To prevent PA loudspeakers in a secure area from being used as microphones, the Speaker Isolation Module SIM-Mk1 is installed within the secure area between an incoming 100V speaker circuit and the speakers to be secured.

The secure area speaker circuit is physically disconnected from the main 100V line by a double pole relay whenever it is not being used to broadcast announcements or warning tones. The relay also shorts out any AC signal on the secure speaker circuit by placing a capacitor across the secure 100V line.

The speaker circuit in the secure area is connected to the main 100V line by a Voice Operated Switch (VOX) whenever audio above a preset trigger threshold is present. The isolated output then reproduces all tones and PA announcements.

The secure speaker wiring is monitored for open and short circuits by the use of a 56k ohm end-of-line (EOL) resistor. Any faults are communicated to the SIM’s fault relay connecting an 8.2k ohm resistor in parallel with the input 100V line.

Multiple loudspeakers up to a maximum of 20 watts may be connected to the 100V Isolated Output of the module. Up to 2 speaker circuits may be connected.

The load presented by the secure speakers is driven by the amplifier driving the incoming 100V Input. The SIM does not have an inbuilt amplifier.

The module draws a maximum current of 70 milliamps and is supplied from the Control Panel. It does not need any additional power supplies or batteries.

The module can also be used on 70V systems. In this case, the secure speakers will also be driven at 70V.

Four diagnostic LEDs indicate the status of the module.

It is fully compliant with the functional requirements of AS2220, AS1670.1-2004 and AS1670.4-2004.

Advantages of using the Speaker Isolation Module SIM-Mk2

1. Reduces AS1851 maintenance and inspection requirement within secure areas, as the module does not require a mains supply or back-up batteries.
2. Provides continuous monitoring of secure area speakers for fault conditions.
3. Easy to install on existing wiring.
4. Analogue technology. No RF emissions.
5. Compact circuit board unit that can be mounted anywhere within the secure area.
6. Four diagnostic LEDs on each module allow easy diagnosis of problems such as: loss of power, loss of audio and open/short circuit faults.
7. Any number of speakers up to 20 watts total load can be connected.
8. The isolation module utilises existing power supply from the Control Unit.
9. Not a significant heat source - requires no additional ventilation.
Speaker Isolation Module for 100V PA lines
Model: SIM-Mk1 (formerly model PISOL)

Description
The Speaker Isolation Module consists of two sections:
1: Voice Operated Switch (VOX)
2: Secure area speaker wiring monitor

1: Voice Operated Switch (VOX)
The speaker circuit in the secure area is connected to the main 100V line by a Voice Operated Switch (VOX) whenever audio on the main 100V line is above a preset trigger threshold.
The input to the VOX is fed via a bandpass filter which makes it less sensitive to signals outside the speech band. When the trigger threshold is exceeded, a double pole audio isolation relay is energized which connects the secure area speaker wiring to the main 100V line.
A 47uF 50V bi-polar capacitor in series with each 100V line isolates the fault monitoring circuit of the secure area speaker wiring from the main 100V line. Apart from these 2 x 47uF capacitors, there is no other circuitry to limit the pass-thru signal bandwidth.

When the audio signal drops below the trigger threshold, the double pole relay is de-energized after a delay (typically 6 seconds). This physically disconnects the secure area speaker circuit from the main 100V line whenever it is not being used to broadcast announcements or warning tones. The audio isolation relay also shorts out any AC signal on the secure speaker circuit by placing a 10uF capacitor across the secure area 100V line.
A green AUDIO LED (Fig 3) lights whenever the audio isolation relay is energized (secure area connected).

If the 24V power supply is interrupted, the audio isolation relay will be de-energized and hence disconnect the secure area speaker wiring. The Fault relay (see below) is also de-energized, communicating a fault condition.

2: Secure area speaker wiring monitor
The secure area speaker wiring is monitored for open and short circuits by the use of a 56k ohm end-of-line (EOL) resistor. Two speaker runs can be connected, in which case each run is terminated with a 110k ohm EOL resistor.
Secure speakers require a DC blocking capacitor to be fitted to each speaker. Typical capacitor size is 1uF (50V bi-polar) per watt of speaker load.

Any faults are communicated to the Control Panel by the Speaker Isolation Module’s fault relay connecting an 8.2k ohm resistor in parallel with the input 100V line. The Fault relay is de-energized when a fault is detected.

Two red LEDs (Fig 3) indicate Open and Short circuit faults on the secure area speaker wiring.

When a short circuit is detected on the secure area speaker wiring, the audio isolation relay is held de-energized so that the main 100V line is not shorted out should the VOX be triggered.

A green OK LED (Fig 3) lights whenever the fault relay is energized indicating that there are no faults on the secure area speaker wiring. There is no separate Power LED as the OK LED or one of the two Fault LEDs will always be lit.

End-of-line (EOL) Resistors
Suitable resistors are supplied. 56k ohms 2% 0.5 watt metal film resistor.
e.g. Altronics R7660 (Pk of 10)
or Element 14 (Farnell) 9340742

110k ohms 2% 0.5 watt metal film resistor.
e.g. Altronics R7607 (Pk of 10)
or Element 14 (Farnell) 9339868
### Absolute Maximum Ratings

- **Supply Voltage**: 30 volts
- **100V Input**: 130V AC
- **Operating Temperature Range**: 0-50 deg C
- **Storage Temperature Range**: 0-90 deg C

### Electrical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply Voltage</strong></td>
<td></td>
<td>18</td>
<td>24</td>
<td>28</td>
<td>Volts</td>
</tr>
<tr>
<td><strong>Supply Current (Max)</strong></td>
<td>Supply = 28V. Audio and OK LEDs on</td>
<td>50</td>
<td>55</td>
<td>70</td>
<td>mA</td>
</tr>
<tr>
<td><strong>Supply Current (Idle)</strong></td>
<td>Supply = 28V. No audio, OK LED on</td>
<td>20</td>
<td>25</td>
<td>35</td>
<td>mA</td>
</tr>
<tr>
<td><strong>Power dissipation</strong></td>
<td>Supply = 28V</td>
<td>0.8</td>
<td>2.0</td>
<td></td>
<td>Watts</td>
</tr>
<tr>
<td><strong>100V line Input</strong></td>
<td>100V AC audio line from power amp</td>
<td>100</td>
<td>120</td>
<td></td>
<td>Volts</td>
</tr>
<tr>
<td><strong>100V Line Output</strong></td>
<td>In parallel with 100V input. For connection of additional unsecured speakers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>100V Isolated Output</strong></td>
<td>100V signal to secure area speakers. Powered from main 100V line</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>End Of Line resistance</strong></td>
<td>EOL at end of Isolated speaker wiring</td>
<td>54k</td>
<td>56k</td>
<td>58k</td>
<td>Ohms</td>
</tr>
<tr>
<td><strong>Time to respond to change of EOL resistance</strong></td>
<td></td>
<td>8</td>
<td>40</td>
<td></td>
<td>Seconds</td>
</tr>
<tr>
<td><strong>Short Circuit detection</strong></td>
<td>Must trip. EOL value</td>
<td>31k</td>
<td></td>
<td></td>
<td>Ohms</td>
</tr>
<tr>
<td><strong>Open Circuit detection</strong></td>
<td>Must trip. EOL value</td>
<td></td>
<td></td>
<td>83k</td>
<td>Ohms</td>
</tr>
<tr>
<td><strong>VOX trigger threshold</strong></td>
<td>Must not trigger. 1kHz sine wave</td>
<td>10</td>
<td></td>
<td></td>
<td>Volts AC</td>
</tr>
<tr>
<td><strong>VOX Release time</strong></td>
<td>1kHz sine wave less than 10V Recovery time until isolation relay opens</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>Seconds</td>
</tr>
<tr>
<td><strong>Fault signalling</strong></td>
<td>DC resistance switched in parallel with the input 100V line under fault conditions</td>
<td>7.7k</td>
<td>8.2k</td>
<td>8.9k</td>
<td>Ohms</td>
</tr>
<tr>
<td><strong>Secure Area Audio Isolation</strong></td>
<td>50Hz to 1kHz</td>
<td>125</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td><strong>50Hz to 20kHz</strong></td>
<td></td>
<td>100</td>
<td>&gt;110</td>
<td></td>
<td>dB</td>
</tr>
</tbody>
</table>
Typical speaker wiring

Control Panel

100V Speaker Out

24V DC Out

100V Out is in parallel with 100V In and is provided for use as a looping point.

100V In
+ -

100V Out
+ -

100V Isolated
+ -

24V
+ -

60mA

Audio

OK

Open

Short

Speaker Isolator Mk1

20 watts max.

56k EOL

Secure Area

Fig 1.

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Wiring with 2 secure area speaker runs

Control Panel

100V Speaker Out 24V DC Out

100V Out is in parallel with 100V In and is provided for use as a looping point.

Speaker Isolator Mk1

100V In 100V Out 100V Isolated 24V 60mA

+ + + + + +

0V 0V 0V 0V

110k EOL 110k EOL

20 watts max.

Secure Area

Fig 2.
PCB Dimensions and monitoring LEDs

Fig 3.

Audio LED  On = VOX triggered
OK LED  On = No secure area speaker wiring faults
Open LED  On = Secure area speaker wiring open
Short LED  On = Secure area speaker wiring short

Mounting holes: 4 x 3mm clearance.

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