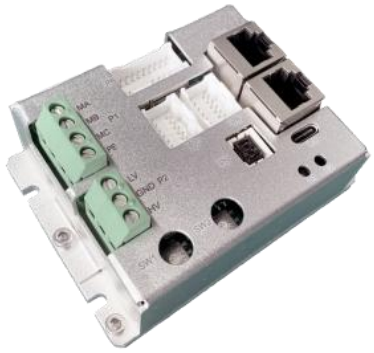
CFD060-5-EM

FlexPro® Series

SPECIFICATIONS

Current Peak	**10 A**
Current Continuous	**5 A**
DC Supply Voltage	**10 – 55 VDC**
Network Communication	**EtherCAT**



The **CFD060-5-EM** offers full tuning control of all servo loops and is designed to drive brushed and brushless servo motors, and closed loop stepper motors. The drive assembly accepts a variety of external command signals, or can use the builtin Motion Engine, an internal motion controller used with Sequencing and Indexing commands. Programmable digital and analog I/O are included to enhance interfacing with external controllers and devices.

The CFD060-5-EM utilizes EtherCAT® network communication using CANopen over EtherCAT (CoE) and is configured via USB. All drive and motor parameters are stored in non-volatile memory.

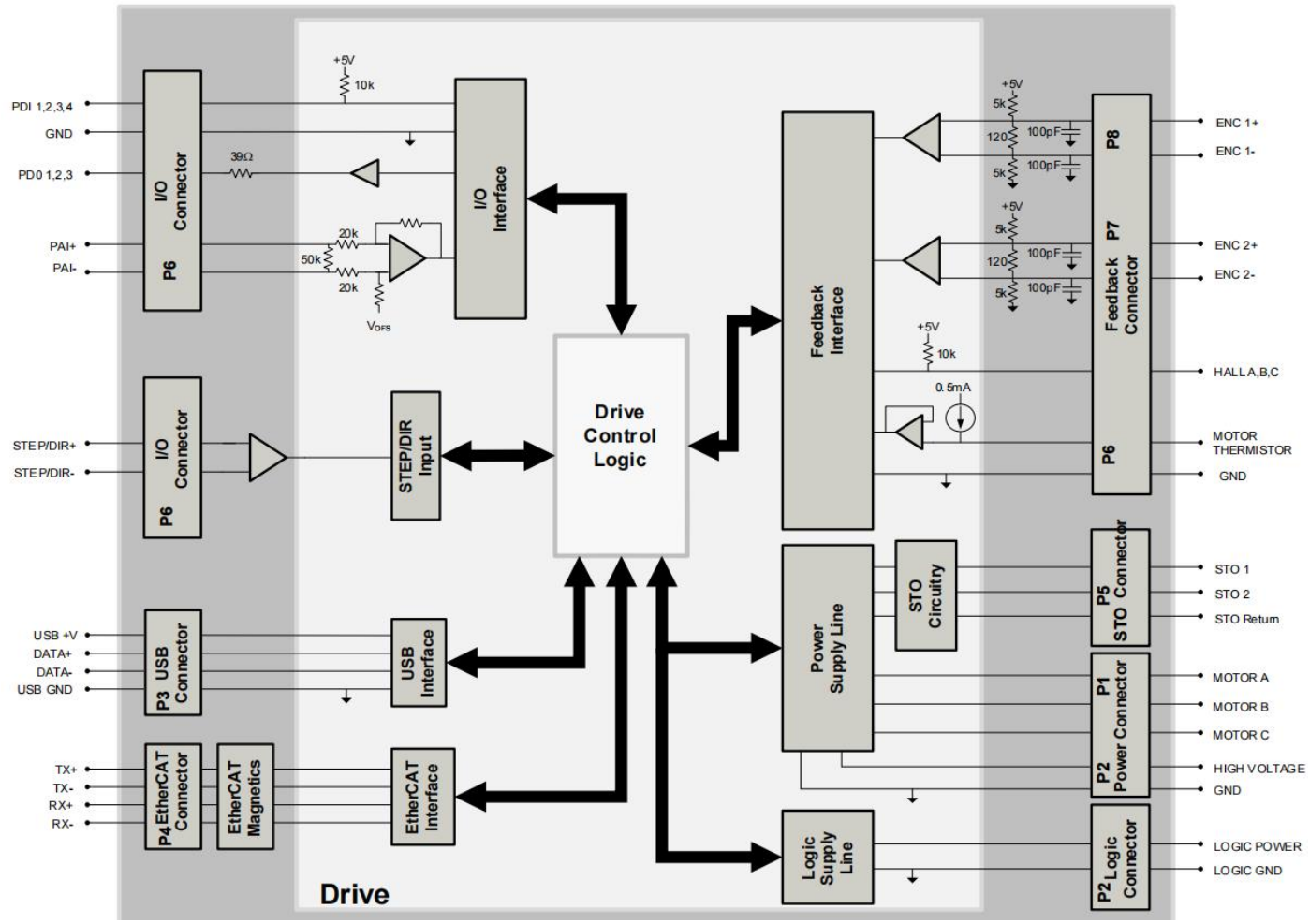
IMPACT™ (**I**ntegrated **M**otion **P**latform **A**nd **C**ontrol **T**echnology) combines exceptional processing capability and highcurrent components to create powerful, compact, feature-loaded servo solutions. IMPACT™ is used in all FlexPro® drives and is available in custom products as well.

FEATURES

- CoE – Based on DSP-402 Device Profile for Drives and Motion Control
- Synchronization using Distributed Clocks
- Position Cycle Times down to 100us
- Four Quadrant Regenerative Operation
- Programmable Gain Settings
- PIDF Velocity Loop
- On-the-Fly Mode Switching
- On-the-Fly Gain Set Switching
- Dedicated Safe Torque Off (STO) Inputs
- Bridge Status, Fault and Network Status LEDs
- I/O Status LEDs
- Standard Connections for Easy Setup

Feedback Supported	• Absolute Encoder BiSS C-Mode EnDat 2.2 • Incremental Encoder • Hall Sensors • Aux Incremental Encoder • Tachometer (±10V)	**Motors Supported**	• Three Phase • Single Phase • Stepper(Pending)	**Modes of Operation**	• Profile Modes • Cyclic Synchronous Modes • Current • Velocity • Position
Command Sources	• Over the Network • ±10V Analog • Sequencing • Indexing • Jogging • Step & Direction • Encoder Following	**Inputs / Outputs**	• 4 Programmable Digital Inputs • 3 Programmable Digital Outputs • 1 Programmable Analog Input	**Agency Approvals**	• RoHS • UL/cUL (Pending) • CE (Pending) • TUV Rheinland (STO) (Pending)

BLOCK DIAGRAM



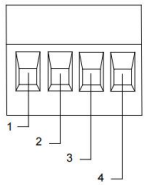
SPECIFICATIONS

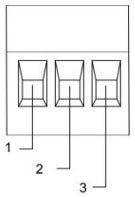
Electrical Specifications		
Description	**Units**	**Value**
DC Supply Input Range	VDC	10 – 55
DC Supply Undervoltage	VDC	8
DC Supply Overvoltage	VDC	58
Logic Supply Input Range (optional)	VDC	10 – 55
Safe Torque Off Voltage (Default)	VDC	5
Bus Capacitance	uf	52.8
Maximum Peak Current Output[1]	A (Arms)	10 (7.1)
Maximum Continuous Current Output[2]	A (Arms)	5 (5)
Efficiency at Rated Power	%	99
Maximum Continuous Output Power	W	272
Maximum Power Dissipation at Rated Power	W	3
Minimum Load Inductance (line-to-line)[3]	µH	150 (@ 48VDC supply); 75 (@24VDC supply); 40 (@12VDC supply)
Switching Frequency	kHz	20
Maximum Output PWM Duty Cycle	%	83
Control Specifications		
Description	**Units**	**Value**
Communication Interfaces[4]	-	EtherCAT® (USB for configuration)
Command Sources	-	±10 V Analog, Over the Network, Sequencing, Indexing, Jogging, Step & Direction, Encoder Following
Feedback Supported	-	Absolute Encoder (BiSS C-Mode), Incremental Encoder, Hall Sensors, Auxiliary Incremental Encoder, ±10 VDC Position, Tachometer (±10V)
Commutation Methods	-	Sinusoidal, Trapezoidal
Modes of Operation	-	Profile Modes, Cyclic Synchronous Modes, Current, Velocity, Position
Motors Supported[5]	-	Three Phase (Brushless Servo), Single Phase (Brushed Servo, Voice Coil, Inductive Load), Stepper (2- or 3-Phase Closed Loop), AC Induction (Closed Loop Vector)
Hardware Protection	-	40+ Configurable Functions, Over Current, Over Temperature (Drive & Motor), Over Voltage, Short Circuit (Phase-Phase & Phase-Ground), Under Voltage
Programmable Digital Inputs/Outputs	-	4/3
Programmable Analog Inputs/Outputs	-	1/0
Primary I/O Logic Level	-	5 VDC, not isolated
Current Loop Sample Time	us	50
Velocity Loop Sample Time	us	100
Position Loop Sample Time	us	100
Maximum Encoder Frequency	MHz	20 (5 pre-quadrature)
Mechanical Specifications		
Description	**Units**	**Value**
Size (H x W x D)	mm (in)	89 x 65x 39.6 (3.5 x 2.56 x 1.56)
Weight	g (oz)	160
Ambient Operating Temperature Range[6]	°C (°F)	0 – 65 (32 – 149)
Storage Temperature Range	°C (°F)	-40 – 85 (-40 – 185)
Relative Humidity	mm (in)	0-95%, non-condensing

Notes

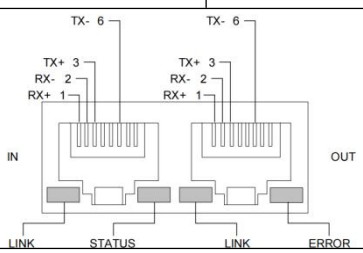
1. Capable of supplying drive rated peak current for 2 seconds with 10 second foldback to continuous value. Longer times are possible with lower current limits.
2. Continuous A_{rms} value attainable when RMS Charge-Based Limiting is used.
3. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
4. EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
5. Maximum motor speed for stepper motors is 600 RPM. Consult the hardware installation manual for 2-phase stepper wiring configuration.
6. Additional cooling and/or heatsink may be required to achieve rated performance.

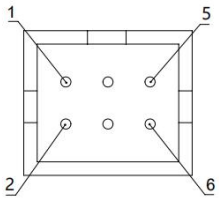
PIN FUNCTIONS

P1-Motor Power Connector			
PIN	Name	Description / Notes	I/O
1	MOTOR A	Motor Phase A.	O
2	MOTOR B	Motor Phase B.	O
3	MOTOR C	Motor Phase C.	O
4	PE	Protective Earth Ground (motor cable shield)	-
Connector Information		4-port screw terminal	
Mating Connector Details		Not Applicable	
Mating Connector Included		Not Applicable	

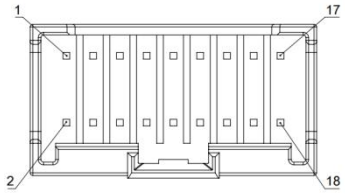
P2-Power Connector			
PIN	Name	Description / Notes	I/O
1	LV	Logic Supply Input (10 – 55VDC) (optional)	I
2	GND	Ground	GND
3	HV	DC Supply Input (10-55 VDC).	I
Connector Information		3-port screw terminal	
Mating Connector Details		Not Applicable	
Mating Connector Included		Not Applicable	

P3-USB Connector			
PIN	Name	Description / Notes	I/O
Connector Information		USB Type C port	
Mating Connector Details		Standard Type C USB connection cable	
Mating Connector Included		No	

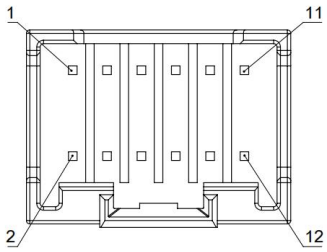
P4-EtherCAT Communication Connectors			
PIN	Name	Description / Notes	I/O
1	RX+	Receiver + (100Base-TX)	I
2	RX-	Receiver - (100Base-TX)	I
3	TX+	Transmitter + (100Base-TX)	O
4	RESERVED	Reserved.	-
5	RESERVED	Reserved.	-
6	TX-	Transmitter - (100Base-TX)	O
7	RESERVED	Reserved.	-
8	RESERVED	Reserved.	-
Connector Information		Shielded, dual RJ-45 socket with LEDs	
Mating Connector Details		CAT 5 Cable	
Mating Connector Included		No	

P5-STO Connector*			
PIN	**Name**	**Description / Notes**	**I/O**
1	STO-1 INPUT	Safe Torque Off – Input 1	I
2	+5VDC	+5V Supply Output	O
3	STO RETURN	Safe Torque Off Return	STORET
4	GND	Ground	GND
5	STO-2 INPUT	Safe Torque Off – Input 2	I
6	+5VDC	+5V Supply Output	O
Connector Information		XHD2.54mm pitch double row straight header 2*3P	
Mating Connector Details		XHD2.54	
Mating Connector Included		No	

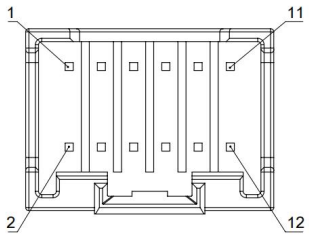
*: If you want to disable the STO function, please use three 2.54MM shorting caps to short 1-2, 3-4, 5-6 of P5.

P6-IO Connector			
PIN	**Name**	**Description / Notes**	**I/O**
1	+5V OUT	+5V Supply Output. Short-circuit protected.	O
2	GND	Ground.	GND
3	PDI-1	General Purpose Programmable Digital Input	I
4	PAI-1+	General Purpose Differential Programmable Analog Input or Reference Signal Input. ±10VDC Range (12-bit Resolution) .	I
5	PDI-2	General Purpose Programmable Digital Input	I
6	PAI-1-	General Purpose Differential Programmable Analog Input or Reference Signal Input. ±10VDC Range (12-bit Resolution) .	I
7	PDI-3	General Purpose Programmable Digital Input	I
8	PDO-3	General Purpose Programmable Digital Output (TTL/8mA)	O
9	PDI-4	General Purpose Programmable Digital Input	I
10	PDO-2	General Purpose Programmable Digital Output (TTL/8mA)	O
11	GND	Ground.	GND
12	PDO-1	General Purpose Programmable Digital Output (TTL/8mA)	O
13	DIR +	Differential Direction Input+.	I
14	STEP +	Differential Step Input.	I
15	DIR -	Differential Direction Input-.	I
16	STEP -	Differential Step Input.	I
17	GND	Ground.	GND
18	THERMISTOR	Motor Thermal Protection.	I
Connector Information		18-pin, dual-row, 2.00 mm spaced plug terminal, vertical mount	
Mating Connector Details		Molex: P/N 51353-1800 (housing); 56134-9100 (contacts)	
Mating Connector Included		No	

P7-Feedback 2 Connector			
PIN	**Name**	**Description / Notes**	**I/O**
1	HALL B	Single-ended Commutation Sensor Inputs.	I
2	HALL A	Single-ended Commutation Sensor Inputs.	I
3	ENC 2 A+	Differential Incremental Encoder A.	I
4	HALL C	Single-ended Commutation Sensor Inputs.	I
5	ENC 2 A-	Differential Incremental Encoder A.	I
6	GND	Ground.	GND
7	+5V OUT	+5V Encoder Supply Output. Short-circuit protected.	O
8	ENC 2 B+	Differential Incremental Encoder B.	I
9	ENC2 INDEX+	Differential Incremental Encoder Index.	I
10	ENC 2 B-	Differential Incremental Encoder B.	I
11	ENC2 INDEX-	Differential Incremental Encoder Index.	I
12	GND	Ground.	GND

Connector Information	12-port, dual-row, 2.00 mm spaced plug terminal, vertical mount	
Mating Connector Details	Molex: P/N 51353-1200 (housing); 56134-9100 (contacts)	
Mating Connector Included	No	

P8-Feedback 1 Connector			
PIN	**Name**	**Description / Notes**	**I/O**
1	HALL B	Single-ended Commutation Sensor Inputs.	I
2	HALL A	Single-ended Commutation Sensor Inputs.	I
3	ENC 2 A+	Differential Data Line for Absolute Encoders (BiSS: SLO+/-) or Differential Incremental Encoder A.	I
4	HALL C	Single-ended Commutation Sensor Inputs.	I
5	ENC 2 A-	Differential Data Line for Absolute Encoders (BiSS: SLO+/-) or Differential Incremental Encoder A.	I
6	GND	Ground.	GND
7	+5V OUT	+5V Encoder Supply Output. Short-circuit protected.	O
8	ENC 2 B+	Differential Clock Line for Absolute Encoders (BiSS: MA+/-) or Differential Incremental Encoder B.	I
9	ENC 2 INDEX+	Differential Reference Mark for Absolute Encoders (Leave open for BiSS and EnDat 2.2) or Differential Incremental Encoder Index.	I
10	ENC 2 B-	Differential Clock Line for Absolute Encoders (BiSS: MA+/-) or Differential Incremental Encoder B.	I
11	ENC 2 INDEX-	Differential Reference Mark for Absolute Encoders (Leave open for BiSS and EnDat 2.2) or Differential Incremental Encoder Index.	I
12	GND	Ground.	GND

Connector Information	12-port, dual-row, 2.00 mm spaced plug terminal, vertical mount	
Mating Connector Details	Molex: P/N 51353-1200 (housing); 56134-9100 (contacts)	
Mating Connector Included	No	

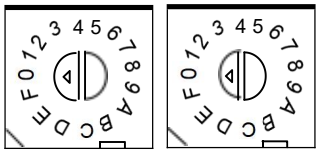
BOARD CONFIGURATION

LED	Description
L1	Indicates that power is available to the drive. GREEN when power is available.
L2	Indicates that logic power is available to the drive. BLUE when logic power is available.

Communication Status LED Functions (on RJ-45 Communication Connectors)

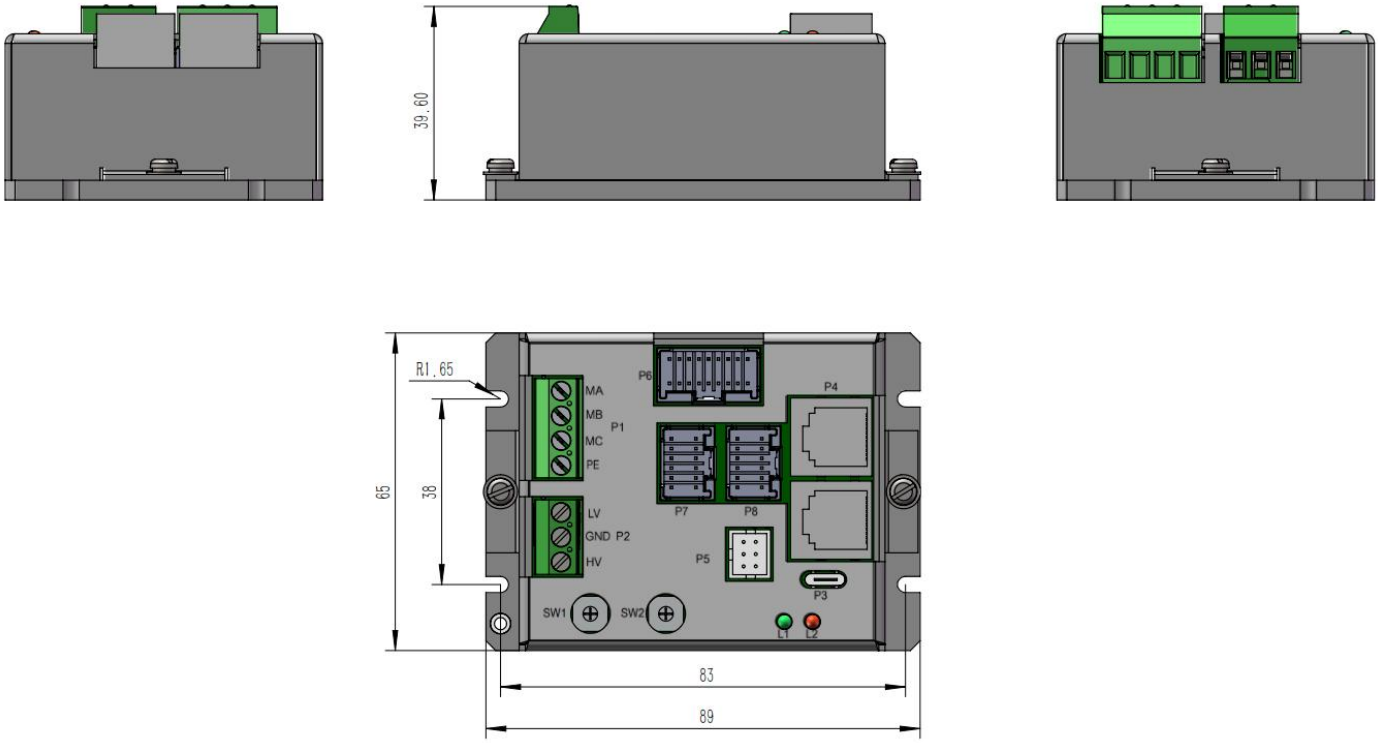
LED		Description
LINK	Green – On Green – Flickering Off	Valid Link - No Activity Valid Link - Network Activity Invalid Link
ETHERCAT STATUS	Green – On	The device is in the state OPERATIONAL
	Green – Blinking (2.5Hz – 200ms on and 200ms off)	The device is in the state PRE-OPERATIONAL
	Green – Single Flash (200ms flash followed by 1000ms off)	The device is in state SAFE-OPERATIONAL
	Green – Flickering (10Hz – 50ms on and 50ms off)	The device is booting and has not yet entered the INIT state or The device is in state BOOTSTRAP or Firmware download operation in progress
	Off	The device is in state INIT
ERROR	Red – On	A PDI Watchdog timeout has occurred. Example: Application controller is not responding anymore.
	Red – Blinking (2.5Hz – 200ms on and 200ms off)	General Configuration Error. Example: State change commanded by master is impossible due to register or object settings.
	Red – Flickering (10Hz – 50ms on and 50ms off)	Booting Error was detected. INIT state reached, but parameter "Change" in the AL status register is set to 0x01:change/error Example: Checksum Error in Flash Memory.
	Red – Single Flash (200ms flash followed by 1000ms off)	The slave device application has changed the EtherCAT state autonomously: Parameter "Change" in the AL status register is set to 0x01:change/error. Example: Synchronization error; device enters SAFE-OPERATIONAL automatically
	Red – Double Flash (Two 200ms flashes separated by 200ms off, followed by 1000ms off)	An application Watchdog timeout has occurred. Example: Sync Manager Watchdog timeout.

Address Selector Switches

Switch Diagram	Description
 SW1 SW2	Hexadecimal switch settings correspond to the drive Station Alias (EtherCAT). Note that drives on an EtherCAT network will be given an address automatically based on proximity to the host. Setting the switches manually is optional, and only necessary if a fixed address is required.

SW1	SW4	Node ID
0	0	000
0	1	001
0	2	002
…	…	…
F	D	253
F	E	254
F	F	255

BOARD CONFIGURATION



Applicable Model	CFD060-01-EM
	CFD060-05-EM
	CFD060-10-EM
	CFD060-25-EM

BOARD CONFIGURATION

CFD _ 060 - 5 - E M

Drive Series
CFD FlexPro

Environment
X EXtended Environment

Maximum DC Bus Voltage
060 60 VDC
100 100 VDC

Feedback
M Multi Encoder

Network Communication
E EtherCAT
C CANopen
R RS485/232
IP Ethernet/IP

Continuous Current
1 1A
5 5A
10 10A
25 25A

Us also has the capability to promptly develop and deliver specified products for OEMs with volume requests. Our Applications and Engineering Departments will work closely with your design team through all stages of development in order to provide the best servo drive solution for your system. Equipped with on-site manufacturing for quick-turn customs capabilities, *ADVANCED* Motion Controls utilizes our years of engineering and manufacturing expertise to decrease your costs and time-to-market while increasing system quality and reliability.

Examples of Customized Products

- Optimized Footprint
- Tailored Project File
- Private Label Software
- Silkscreen Branding
- OEM Specified Connectors
- Optimized Base Plate
- No Outer Case
- Increased Current Limits
- Increased Current Resolution
- Increased Voltage Range
- Increased Temperature Range
- Conformal Coating
- Custom Control Interface
- Multi-Axis Configurations
- Integrated System I/O
- Reduced Profile Size and Weight

Feel free to contact us for further information and details!