



BOOSTER CONTROL AND POWER DISTRIBUTION UNIT (BCPDU)

Line Replaceable Unit

The Booster Control and Power Distribution Unit (BCPDU) is the primary link between the solid rocket booster (SRB) and the core stage on the vehicle, providing thrust vector control and primary power distribution to multiple avionics throughout the system. The BCPDU is a line replaceable unit that was designed for use on NASA's space launch system vehicle. The BCPDU features a 1553 bus controller for command distribution to remote terminal units in the system and features a 1553 remote terminal interface for command receipt and telemetry responses. The unit includes a user programmable telemetry stream for startup, continuous and commanded built-in tests providing health and status and ensuring fault tolerance. High-precision pressure transducer excitation and signal conditioning measure solid rocket motor operational pressures to validate SRB performance. The BCPDU uses a common chassis with common modules including data acquisition, power supply and digital controller which provide the backbone for additional functionality.



LINE REPLACEABLE UNIT

Discrete Excitations & Inputs

28 V Excitations (Qty 3)	Output voltage: 21.0-to-32.0 VDC; rated current 160 μ A
28 V Discrete Inputs (Qty 4)	Input impedance: 225 k Ω \pm 10%; high-level input voltage: 18.0-to-34.0 VDC; low-level input voltage: -1.0 to +5.0 VDC
5 V Excitations (Qty 1)	Output voltage: 4.2-to-5.5 VDC; rated current: 15 mA
5 V Discrete Inputs (Qty 16)	Input impedance: 200 k Ω \pm 5%; high-level input voltage: 3.0-to-5.5 VDC; low-level input voltage: -1.0 to +0.75 VDC

Discrete Outputs

Quantity	7
Output Voltage	24.2-to-32.0 V
Rated Current	10 mA

Pressure Transducer Interface

Transducer Excitation (Qty 1)	Output voltage: 10.0 \pm 0.05 VDC; rated current: 10 mA Test leads available for transducer calibration
Measurement Input (Qty 1)	Input voltage range: -0.4 to +37.5 mVDC; input impedance: > 10 M Ω anti-aliasing filter: -20 dB @ 169 Hz \pm 3.6% Test leads available for transducer calibration

Power/Construction

Input Power	100 W primary power (all outputs active at rated loads) 50 W standby
Operating Voltage	26.1-to-36.0 VDC
Weight	45 lb max
Size	12.0" W x 15.2" L x 8.3" H
Connectors	MIL-C-38999, series III
Non-Operating Temperature	-54 $^{\circ}$ C to +76 $^{\circ}$ C
Operating Temperature	-54 $^{\circ}$ C to +71 $^{\circ}$ C (qual)
Humidity	Up to 100% relative humidity
Pressure	15.26 psia to 0.034 Torr
Pyrotechnic Shock	3,750 Gs @ 4 kHz-to-10 kHz
Random Vibration	13.7 grams

Thrust Vector Control

Current Outputs (Qty 2)	Output voltage: \pm 45 mADC; load range: 100-to-200 Ω
Transducer Excitations (Qty 2)	Output voltage: 26 Vrms \pm 2.3%; frequency: 1,000 \pm 50 Hz
Measurement Inputs (Qty 2)	Input voltage range: 0.00-to-7.155 Vrms; input impedance: 50 Ω k \pm 10%; anti-aliasing filter: -3 dB @ 11 kHz \pm 20%
Valve Driver Outputs (Qty 2)	Output voltage: 22.3-to-32.0 VDC; load range: 62-to-112 Ω
External 24.0-to-32.0 VDC supply required	

KEY FEATURES

- > Designed for highly reliable, fault-tolerant, human-rated launch vehicles
- > Features a 1553 bus controller for command distribution to remote terminal units
- > Allows 1553 remote terminal interface for command receipt and telemetry responses
- > User programmable telemetry stream for health and status and fault tolerance
- > Built-in measurements to validate SRB performance
- > Direct battery interface eliminates need for separate acquisition unit
- > Modular design provides backbone for additional functionality and customization to support a variety of avionics

POWER DISTRIBUTION AND VALVE DRIVER INTERFACE

The modular design of the BCPDU provides multiple output current levels with current and voltage limits rated to match the power consumption needs of a variety of avionics. The switchable power outputs can be individually commanded on/off or automatically configured for delayed operation. The BCPDU interfaces directly with the battery to provide temperature telemetry with excitation and signal conditioning, eliminating the need for a separate data acquisition unit. Multiple valve driver outputs are activated via command or during a sensed fault condition providing fault tolerance in the system.

UNIT

Primary Power Distribution

Rated Current	Voltage Limit	Quantity
10.0 ADC	None	1
2.4 ADC	None	3
3.0 ADC	35 VDC	2 35 V, 3.0 A outputs cannot be active simultaneously
1.2 ADC	32 VDC	2 One 32 V, 1.2 A output is always active

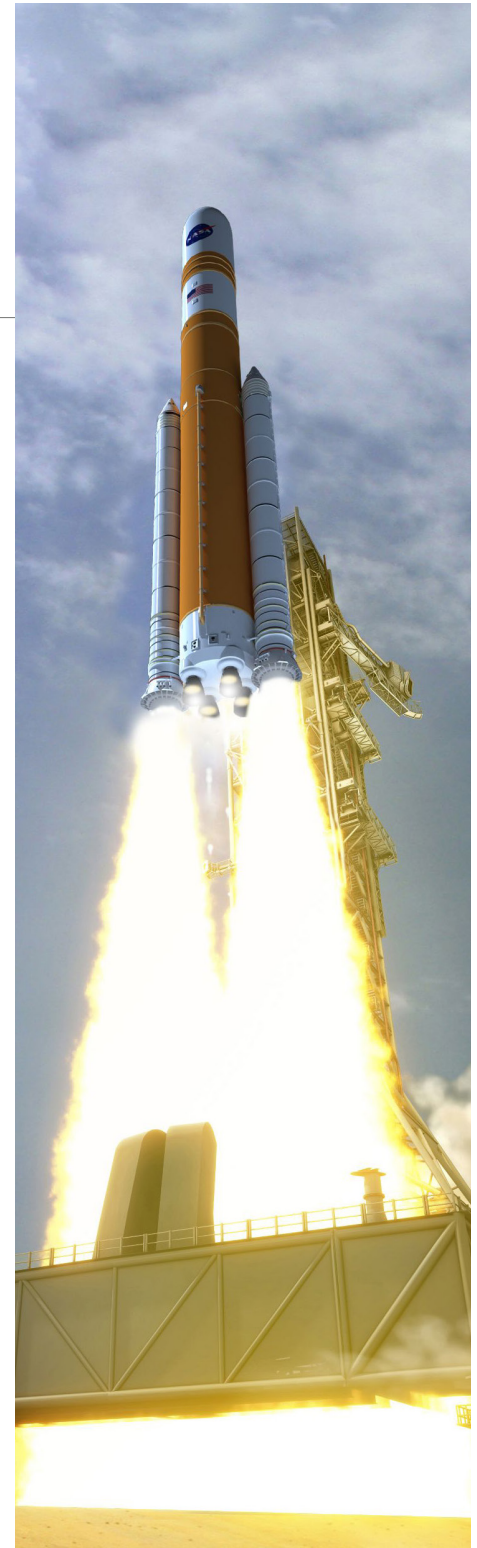
Analog Input Interface

Voltage	Impedance	Anti-aliasing filter
0.0-to-40.0 VDC	483.1 k Ω \pm 5%	-3 dB @ 200 \pm 100 Hz
0.0-to-50.0 mVDC	475 k Ω \pm 5%	-3 dB @ 200 \pm 100 Hz
0.0-to-5.0 VDC	600 k Ω \pm 5%	-3 dB @ 200 \pm 100 Hz

Quantity 1 of each of the input types listed above.

THRUST VECTOR CONTROL (TVC)

The BCPDU provides modular TVC outputs for use with rock and tilt actuators. The interfaces include fault detection, isolation and recovery functionality to ensure reliable and fault-tolerant system operation. Linear variable differential transducer sensor excitation and signal conditioning provide feedback measurements for incorporation into TVC control loop.



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