

# EBS-50 Smart Base station

ESL base station with built-in server

## Specifications manual



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## Revision History

EBS-50 Specifications Manual

Edition	Date	Page	Section	Description of Changes
1 <sup>st</sup>	October 21, 2020	-	-	Initial release.

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# 1 Overview

The EBS-50 is a base station, equipped with two 2.4GHz radios for data communication with Opticon's electronic shelf labels (ESLs) plus a built-in computer that runs the Opticon ESL server. The EBS-50 allows for a very compact ESL system. Everything needed for a running system is the EBS-50 itself, a power supply, and an Ethernet connection (Wi-Fi is optional) plus of course the ESLs themselves.

The product uses Direct Sequence Spread Spectrum RF technology that allows for an ultra-low power consumption combined with a reduced sensitivity to background noise. That means less interference by other radios that operate in the 2.4GHz band. The radio protocol that is used is based on the IEEE 802.15.4 standard that specifies the physical layer and media access control for low-rate wireless personal area networks.

The base station can run a local price/article database on its own flash disk that can be updated remotely, either manually or automatically with database triggers, or it can be configured to use an external database. With the information from the database, the EBS-50 can create images for the ESLs that are connected to it and send those to the corresponding ESLs. Having the option to run the database either locally or externally allows for a very flexible setup of the ESL system, from a very small stand-alone system to very large cloud-based system where the EBS-50 is then the gateway in the shop to the Internet. In that case, a central dashboard server is required where the EBS-50 can upload status information.

The EBS-50 can be controlled via a web browser on any device that connects to the same network. There is no need to connect a keyboard and/or monitor to it, which makes it easier to install the EBS-50 in the most convenient location. Maintenance and configuration to the EBS-50 can then be done from any location provided that that location is connected to the same network as the EBS-50. It is even possible to do that from a remote location but in that case, a VPN tunnel is required because of safety concerns. The EBS-50 can setup that VPN tunnel by itself, provided that the remote location already has a VPN server running but this is usually not needed. The EBS-50s can download configuration and maintenance files from a central server and will store its status information there.

## 2 About the EBS-50 Smart base station

The most important features of the EBS-50 are listed below.

- **Small and compact:** The EBS-50 is not bigger than a regular base station but is powerful enough to handle all basic tasks of a separate ESL server.
- **Built-in computer:** The built-in computer runs a Linux operating system plus Opticon's ESL server, and both are optimized for each other. A separate computer will always have a hassle with libraries and other parts of the operating system that may not be fully compatible or not installed, whereas the EBS-50 comes pre-configured with the correct software.
- **No separate computer needed:** Shop owners usually do not like a separate computer that requires maintenance and updates, especially when this is a Windows computer. The EBS-50 removes the need for this since it has a built-in computer and updates are much easier to do than with a normal computer. The EBS-50 can update itself automatically from a remote server, but updates can also be done with a USB-stick. The frequency of updates is much lower than with a full blown (Linux or Windows) computer since the EBS-50 only contains the software that is really needed to run the server.
- **Power over Ethernet (PoE):** PoE is supported on one of the Ethernet ports to make installation even more simple. When a location has PoE switches, the EBS-50 does not need a separate power supply and so no wall socket is needed.
- **Two Ethernet ports:** The EBS-50 comes with two gigabit Ethernet ports, and a built-in switch and router. This makes larger setups, where more than one base station is required, much easier as it is possible to daisy-chain the base stations via the 2<sup>nd</sup> Ethernet port while the first port is used for the connection with the LAN.
- **USB ports:** Two USB ports are available. One is a USB-host port, with a USB-A style connector and the other is a USB-OTG port, with a micro USB style connector. The main use of the host port is for a Wi-Fi dongle and Opticon will come with a list of approved dongles for which the driver is already installed. This port however can also be used for software updates that come on a USB-stick for those situations where the EBS-50 cannot connect to the Internet.

### 3 Physical Features

#### 3.1 Weight

The weight of the EBS-50 is approx. 250g (TBD)

#### 3.2 Dimensions

The dimensions of the EBS-50 base station: 145 x 110 x 27.1 mm (179.6x158.3x27.1 mm with the antennas mounted alongside the main housing).

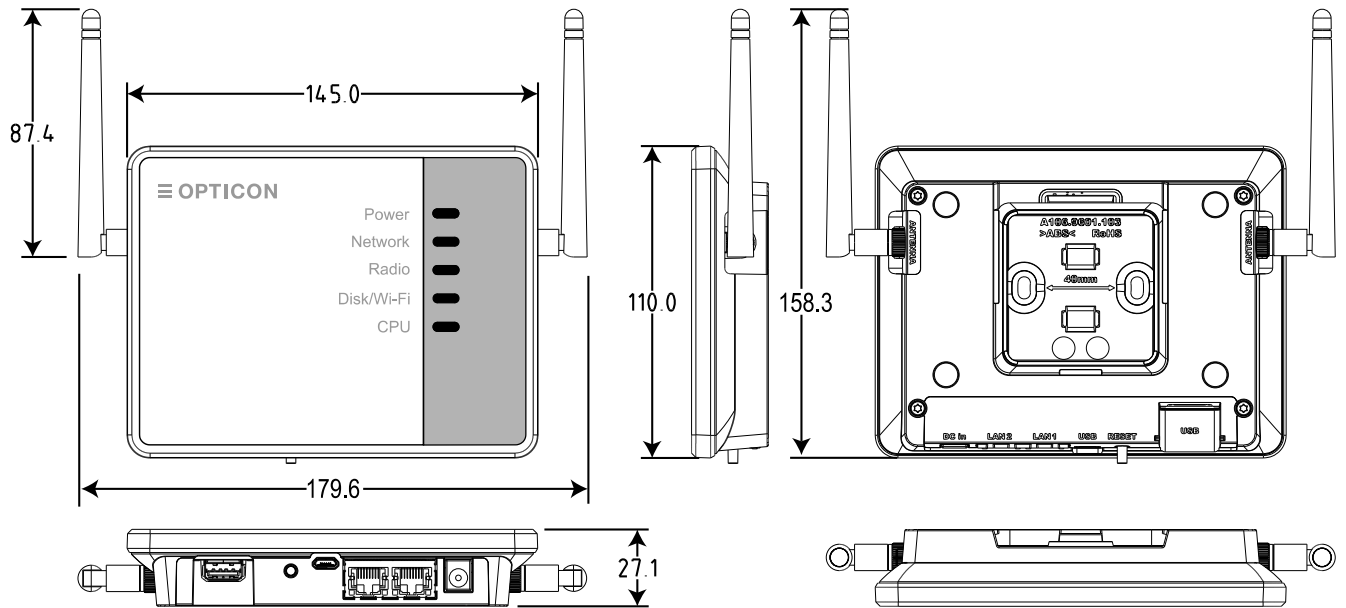


Figure 1: EBS-50 Dimensions

#### 3.3 Maximum total height

The antennas can be rotated, but the most common position is vertical. The height with both antennas in this position and with the base station horizontal, mounted on the mounting plate is 95.3mm.

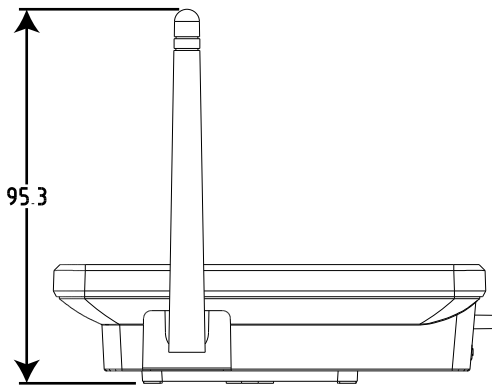


Figure 2: EBS-50 Maximum height



### 3.4 Mounting

The EBS-50 comes with a mounting plate for easy mounting to e.g. a wall or the ceiling. The EBS-50 can slide over the mounting plate to click and lock it into place. To unlock it, use a flat screwdriver to push the locking tap down and then slide the EBS-50 away from the screwdriver.

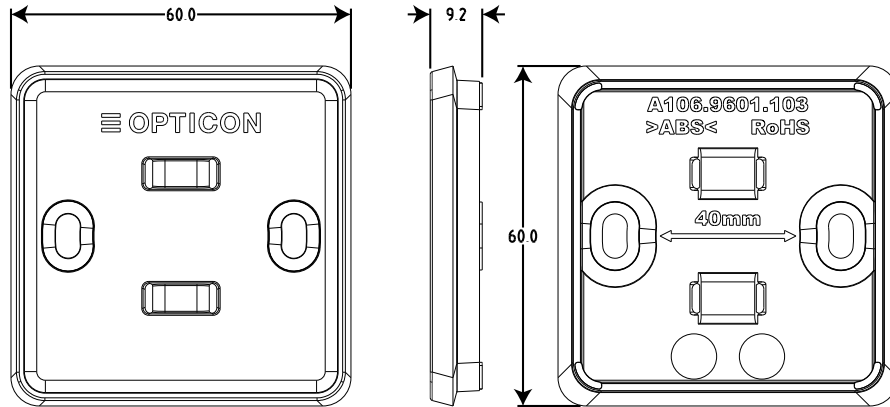


Figure 3: Mounting plate

The mounting plate can be attached to a wall with two screws, spaced 40mm apart. The top of the mounting plate, where the Opticon logo is visible, should face forward, away from the wall. Once the mounting plate is attached, the EBS-50 can slide over the mounting plate until it locks into position.

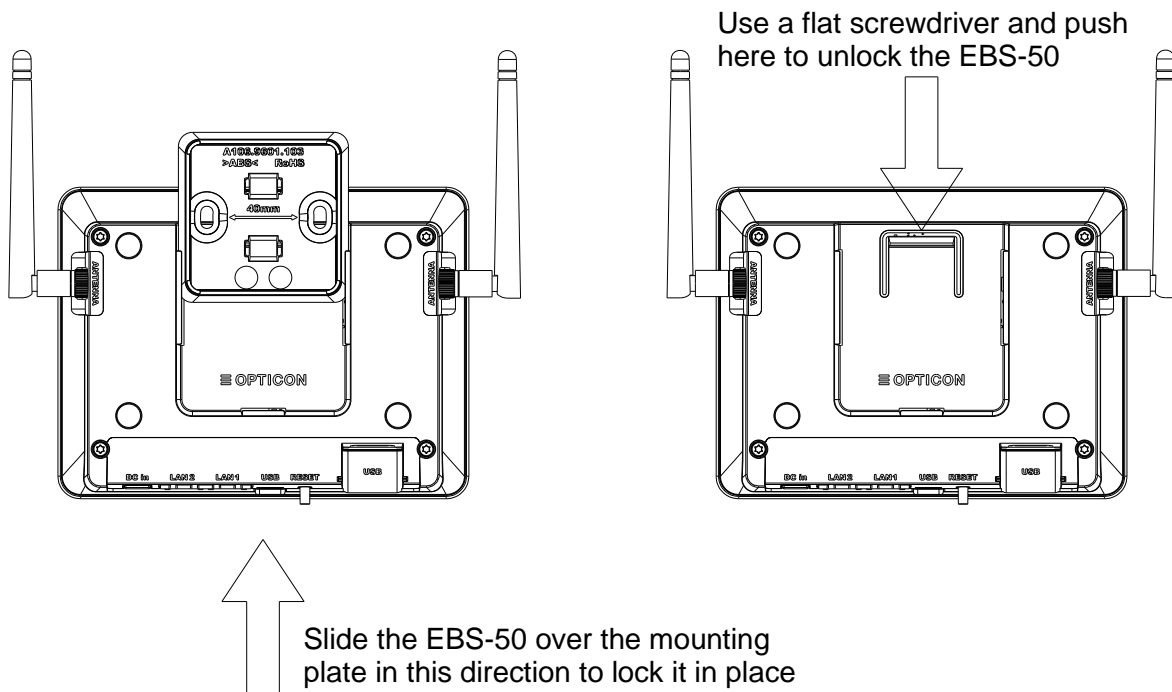


Figure 4: Attaching and detaching the EBS-50 to the mounting plate

## 4 Environmental Specifications

### 4.1 Operating Temperature and Humidity

Temperature: 0 to 70° C

Humidity: 20% to 85% RH

### 4.2 Storage Temperature and Humidity

Temperature: -20 to 70° C

Humidity: 20% to 85% RH

### 4.3 Static Electricity

Air discharge:                   ± 8 kV (No malfunction / Automatic recovery)  
  ± 15 kV (No damage but operator involvement may be required)

Contact discharge:           ± 4 kV (No malfunction / Automatic recovery)  
  ± 8 kV (No damage but operator involvement may be required)

### 4.4 Drop resistance.

The EBS-50 has withstood the following drop test:

Drop the base station 12 times (3 times at each of 4 orientations), from a height of 1m onto a concrete floor as shown below. Note the position of the antennas.

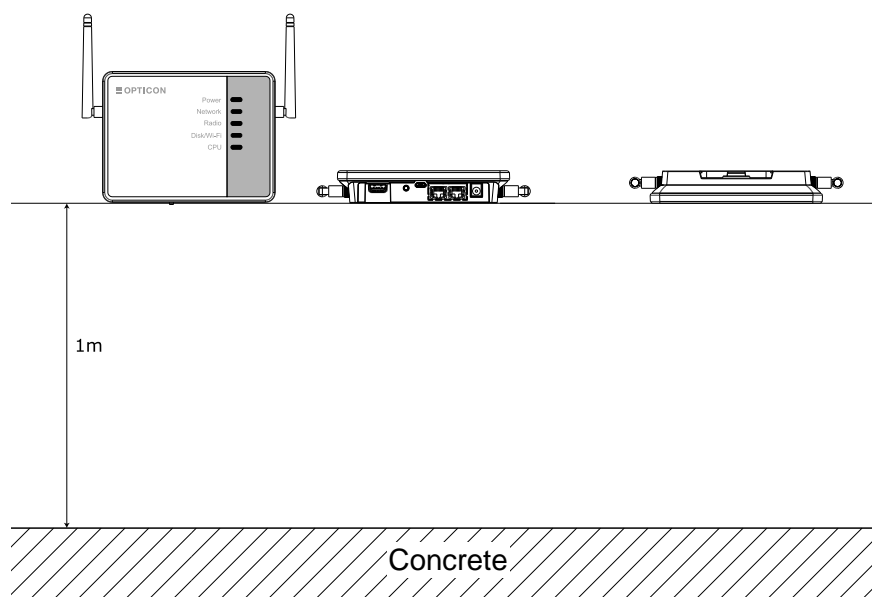


Figure 5: Drop test

### 4.5 Dust and Drip Proof

This product has not undergone any IP tests. The intended use is indoor only.

## 5 Electrical specifications

### 5.1 Computer

Item	Specifications		Remarks
CPU	Type	Dual core ARM Cortex A7	1.2GHz clock speed
		Single core ARM Cortex M4	200MHz clock speed
Memory	Storage	64GByte eMMC	eMMC flash disk
	RAM	512Mbyte	DDR3 memory
Interfaces	2 x Ethernet	10/100/1000 gigabit	Port 1 supports PoE Class 3.
	1 x USB Host	USB-A type dongles supported	
	1 x USB-OTG	Micro USB type connector	

### 5.2 Radio

Items	Specifications		Remarks
Radio	Modulation	DSSS	
	Frequency	2400 ~ 2495 MHz Channel 11 ~ Channel 26 <sup>1</sup>	Channels 27~28 are available on request. <sup>2</sup>
	Baud rate	250 Kbits / second	
	Number of independent radios	2	

<sup>1</sup>Channels 1~10 are reserved for sub-GHz frequencies, which are not supported by the EBS-50.

<sup>2</sup>Local regulations may not allow the use of these channels.

Parameter	Min	Typ	Max	Unit	Remarks
Receiver sensitivity		-100.3		dBm	1% PER
Output power	5.4	10	21.1	dBm	Configurable
Frequency	2400		2495	MHz	

### 5.3 Electrical Characteristics TBD

Parameter		Min	Typ	Max	Remarks
Operating voltage	DC Input	9 V	12V	16V	
	PoE Powered			57V	As per PoE standard
Operating power			7W	10W	Either DC powered or PoE powered

## 6 Interfaces

The drawing below shows the position of the various interfaces on the EBS-50

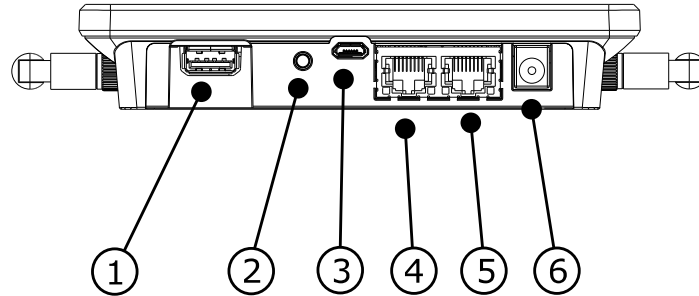


Figure 6: Interfaces

Item	Interface	Connector type	Description
1	USB-Host	Female USB type A	For USB gadgets such as a Wi-Fi dongle
2	Reset switch		
3	USB-OTG	Female USB micro	
4	Ethernet port 1	RJ-45	10/100/1000 Mbps Ethernet with PoE
5	Ethernet port 2	RJ-45	Same as port 1 but without PoE
6	DC Jack		12V DC input

### 6.1 USB-Host

This interface is meant for a USB dongle such as a USB stick or a Wi-Fi dongle. To protect the dongle and make it a bit harder for people to take it away, it is in a recessed area. Therefore, the dongle cannot be too wide. The available size is 18.5x8mm and most small, modern Wi-Fi dongles will fit in.

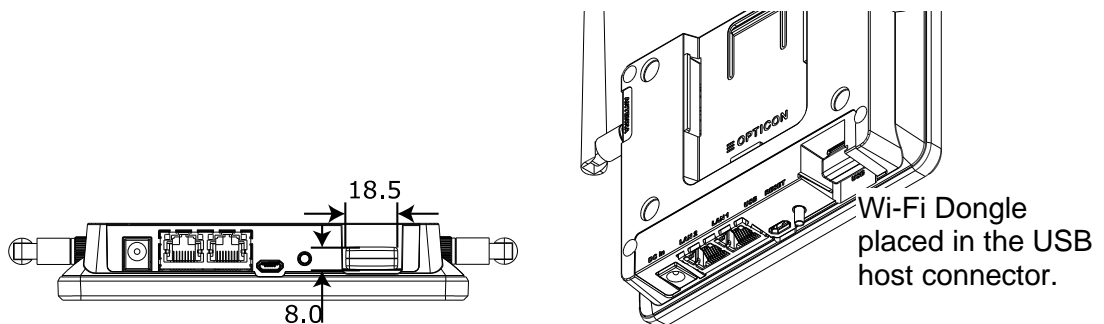


Figure 7: Wi-Fi Dongle

## 6.2 Reset switch

The reset switch can be used to reset the EBS-50 to factory default. This can be used for instance when the operator has made a mistake and has accidentally locked the EBS-50 out from the network. Since the EBS-50 must be controlled via a web-browser, a working Ethernet connection is required to change the setup, so when that is not working the reset switch is the only thing that can bring the EBS-50 back online.

To reset the Ethernet configuration, follow the steps below:

- Remove the power
- Press and hold the reset switch.
- While keeping the switch pressed, apply power (either via the DC jack or PoE)
- Keep the reset key pressed for at least 10 seconds.

When this is done, the Ethernet connection settings are set to automatic (DHCP)

## 6.3 USB-OTG

This port can be used for various other USB gadgets, but its main purpose is for testing, debugging and firmware download during the production in the factory.

## 6.4 Ethernet ports

The EBS-50 has two 10/100/1000 Mbits/s Ethernet ports. Port 1 can be used to power the EBS-50 via Power Over Ethernet (PoE) but can work with non-PoE Ethernet as well. The other port has no PoE capabilities but is the same otherwise. Both ports are configured as a switch so one port can be used for instance to connect to the local network, while the other can be used to daisy-chain other base stations.

## 6.5 DC input connector

This connector has a center pin with a diameter of 2.1mm and a hole diameter of 6.5mm. The mating plug should therefore have a center hole of 2.1mm and an outer diameter of 5.5mm as shown. The center pin is +12V.

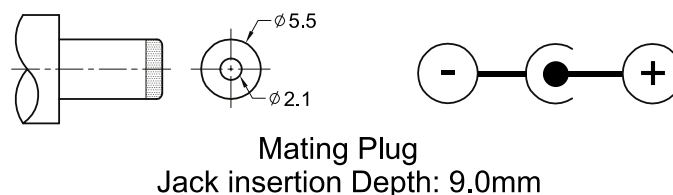


Figure 8: DC plug dimensions

## 7 Indicators

The EBS-50 has 5 LED indicators that are visible from the top of the device.

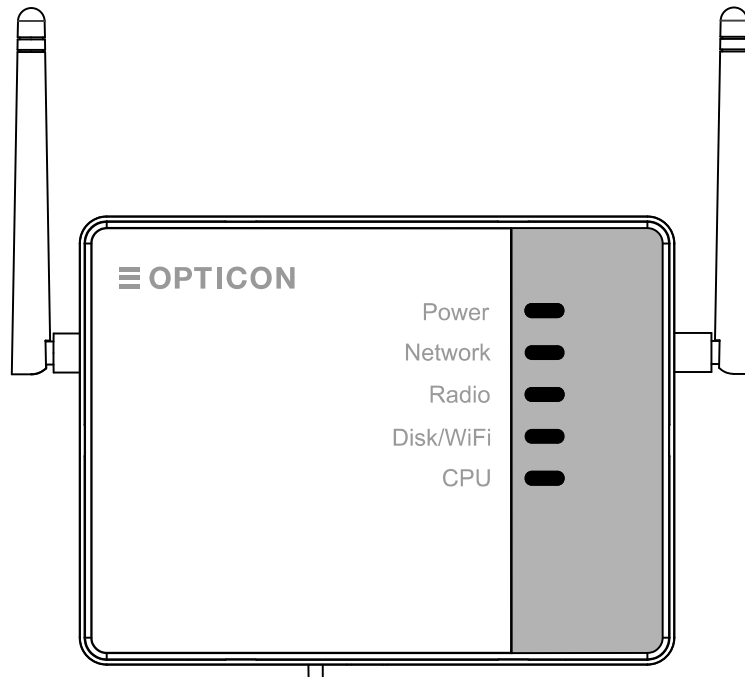


Figure 9: LED Indicators

**Power.** This LED turns red right after the power is applied. The internal computer will then start running and when it is done with the boot process, the led will turn green. If the LED stays red for several minutes, a severe problem has occurred. In that case, it may be required install a fresh operating system via the USB port.

**Network.** This LED turns green when an Ethernet link is established on LAN port 1 and starts flashing green when data is received or sent out. This LED turns red when an Ethernet link is established on LAN port 2 and starts flashing red when data is received or sent out.

**Radio.** This LED flashes green when radio 1 is active and flashes red when radio 2 is active.

**Disk/Wi-Fi.** This LED flashes green when the internal disk is accessed, and it flashes red when the Wi-Fi interface is used (provided that a suitable Wi-Fi dongle is installed)

**CPU.** This LED flashes green when CPU0 is busy and flashes red when CPU1 is busy.

Apart from these LED indicators, the two Ethernet ports have a link (on the left side) and an activity LED (on the right side).

## 8 Labels

### 8.1 Product label

The product label shown below is placed on the back side of the base station.

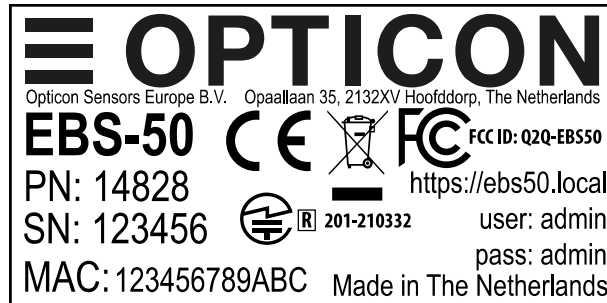


Figure 10: Product label

The label shows product name, article code and the various regulatory logos plus the product's Ethernet MAC address. The addresses for the two 802.15.4 radios are derived from this address. These addresses (both are the same) are essentially the same as the Ethernet address, but with two bytes extra. Below is a description of those addresses:

Ethernet MAC address: M1M2M3-S1S2S3

802.15.4 MAC address: M1M2M3-SaSbS1S2S3

M1M2M3 defines the manufacturer ID, which is 00126A for Opticon and is the same for both address types. The bytes that follow the manufacturer ID, define the product number which is three bytes long for an Ethernet address and 5 bytes for an 802.15.4 address. To convert the two, we have set SaSb both to zero. So e.g. an Ethernet MAC address of 00126A-45AB23 results in an 802.15.4 address of 00126A-**0000**45AB23.

Material: Base + laminate protection against wear.

Base: PP film, thickness 80µm, backing with glue.

Laminate: PET film, clear, thickness 25µm.

Colors: Black & White

The dimensions of the product label are 50 x 25 mm.

### 8.2 Anatel label

The Anatel label is a regulatory label required for the Brazilian market. The size and material specs are the same as those for the product label.



Figure 11: Anatel label

### 8.3 Label positions

The labels are placed as shown below

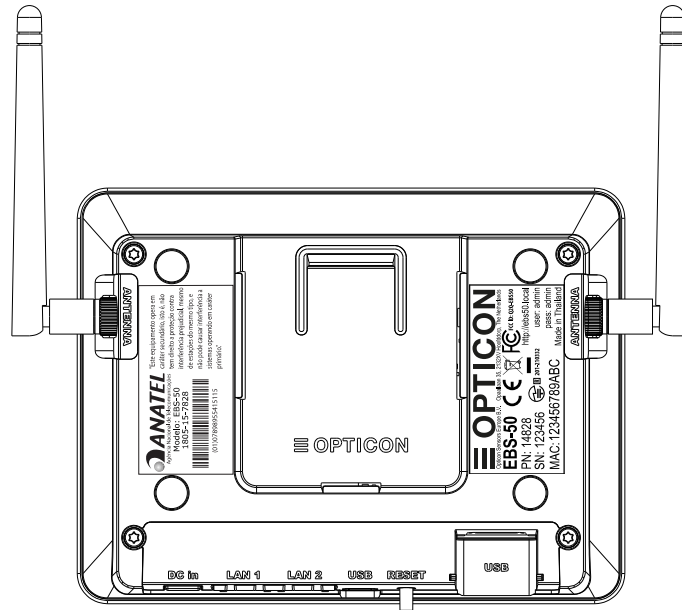


Figure 12: Label position

### 8.4 White box label

The white box label is made from plain paper and is meant to show the product number and serial number. The label size is 60x25mm and the design is shown below.



Figure 13: White box label

The white box label lists the item number and serial number just as on the product label. It also shows a GTIN barcode that has the Opticon manufacturer number and the article code encoded.



## 8.5 Shipment box label

The shipment box label is Opticon's standard shipment box label and contains information about the order number, box quantity, manufacturing spec. number, software versions etc. The label also contains a GTIN barcode. The label is according to Opticon's shipment box standard rev 9 and the size is 160x105mm.

	<b>OPTICON</b>	C/No 001
Opticon Sensors Europe B.V.		Made in Thailand
Opaallaan 35, 2132 XV Hoofddorp, The Netherlands		
Product:	<b>EBS-50</b>	
PO:		QTY: 
	*XXXXXX*	*30*
Spec#:		
	*OF1EBS50.XX*	
Article code	EU: 	US: 
	*14828*	
SN From:		To: 
	*XXXXXX*	*XXXXXX*
Missing Serial Numbers		QTY: 0
1		
2		
Shipping date: XX-XX-XXXX		
Software:		
AP: XXXXXXXXX		
OS: XXXXXXXXX		
Boot: XXXXXXXXX		
		
		
1 87 19982 14828 4		

Figure 14: Shipment box label

## 9 Packing

### 9.1 Individual packing

After putting the base station in a foam bag, it is packed in a white box with the following accessories:

- Two antennas
- One quick start guide
- The safety instructions
- One mounting plate

The white box size is 19x5.5x15.5cm.

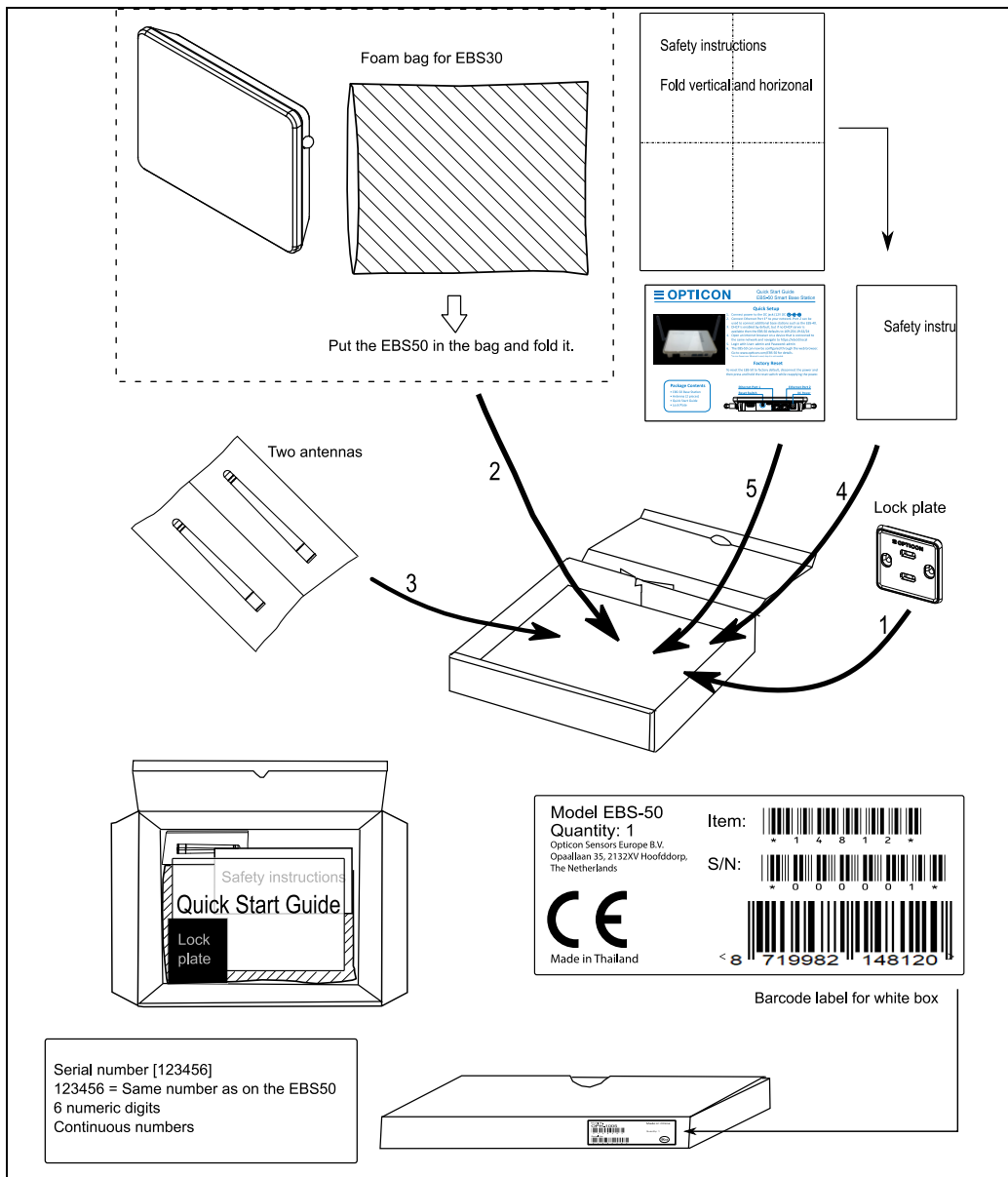


Figure 15: Individual packing

## 9.2 Shipment packing

30 individual EBS-50 boxes are packed into one shipment box.

The weight of the shipment box is 10kg TBD

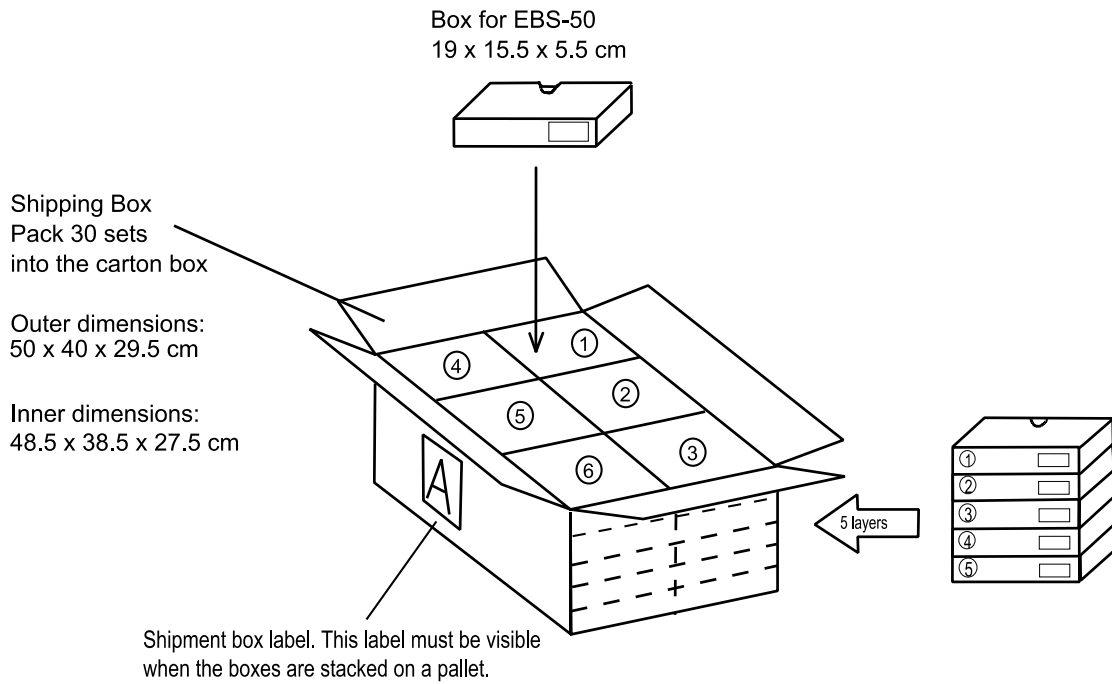


Figure 16: Shipment packing

## 10 Software configuration

### 10.1 Basic setup

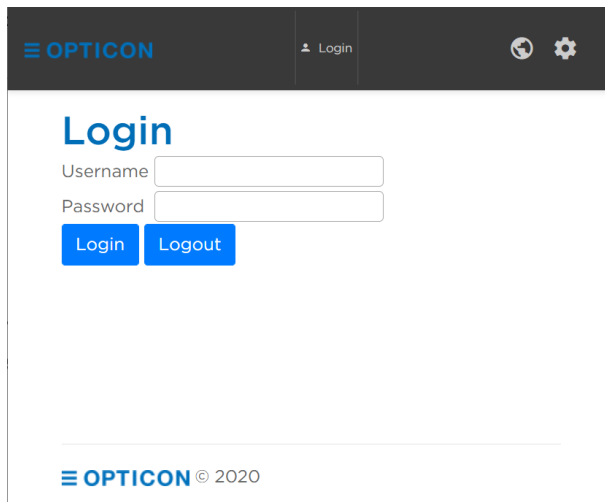
To start working with the EBS-50, the first step that needs to be done is to connect it to a network via Ethernet. Once that is done, the EBS-50 can be configured via any computer on the same network. All that is needed is a web browser. So, start with plugging a network cable into one of the Ethernet ports and plug the other end in a network socket.

Once the EBS-50 has an Ethernet connection, start a browser on any device (all modern browsers are supported) and navigate to:

<http://EBS50.local>

Please note that the EBS50 in this URL is the default hostname that is programmed into the device. It is possible to configure this in the Network setup, so when this has been changed, the URL is different.

When this is done, the login screen is shown:

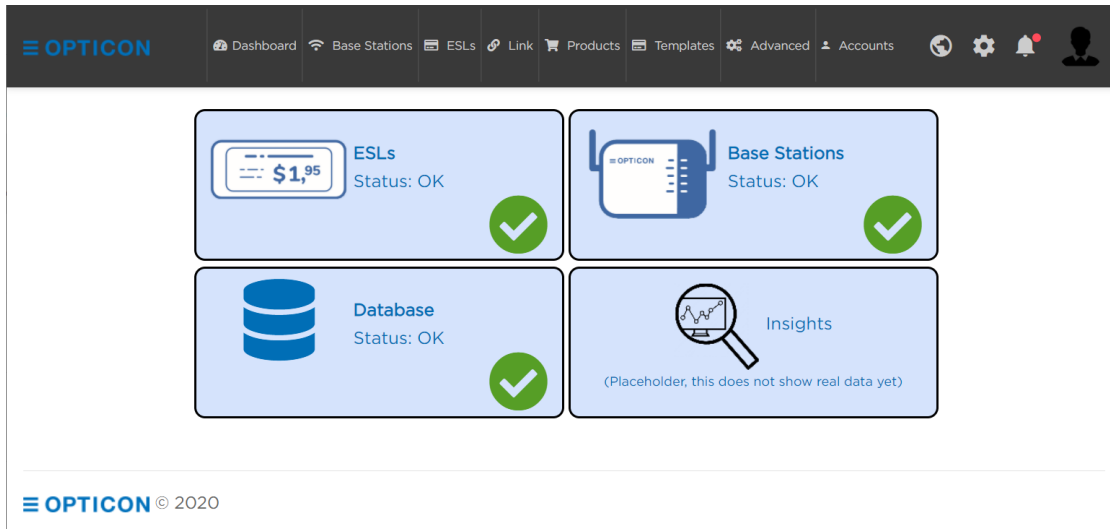


The default username is: Admin

The default password is: Admin

Please note that once users are created in the database, this default user and password are automatically deleted. The users and the roles that are defined there can then be used to login to this page.

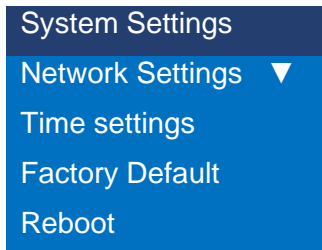
Once logged in, you will see the following screen: TBD!!



This is the ESL dashboard that shows an overview of the system, such as the status of the ESL's, the database, the server etc. This is all explained in the user manual of the EBS-50.

The most important step is to configure the network here which is why this part is added to this specification manual. To configure the network, select the Advanced menu item from the menu bar at the top and then select Network Settings from the drop-down menu.

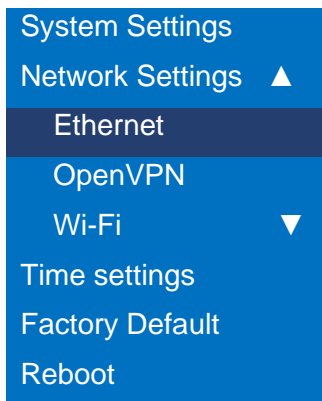
Once this is done, the settings page opens with a menu on the left part of the screen. Below is a description of all the possible settings here.



### System Settings

Hostname:

In the System Settings page, you can configure the host name. This is used for locating the EBS-50 on the network since it can be found with `http://hostname.local`



### Ethernet Settings

IP address type:  Static  Dynamic (DHCP)

IP address:

Subnet mask:

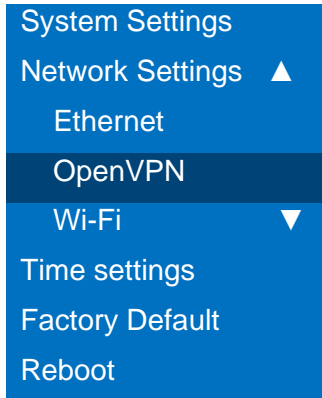
Default gateway:

Primary DNS:

Secondary DNS:

When Network Settings is selected, two more menu items will be visible: Ethernet settings and WiFi settings. The Wifi settings are grayed-out when there is no Wifi dongle installed.

The Ethernet screen allows you to configure the TCP/IP settings.



### OpenVPN Settings

#### General

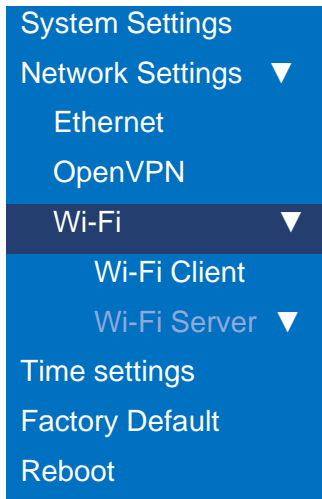
Gateway:

#### Authentication

TBD TBD

Setting up a VPN client allows for secure traffic over Ethernet to an external VPN server.

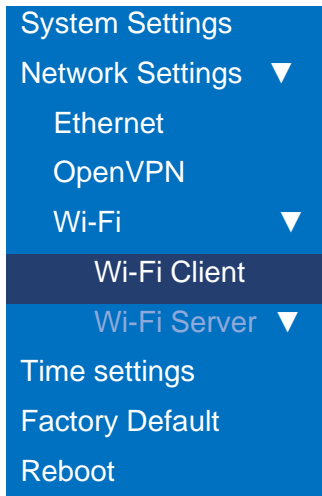
A VPN tunnel improves security, which may be necessary when the ESL server is configured to connect to an external database.



Wifi Server  off  on  
 Wi-Fi Client  off  on

When Wifi Server is set to 'On', the EBS-50 will behave like a Wifi access point allowing clients to connect to it. The Wifi client menu is then disabled.

When Wifi client is selected, the EBS-50 can connect to an existing Wifi network.



#### Available networks

Name	WPA	WPA2	WEP	TKIP	CCMP	Signal strength
Opticon Private		✓			✓	📶
Opticon ESL Demoroom 2.4G	✓	✓		✓	✓	📶
Opticon Guests		✓			✓	📶
Opticon LAN		✓			✓	📶
Opticon Rep		✓			✓	📶

When Wifi Client is selected, the EBS-50 will create a list with all the available networks. When done, it will show the list and when a network is selected, it will ask for the password and then connect to it. It is also possible to enter the Wifi network ID and password manually.

- System Settings
- Network Settings ▼
- Ethernet
- OpenVPN
- Wi-Fi ▼
- Wi-Fi Client
- Wi-Fi Server ▲
- Access point
- IP Settings
- Time settings
- Factory Default
- Reboot

SSID:   Hide SSID

Password:

Frequency:  2.4 Ghz  5 Ghz

Region:

Channel:

When Wifi Server is selected, the Wifi Server menu option will allow you to configure the Access point parameters.

- System Settings
- Network Settings ▼
- Ethernet
- OpenVPN
- Wi-Fi ▼
- Wi-Fi Client
- Wi-Fi Server ▲
- Access point
- IP Settings
- Time settings
- Factory Default
- Reboot

### Wifi IP settings

Default gateway:  .  .  .   
 (=My IP address)

Subnet mask:  .  .  .

### DHCP Server

Start IP address:  .  .  .

End IP address:  .  .  .

Subnet mask is as entered above

Address lease time:  minutes  Infinite

Default gateway is as entered above

Primary DNS:  .  .  .

Secondary DNS:  .  .  .

The IP settings under the Wifi Server option, allows you to select the EBS-50's own IP address (the default gateway) and subnet mask. It also allows you to enable a DHCP server that can configure client Wifi devices that connect to this access point. When the DHCP server is disabled, all related settings will be hidden. In that case, the Wifi clients should all be configured with static IP addresses.

- System Settings
- Network Settings ▼
- Time settings
- Factory Default
- Reboot

### Time Settings

Date (YY:MM:DD)

Time (HH:MM:SS)

Daylight saving time

Synchronize with a time server

Time server:

The Time Settings option allows you to set the time inside the EBS-50, but it is also possible to synchronize with an NTP time server. Visit [www.ntppool.org](http://www.ntppool.org) for a list of public time servers

The options Factory Default and Reboot are fairly self-explaining.

## 10.2 ESL Server setup

The ESL server setup is described in an external manual TBD TBD