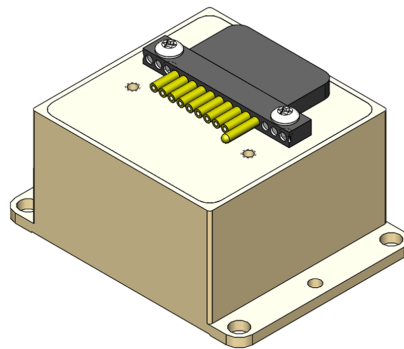




GLADIATOR

TECHNOLOGIES

A300D-40-100 Technical Summary



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Overview

The A300D accel is an ultra low noise three axis MEMS accelerometer with high dynamic range sensors. Each accel is factory calibrated over temperature and conditioned to repeatably perform over demanding environments.

The accel is enabled with VELOX[®] high speed processing, a Gladiator Technologies proprietary technology for rapid sampling. VELOX[®] technology is the driver for increased data outputs, increased filtering options and extremely low latency.

1 Sensor Performance¹

1.1 Accelerometers

Specification	Value	Unit	Variance
Sensor Range	± 40	g	N/A
VRW	0.058	$\text{mg}/\sqrt{\text{Hz}}$	1σ
	0.024	$\text{m/s}/\sqrt{\text{hr}}$	
Bias Stability	0.015	mg	
Bias Over Temperature	0.5	mg	
Scale Factor Error	0.02	%	
Alignment	0.5	mrad	
Vibration Rectification Coefficient	250	$\mu\text{g}/g_{\text{rms}}^2$	
Maximum Bandwidth	800	Hz	N/A

¹Specification values assume a nominal 25°C unless otherwise stated.

1.2 Environmental

Specification	Value
Shock	1000 g 1/2 sine 1/2 ms powered
Vibration	10 g_{rms} (50 Hz to 2 kHz)
Operating Temperature ²	-50°C to +85°
Calibrated Temperature	-50°C to +85°
Non-Operating Temperature ³	-55°C to +105°
MTBF ⁴	TBD hrs

²Accel is rated electronically for this temperature range.

³Accel is related mechanically for this temperature range.

⁴Per MIL-STD-217F, Notice 2 and ANSI/VITA 51.1-2008 with environment: ACI at 55°C ambient.

2 Mechanical

2.1 General Specifications

Specification	Value	Tolerance	Unit
Mass	19.25	± 0.5	grams
Imperial Dimensions (W x L x H) ⁵	1.0 x 1.0 x 0.6	± 0.01	in
Metric Dimensions (W x L x H) ⁵	2.54 x 2.54 x 1.52	± 0.03	cm
Mounting	4ea. No.2-56 Screws	N/A	-

2.2 Part Label



Figure 1: Example A300D-40-100 part label with axis definitions, serial number, and manufacturing date code.

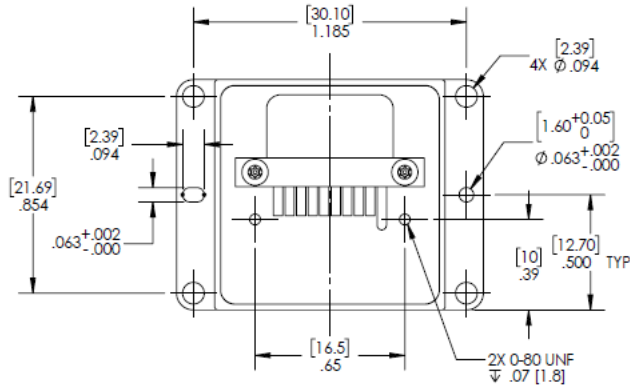
⁵The mounting flange adds an additional 0.33 in (0.84 cm) of total width to the package. Flange height is 0.050 in (0.127 cm) and runs the entire length of the package.

2.3 ESD Protection

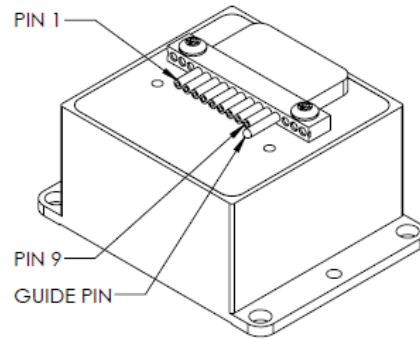
Pin No.	Assignment	ESD Limit	Current Limit
1	RS-422/485 A (+)	± 15 kV HBM ⁶	-
2	RS-422/485 B (-)	± 15 kV HBM	-
3	Power Ground	-	-
4	Not Connected	-	-
5	Supply Voltage (V_{IN})	< +20 V	< 100 mA
6	External Sync Input	± 2 kV HBM	< 25 mA
7	Signal Ground	-	-
8	Self-Test (3.3 V Logic)	± 2 kV HBM	< 25 mA
9	Case	-	-

⁶Human body model.

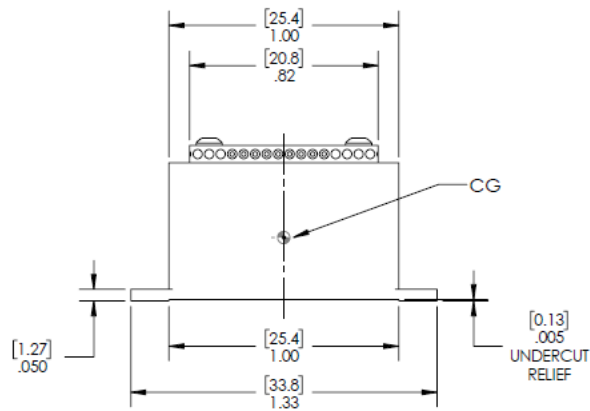
2.4 Outline Drawings



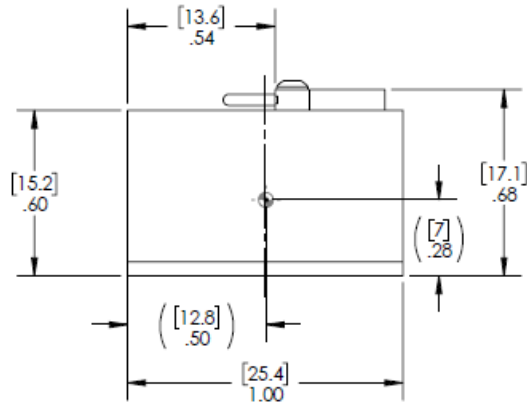
(a) Top View



(b) Isometric View



(c) Front View



(d) Side View

Figure 2: Views of the A300D accel.

3 Communication Interface

3.1 General

Specification	Standard	Unit
Interface ⁷	RS-422/485	-
Data Format	16, 24, or 32	bit
Max. Transmission Rate ^{8,9}	3	MBaud
Max. Output Data Rate (ODR) ⁹	8	kHz

3.2 RS-422/485

Specification	Value	Unit
Common-mode voltage	$-7 \leq V_{CM} \leq +12$	V
Driver differential output level ¹⁰	$2 \leq V_{OD} \leq V_{IN}$	V
Driver output short-circuit current	$-250 \leq I_{SC} \leq 300$	mA
Driver Input Impedance ¹¹	≥ 61	k Ω
Differential termination impedance	120	Ω
Receiver differential threshold voltage	+200	mV

⁷The A300D accel supports both protocols (also called TIA/EIA-485) but does not support RS-485 with multiple devices connected to the same bus.

⁸Same accuracy for CPU clock and serial communications.

⁹User selectable.

¹⁰For a differential driver load of 100 Ω .

¹¹Input resistance from A or B to common ground.

3.3 External Sync

The A300D accel has a variable external sync rate up to 8 kHz. The Accel sampling occurs at the rising edge of the external sync signal and the message is output once sample processing is complete.

Specification	Single	Differential	Accuracy	Unit
Input Frequency ^{12,13}	$50 \leq F_{ExtSync} \leq 8,000$		NA	Hz
Duty Cycle ¹⁴	$1 \leq \text{Duty} \leq 99$ (50 nominal)			%
Glitch Filter ¹⁵	< 50		1/CCF ¹⁶	ns
Input/Common-Mode Voltage	$1.8 \leq 3.3 \leq 5.5$	$-7 \leq V_{CM} \leq +12$	N/A	V
Termination Impedance	5k	120		Ω
Driver Input Impedance ¹⁷	-	≥ 48		k Ω
Differential Threshold Voltage	-	$-200 \leq V_{DT} \leq -50$		mV

3.4 Self-Test

Parameter	Value	Unit
Accelerometer X-axis	0.0 (nominal)	g
Accelerometer Y-axis	0.0 (nominal)	g
Accelerometer Z-axis	1.5 (nominal)	g

¹²The frequency of the external sync signal overrides the internal ODR while the external sync signal is present. This eliminates the internal over-sampling of the sensors, samples the sensors at the external sync frequency, and outputs message packets at the external sync frequency ($F_{ExtSync}$).

¹³The maximum allowed external sync input frequency is 8 kHz.

¹⁴External sync occurs at the rising edge of the signal while the falling edge is ignored. External sync initialization can take up to 30 sync edges depending on the timing accuracy between each pulse edge.

¹⁵Any transitions from low to high and back to low that occur in < 50 ns are ignored. To be valid, the external sync signal pulse must be longer than 50 ns.

¹⁶Core Clock Frequency. See Section 4 for details.

¹⁷Input resistance from A or B to common ground.

4 Firmware

Specification	Value	% Error	Unit
Revision Number ¹⁸	16.2.74.3	N/A	-
Start-Up Time			
Without External Sync	≤ 150 ms	±10%	ms
With External Sync	≤ 150 ms		
Stop Bits	1 or 2	N/A	-
Parity Bit	Even		
Core Clock Frequency ¹⁹ (CCF)	120	±100 PPM typical ±200 PPM max.	MHz

¹⁸Effective 02/16/2021.

¹⁹Same accuracy for CPU clock and serial communications. Deviation over voltage range and calibrated temperature range of the unit.

5 Timing

5.1 Message Transmission Delay

The message transmission delay is a function of the Baud rate. The table below shows the message delay for several Baud rate options.

Baud Rate	Message Delay (μ s)		
	16-bit	24-bit	32-bit
115 kBaud	1145	1432	1718
921 kBaud	143	179	215
1.5 MBaud	88	110	132
3 MBaud	44	55	66

5.2 Baud Rate Resolution

The A300D accel offers Baud rate options up to 3.0 MBaud that can be set to some predefined values.

The table below shows the nominal Baud rate and error for the standard Baud rates offered by Gladiator. In addition, the Baud rate has an accuracy of 200 PPM over temperature.

Desired Baud	Actual Baud	% Error
115,200.00	115,218.43	0.02
921,600.00	923,076.92	0.16
1,500,000.00	1,500,000.00	0.00
3,000,000.00	3,000,000.00	0.00

5.3 Message Protocol

Data Description	No. of Bytes ²⁰	Value
Start of Message	1	Variable
Message Counter	1	Mod 256 Counter (0-255)
Accelerometer X-Axis	2/3/4	Signed 16/24/32-bit integer
Accelerometer Y-Axis	2/3/4	Signed 16/24/32-bit integer
Accelerometer Z-Axis	2/3/4	Signed 16/24/32-bit integer
Temperature	2	Signed 16-bit integer
Status Indicator ²¹	1	Varies by message counter
Checksum	1	Two's Complement Sum

6 Power

Specification	Typical Value	Max. Value	Unit
Supply Voltage ²²	$+3.8 \leq V_{in} \leq +5.5$	+5.5	V
Power Consumption ^{23,24}	275	375	mW
Supply Current ²⁴	55	75	mA

²⁰A byte is defined as having 1 start bit, 8 data bits, even parity, and 1 or 2 stop bits. Thus, there are 11 or 12 bits of data transmitted/received per byte.

²¹See the *Gladiator Technologies Software Reference Manual* for more details on message protocol descriptions.

²²Nominal input voltage is single-sided +5.0 V.

²³Representative of nominal input voltage of +5.0 V, 3.0 Mbaud transmission rate.

²⁴ V_{IN} directly supplies the RS-485 transceiver and the external sync receiver. This can cause the supply power to vary with cable length.

7 Pin Configuration

The A300D accel uses a custom 9-pin connector (Figure 3). Compatible mating connectors are available for purchase.

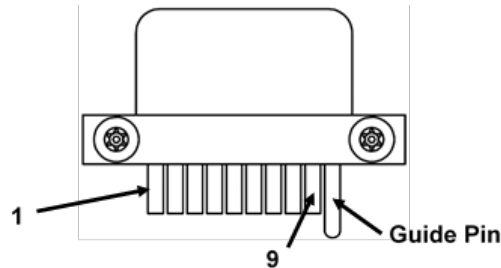


Figure 3: A300D accel 9-pin connector showing orientation to pin 1.

7.1 Single Input Ext. Sync

Pin No.	Assignment	Twisted Pair Pin No.
1	RS-422/485 A (+)	1-2
2	RS-422/485 B (1)	
3	Power Ground	3-5
4	Not Connected	
5	Supply Voltage (V_{IN})	
6	External Sync Input	6-7
7	Signal Ground	
8	Self-Test (3.3 V Logic)	-
9	Case	-

7.2 Differential Ext. Sync

Pin No.	Assignment	Twisted Pair Pin No.
1	RS-422/485 A (+)	1-2
2	RS-422/485 B (1)	
3	Power Ground	3-5
4	Not Connected	
5	Supply Voltage (V_{IN})	
6	Differential Sync A Input	6-8
7	Signal Ground	
8	Differential Sync B Input	
9	Case	-

8 Axis Definitions

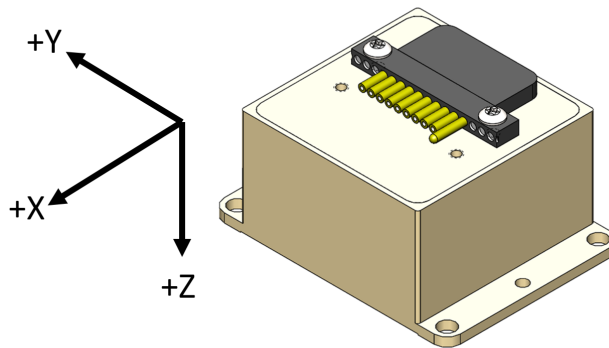


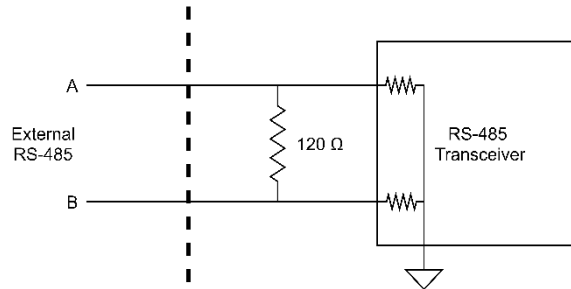
Figure 4: Positive axes for the A300D accel. Positive axes are given by the right-hand rule.

9 Interfacing with the Accel

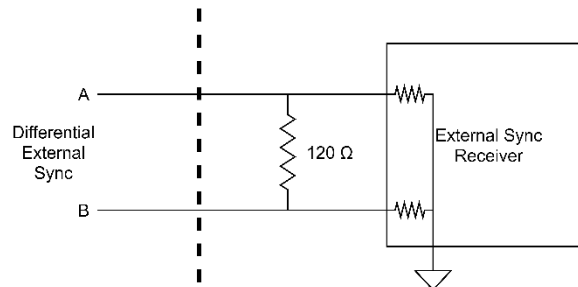
Users can interface with the accel using an SDK. The SDK plugs into a host PC with a USB connection and streams the RS-485 data to a standard serial COM port. Data can be collected and the device modes can be adjusted with Gladiator's Glamr software. Contact sales@gladiatortechnologies.com for more details.

A Simplified Equivalent Input Diagrams

A.1 RS-485

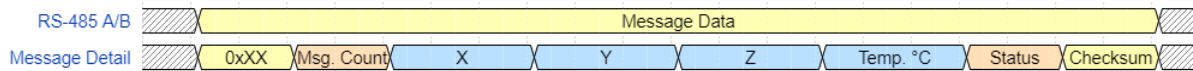


A.2 Differential External Sync



B Message Details

B.1 A300D Accel



B.2 RS-485 Synchronized with External Sync

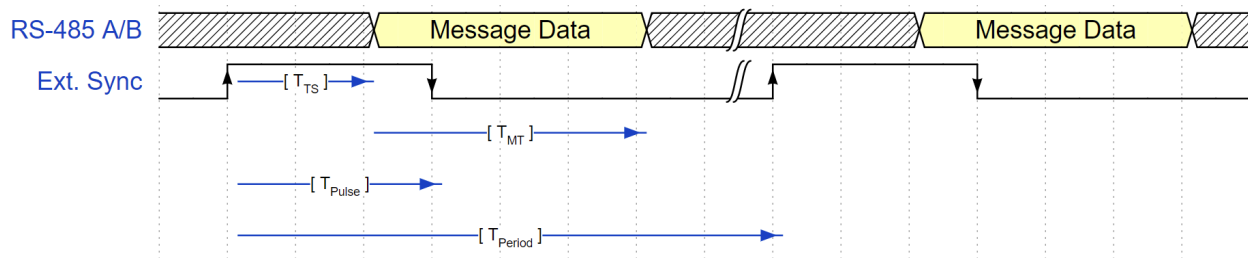


Figure 5: RS-485 message output synchronized with external sync. Timing values are approximate for a 3 MBaud transmission.

Parameter	Value			Unit
	Minimum	Typical	Maximum	
Transmit start time after rising sync pulse (T_{TS})	-	55	-	μS
Message transmission time (T_{MT})	-	61	-	μS
External sync pulse width (T_{Pulse})	50	$T_{period} * 0.50$	$T_{period} * 0.99$	ns
External sync period (T_{Period})	100	-	20,000	μS

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Rev.	Date	Change Description	Page No(s).
A	02/26/2021	Initial document created.	-