



Laser Monitoring System

**EMAX-3100
User Manual**

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1 General Description

The Laser Monitoring System EMAX-3100 is specially designed for acoustic room monitoring.

This system is operated by transmitting an invisible laser beam to the window of the target room. The window pane is slightly vibrating in accordance to the sound waves emanating from speech. The angle of reflection will be slightly changed. The receiver picks up the reflected beam that is modulated by the window pane vibrations. The positional change of the reflected beam will, of course, also be detected. The picked up speech can now be monitored and recorded. The targeted distances Range from 5 meters to 2000 meters.

The Laser Monitoring System consists of a laser transmitter EMAX-3100 TX and a laser receiver EMAX-3100 RX. Both transmitter and receiver can be mounted on a gear head of a tripod.

The transmitter is supplied with a telescopic sight to aid adjustment of the laser beam. An IR-sensitive B/W CCD camera is used for detection and adjustment of the reflected laser beam.

The audio signal, which is gained from the reflected laser beam, will be amplified and fed to an adjustable headphone input and a line output respectively. High-pass and low-pass filters may be used to improve audio quality.

Laser transmitter EMAX-3100 TX

| | |
|-------------------|----------------------------------|
| Laser type | Semiconductor laser |
| Wave length | 790 nm |
| Output power | 30 – 50 mW, internally regulated |
| Focal distance | f = 75 mm |
| Eye piece | Telescopic sight 4x15 |
| Search tone | Switchable |
| Power supply | 12 V DC |
| Power consumption | ca. 100 mA |
| Dimensions | 280 x 100 x 54 mm |
| Weight | 800 g |

Laser receiver EMAX-3100-TX RX

| | |
|--------------------|--|
| Receiving unit | PSD (optical band-pass filter) |
| Lens | f = 75 mm |
| Connections | Headphones, line output |
| Audio filter | Low-pass and high-pass, adjustable |
| Sighting mechanism | B/W camera (75 mm lens) |
| Power supply | 12 V DC |
| Power consumption | ca. 170 mA (with camera), 70 mA (camera off) |
| Dimensions | 170 x 100 x 45 mm |
| Weight | 900 g |

2 Safety note



According to the international standard **IEC 6086325-1 / Edition 1.2 27001-08 .Safety of laser products**, the laser transmitter EMAX-3100-3100 TX is classified as **Laser Device Class 3B**.

A safety zone of at least 20 m is compulsory! Do not direct the laser beam at persons or animals within safety zone! Special Safety Glasses are needed for operation.

3 Getting started

Mount both laser transmitter and laser receiver onto the gear heads of each tripod. Extend the center column of the tripod by at least 10 cm. Bring transmitter and receiver into position.

- Make sure there is a line-of-sight between transmitter/receiver and window of the target room.
- The angle of incidence is equal to the angle of reflection. This applies to horizontal as well as vertical level.
- A higher angle of incidence produces a higher angle of reflection. Detection of the reflected beam can thus be made more difficult.

After transmitter and receiver are brought into position, take the following steps

- Connect a video monitor and headphones to receiver
- Secure power supply for transmitter and receiver
- Turn on camera switch on receiver

4 Operation of Laser Monitoring System

4.1 EMAX-3100 TX laser transmitter set-up

1. Direct laser transmitter at target (window) by means of the telescopic sight.
Large window panes may cause interferences through their natural vibration. You should therefore choose the target point closer to the window frame.
2. Open aperture of transmitter lens (F1.8).
3. Adjust focus of transmitter lens. The value should be approximately the distance to target.

4.2 EMAX-3100 RX laser receiver set-up

1. Adjust receiver by means of CCD camera so that the target point of the laser beam can be seen on the video monitor.
Adjust aperture and focus of camera lens to get an optimum image on the video monitor.
Successful adjustment is indicated by two light spots which can be seen on the monitor:
 - a. Target point of transmitted laser beam
 - b. Target point of reflected laser beam

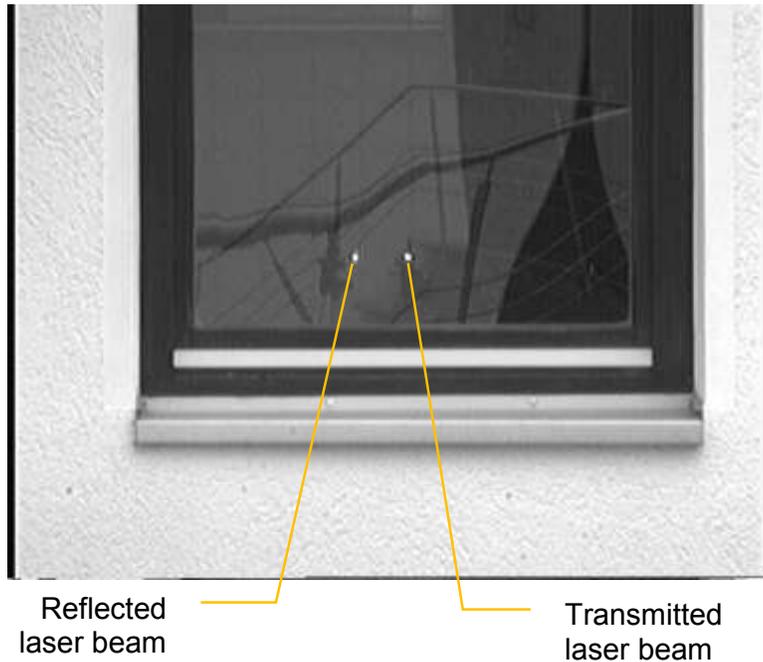


Fig. 1: Target point of the laser beam

2. Fine-tune focus of transmitter lens until target point of transmitted laser beam can be seen clearly on video monitor.
3. Adjust the gear head of the laser transmitter so that the reflected laser beam meets the laser receiver. Target points of both transmitted and reflected laser beam must be brought into same position.

Use the video monitor as adjusting aid. Should you encounter an over modulated display on your monitor which is caused by the reflected laser beam, the adjustment has been successful.

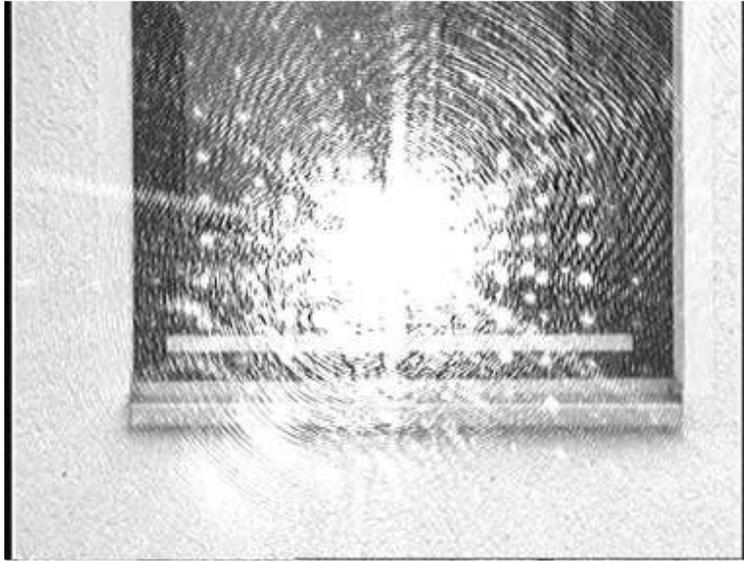


Fig. 2: Successful adjustment

4. Mount the supplied video filter on lens of CCD camera.
5. Stop down lens of CCD camera and focus reflected laser beam through correction of transmitter lens. Adjust focus until you can see an image of the reflected laser beam on your video monitor which is very small. A clear light/dark boundary should be seen in the margin of the image.

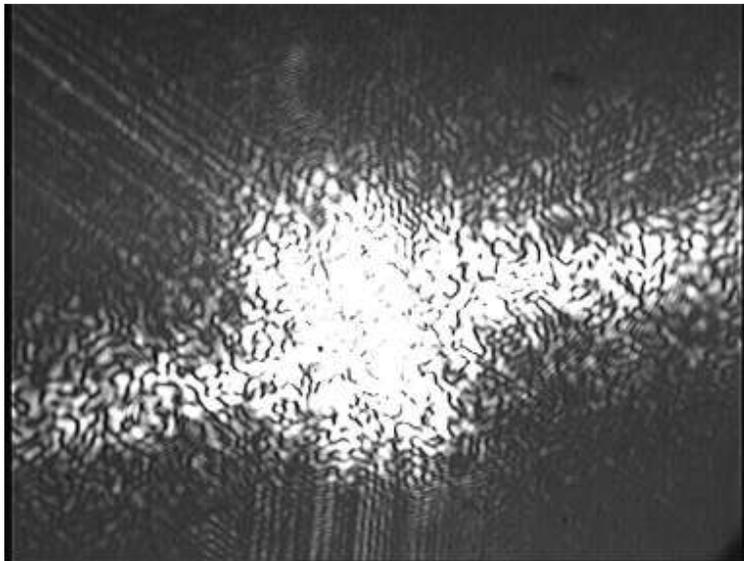


Fig. 3: Focused laser beam

6. Turn on search tone generator of laser transmitter.
7. Open aperture of receiver lens (F1.8) and put focus into (∞) position.

8. Extend centre column of the receiver tripod until the receiver lens is within range of the reflected laser beam. Right height is reached as soon you can hear the search tone of the laser transmitter via your headphones.
9. Turn off search tone generator of laser transmitter.
10. Aim for optimum audio quality by adjusting height, direction and slope of laser receiver.
11. Turn off CCD camera.

4.3 Optimize audio quality

Audio quality is dependent on several factors, e.g. small deformations of window panes or differences in temperature within the line-of-sight of the laser beam may change the angle of reflection. The following steps may be taken to optimize audio quality:

4.3.1 Change laser power

You can change laser power by adjusting the aperture of the transmitter lens. The smaller the aperture, the lower is the laser power.

In general, you should reduce the laser power as much as possible. A major criterion is still the required volume of the audio signal.

4.3.2 Reduce ambient noises

Reflections and overmodulation of the optical sensor may interfere with the audio signal. These interferences may be reduced by adjusting the aperture of the receiver lens.

4.3.3 Audio filter

Assessment of audio quality is very subjective and may vary from user to user. The audio amplifier of the laser receiver gives you the option to use and adjust high-pass and low-pass filters individually.

4.3.4 Choose suitable target points

Rain, may interfere with audio signals. You may reduce those interferences when choosing suitable target points. The adjustment of laser receivers, however, requires some experience and should therefore be regularly trained.

5 Using a laptop as monitor and recorder

Should you wish for better ease of use, you may very well use a laptop as monitor and audio recorder.

Should you decide to use a laptop, it has to be connected to the laser receiver via the supplied switch-on box. The switch-on box is equipped with a video grabber. The video grabber has to be connected to the laptop via USB.

5.1 Video monitor



Launch **VLC media player** by double-click the button . Select a recording device as follows:

1. Open **Media/Open Capture Device...**

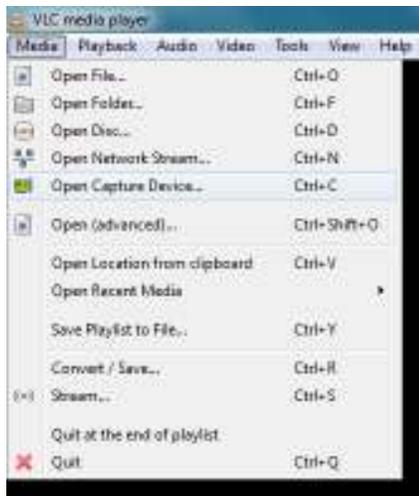


Fig. 4: Open Capture Device

2. Select video device **USB 2.0 Grabber**
3. Select audio device **None**
4. Click the checkbox **Show more options**
5. Set **Caching** to 0 ms
6. Click **[Play]**

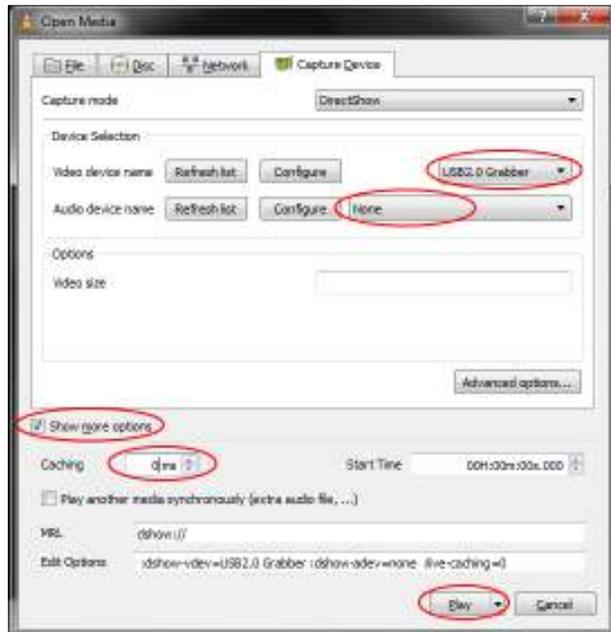


Fig. 5: Select Capture Devices

7. After some seconds a video will be displayed.

5.2 Audio playback and recording

Use the **SR5 Real Time Audio Filter & Spectrum Analyzer** program for playback, editing and recording of audio signals.

For setting the software please see [5.2.2 Settings of the SR5 software](#).

1. Launch **SR5** by double-click the button .
2. Start playback by clicking  button
3. Activate FFT filter by clicking  button (or F2)
4. Open filter window by clicking  button (or F7)



Fig. 6: Program window SR5

5. By dragging the mouse over the filter window, you may create random audio filters to optimise the audio quality. You can reset all audio filters by right-clicking in the filter window and selecting the **All Max** function.

5.2.1 Audio recording

1. Select a file path and file name for your audio recording. Click  button. The program will add date and time to the file name automatically.
2. Start recording by clicking  button.
3. Stop recording by clicking  button.

5.2.2 Settings of the SR5 software

To set the input and output audio devices open **Tools/Setup Audio Devices**.

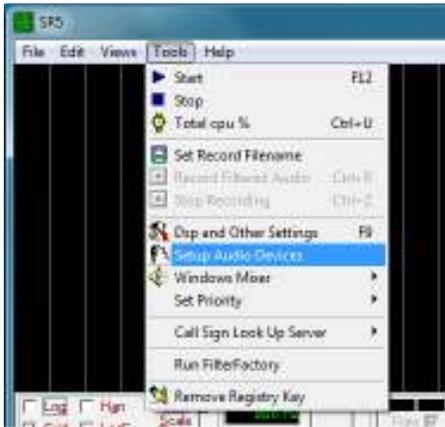


Fig. 7: Setup Audio Devices SR5

Select input devices as shown in the figure below. To set the output devices please select Auto.

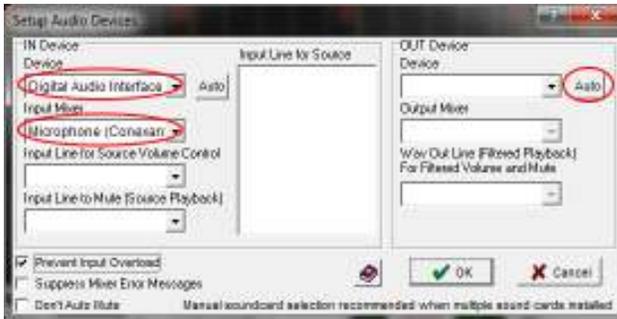


Fig. 8: Select audio devices SR5

5.3 Software information

We have used open-source software which can be downloaded from the internet for free:

- **VLC media player**
Download via www.videolan.org/vlc
- **SR5 Real Time Audio Filter & Spectrum Analyzer**
Download via www.ar5.com

6 Cleaning

The system should be cleaned only with a damp cloth. Please do not use solvents!

7 Technical Data

Laser transmitter EMAX-3100 TX

| | |
|-------------------|----------------------------------|
| Laser type | Semiconductor laser |
| Wave length | 790 nm |
| Output power | 30 – 50 mW, internally regulated |
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| Power consumption | ca. 170 mA (with camera), 70 mA (camera off) |
| Dimensions | 170 x 100 x 45 mm |
| Weight | 900 g |

| | |
|--------------------|--------------------------------|
| Scope of Delivery: | Laser transmitter EMAX-3100 TX |
| | Laser receiver EMAXI-3100 RX |
| | Laptop |
| | Switch-on box |
| | 2 tripods incl. gearheads |
| | 2 Power supply units |
| | User manual, transport box |

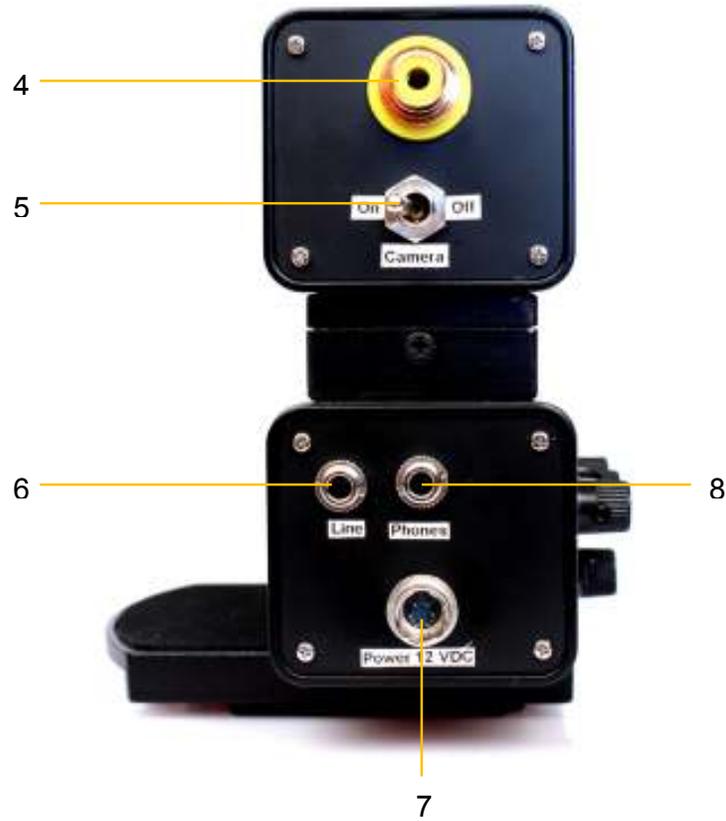
8 Appendix

8.1 Laser transmitter EMAX-3100 TX

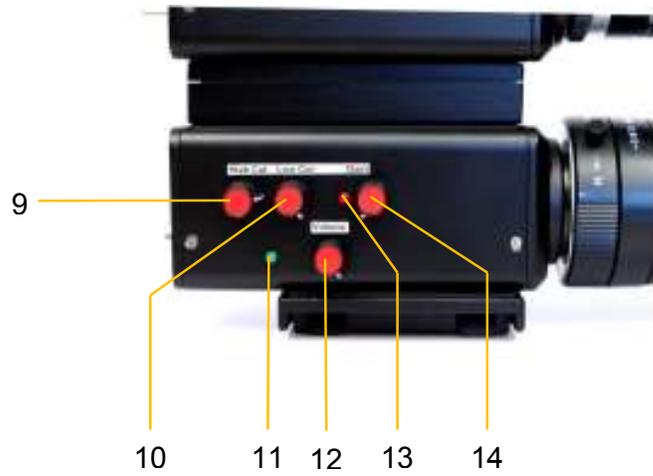


| | |
|---|---|
| 1 | LED Power supply continuous: operating voltage on flashing: operating voltage < 9 V |
| 2 | Connection – power supply |
| 3 | Switch – search tone generator |

8.2 Laser receiver EMAX-3100 RX

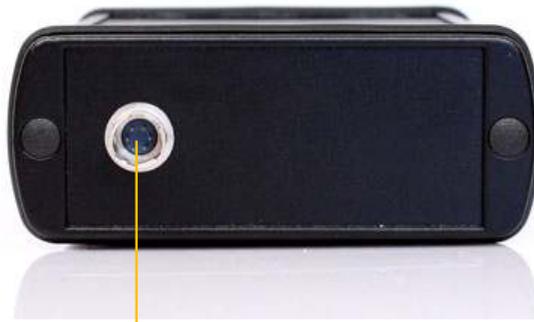


| | |
|---|--|
| 4 | Video output (monitor) |
| 5 | Switch - CCD camera |
| 6 | Line output (recorder) |
| 7 | Connection – power supply (or switch-on box) |
| 8 | Connection - headphones |

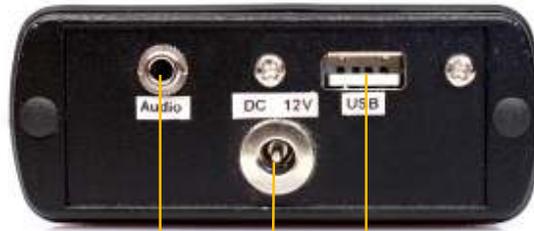


| | |
|----|---|
| 9 | Low-pass control |
| 10 | High-pass control |
| 11 | LED power supply continuous: operating voltage on flashing: operating voltage < 9 V |
| 12 | Volume control |
| 13 | Overmodulation display (CLIP) |
| 14 | Amplifier control (GAIN) |

8.3 Switch-on box



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|----|---------------------------------------|
| 15 | Connection – laser receiver |
| 16 | Line output (for PC microphone input) |
| 17 | Connection – power supply |
| 18 | USB |