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Encoder Instructions

M5-1 and M5-2

INACTIVE DESIGN
 Contact Help Desk

 EXPLOSION PROTECTED, SOLID SHAFT

DESCRIPTION

The Avtron Model M5-1 and M5-2 are Solid Shaft Incremental Encoders (also known as tachometer or rotary pulse generator). They are similar to the model M3 Mill Duty solid shaft incremental encoder but utilize flameproof and increased safety construction. The M5 compliance with the Essential Health and Safety Requirements has been assured by compliance with EN60079-0, EN60079-1 and EN60079-7 (Certificate of Conformity No. DEMKO 02 ATEX 131477X). The M6 is certified for use in CAT 2 (Zone 1) Gas Group IIC potentially explosive atmospheres when marked with the code II 2G Ex de IIC T4 (Tamb -20°C to +80°C). Tamb -40°C also available (Special modification 001).

Mechanically, the M5-1 mounts on a NEMA 56C adapter flange. The M5-2 can be foot mounted by using an optional foot mounting bracket kit. When coupled to a motor or machine, the M5 output is directly proportional to shaft position (pulse count) or speed (pulse rate). The M5 can be used for both control and instrumentation applications.

The enclosures on all Model M5s are rated IP 66 to protect the internal components from the entry of dust and water. All M5s utilize a photoelectric sensing system. The M5 is ideal for demanding industrial environments.

All M5s can be equipped with one or two outputs. Each output is electrically independent and totally isolated. For many applications this feature provides a running spare output by simply interchanging the output connectors. The outputs can be wired as single ended single phase, single ended two phase (A,B), or differential (A Quad B). Additionally, an auxiliary output is available (C,C̄) at 1/4 the base PPR for instrumentation .

M5 ENVIRONMENT

The M5 does not produce flammable gasses or dusts in normal operating modes. The M5 does not cause injury or harm when used in conjunction with the installation guide. The M5 does not produce ignition capable electrical sparks or arcs and has been designed not to produce potential ignition sources from electromagnetic, acoustic, optical or other energy sources. The M5 is not considered as a safety device and is not suitable for connection into a safety system.

The installer should refer to the latest edition of the following standards before installing or operating in a Hazardous Area:

EN 1127-1 Explosive Atmospheres - Explosion prevention and protection, basic concepts, and methodology.

EN 60079-14 Electrical apparatus for explosive gas atmospheres - Part 14: Electrical installations in hazardous areas (other than mines).

The M5 housing and shaft materials are listed in the specifications. These materials are not considered as able to trigger an explosion in normal operating modes and various fault modes in accordance with the requirements for Cat 2 equipment. These materials are not known to react with any explosive atmospheres to which the M5 may be subject. It is however the responsibility of the end user to ensure that the M5 is selected correctly for the potentially explosive atmosphere in which the equipment is to be put into service.

INSTALLATION

Equipment needed for installation

Supplied:

1. M5 Encoder
2. Anti-Seize Compound (copper)

Not Supplied:

- | | |
|---|-----------------------------------|
| Socket Hd. Cap Screw
3/8-16 x 0.75 (4) | 5/16" Hex Wrench (T-Handle style) |
| Washer, Flat 5/16 (4) | Shaft Coupling |
| Washer, Lock 5/16 (4) | Motor Adapter Flange |
| Thread Locker (Loctite 242 recommended) | Dial Indicator |

Optional:

- Foot Bracket Mounting Kit (A28380)
- Armoured Cable Gland

Clean machine shaft of any dirt and check for any burrs or damage.

The encoder must be driven by a positive drive rather than a friction drive. The following means of coupling are acceptable when properly installed: Direct Coupling, Timing Belt/Pulleys, Chain/Sprockets.

With a direct drive, use a flexible coupling and align the shafts as accurately as possible. Example: For a size 62 Thomas Miniature Coupling, angular misalignment must be less than 1.34°, parallel misalignment less than 0.028", and axial float less than ± 0.031". Overhung loads should also be minimized. Installations using timing belts/pulleys should have just enough belt tension to eliminate belt sag. Excessive tension will shorten belt and bearing service life. Refer to the specifications for maximum bearing load ratings. If a rubber slinger disc is used, position it on the shaft so it will rotate freely.

M5 PART NUMBERS AND AVAILABLE OPTIONS

Model	Mounting Style	Shaft Style	Line Driver	Left & Right Output Range	Base PPR	Marker	Connector	Modifications
M5-	0- Non-Standard 1- Face mount 5/8" x 2" shaft 2- Foot mount 5/8" x 2.64" (2" net) shaft	S- Single Ended Shaft	1- 5 to 24 VDC 2- 5 to 18 VDC 3- 12 to 24 VDC*	X- None L- Low Range (Base PPR x 1/2) M- Medium Range (Base PPR x 1) H- High Range (Base PPR x 2)	48- 480 51- 512 60- 600	Z- Marker -- None	T- Conduit Box, Terminal Block, 3/4" NPT W- Conduit Box, Terminal Block and Wire Gland	000- None 001- Low Temp (-40°C)

* Units shipped prior to 2009 were rated 18 to 24 volts. Refer to ID tag on the encoder for specific input voltage requirements.

CAUTION

Do not force or drive the coupling onto the shaft or damage to the bearings may result. The coupling should slide easily on the shaft. Remove nicks and burrs if necessary. Consider driving shaft endplay when positioning coupling.

For more details on alignment specifications, measurement techniques, and special considerations in specifying and installing drive components, refer to separate installation instructions in the Avtron PULSE GENERATOR HANDBOOK.

NEMA 56C FACE MOUNTING INSTRUCTIONS

- 1) Apply anti-seize compound to inner circumference of coupling (both motor and encoder side).
- 2) Loosen set screws in coupling and apply thread locker to set screws.
- 3) Place coupling on motor shaft, inserting to depth per manufacturer's instructions.
- 4) Attach coupling to motor shaft using set screws per manufacturer's instructions.
- 5) Bolt mounting flange (flowerpot) to motor C-Face, using thread locker with fasteners.
- 6) Slide encoder shaft into other side of coupling. **DO NOT FORCE.** Ensure 1/4" keyway aligns with coupling set screw location.
- 7) Ensure C-Face on mounting flange matches and aligns with encoder C-Face precisely.
- 8) Apply thread locker to hex cap screws.
- 9) Align bolt holes of encoder and flange, thread in (4) hex cap screws, using lock washers.
- 10) Tighten set screws on encoders side of coupling.

FOOT MOUNTING INSTRUCTIONS

Equipment needed for installation

Supplied:

- | | |
|--|--------------------------|
| 1. Foot Bracket (A28380) | 4. Nut, Hex 5/16-18 (4) |
| 2. Soc. Hd. Cap Screw
3/8-16 x .75 (4) | 5. Washer, Flat 5/16 (4) |
| 3. Hex Hd. Cap Screw
5/16-18 x 1.50 (4) | 6. Washer, Lock 5/16 (4) |
| | 7. Thread Locker (blue) |

Not Supplied:

- 1/2" Wrench
- 5/16" Hex Wrench (T-Handle style)
- Dial Indicator

The optional foot mounting bracket kit is Avtron P/N A28380. Read all of the following instructions and the Avtron PULSE GENERATOR HANDBOOK prior to beginning any work.

The M5 performance and life will be directly affected by the installation. Following this sequence of steps is recommended.

- 1) The foot mounting bracket must be secured to a flat, rigid, vibration free steel or aluminum base which can be machined to accept 5/16-18 mounting hardware. See next section.
- 2) Temporarily mount the M5 to the foot bracket, install the coupling to the M5 and driver and verify that the location is suitable for installation.
- 3) If the M5 encoder, bracket, and coupling are suited to the area, check motor/encoder shaft alignment with a straight edge from multiple positions around the shaft circumference to verify that it meets specifications.
- 4) While maintaining alignment, precisely mark the position of the foot bracket on its mounting base.
- 5) Remove the M5. Transfer punch or layout the mounting hole pattern as indicated on outline drawing.
- 6) Machine four, 3/8" diameter through holes or tap four, 5/16-18 " holes in center of base slots to give some degree of freedom in final alignment.
- 7) Reinstall the M5 with the flexible coupling loosely in place, and tighten down all mounting hardware. Check motor/encoder shaft alignment with a straight edge from multiple positions around the shaft circumference to verify that it meets specifications. Use thread locker supplied on cap screws which mount M5 to foot bracket.
- 8) Ensure any flat or keyway on the motor and encoder shaft are aligned with the set screw holes of the flexible coupling. Apply thread locker to coupling set screws and tighten per manufacturer's recommendations.
- 9) Recheck alignment and tighten all hardware after first several hours of operation.

MINIMIZE DOWNTIME: Should M5 replacement be required, leave the foot mounting bracket installed on its base and mount the new M5 to the bracket. This maintains the original alignment.

SPECIFICATIONS

ELECTRICAL

- Operating Power (Vin)
 - Volts.....See Line Driver Options
 - Current.....120mA, no load
- Output Format (See Line Driver Options for Levels)
 - 2Ø & Comp (A, A, B, B)
 - Marker: 1/Rev (Z, Z)
 - ÷ 4 (C, C)
- Signal Type.....Incremental, Square Wave, 50 ±10% Duty Cycle.
- Direction Sensing.....ØA leads ØB for CW rotation as viewed from the back of the tach looking at the non-drive end of the motor.
- Transition Sep.....15% minimum
- Frequency Range:.....0 to 150,000 Hz
- PPR.....240, 256, 360, 480, 512, 600, 1024, 1200, 2048, 2500
- See Line Driver Options

MECHANICAL

- Shaft Inertia:.....0.1 Oz. In. Sec.² Typical
- Acceleration:.....5,000 RPM/Sec.
- Starting Torque:.....2.0 Oz. In. (Typical)
- Speed:.....5,000 RPM Max. except -7(2 3/8") 3,600 RPM Max.
- Weight:.....16 lbs. maximum
- Shaft Diameter
Tolerance:.....See drawing on page 4.
- Shaft Engagement:.....See drawing on page 4.
- Bearing Protection:.....Shaft Seal and Double Bearing Seal.
- Bearing Life with no Additional Loading: 6.1 x 10⁶ Revolutions.
- Maximum Additional Bearing Load:
 - 1 (5/8"): 5 pounds axial or 20 pounds radial.
 - 4 & -5 (1" & 1 1/8"): 10 pounds axial or 30 pounds radial.
 - 6 (2"): 25 pounds axial or 75 pounds radial.
 - 7 (2 3/8"): 30 pounds axial or 90 pounds radial.
- Shaft Material: Black Oxide Treated Steel.
- Housing Material: Cast Aluminum with Polane S Plus Polyurethane Enamel Finish.

ENVIRONMENTAL

- Enclosure Rating: IP66
- Operating Temperature: 80°C to -40°C (-40°C optional, -20°C standard)
- Hazardous Locations: Ex de IIC T4 (Tamb -20°C to +80°C Standard, -40°C to +80°C Optional use Modification "001")

OUTPUT TERMINATIONS

Terminal Block: EEx e II compression type. Accepts AWG 14 (2.08mm²) to AWG 20 (.52mm²) stranded wire. Housing available with 3/4 NPT or optional armored cable gland available (maximum ambient temperature with gland +60°C allowing for 20°C rise in housing.)

LINE DRIVER OPTIONS

	Output Options		
	1	2	3*
Voltage Input (Vin)	5-24 VDC	5-18 VDC	12-24 VDC
Output High (Volts)	(Vin) -2 (typ)	(Vin) -1 (typ)	330 ohm pull up
Output High (milliamps)	80 (max.)	80 (avg.), 1500 (peak)	330 ohm pull up
Output Low (Volts)	0.5 (typ)	0.5 (typ)	1 (max.)
Output Low (milliamps)	80 (max.)	80 (avg.), 1500 (peak)	50 (avg.)
Protection	Reverse Voltage, Transient, Short Circuit (high & low)	Reverse Voltage, Transient, Short Circuit (none)	Reverse Voltage, Transient, Short Circuit (low)
Maximum Cable Drive(Feet)	1000 ft. @ 5 V 500 ft. @ 12 V 200 ft. @ 24 V	2000 ft.	1000 ft.

* Units shipped prior to 2009 were rated 18 to 24 volts. Refer to ID tag on the encoder for specific input voltage requirements.

WIRING INSTRUCTIONS

The M5 can be wired for single phase, two-phase, with or without complements, with or without markers. See wiring diagrams.

CAUTION

Do not wire the M5 Encoder while energized. Doing so may damage the encoder, and/or cause risk of fire or explosion.

For bidirectional operation of the encoder, proper phasing of the two output channels is important. Phase A channel leads phase B channel for clockwise shaft rotation as viewed from the anti-drive or accessory end of the motor (M5 mounting end).

CORRECTIVE ACTION FOR PHASE REVERSAL

- 1) **Remove Power.**
- 2) Exchange wires on cable, either at encoder cable end, or at speed controller end (but not both).
 - a) **Single Ended 2 Phase Wiring** (see wiring diagram)
Exchange A and B at the use end of the wires.
 - b) **Differential 2 Phase Wiring** (see wiring diagram)
Exchange **either** A with \bar{A} in the phase A pair **OR** B with \bar{B} in the phase B pair but **NOT** both.
- 3) Apply Power.
- 4) Verify encoder feedback is correct, using hand rotation of shaft, or jog mode of the speed controller.

Refer to the system drawing for specific cable requirements where applicable.

Physical properties of cable such as abrasion, tensile strength, solvents, marine applications, etc., are dictated by the specific application. Requirements for hazardous locations are dictated by the relevant codes. General electrical requirements are: stranded copper, 20 AWG (.52mm²) through 14 AWG (2.08mm²), each wire pair individually shielded with braid or foil with drain wire, 0.05 uF

maximum total mutual or direct capacitance, outer sheath insulator, 2,000 ft. max. (See line driver specifications). Temperature ratings of wire and wire glands should be 20°C over the maximum expected ambient or motor temperature to allow for temperature rise in the encoder itself.

MAINTENANCE

CAUTION

Do not open the M5 housing. Doing so will void the warranty and may cause the risk of fire or explosion.

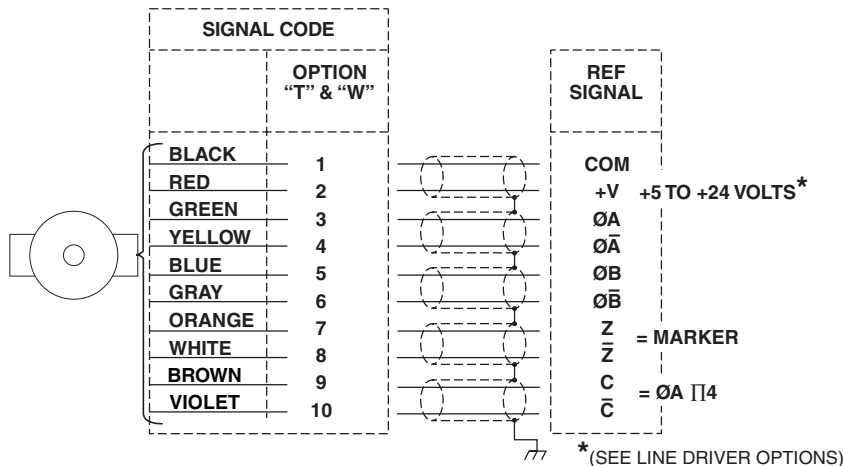
There are no field replaceable parts in an M5. The unit should be returned to the factory for all repairs.

Build up of large amounts of contamination are to be avoided, therefore periodic external cleaning is recommended.

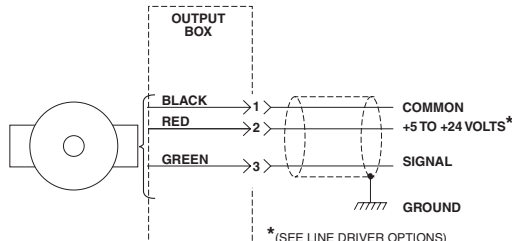
The condition of the bearings is important to the safety of the explosion-proof housing. The bearing manufacturer's rated life (see specifications) can be adversely affected by application specific conditions. If the unit shows signs of bearing wear indicated by noise or degradation of the electrical signal output, it should be returned to the factory for repair.

WIRING DIAGRAMS

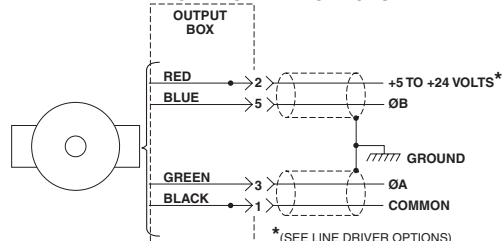
DIFFERENTIAL APPLICATIONS



SINGLE ENDED SINGLE PHASE APPLICATIONS



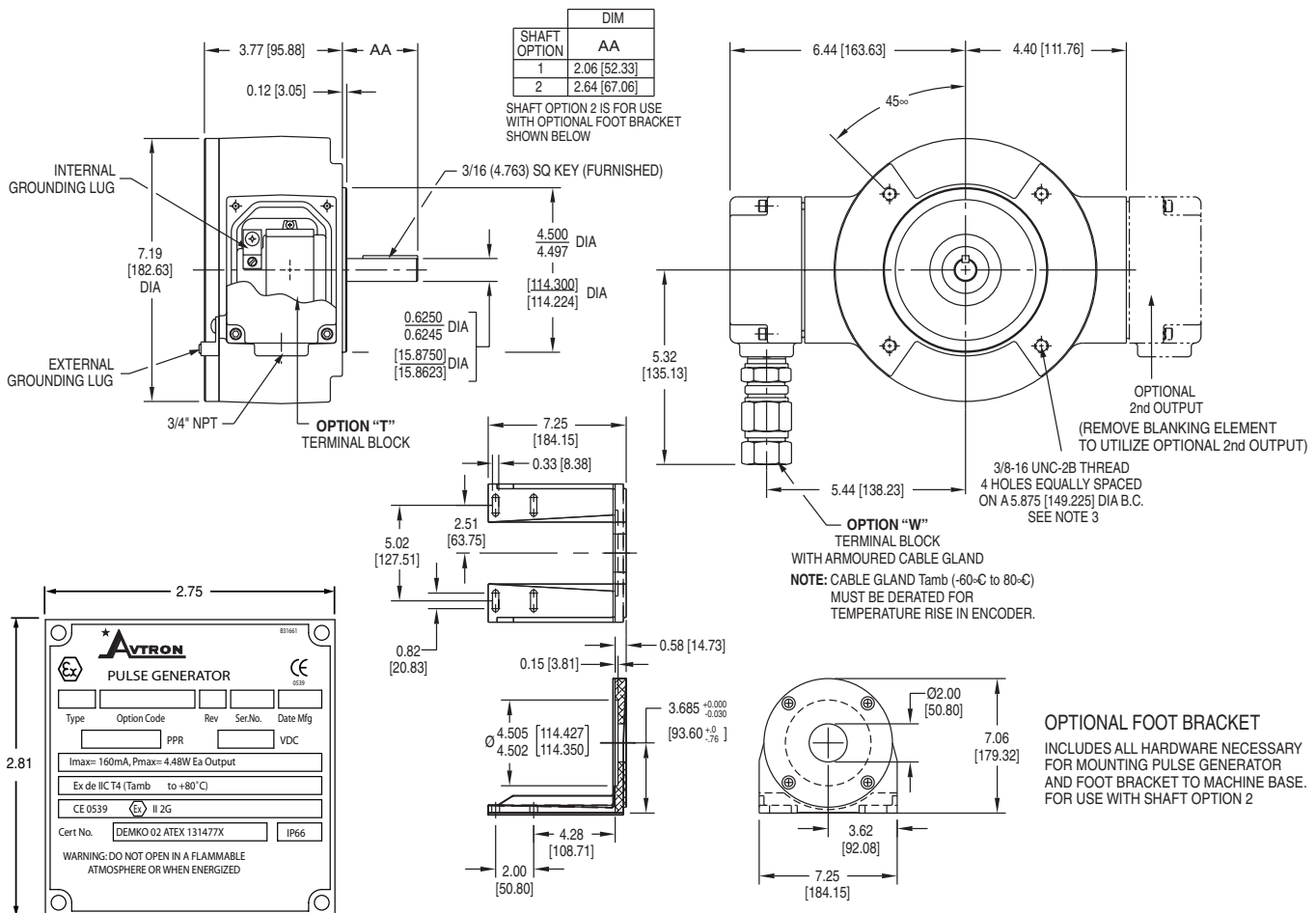
SINGLE ENDED TWO PHASE APPLICATIONS



NOTE: Avtron standard warranty applies. Copies available upon request. Specifications subject to change without notice.

TYPICAL WIRE:
18 AWG (.82mm²) multiple pair, individually shielded

OUTLINE DRAWING



Tamb -20°C to +80°C standard, optional Tamb -40°C to +80°C available with special option codes 001.

- 5 – IDENTIFICATION LABEL: SEE ABOVE
 - 4 – DIMENSIONS IN PARENTHESIS ARE MILLIMETERS
 - 3 – PILOT MOUNTING CONFORMS TO A NEMA 56C FACE
 - 2 – ALL DIMENSIONS ARE APPROX.
 - 1 – WEIGHT: 16 LBS. MAX.
- NOTES:

* "VDC" to be "5-18" or "5-24" or "12-24"

Features and specifications subject to change without notice.
Avtron standard warranty applies. All dimensions are in inches (mm) approx.

EU DECLARATION OF CONFORMITY: The Model M5 Pulse Generator has been assessed and type tested against the following Harmonized European Standards: EN 50081-1:1992, EN 50082-1:1998. The Model M5 has been found to be compliant with the requirements of EU Directive 89/336/EEC provided that the following conditions are met: The electrical supply to the M5 must be within specified limits. The electrical supply must offer suitable protection from voltage surges unless the application does not require such protection. On behalf of Avtron: Stephen L D'Henin, Certification Manager, Epsilon Certification Service.

These instructions have been reviewed and the product evaluated as suitable for our application.

Company Name _____

Authorized Company Representative _____

Title _____ Date _____

