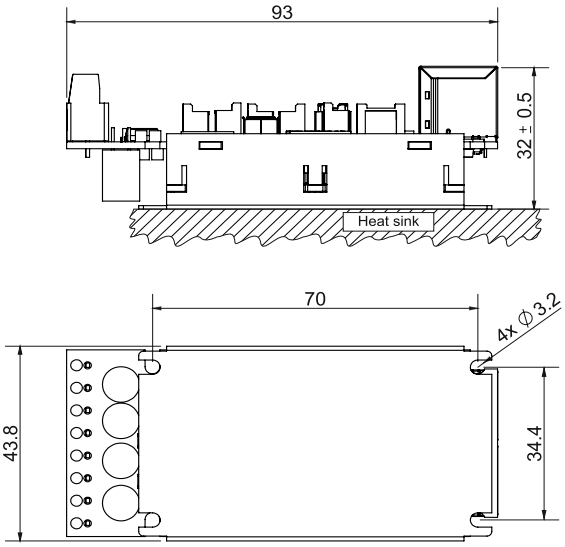
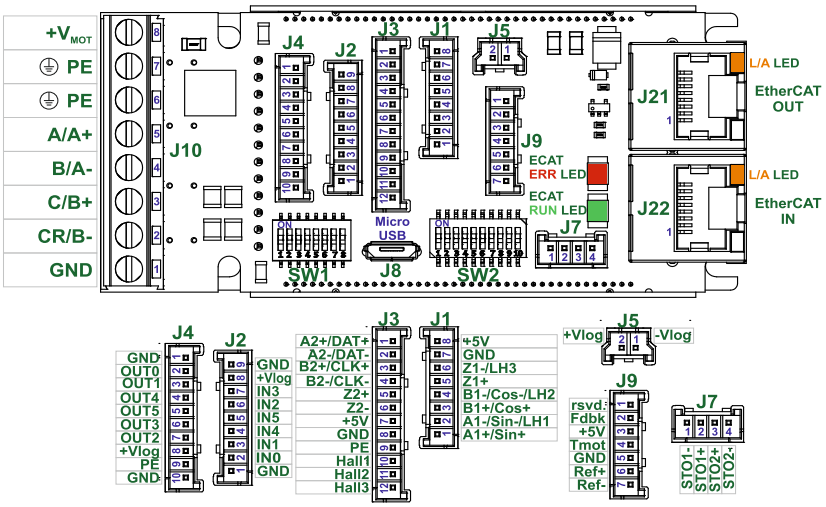
iPOS4810 XZ-CAT DATASHEET

P/N: P022.815.E122

-preliminary-



All dimensions are in mm; Drawing not to scale.



Motor – sensor configurations					
Sensor \ Motor	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder	✓		✓	✓	
Incr. Encoder + Dig. Hall	✓	✓			
Linear Halls	✓				
Digital Hall control only	✓				
Analog Sin/Cos encoder	✓	✓	✓	✓	
SSI / BiSS-C/ EnDAT/ TAMAGAWA/ Panasonic/ Nikon/ Sanyo Denki	✓	✓	✓	✓	
Tacho			✓		
Open-loop (no sensor)				✓	✓

Mating Connectors			
Producer	**Part No.**	**Connector**	**Description**
Molex	35507-0800	J1	2.00mm Pitch Sherlock Housing, 8 Circuits
Molex	35507-0900	J2	2.00mm Pitch Sherlock Housing, 9 Circuits
Molex	35507-1200	J3	2.00mm Pitch Sherlock Housing, 12 Circuits
Molex	35507-1000	J4	2.00mm Pitch Sherlock Housing, 10 Circuits
Molex	35507-0200	J5	2.00mm Pitch Sherlock Housing, 2 Circuits
Molex	35507-0400	J7	2.00mm Pitch Sherlock Housing, 4 Circuits
Molex	35507-0700	J9	2.00mm Pitch Sherlock Housing, 7 Circuits
-	-	J21, J22	Standard 8P8C modular jack (RJ-45) male
Molex	79758-1021	J1, J2, J3, J4 J5, J7, J9	Pre-Crimped Lead Sherlock Female-to-Sherlock Female, Tin (Sn) Plating, 300.00mm Length, 26 AWG, Black
	502128100		2.00mm Pitch, Micro-Latch Female Crimp Terminal, Tin (Sn) Plating, 24-30 AWG, Bag
	638190500		Hand Crimp Tool for 2.00mm Pitch Terminal, 24-30 AWG
J10	M3 screws fixed with 0.5...1Nm using a 2.5mm x 0.3mm tip screwdriver. Wire AWG 12…30 (0.5mm^2… 3.3mm^2), strip length 6.5mm.		

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: 11-50V; Logic SELV/ PELV supply: 9-36V; STO SELV/ PELV supply: 18-40V
- Output current: 10A RMS cont. (BLDC mode); 28A RMS peak, up to 100kHz PWM
- Operating ambient temperature: 0-40°C (over 40°C with derating)
- NTC/PTC analogue Motor Temperature sensor input
- Communication interfaces: USB, Dual RJ45 100Mbps EtherCAT® ports
- Commissioning (set-up) possible through USB, FoE (file-over EtherCAT®), EoE (Ethernet-over-EtherCAT®)
- 128 h/w addresses selectable by h/w sliding switches
- 16k x 16 SRAM memory for data acquisition
- 24k x16 E2ROM to store setup data, TML motion programs, cam tables and other user data
- Feedback Devices (dual-loop support)

1st feedback devices supported:

- Incremental encoder interface (single ended or differential)
- Analogue sin/cos encoder interface (differential 1V_{pp})
- Digital & Linear Hall sensor interface (single-ended and open collector)
- pulse & direction interface (single ended or differential) for external (master) digital reference

2nd feedback devices supported:

- Incremental encoder interface (differential)
- pulse & direction interface (differential) for external (master) digital reference
- SSI / BiSS-C/ EnDAT/ TAMAGAWA/ Panasonic/ Nikon/ Sanyo Denki encoder interface
- Integrated termination resistors for differential Feedback#1 pairs, selectable through sliding switches.
- STO: 2 safe torque-off inputs, safety integrity level (SIL3/Cat3/PLe) acc. to EN61800-5-1; -2/ EN61508-3; -4/ EN ISO 13849-1.
- 6 digital inputs, 12-36V, PNP/NPN programmable: 2 for limit switches, 4 general-purpose
- 6 digital outputs, 5-36V, 0.5A, PNP/NPN programmable: Ready, Error, 4 general-purpose
- 2 analogue inputs: 12-bit, ±10V or 0-5V: Reference, Feedback or general purpose

Connectors description

J1 Feedback #1

Pin	Name	Description
1	A1+/Sin+	Incr. encoder1 A single-ended, or A+ diff. input, or analogue encoder Sin+ diff. input
2	A1-/Sin-/LH1	Incr. encoder1 A- diff. input, or analogue encoder Sin- diff. input if SW2 pin2= ON and pin3=OFF
		Linear Hall 1 input if SW2 pin2= OFF and pin3=ON
3	B1+/Cos+	Incr. encoder1 B single-ended, or B+ diff. input, or analogue encoder Cos+ diff. input
4	B1-/Cos-/LH2	Incr. encoder1 B- diff. input, or analogue encoder Cos- diff. input if SW2 pin5= ON and pin6=OFF
		Linear Hall 2 input if SW2 pin5= OFF and pin6=ON
5	Z1+	Incr. encoder1 Z single-ended, or Z+ diff. input
6	Z1-/LH3	Incr. encoder1 Z- diff. input if SW2 pin8= ON and pin9=OFF
		Linear Hall 3 input if SW2 pin8= OFF and pin9=ON
7	GND	Return ground. Internally connected to all GND signals except STO GND.
8	$+5V_{OUT}$	5V output supply

J2 Digital Inputs

Pin	Name	Description
1	GND	Return ground. Internally connected to all GND signals except STO GND.
2	IN0	12-36V general-purpose digital PNP/NPN input
3	IN1	12-36V general-purpose digital PNP/NPN input
4	IN4	12-36V general-purpose digital PNP/NPN input
5	IN5	12-36V general-purpose digital PNP/NPN input
6	IN2/LSP	12-36V digital PNP/NPN input. Positive limit switch input
7	IN3/LSN	12-36V digital PNP/NPN input. Negative limit switch input
8	$+V_{LOG}$	Positive terminal of the logic supply input: 9 to $36V_{DC}$. Internally connected to other $+V_{LOG}$ pins
9	GND	Return ground. Internally connected to all GND signals except STO GND.

J3 Feedback #2 and Digital Hall

Pin	Name	Description
1	A2+/Pulse+/Data+/SL+	Incr. encoder2 A+ diff. input, or Pulse+, or Data+ for SSI, or Slave+ for BiSS; has internal 120Ω resistor between pins 11 and 12
2	A2- /Pulse-/Data-/SL-	Incr. encoder2 A- diff. input, or Pulse-, or Data- for SSI, or Slave- for BiSS; has internal 120Ω resistor between pins 11 and 12
3	B2+/Dir+/CLK+/MA+	Incr. encoder2 B+ diff. input, or Dir+, or Clock+ for SSI, or Master+ for BiSS; has internal 120Ω resistor between pins 9 and 10
4	B2-/Dir-/CLK-/MA-	Incr. encoder2 B- diff. input, or Dir-, or Clock- for SSI, or Master- for BiSS; has internal 120Ω resistor between pins 9 and 10
5	Z2+	Incr. encoder2 Z+ diff. input; has internal 120Ω resistor between pins 7 and 8
6	Z2-	Incr. encoder2 Z- diff. input; has internal 120Ω resistor between pins 7 and 8
7	$+5V_{OUT}$	5V output supply
8	GND	Return ground. Internally connected to all GND signals except STO GND.
9	PE	Protection Earth
10	Hall 1	Digital input Hall 1 sensor
11	Hall 2	Digital input Hall 2 sensor
12	Hall 3	Digital input Hall 3 sensor

J4 Digital Outputs

Pin	Name	Description
1	GND	Return ground. Internally connected to all GND signals except STO GND.
2	OUT0	5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable
3	OUT1	5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable
4	OUT4	5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable
5	OUT5	5-36V general-purpose digital output, 0.2A PNP/ 0.3A NPN, software selectable
6	OUT3/Ready	5-36V Ready signal digital output, 0.2A PNP/ 0.3A NPN, software selectable
7	OUT2/Error	5-36V Error signal digital output, 0.2A PNP/ 0.3A NPN, software selectable
8	$+V_{LOG}$	Positive terminal of the logic supply input: 9 to $36V_{DC}$. Internally connected to other $+V_{LOG}$ pins
9	PE	Protection Earth
10	GND	Return ground. Internally connected to all GND signals except STO GND.

J5 Logic supply input

Pin	Name	Description
1	$-V_{LOG}$	Negative terminal of the logic supply input: 9 to $36V_{DC}$ from SELV/ PELV type power supply.
2	$+V_{LOG}$	Positive terminal of the logic supply input: 9 to $36V_{DC}$ from SELV/ PELV type power supply.

J7 STO (Safe Torque Off)

Pin	Name	Description	
1	STO2-	Safe Torque Off input 2, negative return (opto-isolated, 0V)	Apply between both STO1+, STO2+ and STO1-, STO2- 24V DC from SELV/ PELV power supply for motor PWM output operation
2	STO2+	Safe Torque Off input 2, positive input (opto-isolated, 18÷40V)	
3	STO1+	Safe Torque Off input 1, positive input (opto-isolated, 18÷40V)	
4	STO1-	Safe Torque Off input 1, negative return (opto-isolated, 0V)	

J9 Analogue inputs

Pin	Name	Description	
1	rsvd	Reserved. Do not connect	
2	FDBK	Analogue input, 12-bit, 0-5V. Reads an analogue feedback (tacho), or general purpose	
3	$+5V_{OUT}$	5V output supply	
4	Temp Mot	NTC/PTC 3.3V input. Used to read an analog temperature value	
5	GND	Return ground. Internally connected to all GND signals except STO GND.	
6	REF+	+/-10V Analogue Input+, 11-bit	Found as variable **REF**
7	REF-	+/-10V Analogue Input-, 11-bit	

J10 Power input and Motor outputs

Pin	Name	Description
1	GND	Negative return (ground) of the power supply
2	CR/B-	**Chopping Resistor output/ Phase B-** for step motors
3	C/B+	**Phase C** for 3-ph motors, B+ for 2-ph steppers
4	B/A-	**Phase B** for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
5	A/A+	**Phase A** for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
6	PE	Earth connection
7	PE	Earth connection
8	+Vmot	Positive terminal of the motor supply: 12 to $48V_{DC}$.

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SW1 – Axis ID settings	
Position	**Description**
1..8	Sets hardware Axis ID that is found in the ECAT register *configured station alias* *Pin 1 is Bit 0... Pin 7 is Bit 6 of the Axis value.* Possible values: from 1 to 255 when all pins OFF; When Axis ID is 255, the EtherCAT register called "*configured station alias"* will be 0.

SW2 – Feedback #1 Signal routing and termination resistors	
Position	**Description**
1	Internally connect 150Ω termination resistor between J1 pin 1 and 2.
2	Internally connect A1-/Sin- signal to J1 pin2; **Remark**: If this pin is ON, SW2 pin 3 must be OFF.
3	Internally connect Linear Hall 1 (LH1) signal to J1 pin2; **Remark**: If this pin is ON, SW2 pin 2 must be OFF.
4	Internally connect 150Ω termination resistor between J1 pin 3 and 4.
5	Internally connect B1-/Cos- signal to J1 pin4; **Remark**: If this pin is ON, SW2 pin 6 must be OFF.
6	Internally connect Linear Hall 2 (LH2) signal to J1 pin4; **Remark**: If this pin is ON, SW2 pin 5 must be OFF.
7	Internally connect 150Ω termination resistor between J1 pin 5 and 6.
8	Internally connect Z1- signal to J1 pin6; **Remark**: If this pin is ON, SW2 pin 9 must be OFF.
9	Internally connect Linear Hall 3 (LH3) signal to J1 pin6; **Remark**: If this pin is ON, SW2 pin 8 must be OFF.
10	Reserved

Electrical characteristics

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

- VLOG = 24 VDC; VMOT = 48VDC
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude / cont. BLDC, DC, stepper) = 10A RMS

Operating Conditions		**Min.**	**Typ.**	**Max.**	**Units**
Ambient temperature		0		40[1]	ºC
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure[2]	Altitude (vs. sea level)	-0.1	0 ÷ 2.5	[2]	Km
	Ambient Pressure	0 [2]	0.75 ÷ 1	10.0	atm
Storage Conditions		**Min.**	**Typ.**	**Max.**	**Units**
Ambient temperature		-40		100	ºC
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm
ESD capability (Human body model)	Not powered; applies to any accessible part			±0.5	kV
	Original packaging			±15	kV

Mechanical Mounting			**Min.**	**Typ.**	**Max.**	**Units**
Airflow			natural convection[3], closed box			
Spacing required for vertical mounting	Between adjacent drives		30			mm
	Between drives and nearby walls		30			mm
	Between drives and roof-top		20			mm
Spacing required for horizontal mounting	Between adjacent drives		4			mm
	Between drives and nearby walls		5			mm
	Space needed for drive removal		10			mm
	Between drives and roof-top		15			mm
Power dissipation	Nominal current, 20KHz			TBD		Watt
Global efficiency	Nominal current, 20KHz	EtherCAT		TBD		%

Environmental Characteristics		**Min.**	**Typ.**	**Max.**	**Units**
Size (Length x Width x Height)	Global size		93 x 43.8 x 32		mm
			~3.66 x 1.72 x 1.26		inch
Weight			83		g
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		36	V_{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	8		40	V_{DC}
	Absolute maximum values, continuous	-0.6		42	V_{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		+45	V
Supply current	+V_{LOG} = 12V		150		mA
	+V_{LOG} = 24V		100		
	+V_{LOG} = 40V		80		

Motor Supply Input (+V_{MOT})		**Min.**	**Typ.**	**Max.**	**Units**
Supply voltage	Nominal values	11		50	V_{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	9		52	V_{DC}
	Absolute maximum values, continuous	-0.6		54	V_{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		57	V
Supply current	Idle		1	5	mA
	Operating	-40	±15	+40	A
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) †			43	A

Motor Outputs (A/A+, B/A-, C/B+, CR/B-)			**Min.**	**Typ.**	**Max.**	**Units**
Nominal output current, continuous[4]	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control				14.1	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)				14.1	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)				10	
Motor output current, peak	maximum TBD s		-40		+40	A
Short-circuit protection threshold			±43		±43	A
Short-circuit protection delay				TBD		µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance			TBD		V
Voltage efficiency				100		%
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} = 36 V	F_{PWM}				µH
		20 kHz				
		40 kHz				
		60 kHz				
		80 kHz				
		100 kHz				
	Minimum value, limited by short-circuit protection; +V_{MOT} = 36 V	20 kHz				µH
		60 kHz				
		40 kHz				
		80 kHz				
		100 kHz				
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz				µs
		40 kHz				
		60 kHz				
		80 kHz				
		100 kHz				
Current measurement	FS = Full Scale accuracy			TBD		%FS

[1] Operating temperature at higher temperatures is possible with reduced current and power ratings
[2] iPOS4810 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] In case of forced cooling (conduction or ventilation) the spacing requirements may drop substantially down to zero as long as the ambient temperature is kept below the maximum operating limit
[4] @20kHz F_{PWM}

Supply Output (+5V)		**Min.**	**Typ.**	**Max.**	**Units**
Output voltage	Current sourced = 250mA	4.8	5	5.2	V
Output current			TBD		mA
Short-circuit			Yes		
Over-voltage			NOT protected		
ESD protection	Human body model	±1			kV
Isolation PE (earth) – GND				±250	V

Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4, IN5)[1]		**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	24	36	
	Hysteresis	1.2	2.4	2.8	
	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”		8	10	
Mode compliance		NPN			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic “LOW”		0	2.2	V
	Logic “HIGH”	6.3	24	36	
	Hysteresis	1.2	2.4	2.8	
	Floating voltage (not connected)		15		
	Absolute maximum, continuous	-10		+39	
	Absolute maximum, surge (duration ≤ 1s)†	-20		+40	
Input current	Logic “LOW”; Pulled to GND		8	10	mA
	Logic “HIGH”; Pulled to +24V	0	0	0	
Input frequency		0		10	kHz
Minimum pulse		6			µs
ESD protection	Human body model	±5			kV

Encoder1 Inputs (A1/A1+, A1-, B1/B1+, B1-, Z1/Z1+, Z1-)	**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 [2]	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

Digital Outputs (OUT0, OUT1, OUT2/Error, OUT3/Ready, OUT4, OUT5)[1]	**Min.**	**Typ.**	**Max.**	**Units**

Mode compliance		PNP 24V			
Default state	Not supplied (+VLOG floating or to GND)	High-Z (floating)			
	Normal operation	Logic “High”			
Output voltage	Logic “HIGH”; output current = 0.2A		V_{LOG}-0.2	V_{LOG}-0.8	V
	Logic “LOW”; output current = 0, no load	open-collector			
	Logic “HIGH”, external load to GND		0		
	Absolute maximum, continuous	-0.3		V_{LOG}+0.3	
	Absolute maximum, surge (duration ≤ 1s)†	-0.5		V_{LOG}+0.5	
Output current	Logic “HIGH”, source current, continuous			0.2	A
	Logic “HIGH”, source current, pulse ≤ 5 s			0.4	A
	Logic “LOW”, means High-Z				mA
Minimum pulse width		2			µs
ESD protection	Human body model	±15			kV

Mode compliance		NPN 24V			
Default state	Not supplied (+VLOG floating or to GND)	High-Z (floating)			
	Normal operation	High-Z			
Output voltage	Logic “LOW”; output current = 0.3A		0.2	0.8	V
	Logic “HIGH”; output current = 0, no load	open-collector			
	Logic “HIGH”, external load to $+V_{LOG}$		V_{LOG}		
	Absolute maximum, continuous	-0.3		V_{LOG}+0.3	
	Absolute maximum, surge (duration ≤ 1s)†	-0.5		V_{LOG}+0.5	
Output current	Logic “LOW”, sink current, continuous			0.3	A
	Logic “LOW”, sink current, pulse ≤ 5 s			0.5	A
	Logic “HIGH”, means High-Z				mA
Minimum pulse width		2			µs
ESD protection	Human body model	±15			kV

[1] The digital inputs and outputs are software selectable as PNP or NPN

[2] For full RS-422 compliance, termination resistors must be connected across the differential pairs; See SW2 settings.

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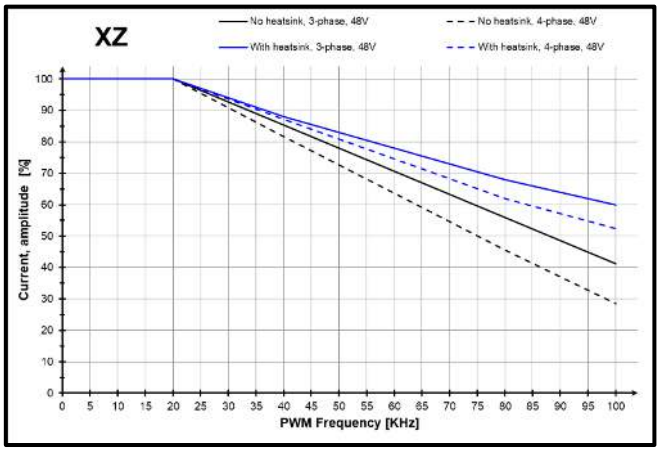
Digital Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units
Mode compliance		TTL / CMOS / Open-collector			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"		0	0.8	V
	Logic "HIGH"	2	5		
	Floating voltage (not connected)		4.4		
	Absolute maximum, surge (duration ≤ 1s) †	-10		+15	
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
ESD protection	Human body model	±5			kV
Linear Hall Inputs (LH1, LH2, LH3)		**Min.**	**Typ.**	**Max.**	**Units**
Input voltage	Operational range	0	0.5÷4.5	4.9	V
Input voltage	Absolute maximum values, continuous	-7		+7	V
	Absolute maximum, surge (duration ≤ 1s) †	-11		+14	
Input current	Input voltage 0…+5V	0		0.2	mA
Interpolation Resolution	Depending on software settings			11	bits
Frequency		0		1	kHz
ESD protection	Human body model	±1			kV
Encoder2 Inputs (A2+, A2-, B2+, B2-, Z2+, Z2-) [1]		**Min.**	**Typ.**	**Max.**	**Units**
Differential mode compliance		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+ A2-, B2-, Z2-		150		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns
Sin-Cos Encoder Inputs (Sin+, Sin-, Cos+, Cos-)		**Min.**	**Typ.**	**Max.**	**Units**
Input voltage, differential	Sin+ to Sin-, Cos+ to Cos-		1	1.25	V_{PP}
Input voltage, any pin to GND	Operational range	-1	2.5	4	V
	Absolute maximum values, continuous	-7		+7	
	Absolute maximum, surge (duration ≤ 1s) †	-11		+14	
Input impedance	Differential, Sin+ to Sin-, Cos+ to Cos- [2]	4.2	4.7		kΩ
	Common-mode, to GND		2.2		kΩ
Resolution with interpolation	Software selectable, for one sine/cosine period	2		10	bits
Frequency	Sin-Cos interpolation	0		450	kHz
	Quadrature, no interpolation	0		10	MHz
ESD protection	Human body model	±1			kV
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		28		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS [3]
Bandwidth (-3Db)	Software selectable	0		1	kHz
ESD protection	Human body model	±5			kV

Safe torque OFF (STO1+,STO1-; STO2+, STO2+)		Min.	Typ.	Max.	Units
Safety function	According to EN61800-5-2	STO (Safe Torque OFF)			
EN 61800-5-1/ -2 and EN 61508-5-3/ -4 Classification	Safety Integrity Level	safety integrity level 3 (SIL3)			
	PFHD (probability of dangerous failures per hour)	$8*10^{-10}$	hour^{-1} (0.8 FIT)		
EN13849-1 Classification	Performance Level	Cat3/PLe			
	MTTFM (meantime to dangerous failure)	377			years
Mode compliance		PNP			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic "LOW"	-20		5.6	V
	Logic "HIGH"	18		36	
	Absolute maximum, continuous	-20		+40	
Input current	Logic "LOW"; pulled to GND		0		mA
	Logic "HIGH", pulled to +Vlog		5	13	
Repetitive test pulses (high-low-high)	Ignored high-low-high			5	ms Hz
				20	
Fault reaction time	From internal fault detection to register DER bit 14 =1 and OUT2/Error high-to-low			30	ms
PWM operation delay	From external STO low-high transition to PWM operation enabled			30	ms
ESD protection	Human body model	±2			kV
BiSS/SSI/ EnDat Encoder Interface from J3		**Min.**	**Typ.**	**Max.**	**Units**
Differential mode (CLOCK, DATA) [1]	For full RS422 compliance, see [1]	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			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				
Ethernet Ports		**Min.**	**Typ.**	**Max.**	**Units**
Standard Compliance		EtherCAT (IEC61158-3/4/5/6-12)			
		Fast Ethernet 100BASE-TX (IEEE802.3u)			
		Auto-negotiation for 100Mbps/s full-duplex			
		Auto-detect MDI/MDI-X			
Power over Ethernet	NOT used by the iPOS4810, requires separate +Vlog SELV/ PELV supply	compliant to IEEE802.3af mode A "Mixed DC & Data"			
		NOT compliant to IEEE802.3af mode B "DC on Spares"			
Isolation GND0,GND1	Requirement for motherboard PCB routing	500			V_{rms}
		1.5			kV_{peak}
Maximum cable length	2-pair UTP Cat5	100	150		m
ESD protection	Human body model	±4			kV

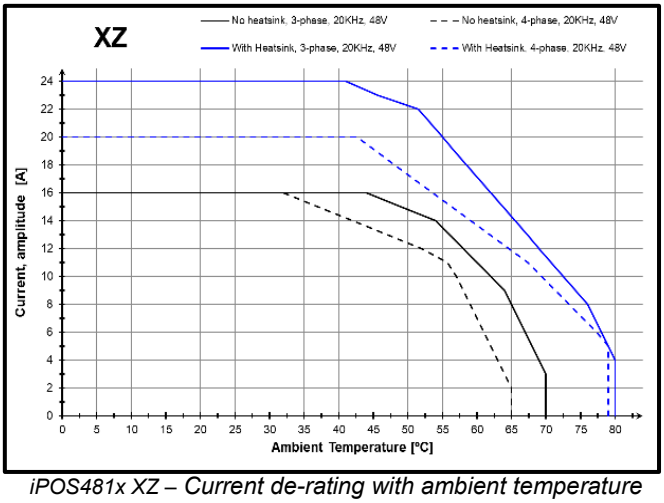
[1] Encoder2 differential input pins have internal 120Ω termination resistors connected across
[2] For many applications, a termination resistor should be connected across SIN+ to SIN-, and across COS+ to COS-. See SW2 settings.
[3] "FS" stands for "Full Scale"

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)				

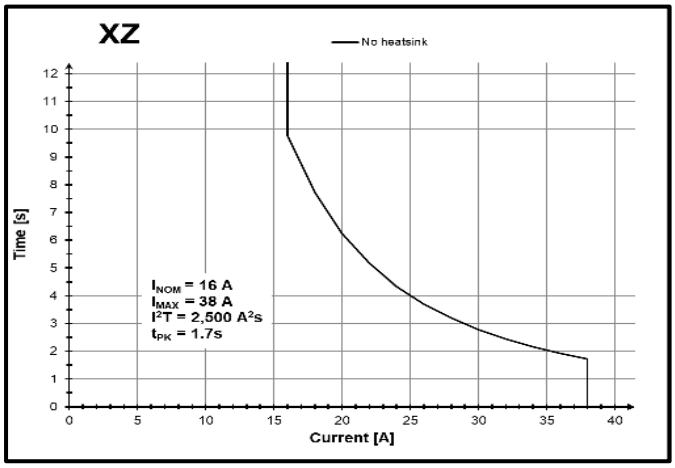
† Stresses beyond values listed under “absolute maximum ratings” may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.



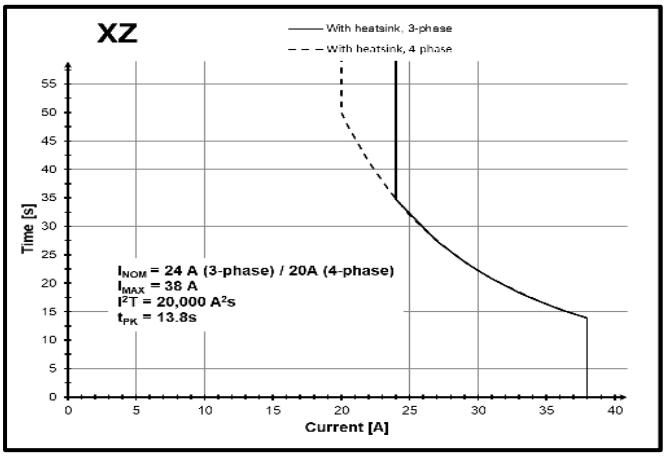
iPOS481x XZ – Current de-rating with PWM frequency, @48V



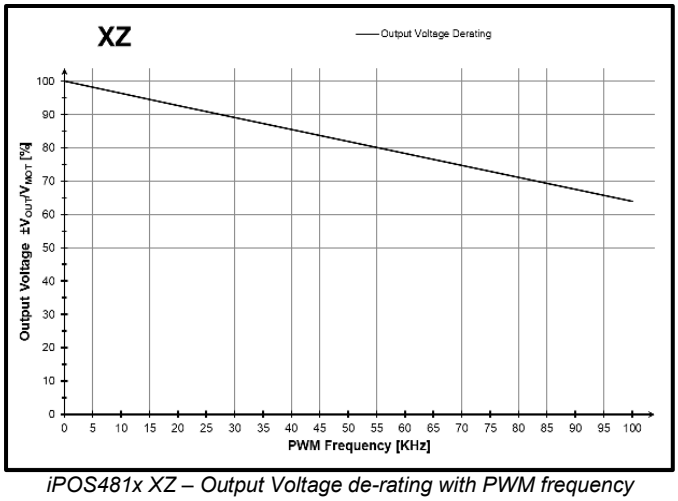
iPOS481x XZ – Current de-rating with ambient temperature



iPOS481x XZ – Over-current diagram (No heatsink)



iPOS481x XZ – Over-current diagram (With heatsink)



iPOS481x XZ – Output Voltage de-rating with PWM frequency