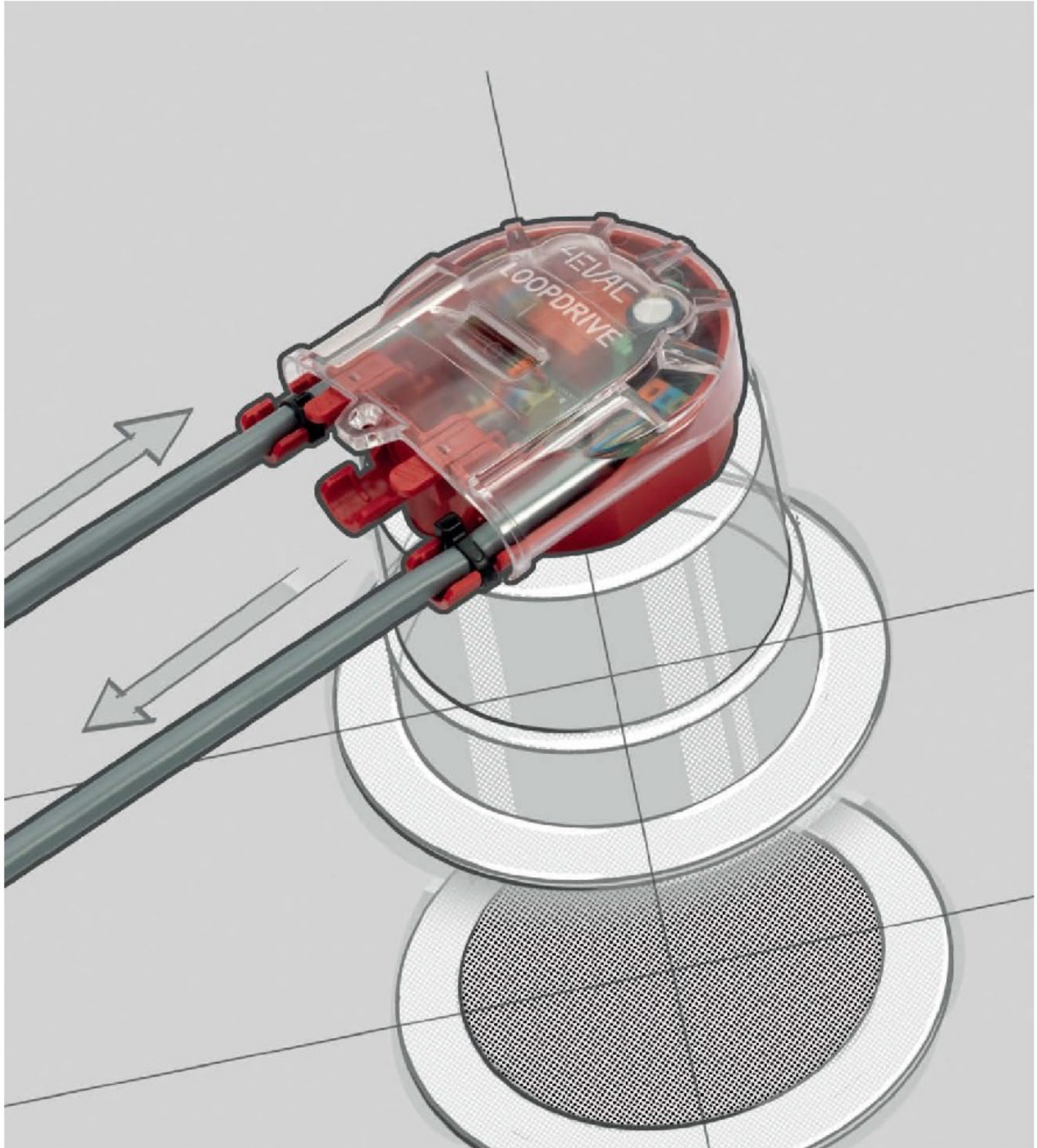


4EVAC

Loopdrive



User and installation manual V01R041

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1. Loopdrive introduction

Loopdrive is EN54 certified system for surveillance of loudspeaker lines in Public Address and Voice Alarm systems. The main task of Loopdrive system is to keep the audio message broadcast in the emergency zone in case of loudspeaker line short circuit. This is done by means of isolating damaged cable section away from the healthy part of the cable.

Loopdrive system covers completely the functionality of Voice Alarm System in the area of loudspeaker line fault detection, according to EN54-16 product standard. As a short-circuit isolator system, Loopdrive is also fully compliant with EN54-17. Loopdrive is capable of detecting and indicating not only short-circuit on the line, but also open line, disconnection of a loudspeaker, disconnection of power amplifier and earth-leakage at any point of the loudspeaker line.

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

Finally, Loopdrive is a simple and smart tool for installers, commissioning engineers and service technicians for easy maintenance routines, quick troubleshooting and repairing faults.

Smart, designed with no-nonsense approach to meet both high safety requirements as well as ease of installation and servicing in the field;

Quick at everything it does: fault detection and isolation, on-site installation and commissioning, finally – automated finding damaged cabling sections during tech service works.

Flexible for easy interfacing to any Voice Evacuation System on the market, with large configuration possibilities to satisfy any tailor-made design requirement;

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

Reliable, catching every line fault at all times and reporting it to the main system with no mistake, EN54 certified for safe long-term operation in severe ambient conditions.

1.1. Loopdrive components

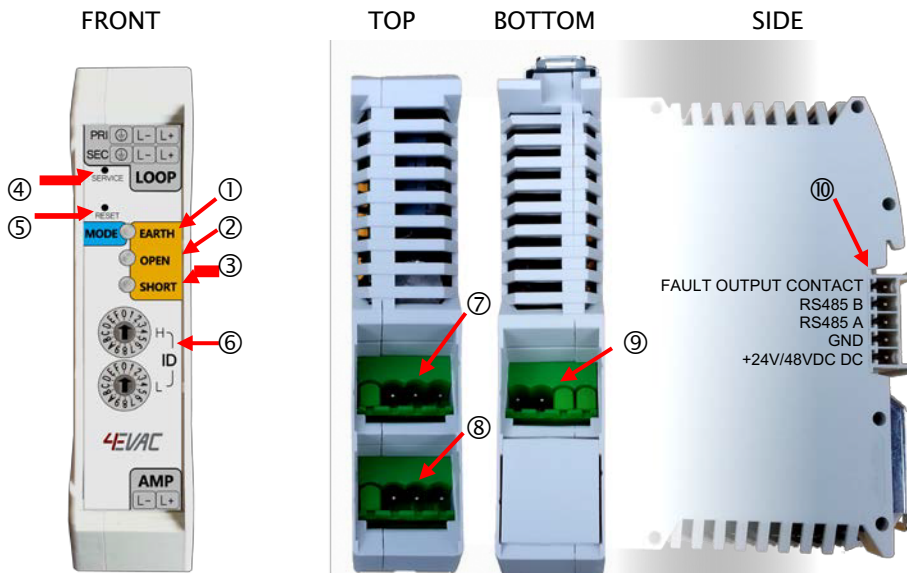
Loopdrive system comprises of two types of devices which play different roles in the system:

LDB (LoopDrive Booster) – 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.

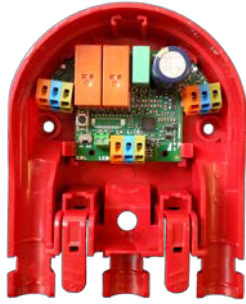


LDB is responsible for monitoring and reporting faults globally (per loudspeaker loop):

- 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)
- Amplifier input open

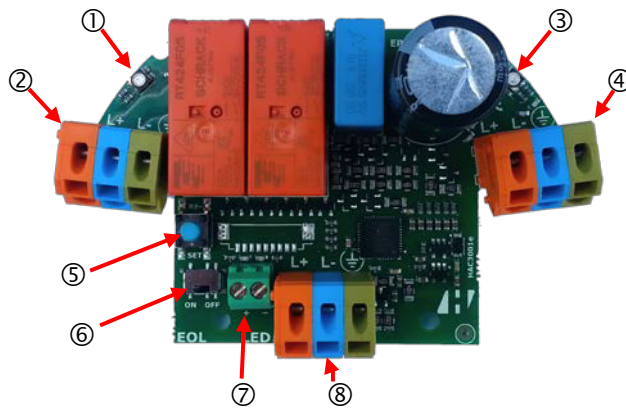


1. MODE/EARTH indicator
2. OPEN indicator
3. SHORT indicator
4. SERVICE button
5. RESET button
6. ID rotary switch
7. LOOP PRIMARY output connector
8. LOOP SECONDARY output connector
9. Power amplifier connector
10. Loopdrive bus DIN rail connector



FIM (Fault Isolator Module) – 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):

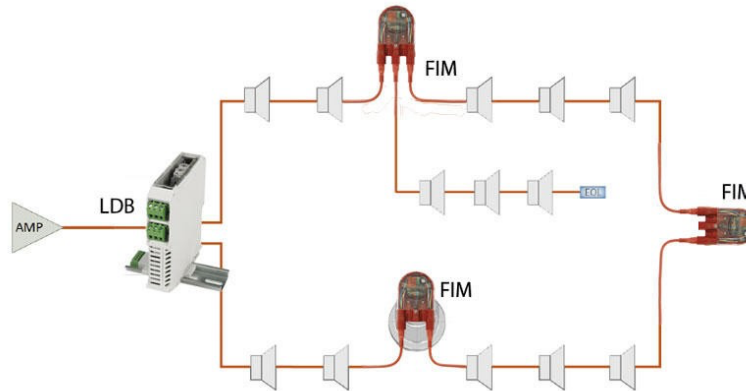
- Loop short (only adjacent segments)
- T-branch short
- T-branch open



1. Indicator A
2. LOOP connector A
3. Indicator B
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

1.2. Main functionality

Architecture of Loopdrive 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.



Picture 1. Loudspeaker loop monitored by Loopdrive.

Loopdrive 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.

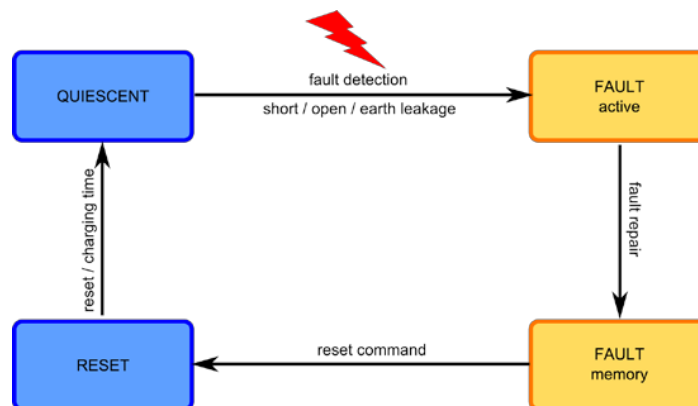
Following types of faults are detected by Loopdrive:

- 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);
- amplifier disconnected.

NOTE:

For the purpose of line monitoring Loopdrive 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. Loudspeaker without a capacitor will be seen as a short-circuit on the loudspeaker line.

Typical Loopdrive duty cycle is shown on picture below:



1.3. Loopdrive indications

Loopdrive modules feature multi-colour LED indicators with different colour 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

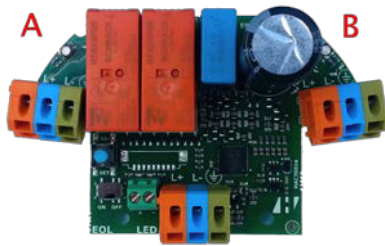
Table 1. LDB indications



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	

Table 2. FIM indications -basic



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)

Table 3. FIM indications - advanced

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: fast = 4 blinks/s slow = 1 blink/s very slow = 1 blink/4s	Fault status: active - fault is currently detected memory - fault was detected in the past and fixed
--	--

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

1.4. Fault contact

Loopdrive 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:

- a. Loopdrive system is powered and running, monitoring entire loudspeaker line,
- b. Power amplifier is connected,
- c. Loop is closed and fully working, every T-Branch is fully operational,
- d. No faults detected.

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

2. Installation and commissioning

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

Several conditions need to be met first to make all features of Loopdrive system work properly:

- a) main loudspeaker line has to be a closed loop,
- b) T-branch lines fitted with multiple loudspeakers require 47k Ω EOL resistor for T-Branch open detection,
- c) every loudspeaker connected to Loopdrive needs to be equipped with DC-blocking capacitor (typical value is 1 ~ 4.7 μ F),
- d) for 100V installations maximum total load of single loop is 800 W, maximum single T-Branch load 50 W,
- e) 24V/48VDC power supply for LDB,
- f) floating output power amplifier (e.g. transformer output),
- g) at least one free control input in the Voice Alarm System for fault contact.

2.1. Cables

Loopdrive 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 guarded by Loopdrive is 8A RMS, which allows loading single 100V line up to 800W.

Loopdrive is fully functional when running on 2-wire loudspeaker cable. For installations with special safety requirements Loopdrive 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.

2.2. How to install LDB in the Voice Alarm System

NOTE: Make sure that you NEVER set or exchange an LDB when powered. Before you place or remove an LDB, make sure you disconnect DC first.

We strongly recommend to first install and connect LDB to the Voice Alarm System 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.

- a. Fix LDB on a DIN rail and connect 24V/48VDC power supply to power terminals on 5-pin rail connector. LDB should boot-up, indicating boot progress with blue blinking on MODE indicator
- b. Within 15 seconds LDB will indicate OPEN fault, since AMP input as well as both LOOP outputs are not connected.
- c. 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.
- d. Connect the outgoing loop cable to PRIMARY output of LDB.

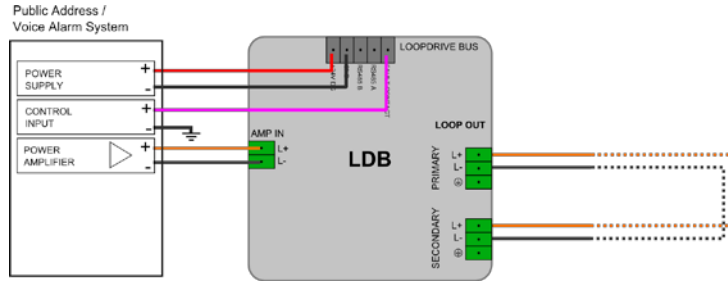
Note:

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.

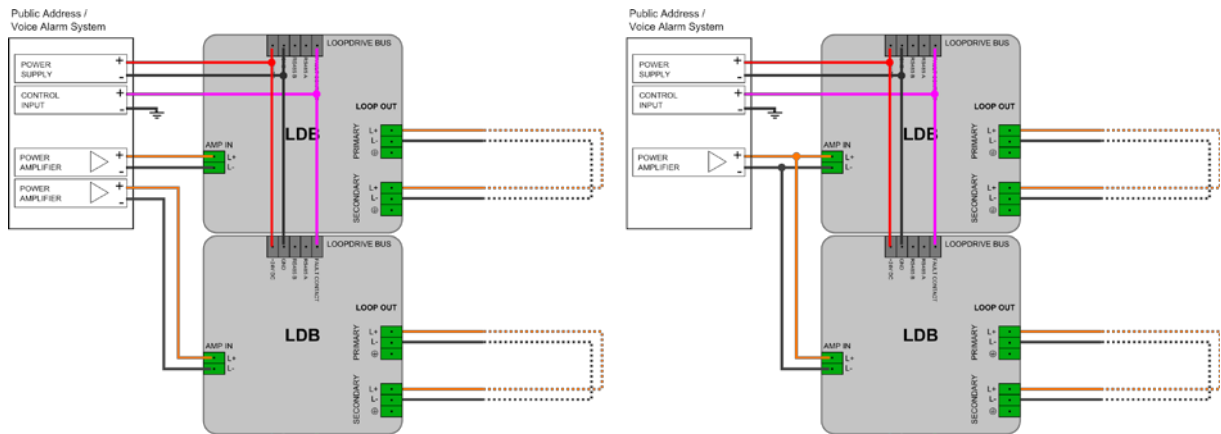
- e. If system includes multiple loops (multiple LDBs), there is a number of ways you can interconnect Loopdrive to the Public Address / Voice Alarm system.
Multiple LDBs can share common fault contact or individual fault control contacts of the main system. Fault contact sharing allows you to reduce 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.

NOTE:

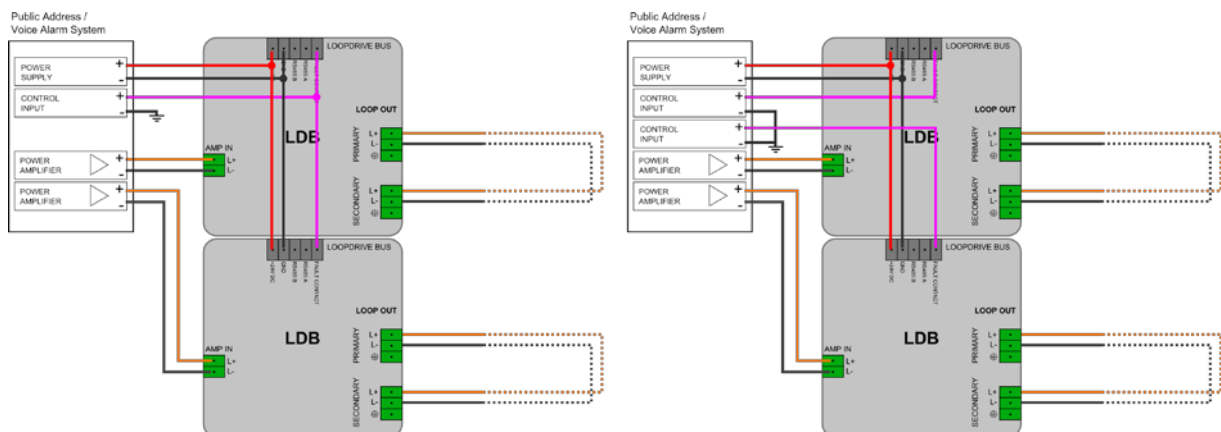
Loopdrive bus (DIN rail) interconnects multiple LDB units, supplying 24V/48V DC power, common fault contact output and RS485 serial bus. Due to current limitation single bus can supply with 24V/48V up to 32 LDB units. Larger number of LDBs should be divided and fitted onto separate power rails. Common RS485 bus and common fault output may be shared up to the maximum number of 256 LDBs in one system



Picture 2. Single LDB wiring diagram

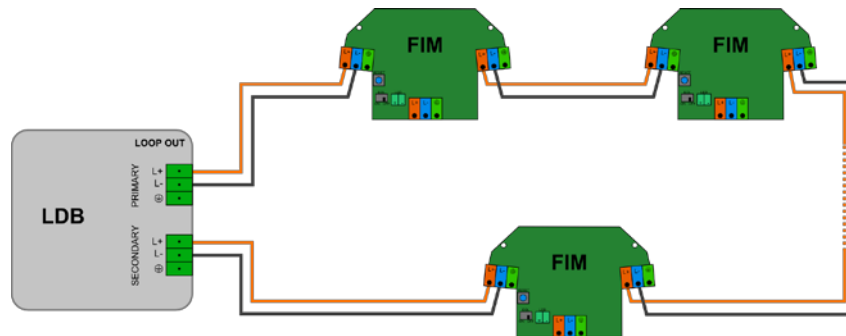


Picture 3. Multiple LDB wiring. Left: individual amplifier channels. Right: shared amplifier.



Picture 4. Multiple LDB wiring. Left: individual fault contact inputs. Right: common fault contact.

- f. If you're planning to proceed with installation of FIM modules on the loop, leave the SECONDARY output of LDB disconnected. Go to next chapter for FIM installation instructions.
- g. 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.



Picture 5. Complete Loopdrive installation diagram.

2.3. How to install FIMs on a loudspeaker line

Before you start connecting FIMs on the loop, make sure that LDB is connected to the rail and powered (see previous chapter).

- a. 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.
- b. 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.

NOTE:

When Loopdrive is in SERVICE MODE, audio signal from power amplifier is not transmitted to the loop.

- c. 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.
- d. LDB should indicate only OPEN fault. If SHORT fault is detected, fix it before FIM installation
- e. Check if EOL switch on the FIM is in OFF position.

NOTE:

EOL switch 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.

- f. Connect FIM to the loop cable on the PRIMARY side of LDB. Mind the cable polarity!

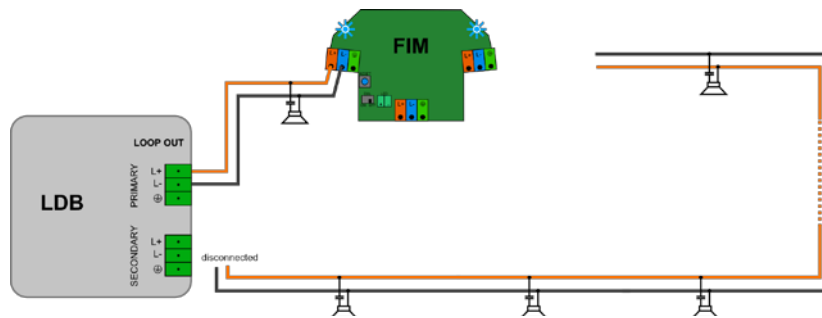
NOTE:

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!

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

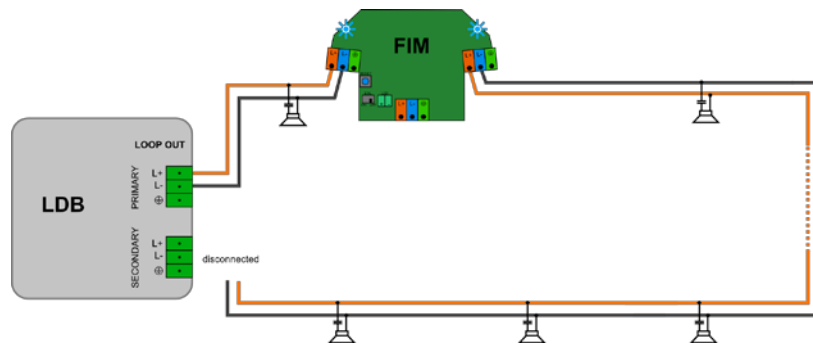
NOTE:

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.



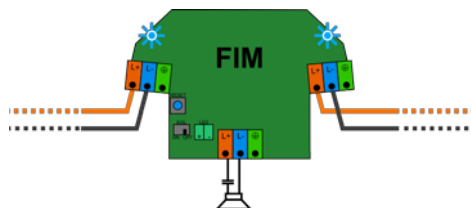
Picture 6. Side A of FIM connected to PRIMARY side of the loop.

- h. Connect the outgoing loop cable to the loop connector on the other side of FIM. Mind the cable polarity!
- i. 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.



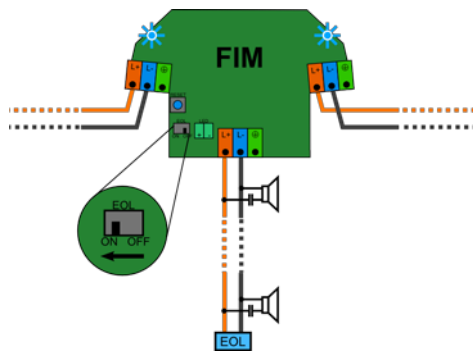
Picture 7. Both sides of FIM properly connected to the loop.

- j. 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 indications table).



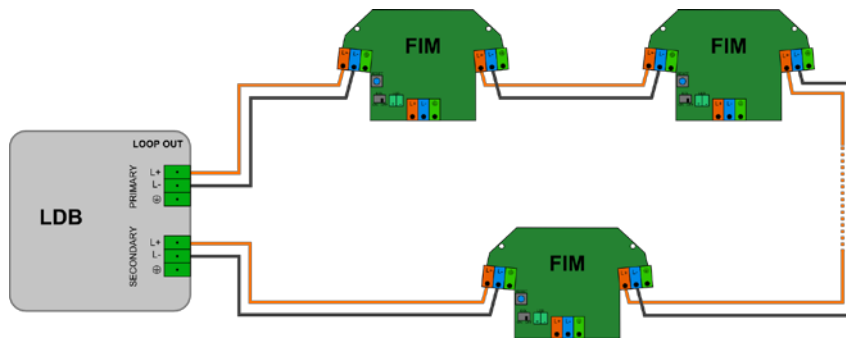
Picture 8. Single loudspeaker connected to T-Branch connector.

- k. 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 indications table).
- l. If the T-Branch cabling is correct, FIM will remain in SERVICE MODE.

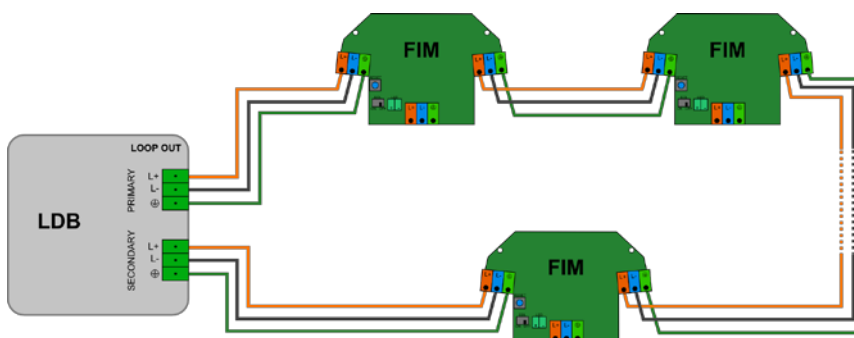


Picture 9. T-Branch line with EOL monitoring.

- m. Proceed with installation of the next FIM module.
- n. 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.
- o. Reset LDB by pushing RESET button. LDB will reboot to QUIESCENT MODE.

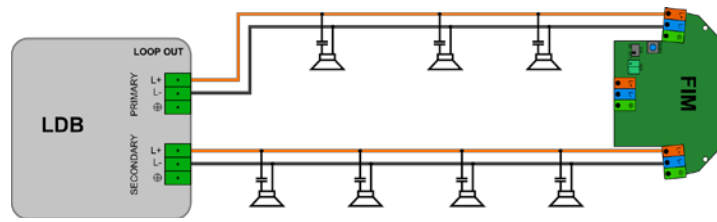


Picture 10. Complete Loopdrive installation diagram.

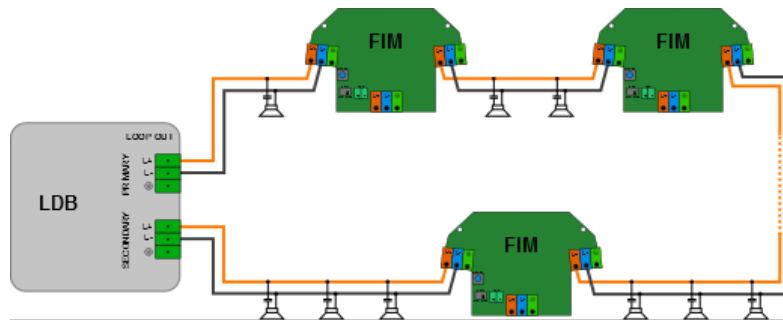


Picture 11. Complete Loopdrive installation - with optional GROUND wire loop.

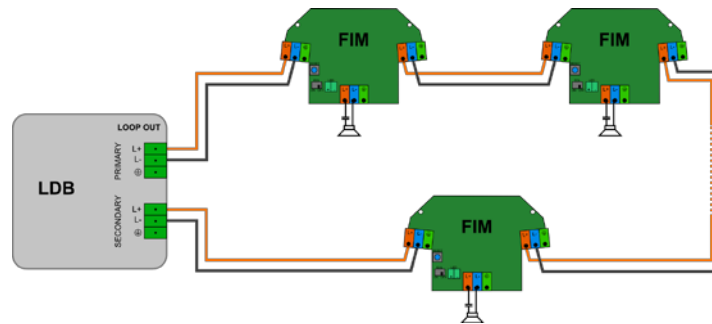
2.4. Examples of Loopdrive installations



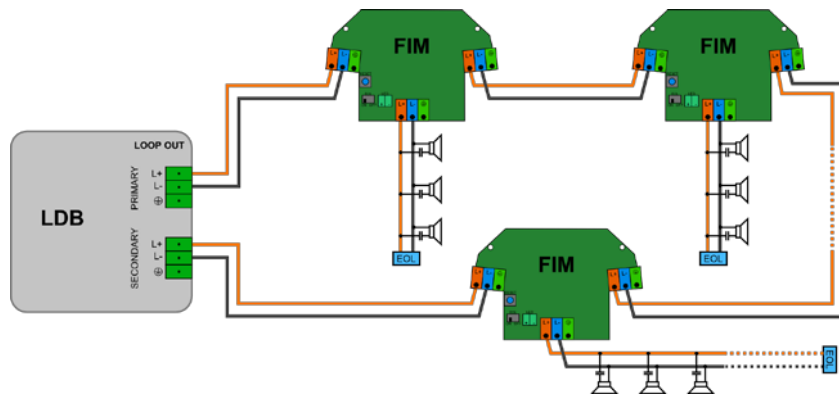
Picture 12. Minimum configuration - equivalent to A/B line.



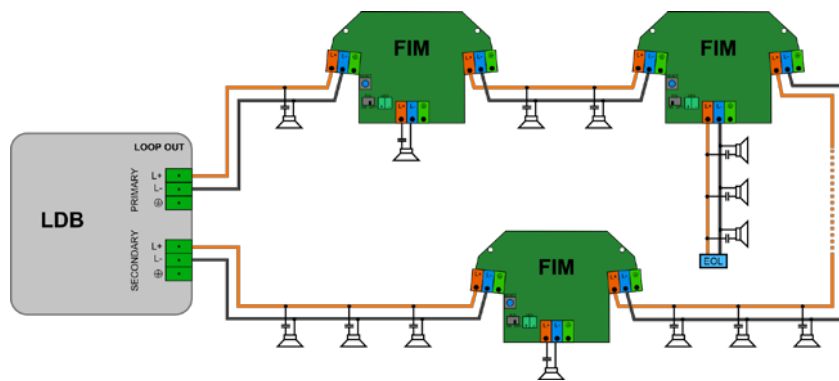
Picture 13. Speakers only on the loop.



Picture 14. One FIM per each speaker.



Picture 15. T-Branch lines with multiple loudspeakers.



Picture 16. Mixed configuration.

3. Routine maintenance inspection

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

- a. Check if LDB is powered
- b. If LDB is indicating FAULT mode (orange LED blinking) go to chapter "Faults".
Continue to next steps only if LDB is indicating QUIESCENT mode.
- c. Put LDB into SERVICE MODE (press SERVICE button for 10 seconds)
- d. Simulate short-circuit fault
 1. Using a jumper make direct short between L+ and L- wire on PRIMARY or SECONDARY output of LDB.
 2. Confirm that SHORT indication on LDB appears.
 3. Confirm that fault contact was activated.
 4. Remove the short circuit. Confirm that SHORT indication on LDB disappears.
- e. Simulate open loop fault
 1. Disconnect loop cable from PRIMARY or SECONDARY output of LDB.
 2. Confirm that OPEN indication on LDB appears.
 3. Confirm that fault contact was activated.
 4. Connect the loop cable back to LDB. Confirm that OPEN indication on LDB disappears.
- f. Put LDB into QUIESCENT mode
- g. Simulate earth leakage fault:
 1. Make direct connection between L+ or L- wire to ground potential (Ground pin of LDB)
 2. Confirm that EARTH indication on LDB appears.

3. Confirm that fault contact was activated.
 4. Remove the connection between L+ or L- to earth.
 5. Confirm that EARTH “active” (fast) indication on LDB turns into “memory” (slow).
 6. Reset LDB into QUIESCENT mode.
- h. Simulate ground wire open fault (optional)
1. Open ground wire on PRIMARY or SECONDARY output of LDB.
 2. Confirm that EARTH indication on LDB appears.
 3. Confirm that fault contact was activated.
 4. Connect ground wire back to LDB.
 5. Confirm that EARTH “active” (fast) indication on LDB turns into “memory” (slow).
 6. Reset LDB into QUIESCENT mode.
- i. Check cables and connectors between LDB and Public Address / Voice Alarm system.

4. Fault finding – LDB

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

Finding a loudspeaker line fault usually starts at the main system rack, where LDB units are located. Observe LDB front panels and compare the indications to indication table in this manual.

NOTE:

Multiple faults can be shown on LDB at same time. SHORT, OPEN and EARTH fault may be detected and indicated simultaneously and should be investigated individually.

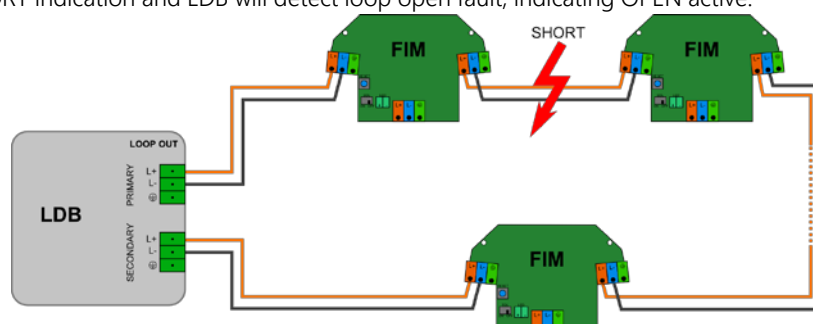
If fault indications on LDB are in “memory” state (slow blinking), simply push RESET button on LDB and after reboot LDB will return to QUIESCENT mode.

Following information relates to situation where there is an active fault indicated. More details you’ll find in LDB indications table (Table 1.) in chapter 1.

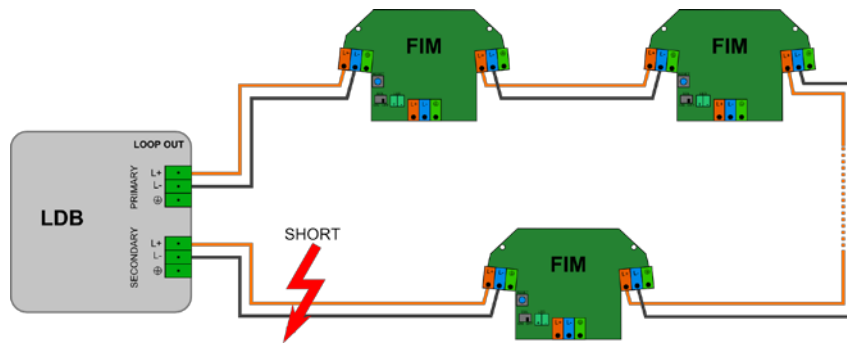
4.1. SHORT fault

LDB shows SHORT fault in following cases:

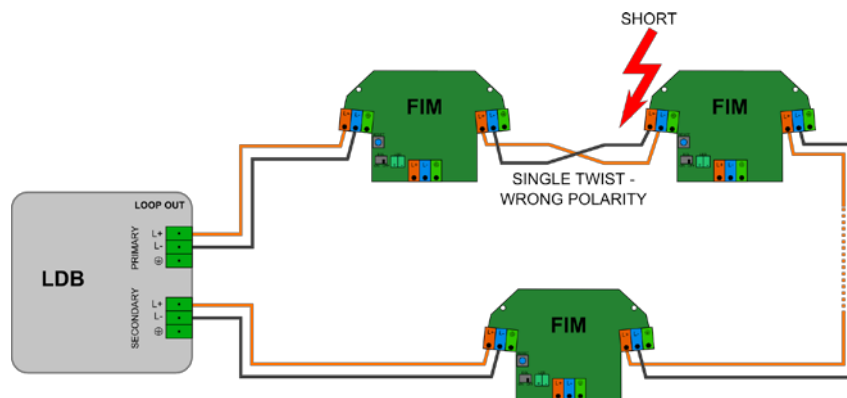
- a. Short circuit on the loop, between FIM modules
 In this case Short fault is located in the field, not directly at LDB connector. FIM modules are isolating faulty section of the cable, so the loop stays open until the short circuit is removed. In this state reset of LDB will clear the SHORT indication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



- b. 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.



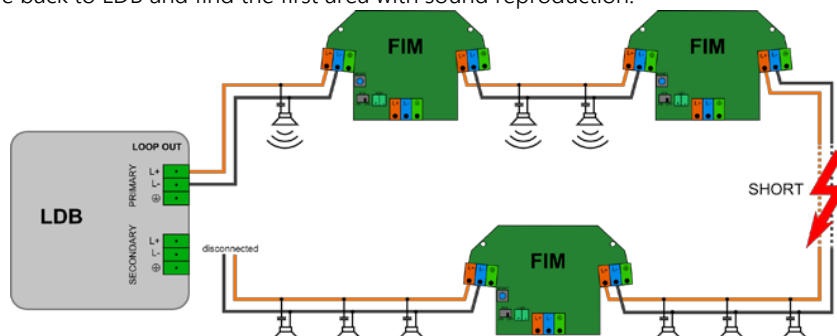
- c. Single (or odd number) twist in loudspeaker cable polarity
 If cabling polarity is mismatched in one place in your installation (or more but odd number), Loopdrive will react with SHORT indication.



What to do?

Reset LDB and observe the following indication:

- a. If LDB returns to SHORT active indication, short circuit is located on the cable section directly connected to PRIMARY or SECONDARY.
- b. 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:
 - a. 4EVAC 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.
 - b. Disconnect loudspeaker cable from SECONDARY output of LDB and put an audio signal in the zone including faulty loop. Loopdrive 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 SECONDARY side back to LDB and find the first area with sound reproduction.



4.2. OPEN fault

LDB shows OPEN fault in following cases:

- a. Loop cable is open (L+ or L- or both wires)
- b. Loop section between FIMs is isolated because of previously detected short circuit. See previous chapter: SHORT indication.
- c. T-Branch fault (OPEN or SHORT)

NOTE:

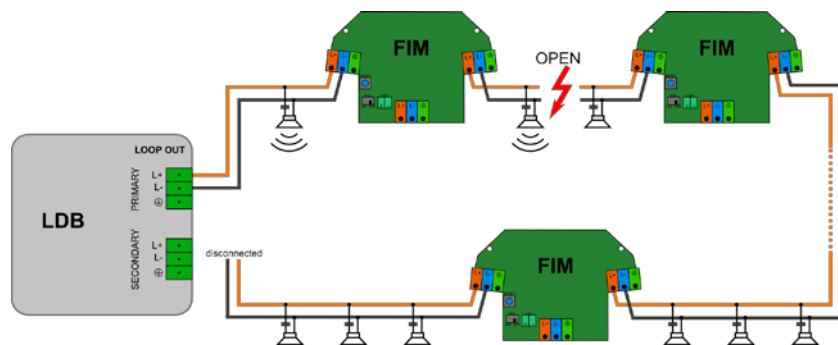
In case of T-Branch fault (OPEN or SHORT), FIM will open both loop relays, isolating T-Branch and causing the loop OPEN fault on LDB. The FIM reporting T-Branch fault will stay open until the fault is still detected. To close the loop again, FIM reset is required after removing the fault.

- d. Power amplifier is disconnected.

What to do?

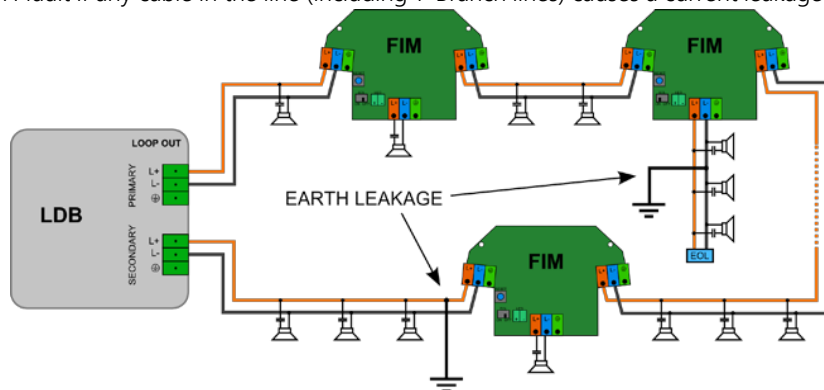
First: check if power amplifier is connected. If so, continue with the same procedure as for SHORT fault. Two alternative solutions are available:

- a. 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 open fault. Please, go to the Loopdrive Sniffer manual for details.
- b. Disconnect loudspeaker cable from SECONDARY output of LDB and put an audio signal in the zone including faulty loop. Loopdrive will feed the loop with audio signal only from PRIMARY side. While listening to loudspeakers follow the loop and find first area (including T-Branched) with no sound reproduction.



4.3. EARTH fault

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

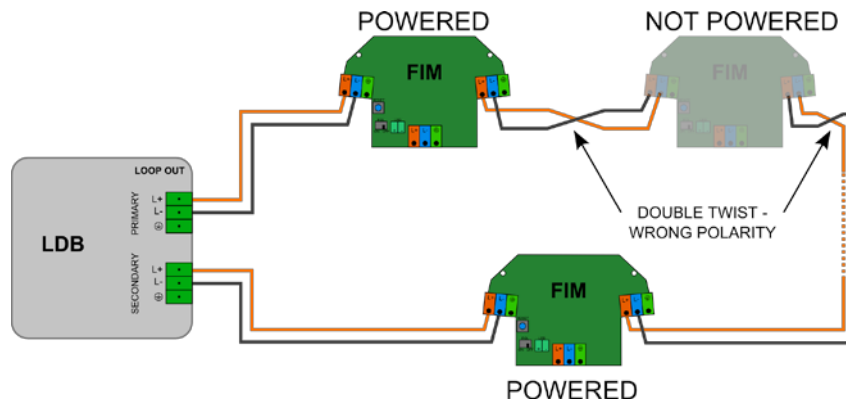


What to do?

To find earth leakage in your installation, please use the FIM tracking feature of Loopdrive 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.

4.4. 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. Loopdrive however will not detect any fault and will act normally, as if the loop was correct.



What to do?

To find double twists in your installation, please use the FIM tracking feature of Loopdrive 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.

5. Fault finding – 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.

NOTE:

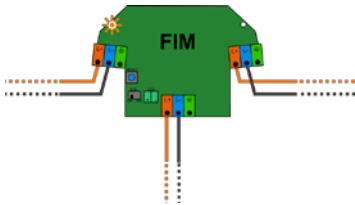
Multiple faults can be shown on FIM at the same time. In this case different fault indications will be superimposed, creating combined indication. FIM can be reset only if all faults are removed and all indications are in "memory" state

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.

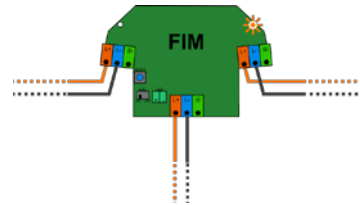
Following information relates to situation where there is an active fault indicated. More details you'll find in FIM indications table (Table 4. and Table 3.) in chapter 1.

5.1. 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.



Picture 17. Short on side A



Picture 18. Short on side B.

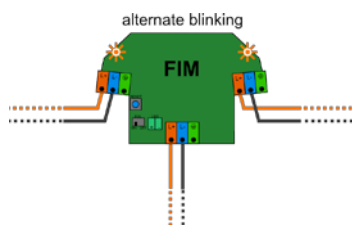
What to do?

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:

- a) push RESET button on the FIM module
or
- b) send REMOTE FIM RESET command by pressing RESET button on LDB for 10 seconds or via Sniffer application.

5.2. 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.



Picture 19. Short on T-Branch

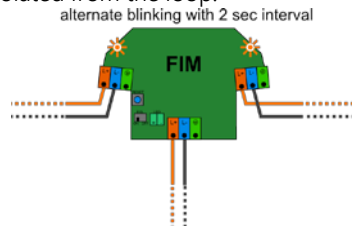
What to do?

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:

- a) push RESET button on the FIM module
or
- b) send REMOTE FIM RESET command by pressing RESET button on LDB for 10 seconds or via Sniffer application.

5.3. Open T-Branch

If 47k Ω 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.



Picture 20. Open T-Branch

What to do?

Reconnect the T-Branch line to FIM, including 47k Ω 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:

- a) push RESET button on the FIM module
or
- b) send REMOTE FIM RESET command by pressing RESET button on LDB for 10 seconds or via Sniffer application.

6. Technical specifications

FIM

Electrical:	
DC Power supply (powered via loop from LDB)	19 ~ 30 VDC, nominal 30 VDC
DC Power consumption	
inrush current	650 μ A (10 ms)
idle current	100 μ A 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 μ A, cont. 1 μ A
AC	same as LOOP
maximum AC load	50 W
Wiring	2-wire, max. 2.5 mm ² , 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 k Ω (L+ to L-)
Functional:	
Interfacing	
Status indicators	2 x two-colour 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)
Mechanical:	
Housing (material)	plastic body (ABS/PC-V0) with transparent cover (PC-V0)
Protection rating	IP 33, IP 55
Dimensions (WxHxD)	
IP 33 housing	110 x 130 x 55 mm
IP 55 housing	110 x 180 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 mm ²
Ext. LED	2-way 3.5 mm screw terminal block
Environmental	
Operating temperature	-25°C ~ +55°C
Storage temperature	-20°C ~ +70°C
Relative humidity	15% – 93%
Compliant standards	
Short-circuit isolators	EN 54-17 (0560 – CPR – 142190002)
Voice evacuation	NEN 2575 NPR 2576
Safety	EN 60065
EMC	EN 55103
Ordering information	

Part No.	FIM-01 Includes: 1 x IP33 housing 1 x release tool 1 x compression gland for speaker mounting
Part No.	FIM-ADP-G IP55, Adapter with 3x compression glands Material: ABS/PC-V0
Part No.	FIM-ADP-S IP55, Adapter with 3x Plug&Play socket Material: ABS/PC-V0

LDB

Electrical:	
DC Power supply	18 – 50 VDC (v2r5)
DC Power consumption	
inrush	1,44W
idle (LDB only)	1.9W
max. power consumption (LDB plus 200 x FIM, full load)	2.4W
AMP input (100V audio)	
max. AC voltage	max cont. 100 V_{RMS} , 300 V_{PP}
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: 0.8 - 2.5 mm ² loop max. length 1 km
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 k Ω (PRI to SEC; AMP+ to AMP-)
Ground leakage detection	< 30 k Ω (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)
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)
Mechanical:	
Housing	Bopla CombiNorm-Connect
Protection rating	IP 30
Dimensions (WxHxD)	17,5 x 114,5 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)

Environmental	
Operating temperature	-10°C ~ +55°C
Storage temperature	-20°C ~ +70°C
Relative humidity	15% ~ 93%
Compliant standards	
Short-circuit isolators	EN 54-17
Voice evacuation	EN 54-16
EMC immunity	EN62368-1:2020+A11:2020 – Audio, video and similar electronic apparatus EN50130-4:2011+A1:2014 – Electromagnetic compatibility Immunity 61000-6-3:2017+A1:2011 - Electromagnetic compatibility 61000-6-4:2019 - Electromagnetic compatibility EN55032:2015+A1:2020 - Electromagnetic compatibility EN55035:2017+A1:2020 - Electromagnetic compatibility EN62479:2010 - EMF
Ordering information	
Part No.	LDB-03
	Includes:
	5-pole DIN-rail bus connector
	5-pole screw connector for DIN-rail bus connector
	2x 3-pole screw connector (Loop PRI and SEC)
	1x 2-pole screw connector (Amplifier)

4EVAC
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