



a Penn Central unit

## UDN-2935Z AND UDN-2950Z BIPOLAR HALF-BRIDGE MOTOR DRIVERS

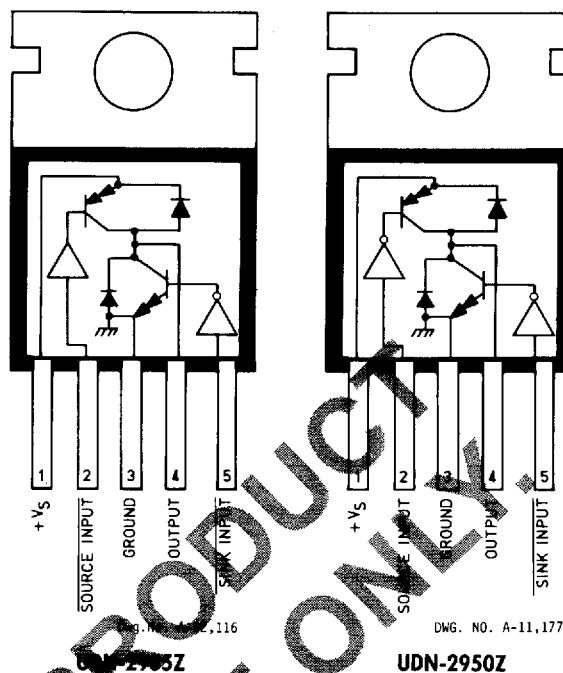
### FEATURES

- 3.5 A Peak Output
- 37 V Min. Output Breakdown
- Output Transient Protection
- Tri-State Outputs
- TTL, CMOS, PMOS, NMOS Compatible Inputs
- Internal Thermal Shutdown
- High-Speed Chopper (to 100 kHz)
- UDN-2935Z Replaces SG3635P
- UDN-2950Z Replaces UDN-2949Z, SN75605
- TO-220 Style Packages

**B**OTH Type UDN-2935Z and UDN-2950Z integrated circuits are designed for servo-motor applications using pulse-width modulation. These two high-current, monolithic half-bridge motor drivers combine a sink-and-source driver with diode transient protection, input gain, level shifting, logic stages, and a voltage regulator for single-supply operation.

The UDN-2935Z output goes high with an active low input at pin 2; it is especially desirable in NMOS microprocessor applications. The UDN-2950Z output goes high with an active high input at pin 2; its inputs can be tied together for single-wire control. The input circuitry of both devices is compatible with TTL and low-voltage CMOS, PMOS, and NMOS logic. Both ICs have logic lockout (tri-state output) that prevents source and sink drivers from turning ON simultaneously.

In typical applications, the chopper drive mode is characterized by low power-dissipation levels, low saturation voltages, and short chopper-storage times for the sink drivers. The motor drivers can be used in pairs for full-bridge operation, or as triplets in three-phase brushless d.c. motor-drive applications. They can also be teamed with the Sprague



Electric UCN-4202A stepper motor translator/driver for bipolar d.c. stepper motor control (see Engineering Bulletin 26184).

The motor drivers' single-chip construction and power-tab TO-220 package enable cost-effective and reliable system designs supported by excellent power-dissipation ratings, minimum size, and ease of installation; because the package's heat tab is at ground potential, several devices can share a common heat sink without insulating hardware.

The Type UDN-2950Z half-bridge motor driver is an improved version of the popular Sprague Type UDN-2949Z, described in Engineering Bulletin 29318. The new driver has a higher output-breakdown rating, logic lockout, and an internal high-temperature shutdown that is triggered at approximately 175°C.

SEMICONDUCTOR DIVISION  
SPRAGUE ELECTRIC COMPANY

115 Northeast Cutoff, WORCESTER, MASS. 01606

UDN-2935Z AND UDN-2950Z  
BIPOLAR HALF-BRIDGE MOTOR DRIVERS

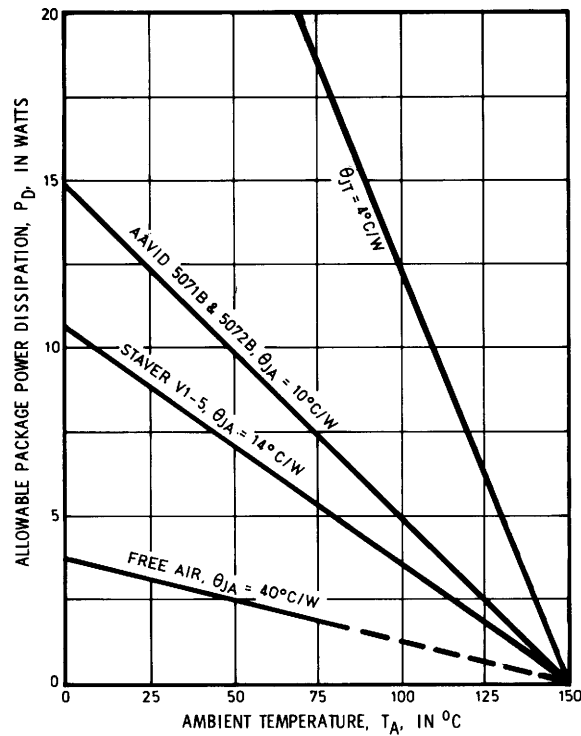
ENGINEERING  
BULLETIN  
29318-1

**UDN-2935Z AND UDN-2950Z  
BIPOLAR HALF-BRIDGE MOTOR DRIVERS**

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage Range, $V_S$ . . . . .	8.0 V to 35 V
Output Voltage Range, $V_{OUT}$ . . . . .	- 2.0 V to $V_S + 2.0$ V
Input Voltage Range, $V_{IN}$ . . . . .	- 0.3 V to + 7.0 V
Peak Output Current (100 ms, 10% d-c), $I_{OP}$ . . . . .	$\pm 3.5$ A
Continuous Output Current, $I_{OUT}$ . . . . .	$\pm 2.0$ A
Package Power Dissipation, $P_D$ . . . . .	See Graph
Operating Temperature Range, $T_A$ . . . . .	- 20°C to + 85°C
Storage Temperature Range, $T_S$ . . . . .	- 55°C to + 85°C

**ALLOWABLE POWER DISSIPATION  
AS A FUNCTION OF AMBIENT TEMPERATURE**



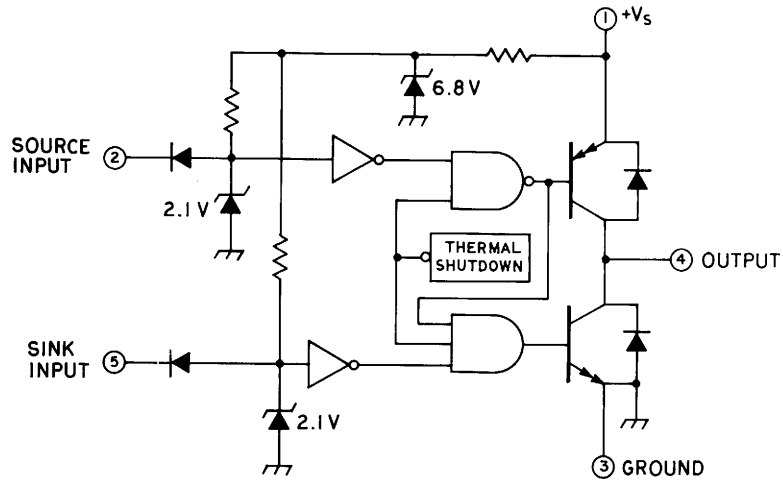
DWG. NO. A-12,000A

**TRUTH TABLE**

Source Driver, Pin 2	Sink Driver, Pin 5	Output, Pin 4	
		UDN-2935Z	UDN-2950Z
Low	Low	High	Low
Low	High	High	High Z
High	Low	Low	High
High	High	High Z	High

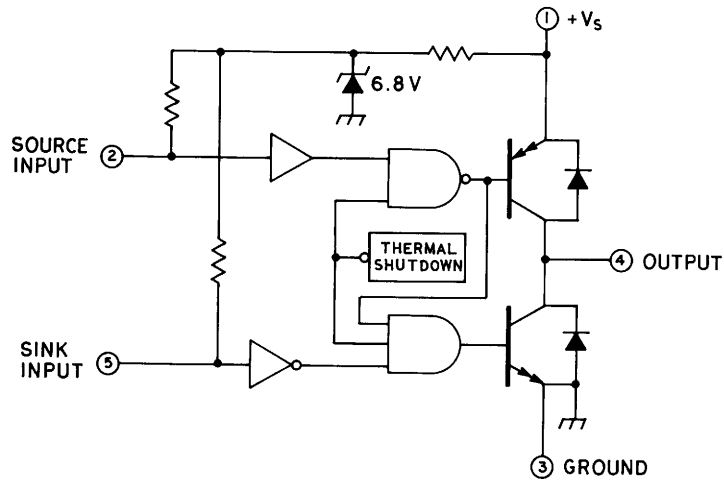
FUNCTIONAL BLOCK DIAGRAMS

UDN-2935Z



Dwg. No. A-12.113

UDN-2950Z



Dwg. No. A-12.112

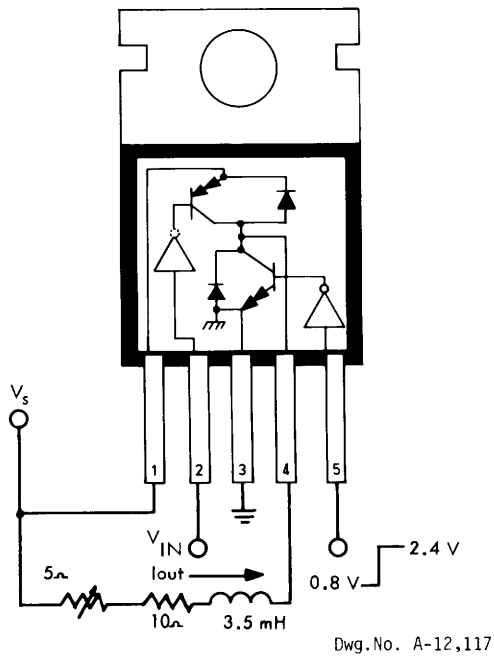
**UDN-2935Z AND UDN-2950Z  
BIPOLAR HALF-BRIDGE MOTOR DRIVERS**

**ELECTRICAL CHARACTERISTICS at  $T_A = +25^\circ\text{C}$ ,  $T_{TAB} = +70^\circ\text{C}$ ,  $V_s = 35\text{ V}$  (unless otherwise noted)**

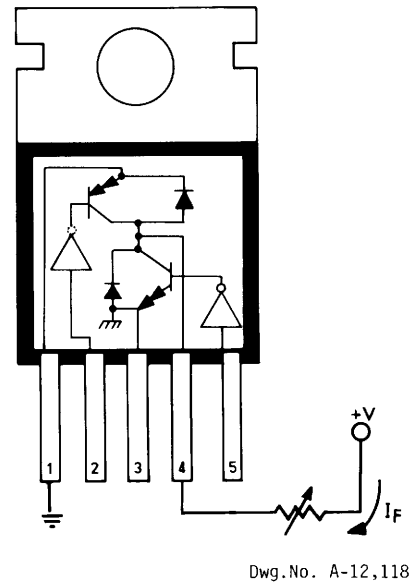
Characteristic	Source Driver Input, Pin 2		Sink Driver Input, Pin 5	Output, Pin 4	Other	Limits		
	UDN-2935Z	UDN-2950Z				Min.	Max.	Units
Output Leakage Current	2.4 V	0.8 V	2.4 V	0 V	—	—	- 500	$\mu\text{A}$
	2.4 V	0.8 V	2.4 V	35 V	—	—	500	$\mu\text{A}$
Output Sustaining Voltage	2.4 V	0.8 V	0.8 to 2.4 V	2.0 A	Fig. 1	35	—	V
Output Saturation Voltage	0.8 V	2.4 V	2.4 V	-2.0 A	—	33	—	V
	2.4 V	0.8 V	0.8 V	2.0 A	—	—	2.0	V
Output Source Current	0.8 V	2.4 V	2.4 V	—	—	-2.0	—	A
Output Sink Current	2.4 V	0.8 V	0.8 V	—	—	2.0	—	A
Input Open-Circuit Voltage	- 250 $\mu\text{A}$	- 250 $\mu\text{A}$	- 250 $\mu\text{A}$	—	—	—	7.5	V
Input Current	—	2.4 V	2.4 V	NC	—	—	- 700	$\mu\text{A}$
	2.4 V	—	2.4 V	NC	—	—	10	$\mu\text{A}$
	0.8 V	0.8 V	0.8 V	NC	—	—	- 1.6	mA
Propagation Delay	2.4 V	0.8 V	0.8 to 2.4 V	2.0 A	—	—	750	ns
	0.8 to 2.4 V	2.4 to 0.8 V	2.4 V	2.0 A	—	—	2.0	$\mu\text{s}$
Clamp Diode Forward Voltage	NC	NC	NC	2.0 A	Fig. 2	—	2.2	V
Supply Current	0.8 V	2.4 V	NC	NC	—	—	35	mA

NOTE: Positive (negative) current is defined as going into (coming out of) the specified device pin.

**TEST FIGURE 1**



**TEST FIGURE 2**



## APPLICATION NOTES

It should be noted that an additional power dissipation component may arise from crossover currents flowing from supply to ground when current direction through the load is reversed. This is due to differences in the switching speeds between the source and sink drivers. Although the internal logic lockout protects these devices from catastrophic failure, the crossover power component can cause device operation at substantially higher junction temperatures.

If timing conditions are ignored, the magnitude of this power can be approximated as:

$$P_D = V_s \times I_C \times t \times f$$

where  $V_s$  = supply voltage

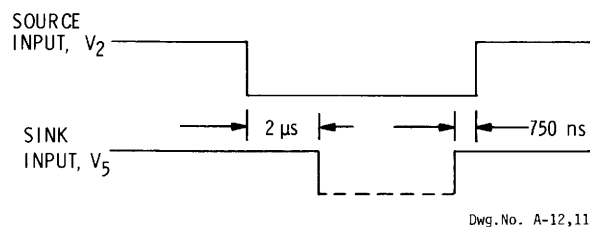
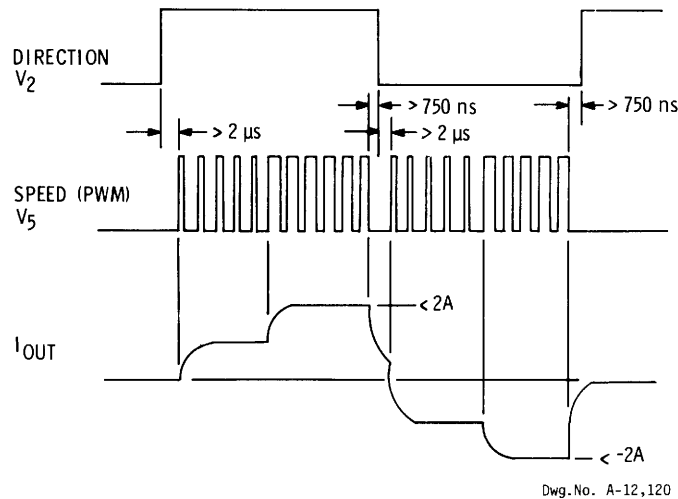
$I_C$  = crossover current ( $\approx 3.5$  A max.)

$t$  = crossover current duration ( $\approx 1$   $\mu$ s)

$f$  = frequency of direction change

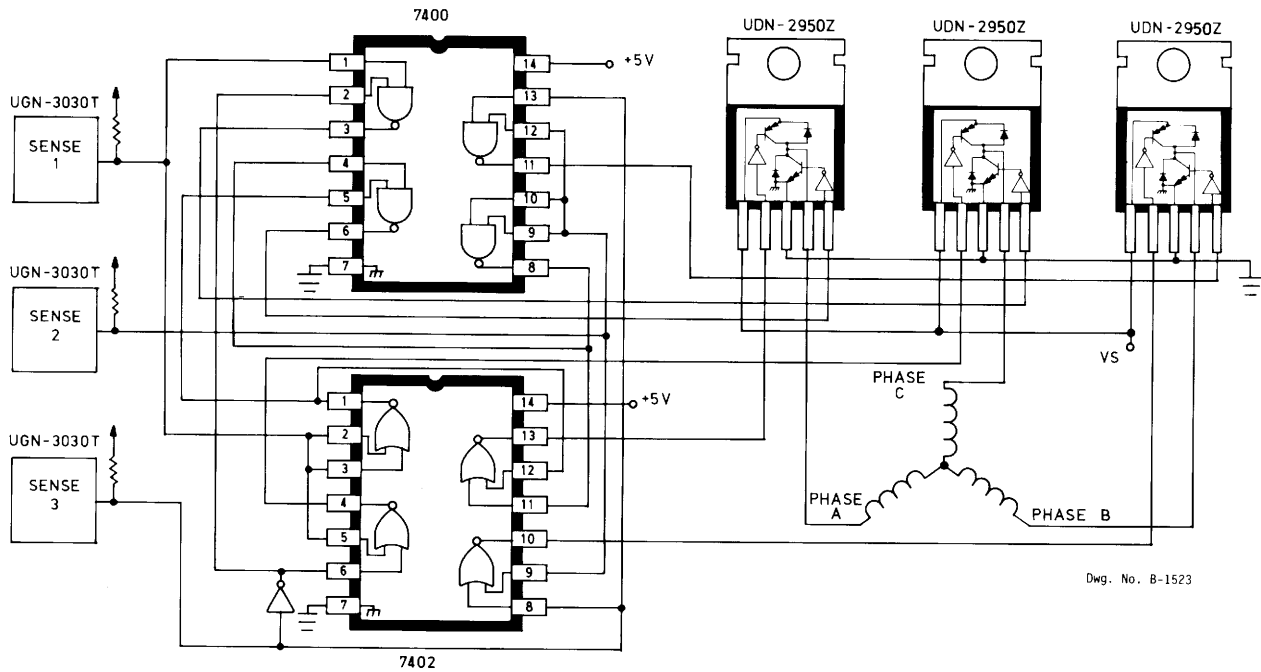
In some applications (high switching speeds or high package power dissipation), it is recommended that the inputs be driven separately, and that the sink driver not be turned ON for at least 2  $\mu$ s (maximum source  $t_{pD}$ ) after the source driver input is turned OFF. The sink driver should be turned OFF at least 750 ns (maximum sink  $t_{pD}$ ) before the source driver is turned ON.

### RECOMMENDED TIMING CONDITIONS (UDN-2950Z shown)

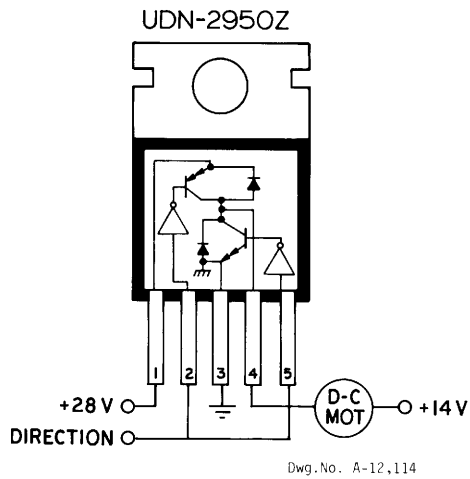


**TYPICAL APPLICATIONS**

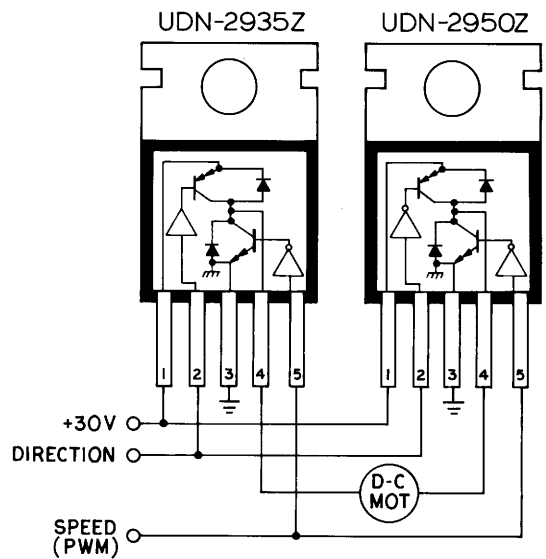
**3-PHASE BRUSHLESS D-C MOTOR DRIVE**



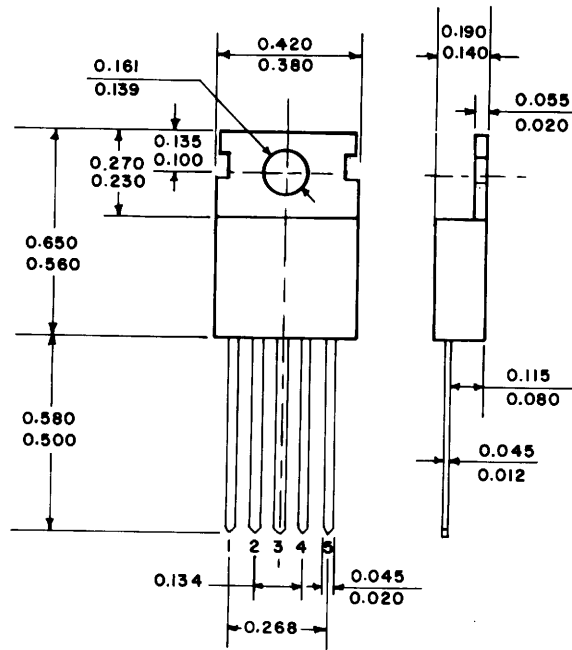
**SINGLE-WINDING D-C  
OR STEPPER MOTOR DRIVE**



**FULL-BRIDGE D-C  
SERVO MOTOR DRIVE**

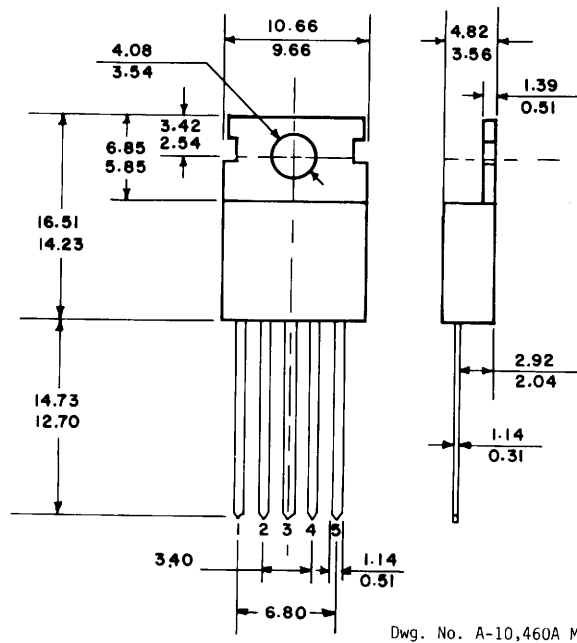


DIMENSIONS IN INCHES



DIMENSIONS IN MILLIMETRES

Based on 1" = 25.4 mm



NOTES:

1. Lead spacing tolerance is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Lead gauge plane is 0.030" (0.76 mm) max. below seating plane.



a Penn Central unit

# SPRAGUE ELECTRIC COMPANY

115 Northeast Cutoff, WORCESTER, MASS. 01606

Tel. 617/853-5000

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23 North Gore Ave.  
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Tel. 314/962-1411

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### TENNESSEE (Eastern)

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Tel. 919/847-8800

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Suite 64  
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Huntsville, AL 35801  
Tel. 205/883-0520

### TEXAS

Sprague Electric Company  
Suite 220  
9319 LBJ Freeway  
Dallas 75243  
Tel. 214/235-1256

Sprague Electric Company  
1106 Clayton Lane — Suite 385E  
Austin 78723  
Tel. 512/458-2514

### UTAH

William J. Purdy Company  
1321 South State St  
Salt Lake City 84115  
Tel. 801/486-8557

### VIRGINIA

Sprague Electric Company  
1 East Preston St.  
Lexington 24450  
Tel. 703/463-9161

Sprague Electric Company  
P.O. Box 39  
Annapolis Junction, MD 20701  
Tel. 301/792-4890

Trinkle Sales Inc.  
1010 Haddonfield — Berlin Rd.  
P.O. Box 5320  
Cherry Hill 08034  
Tel. 609/795-4200

### WASHINGTON

Sprague Electric Company  
3626 Woodland Park, North  
Seattle 98103  
Tel. 206/632-7761

Sprague Electric Company  
Suite H  
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Milwaukee 52307  
Tel. 414/482-1111

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Sprague Electric of Canada, Ltd.  
49 Bental Road  
Toronto, Ont. M6M 4M7  
Tel. 416/766-6123

Sprague Electric of Canada, Ltd.  
85 Albert St.  
Suite 1610  
Ottawa, Ont. K1P 6A4  
Tel. 613/238-2542

### EUROPE

Sprague World Trade Corp.  
3 Chemin de Tavernay  
1218 Grand Saconex/Geneva  
Switzerland  
Tel. 98-4021  
TLX 845-23469

Sprague Benelux  
B.P. 104  
B-9600 Ronse  
Belgium  
Tel. 055-21 53 22  
TLX 85707

Sprague Electric (U.K.) Ltd.  
Sabrook Rd., Salfords  
Surrey, England RH1 5DZ  
Tel. 02934-5666  
TLX 851-877813

Sprague France S.A.R.L.  
3 Rue Camille Desmoulins  
9430 Cachan  
France  
Tel. (1) 547-6600  
TLX 250697

Sprague Elektronik GmbH  
Postfach 700 848  
D-6 Frankfurt/M  
West Germany  
Tel. 0611 60551  
TLX 414008

Sprague Electric Company  
Via G. DeCastro 4  
20144 Milano  
Italy  
Tel. 02 498-7891  
TLX 332321

Sprague Scandinavia AB  
Box 54  
S-182 71 Stocksund  
Sweden  
Tel. (04) 08 8502 20  
TLX 854 15239

### HONG KONG

Sprague World Trade Corp.  
Eastern Branch  
G.P.O. Box 4289  
Hong Kong  
Tel. 3-7440010  
TLX 43395

### JAPAN

Sprague Japan K.K.  
Nishi-Shinjuku KB Bldg.  
11-3, Nishi-Shinjuku 6-Chome  
Shinjuku-ku, Tokyo 160  
Japan  
Tel. (03) 348-5221  
TLX J23328

### KOREA

Tecnomil Ltd.  
Sprague Korea Branch  
Saewoo Building, 5th Floor  
1-499 Yoido-Don  
Young Dug Po-ku, Seoul, Korea  
Tel. (2) 783-9784  
TLX 78726186

### SINGAPORE

Sprague World Trade Corp.  
Singapore Office  
9th Floor, 450/452 Inchoape House  
Alexandra Road  
Singapore 0511  
Tel. 475-1826  
TLX RS 26384

### TAIWAN

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Tecnomil, Ltd.  
8/F, 142, Sec. 4  
Chung Hsiao East Road  
Taipei, Taiwan, R.O.C.  
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