



FP2006/7/8/9 QE20 Amplifier Module Installation Instructions

1. General Description

This sheet describes installation of the various QE20 Amplifier Modules. An Amplifier Module may be used to provide 100V loudspeaker outputs in a QE20 system or as a replacement for an existing module.

There are 4 different models of QE20 Amplifier Module available:

FP2006	FP, QE20 AMP MODULE, QUAD 25W
FP2007	FP, QE20 AMP MODULE, QUAD 60W
FP2008	FP, QE20 AMP MODULE, DUAL 120W
FP2009	FP, QE20 AMP MODULE, SINGLE 240W

These are based on a common design and provide similar functionality, with a varying number of actual amplifiers and power output per amplifier.

Each model provides:

- One (1), two (2), or four (4) 100V audio outputs for driving 100V loudspeakers, rated at 25W, 60W, 120W or 240W. Each 100V output is resistor EOL supervised with up to two branches of wiring.
- Four 24V dc switched GP OUTPUTS that are normally-energised and can be individually turned off – usually for controlling background music volume controllers or similar volume controlling or switching devices that need to be disabled when emergency signals are being generated.
- One (1), two (2), or four (4) isolated line-level audio inputs for background music, paging, etc.
- Connection for standby amplifiers or music amplifiers on the FP2007/8/9 models.
- Front panel indication of the 100V OUPUT audio signals.

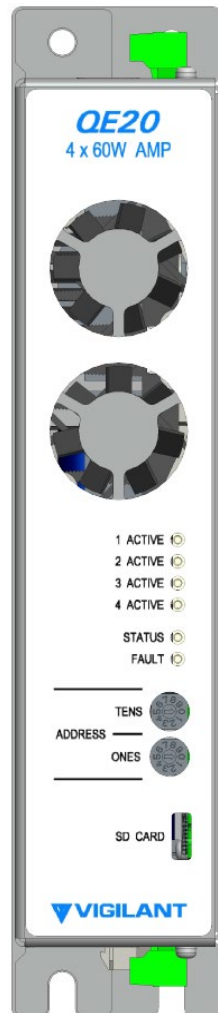


Figure 1 – FP2007 QE20 4 x 60W Amplifier Module

2. Kit Contents

Each kit contains:

- 1 x Amplifier Module
- 1 x RJ45 loom 200mm long for connecting to an adjacent amplifier or Controller
- 1 x RJ45 loom 1000mm long for connecting to an amplifier or Controller in a different frame
- 2 x 24V DC 2-way extension looms (LM0655) for connecting to a PSE (FP2007/8/9) or
- 1 x 24V DC 2-way extension loom (LM0655) and 1 x 3 way splitter loom (LM0656) (FP2006)
- 1 x LT0701, these installation instructions.

3. Mounting the Amplifier Module

The Amplifier Module occupies one of the 60mm positions on a QE20 mounting frame, as shown in Figure 2. 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 is secured to the frame using four M6 x 10 screws. Loosely fit a screw to one of the bottom holes of the desired position, then slide the appropriate open slot at the bottom of the Amplifier Module under the screw head and then fit one of the top screws to secure the module. Fit and tighten all screws to secure the module into position.

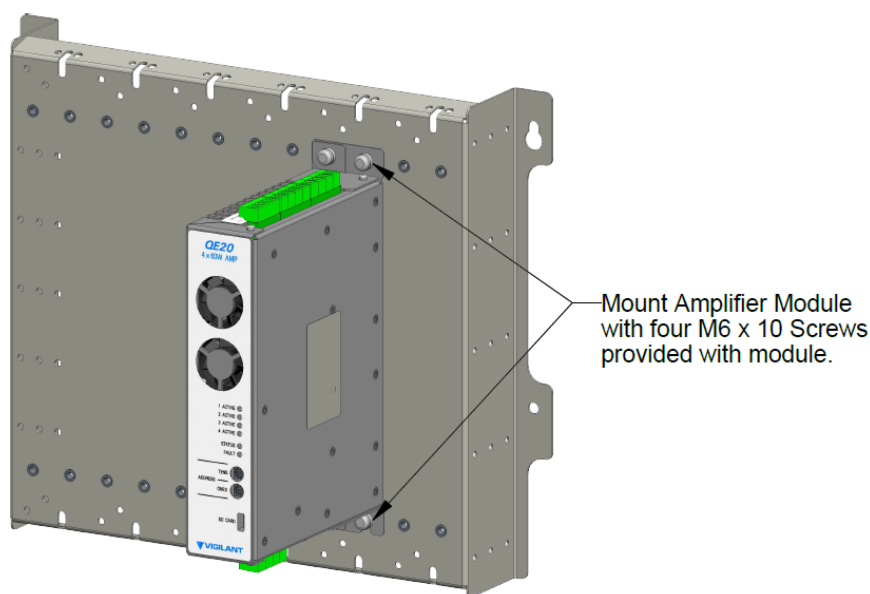


Figure 2 – QE20 Amplifier Module Mounting

4. Replacing An Existing Module

Identify all the field wiring and internal wiring to the existing Amplifier Module so the cables can be reconnected to the correct terminals on the replacement Amplifier Module.

Power down the QE20.

Disconnect the field wiring connectors, the DC power loom, and the RJ45 QBus loom(s).

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

Configure the new module's address switches to the same address as the removed one. Set the switches according to the labelling on the switch – as the physical position for the "0" setting may be different. Refer to Figure 3 for the switch locations.

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

Reconnect all the wiring, making sure each cable is refitted to the correct terminals.

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

Activate a live speech announcement to each zone and check the correct loudspeakers generate the voice announcement.

5. Adding a New Module

When adding an Amplifier Module to an existing QE20, the amplifier will need to be added to the QE20 site configuration using QE20Config. A unique QBus address will be assigned, the particular type of Amplifier Module selected, and the outputs mapped to the zones or functions.

Set the ADDRESS rotary switches (SW1 - TENS and SW2 - ONES) to match the Card Address assigned to the Amplifier Module in the site configuration. Refer to Figure 3 for the switch locations.

Fit the Amplifier Module to the QE20 as per the mounting instructions earlier.

Connect the internal wiring as per Section 6 and the field wiring as per Section 7.

Test the new module as per Section 9.

6. Internal Wiring

The QE20 Amplifier Module requires:

- 24V power loom to be connected.

It is necessary to check that the PSE that the Amplifier Module will be powered from has enough capacity to power the additional module along with all the existing loads that are connected to that PSE. In general, up to 5 x FP2006 4 x 25W amplifiers, or 2 x FP2007/8/9 4 x 60W/ 2x 120W / 1 x 240W Amplifier Modules at full load can be powered by one 27A PSE. The specific PSE the Amplifier is to be powered from should have been determined as part of the upgrade design, taking into account the other loads connected to the PSE.

Each FP2006 4 x 25W Amplifier module connects to a DC output lead of the 27A PSE using 1 LM0656 3-way DC distribution lead, plus 1 x LM0655 15A extension lead if the Amplifier Module is mounted on the top frame of a 40U cabinet.

Each FP2007/8/9 4 x 60W/ 2x 120W / 1 x 240W Amplifier Module connects to a 2-way DC output lead of the 27A PSE using 1 x LM0655 15A DC extension lead, or 2 in series if the Amplifier Module is mounted on the top frame of a 40U cabinet. Do not use the LM0656 3-way DC Distribution lead with these Amplifier Modules as the lead is not rated for the maximum current of these Amplifier Modules.

- An RJ45 QBus loom connected from the RJ45 QBus connector on the QE20 Controller or another QE20 Amplifier Module to one of the RJ45 QBus connectors on the new amplifier. The LM0659 200mm loom is suitable for connecting adjacent modules, and the 1m lead suits separated modules or modules on different frames. Coil up and secure any excess cable.

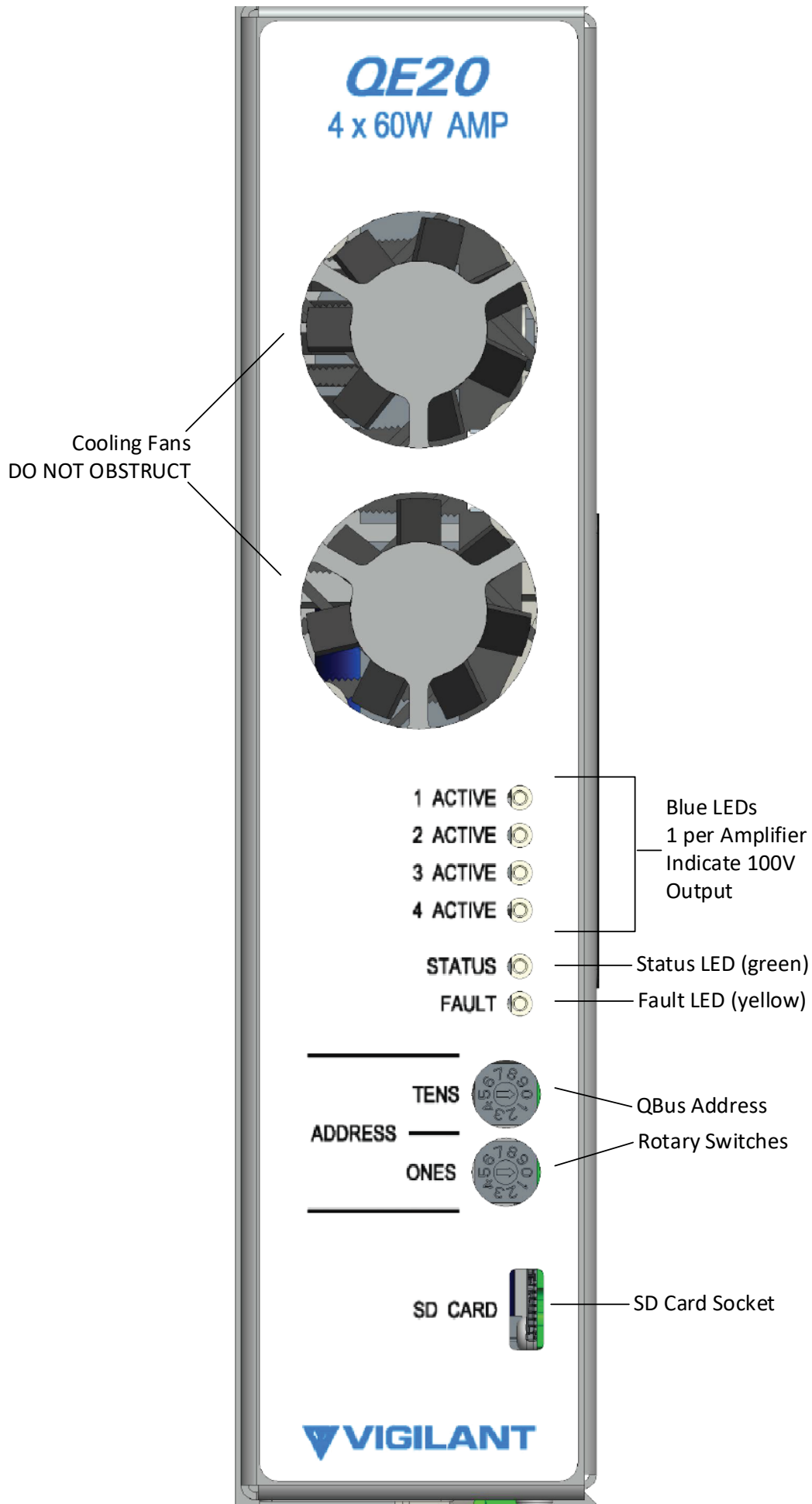


Figure 3 –Amplifier Module Address Switch and LED locations

7. Field Wiring

Refer to the specific QE20 site configuration for the assigned functionality and options for each of the amplifiers, audio inputs and GP outputs on the Amplifier Module.

100V OUTPUT Loudspeaker Wiring

Each QE20 Amplifier Module provides 1, 2 or 4 separate 100V OUTPUTS, rated at 25W, 60W, 120W or 240W depending on the type of Amplifier Module.

The 100V OUTPUTS can be wired directly to the loudspeakers in the emergency zone, or via one or more FP2023 2 x 4 Way 100V Splitter Modules to provide multiple short-circuit isolated outputs to different areas of the zone. Refer to LT0705 for installation and wiring of the FP2023 2 x 4 Way 100V Splitter Module and connection to the amplifier.



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 OUTPUT terminals.

Each 100V OUTPUT has EOL resistor supervision to detect open and short circuit faults, and therefore requires a DC-coupling capacitor in series with each speaker transformer. Most 100V loudspeakers designed for evacuation systems come complete with a suitable capacitor, separate in/out wiring terminals, and a sound level (power) selection link/jumper on the 100V-8ohm transformer. The capacitors must be bipolar, wired in series with the transformer primary, and have a value of about 1 - 5uF per Watt of speaker load (see table).

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 speakers on the output then the amplifier 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.

The wire 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 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 ²	Max Distance 25W	Max Distance 60W	Max Distance 120W	Max Distance 240W
1 (34Ω/km)	580m	240m	120m	60m
2.5 (14Ω/km)	1000m*	590m	300m	150m
4 (8.6Ω/km)	1000m*	960m	480m	240m
10 (3.4Ω/km)	1000m*	1000m*	1000m*	620m

* A maximum cable length 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 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 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 100V speaker wiring has a higher voltage than ELV, it is classed as LV communications wiring and to comply with AS/ACIF S009 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 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).

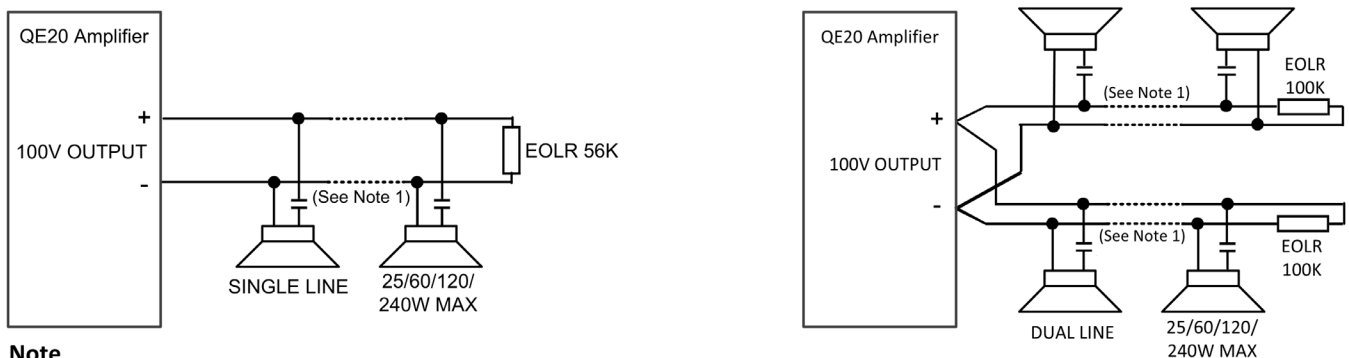
Wiring of Loudspeakers

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 single wire breaks the wiring to the EOL. When fitting each loudspeaker select the lowest power rating that will generate sufficient volume / sound pressure level (SPL) throughout the area served by the loudspeaker.

For a single line of loudspeakers, a 56k end of line EOL resistor needs to be placed at 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 300 for wiring details. If a volume attenuator is required for some or all of the loudspeakers, then refer to drawing 2001-2 Sheet 301 for wiring.



Note
1. Capacitor 10V bipolar. Value 1-5uF per watt of speaker load.

Figure 4 100V Speaker Line Wiring

GP OUTPUT Wiring

The GP OUTPUTS are normally energised 24V dc outputs that switch off when activated (by default this is when the corresponding amplifier is generating alert, evacuate, another emergency signal, live speech or paging – but not music). Typically, each output is wired to a 100V Line Attenuator (volume controller) so that the background music volume to a run of loudspeakers can be locally adjusted. Refer to drawing 2001-2 Sheet 301 (included later) for wiring. Note the attenuator must support dc line supervision (not all do) and that all loudspeakers wired past the attenuator will be subject to the volume setting of the attenuator. Thus, the loudspeaker wiring may need to be run in 2 branches, with one having loudspeakers unaffected by the attenuator and the other wired via the attenuator to loudspeakers that are to be volume controlled.

The GP OUTPUTS can be used for other functions with suitable programming in the site configuration. They could be used as 24V dc outputs directly or connected to a 24V relay to provide isolated contacts. They are controlled using script tokens. Note assigning a 1 state to the output token will turn the output OFF (these outputs are normally energised).

Each GP OUTPUT can have supervision enabled. A fault will be generated if the output is shorted when the output is on, and if the load is removed when the output is off. Note if using the default logic to control the output, the output is normally on, so will not detect removal of the load – e.g., attenuator.

Standby Amplifier Wiring

One or more QE20 amplifiers may be configured as standby amplifiers for other zone amplifiers. If any one of the zone amplifiers fail, then the loudspeakers connected to the failed amplifier are switched over to the 100V OUTPUT of the standby amplifier so that 100V signal generation can continue. For better reliability, the standby amplifier should be a different Amplifier Module to any amplifiers it serves.

The standby amplifier needs to have a power rating at least as large as any of the zone amplifiers it is the standby for. It is recommended the standby amplifier be a 240W amplifier. The 100V OUTPUT of the standby amplifier is connected to the STANDBY/MUSIC inputs of each of the amplifiers it serves. Wire all in parallel, observing the correct polarity of the connections.

Refer to drawing 2001-2 Sheet 302 for wiring information. The cable must be double insulated, rated for 100V or higher, and generally of the same thickness as the speaker cabling. An EOL resistor is not needed on the standby amplifier output.

Music Amplifier Wiring.

In some systems one or more external music amplifiers may be arranged to drive the QE20 loudspeakers in the normal condition, but when an emergency signal needs to be delivered by the QE20 to the loudspeakers the external amplifier is disconnected and the QE20 amplifier can drive the loudspeakers. Some examples of where this could be used are: a shopping centre where all the loudspeakers in a store are connected to a local amplifier so that the store has full control over background music, paging etc; or a public auditorium where a sound system drives the loudspeakers.

The 100V output of the music amplifier is wired into the STANDBY/MUSIC input of each of the amplifiers it serves. These can be wired in parallel using double insulated cable, rated for 100V or higher, and observing the correct polarity. Refer to drawing 2001-2 Sheet 302 for wiring information. Note not all amplifier modules support a music amplifier.

The music amplifier will need to be rated for the sum of all the loads that it drives. The output of the music amplifier does not require capacitor coupling, as capacitors are included in the QE20 Amplifier Module. Note the maximum power that can be transferred through the STANDBY/MUSIC input in music mode is 60W, even for 120W and 240W amplifiers.

AUDIO INPUTS

Each amplifier module provides 1, 2 or 4 audio inputs to match the number of amplifiers in the module. Although the number of inputs and outputs match, any audio input can be switched to any of the 100V outputs of the same amplifier module under control of the QE20.

Wire the audio output of the audio source (music player, paging console, mic preamp, etc) to the audio input using screened cable (earthed at the QE20) and observe the correct polarity.

Refer to drawing 2001-2 Sheet 303 for wiring of the Vigilant PA0688 Microphone PreAmp Module to provide a paging input from a microphone. This shows an optional connection to a WIP/INPUT Module Circuit to activate the audio input when paging is required.

The output level of the audio source should be adjusted to give the correct volume. A level of 315mV RMS is required for full volume. It is best to adjust the level at the source, but the QE20 site configuration can be changed to adjust the input level down if it is too loud.

An ALIM9706 Audio Isolation Module may be required to transformer isolate the audio signal between the source and the QE20 input, or reduce the signal level if it is too high.

8. LED Indications

There are between three and six LED indicators on each QE20 Amplifier Module.

- **1 – 4 ACTIVE** LEDs (one for each amplifier fitted) that flash blue with the audio signal on the 100V output. Generally, these are off, shimmering with any background music and possibly every 30s when the internal amplifier is tested with a 27kHz test tone; On brightly with the alert or evacuate signal; and flickering with live or recorded speech. These do not show the audio signals provided by the MUSIC / STANDBY inputs.
- **STATUS** is on green, blinking off every second or so as the module communicates with the Controller Module, when power is applied. Off means 24V power is not supplied or the amplifier module is faulty. Steady on means the module is not communicating with the Controller, or the module is faulty.
- **FAULT** will flash yellow when there is a fault with any of the 100V outputs, internal amplifiers, GP outputs, internal cooling fans or the module itself. A sequence of 17 flashes is shown, with a long flash indicating that the specific fault is present, and a short flash that the specific fault is not present. For example, if the fourth flash is long, then 100V Output #4 has a wiring fault present. Refer to Table 7.1 for details.

Table 7.1 FAULT LED Flash Indications

Flash Number	Description	Explanation / Action
1-4	Open or short circuit on the corresponding 100V output 1-4. Connection of 100V output to earth, +24V, or 0V.	Field wiring issue. Check the connected loudspeakers and field wiring. Check the EOL resistor(s) are the correct value and fitted. Check for connection of 100V output wires to earth, or to 24V or 0V of the QE20.
5-8	Failure of the internal amplifier for the output 1-4	Faulty module. It will need replacement.
9-12	Fault on GP Output 1-4	Short circuit or overload of the corresponding GP Output. Open circuit when the output is off. Check the load and field wiring of the output.
13	Configuration file fault	The configuration file(s) from the Controller are missing, or invalid data is present in the files. Check for the Amplifier Module not configured in the site configuration, or a firmware mismatch. Note this fault will show while the configuration is being downloaded after a change.
14	Fan 1 failure	Faulty cooling fan. Check for an air blockage, otherwise replace the module.
15	Fan 2 failure	Faulty cooling fan. Check for an air blockage, otherwise replace the module.
16	Not communicating with the Controller over QBus	Amplifier not configured in site configuration, incorrect address set on the rotary switches, QBus wiring not connected between the Controller and the module, or a faulty module on QBus. Check the site configuration, address switch settings, QBus wiring, and for a different module that is faulty or mis-addressed.
17	Other Fault	Internal fault such as: Firmware CRC wrong, I2C/I2S communications failed, internal memory failure, temperature sensor failed, or over-current draw by the module. Check with JCI Technical Support as may need a firmware upgrade. Otherwise replace module.

9. Power On & Testing

Some suggested steps for the initial power up and testing of the QE20 Amplifier Module.

- Add up the total load of all the loudspeakers connected to each 100V OUTPUT. Include all loads connected via 100V Splitter Modules. Alternatively use a 100V Impedance Meter to measure the 100V speaker line load impedance. Check the total load is below the power rating of the QE20 Amplifier that feeds the speaker line. Table 8.1 shows the minimum load impedance that each amplifier power rating supports (the actual load impedance must be greater than this value).

Table 8.1 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 from the QE20 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.
- With each 100V speaker line disconnected from the QE20 measure the dc resistance between the circuit and earth and check it is greater than 1M ohms. It will take some time for the resistance reading to stabilise.
- Power up the QE20 with its site configuration installed. Check for any fault conditions and resolve these.
- Check each configured 100V OUTPUT on the amplifier operates as required by the configuration.
Check the correct loudspeakers generate the alert and evacuate tones, and that live speech is heard loudly and intelligibly.
- Check the required SPL is generated in each emergency zone. Adjust the loudspeaker tapping to a lower power level if the sound level is too high, or a higher power if the sound level is too low. If any speaker tapping is changed to a higher power, then recheck the amplifier is not overloaded. Restart from the first step above.
- Check each configured GP OUTPUT operates as per the site configuration. Generally, the output will provide 24V dc and switch off when the corresponding amplifier is generating Alert, Evac, Live Speech or paging, or the programmed logic equation is false (0).
- Check the configured AUDIO INPUTs are working. Adjust the volume setting at each source to the desired level. The input level can be changed in the QE20 site configuration if changing the source is not possible.
- If a music amplifier is configured, check it operates when the corresponding QE20 amplifier is not generating Alert, Evac, Live Speech or paging.
- If a standby amplifier is configured, simulate an amplifier failure by removing the power lead to the zone amplifier module. Activate Alert or Evac for the amplifier's zone and check that the warning signal is heard via the loudspeakers of the zone. This requires the standby amplifier to be on a different Amplifier Module (recommended). Note that disconnecting the RJ45 QBus lead(s) to the zone amplifier to simulate amplifier failure may also disconnect the standby amplifier if the standby amplifier is wired downstream of the zone amplifier.
- With the batteries in the cabinet disconnected activate Evacuate for all zones (or at least all zones served by each cabinet) for about 1 minute and check that no faults are generated. This is to check that no PSE are overloaded.

10. Amplifier Module Specifications

Power Requirements	18V – 32Vdc
Current Consumption	Refer table below
GP Output Current	Additional to stated current consumption
Operating Temperature Range	-5°C to +45°C 10% to 93% RH non-condensing
100V OUTPUTs	100V rms at full power: 25W/ 60W/ 120W/ 240W 200nF Max Capacitance
EOL Supervision	56K 1 branch; 100K on each of 2 branches
GP OUTPUTs	24V dc switched outputs, normally-energised – max load 100mA. Switches off when the associated amplifier is generating alert, evacuate, speech or paging. Can be controlled via scripts. Optionally supervised. Fault if short circuit or over-current when output is on. Fault if open circuit when output is off.
Audio Inputs	315mV rms nominal for full power. 1V RMS maximum
Standby Amp	Each zone amplifier may have one nominated standby amplifier. The standby amplifier must be of equal or higher power rating, and on a separate amplifier module for better reliability.
Music Amp	Each 100V output may be fed by an external 100V amplifier, when nothing activated on QE20 amplifier. Max power per output 60W (for 120W and 240W amps)

Current Consumption @ 26V dc

Amplifier Type	Idle All 100V outputs off All GP outputs open	Idle All 100V outputs on (no audio) All GP outputs open	Full Evac Power All 100V outputs fully loaded All GP outputs open (Avg, for battery capacity)	1kHz Sine Wave All 100V outputs fully loaded. All GP outputs open. (For PSE loading)
4 x 25W	95mA	480mA	2A	6.2A
4 x 60W	115mA	690mA	3.5A	13.6A
2 x 120W	105mA	400mA	3.3A	13.3A
1 x 240W	110mA	400mA	3.1A	12.7A

11. End User Licence Agreement, Privacy and Open Source Software

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