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**4922c**

*Instruction Manual*  
Publication 189 **SRB**  
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# ***Step Reference Board***

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# Step Reference Board

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## General Description

The 48978-101 and -102 Step Reference Board assemblies provide a means of supplying a stepped adjustable speed reference signal for adjustable speed drives from input control devices such as relay output programmable controllers, or pushbuttons and master switches without signal potentiometers. Input relays operating from the 120VAC control power are activated by the control device contacts and provide signal isolation. Each selected speed point is independently adjustable by one of five potentiometers. The -101 assembly is used for systems requiring a positive speed reference signal for both directions, and the -102 assembly is used for systems requiring a bipolar speed signal.

## Application Information

The 48978-101 & -102 Step Reference Board is used to provide individually adjustable speed reference points for adjustable speed drives from controlling devices not possessing adjustable voltage output capabilities. Devices such as programmable controllers with relay only outputs, and master switches and pendants without signal potentiometers can control the Step Reference Board. The control inputs consist of 120VAC relays.

A standard progressive

maintained control sequence is required for proper operation of the Step Reference board. The first speed point level signal from P1 is available at the Step Reference Board Reference output terminal as soon as the FWD or REV directional relay is closed. The second speed point level signal from P2 is available when the 2nd speed relay is closed. The standard progressive sequence proceeds in this manner through the fifth speed point and P5.

The test points on the Step Reference Board can be used to set and monitor the individual speed point levels, or the output of the adjustable speed drive ramp circuit can be monitored as in standard setup procedures. In either case, to simplify the system adjustments, it is recommended to set the adjustable speed drive Minimum Speed Potentiometer to a fully counterclockwise position, and the Maximum Speed Potentiometer to a fully clockwise position. These adjustments permit the Step Reference Board signals to directly determine system speed level without offset or scaling.

A typical Step Reference Board application will use the first four speed points as stepless points, and the fifth point as a full speed point. The above right table shows speed levels recommended by speed step.

To insure that the adjustable speed drive input circuit loading on the Step Reference Board potenti-

ometers is accounted for, make the above settings with the individual speed points selected with the control device. The signal levels listed above can also be monitored at the adjustable speed drive ramp output. An alternate

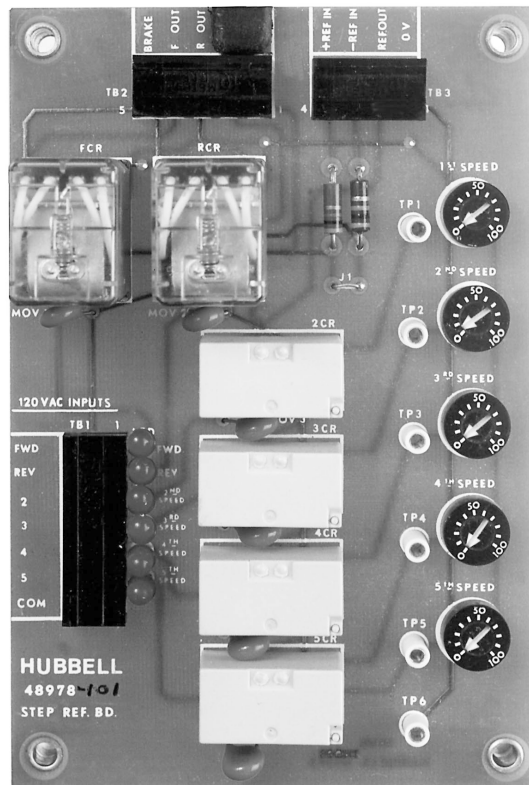
method is to set the speed point potentiometers to the approximate dial positions listed above, then custom adjust the individual signal levels if necessary with the drive system operational.

## Recommend Speed Levels

Speed Point	Test Point†	Signal Level§	Dial Setting
1st	TP1	0.5VDC	10
2nd	TP2	2.0VDC	30
3rd	TP3	3.5VDC	55
4th	TP4	5.0VDC	80
5th	TP5	6.3VDC	100

† The black, common, lead of the digital voltmeter is attached to TP6, 0V and the red, power, lead is attached to the appropriate test point.

§ Signal level is either (+) or (-) voltages depending on whether the speed point being measured is in the Hoist or Lower direction.



# Circuit Description

The Step Reference Board assembly is comprised of six isolating control relays and indicating LED's, and five speed point adjustment potentiometers. See Figures R1 and R2. There are two directional relays, FCR and RCR that connect the adjustable speed drive power supply voltages to the speed point potentiometers. For systems requiring only a positive speed reference signal, the -101 assembly is used, and jumper J1 is in place. This jumper causes a common polarity supply voltage to be connected to the speed point potentiometers when either directional relay is closed. The -102 assembly is used for systems requiring a bipolar speed reference signal, and jumper J1 is removed. This version causes a positive supply voltage to be connected to the speed point potentiometers when directional relay RCR is closed, and a negative supply voltage to be connected to these potentiometers when directional relay FCR is closed.

Resistors R1 and R2 provide current limit protection for the adjustable speed drive power supply. The resistive elements of the speed point potentiometers are all connected in parallel. When a directional relay is closed, the voltage on the wiper of the first point potentiometer, P1, is connected to the reference output terminal through a normally closed 2nd point relay contact. The setting of this potentiometer thus determines the first point speed refer-

ence signal. When the 2nd speed point relay is energized by a programmable controller, pendant or master switch contact closure, the first speed point potentiometer, P1, is disconnected, and the 2nd speed point potentiometer, P2, is connected to the reference output through a normally closed 3rd point relay contact and a normally open 2nd point relay contact. A standard progressive maintained input sequence is required for the stepped operation to continue through the fifth speed point.

The voltage setting of each potentiometer can be measured on the Step Reference board by means of test points. A common test point, TP6 is provided for OV power supply connection. TP1 through TP5 provide the respective speed point voltages. The voltages at

these points should be measured and adjusted only when the respective speed point is selected, as the external circuit of the adjustable speed drive will load the individual potentiometers and change the level somewhat when selected.

Additional directional relay contacts are provided for auxiliary control functions if needed. Two normally closed contacts, one from each directional relay, are connected in series thus providing an Off-Point LV initialization circuit. Two normally open contacts, one from each directional relay are connected in parallel and provide a brake relay or main relay control circuit. An additional normally open contact from each directional relay is also provided for auxiliary control functions.

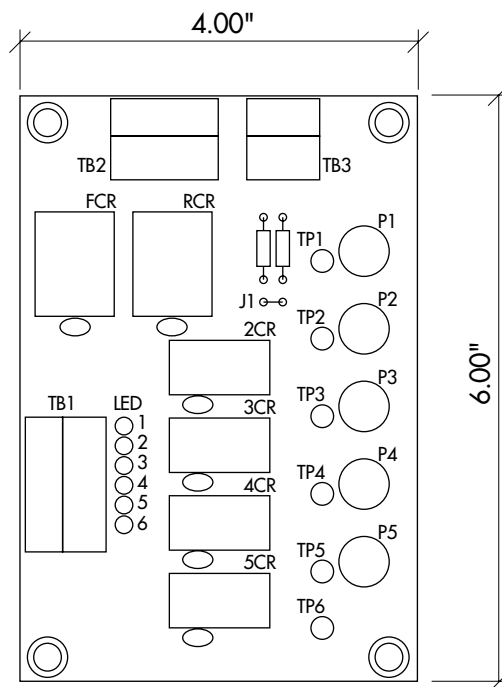


Figure R1 – Step Reference Board Outline

# Specifications

## Input Power and Signals

Input relay control voltage .. 120VAC @ 1.3 VA Max.

Reference supply voltage ... ±24VDC Max.

Loading to Reference supply ..... 1.3 KΩ

## Reference signal output capabilities

Output step reference voltage ..... 0 to 75% of Reference

Output impedance per step ..... 2.5 KΩ Max.

## Output relay contact capabilities

Max resistive switching voltage  
AC current ..... 250VAC  
DC current ..... 30VDC

Max resistive switching current  
AC current ..... 2 amps  
DC current ..... 3 amps

Temperature range ..... -40°F (-40°C) to 122°F (50°C)

## Indicators/Diagnostics

LED's ..... FWD and REV direction for 2nd, 3rd, 4th, and 5th speed points

Test Points ..... TP1, TP2, TP3, TP4, and TP5 individual speed points with TP6 for OV reference



Figure R2 – Step Reference Schematic

