
JPDF 125 V Power Distribution

Functional Description

The 125 V Power Distribution (JPDF) board accepts redundant 125 V dc power inputs and distributes power to other system boards. JPDF works with a floating dc bus that is centered on earth rather than with a grounded system. This permits detection of a system ground fault and carries a non-hazardous live 125 V dc rating.

Input 125 V dc battery power is connected to a terminal board on the IS2020JPDF module. The power is then routed through a 125 V dc 30 A circuit breaker and line filter before being connected to the IS200JPDF board through the J1 connector. Dc voltage is then routed to three fused, non-switched outputs and six fused, switched outputs.

Ac power is routed through the board to the DACA modules where it is converted to dc power. Dc power returns to JPDF where it is combined with the battery power input. JPDF can operate with any combination of one or more inputs active creating a high-reliability source of 125 V dc power for the control system.

The IS2020JPDF module provides full status feedback using a connection to a PPDA I/O pack. Feedback includes bus magnitude, ground fault detection, and detection of excessive ac voltage on the dc bus. Each fused branch circuit is monitored to indicate the presence of output power.

Compatibility

The IS2020JPDF is compatible with the feedback signal connectors, P1/P2, on JPDB, JPDE, JPDS, and JPDM leading to a PPDA I/O pack. Connector JAF1 is compatible with the ac power output on the IS2020JPDB module. Connectors JZ2 and JZ3 are compatible with the connectors on the IS2020DACA module.

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Installation



Caution

In 240 V ac applications, do not inadvertently cross-connect the 240 V ac and the dc voltages. The peak voltage will exceed the MOV rating resulting in a failure.

Most ac supplies operate with a grounded neutral, and if an inadvertent connection between the 125 V dc and the ac voltage is created, the sum of the ac peak voltage and the 125 V dc is applied to MOVs connected between dc and ground. However, in 120 V ac applications, the MOV rating can withstand the peak voltage without causing a failure.

The IS2020JPDF module is base-mounted vertically on a metal back base in a cabinet used by the PDM. A connection must be made between the IS2020JPDF sheet metal and the system protective earth (PE).

Input battery power is applied to terminals DCHI and DCLO. If one or two DACA modules are used, ac power is applied to JAF1, typically from an IS2020JPDB module. DACA modules connect to JPDF through connectors JZ2 and JZ3.

Output circuits are connected as documented for the system.

A power distribution system featuring a PPDA power diagnostic I/O pack requires a 50-pin ribbon cable from JPDF connector P1 to the P2 connector on the board holding PPDA. This connection can pass through other core PDM boards using the P2 connector.

Grounding

The Mark VIe control system divides ground into a protective earth (PE) and a functional earth (FE). The PE ground must be connected to an appropriate earth connection in accordance with all local standards. The minimum grounding must be capable of carrying 60 A for 60 seconds with no more than a 10 volt drop. The FE ground system must be bonded to the PE ground system at one point.

The JPDF is grounded through metal mounting supports fastened to the underlying sheet metal of a metal module. The ground is applied to the metal switch bodies on JPDF. Additionally, the ground is used as a local reference point when creating the feedback signals appearing on P2. The sheet metal of the module is insulated to the surface upon which it is mounted. This is done specifically to allow definition of the JPDF ground independent of the mounting surface. Typically, JPDF is mounted to a back base grounded to FE. JPDF would be located low in the cabinet and a separate ground wire from the JPDF module would be provided to PE. The minimum length of the ground wire is important to keep impedance low at radio frequencies allowing the input line filters to function properly.

Physical Arrangement

The JPDP accepts power input from the right side of the board and delivers power out of the left side. When JPDB is used with JPDP, the JAF1 connector provides ac power to JPDP. JPDP should be physically located beneath JPDB minimizing the length of the JAF1 power wiring. JPDP is mounted to allow a minimum length of grounding wire between the module sheet metal and the nearest PE connection point. Connector P1 transmits feedback signals to a board hosting a PPDA I/O pack. Connector P2 receives feedback from other power distribution boards and passes the signals out of P1 to the PPDA. The P1 and P2 ribbon cable headers on all of the core boards are mounted so the JPDS or JPDM, holding the PPDA I/O pack, is located at the top of the board arrangement. This allows ribbon cables to flow from the top of one board and into the bottom of the next board until the PPDA host is reached.

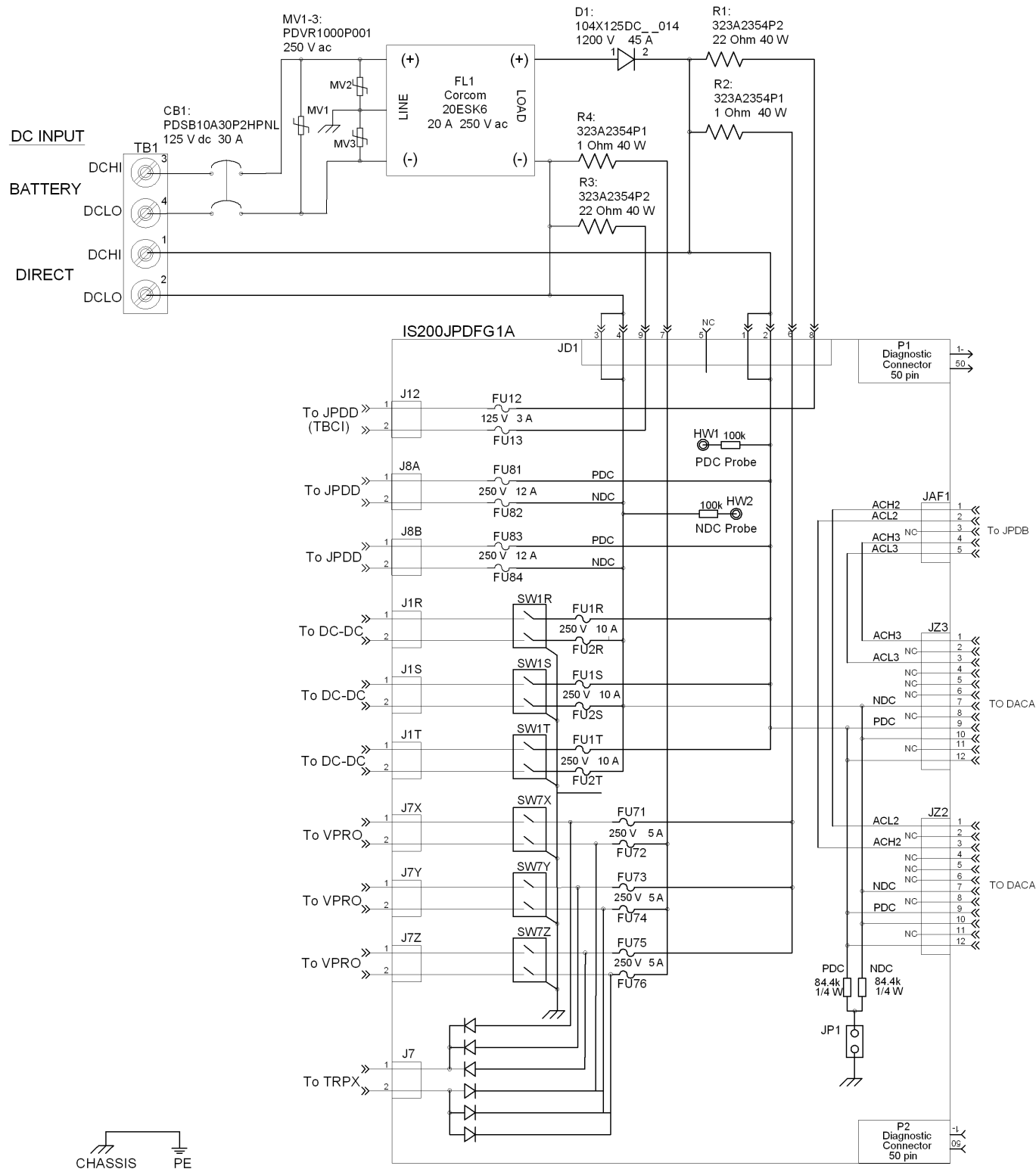
Ground Fault Detection

The IS200JPDP module supports the use of a dc bus that is centered on ground potential by a high resistance. This arrangement allows the detection of a ground fault when the positive bus or negative bus voltage goes to ground potential. In support of this arrangement, the IS200JPDP includes separate voltage feedback sensing for positive and negative power with respect to ground. When the feedback is cabled into a PPDA I/O pack detection of ground faults is provided to the system.

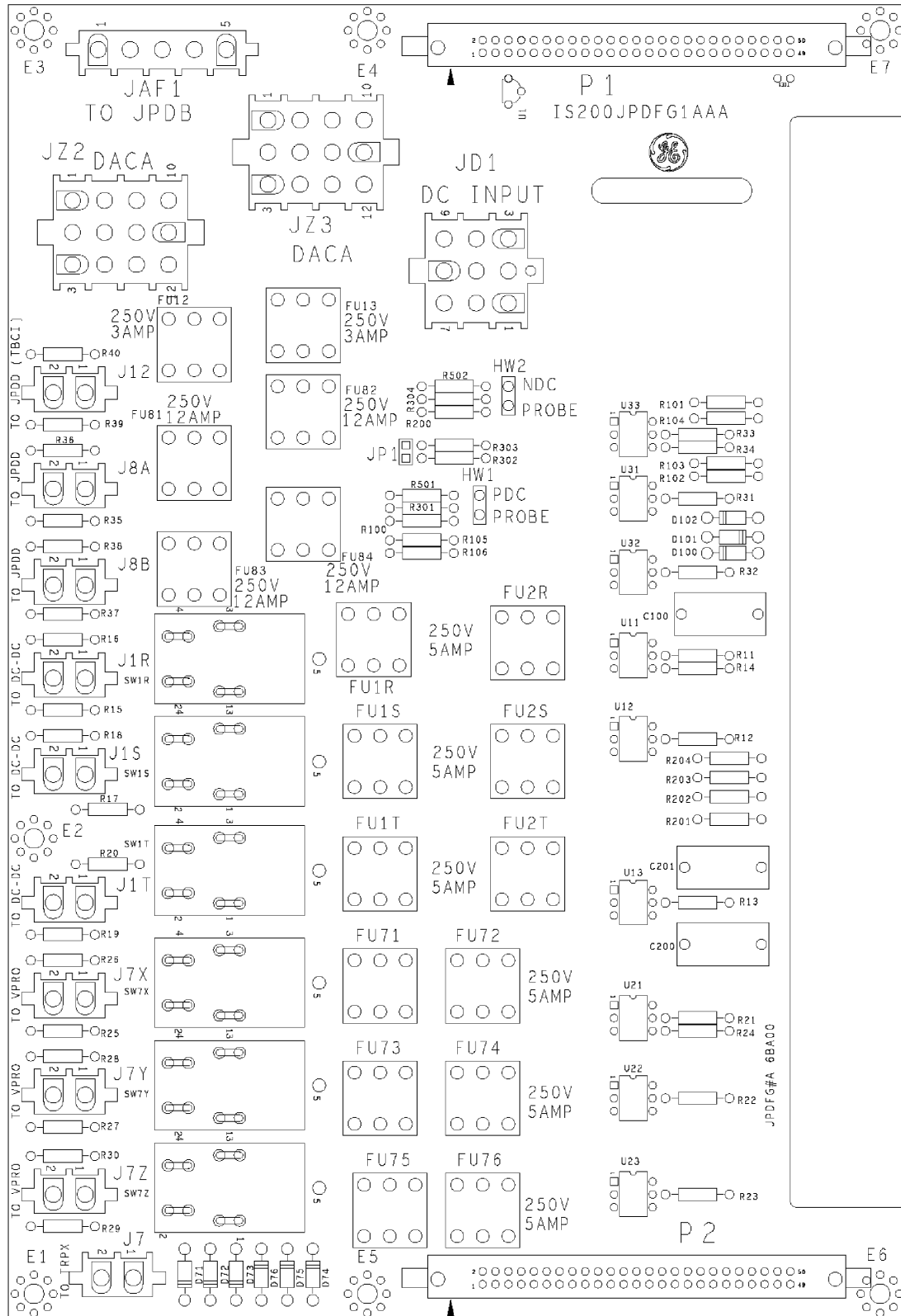
The resistance used centering the dc bus on ground sets the ground detection sensitivity and ground fault currents that can flow. IS200JPDP contains centering resistors selected by jumper JP1. Should centering resistance be provided elsewhere, then the jumper on JPDP should be open. JPDP is designed to then insert minimal centering resistance in the system. If JPDP is providing the centering function, JP1 should be closed. If two JPDP modules are used, only one should have a closed JP1 jumper.

Operation

Dc battery power is applied to terminals DCHI and DCLO. It then goes through a 30 A dc circuit breaker into a filter assembly located under the IS200JPDP circuit board. Filtered output is then passed through a series diode to the JPDP circuit board. Ac power is applied to the JAF1 connector. The 115/230 V ac is routed to two connectors, JZ2 and JZ3, and out to two DACA modules. The DACA modules convert the ac power to 125 V dc. The dc power returns to JPDP through the same JZ2 and JZ3 connectors and combined with battery power if present.



JPDF Electrical Diagram



JPDF Mechanical Board Layout

I/O Characteristics

- The JPDF module has a barrier terminal strip containing two battery input screw terminals located on the right side of the circuit board. The dc input is rated at 30 A, and the voltage should never exceed 145 V dc. Protection of the Branch circuit supplying power to this input is a 30 A circuit breaker, supplied by default as part of the module. This is the primary power input.
- Two dc output screw terminals, located on the same barrier terminal strip, are not normally used, but are provided to allow two JPDF boards to work in parallel.
- JD1 is a nine-pin Mate-N-Lok connector that accepts the power input from the components that are mounted under the JPDF board. JD1 uses a wire harness that is part of the JPDF module assembly.
- JAF1 is a five-pin Mate-N-Lok connector that accepts the 115/230 V ac input from the JPDB board. The 115/230 V ac is routed to two connectors, JZ2 and JZ3, and out to two DACA modules. The DACA modules convert the ac power to 125 V dc.
- Two 12-pin Mate-N-Lok connectors, JZ2 and JZ3, pass ac power to two DACA modules. The DACA modules convert 115/230 V ac to 125 V dc. Dc power returns through the JZ2 and JZ3 connectors.
- Three fused and switched two-pin Mate-N-Lok output connectors, J1R, J1S, and J1T, are provided for powering 125 V dc/28 V dc converters. The 28 V dc is the control power for I/O packs. Positive power is on pin 1 and negative power is on pin 2. The fuses are rated at 5 A.
- Three fused and switched two-pin Mate-N-Lok output connectors, J7X, J7Y, and J7Z, are provided for powering up to three Mate-N-Lok modules. Positive power is on pin 1, negative power is on pin 2, and fuse rating is 5 A. Two 1 W resistors mounted under the board define the minimum source impedance for these circuits.
- A two-pin Mate-N-Lok output connector, J7, is provided to supply power to the system trip boards. Positive power is on pin 1 and negative power is on pin 2. The output power comes from the circuits associated with J7X, J7Y, and J7Z. The output power is combined through diodes and is only lost when all three circuits have blown fuses or open switches.
- There are two 12 A fused two-pin, Mate-N-Lok output dc connectors on both J8A and J8B. They feed remote JPDD boards to provide individual switched/fused circuits to TRLY boards and other system loads. Positive power is on pin 1 and negative power on pin 2.
- A two-pin Mate-N-Lok output connector, J12, is provided specifically to operate TBCI contact input boards. Two 22 Ω resistors mounted under the JPDF board define the minimum source impedance for this circuit. Positive power is on pin 1 and negative power is on pin 2.
- The ground reference jumper is JP1. The dc bus is normally operated without a hard ground connection, but it is desirable to center the dc on earth as part of the ground fault detection scheme. In normal operation, the positive terminal would measure $\frac{1}{2}$ *125 V above ground and the negative terminal would measure the same magnitude below ground potential. The resistors used to center the bus on earth can be supplied externally to the JPDF, or on-board resistors can be used by closing jumper JP1.
- Two 50-pin diagnostic ribbon cable connectors, P1 and P2, are supplied on the top and bottom of the board. Connector P1 transmits feedback signals to a board hosting a PPDA I/O pack. Connector P2 receives feedback from other power distribution boards and passes the signals out of P1 to the PPDA.

Specifications

JPDF Item	Description
Board rating	125 V dc nominal, 145 V dc maximum 30 A circuit breaker protection
Impedance to ground	With JP1 jumper in place > 75 k Ω With JP1 jumper removed > 1500 k Ω
Fuse for connectors J1R, J1S, J1T - FU1R, FU2R, FU1S, FU2S, FU1T, FU2T	10 A 250 V, Bussmann MDA-10 typical
Fuse for connectors J7X, J7Y, J7Z - FU71-FU76	5 A 250 V, Bussmann ABC-5 typical
Fuse for connectors JBA, JBB - FU81-FU84	12 A 250 V, Bussmann ABC-12 typical
Fuse for connector J12: FU12 - FU13	3 A, 250 V, Bussmann ABC-3 typical
Physical	
Modules Size	30.48 cm High x 21.33 cm Wide x 16 cm Deep (12 in x 8.4 in x 6.3 in)
Mounting	Four mounting holes, #10 screws
Temperature	-30 to 65°C (-22 to 149 °F)

Diagnostics

Diagnostic signals routed into PPDA through connector P1 include:

- An electronic ID identifying the board type, revision, and serial number
- Two 125 V dc voltage feedbacks for voltage magnitude determination, ground fault detection, and ac signal present detection
- Six switched/fused dc supply indications for J1R, J1S, J1T, J7X, J7Y, and J7Z
- Three fused dc supply indications for J8A, J8B, and J12
- Two hardware test rings, with series 100 k Ω resistors, are provided for attaching test equipment. HW1 is labeled PDC Probe and HW2 is labeled NDC Probe.

Configuration

JP1 should be in place if JPDF is providing bus voltage centering resistors for ground fault detection. JP1 should be omitted if another location is providing centering resistance.

TBCI boards, when powered by JPDF, should use connector J12 using a JPDD fan-out board. The 44 Ω source impedance is coordinated with the circuit ratings on TBCI.

TRPG/TREG board pair, critical to system operation, should be powered by the J7 connector.