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Technical Manual

NEXUS AM Deactivator

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1   Terms and abbreviations

This chapter describes the terms and abbreviations used in this document.

Term	Abbreviation	Explanation
(Hard) Tag	Tag	Passive component, equipped with a lock to allow attachment to garments, which can be detected by the receiver.
(Paper) Label	Label	Passive component, usually equipped with glue on one side to allow attaching the label to any object, which can be detected by the receiver.
Antenna	ANT	The mechanical structure (which usually consists of a frame, wires and electronic PCB) to allow proper detection of tags and labels. Also referred to as: pedestal, barrier.
Burst Frequency	Fb	The operating frequency of the TRX.
Device Explorer	Device Explorer	Cross Point Device Explorer Software tool for adjustment of Cross Point devices that are connected to the Cross Point Field Bus structure (RS-485).
EAS	EAS	Electronic Article Surveillance
Foiled Twisted Pair	FTP	The FTP cable is surrounded by an outer foil shield.
I/O	I/O	Digital Input/Output
Printed Circuit Board	PCB	The electronic board.
Radio Frequency	RF	Electronic signals generated by a transmitter and detected by a receiver.
Receiver	RX	Electronic device capable of receiving AM signals.
Transceiver	TRX	Electronic device capable of transmitting and receiving AM signals, sharing the same electronic circuitry and housing. Also referred to as mono-antenna.
Unshielded Twisted Pair	UTP	Common network cable.

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2 Introduction

The NEXUS AM Deactivator is a combined label detector and label deactivator, designed for high speed & long distance detection and deactivation of AM labels.

Figure 1: NEXUS AM Deactivator

The NEXUS AM Deactivator can be used as a stand-alone unit or can be connected with Cross Point's Web based Integrated Loss Prevention Platform, CrossCONNECT, allowing reports on deactivation statistics to be generated as well as easy (online) maintenance.

2.1 Field Bus Network structure

The NEXUS AM Deactivator can be connected to Cross Point's AM systems through CAT5 wiring and can be connected to a host (e.g. a CrossCONNECT Access Point or a computer) and communicate with this host using the Cross Point Field Bus Protocol.

This allows retrieval of device information and various settings to be made through use of the software.

All this functionality is described further on in this manual.

2.2 Restrictions and limitations

The following restrictions and limitations must be considered:

2.2.1 Usage in metal environments

The NEXUS AM Deactivator **cannot** be installed in environments where metal surfaces are within **15cm** distance of the deactivator's antenna. Metal has a negative effect on the performance of the deactivator because it de-tunes the antenna, which decreases the detection and deactivation power. Always test the deactivator first before mounting it!

⚠️ **Do not install the NEXUS AM Deactivator in checkouts or desks which consist of metal!**

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2.2.2 Software restrictions

The NEXUS AM Deactivator must be tuned with Cross Point's Device Explorer software.

During setup of Device Explorer you are required to specify your dealer code in order to be able to use the Device Explorer software. If you do not have a dealer code yet then contact Cross Point to obtain one.

2.2.3 Detection/deactivation distances

The specified detection distances are maximum values. Dependent of environmental noise these maximum values might not be achieved. See chapter 2.3 for more details on potential noise sources and installation guidelines.

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2.3   Stand-alone usage

The NEXUS AM Deactivator can be used as stand-alone unit. Adjustments for synchronization, sensitivity and notifications can be made through the Cross Point Device Explorer software on a laptop/PC.

Figure 2: Field Bus connection

2.4   Field Bus Network structure

The NEXUS AM Deactivator can be integrated in Cross Point's Field Bus network in combination with NEXUS AM anti-shoplifting systems.

Figure 3: Field Bus structure in combination with NEXUS RF

By connecting the NEXUS AM Deactivator in the NEXUS AM network, reports on deactivation statistics as well as internet connectivity and remote maintenance can be enabled. See the "Manual CrossCONNECT Access Point" (www.crosspoint.nl) for further information.

2.5 Technical and mechanical specifications

Table 1 shows the mechanical and technical specifications of the NEXUS AM Deactivator.

Specifications

Dimensions (L x W x H)	280 x 240 x 65mm
Power supply	230VAC or 115VAC 50-60Hz
Current consumption	115VAC – 320mA
	230VAC – 160mA
Temperature range	$0 – 50^{o}C$
Frequency	58kHz
Technology	Pulse-listening Acoustic Magnetic (AM)
Detection range	Up to 18cm* (with DR label)
Deactivation range	Up to 18cm* (with DR label)

Table 1: Specifications
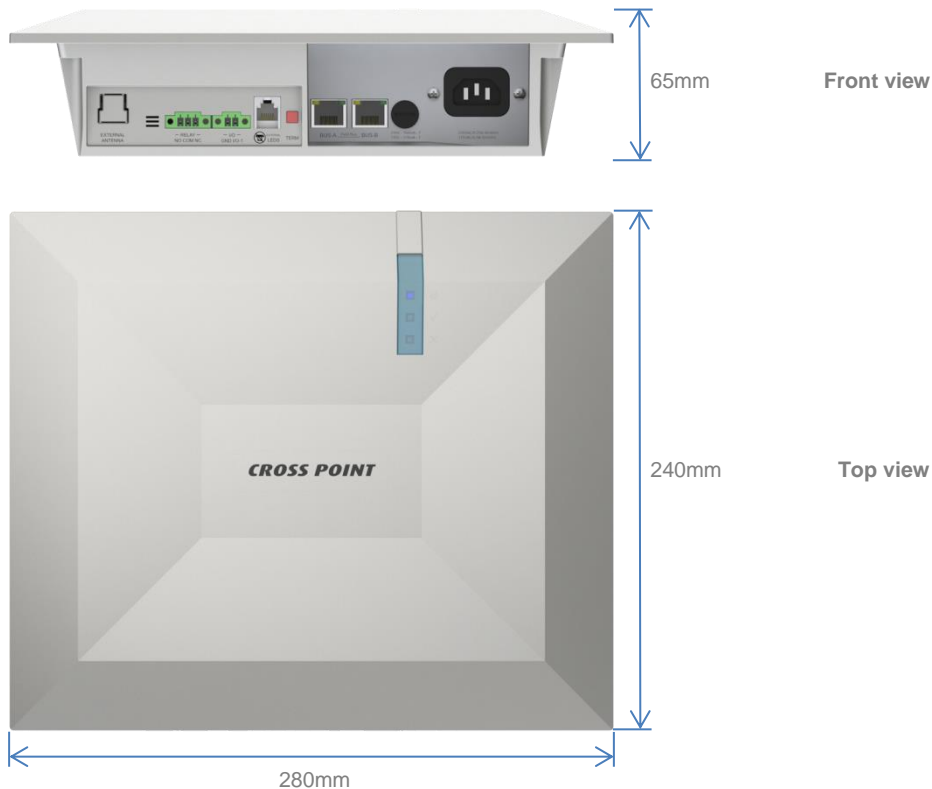
*differs for different brands and environment

65mm   **Front view**

240mm   **Top view**

280mm

Figure 4: NEXUS AM Deactivator dimensions

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3 General AM and EAS issues

This chapter covers the various issues related to Acoustic Magnetic systems, deactivators and Electronic Article Surveillance systems in general, like:

- Noise sources
- Installation guidelines

3.1 Noise sources

Listed below are various noise sources that might affect the performance of any EAS system and deactivator. It is strongly advised to either eliminate these noise sources (as far as possible) or maintain the largest possible distance to these noise sources.

The following devices can create noise signals or absorb AM signals which can reduce the performance of an EAS system and AM deactivator:

- AM systems installed in the same or other shops.
- Any electronic device that operates around 58kHz or produces harmonic frequencies around 58kHz.
- An active laptop. The converter for the backlight in the screen can create a lot of noise which is detected by the EAS system or deactivator and can reduce the performance dramatically. Make sure to keep laptop computers at least 3 meters away from the antennas.
- (Moving) Objects containing metal, like checkouts, sliding and revolving doors, elevators, escalators, roller shutters, frames, etc.
- Electronic devices, like computers, laptop screens, LCD screens, cash registers, engines, transformers, etc.
- Vertically positioned power cables, both low voltage and high voltage.
- Lights (flashing, fluorescent, halogen, gas-discharge, etc.)
- Metal scan systems installed in close vicinity. Cross Point's Metal Scan operates around 19kHz in channel 0 and has a third harmonic frequency around 58kHz.

3.2 Installation guidelines

Listed below are EAS installation guidelines to ensure a proper installed and functioning system. Not following these guidelines might result in less performance of the NEXUS AM Deactivator.

1. Check the shop carefully for possible noise sources prior to installation. If possible noise sources are found then try to eliminate these sources or pick the best position for the deactivator where the influence of these noise sources will be minimized.

2. Avoid unnecessary long cables. If the deactivator is connected to the NEXUS AM system, run the UTP cables in a direct line to the EAS antennas.

3. The NEXUS AM Deactivator is powered by 230VAC or 115VAC mains power. The mains power frequency is 50-60Hz.

4. Mount the deactivator in recessed position into a (cash)desk. Dimensions for the cut-out area are 240 x 200mm.

5. Make sure to properly insert the cables in the connectors.

3.3   Safety instructions

This chapter contains information on safe usage of the NEXUS AM Deactivator. Read this section carefully as it contains important safety guidelines.

> **The NEXUS AM Deactivator generates high inducted voltage signals up to 400VDC. If the housing is opened without disconnecting the mains power first, a high risk of electric shock is introduced.**
>
> **Therefore always disconnect the mains power first and wait at least 30 seconds before opening the housing.**

1. The NEXUS AM Deactivator must be mounted in such a way that it's always possible to disconnect it from the mains power.

2. Always disconnect the mains power prior to opening the housing.

3. After the mains power has been disconnected, wait at least 30 seconds to allow the high voltage to discharge.

4. Only open the housing in case:

   a. The mains voltage needs to be adjusted from 230VAC (default setting) to 115VAC or vice versa. Use switch SW1 to change the mains voltage setting.

   b. The device is not working and one of the internal fuses needs to be checked or replaced.

   c. The device is not working and the antenna connection needs to be checked.

   d. The battery for the internal clock needs to be replaced.

5. Do not place magnetic data holders, like bank cards, credit cards, tapes, etc., close to the NEXUS AM Deactivator, because the magnetic field will destroy the information that is stored on the magnetic data holder. Keep these objects at least 50cm away from the deactivator's antenna while deactivation is active.

3.3.1   Serviceable parts

The following parts of the NEXUS AM Deactivator are serviceable after following the above mentioned safety instructions:

1. External main fuse 160mA (230VAC) or 315mA (115VAC). Make sure to replace this fuse accordingly when the power input is switched!

2. Internal mains power switch for 230VAC to 115VAC. Make sure to replace the external fuse accordingly when the power input is switched!

3. Internal fuses F1 (T500mA) and F2 (T500mA)

4. Internal battery CR 1225 (3V lithium)

4 Equipment and tools

The following equipment and tools are advised to use when installing and tuning the NEXUS AM system.

4.1 General installation tools

The general tools required for installation of an EAS system (drills, screwdrivers, cutters, etc.) are not described in detail.

4.2 Laptop computer

To properly adjust the NEXUS AM Deactivator through Cross Point's software, it is strongly recommended to use a laptop computer.

A laptop will put you in full control of all NEXUS AM Deactivator settings and features.

The following minimal requirements are set for the laptop:

- Intel 1.3GHz or faster processor
- Microsoft Windows XP Home or Professional with Service Pack 3 (32 bit) or Service Pack 2 (64 bit)
- Microsoft Windows Vista with Service Pack 2 (32 bit and 64 bit)
- Microsoft Windows 7 with Service Pack 1 (32 bit and 64 bit)
- Microsoft .NET Framework 3.5 Service Pack 1
- 512MB of RAM (1024MB recommended)
- 50MB of available hard-disk space for Device Explorer
- Minimal screen resolution 1024x768 (recommended 1600x1200)
- Video hardware acceleration

4.3 Software

The NEXUS AM Deactivator is interconnected through the **Cross Point Field Bus**.

To be able to adjust and configure the NEXUS AM Deactivator, **Cross Point Device Explorer** is required.

Please refer to the *Cross Point Device Explorer User Manual* for further details on all features and usage of this software.

5 AM operating principle

The NEXUS AM Deactivator operates on the pulse-listening principle. Using the zero crossing of the 50Hz mains frequency as a trigger, a short burst of 58kHz signal is transmitted and a receiver window is 'opened' after the transmission burst has stopped.

If a label/tag was present within detection range during the transmission burst, the resonance of this label/tag will be detected in the receiver window and a deactivation burst is triggered.

A single 50Hz mains frequency cycle is dived into three phases; phase A, B and C. Each phase covers 1/3 of the 50Hz cycle duration.

A noise reference window is opened to detect the environmental noise. This signal is compared with the signal received in the receiver window and allows the software to properly distinguish a tag signal from a noise signal.

Figure 5 shows the AM operating principle (at 50Hz, with a default delay of 200µs) during one 50Hz cycle.
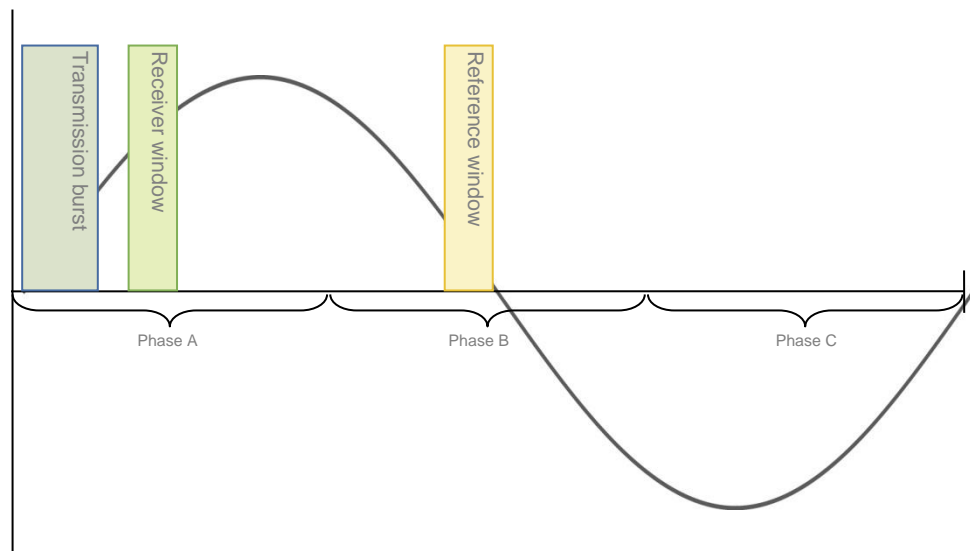

Figure 5: AM operating principle

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5.1 Synchronization principle

When multiple AM systems and deactivators are installed in each other's vicinity, it's very important to properly synchronize the transmission burst and receiver windows for all systems involved. If systems are not properly synchronized they might create false alarms and poor detection! Keep in mind that AM signals, when compared to other EAS technologies, can "travel" quite far.

Figure 6 shows two AM systems that are not properly synchronized.
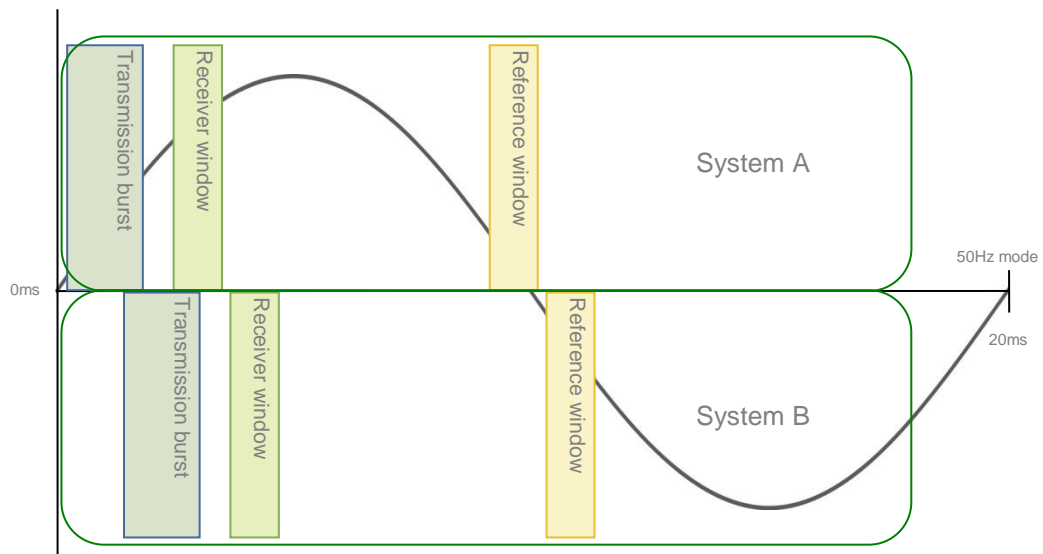

Figure 6: Two AM systems NOT synchronized

The transmission burst of system B starts later than the burst of system A, resulting in the fact that system A is receiving the transmission burst of system B in its receiver window. This will create false alarms and poor detection on system A, where system B will function properly as the transmission burst of system A is not affecting the receiver window of system B.

This problem can be solved by making sure that both systems transmit and receive at the same moment, which can be realized by changing the delay time for one of the two systems.

Example:

System A has currently a delay time of 0.2ms and system B a delay time of 1.4ms. The delay time of system B needs to be corrected to the delay time of system A (or vice versa), so their mutual transmission burst and detection windows will overlap each other (see Figure 7). This will result in both systems working properly without interference (see Figure 8).
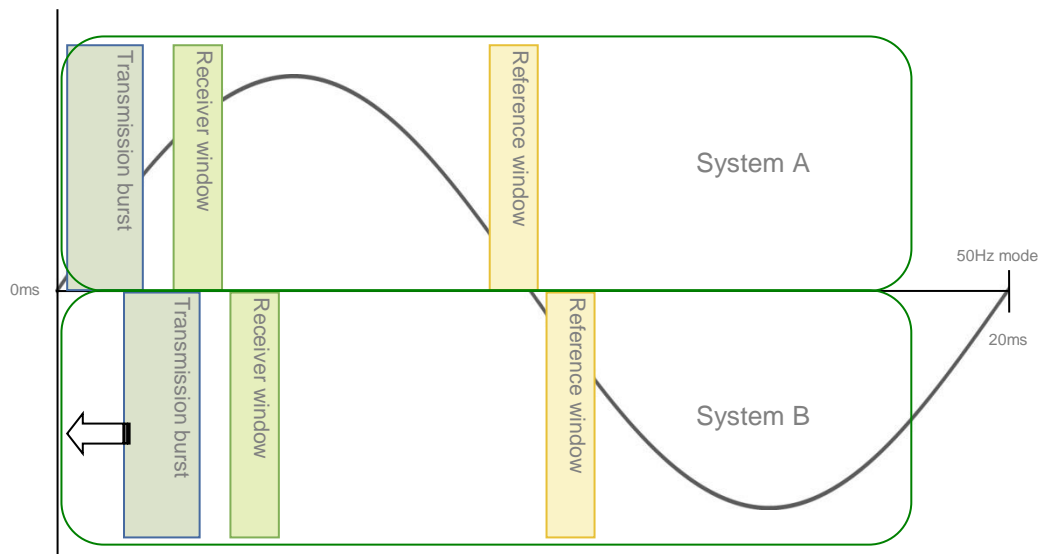
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Figure 7: Correcting the delay time of system B

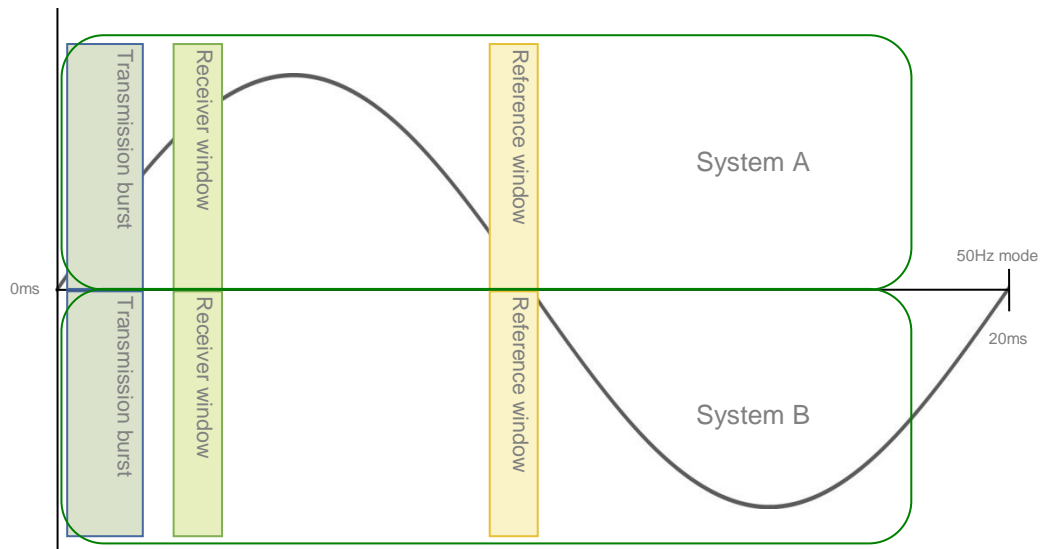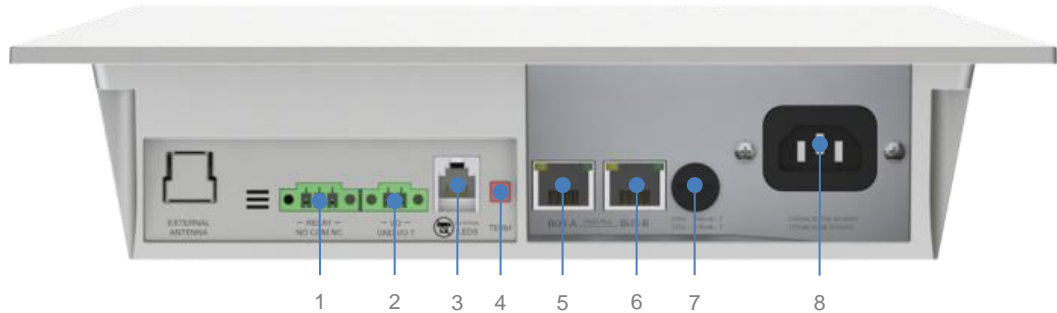Figure 8 shows two AM systems that are properly synchronized.

Figure 8: Two AM systems properly synchronized

The synchronization can be performed by making use of Cross Point's software. The exact synchronization procedures are described in chapter 0.

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6   Connections

This section explains the various connections of the NEXUS AM.

NEXUS AM Deactivator connections explanation

1	Relay connections, potential free. Can be triggered during deactivation.
	Nominal switching capacity: 2A, 30VDC
	Normally Open (NO), Common (COM) and Normally Closed (NC)
2	I/O connections: GND and I/O-1. Can be used as input for a foot switch.
3	External LEDs connector. Type: RJ-11
	Do not connect a telephone line to this connector!
4	Termination switch. Used to terminate the Field Bus. Must be activated when this device is the last device in the Field Bus.
	Pushed: terminated, a red LED between the relay and I/O connectors lights up.
	Not pushed: not terminated.
5	BUS-A: Field bus connector
6	BUS-B: Field bus connector
7	Main fuse: 160mA (230VAC) or 315mA (115VAC)
8	Mains power inlet: 230VAC (default setting) or 115VAC
	Use SW1 to switch to 115VAC if required (see chapter 3.3).

7   Configuration

The NEXUS AM Deactivator must be configured with **Cross Point Device Explorer**. This chapter covers all settings.

It is expected that you already have experience with Cross Point Device Explorer. Please refer to the **Cross Point Device Explorer User Manual** and the **Technical Manual NEXUS AM** in case you need further information. All manuals can be downloaded from www.crosspoint.nl.

7.1   Other devices

The AM Deactivator is located in the **'Other devices'** section of Device Explorer.
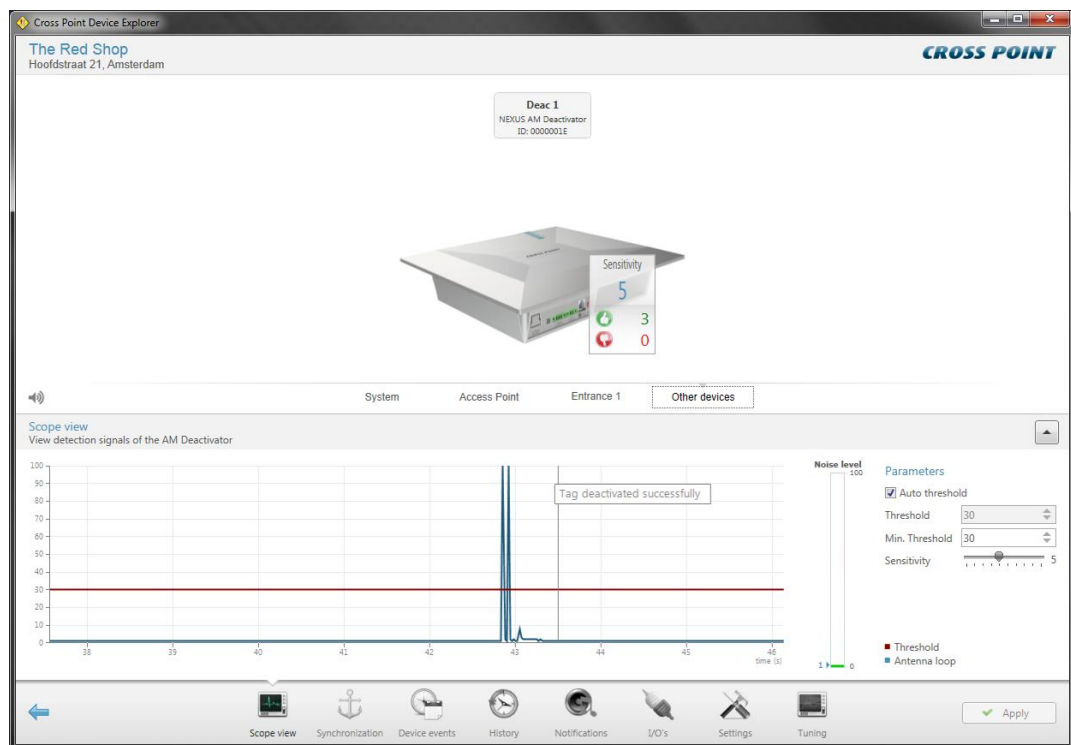

Figure 9: Other devices

After entering the 'Other devices' screen, the Scope view of the AM Deactivator is shown. The scope view shows the threshold level (red line) and signal level (blue line). Furthermore a noise level indicator is visible that shows the amount of ambient noise that is being picked-up by the deactivator.

The threshold level can be adjusted either manually or automatically. In automatic mode, the deactivator will continuously adjust the threshold level to the best value, dependent of the ambient noise.

The NEXUS AM deactivator must detect a label first before it will deactivate the label. The detection height of a label is determined by the **Sensitivity** setting. The detection sensitivity can be adjusted manually between 1 (lowest sensitivity) and 10 (highest sensitivity).

7.2 Synchronization

When AM systems or AM deactivators are installed in relative close vicinity of each other, it is of extreme high importance that the transmission bursts of all transmitters (transceivers) occur at the same moment. To be able to view and change the position of these transmission bursts, the Synchronization screen is available.

⚠️ **When the Synchronization screen is open, the transmission burst of this deactivator is disabled. As a result of this, the deactivator will not detect any labels! Make sure to leave this screen to enable detection and deactivation of labels again.**

When the transmission bursts are not synchronized properly, unwanted deactivations and reduced sensitivity will be the result. The Synchronization screen will show exactly if and where other system transmission bursts are detected.
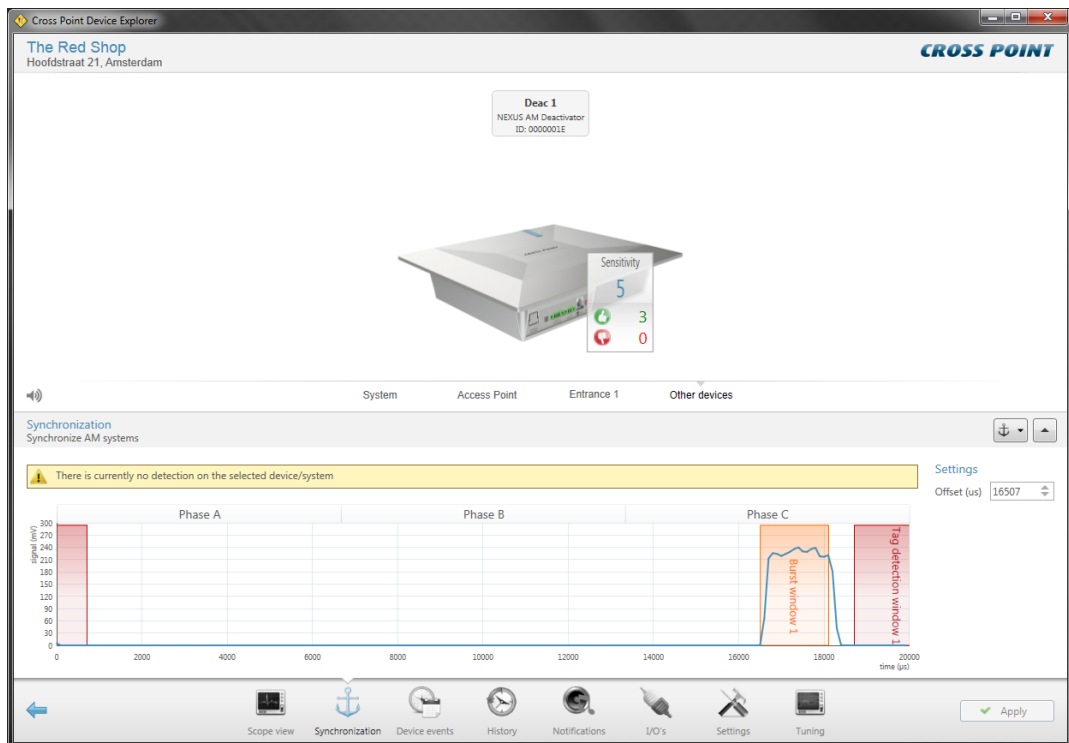

Figure 10: Synchronization

We now have two ways of synchronizing the systems; manually or automatically.

⚠️ **It is advised to tilt the deactivator in a vertical position when synchronizing the unit, as it will detect other AM systems and deactivators better, making it easier to properly synchronize all AM devices.**

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7.2.1 Manual synchronization

By default the transmission burst can be synchronized manually by dragging and moving the burst throughout the complete 20ms time base.

Just hover the mouse cursor over our transmission burst (the cursor will change to a horizontal double arrow) and press down your left mouse button. While keeping the mouse button pressed, move the transmission burst and position it on top of the other system's transmission burst. Together with moving the transmission burst, also the receiver and reference windows will move automatically since they have a fixed reference to the transmission burst.

Figure 10 shows the deactivator's transmission burst having been placed exactly over the transmission burst of another AM system/deactivator. The deactivator's tag detection window is in a clear part of the detection band, which results in proper performance of the deactivator.

7.2.2 Automatic synchronization

Click the Automatic synchronization button to open the underlying menu.

7.2.2.1 Start automatic synchronization mode

When this option is selected, the software will detect the best position for the transmission burst. Just click the Automatic Sync button and within 10 to 15 seconds the software will have determined the best burst offset position.

This option can only be used when other AM systems or AM Deactivators are visible in the synchronization screen.

7.2.2.2 Temporarily disabling entrance bursts

When you start synchronizing entrance(s), start by selecting the Synchronization page of the first entrance. It is very useful to switch the transmission bursts of all other entrances off, so you can determine if there are any other AM systems or deactivators in the area, to which you must synchronize your deactivator.

Click on the green checkmark in front of the entrance/deactivator name to disable the transmission burst of that entrance/deactivator. The disabled icon will appear, indicating the transmission burst for that entrance/deactivator is switched off. Click this icon again to switch the burst on again.

When you leave the Synchronization page, all disabled entrances/deactivators will automatically start bursting again.

7.3   Device events

The Device events screen shows a list of events that occurred on the selected deactivator. All events are date & time stamped.
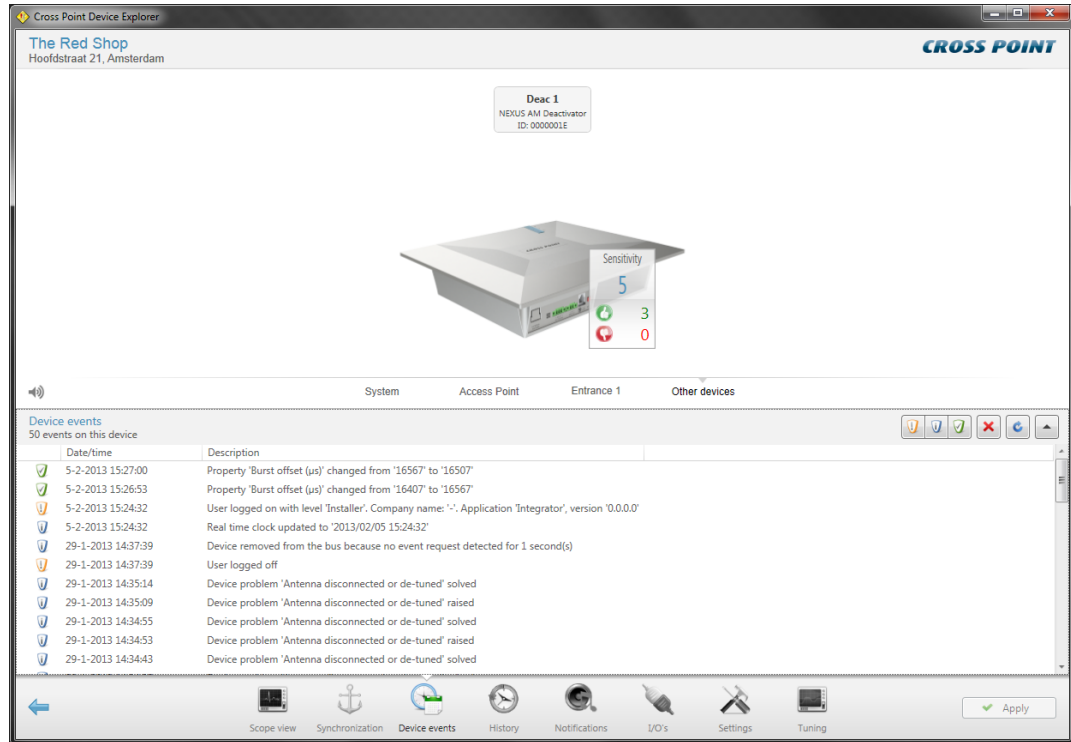

Figure 11: Device events

The events page show security events, status events and configuration events. Each event type can be distinguished by means of their individually colored icons.

By default all types of alarms are displayed, but pressing one or more of the filter buttons will show or hide the selected events.

Click the Delete button to delete all events in the list and to permanently remove them from the connected antennas.

Click the Refresh button to refresh the event list.

All events are date & time stamped, so it's easy to find out when they occurred.

7.4 Deactivation history

The Deactivation history page shows a detailed list of the deactivations for the selected day.
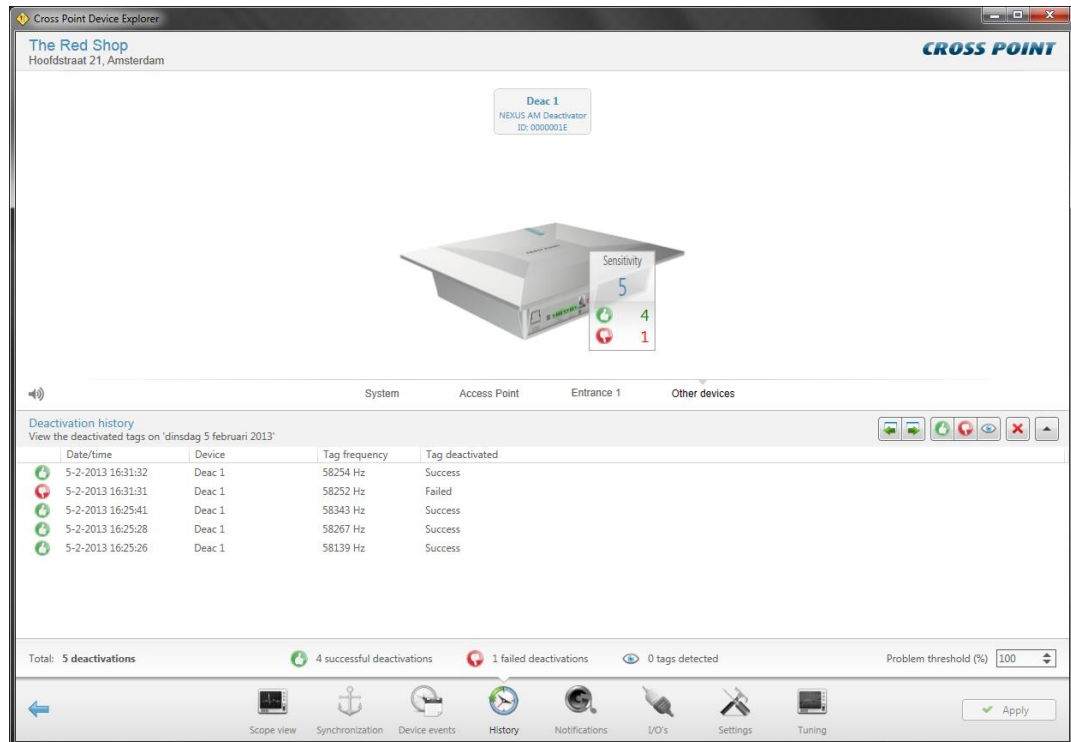

Figure 12: Deactivation history

By default both the successful and failed deactivations are displayed, but pressing one or more of the filter buttons will show or hide the selected deactivations and (if configured as detector) the detected tags.

Click the Delete button to delete all deactivations in the list and to permanently remove them from the selected deactivator.

All deactivations are date & time stamped, so it's easy to find out when they occurred. Click the Previous or Next day buttons to view deactivations that occurred on these days.

The Problem threshold level can be set to a percentage of accepted failed deactivations. For example, if this threshold is set to 10%, a problem will be created if more than 10% of all deactivations for that day have failed. The minimum allowed value is 1%. Set this value to 100% to disable this functionality.

7.5 Notifications

The NEXUS AM Deactivator can notify the user whether the deactivation was successful or not. In the 'Notifications screen' the notifications for successful and failed deactivations can be configured.
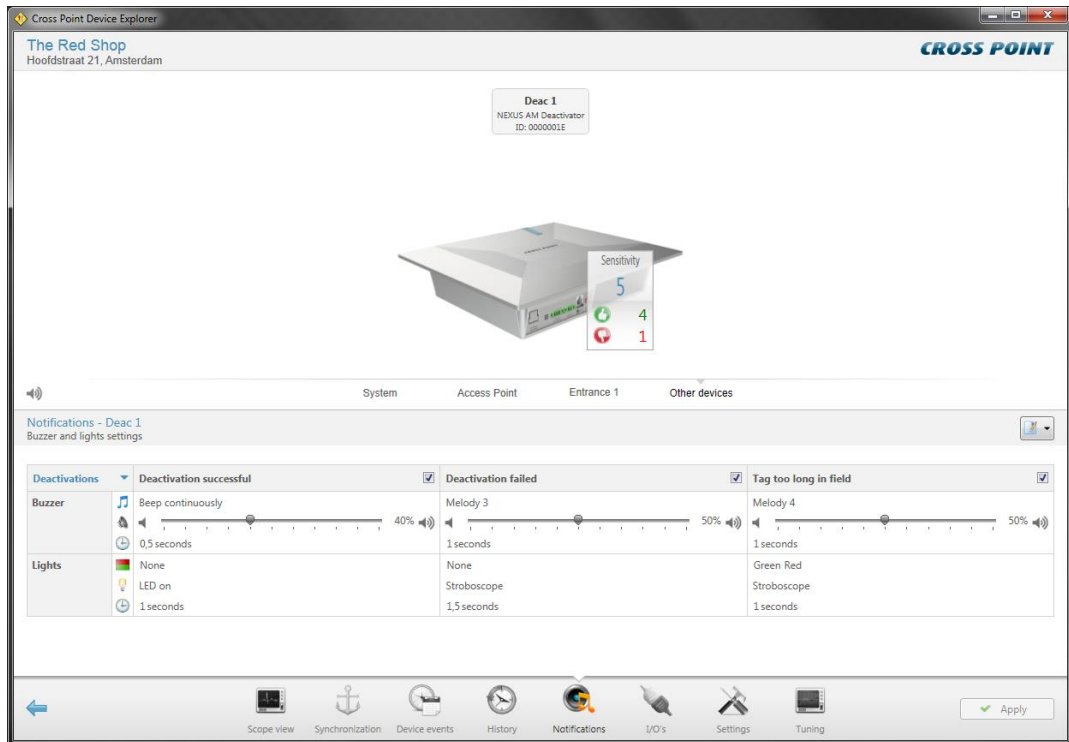

Figure 13: Notifications

The successful, failed and tag too long in field notifications settings for buzzer and lights (located in the housing of the deactivator) can be freely configured according to the wishes of the user.

In case the deactivator is configured as tag detector (see section xxx), also the Tag detected notifications can be set.

Notification settings can be saved for usage in other stores. Click the **Load and save notifications** button and select the option 'Save notifications' from the menu and the Save notifications dialog opens.

A list with pre-defined notifications that have previously been saved appears. Select one from the list to overwrite the selected pre-defined notification, or enter a new name and description for the new notification.

If you have an active internet connection, you can also tick the checkbox in front of the option 'Save on server' to store this new pre-defined notification centrally, so it is also available for your colleagues.

Click the Save button to store the notification.

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7.6   Notifications I/O settings

Besides audio and visual notifications on the NEXUS AM deactivator itself, it is also possible to trigger external devices through an output and relay. This Notification screen enables you to configure these I/O and relay settings.
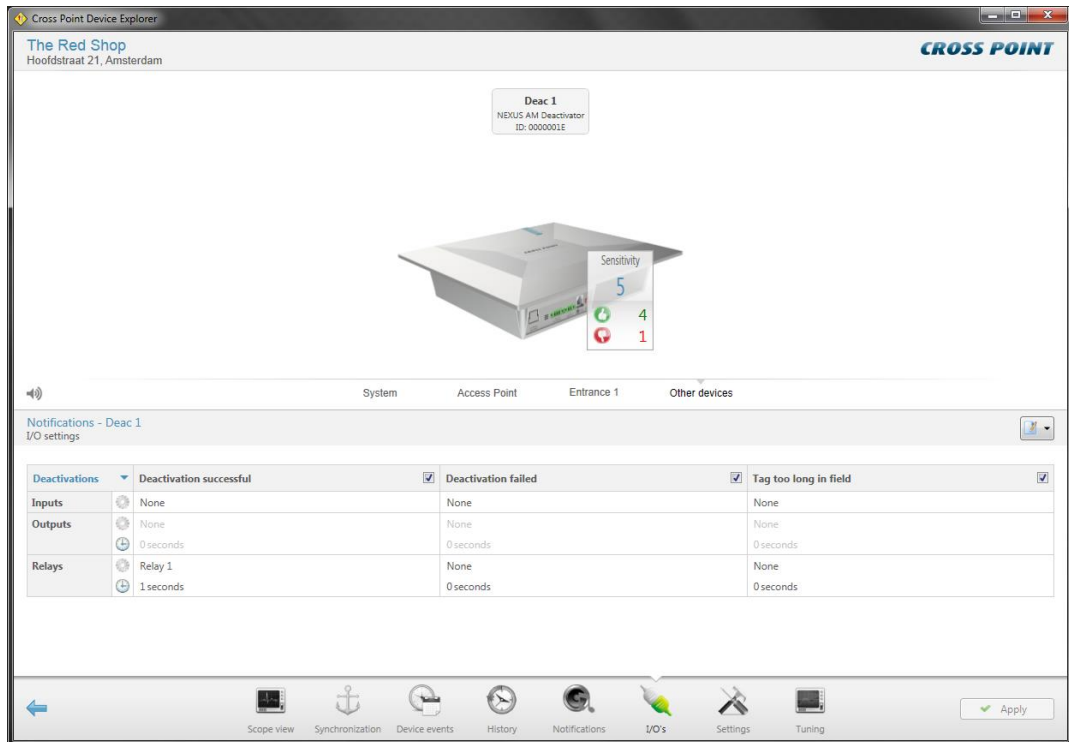

Figure 14: Notifications I/O settings

The successful, failed and tag detected notifications settings for the I/O and relay can be freely configured according to the wishes of the user.

Notification settings can be saved for usage in other stores. Click the **Load and save notifications** button and select the option 'Save notifications' from the menu and the Save notifications dialog opens.

A list with pre-defined notifications that have previously been saved appears. Select one from the list to overwrite the selected pre-defined notification, or enter a new name and description for the new notification.

If you have an active internet connection, you can also tick the checkbox in front of the option 'Save on server' to store this new pre-defined notification centrally, so it is also available for your colleagues.

Click the Save button to store the notification.

7.7   Settings

The Settings configuration screen shows various settings, like sensitivity and tag deactivation range, for the NEXUS AM Deactivator and enables these settings to be changed.
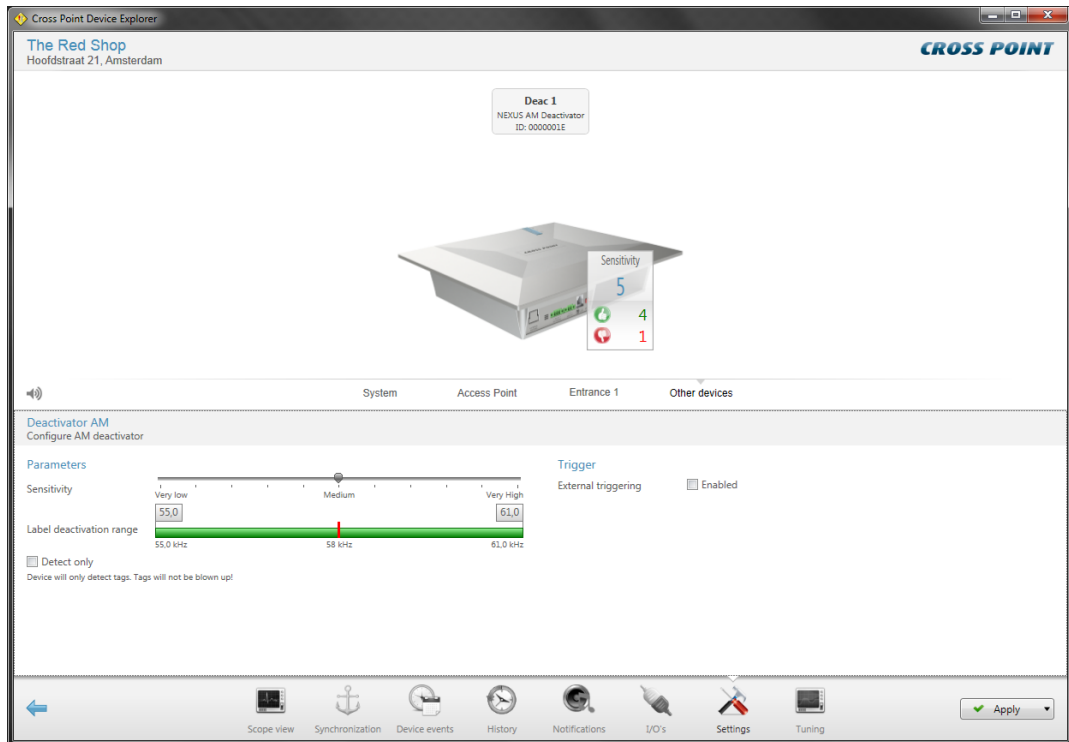

Figure 15: AM Deactivator settings

Parameters

The NEXUS AM deactivator must detect a label first before it will deactivate the label. The detection height of a label is determined by the **Sensitivity** setting. The detection sensitivity can be adjusted manually between 1 (lowest sensitivity) and 10 (highest sensitivity). This setting is the same setting as in the Scope view screen.

The **Label deactivation range** determines within which frequency range labels will be detected and deactivated. By default the range is set to detect labels between 55kHz and 61kHz (6kHz bandwidth total). In case there are many false deactivations caused by ambient noise signals, it can be necessary to reduce this bandwidth. Just click on the edge of the green bar and drag it to the required position. Remember that reducing this bandwidth might result in labels not being properly detected and deactivated, so only reduce this range if it is really necessary!

Trigger

It is possible to have the deactivator deactivate only when it is allowed to do so. For example, after a barcode scanner has successfully read the product's barcode and sends a signal to the deactivator that it is allowed to deactivate.

This can be achieved by enabling this trigger option and make a physical connection between the barcode scanner output and the I/O input of the deactivator.

The 'Trigger on input method' offers various methods as input, like Input low, Input high, Rising edge, Falling edge and Rising or falling edge. This offers you the possibility of adapting the deactivator's input to the output of the external device.

The 'Deactivator enabled for deactivation duration' represents the deactivation time window in which the deactivator can detect and deactivate a label after the trigger was activated by the external device. When this time has passed, the external device must activate the trigger again to open up a new deactivation time window. The minimum value is 1 second and the maximum value is 254 seconds. The option 'Infinite' can be activated if an infinite deactivation window is required.

The 'Number of deactivations' represents the maximum number of deactivations that are allowed within the deactivation time window. If the deactivation time window is set to 'infinite', the number of allowed deactivations will determine when the trigger needs to be activated again.

7.7.1 Tag detector

The NEXUS AM deactivator can also be switched to a tag detector. In the detector mode, the unit only detects DR labels and AM hard tags, without transmitting deactivation pulses. In detector mode, the unit functions as a reminder unit. Please note that the unit can only be either a deactivator or a detector, not both at the same time.

Tick the "Detect only" checkbox to switch the unit to detector mode. The tag detected notification must be configured to give the required buzzer and light signals when a tag is detected. The deactivation notifications (successful and failed) should be disabled.

7.8 Tuning

The NEXUS AM Deactivator is performing at its best when maximum power is being transmitted at 58kHz. The Tuning screen shows a graphical display of the antenna loop tuning and its associated power.

Figure 16: Tuning

The highest voltage output should be at 58kHz (the vertical red line). The spot where the orange curve crosses the red line is the actual transmitted power, also indicated in the white box on the left. A higher output will increase the performance of the deactivator, where a lower output will result in less performance.

The tuning is fixed and cannot be changed. The graph only indicates the antenna voltage, so you can determine if it is reduced when the deactivator is placed in an environment which contains **metal objects**.

If the deactivator is positioned close to metal surfaces, the antenna voltage will drop. When the antenna voltage drops below 47V, a problem will be raised that the antenna is detuned. Since reduced antenna voltage results in less performance, it is strongly recommended to ensure that there is enough distance between the deactivator and metal surfaces and objects (see section 2.2.1).

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8   FCC STATEMENT

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.

To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.

This equipment complies with Part 15 of the FCC rules. Operation is subject to the following 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.

Caution!
To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.