Loudspeaker line isolator system

PRAESENSA

en Installation manual

Table of contents

1   Important product information

1.1   Safety

Notice!
System installation and servicing by qualified personnel only, in accordance with applicable local codes. No user-serviceable parts inside.

1.2   Disposal instructions

Old electrical and electronic appliances.
Electrical or electronic devices that are no longer serviceable must be collected separately and sent for environmentally compatible recycling (in accordance with the European Waste Electrical and Electronic Equipment Directive).
To dispose of old electrical or electronic devices, you should use the return and collection systems put in place in the country concerned.

2   About this manual

This document will describe the solution, possible configurations, installation steps and specific information needed to ensure an EN 54-16 compliant installation of PRAESENSA and the loudspeaker line isolator system.
–   This manual, or an update, in pdf format is available as download www.boschsecurity.com.

2.1   Intended audience

This installation manual is intended for everyone who is authorized to install the loudspeaker line isolator system, and related products.

2.2   Trademarks

Throughout this document trademark names may have been used. Rather than put a trademark symbol in every occurrence of a trademark name, Bosch Security Systems states that the names are used only in an editorial fashion and to the benefit of the trademark owner with no intention of infringement of the trademark.

2.3   Notice of liability

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Bosch Security Systems reserves the right to make changes to features and specifications at any time without prior notification in the interest of ongoing product development and improvement.

2.4   Document history

Release date	Documentation version	Reason
2021.07.28	V1.00	1st edition

3   System introduction

The loudspeaker line isolator system for surveillance of loudspeaker lines in combination with PRAESENSA Public Address and Voice Alarm system. The main task of the loudspeaker line isolator system is to keep the audio message broadcast in the emergency zone in case of a loudspeaker line short-circuit. This is done by means of, isolating damaged cable section away from the healthy part of the cable.

The loudspeaker line isolator system covers completely the functionality of Voice Alarm System in the area of loudspeaker line fault detection, according to EN54-16 product standard. The loudspeaker line isolator is capable of detecting and indicating not only short-circuit on the line, but also open line, disconnection of a loudspeaker and earth-leakage at any point of the loudspeaker line.

The loudspeaker line isolator system provides monitoring of loudspeaker lines and single loudspeakers. In case of fatal failure on the loudspeaker line, the loudspeaker line isolator reacts immediately and keeps seamless audio transmission.

Transparent to keep the full band audio quality unaffected up to 800 W constant AC-power on a single 1000-meter loop.

3.1   Product overview

The Line isolator system comprises of two types of devices which play different roles in the system:

LDB (LoopDrive Booster), with ordering number PRA-LID - is the central unit installed in the Voice Alarm System rack, directly between the amplifier and loudspeaker line. Mounted on a DIN-rail LDB works as the DC-power supply for FIMs and can also generate special service commands to FIMs.

LDB is responsible for monitoring and reporting faults globally (per loudspeaker loop):
–   Loop short (entire loop)
–   Loop open (entire loop)
–   T-branch short (any T-branch)
–   T-branch open (any T-branch)
–   Earth leakage (amplifier input, entire loop, any T-branch)

FIM (Fault Isolator Module) with ordering number PRA-LIM - installed in the field, on the loudspeaker line. FIM functions as the isolator in case of a short-circuit. Responsible for monitoring and reporting faults locally (for local line segments connected to the FIM):
–   Loop short (only adjacent segments)
–   T-branch short
–   T-branch open

3.2   Main functionality

Architecture of the loudspeaker line isolator system allows you to create loudspeaker line in closed-loop topology with extra side-spurs, called T-Branches. The loop as well as every single T-Branch are constantly monitored and searched for any abnormalities in the load and cabling.
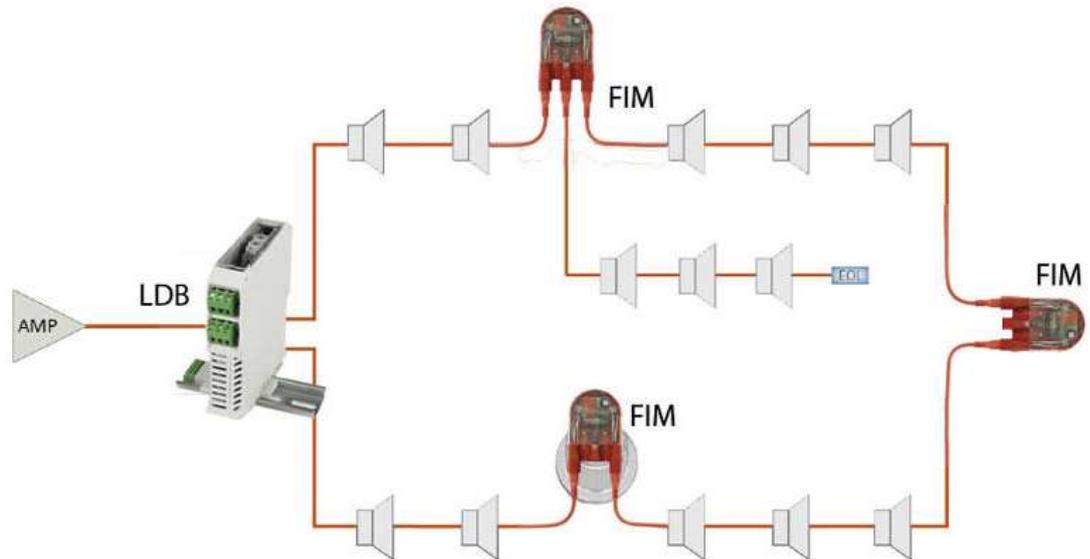

Figure 3.1: Loudspeaker loop monitored by the loudspeaker line isolator

The loudspeaker line isolator system catches multiple faults independently for different loudspeaker lines. It handles also multiple faults at the same time for the same loudspeaker line, regardless the type of the fault.

Following types of faults are detected:
–   Every short-circuit on loudspeaker line immediately after it's occurrence with audio recovery within 4 seconds,
–   open-loop fault on the main loop,
–   open of the T-Branch (with EOL resistor enabled),
–   earth leakage on the main loop,
–   earth leakage of the T-Branch (with EOL resistor enabled).

Notice!

For the purpose of line monitoring the loudspeaker line isolator system generates DC-voltage on the entire loudspeaker line (including T-Branches), therefore each loudspeaker on the line has to be equipped in series with DC-blocking capacitor. Loudspeakers without a capacitor will be seen as a short-circuit on the loudspeaker line.
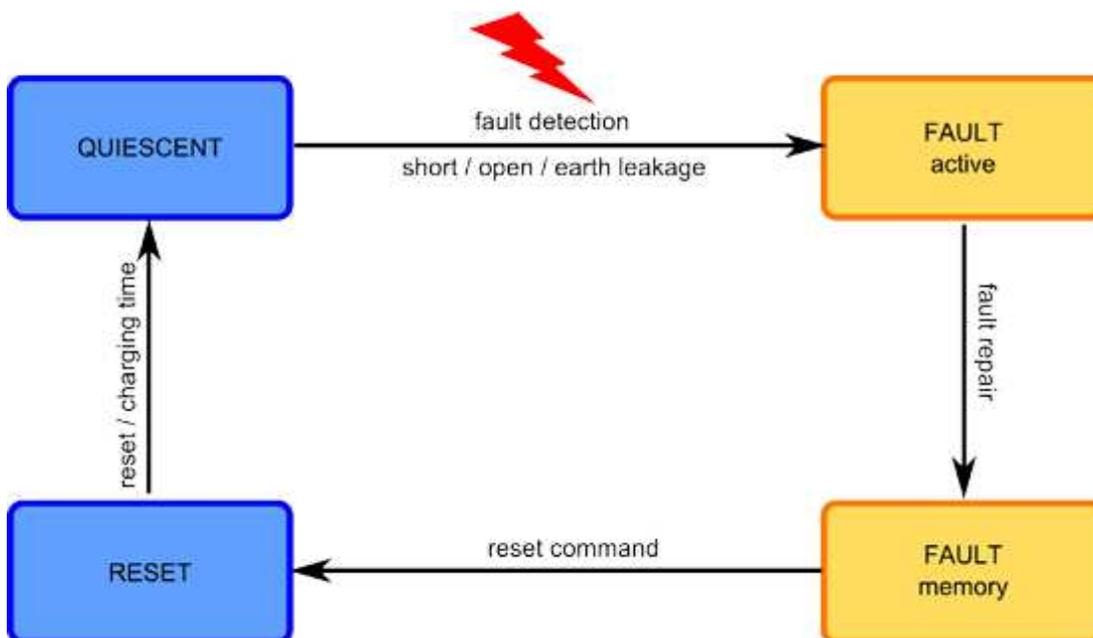

Figure 3.2: Typical loudspeaker line isolator duty cycle

3.3   PRA-LID (LDB) Indicators, buttons and connections
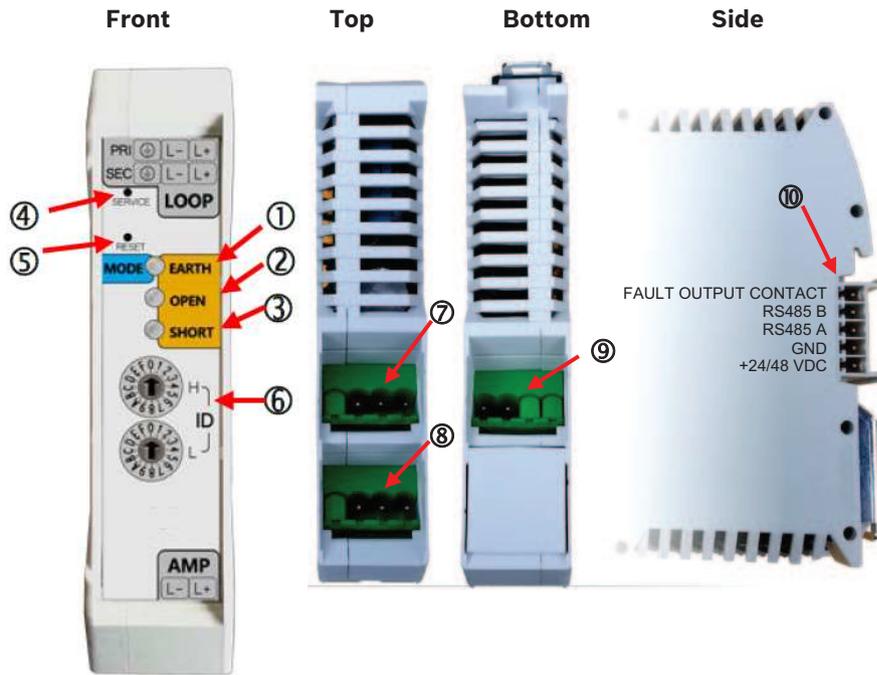
1	**MODE/EARTH** indicator	6	**ID** rotary switch
2	**OPEN** indicator	7	**LOOP PRIMARY** output connector
3	**SHORT** indicator	8	**LOOP SECONDARY** output connector
4	**SERVICE** button	9	**Power amplifier** connector
5	**RESET** button	10	**Loopdrive bus** DIN rail connector

Indicators

Line isolator feature multi-color LED indicators with different color and blinking cycles, which correspond to currently detected state of the loudspeaker line.

General principle of LED indications:

–   BLUE - system OK.

–   ORANGE - fault detected.

Fault detection is always indicated by cyclic blinking. Blinking speed relates to the current status of the fault:

–   ORANGE fast (4 cycles/sec) - fault is currently detected.

–   ORANGE slow (1 cycle/sec) - fault was detected in the past and fixed.

Indication	Corresponding status
MODE indicator	
BLUE continuous	Quiescent mode, system OK
BLUE fast	Service mode
BLUE slow	System rebooting
WHITE fast	Factory reset (started)
WHITE slow	Factory reset (done)
EARTH indicator	
ORANGE fast	Earth fault (active)
ORANGE slow	Earth fault (memory)
OPEN indicator	
ORANGE fast	Loop open (active)
ORANGE slow	Loop open (memory)
SHORT indicator	
ORANGE fast	Loop short (active)
ORANGE slow	Loop short (memory)

Blinking speed:		**Fault status:**	
Fast	4 blinks/s	active	fault is currently detected
Slow	1 blink/s	memory	fault was detected in the past and fixed
Very slow	1 blink/4s		

3.4   PRA-LIM (FIM) Indicators, buttons and connections
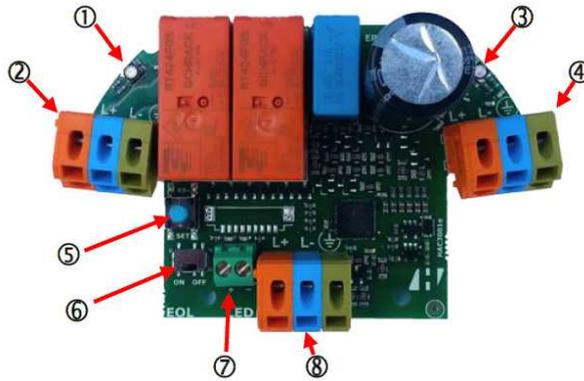
1	Indicator **A**	3	Indicator **B**
2	**LOOP** connector **A**	4	**LOOP** connector **B**
5	**RESET** button	6	**EOL** monitoring switch for T-Branch
7	**External LED** connector (external fault indicator)	8	**T-Branch** connector

Indicators

Line isolator feature multi-color LED indicators with different color and blinking cycles, which correspond to currently detected state of the loudspeaker line.

Caution!

FIM is not capable of indicating EARTH faults and LOOP OPEN faults.

Indication		Corresponding status
A	**B**	
BLUE very slow		Quiescent mode, system OK
BLUE fast		Service mode
BLUE slow		Charging
ORANGE fast	off	LOOP SHORT side A (active)
ORANGE slow	off	LOOP SHORT side A (memory)
off	ORANGE fast	LOOP SHORT side B (active)
off	ORANGE slow	LOOP SHORT side B (memory)

Indication			Corresponding status
A	**A/B interaction**	**B**	
ORANGE fast	simultaneous	ORANGE slow	LOOP SHORT side A (active) LOOP SHORT side B (memory)
ORANGE slow	simultaneous	ORANGE fast	LOOP SHORT side A (memory) LOOP SHORT side B (active)
ORANGE fast	alternating	ORANGE fast	T-Branch SHORT (active)
ORANGE fast	alternating interrupted	ORANGE fast	T-Branch OPEN (active)
ORANGE slow	alternating	ORANGE slow	T-branch SHORT or OPEN (memory)

Blinking speed:		Fault status:	
Fast	4 blinks/s	active	fault is currently detected
Slow	1 blink/s	memory	fault was detected in the past and fixed
Very slow	1 blink/4s		

4   Installation

The loudspeaker line isolator system can be installed on both new and existing loudspeaker line installations.

Several conditions **need to be met first** to make all features work properly:

– Main loudspeaker line has to be a **closed loop**.

– T-branch lines fitted with multiple loudspeakers require **47 kΩ EOL resistor** for T-Branch open detection.

– Every loudspeaker connected to Line isolator needs to be equipped with **DC-blocking capacitor** (typical value is **1 ~ 4.7 μF**).

– For **100 V** installations maximum total load of single loop is **800 W**, maximum single T-Branch load **50 W**.

– 24 or 48 VDC **power supply** for LDB.

4.1   Fault contact

Line isolator provides fault contact output per loudspeaker line for integration with any Voice Alarm System via programmable **control inputs**. Every loudspeaker line can have separate contact closure, or - depending on the system design - multiple loudspeaker lines can share common fault contact.

The contact is **normally open** during **quiescent** mode of the system. During **quiescent** mode:

– Line isolator system is powered and running, monitoring entire loudspeaker line.

– Power amplifier is connected.

– Loop is closed and fully working, every T-Branch is fully operational.

– No faults detected.

Any other state, including **service** mode, amplifier disconnection or even power failure of Line isolator, will immediately close the contact, reporting failure to the main system.

4.2   Wiring

The loudspeaker line isolator system can connect to solid-core wires or stranded wires with conductor diameter of **0.8 - 2.5 mm2**. The maximum current rating of the loudspeaker loop is **8 A RMS**, which allows loading single **100 V** line up to **800 W**.

Fully functional when running on 2-wire loudspeaker cable. For installations with special safety requirements, its supports optional ground wire with open detection.

Maximum length of loop cabling is **1000 m**. Maximum length of T-Branch line is also **1000 m**.

## 4.3   Wiring configurations
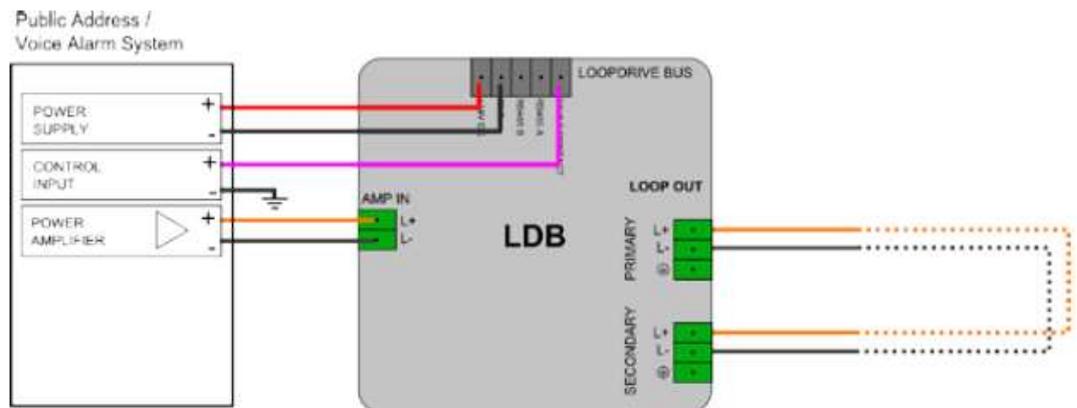
**Figure 4.1:** Single LDB wiring diagram
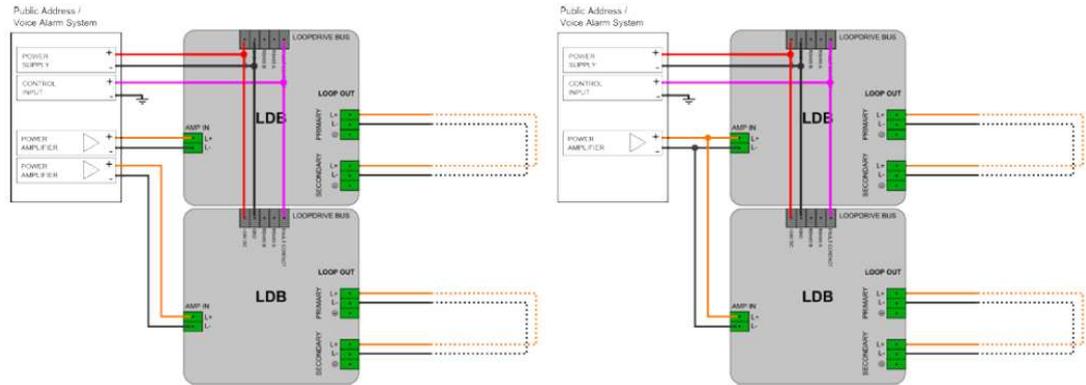
Figure 4.2: Multiple LDB wiring. Left: individual amplifier channels. Right: shared amplifier
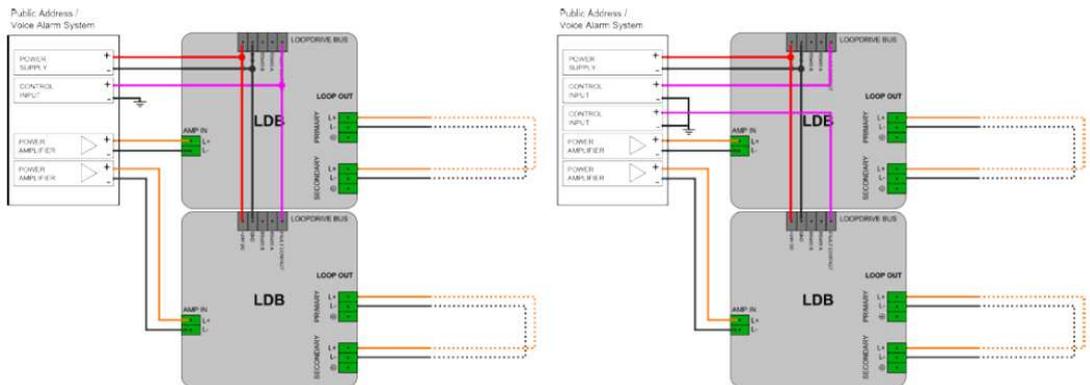

**Figure 4.3:** Multiple LDB wiring. Left: individual fault contact inputs. Right: common fault contact
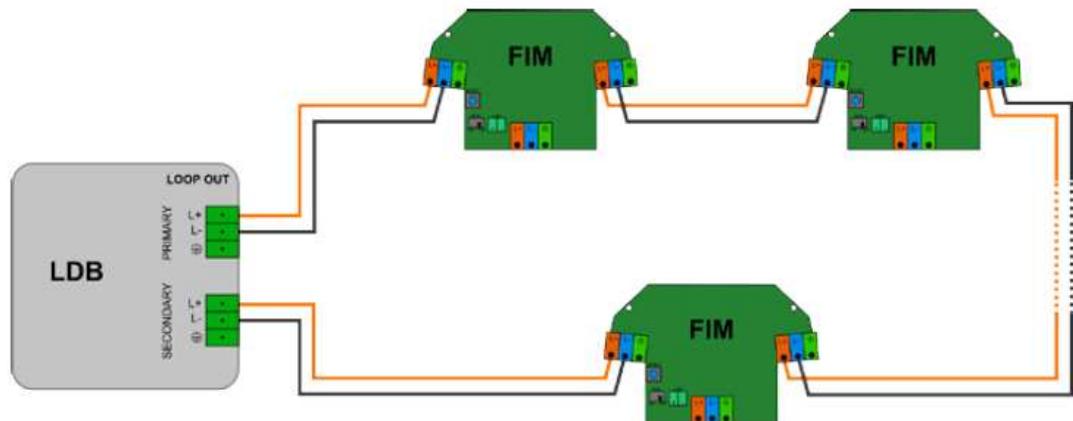
Figure 4.4: Complete loudspeaker line isolator system installation diagram

4.4 Installing PRA-LID (LDB) with PRAESENSA

This section will describe the installation and configuration of the Line Isolator Drive in combination with PRAESENSA to ensure an EN 54-16 compliant installation.

We strongly recommend to first install and connect LDB to PRAESENSA and the loudspeaker line. Having loudspeaker line connected to LDB gives you the DC-power on the line, which is necessary for correct start-up of FIM. Skipping LDB during fresh system installation may result in wrong FIM connections and unnoticed cable faults, which will cost you precious time during system commissioning.

4.4.1 Physical installation

Certification of the PRAESENSA system and Line Isolator Drive (PRA-LID) includes the cabinets (i.e. the enclosed 19"-racks) in which the system elements are mounted. It is allowed to use one or more cabinets, depending on the size of the system. Within the same cabinet family, different heights are allowed up to a maximum height that depends on the brand and type of an approved cabinet. The following cabinets have been approved for use:

– Rital: TS, TS-IT, CX25 series
– Schroff: 20130073 PRAESIDEO
– E.LAN: Diamond series
– Knurr (Emerson): Miracel series

4.4.2 End Of Line (EOL) monitoring

The PRAESENSA End Of Line (EOL) monitoring function **cannot be used** in combination with Line Isolator Drive (PRA-LID). This means that for those loudspeaker output lines, where a Line Isolator Drive (PRA-LID) is connected, this function needs to be disabled in PRAESENSA. The EOL monitoring function will be taken over by the loudspeaker line isolator system and reported via the PRA-LID to the PRAESENSA system.

In this case, the EOL reporting will be done via contact closers. Depending on the chosen configuration, one or multiple PRA-LID contact closers will be connected to an contact input on the PRAESENSA system. The input contact will be configured accordingly in the PRAESENSA system.

4.4.3 Powering of the PRA-LID (LDB)

The PRA-LID (LDB) needs to be powered from the PRAESENSA Multifunction power supply, large (PRA-MPS3). This to ensure a redundant and certified power source solution according EN 54. One of the three 48 V outputs of the PRA-MPS3 device will be used for connecting only PRA-LID (LDB) reaching from one PRA-LID (LDB) to a maximum of 16.

> ⓘ **Notice!**
> The number of PRA-LID (LDB) you can connect to the PRA-MPS3 ranging from 1 to 16, is depending on the configuration. The PRAESENSA power calculator can be used to determine the exact number.

4.4.4 PRA-LID (LDB) | Enable Amplifier Detection setting

The Enable Amplifier Detection option in the PRA-LID (LDB) is not working in combination with PRAESENSA. Therefore, make sure that this **setting is disabled**. This can be done via the Sniffer tool (see LDB Sniffer User guide for more details).

4.5 Installing order PRA-LID (LDB)

1. Fix LDB on a DIN-rail, and connect 24/48 VDC power supply to power terminals on 5-pin rail connector.
   – LDB should boot-up, indicating boot progress with **blue** blinking on **MODE** indicator.
2. Within 15 seconds LDB will indicate **OPEN** fault, since **AMP** input as well as both **LOOP** outputs are not connected.
3. Connect output of power amplifier to the **AMP** input of LDB.
   – LDB is not sensitive for amplifier output polarity, however it is recommended to keep the correct polarity to maintain best acoustic coherence of audio signal.
4. Connect the outgoing loop cable to **PRIMARY** output of LDB.

Notice!

If any short circuit is present on the speaker cable, LDB will immediately detect and isolate the shorted connector and SHORT indication will appear on LDB front panel. If the speaker cable connects to ground causing earth leakage, LDB will detect the earth leakage and EARTH fault indication will appear on LDB front panel. See *PRA-LID (LDB) Indicators, buttons and connections, page 9*.

5.   If system includes multiple loops (multiple LDBs), there is a number of ways you can interconnect Loudspeaker line isolator to the Public Address / Voice Alarm system.
6.   If you are planning to proceed with installation of FIM modules on the loop, leave the **SECONDARY** output of LDB disconnected.
7.   When loop is closed, and all FIMs on the loop are working properly, connect the incoming loop cable to **SECONDARY** output of LDB. Loop is now fully secured.

Multiple LDBs can share common fault contact or individual fault control contacts of the main system. Fault contact sharing allows you to reduce number of control inputs needed for fault reports. Detailed information about the location and type of fault is always available on LDBs front panels, as well as via Sniffer PC application.

Multiple LDBs can also share common power amplifier or have individual power amplifiers from the main system. Amplifier sharing allows you to create multiple loops within one zone, each with individual surveillance.

Refer to
– *PRA-LID (LDB) Indicators, buttons and connections, page 9*

4.6 Installing PRA-LIM (FIM) on a loudspeaker line

Before you start connecting FIMs on the loop, make sure that LDB is connected to the rail and powered. See *Installing order PRA-LID (LDB), page 15*.

1.   For most efficient installation make sure that LDB is in **SERVICE MODE** (blue **MODE** indicator blinking fast).
     – To put LDB into **SERVICE MODE** press SERVICE button for 10 seconds or use Sniffer PC application.
2.   During **SERVICE MODE** LDB will show **OPEN** fault indication as long as the loop is not completely closed.
     – This is the correct indication, since the loop should be closed only at the final stage of installation, to make sure that the entire course of the loop is complete.

Notice!

When the loudspeaker line isolator system is in SERVICE MODE, audio signal from power amplifier is not transmitted to the loop.

3.   Double check if the loudspeaker line cable is connected to the **PRIMARY** loop output of LDB and the **SECONDARY** loop output of LDB is not connected.
4.   LDB should indicate only **OPEN** fault. If **SHORT** fault is detected, fix it before FIM installation.
5.   Check if **EOL** switch (**6**) on the FIM is in **OFF** position.

Notice!

EOL switch (6) should be in ON position only with EOL resistor connected to the termination of T-Branch line. Short circuits on T-Branch are detected and isolated regardless the EOL monitoring switch.

6.   Connect FIM to the loop cable on the **PRIMARY** side of LDB. Mind the cable polarity!

> **Notice!**
> You can connect the loop cable to either A or B side of FIM, both sides are equal. Do not connect loop cable to T-Branch connector!

7.   FIM will power up indicating charging process (blue slow blinking). Wait for FIM to enter **SERVICE MODE** (blue fast blinking).

> **Notice!**
> Brand new FIMs are delivered in FACTORY RESET state. In this state loop relays on FIM's PCB should be in open position. FACTORY RESET state for FIM is temporary. Soon after power up FIM should switch relays to closed position, making a "click" sound, confirming correct relay operation.
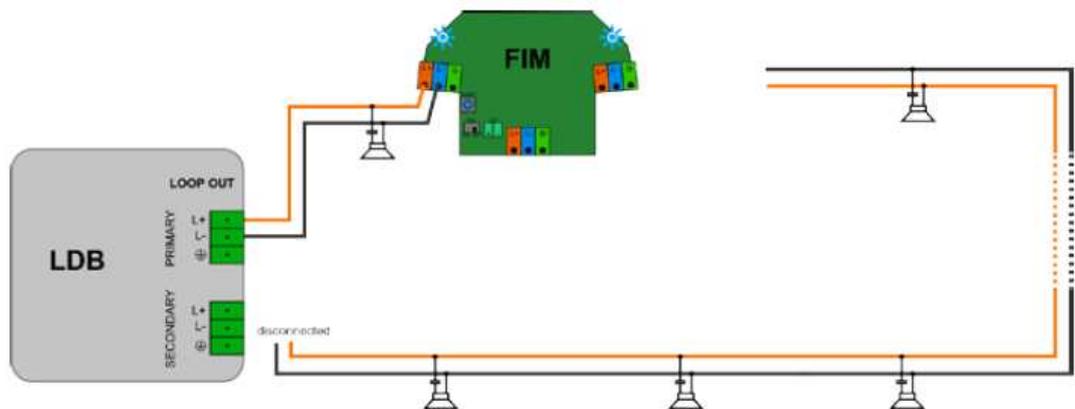

Figure 4.5: Side A of FIM connected to PRIMARY side of the loop

8.   Connect the outgoing loop cable to the loop connector on the other side of FIM. Mind the cable polarity!
9.   If the cabling is correct, FIM will remain in **SERVICE MODE**.
   –   If there's short circuit on the outgoing cable, FIM will change blinking colour to orange, indicating problem. LDB will also detect short circuit and indicate it with **SHORT** indicator. Fix the cabling before further installation.
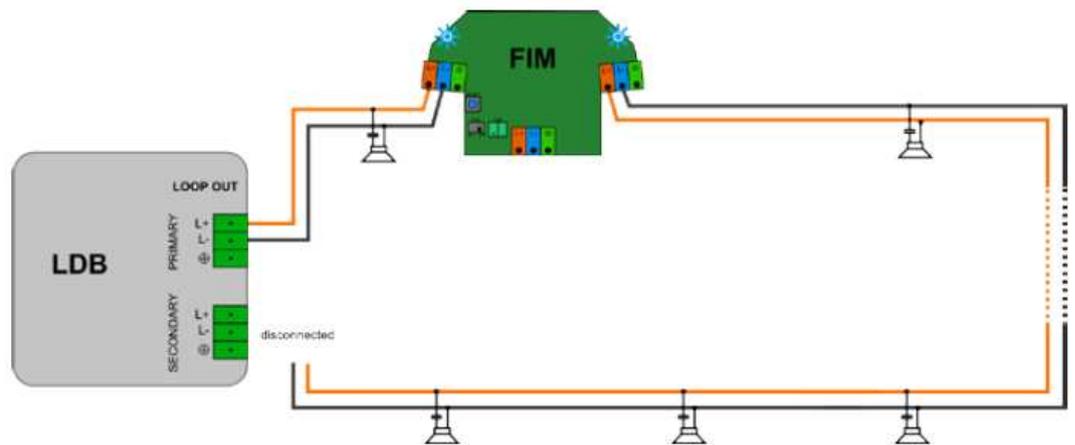

Figure 4.6: Both sides of FIM properly connected to the loop

10.   If needed, connect the loudspeaker or T Branch line to FIM T-Branch connector.

– In case of short circuit on T-Branch, FIM will indicate the problem with orange alternating blinking. See *PRA-LIM (FIM) Indicators, buttons and connections, page 11*.
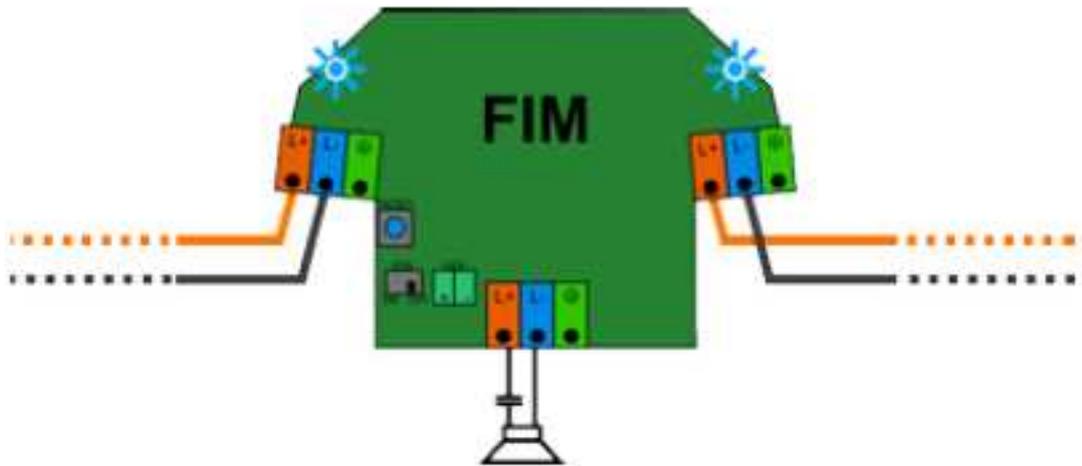

Figure 4.7: Single loudspeaker connected to T-Branch connector

11. If EOL resistor is installed on the end of T-Branch line, switch the EOL monitoring ON. In case of T-Branch line open, FIM will indicate the problem with interrupted orange alternating blinking. See *PRA-LIM (FIM) Indicators, buttons and connections, page 11*.

12. If the T-Branch cabling is correct, FIM will remain in **SERVICE MODE**.
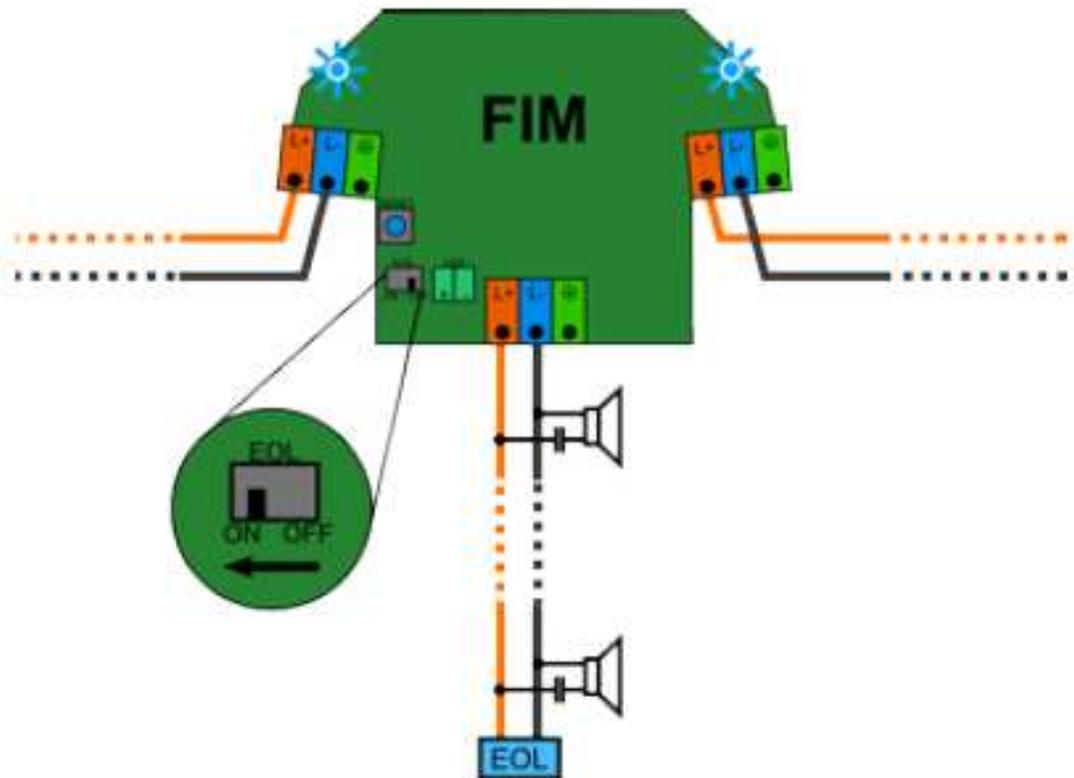

Figure 4.8: T-Branch line with EOL monitoring

13. Proceed with installation of the next FIM module.

14. When the last FIM is installed on loop go back to the LDB and connect the returning loop cable to **SECONDARY** output connector of LDB.

– If cable loop is complete and works correctly, **OPEN** indication on LDB will stop, LDB remains in **SERVICE MODE**.

15. Reset LDB by pushing **RESET** button. LDB will reboot to **QUIESCENT MODE**.
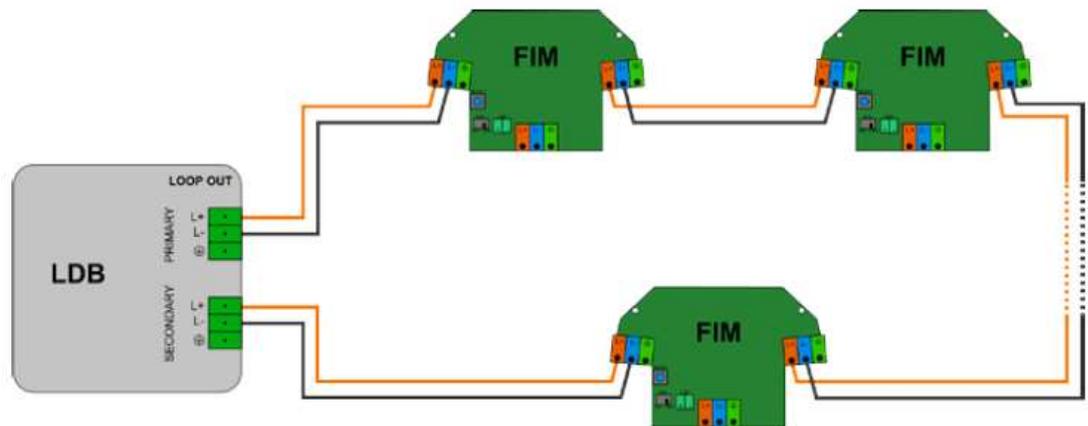

Figure 4.9: Complete loudspeaker line isolator system installation diagram
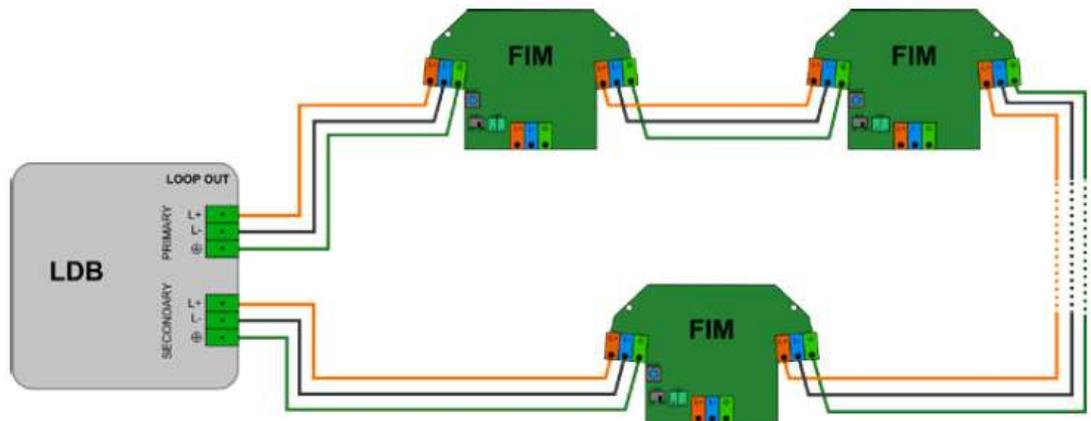
Figure 4.10: Complete loudspeaker line isolator system installation - with optional **GROUND** wire loop

Refer to
– *Installing order PRA-LID (LDB), page 15*
– *PRA-LIM (FIM) Indicators, buttons and connections, page 11*

5   Examples of loudspeaker line isolator system installations
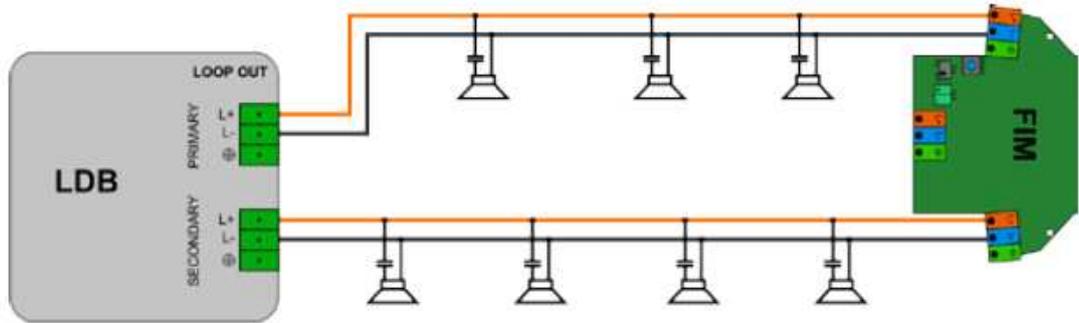
Figure 5.1: Minimum configuration - equivalent to A/B line
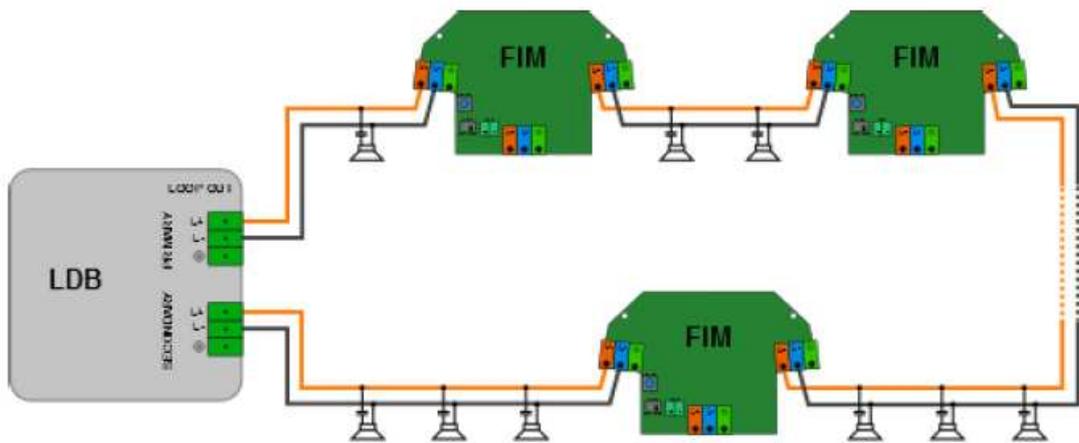
Figure 5.2: Loudspeakers only on the loop
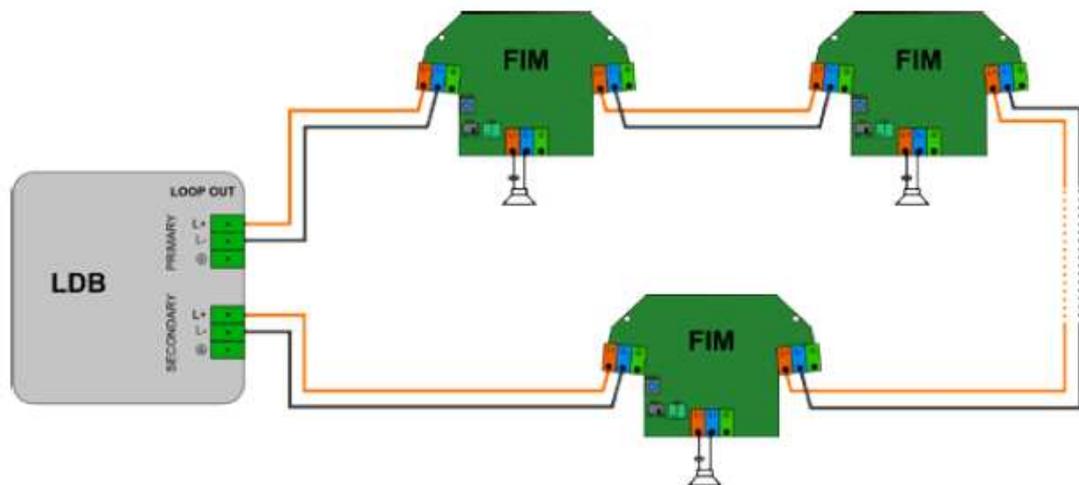
Figure 5.3: One FIM per each loudspeaker
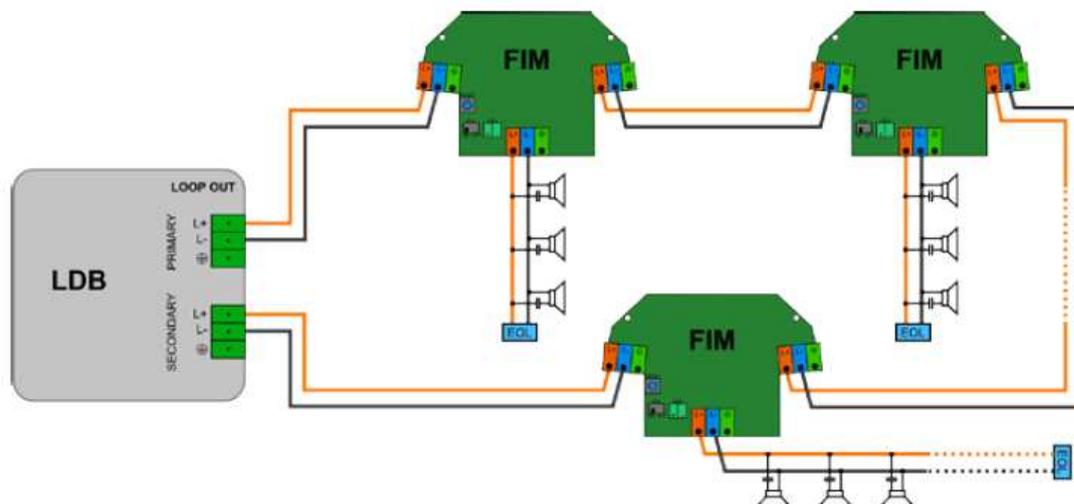
Figure 5.4: T-Branch lines with multiple loudspeakers
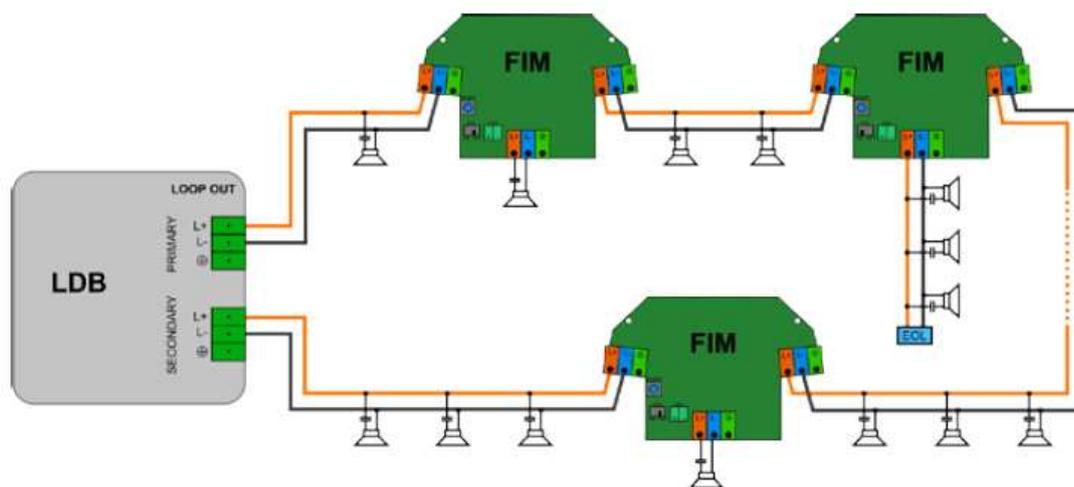
Figure 5.5: Mixed configuration

6   Troubleshooting

The effort and time spent of finding and fixing loudspeaker line faults with the loudspeaker line isolator system is reduced to minimum. Loudspeaker line isolator is designed to locate and report the exact location of a fault, even long time after its occurrence. You can repeat troubleshoot procedures multiple times, any time you want, making sure that repair works will be efficient and accurate.

6.1   PRA-LID (LDB)

Finding a loudspeaker line fault usually starts at the main system rack, where LDB devices are located. Observe LDB front panels and compare the indications.
See *PRA-LID (LDB) Indicators, buttons and connections, page 9*.
Multiple faults can be shown on LDB at the same time. **SHORT**, **OPEN** and **EARTH** fault may be detected and indicated simultaneously and should be investigated individually.
If fault indications on LDB are in "memory" state (slow blinking), simply push **RESET** button on LDB and after reboot LDB will return to **QUIESCENT** mode.
The following chapters relates to situation:
–   *SHORT fault, page 22*
–   *OPEN fault, page 24*
–   *EARTH fault, page 25*
–   *Wrong cable polarity – double twist, page 25*

6.1.1   SHORT fault

LDB shows **SHORT** fault in following cases:
1.   Short circuit on the loop, between FIM modules.
      –   In this case **SHORT** fault is located in the field, not directly at LDB connector. FIM modules are isolating faulty section of the cable, so the loop stays open until the short circuit is removed. In this state reset of LDB will clear the **SHORT** indication and LDB will detect loop open fault, indicating **OPEN** active.

2.   Short circuit on the **PRIMARY** or **SECONDARY** port of LDB.
      –   In this case short circuit is located adjacent to LDB, therefore LDB detects the fault directly and any attempt to reset LDB brings no result - LDB returns to **SHORT** active state.
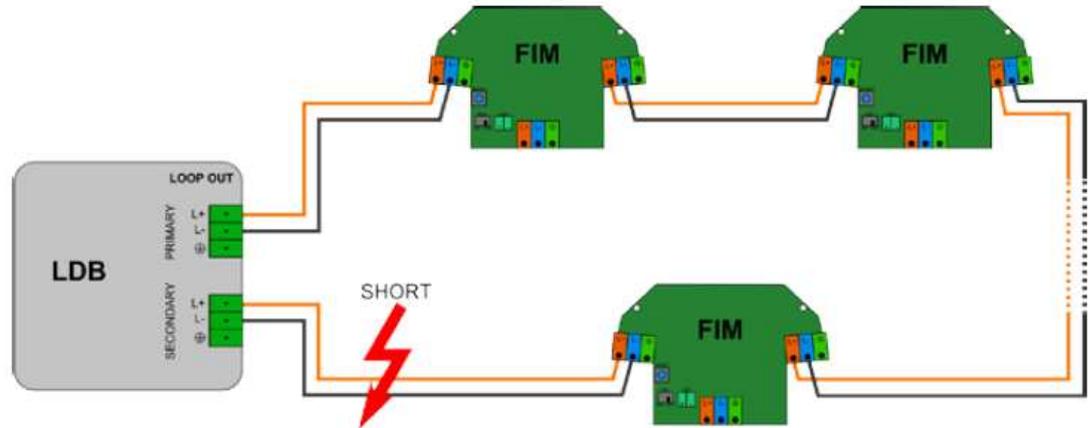
3. Single (or odd number) twist in loudspeaker cable polarity.
    –   If cabling polarity is mismatched in one place in your installation (or more but odd number), loudspeaker line isolator will react with **SHORT** indication.
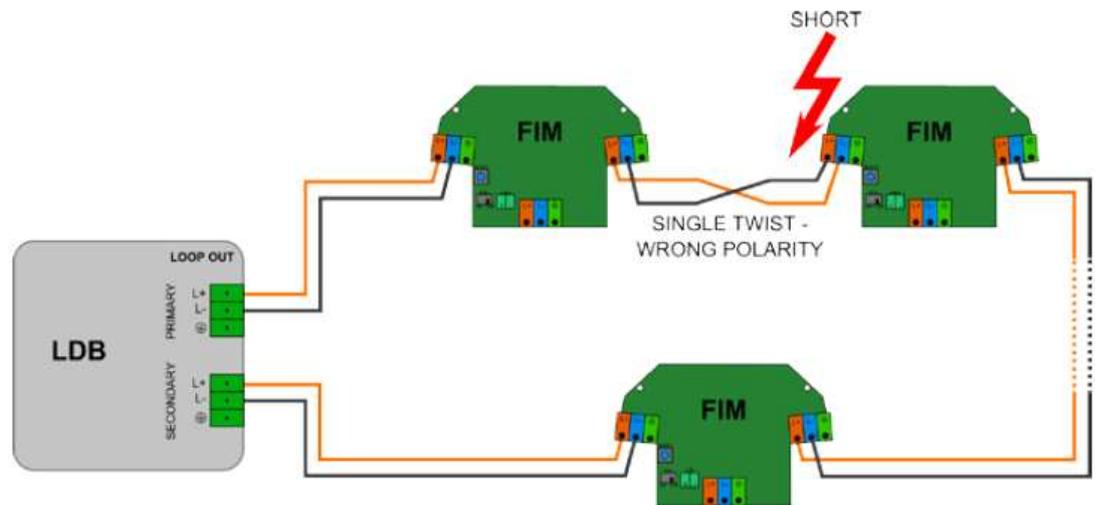
Possible solution

Reset LDB and observe the following indication:

1. If LDB returns to **SHORT** active indication, short circuit is located on the cable section directly connected to **PRIMAR**Y or **SECONDARY**.
2. If LDB turns to **OPEN** active indication, short circuit is located on the loop in the field. You need to take further steps to locate the faulty section. Two alternative solutions are available:
    –   Loopdrive Sniffer (PC application) is the easiest way to go. Use FIM tracking feature for the best result. FIM tracking is automated procedure which allows you to find the exact location of the short fault. Please, go to the Loopdrive Sniffer manual for details. See www.boschsecurity.com
    –   Disconnect loudspeaker cable from **SECONDARY** output of LDB and put an audio signal in the zone including faulty loop. Loudspeaker line isolator will feed the loop with audio signal only from **PRIMARY** side. While listening to loudspeakers follow the loop and find first area with no sound reproduction. This area is isolated from the loop because of the fault. To find the end of isolated section, connect the **SECONAR**Y side back to LDB and find the first area with sound reproduction.
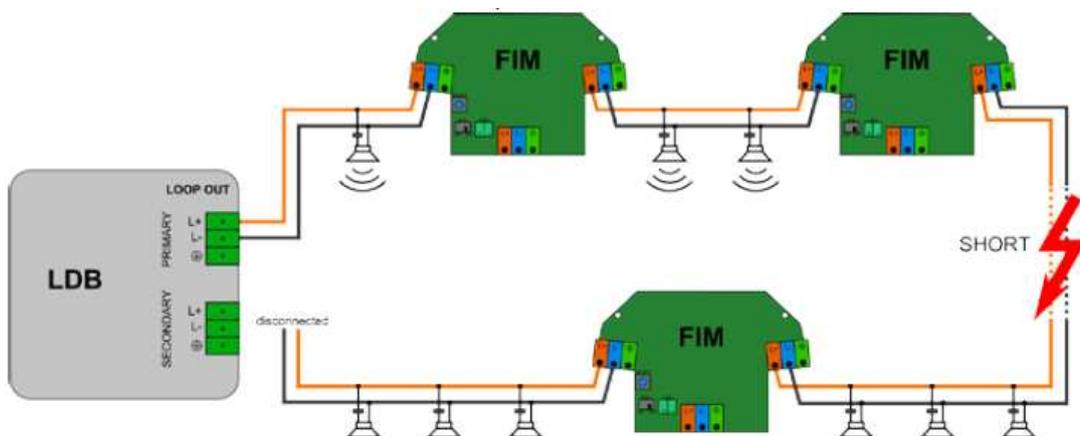
6.1.2   OPEN fault

LDB shows **OPEN** fault in following cases:

1.   Loop cable is open (L+ or L- or both wires).
2.   Loop section between FIMs is isolated because of previously detected short circuit. See *SHORT fault, page 22*.
3.   T-Branch fault (**OPEN** or **SHORT**)

Notice!

In case of T-Branch fault (OPEN or SHORT), FIM will open both loop relays, isolating T-Branch and causing the loop OPEN fault on LDB. The FIM reporting T-Branch fault will stay open until the fault is still detected. To close the loop again, FIM reset is required after removing the fault.

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4.   Power amplifier is disconnected.

Possible solution

1.   Check if power amplifier is connected. If so, continue with the same procedure as for **SHORT** fault. Two alternative solutions are available:
2.   Loudspeaker line isolator Sniffer (PC application) is the easiest way to go. Use FIM tracking feature for the best result. FIM tracking is automated procedure which allows you to find the exact location of the open fault. Please, go to the loudspeaker line isolator Sniffer manual for details. See www.boschsecurity.com
3.   Disconnect loudspeaker cable from **SECONDARY** output of LDB and put an audio signal in the zone including faulty loop. Loudspeaker line isolator will feed the loop with audio signal only from **PRIMARY** side. While listening to loudspeakers follow the loop and find first area (including T-Branches) with no sound reproduction.
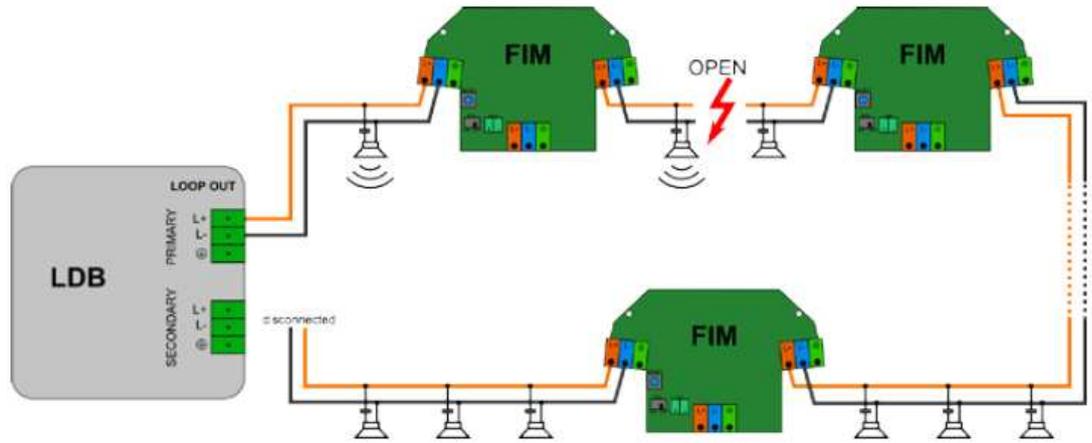
Refer to
– *SHORT fault, page 22*

6.1.3   EARTH fault

LDB reports **EARTH** fault if any cable in the line (including T-Branch lines) causes a current leakage to the ground.
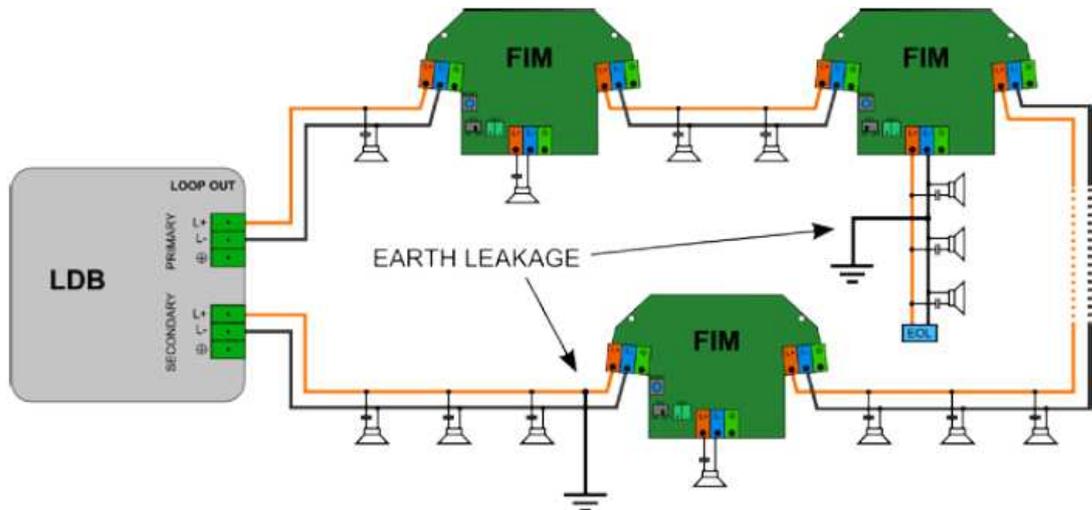
Possible solution

To find earth leakage in your installation, please use the FIM tracking feature of loudspeaker line isolator Sniffer PC application. FIM tracking is automated procedure which allows you to find the exact location of the earth fault. Find more details in the Sniffer manual on www.boschsecurity.com.

6.1.4   Wrong cable polarity – double twist

If there are two (or more but even number) twists in loop cable polarity, some of FIM modules are not powered and therefore system is not fully operational. Loudspeaker line isolator however will not detect any fault and will act normally, as if the loop was correct.
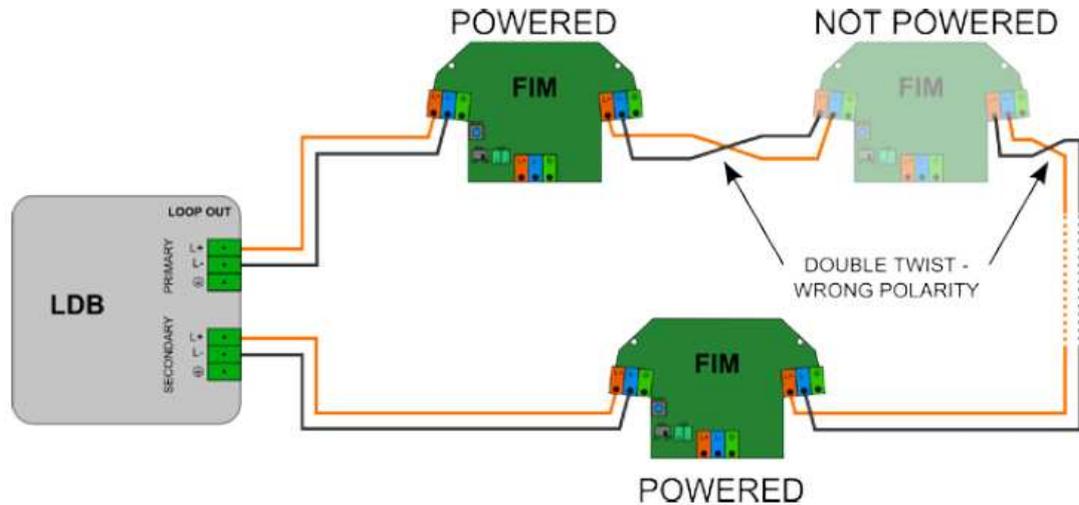
Possible solution

To find double twists in your installation, please use the FIM tracking feature of loudspeaker line isolator Sniffer PC application. FIM tracking allows you to automatically count the number of FIM modules on the loop. Find more details in the Sniffer manual on www.boschsecurity.com.

6.2   PRA-LIM (FIM)

Next step after identifying a fault on LDB is to investigate and fix the cabling in the field. Indication on FIM will help you finding the exact location and type of the fault.

> **Notice!**
> Multiple faults can be shown on FIM at the same time. In this case different fault indications will be superimposed, creating combined indication. FIM can be reset only if all faults are removed and all indications are in "memory" state.

If fault indications on FIM are in "memory" state (slow orange blinking), simply push **RESET** button on FIM (or send REMOTE FIM RESET command from LDB) and after reboot FIM will return to **QUIESCENT** mode.

The following chapters relates to situations where there is an active fault indicated. More details you'll find in FIM indications table. See *PRA-LIM (FIM) Indicators, buttons and connections, page 11*.

– *Short loop, page 27*
– *Short on T-Branch, page 28*
– *Open T-Branch, page 29*

6.2.1   **Short loop**

If loop is shorted on either of the sections connected directly to FIM, the LED indicator on the faulty section side will blink orange fast. FIM is isolating the faulty section with open relay. T-Branch is still operational and fed with audio from the healthy side of the loop.

See *PRA-LIM (FIM) Indicators, buttons and connections, page 11*.

Short on side A   Short on side B

Possible solution

Remove the short-circuit from the loop section. When the problem is fixed, the fast blinking indication on FIM will turn slow. Now you can reset FIM to **QUIESCENT** mode, where both **A** and **B** relays are closed. To reset FIM:

1.   Push **RESET** button on the FIM module. Or,
2.   send REMOTE FIM RESET command by pressing RESET button on LDB for 10 seconds or via Sniffer application.

6.2.2   **Short on T-Branch**

If T-Branch is shorted, both **A** and **B** indicators will blink fast orange alternately. Both relays of the FIM are open, creating an interruption in the loop. T-Branch is isolated from the loop. See *PRA-LIM (FIM) Indicators, buttons and connections, page 11*.
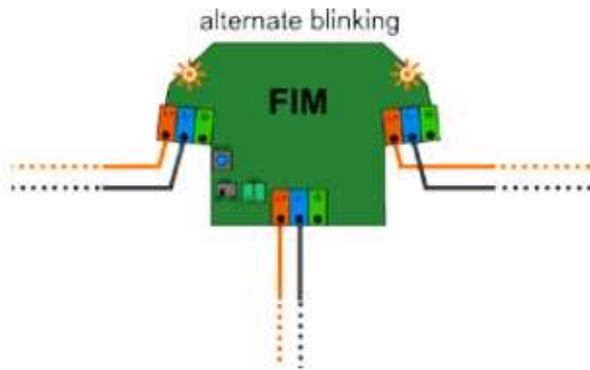
Possible solution

Remove the short-circuit from the T-Branch. When the problem is fixed, the fast blinking indication on FIM will turn slow. Now you can reset FIM to **QUIESCENT** mode, where both **A** and **B** relays are closed. To reset FIM:

1.   Push **RESET** button on the FIM module. Or,
2.   send REMOTE FIM RESET command by pressing RESET button on LDB for 10 seconds or via Sniffer application.

6.2.3   Open T-Branch

If 47 kΩ EOL resistor on T-Branch is missing, FIM with EOL monitoring will detect T-Branch open. In this case both **A** and **B** indicators will blink fast orange alternately with 2 seconds intervals. Both relays of the FIM are open, creating an interruption in the loop. T-Branch is isolated from the loop.

See *PRA-LIM (FIM) Indicators, buttons and connections, page 11*.
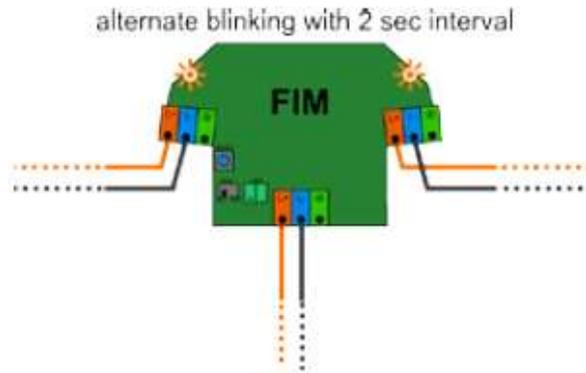
Possible solution

Reconnect the T-Branch line to FIM, including 47 kΩ EOL resistor. When the problem is fixed, the fast blinking indication on FIM will turn slow. Now you can reset FIM to **QUIESCENT** mode, where both **A** and **B** relays are closed. To reset FIM:

1.   Push **RESET** button on the FIM module. Or,
2.   send REMOTE FIM RESET command by pressing RESET button on LDB for 10 seconds or via Sniffer application.

7   Routine maintenance inspection

In order to check correct operation in case of potential cabling failure, simulate faults and observe system reaction. Perform following procedure:

1.   Check if LDB is **powered**.
2.   If LDB is indicating **FAULT** mode (orange LED blinking), see *PRA-LID (LDB), page 22*.
     –   **IMPORTANT**: Continue to next steps only if LDB is indicating **QUIESCENT** mode.
3.   Put LDB into **SERVICE** mode (press **SERVICE** button for 10 seconds).
4.   Simulate **short-circuit** fault.
     –   Using a jumper make direct short between L+ and L- wire on **PRIMAR**Y or **SECONDARY** output of LDB.
     –   Confirm that **SHORT** indication on LDB appears.
     –   Confirm that fault contact was activated.
     –   Remove the short circuit. Confirm that **SHORT** indication on LDB disappears.
5.   Simulate **open loop** fault
     –   Disconnect loop cable from **PRIMARY** or **SECONDARY** output of LDB.
     –   Confirm that **OPEN** indication on LDB appears.
     –   Confirm that fault contact was activated.
     –   Connect the loop cable back to LDB. Confirm that **OPEN** indication on LDB disappears.
6.   Put LDB into **QUIESCENT** mode.
7.   Simulate **earth leakage** fault:
     –   Make direct connection between L+ or L- wire to ground potential (Ground pin of LDB)
     –   Confirm that **EARTH** indication on LDB appears.
     –   Confirm that fault contact was activated.
     –   Remove the connection between L+ or L- to earth.
     –   Confirm that **EARTH** "active" (fast) indication on LDB turns into "memory" (slow).
     –   Reset LDB into **QUIESCENT** mode.
8.   Simulate **ground wire open** fault (optional)
     –   Open ground wire on **PRIMARY** or **SECONDARY** output of LDB.
     –   Confirm that **EARTH** indication on LDB appears.
     –   Confirm that fault contact was activated.
     –   Connect ground wire back to LDB.
     –   Confirm that **EARTH** "active" (fast) indication on LDB turns into "memory" (slow).
     –   Reset LDB into **QUIESCENT** mode.
9.   Check **cables and connectors** between LDB and Public Address / Voice Alarm system.

Refer to
–   *PRA-LID (LDB), page 22*

8   Technical data
8.1   PRA-LID (LDB)

Electrical

DC Power supply	18 - 50 VDC
DC Power consumption	
Inrush	1.44 W
LDB only	1.9 W
LDB full load (plus 200 x FIM)	2.4 W
AMP input (100V audio)	
max. AC voltage	max cont. 100 VRMS, 300 VPP
max. AC current	max cont. 8 A
Frequency range	40 Hz ~ 20 kHz (-3dB)
THD	max 10% (according to EN 54-16)
LOOP output	
AC	same as AMP input
DC voltage	30 V
DC current	max. cont. 130 mA
Wiring	2-wire. Max. 2.5 mm2 / Max. Loop length: 1000 m
Grounding	Earth loop through third connection-pin
Loop relay contact rating	max. 250 VAC / 8 A (Dual-state type)
Maximum total loop load	800 W
Loudspeaker type	only with DC blocking capacitor
Maximum number of FIM connected, single loop	200
Short detection	< 90 Ω (L+ to L-)
Open detection	> 1.8 kΩ (PRI to SEC; AMP+ to AMP-)
Ground leakage detection	< 30 kΩ (L+/L- or AMP+/AMP- to GND)
Functional (Interfacing)	
Status indicators	3 x LED indicator
User buttons	Reset button + Service button
General Fault contact	Pin-to ground (programmable)
Serial data communication	RS-485
Maximum supply current, single DIN rail	8 A

Bus address range	00 - FF (0-255) / max. 32 on single DIN-rail bar
Reset	manual: by reset button or via PC application (access level 3 or 4, EN 54-16)
Reset time	60 s
Fault detection time	
Loop short	< 1 s
Loop open	< 5 s
Earth leakage	10 s
Audio recovery time	
Loop short	< 4 s
Other faults	0 s (no audio interruption)

Environmental

Operating temperature	-5˚C ~ +40˚C
Storage temperature	-20˚C ~ +70˚C
Relative humidity	15% ~ 93%

Mechanical

Housing	Bopla Combinorm-Connect - DIN rail version - IP30
Protection rating	IP 30
Dimensions (W x H x D)	17.5 mm x 114.5 mm x 99 mm
Weight	200 g
Mounting	Quick-snap on DIN-rail, inside rack housing
Connections	
Loopdrive bus	DIN rail connector 5-points 3.5 mm screw terminal block
AMP in	2-point 5 mm screw terminal block (+, -)
LOOP out (PRI/SEC)	3-point 5 mm screw terminal block (L+, L-, optional GND)

8.2 PRA-LIM (FIM)

Electrical

DC Power supply (powered via loop from LDB)	19 - 30 VDC, nominal 30 VDC
DC Power consumption	
Idle current	100 µA continuous
Max. power consumption	20 mW
LOOP connection	
DC	30 V, max. cont. 130 mA
AC Voltage	Max. cont. 100 V^{RMS}, 300 V^{PP}
AC Current	Max. cont. 8 A
AC Frequency range	40 Hz ~ 20 kHz (-3dB)
AC THD	Max.10% (according to EN 54-16)
T-branch output	
DC	560 mV, max. 15 µA, cont. 1 µA
AC	Same as LOOP
Maximum AC load	50 W
Wiring	2-wire, max. 2.5 mm², loop max. length 1 km, outer cable diameter max. 13 mm
Grounding	Optional earth loop through third connection pin
Loop relay contact rating	Max. 250 VAC / 8 A (Dual-state type)
Maximum total loop load	800 W
Loudspeaker type	Only with DC blocking capacitor
Maximum number of FIM's, single loop	200
Maximum number of loudspeakers	
Between FIM's	Infinite within the maximum loop-load of 800W (National standard may limit the number of loudspeakers between FIM's)
T-branch	Infinite within the maximum T-branch load of 50W (National standard may limit the number of loudspeakers)
Short detection	< 90 Ω (L+ to L-)
Open detection (only T-branch with EOL monitoring)	> 360 kΩ (L+ to L-)
Functional: (interfacing)	

Status indicators	2 x two-color LED (orange/blue), 1 x output to optional external fault LED
User buttons	Reset + EOL detection switch
Fault report	Open relays
Reset	Manual, by FIM reset button or by LDB reset
Reset time	< 3s
Full charging time (from complete discharge)	< 50s
Fault detection time	
Loop short, T-branch short	< 1 s
T-branch open (only with EOL monitoring)	< 5 s
Audio recovery time	
Loop short	< 4 s
Other faults	0 s (no audio interruption)

Environmental

Operating temperature	-25˚C ~ +55˚C
Storage temperature	-20˚C ~ +70˚C
Relative humidity	15% - 93%

Mechanical

Housing	Plastic body (ABS/PC-V0) with transparent cover (PC-V0)
Protection rating	IP 33
Dimensions (W x H x D)	IP 33 housing, 110 x 130 x 55 mm
Weight	150 g
Mounting	Surface mounting, on-speaker mounting
Connections	
LOOP / T-branch	3-way 5 mm WAGO push-in terminal block (L+,L-,GND) 0.8 - 2.5 mm2
Ext. LED	2-way 3.5 mm screw terminal block

8.3   Approvals

PRA-LID (LDB)

Emergency standard certifications	
Europe	EN 54-16

Regulatory areas	
Safety	EN 62368-1 EN 62479
Immunity	EN 50130-4 EN 55035
Emissions	EN 61000-6-3 EN 61000-6-4 EN 55032
Environment	EN IEC 63000

Conformity declarations	
Europe	CE

PRA-LIM (FIM)

Emergency standard certifications	
Europe	EN 54-16 EN 54-17

Regulatory areas	
Safety	EN 62368-1 EN 62479
Immunity	EN 50130-4 EN 55035
Emissions	EN 61000-6-3 EN 61000-6-4 EN 55032
Environment	EN IEC 63000

Conformity declarations	
Europe	CE/CPR

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