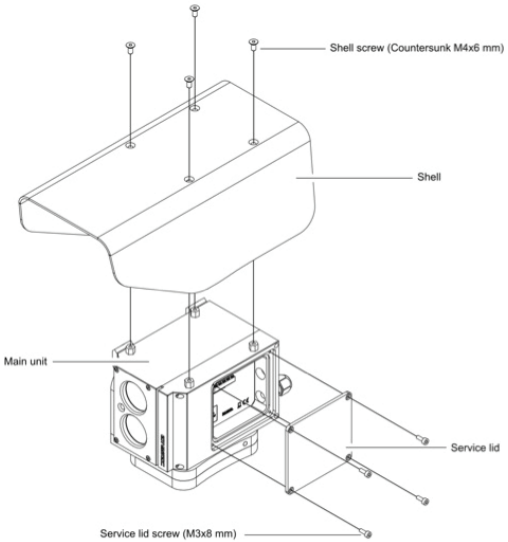
This symbol requires an action or gives an instruction.

WARNING	
Do not use the product for purposes other than detection of people and vehicles. Do not use the product to activate doors or other moving objects, which may cause an accident.	
Never attempt to disassemble or repair the product. It may cause fire or damage to the devices.	
Hold the main unit securely when you install or service it. Exercise care not to bump the product against nearby objects or drop it inadvertently.	
CAUTION	
Do not stare directly into the red alignment laser. Do not leave the red alignment laser turned on after installation process is complete.	
Only use approved Power over Ethernet power supplies. Never try to power the device in other ways than with the RJ45 PoE connection or the 12 VDC connections.	
Do not touch the unit connections with a wet hand or when the product is wet with rain. It may cause short circuit and damage the unit.	
Clean and check the product periodically for safe use. If any problem is found, contact GJD or authorized partner to solve the issue before continuing to use the product.	
This product is intended to detect intruders and is not designed to prevent theft, disasters or accidents. The manufacturer shall not be held liable for any damage to user's property resulting from theft, disasters or accidents.	

1.3. Precautions

- Only use wall brackets and tripod with compatible mounting.
- Install the product only on a solid surface.
- Install the product so that the detection line is not influenced by interference from tall grass or tree branches waiving in the wind.
- For perimeter protection, the unit should be placed at desired detection height and parallel to ground.
- Do not install or leave the product in a location exposed to heat, vibrations or impacts.

1.4. Part identification



2. Installation and detection methods

2.1. Installation methods

The Laser-Watch sensor is compatible with a number of conventional wall brackets used for surveillance cameras, for example Bosch MBE-28B and Axis 0217-031. Using a conventional wall bracket means all standard accessories, such as pole mounts, corner mounts etc., can be used.

When using the product for mobile applications, the threaded UNC 5/8" - 11 hole is compatible with most surveyor tripods.

The sensor must always be mounted on a steady foundation, such as a wall or a pole that is well secured to minimize risk of misalignment due to vibrations.

2.2. Detection methods

With fully adaptable alarm zones, the product has many detection methods depending on application. Below are three typical applications described.

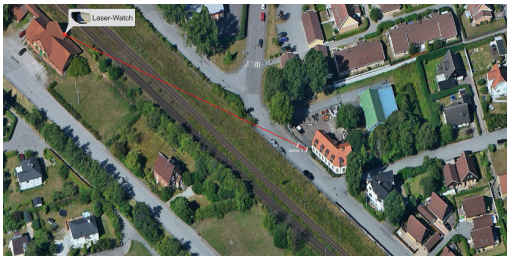
2.2.1. Perimeter detection

The product is used to detect all objects crossing the virtual fence. Zones can be created along the line of sight to permit different actions based on object location. For these types of applications, the sensor should be placed at the desired detection height and be aligned with the ground.



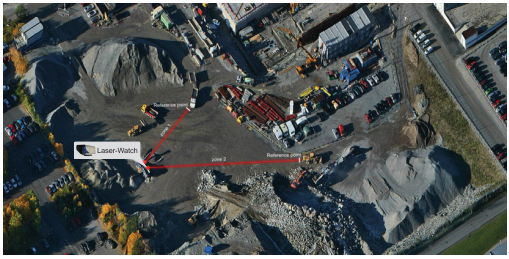
2.2.2. Spot surveillance

Detection is only desired in a specific area, for example a part of a road, an entrance to a house or along a wall. These applications allow the sensor to be located anywhere with a clear line of sight to the detection area.



2.2.3. Change detection

The product is used to detect if an object moves. This application allows the sensor to be located anywhere with a clear line of sight to the object.



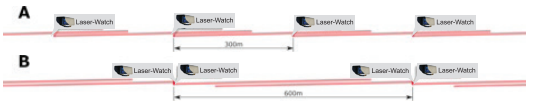
3. Operation principles

3.1. Sensor placement

The sensor has a maximum detection range of up to 500 metres. Recommended range for demanding applications is 300 metres, to ensure detection of small objects such as humans, even in difficult weather conditions.

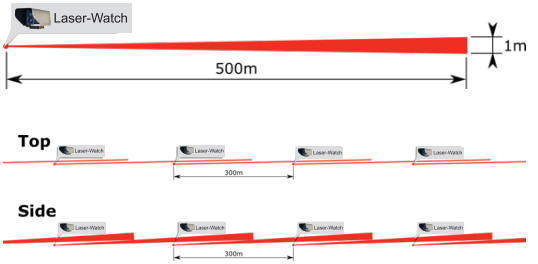
There are two ways to create a continuous virtual fence with the sensors. They can be placed 300 metres apart and have an overlapping detection area as shown in figure A, or they can be placed in pairs, with 600 metres between each pair, as shown in figure B. Sensor placement type A is recommended to get highest security level. With the overlapping detection areas the sensors covers each other. Sensor placement type B allows for cheaper installation due to fewer points needing network connection, but creates a weak point at the sensor locations.

When placing the Laser-Watch opposite each other (as shown in B below), make sure the lasers are crossed and not aimed directly at each other.



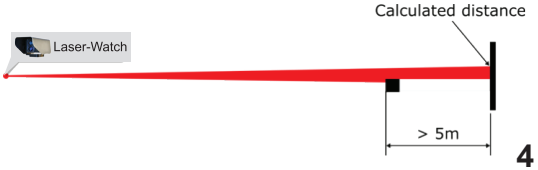
3.2. Laser divergence

The laser has a beam divergence of 2.0x0.2 m Rad. It spreads more in height than in width. This means that the laser beam is approximately 1 x 0.1m at a distance of 500 meter.

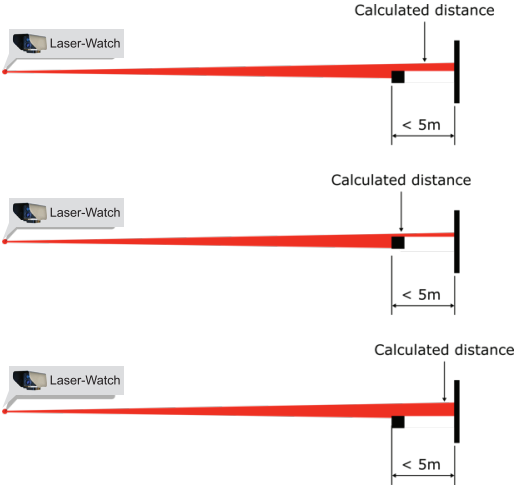


3.3. Multiple reflections

As the laser beam diverges it is possible for the beam to hit multiple targets. Each target will cause a reflection to the sensor. The sensor algorithm analyses the different reflections and calculates a distance to the object. If it is more than 5 meters between the objects the sensor will only use measurements from the far object to calculate object position. If for example a tree branch partly covers the line of sight the laser may still be able to detect objects behind it. It is however strongly recommended to ensure the line of sight is clear to maintain highest performance.

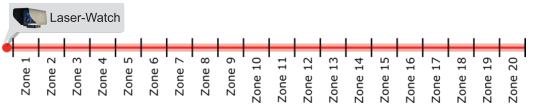


If it is less than 5 meters between the objects the sensor cluster the objects and use weighted averaging to calculate a virtual object position. If each object gets 50% of the laser beam the calculated distance will be in the middle between the objects. If the first object gets 75% and the other 25% the calculated distance will move closer to the first object.



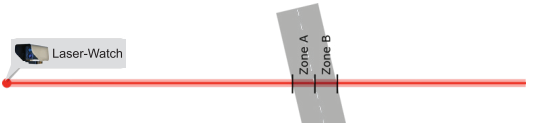
3.4. Alarm zones

Up to 20 alarm zones can be created. Each zone has individual start- and stop distance, alarm sensitivity and alarm action.

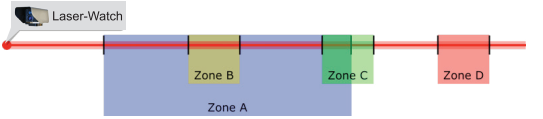


Using all 20 zones makes it possible to have unique alarms for each 25m section of the perimeter if the zones are equally distributed. The sensor is also able to send the exact intrusion distance for even more accurate location. Most times it is not optimal to have the zones equally distributed – it is better to set the zones to match the surrounding area.

For example, if the detection area includes a crossing road it is very useful to create zones to match the road, as seen below.

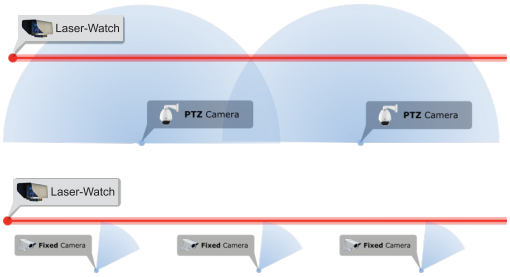


Each zone in the Laser-Watch sensor has an individual start- and stop distance. This means the zones can overlap in any way and also that only areas that are interesting will create alarms. It is also possible to have different alarm sensitivity for each zone, allowing to fine tune the system.



3.5. Combining Laser-Watch with cameras

The Laser-Watch sensor is designed to detect objects and alarm to VMS software or direct to IP cameras. With a dedicated detector fewer cameras can be used since they can be controlled to the exact location of an intrusion. Number of cameras required depends on camera type. Pan-tilt-zoom cameras are very good to use in combination with the Laser-Watch, but fixed cameras can also be used. We recommend using fixed cameras for special locations, such as gates, and PTZ cameras for the rest of the area.



3.6. Network

The Laser-Watch sensors are powered with Power over Ethernet and all communication is made with TCP/IP. For applications that require cables over 100 meters between unit location and nearest switch or router it is necessary to use network extenders or fiber optics.

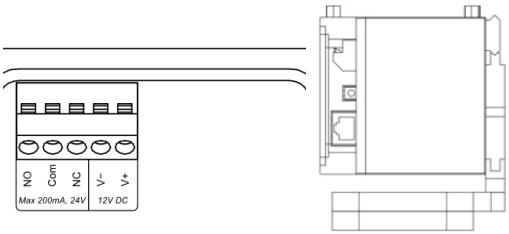
4. Installation and angle adjustment

4.1. Mount the unit

1. Ensure the wall bracket is compatible with the Laser-Watch.
2. Install wall bracket and additional items according to their associated descriptions.
3. Mount the unit on the wall bracket with the four M6 screws.
4. Make a rough alignment with the adjustable wall bracket head.

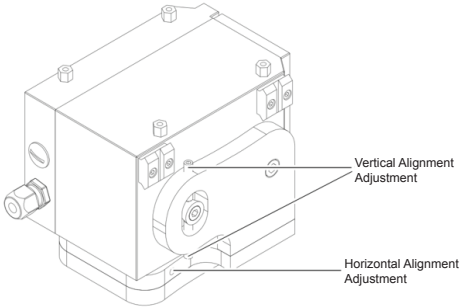
4.2. Electric installation

1. Remove the shell and service lid (see figure in section 1.4.)
2. Insert the network cable without a connector through the cable gland.
3. Follow your connector assembly instruction to patch the network cable.
4. Connect the network cable in the RJ45 connector.
5. Tighten the cable gland to secure the cable and seal the casing.
6. If the relay is desired to be used, replace the plug on the backside with supplied cable gland.
7. Connect the signal cable to the terminals. Choose connection for desired function, normally open (N/O) or normally closed (N/C).
8. Refit the service lid and shell.



4.3. Alignment

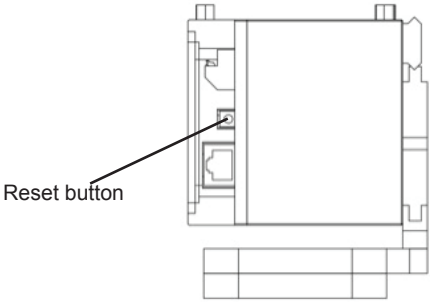
The final alignment adjustment of the sensor is made with the adjustment screws on the sensor. To facilitate alignment, horizontal and vertical adjustments have been separated.



1. Remove the shell.
2. Fasten the telescopic sight (optional) with the quick release mounts.
3. Release all adjustment screws using a 2.5mm Allen key.
4. Screw on one side to push the sensor in the desired direction. 3/4 turns of the adjustment screw equals to 1m movement at 100m, 2m at 200m and so on.
5. When the sensor is aligned, tighten the screws from both sides to lock the alignment.
6. Confirm that alignment is correct after all screws have been tightened.
7. Refit the shell.

4.4. Hardware reset

1. Remove the shell and service lid.
2. Disconnect the network cable.
3. Press and hold the reset button, while reconnecting the network cable.
4. Refit the service lid and shell.
5. The unit will change IP address to default IP and login (see next page).
6. The unit will restart in the bootloader.
7. Please refer to section 5.3.5.



5. User interface

All settings are made through the web based user interface. This means there are no limits in hardware or software for using the systems, all that is needed is a modern web browser.
The instructions for the user interface described below are valid for firmware 1.8.

5.1. Factory default settings

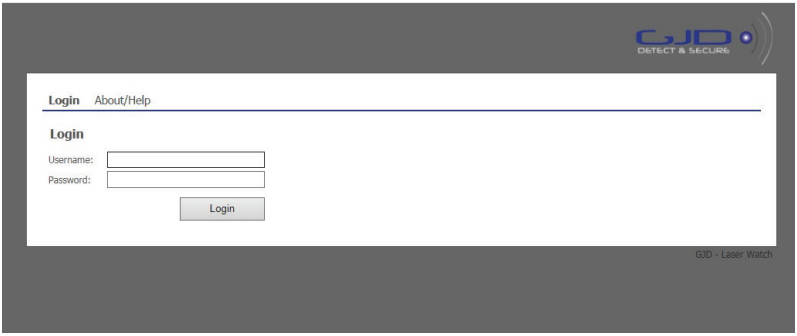
When using the system for the first time, or if a factory reset has been made, the following settings are used.

Product IP number 192.168.0.10
Subnet mask 255.255.255.0
Default router 192.168.0.1

Username admin
Password admin

5.2. Login

1. Open a web browser
2. In the address field, type in the selected unit IP-address.
3. The user interface login page is shown.
4. Login with your username and password.



5.3. Installation and configuration

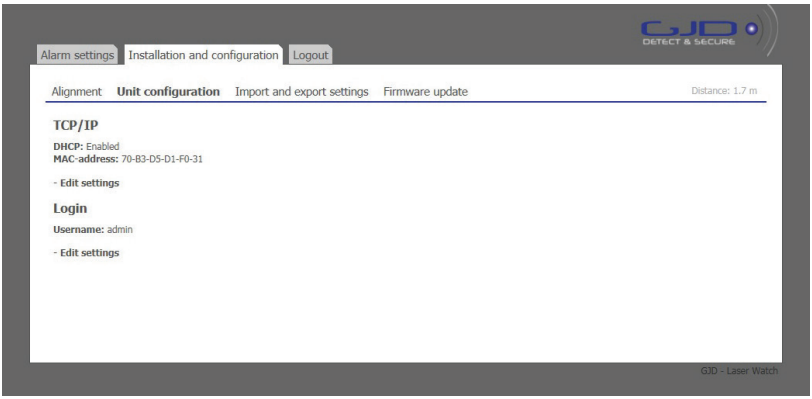
5.3.1. Alignment

1. Open the Installation and configuration tab
2. The default sub-tab is the alignment window.
3. Turn on and off the alignment laser with the buttons. Remember to turn off the laser when the installation process is complete.
4. Two diagrams shows live data from the sensor. The upper diagram shows data from the last 10 seconds and the second data from the last 60 seconds. Each diagram has three curves, representing highest value (green), average value (yellow) and lowest value (blue). This allows the diagram to display rapid changes accurately. It is also a good indication of the signal stability. A remaining big difference between highest and lowest value indicates an unstable reference point, such as tree branches etc.
5. To the right is a table with current distance, highest and lowest distance measured the last 60 second and current weather intensity.

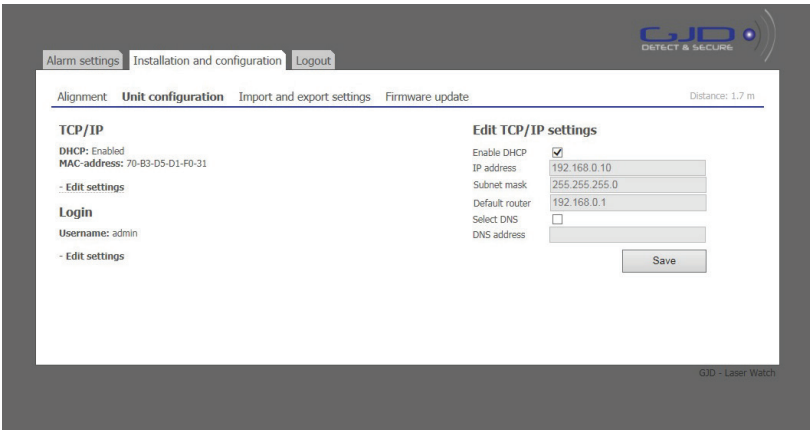


5.3.2. Unit configuration

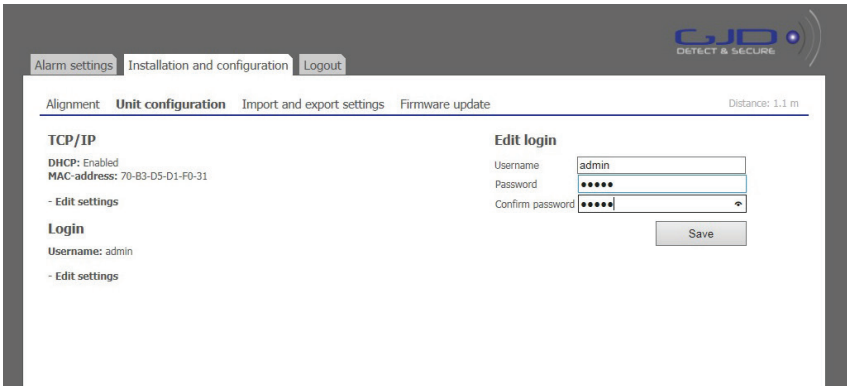
1. Open the sub-tab in the Installation and configuration window.
2. Current settings are shown.



3. To change TCP/IP settings, press "edit settings". Input fields appear to the right.
4. Enter desired settings and press the save button. Remember to reload the page with the new IP address if changed.



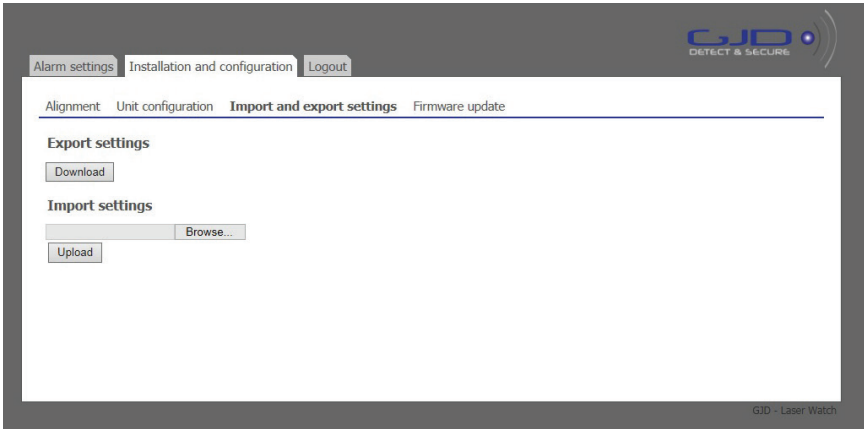
5. To change Login settings, press "edit settings". Input fields appear to the right.
6. Enter a new username and password.
7. Press the save button to confirm.



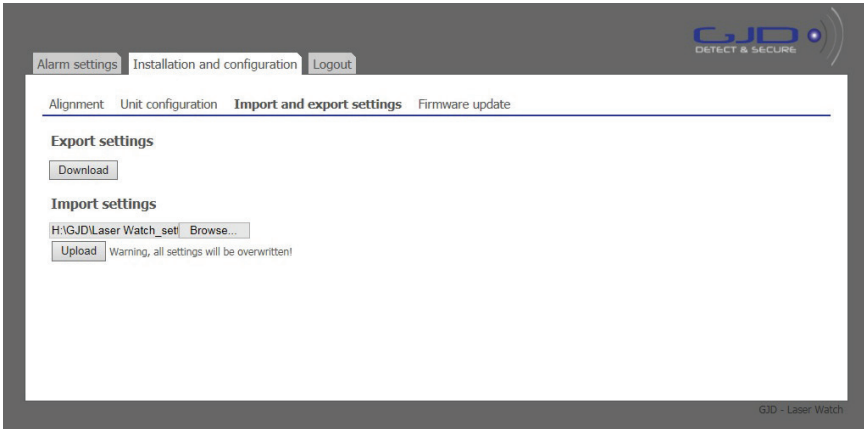
5.3.3. Import and export settings

Alarm settings can be exported as a file for backup purposes and to copy the settings to other units. IP address and Login settings are not included in this file.

1. Open the Import and export settings sub-tab in the Installation and configuration tab.
2. Export all current alarm settings by pressing the Download button. Pay attention to the file location on your hard drive. The file name is individual for each unit as it includes the unit MAC-address.



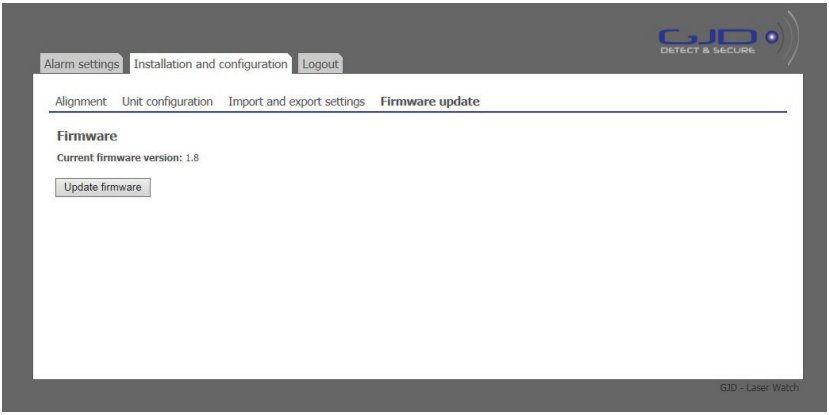
3. To import a setting file, press Choose File button and navigate to the location of your setting file on your hard drive.
4. When the file is selected it is possible to import it with the Upload button. Pay attention to the status message next to the button. Importing a setting file will overwrite all current settings.



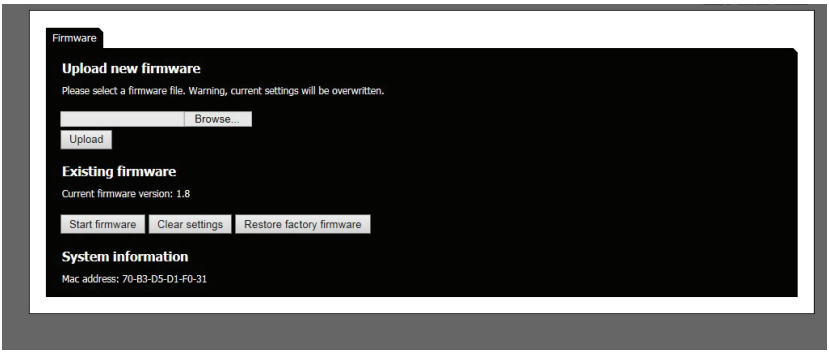
5.3.4. Firmware update

The Laser-Watch firmware can be updated to add new functions or resolve software issues.

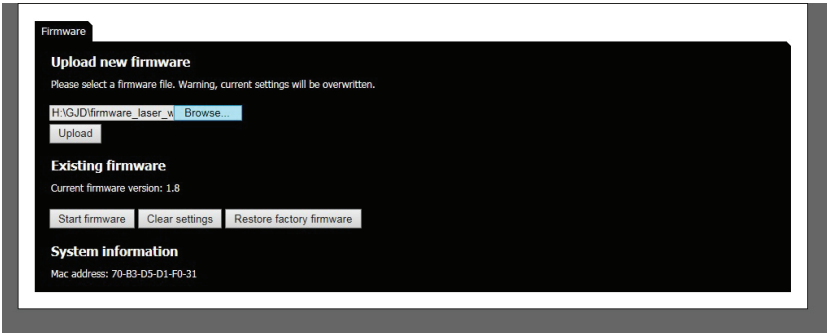
1. Open the Firmware update sub-tab in the Installation and configuration tab. Current firmware version is displayed.
2. Press the Update firmware button to stop the firmware and enter the system bootloader.



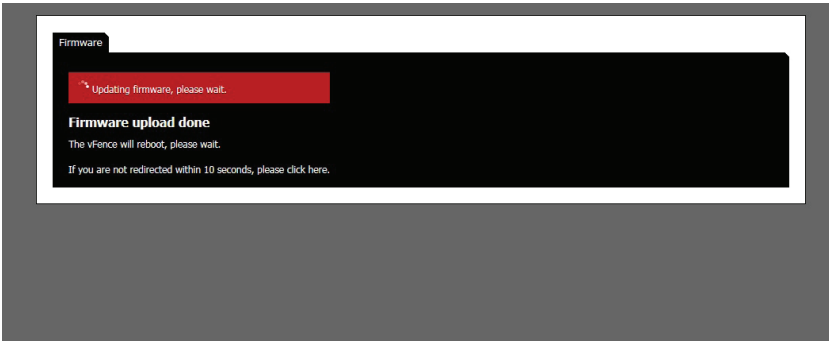
3. In the bootloader, you have the option to upload a new firmware, clear all settings (restore factory settings) and restore factory firmware.



4. To restore factory settings, press Clear settings button. Press Start firmware to start the Laser-Watch firmware again.
5. To upload a new firmware, press Choose File button and navigate to the location of the firmware file on your hard drive. When a file is selected the file name is displayed next to the button. Uploading a new firmware will erase all alarm and configuration settings.



6. Press Upload button. The firmware file will be uploaded to the Laser-Watch. When the file is uploaded, the unit will replace the firmware and then reboot the system with the new firmware.



7. After a reboot the firmware settings page will be shown again.
8. Press Start firmware button to restart the Laser-Watch with the new firmware.

5.3.5. Restart after hardware reset

1. The unit will start in bootloader.
2. If there is any issue with the firmware, please restore factory firmware by pressing Restore factory firmware button.
3. Press the Start firmware button to restart the unit with the factory default IP address and login.

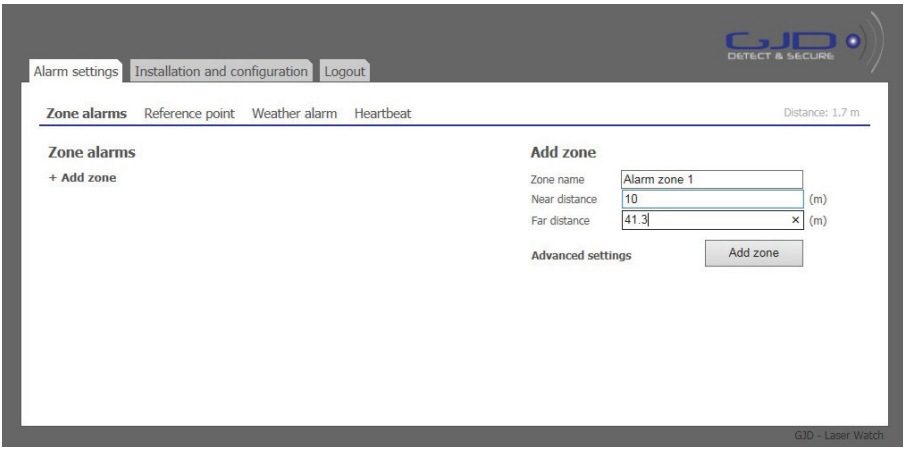
5.4. Alarm settings

The Laser-Watch has four types of alarms, Zone alarm, Reference point alarm, Heartbeat and Weather alarm. All alarms are designed for network communication, but the built-in relay can also be used.

5.4.1. Zone alarms

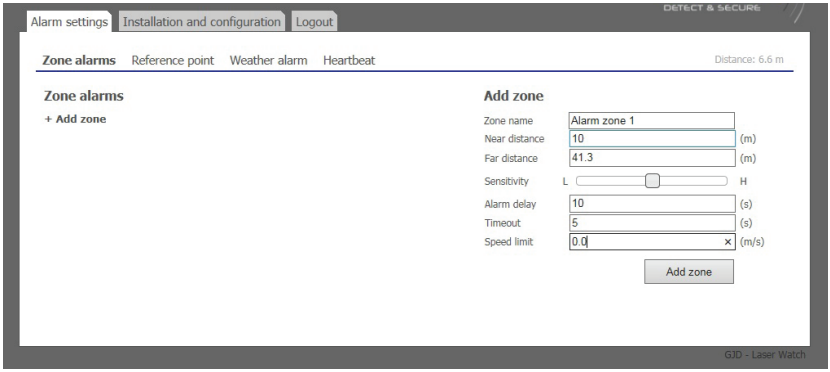
Zone alarms are standard alarm for object detection. Up to 20 zones can be created and each zone can have individual settings and alarm actions.

1. In the Alarm settings tab, open the Zone alarms sub tab (default)
2. Press “+ Add zone” to create an alarm zone. Input fields appear on the right.
3. Enter a unique zone name.
4. Enter the near distance, the distance at which the zone should start.
5. Enter the far distance, the distance at which the zone should end.



Steps 6 to 9 covers advanced settings. These settings are not necessary, but can be used to adapt the zones for special purposes. We recommend to thoroughly verify the function of the alarm zone if these settings are changed.

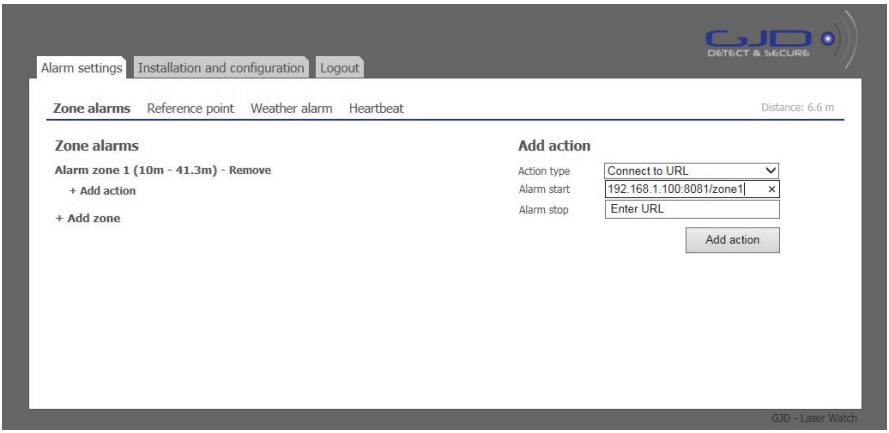
6. Press "Advanced settings". Three new settings are shown.
7. The sensitivity bar allows adjustment of the object detection sensitivity. Increased sensitivity can be used for applications where highest detection is necessary, but will also slightly increase the risk of false alarms. Decreased sensitivity are used for applications where the objects are big and slow, for example detection of boats.
8. Alarm delay is a timer to allow a zone alarm to react if an object has stopped in the zone. Enter the time for which an object must stay in the zone before the alarm is activated. Default value is 0 seconds, maximum is 2 minutes.
9. Timeout specifies the time before a zone alarm resets after an object has been detected. This can be used to avoid extra alarms from objects that creates multiple detections, for example masts on a boat. Default value is 0 seconds, maximum is 2 minutes.
10. Press Add zone button to save the zone settings.



11. Repeat for each zone.
12. To edit a zone, press the zone name. Input fields appear on the right.
13. To remove a zone, press "Remove" next to the zone name. The zone and all actions for the zone will be removed.

5.4.2. Alarm zones actions

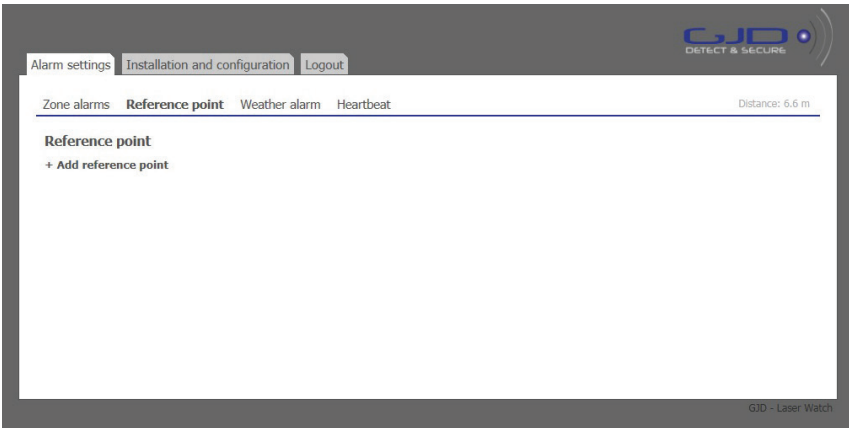
1. Press "+ Add action" under the desired alarm zone. Input fields appear on the right.
2. Choose action event type, "Relay action" or "Connect to URL". For relay action, go to point 5.
3. Enter desired alarm enable URL, for example the VMS server.
4. Depending on VMS, alarm disable URL may be needed.
5. Press the save button to confirm settings.
6. Repeat for each zone.
7. To edit an action, press "Edit" next to the action in the list.
8. To remove an action, press "Remove" next to the action in the list.



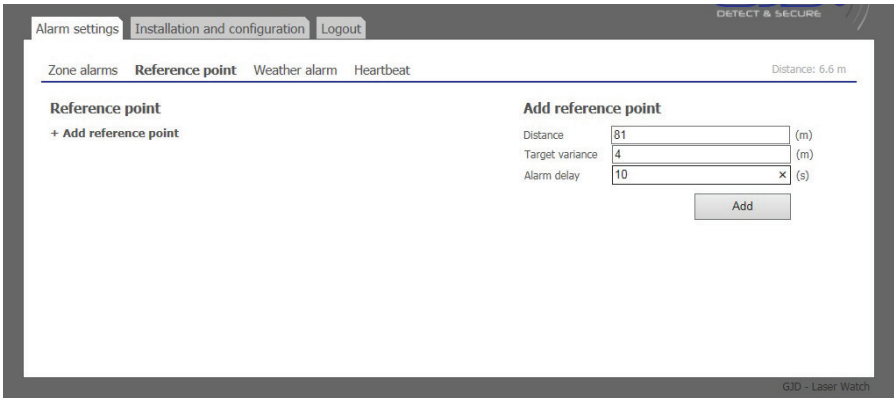
5.4.3. Reference point

Reference point alarm is a tampering alarm used to detect if the sensor has moved or been covered. Reference point alarm is only possible when the product is aligned in a manner where there is a reference object and the signal stability is good.

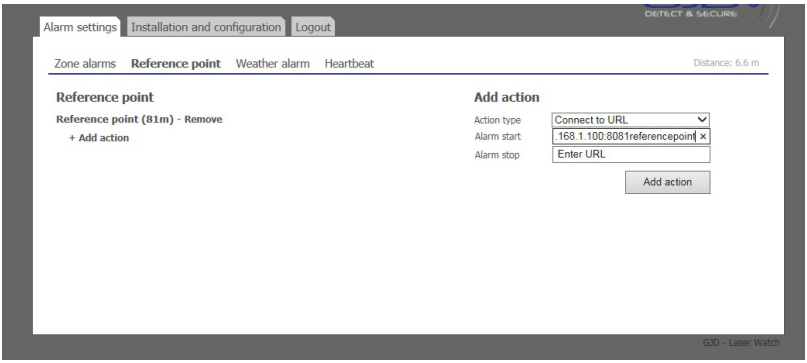
1. In the Alarm settings tab, open the Reference point sub tab.



2. Press "+ Add reference point". Input fields appear on the right.
3. Enter distance to reference point.
4. Enter target variance, the maximum allowed change in distance relative to the reference point before the alarm is triggered.
5. Enter alarm delay, the time which the reference point must be faulty before alarm is sent. To avoid false alarms, the alarm delay should be significantly different from the time of a standard object passage.
6. Press the Add button to confirm the settings.



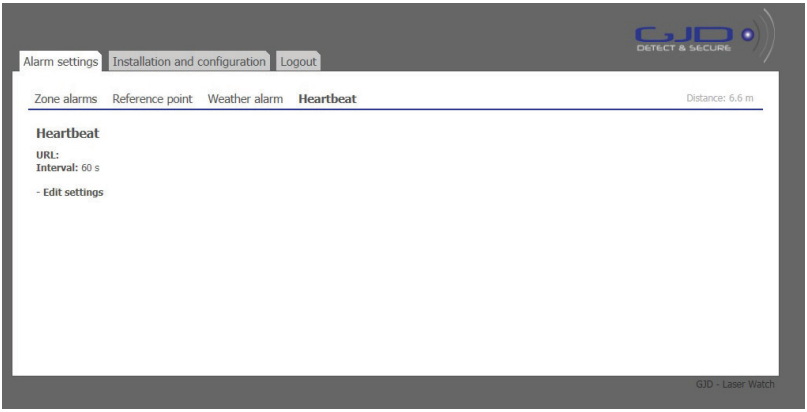
7. Create Alarm actions for the reference point by pressing "+ Add action". Input fields appear on the right.
8. Choose action event type, "Relay action" or "Connect to URL". For relay action, go to point 11.
9. Enter desired alarm enable URL, for example the VMS server.
10. Depending on VMS, alarm disable URL may be needed.
11. Press the save button to confirm settings.



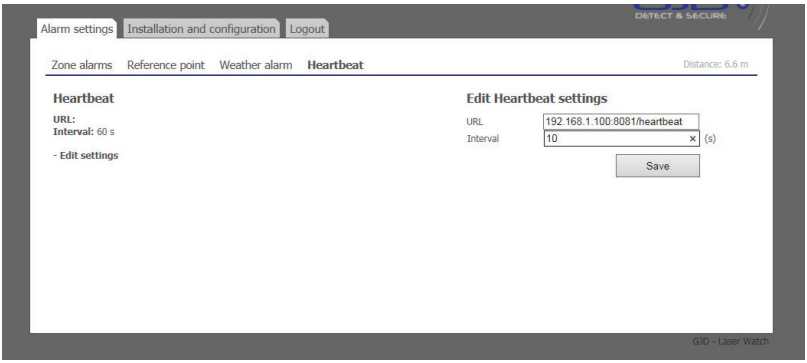
5.4.4. Heartbeat

Heartbeat is a tampering alarm used to detect cable break and product malfunction by periodically sending a short message to the server.

1. In the Alarm settings tab, open the Heartbeat sub tab.



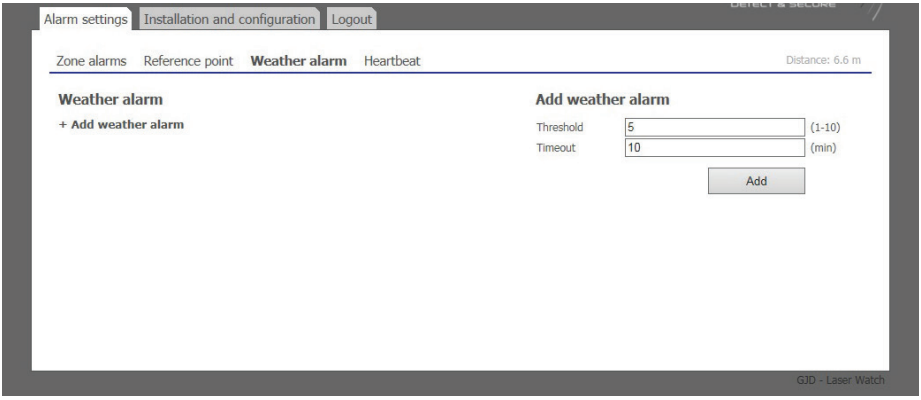
2. Press "Edit settings". Input fields appear on the right.
3. Enter desired URL for Heartbeat, for example the VMS server.
4. Enter desired time interval between Heartbeats.
5. Press the save button to confirm the settings.



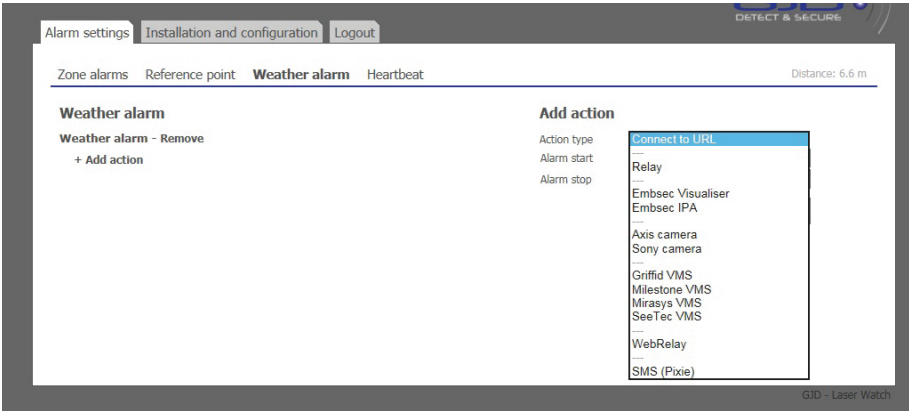
5.4.5. Weather alarm

The unit constantly evaluates the measurement signal to determine the weather intensity at a scale from 0 to 10 to allow alarm actions based on weather intensity.

1. In the Alarm settings tab, open the Weather alarm sub tab.
2. Press "+ Add weather alarm". Input fields appear on the right.
3. Enter desired threshold level on weather intensity alarm (default is 1).
4. Enter timeout, the shortest time the weather alarm is active. Each time the weather intensity exceeds the threshold, the timeout is reset. Default time is 10 minutes.
5. Press the Add button to confirm the settings.



6. Create Alarm actions for the weather alarm by pressing "+ Add action". Input fields appear on the right.
7. Choose action event type.



Connect to URL
If the weather intensity threshold is exceeded, the unit alarms to the URL.
- Enter desired URL, for example the VMS server.
- Depending on VMS, alarm disable URL can be needed.

Relay action
Activates the internal relay.

Disable reference point
If the weather intensity threshold is exceeded, reference point alarms are ignored.

8. Press the Add action button to confirm settings.

5.5. Logout

1. Press the "Logout" tab in the top menu.
2. You will automatically be logged out if anybody logs in from another computer.