



The Class 6 Industrial Ethernet SmartMotor™, which is available in both standard servo (shown) and hybrid servo versions, represents the next step in the evolution of the SmartMotor integrated motor design. The Class 6 motor lineup includes PROFINET®, EtherCAT® and EtherNet/IP™ versions.

These motors are designed for maximum performance and connectivity. They incorporate a high-end, high-speed processor for exceptional performance, Data update rates are as fast as 1 millisecond. There are dual Industrial Ethernet ports onboard (no hub or switch required), as well as connections for RS-485 and USB. Additionally, they provide plenty of I/O, with the option to add more through an external expander, for easy integration into any system.



## Key Features and Benefits

- Simplify wiring, reduce cost through the onboard dual-port Ethernet switch
- Optionally program, configure and get live diagnostics through the USB interface
- Optionally communicate with the motor through the RS-485 half-duplex port, which provides access as a Modbus Remote Terminal Unit (RTU) Slave
- Easily access SmartMotor programmable autonomous control features in slave mode, which allows special user-programmed functions
  - Reduce limit switch wiring and PLC programming through adaptable distributed control
  - Accurately capture position for high-speed registration applications
  - Quickly reduce costs and improve reliability through use of programmable homing and limits
  - Precisely define motion profiles with local cam execution
  - Easy configuration and status monitoring of Industrial Ethernet and field buses
  - Actively monitor/troubleshoot each motor through local error reporting and diagnostic codes
- Local/standalone benefits (see manual for details):
  - Simplify programming and calculate 32-bit precision motion parameters on the fly with floating-point math and trigonometric functions
  - Govern a move by running it on top of a gearing or camming relationship using the dual trajectory generators
  - Create precise spooling/winding shapes and control tension through advanced gearing (supports preset traverse/take-up parameters)
  - Create complex patterns through advanced camming (with cubic spline interpolation and dynamic frequency/amplitude)
  - Highly configurable local I/O for motion control and general-purpose use in user programs:
    - Drive enable input, fault output, travel limits, registration and position capture
    - External encoder input supporting A-quad-B or Step-and-Direction
    - Total of 7 configurable inputs
    - High-current outputs with external brake-control function



### Class 6 EtherCAT® Fieldbus

Industry standard CiA 402 motion profile supports:

- PP, PV, HM, TQ, CSP, CSV, and CST modes
- Dynamic mapping of process data objects (cyclic data exchanges)
- Real time coordinated control using Distributed Clock (DC)

### Class 6 PROFINET® Fieldbus

- PROFINET RTC - Real Time Cyclic transfers
- Class 1 and 2 (certified) - unsynchronized
- Class 3 (certification pending) - synchronized SmartMotor clocks
- PROFINET RTA – Real Time Acyclic protocol
- DCP, LLDP, SNMP, MIB-II, and LLDP MIB support

### Class 6 EtherNet/IP™ Fieldbus

Easily integrates as a position controller (10h) device, for:

- Access to unique SmartMotor commands and parameters
- Improved uptime with optional redundant cabling through Device Level Ring (DLR)
- Optimal performance ensured through Quality of Service (QoS)
- Simplified, modular programming through Add On Instructions (AOI)
- Direct access to SmartMotor native commands and parameters through TCP/IP

Overview

Software

C5 D-Style

C5 M-Style

C6 M-Style

C6 Low-Cost

Cables, Etc.

Actuators

Gearheads

Power Supplies

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SmartMotor™ Series	SM23166MT-EXX	
Continuous Torque at 48 volts	68	oz-in
	0.48	N-m
Peak Torque	128	oz-in
	0.90	N-m
Nominal Continuous Power	189	watts
Nominal Peak Power	213	watts
No Load Speed	4,700	rpm
Voltage Constant	9.08	V/kRPM
Winding Resistance	0.7	Ohms
Encoder Resolution	4,000	counts/rev
Rotor Inertia	0.00103	oz-in-sec <sup>2</sup>
	7.27	10 <sup>-6</sup> kg-m <sup>2</sup>
Weight	1.7	lb
	0.77	kg
Shaft Diameter	.375	in
	9.53	mm
Shaft, Radial Load	15.0	lb
	6.80	kg
Shaft, Axial Thrust Load	3.00	lb
	1.36	kg
EtherCAT Available	Yes	
PROFINET Available	Yes	
EtherNet/IP Available	Yes	

## SM23166MT-EXX



Maximum temperature: 85°C at electronics, 130°C at windings.  
 Recommended ambient temperature range: 0°C – 50°C.  
 Storage temperature range: -10°C – 85°C.  
 Relative humidity: maximum 90%, noncondensing.

SmartMotor™ Series	SM23216MH-EXX	
Continuous Torque at 48 volts	165	oz-in
	1.17	N-m
Peak Torque	300	oz-in
	2.12	N-m
Nominal Continuous Power	60	watts
Nominal Peak Power	115	watts
No Load Speed	2,250	rpm
Encoder Resolution	4,000	counts/rev
Rotor Inertia	0.0065	oz-in-sec <sup>2</sup>
	4.59	10 <sup>-5</sup> kg-m <sup>2</sup>
Weight	2.79	lb
	1.27	kg
Shaft Diameter	.375	in
	9.53	mm
Shaft, Radial Load	16.86	lb
	7.65	kg
Shaft, Axial Thrust Load	3.37	lb
	1.53	kg
EtherCAT Available	Yes	
PROFINET Available	Yes	
EtherNet/IP Available	Yes	

## SM23216MH-EXX

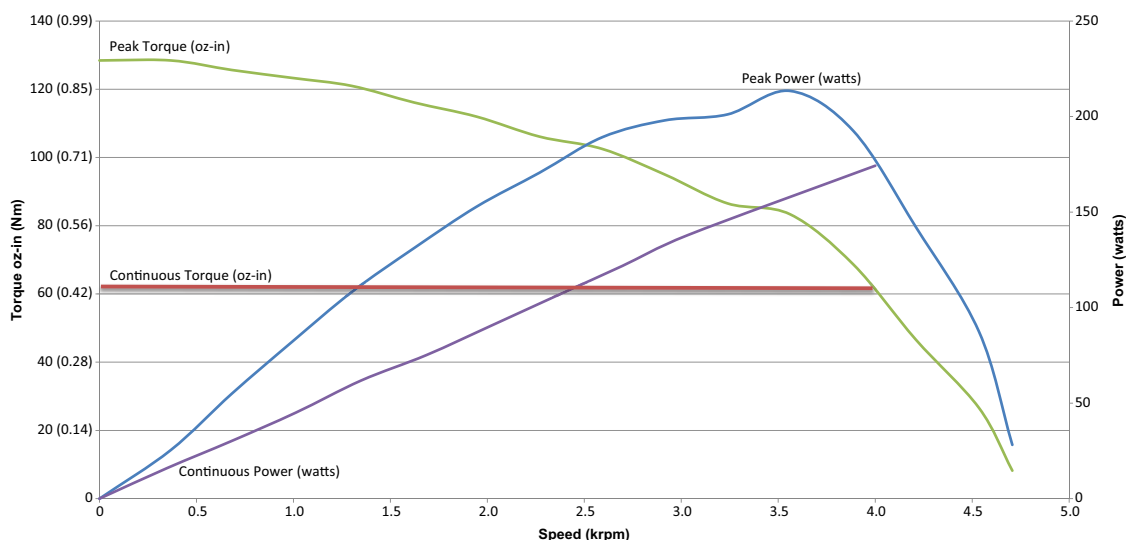


Maximum temperature: 85°C at electronics, 130°C at windings.  
 Recommended ambient temperature range: 0°C – 50°C.  
 Storage temperature range: -10°C – 85°C.  
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\*For other data, please consult the factory.

## SM23166MT-EXX Torque Curves

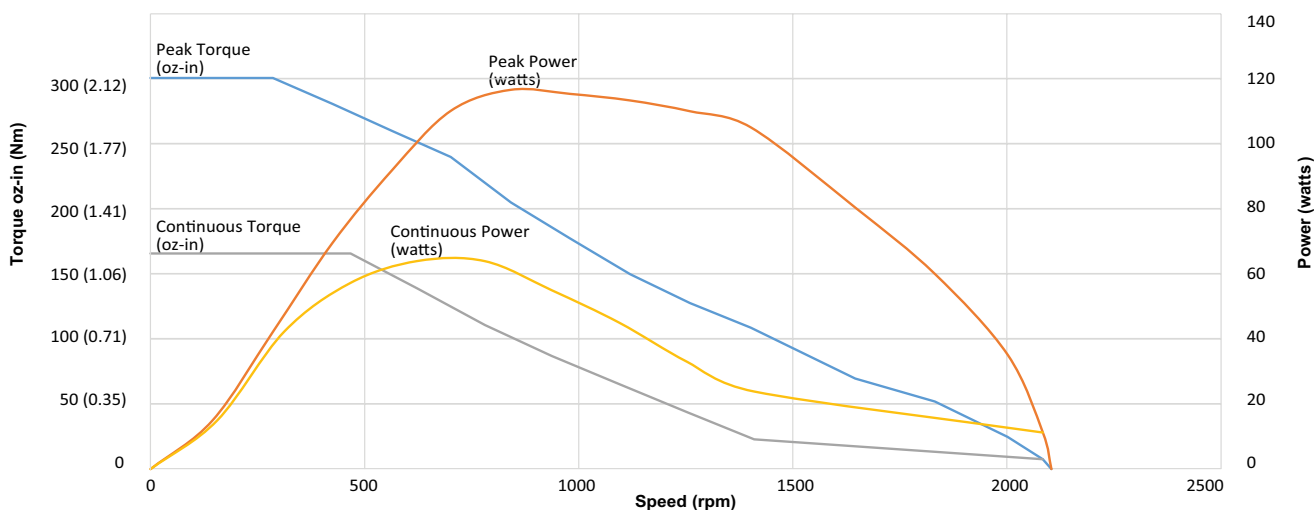
SM23166MT-EXX motor Torque vs. Speed, 48 volts, MDC commutation, 25°C ambient (curves are derated at higher ambient)



Continuous rating based on 25°C ambient temperature, motor mounted to a 6x6x¼ inch aluminum heat sink, and electronics/windings below maximum temperature. Peak torque is available for 3 seconds at a 10% duty cycle.

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- C6 Low-Cost
- Cables, Etc.
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- Gearheads
- Power Supplies

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C6 M-Style

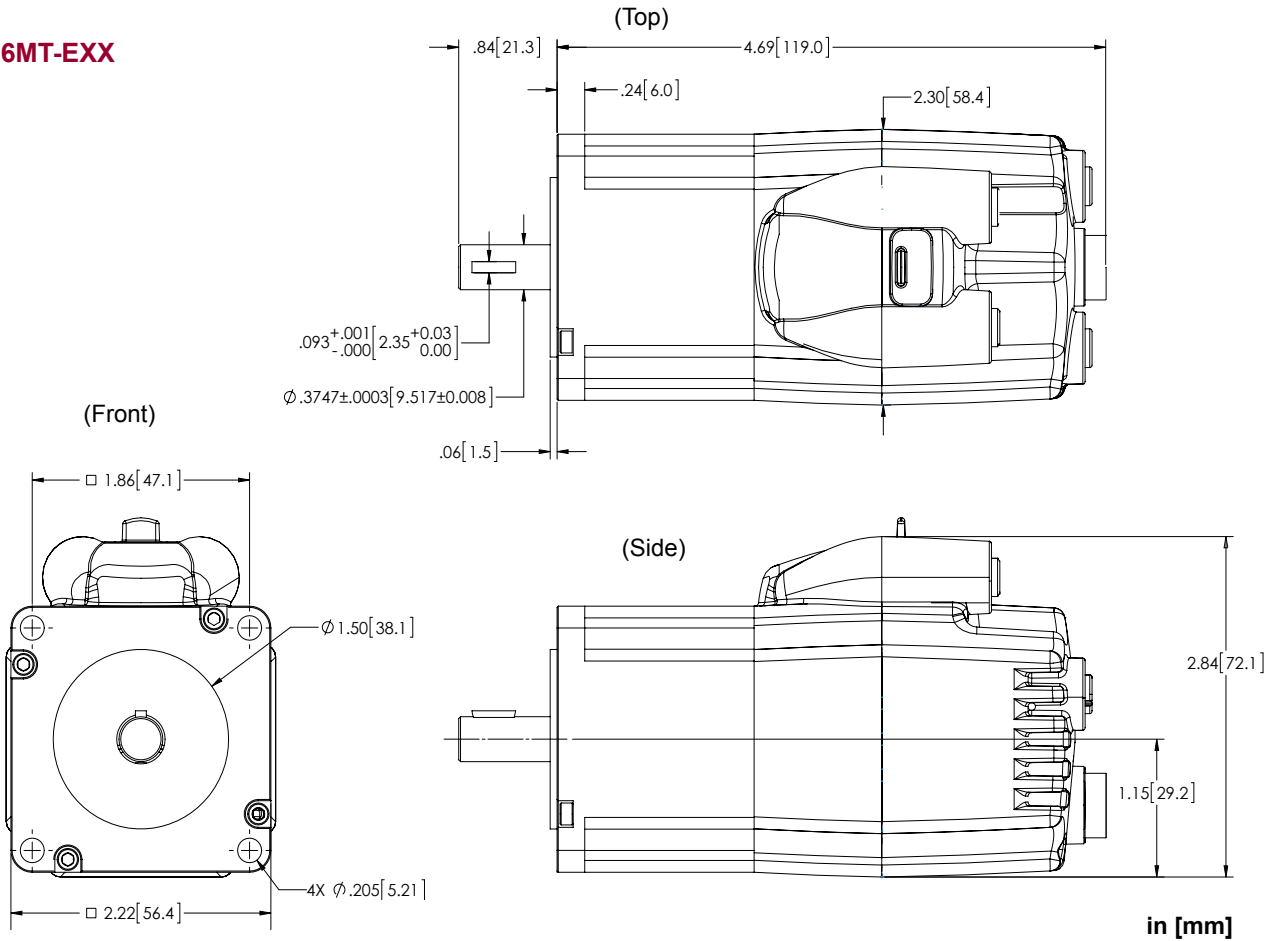
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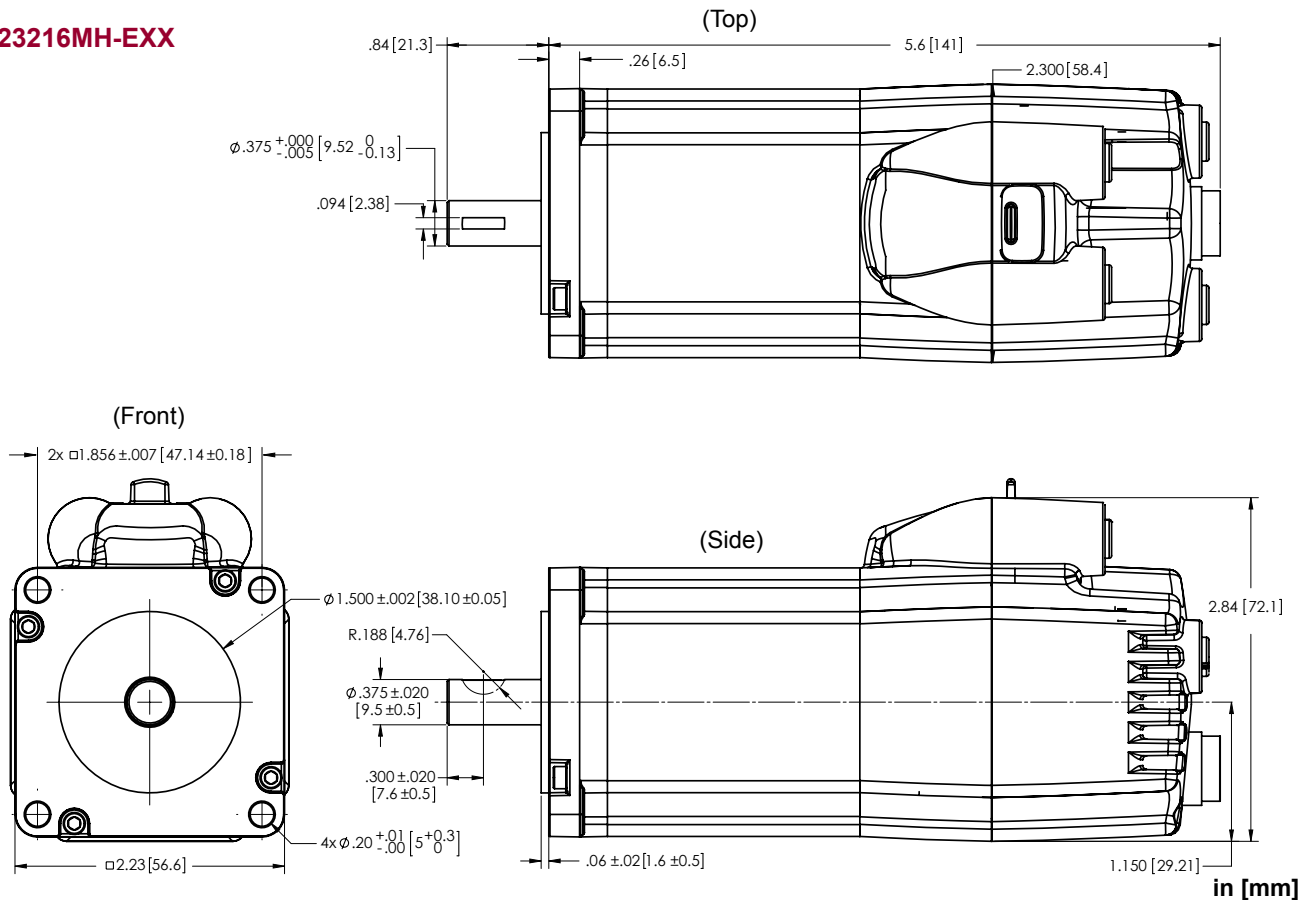
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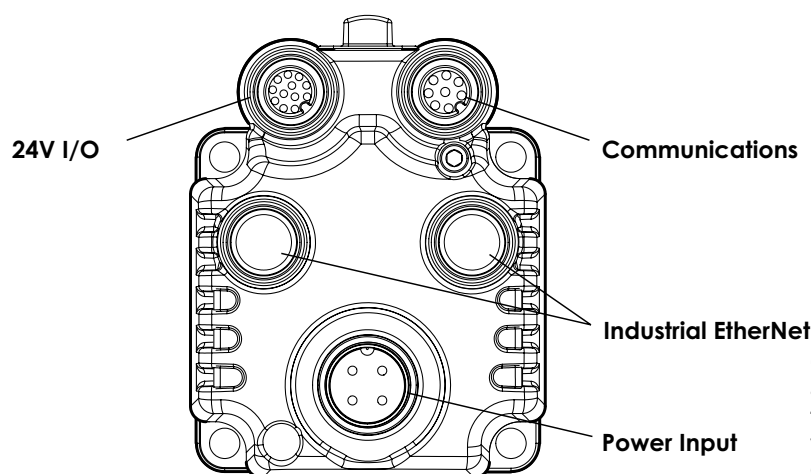
## SM23216MH-EXX



## Class 6 M-Style Connector Pinouts

The following table shows the pinouts for the connectors on the Class 6 M-style SmartMotors.

PIN	Main Power	Specifications	Notes	P1	
1	Control Power In	+24V ( $\pm 20\%$ ), 32V Max.	Also Supplies I/O		
2	Chassis Ground	Chassis Ground Only	Not Connected to Common		
3	Control, Com, I/O and Amplifier Ground	Common Ground (Req'd. Ground)	Nonisolated		
4	Amplifier Power In	+24V Min., 48V Max.	Powers Amplifier Only		
PIN	Communications Connector	Specifications	Notes	P2	
1	Control, Com, I/O and Amp Ground	Common Ground	Nonisolated		
2	RS-485 B, Com ch. 0	115.2 KBAud Max.			
3	RS-485 A, Com ch. 0	115.2 KBAud Max.			
4	Encoder A+ Input/Output	125 KHz Individual Line Frequency	Configurable as Encoder Output		
5	Encoder B- Input/Output	125 KHz Individual Line Frequency	Configurable as Encoder Output		
6	Encoder A- Input/Output	125 KHz Individual Line Frequency	Configurable as Encoder Output		
7	+5V Out	50 mA Max.			
8	Encoder B+ Input/Output	125 KHz Individual Line Frequency	Configurable as Encoder Output		
PIN	24V I/O Connector	Specifications	Notes	P3	
1	IN0 GP, Discrete or Analog Input	Inp Impedance > 10 kohm	<b>For Inputs:</b> 7 Configurable Inputs Low Lvl Thld: 3.6V Max. High Lvl Thld: 5.0V Min. Inp Hysteresis: 1.0V Min. Analog Input Scale: 10V FS		
2	IN1 GP, Discrete or Analog Input	Inp Impedance > 10 kohm			
3	IN2 Pos Limit or GP	Inp Impedance > 10 kohm			
4	IN3 Neg Limit or GP	Inp Impedance > 10 kohm			
5	IN4 GP or Ext. Enc. Index Capture	Inp Impedance > 10 kohm			
6	IN5 GP or Int. Enc. Index Capture	Inp Impedance > 10 kohm			
7	IN6 GP, G Cmd, or Homing Inp (EtherCAT)	Inp Impedance > 10 kohm			
8	IN7 Drive Enable	Inp Impedance > 10 kohm			
9	OUT8 Brake or GP	250 mAmps Max.			<b>For Outputs:</b> Do Not Exceed 500 mAmps Combined
10	OUT9 NOT FAULT	250 mAmps Max.			
11	+24 VDC Out (Supplied from P1, Pin 1)	12.5V Min., 23V Max. Load 2 Amps Max.			
12	Ground Common	Common Ground	Nonisolated		
PIN	Industrial Ethernet Connectors		Specifications	Notes	P4
	EtherNet/IP, EtherCAT	PROFINET	10/100BASE-T	Shield tied to motor housing	
1	+TX	+TD	EtherCAT=100BASE-TX	EtherCAT=Input(L), Output(R)	
2	+RX	+RD			
3	-TX	-TD			
4	-RX	-RD			



**CAUTION:** Exceeding 32 VDC into control power on any of the +24V pins may cause immediate damage to the internal electronics. Exceeding a sustained voltage of 48V to pin 4 of the P1 Power Input may cause immediate damage to the internal electronics. Exceeding these voltage limits will void the warranty.