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Whedco

SMD SERIES
STEPPING MOTOR TRANSLATORS
USER'S MANUAL (001/3)
MODELS
SMD-1X30-1-X & SMD-1X50-1-X

Price $25.00

Pub. No. 001 ■ Revision 3 ■ Copyright 1984

WHEDCO INCORPORATED
1050 Highland Drive ■ Ann Arbor, MI 48108
Technical Support (734) 665-7540 ■ Facsimile (734) 665-6694

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ENGINEERING NOTICE

TRANSLATOR FAULT INDICATORS

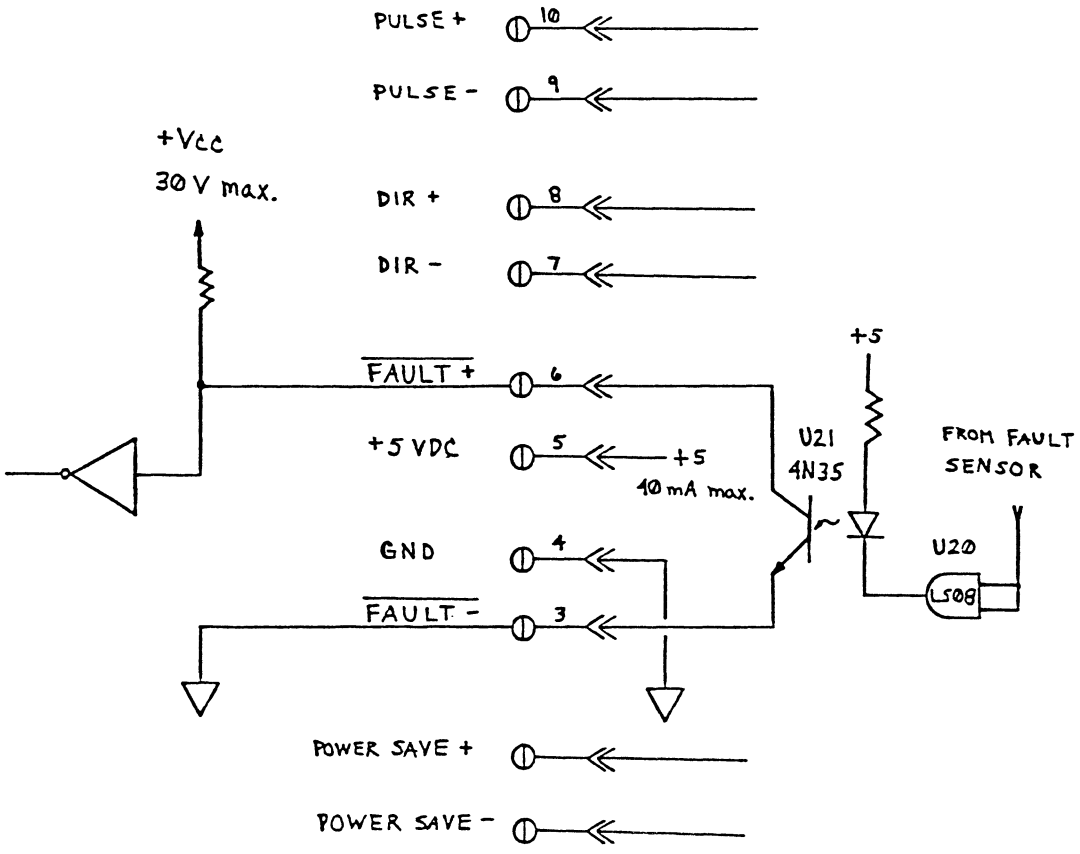
All SMD Series Translators have a red LED which lights when a fault condition is detected. The two possible fault conditions are:

1. Excessive motor current, usually caused by shorted motor leads.

2. Low motor excitation voltage.

If specified by the customer prior to shipment, translators will also be equipped with a fault output line which may be connected to external control equipment (such as a host computer) so that appropriate action may be taken if a fault occurs. When a fault is detected, the 4N35 output provides a current path between pins six and three of the translator control input connector. Note that the output transistor of the 4N35 can sink no more than 100 mA of current.

The circuit which generates this signal is shown below. Note that the user interface shown is not the only possible configuration; it is only provided to illustrate a "typical" application using the fault output.



Note also that one of the warnings on page 16 of the manual no longer applies. The translator will not fail if operated without a motor attached to the output.

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Revision 1

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SECTION 1.0

GENERAL DESCRIPTION

1.1 INTRODUCTION

The Whedco SMD Series Translators are bipolar chopper stepping motor drivers that convert pulse and direction signals from an external source into the corresponding current phase sequence required to drive four-phase stepping motors. The units are completely self-contained including a switching power supply, and incorporate all logic and power switching components needed for bidirectional control of the motor in either the full or half step mode. Optional microstepping capability is also available.

By using a bipolar chopper type of drive, the translator maintains constant current over a large spectrum of operating conditions. This design allows the motor to operate at its peak performance over a wide speed range. It also promotes efficiency in power consumption and packaging by not requiring the use of current limiting resistors necessary with resistance-limited (RL) type drives.

1.2 FEATURES

High efficiency D.C. switching power supply; power MOSFETs enhance reliability.

Package completely self-contained and ready to connect.

No fan required.

Inputs optically isolated to enhance noise immunity.

Outputs are transformer isolated from power input.

No potentiometer adjustments required; all adjustments are D.I.P. switch programmable.

Motor current outputs are field-adjustable for translator compatibility with a wide range of motor makes and sizes.

POWER SAVE input signal reduces motor power consumption by 70% when the motor is at a standstill.

Three (3) mounting choices: panel, through-wall, and base.

All electrical connectors may be removed from translator without disturbing field wiring.

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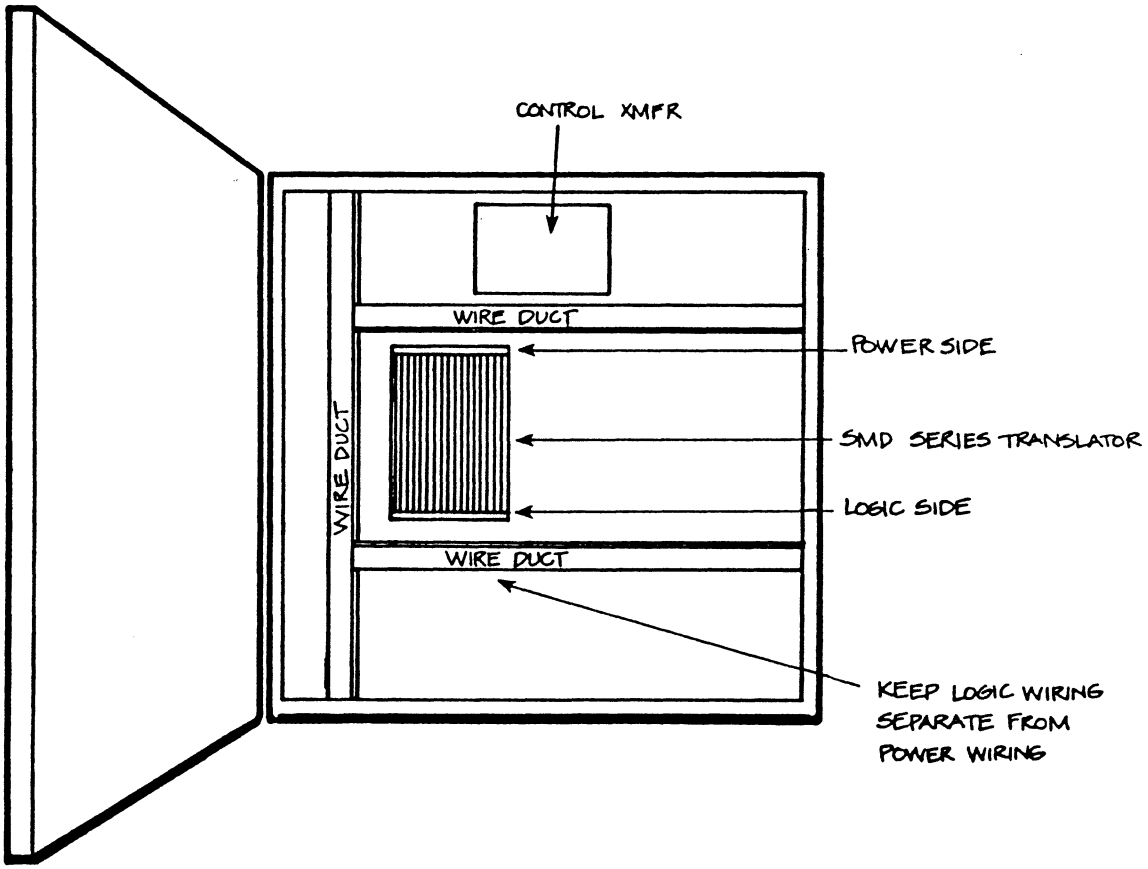
SECTION 2.0

INSTALLATION

2.1 MOUNTING

2.1.1 Panel Mounting. Whedco SMD Series Translators may be mounted vertically in enclosures using the four slotted holes in the translator end plates. It is recommended that the mounting panel or surface be tapped to accept #10-32 UNF machine screws, and that locking hardware be used. For optimum convection cooling, the unit must be mounted with the heat sink fins in a vertical position as shown in Figure 2-1. Whedco does not recommend this mounting method in air-tight enclosures where the ambient temperature will exceed 50 degrees centigrade.

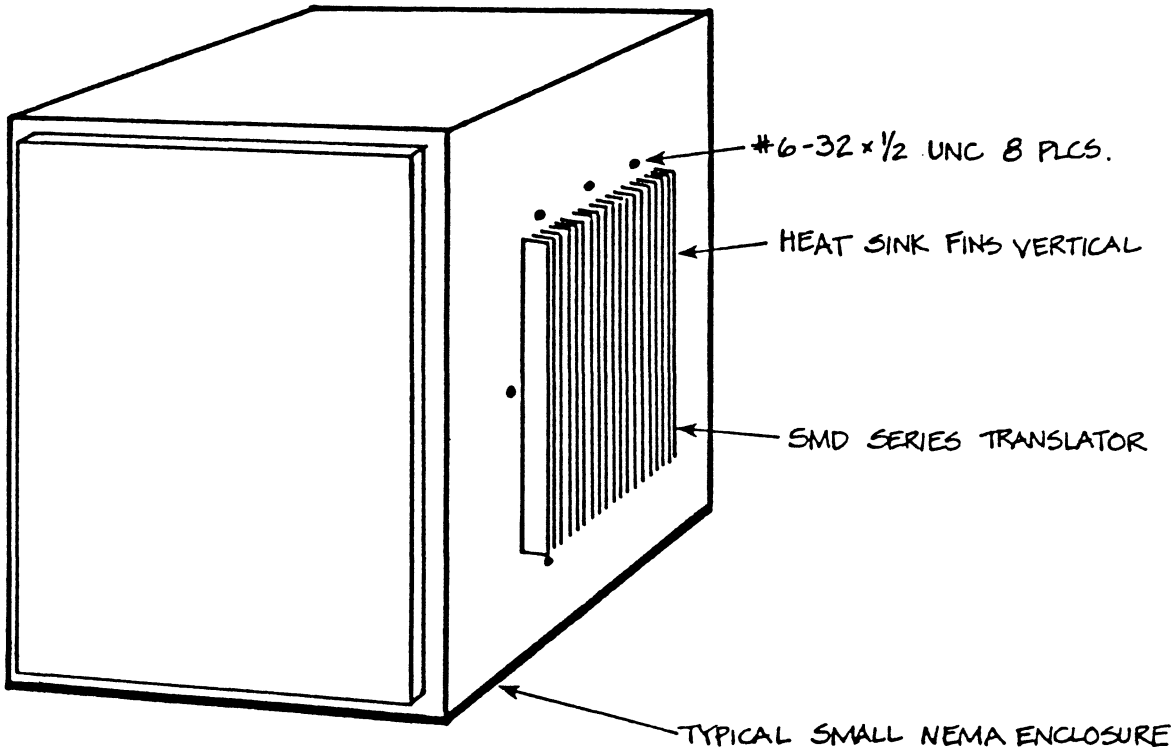
Figure 2-1 Panel Mounting



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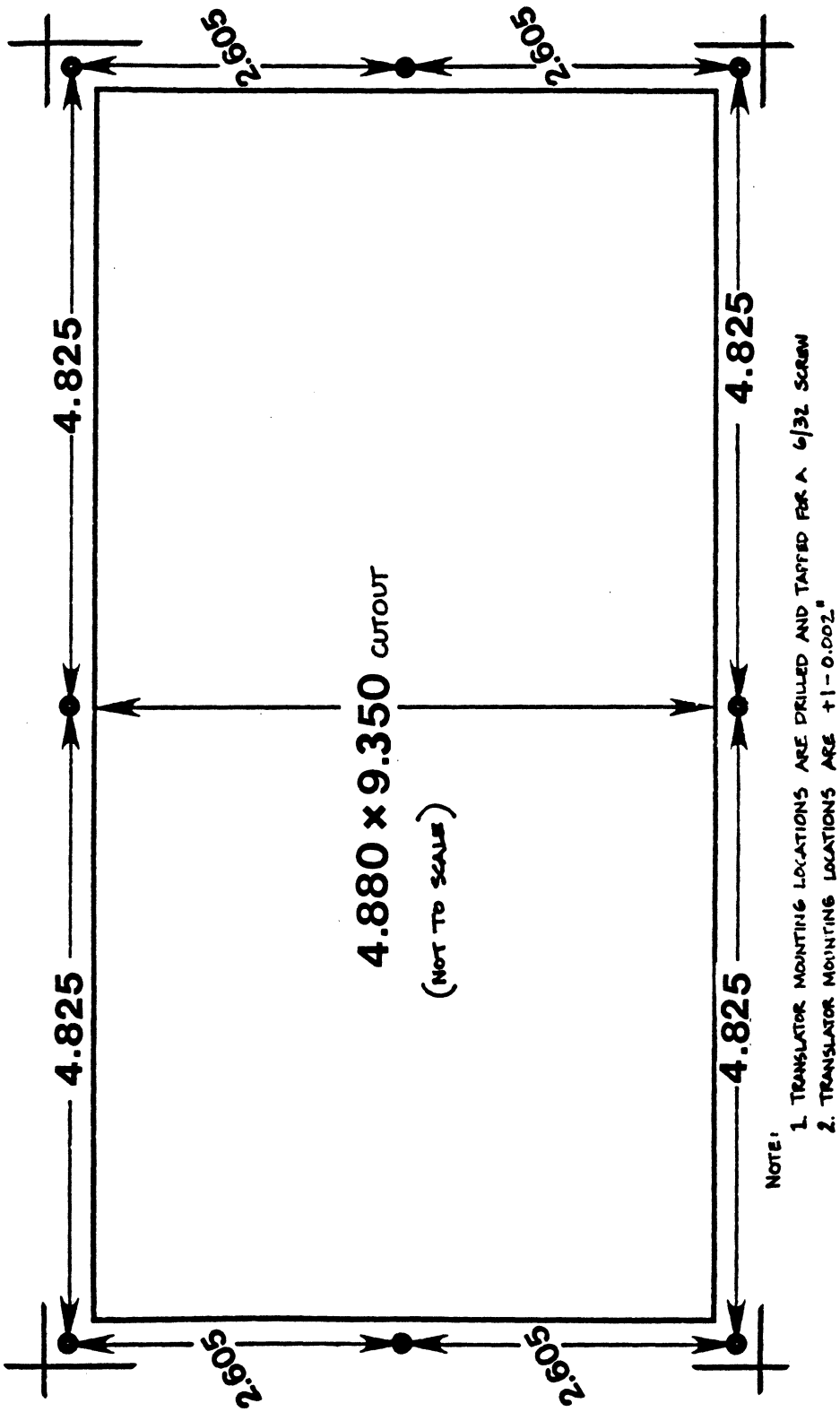
2.1.2 Through-wall heat sink mounting. This mounting method is preferred when the ambient temperature may exceed 50 degrees C., or where other heat-generating devices are mounted in close proximity. Using Figure 2-3 as a guide, cut out the enclosure wall to the dimensions indicated. Drill eight (8) 0.150" diameter holes in the locations indicated by the guide. The unit must be mounted in a vertical position to allow adequate air flow. In some applications, it may be desirable to seal the translator heat sink to the enclosure wall. A thin bead of RTV sealant around the heat sink flange will accomplish this. Use #6-32 x 1/2 UNC screws to mount the translator using the tapped holes provided in the heat sink. Figure 2-2 illustrates this mounting configuration.

Figure 2-2 Through-wall Heat Sink Mounting



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Figure 2-3 Layout for Through-Wall Mounting



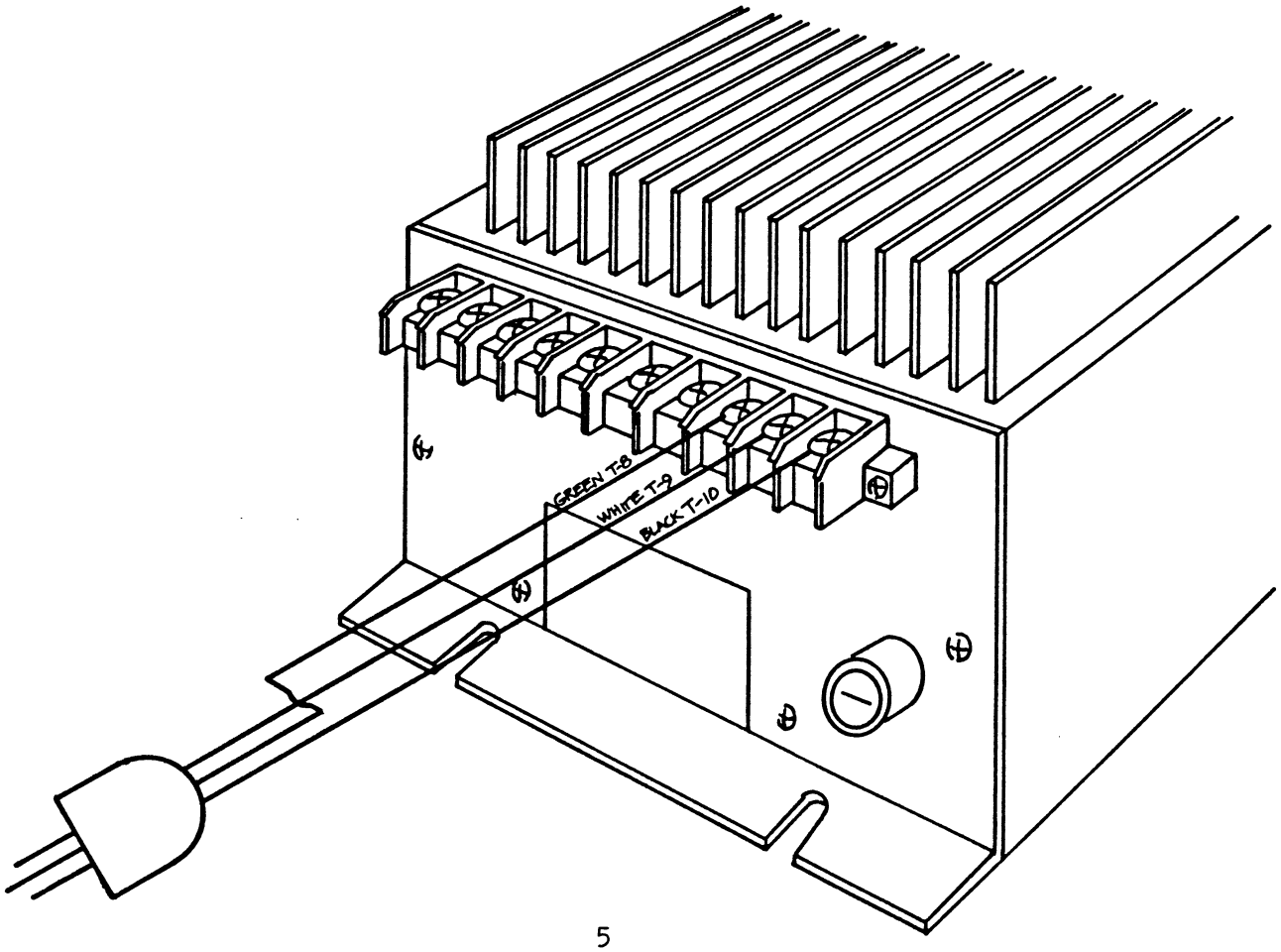
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2.1.3 Base mounting. Whedco SMD Series Translators produce so little heat during operation that in some applications, the unit may be base mounted. This method should only be considered if the ambient temperature will not exceed 100 degrees F., and where air flow is unrestricted past the cooling fins. As with panel mounting, the mounting surface should be tapped to accept #10-32 UNF machine screws and locking hardware should be used.

2.2 CONNECTIONS

2.2.1 Power Input. The SMD Series Translators use 115 VAC at approximately 2.4 to 4.0 Amps, depending on the model selected. Input power is connected to terminal block TB-1 using terminals 8, 9, and 10. In machine tool applications or electrically noisy environment, the use of a separate 1/2 KVA control transformer is strongly recommended. Several SMD translators may be powered from the same control transformer provided that the unit is sized at least 1/2 KVA per translator. When the translator is powered from a control transformer, green wire ground should also be used, even if one leg of the secondary is grounded. Figure 2-4 illustrates proper line wiring. Always make certain that input power falls within the range of 95 to 135 VAC or 135 to 190 VDC before applying power to the translator as irreparable damage may result if improper voltage is applied.

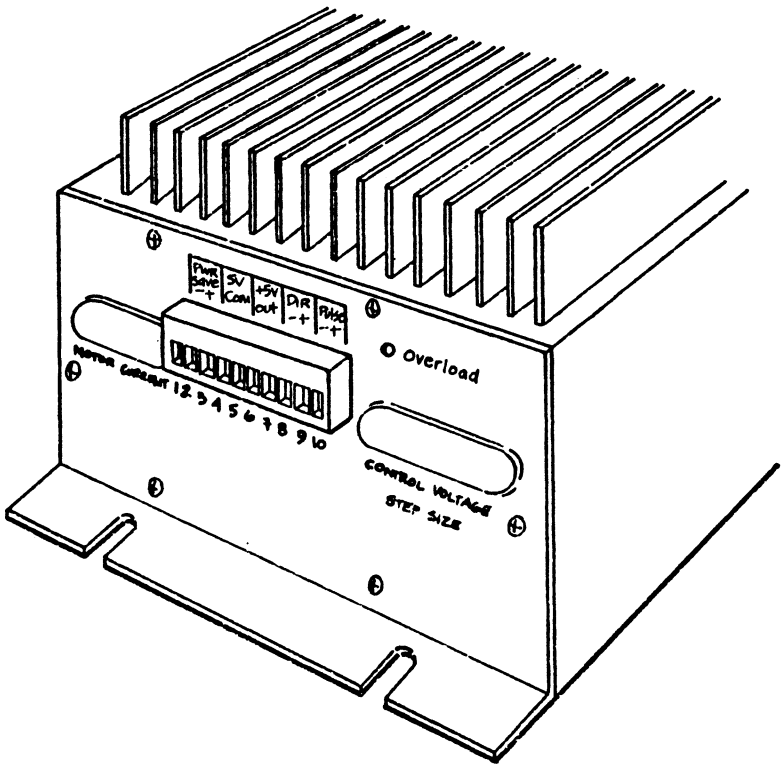
Figure 2-4 Wiring to Power Line (TB-1)



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2.2.2 Control Inputs. Figure 2-5 shows the control input connections as labeled on the rear panel of of the SMD Series Translators:

Figure 2-5 Rear Panel



As illustrated on the rear panel, the translator provides for three (3) control inputs: Pulse, Direction (Dir), and Power Save (Pwr Save). All of these inputs are optically coupled. The inputs accommodate a wide range of interface voltages in a "source" or "sink" configuration without additional hardware modification.

The SMD Series Translators also provide for two (2) other connections on the same terminal block: +5V Out and 5V Com. These connections can be used to power interface circuitry when another source of system logic power is not available. The circuitry will be powered at +5VDC @ 40 ma.

Figures 2-6 through 2-11 illustrate wiring configuration examples for Whedco stepping motor control products, programmable controllers, and popular logic families.

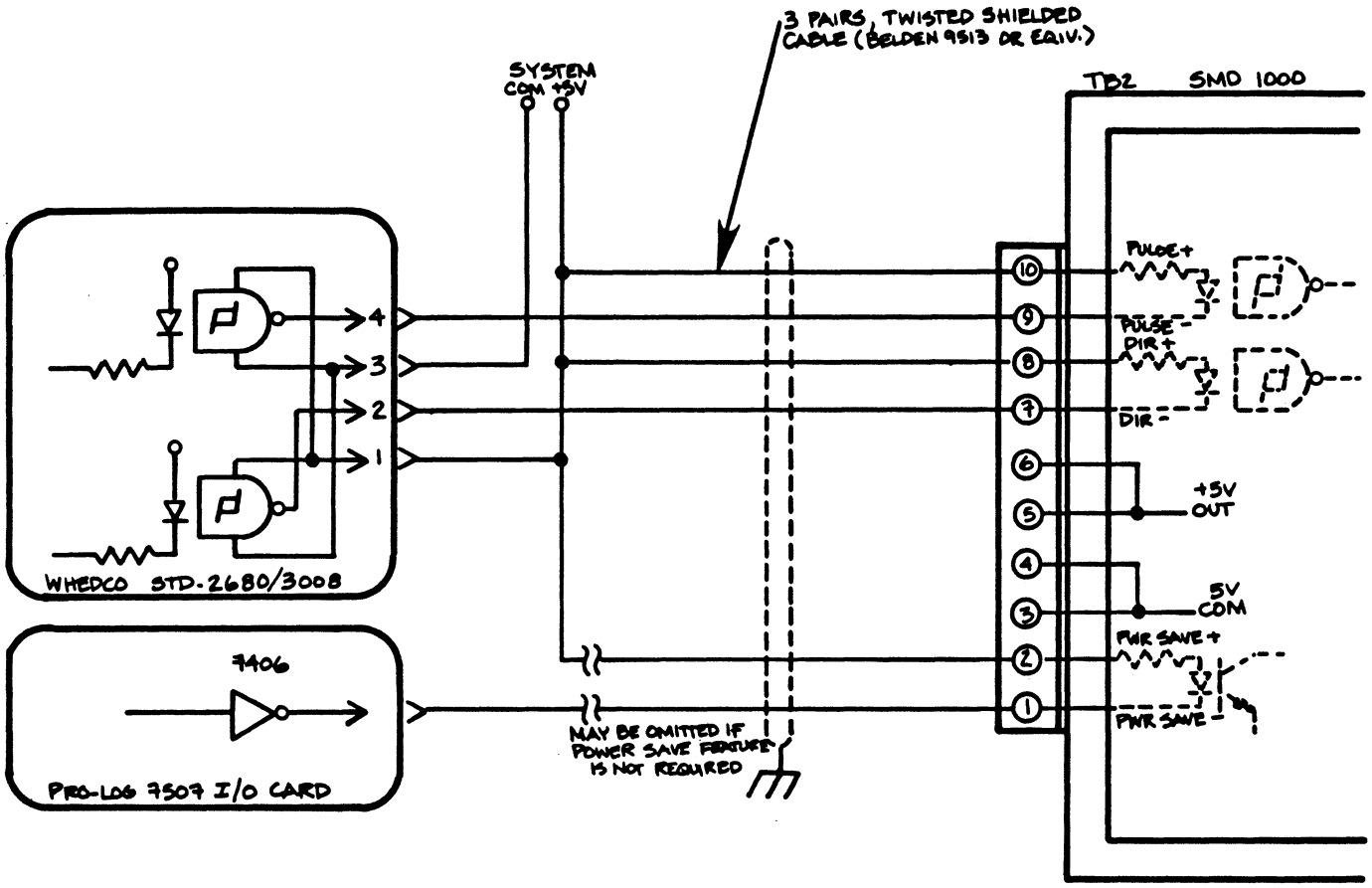
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Figure 2-6 Wiring to TARGET M Microcomputer

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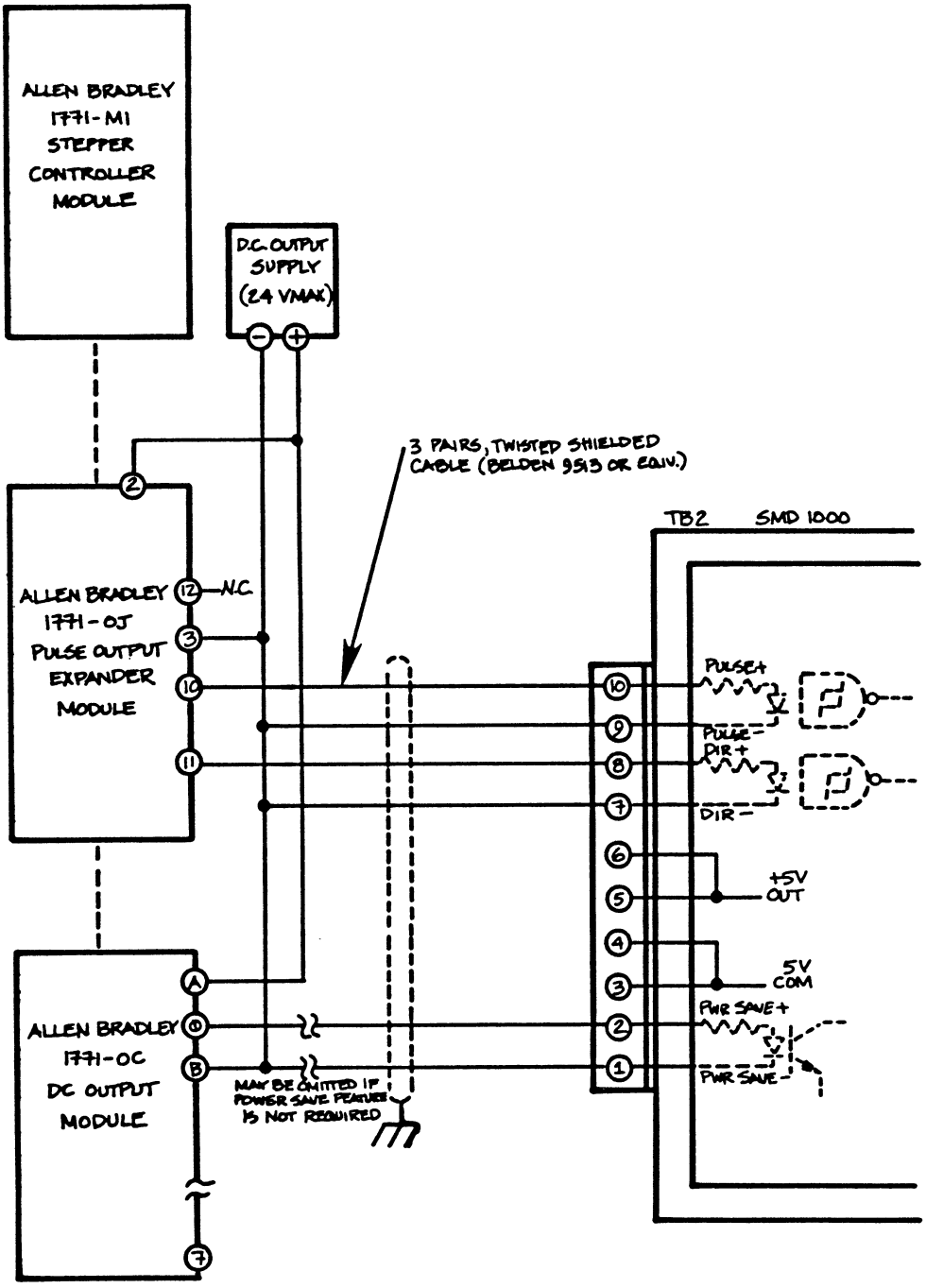
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Figure 2-7 Wiring to Whedco STD-2680/3008 Stepping Motor Controllers



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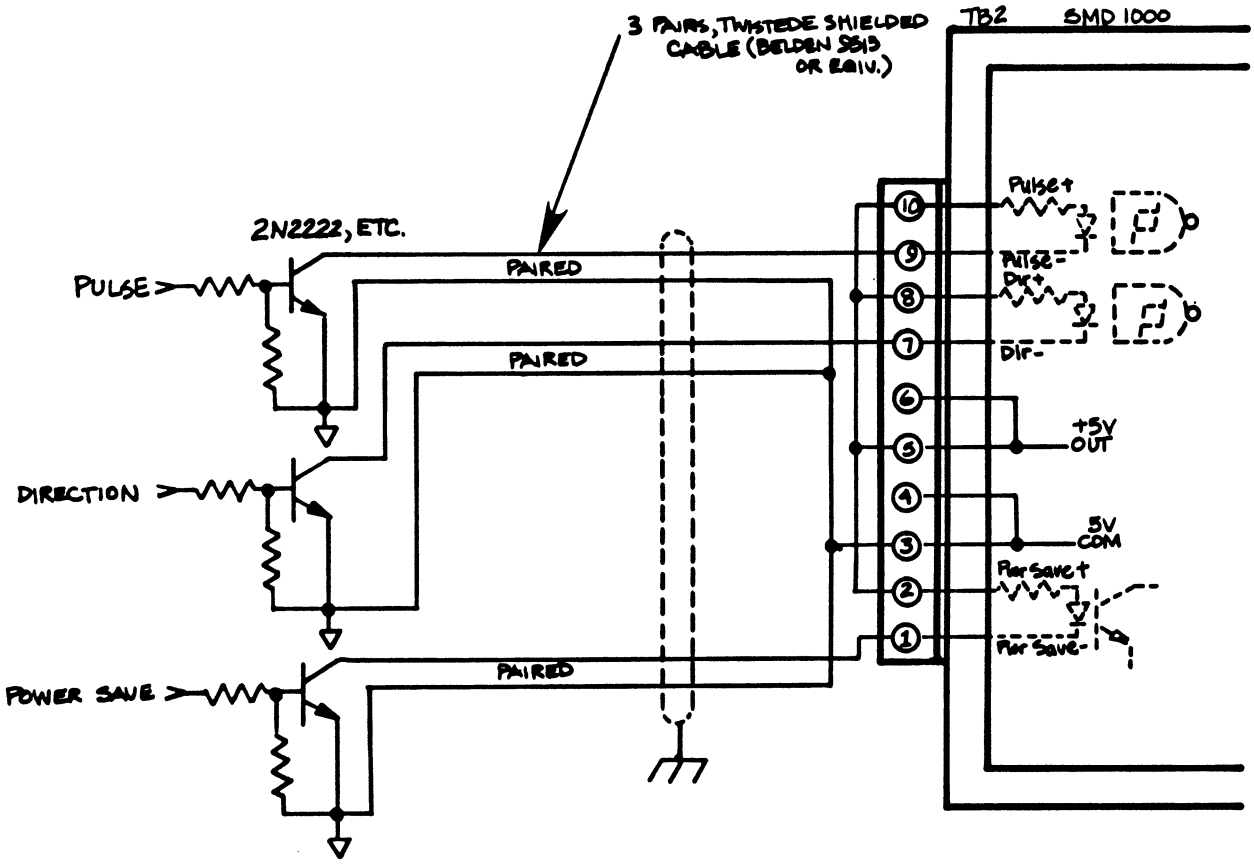
Figure 2-8 Wiring to Allen-Bradley Stepper Positioning Assembly (1)



(1) Also see Section 2.3.3 for setting translator control input interface voltage.

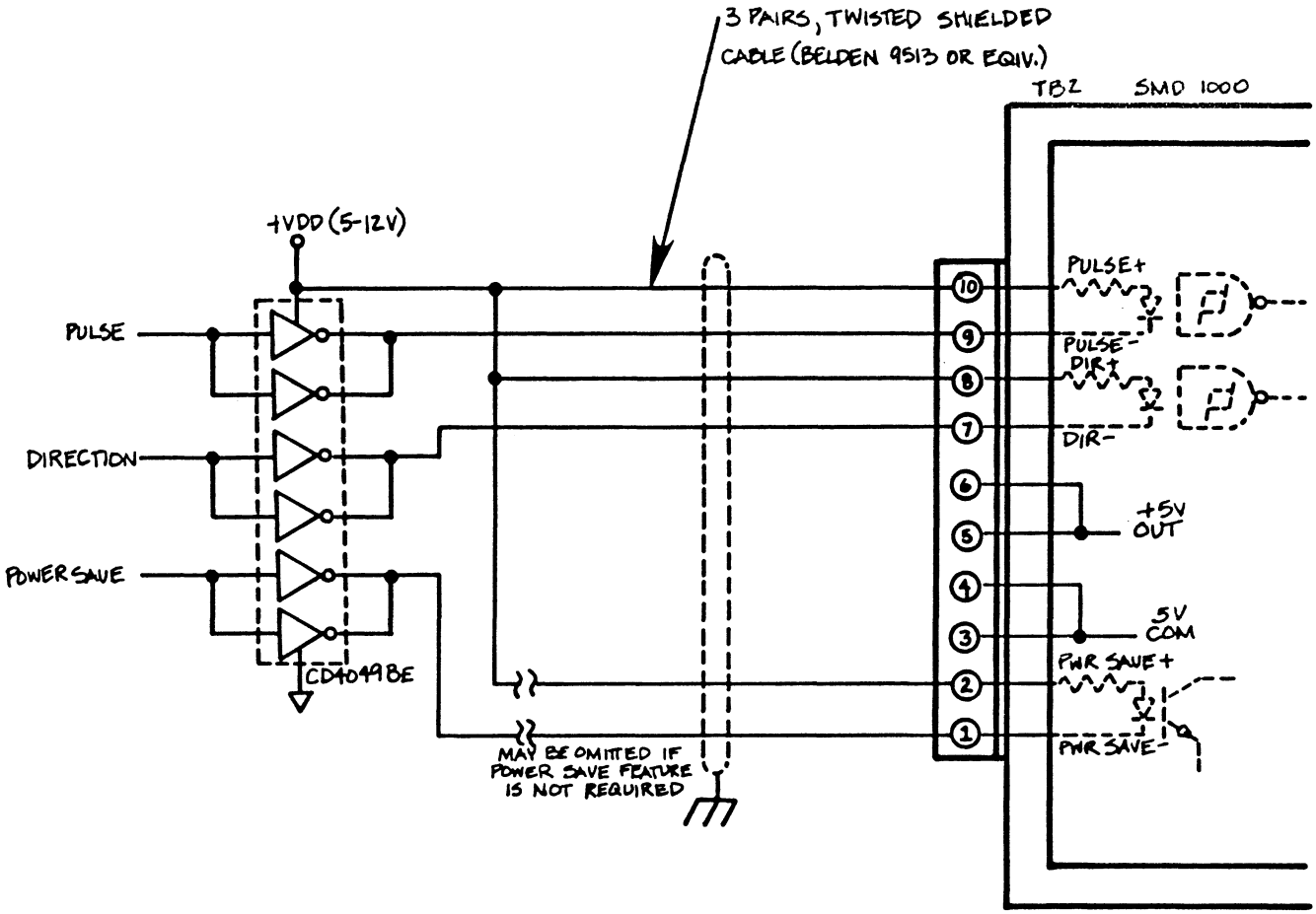
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Figure 2-9 Wiring to Open-Collector Sources
Using Translator 5V Power Supply



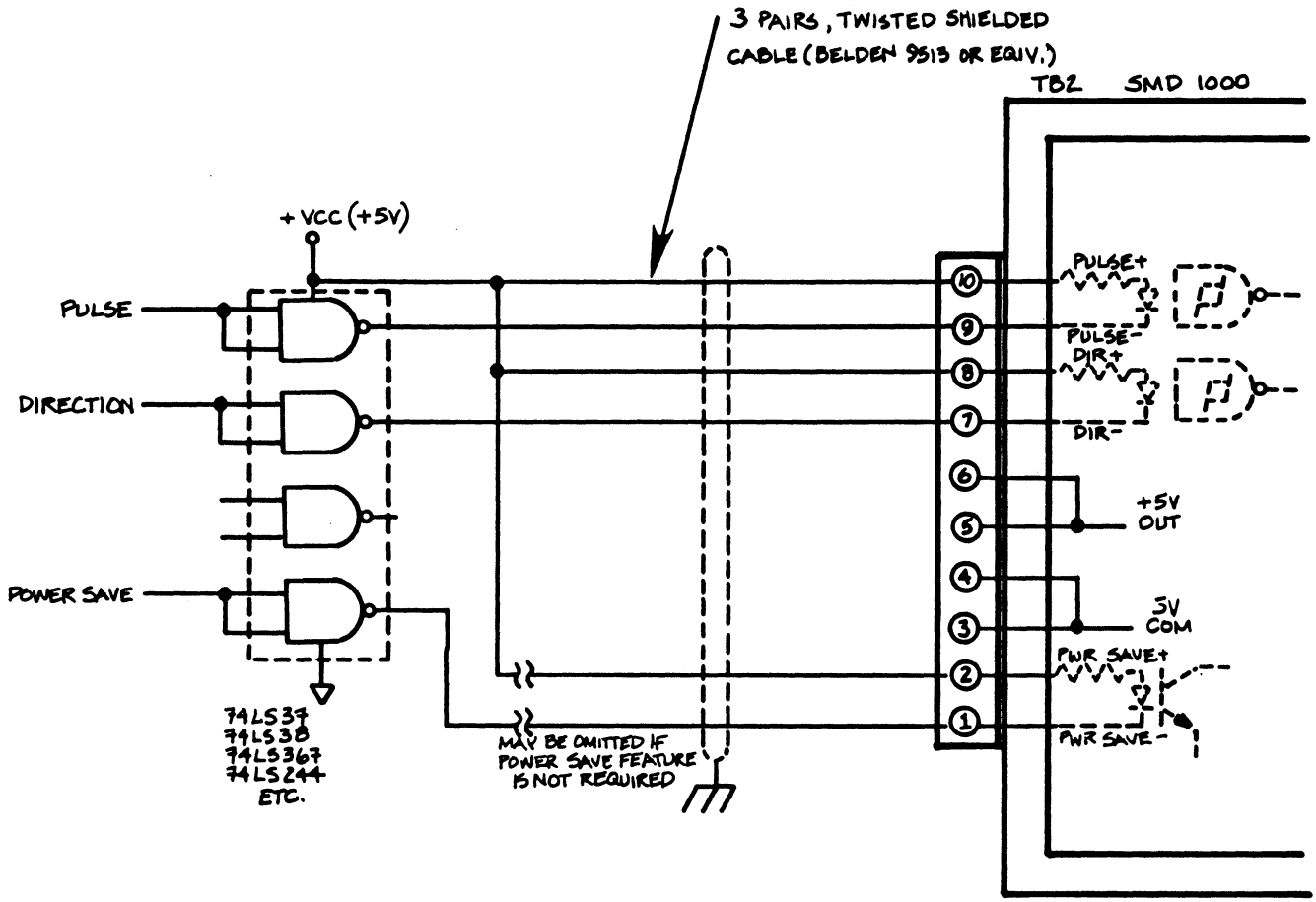
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Figure 2-10 Wiring to CMOS Logic Family



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Figure 2-11 Wiring to LSTTL Logic Family

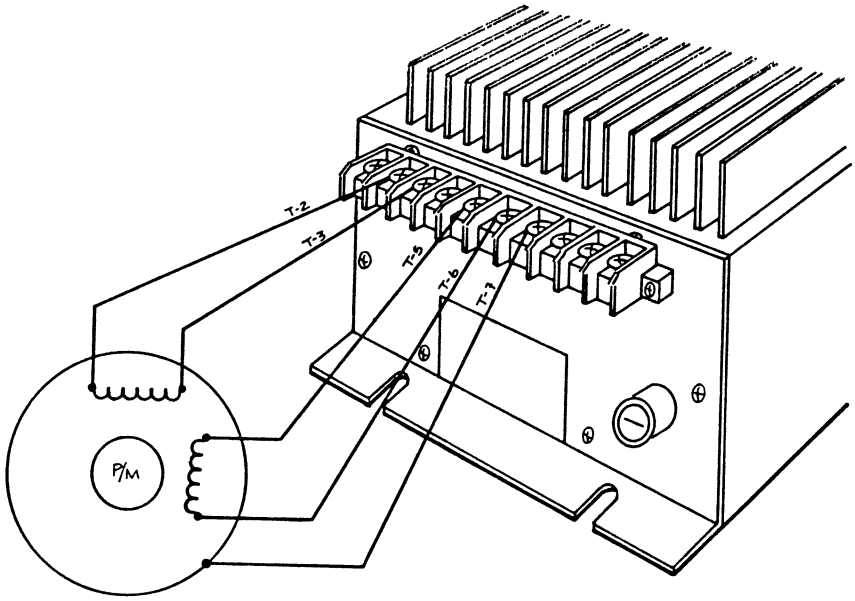


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2.2.3 Motor Drive Outputs. SMD Series Translators are designed to operate with four (4) and six (6) lead motors from most manufacturers.

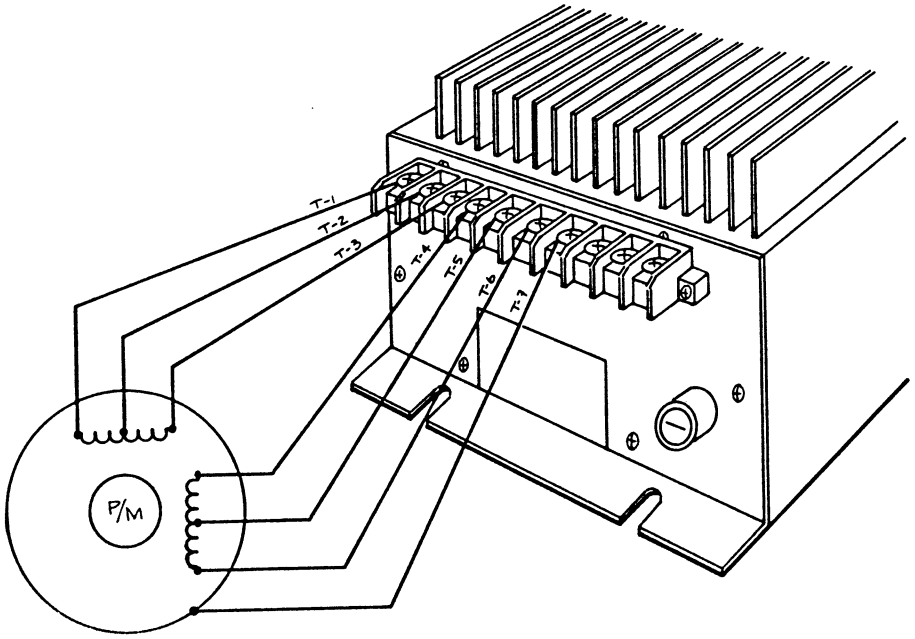
2.2.3.1 4-lead motors. Wiring to 4-lead motors is per Figure 2-12 below:

Figure 2-12 Wiring to 4-lead Motors



2.2.3.2 6-lead motors. Wiring to 6-lead motors is per Figure 2-13 below. Connections to terminals 1 and 4 are optional. If these connections are not made, the unused leads may be simply taped to avoid shorting to the motor case.

Figure 2-13 Wiring to 6-lead Motors



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2.3 FIELD ADJUSTMENTS

The SMD Series Translators provide for field adjustments of the factory settings for motor current, step size, and control input voltages. D.I.P. switches for programming these variables are accessible via the rear panel shown in Figure 2-5 by removing the protective rubber seals. These adjustments should only be made when no power is being applied to the unit.

2.3.1 Motor Current. The output current to the motor is adjustable for the SMD-1030/1130 in 0.20 Amp increments from 0.20 to 3.0 Amps, and for the SMD-1050/1150 in 0.33 Amp increments from 0.33 to 5.0 Amps. To set the motor current, find D.I.P. switch SW1 located behind the rubber seal on the left side of the rear panel. Refer to Table 2-1 below to select the switch setting for the required motor current. Notice that positions 1, 2, 3, and 4 set the current in both motor windings.

Table 2-1 Motor Current D.I.P. Switch Settings (SW1)

Switch Positions 1 2 3 4	SMD-1030/1130 Current Per Phase	SMD-1050/1150 Current Per Phase
1 1 1 1	0.00 Amps*	0.00 Amps*
0 1 1 1	0.20 Amps	0.33 Amps
1 0 1 1	0.40 Amps	0.66 Amps
0 0 1 1	0.60 Amps	1.00 Amps
1 1 0 1	0.80 Amps	1.33 Amps
0 1 0 1	1.00 Amps	1.66 Amps
1 0 0 1	1.20 Amps	2.00 Amps
0 0 0 1	1.40 Amps	2.33 Amps
1 1 1 0	1.60 Amps	2.66 Amps
0 1 1 0	1.80 Amps	3.00 Amps
1 0 1 0	2.00 Amps	3.33 Amps
0 0 1 0	2.20 Amps	3.66 Amps
1 1 0 0	2.40 Amps	4.00 Amps
0 1 0 0	2.60 Amps	4.33 Amps
1 0 0 0	2.80 Amps	4.66 Amps
0 0 0 0	3.00 Amps	5.00 Amps

"1" = switch position open (up) ----------
"0" = switch position closed (down) ----------



*Note: Whedco recommends the units not be operated with zero motor current.

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2.3.2 Step Size. All SMD Series Translators operate in the full or half-step mode. Translators equipped with optional microstepping capability can operate at nominal fractional step sizes to 1/32 of a full step angle. To adjust the step size, find D.I.P. switch SW2 located behind the rubber seal on the right side of the rear panel shown in Figure 2-5. Refer to Table 2-2 to set desired the step size. Note that only Positions 4, 5, and 6 set step size (positions 1 - 3 set control input interface voltage which is discussed in Section 2.3.3.).

Table 2-2 Step Size D.I.P. Switch Settings (SW2)

Step Size	Models Available	Switch Positions 4 5 6	Nominal Step Angle*
Full Step	all	0 0 0	1.800 degrees
Half Step	all	0 0 1	0.900 degrees
1/4 Step	1130/1150	0 1 0	0.450 degrees
1/8 Step	1130/1150	0 1 1	0.225 degrees
1/16 Step	1130/1150	1 0 0	0.113 degrees
1/32 Step	1130/1150	1 0 1	0.057 degrees

"1" = switch position open (up) ---------
"0" = switch position closed (down) -----



*Note: step angle based on 200 step per revolution motor. Instantaneous step angle is motor and load dependent.

2.3.3 Control Input Interface Voltage. The control inputs to the SMD Series Translators are optically coupled, and designed for current mode operation. The inputs may be set to operate in the 5-12 V range or the 12-24 V range. To set the interface voltage, find the D.I.P. switch SW2 located behind the rubber seal on the right side of the rear panel shown in Figure 2-5. Refer to Table 2-3 below to set the inputs at the desired voltage range. Note that only Positions 1, 2, and 3 on SW2 set interface voltage (positions 4 - 6 set step size as discussed in Section 2.3.2.).

Table 2-3 Interface Voltage D.I.P. Switch Settings (SW2)

Control Input	Position	Interface Voltage 5-12 V	12-24 V
Pulse	1	0	1
Direction	3	0	1
Power Save	2	0	1

"1" = switch position open (up) ----------
"0" = switch position closed (down) ------



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SECTION 3.0

OPERATION

3.1 Power Save Feature

The "Power Save" feature of the SMD Series Translators provides a means for reducing power consumption while still maintaining some holding torque when the motor is at a standstill. All SMD Series translators will reduce the set motor current by seventy percent when this feature is employed (e.g.; if D.I.P. switch SW1 is set to 3.0 Amps, the power save signal will reduce motor current to 0.90 Amps as long as the signal is energized).

In applying the power save feature, the user should keep in mind the signal response times shown below:

T - on: 100 microseconds typical, max. motor dependent
T - off: 2.5 milliseconds typical, max. motor inductance dependent

3.2 Short Circuit Protection

All Whedco SMD Series Translators are protected against short circuiting. In the event that any motor output terminal is shorted to another, or is shorted to ground, the translator will cease supplying power to the motor. This condition is indicated by an overload L.E.D. on the control input side of the translator. This L.E.D. is labeled "Overload," and its location is shown in Figure 2-5.

To clear this condition, unplug the unit and recheck the motor wiring in accordance with Section 2.2. Once the short has been corrected, reapply power to the unit. If the Overload L.E.D. is still lit, disconnect the unit, and contact Whedco Customer Service for assistance. Note that power must be removed from the unit for five (5) seconds in order for the L.E.D. circuit to clear.

3.3 Warnings

3.3.1 Operation of the unit longer than 60 seconds without a stepping motor wired to the output terminals will result in unit failure.

3.3.2 Exceeding the maximum specified current draw from the 5 volt supply will result in unit failure.

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SECTION 4.0

MAINTENANCE

4.1 Field Replacement

All SMD Series Translators are mechanically interchangeable regardless of current rating or step size capability. In addition, the terminal blocks detach from the unit with the field wiring intact. For these two reasons, field replacement is very simple.

However, when replacing a unit care should be taken to make sure all D.I.P. switch settings are the same as the unit being replaced. It is especially important that the current setting not exceed the maximum rating for the motor in order to avoid motor damage.

4.2 Service

If a Whedco product malfunctions, it may be returned using the following procedure:

a) obtain a return authorization number by calling Whedco's Product Support Group at (313) 665-0428. You will be asked to supply a purchase order number before a return authorization number can be issued. It is also helpful to provide a description of the problem. When packing the unit for shipment, please reference the return authorization number, your purchase order number and the description of the problem.

b) ship to:

WHEDCO INCORPORATED
4750 Venture Drive
Ann Arbor, MI 48108

All repairs are F.O.B. Ann Arbor, Michigan. Products shipped to Whedco freight collect will be refused. Products meeting the criteria for warranty service will be repaired or replaced free of charge. Products not covered by the warranty will be repaired for a time and materials charge against the customer's purchase order. On non-warranty repairs, an evaluation fee will be charged if the customer chooses not to have the unit repaired or if the unit is found to be non-repairable. Repairs are warranted for thirty (30) days from the date of shipment from Whedco. The repair warranty does not apply to new or different problems and/or failures which may occur.

Unless otherwise requested, repaired warranty products will be shipped prepaid via UPS ground service. Non-warranty repairs are shipped UPS ground prepaid and added to invoice. Other methods of shipment such as UPS Blue or Red label, Federal Express or Emery Air Freight can be arranged, but are at the expense of the owner. A customer's account number must be provided for all services other than UPS.

On-site repair service may be available at a daily rate plus all travel expenses portal-to-portal from Whedco Incorporated. Consult the factory for details.

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4.3 Warranty

Whedco Incorporated warrants its SMD Series stepping motor translators for one (1) year from the date of original shipment. During the warranty period, Whedco will repair or, at its option, replace without charge, any SMD Series translator product returned to Whedco for repair. This warranty does not apply to any product which has been subject to misuse, accident, improper installation, and/or improper application, nor does it apply to any product which has been repaired or altered by others than Whedco authorized service representatives. Whedco shall remain sole arbitrator in all warranty claims.

There are no warranties which extend beyond those herein specifically given. In no event shall Whedco be liable to the purchaser for loss of use, profit or consequential damages, or damages of any kind, including but not limited to accidental loss or damage to other equipment, whether or not said equipment was properly used.

This warranty is in lieu of any other warranty, expressed, implied or statutory, including, without limitation, any implied warranty of merchantability or fitness for a particular purpose. No amendment of this warranty may be effected except in writing by a duly authorized representative of Whedco Incorporated.

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APPENDIX A

SPECIFICATIONS

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SPECIFICATIONS

A.1 ELECTRICAL

POWER REQUIREMENTS
Input Voltage: 95-135 VAC, 50-440 Hz; or 135-190 VDC
Input Current (max.): SMD 1030/1130 2.4 Amps
SMD 1050/1150 4.0 Amps

CONTROL INPUT DRIVE REQUIREMENTS

All inputs are optically coupled. Input voltage is adjustable to accept either 5-12 V or 12-24 V range. +5 V @ 40 ma output is available to interface to internal opto-couplers.

Pulse: 12 ma source or sink capability
Direction: 12 ma source or sink capability
Power Save: 12 ma source or sink capability
Maximum Input Pulse Rate:

Step Increment	Maximum Allowable Input Pulse Rate Per Second
Full Step	30,000
Half Step	60,000
1/4 Step	120,000
1/8 Step	240,000
1/16 Step	480,000
1/32 Step	500,000

MOTOR DRIVE OUTPUTS
Motor Current (max.): SMD-1030/1130 0.20 - 3.0 Amps
(adjustable in 0.20 Amp increments)
SMD-1050/1150 0.33 - 5.0 Amps
(adjustable in 0.33 Amp increments)
Motor Excitation Voltage: +65 VDC +/- 5% (factory set)
Motor Power (max.): SMD-1030/1130 180 watts
SMD-1050/1150 300 watts
Step Size (based on 200 step/revolution motor):

Step Increment	Models Available	Nominal Step Angle
Full Step	all	1.800 degrees
Half Step	all	0.900 degrees
1/4 Step	1130/1150	0.450 degrees
1/8 Step	1130/1150	0.225 degrees
1/16 Step	1130/1150	0.113 degrees
1/32 Step	1130/1150	0.056 degrees

A.2 ENVIRONMENTAL

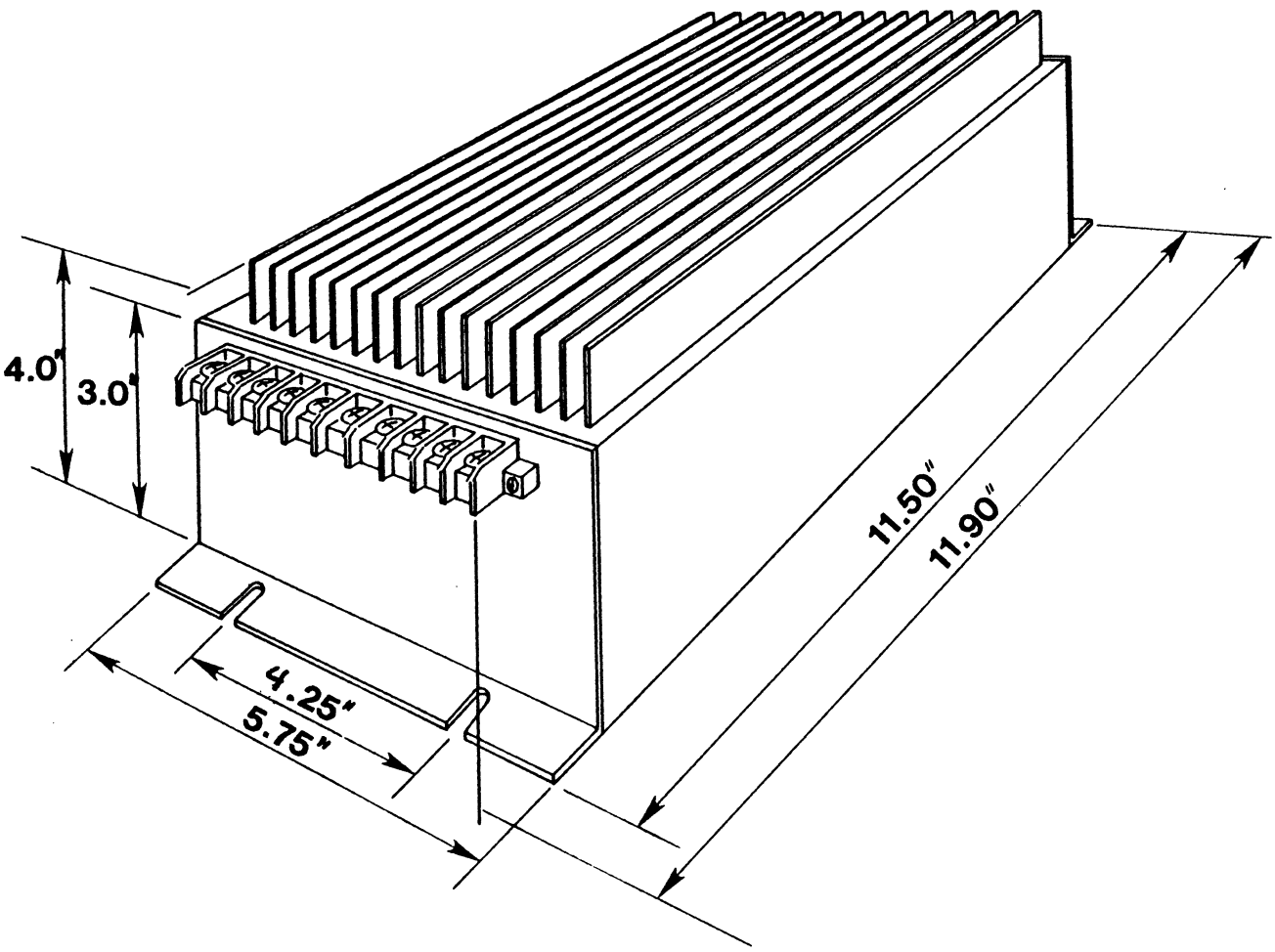
OPERATING TEMPERATURE: 0 to +50 degrees C. free air ambient
STORAGE TEMPERATURE: -40 to +85 degrees C.

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A.3 MECHANICAL

WEIGHT: 6 lbs.
DIMENSIONS: see figure A-1

Figure A-1 Translator Dimensions



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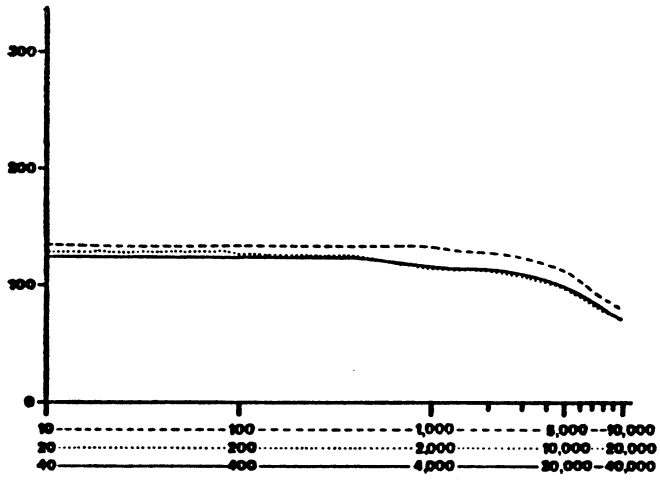
APPENDIX B

MOTOR PERFORMANCE CURVES

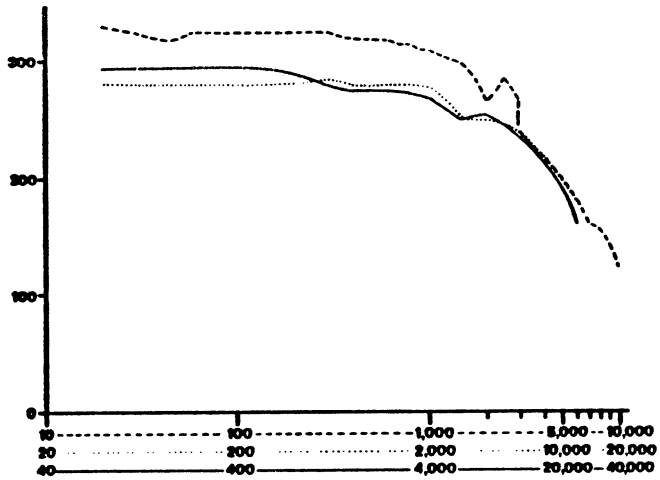
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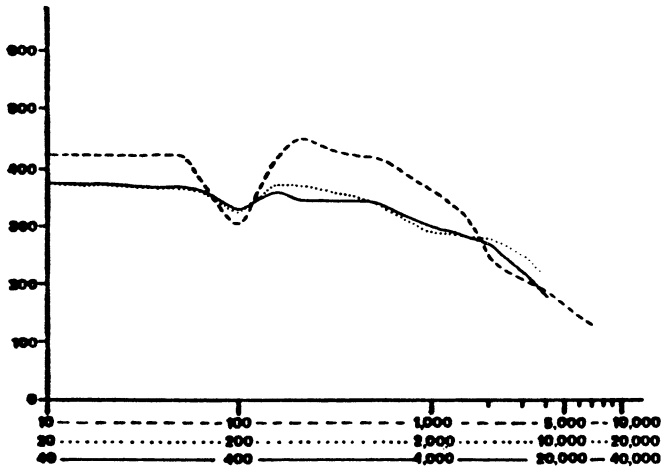
MOTOR PERFORMANCE CURVES
SMD SERIES
STEPPING MOTOR TRANSLATORS



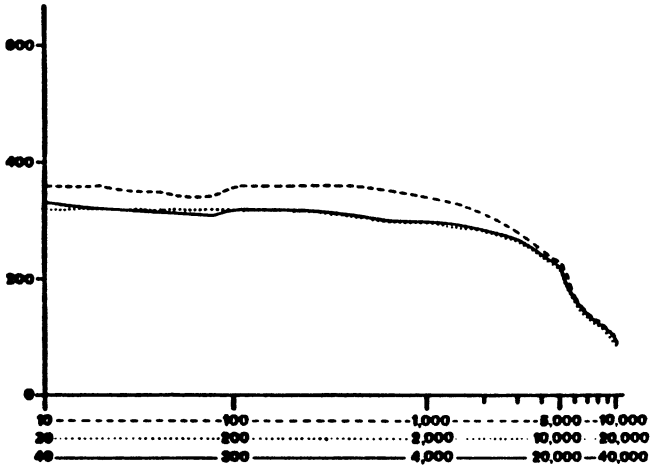
Manufacturer: The Superior Electric Company
Model No: MΦ63-FDΦ9
Current Excitation per Phase: 2.6 Amps



Manufacturer: The Superior Electric Company
Model No: MΦ93-FD3Φ1
Current Excitation per Phase: 5.0 Amps



Manufacturer: The Superior Electric Company
Model No: M112-FJ326
Current Excitation per Phase: 5.0 Amps



Manufacturer: Sigma Instruments, Inc.
Model No: 21-345ΦD2ΦΦBΦ15
Current Excitation per Phase: 5.0 Amps

NOTES

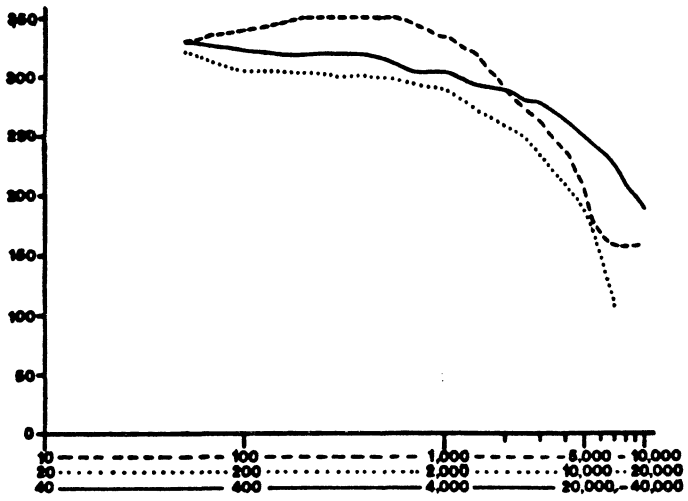
1) Legends:
- ---------- full step
- ..... half step
- ———— quarter step
- —.—.—.—.— eighth step

2) Axis Designations:
X = Velocity in steps per second
Y = torque in ounce-inches

3) Drive Specifications:
Bipolar Chopper
65 volts ± 5%

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MOTOR PERFORMANCE CURVES
SMD SERIES
STEPPING MOTOR TRANSLATORS



Operator: R. Metzner
Motor: Superior M111-FD16
Current: 5A Phase
Voltage: 60VDC
Translator: Whedco SMD-1150

NOTES

1) Legends:
- – – – – – – full step
- ..... half step
- ——— quarter step
- –.–.–.–.– eighth step

2) Axis Designations:
X = velocity in steps per second
Y = torque in ounce-inches

3) Drive Specifications
Bipolar Chopper
65 volts ± 5%

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