

LINEAR AND ROTARY POSITIONERS

OPERATING MANUAL

**No. GEN-1H
Rev. 2**

**Parker Hannifin Corporation
Electromechanical & Drives Div.
1140 Sandyhill Road
Irwin, PA 15642**



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PURPOSE

This manual provides operational information on linear and rotary positioners. Please read the entire manual before operating your new positioner. The positioners performance and service life will be greatly enhanced by proper installation and maintenance. The following procedures will be helpful to you in achieving these objectives.

If at any time you have any questions about your new positioner please contact your authorized dealer or a Sales Applications Engineer (SAE) at the factory at 800-245-6903 or 724-861-8200.

SATISFACTION:

All standard products are covered by a 30-day customer satisfaction guarantee. If for any reason you are not satisfied with your purchased item, it may be returned for full credit, provided it has not been damaged or altered (see "Returns"). All systems are covered by our one-year warranty.

OUT-OF-WARRANTY REPAIR:

Out-of-warranty products are repaired in our service department. You will be notified of the cost, prior to making the repair.

RETURNS:

No product may be returned, in or out of warranty, without a "return authorization number". All returns must reference this number. Parker Hannifin assumes no responsibility for products returned without proper authorization. To obtain this return material authorization (RMA), call the Parker Hannifin Customer Service Department at 800-245-6903 or 724-861-8200.



UNPACKING:

Carefully remove the positioner from the shipping crate and inspect the unit for any evidence of shipping damage. The removal of shipping restraints may be required. Report any damage *immediately* to your authorized dealer. Please save the shipping crate for damage inspection or future transportation of the components.

Incorrect handling of the positioner may adversely affect the performance of the unit in its application. Please observe the following guidelines for the handling and mounting of your new positioner.

- Do not allow the positioner to drop onto the mounting surface; set it into place gently. Impacts can result in flat spots on bearing surfaces or misalignment of drive components.
- Do not drill holes into the positioner or subject the units to impact loads such as hammering, riveting, etc. Parker Hannifin will drill holes if necessary, contact your local distributor or a Parker SAE.
- Do not lift the positioner by the drive screw, manual adjustment knobs or motor drive assembly. The unit should be lifted by the base structure only.
- Do not submerge the positioner in liquids.
- Do not attempt to adjust factory set screws. Factory set adjustments are covered with sealing tape and *unauthorized adjustments may void the product warranty*.

INSTALLATION:

When purchased, the positioner comes with the carriage, bearing housings, and motor adapter fully assembled. On request, a motor can be mounted and aligned to your positioner. Also upon request, either magnetic or optical limit and home switch assemblies designed to protect against over-travel and provide a fixed reference position for programming purposes can be ordered.

Product specification, dimensions and mounting hole configurations for standard products may be obtained by referring to the catalog, or by contacting your authorized dealer.



INSTALLATION (continued)

Mounting the Positioner to a Mounting Surface

A machined plate such as a laboratory optical table or a granite slab will provide the best mounting surface for your new positioner. We recommend the mounting flatness to be 0.0005 inch/foot or better.

The mounting surface (*not* the positioner base pads) may be scraped or shimmed to achieve the required flatness. With a satisfactory mounting surface, the mounting screws are inserted through the available mounting holes in the base of the positioner and tightened to secure the unit.

Mounting a Motor to the Positioner

Positioners supplied with a motor allow for direct mounting of a NEMA 23, 34 or 42 option motor. A coupling is supplied to make the connection between the motor and screw shaft. For helical couplers, assure that the coupler is tight on the screw shaft. For bellows couplers, assure that the collar is tight on the screw shaft and snug on the motor side but not tight. Make the collar snug enough to keep the collar from turning on the coupler. Insert the motor shaft on to the coupler. Once the shaft is inserted, assure the motor is piloted. Attach four bolts to motor flange and tighten. Begin rotation of the motor, (either rotate by hand, or start the motor at a *very* slow speed) and make sure it rotates freely to assure alignment and that the coupler is not being crushed onto the shaft. If you have a bellows coupler and the screw starts to rotate, you may have to loosen the collar on the motor end. If too much pressure is added to any coupling and the coupling is not aligned, it will crush and /or deform the coupler, causing premature wear. Tighten the coupler onto the shaft.

Mounting a Gearhead to the Positioner

If you have a NEMA 23, 34 or 42 gearhead, then it will attach directly to the face of the motor. If not, you will need an adapter, consult your gearhead manufacturer or a Parker SAE. Follow the instructions of the gearhead manufacturer for mounting their gearhead to your motor. The gearhead can be mounted to the motor block on the positioner as directed above for mounting a motor. Certain gearhead manufacturers require a spacer, for long shafts, and a different size coupler to accommodate their shaft size. An adapter may be necessary to fit the gearhead to the positioner, consult the gearhead manufacturer or an SAE at Parker with any questions on this subject.

INSTALLATION (continued)

Mounting the Payload to the Positioner

Before mounting the payload to the positioner, be sure the drive electronics are working and verify that all speeds and positions are attainable. Take notice of the results and record any information that may be helpful to you.

We recommend the mounting flatness to be 0.0005 inch/foot or better. When fixturing the payload to the mechanical positioner, use the mounting screws whose length does not bottom out or hit any components below. Longer screws may project into the interior of the mechanism of the positioner causing damage to the unit.

The positioner carriage has threaded mounting holes for attaching your payload. Some holes have locking threaded inserts. These inserts can be identified by one or more of the coils having a series of straight segments or "chords" (they are also dyed red for identification). When the bolt enters the "grip" coil, these chordal segments flex outward, creating pressure on the bolt. Therefore when tightening the bolt you must overcome the locking element. While doing this it may feel as though you are stripping the bolt. You are not. When tightening the bolt you will have to tighten past the locking element to achieve the tightening torque for your assembly. Consult factory with any questions.

MAINTENANCE

To insure long service and performance to specification, it is essential to keep the positioner bearings and drive elements properly lubricated and free of contamination. The nature of the application in consideration of variables such as environment, duty cycle, speed, etc. will determine the inspection, cleaning, and re-lubrication interval.

Lubrication and maintenance information for nonstandard products and vacuum prepared systems may be obtained from your local representative or consult the factory.

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PARKER HANNIFIN CORPORATION

BEARING LUBRICATION SHEET

SECTION I	
SUPPLIER'S NAME PARKER HANNIFIN CORPORATION	TELEPHONE NO. 1-800-245-6903 OR (724) 861-8200
ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
BEARING TYPE SQUARE RAIL BEARINGS: SIZES 7, 9	
OIL TYPE MULTEMP PS2 A LITHIUM ESTER COMPOUND MADE FOR RUNNING AT LOWER TEMPERATURES (-50 ~ 110 °C) PROTECTS AGAINST WEAR AND CORROSION. FOR MORE INFORMATION CONTACT KYODO YUSHI AT +81-3-3543-5814 OR FAX AT +81-3-3545-6259 OR GO ONLINE AT www.kyodoyushi.co.jp/eng/	
OIL APPEARANCE WHITE CREAM	
SECTION II	
BEARING MAINTENANCE SQUARE RAIL BEARING BLOCKS ARE LUBRICATED AT OUR FACILITY PRIOR TO SHIPMENT. FOR LUBRICATION INSPECTION AND SUPPLY INTERVALS FOLLOWING SHIPMENT, APPLY GREASE ONCE A YEAR. THE TIME PERIOD MAY CHANGE DEPENDING ON FREQUENCY OF USE. INSPECT FOR CONTAMINATION, CHIPS, ETC. AND REPLENISH ACCORDING TO INSPECTION RESULTS	
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ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
BEARING TYPE SQUARE RAIL BEARINGS: SIZES 15, 25	
OIL TYPE SHELL ALVANIA GREASE RL2. LITHIUM SOAP THICKENED GREASE, INHIBITED WITH ADDITIVES THAT PROMOTE LONG SERVICE LIFE AND PROVIDE EXCELLENT LUBRICATION AND CORROSION PROTECTION. FOR MORE INFORMATION CALL SHELL AT 1-800-840-5737 OR LOOK ONLINE AT HTTP://WWW.SHELL-LUBRICANTS.COM/	
OIL APPEARANCE AMBER AND SMOOTH	
SECTION II	
BEARING MAINTENANCE SQUARE RAIL BEARING BLOCKS ARE LUBRICATED AT OUR FACILITY PRIOR TO SHIPMENT. FOR LUBRICATION INSPECTION AND SUPPLY INTERVALS FOLLOWING SHIPMENT, APPLY GREASE ONCE A YEAR. THE TIME PERIOD MAY CHANGE DEPENDING ON FREQUENCY OF USE. INSPECT FOR CONTAMINATION, CHIPS, ETC. AND REPLENISH ACCORDING TO INSPECTION RESULTS	
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ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
BEARING TYPE ROUND RAIL BEARINGS	
OIL TYPE PARKER OIL TYPE #1 MODEL NUMBER A1. LIGHT MACHINE OIL CONTAINING ADDITIVES TO ENHANCE OXIDATION RESISTANCE WITH A VISCOSITY EQUIVALENT TO SAE 10	
OIL APPEARANCE LIGHT YELLOW, FLUID	
SECTION II	
BEARING MAINTENANCE LINEAR RAIL BEARING BLOCKS ARE LUBRICATED AT OUR FACILITY PRIOR TO SHIPMENT. TO INSURE A LONG SERVICE AND PERFORMANCE TO SPECIFICATIONS, IT IS ESSENTIAL TO KEEP THE POSITIONER BEARINGS AND RAILS ADEQUATELY LUBRICATED AND FREE OF CONTAMINATION. THE NATURE OF THE APPLICATION IN CONSIDERATION OF VARIABLES SUCH AS ENVIRONMENT, DUTY CYCLES, SPEED, ETC., WILL DETERMINE THE INSPECTION CLEANING AND RELUBRICATION INTERVAL. IN GENERAL, IT IS DESIRABLE TO CLEAN AND LUBRICATE THE RAILS APPROXIMATELY EVERY 1000 HOURS OF OPERATION	
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BEARING LUBRICATION SHEET

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ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
BEARING TYPE CROSS ROLLER BEARINGS	
OIL TYPE PARKER OIL, TYPE #1 MODEL NUMBER A1. LIGHT MACHINE OIL CONTAINING ADDITIVES TO ENHANCE OXIDATION RESISTANCE WITH A VISCOSITY EQUIVALENT TO SAE 10	
OIL APPEARANCE LIGHT YELLOW, FLUID	
SECTION II	
BEARING MAINTENANCE CROSS ROLLER WAYS AND BEARING CAGES ARE LUBRICATED AT OUR FACILITY PRIOR TO SHIPMENT. TO INSURE A LONG SERVICE AND PERFORMANCE TO SPECIFICATIONS, IT IS ESSENTIAL TO KEEP THE POSITIONER BEARINGS AND WAYS ADEQUATELY LUBRICATED AND FREE OF CONTAMINATION. THE NATURE OF THE APPLICATION IN CONSIDERATION OF VARIABLES SUCH AS ENVIRONMENT, DUTY CYCLES, SPEED, ETC., WILL DETERMINE THE INSPECTION CLEANING AND RELUBRICATION INTERVAL. IN GENERAL, IT IS DESIRABLE TO CLEAN AND LUBRICATE THE WAYS APPROXIMATELY EVERY FIVE HUNDRED (500) HOURS OF OPERATION	
SECTION III	
LUBE APPLICATION COMMAND THE POSITIONER TO TRAVEL TO THE EXTREME ENDS OF TRAVEL TO ACCESS THE WAYS FROM BOTH ENDS. WIPE THE WAYS DOWN THEIR ENTIRE LENGTH WITH A CLEAN CLOTH. APPLY LUBRICATION ON THE WAYS ALLOWING FRESH OIL TO PASS THROUGH THE BEARING RETAINERS AND ONTO THE BEARINGS.	
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PARKER HANNIFIN CORPORATION

ROTARY TABLE LUBRICATION SHEET

SECTION I	
SUPPLIER'S NAME PARKER HANNIFIN CORPORATION	TELEPHONE NO. 1-800-245-6903 OR (724) 861-8200
ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
GEAR TYPE / BEARING TYPE WORM GEARS / CROSS ROLLER OR BALL MAIN BEARING	
OIL TYPE PARKER GREASE TYPE #1 MODEL NUMBER G1. LITHIUM HYDROXYSTAERATE SOAP BASE CONTAINING ADDITIVES TO ENHANCE OXIDATION RESISTANCE AND RUST PROTECTION (VISCOSITY, 70/80 cST AT 100 DEGREES C) IS RECOMMENDED FOR GREASE LUBRICATION	
OIL APPEARANCE BLUE AND VERY TACKY	
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BEARING MAINTENANCE THE WORM SHAFT BEARINGS AND MAIN BEARING ARE LUBRICATED AT THE FACTORY FOR LIFE OF THE SYSTEM. THE WORM GEAR MESH IS ALSO LUBRICATED AT THE FACTORY PRIOR TO SHIPMENT. TO INSURE LONG SERVICE AND PERFORMANCE TO SPECIFICATIONS, IT IS ESSENTIAL TO KEEP THE POSITIONERS GEAR MESH LUBRICATED. INSPECT FOR NOISE OR VIBRATION AND REPLENISH LUBRICATION ACCORDING TO INSPECTION RESULTS. THE NATURE OF THE APPLICATION IN CONSIDERATION OF VARIABLES SUCH AS ENVIRONMENT, DUTY CYCLES, SPEED, ETC., WILL DETERMINE THE RE-LUBRICATE INTERVAL. IN GENERAL IT IS DESIRABLE TO LUBRICATE THE SYSTEM APPROXIMATELY EVERY 500 HOURS OF OPERATION	
SECTION III	
LUBE APPLICATION UTILIZING GREASE FITTINGS LOCATED ON THE SIDE OF THE TABLE, APPLY GREASE AND ROTATE THE TABLE TOP COUNTER CLOCKWISE ALLOWING THE GREASE TO FLOW INTO THE MESH. EXCESSIVE LUBRICATION WILL FORCE GREASE OUT UNDER THE TABLE TOP. EXCESSIVE GREASE WILL NOT HARM THE TABLE AND FORCE GREASE INTO THE MESH AREA FOR LIMITED TRAVEL APPLICATIONS	
SECTION IV	
NOTES CAUTION: DO NOT USE/MIX PETROLEUM BASE GREASES WITH SYNTHETIC BASE GREASES AT ANY TIME. FOR LUBRICATION UNDER SPECIAL OR SEVERE CONDITIONS CONSULT THE FACTORY	



PARKER HANNIFIN CORPORATION

BEARING LUBRICATION SHEET

SECTION I	
SUPPLIER'S NAME PARKER HANNIFIN CORPORATION	TELEPHONE NO. 1-800-245-6903 OR (724) 861-8200
ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
BEARING TYPE RADIAL BEARING (BALL AND LEAD SCREW END BEARINGS—DUPLEX BEARINGS)	
OIL TYPE PARKER GREASE TYPE #2 MODEL NUMBER G2. MOBILITH AW2, LITHIUM 12 HYDROXY	
OIL APPEARANCE DARK BROWN AND VERY TACKY	
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BEARING MAINTENANCE ALL RADIAL BEARINGS ARE PACKED AT THE FACTORY FOR THE LIFE OF THE BEARING	
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PARKER HANNIFIN CORPORATION

BALL SCREW LUBRICATION SHEET

SECTION I	
SUPPLIER'S NAME PARKER HANNIFIN CORPORATION	TELEPHONE NO. 1-800-245-6903 OR (724) 861-8200
ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
DRIVE SCREW TYPE ROLLED BALL SCREW	
OIL TYPE PARKER GREASE TYPE #1 MODEL NUMBER G1. LITHIUM 12 HYDROXYSTEARATE SOAP BASE CONTAINING ADDITIVES TO ENHANCE OXIDATION RESISTANCE AND RUST PROTECTION (VISCOSITY, 70/80 cST AT 100 DEGREES C) IS RECOMMENDED FOR GREASE LUBRICATION AND ISO GRADE 32-100 FOR OIL LUBRICATION	
OIL APPEARANCE BLUE AND VERY TACKY	
SECTION II	
SCREW MAINTENANCE NUT PACKAGES ARE LUBRICATED AT OUR FACILITY PRIOR TO SHIPMENT. FOR LUBRICATION INSPECTION AND SUPPLY INTERVALS FOLLOWING SHIPMENT, APPLY GREASE 1000 HOURS AFTER INITIAL START-UP OPERATIONS. INSPECT FOR CONTAMINATION, CHIPS, ETC. AND REPLENISH ACCORDING TO INSPECTION RESULTS THE NATURE OF THE APPLICATION IN CONSIDERATION OF VARIABLES SUCH AS ENVIRONMENT, DUTY CYCLES, SPEED, ETC. WILL DETERMINE THE INSPECTION AND RE-LUBRICATION INTERVAL. IN GENERAL, IT IS DESIRABLE TO LUBRICATE THE LEAD SCREW APPROXIMATELY EVERY 1000 HOURS OF OPERATION	
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NOTES CAUTION: DO NOT USE/MIX PETROLEUM BASE GREASE WITH SYNTHETIC BASE GREASE AT ANY TIME. FOR LUBRICATION UNDER SPECIAL OR SEVERE CINDITIONS CONSULT THE FACTORY	



PARKER HANNIFIN CORPORATION

BALL SCREW LUBRICATION SHEET

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ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
DRIVE SCREW TYPE STANDARD OR PRECISION GROUND BALL SCREW	
OIL TYPE SHELL ALVANIA GREASE RL2. LITHIUM SOAP THICKENED GREASE, INHIBITED WITH ADDITIVES THAT PROMOTE LONG SERVICE LIFE AND PROVIDE EXCELLENT LUBRICATION AND CORROSION PROTECTION FOR MORE INFORMATION CALL SHELL AT 1-800-840-5737 OR LOOK ONLINE AT HTTP://WWW.SHELL-LUBRICANTS.COM/	
OIL APPEARANCE AMBER AND SMOOTH	
SECTION II	
SCREW MAINTENANCE NUT PACKAGES ARE LUBRICATED AT OUR FACILITY PRIOR TO SHIPMENT. FOR LUBRICATION INSPECTION AND SUPPLY INTERVALS FOLLOWING SHIPMENT, APPLY GREASE 1000 HOURS AFTER INITIAL START-UP OPERATIONS. INSPECT FOR CONTAMINATION, CHIPS, ETC. AND REPLENISH ACCORDING TO INSPECTION RESULTS THE NATURE OF THE APPLICATION IN CONSIDERATION OF VARIABLES SUCH AS ENVIRONMENT, DUTY CYCLES, SPEED, ETC. WILL DETERMINE THE INSPECTION AND RE-LUBRICATION INTERVAL. IN GENERAL, IT IS DESIRABLE TO LUBRICATE THE LEAD SCREW APPROXIMATELY EVERY 1000 HOURS OF OPERATION	
SECTION III	
LUBE APPLICATION WIPE THE SCREW DOWN THE ENTIRE LENGTH WITH A CLEAN CLOTH. APPLY LUBRICATION ON THE SCREW ALLOWING A FILM OF FRESH GREASE TO PASS UNDER THE WIPERS AND INTO THE RECIRCULATING BEARINGS. FOR EXTREME WORKING CONDITIONS SPECIAL GREASE LINES CAN BE ADDED TO THE SYSTEM. A LINE CAN TRANSFER GREASE INTO THE SYSTEM VIA THE THREADED HOLE IN THE NUT. IF GREASE LINES WERE NOT ORDERED & THE WIPE ON METHOD PROVES TO BE INSUFFICIENT, REMOVE THE ONE SCREW THAT HOLDS THE CARRIAGE TO THE NUT BRACKET. SLIDE THE CARRIAGE BACK. ON THE SIDE OF THE NUT IS A THREADED HOLE SUITABLE FOR A GREASE FITTING. PUMP THE NUT FULL OF GREASE AND RE-ATTACH THE NUT BRACKET TO THE CARRIAGE. <i>CAUTION: CONSULT THE FACTORY FOR SPECIAL GREASE SUPPLY LINES AND NUT REMOVAL</i>	
SECTION IV	
NOTES CAUTION: DO NOT USE/MIX PETROLEUM BASE GREASE WITH SYNTHETIC BASE GREASE AT ANY TIME. FOR LUBRICATION UNDER SPECIAL OR SEVERE CINDITIONS CONSULT THE FACTORY	



PARKER HANNIFIN CORPORATION

LEAD SCREW LUBRICATION SHEET

SECTION I	
SUPPLIER'S NAME PARKER HANNIFIN CORPORATION	TELEPHONE NO. 1-800-245-6903 OR (724) 861-8200
ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
DRIVE SCREW TYPE LEAD SCREW WITH A PLASTIC NUT	
OIL TYPE PARKER GREASE TYPE #2, MODEL NUMBER A2. LIGHT MACHINE OIL WITH TEFLON	
OIL APPEARANCE LIGHT YELLOW, FLUID, WITH WHITE RESIDUE AT BOTTOM	
SECTION II	
SCREW MAINTENANCE <p>NUT PACKAGES ARE LUBRICATED AT OUR FACILITY PRIOR TO SHIPMENT. FOR LUBRICATION INSPECTION AND SUPPLY INTERVALS FOLLOWING SHIPMENT, APPLY GREASE 1000 HOURS AFTER INITIAL START-UP OPERATIONS. INSPECT FOR CONTAMINATION, CHIPS, ETC. AND REPLENISH ACCORDING TO INSPECTION RESULTS</p> <p>THE NATURE OF THE APPLICATION IN CONSIDERATION OF VARIABLES SUCH AS ENVIRONMENT, DUTY CYCLE, SPEED, ETC. WILL DETERMINE THE INSPECTION AND RE-LUBRICATION INTERVAL. IN GENERAL, IT IS DESIRABLE TO LUBRICATE THE LEAD SCREW APPROXIMATELY EVERY 1000 HOURS OF OPERATION</p>	
SECTION III	
LUBE APPLICATION <p>DRIVE THE CARRIAGE TOP AWAY FROM THE MOTOR END TO GET A FULL VIEW OF THE SCREW. WIPE THE SCREW DOWN THE ENTIRE LENGTH WITH A CLEAN CLOTH. APPLY LUBRICATION ON THE SCREW ALLOWING A FILM OF FRESH OIL TO PASS OVER THE ENTIRE LENGTH OF THE LEAD SCREW.</p>	
SECTION IV	
NOTES <p>TUBE MUST BE SHAKEN BEFORE APPLICATION</p>	



PARKER HANNIFIN CORPORATION

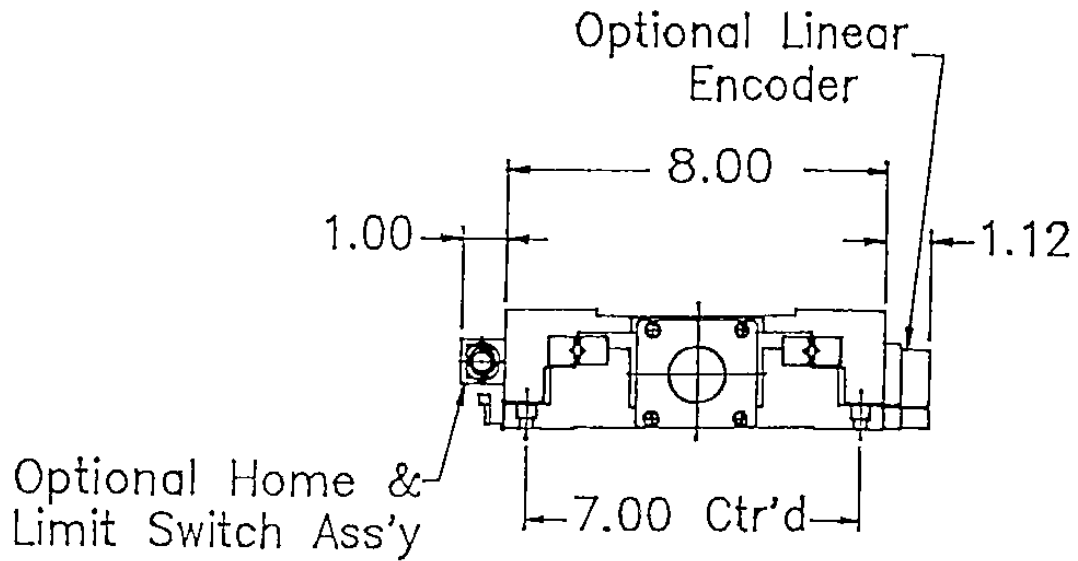
LEAD SCREW LUBRICATION SHEET

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ADDRESS (Number, Street, City and ZIP code) 1140 SANDYHILL ROAD, IRWIN, PA 15642	FAX NO'S (724)861-3330 OR (724)861-3331
DRIVE SCREW TYPE LEAD SCREW WITH A PHOSPHORUS BRONZE NUT	
OIL TYPE PARKER GREASE TYPE #3, MODEL NUMBER A3. LIGHT MACHINE OIL.	
OIL APPEARANCE CLEAR FLUID	
SECTION II	
SCREW MAINTENANCE <p>NUT PACKAGES ARE LUBRICATED AT OUR FACILITY PRIOR TO SHIPMENT. FOR LUBRICATION INSPECTION AND SUPPLY INTERVALS FOLLOWING SHIPMENT, APPLY GREASE 1000 HOURS AFTER INITIAL START-UP OPERATIONS. INSPECT FOR CONTAMINATION, CHIPS, ETC. AND REPLENISH ACCORDING TO INSPECTION RESULTS</p> <p>THE NATURE OF THE APPLICATION IN CONSIDERATION OF VARIABLES SUCH AS ENVIRONMENT, DUTY CYCLE, SPEED, ETC. WILL DETERMINE THE INSPECTION AND RE-LUBRICATION INTERVAL. IN GENERAL, IT IS DESIRABLE TO LUBRICATE THE LEAD SCREW APPROXIMATELY EVERY 1000 HOURS OF OPERATION</p>	
SECTION III	
LUBE APPLICATION <p>DRIVE THE CARRIAGE TOP AWAY FROM THE MOTOR END TO GET A FULL VIEW OF THE SCREW. WIPE THE SCREW DOWN THE ENTIRE LENGTH WITH A CLEAN CLOTH. APPLY LUBRICATION ON THE SCREW ALLOWING A FILM OF FRESH OIL TO PASS OVER THE ENTIRE LENGTH OF THE LEAD SCREW.</p>	
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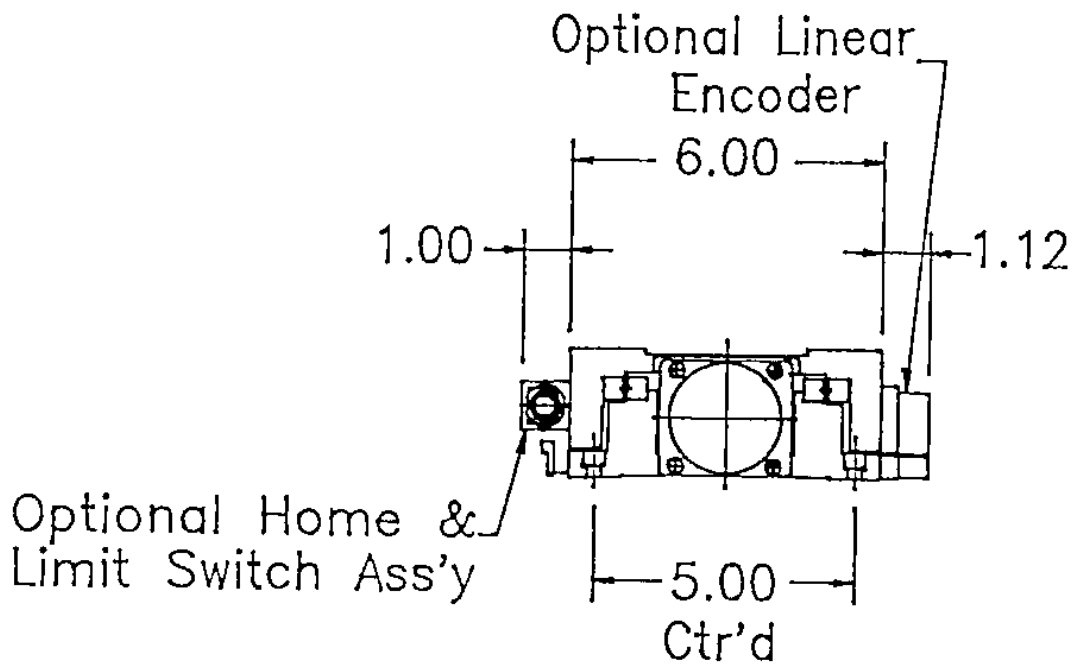


EXAMPLE OF ENCODERS AND LIMIT/HOME SWITCH ASSEMBLY

806000 SERIES



808000 SERIES



STANDARD OPTIONS—LH (Magnetic Limit and Home Switches)

- **Mounting and Adjustment**

- * Remove three (3) each flat head screws, one (1) on top, two (2) on opposite side cover. Then the cover will slide off of the bracket. (NOTE: slide away from connector).
- * Counter bored holes in bracket. These holes are to be used to mount to predrilled and tapped holes in slide top. (NOTE: Hole may be covered by switch).
- * Each switch has two (2) 4-40 button head screws. Loosen both. Do not remove. Slide switch into position. Tighten screws.
- * The magnet height may require adjustment for the proper switch operation. This can be accomplished by the adjusting slots located on the magnet.

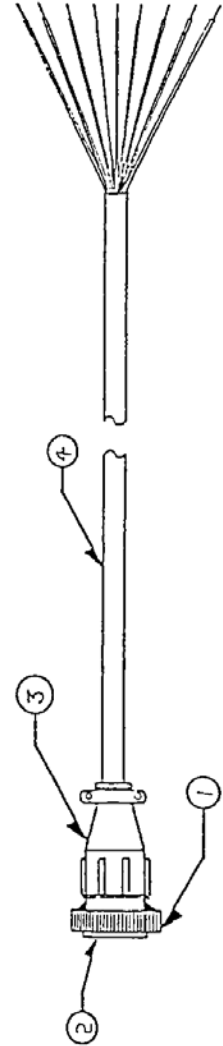
- **Switch Specifications**

- * Electrical: Form C, 0.25 A @ 120 VAC; 0.25 A @ 28VDC
- * Repeatability: .002 in
- * Connector: 9 pin, AMP circular plastic; Mating connector AMP #206485-1; Contact sockets AMP #66504-8; Strain Relief AMP # 206062-1
- * Mating Cable: with pigtailed end (one per LH assembly), PN 006-1102-10

Pin Number	Function	Typical Wire Color
1	CW Limit, normally open	Red
2	CW Limit, normally closed	Blue
3	CW Limit, common	White
4	CCW Limit, normally open	Yellow
5	CCW Limit, normally closed	Orange
6	CCW Limit, common	Green
7	Home, normally open	Purple
8	Home, normally closed	Brown
9	Home, common	Black

REVISIONS		DATE	APPROVED
ZONE	REV	DESCRIPTION	

NOTE:
 1). NUMBER THAT FOLLOWS THE PART NUMBER INDICATES CABLE LENGTH IN FEET. EX: 006-1102-15 IS A 15 FT. CABLE.
 2). MAXIMUM CABLE LENGTH IS 50 FT.
 3). SHIELD WIRE IS TO BE CONNECTED TO CHASSIS GROUND.
WARNING: DO NOT CONNECT SHIELD WIRE TO LOGIC GROUND.



COLOR CODE FOR PIGTAIL		
PIN #	DESCRIPTION	WIRE COLOR
---	LIMIT + (N.O.)	RED
---	LIMIT + (N.C.)	BLUE
---	LIMIT + (COM.)	WHITE
---	LIMIT - (N.O.)	YELLOW
---	LIMIT - (N.C.)	ORANGE
---	LIMIT - (COM.)	GREEN
---	HOME (N.O.)	PURPLE
---	HOME (N.C.)	BROWN
---	HOME (COM.)	BLACK
---	SHIELD	BARE

COLOR CODE FOR ITEM #1		
PIN #	DESCRIPTION	WIRE COLOR
1	LIMIT + (N.O.)	RED
2	LIMIT + (N.C.)	BLUE
3	LIMIT + (COM.)	WHITE
4	LIMIT - (N.O.)	YELLOW
5	LIMIT - (N.C.)	ORANGE
6	LIMIT - (COM.)	GREEN
7	HOME (N.O.)	PURPLE
8	HOME (N.C.)	BROWN
9	HOME (COM.)	BLACK

GR-4	GR-3	GR-2	GR-1	PART OR IDENTIFYING NO.	DESCRIPTION	SPEC.	MATERIAL OR NOTE	ITEM NO.		
QUANTITY					LIST OF MATERIAL					
UNLESS OTHERWISE SPECIFIED					<p>THE INFORMATION CONTAINED HEREIN IS HEREBY MADE AVAILABLE TO THE PUBLIC AND FOR THE PURPOSES OF PATENT INQUIRY AND FOR THE PURPOSES OF FEDERAL AGENCY INFORMATION SERVICES. IT CANNOT BE LEGALLY REPRODUCED BY ANY OTHER MEANS WITHOUT THE EXPRESS WRITTEN PERMISSION OF THE NATIONAL ARCHIVE. OTHER THAN THAT WHICH IT HAS BEEN MADE AVAILABLE TO YOU WITHOUT THE EXPRESS WRITTEN CONSENT OF PARKER INVENTRY DAEDAL DIVISION</p>	<p>DAEDAL MAGNETIC LIMIT/HOME SWITCH CABLE PIGTAIL ENDED</p>				
DIMENSIONS ARE IN INCHES				DATE					SCALE	REV
FRACTIONS TO DECIMALS ON				7/23/51					A	1
0 TO 2 1/32 3 TO 4 1/16 5 AND UP +1/8				DRAWN <i>M. M. M.</i> CHECKED DESIGN ENGRG APPD APPD					FULL REPRO 1 OF 1	REV ~
REMOVE BURRS, BREAK SHARP EDGES MATERIAL										
FINISH										

STANDARD OPTIONS—LH (Magnetic Limit and Home Switches)

- ***Mounting and Adjustment***

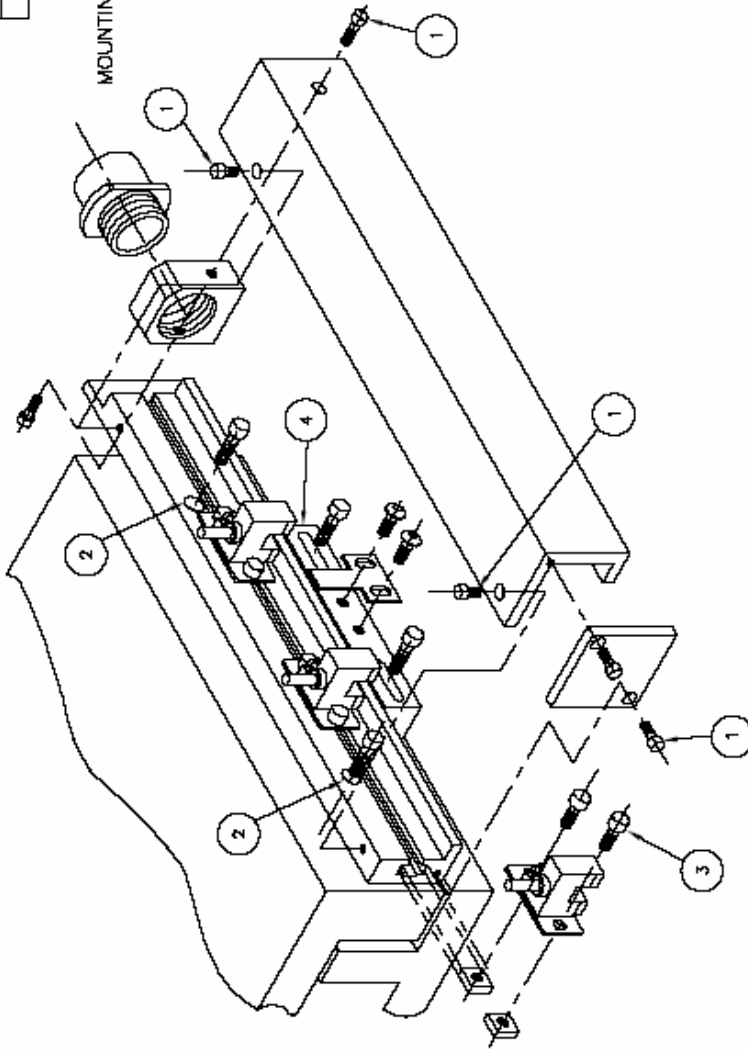
- * See the following pages for a diagram of the assembly

- ***Switch Specifications***

- * Input: 5 VDC, 120 mA
- * Output: 5 V, 20 mA (each), TTL outputs
- * Repeatability: .0002 in
- * Connector: 9 pin, AMP circular plastic; Mating connector AMP #206485-1; Contact sockets AMP #66504-8; Strain Relief AMP # 206062-1
- * Mating Cable: with pigtailed end (one per LH0 assembly), P/N 006-1288-10

Pin Number	Function	Typical Wire Color
1	5-24 VDC, 0.120 amp input	Red
2	Ground	Black
3	Home, normally high	Green
4	Home, normally low	Brown
5	Keying Plug	N/A
6	CW Limit, normally high	White
7	CW Limit, normally low	Blue
8	CCW Limit, normally high	Yellow
9	CCW Limit, normally low	Orange

REVISIONS		
REV	DESCRIPTION	DATE
1	INITIAL RELEASE	~

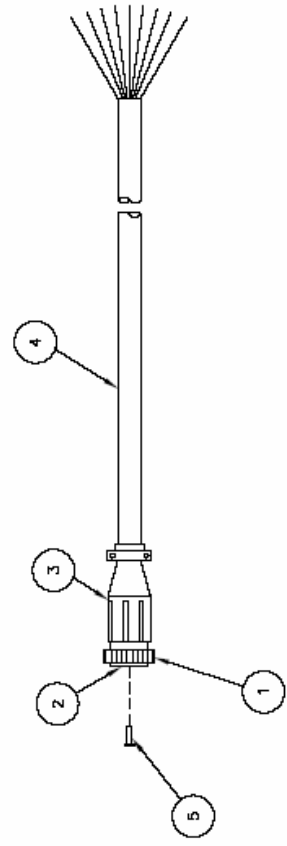


MOUNTING & ADJUSTING OPTICAL LIMIT & HOME SWITCHES

1. REMOVE 4 SOCKET HEAD SCREWS:
2 ON TOP, 1 ON END, 1 ON SIDE
2. C-BORED HOLES IN BRACKET, THESE HOLES TO BE USED TO MOUNT TO PRE-DRILLED & TAPPED HOLES IN SLIDE TOP. (HOLES MAY BE COVERED BY SWITCHES)
3. EACH SWITCH HAS (2) #4-40 SOCKET HEAD SCREWS. LOOSEN BOTH; DO NOT REMOVE. SLIDE SWITCH INTO POSITION. TIGHTEN SCREWS.
4. VANE BRACKET MOUNTS TO PRE-DRILLED & TAPPED HOLES IN BASE OF SLIDE. THIS BRACKET MAY HAVE TO BE ADJUSTED TO GET LIMIT SWITCHES TO ACTIVATE AT EXTREME ENDS OF TRAVEL

<p>ALL PARTS AND ASSEMBLIES TO BE MANUFACTURED PER PARKER HANNIFIN DAEDAL DIVISION SPECIFICATIONS</p>			DAEDAL Division Automation	Manual & Motorized Positioning Systems
<p>STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED</p>	<p>ALL PARTS AND ASSEMBLIES TO BE MANUFACTURED PER PARKER HANNIFIN DAEDAL DIVISION SPECIFICATIONS</p>	<p>THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF PARKER HANNIFIN DAEDAL DIVISION. IT CANNOT BE LOANED, REPRODUCED, COPIED, EITHER WHOLLY OR IN PART, OR USED FOR ANY PURPOSES OTHER THAN THAT WHICH IT HAS BEEN MADE AVAILABLE TO YOU WITHOUT THE EXPRESS WRITTEN CONSENT OF PARKER HANNIFIN DAEDAL DIVISION.</p>	DRAWN: DJB CHECKED: [] DESIGN: [] ENGINEERING: [] MANUFACTURING: [] QUALITY ASSURANCE: [] ASSEMBLY: []	DATE: 3/22/06
<p>IMPERIAL UNITS ALL DIMENSIONS IN INCHES (UNLESS OTHERWISE SPECIFIED)</p>	<p>DECIMALS: X ± .02 XX ± .01 XXX ± .005 XXXX ± .001</p>	<p>ALL THREADS TO BE: UNC-2A DR 2B (COARSE) UNF-2A DR 2B (FINE)</p>	<p>FINISH: RNS FINISH ANGLES ±0 30°</p>	OPTICAL H/L SWITCH ADJUSTMENT ASS'Y
<p>REFERENCE DRAWINGS</p>	<p>CHAMFERS: 45° ± .02 RADI: .02 R.</p>	<p>REMOVE BURRS. BREAK SHARP EDGES</p>	<p>MATERIAL</p>	AutoCad DRAWING: B 006-2065
<p>ASSY or KSPER No.:</p>	<p>SALES ORDER No.:</p>	<p>FILE NAME:</p>	<p>MADE FROM(FILE):</p>	SCALE: NONE REPR: [] SHEET 1 OF 1 REV. 1

REVISIONS		
REV	DESCRIPTION	DATE



NOTE:
 1. NUMBER THAT FOLLOWS THE PART NUMBER INDICATES CABLE LENGTH IN FEET. EX: 00B-XXXX-15 IS A 15 FT. CABLE.
 2. MAXIMUM CABLE LENGTH 50 FT.
 3. SHIELD WIRE IS TO BE CONNECTED TO CHASSIS GROUND. WARNING DO NOT CONNECT SHIELD WIRE TO LOGIC GROUND!

DESCRIPTION	WIRE COLOR
+5 VDC	RED
DC GROUND	BLACK
HOME (N.O.)	GREEN
HOME (N.C.)	BROWN
CW LIMIT (N.O.)	WHITE
CW LIMIT (N.C.)	BLUE
CCW LIMIT (N.O.)	YELLOW
CCW LIMIT (N.C.)	ORANGE
SHIELD	BARE

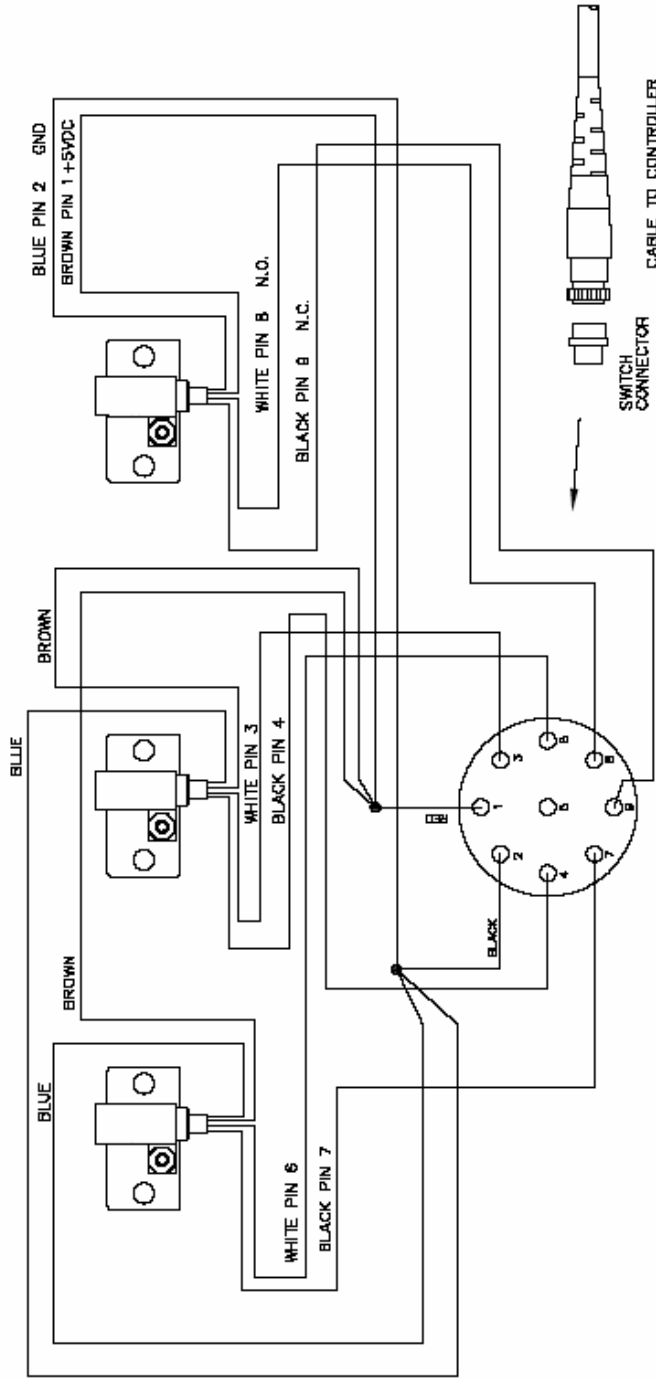
PIN NO.	DESCRIPTION	WIRE COLOR
1	+5 VDC	RED
2	GROUND	BLACK
3	HOME (N.O.)	GREEN
4	HOME (N.C.)	BROWN
5	KEYING PLUG	
6	CW LIMIT (N.O.)	WHITE
7	CW LIMIT (N.C.)	BLUE
8	CCW LIMIT (N.O.)	YELLOW
9	CCW LIMIT (N.C.)	ORANGE

* +5 VDC POWER SUPPLY
 200mA MINIMUM

IMPERIAL UNITS ALL DIMENSIONS IN INCHES (UNLESS OTHERWISE SPECIFIED)		ALL PARTS AND ASSEMBLIES TO BE MANUFACTURED PER PARKER HANNIFIN DAEDAL DIVISION P51000 SPECIFICATIONS	
ALL THREADS TO BE: UNC-2A OR 2B (COARSE) UNF-2A OR 2B (FINE)	STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED	THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF PARKER HANNIFIN DAEDAL DIVISION. IT IS TO BE USED FOR THE PURPOSES SPECIFIED ONLY AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE EXPRESS WRITTEN PERMISSION OF PARKER HANNIFIN DAEDAL DIVISION.	Parker Automation DAEDAL Division Manual & Motorized Positioning Systems
REFERENCE DRAWINGS	DECIMALS X .02 XX ±.01 XXX ±.005 XXXX ±.0005	RMS FINISH 63	OPTICAL L/H SWITCH CABLE PIGTAIL ENDED
ASST or NSFR No.:	ANGLES ±0°30'	RADI: .02 R.	MCM 5-7-91
SALES ORDER No.:	REMOVE BURRS, BREAK SHARP EDGES	FINISH	MCM 5-7-91
FILE NAME:	MATERIAL	ENGINEERING	AutoCad DRAWING B 006-1288
MADE FROM(FILE):	FINISH	MANUFACTURING	SCALE: NTS
		SUBMITTANCE	REPRD: SHIT. 1 OF 1
		ASSEMBLY	REV. ~

REVISIONS		
REV	DESCRIPTION	DATE
1	INITIAL RELEASE	2
		2

SINGLE BRACKET 36" OR LESS



SPLICE ALL 3 BROWN WIRES TO A 2" LONG RED WIRE. COVER SPLICE WITH HEATSHRINK.

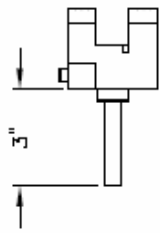
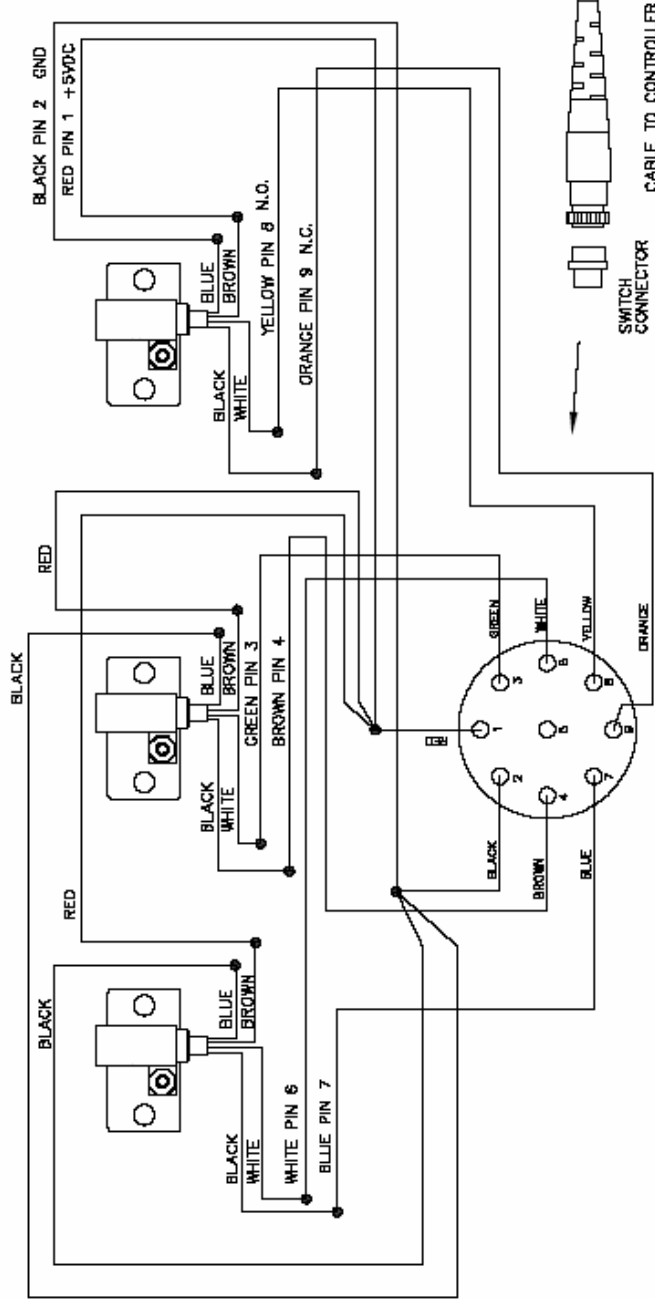
SPLICE ALL 3 BLUE WIRES TO A 2" LONG BLACK WIRE. COVER SPLICE WITH HEATSHRINK.

ALL WIRE 28 AWG

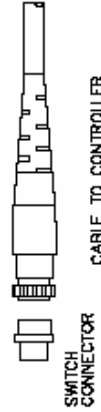
<p>ALL PARTS AND ASSEMBLIES TO BE MANUFACTURED PER PARKER HANNIFIN DAEDAL DIVISION P51000 SPECIFICATIONS</p> <p>THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF PARKER HANNIFIN DAEDAL DIVISION. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE EXPRESS WRITTEN CONSENT OF PARKER HANNIFIN DAEDAL DIVISION.</p>		<p>DAEDAL Division Automation</p> <p>Manual & Motorized Positioning Systems</p>															
<p>IMPERIAL UNITS</p> <p>ALL DIMENSIONS IN INCHES (UNLESS OTHERWISE SPECIFIED)</p> <p>ALL THREADS TO BE: UNC-2A OR 2B (COARSE) UNF-2A OR 2B (FINE)</p>	<p>STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED</p> <table border="1"> <tr> <td>DECIMALS</td> <td>FRACTIONS</td> <td>ANGLES</td> </tr> <tr> <td>X ±.02</td> <td>3/32</td> <td>±0°30'</td> </tr> <tr> <td>XX ±.01</td> <td></td> <td></td> </tr> <tr> <td>XXX ±.005</td> <td></td> <td></td> </tr> <tr> <td>XXXX ±.0025</td> <td></td> <td></td> </tr> </table> <p>CHAMFERS: 45° x .02 RADIUS: .02 R.</p> <p>REMOVE BURRS, BREAK SHARP EDGES</p> <p>MATERIAL</p> <p>FINISH</p>	DECIMALS	FRACTIONS	ANGLES	X ±.02	3/32	±0°30'	XX ±.01			XXX ±.005			XXXX ±.0025			<p>DAEDAL Division Automation</p> <p>Manual & Motorized Positioning Systems</p>
DECIMALS	FRACTIONS	ANGLES															
X ±.02	3/32	±0°30'															
XX ±.01																	
XXX ±.005																	
XXXX ±.0025																	
<p>REFERENCE DRAWINGS</p> <p>ASSY OR NSPER No:</p> <p>SALES ORDER No:</p> <p>FILE NAME:</p> <p>MADE FROM(FILE):</p>	<p>DRAWN: DJB</p> <p>CHECKED: 3/22/86</p> <p>DESIGN:</p> <p>ENGINEERING:</p> <p>MANUFACTURING:</p> <p>QUALITY ASSURANCE:</p> <p>ASSEMBLY:</p>	<p>OPTICAL LIMIT INTERCONNECTION DIAGRAM</p> <p>AutoCad DRAWING B 006-2066</p> <p>SCALE: NONE</p> <p>REFS: BHT. 1 OF 2</p> <p>REV. 1</p>															

MULTIPLE BRACKET OVER 36"

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
1	INITIAL RELEASE	2	2



CUT CABLE ON SWITCH
3" SPLICE WIRES PER
DIAGRAM. COVER EACH
SPLICE WITH HEATSHRINK.
CUT INDIVIDUAL WIRES AS
LONG AS THE BRACKETS.



ALL WIRE 28 AWG

SPLICE ALL 3 RED
WIRES TO A 2" LONG
RED WIRE. COVER SPLICE
WITH HEATSHRINK.

SPLICE ALL 3 BLACK
WIRES TO A 2" LONG
BLACK WIRE. COVER
SPLICE WITH HEATSHRINK.

IMPERIAL UNITS		ALL PARTS AND ASSEMBLIES TO BE MANUFACTURED PER PARKER HANNIFIN DAEDAL DIVISION PS1000 SPECIFICATIONS	
ALL DIMENSIONS IN INCHES (UNLESS OTHERWISE SPECIFIED)		THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF PARKER HANNIFIN CORPORATION. IT IS TO BE REPRODUCED IN ANY FORM OR BY ANY MEANS WITHOUT THE WRITTEN PERMISSION OF PARKER HANNIFIN CORPORATION. ANY OTHER USE IS PROHIBITED. THIS DRAWING IS THE PROPERTY OF PARKER HANNIFIN CORPORATION.	
DECIMALS	±.02	ANGLES	±0°30'
FRACTIONS	±.005	RADI	±.02 R.
CHAMFERS	45° x .02	CHECKED	DJB 3/22/06
REMOVE BURRS, BREAK SHARP EDGES		DESIGN	
MATERIAL		ENGINEERING	
FINISH		MANUFACTURING	
MADE FROM(FILE):		QUALITY ASSURANCE	
		ASSEMBLY	

Parker Automation		DAEDAL Division	
Manual & Motorized Positioning Systems		OPTICAL LIMIT INTERCONNECTION DIAGRAM	
AutoCad DRAWING	B	006-2066	
ENGINE NAME	REFER	REV. 2 OF 2	REV. 1

STANDARD OPTIONS—Linear Encoders)

- ***ELE Specifications***

- * Max Resolution with quadrature: 0.0001 in
- * Non cumulative Accuracy: 0.0004 in
- * Maximum Speed: 15 in/sec
- * Input: 5 VDC @ 220 mA
- * Output: Differential, TTL compatible, RS422 line Drive, 40 mA sink and –40 mA source

- ***ELM Specifications***

- * Max Resolution with quadrature: 0.001 mm
- * Non cumulative Accuracy: 0.010 mm
- * Maximum Speed: 380 mm/sec
- * Input: 5 VDC @ 220 mA
- * Output: Differential, TTL compatible, RS422 line Drive, 40 mA sink and –40 mA source

- ***Encoders***

- * Motor mounted rotary encoders are also available

SPECIFICATION DEFINITIONS

Load Capacity:

The maximum load or weight that a positioning device can support without causing excessive wear or damage to the device. The load capacities stated are based on loads positioned over the bearings, not cantilevered.

Repeatability:

Once a positioning device moves away from a specific point or position, "repeatability" defines how accurately it can repeat, or return to that original position. Repeatability specifications in this manual are for tables only, and exclude motor and encoder effects on repeatability.

Resolution:

The smallest attainable increment of adjustment or positioning. With a manually adjusted positioner, resolution is defined as the smallest movement achievable by controlled rotation of the adjustment screw or micrometer.

Straight Line Accuracy (Straightness and Flatness of Travel):

In theory, a linear slide or stage moves along its axis of travel in a perfectly true straight line. In reality, the actual travel path deviates from the true straight line and flat line in both the horizontal and vertical directions, respectively. Straight and flat line accuracy is defined as the maximum distance that the travel path deviates from the theoretical straight line in either plane, measured from the moving carriage surface center. Specifications for straight line accuracy are for overall travel maximum deviations, and include yaw, pitch, and roll error when measured 2" above the table surface mount.

Concentricity:

In theory, as a table rotates, any point on the surface of the table should travel along a path that forms a perfect circle. In reality, the actual path of travel will deviate from the perfectly true circle. Concentricity defines the maximum difference between a true circle and the actual circular path formed by the rotating point.

Runout (Wobble):

As a rotary table rotates, any point of the surface of the table should remain within a perfectly flat plane that is perpendicular to the axis of rotation. Table runout describes the maximum distance that a point will deviate from that plane.

SPECIFICATION DEFINITIONS (continued)

Table Specifications:

Table specifications in this manual apply to single axis tables only. When one or more positioning tables are integrated with motors, drives and controls, any one component can affect the system specifications.

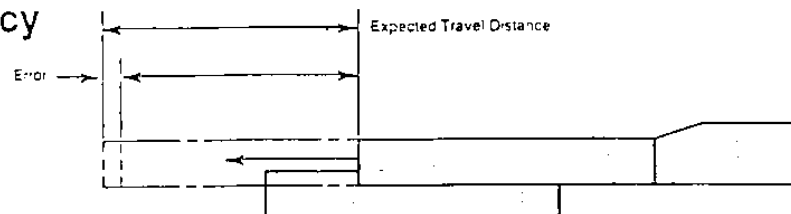
Yaw, Pitch, and Roll:

Yaw, pitch, and roll are terms used to describe angular movement (error) found in all linear table travel. The illustrations on the following page shows how these elements affect straight line and positional accuracy. Flatness of travel is also affected, but is insignificant in most applications.

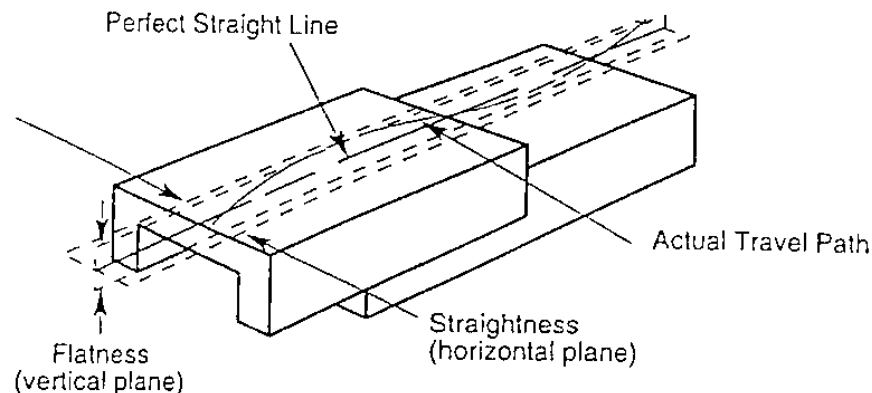
Positional Accuracy:

When ever a motorized positioning table is commanded to travel a desired distance (from one point to another) it should, theoretically move that exact distance and then stop. Positional accuracy is defined as: the maximum allowable difference (error) between the expected travel distance, and the actual travel distance measured 2" above the moving carriage surface center. Positional accuracy specifications include pitch and yaw error for standard center drive tables. Positional accuracy stated, is for tables only, effects of motors and encoders are not included. Positional accuracy specifications are for overall travel maximum deviation defined by the least squares method described on [page 26](#).

Positional Accuracy



Straight Line Accuracy



SPECIFICATION DEFINITIONS (continued)

Inch/inch Specification

The inch/inch specification is used *only* to determine the mean travel deviation **E**, as determined by the least squares method. The inch/inch specification is *not* used to determine a maximum bandwidth deviation.

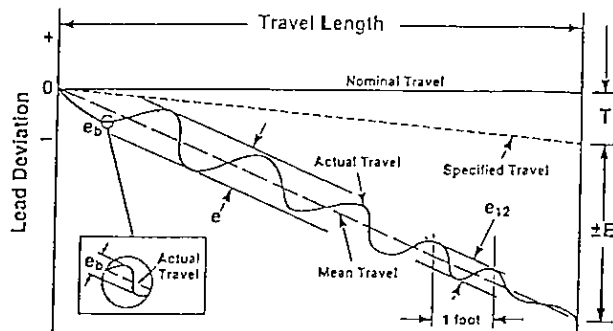
Example: Precision Grade Ball Screw with 4 " of travel
 = 80 micro inches/inch
 = 600 micro inches/foot
E = 320 micro inches

Inch/foot Specification

The inch/foot specification e_{12} is used to determine the maximum bandwidth deviation in a given foot from the mean travel deviation **E**. The inch/foot specification is also used to determine **E** when the inch/inch values in a given foot exceeds the inch/foot values.

Example: Precision Grade Ball Screw with 8" of travel
 = 80 micro inches/inch
 = 600 micro inches/foot
E = 600 micro inches

Example: Precision Grade Ball Screw with 14 " of travel
 = 80 micro inches/inch
 = 600 micro inches/foot
E = 760 micro inches



e Maximum bandwidth deviation for overall travel from mean travel deviation **E**.

E Mean travel deviation is obtained by the least squares method. See the inch/inch and inch/foot definition to determine **E** values. To determine worst case overall travel deviation from specified travel, use **E** for 800 000 Series catalog table as an example.

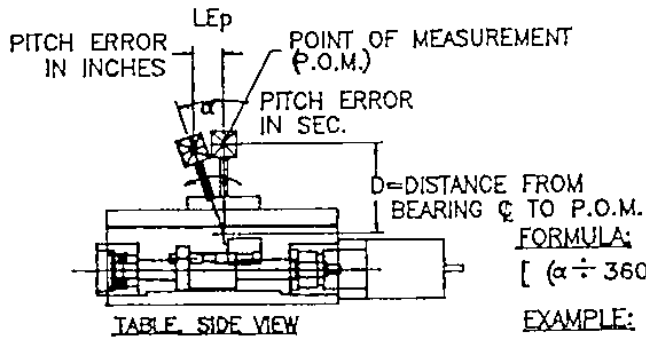
e_b Deviations per revolution normally seen by the screw and bearing combined.

T Values selected by the customer to compensate for elongation caused by temperature changes or external loads. This value is normally set at zero and neglected in most cases.

Notes: Measurements made with screw and assembly at 68°F.

Operating Manual

PITCH ERROR AND ITS EFFECTS ON LINEAR ACCURACY

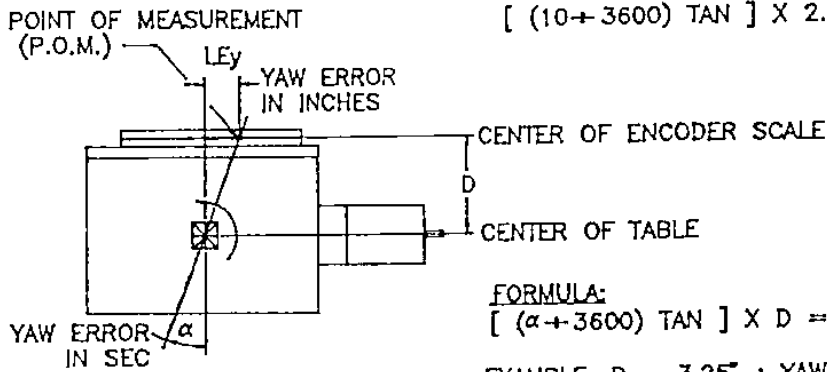


FORMULA:

$$[(\alpha \div 3600) \text{TAN}] \times D = LE_p$$

EXAMPLE: D = 2.5" ; PITCH ERROR = 10 SEC.

$$[(10 \div 3600) \text{TAN}] \times 2.5 = .00012 (3.1\mu)$$



YAW ERROR AND ITS EFFECTS ON LINEAR ACCURACY

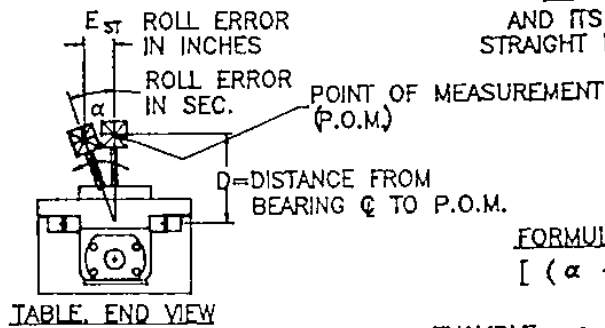
FORMULA:

$$[(\alpha \div 3600) \text{TAN}] \times D = LE_y$$

EXAMPLE: D = 3.25" ; YAW ERROR = 10 SEC.

$$[(10 \div 3600) \text{TAN}] \times 3.25 = .000157 (4.04\mu)$$

ROLL ERROR AND ITS EFFECTS ON STRAIGHT LINE ACCURACY

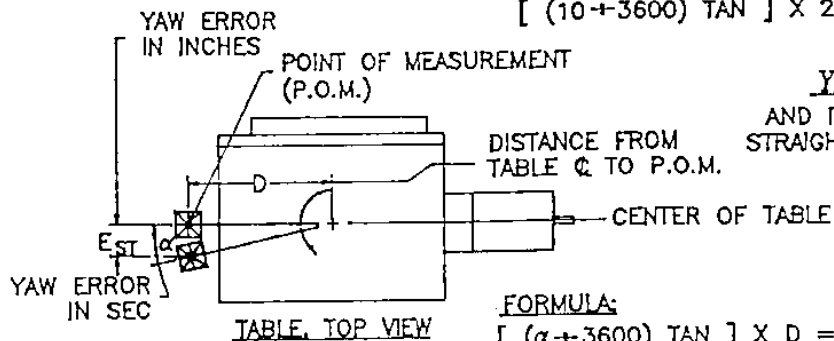


FORMULA:

$$[(\alpha \div 3600) \text{TAN}] \times D = E_{st}$$

EXAMPLE: D = 2" ; ROLL ERROR = 10 SEC.

$$[(10 \div 3600) \text{TAN}] \times 2 = .000,097 (2.47\mu)$$



YAW ERROR AND ITS EFFECTS ON STRAIGHT LINE ACCURACY

FORMULA:

$$[(\alpha \div 3600) \text{TAN}] \times D = E_{st}$$

EXAMPLE: D = 8.5" ; YAW ERROR = 10 SEC.

$$[(10 \div 3600) \text{TAN}] \times 8.5 = .0004 (10.6\mu)$$

REVISION NOTES

- Revision 2: Updated type of grease used on square rail bearings and ball screws. Also updated information on LHO switches. Including drawings 006-2065, 006-1288 and 006-1357