Superior Electric

INSTRUCTIONS
for
SLO-SYN® 2000
OSCILLATOR AND ANALOG
SPEED FOLLOWER
MODEL SS2000-OF

CONTENTS

Section 1: Introduction

1.1 Product Features

The SLO-SYN SS2000-OF Oscillator & Analog Speed Follower is designed for use with Slo-Syn 2000 stepper motor drives, and will also work with most standard "pulse and direction" drives. It provides variable speed control for step motors through a potentiometer adjustment, and analog speed following from a voltage or a current level source.

The SS2000-OF produces an output pulse rate that is proportional to the analog input. The pulse rate is switch selectable and corresponds to a full scale input of either 10 volts DC or 20 mA. The selectable maximum speeds are: 160,000; 80,000; 40,000; 20,000; 10,000; 5,000; 2,500; and 1,250 pulses/sec.

The input is either a current level of 4 to 20 mA, or a differential voltage input of -10 to +10 volts DC. An external potentiometer can also be used by utilizing the +10 and -10 volt power supply outputs on the unit. A +15 volt supply output is available for use with a 4 to 20 mA current source.

There are three user adjustable parameters:

- High Speed Limit
- Acceleration/Deceleration
- Low Speed (Deadband)

1.2 Cautions and Warnings

- High electrical voltages are present inside this unit. An electrical shock hazard exists that may cause serious injury or death if this unit is operated without its protective covers in place.
- Do not exceed the voltage and current ratings of the various input and outputs. Please read the electrical specifications.
- Be sure to mount the unit so that there is adequate space for proper cooling.
- Please follow good wiring practices and keep low level signal lines away from power and motor wiring. This will help prevent potential electrical noise problems.

1.3 Logic and Voltage Conventions

- Motor rotation direction (CW and CCW) is properly oriented when viewing the motor from the end opposite the mounting flange.

1.4 Assumptions

This manual is written in a simple and easy to follow format suitable for both new and experienced motion control users. We assume that the user is knowledgeable in the following areas:

- Basic electrical and electronic skills, including preparing and following an equipment wiring diagram.
- The basics of motion control application, such as torque and speed.

Section 2: Quick Start Up GuideLines

We strongly recommend that the user read and understand the details and specifications found in later sections of this manual before applying this product. However, listed below are the minimum steps necessary to get up and running with references to the appropriate instruction manual sections where further details can be found.

1. Set the speed range for the application. Then determine the high speed and set High Speed Potentiometer. Once this is completed, set the Low speed followed by the Accel/Decel. Refer to section 4.5.3 and 4.5.4 for specific descriptions and instructions.
2. Mount the unit in the location to be used. See Section 3.2.
3. Make all of the appropriate electrical connections. First, connect the signal lines and then connect the AC power. See Section 4.4.
4. Operate the unit and make adjustments if necessary (Section 4.4.2).

Section 3: Installation Guidelines

3.1 General Wiring Guidelines

The SS2000-OF uses modern solid-state electronics to provide the features needed for advanced motion control applications. In some cases, other equipment used in these applications may produce electromagnetic interference (EMI or electrical "noise") that can cause faulty operation of the digital logic used in the SS2000-OF or in any other computer type equipment in the users system.
In general, any equipment that causes arcs or sparks, or that switches voltages or current at high frequencies can cause interference. In addition, AC utility lines are often "polluted" with electrical noise from sources outside a users control, i.e., equipment in the factory next door. Some of the common causes of electrical interference are:

- power from the utility AC line
- relays, contactors, and solenoids
- light dimmers
- arc welders
- motors and motor starters
- induction heaters
- radio controls or transmitters
- switched-mode power supplies
- computer-based equipment
- high frequency lighting equipment
- dc servo and stepping motor drives

The following wiring practices should be used to reduce noise interference:

- **Solid grounding of the system is essential.** Be sure that there is a solid connection to the AC system earth ground. Bond the SS2000-OF Oscillator & Analog Speed Follower case to the system enclosure. Use single point grounding for all related components of the system (a "hub and spokes arrangement"). Keep the ground connections short and direct.

- **Keep signal and power wiring well separated.** If possible use separate conduits and ducts for each. If wires must cross, they should do so at right angles to minimize coupling.

Note: Power wiring includes ac wiring, motor wiring, etc., and signal wiring includes inputs and outputs.

- **Use shielded twisted pair cable for oscillator I/O lines. BE SURE TO GROUND SHIELDS AT ONLY ONE END.** Screw connections are provided for ground shields on the chassis near the I/O connections.

- **Suppress all relays to prevent noise generation.** Typical suppressors are capacitors or MOV's (See manufacturer's literature for complete information). Whenever possible use solid state relays instead of mechanical contact types to minimize noise generation.

3.2 Mounting

The SS2000-OF Oscillator & Analog Speed Follower is mounted by fastening its mounting brackets to a flat surface as shown in Figure 3.1.

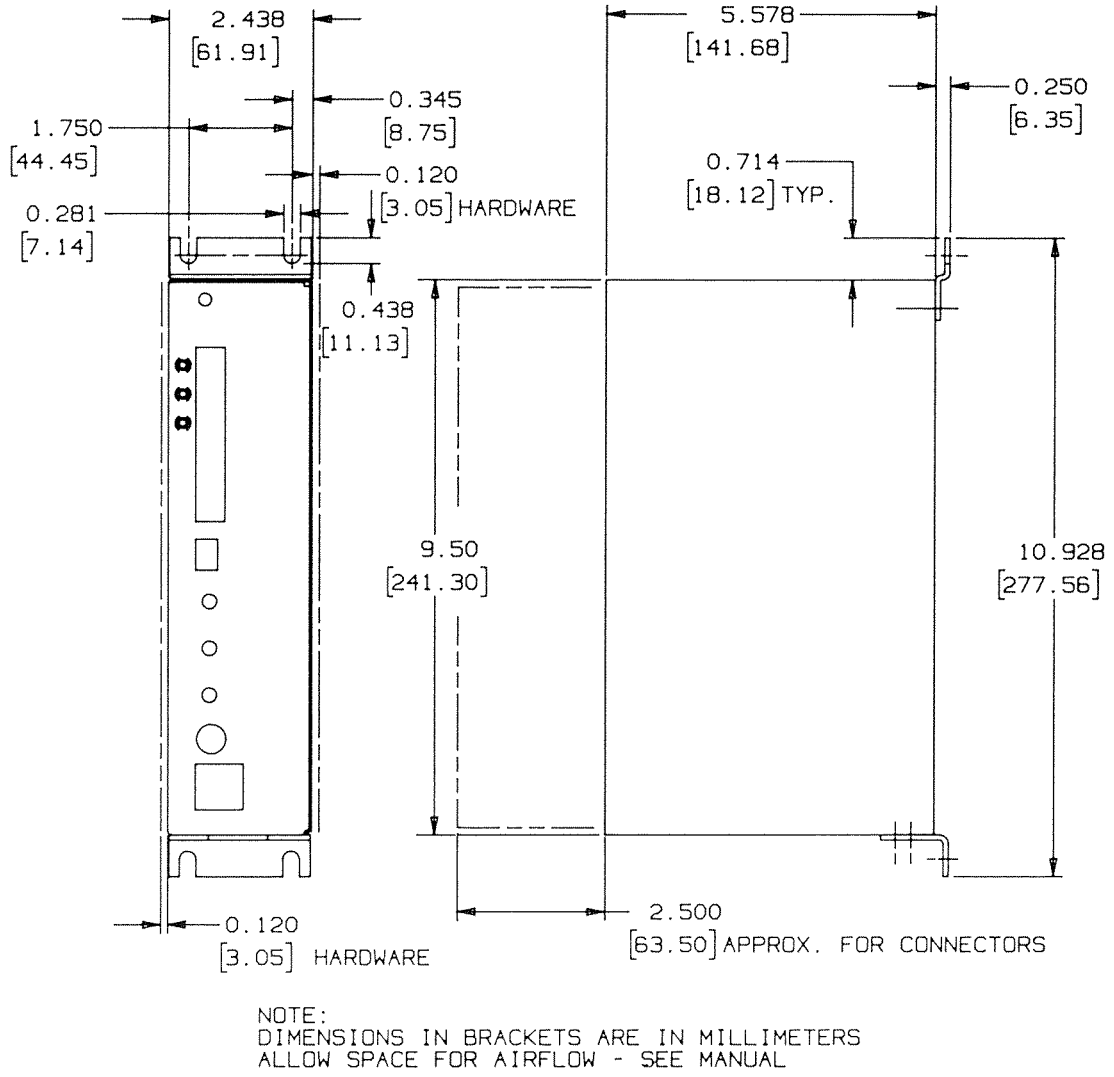


Figure 3.1, Mounting Diagram

When selecting a mounting location, it is important to leave at least two inches (51 mm) of space around the top, bottom, and sides of the unit to allow proper airflow for cooling. It is also important to keep the Oscillator & Analog Speed Follower away from obvious noise sources. If possible, locate the Oscillator & Analog Speed Follower in its own metal enclosure to shield it and its wiring from electrical noise sources. If this cannot be done, keep the Oscillator & Analog Speed Follower at least three feet away from noise sources.

Section 4: Specifications

4.1 Mechanical Specifications

Dimensions	9.5"H x 2.5"W x 5.6"D (241 x 64 x 142 mm)
Weight	3 lb. (1.36 kg)

4.2 Electrical Specifications

AC Input Range	90-265 Vac, 50/60 Hz
AC Current Draw	0.1 A
Fuse Rating	2 A, 250 V
Fuse Type	2 AMP-3AG-250 V

Inputs & Outputs

Outputs

+15VDC, 20 mA max.
+10VDC, 10 mA max.
-10VDC, 10 mA max.

Pulse and Direction (Open Collector Outputs)	
On state current	30 mA max.
Off state voltage	30 V max.
Opto out	5 VDC, 60 mA max.

Inputs

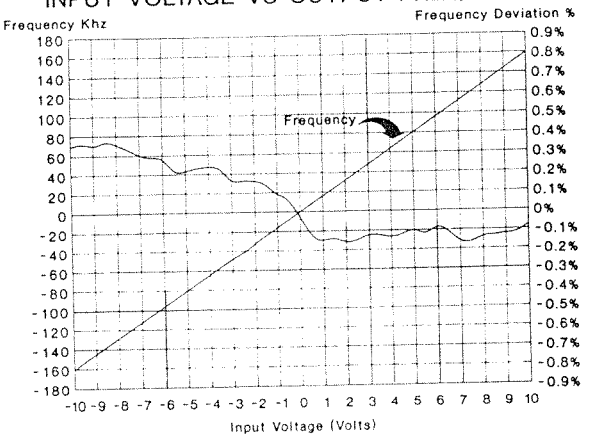
4-20 mA, Current flow into pin

Current < 4 mA	no output
Impedance to ground	221 ohms typical
Vin+, Vin-	Differential input voltage ±10VDC
Input impedance to ground	100K ohms typical.
SIG GND	Signal Ground
GND (2 pins)	Internal Power Ground

4.3 Oscillator Stability

The following curve shows oscillator stability over the full voltage, current and temperature ranges.

INPUT VOLTAGE VS OUTPUT FREQUENCY



4.4 Environmental Specifications

Temperature	
Operating	0°C to 50°C (+32°F to +122°F)
Storage	-40°C to 75°C (-40°F to +167°F)
Humidity	95% Noncondensing

4.5 Signal Specifications

4.4.1 Connector Pin Assignments

All connections are made via an 8 pin connector and a 6 pin connector.

Assignment	Function
+15 V OUT	Output
4-20 mA In	Input
GND	Ground
V IN+	Input
ANALOG GND	Ground
V IN-	Input
+10V OUT	Output
10V OUT	Output
OPTO	Output
PULSE	Output
DIR	Output
NORM/INV	Input
GND	Ground
STOP/RUN	Input

4.5.2 Signal Descriptions

+15 VDC OUT Power Supply
This output power supply can be used as the source voltage for the 4-20 mA converter. The current limit is 20 mA.

4-20 mA IN Analog Current Input
This input converts a 4-20 mA input current to a 0-10V signal which controls the output of the oscillator. A 20 mA signal corresponds to full output frequency. See Figure 4.1 for connection diagram.

GND Return for the 4-20 mA current source.

V IN+ Analog Voltage Input (Noninverting)
Noninverting analog input that controls the rate at which the pulses are sent to the drive. The operating voltage range is -10 V to +10 V. See Figures 4.2 through 4.5 for connection diagrams.

Note: A positive voltage on this pin will produce CW motion on the motor. A negative voltage will produce CCW motion. A voltage on both the V IN+ and the V IN- will cause a difference in output voltage i.e., if V IN+ = 10V and V IN- = 5V, V_{freq} = 5V. This will produce CW motion at half of the set maximum speed.

ANALOG GND Analog Ground
Ground reference for V IN+ and V IN- analog inputs.

V IN- Inverted Analog Voltage Input
Inverted analog input that controls the rate at which the pulses are sent to the drive. The operating voltage range is -10 V to +10 V. See Figures 4.2 - 4.5 for connection diagrams.

Note: A positive voltage on this pin will produce CCW motion on the motor. A negative voltage will produce CW motion. A voltage on both the V IN+ and the V IN- will cause a difference in output voltage, i.e., if V IN+ = 10V and V IN- = 5V, V_{freq} = 5V. This will produce CW motion at half of the set maximum speed.

+10VDC OUT
-10VDC OUT Power Supply Outputs
These outputs are to be used in conjunction with an external potentiometer (2K to 10K ohms) to control the frequency output. The wiper of the potentiometer is connected to the V IN+ terminal. The current limit is 10 mA and requires a minimum potentiometer value of 2K ohms. See figure 4.3.

OPTO Opto-Isolator Output
This +5 Vdc output supply is used as a source voltage for the drive's opto-isolators. The current limitation is 60 mA.

PULSE Pulse Output For Drive
This signal an open collector output to the drive which can sink up to 40 mA. The output produces a square wave which rotates the motor.

DIR This is an open collector output to the drive, which can sink up to 40 mA. This signal controls the direction of the motor.

NORM/$\overline{\text{INV}}$ Control Of Direction Of Rotation
This input signal will reverse the rotational direction of the motor when tied to GND. It is used for controlling the rotational direction of the motor using:

1) 4 - 20 mA input (Figure 4.1)
2) Source voltage, 0 - 10 Vdc (Figure 4.2)
3) High Speed/Base Speed Selection Circuit (Figure 4.5)

This signal input should not be changed while motion is taking place. Direction should be selected prior to enabling any form of the Run commands as stated above.

GND Signal common for the NORM/$\overline{\text{INV}}$- and STOP/$\overline{\text{RUN}}$- input.

STOP/$\overline{\text{RUN}}$ Controls Operation Of Oscillator
When connected to GND, the oscillator is enabled to accelerate and output pulses. If opened-circuited during motion, the oscillator decelerates to low speed and stops. **This input must be closed for normal operation to occur.**

Chassis GND Three PEM nuts have been provided on the chassis for connecting the shield on a shielded cable.

4.6 Switches and Potentiometers

4.6.1 Speed Range Setting

The speed range is switch selectable via a 4 position "DIP" switch. The switch settings are as follows:

S1	S2	S3	S4	Maximum Frequency Pulses/Sec
Off	Off	Off	Off	160,000
On	Off	Off	Off	80,000
Off	On	Off	Off	40,000
Off	Off	On	Off	20,000
Off	Off	Off	On	10,000
On	Off	Off	On	5,000
Off	On	Off	On	2,500
Off	Off	On	On	1,250

The default setting is:
Off Off On Off 20,000

4.6.2 High Speed Adjustment

This potentiometer sets the maximum frequency limit of the oscillator's chosen speed range. The range of this potentiometer is 66% to 100% of the maximum frequency selected. The factory default setting is 100%.

4.6.3 Accel/Decel Adjustment

The function of the ACCEL/DECEL potentiometer is to adjust the rate at which the oscillator "ramps" from low speed to high speed and visa-versa. This is initially set at approximately 1 second.

4.6.4 Low Speed Adjustment

This potentiometer allows a voltage deadband to be set in the oscillator, i.e., no pulses will occur until the voltage exceeds the deadband level. The range of this potentiometer is 0% to 30% of the selected maximum frequency. The low speed default setting is approximately 7%.

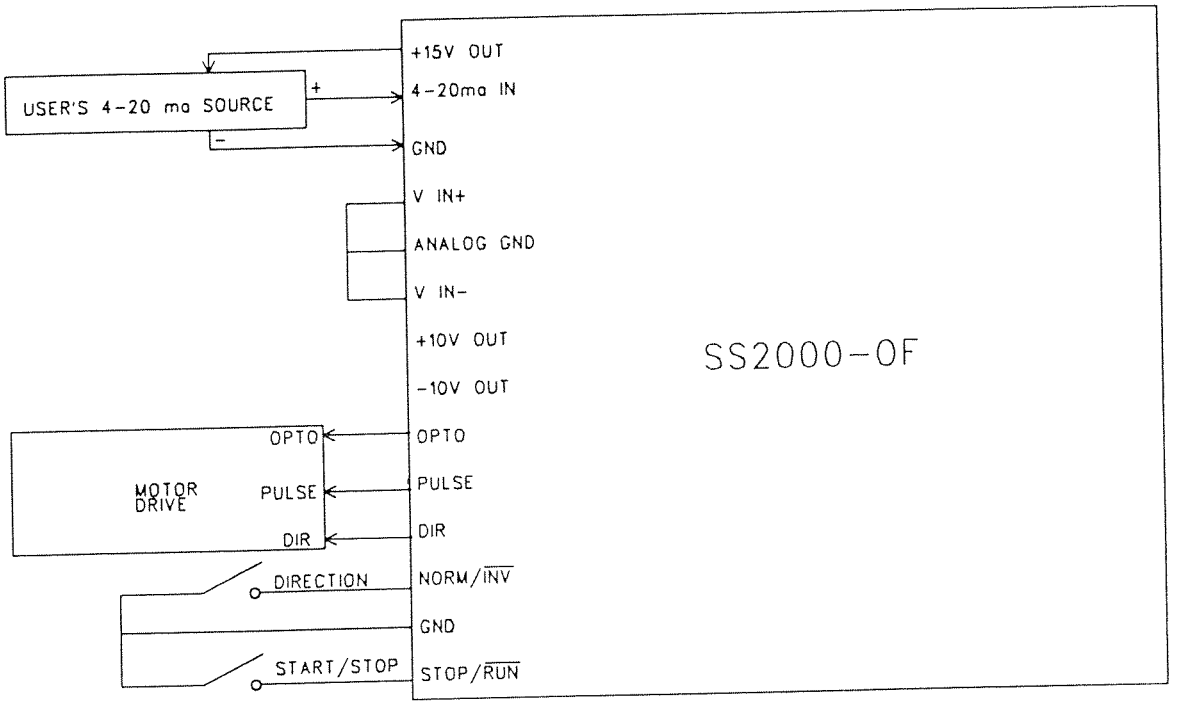


Figure 4.1, 20 mA Input Control Of Oscillator

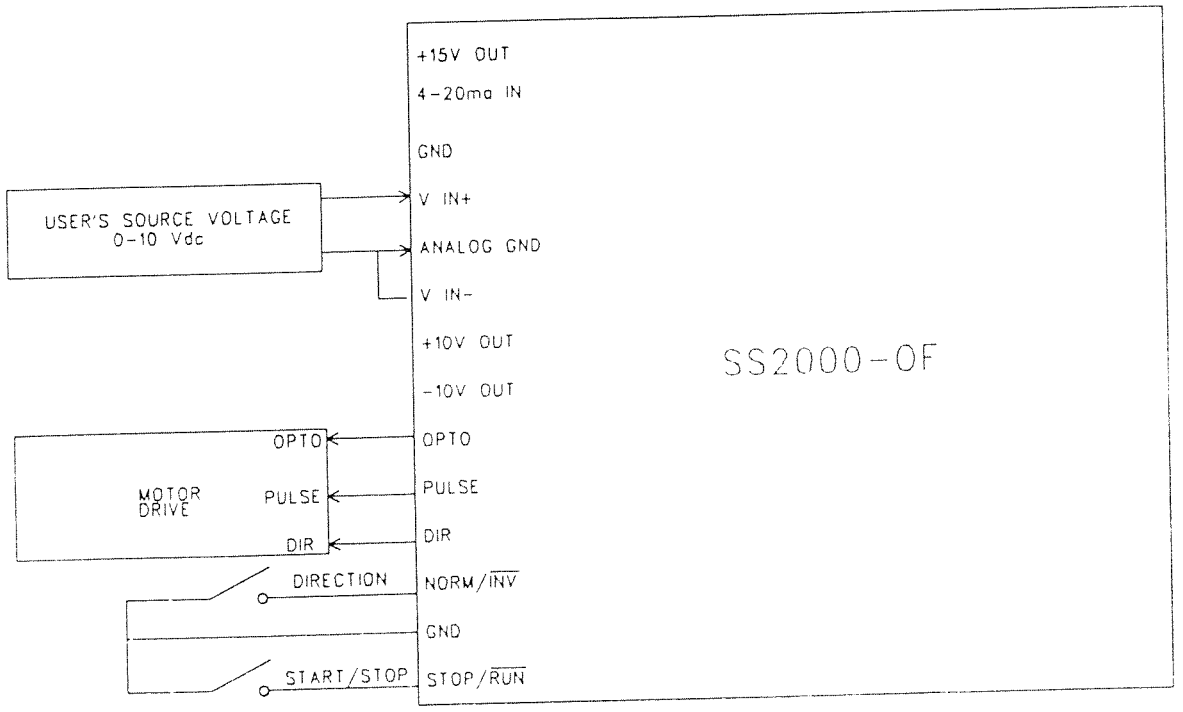


Figure 4.2, User's Voltage Source Control Of Oscillator

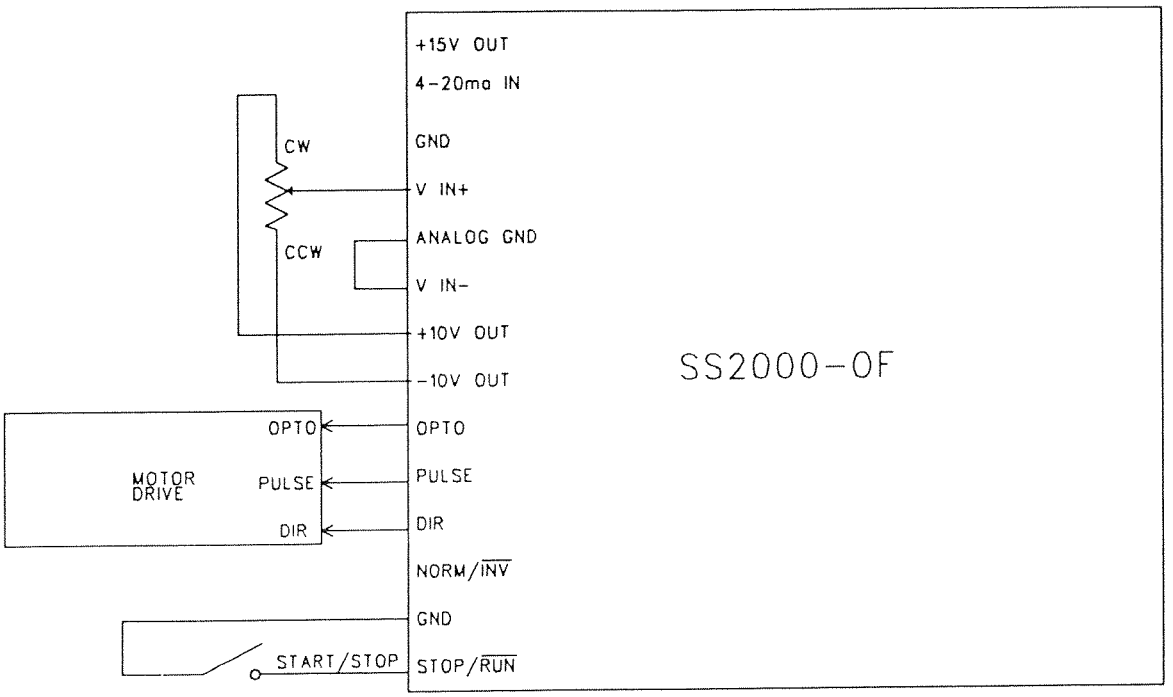


Figure 4.3, External Potentiometer Control Of Oscillator

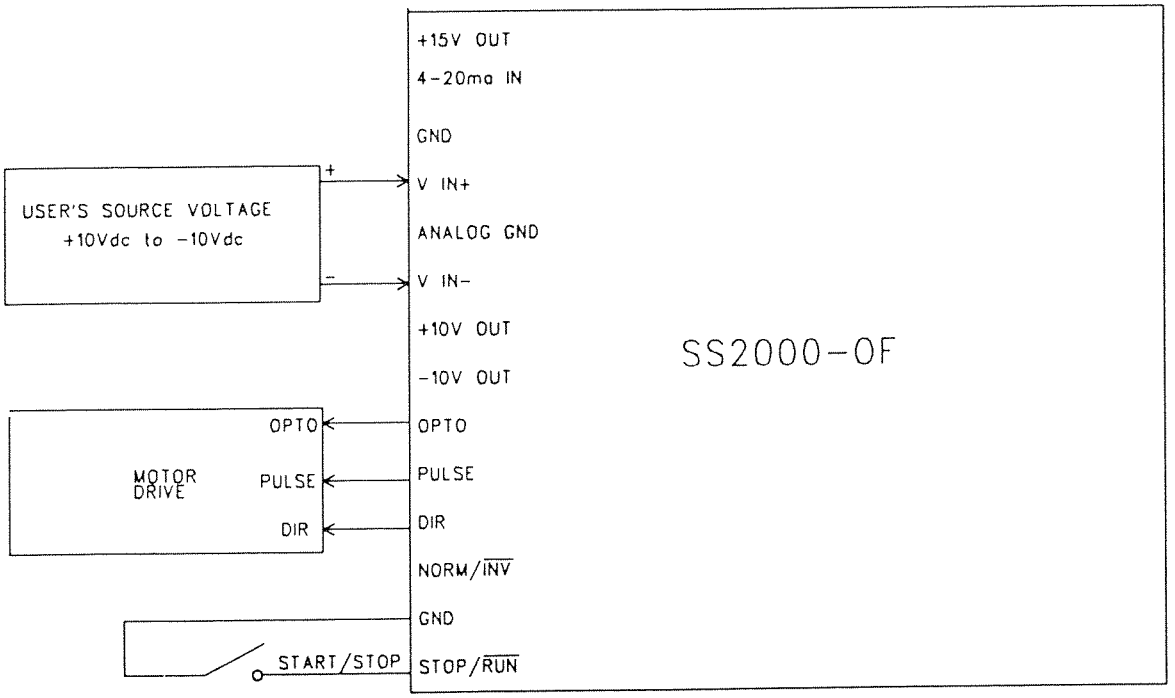


Figure 4.4, Differential Input Control Of Oscillator

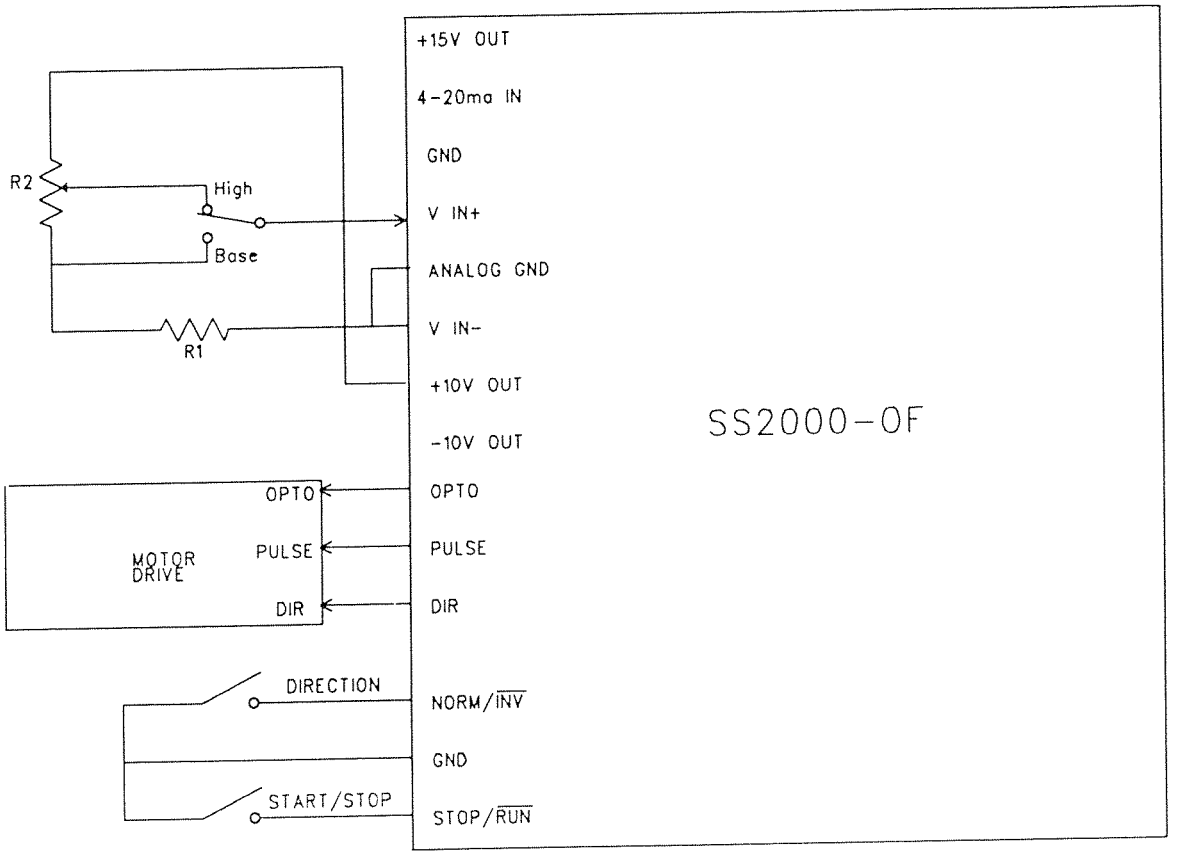


Figure 4.5, User's High Speed/Base Speed Selection Circuit

NOTE:
Formula for calculating Base Speed in % of maximum speed:

Base Speed in % = (R1)/(R1 + R2)

EXAMPLE:
Desired Base Speed is 20% and a 1K ohm potentiometer is used for R2

20/100 = R1/(R1 + 1000)
0.2 R1 + 200 = R1
200 = 0.8 R1
250 = R1

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