

Hacousto Holland bv Industrieweg 87 2651BC Berkel & Rodenrijs		
4E-AM448 user and installation manual	Author:	DD

SUMMARY

This document is the user manual of the 4E-AM448, the surveillance box for amplifiers and loudspeakers lines in IMPACT-MM system.

REVISION AND APPROVAL

Rev.	Date	Nature of Changes	Approved By
01	04-04-2022	Preliminary version	DD

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Thank you for choosing 4EVAC as your Voice Evacuation System solution.

4EVAC Impact is a flexible Voice Evacuation System capable of both standalone and network operation. 4EVAC Impact is certified in accordance with EN54-16 and EN54-4, which are harmonized standards under the Construction Products Regulation, mandatory in the European Union.

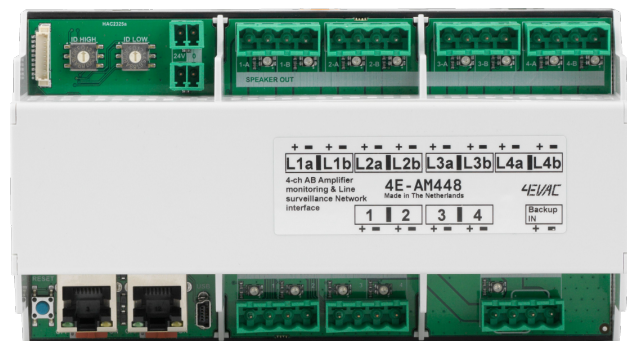
1. What's in the box?

Inside the package you will find:

-  AM448
-  Set of connector plugs

2. General information

4EVAC AM448 is a DIN-rail mounted surveillance box with 4 amplifier inputs and 4 A/B loudspeaker outputs, dedicated for Impact SW and Impact MM voice evacuation systems. AM448 is also the backup amplifier manager, and therefore features additional backup amplifier input, which is shared by all 4 primary amplifier inputs.



AM448 is meant to be installed inside a closed cabinet of IP30 rating (or higher) together with the power amplifier. Alternatively, it is possible to install the AM448 in a IP30 housing placed in a remote location to the main system rack.

3. Block diagram

On the example diagram the AM448 is connected to 4 power amplifiers + backup amplifier. Control and communication with Impact i-Controller runs via L-Net.

Each amplifier channel is split internally into 2 loudspeaker circuits: A and B.

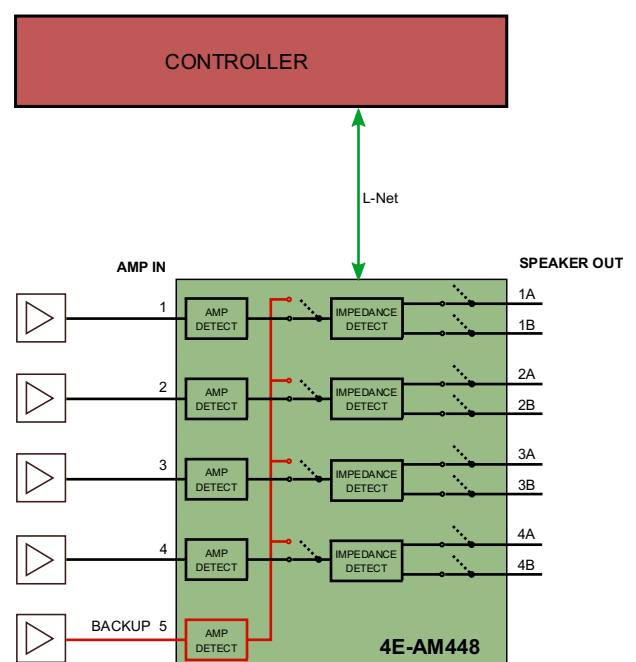
AMP 1 -> LINE 1A + LINE 1B

AMP 2 -> LINE 2A + LINE 2B

AMP 3-> LINE 3A + LINE 3B

AMP 4 -> LINE 4A + LINE 4B

Each of 8 loudspeaker output circuits is monitored individually.



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4. Line monitoring

AM448 provides four A/B output lines = 8 individually monitored 100V loudspeaker circuits (2 circuits per amplifier). The monitoring is based on the measurement of 20kHz pilot signal, feeding the line from the amplifier input.

Output lines can be monitored in one of two measurement ranges:

- High impedance range 20 Ω - 5000 Ω
- Low impedance range 0 Ω - 50 Ω

High impedance range is suitable for 100V / 70V installations, where usually loudspeaker cable is relatively long, includes multiple speakers distributed over a large area. In order to provide accurate measurement, it is required to use EOL module at the end of each loudspeaker circuit.

Low impedance range is suitable for low impedance loudspeakers (total nominal load impedance 4 Ω and higher) and provides effective monitoring up to 50 Ω . In low impedance range, the accuracy of the measurement is highly dependent on the wiring between the AM448 and the loudspeaker. For a reliable measurement, it is necessary to use loudspeaker cable of sufficient conductor diameter. It is also recommended to use single loudspeaker per output in the low impedance range.

Monitoring of the loudspeaker outputs as well as measurement range can be activated or deactivated individually per each of the 8 circuits.

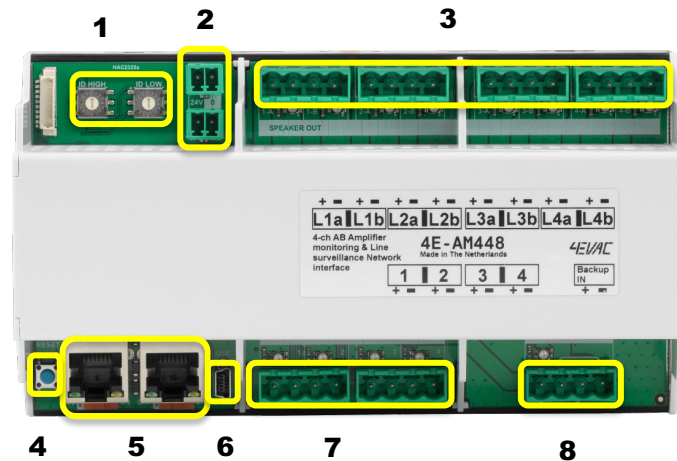
5. Backup amplifier

The power amplifiers of Impact MM voice alarm systems do not include any form of line surveillance; therefore, it is necessary to use the AM448 in order to comply with EN54 standard in terms of amplifier surveillance and loudspeaker line surveillance.

4E-AM448 has four 100V primary audio inputs and one backup amplifier input, which connect directly to amplifier outputs. AM448 takes care of automatic amplifier switchover in case of any primary amplifier's failure.

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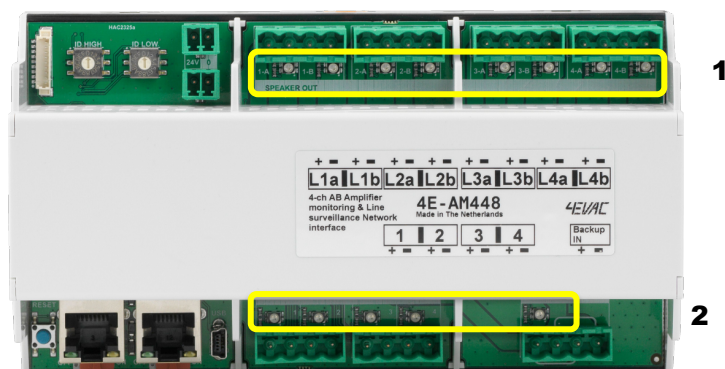
6. Connectors



1. Device ID: this is the address of the device in 4EVAC network
2. DC power input: if the AM448 is not the only device on the L-Net bus, connect here DC supply of 24-30V DC.
3. Speaker out: connect here loudspeaker lines with EOL module, if required.
4. RESET:
 - short press: reset the unit fault status (triggers reset previously shorted loudspeaker lines from isolated state).
 - long press (min 3 seconds): calibrate impedance / EOL measurement
5. L-Net Port (x2): connect here the network cable from the controller and daisy-chain to the next device.
6. Mini-USB port: firmware update
7. AMP input 1 - 4: connect here the output of power amplifiers. AM448 can connect to max. 4 amplifiers.
8. BACKUP input: connect here the output of the backup amplifier. Backup input covers all 4 amplifiers connected to AMP inputs.

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7. Indicators



1. SPEAKER OUT – individual indicator for each loudspeaker circuit.
 - Off: line not monitored / calibration failed
 - Blue blink: line under surveillance (calibration OK)
 - Yellow continuous: line shorted (low impedance fault)
 - Yellow blink: line open (high impedance fault)

2. AMPLIFIER IN – individual indicator for each amplifier.
 - Off: amplifier not monitored / not used
 - Blue: amplifier detected (20kHz level OK)
 - Blue blink fast: backup amplifier engaged (this indication only for BACKUP in)
 - Yellow blink: amplifier not detected (20kHz level too low)

8. EOL module

Loudspeaker lines must be equipped with an EOL module in order to be under stable surveillance. EOL boards are not supplied with AM448 and are available at 4EVAC as separate product.

AM448 supports surveillance of loudspeaker lines based on impedance measurement @ 20 kHz.

For reliable monitoring of speaker line use EOL board. Connect EOL board to the end of the loudspeaker line in parallel, preferably inside the last loudspeaker on the line. EOL is not polarity-sensitive.



NOTE: EOL module features a 145°C thermal fuse, minimizing the risk of line short-circuit under fire conditions. Exposing EOL board to temperatures exceeding 145°C will damage EOL circuit and cause open fault of the loudspeaker line.

The purpose of EOL is to create reference load at the monitoring frequency 20kHz. With EOL connected, monitoring of load impedance is more accurate and less sensitive to slow and long-term impedance drift

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of the loudspeakers due to aging and weather conditions. It also gives more reliable fault indication when a large number loudspeakers is placed on one long line.

8.1. EOL measurement calibration

Once the loudspeaker lines are connected and EOL boards mounted at the end of every line, you can calibrate EOL measurement to currently detected impedance value @20kHz. As result of calibration the reference impedance value is saved for every line to the internal memory of AM448.

It is highly recommended to re-calibrate the impedance measurement:

- After every modification of the loudspeaker line installation,
- After replacing any power amplifier connected to the AM448 module.

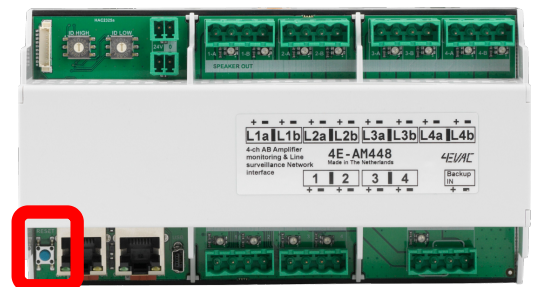


NOTE: Before calibrating impedance, please check the health state of every line with an impedance meter:

1. Check load: measure every loudspeaker line individually with impedance meter and check if the load is as expected. During measurement lines should be disconnected from the AM448.
2. Check EOL: make sure that EOL board is properly connected at the end of every loudspeaker line. Check if the impedance setting is correct on each EOL board.

In order to start calibration, use calibration button located next to the network port.

1. Press and hold for 3 seconds the calibration button. If calibration is started, you will see all LEDs start blinking yellow.
2. Release the CAL button and wait until SW6 will indicate result of calibration on LEDs (see chapter Indications).



If the impedance of the line is within acceptable range, calibration should be successful. If line calibration is not successful, impedance of this line is not acceptable. This could be caused by one of following faults:

- line is overloaded,
- line is shorted,
- line is open,
- EOL is disconnected or damaged.

8.2. Live monitoring of EOL impedance measurement

4EVAC Live monitoring – real time measurement of 20kHz impedance

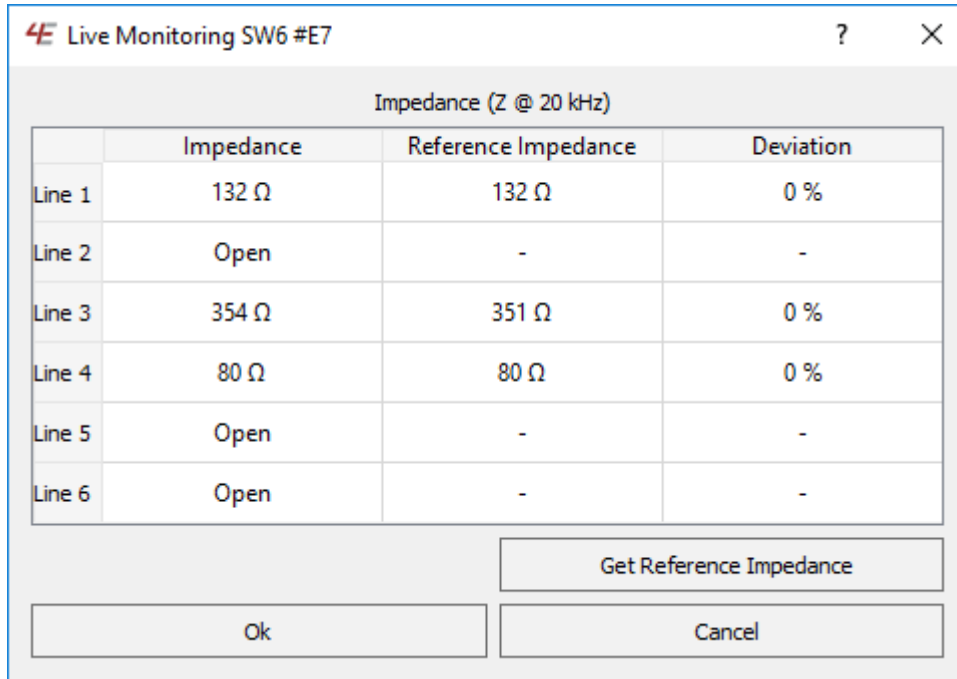
4EVAC systems implement AC line monitoring at 20kHz with EOL. The purpose of EOL monitoring is to detect:

- Any short circuit between + and – conductors of the loudspeaker cable, which would result in total loss of audio signal;
- Any interruption in the loudspeaker line cable, which would result in loss of audio signal in (part of) loudspeakers powered by that line.

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Lack of reliable specifications of loudspeakers and loudspeaker cables, as well as complex nature of combined total impedance of a loudspeaker line makes it impossible to predict or calculate impedance at 20kHz without real measurements.

In order to effectively assess loudspeaker lines monitoring in 4EVAC systems, it is necessary to use *Live Monitoring* feature of the 4EVAC Manager GUI application, where you can observe exact impedance at 20kHz of each loudspeaker line, in real time. (More information on how to use 4EVAC Manager you can find in 4EVAC Manager User Manual).



Impedance (Z @ 20 kHz)			
	Impedance	Reference Impedance	Deviation
Line 1	132 Ω	132 Ω	0 %
Line 2	Open	-	-
Line 3	354 Ω	351 Ω	0 %
Line 4	80 Ω	80 Ω	0 %
Line 5	Open	-	-
Line 6	Open	-	-

Get Reference Impedance

Ok Cancel

Live Monitoring in 4EVAC Manager GUI

In the screenshot above you can see Live monitoring window of 4EVAC Manager software. For each output line following parameters are displayed in real time:

- **Impedance**
This is the actual 20kHz impedance measured in real time by the system. Values below 10Ω are considered as short circuit. Values above 5kΩ are considered as open line.
- **Reference impedance**
This is the reference impedance saved in system memory during impedance calibration.
- **Deviation**
This is the difference between reference impedance and actually measured impedance, expressed in %. Deviation relates directly to Tolerance setting of EOL monitoring (see 4EVAC Manager User Manual)

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9. 4E-AM448 Technical specifications

4E-AM448	
Max. power per amplifier channel	800 W
Max. output current per loudspeaker output	800 W
Input voltage	max. 100V RMS
Output voltage	max. 100V RMS
Input monitoring	20kHz level measurement
Output monitoring	Impedance measurement @ 20kHz with EOL
Hi range	20 Ω - 5000 Ω
Lo range	0 Ω - 50 Ω
Output load	4 Ω minimum
Loudspeaker line redundancy	A/B redundancy Class A loop redundancy



M A D E I N T H E N E T H E R L A N D S

4EVAC is a trade name of:

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