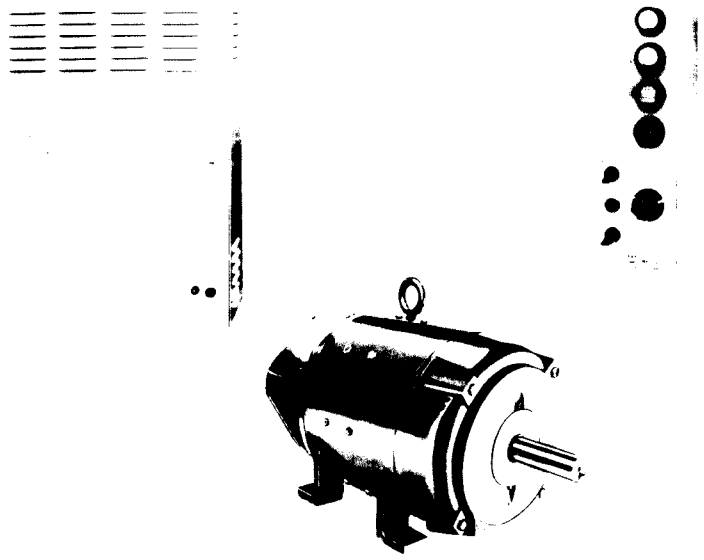
Westinghouse

22-1000
Adjustable Speed Drives



INSTALLATION INSTRUCTION FOR A
22-1000 3 PHASE REVERSING MAGNETIC DRIVE
I. L. 22-1000-21

Westinghouse Electric Corporation

INSTALLATION INSTRUCTIONS

FOR

22-1000, 3 PHASE, REVERSING DRIVES, 9R LOGIC

The basic drive consists of three primary components, the contr-ller, (9RC), tne dc drive motor, (MOT), and the operators control station (OS). The dc drive motor selection is flexible and is not readily fixed in identity as selection is made at time of order entry. The controller, (9RC), selection by style number from Table 1. The operators control stations, (OS), is selected by style number from Table 1 also.

Check Table 1 for the controller (9RC), the operators control station (OS), and the dc motor listing for ratings and style numbers.

Examine all components for damage. If any damage to equipment exists when received, examine tne shipping carton or crate for visible shipping damage. Contact the nearest Westinghouse representative for instructions about handling damage claims.

INSTALLATION INSTRUCTIONS

Installation of the drive equipment should be done using good shop practices for the installation and operation of electrical and mechanical equipment. The power and control wire should be selected in line with all existing local and national electrical codes.

Mounting of the equipment should be in cool, dry, dust-free atmosphere, easily accessable for maintenance and good housekeeping practices.

The dc drive motor must be located, mounted, aligned, and operated in accordance with the specific type of motor being applied.

A. MOUNTING OF EQUIPMENT

1. Mounting The Controller (9RC)

The 9RC controller, when in an enclosure or cabinet, is a type Nema 1 controller and therefore should be located in an area suitable for NEMA 1 enclosures. The location should be dry, dust-free and relatively cool (40 Degrees C ambient or less) to obtain long trouble-free operation. Figure A is the mounting dimensions for use in mounting of either tne open panel or enclosed controller. Three sizes of panels or enclosures are dimensioned, thereby covering all groups for 9RC tabulated in Table 1.

9RC should be securely bolted to a suitable vertical surface that is smooth, dry, and of sufficient area and strength to accept and support the controller.

2. Mounting The Operators Control Station (OS)

The OS is a type NEMA 1 design, therefore it must be located in an area suitable for NEMA 1 enclosures. Figure B is the installation plan for the mounting of OS.

3. Mounting The DC Drive Motor (MOT)

Mounting is dependent upon the type of drive motor supplied and its application. Normal mounting and alignment practices should be followed.

B. ELECTRICAL INTERCONNECTIONS

Reference Schematics

Standard Drive

22-1000-21 (9R) * (Figure 8)

Signal Follow Drive

22-1000-25 (9R) * (Figure 9)

*Plus schematic sheets 2 and 3 (Controller) (Figure 10 and 11)

Reference Diagrams

Standard Drive

Figures 1 to 7

Signal Follow Drive

Figures 1 to 7

DO NOT GROUND ANY CONTROL CIRCUIT LEADS AT ANY TIME

NOTE 1: If the control circuitry cannot be isolated from ground then only the positive side of the incoming signal intelligence can be grounded. (TPH positive, TP, is directly tied to the drive common PSC. If the negative input REF were earth grounded and a second earth ground occurred that would cause PSC to also go to earth ground, it is possible to destroy the controller and damage the DC motor).

B1 The schematic are composite drawings showing:

B1.1 Reversing basic drive in solid lines.

B1.2 Standard options that can be added to basic drive either at time of purchase or at a later date at installation site are shown in dashed or broken lines. It is suggested that the schematic be up-dated each time a function kit is added. Change the dashed or broken lines on the schematic for the option being added to solid lines indicating part of drive.

B1.3 In the carton with the operators control station is packaged an installation instruction leaflet, either I.L. 22-1000-6 or I.L. 22-1000-12, these I.L.'s do not apply to the 22-1000 three phase drives covered in I.L. 22-1000-21. Remove th's I.L. 22-1000-6 or 22-1000-12 and destroy.

B1.4 Figures 1 to 7 show the recommended interconnections between 9RC, OS, and the dc drive motor (MOT), per schematics 22-1000-21 and 22-1000-25 for CEMF (Voltage regulated drives. The inserts on these figures show the additional interconnections and jumper 2J on (CB) change required to convert the CEMF drive to a speed regulated (tachometer feedback) drive. Be sure to change the dashed lines on the schematics for tachometer feedback circuits to solid lines for speed regulated drives.

B1.4.1 The interconnection shown on diagrams Figure 1 to 7 provide the flexibility required to permit the future addition of the various "Option Function Kits" using the detailed instructions provided with each kit.

B1.5 The standard schematic, 22-1000-21, covers drives which incorporate the usual functions of "ON-OFF", "FWD-REV", "RUN", "STOP", "AC POWER ON" indicating light, and a "SPEED CONTROL POTENTIOMETER" in the operators control station (OS), S#1459A12G02.

B1.6 The "Signal-Follow" schematic, 22-1000-25 covers drives which do not provide manual speed control as part of the operators control station (OS). The speed reference signal is an external signal from a suitable source external from the controller. (A suitable source must provide a 0 to (-) 8 VDC input signal - Signal follow input intelligence must be converted into the 0 to (-) 8 VDC signal for input into BC) The operators control station, OS, includes "ON-OFF" switch, "FWD-REV", "RUN", "STOP", pushbuttons, and an "AC POWER ON" indicating light. There is No "SPEED CONTROL" potentiometer included in OS S#1459A12G04.

B2 Interconnections Between DC Drive Motor (MOT) to Controller 9RC

B2.1 Wire Sizing, mark all leads at both ends.

B2.1.1 Armature Circuitry
Reference: Table I
DC Motor Nameplate
Schematic 22-1000-21
22-1000-25

B2.1.1.1 Armature leads, A1 and A2, are sized to carry a minimum of 150% rated dc motor current for one minute.

B2.1.2 Shunt Field Circuitry
Shunt field leads, F1 and F2, use standard control wire of size 14 or larger.

B2.1.3 Tachometer Feedback Circuitry for Speed Regulated Drives, (When used)
Tachometer feedback leads, Tach 1 andTach 2 should always be ran as a twisted pair of standard control of size 16 or larger. DO NOT USE shielded leads.

B2.1.4 Run the required leads, A1, A2, F1, and F2, and tachometer feedback leads Tach 1 and Tach 2, (when used) in a conduit between MOT and 9RC.

B2.2 Connections at MOT
Connect dc motor leads marked A1, A2, F1, and F2 to dc motor terminals identified as A1, A2, F1, and F2 in the dc motor conduit box.
When used, connect the twisted pair of tachometer leads Tach 1 and Tach 2, to the two tachometer leads in the tachometer conduit box. Connect lead marked Tach 1 to one Tach lead and lead marked Tach 2 to the remaining tach lead. A rectifier is provided in the regulator which insures correct tach feedback polarity. Therefore it is not necessary to consider tach polarity when making lead connections. (Figure 5)

B2.3 Connections at 9RC
Connect dc motor leads, A1, A2, F1, and F2 to terminal blocks on the controller panel identified as A1, A2, F1, and F2. (Figure 1, 2, or 3).
These connections will cause the dc drive motor to rotate CCW as viewed from the commutator (brush end) of the motor. When FWD operation is selected A1 is positive when F1 is positive. If CW rotation is desired, it is recommended that armature leads A1 and A2 be interchanged, preferably at the motor conduit box. Always use good electrical practices in the making, taping, and insulating of all electrical connections.

B2.3.1 When used, connect the twisted pair of leads identified as Tach 1 and Tach 2 to screw terminals Tach 1 and Tach 2 on the controller and gate board (CB) in 9RC. (Figure 6)

B3 Interconnections Between Controller (9RC) and Operators Control Station (OS)

B3.1 Standard Drives, OS S#1459A12G02 - See Item B1.5

B3.1.1 In the conduit between 9RC and OS run eleven (11) control leads of size 16 or larger. Mark all leads at both ends as follows: 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, and 13. Make leads 1, 2, and 3 a set of three leads twisted together.

B3.1.2 Connections at 9RC, On Relay Board (RB)

B3.1.2.1 Connect the eleven leads as marked to the screw terminals on RB identified with the same number as the lead, ie 1 to 1, 2 to 2 etc. through 13 to 13. (Figure 7).

B3.1.3 Connections at OS
Reference (Figure 4)

B3.1.3.1 Connect lead marked 11 to the ON terminal of the "ON-OFF" switch. A factory installed wire should already be connected to the ON terminal, the addition of lead marked 11 should make two wires connected to the ON terminal.

B3.1.3.2 Lead marked 12 is connected to the common terminal of the "ON-OFF" switch. (Center terminal of switch).

B3.1.3.3 Connect leads marked 1, 2, and 3, the twisted set, to terminals 1, 2 and 3 of the insulated pot mounting (IPM). Terminal 1 is the bottom terminal on IPM, terminal 4 the top terminal. Terminals are numbered 1, 2, 3, and 4 starting from the bottom of IPM.

B3.1.3.4 Connect lead marked 13 to terminal 4 of IPM.

B3.1.3.5 Connect lead marked 4 to the "RUN" (Top) terminal of the pushbutton contact block.

B3.1.3.6 Connect lead marked 9 to the common (center) terminal between "RUN" and "STOP" of the pushbutton contact block.

B3.1.3.7 Connect lead marked 10 to the "STOP" (bottom) terminal of the pushbutton contact block.

B3.1.3.8 Connect lead marked 7 to the "FWD" (bottom) terminal on the "FWD-REV" switch.

B3.1.3.9 Connect lead marked 8 to the "REV" (top) terminal on the "FWD-REV" switch.

B3.2 Signal Follow Drives, OS, S#1459A12G04 - See Item B1.6

B3.2.1 In the conduit between 9RC and OS run eight (8) control leads of size 16 or larger. Mark all leads at both ends as follows, 4, 7, 8, 9, 10, 11, 12 and 13.

B3.2.2 Connections at 9RC, On Relay Board (RB)

B3.2.2.1 Connect the eight leads as marked to the screw terminals on RB identified with the same number as the lead, ie 4 to 4, 9 to 9 etc. through 13 to 13 (Figure 7).

B3.2.3 Connections at OS
Reference diagram (Figure 4)

B3.2.3.1 Connect lead marked 11 to the ON terminal of the "ON-OFF" switch. A factory installed wire should already be connected to the ON terminal, the addition of lead marked 11 should make two wires connected to the ON terminal.

B3.2.3.2 Connect lead marked 12 to the common (center) terminal of the "ON-OFF" Switch.

B3.2.3.3 Connect lead marked 13 to terminal 4 of the insulated mounting (top terminal) IPM.

B3.2.3.4 Connect lead marked 9 to the common (center) terminal between "RUN" and "STOP" of the pushbutton contact block.

B3.2.3.5 Connect lead marked 4 to the "RUN" (top) terminal of the pushbutton contact block.

B3.2.3.6 Connect lead marked 10 to the "STOP" (bottom) terminal of the pushbutton contact block.

B3.2.3.7 Connect lead marked 7 to the "FWD" (bottom) terminal on the "FWD-REV" switch.

B3.2.3.8 Connect lead marked 8 to the "REV" (top) terminal on the "FWD-REV" switch.

B3.2.4 Signal Follow Input Connections (Figure 7)

B3.2.4.1 The signal Follow intelligence is from an external source, usually customer supplied. Two leads must come into the controller to supply the signal follow reference input. Neither of these two leads can be tied to earth ground. Identify each lead, one as SF (-), the other as SF (+). The reference signal input must go negative over the range of 0 to (-) 8VDC.
If a common signal follow input is used for multiple drives it is necessary to provide ac power isolation by using separate isolation transformers for each drive.

B3.2.4.1.1 Connect the negative signal follow input (SF (-)) to screw terminal 2 on RB (Figure 7).

B3.2.4.1.2 Connect the second of the two signal follow input leads (SF (+)) to screw terminal 3 on RB (Figure 7).
It is suggested that the signal follow input leads SF (-) and SF (+) be ran from their source through conduit to 9RC as a twisted pair of standard control wire of size 16 or larger.

B4 AC Input Power, A, B, & C

B4.1 Rated input, 230 volt, 3 phase 60 HZ to A, B, & C. (Figure 1, 2, or 3)
(50 HZ optional kit)

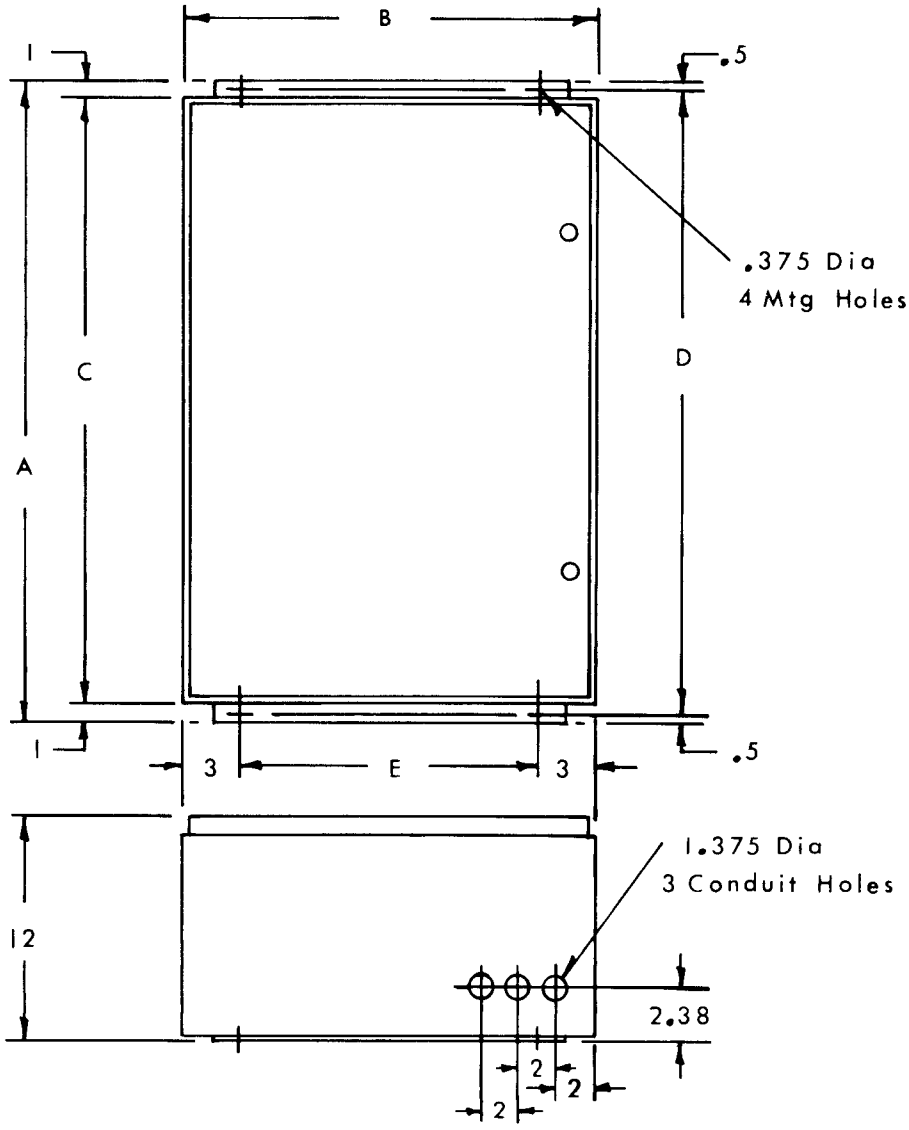
B4.2 Phase Sequence ABC Required

B4.2.1 If other than ABC phasing, or if the input is single phase, gate-pulse-suppression (GPS) will result. The GPS indicating light will become energized to indicate GPS.

B4.2.1 To correct phasing to the required ABC sequence interchange any two of the three incoming AC power leads. DO NOT change internal wiring of the drive.

B4.2.1.2 If GPS is obtained it is necessary to depress the "GPS" pushlight to reset the controller before operation can be re-initiated.

B4.2.1.3 If GPS is initiated by the AC input power single phasing, the power input must be corrected prior to the resetting of the GPS circuitry, see Item 1.1.1 of the Trouble Shooting section of this I.L.



Cabinet Dimensions					
H P	A	B	C	D	E
5	34	22	32	33	16
7.5	34	22	32	33	16
10	38	26	36	37	20
15	38	26	36	37	20
20	38	26	36	37	20
25	38	26	36	37	20
30	42	30	40	41	24
40	42	30	40	41	24

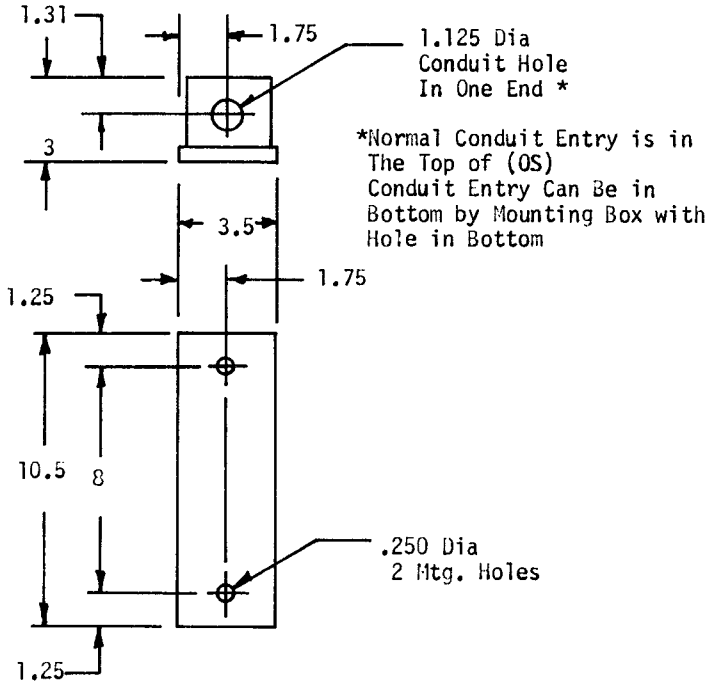
FIGURE A

TABLE I

DC MOTOR RATING (MOT)				FUSE SIZE (A)	CONTROLLER (9RC)				OPERATORS CONTROL STATION (OS) (2)	
					FUSED INPUT		CIRCUIT BREAKER			
HP	ARM VOLTS	(1) FIELD VOLTS	ARM FLA	250 VOLTS AMP	OPEN	ENCLOSED	OPEN	ENCLOSED	STANDARD	SIGNAL FOLLOW (3)
					1492A15	1492A15	1492A17	1492A17	1459A12G02	1459A12G04
5	240	150	18.4	20	G01	G09	G01	G09		
7-1/2			28	30	G02	G10	G02	G10		
10			37	40	G03	G11	G03	G11		
15			53	60	G04	G12	G04	G12		
20			71	100	G05	G13	G05	G13		
25			88	100	G06	G14	G06	G14		
30			111	125	G07	G15	G07	G15		
40			140	150	G08	G16	G08	G16		

NOTES:

(1) Nominal 150 VDC shunt field excitation, terminal blocks F1 to F2.
(2) Remove I.L. 22-1000-6 or -12 (Applies to 22-1000 1 phase drives) from OS and destroy. Use instruction 22-1000-21
(3) If signal follow input is common to more than one drive, each drive must have an isolation transformer.



INSTALLATION PLAN FOR OPERATORS CONTROL STATION (OS)

FIGURE B

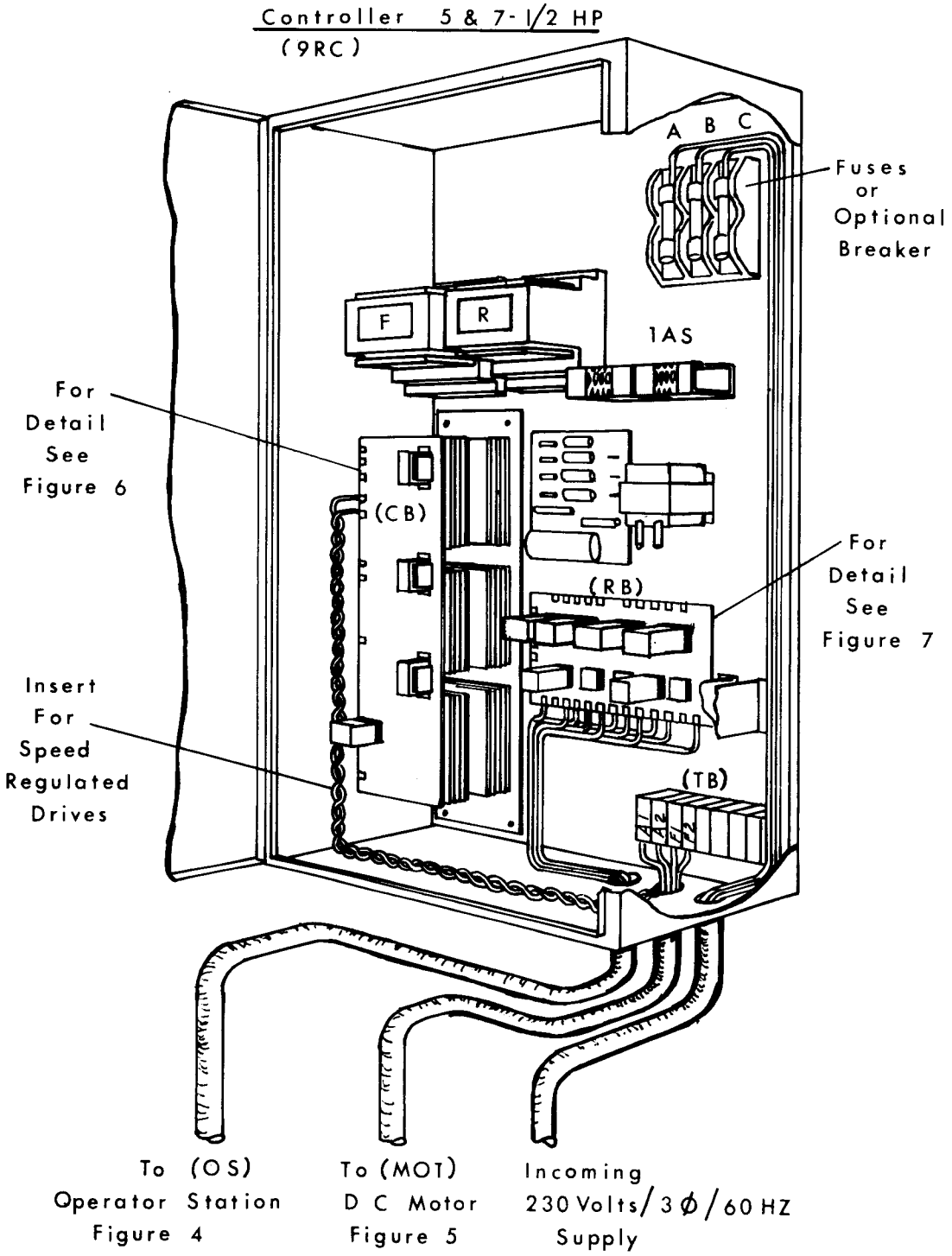

Controller 5 & 7-1/2 HP
(9RC)
A B C
Fuses or Optional Breaker
F
R
1AS
For Detail See Figure 6
(CB)
(RB)
For Detail See Figure 7
Insert For Speed Regulated Drives
(TB)
To (OS) Operator Station Figure 4
To (MOT) D C Motor Figure 5
Incoming 230 Volts/3 Ø/60 HZ Supply

FIGURE - 1

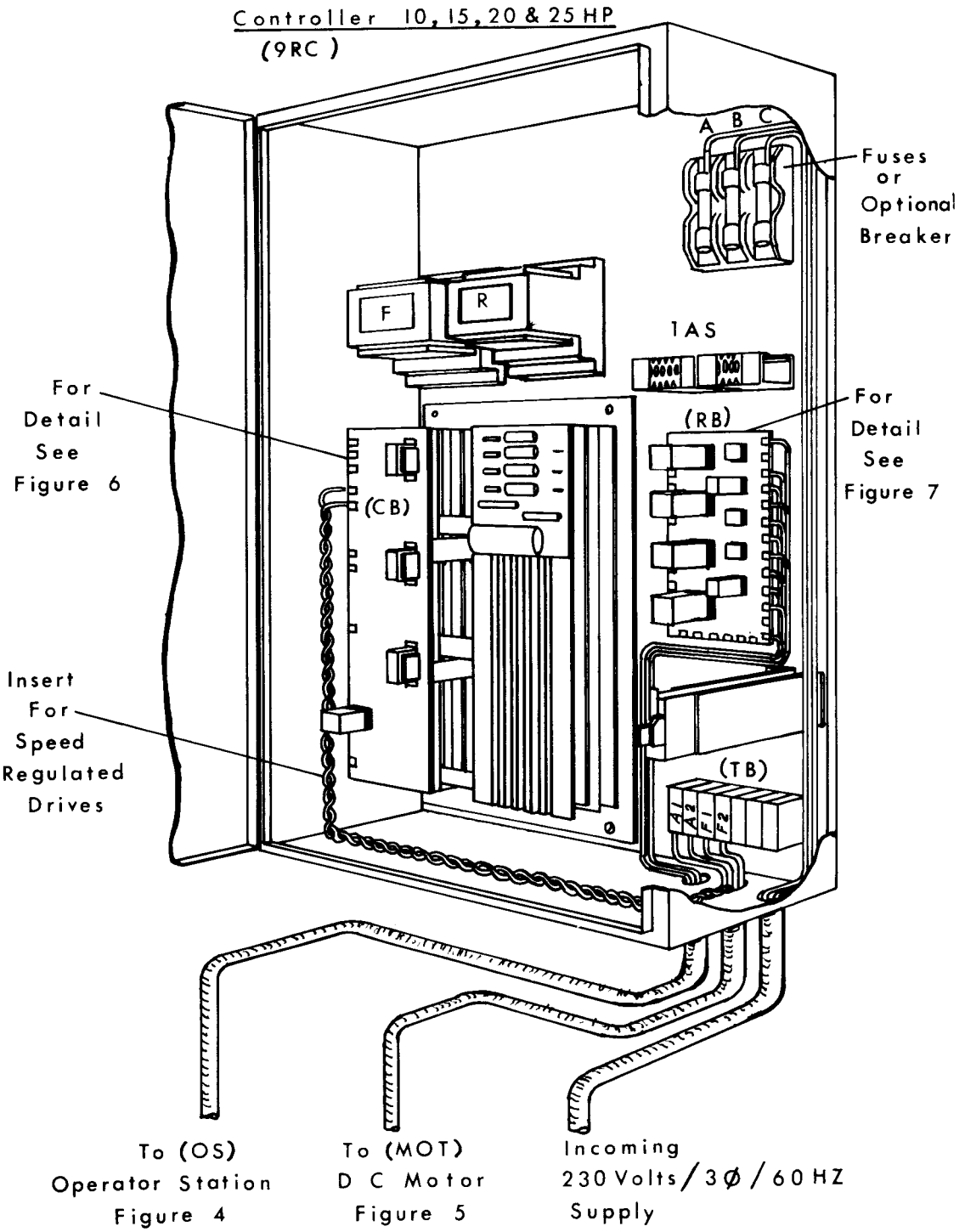

Controller 10, 15, 20 & 25 HP
(9RC)
A B C
Fuses or Optional Breaker
F
R
1AS
(RB)
For Detail See Figure 6
(CB)
For Detail See Figure 7
Insert For Speed Regulated Drives
(TB)
A1
A2
F1
F2
To (OS) Operator Station Figure 4
To (MOT) D C Motor Figure 5
Incoming 230 Volts/3Ø/60 HZ Supply

FIGURE-2

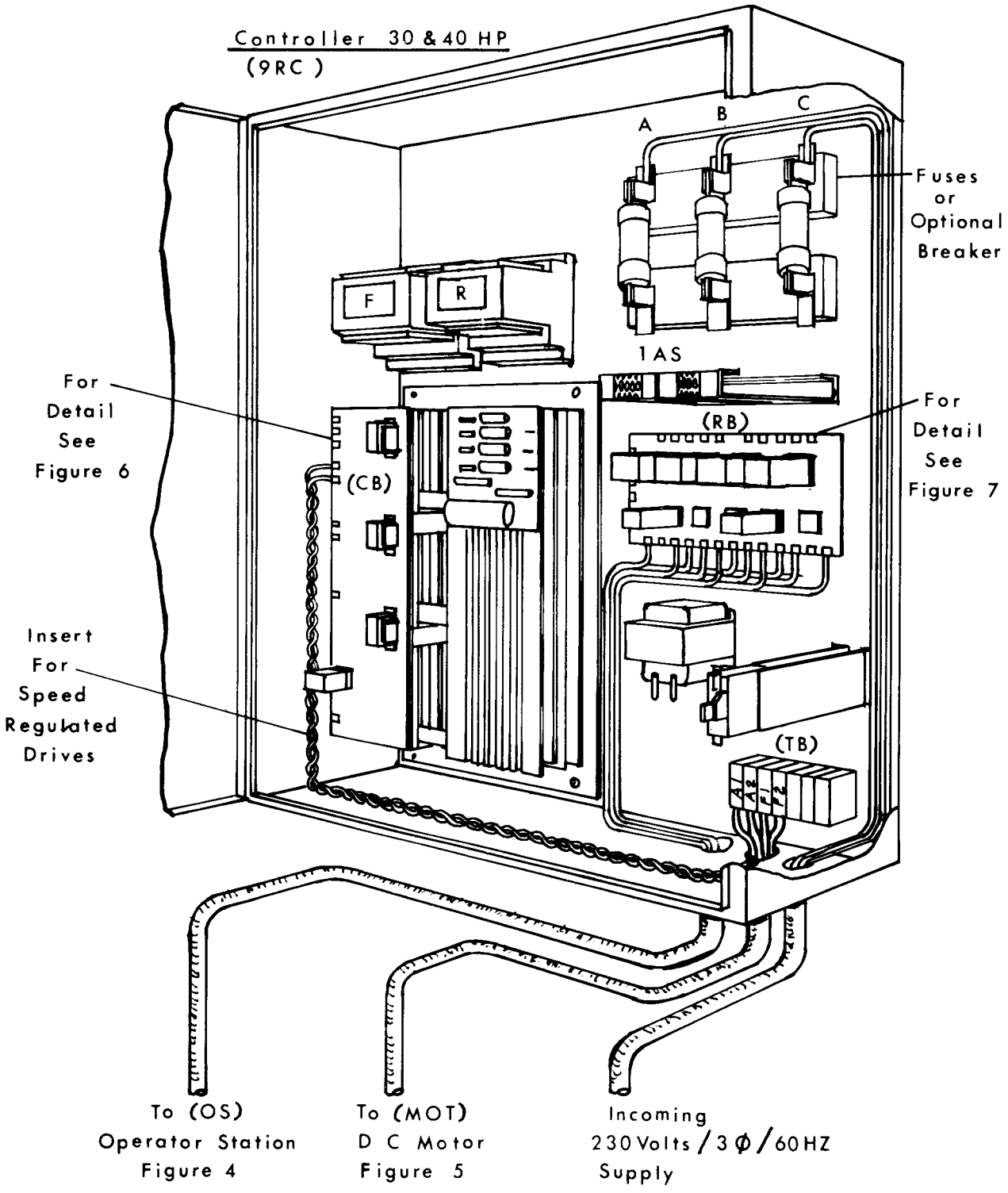

Controller 30 & 40 HP
(9RC)
A
B
C
Fuses or Optional Breaker
F
R
1AS
For Detail See Figure 6
(RB)
For Detail See Figure 7
(CB)
Insert For Speed Regulated Drives
(TB)
To (OS) Operator Station Figure 4
To (MOT) D C Motor Figure 5
Incoming 230 Volts / 3 ϕ / 60 HZ Supply

FIGURE-3

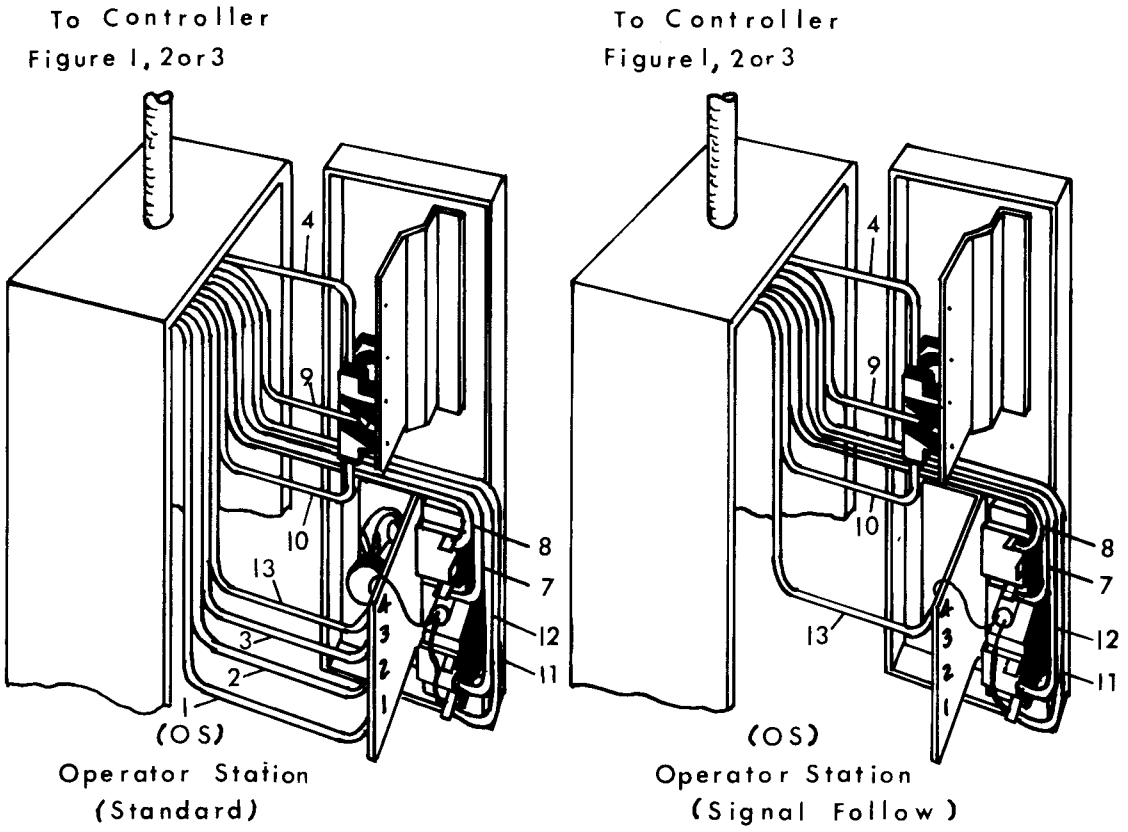


FIGURE-4

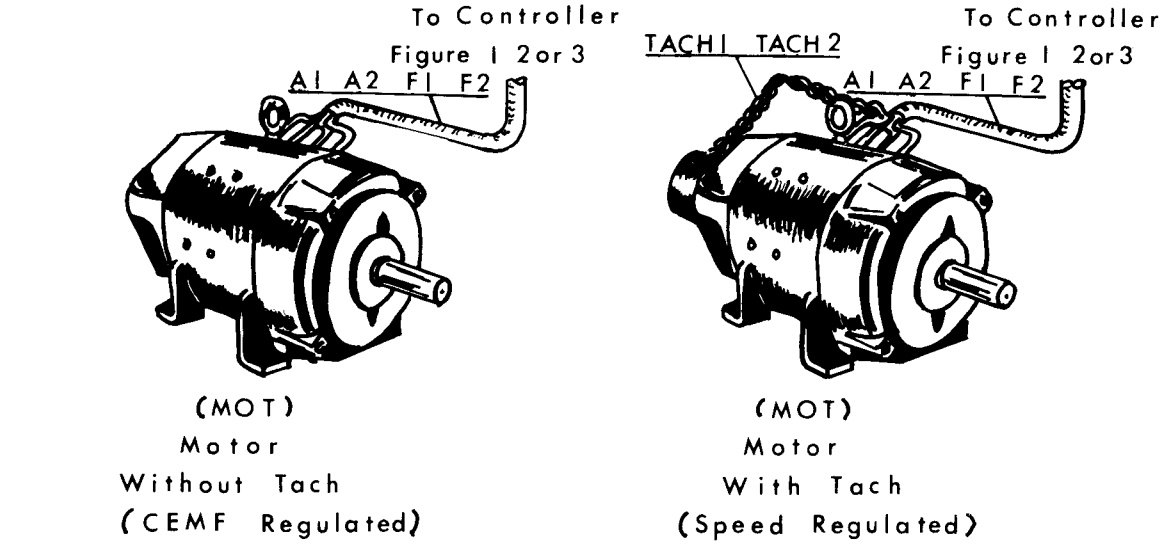
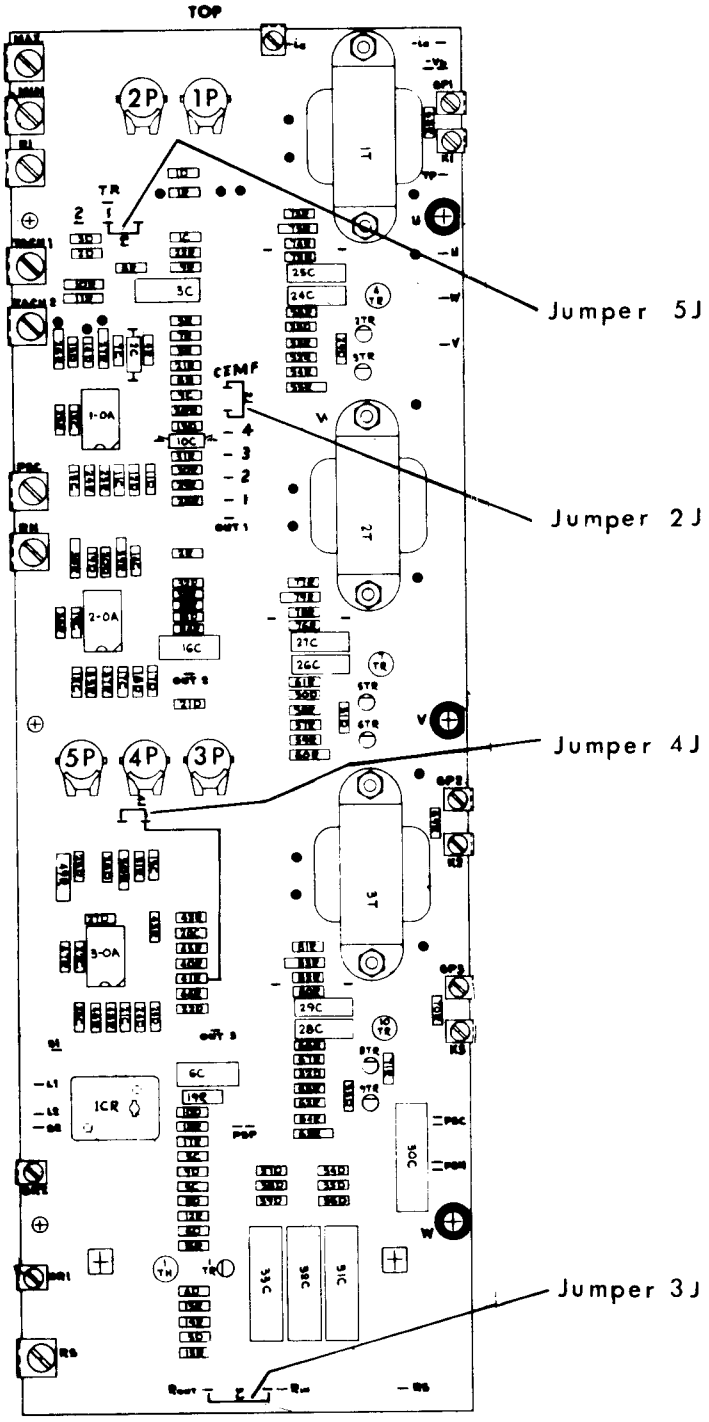


FIGURE-5



REGULATOR CONTROL BOARD
FIGURE 6

RELAY BOARD (9R LOGIC)
(RB)
Standard Drive

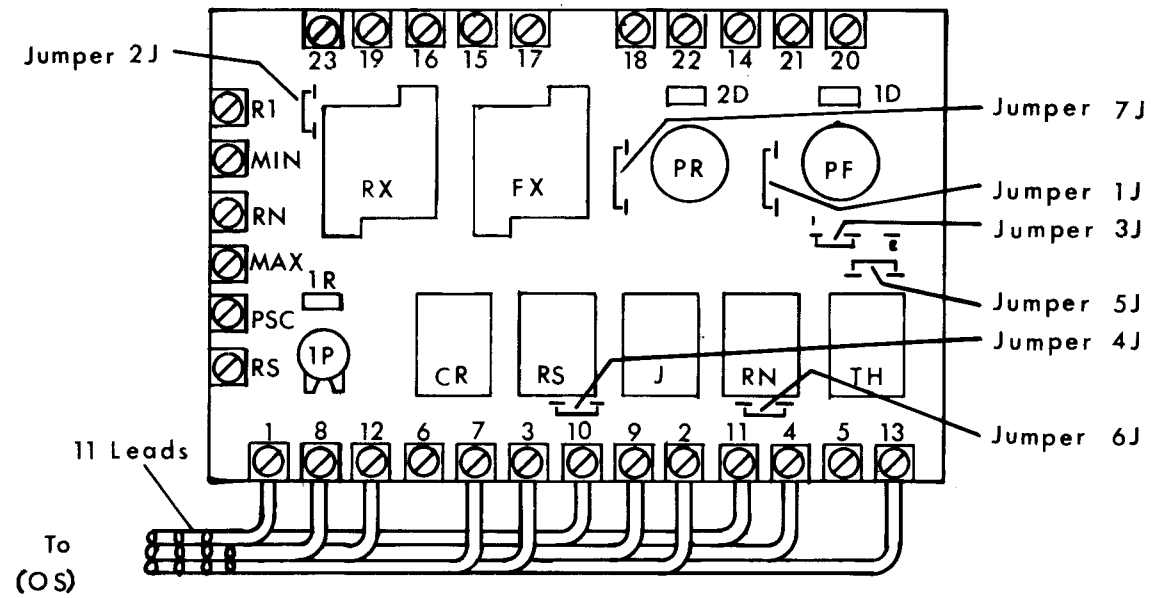
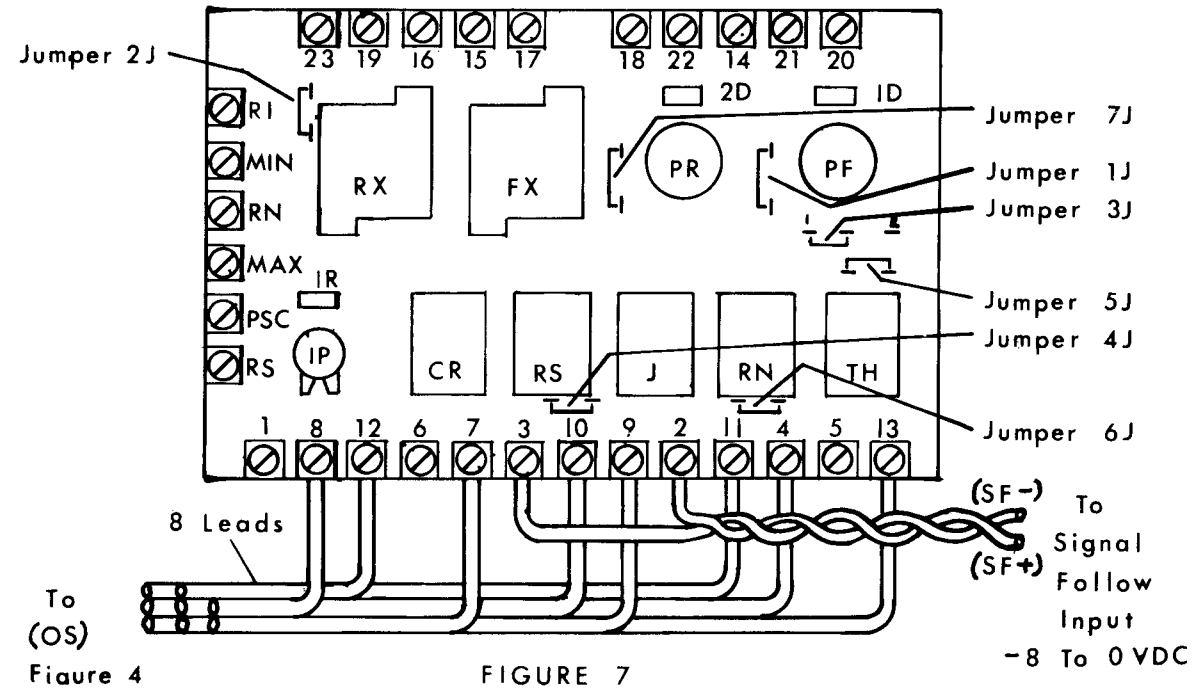


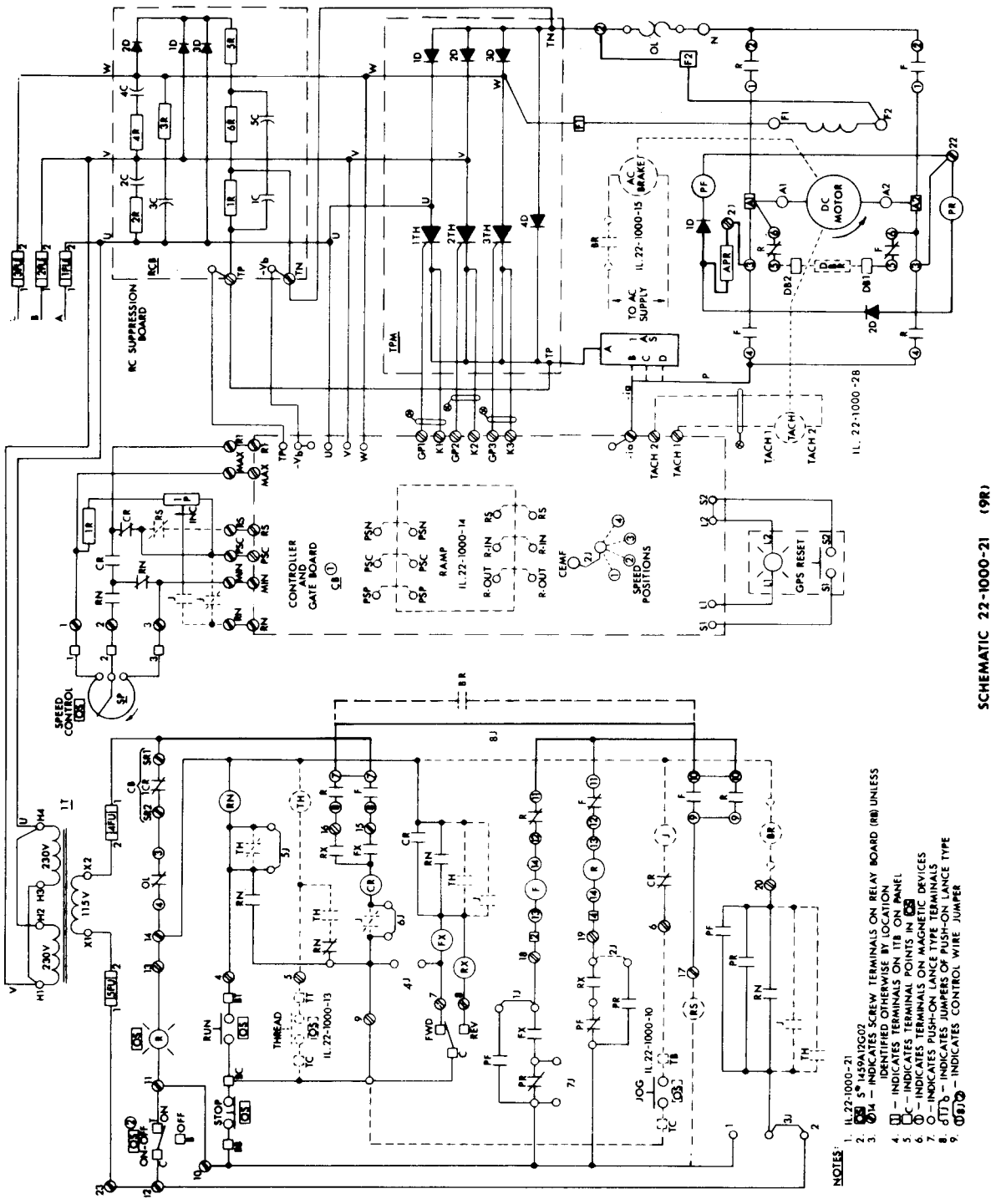
Figure 4

RELAY BOARD (9R LOGIC)
(RB)
Signal Follow Drive



Fiaure 4

FIGURE 7



STANDARD DRIVE (9R)
SCHEMATIC 22-1000-21

FIGURE 8

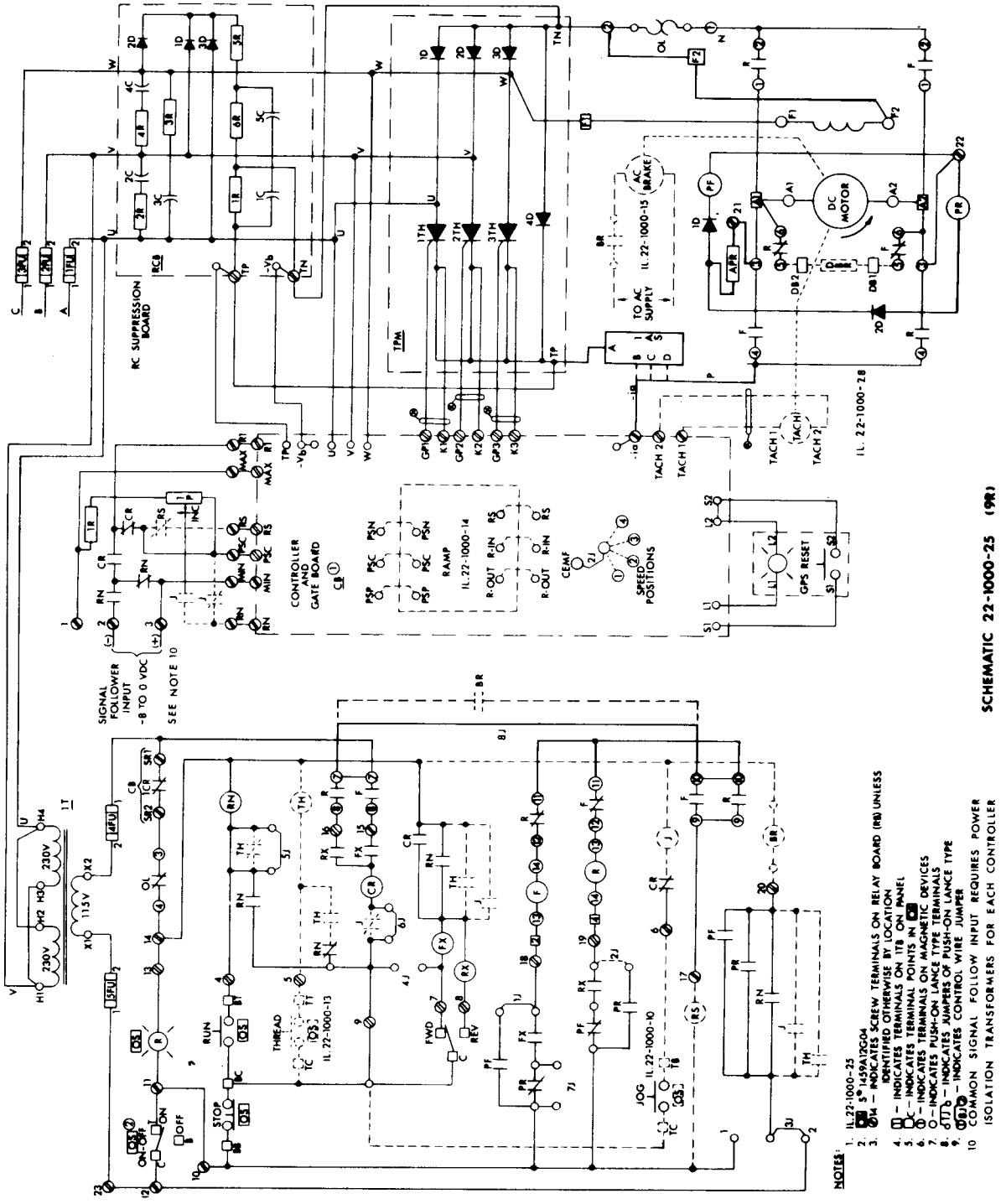

SCHEMATIC 22-1000-25 (9R)
SIGNAL FOLLOW DRIVE (9R)
SCHEMATIC 22-1000-25
NOTES:
1. IL.22-1000-25
2. 5"x5"x.059 ALTGOA
3. – INDICATES SCREW TERMINALS ON RELAY BOARD (RB) UNLESS IDENTIFIED OTHERWISE BY LOCATION
4. – INDICATES TERMINALS ON ITB ON PANEL
5. – INDICATES TERMINAL POINTS IN
6. – INDICATES TERMINALS ON MAGNETIC DEVICES
7. – INDICATES PUSH-ON LANCE TYPE TERMINALS
8. – INDICATES JUMPERS OF PUSH-ON LANCE TYPE
9. – INDICATES CONTROL WIRE JUMPER
10 COMMON SIGNAL FOLLOW INPUT REQUIRES POWER ISOLATION TRANSFORMERS FOR EACH CONTROLLER
RC SUPPRESSION BOARD
CONTROLLER AND GATE BOARD
RAMP IL.22-1000-14
CEMF
SPEED POSITIONS
GPS RESET
TO AC SUPPLY
AC BRAKE
IL.22-1000-15
DC MOTOR
IL.22-1000-28
SIGNAL FOLLOWER INPUT -8 TO 0 VDC
SEE NOTE 10
RUN
STOP
THREAD
FWD
REV
JOG
IL.22-1000-13
IL.22-1000-10

FIGURE 9

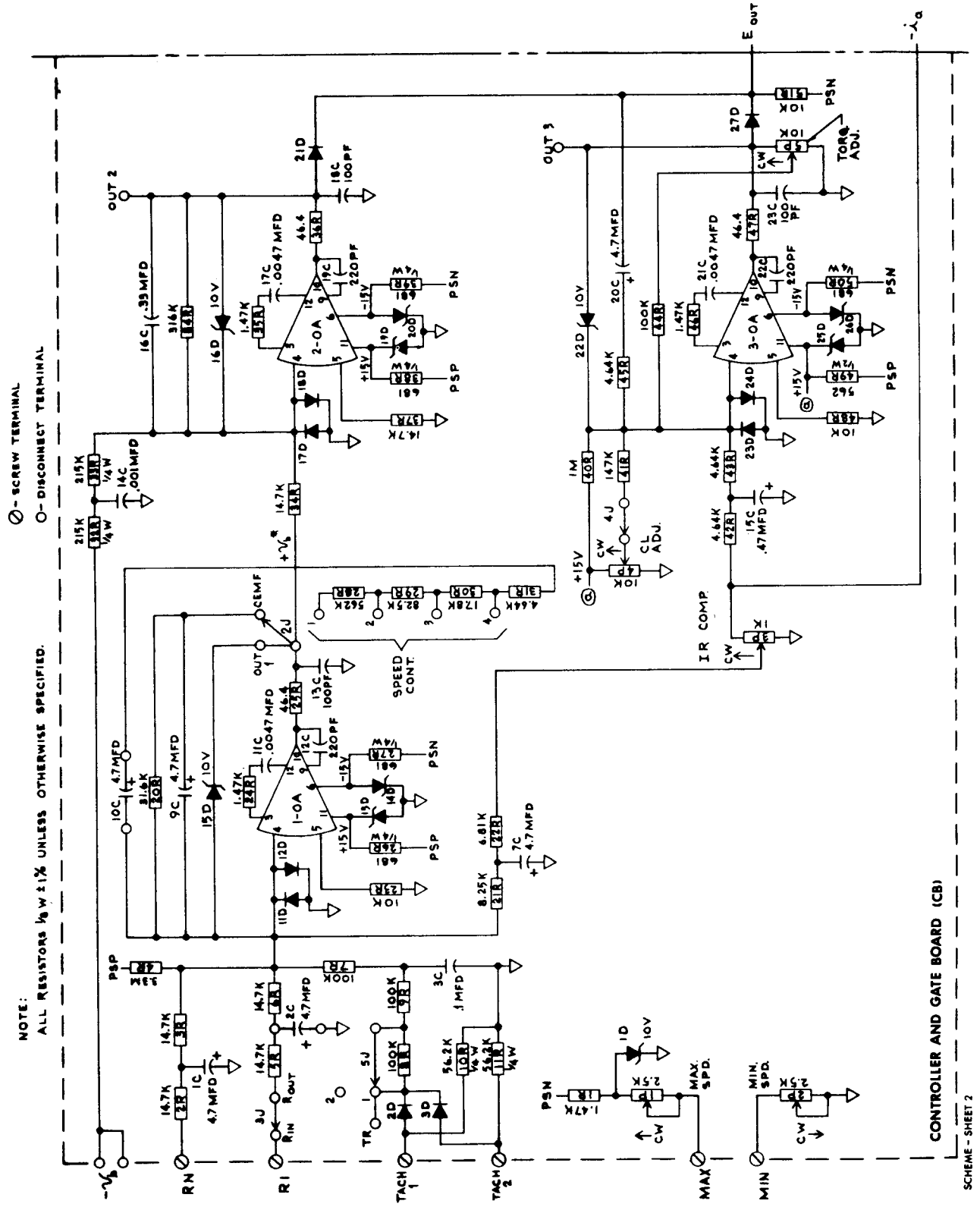

NOTE:
ALL RESISTORS ½ W ±1% UNLESS OTHERWISE SPECIFIED.
⊘- SCREW TERMINAL
O- DISCONNECT TERMINAL
CONTROLLER AND GATE BOARD (CB)
SCHEME - SHEET 2
E OUT
-Ia
OUT 1
OUT 2
OUT 3
SPEED CONT.
IR COMP
TORQ. ADJ.
CL ADJ.
PSN
PSP
CEMF
RN
R1
TACH 1
TACH 2
MAX
MIN
MAX. SPD.
MIN. SPD.
2-0A
1-0A
3-0A

FIGURE 10

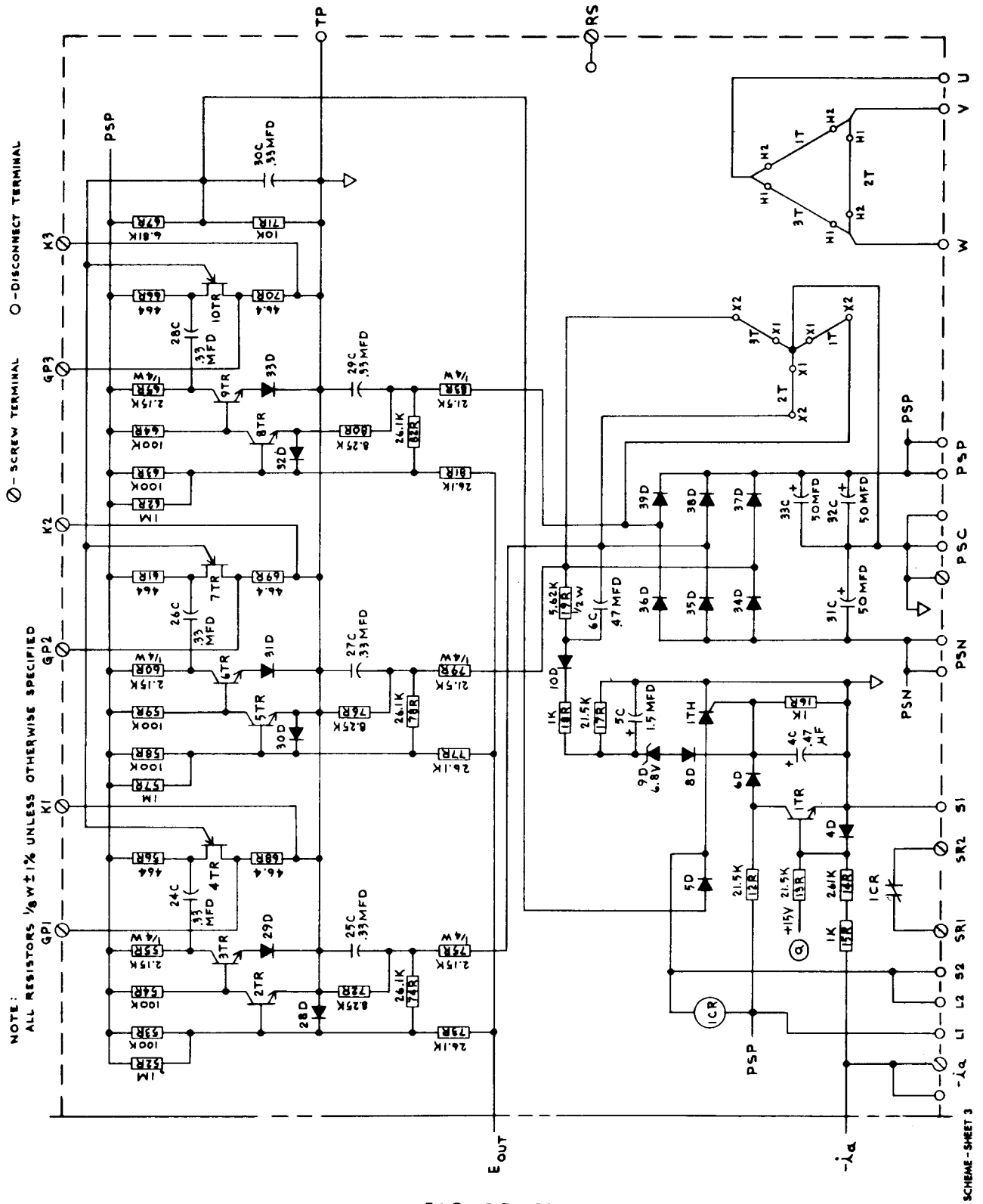

NOTE:
ALL RESISTORS 1/8W ±1% UNLESS OTHERWISE SPECIFIED
O-SCREW TERMINAL
O-DISCONNECT TERMINAL
TP
RS
PSP
K3
K2
K1
GP3
GP2
GP1
E OUT
-ia
SCHEME-SHEET 3

FIGURE 11

START-UP INSTRUCTIONS

SUGGESTED START-UP PROCEDURE

SU1 Check all interconnections per
SU1.1 Standard drive, (Figure 1-7)
SU1.2 Signal Follow Drive, (Figure 1-7)

SU2 Check incoming 3 phase AC supply per section B4.
SU2.1 If a 3 phase power transformer is used, be sure to check transformer voltages.
SU2.1.1 The transformer secondary voltage should be 230 VAC +10%, (-) 6%, A, B, & C.

SU3 Check dc motor connections, see section B2.2; this I.L., to see if connections will give rotation desired.
SU3.1 It is usually a good practice to check dc motor rotation before mechanically connecting the motor to the mechanical load. This is especially true for gear motors for which the gear output shaft rotation may not be obvious.

SU4 Reference Input
SU4.1 Standard Drives - Scheme 22-1000-21
SU4.1.1 Set the speed reference pot SP on OS at minimum.
SU4.2 Signal Follow Drives, Scheme 22-1000-25.
SU4.2.1 Set the signal follow input to minimum, if this is not possible, disconnect the signal input at screw terminals 2 and 3 on relay board RB in 9RC. (Figure 7).

SU5 Set the "ON-OFF" switch on OS to OFF.

SU6 Set the minimum speed pot 2P, on the controller and gate board (CB) to the minimum speed position (maximum CCW position). (Figure 6).

SU7 Set pots 1P (Max. speed), 3P (I.R. Compensation), 4P (Current Limit (C.L..)), and 5P (torque adjust (TA)) in their maximum CCW positions. Pots are on CB. (Figure 6)

SU8 Check the location of jumpers 2J, 3J, 4J, and 5J on CB (Figure 6)

SU8.1 Jumper 2J

SU8.1.1 Voltage regulated drives, 2J is in the CEMF position, factory installed in this position.
SU8.1.2 Speed regulated drives, 2J must be removed from the CEMF position and reconnected in one of the four speed control points. These speed control points are used to compensate for various mechanical time constants.
SU8.1.2.1 Position 1 - Approx. 3 Secs.
Position 2 - Approx. 0.5 Secs., 500 MS
Position 3 - Approx. 0.1 Secs., 100 MS
Position 4 - Approx. 0.02 Secs., 20 MS
SU8.1.2.2 For most installations jumper 2J will produce optimum compensation and stability when in Position 2.

SU8.2 Jumper 3J
SU8.2.1 Jumper 3J is connected between Rin and Rout as shown on (Figure 6).
SU8.2.1.1 3J is removed and scrapped when the "ACCEL-DECEL" kit is installed. See I.L. 22-1000-14 for installation instructions for kit.

SU8.3 Jumper 4J
SU8.3.1 Standard C.L. circuitry.
SU8.3.1.1 4J is in position as shown on Figure 6 for standard internal adjustment of current limit using pot 4P on CB. Figure 6.
SU8.3.1.2 Remove 4J when an external C.L. signal is to be used instead of the standard, "built-in" C.L. signal. One lead of the external signal is connected to the lance pin that is connected to resistor 41R (147K Ohm). The other lead is connected to PSC. Pot 4P (C.L.) is inoperative when jumper 4J is removed and an external C.L. signal is incorporated.

SU8.4 Jumper 5J

SU8.4.1 Jumper 5J is used only with speed regulated drives to recalibrate the tachometer feedback which is connected to screw terminals, Tach 1 and Tach 2 on CB (Figure 6).

SU8.4.1.1 Jumper 5J is used with the following motor RPM and tachometers.

SU8.4.1.1.1 1150 RPM motor base speed with 100 volts/1000 RPM tachometer.

SU8.4.1.1.2 2500 RPM motor base speed with 50 volts/1000 RPM tachometer.

SU8.4.1.2 Jumper 5J is removed and scrapped when the following motor RPM and tachometers are being used.

SU8.4.1.2.1 850 RPM motor base speed with 200 volts/1000 RPM tachometer.

SU8.4.1.2.2 1750 RPM motor base speed with 100 volts/1000 RPM tachometer.

SU8.4.1.2.3 3500 RPM motor base speed with 50 volts/1000 RPM tachometer.

SU9 Check the location of jumpers 1J, 2J, 3J, 4J, 5J, 6J, and 7J on the relay board (RB). (REF Figure 7)

SU9.1 Jumper 1J, and 2J (Figure 7)

SU9.1.1 These jumpers are supplied as part of the "ACCEL-DECEL" Kit. S#1459A15G01, See I.L. 22-1000-14.

SU9.2 Jumper 3J (Figure 7)

SU9.2.1 Jumper 3J is used when the "AC BRAKE" kit, S#1459A18G01 or G02, is incorporated as part of the drive.

SU9.2.1.1 3J is usually connected in position 2 as shown on schematics 22-1000-21 and 22-1000-25. In position 2 the AC brake is set only after the motor armature voltage has been reduced down to the drop-out voltage of anti-plugging relay PF. (approximately 10 to 11 VDC). The AC brake is used primarily as a holding brake. Position 2 is always used when the ACCEL-DECEL Kit is incorporated in the drive functions.

SU9.2.1.2 When 3J is in position 1 the AC brake will be set in the same manner as in position 2 when the "STOP" pushbutton initiates stop, but if the "ON-OFF" switch is turned to the OFF position the AC brake is immediately set and the brake functions immediately to bring the motor to a stop and then the brake functions as a holding brake.

SU9.3 Jumper 4J (Figure 7)

SU9.3.1 Jumper 4J is removed for reversing drives as shown on schematics 22-1000-21 and 22-1000-25.

SU9.4 Jumper 5J (Figure 7)

SU9.4.1 Jumper 5J must always be used except when the "THREAD" Kit, S#1459A17G01 is used. See I.L. 22-1000-13, in the "THREAD" Kit.

SU9.5 Jumper 6J (Figure 7)

SU9.5.1 Jumper 6J must always be used as shown in schematics 22-1000-20 and 22-1000-24 except when the "JOG" Kit S#1459A16G01 is used. See I.L. 22-1000-10, in the "JOG" kit.

SU9.6 Jumper 7J (Figure 7)

SU9.6.1 Jumper 7J is removed for reversing drives as shown on schematics 22-1000-21 and 22-1000-25

The Drive is now ready to have AC Power Applied.

CONTROLLER & GATE BOARD S#1492A10G01

DESCRIPTION OF OPERATION CB

(Figure 6)

The 22-1000, 3 phase controller and gate board (CB) provides gate pulses to the 3 thyristors in the TPM (1TH, 2TH, and 3TH), and controls the firing angles of these pulses in order to provide controlled power for operation of 240 VDC motors from 5 HP through 40 HP. Gate pulse suppression (GPS), phase-sequence-protection, and single-phasing protection are provided.

The CB can be broken down into 3 basic circuits as an aid in the explanation of their functions:

1. Gate and Power Supply Circuit.
2. GPS circuit and Phase-Sequence-Protection.
3. Reference and Feedback Control Circuit.

Following is a simplified description of operation for each of the three basic circuits.

1. Gate and Power Supply Circuit

The power supply consists of three single-phase isolation transformer, 1T, 2T, and 3T, connected to form a 3 phase delta-wye transformer. The 3 phase wye output is rectified by the 3 phase full-wave bridge made-up of diodes 34D through 39D, filtered by 31C, 32C, and 33C to provide + 24 VDC, PSP (+24 VDC) to PSC, PSN (-24 VDC) to PSC. The secondaries of transformers 1T, 2T, and 3T also provide the timing AC waves for sequencing of the gate pulses for firing thyristors 1TH, 2TH, and 3TH in the TPM. The three gating circuits are identical, each providing a gating pulse at the proper phase-time to cause its associated thyristor to be gated on. The three gating circuits are shown on Figure 11 this I.L..

2. G.P.S. Circuit and Phase Sequence Protection

G.P.S. is initiated when the peak armature current reaches approximately 350% of rated armature current. At this time no further firing pulses are supplied to the thyristors, and the armature contactor is tripped out. Armature current is sensed by shunt 1AS, which is calibrated (positions B to A, C to A, and D to A), to hold the absolute value of current signal (-ia) approximately the same irrespective of motor HP. The GPS indicating light is normally OFF and is ON only when a GPS exists. To reset GPS the screw terminals S1 to S2 must be momentarily shorted by the "GPS RESET" pushbutton.

Phase sequence and single-phase protection and indication (by GPS indicating light) is provided. peration of the "GPS RESET" pushbutton will reset the drive.

Operation of the drive cannot be obtained if incorrect phasing exists. Contacts of relay 1CR, screw terminals SR1 to SR2, will open at the initiation of GPS and prohibit the energization of closing of the armature contactor, or any sequencing relay.

3. Reference and Feedback Control Circuits

This circuitry monitors all reference inputs and desired feedback inputs, compares them and computes an error or output signal voltage "E Out" which is fed to the gate pulse generator which gates thyristors 1TH, 2TH, and 3TH in the TPM to produce the desired controlled power supplied to the dc drive motor.

Operational amplifier (2-OA) is a voltage controller which sums armature voltage -Vb to TP (PSC) and the output of amplifier (1-OA) to develop a speed reference signal.

Operational amplifier (1-OA) is an inverting amplifier which sums the negative speed reference signal with the negative current feedback signal set by I.R. Comp pot 3P with CEMF feedback when jumper 2J is in the CEMF position to provide the bus voltage reference signal into the input of amplifier (2-OA). For speed regulated drives the "IR COMP" pot 3P is set in the maximum CCW position and Jumper 2J is connected to one of the four speed control positions to compensate for dc drive mechanical time constants. The output of amplifier (1-OA) is the speed reference input into amplifier (2-OA).

Amplifier (3-OA) is the current controller that is connected in parallel with voltage controller amplifier (2-OA) to develop an output "E Out" for gating of the thyristors in the TPM. Diodes 21D and 27D on the outputs to amplifiers (2-OA) and (3-OA) function to permit only one of the two controllers to control at any time. The least negative outputs between (2-OA) (Out 2) or (3-OA) (Out 3) assumes control of E Out, the controller that is non-conducting with the most negative output will go into negative limit. Diodes 21D and 27D always function to cause one of the parallel controllers to be biased out of control thereby permitting only one controller to be in control.

In speed regulating drives the tachometer output is connected to screw terminals (Tach 1) and (Tach 2) on (CB). Polarity is not important since the signal is rectified within the feedback circuitry.

Terminals (R1) and (RN) are two reference inputs into (CB).

Specifications and Ratings of CB

Input voltage (U, V, W) 230 VAC, 3 phase 60 HZ ± 10%.

DESCRIPTION	CONTROLLER DESIGNATION	TESTER DESIGNATION	BOARD VOLTAGES
Armature Voltage	$-V_b$ to TP	$-V_b$ to TP	0 to -300 VDC
Armature Current	$-I_a$ to PSC	$-I_a$ to PSC	-0.5 VDC at FLA Nom
Input Reference	RIN to PSC	$-V_r$ to PSC	0 to 8 VDC
Speed Controller Output	OUT-1 to PSC	V_{so} to PSC	-0.5 to +10 VDC
Voltage Controller Output	OUT-2 to PSC	$-V_{vo}$ to PSC	+0.5 to -10 VDC
Current Controller Output	OUT-3 to PSC	$-V_{io}$ to PSC	+0.5 to -10 VDC
Tach Feedback	TR to PSC	V_t to PSC	0 to 150 VDC
Power Supply Positive	PSP to PSC	PSP to PSC	+25 VDC Nominal
Power Supply Negative	PSN to PSC	PSN to PSC	-25 VDC Nominal
Gating Reference	E-OUT to PSC	Not Available	0 to -10 VDC

Operation Check

1. Apply correct 3 phase AC power to A, B, & C. If phasing is incorrect the controller will immediately go into GPS and cannot be placed into operation. Determine what is wrong, correct cause, and continue on the operation check.
2. Check transformer 1T voltages per the schematic.
3. Check the shunt field voltage, terminal blocks F1 to F2, the voltage should nominally be 150 VDC ± 5% with F1 positive.
4. Set the "ON-OFF" switch on (OS) to ON. The indicating light on (OS) should be lit.
5. Depress the "RUN" pushbutton on (OS). The dc motor should start to rotate at a slow speed. Check motor rotation and if incorrect, depress the "STOP" pushbutton on (OS). Remove AC power and go back to step 1.1.6 in this I.L. to correct the motor rotation. Re-apply AC power, depress the "RUN" pushbutton and proceed to step 6.
6. Slowly increase the setting of minimum speed pot 2P on (CB) (Figure 6) until the desired minimum motor RPM is obtained while the main speed pot on (OS) is reset CCW. (2P has a range of approximately 0 to 70% motor base RPM).
7. Slowly adjust the speed pot on (OS) CW until the maximum CW position is obtained. Trim the maximum speed pot 3P on (CB) (Figure 6) CW to obtain motor base speed conditions, approximately 250 + 10 VDC N.L. at the motor armature terminals (A1, A2) with rated hot motor field excitation (Motor nameplate data) for a CEMF regulated drive. For speed regulated drive trim to motor nameplate base speed ± 1%. Return the speed pot to the minimum speed position and trim the minimum speed pot 2P, if required. (Figure 6).

8. Setting of CURRENT LIMIT (CL)

C.L. is set by pot 4P on CB. (Figure 6) CW rotation of pot 4P increases the value of armature current at which armature current is limited. The range of 4P is approximately 25% to 175% of dc motor Full Load Amperes (FLA). (25% FLA in CCW position, 175% FLA in CW position). Perform this section of I.L.

a. Turn the "ON-OFF" switch on (OS) to the OFF position.
b. Pots 4P and 5P on CB should be set in the CCW position.
c. Disconnect the dc motor shunt field at terminal block F1, (C.L. is set under stall conditions). Normally the dc motor cannot develop enough torque to cause the motor to rotate with no shunt field excitation. Monitor the motor rotation while setting C.L. If motor starts to rotate above a creep speed STOP the drive and block the motor shaft before continuing this set up.
d. Insert a dc ammeter in the motor armature circuit that has a range of at least 200% of motor rated full load current. Rated current is stamped on the motor nameplate, or typical Full Load Current(FLA) is shown for each motor HP in Table 1.
e. Apply power and start the drive. The motor armature current, under stalled conditions, will rapidly increase to approximately 150% of motor FLA. Carefully but quickly adjust pot 4P CW until stalled armature current of 150% is obtained. Curves showing the relationship of CL initiation % FLA to stalled % FLA are shown in Figure CL. These are typical curves, with current feedback (-ia) obtained from shunt 1AS. Current feedback is between TP (PSC) and terminal -ia on CB, TP be positive. CFB, -ia to TP is approximately -0.5 VDC for rated FLA for all HP ratings, this is obtained by selection of positions B to A, C to A, or D to A on shunt 1AS.
f. Turn switch on (OS) to OFF, remove AC power and allow drive to cool.

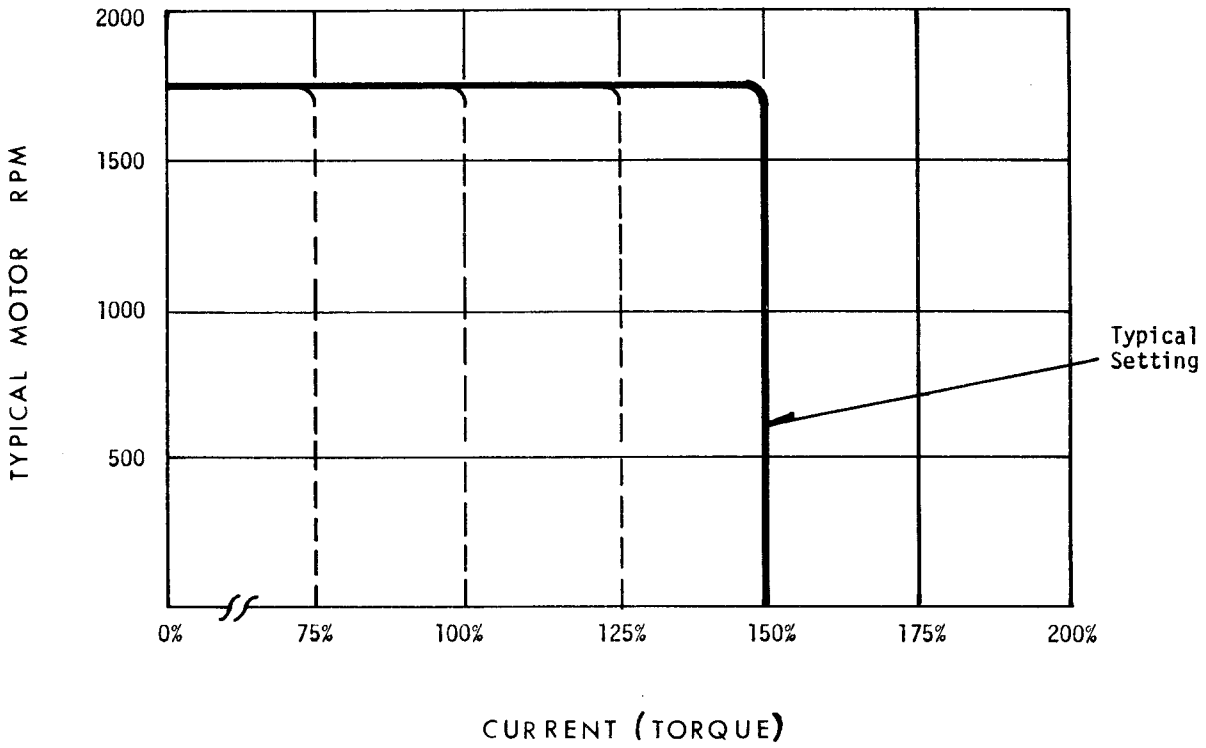


FIGURE CL

9. Setting of Torque Taper

Pot 5P on CB (Figure 6) is used to set torque taper, if and when used.

Pot 5P is normally set in the maximum CCW position, minimum contribution to the regulator.

Torque taper is of use in applications that require increased motor torque at low motor speeds and reduced torque at high motor speeds such as in a winder for increased torque as build-up increases the diameter of the reel. Figure TT is a typical torque taper family of curves showing ranges of taper possible.

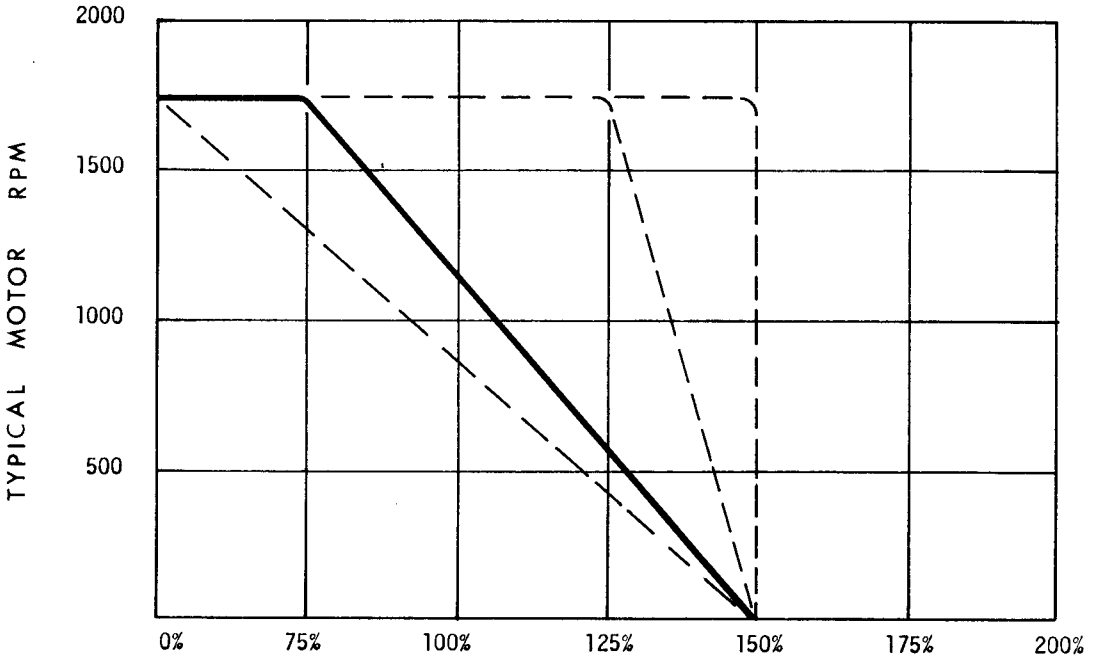


FIGURE TT

10. Setting of I.R. Compensation

I.R. Compensation is set by pot 3P on CB (Figure 6) CW adjustment increases the percent of compensation.

3P is always set for zero compensation (maximum CCW position) for speed regulated, tachometer feedback, drives.

For CEMF regulated drives pot 3P is set to give flat motor RPM full-load to minimum load. This setting is usually made at some operating speed of approximately 20 to 25% of motor base speed. Pot 3P is adjusted to obtain the same motor RPM at rated full-load current as at minimum load at this low motor RPM. If the minimum operating RPM is greater than 20 to 25% of motor base speed, I.R. Comp can be set at the lowest operating speed.

If flat compensation is set at a high motor speed and operation is at a much lower motor speed, instability will result due to over compensation at the low motor speeds.

TROUBLE SHOOTING

Trouble shooting is primarily a matter of common sense and the ability to diagnose trouble to determine probable causes and then to follow a definite procedure in isolating and correcting the cause or causes of the trouble.

Typical Malfunctions, Causes, and Remedies

1. Gate Pulse Suppression (GPS) occurs when AC power is applied.
1.1 Probable cause is incorrect phasing of the incoming 3 phase AC supply. The phasing rotation is not ABC or the AC input is single-phase.
1.1.1 Suggested solution or remedy.
If incoming AC input is 3 phase, interchange any two of the 3 incoming AC leads where they connect to the controller. (DO NOT change any controller leads to correct for incorrect incoming phase sequence). If the input is single-phase then check main supply for availability of all phases. Check the 3 phase protective devices in the controller, circuit breaker C/B or the three AC fuses 1FU, 2FU, and 3FU. Determine the cause of the single-phase and correct same.

2. No AC Control Power.
2.1 Probable causes and corrective measures.
2.1.1 No AC Power to primary of transformer 1T, open the circuit to the transformer. If any one of the fuses 1FU, 2FU, or 3FU were blown, the drive would be in GPS due to single-phase input; if two fuses were blown no AC power would exist. Replace blown fuses.
2.1.2 No AC control power, between screw terminals 23 on RB and SR1 on CB.
2.1.2.1 One or both control fuses 4FU or 5FU are blown; replace fuses.
2.1.3 AC Control Power, between screw terminals 23 on RB and SR1 on CB, but no AC control power between screw terminals 23 to 14 on RB.
2.1.3.1 Overload relay OL tripped; Reset OL.
2.1.3.2 Open circuit between screw terminals SR1 and SR2 on CB. The relay contacts of 1CR are open, a defective relay 1CR is on CB, or GPS exists.
2.1.3.3 Interconnections between 4FU and screw terminal 14 on RB are open, or from 5FU to screw terminals 13, to 12, to 11 on RB are open. Tighten all connections.

3. Indicating light on OS is ON but cannot start drive.
3.1 GPS exists.
3.1.1 See Item 1 in this section.
3.2 Interconnections between OS and RB are loose, open, or incorrectly made.
3.2.1 Correct interconnections.
3.3 "STOP" pushbutton contacts open.
3.3.1 Re-Align operator with contact block, or replace defective contact block.
3.4 "RUN" pushbutton inoperative.
3.4.1 Re-Align operator with contact block, or replace defective contact block.

4. Main contactor F becomes energized, but no reference signal exists between screw terminals R1 and PSC on CB.
4.1 Relay CR on RB does not pick-up.
4.1.1 Jumper 6J on RB is missing or is not connected securely.
4.1.2 Interlocks F in CR circuit not closing.

6. Drive starts and runs, will accelerate as speed pot is adjusted CW, but is very slow in accelerating.

6.1 Load is high and drive is in current limit.

6.1.1 Check armature loading by inserting a suitable dc ammeter in the motor armature circuit. Check Table 1 for typical dc motor FLA or check the motor nameplate. If meter indicates that the armature current is at CL setting, (See Item 8 of operational check in this I.L.), the dc motor is accelerating under C.L. control. If C.L. is set properly and the loading on the dc motor is heavy, a check of loading and dc motor selection should be made to determine if drive selection is correct.

6.1.1.1 If dc motor loading is not excessive, (at desired C.L. value) check C.L. setting and if too low reset per Item 8 of operational check.

7. Cannot obtain rated armature voltage, or motor base speed with speed pot in maximum speed position.

7.1 Check the reference signal, screw terminals R1 to PSC on CB. The voltage should be approximately (-8 VDC) with PSC positive.

7.1.1 If incorrect see Item 7 of Operational Check, this I.L. for instructions in the adjustment of maximum speed pot 3P on CB.

8. Minimum speed incorrect.

8.1 See Items 5 and 6 of operational check in this I.L. for instructions on the adjustment of minimum speed pot 2P on CB.

9. SPEED REGULATED DRIVES

9.1 Speed regulation is poor.

9.1.1 Check to be sure that jumper 2J on CB is in one of the four speed control positions, and not in the CEMF position. (2J is normally in the CEMF position when shipped from the factory and must be moved to one of the speed control positions at time of installation. See Item 3 reference and feedback control circuits for instruction in the positioning of jumper 2J.

9.2 Drive has a tendency to become unstable when load is applied or at the end of acceleration.

9.2.1 Jumper 2J may be in the wrong position, if not in position 1 move jumper to next lower numbered position. (ie from 4 to 3, 3 to 2, or 2 to 1). Recheck operation.

9.3 Drive is very sluggish in response.

9.3.1 Move jumper 2J to next higher numbered position. (1 to 2, 2 to 3, or 3 to 4). Recheck operation.

9.4 Cannot reach maximum speed but reference signal into R1 to PSC on CB is at least (-8 VDC) PSC positive.

9.4.1 Check to see if jumper 5J is connected on CB. Jumper 5J should only be used if the tachometer voltage Tach 1 to Tach 2 is 150 volts or less at maximum motor RPM. If the tach voltage is greater than 150 volts, remove and discard jumper 5J (Refer to section SU8.4).

9.4.2 Check to see if operation is in current limit, check load using suitable ammeter in armature circuit. Do not set C.L. above 150% FLA if operation in CL is to exceed one minute in duration for each eleven minutes of operation, or damage to motor and or controller can occur.

If the preceeding tabulation of typical malfunctions that can occur on any type of static (SCR) type of drive, and the suggested causes and remedies does not diagnose or lead to corrective measures contact your nearest Westinghouse Representative.