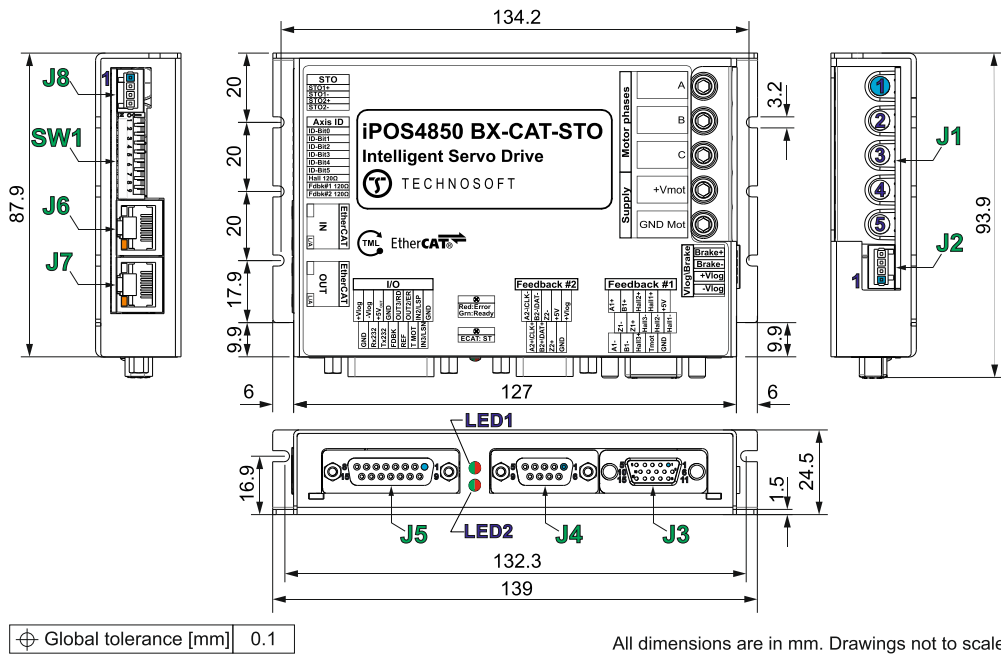




# iPOS4850 BX-CAT-STO DATASHEET

## P/N: P029.300.E321



⊕ Global tolerance [mm] 0.1


All dimensions are in mm. Drawings not to scale.

### Features

- Motion controller and drive in a single compact unit based on MotionChip™ technology
- Universal solution for control of rotary and linear brushless and brushed motors
- Advanced motion control capabilities (PVT, S-curve, electronic cam)
- Motor supply: 12-60V; Logic supply: 9-36V
- Output current with / without external heat sink:
  - Nominal: 45 / 35.4A<sub>RMS</sub> (64 / 50A sinusoidal amplitude)
  - Peak: 64A<sub>RMS</sub> (90A sinusoidal amplitude)
- Thermal Protection: The internal temperature sensor disables the PWM outputs if the measured temperature exceeds 95°C
- Feedback Devices (dual-loop support)
  - 1<sup>st</sup> feedback devices supported:
    - Incremental encoder interface (single ended or differential)
    - pulse & direction interface (single ended or differential) for external (master) digital reference
    - Digital Hall sensor interface (single-ended and open collector)
  - 2<sup>nd</sup> feedback devices supported:
    - Incremental encoder interface (single ended or differential)
    - pulse & direction interface (single ended or differential) for external (master) digital reference
    - BiSS / SSI / EnDAT / TAMAGAWA / Panasonic/ Nikon/ Sanyo Denki encoder interface
- 2 digital PNP inputs, 7-36V: 2 limit switches
- 2 digital outputs, 5-36V, NPN open-collector: Ready, Error 0.5A
- Solenoid driver for motor brake, 2A, commanded by OUT0 NPN type
- 2 analogue inputs, 12-bit, 0-5V: Reference and Feedback (for Tacho), or general purpose
- RS-232 serial & dual 100Mbps RJ45 EtherCAT® interfaces
- 64 h/w addresses selectable by DIN switch
- Commissioning (set-up) possible through RS-232, FoE (file-over-EtherCAT®), EoE (Ethernet-over-EtherCAT®)
- 16k x 16 SRAM memory for data acquisition
- 24k x16 E2ROM to store setup data, TML motion programs, cam tables and other user data
- \*STO: 2 safe torque-off inputs, 18-36V, safety integrity level SIL3/Cat3/PLe acc. to EN61800-5-1; -2/ EN61508-3; -4/ EN ISO13849-1.


\*The STO circuit must be supplied with minimum 18V to enable PWM output

Sensor	Motor		
	PMSM	BLDC	DC BRUSH
Incr. Encoder	Ⓢ		Ⓢ
Incr. Encoder + Dig. Hall	Ⓢ	Ⓢ	
SSI / BiSS-C / EnDAT / Tamagawa / Panasonic / Nikon / Sanyo Denki	Ⓢ	Ⓢ	Ⓢ
Tacho			Ⓢ

Mating Connectors			
Ref	Producer	Part No.	Description
J2&J8**	Wago	733-104	Pluggable terminal block 4-pole Pin spacing 2.5 mm
J3	generic	15-pin High Density D-Sub male	Feedback #1 + Digital Hall input
J4	generic		9-pin Sub-D male
J5	generic	15-pin D-Sub male, DB15	I/O; Analog; RS232
J6&J7	Standard 8P8C modular jack (RJ-45) male		
J1*	High AMP wire. 4mm HEX socket. AWG 6-16 wire gauge. Strip: - min 8 mm for cables with isolation diameter less than 6.5 mm; - min 12 mm/ max 15 mm for cables with isolation diameter bigger than 6.5 mm.		
	<b>Avoid generating metal debris/filings into drive from the wire leads! In case of multi-stranded wires, a proper ferrule must be used as wire terminal.</b> 		

\* For more recommendations about wires and ferrules, check the User Manual of the drive.

\*\* Connector delivered with the drive

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Pin	Name	Description
J1	1	<b>A/A+</b> Phase A for 3-ph motors, Motor+ for DC brush motors
	2	<b>B/A-</b> Phase B for 3-ph motors, Motor- for DC brush motors
	3	<b>C</b> Phase C for 3-ph motors
	4	<b>+V<sub>MOT</sub></b> Positive terminal of the motor supply input: 11 to 60V <sub>DC</sub>
	5	<b>GND</b> Ground for motor supply

Pin	Name	Description
J2	1	<b>-V<sub>LOG</sub></b> Negative terminal of the logic supply input: 9 to 36V <sub>DC</sub> from SELV/ PELV type power supply connected internally to all GND pins
	2	<b>+V<sub>LOG</sub></b> Positive terminal of the logic supply input: 9 to 36V <sub>DC</sub> from SELV/ PELV type power supply; connected internally to all +V <sub>log</sub> pins
	3	<b>BRAKE-</b> Negative terminal for the motor brake input; commanded as OUT0; connected internally to all GND pins
	4	<b>BRAKE+</b> Positive terminal for the motor brake input; connected internally to all +V <sub>log</sub> pins

Pin	Name	Description
1	<b>+5V<sub>OUT</sub></b> 5V output supply for I/O usage	
2	<b>Hall 1+</b> Digital input Hall 1 sensor input or Hall1+ diff. sensor input; for differential connection SW1 bit 7 must be ON	
3	<b>Hall 2+</b> Digital input Hall 2 sensor input or Hall2+ diff. sensor input; for differential connection SW1 bit 7 must be ON	
4	<b>B1+</b> Incr. encoder 1 B single-ended input, B1+ diff. input; for differential connection SW1 bit 8 must be ON	
5	<b>A1+</b> Incr. encoder 1 A single-ended input, A1+ diff. input; for differential connection SW1 bit 8 must be ON	
6	<b>Hall 1-</b> Hall1- diff. sensor input; for differential connection SW1 bit 7 must be ON	
7	<b>Hall 2-</b> Hall2- diff. sensor input; for differential connection SW1 bit 7 must be ON	
J3	8	<b>Hall 3-</b> Hall3- diff. sensor input; for differential connection SW1 bit 7 must be ON
	9	<b>Z1+</b> Incr. encoder 1 Z single-ended input, Z1+ diff.; for differential connection SW1 bit 8 must be ON
10	<b>Z1-</b> Incr. encoder 1 Z- diff. input; for differential connection SW1 bit 8 must be ON	
11	<b>GND</b> Return ground for sensors supply	
12	<b>Temp Mot</b> Analogue input, 12-bit, 0-3.3V. Used to read an analog temperature value	
13	<b>Hall 3+</b> Digital input Hall 3 sensor input or Hall3+ diff. sensor input; for differential connection SW1 bit 7 must be ON	
14	<b>B1-</b> Incr. encoder 1 B1- diff. input; for differential connection SW1 bit 8 must be ON	
15	<b>A1-</b> Incr. encoder 1 A1- diff. input; for differential connection SW1 bit 8 must be ON	

Pin	Name	Description
1	<b>+V<sub>LOG</sub></b> Positive terminal of the logic supply input: 12 to 36V <sub>DC</sub>	
2	<b>+5V<sub>OUT</sub></b> 5V output supply	
3	<b>Z2-</b> Incr. encoder 2 Z- diff. input; for differential connection SW1 bit 9 must be ON	
J4	4	<b>B2-/ Dir-/ Data-/SL-</b> Incr. encoder 2 B2- diff. input or Dir-, or Data- for SSI, or Slave- for BiSS; for differential connection SW1 bit 9 must be ON
	5	<b>A2-/ Pulse-/CLK-/MA-</b> Incr. encoder 2 A- diff. input, or Pulse-, or Clock- for SSI, or Master- for BiSS; or differential connection SW1 bit 9 must be ON
	6	<b>GND</b> Ground
	7	<b>Z2+</b> Incr. encoder 2 Z single-ended input, Z2+ diff. input; for differential connection SW1 bit 9 must be ON
	8	<b>B2+/ Pulse+/ Data+/ SL+</b> Incr. encoder 2 B single-ended input, B2+ diff. input or Pulse+, or Data+ for SSI, or Slave+ for BiSS; for differential connection SW1 bit 9 must be ON
9	<b>A2+/ Pulse+/ CLK+/ MA+</b> Incr. encoder 2 A single-ended input, A2+ diff. input or Pulse+, or Clock+ for SSI, or Master+ for BiSS; for differential connection SW1 bit 9 must be ON	


Port	Name	Description
J6	<b>ECAT IN</b>	EtherCAT standard RJ45 Ethernet IN port.
J7	<b>ECAT OUT</b>	EtherCAT standard RJ45 Ethernet OUT port.

Pin	Name	Description
1	<b>GND</b>	Ground
2	<b>IN2/LSP</b>	5-36V digital PNP input. Positive limit switch input
3	<b>OUT2/ Error</b>	5-36V 0.5A, active low, NPN open-collector/TTL pull-up. Drive Error output (default). Can be set as general-purpose output.
		5-36V 0.5A, active low, NPN open-collector/TTL pull-up. Drive Ready output (default). Can be set as general-purpose output.
4	<b>OUT3/ Ready</b>	5-36V 0.5A, active low, NPN open-collector/TTL pull-up. Drive Ready output (default). Can be set as general-purpose output.
5	<b>GND</b>	Ground
6	<b>+5V<sub>OUT</sub></b>	5V output supply
J5	7	<b>-V<sub>LOG</sub></b> Negative terminal of the logic supply input: 9 to 36V <sub>DC</sub> from SELV/ PELV type power supply; connected internally to all GND pins
		<b>+V<sub>LOG</sub></b> Positive terminal of the logic supply input: 9 to 36V <sub>DC</sub> from SELV/ PELV type power supply; connected internally to all +V <sub>log</sub> pins
9	<b>IN3/LSN</b>	5-36V digital PNP input. Negative limit switch input
10	<b>Temp Mot</b>	Analogue input, 12-bit, 0-3.3V. Used to read an analog temperature value
11	<b>REF</b>	Analogue input, 12-bit, 0-5V
12	<b>FDBK</b>	Analogue input, 12-bit, 0-5V
13	<b>232TX</b>	RS-232 Data Transmission
14	<b>232RX</b>	RS-232 Data Reception
15	<b>GND</b>	Ground

Pin	Name	Description
J8	1	<b>STO1+</b> Safe Torque Off input 1, positive input (Opto-isolated, 18+36V) Apply between both STO1+, STO2+ and STO1-, STO2- 24V DC
	2	<b>STO1-</b> Safe Torque Off input 1, negative return (Opto-isolated, 0V)
	3	<b>STO2+</b> Safe Torque Off input 2, positive input (Opto-isolated, 18+36V) from SELV/ PELV power supply for motor
	4	<b>STO2-</b> Safe Torque Off input 2, negative return (Opto-isolated, 0V) PWM output operation

Pin	Name	Description
SW1	1	<b>ID-Bit0</b>
	2	<b>ID-Bit1</b>
	3	<b>ID-Bit2</b>
	4	<b>ID-Bit3</b>
	5	<b>ID-Bit4</b>
	6	<b>ID-Bit5</b>
	7	<b>Hall 120Ω</b> Internally connects 120Ω termination resistors between J3.2 and J3.6; J3.3 and J3.7; J3.13 and J3.8.
	8	<b>Fdbk #1 120Ω</b> Internally connects 120Ω termination resistors between J3.5 and J3.15; J3.4 and J3.14; J3.9 and J3.10.
	9	<b>Fdbk #2 120Ω</b> Internally connects 120Ω termination resistors between J4.9 and J4. 5; J4.8 and J4.4; J4.7 and J4.3.

Name	Color	Description
LED1	RED	Turned on when the drive detects an error condition
	GREEN	Lit after power-on when the drive initialization ends. Turned off when an error occurs.
LED2	RED	EtherCAT® ERROR and RUN indicators combined. Shows the state of the EtherCAT® Status Machine
	GREEN	

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### Electrical characteristics

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

- $T_{amb} = 24^{\circ}\text{C}$ ,  $V_{LOG} = 24\text{ VDC}$ ;  $V_{MOT} = 48\text{ VDC}$
- Supplies start-up / shutdown sequence: any
- Load current (sinusoidal amplitude) = 64A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		+40	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude /pressure <sup>1</sup>	Altitude (vs. sea level)	-0.1	0 + 2	2	km
	Ambient Pressure	0	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					
Mounted on heatsink	It is necessary to mount the iPOS4850 BX-CAT-STO on a metallic heatsink using the provided mounting holes. If the integrated internal thermal sensor exceeds 95°C, the drive outputs turn off.				
Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Without mating connectors	139 x 93.9 x 24.5			mm
		~5.47 x 3.7 x 0.96			inch
Weight	Without mating connectors	TBD			g
Power dissipation	Idle (no load)	3.6			W
	Operating	see theoretical chart			
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	24	36	V <sub>DC</sub>
	Absolute maximum values, drive operating but outside guaranteed parameters	8	24	40	V <sub>DC</sub>
	Absolute maximum values, surge (duration ≤ 10ms) <sup>†</sup>	-1		+45	V
Supply current	No enc. No Load on Digital Outputs	+V <sub>LOG</sub> = 9V	190		mA
		+V <sub>LOG</sub> = 12V	170		
		+V <sub>LOG</sub> = 24V	110		
		+V <sub>LOG</sub> = 36V	80		
Motor Supply Input (+V <sub>MOT</sub> )		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	12	48	60	V <sub>DC</sub>
	Absolute maximum values, drive operating but outside guaranteed parameters	11		70	V <sub>DC</sub>
	Absolute maximum values, surge (duration ≤ 10ms) <sup>†</sup>	-1		75	V
Supply current	Idle	1		5	mA
	Operating	-50	±10	+50	
	Absolute maximum value, short-circuit condition (Duration ≤ 10ms) <sup>†</sup>			100	
Digital Inputs (IN2/LSP, IN3/LSN)		Min.	Typ.	Max.	Units
Mode compliance	PNP				
Default state	Input floating (wiring disconnected) Logic LOW				
Input voltage	Logic "LOW"	-10	0	3.3	V
	Logic "HIGH"	6.7		36	
	Floating voltage (not connected)	0			
	Absolute maximum, continuous	-10		+39	
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>	-20		+40	
Input current	Logic "LOW"; pulled to GND	0			mA
	Logic "HIGH"	V <sub>LOG</sub> =24V	9.15		
		V <sub>LOG</sub> =36V	13.7		
Input frequency		0		150	kHz
Minimum pulse		3.3			µs
ESD protection	Human body model 0.1nF 1.5 kΩ	±1			kV
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


Motor Outputs (A/A+, B/A-, C)		Min.	Typ.	Max.	Units
Nominal current	Sinusoidal RMS <sup>2</sup>			45	A <sub>RMS</sub>
	Sinusoidal RMS <sup>3</sup>			35.4	
	Sinusoidal amplitude <sup>2</sup>			64	A
	Sinusoidal amplitude <sup>3</sup>			50	
Peak current	maximum 13s with 6 AWG wires, external heatsink	-90		+90	A
Short-circuit protection threshold				±100	A
Short-circuit protection delay		5	10		µs
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> = 48 V	F <sub>PWM</sub>			µH
		20 kHz	330		
	40 kHz	150			
	60 kHz	120			
Motor electrical time-constant (L/R)	Minimum value, limited by short-circuit protection; +V <sub>MOT</sub> = 48 V	20 kHz	120		µH
		40 kHz	40		
		60 kHz	30		
Current measurement	FS = Full Scale accuracy	20 kHz	250		µs
		40 kHz	125		
		60 kHz	100		
Digital Outputs (OUT2/Error, OUT3/Ready)		Min.	Typ.	Max.	Units
Mode compliance	All outputs (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	OUT2/Error, OUT3/Ready		Logic "LOW"	
	Normal operation	OUT2/Error		Logic "HIGH"	
Output voltage	Logic "LOW"; output current = 0.5A			0.8	V
	Logic "HIGH"; output current = 0, no load	2.9	3	3.3	
	Logic "HIGH", external load to +V <sub>LOG</sub>	V <sub>LOG</sub>			
	Absolute maximum, continuous	-0.5		V <sub>LOG</sub> +0.5	
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>	-1		V <sub>LOG</sub> +1	
Output current	Logic "LOW", sink current, continuous, OUT2/Error, OUT3/Ready			0.5	A
	Logic "HIGH", source current; external load to GND; V <sub>OUT</sub> ≥ 2V	OUT2/Error, OUT3/Ready		2	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
Digital Hall Inputs (Hall1+, Hall1-, Hall2+, Hall2-, Hall3+, Hall3-) <sup>4</sup>		Min.	Typ.	Max.	Units
Mode compliance	TTL / CMOS / Open-collector				
Default state	Input floating (Wiring disconnected) Logic HIGH				
Input voltage	Logic "LOW"	0		0.8	V
	Logic "HIGH"	2	5		
	Floating voltage (Not connected)	4.4			
	Absolute maximum, surge (duration ≤ 1s) <sup>†</sup>	-10		+15	
Input current	Logic "LOW"; Pull to GND	1.2			mA
	Logic "HIGH"; Internal 4.7KΩ pull-up to +5	0	0	0	
Minimum pulse width		2			µs
Differential mode compliance	RS422 compliance	TIA/EIA-422-A			
	Hysteresis	±0.06	±0.1	±0.2	V
Differential mode	-14		+14		
Input voltage	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential			120		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns
ESD protection	Human body model	±5			kV

<sup>1</sup> iPOS4850 BX-CAT-STO 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>2</sup> With adequate thermal heat sink

<sup>3</sup> No thermal heat sink (worst case scenario)

<sup>4</sup> All differential Hall input pins have internal 120Ω termination resistors connected across if SW1 pin 7 is put on "ON" position

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Encoder Inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, A2+, A2-, B2+, B2-, Z2+, Z2-)		Min.	Typ.	Max.	Units
Single-ended mode compliance	Leave negative inputs disconnected	TTL / CMOS / Open-collector			
Input voltage, single-ended mode A/A+, B/B+	Logic "LOW"			1.6	V
	Logic "HIGH"	1.8			
	Floating voltage (not connected)		3.3		
Input voltage, single-ended mode Z/Z+	Logic "LOW"			1.2	V
	Logic "HIGH"	1.4			
	Floating voltage (not connected)		4.7		
Input current, single-ended mode A/A+, B/B+, Z/Z+	Logic "LOW"; Pull to GND		5.5	6	mA
	Logic "HIGH"; Internal 2.2K $\Omega$ pull-up to +5	0	0	0	
Differential mode compliance	For full RS422 compliance, see SW1 settings (pin 8 and 9)	TIA/EIA-422-A			
Input voltage, differential mode	Hysteresis	$\pm 0.06$	$\pm 0.1$	$\pm 0.2$	V
	Common-mode range (A+ to GND, etc.)	-7		+7	
Input impedance, differential	A1+ to A1-, B1+ to B1-, Z1+ to Z1-		1		k $\Omega$
			1		
Input frequency	Single-ended mode, Open-collector / NPN	0		5	MHz
	Differential mode, or Single-ended driven by push-pull (TTL / CMOS)	0		10	
Minimum pulse width	Single-ended mode, Open-collector / NPN	1			$\mu$ s
	Differential mode, or Single-ended driven by push-pull (TTL / CMOS)	50			
Input voltage, any pin to GND	Absolute maximum values, continuous	-7		+7	V
	Absolute maximum, surge (duration $\leq 1$ s) <sup>†</sup>	-11		+14	
ESD protection	Human body model	$\pm 1$			kV
<b>Absolute Encoder Interface: SSI, BiSS-C, EnDAT</b>					
Differential mode (CLOCK, DATA) <sup>1</sup>	For full RS422 compliance, see <sup>1</sup>	TIA/EIA-422			
CLOCK Output voltage	Differential; 50 $\Omega$ differential load	2.0	2.5	5.0	V
	Common-mode, referenced to GND	2.3	2.5	2.7	
CLOCK frequency	Software selectable	1000, 2000, 3000, 4000	kHz		
DATA Input hysteresis	Differential mode	$\pm 0.1$	$\pm 0.2$	$\pm 0.5$	V
Data input impedance	Termination resistor on-board		120		$\Omega$
DATA Input common mode range	Referenced to GND	-7		+12	
	Absolute maximum, surge (duration $\leq 1$ s) <sup>†</sup>	-25		+25	
DATA format	Software selectable	Binary / Gray			
		Single-turn / Multi-turn			
		Counting direction			
DATA resolution	Single-turn			56	Bits
	Multi-turn and single-turn			56	
If total resolution >31 bits, some bits must be ignored by software setting to achieve a max 31 bits resolution					
<b>Conformity</b>					
EU Declaration	2014/30/EU (EMC), 2014/35/EU (LVD), 2011/65/EU (RoHS), 1907/2006/EC (REACH), 93/68/EEC (CE Marking Directive), EC 428/2009 (non-dual-use item, output frequency limited to 590Hz)				
<b>Analog 0...5V Inputs (REF, FDBK)</b>					
Input voltage	Operational range	0		5	V
	Absolute maximum values, continuous	-12		+18	
	Absolute maximum, surge (duration $\leq 1$ s) <sup>†</sup>			$\pm 36$	
Input impedance	To GND		14.7		k $\Omega$
Resolution			12		bits
Integral linearity				$\pm 2$	bits
Offset error				$\pm 2$	bits
Gain error				$\pm 1\%$	% FS <sup>1</sup>
Bandwidth (-3dB)	Software selectable	0		1	kHz
ESD protection	Human body model	$\pm 2$			kV
<b>Operating temperature</b>					
Ambient Temperature	Non condensing	Min.	Typ.	Max.	Units
		0		40	
Ambient temperature can exceed 40°C if the internal temperature sensor measures less than 95°C					

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 <sup>*</sup>	By hardware sliding switch	1 + 63, 255			-
	By software	1 + 255			
MAC addressing		none			-
ESD protection	Human body model	$\pm 15$			kV
Remark: When Axis ID is 255, the EtherCAT register called "configured station alias" will be 0.					
<b>Solenoid Driver (OUT0/Brake)</b>					
		Min.	Typ.	Max.	Units
Brake+/Brake-: solenoid driver, 2A, overcurrent protected (Brake+ connected internally to +V <sub>log</sub> ). Current flows into solenoid from Brake+ to Brake-; commanded by OUT0 digital output					
Default state	Not supplied (+V <sub>log</sub> floating or to GND)		High-Z (floating)		
	Immediately after power-up	Brake-	High-Z (floating)		
	Normal operation	Brake-	High-Z (floating)		
Output voltage	Logic "LOW" (Brake-)			0.2	V
	Logic "HIGH"; load present		+V <sub>log</sub>		
	Logic "HIGH"; no load present		+5V		
Output current	Absolute maximum, continuous	-0.5		55	mA
	Logic "LOW", sink current, continuous, Brake-			2	
Output current	Logic "HIGH", leakage current; external load to +V <sub>log</sub> ; V <sub>out</sub> = V <sub>log</sub> max = 55V			0.2	mA
<b>Supply Output (+5V)</b>					
Output voltage	Current sourced = 500mA	4.8	5	5.2	V
Output current				450	mA
Short-circuit		protected			
Over-voltage		NOT protected			
ESD protection	Human body model 0.1nF 1.5 k $\Omega$	$\pm 2$			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.

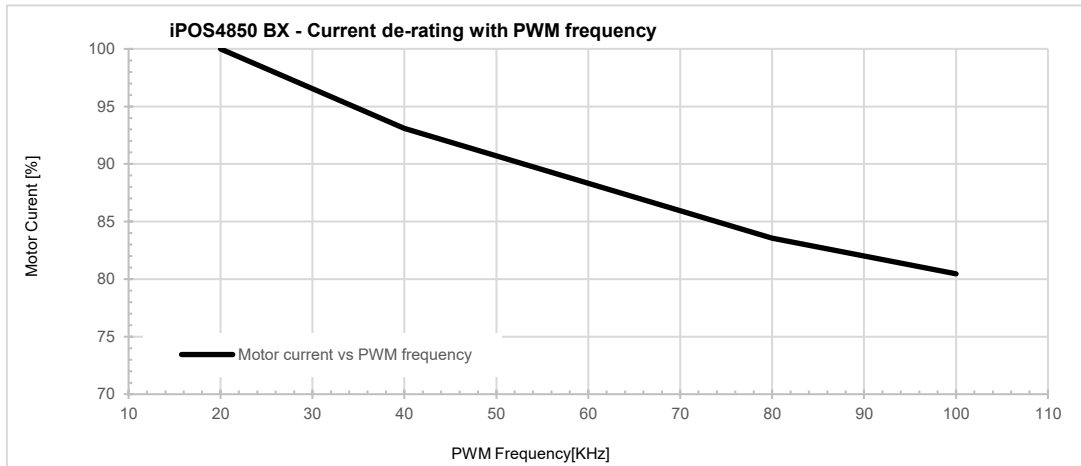
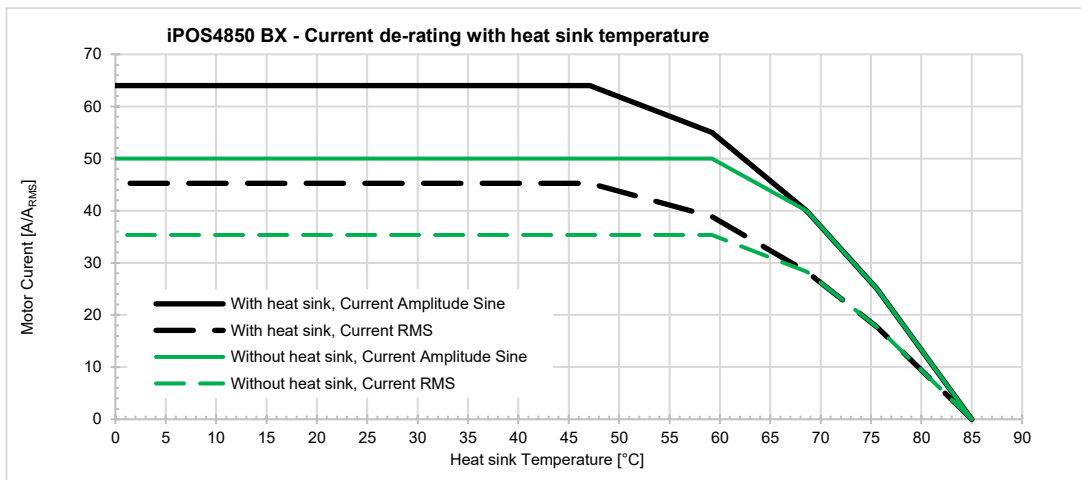
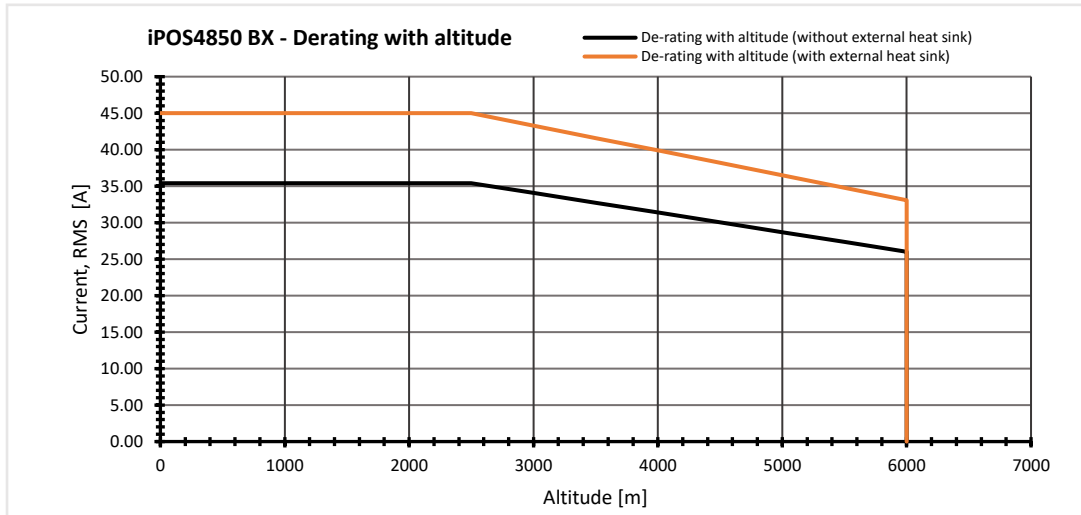
<sup>1</sup> "FS" stands for "Full Scale"

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