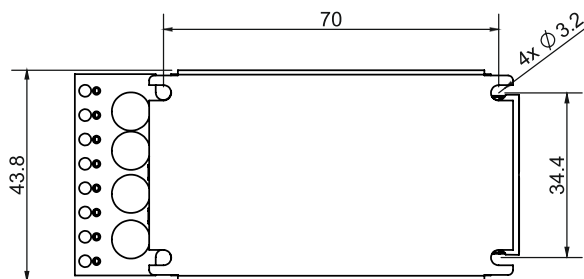
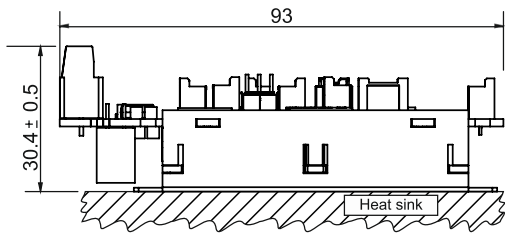


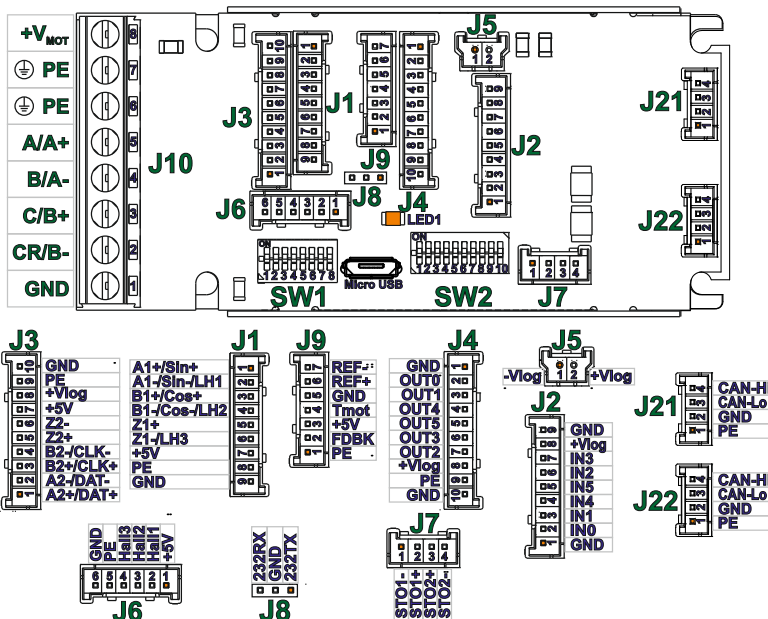


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All dimensions are in mm; Drawing not to scale.



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)				Ⓢ	Ⓢ

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
 - Motor output current:
 - Nominal: 15A_{RMS} / 21.2A amplitude;
 - Peak: 28.3A_{RMS} / 40A amplitude.
- Operating ambient temperature: 0-40°C (over 40°C with derating)
- NTC/PTC analogue Motor Temperature sensor input
- Communication interfaces: USB; TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v.2.2.13 and CiA 402 v4.1.1) protocols
- 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 Hall sensor interface (single-ended / open collector)
 - Linear Hall sensors interface
 - 2nd feedback devices supported:
 - Incremental encoder interface (differential)
 - BiSS / SSI / EnDAT / TAMAGAWA / Panasonic / Nikon / Sanyo Denki encoder interface
- Pulse & direction reference (single-ended or differential) capability
- Integrated termination resistors for differential Feedback#1 pairs, selectable through sliding switches.
- STO: 2 safe torque-off inputs, safety integrity level (SIL3/Cat3/PEL) 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
- 5 x digital outputs, 5-36V: 0.4A NPN / 0.3A PNP, polarity software selectable: Ready, Error or general-purpose
- 1 x dedicated motor brake or general-purpose output (OUT0): 2A NPN / 1.5A PNP, polarity software selectable
- 2 x analogue inputs, 12-bit: ±10V Reference (via REF+ and REF- pins), 0-5V Feedback or general-purpose

Mating Connectors

Producer	Part No.	Connector	Description
Molex	355070900	J1, J2	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 9 Circuits
Molex	355071000	J3, J4	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 10 Circuits
Molex	355070200	J5	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 2 Circuits
Molex	355070600	J6	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 6 Circuits
Molex	355070400	J7, J21, J22	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 4 Circuits
Molex	355070700	J9	2.00mm Pitch Sherlock Wire-to-Board Housing, Natural, 7 Circuits
Molex	797581021	J1, J2, J3, J4, J5, J6, J7, J9, J21, J22	Pre-Crimped Lead Sherlock Female-to-Sherlock Female, Tin (Sn) Plating, 300.00mm Length, 26 AWG, Black
	638190500		Hand Crimp Tool for 2.00mm Pitch Terminal 24-30 AWG
	502128100		2.00mm Pitch, Micro-Latch Female Crimp Terminal, Tin (Sn) Plating, 24-30 AWG, Bag
J10	M3 screws fixed with 0.5...1Nm using a 2.5mm x 0.3mm tip screwdriver. Wire AWG 12...30 (0.5mm²... 3.3mm²), strip length 6.5mm.		

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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 B- 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	+5V _{OUT}	5V output supply
8	PE	Protection Earth
9	GND	Return ground. Internally connected to all GND signals except STO GND.

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		
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 1 and 2
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 1 and 2
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 3 and 4
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 3 and 4
5	Z2+	Incr. encoder2 Z+ diff. input; has internal 120Ω resistor between pins 5 and 6
6	Z2-	Incr. encoder2 Z- diff. input; has internal 120Ω resistor between pins 5 and 6
7	+5V _{OUT}	5V output supply
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.

J8 Serial communication		
Pin	Name	Description
1	232TX	RS-232 Data Transmission.
2	GND	Return ground. Internally connected to all GND signals except STO GND.
3	232RX	RS-232 Data Reception.

J4 Digital Outputs		
Pin	Name	Description
1	GND	Return ground. Internally connected to all GND signals except STO GND.
2	OUT0	12-36V general-purpose digital output, 1.5A PNP/ 2A NPN, software selectable
3	OUT1	12-36V general-purpose digital output, 0.3A PNP/ 0.4A NPN, software selectable
4	OUT4	12-36V general-purpose digital output, 0.3A PNP/ 0.4A NPN, software selectable
5	OUT5	12-36V general-purpose digital output, 0.3A PNP/ 0.4A NPN, software selectable
6	OUT3/Ready	12-36V Ready signal digital output, 0.3A PNP/ 0.4A NPN, software selectable
7	OUT2/Error	12-36V Error signal digital output, 0.3A PNP/ 0.4A 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.

J6 Digital Hall		
Pin	Name	Description
1	+5V _{OUT}	5V output supply
2	Hall 1	Digital input Hall 1 sensor
3	Hall 2	Digital input Hall 2 sensor
4	Hall 3	Digital input Hall 3 sensor
5	PE	Protection Earth
6	GND	Return ground. Internally connected to all GND signals except STO GND.

J7 STO (Safe Torque Off)		
Pin	Name	Description
1	STO1-	Safe Torque Off input 1, negative return (opto-isolated, 0V)
2	STO1+	Safe Torque Off input 1, positive input (opto-isolated, 18÷40V)
3	STO2+	Safe Torque Off input 2, positive input (opto-isolated, 18÷40V)
4	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

J9 Analogue inputs		
Pin	Name	Description
1	PE	Protection Earth
2	FDBK	Analogue input, 12-bit, 0-5V. Reads 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+	Analogue Input+, 11-bit for 0...10V
7	REF-	Analogue Input-, 11-bit for -10...0V

Found as variable REF

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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} .

J21 & J22 CAN		
Pin	Name	Description
1	PE	Earth connection
2	GND	Return ground. Internally connected to all GND signals except STO GND.
3	Can Lo	CAN-Bus negative line (dominant low)
4	Can Hi	CAN-Bus positive line (dominant high)

SW1 – Axis ID settings	
Position	Description
1..7	7-bit H/W Axis ID register Switch 1 is Bit 0... Switch 7 is Bit 6 of the Axis value. Switch ON -> Bit = 0 Switch OFF -> Bit = 1 AxisID values: from 1 to 127 and 255 when all switches are ON. In CANopen, when Axis ID is 255 the drive will be in LSS inactive state.
8	Switch ON = CANopen mode; Switch OFF = TMLCAN mode.

SW2 – Feedback #1 Signal routing and termination resistors	
Position	Description
1	Internally connect 120Ω 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 120Ω 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 120Ω 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	Internally connect 120Ω termination resistor between CAN-Hi and CAN-Lo signals (pins 3 and 4 of J21 & J22 connectors are internally connected)

LEDs	
LED1 - yellow	Indicates that logic supply is present.

Electrical characteristics


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

- V_{LOG} = 24 VDC; V_{MOT} = 48VDC; F_{PWM} = 20kHz
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude) = 21.2 A

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 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
Insertion force	Using recommended mating		12	18	N
Extraction force	connectors	8	10		N
Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Global size			93 x 43.8 x 30.4(±0.5)	mm
				~3.66 x 1.72 x 1.2(±0.01)	inch
Weight			~92		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		
Utilization Category	Acc. to 60947-4-1 (IPEAK ≤ 1.05*INOM)			DC-1	
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	±10	+40	
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) [†]			43	
Utilization Category	Acc. to 60947-4-1 (IPEAK ≤ 4.0*INOM)			DC-3	
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 250mA	4.95	5.11	5.25	V
Output current		360	450		mA
Short-circuit				NOT protected	
Over-voltage				NOT protected	
ESD protection	Human body model	±1			kV
Isolation PE (earth) – GND				±250	V

¹Operating temperature at higher temperatures is possible with reduced current and power ratings
²iPOS4815 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.

³In 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

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Motor Outputs (A/A+, B/A-, C/B+, CR/B-)		Min.	Typ.	Max.	Units	
Nominal current	PMSM motors sinusoidal amplitude			21.2	A	
	PMSM motors sinusoidal RMS			15		
	DC/BLDC motors continuous			18.3		
Peak current	maximum 12.5 s	-40		+40	A	
Short-circuit protection threshold			70		A	
Short-circuit protection delay		1.5		3.3	µs	
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		0.15		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} = 48 V	F _{PWM}			µH	
		20 kHz	400			
		40 kHz	200			
		60 kHz	150			
		80 kHz	100			
	Minimum value, limited by short-circuit protection; +V _{MOT} = 48 V	20 kHz	150			µH
		60 kHz	50			
		40 kHz	40			
		80 kHz	20			
		100 kHz	10			
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	-9.3	+/- 3.4	+9.3	%FS	
Digital Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units	
Mode compliance		TTL / CMOS / Open-collector				
Default state		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		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	
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4, IN5)¹		Min.	Typ.	Max.	Units	
Mode compliance		PNP				
Default state		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		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		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	
Minimum pulse width	Single-ended mode, Open-collector / NPN	1			µs
	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 ≤ 1s) [†]	-11		+14	
ESD protection Human body model		±1			kV
Digital Outputs (OUT1, OUT2/Error, OUT3/Ready, OUT4, OUT5)³		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 = 0.3A		V _{LOG-1.0}	V _{LOG-2.0}	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			
Logic "HIGH", source current, pulse ≤ 5 s				0.4	A
Logic "LOW", means High-Z				20	µA
Minimum pulse width		3	1.5		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, 120Ω termination resistors must be connected across the differential pairs, as close as possible to the drive input pins.

³ The digital inputs and outputs are software selectable as PNP or NPN

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Mode compliance		NPN 24V			
Default state	Not supplied (+V _{LOG} floating or to GND)	High-Z (floating)			
	Normal operation	High-Z			
Output voltage	Logic "LOW"; output current = 0.4A	0.6	1.3	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		0.4	A	
	Logic "LOW", sink current, pulse ≤ 5 s		0.5	A	
	Logic "HIGH", means High-Z		20	μA	
Minimum pulse width		5	1.8	μs	
ESD protection	Human body model	±15		kV	

OUT0 – Brake or general-purpose digital output[†] Min. Typ. Max. Units

Mode compliance		PNP 24V			
Default state	Not supplied (+V _{LOG} floating or to GND)	High-Z (floating)			
	Normal operation	Logic "High"			
Output voltage	Logic "HIGH"; output current = 1.5A	V _{LOG} -0.4	V _{LOG} -0.7	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		1.5	A	
	Logic "HIGH", source current, pulse ≤ 5 s		2.0	A	
	Logic "LOW", means High-Z		50	μA	
Minimum pulse width		30	15	μs	
ESD protection	Human body model	±15		kV	

Mode compliance		NPN 24V			
Default state	Not supplied (+V _{LOG} floating or to GND)	High-Z (floating)			
	Normal operation	High-Z			
Output voltage	Logic "LOW"; output current = 2.0A	0.2	0.3	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		2.0	A	
	Logic "LOW", sink current, pulse ≤ 5 s		2.5	A	
	Logic "HIGH", means High-Z		50	μA	
Minimum pulse width		30	10	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

Encoder2 Inputs (A2+/Data+, A2-/Data-, B2+/Clk+, B2-/Clk-, Z2+, Z2-) ²		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

BISS / SSI / EnDAT / TAMAGAWA / Panasonic/ Nikon / Sanyo Denki Encoder Interface from J3 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			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					

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}
	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- ³	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 ⁴
Bandwidth (-3db)	Software selectable	0		1	kHz
ESD protection	Human body model	±5			kV

¹ The digital inputs and outputs are software selectable as PNP or NPN
² Feedback#2 differential input pins have internal 120Ω termination resistors connected across

³ For many applications, a 120Ω termination resistor should be connected across SIN+ to SIN-, and across COS+ to COS-. Please consult the feedback device datasheet for confirmation.

⁴ "FS" stands for "Full Scale"

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Analog +/-10V Input (REF)		Min.	Typ.	Max.	Units
Input voltage	Operational range	-10		+10	V
	Absolute maximum values, continuous	-15		+15	
	Absolute maximum, surge (duration ≤ 1s) [†]			±20	
Input impedance	To GND		50		kΩ
	Differential		80		
Resolution			12		bits
Integral linearity				±2	bits
Offset error			±10	±35	bits
Gain error			±2%	±5%	% FS ¹
Bandwidth (-3db)	Software selectable	0		1	kHz
ESD protection	Human body model	±15			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 (mean time 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
				20	Hz
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

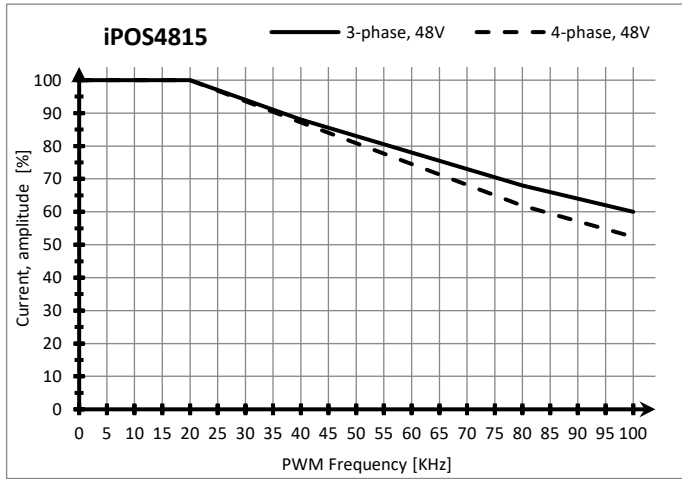
CAN-Bus		Min	Typ	Max	Units
Compliance		ISO11898, CiA-301v4.2, CiA 305 v2.2.13, 402v3.0			
Bit rate	Software selectable	125		1000	Kbps
Bus length	1Mbps			25	m
	500Kbps			100	
	≤ 250Kbps			250	
Resistor	Between CAN-Hi, CAN-Lo	SW2 pin 10			
Node addressing	Hardware: by SW1	1 ÷ 127 & 255 LSS non-configured (CANopen); 1 ÷ 127 & 255 (TMLCAN)			
	Software	1 ÷ 127 (CANopen); 1- 255 (TMLCAN)			
Voltage, CAN-Hi or CAN-Lo to GND	Absolute maximum, continuous	-36		36	V
ESD protection	Human body model	±15			kV

Conformity	
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)

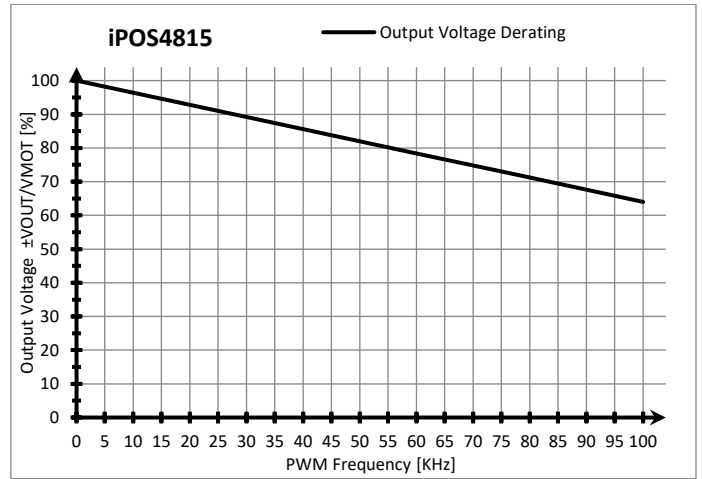
[†] Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

¹ "FS" stands for "Full Scale"

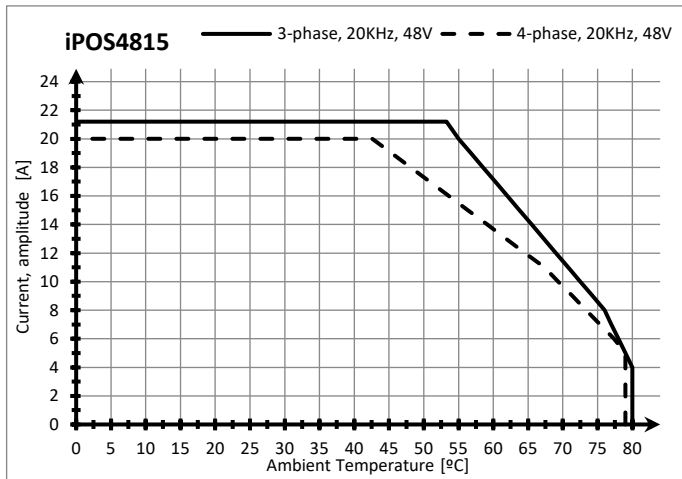
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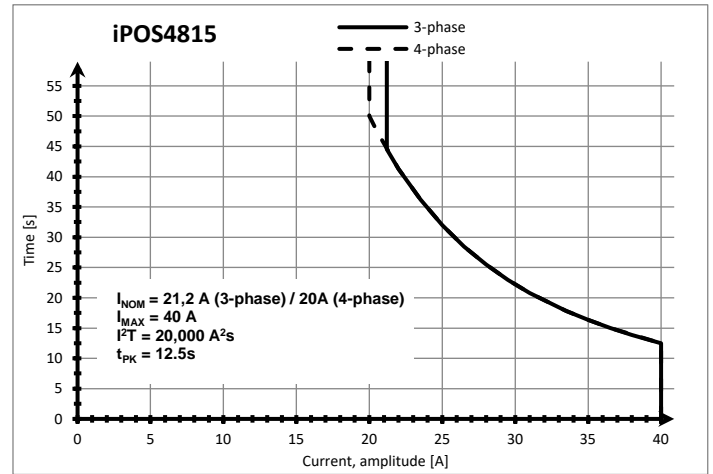
iPOS4815 – Current de-rating with PWM frequency



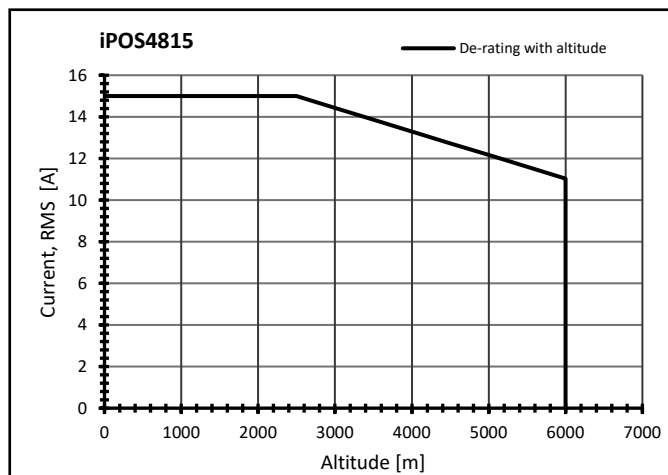
iPOS4815 – Output Voltage de-rating with PWM frequency



iPOS4815 – Current de-rating with ambient temperature



iPOS4815 – Over-current diagram (No heatsink)



iPOS4815 MZ – De-rating with the altitude

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