

**DC Brushless Servo Amplifier
Resolver Feedback**

Model SM190-26R

Parker Hannifin Corporation
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IMPORTANT

User Information

To ensure that the equipment described in this user guide, as well as all the equipment connected to and used with it, operates satisfactorily and safely, all applicable local and national codes that apply to installing and operating the equipment must be followed. Since codes can vary geographically and can change with time, it is the user's responsibility to identify and comply with the applicable standards and codes. **WARNING: Failure to comply with applicable codes and standards can result in damage to equipment and/or serious injury to personnel.**

Personnel who are to install and operate the equipment should study this user guide and all referenced documentation prior to installation and/or operation of the equipment.

In no event will the provider of the equipment be liable for any incidental, consequential, or special damages of any kind or nature whatsoever, including but not limited to lost profits arising from or in any way connected with the use of this user guide or the equipment.

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Since Parker constantly strives to improve all of its products, we reserve the right to change this user guide and equipment mentioned therein at any time without notice.

Technical Assistance ⇨ *Contact your local automation technology center (ATC) or distributor, or ...*

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MODEL SMA190-26R DC BRUSHLESS SERVO AMPLIFIER, RESOLVER FEEDBACK

±180 Volts at ±26A Peak, ±13A Continuous

FEATURES

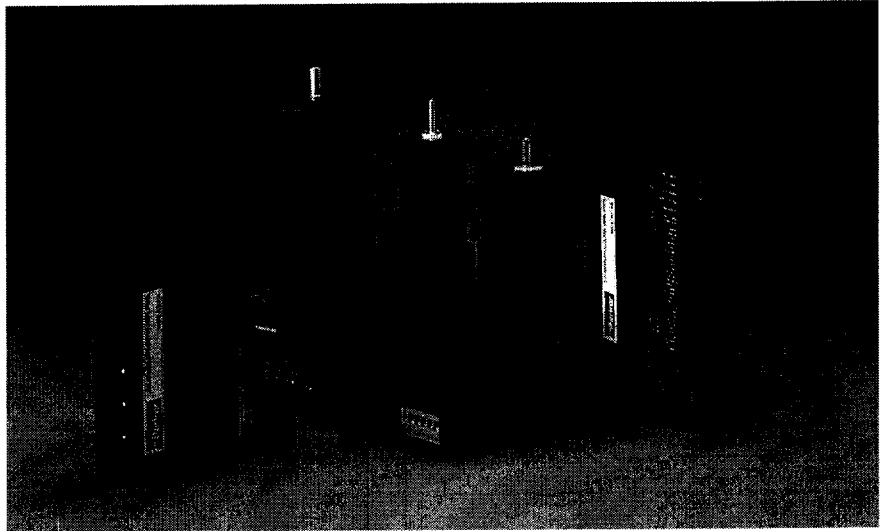
- Resolver feedback
 - encoder emulation
 - tach emulation
- Wide voltage range 60-190V
- 13A continuous, 26A peak
- 25 kHz pwm frequency
- Fault protections:
 - Output shorts
 - Over/under voltage
 - Over temperature
- 2.5kHz Bandwidth
- 0.2-40 mH load inductances
- Separate peak, peak-time, and continuous current limits
- Simplified compensation adjustments
- Surface mount technology

APPLICATIONS

- X-Y stages
- Automated assembly machinery
- Robotics
- Component insertion machines

THE OEM ADVANTAGE

- n Component header customizes amps for different motors
- n Conservatively rated components for high MTBF



PRODUCT DESCRIPTION

Brushless Amplifier, SMA190-26R

Model SMA190-26R is a complete pwm servo amplifier that operates from transformer-isolated single-voltage power supplies and provides six-step commutation of dc brushless servo motors. A read-only memory chip converts standard two-phase resolver position data to Hall signals that control motor commutation for motors with 1-4 electrical cycles per revolution.

Power output is four-quadrant for rapid acceleration and deceleration. Amplifier operates in torque (current) mode for use with microprocessor based control cards.

Derived encoder outputs give position feedback, emulating a 1024 line quadrature encoder. A "tachometer" output signal provides velocity information. Both permit use with programmable logic controls (PLC's) that require speed-loops for motion modules or position controllers requiring encoder quadrature signals. An internal header socket holds components that configure current limits and load-inductance compensation to set up the Model SMA190-26R for different loads and applications.

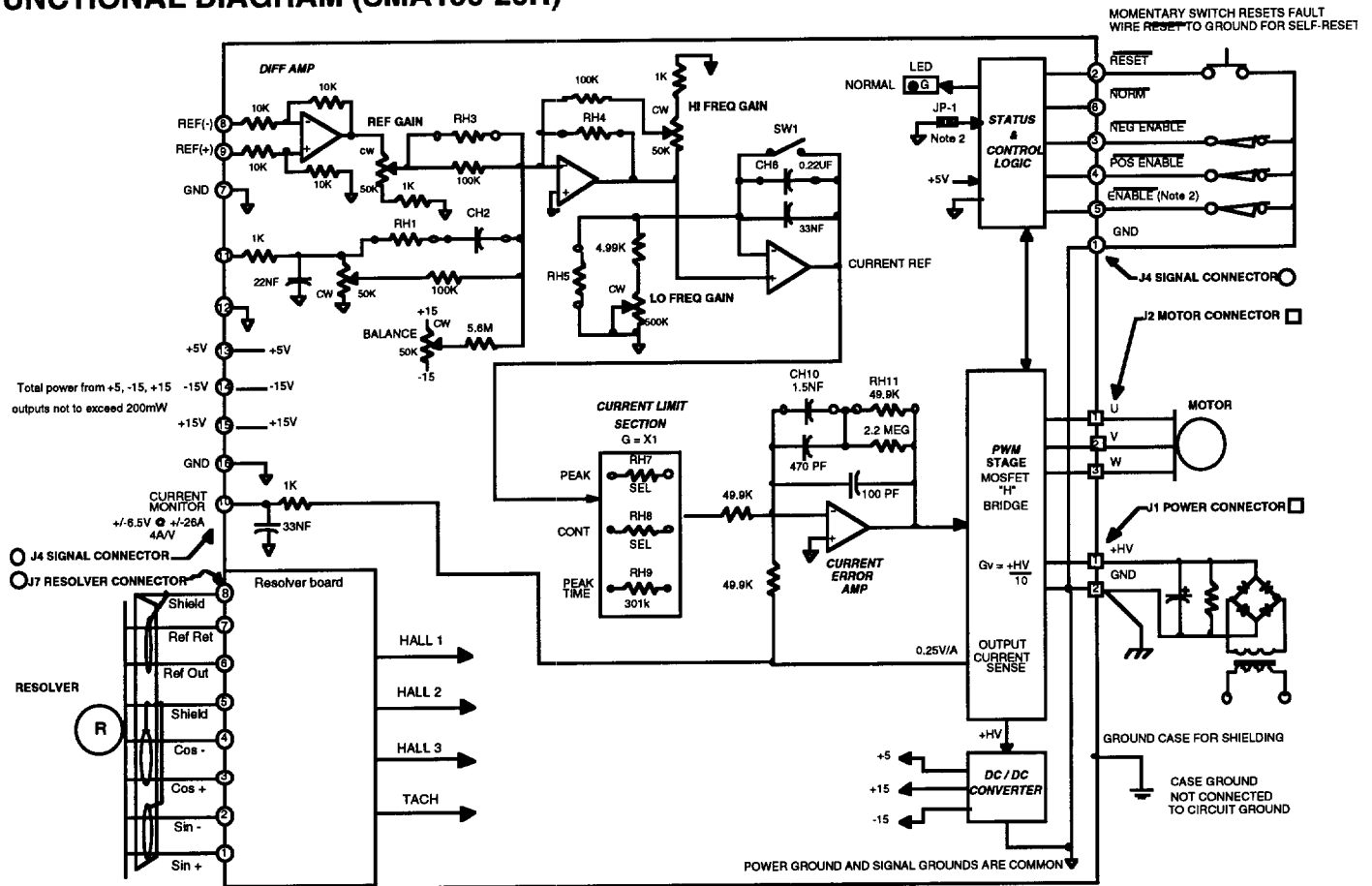
Separate peak current, continuous current, and peak-time limits allow high acceleration without sacrificing protection against continuous motor overloads.

Over and under-voltage conditions will cause the unit to shutdown temporarily. Heatplate over-temperature and shorts from output to output, or output to ground will cause a latching disable that can be reset by grounding the Reset input, or by cycling power. Self-reset will occur if /Reset input is wired to ground. High quality components and conservative design insure long service life and high reliability in industrial installations.

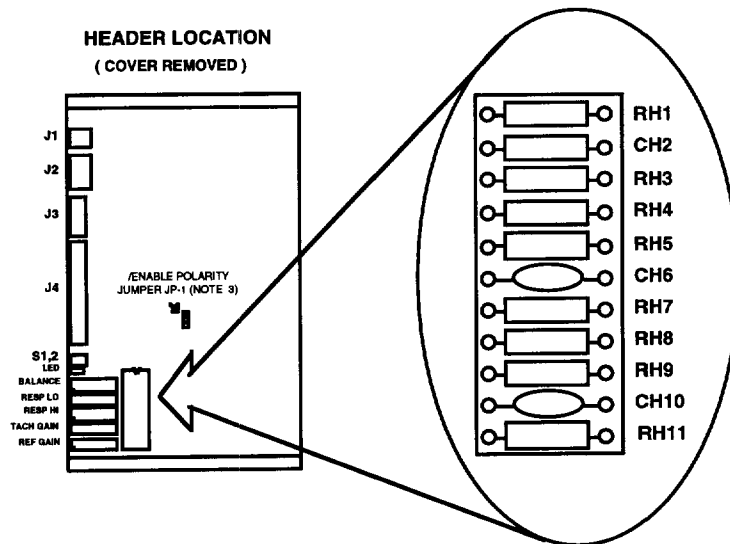

Motion & Control

MODEL SMA190-26R DC BRUSHLESS SERVO AMPLIFIER, RESOLVER FEEDBACK

FUNCTIONAL DIAGRAM (SMA190-26R)



CONNECTOR & INTERNAL LAYOUT



Notes:

- Components shown in dotted lines are not installed at factory.
- Jumper JP-1 is delivered in non-shorting position, making /Enable input ground-active (+5V or open inhibits). To invert logic of /Enable input install jumper between pins. Now, +5V or open enables, ground inhibits. Note: the /Pos and /Neg enable inputs are not affected by this jumper, and remain ground-enable, +5V or open inhibits.

MODEL SMA190-26R

DC BRUSHLESS SERVO AMPLIFIER, RESOLVER FEEDBACK

TECHNICAL SPECIFICATIONS

Typical at 25°C, +HV = +190VDC. Load = 200μH. in series with 1 ohms.

OUTPUT POWER		
Peak power		±180V @ 20A, 3600W
2 Sec		±179V @ 26A, 4650W
500 mSec		±182V @ 13A, 2360W
Continuous power		
OUTPUT VOLTAGE		$V_{out} = 0.97 \cdot HV - (0.2)(I_{out})$
MAXIMUM CONTINUOUS OUTPUT CURRENT		
At 25°C, ambient, 190VDC, perpendicular to thermally conductive mounting surface		
Convection cooled, no heatsink		
Fan cooled, 400 ft/min, no heatsink		
At 190VDC, ±13A, fan-cooled with heatsink		
		±9A
		±13A
		50°C max. ambient
LOAD INDUCTANCE		
Selectable with components on header socket		0.2mH to 40mH (Consult factory for higher inductances)
BANDWIDTH		
Small signal		-3dB @ 2.5kHz with 200μH load
PWM SWITCHING FREQUENCY		
		25kHz
INPUT CHARACTERISTICS		
Reference		Differential, 20KΩ between inputs
GAINS		
Input differential amplifier		x1 to x.02 (Potentiometer adjustable)
Servo preamplifier		x1 to x52 (Potentiometer adjustable, with RH3, RH4 not installed)
Integrator		x1 (at f >> integrator break frequency)
PWM transconductance stage		4A/V
POTENTIOMETERS		
		Reference gain, Tachometer gain, Balance
		Preamp gain, Preamp integrator break frequency
LOGIC INPUTS		
		/Enable, /Forward Enable, /Reverse Enable, /Reset (Ground = enabled, +5V or open inhibits)
		Internal jumper inverts logic of /Enable only, so that +5V enables & ground inhibits
LOGIC OUTPUTS		
/Normal (+Fault)		LO (current sinking) when unit operating normally. 2mA maximum, +5V maximum ratings
		Note: Do not connect output to devices that operate at voltages >+5V.
MONITOR OUTPUT		
Current monitor		±6.5V @ ±26A (4A/volt)
AUXILIARY POWER OUTPUTS		
+5VDC		30mA (Includes power for Hall sensors)
+15VDC		10mA
-15VDC		-10mA
<i>Note: Total DC power from all auxiliary outputs and Hall outputs not to exceed 200mW</i>		
PROTECTIVE FEATURES		
Output shorts: output to output, output to ground		Latches unit OFF (Reset input resets, ground input for self-reset)
Heatplate overtemperature		Shutdown at 70°C (Latches unit OFF)
Power supply voltage too low (Undervoltage)		Shutdown at +HV <22VDC (Operation resumes when >22V)
Power supply voltage too high (Overvoltage)		Shutdown at +HV >196VDC (Operation resumes when <196V)
POWER REQUIREMENTS		
Model SMA190-26R:		60-190VDC @ 26A peak
Minimum power consumption		2W
Maximum power consumption		61W @ 12.5A continuous, 232W @ 26A peak
THERMAL REQUIREMENTS		
Storage temperature range		-30 to +85°C
Operating temperature range		0 to 70°C baseplate temperature
MECHANICAL		
Size		Amplifier: 4.4 x 7.32 x 1.29" (112 x 186 x 32.7mm), with heatsink: 4.4 x 7.32 x 2.6 (112 x 186 x 66mm)
Weight		1.32 lb (0.60 kg.) for SMA190-26R, 1.48lb (0.67 kg.) for SMA190-26R, add 1.35 lb (0.61 kg) for heatsink
CONNECTORS		
DC power (J1)		Phoenix: MSTB 2.5/3-ST-5.08;Curtis: PA256 10.16/2
Motor (J2)		Phoenix: MSTB 2.5/5-ST-5.08; Curtis: PA256 10.16/3
Signal (J4)		Housing: Molex: 22-01-3167; Terminals (16) Molex 08-50-0114
Note: If using Phoenix, Weidmuller or equivalent connectors, some positions are no-connects. Observe J1 and J2 to see missing pins. Curtis connectors are delivered with unused contacts removed from connector housing.		

RESOLVER FEEDBACK

Connections

Power for the option card is supplied by the DC/DC converter on the amplifier motherboard.

The Hall signals and tachometer emulator signals from the card connect to the amplifier via the card mounting connector. User-accessible connectors on the card connect to the resolver, and to the encoder inputs on an external controller.

Monitor signals are provided to measure the resolver Reference and Sine signals. A Sync function is provided which lets multiple amplifiers be jumpered together to synchronize the reference signals to eliminate interference between them.

Resolver

Resolvers used must be of the type using two stators separated by 90° and a rotating winding that excites the stators. These typically have 2:1 ratios of primary (Reference) to secondary (Sin & Cos). The 1.8 to 4Vrms output range of the Reference output permits adjustment of the Sin/Cos signals to the 2.0Vrms requirement of the option card.

The 3-10kHz frequency range of the Reference signal drives a wide range of resolvers.

Phase adjust switches and a potentiometer provide adjustments to zero-out the phase difference between the reference and Sin signals.

A two section DIP switch sets the number of motor electrical cycles per resolver revolution from 1 to 4.

Reference Signal

This is the signal which excites the rotor of the resolver. It should be adjusted so that the Sin signal has an amplitude of 2.0Vrms (5.6V p-p) when the shaft is rotated to the point of maximum output. Typical resolvers have 2:1 ratios from Ref inputs to Sin or Cos outputs. Thus the reference signal from the option card will be in the 4Vrms range in most cases.

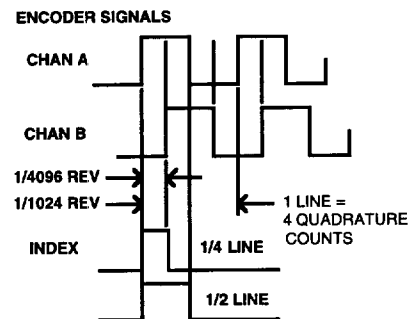
Encoder Emulation

The position of the resolver is tracked by a position-feedback loop in the resolver integrated circuit. This position is then converted into a two-phase quadrature encoder signal which can be used by position controllers.

The electrical resolution of the position loop is 4096 parts per revolution. Each of these parts comprises a digital code, and four codes constitute an encoder 'line', giving the equivalent of a 1024 line quadrature encoder.

Index Signal

A once-per-revolution index signal is part of the encoder emulation. The width of this signal may be set to 1/4 or 1/2 of an encoder cycle using the DIP switch S3.



Commutation

An EPROM chip converts the binary output from the resolver converter into Hall signals for commutation. These connect to the amplifier Hall inputs internally to operate the motor in six-step (trapezoidal) mode.

The standard EPROM will drive motors having 1,2,3, or 4 Hall cycles per mechanical revolution of the motor (2, 4, 6, or 8 pole motors).

Synchronization

When using multiple resolvers in a motion control system, coupling between cables can introduce noise due to the slightly differing frequencies between oscillators on different resolver cards. In such a case, the oscillators can be wired together via a Sync connector so that all will operate at the same frequency. Connecting these inputs via a 'daisy-chain' cable will cause all resolvers to oscillate at the same frequency.

Tachometer Emulation

A tach signal provided by the resolver card makes it possible to configure the drive as a velocity-loop. This is particularly useful with PLC's with motion control modules which output position error signals. Velocity loop operation frequently improves the performance of microprocessor controls which derive velocity information from the encoder signal. Scaling potentiometers on both the resolver card and amplifier permit the user to set the RPM/volt factor over a wide range.

Cabling

Shielded cable should be used for connection to the resolver, and grounded at the amplifier. The motor case should also be grounded. This will minimize coupling between the motor windings and the resolver.

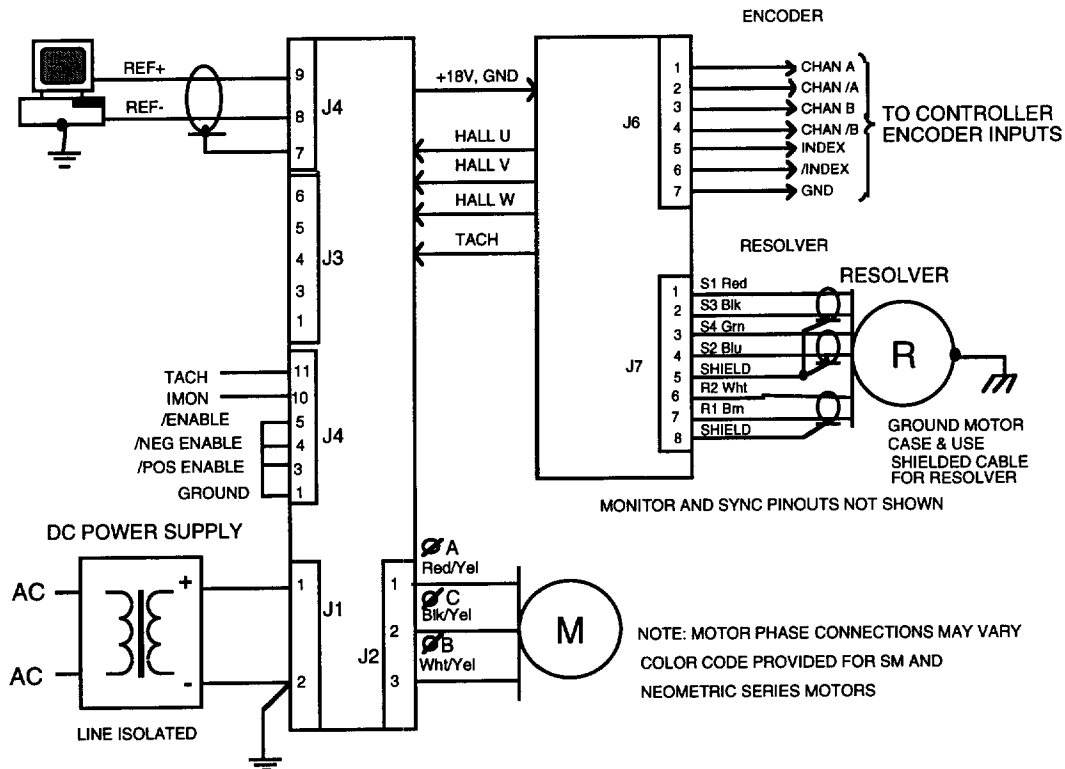
MODEL SMA190-26R

DC BRUSHLESS SERVO AMPLIFIER, RESOLVER FEEDBACK

RESOLVER OPTION SPECIFICATIONS

REFERENCE OUTPUT	Frequency Amplitude	3 to 10kHz 1.8 to 4.0 VRMS, 50mA RMS max
ENCODER EMULATION	Outputs Accuracy Resolution Bandwidth Max. speed Index output	Ch. A,B, and Index, differential line driver (+5V CMOS, 24mA source/sink) ±10.6 arc mins. ±1 lsb (±1/2 encoder cycle ±1 lsb) 1024 lines/rev (4096 quadrature counts), non-adjustable 700 Hz. min. 375 resolver cycles/sec max (1.5M quadrature counts/sec) Index width settable to 1/4, or 1/2 encoder cycle (1/1024 rev)
TACHOMETER OUTPUT	Connects to amplifier tachometer input internally. Tach voltage can be monitored at amplifier J4-11. Output voltage range ±4V. Tach Gain pots on option card and amplifier interact. Adjust so that tach voltage does not exceed the ±4V range, or clipping may occur.	
POTENTIOMETERS	Reference frequency, reference amplitude, sin-ref phase adjust, tach gain	
DIP SWITCHES	Sin/reference phase adjust (2 switches), motor electrical cycles (2 switches), index width (1 switch)	
CONNECTORS	Sync (J5): Housing: Molex 22-01-2027, Terminals (2) Molex 08-50-0114 Encoder (J6): Housing: Molex 22-01-2077, Terminals (7): Molex 08-50-0114 Resolver (J7): Housing: Molex 22-01-2087; Terminals (8): Molex 08-50-0114 Monitor (J8): Housing Molex 22-01-2037, Terminals (3) Molex 08-50-0114	
HALL OUTPUTS	U,V,W commutation signals, 120° phasing, internally connected to amplifier	
MONITOR OUTPUTS	Ref & Sin signals. Used to measure amplitude, and to adjust phasing between Sin and Ref signals	
SYNCHRONIZATION	Jumper resolver cards together to synchronize excitation oscillators Oscillators will sync to lowest frequency when adjusted within ±1%.	
DIP SWITCHES	S1, S2 Sin/ref phase adjust. Range will vary with frequency. Adjust so that pot can set Sin/Ref phase difference to zero°. S3 Index pulse width; sets index pulse to 1/4096 or 1/2048 revolution (1/4 or 1/2 encoder line) S4, S5 Motor electrical cycles per revolution setting. Standard choices are 1, 2, 3, or 4 cycles per revolution. Other options possible, consult factory.	

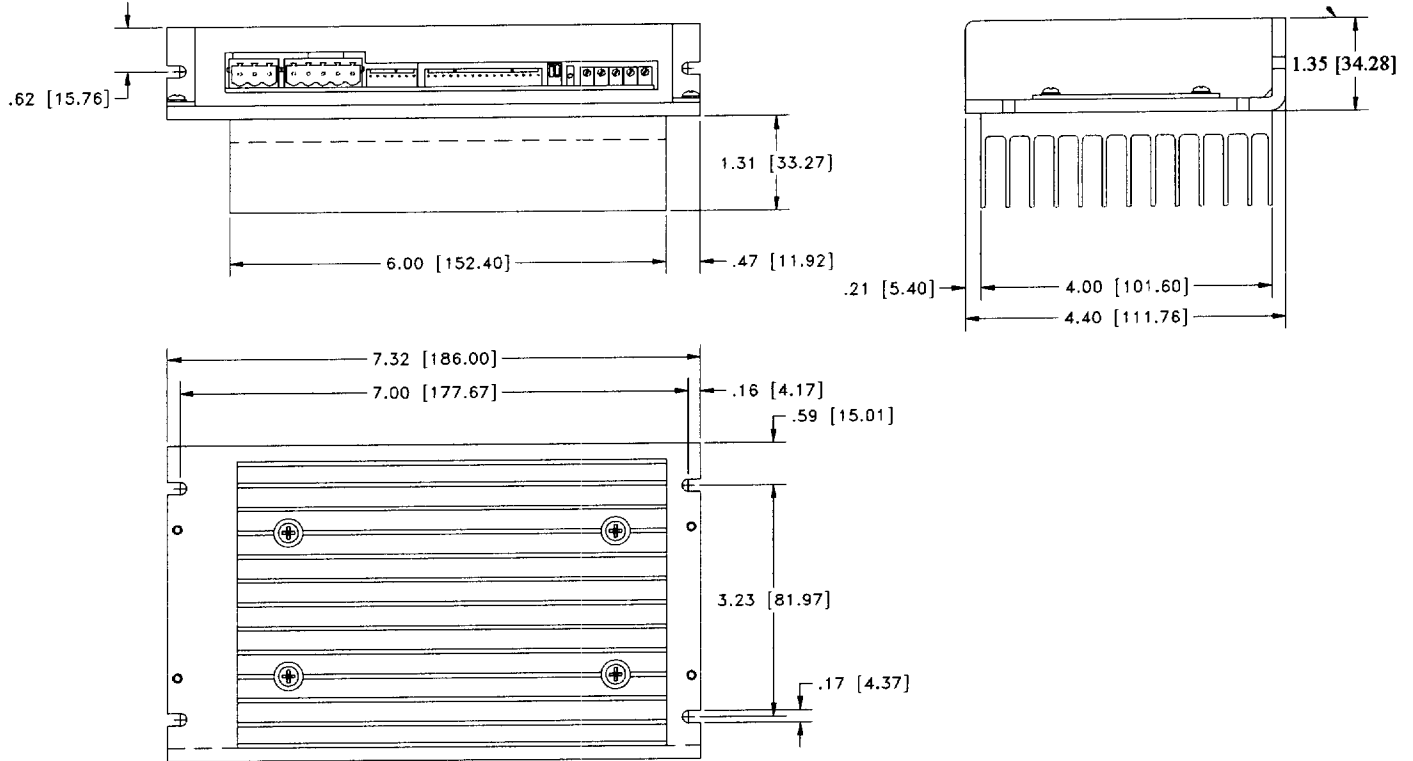
TYPICAL CONNECTIONS



MODEL SMA190-26R
DC BRUSHLESS SERVO AMPLIFIER, RESOLVER FEEDBACK

OUTLINE DIMENSIONS

Dimensions in inches (mm.) Optional heatsink included in dimensions.



ORDERING GUIDE

SMA190-26R	Model SMA190-26R with Resolver feedback
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Notes:

1. For optional heatsink, specify additional part number SMA-HSR



