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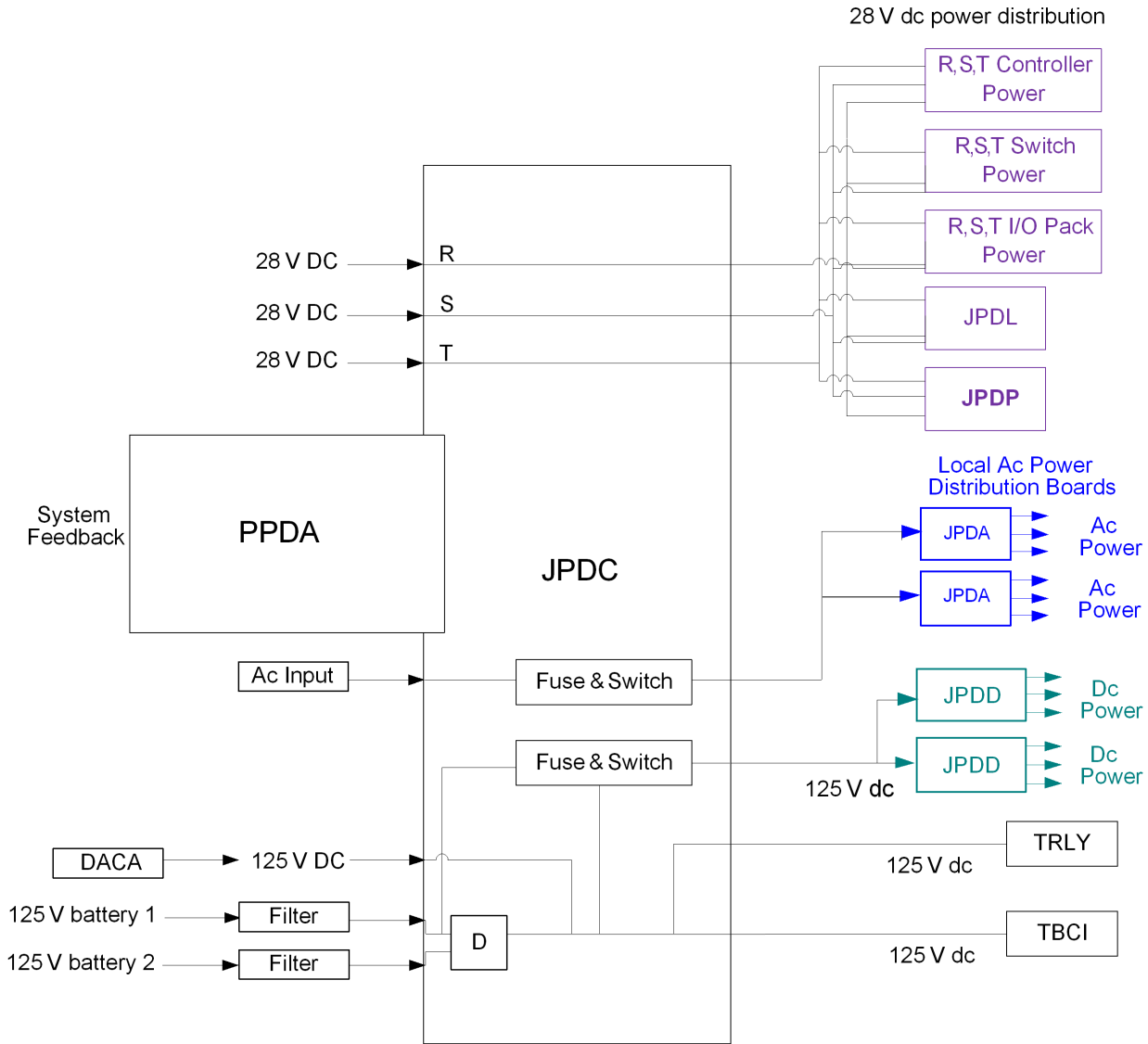
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JPDC Power Distribution Module

Functional Description

The IS2020JPDC Power Distribution Module (JPDC) combines input and output functions from several previous designs to provide distribution of 125 V dc, 115/230 V ac, and 28 V dc to other boards within a turbine control system.



PDM with JPDC Basic Layout

Compatibility

JPDC can host a Power Distribution System Feedback (PPDA) pack used in the Mark VIe Power Distribution System. JPDC can also receive diagnostic feedback signals from other distribution boards and route these signals to the PPDA I/O pack as well.

The intent is that the PPDA I/O pack should be mounted on the JPDC module. Therefore, no provision is made to transmit diagnostic signals from JPDC to another distribution board.

Module Versions

IS2020JPDCG01: Standard version for most applications.

IS2020JPDCG02: Special version which includes a wire jumper on the D1 diode assembly. The jumper permits the JD2 *Battery B* input connector to be used as an output connector.

The IS2020JPDC module contains the IS200JPDCG1Axx board. Revisions IS200JPDCG1ADC and higher have the following changes:

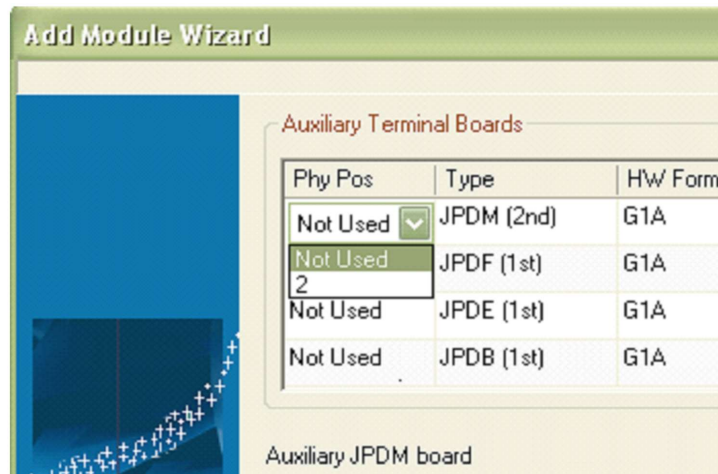
- In the diagnostic signal path *A5* (AC1 feedback magnitude), a signal isolation transformer is added. This provides galvanic isolation between FE/PE and JAC, the ac line connection. With the addition of the isolation transformer, the AC1 feedback signal displayed in the ToolboxST application has a tolerance of $\pm 15\%$, relative to the reading.

Installation

The JPDC module is typically mounted vertically with the 115/230 V ac input connector (JAC) at the bottom. It is attached with four screws using the mounting holes located at the top and bottom of the module base. Location within the control cabinet is not critical, however, distribution boards are usually mounted low in the cabinet to facilitate grounding. Refer to the section, [Grounding](#).

The optional PPDA I/O pack is plugged into connector JA1. It is secured to the JPDC base using an angle bracket, held in place with nuts threaded onto studs, that are permanently attached to the base for that purpose.

Both the JPDC and JPDM power distribution boards consume two groups of feedback signals with the PPDA I/O pack, so when used, the next available position will be two groups higher.



Diagnostic feedback inputs from other distribution boards are routed to JPDC through a 50-pin ribbon cable attached to connector P2.

Input power connections include:

- Either one or two 125 V dc battery input connections through connectors JD1 and JD2
- 125 V dc DACA module connection made using connector JZ2
- 115 or 230 V ac input applied to connector JAC

Up to three separate 28 V dc sources can be made to connectors JR, JS, and JT respectively. The positive sides of these three inputs are isolated from each other and designated as 28PR, 28PS, and 28PT power buses. If only one 28 V dc input is used, the three power buses can be linked together if desired. Refer to the section, [Operation](#).



To replace a JPDC, replace the entire module. Refer to the section, [Module Replacement](#). Do not remove the board from its mounting plate.

Attention

Grounding

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 V drop. The FE ground system must be bonded to the PE ground system at one point.

The FE circuitry on the JPDC board is grounded through metal mounting supports fastened to the underlying sheet metal of the module. The FE ground is used as a local reference point when creating the feedback signals appearing on P2. Typically, the JPDC module is mounted to a back base grounded to FE, completing the path to ground.

The metal switch bodies on the JPDC are tied to PE circuitry on the board. Separate ground wires from the JPDC module, screw connections E5 and or E6 must be connected to the enclosure PE bus.

When input line filters are inserted in line with the JPDC, the filters should be located either on a PE grounded base or near the enclosure PE bus. When PE ground wires are run from the filters to the PE bus, 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 IS2020JPDC module consists of a 6.75 x 19.0 in IS200JPDC board, a diode assembly, and two resistors mounted on a steel base.

Voltage levels on the JPDC board increase from top to bottom with 28 V dc circuits on the top and left side, 125 V dc in the center and right side, and 115/230 V ac on the bottom.

Operation

Ac Power Distribution

An input of either 115 V ac or 230 V ac is supplied to JPDC through connector JAC. The maximum allowable current is 12.5 amps rms. It is expected that the low or neutral side of the input power is grounded. (Refer to the functional diagram)

Two ac outputs are provided. Both are protected by a 10 A time-delay fuse on the high side only (Pin 1 of each connector). The output at JAC1 is controlled by toggle switch SWAC1. The JAC2 output is not switched.

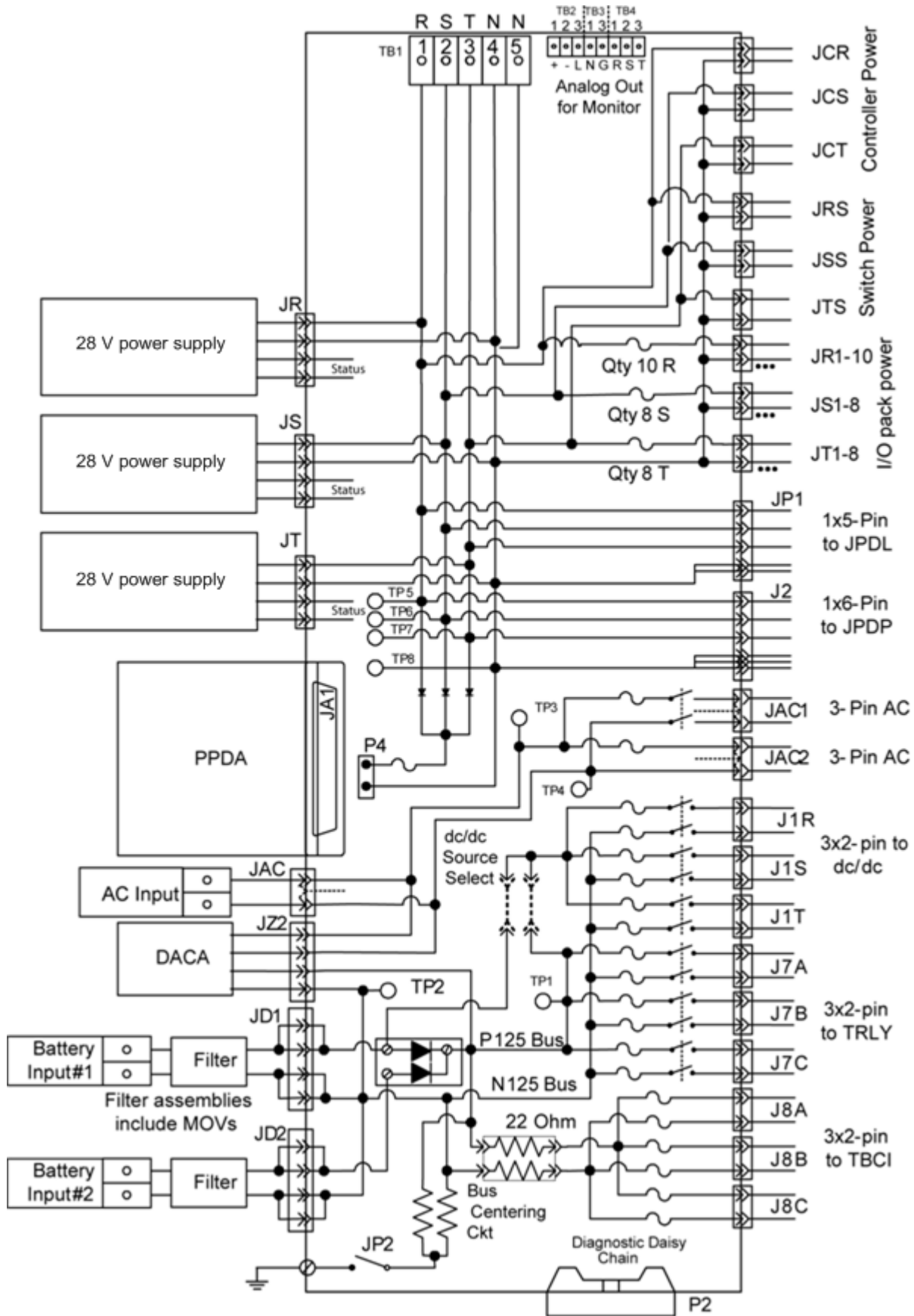
125 V dc Power Distribution

JPDC can accept two battery inputs through connectors JD1 and JD2. Provision is also made for a third 125 V dc input from an ac/dc converter such as IS2020DACA through connector JZ2. Each input is typically routed through an external filter.

Input voltage range 90 – 145 V dc.

The two battery inputs are OR'ed together by diode module D1 and are OR'ed with 125 V dc from DACA by a diode on the DACA module. The OR'ed 125 V dc inputs combine on JPDC to form a 125 V dc bus labeled PDC. The return paths of the 125 V dc inputs are connected together and labeled NDC. Total 125 V dc current flow should not exceed 20 amps.

All three 125 V dc inputs are floating with respect to ground. When jumper JP2 is installed, each side of the 125 V dc bus is connected to FE ground through approximately 84 k ohms of resistance to provide a means of ground fault detection.



JPDC Electrical One-line Diagram

Nine 125 V dc outputs are provided

- Three outputs J1R, J1S, and J1T provide power to the inputs of three external 125 V dc input / 28 V dc output power supplies which supply JPDC with 28 V dc power. These outputs are fuse-protected and controlled by toggle switches SW1R, SW1S, and SW1T.



When SW1R, SW1S, and SW1T are switched OFF, wait at least 30 seconds before turning them back ON. This prevents damage to the input circuits of the 28 V dc power supplies.

Caution

- Outputs J1R, J1S, and J1T can be powered from either the PDC bus or from Battery A only. Refer to the section, [Configuration](#).
- Three outputs J7A, J7B, and J7C are fuse-protected and controlled by toggle switches. They provide output power to the Relay Output (TRLY) terminal board and similar boards.
- Three outputs J8A, J8B, and J8C are only fuse-protected. A 22 W resistor is inserted in series with each side to limit output power. These outputs supply power to boards such as the Contact Input (TBCI) terminal board, which require a source with limited short circuit capability to meet agency requirements.

28 V dc Power Distribution

JPDC provides for TMR or Simplex 28 V dc power distribution. Three separate 28 V input connectors; JR, JS, and JT are provided. On each connector, two pins are connected in parallel to increase current-carrying capacity.

Eight output connectors do not have fuse protection: J1, JP1, JCR, JCS, JCT, JRS, JSS, and JTS. Output current should not exceed 12.5 A.

Twenty-six outputs have 1.6 A polyfuse protection. In TMR configuration, ten of these, JR1 through JR10, provide 28 PR power, eight provide 28 PS power, and eight provide 28 PT power.

One output, P4, has 0.5 A polyfuse protection and provides power to the PPDA I/O pack. In response to overcurrent, the polyfuse latches off. Cycle power to the polyfuse to reset it.

Diagnostic Feedback Signals

FDBK_A1: Attenuated voltage difference from PDC bus to ground. $V_{A1}/VPDC = 0.033316 \text{ V/V}$.

FDBK_A2: Attenuated voltage difference from NDC bus to ground $V_{A1}/VPDC = -0.033316 \text{ V/V}$.

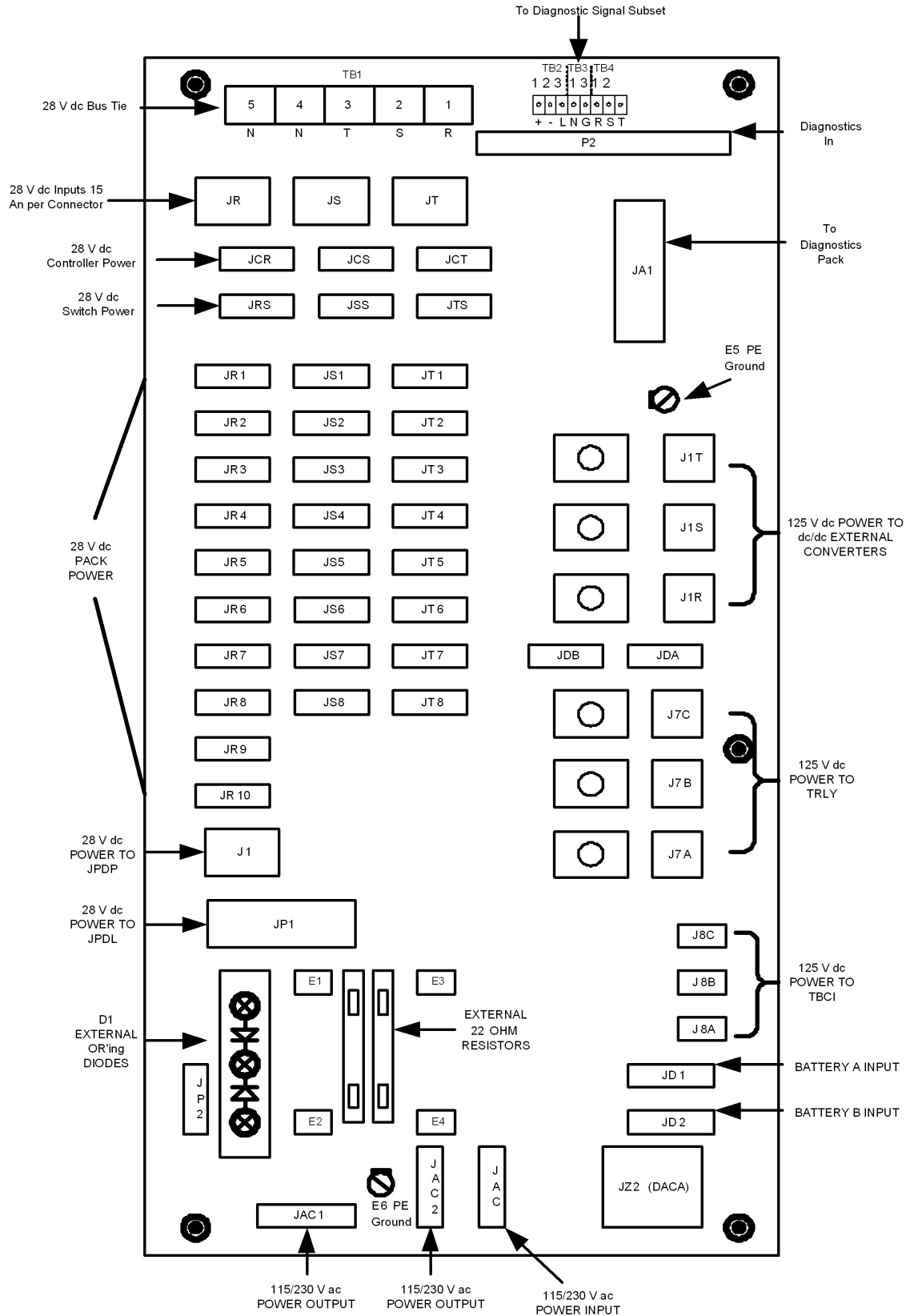
FDBK_A3 and FDBK_A4: Multiplexed feedbacks from J1S-T and J7A-C. (Requires PPDA I/O pack).

FDBK_A5: Attenuated AC input voltage: V_{A5}/VAC is approximately 0.01885 V/V.

FDBK_B1: Multiplexed feedbacks from Battery 1 input, Battery 2 input, JAC1 output, and JAC2 output. (Requires PPDA I/O pack).

FDBK_B2 – FDBK_B4: Attenuated 28VDC R, S, and T inputs. Attenuation ratio = $V_{feedback}/V_{in} = 0.143 \text{ V/V}$.

Feedback_B5: Multiplexed feedbacks from external 28 V dc power supplies. (Requires PPDA I/O pack).



JPDC Connector Locations

Specifications

Item	Description	
28 V dc inputs	Three 9-pin Mate-N-Lok connectors for 28 V dc Power Supply inputs: (JR, JS, JT) One 50-pin ribbon cable with diagnostic data from upstream boards (P2) One 5-screw terminal block for daisy chaining power distribution boards	19 A max each 15 V max 35 A max per screw
28 V dc outputs	One 6-pin Mate-N-Lok connector for a JPDP board (J1) One 5-pin Mate-N-Lok connector for a JPDL board (JP1) Three 2-pin Mate-N-Lok connectors for CPCI control rack power (JCR, JCS, JCT) Three 2-pin Mate-N-Lok connectors for LAN switch power (JRS, JSS, JTS) Twenty six 2-pin mini-Mate-N-Lok connections fused, for auxiliary devices (JR1-JR10), (JS1-JS-8), (JT1-JT8) One 5-screw terminal block for daisy chaining power distribution boards (TP1) One 2-pin connection for 28 V dc power to the PPDA I/O pack (P4) One 62-pin D-shell connection for PPDA I/O pack (JA1)	13 A max per pin 13 A max per pin 13 A max per pin 13 A max per pin 1.6 A polyfuse 35 A max per screw 0.5 A polyfuse 15 V max
115/230 V ac input	One 3-pin Mate-N-Lok connector (JAC) Board Rating	13 A max. 115/230 V ac 50/60 Hz 30 A circuit breaker protection
115/230 V ac output	Two 3-pin Mate-N-Lok connectors (JAC1, JAC2) Fuses for connectors JAC1-JAC2 and FUAC1-FUAC2: FU1-FU8	10 A max. each 10 A, 250 V, Littelfuse® 218010 is typical.
125 V dc battery inputs	Two 4-pin Mate-N-Lok connectors (JD1, JD2)	20 A max. total current
125 V dc DACA input	One 12-pin Mate-N-Lok connector (JZ2) Board Rating Impedance to ground Fuses for connectors J1R: FU1R- FU2R, J1S: FU1S-FU2S, J1T: FU1T-FU2T Fuses for connectors J7A: FU71-FU72, J7B: FU73-FU74, J7C: FU75-FU76 Fuses for connectors J8A: FU81-FU82, J8B: FU83-FU84, J8C: FU85-FU86 Temperature Range Board Size Module Size Mounting	10 A max. 125 V dc nominal, 145 V dc maximum, 30 A circuit breaker protection JP1 jumper in place >75 kΩ JP1 jumper removed > 1500 kΩ 10 A 250 V, Littelfuse 218010 is typical 10 A 250 V, Littelfuse 217010 is typical 3.15 A 250 V, Littelfuse 2173.15 is typical -30 to 65°C (-22 to 149 °F) 17.2 cm Wide x 48.26 cm High (6.75 in x 19.0 in) 17.78 cm Wide x 51.81 cm High x 7.62 cm Deep (7.0 in x 20.4 in x 3 in) Back-panel mounting, adjacent to other power distribution boards
Temperature	-30 to 65°C (-22 to 149 °F)	

Diagnostics

Diagnostic Feedbacks

JPDC provides for the connection of a PPDA I/O pack for power distribution feedback to the IONet. The PPDA I/O pack mounts on the JPDC.

JPDC uses two feedback signal groups on the PPDA I/O pack connector comprised of the following ten diagnostic signals:

Signal	Description
A1	PDC bus volts to earth magnitude
A2	NDC bus volts to earth magnitude
A3	J7A, J7B, J7C (125 V dc outputs) feedback multiplexed
A4	J1R, J1S, J1T (125 V dc outputs) feedback multiplexed
A5	AC1 feedback magnitude
B1	JAC1, JAC2, BATT1, and BATT2 feedback multiplexed
B2	28 V dc R feedback magnitude
B3	28 V dc S feedback magnitude
B4	28 V dc T feedback magnitude
B5	28 V dc R, S, T, P, S contacts multiplexed

There are no feedback signals provided for the three fused TBCI terminal board outputs (J8A, J8B, and J8C) since each TBCI terminal board has its own voltage monitoring circuit.

Feedbacks also include an electronic ID identifying the board type, revision, and serial number.

A P1 connector is not provided to feed JPDC diagnostic signals to another location.

A 50-pin ribbon cable connector (P2) is used to daisy chain the diagnostic signals from other distribution boards to JPDC. Up to four additional boards may be cabled into JPDC for PPDA I/O pack reception. In a JPDC-based PDM system, the PPDA I/O pack must be mounted on JPDC.

Three terminal boards (TB2, TB3, and TB4) are mounted end to end at the top of JPDC and permit access to the analog diagnostic feedback signals without the need for a PPDA I/O pack.

Diagnostic Circuits

Test rings TP1 and TP2 are connected to ACH and ACL respectively of the ac input line to allow monitoring ac bus voltage. Each has a 30.1 K buffer resistor in series. Test rings TP3 and TP4 are connected to positive and negative sides respectively of the 125 V dc bus. Each has a 30.1 K buffer resistor. Test ring TP5 is connected to the negative or return side of all three 28 V dc inputs. (No buffer resistor is provided). Test rings TP6, TP7, and TP8 are connected to 28PR, 28PS, and 28PT respectively. These are the positive lines of the three 28 V dc TMR power inputs. (No buffer resistors are provided).

Configuration

28 V dc TMR Configuration

- Separate power inputs are received through connectors JR, JS, and JT.
- The positive sides of the three inputs are connected to separate power buses, designated as 28PR, 28PS, and 28PT respectively. The return sides of the three inputs are connected together and designated as 28N.
- Output power is distributed from the three buses through separate R, S, and T output connectors.

28 V dc Simplex Configuration

- One, two, or three 28 V dc power inputs can be received through connectors JR, JS, and JT.
- The three power buses can be connected into a single bus by inserting jumpers between terminals 1, 2, and 3 of terminal board TB1.
- All output connectors are fed from the single 28 V dc bus.

125 V dc outputs to external 125 V dc/28 V dc power supplies

- Two options are provided for the selection of power outputs through connectors J1R, J1S, and J1T.
- For normal operation, a shorting plug is inserted in connector JDB. This configuration selects 125 V dc power from the entire P125 bus, which is fed by both battery inputs and the DACA input.
- A second mode of operation allows the user to replace the DACA supply with an ac/dc converter of lower power rating. In such a case the shorting plug should be moved to connector JDA. This configuration selects power for connectors J1R, J1S, and J1T from Battery A only and allows the lower-rated ac/dc converter to supply power only to the other 125 V dc outputs.



Never jumper connectors JDA and JDB at the same time.

Caution

Handling Precautions



Caution

To prevent component damage caused by static electricity, treat all boards with static sensitive handling techniques. Wear a wrist grounding strap when handling boards or components, but only after boards or components have been removed from potentially energized equipment and are at a normally grounded workstation.



Warning

This equipment contains a potential hazard of electric shock, burn, or death. Ensure that all Lockout/Tagout procedures are followed prior to replacing terminal boards. Only personnel who are adequately trained and thoroughly familiar with the equipment and the instructions should install, operate, or maintain this equipment.

Module Replacement

➤ To replace the module

1. Lockout and/or tagout all energy sources to the module.
 2. Check the voltage on each terminal to ensure no voltage is present.
 3. Note the orientation of the module and the location of any jumpered connections. Verify the label and unplug all connectors.
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Note Do NOT remove any jumpers, if applicable.

4. Unscrew and remove the board grounding wires.
5. Remove the hardware used to fasten the module to the cabinet.
6. Inspect the new module for shipping damage.
7. Install the new module into the cabinet in the same orientation as the old module.
8. Verify all jumpered connections on the new module, are the same as those jumpered on the old module.
9. Reconnect the board grounding wires.
10. Reconnect all wire and cable connectors.
11. Remove the Lockout and/or tagout and restore power to the module.
12. Test/verify that all switches, fuses, LEDs, and I/O packs function properly.