



# DATA ACQUISITION CONTROL UNIT (DACU)

## Line Replaceable Unit

The Data Acquisition Control Unit (DACU) is a fully programmable, line replaceable unit that offers a scalable architecture, providing an interface to a large variety of analog sensors and digital data sources. The DACU is currently designed for distributed data acquisition on NASA's high-reliability, man-rated Space Launch System.

	DIFFERENTIAL 5 V INPUTS	RTD INPUTS	HIGH-FREQUENCY VOLTAGE INPUT 2 KHZ
<b>Analog Sensor Inputs</b>			
Channel Count	32 channels	64 channels (1 internal)	7 channels
Input Range	0.0 V-to-5.5 V	0.0 V-to-12.0 V	0.0 V-to-5.0 V
Spans	32 programmable spans 10 mV-to-5,000 mV	32 programmable spans 72 mV-to-12,000 mV	8 programmable spans 300 mV-to-5,000 mV
Excitation Source	N/A	2 mA constant current	N/A
Offset	Spans ≤ 15 mV programmable ± 20 mV in ≤ 20 µV steps Spans > 15 mV, ≤ 150mV programmable ± 50 mV in ≤ 20 µV steps Spans > 150 mV programmable ± 5V in ≤ 1 mV steps	Spans ≤ 100 mV programmable ± 325 mV in ≤ 100 µV steps Spans > 100 mV programmable ± 10 V in ≤ 1 mV steps	Programmable -10.0 V to +10.0 V in 312.5 µV steps
Accuracy	≥ 2,250 mV ± 0.4% + ½ LSB 750 mV to 2,000 mV ± 0.8% + ½ LSB 50 mV-to-500 mV ± 0.8% + ½ LSB 30 mV-to-40 mV ± 2.0% + ½ LSB < 30 mV ± 3.0% + ½ LSB	≥ 200 mV ± 0.8% + ½ LSB 72 mV-to-100 mV + ½ LSB	≥ 1,000 mV ± 1.6% + ½ LSB 300 mV-to-500 mV ± 2.0% + ½ LSB
Resolution	12 bits	12 bits	8 bits
Sample Rate	50 sps per input	Programmable 1, 2, 5, 10 sps per input	5 ksps per input
Filtering	N/A	N/A	6-pole Butterworth, ± 0.5 dB in passband, -5 dB @ 2.6 kHz
Input Impedance	> 5 Meg Ω sampling > 10 Meg Ω Non-sampling > 30 kΩ powered off	N/A	N/A
CMRR	72 dB min @ 10 VDC and 55 dB min @ 1 kHz	N/A	N/A
Source Impedance	1,200 Ω, 3,000 pF line-to-line	N/A	N/A
Source Capacitance	N/A	N/A	≤ 1,000 pF



### KEY FEATURES

- > Fully programmable and scalable architecture supports distributed data acquisition of a wide range of sensors
- > Designed for highly reliable human-rated launch vehicles
- > Provides configuration for over 100 sensor inputs and excitation
- > Configurable telemetry tables allow sensor selection and sampling rates for efficient use of bandwidth
- > RS-422 compatible interface
- > Customization of telemetry for each mission phase including direct-to-ground or through Tracking and Data Relay Satellite System (TDRSS)

## PROGRAMMABLE AND SCALABLE ARCHITECTURE

- > Four data acquisition sub-assemblies within the DACU provide over 100 sensor inputs including charge accelerometer, voltage accelerometer, pressure, resistance temperature detector (RTD) as well as generic telemetry inputs. Programmable gain and offset combinations for each individual channel allow for custom views of telemetry on a per-channel basis. The unit also provides 122 sensor excitation outputs including 28 V, precision 10 V and constant current RTD.
- > The DACU allows for efficient use of telemetry bandwidth through multiple user-configurable telemetry tables which allow selection of sensor quantity and sampling rate for each sensor. This allows telemetry configuration specific to each location on the vehicle, easy modifications per evolving mission needs and offers customization of telemetry for each mission phase such as direct-to-ground or through TDRSS.
- > Four common data acquisition sub-assemblies within the DACU allow the unit to be scaled as necessary. The DACU offers full-duplex, high-level data link control (HDLC) RS-422 interface for commanding and telemetry, four times full-duplex HDLC RS-422 secondary data for telemetry requests and four times RS-422 amplifiers to ensure data integrity for longer cable runs.

	HIGH-FREQUENCY VOLTAGE INPUT 4 KHZ	HIGH-FREQUENCY CHARGE INPUT	LOW-FREQUENCY INPUTS
<b>Analog Sensor Inputs (Contd.)</b>			
Channel Count	5 channels	2 channels	12 channels
Input Range	0.0 V-to-5.0 V	±870 pC-to-±8,700 pC (±2,175 pC nom) ±2,900 pC-to-±29,000 (±7,250 pC nom)	4.0 V (±2.0 V differential)
Spans	8 programmable spans 300 mV-to-5,000 mV	0.4 x nominal-to-4.0 x nominal	15 programmable spans
Analog Gain	1, 1.25, 1.5, 2, 4	N/A	N/A
Digital Gain	1, 2, 4	N/A	N/A
Offset	Programmable -10.0 V to +10.0 V in 312.5 µV steps	N/A	Programmable -10.0 V to +10.0 V in 312.5 µV steps
Accuracy	≥ 1,000 mV ± 1.6% + ½ LSB 300 mV-to-500 mV ± 2.0% + ½ LSB	≥ Nominal range ± 1.6% + ½ LSB 0.4 x nom ± 2.0% + ½ LSB	Total gain ≤ 2: ± 0.8% + 2 LSB Total gain > 2, ≤ 3: ± 1.2% + 3 LSB total gain > 3, ≤ 8: ± 1.6% + 4 LSB Total gain ≥ 16: ± 2.0% + 5 LSB
Resolution	8 bits	8 bits	12 bits
Sample Rate	10 ksps per input	5 ksps per input	2,500 sps per input
Filtering	6-pole Butterworth, ± 0.5 dB in passband, -5 dB @ 5.2 kHz	8-pole Butterworth ± 0.5 dB in passband, -5 dB @ 2.6 kHz	Analog: 3-pole Butterworth, -3 dB @ 250 Hz Digital: N = 100 FIR, 10:1 decimation, -3 dB @ ≤ 135 Hz
Input Impedance	N/A	N/A	> 10 Meg Ω DC > 10 k Ω AC > 10 k Ω powered off
CMRR	N/A	N/A	60 dB min @ 13 VDC and 55 dB min @ 1 kHz
Source Impedance	N/A	N/A	0 < Z ≤ 500 Ω
Source Capacitance	≤ 1,000 pF	≤ 8,000 pF	N/A
Over-Voltage Protection	N/A	N/A	± 36 V

	+28 VDC EXCITATIONS	+10 VDC EXCITATIONS
Excitation Count	36 excitation outputs	36 excitation outputs
Accuracy	± 4.0 V	± 10 mV
Current	30 mA per output (current limited)	15 mA per output (foldback limited)
Groups	3 excitations per group	4 or 5 excitations per group
Isolation	> 1 Meg Ω from primary	> 1 Meg Ω from primary

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1025 W. NASA Boulevard  
Melbourne, FL 32919  
t 800 852 5105 | f 513 573 6290  
SpaceSales.cin@L3Harris.com