

CK3C PMAC Motion Controller

CK3C compact, industrial motion and automation controller

- 50 μ sec servo update (local)
- Wide selection of encoder feedback
- Various amplifier interface
- On-board digital & analog I/Os
- EtherCAT master
- High-speed position compare
- Full library of PMAC motion control
- Additional 8 servo axes
- Additional I/O



- General Description
- Part Number Designation
- Specifications
- Performance
- Dimensions

General Description

The CK3C is a 4 axis motion controller with an embedded Power PMAC ARM CPU. The CK3C is hardware compatible with both its predecessors: the Power Clipper and Turbo Clipper family members.

It supports virtually any type of feedback device (with the optional ACC-84S and ACC-51S) and is typically used to drive the following types of motors when given the correct hardware stack and drive combination:

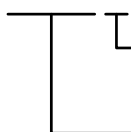
- 3-phase AC/DC brushless servo (synchronous) -- rotary/linear
- DC brush
- 2-phase stepper

For the latest hardware layout and connector locations, please refer to the CK3C User's Manual.

Part Number Designation

PRODUCT:	CK3C
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CK3C-AX1□□□□



Embedded Option:

[blank]: Standard Pins
E: Extended Embedded Pins

Additional Options:

100: 1x 1000 Base-T Ethernet Port

201: 2x 1000 Base-T Ethernet Ports, 4x 16-bit Analog Inputs, 1x Additional Analog Output

211: 1x 1000 Base-T Ethernet Port, 4x 16-bit Analog Inputs, 1x Additional Analog Output, EtherCAT Master with I/O Expansion License

231: 1x 1000 Base-T Ethernet Port, 4x 16-bit Analog Inputs, 1x Additional Analog Output, EtherCAT Master with I/O and 8 Servo Axis Expansion License

Type of Unit	Model	CPU	Memory	Ethernet Port(s)	EtherCAT License	Analog I/O	Extended Pin
Controller Unit	CK3C-AX1100	Coretex-A7 Dual core 1GHz	RAM: 1 GB Flash: 1 GB	1	No	No	No
	CK3C-AX1201			2	No	4x 16-bit AI 1x Filtered PWM AO	No
	CK3C-AX1211			2	I/O Only	4x 16-bit AI 1x Filtered PWM AO	No
	CK3C-AX1231			2	8 Servo	4x 16-bit AI 1x Filtered PWM AO	No
	CK3C-AX1100E			1	No	No	Yes
	CK3C-AX1201E			2	No	4x 16-bit AI 1x Filtered PWM AO	Yes
	CK3C-AX1211E			2	I/O Only	4x 16-bit AI 1x Filtered PWM AO	Yes
	CK3C-AX1231E			2	8 Servo	4x 16-bit AI 1x Filtered PWM AO	Yes

Axis Modules - ACC-24S3

Part Number	Description
3-4050000-000-000000	4-Channel expansion
3-4050000-000-010000	4-Channel expansion with 4 analog inputs & 1 Filtered PWM output

Sinusoidal Encoder Modules - ACC-51S

Part Number	Description
3-3674-0-0002-000000	2-Channel 4096x interpolator stack board for sinusoidal encoders
3-3674-0-0012-000000	4-Channel 4096x interpolator stack board for sinusoidal encoders

Serial Encoder Modules - ACC-84S

Part Number	Description
3-3936-0-0002-000000	4-Channel SSI serial encoder protocol
3-3936-0-0003-000000	4-Channel ENDAT serial encoder protocol
3-3936-0-0006-000000	4-Channel Yaskawa Sigma II & III serial encoder protocol
3-3936-0-0008-000000	4-Channel Panasonic serial encoder protocol
3-3936-0-000B-000000	4-Channel BISS-C serial encoder protocol
3-3936-0-000D-000000	4-Channel Mitsubishi serial encoder protocol
3-3936-0-000E-000000	4-Channel 1S serial encoder protocol
3-3936-0-0XY2-000000	XY2-100 serial link for 2-axis and 3-axis laser scan heads and galvanometers
3-3936-0-0TBC-000000	4-Channel table based compare protocol

Analog Output Modules - ACC-8AS

Part Number	Description
3A0-603673-10X	4-Channel dual 16-bit DAC analog board

PWM Output Modules - ACC-8FS

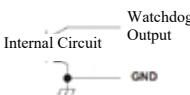
Part Number	Description
3F0-603673-10X	4-Channel direct PWM breakout board

4-Channel Breakout Board

Part Number	Description
CBB4-00-000-000-1000	CK3C breakout board with separate connectors for each encoder, each flag set, and servo amplifier output

Specifications

1. Classification		
1.1 Name	CK3C	
1.2 Type	Power PMAC ARM Motion Controller	
2. Construction		
2.1 Dimensions	(Not including extended pins, CK3C-AX1□□□) (Height / Depth / Width): 244.4 / 114.7 / 22.3 mm	
	(Including extended pins, CK3C-AX1□□□E) (Height / Depth / Width): 244.4 / 114.7 / 29.2 mm	
2.2 Enclosure	Mounted vertically in a panel	
2.3 Air Flow Clearances	2.4" (61 mm) above and below unit for air flow.	
2.4 Cooling	Natural convection and built-in CPU fan.	
2.5 Grounding	Ground of 100 Ω or less	
3. General/Mechanical		
3.1 Weight	≈ 420g	
3.2 External Terminals	[Communications connector] For EtherCAT communications: • RJ45 × 1 (Shield supported) For Ethernet communications • RJ45 × 1 (Shield supported)	
	[USB port] For external memory connection, USB 3.0 host × 1 Type A	
3.3 Max. Number of Stacked Units	4 (including CK3C Controller) Max number of ACC-24S3's allowable: 1	
3.4 EtherCAT Communications	Communications protocol	EtherCAT protocol
	Mode	DC sync, Free run
	Baud rate	100 Mbps
	Physical layer	100BASE-TX (IEEE 802.3)
	Topology	Line, daisy chain, and branching
	Transmission media	Twisted-pair cable of category 5 or higher (double-shielded cable with aluminum tape and braiding)
	Transmission distance	Distance between nodes: 100 m or less
	Maximum number of slaves	8
	Minimum EtherCAT cycle Period	500usec min (8 axis slaves with total 32 PDO)
	Range of node addresses that can be set	1 to 8
3.6 Ethernet Communications	Physical layer	1000BASE-T
	Frame length	1,514 bytes max.
	Media access method	CSMA/CD
	Modulation	Baseband
	Topology	Star
	Transmission media	Twisted-pair cable of category 5, 5e, or higher (shielded cable)

	Maximum transmission distance between Ethernet switch and node		100 m
	Maximum number of cascade connections		There are no restrictions if an Ethernet switch is used
3.7 USB Port	Physical layer		USB 3.0 compliant, type A connector. Output voltage: 5 V, 0.9 A max.
	Transmission distance		3 m max.
3.8 Watchdog Timer Output	Output form		Open drain output (Under WD condition the output is open)
	Rated voltage		5 VDC
	Operating load voltage range		20.4 to 26.4 VDC
	Maximum value of load current		0.1 A
	Leakage current		0.1 mA max
	Residual voltage		1.5 VDC max.
	ON/OFF response time		10 ms max./10 ms max.
	Isolation method		No isolation
	Circuit Configuration		
	4. Ratings		
4.1 Digital Power Supply	Input voltage		5 VDC ± 0.2 VDC (3.8A max.)
	Isolation		No isolation
	Maximum input voltage ripple		0.1 Vp-p
	Power down detection		4.6 VDC min. low voltage fault detection on 5 VDC input
	Flags Power Supply (from TB1)	5V – 24V (from TB1)	
4.2 Analog I/O Power Supply	Input voltage		+12 VDC (+3.5 VDC/-0.2 VDC) (0.8 A max.)
			-12 VDC (0.2 VDC/-3.5 VDC) (0.8 A max.)
	Isolation		No isolation
	Maximum input voltage ripple		0.1 Vp-p
6. Environmental Test			
6.1 Ambient temperature		15 to 35°C	
6.2 Humidity		30% to 75%	
7. Environmental Storage			
7.1 Ambient temperature		-25 to 70°C with no condensation or icing.	
7.2 Atmosphere		Must be free from corrosive gases.	
7.3 Ambient humidity		10 – 90 % RH (without condensation or icing)	

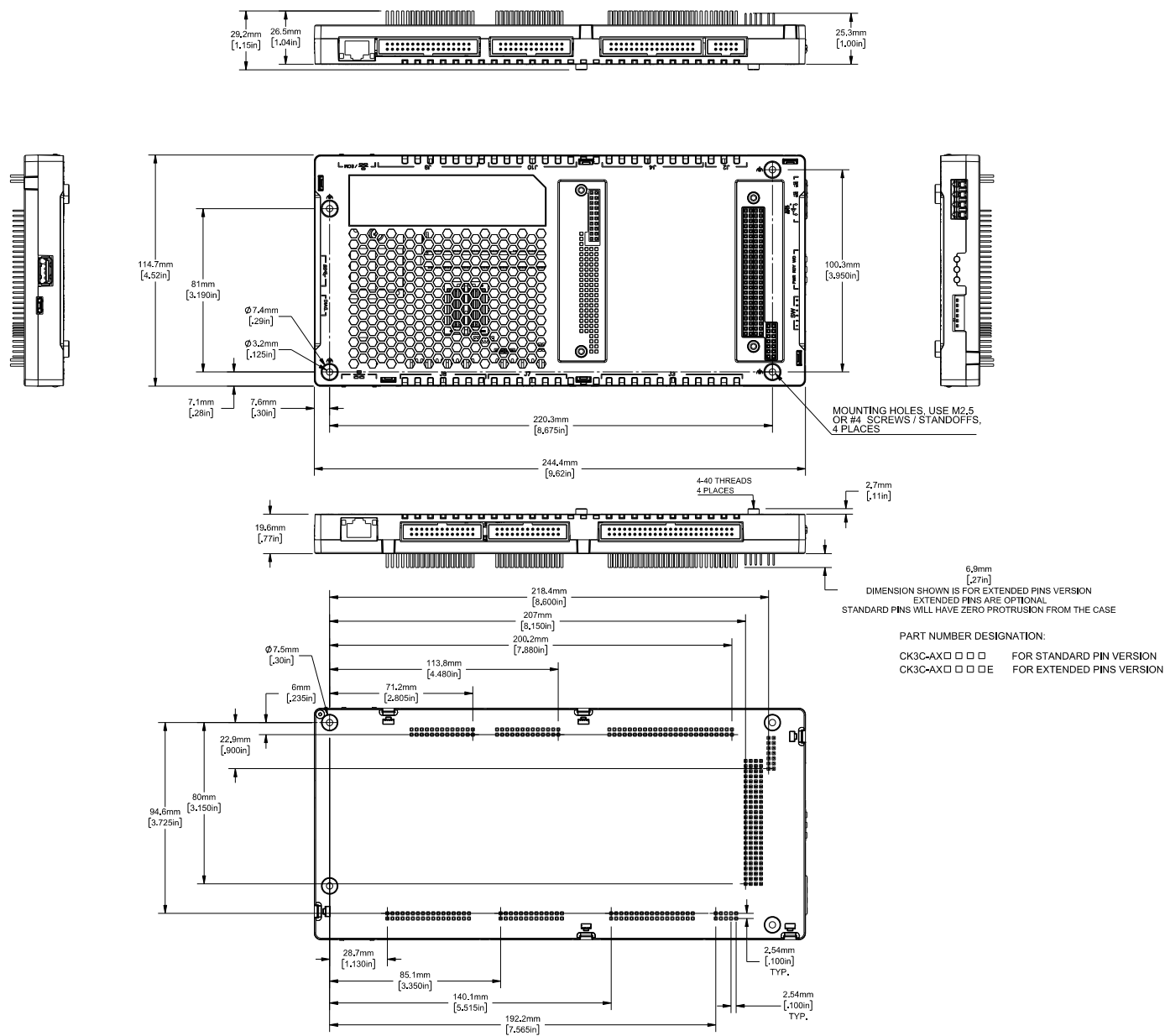
8. Environmental Operation	
8.1 Ambient operating temperature	0 to 55°C
8.2 Ambient operating humidity	10% to 90% RH (without condensation or icing)
8.3 Atmosphere	Must be free from corrosive gases.
8.5 Maximum operating altitude	1,000 m
8.6 Vibration resistance	Conforms to IEC 60068-2-6. 5 to 8.4 Hz with 3.5-mm amplitude, 8.4 to 150 Hz, acceleration of 9.8 m/s ² each in X, Y, and Z directions 100 min (10 sweeps of 10 min each = 100 min total)
8.7 Shock resistance	Conforms to IEC 60068-2-27, 147 m/s ² , 3 times each in X, Y, and Z directions
8.8 Insulation resistance	20 MΩ min. between isolated circuits (at 100 VDC)
8.9 Di-electric strength	510 VAC between isolated circuits for 1 minute at a leakage current of 5 mA max.

Performance

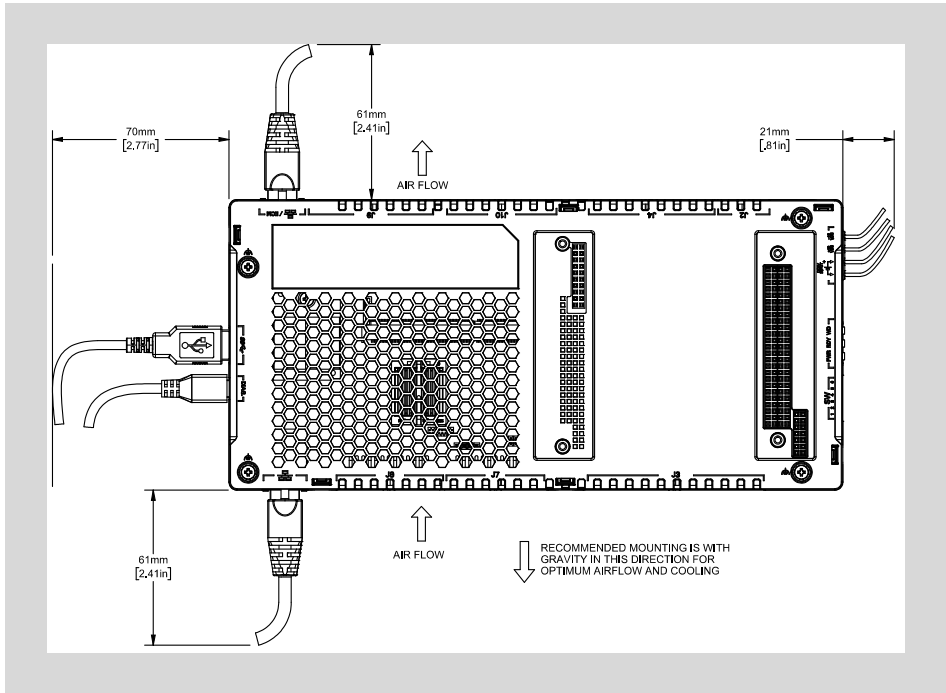
1. Standard (Power Clipper without additional accessory options)		
1.1 OS	Linux 4.0 Kernel / Xenomai	
1.2 Memory	Main memory: 1 GB (non-ECC) Flash memory: 1 GB	
1.3 Motion Control	Maximum number of controlled axes	Analog: 8 axes max. (8 axes max. with ACC-24S3) EtherCAT: 8 axes max
	Control method	Direct Control: With Controller unit or ACC-24S3 Network: EtherCAT of Controller unit
1.4 Limits, Flags, and EQU	Per channel: <ul style="list-style-type: none">• 2 limit inputs (Plus and Minus)• 2 flag inputs (Home and User)• 1 EQU output	
1.5 Step and Direction (PFM)	The step and direction outputs can be connected in single-ended configuration for 5V (input signal) amplifiers.	
1.6 Digital I/O	Inputs: Up to 32 (16 inputs by default) Outputs: Up to 32 (16 inputs by default)	
1.7 Servo Interface	4-Channel servo interface, each including: <ul style="list-style-type: none">• Quadrature encoder (with index) interface• UVW digital Hall sensor interface• Serial encoder interface, with software selectable protocol, from the following:<ul style="list-style-type: none">○ SSI○ EnDat 2.1/2.2 (2.1-compatible features only) with delay compensation○ Hiperface○ Yaskawa Sigma I○ Yaskawa II/III/V (no position reset or fault clear)○ Tamagawa FA-Coder○ Panasonic (no servo clock output)○ Mitutoyo○ Kawasaki○ Basic quadrature (no index, no capture)• Filtered PWM analog output (~13-bit resolution)• Pulse & direction output• Input flags (Plus Limit, Minus Limit, Home, User) at 5V CMOS levels (24V tolerant)• Position compare (EQU) output• Amplifier-enable output and amplifier-fault input flags• Brake control output	
1.8 Amplifier Output	<ul style="list-style-type: none">• Analog voltage ±10V (Filtered PWM)• Analog voltage ±10V (True DAC)• Direct PWM• Pulse & direction (PFM)	
3. Accessory Descriptions		

3.1 ACC-24S3	<p>The ACC-24S3 can be stacked on top of the CK3C to provide an additional 4 channels of servo interface circuitry and 32 additional digital I/O points equivalent to what is on the CK3C itself. Optionally, it can provide 4 additional 12-bit ADCs and 1 additional filtered-PWM analog output (~13 bits).</p> <p>Only one ACC-24S3 board can be used with each CK3C. If it is installed on top of the CK3C, only one small stack board (ACC-8AS, 8FS, 8TS, 51S, 84S) can be installed directly on the CK3C between it and the ACC-24S3. Two of these small stack boards can be installed on top of the ACC-24S3.</p>
3.2 ACC-51S	<p>The ACC-51S can be stacked on top of either the CK3C or the ACC-24S3 to provide 4 channels of sinusoidal encoder interpolation with 16,384 states per line.</p> <p>The sinusoidal encoder inputs passed through the ACC-51S <i>cannot</i> be used simultaneously with the main quadrature encoder inputs of the same channel of the CK3C or ACC-24S3 without interference. However, it is possible to pass digital quadrature signals through the ACC-51S.</p>
3.3 ACC-84S	<p>The ACC-84S can be stacked on top of either the CK3C or the ACC-24S3 to provide 4 channels of serial-encoder interface. The ACC-84S can be ordered from the factory with a single encoder protocol installed from the following list:</p> <ul style="list-style-type: none"> • EnDat2.2 with additional information, no delay compensation • BiSS-B/C • Yaskawa II/III/V with position reset and fault clear • Tamagawa FA-Coder with servo clock output • Mitsubishi • SSI (no capabilities over CK3C's built-in interface) • Panasonic (no capabilities over CK3C's built-in interface) • Mitutoyo (no capabilities over CK3C's built-in interface) <p>The serial-encoder inputs on the ACC-84S <i>can</i> be used simultaneously with the serial-encoder input on the same channel of the CK3C or ACC-24S3 without interference.</p>
3.4 ACC-8AS	<p>The ACC-8AS can be stacked on top of either the CK3C or the ACC-24S3 to provide 4 channels of True-DAC output ($\pm 10V$) to analog amplifiers.</p>
3.5 ACC-8FS	<p>The ACC-8FS can be stacked on top of either the CK3C or the ACC-24S3 to provide 4 channels of 3-phase direct-PWM output through Mini-D 36-pin connectors to “power block” amplifiers. This board is mainly used for applications where the CK3C is performing both the commutation and digital current loop closure for brushless motors.</p> <p>The 3-phase PWM outputs of the ACC-8FS <i>cannot</i> be used simultaneously with the filtered-PWM analog output on the same channel of the CK3C or ACC-24S3. However, they <i>can</i> be used simultaneously with the PFM (pulse-and-direction) outputs of the same channel of the CK3C or ACC-24S3 without interference.</p>

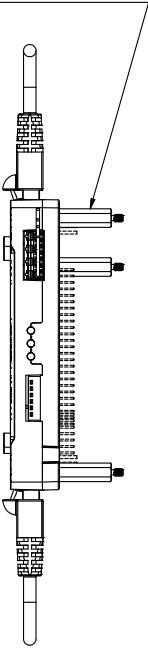
CK3C Dimensions



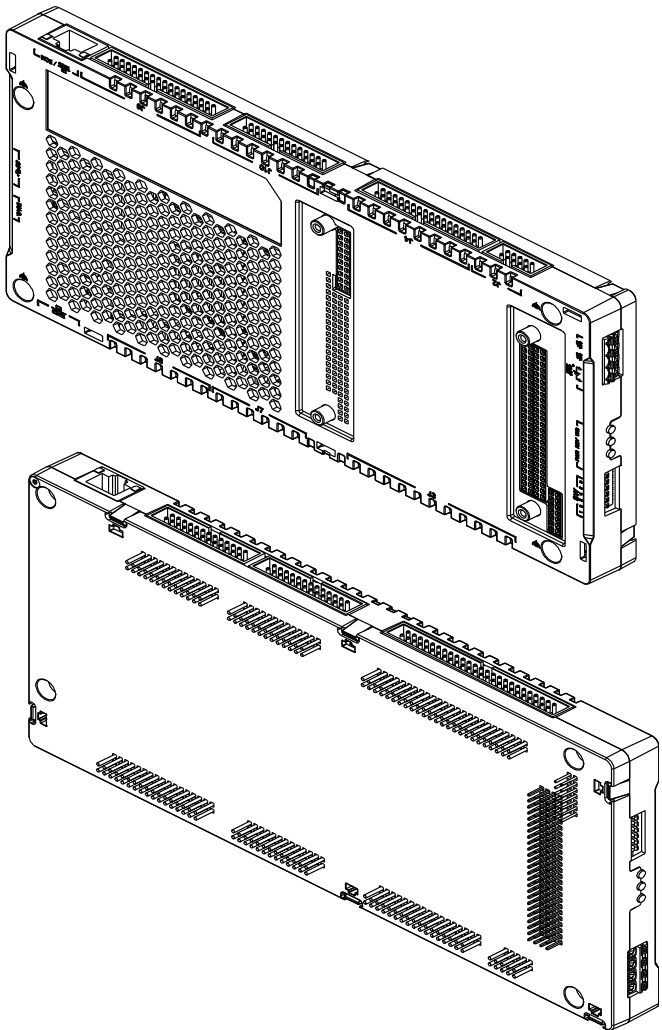
CK3C Panel Clearance and Mounting Direction



USE APPROPRIATE LENGTH
STANDOFF FOR MOUNTING.
M2.5 OR #4 SCREWS/STANDOFFS
ARE RECOMMENDED.



CK3C Isometric View



This specification sheet is provided to the customers of Delta Tau Data Systems, Inc. as a reference.

REVISION HISTORY				
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A	May 12, 2023	SM	AA	AA

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