Taurus 400 OTiS Interface Control Document

August 2024
601-0067-000 Rev A

Version History

Rev	Date	Notes
A	8/28/2024	Initial Release

Table of Contents

Introduction

Allocor created the Taurus 400 OTiS to fill a market need for more professional, reliable, customizable and better constructed and tested motor controllers. Addressing both the increased needs for higher voltage systems in the advanced vehicle market and complaints from customers of other hobby derived motor controllers the Taurus 400 OTiS is the perfect solution for electric vehicle drive systems at an attractive size, weight, power, cost and lead time..

The Taurus 400 series is an advanced high voltage, high power, extremely efficient BLDC motor controller that can be customized to meet your needs. This controller, like others in our Taurus motor controller line, implements full FOC/SVPWM for highly efficient operation between 270VDC and 405VDC. Along with comms, packaging, connectorization, and software implementation, the power stage can be tailored precisely for the end user's application with ideal operation from 10kW-20kW for this voltage range. The controller provides isolated CAN 2.0 and RS-485 communications, giving you more feedback and control of your propulsion system.

The Taurus 400 series implements full four quadrant Field Oriented Control (FOC) utilizing Space Vector Pulse Width Modulation (SVPWM). Paired with the latest SiC MOSFET technology, these controllers achieve exceptional motor and controller efficiency without the large torque ripple of standard 6-step (trapezoidal) commutation. No sensors, no problem. All Taurus controllers run an advanced sensorless estimator. Optionally, sensors can be added for seamless low RPM operation and parking.

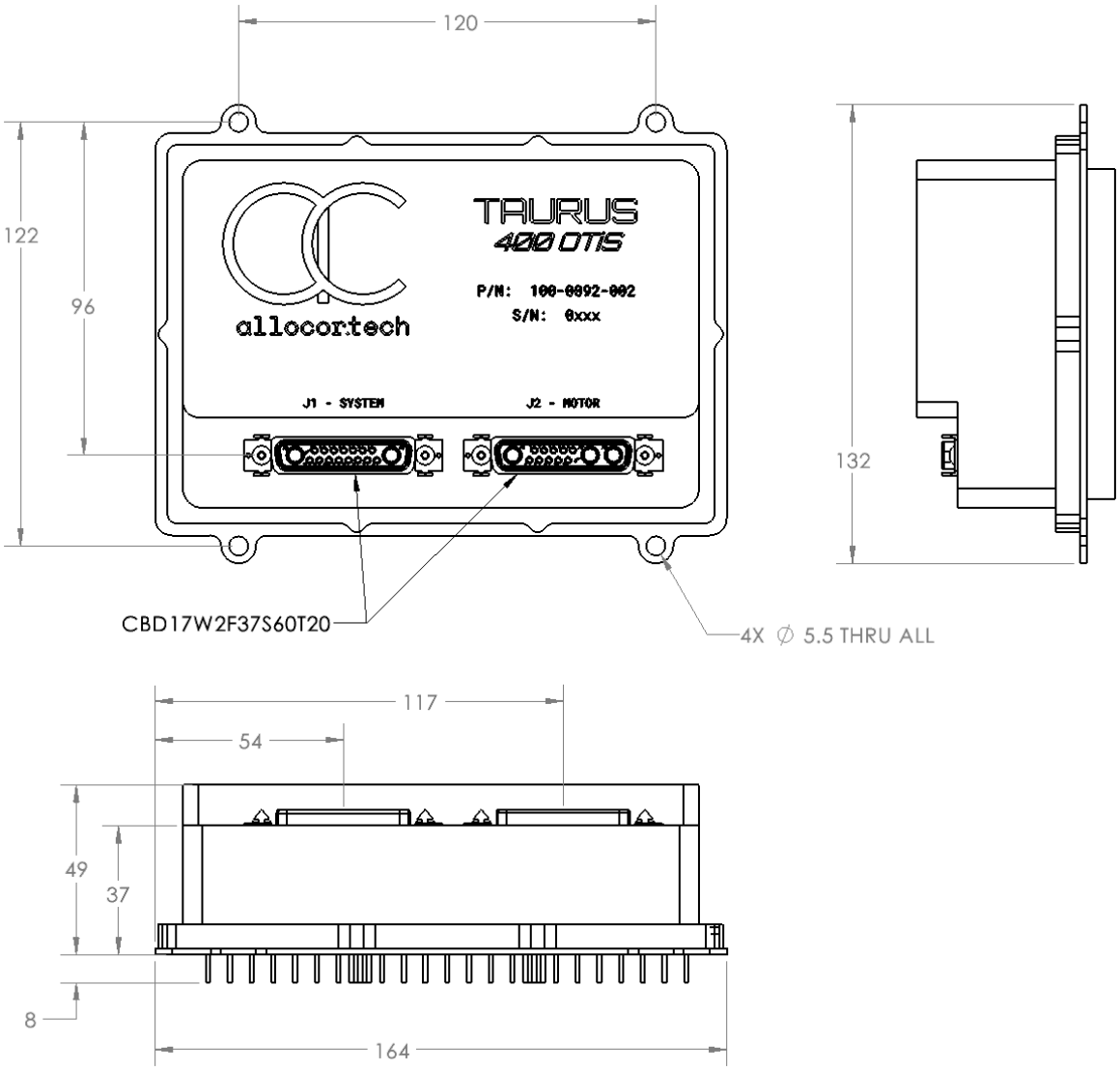
Existing high voltage industry solutions are big and heavy, often requiring large heat sinks and fans. Moving away from IGBTs and Electrolytics to higher end power components results in improved efficiency. This means less heat and an overall smaller and lighter controller due to a smaller heat sink. Working with our customers to tailor packaging and thermal management to their needs allows further reductions in size and weight.

Along with an available software SDK, the Taurus 400 hardware IP can be tailored to various custom packages, including winglets, booms, etc.(see examples below). Additionally, implementations for lower voltage/power have also been realized. Contact allocortech to get more information on customization.

The Taurus 400 OTiS is intended to give users more capability, customization and general robustness than other similar offerings, particularly those in the hobby space. With an attractive SWaP and high quality, professional grade connectors the Taurus OTiS is capable of driving electric propulsion systems of larger, more complex vehicles.

Mechanical

Dimensions and Outline



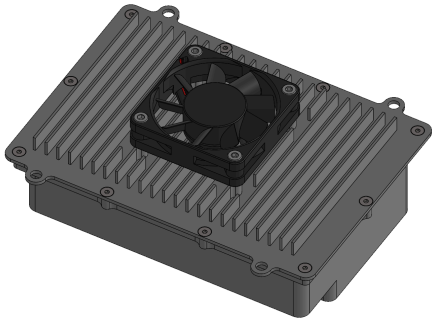
Mass

The mass of the OTiS unit is 815g.

Mounting Interfaces

OTiS has four ϕ5.5mm unit mounting holes in a 120mm x 122mm rectangular pattern.

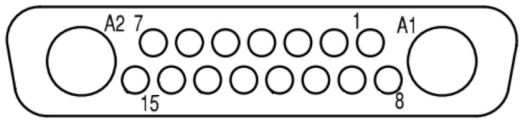
There is also an integrated M4 mounting pattern (50mm x 50mm) on the fins for mounting a cooling fan if natural airflow is not available.



Electrical

Connector List

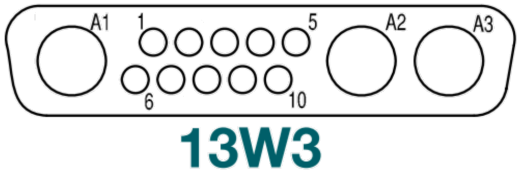
P1 - SYSTEM (HV Power Input and Communications)

 17W2	Connector P/N: Mating Connector P/N:	CBD17W2F37S600X CBC17W2M0000

P1 Connector Pinout

Pin	Name	Function	Notes
1	NC		
2	RS422_RX_P	RS-422 Receive Positive	Full Duplex, Referenced to LVD GND
3	RS422_TX_N	RS-422 Transmit Negative	Full Duplex, Referenced to LVD GND
4	N/C	N/C	
5	N/C	N/C	
6	CAN_P	CAN Positive	Referenced to LVD GND
7	CAN_N	CAN Negative	Referenced to LVD GND
8	N/C	N/C	
9	RS422_RX_N	RS-422 Receive Negative	Full Duplex, Referenced to LVD GND
10	RS422_TX_P	RS-422 Transmit Positive	Full Duplex, Referenced to LVD GND
11	N/C	N/C	
12	See Notes	See Notes	Rev A: N/C Rev B and beyond: LVD GND
13	LVD GND	LVD GND	Ground for +28Vin, CAN, and RS422
14	See Notes	See Notes	Rev A: N/C Rev B and beyond: LVD GND
15	+28Vin	28V input	LVD GND referenced
A1	VIN	HV Input	
A2	GND	HV Return	

P2 - MOTOR (Phase Outputs and Sensor Connections)

	Connector P/N: Mating Connector P/N:	CBD13W3F37S600X CBC13W3M0000

P2 Connector Pinout

Pin	Name	Function	Notes
1	N/C	N/C	
2	SENSOR_GND	Sensor Power GND	
3	M_TEMP-	Motor Temperature Sensor Negative	
4	SENSOR_C_RAW	Sensor C Input	
5	SENSOR_A_RAW	Sensor A Input	
6	N/C	N/C	
7	SENSOR_VDD	Sensor Power Vdd	
8	M_TEMP+	Motor Temperature Sensor Positive	
9	SENSOR_D_RAW	Sensor D Input	
10	SENSOR_B_RAW	Sensor B Input	
A1	PHASE_W	Motor Phase W	
A2	PHASE_V	Motor Phase V	
A3	PHASE_U	Motor Phase U	

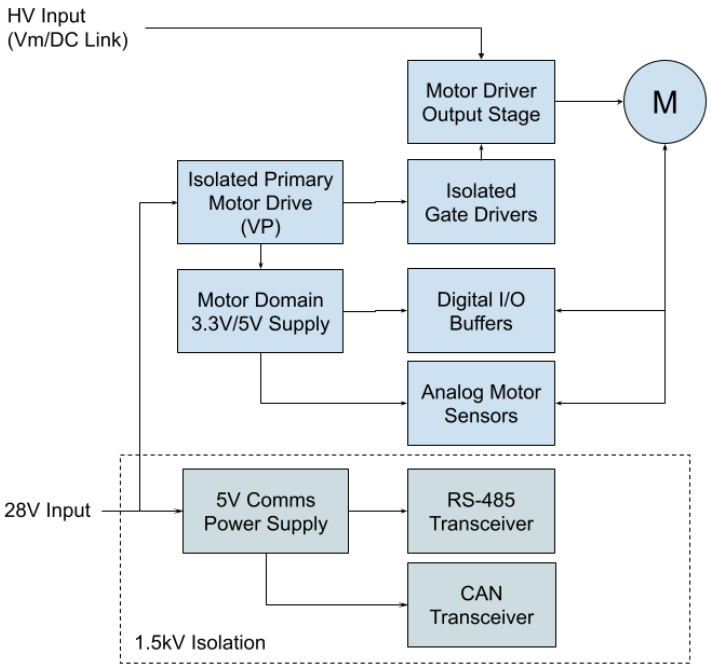
Electrical Characteristics

Parameter	Min	Nominal	Max	Units
HV Input Operating Voltage	80	355	405	V
UVW Phase Current Ratings	-	50	90	A_{RMS}
DC Input Current Ratings		50	70	A
LV Input Operating Voltage	9	28	36	V
LV Input Current	-	200	500	mA
SENSOR_A/B/C/D to HV-GND	-3.0		6.3	V
CAN Common Mode to LV-GND	-2		+7	V
RS-422 Common Mode to LV-GND	-25		+25	V
RS-422 Transient Fault Protection to LV-GND	-65		+65	V
HV GND to LV-GND	-500		500	V
Switching Frequency		40	50	kHz
CAN, RS485, RS422 Isolation	-500		500	V
CAN 2.0 Bit Rate			1	Mbps
RS485 Bit Rate			3	Mbps
RS232 Bit Rate			1	Mbps
Update Rate			1	khz

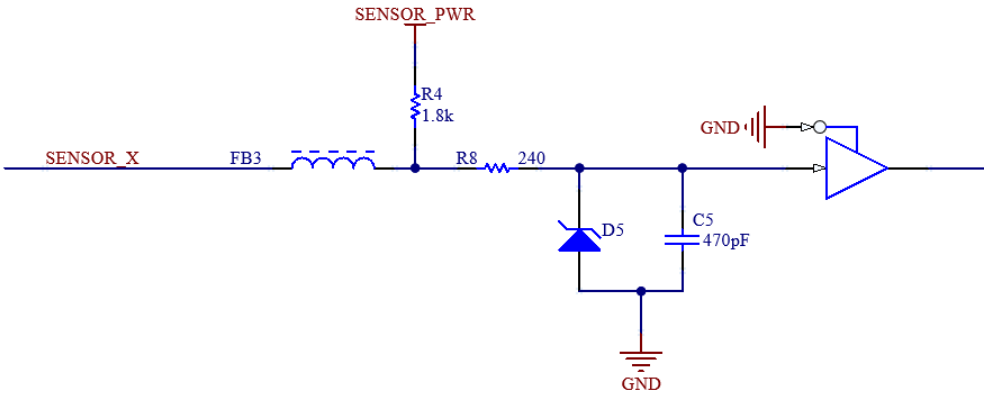
Power Topology

The communications signals (CAN, RS-RS-422) are referenced to the 28V input power supply, which is assumed to be isolated from the High Voltage input, and also the reference that is used for all devices attached to this communications network. If additional communications isolation is required, it should be handled outside of the Taurus

The motor sensor I/O signals are referenced to the motor ground, since they remain in the motor domain. The power supplies for these I/O's are sourced from an isolated supply attached to the 28V input. Low CMTI devices are used to ensure minimal coupling across these isolated supplies.



Hall/QEP Sensor Inputs



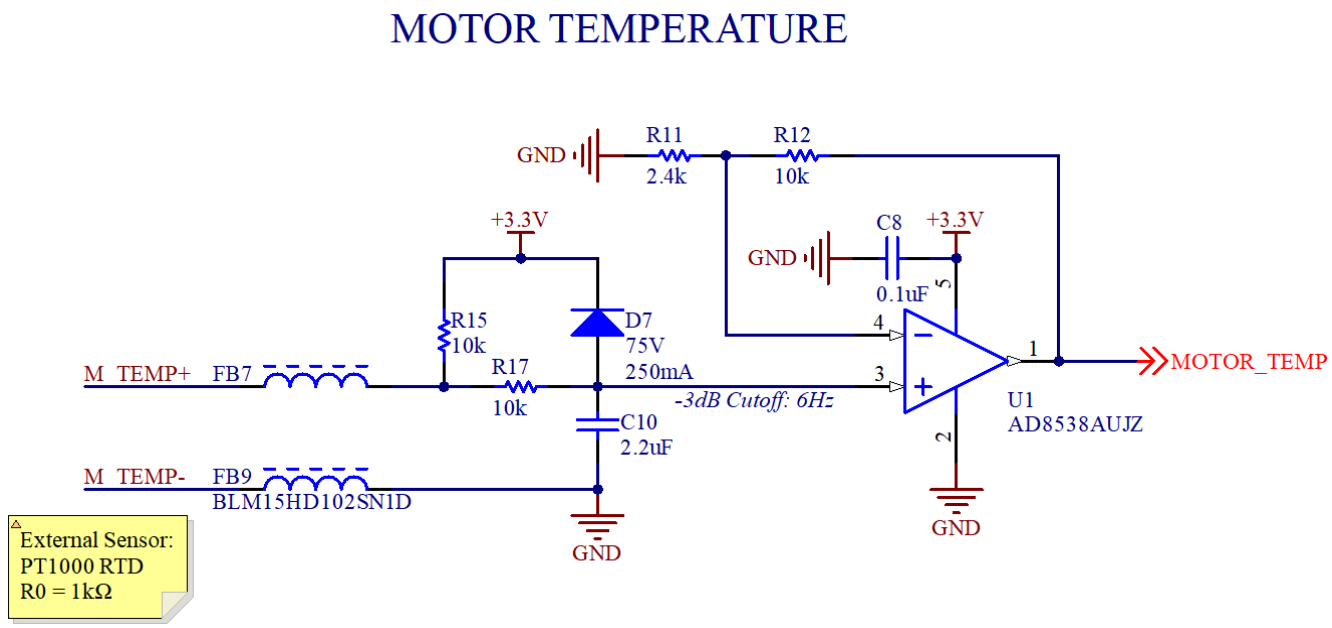
Each sensor input has a 1.8kΩ pull-up for the case of open-collector output Hall sensors. The signal is also filtered through a 240Ω/470pF (F_C = 1.4Mhz) RC low-pass filter. Then all 4 input sensor signals enter a logic buffer with <4.8ns delay.

Specification	Rating
V_{IH} High-Level Input Voltage	2.0V
V_{IL} Low-Level Input Voltage	0.8V
Voltage Max (Continuous)	6.3V
Voltage Min (Continuous)	-3.0V

Analog Input

The default configuration is a motor temperature sensor with a range of -70C to +200C

Alternate configurations are available on request to operate with different sensors or have different optimized temperature ranges. Standard software will measure temperature from a 1kΩ PTC1000 sensor.



Environmental

The below specifications are design goals, and have not been fully qualified through environmental qualification testing.

Grounding and Bonding

For high voltage motor configurations, the 3-phase bundle must be shielded, since high voltage switching will generate EMI, likely impacting the communications signaling. Additionally, care should be taken to ensure tight bonding between the motor and motor controller, ideally through vehicle chassis bonding.

Temperature

Operating: -40°C to 70°C (May operate higher, depending on cooling configuration)

Storage: -40°C to 105°C

On-board temperature sensors are included at the following locations. The specific limits are as follows, which software should adhere to. These thresholds assume adequate air flow and/or heat sinking of the Taurus.

Device	Recommended Limit
Inverter MOSFETs	125°C
Internal Processor	125°C
PCBA Temperature	95°C

Vibration and Shock

Designed to meet DO-160 Category R.

Pressure

Designed for spacing for -5,000k to 40,000 feet pressure altitude MSL (not formally qualified)

Humidity and Water Ingress

Units are sealed and conformal coated to withstand condensing humidity and falling water per DO-160 Category W.

Corrosion

Coated aluminum enclosures. Various coatings for enclosures upon request.
Connectors are tin plated steel, however, other options are available.

Software [TBD]