SABER

DC 3202

DC 3202
DC 3202
DC 3202
DC 3202

Installation • Operation • Maintenance

DC Drives

Technical Manual
TM 3140

MagneTek
Drives & Systems

NOTICE

This equipment is exempted from FCC regulations.

See 47CFR15.801.

CAUTION

NEVER CONNECT CAPACITORS ACROSS THE INVERTER OUTPUT AND MOTOR. UPON APPLICATION OF POWER, THE INVERTER INITIALLY SEES THE CAPACITORS AS A SHORT CIRCUIT, HIGH CURRENTS RESULT AND EQUIPMENT WILL BE DAMAGED.

IF REQUIRED, POWER FACTOR CORRECTION CAPACITOR NETWORKS MAY BE CONNECTED ACROSS THE INPUT POWER SOURCE ONLY AFTER CONSULTING LOUIS ALLIS.

IMPROPER USE OF POWER FACTOR CORRECTION CAPACITOR NETWORKS WILL DAMAGE EQUIPMENT.

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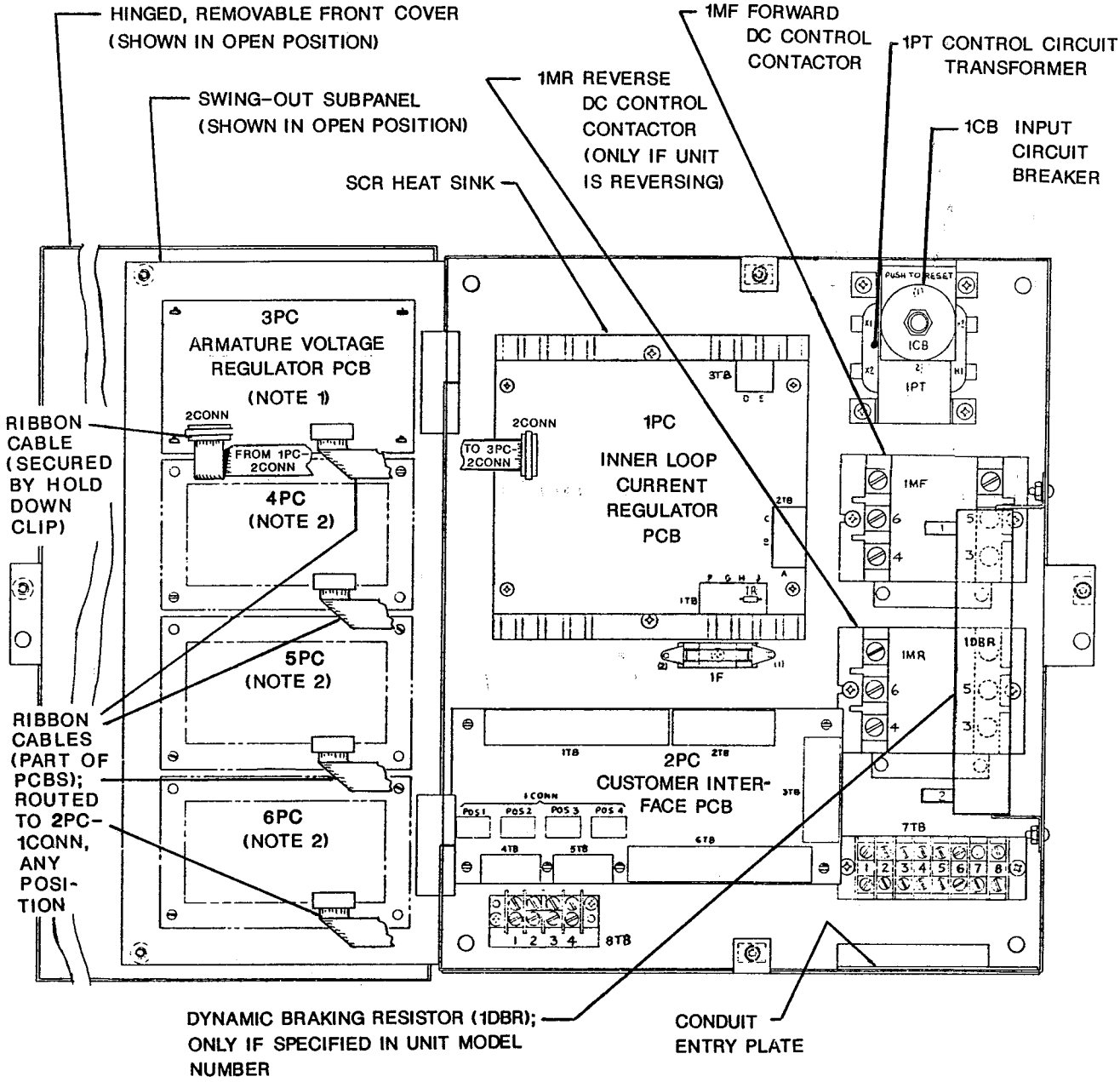


NOTES:

1. TACH FEEDBACK SPEED REGULATOR PCB MODIFICATION MOUNTS IN PLACE OF 3PC.
2. 4PC, 5PC AND 6PC ARE POSITIONS FOR MODIFICATION PCBS, WHEN PRESENT. IN A REVERSING UNIT, THE ANTI-PLUG PCB IS INSTALLED IN 5PC POSITION.

Figure 1-1. Layout

SECTION 1. GENERAL

1.1 PRE-INSTALLATION CONSIDERATION

1.1.1 Receipt of Shipment

All equipment is tested against defect at Louis Allis. 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 Louis Allis District Office. Always refer to the Louis Allis order number, equipment description, and serial number when contacting Louis Allis Drives and Systems.

1.1.2 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.

1.2 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 insure that the equipment is dry and that no condensation has accumulated. The equipment warranty does not cover damage due to improper storage.

When packing the Controller for reshipment, secure the hinged modification PC panel to the chassis, with the two permanently mounted screws. If a cover was supplied, ensure that the cover hinge is properly positioned on the chassis hinge and secured to the chassis with the permanently mounted screw.

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

1.3 DESCRIPTION OF EQUIPMENT

Saber 3202 drives are 1-5HP standard purpose, static adjustable speed DC drives manufactured by Louis Allis. The drive consists of a solid state power unit (hereafter referred to as Controller), a DC motor, and an Operator Control Station.

1.3.1 Operator Control Station

Controls necessary for the remote operation of the drive are located on the Operator Control Station (OCS). This is a small general purpose enclosure designed for industrial applications.

1.3.2 Controller (Refer to Figure 1-1)

The Controller converts single-phase AC input power to controlled DC power for DC motor speed control. It features "state of the art" circuitry and attractive design.

The basic Saber 3202 Controller consists of 1PC (Inner Current Loop Regulator), 2PC (Customer Interface), and 3PC (Armature Voltage Regulator).

1.3.3 DC Motor

Louis Allis Flexitorq® DC motors are built in accordance with NEMA standards and are designed specifically for use with single-phase, full wave rectified power supplies.

For other DC motor information, refer to the DC motor instruction manual.

Table 1.1. Controller Specifications

INPUT VOLTAGE	230 VAC -5%, +10%, 1 phase, 50/60HZ, ±2HZ.
OUTPUT VOLTAGE	200 VDC field voltage, 180 VDC armature voltage.
OVERLOAD CAPACITY	150% for 1 minute, 200% for 5 seconds.
SPEED CONTROL ACCURACY:	
With Armature Voltage FDBK	±5% due to load changes, ±15% due to other variables.
With Tachometer FDBK	±1% due to load changes, ±3% due to other variables.
CONTROLLABLE SPEED RANGE	20:1 by armature feedback regulation, 30:1 by tachometer feedback regulation.
OPERATING AMBIENT TEMP RANGE	+10°C to +40°C.
STORAGE TEMPERATURE RANGE	-30°C to +65°C.
MAXIMUM OPERATING ALTITUDE	3,300 feet above sea level without derating.
SIZE	Refer to Figure 3-1, Outline Dimensions.
WEIGHT	Approx. 23.5 pounds.

Table 1.2. Motor Specifications

HORSEPOWER RANGE AVAILABLE	1, 1.5, 2, 3 and 5HP
BASE SPEEDS (STANDARD MOTORS)	1750 and 2500 RPM
CONTINUOUS OPERATING SPEED RANGE:	
Drip-Proof (DPG)	20:1 for 100% average torque
Totally Enclosed Fan Cooled (TEFC) 1-3HP Totally Enclosed Non-Ventilated (TENV) 5HP	20:1 for 100% average torque
SHUNT FIELD VOLTAGE	200 VDC
ARMATURE VOLTAGE	180 VDC
AMBIENT TEMPERATURE	40°C maximum
OPERATING ALTITUDE	3,300 feet above sea level maximum
SERVICE FACTOR	1.00

1.4 MODIFICATION KITS

The modification kits available for the Saber 3202 Controller are listed below.

KIT	PART NUMBER
THREAD	46S02445-0010
JOG	46S02445-0020
THREAD/JOG	46S02445-0030
CONTROLLED STOP	46S02444-0010
V/I FOLLOWER	46S02451-0010
TACH FEEDBACK SPEED REGULATOR	46S02452-0010

The modification kits may be inserted into position 4PC, 5PC, or 6PC (whichever is available) with the exception of the Tach Feedback Speed Regulator modification kit, which replaces 3PC (Armature Voltage Regulator), and is to be inserted into position 3PC. Instructions for modification kits(s) supplied with your Controller are located in the back of this instruction manual.

1.5 CONTROLLER TYPE AND MODEL IDENTIFICATION

Two methods have been established for identifying the Controller features and installed modification(s).

METHOD 1

If the Controller is customer designed, a serial number will be assigned at the factory and will be located on the Controller nameplate. Record the serial number in the space below.

SERIAL NUMBER _____

DATE INSTALLED _____

This "Serial Number" should always be included in any correspondence with Louis Allis.

METHOD 2

If the Controller has not been custom designed, a 53SFA "Model Number" will appear on the controller nameplate. Record the model number in the space below:

DATE INSTALLED _____

53SFA___ ___ ___ ___ ___ ___ 0
I II III IV V VI VII

This "Model Number" should always be included in any correspondence with Louis Allis.

The number has been constructed so that each character identifies specific features on modifications included in the Controller when shipped. A description of what each character represents follows.

IMPORTANT

If in the future a different type of feedback (IV) is used, or modifications (V) are added, the "Model Number" must be changed by the customer.

I. Designates whether the basic drive is reversing or non-reversing and supplied with or without a cover.

1 - non-reversing; without cover (1, 1.5, 2HP)

2 - non-reversing; without cover (3, 5HP)

3 - non-reversing; with cover (1, 1.5, 2HP)

4 - non-reversing; with cover (3, 5HP)

5 - reversing; without cover (1, 1.5, 2HP)

6 - reversing; without cover (3, 5HP)

7 - reversing; with cover (1, 1.5, 2HP)

8 - reversing; with cover (3, 5HP)

II. Designates the specific horsepower of the Controller as well as the ohmic value of the required 1/4 watt 1% calibrating resistor.

1 - 1HP; 130K

2 - 1.5HP; 90.9K

3 - 2HP; 68.1K

4 - 3HP; 115.0K

5 - 5HP; 68.1K

III. Designates the amperage and voltage rating of the circuit breaker for each HP.

1 - 7.5 amp, 250 VAC (1HP)

2 - 15 amp, 250 VAC (1.5, 2HP)

3 - 25 amp, 250 VAC (3HP)

4 - 40 amp, 250 VAC (5HP)

IV. Designates the type of speed regulation.

1 - Armature Voltage Feedback

2 - Tachometer Feedback

V. Designates the modification kit(s) included in Controller.

0 - None

1 - Controlled Stop

2 - Thread

3 - Jog

4 - Thread/Jog

V. (Continued)

5 - V/I (Voltage/Current) Follower

6 - Controlled Stop and Thread

7 - Controlled Stop and Jog

8 - Controlled Stop and Thread/Jog

9 - Controlled Stop and V/I (Voltage/Current) Follower

A - Thread and V/I (Voltage/Current) Follower

B - Jog and V/I (Voltage/Current) Follower

C - Thread/Jog and V/I (Voltage/Current) Follower

D - Controlled Stop, Thread and V/I (Voltage/Current) Follower *

E - Controlled Stop, Jog, and V/I (Voltage/Current) Follower *

F - Controlled Stop, Thread/Jog and V/I (Voltage/Current) Follower *

* These combinations cannot be used in a reversing Controller, due to the Anti-Plug PCB being placed in the 5PC position, which leaves only two modification positions available.

VI. Designates whether the drive contains a Dynamic Braking Resistor (DBR) and if so, the value for each HP.

0 - No Dynamic Braking

1 - DBR 15 ohm, 175 watts; 1, 1.5HP

2 - DBR 7 ohm, 160 watts; 2, 3HP

3 - DBR 4.3 ohm, 225 watts; 5HP

VII. Always zero (has no significance).

SECTION 2. PARTS LIST

2.1 INTRODUCTION

Table 2.1 lists the PCs contained in the basic Controller.

Table 2.2 lists the recommended spare parts for the Controller.

2.2 INSTALLATION OF ANTI-PLUG 46S02453-0010

Install the Anti-Plug PCB into modification position 5PC. Route and dress the individual wires as indicated in Figure 1.1, Layout, and connect as described below.

WIRE NUMBER	CONNECT TO
C1	2PC-1TB-2
C2	2PC-1TB-3
C3	1MF-7
C4	1MF-6

Table 2.1. Controller PC's

PART DESCRIPTION	SYMBOL	LOUIS ALLIS PART NUMBER
Current Regulator	1PC	46S02409-0010 (1, 1.5, 2HP) or 46S02409-0020 (3, 5HP)
Customer Interface	2PC	46S02454-0010
Armature Voltage Regulator	3PC	46S02437-0010

Table 2.2. Recommended Spare Parts For Controller

PART DESCRIPTION	SYMBOL	LOUIS ALLIS PART NUMBER	RECOMMENDED STOCKED QUANTITY BASED ON THE NUMBER OF IDENTICAL CONTROLLERS			
			1-4	5-9	10-25	26 & UP
PRINTED CIRCUIT MODULES:						
Current Regulator	1PC	46S02409-0010 (1, 1.5, 2HP) or 46S02409-0020 (3, 5HP)	1	1	2	3
Customer Interface	2PC	46S02454-0010	1	1	2	3
Armature Voltage Reg.	3PC	46S02437-0010	1	1	2	3
Anti-Plug (Option) (see para. 2.2)	5PC	46S02453-0010	1	1	2	3

Table 2.2. Recommended Spare Parts For Controller (Continued)

PART DESCRIPTION	SYMBOL	LOUIS ALLIS PART NUMBER	RECOMMENDED STOCKED QUANTITY BASED ON THE NUMBER OF IDENTICAL CONTROLLERS			
			1-4	5-9	10-25	26 & UP
MODIFICATIONS:						
Thread	4PC, 5PC or 6PC	46S02445-0010	1	1	2	3
Jog	4PC, 5PC or 6PC	46S02445-0020	1	1	2	3
Thread/Jog	4PC, 5PC or 6PC	46S02445-0030	1	1	2	3
Controlled Stop	4PC, 5PC or 6PC	46S02444-0010	1	1	2	3
V/I (Voltage/Current) Follower	4PC, 5PC or 6PC	46S02451-0010	1	1	2	3
Tach Feedback Speed Regulator	3PC	46S02452-0010	1	1	2	3
Loop Contactor	1MF	05P00031-0061	0	1	2	2
Elec. Interlock 1 N.O.	1MF	05P00021-0089	0	1	2	2
Fuse	1F	05P00017-0138	1	2	3	4
Silicone Rectifier 240V 25A Bridge (1, 1.5, 2HP only) (ref. para. 2.3)	1SCR	05P00050-0220	1	2	3	4
Silicone Rectifier SCR Module (3 & 5HP only) (ref. para. 2.4)	1A SCR 1B SCR	05P00050-0286	2	4	6	8

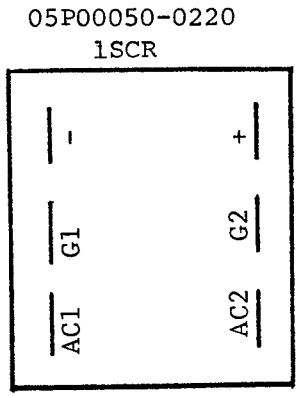
Table 2.2. Recommended Spare Parts For Controller (Continued)

PART DESCRIPTION	SYMBOL	LOUIS ALLIS PART NUMBER	RECOMMENDED STOCKED QUANTITY BASED ON THE NUMBER OF IDENTICAL CONTROLLERS			
			1-4	5-9	10-25	26 & UP
Silicone Rectifier (3 & 5HP only) (ref. para. 2.4)	1RT	05P00050-0114	1	2	3	4
Potentiometer 2.5K, 2W (for speed setter) with 1.0 inch long shaft		43T00572-2524	1	1	2	2

2.3 INSTALLATION OF 1SCR SILICONE RECTIFIER 240V 25A BRIDGE (1, 1.5, 2HP)

With a clean lint free cloth, wipe the old silicone oil from the heat sink mounting surface. Apply silicone oil (GE SF1154 or equivalent) to the bridge and heat sink mounting surfaces. Connect the wires as described below.

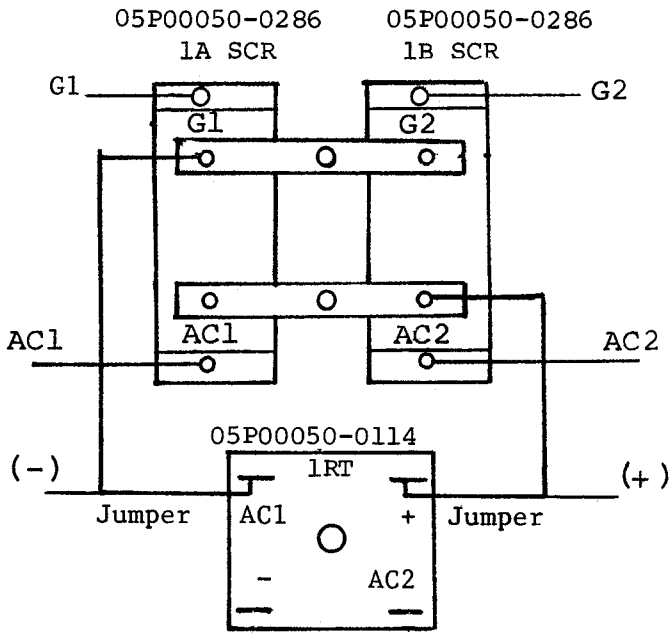
WIRE NUMBER	CONNECT TO
-	2TB-C (1PC)
+	tab K (1PC)
G1	3TB-D (1PC)
G2	3TB-E (1PC)
AC1	2TB-A (1PC)
AC2	2TB-B (1PC)



2.4 INSTALLATION OF 1A SCR/1B SCR SILICONE RECTIFIER SCR MODULE AND 1RT SILICONE RECTIFIER (3, 5HP)

With a clean lint free cloth, wipe the old silicone oil from the heat sink mounting surface. Apply silicone oil (GE SF1154 or equivalent) to the module and heat sink mounting surfaces. Connect the applicable wires as described below.

WIRE NUMBER	CONNECT TO
-	2TB-C (1PC)
+	tab K (1PC)
G1	3TB-D (1PC)
G2	3TB-E (1PC)
AC1	2TB-A (1PC)
AC2	2TB-B (1PC)



SECTION 3. INSTALLATION

3.1 GENERAL

Installation and interconnection wiring must be done in conformance with the National Electric Code, regulations of the Occupational Safety and Health Administration, and/or other national, regional, or industry codes and standards.

3.2 MOUNTING

3.2.1 Power Unit

The power unit enclosure is designed for wall mounting and is secured to the wall using standard hardware. The white cover may temporarily be removed to aid in mounting the enclosure to the wall. Refer to Figure 3-1.

3.2.2 DC Motor

Refer to the DC motor instruction manual for mounting requirements.

3.3 ELECTRICAL INTERCONNECTIONS

3.3.1 General

If you have the basic drive with no modification kits, refer to and make connections as shown on 02Y00025-0106 Relay Logic and Interconnection Armature Voltage Feedback/E-Stop.

IMPORTANT

Read and understand all notes on the schematic and interconnection diagrams before wiring.

3.3.2 Interconnection Diagrams

To locate the correct interconnection and Operator Control Station (OCS) information for drives containing modifications, refer to the appropriate 02Y00025 modification instructions; identify the relay logic and interconnection diagram applicable to your drive and make connections accordingly.

3.4 MOTOR FIELD CONNECTIONS

IMPORTANT

Read and understand the DC motor manual and this section before connecting motor.

There are three types of field connections for the Flexitorq® DC motors.

1. Shunt Field
2. Series Field (Generally not used)
3. Compound (Series and Shunt) Field

When the controller is ordered with a motor, Louis Allis supplies a Shunt Field (Shunt Wound) DC motor. If desired, the customer may use a Series or Compound Field (Wound) DC motor.

Check the motor nameplate to determine which type of field your motor has. Each type of motor field is described in paragraph 3.4.1 thru 3.4.3.

For future reference, make notation of the applicable motor field connections on the interconnection and schematic diagrams in this manual. Shunt field connections are normally designated F1 and F2. Series field connections are normally designated S1 and S2. Armature connections are designated A1 and A2.

The motor may be provided with control leads (C1 and C2) to commutating field. These leads are not used with this drive and should be taped.

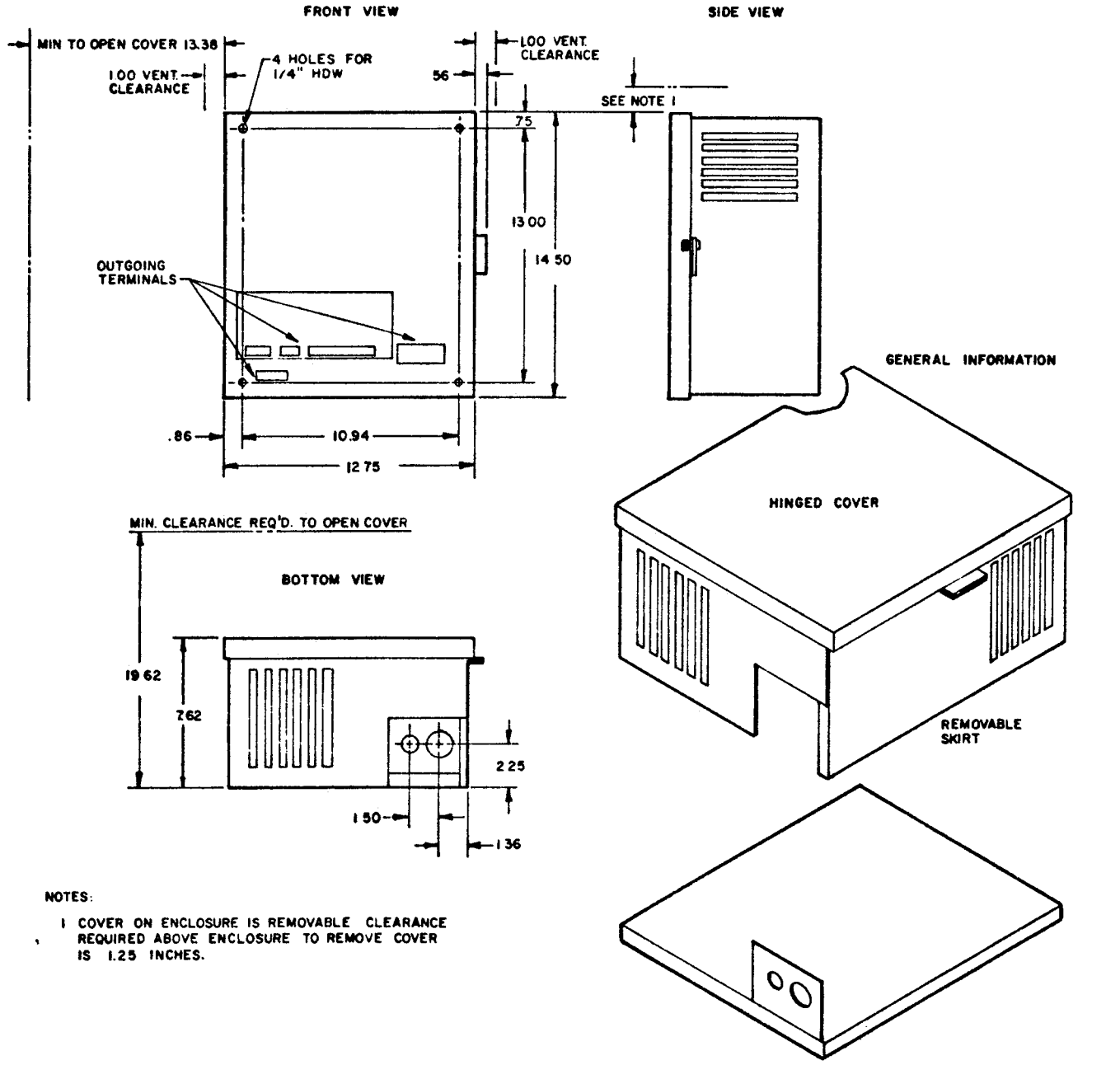


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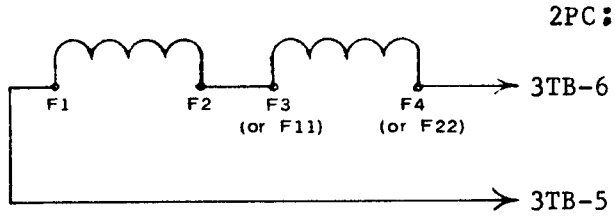
Figure 3-1. Saber 3202 Controller Outline Dimensions

3.4.1 Shunt Field

A Shunt Field is normally connected in parallel with the motor armature and commutator field as shown in the Flexi-torq motor manual. However, for this controller application, the motor is to be connected as shown in Figure 3-2. Connect F1 to 2PC-3TB-5 and F2 to 2PC-3TB-6. Connect A1 to 7TB-1 (-) and A2 to 7TB-2 (+), for desired motor rotation.

The DC motor may be furnished with a dual (100/200 volt) shunt field. If this is the case, the field connections will be designated as shown below.



Connect F1 to 2PC-3TB-5 and F4 (or F22) to 2PC-3TB-6.

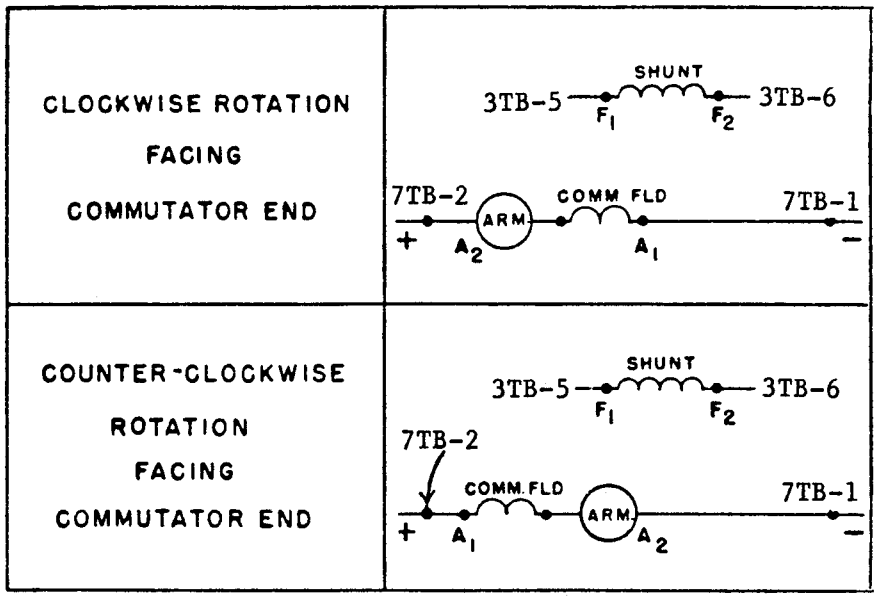


Figure 3-2. Shunt Motor

3.4.2 Series Field

A series field is connected in series with the motor armature and commutator field as shown in Figure 3-3. Series motors characteristically have high torque at low speeds and low torque at high speeds.

CAUTION

SERIES MOTORS MUST NEVER BE RUN WITHOUT A MECHANICAL LOAD COUPLED TO THE MOTOR SHAFT, AS DESTRUCTIVELY HIGH MOTOR SPEED MAY RESULT.

Connect A1 or A2 to S1 for desired motor rotation. Connect S2 to 7TB-1 and connect the remaining A1 or A2 to 7TB-2.

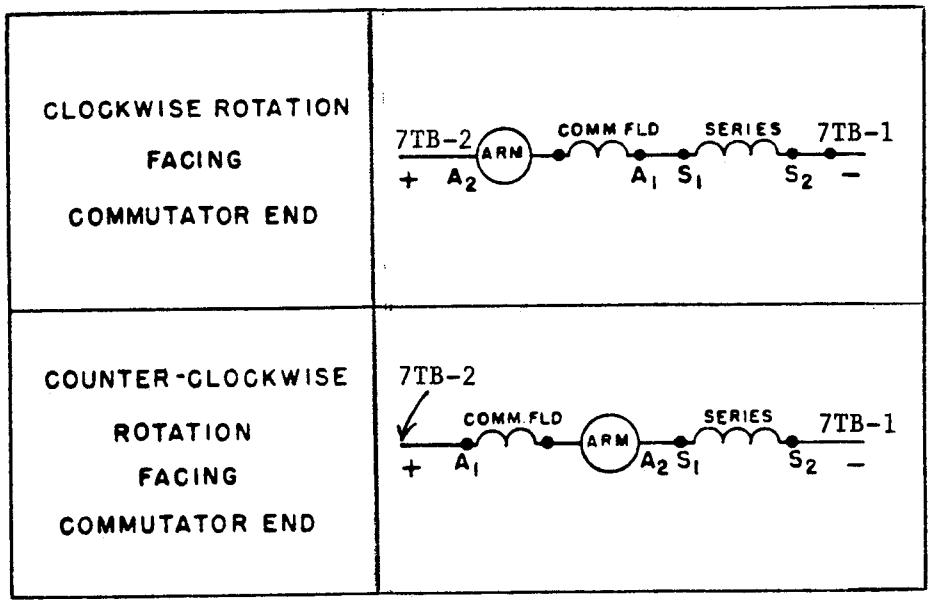


Figure 3-3. Series Motor

3.4.3 Compound (Series and Shunt) Field

A compound field contains both a series field and a shunt field as shown in Figure 3-4.

Connect S2 to 7TB1 (-). Connect F1 to 2PC - 3TB-5 (+) and F2 to 2PC - 3TB-6 (-). Connect A1 or A2 to S1 for desired motor rotation. Connect the remaining A1 or A2 to 7TB-2 (+).

3.4.4 Tach Information

Refer to the following instructions before installing tachometer:

AC tachometers may be of the dual voltage type. Lead tagging for 45 VAC/1000RPM connections is T1-T2. Tagging for 90 VAC/1000RPM connections is T1-T3. An alternate tachometer which is 28 VAC/1000RPM is also available. The terminals on this tach are labeled 1 (+) and 2 (-).

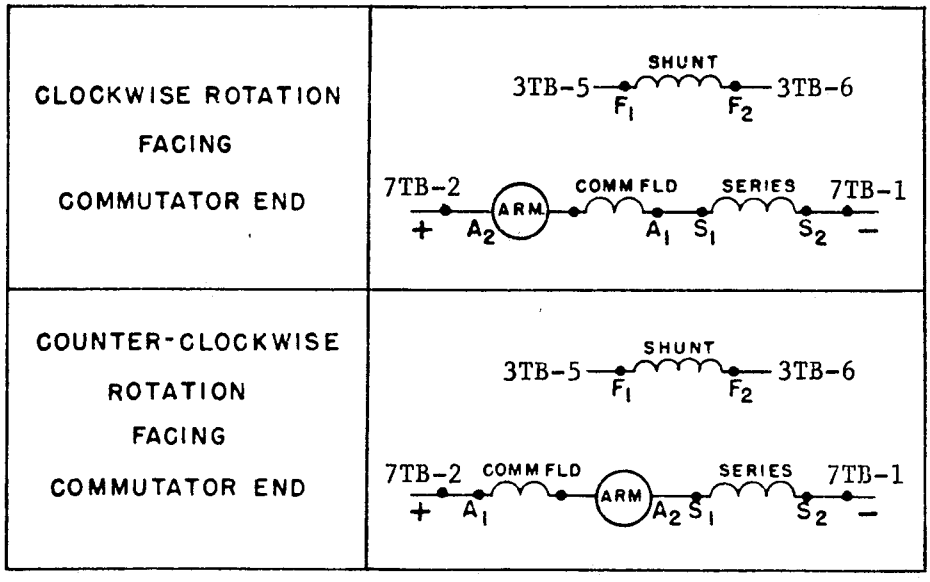


Figure 3-4. Compound Field Motor

SECTION 4. DESCRIPTION OF CONTROLS

4.1 GENERAL

Table 4.1 lists the potentiometer adjustments on 3PC, Armature Voltage Regulator, by reference designator, name, and function. Figure 4-1, Location of Pots, shows the physical location of the potentiometers listed in Table 4.1.

NOTE

If your drive contains the Tachometer Feedback Speed Regulator PC, disregard this section and reference Modification Instructions 02Y00025-0105.

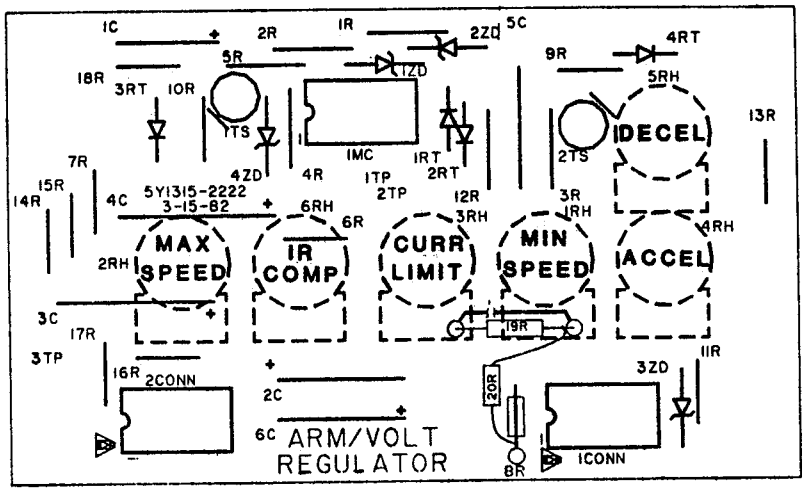


Figure 4-1. Location of Pots

Table 4.1. Functions of Adjustments

REFERENCE DESIGNATOR	NAME	FUNCTION
1RH	MIN. SPEED	Sets minimum speed of the drive. Turning CW increases the minimum operating speed.
2RH	MAX. SPEED	Sets maximum speed of the drive. Turning CW increases the maximum operating speed.
3RH	CURRENT LIMIT	Limits maximum average drive current available. Turning CW increases available current.
4RH	ACCEL	Sets acceleration rate of the drive. Turning CW increases acceleration time.
5RH	DECEL	Sets deceleration rate of the drive. Turning CW increases deceleration time.
6RH	IR COMPENSATION	Sets amount of speed boost when motor becomes loaded. Turning CW increases speed under load.

SECTION 5. ADJUSTMENTS

5.1 INTRODUCTION

These adjustments are for a basic drive containing Armature Voltage Regulator Feedback, and are to be made BEFORE adjusting any modifications.

If your drive contains the Tachometer Feedback Speed Regulator PC modification, disregard paragraphs 5.2 and 5.3 and refer to Modification Instructions 02Y00025-0105.

5.2 INITIAL POTENTIOMETER SETTINGS

NOTE

The following adjustments are to be made with all power removed from the drive.

1. Set the SPEED pot (in OCS) fully counterclockwise (CCW).

2. Set the following pots on Armature Voltage Regulator (3PC) fully CCW.

MIN. SPEED	1RH
MAX. SPEED	2RH
ACCEL	4RH
DECEL	5RH
IR COMP	6RH

IMPORTANT

The CURR LIMIT (3RH) pot has been set at the factory and should not need to be readjusted. Your current limit is set properly at 150% of rated motor current. If it does become necessary to readjust the current limit pot, refer to para. 5.4.

5.3 INITIAL ADJUSTMENTS - ENERGIZED DRIVE

1. Apply 230 VAC, single phase power to the drive unit.

2. Press RUN push button.

3. Turn MIN SPEED pot clockwise (CW) until desired minimum operating speed is reached.

4. Slowly turn SPEED pot CW and observe motor speed increase. With SPEED pot fully CW, turn MAX SPEED pot CW until maximum operating speed is reached.

CAUTION

DO NOT SET MAX SPEED POT TO A SETTING WHICH WILL ALLOW A MOTOR SPEED OR ARMATURE VOLTAGE HIGHER THAN THAT INDICATED ON THE MOTOR NAMEPLATE, AS MOTOR DAMAGE MAY RESULT.

5. Start and stop the motor several times by pressing the RUN and STOP push buttons. Observe the acceleration and deceleration rates, and adjust the ACCEL and DECEL pots to obtain desired acceleration and deceleration rates.

6. To adjust the IR compensation, prepare to measure the exact motor speed while the motor is running at desired speed, no load. Write the exact motor speed here _____ . Apply the desired working load and adjust IR COMP pot to obtain a motor speed 0.5% lower than the recorded no load speed.

5.4 READJUSTMENT OF CURR LIMIT POT

1. Run the drive at 80% speed and apply a load to the motor at which current limit is desired.

2. Slowly turn CURR LIMIT pot counter-clockwise (CCW) until the drive goes into current limit (i.e., armature voltage begins to decrease).

5.5 START/STOP INSTRUCTIONS

Once the Installation and Adjustment paragraphs 3.1 thru 5.4 have been completed, the drive may routinely be started and stopped as described in paragraphs 5.5.1 and 5.5.2.

5.5.1 Start

1. Apply power to the controller.

2. Press the RUN push button.

3. Advance the SPEED pot to obtain the desired motor speed.

5.5.2 Stop

1. Press the STOP push button.

2. Remove power to the controller.

SECTION 6. THEORY OF OPERATION

6.1 DRIVE OPERATION

The Saber 3202 drive is a speed regulated DC drive. The speed of a shunt wound DC motor will drop slightly when load is applied. The amount of motor speed change between no load and full load, is called regulation. To improve on the motor regulation characteristics, power input to the motor must vary with load. This is achieved by continually monitoring motor speed and comparing it to desired speed. Desired speed is set by the reference signal, or SPEED pot, while the armature voltage feedback signal represents actual motor speed.

The controller converts AC input power to controlled DC output power. The regulator portion of the Controller continuously compares reference and feedback signals and varies output power accordingly to provide accurate speed regulation. This type of system is commonly referred to as a closed loop system.

Two types of feedback are offered on the Saber 3202 drive. The standard drive utilizes armature voltage feedback with load (IR) compensation, which provides 5% speed regulation. 1% speed regulation is available with the Tach Feedback Speed Regulator modification kit, 46S02452-0010.

Figure 6-1 shows the simplified diagram of the standard drive using armature voltage feedback with load (IR) compensation. This method of speed control does not monitor speed directly. Armature voltage is measured as an approximate measurement of speed. Since the speed of a DC shunt motor will decrease slightly when load is applied, a load (IR) compensation circuit is included to compensate for load speed change.

Protection circuits are included in all Saber 3202 drives to protect the drive components from overload damage. Control signals from these circuits keep the Controller output within preset safe limits by continually monitoring armature voltage and current.

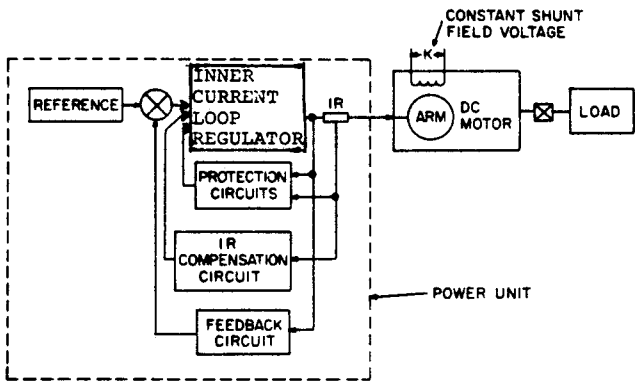


Figure 6-1. Block Diagram - Standard Drive with Armature Voltage Feedback

A custom designed Saber 3202 drive may have additional circuitry or reference and feedback circuits other than those mentioned in this section. These additional circuits function so as to add to or replace the normal reference and feedback signal(s). The primary controlling factor still remains a reference and feedback comparison. Refer to individual module descriptions, or other descriptive material included with this instruction manual, for the operation of these circuits.

6.2 CONTROLLER

The main function of the Controller is to supply controlled DC motor armature voltage. Controlled armature voltage is variable from 0-180 VDC. The instantaneous value of voltage depends on SPEED pot setting and motor load. The Controller also supplies a constant DC voltage (200 VDC) to the motor shunt field.

The regulator portion of the Controller maintains the motor speed constant with the feedback signal approximately equal to reference signal. The basic regulator consists of the Armature Voltage Regulator and the Current Regulator. The Armature Voltage Regulator supplies an error current signal, which is the difference between desired and actual speed, to the Current Regulator. The Current Regulator then regulates motor speed, according to the error current signal.

6.3 REVERSING WITH ANTI-PLUG

This optional feature allows the motor to change direction by changing the direction of current flow through the armature with a second electrically interlocked loop contactor. When the FORWARD/REVERSE switch position is changed, Run relay 1CR de-energizes and cannot be energized again until the motor has come to a complete stop. Motor speed is monitored by measuring the motor armature voltage. When the motor has reached a complete stop, motor armature voltage will be zero, allowing relay 6CR to energize. Relay 6CR energizing, allows the Run relay to energize when the RUN push button is pressed.

6.4 DYNAMIC BRAKING

An optional feature of the drive is the Dynamic Braking Resistor (DBR). If the DBR is present, when the armature circuit opens, the DBR is placed across the armature. The motor acts as a generator while coasting to a stop and the rotational energy is dissipated by the DBR in the form of heat, bringing the motor to a very rapid stop.

SECTION 7. TROUBLESHOOTING

7.1 GENERAL

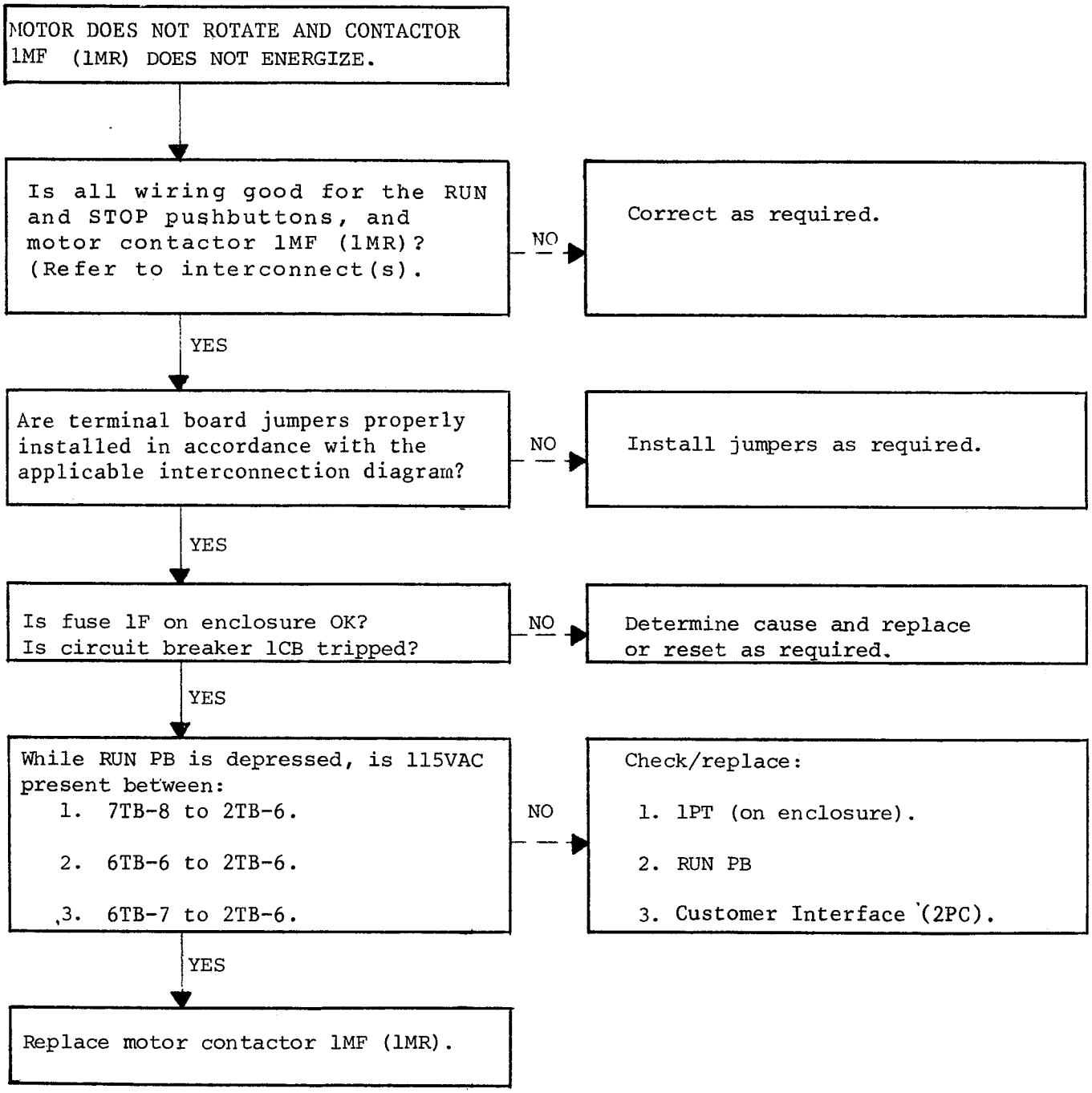
Three troubleshooting flow charts are provided as an aid in identifying the probable cause and performing the corrective action for each of the system faults.

Before proceeding to the flow charts, ensure that the CURR LIMIT pot is NOT at 0%. If the CURR LIMIT pot is at 0%, refer to and complete paragraph 5.4 before proceeding.

	OBSERVED SYMPTOM	USE FLOWCHART
1.	Motor does not rotate and contactor 1MF does not energize.	A
2.	Motor does not rotate, but 1MF energizes.	B
3.	Motor rotation is too fast, too slow, or erratic.	C

If the drive cannot be successfully repaired, contact the nearest Louis Allis District Office for field service assistance.

FLOWCHART "A"


MOTOR DOES NOT ROTATE AND CONTACTOR 1MF (1MR) DOES NOT ENERGIZE.
Is all wiring good for the RUN and STOP pushbuttons, and motor contactor 1MF (1MR)? (Refer to interconnect(s).
NO
Correct as required.
YES
Are terminal board jumpers properly installed in accordance with the applicable interconnection diagram?
NO
Install jumpers as required.
YES
Is fuse 1F on enclosure OK? Is circuit breaker 1CB tripped?
NO
Determine cause and replace or reset as required.
YES
While RUN PB is depressed, is 115VAC present between:
1. 7TB-8 to 2TB-6.
2. 6TB-6 to 2TB-6.
3. 6TB-7 to 2TB-6.
NO
Check/replace:
1. 1PT (on enclosure).
2. RUN PB
3. Customer Interface (2PC).
YES
Replace motor contactor 1MF (1MR).

FLOWCHART "B"

MOTOR DOES NOT ROTATE: CONTACTOR 1MF ENERGIZES.

Is jumper in place from 4TB – 5 to 4TB – 6 ?
- NO → Install as required.

Is ribbon cable OK and in place from:
1. 2CONN on 3PC to 2CONN on 1PC.
2. 1CONN on 3PC to 1CONN on 2PC.
- NO → Replace/correct as required.

Is calibrating resistor value correct and in place? (Ref. Para. 1.5)
- NO → Replace/correct as required.

Is voltage at 4TB-3 -10VDC ±5% relative to common (3TP on 1PC)?
- NO → Is voltage at 1CONN (5) on 3PC -10VDC ±5%?
  - NO → Replace 3PC.
  - YES → Is there continuity between 1CONN (5) on 3PC and 4TB-3?
    - NO → Replace 2PC.
    - YES → Replace/correct as required.

Is 103VDC (-5+10%) field supply present from terminals 3TB-5(+) to 3TB-6(-)?
- NO → Is 115VAC present between 1TB (F) and 1TB (G) ?
  - NO → Replace/correct as required.
  - YES → Replace 1PC.

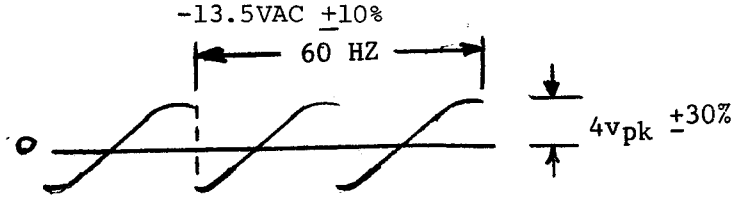
Are voltage signals on 1PC at 1TP, 2TP, 4TP correct? *
- NO → Is 115VAC present between 1TB (F) and 1TB (G) ?
  - NO → Replace/correct as required.
  - YES → Replace 1PC.

Is 150mV shunt in place from 3TB (L) to (K) on 1PC?
- NO → Install as required.

Is all wiring between 1PC and power module OK?
- NO → Correct as required.

Replace power module.

* VOLTAGE SIGNALS

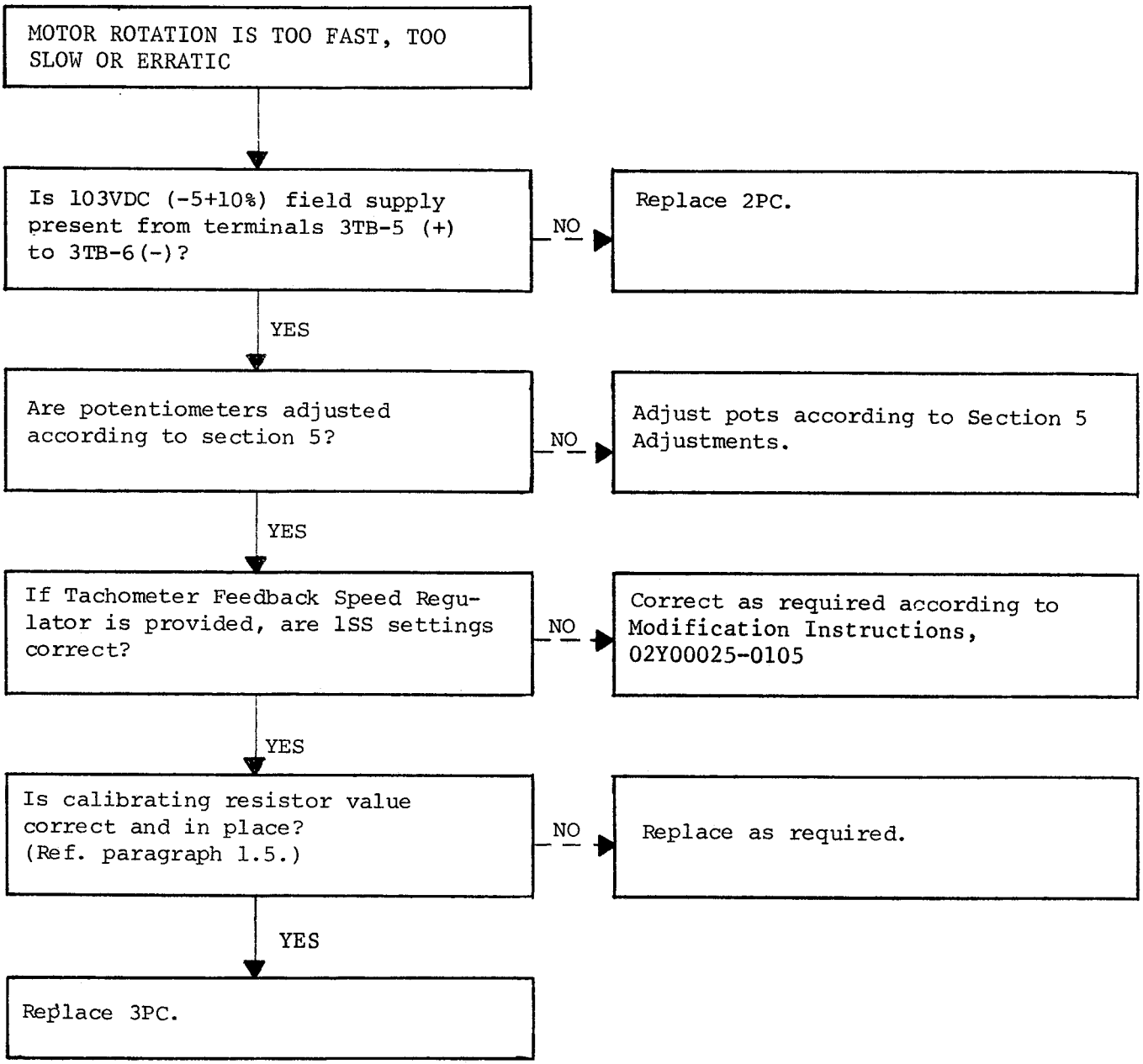
1TP	+13.5VDC ±10%
2TP	-13.5VAC ±10%
4TP	

KEY

YES →

NO - - - →

FLOWCHART "C"


MOTOR ROTATION IS TOO FAST, TOO SLOW OR ERRATIC
Is 103VDC (-5+10%) field supply present from terminals 3TB-5 (+) to 3TB-6(-)?
NO
Replace 2PC.
YES
Are potentiometers adjusted according to section 5?
NO
Adjust pots according to Section 5 Adjustments.
YES
If Tachometer Feedback Speed Regulator is provided, are 1SS settings correct?
NO
Correct as required according to Modification Instructions, 02Y00025-0105
YES
Is calibrating resistor value correct and in place? (Ref. paragraph 1.5.)
NO
Replace as required.
YES
Replace 3PC.

SECTION 8. MODIFICATIONS

8.1 INTRODUCTION

The modification kits available for the Saber 3202 controller are:

THREAD	46S02445-0010
JOB	46S02445-0020
THREAD/JOG	46S02445-0030
CONTROLLED STOP	46S02445-0010
V/I (VOLTAGE/CURRENT) FOLLOWER	46S02451-0010
TACH FEEDBACK SPEED REGULATOR	46S-2452-0010

A brief description of the function and operation of each modification is included in the following paragraphs.

8.1.1 Thread

The Thread modification enables the DC motor to rotate at the speed set by the THREAD ADJUST pot after the THREAD push button on the Operator Control Station (OCS) has been pressed. The motor will rotate at Thread speed until the RUN or STOP push button is pressed. If the STOP push button is pressed, the motor will coast to a stop.

If the drive is non-reversing, when the RUN push button is pressed, normal motor speed will be obtained.

If the drive is the reversing type, when the STOP push button is depressed, the motor will coast to a stop. Normal motor speed may then be obtained by pressing the RUN push button after the motor has come to a complete stop.

In the Thread mode of operation, the Thread function replaces the reference voltage to the Tach Feedback or Armature Volt Regulator (3PC). The THREAD ADJUST setting determines the amount of reference voltage supplied to the regulator LAC circuit. Component values for the Thread modification have been selected so Thread speed may be adjusted from zero to approximately 45% of top speed.

8.1.2 Jog

The Jog modification enables the DC motor to rotate at the speed set by the JOG ADJUST pot as long as the JOG push button on the Operator Control Station is held depressed. The motor will continue to run at Jog speed until the JOG push button is released, at which time the motor will coast to a stop. Normal motor speed is then obtained by pressing the RUN push button. If the drive is the reversing type, the motor must coast to a complete stop in order for the RUN push button to have any effect.

In the Jog mode of operation, the Jog function replaces the reference voltage to the Tach Feedback or Armature Voltage Regulator (3PC). The JOG ADJUST setting determines the amount of reference voltage supplied to the voltage comparator mode. Component values for the Jog modification have been selected so Jog speed may be adjusted from zero to approximately 45% of top speed.

8.1.3 Thread/Jog

The Thread/Jog modification incorporates the functions of the separate Thread and Jog modifications as described in paragraphs 8.1.1 and 8.1.2.

8.1.4 Controlled Stop

When the STOP push button is pressed, the motor speed will decrease at a rate determined by the DECEL potentiometer on the regulator board. At a speed range from 0 to 30% of top speed, relay switching opens the armature circuit and the motor coasts to a stop. The speed at which the armature opens is set by the DROP OUT pot.

IMPORTANT

For Drives equipped with Controlled Stop, an Emergency Stop (E-STOP) push button should be used to bypass the Controlled Stop feature in case of an emergency. The E-STOP push button may be OCS mounted or in any accessible location. When combined with the Dynamic Braking Resistor (DBR) feature, the motor speed will rapidly decrease to zero when the E-STOP push button is pressed.

8.1.5 V/I (Voltage Current) Follower

The V/I Follower modification translates an externally provided voltage or current signal (selected by switch 1SS-1; open for voltage, closed for current) to an output usable as a speed reference signal. The input signal is single ended and ranges from 5V to 220 VDC, or 5V to 220 VAC, and the maximum input current ranges from 5mA to 50mA.

When placed in the AUTO mode of operation, the DC motor speed will follow the external source at a ratio determined by the RATIO pot. When placed in the MANUAL mode of operation, the DC motor speed is controlled by the SPEED potentiometer. When the external source is AC, rectification and filtering must be added to the circuit by the closure of switches 1SS-2 and 1SS-3.

8.1.6 Tach Feedback Speed Regulator

The Tach Feedback Speed Regulator modification provides 1% speed regulation. Speed regulation is is always defined as a percentage of top speed, NOT set speed. This means an adjustable speed drive with 1% regulation and a 1750 RPM motor will have a possible speed variation of 17.5 RPM at all operating speed.

The actual operating speed may vary more than 1% when the load is first applied, but will not vary any more than 1% after the speed has stabilized.

Either an AC or DC tach may be used, as the tach signal is fed into an Absolute Value Circuit. The output of an Absolute Value Circuit is always positive. This positive speed feedback signal is then compared with the negative speed reference supplied by the SPEED pot. The speed feedback signal will always be opposite in polarity to the speed reference signal. If the two signals are equal and opposite in polarity they cancel each other. When they are not equal and opposite, an error signal is developed. It is this error signal which controls the firing time of the Power Bridge SCRs, to increase or decrease armature voltage as required. Armature voltage may vary from zero to 180 VDC; the higher the armature voltage, the faster the DC motor turns.

8.2 INSTALLATION

The modifications mount on the hinged panel, which is visible after the front white cover has been opened. The modifications mount on snap-in standoffs in any available position (4PC, 5PC, or 6PC). An exception is the Tach Feedback Speed Regulator modification, which replaces the Armature Voltage Regulator PC, and mounts in position 3PC.

SECTION 9. DRAWINGS

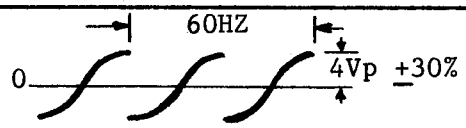
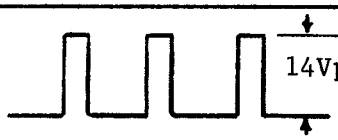
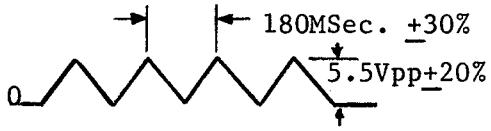
9.1 INTRODUCTION

This section contains the Saber 3202 Signal Flow Diagram with Armature Voltage Regulator Feedback. Tables 9.1 and 9.2 describe test point voltages and waveforms which pertain to the Signal Flow Diagram. Table 9.3 describes voltage measurements on terminals of the Customer Interface PC (2PC).

The drive operating condition is described in the Tables for each test point and/or waveform.

The Saber 3202 Relay Logic and Interconnect Diagram(s) for any modification(s) are also supplied in this section.

Table 9.1. Inner Current Loop Regulator (1PC) Measurements

TEST POINTS	MEASURED VALUE OR SIGNAL	NOTES
1TP (Ref. 3TP)	+14VDC ±1.5	Control power supply.
2TP (Ref. 3TP)	-14VDC ±1.5	Control power supply.
3TP	Control Common	Control common.
4TP (Ref. 3TP)		Sync voltage signal.
5TP (Ref. 3TP)		Firing pulses, function of speed reference.
6TP (Ref. 3TP)	0 to -1.00VDC ±10% (@ 100% of rated current)	Current feedback signal.
7TP (Ref. 3TP)	0 to +10VDC	Voltage comparator output, function of CURRENT LIMIT pot setting.
8TP (Ref. 3TP)		t = function of load and speed.
9TP*		Triangular wave generator output.

*With respect to C_{HV} (6MC-4 or 1PT-X2).

Table 9.2. Armature Voltage Regulator (3PC) Measurements

TEST POINT	MEASURED VALUE	NOTES
1TP (Ref. 3TP on 1PC)	0 to -5VDC	L.A.C. output
2TP (Ref 3TP on 1PC)	0 to +10VDC	Voltage comparator output, function of CURRENT LIMIT pot setting
3TP (Ref. 3TP on 1PC	0 to +3.98VDC	Armature voltage feedback.

Table 9.3. Customer Interface (2PC) Measurements

TERMINALS	MEASURED VALUE	NOTES
3TB-1 to 3TB-2	230VAC -5% +10%	When power is applied.
3TB-5 (+) to 3TB-6 (-)	103VDC -5% +10%	Field economy voltage.
3TB-5 (+) to 3TB-6 (-)	206VDC -5% +10%	After RUN pushbutton has been pressed.
1TB-10 to 1TB-11	115VAC -7% +12%	After RUN pushbutton has been pressed.
2TB-4 to 2TB-6	115VAC -7% +12%	After RUN pushbutton has been pressed.

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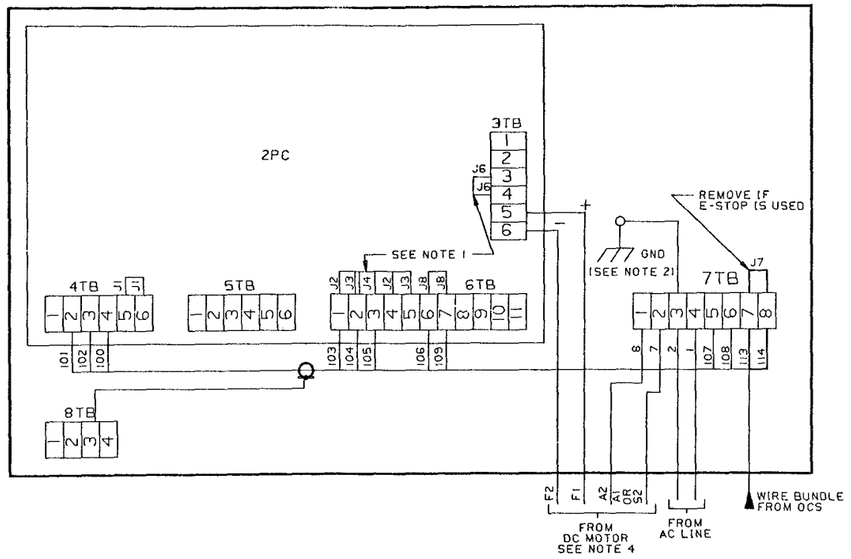
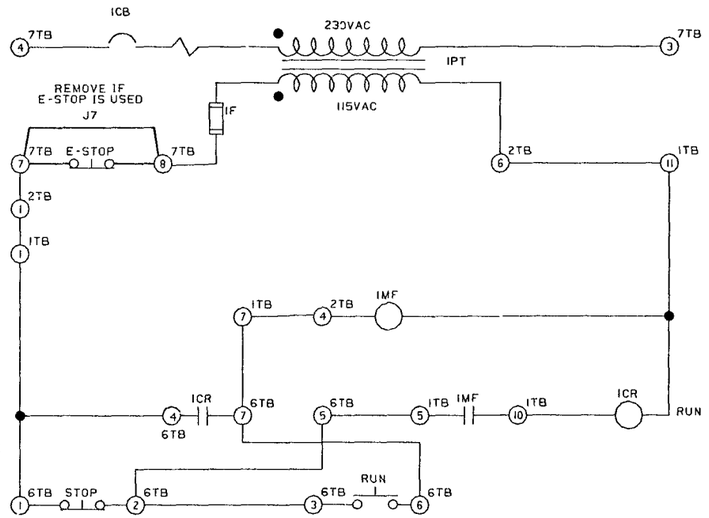
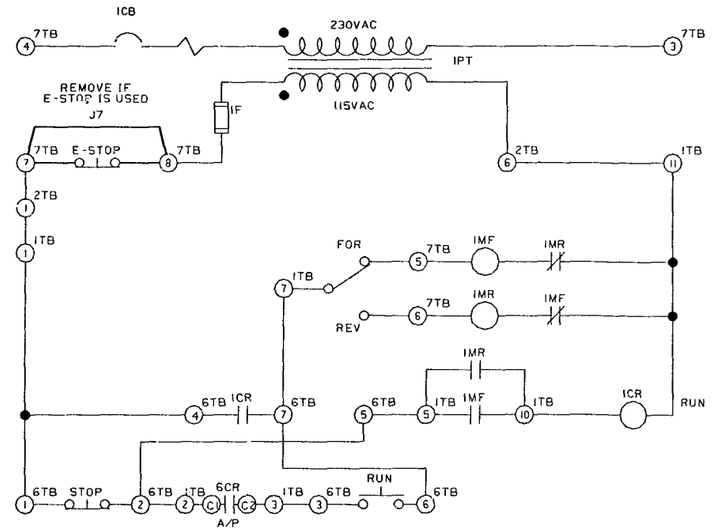
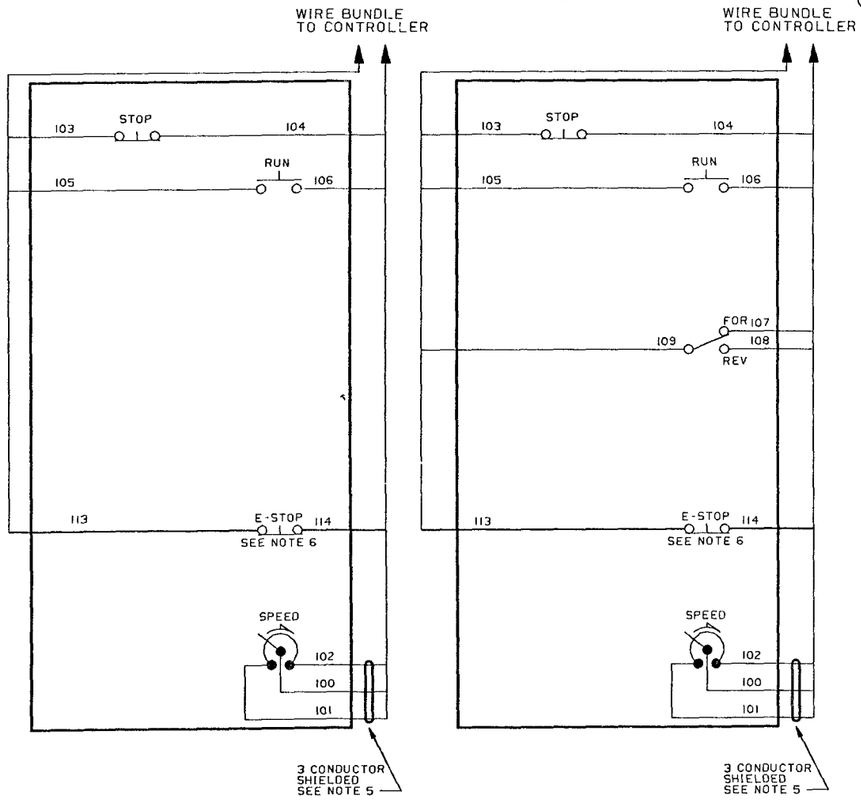


NON-REVERSING/ARMATURE VOLTAGE FEEDBACK REGULATOR WITH E-STOP



REVERSING ARMATURE FEEDBACK VOLTAGE REGULATOR WITH ANTI-PLUG. E-STOP





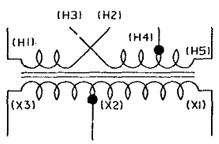
OPERATOR CONTROL STATION FOR NON-REVERSING CONTROLLERS

OPERATOR CONTROL STATION FOR REVERSING CONTROLLERS SEE NOTE 1

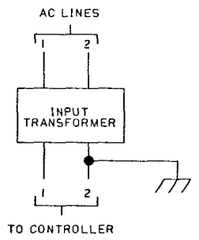
NOTES.

1. REMOVE J4 AND J6 FOR REVERSING CONTROLLER.
2. TO BE GROUNDED BY CUSTOMER IF CONDITIONS PERMIT
3. TRANSFORMER FURNISHED FOR 208V, 440V, AND 575V APPLICATIONS ONLY IF CUSTOMER SPECIFIED.

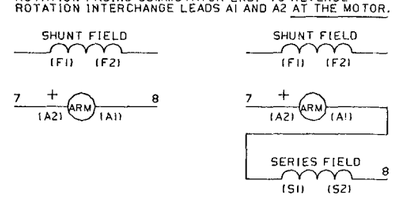
INPUT VOLTS	CONN. TOGETHER	CONN. INCOMING LINE	230V OUTPUT
208	H1-H3 H2-H4	H1-H4	X1-X2
230	H1-H3 H2-H4	H1-H4	X1-X2
460	H2-H3	H1-H4	X1-X2
575	H2-H3	H1-H5	X1-X2



IF CUSTOMER SYSTEM IS GROUNDED IT MUST BE AS FOLLOWS.



4. DC MOTOR SHOWN CONNECTED FOR COUNTERCLOCKWISE ROTATION FACING COMMUTATOR END. TO REVERSE ROTATION INTERCHANGE LEADS A1 AND A2 AT THE MOTOR.



5. WIRES MAY BE RUN IN COMMON CONDUIT THIS CONDUIT MUST NOT CONTAIN POWER, AC CONTROL OR FIELD CONDUCTORS.

   WHERE SHIELDED WIRE IS SPECIFIED, #18GA AWG INSULATED SHIELDED WIRE IS REQUIRED (2 CONDUCTOR BELDEN #8700I, 3-CONDUCTOR BELDEN #8770 OR EQUIVALENT). CONNECT SHIELD AT CONTROLLER END ONLY AS IDENTIFIED IN DIAGRAM. THE FAR END OF THE SHIELD IS TO BE DRESSED NEATLY AND LEFT UNCONNECTED. PROVIDE ADEQUATE INSULATION ON ALL SHIELDS TO ISOLATE THEM FROM GROUND AND OTHER CONDUCTORS.
   DO NOT CONNECT SHIELDS TO EARTH GROUND.
   SHIELDED WIRES SHOULD BE PLACED IN SEPARATE CONDUIT WHICH DOES NOT CONTAIN POWER, AC CONTROL OR FIELD CONDUCTORS. WITHIN CABINETS THESE CONDUCTORS SHOULD BE BUNDLED SEPARATELY FROM POWER, AC CONTROL AND FIELD CONDUCTORS.

6. WIRES NUMBERED 113 AND 114 REQUIRED ONLY IF E-STOP IS USED.

CHANGES

NO.	REMARKS	DATE
1	STD-1730 3-22-83	
2	STD-1904 12-16-83	
3	STD-2314 5-30-85	

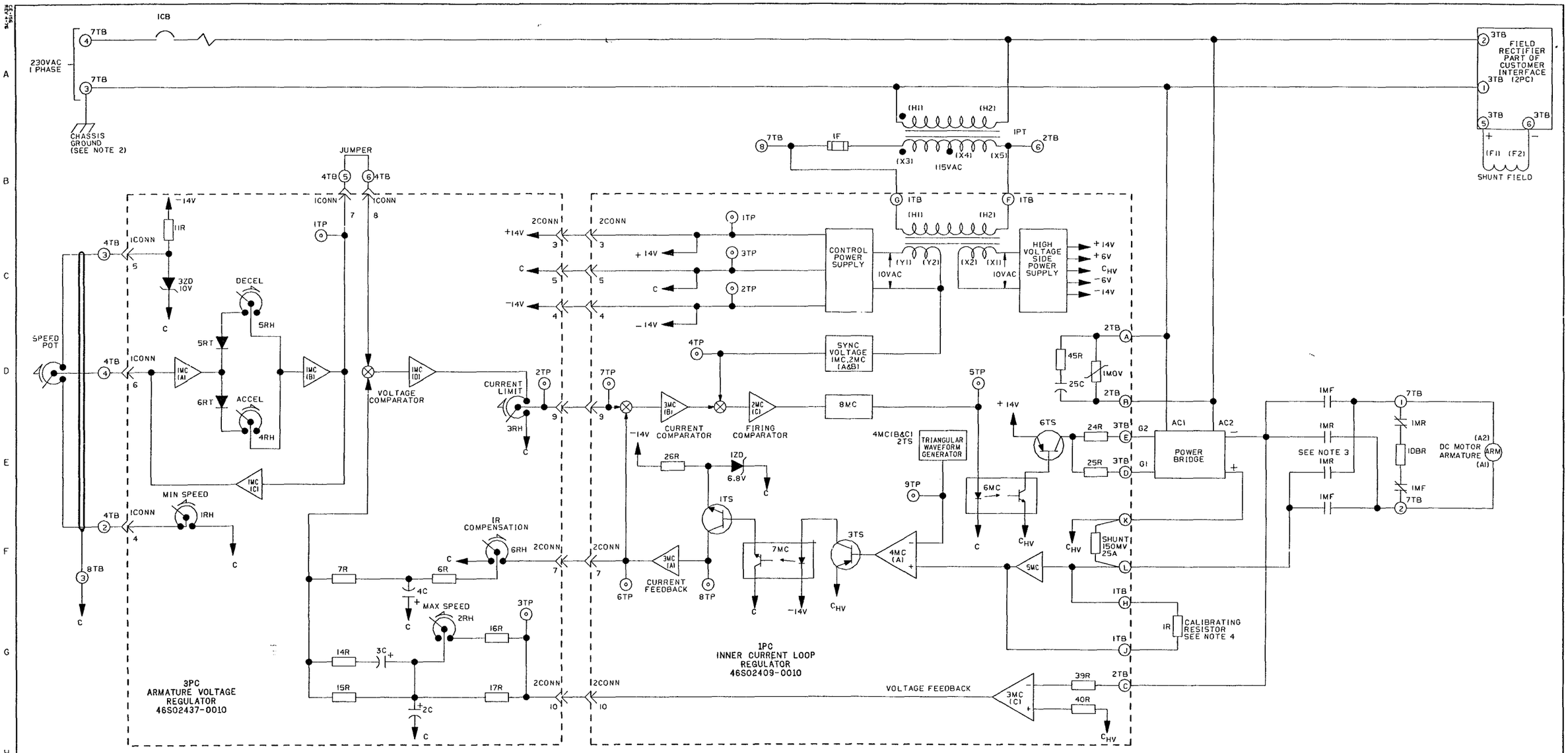
DR BY	DATE	APPV'L	DATE
CH BY	DATE	APPV'L	DATE
ENG	DATE	ISSUED	DATE

RELAY LOGIC AND INTERCONNECTION ARMATURE VOLTAGE FEEDBACK/ E-STOP FOR SABER 3202

D

SHEET 1 OF 2

02Y00025-0106



NOTES.

1. *1DBR (DYNAMIC BRAKING RESISTOR) IS OPTIONAL.
2. GROUND ONLY IF THE CUSTOMER'S INPUT POWER WILL NOT BE AFFECTED.
3. CONTACTOR 1MR USED WITH REVERSING CONTROLLER ONLY
4. SELECTED AT TIME OF MANUFACTURING. SEE PARAGRAPH 1.5 OF MANUAL FOR RESISTANCE VALUE.

CHANGES		
NO.	REMARKS	DATE
	SEE SHT 1 FOR CHANGE	RRR 5-31-85

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A Division of Magnetek, Inc.

DR BY	DATE	APPV'L	DATE
CH BY	DATE	APPV'L	DATE
ENG	DATE	ISSUED	DATE

SIGNAL FLOW DIAGRAM
FOR REVERSING/NON-REVERSING
SABER 3202 CONTROLLER
WITH ARMATURE VOLTAGE FDBK

D

SHEET 2 OF 2

02Y00025-0106