



## FP2023 QE20 2 x 4 Way 100V Splitter Module Installation Instructions

### 1. General Description

This sheet describes installation of the FP2023 QE20 2 x 4 Way 100V Splitter Module. This module can be used to split two QE20 Amplifier 100V outputs into sets of 4, or 1 Amplifier 100V output into 8, short-circuit isolated 100V loudspeaker feeds for different areas of an evacuation zone, as a replacement for an existing module. It provides:

- Two 100V Splitter PCBs mounted on a common bracket for easy installation on the QE20 frame.
- Two 100V inputs from QE20 Amplifier Module 100V outputs, which could be daisy-chained together.
- Two sets of four 100V loudspeaker outputs that are short-circuit isolated from each other, so that a short circuit on one loudspeaker output does not stop the others from working.

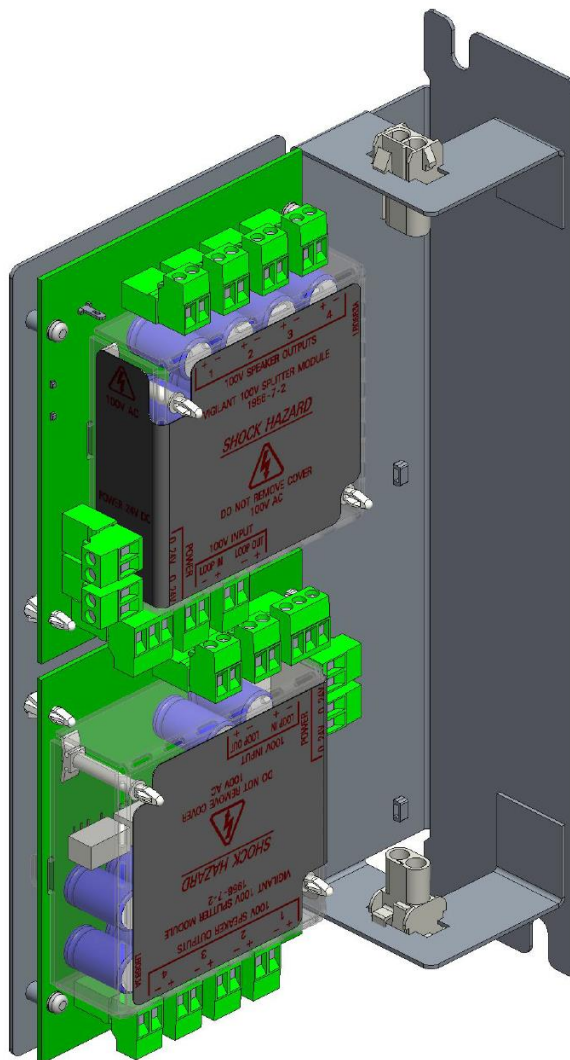


Figure 1 – FP2023 QE20 2 x 4 Way 100V Splitter Module

### 2. Kit Contents

The FP2023 kit contains:

- 1 x QE20 2 x 4-Way 100V Splitter Module
- 1 x LM0655 24V DC Distribution Lead 1m
- 2 x M6 x 10 screws for mounting the module on the frame
- 1 x LT0705, these instructions.

### 3. Mounting the 2 x 4 Way 100V Splitter Module

The 2 x 4 Way 100V Splitter Module occupies one of the 60mm positions on a QE20 mounting frame. Generally, it can be mounted in any position, but refer to the existing QE20 panel layout for an empty position when adding to a system. It has 24V power connectors at both ends of the module, so it can be mounted with access to the PCBs on the bracket from the left or the right-hand side. Usually, it will be mounted adjacent to the Amplifier Module it is connected to, but this is not essential.

It is secured to the frame using two M6 x 10 screws. Loosely fit one screw to the bottom hole of the desired position, then slide the open slot at the bottom of the module under the screw head and then fit the top screw to secure the module. Tighten both screws to lock the module into position.

### 4. Replacing an Existing Module

When replacing an existing module the internal wiring of the new module will need to be changed to match the existing one if the two 100V Splitters are connected in series to make an 8-way output. Refer to Section 6 Internal Wiring below.

Identify all the field wiring and internal wiring to the 100V Splitter Module so the cables can be reconnected to the correct terminals later.

Power down the QE20.

Disconnect the field wiring connectors, the DC power loom, and the 100V input looms from the amplifier(s).

Remove the top mounting screw and loosen the bottom mounting screw, so that the existing module can be removed.

Fit the slot of the new module under the lower screw, and then fit the top mounting screw. Tighten all the screws to secure the module in position.

Reconnect all the wiring, making sure each cable is refitted to the same position as before.

Turn on the QE20 and check there no faults are generated.

Conduct a live speech announcement to each zone served by the 100V Splitter Module and check the correct loudspeakers generate the voice announcement.

### 5. Adding a Module

If the two 100V Splitters need to be connected to the same amplifier, then the internal wiring needs to be modified. Refer to Section 6 Internal Wiring below.

Mount the new module in an available position on a mounting frame and connect the 24V dc power lead.

Wire the 100V Input(s) to the correct amplifier output(s) or the previous 100V Splitter Module. Refer to Section 6 Internal Wiring below.

Connect the loudspeaker feeds to the 100V Outputs of the 100V Splitter Module. Refer to Section 7 Field Wiring below.

### 6. Internal Wiring

The QE20 100V Splitter Module requires:

- 24V power loom to be connected. Connect a spare output of a 3-Way 24V DC Distribution Loom LM0656 to one of the 100V Splitter Module 24V DC input connectors. In there is no spare LM0656 output, connect one the 100V Splitter Module 24V DC Input Connectors to a 27A PSE output using the LM0655 1m extension lead. This is long enough to go between a Splitter on the top frame and a PSE on the bottom frame of 3 frames.
- Wiring of the 100V feeds from the 1 or 2 amplifier 100V outputs. Suitable double-insulated cables are provided on the module for this purpose. Connect each cable to the 100V OUTPUT of the required amplifier, observing the correct polarity. Connect the brown wire to +ve, blue wire to –ve.

Refer to drawing 2001-2 Sheet 304 (included) for details on wiring each 100V Splitter PCB to separate amplifier outputs and to the loudspeakers.

**WIRING MODIFICATION FOR 8 OUTPUTS**

If the two 100V Splitter PCBs need to be connected to the same QE20 Amplifier 100V output (so that the 100V feed is split into up to 8 or more outputs), then the internal wiring of the QE20 2 x 4 Way 100V Splitter Module needs to be changed as follows.

The 100V feed from the amplifier is daisy-chained from one 100V Splitter PCB to another using the cabling provided. Trim the 100V INPUT loom of the second 100V Splitter PCB to a suitable length and connect it to the 100V INPUT LOOP OUT 2-way connector (J7) of the previous 100V Splitter PCB. The last 100V Splitter PCB must have the 56K EOL resistor fitted (sleeved with insulation). Wire the C and NO contacts of each of the 100V Splitter PCB Fault relays in series with the EOL resistor and the last 2-way connector (J7), so that any 100V Splitter PCB Fault relay opening (they are normally energised) disconnects the EOL on Fault. The existing 56K EOL resistor on the first PCB is not required.

If more than 8 short-circuit-isolated speaker feeds are required from the same amplifier, a second FP2023 2 x 4 Way 100V Splitter Module can be daisy-chained to the first in a similar manner. Connect the 100V input of the second module to the 100V INPUT LOOP OUT (J7) terminals of the second 100V Splitter PCB on the first module. Wire the C and NO contacts of all of the Fault relays in series with the 56K EOL resistor on the last PCB in the chain.

Refer to drawing 2001-2 Sheet 305 (included) for details.

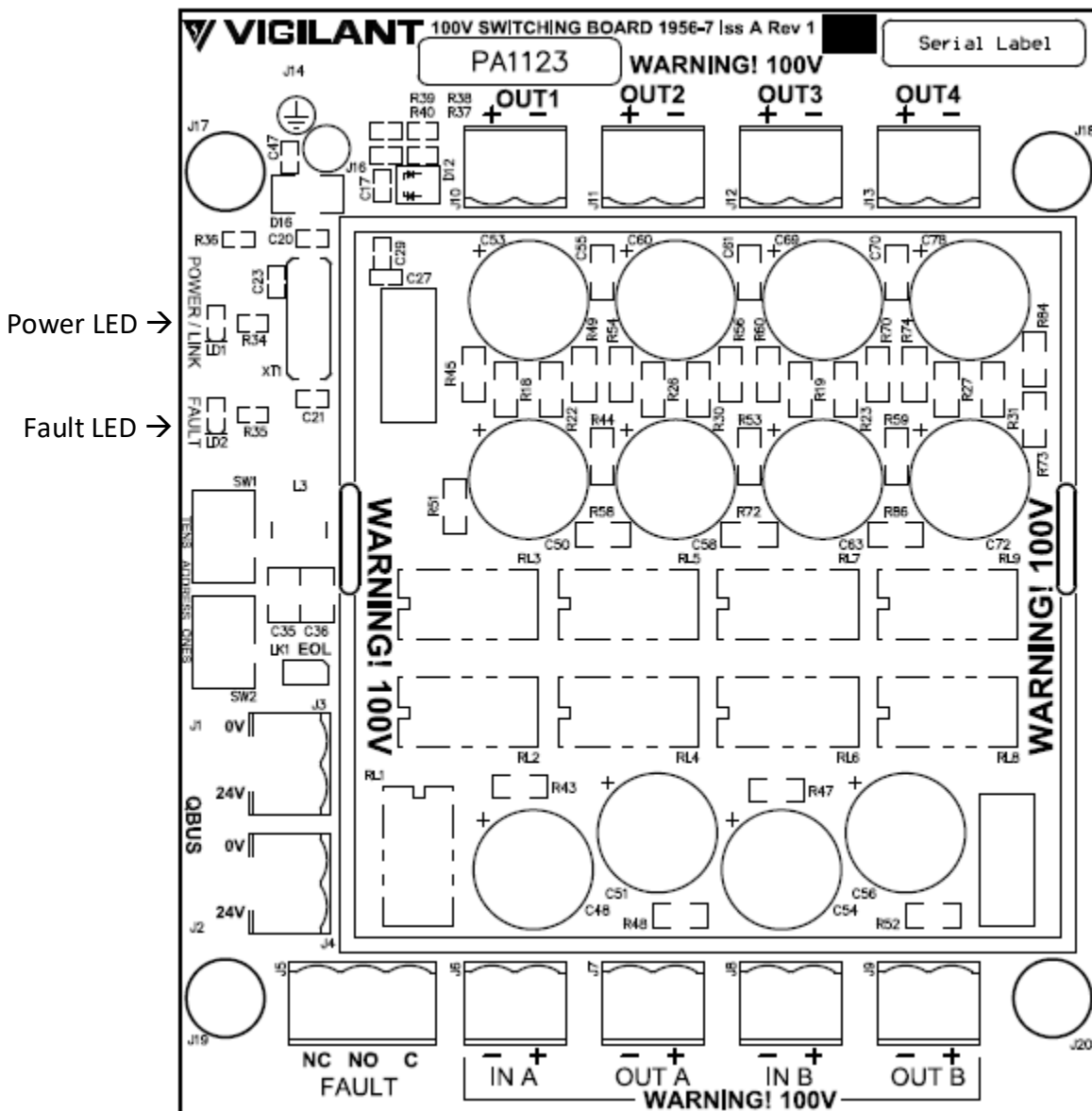


Figure 2 –100V Splitter PCB Indicators

## 7. Field Wiring

### 100V Loudspeaker Wiring

Each 100V Splitter PCB provides 4 separate 100V speaker outputs, each rated up to 100W, with the total for all 4 outputs summed together being a maximum of 120W or the rating of the amplifier that feeds the 100V Splitter PCB if it is lower.



The 100V speaker wiring is defined as LV circuits and is subject to the Australian Standard AS/ACIF S009:2013.

Ensure that 100V speaker cabling is appropriately separated and insulated from LV mains power wiring, ELV cabling and other customer cabling such as fire detection and control circuits. 100V speaker wiring is required to be double insulated.

Note: A 100V warning label is provided which should be placed near to the 100V Out terminals.

Each 100V Splitter Output has EOL resistor supervision to detect open and short circuit faults, and therefore requires a DC-decoupling capacitor in series with each speaker transformer. Most 100V loudspeakers designed for evacuation systems come complete with a suitable capacitor and transformer, in/out wiring terminals, and sound level (power) selection link/jumper. The capacitor must be bipolar, wired in series with the transformer primary, and have a value of about 1 - 5uF per Watt of speaker load (see below).

Speaker Load	0.33W - 0.5W	1W - 5W	10W - 20W	40W
Capacitor	1uF	10uF	47uF	100uF

It is possible to use a higher value capacitor on each speaker. However, if there are many loudspeakers on the line then the 100V Splitter Module may indicate a fault on power up. This will clear after a few minutes, once the supervision voltage on the line has stabilised. The capacitor's voltage rating must be at least 10V.

For a single line of loudspeakers, a 56k end of line EOL resistor needs to be fitted to the OUT terminals of the last loudspeaker. If wiring in two branches, then two 100k resistors are used, one on each branch. See drawing 2001-2 Sheet 304 (included) for wiring details.

The wire type used for the 100V line needs to be rated for at least 100V operation, be fire-rated and of sufficient thickness to not cause excessive voltage drop at full load. Table 6.1 shows the maximum distances for common cable sizes and power ratings to keep the voltage drop below 5%. It is recommended that if the required distance is very close to the limit for a given cable thickness, then the next thicker cable available should be used, as this will allow extra load to be added in the future should it be needed.

Table 6.1 Maximum Cable Length v Cable Size and Power Rating

Cable Thickness mm <sup>2</sup>	Max Distance 25W	Max Distance 60W	Max Distance 120W
1 (34Ω/km)	580m	240m	120m
2.5 (14Ω/km)	1000m*	590m	300m
4 (8.6Ω/km)	1000m*	960m	480m
10 (3.4Ω/km)	1000m*	1000m*	1000m*

\* An arbitrary maximum distance of 1000m is applied.

The inherent capacitance of the speaker cable presents a load to the amplifier that must be considered, particularly for long cables and when screened cable is used. Table 6.2 below shows the maximum cable capacitance that each amplifier rating can support, and the equivalent cable length for unshielded and shielded cable. The cable lengths are calculated to keep the capacitive load below 200nF. Note if there are multiple branches (e.g., connections via 100V Splitter Modules), then the sum of all the "connected" 100V loudspeaker cable needs to be used.

Whether to use screened or unshielded cable is closely tied with the segregation requirements. If unshielded speaker cable is run too close to other electrically noisy cables (e.g., mains, other 100V speaker cables, etc.) that aren't screened, then the speaker cable can pick up electrical noise that may be heard through the loudspeakers in quiet environments (e.g., hotel rooms, bedrooms). Equally, when the QE20 amplifier is generating loud signals, electrical noise may be generated into other close unshielded cabling that could be susceptible to audio frequency

noise (e.g., MX addressable loop cables).

Table 6.2 Cable Capacitance & Length v Amplifier Power Rating

Amplifier Rating	Maximum Cable capacitance	Maximum cable length of unshielded cable	Maximum cable length of shielded cable
25W	200nF	1000m	750m
60W	200nF	1000m	750m
120W	200nF	1000m	750m
240W	200nF	1000m	750m

Segregation (Australia)

As speaker wiring has a higher voltage than ELV, it is classed as LV communications wiring and to comply with AS/ACIF S009:2013 it must be segregated from ELV wiring (detector loops, communications wiring, etc) and from mains wiring. With adequate separation there is little benefit in having it shielded, and therefore it should be unshielded to minimise capacitance. Refer to AS/ACIF S009:2013 for more details of the segregation requirements.

Segregation (New Zealand)

As speaker wiring has a higher voltage than ELV, it must be double-insulated, but may then be in the same conduit as ELV wiring. If there is detector loop or communications signal wiring in the same conduit, the speaker wiring should be shielded to minimise crosstalk from the communication signals to the speakers and vice versa. Otherwise, it may be worthwhile to make the speaker wiring unshielded and segregate it from ELV wiring (i.e., spaced 100mm or more away and probably in a separate conduit).

Wiring of Loudspeakers

Observe the polarity and in/out indications of the terminals on the loudspeakers so they operate in phase. Connect the amplifier 100V OUTPUT +ve wire to the RED, +ve, or 100V terminal of each loudspeaker, and use the in/out terminals, so that disconnecting a loudspeaker breaks the wiring to the EOL. When fitting each loudspeaker select the lowest power rating that will generate sufficient sound level - volume (SPL) throughout the area served by the loudspeaker.

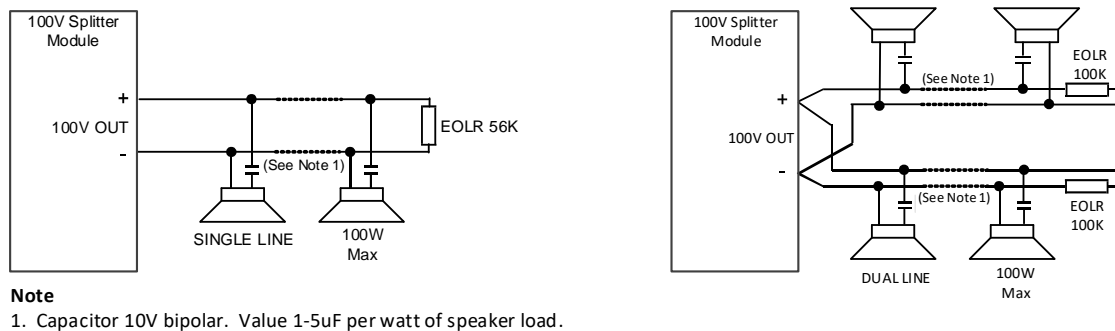


Figure 3 100V Speaker Line Wiring

Refer to drawing 2001-2 Sheet 304 (included) for 100V Splitter Module loudspeaker wiring.

Each 100V Output of the 2 x 4 Way 100V Splitter Module comes factory-fitted with a 56K EOL resistor. Remove this for outputs that are connected to loudspeaker wiring, and leave fitted for unused outputs.

## 8. LED Indications

There are two LED indicators on each PCB of the QE20 2 x 4 Way 100V Splitter Module. Refer to Figure 2.

The LEDs on one PCB may be seen directly, while the LEDs on the other are reflected off the metalwork at the back of the module.

LED Name	Colour	Description
POWER/LINK	Green	<p>OFF – no power applied            Flashing – should not occur other than on start-up. If present indicates restarting or factory test mode.            ON – 100V Splitter Module is operating.</p>
FAULT	Yellow	<p>OFF – no fault present.            Flashing – fault present            When a Fault is present the FAULT LED shows a sequence of 13 flashes followed by a pause, with each flash short (250msec) if that fault is not present and long (750msec) if that fault is present.            The faults are indicated in this order:</p> <ol style="list-style-type: none"> <li>1. OUT1 100V output has a short circuit fault – the output is isolated from the QE20.</li> <li>2. OUT2 100V output has a short circuit fault – the output is isolated from the QE20.</li> <li>3. OUT3 100V output has a short circuit fault – the output is isolated from the QE20.</li> <li>4. OUT4 100V output has a short circuit fault – the output is isolated from the QE20.</li> <li>5. OUT1 100V output has an open circuit or undefined fault – the output is still connected to the QE20.</li> <li>6. OUT2 100V output has an open circuit or undefined fault – the output is still connected to the QE20.</li> <li>7. OUT3 100V output has an open circuit or undefined fault – the output is still connected to the QE20.</li> <li>8. OUT4 100V output has an open circuit or undefined fault – the output is still connected to the QE20.</li> <li>9. Always no fault.</li> <li>10. Always no fault.</li> <li>11. Firmware CRC Incorrect. Replace the 100V Splitter Module.</li> <li>12. Software Fault. Will not occur.</li> <li>13. Unexpected restart occurred. Something happened to cause the 100V Splitter Module microprocessor to restart. If this does not clear, even after power down/up, replace the 100V Splitter Module.</li> </ol>

## 9. Power On & Testing

Some suggested steps for the initial power up and testing of the 2 x 4 Way 100V Splitter Module in a QE20.

- Add up the total load of all the loudspeakers connected to each 100V line. Alternatively use a 100V Impedance Meter to measure each 100V speaker line load impedance. Check each is below 100W, the sum of all 4 on each 100V Splitter PCB is less than 120W, and the sum of all inter-connected 100V Splitter PCB loads is less than the rating of the QE20 Amplifier that is driving the 100V Splitter PCBs. Table 9.1 shows the minimum load impedance that each amplifier power rating supports (the actual load impedance must be greater than this value).

Table 9.1 Amplifier Minimum Load Impedance

Amplifier Rating	Minimum Load Impedance (ohms)
25W	400 ohms
60W	167 ohms
120W	83 ohms
240W	41.7 ohms

- With each 100V speaker line disconnected measure the dc resistance across the line and check it is 56K. It will take some time for the resistance reading to stabilise as the speaker capacitors charge up.
- Power up the QE20 with its site configuration installed. Check for any fault conditions and resolve these.
- Check the loudspeakers on each 100V speaker line are working when the emergency zone is activated.
- Check the required sound pressure level (SPL) is generated in each emergency zone. Adjust the loudspeaker tapping to a lower power level if the SPL is too high, or a higher power if the SPL is too low. If any speaker tapping is changed to a higher power then recheck the Splitter and amplifier 100V outputs are not overloaded. See the first step above.
- With the batteries disconnected activate Evacuate for All Zones (or at least all zones served by the cabinet) for at least 1 minute and make sure no fault is generated. This is to check the outputs of each PSE are not overloaded.

## 10. 100V Splitter Module Specifications

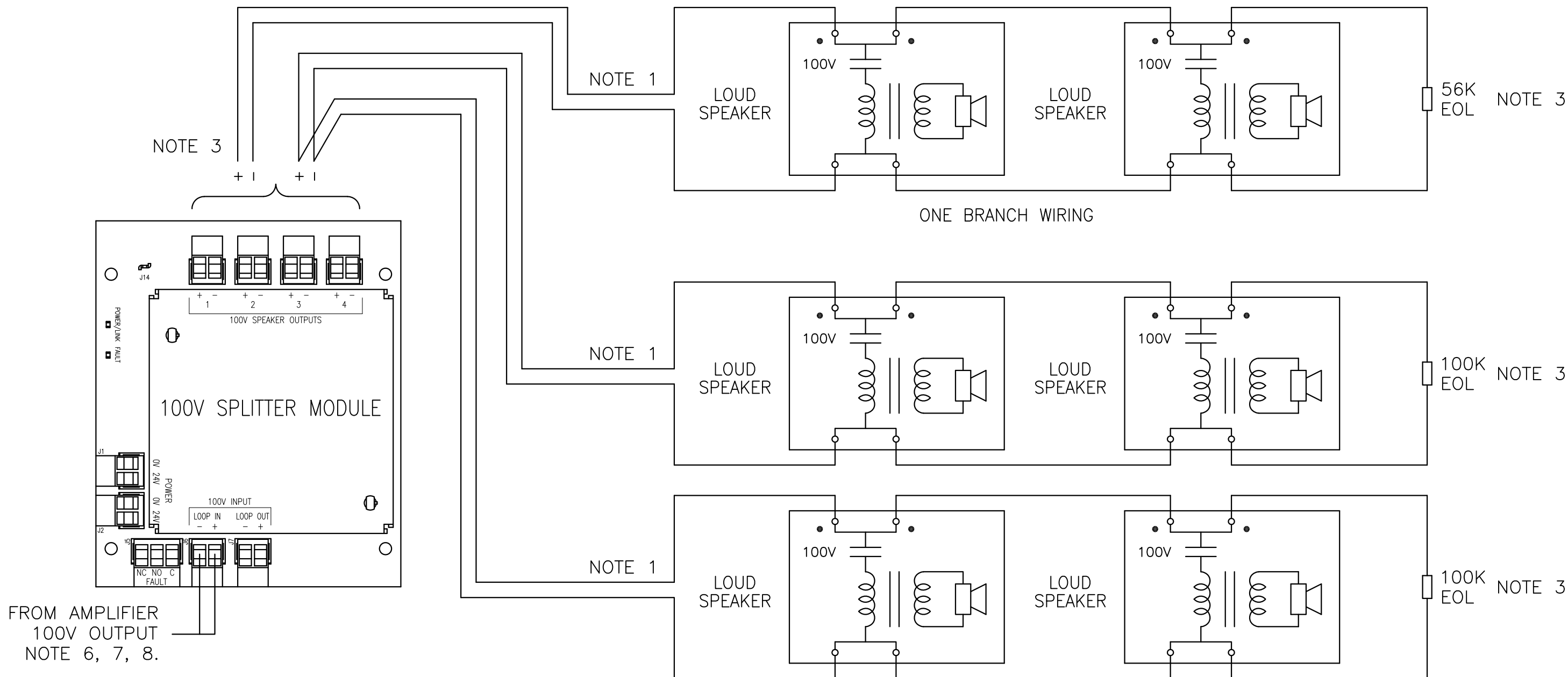
Power Requirements	19.2V – 28.8Vdc, 30mA typ @ 24V, all outputs normal 80mA max, all 8 outputs in short circuit fault (relays operated)
Operating Temperature Range	-5°C to +45°C 10% to 93% RH non-condensing
100V Outputs	Each output 100W max, all 4 < 120W (or rating of QE20 Amplifier if lower)
EOL Supervision	1 Branch - 56k EOL Resistor 2 Branches - 100k EOL Resistor on each branch
Fault Relay	Normally energised, drops out on any fault or power fail. Change-over contacts 2A @ 30Vdc.
100V Speaker Cable	>100V, fire-rated, maximum capacitance (summed per QE20 amplifier) 200nF

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**NOTES:**

1. USE DOUBLE INSULATED, FIRE RATED, 100V RATED CABLE OF SUFFICIENT THICKNESS FOR THE CONNECTED LOAD.
2. USE 100V LOUDSPEAKERS WITH BUILT-IN CAPACITOR & TRANSFORMER. USE IN/OUT TERMINALS & OBSERVE POLARITY. CONNECT +VE WIRE TO RED/MARKED/+VE TERMINAL OF LOUDSPEAKERS.
3. FIT 56K EOL TO LAST LOUDSPEAKER WHEN ONE BRANCH. FIT 100K EOL TO EACH LAST LOUDSPEAKER WHEN TWO BRANCHES. FIT 56K EOL TO UNUSED 100V SPEAKER OUTPUTS.
4. SEGREGATE 100V CABLING AS PER STANDARDS EG. AS/CA S009.
5. REFER SHEET 301 IF VOLUME ATTENUATOR REQUIRED.
6. CONNECT SPLITTER 100V INPUT TO AMPLIFIER 100V OUTPUT. OBSERVE POLARITY.
7. REFER SHEET 305 FOR WIRING TWO 100V SPLITTER PCBS IN SERIES TO CREATE 8 x 100V OUTPUTS.
8. 24V AND FAULT RELAY WIRING NOT SHOWN.

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3rd ANGLE PROJECTION

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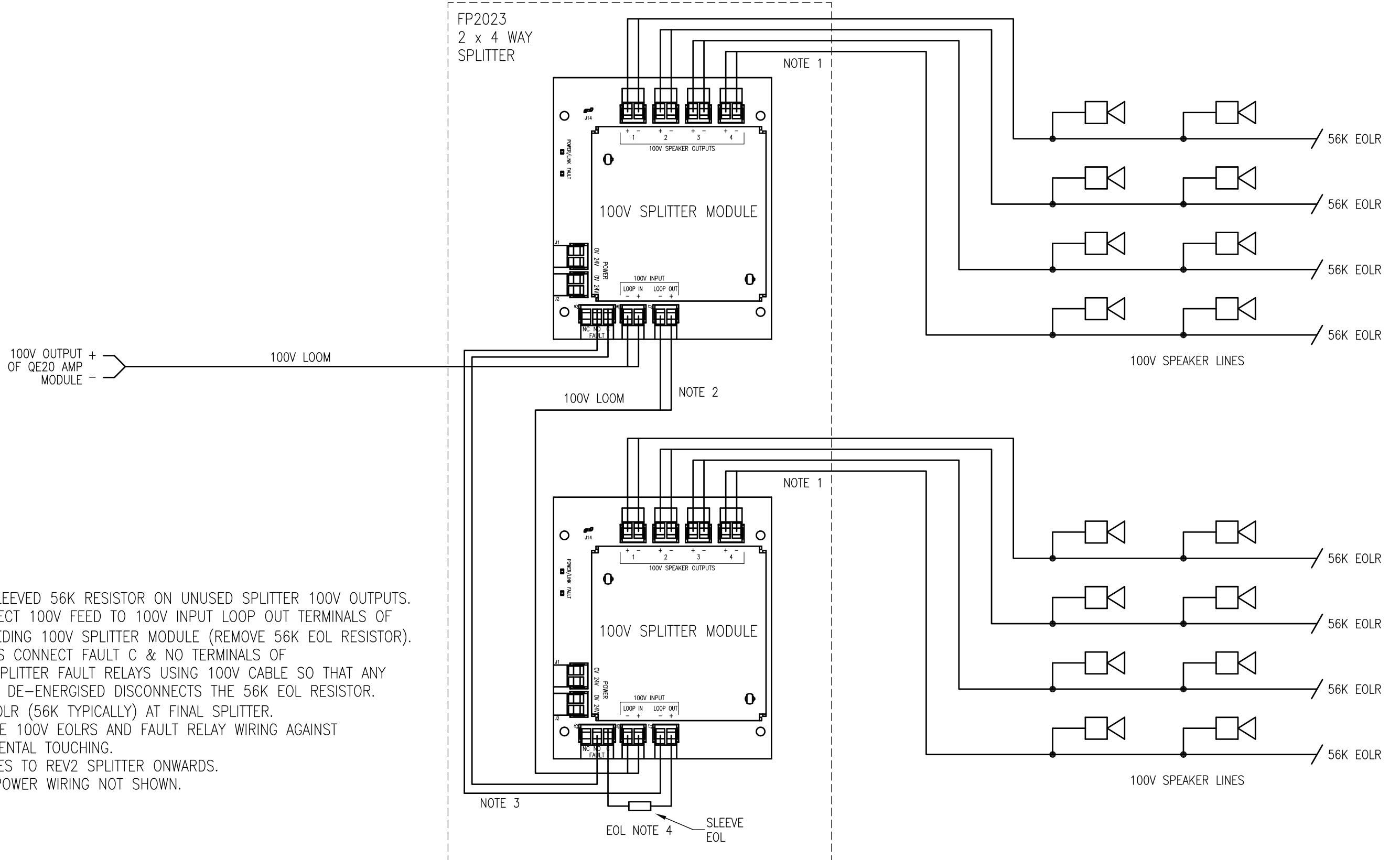
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**QE20 SPLITTER MODULE  
 100V LOUD SPEAKER  
 FIELD WIRING DIAGRAM**

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- NOTES:
1. FIT SLEEVED 56K RESISTOR ON UNUSED SPLITTER 100V OUTPUTS.
  2. CONNECT 100V FEED TO 100V INPUT LOOP OUT TERMINALS OF PRECEDING 100V SPLITTER MODULE (REMOVE 56K EOL RESISTOR).
  3. SERIES CONNECT FAULT C & NO TERMINALS OF ALL SPLITTER FAULT RELAYS USING 100V CABLE SO THAT ANY RELAY DE-ENERGISED DISCONNECTS THE 56K EOL RESISTOR.
  4. FIT EOLR (56K TYPICALLY) AT FINAL SPLITTER.
  5. SLEEVE 100V EOLRS AND FAULT RELAY WIRING AGAINST ACCIDENTAL TOUCHING.
  6. APPLIES TO REV2 SPLITTER ONWARDS.
  7. 24V POWER WIRING NOT SHOWN.

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**QE20 2 x 4 WAY 100V SPLITTER  
 MODIFICATION FOR 8 OUTPUTS  
 WIRING DIAGRAM**

DRAWING No: 2001-2 SHEET 305 of N

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