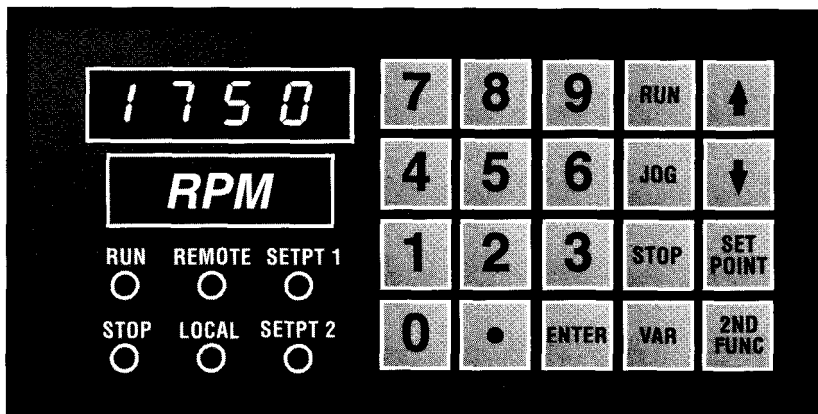


MicroSpeed 196



Motor Control Manual Version 3.2

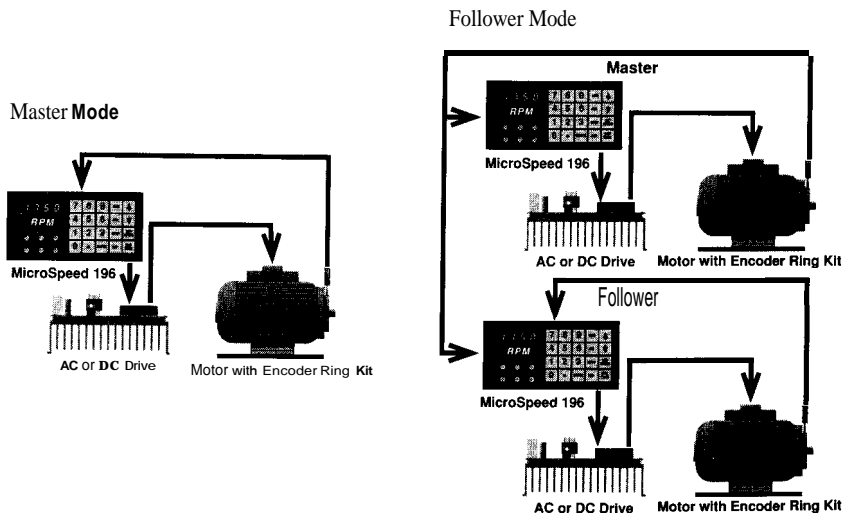
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I. INTRODUCTION

The MicroSpeed 196 is a closed-loop motion control device, designed to operate as a stand-alone Master, controlling a single AC, DC, or servo-type variable-speed drive of any horsepower; or as a Follower control in more complex multi-motor drive systems. The MicroSpeed 196 takes the place of the manually operated speed potentiometer by providing the speed reference voltage to the variable speed drive (0 to $\pm 10V_{dc}$ typically). The Speed Set Point is entered via the front panel keypad or remotely over the RS422 link. By continually comparing the feedback frequency with the desired set point, the set point is accurately maintained.

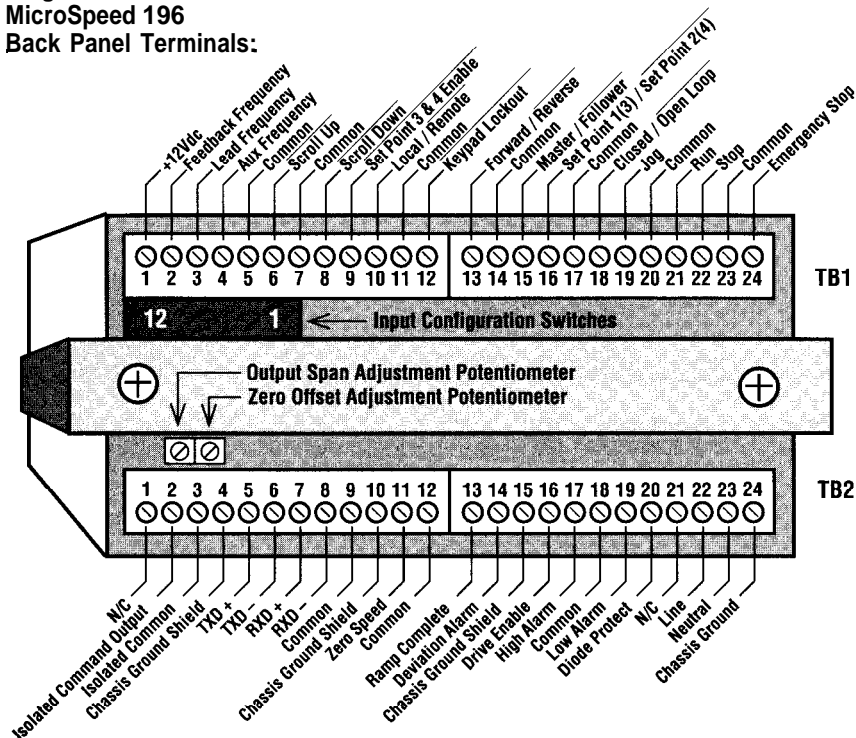
HOW TO USE THIS MANUAL

This manual is designed in sequential order, from basics to the highest level of MicroSpeed 196 programming. The deeper you read into each section, the less relevant the options may be to your application. If this is the case, glance at the topics, to ensure that you don't miss useful information, then go to the next section. Each section begins with the basics, and then leads into more complicated levels of programming. Everyone who uses this manual should at least study the sections through Section V, "Programming Master Mode", then skip to the sections required for your application. It is, however, important to read Section IX, "Tuning the Microspeed 196". This section is the key to the control's performance.

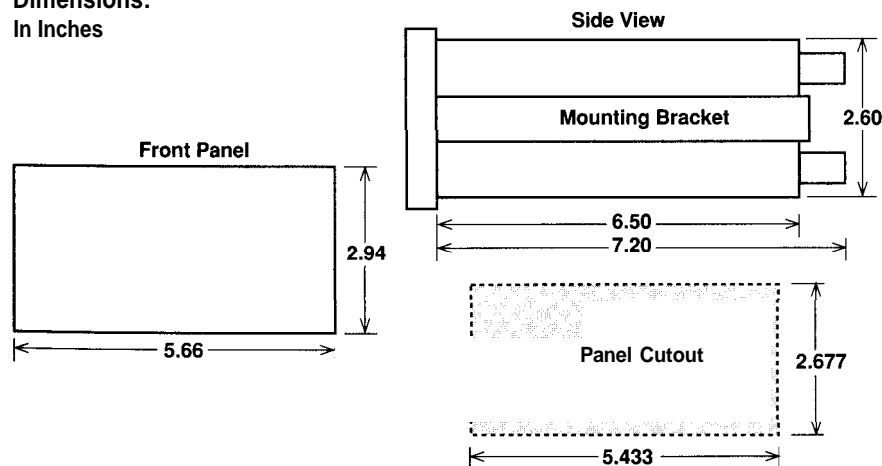


II. MicroSpeed 188 • Layout

Diagram 1
MicroSpeed 196
Back Panel Terminals:

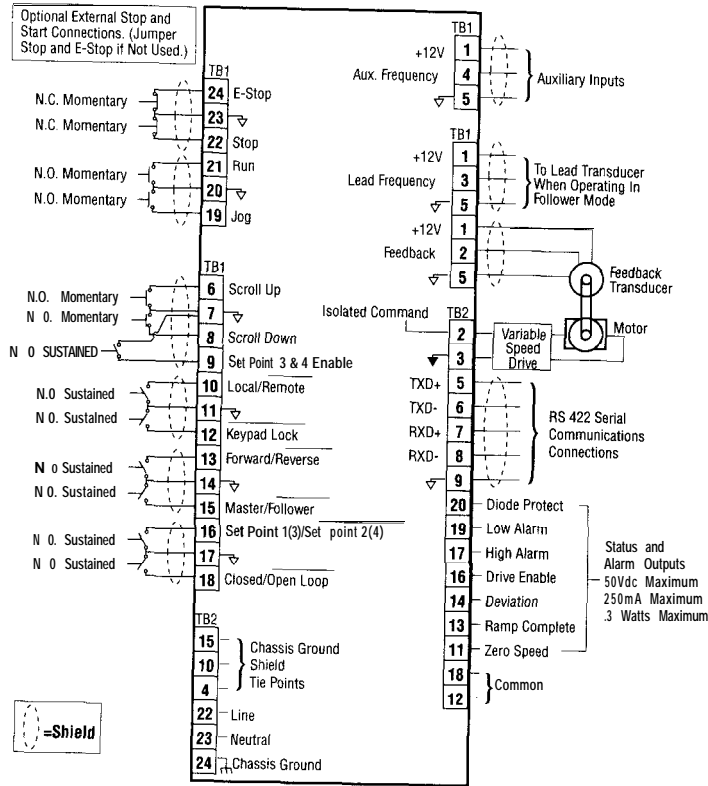


Dimensions:
In Inches



III. Wiring the MicroSpeed 196 and I/O Functions

Diagram 2
MicroSpeed 196 Connections:



Proper Wiring Methods - Shielded cable is required for all signal wires connected to the MicroSpeed 196, except for the AC input power. The shields should be tied on one end only. Tie shields to the earth ground or common terminals provided on the MicroSpeed 196. **Important: Never use shielded cable with unused conductors.** Unused conductors act as antennas and will corrupt your signals. Attempting to send one signal down two wires, or grounding extra conductors will not prevent this from happening.

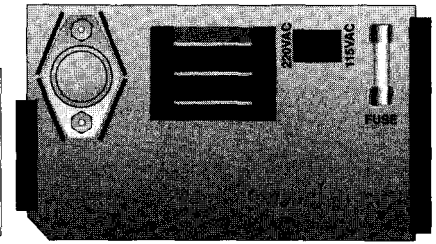
Power Connection - Power to the MicroSpeed 196 is 115Vac (standard) or 230Vac (optional), and is switch selectable. Power input to the MicroSpeed 196 should be as clean as possible, so that the control circuitry is not exposed to spikes or other noise. Noise immunity is built into the unit; however, care should still be taken. Terminal locations for power are as follows:

- TB2-22 = Line (L1)
- TB2-23 = Neutral (L2)
- TB2-24 = Chassis Ground

How to Change to 230Vac Power

Diagram 3
MicroSpeed 196
Power Board:

Microspeed 196 Power Board



Disconnect AC power to unit. Remove Power Board from control. Move Switch position for correct voltage. Replace fuse (.25 FB for 115Vac or .125FB for 230Vac). Change or remove Voltage Label on outside of control.

Connection to Drive - The connection to the drive must be a shielded, twisted-pair cable. The **Isolated Command Output** is connected to the input terminal on the drive that is normally connected to the wiper of the speed potentiometer. The isolated common terminal on the MicroSpeed 196 is connected to reference common on the drive. Terminal locations are as follows:

- TB2-2 = Isolated Command Output
- TB2-3 = Isolated Common

EXTERNAL START/STOP SWITCHES:

Run - The **Run** input functions as a motor start, causing the MicroSpeed 196 to ramp the motor speed to the selected set point. Typically, a **N.O. Momentary** switch is wired from TB1-21 (Run input) to common.

Stop - The **Stop** input functions as a motor stop, causing the MicroSpeed 196 to ramp the motor speed down to zero. This also must be activated to clear a no feedback shut-down error. Typically, a **N.C. Momentary** switch is wired from TB1-22 (Stop input) to common.

IMPORTANT: If an external Stop switch is NOT used, jumper TB1-22 to TB1-23 (factory installed).

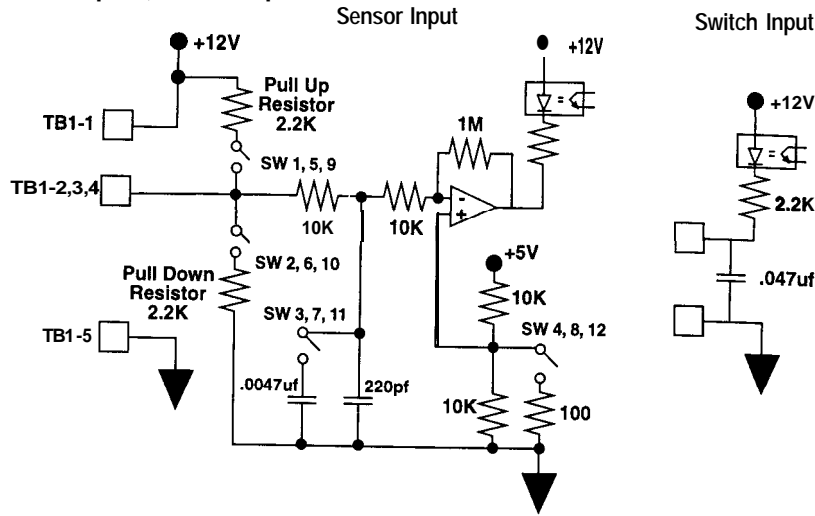
Single Contact Run/Stop - To control the Run/Stop function with a single contact, jumper **Run to Stop (TB1-21 to TB1-22)** and switch to common (Open = **Stop**, Closed = **Run**). When Run/Stop is used in this way, the front panel **RUN** and **STOP** keys are disabled, and the **E-Stop** must be a **N.C. Maintained** contact.

E-STOP - The Emergency Stop input functions as an immediate stop. This function is provided only on the terminal strip. The E-Stop should be used in emergency situations only, because it overrides all other functions. Typically, a **N.C. Momentary** switch is wired from terminal **TB1-24 (E-Stop)** to common.

IMPORTANT: If an external E-Stop switch is not used, jumper TB1-24 to TB1-23 (factory installed).

Jog - The Jog input accelerates the motor to the programmed speed and stops the motor when the contact is opened. (See "Section VII, Programming-Jog Mode" for details.) Typically, an **N.O. Momentary** switch is wired from TB1-19 (Jog) to common.

Diagram 4
Sensor Inputs, Switch Inputs:



Sensor Connections - The MicroSpeed 196 can accept: NPN Open Collector, 3-wire (factory standard configuration); PNP Open Collector, 3-wire; Magnetic pick-up, 2-wire; and Logic Level inputs. All sensors should have shielded cable with no unused conductors.

The supply terminal (+12 Vdc unregulated) when using powered sensors (NPN or PNP) for Feedback, Lead, or Auxiliary signals is terminal TB1-1.
 The common terminal for all sensor connections is terminal TB1-5.
 The Feedback Signal input is terminal TB1-2.
 The Lead Signal input is terminal TB1-3.
 The Auxiliary Signal input is terminal TB1-4.

Note: When sharing signals, never use more than one pull-up resistor. See Diagram 4 for switch locations. See table below for sensor configurations.

Table 1 **SENSOR SWITCH SETTINGS**

	Feedback Sensor				Lead Signal				Auxiliary Input			
	12	11	10	9	8	7	6	5	4	3	2	1
NPN Open Collector	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
PNP Open Collector	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
Zero Crossing	ON	ON	ON	OFF	ON	ON	ON	OFF	ON	ON	ON	OFF
Logic Level	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

NPN Open Collector; 2.2K pull-up to +12V, trigger point at 2.5V
 PNP Open Collector; 2.2K pull-down to common, trigger point at 2.5V
 Zero Crossing (Mag); 100mV minimum peak, trigger point at 50mV
 Logic Level; trigger point at 2.5V

EXTERNAL CONTROL INPUTS:

The external control inputs give the operator control over the operating parameters of the MicroSpeed 196. These parameters include: Master/Follower modes; Keypad Lockout; Forward/Reverse (positive or negative voltage output); Closed/Open Loop modes; and Local/Remote.

Note: All external control inputs should be Sustained, Normally Open switches, or hardwired.

Master/Follower - This input tells the MicroSpeed 196 to operate independently (as a Master), or to follow the lead signal of another device (feedback from a lead motor or a generated signal from a PLC). The MicroSpeed 196 only reads this input while stopped in the Ready mode. Wiring of the Master/Follower input is as follows: TB1-15 (Master/Follower) to common (Open = Master; Closed = Follower).

Keypad Lockout - This input disables selected entries from the front panel keypad of the MicroSpeed 196, as defined by programming the Keypad Lockout Selection variable. Use of this function is highly recommended. Wiring of the Keypad Lockout input is as follows: TB1-12 (Keypad Lockout) to common (Open=Keypad Available; Closed=Keypad Lockout).

Forward/Reverse - This controls the voltage polarity of the Isolated Command Output. Forward is a positive voltage. Reverse is a negative voltage. The polarity will change immediately when the switch is closed or opened. Wiring of the Forward/Reverse input is as follows: TB1-13 (Forward/Reverse) to common (Open=Forward; Closed = Reverse).

Closed/Open Loop - This enables or disables the PID control. In Open Loop mode, the feedback is ignored, so control is extended to providing a particular command output voltage only, with no correction to maintain a set point. Wiring of the Closed/Open Loop input is as follows: TB1-18 (Closed/Open LOOP) to common (Open = Closed Loop, Closed = Open Loop).

Local/Remote - This input controls the point of information entry to the MicroSpeed 196. In Local mode, commands for all functions and programming are taken from the front panel keypad and terminal strip. In Remote mode, all programming and speed commands must come over the RS-422 link. (Refer to "Section XII, the *Serial Communications*" for more information.) Wiring of the Local/Remote switch is as follows: TB1-10 (Local/Remote) to common (Open=Local; Closed = Remote).

SETPOINT CONTROL INPUTS:

There are eight set points that can be programmed into memory (four master Speed Set Points, and four follower Ratio Set Points). These eight set points allow the operator to use different speeds upon start-up, and to alter speed by toggling from one set point to another. The speed change will follow the ramp profile programmed for Accel and Decel. Two switches control which programmed set point is active. The two inputs are: Set Point 3 & 4 Enable, and Set Point 1(3)/Set Point 2(4).

Active Set Point Set Point 1(3)/Set Point 2(4) Set Point 3 & 4 Enable

Set Point 1	Open	Open
Set Point 2	Closed	Open
Set Point 3	Open	Closed
Set Point 4	Closed	Closed

Set Point 3 & 4 Enable - Wiring of the Set Point 3 & 4 Enable input is as follows: TB1-9 (Set Point 3 & 4 Enable) to common (Open = Set Points 1 & 2 Enabled; Closed = Set Points 3 & 4 Enabled).

Set Point 1(3)/Set Point 2(4) - Wiring of the Set Point 1(3)/Set Point 2(4) input is as follows: TB1-16 (Set Point 1(3)/Set Point 2(4)) to common (Open = Set Point 1(3); Closed = Set Point 2(4)).

Scroll Up/Scroll Down - These inputs are used to make small changes to the active set point while running. The high and low alarm outputs can be tied to these inputs, preventing operators from running too fast or too slow. N.O. Momentary contacts should be used when wiring the Scroll Up/Scroll Down inputs. The terminals are: Scroll Up = TB1-6; Scroll Down = TB1-8.

WIRING STATUS AND ALARM OUTPUTS:

The status and alarm outputs provide a completed circuit when a programmed result occurs. (See “*Status and Alarm Outputs*” in Section VIII, “*Programming Operational Variables*”). The outputs are Open Collector NPN transistors, rated for 50Vdc, 250mA and .3-watt maximums.

These outputs are intended to be used with the MicroSpeed 196 inputs, relays, LEDs, etc. Power to the output circuits should be wired parallel with the Diode Protect (TB2-20) terminal if inductive loads are driven, to avoid damage to the output circuitry. (See Diagram 5: “Wiring Status and Alarm Outputs”).

Diode Protect (TB2-20) - This is a protection circuit (back EMF diode). Input power from the power supply should be wired in parallel with this terminal.

Drive Enable (TB2-16) - This output can be actuated under one of the three programmable conditions. Drive Enable is used to give the MicroSpeed 196 control over the Run/Stop command on the drive, or on other MicroSpeed units.

Low Alarm (TB2-19) - If the shaft speed drops below this programmed setting, the output will conduct in order to actuate a load.

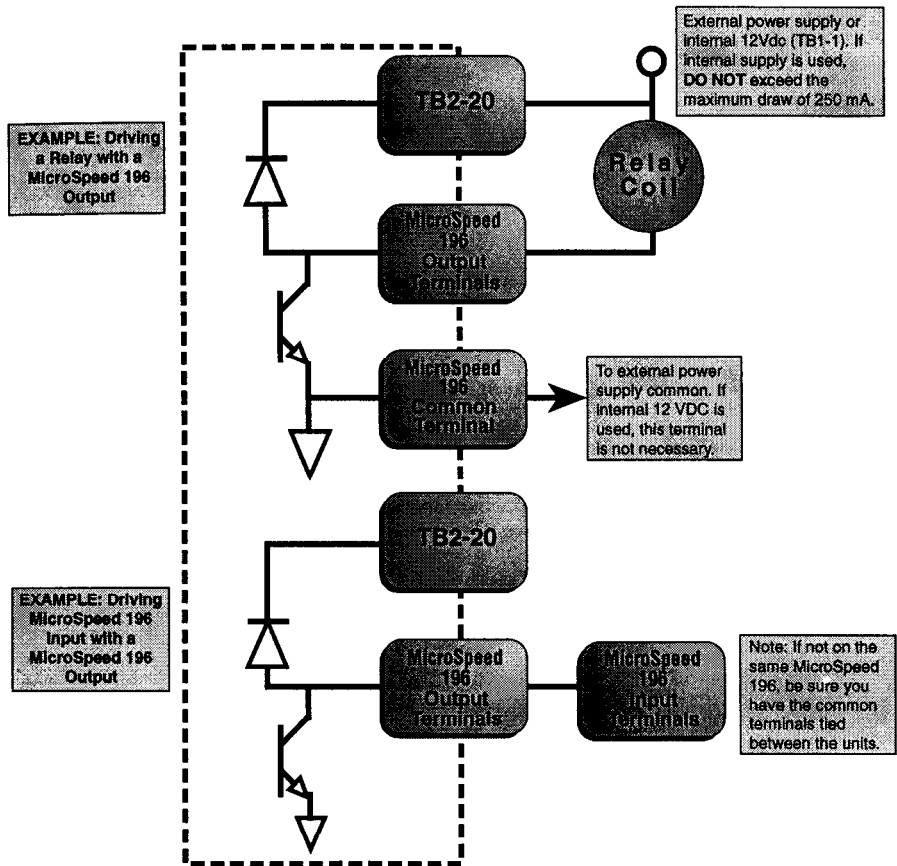
High Alarm (TB2-17) - If the shaft speed goes above this programmed setting, the output will conduct in order to actuate a load.

Deviation Alarm (TB2-14) - This output is active in the Follower mode. If the follower shaft is ahead or behind the Master exceeding the value programmed, the output will actuate the load.

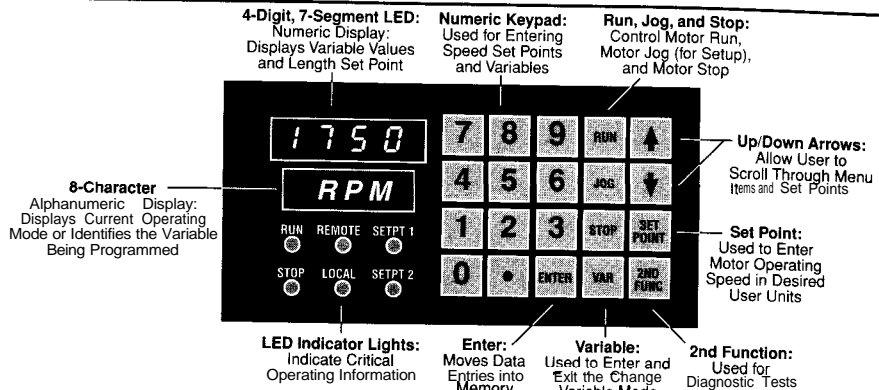
Ramp Complete (TB2-13) - This is a nonprogrammable output. This output is actuated when the Speed Set Point selected is reached (Master mode only).

Zero Speed (TB2-11) - This is a nonprogrammable output. This output is actuated when there is no feedback present, i.e., when the motor or shaft rotation has stopped, or feedback is lost, due to an external problem.

**Diagram 5
Wiring Status and Alarm Outputs:**



IV. PROGRAMMING • GENERAL



ENTERING AND ALTERING SET POINTS :

Set Point - The set point can be adjusted to any speed (or ratio) by pressing **SET POINT**, entering a new speed using the number keys, and pressing **ENTER**. This changes the programming of the current set point (Set Point 1,2,3,4 or Ratio 1,2,3,4). The motor will immediately ramp to the new setting. If you wish to change a non-selected set point, press **SET POINT**, then press the **UP** or **DOWN** arrows until the desired set point is displayed, and enter the new set point.

Note: Decimal locations are fixed via programmable variables, and are not entered when changing setpoints. The front panel LED displays will indicate which set point is active.

SET POINT LIGHTS ON	=	ACTIVE SET POINT
1		1
2		2
1&2		3
NONE		4

Using the Arrow Keys to Alter Set Points - Minor adjustments to the set point can be made by pressing the **UP** or **DOWN** arrows while the system is running. If an **UP** or **DOWN** arrow key is pressed, the active set point will increase or decrease. The rate of this change will increase if the key is held.

Programming THE VARIABLES:

The MicroSpeed 196 is programmed by entering data into a menu of variables. Only the variables that affect operation of the unit as it relates to the application must be programmed. Upon power up, the MicroSpeed 196 will display **READY** on the alphanumeric display. This indicates that the MicroSpeed 196 is ready for operation or programming. To program a variable, press **VAR** on the front panel keypad. The alphanumeric display will prompt for a variable number, and the numeric display will indicate two zeros (00), which will reflect the variable number entered. Enter the desired variable number and press **ENTER**. If you are unsure of the variable, the **UP** and **DOWN** arrows on the keypad will allow you to scroll through the menu of variables. As you

scroll, the numeric display will indicate the number of the variable, and the alphanumeric display will name the variable. Press **ENTER** when the desired variable is displayed.

When the variable to be programmed is accessed, enter data using the numeric keys, and then press **ENTER**.

Note: A decimal point cannot lead an entry; the decimal place must be preceded by a zero (0).

After **ENTER** is pressed, the display will ask for another variable number. If there is no other variable data to be entered, press the **VAR** key to return to the **READY** mode.

List of Variables:

Reference Variables - These variables tell the MicroSpeed 196 how to control the motor, and can be changed in **READY** mode only:

- 01 Maximum RPM
- 02 User Units at Maximum RPM
- 03 Feedback Pulses per Revolution
- 04 Maximum Lead RPM (Follower)
- 05 Lead Pulses Per Revolution (Follower)
- 23 User Unity Ratio (Follower)

Operational Variables:

- 06 Jog Speed in User Units
- 07 Acceleration Time
- 08 Deceleration Time
- 10 User Unit Label
- 11 Keypad Lockout Selection
- 21 Display Selection
- 22 Follower Display Selection
- 29 Jog Ramp Selection

Control Loop Variables-These variables tell the control how to correct for speed errors:

- 09 Maximum Lead Wind-up (Follower)
- 12 Gain-P
- 13 Reset-I
- 14 Rate-D

Status and Alarm Outputs:

- 15 High Alarm
- 16 Low Alarm
- 17 Deviation Alarm (Follower)
- 18 Drive Enable

Auxiliary Mode Variables- Allows for a third frequency, i.e., dancer systems, to trim the Follower mode ratio:

- 24 Auxiliary Mode Selection
- 25 Auxiliary Reference Frequency
- 26 Auxiliary Gain Percentage
- 27 Auxiliary Trim Selection
- 28 Auxiliary Input Delay

V. PROGRAMMING • MASTER MODE

Program the following variables when using the MicroSpeed 196 in any mode. (These are the only required variables if the MicroSpeed 196 will be used exclusively in Master mode.) After programming the variables, go to Section IX **“Tuning the Microspeed 196.”** Then, after all programming and tuning is complete, go to “Appendix A,” and record your entries.

Variable 01 - Maximum RPM - This number represents the revolutions per minute of the shaft on which the feedback sensor is mounted, when the MicroSpeed 196 is running the motor at maximum operating speed.

Note: The drive system must be able to run 10% faster than the value programmed into Variable 01 (maximum rpm.)

Variable 02 - User Units at Maximum RPM - This number will set up the MicroSpeed 196 to translate rpms to units of production that are more appropriate to the user, such as “Feet per Minute,” or “Gallons per Hour,” etc. The Speed Set Points and the linear tach display will then be relative to the operation. To use this variable, first determine the value of the user units at maximum rpm. If the rpm of the monitored shaft is desired, enter the same value as Variable 01. Otherwise, you must calculate the user unit at the speed entered into Variable 01. Or you can enter the same value as Variable 01, run at that speed, measure the actual units, and then enter the measured value. Use Variable 10 to program the alphanumeric display to show the appropriate user unit, i.e., PPM, GPM, GPH, etc. (see Section VIII, **“Programming Operational Variables”** in this manual for details and the list of display options.

Variable 03 - Feedback Pulses Per Revolution - This is the number of digital pulses produced by the feedback sensor on the monitored shaft for each shaft revolution.

Note: Variable 03 will not accept decimals, the entry must be a whole number.

Example 1 - The feedback sensor in this case is a Ring Kit at 60 ppr, mounted on the motor shaft. The rated motor speed is 1750 rpm, but the operation only requires 1500 rpm. The desired display is rpm. Then Variable 01 would be 1500, Variable 02 would be 1500, and Variable 03 would be 60.

Example 2 - In this case, the feedback sensor is a 600 ppr encoder, mounted on a intermediate downstream shaft. The speed of this shaft is not known, but we do know we want a maximum line speed of 200 feet per minute. Enter the PPR value (600 PPR) into variable 03. Then go into diagnostic 9 (explained in section IX: **“Calibrating the Isolated Command Output through the Drive”**) and slowly ramp up the system speed until 200 ft./min. is obtained. The display will read out the rpm value needed for Variable 01. In this example, 623 rpm. Now leave Diagnostic 9, and enter 623 into Variable 01, and 200 into Variable 02. Adjust the Output Span Potentiometer as shown in Section IX for proper operation.

VI. PROGRAMMING • FOLLOWER MODE

The Microspeed 196 in the Follower mode mirrors a lead frequency input, and can be scaled by the Ratio Set Point. The lead frequency is typically generated from a digital transducer on another shaft. The initial relationship between the lead and follower is set up in Variables 01 through 05. This relationship will be referred to as the Unity Ratio. First, program the Microspeed 196 Variables 01–03 per the Master mode instructions. Then, program the Lead Input to set up the Unity Ratio. The MicroSpeed 196 maintains both velocity and rotational control so that the cumulative following error is zero. A set point ramp, cessation of the lead frequency, or a STOP command, will set the follower error count to zero. The ACCEL and DECEL variables are active only when the Ratio Set Point is changed by a value greater than 10% of the Unity Ratio, or by a STOP command.

Note: Follower control operates best when the lead and follower frequencies are relatively equal. Example: When a lead frequency is 200 Hz, and the follower frequency is 2000 Hz, one lead pulse controls 10 follower pulses. This situation can result in unstable follower operation.

Variable 04 - Maximum Lead RPM - This is the maximum rpm of the lead motor, or of the shaft being monitored by the transducer that is producing the lead frequency signal. The relationship of the Maximum Lead RPM (Var 04) at the User Unity Ratio (Var 23) set point will result in the motor speed running at Maximum RPM (Var 01).

Variable 05 - Lead Pulses per Revolution - This is the number of pulses per revolution generated by the transducer that is producing the lead frequency.

Note: When generating the lead signal from a non-rotational source and only Hz. is known, enter 60 into Variable 05 (lead PPR). Then enter the frequency into Variable 04 (Max. Lead RPM).

Variable 23 - User Unity Ratio - This variable allows the Ratio Set Point to be programmed in User Units in the Follower mode (such as turns/foot). It is also used as the Unity Ratio value in the ratio tach display mode. When this value is entered into the Ratio Set Point, the follower motor will run at the relationship programmed into Variables 01-05.

Note: Variable 23 (User Unity Ratio) is applied when the operation is based on units other than time (i.e. threads/inch vs. cuts/minute). If your operation has a time based relationship, then leave Variable 23 at the default value.

Example: Assume that the Unity Ratio between the Lead and Follower in a ball screw thread-cutting operation results in 50.00 threads per inch being cut by the follower machinery at its fastest rate. The lead motor turns at 1000 RPM with 60 PPR. The follower motor must turn at 1500 rpm with 60 ppr. The variables would be programmed as follows: Var 01 & 02 = 1500, Var 03 = 60, Var 04 = 1000, Var 05 = 60, and Var 23 = 50.00.

Entering a Ratio Set Point of 50.00 will always produce 50 threads per inch. Changing the Ratio Set Point to 25.00 will halve the follower motor speed in relation to the lead motor and produce 25 threads per inch.

VII. PROGRAMMING • JOG MODE

When the Jog function is initiated and held, the MicroSpeed 196 will accelerate to the speed programmed in Variable 06. Variable 29 enables you to follow the accel/ decel times (Variables 07 and 08) or to bypass the ramp times.

Variable 06 - Jog Speed in User Units - Enter the desired jog speed in user units, then press ENTER.

Variable 29 - Jog Ramp Selection - This variable allows the operator to select the following jog ramp profiles:

- 0000 = No Ramp Time
- 0001 = Ramp on Decel
- 0010 = Ramp on Accel
- 0011 = Ramp on Accel and Decel

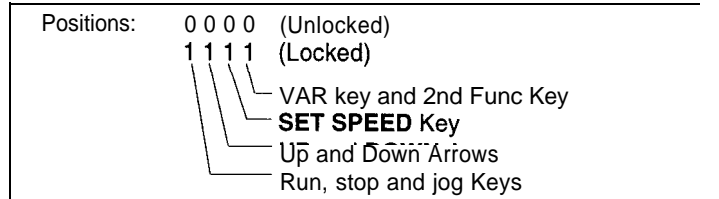
VIII PROGRAMMING • OPERATIONAL VARIABLES

Variable 07 - Acceleration Time - When the acceleration time is accessed, the alpha-numeric display will read AccTime. Enter the time in seconds desired for acceleration from 0V (motor stop) to maximum output. The smallest unit of time is 1/10 second.

Variable 06 - Deceleration Time - When the deceleration time is accessed, the alpha-numeric display will read DcelTime. Enter the time in seconds for deceleration from maximum output to 0V (motor stop). The smallest unit of time is 1/10 second,

Variable 11 - Keypad Lockout - When Variable 11 is accessed, the alpha-numeric display will read Key Lock. Each zero represents a different section of the keypad that can be independently “locked.” The section of the keypad that is locked is determined by placing a 1 (one) in the appropriate location. Any section or combination of sections can be locked. (See chart below for lockout positions and descriptions.) After all programming and tuning is complete, activate the lock out by installing a jumper on TB1-12 to TBI-11.

Note: It is recommended that you “lock out” your variables, so that the MicroSpeed 196 cannot be inadvertently reprogrammed.



DISPLAY:

Variable 21 - Display Selection - This Variable allows the user to select the information that will be displayed on the Numeric display. Mode 0000 is commonly used in normal operation, while modes 0001 through 0007 are typically used during setup or troubleshooting only. When Variable 21 is selected, the alphanumeric display will read

Display#. To select the numeric display mode during operation, enter a number from the following list:

- 0000 = Tachometer in User Units
- 0001 = Feedback Frequency in Hertz or Kilohertz
- 0002 = Lead Frequency in Hertz or Kilohertz (Follower)
- 0003 = Auxiliary Frequency in Hertz (Auxiliary Mode)
- 0004 = Follower Error in Number of Pulses
- 0005 = Total Output in DAC Bits (0 to 4094)
- 0006 = Output Error in DAC Bits (-999 to 4094)
- 0007 = Alarms (a “1” Indicates the Alarm Is Active)
 - 1000 = Zero Speed
 - 0100 = High Alarm
 - 0010 = Low Alarm
 - 0001 = Deviation Alarm

Variable 22 - Follower Display - When the MicroSpeed 196 is in the Follower mode, the numeric display can be used as a linear tachometer (displaying actual speed in user units), or it can be used to display the ratio that the Follower is maintaining to the lead (i.e. the unit would read 1.000 when the follower was running at a 1:1 ratio to the lead). When Variable 22 is selected, the alphanumeric display will read **Tach Sel**. To select between the two follower display options, enter one of the following numbers:

- 0000 = Linear Tachometer in User Units (Units from Variable 02)
- 0001 = Ratio Tachometer in User Ratio Units (Units from Variable 23)

Variable 10 - User Unit Label - This variable allows the user to select what the alphanumeric display will display during normal operation -when the display is in Tach in User Units mode. The default label is RPM. To program Variable 10, enter the code that corresponds to the desired user unit label from Table 3 below.

Table 3 - User Unit Labels

0- R P M	1 · FPM	2- GPM
3 · REV/SEC	4- REV/MIN	5- REV/HR
6 · INCH/SEC	7 · INCH/MIN	8 · INCH/HR
9 · FEET/SEC	10 · FEET/MIN	11 · FEET/HR
12 · YARD/SEC	13 · YARD/MIN	14 · YARD/HR
15 · MM/SEC	16 · MM/MIN	17- MM/HR
18 CM/SEC	19- CM/MIN	20 · CM/HR
21 · MET/SEC	22 · MET/MIN	23 · MET/HR
24 · OZ/SEC	25 · OZ/MIN	26- OZ/HR
27 GAL/SEC	28- GAL/MIN	29- GAL/HR
30 · ML/SEC	31 · ML/MIN	32 MI/HR
33 · LIT/SEC	34 · LIT/MIN	35 · LIT/HR
36 · HERTZ	37 · KHERTZ	38 · MHZ
39 · BOT/SEC	40 · BOT/MIN	41 · BOT/HR
42 · CAN/SEC	43 · CAN/MIN	44 · CAN/HR
45 · LBS/SEC	46 · LBS/MIN	47 · LBS/HR
48 · TURN/SEC	49 · TURNIMI	50 · TURN/HR
51 · THRD/SEC	52 · THRD/MI	53 · THRDIHR
54 · PART/SEC	55 · PART/MIN	56 · PARTSIHR
57 · Percent%	58 · RATIO%	65 · Customized

Diagnostic 0 – Custom User Unit Labels:

If the choices presented in Variable 10 do not provide the display that is needed, a Custom User Unit Label can be created, for both Master and Follower modes if the MicroSpeed 196 will be used in both modes. When programming the MicroSpeed 196 custom display, the Master/Follower input must be in the appropriate position.

Note: The Custom User Unit Label has two preprogrammed labels; one for Master Mode, defaulted to “RPM”, and one for Follower Mode, defaulted to “Ratio % “.

The following characters are available in the User Unit display:

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789/*_and”blank.”

Use the following steps to program the desired display:

1. Enter Diagnostic 0 by pressing **2ND Func** and then the 0 key.
2. The alphanumeric display will show eight underscore characters:
 ----- Press the ↑ (up arrow) or ↓ (down arrow) key to scroll through the list of characters until the desired character for the first position is displayed.
3. Press the Enter key. This will lock the character into that position and move to the next character on the eight character display. Repeat steps B and C until all eight characters have been selected and entered.
4. After the rightmost character has been entered you will exit Diagnostic 0 and return to the READY mode.

Note: Pressing 2nd Func at any time will cause an exit from Diagnostic 0 and will return the MicroSpeed 196 to the READY mode.

5. To display your custom user unit label during operation, set variable 10 to 65 (The preprogrammed user unit labels in Variable 10 are still available by setting Variable 10 to the desired display number.

To clear the previously programmed label, re-enter to Diagnostic 0 (See Step 1 above for instructions.)

STATUS AND ALARM OUTPUTS:

Variable 18 - Drive Enable - This output is designed to give the MicroSpeed 196 control of the Run/Stop input on the controlled drive or other MicroSpeed 196's, based on the conditions it is monitoring. Drive Enable is actuated when RUN or JOG is pressed, and is deactivated automatically when E-Stop is pressed, or upon loss of power, thus disabling the drive. Drive Enable will perform one of the following options when a normal STOP command is given.

The following options can be entered into Variable 18:

Variable 18 – 0001 The **Drive Enable** output waits for the Command Output Voltage to reach 0V (zero) before disabling the drive.

Variable 18 – 0002 The **Drive Enable** output waits for the Command Output Voltage to reach 0V (zero) and for the Feedback frequency to reach 0Hz (zero) before disabling the drive.

Variable 18 – 0003 The **Drive Enable** output immediately disables the drive upon a STOP command, and the Analog Output goes to zero (0) immediately.

Note: Disabling the drive prevents any motor creep or other unwanted motor movement when the motor is stopped.

Variable 15 - High Alarm - This output is activated if the speed of the monitored shaft exceeds the value programmed. When **High Alarm** is accessed, the alphanumeric display will read "**Hi Alarm**". Enter the speed in user units above which the High Alarm output will be activated.

Variable 16 - Low Alarm - This output is activated if the speed of the monitored shaft drops below the level of the number entered in this variable. When the **Low Alarm** is accessed, the alphanumeric display will read "**Lo Alarm**". Enter the speed in user units under which the **Low Alarm** output will be activated.

Variable 17 - Deviation Alarm - This output is active in the Follower mode only, and is programmed in revolutions of the follower feedback sensor. No decimal points are allowed in this entry. The output will activate if the follower feedback sensor deviates ahead or behind the lead shaft exceeding the programmed revolutions.

IX.

Tuning the MicroSpeed 196

Calibrating the Isolated Command Output to the Drive:

1. Program the MicroSpeed 196 variables.

Note: Variable 03 PPR must be programmed.

2. Select the proper polarity of the Command Output Voltage using the Forward/Reverse Input. (Open = Positive; Closed = Negative)
3. Access Diagnostic 9 (Digital Potentiometer) by pressing 2nd Function key, then the 9 key. The alphanumeric display will read Pot % 00.
4. Adjust the Zero Offset potentiometer (located on the back of the MicroSpeed 196) clockwise (or counterclockwise if reverse is selected), until the motor begins to creep, then back off until it stops creeping.
5. Press and hold the ↑ (up arrow) key until the alphanumeric display reads Pot % 90. The numeric display will be showing motor speed in RPM. Adjust the Output Span potentiometer (CW increases, ccw decreases) until the rpm displayed in the numeric display is equal to the maximum rpm programmed in Variable 01.

Note: The drive and motor are set up to run at maximum speed while the MicroSpeed 196 is providing 90% Command Outputs, so that 10% Command Authority will be available to compensate for slowdown caused by loading, etc., when the motor is running at maximum set point.

6. Press and hold the **DOWN** arrow key until the alphanumeric display reads **Pot % 00**.
7. Press **2ND FUNC** to exit the **Digital Potentiometer** mode.

FUNCTION AND TUNING OF THE PID VARIABLES:

The PID Variables make up the difference between the Expected Analog Output and the Required Analog Output. The Expected Analog Output is based on a linear relationship of 0-90% Command Output equal to 0 – 100% of the maximum speed entered into Variable 01. The Required Analog Output is the actual Command Output necessary to maintain the correct speed. A 0-100% Command Output is equal to 0-4094 DAC bits,

IMPORTANT! Higher values in the PID Variables result in a faster correction time and a tighter motor speed control. If the difference between the Expected Output and the Required Output is extreme, the MicroSpeed 196 will begin changing its output in the wrong direction, before the increasing error allows the PID Variables to overcome this. Therefore, adjusting the output to the drive is very important.

PID VARIABLES:

Variable 12 - (P) Proportional (or Gain) - Gain is the most active and important tuning Variable. The Gain correction takes place every .01 seconds. A higher value entered in this Variable (a number between 1 and 100) results in a faster change in the Command Output to correct for error and, therefore, tighter motor control.

In the Master mode, the correction amount is based on the formula:

$$\frac{\text{Percent error from the desired speed} \times \text{Gain number} \times \text{the last DAC value} \times \text{a constant}}{8}$$

In Master Mode, the correction is limited to 25% of the total output per 10 msec cycle.

In the Follower mode, the correction change is based on the formula:

$$\frac{\text{Pulses of error} \times \text{Gain number}}{8}$$

Variable 13 - (I) Integral (or Reset) - The **Integral** operates as a long term correction. It will add or subtract one DAC bit based on a positive or negative error. If the **Integral** error is set at 100, this will happen every 20 msec. Each whole number below 100 will add 10 msec to the loop time this bit is added.

Variable 14 - (D) Derivative (or Rate) -The **Derivative** operates as a boost to the **Gain** (Variable 12). Its function is to reduce the time it takes to eliminate a large error. In Master mode, it operates identically to the **Gain**, except it has only half the authority to change the output. In Follower mode, it operates identically to the **Gain** with the same authority, but is only active when the error is greater than one Follower Feedback Sensor revolution.

Use the following steps to tune the PID Variables:

Note: Before beginning PID tuning, be sure that the Command Output has been calibrated to the drive, and that all ACCEL and DECEL adjustments on the drive have been set to their minimum positions. Failure to make these adjustments will degrade the accuracy of the control.

1. Set Variable 13 (I) and Variable 14 (D) to zero (0).
2. Start the motor and set the speed to run at the most common operating speed.
3. Begin increasing the **Gain** (Variable 12) until instability (over and undershooting) occurs. At this point, decrease the **Gain** until the motor stabilizes. The motor should now be operated at different speeds throughout the operation range to ensure stability.
4. Begin adding **Integral** (Variable 13) into the control loop. Keep increasing this number until the motor begins to hunt above and below the Set Point, then back off the number until the hunting stops.
5. **Derivative** (Variable 14) can then be activated. Again, increase the value until instability occurs and then back off. The most common value is usually from 50 - 100% of the value in the **GAIN** variable.
6. Run the the motor at all operating speeds to ensure stability. If instability occurs, retune the PID parameters at the unstable speed.

FOLLOWER MODE PID CONSIDERATIONS:

Variable 09 - Max Lead Wind-Up - If you are speed matching and have very fast master speed changes, or if you are bringing the Follower motor on-line with the master motor already running, you may want to limit the maximum error accumulated. The MicroSpeed 196 can be programmed to make up every revolution missed, up to 9,999, or can be limited down to one revolution. Care must be taken, however, not to limit the error count so low, that the MicroSpeed 196 cannot hold correct speed.

*Note: Most applications should leave **Max. Lead Wind-Up** at the default value of 100.*

Using the integral? - The MicroSpeed 196 in the Follower mode operates on a zero error basis. For every master pulse, the MicroSpeed 196 will attempt to force a corresponding follower pulse. The MicroSpeed 196 generates its expected analog output based on the frequency of the lead motor. The **Gain** variable then uses error pulses between the master and follower motor to lock the speeds together. Some phase error between the shafts will occur. The degrees of phase error depends on the **Gain** number (Var 12) x pulses per revolution, and the difference between the expected and required output. If you are speed matching, a phase error is not a problem. If you need the phases locked, you must add Integral to the PID loop. Integral (Var 13) will add or subtract one DAC bit (out of 4095) at the programmed rate until the error count is zero pulses. Integral will over or under-speed the motor for the required time period. (This is not desirable if you are only speed matching.)

Softening the Master Motor - Every system (motor, drive, gearing, and load) has a response time i.e., the ability of the system to respond to a change in speed command. If we demand a change that is faster than a machine's response time, we generate error. Often when a follower motor's speed is erratic (jumping or lagging), the only way to correct this is to slow down the rate of change on the master motor. This includes the ACCEL and DECEL rates, as well as the PID on the master control. Basically, this allows the follower control's PID Variables the time needed to overcome the delays in the follower system. To slow down the PID response of the master - the MicroSpeed 196 - turn the **Derivative** to zero, increase the **Integral** and reduce the **Gain**. This will **slowly** correct the lead motor's speed.

XI.

DIAGNOSTIC TESTS AND 2ND FUNCTION KEY

To access the Diagnostics and 2nd Functions, the unit must be in the “Ready” mode, press **2ND FUNC**, then enter the number of the diagnostic test desired. To exit the diagnostic test, press **2ND FUNC** again.

Diag. 0 - Custom User Label Programming - THIS IS NOT A TEST!
Refer to Section VIII, “*Programming the Display*,” for information.

Diag. 1 - Keypad Test - In this test, pressing each key on the front panel keypad will result in the alphanumeric display showing the name of the key pressed. The numeric display will show 0000 for keys that are not numbers, and will display the numeral (for example: 1111, 2222, etc.) when the number keys are pressed. If any key does not produce the proper display, that key may not be functioning. Contact the factory if this occurs.

Diag. 2 - Display Test - This test is to make sure that all of the LED segments on the displays and all of the LED indicator lights are working correctly. During the test, the Numeric display will scroll through all the numbers (i.e. 1111, 2222, 3333, etc.) and will place the decimal point in each possible location. The alphanumeric display will also display all of the numbers (i.e. 11111111, 22222222, etc.). The six LEDs on the front of the unit indicating switch position and operating condition will light up one at a time. If a segment is missing, or an LED indicator light fails, contact the factory.

Diag. 3 - Input Switch Test -This is a test for each of the remotely wired inputs. Each possible input (**Local/Remote, Keypad Lockout, Forward/Reverse, etc.**) is represented by a 0 or a 1 on the alphanumeric display. The **E-Stop, Run, Jog,** and **Stop** inputs are represented by a 0 or a 1 on the speed display. Toggle the input to check whether or not it is properly wired. When the digit corresponding to that input is displayed as 0 the switch is Open, when it is displayed as 1 it is activated. E-Stop and **Stop** are 1 when opened and 0 when closed. **Left to right**, the eight digits on the alphanumeric display (00000000) correspond to the following inputs: Closed/Open Loop; Master/Follower; Forward/Reverse; Keypad Unlocked/Locked out; Set Point 1(3)/2(4); Set Point 3 & 4 Disabled/Set Point 3 & 4 Enabled; No Scroll/Scroll Down; No Scroll/Scroll Up. Left to right, the four digits on the numeric display (0000) correspond to the following command inputs: E-Stop; Run; Jog; Stop.

Diag. 4 - Memory Test - This is an internal test by the micro-processor on its memory locations. The alphanumeric display will show “Test ROM” for a few seconds, then it will show either, “ROM ok” or “Fail.” If the test fails, contact the factory.

Diag. 5 - Alarm Output Test - This is a test of the Status and Alarm outputs. In this test, pressing a 1 through 6 on the keypad will result in completion of one of the Output circuits. When in this diagnostic, the alphanumeric display will read “Output” until a key (1 through 6) is pressed, then it will name the output being tested and the circuit will be completed. A light wired into the circuit will illuminate, a relay will actuate, or an alarm will sound, depending on how the circuit is wired. After an output is tested, press the STOP button to turn the output off. To exit the Diagnostic, press the Stop, then

the 2ND FUNC key. The following numbers correspond to the following outputs:

1 = Ramp Complete; 2 = Zero Speed; 3 = High Alarm; 4 = Low Alarm; 5 = Deviation Alarm; 6 = Drive Enable

Diag. 6 - Communications Test - This test is used to test the RS422 hardware. To perform the test, place a jumper wire between the Send and Receive lines at the terminal (RXD- to TXD- and RXD+ to TXD+). The MicroSpeed 196 tests its communication circuitry to make sure it is functioning. If it is, the alphanumeric display will read “Pass” and the numeric display will name the node address. If it is not functioning properly, the alphanumeric display will display “Fail.”

Diag. 7 - Reset to Factory Programming -This is Not a Test. Pressing 2nd FUNC, then accessing Diag. 7 will reset the programming in memory to the factory defaults (see Appendix I for factory default settings). The alphanumeric display will read “Reset”.

Diag. 8 - Not Used.

Diag. 9 - Digital Speed Pot - This function is explained in Section IX “*Calibrating the Isolated Command Output to the Drive*”. It can be used as a test of the analog output.

XII. SERIAL COMMUNICATIONS • VIA RS422

USING THE REMOTE SERIAL INTERFACE:

To control through the RS422 Serial Interface, the **Local/Remote Input (TB1-10)** must be closed to common (**TB1-11**). This allows the MicroSpeed 196 to accept commands over the RS422 link. The MicroSpeed 196 can be set up to only accept commands over the RS422 link, or to allow some operator control as programmed with Variable 30. All new set points and programming must come over the RS422 link, except for speed changes with the scroll, or set point 1 - 4 switches. The **E-Stop** input is also active in any mode of operation, and cannot be disabled.

Note: It is recommended that an optically isolated RS422 link be used between your computer and the MicroSpeed 196. Electrical noise will corrupt data on the computer, causing it to send bad data, interpret data incorrectly, or lock up computer functions. Prolonged exposure of your computer to electrical noise will destroy your computer!

Important: Remote setup Variables must be Setup from the keypad.

VARIABLE 19 - NODE ADDRESS - Enter an address from 1 - 99. This address will be used in the command format to talk to the MicroSpeed 196 with that specific address. When using a global command (address 00) the MicroSpeed 196 with node address 01 will be the only MicroSpeed 196 to answer the host computer, but all MicroSpeed 196's will respond to global commands. Never duplicate an address on the same communications port.

VARIABLE 20 - BAUD RATE - Enter the number (1-6) corresponding to the desired operating baud rate. Each character has one start bit, eight data bits, one stop bit, and no parity.

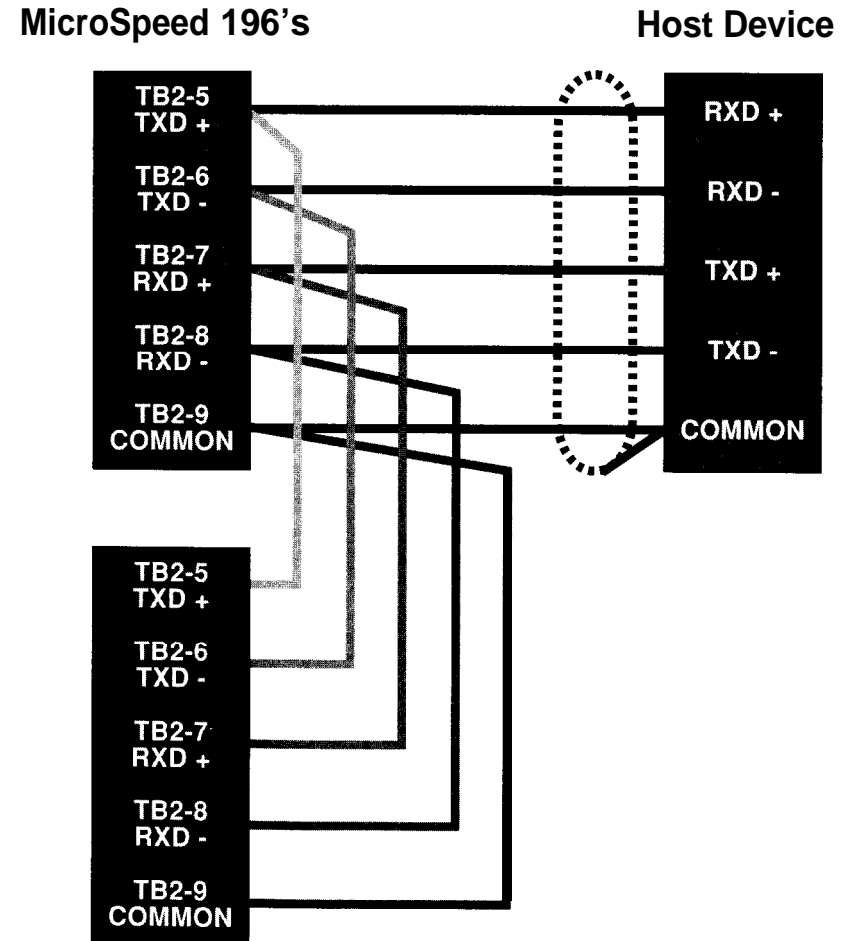
- 1 = 300
- 2 = 1200
- 3 = 2400
- 4 = 4800
- 5 = 9600
- 6 = 19200

VARIABLE 30 - EXTERNAL SWITCH ENABLE IN REMOTE MODE - This variable allows the external inputs to be active during Remote mode. Entering a 1 enables the function. Entering a 0 disables the function. Default is 0000, or all functions controlled by the RS422 link. Any combination of functions can be selected:

- 0001 = Run, Stop, and Jog inputs enabled
- 0010 = Forward/Reverse, Master/Follower, Closed/Open Loop, Scroll up and Scroll Down inputs enabled
- 0100 = Set Points 1,2,3&4 Enabled
- 1000 = Keypad **RUN**, **STOP**, and **JOG** enabled

Variable 48 - Buffer Error - This variable is used to help diagnose communication errors. If the variable displays a 1, then characters outside the Microspeed 196 protocol format have been received by the MicroSpeed 196. If the variable displays a 2, then transmissions have been sent to the MicroSpeed 196 faster than it can process the information and respond. The most recent error is kept in this variable until you set it to 0.

Diagram 8
RS422 Hook-Up



COMMUNICATION PROTOCOL:

The communication protocol is a 13-character command format. Each character has one start bit, eight data bits, one stop bit, and no parity. The host sends messages in this format and the addressed MicroSpeed 196 responds in the identical format. The time from the end of the host message to the beginning of the MicroSpeed 196 message can vary from 10 to 30 milliseconds, depending on the type of the host message. The following diagram shows the command format.

0	1	2	3	4	5	6	7	8	9	10	11	12
stx	device	node	node	mess	var#	var#	data	data	data	data	dec.	etx
	type	addr	addr	type	10's	1's	1000's	100's	10's	1's	pt.	
		10's	1s								loc.	

Char #	Description	ASCII Value	hex	Typical Keyboard
0	stx (start of transmission)	02	hex	ctrl-B
1	device type	03	hex	0
2	node address (10's digit)	30-39	hex	0-9
3	node address (1's digit)	30-39	hex	0-9
4	message type	30-33	hex	0-3
5	variable (10's digit)	30-39	hex	0-9
6	variable (1's digit)	30-39	hex	0-9
7	data (1000's digit)	30-39	hex	0-9
8	data (100's digit)	30-39	hex	0-9
9	data (10's digit)	30-39	hex	0-9
10	data (1's digit)	30-39	hex	0-9
11	decimal point location	30-34	hex	0-4
12	etx (end of transmission)	03	hex	ctrl-C

DESCRIPTION OF CHARACTERS:

Character 0 - stx - This character is used to indicate the start of a message. The MicroSpeed 196 uses this character to open a new segment in the receive buffer.

Character 1 - Device Type - Always a 0 for the MicroSpeed 196.

Character 2 and 3 - Node Address (10's and 1's digits) - Used to select an individual MicroSpeed 196 on the communications link. Corresponds to Variable 19 on the MicroSpeed 196. Character 2 is the 10's location and character 3 is the 1's location. A node address of 00 is a **Global Command**. All MicroSpeed 196 units are affected by a global command, but only address 01 will return a response to the host.

Character 4 - Message Type - Tells what kind of message is being sent. This is also the location at which the MicroSpeed 196 will indicate an error in a host communication. Valid characters from the host are 0 (command), 1 (read variable), or 2 (write variable). The MicroSpeed 196 will echo the host in this character location unless the host communication message has an error; if this occurs, it will send back a 3 (error).

Characters 5 and 6 - Variable Number (10's and 1's digits) - These are variable number specifiers during read and write messages. In command messages, the Character 6 (1's) location specifies the type of command (start, stop, etc). In an error response from the MicroSpeed 196, the error type is specified in Character 6.

Characters 7-10 - Data Field - These characters hold the data being passed between the host and the MicroSpeed 196. Ch#7 = 1000's, Ch#8 = 100's, Ch#9 = 10's, Ch#10 = 1's.

Character 11 - Decimal Location - This specifies the location of the decimal point in the data field.

Value Entered	Decimal Location
0	X.XXX
1	XX.XX
2	XXX.X
3	XXXX.
4	XXXX (no decimal point)

Character 12 - etx - This character signifies the end of the message transmission.

USING THE SERIAL PROTOCOL:

Global Messages - The global message is given using the **Node Address 00**. Only **Node 01** will return a response, but all MicroSpeed 196 units will act on the message.

Note: Global Read commands are not allowed and will prompt Node 01 to respond with an error message.

Read a Variable - 1 - Select the Node Address (you cannot do a global read). Enter the message type as 1 (Ch#4). Enter the variable you wish to read into Characters 5 and 6. The MicroSpeed 196 will mirror the message string with the data and decimal field filled.

Example: Read Node 1, Variable 01, when Variable 01 = 1800
 Message Sent - stx00110100000etx
 Message Returned - stx00110118004etx

Write to a Variable - 2 - Used just like a read, only the message type is 2, and you must fill the data field and decimal locator. A global write command is allowed.

Example: Write Node 27, Variable 02, the Data 15.00
 Message Sent - stx02720215001etx
 Message Returned - stx02720215001etx

Command Messages - 0 - There are 9 different command messages that can be sent to the MicroSpeed 196. Enter the 0 as the message type (ch# 4) and the command type (0-8) is entered into the character 6 location var# 1's).

MESSAGE TYPE	COMMAND TYPE	FUNCTION
0	0	Start
0	1	Stop
0	2	E-Stop
0	3	Set to factory defaults.
0	4	Change set point (immediate change).
0	5	Load master set point (wait for execute).
0	6	Execute loaded master set point.
0	7	Load follower set point (wait for execute).
0	8	Execute loaded follower set point.

Example: Command All MicroSpeed 196 units to Stop
 Message Sent- stx00000100000etx
 Message Returned- stx00100100000etx

Command Message Type Definitions:

Start - 0 - Starts the specified MicroSpeed 196. If the front or back panel stop has been enabled (with Var 30) and **Stop** is held, this command will be ignored.

Stop - 1 - Stops the specified MicroSpeed 196.

E-stop - 2 - E-stops the specified MicroSpeed 196.

Set to Factory Defaults - 3 - Sets all variables, except Node Address (Var 19) and Baud Rate (Var 20), to the default values.

Set Point Changes:

Only the active set point can be changed via commands 4 – 8. To change a nonselected set point, use the write message type. The decimal location is fixed by Variable 02 in the Master mode or Variable 23 in the Follower mode. You cannot write to the active set point's variable while running.

Change Set Point - 4 - Changes the presently selected set point to the value sent.

Load Master Set Point - 5 - Allows for a new speed set point to be loaded, but not executed. The value will be stored in Variable 49.

Execute Master Set Point - 6 - Moves the loaded speed set point into the active set point (1 – 4), and ramps to the new value.

Load Follower Set Point - 7 - Allows for a new ratio set point to be loaded, but not executed. The value will be stored in Variable 49.

Execute Follower Set Point - 8 - Moves the loaded ratio set point into the active set point (1 – 4), and ramps to the new value.

Error Message - 3 - If the MicroSpeed 196 detects an error in a message, it will respond with a 3 in the Character #4 position. The type of error will be specified in the Character #6 position.

Error type	Problem
1	Parity Error (Standard Definition)
2	Data Error (Data Outside of Range 1 - 9)
3	Global Read Error (Cannot Use the Address 00 During Read)
4	Ext Error (Ext Came Early, Late or Not At All)
5	Command Error (Reference Below)

Command Error - Any of the following conditions will give a command error:

- Message type out of range (0-2).
- Command type out of range (0-8).
- Variable value out of range.
- Write command sent to a protected variable while running.
- Command or write sent while in local mode.
- Load or execute new Master set point while in Follower mode.
- Load or execute new Follower set point while in Master mode.

REMOTE VARIABLES:

The Following variables are only available over the RS422 serial port:

- 49 - New Set Point (Explained in Command, Changing Set Points – Monitor only)
- 50 - Serial Status (Explained Below – Monitor Only)
- 51 - Master or Follower Mode (0=Master, 1=Follower)
- 52 - Closed or Open Loop (0=Closed Loop, 1 =Open Loop)
- 53 - Forward or Reverse (0=Forward, 1 =Reverse)
- 54 - Master Set Point 1 in User Units
- 55 - Master Set Point 2 in User Units
- 56 - Master Set Point 3 in User Units
- 57 - Master Set Point 4 in User Units
- 58 - Follower Set Point 1 in User Ratios
- 59 - Follower Set Point 2 in User Ratios
- 60 - Follower Set Point 3 in User Ratios
- 61 - Follower Set Point 4 in User Ratios
- 62 - Display (Explained Below – Monitor Only)
- 63 - Alarm Status (Explained Below – Monitor Only)
- 64 - Spare for Future Use
- 65- Spare for Future Use

Serial Status: Variable 50 - Contains information on the present state of the MicroSpeed 196. The data is returned in Characters 7 – 10.

Char #7 (1000's) Operation	Char #8 (100' s) status Local/Remote	Char #9 (10 's) Active Set Point
0 = E-Stop	0 = Local	1 = set point 1
1 = Deceling	1 = Remote	2 = set point 2
2 = Stopping		3 = set point 3
3 = Acceling		4 = set point 4
4 = Running		
5 = Ready Mode		
7 = No Feedback		
8 = Digital Speed Pot Mode (Diag #9)		

Variable 62 - Display - This variable will return whatever is *on the numeric display of the MicroSpeed196*. Refer to display variables 21 and 22 for information on what can be displayed.

Note: It is possible to receive a negative sign in Character #7, (1000's data) if the follower error-pulses, or the error output is being displayed.

Variable 63 - Alarm Status - Refer to Display (Variable 21) for coding. This will return the status of the alarm outputs, per Variable 21, Option 7.

SERIAL COMMUNICATIONS APPENDIX

Protected Variables in the Run Mode:

Var 01	Maximum Speed in RPM
Var 02	User Units at Maximum Speed
Var 03	PPR
Var 04	Maximum Lead RPM
Var 05	Lead PPR
Var 23	User Unity Ratio
Var 51	Master/Follower

The active set point will only change with a Change Set Point command. A write command to the active set point while running will return an error message.

Possible Causes for No Communications.

The unit does not act on or respond to messages sent.

1. Check Baud Rate and Address.
2. Check wiring.
3. Check Variable 48 for buffer communication errors.
4. All 13 characters not sent.
5. Check power to unit.
6. Do a Diagnostic 6 communications test,

The unit acts on a message but does not return a response.

1. Using global commands without Node 1 on line.
2. Not waiting long enough for response.
3. The MicroSpeed 196 transmit lines are open or shorted.
4. More than one MicroSpeed 196 with the same node address.
5. Do a Diagnostic 6 communications test.

APPENDIX A

SPECIFICATIONS

Input Power:

Voltage	115 Vac, or 230 Vac, 50/60 Hz, 10
Fuse	1/4 Amp. Fast Blow, 115 Vac./ 1/8 Amp. Fast Blow, 230Vac.
Transducer Supply	12 Vdc, (unregulated) 250 mA Max.

Transducer Input:

Wave Shape	Square, Sine
Types	NPN Open Collector - PNP Open Collector - Magnetic Pickup (Zero Crossing) - Logic Level
Maximum Input Frequency	40 Khz - Master, 32 Khz - Follower
Internal Pull-Up	2.2 K Ω , Pull-up to 12 V
Trigger Levels	2.5 Vdc NPN, PNP, and Logic Level 50 mV - Zero Crossing (100 mv Peak Minimum Signal)

Analog Output:

Type	Optically Isolated 0 to ± 15 Vdc
Maximum Output Current	Adjustable from ± 3 Vdc to ± 15 Vdc 10 mA Maximum
Resolution	12-bit D/A Converter

External Control Inputs (Back Panel):

Sustained Contact Closures	Forward/Reverse Closed Loop/Open Loop Master/Follower Keypad Unlocked/Keypad Locked Set Points 1 & 3 / Set Points 2 & 4 Set Points 3 & 4 Enable Local Command/Remote Command
Momentary Contact Closures.	Scroll Up/12 Scroll Down

External Start/Stop Switches (Back Panel):

Momentary, N.O.	Run
Momentary, N.C.	Stop
Momentary, N.O.	Jog
Momentary, N.C.	Emergency Stop

Back Panel Transistor Outputs:

NPN, open Collector Drivers (50 Vdc Max, 250 mA .3 Watts Max.)	High Alarm Low Alarm Ramp Compete Zero Speed Deviation Drive Enable
--	--

Operational Specifications:

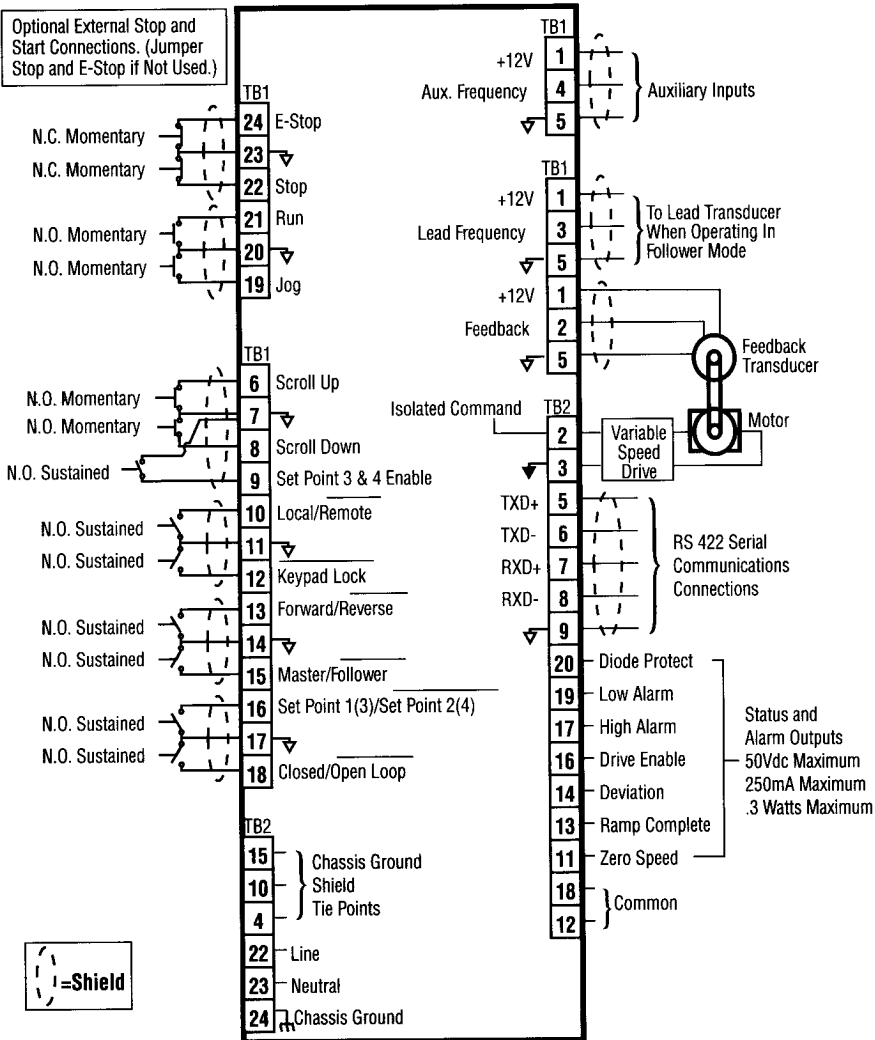
Accuracy	.01% of Speed Set Point (Master) Zero Cumulative Error (Follower1)
Respons	10-Millisecond Control Loop, Individually Adjustable PID Gains
Modes of Operation	Master/Follower/Auxiliary Trim
Preset Speeds	4 Master, 4 Follower, 1 Jog
Accel/Decel Times	User Programmable from 0.1 to 600 Seconds
Processor	Intel 80C196TB 16-Bit Micro Controller
Speed Display	4-Digit, 7-Segment LED, .43-Inch height
Alphanumeric Display	8-Character, 5 x 7 Dot Matrix, .20-Inch height
Function LEDs	1 Run (Green) 1 Stop (Red) 1 Local (Amber) 1 Remote (Amber) 1 Set Point 1 (Amber) 1 Set Point 2 (Amber)
Diagnostics/2nd Function	Diag. 0 Custom User Unit Display Diag. 1 Keypad Test Diag. 2 Display Test Diag. 3 Input Test Diag. 4 Memory Test Diag. 5 Output Test Diag. 6 Serial Interface Test Diag. 7 Return to Factory (Programming Defaults) Diag. 8 Not Used Diag. 9 Digital Speed Potentiometer
Computer Interface	RS422 Interface Standard, 300 to 19200 Baud, 13 Character String, 1 Start, 8 Data, No Parity, 1 Stop

Mechanical/Environmental Specifications:

Enclosure Material	Cold Rolled Steel
KeyPad	Tactile Feedback Membrane, Chemical Resistant, Splashproof
Operating Temperature	0°C to +50°C
Humidity	0 to 90%, Non-Condensing
Panel Cutout	5.4-inch Width x 2.7-inch Height x 7.20-inch Depth
Weight	6 lbs.

Specifications Subject to Change Without Notice

Optional External Stop and Start Connections. (Jumper Stop and E-Stop if Not Used.)



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