



*Installation* ● *Operation* ● *Maintenance*

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*Regenerative  
DC Drives*

*Technical Manual  
TM 3310*

## ADDENDUM TO TM 3310

### Saber DC 3208

A feature improvement has been made to the Saber DC 3208 to enhance the ability to retain drive parameter set up values in nonvolatile memory during periods of power source brownouts. A "Memory Protect" switch has been added to the CPU/Control PCB (new part number 46S02823-0011) and new keypad functions have been added to Save (FCTN 70) and Recall (FCTN 71) the set up values in a switch protected secure location. The procedures to follow are given below.

#### TO PERMANENTLY SAVE SET UP VALUES.

After all programmable features of the drive have been selected and all set up adjustments have been entered, save these values in protected nonvolatile memory with the following procedure:

1. Move the "Memory Protect" switch lever to the UP position.

The yellow ("Memory Unprotect") LED next to the switch should come ON to indicate that the nonvolatile memory can be changed.

2. Press [SET], 70, [ENT].

The display will flash "SAVED" for a few seconds to indicate a successful data store (If "PROTECTD" is displayed, you have not followed Step 1.)

3. Move the "Memory Protect" switch lever to the DOWN position.

The yellow LED should be OFF to indicate that the nonvolatile memory is safely protected.

The permanently saved values will be automatically reloaded each time the Saber DC 3208 is powered up. It is important to resave them as outlined above after the initial equipment set, *and* each time thereafter that a permanently desired readjustment is made.

#### TO RECALL PREVIOUSLY SAVED VALUES.

The previously saved values may be reloaded manually, when the drive is stopped and the contactor open, by pressing [SET], 71, [ENT]. The display will flash a "RCALLSET" message to indicate that all settings have been recalled. The saved values will also be recalled automatically on each drive power up.

The "Memory Protect" switch and "Memory Unprotect" LED are located on the CPU/Control PCB, 46S02823-0011, as shown on Sheet 1 of Figure 1-1 (page 1-8). These parts are accessible without removing the 43T01669-0010 REV-2 front cover.

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## SECTION 1. INTRODUCTION

### 1.1 DESCRIPTION

The Saber 3208 is a four quadrant variable speed DC motor drive suitable for use with shunt wound or permanent magnet motors from 1/8 to 10 Horsepower. It is microprocessor controlled and contains many features desirable for both complex stand alone and coordinated systems applications. Primary operating modes include digitally accurate speed regulation using armature signals or optional AC or DC or digital tachometers for feedback, and torque regulation using motor current feedback. System features include provisions for RUN, JOG, THREAD, FOLLOWER, CONTROLLED STOP, QUICK STOP, ACCEL/DECEL, TRIM, CASCADED REFERENCE, and TRSF (Torque Regulated Speed Follower) operating modes. The control configuration is programmable with all set up selections and parameter adjustments digitally stored in nonvolatile memory. Primary interfaces to the drive are  $\pm 10$  VDC analog and 24 VDC logic signals. An RS-232 communication link is provided for remote control, remote data logging and loading of set up parameters.

Power conversion and control is accomplished with a fully regenerative single phase 8 SCR power circuit with protective fuses and transient suppression. The power circuit includes a motor shunt field supply and a DC loop contactor with provision for resistive dynamic braking and E-STOP interlocking as standard. Other physical features include a removable terminal block for ease of field wiring, an easy to use keyboard and alphanumeric display for data entry and monitoring, and a stable signal source for analog reference wiring.

### 1.2 OPERATING FUNCTION FEATURES

- RUN                    - Starts drive by closing contactor and activating regulation functions when initiated by momentary push button or PLC signal. In Speed mode, selects RUN ACCEL/DECEL times and applies speed reference from external run command signal or FOLLOWER input (if enabled) or keyboard (if enabled). In Torque mode, applies current reference from external torque command signal or FOLLOWER (if enabled). Terminates when STOP, Q-STOP or THREAD is initiated.
- JOG                    - Starts drive when push button circuit is held closed and drive is in STOP condition. Selects programmed JOG speed reference and ACCEL/DECEL times. Terminates when push button is released or STOP is pressed. Selectable controlled stop or coast-to-stop feature with programmable contactor drop out delay.

- THREAD - Starts drive when initiated by momentary push button. Selects programmed THREAD speed reference and ACCEL/DECEL times. Terminates when STOP, Q-STOP or RUN is initiated.
- STOP - Initiated when STOP circuit is opened. Will begin CONTROLLED STOP mode from RUN, THREAD, or JOG (if enabled), otherwise will cause contactor to open and coast-to-stop. STOP circuit and 115 VAC contactor interlock must be closed for drive to operate. Controlled stop drop out speed is adjustable.
- QUICK STOP - Initiated when momentary push button is pressed. Will cause controlled stop action with separately programmable Decel rate.
- FOLLOWER - Initiated by a maintained logic signal contact. When activated, feeds follower signal as reference to speed or torque regulator in RUN mode. Separate ACCEL/DECEL rate for speed follower. Has LOW SPEED TRACKING offset, RATIO, and ANTI-REVERSE adjustments. Can follow  $\pm 10$  VDC,  $\pm 5$  VDC,  $\pm 20$  mA or 4-20 mA signals with reversible differential input. RATIO has provision for external signal input with Upper and Lower limit settings. If optional Digital Tachometer Follower is provided, it will be selected as the follower source.
- TRSF - Torque Regulated Speed Follower is active in speed mode when TRIM logic signal is active. Compares external torque command with measured motor current and applies the difference as a trim to speed reference. Has adjustments for SPAN and DROOP. If not used, set DROOP to zero.
- TRIM - Initiated by a maintained logic signal contact. When activated, adds external trim signal to either internal speed reference after Accel/Decel function or to torque (current) reference. Has SPAN adjustment for sensitivity. If not used, set TRIM SPAN to zero.
- REVERSE - Initiated by a maintained logic contact signal. When activated, causes polarity (direction) reversal of all speed or torque references including FOLLOWER and TRIM.

- SPEED REGULATOR TUNING - Uses Per Unit Inertia and Response (Crossover Frequency) adjustments. May enter separate Proportional and Integral gains if necessary. Has  $WK^2$  feed forward torque compensation for accurate reference cascading. Has SPEED LIMIT adjustment. Armature voltage regulator has automatic IR drop compensation with BOOST/DROOP adjustment. Tachometer feedback options include calibration adjustments.
  
- CURRENT REGULATOR TUNING - Self tuning for current regulator with wide range of motors. May enter separate Proportional and Integral gains if necessary. Has separate regenerative and non-regenerative CURRENT LIMIT adjustments and Instantaneous Static Trip (IST). Current feedback calibration is by selection of burden resistor hardware.
  
- TACH LOSS - Tach Loss function detects loss of tachometer signal or incorrect tachometer polarity when running.
  
- OVERLOAD - Electronic Overload follows NEC time-magnitude curves and will cause drive to stop when tripped. Requires manual reset. May be defeated.
  
- OVERSPEED TRIP - Has adjustable trip speed. Will cause drive to stop when tripped.
  
- REMOTE CONTROL - Uses RS-232 communication port for logic and reference commands, data reporting and loading of parameter data. Has two selectable baud rates with hardware handshaking for flow control. Initiated when LOCAL/REMOTE logic circuit is closed and proper start-up characters are received. Opening of STOP circuit will override and cause the drive to stop.

### 1.2.1 Analog Inputs

Analog input channels to the drive are single ended, rated for  $\pm 10$  VDC duty and have 50K ohms of loading. Command inputs for TORQUE, TRIM, and SPEED references have span (gain) adjustments. The FOLLOWER input is differential and can be selected for  $\pm 10$  VDC,  $\pm 5$  VDC or  $\pm 20$ mA scaling. FOLLOWER RATIO input has programmable Upper and Lower span limits.

### 1.2.2 Analog Outputs

Three analog output channels are available. Each channel has  $\pm 10$  VDC at 4mA capability, a scale factor SPAN adjustment, and is op-amp buffered.

- |                    |   |
|--------------------|---|
| REFERENCE<br>SPEED | - Outputs an image of the speed reference after ACCEL/DECEL control and TRIM addition.  |
| ACTUAL<br>SPEED    | - Outputs the measured speed of the motor. This is a result of a calculation when armature voltage feedback is used.  |
| PROGRAM-<br>MABLE  | - This channel may be keyboard selected to output one of many signal sources from within the controller. Available on test jacks on the front panel and on the terminal connection strip. |

### 1.2.3 Logic Inputs

Logic inputs are 24 VDC operated from a self-contained power source via remote push buttons and switches or PLC signals. Input channels for RUN, JOG, THREAD, STOP, QUICK STOP, FOLLOWER, TRIM, REVERSE, and REMOTE operate as described above. An additional input is used to select SPEED or TORQUE operating mode. All logic commands are interactive and may be operated while running.

A 115 VAC contactor coil interlock is provided for operation lockout.

### 1.2.4 Logic Outputs

One FAULT relay contact output rated for 115 VAC duty is available for interlocking the drive with other equipment. This relay is active during normal power on conditions and drops out when drive power is lost or in the event of a TACH LOSS, OVERSPEED, OVERLOAD (when enabled), IST, LOW LINE, or other internal nonrecoverable fault. A FAULT RESET push button is provided to reset recoverable faults. A First Fault readout is available from the keyboard.

One 24 VDC logic output is provided for speed or current sensing and may be keyboard selected to do one of the following:

1. Senses current magnitude and becomes active when current exceeds a programmable threshold.
2. Senses speed magnitude and becomes active when speed exceeds a programmable threshold.
3. Senses magnitude of set speed versus actual speed and becomes inactive when drive is running within a programmable threshold range of the set speed.

### 1.3 AVAILABLE OPTIONS

The following items are available to aid application and to further enhance the performance of the Saber 3208.

#### A. DIGITAL TACHOMETER INTERFACE PCB

Use for precise speed feedback and best speed regulation tracking. Requires use of two channel rotary encoder with a minimum of 245 counts per revolution (adjustable). A +5 VDC power source is available for tachometer.

#### B. ANALOG TACHOMETER INTERFACE PCB

Use for improved speed feedback over armature voltage control. Interfaces with common AC and DC tachometer voltages. AC tachometers should have at least 24 poles and may be used on reversing drives.

#### C. ANALOG FOLLOWER PCB

Use for following analog voltage signals other than  $\pm 10$  VDC or  $\pm 5$  VDC or current signals other than  $\pm 20$ mA or 4-20mA. Will accommodate AC or DC voltage inputs up to 480 volts peak or current signal ranges of 1-5, 2-10, 4-20, and 10-50mA. Has adjustments for OFFSET and RATIO.

#### D. DIGITAL TACHOMETER FOLLOWER PCB

Use for precision line speed tachometer follower input. Requires use of two channel rotary encoder with a minimum of 245 counts per revolution (adjustable). A +5 VDC power source is available for tachometer.

#### E. FIELD LOSS PROTECTION

Use for motor field loss sensing and interlocking with STOP or FAULT circuits. Isolated relay contact output and internal drop out adjustment.

### 1.4 PERFORMANCE AND AMBIENT SPECIFICATIONS

- A. Input Voltage: 115/230 VAC  $\pm 10\%$   
Input Frequency: 48 to 62HZ
- B. Adjustable Current Limit: 1 to 200%.
- C. Overload for One Minute: 150% of rated full load
- D. Service Factor: 1.0
- E. Field Voltage: 103/207 VDC nominal, unregulated.

#### 1.4 PERFORMANCE AND AMBIENT SPECIFICATIONS (Continued)

- F. Maximum Field Current: 3.0 ADC.
- G. Operating Temperature: 0 to +55°C.
- H. Storage Temperature: -30 to +85°C.
- I. Maximum Operating Altitude: 3,300 feet above sea level.

#### NOTICE

This equipment is exempted from FCC regulations.

See 47CFR15.801.

#### 1.5 PRE-INSTALLATION CONSIDERATIONS

##### 1.5.1 Receipt of Shipment

All equipment is tested against defect at MagneTek Drives & Systems. Any damages or shortages evident when the equipment is received must be reported immediately to the commercial carrier who transported the equipment. Assistance, if required, is available from the nearest MagneTek District Office. Always refer to the order number, equipment description, and serial number when contacting MagneTek Drives & Systems.

##### 1.5.2 Unpacking Instructions

Remove the protective shipping material from around the equipment. Remove all packing material. Unbolt the equipment from its crate. Inspect for loose wiring. Make sure that all contact wedges and other shipping devices have been removed.

#### 1.6 PACKING INSTRUCTIONS FOR RESHIPMENT OR STORAGE

For long periods of storage, equipment should be covered to prevent corrosion and should be placed in a clean, dry location. If possible, equipment should be stored in its original crating. Periodic inspection should be made to ensure that the equipment is dry and that no condensation has accumulated. The equipment warranty does not cover damage due to improper storage.

The drive should be bolted in a crate which provides at least 2 inches of clearance. The drive should then be wrapped in polyethylene and covered with wax impregnated double walled #350 corrugation and crated. Assistance, if required, is available from the nearest MagneTek District Office.

#### 1.7 PRECAUTIONARY STATEMENTS

In addition to notes, the following types of precautionary statements appear in this manual.

IMPORTANT - A statement of conditions which should be observed during drive system setup or operation to ensure dependable service.

CAUTION - A statement of conditions which must be observed to prevent undesired equipment faults or degraded drive system performance.

WARNING - A statement of conditions which **MUST BE OBSERVED** to prevent personal injury or serious equipment damage.

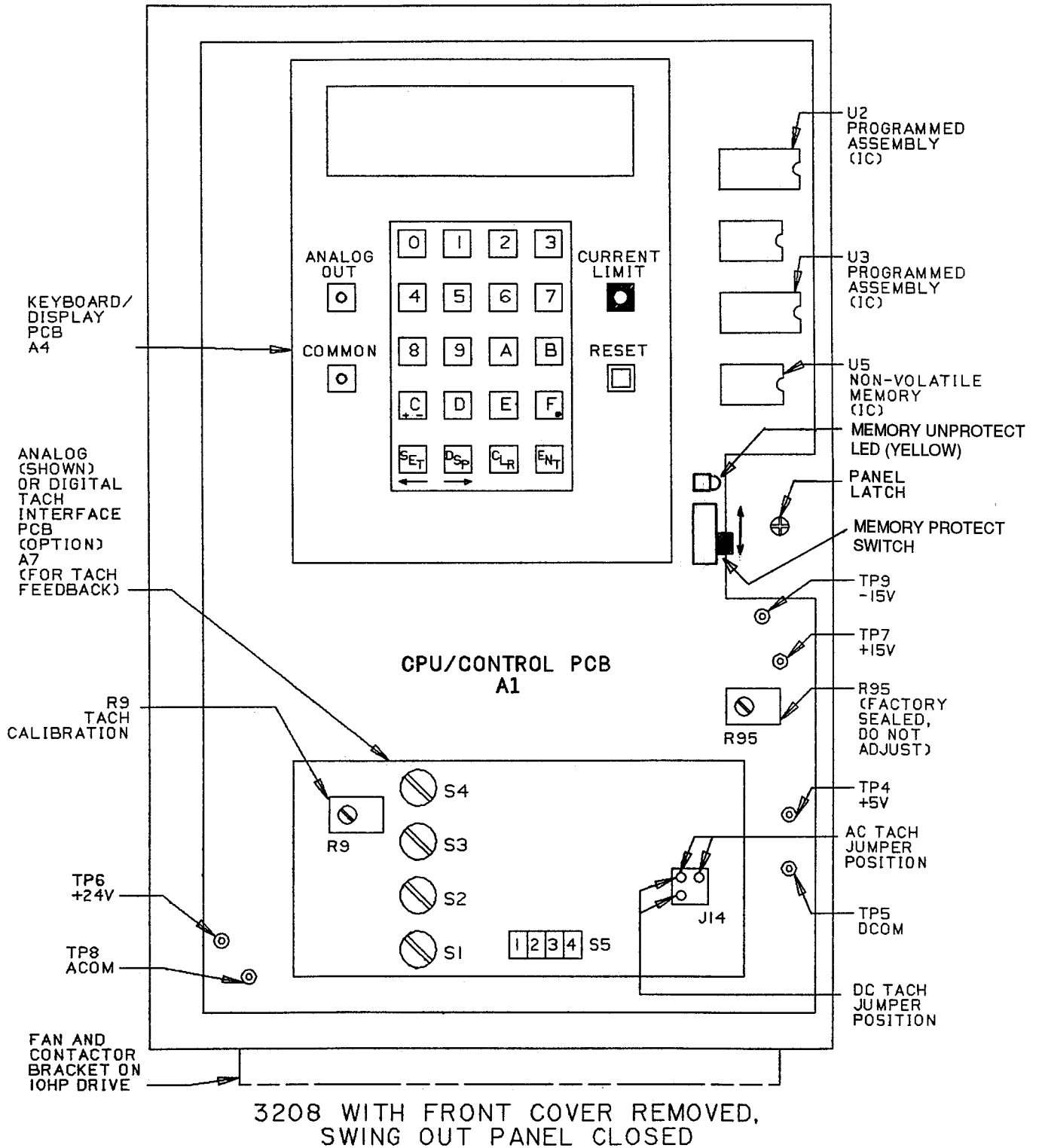
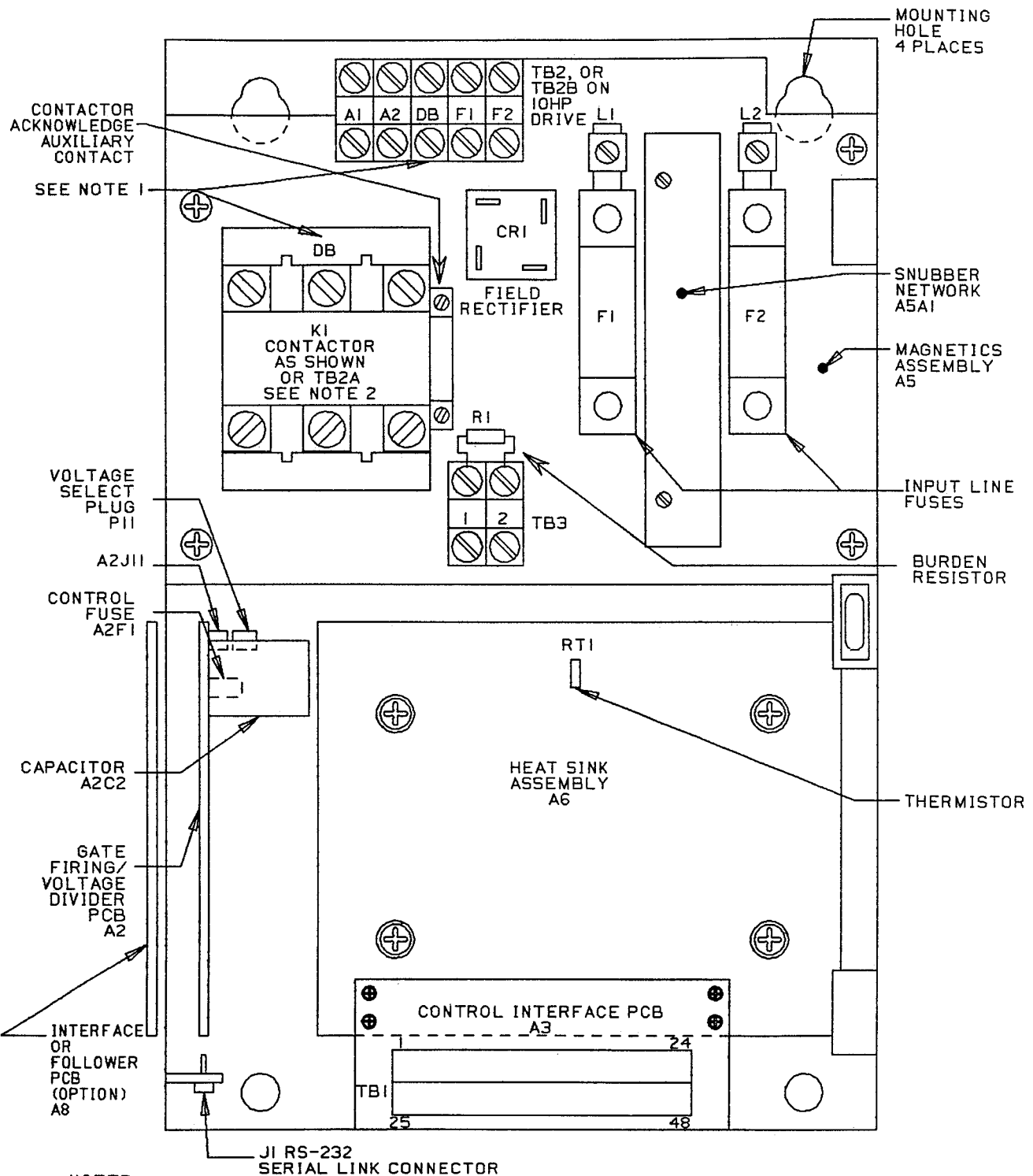


Figure 1-1. Saber 3208 Component Location Diagram  
(Sheet 1 of 2)





NOTES:

1. THE DB TERMINAL IS PART OF THE CONTACTOR ON DRIVES WITH MOTOR CURRENT RATINGS GREATER THAN 8.4 AMPS D.C. OTHERWISE THE DB TERMINAL IS PART OF TB2 AS SHOWN.
2. FOR 10HP DRIVE, CONTACTOR IS EXTERNAL TO POWER CUBE, WIRED TO TB2A, TB2B AND TB3.

TD.1.M88208.E.F101.1B

3208 WITH SWING OUT PANEL OPEN

Figure 1-1. Saber 3208 Component Location Diagram (Sheet 2 of 2)

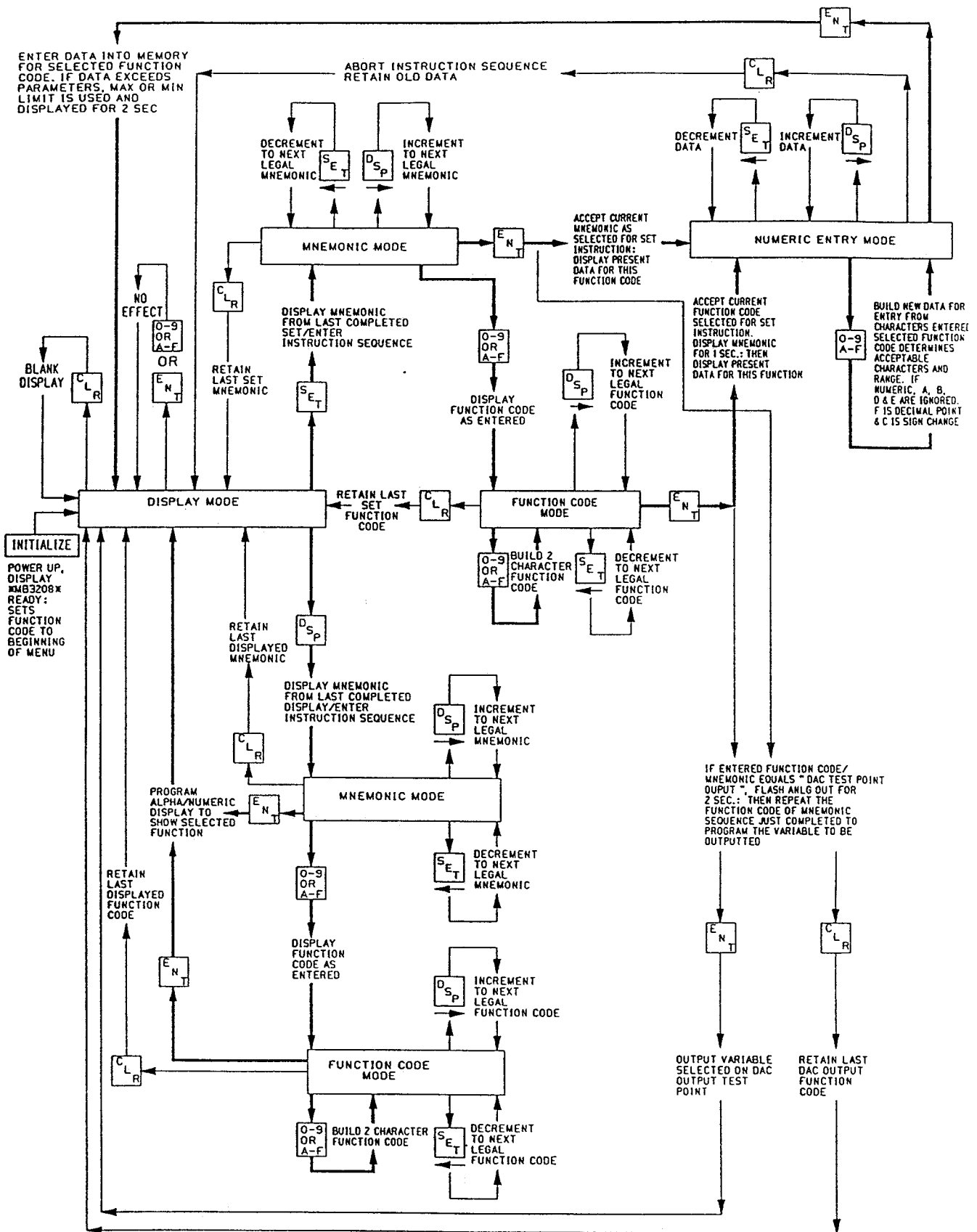


Figure 2-1. Saber 3208 Keyboard/Display State Diagram

## SECTION 2. KEYBOARD/DISPLAY OPERATION

### 2.1 INTRODUCTION

This section provides users, possessing limited "computer" background, sufficient information to confidently and successfully "program" the drive.

Programming tasks are completed via the Keyboard/Display, using simple alpha/numeric codes. Unit response is displayed in easily interpreted English abbreviations (MNEMONICS). There are four basic operational modes, which are explained in the following paragraphs and shown in Figure 2-1.

### 2.2 DISPLAY MODE

This mode provides a visual display and verification of drive functions that the user can view or alter (program). It is, therefore, an integral part of the other modes.

This mode is always entered when power is first applied. If no faults exist, "\*MB3208\*" or "READY" will be displayed. Once a message is displayed, the user must press either the DSP (DISPLAY) or SET key to enter the Mnemonic mode. If CLR (CLEAR) is pressed, the display will go blank. Pressing any other key will have no affect on the display or unit performance.

Once the Mnemonic mode is entered, and a task is performed or a parameter display setup is altered, the mnemonic for that parameter will appear on the display for 2 seconds, followed by a continuous display of the parameter value. The completion of subsequent tasks will be displayed in similar fashion, except that instead of a continuous display of the just completed task, the monitor will only display it for a period of 2 seconds and then revert back to a continuous display of the previous mnemonic value.

If the display was preprogrammed to monitor a specific parameter, the value of the parameter will be continually updated and displayed.

### 2.3 MNEMONIC MODE

The Mnemonic mode is entered from the Display mode by pressing either the SET or DSP key. Subsequent pressings of these keys will result in an increment/decrement function (to be discussed later). The SET key is used to either change a specific parameter or to change a particular drive status. The DSP key is used to view or monitor the value of a parameter without changing its value. When this mode is entered, an abbreviated form of a function name (mnemonic) is displayed which will be the last parameter that was set or displayed. The retaining of this

"last" function code is reset to 00 upon power up. When the mnemonic appears, if it is not the desired mnemonic, the DSP or SET key is used to increment or decrement, respectively, to the desired mnemonic. When scrolling through the mnemonics, if the DSP key was used to start the sequence, function codes pertaining to drive status changes will be skipped over (the mnemonics will not be shown). Only the next applicable function mnemonic will be displayed. Likewise, only settable functions will be accessible if the SET key was initially pressed. Holding down of either key for more than one second initiates the auto-key-repeat feature which results in a 4HZ scrolling rate.

When the desired function mnemonic is displayed, pressing the ENT (ENTER) key will access the Numeric Entry mode. If the SET key was initially pressed, the drive parameter or status may now be changed (reprogrammed). If the DSP key was initially pressed, the display will commence a continuous monitoring of the selected parameter.

#### 2.4 FUNCTION CODE MODE

The Function Code mode is entered from the Mnemonic mode by pressing any of the numeric keys (0-9) or letter keys (A-F). This mode allows direct function code entry by simply typing in the two digit function code, followed by the ENT key to conclude the function search. Invalid function codes will result in the display of a "NO FCTN" message.

Scrolling through the function code numbers can be performed in a similar fashion as in the Mnemonic mode. Again, once the desired function mnemonic is displayed, pressing the ENT key will access the Numeric Entry mode.

Table A1 of the Appendix lists each function in alphabetic order, while Table A2 lists each function in numerical order. Section 5 provides a description of each function code.

#### 2.5 NUMERIC ENTRY MODE

The Numeric Entry mode allows the user to alter the value of a specific parameter within a limited range of values. This mode can only be entered from the Mnemonic mode by first pressing the SET key, then either searching for the desired mnemonic OR entering in the corresponding function code, and finally pressing the ENT key. The current value and units of that particular parameter will be displayed in its correct format, while awaiting new digit entry from the keyboard.

Floating point decimal data is entered using keys 0-9 and the F (decimal point) key. If negative data entry is allowed for the particular variable, the C (change sign; +/-) key can be pressed at any time during the data entry. (The change sign key is ignored if negative entry is not allowed.) If the data field is

full, pressing another digit key will clear the data field with the new digit shown in the rightmost position.

Pressing the ENT key results in the accepted value being displayed for two seconds followed by reverting back to the previously displayed message. If data outside the acceptable range of the parameter is keyed in, the nearest acceptable value is taken for the parameter entry. If the entered data exceeds the acceptable number of significant digits for that particular parameter, a temporary "OVERFLOW" message will result. At this point, pressing any digit will start a new data field. As with any mode outside of the Display mode, pressing the CLR key will abort the key sequence and revert back to the Display mode with the parameter value left unchanged.

For selected parameters, data can be incremented or decremented while the drive is awaiting the first digit entry. The DSP or SET key is used for this purpose along with the auto-key-repeat feature. For each press of the key, the new value is entered into memory with the drive responding in a respective manner. Digit entry can still be entered by pressing any digit. When the desired value is reached during the increment/decrement process, pressing either ENT or CLR will exit the Numeric Entry mode. The increment/decrement keys will be ignored for parameters not allowing this feature. Information regarding specific parameters can be found in Table 3 Settable Parameters of the Appendix.

## 2.6 SPECIAL FEATURES AND FUNCTIONS

### 2.6.1 Analog DAC Output Setup

An additional feature of the drive includes an analog voltage output which can be measured between the two test points on the Keyboard/Display labeled ANALOG OUTPUT and COMMON. This enables the user to monitor, using test equipment such as an oscilloscope, a voltage proportional to any displayable parameter for troubleshooting purposes. The scaling of the output is controlled by the selectable Analog Output Scaling Adjustment (FCTN 42). See start-up procedures in Section 3 for scaling examples.

To set up the DAC output, press the SET or DSP key. At this point, either the mnemonic "DACSETUP" can be searched for by scrolling through the mnemonics, or function code "19" can be directly entered, followed by pressing the ENT key. The display will flash an "ANLG OUT" message for one second, followed by the mnemonic for the parameter that the DAC was previously displaying. (Upon power up, the DAC output is permanently programmed to monitor the Current Command.) At this time, the mnemonic for the desired parameter can be searched for, or the function code for the specific parameter can be typed in, finally followed by pressing the ENT key. The display will then confirm the new DAC setup by displaying "NEW DAC" for two seconds. The keyboard will again revert back to the Display mode.

### 2.6.2 Nominal or Percent Display

The Keyboard/Display can be set to operate in either a nominal or a percent display format. In the nominal mode, parameters are displayed in their nominal value. In the percent mode, the value is displayed as percent of rated along with a % sign. The SET key sequence must be used to change display modes. Note that not all parameters can be displayed in the percent format (e.g. motor rated parameters). Such parameters will always be displayed as if in the nominal mode.

### 2.6.3 Keystroke Fault Detection

There are certain keystroke sequences which are not allowed. When attempted, a fault message will be displayed. The following list explains the most commonly encountered fault messages.

NO FCTN: Message appears during the Function Code mode when an attempt is made to enter a function code that is beyond the list of codes for this version of the drive.

NO ENTRY: Message appears when entry into a different control mode is denied for any reason, usually if the loop contactor is not open.

SET N/A: Message will appear if an attempt is made to change a non-settable parameter by typing in the specific function code.

DSP N/A: Message will appear if an attempt is made to change a particular drive status by first pressing the DSP key. Review Sections 2.3 thru 2.5 for correct procedures.

OVERFLOW: During numeric entry for a particular parameter, too many significant whole digits were entered for the respective format. Refer to Table 3 of the Appendix for the acceptable range of values for the parameter.

### 2.6.4 Miscellaneous Messages

\*MB3208\* or READY: Messages indicate that the drive is awaiting any keyboard operation starting from the Display mode.

xxxx-ON or xxxx-OFF: A specific drive status change has been successfully completed by using the SET keystroke sequence. (Temporary status indication.)

### 2.7 DRIVE FAULT LOGIC MODE

Should a drive operation fault of any type occur, the Keyboard/Display operation will be over-ridden with the display annunciating the type of fault (see Section 6). Keyboard/Display operation will remain locked out until the fault condition is corrected and the RESET button is pressed.

## 2.8 KEYBOARD/DISPLAY SET/DISPLAY EXAMPLES

### NOTE

--- indicates no key pressed.  
 \_ indicates no character displayed.

#### 1. Display Line Voltage:

<u>Key Pressed</u>	<u>Display Response</u>
---	"*MB3208*" or continuous parameter display
DSP	Last displayed parameter mnemonic (e.g. RAT AMPS)
5	FCTN 5
4	FCTN 5 $\bar{4}$
ENT	LINEVOLT (2 sec) then actual line voltage with continuous update.

#### 2. Change the rated amps parameter from 5 amps to 7.5 amps:

<u>Key Pressed</u>	<u>Display Response</u>
---	"*MB3208*" or continuous parameter display
SET	Last altered parameter mnemonic (e.g. THD SPD)
0	FCTN 0
0	FCTN 0 $\bar{0}$
ENT	RAT AMPS (2 sec) then 5.00 A
7	7 A
.(F)	7. A
5	7.5 A
ENT	(BLINK) 7.50 A
---	After 2 sec keyboard reverts back to Display mode.

3. Change the motoring current limit from 150% to 125%:

<u>Key Pressed</u>	<u>Display Response</u>
---	"*MB3208*" or continuous parameter display
SET	Last altered parameter mnemonic (e.g. RAT AMPS)
1	FCTN 1
8	FCTN 1 $\bar{8}$
ENT	% ON (Percent Display mode enabled)
---	After 2 sec keyboard reverts back to Display mode.
SET	Last altered parameter mnemonics (e.g. RAT AMPS)
0	FCTN 0
7	FCTN 0 $\bar{7}$
ENT	MCURLIMS (2 sec) then 150.0%
1	1 %
2	12 %
5	125 %
ENT	(BLINK) 125.0%
---	After 2 sec keyboard reverts back to Display mode.

4. Set DAC output to monitor motor armature current:

<u>Key Pressed</u>	<u>Display Response</u>
---	"*MB3208*" or continuous parameter display
SET	Last altered parameter mnemonic (e.g. RAT AMPS)
1	FCTN 1
9	FCTN 1 $\bar{9}$
ENT	ANLG OUT (2 sec) then last DAC out parameter mnemonic
5	FCTN 5
2	FCTN 5 $\bar{2}$
ENT	NEW DAC (output current outputted as analog voltage to ANALOG OUT jack of Keyboard/Display and to terminal A3TB1-40.)
---	After 2 sec keyboard reverts back to Display mode.



## SECTION 3. INSTALLATION AND START-UP

### IMPORTANT

Complete procedures as they are presented. Do not "skip" steps unless directed to do so. A check-off block ([ ]) is provided to assist the installer in completing the start-up process.

#### 3.1 PHYSICAL INSTALLATION

The power converter is air cooled. The highest HP rated units are cooled by a fan; all others are cooled by convection. Select a site for installing the drive which is clean and well ventilated; maintenance will be minimized if the drive is located in a clean atmosphere.

#### Check

- [ ] The drive must be vertically mounted. Secure the drive to a wall, cabinet panel or other vertical structure using the bolt holes provided. Ensure that the unit is level.

#### 3.2 ELECTRICAL HOOKUP

Refer to the equipment interconnection diagram for detailed wiring information. Ensure that wire size and disconnect devices conform to the installation contractor's drawings and all applicable codes. Observe the following:

- [ ] A. In long cable runs, avoid excessive voltage drop.
- [ ] B. Separate the leads used for reference, feedback, and other low level signals from those used for the motor armature, field, and AC power.
- [ ] C. Connect all shields on shielded wire to system common (not ground) AT THE CONTROLLER END ONLY (see Figure 3-1). Twisted shielded pair wire should be used for long runs.

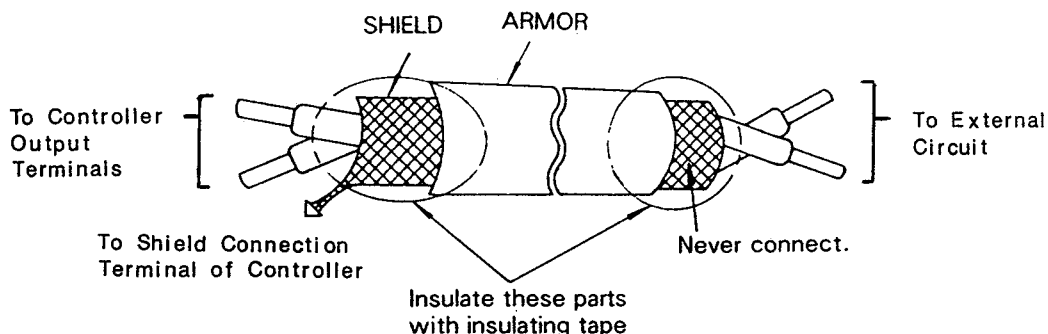


Figure 3-1. Shielded Lead Termination

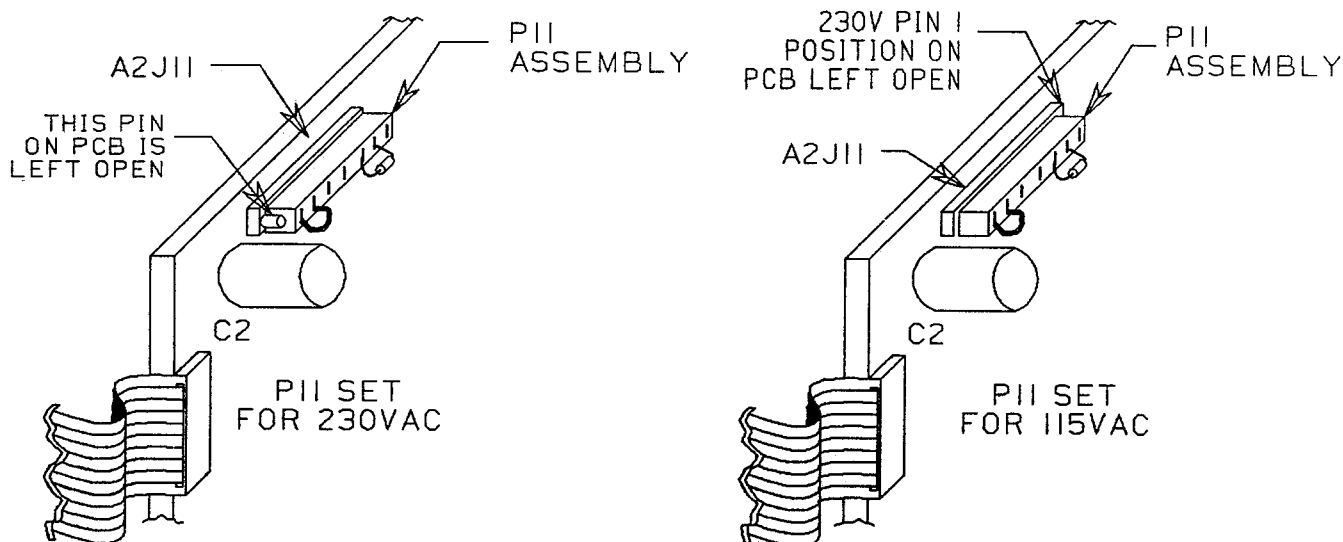
### 3.3 PREPOWER CHECK - NO POWER APPLIED

#### Check

- [ ] A. Inspect equipment for signs of damage, loose connections or other defects.
- [ ] B. Ensure the power line voltage and frequency are correct for the drive system.
- [ ] C. Remove all shipping devices and relay wedges.
- [ ] D. Ensure that all electrical connections are secure.
- [ ] E. Ensure that all transformers are connected for proper voltage according to the drive system schematic.
- [ ] F. Connect motor armature, operator control station, and motor tach (if applicable) to drive per inter-connection diagram.
- [ ] G. DO NOT CONNECT MOTOR FIELD WIRES AT THIS TIME.
- [ ] H. Verify P11 is correctly positioned (see Figure 3-2).

#### CAUTION

DRIVE MAY BE DAMAGED IF P11 IS IMPROPERLY INSTALLED.



TD.1 MB3208.E.F163.2

Figure 3-2. P11 - 115/230 VAC Selection

- [ ] I. Refer to Section 7. Select and install the proper burden resistor for the drive.

### 3.4 START-UP PROCEDURE

#### IMPORTANT

The start-up procedure to be used depends on the configuration in which the Saber 3208 is employed.

- If the Saber 3208 is used in stand-alone configuration (WITHOUT a MicroTrac Regulator), continue start-up procedures at paragraph 3.5.
- If the Saber 3208 is used in conjunction with a MicroTrac Regulator, go to paragraph 3.9 to complete start-up procedures.

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC

#### IMPORTANT

All settable parameters and operating modes are stored in non-volatile battery backed-up memory (U5 on the CPU/Control PCB) so that they will be saved when power is removed from the drive. Although the typical life expectancy of this part is 10 years, it will eventually have to be replaced, and the new part reprogrammed. Therefore, in all the following start-up steps, whenever a value is entered for a settable parameter, or an Enable is activated (set), it MUST BE RECORDED on the Saber 3208 Start-Up Record Sheet at the front of this manual.

#### 3.5.1 Initial Settings

##### Check

- [ ] A. Connect line power to drive (through open disconnect device).
- [ ] B. Apply power to the drive. Observe display of "\*MB3208\*" and then "READY".
- [ ] C. Set Rated Motor Current (FCTN 00) in amps (see motor nameplate), and record.
- [ ] D. Set Base Motor Speed (FCTN 02), in RPM (see motor nameplate), and record.

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### Check

- [ ] E. Set Rated Line Voltage (FCTN 03) (either 230 or 115 VAC). This AUTOMATICALLY SETS the rated motor voltage to either 180V (for 230 VAC) or 90V (for 115 VAC).

#### NOTE

Step F is only applicable to digital tach feedback systems.

- [ ] F. Set Feedback Tachometer Pulses Per Revolution (FCTN 04) (from digital tach nameplate).
- [ ] G. If analog tach feedback is used, refer to Section 8.1 and complete procedure before proceeding.
- [ ] H. If present on the operator control station, set the following switches as indicated:

<u>SWITCH</u>	<u>POSITION</u>
Remote/Local switch	Local
Trim On/Off switch	Off
Reverse On/Off switch	Off
Follower On/Off switch	Off
Speed/Torque switch	Speed

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### 3.5.1.1 Self Tuning Procedure

This procedure will circulate current through the motor armature. It requires that the MOTOR SHAFT NOT ROTATE. Therefore:

#### Check

- [ ] If the motor has a shunt field, TURN POWER OFF and disconnect motor field.
- [ ] If the motor has a permanent magnet field, TURN POWER OFF and lock the shaft mechanically so that it cannot rotate.
- [ ] A. If the drive is equipped with the Field Loss option, REMOVE POWER from the drive, install a jumper across the Field Loss contact in the Stop line.

#### NOTE

FOR SELF TUNING IN THE REMOTE MODE, PROCEED TO STEP E (IGNORE STEPS B THRU D).

- [ ] B. Apply power. Select the Current Regulator Self Tuning Procedure (FCTN 1A); observe display of "GAIN SET".
- [ ] C. Within 30 seconds, press the RUN button. This step will start a procedure which will measure the motor circuit parameters and calculate all the current regulator gain values and a nominal IR compensation value. After the test is finished, the display will read either "COMPLETE" or "ABORTED". If aborted, check for one of the following:
  1. RUN was not pressed within 30 seconds. Repeat from step B.
  2. RUN was pressed but contactor did not close. Check contactor interlock and run/stop wiring. Correct and repeat from step B.
  3. Contactor closed and motor started spinning. Verify that motor field is disconnected. If motor has permanent magnet field, rotor must be securely locked so that it cannot turn. Correct and repeat from step B.
  4. Contactor closes, but no current is built up and "ABORTED" is displayed 30 seconds after contactor closes. Check for open circuit in armature loop. Correct and repeat from step B.

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

- D. After procedure is "COMPLETE", display (but DO NOT CHANGE) and record the following values:

#### Check

- [ ] 1. Load Resistance (FCTN 05).
  - [ ] 2. Load Inductance (FCTN 06).
  - [ ] 3. Discontinuous Current Regulator Proportional Gain (FCTN 2D).
  - [ ] 4. Discontinuous Current Regulator Integral Gain (FCTN 2E).
  - [ ] 5. Continuous Current Regulator Proportional Gain (FCTN 2F).
  - [ ] 6. Continuous Current Regulator Integral Gain (FCTN 3D).
- E. When Self Tuning is commanded by a remote host computer via the serial link, there are some basic differences in both the serial communication, and the Self Tuning Function operation.
- 1. After invoking Self Tuning over the serial link, the tuning process begins immediately without requiring a subsequent Run command.
  - 2. After invoking Self Tuning, the 3208 will delay sending a return message back to the host for up to 30 seconds. Then, if tuning completes, the 3208 sends a Checksum Acknowledgement message back. If tuning aborts, a Syntax Error Code 03 message is returned to the host.
  - 3. If Self Tuning is invoked over the serial link while the drive is in local control mode, a Syntax Error Code 03 message is returned.
  - 4. During the tuning process, no serial communication commands will be processed.
- [ ] F. If applicable, remove power from the drive, remove the jumper installed in Step A, to restore the Field Loss option.

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

- [ ] G. With power disconnect locked out, CONNECT THE MOTOR FIELD or UNLOCK THE MOTOR SHAFT.

#### NOTE

The nominal fixed field supply voltage is 207 VDC for 230 VAC input, 104 VDC for 115 VAC input. The motor nameplate either specifies shunt field voltage directly, or field current and resistance from which voltage can be calculated. If rated motor field voltage varies significantly from the nominal supply, a series trim resistor may be required in the field circuit to achieve base motor speed.

### 3.5.2 Calibration of Drive for Particular Motor and Tachometer Check

- [ ] A. Set Motoring Current Limit (FCTN 07) to 60 percent of rated motor current.
- [ ] B. Set Regenerating Current Limit (FCTN 08) to 60 percent of rated motor current.

#### NOTE

All acceleration and deceleration times are set in seconds, in 0.1 second increments. The allowable range is 0 thru 999.9 seconds.

- [ ] C. Set Run Acceleration Time (FCTN 09) to 10 seconds.
- [ ] D. Set Run Deceleration Time (FCTN 0A) to 10 seconds.
- [ ] E. Set Voltage Feedback Enable (FCTN 28). This is NECESSARY FOR INITIAL SETUP of the drive, even if it will finally utilize speed feedback.
- [ ] F. Set Per Unit Inertia (FCTN 33) to 0.5 seconds if the motor is not attached to the load at this time, or to 1.0 seconds if the motor is coupled to a load.
- [ ] G. Set Response (FCTN 34) to 3 radians.
- [ ] H. Set the Keyboard Run Reference Enable (FCTN 26).
- [ ] I. Set Run Speed (FCTN 13) to zero.
- [ ] J. Press the RUN button. The contactor should close and the motor should remain stopped or creep slowly in either direction.

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### Check

- [ ] K. Increase Run Speed (FCTN 13) to approximately 10 percent of rated speed. Verify that the motor turns and that speed is stable. If the CURRENT LIMIT lamp is lit, press STOP and wait for the contactor to open. Then check for the presence of field voltage, and with power disconnected, check the integrity of the field wiring connections. Correct the condition, and repeat from step J.
  
- [ ] L. Set Run Speed to 50 percent of rated speed. Verify that motor turns at a greater speed and that speed is stable.

#### NOTE

It will take approximately 4 seconds for the motor to accelerate from 10 to 50 percent speed.

- [ ] M. Display Output Voltage (FCTN 53). This should be 50 percent of rated motor voltage  $\pm 10$  percent.
  
- [ ] N. Press STOP.

#### 3.5.3 Calibration of the Drive for Particular Operator Control Station

#### IMPORTANT

Thread settings are only applicable if the operator control station is equipped with a THREAD push button.

#### Check

- [ ] A. Set Thread Speed (FCTN 14) to the desired Thread mode preset speed. This value may be set over a range of -100 to +100 percent of rated speed.
  
- [ ] B. Set Thread Acceleration Time (FCTN 0D).
  
- [ ] C. Set Thread Deceleration Time (FCTN 0E).

#### IMPORTANT

Jog settings are only applicable if the operator control station is equipped with a JOG push button.

- [ ] D. Set Jog Speed (FCTN 15) to the desired Jog mode preset speed. This value may be set over a range of -100 to +100 percent of rated speed.



### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### Check

- [ ] E. Set Jog Acceleration Time (FCTN 0F).
- [ ] F. Set Jog Deceleration Time (FCTN 10).
- [ ] G. Set Jog Contactor Drop Out Delay (FCTN 12) for the desired time the loop contactor will remain energized after the Jog command is removed. This time delay is settable from zero to 4 seconds.

#### IMPORTANT

This delay will not be active if Jog Controlled Stop is enabled.

- [ ] H. Set either Jog Controlled Stop Enable (FCTN 1D) or Jog Controlled Stop Disable (FCTN 1E) depending on whether controlled stop or coast to stop is desired from Jog. Enabling this function causes the Jog Contactor Drop Out Delay to be inactive.

#### IMPORTANT

The Quick Stop Deceleration setting is only applicable if the operator control station is equipped with a QUICK STOP push button.

- [ ] I. Set Quick Stop Deceleration Time (FCTN 11).

#### 3.5.4 General Drive Settings

#### IMPORTANT

It is recommended that the following function be enabled because it is a PROTECTIVE FUNCTION for the motor.

#### Check

- [ ] A. Set either Motor Overload Enable (FCTN 1F) or Motor Overload Disable (FCTN 20) depending on whether or not the inverse time overload trip function is desired. (See description of MOTOR OVERLOAD ENABLE/DISABLE in Section 5).
- [ ] B. Set either Controlled Stop Enable (FCTN 1B) or Controlled Stop Disable (FCTN 1C) depending on whether controlled stop or coast to stop is desired from Run and Thread.

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### Check

- [ ] C. If Controlled Stop Enable was chosen, set the Controlled Stop Contactor Drop Out Speed (FCTN 16).
- [ ] D. Set Torque Regulated Follower Droop (FCTN 36) for zero percent.
- [ ] E. Set the Overspeed Trip Threshold (FCTN 35) to the desired value. It should be set 5 to 10 percent higher than the highest expected operating speed in order to avoid nuisance fault trips. Short acceleration times and high regulator gains will cause motor speed overshoots.
- [ ] F. Speed Limit (FCTN 37) sets the maximum allowable motor speed. Set in RPM or as a percent of rated, this adjustment has an allowable range of zero to 120 percent of base motor speed. Set this function to the desired value.
- [ ] G. If the logic output hardware channel is to be configured to provide a specific indication, this should now be done by selecting FCTN 29, 2A, or 2B. See the functional descriptions for UP TO SPEED, SPEED SENSE, and CURRENT SENSE LOGIC ENABLES in Section 5 of this manual for additional information.
- [ ] H. There are three Analog Outputs available to the user on the Customer Interface PCB. They are:
  1. Speed Feedback on A3TB1-39
  2. Speed Reference on A3TB1-38
  3. Selectable Analog Output on A3TB1-40.

These outputs have a  $\pm 10$  volt signal range which is scaled by keyboard function settings 3E, 3F, and 42 respectively. The output signals are multiplied by the keyboard adjustment settings. For a 10 volt output at rated motor speed or speed reference, set the appropriate scale factor to 100%. For a 5 volt output at rated motor speed or speed reference, set the appropriate scale factor for 50%.

The Selectable Analog Output is selected by setting FCTN 19, Digital/Analog Converter (DAC) Setup. See paragraph 2.8 example 4 of this manual for programming instructions for this output channel. Scaling of this output via function 42 is identical to scaling of the speed feedback or reference.

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### Check

- [ ] I. Set Per Unit Inertia (FCTN 33) and Response (FCTN 34) per paragraph 3.6 of this manual.
- [ ] J. Set Reference Smoothing (FCTN 44) to 4.
- [ ] K. Set current limit values (FCTN 07 and 08) to desired values.

#### IMPORTANT

The drive must be stopped (motor not running) before a change from the Keyboard Run Reference to the Analog Run Reference, or vice versa, will be allowed.

- [ ] L. If the drive will be used as a voltage regulator only, with an external voltage command potentiometer for drive control, activate (set) Analog Run Reference Enable (FCTN 25).
- [ ] M. If the drive will be used as a voltage regulator only, without tach feedback, and if the drive will be used in the Follower mode of operation, perform the Follower mode setup instructions per paragraph 3.7 of this manual.
- [ ] N. If the drive will be used as a voltage regulator only, without tach feedback, and if the drive will be used with an externally provided Torque Command signal in addition to a Speed Command, perform the torque regulated speed follower (TRSF) setup instructions per paragraph 3.8 of this manual. If the drive will not be used in a TRSF mode, set Torque Regulated Speed Follower Droop (FCTN 36) to zero percent.
- [ ] O. If the drive will be used as a voltage regulator only, without tach feedback, and if the drive will be used with an externally provided Trim Command in addition to a Speed Command, perform the adjustment in this step. The Trim Command Span Adjustment sets the effective range that the trim command input signal (wired to A3TB1-9) will have on motor speed. This adjustment is scaled so that a 10 volt command input corresponds to 100 percent speed (rated speed) with Span set to 100 percent. Set Trim Command Span to the desired range of trim control.
  - A. Display Trim Command Input (FCTN 4F).

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### Check

- [ ] O. (Continued)
  - B. Apply the maximum expected Trim Command signal to the drive.
  - C. Adjust the setting of Trim Command Span Adjustment (FCTN 41) until the desired maximum percentage of trim speed is displayed.
- [ ] P. If the drive uses tachometer feedback, proceed to para. 3.5.5, Speed Regulator Setup; otherwise, START-UP IS NOW COMPLETE. Stop the drive. If Run Acceleration and Deceleration times (FCTN 09 and 0A) other than 10 seconds are desired, enter them now. If the keyboard will be used to provide the speed command to the drive, set Run Speed (FCTN 13) to the desired value. Otherwise enable the Analog Reference Enable (FCTN 25). If it is desired that values be displayed in nominal units rather than as percents, set FCTN 17, Set Nominal Values. Select the Drive Status Feedback Function (FCTN 2C), and record status of drive enables.

#### 3.5.5 Speed Regulator Setup

##### IMPORTANT

A Tach Interface option PCB must be installed for this check.

#### Check

- [ ] A. Set Run Speed (FCTN 13) for 50 percent.
- [ ] B. Display Tachometer Feedback (FCTN 6A).
- [ ] C. Press Run. Tach Feedback should be at +50 percent of rated speed  $\pm 20$  percent. If the display is -50 percent  $\pm 20$  percent, the tachometer is connected backwards. Press the STOP button, and remove power from the drive. Reverse the tachometer wires, and then repeat this step.

If the display is nearly zero ( $\pm 5$  percent of rated speed) check for the following:

1. Broken wire from the tach.
2. Loose connector between Tach Interface and Control Interface or between Tach Interface PCB(s).

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### Check

#### C. (Continued)

- [ ] If drive has analog tach feedback, check the voltage at ATI OUTPUT test point, TP2, on Analog Tach Interface PCB with respect to common, TP6. The voltage should be  $+4 \pm 0.8$  VDC. If the voltage is positive, and non-zero, but not within spec, recheck tach scaling (switches S1 thru S4 and setting of R9 on Analog Tach Interface PCB; see Section 8).
- [ ] If drive has digital tach feedback, and the Tach Speed display is positive, and non-zero, but not within the  $\pm 20$  percent spec, recheck the setting of Base Motor Speed (FCTN 02) and Feedback Tach Pulses Per Revolution (FCTN 04).
- [ ] D. Stop the drive.
- [ ] E. Set Tach Feedback Enable (FCTN 27).
- [ ] F. Set Run Speed (FCTN 13) to zero.
- [ ] G. Press the RUN push button. The contactor should close and the motor should remain stopped or creep slowly in either direction.
- [ ] H. Increase Run Speed to approximately 10 percent of rated speed. Verify that the motor turns and that speed is stable.
- [ ] I. Set Run Speed to 50 percent of rated speed. Verify that motor turns at a greater speed and that speed is stable.

#### NOTE

It will take approximately 4 seconds for the motor to accelerate from 10 to 50 percent speed.

- [ ] J. Display Speed Feedback Output Signal (FCTN 4B). This should be  $+50$  percent of rated speed  $\pm 1$  percent.
- [ ] K. Set Run Acceleration and Deceleration times (FCTN 09 and 0A) to the desired values.
- [ ] L. If the drive will be run using the keyboard to provide the speed command, set Run Speed (FCTN 13) to the desired value. Otherwise, stop the drive, and set the Analog Reference Enable (FCTN 25).

### 3.5 START-UP OF SABER 3208 W/O MICROTRAC (Continued)

#### Check

- [ ] M. If the current limit values (FCTN 07 and 08) were increased while measuring Per Unit Inertia, set them back to the desired values.
- [ ] N. If the drive will be used in the Follower mode of operation, perform the follower setup instructions per paragraph 3.7 of this manual.
- [ ] O. If the drive will be used with an externally provided Torque Command signal in addition to a Speed Command, perform the torque regulated speed follower (TRSF) setup instructions per paragraph 3.8 of this manual. If the drive will not be used in a TRSF mode, set Torque Regulated Speed Follower Droop (FCTN 36) to zero percent.
- [ ] P. If the drive will be used with an externally provided Trim Command in addition to a Speed Command, perform the adjustment in this step. The Trim Command Span Adjustment sets the effective range that the trim command input signal (wired to A3TB1-9) will have on motor speed. This adjustment is scaled so that a 10 volt command input corresponds to 100 percent speed (rated speed) with Span set to 100 percent.
  - A. Display Trim Command Input (FCTN 4F).
  - B. Apply the maximum expected Trim Command signal to the drive.
  - C. Adjust the setting of Trim Command Span Adjustment (FCTN 41) until the desired maximum percentage of trim speed is displayed.
- [ ] Q. If system response to load changes is sluggish, increase the setting for Response (FCTN 34). See the definition of RESPONSE in Section 5 of this manual.
- [ ] R. START-UP IS NOW COMPLETE. Select the Drive Status Feedback Function (FCTN 2C) and record status of drive enables.

### 3.6 PER UNIT INERTIA AND RESPONSE ADJUSTMENT

3.6.1 If motor horsepower, base motor speed, and the combined motor and load inertia is known, then Per Unit Inertia can be calculated using the following formula.

$$t = \frac{(\text{INERTIA (WK}^2\text{)}) \times (\text{MOTOR BASE SPEED})^2}{(1.610,000) \times (\text{MOTOR HORSEPOWER})}$$

Where t = Per Unit Inertia in seconds. Enter this value for Per Unit Inertia (FCTN 33).

3.6.2 If the combined motor and load inertia is not known, Per Unit Inertia can be measured using the following procedure.

- A. Verify that Run Acceleration and Deceleration (FCTN 09 and 0A) are set for 10 seconds.
- B. Set FCTN 18, to display reading as a Percent of Rated.
- C. Set Run Speed, FCTN 13 for 100 percent.
- D. Display Current Command, FCTN 50.
- E. Press Run. Wait 5 seconds, then record the displayed value of Current Command. Allow the motor to continue accelerating to top speed.

#### NOTE

If the CURRENT LIMIT indicator comes on while performing this step, or step F below, the data taken is invalid. Stop the drive, and increase current limit settings (FCTN 07 and 08) until CURRENT LIMIT indicator no longer comes on, then repeat step E.

- F. Press Stop. Wait 5 seconds, then record the displayed value of Current Command, including the sign of the value.
- G. Using signed arithmetic, calculate Per Unit Inertia using the following formula.

$$t = \frac{(\text{AVE ACCEL CURRENT COMMAND}) - (\text{AVE DECEL CURRENT COMMAND})}{20}$$

Where t = Per Unit Inertia in seconds. Enter this value for Per Unit Inertia (FCTN 33).

3.6.3 Response is the crossover frequency or bandwidth of the drive expressed in radians. This setting has a 0 to 10 radian range. By increasing this setting, the time to recover from instantaneous load changes will be decreased, and drive responsiveness to step changes in speed command will increase. A SETTING WHICH IS TOO GREAT MAY CAUSE INSTABILITY AND WILL ALWAYS CAUSE OVERSHOOT OF STEP REFERENCE CHANGES WHEN SHORT ACCELERATION OR DECELERATION TIMES (FCTN 09 and 0A) ARE SET.

Set Response (FCTN 34) to the desired value.

### 3.7 FOLLOWER MODE SETUP

An analog signal follower circuit is included as part of the standard Saber 3208 with provisions for various types of signal inputs. Use Table 3-1 to select the type of signal to be followed, the desired action, and initial adjustment settings. Make the appropriate selector switch settings on the CPU/Control PCB and enter the initial settings for Low Speed Tracking and Upper and Lower Ratio as indicated in the table. The Follower mode will be active when the drive is running and the FOLLOWER logic input signal is active.

#### IMPORTANT

This procedure is applicable ONLY to drives which DO NOT have an Analog Follower option PCB (46S02822-0010) in the A8 position. IF THE DRIVE DOES HAVE this option, proceed to Section 8.2 for hardware and software setup instructions.

#### 3.7.1 Follower Adjustments

The drive RATED SPEED, LOW SPEED TRACKING, and RATIO adjustments are interactive. Be sure that the RATED SPEED adjustment has been made and is correct for the application and that the drive performs as expected in the MANUAL operating mode before attempting final adjustments for LOW SPEED TRACKING and RATIO. The internal signal that the drive will follow may be displayed via FCTN 4E, in units of percent.

If the follower signal will be used to modulate the drive current, follow the adjustment procedure below, but substitute the word "current" for the word "speed" in the text.

1. Set the anti-reverse clamp OFF (set FCTN 24, Anti-Reverse Disable). Display the Speed/Torque Follower Reference Signal (FCTN 4E).
2. Apply the minimum external signal, zero if the desired operation is bidirectional. Set Low Speed Tracking (FCTN 3A) for the desired minimum operating speed.



Table 3-1. Analog Follower Signal Input Selection

TYPE #	INPUT SIGNAL RANGE (DC ONLY)	DESIRED ACTION (NOTE 1)	SWITCH POSITION ON CPU CONTROL PCB				LOW SPEED TRACKING (FCTN 3A)	RATIO FOR RATED SPEED (FCTN 3B/3C)
			S1-1	S1-2	S1-3	S1-4		
1	±10V	BI-DIR	-	-	-	-	0.0%	100.0%
2	±5V	BI-DIR	X	-	-	-	0.0%	100.0%
3	0 to 10V	UNIDIR	X	X	-	-	100.0%	50.0%
4	0 to 5V	UNIDIR	X	X	-	-	100.0%	100.0%
5	±20mA*	BI-DIR	-	-	X	X	0.0%	100.0%
6	0 to 20mA*	UNIDIR	X	X	X	X	100.0%	50.0%
7	4 to 20mA*	UNIDIR	X	X	X	X	60.0%	62.5%

Notes:

1. BI-DIR indicates bidirectional operation, UNIDIR indicates unidirectional operation.
2. An X in the columns above indicate that the switch should be closed (ON).
3. \* If the desired signal to follow is ±50mA, 0 to 50mA or 10 to 50mA, install a 162.0 ohm resistor across terminals A3TB1-11 and 12 and set switches and adjustments as indicated in the table for signal Type #5, 6, or 7 as appropriate.

### 3.7 FOLLOWER MODE SETUP (Continued)

#### 3.7.1 Follower Adjustments (Continued)

3. Apply the maximum external signal. Set both Upper and Lower Ratios (FCTN 3B and 3C) for the desired maximum operating speed.
4. If the drive runs backwards when in the Follower mode, reverse the polarity of the follower signal by reversing connections at the terminal strip A3TB1-11 and A3TB1-12 OR activate the REVERSING logic signal in parallel with the FOLLOWER logic signal.
5. If it is desired that the drive speed should not reverse when the signal to be followed is below the minimum level, set the anti-reverse clamp ON (set FCTN 23, Anti-Reverse Enable).
6. If it is desired that drive Acceleration and Deceleration rates be limited when in the Follower mode, make the appropriate time rate settings for FCTN 0B and 0C. For quickest follower response, the Follower Acceleration and Deceleration rates should be set to zero. These settings will be in effect only when the Follower mode is ON and the drive is attempting to speed follow the external signal. (Does not apply to the drive current follower mode.)
7. Display Speed Feedback (FCTN 4B) [or Output Current (FCTN 52)]. Start the drive and energize the FOLLOWER logic signal to turn the Follower mode ON. Repeat steps 2 through 6 above to verify proper settings for Low Speed Tracking and Ratio, and to ensure that the proper end points are approached without signal saturation. Make final adjustments to these settings in small numeric increments and re-test over the follower signal range until the desired results are obtained.

#### 3.7.2 External Ratio Adjustments

The standard Saber 3208 signal follower has a provision for an external analog signal to be used as a RATIO adjustment. When used, this  $\pm 10V$  signal may be applied at terminal A3TB1-10. With +10 VDC applied, the follower RATIO will be set at the Upper Ratio limit as entered via FCTN 3B. With -10 VDC applied, the follower RATIO will be set at the Lower Ratio limit entered via FCTN 3C. With an external ratio signal between +10V and -10V (including zero), the actual ratio used will be calculated to be proportionally between these limits. If this feature is desirable, do the following:

1. Set the desired Upper Ratio limit (FCTN 3B)  
Set the desired Lower Ratio limit (FCTN 3C)

### 3.7.2 External Ratio Adjustments (Continued)

2. Start the drive, turn the Follower mode ON, and adjust the signal to be followed to maximum value. Verify by adjusting the external RATIO signal that the proper Ratio range is obtained. Adjust the Upper Ratio and Lower Ratio settings as necessary.

#### NOTE

If the external RATIO provision is not used, both Upper and Lower Ratio settings must be entered as the same value.

### 3.7.3 Digital Tachometer Follower

A digital tachometer may be used as the reference signal source for follower operation but requires that an optional Digital Tachometer Interface PCB (46S02663-0020) be installed in the A8 position.

The Digital Tachometer Follower will be automatically sensed and selected as the source of the follower input signal when drive power is turned ON and if properly connected to the drive.

If this optional feature is used, do the following:

1. Verify that the connection cable is plugged in between J16 on the Digital Tachometer Follower Interface PCB and J16 on the Control Interface PCB (A3).
2. Verify that the Digital Tachometer Interface PCB contains a jumper wire between points E1 and E3 on the card.
3. Verify that the digital tachometer is wired to the terminal strip A3TB1 in accordance with the connection diagram.
4. Enter the Follower Tachometer Pulses Per Revolution parameter value (FCTN 39).
5. Initially set Low Speed Tracking (FCTN 3A) to 0.0%. Set Upper and Lower Ratios (FCTN 3B and 3C) to 100.0%.
6. Follow set up and fine tuning instructions located in sections 3.7.1 and 3.7.2. When adjusting the digital tachometer follower input signal, the signal source tachometer must be rotating and providing the proper signal. This may be checked by displaying Follower Command Input (FCTN 45).
7. If the follower tachometer signal results in reversed drive rotation, Reverse the wiring connections for follower tachometer signals A and  $\bar{A}$  at A3TB1.

### 3.8 TORQUE REGULATED SPEED FOLLOWER SETUP

Torque Regulated Speed Followers (TRSF) are generally used with a cascaded speed reference system on web feed continuous process line drives. The purpose of a TRSF drive is to provide for some settable tension in the material being processed. A torque command signal, generally derived by means of a potentiometer, is compared to armature current feedback to generate torque error. Torque error is added to the drive speed reference as a speed trim for outer loop torque control. The advantage of TRSF is that it is inherently more stable than other types of torque regulators, and will not run away if the web is broken. TRSF mode is active when the drive is running in the speed regulator mode with the TRIM logic function turned on.

There are two software adjustments associated with the TRSF mode, the Torque Command Span adjustment, and the Torque Regulated Speed Follower Droop adjustment.

3.8.1 To avoid interference from the Speed Trim analog input, set the Trim Command Span Adjustment (FCTN 41) to zero percent.

3.8.2 The Torque Command Span Adjustment sets the effective range that the torque reference input signal (wired to A3TB1-15) will have on motor current. The span setting multiplies the torque reference input such that if it is set for 100 percent, a 10 volt input corresponds to rated current. The torque command span multiplier may be set between zero and  $\pm 999.9\%$ .

- A. Set Droop (FCTN 36) to zero percent.
- B. Display Torque Reference (FCTN 6C).
- C. Apply the maximum Torque Reference input signal to the drive that the operator will use.
- D. Adjust the setting of Torque Command Span Adjustment (FCTN 40) until the desired percentage of output current is displayed.

3.8.3 Torque Regulated Speed Follower Droop adjusts the percent of influence torque error will have on the drive speed reference. The allowable range is from zero to 999.9%, with negative entries disallowed. The scaling is such that a setting of 100 percent yields a 100 percent speed change for a 100 percent torque error. For example, with desired torque equal to 50 percent, and current feedback equal to 10 percent, a droop setting of 20 percent will yield a speed reference correction of 8 percent.

- A. Run the drive and machinery with the process web in place.
- B. Turn the TRIM logic input signal on to activate TRSF mode.

### 3.8.3 (Continued)

- C. Display Output Current (FCTN 52), or monitor web tension, and adjust Droop (FCTN 36) to obtain the desired tension correction.

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### 3.9 START-UP OF SABER 3208 WITH MICROTRAC

Two of the 3208 variables as displayed do not agree with their MicroTrac counterparts. They are Speed Feedback Output Signal (FCTN 4B) and Output Voltage (FCTN 53).

- A. Speed feedback as displayed on MicroTrac is an accurate reflection of true motor speed based on tachometer feedback. The Speed Feedback Output Signal on 3208 (FCTN 4B) is an approximate calculation of motor speed based on motor CEMF, which will vary from the MicroTrac displayed value.
- B. The armature voltage as displayed on MicroTrac may be different than the Output Voltage (FCTN 53) displayed on 3208. This is because the MicroTrac display is armature terminal voltage and the 3208 output voltage display is motor CEMF.

#### IMPORTANT

All settable parameters and operating modes are stored in non-volatile battery backed-up memory (U5 on the CPU/Control PCB) so that they will be saved when power is removed from the drive. Although the typical life expectancy of this part is ten years, it will eventually have to be replaced, and the new part reprogrammed. Therefore, in all the following start-up steps, whenever a value is entered for a settable parameter or an Enable is activated (set), it MUST BE recorded on the Saber mb3208 Start-Up Record Sheet at the front of this manual.

#### 3.9.1 Drive Calibration for Particular Motor

##### Check

- [ ] A. Connect line power to drive (through open disconnect device).
- [ ] B. Apply power to the drive. Observe display of "\*MB3208\*" and then "READY".
- [ ] C. Set Rated Motor Current (FCTN 00) in amps (see motor nameplate), and record.
- [ ] D. Set Base Motor Speed (FCTN 02), in RPM (see motor nameplate), and record.

### 3.9 START-UP OF SABER 3208 WITH MICROTRAC (Continued)

#### 3.9.1 Drive Calibration for Particular Motor (Continued)

##### Check

- [ ] E. Set Rated Line Voltage (FCTN 03) (either 230 or 115 VAC). This will automatically set the rated motor voltage to either 180V (for 230 VAC) or 90V (for 115 VAC).
- [ ] F. Remove input power.

#### 3.9.2 Self Tuning Procedure

This procedure will circulate current through the motor armature. It requires that the MOTOR SHAFT NOT ROTATE. Therefore:

##### Check

- [ ] If the motor has a shunt field, TURN POWER OFF and disconnect motor field.
- [ ] If the motor has a permanent magnet field, TURN POWER OFF and lock the shaft mechanically so that it cannot rotate.
- [ ] A. Install a jumper between terminals A3TB1-1 and A3TB1-2.
- [ ] B. Install a maintained switch between terminals A3TB1-20 and A3TB1-21. Switch MUST be OPEN at this time.
- [ ] C. Apply input power.
- [ ] D. Select the Current Regulator Self Tuning Procedure (FCTN 1A); observe display of "GAIN SET".
- [ ] E. Within 30 seconds, close the switch installed in step B. This will start a procedure which will measure the motor circuit parameters and calculate all the current regulator gain values and a nominal IR compensation value. After the test is finished, the display will read either "COMPLETE" or "ABORTED". OPEN SWITCH. If aborted, check for one of the following:
  1. Switch was not closed within 30 seconds. Repeat from step C.
  2. Contactor did not close. Check contactor interlock (jumper installed in step A) and run/stop wiring (switch installed in step B). Correct and repeat from step C.



### 3.9 START-UP OF SABER 3208 WITH MICROTRAC (Continued)

#### 3.9.2 Self Tuning Procedure (Continued)

##### Check

3. Contactor closed and motor started spinning. Verify that motor field is disconnected. If motor has permanent magnet field, rotor must be securely locked so that it cannot turn. Correct and repeat from step C.
  4. Contactor closes, but no current is built up and "ABORTED" is displayed 30 seconds after contactor closes. Check for open circuit in armature loop. Correct and repeat from step C.
- F. After procedure is "COMPLETE", display (but DO NOT CHANGE) and record the following values:
- [ ] 1. Load Resistance (FCTN 05).
  - [ ] 2. Load Inductance (FCTN 06).
  - [ ] 3. Discontinuous Current Regulator Proportional Gain (FCTN 2D).
  - [ ] 4. Discontinuous Current Regulator Integral Gain (FCTN 2E).
  - [ ] 5. Continuous Current Regulator Proportional Gain (FCTN 2F).
  - [ ] 6. Continuous Current Regulator Integral Gain (FCTN 30).
- [ ] G. Remove input power.
- [ ] H. Remove installed jumper between terminals A3TB1-1 and A3TB1-2.
- [ ] I. Remove maintained switch installed between terminals A3TB1-20 and A3TB1-21.
- [ ] J. With power disconnect locked out, CONNECT THE MOTOR FIELD or UNLOCK THE MOTOR SHAFT.

### 3.9 START-UP OF SABER 3208 WITH MICROTRAC (Continued)

#### 3.9.3 Torque Regulator Enable

##### Check

- [ ] A. If a maintained Torque/Speed switch is provided, verify that it is in the Torque position for use with MicroTrac. If not, verify that jumper wire is installed between A3TB1-42 and A3TB1-44.
- [ ] B. Apply input power.
- [ ] C. To prevent MicroTrac speed regulator windup, set the motoring and regenerating drive current limit settings, function codes 07 and 08, to a value which is 5% higher than the value entered into the MicroTrac unit.
- [ ] D. The motor overload protective function is performed by MicroTrac, so the 3208 motor overload disable, function code 1F, must be set.
- [ ] E. MicroTrac performs the controlled stop function. Therefore the 3208 controlled stop disable and jog controlled stop disable, function codes 1B and 1E, must be set.
- [ ] F. If the logic output hardware channel is to be configured to provide a specific indication, this should now be done by selecting function 29, 2A, or 2B. See the functional descriptions for Up to Speed, Speed Sense, and Current Sense Enables in chapter 5 of this manual for additional information.
- [ ] G. A selectable analog output signal is available at test point 1 (ANALOG OUT) of the Keyboard/Display card, A4, with respect to test point 2 (COMMON) on the same card. This output is enabled by setting DAC Setup (FCTN 19), and then entering the function code of the function desired to be displayed as an analog output. This output has a  $\pm 10$  volt signal range which is scaled by keyboard function setting 42. The output signal is multiplied by the keyboard adjustment setting. If output current is selected as the output variable, for a 10 volt output at rated armature current, set the scale factor to 100%. For a 5 volt output at rated armature current, set the scale factor to 50%. If desired, select a variable, and scale appropriately.
- [ ] H. THIS COMPLETES THE START-UP PROCEDURE.

All other 3208 settings relate to outer loop regulator functions only, and will therefore have no affect on drive operation with MicroTrac.

SECTION 4. SERIAL COMMUNICATION

This section has been intentionally deleted.

SECTION 5. FUNCTION DESCRIPTIONS

ACTUAL SPEED FEEDBACK OUTPUT CHANNEL SCALING ADJUSTMENT FCTN 3E

An analog representation of the speed feedback signal currently in use by the drive is available on the Control Interface card A3TB1-39. This adjustment controls the signal scaling by internal multiplication prior to output. Adjustment of the scaling for this channel will not affect actual motor speed. Entered in percent via the keyboard, this adjustment has an allowable range of  $\pm 999.9\%$ . Maximum output from this channel is  $\pm 10$  VDC. Entry of negative scaling will cause an inversion of the speed feedback signal such that positive motor speed will result in a negative speed signal output. An example of scale adjustments and their effect on per unit representative outputs follows:

SCALE SETTINGS	OUTPUT SIGNAL REPRESENTATION
50%	10 VDC = 200% Rated Motor Speed
200%	10 VDC = 50% Rated Motor Speed

ANALOG RUN REFERENCE ENABLE FCTN 25

See KEYBOARD RUN REFERENCE ENABLE.

ANALOG RUN SPEED COMMAND SPAN ADJUSTMENT FCTN 3D

This adjustment controls the effective range of the external run speed command input signal connected to A3TB1-14. Entered in percent via the keyboard, this adjustment has an allowable range of  $\pm 999.9\%$ , and is used as a multiplier of the analog run speed command. Entry of a negative span will cause an inversion of the run speed command such that a positive command signal input will result in a negative speed reference. An example of span adjustments and their effect on per unit outputs follows:

INPUT SIGNAL	SPAN SETTING	RESULTING INTERNAL SPEED REFERENCE
$\pm 10$ VDC	50%	$\pm 50\%$ Rated Speed
$\pm 10$ VDC	200%	$\pm 200\%$ Rated Speed

#### ANTI-REVERSE CLAMP ENABLE/DISABLE

FCTN 23/24

The anti-reverse clamp is used in conjunction with the follower mode. With anti-reverse enabled, reverse follower command inputs are clamped at zero.

#### BASE MOTOR SPEED

FCTN 02

The base motor speed setting is the nominal motor speed value as indicated on the motor nameplate.

#### BOOST/DROOP SETTING

FCTN 38

Boost/droop is active only when voltage feedback (FCTN 28) is enabled, or if there is no tachometer feedback card on the drive. Its purpose is to increase or decrease the feedback signal in proportion to the load current. Its range is  $\pm 10$  percent of rated armature voltage at rated current. This is in ADDITION TO IR Compensation which is internally set by the drive for zero speed droop during Self Tuning.

#### CONTINUOUS CURRENT REGULATOR INTEGRAL GAIN

FCTN 30

This is the integral gain used in the PI current regulator when the load current is continuous. For most applications, this setting has little affect on response or accuracy. This gain is set by running SELF TUNE (FCTN 1A) during drive setup, and is normally not readjusted thereafter.

In certain systems which require high response and minimal phase lag in the current regulator, it may be necessary to increase this setting. A setting which is excessive may result in instability. This setting has no affect when the load current is discontinuous.

The drive conduction mode (continuous or discontinuous) can be determined by displaying Output Current Ripple, FCTN 54.

#### CONTINUOUS CURRENT REGULATOR PROPORTIONAL GAIN

FCTN 2F

This is the proportional gain used in the PI current regulator when the load current is continuous. For most applications, this setting is the controlling factor in current regulator response. This gain is set by running SELF TUNE (FCTN 1A) during drive setup, and is normally not readjusted thereafter. By increasing this setting, the response of the current regulator will be increased. A setting which is excessive will cause instability. This setting has no affect when the load current is discontinuous.

#### CONTROLLED STOP CONTACTOR DROP OUT SPEED

FCTN 16

This is the motor speed at which controlled stop deceleration of the motor stops, and the contactor is opened.

#### CONTROLLED STOP ENABLE/DISABLE

FCTN 1B/1C

Controlled stop enables the drive to be stopped from Run or Thread at a preset deceleration rate. When STOP is pressed, the drive decelerates at the appropriate rate, depending on the previous mode of operation (Run or Thread) until the preset Controlled Stop Contactor Drop Out Speed is reached, at which time the contactor opens and the motor coasts to a stop. If dynamic braking is included with the drive, dynamic braking begins when the contactor opens.

If controlled stop is disabled, and a normal stop is initiated, the contactor opens immediately, and the motor coasts to a stop. If dynamic braking is included with the drive, dynamic braking begins when the contactor opens.

#### CURRENT COMMAND

FCTN 50

The current command signal is the input to the first stage of the current regulator software function block, the current limit function. Motor current will follow this reference unless some type of limiting, such as current limiting is in effect. It is displayed as amps or as a percentage of rated motor current.

#### CURRENT REFERENCE

FCTN 51

This is the magnitude of the output of the current limit function, which is the actual reference input to the current regulator. Current Reference will be equal to the magnitude of the Current Command except when the drive is in current limit. Current Reference will never exceed current limit.

#### CURRENT REGULATOR TEST PROCEDURE ENABLE

FCTN 6E

This is a special test mode which is used in conjunction with the thyristor firing verification and current feedback verification procedures. It is recommended that it be set ONLY by MagneTek Drives & Systems personnel. The mode is cancelled each time the drive is stopped or when drive line power is removed.

## CURRENT SENSE ENABLE

FCTN 2B

Current Sense Enable controls the logic output at A3TB1-41 in conjunction with the Logic Output Threshold Set point (FCTN 43). Setting this function enables the logic output to be used as an indication that the motor current has reached a preset absolute value. When set, current feedback is compared to the value set for the threshold set point. With current feedback less than the set point value, the logic output is a logic high. When current feedback is greater than the set point value, the logic output is switched to a logic low to indicate that the absolute value of set current has been reached.

Enabling this function automatically disables Up to Speed Enable (FCTN 29) and Speed Sense Enable (FCTN 2A).

## DIGITAL/ANALOG CONVERTER (DAC) SETUP

FCTN 19

This may be used as a diagnostic function. After entering FCTN 19, enter the code of any displayable function. The value will be converted to an analog voltage at a rate of 60 times per second, and the voltage will be available at the ANALOG OUT jack of the Keyboard/Display, with reference to the COMMON jack. This output is also available on A3TB1-40 with respect to common on A3TB1-37. The scaling of the output is determined by the setting of the Selectable Analog Output Channel Scaling Adjustment (FCTN 42). This output is intended mainly for use with an oscilloscope or strip chart recorder.

## DISCONTINUOUS CURRENT REGULATOR INTEGRAL GAIN

FCTN 2E

This is the integral gain used in the PI current regulator when the load current is discontinuous. For most applications, this setting is the controlling factor in current regulator response. This gain is set by running SELF TUNE (FCTN 1A) during drive setup, and is not normally readjusted thereafter. By increasing this setting, the response of the current regulator will be increased. A setting which is excessive will cause instability. This setting has no affect when the load current is continuous.

## DISCONTINUOUS CURRENT REGULATOR PROPORTIONAL GAIN

FCTN 2D

This is the proportional gain used in the PI current regulator when the load current is discontinuous. For most applications, this setting has little affect on response or accuracy. This gain is set by running SELF TUNE (FCTN 1A) during drive setup, and is not normally readjusted thereafter.

DISCONTINUOUS CURRENT REGULATOR PROPORTIONAL GAIN  
(Continued)

FCTN 2D

In certain systems which require high response and minimal phase lag in the current regulator, it may be necessary to increase this setting. A setting which is excessive may result in instability and will always result in excessive current ripple. This setting has no affect when the load current is continuous.

DRIVE STATUS FEEDBACK FUNCTION

FCTN 2C

This function automatically scans and sequentially displays the status of the following drive enables:

<u>Drive Status</u>	<u>Indication</u>
1. Feedback mechanism	TFDBK ON or VFDBK ON
2. Analog vs. Keyboard Run Reference selection	AN REFON or KEYREFON
3. Percent vs. Nominal Display mode	% ON or NOM ON
4. Overload enable	OVRLD ON or OVRLD OF
5. Controlled Stop enable	CSTOP ON or CSTOP OFF
6. Jog Controlled Stop enable	JSTOP ON or JSTOP OFF
7. Logic Output Enable Status	UP2SPDON or SPDSNSON or CURSNSON
8. Follow Mode Anti-Reverse enable	AREV ON or AREV OFF
9. Zero Band enable	ZBAND ON or ZBAND OF
10. Drive control mode	LOCAL ON or REMOT ON

FEEDBACK TACH PULSES PER REVOLUTION (DIGITAL TACH)

FCTN 04

This setting is applicable only to drives with digital tachometer feedback. The digital tach pulses per revolution setting is the value as indicated on the digital feedback tach nameplate.



+ 5 VDC CONTROL VOLTAGE FCTN 56

This is the actual measured value of the +5 VDC  $\pm$ 5 percent power supply control voltage.

+ 15 VDC CONTROL VOLTAGE FCTN 57

This is the actual measured value of the +15 VDC  $\pm$ 5 percent power supply control voltage.

- 15 VDC CONTROL VOLTAGE FCTN 58

This is the actual measured value of the -15 VDC  $\pm$ 5 percent power supply control voltage.

FIRING ANGLE FCTN 5B

This is the actual amount of phase delay (in degrees) which is set for the thyristor armature bridge. Zero degrees is "full on".

FIRST FAULT FCTN 6D

This function displays the first fault which occurred in the drive for diagnostic purposes. The first fault message is stored in non-volatile memory so that if power must be removed and reapplied before the display can be viewed, the fault message can be displayed by enabling this function. The fault message is cleared whenever a Run, Thread or Jog command is applied to the drive, or if the drive RESET button is pressed with no drive fault present.

FOLLOWER COMMAND INPUT FCTN 45

The drive uses this signal as its basic speed reference when in the speed regulated follower mode of operation. Follower command may be derived from any one of the following follower signal sources:

- A. an analog tach via the Analog Follower card,
- B. a digital tach via the Digital Tach Interface card,
- C. any signal source which does not exceed  $\pm$ 10 VDC, or current source of 4 to 20, -20 to +20 or 0 to 50 milliamps, directly without the need for an Analog Follower card (i.e.: wired directly to A3TB1-11 and 12),

FOLLOWER COMMAND INPUT  
(Continued)

FCTN 45

D. any AC signal source, or any DC signal source which exceeds  $\pm 10$  VDC via the Analog Follower card.

It is displayed in RPM or as a percentage of rated motor speed.

FOLLOWER MODE ACCELERATION TIME

FCTN 0B

This setting determines the time in seconds for the drive to ramp from zero to rated speed (or voltage) in the follower mode of operation.

FOLLOWER MODE DECELERATION TIME

FCTN 0C

This setting determines the time in seconds for the drive to ramp (controlled stop) from rated speed (or voltage) to zero in the follower mode of operation.

FOLLOWER MODE UPPER AND LOWER RATIO LIMIT SETTINGS

FCTN 3B/3C

These settings are applicable only to drives which are being used in a follower mode. These adjustments affect the follower command input signal being applied to A3TB1-11 and 12 after it has been adjusted by the anti-reverse clamp (FCTN 23/24) and low speed tracking (FCTN 37). Set in percent via the keyboard, these adjustments have an allowable range of zero to 999.9% of rated motor speed. Negative entries are not allowed. The ratio setting in use is determined by the value of the  $\pm 10$  VDC ratio command input signal applied to A3TB1-10. With +10 VDC applied, the follower command will be applied directly to the more positive of the two ratio settings. With -10 VDC applied, the follower command will be applied directly to the less positive of the two ratio settings. With zero volts applied, the follower command will be applied to a value which is midway between the two ratio settings. The Ratio limit Setting which is currently being used by the drive (the Active ratio limit) can be seen by displaying function 6B.

Note that if the Ratio Command Input signal is not provided to the drive, both Ratio Limit Settings must be set to the same desired ratio value.

FOLLOWER ON/OFF SWITCH INPUT STATUS

FCTN 67

This diagnostic function reports the status of the follower on/off input logic line. For follower on this function will read "1". For follower off this function will read "0".

FOLLOWER TACH PULSES PER REVOLUTION

FCTN 39

This setting is applicable only to drives with a follower digital tachometer. This setting is the value as indicated on the tachometer nameplate.

GO-TO-LOCAL MODE/GO-TO-REMOTE MODE

FCTN D2/D1

These functions can be invoked only via the serial link. Go-to-Remote will enable all of the serial link functions, and disable all of the "SET" functions of the Keyboard/Display. Go-to-Remote will only be honored if the Remote/Local hardware switch on the operator control station is in the REMOTE position. Go-to-Local can be executed at any time, and will disable all but the display functions of the serial link. The "SET" functions of the Keyboard/Display will be enabled.

NOTE

1. When in remote control mode, only the Stop or Q-Stop push button on the OCS remains functional.
2. Activating Go-to-Remote preloads Remote Run Speed (FCTN 59) with the speed command value previously in use in the local mode.

JOG ACCELERATION TIME

FCTN 0F

The jog acceleration setting determines the time in seconds for the drive to ramp from zero to rated speed (or voltage) in the jog mode.

JOG CONTACTOR DROP OUT DELAY

FCTN 12

Jog contactor drop out delay is the time in seconds which the contactor will remain energized after the JOG push button is released. The time is settable from 0 to 4 seconds. Using this delay will prevent unnecessary "banging" of the contactor during rapid jog cycles. This delay is not active if jog controlled stop is enabled.

JOG CONTROLLED STOP ENABLE/DISABLE

FCTN 1D/1E

Jog controlled stop enables the drive to be stopped at the preset jog deceleration rate when the JOG button is released. The drive decelerates at the controlled rate until the preset Controlled Stop Contactor Drop Out Speed is reached, and the contactor opens. The motor then coasts to a stop. If dynamic braking is included with the drive, dynamic braking begins when the contactor opens.

If jog controlled stop is disabled, and the JOG button is released, the contactor opens after Jog Contactor Dropout Delay and the motor coasts to a stop. If dynamic braking is included with the drive, dynamic braking begins when the contactor opens.

JOG DECELERATION TIME

FCTN 10

The jog deceleration setting determines the time in seconds for the drive to ramp (controlled stop) from rated speed (or voltage) to zero in the jog mode. With jog deceleration time set to zero, the drive will stop quickly when the JOG button is released.

JOG PUSH BUTTON INPUT STATUS

FCTN 61

This diagnostic function reports the status of the jog input logic line. For jog enabled this function will read "1". For jog disabled this function will read "0".

JOG SPEED

FCTN 15

The speed the motor will attain when the JOG push button is pressed and held.

KEYBOARD RUN REFERENCE ENABLE/ANALOG  
RUN REFERENCE ENABLE

FCTN 26/25

When the Analog Run Reference is enabled, the command for the speed regulator (in Run) will be read from the analog voltage at the speed command input. When the Keyboard Run Reference is enabled, the command for speed regulator (in Run) will be set by the Keyboard/Display (RUN SPEED function).

These commands affect the LOCAL Run mode of operation only. When Run is commanded from Remote Control over the serial link, the Remote Run Speed (FCTN 5E) is used by the drive to determine motor speed.

#### LINE FREQUENCY

FCTN 5A

This is the actual measured value of the input power line frequency in Hertz.

#### LINE VOLTAGE

FCTN 54

This is the actual measured value of input line voltage in RMS AC volts.

#### LINEAR ACCEL/DECEL CONTROL INPUT SIGNAL

FCTN 47

This function is provided for diagnostic purposes only. This signal is the output from the reversing control block in software, and is equal in value to the speed command input signal, but may be different in sign. It is displayed in RPM or as a percentage of rated motor speed.

#### LINEAR ACCEL/DECEL CONTROL OUTPUT SIGNAL

FCTN 48

This signal is the output from the linear acceleration-deceleration ramp generator function block in software. This block generates a signal which ramps from its present output value to the value applied to its input in the time programmed for acceleration or deceleration for the particular mode of operation currently in use (Run, Jog, Thread, Quickstop). It is displayed in RPM or as a percentage of rated motor speed.

#### LOAD INDUCTANCE

FCTN 06

Load inductance is the total armature circuit inductance including wiring in millihenries. This value is automatically entered by running the regulator Self Tuning Function. After running this procedure, the value of load inductance as displayed will be approximately 20 percent higher than the published "saturated" inductance of the motor.

#### LOAD RESISTANCE

FCTN 05

Load resistance is the total armature circuit resistance including wiring in milliohms. This value is used internally by the computer to calculate and compensate for the IR drop of the armature circuit. It is recommended that this parameter be entered automatically by running the regulator Self Tuning Function. If it is necessary to enter this parameter manually, the value must be determined by an accurate resistance measurement taken at the drive end of the armature circuit.

## LOGIC OUTPUT THRESHOLD SET POINT

FCTN 43

This setting determines the point at which the logic output on A3TB1-41 will be switched. Settable from zero to 200 percent of rated, this threshold adjustment determines the magnitude of the signal to be compared with the feedback (speed or current) for applications where the logic output is to be used to indicate that an absolute value of speed or current has been attained. In these cases, this signal is used in conjunction with the enabling of Speed Sense Enable (FCTN 2A) or Current Sense Enable (FCTN 2B). For speed mode applications requiring a logic output to indicate "UP TO SPEED", this setting determines the percent speed error (accel/decel function input minus actual speed) at which the logic output will be switched. Use in conjunction with the Up to Speed Enable function (FCTN 29).

## LOOP CONTACTOR STATUS

FCTN 69

This diagnostic function reports the status of the loop contactor. With the loop contactor closed this function will read "1". With the loop contactor open this function will read "0".

## LOW SPEED TRACKING

FCTN 3A

This setting is applicable only for drives which are being used in a follower mode. The Low Speed Tracking adjustment for the follower is the percent value to be added to the follower command input signal. This may be used to offset a 4-20 milliamp input signal so that 4 milliamps means zero speed.

## MOTOR OVERLOAD ENABLE/DISABLE

FCTN 1F/20

Motor overload enable activates the inverse time overload trip function of the drive (see Figure 5-1). This is a PROTECTIVE function for the motor. It is RECOMMENDED that this function be ENABLED.

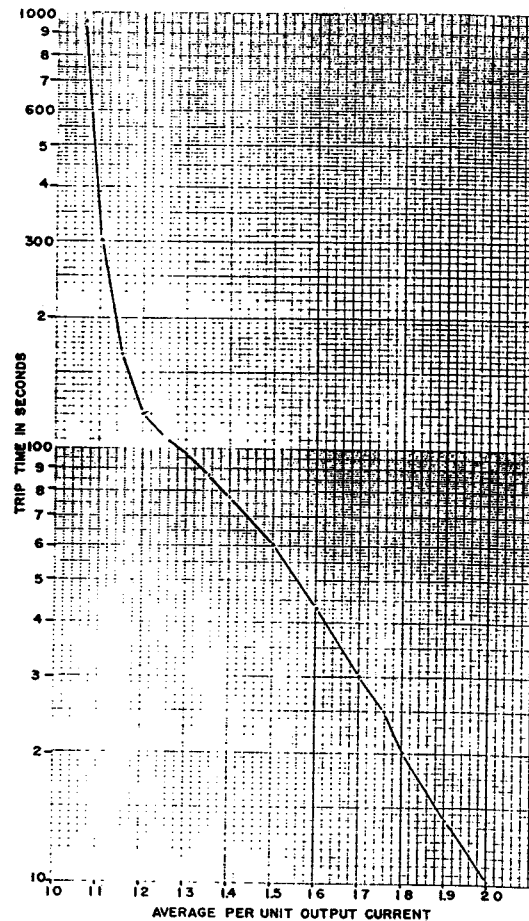


Figure 5-1. Inverse Time Overload Fault Curve

## MOTORING CURRENT LIMIT SETTING

FCTN 07

The motoring current limit setting is the desired maximum output current when motoring. This value is normally equal to the Regenerating Current Limit setting.

## MOTORING CURRENT LIMIT (ACTIVE)

FCTN 5C

This is the value used by the computer as the maximum motoring output current. It will never be higher than the value entered for the Motoring Current Limit Setting (FCTN 07) but may be lower if SCR junction temperatures exceed safe operating levels.

#### OUTPUT CURRENT

FCTN 52

This is the actual measured value of output current to the motor in DC amps.

#### OUTPUT CURRENT RIPPLE

FCTN 55

This is a dimensionless figure of merit which represents the peak-to-peak variation between output current pulses. Also, the last character of the display will be a "D" if the motor current is discontinuous, or a "C" if the current is continuous.

When transmitted to a remote host computer via the serial link, the continuous/discontinuous ("C" or "D") character is not included.

#### OUTPUT VOLTAGE

FCTN 53

This is the actual value of the motor CEMF (counter electromotive force). CEMF is equal to the armature voltage as measured at the armature terminals of the drive minus the IR drop of the motor.

#### OVERSPEED TRIP THRESHOLD

FCTN 35

Determines the motor speed at which the drive will shut down on an Overspeed fault. This value must be set higher than the value entered for Maximum Motor Speed to avoid nuisance drive faults (see OVER SPD under Drive Faults in Section 6).

#### PER UNIT INERTIA

FCTN 33

Per unit inertia is the time in seconds that it takes to accelerate the load inertia from zero speed to rated speed with 1.0 per unit torque. This setting has a 0 to 10 second range. If this setting is too low, large changes in speed command will result in motor speed overshoots with long accel/decel times. If this setting is too high, large changes in speed command will result in transient speed droop immediately after set speed is reached, with long accel/decel times.

#### QUICKSTOP DECELERATION TIME

FCTN 11

The time in seconds for the drive to ramp from rated speed (or voltage) to a stop when the Quick Stop is activated. This time may be set to zero for a "current limit" regenerative stop.



## QUICKSTOP PUSH BUTTON INPUT STATUS

FCTN 63

This diagnostic function reports the status of the quickstop input logic line. For quickstop enabled this function will read "1". For quickstop disabled this function will read "0".

## RATED LINE VOLTAGE

FCTN 03

The nominal value of the single phase AC input voltage, either 230 or 115 VAC.

## RATED MOTOR CURRENT

FCTN 00

The rated motor current setting is the DC motor current value as indicated on the motor nameplate.

## RATED MOTOR VOLTAGE

FCTN 01

Rated motor voltage is the nominal motor voltage value as indicated on the motor nameplate.

## RATIO LIMIT SETTING (ACTIVE)

FCTN 6B

This function is provided for diagnostic purposes. The Active Ratio Limit Setting is applicable only to the follower mode of operation, and is the ratio limit currently in use by the drive. The Active Ratio Limit is determined by the value of the ratio command input signal applied to A3TB1-10. See description of the Follower Mode Upper and Lower Ratio Limit Settings in this chapter for additional information.

## REFERENCE SMOOTHING

FCTN 44

The value of the externally applied analog speed command input to the drive is read by the drive once every line cycle, approximately every 16.7 milliseconds. Reference Smoothing is the number of times that the speed command is read and averaged before being used as the drive's speed command. The purpose of this setting is to eliminate the effects of noise pickup on the analog input signal line, and disturbances caused by the analog to digital signal conversion resolution. Reference Smoothing is a settable number from 1 to 10. Reference Smoothing also affects the follower command input signal.

REGENERATING CURRENT LIMIT SETTING

FCTN 08

The regenerating current limit setting is the desired maximum output current when regenerating. This value is normally equal to the value for Motoring Current Limit Setting.

REGENERATING CURRENT LIMIT (ACTIVE)

FCTN 5D

This is the value used by the computer as the maximum regenerating output current. It will never be higher than the value entered for the Regenerating Current Limit Setting (FCTN 0A) but may be lower if SCR junction temperatures exceed safe operating levels.

REMOTE/LOCAL SWITCH INPUT STATUS

FCTN 64

This diagnostic function reports the status of the remote/local input logic line. For remote control enabled this function will read "1". For local control enabled this function will read "0".

REMOTE QUICKSTOP ENABLE

FCTN D4

Remote Quickstop can be invoked only via the serial link, and only when the drive is in the remote control mode. When activated, the drive will decelerate to a stop in the time set for Quick Stop Deceleration Time (FCTN 11), regeneratively in current limit if the time selected is short.

REMOTE RESET ENABLE

FCTN D0

Remote Reset can be invoked only via the serial link, and only when the drive is in the remote control mode. The activation of this function will clear all drive faults except a CPU FAULT which can only be cleared by a power up restart.

REMOTE RUN ENABLE

FCTN D5

Remote Run can be invoked only via the serial link, and only when the drive is in the remote control mode. The activation of this function will start the drive and accelerate the motor at the rate set by Run Acceleration Time (FCTN 0B) up to the Remote Run Speed (FCTN 59).

REMOTE RUN SPEED COMMAND

FCTN 5E

Remote run speed is the command value used whenever the drive is running in the remote control mode.

NOTE

Whenever control is transferred from local mode to remote control mode, Remote Run Speed is "pre-loaded" with the speed command value previously in use in the local mode.

REMOTE SET NOMINAL VALUES/REMOTE SET AS A PERCENT OF RATED

FCTN D7/D8

Remote Set Nominal/Set Percent can be invoked only via the serial link, and only when the drive is in the remote control mode. When activated, these functions are identical to Set Nominal/Set Percent (FCTN 17 and 18).

REMOTE STOP ENABLE

FCTN D3

Remote Stop can be invoked only via the serial link, and only when the drive is in the remote control mode. When activated the drive will stop by the means selected (Controlled Stop/coast to stop/dynamic braking, etc.).

REMOTE THREAD ENABLE

FCTN D6

Remote Thread can be invoked only via the serial link, and only when the drive is in the remote control mode. The activation of this function will start the drive and accelerate the motor at the rate set by Thread Acceleration Time (FCTN 0D) up to the Thread Speed (FCTN 14).

RESPONSE

FCTN 34

Response is the crossover frequency or bandwidth of the drive expressed in radians. This setting has a 0 to 10 radian range. By increasing this setting, the time to recover from instantaneous load changes will be decreased, and drive responsiveness to step changes in speed command will increase. A SETTING WHICH IS TOO GREAT MAY CAUSE INSTABILITY AND WILL ALWAYS CAUSE OVERSHOOT OF STEP REFERENCE CHANGES WHEN SHORT ACCELERATION OR DECELERATION TIMES (FCTN 09 and 0A) ARE SET.

REVERSE ON/OFF SWITCH INPUT STATUS

FCTN 66

This diagnostic function reports the status of the reverse on/off input logic line. For reverse on this function will read "1". For reverse off this function will read "0".

RUN ACCELERATION TIME

FCTN 0B

The run acceleration setting determines the time in seconds for the drive to ramp from zero to rated speed (or voltage) in the run mode.

RUN DECELERATION TIME

FCTN 0A

The run deceleration setting determines the time in seconds for the drive to ramp (controlled stop) from rated speed (or voltage) to zero in the run mode.

RUN PUSH BUTTON INPUT STATUS

FCTN 60

This diagnostic function reports the status of the run input logic line. For run enabled this function will read "1". For run disabled this function will read "0".

RUN SPEED

FCTN 13

The speed the motor will attain when the RUN button is pressed, if Keyboard Run Reference has been enabled (FCTN 26).

SCR HEAT SINK TEMPERATURE

FCTN 59

This function code is provided for diagnostic purposes. This is the actual measured heat sink temperature in Celcius degrees.

SELECTABLE ANALOG OUTPUT CHANNEL SCALING ADJUSTMENT

FCTN 42

This adjustment controls the scaling of the variable selected to be outputted at A3TB1-40. Entered in percent via the keyboard, this adjustment has an allowable range of  $\pm 999.9\%$ . The maximum output of this channel is limited to  $\pm 10$  VDC. Entry of negative scaling will cause an inversion of the signal being displayed. Also see Digital/Analog Converter Setup, FCTN 19, for additional information.

## SELF TUNING FUNCTION

FCTN 1A

This function will circulate current through the motor to measure motor parameters, and then calculate and remember the following:

1. Load Resistance, FCTN 05.
2. Load Inductance, FCTN 06.
3. Discontinuous Current Rgltr. Proportional Gain, FCTN 2D.
4. Discontinuous Current Rgltr. Integral Gain, FCTN 2E.
5. Continuous Current Rgltr. Proportional Gain, FCTN 2F.
6. Continuous Current Rgltr. Integral Gain, FCTN 30.

See Section 3.5.1.1 or 3.6.2 for details on how to operate this function.

## SET NOMINAL/SET % (Percent)

FCTN 17/18

Set Nominal programs the display mode to display and accept all values in nominal units (volts, amps, RPM, etc.). Rated (absolute) values must be entered in the Set Nominal mode. Set Percent causes those values which can be related to a rated value (rated motor volts, amps, etc.) to be displayed and accepted as a percent of rated.

These functions control the set and display of values for the Keyboard/Display only, and are completely independent of the Remote Set Nominal/Set Percent functions (FCTN D7 and D8).

## SPEED COMMAND INPUT

FCTN 46

This is the command input presently in use by the drive as its basic speed reference when in the speed regulated mode of operation. Speed command may be derived from any one of the following sources:

- |  |         |
|--|---------|
| A. Keyboard Run Speed setting  | FCTN 13 |
| B. Keyboard Thread Speed setting   | FCTN 14 |
| C. Keyboard Jog Speed setting  | FCTN 15 |
| D. Analog follower command signal in the follower mode   |         |
| E. Externally applied analog run command signal after modifications by the analog run speed command span adjustment (FCTN 39). |         |
| F. Run speed command input via the RS-232 serial link.   |         |

It is displayed in RPM or as a percentage of rated motor speed.

## SPEED FEEDBACK OUTPUT SIGNAL

FCTN 4B

Speed feedback is representative of actual motor speed, and is the value used by the speed regulator function block for comparison with the speed reference output. Speed feedback may be the tach feedback signal or the IR and boost/droop compensated voltage feedback signal depending on the selection of functions 27 and 28, Tach or Voltage Feedback enables respectively. It is displayed in RPM or as a percentage of rated motor speed.

## SPEED LIMIT

FCTN 37

This adjustment sets the maximum allowable speed reference output signal thereby limiting motor speed to this value. Set in RPM or as a percent of base motor speed, this adjustment has an allowable range of zero to 120.0 percent of rated motor speed.

## SPEED LIMIT INPUT SIGNAL

FCTN 49

This signal is the input to the speed limit software block function. This signal is the summation of the linear acceleration control output, the externally applied trim command, and the torque regulated speed follower reference. It is displayed in RPM or as a percentage of rated motor speed.

## SPEED REFERENCE ANALOG OUTPUT CHANNEL SCALING ADJUSTMENT FCTN 3F

An analog representation of the speed reference signal currently in use by the drive (speed command after conditioning by the accel/decel function and any trim correction), is available on the Control Interface card A3TB1-38, for use in drive cascading. This adjustment controls the scaling of this signal. Adjustment of the scaling for this channel will not affect the drive speed reference. Entered in percent via the keyboard, this adjustment has an allowable range of  $\pm 999.9\%$ . Maximum output from this channel is  $\pm 10$  VDC. Entry of negative scaling will cause an inversion of the speed reference channel signal such that positive speed command will result in negative speed reference signal output. An example of scale adjustments and their effect on per unit representative outputs follows:

SCALE SETTING	OUTPUT SIGNAL	PERCENT OUTPUT REPRESENTATION
50%	10 VDC	200% Rated Speed Reference
200%	10 VDC	50% Rated Speed Reference

#### SPEED REFERENCE OUTPUT SIGNAL

FCTN 4A

This signal is the reference input to the speed regulator function block in software, and is provided for diagnostic purposes. It is displayed in RPM or as a percentage of rated motor speed.

#### SPEED REGULATOR INTEGRAL GAIN

FCTN 32

This is the integral gain used by the speed regulator. The value of this gain is recalculated whenever a new value for Per Unit Inertia (FCTN 33) or Response (FCTN 34) is entered, unless the value set for Response is zero. If the value of this gain appears to be inappropriate, re-check the values of Functions 33 and 34 that were entered during drive start-up.

#### SPEED REGULATOR PROPORTIONAL GAIN

FCTN 31

This is the proportional gain used by the speed regulator. This gain is the controlling factor in determining regulator response. The value of this gain is recalculated whenever a new value for Per Unit Inertia (FCTN 33) or Response (FCTN 34) is entered, unless the value set for Response is zero. If the value of this gain appears to be inappropriate, re-check the values of functions 33 and 34 that were entered during drive start-up.

#### SPEED SENSE ENABLE

FCTN 2A

This Enable controls the logic output at A3TB1-41 in conjunction with the Logic Output Threshold Set point (FCTN 43). Setting this function enables the logic output to be used as an indication that the motor speed has reached a preset absolute value. When set, speed feedback is compared to the value set for the threshold set point. With speed feedback less than the set point value, the logic output is a logic high. When speed feedback is greater than the set point value, the logic output is switched to a logic low to indicate that the absolute value of set speed has been reached.

Enabling this function automatically disables Up to Speed Enable (FCTN 29) and Current Sense Enable (FCTN 2B).

#### SPEED/TORQUE REFERENCE SIGNAL

FCTN 4E

This signal is representative of the externally applied follower command input after it has been conditioned by the low speed tracking adjustment and the follower mode ratio setting currently in use. It is displayed as a per unitized value.

## SPEED/TORQUE SWITCH INPUT STATUS

FCTN 68

This diagnostic function reports the status of the speed/torque input logic line. For speed mode enabled this function will read "0". For torque mode enabled this function will read "1".

## STOP PUSH BUTTON INPUT STATUS

FCTN 5F

This diagnostic function reports the status of the stop input logic line. For stop enabled this function will read "0". For stop disabled this function will read "1".

## TACH FEEDBACK SIGNAL

FCTN 6A

This signal is the motor speed as read by a tachometer, either digital or analog

## TACH FEEDBACK/VOLTAGE FEEDBACK ENABLE

FCTN 27/28

Tach feedback enable allows a digital or analog tach to be used as the feedback source to the speed regulator. Voltage regulation is not as precise as true speed regulation with a tachometer.

## THREAD ACCELERATION TIME

FCTN 0D

The thread acceleration setting determines the time in seconds for the drive to ramp from zero to rated speed (or voltage) in the thread mode

## THREAD DECELERATION TIME

FCTN 0E

The thread deceleration setting determines the time in seconds for the drive to ramp (controlled stop) from rated speed (or voltage) to zero in the thread mode

## THREAD PUSH BUTTON INPUT STATUS

FCTN 62

This diagnostic function reports the status of the thread input logic line. For thread enabled, this function will read "1". For thread disabled, this function will read "0".



## THREAD SPEED

FCTN 14

Thread speed is the motor speed which will be attained when the THREAD push button is pressed.

## TORQUE COMMAND SPAN ADJUSTMENT

FCTN 40

This adjustment controls the effective range of the external torque command input signal connected to A3TB1-15. Entered in percent via the keyboard, this adjustment has an allowable range of  $\pm 999.9\%$ , and is used as a multiplier of the torque command input signal. Entry of a negative span will cause an inversion of the torque command such that a positive torque command will result in less torque. An example of span adjustments and their effect on per unit outputs follows:

INPUT SIGNAL	SPAN SETTING	PERCENT OUTPUT REPRESENTATION
$\pm 10$ VDC	50%	50% Rated Torque
$\pm 10$ VDC	200%	200% Rated Torque

## TORQUE FOLLOWER REFERENCE INPUT

This signal is representative of the externally applied torque command after it has been conditioned by the torque command span adjustment and the reversing function block. It is displayed as a percent of rated value.

## TORQUE REFERENCE

FCTN 6C

Torque Reference is the externally applied torque command input signal after it has been conditioned by the Torque Command Span Adjustment. Its primary function is for drive setup of the torque regulated speed follower function, or for later diagnostic purposes.

## TORQUE REGULATED SPEED FOLLOWER DROOP

FCTN 36

This adjustment controls the gain of the torque regulator which is used in conjunction with the torque regulated speed follower mode of operation. Entered in percent via the keyboard, this adjustment has an allowable range of zero to 999.9%. Negative entries are not allowed.

## TORQUE REGULATED SPEED FOLLOWER REFERENCE INPUT

FCTN 4C

This signal is representative of the externally applied torque command after it has been conditioned by the torque command span adjustment, actual current feedback, and the value entered for the droop function 36. It is displayed in RPM or as a percentage of rated motor speed.

## TRIM COMMAND INPUT

FCTN 4F

This signal is representative of the externally applied trim command signal after it has been conditioned by the trim command span adjustment and the reversing function block. It is displayed in RPM or as a percentage of rated motor speed.

## TRIM COMMAND SPAN ADJUSTMENT

FCTN 41

This adjustment controls the effective range of the external trim command input signal connected to A3TB1-9. Entered in percent via the keyboard, this adjustment has an allowable range of  $\pm 999.9\%$ , and is used as a multiplier of the trim command input signal. Entry of a negative span will cause an inversion of the trim command such that a positive trim command will result in a less positive speed reference. An example of span adjustments and their effect on per unit outputs follows:

INPUT SIGNAL	SPAN SETTING	PERCENT OUTPUT REPRESENTATION
$\pm 10$ VDC	50%	50% Rated Torque
$\pm 10$ VDC	200%	200% Rated Torque

## TRIM ON/OFF SWITCH INPUT STATUS

FCTN 65

This diagnostic function reports the status of the trim on/off input logic line. For trim on this function will read "1". For trim off this function will read "0".

## UP TO SPEED ENABLE

FCTN 29

Up to Speed enable controls the logic output at A3TB1-41 in conjunction with the Logic Output Threshold Set point (FCTN 43). Setting this function enables the logic output to be used as an Up to Speed indication. When set, the magnitude of speed error (The difference between the Linear Accel/Decel Control Input signal and the Speed Feedback signal) is compared to the percentage value set for the Logic Output Threshold Set point. With speed error larger than the set

UP TO SPEED ENABLE  
(Continued)

FCTN 29

point, the logic output is a logic high. When speed error is less than the set point, the logic output is switched to a logic low to indicate that the drive is Up to Set Speed.

Enabling this function automatically disables Speed Sense Enable (FCTN 2A) and Current Sense Enable (FCTN 2B).

VOLTAGE FEEDBACK ENABLE

FCTN 28

See TACH FEEDBACK ENABLE.

ZERO BAND ENABLE/DISABLE

FCTN 21/22

Enabling zero band causes a "dead band" (zero output current) in the motor speed region between negative Controlled Stop Contactor Drop Out Speed and positive Controlled Stop Contactor Drop Out Speed (FCTN 16). Whenever the speed regulator reference and actual motor speed are within this region, the speed regulator is disabled, and motor current is set to zero. On drives utilizing analog tach feedback, activation of this function will prevent motor creep with low or zero reference applied in spite of analog offsets or temperature drift.

## SECTION 6. FAULT DESCRIPTIONS

### 6.1 INTRODUCTION

All faults listed in paragraph 6.2 can be manually reset, unless otherwise specified, by:

- a. pressing the fault RESET push button, or
- b. removing and reapplying power to the drive after 1 second.

### 6.2 DRIVE FAULTS

#### CPU FALT (COMPUTER FAULT)

Display indicates that a major disruption has occurred in the basic operation of the computer. THIS FAULT WILL NOT RESPOND TO THE FAULT RESET PUSH BUTTON. It can only be cleared by removing power from the drive. Refer to Section 9 (Table 9-1, Symptom 13) to troubleshoot this problem. A CPU fault will occur if input power is removed from the drive and reapplied before the internal power supply decays (usually within 1/2 second).

#### CPUMEMER (COMPUTER MEMORY ERROR)

Display indicates that the computer RAM failed the power-up read/write test. Refer to Section 9, (Table 9-1, Symptom 12) to troubleshoot this problem.

#### IST FALT (INSTANTANEOUS OVERCURRENT)

Displayed whenever the instantaneous value of output current exceeds 225 percent of rated motor current. The current regulator gain settings should be checked before a hardware failure is suspected. Current regulator gains, which are too high, will result in IST faults.

#### LO MEMER (LOWER BYTE MEMORY ERROR)

Display indicates that the lower byte RAM chip failed the power-up read/write test. Refer to Section 9 (Table 9-1, Symptom 12) to troubleshoot this problem.

#### LOW LINE (LOW AC LINE VOLTAGE)

Displayed if a single cycle of line voltage is below 70 percent, or if a three cycle average is below 80 percent of the nominal line voltage value. Before a hardware failure is suspected, the line voltage should be analyzed.

#### NV ERROR (NON-VOLATILE MEMORY CHECKSUM ERROR)

During normal operation, each time a drive setting or status selection is changed, the sum of all of the settings (including the new one) is calculated and stored in non-volatile memory. On power-up, this sum is recalculated and compared with the last sum that was stored. If the sums do not match, this display indicates that one or more of the variables or status selections are in error. Press the fault RESET to clear the fault indication; then refer to Section 9, TROUBLESHOOTING, to troubleshoot this problem.

#### OVERLOAD (MOTOR OVERLOAD)

Displayed if the product of average output current and time exceeds the inverse time overload value at any point on the curve as illustrated in Figure 9. Before a hardware failure is suspected, the drive loading should be analyzed.

#### OVER SPD (MOTOR OVERSPEED)

Displayed whenever instantaneous motor speed exceeds the set Overspeed Trip Threshold value. Before a hardware failure is suspected, the Overspeed Trip Threshold and the Response values should be checked. Response settings which are too high will cause speed overshoots. An overspeed threshold setting which is too close to the maximum expected operating speed will cause nuisance overspeed fault shutdowns. Also re-check the value entered for Per Unit Inertia. An inertia setting which is too low may cause speed overshoots if long acceleration times have been entered.

#### OVERTEMP (OVER TEMPERATURE)

Displayed whenever the temperature of the power bridge heat sink reaches 100 degrees Celsius. Before a hardware failure is suspected, check the ambient temperature, drive loading and ventilation to determine whether they are within the operating specifications of the drive.

#### REV TACH (REVERSED TACH)

Displayed if:

1. the tachometer leads from an analog DC tach are reversed,
2. the drive utilizes DC tach feedback, but jumper J14 on the Analog Tach Interface PCB is in the AC Tach position,

REV TACH (REVERSED TACH) (Continued)

3. the drive utilizes digital tach feedback, and any two of the four tach leads are interchanged.

Before a hardware failure is suspected, check for any of the above conditions.

SYNC FLT (LINE SYNCHRONIZATION FAULT)

Displayed whenever the drive is unable to achieve or maintain synchronization with the AC power line. Refer to Section 9 (Table 9-1, Symptom 6) to troubleshoot this problem.

TACHLOSS (TACHOMETER FEEDBACK LOSS)

Displayed if there is a loss of the tachometer feedback signal when substantial motor voltage is present. Refer to Section 9 (Table 9-1, Symptom 10) to troubleshoot this problem.

UP MEMER (UPPER BYTE MEMORY ERROR)

Display indicates that the upper byte RAM chip failed the power-up read/write test. Refer to Section 9 (Table 9-1, Symptom 12) to troubleshoot this problem.

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## SECTION 7. BURDEN RESISTOR SELECTION/INSTALLATION

Install a burden resistor to match motor current rating. For any given motor horsepower and voltage rating, the rated motor current can vary over a considerable range. The accuracy of the drive is, however, dependant on the exact value of the feedback burden resistor. To insure that the drive can be matched to the exact motor rating, one burden resistor is mounted in the drive between terminals A5TB3-1 and A5TB3-2, and up to a maximum of four loose resistors are included with the drive. From the motor nameplate, determine rated motor current. Then, from Table 7-1, select the exact burden resistor required. If necessary, remove the burden resistor mounted in the drive and replace with the exact value required. Retain the other resistors for possible future use.

Table 7-1 Burden Resistors

46S02655- "KIT" SUPPLIED	MOTOR CURRENT RANGE (AMPS)	RESISTOR OHMIC VALUE	RESISTOR MARKING CODE
-0010	1.44 to 1.51	226.0	2260F
	1.52 to 1.59	215.0	2150F
	1.60 to 1.67	205.0	2050F
	1.68 to 1.76	196.0	1960F
-0040	2.50 to 2.64	130.0	1300F
	2.65 to 2.79	121.0	1210F
	2.80 to 2.94 (1/2HP)	115.0	1150F
	2.95 to 3.10 (1/2HP)	110.0	1100F
-0020	2.90 to 3.04 (1/4HP)	113.0	1130F
	3.05 to 3.19 (1/4HP)	107.0	1070F
	3.20 to 3.34	102.0	1020F
	3.35 to 3.50	97.6	97R6F
-0050	7.20 to 7.50	90.0	90R9F
	3.80 to 3.99; 7.60 to 7.90	84.5	84R5F
	4.00 to 4.19; 8.00 to 8.30	80.6	80R6F
	4.20 to 4.39; 8.40 to 8.70	76.8	76R8F
	4.40 to 4.60; 8.80 to 9.20	75.0	75R0F
-0030	4.50 to 4.79; 9.20 to 9.59	107.0	1070F
	4.80 to 5.09; 9.60 to 10.00	102.0	1020F
	5.10 to 5.29; 10.1 to 10.5	97.6	97R6F
	5.30 to 5.49; 10.6 to 11.0	93.1	93R1F
	5.50 to 5.80; 11.1 to 11.6	88.7	88R7F



Table 7-1 Burden Resistors (Continued)

46S02655- "KIT" SUPPLIED	MOTOR CURRENT RANGE (AMPS)	RESISTOR OHMIC VALUE	RESISTOR MARKING CODE
-0060	13.9 to 14.5	143.0	1430F
	14.6 to 15.2	133.0	1330F
	15.3 to 15.9	127.0	1270F
	16.0 to 16.6	121.0	1210F
	16.7 to 17.4	118.0	1180F
-0070	21.4 to 22.4	90.9	90R9F
	22.5 to 23.4	86.6	86R6F
	23.5 to 24.4	82.5	82R5F
	24.5 to 25.6	80.6	80R6F
-0080	33.3 to 34.9	118.0	1180F
	35.0 to 36.5	113.0	1130F
	36.6 to 38.1	107.0	1070F
	38.2 to 39.9	102.0	1020F
-0090	44.0 to 46.1	88.70	88R7F
	46.2 to 48.2	84.5	84R5F
	48.3 to 50.3	80.6	80R6F
	50.4 to 52.6	76.8	76R8F

SECTION 8. SETUP FOR OPTION PCBs (BY REF. DESIG.)

8.1 (A7): ANALOG TACH INTERFACE PCB (46S02665-0010) SETUP AND ADJUSTMENT PROCEDURE

NOTE

This procedure is applicable to analog tach feedback systems only.

Check

- [ ] 1. Verify that power is removed from drive.
- [ ] 2. Table 8-1 lists available tachs (both DC and AC) by "nominal" Tach Volts per 1000 RPM (see tach nameplate) versus Rated Motor Speed. For each allowable combination, the switches (S1 thru S4) which must be CLOSED on the Analog Tach Interface PCB are specified. Close the specified switch(es) by fully engaging the screw terminal on the top of each switch. Switches to be left open should have their screw terminals removed.

Table 8-1. Base Motor Speed vs Tach Volts/1000 RPM

BASE MOTOR RPM	NOMINAL DC OR AC TACH VOLTS/1000 RPM							
	20	28	30	45	50	90	100	200
300	--	--	--	--	--	1,2,3,4	1,2,3,4	1,3,4
400	--	--	--	--	--	1,2,3,4	1,2,3,4	1,2,3
500	--	--	--	1,2,3,4	1,2,3,4	2,3,4	1,3,4	2,4
650	--	--	--	1,2,3,4	1,2,3,4	1,3,4	1,3,4	4
850	--	1,2,3,4	1,2,3,4	2,3,4	2,3,4	3,4	1,2,4	1,3
1150	1,2,3,4	1,2,3,4	1,2,3,4	2,3,4	1,3,4	2,4	1,4	1
1750	1,2,3,4	2,3,4	1,3,4	1,2,4	1,2,4	2,3	3	--
2500	1,3,4	3,4	3,4	1,4	1,4	1	none	--
3500	3,4	2,4	2,4	2,3	3	--	--	--

NOTE: -- indicates unusable motor/tach combination.

8.1 (A7): ANALOG TACH INTERFACE PCB (46S02665-0010) SETUP AND  
ADJUSTMENT PROCEDURE (Continued)

Check

- [ ] 3. After correct positioning of switches S1 thru S4, check switch S5 for proper setup (see Table 8-2).

Table 8-2. Analog Tach Interface Switch S5 Settings

POSITION	S5-1	S5-2	S5-3	S5-4
open	DC Tach	tach feedback	not connected	
closed	AC Tach	tach reference		

- [ ] 4. Insure that jumper J14 is in the DC tach position for DC tach feedback, or in the AC tach position for AC tach feedback.
- [ ] 5. Remove the analog tach wire from TB1-31 on the Control Interface PCB (A3).
- [ ] 6. Install a wire jumper between Control Interface PCB TB1-31 and TB1-7 (-10.7 VDC).
- 7. If a DC Tach is used:
  - [ ] a. Apply power to the drive.
  - [ ] b. Display Tachometer Feedback signal (FCTN 6A).
  - [ ] c. Refer to the tach nameplate to determine the exact tachometer voltage per 1000 RPM.
  - [ ] d. Calculate Display RPM using the following formula:  

$$\text{DISPLAY RPM} = 10,700/\text{TACH VOLTS per thousand RPM}$$
  - [ ] e. Slowly adjust potentiometer R9 on the Analog Tach Interface PCB until a stable display of RPM equal to or slightly greater than the calculated value is achieved.

7. If a DC Tach is used: (Continued)

Check

NOTE

Some RPM values will appear briefly on the display, but cannot be held on that value by the adjustment of the potentiometer.

- [ ] f. Remove power from the drive. Remove jumper between TB1-31 and TB1-7. Reconnect analog tach wire to TB1-31.

This completes setup and adjustment of the Analog Tach Interface PCB when using a DC Tach.

8. If an AC tach is used:

- [ ] a. Calculate the normalized feedback voltage using the formula:  $FDBK\ V = 95/TACH\ VAC$  per thousand RPM.
- [ ] b. Apply power to the drive.
- [ ] c. Connect a DC voltmeter between TP2 (ATI output) and common (TP8).
- [ ] d. Adjust potentiometer R9 on the Analog Tach Interface PCB until the DC voltmeter reading equals the value calculated in step 15.
- [ ] e. Remove power from drive. Remove jumper between TB1-31 and TB1-7. Reconnect analog tach wire to TB1-31.

This completes setup and adjustment of the Analog Tach Interface PCB when using an AC Tach.

NOTE

Several different option PCBs may be used as A8, but only one of them can be present.

## 8.2 (A8): FOLLOWER MODE SETUP FOR ANALOG FOLLOWER PCB (46S02822-0010)

The following setup instructions are applicable only if the drive has an optional Analog Follower PCB installed (usually mounted on the left side of the chassis).

### CAUTION

BE SURE ALL POWER IS TURNED OFF BEFORE ATTEMPTING TO CONNECT THE FOLLOWER SIGNAL WIRES OR MAKE VOLTAGE SELECTION SWITCH SETTINGS.

#### 8.2.1 Signal Connections

##### Check

- [ ] 1. Verify that the follower input signal is connected to the Analog Follower option PCB as follows:
  - ( + ) follower input to TB2-3
  - ( - ) follower input to TB2-1.
  
- [ ] 2. Verify that the Analog Follower PCB output is connected to the Saber 3208 drive input terminals as follows:
  - Follower output TB2-8 to drive input A3TB1-11.
  - Follower output TB1-9 to drive input A3TB1-12.

#### 8.2.2 Input Voltage Range Selection

- [ ] There are eight screw terminal type switches on the Analog Follower PCB. Determine the maximum voltage level which will be applied to input terminals TB1-1 and 3. Open and close the switches as indicated below. Close the specified switches by fully engaging the screw terminal on the top of each switch. Switches to be left open should have their screw terminals removed.

MAXIMUM INPUT VOLTAGE  
DC or PEAK AC

SWITCH POSITIONS

---

10 volts or any CURRENT signal input	S1 thru S8 closed
20 volts	S1 thru S6 closed, S7 & 8 open
145 volts	S1 thru S4 closed, S5 thru S8 open
260 volts	S1 & S2 closed, S3 thru S8 open
480 volts	S1 thru S8 open

---

### 8.2.3 Input Current Range Selection

#### Check

- [ ] If the analog signal to be followed is a current signal, set switch S9 positions 5 thru 8 as indicated below. If the signal to be followed is a voltage signal, switch positions S9-5 through S9-8 must be OFF (open).

#### SWITCH POSITIONS

CURRENT FOLLOWER INPUT RANGE	S9-5	S9-6	S9-7	S9-8
1-5 MILLIAMPS	X	-	-	-
2-10 MILLIAMPS	-	X	-	-
4-20 MILLIAMPS	-	-	X	-
18-50 MILLIAMPS	X	X	X	X

X indicates switches to close (ON).  
- indicates switches to open (OFF).

### 8.2.4 Signal Rectification

- [ ] 1. If the signal to be followed is from an AC voltage source, close switches S9-3 and S9-4 (ON) and open switch S9-2 (OFF) on the Analog Follower PCB.
- [ ] 2. If the signal to be followed is from a DC voltage or current source, open switch S9-3 (OFF) and close switch S9-2 (ON) on the Analog Follower PCB. Switch S9-4 may be closed to provide more signal filtering if desired.

### 8.2.5 External Ratio

An external 5K ohms potentiometer may be installed for remote RATIO adjustments in place of the internal RATIO adjustment (R14) on the Analog Follower PCB. MagneTek Drives & Systems part no. 43T00572-5023 is recommended. Using three conductor shielded wire, make connections as described below:

If an external RATIO potentiometer will not be used, switch S9-1 must be ON (closed) for proper operation.

### 8.2.5 External Ratio (Continued)

#### Check

- [ ] 1. Connect clockwise terminal to Analog Follower terminal TB2-5.
- [ ] 2. Connect counterclockwise terminal to Analog Follower terminal TB2-7.
- [ ] 3. Connect wiper terminal to Analog Follower terminal TB2-6.
- [ ] 4. Connect wiring shield to Analog Follower terminal TB2-7. Leave wiring shield at the potentiometer end disconnected and insulated from ground.
- [ ] 5. On the Analog Follower PCB, set switch S9-1 to the OFF (open) position if a remote RATIO adjustment will be used.

### 8.2.6 Drive Set-Up

- [ ] 1. Refer to Section 3.7 and set selector switches S1 on the drive CPU board per signal type #1 if the signal to be followed is bidirectional, or for signal type #3 if the signal to be followed is unidirectional or is from an AC voltage source.
- [ ] 2. Apply drive power. Use the keyboard to enter the appropriate settings for Low Speed Tracking (FCTN 3A) and Upper and Lower Ratio Adjustment settings (FCTNS 3B & 3C), as indicated in para. 8.2.7. These settings should not be changed unless instructed to do so in order to preserve the resolution of the drive follower digitized input. The potentiometers on the Analog Follower PCB will be adjusted to provide the proper signal range used for follower adjustments.

### 8.2.7 Initial Adjustment Settings

- [ ] 1. Set the CURRENT OFFSET adjustment on the Analog Follower PCB (R12) fully counterclockwise.
- [ ] 2. Set the RATIO adjustment (internal R14 or the external potentiometer, if used) fully clockwise.
- [ ] 3. Set the MAX RATIO adjustment (R13) on the Analog Follower PCB fully clockwise.
- [ ] 4. Connect a DC voltmeter to monitor the  $\pm 10$  VDC signal at TP4 with respect to TP5 on the Analog Follower PCB.

### 8.2.7 Initial Adjustment Settings (Continued)

#### Check

- [ ] 5. Display FCTN 4E. This is the internal signal that the drive will follow, displayed in percent.
- [ ] 6. Set Anti-Reverse (FCTN 24) OFF.

### 8.2.8 Bidirectional Range Adjustments

If the follower will be used for bidirectional operation, do the following:

- [ ] 1. Use the keyboard to set Low Speed Tracking (FCTN 3A) to 0.0%, and Upper and Lower Ratio (FCTNS 3B & 3C) to 105%.
- [ ] 2. Apply a zero follower command signal.
- [ ] 3. Adjust CURRENT OFFSET (R12) for zero at the drive display. The DC voltmeter should also read zero.
- [ ] 4. Apply the maximum positive follower signal.
- [ ] 5. Adjust the MAX RATIO (R13) for 100.0% on the drive display. The DC voltmeter should read -9.52 VDC.
- [ ] 6. The CURRENT OFFSET and MAX RATIO adjustments may interact. Repeat steps 2 through 5 until the readings are as indicated.
- [ ] 7. Apply the maximum negative follower signal. Verify that the drive display shows -100.0%.
- [ ] 8. The bidirectional signal range adjustments are complete. Skip to para. 8.2.10.

### 8.2.9 Unidirectional Range Adjustments

If the follower will be used for unidirectional operation, do the following:

- [ ] 1. Use the keyboard to set Low Speed Tracking (FCTN 3A) to 95.0%, and Upper and Lower Ratio (FCTNS 3B & 3C) to 52.5%.
- [ ] 2. Apply the minimum follower signal, not necessarily zero for offset current signal inputs (4-20mA type).
- [ ] 3. Adjust CURRENT OFFSET (R12) for 0.0% at the drive display. The DC voltmeter should read -0.5 VDC.



### 8.2.9 Unidirectional Range Adjustments (Continued)

#### Check

- [ ] 4. Apply the maximum follower signal.
- [ ] 5. Adjust MAX RATIO (R13) for 100.0% on the drive display. The DC voltmeter should read -9.5 VDC.
- [ ] 6. The CURRENT OFFSET and MAX RATIO adjustments will interact. Repeat steps 1 through 4 until the readings are as indicated.

### 8.2.10 Final Follower Adjustments

The previous steps adjusted the follower analog signal to be within range for digitizing by the Saber 3208 follower input. Do not change the CURRENT OFFSET, MAX RATIO or RATIO potentiometer settings until the following steps are completed.

- [ ] 1. If a nonzero drive speed is desired with the minimum follower signal input, apply the minimum follower signal and use the keypad to readjust Low Speed Tracking (FCTN 3A) so that the display indicates slightly less than the desired minimum drive speed reference.
- [ ] 2. If it is desired that the drive run at other than rated speed with the maximum follower signal present, apply the maximum follower signal input and use the keyboard to adjust Upper and Lower Ratio settings (FCTNS 3B & 3C) so that the display shows slightly more than the desired drive speed reference for maximum follower signal input with the analog RATIO adjustment set at maximum.
- [ ] 3. These settings will interact. Repeat steps 1 and 2, adjusting Low Speed Tracking and Upper and Lower Ratio settings in small increments until the desired speed range is accommodated.
- [ ] 4. If it is desired that the drive not reverse in the event that the minimum follower signal is not supplied, set Anti-Reverse ON (FCTN 23).
- [ ] 5. Reduce the follower signal to minimum. Start the drive and energize the follower circuit. Observe drive speed while varying the signal to be followed over the operating range to verify proper operation.

If the desired speed range is not met, repeat steps 1, 2, and 3 above. Set the Low Speed Tracking for slightly less speed, and/or set Upper and Lower Ratio for slightly faster speed, whichever is appropriate.

8.2.10 Final Follower Adjustments (Continued)

Check

- [ ] 6. The analog CURRENT OFFSET and RATIO adjustments may now be used to make minor adjustments to the drive speed response to the follower signal. Use a technique similar to the above when making these interactive adjustments. Do not change LOW SPEED TRACKING or Upper or Lower RATIO settings.
  
- [ ] 7. In the event that the signal range to be handled changes significantly, repeat all steps in this procedure.

### 9.3 SPECIAL HANDLING REQUIREMENTS

#### CAUTION

MANY ELECTRONIC PARTS INTERNAL TO THE DRIVE CONTROLLER CAN BE EASILY DAMAGED BY STATIC ELECTRICITY AND ELECTROSTATIC DISCHARGE (ESD). THIS STATIC CHARGE BUILDUP OCCURS ON YOUR BODY AND OTHER OBJECTS FROM NORMAL MOTIONS SUCH AS WALKING, RUBBING ON CLOTHING AND MOVING OBJECTS FROM PLACE TO PLACE. FOLLOW THE PRECAUTIONARY GUIDELINES LISTED BELOW TO PREVENT DESTRUCTIVE DAMAGE WHEN TROUBLESHOOTING OR REPLACING PRINTED WIRING BOARDS OR OTHER PARTS OF THIS EQUIPMENT.

1. Read the removal and installation instructions contained herein before attempting to remove or replace a printed wiring board or other component.
2. Always touch yourself and/or instrument probes that you intend to use to the metallic chassis BEFORE touching internal wires or components. This will help equalize electrostatic voltage potentials and prevent static discharge into sensitive circuitry.
3. Never touch internal wiring, printed wiring board components, or test points with fingers or attach instrument probes with the equipment energized. Turn power OFF, discharge yourself and the instrument probe to the chassis. Attach the probe as desired, and ONLY THEN turn power ON if required for testing. Use the same procedure when removing attached probes.
4. After removing circuit cards, always place them on a properly installed antistatic workstation surface, a grounded metallic surface or in an antistatic protective bag, but FIRST equalize electrostatic voltage potentials by touching the surface or bag with your hands BEFORE touching the circuit card to that surface. Likewise, before touching a circuit card laying on an antistatic or metallic surface always touch the surface FIRST with your hands before touching the circuit card. The use of electrically conductive wrist straps, bonded to a grounded workstation surface, is highly encouraged for good ESD protection.
5. When installing replacement circuit boards, leave the new board in its antistatic bag till just prior to installation. Remove the card from the bag at the last minute and make necessary jumper or programming switch adjustments. While holding the card, touch the equipment chassis with your hand to equalize electrostatic voltage potentials BEFORE allowing the board to touch any wires or chassis parts.

6. Circuit cards sent back to MagneTek Drives & Systems for repair MUST be placed in an antistatic protective bag for shipment.

#### 9.4 TROUBLESHOOTING PROCEDURES

Troubleshooting consists of a logical series of operational checks and observations designed to localize a fault to a specific printed circuit board (PCB) or other major component. Corrective action is therefore directed toward isolation of the fault only to the major component level and substitution of a spare part. For minimum downtime, MagneTek Drives & Systems recommends that the user stock spare major parts.

Normally a problem will be limited to a single circuit card or component. Therefore, if more than one item was substituted in the process of isolating the fault, assume that the last item changed was the cause of the original problem. Follow the procedure steps in the table corresponding to the fault symptom observed. After applying the corrective action, observe the system in operation. If the symptom no longer exists, you have cleared the fault. If the symptom still exists, continue with the next step in the diagnostic process. Once the fault is isolated, it may be desirable to reinstall the original parts back into the drive, one at a time with testing at each step, in order to maintain spare part supplies.

Table 9-1 lists typical symptoms of drive faults and the recommended corrective action to locate and resolve the source of the problem. This listing is only typical and is not all inclusive. If the stated corrective action fails to resolve the fault or if the fault is not described by one of the listed symptoms, contact your nearest MagneTek Drives & Systems Field Service representative for assistance.

Repair of printed circuit boards requires special techniques and test facilities. For this reason, field repair is not authorized and replacement of a suspect board is recommended.

Defective or questionable printed circuit boards should be returned to MagneTek Drives & Systems, Service Department, 16555 W. Ryerson Road, New Berlin, Wisconsin 53151, for repair and test. The printed circuit board, in its antistatic protective bag, should be individually protected with one inch thickness of soft wrapping material before it is packed in a suitable carton. MagneTek Drives & Systems assumes no responsibility for printed circuit boards returned without proper return tags and forms. Contact the nearest MagneTek Drives & Systems District Office for proper return tags and forms.

Table 9-1. Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
<b>1. BLOWS FUSES</b>		
A. When power is applied	1. Failed field rectifier.	Check field rectifier and motor field circuit. Repair as necessary.
	2. Failed SCR module.	Check SCR modules. Replace as necessary.
B. When starting or during torque reversals	1. Ground fault in motor armature.	Check motor armature circuit for ground faults.
	2. Faulty SCR module.	Check SCR modules. Replace as necessary.
	3. Faulty SCR gate wiring.	Check SCR gate wiring. Check cable from Gate Firing PCB to CPU/Control PCB.
	4. Faulty pulse transformer circuit.	Replace Gate Firing PCB.
	5. Faulty CPU/Control	Replace CPU/Control PCB.
C. After running for long periods of time	Overtemperature from loose connections.	Check all power connections. Tighten if necessary.
<b>2. DOES NOT START</b>		
A. Contactor does not pickup	1. Open interlock circuit.	Close interlock circuit.
		NOTE
		If contactor interlock is not used, a jumper must be present. See connection diagram for proper location.

Table 9-1. Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
2. DOES NOT START (Cont'd)	2. STOP circuit de-energized or QUICKSTOP energized.	Check for open field loss interlock, if used. Check 24 VDC logic signals at TB1. Correct as necessary.
	3. START logic command not activated.	Verify PB logic input to TB1. Correct as necessary.
	4. Faulty contactor coil or coil wiring.	Check for 115 VAC at contactor coil connections. If voltage is present but contactor does not pick-up, replace contactor or contactor coil.
	5. Faulty pilot relay or wiring.	If pilot relay clicks, check interlock circuit and contactor coil wiring. Replace Control Interface PCB.
	6. Faulty internal operation.	a. Replace Control Interface PCB. b. Replace CPU/Control PCB.
	B. Contactor picks up, but no start	1. Faulty contactor acknowledge circuit (Contactor drops out after several seconds).

Table 9-1. Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
2. DOES NOT START (Cont'd)		
B. (Cont'd)	2. Zero speed command or excessive acceleration time.	<p>Verify that commanded speed is not set at zero, causing no movement. Display Drive Status, function 2C, to verify operating mode, then verify proper speed reference and programmed acceleration time settings. If using analog reference input, verify that signal is present at terminal strip with VOM and function 46.</p> <p>If zero speed band is enabled, ensure that commanded speed is greater than drop out speed setting (function 16).</p>
	3. Motor Field Loss	<p>Use ammeter to verify that motor field is connected and is drawing current. Correct as necessary.</p>
	4. Open motor armature circuit.	<p>With drive in RUN mode, display Output Voltage, function 53. If voltage is greater than 20 VDC and no armature current flows, repair motor armature or wiring.</p>
	5. Faulty internal wiring.	<p>Check all internal cables and connections.</p>
	6. Faulty CPU/Control PCB.	<p>a. Replace CPU/Control PCB.  b. Replace Control Interface PCB.  c. Replace Gate Firing PCB.</p>

Table 9-1. Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
3. NO RESPONSE ON DISPLAY	1. Blown fuses.	Check main fuses. Check control fuse on Gate Firing PCB.
	2. Incorrect voltage set up.	Ensure that voltage select plug P11 is in the proper position for applied line voltage.
	3. Faulty connections.	Inspect all internal wiring cables between circuit cards.
	4. Power supply failure.	With power on, voltage between TP6 and TP8 on CPU/Control PCB should measure 19-26 VDC. If not, check power supply transformer T1 and wiring. Replace Gate Firing PCB. If OK, verify other circuit voltages with respect to TP8: +5 VDC at TP4, +15 VDC at TP7, -15 VDC at TP9. If not OK, replace CPU/Control PCB.
	5. Major component failure.	If drive runs, but display does not work, replace Keyboard/Display PCB.
4. POOR SPEED REGULATOR PERFORMANCE	Improper speed (or voltage) regulator tuning.	Retune speed or voltage regulator (see Section 9.7). If no help, retune current regulator (Self Tuning Procedure) and repeat.
5. "IST FALT" DISPLAYED	1. Improper current feedback burden resistor.	Inspect burden resistor (R1 on TB3). Check for proper value per Section 7.



Table 9-1. Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
5. "IST FALT" DISPLAYED (Cont'd)	2. Improper current regulator tuning.	Compare current regulator gain settings with start-up record. Correct if necessary. Perform Self Tuning Procedure.
	3. Intermittent short or ground fault in motor armature.	Check motor armature and wiring for shorts and ground faults.
	4. Faulty connections.	Check for loose power or signal connections within the controller. Correct as necessary.
	5. Faulty circuit cards.	a. Replace Gate Firing PCB. b. Replace CPU/Control PCB. c. Replace current sensing device.
	6. "LOW LINE" OR "SYNC FLT" DISPLAYED	Excessively noisy power line or line voltage dips below 70% or averages below 80% of rated.
7. "OVERSPD" DISPLAYED	1. Inappropriate Overspeed Trip threshold setting.	Check Overspeed Trip Threshold setting (function 35). Trip Threshold must be set higher than maximum expected speed.
	2. Speed regulator overshoot.	a. Re-tune speed or voltage regulator (see Section 9.7). b. Reduce Acceleration rate to minimize overshoot.

Table 9-1. Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
8. "OVERLOAD" DISPLAYED	Drive load too heavy or faulty motor.	<p>Monitor output current (function 52) during operations that cause overload fault. Determine if it is within design expectations of machinery. If not, check motor field for proper strength or motor armature for shorts.</p> <p>If overload fault occurs during acceleration of high inertia load, increase Acceleration time to demand less current. Re-belt motor to require less amperes for application.</p>
9. "OVERTEMP" DISPLAYED	<p>1. Drive overheating.</p> <p>2. Drive and motor overload.</p> <p>3. Faulty thermistor device.</p>	<p>Check heat sink and fan for dirt build-up; clean if necessary. Check fan for proper operation; replace if necessary. Improve ventilation with air less than 55°C.</p> <p>If Overload Trip has been disabled, see actions for "OVERLOAD" display.</p> <p>Press RESET to restore active display, then display H.S. Temp (function 59). Displayed value should be heat sink temperature. After one hour of no operation, the heat sink temperature should be approximately the same as ambient air. Check thermistor connections. Replace thermistor device if this cannot be verified.</p>

Table 9-1. Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
9. "OVERTEMP" DISPLAYED (Cont'd)	4. Faulty circuits.	a. Replace CPU/Control PCB. b. Replace Gate Firing PCB.
10. "TACHLOSS" OR "REV TACH" DISPLAYED	1. Loss of tachometer signal or reversed DC tach polarity with substantial motor voltage present.  2. Faulty Tach Interface PCB.	Check for broken wiring to tachometer. Check for reversed input connections with DC or pulse type tachometer. Check for proper cali- bration set up for AC or DC tachometer.  Replace Tach Interface PCB. Perform calibra- tion set up on replace- ment board before run- ning.
11. "NV ERROR" DISPLAYED	Electrical noise or other malfunction has caused a change in one or more stored parameter set up values.	a. Display Drive Status (FCTN 2C). Record, BUT DO NOT CHANGE, any displayed status selections which differ from those recorded on the Start-Up Record Sheet. b. Display each drive setting. See Start- Up Record Sheet, and Table 3 of manual. Record, BUT DO NOT CHANGE, any displayed settings which do not agree with recorded values. c. Correct all erroneous status selections and settings. d. If fault recurs, replace CPU/Control PCB.

Table 9-1. Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
12. "CPUMEMER", "LO MEMER" OR "UP MEMER" DISPLAYED	Faulty operation of CPU/Control PCB.	Replace CPU/Control PCB.
13. "CPU FALT" DISPLAYED	1. Power line dip below 50%.  2. Faulty operation of CPU/Control PCB.	Check for intermittent power source connection. Correct as required.  Replace CPU/Control PCB.

## 9.5 SCR TESTING AND REPLACEMENT

The power bridge (Figure 9-1) contains modular type SCRs (thyristors), with each module containing two SCRs.

### WARNING

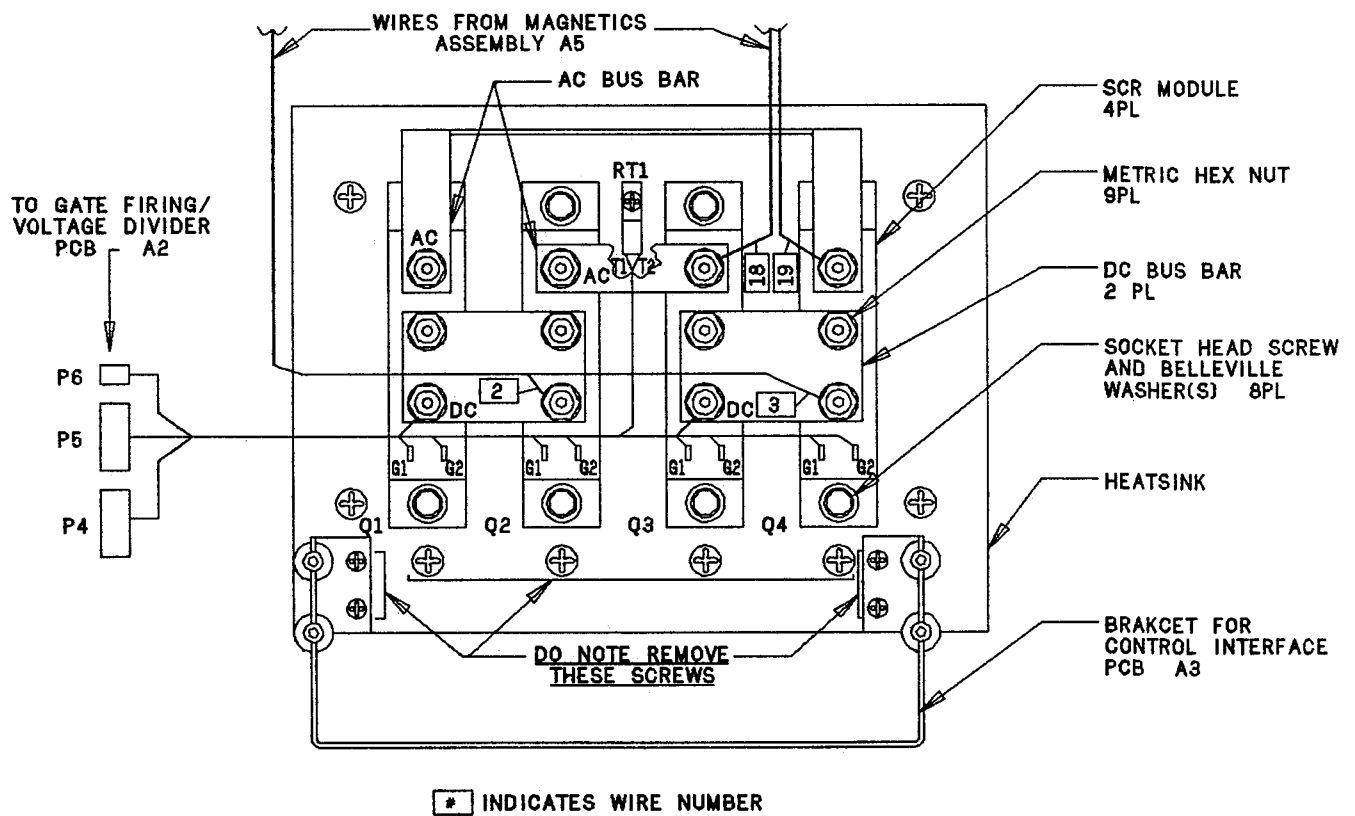
#### HIGH VOLTAGE

PERSONNEL WILL BE EXPOSED TO HIGH VOLTAGE WHEN THE CONTROLLER IS OPENED. ELECTRICAL SHOCK CAN CAUSE SERIOUS OR FATAL INJURY. REMOVE AC INPUT POWER AND ANY ASSOCIATED EXTERNAL CONTROL OR INTERLOCK CIRCUIT POWER BEFORE ATTEMPTING TO PERFORM ANY MAINTENANCE FUNCTION ON THE POWER BRIDGE.

SCRs may be tested by using the following procedures to check for shorts or open circuits. When readings fall outside the acceptable range, do not replace an SCR until a comparison is made with other SCRs in the rectifier bridge. Always use the same ohmmeter when performing comparison tests.

#### 9.5.1 Testing SCR Devices Without Removing From the Heat Sink

1. Be sure all power is turned off.
2. Follow disassembly steps in 9.5.2 to remove all power wires and bus bar links from the SCR modules.
3. Using a DC ohmmeter in the X10K range, measure the resistance between each module power terminal and the other two terminals on the module (6 measurements). Repeat for each SCR module. All measurements should read greater than 1.7 megohms.
4. Any module that has one or more readings less than 1.7 megohms should be replaced.
5. Reassemble bus bar and wire connections per 9.5.3, steps 12-15.



TD I MB3208.E.F1G9.2

Figure 9-1. SCR Bridge (Heat Sink Assembly, A6) Configuration

### 9.5.2 Disassembly of SCR Power Connections

1. Open the swing out panel by turning the captive fastening screw (at the right side) 1/4 turn.
2. Verify that the following items are marked:
  - a. Wire #2: from terminal lug on DC bus bar on SCRs Q1 and Q2, to contactor A5K1 terminal (5) or to A5TB2A terminal (A1).
  - b. Wire #3: from terminal lug on DC bus bar on SCRs Q3 and Q4, to contactor A5K1 terminal (6) or to A5TB2A terminal (A2).
  - c. Wire #18 (qty. 2): both from terminal lug at AC bus bar on SCR Q4; one to Snubber PCB terminal E1, one going into hole below right fuse (F2).
  - d. Wire #19 (qty. 2): both from terminal lug at AC bus bar on SCR Q3; one to Snubber PCB terminal E2, one going into hole below left fuse (F1).

#### NOTE

Metric hex nuts, M5, 8mm (.315 in.), are used on the heat sink assembly. Ensure that the proper tool is used for disassembly and assembly.

3. Remove all metric nuts and washers securing wires and bus bars to the module. Set aside hardware and bus bars.

### 9.5.3 SCR Module Removal and Installation

1. Perform procedures in 9.5.2.
2. Disconnect P2A ribbon cable connector from J2A on the Control Interface PCB.
3. Remove four (4) screws securing Control Interface PCB to bracket on heat sink assembly; with harness wiring still connected, carefully lower board out of drive.
4. Disconnect harness leads from gate tabs on the modules.
5. Using an Allen wrench or key, remove the two socket-head screws, with Belleville washers, holding the SCR module to the heat sink, and gently pull the module from its position.

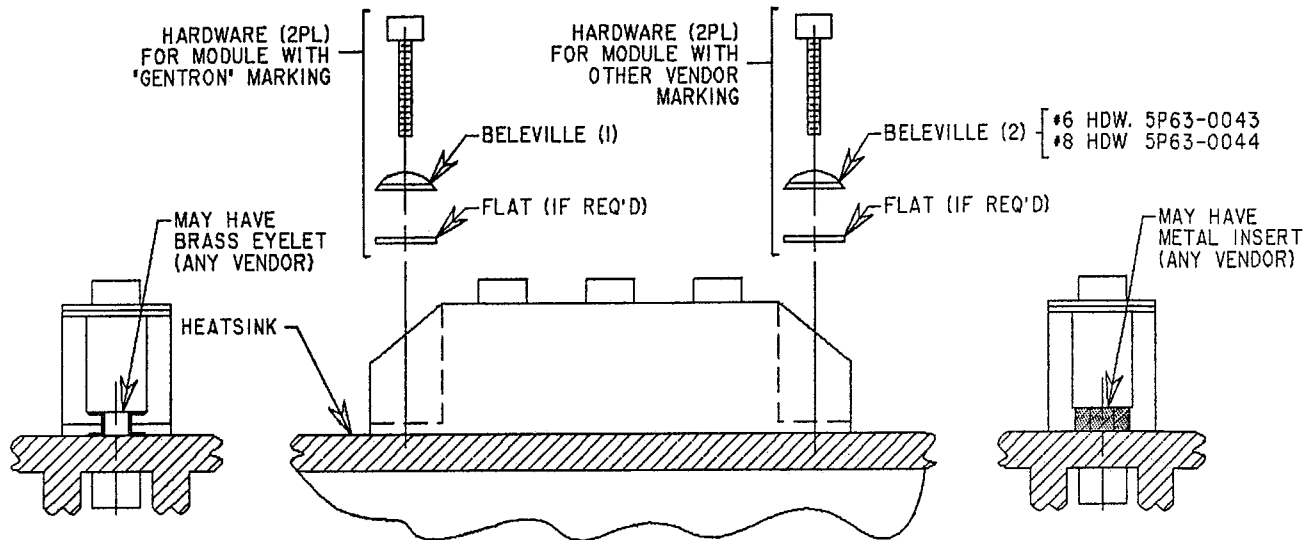
6. See Figure 9-2. Examine the new module to determine number of washers (Belleville and flat) required under each socket-head screw. If the module has a plastic housing, a flat washer of appropriate size should be under the Belleville washer(s). Modules that have a brass eyelet in the mounting hole must also have a flat washer installed. If the module has metal inserts for the Belleville washers to "seat" on, do not use the flat washer.
7. Apply a thin, even coating of thermal joint compound (NOT Pentrox A) to the entire bottom (mounting surface) of the module. Position the module on the heat sink and loosely install socket-head screws with Belleville washers (and, if required, flat washers).

IMPORTANT

DO NOT use a torque wrench to tighten the hardware. The correctly flattened Belleville washer as described below provides the proper mounting pressure.

8. Start by tightening both screws equally (alternately) with an Allen wrench or hex key. Continue with this procedure until the Belleville washers are flat. An abrupt change in torque will be detected when the Belleville becomes flat.
9. Wipe off any excess thermal joint compound from module and heat sink.
10. Remove the three terminal studs (headless screws) from the old module and install them into threaded terminals of the new module.
11. Reconnect harness wires to gate tabs on all modules.
12. Position AC and DC bus bars over terminal studs on modules. Position harness wires and loosely install one hex nut to hold each bus bar.
13. At two other terminal studs for each DC bus bar, loosely install Belleville washer and hex nut.
14. At the remaining terminal stud for each bus bar, position lug of AC or DC bus wires and loosely install Belleville washer and hex nut.
15. Tighten all hex nuts to 26 inch-pounds.





TD 1.MOD.MOUNT

Figure 9-2. Module Mounting Combinations

16. Carefully lift Control Interface PCB back into drive; locate to bracket on heat sink assembly and re-install four (4) securing screws.
17. Reconnect P2A connector to J2A on Control Interface PCB.
18. Close the swing out panel, and secure by pressing on captive fastening screw at the right side.

#### 9.6 PRINTED CIRCUIT BOARD REPLACEMENT PROCEDURES

Since most replacement procedures are obvious, only those boards which require special procedures are covered in the following paragraphs.

### 9.6.1 Replacing Control Interface PCB

1. Remove all power to the drive and any associated external control or interlock circuitry.

#### NOTE

The front cover does not have to be removed for replacement of this PCB.

2. Open the swing out panel by turning the captive fastening screw (at the right side) 1/4 turn.
3. Label each wire going to TB1 terminal block with the corresponding number, then remove all wires from TB1.
4. Remove P2A, P7 and P12 (also P15 and P16 if applicable) ribbon cables from their connectors on the Control Interface PCB.
5. Remove the four (4) screws holding the PCB.
6. Install the new PCB.
7. Connect P2A, P7 and P12 ribbon cables to J2A, J7 and J12, respectively; (also P15 and P16 to J15 and J16 if applicable).
8. Replace all wires into TB1.
9. Close the swing out panel, and secure by pressing on captive fastening screw at the right side.
10. Replacement of the Control Interface PCB is complete.

### 9.6.2 Replacing CPU/Control PCB

1. Verify that your records for all settable parameters are complete and up to date (Start-Up Record Sheet at the front of this manual). You will need this information in order to reload and restore proper set up values into the replacement PCB.
2. Remove all power to the drive and any associated external control or interlock circuitry.
3. Remove the front cover by pulling gently on the four (4) fasteners, in each corner, to unlock them.
4. Change the replacement PCB's switch settings and jumper positions to correspond with those on the replaced PCB.

NOTE

Steps 5 thru 7 are necessary because U2 and U3 contain the program for running the drive. U5 contains all of the drive settings entered during initial start-up.

NOTE

The positions of U2, U3 and U5 are shown in Figure 1-1.

5. Remove U2 (integrated circuit) from the replaced PCB, using a small screwdriver to pry it up, and install it in the corresponding position on the replacement PCB.
6. Repeat step 4 for U3.
7. Observe that U5 is left-justified in its socket (the right-most four (4) holes of the socket are not used). Remove U5 from the replacement PCB and save it in an antistatic bag or foam. It may be used in later troubleshooting procedures. Remove U5 from the replaced PCB and install it in the corresponding position on the replacement PCB.
8. Remove ribbon cable P3A from the Keyboard/Display PCB.
9. Open the swing out panel by turning the captive fastening screw (at the right side) 1/4 turn.
10. Remove four (4) screws on the back of the swing out panel, while holding the Keyboard/Display PCB so it doesn't fall. Remove the Keyboard/Display PCB.
11. Remove P1 and P2 from the CPU/Control PCB, and J12 from the Tach Interface PCB, if one is installed.
12. From the bottom of the swing out panel, remove the four (4) screws which secure the CPU/Control PCB.
13. Slide the CPU/Control PCB out of the swing out panel.
14. Remove the Tach Interface PCB, if present, by first removing P3B from the CPU/Control PCB. Then turn the CPU/Control PCB over while squeezing and, at the same time, pushing the bottom of the three PCB holding clips.
15. Install the Tach Interface PCB into the replacement CPU/Control PCB by pushing the bottom of the PCB holding clips into the appropriate holes. Then install P3B into the CPU/Control PCB.

16. Slide the replacement CPU/Control PCB into position in the swing out panel, and secure by replacing the screws through the bottom of the swing out panel.
17. Reconnect P1 and P2 into their connectors. Also, if applicable, reconnect J12 to the Tach Interface PCB.
18. Install the Keyboard/Display PCB by holding it in position and replacing the screws through the back of the swing out panel. Then connect P3A back into the connector on the Keyboard/Display PCB.
19. Close the swing out panel, and secure by pressing on captive fastening screw at the right side.
20. Replace the front cover; push in on the four (4) fasteners to hold it in place.
21. Turn drive power ON, but DO NOT ATTEMPT TO START THE MOTOR. Using the Keyboard, VERIFY that all parameter functions are set to the values recorded on the Start-Up Record Sheet at the front of this manual.
22. If the drive experiences recurring Non-Volatile Error faults (NV ERROR), de-energize the drive, and remove U5 from the CPU/Control PCB. Install the new U5 device which was put away in step 7 of this procedure, being careful to verify that it is left-justified in its socket. Using the keyboard, SET all parameter functions to the values recorded on the Drive Start-Up Record Sheet. If the record sheet information is not up to date, perform installation and start-up procedures as necessary to restore intended operation.
23. Replacement of the CPU/Control PCB is complete.

#### 9.6.3 Replacing Gate Firing/Voltage Divider PCB

1. Remove all power to the drive and any associated external control or interlock circuitry.

##### NOTE

The front cover does not have to be removed for replacement of this PCB.

2. Open the swing out panel by turning the captive fastening screw (at the right side) 1/4 turn.

##### NOTE

The SCRs (four (4) rectangular devices mounted to the heat sink) are numbered from left to right Q1, 2, 3 and 4.

3. Verify that the following items are marked:
  - a. Wire #2: from terminal lug on DC bus bar on SCR 's Q1 and Q2, to contactor terminal (5) or to A5TB2A terminal (A1).
  - b. Wire #3: from terminal lug on DC bus bar on SCR is Q3 and Q4, to contactor terminal (6) or to A5TB2A terminal (A2).
  - c. Wire #18 (qty. 2): both from terminal lug at AC bus bar on SCR Q4; one to Snubber PCB terminal E1, one going into hole below right fuse (F2).
  - d. Wire #19 (qty. 2): both from terminal lug at AC bus bar on SCR Q3; one to Snubber PCB terminal E2, one going to hole below left fuse (F1).
  - e. P4, P5 and P6: harness connectors going to the Gate Firing/Voltage Divider PCB.
4. Remove wires 2, 3, 18 and 19 at the lugs on the heat sink assembly.
5. Remove connectors P4, P5 and P6 from the Gate Firing/Voltage Divider PCB.
6. Remove connectors P2A, P7 and P12 from the Control Interface PCB.
7. If necessary, move the heat sink assembly to a safe resting place after removal. Label and remove all control wiring to TB1 on the Control Interface PCB.
8. Remove the screw from each corner of the heat sink, and lower the heat sink assembly (with Control Interface PCB) out of the drive.
9. Remove connectors P2B, P8, P9, P10 and P13 from the Gate Firing/Voltage Divider PCB.
10. Remove the Gate Firing/Voltage Divider PCB from mounting clips in the drive.
11. Note the position of P11 on the replaced PCB and make sure that P11 on the replacement PCB is in the same position.
12. Remove connector P7 from the replaced PCB and install into the replacement PCB.
13. Install the replacement PCB on mounting clips in the drive.
14. Reconnect P2B, P8, P9, P10 and P13 into the Gate Firing/Voltage Divider PCB.

15. Slide the heat sink assembly up into position and install four (4) securing screws.
16. Reconnect P4, P5 and P6 to Gate Firing/Voltage Divider PCB.
17. Reconnect P2A, P7 and P12 to the Control Interface PCB.
18. Reconnect wires 2, 3, 18 and 19 to lugs on the heat sink assembly.
19. Replace all previously removed control wiring to TB1 on the Control Interface PCB.
20. Close the swing out panel, and secure by pressing on captive fastening screw at the right side.
21. Replacement of the Gate Firing/Voltage Divider PCB is complete.

## 9.7 SPEED REGULATOR AND VOLTAGE REGULATOR TUNING

The proportional and integral gain settings for the speed regulator affect the dynamic performance of the motor control in a velocity regulated system.

Speed regulator proportional and integral gains are RECALCULATED whenever a new value for Per Unit Inertia (FCTN 33) or Response (FCTN 34) is entered, unless the value set for response is zero.

During drive start-up, Per Unit Inertia was entered as a known value, or was calculated based on measurements, and then entered. If it was entered as a "known" value, check its accuracy by performing the measurements specified in Section 3.6 of this manual. This value will remain fixed for the life of the system, unless there is a mechanical change in the load inertia or a change in the gear ratio between the motor and load.

A value of 3 radians for response was recommended during drive start-up to yield stable and acceptable system response with the drive attached to "typical" machinery. This is a good starting point.

### 9.7.1 Fine Tuning

Items that affect the need for velocity regulator fine tuning are: the need for precise regulation, cyclic load changes, cyclic speed command changes, and the need to reduce the magnitude and/or recovery time for speed overshoots when such disturbances occur.

If any of these situations dictate an increase in system responsiveness, an increase in the value set for response is suggested, with the computer recalculating the values necessary for the two speed regulator gains. However, to achieve peak system performance, it may be necessary to individually adjust these gains.

The two regulator gains are:

Speed Regulator Proportional Gain	FCTN 31
Speed Regulator Integral Gain	FCTN 32

In general, the proportional gain setting controls the magnitude of the drive response to a velocity disturbance. The integral gain controls the response recovery time. The ratio between these two gain settings, in conjunction with the load inertia, controls the overall stability of the velocity system.

If performance seems sluggish and under damped, increase the response adjustment. If satisfactory results cannot be obtained by increasing response, set response back to its original value. Then set response to zero, and increase the proportional gain setting. If the system becomes oscillatory, increase the integral gain also in a similar proportion. If a low inertia load is attached, reduce both integral and proportional gains, then adjust the proportional gain to control overshoot. If the motor coupling system or belts have backlash, or if the load inertia is greater than 8 times the motor, increase the integral gain and decrease the proportional gain to stabilize the system, as the regulator will need to be slowed down to compensate for system backlash.

If drive speed tracking time delay is a problem on cascaded reference system drives, a reduction of the Reference Smoothing adjustment (FCTN 44) may be necessary. Decreasing this setting will shorten tracking delays, but may cause the output current to "jitter" as observed on an analog meter. If this happens, record the values for the speed regulator proportional and integral gains, and then reduce the Per Unit Inertia setting (FCTN 33). Then readjust the proportional and integral gains as necessary following previously stated guidelines.

## 9.8 SPARE PARTS

It is recommended that the customer stock on site spare parts to minimize costly down time. Prices may be obtained from your local MagneTek Drives & Systems representative.

Table 9.1 lists parts which have a high probability of needing replacement.

Table 9.1. Recommended Spare Parts

DESCRIPTION	REF. DESIG.	PART NUMBER
Fuse <u>3208 HP (RMS Amps)</u> <u>Fuse Rating</u> 0.12 (3.0); 0.25 (1.6)      5A 0.25 (4.7); 0.50 (3.9)      8A 0.75 (13.4)      10A 0.50 (7.8); 1 (8.4)      15A 0.75 (13.4); 1.5 (13.6)      20A 1 (15.2); 2 (17.0)      25A 3(25.0)      40A 5 (40.8)      60A 7.5 (52.8)      80A 10 (63.0)      150A	F1, F2	05P00017-0106 05P00017-0287 05P00017-0283 05P00017-0103 05P00017-0134 05P00017-0116 05P00017-0284 05P00017-0176 05P00017-0285 05P00017-0142
SCR Module  0.12 - 2 HP 5 HP 7.5 HP 10 HP	A6Q1, Q2, Q3, Q4	05P00050-0326 05P00050-0311 05P00050-0312 05P00050-0313
Fan      (10HP only)	1MTR	05P00016-0027
Contactor <u>3208 HP (RMS Amps)</u> 0.12-0.50; 0.75 (6.3); 1 (8.4) 0.75 (13.4); 1 (15.2); 1.5-5 7.5 HP	A6K1	05P00031-0063 05P00031-0061 05P00031-0091
Contactor 10 HP	K1	05P00031-0054
Field Rectifier	A6CR1	05P00050-0258



Table 9.1. Recommended Spare Parts (Continued)

DESCRIPTION	REF. DESIG.	PART NUMBER
Basic PCBs:		
CPU/Control	A1	46S02823-0011
Gate Firing/Voltage Divider	A2	46S02659-0011
Control Interface	A3	
(for stand-alone)		46S02821-0010
(for use with MicroTrac)		46S02821-0020
Keyboard/Display	A4	
(for stand-alone)		46S02820-0011
(for use with MicroTrac)		46S02820-0020
Option PCBs:		
Digital Tach Interface	A7	46S02663-0010
Analog Tach Interface	A7	46S02665-0010
Digital Tach Interface	A8*	46S02663-0020
Analog Follower	A8*	46S02822-0010
Thumbwheel Interface	A8*	46S02764-0010
Digital Reference Interface	A8*	46S02763-0010
Burden Resistor Kit	R1	See Table 7-1
Power Supply Transformer	T1	05P00204-0112

\* Only one board can be installed in the A8 location.

**SABER 3208 START-UP RECORD SHEET  
(MUST BE COMPLETED AT TIME OF START-UP)**

**IMPORTANT**

**ALWAYS UPDATE THIS PAGE ANY TIME SETTINGS ARE CHANGED.**

00-RAT AMPS _____	17-SET NOM ..... _____	30-IG C CUR _____
02-BASE SPD _____	18-SET % ..... _____	31-PG SPDRG _____
03-RAT LVLT _____	1B-CSTOP EN ..... _____	32-IG SPDRG _____
04-FDBK P/R _____	1C-CSTOPDIS ..... _____	33-INERTIA _____
05-LOAD RES _____	1D-JSCTP EN ..... _____	34-RESPONSE _____
06-LOAD MHY _____	1E-JCSTPDIS ..... _____	35-OSPD THR _____
07-MCURLIMS _____	1F-OVRLD EN ..... _____	36 - DROOP _____
08-RCURLIMS _____	20-OVRLDDIS ..... _____	37-SPD LIMIT _____
09-RUN ACEL _____	21-ZBAND EN ..... _____	38-BSTDROOP _____
0A-RUN DCEL _____	22-ZBANDDIS ..... _____	39-FOL P/R _____
0B-FOL ACEL _____	23-A REV EN ..... _____	3A-LOSPD TK _____
0C-FOL DCEL _____	24-A REVDIS ..... _____	3B-UPFOLRAT _____
0D-THD ACEL _____	25-AN REFEN ..... _____	3C-LOFOLRAT _____
0E-THD DCEL _____	26-KEYREFEN ..... _____	3D-AGSPDSPN _____
0F-JOG ACEL _____	27-TFDBK EN ..... _____	3E-ACTSPDSC _____
10-JOG DCEL _____	28-VFDBK EN ..... _____	3F-SPDRFSCL _____
11-QSP DCEL _____	29-UP2SPDEN ..... _____	40-TQCMDSPN _____
12-JOGDELAY _____	2A-SPDSNSEN ..... _____	41-TMCMDSPN _____
13-RUN SPD _____	2B-CURSSENSE ..... _____	42-SELAGSCL _____
14-THD SPD _____	2D-PG D CUR _____	43-LGTHR SP _____
15-JOG SPD _____	2E-IG D CUR _____	44-REFSMOTH _____
16-DROP SPD _____	2F-PG C CUR _____	5E-RMTRNSPD _____

**LEGEND:**

\_\_\_\_\_ ENTER PARAMETER VALUE SET AT START-UP  
 ..... ENTER EITHER (E)NABLE OR (D)ISABLE SET AT START-UP

APPENDIX

Contents

Table A1	Function Codes in Alphabetical Order
Table A2	Function Codes in Numerical Order
Table A3	Settable Parameters

## LEGEND FOR TABLES

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#	NUMBER OF LINE CYCLES
---	UNITS NOT APPLICABLE TO THIS FUNCTION
AMPS	A PARAMETER WHICH CAN BE DISPLAYED IN AMPERES
DEGC	A PARAMETER WHICH IS DISPLAYED IN DEGREES CELSIUS
DSPL	A PARAMETER WHICH CAN BE DISPLAYED BUT NOT SET
HZ	A PARAMETER WHICH IS DISPLAYED IN CYCLES PER SECOND
MHNY	A PARAMETER WHICH IS SET AND DISPLAYED IN MILLIHENRIES
MOHMS	A PARAMETER WHICH IS SET AND DISPLAYED IN MILLIOHMS
PCT	A PARAMETER WHICH IS SET AND DISPLAYED AS A PERCENT OF RATED
P/R	A PARAMETER WHICH IS SET AND DISPLAYED AS PULSES PER REVOLUTION
RADN	A PARAMETER WHICH IS SET AND DISPLAYED IN RADIANS
RPM	A PARAMETER WHICH CAN BE DISPLAYED IN MOTOR RPM
SEC	A PARAMETER WHICH IS SET AND DISPLAYED IN SECONDS
SET	A FUNCTION WHICH CAN BE ENABLED BUT NOT DISPLAYED
S/D	PARAMETER CAN BE BOTH SET AND DISPLAYED
VAC	A PARAMETER WHICH CAN BE DISPLAYED IN AC VOLTS
VDC	A PARAMETER WHICH CAN BE DISPLAYED IN DC VOLTS
(N/A)	NO MNEMONIC ASSIGNED TO THIS FUNCTION

Table A1. Functional Codes in Alphabetical Order

FUNCTION DESCRIPTION	MNEMONIC	FCTN CODE	UNITS	TYPE
Actual Speed Feedback Output Channel Scaling Adjustment	ACTSPDSC	3E	PCT	S/D
Analog Run Reference Enable	AN REFEN	25	---	S/D
Analog Run Speed Command Span Adjustment	AG SPDSPN	3D	PCT	S/D
Anti-reverse Clamp Disable	A REVDIS	24	---	S/D
Anti-reverse Clamp Enable	A REV EN	23	---	S/D
Base Motor Speed	BASE SPD	02	RPM	S/D
Boost/Droop Setting	BSTDROOP	38	VDC	S/D
Continuous Current Rgltr. Integral Gain	IG C CUR	30	---	S/D
Continuous Current Rgltr. Proportional Gain	PG C CUR	2F	---	S/D
Controlled Stop Contactor Drop Out Speed	DROP SPD	16	RPM	S/D
Controlled Stop Disable	CSTOPDIS	1C	---	S/D
Controlled Stop Enable	CSTOP EN	1B	---	S/D
Current Command	CUR CMD	50	AMPS	DSPL
Current Reference	CUR REF	51	AMPS	DSPL
Current Regulator Test Procedure Enable	CUREGTST	6E	---	SET
Current Sense Enable	CURSNSEN	2B	---	S/D
Digital/Analog Converter (DAC) Setup	DACSETUP	19	---	SET
Discontinuous Current Rgltr. Integral Gain	IG D CUR	25	---	S/D
Discontinuous Current Rgltr. Proportional Gain	PG D CUR	2D	---	S/D
Drive Status Feedback Function	STATUS	2C	---	S/D
Feedback Tach Pulses Per Revolution (Digital Tach)	FDBK P/R	04	P/R	S/D
+ 5 VDC Control Voltage	+ 5 VDC	56	VDC	DSPL
+ 15 VDC Control Voltage	+15 VDC	57	VDC	DSPL
- 15 VDC Control Voltage	-15 VDC	58	VDC	DSPL
Firing Angle	FIR ANGL	5B	DEG	DSPL
First Fault	FRST FLT	6D	---	SET
Follower Mode Acceleration Time	FOL ACEL	0B	SEC	S/D
Follower Mode Deceleration Time	FOL DCEL	0C	SEC	S/D
Follower Mode Lower Ratio Setting	LOFOLRAT	3C	PCT	S/D
Follower Mode Upper Ratio Setting	UPFOLRAT	3B	PCT	S/D
Follower On-Off Switch Status	FOL SW	67	---	DSPL
Follower Tach Pulses Per Revolution	FOL P/R	39	P/R	S/D

Table A1. Functional Codes in Alphabetical Order  
(Continued)

FUNCTION DESCRIPTION	MNEMONIC	FCTN CODE	UNITS	TYPE
Go-to-Local Mode	(N/A)	D2	---	S/D
Go-to-Remote Mode	(N/A)	D1	---	S/D
Jog Acceleration Time	JOG ACEL	0F	SEC	S/D
Jog Contactor Drop Out Delay	JOGDELAY	12	SEC	S/D
Jog Controlled Stop Disable	JCSTPDIS	1E	---	S/D
Jog Controlled Stop Enable	JCSTP EN	1D	---	S/D
Jog Deceleration Time	JOG DCEL	10	SEC	S/D
Jog Push Button Input Status	JOG PB	61	---	DSPL
Jog Speed	JOG SPD	15	RPM	S/D
Keyboard Run Reference Enable	KEYREFEN	26	---	S/D
Line Frequency	LINEFREQ	5A	HZ	DSPL
Line Voltage	LINEVOLT	54	VAC	DSPL
Linear Accel/Decel Control Input Signal	LAC INPT	47	RPM	DSPL
Linear Accel/Decel Control Output Signal	LAC OUT	48	RPM	DSPL
Load Inductance	LOAD MHY	06	MHNY	S/D
Load Resistance	LOAD RES	05	MOHMS	S/D
Logic Output Threshold Set Point	LGTHR SP	43	PCT	S/D
Loop Contactor Status	CNTOR ST	69	---	DSPL
Low Speed Tracking	LOSPD TK	3A	PCT	S/D
Motor Overload Disable	OVRLLDIS	20	---	S/D
Motor Overload Enable	OVRLD EN	1F	---	S/D
Motoring Current Limit Setting	MCURLIMS	07	AMPS	S/D
Motoring Current Limit (Active)	MOCURLIM	5C	AMPS	DSPL
Output Current	OUT CURR	52	AMPS	DSPL
Output Current Ripple	CUR RIPL	55	---	DSPL
Output Voltage	OUT VOLT	53	VDC	DSPL
Overspeed Trip Threshold	OSPD THR	35	RPM	S/D
Per Unit Inertia	INERTIA	33	SEC	S/D
Quickstop Deceleration Time	QSP DCEL	11	SEC	S/D
Quickstop Push Button Input Status	QSTP PB	63	---	DSPL
Rated Line Voltage	RAT LVLT	03	VAC	S/D
Rated Motor Current	RAT AMPS	00	AMPS	S/D
Rated Motor Voltage	RAT VLTS	01	VDC	DSPL
Ratio Limit Setting (Active)	ACTRATIO	6B	PCT	DSPL
Reference Smoothing	REFSMOTH	44	#	S/D
Regenerating Current Limit Setting	RCURLIMS	08	AMPS	S/D

Table A1. Functional Codes in Alphabetical Order  
(Continued)

FUNCTION DESCRIPTION	MNEMONIC	FCTN CODE	UNITS	TYPE
Regenerating Current Limit (Active)	RGCURLIM	5D	AMPS	DSPL
Remote/Local Switch Input Status	RMTLOCSW	64	---	DSPL
Remote Quickstop Enable	(N/A)	D4	---	SET
Remote Reset Enable	(N/A)	D0	---	SET
Remote Run Enable	(N/A)	D5	---	SET
Remote Run Speed Command	RMTRNSPD	5E	RPM	S/D
Remote Set Nominal Values	(N/A)	D7	---	S/D
Remote Set as a Percent of Rated	(N/A)	D8	---	S/D
Remote Stop Enable	(N/A)	D3	---	SET
Remote Thread Enable	(N/A)	D6	---	SET
Response	RESPONSE	34	RADN	S/D
Reverse On/Off Switch Input Status	REV SW	66	---	DSPL
Run Acceleration Time	RUN ACEL	09	SEC	S/D
Run Deceleration Time	RUN DCEL	0A	SEC	S/D
Run Push Button Input Status	RUN PB	60	---	DSPL
Run Speed	RUN SPD	13	RPM	S/D
SCR Heat Sink Temperature	HS TEMP	59	DEGC	DSPL
Selectable Analog Output Channel Scaling Adjustment	SELAGSCL	42	PCT	S/D
Self Tuning Function	SELFTUNE	1A	---	SET
Set as a Percent of Rated	SET %	18	---	S/D
Set Nominal Values	SET NOM.	17	---	S/D
Speed Command Input	SPD CMD	46	RPM	DSPL
Speed Feedback Output Signal	SPDFBOUT	4B	RPM	DSPL
Speed Limit	SPD LIMT	37	RPM	S/D
Speed Limit Input Signal	SPDLMTIN	49	RPM	DSPL
Speed Reference Analog Output Channel Scaling Adjustment	SPDRFSCL	3F	PCT	S/D
Speed Reference Output Signal	SPDRFOUT	4A	RPM	DSPL
Speed Regulator Integral Gain	IG SPDRG	32	---	S/D
Speed Regulator Proportional Gain	PG SPDRG	31	---	S/D
Speed Sense Enable	SPDSNSEN	2A	---	S/D
Speed Torque Reference Signal	SPDTQ RF	4E	PCT	DSPL
Speed/Torque Switch Input Status	SPDTQ SW	68	---	DSPL
Stop Push Button Input Status	STOP PB	5F	---	DSPL
Tach Feedback Signal	TACHFDBK	6A	---	DSPL
Tach Feedback Enable	TFDBK EN	27	---	S/D
Thread Acceleration Time	THD ACEL	0D	SEC	S/D
Thread Deceleration Time	THD DCEL	0E	SEC	S/D
Thread Push Button Input Status	THRD PB	62	---	DSPL
Thread Speed	THD SPD	14	RPM	S/D
Torque Command Span Adjustment	TQCMDSPN	40	PCT	S/D
Torque Follower Reference Input	TQ FOLRF	4D	AMPS	DSPL
Torque Reference	TRQ REF	6C	AMPS	DSPL

Table A1. Functional Codes in Alphabetical Order  
(Continued)

FUNCTION DESCRIPTION	MNEMONIC	FCTN CODE	UNITS	TYPE
Torque Regulated Speed Follower Droop	DROOP	36	PCT	S/D
Torque Regulated Speed Follower Reference Input	TRSF REF	4C	RPM	DSPL
Trim Command Input	TRIM CMD	4F	RPM	DSPL
Trim Command Span Adjustment	TMCMDSPN	41	PCT	S/D
Trim On/Off Switch Input Status	TRIM SW	65	---	DSPL
Up To Speed Enable	UP2SPDEN	29	---	S/D
Voltage Feedback Enable	VFDBK EN	28	---	S/D
Zero Band Disable	SBANDDIS	21	---	S/D
Zero Band Enable	ZBAND EN	22	---	S/D



Table A2. Function Codes in Numerical Order

FCTN CODE	MNEMONIC	FUNCTION DESCRIPTION	UNITS	TYPE
00	RAT AMPS	Rated Motor Current	AMPS	S/D
01	RAT VLTS	Rated Motor Voltage	VDC	DSPL
02	BASE SPD	Base Motor Speed	RPM	S/D
03	RAT LVLT	Rated Line Voltage	VAC	S/D
04	FDBK P/R	Feedback Tach Pulses Per Revolution	P/R	S/D
05	LOAD RES	Load Resistance	MOHMS	S/D
06	LOAD MHY	Load Inductance	MHNY	S/D
07	MCURLIMS	Motoring Current Limit Setting	AMPS	S/D
08	RCURLIMS	Regenerating Current Limit Setting	AMPS	S/D
09	RUN ACEL	Run Acceleration Time	SEC	S/D
0A	RUN DCEL	Run Deceleration Time	SEC	S/D
0B	FOL ACEL	Follower Mode Acceleration Time	SEC	S/D
0C	FOL DCEL	Follower Mode Deceleration Time	SEC	S/D
0D	THD ACEL	Thread Acceleration Time	SEC	S/D
0E	THD DCEL	Thread Deceleration Time	SEC	S/D
0F	JOG ACEL	Jog Acceleration Time	SEC	S/D
10	JOG DCEL	Jog Deceleration Time	SEC	S/D
11	QSP DCEL	Quick Stop Deceleration Time	SEC	S/D
12	JOGDELAY	Jog Contactor Drop Out Delay	SEC	S/D
13	RUN SPD	Run Speed	RPM	S/D
14	THD SPD	Thread Speed	RPM	S/D
15	JOG SPD	Jog Speed	RPM	S/D
16	DROP SPD	Controlled Stop Contactor Drop Out Speed	RPM	S/D
17	SET NOM.	Set Nominal Values	---	S/D
18	SET %	Set as a Percent of Rated	---	S/D
19	DACSETUP	Digital/Analog Converter Setup	---	S/D
1A	SELFTUNE	Current Regulator Self Tuning Procedure	---	SET
1B	CSTOP EN	Controlled Stop Enable	---	S/D
1C	CSTOPDIS	Controlled Stop Disable	---	S/D
1D	JCSTP EN	Jog Controlled Stop Enable	---	S/D
1E	JCSTPDIS	Jog Controlled Stop Disable	---	S/D
1F	OVRLD EN	Motor Overload Enable	---	S/D
20	OVRLDDIS	Motor Overload Disable	---	S/D
21	ZBAND EN	Zero Band Enable	---	S/D
22	ZBANDDIS	Zero Band Disable	---	S/D
23	A REV EN	Anti-Reverse Clamp Enable (Follower Mode)	---	S/D
24	A REVDIS	Anti-Reverse Clamp Disable (Follower Mode)	---	S/D
25	AN REFEN	Analog Run Reference Enable	---	S/D
26	KEYREFEN	Keyboard Run Reference Enable	---	S/D
27	TFDBK EN	Tach Feedback Enable	---	S/D
28	VFDBK EN	Voltage Feedback Enable	---	S/D
29	UP2SPDEN	Up To Speed Logic Enable	---	S/D

Table A2. Function Codes in Numerical Order  
(Continued)

FCTN CODE	MNEMONIC	FUNCTION DESCRIPTION	UNITS	TYPE
2A	SPDSNSEN	Speed Sense Logic Enable	---	S/D
2B	CURSSEN	Current Sense Logic Enable	---	S/D
2C	STATUS	Drive Status Feedback Function	---	S/D
2D	PG D CUR	Discontinuous Current Regulator Proportional Gain	---	S/D
2E	IG D CUR	Discontinuous Current Regulator Integral Gain	---	S/D
2F	PG C CUR	Continuous Current Regulator Proportional Gain	---	S/D
30	IG C CUR	Continuous Current Regulator Integral Gain	---	S/D
31	PG SPDRG	Speed Regulator Proportional Gain	---	S/D
32	IG SPDRG	Speed Regulator Integral Gain	---	S/D
33	INERTIA	Per Unit Inertia	SEC	S/D
34	RESPONSE	Response (Crossover Frequency in Radians)	RADN	S/D
35	OSPD THR	Overspeed Trip Threshold	RPM	S/D
36	DROOP	Torque Regulated Follower Droop (Gain)	PCT	S/D
37	SPD LIMT	Speed Limit	RPM	S/D
38	BSTDROOP	Boost/Droop Setting	PCT	S/D
39	FOL P/R	Follower Tach Pulses Per Revolution	P/R	S/D
3A	LOSPD TK	Low Speed Tracking (Follower Mode)	PCT	S/D
3B	UPFOLRAT	Follower Mode Upper Ratio Setting	PCT	S/D
3C	LOFOLRAT	Follower Mode Lower Ratio Setting	PCT	S/D
3D	AGSPDSPN	Analog Run Speed Command Span Adjustment	PCT	S/D
3E	ACTSPDSC	Actual Speed Feedback Analog Output Channel Scaling Adjustment	PCT	S/D
3F	SPDRFSCL	Speed Reference Analog Output Channel Scaling Adjustment	PCT	S/D
40	TZCMDSPN	Torque Command Span Adjustment	PCT	S/D
41	TMCMDSPN	Trim Command Span Adjustment	PCT	S/D
42	SELAGSCL	Selectable Analog Output Channel Scaling Adjustment	PCT	S/D
43	LGTHR SP	Logic Output Threshold Set Point	PCT	S/D
44	REFSMOTH	Reference Smoothing	#	S/D
45	FOLCMDIN	Follower Command Input	RPM	DSPL
46	SPDCMDIN	Speed Command Input	RPM	DSPL
47	LAC INPT	Linear Accel/Decel Control Input Signal	RPM	DSPL
48	LAC OUT	Linear Accel/Decel Control Output Signal	RPM	DSPL
49	SPDLMTIN	Speed Limit Input Signal	RPM	DSPL
4A	SPDRFOUT	Speed Reference Output Signal	RPM	DSPL
4B	SPDFBOUT	Speed Feedback Output Signal	RPM	DSPL
4C	TRSF REF	Torque Regulated Speed Follower Reference Input	RPM	DSPL

Table A2. Function Codes in Numerical Order  
(Continued)

FCTN CODE	MNEMONIC	FUNCTION DESCRIPTION	UNITS	TYPE
4D	TQ FOLRF	Torque Follower Reference Input	AMPS	DSPL
4E	SPDTQ RF	Speed/Torque Follower Reference Signal	PCT	DSPL
4F	TRIM CMD	Trim Command Input	RPM	DSPL
50	CUR CMD	Current Command	AMPS	DSPL
51	CUR REF	Current Reference	AMPS	DSPL
52	OUT CURR	Output Current	AMPS	DSPL
53	OUT VOLT	Output Voltage	VDC	DSPL
54	LINEVOLT	Line Voltage	VAC	DSPL
55	CUR RIPL	Output Current Ripple	---	DSPL
56	+5 VDC	+5 VDC Control Voltage	VDC	DSPL
57	+15 VDC	+15 VDC Control Voltage	VDC	DSPL
58	-15 VDC	-15 VDC Control Voltage	VDC	DSPL
59	HS TEMP	SCR Heat Sink Temperature	DEGC	DSPL
5A	LINEFREQ	Line Frequency	HZ	DSPL
5B	FIR ANGL	Firing Angle	DEG	DSPL
5C	MOCURLIM	Motor Current Limit (Active)	AMPS	DSPL
5D	RGURLIM	Regenerating Current Limit (Active)	AMPS	DSPL
5E	RMTRNSPD	Remote Run Speed Command	RPM	S/D
5F	STOP PB	Stop Push Button Input Status	---	DSPL
60	RUN PB	Run Push Button Input Status	---	DSPL
61	JOG PB	Jog Push Button Input Status	---	DSPL
62	THRD PB	Thread Push Button Input Status	---	DSPL
63	QSTP PB	Quickstop Push Button Input Status	---	DSPL
64	RMTLOCSW	Remote/Local Switch Status	---	DSPL
65	TRIM SW	Trim On-Off Switch Status	---	DSPL
66	REV SW	Reverse On-Off Switch Status	---	DSPL
67	FOL SW	Follower On-Off Switch Status	---	DSPL
68	SPDTQ SW	Speed/Torque Switch Status	---	DSPL
69	CNTOR ST	Loop Contactor Status	---	DSPL
6A	TACHFDBK	Tachometer Feedback Signal	---	DSPL
6B	ACTRATIO	Ratio Limit Setting (Active)	PCT	DSPL
6C	TRQ REF	Torque Reference	AMPS	DSPL
6D	FRST FLT	First Fault	---	DSPL
6E	CUREGTST	Current Regulator Test Procedure Enable	---	SET
6F	HEXMONEN	Hex Monitor Enable - <u>SERVICE TOOL ONLY</u> - Not Settable or Displayable		
DO	(N/A)	Remote Reset Enable	---	SET
D1	(N/A)	Go-to-Remote Mode	---	S/D
D2	(N/A)	Go-to-Local Mode	---	S/D
D3	(N/A)	Remote Stop Enable	---	SET
D4	(N/A)	Remote Quickstop Enable	---	SET
D5	(N/A)	Remote Run Enable	---	SET

Table A2. Function Codes in Numerical Order  
(Continued)

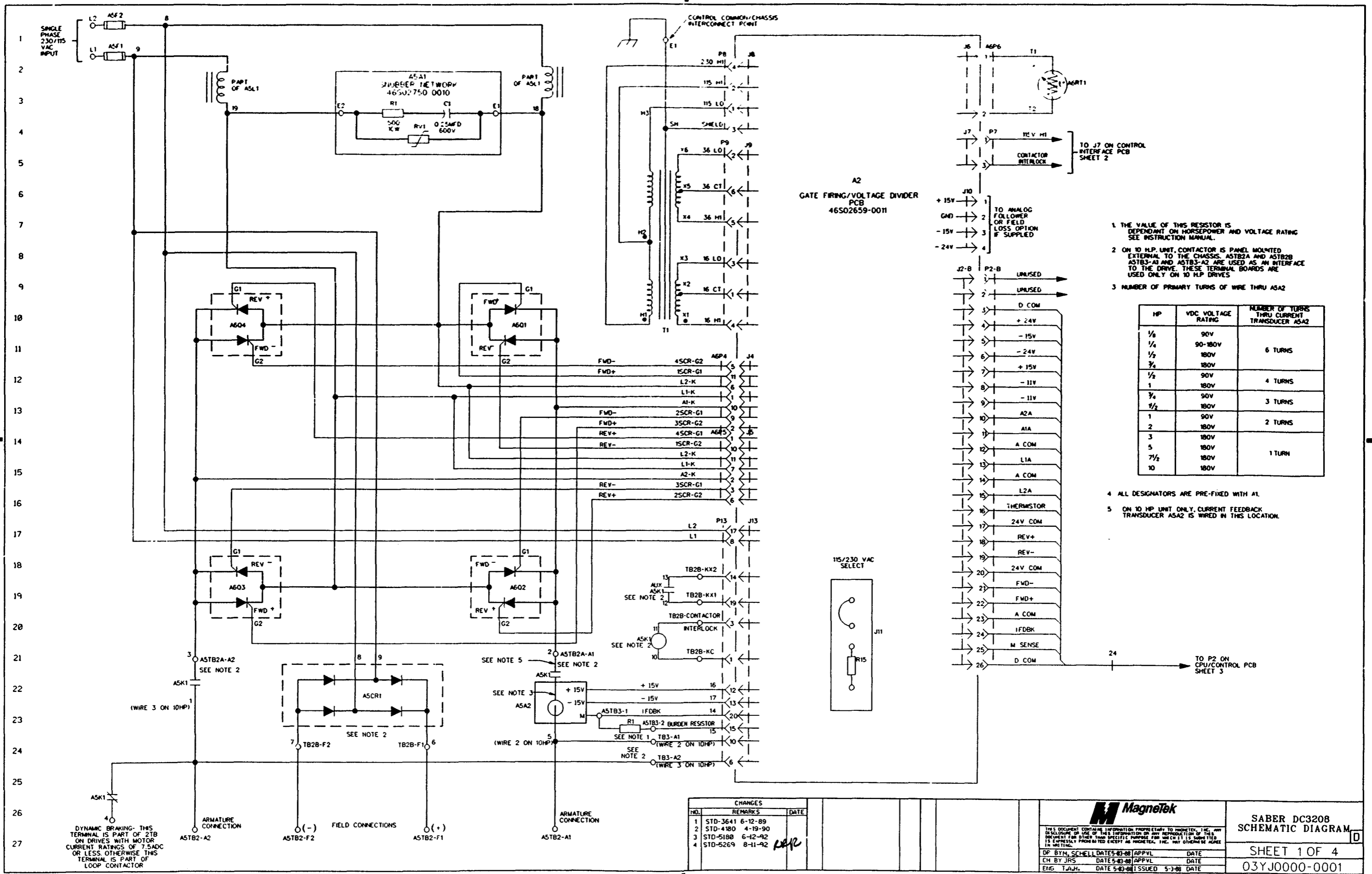
FCTN CODE	MNEMONIC	FUNCTION DESCRIPTION	UNITS	TYPE
D6	(N/A)	Remote Thread Enable	---	SET
D7	(N/A)	Remote Set Nominal Values	---	S/D
D8	(N/A)	Remote Set as a Percent of Rated	---	S/D

Table A3. Settable Parameters

FCTN CODE	PARAMETER MNEMONIC	ALLOWABLE INPUT RANGE	INCREMENT SIZE	PERCENT ALLOWED	INC/DEC ALLOWED	NEGATIVE ALLOWED
00	RAT AMPS	0.12 - 99.99 A	0.01 A	NO	NO	NO
02	BASE SPD	0 - 5000 RPM	1 RPM	NO	NO	NO
03	RAT LVLTL	115.0 or 230.0 V	N/A	NO	NO	NO
04	FDBK P/R	50 - 9999 P/R	1 P/R	NO	NO	NO
05	LOAD RES	50 - 9999 MOHMS	1 MO	NO	NO	NO
06	LOAD MHY	0.1 - 999.9 MHNYS	0.1 MH	NO	NO	NO
07	MCURLIMS	0 A - 2.0 P.U.	0.01 A	YES	YES	NO
08	RCURLIMS	0 A - 2.0 P.U.	0.01 A	YES	YES	NO
09	RUN ACEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
0A	RUN DCEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
0B	FOL ACEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
0C	FOL DCEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
0D	THD ACEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
0E	THD DCEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
0F	JOG ACEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
10	JOG DCEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
11	QSP DCEL	0.0 - 999.9 SEC	0.1 S	NO	YES	NO
12	JOGDELAY	0.0 - 4.0 SEC	0.1 S	NO	YES	NO
13	RUN SPD	-1.0 - +1.0 P.U.	1 RPM	YES	YES	YES
14	THD SPD	-1.0 - +1.0 P.U.	1 RPM	YES	YES	YES
15	JOG SPD	-1.0 - +1.0 P.U.	1 RPM	YES	YES	YES
16	DROP SPD	0.01 P.U. - 2.0 P.U.	1 RPM	YES	YES	NO
2D	PG D CUR	0 - 100	1	NO	YES	NO
2E	IG D CUR	0 - 10000	1	NO	YES	NO
2F	PG C CUR	0 - 1000	1	NO	YES	NO
30	IG C CUR	0 - 100	1	NO	YES	NO
31	PG SPDRG	0 - 10000	1	NO	YES	NO
32	IG SPDRG	0 - 1000	1	NO	YES	NO
33	INERTIA	0 - 10 SEC	0.01S	NO	YES	NO
34	RESPONSE	0 - 10 RADIANS	0.1 RD	NO	YES	NO
35	OSPD THR	0.5 - +2.0 P.U.	1 RPM	YES	YES	NO
36	DROOP	0 - +999.9%	0.1%	YES	YES	NO
37	SPD LIMT	0 RPM - 1.2 P.U.	1 RPM	YES	YES	NO
38	BSTDROOP	-10.0 - +10.0%	0.1%	YES	YES	YES
39	FOL P/R	50 - 9999 P/R	1 P/R	NO	NO	NO
3A	LOSPD TK	-300.0 - +300.0%	0.1%	YES	YES	YES
3B	UPFOLRAT	0 - +999.9%	0.1%	YES	YES	NO
3C	LOFOLRAT	0 - +999.9%	0.1%	YES	YES	NO
3D	AGSPDSPN	-999.9 - +999.9%	0.1%	YES	YES	YES
3E	ACTSPDSC	-999.9 - +999.9%	0.1%	YES	YES	YES
3F	SPDRFSCL	-999.9 - +999.9%	0.1%	YES	YES	YES
40	TQCMDSPN	-999.9 - +999.9%	0.1%	YES	YES	YES
41	TMCMDSPN	-999.9 - +999.9%	0.1%	YES	YES	YES

Table A3. Settable Parameters (Continued)

FCTN CODE	PARAMETER MNEMONIC	ALLOWABLE INPUT RANGE	INCREMENT SIZE	PERCENT ALLOWED	INC/DEC ALLOWED	NEGATIVE ALLOWED
42	SELAGSCL	-999.9 - +999.9%	0.1%	YES	YES	YES
43	LGTHR SP	0 - +999.9%	0.1%	YES	YES	NO
44	REFSMOTH	1-10	1	NO	YES	NO
5E	RMTRNSPD	-1.0 - +1.0 P.U.	1 RPM	YES	YES	YES

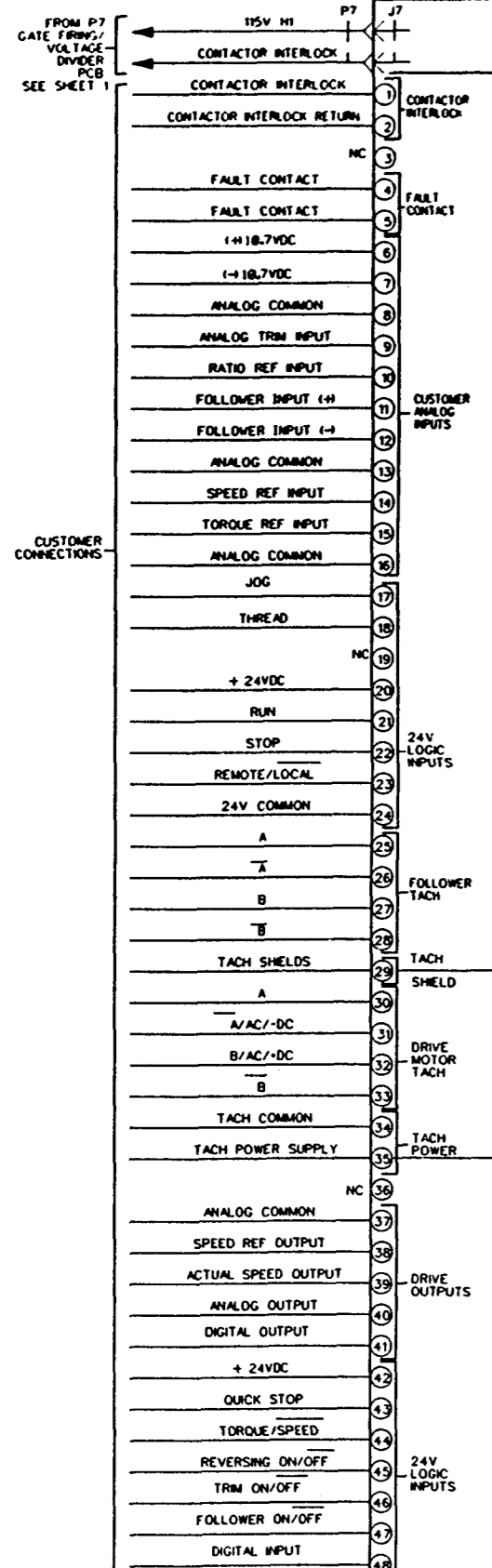


- 1 THE VALUE OF THIS RESISTOR IS DEPENDANT ON HORSEPOWER AND VOLTAGE RATING SEE INSTRUCTION MANUAL.
- 2 ON 10 HP UNIT, CONTACTOR IS PANEL MOUNTED EXTERNAL TO THE CHASSIS. ASTB3-A1 AND ASTB3-A2 ARE USED AS AN INTERFACE TO THE DRIVE. THESE TERMINAL BOARDS ARE USED ONLY ON 10 HP DRIVES
- 3 NUMBER OF PRIMARY TURNS OF WIRE THRU ASA2

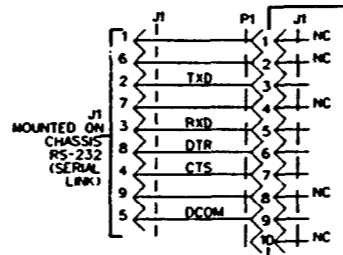
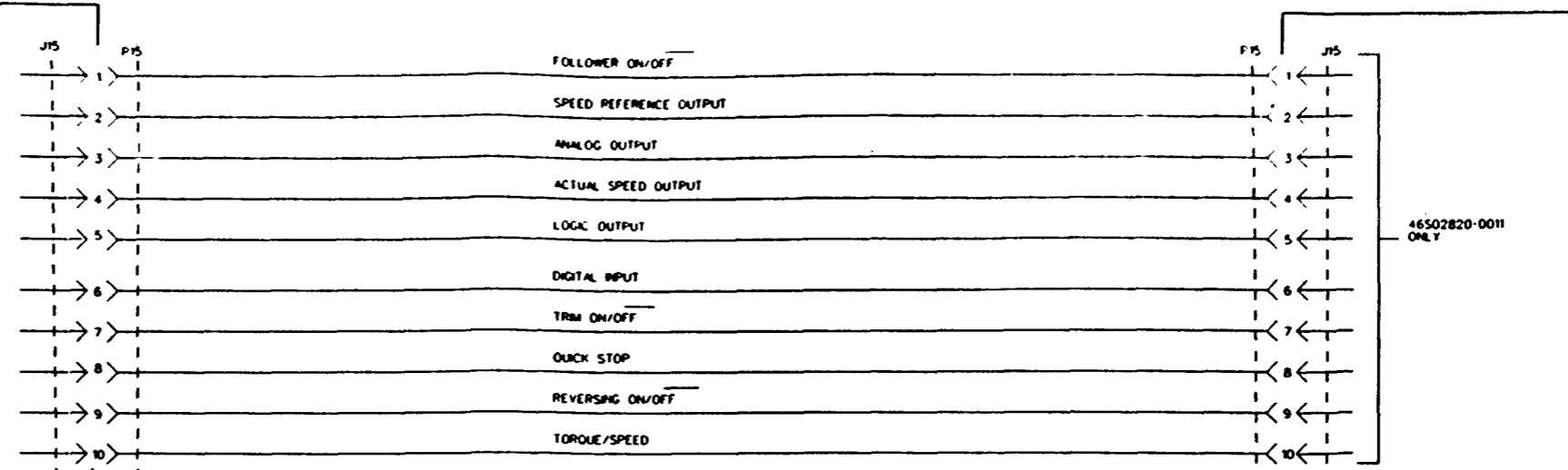
HP	VDC VOLTAGE RATING	NUMBER OF TURNS THRU CURRENT TRANSDUCER ASA2
1/8	90V	6 TURNS
1/4	90-180V	
1/2	180V	
3/4	180V	4 TURNS
1	180V	
1 1/2	90V	3 TURNS
2	180V	
3	90V	2 TURNS
5	180V	
7 1/2	180V	1 TURN
10	180V	

- 4 ALL DESIGNATORS ARE PRE-FIXED WITH A1.
- 5 ON 10 HP UNIT ONLY, CURRENT FEEDBACK TRANSDUCER ASA2 IS WIRED IN THIS LOCATION.

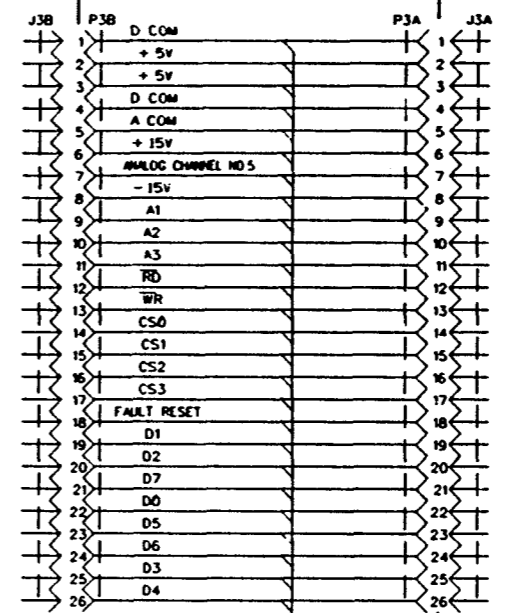
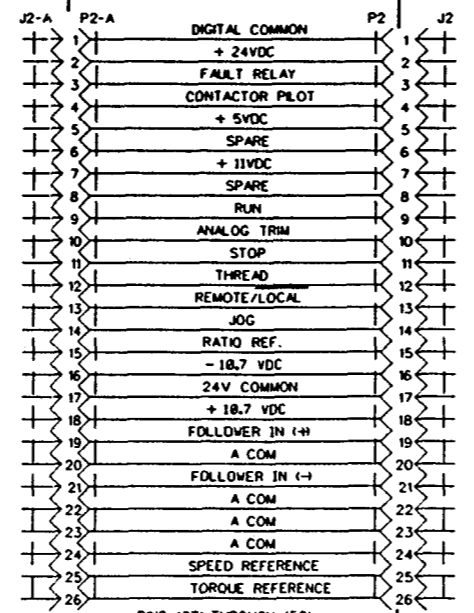
ORIGINAL



A3  
CONTROL INTERFACE PCB  
46502821-0010



A1  
CPU/CONTROL PCB  
46502823-0011



A4  
KEYBOARD/DISPLAY PCB  
46502820-0011 (STANALONE) OR  
46502820-0020 (W/MICROTRAC)

NOTES:  
5 THE SIGNAL FOLLOWER IS INTERNALLY SETUP ON THE CPU-CONTROL PCB, 46502823-0011 AS SHOWN IN THE TABLE

X - SWITCH CLOSED

FOLLOWER INPUT RANGE	FOLLOWER SETUP SWITCH POSITIONS			
	1	2	3	4
- 10 TO + 10 VOLT D.C.				
- 5 TO + 5 VOLT D.C.	X			
0 TO + 5 VOLT D.C.	X			
0 TO + 10 VOLT D.C.	X			
0 OR 4 TO 20 MILLIAMP	X	X	X	X
- 20 TO - 20 MILLIAMP	X	X	X	X
0 OR 10 TO 50 MILLIAMP USER MUST INSTALL A 162 OHM, 1/2W 1% RESISTOR BETWEEN A3TB1-11 AND A3TB1-12	X	X	X	X

THE SIGNAL FOLLOWER IS SET UP FOR A DIFFERENTIAL INPUT FOR SINGLE ENDED INPUT, ON THE CONTROL INTERFACE PCB, JUMPER TB1-11 OR TB1-12 TO TB-13 AS REQUIRED

CHANGES		
NO.	REMARKS	DATE
	SEE SHEET 1 FOR LATEST CHANGES	8-11-92

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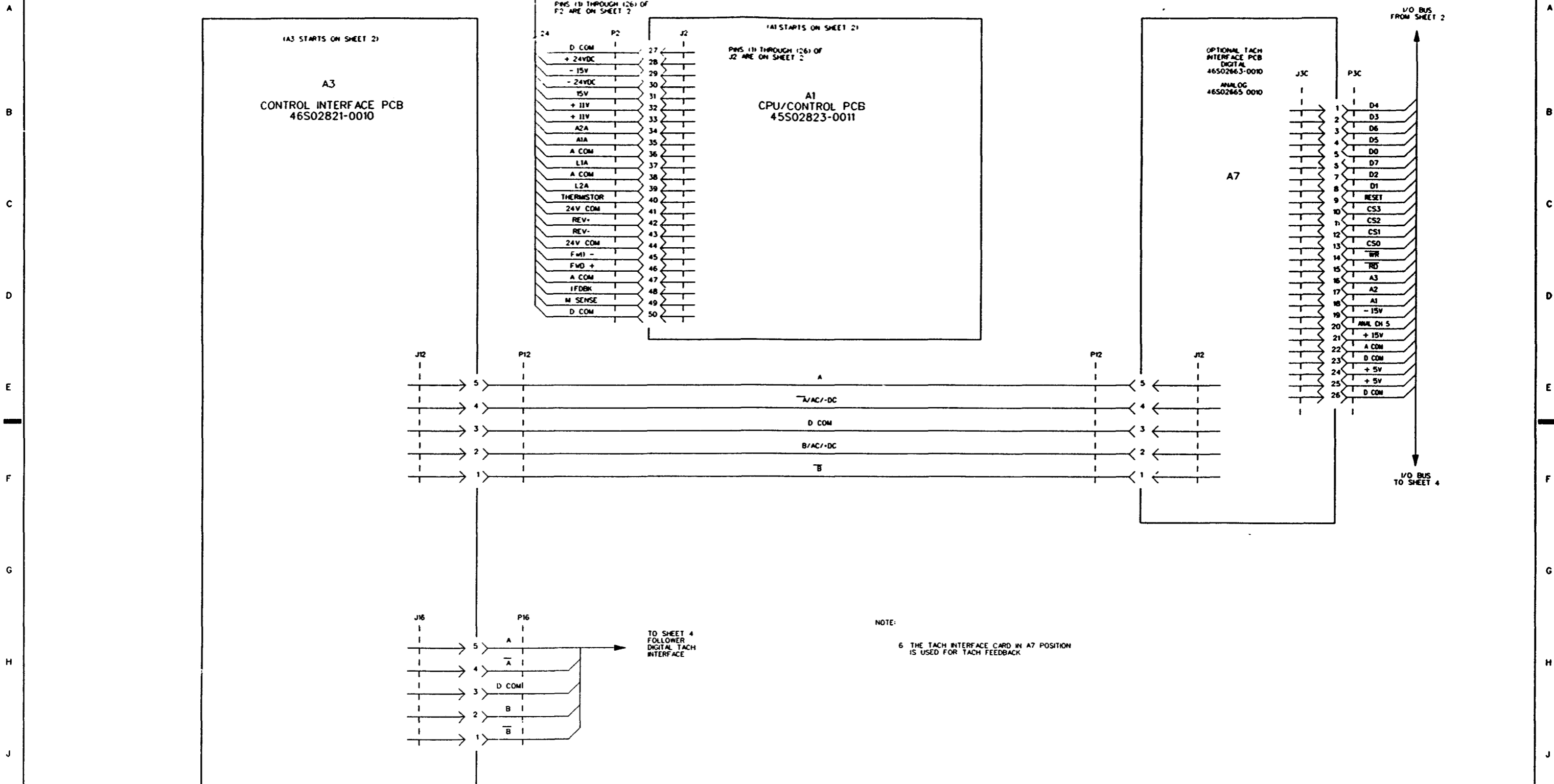
OR BY M. SCHELL DATE 08-08-88 APPVL DATE  
CH BY JMS DATE APPVL DATE  
ENG T.A.M. DATE ISSUED 6-7-88 DATE

SABER DC3208  
SCHEMATIC DIAGRAM

SHEET 2 OF 4

03YJ0000-0001

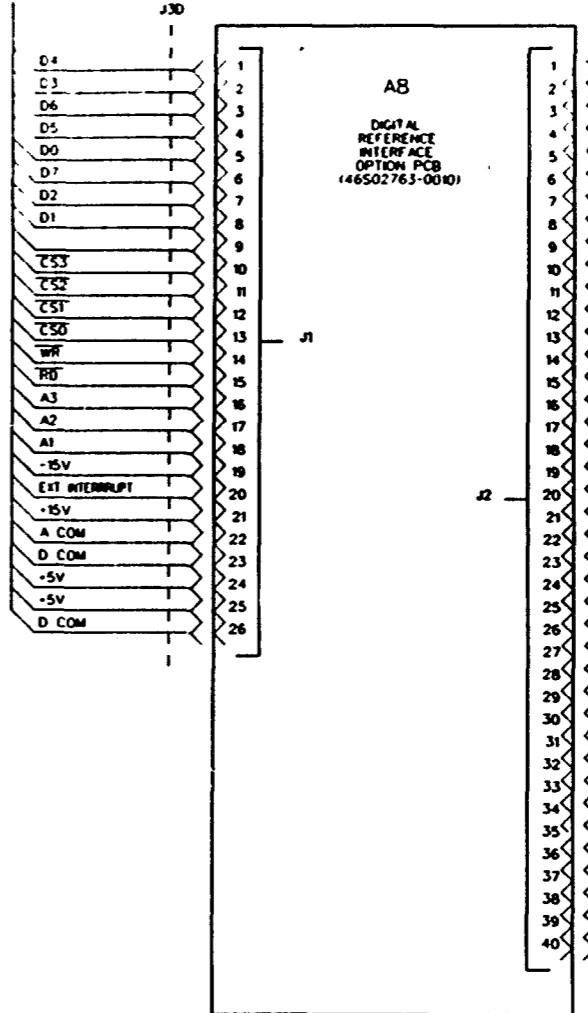
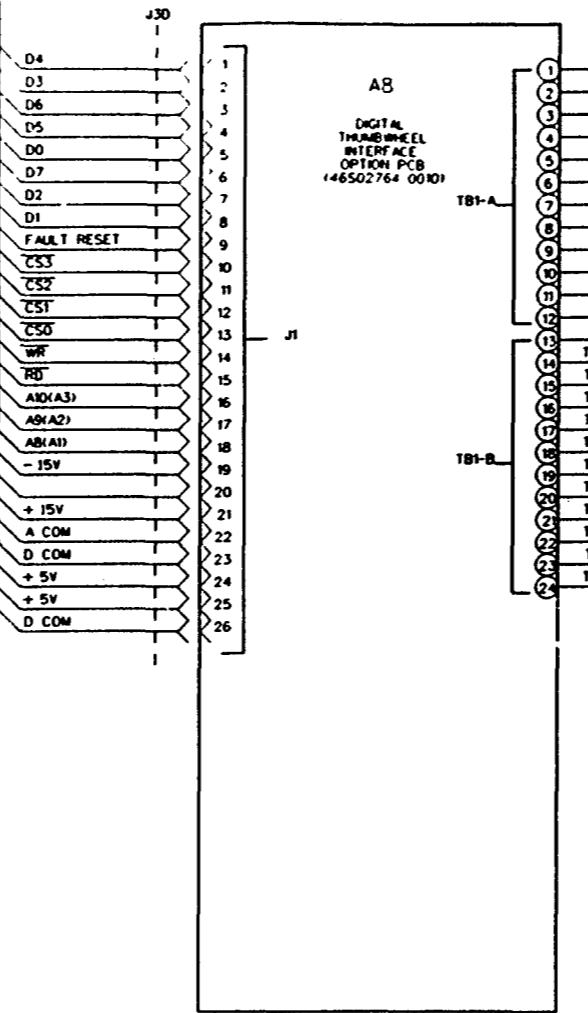
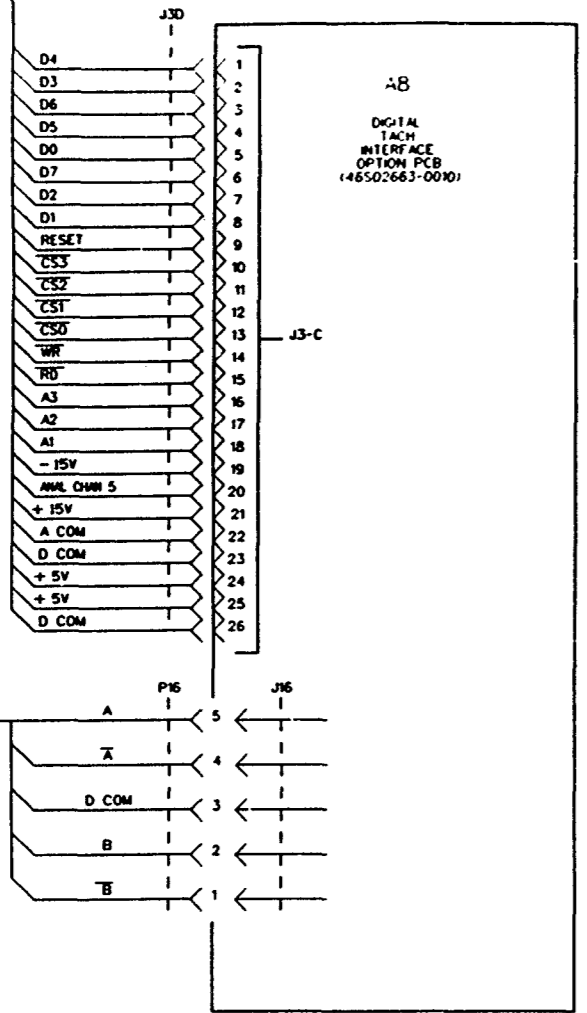




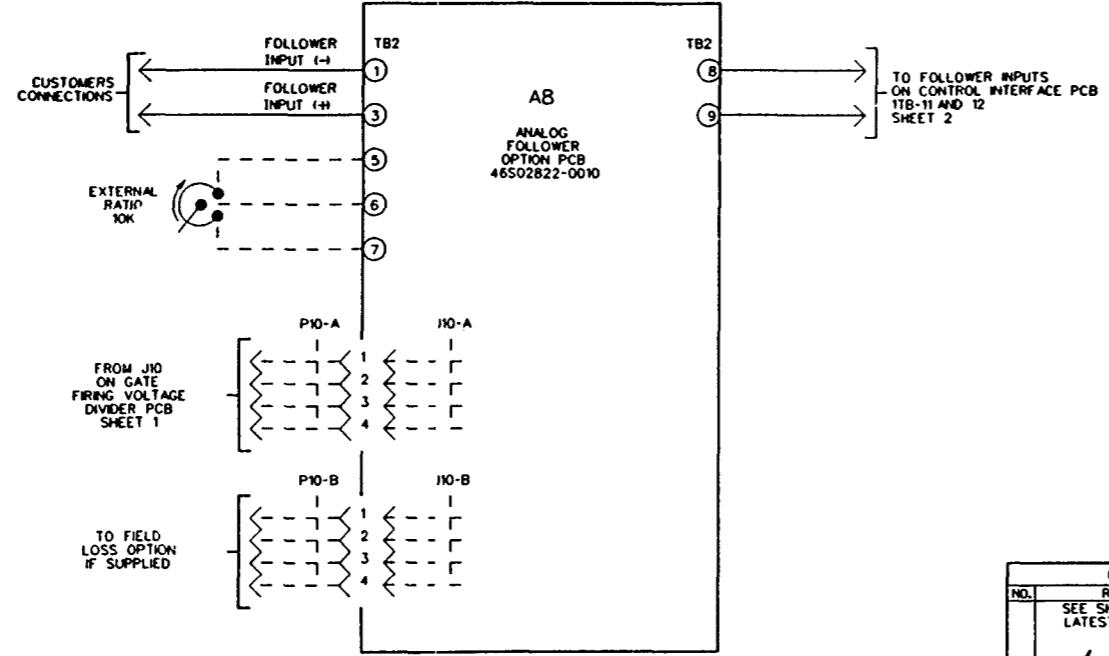
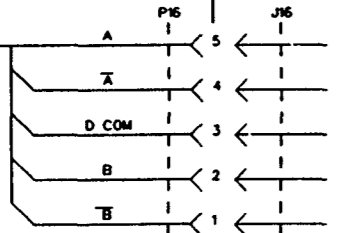
CHANGES			MAGNETEK		SABER DC3208 SCHEMATIC DIAGRAM	
NO.	REMARKS	DATE	DR BY	DATE	APPVL	DATE
	SEE SHEET 1 FOR LATEST CHANGES					
	6-16-92					
			DR BY	DATE	APPVL	DATE
			CH BY	DATE	APPVL	DATE
			ENG	DATE	ISSUED	DATE

SHEET 3 OF 4  
03YJ0000-0001

FROM SHEET 3 I/O BUS



FROM A3 J16 SHEET 3

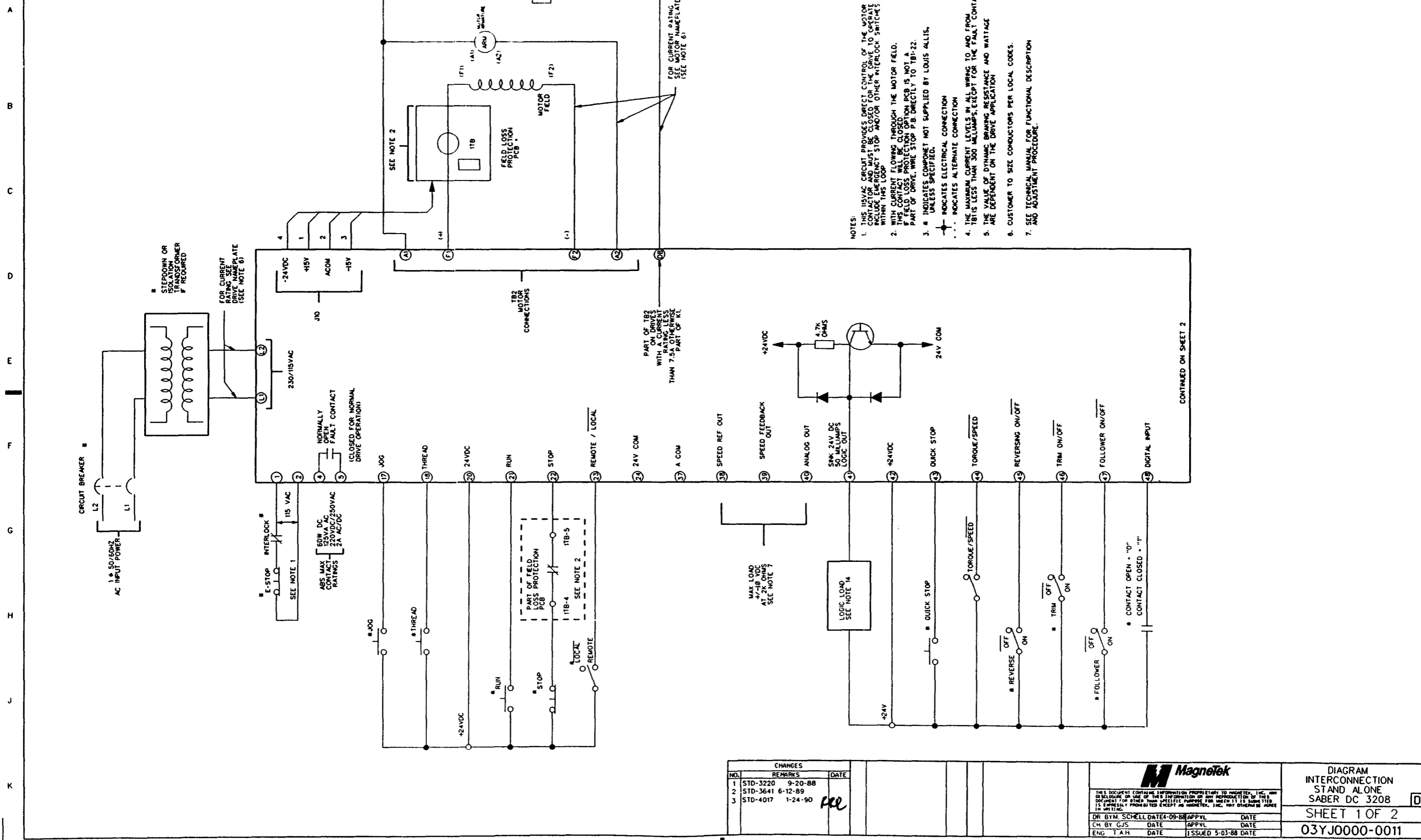


SYSTEM CONNECTIONS

SYSTEM CONNECTIONS

- NOTES:
- 7 ANALOG COMMON IS DENOTED "A COM" DIGITAL COMMON IS DENOTED "D COM" OR "C" 24V COMMON IS DENOTED "24VC" OR "24V COM"
  - 8 THE FOUR CIRCUIT CARDS SHOWN ON THIS SHEET ARE MUTUALLY EXCLUSIVE DRIVE REFERENCE INTERFACE ASSEMBLIES FOR THIS REASON THEY ARE ALL DESIGNATED AB

CHANGES			MAGNETEK		SABER DC3208 SCHEMATIC DIAGRAM	
NO.	REMARKS	DATE	DR BY	DATE	APPVL	DATE
	SEE SHEET FOR LATEST CHANGE					
	4-19-90					
			DR BY: G.S. DATE: 6-88 CH BY: G.S. DATE: APPVL: DATE: ENG: T.A.M. DATE: ISSUED: 6-7-88		SHEET 4 OF 4 03YJ0000-0001	



CHANGES		
NO.	REMARKS	DATE
1	STD-3220	9-20-88
2	STD-3641	6-12-89
3	STD-4017	1-24-90

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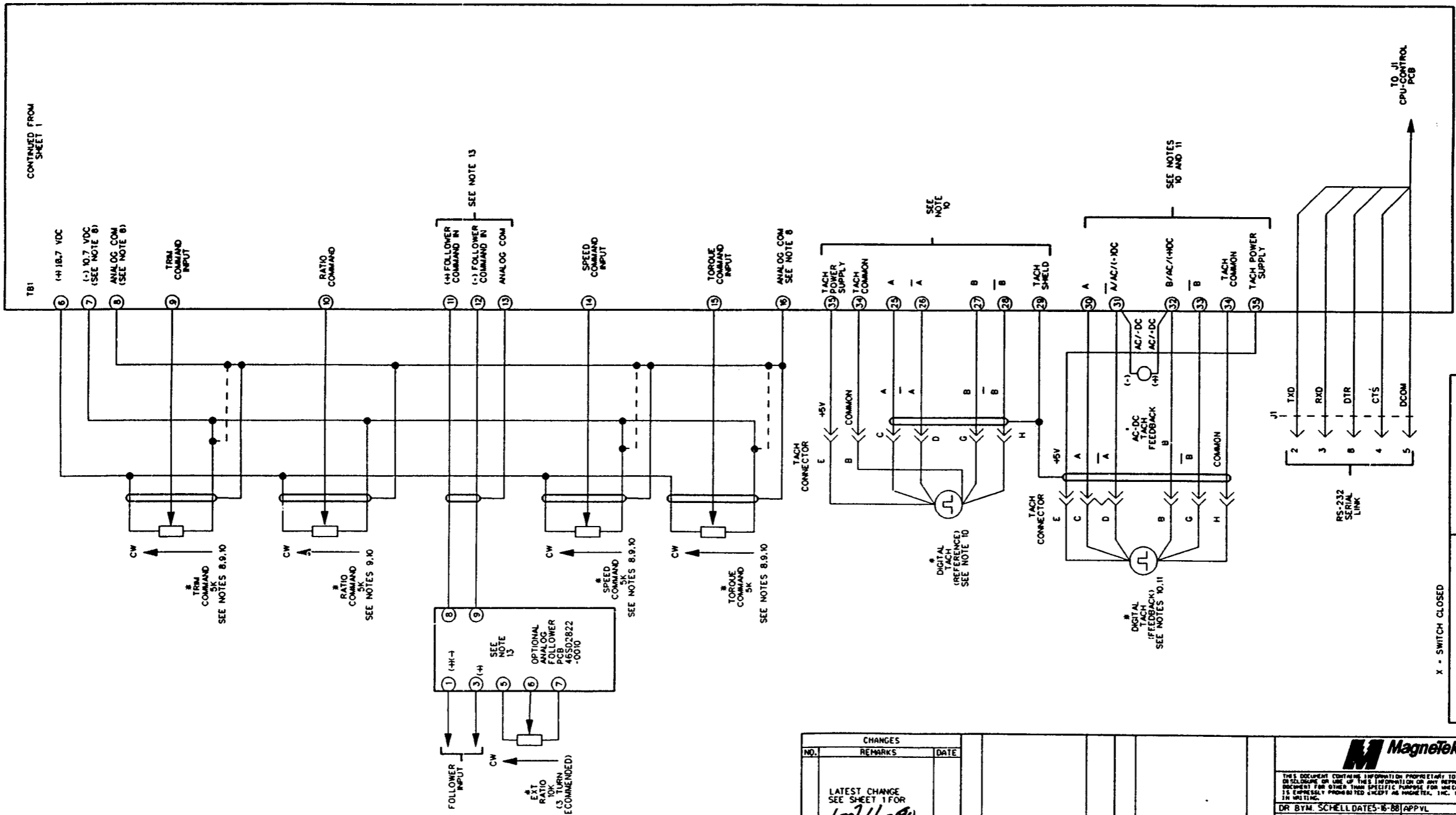
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INTERCONNECTION  
STAND ALONE  
SABER DC 320B

SHEET 1 OF 2

03YJ0000-0011

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CH BY GJS	DATE	APPVIL	DATE
ENG T.A.H.	DATE	ISSUED	5-03-88 DATE



CONTINUED FROM SHEET 1

TBI (+H) 18.7 VDC

(L) 10.7 VDC (SEE NOTE 8)

ANALOG COM (SEE NOTE 8)

TRM COMMAND INPUT

RATIO COMMAND

SEE NOTE 13

(+H) FOLLOWER COMMAND IN

(-H) FOLLOWER COMMAND IN

ANALOG COM

SPEED COMMAND INPUT

TORQUE COMMAND INPUT

ANALOG COM (SEE NOTE 8)

SEE NOTE 10

TACH POWER SUPPLY

TACH COMMON

TACH A

TACH B

TACH SHIELD

SEE NOTES 10 AND 11

AC/DC TACH FEEDBACK (+)

AC/DC TACH FEEDBACK (-)

AC/DC TACH FEEDBACK (H)

AC/DC TACH FEEDBACK (L)

TACH POWER SUPPLY

TO J1 CPU-CONTROL PCB

\* TRM COMMAND 5K  
SEE NOTES 8,9,10

\* RATIO COMMAND 5K  
SEE NOTES 9,10

\* SPEED COMMAND 5K  
SEE NOTES 8,9,10

\* TORQUE COMMAND 5K  
SEE NOTES 8,9,10

DIGITAL TACH (REFERENCE)  
SEE NOTE 10

DIGITAL TACH FEEDBACK (-)  
SEE NOTES 10,11

FOLLOWER INPUT RANGE	FOLLOWER SETUP SWITCH POSITIONS			
	1	2	3	4
-18 TO +18 VOLT D.C.				
-5 TO +5 VOLT D.C.				
0 TO +6 VOLT D.C.				
0 TO +8 VOLT D.C.				
0 OR 4 TO 20 MILLIAMP				
-20 TO +20 MILLIAMP				
0 OR 10 TO 50 MILLIAMP USED IN 1/2 RESISTOR BETWEEN A3T81-11 AND A3T81-12				

X - SWITCH CLOSED

THE SIGNAL FOLLOWER IS SET UP FOR A DIFFERENTIAL INPUT. FOR SINGLE ENDED INPUT, ON CONTROL INTERFACE PCB, JUMPER TBI-11 OR TBI-12 TO TBI-13 AS REQUIRED.

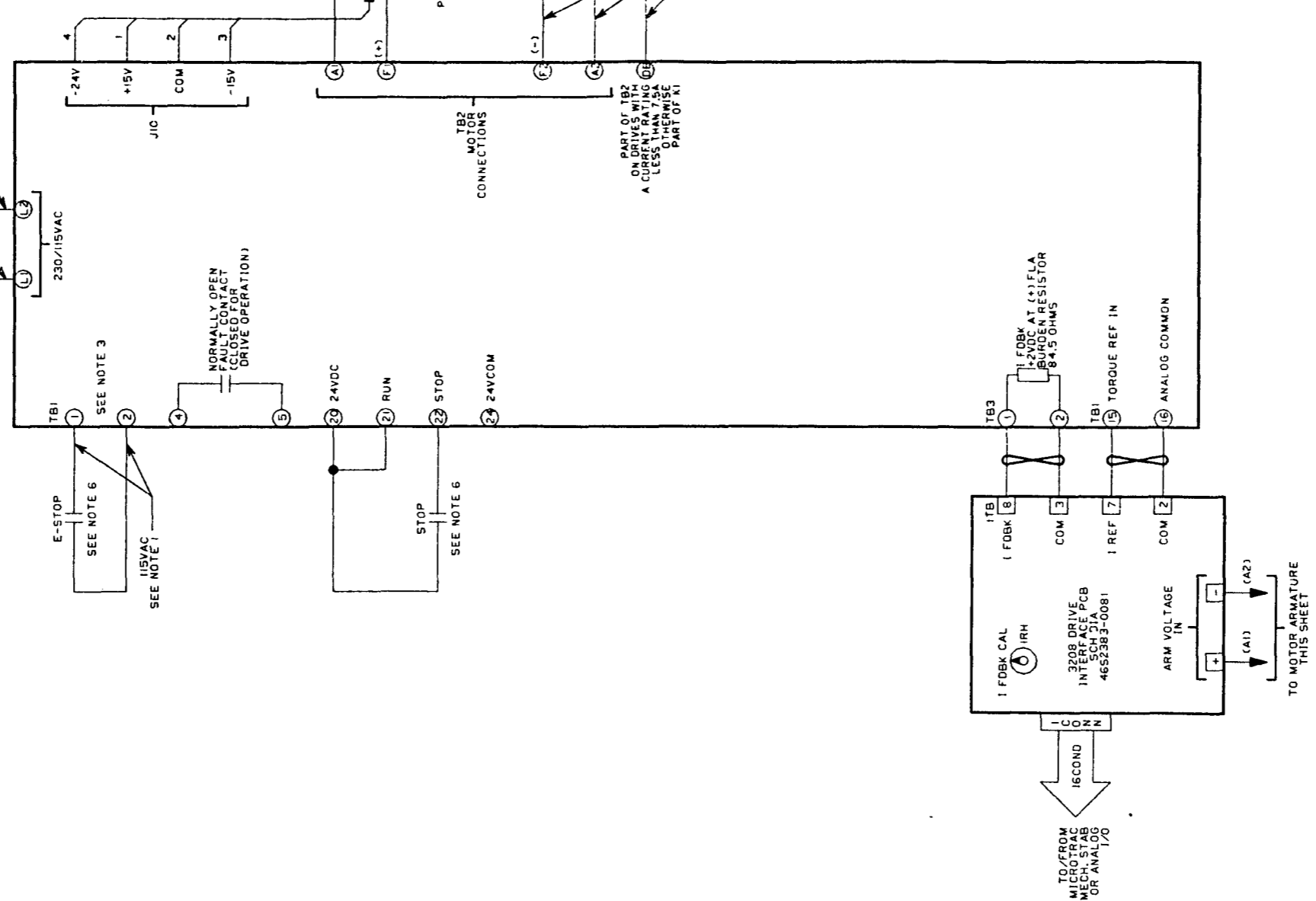
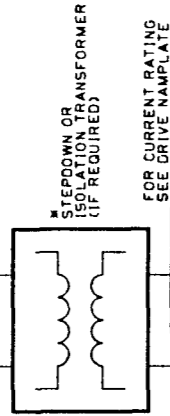
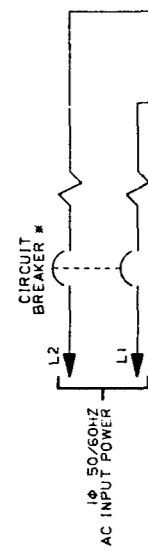
CHANGES		
NO.	REMARKS	DATE
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CH BY JUR DATE	APPVL DATE
ENG T.A.M. DATE	ISSUED 5-03-88 DATE

DIAGRAM INTERCONNECTION STAND ALONE SABER DC 3208  
SHEET 2 OF 2  
03YJ0000-0011

ORIGINAL

8. FOR BIDIRECTIONAL MOTOR ROTATION, CONNECT THE COUNTER CLOCKWISE (CCW) TERMINAL OF THE REFERENCE POTENTIOMETER TO TBI-11 FOR UNIDIRECTIONAL ROTATION, CONNECT TO TBI-10 AND 10.
9. THE FOUR REFERENCE SIGNALS DEPICTED ON THIS SHEET AS POTENTIOMETERS SOURCE DRIVEN FROM AN ANALOG SOURCE, RATIO, OR TORQUE REFERENCES ARE NOT REQUIRED FOR PROPER DRIVE OPERATION IF NOT APPLICABLE. NO CONNECTIONS ARE REQUIRED FOR THESE SIGNALS.
10. ALL WIRES TO AND FROM TACHOMETERS OR REFERENCE POTENTIOMETERS MUST BE PLACED IN A SEPARATE CONDUIT WHICH DOES NOT CONTAIN POWER, AC CONTROL OR WITHIN CABLES. THESE CONDUCTORS MUST BE BUNDLED SEPARATELY FROM POWER, AC CONTROL OR FIELD CONDUCTORS.
11. THE FEEDBACK DIGITAL TACH CAN BE POWERED BY THE ANALOG FOLLOWER TACH SUPPLY OR BY A SEPARATE 11 VDC UNREGULATED SUPPLY. THE SIGNAL FOLLOWER IS INTERNALLY SET UP ON THE CPU-CONTROL PCB, 46502823-0000 AS SHOWN IN THE TABLE BELOW.
12. THE ANALOG FOLLOWER IS REQUIRED WHEN AT FULL SPEED.
13. WHEN AN ANALOG FOLLOWER PCB IS SUPPLIED, USE THE FOLLOWER INPUT SET UP INSTRUCTIONS PROVIDED IN NOTE 13 TO SET SWITCHES FOR PARTICULAR APPLICATION.



- NOTES
1. THIS 115VAC CIRCUIT PROVIDES DIRECT CONTROL OF THE MOTOR CONTACTOR AND MUST BE CLOSED FOR THE DRIVE TO OPERATE. INCLUDE EMERGENCY STOP AND/OR OTHER INTERLOCK SWITCHES WITHIN THIS LOOP.
  2. WITH CURRENT FLOWING THROUGH THE MOTOR FIELD, THIS CONTACT WILL BE CLOSED. IF FIELD LOSS PROTECTION OPTION P.C.B. IS NOT A PART OF THE DRIVE, WIRE STOP P.B. DIRECTLY TO 1TB-7.
  3. THE MAXIMUM CURRENT LEVELS IN ALL WIRING TO/FROM 1TB1 IS LESS THAN 300 MILLIAMPS, EXCEPT FOR THE FAULT CONTACT.
  4. THE VALUE OF DYNAMIC BRAKING RESISTANCE AND WATTAGE ARE DEPENDENT ON THE DRIVE APPLICATION. SEE OPERATORS MANUAL FOR DETAILS.
  5. CUSTOMER TO SIZE CONDUCTORS PER LOCAL CODES.
  6. CONTACTS FROM MICRO TRAC CONTROLLER.
- \* - INDICATES COMPONENTS NOT SUPPLIED BY LOUIS ALLIS UNLESS SPECIFIED.  
 - - - INDICATES ELECTRICAL CONNECTIONS.  
 - - - INDICATES ALTERNATE CONNECTION.

CHANGES		
NO.	REMARKS	DATE
1	STD-3342	11-14-88

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CHK BY	CS	DATE		APPL'D	DATE
ENG	TAH	DATE	12-6-88	ISSUED	DATE

SABER DC 3208  
MICRO-TRAC  
INTERCONNECTION DIAGRAM

SHEET 1 OF 1  
03YJ0000-0021



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