

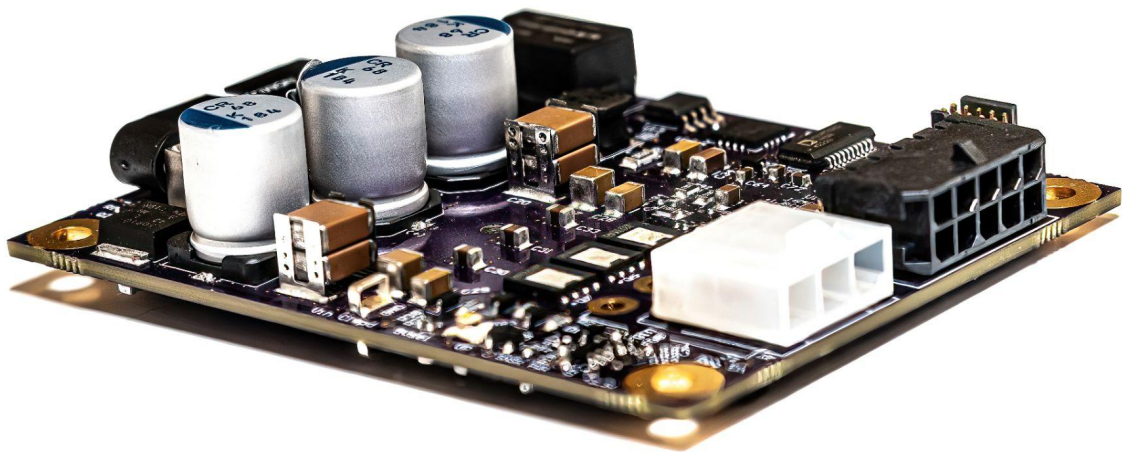
allocortech inc.

Taurus AE Physical ICD

601-0057-000

Revision A

9 December, 2022



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<https://allocor.tech>



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Version History

| Revision | Changes |
|----------|-----------------|
| A | Initial Release |



Introduction

The allocortech inc Taurus AE (Actuator Edition) is a BLDC motor controller that implements full FOC/SVPWM for high efficiency operation up to 2kW peak power. The Taurus AE has isolated communications channels configurable for CAN 2.0, RS-422/485, or RS-232. It also provides general-purpose digital output/input, which can be configured for PWM output/input capture. A set of 4 digital sensor inputs can either be used for Hall sensor input or Quadrature Encoder input signals from the motor. Additionally, there are 2 differential analog sensor inputs that may be used for measuring motor temperature or other analog sensors.

Scope of this Document

This document covers the mechanical and electrical specifications of the allocortech Inc Taurus AE (part number 100-0063 and variants). The software development interfaces will be covered in other documents.

List of Abbreviations

| | |
|-----------------|---|
| 4W RS485 | Four wire, full duplex, differential serial (aka RS-422) with RS-485 line levels. |
| BLDC | Brushless DC (motor) |
| CAN | Controller Area Network, serial protocol ISO 11898 |
| EMI | Electromagnetic Interference |
| GND | Power or Digital Ground, isolated from Chassis Ground |
| GPI | General Purpose Input |
| GPO | General Purpose Output |
| PWM | Pulse Width Modulation |

References

CAN 2.0 Specification



Electrical Interface

Connector Pinouts

J1 - Primary Connector

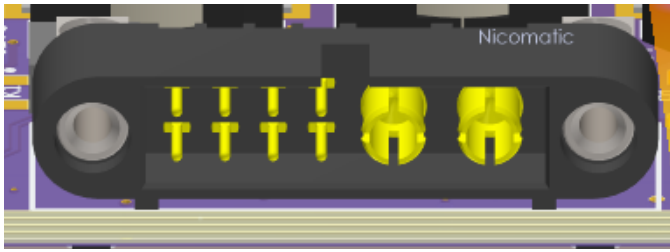
Part Number: 221V08F26-0200-3400CM

Recommended Mating Part Numbers

- 222S08M16C-0200-4310 (16-20AWG HP)
- 222S08M16C-0200-4315 (14AWG HP)
- 222S08M16C-0200-4320 (12AWG HP)

Backshells:

- Simple Potting Dam Backshell: 14487-21
- Straight, RA, and 45° backshells also available



| | | | | | |
|---|---|---|---|-----|-----|
| 4 | 3 | 2 | 1 | HP2 | HP1 |
| 8 | 7 | 6 | 5 | | |

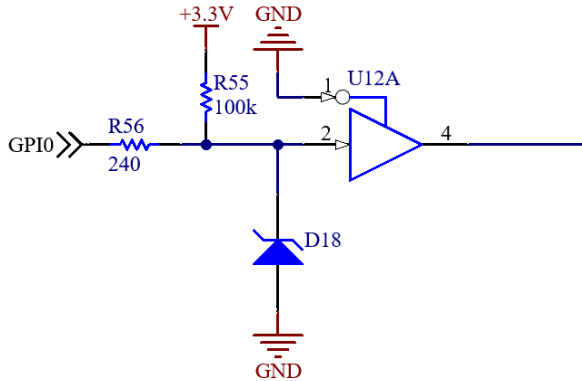
| Pin | Name | Primary Function | Alternate Function A | Alternate Function B |
|-----|----------|---|----------------------|----------------------|
| HP1 | VIN | Primary Power Input (+) | - | - |
| HP2 | GND | Primary Power Input (-) | - | - |
| 1 | RS232 TX | RS-232 Transmit | - | RS-422 RX+ |
| 2 | RS232 RX | RS-232 Receive | - | RS-422 RX- |
| 3 | CAN_H | CAN High | RS-485+ | RS-422 TX+ |
| 4 | CAN_L | CAN Low | RS-485- | RS-422 TX- |
| 5 | GPO0 | General-Purpose Output (channel 0) | - | - |
| 6 | GPI0 | General-Purpose Input (channel 0) | - | - |
| 7 | GND | Reference ground for GPI0/GPO0 | - | - |
| 8 | ISO-GND | Isolated reference ground for pins 1-4 (RS-232, RS-485, RS-422 and CAN) | - | - |

Isolated signals support up to 400V isolation from the primary power input.



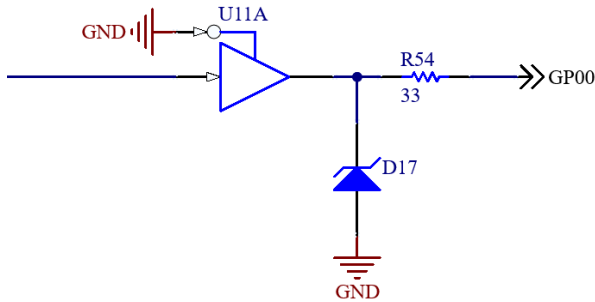
VIN/GND Primary Power Input: 18-60V, see Electrical Ratings for details.

General Purpose Input



| Specification | Rating |
|-----------------------------------|-------------|
| Input Clamp Current | -20mA (max) |
| V_{IH} High-Level Input Voltage | 1.39V |
| V_{IL} Low-Level Input Voltage | 0.65V |
| Voltage Max (Continuous) | 8.1V |
| Voltage Min (Continuous) | -4.8V |

General Purpose Output



| Specification | Rating |
|---------------------------|--|
| I_{out} Continuous | +/-25mA |
| High-Level Output Current | -7mA @ 3.3V -8mA @ 5V |
| Low-Level Output Current | 7mA @ 3.3V 8mA @ 5.0V |
| V_{OH} | 2.9V@3.3V / -5.5mA 4.6V@5.0V / -8mA |
| V_{OL} | 0.1V @ 20μA |

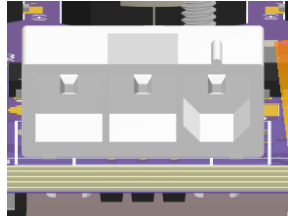
Note: compensation for 33Ω series resistor not included.



J2 - Motor Connector

Part number: Molex 39-30-3037

Recommended Mating Part Number: Molex 39-01-4030



| | | |
|---|---|---|
| 3 | 2 | 1 |
|---|---|---|

| Pin | Name | Notes |
|-----|---------------|----------------|
| 1 | Motor Phase W | 13A Continuous |
| 2 | Motor Phase V | 13A Continuous |
| 3 | Motor Phase U | 13A Continuous |

J4 - Sensor Connector

Part Number: Molex 43045-1000

Recommended Mating Part Number: Molex 43025-1000

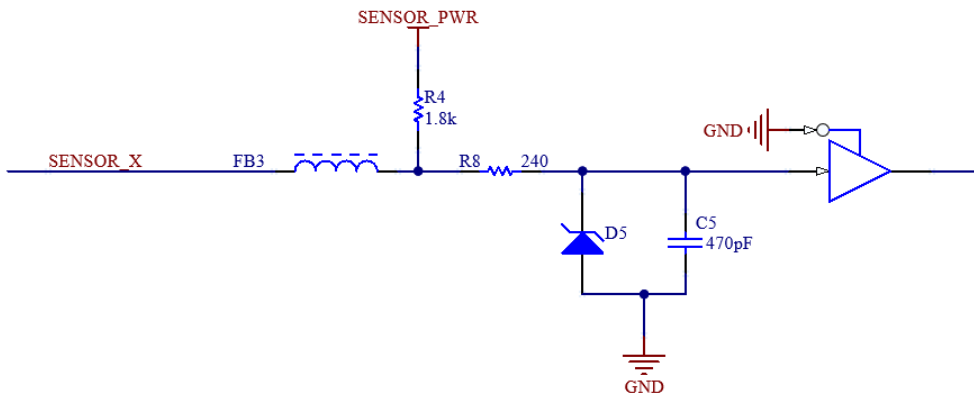


| | | | | |
|----|---|---|---|---|
| 10 | 9 | 8 | 7 | 6 |
| 5 | 4 | 3 | 2 | 1 |

| Pin | Name | Function | Alt Function | Notes |
|-----|------------|------------|--------------|--|
| 1 | SENSOR_GND | Hall GND | QEP GND | Connected to power ground. |
| 2 | M_TEMP_A+ | - | - | Analog Input A |
| 3 | M_TEMP_A- | - | - | Reference for Analog Input A |
| 4 | M_TEMP_B+ | - | - | Analog Input B |
| 5 | M_TEMP_B- | - | - | Reference for Analog Input B |
| 6 | SENSOR_VDD | Hall Power | QEP Power | 3.3V (default), Software configurable to 5V. 250mA Current Limit |
| 7 | SENSOR_A | Hall A | QEP Index | Input, 1.8kΩ pull-up to SENSOR_VDD |
| 8 | SENSOR_B | Hall B | QEP Phase A | Input, 1.8kΩ pull-up to SENSOR_VDD |
| 9 | SENSOR_C | Hall C | QEP Phase B | Input, 1.8kΩ pull-up to SENSOR_VDD |
| 10 | SENSOR_D | - | - | Input, 1.8kΩ pull-up to SENSOR_VDD |



Hall/QEP Sensor Inputs

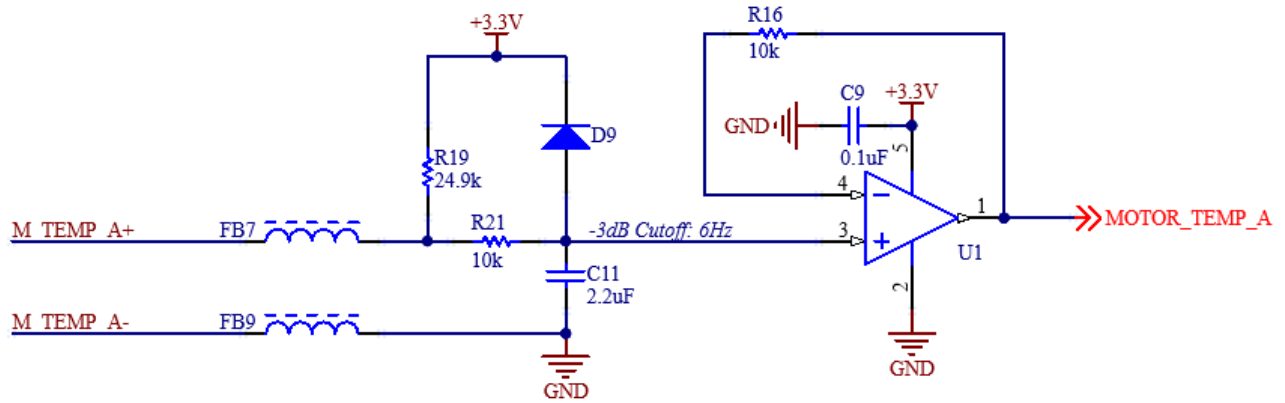


Each sensor input has a 1.8k Ω pull-up for the case of open-collector output Hall sensors. The signal is also filtered through a 240 Ω /470pF ($F_c = 1.4\text{MHz}$) RC low-pass filter. Then all 4 input sensor signals enter a logic buffer with <4.8ns delay.

| 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 Inputs



Both analog inputs are electrically equivalent to the above circuit. Alternate resistor configurations are available on request to achieve different gains.

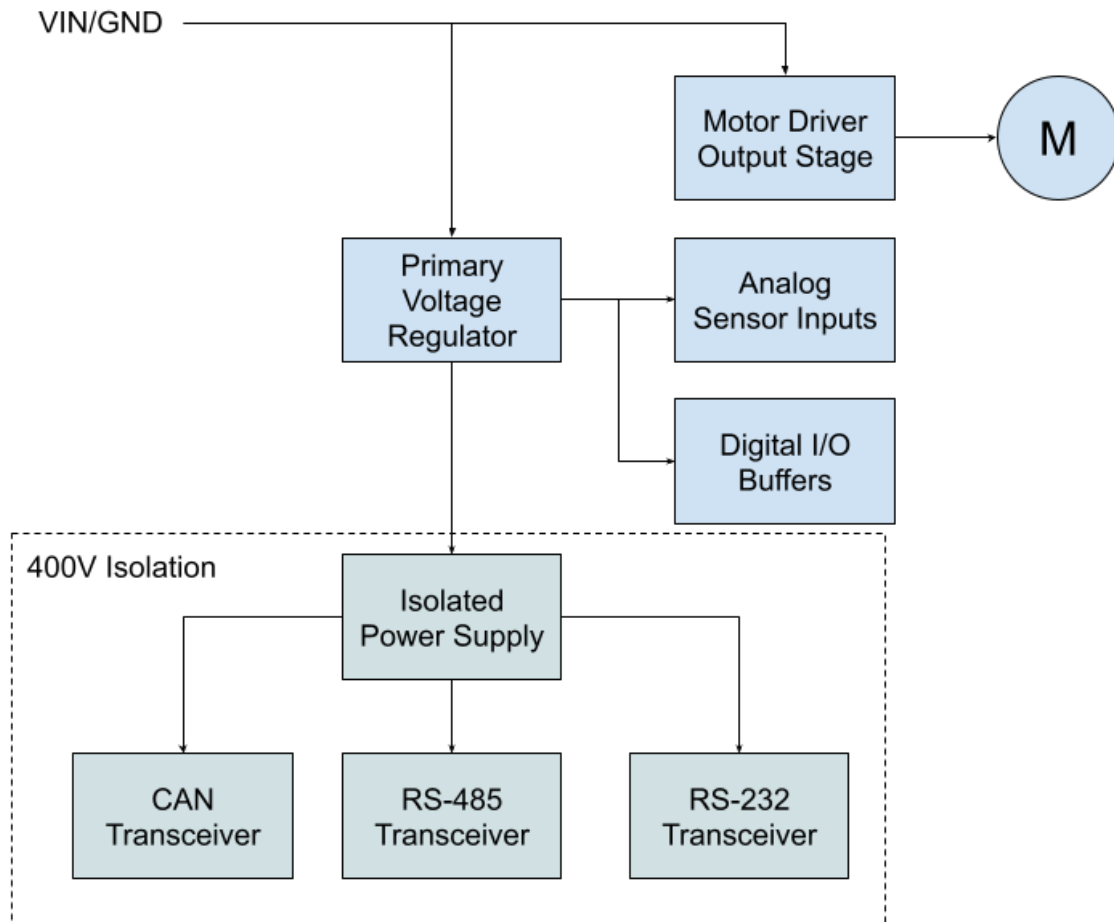
Standard software will measure temperature from a 10k Ω NTC thermistor with $\beta = 3490K$ (e.g. NXRT15XV103FA1B040).



Functional Interface

Power Topology

The communications signals (CAN, RS-485/RS-422, RS-232) are isolated from the main power input. However, some signals, specifically motor sensor inputs and digital input/output signals are not isolated, and are referenced to the main power ground.





Absolute Maximums

| Parameter | Min | Max | Units |
|--|--------------------------------|----------------------------------|-------|
| Input Voltage on VIN | -0.5 * | 60 | V |
| VIN Current | ±20 (continuous) ±30 (peak) | | A |
| System/Idle Power | 1.0 | 1.5 | W |
| Motor Power | 0 | 1200 (continuous) 1800 (peak) | W |
| GPI0 Voltage to GND | -4.8 | 8.1 | V |
| GPO0 Voltage to GND | -1.3 | SENSOR_VDD + 1.3 | V |
| SENSOR_A/B/C/D to GND | -3.8 | SENSOR_VDD + 3.8 | V |
| CAN Common Mode to ISO-GND | -2 | +7 | V |
| RS-485 Common Mode to ISO-GND | -25 | +25 | V |
| RS-485 Transient Fault Protection to ISO-GND | -65 | +65 | V |
| RS-232 RX to ISO-GND | -25 | +25 | V |
| RS-232 TX to ISO-GND | -13.2 | +13.2 | V |
| GND to ISO-GND | -400 | +400 | V |

* The Taurus-AE can withstand up to 8A in the case of reverse power polarity.



Communications Parameters

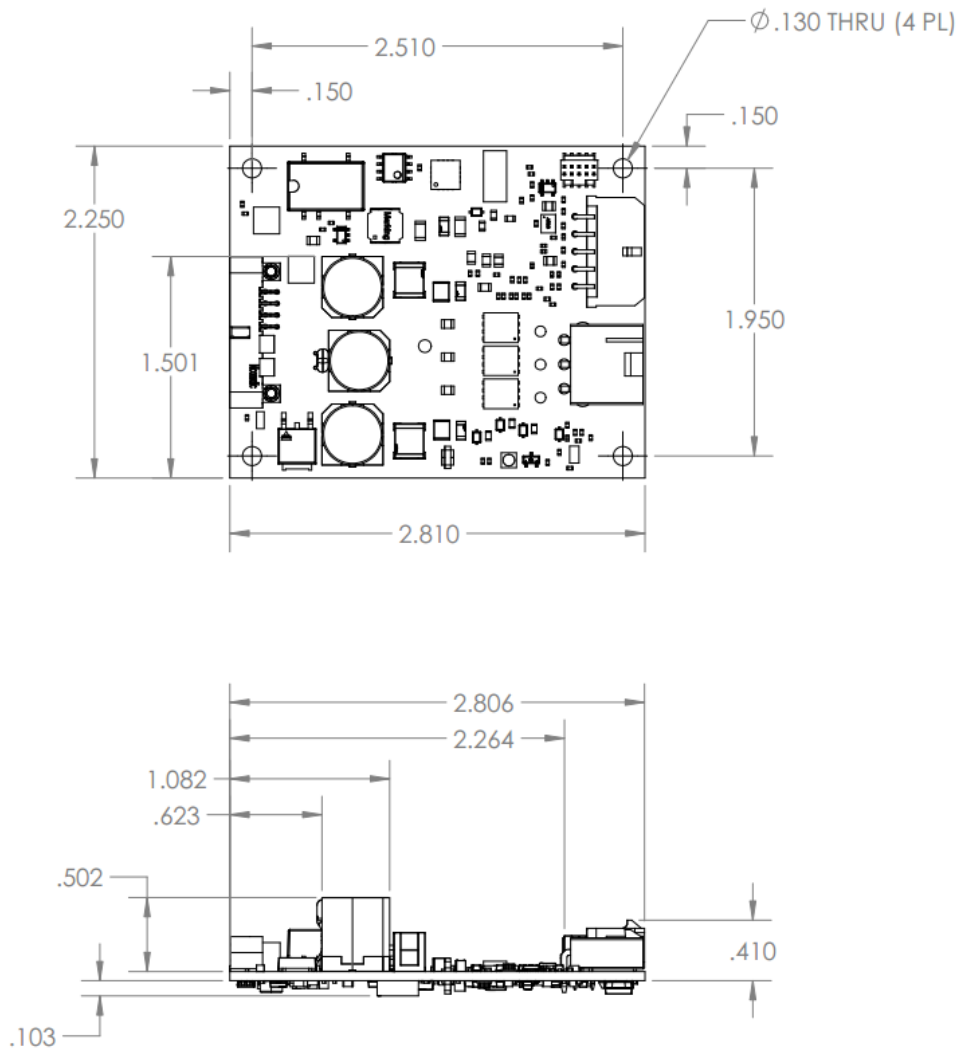
| Parameter | Min | Nom | Max | Units |
|---|-----------|------|-------|-------|
| CAN Differential Output Voltage (dominant) | 1.5 | | 3.0 | V |
| CAN Differential Output Voltage (recessive) | -0.12 | | 0.012 | V |
| RS-422/485 Differential Output | 1.5 @ 54Ω | | | V |
| RS-422/485 Common Mode Output Voltage | | 2.5 | 3 | V |
| RS-422/485 Input Rising Threshold | 40 | | 200 | mV |
| RS-422/485 Input Falling Threshold | -200 | | -40 | mV |
| RS-232 TX High Level | 5.0 | 5.4 | | V |
| Low Level | | -5.4 | -5.0 | V |
| RS-232 RX High threshold | | 1.8 | 2.4 | V |
| Low threshold | 0.8 | 1.5 | | V |
| Operating limit | -25 | | +25 | V |

For more detailed information, see the datasheets for the following transceivers:

| | |
|------------|-------------|
| RS-232 | MAX3227 |
| CAN 2.0 | SN65HVD255D |
| RS-422/485 | MAX14775 |



Mechanical Interface



Measurements given in inches.

Mounting Holes

- 4x 0.130"
- 2.510" x 1.950" square pattern
- Plated, electrically isolated

Weight: 37 g



Environmental

Temperature

Operating: -40°C to 105°C

Storage: -40° 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-AE.

| Device | Recommended Limit |
|--------------------|-------------------|
| Inverter MOSFETs | 125°C |
| Internal Processor | 125°C |
| Bulk Capacitor | 105°C |

Note: RS-232 not available across the full temperature range.