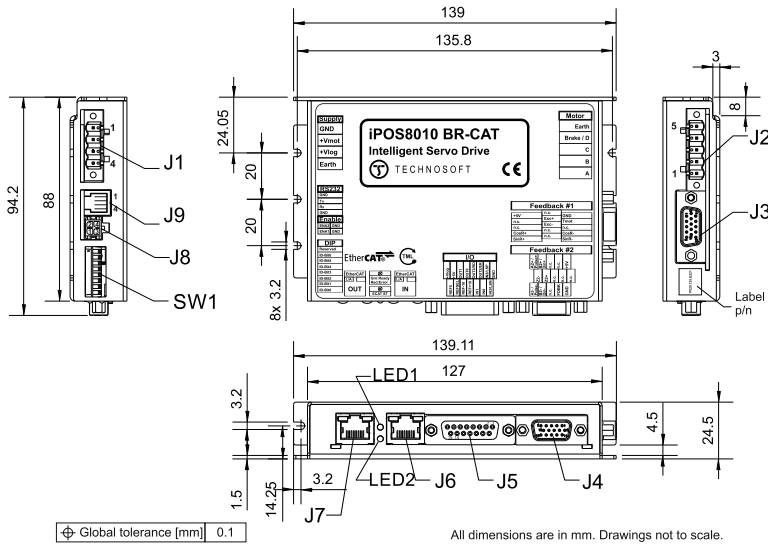


# iPOS8010 BR-CAT DATASHEET

P/N: P029.025.E224



Sensor	Motor			
	PMSM	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder	Ⓢ	Ⓢ	Ⓢ	
Resolver	Ⓢ			
Tacho		Ⓢ		
Open-loop (no sensor)			Ⓢ	Ⓢ

Mating connectors			
Producer	Part No.	Connector	Description
Camden	CTBA9208/4FL	J1	Supply input, 4x5.08 female counter part for cable
Camden	CTBA9208/5FL	J2	Motor power, 5x5.08 female counter part for cable
	generic 15-pin High Density D-Sub male	J3,J4	Feedback #1 & #2
	generic RJ10-4/4 phone plug	J9	RS232
	generic 15-pin D-Sub male, DB15	J5	I/O ; Analog
MOLEX	43025-0400	J8	MICROFIT RECEPTACLE HOUSING, 2x2 WAY
MOLEX	43030-0007	J8	CRIMP PIN, MICROFIT, 5A
-	-	J6, J7	Standard 8P8C modular jack (RJ-45) male

- ### Features
- Motion controller and drive in a single compact unit based on MotionChip™ technology
  - Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors
  - Advanced motion control capabilities (PVT, S-curve, electronic cam)
  - Motor supply: 12-80V; Logic supply 12-36V
  - Output current: 10A cont. (BLDC mode); 20A<sub>PEAK</sub>, up to 125kHz PWM
  - Feedback Devices (dual-loop support)
    - 1<sup>st</sup> feedback device supported:
      - Resolver (differential)
    - 2<sup>nd</sup> feedback devices supported:
      - Incremental encoder interface (differential)
        - pulse & direction interface (differential) for external (master) digital reference
  - Separate ENABLE circuit: connect both ENA1 and ENA2 inputs to +24V, to allow motor PWM output operation
  - 4 digital inputs, 5-36V, PNP/NPN programmable: 2 for limit switches, 2 general-purpose
  - 4 digital outputs, 5-36V, 0.5A, NPN open-collector: Ready, Error, 2 general-purpose
  - 2 analogue inputs: 12-bit, 0-5V: Reference, Feedback or general purpose
  - RS-232 serial & dual 100Mbps RJ45 EtherCAT® interfaces
    - EtherCAT® with CAN application protocol over EtherCAT (CoE)
    - 127 h/w addresses selectable by DIP switch
    - 16k x 16 SRAM memory for data acquisition
    - 16k x 16 E<sup>2</sup>ROM to store setup data, TML motion programs, cam tables and other user data
    - Operating ambient temperature: 0-40°C (over 40°C with derating)
    - Programmable protections: short-circuit between motor phases and from motor phases to GND, over/under-voltage, over-current, I<sup>2</sup>t, control error

### Connector Description

Pin	Name	Type	Description
1	GND	-	Negative return (ground) of the power supply
2	+V <sub>MOT</sub>	I	Positive terminal of the motor supply: 9 to 80V <sub>DC</sub> .
3	+V <sub>LOG</sub>	I	Positive terminal of the logic supply input: 9 to 36V <sub>DC</sub>
4	Earth	-	Earth connection

Pin	Name	Type	Description
1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
3	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
4	CR / B-	O	Chopping Resistor output/ Phase B- for step motors
5	Earth	-	Earth connection

Port	Name	Type	Description
J6	ECAT IN	I	EtherCAT standard RJ45 Ethernet IN port
J7	ECAT OUT	O	EtherCAT standard RJ45 Ethernet OUT port

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Pin	Name	Type	Description
1	+5V <sub>OUT</sub>	O	5V output supply for I/O usage
2, 3	n.c.		Not connected
4	CosR+	I	Positive Cosine input from the resolver
5	SinR+	I	Positive Sine input from the resolver
6	n.c.		Not connected
7	Exc+	O	Positive excitation output for the resolver
8	Exc-	O	Negative excitation output for the resolver
9, 10	n.c.		Not connected
11	GND	-	Return ground for sensors supply
12	Temp Mot	I	Analogue input, 12-bit, 0-3.3V. Used to read an analog temperature value
13	n.c.		Not connected
14	CosR-	I	Negative Cosine input from the resolver
15	SinR-	I	Negative Sine input from the resolver

Pin	Name	Type	Description
1	+5V <sub>OUT</sub>	O	5V output supply for I/O usage
2,3	n.c.		Not connected
4	B2+/Dir+	I	Incr. encoder2 B+ diff. input, or Dir+
5	A2+/Pulse+	I	Incr. encoder2 A+ diff. input, or Pulse+
6,8	n.c.		Not connected
9	Z2+	I	Incr. encoder2 Z+ diff. input
10	Z2-	I	Incr. encoder2 Z- diff. input
11	GND	-	Return ground for sensors supply
12	FDBK	I	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tacho), or used as general purpose analogue input
13	n.c.		Not connected
14	B2-/Dir-	I	Incr. encoder2 B- diff. input, or Dir-
15	A2-/Pulse-	I	Incr. encoder2 A- diff. input, or Pulse-

Pin	Name	Type	Description
1	GND	-	Return ground for I/O pins
2	IN2/LSP	I	5-36V digital PNP/NPN input. Positive limit switch input
3	OUT2/Error	O	5-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red LED
4	OUT3/Ready	O	5-36V 0.5A, drive Ready output, active low, NPN open-collector/TTL pull-up. Also drives the green LED.
5	OUT0	O	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
6	OUT1	O	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
7	+5V <sub>OUT</sub>	O	5V output supply for I/O usage
8	+V <sub>LOG</sub>	I	Positive terminal of the logic supply input: 9 to 36V <sub>DC</sub>
9	IN3/LSN	I	5-36V digital PNP/NPN input. Negative limit switch input
10	IN0	I	5-36V general-purpose digital PNP/NPN input
11	IN1	I	5-36V general-purpose digital PNP/NPN input
12	REF10+	I	Analogue input, 11-bit, ±10V differential, positive pin. Used to read an analog position, speed or torque reference.
13	REF10-	I	Analogue input, 11-bit, ±10V differential, negative pin. Used to read an analog position, speed or torque reference. Connected to GND when REF5 is used.
14	REFSEL	I	Analogue input range selection : floating for ±10V (REF10+, REF10- inputs) or connected to GND for 0-5V (REF5 input) .
15	REF5	I	Analogue input, 12-bit, 0-5V. Used to read an analog position, speed or torque reference.

Pin	Name	Type	Description
1	ENA1	I	Enable circuit input1; connect ENA1&ENA2 to +24V to activate motor operation
2	ENA2	I	Enable circuit input2; connect ENA1&ENA2 to +24V to activate motor operation
3	GND	-	Return ground
4	GND	-	Return ground

Pin	Name	Type	Description
1	GND	-	Return ground for RS-232 pins
2	232TX	O	RS-232 Data Transmission
3	232RX	I	RS-232 Data Reception
4	GND	-	Return ground for RS-232 pins

Pin	Name	Type	Description
1	Reserved	-	-
2	ID-Bit6	-	
3	ID-Bit5	-	
4	ID-Bit4	-	Hardware AxisID selection switches
5	ID-Bit3	-	They represent the first 7 bits of an 8 bit Axis ID number.
6	ID-Bit2	-	
7	ID-Bit1	-	
8	ID-Bit0	-	

### Electrical characteristics

All parameters measured under the following conditions (unless otherwise specified):


- Tamb = 0...40°C, VLOG = 24 VDC; VMOT = 80VDC
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude / continuous BLDC, DC, stepper) = 10A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature <sup>1</sup>		0		+40	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure <sup>2</sup>	Altitude (vs. sea level)	-0.1	0 + 2	2	Km
	Ambient Pressure	0 <sup>2</sup>	0.75 ± 1	10.0	atm
Storage Conditions		Min.	Typ.	Max.	Units
Ambient temperature		-40		+85	°C
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm
Mechanical Mounting		Min.	Typ.	Max.	Units
Airflow		natural convection <sup>3</sup> , closed box			
Environmental Characteristics		Min.	Typ.	Max.	Units
Size ( Length x Width x Height )	Without mating connectors	139 x 94.2 x 24.5			mm
		~5.47 x 3.7 x 0.97			inch
Weight	Without mating connectors	240			g
	Idle (no load)	3.6			W
Power dissipation	Operating	11			W
Efficiency		98			%
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol- based			
Protection degree	According to IEC60529, UL508	IP20			-
Logic Supply Input (+V <sub>LOG</sub> )		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	9		36	V <sub>DC</sub>
	Absolute maximum values, drive operating but outside guaranteed parameters	8		40	V <sub>DC</sub>
	Absolute maximum values, surge (duration ≤ 10ms) <sup>†</sup>	-1		+45	V
Supply current	No Load on Digital Outputs	+V <sub>LOG</sub> = 9V	320		mA
		+V <sub>LOG</sub> = 12V	260		
		+V <sub>LOG</sub> = 24V	190		
		+V <sub>LOG</sub> = 36V	170		

<sup>1</sup> Operating temperature can be extended up to +65°C with reduced current and power ratings.

<sup>2</sup> iPOS8010 can be operated in vacuum (no altitude restriction), but at altitudes over 2,500m, current and power rating are reduced due to thermal dissipation efficiency.

<sup>3</sup> It is recommended to mount the iPOS8010 BR-CAT on a metallic support using the provided mounting holes, for better reliability and reduced de-rating due to heat dissipation

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Motor Supply Input (+V <sub>MOT</sub> )		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	12	80	90	V <sub>DC</sub>
	Absolute maximum values, drive operating but outside guaranteed parameters	11		94	V <sub>DC</sub>
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		95	V
Supply current	Idle		1	5	mA
	Operating	-20	±10	+20	A
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) †			45	A
Motor Outputs (A/A+, B/A-, C/B+, BR/B-)		Min.	Typ.	Max.	Units
Nominal output current, continuous	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control			10	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)			10	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)			7.1	
Motor output current, peak	maximum 10s	-20		+20	A
Short-circuit protection threshold	measurement range			±45	A
Short-circuit protection delay		5	10		µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		±0.3	±0.5	V
Off-state leakage current			±0.5	±1	mA
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V <sub>MOT</sub> = 80 V	F <sub>PWM</sub>			µH
		20 kHz	330		
		40 kHz	150		
		60 kHz	120		
		80 kHz	80		
		100 kHz	60		
Minimum value, limited by short-circuit protection; +V <sub>MOT</sub> = 80 V	20 kHz	120		µH	
	40 kHz	40			
	60 kHz	30			
	80 kHz	15			
	100 kHz	8			
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz	250		µs
		40 kHz	125		
		60 kHz	100		
		80 kHz	63		
		100 kHz	50		
Current measurement	FS = Full Scale accuracy		±5	±8	%FS
Resolver Interface		Min.	Typ.	Max.	Units
Excitation frequency	Software selectable	3	6	12	kHz
Excitation voltage	Software selectable	1.4	1.6 - 7.2	8	V <sub>PP</sub>
Excitation current				50	mA <sub>RMS</sub>
Resolver coupling ratio		1:2		2:1	-
Sin / Cos Input voltage		2.3	3.15	4	V <sub>PP</sub>
Sin / Cos Input impedance			60		kΩ
Position Resolution			14		


Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN,) <sup>1</sup>		Min.	Typ.	Max.	Units
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW"	-10	0	2.2	V
	Logic "HIGH"	6.3		36	
	Floating voltage (not connected)		0		
	Absolute maximum, continuous	-10		+39	
Input current	Absolute maximum, surge (duration ≤ 1S) †	-20		+40	mA
	Logic "LOW"; pulled to GND		0		
	Logic "HIGH"		1.3	2	

Mode compliance		NPN			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"	-10		2.2	V
	Logic "HIGH"	6.3		36	
	Floating voltage (not connected)		3		
	Absolute maximum, continuous	-10		+36	
	Absolute maximum, surge (duration ≤ 1S) †	-20		+40	
Input current	Logic "LOW"; Pulled to GND	-1.6	0.6	1	mA
	Logic "HIGH"; Pulled to +24V			0.3	

Input frequency		0		150	kHz
Minimum pulse		3.3			µs
ESD protection	Human body model	±2			kV

Digital Outputs (OUT0, OUT1, OUT2/Error, OUT3/ Ready)		Min.	Typ.	Max.	Units	
Mode compliance	All outputs (OUT0, OUT1, OUT2/Error, OUT3/Ready)	NPN 24V				
Default state	Not supplied (+V <sub>LOG</sub> floating or to GND)	High-Z (floating)				
	Immediately after power-up	OUT0, OUT1 OUT2/Error, OUT3/ Ready	Logic "HIGH"			
	Normal operation	OUT0, OUT1, OUT2/Error OUT3/Ready	Logic "LOW"			
Output voltage	Logic "LOW"; output current = 0.5A			0.8	V	
	Logic "HIGH"; output current = 0, no load	OUT2/Error, OUT3/ Ready	2.9	3		3.3
	Logic "HIGH", external load to +V <sub>LOG</sub>	OUT0, OUT1	4	4.5		5
	Absolute maximum, continuous			V <sub>LOG</sub>		
	Absolute maximum, surge (duration ≤ 1S) †		-0.5			V <sub>LOG</sub> +0.5
			-1			V <sub>LOG</sub> +1
Output current	Logic "LOW", sink current, continuous OUT0=2A			0.5	A	
	Logic "LOW", sink current, pulse ≤ 5 sec. OUT0=3A			1	A	
	Logic "HIGH", source current; external load to GND; V <sub>OUT</sub> ≥ 2.0V	OUT2/Error, OUT3/ Ready			2	mA
		OUT0, OUT1			4	mA
	Logic "HIGH", leakage current; external load to +V <sub>LOG</sub> ; V <sub>OUT</sub> = V <sub>LOG</sub> max = 40V		0.1	0.2		mA
Minimum pulse width		2			µs	
ESD protection	Human body model	±15			kV	

<sup>1</sup> The digital inputs are software selectable as PNP or NPN

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Encoder Inputs (A2+, A2-, B2+, B2-, Z2+, Z2-) <sup>1</sup>		Min.	Typ.	Max.	Units
Differential mode compliance	For full RS422 compliance, see <sup>1</sup>	TIA/EIA-422-A			
Input voltage	Hysteresis	±0.06	±0.1	±0.2	V
	Differential mode	-14		14	
	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential	A2+, B2+, Z2+		2.2		kΩ
	A2-, B2-, Z2-		1.6		
Analog 0...5V Inputs (REF, FDBK)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		4.95	V
	Absolute maximum values, continuous	-12		+18	
	Absolute maximum, surge (duration ≤ 1S) <sup>†</sup>			±36	
Input impedance	To GND		8		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS <sup>2</sup>
Bandwidth (-3dB)	Software selectable	0		1	kHz
ESD protection	Human body model	±2			kV
Analog ±10V Input (Ref)		Min.	Typ.	Max.	Units
Differential voltage range			±10		V
Common-mode voltage range	Referenced to GND	-12	0...10	+50	V
Input impedance	Differential		40		kΩ
Common-mode impedance	Referenced to GND		20		kΩ
Resolution			12		bits
Integral linearity				0.036	%FS <sup>2</sup>
Offset error	Common-mode voltage = 0...10 V		±0.2	±0.5	%FS <sup>2</sup>
Gain error	Common-mode voltage = 0...10 V		±10	±12	%FS <sup>2</sup>
Bandwidth (-3dB)	Depending on software settings		1.5		kHz

RS-232		Min.	Typ.	Max.	Units
Compliance		TIA/EIA-232-C			
Bit rate	Software selectable	9600		115200	Baud
Short-circuit	232TX short to GND	Guaranteed			
ESD protection	Human body model	±2			kV
EtherCAT®		Min.	Typ.	Max.	Units
Compliance		IEEE802.3, IEC61158			
Transmission line specification	According to TIA/EIA-568-5-A	Cat. 5e.UTP			
J5, J6 pinout	EtherCAT® supports MDI/MDI-X auto-crossover	TIA/EIA-568-A or TIA/EIA-568-B			
Software protocols compatibility		CoE, CiA402, IEC61800-7-301			
Node addressing	By hardware DIP switch	1 + 127			-
	By software	1 + 255			
MAC addressing		none			-
ESD protection	Human body model	±15			kV
Enable circuit (ENA1, ENA2)		Min.	Typ.	Max.	Units
Enable function		Disables motor power when either ENA1 or ENA2 is disconnected from the power source			
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW"	-10		2.2	V
	Logic "HIGH"	6.3		36	
	Absolute maximum, continuous	-10		+39	
Input current	Logic "LOW"; pulled to GND		0		mA
	Logic "HIGH"; pulled to +Vlog		9	13	
Pulse duration	Ignored low-high-low			1	ms
	Ignored high-low-high			1.5	
	Accepted pulse	tdb			
Fault reaction time	From internal fault detection to register DER bit 14 = 1 and OUT2/Error high-to-low			tdb	ms
ESD protection	Human body model	±2			kV
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 500mA	4.8	5	5.2	V
Output current		330	350		mA
Short-circuit		NOT protected			
Over-voltage		NOT protected			
ESD protection	Human body model	±2			kV

<sup>†</sup> Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

<sup>1</sup> All differential input pins have internal 120Ω termination resistors connected across

<sup>2</sup> "FS" stands for "Full Scale"

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