

WAGNER INDUSTRIES, INC.

Roll To Roll Manufacturing Line
Model #: R2R-1

Manufactured for Purdue University

Manufactured by:
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Serial #: H3859

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WAGNER MODEL R2R-1
S/N H3859
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CH 1

WAGNER MODEL R2R-1
S/N H3859MH

SAFETY

THIS MACHINE WAS DESIGNED AND BUILT AS A RESEARCH TOOL FOR USE IN A UNIVERSITY ENVIRONMENT. IT USES MATERIALS AND COMPONENTS THAT COULD PRODUCE SERIOUS INJURIES OR DEATH IF USED WITHOUT PROPER TRAINING AND SUPERVISION. NEVER ATTEMPT TO USE THIS MACHINE WITHOUT A FULL UNDERSTANDING AND TRAINING OF THE EXPERIMENTS YOU ARE ATTEMPTING TO PERFORM.

THERE ARE CERTAIN CONDITIONS AND SITUATIONS THAT ARE HARMFUL TO HUMANS. AMONG THESE ARE HIGH VOLTAGES, HIGH TEMPERATURES, VERY POWERFUL MAGNETIC FIELDS UP TO 3 TESLAS, LASER BEAMS TO 100 WATTS, UV LAMP INTENSITIES AND SPECTRAL OUTPUT THAT CAN CAUSE EYE DAMAGE, AND PINCH POINTS THAT CAN CRUSH OR CAUSE SERIOUS INJURY. COMMON SENSE MUST ALWAYS PREVAIL WHEN USING THE MAXWELL R2R RESEARCH MACHINE. IF IN DOUBT, ASK YOUR INSTRUCTOR FOR DIRECTIONS.

NEVER ATTEMPT TO CHANGE FUSES OR OVERRIDE BREAKERS.

SERVICING OF THIS MACHINE MUST BE PERFORMED WITH POWER AND AIR OFF.

NEVER USE THIS MACHINE WITH GUARDS REMOVED OR DEFEATED. INJURY MAY RESULT.

ALWAYS USE PROTECTIVE EYEWARE WHEN THE LASER IS IN USE.

SAFETY BEACONS WILL BE ON WHEN A POTENTIALLY DANGEROUS CONDITION IS PRESENT IN A CERTAIN SECTION OF THE MACHINE

CH 2

WAGNER MODEL R2R-1
S/N H3859

GENERAL DESCRIPTION

THE R2R-1 MACHINE WAS DEVELOPED AS A RESEARCH TOOL FOR THE TESTING AND EXPERIMENTATION OF POLYMERS IN MULTIPLE FIELDS OF USE.

THE MACHINE CAN TRANSPORT EITHER KAPTON OR METALLIC FILMS UP TO 8" WIDE THRU THE MACHINE AT LINE SPEEDS FROM 10MM/MIN TO 450MM/MIN.

A UNIQUE 10" WIDE STAINLESS STEEL CONTINUOUS CONVEYOR BELT TRANSPORTS THE FILM THRU THE E-SPIN SECTION AFTER IT IS UNWOUND AND EDGE GUIDED FOR POSITIONING THRU THE DOCTOR BLADE COATER. THE FILM AND BELT CONTINUE AS A "SANDWICH" THRU THE E-SPIN CHAMBER WHERE THE ENVIRONMENT IS TEMPERATURE AND HUMIDITY CONTROLLED WHILE THE E-SPIN PROCESS TAKES PLACE. THE BELT THEN TURNS DOWN AND IS DIRECTED UNDER THE NEXT SEVERAL SECTIONS SINCE THE TEMPERATURES AND MAGNETIC FIELDS MUST BE AVOIDED. HOWEVER, THE FILM CONTINUES STRAIGHT THRU THE REMAINDER OF THE MACHINE. THE FIRST ITEM THE FILM REACHES IS THE SLOT DIE EXTRUDER. THE SYSTEM IS DESIGNED AS A PELLET FEED HOPPER AND MULTIPLE TEMPERATURE ZONE SCREW AUGER WITH HARDENED CONTACT POINTS. AN ARGON PURGED HOPPER ELIMINATES ATMOSPHERIC CONTAMINATION SUCH AS WATER VAPOR.

AT THE POINT OF THE SLOT DIE EXIT, A SERIES OF HEATED PLATES ASSURES THAT THE EXTRUDED MATERIAL (NOW IN WEB FORM) DOES NOT COOL TO THE POINT OF SOLIDIFICATION. EACH PLATE CAN BE TEMP CONTROLLED INDIVIDUALLY EVERY 6 INCHES (150MM) A 6MM GAP ASSURES THAT THE TEMPERATURES ARE ISOLATED FROM ADJACENT SECTIONS.

AN E-FIELD UNIT ALLOWS FOR THE APPLICATION OF A 0-25KV FIELD ABOVE THE FILM AND COATING WITH A HEIGHT ADJUSTMENT OF 1-25MM A DIGITAL READOUT DISPLAYS THE GAP SETTING.

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GENERAL DESCRIPTION

A CHARGED UPPER COPPER BELT MATCHES THE FILM SPEED TO AVOID SHEAR EFFECTS OF THE FIELD AGAINST THE COATINGS. HEATERS ARE LOCATED ABOVE THE UPPER BELT IN ORDER TO RETAIN A HEATED ENVIRONMENT DURING E-FIELD TESTS. THE NEXT SECTION HAS THE OPTION OF PLACING THE U/V HERE OR AFTER THE MAGNET. THE U/V WILL BE DESCRIBED LATER IN THIS SECTION.

THE LASER IS A 100 WATT I/R SYNRAD UNIT THAT HAS THE OPTION OF VERTICAL BEAM TRAVEL OR ANGLES FOR INTERSECTING THE FILM AT A POINT THAT IS CENTERED WITHIN THE MAGNET POLE PIECES FOR HEATING OF THE POLYMER WHILE IN THE FIELD. VARIABLE POWER LEVELS AND SWEEP WIDTHS AND RATES CAN BE CONTROLLED AT THE PC STATION LOCATED PRIOR TO THE E-SPIN CABINET.

THE LASER AND MAGNET AREA IS SUPPLIED WITH A METALLIC (ALUMINUM) SHIELD SO AS TO PREVENT ESCAPING OF LASER RADIATION. USERS MUST ALWAYS WEAR EYE PROTECTION WHEN THE LASER IS IN USE.

THE MAGNET HAS A UNIQUE RECTANGULAR POLE PIECE DESIGN THAT PRODUCES AN ALTERED RECTANGULAR FIELD THAT INCREASES THE FIELD EXPOSURE TIMES ALONG THE EDGES. NORMAL TOROIDAL FIELDS HAVE AN INCREASINGLY REDUCED FIELD STRENGTH AS THE SIDES OF THE TEST FILM ARE APPROACHED.

THE U/V HEAD IS A SELF CONTAINED MERCURY LAMP WITH A 3000 WATT POWER SUPPLY. INTERNAL SHUTTER AND WATER COOLING ALLOW FOR EXTENDED EXPOSURES. POWER LEVELS ARE ADJUSTABLE AND A HMI SCREEN DISPLAYS THE CONDITIONS PROGRAMMED. EXACT LAMP SPECTRUM IS AVAILABLE IN THE U/V SECTION OF THIS MANUAL.

WAGNER MODEL R2R-1
S/N H3859

GENERAL DESCRIPTION

GAP SETTINGS OF THE MAGNETS POLE PIECES ARE ADJUSTABLE BUT HAVE BEEN FACTORY SET AT APPROX 25MM. FILM TRAVEL THRU THE POLES IS NEAR CENTER VERTICALLY. A HALL EFFECT PROBE MONITORS THE FIELD STRENGTH WHICH IS DISPLAYED AS A 0-2.5 TESLA (APPROX) READOUT ON THE OPERATORS PANEL. POWER IS SET BY MANUALLY ADJUSTING THE MAGNETS COIL VOLTAGE AND CURRENT ON THE POWER SUPPLY AT THE REAR OF THE MACHINE FRAME.

AN OPEN AREA ALLOWS FOR THE MOUNTING OF ANCILLARY OR OPTIONAL EQUIPMENT BY THE USER.

A DUAL OVEN AREA NEAR THE OUTFEED END OF THE MACHINE CONTAINS HEATED PLATES THAT CAN PRODUCE UP TO APPROX 100C TEMPERATURES OR HIGHER FOR FINAL CURING AND/OR SOLVENT EVAPORATION. INTERNAL LIGHTING AND VIEW PORTS ALLOW FOR VISUAL INSPECTION OF THE PRODUCT PRIOR TO REWINDING.

THE STAINLESS STEEL BELT REJOINS THE FILM AT THE ENTRANCE TO THE FIRST OF THE TWO OVENS. THIS IS TO ASSURE THAT THE FILM IS TRANSPORTED THRU THE MACHINE AT THE EXACT BELT SPEED. AN EXIT NIP ROLLER LOCATED OVER THE TURN AROUND DRIVE DRUM "PINCHES" THE FILM LIGHTLY TO CONTROL THE FILM SPEED.

THE BELT RETURNS UNDER THE TOP WEB PATH AND THE FILM IS EXITED TO THE REWIND MODULE. AN EDGE GUIDE STEERS THE FILM ONTO A TENSION CONTROLLED TAKEUP SPINDLE AS FINISHED PRODUCT. AN OPTIONAL UNWIND SHAFT ALLOWS FOR THE USER TO ADD AN INTERLEAF MATERIAL TO PROTECT THE LAYERS OF REWOUND PRODUCT. THE MACHINE USES A UNIQUE BELT GUIDING SYSTEM TO PREVENT DAMAGE TO THE STAINLESS STEEL BELT. AN ALARM SENSING SYSTEM STOPS THE MACHINE IF ANY GUIDING FAILURE SHOULD OCCUR. BELT TENSION IS PNEUMATICALLY CONTROLLED AT THE INFEED END OF THE MACHINE.

CH 3

WAGNER MODEL R2R-1
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UNW ND

SEC 3

THE UNW ND MODULE CONSISTS OF A 8" WIDE FILM UNW ND SHAFT WITH 3" DIAMETER PNEUMATIC BLADDER CORE CHUCK WITH INFLATION GUN AND COIL HOSE. THE SHAFT CAN HOLD UP TO A 50 POUND ROLL OF PRODUCT AND HAS A CAPACITY OF A 12 INCH DIAMETER ROLL. THE ROLL CAN UNW ND IN EITHER DIRECTION CW OR CCW.

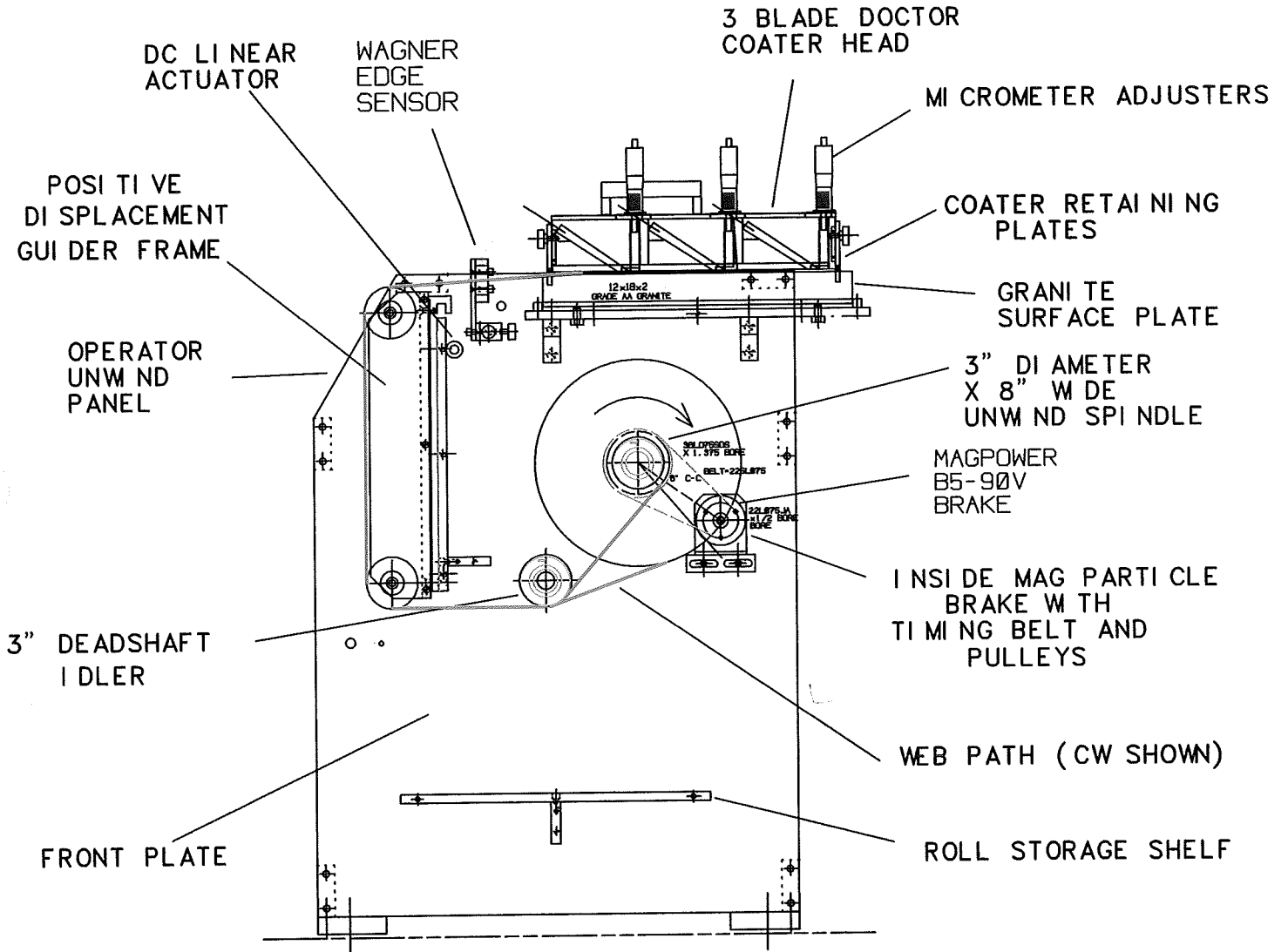
TENSION IS CONTROLLED BY A MAGNETIC PARTICLE BRAKE THAT IS CONTROLLED BY A TENSION SET POTENTIOMETER WITH A DIGITAL READOUT. THE UNW ND TENSION IS AUTOMATICALLY DESIGNED TO HOLD CONSTANT TENSION TO THE INFEED OF THE MACHINE.

AN ALL ELECTRIC WAGNER INDUSTRIES EDGE GUIDE SYSTEM CONSISTS OF A VISIBLE LED LIGHT SOURCE AND PHOTORECEIVER IN A "C" SHAPED EDGE SENSOR AT THE FRAME SIDE OF THE UNW ND. WHEN THE SENSOR IS HALF COVERED, IT SENDS A SIGNAL TO THE AMPLIFIER LOCATED AT THE REAR OF THE UNW ND MODULE. THE AMPLIFIER THEN SENDS A CORRECTION SIGNAL TO A 12 VOLT DC LINEAR ACTUATOR WHICH MOVES A POSITIVE DISPLACEMENT GUIDER FRAME. THE WEB IS DIVERTED LEFT OR RIGHT DEPENDING ON THE DIRECTION OF THE ERROR DETECTED.

THE FILM OR WEB LEAVES THE GUIDER FRAME AND IS FED TO THE GRANITE PLATE AT THE TOP OF THE UNW ND. THE GRANITE PLATE IS A PRECISION GROUND FLAT SURFACE ONTO WHICH A 3 CHAMBER DOCTOR BLADE COATER ASSEMBLY IS PLACED. A PAIR OF MACHINED CROSSPLATES HELP TO LOCATE THE COATER IN A FIXED POSITION. BLADE OPENING DEPTH MICROMETER ADJUSTERS CONTROL THE GAP OPENING WHICH THEN CONTROLS THE COATING THICKNESS. COVER PLATES HELP TO KEEP THE COATING SOLVENTS FROM ESCAPING. THE WEB PATH OF THE UNW ND IS SHOWN ON PAGE 2 OF 2 OF THIS SECTION.

UNWIND

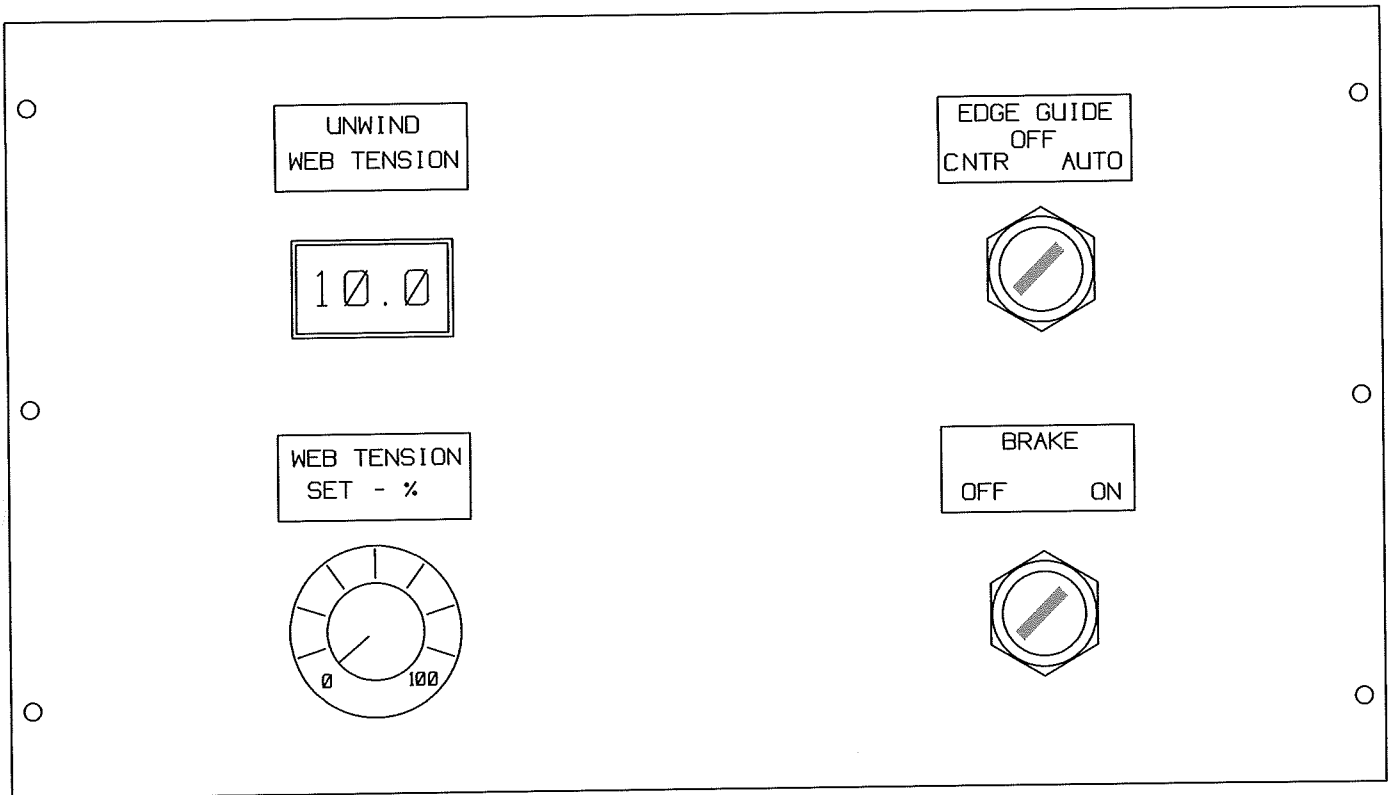
SEC 3A



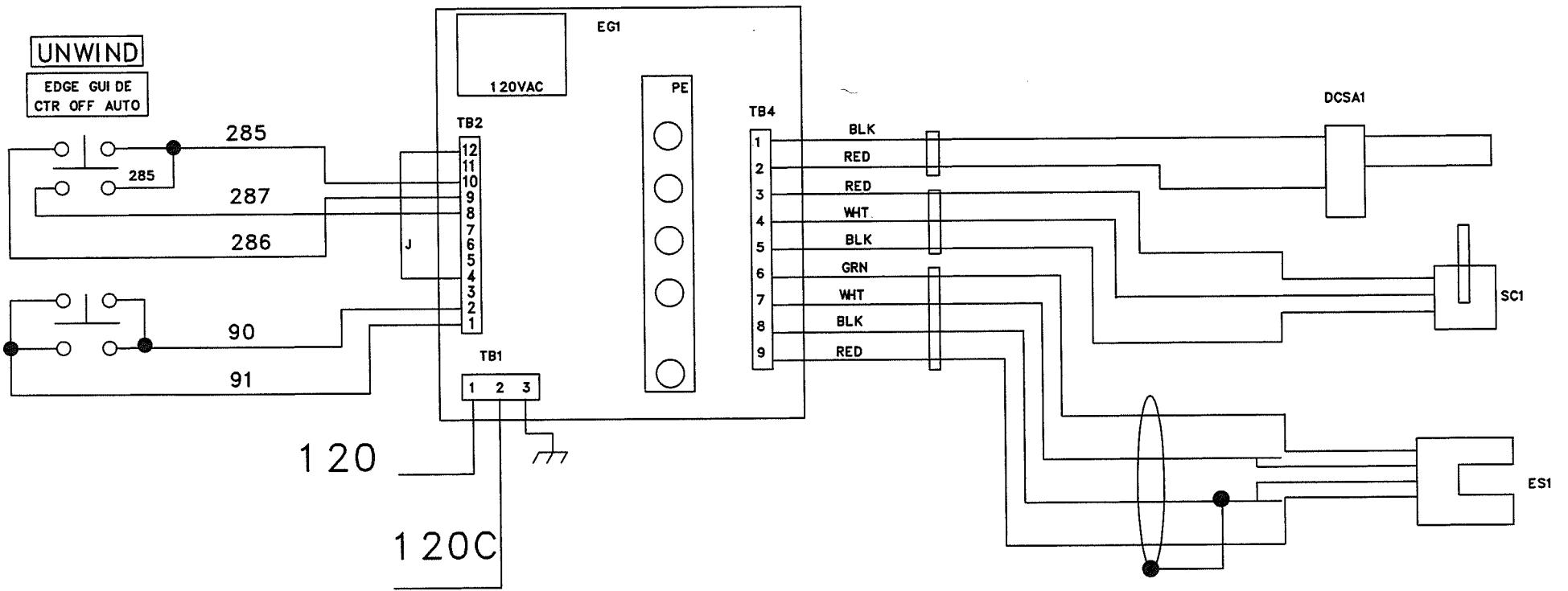
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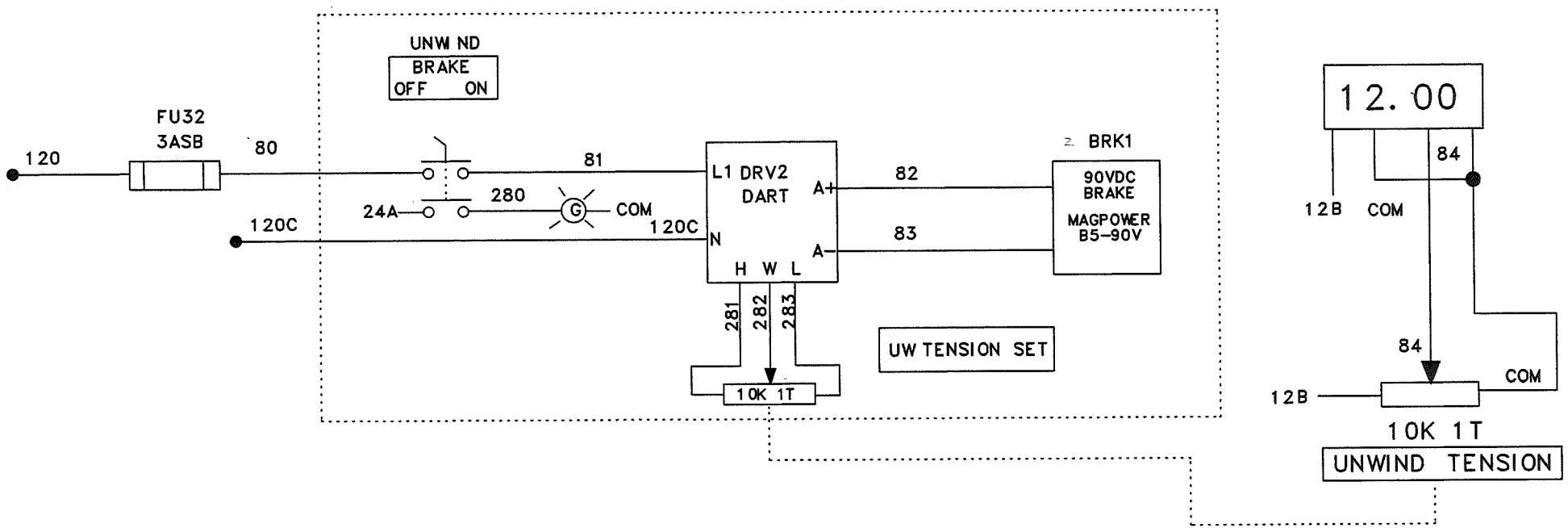
UNWIND PANEL

SEC 3B



U/W EDGE GUIDE







A Maxcess
International
Company

Magnetic Power Systems, Inc.

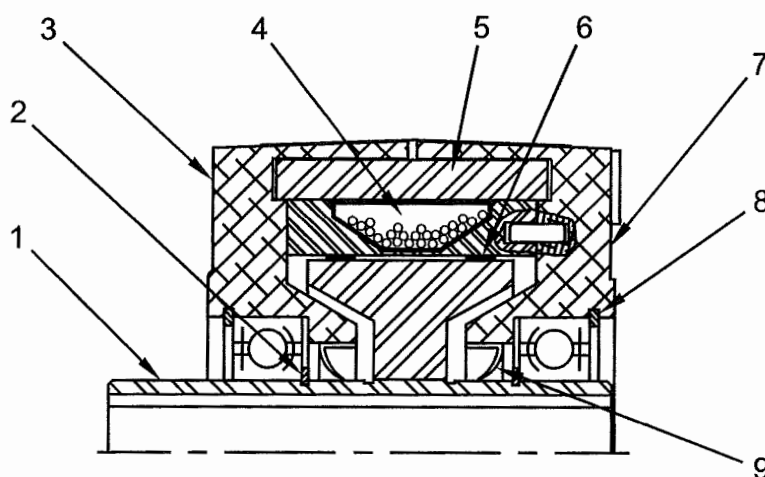
1626 Manufacturers Drive. Fenton, MO 63026

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INSTALLATION & MAINTENANCE MANUAL

B5 BRAKE

CAUTION: This product contains rotating parts which could cause injury. At time of installation, appropriate protective guards should be installed by the user according to his use of this product.



Parts List

1	Rotor	6	Magnetic Powder
2	Inner Snap Rings (2)	7	Right Stator
3	Left Stator	8	Outer Snap Rings (2)
4	Coil	9	Seals (2)
5	Stator Ring		

Theory of Operation

The brake consists of a stator, rotor, coil, stator ring, shaft, magnetic powder and bearings which support and align the rotor in the stator.

The magnetic powder occupies the space between the rotor and the coil. This magnetic powder is the key element in the brake in that it functions as the variable bond or link between the rotor and the stationary coil. The coil is secured to the stator and the stator is connected to ground (machine frame) through a torque arm.

A current in the coil creates a magnetic field (flux) which passes through the rotor, the coil housing, and the magnetic powder. The flux aligns the powder forming links or bonds between the rotor and the coil. The degree of bond action is directly proportional to the amount of current in the coil.

Mechanical Installation

Install the brake as follows:

1. Refer to catalog sheet for mounting dimensions.
2. Prior to installation, check the rotation by hand and observe that it is smooth and free of binding or scraping.
3. Mount the brake on the shaft and tighten the two set screws.
4. Attach a torque arm to the tapped holes and the machine frame with a "loose" or "floating" mount to prevent binding forces on the brake bearings.

Electrical Installation

1. Connect the two wires in the junction box to the 90 vdc power source.
2. For fan cooled brakes, connect the fan to the AC input and provide protective circuitry that will ensure the fan is on while the brake is in operation.
3. Refer to catalog sheet for electrical specifications.

Maintenance

Due to its small number of moving components and its basic design, maintenance of the brake is generally necessary only after extended service. Once a system problem is determined and the brake is found to be the cause, disassembly of the brake and replacement of the Repair Kit parts will generally recondition the brake to the "as new" condition.

When a problem appears in the system, ensure that all couplings, belts, etc., are functioning properly. In addition, check that the electrical system is working properly and that any control device is functioning as indicated by a voltmeter applied across the dc power supply output. When it is determined that the brake is at fault, it will be necessary to overhaul the brake. Prior to overhaul, troubleshoot the brake per the following instructions and be sure that a repair parts kit is available.

NOTE: When ordering parts not contained in the kit, provide the model number, serial number and parts list item number.

Fan lubrication instructions are on the fan nameplate.

Troubleshooting

Use the troubleshooting chart as a guide for solving system and brake problems.

PROBLEM	POSSIBLE CAUSE	ACTION
Load is not controlled by brake.	Power supply voltage output low.	Replace or repair control.
	Magnetic powder has deteriorated or is partially lost.	Overhaul brake using repair kit.
	Coil is open.	Replace coil.
Load operates in an intermittent manner with proper 90vdc.	Coil is intermittently open.	Replace coil.
Brake is noisy and has some vibration.	Bearings are worn.	Overhaul brake using repair kit.

Disassembly

1. Remove set screws from shaft.
2. Remove conduit box cover and four through bolts.
3. Remove snap rings and shims. Observe location and number of shims on right stator. These must be replaced in same position at assembly.
4. Remove right stator and bearing by tapping lightly on shaft with a soft mallet. The inner snap ring will prevent the seal from coming off with the right stator.
5. Lift out coil and stator ring. (Do not remove stator ring from coil unless coil is to be replaced. Coil can only be pressed out in direction of lead slot).
6. Remove rotor assembly from left stator by tapping lightly on shaft with a soft mallet.
7. Remove inner snap rings and seals from the shaft.
8. Remove bearings from left and right stator by tapping out with a soft mallet.
9. Clean gasket compound from sides of coil and insides of stator halves. Do not immerse coil in solvent.

Re-assembly

IMPORTANT: re-assembly of the brake must be performed in a clean area. The brake components must be cleaned with solvent and be totally free of any grease or oil. Discard all bearings, seals, and magnetic powder from disassembled brake as these are kit parts and will be replaced at overhaul. Any oil or grease on parts will cause failure when the unit is rebuilt.

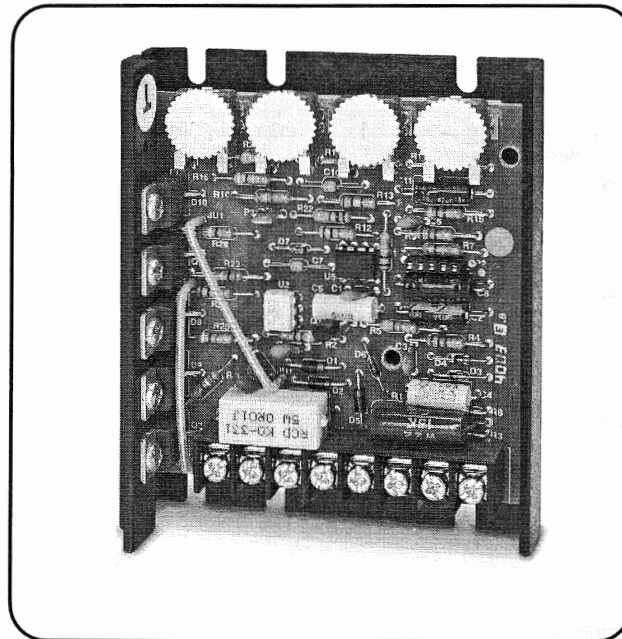
1. Press new seals into left and right stator with seal lips facing to the inside of the brake.
2. Support rotor on bench with the set-screw end up. Wrap a 6" x 6" piece of paper or thin plastic around the shaft to allow seal to slide over the snap ring groove.
3. Slide left stator and seal down over the shaft until it bottoms; then pull the paper tube out from under the seal lip.
4. Install inner snap ring, then slide bearing over shaft into the housing bore with the seal facing down. Install outer snap ring. Now turn this assembly over.
5. If coil and stator ring are separated, heat stator ring in oven or with torch until hot to the touch, then slide coil into place from side with slot. Center coil in ring.
6. Set coil assembly into the stator ring, aligning the leads with the groove.
7. Install right stator frame and seal assembly using paper tube as in Step 3. (Align pin in stator with hole in coil.)
8. Install inner snap ring, bearing, shims and outer snap ring.
9. Install four through bolts and nuts, and junction box cover.
10. Turn shaft by hand to insure a smooth rotation of rotating assembly.
11. To fill the brake with magnetic powder, perform the fill operation on a clean piece of paper. Any spillage is retained to be poured into the brake. Place the brake on a 45 degree angle with the powder fill hole at the 3 o'clock position. Fill the brake with all the powder in the repair parts kit. While filling, slowly rotate the shaft to evenly distribute the powder. Install the sealing washer and powder fill screw.
12. Replace the two set screws.

125D CONTROL SERIES

DART
CONTROLS

Instruction Manual

Variable Speed Control



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WARRANTY

Dart Controls, Inc. (DCI) warrants its products to be free from defects in material and workmanship. The exclusive remedy for this warranty is DCI factory replacement of any part or parts of such product which shall within 12 months after delivery to the purchaser be returned to DCI factory with all transportation charges prepaid and which DCI determines to its satisfaction to be defective. This warranty shall not extend to defects in assembly by other than DCI or to any article which has been repaired or altered by other than DCI or to any article which DCI determines has been subjected to improper use. DCI assumes no responsibility for the design characteristics of any unit or its operation in any circuit or assembly. This warranty is in lieu of all other warranties, express or implied; all other liabilities or obligations on the part of DCI, including consequential damages, are hereby expressly excluded.

NOTE: Carefully check the control for shipping damage. Report any damage to the carrier immediately. Do not attempt to operate the drive if visible damage is evident to either the circuit or to the electronic components.

All information contained in this manual is intended to be correct, however information and data in this manual are subject to change without notice. DCI makes no warranty of any kind with regard to this information or data. Further, DCI is not responsible for any omissions or errors or consequential damage caused by the user of the product. DCI reserves the right to make manufacturing changes which may not be included in this manual.

WARNING

Improper installation or operation of this control may cause injury to personnel or control failure. The control must be installed in accordance with local, state, and national safety codes. Make certain that the power supply is disconnected before attempting to service or remove any components!!! If the power disconnect point is out of sight, lock it in disconnected position and tag to prevent unexpected application of power. Only a qualified electrician or service personnel should perform any electrical troubleshooting or maintenance. At no time should circuit continuity be checked by shorting terminals with a screwdriver or other metal device.

INTRODUCTION

- The 123D variable speed control is available in a range of 150mA through 5.5 ADC (or up to 10 ADC if using a suitable external heatsink) at 24 through 36 VAC input.
- The 125D variable speed control is available in a range of 150mA through 1/4 H.P. at 120/240 VAC input.
- The 125DV variable speed control is available in a range of 1/8 through 1 H.P. at 120/240 VAC input. With -HS(125D) or suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum U.L. rating can be increased to 2 H.P. and 10 Amps DC.
- The control is designed for DC Permanent Magnet, Shunt Wound, and some Universal (AC/DC) motors in the above horsepower ranges.
- Incoming AC voltage is converted to adjustable full wave rectified DC voltage to operate the DC motor. Also, a full wave field voltage is provided for shunt wound motors (see page 11 for voltages).
- The control incorporates transient voltage protection with adjustable current limit which fits into a compact package. It features adjustable minimum and maximum speeds along with adjustable IR compensation and an inhibit function.
- Options are available to change ACCEL/DECEL time (see page 8, -15 / -K options).
- cULus Recognized under, U.L. File # E78180.

CONTROL FEATURES

MINIMUM SPEED - Allows adjustment of the motor speed when the speedpot is set at minimum (CCW). This permits the user to eliminate "Deadband" on the main speed control, permitting zero calibration. Clockwise rotation of "MIN" trimpot increases speed.

MAX SPEED (Maximum Speed) - Allows adjustment of the motor speed when the speedpot is set at maximum (CW). This permits the user to eliminate the top end "Deadband", which will provide full speed at maximum rotation. Rotation of the "MAX" trimpot in the clockwise direction increases the maximum motor speed.

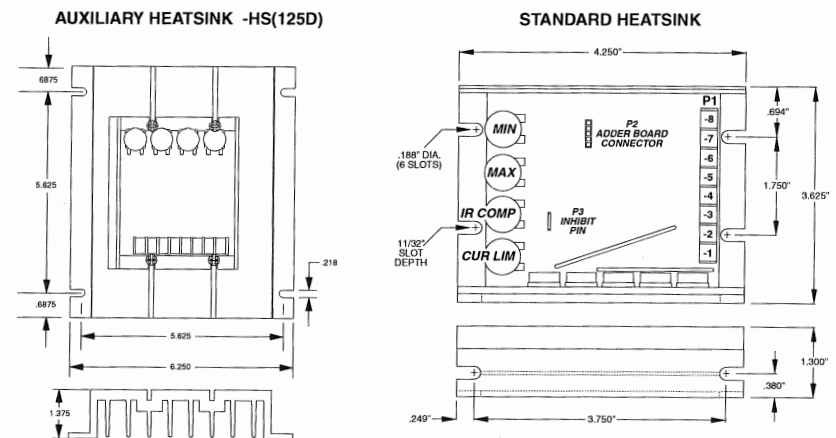
I.R. COMP (Speed Regulation) - This allows for adjustment of the circuitry that controls the speed regulation of the motor. The circuitry controls armature speed by changing the armature voltage to compensate for increased or decreased motor loading. Clockwise rotation of the "IR COMP" trimpot will increase compensation.

CUR. LIM. (Current Limit) - Provides protection from excessive armature current by limiting the maximum armature current the control can provide. This enables adjustment of the maximum torque the motor can deliver. Torque adjustment (Cur. Lim.) is preset at 125% of rated motor torque (current) based on horsepower. Clockwise rotation of the "CUR. LIM." trimpot increases the torque (current) the control will provide.

INHIBIT TERMINAL PIN - Allows the user a choice of stopping and starting hard (fast) or stopping hard with a soft start through an adjustable acceleration ramp, without breaking the AC lines (see page 6).

TERMINAL STRIP - Allows for connection of AC lines, motor leads, motor field (if needed), and speed potentiometer

125D SERIES HEATSINK DIMENSIONS



MOUNTING PROCEDURE

1. Six 3/16" wide slots are provided for control mounting.
2. Control chassis can be used as a template.
3. Use standard hardware to mount.

CAUTION:

DO NOT MOUNT WHERE AMBIENT TEMPERATURE IS OUTSIDE THE RANGE OF -10° C (15° F) TO 45° C (115° F)

MODEL SELECTION

HORSEPOWER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT* AMPS DC	MODEL NUMBER
150mA thru 5.5 A	24 to 36 VAC	0-20 / 0-30 VDC	5.5A	123D-C*
1/50 thru 1/8	120/240 VAC	0-90 / 0-180 VDC	1.2A	125D-12C
1/8 thru 1	120/240 VAC	0-90 / 0-180 VDC	5.5A	125DV-C*

NOTE: * With -HS(125D) or suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum UL Rating for output amps can be increased to 10 amps D.C.

WIRING PROCEDURE & FUSING

1. Size all wires which carry armature or line currents **AS SPECIFIED BY NATIONAL, STATE, AND/OR LOCAL CODES**. All other wires may be # 18 AWG or smaller as permitted by local code.
2. **Separate control wires** from the armature and AC lines when routed in conduit or in wire trays.
3. **Fusing** - The motor and control are protected against overloads by the current limit circuit and a customer installed fuse in the AC line. **THIS PROTECTION ALREADY MAY BE PROVIDED BY THE CUSTOMER WITH CIRCUIT BREAKERS OR FUSES IN BOTH MAIN LINES. IF NOT:**

FOR 120 VAC INPUT - fuse protection should be added by the customer in AC Line 1 (see following chart)

FOR 240 VAC INPUT - fuse protection should be added by the customer in AC Line 1 and Line 2 (see following chart)

FUSING ADDED BY CUSTOMER (Bussman ABC or Little Fuse 314 Series ceramic fuses)

HORSEPOWER	120 VAC INPUT	240 VAC INPUT
1/50	2 AMP	-----
1/20	2 AMP	1 AMP
1/8	3 AMP	2 AMP
1/4	4 AMP	3 AMP
1/3	6 AMP	3 AMP
1/2	8 AMP	4 AMP
3/4	12 AMP	6 AMP
1.0	15 AMP	8 AMP
1.5	-----	12 AMP
2.0	-----	15 AMP

NOTE: To determine fusing for the 123D-C Series control (24 to 36 VAC input), use 200% of Full Load Current.

TERMINAL STRIP WIRING INSTRUCTIONS

The 125D Series uses an 8 position terminal strip for ease of connection.

- P1-1,2** (AC or L) 120 VAC - Connect incoming hot AC or L (black wire) to P1-1 and neutral AC or N (white wire) to P1-2. Connect ground (green wire) to CHASSIS of control.
240 VAC - Connect both hot sides (L & N), one to P1-1 and one to P1-2. Connect ground wire to CHASSIS of control.
- P1-3** (+Arm) Connect to PLUS (+) Armature wire on motor. 0-90 VDC for 120 VAC input or 0-180 VDC for 240 VAC input. See "SPECIFICATIONS" for output rating.
- P1-4** (-Arm/-Field) Connects to MINUS (-) Armature wire on motor and, if necessary, connect MINUS (-) Field wire of SHUNT WOUND MOTOR.

(continued)

P1-5

(+Field) **DO NOT** use for Permanent Magnet Motor. This supplies +Field voltage for a SHUNT WOUND MOTOR (refer to field voltage table). For motors with dual voltage field (ie. 50/100V or 100/200V), make sure highest value is connected.

FIELD VOLTAGE TABLE				
VAC INPUT	24	36	120	240
VDC FIELD	20	30	100	200

P1-6

(Speedpot Hi) Connects to high side (white wire) of Speedpot (CW end). This is internal +12 volts. For start-stop applications, the connection between this terminal and Speedpot HI can be opened and closed by a SPST switch. **INPUT MUST NOT BE GROUNDED!**

P1-7

(Speedpot Wiper) Connects to wiper (red wire) of Speedpot (center lead). For Voltage Follower applications, this **INPUT MUST NOT BE GREATER THAN +12V MAXIMUM AND MUST NOT BE GROUNDED!**

P1-8

(Speedpot Lo) Connects to Low side (orange wire) of 5K Speedpot (CCW end). This input is raised and lowered by the MIN. trimpot (5K). Electronic speed input (voltage follower) may be referenced to Speedpot LO if the MIN trimpot adjustments are to be active. Otherwise, inputs may be referenced to -ARM, which will bypass the MIN trimpot. **INPUT MUST NOT BE GROUNDED!**

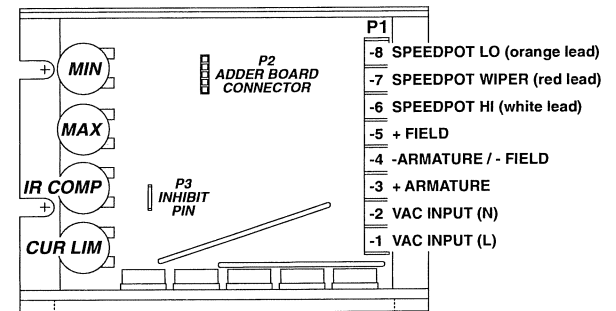
Warning:

1. Be sure the control housing is properly grounded.
2. Armature connections must not be switched or broken while the control is on. Serious control damage may result.
3. For non-speedpot applications, the input connection to the LO, WIPER, and HI terminals must not be grounded! Serious control damage may result from a grounded input.

123D/125D HOOK-UP DIAGRAM

Warning:

Do not attempt to perform Hi-pot test across AC lines with control in circuit. This will result in immediate or long term damage to the control.



CONTROL START-UP

WARNING: ALL POWER MUST BE TURNED OFF BEFORE PROCEEDING!

1. Recheck all wiring. Accidental grounds, loose or pinched wires on armature or speedpot wires may damage the control when power is applied.
2. Check to see that incoming service is of correct voltage.
3. Turn speedpot to zero (fully CCW).
4. Turn power on, and advance speedpot while observing motor. **Power must be off before step 5 can be accomplished!**
5. If motor rotation is incorrect, turn power off at external disconnect and reverse +ARM and -ARM connections.
6. Check for satisfactory operation throughout the speed range.
7. If operation is satisfactory, no readjustments are needed.
8. If instability or surging is observed, or if maximum speed is higher than desired, see "TRIMPOT ADJUSTMENT CHART" on page 5.
9. For other problems, consult page 11, "IN CASE OF DIFFICULTY".

TRIMPOT ADJUSTMENT CHART & PROCEDURE

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.					
	C.L.	I.R.	MAX	MIN	HP
125D-12C 120 VAC input; 0-90 VDC output					1/50
					1/20
					1/8
125DV-C 120 VAC input; 0-90 VDC output					1/8
					1/4
					1/3
					1/2
					3/4*
					1.0*
					1.0*
Operation of the control beyond $\pm 10\%$ of the normal line voltage could result in re-adjustment. These adjustments are permanent, periodic re-adjustment is normally not needed.					

Settings apply when using a 5K ohm master speedpot. This chart is used in conjunction with the adjustment procedure and is approximate.					
HP	C.L.	I.R.	MAX	MIN	
1/20					125D-12C 240 VAC input; 0-180 VDC output
1/8					
1/4					
1/4					125DV-C 240 VAC input; 0-180 VDC output
1/3					
1/2					
3/4					
1.0					
1.5*					
2.0*					

* NOTE: ADDITIONAL CUSTOMER HEATSINK REQUIRED FOR 125DV-C (120 VAC INPUT - GREATER THAN 1/2 H.P. MOTORS) AND (240 VAC INPUT - GREATER THAN 1 H.P. MOTORS). 12S EXTRUSION TEMPERATURES SHOULD NOT EXCEED 70 DEGREES C.

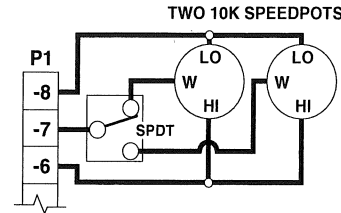
NOTE: FOR DETERMINING TRIMPOT SETTINGS FOR THE 123D-C SERIES, SEE TRIMPOT SETTINGS PROCEDURE BELOW.

TRIMPOT	FUNCTION	ADJUSTMENT
MIN.	Sets minimum motor speed when speedpot is set at zero. CW rotation will increase minimum motor speed.	<ol style="list-style-type: none"> 1. Set Speedpot to zero (fully CCW). 2. Rotate MIN trimpot CW until motor starts to rotate. 3. Slowly rotate MIN trimpot CCW until motor stops. NOTE: If motor rotation is desired, rotate MIN trimpot CW until desired MIN speed is reached.
IR COMP	Provides a means of improving motor speed regulation in the armature feedback mode. If a slowdown due to load change is of no concern, rotate this trimpot fully CCW.	<ol style="list-style-type: none"> 1. Set Speedpot at 50%. 2. Observe motor speed at no load condition. 3. Apply full load to motor. 4. Turn IR COMP trimpot CW to obtain the same motor speed as with no load.
MAX.	Sets maximum motor speed when speedpot is set at maximum (fully CW rotation). CW rotation of MAX trimpot increases maximum motor speed.	<ol style="list-style-type: none"> 1. TURN DRIVE POWER OFF!! 2. Connect a DC Voltmeter: + to +ARM, - to -ARM. NOTE: Meter must not be grounded!! <ol style="list-style-type: none"> 3. Set meter voltage range: (90 VDC for 120 VAC, 180 VDC for 240 VAC). 4. Turn power on. Set Speedpot at 100%. 5. Adjust MAX trimpot to rated motor armature voltage as shown on meter. NOTE: A tachometer or strobe may be used in lieu of a meter. Follow above steps, except adjust MAX trimpot to rated motor base speed indicated by tachometer or strobe.
CUR.LIM.	Limits DC motor armature current (torque) to prevent damage to the motor or control. The current limit is set for the rated motor current. CW rotation of this trimpot increases the armature current (or torque produced).	<ol style="list-style-type: none"> 1. TURN DRIVE POWER OFF! 2. Connect a DC Ammeter between A1 on motor and +ARM on control. This is in series with the motor. 3. Turn power on. 4. Set Speedpot at the 50% position. 5. Apply friction braking to motor shaft until motor stalls. 6. With motor stalled, set current at 125% of rated motor armature current by adjusting CUR.LIM. trimpot.

CONTROL MODIFICATIONS

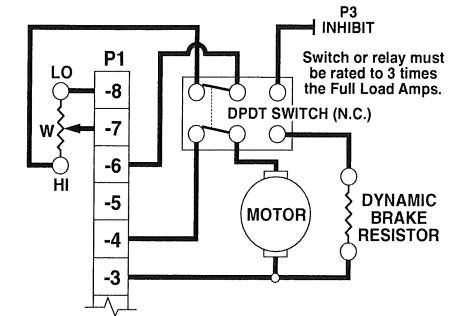
TWO SPEED OPERATION

Two pot operation is done using two 10K ohm speed potentiometers in parallel (both HI's to P1-6, both LO's to P1-8). The WIPER is switched using a SPDT switch.



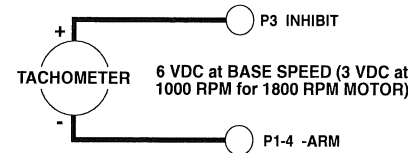
DYNAMIC BRAKING

A DPDT switch is used to inhibit the control and to connect the DBR (dynamic brake resistor) in parallel (both HI's to P1-6, both LO's to P1-8). The WIPER is switched using a SPDT switch. Typical values for the DBR (dynamic brake resistor) are 5 ohms for 120V, 10 ohms for 240V (both 35W to 50W). Note that motor horsepower, inertia, and cycle time effect sizing of the DBR. NOTE: This modification cannot be used with any of the -15 options.



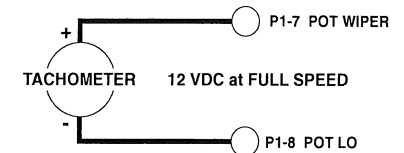
TACHOMETER FEEDBACK

Improves speed regulation to $\pm 1/2\%$ of base speed.



TACHOMETER FOLLOWER

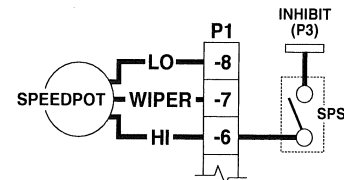
Allows control output to follow tachometer voltage.



NOTE: NEED 1% OR LESS - TACH OUTPUT RIPPLE

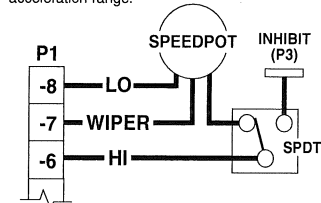
INHIBIT (USED INDEPENDENTLY)

The customer supplied SPST switch is connected in series between the speedpot HI (P1-6) and the Inhibit pin (P3). To inhibit (stop motor), speedpot HI is closed to the Inhibit pin. To restart, the switch is returned to open. NOTE: The control will stop and start fast.



INHIBIT (USED WITH SPEEDPOT)

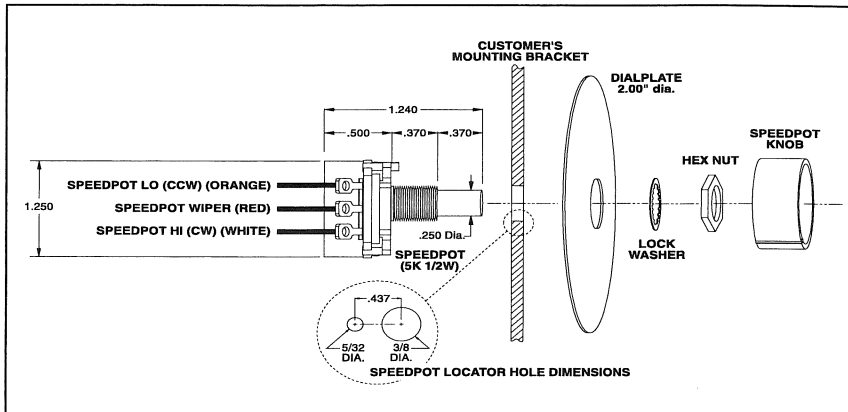
The Common of the SPDT switch is connected to control pot HI and is switched between Speedpot HI and the Inhibit pin (P3). To inhibit (stop motor), speedpot HI is closed to the Inhibit pin. To restart, the switch is returned to Speedpot HI. NOTE: The control will stop fast and soft start through a fixed acceleration range.



NOTE: Permits starting and stopping of motor without breaking AC lines. In the event of SCR failure or false triggering, the Inhibit circuit will not stop motor.

Always use a shielded wire when connecting to the inhibit terminal. The shield should be connected to -Armature or Common of the control.

SPEEDPOT KIT ASSEMBLY



OPTION DESCRIPTIONS

-1 option Electronic Speedpot Interlock

Field or Factory Installed
Available All Models

The -1 adder board connects to the 125 series board through use of a female connector and plastic standoff support.

When incoming AC power to the control is applied, the Electronic Interlock will prevent the motor from starting until the speedpot is first rotated to the zero position and then rotated clockwise toward the set speed.

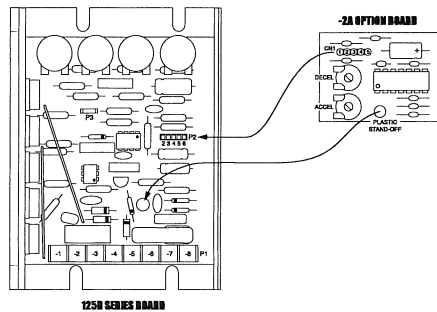
Also, should the incoming AC power be interrupted for any reason, then restored, the Electronic Interlock will prevent an automatic restart of the motor. To restart, the speedpot must first be rotated to the zero position and then rotated clockwise toward the set speed.

CAUTION: The Electronic Interlock becomes inoperative if SCR failure should occur.

-2A option Individually Adjustable Linear Accel and Decel

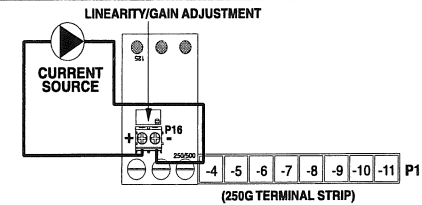
Field or Factory Installed
Available All Models

This option plugs into the five position expansion connector on the 125D main board. The -2A option overrides the fixed accel ramp built into the 125D control, providing independently adjustable linear accel and decel from 0.5 to 8.0 seconds. To install, flip over the -2A option board so the printed circuit lines are visible. Align the male connector CN1 (-2A option) with the female connector P2 (125D board) so terminal CN1-1 fits into P2-6, CN1-2 in P2-5, etc. Align the plastic stand-off on the -2A option board with the hole shown on the 125D main board. Once connectors and stand-off are aligned, snap into place. Adjustment of both trim pots is accomplished via the labeled access holes on the back side of the -2A option board. Full CCW rotation equals minimum accel or decel time and full CW rotation equals maximum accel or decel time. Note: Each trim pot operates independently of the other.



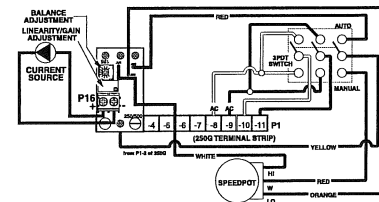
-5 option Isolated 4-20 ma.Signal Follower

Field or Factory Installed
Available on Chassis Only*



-7 option Isolated 4-20 ma. Signal Follower with Auto/Manual Switch

Enclosed - Factory Installed only
Chassis - Factory or Field Installed
Chassis - switch & wiring are customer provided



-5 and -7 option Hookup Procedure

DO NOT USE TRIMPOT CHART TO ADJUST MIN AND MAX TRIMPOTS ON MAIN BOARD. IF ADJUSTMENT IS NEEDED THEN REFER TO THE SETUP PROCEDURE BELOW.

The -5 option is a 4-20 mA isolated signal card that replaces the speedpot to control speed. The 4-20 mA signal input can be either grounded or ungrounded. The board sets on spacers screwed to the pot HI, Wiper, and LO terminals on the main board using long screws. The current source connects to the + and - two position terminal strip (P16-1 and -2) on the -5 option board.

The Linearity trimpot on the -5 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the Max and Min trimpot settings on the control for your specific application. If needed then refer to the setup procedure below.

The -7 option is also a 4-20 mA isolated signal card but it allows the control to be run in either the Manual mode via a speed pot or the Auto mode via the 4-20 mA signal. This option also includes a Balance trimpot which is used to scale the maximum speed in the Manual mode. It is factory set so the maximum speed in Manual mode equals the maximum speed in Auto mode. The Linearity trimpot on the -7 option board is set at the factory for proper linearity, however this trimpot may need to be re-set after tuning the Max and Min trimpot settings on the control or if the Balance trimpot on the -7 must be reset for your specific application. If needed then refer to the setup procedure below.

The following is the recommended procedure to set up the -5/-7 option on the 125/250/500 Series:

- 1) With the 125/250/530 oriented so that trim pots are along the top, adjust Min trimpot to minimum (full CCW) and Max trimpot to 50%. The voltage is set below the typical motor voltage to make certain the drive is NOT in saturation before setting the -5/-7 board saturation point.
- 2) Set the Linearity/gain pot on the -5/-7 full CW. This is a 20 turn pot and you should hear a clicking with each turn when fully up or just count 20 turns.
- 3) Make certain your motor is connected to +/-ARM output of the drive, the AUTO / MAN switch is in AUTO mode for -7 options, and source power for the control is turned on. (Note: For proper tuning this setup is best done on an unloaded motor.)

4) With power applied and a voltmeter monitoring motor output Vdc, apply 4mA to -5/-7 board. Check voltmeter reading and adjust the Linearity/gain trimpot, R16, on the -5/-7 board CCW until motor output voltage is less than 0.1Vdc.

5) Now apply 20mA to the -5/-7 board and adjust the Max trimpot to a voltage that is 5 volts (15 volts for the 250G series controls) above the final desired max motor voltage output. Adjust the Linearity/gain trimpot on the -5/-7 board CCW until the motor output voltage decreases to the desired max voltage set point.

6) Now, apply 4mA to the -5/-7 board again and adjust the Min trimpot to deadband or the desired minimum motor voltage output. The deadband point is where you are at 0Vdc and any further increase of the Min trimpot would result in an output to the motor. Re-apply 20mA to the -5/-7 board and verify max output has not changed. A small adjustment may be needed to the Max trimpot to reset to desired max output.

7) Adjust 4-20 input to 12mA. If tuned properly the output voltage of an unloaded motor should be within a few volts of 1/2 output (based on max output setting above).

-7 option only: With 20mA applied to the -7 in Auto mode, move AUTO/MANUAL switch to MANUAL.

8) In manual mode turn the speedpot full CW, note motor voltage output reading on voltmeter. If not equal to output at 20mA in Auto Mode, adjust the Balance trimpot on the -7 board (CW or CCW) until the same reading is achieved. The motor output Vdc should not change more than 1 Vdc when flipping back and forth between AUTO and MANUAL position.

-11 option

10 Turn Master SpeedPot

Field Installed
Available All Models

Provides finer control of speed. Use standard Hook-up directions and Trimpot Chart (page 5).

-15B / -K options

Acceleration Time Ranges

Factory Installed

This option provides the Accel times shown below. The standard Accel time is 0.5 seconds.

	-15B OPTION	-K OPTION
ACCELERATION TIME	4 seconds	6 seconds

USE STANDARD HOOK-UP

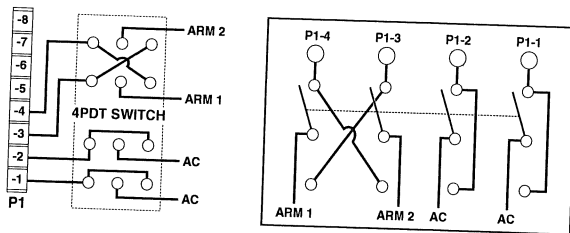
-29B option

Manual Forward-Off-Reverse Switch

Field Installed Only

Permits reversing of motor. This is accomplished using a 4PDT blocked center switch. When switched between the forward/reverse positions, a delay is encountered due to the blocked center position, which protects the control from any voltage that may be at the ARM terminals. The center position is OFF/NEUTRAL.

THE MOTOR MUST COME TO A COMPLETE STOP BEFORE CHANGING DIRECTIONS. IF THE MOTOR DOES NOT COME TO A COMPLETE STOP, SERIOUS DAMAGE TO THE CONTROL MAY RESULT. BYPASS OF THE SWITCH CENTER BLOCK MAY RESULT IN DAMAGE TO THE CONTROL.



-55H option

Isolated Signal Input

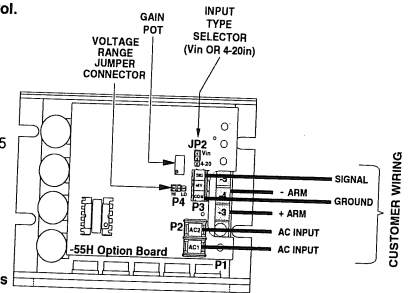
Factory or Field Installed

NOTE: This option cannot be used on the 123D-C series control.

This option card allows for the use of either a grounded or non-grounded remote DC signal such as 0 to 5 through 0 to 250Vdc, 4-20mA current, or a remote speed pot. The DC input signal type can be selected for voltage (Vin) or current (4-20mA) via the JP2 jumper clip. There is a Hi/Lo range jumper selection that should be set to the (Lo) setting when using a 4-20mA signal or voltage ranges of 0-5 through 0-25Vdc. When using voltage ranges of 0-25 through 0-250 this jumper must be set to (Hi). The GAIN trimpot is used to set full linear output in reference to the input signal range. The output of this remote signal isolation board is a linear signal that is proportional to the remote input signal being supplied.

(FOR SHUNT WOUND MOTOR, SEE PAGE 4 OF MANUAL FOR FIELD CONNECTIONS).

CAUTION: DO NOT use TRIMPOT ADJUSTMENT CHART. Set pots using directions in following SET-UP PROCEDURE.



SETUP PROCEDURE FOR -55H AND -56H OPTIONS

1. With NO power to control, connect a DC Voltmeter to control outputs as follows: Meter COMMON to the -ARM terminal, Meter POSITIVE to the +ARM terminal. Select correct meter range (0-90V or 0-180V).
2. Preset GAIN pot on the remote signal board fully CCW.
3. Place the JP2 jumper clip in the proper position based on the input signal being used.
4. Place the P4 jumper clip in the Lo position for 4-20mA signals or voltage signals less than 25Vdc. Place the P4 jumper clip in the Hi position for voltage signals greater than 25Vdc. (NOTE: Never exceed 250Vdc)
5. Make sure all connections are properly made per the hookup connection diagram and then apply AC power to the controller.
6. Set the remote input signal to its lowest setting. Adjust the MIN trimpot to deadband (the point just before an increase causes an output).
7. Apply the maximum remote input signal. Motor should start to run. Adjust the GAIN pot CW until no further increase in control output voltage occurs and then decrease the gain pot slowly until output voltage to the motor drops approximately 5Vdc.
8. Set the MAX trimpot on the control to the correct motor voltage.
9. Some interaction between trimpots may occur. Recheck the Min trimpot setting and repeat steps 6 through 8 as needed.

-56H option

Isolated Signal Input with Auto / Manual Switch

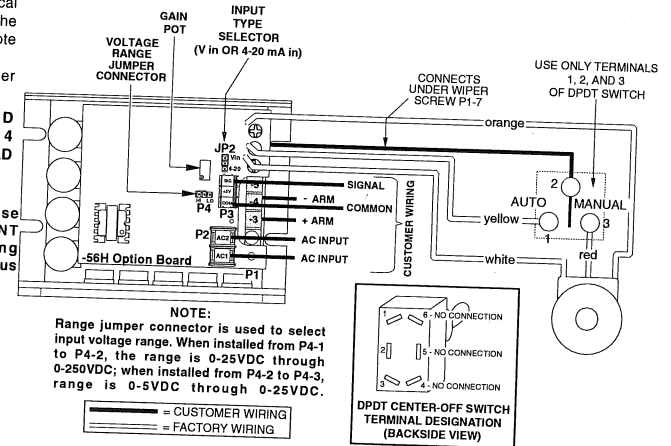
Factory or Field Installed

NOTE: This option cannot be used on the 123D-C series control.

The -56H option is identical to the -55H option with the added ability to have remote Auto/Manual switching. See -55H for more further detail.

(FOR SHUNT WOUND MOTOR, SEE PAGE 4 OF MANUAL FOR FIELD CONNECTIONS).

CAUTION: DO NOT use TRIMPOT ADJUSTMENT CHART. Set pots using directions in the previous SET-UP PROCEDURE.



IN CASE OF DIFFICULTY

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION(S)
Motor doesn't operate	- Blown Fuse or Breaker - Incorrect or no power source - Speedpot set at zero - Worn motor brushes	Replace Fuse or reset breaker Install proper service Adjust Speedpot CW to start Replace brushes
Armature output voltage cannot be adjusted, output is a constant DC level	- No motor or load connected - Speedpot low connection open	Check that motor or load is connected to armature terminals Check that speedpot low wire is connected
Motor stalls, or runs very slowly with speed control turned fully CW	- Low Voltage - Overload Condition - Worn motor brushes - MAX SPEED set incorrectly	Check that VAC is above 100VAC Reduce load or increase motor size and/or Cur. Lim. setting. Replace brushes See ADJUSTMENT PROCEDURE
Motor hunts	- Motor current less than 150mA - Too much IR COMP - Motor is in current limit - Motor speed is above rated speed - Max set too high	Motor current must be greater than 150mA D.C. See ADJUSTMENT PROCEDURE See ADJUSTMENT PROCEDURE Reduce Speed See ADJUSTMENT PROCEDURE
Repeated fuse blowing	- Low Voltage - Overload Condition - Worn motor brushes - Defective motor bearings - Defective electrical components	Check that VAC is above 100VAC Reduce load Replace Replace Call Dart Distributor or Representative

If control still will not operate, go to www.dartcontrols.com/support or call (317) 873-5211.

SPECIFICATIONS

AC input voltage	±10% of rated line voltage
Acceleration	0.5 seconds (standard 125D)
Amps - DC output	150 mA to 5.5 ADC*
Controller overload capacity	200% for one minute
Current limit trimpot range	0.3 to 2.5 ADC (125D); 1 to 15 ADC (123D & 125DV)
Deceleration	0.5 seconds (standard 125D)
Dimensions and weights:	

	WIDTH	LENGTH	DEPTH	WEIGHT
ENGLISH	3.625"	4.250"	1.300"	8.00 oz.
METRIC	92mm	108mm	33mm	228 gms.

Drive service factor	1.0
Efficiency	85% typical
Input frequency	50 or 60 Hertz
Max. trimpot speed range	60% to 110% of base speed
Min. trimpot speed range	0% to 30% of maximum speed
Power devices	isolated case tab
Shunt field voltage	20VDC for 24VAC input; 30VDC for 36VAC input; 100VDC for 120VAC input; 200VDC for 240VAC input; 1 amp maximum
Speed control	via 5kΩ 2W potentiometer or 0-10VDC isolated signal
Speed range	50:1
Speed regulation	±1% of base speed
Temperature range	-10° to 45° C. ambient (15° to 115° F.)
Transient protection	G-Mov**
Trigger	opto-coupler
Type ramp of accel/decel	RC time constant

* With -HS(125D) or suitable external heatsink (where 125D extrusion temperature does not exceed 70° C.), maximum UL rating for output amps can be increased to 10 amps D.C.

** not used on the 123D-C series control

TYPICAL MOTOR CURRENTS

Horsepower	1/50	1/20	1/8	1/4	1/3	1/2	3/4	1.0	1.5	2.0
Typical AC Amps (120VAC)	0.50	1.00	1.60	3.50	4.40	6.50	9.30	13.20	-----	-----
Typical Arm Amps (120VAC)	0.42	0.81	1.20	2.70	3.40	5.00	8.20	10.90	-----	-----
Typical AC Amps (240VAC)	-----	0.80	0.90	1.80	2.20	3.30	4.80	6.50	9.70	12.90
Typical Arm Amps (240VAC)	-----	0.40	0.60	1.40	1.70	2.50	3.70	5.00	8.20	11.60

125D SERIES PARTS PLACEMENT & LIST

RESISTORS

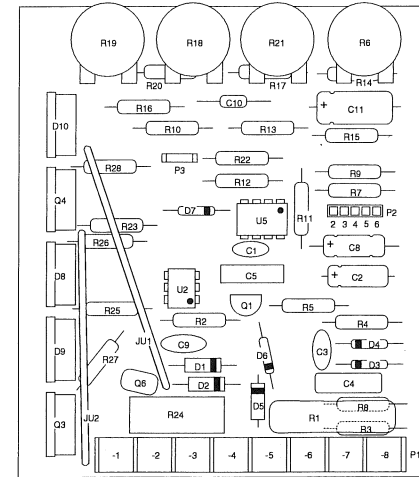
R1	15K 6W
R2	470 Ω
R3	2.7K
R4	2.7K
R5	82K
R6	5K (MIN TRIM)
R7	300K
R8	180K
R9	1.2M
R10	39K
R11	100K
R12	10K
R13	2.2K
R14	820 Ω
R15	4.7K
R16	470K
R17	1K
R18	100 Ω (I.R. TRIM)
R19	5K (C.L. TRIM)
R20	300K
R21	10K (MAX TRIM)
R22	1K
R23	300K
R24	.01 Ω 5W
R25	91K
R26	1K
R27	390 Ω
R28	390 Ω
R29	5K SPEEDPOT*

ACCEL CHANGES

Replace N.P. cap with polarized cap (see above)
-15A ... C8 ... 33uf 16V
-15B ... C8 ... 15uf 25V
-15C ... C8 ... 4.7uf 16V
-K ... C8 ... 22uf 16V

125D-12C (1/50 thru 1/8 H.P.) CHANGES:

R24062 Ω 5W



ACTIVE DEVICES

Q1	2N6027
U2	3052 MOC
Q3	S4015L
Q4	S4015L
U5	LM358 IC
Q6	275V G-MOV

CAPACITORS

C1	.01μF 100V
C2	10μF 35V
C3	0.1μF 100V
C4	.035μF 400V
C5	.22μF 1KV
C8	1μF 50V N.P.
C9	.0047μF 1KV
C10	.1μF 50V
C11	47μF 16V

DIODES

D1	1N4005
D2	1N4005
D3	1N914B
D4	1N5242B
D5	1N4005
D6	1N5239B
D7	1N914B
D8	D4015L
D9	D4015L
D10	D4015L

123D-C CHANGES:

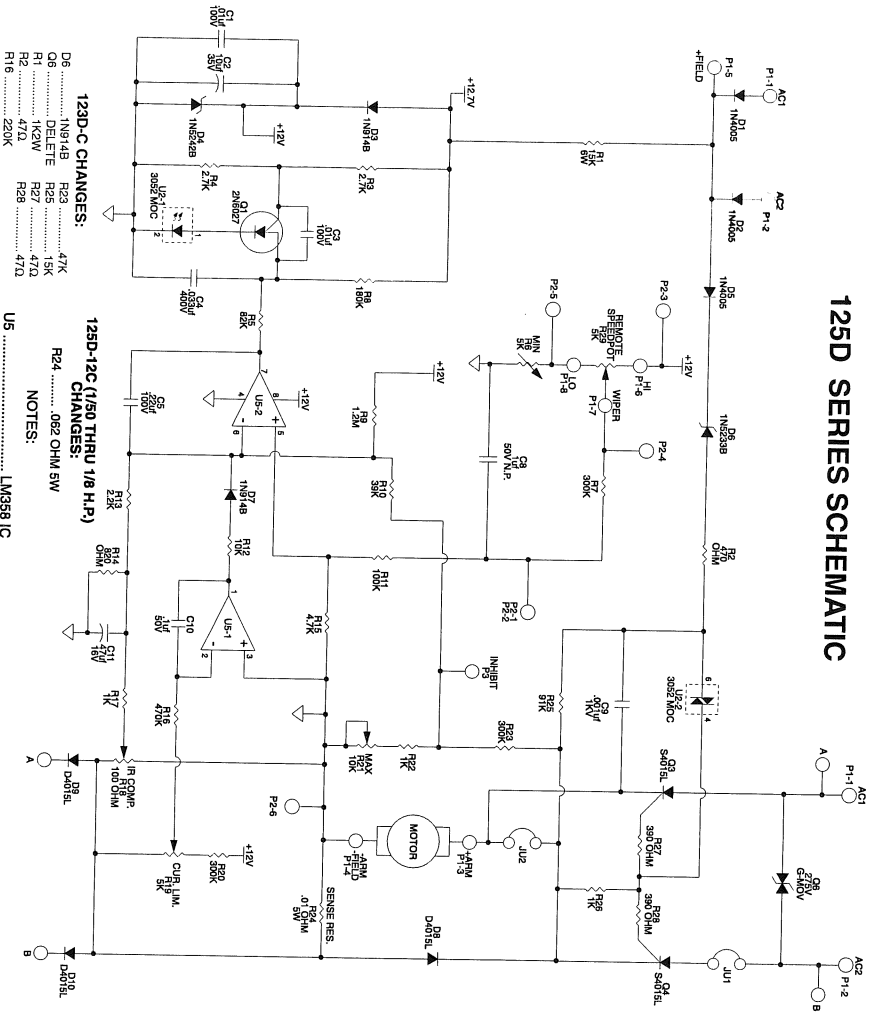
D6	1N914B (reverse direction)
Q6	DELETE
R1	1K 2W
R2	47Ω
R16	220K
R23	47K
R25	15K
R27	47Ω
R28	47Ω

MISCELLANEOUS

JU1	18GA. SOLID INSULATED WIRE
JU2	18GA. SOLID INSULATED WIRE
PCB	A-4-2033F PRINTED CIRCUIT
P1 (-1 THRU -8)	8 POS. TERMINAL STRIP
P2 (-2 THRU -6)	5 POS. FEMALE CONNECTOR
P3	3/16" MALE SPADE PIN

NOTES:

125D SERIES SCHEMATIC



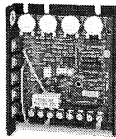
REPAIR PROCEDURE

In the event that a Product manufactured by Dart Controls Incorporated (DCI) is in need of repair service, it should be shipped, freight paid, to: Dart Controls, Inc., 5000 W. 106th Street, Zionsville, IN. 46077, ATTN: Repair Department. Please include Name, Shipping Address (no P.O. Box), Phone Number and if possible, e-mail address.

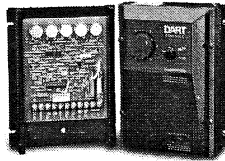
Those orders received from anyone without an existing account with DCI must specify if they will be paying COD or Credit Card (Master Card/Visa/American Express). This information is required before work will begin. If you have an account with Dart your order will be processed according to the terms listed on your account. Products with Serial Number date codes over 5 years old will automatically be deemed Beyond Economical Repair (BER). A new, equivalent device will be offered at a substantial discount.

Completed repairs are returned with a Repair Report that states the problem with the control and the possible cause. Repair orders are returned via UPS Ground unless other arrangements are made. If you have further questions regarding repair procedures, contact Dart Controls, Inc. at 317-873-5211.

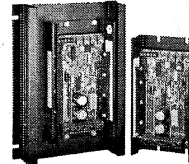
YOUR MOTOR SPEED CONTROL SOLUTIONS PROVIDER



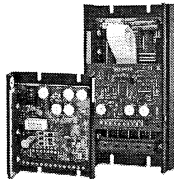
125D SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 1.0 HP



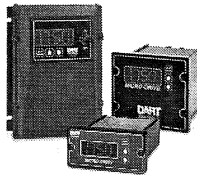
250G SERIES
AC INPUT - VARIABLE DC OUTPUT
1/50 HP through 2.0 HP



65 SERIES
DC INPUT - VARIABLE DC OUTPUT
CURRENT RATINGS OF 20, 40, AND
60 AMPS



700/COMMUTROL SERIES
DC BRUSHLESS
5 & 20 Amp for
12, 24, & 36VDC inputs



MDP SERIES
PROGRAMMABLE
CLOSED LOOP DC
SPEED CONTROL



DM SERIES
FIELD PROGRAMMABLE
DIGITAL TACHOMETER

Dart Controls, Inc. is a designer, manufacturer, and marketer of analog and digital electronic variable speed drives, controls, and accessories for AC, DC, and DC brushless motor applications.

Shown above is just a sampling of the expanded line of Dart controls that feature the latest in electronic technology and engineering. Products are manufactured in the U.S.A. at our Zionsville (Indianapolis,

Indiana) production and headquarters facility - with over 2,000,000 variable speed units in the field.

In addition to the standard off-the-shelf products, you can select from a wide variety of options to customize controls for your specific application. For further information and application assistance, contact your local Dart sales representative, stocking distributor, or Dart Controls, Inc.

www.dartcontrols.com
ISO9001:2008 REGISTERED

Dart Controls, Inc.

Manufacturer of high quality DC and AC motor speed controls and accessories since 1963.

P.O. Box 10
5000 W. 106th Street
Zionsville, Indiana 46077
Phone: (317) 873-5211
Fax: (317) 873-1105

CH 4

WAGNER MODEL R2R-1
S/N H3859

DOCTOR BLADE COATER

SEC 4

THE FILM OR WEB LEAVES THE GUIDER FRAME AND IS FED TO THE GRANITE PLATE AT THE TOP OF THE UNWIND. THE GRANITE PLATE IS A PRECISION GROUND FLAT SURFACE ONTO WHICH A 3 CHAMBER DOCTOR BLADE COATER ASSEMBLY IS PLACED. A PAIR OF MACHINED CROSSPLATES HELP TO LOCATE THE COATER IN A FIXED POSITION. BLADE OPENING DEPTH MICROMETER ADJUSTERS CONTROL THE GAP OPENING WHICH THEN CONTROLS THE COATING THICKNESS. COVER PLATES HELP TO KEEP THE COATING SOLVENTS FROM ESCAPING.

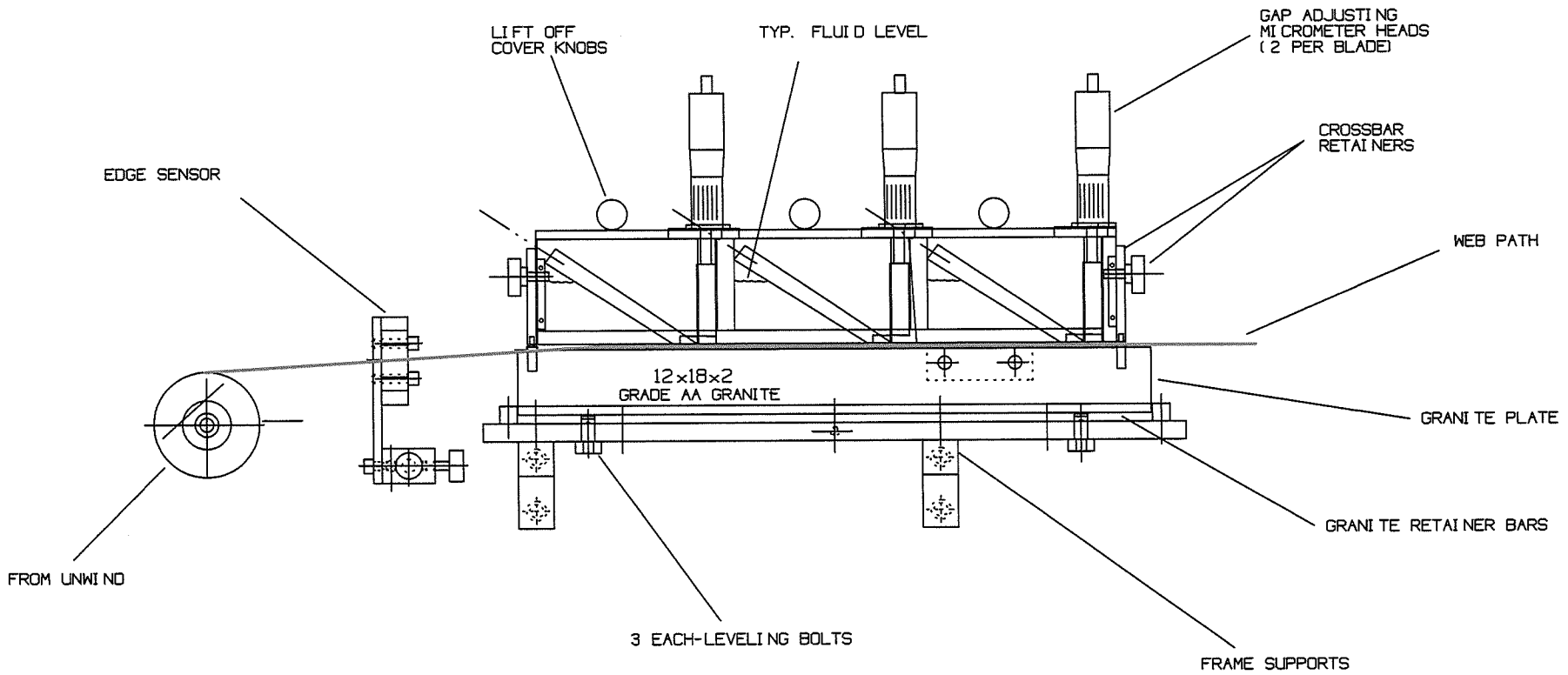
A SIDE VIEW OF THE COATER IS SHOWN ON PAGE 2 OF 2 OF THIS SECTION.

TO LEVEL THE COATER ASSEMBLY, 3 EACH FINE THREAD BOLTS ARE LOCATED UNDER THE GRANITE MOUNTING PLATE. THE SINGLE BOLT ADJUSTS THE "X" OR IN WEB DIRECTION LEVELING WHILE THE TWO SIDE BY SIDE BOLTS ADJUST THE "Y" DIRECTION LEVEL SETTING.

USE A PRECISION MACHINISTS LEVEL ($\pm .005$ " / FT ACCURACY). PLACE LEVEL ON TOP OF CLEAN GRANITE SURFACE IN THE DIRECTION BEING LEVELED. RECHECK TWICE AFTER INITIAL ADJUSTMENTS. CHECK EVERY 3-6 MONTHS FOR ACCURACY.

DOCTOR BLADE COATER

SEC 4A



(0)

Total: 50.00

DOCTOR BLADE ASSEMBLIES

HOME ABOUT US PRODUCT DESCRIPTIONS SHOP



P.O. Box 296
Morrisville, PA 19067, USA
215-493-2008

ABOUT

<https://www.drblade.com/store/>

SHOP BLADES

About Our Blades

Doctor Blade Assemblies made by Tape Casting Warehouse, Inc. have been proven in use for over 20 years.

A spark-proof, lightweight, all aluminum housing is designed to ride directly on the carrier film. This avoids thickness variations from carrier thickness variation and gives a stable blade gap setting.

The Blade Gap is set using two micrometers per blade, each marked in 0.0001" increments. Dual micrometer adjustment gives control over blade gap as well as blade levelness.

The Blade Itself is made of stainless steel and surface ground and polished for flatness. The steel blade provides excellent abrasion resistance against the ceramic slip at normal and even high casting speeds.

For those casting on steel belt machines, the doctor blade housing may be made of Delryn®/Teflon® to avoid marring the continuous belt.

The reservoir design makes this doctor blade assembly function excellently for stationary blade/moving carrier machines, moving blade machines as well as for hand-drawn casting.

The back wall of the reservoir is set at a 45° angle which allows "low impact" slip additions to the reservoir. This helps to avoid green tape thickness variation due to changing forces on the reservoir head.

The doctor blade assembly is also designed in such a way that both single and double doctor blade assemblies have the same outside dimensions to allow easy changeover.

CH 5

WAGNER MODEL R2R-1
S/N H3859

E-SPI N CABI NET

SEC 5

THE E-SPI N ENCLOSURE IS CONSTRUCTED OF HI STRENGTH POLYCARBONATE AND CONTAINS THE 9 STATION DROPPER BOTTLE AND NEEDLE RASTERIZER, 9 CHANNELS OF HIGH VOLTAGE POWER SUPPLIES, 9 VOLTAGE TO PRESSURE CONVERTER MODULES, INTERFACE DIGITAL AND ANALOG MODULES, Rh AND TEMPERATURE SYSTEM AND VARIOUS POWER SUPPLIES AND SERVO CONTROL SYSTEM AND AMPLIFIER. LIMIT SWITCHES AND PROX SENSORS ARE USED FOR END OF TRAVEL AND DOOR OPEN SENSOR.

THE RASTERIZER TRAVEL AND SPEED ARE CONTROLLED BY THE PC THAT IS LOCATED TO THE LEFT OF THE CABINET. THIS IS A LABVIEW BASED SYSTEM THAT HAS ALL THE NECESSARY INPUTS THAT SENSE THE RASTERIZER TRAVEL DISTANCE AND SPEED AS WELL AS CONTROL THE DROPPER PRESSURES AND HIGH VOLTAGE CONDITIONS. THE SERVO SYSTEM AMPLIFIER IS LOCATED IN THE REAR OF THE CABINET BEHIND THE MAIN REAR VERTICAL PLATE. THE POWER SUPPLIES ARE ALSO LOCATED NEXT TO THE SERVO AMPLIFIER. ON THE FRONT OF THE MAIN VERTICAL PLATE ARE 9 25KV POWER SUPPLIES THAT PROVIDE DC STATIC POTENTIALS NECESSARY TO GENERATE THE TAYLOR CONES FOR THE FIBER GENERATION. ON THE REAR OF THE VERTICAL PLATE ARE 9 EACH E-P CONVERTER MODULES THAT CONVERT 0-5VDC TO 0 TO 0.34 PSI (10" H2O) WHEN AT 0 VDC, A SLIGHT VACUUM IS PRESENT AT ANY ONE OR ALL OF THE DROPPER BOTTLES TO AVOID DRIPPING. FOR EXTENDED PERIODS OF NON USE OF A PARTICULAR CHANNEL OR CHANNELS, THE SHUT OFF VALVE ON THE INLET SIDE OF THE DROPPER BOTTLE SHOULD BE TURNED OFF. THE E-SPI N CABINET CONTAINS NUMEROUS WIRING CONNECTIONS THAT ARE LOCATED ON THE INSIDE LEFT REAR WALL OF THE CABINET. WIRING TO THE VARIOUS INTERFACE MODULES ARE SHOWN AFTER PAGE 3 OF THIS SECTION.

ACCESS TO THE REAR ENCLOSURE WIRING IS MADE THRU A REMOVABLE COVER AT THE REAR OF THE MACHINE. BE SURE TO RE-INSTALL THIS COVER IF SERVICING THIS MACHINE OR IT'S WIRING.

WAGNER MODEL R2R-1
S/N H3859

E-SPIN CABINET

SEC 5

EACH OF THE DROPPER ASSEMBLIES MAY BE ADJUSTED UP OR DOWN AS REQUIRED USING THE LOCK KNOB ON THE REAR OF EACH ASSEMBLY. THE ATTACHED SCALE MAY BE USED AS A REFERENCE. THE OVERALL HEIGHT OF THE RASTERIZER FRAME MAY BE RAISED OR LOWERED AS NEEDED BY USING THE UP/DOWN MOMENTARY SWITCH ON THE UPPER RIGHT SIDE OF THE CABINET. A POINTER FOR HEIGHT REFERENCES IS MOUNTED NEXT TO THE BALLSCREW ON THE REAR VERTICAL PLATE. NEVER TRY TO FORCE THE MOTOR BEYOND IT'S UPPER OR LOWER TRAVEL LIMITS. DOING SO COULD DAMAGE THE GEARMOTOR AT THE TOP OF THE FRAME.

THE FRONT DOORS ARE HELD ON PLACE WITH MAGNETIC STRIPS ALONG THE TOP AND BOTTOM OF THE DOORS. THE LEFT DOOR SHOULD ALWAYS BE CLOSED FIRST SINCE THERE IS A VERTICAL SEAL ON THE RIGHT DOOR THAT OVERLAPS THE LEFT. A PROX SWITCH AT THE TOP OF THE FRAME SENSES WHEN THE DOOR IS OPENED. IF THE HIGH VOLTAGE POWER SUPPLIES ARE ON, THE OPEN DOOR WILL TURN OFF THE HIGH VOLTAGE THEREBY AVOIDING INJURY OR SHOCK TO THE USER. NEVER TRY TO DEFEAT THE DOOR PROX SWITCH!

THE TWO FRONT DOORS HAVE A SERIES OF 1/2" HOLES THAT ALLOW AN INSULATED PROBE TO BE INSERTED FOR CLEANING OF VARIOUS NEEDLES FROM TIME TO TIME. TAPERED RUBBER PLUGS ARE PROVIDED TO PLUG THE HOLES WHEN NEEDED.

THE BOTTOM PLATE OF THE CHAMBER IS HEATED WITH SILICON CONTACT STRIPS ON THE UNDERSIDE THAT WILL HEAT INCOMING NITROGEN GAS. THIS GAS PASSES THRU DESSICANT BAGS AND RISES THRU SLOTS IN THE BASE PLATE. THIS HEATED GAS FORCES MOISTURE OUT OF THE CABINET AND CAN LOWER THE RH DOWN TO AS LOW AS 20% WHEN NEEDED. THE OMEGA CONTROLLER ON THE MAIN OPERATOR PANEL CONTROLS THE HUMIDITY AND THE TEMPERATURE. THE SENSOR IS LOCATED CENTRALLY AT THE OUTER END OF THE RASTERIZER FRAME.

E-SPI N CABINET

SEC 5A

WINDOWS BASED
PC & MONI TOR

CONTROLS:
RASTERI ZER
HV VOLTAGES
DROPPER PRESSURES
LASER

LED AI MING KNOBS

VENTS

LIFT DC GEARMOTOR

DOOR OPEN PROX.

EXTENDED FRONT
LEXAN ENCLOSURE

FRAME UP/DOWN

LED LI GHTING ON/OFF

PRESSURE LI NES

E/P MODULES (ON REAR)

HV POWER SUPPLI ES

SHUT OFF VALVES

RASTERI ZER FRAME

HV WI RE CLI P

LUER TI P NEEDLE

RASTERI ZER SERVO GEARMOTOR
WI TH ENCODER & PROX SW' S.

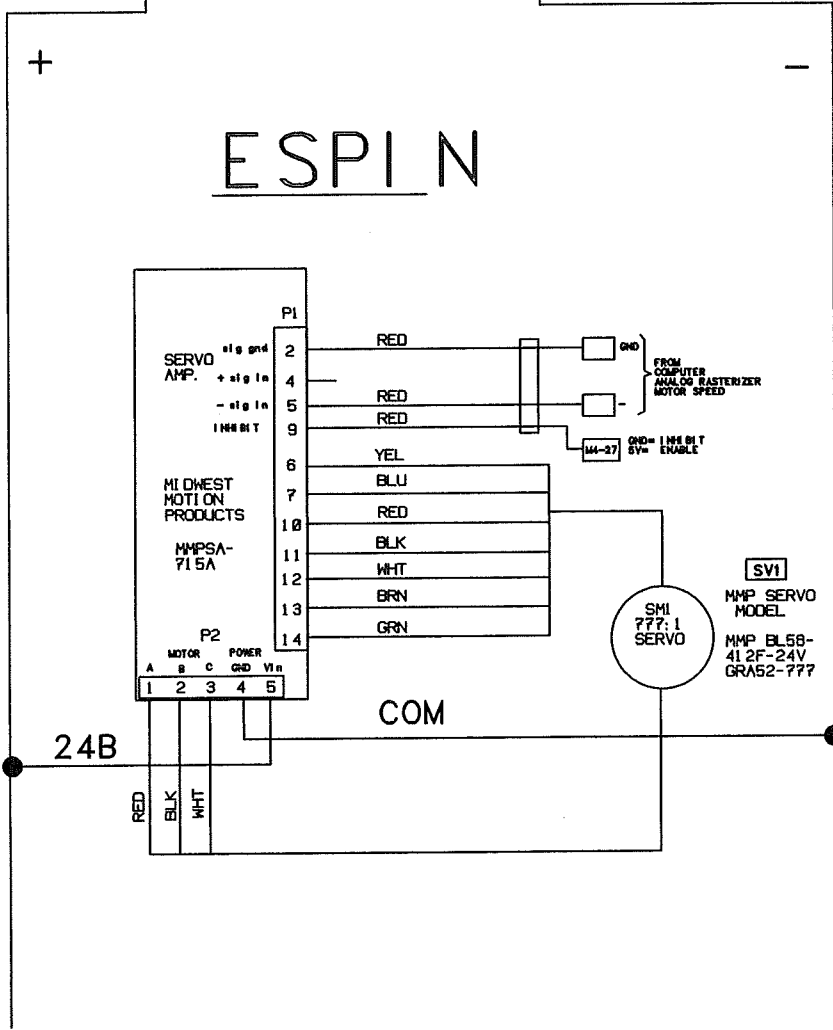
REAR SUPPORTS

FROM UNWI ND

LIFT BALLSCREW

DESSI CANT DRAWER

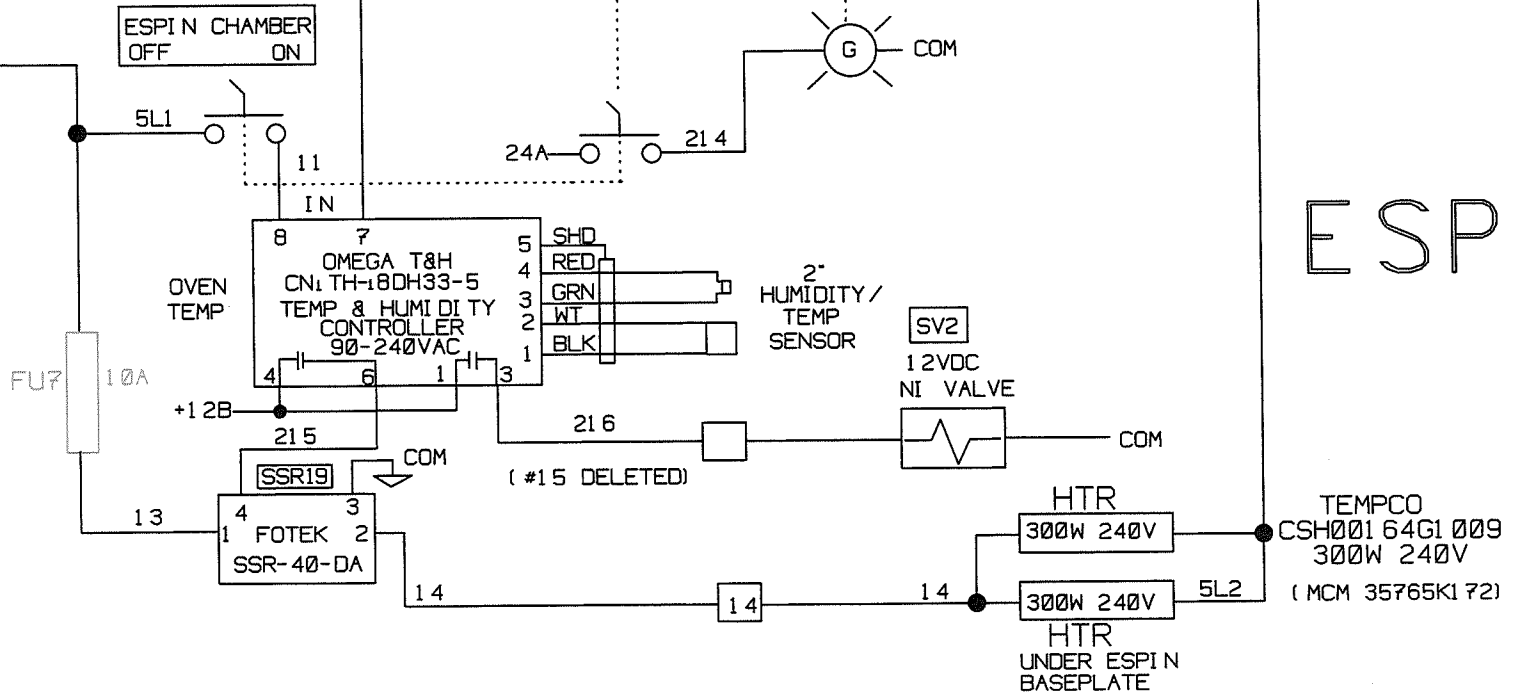
L1 PS2 L2
 COUTANT /
 LAMBDA
 DRP-480-1
 24V 20A
 + -



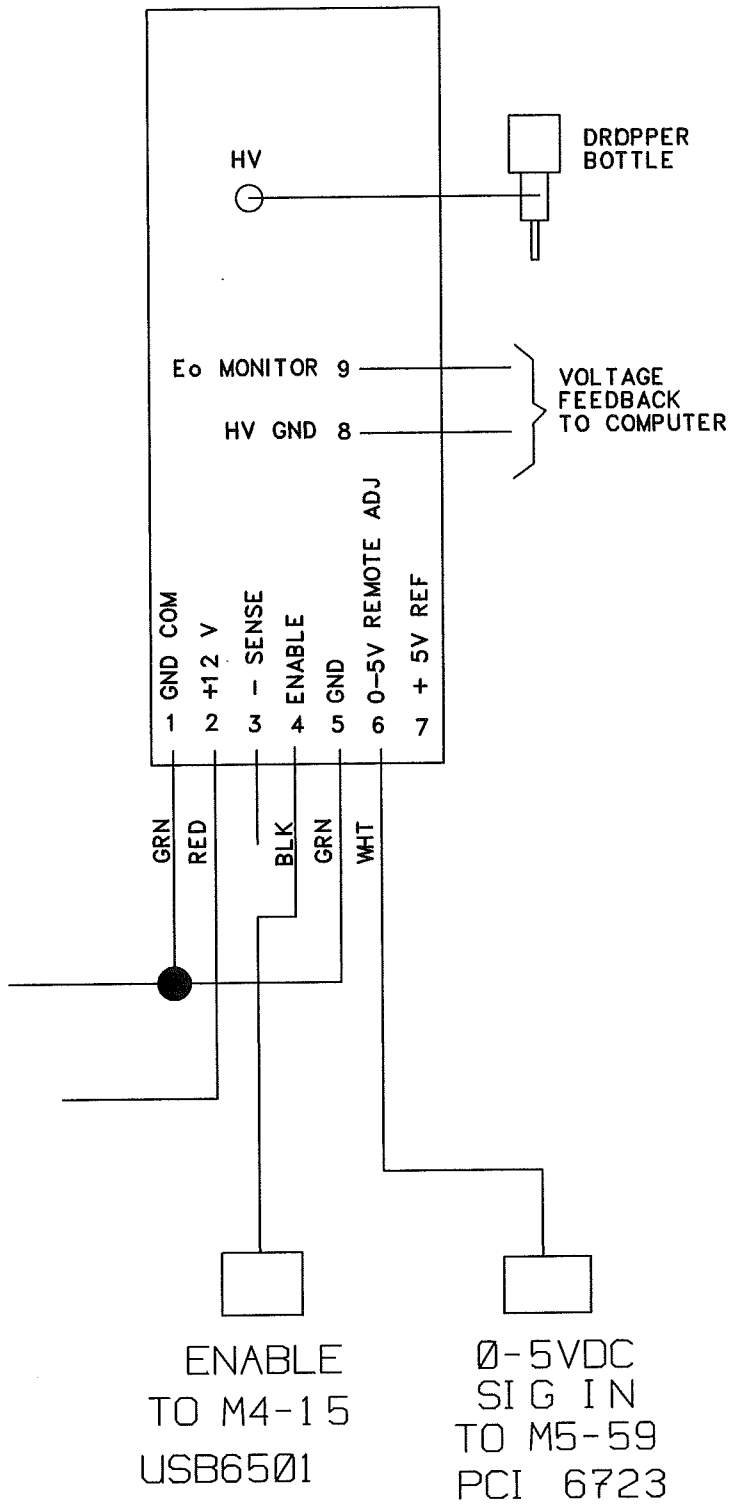
5L1

5L2

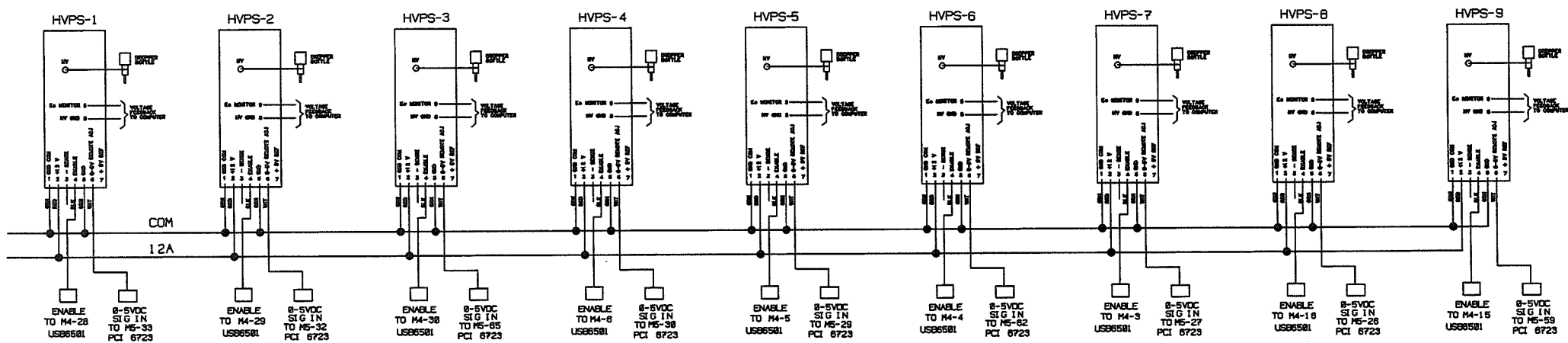
208V



HVPS-9



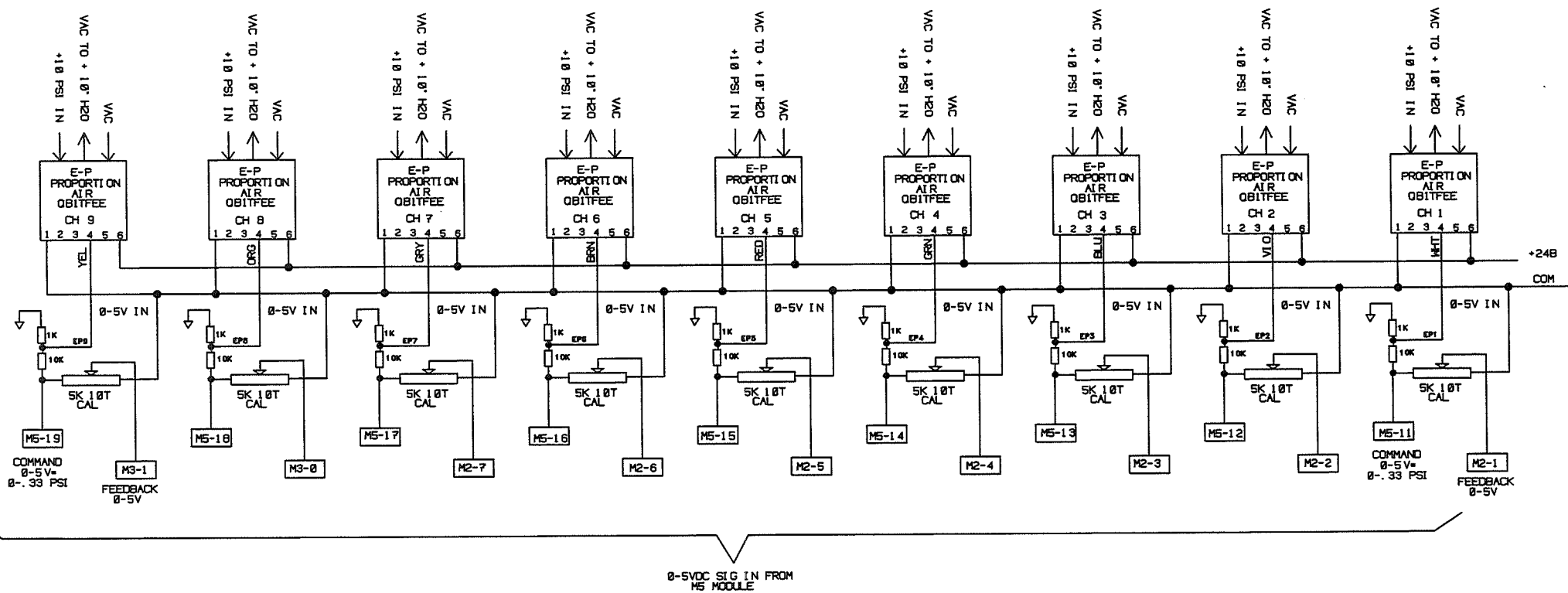
HV POWER SUPPLIES
TYPICAL



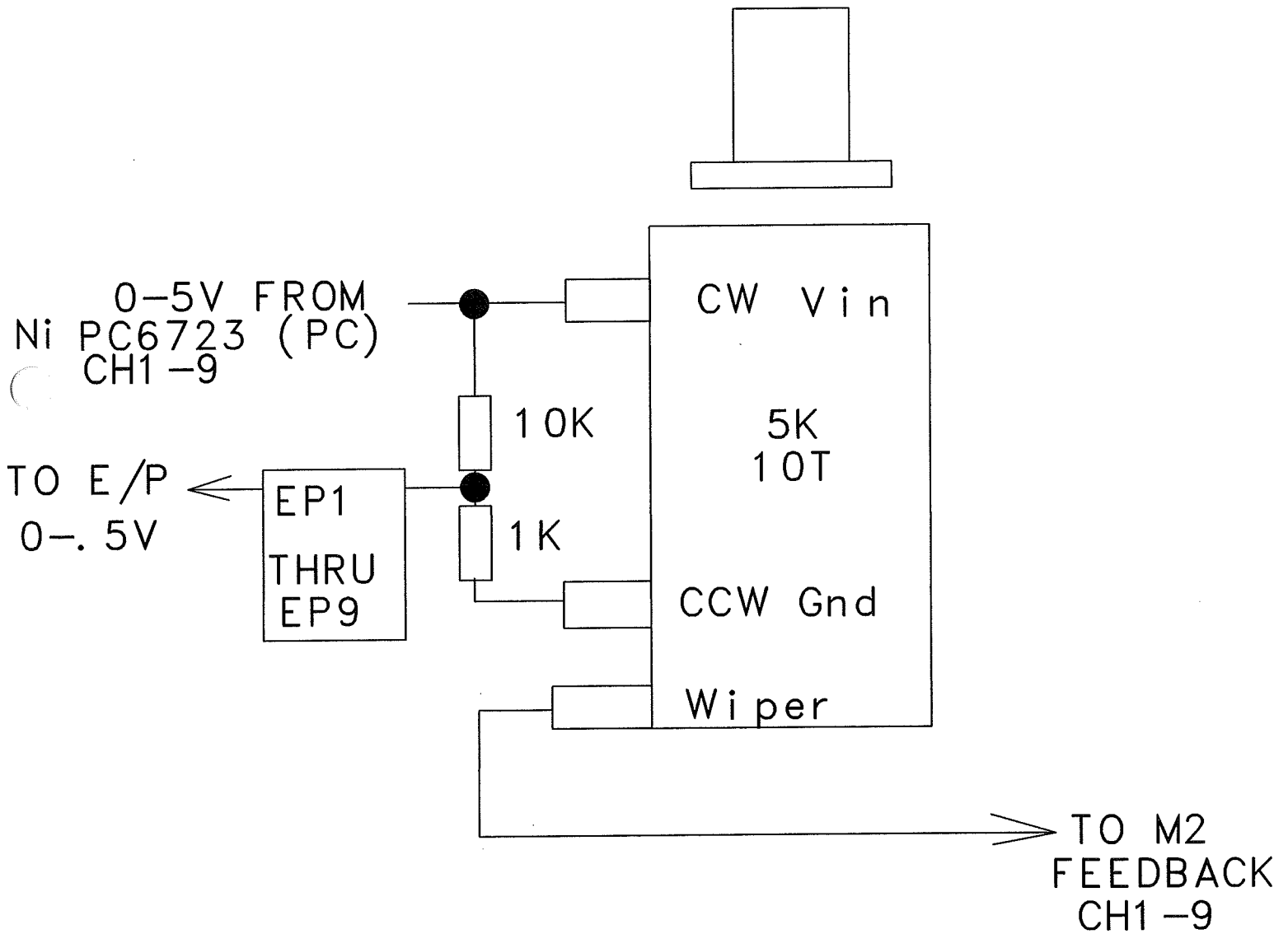
HVPS 1 THRU 9

NOTE: ALL POWER SUPPLIES ARE ULTRAVOLT MODEL # 25A12-P4

TO PC EXTERNAL MODULES M4 & M5



TYPICAL CALIBRATION
POT W R I N G CH1-9

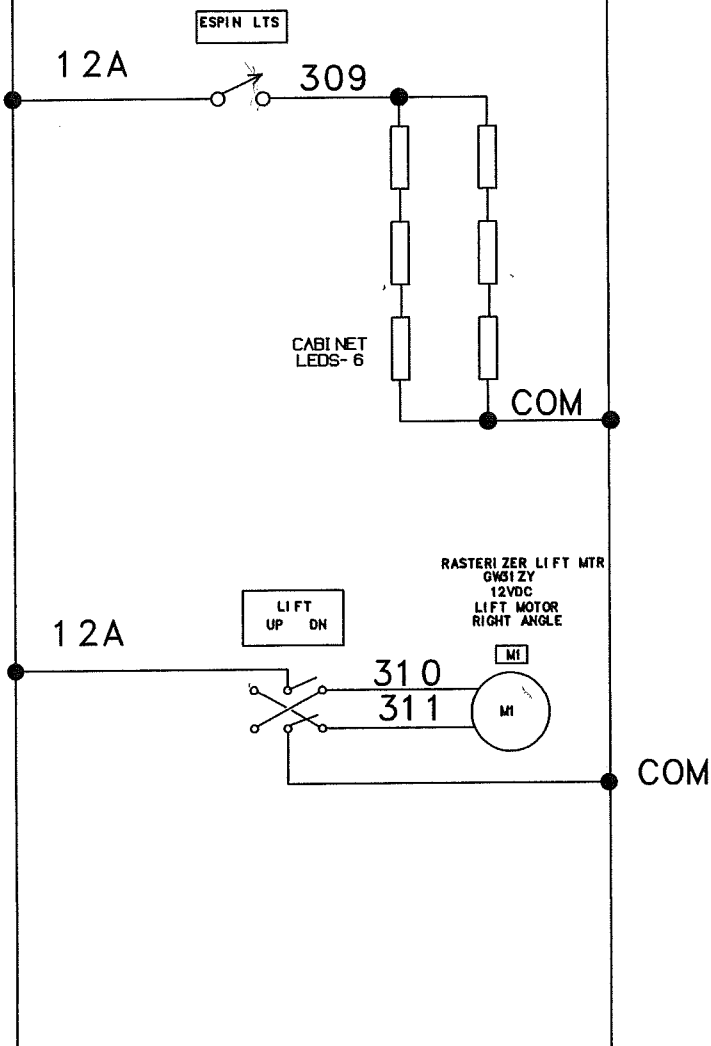


E/P CALIBRATIONS FOR 10PSI IN

CHANNEL	PSI @ 0V IN	PSI @ 2.5V IN	PSI @ 5.0V IN	FEEDBACK @ .34PSI @ 5V
1	0.0	.15	.36	.370
2	0.0	.16	.34	.340
3	0.0	.13	.35	.357
4	0.0	.18	.34	.342
5	0.0	.18	.34	.342
6	0.0	.22	.32	.326
7	0.0	.20	.32	.321
8	0.0	.20	.33	.327
9	0.0	.16	.34	.340

L1 PS3 L2
CL-1 80W-1 2V
+ -

ESPIN

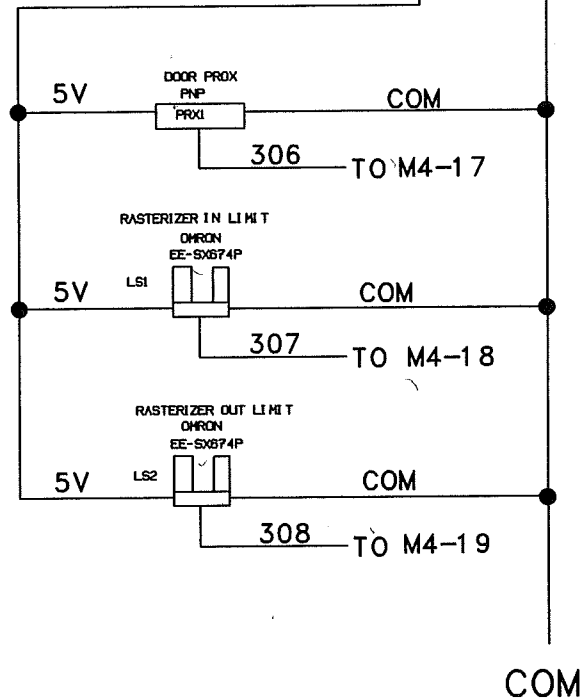
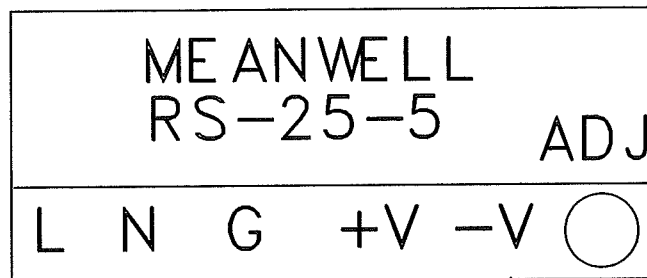


PS5

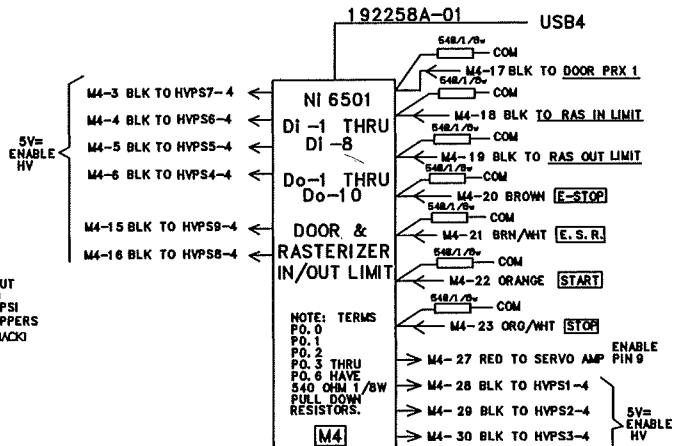
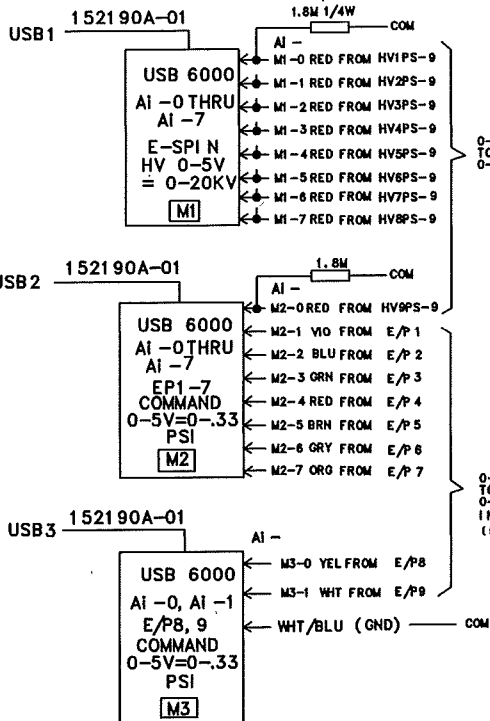
5V

5A

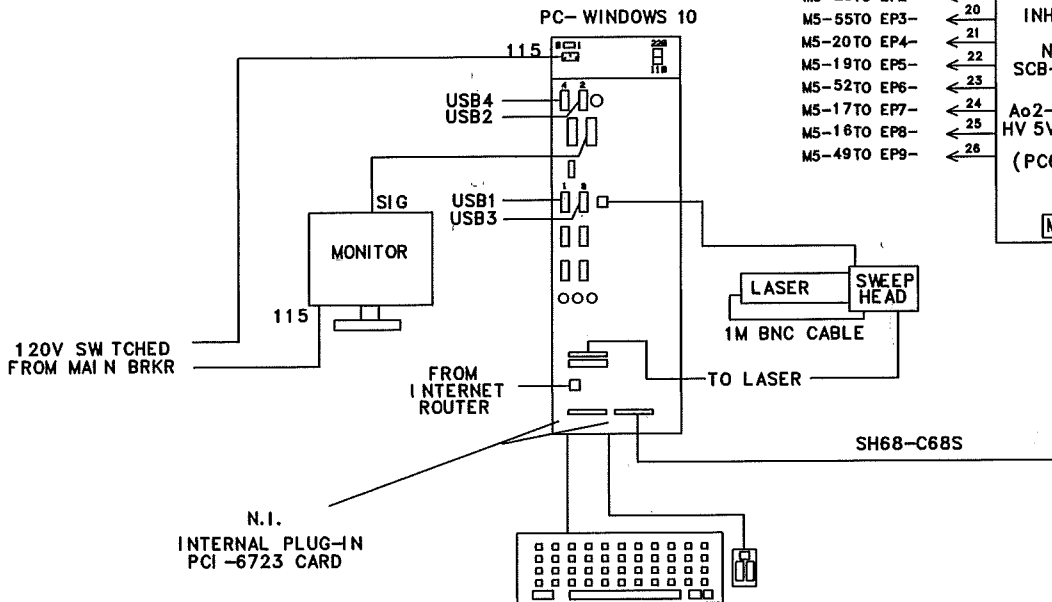
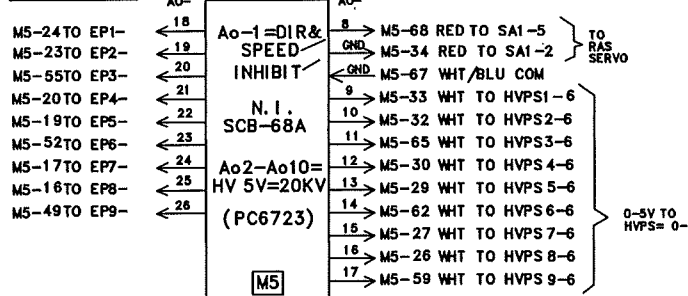
120C 120



NOTE: 1.8M TO COM ON ALL HV PIN 9 OUTPUTS TO SCALE PROPER READING ON SCREEN



0-5V COMMANDS



SEC5A

Basic Overview for E-Spinning Diagnostic Application

Created 02/27/2018

This is the main display when the Diagnostic Application is launched.

The screenshot shows the 'Diagnostic Application' window with the following components:

- NI 6501 Selection:** A dropdown menu showing 'USB-6501'.
- NI 6000 #1:** A dropdown menu showing 'USB-6000-1'.
- NI 6000 #2:** A dropdown menu showing 'USB-6000-2'.
- NI 6000 #3:** A dropdown menu showing 'USB-6000-3'.
- NI 6723 Selection:** A dropdown menu showing 'PCI-6723'.
- START NI 6501 ACQUISITION:** A green arrow button.
- START:** Three green arrow buttons for the NI 6000 modules.
- START NI 6723 ACQUISITION:** A green arrow button.
- DIGITAL INPUT:** A vertical column of seven status indicators: Rasterizer OUT Limit, Rasterizer IN Limit, Door Closed, Start, Stop, E-Stop, ESR, and Laser Feedback.
- DIGITAL OUTPUT:** A vertical column of nine 'LOW' buttons labeled 'Rasterizer Move Inhibit' and 'HV #1 Inhibit' through 'HV #9 Inhibit'.
- ANALOG INPUT (HV #1-8):** A vertical column of eight digital display boxes, each showing '0'.
- ANALOG INPUT (HV #9):** A digital display box showing '0'.
- ANALOG INPUT (E-P #8-9):** Two digital display boxes, each showing '0'.
- ANALOG OUTPUT:** A grid of 18 digital display boxes (HV #1-9 and Dropper #1-9) with 6-digit displays (0-5) and a progress bar above each.
- EXIT:** A red 'X' button at the bottom center.
- RASTERIZER MOTION:** A horizontal slider at the bottom right with a scale from -10 to 10.
- HALT MOTION:** A red square button at the bottom right.

To start acquiring Digital input and controlling Digital outputs signals; click the **START NI 6501 ACQUISITION**

The screenshot shows the 'Diagnostic Application' window. At the top, there are five selection boxes: 'NI 6501 Selection' (with 'USB-6501' selected), 'NI 6000 #1' (with 'USB-6000-1' selected), 'NI 6000 #2' (with 'USB-6000-2' selected), 'NI 6000 #3' (with 'USB-6000-3' selected), and 'NI 6723 Selection' (with 'PCI-6723' selected). Below these are five 'START' buttons. The first button, 'START NI 6501 ACQUISITION', is highlighted with a red box. The interface is divided into several functional areas:

- DIGITAL INPUT:** Includes indicators for Rasterizer OUT Limit, Rasterizer IN Limit, Door Closed, Start, Stop, E-Stop, ESR, and Laser Feedback.
- DIGITAL OUTPUT:** Includes 'LOW' buttons for Rasterizer Move Inhibit and HV #1 through #9 Inhibit.
- ANALOG INPUT:** Includes digital displays for HV #1 through #8 and E-P #8 through #9.
- ANALOG OUTPUT:** Includes digital displays for HV #1 through #9 and Dropper #1 through #9.

At the bottom, there is an 'EXIT' button and a 'RASTERIZER MOTION' control bar with a 'HALT MOTION' button.

Once the NI 6501 section is running the input and output controls will become enabled.

The screenshot displays a software interface titled "Diagnostic Application" with several control panels:

- NI 6501 Selection:** Includes a dropdown menu for "NI 6501" and "USB-6501".
- NI 6000 #1:** Includes a dropdown menu for "NI 6000 #1" and "USB-6000-1".
- NI 6000 #2:** Includes a dropdown menu for "NI 6000 #2" and "USB-6000-2".
- NI 6000 #3:** Includes a dropdown menu for "NI 6000 #3" and "USB-6000-3".
- NI 6723 Selection:** Includes a dropdown menu for "NI 6723" and "PCI-6723".

Below the selection panels are status and control buttons:

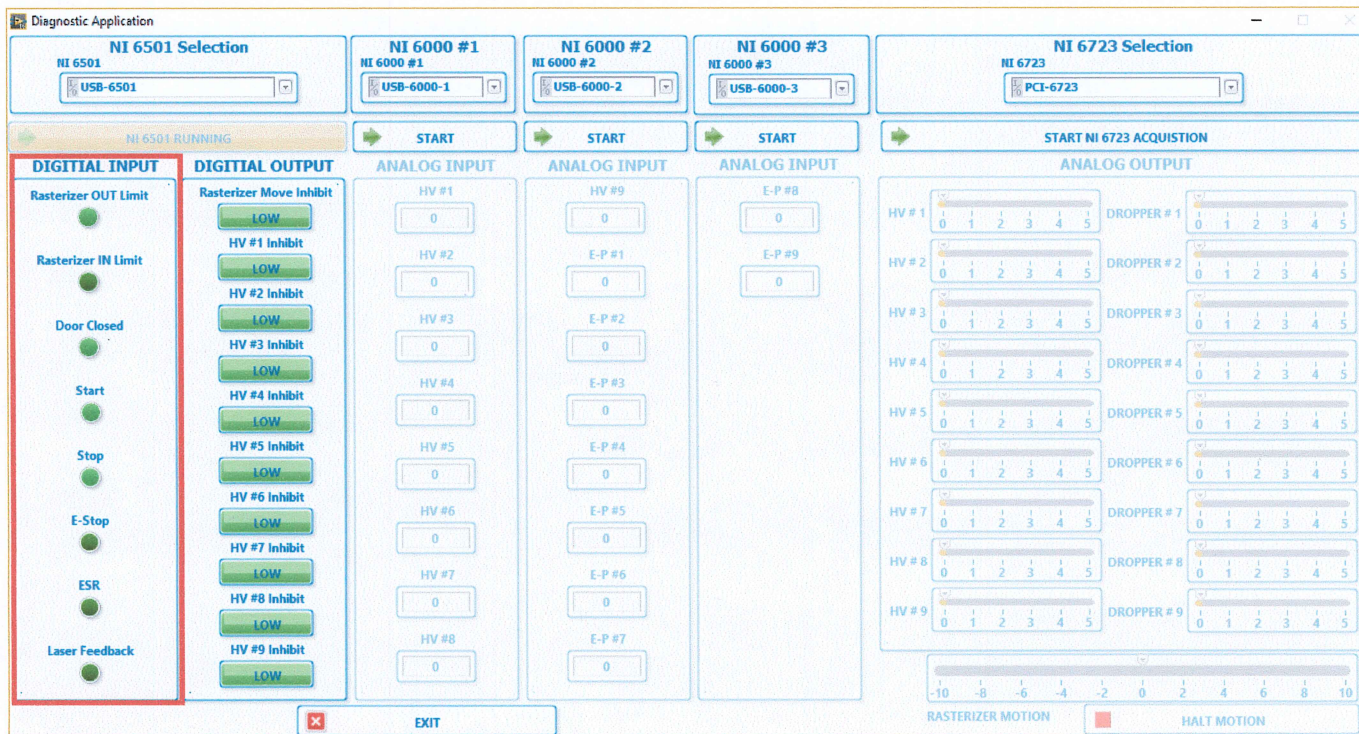
- NI 6501 RUNNING:** A green bar with a right-pointing arrow.
- START:** Three green buttons with right-pointing arrows, one for each NI 6000 section.
- START NI 6723 ACQUISITION:** A green button with a right-pointing arrow.

The main control area is divided into several sections:

- DIGITAL INPUT:** Features seven indicator lights for "Rasterizer OUT Limit", "Rasterizer IN Limit", "Door Closed", "Start", "Stop", "E-Stop", "ESR", and "Laser Feedback".
- DIGITAL OUTPUT:** Features nine green buttons labeled "HV #1 Inhibit" through "HV #9 Inhibit", each with a "LOW" indicator.
- ANALOG INPUT:** Features three columns of digital input displays labeled "HV #1" through "HV #8", "E-P #1" through "E-P #7", and "E-P #8". Each display shows a value of "0".
- ANALOG OUTPUT:** Features two columns of digital output displays labeled "DROPPER #1" through "DROPPER #9". Each display shows a value of "0".
- ANALOG OUTPUT (Bottom):** A horizontal slider ranging from -10 to 10, with a red square indicator and labels "RASTERIZER MOTION" and "HALT MOTION".

An "EXIT" button is located at the bottom center of the interface.

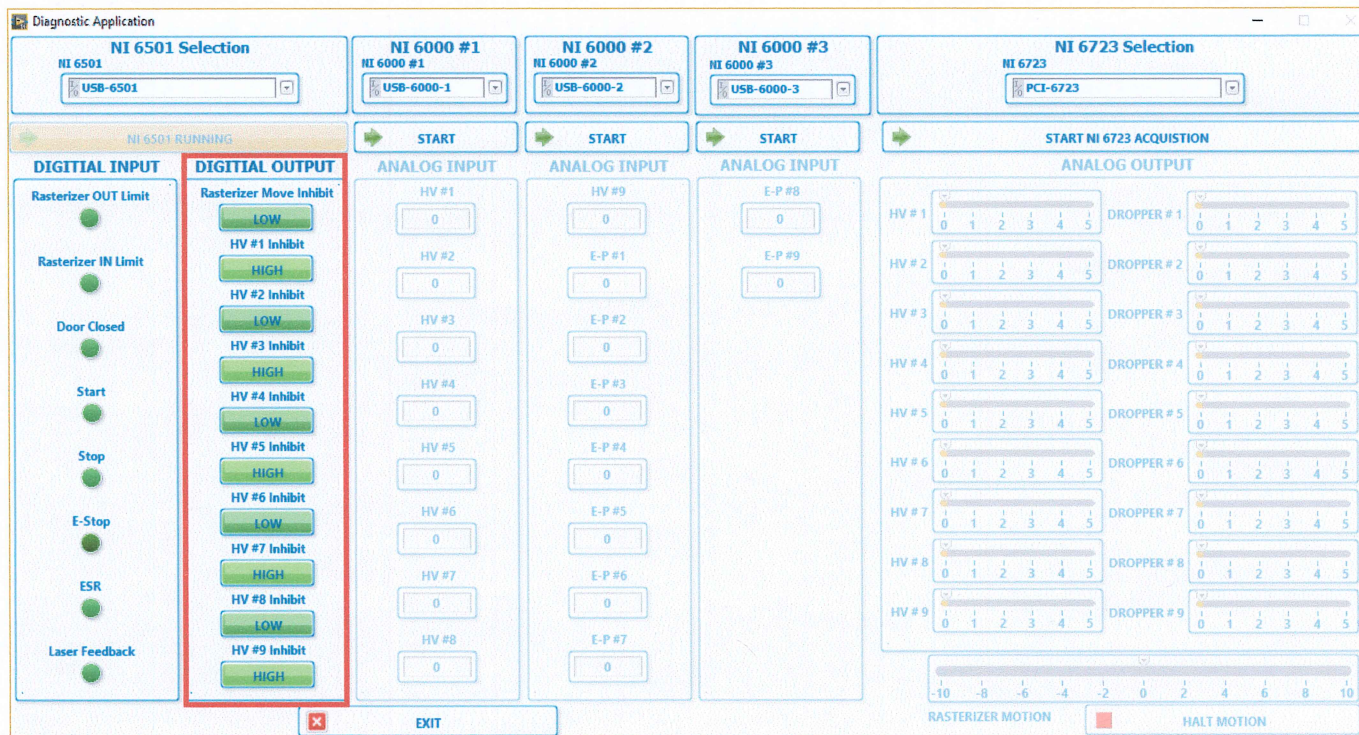
When the NI-6501 is running the Digital Inputs will show when show the state of the Digital Input lines.
 If the input is HIGH (over 3 volts) the light will be bright green.
 If the input is LOW (below 2.5 Volts) the light will be dark green.
 NOTE: This are TTL lines so there is a "dead" zone when transitioning between HIGH and LOW.



When the NI-6501 is running the Digital Outputs will be enabled.

These are simply push button controls.

Pressing the Button will toggle the output between HIGH (5 v) to LOW (0 v)

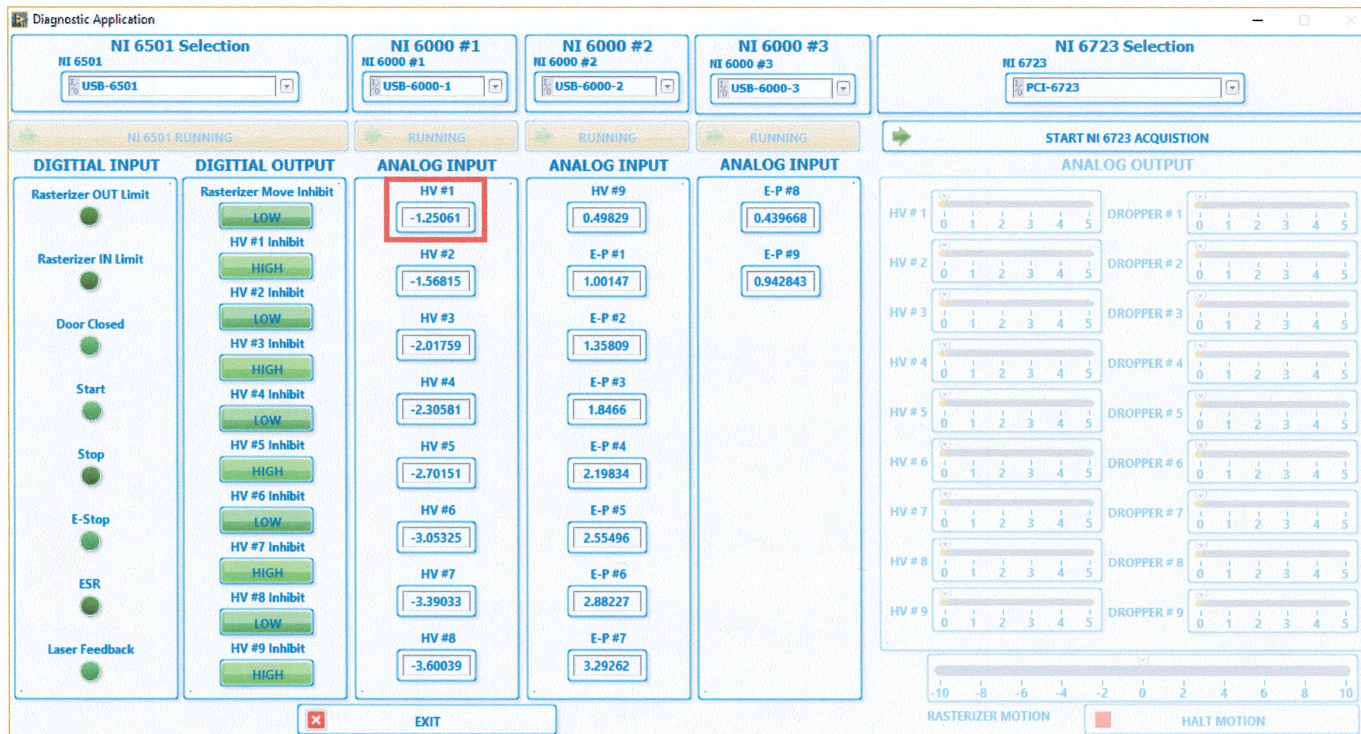


To start acquiring Analog input.
Click each
START
under each of the 6000

The screenshot shows a software interface titled "Diagnostic Application". At the top, there are five selection boxes: "NI 6501 Selection" (with "NI 6501" and "USB-6501" dropdowns), "NI 6000 #1" (with "NI 6000 #1" and "USB-6000-1" dropdowns), "NI 6000 #2" (with "NI 6000 #2" and "USB-6000-2" dropdowns), "NI 6000 #3" (with "NI 6000 #3" and "USB-6000-3" dropdowns), and "NI 6723 Selection" (with "NI 6723" and "PCI-6723" dropdowns). Below these are three "START" buttons, each with a green arrow icon, corresponding to the three NI 6000 selection boxes. These three "START" buttons are highlighted with a red rectangular box. Below the "START" buttons are several sections: "DIGITAL INPUT" with indicators for "Rasterizer OUT Limit", "Rasterizer IN Limit", "Door Closed", "Start", "Stop", "E-Stop", "ESR", and "Laser Feedback"; "DIGITAL OUTPUT" with "LOW" and "HIGH" buttons for "HV #1 Inhibit" through "HV #9 Inhibit"; "ANALOG INPUT" with "0" input boxes for "HV #1" through "HV #8" and "E-P #8" through "E-P #9"; and "ANALOG OUTPUT" with "0" input boxes for "DROPPER #1" through "DROPPER #9". At the bottom, there is an "EXIT" button and a "HALT MOTION" indicator.

When the 6000s are running the Analog Inputs will show the RAW input voltage readings.

NOTE: some of the signals may be wired incorrectly but as long as we can see the voltage changing, I can reconfigure how the software displays them.



To start controlling the Analog Outputs; click
START NI 6723 ACQUISITION

Diagnostic Application

NI 6501 Selection
NI 6501
USB-6501

NI 6000 #1
NI 6000 #1
USB-6000-1

NI 6000 #2
NI 6000 #2
USB-6000-2

NI 6000 #3
NI 6000 #3
USB-6000-3

NI 6723 Selection
NI 6723
PCI-6723

NI 6501 RUNNING RUNNING RUNNING RUNNING **START NI 6723 ACQUISITION**

DIGITAL INPUT
Rasterizer OUT Limit
Rasterizer IN Limit
Door Closed
Start
Stop
E-Stop
ESR
Laser Feedback

DIGITAL OUTPUT
Rasterizer Move Inhibit
HV #1 Inhibit
HV #2 Inhibit
HV #3 Inhibit
HV #4 Inhibit
HV #5 Inhibit
HV #6 Inhibit
HV #7 Inhibit
HV #8 Inhibit
HV #9 Inhibit

ANALOG INPUT
HV #1
HV #2
HV #3
HV #4
HV #5
HV #6
HV #7
HV #8

ANALOG INPUT
HV #9
E-P #1
E-P #2
E-P #3
E-P #4
E-P #5
E-P #6
E-P #7

ANALOG INPUT
E-P #8
E-P #9

ANALOG OUTPUT
HV #1
HV #2
HV #3
HV #4
HV #5
HV #6
HV #7
HV #8
HV #9
DROPPER #1
DROPPER #2
DROPPER #3
DROPPER #4
DROPPER #5
DROPPER #6
DROPPER #7
DROPPER #8
DROPPER #9

EXIT

RASTERIZER MOTION HALT MOTION

Channel	Value
HV #1	-1.25061
HV #2	-1.56815
HV #3	-2.01759
HV #4	-2.30581
HV #5	-2.70151
HV #6	-3.05325
HV #7	-3.39033
HV #8	-3.60039
HV #9	-3.60039
E-P #1	0.49829
E-P #2	1.00147
E-P #3	1.35809
E-P #4	1.8466
E-P #5	2.19834
E-P #6	2.55496
E-P #7	2.88227
E-P #8	0.439668
E-P #9	0.942843

When the 6723 is running, you will be able to control the analog voltage outputs to the HV and Droppers.

The screenshot displays a software interface titled "Diagnostic Application" with several control panels:

- NI 6501 Selection:** Includes a dropdown menu for "NI 6501" and a "USB-6501" selection.
- NI 6000 #1:** Includes a dropdown menu for "NI 6000 #1" and a "USB-6000-1" selection.
- NI 6000 #2:** Includes a dropdown menu for "NI 6000 #2" and a "USB-6000-2" selection.
- NI 6000 #3:** Includes a dropdown menu for "NI 6000 #3" and a "USB-6000-3" selection.
- NI 6723 Selection:** Includes a dropdown menu for "NI 6723" and a "PCI-6723" selection.

Below the selection panels are status indicators for each module, all showing "RUNNING".

The main control area is divided into several sections:

- DIGITAL INPUT:** Features status indicators for "Rasterizer OUT Limit", "Rasterizer IN Limit", "Door Closed", "Start", "Stop", "E-Stop", "ESR", and "Laser Feedback".
- DIGITAL OUTPUT:** Controls "Rasterizer Move Inhibit" (LOW/HIGH) and "HV #1 Inhibit" through "HV #9 Inhibit" (LOW/HIGH).
- ANALOG INPUT:** Displays voltage readings for HV #1 through HV #8.
- ANALOG INPUT:** Displays voltage readings for E-P #1 through E-P #9.
- ANALOG OUTPUT:** Controls "HV #1" through "HV #9" and "DROPPER #1" through "DROPPER #9" using sliders.

At the bottom, there are "EXIT" and "HALT MOTION" buttons, along with a "RASTERIZER MOTION" indicator.

To change the output voltage simply LEFT Click on the down arrow and drag it left or right.

The screenshot displays a software interface titled "Diagnostic Application" with several control panels:

- NI 6501 Selection:** USB-6501
- NI 6000 #1:** USB-6000-1
- NI 6000 #2:** USB-6000-2
- NI 6000 #3:** USB-6000-3
- NI 6723 Selection:** PCI-6723

Below these are status indicators: NI 6501 RUNNING, RUNNING, RUNNING, RUNNING, and NI 6723 RUNNING.

The main control area is divided into several sections:

- DIGITAL INPUT:** Rasterizer OUT Limit, Rasterizer IN Limit, Door Closed, Start, Stop, E-Stop, ESR, Laser Feedback.
- DIGITAL OUTPUT:** Rasterizer Move Inhibit (LOW), HV #1 Inhibit (HIGH), HV #2 Inhibit (LOW), HV #3 Inhibit (HIGH), HV #4 Inhibit (LOW), HV #5 Inhibit (HIGH), HV #6 Inhibit (LOW), HV #7 Inhibit (HIGH), HV #8 Inhibit (LOW), HV #9 Inhibit (HIGH).
- ANALOG INPUT:** HV #1 (3.58085), HV #2 (3.37567), HV #3 (2.99951), HV #4 (2.75525), HV #5 (2.35955), HV #6 (1.96385), HV #7 (1.54861), HV #8 (1.22618).
- ANALOG INPUT:** HV #9 (-4.09868), E-P #1 (-3.76649), E-P #2 (-3.54177), E-P #3 (-3.14118), E-P #4 (-2.84807), E-P #5 (-2.51099), E-P #6 (-2.15926), E-P #7 (-1.69028).
- ANALOG INPUT:** E-P #8 (-4.13288), E-P #9 (-3.80557).
- ANALOG OUTPUT:** HV #1 through HV #9 and DROPPER #1 through DROPPER #9, each with a slider control.

At the bottom, there is an "EXIT" button and a "RASTERIZER MOTION" slider with a "HALT MOTION" button.

IGNORE THE RASTERIZER MOTION CONTROL.

We will test the motion after completing all other tests.

The screenshot displays a 'Diagnostic Application' window with several control panels. At the top, there are selection dropdowns for NI 6501 (USB-6501), NI 6000 #1 (USB-6000-1), NI 6000 #2 (USB-6000-2), NI 6000 #3 (USB-6000-3), and NI 6723 (PCI-6723). Below these are status bars for 'NI 6501 RUNNING', 'RUNNING', 'RUNNING', 'RUNNING', and 'NI 6723 RUNNING'. The main interface is divided into several sections:

- DIGITAL INPUT:** Includes indicators for Rasterizer OUT Limit, Rasterizer IN Limit, Door Closed, Start, Stop, E-Stop, ESR, and Laser Feedback.
- DIGITAL OUTPUT:** Features buttons for Rasterizer Move Inhibit (LOW), and HV #1 through #9 Inhibit (HIGH/LOW).
- ANALOG INPUT:** Displays numerical values for HV #1 through #9 and E-P #1 through #9.
- ANALOG OUTPUT:** Shows numerical values for HV #1 through #9 and Dropper #1 through #9, each with a corresponding slider.
- Bottom Panel:** Contains an 'EXIT' button and a 'RASTERIZER MOTION' slider (ranging from -10 to 10) with a 'HALT MOTION' button.

SPECIFICATION

Accuracy:
±0.5°C temp;
0.03% rdg. process typical

Resolution:
1°/0.1°; 10 µV process

Temperature Stability:
0.04°C/°C RTD;
0.05°C/°C TC @ 25°C (77°F);
50 ppm/°C process

Display:
4-digits, 9-segments LED,
10.2 mm (0.40") with red, green and
amber programmable colors

Input Types:
Thermocouple, RTD, Analog Voltage
and Current

TC: (ITS90)
J, K, T, E, R, S, B, C, N, L

RTD: (ITS68)
100/500/1000 ohm Pt sensor
2-, 3-, or 4-wire; 0.00385 or 0.00392
curve

Voltage:
0 to 100 mV, 0 to 1 V, 0 to 10 Vdc

Current:
0 to 20 mA (4 to 20 mA)

Output 1:
Relay 250 Vac @ 3 A Resistive Load
SSR, Pulse, Analog Voltage and C/L

Output 2:
Relay 250 Vac @ 3 A Resistive Load,
SSR, Pulse

Options: Communication
RS-232 / RS-485 or 10BaseT
or Excitation: 24 Vdc @ 25 mA
Exc. not available for Low Power Option

Line Voltage/Power:
90 - 240 Vac ±10%, 50 - 400 Hz*, or
110 - 375Vdc, 4W for i16; 5W for i16D
* No CE compliance above 60 Hz

Low Voltage Power Option:
12-36 Vdc, 3 W, power for i16
20-36 Vdc, 4 W, power for i16D**
** Units can be powered safely with 24 Vac
but No Certification for CE/UL are claimed.

Dimensions:
48 H x 48 W x 127 D mm
(1.89 x 1.89 x 5")

Weight:
159 g (0.35 lb)

Approvals:
UL, C-UL, CE per EN61010-1:2001

WARNING: These products are not designed for use in, and should not be used for, patient-connected applications.

 This device is marked with the international caution symbol. It is important to read the Setup Guide before installing or commissioning this device, as the guide contains important information relating to safety and EMC.

It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

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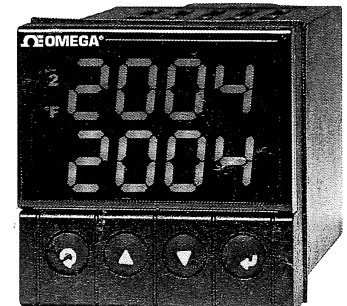
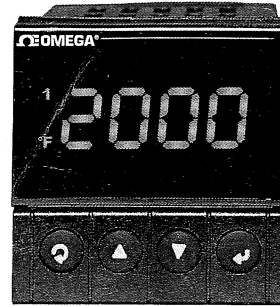
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Temperature & Humidity controller for E-Spin Cabinet

QUICK START 

CE

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TEL: (514) 856-6928 FAX: (514) 856-6886
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Engineering Service: 1-800-872-9436 / 1-800-USA-WHEN®

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e-mail: sales@omega.co.uk

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of one (1) year from the date of purchase. In addition to OMEGA's standard warranty period, OMEGA Engineering will extend the warranty period for four (4) additional years if the warranty card enclosed with each instrument is returned to OMEGA.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department issues an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

- Purchase Order number under which the product was PURCHASED.
- Model and serial number of the product under warranty, and
- Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

- Purchase Order number to cover the COST of the repair.
- Model and serial number of product, and
- Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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This Quick Start Reference provides information on setting up your instrument for basic operation. The latest complete Communication and Operational Manual as well as free Software and ActiveX Controls are available at www.omega.com/specs/iseries or on the CD-ROM enclosed with your shipment.

SAFETY CONSIDERATION



This device is marked with the international Caution symbol.

The instrument is a panel mount device protected in accordance with EN 61010-1:2001, electrical safety requirements for electrical equipment for measurement, control and laboratory. Remember that the unit has no power-on switch. Building installation should include a switch or circuit-breaker that must be compliant to IEC 947-1 and 947-3.

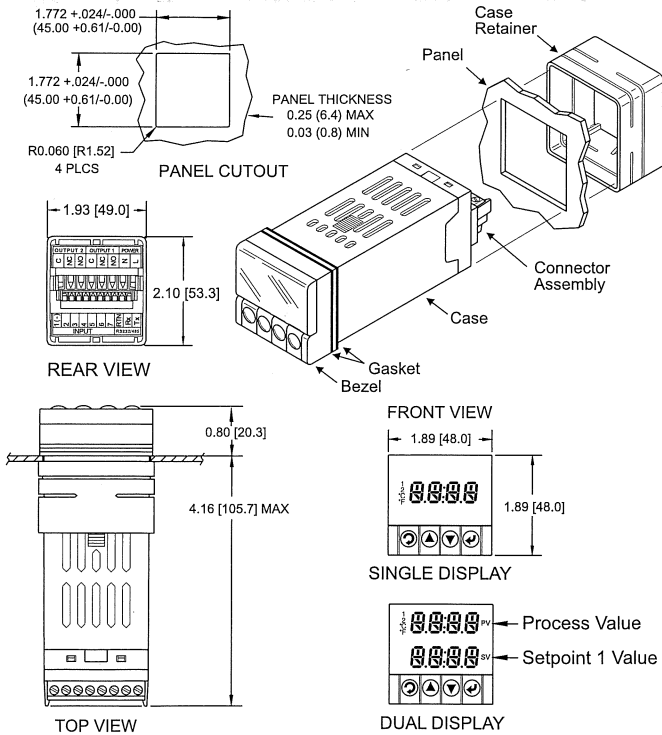
SAFETY:

- Do not exceed voltage rating on the label located on the top of the instrument housing.
- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reasons.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.

EMC:

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wire close to the instrument if EMC problems persist.

MOUNTING



Panel Mounting Instruction:

- Using the dimensions from the panel cutout diagram shown above, cut an opening in the panel.
- Insert the unit into the opening from the front of the panel so the gasket seals between the bezel and the front of panel.
- Slide the retainer over the rear of the case and tighten against the backside of the mounting panel.

Disassembly Instruction:

If necessary, the unit may be removed from the panel and stored.



Warning: Disconnect all ac power from the unit before proceeding.

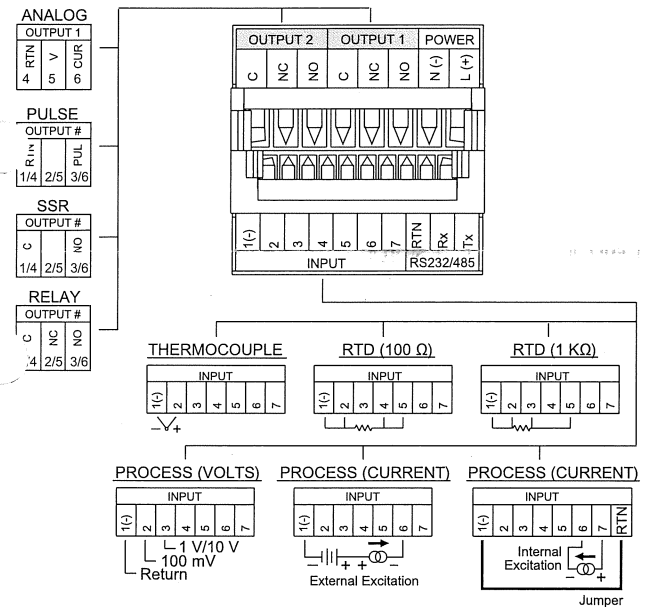
- Make sure the AC power is disconnected.
- Remove all wiring connections from the rear of the meter. To remove power and input connectors squeeze top and bottom of the case near the connector site for release, then pull connectors from the case.
- To remove meter from the case, squeeze top and bottom of the bezel to release, then pull from case.

WIRING

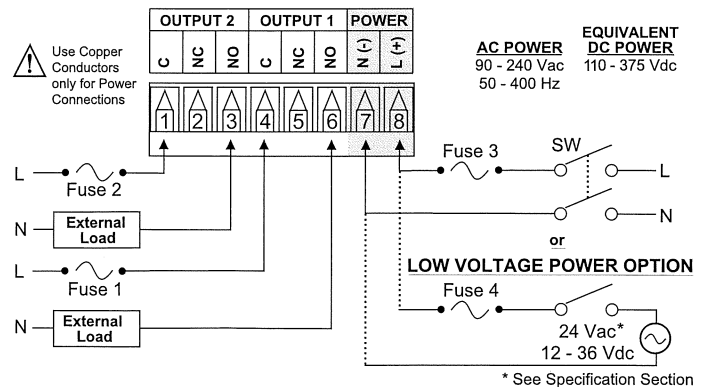
Wire the instrument according to the figure shown below.



Warning: Do not connect ac power to your device until you have completed all input and output connections. This device must only be installed by a specially trained electrician with corresponding qualifications. Failure to follow all instructions and warnings may result in injury!



Connect the main power connections as shown in the figure below.



FUSE	Connector	Output Type	For 115Vac	For 230Vac	DC
FUSE 1	Output 1	Relay	3 A(T)	3 A(T)	-
FUSE 2	Output 2	Relay	3 A(T)	3 A(T)	-
FUSE 3	Power	N/A	100 mA(T)	100 mA(T)	100 mA(T)
FUSE 4	Power	N/A	N/A	N/A	400 mA(T)

CONFIGURATION

MENU Mode:

Flashing display in MENU Mode means you can make your selection by pressing **↵** button. If the flashing display is not a four digit value, pressing **↵** button will always direct the instrument one step backward of the top menu item. The second push on the **↵** button will reset the instrument except after the setpoint and the alarms, that will go to the RUN Mode without resetting the instrument. The **↵** button will always sequence the instrument thru the menu items.

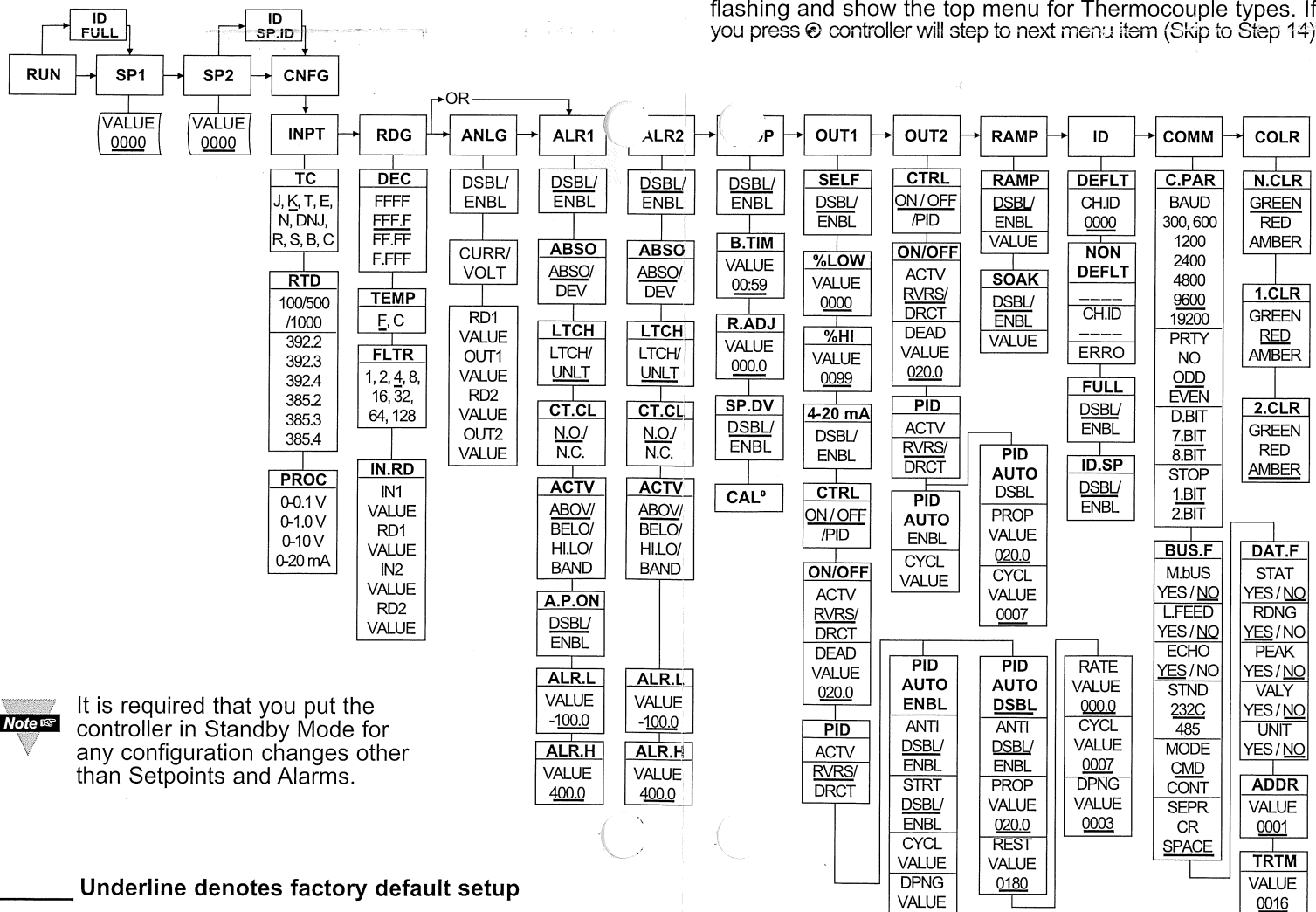
The **↵** button has two functions:

1. To save a selected flashing display
2. To direct the instrument to the next submenu level

RUN Mode:

- ↵** causes the display to flash the PEAK with the corresponding value. Press again to go back to RUN Mode.
- ↵** causes the display to flash VALLEY with the corresponding value. Press again to go back to RUN Mode.
- ↵** causes flashing PEAK or VALLEY to reset corresponding values. Pressing **↵** twice will cause the display to flash **Stby** and put the instrument into standby, which disables all outputs and alarms. Press **↵** one more time to go back to RUN Mode.

FLOW CHART



OPERATION - (For Thermocouple Input)

Step 1. Apply Power to the Instrument

When your device is first powered up it will display the ambient temperature (assume 75°F).

Step 2. Enter Setpoint 1 Menu

Press **↵** one time from run mode to get to **SP1** Setpoint 1.

Step 3. Enter the Setpoint 1 Value Submenu

Press **↵**. Display shows the previous selection of Setpoint 1.

Step 4. Change the Setpoint 1 Value

Press **↵** or **↵** until desired value is displayed.

Step 5. Store the Setpoint 1 Value

Set the Setpoint 1 to 10 degree higher than Process value (SP1 = 85) and press **↵** to store, display flashes **Stby** message and advances to **SP2** Setpoint 2 Menu.

Step 6. Store the Setpoint 2 Value

Repeat steps 3 and 4. Set the Setpoint 2 to 5 degree higher than Process value (SP2 = 80) and press **↵** to store, display flashes **Stby** message and advances to **ENFG** Configuration Menu.

Step 7. Enter the Input Type Menu

Press **↵** to enter **INPT** Input Type Menu.

Step 8. Enter to the submenu items of Input Menu

Press **↵** to display Input: Process, RTD or Thermocouple. If flashing **TC** is displayed press **↵** and proceed to Step 11.

Step 9. Scroll through available selection of Input Menu

Press **↵** until a flashing **TC** for Thermocouple is displayed.

Step 10. Enter to the Thermocouple Input Submenu

Press **↵** to store Thermocouple Input. The display will stop flashing and show the top menu for Thermocouple types. If you press **↵** controller will step to next menu item (Skip to Step 14).

Step 11. Enter to the Thermocouple Type Input Submenu
Press **⏏** to display flashing, previously selected Thermocouple type.

Step 12. Scroll through available selection of TC types
Press **⏏** to sequence thru flashing Thermocouple types, (select k -for type "K" CHROMEGA®/ALOMEGA®)
J K T E N DIN J R S B C - TC types
J k t E N dNJ R S b C - Display

Step 13. Store TC type
After you have selected the Thermocouple type press **⏏** to store your selection, the instrument automatically advances to the next menu item.

Step 14. Enter to Reading Configuration Menu
The display shows **RdG** Reading Configuration, which is the top menu for 4 submenus: Decimal Point, Degree Units, Filter Constant and Input/Reading Submenus.

Step 15. Enter to Decimal Point Submenu
Press **⏏** to show **DEC** Decimal Point.

Step 16. Display the Decimal Point position
Press **⏏** again to display the flashing Decimal Point position.

Step 17. Select the Decimal Point position
Press **⏏** to select **FFF.F** Decimal Point position.

Step 18. Store selected Decimal Point position
By pressing **⏏** momentarily the Decimal Point position will be stored and the instrument will go to the next menu item.

Step 19. Enter to Temperature Unit Submenu
Display shows **TEMP** Temperature Unit.

Step 20. Display available Temperature Units
Press **⏏** to display the flashing Degree **F** or **C**.

Step 21. Scroll through Temperature Units selection
Press **⏏** to select **F** Degree.

Step 22. Store the Temperature Unit
Press **⏏** to display momentarily that the Degree Unit has been stored and the instrument will go automatically to the next menu item.

Step 23. Enter the Filter Constant Submenu
Display shows **FILT** Filter Constant Submenu.

Step 24. Display the Filter Constant Value Submenu
Press **⏏** to display the flashing, previously selected Filter Constant.

Step 25. Scroll through available Filter Constants
Press **⏏** to sequence thru Filter Constants **0001**, **0002**, **0004**, **0008**, **0016**, **0032**, **0064** and **0128**.

Step 26. Store the Filter Constant
Press **⏏** momentarily to store **0004** Filter Constant and the instrument will automatically go to the next menu item.

Step 27. Enter Alarm 1 Menu
The display will show **ALR 1** the top menu for Alarm 1. In the following steps we are going to enable Alarm 1, Deviation, Unlatch, Normally Open, Active Above, Enable at power on and +2°F High Alarm i.e. Process Value > Setpoint 1 Value +2°F will activate Alarm 1.

Note If Analog Output Option is installed and enabled, the controller will skip Alarm 1 Menu item to Analog Output.

Step 28. Enter Alarm 1 Enable/Disable Submenu
Press **⏏** to display flashing **DSBL** / **ENBL**.

Step 29. Enable Alarm 1 Submenu
If flashing **ENBL** is displayed, press **⏏**, if **DSBL** is displayed, press **⏏** until **ENBL** is displayed, then press **⏏** to store and go to the next menu item.

Step 30. Select the Deviation Control Type Submenu
Press **⏏**. If flashing **DEV** Deviation is displayed press **⏏**, otherwise press **⏏** until flashing **DEV** is shown. Now press **⏏** to store and go to next menu item.

Step 31. Select the Latched Type Submenu
Press **⏏**. If flashing **UNLE** Unlatched is displayed press **⏏**, otherwise press **⏏** until **UNLE** is displayed. Press **⏏** to store and advance to next menu item.

Step 32. Select the Normally Open Type of Contact Closure Submenu
Press **⏏**. If flashing **N.O.** Normally Open is displayed, press **⏏**, otherwise press **⏏** until **N.O.** is displayed. Press **⏏** to store and advance to next menu item.

Step 33. Select the Above Type of Active Submenu
Press **⏏**. If flashing **ABO** Above is displayed, press **⏏**, otherwise press **⏏** until **ABO** is displayed. Press **⏏** to store and advance to next menu item.

Step 34. Enable Alarm 1 at Power On (A.P.ON)
Press **⏏**. If flashing **ENBL** is displayed, press **⏏**, otherwise press **⏏** until **ENBL** is displayed. Press **⏏** to store and advance to next menu item.

Step 35. Enter Alarm 1 High Submenu
Press **⏏** twice to skip **ALR.L** Alarm 1 Low value. **ALR.L** is for below & **ALR.H** for above.

Step 36. Set the Alarm 1 High value (ALR.H)
Press **⏏**. Press **⏏** or **⏏** until value to set the display to **002.0**. Press **⏏** to save.

Step 37. Enter the Alarm 2 Menu
The display will show **ALR2** the top menu for Alarm 2. Repeat steps from 28 to 36 to set for Alarm 2 the same conditions as for Alarm 1.

Step 38. Skip the Loop Break Time Menu (LOOP)
Press **⏏** to go to the **OUT 1** Output 1 Menu item.

Step 39. Configuration the Output 1 Menu

Note Set Alarm 1 Disabled (Step 29) to be able to Enable Output 1.

Configure Out 1 as **CTRL / PID, ACTN / RMS, AUTO / DSBL, ANCL / ENBL, PROP / 005.0, REST / 0100, RATE / 010.0, CYCL / 0010** and **DPNG / 0003**. Please refer to the operator's manual if needed. Press **⏏** to save and go to the next menu item.

Step 40. Configuration of Display Color Selection
Press **⏏** until the **COLOR** Display Color Selection Menu appears on the Display. Configure **COLOR** as **NCLR / GRN** (green), **I CLR / RED** (red), **P CLR / AMBR** (amber). Please refer to the operator's manual if needed.

Step 41. Run a Test
Press **⏏** until reset the controller and return to **RUN** Mode to display **075.0** (Ambient Temperature). Now you are ready to observe temperature as it rises 10°F higher than displayed. Touch the tip of the Thermocouple to raise the temperature above the Alarm 2 High value **082.0**, and AL2 will turn on, and Display Color will change from Green to Amber. Continue touching the tip to raise the temperature above the Alarm 1 High value **087.0** and Display Color will change from Amber to Red. Annunciator "1" is turning on and off displaying output 1.



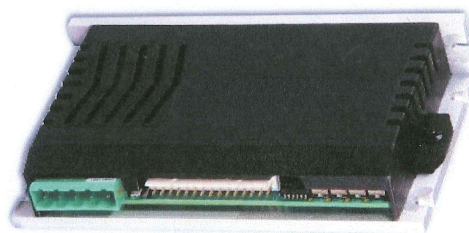
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M/M

FAX (480) 247-4086
SALES@MIDWESTMOTION.COM

MMP SA-715A SERVO AMPLIFIER

Drives DC motor that rasters spinning heads

Description	Power Range	
<p>The MMP SA-715A servo amplifier is designed to drive brushed or brushless type DC motors at a high switching frequency. A single red/green LED indicates operating status. The drive is fully protected against over-voltage, under-voltage, over-current, over-heating and short-circuits across motor, ground and power leads. Furthermore, the drive can interface with digital controllers or be used stand-alone, and requires only a single unregulated DC power supply. Loop gain, current limit, input gain and offset can be adjusted using 14-turn potentiometers. The offset adjusting potentiometer can also be used as an on-board input signal for testing purposes. This drive can use quadrature encoder inputs for velocity control.</p>	Peak Current	15 A
	Continuous Current	7.5 A
	Supply Voltage	20 - 80 VDC



Features

- ↳ Four Quadrant Regenerative Operation
- ↳ DIP Switch Selectable Modes
- ↳ DIP Switch Configurable Loop Tuning
- ↳ Selectable Inhibit Logic
- ↳ Adjustable Current Limits
- ↳ High Switching Frequency
- ↳ Differential Input Command
- ↳ Digital Fault Output Monitor
- ↳ On-Board Test Potentiometer
- ↳ Offset Adjustment Potentiometer
- ↳ Adjustable Input Gain
- ↳ Selectable 120/60 Hall Commutation Phasing
- ↳ Encoder Velocity Mode
- ↳ Velocity Monitor Output
- ↳ Current Monitor Output
- ↳ Drive Status LED

MODES OF OPERATION

- ↳ Current
- ↳ Encoder Velocity
- ↳ Duty Cycle (Open Loop)

COMMAND SOURCE

- ↳ ±10 V Analog

FEEDBACK SUPPORTED

- ↳ Hall Sensors
- ↳ Incremental Encoder

MOTORS SUPPORTED

- ↳ Three Phase (Brushless)
- ↳ Single Phase (Brushed, Voice Coil, Inductive Load)

COMPLIANCES & AGENCY APPROVALS

- ↳ UL
- ↳ cUL
- ↳ CE Class A (LVD)
- ↳ CE Class A (EMC)
- ↳ RoHS II

MIDWEST MOTION PRODUCTS

SPECIFICATIONS

Description	Power Specifications		Value
	Units		
DC Supply Voltage Range	VDC	20 - 80	
DC Bus Over Voltage Limit	VDC	88	
DC Bus Under Voltage Limit	VDC	15	
Maximum Peak Output Current ¹	A	15	
Maximum Continuous Output Current	A	7.5	
Maximum Continuous Output Power at Continuous Current	W	570	
Maximum Power Dissipation at Continuous Current	W	30	
Minimum Load Inductance (Line-To-Line) ²	µH	200	
Internal Bus Capacitance	µF	TBD	
Low Voltage Supply Outputs	-	±10 VDC (3 mA), +6 VDC (30 mA)	
Switching Frequency	kHz	22	

Description	Control Specifications		Value
	Units		
Command Sources	-	±10 V Analog	
Feedback Supported	-	Hall Sensors, Incremental Encoder	
Commutation Methods	-	Trapezoidal	
Modes of Operation	-	Current, Encoder Velocity, Duty Cycle (Open Loop)	
Motors Supported	-	Three Phase (Brushless), Single Phase (Brushed, Voice Coil, Inductive Load)	
Hardware Protection	-	Over-Current, Over-Temperature, Over-Voltage, Under-Voltage, Short-Circuit (Phase-Phase & Phase-Ground)	
Primary I/O Logic Level	-	5V TTL	

Description	Mechanical Specifications		Value
	Units		
Agency Approvals	-	CE Class A (EMC), CE Class A (LVD), cUL, RoHS II, UL	
Size (H x W x D)	mm (in)	129.3 x 75.8 x 25.1 (5.09 x 2.98 x 0.99)	
Weight	g (oz)	249.5 (8.8)	
Heatsink (Base) Temperature Range ³	°C (°F)	0 - 65 (32 - 149)	
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)	
Form Factor	-	Panel Mount	
P1 Connector	-	16-pin, 2.54 mm spaced, friction lock header	
P2 Connector	-	5-port, 5.08 mm spaced, quick disconnect terminal	

Notes

1. Maximum duration of peak current is ~2 seconds. Peak RMS value must not exceed continuous current rating of the drive.
2. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
3. Additional cooling and/or heatsink may be required to achieve rated performance.

PIN FUNCTIONS

P1 - Signal Connector				
Pin	Name	Description / Notes	I/O	
1	+10V 3mA OUT	±10 V @ 3 mA low power supply for customer use. Short circuit protected. Reference ground common with signal ground.	O	
2	SIGNAL GND		GND	
3	-10V 3mA OUT		O	
4	+REF IN	Differential Reference Input (±10 V Operating Range, ±15 V Maximum Input)	I	
5	-REF IN		I	
6	ENCODER-B IN	Single-ended encoder channel B input. +5 V logiclevel.	I	
7	ENCODER-A IN	Single-ended encoder channel A input. +5 V logiclevel.	I	
8	CURRENT MONITOR	Current Monitor. Analog output signal proportional to the actual current output. Scaling is 2.0 A/V. Measure relative to signal ground.	O	
9	INHIBIT / ENABLE	TTL level (+5 V) inhibit/enable input. Pull to ground to inhibit drive (SW1-5 ON). Pull to ground to enable drive (SW1-5 OFF). Inhibit turns off all power devices.	I	
10	+V HALL 30mA OUT	Low Power Supply For Hall Sensors (+6 V @ 30 mA). Referenced to signal ground. Short circuit protected.	O	
11	GND	Signal Ground	GND	
12	HALL 1	Single-ended Hall/Commutation Sensor Inputs (+5 V logiclevel). Leave open for brushed motors.	I	
13	HALL 2		I	
14	HALL 3		I	
15	VEL MONITOR OUT	Velocity Monitor. Analog output proportional to motor speed. In Encoder Velocity mode, output is proportional to the encoder line frequency. Encoder Velocity scaling is 22 kHz/V.	O	
16	FAULT OUT	TTL level (+5 V) output becomes high when power devices are disabled due to at least one of the following conditions: inhibit, invalid Hall state, output short circuit, over voltage, over temperature, power-up reset.	O	

P2 - Power Connector				
Pin	Name	Description / Notes	I/O	
1	A	Motor Phase A	O	
2	B	Motor Phase B	O	
3	C	Motor Phase C	O	
4	POWER GND	Power Ground (Common With Signal Ground)	PGND	
5	HIGH VOLTAGE	DC Power Input	I	

HARDWARE SETTINGS

Configuration Switch Functions


SW1	Description	Setting	
		On	Off
1	Duty Cycle mode selector. Activates internal PWM feedback.	Duty Cycle mode	Other modes
2	60/120 degree commutation phasing setting	120 degrees	60 degrees
3	Outer loop integration. Activates or deactivates integration. ON, by default, for current mode and OFF for other modes.	Inactive	Active
4	Test/Offset. Switches the function of the Test/Offset pot between an on-board command input for testing or a command offset adjustment. OFF by default.	Test	Offset
5	Inhibit logic. Sets the logic level of inhibit pins.	Drive Inhibit is active low	Drive Inhibit is active high
6	Velocity feedback polarity. Changes the polarity of the internal feedback signal and the velocity monitor output signal. Inversion of the feedback polarity may be required to prevent a motor run-away condition. ON by default.	Standard	Inverted

Mode Selection Table

	SW1	SW3	Encoder
CURRENT	OFF	ON	Not Connected
DUTY CYCLE	ON	OFF	Not Connected
ENCODER VELOCITY*	OFF	OFF	Connected

*Note: Use SW1-6 to change the feedback polarity if necessary. This may be required to prevent a run-away condition.

Potentiometer Functions

Potentiometer	Description	Turning CW
1	Loop gain adjustment for duty cycle / velocity modes. Turn this pot fully CCW in current mode.	Increases gain
2	Current limit. It adjusts both continuous and peak current limit while maintaining their ratio.	Increases limit
3	Reference gain. Adjusts the ratio between input signal and output variables (voltage, current, or velocity).	Increases gain
4	Offset / Test. Used to adjust any imbalance in the input signal or in the amplifier. Can also be used as an on-board signal source for testing purposes.	Adjusts offset in negative direction 

Note: Potentiometers are approximately linear and have 12 active turns with 1 inactive turn on each end. Test points are provided on the drive PCB near each potentiometer to measure the potentiometer value.



Loop Tuning Switch Functions

In general, the drive will not need to be further tuned beyond the default configuration. However, for applications requiring more precise tuning, DIP switches can be used to adjust the current and velocity loop tuning values. Some general rules of thumb to follow when tuning the drive are:

- A larger resistor value will increase the proportional gain, and therefore create a faster response time.
- A larger capacitor value will increase the integration time, and therefore create a slower response time.

Proper tuning will require careful observation of the loop response on a digital oscilloscope to find optimal DIP switch settings for the specific application.

(Note: Drive cover must be removed to access SW2 and SW3)

SW2 DIP switches 1-4 add additional parallel capacitance to the velocity loop integrator capacitor (see Block Diagram). The resulting velocity loop capacitance values are given in the table below along with the appropriate DIP switch settings. By default, all SW2 switches are OFF (shaded in the SW2 table below).

Switch	SW2 Velocity Loop Integrator Capacitance Options (µF)															
	.047	.147	.267	.367	.517	.617	.737	.837	1.047	1.147	1.267	1.367	1.517	1.617	1.737	1.837
SW2-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
SW2-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
SW2-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
SW2-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON

Note: The velocity loop integrator capacitor can be shorted entirely by setting SW1-3 to OFF.

SW3 DIP switches add additional resistance and capacitance to the current loop tuning circuitry. SW3 switches 1-5 add additional series resistance to the current loop gain resistor, and SW3 switches 6-10 add additional parallel capacitance to the current loop integrator capacitor (see Block Diagram). Capacitance and resistance values are given in the tables below along with the appropriate DIP switch settings.

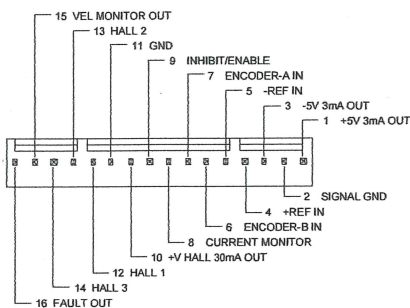
Switch	SW3 Current Loop Proportional Gain Resistance Options (kΩ)															
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
SW3-1	ON	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
SW3-2	ON	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
SW3-3	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF
SW3-4	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SW3-5	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
Switch (continued)	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320
SW3-1	ON	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
SW3-2	ON	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
SW3-3	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF
SW3-4	ON	ON	ON	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SW3-5	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Switch	SW3 Current Loop Integrator Capacitance Options (µF)																
	.0047	.0094	.0247	.0294	.0517	.0564	.0717	.0764	.0987	.1034	.1187	.1234	.1457	.1504	.1647	.1694	Short
SW3-6	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	ON
SW3-7	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	ON
SW3-8	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON
SW3-9	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON
SW3-10	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON

MECHANICAL INFORMATION

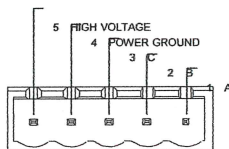
P1 - Signal Connector

Connector Information	16-pin, 2.54 mm spaced, friction lock header	
Mating Connector	Details	Molex: P/N 22-01-3167 (connector) and P/N 08-50-0114 (insert terminals)
	Included with Drive	Yes



P2 - Power Connector

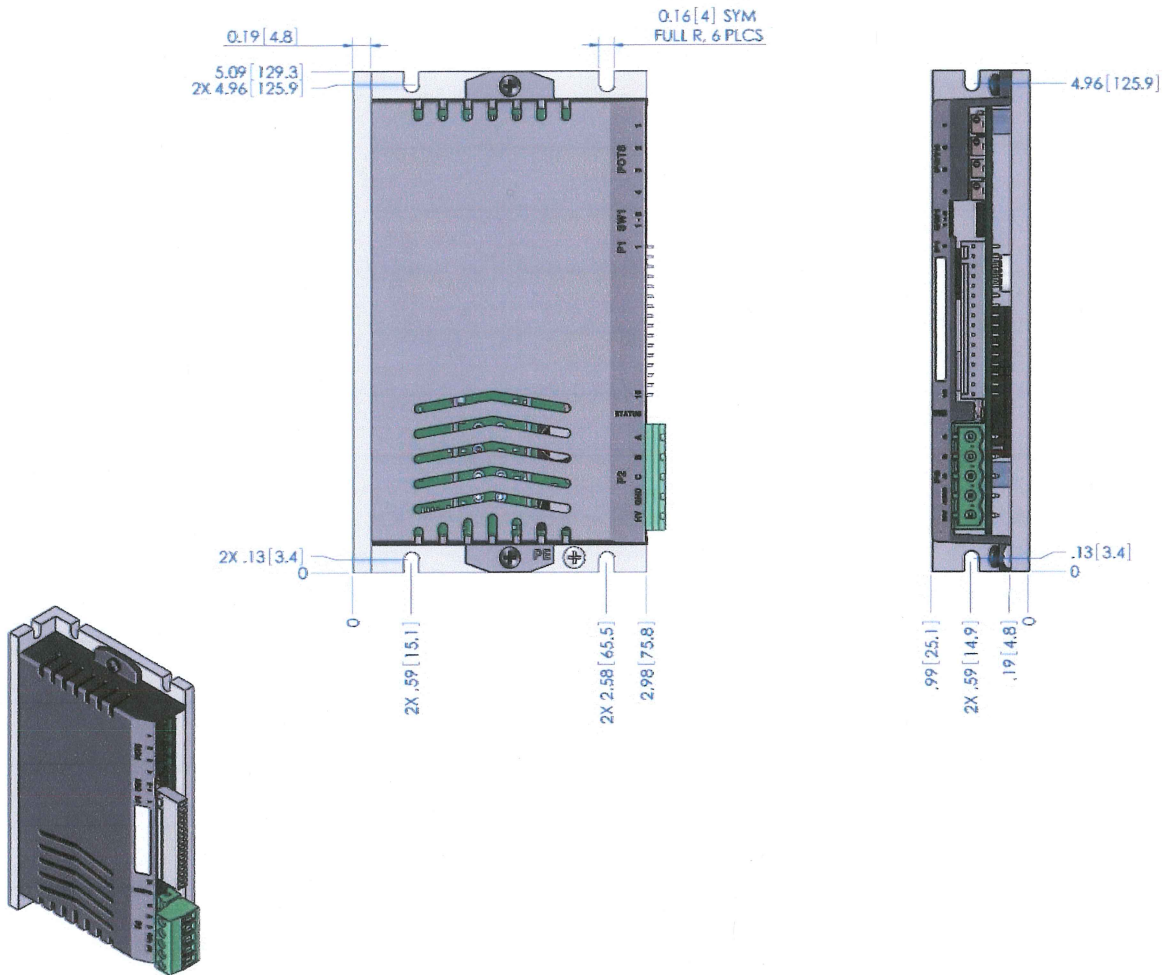
Connector Information	5-port, 5.08 mm spaced, quick-disconnect terminal	
Mating Connector	Details	Phoenix: P/N 1911994
	Included with Drive	Yes



*Red 18/20
white
Black*

*5 CONDUCTOR
Red
Blue
VIOLET
Black
GRAY
200R 15
6A*

MOUNTING DIMENSIONS



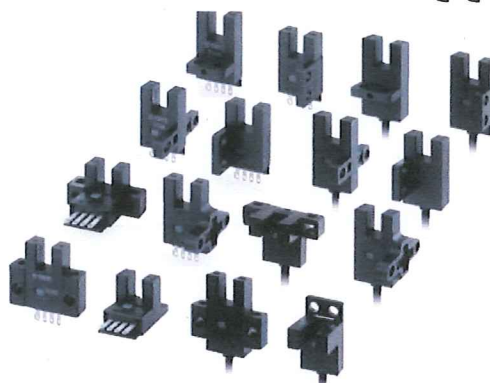
EE-SX47/67

CSM_EE-SX47/67_DS_E_12_2

Global Standard Slot-type photomicrosensors with 50- to 100-mA direct switching capacity.



- Series includes models that enable switching between dark-ON and light-ON operation.
- Response frequency as high as 1 kHz.
- Easy operation monitoring with bright light indicator.
- Wide operating voltage range: 5 to 24 VDC
- Models in which the light indicator turns ON for dark-ON operation are also available.
- A wide range of variations in eight different shapes.
- Flexible robot cable is provided as a standard feature. *2



Be sure to read *Safety Precautions* on page 5.

*1. Pre-wired Models are available only in the EE-SX67 Series.
*2. Only for Pre-wired Models.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

Ordering Information

Connector

Infrared light

Appearance	Sensing method	Connect-ing method	Sensing distance	Output configuration	Indicator mode	Model	
						NPN output	PNP output
Standard 	Through-beam type (with slot)	Connector (4 poles)	5 mm (slot width)	Dark-ON/Light-ON (selectable) *3 *4	Incident light	EE-SX670	EE-SX670P
					No incident light	EE-SX670A	EE-SX670R
Light-ON				Incident light	EE-SX470	—	
L-shaped 				Dark-ON/Light-ON (selectable) *3 *4	Incident light	EE-SX671	EE-SX671P
					No incident light	EE-SX671A	EE-SX671R
				Light-ON	Incident light	EE-SX471	—
T-shaped, slot center 7 mm 				Dark-ON/Light-ON (selectable) *3 *4	Incident light	EE-SX672	EE-SX672P
					No incident light	EE-SX672A	EE-SX672R
				Light-ON	Incident light	EE-SX472	—
Close-mounting 				Dark-ON/Light-ON (selectable) *3 *4	Incident light	EE-SX673	EE-SX673P
		No incident light	EE-SX673A	EE-SX673R			
Close-mounting 	Dark-ON/Light-ON (selectable) *3 *4	Incident light	EE-SX674	EE-SX674P			
		No incident light	EE-SX674A	EE-SX674R			
	Light-ON	Incident light	EE-SX474	—			
T-shaped, slot center 10 mm 	Dark-ON/Light-ON (selectable) *3 *4	Incident light	EE-SX675	EE-SX675P			
F-shaped 	Dark-ON/Light-ON (selectable) *3 *4	Incident light	EE-SX676	EE-SX676P			
R-shaped 	Dark-ON/Light-ON (selectable) *3 *4	Incident light	EE-SX677	EE-SX677P			

*3. Dark-ON when the L terminal of the connector is opened, and light-ON when the L terminal and positive (+) terminal are connected. Do not connect the L terminal to 0 V when using dark-ON operation. When using light-ON, it is useful to select the connector EE-1001-1. The L terminal and positive (+) terminal of this connector are connected in advance.

*4. If you do not use the L terminal wire ((2) pink) when you use a Connector with Cable for an EE-1006 or EE-1010-series Photomicrosensor, noise may affect the Photomicrosensor. To prevent the effects of noise, cut the unused L terminal wire at the base of the connector and wrap it with insulating tape to prevent it from coming in contact with other terminals.

PROPORTION AIR

QB1T/QB2T

INSTALLATION & MAINTENANCE INSTRUCTIONS

DESCRIPTION / IDENTIFICATION

The QB series valve uses Proportion- Air closed loop technology for Pressure control. It gives an output pressure proportional to an electrical command signal input.

The QB1 is a complete closed loop servo system consisting of valves, manifold, housing and electronic controls. Pressure is controlled by the use of two solenoid valves. One valve functions as inlet control, the other as exhaust. The pressure output is measured by a pressure transducer internal to the QB1 and provides a feedback signal to the electronic controls. This feedback signal is compared with the command signal input. A difference between the two signals causes one of the solenoid valves to open, allowing flow in or out of the system. Accurate pressure is maintained by controlling these two valves.

The QB2 is similar to the QB1 but uses a double loop control scheme. In addition to the internal pressure transducer, the QB2 receives an electrical signal from an external sensing device. This primary feedback signal is compared against the command signal input. This comparison is then summed with the internal pressure transducer signal. The gain of the circuit is such that priority is given to the external feedback signal. A difference between the command signal and the feedback signal causes one of the solenoid valves to be activated.

A monitor output is provided for the system measurement. All QB valves come standard with an analog voltage monitor output.

QB1 monitor output is an amplified signal from the internal pressure transducer. QB2 monitor output is a buffered signal from the primary external transducer connected to the QB2. For QB valves with model number TFEE or TFIE the monitor output is voltage. The monitor output is analog current, if the valve model number is TFEC or TFIC. See ordering information for further details.

INSTALLATION

1. Apply a small amount of anaerobic sealant (provided) to the male threads of the in-line filter supplied with valve.

CAUTION: USE ONLY THE THREAD SEALANT PROVIDED. OTHER SEALANTS SUCH AS PTFE TAPE AND PIPE DOPE CAN MIGRATE INTO THE FLUID SYSTEM CAUSING FAILURES.

2. Install the in-line filter into the port labeled IN on QB valve.
3. Connect supply line to the in-line filter port. Connect device being controlled to port labeled OUT on QB valve.
4. Mount valve accordingly.
5. The valve can be mounted in any position without affecting performance. Mounting bracket QBT-01 (ordered separately) can be used to attach valve to a panel or wall surface.
6. Proceed with electrical connections.

SPECIFICATIONS

ELECTRICAL

SUPPLY VOLTAGE.....	15-24 VDC
SUPPLY CURRENT.....	250mA req'd.
COMMAND SIGNAL	
VOLTAGE.....	0-10 VDC
CURRENT.....	4-20mA
COMMAND SIGNAL IMPEDANCE	
VOLTAGE.....	4.75 KΩ
CURRENT.....	100 Ω
ANALOG MONITOR SIGNAL	
VOLTAGE.....	0-10 VDC @ 20mA max
CURRENT.....	4-20mA sinking (sourcing opt.)

MECHANICAL

PRESSURE RANGES.....	29.9 in. Hg (vac) - 500 psig (760 mmHg (vac) - 34.47 BAR)
OUTPUT PRESSURE†.....	0-100% of range
FLOW RATE.....	1.2 SCFM max @ 100 psig inlet (34L/min @ 6.89 BAR)
Cv CAPACITY.....	0.04
MIN. CLOSED END VOLUME.....	1 in ³
FILTRATION RECOMMENDED.....	20 micron nominal (included)
LINEARITY/HYSTERESIS.....	<±0.15% F.S. BFSL
REPEATABILITY.....	<±0.02% F.S.
ACCURACY.....	<±0.2% F.S.
WETTED PARTS‡.....	Elastomers - Fluorocarbon Manifold - Brass Valves - Nickel plate brass P. Transducer - Silicon, Aluminum

PHYSICAL

OPERATING TEMPERATURE.....	32-158°F [0-70°C]
WEIGHT.....	1.02 lb [0.50 Kg]
PROTECTION RATING.....	NEMA 4
HOUSING.....	Aluminum
FINISH.....	Black Anodized

† Pressure ranges are customer specified. Output pressures other than 100% are available.
‡ Others available

TABLE 1

RATED INLET PRESSURE FOR STANDARD QB VALVES

For valves ordered with MAX. calibrated pressure of:	Max. inlet pressure is:
Vacuum up to 10 psig (0.69 bar)	Consult factory
10.1 up to 30 psig (0.70 up to 2 bar)	35 psig (2.4 bar)
31 up to 100 psig (2.1 up to 7 bar)	110 psig (7.6 bar)
101 up to 175 psig (7 up to 12 bar)	190 psig (13 bar)
176 up to 300 psig (12.1 up to 20.7 bar)	330 psig (22.8 bar)
301 up to 500 psig (20.8 to 34.5 bar)	550 psig (37.9 bar)

NOTE: Valves with options S67, S91, or S106 can handle higher inlet pressures. Inlet pressure are not the same for valves mounted to volume boosters. Consult factory for further information.

RE-CALIBRATION PROCEDURE

All QB control valves come calibrated from the factory by trained personnel using precision calibration equipment. The QB valve is a closed loop control valve using a precision electronic pressure sensor. Typical drift is less than 1% over the life of the product. If your QB valve appears to be out of calibration by more than 1%, it is not likely to be QB. Check the system for plumbing leakage, wiring and electronic signal levels. Verify the accuracy of your measuring equipment before re-calibrating. Consult factory if you have any questions or require assistance. If the QB valve needs re-calibration, use the procedure described below:

QB1 VALVES

- Identify the inputs and outputs of the valve using the model number of the valve, calibration card included with the valve, and the information provided in this sheet.
- Connect a precision measuring gage or pressure transducer to the OUT port of the QB.
NOTE: THERE MUST BE A CLOSED VOLUME OF AT LEAST 1 CU. IN. (17 CC) BETWEEN THE VALVE OUTLET AND THE MEASURING DEVICE FOR THE VALVE TO BE STABLE.
- Connect the correct supply source to the IN port of the QB, making sure the pressure does not exceed the rating for the valve (See Table 1).
- Locate the plastic calibration access cap on top of the QB valve and completely remove it. Located underneath are two adjustment trimpots, Zero "Z" and Span "S". See figure 1 for pots location.
- NOTE: Only use this step if your device is totally out of calibration. If it is slightly out of calibration, omit this step and move on to paragraph 6. Using a small screwdriver, turn both trimpots 15 turns clockwise. Then turn both trimpots 7 turns counterclockwise. This will put the QB roughly at mid-scale.
- Make correct electrical connections as noted. Make sure there is a proper meter in place to measure the command input to the QB.
- Set the electrical command input to MAXIMUM value.
- Adjust the SPAN pot until MAXIMUM desired pressure is reached (clockwise *increases* pressure).
- Set the electrical command input to MINIMUM value.
- Adjust the ZERO pot until MINIMUM desired pressure is reached (clockwise *increases* pressure).
- Repeat ZERO and SPAN adjustments, which interact slightly, until QB1 valve is calibrated back to proper range. Step 6 - 9.
- Replace calibration access cap.

QB2 VALVES

This section assumes there is a properly scaled and calibrated transducer for use as 2nd loop feedback signal. For information on re-calibrating Proportion-Air DS series pressure transducers see sheet BR060.

- Follow, in order, steps 1-5 as noted in the section titled QB1 VALVES.
- Make correct electrical connections as noted. Make sure there is a proper meter in place to measure the command input to the QB2. Make sure the 2nd loop signal is connected.
- Set the electrical command input to MAXIMUM value.
- Adjust the SPAN pot until MAXIMUM desired pressure is reached (clockwise *increases* pressure).
- Set the electrical command input to MINIMUM value.
- Adjust the ZERO pot until MINIMUM desired pressure is reached (clockwise *increases* pressure).
- Repeat ZERO and SPAN adjustments, which interact slightly, until QB2 valve is calibrated back to proper range. Steps 3 - 6.
- Replace calibration access cap.

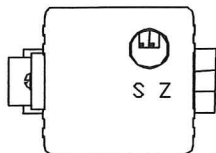


Figure 1

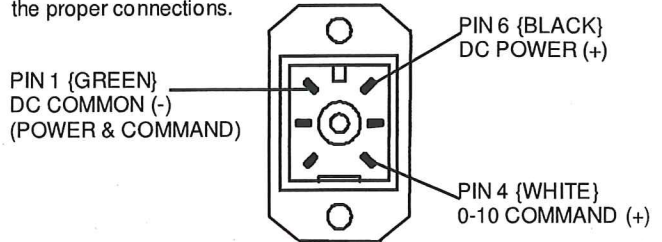
ELECTRICAL CONNECTIONS

- Turn off all power to valve.
- Identify the valve's command input and analog output using the calibration card included in the package and the ordering information section on the last page of this sheet.
- Proceed to the appropriate section corresponding to the type of valve being installed.

NOTE: ALL COLOR CODES RELATE TO QB'S ORDERED FROM THE FACTORY WITH WIRE LEADS.

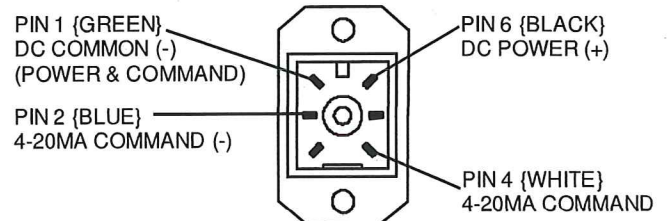
Voltage command valves

All voltage command QB's use common mode voltage, meaning the DC Common pin (Pin 1) is the common reference for both power and command. Pin 1 is used as both the command signal common and power supply common. The following diagram shows the proper connections.



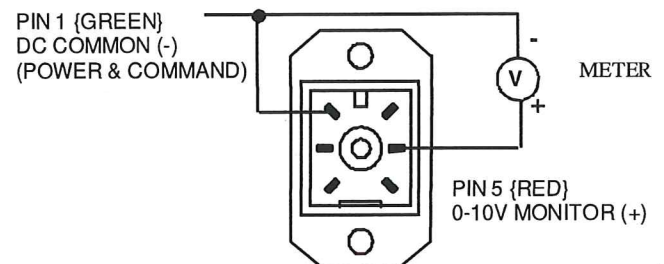
Current command valves

All current command QB's use a differential current loop scheme (not isolated), meaning current flow is from Pin 4 to Pin 2 on the QB valve. Some applications may require the common of the power supply that provides loop power for the 4-20mA command to be tied to power supply common. The following diagram shows the correct connection for conventional current flow.



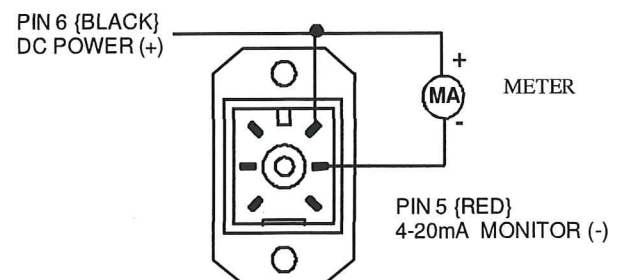
Voltage monitor (TFEE or TFIE)

Use the following wiring diagram for QB valves with a voltage monitor output.

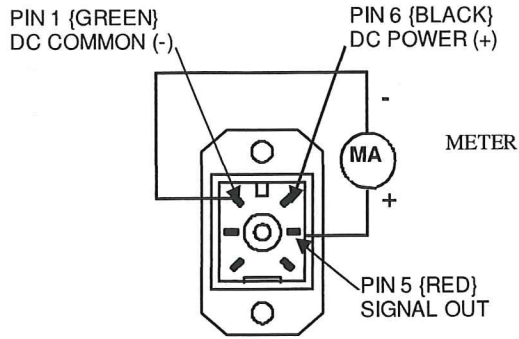


Current monitor (TFEC or TFIC)

Use the following wiring diagram for QB valves with a current sinking monitor output.

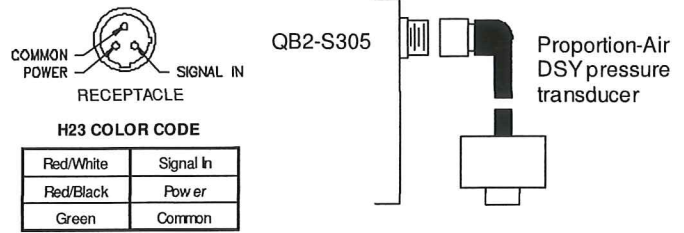


Current Sourcing Monitor (TFES or TFIS)



QB2-S305 option valves

Second loop signal is plugged into auxiliary receptacle on opposite side.

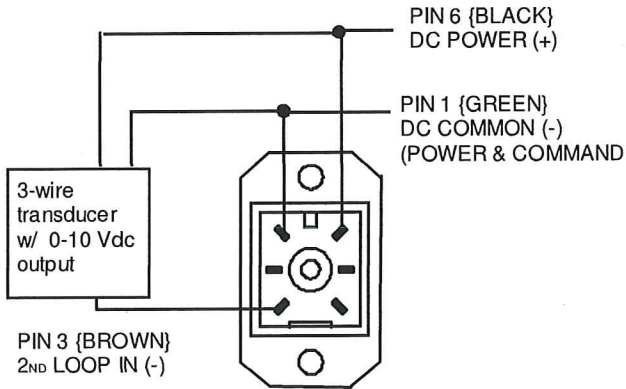


QB2 SECOND LOOP CONNECTIONS

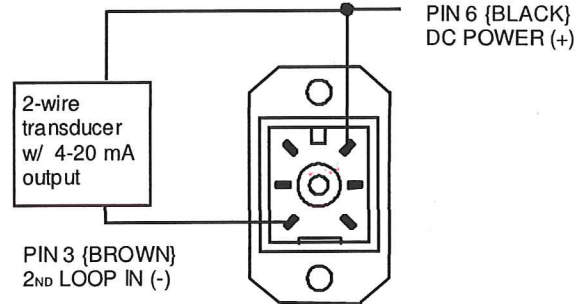
All QB2 valves are *designed to accept a 0-10 volt second loop input signal, unless ordered with special option code S230 (4-20 mA second loop input)*. Reference the following wiring diagrams for details.

Standard QB2 valves

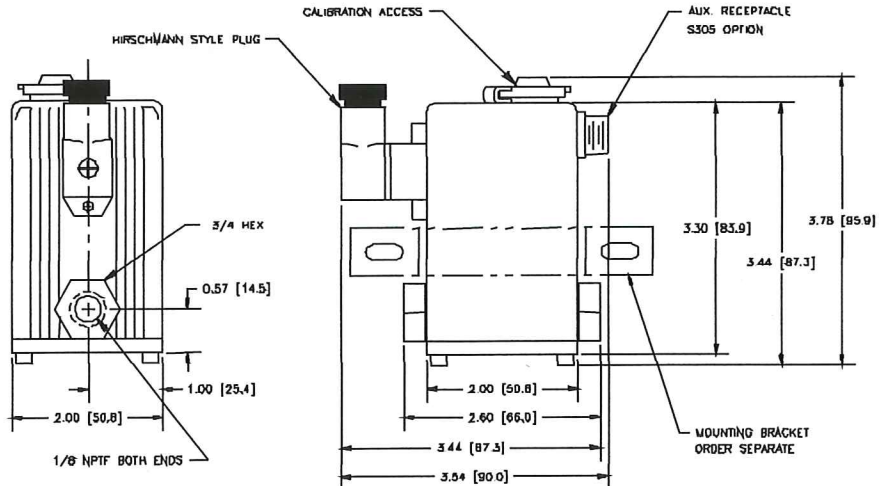
Second loop signal is wired into the main electrical connector.



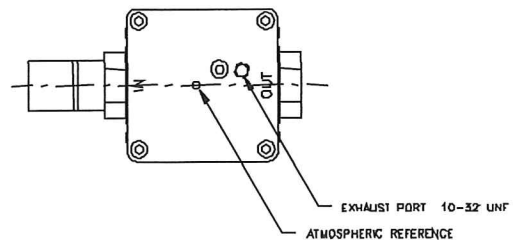
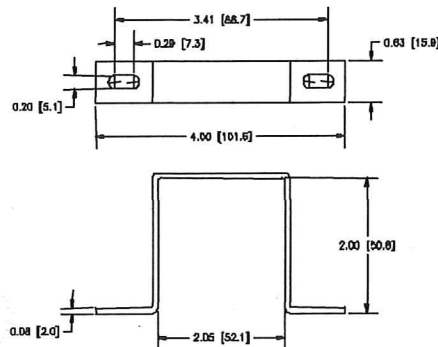
QB2-S230 option valves



DIMENSIONS in [mm]



MOUNTING BRACKET



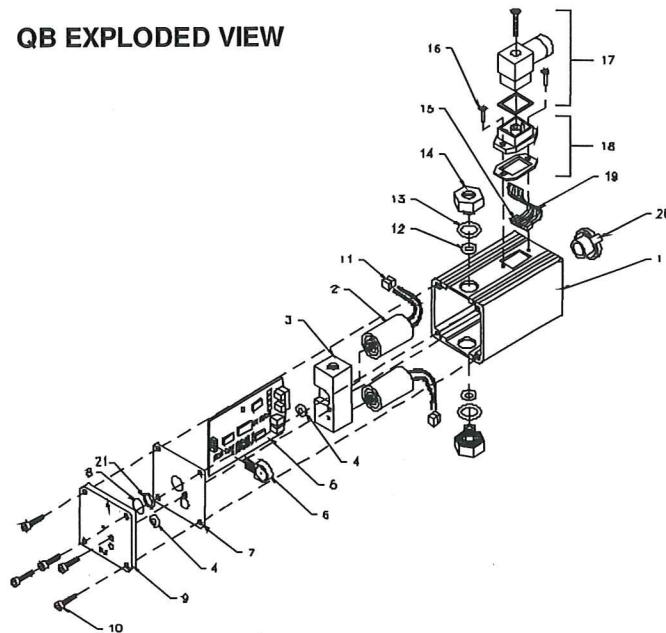
PARTS LIST

1. Housing
2. Valve (2)
3. Manifold
4. O-ring (2)
5. Electronic board
6. Sensor
7. Gasket
8. Filter/Breather
9. Lid
10. Screw (5)
11. Connector (2)
12. O-ring (2)
13. O-ring (2)
14. Fitting (2)
15. Connector
16. Screw (2)
17. Connector assembly
18. Receptacle assembly
19. Wire harness
20. Cap
21. O-ring

PART NUMBERS FOR REPLACEMENT ITEMS*

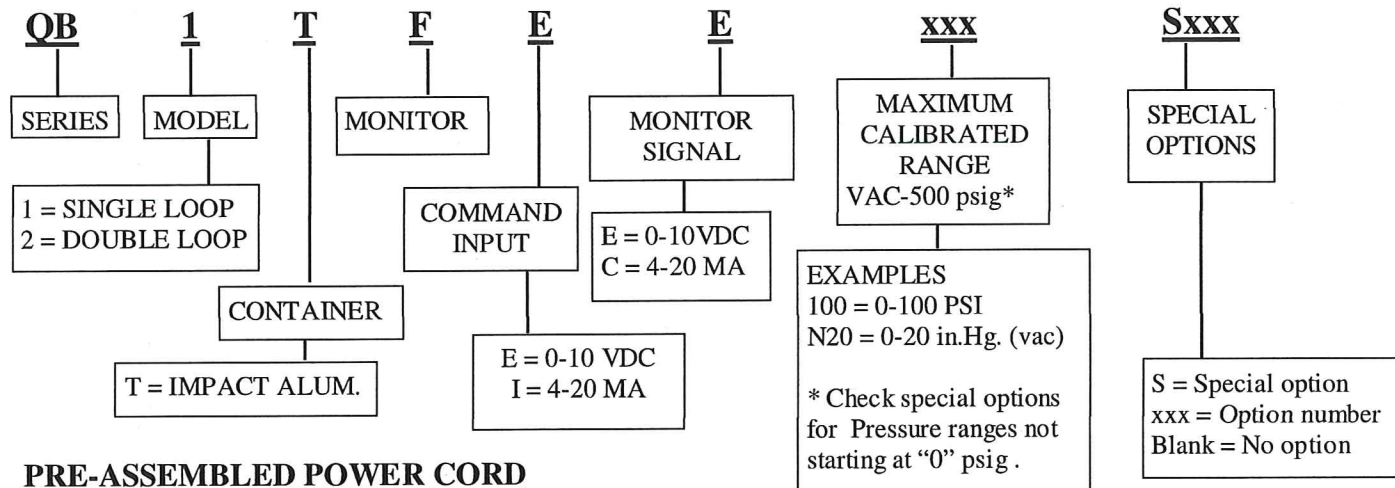
2. Consult factory
4. H134
6. Consult factory
7. H1054
10. H1049
12. H2014
13. H011
14. H1048
17. H615 *#9.35 x 9*
20. H368
21. H040

QB EXPLODED VIEW



* Include complete QB part number & any modification numbers when ordering replacement parts

ORDERING INFORMATION



PRE-ASSEMBLED POWER CORD

QBT-C-6

Length in feet (Other length are available from 1 to 25 feet)

MOUNTING BRACKET

QBT-01

Proportion-Air products are warranted to the original purchaser only against defects in material or workmanship for one (1) year from the date of manufacture. The extent of Proportion-Air's liability under this warranty is limited to repair or replacement of the defective unit at Proportion-Air's option. Proportion-Air shall have no liability under this warranty where improper installation or filtration occurred.

All specifications are subject to change without notice. **THIS WARRANTY IS GIVEN IN LIEU OF, AND BUYER HEREBY EXPRESSLY WAIVES, WARRANTIES OR LIABILITIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING WITHOUT LIMITATION ANY OBLIGATION OF PROPORTION-AIR WITH REGARD TO CONSEQUENTIAL DAMAGES, WARRANTIES OF MERCHANTABILITY, DESCRIPTION, AND FITNESS FOR A PARTICULAR PURPOSE.**

WARNING: Installation and use of this product should be under the supervision and control of properly qualified personnel in order to avoid the risk of injury or death.

PROPORTION-AIR, INC. BOX 218 MCCORDSVILLE, IN USA 46055
 PHONE: (317)335-2602 FAX: (317)335-3853
 web site: www.proportionair.com email address: info@proportionair.com

Parker

Hannifin Corp.

LINEAR AND ROTARY POSITIONERS

OPERATING MANUAL

No. GEN-1H
Rev. 2

Parker Hannifin Corporation
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.

LUBRICATION SHEETS

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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	
SECTION III	
LUBE APPLICATION APPLY GREASE UTILIZING GREASE FITTINGS LOCATED ON THE EDGE SURFACE OF BEARING BLOCKS	
SECTION IV	
NOTES CAUTION: DO NOT USE/MIX PETROLEUM BASE GREASE WITH SYNTHETIC BASE GREASE AT ANY TIME. FOR LUBRICATION UNDER SPECIAL OR SEVERE SERVICE 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 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	
SECTION III	
LUBE APPLICATION APPLY GREASE UTILIZING GREASE FITTINGS LOCATED ON THE EDGE SURFACE OF BEARING BLOCKS	
SECTION IV	
NOTES CAUTION: DO NOT USE/MIX PETROLEUM BASE GREASE WITH SYNTHETIC BASE GREASE AT ANY TIME. FOR LUBRICATION UNDER SPECIAL OR SEVERE SERVICE 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 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 <p>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.</p> <p>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</p>	
SECTION III	
LUBE APPLICATION <p>WIPE THE RAILS DOWN THEIR ENTIRE LENGTH WITH A CLEAN CLOTH. APPLY LUBRICATION ON THE RAILS ALLOWING A FILM OF FRESH OIL TO PASS UNDER THE WIPERS AND INTO THE RECIRCULATING BEARINGS</p>	
SECTION IV	
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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 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.	
SECTION IV	
NOTES	



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	
SECTION II	
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	
SECTION II	
BEARING MAINTENANCE ALL RADIAL BEARINGS ARE PACKED AT THE FACTORY FOR THE LIFE OF THE BEARING	
SECTION III	
LUBE APPLICATION	
SECTION IV	
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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	
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	
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

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 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 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 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	
SECTION III	
LUBE APPLICATION 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.	
SECTION IV	
NOTES TUBE MUST BE SHAKEN BEFORE APPLICATION	



PARKER HANNIFIN CORPORATION

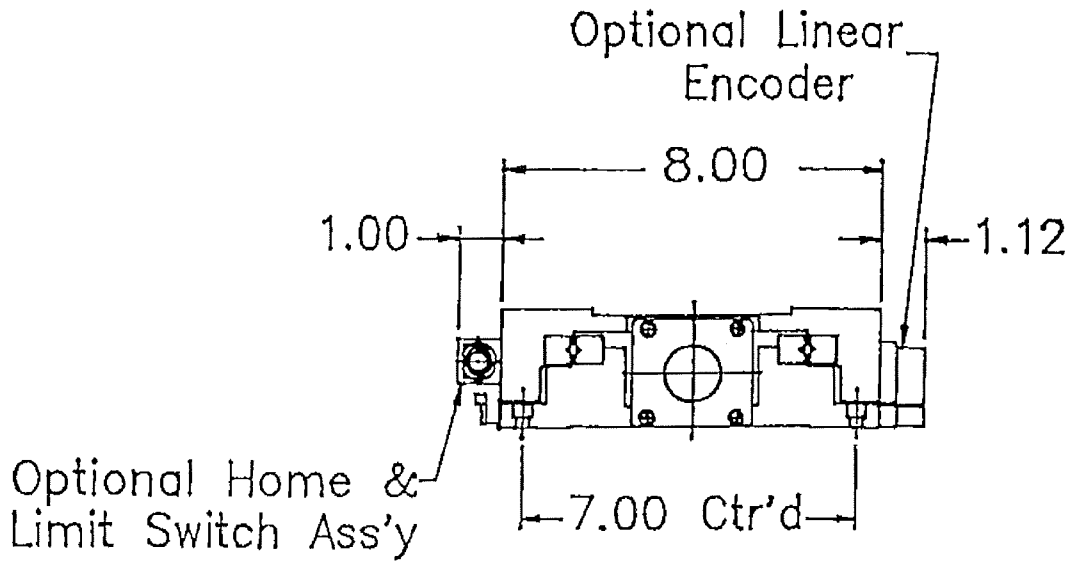
LEAD SCREW LUBRICATION SHEET

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 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>	
SECTION IV	
NOTES	

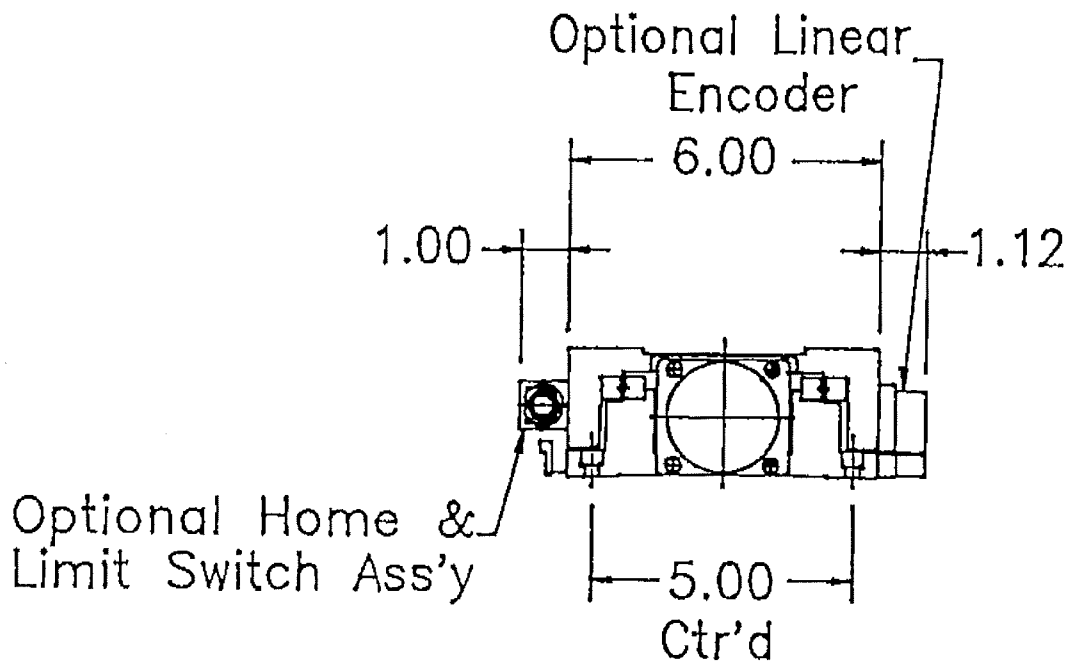


EXAMPLE OF ENCODERS AND LIMIT/HOME SWITCH ASSEMBLY

806000 SERIES



808000 SERIES



STANDARD OPTIONS—LH (Magnetic Limit and Home Switches)

- **Mounting and Adjustment**

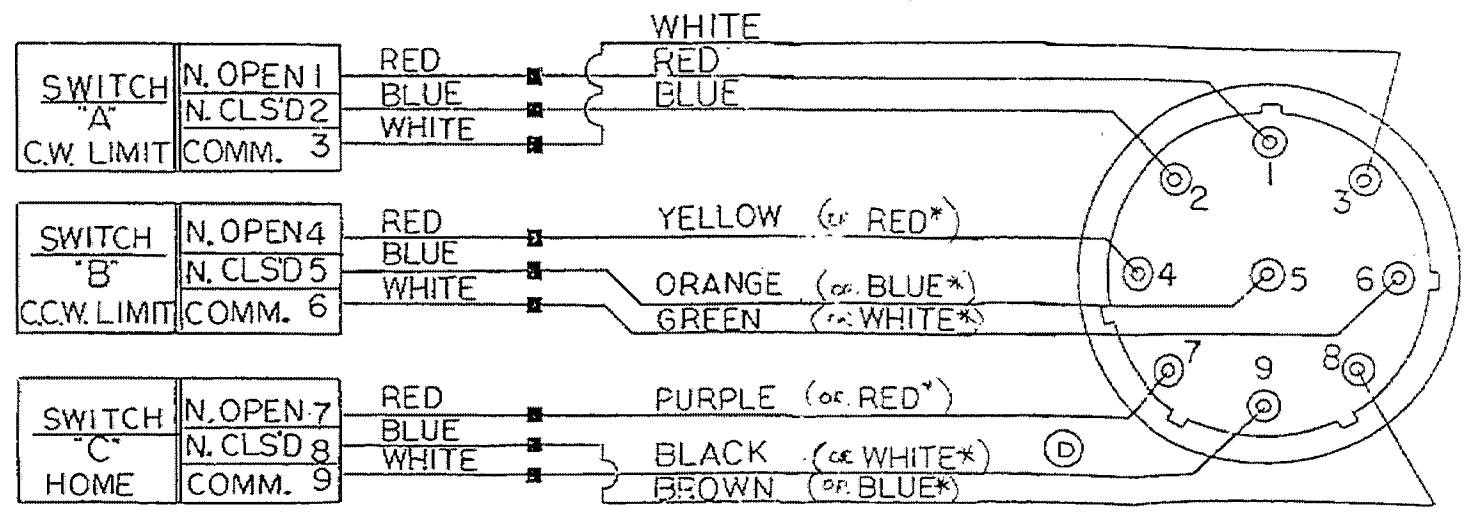
- * Remove three (3) each flat head screws, one (1) on top, two (2) on opposite side cover. Then the cover will slide off of the bracket. (NOTE: slide away from connector).
- * Counter bored holes in bracket. These holes are to be used to mount to predrilled and tapped holes in slide top. (NOTE: Hole 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				
ZONE	REV	DESCRIPTION	DATE	APPROVED

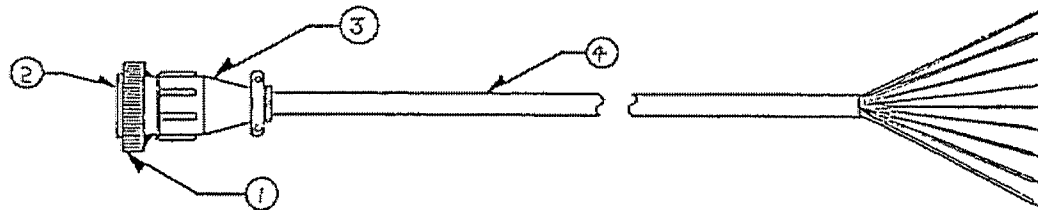


WIRING DIAGRAM

* ON SHORT TRAVEL TABLES
WIRES ARE NOT SPLICED.

CR-4	CR-3	GR-2	GR-1	PART OR IDENTIFYING NO.	DESCRIPTION	SPEC.	MATERIAL OR NOTE	ITEM NO.
QUANTITY				LIST OF MATERIAL				
UNLESS OTHERWISE SPECIFIED				<small>THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF AND FOR THE PURPOSES OF PARKER HANNIFIN CORP./DAEDAL DIVISION. IT CANNOT BE LAWFULLY REPRODUCED IN ANY FORM NOR EMPLOYED BY ANY THIRD PARTY, NOR USED FOR ANY PURPOSE OTHER THAN THAT WHICH IT HAS BEEN MADE AVAILABLE TO YOU WITHOUT THE EXPRESS WRITTEN CONSENT OF PARKER HANNIFIN DAEDAL DIVISION.</small>				
<small>DIMENSIONS ARE IN INCHES TOLERANCES ON</small> <small>FRACTIONS DECIMALS ANGLES</small> <small>0 TO 4 ±1/32 .001 ±0.30° ±30°</small> <small>4 TO 8 ±1/16 .002 ±0.05 ±45°</small> <small>8 AND UP ±1/8 RUS FINISH ✓</small>								
REMOVE BURRS, BREAK SHARP EDGES				DRAWN	<i>Merrie</i>	173-57	DAEDAL	
MATERIAL				CHECKED				
FINISH				DESIGN			INNERCONNECTION DIAGRAM MAGNETIC LIMIT & HOME SWITCHES	
				ENGRG				
				APPD			A	003-1018
				APPD			SCALE FULL	REPRO ~
							SHT 1 OF 1	REV ~

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



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 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

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

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				THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF AND FOR THE PURPOSES OF PARKER HANNIBY CORPORATION. IT CANNOT BE LOANED, REPRODUCED IN ANY FORM NOR DIVULGED TO ANY THIRD PARTY NOR USED FOR ANY PURPOSE OTHER THAN THAT WHICH IT HAS BEEN MADE AVAILABLE TO YOU WITHOUT THE EXPRESS WRITTEN CONSENT OF PARKER HANNIBY DAEDAL DIVISION.											
DIMENSIONS ARE IN INCHES TOLERANCES ON				<div style="text-align: center; font-size: 2em; font-weight: bold;">DAEDAL</div>											
<table border="0"> <tr> <td>FRACTIONS</td> <td>DECIMALS</td> <td>ANGLES</td> </tr> <tr> <td>0 TO 4 1/32</td> <td>.XX ±.01</td> <td>±0.30°</td> </tr> <tr> <td>4 TO 2 1/16</td> <td>.500 ±.005</td> <td>✓</td> </tr> <tr> <td>2 AND UP 1/8</td> <td>RHS FINISH</td> <td>✓</td> </tr> </table>									FRACTIONS	DECIMALS	ANGLES	0 TO 4 1/32	.XX ±.01	±0.30°	4 TO 2 1/16
FRACTIONS	DECIMALS	ANGLES													
0 TO 4 1/32	.XX ±.01	±0.30°													
4 TO 2 1/16	.500 ±.005	✓													
2 AND UP 1/8	RHS FINISH	✓													
REMOVE BURRS, BREAK SHARP EDGES				CHECKED	DRAWN	<i>Memoinda</i>	7/23/57								
MATERIAL				DESIGN											
FINISH				ENGRG											
				APPD											
				APPD											
				SCALE	FULL	REPRO	~	SHT 1 OF 1 REV ~							

STANDARD OPTIONS—LH (Magnetic Limit and Home Switches)

- ***Mounting and Adjustment***

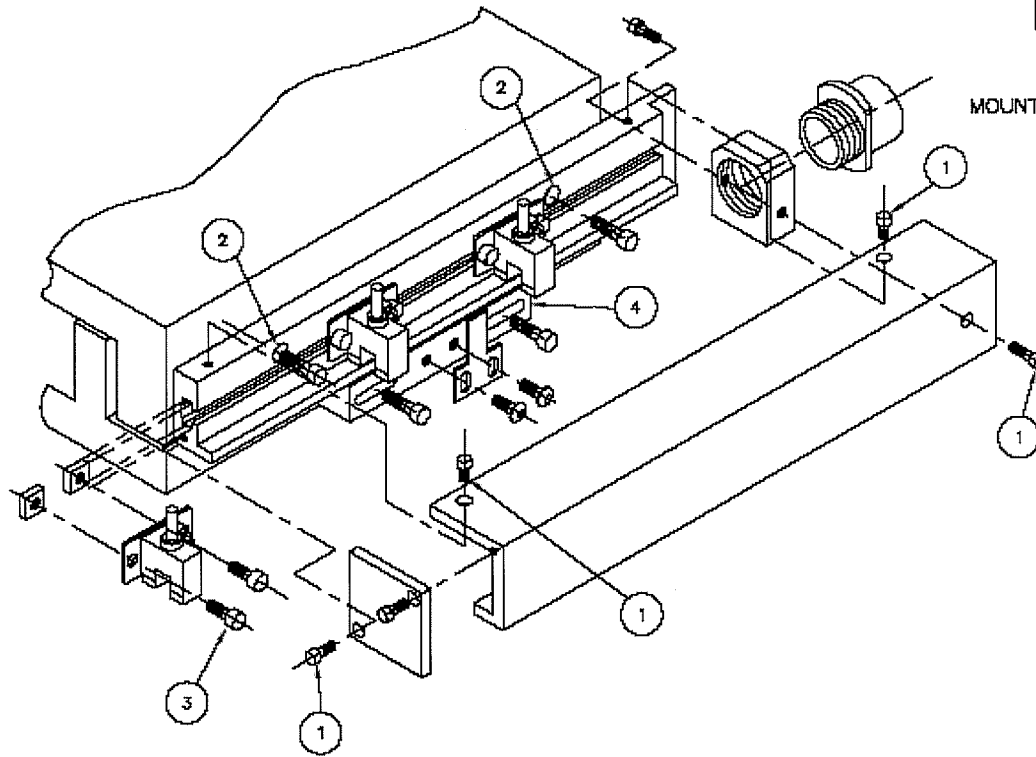
- * See the following pages for a diagram of the assembly

- ***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	APPROVED
1	INITIAL RELEASE	~	~

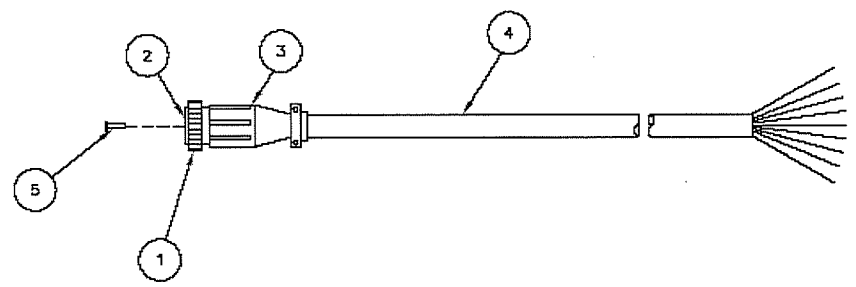


MOUNTING & ADJUSTING OPTICAL LIMIT & HOME SWITCHES

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.

IMPERIAL UNITS ALL DIMENSIONS IN INCHES (UNLESS OTHERWISE SPECIFIED)		STANDARD TOLERANCES, UNLESS OTHERWISE SPECIFIED			ALL PARTS AND ASSEMBLIES TO BE MANUFACTURED PER PARKER HANNIFIN DAEDAL DIVISION PS1000 SPECIFICATIONS		
ALL THREADS TO BE: UNC-2A DR 2B (COARSE) UNF-2A DR 2B (FINE)		DECIMALS	RMS FINISH	ANGLES	<small>THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF AND FOR THE PURPOSES OF PARKER HANNIFIN CORP. DAEDAL DIVISION. IT CANNOT BE LAWFULLY REPRODUCED IN ANY FORM NOR QUALIFIED TO ANY THIRD PARTY, NOR USED FOR ANY PURPOSE OTHER THAN THAT WHICH IT HAS BEEN MADE AVAILABLE TO YOU WITHOUT THE EXPRESS WRITTEN CONSENT OF PARKER HANNIFIN DAEDAL DIVISION.</small>		
		X ±.02 XXX ±.01 XXXX ±.005 XXXXX ±.0005	B _A V	±0°30'			
REFERENCE DRAWINGS	CHAMFERS: 45° x .02	RADII: .02 R.	DRAWN	DJB	3/22/06		
ASSY or NSPER No.:	REMOVE BURRS, BREAK SHARP EDGES		CHECKED				
SALES ORDER No.:	MATERIAL		DESIGN			OPTICAL H/L SWITCH ADJUSTMENT ASS'Y AutoCad DRAWING B 006-2065 SCALE: NONE REPRO: ENG. 1 OF 1 REV. 1	
FILE NAME:	FINISH		ENGINEERING				
MADE FROM(FILE):			MANUFACTURING				
			QUALITY ASSURANCE				
			ASSEMBLY				

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED



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!

COLOR CODE FOR ITEM #1		
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

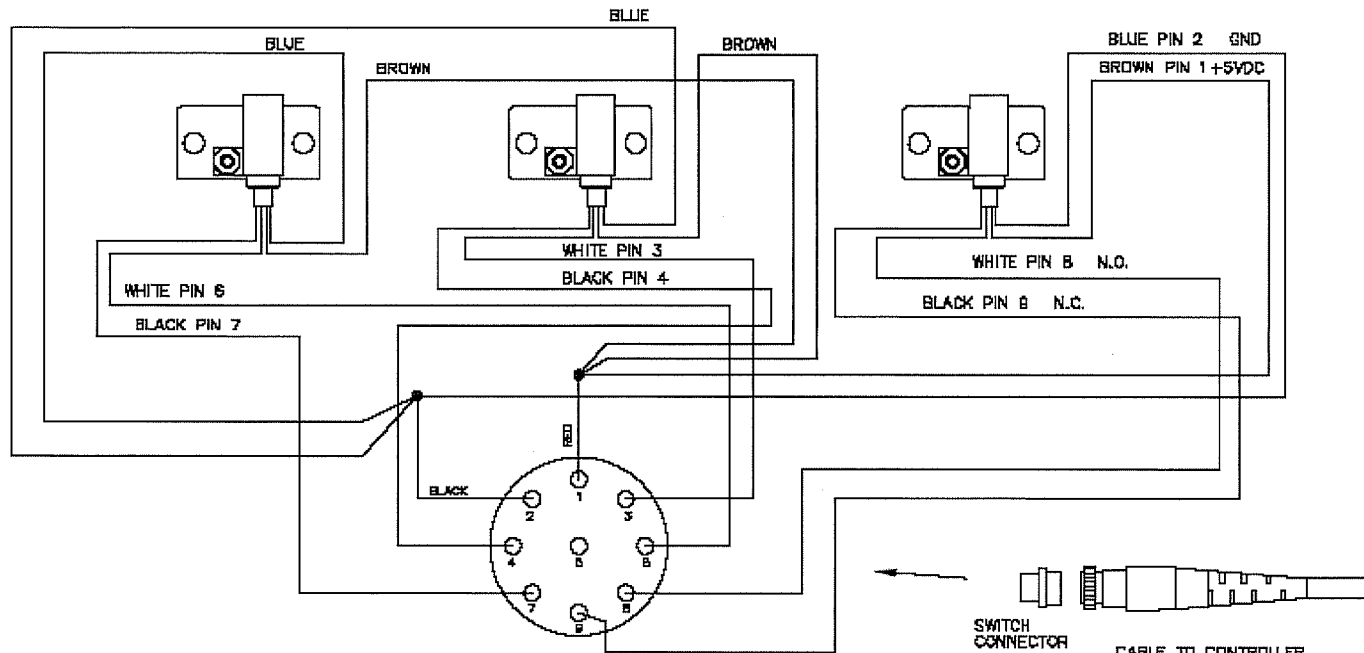
	DESCRIPTION	WIRE COLOR
*	+5 VDC	RED
*	DC GROUND	BLACK
*	HOME (N.O.)	GREEN
*	HOME (N.C.)	BROWN
*	CW LIMIT (N.O.)	WHITE
*	CW LIMIT (N.C.)	BLUE
*	CCW LIMIT (N.O.)	YELLOW
*	CCW LIMIT (N.C.)	ORANGE
*	SHIELD	BARE

* +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 PS1000 SPECIFICATIONS			
STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED		THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF AND FOR THE PURPOSES OF PARKER HANNIFIN CORP. DAEDAL DIVISION. IT CANNOT BE LAWFULLY REPRODUCED IN ANY FORM NOR DIVULGED TO ANY THIRD PARTY, NOR USED FOR ANY PURPOSE OTHER THAN THAT WHICH IT HAS BEEN MADE AVAILABLE TO YOU WITHOUT THE EXPRESS WRITTEN CONSENT OF PARKER HANNIFIN DAEDAL DIVISION.			
ALL THREADS TO BE: UNC-2A OR 2B (COARSE) UNF-2A OR 2B (FINE)		DECIMALS .X ±.02 .XX ±.01 .XXX ±.005 .XXXX ±.0005	RMS FINISH 63	ANGLES ±0°30'	Parker DAEDAL Division Automation Manual & Motorized Positioning Systems
REFERENCE DRAWINGS	CHAMFERS: 45° x .02	RADIOI: .02 R.	DRAWN	MCM	5-7-91
AGSY or NSPER No.:	REMOVE BURRS, BREAK SHARP EDGES	CHECKED	MCM	5-7-91	
SALES ORDER No.:	MATERIAL	DESIGN			
FILE NAME:	FINISH	ENGINEERING			
MADE FROM(FILE):		MANUFACTURING			
		QUALITY ASSURANCE			
		ASSEMBLY			
OPTICAL L/H SWITCH CABLE PIGTAIL ENDED			AutoCad DRAWING B 006-1288		
			SCALE: NTS	REPRO:	SHT. 1 OF 1

SINGLE BRACKET 36" OR LESS

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
1	INITIAL RELEASE	~	~



ALL WIRE 28 AWG

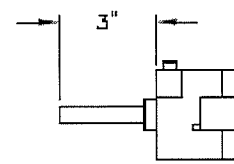
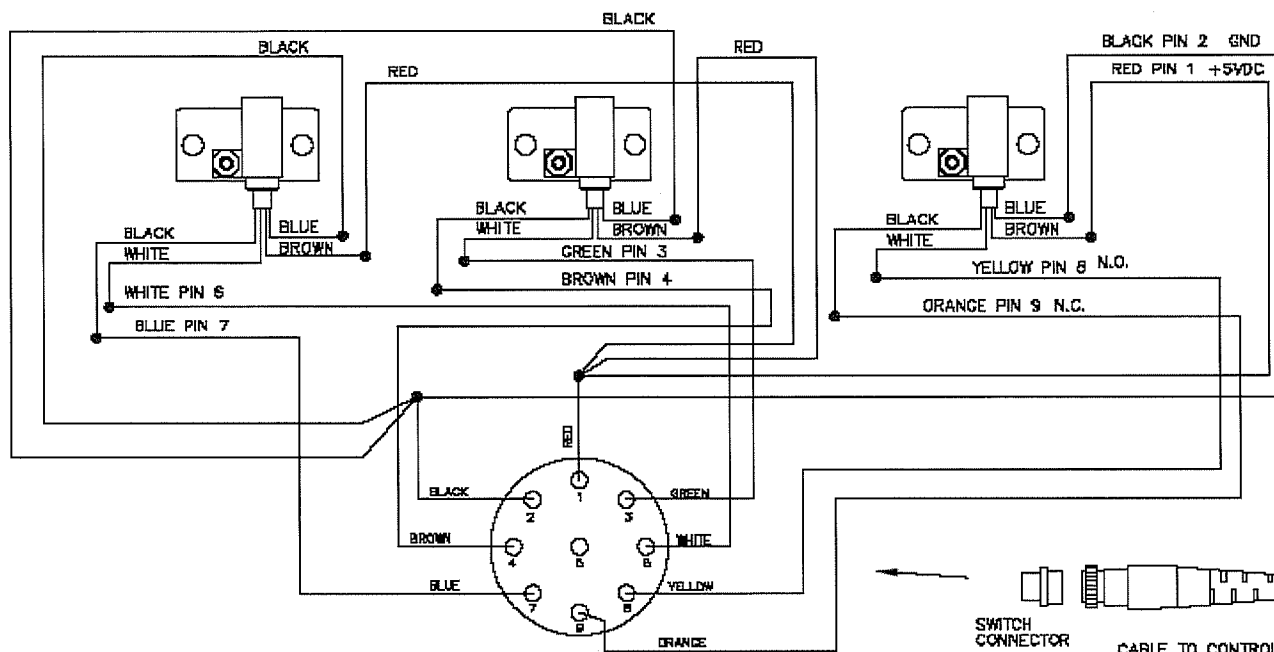
SPLICE ALL 3 BROWN WIRES TO A 2" LONG RED WIRE. COVER SPLICE WITH HEATSHRINK.

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

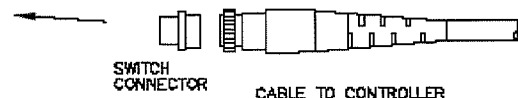
IMPERIAL UNITS ALL DIMENSIONS IN INCHES (UNLESS OTHERWISE SPECIFIED)		ALL PARTS AND ASSEMBLIES TO BE MANUFACTURED PER PARKER HANNIFIN DAEDAL DIVISION PS1000 SPECIFICATIONS		THE INFORMATION CONTAINED HEREIN IS BEING MADE AVAILABLE ONLY AS THE PROPERTY OF AND FOR THE PURPOSES OF PARKER HANNIFIN CORP. (DAEDAL DIVISION). IT CANNOT BE LAWFULLY REPRODUCED IN ANY FORM NOR DERIVED TO ANY THIRD PARTY, NOR USED FOR ANY PURPOSE OTHER THAN THAT WHICH IT HAS BEEN MADE AVAILABLE TO YOU WITHOUT THE EXPRESS WRITTEN CONSENT OF PARKER HANNIFIN DAEDAL DIVISION.	
STANDARD TOLERANCES, UNLESS OTHERWISE SPECIFIED		DECIMALS .X ±.02 .XX ±.01 .XXX ±.005 .XXXX ±.0005	RMS FINISH 63	ANGLES ±0°30'	DRAWN DJB 3/22/08
ALL THREADS TO BE: UNC-2A OR 2B (COARSE) UNF-2A OR 2B (FINE)		CHAMFERS: 45° x .02 RADIUS: .02 R.	REMOVE BURRS, BREAK SHARP EDGES	DESIGN	ENGINEERING
REFERENCE DRAWINGS	MATERIAL	FINISH	MANUFACTURING	QUALITY ASSURANCE	ASSEMBLY
ASSY or NSFR No.:	SALES ORDER No.:	FILE NAME:	MADE FROM(FILE):	AutoCad DRAWING	B 006-2066
PARKER DAEDAL Automation		Manual & Motorized Positioning Systems		OPTICAL LIMIT INTERCONNECTION DIAGRAM	
SCALE: NONE	REFR:	BHT: 1 OF 2	REV: 1	AutoCad DRAWING B 006-2066	

MULTIPLE BRACKET OVER 36"

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
1	INITIAL RELEASE	~	~



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 DIMENSIONS IN INCHES
(UNLESS OTHERWISE SPECIFIED)

ALL THREADS TO BE:
UNC-2A OR 2B (COARSE)
UNF-2A OR 2B (FINE)

REFERENCE DRAWINGS	CHAMFERS: 45° x .02	RADII: .02 R.
ASSY or NSPER No.:	REMOVE BURRS, BREAK SHARP EDGES	
SALES ORDER No.:	MATERIAL	
FILE NAME:	FINISH	
MADE FROM(FILE):		

ALL PARTS AND ASSEMBLIES TO BE MANUFACTURED PER PARKER HANNIFIN DAEDAL DIVISION PS1000 SPECIFICATIONS

STANDARD TOLERANCES
UNLESS OTHERWISE SPECIFIED

DECIMALS	RMS FINISH	ANGLES
.X ±.02	63	±0°30'
.XX ±.01		
.XXX ±.005		
.XXXX ±.0005		

THE INFORMATION CONTAINED HEREIN IS BEING
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AND FOR THE PURPOSES OF PARKER HANNIFIN
CORP. (DAEDAL DIVISION). IT CANNOT BE LOANED,
REPRODUCED IN ANY FORM NOR DERIVED TO
ANY THIRD PARTY, NOR USED FOR ANY PURPOSE
OTHER THAN THAT WHICH IT HAS BEEN MADE
AVAILABLE TO YOU WITHOUT THE EXPRESS WRITTEN
CONSENT OF PARKER HANNIFIN DAEDAL DIVISION

Parker DAEDAL Division Manual & Motorized
Automation Positioning Systems

OPTICAL LIMIT INTERCONNECTION DIAGRAM

AutoCad DRAWING	B	006-2066
SCALE: NONE	REFS:	BHT: 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.

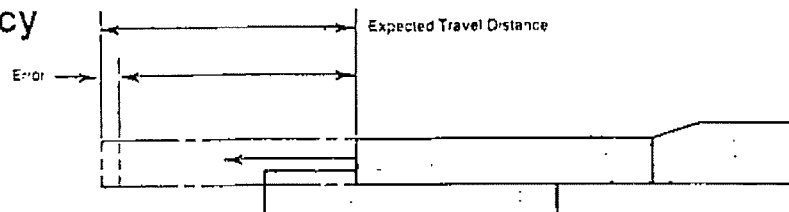
Yaw, Pitch, and Roll:

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.

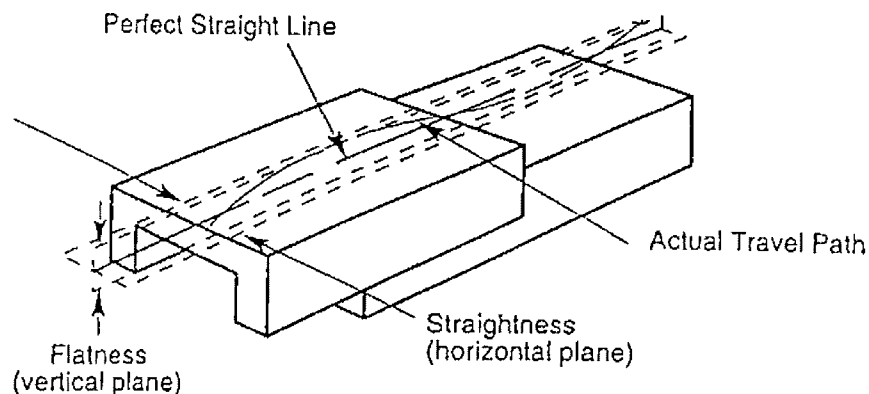
Positional Accuracy:

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.

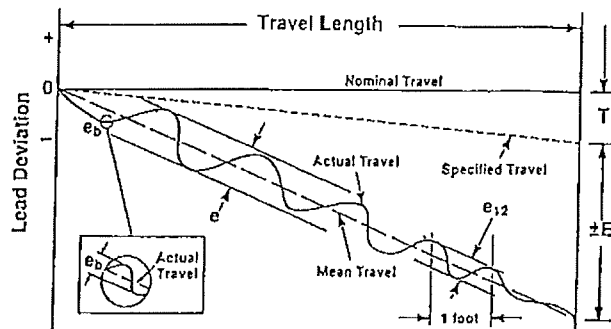
Example: Precision Grade Ball Screw with 4 " of travel
 = 80 micro inches/inch
 = 600 micro inches/foot
E = 320 micro inches

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

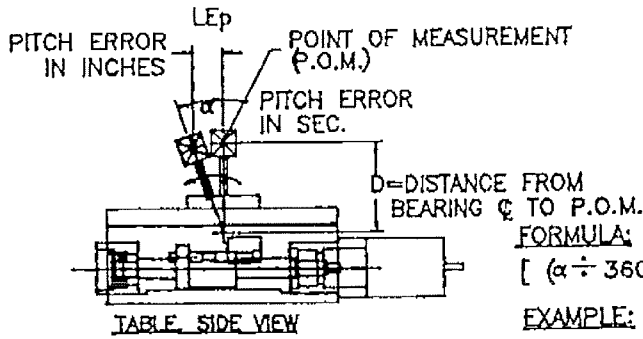


- e** Maximum bandwidth deviation for overall travel from mean travel deviation **E**.
- E** Mean travel deviation is obtained by the least squares method. See the inch/inch and inch/foot definition to determine **E** values. To determine worse case overall travel deviation from specified travel, use **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

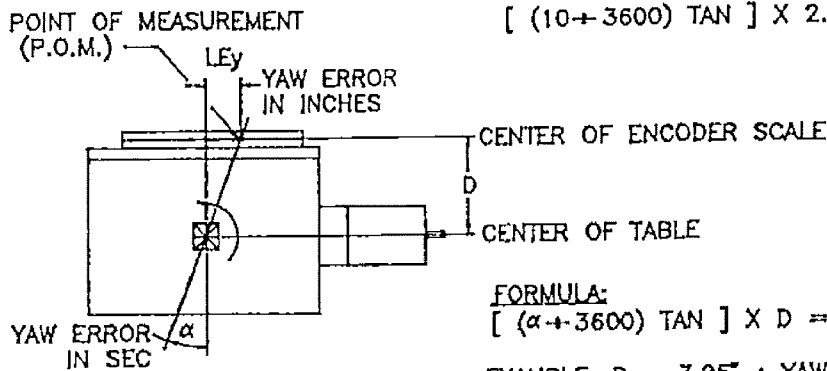


FORMULA:

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

EXAMPLE: $D = 2.5''$; PITCH ERROR = 10 SEC.

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



YAW ERROR AND ITS EFFECTS ON LINEAR ACCURACY

FORMULA:

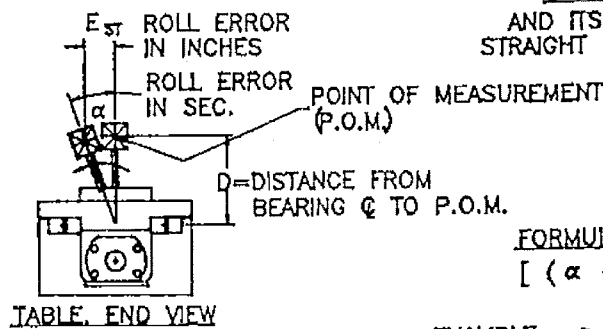
$$[(\alpha \div 3600) \text{TAN}] \times D = LE_y$$

EXAMPLE: $D = 3.25''$; YAW ERROR = 10 SEC.

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

ROLL ERROR

AND ITS EFFECTS ON
STRAIGHT LINE ACCURACY

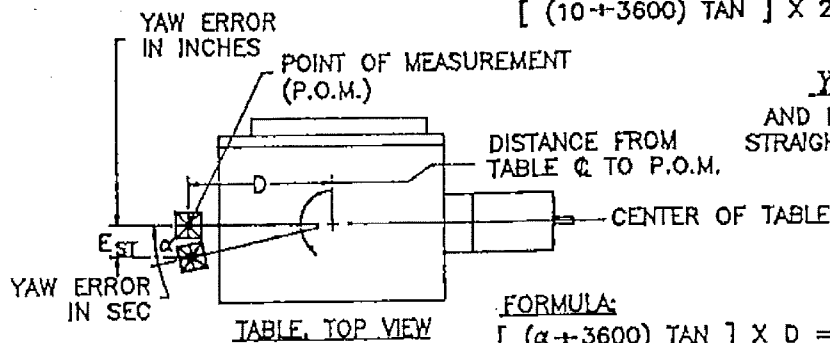


FORMULA:

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

EXAMPLE: $D = 2''$; ROLL ERROR = 10 SEC.

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



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.

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

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