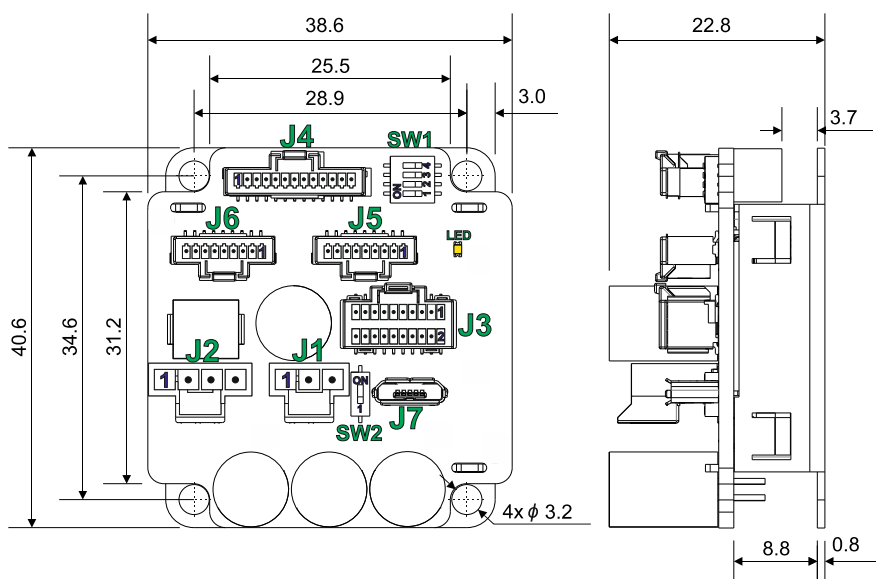




iPOS4803S Microdrive EtherCAT

DATASHEET

P/N: P020.801.E222



All dimensions are in mm. Drawing not to scale.

Motor – sensor configurations			
Sensor \ Motor	PMSM	BLDC	DC BRUSH
Incr. Encoder	Ⓣ		Ⓣ
Incr. Encoder + Dig. Hall	Ⓣ	Ⓣ	
Linear Halls	Ⓣ		
Digital Halls control only	Ⓣ		
SSI / BiSS-C/ EnDAT/ TAMAGAWA/ Panasonic/ Nikon / Sanyo Denki	Ⓣ	Ⓣ	Ⓣ
Tacho			Ⓣ

Mating Connectors			
Producer	Part No.	Connector	Description
Molex	1053071203	J1	1x3 Nano-Fit, 2.50mm Pitch Nano-Fit Wire-to-Board Housing, 3 circuits
Molex	1053071204	J2	1x4 Nano-Fit, 2.50mm Pitch Nano-Fit Wire-to-Board Housing, 4 circuits
Molex	5011892010	J3	2x10 Pico-Clasp, 1.00mm Pitch Pico-Clasp Wire-to-Board Housing, 20 Circuits
Molex	5013301300	J4	1x13 Pico-Clasp, 1.00mm Pitch Pico-Clasp Wire-to-Board Housing, 13 Circuits
Molex	5013300900	J5, J6	1x9 Pico-Clasp, 1.00mm Pitch Pico-Clasp Wire-to-Board Housing, 9 Circuits
Tensility International Corp	1002333	J7	USB cable, Cable USB A Male - Micro B Male, 1m, shielded, black, 9.6mm plastic width
Molex	0797582140	J1, J2	Pre-Crimped wires for Nano-Fit Cable Assembly, Nano-Fit Crimp Terminal Socket to Nano-Fit Crimp Terminal Socket, 300mm
Molex	0797581019	J3, J4, J5, J6	Pre-Crimped wires for Pico-Clasp Cable Assembly, Pico-Clasp Crimp Terminal Socket to Pico-Clasp Crimp Terminal Socket, 300mm
Molex	1053001400	J1, J2	Nano-Fit Crimp Terminal, Female, 0.76µm Gold (Au) Plating, Lubricated, 24-26 AWG
Molex	5011937000	J3, J4, J5, J6	1.00mm Pitch, Pico-Clasp Female Crimp Terminal, Gold Plating 0.10µm, 28-32 AWG, Reel
Molex	638191500	J1, J2	Crimp Tool, Ratchet, Molex Pico-Clasp 501193 & 501334 Series 32-28AWG Contacts
Molex	638276000	J3, J4, J5, J6	Crimp Tool, Ratchet, Molex Nano-Fit 105300 Series 26-24AWG Socket Contacts, 207129 Series

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 (CSP, PVT, S-curve, electronic gearing and cam) ▪ Motor supply: 48V nominal ▪ Motor output current per axis: ▪ 4A_{RMS} / 5.6A amplitude nominal; ▪ 9.9A_{RMS} / 15A amplitude peak. ▪ Logic supply: 24V nominal, 48V max ▪ Feedback Options (1x Hall sensors + 2x encoders) ▪ 1 x Hall sensor interface (digital or linear) ▪ 1st feedback devices supported: ▪ Incremental A / B (index Z available only for 1 encoder): differential or single-ended ▪ Absolute: differential or single-ended encoder. Supported protocols: SSI, BiSS, EnDAT, TAMAGAWA, Panasonic, Nikon, Sanyo Denki ▪ pulse & direction interface (single-ended or differential) for external (master) digital reference ▪ 2nd feedback devices supported: ▪ Incremental encoder interface (differential) ▪ Absolute differential encoder. Supported protocols: SSI, BiSS, EnDAT, TAMAGAWA, Panasonic, Nikon, Sanyo Denki ▪ pulse & direction interface (differential) for external (master) digital reference ▪ 1 x analogue input configurable by software: 12-bit 0-5V: Reference, Feedback or general purpose ▪ Up to 6 x software selectable digital inputs: ▪ 2 x limit switches + 1 x enable input or 3 x general-purpose inputs, NPN, pull-to-GND to activate, pull-up on-board to +5V ▪ 3 x configurable I/O pin (I/O0, I/O1, I/O4), individually software selectable as: ▪ Digital input, NPN, pull-to-GND to activate, with pull-up on-board to +5V ▪ Digital output, NPN (open-collector): I/O0 able to pull 1.5A which can drive inductive loads (such as mechanical brake), with +5V on-board pull-ups; I/O1&4 which can pull 0.1A ▪ RS-232 serial & USB & dual 100Mbps EtherCAT® interfaces ▪ Commissioning (set-up) possible through RS232, USB, FoE (File-over-EtherCAT) or EoE (Ethernet-over-EtherCAT) ▪ Operating ambient temperature: 0-40°C (over 40°C with de-rating) ▪ Programmable protections: any short-circuit between motor phases, GND and/or supply, over/under-voltage, over-current, I²t, control error ▪ >99% voltage efficiency ▪ 12-bit current measurement resolution

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Pin	Name	Type	Description
J1	1	+Vmot	I Positive terminal of the motor supply: 7 to 48 V _{DC} .
	2	GND	- Ground return.
	3	+Vlog	I Positive terminal of the logic supply input: 6 to 48 V _{DC} .

Pin	Name	Type	Description
J2	1	A	O Phase A for 3-ph motors, Motor+ for DC brush motors.
	2	B	O Phase B for 3-ph motors, Motor- for DC brush motors.
	3	C	O Phase C for 3-ph motors.
	4	GND	- Ground return.

Pin	Name	Type	Description
J3	1	232TX	O RS-232 Data Transmission.
	2	232RX	I RS-232 Data Reception.
	3	GND	- Ground return.
J4	4	+Vlog	I Positive terminal of the logic supply input: 6 to 48 V _{DC} .
	5	IN2/LSP	I 5-60V digital NPN input. Positive limit switch input.
	6	IN3/LSN	I 5-60V digital NPN input. Negative limit switch input.
	7	I/O0	I/O 5-50V NPN general-purpose digital programmable input IN0 /or NPN 1.5A output OUT0.
	8	I/O1	I/O 5-50V NPN general-purpose digital programmable input IN1 / or NPN 0.1A output OUT1.
	9	I/O4	I/O 5-50V NPN general-purpose digital programmable input IN4 / or NPN 0.1A output OUT4.
	10	IN5/Enable	I 5-60V digital NPN input. Drive Enable input.
	11	GND	- Ground return.
	12	AnalogIn	I Analog input (range software selectable 0-5V or ±10V)
	13	+5V	O Supply for all feedback sensors.

Pin	Name	Type	Description
J5	1	GND	- Ground return.
	2	Hall1 / LH1	I Digital Hall, or Linear Hall sensor 1.
	3	+5V	O 5V supply for all feedback sensors.
	4	Hall2 / LH2	I Digital Hall, or Linear Hall sensor 2.
	5	+5V	O 5V supply for all feedback sensors.
	6	Hall3 / LH3	I Digital Hall, or Linear Hall sensor 3.
	7	EncA1+/EncA1 Dt1+/Dt1	I Encoder 1 A / data positive (differential or single-ended).
	8	GND	- Ground return.
	9	EncA1-/Dt1-	I Leave open for single-ended; set SW1 pin 1 for differential.
	10	+5V	O 5V supply for all feedback sensors.
J6	11	EncB1+/EncB1 Clk1+/Clk1	I Encoder 1 B / clock positive (differential or single-ended).
	12	EncA2+/EncA2 Dt2+/Dt2	I Incr. encoder2 A+ diff. input, or Pulse+, or Data+ for SSI, or Slave+ for BiSS; has 120Ω resistor between pins 12 and 14.
	13	EncB1/ Clk1-	I Leave open for single-ended; set SW1 pin 2 for differential.
	14	EncA2-/Dt2-	I Incr. encoder2 A- diff. input, or Pulse-, or Data- for SSI, or Slave- for BiSS; has 120Ω resistor between pins 12 and 14.
	15	Z1+	I Incr. encoder1 Z single-ended or Z+ diff. input.
	16	EncB2+/EncB2 Clk2+/Clk2	I/O Incr. encoder2 B+ diff. input, or Dir+-, or Clock+ for SSI, or Master+ for BiSS; has 120Ω resistor between pins 16 and 18.
	17	Z1-	I Leave open for single-ended; set SW1 pin 3 for differential.
	18	EncB2- Clk2-	I Incr. encoder2 B- diff. input, or Dir--, or Clock- for SSI, or Master- for BiSS; has 120Ω resistor between pins 16 and 18.
	19	GND	- Ground return.
	20	+Vlog	I Positive terminal of the logic supply: 6 to 48 V _{DC} .

Pin	Name	Type	Description
J5 - ECAT IN	1	GND	- Ground return.
	2	Rsvd	- Reserved. Do not connect.
	3	Rsvd	- Reserved. Do not connect.
	4	Rsvd	- Reserved. Do not connect.
	5	SHIELD 0	- Shield connection for ECAT IN port. Connect directly to RJ45 shield.
	6	TX0+	I/O Transmit/Receive positive, ECAT IN port. Connect directly to RJ45 pin1.
	7	TX0-	I/O Transmit/Receive negative, ECAT IN port. Connect directly to RJ45 pin2.
	8	RX0+	I/O Receive/Transmit positive, ECAT IN port. Connect directly to RJ45 pin3.
	9	RX0-	I/O Receive/Transmit negative, ECAT IN port. Connect directly to RJ45 pin6.

Pin	Name	Type	Description
J6 - ECAT OUT	1	GND	- Ground return.
	2	Rsvd	- Reserved. Do not connect.
	3	Rsvd	- Reserved. Do not connect.
	4	Rsvd	- Reserved. Do not connect.
	5	SHIELD 1	- Shield connection for ECAT OUT port. Connect directly to RJ45 shield.
	6	TX1+	I/O Transmit/Receive positive, ECAT OUT port. Connect directly to RJ45 pin1.
	7	TX1-	I/O Transmit/Receive negative, ECAT OUT port. Connect directly to RJ45 pin2.
	8	RX1+	I/O Receive/Transmit positive, ECAT OUT port. Connect directly to RJ45 pin3.
	9	RX1-	I/O Receive/Transmit negative, ECAT OUT port. Connect directly to RJ45 pin6.

Pin	Name	Type	Description
J7 - USB	1	+V USB	I USB supply.
	2	USB DM	I/O USB data-.
	3	USB DP	I/O USB data+.
	4	Rsvd	- Reserved. Do not connect.
	5	GND	- Ground return.
	6	SHELL	- Internally connected to pin 5 of J7.

SW1 – Axis ID and Feedback Resistors selection	
Position	Description
1	ON = Connect an 120Ω resistor between EncA1-/Dt1- and EncA1+/EncA1/Dt1+/Dt1 feedback pins.
2	ON = Connect an 120Ω resistor between EncB1/Clk1- and EncB1+/EncB1/Clk1+/Clk1 feedback pins.
3	ON = Connect an 120Ω resistor between Z1- and Z1+ feedback pins.

SW1 – Position 4	SW2	AxisID
OFF	OFF	255, the EtherCAT register called "configured station alias" will be 0
OFF	ON	1
ON	OFF	128
ON	ON	129

LED
The LED (yellow) shows the status of the drive that its logic is supplied

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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 / continuous BLDC, DC brush) = 5.6A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		40 ¹	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure ²	Altitude (vs. sea level)	-0.1	0 + 2.5		Km
	Ambient Pressure	0 ²	0.75 ± 1	10.0	atm
Storage Conditions		Min.	Typ.	Max.	Units
Ambient temperature		-40		100	°C
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 horizontal mounting	Between adjacent drives		10		mm
	Between drives and nearby walls		10		mm
	Space needed for drive removal		20		mm
	Between drives and roof-top		30		mm
Insertion force	Using recommended mating		20		N
Extraction force	connectors		8		N
Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Global size	40.6 x 38.6 x 22.8			mm
		~1.6 x 1.52 x 0.9			inch
Weight		20			g
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol- based			
Protection degree	According to IEC60529	IP20			
Logic Supply Input (+V _{LOG})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	6	24	48	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	4.9		60	V _{DC}
	Absolute maximum values, continuous	-0.5		63	V _{DC}
Supply current	+V _{LOG} = 12V		90	150	mA
	+V _{LOG} = 24V		60	90	
	+V _{LOG} = 48V		45	60	
Voltage Measurement	Total error			1.5	%
Motor Supply Input (+V _{MOT})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	7		48	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	6		60	V _{DC}
	Absolute maximum values, continuous	-0.5		63	V _{DC}
Supply current	Idle		25		mA
	Operating	-15	±3	+15	A
	Absolute maximum value, short-circuit condition (Duration ≤ 10ms) [†]			16.5	A
Voltage Measurement	Total error			1.5	%

Motor Outputs (A/A+, B/A-, C)		Min.	Typ.	Max.	Units
Nominal output current, continuous ⁴	for DC brushed and BLDC motors with Hall-based trapezoidal control		5.6	15	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)		5.6	15	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)		4	9.9	
Motor output current, peak	maximum 2.5s	-15		+15	A
Short-circuit protection threshold		±16.5		±18	A
Short-circuit protection delay		2		4	µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		0.1		V
Off-state leakage current			0.3	1	mA
Voltage Efficiency ⁴			92		%
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V _{MOT} = 48 V	F _{PWM}			µH
		20 kHz		900	
		40 kHz		480	
		60 kHz		320	
		80 kHz		240	
		100 kHz		200	
	Minimum value, limited by short-circuit protection; +V _{MOT} = 48 V	20 kHz		270	µH
		40 kHz		150	
		60 kHz		100	
		80 kHz		80	
		100 kHz		60	
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz		330	µs
		40 kHz		170	
		60 kHz		140	
		80 kHz		80	
		100 kHz		66	
Current measurement	FS = Full Scale accuracy		±2	±3	%FS
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN5/ENA)		Min.	Typ.	Max.	Units
Mode compliance		NPN			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"	IN0, IN1, IN4, IN5/ENA		1.4	V
	Logic "HIGH"		3.1	2.5	
	Hysteresis		0.9	1.1	
	Logic "LOW"	IN2/LSP, IN3/LSN		1.4	
	Logic "HIGH"		4	3.5	
	Hysteresis			0.6	
	Floating voltage (not connected)			4.5	
	Absolute maximum, continuous		-5	+55	
Input current	Logic "LOW"; Pulled to GND		9	10	mA
	Logic "HIGH"; Pulled to +24V			0.4	
Input frequency		0		500	kHz
Minimum pulse		1			µs
ESD protection	Human body model	±2			kV
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 400mA	5.05	5.2	5.25	V
Output current ⁴		400	650		mA
Short-circuit to GND protection		Yes / Drive resets at event			
Over-voltage protection		NOT protected			
ESD protection	Human body model	±1			KV

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings

² iPOS4803 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 For more details see the "5V Output de-rating" graph

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Digital Outputs (OUT0, OUT1, OUT4)		Min.	Typ.	Max.	Units
Mode compliance	All outputs (OUT0, OUT1, OUT4)	NPN 24V			
Default state	Not supplied (+V _{LOG} floating)	High-Z (floating)			
	Immediately after power-up	Logic "HIGH"			
Output voltage	Logic "LOW"; output current = 1.5A for OUT0/ 0.05A for the other digital outputs			0.4	V
	Logic "HIGH"; output current = 0, no load	4	4.5	5	
	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	OUT1, OUT4		0.1	A
		OUT0		1.5	A
	Logic "HIGH", source current; external load to GND; V _{OUT} ≥ 2.0V			5	mA
	Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} max = 40V		0.05	0.1	mA
Minimum pulse width		0.5			μs
ESD protection	Human body model	±15			kV
Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units
Mode compliance		TTL / CMOS / Open-collector (NPN sink), or analog (linear) 0...5V			
Default state		4.5	4.7	5	V
Input voltage	Digital	Input floating (Wiring disconnected)			
		Logic "LOW"		1.5	
		Logic "HIGH"		2.5	
		Hysteresis		0.5	
Input current	Analog	0	0.5...4.5	4.95	mA
	Logic "LOW"; Pull to GND		2.3		
Minimum pulse width			70		μs
ESD protection	Human body model		±15		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
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 software	1 + 255			-
	By hardware	1, 128, 129, 255			
MAC addressing		none			-
ESD protection	Human body model	±15			kV
Encoder Inputs (A+, A-, B+, B-, Z+, Z-, A2+, A2-, B2+, B2-) [†]		Min.	Typ.	Max.	Units
Single-ended mode compliance	Leave A1-, B1-, Z1-, A2-, B2-floating	TTL/CMOS/Open-collector (NPN)			
Single-ended threshold	A1+, B1+, Z1+, A2+, B2+	1.2	1.3	1.5	V
Single-ended input current	Input pulled to GND against on-board 2.2 KΩ pull-up to +5V		2.2	2.5	mA
Differential mode compliance		TIA/EIA-422-A			
Input voltage	Hysteresis	±0.03	±0.05	±0.2	V
	Differential mode	-15		+15	
	Common-mode range (A+ to GND, etc.)	-7		+12	
Input impedance, differential	A+, A2+, B+, B2+, Z+, Z2+		2.2		kΩ
	A-, A2-, B-, B2-, Z-, Z2-		4.4		
Input frequency	Differential mode	0		15	MHz
Minimum pulse width	Differential mode	33			ns
ESD protection	Human body model	±30			kV

Absolute encoder interface: SSI, BiSS-C, EnDAT, Tamagawa, Nikon, Sanyo Denki		Min.	Typ.	Max.	Units
Differential mode (CLOCK, DATA)	For full RS422 compliance, see ¹	TIA/EIA-422-A			
CLOCK (DATA) Output voltage	Differential; 50Ω differential load	1.5	3.3		V
	Common-mode, referenced to GND	1	1.7	3	
CLOCK frequency	Software selectable	1000, 2000, 3000, 4000			kHz
CLOCK (DATA) Short-circuit protection	Common-mode voltage ±15V	Yes, protected			
DATA format	Software selectable	Binary / Gray			
		Single-turn / Multi-turn			
		Counting direction			
		CRC type			
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				
Analog Inputs (REF, FDBK)					
0...5V Mode		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		4.95	V
	Absolute maximum values, continuous	-12		+18	
	Absolute maximum, surge (duration ≤ 1s)			±36	
Input impedance	To 1.447V		20		kΩ
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS ²
Bandwidth (-3dB)	Software selectable	0		1.5	kHz
ESD protection	Human body model	±2			kV
±10V Mode		Min.	Typ.	Max.	Units
Differential voltage range			±10		V
Common-mode voltage range	Referenced to GND	-12	0...10	+50	V
Input impedance	To 1.447V		20		kΩ
Resolution			12		bits
Integral linearity				0.036	%FS ²
Offset error	Common-mode voltage = 0...10 V		±0.2	±0.5	%FS ³
Gain error	Common-mode voltage = 0...10 V		±0.5	±3	%FS ³
Bandwidth (-3dB)	Software selectable	0		5.5	kHz

[†] 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 Full RS-422 compatibility, as well as noise rejection improvement requires a 120Ω resistor connected across each signal pair via SW1 (A1+/A1-, B1+/B1-, Z1+/Z1-)

² "FS" stands for "Full Scale"

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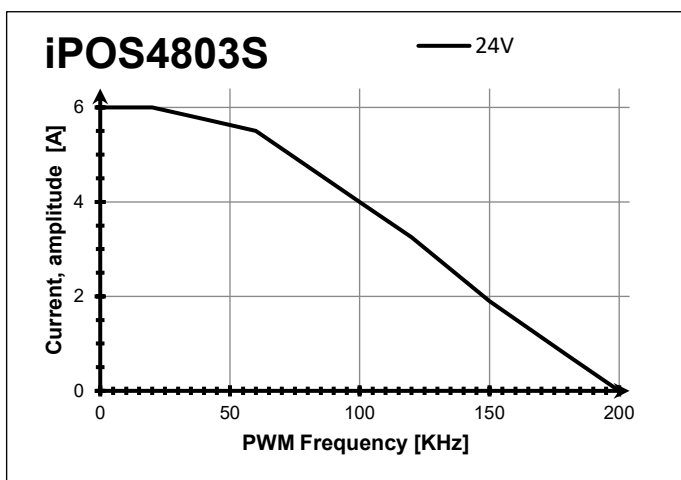


Figure 1 iPOS4803S De-rating with PWM frequency

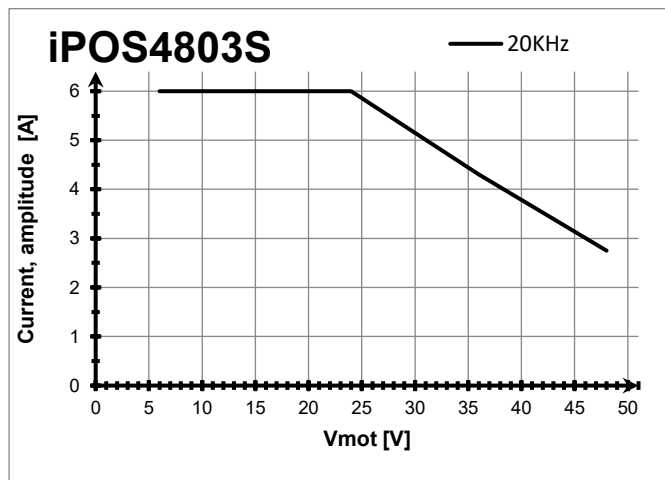


Figure 3 iPOS4803S De-rating with motor supply

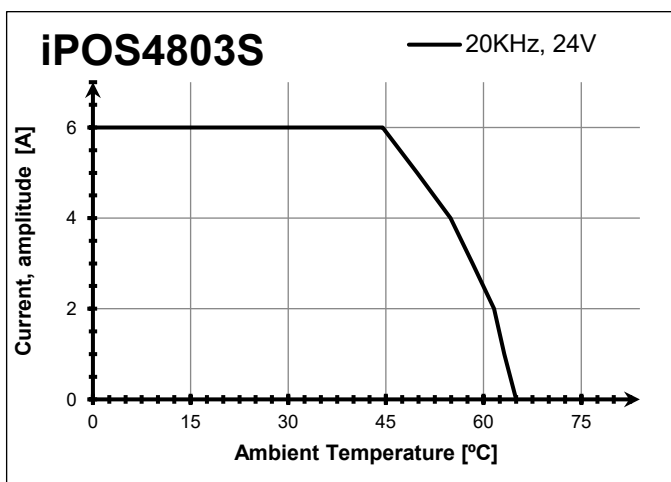


Figure 2 iPOS4803S De-rating with ambient temperature

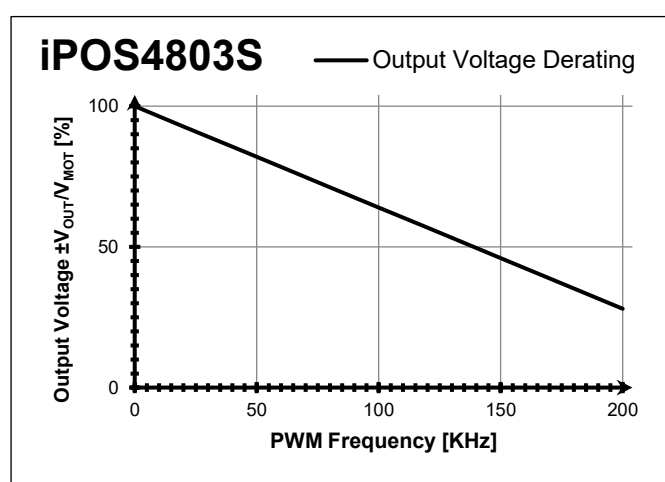


Figure 4 iPOS4803S Output Voltage De-rating with PWM frequency

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