MILLSWOOD engineering

900W PDU

PRODUCT MANUAL

1 General Description

The Millswood Engineering 900W Power Distribution Unit converts unregulated battery voltage down to a set of regulated outputs suitable for distribution within small to medium-sized UAVs.

The 900W PDU provides three high-power outputs (Avionics, Servo and Payload), and one low-power output (+5V). The Avionics, Servo and low-power outputs are fully duplicated internally to maximise system reliability through redundancy.

The 900W PDU has dual battery inputs with automatic and glitch-free switchover between the two. An umbilical input ensures that batteries are not depleted during pre-flight checks prior to take-off.

Figure 1 – 900W PDU (IP67 enclosure)

2 Features

- Four independent power supply systems:
    - Avionics: 12 – 28V
    - Servo: 6 – 28V
    - Payload: 12 – 28V
    - Low-power: +5V
- Avionics, Servo and Payload outputs are user-configurable for voltage.
- Avionics, Servo and low-power outputs have 100% redundancy (i.e. the outputs are the result of combining two identical and independent power supplies, each of which is capable of supplying 100% of rated load).
- Two battery inputs. Battery voltage may range from 24 to 55 VDC. Supported battery types include:
    - LiPo: 10 – 12S
    - LiS: 15 – 20S
    - LiFe: 10 – 14S
- Umbilical input: 28 – 60 VDC.
- RS232 and CAN monitoring interfaces provide extensive reporting of voltages, currents and internal temperature.
- Available in either IP67 or slimline enclosure.
- Weight: TBD.
- Dimensions: TBD.

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3 Contents

4 Warnings

4.1 High-voltage

The PDU generates voltages up to a maximum of 28VDC, which is generally considered to be safe. However, the PDU can accept input voltages up to 60VDC which is considered to be potentially hazardous. Make sure that no part of your body (or anybody else's) can come into contact with the input voltages.

4.2 Output short-circuits

Short-circuiting an output to ground can result in large current flows. This is especially true of the Servo output because it is redundantly powered and can therefore deliver twice its rated current. Under optimal conditions the short-circuit current of the Servo output exceeds 50 Amps which is sufficient to vaporise wiring and perhaps even start a fire.

4.3 Bench testing output short-circuit current tolerance

Operating the PDU from a current-limited bench power supply whilst short-circuiting an output to ground can result in an unstable system, and may damage the PDU.

This occurs because the PDU draws increased current when an output is short-circuited to ground. If the bench power supply reaches its current limit it will reduce its output voltage and the PDU will shut down if the supply voltage falls below 24V. Once the PDU has shut down it draws very little current, and the bench power supply will attempt to restore its output voltage. In response, the PDU will attempt to start up again, causing the bench power supply to go back into current limiting. Rapid on/off cycling results, which is potentially destructive to the PDU and should not be allowed to occur.

4.4 Thermal management

No device is 100% efficient, and the 900W PDU is no exception. When delivering rated power from all outputs the PDU generates approximately 50W of heat. This heat must be dissipated into the environment in order to prevent excessive temperature rise within the PDU. The redundant pair of thermostatically-controlled fans are an essential part of this process. Make sure that the fans have adequate access to a source of environmental air, and are not recirculating the same hot air around the PDU.

5 Overview

The 900W PDU takes power from 3 possible sources and creates 4 regulated output rails as shown in Table 1 below:

Output	Redundancy	Voltage
Avionics	Yes	User-configurable
Servo	Yes	User-configurable
Payload	No	User-configurable
Low-power	Yes	Fixed at +5V

Table 1 – Outputs

The high-power outputs are tailored to suit the Avionics, Servo and Payload demands of unmanned aircraft, and are named accordingly. There is also a +5V output intended for low power devices. For enhanced reliability, the Avionics, Servo and +5V outputs are driven by redundant pairs of power supplies. The individual power supplies making up the redundant pairs can each deliver the full rated power of their associated output.

The Avionics, Servo and Payload outputs are all user-configurable for voltage. The Payload output can be shed (turned off) automatically when the batteries become depleted, if configured to do so.

The PDU draws power from whichever input has the highest voltage. This means that as long as one input meets the minimum input voltage requirements, all power supplies will be regulated to their correct output voltages.

The PDU includes 2 shutdown inputs: a Payload shutdown input and a Master shutdown input.

The PDU has RS232 and CAN communications interfaces which are used for firmware update, configuration, monitoring and control.

5.1 Internal architecture

The internal architecture of the PDU is shown in Figure 2 below. Only the main power pathways are shown. Diodes shown are not physical diodes; they are "ideal diodes" implemented with FET switches.

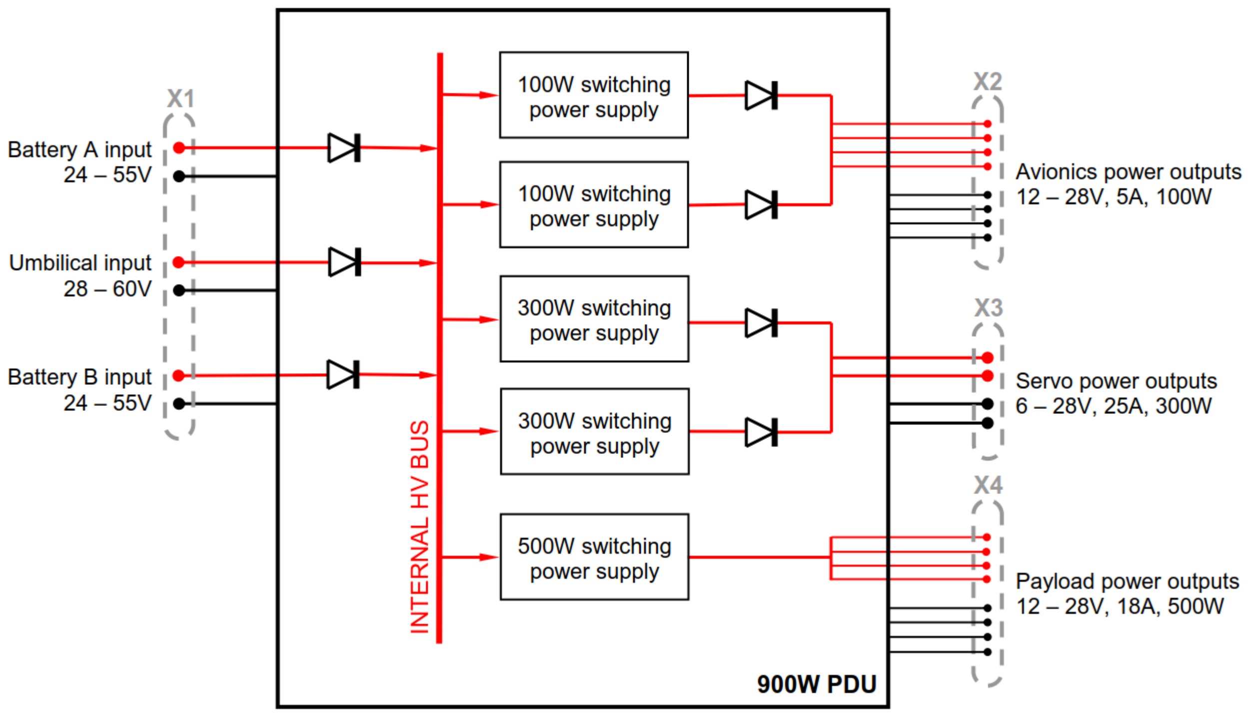


Figure 2 – 900W PDU internal architecture

5.2 Fault Tolerance

The 900W PDU is a fault tolerant device and is able to deliver flight-critical power in the presence of many internal and external faults. It achieves this through input power source redundancy, internal power supply redundancy, internal circuit compartmentalisation and robust I/O protection.

5.2.1 Microcontroller independent operation

Microcontrollers often represent a vulnerability to system reliability because of the risk of software bugs. With this in mind, the PDU has been compartmentalised such that failure of the microcontroller (due to hardware malfunction or software errors) does not affect any of the outputs. Thermostatic fan operation is accomplished by hardware and does not involve the microcontroller. The PDU will also power-up from cold and provide all power outputs without a functioning microcontroller.

The 900W PDU uses its microcontroller for firmware updates, configuration changes, monitoring, communications and miscellaneous features (load balancing, fan override and payload shedding). Only these functions are lost if the microcontroller is non-functional. The default state for the Payload output with a non-functional microcontroller is on (not shed).

5.2.2 Redundancy

The PDU has redundant battery inputs. Failure – even to a dead-short – of either battery has no effect on the continued normal operation of the PDU as long as at least one source of power remains connected to the PDU.

The PDU has internal redundancy of Avionics, Servo and +5V power supply systems. This means that internally there are 2 identical power supplies which have their outputs combined with either a physical or ideal diode. Each of the power supplies is able to supply the full rated load on its own. Changeover is instantaneous; there is no transient dropout should one of the power supplies fail.

5.2.3 Input protection

The Battery and Umbilical inputs are protected against:

- Reverse polarity, unlimited duration
- Transient overvoltage
- Short circuit to ground, unlimited duration

5.2.4 Output protection

The Avionics, Servo and Payload outputs are protected against:

- Short circuit to ground, unlimited duration
- Transient overvoltage

Output short-circuits to ground are current limited. An output short-circuit to ground does not affect other outputs, provided that the input power sources are able to meet the increased current demand.

5.3 Communications

The 900W PDU has both RS232 and CANbus interfaces that perform essentially the same functions, these being:

- Configuration (of settings stored in the PDU's non-volatile memory),
- Control (real-time control of the PDU's various features),
- Monitoring (of measured voltages, currents, temperatures, etc), and
- Updating the PDU's firmware (RS232 only).

Once the PDU has been configured, there is no requirement to connect anything to either communications interface – the PDU will operate quite normally with no communications at all.

5.3.1 RS232 interface

The RS232 interface operates at 57600 baud, full-duplex, with 8 data bits and no parity (57600 8N1). The RS232 hardware layer is compliant with TIA/EIA-232-F and ITU V.28.

A Windows application that provides easy access to most of the 900W PDU's various features may be downloaded from www.millswoodeng.com.au/downloads.html

Figure 3 – 900W PDU configuration utility

Using the configuration utility relieves the user from the burden of writing software in order to configure and control the PDU. The RS232 protocol is described in a separate document for the purpose of more tightly integrating the PDU with other hardware and software.

5.3.2 CAN interface

CAN offers faster and more reliable communication than is possible with RS232. The PDU's CAN interface operates at 1Mbit/s. It is not terminated internally.

The CAN protocol is described in a separate document for the purpose of more tightly integrating the PDU with other hardware and software.

6 Configuration Software

A Windows application is provided to configure the 900W PDU. This app can be downloaded from www.millswoodeng.com.au/downloads.html. To configure a PDU using this app requires a bidirectional RS232 connection between PC and PDU.

6.1 RS232 box

From the RS232 box at the bottom of the window, select the com (serial) port connected to the PDU and press the "Open" button.

The "Rescan" button searches the PC for all available com ports. Sometimes this is necessary for the app to register that an RS232 adapter has been plugged into the PC.

The "Update firmware" button allows the firmware in the PDU to be upgraded. This should be an infrequent occurrence.

6.2 Configure tab

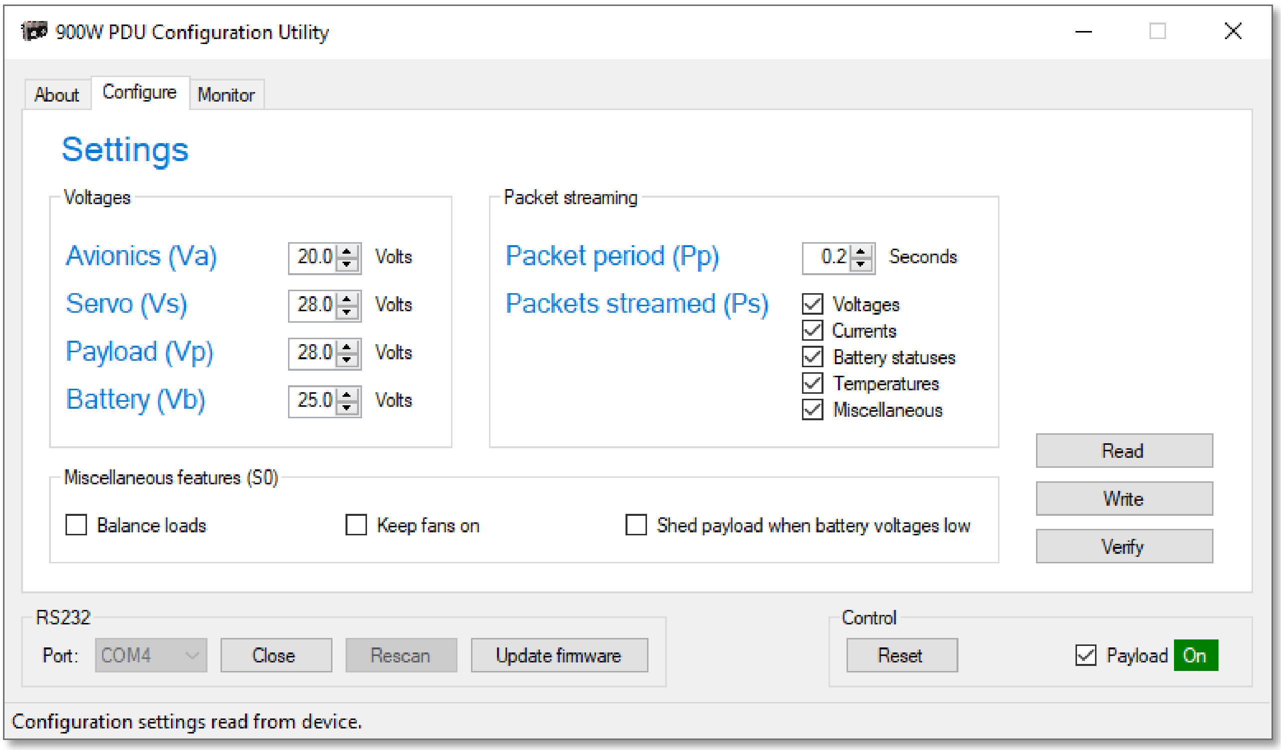


Figure 4 – Configure tab

Settings may be read from the PDU by pressing the "Read" button, written to the PDU by pressing the "Write" button, or the current PDU settings compared with the values displayed on-screen by pressing the "Verify" button.

Settings displayed on the "Configure" tab are stored in non-volatile memory in the PDU when the "Write" button is pressed. The endurance of the non-volatile memory in the PDU is greater than 100,000 writes, so changing the settings a few times is of no concern.

Note that changing the settings on-screen does not automatically write them to the PDU; the "Write" button must be pressed to do this.

6.2.1 Voltages

The Avionics, Servo and Payload output voltages are set here.

The Battery voltage should be set to the fully-charged, no-load terminal voltage of the battery (or batteries).

Note that if two batteries are used, they must have the same nominal voltage (although they may have different mAh capacities).

Note also that the Battery voltage setting does not change any actual voltages; it is there to tell the PDU what the nominal battery voltage will be. This information is used by the PDU to decide when to shed the Payload, if that feature is enabled.

6.2.2 Packet streaming

The Packet period determines how often telemetry data is sent via RS232 and CANbus. The Packets streamed determines what information is sent.

Note that the monitoring tab in this app requires that all packets are sent regularly in order to function correctly.

6.2.3 Miscellaneous features

6.2.3.1 Balance loads

This setting turns dynamic load balancing on and off for the Avionics and Servo outputs. Enabling balancing causes the PDU to dynamically adjust the output voltages of these converters so that output currents (and therefore powers) are shared more equally between the redundant pairs of converters that drive these outputs.

Balancing spreads the heat generation within the PDU more evenly, reducing the maximum temperatures reached and improving long-term reliability.

The avionics outputs are balanced to within 0.5 Amps; the servo outputs are balanced to within 1 Amp.

6.2.3.2 Keep fans on

If enabled, this setting forces the fans to remain on at all times. If disabled, fans operate thermostatically, only turning on when the internal temperature exceeds +63°C, and turning off when the internal temperature falls below +53°C.

Note that there are multiple temperature sensors within the PDU, and the fans operate from different sensors to the one used to generate telemetry data. The reported temperature will not align precisely with the observed thermostatic fan behaviour.

6.2.3.3 Shed payload when battery voltages low

This setting allows the payload output to be controlled by the battery voltage. If the lowest battery voltage present is less than the configured battery voltage minus 6.25% (the shedding threshold), then the payload output is shed (turned off). There is hysteresis of 2V, so the payload is turned back on when the lowest battery voltage rises to 2V above the shedding threshold.

Obviously it is important to have the battery voltage set correctly when using this feature.

6.3 Monitor tab

The Monitor tab displays all of the telemetry data sent by the PDU.

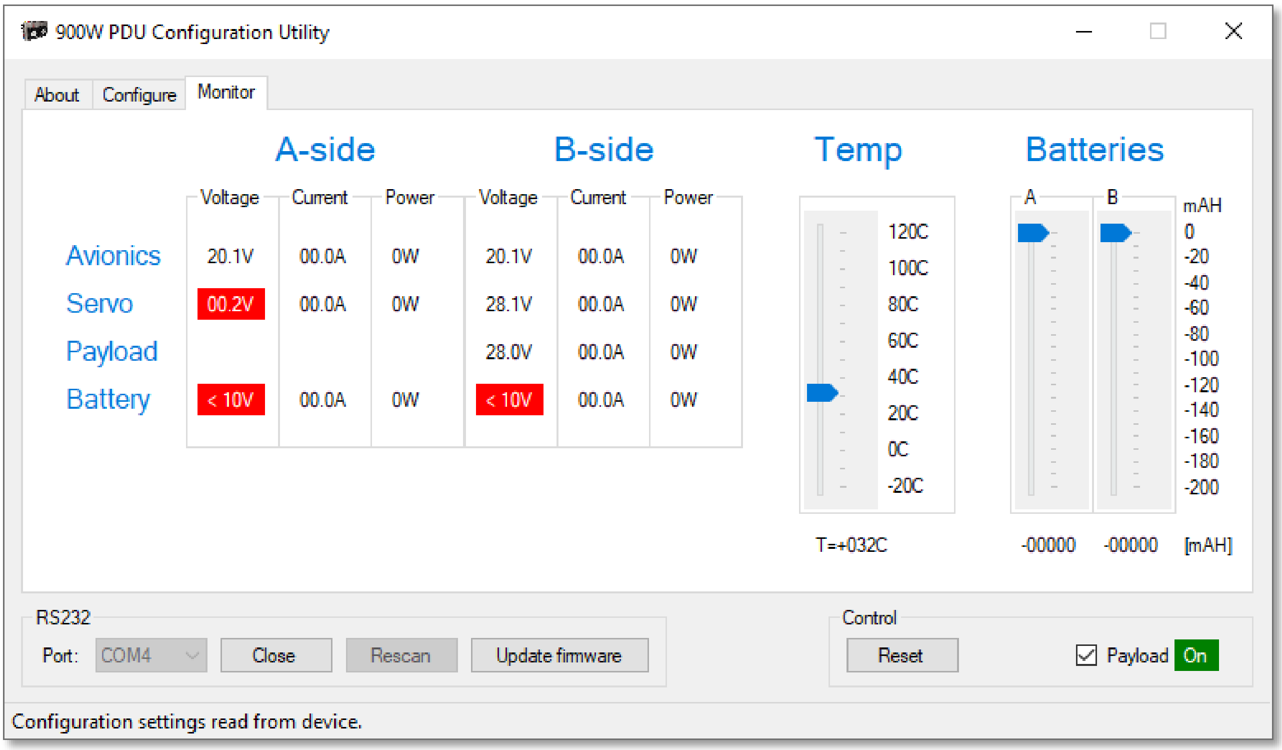


Figure 5 – Monitor tab

Note that powers are derived values calculated by the app; they are not sent in the telemetry data streams.

Note also that the payload output is not redundantly powered, and so there is no "A-side" data for this output.

Measured (and derived) values that lie outside of normal operating limits are highlighted in red.

6.4 Control box

Pressing the "Reset" button restarts the firmware in the PDU. The PDU's firmware version and unique serial number are then reported by the PDU and displayed in the status bar at the bottom of the window. The accumulated battery energies (mAh consumed) are also reset to zero.

The payload output can be turned on and off by clicking in the checkbox to the left of the word "Payload". The status of the payload output is shown on the right: this may be On (highlighted in green), Shed (highlighted in red), or Off (not highlighted).

7 Connections listed by Function

7.1 Power inputs

The PDU has 3 power inputs: Battery A, Battery B and Umbilical power. Internal low-loss switching is implemented such that disconnection or failure of a power source – even to a dead short – has no effect on the operation of the PDU as long as at least one power source to the PDU is present. All power inputs are transient and reverse polarity protected.

Pin location on Variant A	Pin location on Variant C	Name	Type	Description
	X2:C	Battery B +	Input	Connect to positive terminal of Battery B. See Table 3 for recommended battery types. A second battery is optional.
	X2:D	Battery B –	Ground	Connect to negative terminal of Battery B.
	X2:E	Umbilical +	Input	Connect to an external source of DC power. The Umbilical power input is intended for powering the PDU externally when the aircraft is on the ground. The umbilical input voltage must be equal to or greater than the battery voltage in order for umbilical power to be used in preference to the batteries. A ground cart supplying umbilical power from four series-connected 12V lead-acid batteries will meet this requirement, provided that one of the recommended battery types is used. Rated input voltage is 28 to 60VDC.
	X2:F	Umbilical –	Ground	Ground connection for Umbilical power input.
	X2:G	Battery A +	Input	Connect to positive terminal of Battery A. See Table 3 for recommended battery types.
	X2:H	Battery A –	Ground	Connect to negative terminal of Battery A.

Table 2 – Power inputs

7.1.1 Recommended battery types

The following battery types are recommended:

Battery type	Fully-charged no-load terminal voltage
LiPo: **10S – 12S**	42.0V – 50.4V
LiS: **15S – 20S**	37.5V – 50.0V
LiFe: **10S – 14S**	36.0V – 50.4V

Table 3 – Recommended battery types

If two batteries are fitted they should have the same terminal voltage, although they may be of different types and have different mAH capacities.

It is possible to use other types of batteries as long as the following guidelines are observed:

The battery voltage must be greater than the maximum output voltage by at least 4 volts. This must remain the case even when the batteries are under load and partially depleted. For example, a partially depleted LiPo under load may only produce 3.7V per cell – less if the battery is old or unbalanced. Therefore an 8S LiPo cannot be relied upon to produce more than 29.6V, which does not give it the required 4V headroom if the maximum possible output voltage of 28V is used. This is why 8S LiPo does not appear in Table 3 above.

However, if the maximum output voltage is less than 28V – say 24V – then 8S LiPo becomes a possibility, as the 4V headroom requirement is fulfilled.

The battery voltage must always be greater than 24V. This must remain the case even when the batteries are under load and partially depleted. Below 24V the switching converters in the PDU are not guaranteed to remain operational.

Batteries with fully-charged no-load terminal voltages up to 55V are permitted, but high battery voltages make it difficult to provide a suitable umbilical supply. The reason for this is that the umbilical voltage must lie between the battery voltage and 60V, and this range becomes smaller as the battery voltage increases. For example, a 12S LiPo has a fully-charged no-load terminal voltage of 50.4V, and so the umbilical voltage must be somewhere in the range 50.4 to 60V. Higher battery voltages make this a progressively more challenging requirement to meet.

7.2 Power outputs

The PDU has 4 power outputs: Avionics, Servo, Payload and +5VDC. The Avionics, Servo and +5VDC outputs are redundantly powered. The Avionics, Servo and Payload outputs are user-configurable for voltage.

Pin location on Variant A	Pin location on Variant C	Name	Type	Description
	X2:A	Servo +	Output	Redundantly-powered output intended to supply an unmanned aircraft's servo bus. Voltage is user-configurable from 6 to 28VDC in 0.1V steps. Rated current is 25 Amps continuous; rated power is 300 Watts continuous.
	X2:B	Servo –	Ground	Ground connection for servo power output.
	X3:4, 14	+5VDC	Output	Redundantly-powered output intended to supply systems that require small amounts of power at +5VDC. Rated current is 0.5 Amps continuous; rated power is 2.5 Watts continuous.
	X3:6, 7, 8, 9, 10	Avionics +	Output	Redundantly-powered output intended to supply an unmanned aircraft's mission-critical flight systems such as autopilot, ECU (Engine Control Unit), etc. Voltage is user-configurable from 12 to 28VDC in 0.1V steps. Rated current is 5 Amps continuous; rated power is 100 Watts continuous.
	X3:16, 17, 18, 19, 20	Avionics –	Ground	Ground connection for avionics power output.
	X7:A, C	Payload +	Output	High-power output intended to supply an unmanned aircraft's non mission-critical payload systems. This output is not redundantly powered. Can be turned on and off via remote command or hardware signal. Voltage is user-configurable from 12 to 28VDC in 0.1V steps. Rated current is 18 Amps continuous; rated power is 500 Watts continuous.
	X7:B, D	Payload -	Ground	Ground connection for payload power output.

Table 4 – Power outputs

7.3 Communications interfaces

The PDU has 2 communications interfaces: RS232 and CAN.

Pin location on Variant A	Pin location on Variant C	Name	Type	Description
	X3:1	CANH	I/O	High-side connection for CAN interface. Unterminated. Maximum bus length is 10m; maximum stub length is 30cm. The CAN protocol is described in separate document.
	X3:11	CANL	I/O	Low-side connection for CAN interface.
	X3:3	RS232 Rx	Input	Receive input for RS232 interface. Uses true RS232 voltage levels (not logic level). The RS232 protocol is described in separate document.
	X3:13	RS232 Tx	Output	Transmit output for RS232 interface.
	X3:2, 12	Ground	Ground	Ground reference for CAN and RS232.

Table 5 – Communications interfaces

7.4 Shutdown inputs

The PDU has 2 shutdown inputs: Payload shutdown and Master shutdown.

Pin location on Variant A	Pin location on Variant C	Name	Type	Description
	X7:2	Payload shutdown	Input	When shorted to ground this input turns the payload off. This input overrides software control. Leave unconnected if functionality not required.
	X7:4	Ground	Ground	Ground reference for payload shutdown input.
	X3:5	Master shutdown	Input	When shorted to ground this input places the PDU in a minimum power consumption state. All power supplies are turned off, and all monitoring and communications ceases. Leave unconnected if functionality not required.
	X3:15	Ground	Ground	Ground reference for master shutdown input.

Table 6 – Shutdown inputs

8 Connections listed by Physical Location

8.1 Variant A

8.2 Variant C

9 Visual Indicators

10 Mating Connectors and Wiring Harnesses

The 900W PDU is available in two enclosure styles to suit different operating environments. Variant A is designed for harsh environments and has an IP67 rated enclosure with Lemo M series (circular) connectors. Variant C is designed to have minimum size and weight and uses Harwin M80 series (rectangular) connectors. There is currently no Variant B.

A suitable set of wiring harnesses is supplied with each PDU. Information in the following sections is for reference.

10.1 Variant A

10.1.1 Mating connectors

X connectors are required to interface with the PDU as listed in Table 7 below. The connectors specified are from the Lemo M series. Connectors are available ex-stock from the major online distributors.

Connector	Picture	Details
X1		
X3		
X4, X5, X6		
X7		
X8		

Table 7 – Variant A mating connectors

10.1.2 Wiring harnesses

Harness	Picture	Details
X1		
X3		
X4, X5, X6		
X7		
X8		

Table 8 – Variant A wiring harnesses

10.2 Variant C

10.2.1 Mating connectors

Three connectors are required to interface with the PDU, one of each type listed in Table 9 below. The connectors specified are from the Harwin M80 Datamate series. Connectors are available ex-stock from the major online distributors.

Connector	Picture	Details
X2		Harwin part number: M80-4000000F1-08-325-00-000 Available from: Mouser (PN: 855-M80-40000F108325) Digi-Key (PN: 952-1649-ND) element14 (PN: 1895197)
X3		Harwin part numbers: M80-4XY20ZZ where X is 6 or 8, Y is 0, 1, 5 or 6, and ZZ is 05 or 42 Available from: Mouser (multiple part numbers) Digi-Key (multiple part numbers) element14 (multiple part numbers)
X7		Harwin part number: M80-4C10405F1-04-325-00-000 Available from: Mouser (PN: 855-M804C10405F14325) Digi-Key (PN: 952-1258-ND) element14 (PN: 2853704)

Table 9 – Variant C mating connectors

10.2.2 Wiring harnesses

Fully-assembled wiring harnesses are available ex-stock from the major online distributors for 2 of the 3 connectors used in the PDU.

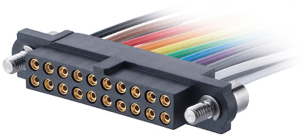
Harness	Picture	Details
X2		Harwin part number: M80-FC22068F2-0150L Available from: Mouser (PN: 855-M80FC325F108150L) Avnet (PN: M80-FC325F1-08-0150L) element14 (PN: 3225844)
X3		Harwin part number: M80-FC325F1-08-0150L Available from: Mouser (PN: 855-M80FC22068F2150L) Digi-Key (PN: M80-FC22068F2-0150L) element14 (PN: 3225805)

Table 10 – Variant C wiring harnesses

11 Specifications

11.1 Absolute Maximum Ratings Note 1

Symbol	Parameter	Min	Max	Unit
V_{BAT}, V_{UMB}	Battery and Umbilical input voltage **Note 2**	-55	+66	V_{DC}
V_{AVI}, V_{SER}, V_{PAY}	Avionics, Servo and Payload output voltage **Note 3**	-1	+33	V_{DC}
V_{LP}	Low-power output voltage **Note 3**	-0.5	+5.5	V_{DC}
V_{RS232_I}	RS232 input voltage	-25	+25	V_{DC}
V_{RS232_O}	RS232 output voltage	-13.2	+13.2	V_{DC}
V_{CAN_L}, V_{CAN_H}	CAN L and H voltage	-42	+42	V_{DC}
V_{SHDN}	Master and Payload shutdown input voltage	-0.5	+30	V_{DC}
T_{INT}	Internal temperature	-55	+105	°C

Table 11 – Absolute Maximum Ratings

Note 1: Absolute maximum ratings are those values beyond which damage to the product may occur. Functional operation under these conditions is not implied (or recommended).

Note 2: Pin protected from overvoltage by a Transient Voltage Suppressor (TVS) diode. Excursions above absolute maximum rating will be clamped, resulting in large current flows.

Note 3: Pin protected from reverse and overvoltage by a TVS / Zener diode. Excursions beyond absolute maximum ratings will be clamped, resulting in large current flows.

11.2 Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{UMB}	Umbilical input voltage	28	60	V_{DC}
V_{BAT}	Battery input voltage	24	55	V_{DC}
T_{INT}	Internal temperature	-40	+85	°C
Alt	Altitude	0	10,000	m_{AMSL}

Table 12 – Recommended Operating Conditions

11.3 Electrical Specifications (T_{INT} -40 to +85°C, typical values given for T_{INT} = +25°C)

11.3.1 Power outputs

	Min	Typ	Max	Unit
Avionics output				
Voltage range	12.0		28.0	V_{DC}
Voltage setting accuracy		±0.1	±0.2	V_{DC}
Continuous output current capability Note 1	5			A_{DC}
Continuous output power			100	W
Dropout voltage			4	V
Load regulation			TBD	mV
Ripple and noise Note 4		TBD	TBD	mV_{PP}
Servo output				
Voltage range	6.0		28.0	V_{DC}
Voltage setting accuracy		±0.1	±0.2	V_{DC}
Continuous output current capability Note 2	25			A_{DC}
Continuous output power			300	W
Dropout voltage			4	V
Load regulation			TBD	mV
Ripple and noise Note 4		TBD	TBD	mV_{PP}
Payload output				
Voltage range	12.0		28.0	V_{DC}
Voltage setting accuracy		±0.1	±0.2	V_{DC}
Continuous output current capability	18			A_{DC}
Continuous output power			500	W
Dropout voltage			4	V
Load regulation			TBD	mV
Ripple and noise Note 4		TBD	TBD	mV_{PP}
Low-power output				
Voltage	4.8	5.0	5.2	V_{DC}
Continuous output current capability	0.5			A_{DC}
Continuous output power			2.5	W
Load regulation			TBD	mV
Ripple and noise Note 4		TBD	TBD	mV_{PP}
All outputs				
Total continuous output power			900	W

Table 13 – Power outputs

Note 1: Derate current linearly above 20V to observe continuous output power specification.
Note 2: Derate current linearly above 12V to observe continuous output power specification.
Note 3: Maximum of 10 seconds per minute.
Note 4: 20MHz bandwidth, maximum continuous rated current / power.

Current capability specifications give the minimum current that an output is guaranteed to be able to deliver.

11.3.2 Quiescent characteristics

	Min	Typ	Max	Unit
Quiescent battery current (master shutdown)		20	30	mA
Quiescent battery current (payload shutdown)				
V_{BAT} = 24V, V_A=12V, V_S=6V		TBD	TBD	mA
V_{BAT} = 37V, V_A=20V, V_S=12V		TBD	TBD	mA
V_{BAT} = 50V, V_A=28V, V_S=28V		TBD	TBD	mA
Quiescent battery current (all outputs on)				
V_{BAT} = 24V, V_A=12V, V_S=6V, V_P = 12V		TBD	TBD	mA
V_{BAT} = 37V, V_A=20V, V_S=12V, V_P = 20V		TBD	TBD	mA
V_{BAT} = 50V, V_A=28V, V_S=28V, V_P = 28V		TBD	TBD	mA

Table 14 – Quiescent characteristics

Quiescent current characterisations performed with one battery connected, fans off.
*See **Error! Reference source not found.** for detailed characterisation.*

11.3.3 Communications interfaces

	Min	Typ	Max	Unit
CAN				
Baud rate		1.0000		Mb/S
Baud rate stability	-50		+50	ppm
Bus length			10	m
Stub length			30	cm
RS232				
Baud rate		57.6		kb/S

Table 15 – Communications interfaces

11.3.4 Digital inputs

	Min	Typ	Max	Unit
Shutdown inputs				
Resistance to ground to shut down			TBD	kΩ
Resistance to ground to power up	TBD			kΩ

Table 16 – Digital inputs

11.3.5 Monitoring

	Min	Typ	Max	Unit
Voltage				
Accuracy		±0.1	±0.2	V_{DC}
Current				
Accuracy		±0.1	±0.2	A_{DC}
Temperature				
Accuracy		±5	±10	°C

Table 17 – Monitoring

11.4 Typical Characteristics (+25°C)

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11.5 Mechanical Characteristics

11.5.1 Mounting

The underside of the enclosure has 9 x M3 tapped holes for mounting the PDU to a flat surface. A template for drilling holes into the mounting surface is given in Figure 6 below:

Figure 6 – Mounting hole locations

Be careful not to distort the enclosure by mounting to a warped surface. Mounting screws should project no more than 7.0mm into the enclosure.

12 Documentation change log