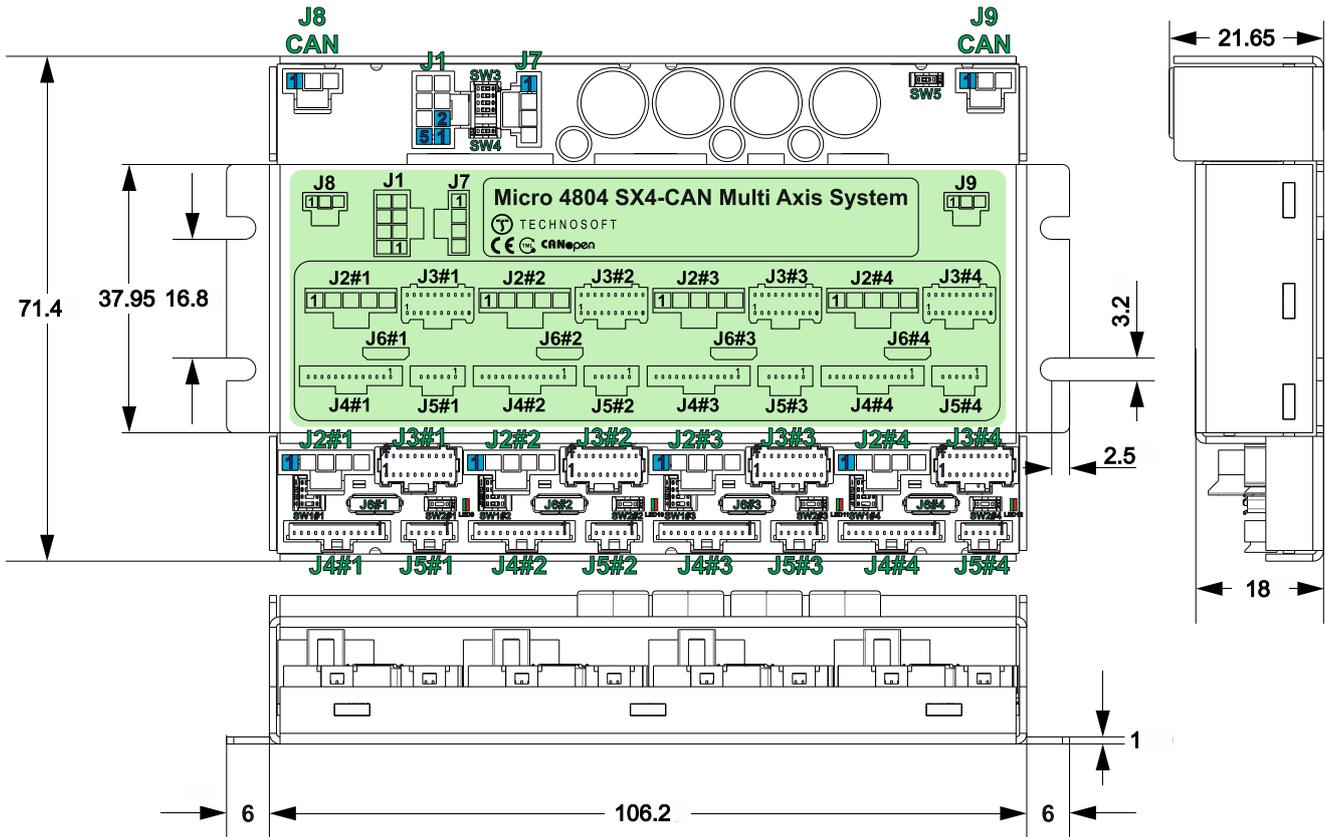


Micro 4804 SX4-CAN Multi Axis System DATASHEET

P/N: P020.102.E404



All dimensions are in mm. Drawing not to scale.

Motor – sensor configurations

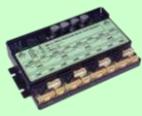
Sensor	Motor				
	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder	Ⓢ		Ⓢ	Ⓢ	
Incr. Encoder + Dig. Hall	Ⓢ	Ⓢ			
Linear Halls	Ⓢ				
Digital Hall control only	Ⓢ				
BISS / SSI / EnDAT / TAMAGAWA / Nikon / Sanyo Denki / Panasonic	Ⓢ	Ⓢ	Ⓢ	Ⓢ	
Tacho			Ⓢ		
Open-loop (no sensor)				Ⓢ	Ⓢ

Features

- Compact 4-axis CAN motion system that integrates a motion controller and drive into a single unit, powered by MotionChip™ technology.
- Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors
- Advanced motion control features, including CSP, CSV, CST, PVT, S-curve, electronic gearing, camming, and more.
- Motor supply: 48V nominal
- Motor output current per axis:
 - Nominal: 4A_{RMS} / 5.7A amplitude for PMSM motors
 - 5A for DC / BLDC / Step motors
 - Peak: 11.3A_{RMS} / 16A amplitude
- Logic supply: 24V nominal, 48V max

- Feedback Devices per axis:
 - 1 x Hall sensor interface (digital or linear)
 - Feedback#1 and Feedback#2 can be:
 - Incremental encoder A / B (index Z only for Feedback #1): differential or single-ended;
 - Absolute encoder: differential or single-ended. Supported protocols: SSI, BiSS, EnDAT, Tamagawa, Panasonic, Nikon, Sanyo Denki.
- Integrated termination resistors for each axis's feedback connectors, selectable via sliding switches
- 1 x analogue input per axis, 12-bit, software selectable: 0-5V or ±10V; Reference, Feedback or General purpose
- 3 x digital inputs per axis: 2 for limit switches + one Enable, NPN, pull-up on-board to +5V. Pull to GND to activate.
- 3 x configurable I/Os per axis, each software selectable as:
 - Digital input, NPN, with pull-up on-board to +5V. Pull to GND to activate;
 - Digital output, NPN (open-collector), with pull-up on-board to +5V. Sink current: 1 x 1.5A to drive inductive loads (such as mechanical brake), 2 x 50mA.
- Communication interfaces: RS232; USB; TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v.2.2.13 and CiA 402 v3.0) protocols
- 24Kwords E²ROM per axis to store setup data, TML motion programs, cam tables and other user data
- 16Kwords SRAM memory per axis for data acquisition
- 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 drive & motor, control error
- >98% voltage efficiency, >98% power efficiency

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Mating Connectors			
Producer	Part No.	Connector	Description
Molex	1053071203	J8, J9	1x3 Nano-Fit, 2.5mm Pitch Nano-Fit Wire-to-Board Housing, 3 circuits
Molex	1053071204	J7	1x4 Nano-Fit, 2.5mm Pitch Nano-Fit Wire-to-Board Housing, 4 circuits
Molex	1053071205	J2#x1	1x5 Nano-Fit, 2.5mm Pitch Nano-Fit Wire-to-Board Housing, 5 circuits
Molex	5011892010	J3#x1	2x10 Pico-Clasp, 1mm Pitch Pico-Clasp Wire-to-Board Housing, 20 Circuits
Molex	5013301300	J4#x1	1x13 Pico-Clasp, 1mm Pitch Pico-Clasp Wire-to-Board Housing, 13 Circuits
Molex	1053081208	J1	Nano-Fit Receptacle Housing, TPA Capable, 2.5mm Pitch, Dual Row, 8 Circuits, Black, Glow-Wire Capable
Tensility International Corp	1002333	J6#x1	USB cable, Cable USB A Male - Micro B Male, 1m, shielded, black, 9.6mm plastic width
Molex	0797582140	J1, J7, J8, J9, J2#x1	Pre-Crimped wires for Nano-Fit
Molex	0797581019	J3#x1, J4#x1	Pre-Crimped wires for Pico-Clasp
Molex	1053002400	J1, J7, J8, J9, J2#x1	Pins for Nano-Fit
Molex	5011937000	J3#x1, J4#x1	Pins for Pico-Clasp
Molex	638275600	J1, J7, J8, J9, J2#x1	Crimp tool Nano Fit
Molex	638191500	J3#x1, J4#x1	Crimp tool Pico-Clasp

Pin	Name	Type	Description
1,2,3	+Vmot	I	Positive terminal of the motor supply: 7 to 48 V _{DC} . Internally connected to all 4 drives +V _{mot} pins.
4	PE	-	Earth connection.
5,6,7	GND	-	Ground return. Internally connected to other GND pins.
8	PE	-	Earth connection

Pin	Name	Type	Description
1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
3	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
4	Cr/B-	O	Chopping resistor / Phase B- for 2-ph steppers
5	PE	-	Earth connection for motor cable shielding

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

¹ "x" can be drive 1, 2, 3 or 4

Pin	Name	Type	Description
1	GND	-	Ground return. Internally connected to other GND pins.
2	Hall1	I	Digital Hall, or Linear Hall sensor 1.
3	+5V	O	5V supply for all feedback sensors.
4	Hall2	I	Digital Hall, or Linear Hall sensor 2.
5	+5V	O	5V supply for all feedback sensors.
6	Hall3	I	Digital Hall, or Linear Hall sensor 3.
7	EncA1+/EncA1 Dt1+/Dt1	I	Encoder 1 A+ / Data+ diff. input or single-ended input. Set SW1 pin 1 for differential.
8	GND	-	Ground return.
9	EncA1-/Dt1-	I	Encoder 1 A-/Data- diff. input. Set SW1 pin 1 for differential.
10	+5V	O	5V supply for all feedback sensors.
11	EncB1+/EncB1 Clk1+/Clk1	I	Encoder 1 B+ / Clock+ diff. input or single-ended input. Set SW1 pin 2 for differential.
12	EncA2+/EncA2 Dt2+/Dt2	I	Incr. encoder 2 A+ / Data+ diff. input or single-ended input. Set SW1 pin 4 for differential.
13	EncB1-/Clk1-	I	Encoder 1 B- / Clock- diff. input. Set SW1 pin 2 for differential.
14	EncA2-/Dt2-	I	Incr. encoder 2 A- / Data - diff. input. Set SW1 pin 4 for differential.
15	Z1+	I	Incr. encoder 1 Z / Z+ diff. input or single-ended input. Set SW1 pin 3 for differential.
16	EncB2+/EncB2 Clk2+/Clk2	I/O	Encoder 2 B+ / Clock+ diff. input or single-ended input. Set SW2 pin1 for differential.
17	Z1-	I	Incr. encoder 1 Z- diff. input. Set SW1 pin 3 for differential.
18	EncB2-/Clk2-	I	Encoder 2 B- / Clock- diff. input. Set SW2 pin1 for differential.
19	GND	-	Ground return.
20	+Vlog	I	Positive terminal of the logic supply input: 6 to 48 V _{DC} . Internally connected to other +V _{log} pins.

Pin	Name	Type	Description
1	GND	-	Ground return.
2	Can Lo	I/O	CAN-Bus negative line (dominant low)
3	Can Hi	I/O	CAN-Bus positive line (dominant high)

Port	Name	Type	Description
J6#x1	USB	I/O	Standard Micro USB for PC data transfer
J5#x1	Reserved	-	Reserved. Do not connect.

Pin	Name	Type	Description
1	Rsvd	-	Reserved. Do not connect.
2	GND	-	Ground return. Internally connected to other GND pins.
3	+Vlog	I	Positive terminal of the logic supply input: 6 to 48 V _{DC} . Internally connected to all 4 drives +V _{log} pins.
4	PE	-	Earth connection

SW1#x1 – 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 A / Z1+ feedback pins.
4	ON = Connect an 120Ω resistor between EncA2-/Dt2- and EncA2+/EncA2/Dt2+/Dt2 feedback pins.

SW2#x1 – Feedback Resistors selection

1	ON = Connect an 120Ω resistor between EncB2-/Clk2- and EncB2+/EncB2/Clk2+/Clk2 feedback pins.
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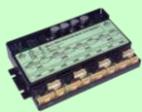
SW5 – CAN Resistors selection

1	ON = Connect an 120Ω resistor between CAN Hi and CAN Lo signals. Physically located near J9 connector.
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SW4 – Protocol selection

1	OFF – CANOpen mode ON – TMLCAN mode
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SW3 - AxisID selection							
SW3				Drive AxisID			
Pin 1	Pin 2	Pin 3	Pin 4	Drive #1	Drive #2	Drive #3	Drive #4
off	off	off	off	1	2	3	4
off	off	off	on	9	10	11	12
off	off	on	off	17	18	19	20
off	off	on	on	25	26	27	28
off	on	off	off	33	34	35	36
off	on	off	on	41	42	43	44
off	on	on	off	49	50	51	52
off	on	on	on	57	58	59	60
on	off	off	off	65	66	67	68
on	off	off	on	73	74	75	76
on	off	on	off	81	82	83	84
on	off	on	on	89	90	91	92
on	on	off	off	97	98	99	100
on	on	off	on	105	106	107	108
on	on	on	off	113	114	115	116
on	on	on	on	121	122	123	124

LEDs			
TML ERR	RED	Turned on when the drive detects an error condition.	LED9 → drive #1 LED10 → drive #2
TML RDY	GREEN	Lit after power-on when the drive initialization ends. Turned off when an error occurs.	LED11 → drive #3 LED12 → drive #4

Electrical characteristics

- All parameters measured under the following conditions (unless otherwise specified):
- $V_{LOG} = 24$ VDC; $V_{MOT} = 48$ VDC; $F_{PWM} = 20$ kHz
 - Ambient temperature = 25°C (typical values) / 0°C...40°C (min/max values)
 - Supplies start-up / shutdown sequence: -any-
 - Load current = nominal
 - Data is provided for each axis of the system

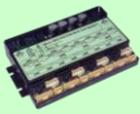
Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		40 ¹	°C
Ambient humidity				90	%Rh
Altitude / pressure ²					
Altitude (vs. sea level)		-0.1	0 ± 2.5	2	Km
Ambient Pressure		0	0.75 ± 1	10.0	atm
Storage Conditions		Min	Typ	Max	Units
Ambient temperature		-40		100	°C
Ambient humidity				100	%Rh
Ambient Pressure		0		10.0	atm
ESD capability (Human body model)				±5	kV
Original packaging				±15	kV
Mechanical Mounting		Min	Typ	Max	Units
Airflow		natural convection, closed box, vertical			
Spacing required between adjacent drives		10			mm
Spacing required above drive		30	80		
For counter-connectors & cable bending					
Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)		118.2 x 71.4 x 21.7			mm
Global size		~4.65 x 2.81 x 0.85			inch
Weight		150			g
Cleaning agents		Dry cleaning is recommended			
Protection degree		According to IEC60529			
IP20					
Power dissipation		Idle ($I_{MOT} = 0A$)			
		1			1.2
		Full power ($I_{MOT} = nominal$)			2.0
					2.4
Power efficiency		Full power ($I_{MOT} = nominal$)			98.7
Voltage efficiency		$f_{PWM} = 20KHz$			98.3
		$f_{PWM} = 100KHz$			91.4
Surface temperature of metallic baseplate		40			°C
Logic Supply Input (+V _{LOG})		Min	Typ.	Max.	Units
Nominal values		6	24	48	V _{DC}
Supply voltage		Absolute maximum values, drive operating but outside guaranteed parameters			4.9
		Absolute maximum values, continuous			50
					V _{DC}
					52
					V _{DC}
Supply current		+V _{LOG} = 12V			90
		+V _{LOG} = 24V			150
		+V _{LOG} = 48V			60
					90
					60
Utilization category		Acc. to 60947-4-1($I_{PEAK} \leq 1.05 \cdot I_{NOM}$)			DC-1

Motor Supply Input (+V _{MOT})		Min	Typ.	Max.	Units
Nominal values		7		48	V _{DC}
Supply voltage		Absolute maximum values, drive operating but outside guaranteed parameters			6
		Absolute maximum values, continuous			50
					V _{DC}
					52
					V _{DC}
Supply current		Idle			0.3
		Operating			±7
					+16
					A
Voltage measurement error					±0.15
					±0.25
					V
Utilization category		Acc. to 60947-4-1($I_{PEAK} \leq 4.0 \cdot I_{NOM}$)			DC-3
Motor Outputs (A/A+, B/A-, C/B+, CR/B-)		Min.	Typ.	Max.	Units
Nominal current		PMSM motors sinusoidal amplitude			±5.7
		PMSM motors sinusoidal RMS			4
		DC/BLDC/STEP motors continuous			5
					A
Peak current		maximum 4 seconds			-16
					+16
					A
Short-circuit protection threshold					±25
					±28
					A
Short-circuit protection delay					2.6
					3.5
					µs
On-state voltage drop		Nominal output current; including typical mating connector contact resistance			50
					70
					mV
Off-state leakage current					0.3
					1
					mA
Current measurement		Accuracy (FS = Full Scale)			±1
					±1.5
					%FS
		Noise (current ≤ 2A)			±4
					±6
					mA
		Noise (current ≥ 2A)			±30
					±50
					mA
		Offset drift (compensated @ AxisOn)			±0.16
					mA/°C
Motor inductance (phase-to-phase)		Recommended value to avoid spurious short-circuit protection, triggered by ripple			
		Fast loop ³ V_{MOT}			
		50µs 48V			133
		100µs 48V			266
		50µs 24V			66
		100µs 24V			133
					µH
Motor electrical time-constant (L/R)		Recommended value for ±5% current measurement error			
		$F_{PWM} = 20$ kHz			330
		$F_{PWM} = 40$ kHz			170
		$F_{PWM} = 60$ kHz			140
		$F_{PWM} = 80$ kHz			80
		$F_{PWM} = 100$ kHz			66
					µs
Digital Inputs (IN0, IN1, IN2/LSP, IN3/LSN, IN4, IN5/ENA)		Min.	Typ.	Max.	Units
Mode compliance		NPN (sink)			
Default state		Input floating (wiring disconnected)			
		Logic HIGH			
Input voltage		Logic "LOW"			1.4
		Logic "HIGH"			1.8
		IN0, IN1, IN4, IN5/ENA			3.1
					2.5
		Hysteresis			0.9
					1.1
					1.4
		Logic "LOW"			1.4
		Logic "HIGH"			1.6
		IN2/LSP, IN3/LSN			4
					3.5
		Hysteresis			0.6
					4.7
		Floating voltage (not connected)			
					4.7
		Absolute maximum, continuous			-2
		IN2/LSP, IN3/LSN, IN5/ENA			+80
		IN0, IN1, IN4			-0.5
					$V_{LOG} + 0.5$
Input current		Logic "LOW"; Pulled to GND			6.5
		Logic "HIGH"; Pulled to +24V			8
					0.2
					0.4
					mA
Input frequency		Logic "HIGH"; Pulled to +24V			0
					500
					kHz
Minimum pulse					1
					µs
ESD protection - Human body model					±2
					kV
Digital Outputs (OUT0, OUT1, OUT4)		Min.	Typ.	Max.	Units
Mode compliance		NPN (sink) 24V			
Load type		Resistive, Inductive			
Default state		Not supplied (+V _{LOG} floating)			
		Immediately after power-up			
		Logic "HIGH"			
Output voltage		Logic "LOW"; output current = 1.5A for OUT0/0.05A for OUT1, OUT4			0.4
		Logic "HIGH"; output current = 0, no load			4
		Logic "HIGH"; external load to +V _{LOG}			4.7
		Absolute maximum, continuous (free-wheeling diodes to +V _{LOG} to GND)			V_{LOG}
		Absolute maximum, continuous (free-wheeling diodes to +V _{LOG} to GND)			-0.5
					$V_{LOG} + 0.5$
		Absolute maximum, surge (duration ≤ 1s) [†]			-1
					$V_{LOG} + 1$
Output current		Logic "LOW", sink current, short duration, duty cycle ≤ 1%			5s max
		OUT1, OUT4			0.1
		OUT0			2
		OUT1, OUT4			0.15
		OUT0			2.5
		Logic "LOW", sink current, continuous; $V_{OUT} \leq 0.4V$			0.05
		OUT1, OUT4			1.5
		OUT0			1.5
		Logic "HIGH", source current; external load to GND; $V_{OUT} \geq 2.0V$			5
					mA
		Logic "HIGH", leakage current; external load to +V _{LOG} ; $V_{OUT} = V_{LOG}$ max = 40V			$V_{LOG} = 24V$
					0.18
					0.2
					0.42
					0.45
					mA
Minimum pulse width					0.5
					µs
ESD protection - Human body model					±25
					kV

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings
² Micro 4804 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 Fast loop period of 50µs is not possible with all feedback device types.

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Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 400mA ¹	5.05	5.2	5.25	V
Output current ¹	Output voltage ≥ 4.85V			1,200	mA
Short-circuit to GND protection		Yes / Drive resets at event			
Over-voltage protection		NOT protected			
ESD protection	Human body model	±1			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	Input floating (Wiring disconnected)	4.5	4.8	5.2	V
Input voltage	Digital	Logic "LOW"	1.5	1.7	
		Logic "HIGH"	3	2.5	
	Hysteresis		0.5		
	Analog	0	0.5...4.5	4.95	
Input current	Logic "LOW"; Pull to GND		2.4		mA
	Logic "HIGH"; Internal 2.2KΩ pull-up to +5		0		
Minimum pulse width			66		μs
ESD protection - Human body model			±15		kV
Encoder Inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, A2+, A2-, B2+, B2-) ²		Min.	Typ.	Max.	Units
Single-ended mode compliance	Leave A1-, B1-, Z1-, A2-, B2- floating	TTL / CMOS / Open-collector (NPN sink)			
Single-ended threshold	A1+, B1+, Z1+, A2+, B2+	1.3	1.4	1.5	V
Single-ended input current	Input pulled to GND against on-board 2.2 KΩ pull-up to +5V		2.4	2.7	mA
Differential mode compliance	For full RS422 compliance, see ¹	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	Common-mode (A1+ to GND, etc.)		2.2		kΩ
	Differential (A1+ to A1-, etc.)		4.4		
Input frequency	Differential mode	0		15	MHz
Minimum pulse width	Differential mode	33			ns
ESD protection	Human body model	±30			kV
RS-232		Min.	Typ.	Max.	Units
Compliance TIA/EIA-232-C					
Bit rate	Default	9600			Baud
	Software selectable	9600		115200	
Output voltage		±5	±5.7		V
Short-circuit		232TX to GND			
		Guaranteed			
Input voltage	Absolute maximum, continuous	-30		+30	V
ESD protection	Human body model	±15			kV
Absolute encoder interface:					
SSI, BiSS-C, EnDAT, Tamagawa, Nikon, Sanyo Denki					
Single-ended mode	Not recommended, reduced robustness & speed				
Differential mode compliance	For full RS422 compliance, see ¹	TIA/EIA-422-A			
Output voltage	Differential; 50Ω differential load	1.5	3.3		V
	Common-mode, referenced to GND	1	1.7	3	
CLOCK frequency	Nikon, Sanyo Denki	2.5, 4			MHz
	Panasonic, Tamagawa	2.5			
	All others	1, 2, 3, 4			
Output 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	Including CRC, flags, ...		64		Bits
If total resolution >31 bits, some bits must be ignored by software setting to achieve a max. 31 bits resolution					

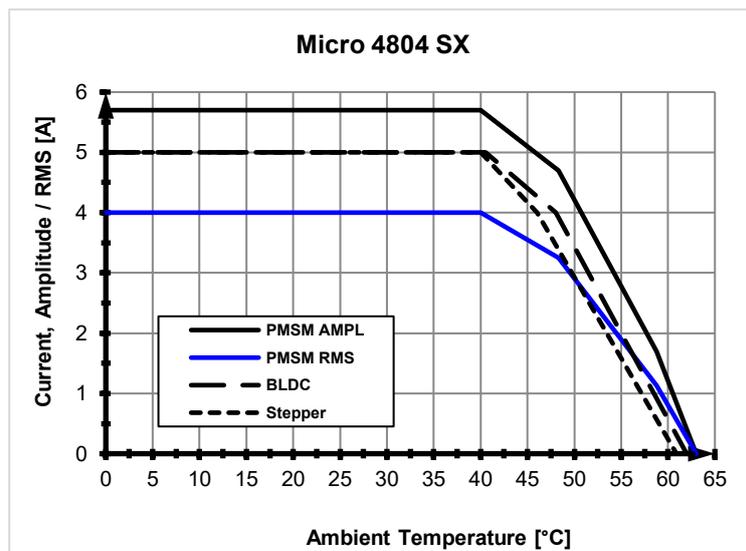
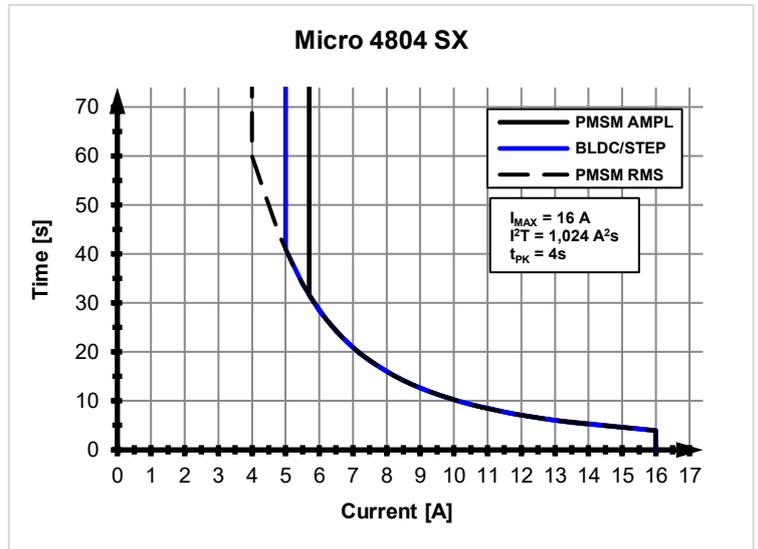
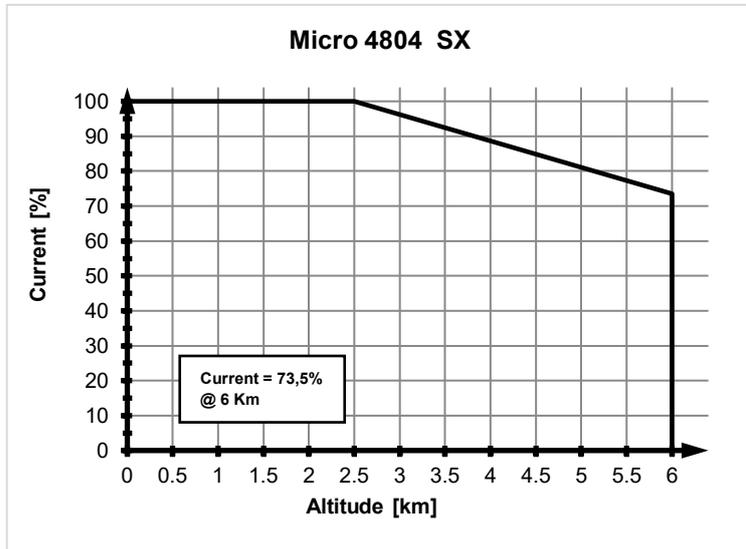
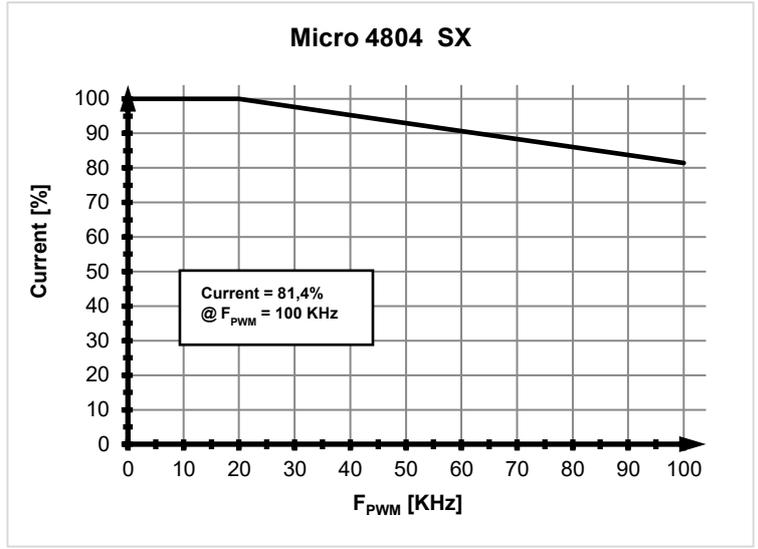
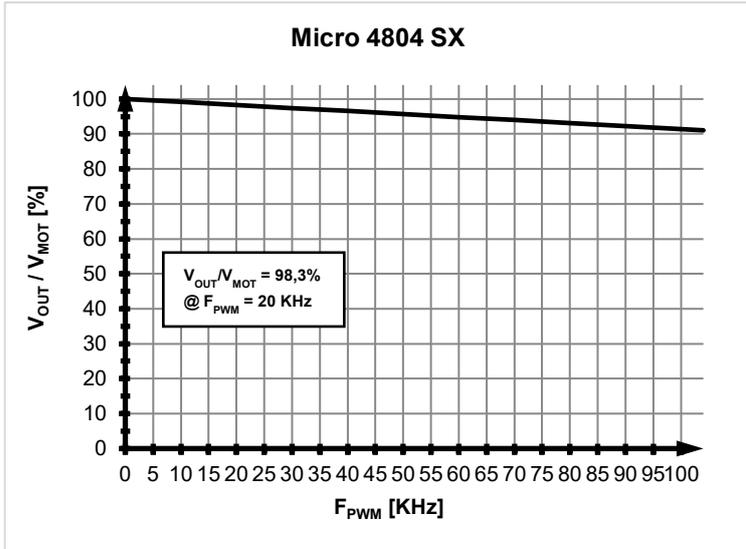
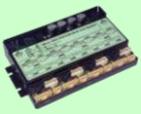
Analog Input (REF/ FDBK)		Min.	Typ.	Max.	Units	
Input voltage	Operational range	0...5, -10...+10				
	Absolute maximum values, continuous	-22		+26	V	
	Absolute maximum, surge (duration ≤ 1s)			±38		
Input impedance	To 1.44V		20		kΩ	
Bandwidth (-3dB)	Software selectable	0		5.3	kHz	
Resolution		12				
Integral linearity				±1	bits	
Offset error	Range -10V ... +10V		±10	±30	mV	
	Range 0 ... +5V		±15	±40		
Gain error	Range -10V ... +10V		±30	±50	mV	
	Range 0 ... +5V		±25	±40		
ESD protection	Human body model	±1.5			kV	
CAN-Bus		Min.	Typ.	Max.	Units	
Compliance		CAN 2.0B, ISO 11898-2				
Software protocols compatibility		CiA301, CiA305, CiA402, TechnoCAN, TMLcan				
Bit rate	Software selectable	125, 250, 500, 1000			KBaud	
Node addressing	TMLcan				-	
	CANopen	SW3 selectable			1+124	
Voltage	Common-mode, operating	-12		+12	V	
	Common-mode, max. continuous	-58		+58	V	
	Differential, max. continuous	-45		+45	V	
Input impedance	Differential	40			90	KΩ
	Common-mode	20			45	KΩ
Termination resistor (120Ω)		Included – SW5				
ESD protection	Human body model	±10			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 Specified currents are intended per drive. Each drive has separate +5V outputs

² To achieve full RS-422 compatibility and enhance noise rejection, it is necessary to connect an 120Ω resistor across each signal pair (A1+/A1-, B1+/B1-, Z1+/Z1-, A2+/A2-, B2+/B2-). This can be done through SW1 and SW2.

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