



FP2001 QE20 27A PSE Installation Instructions

1. General Description

This sheet describes installation of the FP2001 QE20 27A Power Supply Equipment (PSE). The PSE can be fitted as an additional power supply when expanding a QE20 system or for replacement of an existing 27A PSE.

Each PSE provides a regulated 26V dc output at up to 27A to power up to 480W of amplifier load. Up to 4 PSE may be connected to the same battery in the same cabinet.

An FP2027 Fuse Board can be fitted to the PSE to provide 4 independently fused outputs for field wiring or other uses.

Generally, the PSE can be readily fitted to expand existing QE20 cabinets, except if adding the PSE to a 28U QE20 panel that has only a 2-way battery lead set and two PSE are fitted already. In this situation an additional GPO outlet, LM0651 4-way Battery lead set and additional battery leads (LM0652 and LM0653) will also be needed.

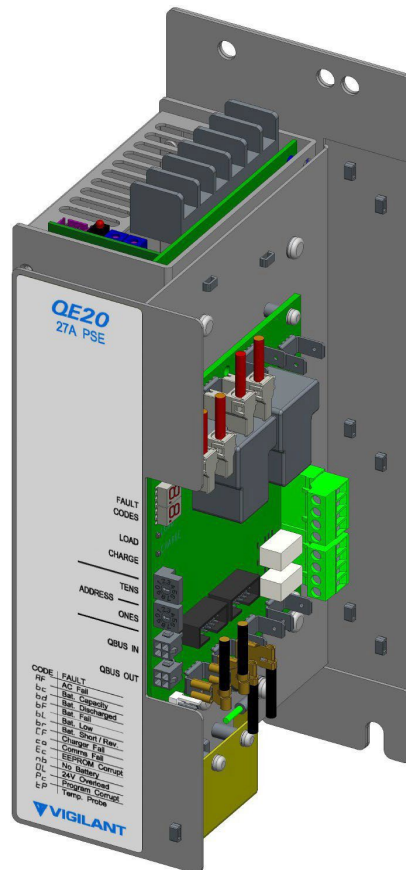


Figure 1 – FP2001 QE20 27A Power Supply Equipment (PSE)

2. Kit Contents

Each kit contains:

- 1 x QE20 27A Power Supply c/w mains cord, 2 x 24V LM0654 output leads and temperature sensing lead
- 1 x QBus 4-way Power/Comms loom to connect to another PSE or QBus module
- 2 x LM0675 Red 6.3QF to stripped end leads connected to the +BATT IN terminals
- 2 x LM0676 Black 6.3QF to stripped end leads connected to the -BATT IN terminals
- 2 x M6 x 10 screws to secure the module onto the mounting frame
- 4 x 3-way Splicing connectors to wire into existing battery connection lead
- 3 x Cable Ties to secure the Power/Comms loom
- 1 x LT0694, these installation instructions.

3. Mounting the 27A PSE

Each 27A PSE is 100mm wide and occupies 1.5 or 2 of the 60mm mounting positions on a QE20 mounting frame. Three PSE can be mounted on a frame, leaving one empty 60mm module position as shown in Figure 2. Otherwise, by over-hanging the left and right-hand side PSEs by 15mm each, it is possible to mount 4 PSEs on the mounting frame, with nothing else fitted. This is shown in Figure 3.

Generally, the PSEs will be mounted from left to right, on the lowest frame in the cabinet, closest to the mains GPO outlets and batteries in the bottom of the cabinet.

Refer to the existing QE20 panel layout for the positions of the PSEs and the available positions when adding one.

Each PSE is secured to the frame using two M6 x 10 screws supplied with the PSE, as shown in Figure 4. Loosely fit one screw to the bottom mounting hole of the desired position and slide the slot of the PSE under the screw head. Fit the mounting screw to the top mounting hole and tighten both screws to hold the PSE in place.

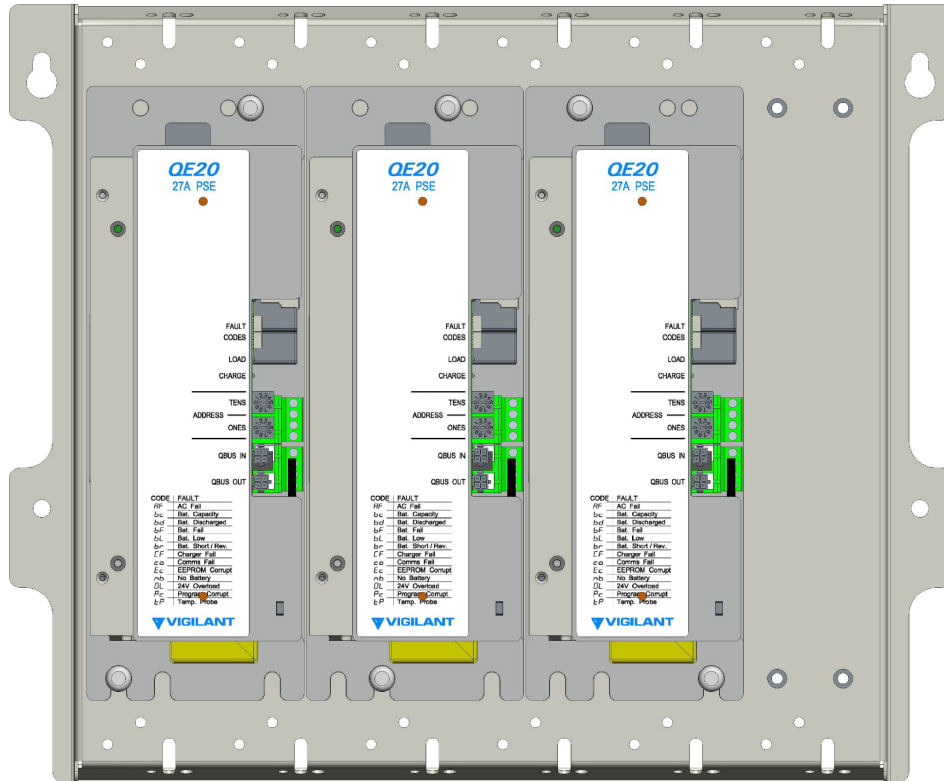


Figure 2 – QE20 27A PSE Positioning – 3 per Frame

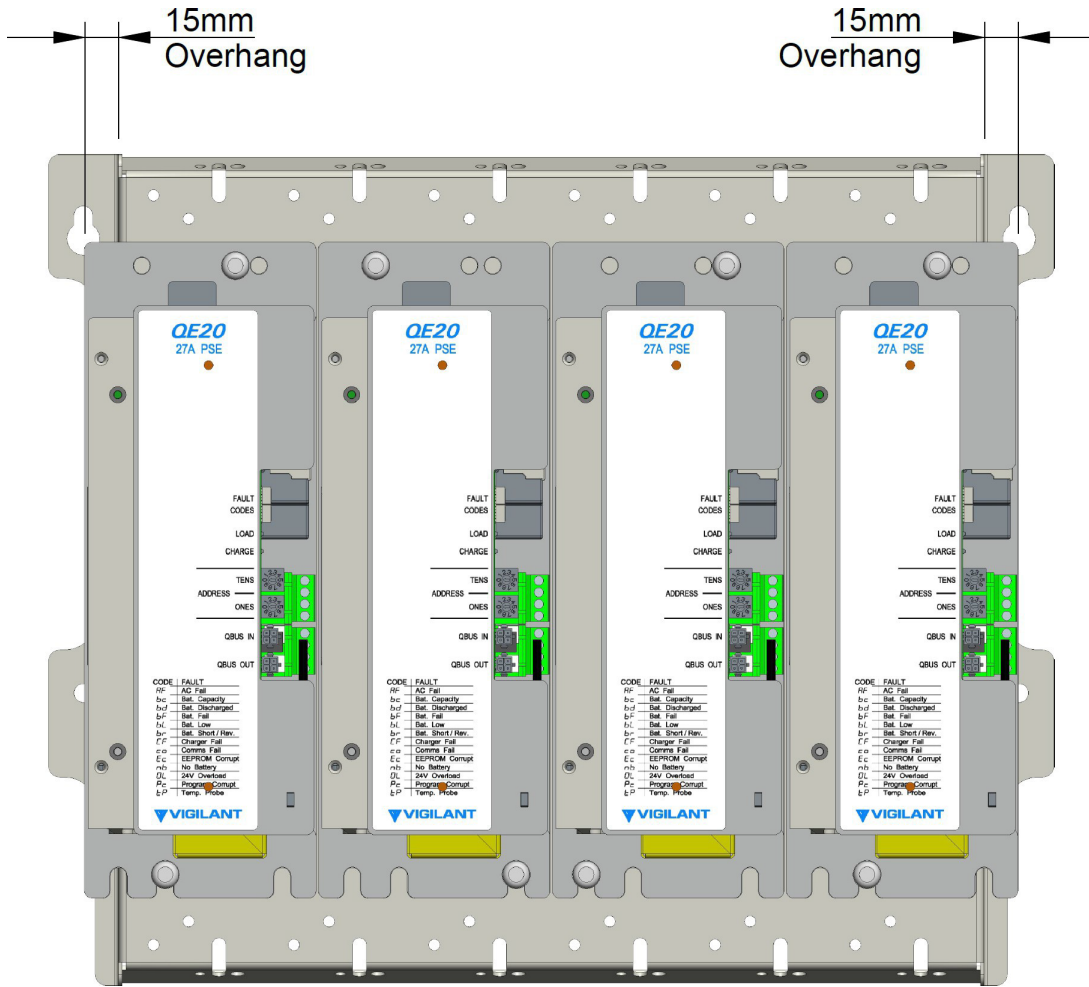


Figure 3 – QE20 27A PSE Positioning – 4 per Frame

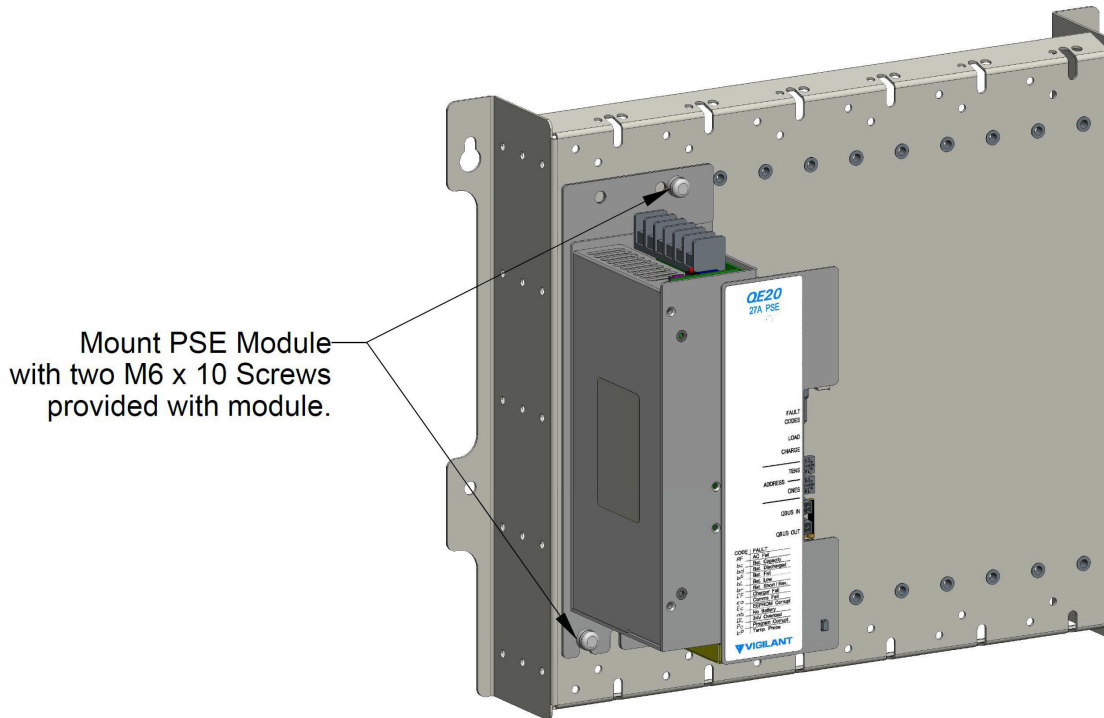


Figure 4 – QE20 27A PSE Mounting

4. Replacing an Existing PSE

The steps for replacing an existing PSE are.

- 1) Turn off the mains power feed to the PSE and unplug the power lead from the GPO.
- 2) Unplug the grey or black rectangular connector(s) in the battery lead to disconnect the batteries.
- 3) If the PSE has a fuse board mounted in the front, label the output wiring and then disconnect from the fuse board.
- 4) Cut the red and black battery leads that extend from J6 and J7 into the battery loom just below the bottom of the PSE. Refer to Figure 5.

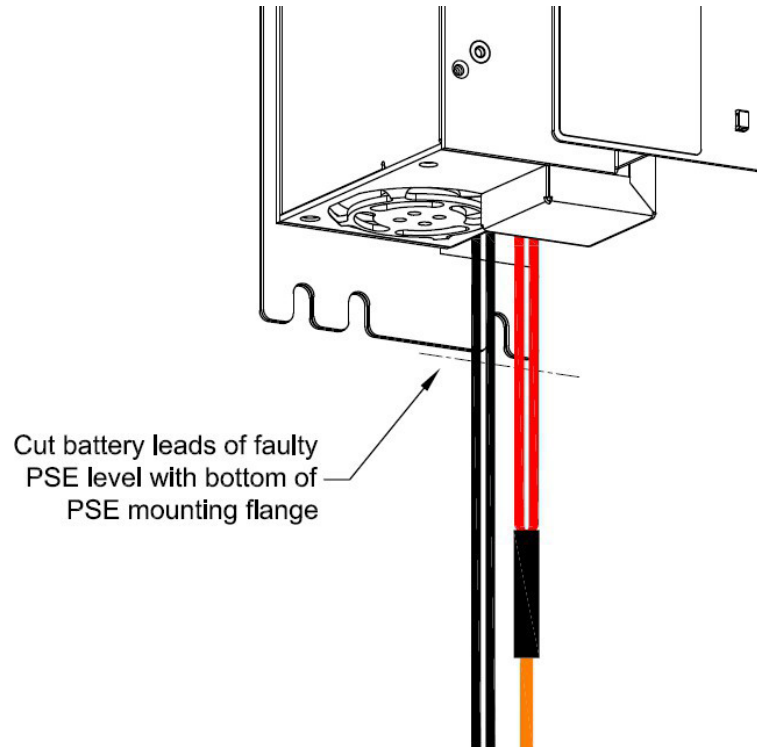


Figure 5 - Cut the Battery Leads just below the PSE being replaced

- 5) Unplug the 24V DC output leads at the top of the PSE that connect to the internal distribution leads to the QE20 Modules.
- 6) Unplug the QBus looms that are plugged into J20 and J21.
- 7) Loosen the bottom mounting screw and then remove the top mounting screw that retains the PSE on the mounting frame.
- 8) Partially remove the PSE module and then unplug any wiring connected to the PSE FAULT relay, MAINS FAIL relay and BATT TEST terminals and any additional DC output leads on J2/3 and J8/9.
- 9) Remove the faulty PSE. If it has a Fuse Board mounted in the front, remove the Fuse Board from the PSE and transfer to the replacement PSE.
- 10) Configure the replacement PSE by setting the address rotary switches and Standalone Link LK1 as per the removed PSE. Refer to Figure 7 for the switch, LED and link locations.
- 11) Fit the stripped end red leads to the +VBATT IN terminals J6 and the black leads to the -VBATT In terminals J7, if not already fitted.
- 12) Position the replacement PSE close to its final position and reconnect the QBus looms to J20 and J21, and any wiring to the PSE FAULT relay, MAINS FAIL relay and BATT TEST terminals. Reconnect any additional DC output leads to J2/3 and J8/9.
- 13) Slide the replacement PSE mounting edge under the lower screw and fit the top screw. Tighten both screws.
- 14) Reconnect the DC output leads to the correct internal panel looms.
- 15) Reconnect any output wiring on the optional Fuse Board.
- 16) Run the battery temperature sensing lead down into the battery space.

- 17) Strip the ends of the battery looms where they were cut and insert the wires into the inline connectors as shown in Figure 6. Double check the battery leads are connected correctly – Red wires together and black wires together.

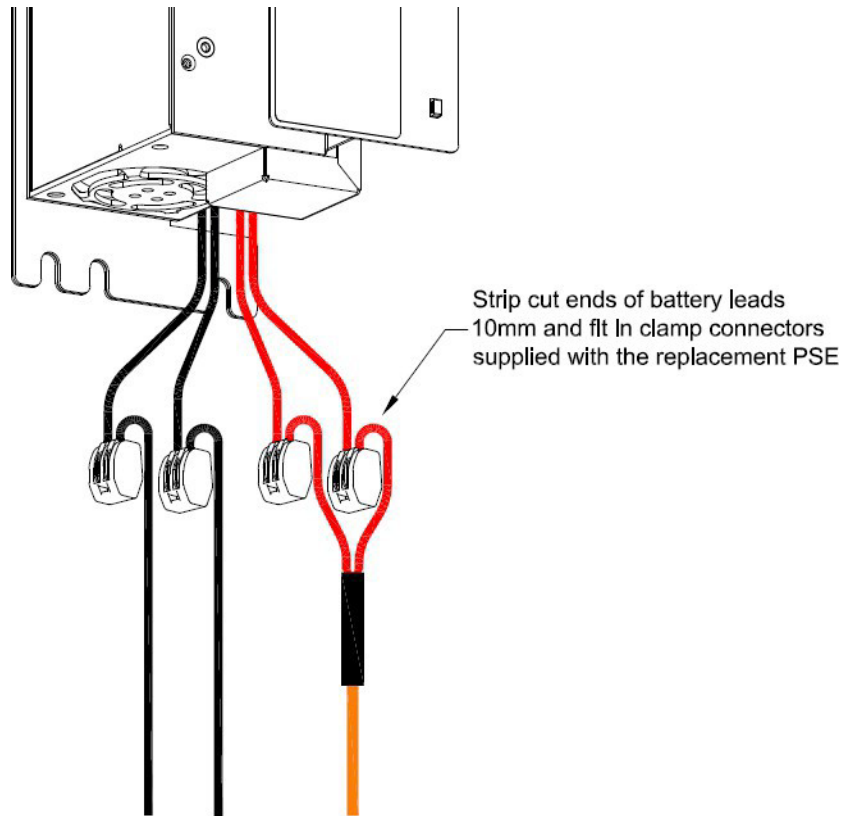


Figure 6 - Strip and Connect Battery Leads to Inline Connectors

- 18) Reconnect mains power and turn on. Check that the PSE operates correctly and the only fault code shown is **nb** (no battery).
- 19) Reconnect the battery and check that all faults are cleared.

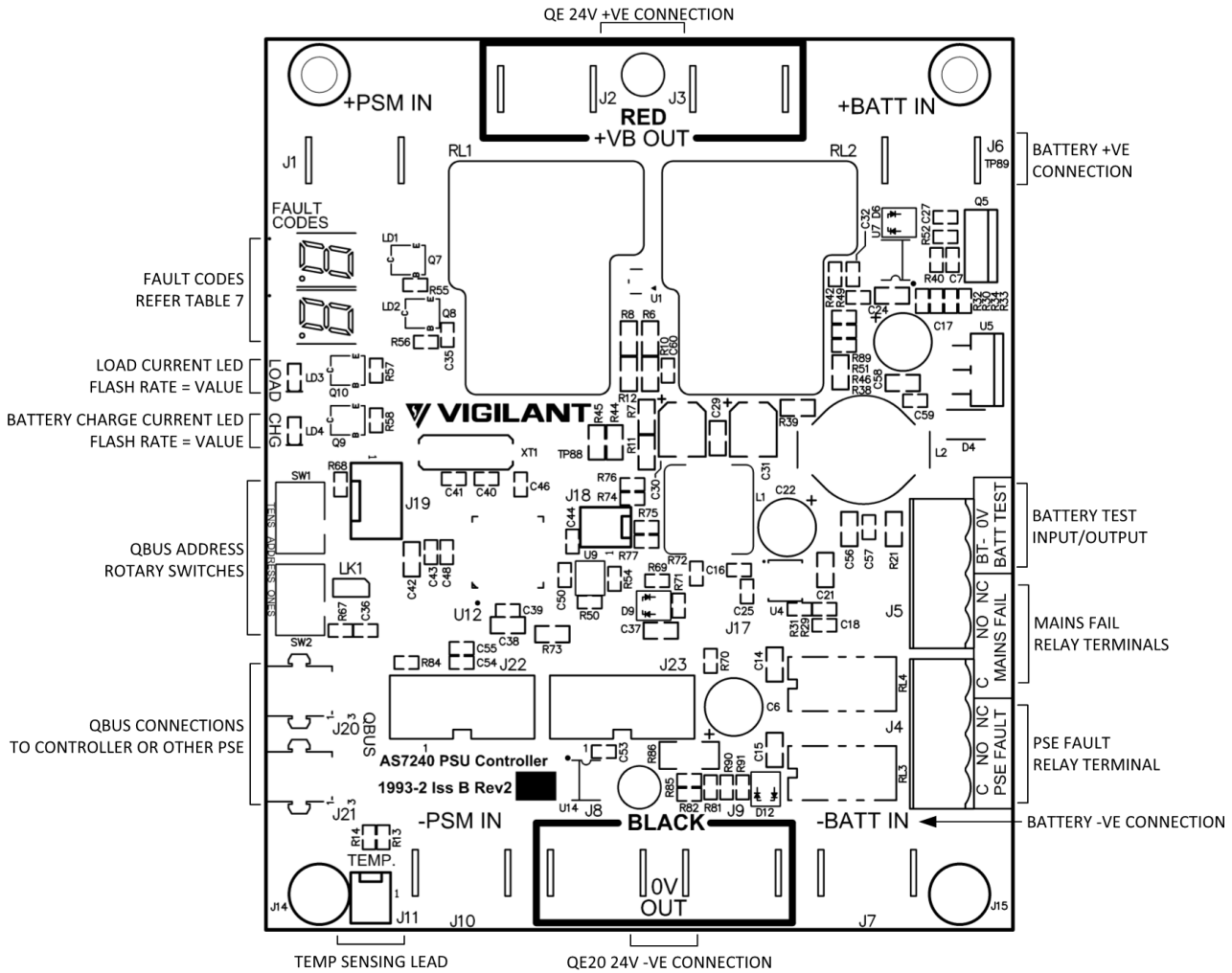


Figure 5 –27A PSE Switch, LED and Connector locations

5. Fitting a New PSE

QE20 Site Configuration

The QE20 site configuration will need to be changed to add the new PSE module. The Card Address used is the address that needs to be selected on the Address rotary switches of the new PSE. A number of parameters can be selected to adjust the PSE's operation. These include:

- Disabling of battery charging
- Disabling temperature compensation
- Battery low voltage threshold
- Mains Fail delay

Generally, only the Mains Fail delay might need to be changed, as most PSE will have battery charging enabled.

Addressing a new module

The QBus address rotary switches, SW1 and SW2, on the 27A PSE need to be set to the Card Address assigned to the PSE in the site configuration. If the Address is set to 00 when the PSE is powered up, then the PSE will go into Bootloader mode. To clear this set the address correctly, power down the PSE completely and power it up again.

Lk1 Stand Alone Operation

This link is NOT fitted in QE20 systems.

Installation

If the optional Fuse Board is required, this is fitted as per the instructions for the Fuse Board – LT0727.

If there are no spare mains power sockets available, then an additional mains GPO will need to be fitted and wired by a suitably qualified electrician. Check the mains cable and circuit breaker are sufficient for the additional load.

If there is not a spare PSE connection on the PSE to battery loom – see Figure 8 (e.g., the cabinet is 28U with 2 PSE and only a 2 PSE battery lead set fitted), then a LM0651 4-way PSE Battery lead set is going to be required. Disconnect the old 2-way lead set from the existing PSEs and connect the new lead set to the existing PSEs and the new one when it is installed. See Figure 8.

Mount the PSE as per Section 3 and connect the internal wiring as per Section 5.

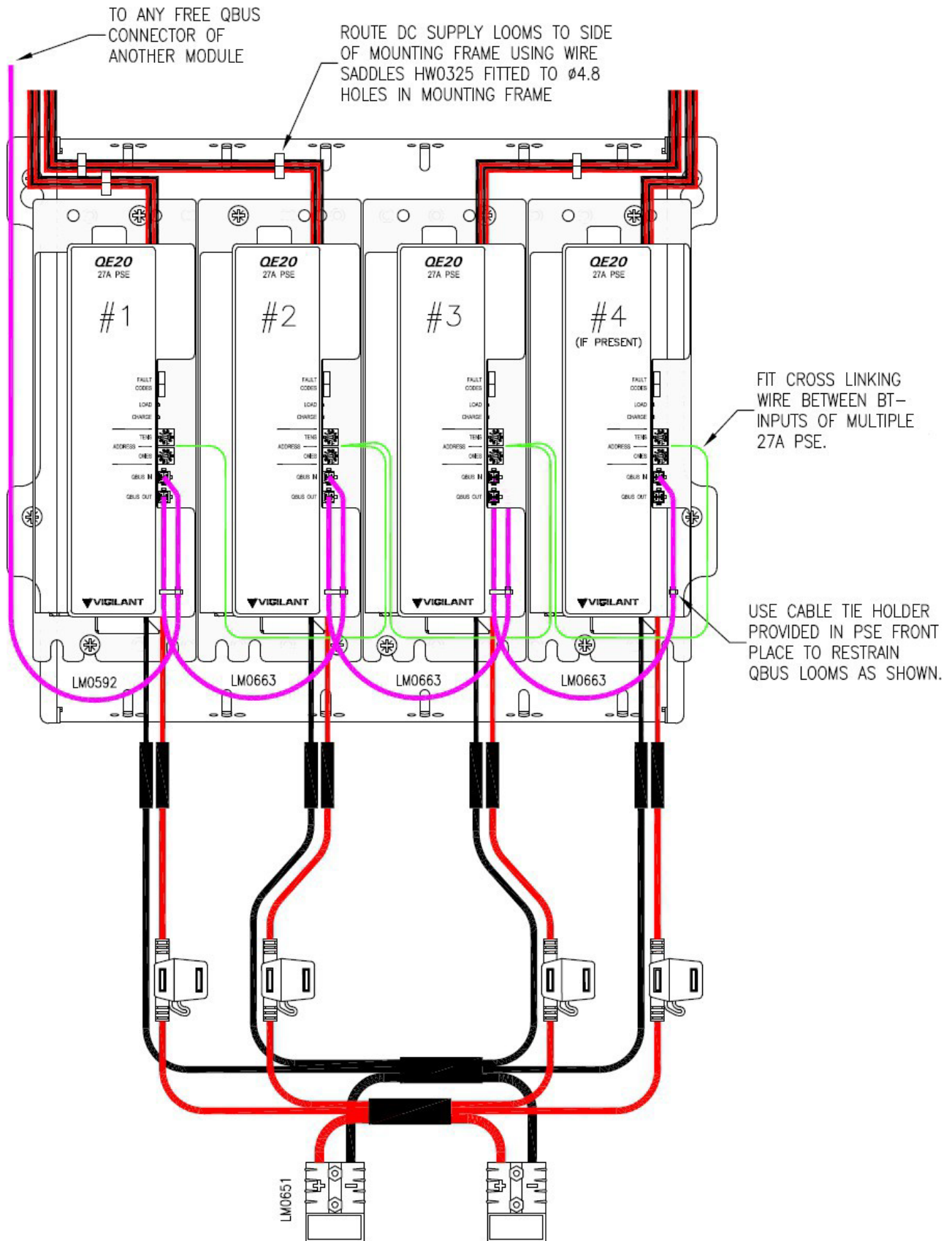
Connect any field wiring as per Section 6.

Power up and test the PSE as per Section 8.

5. Internal Wiring

The QE20 27A PSE requires or provides the following internal wiring connections.

- 230V ac mains using the fitted mains lead plugged into one of the mains outlets mounted on the back wall of the cabinet. Do not piggy-back multiple PSE mains leads into one mains outlet.
- 24V Battery connections using either the 2 x PSE lead (LM0650) or the 4 x PSE lead (LM0651) to join 2 or 4 PSE units together and to the batteries.
- 24 V DC output on LM0654 leads that can connect to either a 3-way lead (LM0656) for low current modules (Controller, WIP/INPUT, Relay Output (low current loads), Master User Interface, RS485 Network, Fibre Network Kit, fan cooling module, 4 x 25W amplifier, 100V Splitter) or a single 2-way lead (LM0655) to high current amplifier modules (4 x 60W, 2 x 120W, 1 x 240W, Relay Output Module with a large load). Up to four x LM0654 leads can be connected to the DC output terminals **+VB OUT J2/3** and **0V Out J8/9**.
- Temperature sensing lead run from J11 on the PSE, with the sensing element positioned near the batteries.
- The 4-way QBus Power/Comms loom from J20 or J21 on the PSE to one of the 4-way QBus connectors J23 or J24 on the Controller, or a 4-way QBus connector on another QBus module (e.g. 27A PSE) that is directly or indirectly (via another module) connected to the Controller QBus port.
- A linking wire between the BT- terminals of each PSE connected to the same battery within the same cabinet. This links the Battery Test signal so that all the battery chargers turn off for a battery test at the same time. Multi-PSE systems will be provided with this wiring from the factory.
- A linking wire (Black 2mm²) between the 0V terminal of one of the PSE in the cabinet to the 0V terminal of one of the PSE in the next cabinet. Multi-cabinet systems will be provided with this wiring from the factory.



THREE OR FOUR 27A PSE MOUNTED ON FRAME WITH BATTERY LOOM LM0651 FITTED

Figure 8 – QE20 27A PSE Wiring to 24V Batteries
 If Loom is LM0650 2-way PSE Battery Lead set then there is only 1 Battery Connector

6. Field Wiring

PSE FAULT

This is a normally energised, voltage-free, change-over relay that drops out in a fault condition or when both mains and battery power are not available. It may be wired to adjacent external devices if the PSE Fault status needs to be monitored or activate something. This relay does not drop out on Mains Fail.

MAINS FAULT

This is a normally energised, voltage-free, change-over relay that drops out when mains power is not available. It may be wired to external devices if the Mains Power status needs to be monitored or activate something.

The PSE may be programmed with a time delay via the QE20 site configuration (default value 85 minutes, 5100s) that determines how long after mains fail the relay actually drops out and a fault is signalled on the QE20. This can be used to bypass momentary or short-term mains failures. The value may be set to a delay in the range of 0 – 5400s (90 mins).

FUSED DC OUTPUTS

An optional FP2027 Fuse Board can be fitted to the front of the PSE to provide 4 separately fused 1A DC outputs suitable for wiring to internal or external devices requiring fused 24V dc power from the QE20. This includes Paging Consoles, Microphone Preamplifiers, etc. Note the supply is battery backed, so these load currents need to be included in the battery calculations, unless the outputs are switched off on mains fail.

Details for the Fuse Board are contained in LT0727.

7. LED Indications

There are two LED indicators and two 7-Segment displays on the 27A PSE.

- **“LOAD” Load Current** This green LED indicator (LD3) flashes at a rate determined by the load current, averaged over the previous few seconds. With no load, the flash rate is 0.5Hz. As the load increases, so does the flash rate, up to 10Hz at full load.
- **“CHG” Charge Current** This green LED indicator (LD4) flashes at a rate determined by the battery charging current. With no charging current, the flash rate is 0.5Hz. As the charging current increases, so does the flash rate, up to 10Hz at full charge current. If charging is disabled on the PSE this indicator will not flash at all. If the system load is being supplied by the battery (e.g., due to mains failure), this indicator will be continuously on.

If both LOAD and CHG are flashing together at ~8Hz, then the PSE is in Bootloader mode. Check the Address Rotary switches are not set to 00. If so, change the rotary switches to the correct address, power the PSE down totally, then power up again.

- **QBus Communications** The decimal point on the seven-segment display will blink on every few seconds when the PSE is operating and communicating correctly with the QE20 Controller.

Fault Codes – 7 Segment Display

The two-digit 7-segment display labelled **FAULT CODES** will light when the PSE detects a fault condition. When multiple faults are present, the codes will be displayed sequentially. The codes are:

Fault	Display Code	Detail
Mains Fail	AF	“AC Mains Fail” (instant). The mains fail fault is delayed.
Battery Capacity Low	bc*	A long-term battery test has failed – the battery voltage dropped too low. This fault latches until a successful long term battery test occurs.
Battery Discharged	bd	The battery voltage is extremely low and has been disconnected to protect the battery. The system is non-functional when this code is displayed.
Battery Fail	bF	Battery Fail fault (below 21.6V). The battery is severely discharged. May take up to 30 seconds to detect.
Battery Low	bL	Battery Low fault (below 24.2V). The battery is at least 50% discharged.
Battery Shorted or Reversed	br	May take up to 30 seconds to detect.
Charger Fault	cF	Charger is not delivering charge to the battery when it should.
Comms failure	co	No QBus messages received from the QE20 Controller. Check the QBus connections, PSE Address Switches, Controller operation, site configuration, and perhaps for another faulty module on the QBus chain.
EEPROM Corrupt	Ec	Failed self test on the PSE Board. Replace the PSE.
Battery not connected	nb	“No battery” (or battery voltage is <13V). May take up to 30 seconds to detect. Check the battery connection and in-line fuse.
24V output overload	OL	Peak 24V output current has exceeded the nominal capacity too often in the last 30 seconds. Check the system design, amplifier loads, etc. Updates

		at 6s intervals. As the overload threshold is set at 24A, this may occur on a heavily loaded PSE when Alert or Evacuate is running. It does not generate a fault condition. Check the wiring – which amplifiers are powered by this PSE, to make sure additional amplifiers have not been inadvertently connected.
Program corrupt	Pc	Failed self test on the PSE Board. Replace PSE.
Temperature probe wiring fault	tP	The temperature probe is disconnected or shorted.

*The long-term battery capacity test schedule based on the Base Application setting:

Australia

Compliance Standard: AS7240-4:2018

Schedule: The test is conducted weekly on Wednesdays at 9:00 AM for a duration of 1 hour.

Fault Status: The fault warning signal remains latched until it is manually reset or a subsequent battery test passes.

New Zealand

Compliance Standard: NZS4512:2021

Schedule: The test is conducted on Mondays, Wednesdays, and Fridays at 9:00 AM for a duration of 1 hour.

Fault Status: The fault warning remains latched throughout the extended test. After the test ends, the Battery Capacity (BC) fault status stays active at the power supply. When a new test begins, the fault clears automatically if battery is in healthy state.

At initial power on, the PSE software version (**A.B**) will be displayed, followed by a “walking segment” display test. System power is available almost immediately after initial power on.

8. Power On & Testing

Turning PSE On/Off

Mains power to the PSE can be switched on and off using the switch on the mains outlet inside the cabinet. To completely isolate the mains supply from the PSE, remove the PSE mains plug from the mains outlet.

The batteries can be isolated by unplugging the grey or black rectangular connector in the battery lead.

If the permanent mains power supply is not available during initial testing, a temporary mains lead may be used. Ensure the mains source and the temporary lead are sufficient to meet the power requirements of the PSE. It is recommended that only one heavily loaded zone be activated at a time when the PSE is operating off a temporary mains supply.

Initial Power On

For the first tests apply mains power only to check the operation of the PSE and QE20 without a battery. Once this is confirmed a battery can be connected and charged.

- Power on and wait for the QE20 to start up.
- Check the POWER and AUTO LEDs on the QE20 User Interface turn on and that no faults are initially generated. If faults are generated refer to the QE20 Operator Manual (LT0711) for instructions on using the LCD touchscreen to determine the faults that are present.
- After 30 seconds the General Fault and Power Fault LEDs on the QE20 will turn on and a battery not connected (**nb**) fault code will be shown on the PSE.
- Connect the batteries and check the fault is cleared after 30 seconds.

Refer to the QE20 Installation Manual LT0712 for commissioning instructions.

Checking Battery Charger Voltage

To check the open circuit battery charger voltage the following procedure can be used:

1. Operate the PSE from mains with a good battery connected so that no fault is shown.

Disconnect the battery and measure the open circuit charger voltage from the PSE within 30 seconds. If the voltage drops to ≈10V repeat the process until a valid reading (≈27.3V) is obtained. [Every 30 seconds the PSE turns off the charger to measure the battery voltage. With no battery connected, the charger will not turn on again.]

Reconnect the battery.

9. 27A PSE Specifications (each unit)

Dimensions	100mmW x 280mmH x 150mmD excluding leads & optional Fuse Board
Leads	Mains 3 pin AS/NZS 3112 plug 300mm lead length
DC Output Terminals	DC Output +24V, 0V on 6.3mm QC terminals +24V Red J2/J3 & 0V Black J8/J9 2 x LM0654 leads with 2-way 24V DC connector for QE20 Modules Option for two additional LM0654 leads.
Operating Conditions	-5°C to +45°C external to cabinet, 10% to 93% RH non-condensing
Input Voltage / Current	230-240VAC \pm 15%, 50-60Hz; <4.2A @ 230VAC
Power Factor	>0.95 @ 230VAC
Heat Dissipation	160W max
Battery Load with AC Off	90-120mA @ 25V (excludes any connected DC loads)
<u>PSE DC Output</u>	
Output Voltage (mains operation)	26VDC nominal
Output Voltage (battery operation)	Battery Voltage
Minimum Output Current	0A (AS7240.4 P _{min} rating of 0W)
Max Output Current, while charging batteries	20A (AS7240.4 P _a rating of 520W)
Max Output Current, with battery charging suppressed	27A (AS7240.4 P _b rating of 700W)
Overload Fault Indication Threshold	When peak current exceeds ~24A
<u>Battery Charger</u>	
Battery type	Valve regulated lead-acid type (VRLA) only.
Charge Voltage	27.3V float voltage (20°C nominal).
Charge Current	2.5A max charge current per PSE, when configured.
Temperature Compensation	Float voltage changes -35mV/°C
Battery capacity	Up to 150Ah, that meets the region-specific AS7240.4:2018 and NZS4512: 2021 performance requirements.
Charger Fault Condition	Battery voltage < 24.5V and charge current < 100mA
<u>Inputs /Outputs</u>	
PSE Fault Relay	Clean change-over contacts - 2A @ 30VDC resistive; normally energised
Mains Fail Output	Clean change-over contacts - 2A @ 30VDC resistive; normally energised
BT-	Battery Test Input / Output – link between PSE connected to same battery Low voltage is turn off charger and conduct battery test
<u>Fuses</u>	Individual battery lead: 30A ATO blade type (green) Common battery link lead: 100A Littelfuse MIDI cat 0498-100

Battery Voltage Fault Thresholds

Battery Voltage	Meaning	Fault Display
Above 24.5V	Normal	-
Below 24.5V	Test Fail during a long term Battery Test	bc
Below 24.2V	Battery Low – about 50% discharged	bL
Below 21.6V	Battery Fail – practically no capacity remaining	bF
Below 18V	Battery Discharged (and system load may be disconnected)	bd
Below 13V	Battery is not connected – no battery	nb
Below 1V	Battery is shorted or reversed	br

10. End User Licence Agreement, Privacy and Licensed Software

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www.johnsoncontrols.com/techterms