

Micro9000™  
Preconfigured  
Solutions  
Drive Adjustment  
Supplement  
Follower Section



Startup and Installation  
Instruction Manual D2-3238  
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**ELECTRIC SYSTEMS, INC.**  
**Chattanooga, Tennessee**



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# PRE-CONFIGURED SOLUTIONS DRIVE ADJUSTMENT SUPPLEMENT FOLLOWER SOLUTION

## INTRODUCTION

### DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED, SHOULD INSTALL, ADJUST, OPERATE, AND/OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

### WARNING

THIS MANUAL IS A SUPPLEMENT TO MANUAL D2-3236. COMPLETE ALL PROCEDURES IN D2-3236 EXCEPT THOSE ENTITLED "TUNING THE DRIVE" BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

This supplement is intended as a final software adjustment guide specifically for the Follower Solution. The adjustments described in this supplement must be made in addition to the instructions stated in Instruction Manual (D2-3236) and sales order documentation provided with the drive. This supplement will be referenced in those documents when applicable.

The Follower Solution Drive has been

preconfigured to "follow" a selected reference input. The choice of Manual or Auto Mode are provided for speed regulation. In the Manual Mode of operation, drive speed is regulated with a speed potentiometer for full speed adjustment (acceleration or deceleration). In the Auto Mode (or Follower Mode), in addition to a 0–10 volt and 4–20 mA input, the drive also accepts a frequency speed reference (0–100 kHz). An internal preset (JOG mode – Forward/Reverse) is available and adjustable. In the Auto Mode, the Manual speed potentiometer acts as a proportional line speed trim of up to 20% of the Auto Mode reference. The Major loop feedback (analog or digital tachometer) is selectable through jumper connections. Also selectable is armature voltage feedback with or without IR compensation. The analog output signals (10 VDC analog and 100 kHz frequency) can be scaled to the required values for the application. Also provided in this supplement are instructions to adjust maximum speed in Manual and Auto Mode, minimum speed (for Manual operation only), and scaling of speed level and current level detection outputs.

Following this introduction is a "Glossary of Adjustments." This glossary is intended as a guide for locating desired adjustments. It is organized in alphabetical order by adjustment and refers the user to the appropriate sec-

tion. At the end of this supplement is a "Variable Adjustment Log". This log lists all of the adjustments in the order as they appear in this supplement, the variables that the adjustments affect, the factory set default value, and gives a space to write in the new value assigned to that variable.

The following adjustment instructions are given in this supplement:

### Section 1:

**Speed Feedback Scaling** – Setting or scaling the values for analog or digital tachometer input.

### Section 2:

**Speed Reference Scaling** – Scaling the speed reference inputs for Manual Mode or Auto Mode reference input, and preset Jog Mode (Forward/Reverse).

### Section 3:

**Output Signals** – Adjusting the analog, frequency and digital outputs to achieve the desired speed, current, and monitoring signals.

### Section 4:

**Final Adjustments** – Tuning the drive to the application.

### Section 5:

**Save Parameters** – Saving the changes made to the drive configuration.

## GLOSSARY OF ADJUSTMENTS

Function Name	Description	Section
A-C Line Frequency	Frequency of the A-C Line	4: Final Adjustments
Acceleration Rate (Manual Mode)	The rate at which the motor accelerates with Manual speed reference from zero.	4: Final Adjustments
Current Indication (Analog)	Output proportional to the motor armature current 0 – 10VDC, or 0 – +/-10VDC (S6R only)	3: Output Signals
Current Indication (Frequency)	A variable frequency pulse train output used to give indication of motor armature current (0–100kHz)	3: Output Signals
Current Level Detector	Output used to indicate when the drive has reached a desired current level	3: Output Signals
Current Limit (Negative)	The preset value at which the output current is limited in the motoring reverse direction or regenerating (REGEN) in the forward (FWD) direction (S6R only)	4: Final Adjustments
Current Limit (Positive)	The preset value at which the output current is limited in the forward (FWD) direction or regenerating (REGEN) in the Reverse (REV) direction (S6R).	4: Final Adjustments
Deceleration Rate (Manual Mode)	The rate at which the drive output decreases from manual top speed to zero.	4: Final Adjustments
IR Compensation	Compensates for speed droop due to IR drop in a voltage regulated motor	4: Final Adjustments
Jog Acceleration Rate	The rate at which the motor accelerates in the JOG mode	4: Final Adjustments
Jog Deceleration Rate	The rate at which the motor decelerates in the JOG mode	4: Final Adjustments
Jog Speed (Forward)	A presettable motor speed reference, enabled when the JOG pushbutton is depressed (S6) or the JOG pushbutton is depressed and the FWD-REV selector switch is in FWD (S6R)	2: Speed Reference Scaling
Jog Speed (Reverse)	A presettable motor speed reference, enabled when the JOG pushbutton is depressed and the FWD-REV selector switch is in REV (S6R only)	2: Speed Reference Scaling

<b>Function Name</b>	<b>Description</b>	<b>Section</b>
Maximum Speed (Auto Mode)	Speed at which the motor runs with maximum auto reference	4: Final Adjustments
Maximum Speed (Manual Mode)	Speed at which the motor runs with maximum manual reference	4: Final Adjustments
Memory Save	Saving the variable values entered into the drive	5: Save Parameters
Minimum Speed (Manual Mode)	Speed at which the motor runs in manual mode when speed pot input reference is zero	4: Final Adjustments
Reference Input, 0-10 VDC or 0- +/-10 VDC (S6R only) (Auto Mode)	Input used as a drive reference in AUTO mode	2: Speed Reference Scaling
Reference Input, 0-100 kHz (Auto Mode)	Input used as a drive reference in AUTO mode	2: Speed Reference Scaling
Reference Input, 4-20 mA (Auto Mode)	Input used as a drive reference in AUTO mode	2: Speed Reference Scaling
Reference Potentiometer Input (Manual Mode)	Input used as a drive reference in MANUAL mode	2: Speed Reference Scaling
Speed Indication (Analog)	Output proportional to the speed of the motor. 0-10VDC or 0- +/-10VDC (S6R only)	3: Output Signals
Speed Indication (Frequency)	A variable frequency pulse train output used to give indication of motor speed (0-100kHz)	3: Output Signals
Speed Level (or Band) Detector	Output used to indicate when the motor has reached a desired speed level (or band)	3: Output Signals
Stability (Speed or Voltage Loop)	Proportional Gain of the Speed or Voltage Loop - determines smoothness of drive response	4: Final Adjustments
Tachometer Feedback (Analog)	Input used for Analog Drive Feedback	2: Speed Feedback Scaling
Tachometer Feedback (Digital)	Input used for Digital Drive Feedback	2: Speed Feedback Scaling

## SIGNAL INTERFACE CARD JUMPER SETTINGS

The Follower Solution utilizes the inputs and outputs provided on the Signal Interface Kit. The table below lists the Signal Interface jumpers and pin positions that apply for this configuration. Before proceeding with adjustments, check the jumper settings and verify they are in the positions below.

<b>Analog Input Range</b>	
<b>Jumper</b>	<b>Position</b>
J14S	Pins 1 – 3
J15S	Pins 2 – 4
J16S	Pins 1 – 3
J17S	Pins 1 – 2
<b>4–20 mA Analog Input</b>	
J18S	Pins 1 – 2
<b>Analog Input Offset</b>	
J19S	Pins 1 – 2
J20S	Pins 2 – 3
J21S	Pins 1 – 2
J22S	Pins 2 – 3
<b>High Voltage Input Compensation</b>	
J23S	Pins 2 – 3





# SECTION 1: SPEED FEEDBACK SCALING

## DANGER

ALL ADJUSTMENTS ARE MADE WITH POWER ON. EXERCISE EXTREME CARE BECAUSE HAZARDOUS VOLTAGE EXISTS. THIS EQUIPMENT IS AT LINE VOLTAGE WHEN THE INCOMING DISCONNECT OR CIRCUIT BREAKER IS CLOSED. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

## WARNING

BEFORE PROCEEDING, MAKE SURE YOU CAN QUICKLY STOP THE DRIVE IF NECESSARY. IF THE INPUT DISCONNECT AND/OR MAINTAINED RUN PERMISSIVE STOP PUSHBUTTON ARE NOT WITHIN YOUR REACH, HAVE AN ASSOCIATE STATIONED TO OPERATE THEM SHOULD THE DRIVE MALFUNCTION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Table 1.

Jumper Selection Table for Tachometer Feedback

Input	Jumper
Analog Tach	Remove JC – JE
Digital Tach	JC – JE

### 1. Analog Feedback Tachometer Input (Reference Sheet 5 of W/P Drawing)

Analog input channel (ANALOG IN 0), terminals AW to AS, is used for the analog tachometer feedback signal. This input is scaled for a signal of:

- a) 0 to 57.5 VDC for an 1150 RPM motor with a 50 VDC/1000 RPM tachometer, or:

- b) 0 to +/-57.5 VDC for a +/-1150 RPM motor with a 50 VDC/1000 RPM tachometer (S6R drive).

To enable this analog input channel, the jumper between terminals JC and JE must be removed. (See Table 1.) This jumper is only used when a digital pulse tachometer is utilized for feedback.

## WARNING

THE JUMPER TERMINALS JC AND JE MUST BE REMOVED TO ENABLE THE ANALOG INPUT CHANNEL USED FOR TACHOMETER FEEDBACK. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

If the analog tachometer maximum application voltage is other than that shown above, this input must be rescaled for the new voltage range. The maximum application tachometer voltage must not exceed 145 VDC.

## WARNING

PROPER SPEED CONTROL AND OVERSPEED PROTECTION REQUIRES THAT THE TACHOMETER VOLTAGE AT MAXIMUM APPLICATION SPEED DOES NOT EXCEED + OR - 145 VDC. EXCEEDING THIS LIMIT COULD SATURATE THE INPUT CHANNEL. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

To rescale to a new range, change the following variables:

- **IN\_SI\_0\_A0\_RNG%**

(Factory set to = 28487 with max speed of motor at 1150 RPM, with a 50VDC/1000 RPM tachometer. For max. speed of motor at 1750 RPM using 50 VDC/1000 RPM tachometer, set this variable = 18720.)

Access Level = 2

Change this variable to:

= 1638000/maximum feedback (volts)

Variable

Limits: Use whole numbers, Maximum Number = 32767

- **IN\_SI\_0\_A0\_OFS%**

(Factory set to = 14243 with max speed of motor at 1150 RPM, with a 50VDC/1000 RPM tachometer. For max. speed of motor at 1750 RPM using 50 VDC/1000 RPM tachometer, set this variable = 9360.)

Access Level = 1

Change this variable to:

= IN\_SI\_0\_A0\_RNG% / 2

Variable

Limits: Use whole numbers, Maximum Number = 16383

### 2. Digital Feedback Tachometer Input (Reference Sheet 5 of W/P Drawing)

The digital feedback tachometer input is set up for a feedback of 0–2300 Hz for 1150 RPM, for a 120 PPR tachometer with the jumper between terminals JC & JE. (Refer to Table 1).

## WARNING

THERE MUST BE A JUMPER AT TERMINALS JC AND JE TO ENABLE THE DIGITAL INPUT CHANNEL USED FOR PULSE TACHOMETER FEEDBACK. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

If a range other than this is required, change the following variables:

- **PT\_TACH\_PPR%**

(Factory set to = 120.)

Access Level = 4

Change this variable to:

= the number of pulses per revolution of the digital feedback tachometer.

Variable

Limits: Use whole numbers,  
Minimum Number = 18  
Maximum Number = 2500

- **PT\_RPM\_PN%**

(Factory set to = 1150.)

Access Level = 4

Change this variable to:

= the maximum RPM of the motor, **but not to exceed the base speed of the motor.**

Variable

Limits: Use whole numbers,  
Minimum Number = 300  
Maximum Number = 4000

- **PT\_ANALOG\_SCALE%**

(Factory set to = 3.)

This variable is set up to give an analog voltage proportional to the motor speed, at test points J27A and J28 (PT ANALOG TEST SIGNAL). By entering a number 0 through 5, the kHz value associated with that number generates 5.0 volts. Select and enter the number with the closest frequency that is greater than or equal to the pulse tachometer frequency at top speed.

Frequency =  $PPR \times RPM / 60$  (Hz)

Access Level = 0

- 0 = 250 kHz max pulse tach feedback
- 1 = 62.5 kHz max pulse tach feedback
- 2 = 16 kHz max pulse tach feedback
- 3 = 3.9 kHz max pulse tach feedback
- 4 = 976 Hz max pulse tach feedback
- 5 = 244 Hz max pulse tach feedback

## SECTION 2: SPEED REFERENCE SCALING

### MANUAL MODE:

#### 1. Manual Mode – Reference Potentiometer Input (Reference Sheet 2 of W/P Drawing)

This input, ANALOG IN 1, (terminals AM, CL and CS – Refer to Sheet 3 of W/P) is set up for a maximum reference of 8 VDC when in the Manual Mode. If a maximum input other than 8 VDC is required, but not exceeding 10 VDC, this input must be scaled for the new range.

To scale for a different range, change the following variable:

- **IN\_SI\_0\_A1\_RNG%**

(Factory set to = 5119.)

Access Level = 2

Change this variable to:

= 40950 / maximum input in volts.

Variable

Limits: Use whole numbers,  
Maximum Number = 32767

### AUTO MODE:

#### WARNING

IN AUTO MODE THE DRIVE FOLLOWS THE SUPPLIED REFERENCE WITH NO PRESET MINIMUM SPEED. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

#### Note

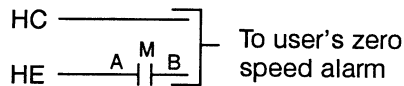
*The Manual Speed Potentiometer acts as a proportional line speed trim of up to 20% of the Auto Mode reference.*

**Table 2.  
Jumper Selection Table  
for Speed Reference Input**

Input	Jumper
4 – 20 mA	JF – JG JH – JJ
0 – ±10 VDC	JH – JJ Remove JF – JG
0 – 100 kHz	JF – JG Remove JH – JJ

#### Note

*A zero speed alarm, digital output is available at terminals HC & HE and must be connected as follows:*



(See W/D Sheet 2, 2.1, and 4.)

#### Note

*With operation in auto mode with bipolar input, either the forward/reverse or bipolar reference can change the direction of operation. Make sure the bipolar input is connected correctly.*

#### 1. Auto Mode – Reference Input 0 – 10 VDC or 0 – +/-10 VDC (Reference Sheet 2 of W/P Drawing)

This input, ANALOG IN 2, (terminals AK and AL – See Table 2 for jumper settings) is scaled for a reference of 0–10 VDC, for S6 drive, or 0 – +/-10 VDC for S6R drive.

If a range other than this is required, but not exceeding 10 VDC, this input must be adjusted for the new range. Change the following variables:

- **IN\_SI\_0\_A2\_RNG%**

(Factory set to = 8190.)

Access Level = 2

Change this variable to:

= 163800 / (max input volts x 2)

Variable

Limits: Use whole numbers,  
Maximum Number = 32767

- **IN\_SI\_0\_A2\_OFS%**

(Factory set to = 4095.)

Access Level = 1

Change this variable to:

= IN\_SI\_0\_A2\_RNG% / 2

Variable

Limits: Use whole numbers,  
Maximum Number = 16383

#### 2. Auto Mode – Reference Input, 4–20mA (Reference Sheet 2 of W/P Drawing)

This input, ANALOG IN 3 (terminals AH and AJ – See Table 2 for jumper settings), is set up for a reference of 4–20 mA.

If a range other than 4–20 mA is required, but not exceeding 20 mA, this input must be adjusted for the proper range. Change the following variables:

- **IN\_SI\_0\_A3\_RNG%**

(Factory set to = 5119.)

Access Level = 2

Change this variable to:

=  $20475 / [(\text{max input in mA}) \times 0.25 - (\text{minimum input in mA}) \times 0.25]$

Variable

Limits: Use only whole numbers,  
Maximum Number = 32767

- **IN\_SI\_0\_A3\_OFS%**

(Factory set to = 1024.)

Access Level = 1

Change this variable to:

=  $\text{IN\_SI\_0\_A3\_RNG\%} \times (\text{min input in mA}) \times 0.25 / 5$

Variable

Limits: Use only whole numbers,  
Maximum Number = 32767

### 3. Auto Mode – Reference Input 0–100 kHz (Reference Sheet 2 of W/P Drawing)

This input, FREQUENCY IN 0, (terminals BK, BL and BM – See Table 2 for jumper settings) is set for a reference of 0–100 kHz.

If a range other than this is required, but not exceeding 100 kHz, change the following variables:

- **IN\_SI\_0\_F0\_MAX%**

(Factory set to = 200.)

Access Level = 4

Change this variable to:

=  $2 \times \text{maximum input in kHz}$

Variable

Limits: Use only whole numbers,  
Minimum Number = 2 kHz  
Maximum Number = 250 kHz

### 4. Jog Mode – Forward Jog Speed (Reference Sheet 4 of W/P Drawing)

Forward Jog Speed is the preset speed that the drive will run at when the JOG pushbutton is depressed (S6), or the JOG pushbutton is depressed and the FWD-REV selector switch is in FWD (S6R only). This speed may be changed as required but should always be set high enough to keep the motor rotating. This speed is set for 10% of maximum drive speed.

To adjust the forward jog speed, change the following variable:

- **L2\_SEL\_0\_INPUT0%**

(Factory set to = 410.)

Access Level = 0

Change this variable to:

=  $(\text{desired speed in \%}) \times (40.95)$

Variable

Limits: Use only whole numbers,  
Maximum Number = 1000  
or 24% speed.

### 5. Jog Mode – Reverse Jog Speed (Reference Sheet 4 of W/P Drawing)

Reverse Jog Speed is the preset speed (for S6R only) that the drive will run at when the JOG pushbutton is depressed and the FWD/REV selector switch is in the REV position. This speed may be changed as required but should always be set high enough to keep the motor rotating. This speed is set for 10% of maximum drive speed.

To adjust the reverse jog speed, change the following variable:

- **L2\_SEL\_0\_INPUT1%**

(Factory set to = -410.)

Access Level = 0

Change this variable to:

=  $(\text{desired speed in \%}) \times (-40.95)$

Variable

Limits: Use only whole numbers,  
Maximum Number = -1000  
or -24% speed.

## SECTION 3: OUTPUT SIGNALS

### 1. Analog Speed Indication 0–10 VDC or 0– +/-10 VDC Output (Reference Sheet 2 of W/P Drawing)

This output, ANALOG OUT 0 (terminals AF and AG), is set up for an output of 0– 10 VDC (for S6), or 0 – +/-10 VDC (for S6R) at 120% of motor speed.

If a range other than this is required, but not to exceed 10 VDC, the output must be adjusted to the new range. Change the following variables:

- **OUT\_SI\_0\_A0\_RNG%**

(Factory set to = 9828.)

Access Level = 2

Change this variable to:

= 98280 / max output in volts

Variable

Limits: Use only whole numbers,  
Maximum Number = 32767

- **OUT\_SI\_0\_A0\_OFS%**

(Factory set to = 4914.)

Access level = 2

Change this variable to:

= OUT\_SI\_0\_A0\_RNG% / 2

Variable

Limits: Use only whole numbers,  
Maximum Number = 16383

### 2. Analog Current Indication 0–10 VDC or 0– +/-10 VDC Output (Reference Sheet 2 of W/P Drawing)

This output, ANALOG OUT 1 (terminals AC and AE), is set up for an output of 0– 10 VDC (for S6), or 0– +/-10 VDC (for S6R) at 200% of armature current.

If a range other than this is required, but not to exceed 10 VDC, the output must be adjusted to the new range.

Change the following variables:

- **OUT\_SI\_0\_A1\_RNG%**

(Factory set to = 10920.)

Access Level = 2

Change this variable to:

= 109200 / max output in volts

Variable

Limits: Use only whole numbers,  
Maximum Number = 32767

- **OUT\_SI\_0\_A1\_OFS%**

(Factory set to = 5460.)

Access Level = 2

Change this variable to:

= OUT\_SI\_0\_A1\_RNG% / 2

Variable

Limits: Use only whole numbers,  
Maximum Number = 16383

### 3. Frequency Speed Indication 0–100kHz Output (Reference Sheet 2 of W/P Drawing)

This output, FREQUENCY OUT 0 (terminals BB, BC and BE), is set up for an output of 0–100kHz, at 120% of motor speed.

If a range other than this is required, but not to exceed 100 kHz, the output must be adjusted to the new range. Change the following variables:

- **OUT\_SI\_0\_F0\_MAX%**

(Factory set to = 200.)

Access Level = 4

Change this variable to:

= 2 x max output in kHz

Variable

Limits: Use only whole numbers,  
Minimum Number = 5 (kHz)  
Maximum Number = 1250  
(kHz)

### 4. Frequency Current Indication 0–100kHz Output (Reference Sheet 2 of W/P Drawing)

This output, FREQUENCY OUT 1 (terminals AA, AB, and BA) is set up for an output of 0–100kHz, at 200% of armature current.

If a range other than 0–100kHz is required, but not exceeding 100kHz, this output must be adjusted for the new range. Change the following variables:

- **OUT\_SI\_0\_F1\_MAX%**

(Factory set to = 200.)

Access Level = 4

Change this variable to:

= 2 X max output in kHz

Variable

Limits: Use only whole numbers,  
Minimum Number = 5 (kHz)  
Maximum Number = 1250  
(kHz)

## 5. Current Level Detector (Reference Sheet 1 of W/P Drawing)

The current level detector provides a logic high output (Signal Interface output variable OUT\_SI\_0\_DIG\_3@, at terminals HA and HB) after a time delay (set by the timer block variable ML\_TMR\_0\_DLY\_T%) when the operating armature current is greater than a low preset level (compare block variable ML\_CMP\_0\_THR\_LO%). The timer setting allows the current to exceed the set rating of the low preset level during acceleration, or allows the current to settle out before indicating (avoiding unwanted indications). The current feedback is taken from the armature current feedback variable (FLD\_ARM\_I\_FB%) and monitored by the compare block input (ML\_CMP\_0\_INPUT%). The time delay and the low preset level are adjustable. To adjust the current level detector, change the following variables:

- **ML\_TMR\_0\_DLY\_T%**  
(Factory set to = 1000 [10 seconds])  
Change this variable to:  
Access Level = 1  
= desired time in milliseconds/(10)  
Variable  
Limits: Use only whole numbers,  
Maximum Number = 32767  
or 328 seconds

- **ML\_CMP\_0\_THR\_LO%**  
(Factory set to = 2735 [to indicate at greater than 100% of armature current])

Change this variable to:

Access Level = 1

= (desired current in %) x 27.35

Variable

Limits: Use only whole numbers  
Maximum Number = 4095  
or 150% of armature current.

## 6. Speed Level (or Band) Detector (Reference Sheet 1 of W/P Drawing)

The speed level (or band) detector provides a logic high output (Signal Interface output variable OUT\_SI\_0\_DIG\_0@ at terminals HH & HJ) after a time delay (set by the timer block variable ML\_TMR\_1\_DLY\_T%). The timer block (1) is activated when the compare block (1) is turned on. The compare block is turned on when the speed level is equal to or greater than the number set as the low preset level (ML\_CMP\_1\_THR\_LO%). The compare block turns off when the speed level is greater than the number set as the high preset level (ML\_CMP\_1\_THR\_HI%). The timer setting allows the speed to exceed the set rating of the low preset level during acceleration, or allows the speed to settle out before indicating (avoiding unwanted indications). The speed feedback is taken from the major loop feedback variable (L2\_FB\_ABS%) and monitored by the compare block input (ML\_CMP\_1\_INPUT%). The time delay, and low and high preset levels are adjustable. Compare Block (2) and Timer Block (2) are used as a zero speed alarm. (Note: These are available but must not be adjusted.) To adjust the speed level (band) detector, change the following variables:

- **ML\_TMR\_1\_DLY\_T%**  
(Factory set to = 50 [0.5 seconds])

Access Level = 1

Change this variable to:

= desired time in milliseconds/(10)

Variable

Limits: Use only whole numbers  
Maximum Number = 32767,  
or 328 seconds

- **ML\_CMP\_1\_THR\_LO%**  
(Factory set to = 0.)

Access Level = 1

Change this variable to:

= (desired speed in %) x (40.95)

Variable

Limits: Use only whole numbers,  
Maximum Number = 4095  
or 100% speed

- **ML\_CMP\_1\_THR\_HI%**  
(Factory set to = 10.)

Access Level = 1

Change this variable to:

= (desired speed in %) x (40.95)

Variable

Limits: Use only whole numbers,  
Maximum Number = 4095  
or 100% speed

## SECTION 4: FINAL ADJUSTMENTS

### 1. A-C Line Frequency (Reference Sheet 6 of W/P Drawing)

The drive is set for 60Hz A-C line frequency. If used on other than a 60Hz supply, the following variable needs to be changed:

- **CML\_AC\_FREQU%**

(Factory set to = 60.)

Access Level = 4

Change this variable to:

= frequency of the A-C line (Hz)

Variable

Limits: Use only whole numbers,  
Minimum Number = 48  
Maximum Number = 62

### 2. Maximum Speed (Manual Mode) (Reference Sheet 3 of W/P Drawing)

The maximum speed in the Manual Mode, is the speed the motor runs at with maximum manual drive reference. This speed is set for 100% of drive top speed. If a maximum drive speed less than the drive top speed is required, change the following variables:

- **L2\_RA\_GAIN\_MUL%**

(Factory set to = 4095.)

Access Level = 1

Change this variable to:

= [4095 x (desired maximum speed in RPM)] / (drive top speed in RPM)

Variable

Limits: Use only whole numbers,  
Maximum Number = 4095 or  
100% speed

#### Note

*The following variable (set for 100% of drive speed) must be changed whenever the minimum manual speed is changed (See Minimum Speed, Manual Mode):*

- **L2\_RA\_GAIN\_DIV%**

(Factory set to = 4311.)

Access Level = 2

Change this variable to:

= desired speed number =  
L2\_REFA% + L2\_RA\_OFFSET%.

Variable

Limits: Use only whole numbers,  
Maximum Number = 32767

### 3. Maximum Speed (Auto Mode) (Reference Sheet 3 of W/P Drawing)

The maximum Auto Mode speed is the drive maximum speed when the drive reference is at maximum. If a maximum drive speed less than the drive top speed is desired, then change the following variable:

- **L2\_RB\_GAIN\_MUL%**

(Factory set to = 4095.)

Access Level = 1

Change this variable to:

= [4095 x (desired max speed in RPM)] / (drive top speed in RPM)

Variable

Limits: Use only whole numbers,  
Maximum Number = 4095,  
or 100% speed

### 4. Minimum Speed (Manual Mode) (Reference Sheet 3 of W/P Drawing)

#### WARNING

THE DRIVE IS INTENDED TO OPERATE AT A PREDETERMINED SPEED IN MANUAL MODE UNLESS DISCONNECTED FROM THE POWER SOURCE. IF THE APPLICATION REQUIRES ZERO SPEED OPERATION WITHOUT SUCH DISCONNECTION, THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

In the MANUAL mode of operation, the drive continues to run at a preset minimum speed when the speed pot is turned to zero. This speed can be changed, but should always be set high enough to keep the motor rotating. If this speed is changed (set for 5% of maximum drive speed), then the maximum manual speed must also be changed (See Maximum Speed, Manual Mode).

Change the following variable:

- **L2\_RA\_OFFSET%**

(Factory set to = 216.)

Access Level = 1

Change this variable to:

= (desired minimum speed in RPM) x  
4095 / (maximum speed in RPM) -  
(desired minimum speed in RPM)

Variable

Limits: Use only whole numbers,  
Maximum Number = 4095  
or 100% speed.

## 5. Drive Acceleration Rate (Manual Mode) (Reference Sheet 3 of W/P Drawing)

The drive acceleration rate is the rate at which the drive output increases from zero to manual top speed.

To change the drive acceleration rate, change the following variable:

- **L2\_RA\_ACCEL%**

(Factory set to = 500 [20 seconds].)

Access Level = 1

Change this variable to:

= 10000 / acceleration time in seconds

Variable

Limits: Use only whole numbers,

Minimum Number = 1

Maximum Number = 32767

## 6. Drive Deceleration Rate (Manual Mode) (Reference Sheet 3 of W/P Drawing)

The drive deceleration rate is the rate at which the drive output decreases from manual top speed to zero.

To change the drive deceleration rate, change the following variable:

- **L2\_RA\_DECEL%**

(Factory set to = 400 [25 seconds].)

Access Level = 1

Change this variable to:

= 10000 / deceleration time in seconds

Variable

Limits: Use only whole numbers,

Minimum Number = 1

Maximum Number = 32767

## 7. Jog Acceleration Rate (Reference Sheet 4 of W/P Drawing)

The jog acceleration rate is the rate at which the drive output increases from zero speed to jog speed. To change the jog acceleration rate, change the following variable:

- **JOG\_RA\_ACCEL%**

(Factory set to = 10000 [1 second].)

Access Level = 2

Change this variable to:

= (10000 x jog speed in RPM) / (acceleration time in seconds x top speed of the drive in RPM)

Variable

Limits: Use only whole numbers,

Minimum Number = 1

Maximum Number = 32767

## 8. Jog Deceleration Rate (Reference Sheet 4 of W/P Drawing)

The jog deceleration rate is the rate at which the drive output decreases from jog speed to zero speed.

To change the jog deceleration rate, change the following variable:

- **JOG\_RA\_DECEL%**

(Factory set to = 5000 [2 seconds].)

Access Level = 2

Change this variable to:

= (10000 x jog speed in RPM) / (deceleration time in seconds x top speed of the drive in RPM)

Variable

Limits: Use only whole numbers,

Minimum Number = 1

Maximum Number = 32767

## 9. Positive Current Limit (Reference Sheet 5 of W/P Drawing)

The positive current limit is the value of positive current output the drive is limited to. This limit applies to forward motoring (S6) and both forward motoring and reverse regenerating current on S6R drives.

This limit is set for 150% of drive current. To adjust the limit, change the following variable:

- **L2\_PI\_LIM\_HI%**

(Factory set to = 4095. Do not set greater than 4095.)

Access Level = 1

Change this variable to:

= [(% of current limit desired) x 2730] / 100

Variable

Limits: Use only whole numbers,

Maximum Number = 4095 or

150% drive current

## 10. Negative Current Limit (Reference Sheet 5 of W/P Drawing)

The negative current limit is the value of negative current the drive is limited to. This limit is the forward regenerating and reverse motoring current on an S6R drive only.

The limit is factory set for -150% of drive current. To adjust the limit, change the following variable.

- **L2\_PI\_LIM\_LO%**

(Factory set to = -4095. Do not set greater than -4095.)

Access Level = 1

Change this variable to:

= [(% of current limit desired) x -2730] / 100

Variable

Limits: Use only whole numbers,

Maximum Number = -4095

or -150% drive current



## 11. IR Compensation (Reference Sheet 5 of W/P Drawing)

This value sets the amount of IR drop compensation used by the drive when set up as a voltage regulator. The variable FLT\_TL\_DISABLE@ must be ON to function as a voltage regulator.

### WARNING

ALL FOLLOWER DRIVES ARE SHIPPED CONFIGURED AS SPEED REGULATOR DRIVES (TACHOMETER FEEDBACK). TO USE IR COMPENSATION, THE DRIVE MUST BE SET UP AS A VOLTAGE REGULATED DRIVE (ARMATURE VOLTAGE FEEDBACK). THE TACHOMETER LOSS VARIABLE FLT\_TL\_DISABLE@ MUST BE SET TO "ON" TO FUNCTION AS A VOLTAGE REGULATOR. REFER TO THE DRIVE DOCUMENTATION MANUAL (D2-3181) TO CONVERT FROM A SPEED REGULATED DRIVE TO A VOLTAGE REGULATED DRIVE ("CONFIGURING THE BASIC MICRO9000"). FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

The IR compensation value is set for 5%. To change this value change the following variable:

### Note

*A larger negative value provides larger IR compensation.*

- **ML\_SEL\_1\_I2\_MUL%**

(Factory set to = -8 [5%.])

Access Level = 1

Change this variable to:

=  $[-4095 \times (\text{desired percentage of IR compensation})] / 2730$

Variable

Limits: Use only whole numbers,  
Maximum Number = -32767

## 12. Stability (Speed or Voltage Loop)(Reference Sheet 5 of W/P Drawing)

This is the proportional gain of the speed or voltage loop which determines how quickly and smoothly the drive responds to requests for speed changes.

- **L2\_PI\_KP%**

(Factory set to = 880.)

Access Level = 1

Larger values result in faster response, but may show less stability. If the drive "overshoots" the speed set point when changes to the speed reference are made, or if the drive "hunts" or is unstable, reduce the value of this variable.

Variable

Limits: Use only whole numbers,  
Minimum Number = 10  
Maximum Number = 12800



## SECTION 5: SAVE PARAMETERS

After completing all modifications to the drive the values must be saved.

Change **MEM\_SAVE@** = ON.

Access Level = 2

### **Note**

*A memory save using the MEM\_SAVE@ command must be executed before a power shutdown, or all of the adjusted values will not be saved in the configuration. The variable MEM\_SAVE@ is automatically set back to OFF upon completion of a save.*

Before the drive will operate the access level must be 0, 1 or 2. This can be verified by either setting the variable SYS\_ACCESS\_KEY% = 0, or turning the power to the drive "OFF" and then "ON". The drive is now ready to run with the new tuning values.



**APPENDIX A:  
FOLLOWER SECTION  
Variable Adjustment Log Record  
SYSTEM NAMES: F 1422406, F 1425006, F 1432406, F 1435006**

Adjustment	Variable	Factory Set Default Value	Value	Value
Analog Feedback Tachometer Input	IN_SI_0_A0_RNG%	28487		
	IN_SI_0_A0_OFS%	14243		
Digital Feedback Tachometer Input	PT_TACH_PPR%	120		
	PT_RPM_PN%	1150		
	PT_ANALOG_SCALE%	3		
MANUAL Mode Reference Potentiometer Input	IN_SI_0_A1_RNG%	5119		
AUTO Mode Reference Input, 0-10VDC or 0 to +/-10 VDC	IN_SI_0_A2_RNG%	8190		
	IN_SI_0_A2_OFS%	4095		
AUTO Mode Reference Input, 4-20 mA	IN_SI_0_A3_RNG%	5119		
	IN_SI_0_A3_OFS%	1024		
AUTO Mode Reference Input, 0-100 kHz	IN_SI_0_F0_MAX%	200		
Forward Jog Speed	L2_SEL_0_INPUT0%	410		
Reverse Jog Speed	L2_SEL_0_INPUT1%	-410		
Analog Speed Indication 0-10 VDC or 0- +/-10 VDC Output	OUT_SI_0_A0_RNG%	9828		
	OUT_SI_0_A0_OFS%	4914		
Analog Current Indication 0-10 VDC or 0- +/-10 VDC Output	OUT_SI_0_A1_RNG%	10920		
	OUT_SI_0_A1_OFS%	5460		
Frequency Speed Indication 0-100kHz Output	OUT_SI_0_F0_MAX%	200		

Adjustment	Variable	Factory Set Default Value	Value	Value
Frequency Current Indication 0–100kHz Output	OUT_SI_0_F1_MAX%	200		
Current Level Detector	ML_TMR_0_DLY_T%	1000		
	ML_CMP_0_THR_LO%	2735		
Speed Level (or Band) Detector	ML_TMR_1_DLY_T%	50		
	ML_CMP_1_THR_LO%	0		
	ML_CMP_1_THR_HI%	10		
A-C Line Frequency	CML_AC_FREQU%	60		
Maximum Speed (Manual Mode)	L2_RA_GAIN_MUL%	4095		
	L2_RA_GAIN_DIV%	4311		
Maximum Speed (Auto Mode)	L2_RB_GAIN_MUL%	4095		
Minimum Speed (Manual Mode)	L2_RA_OFFSET%	216		
Drive Acceleration Rate (Manual Mode)	L2_RA_ACCEL%	500		
Drive Deceleration Rate (Manual Mode)	L2_RA_DECEL%	400		
Jog Acceleration Rate	JOG_RA_ACCEL%	10000		
Jog Deceleration Rate	JOG_RA_DECEL%	5000		
Positive Current Limit	L2_PI_LIM_HI%	4095		
Negative Current Limit (S6R) (S6)	L2_PI_LIM_LO%	-4095 0		
IR Compensation	ML_SEL_1_I2_MUL%	-8		
Stability (Speed or Voltage Loop)	L2_PI_KP%	880		

## APPENDIX B DEFAULT "AS SHIPPED" JUMPER SETTINGS

### SIGNAL INTERFACE CARD

Analog Input Range	
Jumper	Position
J14S	Pins 1 - 3
J15S	Pins 2 - 4
J16S	Pins 1 - 3
J17S	Pins 1 - 2
4-20 mA Analog Input	
J18S	Pins 1 - 2
Analog Input Offset	
J19S	Pins 1 - 2
J20S	Pins 2 - 3
J21S	Pins 1 - 2
J22S	Pins 2 - 3
High Voltage Input Compensation	
J23S	Pins 2 - 3

### TACHOMETER FEEDBACK

Shipped default for digital tachometer with a jumper from JC-JE. Remove jumper for an analog tachometer.

### SPEED REFERENCE INPUT

Shipped default for 4-20 mA, jumpers from JF-JG, and JH-JJ. See chart below for other settings:

Input	Jumper
4 - 20 mA	JF - JG JH - JJ
0 - $\pm$ 10 VDC	JH - JJ Remove JF - JG
0 - 100 kHz	JF - JG Remove JH - JJ











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