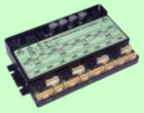
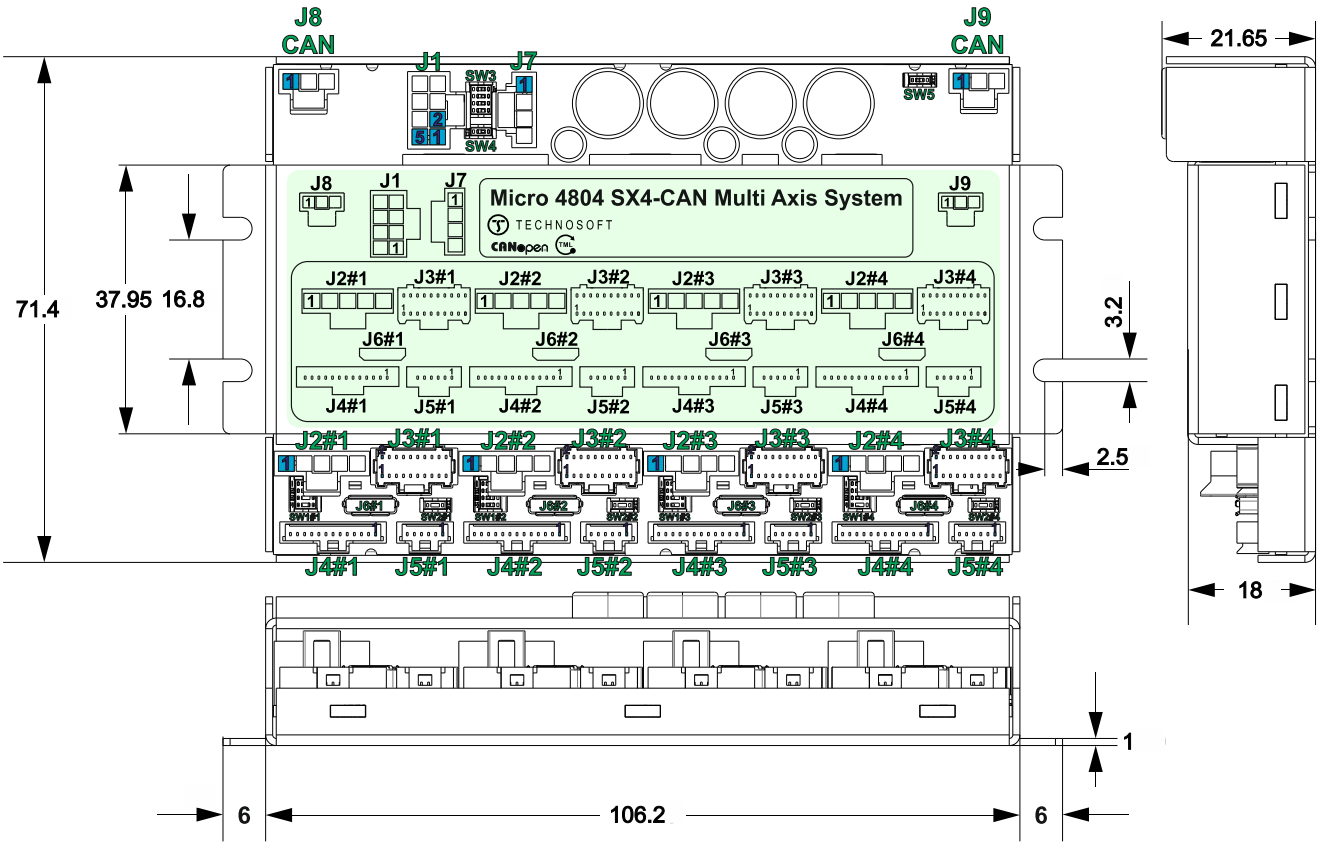


# Micro 4804 SX4-CAN Multi Axis System
## DATASHEET
## P/N: P020.102.E404

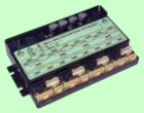



All dimensions are in mm. Drawing not to scale.

| 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: 5.7$A_{RMS}$ / 8A amplitude for PMSM motors
    7A for DC / BLDC / Step motors
  - Peak: 11.3$A_{RMS}$ / 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 0.1A.
- Communication interfaces: RS232; USB; TMLCAN and CANopen (CiA 301 v4.2, CiA 305 v.2.2.13 and CiA 402 v3.0) protocols
- 24Kwords $E^2$ROM 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, $I^2t$ 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#x[1] | 1x5 Nano-Fit, 2.5mm Pitch Nano-Fit Wire-to-Board Housing, 5 circuits | |
| Molex | 5011892010 | J3#x[1] | 2x10 Pico-Clasp, 1mm Pitch Pico-Clasp Wire-to-Board Housing, 20 Circuits | |
| Molex | 5013301300 | J4#x[1] | 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#x[1] | USB cable, Cable USB A Male - Micro B Male, 1m, shielded, black, 9.6mm plastic width | |
| Molex | 0797582140 | J1, J7, J8, J9, J2#x[1] | Pre-Crimped wires for Nano-Fit | Cable Assembly, Nano-Fit Crimp Terminal Socket to Nano-Fit Crimp Terminal Socket, 300mm |
| Molex | 0797581019 | J3#x[1], J4#x[1] | Pre-Crimped wires for Pico-Clasp | Cable Assembly, Pico-Clasp Crimp Terminal Socket to Pico-Clasp Crimp Terminal Socket, 300mm |
| Molex | 1053001400 | J1, J7, J8, J9, J2#x[1] | Pins for Nano-Fit | Nano-Fit Crimp Terminal, Female, 0.76µm Gold (Au) Plating, Lubricated, 24-26 AWG |
| Molex | 5011937000 | J3#x[1], J4#x[1] | Pins for Pico-Clasp | 1.00mm Pitch, Pico-Clasp Female Crimp Terminal, Gold Plating 0.1µm, 28-32 AWG, Reel |
| Molex | 638276000 | J1, J7, J8, J9, J2#x[1] | Crimp tool Nano Fit | Crimp Tool, Ratchet, Molex Nano-Fit 105300 Series 26-24AWG Socket Contacts, 207129 Series |
| Molex | 638191500 | J3#x[1], J4#x[1] | Crimp tool Pico-Clasp | Crimp Tool, Ratchet, Molex Pico-Clasp 501193 & 501334 Series 32-28AWG Contacts |

**J1**

| 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 |

**J2#x[1]**

| 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 |

**J4#x[1]**

| 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 input IN0 or output OUT0 |
| 8 | I/O1 | I/O | 5-48V 0.1A NPN (sink) general-purpose digital programmable input IN1 or output OUT1 |
| 9 | I/O4 | I/O | 5-48V 0.1A NPN (sink) general-purpose digital programmable input IN4 or output OUT4 |
| 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. |

**J3#x[1]**

| 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. |

**J8, J9**

| 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) |

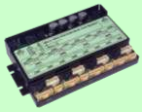
| Port | Name | Type | Description |
|---|---|---|---|
| J6#x[1] | USB | I/O | Standard Micro USB for PC data transfer |
| J5#x[1] | Reserved | - | Reserved. Do not connect. |

**J7**

| 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#x[1] – 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#x[1] – Feedback Resistors selection** | |
| 1 | ON = Connect an 120Ω resistor between EncB2-/Clk2- and EncB2+/EncB2/Clk2+/Clk2 feedback pins. |
| **SW5 – CAN Resistors selection** | |
| 1 | ON = Connect an 120Ω resistor between CAN Hi and CAN Lo signals. |
| **SW4 – Protocol selection** | |
| 1 | **OFF** – CANOpen mode<br>**ON** – TMLCAN mode |

[1] "x" can be drive 1, 2, 3 or 4



# Micro 4804 SX4-CAN Multi Axis System
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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 |

## 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 | Non-condensing | 0 | | 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 | Non-condensing | 0 | | 100 | %Rh |
| Ambient Pressure | | 0 | | 10.0 | atm |
| ESD capability (Human body model) | Not powered; applies to any accessible part | | | ±5 | kV |
| | Original packaging | | | ±15 | kV |

| Mechanical Mounting | | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Airflow | natural convection, closed box | | | | |
| Spacing required between adjacent drives | | 10 | | | mm |
| Spacing required above drive | For counter-connectors & cable bending | 30 | 80 | | |

| Environmental Characteristics | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Size (Length x Width x Height) | Global size | | 118.2 x 71.4 x 21.7 | | mm |
| | | | ~4.65 x 2.81 x 0.85 | | inch |
| Weight | | | 150 | | g |
| Cleaning agents | Dry cleaning is recommended | | Only Water- or Alcohol- based | | |
| Protection degree | According to IEC60529 | | IP20 | | - |
| Power dissipation | Idle ($I_{MOT}$ = 0A) | | 1 | 1.2 | W |
| | 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 |
|---|---|---|---|---|---|
| Supply voltage | Nominal values | 6 | 24 | 48 | $V_{DC}$ |
| | Absolute maximum values, drive operating but outside guaranteed parameters | 4.9 | | 50 | $V_{DC}$ |
| | Absolute maximum values, continuous | -0.5 | | 53 | $V_{DC}$ |
| Supply current | +$V_{LOG}$ = 12V | | 90 | 150 | mA |
| | +$V_{LOG}$ = 24V | | 60 | 90 | |
| | +$V_{LOG}$ = 48V | | 45 | 60 | |
| Utilization category | Acc. to 60947-4-1($I_{PEAK}$<=1.05*$I_{NOM}$) | DC-1 | | | |

| 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 | | 50 | $V_{DC}$ |
| | Absolute maximum values, continuous | -0.5 | | 53 | $V_{DC}$ |
| Supply current | Idle | | 0.3 | | mA |
| | Operating | -16 | ±7 | +16 | A |
| Voltage measurement error | | | ±0.15 | ±0.25 | V |
| Utilization category | Acc. to 60947-4-1 ($I_{PEAK}$<=4.0*$I_{NOM}$) | DC-3 | | | |

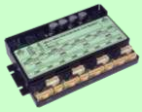
| Motor Outputs (A/A+, B/A-, C/B+, CR/B-) | | | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Nominal current | PMSM motors sinusoidal amplitude | | | | | ±8 | A |
| | PMSM motors sinusoidal RMS | | | | | 5.7 | $A_{RMS}$ |
| | DC/BLDC/STEP motors continuous | | | | | 7 | A |
| Peak 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 | |
| | Offset drift (compensated @ AxisOn) | | | | | ±0.16 | mA/ºC |
| Motor inductance (phase-to-phase) | Recommended value to avoid spurious short-circuit protection, triggered by ripple | Fast loop[3] | $V_{MOT}$ | | | | µH |
| | | 50µs | 48V | | 133 | | |
| | | 100µs | 48V | | 266 | | |
| | | 50µs | 24V | | 66 | | |
| | | 100µs | 24V | | 133 | | |
| Motor electrical time-constant (L/R) | Recommended value for ±5% current measurement error | $F_{PWM}$ = 20 kHz | | | 330 | | µs |
| | | $F_{PWM}$ = 40 kHz | | | 170 | | |
| | | $F_{PWM}$ = 60 kHz | | | 140 | | |
| | | $F_{PWM}$ = 80 kHz | | | 80 | | |
| | | $F_{PWM}$ = 100 kHz | | | 66 | | |

| 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" | IN0, IN1, IN4, IN5/ENA | | 1.4 | 1.8 | V |
| | Logic "HIGH" | | 3.1 | 2.5 | | |
| | Hysteresis | | 0.9 | 1.1 | 1.4 | |
| | Logic "LOW" | IN2/LSP, IN3/LSN | | 1.4 | 1.6 | |
| | Logic "HIGH" | | 4 | 3.5 | | |
| | Hysteresis | | | 0.6 | | |
| | Floating voltage (not connected) | | | 4.7 | | |
| | Absolute maximum, continuous | IN2/LSP, IN3/LSN, IN5/ENA | -2 | | +80 | |
| | | IN0, IN1, IN4 | -0.5 | | $V_{LOG}$+0.5 | |
| Input current | Logic "LOW"; Pulled to GND | | | 6.5 | 8 | mA |
| | Logic "HIGH"; Pulled to +24V | | | 0.2 | 0.4 | |
| Input frequency | | | 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) | | | High-Z (floating) | | | |
| | Immediately after power-up | | | Logic "HIGH" | | | |
| Output voltage | Logic "LOW"; output current = 1.5A for OUT0/ 0.05A for OUT1, OUT4 | | | | | 0.4 | V |
| | Logic "HIGH"; output current = 0, no load | | | 4 | 4.7 | 5.2 | |
| | Logic "HIGH", external load to +$V_{LOG}$ | | | | $V_{LOG}$ | | |
| | 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 | A |
| | | | OUT0 | | | 2 | |
| | | 0.5s max | OUT1, OUT4 | | | 0.15 | |
| | | | OUT0 | | | 2.5 | |
| | Logic "LOW", sink current, continuous; $V_{OUT}$ ≤ 0.4V | | OUT1, OUT4 | | | 0.05 | |
| | | | OUT0 | | | 1.5 | |
| | 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 | $V_{LOG}$=24V | | | 0.18 | 0.2 | mA |
| | | $V_{LOG}$=48V | | | 0.42 | 0.45 | |
| Minimum pulse width | | | | 0.5 | | | µs |
| ESD protection - Human body model | | | | ±25 | | | kV |

| Supply Output (+5V) | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Output voltage | Current sourced = 400mA[4] | 5.05 | 5.2 | 5.25 | V |
| Output current[4] | 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 |

[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.
[4] Specified currents are intended per drive. Each drive has separate +5V outputs





| 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 | V |
| | | 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-)[1] | | 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 | Software selectable | 9600 | | 115200 | Baud |
| 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 |

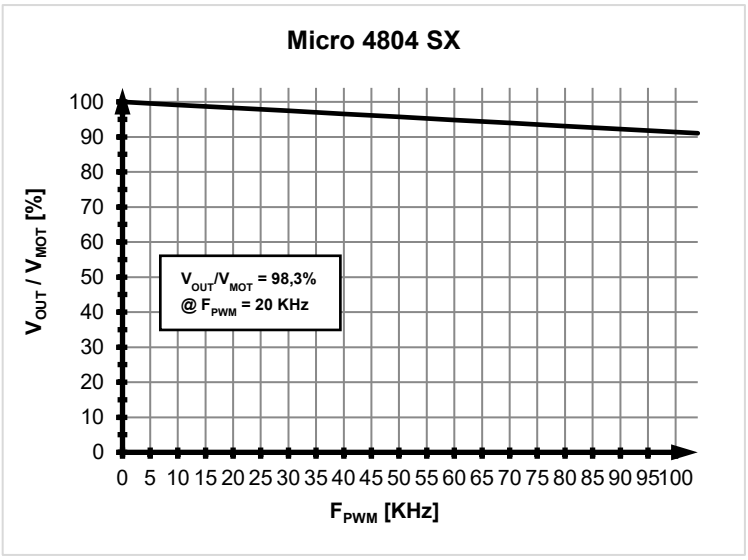
| Absolute encoder interface: SSI, BISS-C, EnDAT, Tamagawa, Nikon, Sanyo Denki | | Min | Typ. | Max | Units |
|---|---|---|---|---|---|
| Single-ended mode | Not recommended, reduced robustness & speed | | | | |
| Differential mode compliance | For full RS422 compliance, see[1] | TIA/EIA-422-A | | | |
| 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 | | | | |

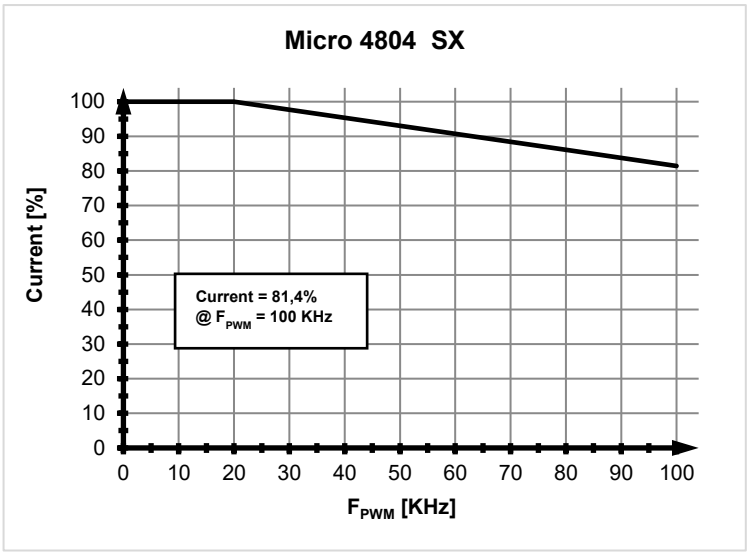
| Analog Input (REF/ FDBK) | | Min | Typ. | Max | Units |
|---|---|---|---|---|---|
| Input voltage | Operational range | 0…5, -10…+10 | | | V |
| | Absolute maximum values, continuous | -22 | | +26 | |
| | Absolute maximum, surge (duration ≤ 1s) | | | ±38 | |
| Input impedance | To 1.44V | | 20 | | kΩ |
| Bandwidth (-3dB) | Software selectable | 0 | | 5.3 | kHz |
| Resolution | | 12 | | | bits |
| Integral linearity | | | | ±1 | bits |
| Offset error | Range -10V … +10V | | | ±3 | ±10 | bits |
| | Range 0 …+5V | | | ±10 | ±30 | |
| Gain error | Range -10V … +10V | | | ±0.3 | ±0.5 | % |
| | Range 0 …+5V | | | ±0.5 | ±0.8 | |
| ESD protection | Human body model | ±1.5 | | | kV |

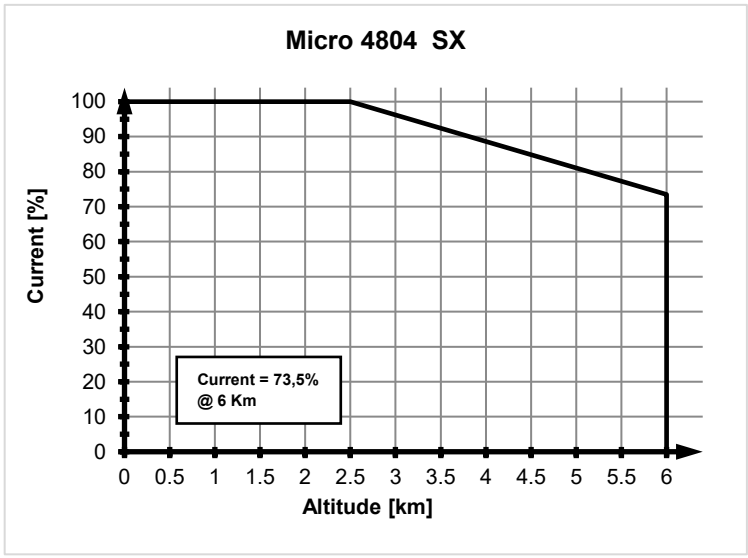
| CAN-Bus | | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Compliance | | | CAN 2.0B, ISO 11898-2 | | | |
| Software protocols compatibility | | | CiA301, CiA305, CiA402, TechnoCAN, TMLcan | | | |
| Bit rate | Software selectable | | 125, 250, 500, 1000 | | | KBaud |
| Node addressing | TMLcan | SW3 selectable | 1÷124 | | | - |
| | CANopen | | | | | - |
| 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 |

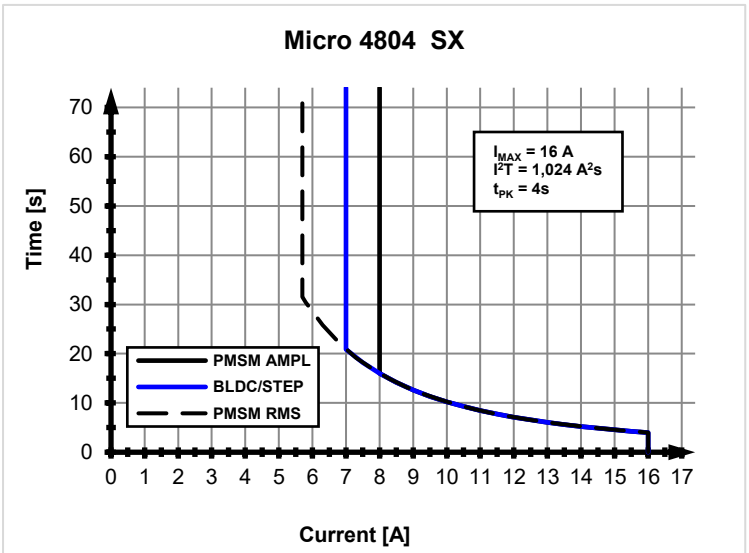
† Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

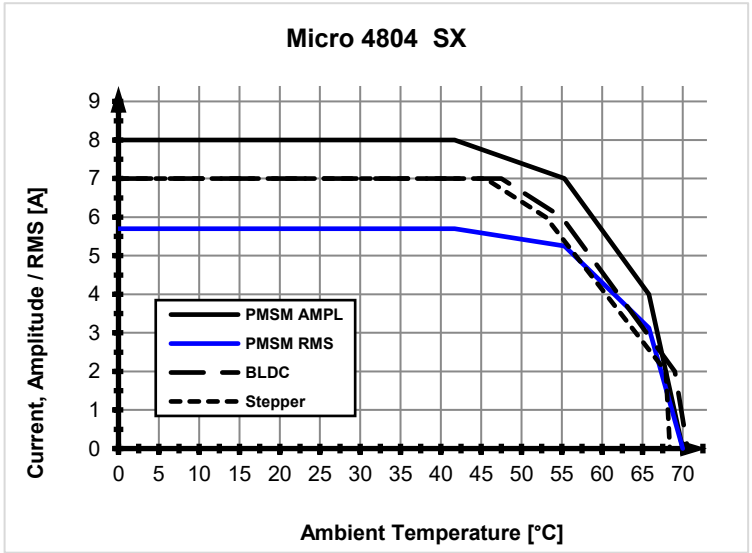
[1] To achieve full RS-422 compatibility and enhance noise rejection, it is necessary to connect an 120Ω resistor across each signal pair (A1+/A1-, B1+/B1-, Z1+/Z1-, A2+/A2-, B2+/B2-). This can be done through SW1 and SW2.


Micro 4804 SX
100
90
80
70
60
50
40
30
20
10
0
$V_{OUT}$ / $V_{MOT}$ [%]
$V_{OUT}/V_{MOT}$ = 98,3%
@ $F_{PWM}$ = 20 KHz
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
$F_{PWM}$ [KHz]


Micro 4804 SX
100
90
80
70
60
50
40
30
20
10
0
Current [%]
Current = 81,4%
@ $F_{PWM}$ = 100 KHz
0 10 20 30 40 50 60 70 80 90 100
$F_{PWM}$ [KHz]


Micro 4804 SX
100
90
80
70
60
50
40
30
20
10
0
Current [%]
Current = 73,5%
@ 6 Km
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6
Altitude [km]


Micro 4804 SX
70
60
50
40
30
20
10
0
Time [s]
$I_{MAX}$ = 16 A
$I^2T$ = 1,024 $A^2s$
$t_{PK}$ = 4s
PMSM AMPL
BLDC/STEP
PMSM RMS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Current [A]


Micro 4804 SX
9
8
7
6
5
4
3
2
1
0
Current, Amplitude / RMS [A]
PMSM AMPL
PMSM RMS
BLDC
Stepper
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70
Ambient Temperature [°C]