

SECTION VIII

OPTIONS

Options are available for Series 3120 controllers which increase the functional use of the basic controller. Table 8-1 lists all available options and allowable option combinations.

Options can be added to the controller at any time. Each option consists of all required components, mounting hardware, and instruction sheet.

Table 8-10: ALLOWABLE OPTION COMBINATIONS

REMARKS	OPTION GROUP	OPTION NUMBER	OPTION	TYPE ^a	MOUNTED IN MODULE ^a
Feedback Options: Choice of one within this group unless Option 1037 is selected. Can be combined with options selected from all groups except Group C.	A ^b	1037	Input and Feedback Interface Board	SP	Y ^c
		1061C	Feedback, Tachometer, AC or DC	SP	Y
		1062A	Feedback, Digital Pulse Generator	SP	Y
		1064	Torque (Current) Limit Control	SP	Y
		1190	Torque Taper	SP	Y
Input Options: Choice of one within this group unless Option 1037 is selected. Can be combined with options selected from all groups except Group C. Note: (a) Specify AC Load Current. Current transformer must be mounted separately.	B ^b	1034 (Std)	Acceleration/Deceleration, Linear	STD	Y
		1037	Input and Feedback Interface Board	SP	Y ^c
		1049	Follower, External DC Signal	SP	Y
		1050	Follower, External AC Signal	SP	Y
		1050A (a)	Follower, AC Current Transducer	SP/SE	Y
		1051	Follower, Master Isolated Reference Controller	SP	Y
		1055	Follower, AC or DC Tachometer Generator	SP	Y
		1057A	Follower, Digital Pulse Generator	SP	Y
		1059	Reference, Precision	SP	Y
1065	Isolator, Speed Potentiometer	SP	Y		
Input and Feedback Options: Choice of one within this group. Can be combined with options selected from all groups except Groups A and B.	C ^b	1064A	Follower, Current Regulator	SP	Y
		1191	Centerwind Torque Taper	SP	Y
		1220	Constant Velocity Winder	SP	Y
(Continued on next page)					

Table 8-10: ALLOWABLE OPTION COMBINATIONS

REMARKS	OPTION GROUP	OPTION NUMBER	OPTION	TYPE ^a	MOUNTED IN MODULE ^a
<p>Miscellaneous Options: Choice of any or all within this group. Can be combined with options selected from any and all groups.</p> <p>Notes: (a) Requires Option 1076, Anti-plug Protection (b) Line Reactor on Models 3121 and 3122 is mounted within the 3120M Module (c) Requires Option 1061C, Tachometer Feedback (d) Can only select Option 1029 or 1079, not both (e) Cannot be used with options from Group B (f) Does not include provisions for switching (g) Requires Option 1004 or 1004C (h) Can only select Option 1058 or 1058A, not both (i) Can only select Option 1081B or 1081C, not both</p>	D ^d	1011	Circuit Breaker Handle & Enclosure Mod	S	N
		1018	Fuses, Current Limiting	S	N ^c
		1019B (g)	Jog Reverse	S	N
		1024	Preset Speed, Independent, Adjustable	S	N ^c
		1027 (Std)	Field Economy	STD	Y
		1029 (c)	Field Regulator	S	N ^c
		1032	Potentiometer, Motor Operated	S	N ^c
		1037A (g)	Input and Feedback Adapter, 1-Position*	S	N ^c
		1037B (f)	Input and Feedback Adapter, 2-Position*	S	N ^c
		1039 (a)	Dynamic Braking	S	N
		1047 (e)	Controlled (Ramp) Stop	S	N ^c
		1058 (h)	Follower/Manual Mode Select (Relays)	S	N ^c
		1058A (h)	Follower/Manual Mode Select (Toggle-Switch)*	SE	N
		1066	Light, POWER ON	S	N ^c
		1067	Light, MOTOR ON	S	N ^c
		1070	Meter, Load, Door Mounted	S	N ^c
		1070A	Meter, Analog Speed, Door Mounted	S	N ^c
		1070B	Meter, Digital Speed, Door Mounted	S	N ^c
		1072A	Auxiliary Contacts	S	N
		1073	Test Meter	STD	Y
		1074 (b)	Reactors, AC Line Inductors	S	Y ^e
		1076	Antiplug Protection (APR)	SP	Y
		1077	Field Loss Protection	S	N
		1079 (d)	Field Power Supply, Constant Current	S	Y ^c
		1081B (i)	Torque (Current) Monitor*	S	N ^c
		1081C (i)	Torque (Current) Monitor, Inverse	S	N ^c
		1085	Controller Without Enclosure	S	N
		1135	Thermal Overload, SCR Bridge	S	Y
		1139	Enclosure, Larger NEMA 1	S	N ^c
		1147	Enclosure Mod, NEMA 12, Ventilated	S	N ^c
1165	Paint Finish, Special	S	N		
1166	Instruction Manual	-	N		
1170	Fans, SCR Bridge	S	Y		
1230	Contactors, Two-Pole	SE	N		
(Continued on next page)					

Table 8-10: ALLOWABLE OPTION COMBINATIONS

REMARKS	OPTION GROUP	OPTION NUMBER	OPTION	TYPE ^a	MOUNTED IN MODULE ^a
Reversing Options: Choice of one within this group. Can be combined with options selected from any and all groups Note: (a) Requires Option 1076, Antiplug Protection	E ^d	1004 (a)	Reversing, Armature (Magnetic Control)	S	N
		1004C (a)	Reversing, Field	S	N ^c
Jog Forward Options: Choice of one within this group. Can be combined with options selected from any and all groups.	F ^d	1019	Jog Forward (Push-Button Selection)	S	N
		1019A	Jog, Hard (Push-Button Selection)	S	N ^c
		1022	Jog, Toggle-Switch Selection*	SE	N
Thread and Crawl Options: Choice of one within this group. Can be combined with options selected from any and all groups Note: (a) Requires Option 1061C, Tach Feedback	G ^d	1023	Thread (Preset, Independent, Adjustable)	S	N
		1023A (a)	Crawl (Preset, Independent, Adjustable)	S	N
Blower Motor Control Options: Choice of one within this group. Can be combined with options selected from any and all groups Note: (a) Unit-cooled motors require two blower circuits.	H ^d	1071 (a)	Blower Motor Control	S	N ^c
		1071A (a)	Blower Motor Fuses	S	N ^c
Operator Control Options: Choice of one within this group. Can be combined with options selected from any and all groups	K ^f	1120	Control Station	SE	N
		1120A	Potentiometer, 10-Turn, MOTOR SPEED	SE	N
		1120B	Potentiometer, 1-Turn, MOTOR SPEED	SE	N
		1120C	Potentiometer, 10-Turn With Digital Counter, MOTOR SPEED	SE	N

a. S = Standard Internal Mounted Option
SE = Standard External Mounted Option
SP = Standard Plug-In Internal Mounted Option
STD = Standard Feature

Y = Yes

N = No

b. Options in Groups A, B and C are simple plug-in additions, and can be supplied as factory installed or as field kits.

c. Requires application engineering.

d. Options in Groups D, E, F, G and H are supplied as factory installed only unless they are followed by an *, in which case they can be supplied as factory installed or as field kits.

e. External to the 3120M Module in Models 3123 through 3127.

f. Options in Group K are supplied as field kits only for separate mounting.

OPTION	DESCRIPTION
<p>1004</p>	<p>REVERSING, ARMATURE (MAGNETIC CONTROL)</p> <p>Includes a motor armature reversing contactor with electrical and mechanical interlocks. See Figure 10-1 (page 10-2) and Figure 10-3 (page 10-4) for armature reversing logic. Antiplug Protection (Option 1076) is required, but is not included with Option 1004.</p> <p>The direction of motor rotation is controlled by Run FORWARD and REVERSE pushbuttons.</p> <p>Option 1004 can be combined with Dynamic Braking (Option 1039) to reduce the time required for motor reversal.</p>
<p>1004C</p>	<p>REVERSING, FIELD</p> <p>Similar to Option 1004 except a shunt field reversing contactor is supplied instead of an armature reversing contactor. Option 1004C includes field loss protection and a timer. A time delay is required to allow time for the shunt field to reverse. This option should only be used with shunt-wound motors or for only reverse jogging duty if the motor has a stabilized series field.</p> <p>Antiplug Protection (Option 1076) is required, but is not included with Option 1004C.</p>
<p>1011</p>	<p>CIRCUIT BREAKER HANDLE AND ENCLOSURE MODIFICATION</p> <p>Includes a door-mounted handle to operate the input line circuit breaker, interlocked so as to prohibit opening the enclosure door when the circuit breaker is turned-on.</p> <p>To service the controller with the controller door open and the circuit breaker turned-on, insert a screwdriver in the screw slot on the handle, and twist the screwdriver. This releases the handle interlock from the circuit breaker operator mechanism, thereby allowing the door to open without turning-off the circuit breaker.</p>
<p>(Continued on next page)</p>	

OPTION	DESCRIPTION
1018	<p>FUSES, CURRENT LIMITING</p> <p>Includes three-pole current-limiting I^2t subcycle Class J fuses with a clearing capacity of at least 100,000 symmetrical amperes for protection of the AC line supply bus from fault conditions.</p> <p>This option consists of either individual current limiting fuses or a current limiting fuse assembly. The fuse assembly connects to the bottom (load side) of the controller input line circuit breaker, and is standard in controllers rated 300 HP and greater.</p> <p>In extremely rare cases, during a high fault condition in which abnormally high line current is drawn, a current limiting fuse will open. When one fuse opens in a fuse assembly, all three phases of the line supply interrupt simultaneously. One or more of the three buttons in the fuse assembly then “pop out,” indicating which current limiting fuse has opened. The blown current limiting fuse must then be replaced, after the fault has been corrected.</p>
1019	<p>JOG FORWARD (PUSHBUTTON SELECTION)</p> <p>Includes a relay and a JOG SPEED potentiometer, mounted in the controller.</p> <p>A Jog command may be initiated by a JOG pushbutton or by external logic. Jog action is momentary, causing the motor to rotate only while the JOG pushbutton is depressed or external logic is activated.</p> <p>Jog speed is normally adjustable from 0 to 1/3 of motor base speed with the JOG SPEED potentiometer. This potentiometer can be preset.</p> <p>See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical jog logic.</p>
1019A	<p>JOG, HARD (PUSHBUTTON SELECTION)</p> <p>Provides a hard, instantaneous jog action that bypasses the acceleration circuit. Option 1019A includes Option 1019.</p> <p>This option is useful on machines with high starting torque when instantaneous jog action is required.</p>
(Continued on next page)	

OPTION	DESCRIPTION
<p>1019B</p>	<p>JOG REVERSE (PUSHBUTTON SELECTION)</p> <p>Includes a relay and a JOG REVERSE SPEED potentiometer, mounted in the controller. Option 1004 (Reversing, Armature) or Option 1004C (Reversing, Field) is required, but not included with Option 1019B.</p> <p>Jog Reverse is initiated by a JOG REVERSE pushbutton or by external logic. Jog reverse is momentary, causing the motor to rotate only while the JOG REVERSE button is depressed or external logic is activated.</p> <p>Jog Reverse speed is normally adjustable from 0 to 1/3 of motor base speed with the JOG REVERSE SPEED potentiometer. This potentiometer can be preset.</p> <p>See Figure 10-3 (page 10-4) for typical jog reversing logic.</p>
<p>1023</p>	<p>THREAD</p> <p>Includes a relay and a THREAD SPEED potentiometer. A Thread command is initiated by a THREAD pushbutton or by external logic. Thread action is maintained, causing continuous motor rotation after the THREAD pushbutton is released until either a Run or Stop command is initiated.</p> <p>Thread speed is normally adjustable from 0 to 1/3 of motor base speed with the THREAD SPEED potentiometer. This potentiometer can be preset. On reversing drives, thread speed is normally identical for forward and reverse directions.</p>
<p>1023A</p>	<p>CRAWL</p> <p>Similar to Thread Option 1023, except it provides a highly regulated speed range from 1/100 to 1/10 of motor base speed. A Crawl command is initiated by a CRAWL pushbutton or by external logic.</p> <p>Tachometer Feedback (Option 1061C) is required, but is not included with Option 1023A, for low speed stability, regulation and repeatability.</p> <p>On reversing drives, crawl speed is normally identical for forward and reverse directions.</p> <p>See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical crawl logic.</p>
<p>(Continued on next page)</p>	

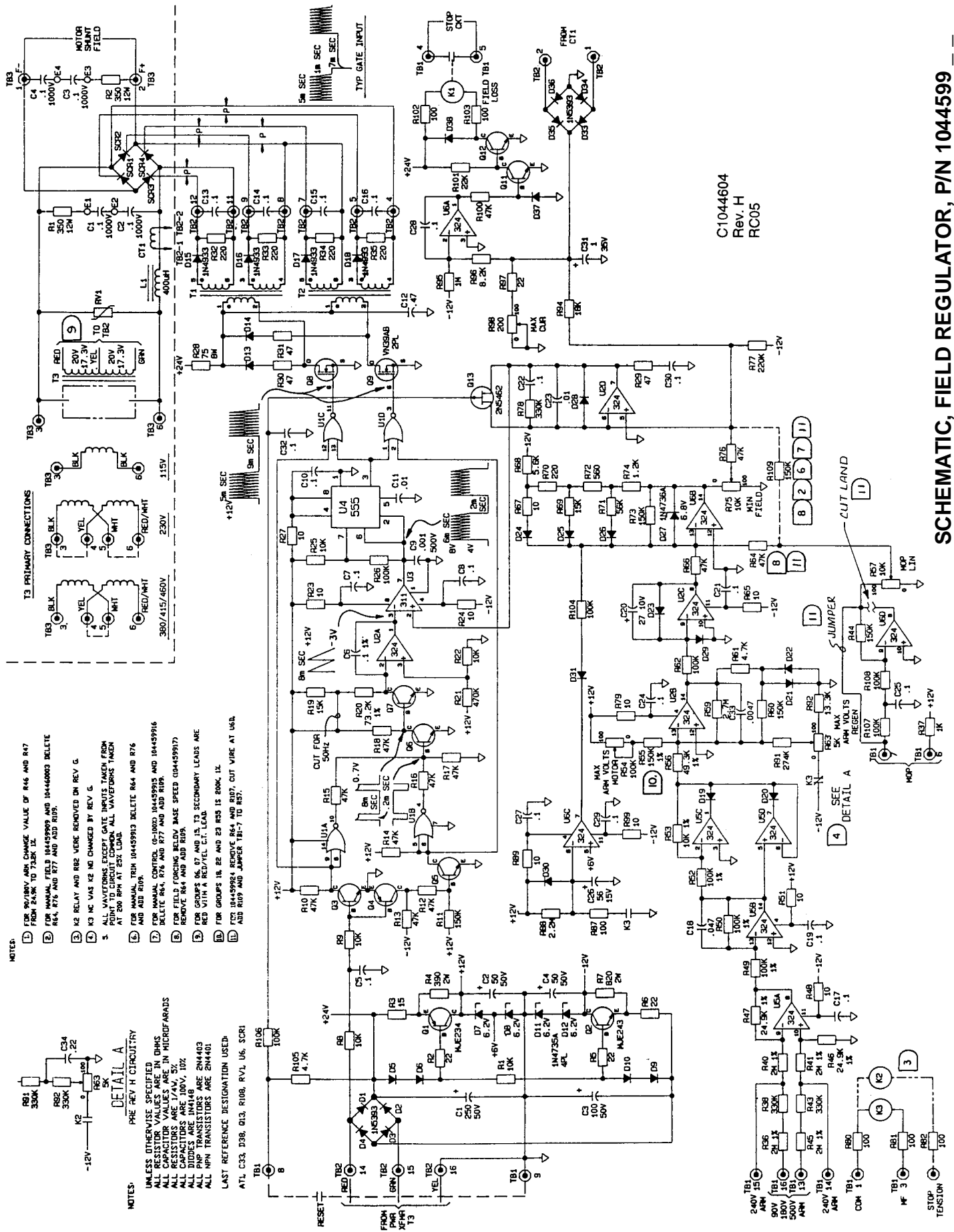
OPTION	DESCRIPTION																		
<p>1024</p>	<p>PRESET SPEED</p> <p>Similar to Thread Option 1023, except it provides a speed range from 0 to maximum motor speed. A Preset Speed command is initiated by a PRESET SPEED pushbutton or external logic.</p> <p>Option 1024 does not include logic to prevent simultaneous selection of multiple speeds.</p> <p>See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical preset speed logic.</p>																		
<p>1029</p>	<p>FIELD REGULATOR</p> <p>Includes a regulated power conversion module, which provides regulated motor field current, field loss protection, tachometer signal loss protection, field economy, and a smooth transfer from armature control to coordinated armature/ field control. Options 1061C (Tachometer Feedback) and 1076 (Antiplug Protection) are required with Option 1029.</p> <p>Standard 3120 Drives provide constant torque with variable horsepower from 0 to motor base speed by armature voltage control. Option 1029 provides coordinated automatic armature and field voltage control for extended speed range and constant horsepower operation, as shown below.</p> <p>If no operation command is initiated within about 90 seconds after the armature contactor drops out, the shunt field power reduces about 50%. This is commonly known as field economy, which allows the motor shunt field to remain energized when the motor is in a standby condition without damaging the shunt field windings.</p> <div> <table border="1"> <caption>Graph Data: Torque and Horsepower vs. Speed</caption> <thead> <tr> <th>% Rated Base Speed</th> <th>% Rated Torque (Dashed Line)</th> <th>% Rated Horsepower (Solid Line)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>100</td> <td>0</td> </tr> <tr> <td>50</td> <td>100</td> <td>50</td> </tr> <tr> <td>100</td> <td>100</td> <td>100</td> </tr> <tr> <td>150</td> <td>~75</td> <td>100</td> </tr> <tr> <td>200</td> <td>~55</td> <td>100</td> </tr> </tbody> </table> </div> <p>If the shunt field power is interrupted, a field loss relay drops out in the field regulator and initiates a Stop function by dropping out the armature contactor.</p> <p>(Continued on next page)</p>	% Rated Base Speed	% Rated Torque (Dashed Line)	% Rated Horsepower (Solid Line)	0	100	0	50	100	50	100	100	100	150	~75	100	200	~55	100
% Rated Base Speed	% Rated Torque (Dashed Line)	% Rated Horsepower (Solid Line)																	
0	100	0																	
50	100	50																	
100	100	100																	
150	~75	100																	
200	~55	100																	

OPTION	DESCRIPTION
1029	<p>FIELD REGULATOR (Contd)</p> <p>If the tachometer signal is interrupted, a relay drops out on a separately supplied printed wiring board, which also initiates a Stop function.</p> <p>The field regulator consists of a power section and a control section.</p> <p>The power section contains a single-phase full-wave SCR bridge, which supplies the DC to the motor shunt field.</p> <p>The control section consists of a phase control circuit, current regulator, armature voltage conditioning circuit, field economy circuit, field loss circuit, and low voltage power supply. These circuits are located on a printed wire board, and control the SCR bridge according to operation requirements.</p> <p>Option 1029 can be used with 150, 240, or 300 VDC motor shunt fields.</p> <p>Two sets of adjustment instructions are provided. Use the following set of adjustment instructions if the part number of the field regulator is 1044599_ _ . If the part number of the field regulator is 1060724_ _ or 106072801, follow the adjustment instructions starting on page 8-10.</p> <p><u>Adjustment Instructions For PN 1044599 _ _</u></p> <ol style="list-style-type: none"> 1. Turn-off the AC supply voltage to the controller and field regulator. 2. Connect a DC ammeter in series with the motor shunt field, and connect a DC voltmeter across the motor shunt field. 3. Set the input speed reference at zero. 4. Turn the following potentiometers fully counterclockwise on the field regulator circuit board: <ol style="list-style-type: none"> a. MOP LIN (R57) b. MAX ARM V MOTOR (R54) c. MIN FIELD (R75) 5. Set the MAX CUR Potentiometer (R98) at 50% on the field regulator circuit board. 6. Turn-on the AC supply voltage to the controller and field regulator. <p>(Continued on next page)</p>

OPTION	DESCRIPTION
1029	<p>FIELD REGULATOR (Contd)</p> <ol style="list-style-type: none"> 7. Wait about 2 minutes and then turn MIN FIELD Potentiometer R75 clockwise until the field ammeter reads slightly less than the desired minimum motor shunt field current. After adjusting R75, be sure the Field Loss Relay (K1) is energized on the field regulator. <p>Note: The minimum shunt field current required to attain maximum motor speed should be shown on the motor data plate.</p> <ol style="list-style-type: none"> 8. Turn-off the AC supply voltage and then turn it back on, and within 90 seconds, adjust MAX CUR Potentiometer R98 until the field ammeter records rated motor shunt field current. 9. Repeat steps 6, 7, and 8 until there is no interaction of these adjustments. 10. Wait about 90 seconds and check that the field regulator switches to the field economy mode. This will be indicated by a drop in the field ammeter reading. 11. Disconnect the DC voltmeter and connect it across the motor armature. 12. Initiate a Start command and slowly increase the speed reference signal to 100%, being careful not to exceed rated motor armature voltage. 13. Adjust the MAX SPD TACH potentiometer on the feedback board in the 3120M Module so that the motor runs slightly faster than rated base speed. 14. Adjust MAX ARM V MOTOR Potentiometer R54 so that the DC voltmeter reads rated motor armature voltage. 15. Adjust the MAX SPD TACH potentiometer on the feedback board so that the motor runs at maximum speed. <p>Note: Be sure the motor armature voltage does not exceed the motor rating. If armature voltage starts to increase, adjust MIN FIELD Potentiometer R75 to maintain rated armature voltage.</p> <p>(Continued on next page)</p>

OPTION	DESCRIPTION
<p>1029</p>	<p>FIELD REGULATOR (Contd)</p> <p>16. Decrease the speed reference signal to minimum and check minimum speed. If necessary, adjust the MIN SPD Potentiometer (R17) on the input board in the 3120M Module for the desired minimum speed. For zero minimum speed, turn R17 fully counterclockwise.</p> <p>17. If necessary, readjust acceleration and deceleration as described in step 11 on page 3-4.</p> <p>18. Initiate a Stop command, turn-off the AC supply voltage to the controller and field regulator, and disconnect the meters.</p> <p>(Continued on next page)</p>

SCHEMATIC, FIELD REGULATOR, P/N 1044599



C1044604
Rev. H
RC05

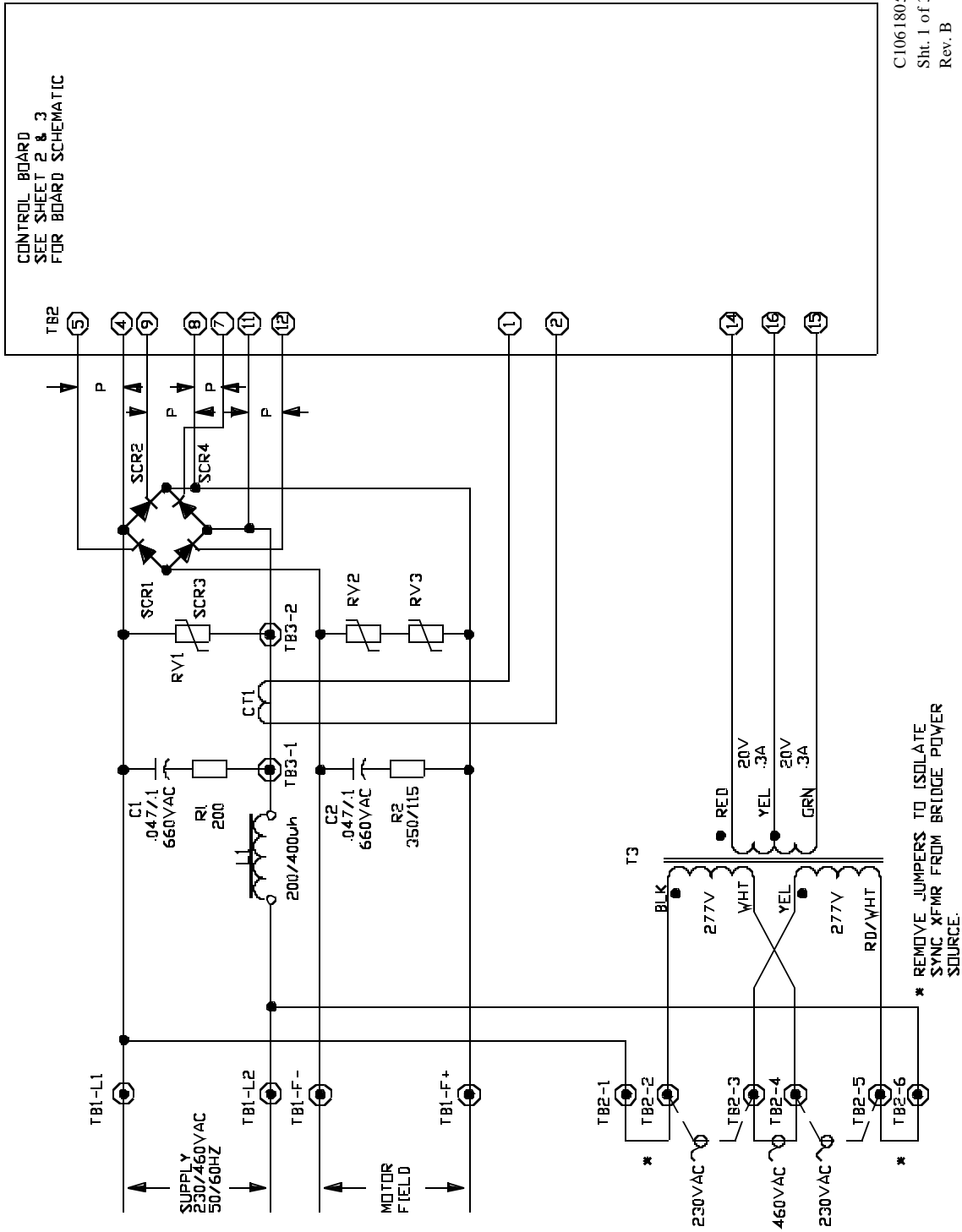
- NOTES:**
- FOR 90/180V AMR CHANGE VALUE OF R46 AND R47 FROM 24.9K TO 73.8K Ω.
 - FOR MANUAL FIELD 10445999 AND 10446003 DELETE R64, R76 AND R77 AND ADD R109.
 - K2 RELAY AND R82 WERE REMOVED ON REV. G.
 - K3 NC WAS KE2 NO CHANGED BY REV. G.
 - ALL WAVEFORMS EXCEPT GATE THURTS TAKEN FROM POINT TO CIRCUIT COMMON. ALL WAVEFORMS TAKEN AT 200 RPM AT 25% LOAD.
 - FOR MANUAL TRIM 104459913 DELETE R64 AND R76 AND ADD R109.
 - FOR MANUAL CONTROL (G-1002, 104459915 AND 104459916) DELETE R64, R76 AND R77 AND ADD R109.
 - FOR FIELD FORCING BELOW BASE SPEED (084459917) REMOVE R64 AND ADD R109.
 - FOR GROUPS 06, 07 AND 13, T3 SECONDARY LEADS ARE RED WITH A RED/YEL. C.T. LEAD.
 - FOR GROUPS 18, 22 AND 23 R53 IS 200K Ω.
 - FOR 10446004, REMOVE R64 AND R87, CUT WIRE AT U6A, ADD R109 AND JUMPER T81-7 TO R57.

DETAIL A
PRE-REV H CIRCUITRY

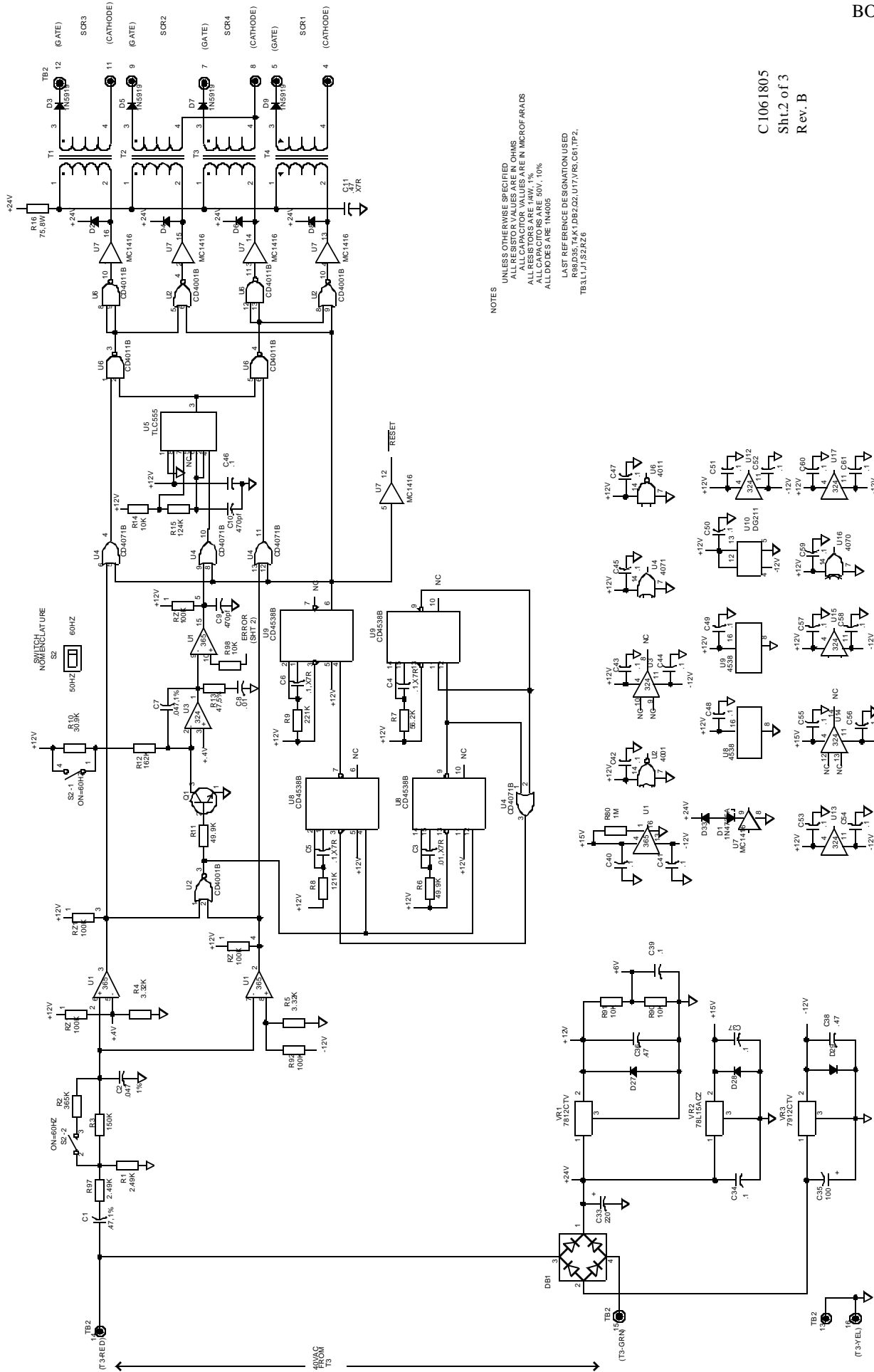
UNLESS OTHERWISE SPECIFIED, DIMS ARE IN MILLIMETERS.
ALL CAPACITOR VALUES ARE IN MICROFARADS.
ALL RESISTOR VALUES ARE IN OHMS, UNLESS OTHERWISE SPECIFIED.
ALL CAPACITORS ARE 100V, 5%.
ALL DIODES ARE 1N4148.
ALL PNP TRANSISTORS ARE 2N4403.
ALL NPN TRANSISTORS ARE 2N4401.
LAST REFERENCE DESIGNATION USED:
A71, C33, D38, Q13, R108, R41, U6, SCR1

OPTION	DESCRIPTION
1029	<p>FIELD REGULATOR (Contd)</p> <p><u>Adjustment Instructions For PN 106072801 And 1060724</u> --</p> <p>Further information on these field regulators can be found in equipment manual BOOK 0880.</p> <ol style="list-style-type: none"> 1. Turn-off the AC supply voltage to the controller and field regulator. 2. Connect a DC ammeter in series with the motor shunt field, and connect a DC voltmeter across the motor shunt field. 3. Set the input speed reference at zero. 4. Preset the following potentiometers on the field regulator circuit board: <ol style="list-style-type: none"> a. INT GAIN = 50% b. PROP GAIN = 0% c. MIN FIELD = 50% d. MAX FIELD = 0% e. FLD ECON = 50% 5. Set Switch S1-10 to CLOSED (ON) position on the field regulator circuit board. 6. Turn-on the AC supply voltage to the controller and field regulator. 7. Turn MIN FIELD Potentiometer R48 clockwise until the field ammeter reads slightly less than the desired minimum motor shunt field current. After adjusting R48, be sure the Field Loss Relay (K1) is energized on the field regulator, and the field current is greater than 0.4A. <p style="margin-left: 40px;">Note: The minimum shunt field current required to attain maximum motor speed should be shown on the motor data plate.</p> 8. Turn-off the AC supply voltage, set Switch S1-10 to OPEN (OFF) position, and then turn the AC supply back on, and within 90 seconds, adjust MAX CUR Potentiometer R62 until the field ammeter records rated motor shunt field current. 9. Repeat steps 5, 6, 7 and 8 until there is no interaction of these adjustments. <p>(Continued on next page)</p>

OPTION	DESCRIPTION
1029	<p>FIELD REGULATOR (Contd)</p> <p>10. Wait about 2 minutes. The field regulator will switch to the field economy mode. Adjust FLD ECON Potentiometer R86 for a field current that is 70% of rated field current. Be sure the field current is greater than 0.4A.</p> <p>11. Disconnect the DC voltmeter and connect it across the motor armature.</p> <p>12. Initiate a Start command and slowly increase the speed reference signal to 100%, being careful not to exceed rated motor armature voltage.</p> <p>13. Adjust the MAX SPD TACH potentiometer on the feedback board in the 3120M Module, so that the motor runs slightly faster than rated base speed.</p> <p>14. Adjust ARM V MOTOR Potentiometer R75 so that the DC voltmeter reads rated motor armature voltage.</p> <p>15. Adjust the MAX SPD TACH potentiometer on the feedback board so that the motor runs at maximum speed.</p> <p>Note: Be sure the motor armature voltage does not exceed the motor rating. If armature voltage starts to increase, adjust MIN FIELD Potentiometer R75 to maintain rated armature voltage.</p> <p>16. Decrease the speed reference signal to minimum and check minimum speed. If necessary, adjust the MIN SPD Potentiometer (R17) on the input board in the 3120M Module for the desired minimum speed. For zero minimum speed, turn R17 fully counterclockwise.</p> <p>17. If necessary, readjust acceleration and deceleration as described in step 11 on page 3-4.</p> <p>18. Initiate a Stop command, turn-off the AC supply voltage to the controller and field regulator, and disconnect the meters.</p>
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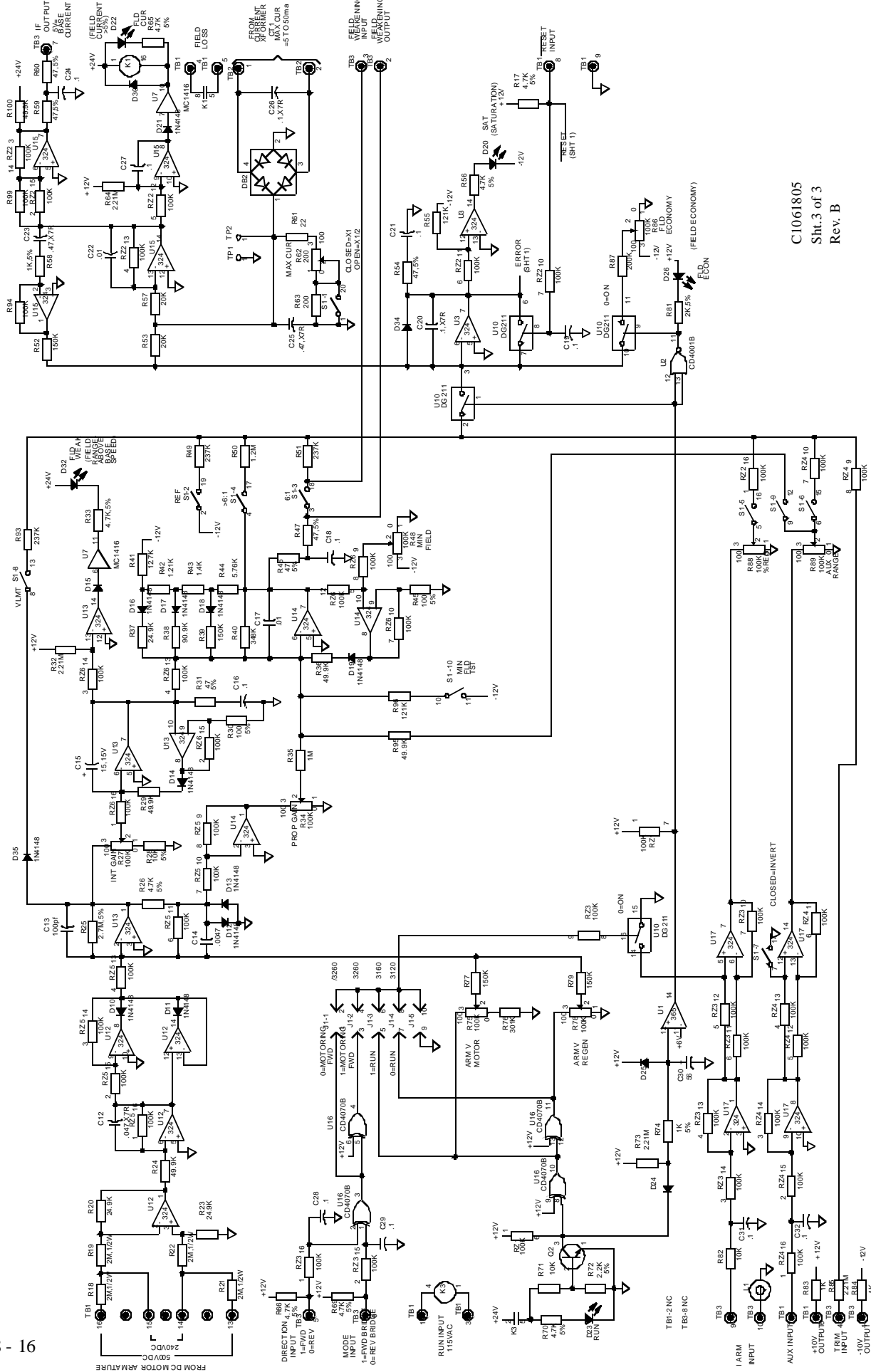
SCHEMATIC, FIELD REGULATOR, P/N 1060724 __ & 106072801 (Continued on next page)



NOTES
 UNLESS OTHERWISE SPECIFIED
 ALL RESISTOR VALUES ARE IN OHMS
 ALL CAPACITOR VALUES ARE IN MICROFARADS
 ALL RESISTORS ARE 1/4W, 1%
 ALL CAPACITORS ARE 50V, 10%
 ALL DIODES ARE 1N4005
 LAST REFERENCE DESIGNATION USED
 R86D35.74*1.D82.Q2.U17/R8.C61.TP2.
 TB3.L1.J1.S2Z26

C 1061805
 Sht.2 of 3
 R ev. B

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C1061805
 Sht.3 of 3
 Rev. B

SCHEMATIC, FIELD REGULATOR, P/N 1060724 __ & 106072801 (Cont'd)

OPTION	DESCRIPTION
1032	<p>POTENTIOMETER, MOTOR OPERATED</p> <p>Includes a motorized speed selector assembly, which contains a fractional horsepower pilot motor, adjustable cam-operated snap-action switches, and the controller speed control potentiometer. The pilot motor turns a camshaft that activates and deactivates the snap-action switches, and rotates the potentiometer.</p> <p>Option 1032 permits smooth controlled (common rate) acceleration and deceleration of the drive motor by FASTER and SLOWER pushbuttons in the operator control station or by external contacts. The rate of acceleration and deceleration, determined by pilot motor speed, is factory adjusted between 20 and 180 seconds, as specified for the application. However, this rate cannot be faster than that allowed by the linear accel/decel board.</p> <p>The standard speed selector assembly includes 5 switches. Three of the switches are used to set high and low speed limits and to interlock external devices requiring operation in relation to motor speed. A maximum of 9 cams and switches can be installed in the standard speed selector assembly. Each switch is single-pole double-throw with a 10 ampere, 250 VAC rating.</p> <p>During a Run operation, whenever the FASTER pushbutton is pushed, the pilot motor rotates the speed control potentiometer in the increase speed direction until the FASTER button is released or the high speed limit switch is activated. When the FASTER button is released, the position of the speed control potentiometer is maintained. Normally, when the high speed limit switch is activated, the motor runs at rated base speed and the wiper arm of the speed control potentiometer is on its 100 end land.</p> <p>The cam that operates the high speed limit switch is normally factory adjusted to depress the switch at all speeds below base speed. When the motor reaches base speed, the cam releases the switch which interrupts the power to the pilot motor, thereby preventing further speed increase.</p> <p>Whenever the SLOWER pushbutton is pushed while the motor is running, the pilot motor rotates the speed control potentiometer in the decrease speed direction until the SLOWER button is released or the low speed limit switch is activated. When the SLOWER button is released, the position of the speed control potentiometer is maintained. Normally, when the low speed limit switch is activated, the motor runs at minimum speed, and the wiper arm of the speed control potentiometer is on its zero end land.</p> <p>(Continued on next page)</p>

OPTION	DESCRIPTION
1032	<p>POTENTIOMETER, MOTOR OPERATED (Contd)</p> <p>The cam that operates the low speed limit switch is normally factory set to depress the switch at all speeds above minimum speed. When the motor decelerates to minimum speed, the cam releases the switch which interrupts the power to the pilot motor, thereby preventing further speed decrease.</p> <p>When a Stop command is initiated, the speed selector assembly resets automatically to its minimum or starting position.</p>
1039	<p>DYNAMIC BRAKING</p> <p>Provides exponential rate braking of the motor armature. Dynamic braking occurs when the circuit opens between the controller and the motor armature, and a resistor(s) connects across the motor armature. This is accomplished by a normally-closed armature contactor contact(s), mechanically interlocked with the normal run contact. See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical schematics.</p> <p>When a Stop (braking) command is initiated, the motor functions as a DC generator and feeds the kinetic energy of its armature and connected load through the dynamic braking resistor(s), where it is dissipated as heat. This opposes motor rotation, thereby stopping the motor.</p> <p>The dynamic braking resistor(s) is rated for stopping a typical load a maximum number of stops per minute from base speed as shown in the tables on page 8-16. A typical load is defined as:</p> <ul style="list-style-type: none"> • Not exceeding rated-load torque. • External load inertia (beyond the motor shaft) not exceeding that of the motor armature. • Friction and windage losses produce a braking torque equivalent to 10% of rated motor torque. <p>The dynamic braking resistor(s) is mounted inside the controller enclosure on 230V controllers through 30 HP and 460V controllers through 60 HP. Higher rated controllers have the resistor(s) mounted within a ventilated penthouse enclosure on top of the controller enclosure.</p> <p>CAUTION: HIGH INERTIA LOADS MAY EXTEND BRAKING TIME BEYOND THE WATTAGE RATING OF THE RESISTOR(S).</p> <p>(Continued on next page)</p>

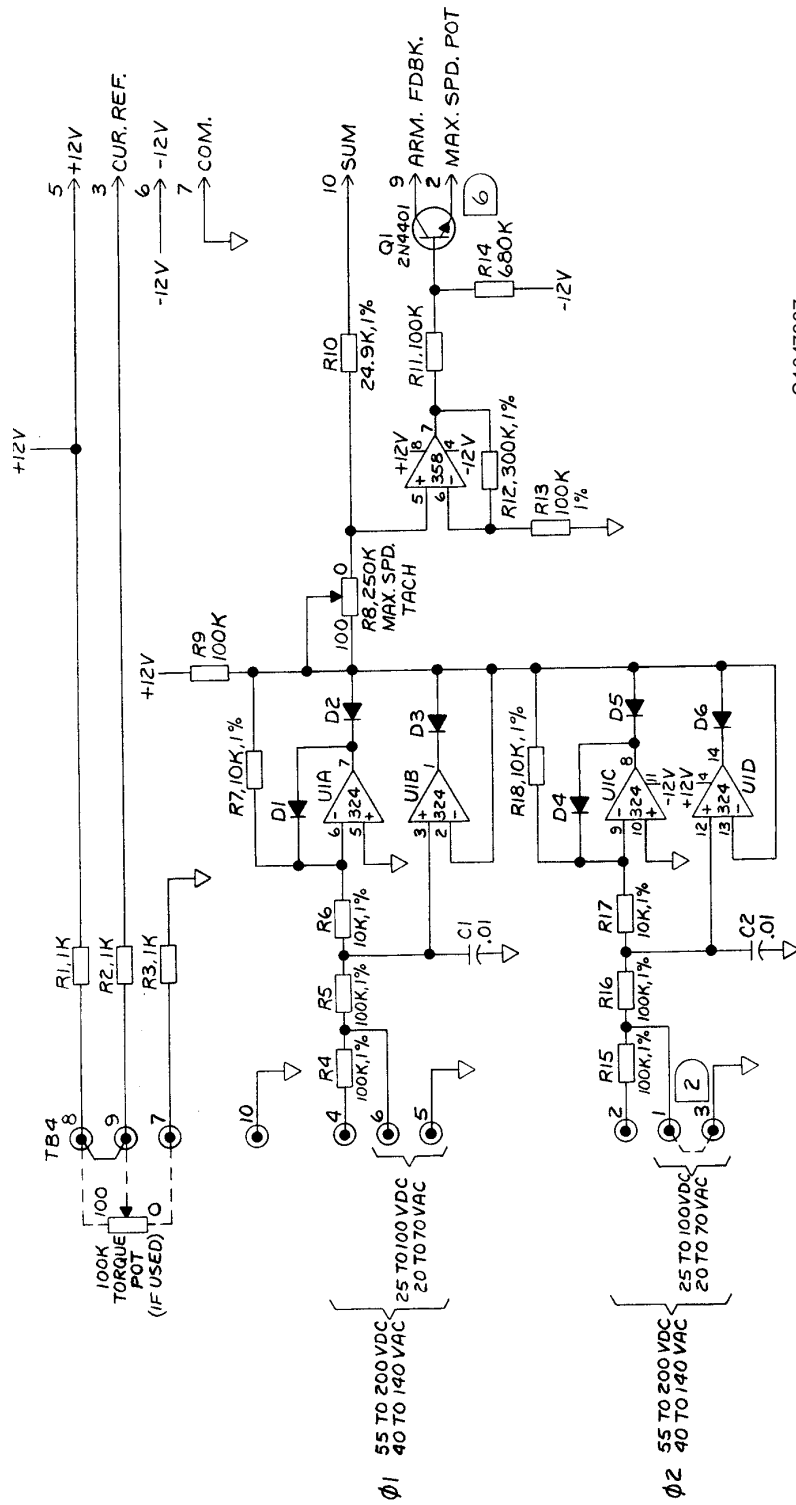
OPTION	DESCRIPTION
1039	DYNAMIC BRAKING (Contd) Antiplug Protection (Option 1076) is required, but is not included, with Option 1039.

COMPONENT	LINE VOLTAGE	RATED HORSEPOWER @ 1750 RPM											
		5	7.5	10	15	20	25	30	40	50	60	75	100
Braking Torque %	230V	205	132	102	157	125	144	124	170	136	170	138	189
	460V	277	178	138	182	130	182	147	138	110	152	152	115
Stops Per Minute	230V	5	5	5	5	5	5	5	5	5	5	5	5
	460V	5	5	5	5	5	5	5	5	5	5	5	5
Stopping Time, Typical (Sec)	230V	0.9	1.1	1.4	1.4	1.4	0.9	1.5	1.7	1.5	2.1	1.9	1.4
	460V	0.7	1.2	1.2	1.3	1.5	1.1	1.5	1.4	1.8	1.2	1.8	1.9

COMPONENT	LINE VOLTAGE	RATED HORSEPOWER @ 1750 RPM											
		125	150	200	250	300	400	500	600	700	800	900	1000
Braking Torque %	230V	152	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	460V	187	157	229	186	155	157	171	162	139	155	138	156
Stops Per Minute	230V	3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	460V	3	3	1	1	1	1	1	1	1	1	1	1
Stopping Time, Typical (Sec)	230V	2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	460V	1.8	2.1	2.2	2.5	2.4	2.2	2.1	2.1	2.4	2.2	2.4	2.2

OPTION	DESCRIPTION
1047	CONTROLLED (RAMP) STOP Includes a voltage-sensing relay which holds in the motor armature contactor until a preset minimum speed is reached, thereby providing smooth controlled linear deceleration. This option may be combined with Dynamic Braking (Option 1039) to provide two stopping modes: Emergency Dynamic Braking and Normal (controlled linear rate). The operator control station must then include two separate STOP pushbuttons.
(Continued on next page)	

OPTION	DESCRIPTION
1058	<p>FOLLOWER/MANUAL MODE SELECT (RELAYS)</p> <p>Includes relay logic which allows remote selection of the controller operation mode. Option 1058 allows the controller to follow the speed reference signal from either the speed control potentiometer (MANUAL selection) or an external signal source (FOLLOWER selection).</p>
1061C	<p>FEEDBACK, TACHOMETER AC OR DC</p> <p>Includes a plug-in printed wiring board (Tachometer Feedback 1047365) which inserts into the feedback receptacle on the control board.</p> <p>This option inhibits the IR compensation circuitry in the 3120M Module, and provides expanded speed range, improved speed regulation (see Table 9-3, page 9-3), and reduced sensitivity to operating conditions, such as line voltage variations, ambient temperature changes, and motor field heating.</p> <p>This option also provides protection from overspeed that could result from loss of field excitation in a shunt-wound motor. If the tachometer signal is lost, the controller switches to armature feedback automatically.</p> <p>The tachometer feedback board accepts the output of either a DC tachometer generator (25 to 200 VDC at maximum speed) or a 2-phase (4-wire) AC tachometer generator (20 to 140 VDC VAC at maximum speed). The tachometer generator is normally mechanically coupled to the drive motor armature.</p> <p>See “Adjustment Instructions” starting on page 6-3.</p> <p>(Continued on next page)</p>



C1047367

NOTES -

1. AC TACH MUST BE 2 ϕ .
2. WITH DC TACH, USE ONLY ϕ 1 INPUT AND SHORT THE UNUSED INPUT TO COM.
3. USE HIGH VOLTAGE INPUT FOR 2 ϕ 50V PER 1000 AT 1750 RPM.
4. UNLESS OTHERWISE SPECIFIED ALL RESISTOR VALUES ARE IN OHMS. ALL CAPACITOR VALUES ARE IN MICROFARADS ALL RESISTORS ARE $\frac{1}{4}$ W, 5% ALL CAPACITORS ARE 100 V, 10% ALL DIODES ARE 1N4148
5. LAST REFERENCE DESIGNATION USED, R18, D6, C2, U2, Q1
6. TRANSISTOR Q1 OMITTED ON 104736502

SCHEMATIC, TACHOMETER FEEDBACK CIRCUIT BOARD

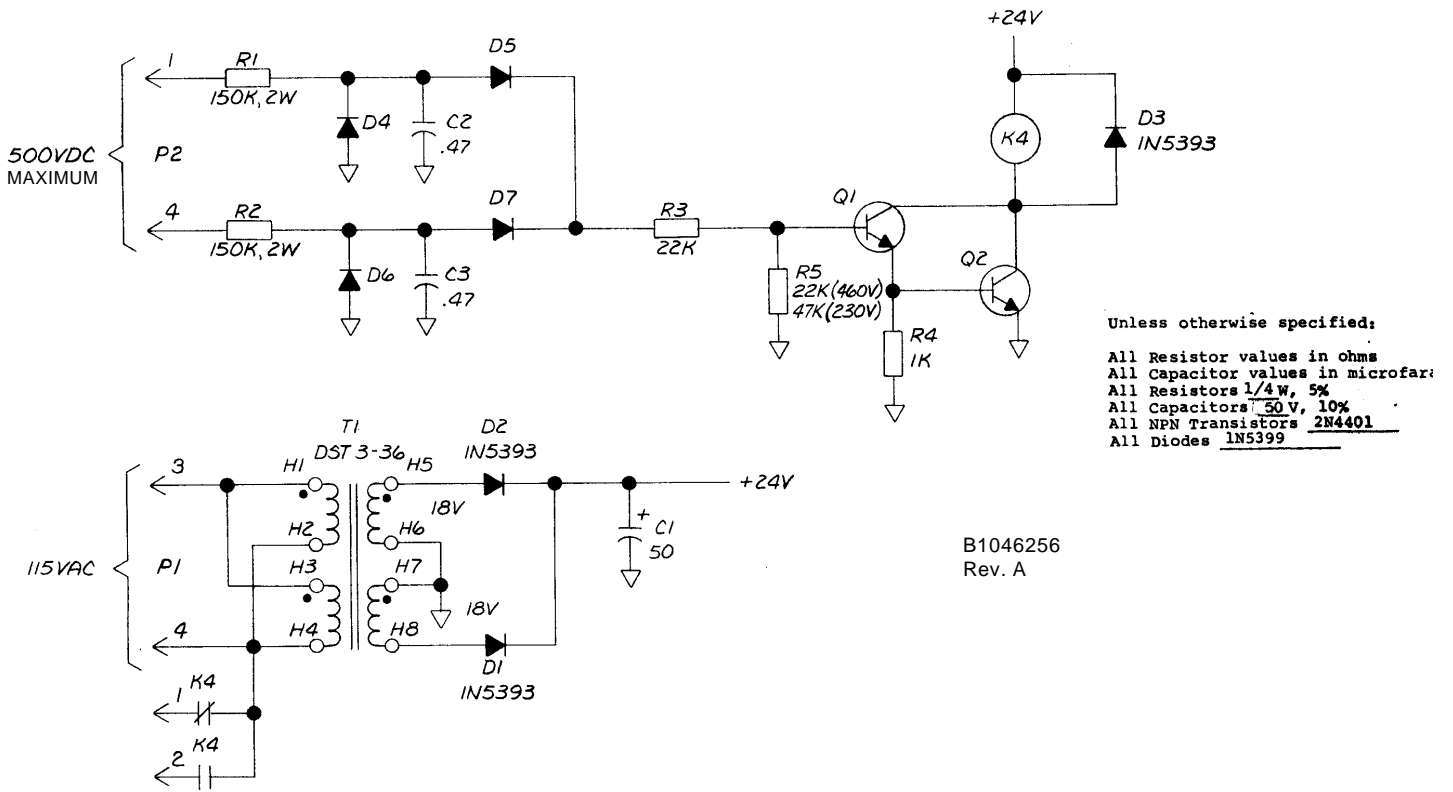
OPTION	DESCRIPTION
1066	<p>LIGHT, POWER ON</p> <p>Includes a door-mounted pilot lamp which lights whenever the input line circuit breaker is closed (turned-on), thereby indicating the controller is energized.</p> <p>See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical schematics.</p>
1067	<p>LIGHT, MOTOR ON</p> <p>Includes a door-mounted pilot lamp which lights whenever the motor armature contactor pulls in, thereby indicating the motor is running or is ready for operation.</p> <p>See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical schematics.</p>
1070	<p>METER, LOAD</p> <p>Includes a DC meter, wired to the controller Shunt (SH1). Two fuses and a calibration potentiometer may also be included. The meter and potentiometer (if used) are normally mounted on the controller enclosure door. This option may also be supplied as a separately cased instrument for remote mounting. If this option is supplied as a field kit for remote mounting, meter fusing is recommended. (Recommended fuse rating: 1/2 ampere, 600 VAC, Type BBS.)</p> <p style="text-align: center;">CAUTION</p> <p style="text-align: center;">IF A GROUND DEVELOPS IN AN UNPROTECTED (UNFUSED) METER CIRCUIT, CONTROLLER DAMAGE MAY OCCUR.</p> <p>The load meter measures the voltage dropped across Shunt SH1, connected in series with the motor armature. When the motor is maintaining speed or is decelerating, the meter should read less than full-load rated armature current. However, when the motor is accelerating, the meter may momentarily reach 150% armature current (current limit setting) before dropping off to its normal operating range. If armature current becomes excessive, see Indication 15 in the troubleshooting table (Table 6-1) on page 6-11.</p> <p>See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical schematics.</p>
(Continued on next page)	

OPTION	DESCRIPTION
<p>1070A</p>	<p>METER, SPEED INDICATOR (ANALOG)</p> <p>Includes a voltmeter, calibrated in motor RPM. Two fuses and a calibration potentiometer may also be included. The meter and potentiometer (if used) are normally mounted on the controller enclosure door.</p> <p>Option 1070A can be connected directly across the motor armature for a full-scale accuracy of about 10%. For improved accuracy with changing load conditions, Option 1070A can be connected to a motor-mounted AC or DC tachometer generator for a full-scale accuracy of 2%. This option may be supplied as a separately cased instrument for remote mounting, and for use with a tachometer generator. When supplied for tachometer generator operation, Option 1070A normally does not require fusing. However, if this option is mounted remotely and connected to the motor armature, meter fusing is recommended. (Recommended fuse rating: 1/2 ampere, 600 VAC, Type BBS.)</p> <p style="text-align: center;">CAUTION</p> <p style="text-align: center;">IF A GROUND DEVELOPS IN AN UNPROTECTED (UNFUSED) METER CIRCUIT, CONTROLLER DAMAGE MAY OCCUR</p> <p>See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical schematics.</p>
<p>1070B</p>	<p>METER, SPEED INDICATOR (DIGITAL)</p> <p>Similar to Option 1070A, except the speed indicator consists of a 4-digit meter with half-inch high LED display.</p> <p>See Figure 10-2 (page 10-3) and Figure 10-3 (page 10-4) for typical schematics.</p>
<p>1071</p>	<p>BLOWER MOTOR CONTROL</p> <p>Includes a three-pole motor starter with 3-leg overload protection, and 3- pole line fuses. Option 1071 controls and protects a three-phase force ventilation blower motor, mounted on the drive motor. The blower motor normally energizes when the input line circuit breaker is turned-on.</p> <p>The line fuses protect the blower motor and motor wiring from shorts and grounds. If a fuse blows, replace it with an exact replacement. Substitute fuses can cause blower motor damage.</p> <p>(Continued on next page)</p>

OPTION	DESCRIPTION
1071	<p>BLOWER MOTOR CONTROL</p> <p>The overload relay protects the blower motor from excessive current by tripping when the current exceeds 125% of its AC rating over a time period of continuous operation. Blower motor current flows through three heating elements (one per phase) in the overload relay. If this current flow exceeds the rating of the heating element(s) for a time period dependent on the amount of overload and the ambient temperature, an element(s) expands and trips the relay. As a result, the relay opens a normally-closed contact, usually connected in the controller run/stop logic, which stops the blower and drive motors.</p> <p>When tripped, the overload relay must be reset manually by depressing its reset button after the heating element(s) cools. If repeated tripping occurs, check all connections on the overload relay, including heater element screws, and tighten accordingly. Check the blower motor intake screen, and remove all dirt, dust, and debris from the screen. Check the three-phase blower motor currents with a clamp-on ammeter. Currents must be balanced within 10%. If blower motor currents are unbalanced, check for shorted blower motor windings. If current balance is satisfactory, check for a mechanical overload, shorted blower motor windings, and faulty bearings. Repair accordingly.</p>
1071A	<p>BLOWER MOTOR FUSES</p> <p>Includes three-pole line fuses to protect a three-phase force ventilation blower motor, mounted on the drive motor. The blower motor normally energizes when the input line circuit breaker is turned-on.</p> <p>The blower motor fuses protect the blower motor and motor wiring from shorts, grounds and excessive current. If a fuse blows, replace it with an exact replacement. Substitute fuses can cause blower motor damage.</p> <p>If the replacement fuse blows, check the blower motor intake screen, and remove all dirt, dust, and debris from the screen. Check the three-phase blower motor currents with a clamp-on ammeter. Currents must be balanced within 10%. If currents are unbalanced, check for shorted blower motor windings. If current balance is satisfactory, check for mechanical overload, shorted blower motor windings, and fault bearings. Repair accordingly.</p>
1072A	<p>AUXILIARY CONTACTS</p> <p>Includes two auxiliary contacts, mounted on the motor armature contactor. These contacts may be used for interlocking external devices (e.g., pilot lights, starters) with the armature contactor, but may not be used for brake solenoid control. Each contact is Form C, rated 10 amperes, 250 VAC</p>
(Continued on next page)	

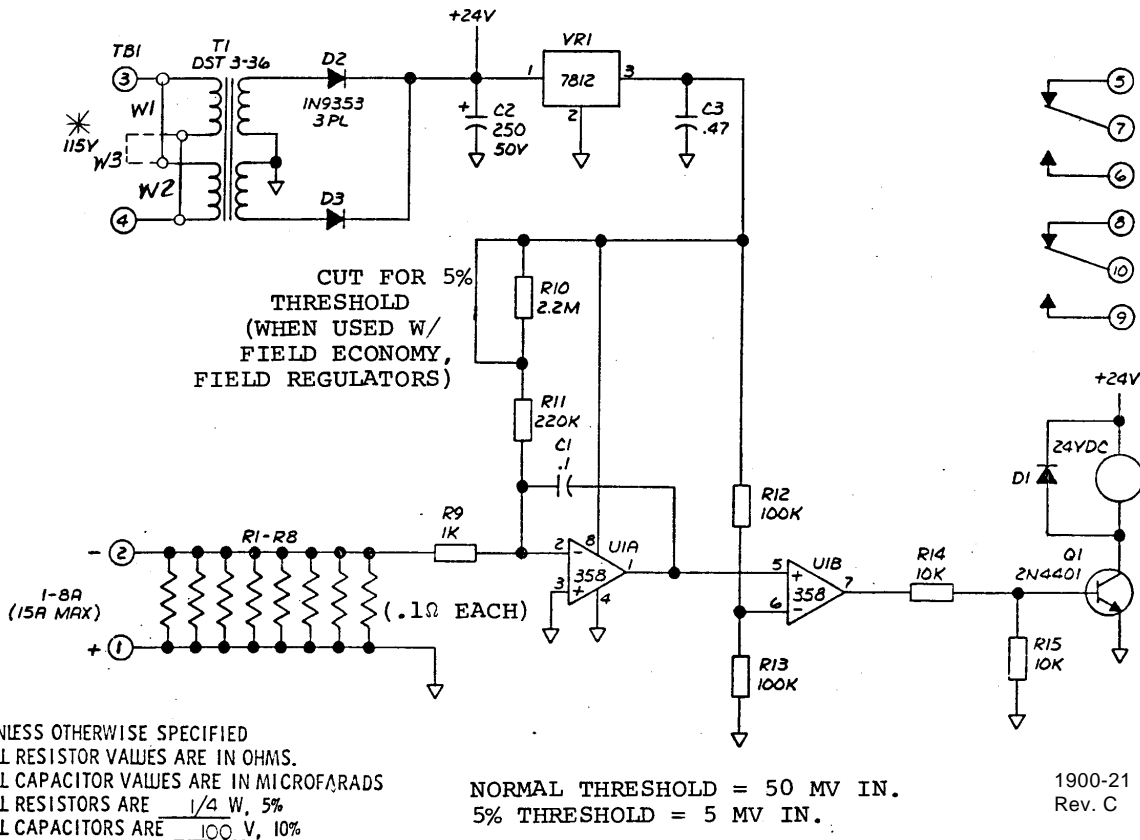
OPTION	DESCRIPTION
<p>1074</p>	<p>REACTORS, AC LINE INDUCTORS</p> <p>Includes AC line reactors (chokes) which series connect in the AC supply immediately before the 3120M Module. See Figure 10-1 (page 10-2), Figure 10-2 (page 10-3), and Figure 10-3 (page 10-4) for typical schematics. Three line reactors, one per phase, are provided for Model 3121, 3122, 3123, and 3125 Controllers, and six line reactors, two in parallel per phase, for Model 3124 Controllers and controllers rated above 500 HP.</p> <p>These reactors oppose rapid line current changes and surges, to help protect the SCR bridge from transients (di/dt) and to help prevent extraneous electrical surges from entering the AC lines.</p> <p>Option 1074 is not normally needed when a controller is connected to the AC supply through an isolation transformer.</p> <p>However, Option 1074 is recommended for the following applications:</p> <ul style="list-style-type: none"> • The KVA of the AC supply is greater than three times the horsepower rating of the controller. • Power factor correction capacitors are connected to the load side of the transformer supplying the controller. • A controller rated 300 horsepower or greater is connected to an AC supply with less than 50 microhenries inductance line to line, or to an AC supply with available fault current greater than 24,000 amperes.
<p>1076</p>	<p>ANTIPLUG PROTECTION</p> <p>Includes a circuit board which plugs into the relay/interface board and connects across the output of the SCR bridge (armature circuit). Option 1076 is required in controllers with Option 1004 (Reversing) and Option 1039 (Dynamic Braking).</p> <p>This option prevents reversing (or restarting) the motor after a Reverse (or Stop) command is initiated until motor speed reduces sufficiently to prevent potentially damaging electrical surges and mechanical stresses.</p> <p>(Continued on next page)</p>

OPTION	DESCRIPTION
1076	<p>ANTIPLUG PROTECTION (Contd)</p> <p>The APR option board provides a Relay (K4) which picks up immediately after the motor starts and drops out immediately before the motor stops. A K4 contact, connected in the run/stop logic, prevents restarting the motor until the motor has practically stopped. When K4 drops out, it also activates the field economy circuit on the standard field supply board which reduces the motor shunt field voltage about 34%. See Figure 10-1 (page 10-2) for a typical schematic.</p>



SCHEMATIC, APR BOARD

OPTION	DESCRIPTION
<p>1077</p>	<p>FIELD LOSS PROTECTION</p> <p>Includes a circuit board that connects in the controller shunt field circuit.</p> <p>If the shunt field current is interrupted or drops below the minimum excitation requirements of the drive motor, a relay on the circuit board drops out and shuts down the controller by opening the controller run/stop logic.</p> <p>Option 1077 contains eight calibration Resistors (R1 through R8). If this option is supplied as a field kit, calibration resistors must be cut out so that the number of remaining resistors equal the shunt field current rating. For example, for a 3 ampere shunt field, cut out any five calibration resistors so that only 3 resistors remain. Do not remove any calibration resistors if field current is rated between 8 and 15 amperes.</p> <p>This option requires an external single-phase 115/230 VAC, 50/60 Hz line supply. For 230 VAC operation, remove Jumpers W1 and W2, and add Jumper W3.</p>



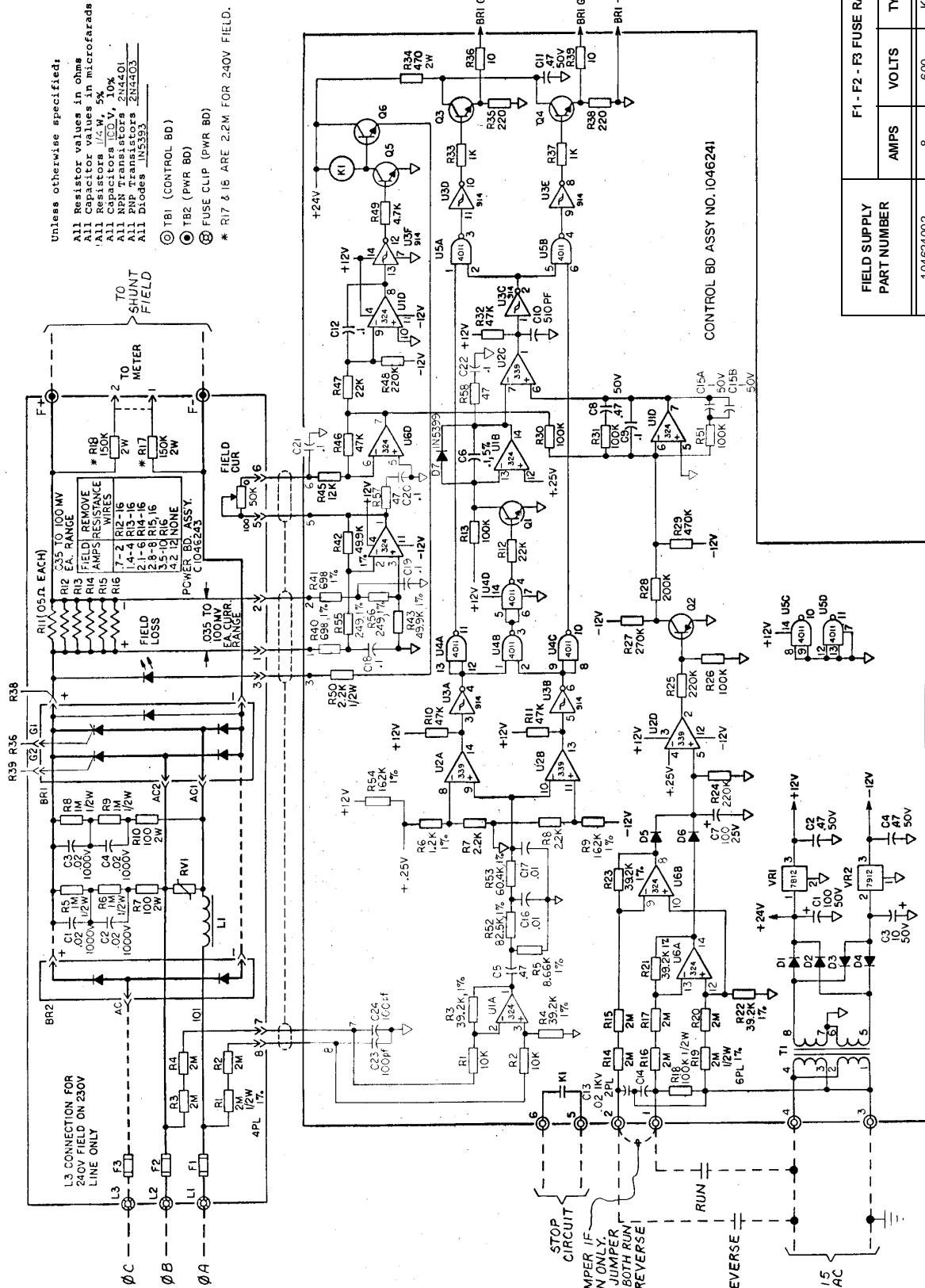
* FOR 230VAC OPERATION, REMOVE JUMPER W1 & W2 ON BOARD & ADD JUMPER W3

SCHEMATIC, FIELD LOSS

OPTION	DESCRIPTION
1079	<p>FIELD SUPPLY, CONSTANT CURRENT</p> <p>Includes a field supply module that replaces the standard field supply in the controller. This module maintains the motor shunt field current at an adjustable preset level, thereby making a standard armature voltage feedback drive less sensitive to changes in motor temperature and AC line voltage.</p> <p>This option can be used to weaken or strengthen motor field excitation to allow operation at nonstandard motor speeds with rated armature voltage applied. Weakening the field strength will increase motor speed above rated base speed and will reduce motor torque. Conversely, increasing the field strength will increase torque and reduce motor speed to less than rated base speed. These capabilities may be useful for multi-drive systems where it may be necessary to match motor speeds or equalize loads.</p> <p>About 30 seconds after the motor armature contactor drops out, shunt field current drops to about 50% of rated, thereby allowing the shunt field to remain energized when the motor is in a standby condition without damaging the shunt field windings.</p> <p>If the shunt field current is interrupted or drops to about 25% of rated, a field loss relay drops out on the field supply module and initiates a Stop function by dropping out the motor armature contactor. When this occurs, a Light Emitting Diode (FLD LOSS) lights on the top field supply circuit board, thereby providing an indication of a lost field condition.</p> <p><u>Adjustment Instructions</u></p> <ol style="list-style-type: none"> 1. Turn-off all AC supply voltage to the controller and field supply module. 2. Be sure the field supply module is connected to the controller as shown on the drawings supplied with the controller. 3. Connect a DC ammeter in series with the motor shunt field and connect a DC voltmeter across the motor armature. 4. Connect a wire jumper across Terminals 2 and 4 on Terminal Board TB1 on the bottom field supply circuit board. 5. Check the part number of the field supply module, located on the top circuit board. Then check the motor data plate for rated shunt field current. Correlate the part number with the rated field current in the following table and remove (cut out) the appropriate shunt wire(s) from the field supply top circuit board.

FIELD SUPPLY PART NUMBER	RATED FIELD CURRENT (AMPS)	REMOVE SHUNT WIRES	ADJUSTABLE FIELD CURRENT RANGE (AMPS)
104624002 Or 104624004	0.7 - 1.7	R12, R13, R14, R15 & R16	0.7 - 2.0
	1.8 - 3.1	R13, R14, R15 & R16	1.4 - 4.0
	3.2 - 4.4	R14, R15 & R16	2.1 - 6.0
	4.5 - 7.0	R15 & R16	2.8 - 8.0
104624003 Or 104624005	3.5 - 7.0	R16	3.5 - 10.0
	7.1 - 12.0	None	4.2 - 12.0

OPTION	DESCRIPTION
1079	FIELD SUPPLY, CONSTANT CURRENT (Contd)
	<p>6. Turn-on the AC supply voltage to the controller and field supply module.</p> <p>7. Adjust the FLD CUR potentiometer on the field supply top circuit board for rated shunt field current on the ammeter.</p> <p>8. Initiate a Run command and set the input speed reference signal to the controller at +10 VDC (if used, turn the speed control potentiometer fully clockwise).</p> <p>9. Check that the motor is running at rated base speed and that rated voltage is applied to the motor armature. If base speed or rated armature voltage cannot be attained, follow step 10 or 11, as applicable. Otherwise, skip to step 12.</p> <p>10. If the controller does not have Tachometer Feedback (Option 1061C) and base speed cannot be attained, adjust the speed reference signal so that rated armature voltage is applied to the motor. Then readjust the FLD CUR potentiometer until the motor runs at rated base speed.</p> <p>11. If the controller has Tachometer Feedback (Option 1061C) and rated armature voltage cannot be attained, adjust the speed reference signal until the motor runs at rated base speed. Then readjust the FLD CUR potentiometer until rated armature voltage is attained.</p> <p>12. Initiate a Stop command, turn-off the AC supply voltage to the controller and field supply module, remove the wire jumper from Terminals TB1-2 and TB1-4, and disconnect the meters.</p>
(Continued on next page)	



Unless otherwise specified:
 All Resistor values in ohms
 All Capacitor values in microfarads
 All Resistors 1/4W, 5%
 All Capacitors 100V, 10%
 All NPN Transistors 2N4201
 All PNP Transistors 2N4203
 All Diodes 1N5353

⊙ TBI (CONTROL BD)
 ⊙ TB2 (PWR BD)
 ⊙ FUSE CLIP (PWR BD)
 * R17 & 16 ARE 2.2M FOR 240V FIELD.

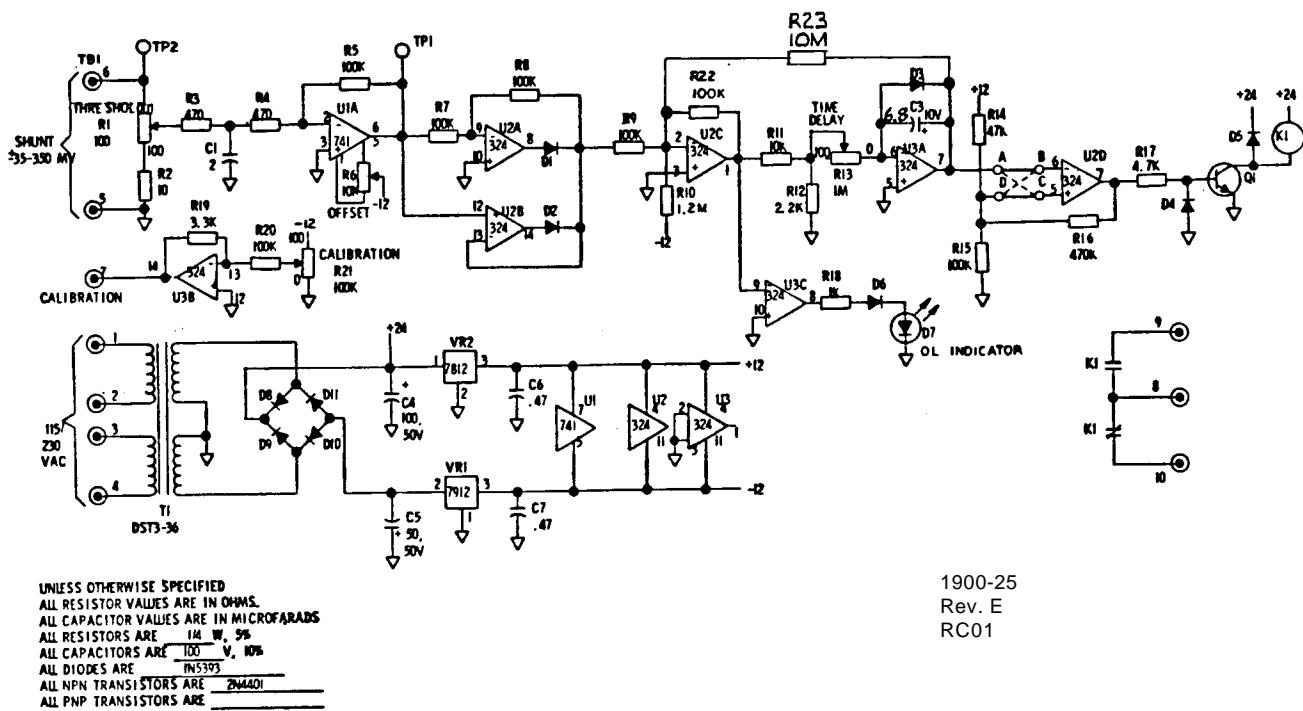
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 Rev. A
 RC02

FIELD SUPPLY PART NUMBER	F1 - F2 - F3 FUSE RATING		
	AMPS	VOLTS	QTY
104624002	8	600	KTK 2
104624003	15	600	KTK 2
104624004	8	600	KTK 3
104624005	15	600	KTK 3

SCHEMATIC, FIELD SUPPLY MODULE

OPTION	DESCRIPTION
1081C	<p>OVERLOAD PROTECTION, STATIC INVERSE</p> <p>Includes a circuit board in a vinyl mounting track which provides an adjustable inverse current vs. time static overload circuit. This circuit continuously monitors motor armature current and drops out a Relay (K1) after a time delay from when a preset trip point is exceeded. Option 1081C integrates armature current with time which produces exponentially shorter trip times with increasingly greater armature current. An LED Overload Indicator (D7) lights on the circuit board when the overload circuit trips.</p> <p>Relay K1 provides one set of Form C contacts rated 1 ampere at 120 VAC or 28 VDC resistive load, which may be used to shut down the controller under sustained overload conditions to prevent motor damage, or may be used to signal audible or visual alarms or operate auxiliary control devices (e.g., pumps, fans, or valves). When tripped, Option 1081C resets automatically when the motor armature current decreases below the trip point.</p> <p><u>Adjustment Instructions</u></p> <ol style="list-style-type: none"> <li>1. Turn-on the AC supply voltage. <li>2. Adjust the OFFSET Potentiometer (R6) for zero volts at Test Point TP1, with respect to Terminal 5, on the circuit board. <li>3. Calculate the millivoltage drop across the controller Shunt (SH1) at the desired trip point. <li>4. Adjust the CALIBRATION Potentiometer (R21) until the millivoltage calculated in step 3 is recorded at Terminal 7, with respect to Terminal 5, on the circuit board. <li>5. Disconnect Shunt SH1 from the circuit board. <li>6. Jumper Terminal 7 to Terminal 6 on the circuit board. <li>7. Adjust the THRESHOLD Potentiometer (R1) until Overload Indicator D7 lights. <li>8. Remove the jumper from Terminals 6 and 7, and reconnect Shunt SH1 to the circuit board. <p>(Continued on next page)</p>

OPTION	DESCRIPTION
<p>1081C</p>	<p>OVERLOAD PROTECTION, STATIC INVERSE (Contd)</p> <p>9. Run the motor at rated base speed and readjust CALIBRATION Potentiometer R21 so that Indicator D7 lights at the desired load.</p> <p>10. Adjust the TIME DELAY Potentiometer (R13) for the amount of delay (1 to 90 seconds) from when Indicator D7 lights until Relay K1 drops out.</p>



SCHEMATIC, STATIC INVERSE OVERLOAD CIRCUIT BOARD

OPTION	DESCRIPTION
<p>1085</p>	<p>CONTROLLER WITHOUT ENCLOSURE</p> <p>Consists of an unenclosed panel-mount version of a 3120 Controller.</p> <p>When selecting an enclosure for Option 1085, be sure of adequate ventilation so that the temperature inside the enclosure does not exceed 55°C (131°F).</p>

OPTION	DESCRIPTION
1120	<p>OPERATOR CONTROL STATION, SERIES SCS160</p> <p>Includes a standard operator control station, listed below, for separate mounting by the user. Control elements are mounted within the station; however, external wiring terminations must be completed by the user. See Figure 2-6 (page 2-4) for dimensions.</p>

CATALOG NUMBER ^a	USE WITH CONTROLLER OPTIONS	CONTROL ELEMENTS		
		Push Button ^b	Toggle Switch ^c	Potentiometer
SCS161	Basic	Run, Stop	NA	1-Turn Run
SCS163	1022	Run, Stop	Run/Jog	1-Turn Run 1-Turn Jog
SCS165	1019	Run, Stop, Jog	NA	1-Turn Run
SCS166	1004	Run Fwd, Run Rev, Stop	NA	1-Turn Run

a. NEMA Type 1 enclosure with TENV industrial rated components.

b. All push buttons have one normally-open and one normally-closed contact blocks.

c. All toggle switches have maintained contacts.

OPTION	DESCRIPTION
1135	<p>THERMAL OVERLOAD, SCR BRIDGE</p> <p>Includes a thermal switch with a normally-closed contact mounted on the heat sink of the SCR bridge. This device stops or prevents the drive from operating with abnormally high heat-sink temperature.</p>
1139	<p>ENCLOSURE, LARGER NEMA TYPE 1</p> <p>Includes a wall or floor mounted indoor enclosure, larger than the standard enclosure, for use when selected options or auxiliary equipment cannot be mounted in the standard enclosure.</p>

OPTION	DESCRIPTION
<p style="text-align: center;">1147</p>	<p>ENCLOSURE MODIFICATION, NEMA TYPE 12, VENTILATED</p> <p>Includes neoprene door sealing gaskets and filters for all ventilation openings for modifying the controller enclosure to NEMA Type 12 configuration.</p> <p>Option 1147 is intended for use indoors in nonhazardous areas to protect the controller from airborne fibers, lint, dust, dirt and flyings. Where heavy contamination exists, a totally enclosed, sealed NEMA Type 12 enclosure is recommended.</p>
<p style="text-align: center;">1170</p>	<p>BLOWER, SCR BRIDGE</p> <p>Includes a blower which mounts beneath the SCR bridge in Model 3121 Controllers. Option 1170 is standard on Model 3122 through 3127 Controllers.</p>
<p style="text-align: center;">1230</p>	<p>DC CONTACTOR, TWO-POLE</p> <p>Provides the second DC contactor so that both sides of the DC motor armature can be disconnected from the 3120 Controller. This option is standard on all 3120 Controllers through 250 HP @ 460 VAC.</p>