

## VULCAN SERVO DRIVE DATASHEET



### Rugged Servo Drive That Can Take The Heat

The Vulcan drive incorporates our rugged control and power driver modules, an integrated MIL-STD-461 EMI filter, inrush, military grade connectors and submersible case. The Vulcan operates at high voltages, and temperatures up to 121°C, making it ideal for defense, energy, oil and gas, aviation, automotive, or heavy industrial applications in outdoor, high temperature, high vibration, or other extreme environmental conditions.



### Specifications & Features:

- Bus Voltage (DC) 24V to 610V
- Peak Current up to 65A
- Output Power 12kW
- Operating Temperature - 40°C to 121°C
- Maximum Electrical Speed 75,000 RPM
- Weight 11.5 lbs./5.2 kg
- Size: 16.3" L x 6.3" W x 3.0" H
- Shock and vibration tolerant construction
- Configurable, user friendly GUI with integrated oscilloscope feature

### Configurations:

- Single or Dual axis configuration
- Motor Types: DC brushless, brushed and induction
- Feedback: sensorless. Encoder, hall & resolver
- Cooling Options: Liquid
- Packaging: Ruggedized

# Vulcan Servo Drive

## **Overview**

The following describes both the electrical and physical interfaces for the Vulcan Servo Drive. Included in this document is all the information necessary to integrate the Vulcan Servo Drive with other system components.

In order to design a multi-use capability, networking has been emphasized in the Vulcan Servo Drive. The Vulcan Servo Drive can be connected to the following two types of networks:

RS-422, Controller Area Network (CAN)

Both networks are ideal for real-time embedded networking. They have been proven to be stable and robust as well as flexible. Thus, the Vulcan Servo Drive can easily be modified through software to accept commands and report feedback without hardware modification.

This document discusses the system interconnect by functional group. The four groups are as follows:

Motor Input Power, Motor Output, System, Feedback

## **Motor Input Power**

The Motor Input Power is the main power input to drive the motors. The power signals are isolated from the control circuitry.

The power connector is an insert arrangement 16-10, part number MS3452L16-10P. The MS3452 series features box mounting and crimped pins. The box connections are pins and they mate with a socket-type connector, part number MS3456L16-10S.

## **Motor Output**

The motor connector contains the following signals:

Phase A, Phase B, Phase C, Brake, Regeneration, Interlock, Chassis

The motor connector is an insert arrangement 24-19. The connector part number is MS3470L24-19S. The MS3470 series features box mounting and crimped pins. The connections are sockets and they mate with a pin-type connector, part number MS3476L24-19P.

The Vulcan Servo Drive provides two 24 V brake drivers. The brake current is nominally 1 amp and is current limited to 1.5 A +/- 10%.

## **System**

The system signals are routed to a 37-pin connector. The connector is type D38999/20FD35AN (insert arrangement 13-35). It accepts a size 22D pin (AWG wire size 22-28). The connections are pins and they mate with a socket-type connector, PN D38999/26FD35SN.

The system signals are the main interface used in an end application. This interface includes low-level power and several networking and discrete I/O signals. Since the end use of the Vulcan Servo Drive is unknown, a generic interface has been provided to include the following:

Low-Level Power (28 VDC In), Fan Output, RS422, 3 Digital Inputs, 2 Analog Inputs, USB, 4 Analog Test Points Out, 2 Digital Outputs, CAN, 5 VDC Out.

This interface also includes service inputs that can be used for the following test and update functions: Connect using the Host Interface for the Vulcan Servo (HiDS), Monitor the four Analog Test Points, Inject an Analog Test Signal, Reprogram Internal Flash Memory.

### **Feedback**

The Vulcan Servo Drive contains a motor feedback interface. The feedback interface is on a single 37-pin connector. The connector is type D38999/20FD35AA (Insert arrangement 15-35, A clocking). It accepts a size 22D pin (AWG wire size 22-28). The connections are pins and they mate with a socket-type connector, part number JD38999/26FD35SA.

There are three feedback configurations:

Dual Resolver, Dual Encoder, Single Resolver and BiSS-C.

Hall sensor feedback is also available and is interchangeable with the Encoder signals. Contact ESI Motion for details.

### **Signal Description**

The Vulcan Servo Drive includes a CAN physical interface compliant to the ISO 11898-2 specification. The maximum data rate is 1 Mbps for a bus length of 40 meters. The CAN interface meets the extended common mode range of  $-7$  to  $+12$  V. No internal bus termination is provided.

The Vulcan Servo Drive includes an RS422 physical interface compliant to the TIA/EIA-422-B specification. The Vulcan Servo Drive is capable of a 1 Mbps data rate. The RS422 pins are short circuit protected from  $-7$  V to  $+12$  volts.

The Vulcan Servo Drive includes five digital inputs and well as two digital outputs. The Digital I/O signals are optically isolated from the internal DSP unit. The digital inputs include varistors rated to 5.6 V. Note that the 1000 pF capacitors are used to protect the circuit from ESD damage – all ESD capacitors are rated at 100 VDC.

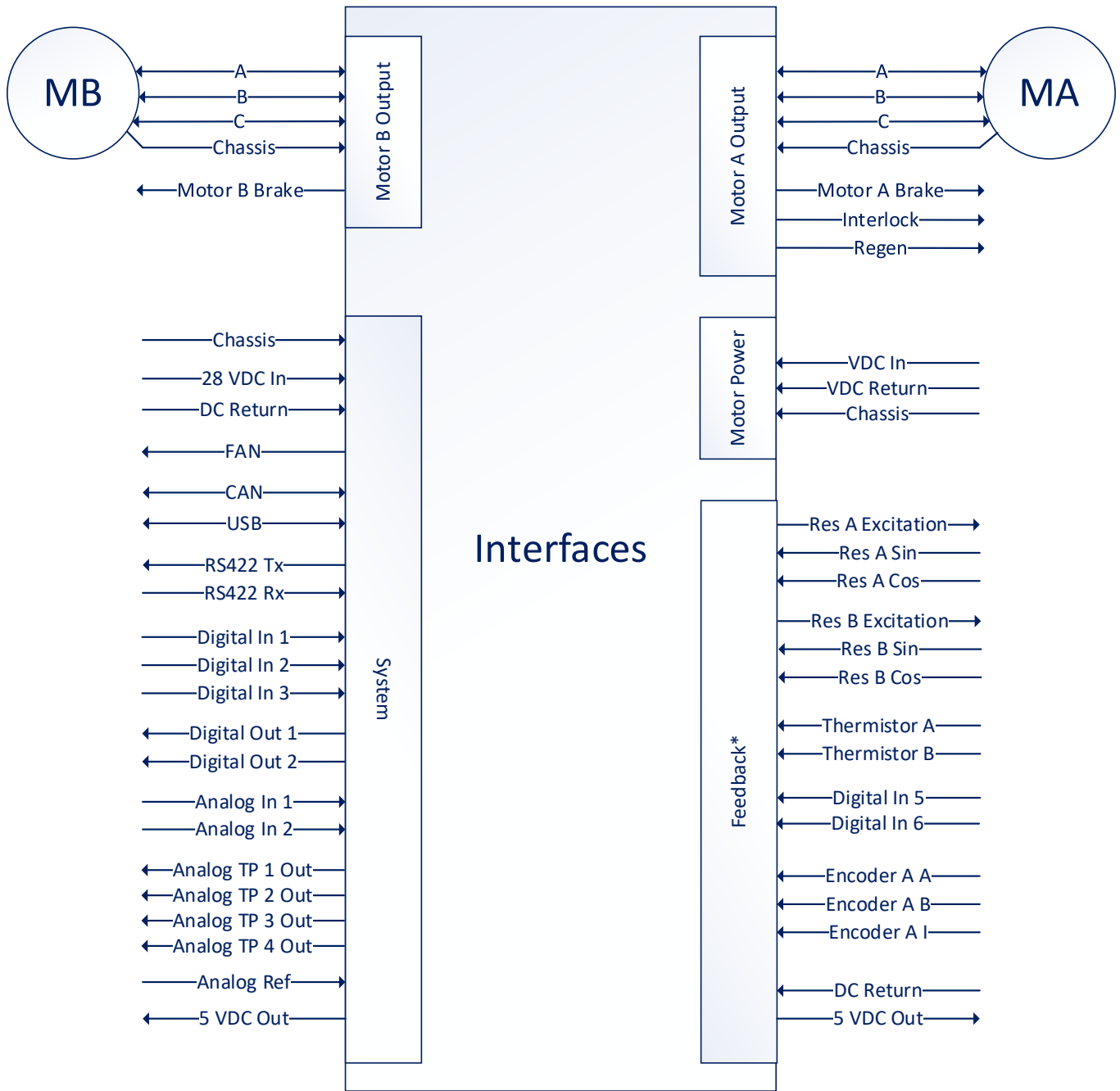
The Vulcan Servo Drive includes two analog inputs. These inputs may be configured through software as a control or test input. In a control mode, the signal may be used to give the Vulcan Servo Drive a torque or velocity command. In test mode, the signal may be used to inject a test signal into the system. The analog inputs have a differential voltage input range of  $\pm 10$  V.

The four analog test points are routed to the system connector for monitoring. The user may use the HiDS to setup the analog test points. The voltage range on the analog test points are  $\pm 2.5$  V. The test points are buffered with a 100 Ohm resistor.

The user may connect a standard USB port to the USB D+, USB D-, USB VBUS and USB GND for access to the HiDS functions.

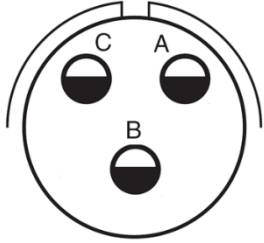
The user may use the USB port to reprogram the internal FLASH memory. A flash update program is provided by ESI Motion.

# System Diagram

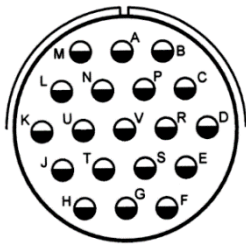


\* Dual Resolver Shown

# Vulcan Servo Drive



Motor Input Power, J1, MS3452L16-10P	
PIN	DESCRIPTION
A	Motor VDC In
B	Motor VDC Return
C	Chassis

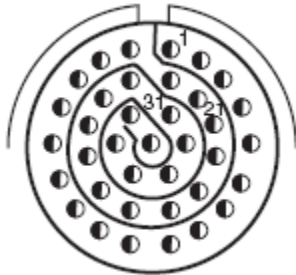


Motor Output, J2, MS3470L24-19S	
PIN	DESCRIPTION
A	Motor A Phase A
B	Motor A Phase B
C	Motor A Phase C
D	Chassis
E	Regeneration (-)
F	Regeneration (+)
G	Chassis
H	Motor B Phase C**
J	Motor B Phase B**
K	Motor B Phase A**
L	Interlock
M	Interlock Return
N	Motor A Brake (-)
P	Motor A Brake (+)
R	Motor B Brake (-)
S	Motor B Brake (+)
T	Unused
U	Unused
V	Unused



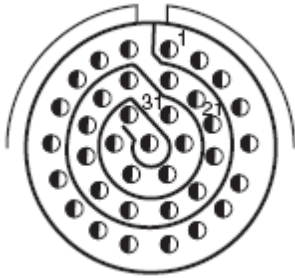
\*\* Used in parallel with pins A, B, and C for single Axis drives with continuous current requirements greater than 32 A.

**System, J3, D38999/20FD35AN**



PIN	DESCRIPTION	WIRE GAUGE
1	Chassis	22-28
2	28 VDC In	22
3	28 VDC In	22
4	Fan Power Out	22-28
5	Digital In 3 (+)	22-28
6	RS422 Tx (+)	22-28
7	RS422 Tx (-)	22-28
8	RS422 Rx (+)	22-28
9	RS422 Rx (-)	22-28
10	Digital In 1 (+)	22-28
11	Digital In 1 (-)	22-28
12	Digital In 2 (+)	22-28
13	Digital In 2 (-)	22-28
14	Analog Reference	22-28
15	Analog In 1 (+)	22-28
16	Analog In 1 (-)	22-28
17	Analog In 2 (+)	22-28
18	Analog In 2 (-)	22-28
19	DC Return	22
20	USB DP	22-28
21	USB DN	22-28
22	USB Vbus	22-28
23	USB Gnd	22-28
24	Digital In 3 (-)	22-28
25	Spare	22-28
26	Spare	22-28
27	Analog Test Point 1 Out	22-28
28	Analog Test Point 2 Out	22-28
29	Analog Test Point 3 Out	22-28
30	Analog Test Point 4 Out	22-28
31	Digital Out 1 (+)	22-28
32	Digital Out 1 (-)	22-28
33	Digital Out 2 (+)	22-28
34	Digital Out 2 (-)	22-28
35	CAN H	22-28
36	CAN L	22-28
37	5 VDC Out**	22-28





Feedback, J4, D38999/20FD35AA				
PIN	DUAL RESOLVER	DUAL ENCODER	SINGLE RESOLVER AND BISS-C	WIRE GAUGE
1	Chassis	Chassis	Chassis	22-28
2	Resolver A Excitation (+)	Unused	Resolver A Excitation (+)	22-28
3	Resolver A Excitation (-)	Unused	Resolver A Excitation (-)	22-28
4	Resolver A Sin (+)	Analog In 3 (+)	Resolver A Sin (+)	22-28
5	Resolver A Sin (-)	Analog In 3 (-)	Resolver A Sin (-)	22-28
6	Resolver A Cos (+)	Analog In 4 (+)	Resolver A Cos (+)	22-28
7	Resolver A Cos (-)	Analog In 4 (-)	Resolver A Cos (-)	22-28
8	Resolver B Excitation (+)	Unused	BiSS-C Clk (+)	22-28
9	Resolver B Excitation (-)	Unused	BiSS-C Clk (-)	22-28
10	Resolver B Sin (+)	Analog In 5 (+)	Unused	22-28
11	Resolver B Sin (-)	Analog In 5 (-)	Unused	22-28
12	Resolver B Cos (+)	Analog In 6 (+)	Unused	22-28
13	Resolver B Cos (-)	Analog In 6 (-)	Unused	22-28
14	Thermistor A (+)	Thermistor A (+)	Thermistor A (+)	22-28
15	Thermistor A (-)	Thermistor A (-)	Thermistor A (-)	22-28
16	Thermistor B (+)	Thermistor B (+)	Thermistor B (+)	22-28
17	Thermistor B (-)	Thermistor B (-)	Thermistor B (-)	22-28
18	5 VDC Out**	5 VDC Out**	5 VDC Out**	22-28
19	DC Return	DC Return	DC Return	22
20	Unused	Encoder B A (+)	Unused	22-28
21	Unused	Encoder B A (-)	Unused	22-28
22	Unused	Encoder B B (+)	Unused	22-28
23	Unused	Encoder B B (-)	Unused	22-28
24	Unused	Encoder B I (+)	Unused	22-28
25	Unused	Encoder B I (-)	Unused	22-28
26	Digital In 5 (+)	Digital In 5 (+)	Digital In 5 (+)	22-28
27	Digital In 5 (-)	Digital In 5 (-)	Digital In 5 (-)	22-28
28	Digital In 6 (+)	Digital In 6 (+)	Digital In 6 (+)	22-28
29	Digital In 6 (-)	Digital In 6 (-)	Digital In 6 (-)	22-28
30	5 VDC Out**	5 VDC Out**	5 VDC Out**	22-28
31	DC Return	DC Return	DC Return	22
32	Encoder A A (+)	Encoder A A (+)	BiSS-C Data (+)	22-28
33	Encoder A A (-)	Encoder A A (-)	BiSS-C Data (-)	22-28
34	Encoder A B (+)	Encoder A B (+)	Unused	22-28
35	Encoder A B (-)	Encoder A B (-)	Unused	22-28
36	Encoder A I (+)	Encoder A I (+)	Unused	22-28
37	Encoder A I (-)	Encoder A I (-)	Unused	22-28





# Electrical Characteristics

Signal Description			
SIGNAL	MINIMUM	MAXIMUM	UNITS
VDC In	24	610	V
Peak Phase Current	-	32 (65) <sup>(7)</sup>	A
Regeneration Current	-	15	A
Brakes	-	24	V
Brakes Current	-	1.5	A
Interlock <sup>(1)</sup>	1	18	V
28 VDC In	24	32	V
28 VDC In Current <sup>(5)</sup>	-	0.3	A
Fan Out	-	24	V
Fan Out Current	-	1.5	A
Digital In <sup>(1)</sup>	1	18	V
Digital Out Current <sup>(1)</sup>	9	54	mA
Analog In <sup>(1)</sup>	-10	10	V
Analog In Impedance <sup>(1)</sup>	-	224	K Ohm
Analog Out <sup>(1)</sup>	-2.5	2.5	V
Analog Out Impedance <sup>(1)</sup>	-	100	Ohm
5 VDC Out Current	-	500	mA
Resolver Excitation <sup>(1)</sup>	4.2	-	V rms
Resolver Sin, Cos, Analog In <sup>(1)</sup>	-5	5	V ac
Resolver Frequency	10	319K	Hz
Resolver Impedance	-	20	K Ohm
Thermistor <sup>(1)(6)</sup>	-	1100	Ohm
CAN <sup>(1)(3)(4)</sup>	-	1000	K bps
RS422 <sup>(1)(2)(3)</sup>	-	1000	K bps
USB 2.0 <sup>(1)</sup>	-	12	M bps
Encoder, BiSS-C Data <sup>(1)</sup>	0	5	V
Encoder, BiSS-C Data Impedance <sup>(1)</sup>	-	120	Ohm
BiSS-C Clock <sup>(1)</sup>	3	5	V
BiSS-C Clock Current <sup>(1)</sup>	-250	250	mA

<sup>(1)</sup> ESD protection.

<sup>(2)</sup> Physical Interface compliant to the TIA/EIA-422-B.

<sup>(3)</sup> Short circuit protection from -7 V to 12 V protection.

<sup>(4)</sup> Compliant to ISO 11898-2 specification.

<sup>(5)</sup> No Fan or Brakes.

<sup>(6)</sup> Recommended NTC 100k, Epcos part # B57540G104F.

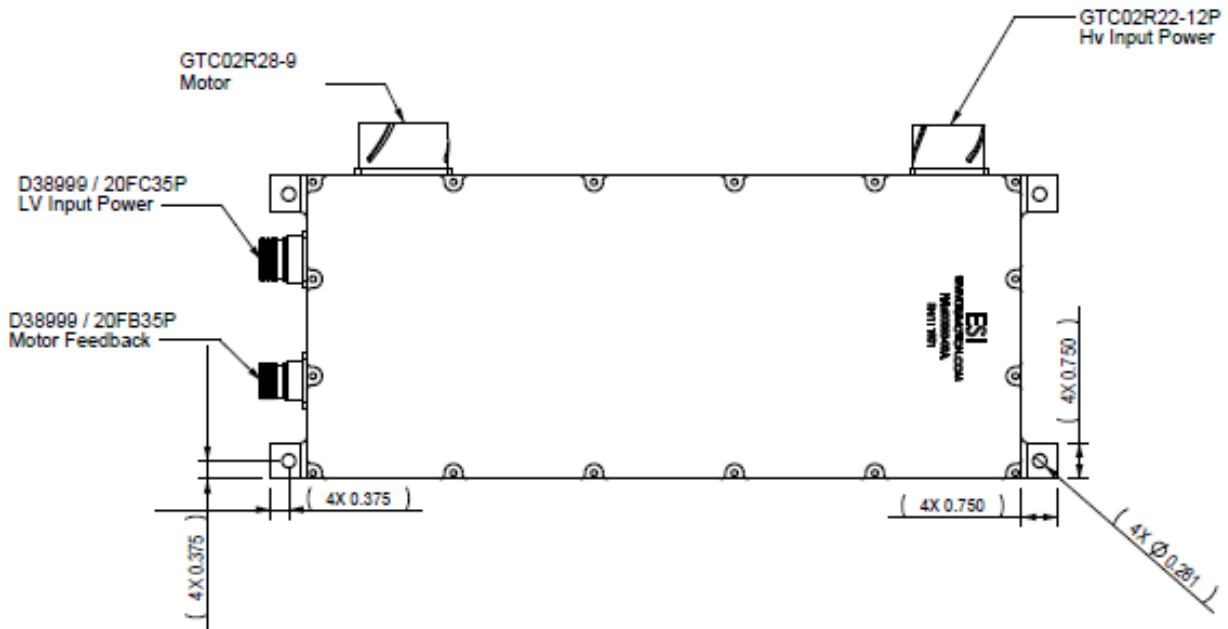
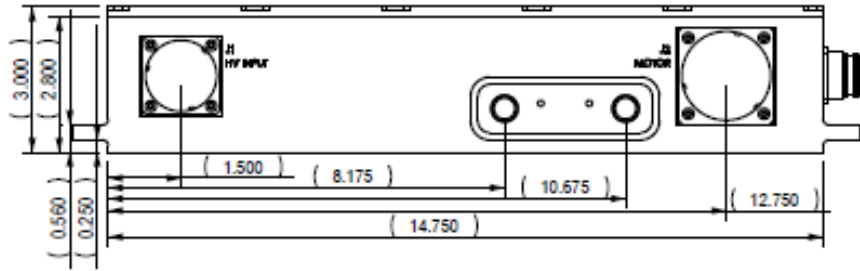
<sup>(7)</sup> Parallel Phase Configuration



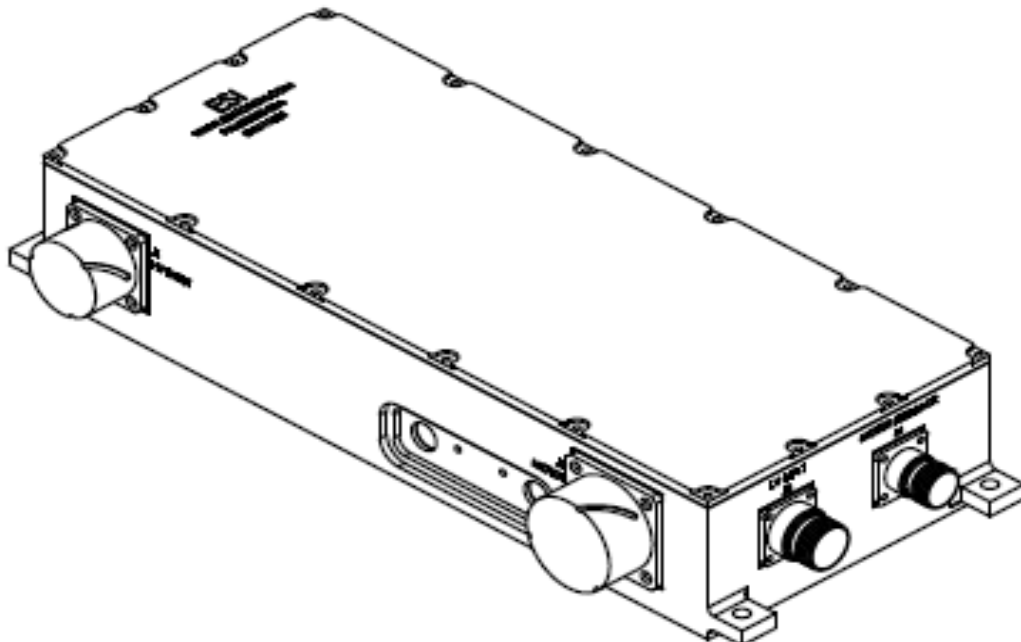
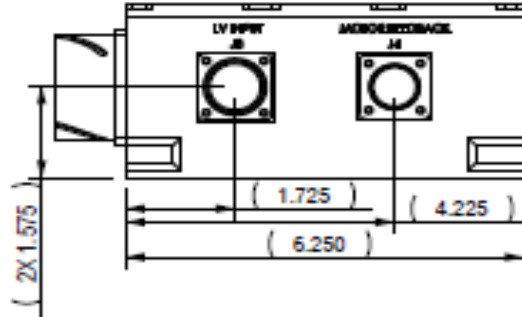


**Mechanical**

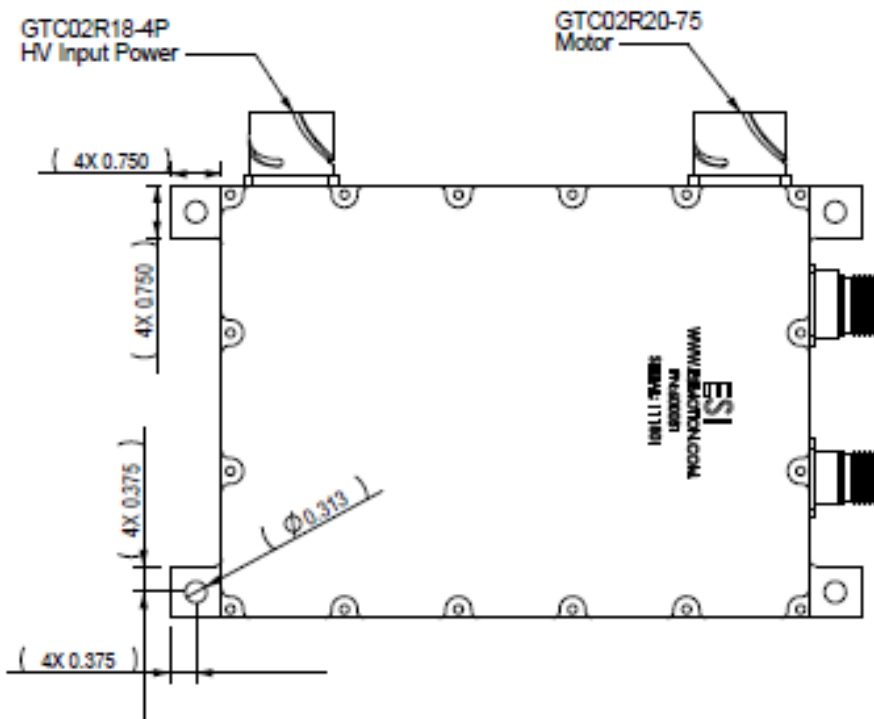
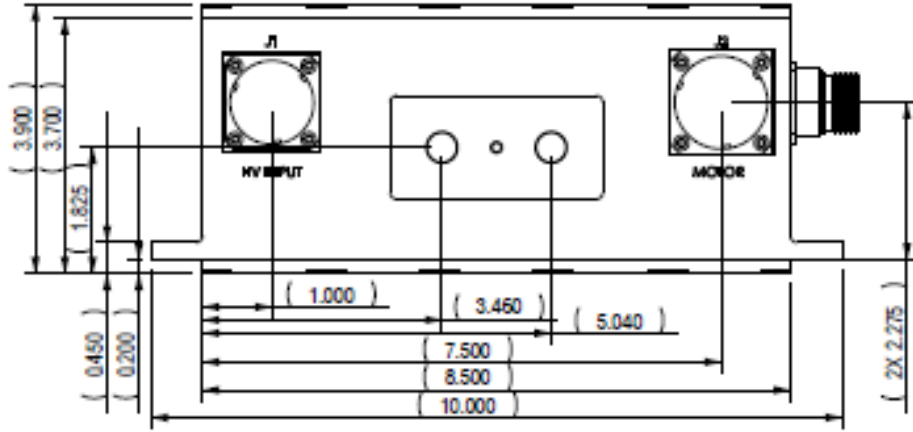
**Vulcan Servo Drive High Current**



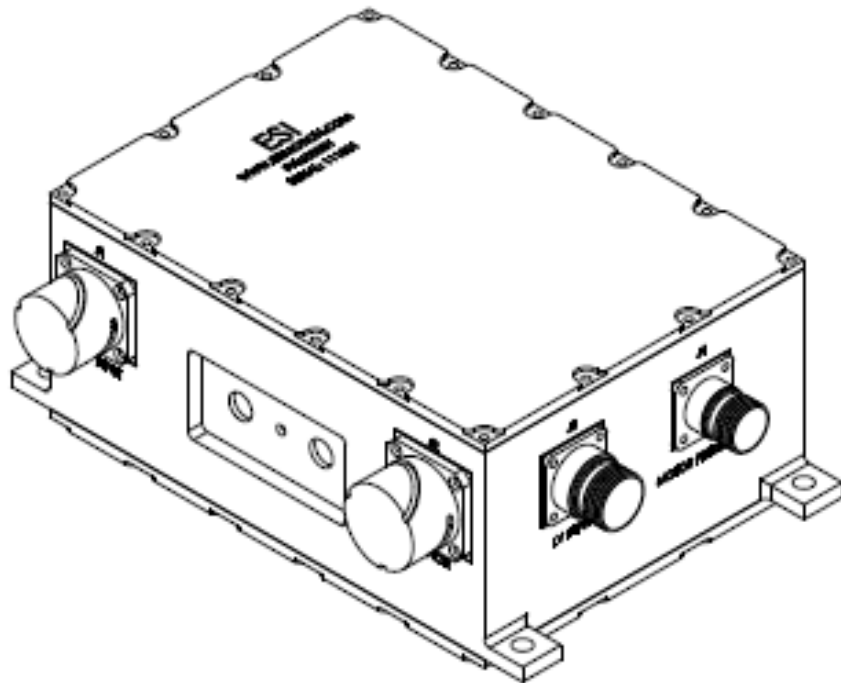
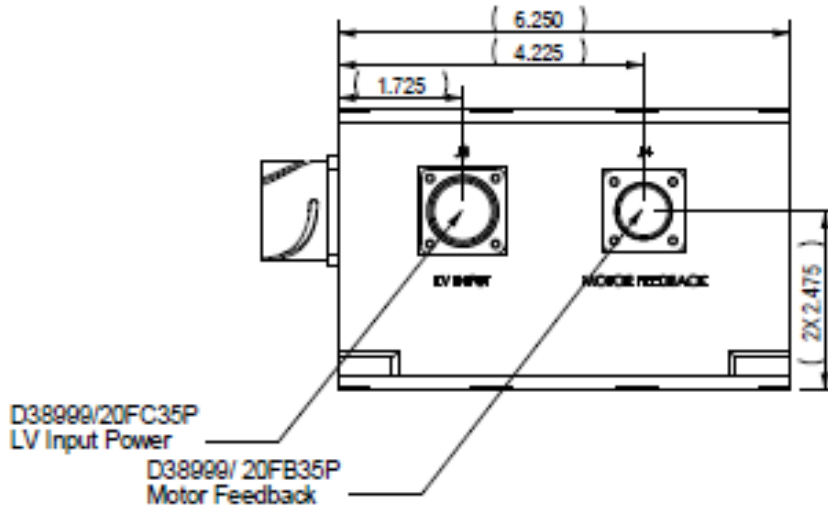
# Mechanical



**Mechanical**

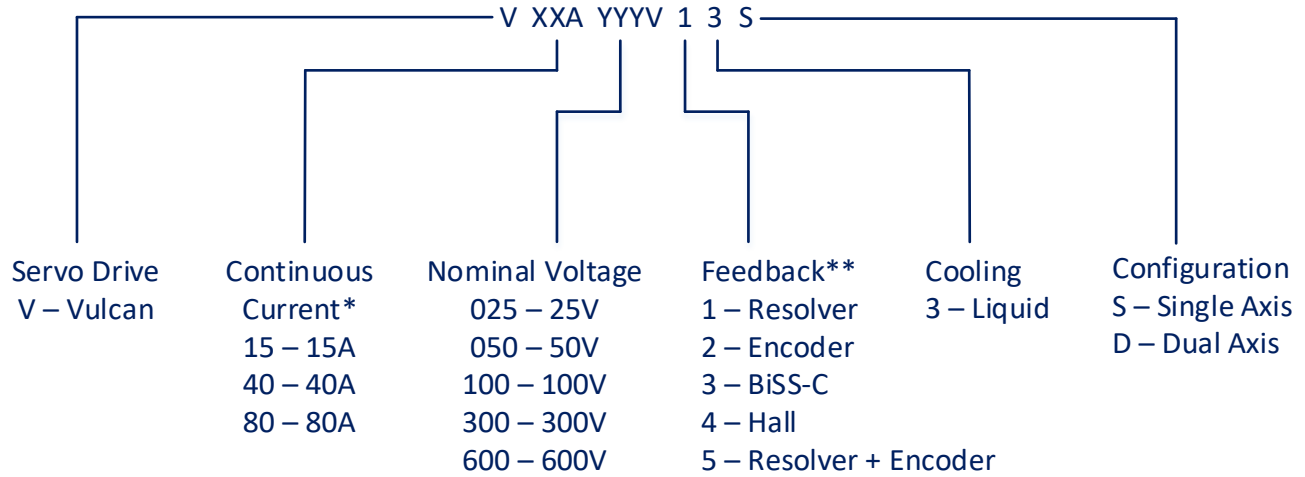


# Mechanical



# Ordering Information

## Ordering Information



\* Peak Sine Wave

\*\* All Feedback options include Sensorless

**Example:**

**Part Number: V40A300V13D**

- Servo Drive: Vulcan
- Continuous Current: 40A
- Nominal Voltage: 300V
- Feedback: Resolver
- Cooling: Liquid
- Configuration: Dual-axis



**Important Information:**

ESI MOTION makes no warranty, either express or implied, including but not limited to any implied warranties of merchantability and fitness for a particular purpose, regarding any marketing materials and makes such materials available solely on an "as-is" basis. In no event shall ESI MOTION be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of the purchase or use of these materials, and the sole and exclusive liability of ESI MOTION, regardless of the form of action, shall not exceed the purchase price of this product. Moreover, ESI MOTION shall not be liable for any claim of any kind whatsoever against the use of these materials by any other party.