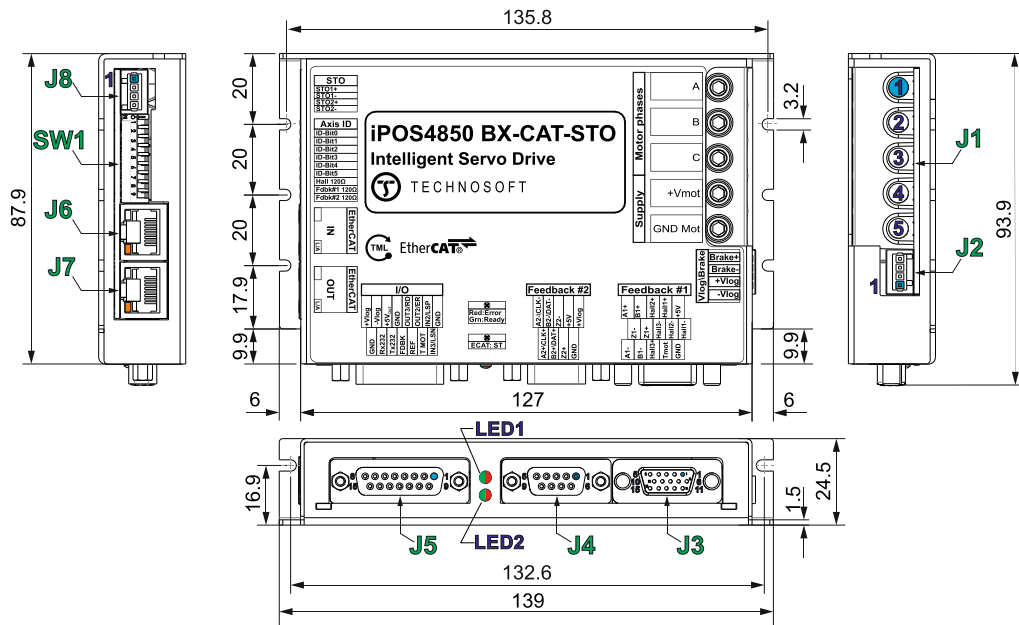




iPOS4850 BX-CAT-STO DATASHEET

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_{RMS} (64 / 50A sinusoidal amplitude)
 - Peak: 64A_{RMS} (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)
- 1st 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)
- 2nd 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 x 16 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.		
	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.		

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

** Connector delivered with the drive

Name ALN	First edition September 2, 2021	Document template: P099.TQT.564.0001	Last edition July 27, 2026	Visa: AS
 TECHNOSOFT		Title of document iPOS4850 BX-CAT-STO PRODUCT DATA SHEET	N° document P029.300.E321.DSH.10H	
				Page: 1 of 5



IPOS4850 BX-CAT-STO DATASHEET

P/N: P029.300.E321

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

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

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

Pin	Name	Description
1	+V _{LOG}	Positive terminal of the logic supply input: 12 to 36V _{DC}
2	+5V _{OUT}	5V output supply
3	Z2-	Incr. encoder 2 Z- diff. input; for differential connection SW1 bit 9 must be ON
J4	4 B2-/ Dir-/ Data-/SL-	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 A2-/ Pulse-/CLK-/MA-	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 GND	Ground
	7 Z2+	Incr. encoder 2 Z single-ended input, Z2+ diff. input; for differential connection SW1 bit 9 must be ON
	8 B2+/ Pulse+/ Data+/ SL+	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	A2+/ Pulse+/ CLK+/ MA+	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	ECAT IN	EtherCAT standard RJ45 Ethernet IN port.
J7	ECAT OUT	EtherCAT standard RJ45 Ethernet OUT port.

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

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

Pin	Name	Description
SW1	1 ID-Bit0	Hardware AxisID selection switches All ON – AxisID= 63 All OFF – AxisID= 255 When Axis ID is 255, the EtherCAT register called "configured station alias" will be 0.
	2 ID-Bit1	
	3 ID-Bit2	
	4 ID-Bit3	
	5 ID-Bit4	
	6 ID-Bit5	
	7 Hall 120Ω	Internally connects 120Ω termination resistors between J3.2 and J3.6; J3.3 and J3.7; J3.13 and J3.8.
	8 Fdbk #1 120Ω	Internally connects 120Ω termination resistors between J3.5 and J3.15; J3.4 and J3.14; J3.9 and J3.10.
	9 Fdbk #2 120Ω	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 GREEN	EtherCAT® ERROR and RUN indicators combined. Shows the state of the EtherCAT® Status Machine

Name ALN	First edition September 2, 2021	Document template: P099.TQT.564.0001	Last edition July 27, 2026	Visa: AS
 TECHNOSOFT		Title of document IPOS4850 BX-CAT-STO PRODUCT DATA SHEET		N° document P029.300.E321.DSH.10H Page: 2 of 5



iPOS4850 BX-CAT-STO DATASHEET

P/N: P029.300.E321

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 ¹		0		+40	°C	
Ambient humidity	Non-condensing	0		90	%Rh	
Altitude /pressure ²	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 _{LOG})		Min.	Typ.	Max.	Units	
Supply voltage	Nominal values		9	24	36	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters		8	24	40	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) [†]		-1		+45	V
Supply current	No enc. No Load on Digital Outputs	+V _{LOG} = 9V		190	mA	
		+V _{LOG} = 12V		170		
		+V _{LOG} = 24V		110		
		+V _{LOG} = 36V		80		
Motor Supply Input (+V _{MOT})		Min.	Typ.	Max.	Units	
Supply voltage	Nominal values		12	48	60	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters		11		70	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) [†]		-1		75	V
Supply current	Idle			1	5	mA
	Operating		-50	±10	+50	A
	Absolute maximum value, short-circuit condition (Duration ≤ 10ms) [†]				100	A
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) [†]		-20		+40	
Input current	Logic "LOW"; pulled to GND			0	mA	
	Logic "HIGH"	V _{LOG} =24V	9.15			
		V _{LOG} =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 ³			45	A _{RMS}
	Sinusoidal RMS ⁴			35.4	
	Sinusoidal amplitude ³			64	A
	Sinusoidal amplitude ⁴			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 _{MOT} = 48 V	F _{PWM}			µH
		20 kHz	330		
		40 kHz	150		
	Minimum value, limited by short-circuit protection; +V _{MOT} = 48 V	20 kHz	120		µH
		40 kHz	40		
		60 kHz	30		
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz	250		µs
		40 kHz	125		
		60 kHz	100		
Current measurement	FS = Full Scale accuracy		±5	±8	%FS
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 _{LOG} floating or to GND)	High-Z (floating)			
	Immediately after power-up	OUT2/Error, OUT3/Ready	Logic "LOW"		
	Normal operation	OUT2/Error, OUT3/Ready	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 _{LOG}		V _{LOG}		
	Absolute maximum, continuous	-0.5		V _{LOG} +0.5	
	Absolute maximum, surge (duration ≤ 1s) [†]	-1		V _{LOG} +1	
Output current	Logic "LOW", sink current, continuous, OUT2/Error, OUT3/Ready			0.5	A
	Logic "HIGH", source current; external load to GND; V _{OUT} ≥ 2V			2	mA
	Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} 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-) ⁵		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) [†]	-10		+15	
	Logic "LOW"; Pull to GND			1.2	
Input current	Logic "HIGH"; Internal 4.7KΩ pull-up to +5	0	0	0	mA
Minimum pulse width		2			µs
Differential mode compliance	RS422 compliance	TIA/EIA-422-A			
	Hysteresis	±0.06	±0.1	±0.2	V
Input voltage	Differential mode	-14		+14	
	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

¹ For extended temperature range, down to -30°C, a special execution is required.

² 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.

³ With adequate thermal heat sink

⁴ No thermal heat sink (worst case scenario)

⁵ All differential Hall input pins have internal 120Ω termination resistors connected across if SW1 pin 7 is put on "ON" position

Name ALN	First edition September 2, 2021	Document template: P099.TQT.564.0001	Last edition July 27, 2026	Visa: AS
 TECHNOSOFT		Title of document iPOS4850 BX-CAT-STO PRODUCT DATA SHEET	N° document P029.300.E321.DSH.10H	
		Page: 3 of 5		



IPOS4850 BX-CAT-STO DATASHEET

P/N: P029.300.E321

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 2.2KΩ 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	±0.06	±0.1	±0.2	V
	Common-mode range (A+ to GND, etc.)	-7		+7	
Input impedance, differential	A1+ to A1-, B1+ to B1-		1		kΩ
	Z1+ to Z1-		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	MHz
Minimum pulse width	Single-ended mode, Open-collector / NPN	1			μs
	Differential mode, or Single-ended driven by push-pull (TTL / CMOS)	50			ns
Input voltage, any pin to GND	Absolute maximum values, continuous	-7		+7	V
	Absolute maximum, surge (duration ≤ 1s) [†]	-11		+14	
ESD protection	Human body model	±1			kV
Absolute Encoder Interface: SSI, BiSS-C, EnDAT		Min.	Typ.	Max.	Units
Differential mode (CLOCK, DATA) [†]	For full RS422 compliance, see [†]	TIA/EIA-422			
CLOCK Output voltage	Differential; 50Ω 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	±0.1	±0.2	±0.5	V
Data input impedance	Termination resistor on-board		120		Ω
DATA Input common mode range	Referenced to GND	-7		+12	
	Absolute maximum, surge (duration≤1s) [†]	-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				
Conformity		Min.	Typ.	Max.	Units
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)				
Analog 0...5V Inputs (REF, FDBK)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		5	V
	Absolute maximum values, continuous	-12		+18	
	Absolute maximum, surge (duration ≤ 1s) [†]			±36	
Input impedance	To GND		14.7		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS [†]
Bandwidth (-3dB)	Software selectable	0		1	kHz
ESD protection	Human body model	±2			kV
Operating temperature		Min.	Typ.	Max	Units
Ambient Temperature	Non condensing	0		40	°C
		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*	By hardware sliding switch	1 ÷ 63, 255			-
	By software	1 ÷ 255			
MAC addressing		none			-
ESD protection	Human body model	±15			kV
Remark: When Axis ID is 255, the EtherCAT register called "configured station alias" will be 0.					
Solenoid Driver (OUT0/Brake)		Min.	Typ.	Max.	Units
Brake+/Brake-: solenoid driver, 2A, overcurrent protected (Brake+ connected internally to +V _{log}). Current flows into solenoid from Brake+ to Brake-; commanded by OUT0 digital output					
Default state	Not supplied (+V _{LOG} 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 _{log}		
	Logic "HIGH", no load present		+5V		
	Absolute maximum, continuous		-0.5	55	
Output current	Logic "LOW", sink current, continuous, Brake-			2	A
	Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} max = 55V			0.2	mA
Supply Output (+5V)		Min.	Typ.	Max	Units
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 kΩ	±2			kV

[†] 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.

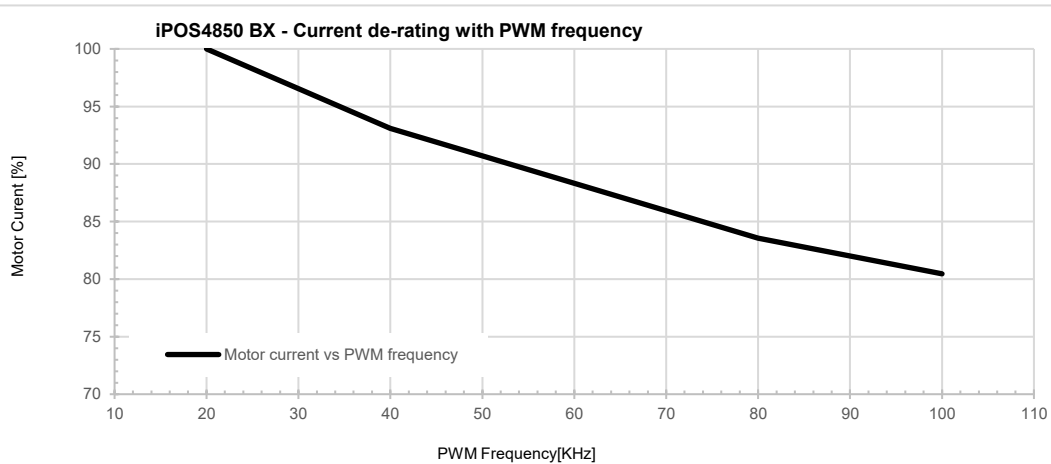
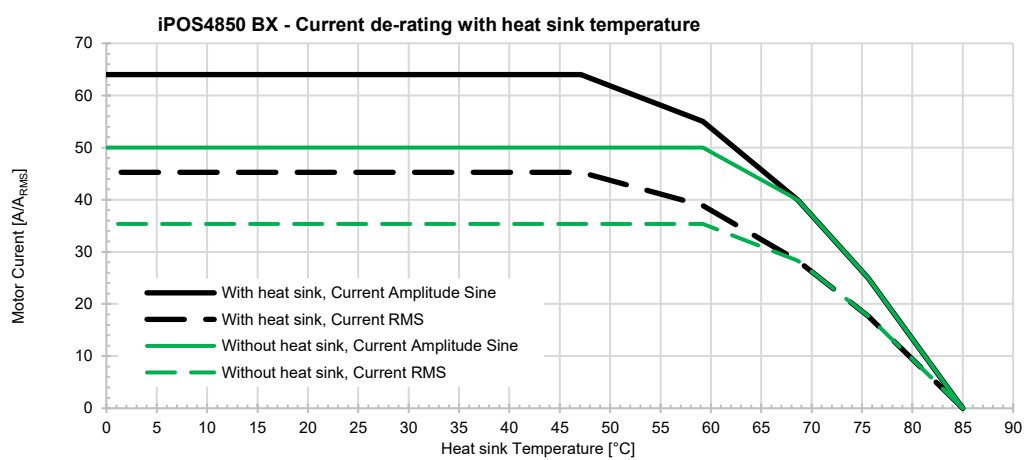
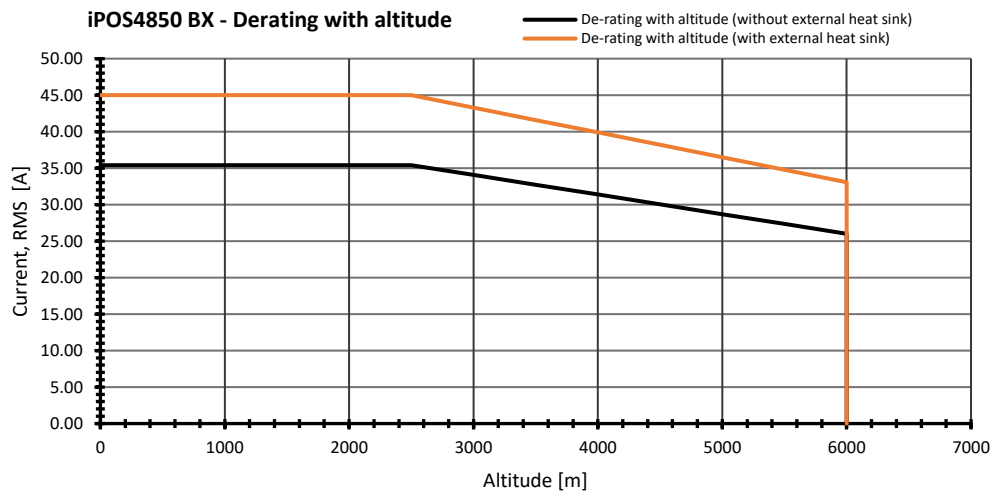
¹ "FS" stands for "Full Scale"

Name	First edition	Document template: P099.TQT.564.0001	Last edition	Visa:
ALN	September 2, 2021		July 27, 2026	AS
 TECHNOSOFT		Title of document	N° document	
		iPOS4850 BX-CAT-STO	P029.300.E321.DSH.10H	
		PRODUCT DATA SHEET	Page: 4 of 5	



iPOS4850 BX-CAT-STO DATASHEET

P/N: P029.300.E321



Name ALN	First edition September 2, 2021	Document template: P099.TQT.564.0001	Last edition July 27, 2026	Visa: AS
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